

ELECTRON TUBES



SEMICONDUCTORS

ENGINEER'S HANDBOOK

CBS-HYTRON Danvers, Massachusetts



RECEIVING TUBES

(Numerical-Alphabetical Order)

With cross indexing to Reference Guides
for Seldom-Used Tubes.

NOTE: Complete data for tubes which are identical except for heater ratings are listed under that type which has the lowest heater voltage.



ELECTRON TUBES AND SEMICONDUCTORS

ENGINEER'S HANDBOOK

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CBS-HYTRON
DIVISION OF COLUMBIA BROADCASTING SYSTEM, INC.
DANVERS, MASSACHUSETTS

P R E F A C E

This CBS Engineer's Handbook has been especially prepared for the electronic engineer whose chief concern is with electron tubes, semiconductors, and their associated circuits. The book can be used both for solving design problems and for quick, accurate reference. It contains complete RETMA data and characteristic curves on current receiving and television picture tubes regardless of manufacture and abbreviated data for tubes of these categories as well as for a wide variety of special-purpose tubes.

CBS semiconductors are completely described. The transistor and diode data, along with their characteristic curves, present significant information for the circuit designer, field engineer, and application engineer.

The CBS Engineer's Handbook is based on the theory that the engineer wants complete information and characteristic curves on electron devices being used in new equipment, and reference material on such devices encountered in older equipment, particularly if the data are contained in a minimum number of compact volumes. Up-to-date information is supplied by continually reviewing the material and revising it to fit current needs.

An outstanding feature of this book is the emphasis on easy readability: For example, it contains improved basing diagrams with special treatment for double-section tubes, two-color characteristic curves, two-color data pages, typography, carefully selected for legibility, and is printed on high quality paper.

Revised data and data for new electron devices are made available through a periodic supplement service. In order to enroll for this service, simply fill out the attached post card and mail.

This publication was prepared by CBS-Hytron, Technical Information Service, 100 Endicott Street, Danvers, Massachusetts.

C O N T E N T S

Receiving Tubes (Numerical—Alphabetical Order)*

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Table II Detector-Amplifiers (diode and triode, tetrode, pentode combined)

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Table VI Audio Power Amplifiers (triode, tetrode, and pentode)

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Picture Tubes (Numerical—Alphabetical Order)

Picture Tube Reference Guide

Crystal Diode Reference Guides

Germanium and Silicon Diodes

Silicon Power Rectifiers

Transistors (Numerical)

Special Purpose Tube Reference Guides

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Table II Gaseous Diodes (voltage regulator and reference)

Table III Gaseous Triodes and Tetrodes (cold cathode and thyratron)

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Glossary

Interpretation of Electron Tube Ratings and Characteristics.

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Rectifiers, Ratings and Rating Charts

Screen Grid Ratings and Rating Chart

Explanation of Tube Type Numbering System

Quadrature FM Detector for TV (3BN6-6BN6, etc.)

Use of Tube Testers

Installation and Handling of Picture Tubes

RETMA Color Codes

Resistance-Coupled Amplifier Charts

CHARACTERISTIC CURVES

*Complete data for tubes which are identical except for heater ratings are listed under that type which has the lowest heater voltage.

For additional information on a particular tube or semiconductor, write to Technical Information Service, CBS-Hytron, Danvers, Massachusetts.

N O T E S O N U S E

Electron Tube Outline Drawings: If more than one outline applies, the most common or current type is illustrated. Base style is indicated inside bulb to aid identification.

Application Description: The descriptive line preceding the electrical data is the most general use for the device.

Basing Diagrams: Electron tubes have diagrams founded on the RETMA standards. Each pin is labeled with its principal connection. Secondary elements internally connected may not be indicated in the pin label. Transistor basing diagrams in this handbook originate with CBS-Hytron and indicate symbolically the element connections.

Basing Diagram Key: P—plate; G—grid; G1—grid 1, etc.; G2-4—grid 2 and 4 internally connected, etc.; K—cathode; IS—internal shield; IC—internal connection (do not use); $\frac{S}{NC}$ —shell for metal envelopes or no connection for glass envelopes; TAR—target; SA—starter; DP—diode plate; H—heater; HCT—heater center tap; F—filament; FCT—filament center tap; A—anode, in picture tubes includes internally connected grids and internal coating, sometimes called the ultor; C—external conductive coating of picture tubes. Transistor leads and pins: E—emitter; C—collector, B—base.

NOTE: Double circled pins connect to elements of Section 2 in multiple section tubes.

ELECTRON TUBES AND SEMICONDUCTORS

ENGINEER'S HANDBOOK

TABLE OF CONTENTS

Table of contents is arranged in alphabetical order for rapid location of complete data on any particular electron tube or semiconductor, not including Seldom-used Receiving Tubes, Picture Tube Reference Guide, and Special Purpose Tube Guide. Grouped type numbers indicate family of types appearing together.

Note that the **CBS Engineer's Handbook** is designed for maximum technical information in a conveniently sized book without sacrificing any EIA specification. Complete EIA data for tubes which are identical except for heater ratings is listed under that type which has the lowest heater voltage. Use of the table of contents helps identify this prototype.

Key to abbreviations referring to sections in handbook:

RT—Receiving Tube
PT—Picture Tubes

SP—Special Purpose
SC—Semiconductor

Designation	Referent*	Sect.	Designation	Referent*	Sect.	Designation	Referent*	Sect.
OZ4	—	RT	1N60	—	SC	1N501	—	SC
OZ4A	—	RT	1N63	—	SC	1N502	—	SC
OZ4G	—	RT	1N64	—	SC	1N636	—	SC
1A7GT	—	RT	1N65	—	SC	1R5	—	RT
1AX2	—	RT	1N67/1N67A	—	SC	1S5	—	RT
1B3GT	—	RT	1N68A	—	SC	1T4	—	RT
1G3GT/1B3GT	—	RT	1N69A	—	SC	1U4	—	RT
1H5GT	—	RT	1N70	—	SC	1U5	—	RT
1L4	—	RT	1N71	—	SC	1V2	—	RT
1N34	—	SC	1N73	—	SC	1X2	1X2B	RT
1N34A	—	SC	1N74	—	SC	1X2A	1X2B	RT
1N35	—	SC	1N75	—	SC	1X2B	—	RT
1N38/1N38B	—	SC	1N81A	—	SC	2AF4	2AF4A	RT
1N39/1N39A	—	SC	1N82	—	SC	2AF4A	—	RT
1N40	—	SC	1N82A	—	SC	2B3	1B3GT	RT
1N42	—	SC	1N90	—	SC	2BN4	—	RT
1N48	—	SC	1N116	—	SC	2CY5	—	RT
1N51	—	SC	1N126A	—	SC	2N155	—	SC
1N52	—	SC	1N127A	—	SC	2N156	—	SC
1N54	—	SC	1N128	—	SC	2N158	—	SC
1N54A	—	SC	1N198	—	SC	2N255	—	SC
1N55/1N55A	—	SC	1N497	—	SC	2N256	—	SC
1N55B	—	SC	1N498	—	SC	2N438	—	SC
1N56/1N56A	—	SC	1N499	—	SC	2N439	—	SC
1N58/1N58A	—	SC	1N500	—	SC	2N440	—	SC

*Refers to type designation that has full data except for differences given.

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Designation	Referent*	Secl	Designation	Referent*	Secl	Designation	Referent*	Secl
2T4	—	RT	5CG8	—	RT	6AX5GT	—	RT
3A2	—	RT	5CL8	—	RT	6AX8	—	RT
3A3	—	RT	5CM6	—	RT	6AZ8	—	RT
3AL5	—	RT	5CM8	—	RT	6BA6	3BA6	RT
3AU6	—	RT	5CZ5	—	RT	6BA8	—	RT
3AV6	—	RT	5J6	—	RT	6BA8A	—	RT
3BA6	—	RT	5T8	—	RT	6BC4	—	RT
3BC5	—	RT	5U4G	—	RT	6BC5	3BC5	RT
3BE6	—	RT	5U4GB	—	RT	6BC7	—	RT
3BN4	2BN4	RT	5U8	—	RT	6BC8	4BC8	RT
3BN6	—	RT	5V4G	—	RT	6BD4A	—	RT
3BU8	—	RT	5V6GT	—	RT	6BD6	—	RT
3BY6	—	RT	5X8	—	RT	6BE6	3BE6	RT
3BZ6	—	RT	5Y3GT	—	RT	6BE8	5BE8	RT
3CB6	—	RT	5Y4GT	5Y3GT	RT	6BE8A	5BE8	RT
3CE5	—	RT	5Z3	5U4G	RT	6BF5	—	RT
3CF6	—	RT	6AB4	—	RT	6BF6	—	RT
3CE5	—	RT	6AC7	—	RT	6BG6G	—	RT
3CF6	—	RT	6AF4	2AF4	RT	6BG6GA	—	RT
3CS6	—	RT	6AF4A	2AF4A	RT	6BH6	—	RT
3D21B	—	SP	6AG5	—	RT	6BH8	—	RT
3DK6	—	RT	6AG7	—	RT	6BI6	—	RT
3DT6	—	RT	6AH4GT	—	RT	6BI7	—	RT
3Q4	3V4	RT	6AH6	—	RT	6BK4	—	RT
3Q5GT	—	RT	6AK5	—	RT	6BK5	—	RT
3S4	—	RT	6AK6	—	RT	6BK7A	5BK7A	RT
3V4	—	RT	6AL5	3AL5	RT	6BK7B	5BK7A	RT
4AU6	3AU6	RT	6AL7GT	—	RT	6BL4	—	RT
4BA6	3BA6	RT	6AM4	—	RT	6BL7GT	—	RT
4BC5	3BC5	RT	6AM8	5AM8	RT	6BN4	2BN4	RT
4BC8	—	RT	6AN8	5AN8	RT	6BN6	3BN6	RT
4BE6	3BE6	RT	6AQ5	5AQ5	RT	6BQ5	—	RT
4BN6	3BN6	RT	6AQ5A	5AQ5	RT	6BQ6GT	—	RT
4BQ7A	—	RT	6AQ6	—	RT	6BQ6GA	—	RT
4BS8	—	RT	6AR5	—	RT	6BQ6GTA	—	RT
4BU8	3BU8	RT	6AR8	—	RT	6BQ6GTB	—	RT
4BX8	—	RT	6AS5	—	RT	6BQ7A	4BQ7A	RT
4BZ7	—	RT	6AS8	5AS8	RT	6BR8	5BR8	RT
4BZ8	—	RT	6AT6	—	RT	6BS8	4BS8	RT
4CB6	3CB6	RT	6AT8	5AT8	RT	6BU8	3BU8	RT
4CX7	—	RT	6AT8A	5AT8	RT	6BV8	—	RT
5AM8	—	RT	6AU4GT	—	RT	6BX7GT	—	RT
5AN8	—	RT	6AU4GTA	—	RT	6BY5GA	—	RT
5AQ5	—	RT	6AU5GT	—	RT	6BY6	3BY6	RT
5AS4	5U4GB	RT	6AU6	3AU6	RT	6BY8	—	RT
5AS8	—	RT	6AU6A	3AU6	RT	6BZ6	3BZ6	RT
5AT8	—	RT	6AU8	—	RT	6BZ7	4BZ7	RT
5AV8	5AN8	RT	6AU8A	—	RT	6BZ8	4BZ8	RT
5AW4	—	RT	6AV5GA	—	RT	6C4	—	RT
5B8	—	RT	6AV5GT	—	RT	6C5	—	RT
5BE8	—	RT	6AV6	3AV6	RT	6C5GT	—	RT
5BK7A	—	RT	6AW8	—	RT	6CA5	—	RT
5BQ7A	4BQ7A	RT	6AW8A	—	RT	6CB5	—	RT
5BR8	—	RT	6AX4GT	—	RT	6CD6G	—	RT

*Refers to type designation that has full data except for differences given.

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Designation	Referent*	Sect.	Designation	Referent*	Sect.	Designation	Referent*	Sect.
6CD6GA	—	RT	6Q7	—	RT	9U8A	5U8	RT
6CE5	3CE5	RT	6Q7G	—	RT	9X8	5X8	RT
6CF5	3CF5	RT	6Q7GT	—	RT	10ABP4	—	PT
6CG7	—	RT	6S4	—	RT	10BP4A	—	PT
6CG8	5CG8	RT	6S4A	—	RT	10C8	—	RT
6CG8A	5CG8	RT	6S8GT	—	RT	10DA7	6DA7	RT
6CH8	—	RT	6SA7	—	RT	11C5	35C5	RT
6CL6	—	RT	6SA7G	—	RT	12AB5	—	RT
6CL8	5CL8	RT	6SA7GT	—	RT	12AC6	—	RT
6CM6	—	RT	6SC7	—	RT	12A06	—	RT
6CM7	—	RT	6SG7	—	RT	12AE6	—	RT
6CN7	—	RT	6SG7GT	—	RT	12AF6	—	RT
6CR6	—	RT	6SH7	—	RT	12AJ6	—	RT
6CS6	3CS6	RT	6SJ7	—	RT	12AL5	3AL5	RT
6CS7	—	RT	6SJ7GT	—	RT	12AL8	—	RT
6CU5	—	RT	6SK7	—	RT	12AQ5	5AQ5	RT
6CU6	—	RT	6SK7GT	—	RT	12AT6	6AT6	RT
6CU8	—	RT	6SL7GT	—	RT	12AT7	—	RT
6CX7	4CX7	RT	6SN7GT	—	RT	12AU6	3AU6	RT
6CX8	—	RT	6SN7GTA	—	RT	12AU7	7AU7	RT
6CY5	2CY5	RT	6SN7GTB	—	RT	12AU7A	7AU7	RT
6CY7	—	RT	6SQ7	—	RT	12AV5GA	6AV5GA	RT
6CZ5	5CZ5	RT	6SQ7G	—	RT	12AV6	3AV6	RT
6DA7	—	RT	6SQ7GT	—	RT	12AV7	—	RT
6DB5	—	RT	6T4	—	RT	12AX4GT	6AX4GT	RT
6DC6	—	RT	6T8	—	RT	12AX4GTA	6AX4GT	RT
6DE6	—	RT	6T8A	—	RT	12AX7	—	RT
6DG6GT	6W6GT	RT	6U8	—	RT	12AZ7	—	RT
6DC6	—	RT	6U8A	—	RT	12B4	—	RT
6DN6	—	RT	6V3A	—	RT	12B4A	—	RT
6DT6	3DT6	RT	6V6GT	—	RT	12BA6	3BA6	RT
6DQ6	—	RT	6V6	—	RT	12BD6	6BD6	RT
6DQ6A	—	RT	6V6GTA	—	RT	12BE6	3BE6	RT
6H6GT	—	RT	6W4GT	—	RT	12BF6	6BF6	RT
6H6	—	RT	6W6GT	—	RT	12BH7	—	RT
6J5	—	RT	6X4	—	RT	12BH7A	—	RT
6J5GT	—	RT	6X8	5X8	RT	12BK5	6BK5	RT
6J6	5J6	RT	6X8A	5X8	RT	12BL6	—	RT
6J6A	5J6	RT	6Y6GA	—	RT	12BQ6GT	6BQ6GT	RT
6K6GT	—	RT	6Y6G	—	RT	12BQ6GA	6BQ6GT	RT
6K7	—	RT	7AU7	—	RT	12BQ6GTA	6BQ6GT	RT
6K7G	—	RT	8AU8	6AU8	RT	12BQ6GTB	6BQ6GT	RT
6K7GT	—	RT	8BA8A	6BA8A	RT	12BR7	—	RT
6K8	—	RT	8BH8	6BH8	RT	12BV7	—	RT
6K8G	—	RT	8CG7	6CG7	RT	12BY7	—	RT
6K8GT	—	RT	8CM7	6CM7	RT	12BY7A	—	RT
6L6	—	RT	8CN7	6CN7	RT	12BZ7	—	RT
6L6G	—	RT	8CS7	6CS7	RT	12C5	—	RT
6L6GA	—	RT	8DP4	—	PT	12CA5	6CA5	RT
6L6GB	—	RT	8JP4	—	PT	12CM6	6CM6	RT
6L7	—	RT	8XP4	—	PT	12CN5	—	RT
6L7G	—	RT	8SN7GTB	6SN7GTB	RT	12CR6	6CR6	RT
6N7	—	RT	9AU7	7AU7	RT	12CT8	—	RT
6N7GT	—	RT	9CL8	5CL8	RT	12CU5	6CU5	RT

*Refers to type designation that has full data except for differences given.

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Designation	Referent*	Sect.	Designation	Referent*	Sect.	Designation	Referent*	Sect.
12CU6	6CU6	RT	17ATP4,A	—	PT	21ZP4A,B	—	PT
12CX6	—	RT	17AV5GA	6AV5GA	RT	24ADP4	—	PT
12CY6	—	RT	17AVP4,A	—	PT	24CP4A	—	PT
12D4	—	RT	17AX4GT	6AX4GT	RT	24DP4A	—	PT
12DB5	6DB5	RT	17BP4A,B	—	PT	24TP4	—	PT
12DF5	—	RT	17CA5	6CA5	RT	24VP4A	—	PT
12DK5	—	RT	17CP4	—	PT	24YP4	24DP4A	PT
12DL8	—	RT	17CU5	6CU5	RT	25AV5GT	6AV5GT	RT
12DM5	—	RT	17DQ6	6DQ6	RT	25AV5GA	6AV5GT	RT
12DQ6	6DQ6	RT	17DQ6A	—	RT	25AX4GT	6AX4GT	RT
12DQ6A	6DQ6	RT	17GP4	—	PT	25BK5	6BK5	RT
12EL6	—	RT	17H3	—	RT	25BQ6GT	6BQ6GT	RT
12EM6	—	RT	17HP4,B	—	PT	25BQ6GA	6BQ6GT	RT
12F8	—	RT	17JP4	—	PT	25BQ6GTB	6BQ6GT	RT
12J5GT	6J5GT	RT	17L6GT	12L6GT	RT	25C5	12C5	RT
12J8	—	RT	17LP4,A	—	PT	25CA5	6CA5	RT
12K5	—	RT	17QP4,A	—	PT	25CD6G	6CD6G	RT
12L6GT	—	RT	17TP4	—	PT	25CD6GA	6CD6G	RT
12LP4A	—	PT	17YP4	—	PT	25CD6GB	6CD6G	RT
12SG7	6SG7	RT	18A5	—	RT	25CU6	6CU6	RT
12SK7	6SK7	RT	19AP4A,B	—	PT	25DN6	6DN6	RT
12SK7GT	6SK7	RT	19AU4GT	6AU4GT	RT	25DQ6	6DQ6	RT
12SN7GT	6SN7GT	RT	19AU4GTA	6AU4GT	RT	25EC6	—	RT
12SN7GTA	6SN7GT	RT	19BG6G	6BG6G	RT	25F5	—	RT
12SQ7GT	6SQ7GT	RT	19BG6GA	6BG6G	RT	25L6GT	12L6GT	RT
12U7	—	RT	19J6	5J6	RT	25W4GT	6W4GT	RT
12V6GT	6V6GT	RT	19T8	5T8	RT	25Z6GT	—	RT
12W6GT	6W6GT	RT	20CP4,A,B,D	—	PT	27EP4	—	PT
12X4	6X4	RT	20DP4,A,B,C	—	PT	27RP4	27EP4	PT
14BP4	—	PT	20HP4,A,C,D	—	PT	35B5	35C5	RT
14CP4	—	PT	21ACP4,A	—	PT	35C5	—	RT
14QP4,A	—	PT	21ALP4A,B	—	PT	35L6GT	—	RT
14RP4,A	—	PT	21AMP4,A	—	PT	35W4	—	RT
16AEP4	—	PT	21AP4	—	PT	35Z5GT	—	RT
16AP4A	—	PT	21ATP4,A	—	PT	50B5	12C5	RT
16DP4A	—	PT	21AUP4,A,B	—	PT	50C5	12C5	RT
16GP4,B	—	PT	21AVP4,A,B	—	PT	50L6GT	12L6GT	RT
16JP4A	—	PT	21AWP4	—	PT	117Z3	—	RT
16KP4	—	PT	21EP4A,B	—	PT	117Z6GT	—	RT
16LP4A	—	PT	21FP4,A,C	—	PT	6146	—	SP
16RP4,A	—	PT	21MP4	—	PT	6216	—	SP
16TP4	—	PT	21WP4,A	—	PT	6955	—	SP
16WP4A	—	PT	21XP4,A	—	PT	7025	—	SP
16ZP4	16LP4A	PT	12YP4,A	—	PT			

*Refers to type designation that has full data except for differences given.

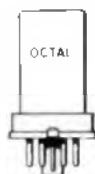
01 • 01A • 01AA • 01B • 00 • 00A

(See chart for seldom-used tubes)



0Z4

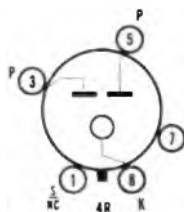
0Z4A • 0Z4G



Gaseous full-wave rectifier for vibrator-type B supplies

HEATER CHARACTERISTICS

Heater voltage NONE REQUIRED
Heater current NONE REQUIRED



ELECTRICAL DATA

MAXIMUM RATINGS (Design center values)

	0Z4, 0Z4G	0Z4A
Plate supply voltage, peak starting	300	volls
Plate to plate voltage, peak	1000	volls
Plate voltage, peak inverse		880 volts
Plate current, peak	200	ma
Output voltage, d-c	300	300 volts
Output current, d-c (min.)	30	30 ma
Output current, d-c (max.)	75	85 ma
Dynamic tube voltage drop, average	24	24 volts

ENGINEERING DESIGN DATA

0Z4

0Z4A • 0Z4G

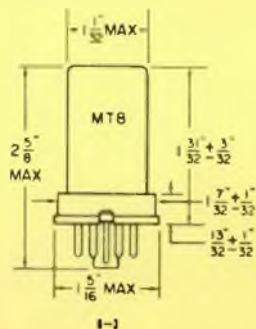
SEPTEMBER 7, 1956

Gaseous f-w rectifier

MECHANICAL DATA

0Z4, 0Z4A

Cathode, cold MT-8
Bulb JETEC 8-3
Outline Octal 6-pin (B6-23)
Base 4R
Basing Any
Mounting Any



PIN CONNECTIONS

Pin 1	Shell
Pin 2	N. C.
Pin 3	Plate 2
Pin 5	Plate 1
Pin 7	N. C.
Pin 8	Cathode

APPLICATION

Type 0Z4 is a gaseous f-w rectifier for mobile equipment employing a vibrator-type power supply.

NOTES

Type 0Z4G has a dwarf shell octal 5-pin base and a T-7 glass envelope.

1A3 • 1A4P/T • 1A5G/GT • 1A6

(See chart for seldom-used tubes)

CBS ELECTRON TUBES



1A7GT



1A7GT

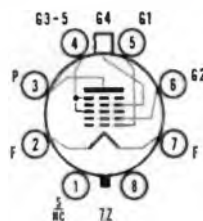
SEPTEMBER 7, 1956

Pentagrid converter

**Radio-frequency converter for portable
battery powered receivers**

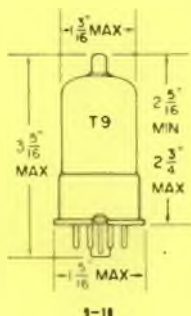
FILAMENT CHARACTERISTICS

Voltage, a-c or d-c.....	1.4 volts
Current.....	50 ma



MECHANICAL DATA

Cathode, coated unipotential.....	T-9
Bulb.....	9-18
Outline.....	9-18
Base.....	Small wafer octal 8-pin, metal sleeve (B8-26)
Basing.....	.72
Cap.....	Skirted miniature (C1-3)
Mounting position.....	Any



ELECTRICAL DATA

MAXIMUM RATINGS (Design center values)

Plate voltage.....	110 volts
Grid 3 and 5 voltage.....	60 volts
Grid 3 and 5 supply voltage.....	110 volts
Grid 2 voltage.....	110 volts
Grid 4 circuit resistance, minimum.....	1.0 meg
Cathode current, total.....	4.0 ma

CHARACTERISTICS AND TYPICAL OPERATION

Converter Service (Separate excitation)

Plate voltage.....	90 volts
Grid 2 (signal grid) voltage.....	90 volts
Grid 3 and 5 (oscillator anode) voltage*.....	45 volts
Grid 4 voltage.....	0 volts
Grid 1 (oscillator grid) resistor.....	0.2 meg
Plate resistance (approx.).....	0.6 meg
Conversion transconductance.....	250 μ hos
Cathode current.....	2.5 ma
Plate current.....	0.6 ma
Grid 3 and 5 (oscillator anode) current.....	0.7 ma
Grid 2 current.....	1.2 ma
Grid 1 (oscillator grid) current.....	0.035 ma

Oscillator Characteristics, Not Oscillating

Plate voltage.....	90 volts
Grid 2 voltage.....	90 volts
Grid 3 and 5 (oscillator anode) voltage.....	45 volts
Grid 4 voltage.....	0 volts
Grid 1 (oscillator grid) voltage.....	0 volts
Transconductance between grid 1 and grid 2.....	550 μ hos
Amplification factor between grid 1 and grid 2.....	40
Cathode current.....	2.2 ma

NOTE:

*Obtained preferably by using a properly by-passed 70,000 ohm resistor in series with a 90-volt supply.

PIN CONNECTIONS

Pin 1.....	B. S.
Pin 2.....	Positive Filament
Pin 3.....	Plate
Pin 4.....	Grid 3, Grid 5
Pin 5.....	Grid 1
Pin 6.....	Grid 2
Pin 7.....	Negative Filament
Pin 8.....	N. C.
Cap.....	Grid 4

1AB5 • 1AF4 • 1AF5

(See chart for seldom-used tubes)



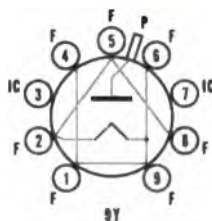
1AX2



Half-wave power rectifier for cathode-ray-tube anode supplies

FILAMENT CHARACTERISTICS

Voltage, a-c or d-c* 1.4 volts
Current 0.65 amp



ELECTRICAL DATA

DIRECT INTERELECTRODE CAPACITANCES

Filament to plate 0.55 μ f

MAXIMUM RATINGS (Design center values unless noted)

Rectifier Service†

Plate voltage, peak inverse (absolute max.) 25,000 volts
Output current, d-c 1.0 ma
Plate current, peak steady state 11.0 ma

TYPICAL OPERATION

TV Pulse Rectifier

Plate voltage, positive pulse 20,000 volts
Plate voltage, negative pulse 5000 volts
Output current, d-c 0.3 ma
Output voltage, d-c 20,000 volts

NOTES:

*Should not be less than 1.2 volts nor more than 1.6 volts.

†Voltage pulse duration must not exceed 10 μ s in a 525-line, 30-frame system.



1B3GT

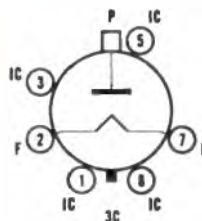


H-w rectifier for cathode-ray-tube anode supplies

FILAMENT CHARACTERISTICS

Voltage, a-c or d-c* 1.25 volts
Current 0.2 amp

*Must not exceed 1.45 volts or be less than 1.05 volts.



CBS ELECTRON TUBES

ENGINEERING DESIGN DATA

1AX2

SEPTEMBER 10, 1956

Single diode

CHARACTERISTIC CURVES

(In curve section following APPENDIX)

Plate 111A

MECHANICAL DATA

Cathode, coated filament

Bulb T-6½

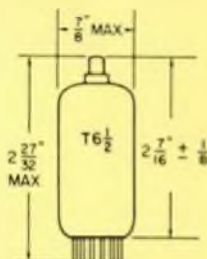
Outline JETEC 6-7

Base Miniature 9-pin (E9-1)

Basing 9Y

Cap. Skirted miniature C1-33 or C1-2

Mounting position Any



PIN CONNECTIONS

Pin 1 Filament, Shield
Pin 2 Filament
Pin 3 N. C.*
Pin 4 Filament, Shield
Pin 5 Filament
Pin 6 Filament, Shield
Pin 7 N. C.*
Pin 8 Filament
Pin 9 Filament
Cap Plate

NOTES

Type 1AX2 is similar to type 1X2B. In most cases type 1AX2 is interchangeable with the 1X2 and 1X2A if the current limiting resistor is removed.

*Do not use except for filament circuit connection.

1B3GT

MAY 6, 1957

Single diode

CHARACTERISTIC CURVES

(In curve section following APPENDIX)

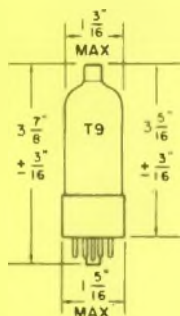
Plate 111A

ENGINEERING DESIGN DATA

1B3GT (cont.)

MECHANICAL DATA

Cathode, coated filament	T-9
Bulb	As shown
Outline	(B5-82, B6-8, or B7-166)
Base	(B5-85, B6-60, or B7-47)
Basing	3C
Cap.	C1-34
Mounting position	Any



PIN CONNECTIONS

Pin 1	I. C.*
Pin 2	Filament
Pin 3	I. C.*
Pin 4	N. C.
Pin 5	I. C.*
Pin 6	N. C.
Pin 7	Filament, I. S.
Pin 8	I. C.*
Cap.	Plate

*Pins 1, 3, 4, 5, 6, and 8 may be connected to pin 7 or its corona shield, 4 and 6 as tie points near filament potential.

NOTES

This tube may produce soft X-rays which can constitute a health hazard. Proper shielding in equipment design will prevent this danger.

1H5GT

SEPTEMBER 10, 1956

Diode—high-mu triode

MECHANICAL DATA

Cathode, coated unipotential	T-9
Bulb	As shown
Outline	JETEC 9-18
Base	Small wafer octal 7-pin (B7-27)
Basing	SZ
Mounting position	Any

1B3GT (cont.)

ELECTRICAL DATA

DIRECT INTERELECTRODE CAPACITANCES

Plate to filament: p to 1 + i.s.	1.3 μ f
----------------------------------	-------------

MAXIMUM RATINGS (Design center values unless noted)

Flyback Rectifier Service*

Plate voltage, peak inverse	26 kv
Total d-c and peak (absolute max.)	21 kv
D-c	0.5 ma
Output current, d-c	50 ma
Plate current, peak steady state	

CHARACTERISTICS

Tube voltage drop conducting 7 ma	100 volts
-----------------------------------	-----------

NOTE:

*Voltage pulse duration must not exceed 10 μ s in a 30-frame, 525-line system.

**1B4/951 • 1B4P/T • 1B5/25S
1B6 • 1B7G/GT • 1B8GT
1C5G/GT • 1C6 • 1C7G • 1C8
1D5GP/GT • 1D7G • 1D8GT
1E4/G • 1E5GP • 1E5G/GT
1E7G/GT • 1F4 • 1F5G • 1F6
1F7G/GH/GV • 1G4G/GT
1G5G/GT • 1G6G/GT
1H4G/GT**

(See chart for seldom-used tubes)



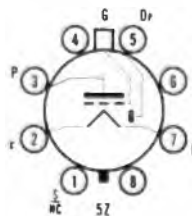
1H5GT



Detector and audio amplifier for battery-type receivers

FILAMENT CHARACTERISTICS

Voltage, d-c	1.4 volts
Current	50 ma



CBS ELECTRON TUBES



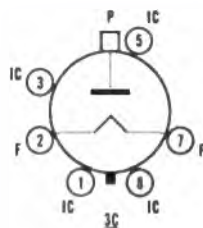
1G3GT/ 1B3GT



H-w rectifier for cathode-ray-tube anode supplies

FILAMENT CHARACTERISTICS

Voltage, a-c*..... 1.25 volts
Current..... 0.2 amp
*Must not exceed 1.45 volts or be less than 1.05 volts.



ELECTRICAL DATA

DIRECT INTERELECTRODE CAPACITANCES

Plate to filament, approx.: p to f + i.s..... 1.3 μ f

MAXIMUM RATINGS (Design center values unless noted)

Rectifier Service	R-f†	Flyback‡	
Plate voltage, peak inverse			
Total d-c and peak (absolute maximum).....	33	26	kv
D-c.....		21	kv
Output current, d-c.....	1.0	0.5	ma
Plate current, peak steady state.....	30	50	ma

CHARACTERISTICS

Tube voltage drop, conducting 7 ma..... 100 volts

NOTES:

†Frequency range of supply voltage is 1.5 Kc to 100 Kc.

‡Voltage pulse duration must not exceed 10 μ s in a 30-frame, 525-line system.

ENGINEERING DESIGN DATA

1G3GT/ 1B3GT

JUNE 1, 1958

Single diode

CHARACTERISTIC CURVES

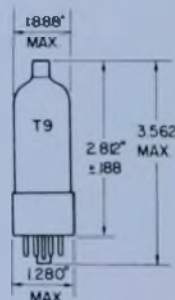
(In curve section following APPENDIX)

Plate, same as for type 1B3GT..... 111A

MECHANICAL DATA

Cathode, coated filament

Bulb.....	T-9
Cap.....	C1-34
Outline, JETEC.....	9-53 or 9-54
Base, JETEC.....	B5-82
B6-8, B7-166, B5-85, B6-60, B7-47	
Basing.....	3C
Mounting position.....	Any



PIN CONNECTIONS

Pin 1.....	I. C.*
Pin 2.....	Filament
Pin 3.....	I. C.*
Pin 4.....	N. C.†
Pin 5.....	I. C.*
Pin 6.....	N. C.‡
Pin 7.....	Filament, I. S.
Pin 8.....	I. C.*

*On 5-pin bases, pin 1 is omitted.

†On 5-pin bases, 6-pin bases, and 7-pin B7-166 base; pin 4 is omitted.

‡On 5-pin bases, 6-pin bases, and 7-pin B7-47 base; pin 6 is omitted.

*Pins 1, 3, 4, 5, 6, and 8 may be connected to pin 7 or its corona shield; 4 and 6 may be tie points near filament potential

NOTE

This tube may produce soft X-rays which can constitute a health hazard. Proper shielding in equipment design will prevent this danger.

ENGINEERING DESIGN DATA

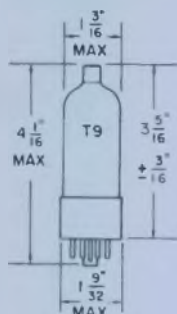
1J3

JUNE 1, 1958

Single diode

MECHANICAL DATA

Cathode, filament	
Bulb	T-9
Outline	As shown
Base JETEC	B6-8, B6-60
Basing	3C
Mounting position	Any



PIN CONNECTIONS

Pin 1	1. C *
Pin 2	Filament
Pin 3	1. C *
Pin 5	1. C *
Pin 7	Filament, 1. S.
Pin 8	1. C *

*Pins 1, 3, 5, and 8 may be connected to pin 7 or its corona shield.

NOTES

This tube may produce soft X-rays which constitute a health hazard. Proper shielding in equipment design will prevent this danger.



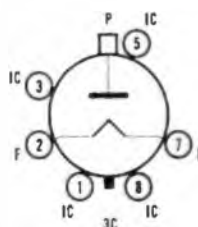
1J3



H-w rectifier for cathode-ray-tube anode supplies

FILAMENT CHARACTERISTICS

Voltage, a-c	1.25 volts
Current	0.2 amp
*Must not exceed 1.45 volts or be less than 1.05 volts.	



ELECTRICAL DATA

DIRECT INTERELECTRODE CAPACITANCES

Plate to filament, approx.: p to f + i.s.	1.6 μ f
---	-------------

MAXIMUM RATINGS (Design center values unless noted)

Rectifier Service†

Plate voltage, peak inverse	
Total d-c and peak (absolute maximum)	26 kv
D-c	21 kv
Output current, d-c	0.5 ma
Plate current, peak steady state	50 ma

CHARACTERISTICS

Tube voltage drop, conducting 7 ma	250 volts
------------------------------------	-----------

NOTE:

†Voltage pulse duration must not exceed 10 μ s in a 30-frame, 525-line system.



1K3

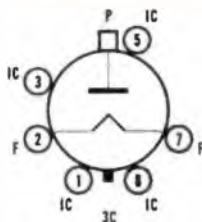


H-w rectifier for cathode-ray-tube anode supplies

FILAMENT CHARACTERISTICS

Voltage, a-c* 1.25 volts
 Current 0.2 amp

*Must not exceed 1.45 volts or be less than 1.05 volts.



ELECTRICAL DATA

DIRECT INTERELECTRODE CAPACITANCES

Plate to filament, approx.: p to f + i.s. 1.6 μ f

MAXIMUM RATINGS (Design center values unless noted) Rectifier Service†

Plate voltage, peak inverse 26 kv
 Total d-c and peak (absolute maximum) 21 kv
 D-c 0.5 ma
 Output current, d-c 50 ma
 Plate current, peak steady state 50 ma

CHARACTERISTICS

Tube voltage drop, conducting 7 ma 250 volts

NOTE:

†Voltage pulse duration must not exceed 10 μ s in a 30-frame, 525-line system.

ENGINEERING DESIGN DATA

1K3

DECEMBER 30, 1959

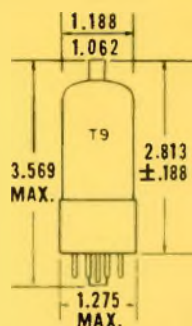
Single diode

CHARACTERISTIC CURVES

(in curve section following APPENDIX)
 Plate 230

MECHANICAL DATA

Cathode, filament T-9
 Bulb As shown
 Outline B6-8, B6-60
 Base, JETEC 3C
 Basing Any
 Mounting position Any



PIN CONNECTIONS

Pin 1 I. C.*
 Pin 2 Filament
 Pin 3 I. C.*
 Pin 5 I. C.*
 Pin 7 Filament, I. S.
 Pin 8 I. C.*

*Pins 1, 3, 5, and 8 may be connected to pin 7 or its corona shield.

NOTES

This tube may produce soft X-rays, which constitute a health hazard. Proper shielding in equipment design will prevent this danger. Type 1K3 is identical to type 1J3 except for bulb length.



1H5GT (cont.)

ELECTRICAL DATA

DIRECT INTERELECTRODE CAPACITANCES—Shield†

Grid to plate: g1 to p	1.1	μμf
Input: g1 to f + b.s.	0.75	μμf
Output: p to f + b.s.	4.6	μμf

†JETEC shield 308 connected to negative filament terminal.

MAXIMUM RATINGS (Design center values)

Plate voltage	110	vols
Diode operation current	0.25	ma

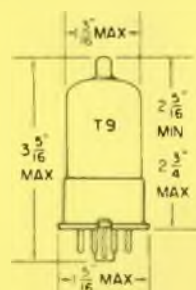
CHARACTERISTICS AND TYPICAL OPERATION

Class A Amplifier

Plate voltage	67.5	90	vols
Control-grid voltage	0	0	vols
Plate resistance (approx.)	0.30	0.24	meg
Transconductance	210	275	μmhos
Amplification factor	60	65	
Plate current	0.06	0.15	ma
Average diode current with 10 volts d-c applied	1.5	1.5	ma

ENGINEERING DESIGN DATA

1H5GT (cont.)



PIN CONNECTIONS

Pin 1	Base Sleeve
Pin 2	Positive Filament
Pin 3	Triode Plate
Pin 4	N. C.
Pin 5	Diode Plate†
Pin 7	Neg. Filament, Diode Shield
Pin 8	N. C.
Cap.	Triode Grid

APPLICATION

CBS type 1H5GT is a filament type diode and high-μ triode designed for use as a combined detector and audio-frequency amplifier in low-drain battery-operated equipment.

NOTES

†Diode plate is located at negative end of filament.

1H6G/GT • 1J5G • 1J6G/GT

(See chart for seldom-used tubes)



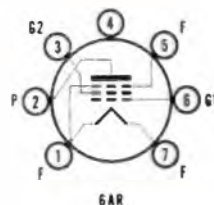
1L4



R-f or i-f amplifier for battery-powered receivers

FILAMENT CHARACTERISTICS

Voltage, d-c.	1.4	vols
Current	50	ma



ELECTRICAL DATA

DIRECT INTERELECTRODE CAPACITANCES

Grid to plate: g1 to p, max.	0.008	μμf
Input: g1 to f + g2 + g3	3.6	μμf
Output: p to f + g2 + g3	7.5	μμf

MAXIMUM RATINGS (Design center values)

Plate voltage	110	vols
Grid 2 voltage	90	vols
Grid 2 supply voltage	110	vols
Grid 1 voltage	0	vols
Cathode current	6.5	ma

1L4

SEPTEMBER 10, 1956

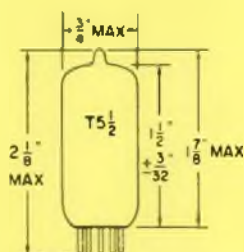
Sharp-cutoff pentode

MECHANICAL DATA

Cathode, coated filament	
Bulb	T-5½
Outline	JETEC 5-2
Base	Miniature 7-pin (E7-1)
Basing	SAR
Mounting position	Any

ENGINEERING DESIGN DATA

1L4 (cont.)



PIN CONNECTIONS

Pin 1	Neg. Filament, Grid 3, I. S.
Pin 2	Plate
Pin 3	Grid 2
Pin 4	N. C.
Pin 5	Neg. Filament, Grid 3, I. S.
Pin 6	Grid 1
Pin 7	Positive Filament

APPLICATION

Type 1L4 is a sharp-cutoff pentode intended for use as an r-f or i-f amplifier in battery-type receivers.

1L4 (cont.)

CHARACTERISTICS AND TYPICAL OPERATION

Class A Amplifier

Plate voltage	90	90	volts
Grid 2 (screen) voltage	67.5	90	volts
Grid 1 (control-grid) voltage	0	0	volts
Plate resistance	0.6	0.35	meg
Transconductance	925	1025	μ hos
Plate current	2.9	4.5	ma
Grid 2 current	1.2	2.0	ma
Grid 1 voltage (approx.) for $I_b = 10 \mu$ a	-6.0	-8.0	volts

**1L6 • 1LA4/E • 1LA6 • 1LB4
1LB6 • 1LC5 • 1LC6 • 1LD5
1LE3 • 1LF3 • 1LG5 • 1LH4
1LN5 • 1N5GT**

(See chart for seldom-used tubes)

**1N6G • 1P5GT/G • 1Q5GT/G
1Q6 • 1R4**

(See chart for seldom-used tubes)



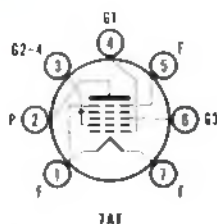
1R5



Radio frequency converter for portable battery powered receivers

FILAMENT CHARACTERISTICS

Voltage, d-c	1.4 volts
Current	50 ma



ELECTRICAL DATA

DIRECT INTERELECTRODE CAPACITANCES

Signal grid to mixer plate: g3 to p	0.4	μmf
R-f input: g3 to all others	7.0	μmf
Mixer output: p to all others	7.5	μmf
Oscillator input: g1 to all others	3.8	μmf
Oscillator grid to mixer plate: g1 to p, max.	0.10	μmf
Oscillator grid to signal grid: g1 to g3, max.	0.2	μmf

MAXIMUM RATINGS (Design center values)

Plate voltage	90 volts
Grid 2 and 4 voltage	67.5 volts
Grid 2 and 4 supply voltage	90 volts
Grid 3 voltage	0 volts
Cathode current, total	5.5 ma

CHARACTERISTICS AND TYPICAL OPERATION

Converter Service (Separate excitation)

Plate voltage	45	67.5	90 volts
Grid 3 (signal grid) voltage	0	0	0 volts
Grid 2 and 4 (oscillator anode) voltage	45	67.5	67.5 volts
Grid 1 (oscillator grid) resistor	0.1	0.1	0.1 meg
Grid 1 (oscillator grid) voltage, rms	15	25	25 volts
Plate resistance (approx.)	0.5	0.4	0.4 meg
Conversion transconductance	210	280	280 μmhos
Cathode current	3.0	5.2	5.3 ma
Plate current	0.7	1.4	1.5 ma
Grid 2 and 4 (oscillator anode) current	2.1	3.5	3.5 ma
Grid 1 (oscillator grid) current	0.15	0.25	0.25 ma
Grid 3 voltage (approx.)			
for $g_c = 10 \mu\text{mhos}$	-7.0	-13	-13 volts
Grid 3 voltage (approx.)			
for $g_c = 100 \mu\text{mhos}$	-2.2	-4.9	-5.0 volts

Oscillator Characteristics, Not Oscillating

Plate voltage	67.5 volts
Grid 3 voltage	0 volts
Grid 2 and 4 (oscillator anode) voltage	67.5 volts
Grid 1 (oscillator grid) voltage	0 volts
Transconductance between grid 1 and grids 2 + 4 connected to plate	1400 μmhos
Amplification factor between grid 1 and grids 2 + 4 connected to plate	6.5
Cathode current	9.0 ma
Grid 1 voltage (approx.) for $I_b = 10 \mu\text{a}$	17 volts

1S4

(See chart for seldom-used tubes)

CBS ELECTRON TUBES

ENGINEERING DESIGN DATA

1R5

APRIL 10, 1956

Pentagrid converter

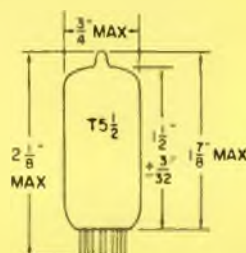
CHARACTERISTIC CURVES

(In curve section following APPENDIX)

Plate-triode connected (G2, 3, & 4 tied to P)	112A
Operation; g_c & I_b vs. I_{c1}	112B
Operation; g_c & I_b vs. I_{c1}	112C
Operation; g_c vs. E_{c3}	112D

MECHANICAL DATA

Cathode, coated filament	
Bulb	T-5 1/2
Outline	S-2
Base	7-pin Miniature (E7-1)
Basing	7AT
Mounting position	Any



PIN CONNECTIONS

Pin 1	Neg. Filament, Grid 5
Pin 2	Plate
Pin 3	Grid 2, Grid 4
Pin 4	Grid 1
Pin 5	Neg. Filament, Grid 5
Pin 6	Grid 3
Pin 7	Positive Filament

APPLICATION

R-f converter for battery-type receivers.

ENGINEERING DESIGN DATA

1S5

APRIL 10, 1956

Diode—sharp-cutoff pentode

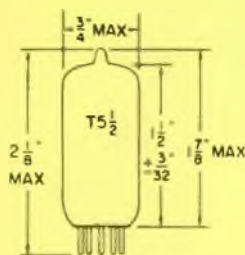
CHARACTERISTIC CURVES

(In curve section following APPENDIX)

Plate ($E_{c2}=67.5V$)	114A
Plate-triode connected	114B
Transfer ($E_b=67.5V$, $E_{c2}=67.5V$)	114C
Transfer ($E_b=67.5V$, $E_{c2}=45V$)	114D
Diode operation	114E

MECHANICAL DATA

Cathode, coated filament	
Bulb	T-5½
Outline	JETEC 5-2
Base	7-pin Miniature (E7-L)
Basing	6AU
Mounting position	Any



PIN CONNECTIONS

Pin 1	Neg. Filament, Grid 3
Pin 2	N. C.
Pin 3	Diode Plate
Pin 4	Grid 2
Pin 5	Plate
Pin 6	Grid 1
Pin 7	Positive Filament

REFERENCES

See APPENDIX for additional R-C amplifier data.

APPLICATION

A-m detector and audio amplifier in battery powered portable radio receivers. The 1S5 is identical to type 1U5 except for basing and capacitances.



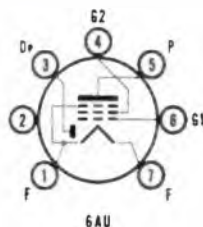
1S5



Diode detector—pentode voltage amplifier for audio service in battery powered receivers

FILAMENT CHARACTERISTICS

Voltage, d-c	1.4 volts
Current	50 ma



ELECTRICAL DATA

DIRECT INTERELECTRODE CAPACITANCES

	No shield	Shielded
Grid to plate: g1 to p, max.	0.2	μμf
Input: g1 to f + g2 + g3	2.2	μμf
Output: p to f + g2 + g3	2.4	μμf
Diode plate to grid 1: dp to g1, max.	0.1	0.1 μμf

†JETEC shield 316 connected to pin 1

MAXIMUM RATINGS (Design center values)

Plate voltage	90 volts
Grid 2 voltage	90 volts
Input: g1 to f + g2 + g3	~50 volts
Grid 1 voltage, positive d-c	0 volts
Cathode current	3.0 ma
Diode current for continuous operation	0.25 ma

CHARACTERISTICS AND TYPICAL OPERATION

Class A Amplifier

Plate voltage	67.5 volts
Grid 3 (suppressor)	connected to filament at socket
Grid 2 supply voltage	67.5 volts
Grid 1 (control-grid) voltage	0 volts
Plate resistance (approx.)	0.6 meg
Transconductance	625 μmhos
Plate current	1.6 ma
Grid 2 current	0.4 ma
Grid 1 voltage (approx.) for $I_b = 10 \mu a$	-5 volts
Diode current, av., at 10 volts d-c	1.5 ma

Pentode unit as resistance coupled amplifier

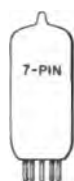
Plate supply voltage	45	90 volts
Grid 2 supply voltage	45	90 volts
Grid 1 voltage	0	0 volts
Plate load resistor	470,000	470,000 ohms
Grid 1 resistor	10	10 meg
Grid 2 series resistor	2.2	2.2 meg
Grid 2 by-pass capacitor	0.1	0.1 μf
Input capacitor	0.01	0.01 μf
Output capacitor	0.01	0.01 μf
Grid resistor of following stage	1.0	1.0 meg
Signal source impedance	1000	1000 ohms
Distortion	5	5 %
Output voltage	5.5	17.0 volts
Voltage gain at 400 cps	33	50

1SA6GT • 1SB6GT

(See chart for seldom-used tubes)



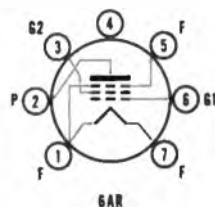
1T4



Pentode voltage amplifier for r-f or i-f service
in battery powered receivers

FILAMENT CHARACTERISTICS

Voltage, d-c	1.4 volts
Current	50 ma



ELECTRICAL DATA

DIRECT INTERELECTRODE CAPACITANCES

	No shield	Shielded
Grid to plate: g1 to p, max.	0.01	0.01 μf
Input: g1 to f + g2 + g3 + i.s.	3.6	3.6 μf
Output: p to f + g2 + g3 + i.s.	7.5	7.5 μf

†JETEC shield 316 connected to pin 1

MAXIMUM RATINGS (Design center values)

Plate voltage	90 volts
Grid 2 voltage	90 volts
Grid 1 voltage, positive d-c	0 volts
Cathode current	5.5 ma

CHARACTERISTICS AND TYPICAL OPERATION

Class A Amplifier

Plate voltage	45	67.5	90	90 volts
Grid 3 (suppressor)	connected to filament at socket			
Grid 2 (screen) voltage	45	67.5	45	67.5 volts
Grid 1 (control-grid) voltage	0	0	0	0 volts
Plate resistance (approx.)	0.35	0.25	0.8	0.5 meg
Transconductance	700	875	750	900 μmhos
Plate current	1.7	3.4	1.8	3.5 ma
Grid 2 current	0.7	1.5	0.65	1.4 ma
Grid 1 voltage (approx.) for $g_m = 10 \mu\text{mhos}$	-10	-16	-10	-16 volts

ENGINEERING DESIGN DATA

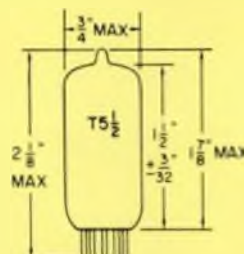
1T4

APRIL 10, 1956

Remote-cutoff
pentode

MECHANICAL DATA

Cathode, coated filament	
Bulb	T-5 1/2
Outline	JETEC 5-2
Base	7-pin Miniature (E7-1)
Banding	6AR
Mounting position	Any



PIN CONNECTIONS

Pin 1	Neg. Filament, Grid 3, I. S.
Pin 2	Plate
Pin 3	Grid 3
Pin 4	N. C.
Pin 5	Neg. Filament, Grid 3, I. S.
Pin 6	Grid 1
Pin 7	Positive Filament

APPLICATION

Remote-cutoff i-f, i-f amplifier. Because of internal shielding an external bulb shield is not needed.

1T5GT

(See chart for seldom-used tubes)

ENGINEERING DESIGN DATA

1U4

APRIL 10, 1956

Sharp-cutoff pentode

CHARACTERISTIC CURVES

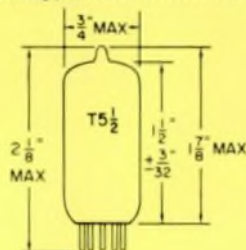
(In curve section following APPENDIX)

Plate ($E_{c2} = 90V$)..... 113A

Transfer ($E_b = 90V$, $E_{c2} = 90V$)..... 113B

MECHANICAL DATA

Cathode, coated filament
Bulb..... T-5½
Outline..... JEDEC 5-2
Base..... 7-pin Miniature (E7-1)
Basing..... 6AR
Mounting position..... Any



PIN CONNECTIONS

Pin 1..... Neg. Filament, Grid 3, I. S.
Pin 2..... Plate
Pin 3..... Grid 2
Pin 4..... N. C.
Pin 5..... Neg. Filament, Grid 3, I. S.
Pin 6..... Grid 1
Pin 7..... Positive Filament

APPLICATION

R-f, i-f amplifier or audio amplifier for which R-C amplifier data are given. This tube is used in battery-powered equipment.

1U5

APRIL 10, 1956

Diode—sharp-cutoff pentode

CHARACTERISTIC CURVES

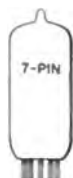
(See type 1S5 for listing)

MECHANICAL DATA

Cathode, coated filament
Bulb..... T-5½
Outline..... JEDEC 5-2
Base..... 7-pin Miniature (E7-1)
Basing..... 6BW
Mounting position..... Any



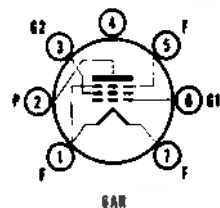
1U4



Pentode voltage amplifier for r-f, i-f and audio service in battery powered receivers

FILAMENT CHARACTERISTICS

Voltage, d-c..... 1.4 volts
Current..... 50 ma



ELECTRICAL DATA

DIRECT INTERELECTRODE CAPACITANCES

	No shield	Shield†	
Grid to plate: g1 to p, max.....	0.01	0.01	μμf
Input: g1 to f + g2 + g3 + i.s.....	3.6	3.6	μμf
Output: p to f + g2 + g3 + i.s.....	7.5	7.5	μμf

†JEDEC shield 316 connected to pin 1 or pin 5

MAXIMUM RATINGS (Design center values)

Plate voltage.....	110 volts
Grid 2 voltage.....	110 volts
Grid 1 voltage, positive d-c.....	0 volts
Cathode current.....	6.0 ma

CHARACTERISTICS AND TYPICAL OPERATION

Class A Amplifier

Plate voltage.....	90 volts
Grid 3 (suppressor).....	connected to filament at socket
Grid 2 (screen) voltage.....	90 volts
Grid 1 (control-grid) voltage.....	0 volts
Plate resistance (approx.).....	1.0 meg
Transconductance.....	900 μmhos
Plate current.....	1.6 ma
Grid 2 current.....	0.45 ma
Grid 1 voltage (approx.) for $I_b = 10 \mu a$	-4 volts



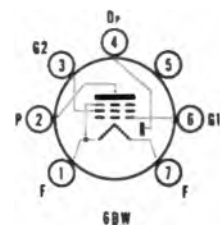
1U5



Diode detector—pentode voltage amplifier for audio service in battery powered receivers

FILAMENT CHARACTERISTICS

Voltage, d-c..... 1.4 volts
Current..... 50 ma



1U5 (cont.)

ELECTRICAL DATA

DIRECT INTERELECTRODE CAPACITANCES

	No shield	Shield†
Grid to plate: g1 to p, max.	0.2	μuf
Input: g1 to f + g2 + g3	2.2	μuf
Output: p to f + g2 + g3	2.4	μuf
Diode plate to grid 1: dp to g1, max.	0.04	0.04 μuf

†JETEC shield 316 connected to pin 1

Type 1U5 is identical to type 1S5 except for basing and capacitances.

ENGINEERING DESIGN DATA

1U5 (cont.)

PIN CONNECTIONS

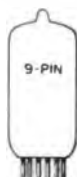
Pin 1	Neg. Filament, Grid 3
Pin 2	Pentode Plate
Pin 3	Grid 2
Pin 4	Diode Plate
Pin 5	N. C.
Pin 6	Grid 1
Pin 7	Positive Filament

1U6 • 1V

(See chart for seldom-used tubes)



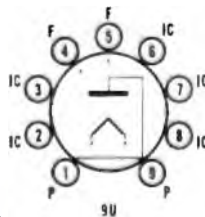
1V2



Half-wave rectifier for cathode-ray-tube anode supplies

FILAMENT CHARACTERISTICS

Voltage, a-c	0.625 volt
Current	0.3 amp



ELECTRICAL DATA

DIRECT INTERELECTRODE CAPACITANCE

Plate to filament	0.8 μuf
-------------------	---------

MAXIMUM RATINGS (Design center values)

Pulsed Rectifier Service*

Plate voltage	
Total d-c and peak (absolute max.)	8.25 kv
D-c	6.6 kv
Plate current, peak steady state	10 ma
Plate current, average	0.5 ma

CHARACTERISTICS

Tube drop conducting 7 ma, approx.	135 volts
------------------------------------	-----------

†Should not exceed .725 volts nor be less than .525 volts.

*Voltage pulse duration must not exceed 10μs in a 525-line, 30 frame system.

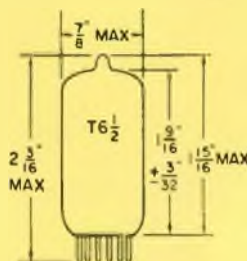
1V2

MAY 14, 1956

Single diode

MECHANICAL DATA

Cathode, coated filament	
Bulb	T-6½
Outline	JETEC 6-2
Base	9-pin Miniature (E9-1)
Basing	9U
Mounting position	Any



PIN CONNECTIONS

Pin 1	Plate
Pin 2	I. C.
Pin 3	I. C.
Pin 4	Filament
Pin 5	Filament
Pin 6	I. C.*
Pin 7	I. C.
Pin 8	I. C.
Pin 9	Plate

*May be connected to filament resistor.

1W4

(See chart for seldom-used tubes)

CBS ELECTRON TUBES

APPLICATION

Half-wave rectifier for television cathode-ray-tube anode supplies.

ENGINEERING DESIGN DATA

1X2

1X2A • 1X2B

APRIL 10, 1956

Single diode

CHARACTERISTIC CURVES

(In curve section following APPENDIX)

Plate 111A

MECHANICAL DATA

Cathode: coated filament
Bulb T-6½
Outline JEDEC 6-7
Base 9-pin Miniature (E9-1)
Basing 9Y
Cap Skirted Miniature (C1-2 or C1-33)
Mounting position Any



PIN CONNECTIONS

Pin 1 Filament I. S.
Pin 2 Filament
Pin 3 N. C.*
Pin 4 I. C. to Pin 1
Pin 5 I. C. to Pin 2
Pin 6 I. C. to Pin 1
Pin 7 N. C.*
Pin 8 I. C. to Pin 2
Pin 9 I. C. to Pin 1
Cap Plate

*Do not use except for filament circuit connection.

REFERENCES

For Absolute Maximum Ratings and Design Center Maximum Ratings systems refer to APPENDIX under RETMA Engineering Standard M9-210.

APPLICATION

Single diode designed for use as a high-voltage rectifier in television receivers and other high-voltage low-current applications. It can be used in both flyback and r-f types of supplies as well as for use at power line frequency.

NOTES

Types 1X2A and 1X2 are identical to the 1X2B except for their lower peak-inverse plate voltages.



1X2

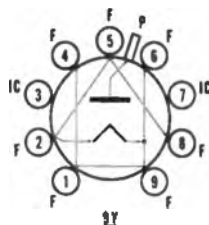
1X2A



Half-wave rectifier for cathode-ray-tube anode supplies

FILAMENT CHARACTERISTICS

Voltage, a-c or d-c 1.25 volts
Current 0.2 amp



MAXIMUM RATINGS (Absolute maximum value)

	1X2	1X2A
Plate voltage, peak inverse	15	20 kv

Types 1X2 and 1X2A are identical to type 1X2B except for lower peak inverse plate voltage.



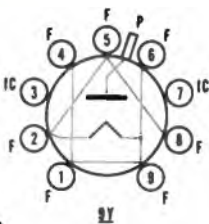
1X2B



Half-wave rectifier for cathode-ray-tube anode supplies

FILAMENT CHARACTERISTICS

Voltage, a-c or d-c 1.25 volts
Current 0.2 amp



ELECTRICAL DATA

DIRECT INTERELECTRODE CAPACITANCE

Plate to filament 1.0 μ f

MAXIMUM RATINGS (Design center values unless noted)

Flyback Rectifier Service*
Plate voltage, peak inverse (absolute max.) 22 kv
Output current, d-c 0.5 ma
Plate current, peak steady state 45 ma

CHARACTERISTICS

Tube Voltage Drop
Conducting 7 ma 100 volts

TYPICAL OPERATION

Flyback Rectifier Service*
Peak plate voltage, positive 18 kv
Peak plate voltage, negative 2,000 volts
Output voltage, d-c 18 kv
Peak plate current 35 ma
Output current, d-c 0.1 ma

NOTES:

*Voltage pulse duration must not exceed 10 μ s in a 525-line, 30-frame system.

2A3/2A3H • 2A5 • 2A6 • 2A7/S

(See chart for seldom-used tubes)



2AF4



Triode for uhf local oscillator service, heater warm-up controlled for series strings

Type 2AF4 is identical to type 2AF4A except for bulb length.



2AF4A

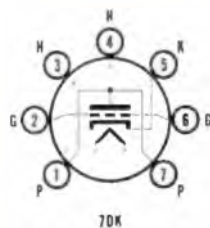


Triode for uhf local oscillator service, heater warm-up controlled for series strings

HEATER CHARACTERISTICS

Voltage, a-c or d-c.....	2.35 volts
Current.....	600 ma
Peak heater-cathode voltage, max.	
Heater negative to cathode.....	50 volts
Heater positive to cathode*.....	50 volts
Warm-up time.....	11 secs. average
(See Series-String Heaters section of APPENDIX in CBS Tube Manual)	

*D-c component must not exceed 25 volts max.



ELECTRICAL DATA

DIRECT INTERELECTRODE CAPACITANCES

Grid to plate: g1 to p.....	1.9 μ f
Input: g1 to k + h.....	2.2 μ f
Output: p to k + h.....	0.45 μ f

MAXIMUM RATINGS (Design center values)

Plate voltage.....	150 volts
Control-grid voltage, negative d-c.....	-50 volts
Control-grid current, d-c.....	8.0 ma
Plate input.....	2.5 watts
Plate dissipation.....	2.25 watts
Cathode current.....	28 ma
Control-grid circuit resistance	
Fixed bias.....	Not recommended
Self bias.....	0.5 meg

CBS ELECTRON TUBES

ENGINEERING DESIGN DATA

2AF4

APRIL 10, 1956

Medium-mu triode

MECHANICAL DATA

Bulb.....	T-5½
Outline.....	JETEC 5-2
Maximum over-all length.....	2½ inches
Maximum seated height.....	1½ inches

2AF4A

APRIL 10, 1956

Medium-mu triode

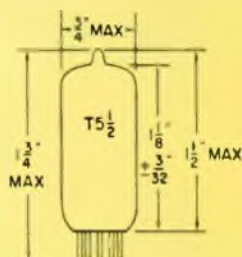
CHARACTERISTIC CURVES

(In curve section following APPENDIX)

Plate.....	116A
Transfer (r_p , g_m , μ).....	116B
Average, i_c , ΔE_c	116C

MECHANICAL DATA

Cathode, coated unipotential	
Bulb.....	T-5½
Outline.....	JETEC 5-1
Base.....	7-pin Miniature (E7-1)
Basing.....	7DK
Mounting position.....	Any



PIN CONNECTIONS

Pin 1.....	Plate
Pin 2.....	Grid
Pin 3.....	Heater
Pin 4.....	Heater
Pin 5.....	Cathode
Pin 6.....	Grid
Pin 7.....	Plate

ENGINEERING DESIGN DATA

2AF4A (cont.)

REFERENCES

See discussion of series-string heater circuits in APPENDIX.

APPLICATION

UHF TV receiver local oscillator for 600-ma series-string heater circuits.

NOTES

The 2AF4A is identical to type 6AF4A except for heater characteristics. Type 2AF4 and 6AF4 are identical to the 2AF4A and 6AF4A respectively except for bulb length.

2AF4A (cont.)

CHARACTERISTICS

Class A₁ Amplifier

Plate voltage.....	80	100	volts
Cathode-bias resistor.....	150	150	ohms
Plate resistance (approx.).....	2270	2130	ohms
Transconductance.....	6600	7500	μ mhos
Amplification factor.....	15	16	
Plate current.....	16	20	ma

TYPICAL OPERATION

Oscillator at 350 megacycles

Plate voltage.....	100	volts
Control-grid voltage.....	-4	volts
Control-grid resistor.....	10,000	ohms
Plate current.....	22	ma
Control-grid current.....	0.4	ma
Power output.....	160	mw

2B3

JUNE 1, 1957

Single diode

CHARACTERISTIC CURVES

(In curve section following APPENDIX)

Plate.....111A

APPLICATION

Type 2B3 is a high voltage rectifier intended for CRT anode supplies. It differs electrically from the type 1B3GT in its higher filament voltage designed for connection to the flyback transformer without a dropping resistor.



2B3

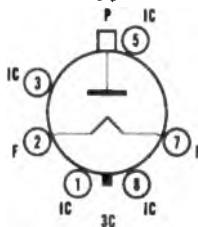


H-w rectifier for cathode-ray-tube anode supplies

FILAMENT CHARACTERISTICS

Voltage, a-c or d-c.....	1.75	volts
Current.....	0.25	amp

*Must not exceed 2.0 volts or be less than 1.5 volts.



Type 2B3 is identical to type 1B3 except for filament characteristics and basing.

2B7/S

(See chart for seldom-used tubes)



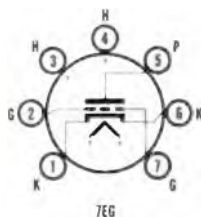
2BN4



R-f amplifier in vhf television tuners, heater warm-up controlled for series strings

HEATER CHARACTERISTICS

Voltage, a-c or d-c	2.3 volts
Current	600 ma
Peak heater-cathode voltage, max.	
Heater negative to cathode	100 volts
Heater positive to cathode	100 volts
Warm-up time	11 secs. average
(See Series-String Heaters section of APPENDIX in CBS Tube Manual).	



ELECTRICAL DATA

DIRECT INTERELECTRODE CAPACITANCES—Shield

Grid to plate: g1 to p	1.2 μf
Input: g1 to k + h	3.2 μf
Output: p to k + h	1.4 μf
Heater to cathode: h to k	2.8 μf

†JETEC shield 316 connected to cathode.

MAXIMUM RATINGS (Design maximum values)

Plate voltage	275 volts
Control-grid voltage, positive d-c	0 volts
Plate dissipation	2.2 watts
Cathode current	22 ma
Control-grid circuit resistance	0.5 meg

CHARACTERISTICS AND TYPICAL OPERATION

Class A Amplifier

Plate voltage	150 volts
Cathode-bias resistor	220 ohms
Plate resistance (approx.)	6300 ohms
Transconductance	6800 μmhos
Amplification factor	43
Plate current	9.0 ma
Control-grid voltage (approx.) for $I_b = 100 \mu\text{a}$	-6.0 volts

ENGINEERING DESIGN DATA

2BN4

JUNE 1, 1957

Medium-mu triode

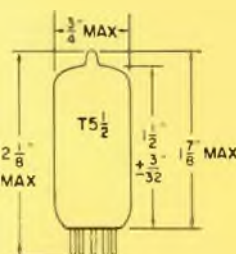
CHARACTERISTIC CURVES

(In curve section following APPENDIX)

Plate	101A
Transfer	101B
Characteristics; r_p , g_m , μ	101C

MECHANICAL DATA

Cathode, coated unipotential	
Bulb	T-5½
Outline	JETEC 5-2
Base	Miniature 7-pin (E7-1)
Basing	7EG
Mounting position	Any



PIN CONNECTIONS

Pin 1	Cathode
Pin 2	Grid
Pin 3	Heater
Pin 4	Heater
Pin 5	Plate
Pin 6	Cathode
Pin 7	Grid

REFERENCE

See explanation of warm-up controlled heater circuits in APPENDIX.

APPLICATION

Type 2BN4 is a miniature medium-mu triode intended primarily for application as an r-f amplifier in vhf television tuners. It is similar to one section of a 6BZ7.

NOTES

Type 2BN4 is identical to 3BN4 and 6BN4 except for heater characteristics.

2E5 • 2G5 • 2S/4S

(See chart for seldom-used tubes)



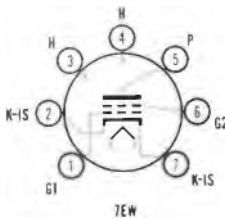
2CY5



Tetrode voltage amplifier for r-f service in VHF tuners of series string heater TV receivers

HEATER CHARACTERISTICS

Voltage, a-c or d-c.....	2.4 volts
Current.....	600 ma
Peak heater-cathode voltage, max.	
Heater negative to cathode.....	100 volts
Heater positive to cathode.....	100 volts
Warm-up time.....	11 secs. average
(See Series-String Heaters section of APPENDIX in CBS Tube Manual)	



ELECTRICAL DATA

DIRECT INTERELECTRODE CAPACITANCES

Grid to plate: g1 to p, max.....	0.03 μ f
Input: g1 to k + h + g2.....	4.3 μ f
Output: p to k + h + g2.....	2.75 μ f

†JETEC shield 316 connected to cathode.

MAXIMUM RATINGS (Design maximum values)

Plate voltage.....	180 volts
Grid 2 voltage.....	See Rating Chart in APPENDIX
Grid 2 supply voltage.....	180 volts
Grid 1 voltage, positive d-c.....	0 volts
Plate dissipation.....	2.0 watts
Grid 2 dissipation.....	0.5 watt
Cathode current.....	20 ma

CHARACTERISTICS AND TYPICAL OPERATION

Class A Amplifier

Plate voltage.....	125 volts
Grid 2 (screen) voltage.....	80 volts
Grid 1 (control-grid) voltage.....	-1 volts
Plate resistance (approx.).....	0.125 meg
Transconductance.....	8000 μ mhos
Plate current.....	10 ma
Grid 2 current.....	1.4 ma
Grid 1 voltage (approx.) for $I_b = 20 \mu$ a.....	-6 volts

NOTES:

Other heater voltage versions of this tube include types: 3CY5 with a 2.9 volt, 450 ma warm-up controlled heater; 4CY5 with a 4.5 volt, 300 ma warm-up controlled heater; 6CY5 with a 6.3 volt, 200 ma heater.

ENGINEERING DESIGN DATA

2CY5

JUNE 1, 1958

Vhf tetrode

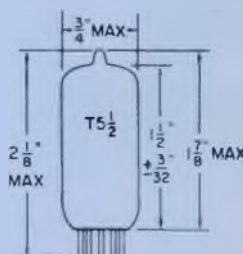
CHARACTERISTIC CURVES

(In curve section following APPENDIX)

Screen Grid Rating.....	100A
Transfer; I_p , gm, I_b , I_{c2}	216A
Hot input impedance.....	216B

MECHANICAL DATA

Cathode, coated unipotential.....	
Bulb.....	T-5½
Outline.....	JETEC 5-2
Base.....	7-pin Miniature (E7-1)
Basing.....	7EW
Mounting position.....	Any



PIN CONNECTIONS

Pin 1.....	Grid 1
Pin 2.....	Cathode, I. S.
Pin 3.....	Heater
Pin 4.....	Heater
Pin 5.....	Plate
Pin 6.....	Grid 2
Pin 7.....	Cathode, I. S.

APPLICATION

Designed for better operation of vhf tuners, providing maximum gain-to-noise ratio. It has a high input impedance for a favorable gain-bandwidth factor.





2T4

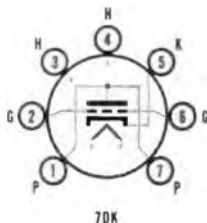


Triode for uhf local oscillator service, heater warm-up controlled for series strings

HEATER CHARACTERISTICS

Voltage, a-c or d-c	2.35 volts
Current	600 ma
Peak heater-cathode voltage, max.	
Heater negative to cathode	50 volts
Heater positive to cathode*	50 volts
Warm-up time	11 secs. average
(See Series-String Heaters section of APPENDIX in CBS Tube Manual)	

*D-c component must not exceed 25 volts max.



ELECTRICAL DATA

DIRECT INTERELECTRODE CAPACITANCES

	No shield	Shield†	
Grid to plate: g1 to p	1.7	1.7	μf
Input: g1 to k + h	3.3	2.9	μf
Output: p to k + h	1.8	0.25	μf
Heater to cathode†	2.9	3.0	μf
Grid to cathode†	2.6	2.6	μf
Plate to cathode†	0.18	0.2	μf
Grounded grid operation			
Input	5.7	5.5	μf
Output	3.4	1.8	μf

†JETEC shield 316 connected to cathode.

†Measured between specified elements only. When external shield is used it shall be grounded.

MAXIMUM RATINGS (Design center values)

Plate voltage	200 volts
Control-grid current, d-c	3.0 ma
Plate dissipation	3.5 watts
Cathode current	30 ma

CHARACTERISTICS

Class A Amplifier

Plate voltage	80 volts
Cathode-bias resistor	150 ohms
Plate resistance (approx.)	1860 ohms
Transconductance	7000 μmhos
Amplification factor	13
Plate current	18 ma
Control-grid voltage (approx.) for $I_b = 50 \mu\text{a}$	-15 volts

TYPICAL OPERATION

Oscillator at 950 megacycles

Plate voltage	80 volts
Control-grid voltage (self bias)	-4 volts
Control-grid resistor	10,000 ohms
Plate current	18 ma
Control-grid current	400 μa

ENGINEERING DESIGN DATA

2T4

APRIL 10, 1956

Medium-mu triode

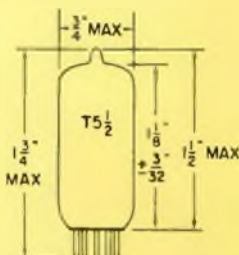
CHARACTERISTIC CURVES

(In curve section following APPENDIX)

Plate	117A
Plate (Positive E_c)	117B
Transfer ($E_b = 80\text{V}$)	117C

MECHANICAL DATA

Cathode, coated unipotential	
Bulb	T-5½
Outline	JETEC 5-1
Base	7-pin Miniature (E7-1)
Basing	7DK
Mounting position	Any



PIN CONNECTIONS

Pin 1	Plate
Pin 2	Grid 1
Pin 3	Heater
Pin 4	Heater
Pin 5	Cathode
Pin 6	Grid 1
Pin 7	Plate

REFERENCES

See discussion of series-string heater circuits in APPENDIX.

APPLICATION

Uhf TV receiver local oscillator for 600-ma series-string heater circuits.

NOTES

The 2T4 is identical to type 6T4 except for heater characteristics.

2V2•2V3G•2W3/GT•2Z2/G84

(See chart for seldom-used tubes)

CBS ELECTRON TUBES

ENGINEERING DESIGN DATA

3A2

APRIL 27, 1956

Single h-v diode

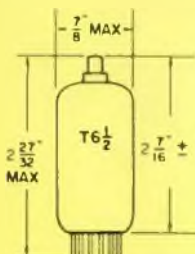
CHARACTERISTIC CURVES

(in curve section following APPENDIX)

Plate..... 111A

MECHANICAL DATA

Cathode, coated unipotential
Bulb..... T-6½
Outline..... JETEC 6-7
Base..... 9-pin Miniature (E9-1)
Basing..... 9DT
Cap..... Skirted Miniature (C1-33)
Mounting position..... Any



PIN CONNECTIONS

Pin 1..... Heater, Cathode, I. S.
Pin 2..... Heater
Pin 3..... N. C.*
Pin 4..... Heater, Cathode, I. S.
Pin 5..... Heater
Pin 6..... Heater, Cathode
Pin 7..... N. C.*
Pin 8..... Heater
Pin 9..... Heater, Cathode, I. S.
Cap..... Plate

*May be used as the point for heater dropping resistor or may be connected to heater. Do not connect to any other circuit.

APPLICATION

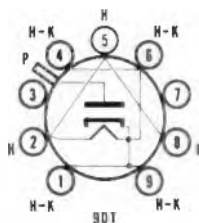
Type 3A2 is a high voltage, half-wave rectifier suitable for television flyback type power supplies. The average output current and voltage is suitable for picture tube anode power.



3A2



Half-wave rectifier for cathode-ray-tube
anode supplies



HEATER CHARACTERISTICS

Voltage, a-c..... 3.15 volts

Current..... 0.22 amp

ELECTRICAL DATA

DIRECT INTERELECTRODE CAPACITANCE

Plate to cathode, heater,
and internal shield: p to k + h + i.s..... 1.0 μ f

MAXIMUM RATINGS (Design center values)

TV Pulse Rectifier Service*

Plate voltage, peak inverse..... 18 kv

Plate current, peak steady state..... 80 ma

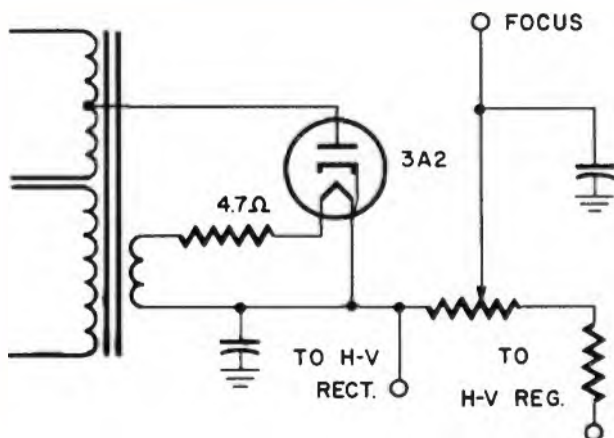
Plate current, average..... 1.5 ma

NOTES:

*Voltage pulse duration must not exceed 10 μ s in a 525-line, 30-frame system.

TYPICAL CIRCUIT

TRI-COLOR FOCUS RECT.





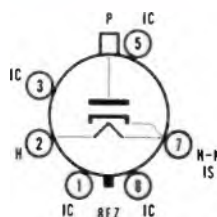
3A3



Half-wave rectifier for tricolor cathode-ray-tube
anode supplies

HEATER CHARACTERISTICS

Voltage, a-c.....	3.15 volts
Current.....	0.22 amp



ELECTRICAL DATA

DIRECT INTERELECTRODE CAPACITANCE

Plate to cathode, heater, internal shield: p to k + h + i.s.....	1.5	μf
---	-----	----

MAXIMUM RATINGS (Design center values)

TV Pulse Rectifier Service*

Plate voltage, peak inverse.....	30	kv
Plate current, peak steady state.....	80	ma
Plate current, average.....	1.5	ma

NOTES:

*Voltage pulse duration must not exceed 10 μs in a 525-line, 30-frame system.

3A5 • 3A8GT

(See chart for seldom-used tubes)



3A5

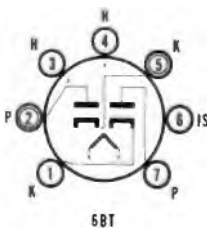


Duodiode detector for warm-up time controlled,
600-ma heater strings

HEATER CHARACTERISTICS

Voltage, a-c or d-c.....	3.15 volts
Current.....	600 ma
Peak heater-cathode voltage, max. Heater negative to cathode.....	200 volts
Heater positive to cathode*.....	200 volts
Warm-up time.....	11 secs. average (See Series-String Heaters section of APPENDIX in CBS Tube Manual)

*D-c component must not exceed 100
volts max.



CBS ELECTRON TUBES

ENGINEERING DESIGN DATA

3A3

APRIL 24, 1956

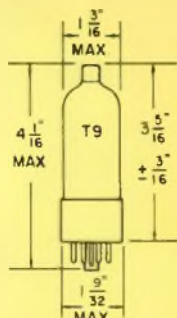
Single diode

CHARACTERISTIC CURVES

(In curve section following APPENDIX
Plate..... 111A

MECHANICAL DATA

Cathode, coated unipotential
Bulb..... T-4
Outline..... As shown
Base Intermediate shell 6-pin octal (B6-8)
Basing..... 8E2
Cap..... Small (C1-34)
Mounting position..... Any



PIN CONNECTIONS

Pin 1.....	I. C./
Pin 2.....	Heate
Pin 3.....	I. C./
Pin 5.....	I. C./
Pin 7.....	Heater, Cathode, I.S
Pin 8.....	I. C./
Cap.....	Plate

*Do not use except for heater circuit
connection.

APPLICATION

The 3A3 is a high-voltage half-wave recti-
fier designed for use in the flyback
system of color television receivers to
provide dependable anode power for the
picture tube.

3A5

APRIL 27, 1956

Double diode

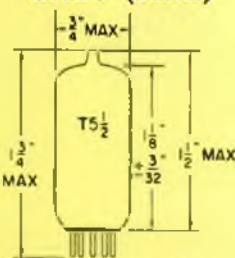
CHARACTERISTIC CURVES

(In curve section following APPENDIX)
Plate..... 120A
Operation..... 120E
Operation..... 120C

MECHANICAL DATA

Cathode, coated unipotential
Bulb..... T-5½
Outline..... JETEC 5-1
Base..... 7-pin Miniature (E7-1)
Basing..... 6B1
Mounting position..... Any

3AL5 (cont.)



PIN CONNECTIONS

Pin 1	Cathode (Sect. 1)
Pin 2	Plate (Sect. 2)
Pin 3	Heater
Pin 4	Heater
Pin 5	Cathode (Sect. 2)
Pin 6	Internal Shield
Pin 7	Plate (Sect. 1)

APPLICATION

Type 3AL5 is a miniature double diode designed for high-frequency operation. Each section has a resonant frequency of approximately 700 megacycles. An internal shield connected to pin 6 permits independent operation of each diode.

NOTES

Type 3AL5 is identical to the 6AL5 and 12AL5 except for heater characteristics.

3AU6

APRIL 27, 1956

Sharp-cutoff pentode

CHARACTERISTIC CURVES

(In curve section following APPENDIX)

Screen Grid Rating	100A
Plate ($E_{c2}=100V$)	121A
Plate ($E_{c2}=150V$)	121B
Plate—triode connected	121C
Transfer; I_b & I_{c2}	121D
Transfer; g_m	121E

MECHANICAL DATA

Cathode, coated unipotential	
Bulb	T-5 1/2
Outline	JETEC S-2
Base	7-pin Miniature (E7-1)
Basing	7BK
Mounting position	Any

3AL5 (cont.)

ELECTRICAL DATA

DIRECT INTERELECTRODE CAPACITANCES

	No Shield	Shield†	
Plate input (each section): p to k + h & i.s.	2.5	3.2	$\mu\mu\text{f}$
Cathode input (each section): k to p + h & i.s.	3.4	3.6	$\mu\mu\text{f}$
Plate to plate:			
p1 to p2 (all others grounded), max.	0.068	0.026	$\mu\mu\text{f}$
Cold resonant frequency (each unit, approx.)	700		mc
†JETEC shield 316 connected to pin 6.			

MAXIMUM RATINGS (Design center values)

Plate voltage, peak inverse	330	volts
Plate current, peak steady state (each plate)	54	ma
Output current, d-c (each plate)	9	ma

TYPICAL OPERATION

Half-Wave Rectifier*

Plate supply voltage, rms (each plate)	117	volts
Plate supply impedance, min. total effective (each plate)	300	ohms
Output current, d-c (each plate)	9.0	ma

NOTES:

*The two units may be used separately or in parallel.



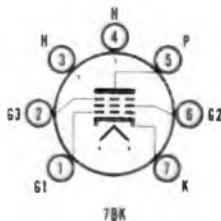
3AU6



**R-f amplifier, f-m limiter, & audio amplifier,
heater warm-up controlled for series strings**

HEATER CHARACTERISTICS

Voltage, a-c or d-c	3.15	volts
Current	600	ma
Peak heater-cathode voltage, max.		
Heater negative to cathode	200	volts
Heater positive to cathode*	200	volts
Warm-up time	11	secs. average
(See Series-String Heaters section of APPENDIX in CBS Tube Manual)		
*D-c component	100	volts max.



ELECTRICAL DATA

DIRECT INTERELECTRODE CAPACITANCES

Grid to plate: g1 to p, max.	0.0035	$\mu\mu\text{f}$
Input: g1 to k + h + g2 + g3 & i.s.	5.5	$\mu\mu\text{f}$
Output: p to k + h + g2 + g3 & i.s.	5.0	$\mu\mu\text{f}$

3AU6 (cont.)

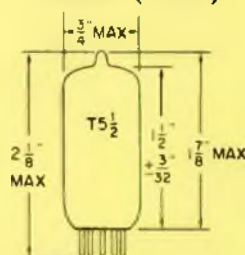
MAXIMUM RATINGS (Design center values)

	Triode†	Pentode
Plate voltage	250	300 volts
Grid 2 voltage	See Rating Chart in Appendix	
Grid 2 supply voltage	0	300 volts
Grid 1 voltage, positive d-c.	0	0 volts
Plate dissipation	3.2	3 watts
Grid 2 dissipation	0.65	watt

CHARACTERISTICS AND TYPICAL OPERATION

Class A Amplifier	Triode†		Pentode	
Plate supply voltage.....	250	100	250	250 volts
Grid 3 (suppressor).....	connected to cathode at socket			
Grid 2 (screen) voltage.....		100	125	150 volts
Cathode bias resistor.....	330	150	100	68 ohms
Plate resistance (approx.).....	.0075	0.5	1.5	1.0 meg
Transconductance.....	4800	3900	4500	5200 μ hos
Plate current.....	12.2	5.0	7.6	10.6 ma
Grid 2 current.....		2.1	3.0	4.3 ma
Grid 1 voltage (approx.) for $I_b = 10 \mu$ a.....		-4.2	-5.5	-6.5 volts
Amplification factor.....	36			
†Grid 2 (screen) tied to plate.				

3AU6 (cont.)



PIN CONNECTIONS

Pin 1	Grid 1
Pin 2	Grid 3, i. s.
Pin 3	Heater
Pin 4	Heater
Pin 5	Plate
Pin 6	Grid 2
Pin 7	Cathode

REFERENCES

See the APPENDIX for R-C amplifier data

NOTES

Type 3AU6 is identical to 4AU6, 6AU6 and 12AU6 except for heater characteristics.



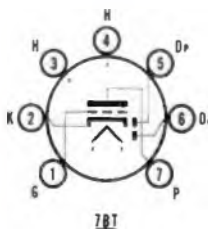
3AV6



Detector, avc, and audio amplifier, heater warm-up controlled for series strings

HEATER CHARACTERISTICS

Voltage, a-c or d-c	3.15 volts
Current	600 ma
Peak heater-cathode voltage, max.	
Heater negative to cathode	200 volts
Heater positive to cathode*	200 volts
Warm-up time	11 secs. average
(See Series-String Heaters section of APPENDIX in CBS Tube Manual)	
*D-c component must not exceed 100 volts max.	



ELECTRICAL DATA

DIRECT INTERELECTRODE CAPACITANCES

	No Shield	Shield†	
Grid to plate: g1 to p	2.0	2.0	μ f
Input: g1 to k + h	2.2	2.2	μ f
Output: p to k + h	0.8	1.2	μ f
Plate (diode 2) to grid, max.	0.04	0.04	μ f
†JETEC shield 316 connected to cathode			

3AV6

APRIL 27, 1956

**Duodiode—
high-mu triode**

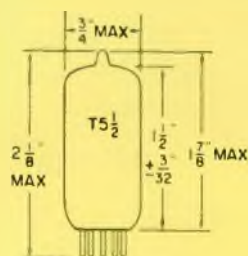
CHARACTERISTIC CURVES

(In curve section following APPENDIX)

Plate	122A
Transfer; f_p , gm, μ a.	122B
Operation; each diode	122C

MECHANICAL DATA

Cathode, coated unipotential	
Bulb	T-5½
Outline	JETEC 5-2
Base	7-pin Miniature (E7-1)
Basing	7BT
Mounting position	Any



CBS ELECTRON TUBES

ENGINEERING DESIGN DATA

3AV6 (cont.)

PIN CONNECTIONS

Pin 1	Triode Grid
Pin 2	Cathode
Pin 3	Heater
Pin 4	Heater
Pin 5	Diode Plate 2
Pin 6	Diode Plate 1
Pin 7	Triode Plate

REFERENCES

See explanation of series-string heater circuits in APPENDIX. R-C amplifier data for this tube is included in the APPENDIX.

APPLICATION

Type 3AV6 is a miniature, high mu duodiode-triode designed for use as a detector, avc tube, and audio amplifier in 600-ma. heater strings. When used in heater strings with other 600-ma. types having the same heater warm-up characteristic, heater voltage surges across the individual tubes will be minimized during warm-up.

NOTES

Type 3AV6 is identical to type 6AV6 and 12AV6 except for heater characteristics.

3AV6 (cont.)

MAXIMUM RATINGS (Design center values)

Plate voltage	300 volts
Diode voltage drop conducting 0.8 ma.	10 volts
Control-grid voltage, positive d-c.	0 volts
Plate dissipation	0.5 watt

CHARACTERISTICS AND TYPICAL OPERATION

Class A Amplifier

Plate voltage	100	250 volts
Control-grid voltage	-1	-2 volts
Plate resistance (approx.)	.08	.0625 meg
Transconductance	1250	1600 μ hos
Amplification factor	100	100
Plate current	0.5	1.2 ma

3B7/1291

(See chart for seldom-used tubes)

3BA6

MAY 18, 1956

Remote-cutoff pentode



3BA6

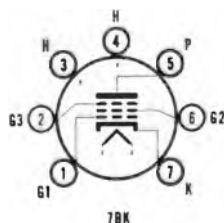


Pentode amplifier for r-f or i-f service, heater warm-up controlled for series strings

HEATER CHARACTERISTICS

Voltage, a-c or d-c	3.15 volts
Current	600 ma
Peak heater-cathode voltage, max.	
Heater negative to cathode	200 volts
Heater positive to cathode*	200 volts
Warm-up time	11 secs. average
(See Series-String Heaters section of APPENDIX in CBS Tube Manual)	

*D-c component must not exceed 100 volts max.



CHARACTERISTIC CURVES

(In curve section following APPENDIX)

Screen Grid Rating	100A
Plate ($E_{c2}=100V$)	124A
Transfer, I_{c2} ($E_b=250V$)	124B
Transfer, I_b ($E_b=250V$)	124C
Transfer, g_m ($E_b=250V$)	124D

MECHANICAL DATA

Cathode, coated unipotential	
Bulb	T-5 1/2
Outline	JETEC 5-2
Base	7-pin Miniature (E7-1)
Basing	7BK
Mounting position	Any

CBS ELECTRON TUBES

3BA6 (cont.)

ELECTRICAL DATA

DIRECT INTERELECTRODE CAPACITANCES

	No Shield	Shielded	
Grid to plate: g1 to p, max.	0.0035	0.0035	μf
Input: g1 to k + h + g2 + g3	5.5	5.5	μf
Output: p to k + h + g2 + g3	5.0	5.5	μf

†JETEC shield 316 connected to cathode.

MAXIMUM RATINGS (Design center values)

Plate voltage	300 volts
Grid 2 voltage	See Rating Chart in Appendix
Grid 2 supply voltage	300 volts
Grid 1 voltage, negative d-c	50 volts
Grid 1 voltage, positive d-c	0 volts
Plate dissipation	3.0 watts
Grid 2 dissipation	0.6 watt

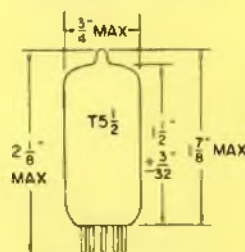
CHARACTERISTICS AND TYPICAL OPERATION

Class A Amplifier

Plate voltage	100	250 volts
Grid 3 (suppressor)	connected to cathode at socket	
Grid 2 (screen) voltage	100	100 volts
Cathode bias resistor	68	68 ohms
Plate resistance (approx.)	0.25	1.0 meg
Transconductance	4300	4400 μmhos
Plate current	10.8	11.0 ma
Grid 2 current	4.4	4.2 ma
Grid 1 voltage (approx.) for $g_m = 40 \mu\text{mhos}$	-20	-20 volts

ENGINEERING DESIGN DATA

3BA6 (cont.)



PIN CONNECTIONS

Pin 1	Grid 1
Pin 2	Grid 3, I. S.
Pin 3	Heater
Pin 4	Heater
Pin 5	Plate
Pin 6	Grid 2
Pin 7	Cathode

REFERENCES

See explanation of series-string heater circuits in APPENDIX.

APPLICATION

Type 3BA6 is a miniature, remote-cutoff pentode designed for use as a high gain i-f or i-f amplifier. It features low grid-to-plate capacitance, high transconductance, and controlled heater warm-up time characteristics.

NOTES

Type 3BA6 is identical to the 6BA6 and 12BA6 except for heater characteristics.



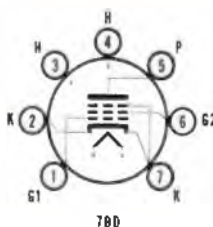
3BC5



Pentode amplifier for r-f or i-f service, heater warm-up controlled for series strings

HEATER CHARACTERISTICS

Voltage, a-c or d-c	3.15 volts
Current	600 ma
Peak heater-cathode voltage, max.	
Heater negative to cathode	200 volts
Heater positive to cathode*	200 volts
Warm-up time	11 secs. average
(See Series-String Heaters section of APPENDIX in CBS Tube Manual)	
*D-c component must not exceed 100 volts max.	



CBS ELECTRON TUBES

3BC5

APRIL 27, 1956

Sharp-cutoff pentode

CHARACTERISTIC CURVES

(In curve section following APPENDIX)

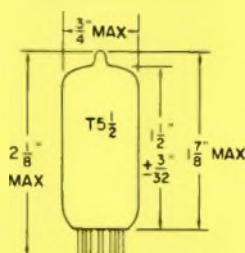
Screen Grid Rating	100A
Plate ($E_{c2} = 150V$)	125A
Plate, $\Delta E_{c2} (E_{c1} = 0V)$	125B
Transfer; i_b & $i_{c2} (E_b = 250V)$	125C
Transfer; $g_m (E_b = 250V)$	125D

MECHANICAL DATA

Cathode, coated unipotential	
Bulb	T-5½
Outline	JETEC 5-2
Base	7-pin Miniature (E7-1)
Basing	7BD
Mounting position	Any

ENGINEERING DESIGN DATA

3BC5 (cont.)



PIN CONNECTIONS

Pin 1	Grid 1
Pin 2	Cathode, Grid 3, I. S.
Pin 3	Heater
Pin 4	Heater
Pin 5	Plate
Pin 6	Grid 2
Pin 7	Cathode, Grid 3, I. S.

REFERENCES

See explanation of series-string heater circuits in the APPENDIX. The APPENDIX section describing screen grid voltage ratings gives complete details required for designing the screen power circuit for this tube.

APPLICATION

Type 3BC5 is a sharp-cutoff pentode of miniature construction. It may be used at frequencies up to 400 megacycles and is useful in television receivers.

NOTES

Type 3BC5 is identical to the 6BC5 except for heater characteristics.

3BC5 (cont.)

ELECTRICAL DATA

DIRECT INTERELECTRODE CAPACITANCES

Pentode connection	No Shield	Shield	
Grid to plate: g1 to p, max.	0.030	0.020	$\mu\mu\text{f}$
Input: g1 to k + h + g2 + g3 & i.s.	6.5	6.6	$\mu\mu\text{f}$
Output: p to k + h + g2 + g3 & i.s.	1.8	2.6	$\mu\mu\text{f}$

Triode connection (g2 tied to plate)

Grid to plate: g1 to p + g2	2.5	2.5	$\mu\mu\text{f}$
Input: g1 to k + h + g3 & i.s.	3.9	4.0	$\mu\mu\text{f}$
Output: p to k + h + g2 + g3 & i.s.	3.0	4.3	$\mu\mu\text{f}$

†JETEC shield 316 connected to cathode.

MAXIMUM RATINGS (Design center values)

	Triode*	Pentode
Plate voltage	300	300 volts
Grid 2 voltage	Plate	See Rating Chart
Grid 2 supply voltage	Plate	300 volts
Grid 1 voltage, positive d.c.	0	0 volts
Plate dissipation	2.5	2.0 watts
Grid 2 dissipation		0.5 watt

CHARACTERISTICS AND TYPICAL OPERATION

Class A Amplifier	Triode*	Pentode
Plate voltage	250	180 100 125 150 volts
Grid 3 (suppressor)		connected to cathode at socket
Grid 2 (screen) voltage	Plate	Plate 100 125 150 volts
Cathode bias resistor	820	330 180 100 180 ohms
Plate resistance (approx.)	.009	.006 0.6 0.5 0.8 meg
Transconductance	4400	6000 4900 6100 5700 μmhos
Plate current	6.0†	8.0† 4.7 8.0 7.5 ma
Grid 2 current		1.4 2.4 2.1 ma
Grid 1 voltage (approx.) for $I_b = 10 \mu\text{a}$		-5.0 -6.0 -8.0 volts
Amplification factor	40	42

NOTES:

*Grid 2 tied to plate.

†Total current flowing to plate and grid 2.

3BE6

APRIL 27, 1956

Remote-cutoff heptode

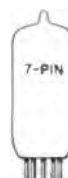
CHARACTERISTIC CURVES

(In curve section following APPENDIX)

Plate (triode connected)	126A
Operation: g_c & I_b vs. I_{c1}	126B
Transfer: g_c , I_b & I_{c2+4} vs. E_{c1} ($E_b = 250\text{V}$)	126C
Transfer: g_c , I_b & I_{c2+4} vs. E_{c1} ($E_b = 100\text{V}$)	126D
Operation (g_c vs. I_{c1})	126E

CBS

3BE6



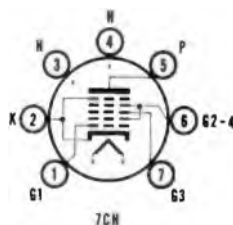
Radio-frequency converter for warm-up time
controlled, 600-ma heater strings

HEATER CHARACTERISTICS

Voltage, a-c or d-c	3.15 volts
Current	600 ma
Peak heater-cathode voltage, max.	
Heater negative to cathode	200 volts
Heater positive to cathode*	200 volts
Warm-up time	11 secs. average

(See Series-String Heaters section of APPENDIX in CBS Tube Manual)

*D-c component must not exceed 100 volts max.



CBS ELECTRON TUBES

3BE6 (cont.)

ELECTRICAL DATA

DIRECT INTERELECTRODE CAPACITANCES

	Shield†	No Shield	
Signal grid to mixer plate: g3 to p.....	0.25	0.30	μf
R-f input: g3 to all others, max.....	7.0	7.0	μf
Mixer output: p to all others.....	13	8.0	μf
Grid 3 to plate: g3 to p, max.....	0.25	0.30	μf
Oscillator input: g1 to all others.....	5.5	5.5	μf
Oscillator output: k and g5 to all except g1.....	20	15	μf
Oscillator grid to cathode and grid 5: g1 to k and g5.....	3.0	3.0	μf
Oscillator grid to mixer plate: g1 to p, max.....	0.05	0.1	μf
Oscillator grid to signal grid: g1 to g3, max.....	0.15	0.15	μf

†JTEC shield 316 connected to cathode.

MAXIMUM RATINGS (Design center values)

Plate voltage.....	300	volts
Grid 2 and 4 voltage.....	100	volts
Grid 2 and 4 supply voltage.....	300	volts
Grid 3 voltage, negative d-c.....	50	volts
Grid 3 voltage, positive d-c.....	0	volts
Plate dissipation.....	1	watt
Grid 2 and 4 dissipation.....	1	watt
Cathode current, total.....	14	ma

CHARACTERISTICS AND TYPICAL OPERATION

Converter Service (Separate excitation)*

Plate voltage.....	100	250	volts
Grid 3 (signal grid) voltage.....	-1.5	-1.5	volts
Grid 2 and 4 (oscillator anode) voltage.....	100	100	volts
Grid 1 (oscillator grid) resistor.....	20,000	20,000	ohms
Grid 1 (oscillator grid) voltage, rms.....	10	10	volts
Plate resistance (approx.).....	0.4	1.0	meg
Conversion transconductance.....	455	475	μmhos
Plate current.....	2.6	2.9	ma
Grid 2 and 4 (oscillator anode) current.....	7.0	6.8	ma
Grid 1 (oscillator grid) current.....	0.5	0.5	ma
Grid 3 voltage (approx.) for $g_c = 10 \mu\text{mhos}$	-30	-30	volts
Grid 3 voltage (approx.) for $g_c = 100 \mu\text{mhos}$	-6	-6	volts

Oscillator Characteristics, Not Oscillating

Plate voltage.....	100	volts
Grid 3 voltage.....	0	volts
Grid 2 and 4 (oscillator anode) voltage.....	100	volts
Grid 1 (oscillator grid) voltage.....	0	volts
Transconductance between grid 1 and grid 2.....	7250	μmhos
Amplification factor between grid 1 and grid 2.....	20	
Cathode current.....	25	ma
Grid 1 voltage (approx.) for $I_b = 10 \mu\text{a}$	-11	volts

*Values listed correspond closely to those for a self-excited oscillator circuit operating with zero bias.

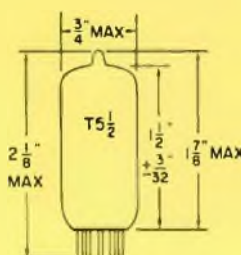
ENGINEERING DESIGN DATA

3BE6 (cont.)

MECHANICAL DATA

Cathode, coated unipotential

Bulb.....	T-5½
Outline.....	5-2
Base.....	7-pin Miniature (E7-1)
Basing.....	7CH
Mounting position.....	Any



PIN CONNECTIONS

Pin 1.....	Grid 1
Pin 2.....	Cathode, Grid 5
Pin 3.....	Heater
Pin 4.....	Heater
Pin 5.....	Plate
Pin 6.....	Grid 2, Grid 4
Pin 7.....	Grid 3

REFERENCES

See explanation of series-string heater circuits in APPENDIX.

APPLICATION

Type 3BE6 is designed to function as a mixer and oscillator in superheterodyne circuits in standard broadcast, f-m, and vhf television bands.

NOTES

Type 3BE6 is identical to the 6BE6 and 12BE6 except for heater characteristics.

CBS

3BN4



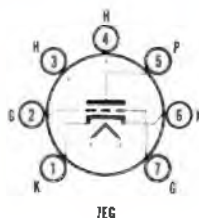
R-f amplifier in vhf television tuners, heater warm-up controlled for series strings

HEATER CHARACTERISTICS

Voltage, a-c or d-c.....	2.8	volts
Current.....	450	ma
Peak heater-cathode voltage, max. Heater negative to cathode.....	100	volts
Heater positive to cathode.....	100	volts
Warm-up time.....	11	secs. average

(See Series-String Heaters section of APPENDIX in CBS Tube Manual).

Type 3BN4 is identical to types 2BN4 and 6BN4 except for heater characteristics. See type 2BN4 for ratings and operating characteristics.



CBS ELECTRON TUBES

3BN4

JUNE 1, 1957

Medium-mu triode

CHARACTERISTIC CURVES

(In curve section following APPENDIX)

Plate.....	101A
Transfer.....	101B
Characteristics; I_p , g_m , μ	101C

APPLICATION

Type 3BN4 is a miniature medium-mu triode intended primarily for application as an r-f amplifier in vhf television tuners.

ENGINEERING DESIGN DATA

3BN6

MAY 18, 1956

Gated beam pentode

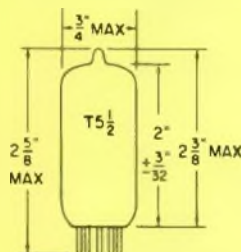
CHARACTERISTIC CURVES

(In curve section following APPENDIX)

Plate ($E_{c2} = 60V$, $E_{c3} = 3V$)	127A
Operation	127B
Transfer; E_{c1} vs. I_b , ΔE_{c3}	127C
Transfer; E_{c3} vs. I_b , ΔE_{c1}	127D

MECHANICAL DATA

Cathode, coated unipotential	
Bulb	T-5½
Outline	JETEC 5-3
Base	7-pin Miniature (E7-1)
Basing	7DF
Mounting position	Any



PIN CONNECTIONS

Pin 1	Cathode, Focus Electrode, I. S.
Pin 2	Grid 1 (signal or limiter)
Pin 3	Heater
Pin 4	Heater
Pin 5	Grid 2 (accelerator)
Pin 6	Grid 3 (quadrature)
Pin 7	Plate

REFERENCES

See explanation of warm-up time controlled series-string heater circuits in APPENDIX.

APPLICATION

Type 3BN6 is designed to function as an f-m discriminator, f-m limiter, and audio amplifier in f-m receivers and intercarrier type television receivers.

NOTES

Type 3BN6 is identical to the 6BN6 except for heater characteristics. An understanding of the operation of this gated-beam tube can be clarified by an examination of its internal construction which is shown in the Appendix.



3BN6

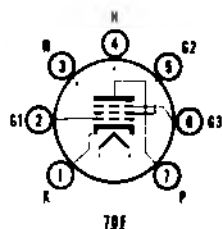


Gated-beam tube for service as f-m discriminator, limiter, and audio amplifier, heater warm-up controlled for series strings

HEATER CHARACTERISTICS

Voltage, a-c or d-c	3.15 volts
Current	600 ma
Peak heater-cathode voltage, max.	
Heater negative to cathode	200 volts
Heater positive to cathode*	200 volts
Warm-up time	11 secs. average
(See Series-String Heaters section of APPENDIX in CBS Tube Manual)	

*D-c component must not exceed 100 volts max.



ELECTRICAL DATA

DIRECT INTERELECTRODE CAPACITANCES

Grid 1 to all: g1 to k + h + g2 + g3 + p	4.2	$\mu\mu\text{f}$
Grid 3 to all: g3 to k + h + g1 + g2 + p	3.3	$\mu\mu\text{f}$
Grid 1 to grid 3: g1 to g3, max.	0.004	$\mu\mu\text{f}$

MAXIMUM RATINGS (Design center values)

Plate supply voltage	300 volts
Grid 2 voltage	100 volts
Grid 1 voltage, peak positive	55 volts
Cathode current, d-c	11.5 ma

CHARACTERISTICS AND TYPICAL OPERATION

Limiter-Discriminator Service*

Input signal center frequency	10.7	10.7	4.5 mc
Frequency deviation	± 75	± 75	± 25 kc
Plate supply voltage	85	285	270 volts
Plate voltage	63	122	121 volts
Grid 2 (accelerator) voltage	55	100	100 volts
Cathode bias resistor†	200-400	200-400	200-400 ohms
Plate load resistor, R_L	.085	0.33	0.33 meg
Plate linearity resistor, R_a	470	1500	1000 ohms
Integrating capacitor, C_i	0.002	0.001	0.001 μf
Coupling capacitor, C_c	0.25	0.01	0.25 μf
Minimum signal voltage for limiting action, rms‡	1.25	1.25	1.25 volts
Plate current, d-c	0.25	0.49	0.44 ma
Grid 2 current	4.1	9.8	10.0 ma
Input signal level for a-m rejection at			
E sig = 2.0 volts, rms..	31	20	25 db
A-m rejection at			
E sig = 3.0 volts, rms..	30	29	30 db
Total harmonic distortion	2.0	1.6	1.8 %
Peak audio output voltage	6.0	16.6	16.8 volts

NOTES:

*See diagram in Basic Circuits section of Appendix.

†Adjust for maximum a-m rejection in the output of the limiter-discriminator stage at the specified signal level. A-m rejection is measured with an applied signal containing 30 percent amplitude modulation and 30 percent frequency modulation.

‡At signals above specified level, limiting is within ± 2 db.

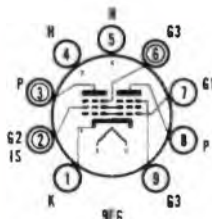
3BU8



Combined sync and agc tube for television receivers, heater warm-up controlled for series strings

HEATER CHARACTERISTICS

Voltage, a-c or d-c.....	3.15	volts
Current.....	600	ma
Peak heater-cathode voltage, max.		
Heater negative to cathode.....	200	volts
Heater positive to cathode*	200	volts
Warm-up time.....	11	secs. average
(See Series-String Heaters section of APPENDIX in CBS Tube Manual.)		
*D-c component must not exceed 100 volts max.		



ELECTRICAL DATA

DIRECT INTERELECTRODE CAPACITANCES

Grid 3 to plate, each section	1.9	μCi
Grid 1 to all others	6.0	μCi
Grid 3 (each section) to all others	3.6	μCi
Plate (each section) to all others	3.0	μCi
Grid 3 (section 1) to grid 3 (section 2), max.	0.0015	μCi

MAXIMUM RATINGS (Design center values)

Plate voltage*	300	volts
Grid 2 voltage...	120	volts
Grid 3 voltage, positive d-c*	1.0	volt
Grid 3 voltage, negative d-c*	50	volts
Grid 3 voltage, peak positive*	50	volts
Grid 1 voltage, negative d-c	50	volts
Plate dissipation*	1.1	watts
Grid 2 dissipation	0.75	watt
Cathode current ..	12	ma
Grid 1 circuit resistance	0.5	meg
Grid 3 circuit resistance	0.5	meg

AVERAGE CHARACTERISTICS

Both Sections Operating

Plate voltage*	100	100	volts
Grid 2 (screen) voltage	67.5	67.5	volts
Grid 3 (suppressor) voltage*	-10	0	volts
Plate current*		2.2	ma
Grid 2 current	6.5	3.3	ma
Cathode current	6.6	7.8	ma

Each Section (Plate and Grid 3 of Opposite Section Grounded)

Plate voltage	100	100 volts
Grid 2 (screen) voltage	67.5	67.5 volts
Grid 3 (suppressor) voltage	0	0 volts
Grid 1 (control-grid) voltage	0	†
Transconductance (grid 3)		180 μ hos
Transconductance (grid 1)	1500	μ hos
Plate current		2.2 ma
Grid 3 voltage when $i_b = 100 \mu$ a		-4.5 volts
Grid 1 voltage when $i_b = 100 \mu$ a		-2.3 volts

NOTES:

†With grid current adjusted for 100 μ a. d-c

*Each section

ENGINEERING DESIGN DATA

3BU8

OCTOBER 14, 1956

Sharp-cutoff duopentode

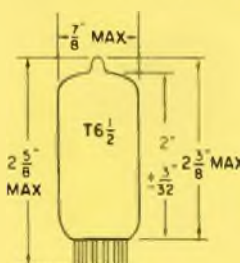
CHARACTERISTIC CURVES

(in curve section following APPENDIX)

Plate ($E_{c2} = 67.5V$, $I_{c1} = 0.1$ ma)	176A
Plate ($E_{c2} = 67.5V$, $E_{c3} = 0V$)	176B
Characteristics; I_{b1} , I_{c2}	176C
Characteristics; I_{c2} , I_{c3} vs. E_b	176D
Screen characteristics ($E_{c3} = 67.5V$)	176E
Transfer, both sections ($E_{c3} = 0V$)	176F
Transfer, each section ($E_{c1} = 0V$)	176G

MECHANICAL DATA

Cathode, coated unipotential	
Bulb	T-6½
Outline	JETEC 6-3
Base	Miniature 9-pin (E9-1)
Basing	9FG
Mounting position	Any



PIN CONNECTIONS

Pin 1	Cathode
Pin 2	Grid 2 (Sect. 2)
Pin 3	Plate (Sect. 2)
Pin 4	Heater
Pin 5	Heater
Pin 6	Grid 3 (Sect. 2)
Pin 7	Grid 1
Pin 8	Plate (Sect. 1)
Pin 9	Grid 3 (Sect. 1)

REFERENCES

See explanation of warm-up time controlled series-string heater circuits in APPENDIX

APPLICATION

Type 38U8 is a sharp-cutoff duopentod designed for application as a combined sync and agc tube in television receivers. It has separate plates and number 1 grids and a common screen, cathode and grid 1. In a suitable circuit one section is used as a sync separator and sync clipper while the other section generates the agc voltage. Noise suppression for both circuits may be applied to grid 1.

ENGINEERING DESIGN DATA

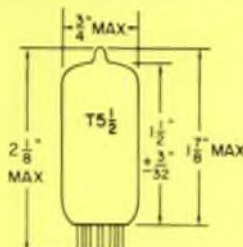
3BY6

APRIL 27, 1956

Dual-control heptode

MECHANICAL DATA

Cathode, coated unipotential
Bulb.....T-5½
Outline.....5-2
Base.....7-pin Miniature (E7-1)
Basing.....7CH
Mounting position.....Any



PIN CONNECTIONS

Pin 1.....	Grid 1
Pin 2.....	Cathode, Grid 5
Pin 3.....	Heater
Pin 4.....	Heater
Pin 5.....	Plate
Pin 6.....	Grids 2 & 4
Pin 7.....	Grid 3

REFERENCES

See explanation of warm-up controlled series-string heater circuits in APPENDIX.

APPLICATION

Type 3BY6 is a miniature, dual-control heptode designed to function as a sync separator or sync clipper in television receivers. Each of the two independent control grids has sharp cutoff characteristics.

NOTES

Type 3BY6 is identical to the 6BY6 except for heater characteristics.



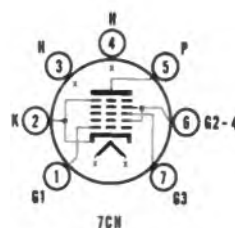
3BY6



Gated amplifier for service as sync separator or clipper, heater warm-up controlled for series strings

HEATER CHARACTERISTICS

Voltage, a-c or d-c.....3.15 volts
Current.....600 ma
Peak heater-cathode voltage, max.,
Heater negative to cathode.....200 volts
Heater positive to cathode*.....200 volts
Warm-up time.....11 secs. average
(See Series-String Heaters section of APPENDIX in CBS Tube Manual)
*D-c component must not exceed 100 volts max.



ELECTRICAL DATA

DIRECT INTERELECTRODE CAPACITANCES

Grid 1 to plate: g1 to p.....	0.08	μf
Grid 3 to plate: g3 to p.....	0.35	μf
Grid 1 to all others:		
g1 to k + h + g2 + g3 + g4 + g5 + p.....	5.4	μf
Grid 3 to all others:		
g3 to k + h + g1 + g2 + g4 + g5 + p.....	6.9	μf
Plate to all others:		
p to k + h + g1 + g2 + g3 + g4 + g5.....	7.6	μf
Grid 1 to grid 3: g1 to g3, max.....	0.15	μf

MAXIMUM RATINGS (Design center values)

Plate voltage.....	300 volts
Grid 2 and 4 voltage.....	See Rating Chart in Appendix
Grid 2 and 4 supply voltage.....	300 volts
Grid 3 voltage, negative d-c.....	50 volts
Grid 3 voltage, positive d-c.....	0 volts
Grid 3 voltage, peak positive.....	25 volts
Grid 1 voltage, negative d-c.....	100 volts
Plate dissipation.....	2.0 watts
Grid 2 and 4 dissipation.....	1.0 watt
Grid 3 input.....	0.1 watt
Grid 1 input.....	0.1 watt
Grid 3 circuit resistance	
With fixed bias.....	0.5 meg
With cathode bias.....	1.0 meg
Grid 1 circuit resistance	
With fixed bias.....	0.5 meg
With cathode bias.....	1.0 meg

CHARACTERISTICS AND TYPICAL OPERATION

Class A Amplifier

Plate voltage.....	250	250	250 volts
Grid 2 and 4 (screen) voltage.....	100	100	100 volts
Grid 3 voltage.....	0		-2.5 volts
Grid 1 voltage.....	-4.0		-2.5 volts
Grid 3 transconductance.....			500 μmhos
Grid 1 transconductance.....			1900 μmhos
Plate current.....			6.5 ma
Screen current.....			9.0 ma
Grid 3 voltage (approx.) for $I_b = 35 \mu a$		-15	volts
Grid 1 voltage (approx.) for $I_b = 35 \mu a$	-12		volts

Sync Separator and Sync Clipper

Plate voltage.....	25	25	10 volts
Grid 2 and 4 (screen) voltage.....	25	25	25 volts
Grid 3 voltage.....	0		0 volts
Grid 1 voltage.....	0		0 volts
Plate current.....			1.4 ma
Screen current.....			3.5 ma
Grid 3 voltage (approx.) for $I_b = 50 \mu a$		-2.5	volts
Grid 1 voltage (approx.) for $I_b = 50 \mu a$	-2.3		volts

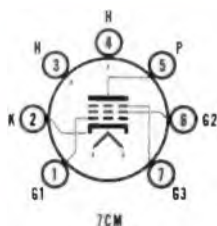
CBS ELECTRON TUBES

CBS**3BZ6**

**Pentode i-f amplifier for gain-controlled stages,
heater warm-up controlled for series strings**

HEATER CHARACTERISTICS

Voltage, a-c	3.15 volts
Current	600 ma
Peak heater-cathode voltage, max.	
Heater negative to cathode†	300 volts
Heater positive to cathode*	200 volts
Warm-up time	11 secs. average
(See Series-String Heaters section of APPENDIX in CBS Tube Manual)	
†D-c component must not exceed 200 volts max.	
*D-c component must not exceed 100 volts max.	

**ELECTRICAL DATA****DIRECT INTERELECTRODE CAPACITANCES**

	No Shield	Shield	
Grid to plate: g1 to p, max.	0.025	0.015	μf
Input: g1 to k + h + g2 + g3 & i.s.	7.0	7.0	μf
Output: p to k + h + g2 + g3 & i.s.	2.0	3.0	μf

†JETEC shield 316 connected to cathode

MAXIMUM RATINGS (Design maximum values)

Plate voltage	330 volts
Grid 2 voltage	See Rating Chart in Appendix
Grid 2 supply voltage	330 volts
Plate dissipation	2.3 watts
Grid 2 dissipation	0.55 watt
Grid 1 circuit resistance	
Fixed bias	0.25 meg
Self bias	1.0 meg

CHARACTERISTICS AND TYPICAL OPERATION

Class A Amplifier	
Plate voltage	125 volts
Grid 3 (suppressor)	connected to cathode at socket
Grid 2 (screen) voltage	125 volts
Cathode bias resistor	56 ohms
Plate resistance (approx.)	0.26 meg
Transconductance	8000 μmhos
Plate current	14 ma
Grid 2 current	3.6 ma
Grid 1 voltage (approx.) for $g_m = 50 \mu\text{mhos}$	-19 volts
Transconductance ($E_{c1} = -4.5\text{V}$, $R_k = 0$)	700 μmhos

3C6

(See chart for seldom-used tubes)

CBS ELECTRON TUBES**ENGINEERING
DESIGN DATA****3BZ6**

FEBRUARY 25, 1957

**Semiremote-cutoff
pentode****CHARACTERISTIC CURVES**

(In curve section following APPENDIX)

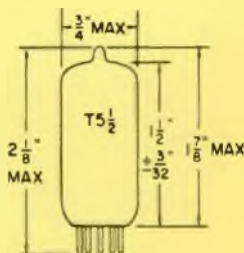
Screen Grid Rating.....100A

Plate ($E_{c2} = 150\text{V}$).....129A

Transfer ($E_b = 200\text{V}$, $E_{c2} = 150\text{V}$)...129B

MECHANICAL DATA

Cathode, coated unipotential	
Bulb	T-5½
Outline	JETEC 5-2
Base	7-pin Miniature (E7-1)
Basing	7CM
Mounting position	Any

**PIN CONNECTIONS**

Pin 1	Grid 1
Pin 2	Cathode
Pin 3	Heater
Pin 4	Heater
Pin 5	Plate
Pin 6	Grid 2
Pin 7	Grid 3, I. S.

REFERENCES

See explanation of warm-up controlled series-string heater circuits in the APPENDIX.

APPLICATION

Type 3BZ6 is a high g_m , semiremote cutoff pentode amplifier designed to function as an agc i-f amplifier in television receivers. Its grid bias characteristic reduces cross modulation caused by strong signals yet provides high amplification for weak signals.

NOTES

Type 3BZ6 is identical to the 6BZ6 except for heater characteristics.

ENGINEERING DESIGN DATA

3CB6

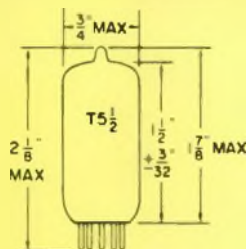
MAY 17, 1956

Sharp-cutoff pentode

CHARACTERISTIC CURVES
(In curve section following APPENDIX)
Plate ($E_c = 150V$) 130A
Plate ($E_c = E_1 = 0V$), ΔE_c 130B
Transfer ($E_b = 200V$, $E_c = 0V$) 130C
Transfer ($E_b = 200V$, $E_c = 0V$) 130D

MECHANICAL DATA

Cathode, coated unipotential
Bulb T-5½
Outline JETEC S-2
Base 7-pin Miniature (E7-1)
Basing 7CM
Mounting position Any



PIN CONNECTIONS

Pin 1 Grid 1
Pin 2 Cathode
Pin 3 Heater
Pin 4 Heater
Pin 5 Plate
Pin 6 Grid 2
Pin 7 Grid 3, I. S.

REFERENCES

See explanation of warm-up controlled series string circuits in APPENDIX.

APPLICATION

Type 3CB6 is designed for television use as an i-f amplifier in the vicinity of 40 megacycles. It may also be used in vhf television tuners as an i-f amplifier.

NOTES

Type 3CB6 is identical to the 6CB6 except for heater characteristics.



3CB6

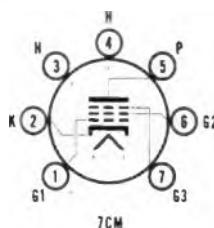


Pentode amplifier for r-f or i-f service, heater warm-up controlled for series strings

HEATER CHARACTERISTICS

Voltage, a-c or d-c 3.15 volts
Current 600 ma
Peak heater-cathode voltage, max.
Heater negative to cathode 300 volts
Heater positive to cathode* 200 volts
Warm-up time 11 secs. average
(See Series-String Heaters section of APPENDIX in CBS Tube Manual)

*D-c component must not exceed 100 volts max.



ELECTRICAL DATA

DIRECT INTERELECTRODE CAPACITANCES

	No Shield	Shield
Grid to plate: g1 to p, max.	0.025	0.15 μf
Input: g1 to k + h + g2 + g3 & i.s.	6.5	6.5 μf
Output: p to k + h + g2 + g3 & i.s.	2.0	3.0 μf

*JETEC shield 316 connected to cathode

MAXIMUM RATINGS (Design maximum values)

Plate voltage	330 volts
Grid 2 voltage	See Rating Chart in APPENDIX
Grid 2 supply voltage	330 volts
Grid 1 voltage, positive d-c	0 volts
Plate dissipation	2.3 watts
Grid 2 dissipation	0.55 watt

CHARACTERISTICS AND TYPICAL OPERATION

Class A Amplifier

Plate voltage	125 volts
Grid 3 (suppressor)	connected to cathode at socket
Grid 2 (screen) voltage	125 volts
Cathode bias resistor	56 ohms
Plate resistance (approx.)	0.28 meg
Transconductance	8000 $\mu mhos$
Plate current	13 ma
Grid 2 current	3.7 ma
Grid 1 voltage (approx.) for $I_b = 20 \mu a$	-6.5 volts
Plate current at $E_c = -3V$, $R_k = 0$	2.8 ma



3CE5

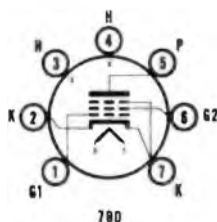


**Controlled-cutoff pentode for r-f or i-f service,
heater warm-up controlled for series strings**

HEATER CHARACTERISTICS

Voltage, a-c or d-c.....	3.15 volts
Current.....	600 ma
Peak heater-cathode voltage, max. Heater negative to cathode.....	200 volts
Heater positive to cathode*.....	200 volts
Warm-up time.....	11 sec. average
(See Series-String Heaters section of APPENDIX in CBS Tube Manual)	

*D-c component must not exceed 100 volts max.



ELECTRICAL DATA

DIRECT INTERELECTRODE CAPACITANCES

Grid to plate: g1 to p, max.....	0.030 $\mu\mu\text{f}$
Input: g1 to k + h + g2 + g3.....	6.5 $\mu\mu\text{f}$
Output: p to k + h + g2 + g3.....	1.9 $\mu\mu\text{f}$

MAXIMUM RATINGS (Design center values)

Plate voltage.....	300 volts
Grid 2 voltage.....	150 volts
Plate dissipation.....	2.0 watts
Grid 2 dissipation.....	0.5 watt

CHARACTERISTICS AND TYPICAL OPERATION

Class A Amplifier

Plate voltage.....	125 volts
Grid 3 (suppressor).....	connected to cathode at socket
Grid 2 (screen) voltage.....	125 volts
Grid 1 (control-grid) supply voltage.....	-1 volts
Grid 1 resistor (bypassed)*.....	1.0 meg
Plate resistance (approx.).....	0.3 meg
Transconductance.....	7600 μmhos
Plate current.....	11.0 ma
Grid 2 current.....	2.8 ma
Grid 1 voltage (approx.) for $I_b = 35 \mu\text{a}$	-5.0 volts

NOTE:

*Bypass of 1000 μf .

ENGINEERING DESIGN DATA

3CE5

NOVEMBER 1, 1957

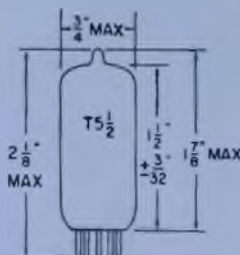
**Controlled
sharp-cutoff pentode**

CHARACTERISTIC CURVES (In curve section following APPENDIX)

Plate ($E_c = 125\text{V}$).....	197A
Plate ($E_c = E_{c1} = 0\text{V}$), ΔE_{c2}	197B
Transfer ($E_b = 125\text{V}$, $E_{c1} = 0\text{V}$).....	197C
Transfer ($E_b = 125\text{V}$, $E_{c1} = 0\text{V}$).....	197D

MECHANICAL DATA

Cathode, coated unipotential	
Bulb.....	T-5½
Outline.....	JETEC 5-2
Base.....	7-pin Miniature (ET-1)
Basing.....	7BD
Mounting position.....	Any



PIN CONNECTIONS

Pin 1.....	Grid 1
Pin 2.....	Cathode, Grid 3, I. S.
Pin 3.....	Heater
Pin 4.....	Heater
Pin 5.....	Plate
Pin 6.....	Grid 2
Pin 7.....	Grid 3, Cathode, I. S.

REFERENCES

See explanation of warm-up controlled heater circuits in APPENDIX.

APPLICATION

Designed to obtain better performance of low cost vhf television tuners and i-f stages by improved plate current cutoff characteristic.

NOTES

Type 3CE5 is identical to type 6CE5 except for heater characteristics.

ENGINEERING DESIGN DATA

3CF6

JUNE 10, 1956

Controlled sharp-cutoff pentode

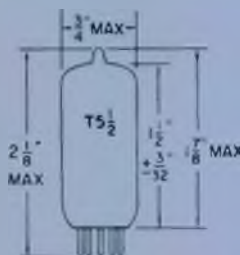
CHARACTERISTIC CURVES

(In curve section following APPENDIX)

Plate ($E_{c2} = 150V$)	130A
Plate ($E_{c3} = E_{c1} = 0V$, ΔE_{c2})	130B
Transfer ($E_b = 200V$, $E_{c3} = 0V$)	130C
Transfer ($E_b = 200V$, $E_{c3} = 0V$)	130D

MECHANICAL DATA

Cathode, coated unipotential	
Bulb	T-5 $\frac{1}{2}$
Outline	JETEC 5-2
Base	7-pin Miniature (E7-1)
Basing	7CM
Mounting position	Any



PIN CONNECTIONS

Pin 1	Grid 1
Pin 2	Cathode
Pin 3	Heater
Pin 4	Heater
Pin 5	Plate
Pin 6	Grid 2
Pin 7	Grid 3, f. S.

REFERENCES

See explanation of warm-up controlled heater circuits in APPENDIX.

APPLICATION

Type 3CF6 is a miniature, sharp-cutoff pentode designed for TV use as an i-f amplifier operating in the vicinity of 40 megacycles and as an r-f amplifier operating in vhf TV tuners. There is a separate connection for the suppressor grid and internal shield.

NOTES

Type 3CF6 is identical to type 6CF6 except for heater characteristics, and to the 3CB6 except for closely controlled grid cutoff characteristics. Characteristics curves for the 3CB6 may also be used for the 3CF6.



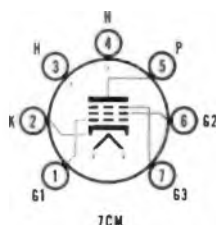
3CF6



Controlled-cutoff pentode for r-f or i-f service,
heater warm-up controlled for series strings

HEATER CHARACTERISTICS

Voltage, a-c or d-c	3.15 volts
Current	600 ma
Peak heater-cathode voltage, max.	
Heater negative to cathode	300 volts
Heater positive to cathode	200 volts
Warm-up time	11 sec. average
(See Series-String Heaters section of APPENDIX in CBS Tube Manual)	
*D-c component 100 volts max.	



ELECTRICAL DATA

DIRECT INTERELECTRODE CAPACITANCES

Grid to plate: g1 to p, max.	0.020 μf
Input: g1 to k + h + g2 + g3	6.3 μf
Output: p to k + h + g2 + g3	1.9 μf

MAXIMUM RATINGS (Design center values)

Plate voltage	300 volts
Grid 2 voltage	150 volts
Plate dissipation	2.0 watts
Grid 2 dissipation	0.5 watt

CHARACTERISTICS AND TYPICAL OPERATION

Class A Amplifier

Plate voltage	200 volts
Grid 3 (suppressor)	connected to cathode at socket
Grid 2 (screen) voltage	150 volts
Cathode bias resistor	180 ohms
Plate resistance (approx.)	0.6 meg
Transconductance	6200 $\mu mhos$
Plate current	9.5 ma
Grid 2 current	2.8 ma
Grid 1 voltage (approx.) for $I_b = 35 \mu a$	-6.5 volts



3CS6



Heptode sync separator and clipper, heater warm-up controlled for series strings

HEATER CHARACTERISTICS

Voltage, a-c or d-c.....	3.15 volts
Current.....	600 ma
Peak heater-cathode voltage, max.	
Heater negative to cathode.....	200 volts
Heater positive to cathode*.....	200 volts
Warm-up time.....	11 sec. average
(See Series-String Heaters section of APPENDIX in CBS Tube Manual)	
*D-c component must not exceed 100 volts max.	

ELECTRICAL DATA

DIRECT INTERELECTRODE CAPACITANCES

Grid 3 to plate: g3 to p, max.....	0.36	μf
Grid 3 to all except plate.....	7.0	μf
Output: p to all others.....	7.5	μf
Grid 1 to plate: g1 to p, max.....	0.07	μf
Grid 1 to all except plate.....	5.5	μf
Coupling: g1 to g3, max.....	0.22	μf

MAXIMUM RATINGS (Design center values)

Plate voltage.....	300 volts
Grid 2 and 4 voltage.....	100 volts
Grid 2 and 4 supply voltage.....	300 volts
Plate dissipation.....	1.0 watt
Grid 2 and 4 dissipation.....	1.0 watt
Cathode current, total.....	14 ma
Grid 1 circuit resistance.....	0.47 meg
Grid 3 circuit resistance.....	2.2 meg

CHARACTERISTICS

Plate voltage.....	10	100	100 volts
Grid 3 (signal grid 2) voltage.....	0	-1	0 volts
Grid 2 and 4 (screen) voltage.....	30	30	30 volts
Grid 1 (signal grid 1) voltage, rms.....	0	0	-1.0 volts
Plate resistance (approx.).....	0.7	1.0	meg
Transconductance between grid 1 and plate.....		1100	μmhos
Transconductance between grid 3 and plate.....		1500	μmhos
Plate current.....	2.0	0.8	1.0 ma
Grid 2 and 4 (screen) current.....	4.5	5.5	1.3 ma
Grid 1 voltage (approx.) for $I_b = 50 \mu\text{A}$			-2.5 volts
Grid 3 voltage (approx.) for $I_b = 50 \mu\text{A}$			-2.2 volts

3D6

(See chart for seldom-used tubes)

CBS ELECTRON TUBES

ENGINEERING DESIGN DATA

3CS6

JUNE 10, 1956

Dual control heptode

CHARACTERISTIC CURVES

(In curve section following APPENDIX)

Plate ($E_{c2+4} = 30\text{V}$, $E_{c1} = 0\text{V}$)..... 131A

Plate ($E_{c2+4} = 30\text{V}$, $E_{c1} = 0\text{V}$)..... 131B

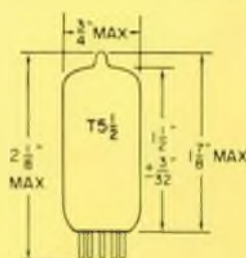
Transfer ($E_b = 100\text{V}$, $E_{c2+4} = 30\text{V}$, $E_{c1} = 0\text{V}$)..... 131C

Transfer ($E_b = 100\text{V}$, $E_{c2+4} = 30\text{V}$, $E_{c1} = 0\text{V}$)..... 131D

Characteristics ($E_{c2+4} = 30\text{V}$, $E_{c1} = 0\text{V}$)..... 131E

MECHANICAL DATA

Cathode, coated unipotential.....	T-5½
Bulb.....	5-2
Outline.....	7-pin Miniature (E7-1)
Base.....	7CH
Basing.....	Any
Mounting position.....	Any



PIN CONNECTIONS

Pin 1.....	Grid 1
Pin 2.....	Cathode, Grid 5
Pin 3.....	Heater
Pin 4.....	Heater
Pin 5.....	Plate
Pin 6.....	Grid 2, Grid 4
Pin 7.....	Grid 3

REFERENCES

See explanation of warm-up controlled series-string heater circuits in APPENDIX.

APPLICATION

Type 3CS6 is a miniature, dual-control heptode designed for TV service as a sync separator and sync clipper for 600-ma. controlled warm-up time heater strings. It is well adapted to this type of application because of the control characteristics of the two independent control grids 1 and 3.

NOTES

Type 3CS6 is identical to type 6CS6 except for heater characteristics.

ENGINEERING DESIGN DATA

3DT6

OCTOBER 14, 1956

Sharp-cutoff pentode

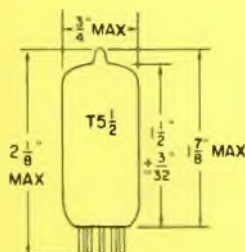
CHARACTERISTIC CURVES

(In curve section following APPENDIX)

Screen Grid Rating	100A
Plate ($E_{c2}=100V$, $E_{c3}=0V$)	188A
Characteristics; I_{c1} , I_{c2} ($E_{c2}=100V$, $E_{c3}=0V$)	188B
Plate ($E_{c2}=100V$, $E_{c3}=0V$)	188C
Characteristics; I_{c2} ($E_{c2}=100V$, $E_{c3}=0V$)	188D
Transfer; I_b , I_{c2} ($E_b=150V$, $E_{c2}=100V$)	188E
Transfer; I_b , I_{c2} ($E_b=150V$, $E_{c2}=100V$, $E_{c3}=0V$)	188F

MECHANICAL DATA

Cathode, coated unipotential	
Bulb	T-5½
Outline	JETEC 5-2
Base	Miniature 7-pin (E7-1)
Basing	7EN
Mounting position	Any



PIN CONNECTIONS

Pin 1	Grid 1
Pin 2	Cathode, I. S.
Pin 3	Heater
Pin 4	Heater
Pin 5	Plate
Pin 6	Grid 2
Pin 7	Grid 3



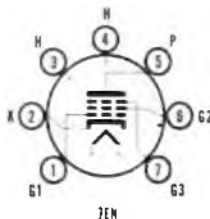
3DT6



Dual controlled pentode for f-m detector and limiter, mixer, or gain-controlled amplifier use, heater warm-up controlled for series strings

HEATER CHARACTERISTICS

Voltage, a-c or d-c	3.15 volts
Current	600 ma
Peak heater-cathode voltage, max.	
Heater negative to cathode	200 volts
Heater positive to cathode*	200 volts
Warm-up time	11 secs. average
(See Series-String Heaters section of APPENDIX in CBS Tube Manual.)	
*D-c component must not exceed 100 volts max.	



ELECTRICAL DATA

DIRECT INTERELECTRODE CAPACITANCES—Shield†

Grid 1 to plate: g1 to p	0.02 μf
Grid 1 to grid 3: g1 to g3	0.1 μf
Grid 3 to all others	6.1 μf
Grid 1 to grid 2 + grid 3 + heater + cathode + i.s.	5.8 μf
Grid 3 to plate	1.4 μf

†JETEC shield 316 connected to cathode.

MAXIMUM RATINGS (Design center values)

F-m Detector Service*

Plate voltage	300 volts
Grid 2 voltage	See Rating Chart in APPENDIX
Grid 2 supply voltage	300 volts
Grid 3 voltage	25 volts
Grid 1 voltage, positive d-c	0 volts
Plate dissipation	1.5 watts
Grid 2 dissipation (for grid 2 volts up to 150 volts)	1.0 watt
Grid 2 dissipation (for grid 2 volts between 150 and 300 volts)	See Rating Chart in APPENDIX
Grid 1 circuit resistance	
Fixed bias	0.25 meg
Self bias	0.5 meg

CHARACTERISTICS AND TYPICAL OPERATION

Class A Amplifier

Plate supply voltage	150 volts
Grid 3 (suppressor) supply voltage	connected to cathode at socket
Grid 2 supply voltage	100 volts
Cathode bias resistor	560 ohms
Plate resistance (approx.)	0.15 meg
Transconductance	
Grid 1 to plate	800 $\mu mhos$
Grid 3 to plate	515 $\mu mhos$
Plate current	1.1 ma
Grid 2 current	2.1 ma
Grid 1 voltage (approx.) for $I_b = 10 \mu a$	-4.5 volts
Grid 3 voltage (approx.) for $I_b = 10 \mu a$	-3.5 volts



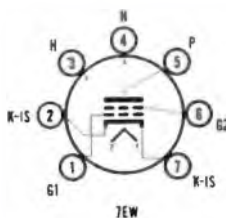
3CY5



Tetrode voltage amplifier for r-f service in VHF tuners of series string heater TV receivers

HEATER CHARACTERISTICS

Voltage, a-c or d-c.	2.9 volts
Current	450 ma
Peak heater-cathode voltage, max.	
Heater negative to cathode	100 volts
Heater positive to cathode	100 volts
Warm-up time	11 secs. average
(See Series-String Heaters section of APPENDIX in CBS Tube Manual)	



ELECTRICAL DATA

DIRECT INTERELECTRODE CAPACITANCES

Grid to plate: g1 to p, max.	0.03 $\mu\mu\text{f}$
Input: g1 to k + h + g2	4.3 $\mu\mu\text{f}$
Output: p to k + h + g2	2.75 $\mu\mu\text{f}$

†JETEC shield 316 connected to cathode.

MAXIMUM RATINGS (Design maximum values)

Plate voltage	180 volts
Grid 2 voltage	See Rating Chart in APPENDIX
Grid 2 supply voltage	180 volts
Grid 1 voltage, positive d-c.	0 volts
Plate dissipation	2.0 watts
Grid 2 dissipation	0.5 watt
Cathode current	20 ma

CHARACTERISTICS AND TYPICAL OPERATION

Class A Amplifier

Plate voltage	125 volts
Grid 2 (screen) voltage	80 volts
Grid 1 (control-grid) voltage	-1 volts
Plate resistance (approx.)	0.125 meg
Transconductance	8000 μmhos
Plate current	10 ma
Grid 2 current	1.4 ma
Grid 1 voltage (approx.) for $I_b = 20 \mu\text{a}$	-6 volts

Type 3CY5 is identical to types 2CY5, 4CY5, and 6CY5 except for heater characteristics.

ENGINEERING DESIGN DATA

3CY5

MARCH 30, 1959

Vhf tetrode

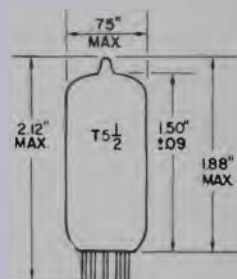
CHARACTERISTIC CURVES

(In curve section following APPENDIX)

Screen Grid Rating	100A
Transfer; r_p, g_m, I_b, I_{r2}	216A
Hot Input Impedance	216B

MECHANICAL DATA

Cathode, coated unipotential	
Bulb	T-5½
Outline	JETEC S-2
Base	7-pin Miniature (E7-1)
Basing	7EW
Mounting position	Any



PIN CONNECTIONS

Pin 1	Grid 1
Pin 2	Cathode, I. S.
Pin 3	Heater
Pin 4	Heater
Pin 5	Plate
Pin 6	Grid 2
Pin 7	Cathode, I. S.

APPLICATION

Designed for better operation of VHF television tuners, providing maximum gain-to-noise ratio. Operation is permissible with low plate and screen voltages. It has a high input impedance for a favorable gain-bandwidth factor.



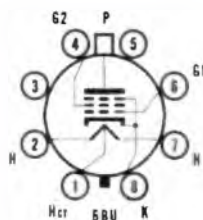
3D21B



High power pulse modulator for high voltage circuits

HEATER CHARACTERISTICS

	Parallel	Series
Heater voltage, a-c or d-c	6.3	12.6 $\pm 10\%$ volts
Heater current	1.7	0.85 amp
Peak heater-cathode voltage, max.	150	volts
Cathode pre-heating, min.	30	30 sec



ELECTRICAL DATA

MAXIMUM RATINGS (Absolute maximum values)*

Plate voltage†	3500 volts
Peak plate voltage including transient††	5000 volts
Grid 2 voltage†	850 volts
Negative grid 1 voltage, instantaneous†	-500 volts
Positive grid 1 voltage	+220 volts
Plate dissipation	15 watts
Grid 2 dissipation	3 watts
Grid 1 dissipation	0.5 watt

CHARACTERISTICS

Plate voltage	600 volts
Grid 2 voltage	300 volts
Grid 1 voltage	-30 volts
Plate current	30 ma
Grid 2 current	2.5 ma
Transconductance	5500 μ mhos

TYPICAL OPERATION

Pulse Modulator Service

Plate voltage	3500	2500	1500	volts
Grid 2 voltage	800	800	800	volts
Grid 1 voltage	-150	-150	-150	volts
Signal voltage (peak above ground)	150	150	150	volts
Load resistance	450	305	160	ohms
Power output (approx.)	21	14	7	kw

NOTES:

*Pulse lengths of 10 μ sec. Total pulse length in any 240 μ sec period shall not exceed 12 μ sec.

†Series resistance must be inserted in the power supply sufficient to limit the short-circuit current to less than 0.5 ampere.

††With a screen potential not exceeding 400 V d-c and when no instantaneous voltage due to transient is present (essentially resistance plate load) a maximum plate potential of 4500 V d-c may be used.

ENGINEERING DESIGN DATA

3D21B

JUNE 1, 1958

Beam power tube

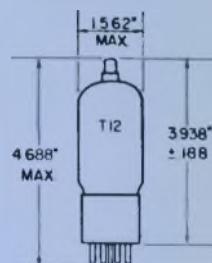
CHARACTERISTIC CURVES

(In curve section following APPENDIX)

Plate, i_p , i_{c2} , i_{c1}	2002A
Plate	2002B
Plate	2002C
Grid	2002D

MECHANICAL DATA

Bulb	T-12
Maximum diameter	1 1/16 inches
Maximum overall length	4 1/2 inches
Maximum seated height	4 1/16 inches
Basing	6BU
Base	Medium shelf octal 8-pin, B8-11
Cap	Skirted miniature, C1-2
Mounting position	Any



PIN CONNECTIONS

Pin 1	Heater Center Tap
Pin 2	Heater
Pin 3	No Connection
Pin 4	Grid 2
Pin 5	No Connection
Pin 6	Grid 1
Pin 7	Heater
Pin 8	Cathode
Cap	Plate

APPLICATION

The CBS-Hytron, USN-3D21B pulse modulator, is a compact, economical beam power tube capable of delivering 21 kw in 10 microsecond pulses.

The 3D21B, which is 100% factory pulse-tested, may also be used as a high-voltage blocking oscillator, hard switch tube, deflection amplifier, and regulator or pass tube in high-voltage supplies.

This tube is the most powerful pulse modulator of its size and the result of fifteen years of specialized tube technology. It features an open-type plate of large area for high thermal dissipation, a non-warping cathode, and gold-plated special alloy grids with heavy side rods and oversize heat radiators.



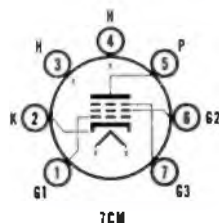
3DK6



**Pentode amplifier for i-f service in TV receivers,
heater warm-up controlled for series strings**

HEATER CHARACTERISTICS

Voltage, a-c or d-c.....	3.15 volts
Current.....	600 ma
Peak heater-cathode voltage, max.	
Heater negative to cathode.....	300 volts
Heater positive to cathode*.....	200 volts
Warm-up time.....	11 secs. average
(See Series-String Heaters section of APPENDIX in CBS Tube Manual)	
*D-c component 100 volts max.	



ELECTRICAL DATA

DIRECT INTERELECTRODE CAPACITANCES

Grid to plate: g1 to p, max.....	0.020 μ f
Input: g1 to k + h + g2 + g3.....	6.3 μ f
Output: p to k + h + g2 + g3.....	1.9 μ f

MAXIMUM RATINGS (Design center values)

Plate voltage.....	300 volts
Grid 2 voltage.....	See Rating Chart in APPENDIX
Grid 2 supply voltage.....	300 volts
Grid 1 voltage, positive d-c.....	0 volts
Plate dissipation.....	2.0 watts
Grid 2 dissipation.....	0.5 watt

CHARACTERISTICS AND TYPICAL OPERATION

Class A Amplifier

Plate voltage.....	125 volts
Grid 3 (suppressor).....	connect to cathode at socket
Grid 2 (screen) voltage.....	125 volts
Cathode bias resistor.....	56 ohms
Plate resistance (approx.).....	0.35 meg
Transconductance.....	9800 μ mhos
Plate current.....	12.0 ma
Grid 2 current.....	3.8 ma
Grid 1 voltage (approx.) for $I_b = 20 \mu$ a.....	-6.5 volts

NOTE:

Other heater voltage versions of this tube include types: 4DK6 with a 4.2 volt, 450 ma warm-up controlled heater; 6DK6 with a 6.3 volt, 600 ma heater.

ENGINEERING DESIGN DATA

3DK6

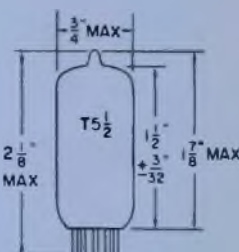
JUNE 1, 1958

Sharp-cutoff pentode

CHARACTERISTIC CURVES
(In curve section following APPENDIX)
Screen Grid Rating..... 100A
Transfer; f_p , gm, I_b , I_{c2} 217A

MECHANICAL DATA

Cathode, coated unipotential
Bulb..... T-5 1/2
Outline..... JETEC 5-2
Base..... 7-pin Miniature (E7-1)
Basing..... 7CM
Mounting position..... Any



PIN CONNECTIONS

Pin 1.....	Grid 1
Pin 2.....	Cathode
Pin 3.....	Heater
Pin 4.....	Heater
Pin 5.....	Plate
Pin 6.....	Grid 2
Pin 7.....	Grid 3, I. S.

APPLICATION

A wide band, high frequency pentode particularly suited for use as an i-f amplifier tube in television receivers.

3DT6 (cont.)

Locked-Oscillator, Quadrature Grid F-M Detector (Carrier Frequency of 4.5 Mc)*

Input Signal to Grid of Driver.....	15	200	500mv rms
Plate supply voltage.....	250	250	250 volts
Grid 3 voltage (from 0.56 meg resistor).....	-5	-6	-6.4 volts
Grid 2 supply voltage.....	100	100	100 volts
Cathode-bias resistor.....	560	560	560 ohms
Plate load resistor.....	0.27	0.27	0.27 meg
Plate current.....	0.23	0.22	0.21 ma
Grid 2 current.....	3.4	5.5	6.0 ma
Grid 1 current.....	0.013	0.6	0.8 ma
Bandwidth (10% total harmonic distortion).....	65	120	118 kc
A-m rejection (approx.)†.....	33	29	28 db
Audio output voltage, rms (approx.)			
With ± 7.5 kc deviation from			
mean value of 4.5 Mc.....	5.5	6.5	7.5 volts
With a ± 25 kc deviation from			
mean value of 4.5 Mc.....	17	21	23 volts
Total harmonic distortion			
With a ± 25 kc deviation from			
mean value of 4.5 Mc.....	2	3	4 %
Sensitivity			
With a ± 7.5 kc deviation from			
mean value of 4.5 Mc.....			5 mv▲
With a ± 25 kc deviation from			
mean value of 4.5 Mc.....			15 mv▲

NOTES:

*See diagram of typical circuit in Circuits section of APPENDIX.

†Ratio of audio output voltage produced by 30% amplitude modulation of the 4.5 Mc carrier frequency to the audio output produced by a ± 25 Kc deviation from the 4.5 Mc carrier frequency with a modulating frequency of 400 cps in both cases.

▲Signal level at which detector circuit will handle the indicated deviation in frequency from the mean value of 4.5 Mc before distortion occurs.

ENGINEERING DESIGN DATA

3DT6 (cont.)

REFERENCES

See explanation of warm-up time controlled series-string heater circuits in APPENDIX.

APPLICATION

Type 3DT6 is a sharp-cutoff pentode designed to operate as a dual control tube for f-m detectors, mixers, or audio amplifiers and gain-controlled amplifiers. It is often used in a locked-oscillator—quadrature-grid circuit.

In this circuit the 3DT6 functions as a combined detector and limiter, its audio power output is high and is capable of sufficiently driving an audio power amplifier such as the 6AQ5.

NOTES

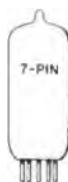
Type 3DT6 is identical to the 6DT6 except for heater characteristics. Circuit design in quadrature grid f-m detector use is similar to that of the 3BN6 and 6BN6 which is described in the APPENDIX.

3E5 • 3E6 • 3LE4 • 3LF4

(See chart for seldom-used tubes)



3Q4

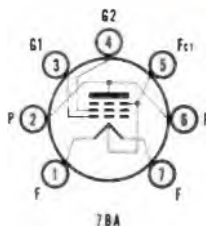


Audio power amplifier for battery-powered receivers

FILAMENT CHARACTERISTICS

	Series	Parallel	
Voltage, d-c.....	2.8	1.4	volts
Current.....	50	100	ma

Type 3Q4 is identical to type 3V4 except for a different basing diagram. For an explanation of series/parallel filament connections see the notes for type 3V4.



3Q4

JUNE 10, 1956

Filamentary beam
power pentode

CHARACTERISTIC CURVES

(In curve section following APPENDIX)
Plate ($E_{c2} = 90V$)..... 133A
Operation ($E_b = E_{c2} = 90V$, $E_{c1} = -4.5V$)..... 133B

NOTE

Refer to type 3S4 for basing and pin connections.

ENGINEERING DESIGN DATA

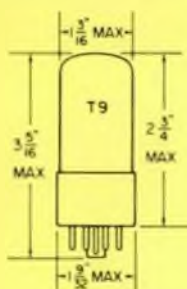
3Q5GT

JUNE 10, 1956

Filamentary beam power pentode

MECHANICAL DATA

Cathode, coated filament	
Bulb	T-9
Outline	JETEC 9-11
Base	Intermediate shell 7-pin octal (B7-7)
Basing	7AP
Mounting position	Any



PIN CONNECTIONS

Pin 1	N. C.
Pin 2	Positive Filament
Pin 3	Plate
Pin 4	Grid 2
Pin 5	Grid 1
Pin 7	Neg. Filament (Series)
Pin 8	Neg. Filament (Parallel), 0. P.

APPLICATION

Type 3Q5GT is a beam power audio amplifier used in the output stage of portable battery-powered receivers having octal sockets.

NOTES

With series filament connection, the filament voltage is applied across the two sections between pins 2 and 7, and grid voltage is referred to pin 7. When parallel connected, filament voltage is applied across the two sections between pin 8 and pins 2 and 7, and grid voltage is referred to pin 8.



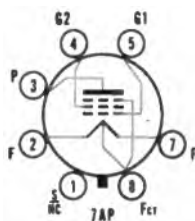
3Q5GT



Audio power amplifier for use in portable
battery-powered receivers

FILAMENT CHARACTERISTICS

	Series	Parallel*
Voltage, d-c	2.8	1.4 volts
Current	50	100 ma



ELECTRICAL DATA

DIRECT INTERELECTRODE CAPACITANCES

Grid to plate: g1 to p.	0.6	μf
Input: g1 to f (center-tap) + b.p. + g2.	8.0	μf
Output: p to f (center-tap) + b.p. + g2.	6.5	μf

MAXIMUM RATINGS (Design center values)

	Series Filament	Parallel Filament
Plate voltage	110	110 volts
Grid 2 voltage	110	110 volts
Cathode current, zero signal	6	12 ma
Grid circuit resistance	1.0	1.0 meg

CHARACTERISTICS AND TYPICAL OPERATION

Class A Amplifier	Series Filament			Parallel Filament		
	90	110	85	90	110	volts
Plate voltage	90	110	85	90	110	volts
Grid 2 (screen) voltage	90	110	85	90	110	volts
Grid 1 (control-grid) voltage	-4.5	-6.6	-5.0	-4.5	-6.6	volts
Plate resistance (approx.)	0.08	0.11	0.07	0.09	0.1	meg
Transconductance	2000	2000	1950	2200	2200	μmhos
Grid 1 input voltage, peak a-f	4.5	5.1	5.0	4.5	5.4	volts
Plate current	8.0	8.5	7.0	9.5	10.0	ma
Grid 2 current, zero signal	1.0	1.1	0.8	1.3	1.4	ma
Load resistance impedance	8000	8000	9000	8000	8000	ohms
Total harmonic distortion (approx.)	8.5	8.5	5.5	6.0	6.0	%
Power output, maximum signal	230	330	250	270	400	mw

NOTE:

*For parallel filament connection tie pins 2 and 7. Pin 8 connects to negative potential.



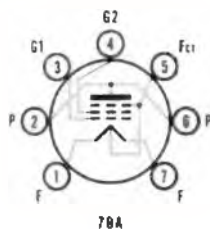
3S4



Audio power amplifier for use in portable battery-powered receivers

FILAMENT CHARACTERISTICS

	Series	Parallel*
Voltage, d-c	2.8	1.4 volts
Current	50	100 ma



ELECTRICAL DATA

DIRECT INTERELECTRODE CAPACITANCES

Grid to plate: g1 to p	0.3 $\mu\mu\text{f}$
Input: g1 to f (center-tap) + g3 + g2	4.8 $\mu\mu\text{f}$
Output: p to f (center-tap) + g3 + g2	4.0 $\mu\mu\text{f}$

MAXIMUM RATINGS (Design center values)

	Series Filament	Parallel Filament
Plate voltage	90	90 volts
Grid 2 voltage	67.5	67.5 volts
Cathode current, zero signal	4.5	9.0 ma
Cathode current, maximum signal	6.0	12.0 ma
Grid 1 circuit resistance		
Fixed bias	2.2	meg
Self bias	2.2	meg

CHARACTERISTICS AND TYPICAL OPERATION

Class A Amplifier	Series Filament	Parallel Filament
Plate voltage	67.5	90
Grid 2 (screen) voltage	67.5	67.5
Grid 1 (control-grid) voltage	-7	-7
Plate resistance (approx.)	0.1	0.1
Transconductance	1400	1425
Grid 1 input voltage, peak a-f	7	7
Plate current, zero signal	6.0	6.1
Grid 2 current, zero signal	1.2	1.1
Load resistance impedance	5000	8000
Total harmonic distortion (approx.)	12	13
Power output, maximum signal	160	235

Typical Operation with Single Filament Section

Plate voltage	90
Grid 2 (screen) voltage	67.5
Grid 1 (control-grid) voltage	-7
Plate resistance (approx.)	0.2
Transconductance	800
Grid 1 input voltage, peak a-f	7
Plate current, zero signal	3.7
Grid 2 current, zero signal	0.7
Load resistance	16,000
Total harmonic distortion (approx.)	12
Power output, maximum signal	145

NOTE:

*For parallel filament connection tie pins 1 and 7. Pin 5 connects to negative potential.

ENGINEERING DESIGN DATA

3S4

JUNE 10, 1956

Filamentary beam power pentode

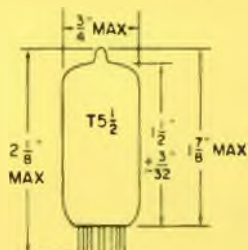
CHARACTERISTIC CURVES

(In curve section following APPENDIX)

Plate ($E_{c2} = 67.5\text{V}$) 132A

MECHANICAL DATA

Cathode, coated unipotential	
Bulb	T-5½
Outline	JETEC 5-2
Base	7-pin Miniature (E7-1)
Basing	7BA
Mounting position	Any



PIN CONNECTIONS

Pin 1	Neg. Filament (Series)
Pin 2	Plate
Pin 3	Grid 1
Pin 4	Grid 2
Pin 5	Neg. Filament (Parallel, Grid 3)
Pin 6	Plate
Pin 7	Positive Filament

NOTES

With filament voltage applied across the two sections in series between pins 1 and 7, Grid 1 voltage is referred to pin 1. Filament voltage applied across the two sections in parallel between pins 5 and 7, pins 1 and 7 connected together. Grid 1 voltage is referred to pin 5.

The cathode current rating is given for each 1.4 volt filament section. For series operation of the sections, a shunting resistor must be connected across the section between pins 1 and 5 to bypass any cathode current in excess of the rated maximum per section. When other tubes in series filament arrangement contribute to the filament current of the 3S4, an additional shunting resistor may be required between pins 1 and 7.

Either filament section may be operated singly with the other section floating. Such operation, however, may impair the emission capabilities of the unused section. Although in subsequent operation the unused section may be operated in series with the used section, it should not be operated singly.

ENGINEERING DESIGN DATA

3V4

JUNE 10, 1956

Filamentary beam power pentode

CHARACTERISTIC CURVES

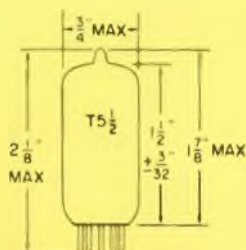
(In curve section following APPENDIX)

Plate ($E_{c2} = 90V$) 133A

Operation ($E_b = E_{c2} = 90V$, $E_{c1} = -4.5V$) 133B

MECHANICAL DATA

Cathode, coated filament	
Bulb	T-5½
Outline	JETEC 5-2
Base	7-pin Miniature (E7-1)
Basing	6BX
Mounting position	Any



PIN CONNECTIONS

Pin 1	Neg. Filament (Series)
Pin 2	Plate
Pin 3	Grid 2
Pin 4	N. C.
Pin 5	Neg. Filament (Parallel)
Pin 6	Grid 1
Pin 7	Positive Filament

NOTES

Filament voltage applied across the two sections in series between pins 1 and 7. Grid 1 voltage is referred to pin 1. Filament voltage applied across the two sections in parallel between pin 5 and pins 1 and 7 connected together. Grid 1 voltage is referred to pin 5.

The cathode current rating is given for each 1.4 volt filament section. For series operation, a shunting resistor must be connected between pins 1 and 5 to bypass any cathode current in excess of the rated maximum per section. When other tubes in series filament arrangement contribute to the filament current of the 3V4, an additional shunting resistor may be required between pins 1 and 7.

For single filament section operation, either section may be operated singly with the other section floating. Such operation, however, may impair the emission capabilities of the unused section. Although in subsequent operation the unused section may be operated in series with the used section it should not be used singly.



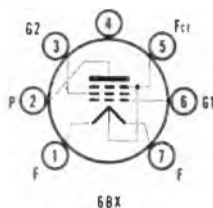
3V4



Audio power amplifier for use in
battery-powered receivers

HEATER CHARACTERISTICS

	Series	Parallel*
Voltage, d-c	2.8	1.4 volts
Current	50	100 ma



ELECTRICAL DATA

DIRECT INTERELECTRODE CAPACITANCES

Grid to plate: g1 to p	0.20	μf
Input: g1 to f (center-tap) + g3 + g2	5.5	μf
Output: p to f (center-tap) + g3 + g2	3.8	μf

MAXIMUM RATINGS (Design center values)

	Series Filament	Parallel Filament
Plate voltage	90	90 volts
Grid 2 voltage	90	90 volts
Grid 2 supply voltage	-4.5	-5.0 volts
Cathode current, maximum signal	6	12 ma
Cathode current, zero signal	6	12 ma
Grid circuit resistance		
Fixed bias	2.2	meg
Self bias	2.2	meg

CHARACTERISTICS AND TYPICAL OPERATION

Class A Amplifier	Series	Parallel
Plate voltage	90	85 90 volts
Grid 2 (screen) voltage	90	85 90 volts
Grid 1 (control-grid) voltage	-4.5	-5.0 ~4.5 volts
Plate resistance (approx.)	0.12	0.12 0.10 meg
Transconductance	2000	1975 2150 μmhos
Grid 1 input voltage, peak a-f	4.5	5.0 4.5 volts
Plate current, zero signal	7.7	6.9 9.5 ma
Grid 2 current, zero signal	1.7	1.5 2.1 ma
Load resistance impedance	10,000	10,000 10,000 ohms
Total harmonic distortion (approx.)	7	10 7 %
Power output, maximum signal	0.24	0.25 0.27 mw

Typical Operation with Single Filament Section

Plate voltage	90 volts
Grid 2 (screen) voltage	90 volts
Grid 1 (control-grid) voltage	-4.5 volts
Plate resistance	0.2 meg
Transconductance	1100 μmhos
Grid-to-grid input voltage, peak a-f	4.5 volts
Plate current, zero signal	4.8 ma
Grid 2 current, zero signal	1.1 ma
Load resistance	20,000 ohms
Total harmonic distortion (approx.)	7 %
Power output, maximum signal	135 mw

NOTE:

*For parallel connection tie pins 1 and 7. Connect pin 5 to negative potential.

4A6G

(See chart for seldom-used tubes)

CBS ELECTRON TUBES



4AU6



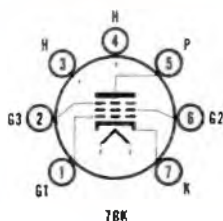
R-f amplifier, heater warm-up controlled

HEATER CHARACTERISTICS

Voltage, a-c or d-c. 4.2 volts
 Current. 450 ma
 Peak heater-cathode voltage, max.
 Heater neg. to cathode. 200 volts
 Heater pos. to cathode* 200 volts
 Warm-up time 11 secs. average
 (See Series-String Heaters section of
 APPENDIX in CBS Tube Manual).

*D-c component must not exceed 100
 volts max.

Type 4AU6 is identical to types 3AU6, 6AU6 and 12AU6 except for heater characteristics. See type 3AU6 for ratings and operating characteristics.



4BA6



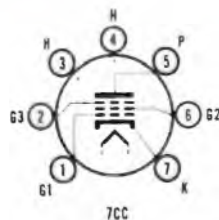
**Pentode amplifier for gain controlled r-f or i-f stages,
heater warm-up controlled for series strings**

HEATER CHARACTERISTICS

Voltage, a-c or d-c. 4.2 volts
 Current. 450 ma
 Peak heater-cathode voltage, max.
 Heater neg. to cathode. 200 volts
 Heater pos. to cathode* 200 volts
 Warm-up time 11 secs. average
 (See Series-String Heaters section of
 APPENDIX in CBS Tube Manual).

*D-c component must not exceed 100
 volts max.

Type 4BA6 is identical to types 3BA6, 6BA6 and 12BA6 except for heater characteristics. See type 3BA6 for ratings and operating characteristics.



4BC5



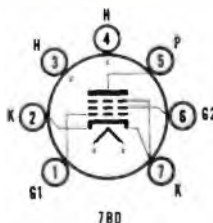
R-f amplifier, heater warm-up controlled

HEATER CHARACTERISTICS

Voltage, a-c or d-c. 4.2 volts
 Current. 450 ma
 Peak heater-cathode voltage, max.
 Heater neg. to cathode. 200 volts
 Heater pos. to cathode* 200 volts
 Warm-up time 11 secs. average
 (See Series-String Heaters section of
 APPENDIX in CBS Tube Manual).

*D-c component must not exceed 100
 volts max.

Type 4BC5 is identical to types 3BC5 and 6BC5 except for heater characteristics. See type 3BC5 for ratings and operating characteristics.



ENGINEERING DESIGN DATA

4AU6

JUNE 1, 1957

Sharp-cutoff pentode

CHARACTERISTIC CURVES (In curve section following APPENDIX)

Screen Grid Rating. 100A
 Plate ($E_{c2} = 100V$). 121A
 Plate ($E_{c2} = 150V$). 121B
 Plate, triode connected. 121C
 Transfer; I_b & I_{c2} 121D
 Transfer; g_m 121E

APPLICATION

Type 4AU6 is a miniature sharp-cutoff pentode amplifier capable of high-frequency operation. It is identical to the 3AU6, 6AU6, and 12AU6 except for heater characteristics. R-C amplifier data are given in the APPENDIX.

4BA6

JUNE 1, 1957

**Remote-cutoff
pentode**

CHARACTERISTIC CURVES (In curve section following APPENDIX)

Screen Grid Rating. 100A
 Plate ($E_{c2} = 100V$). 124A
 Plate ($E_{c2} = 150V$). 124B
 Transfer; I_{c2} ($E_b = 250V$). 124C
 Transfer; I_b ($E_b = 250V$). 124D
 Transfer; g_m ($E_b = 250V$). 124E

APPLICATION

Type 4BA6 is a miniature, remote-cutoff pentode designed for use as a high gain r-f or i-f amplifier. It features low grid-to-plate capacitance, high transconductance, and controlled heater warm-up time characteristics.

4BC5

JUNE 1, 1957

Sharp-cutoff pentode

CHARACTERISTIC CURVES (In curve section following APPENDIX)

Screen Grid Rating. 100
 Plate ($E_{c2} = 150V$). 125
 Plate; ΔE_{c2} ($E_{c1} = 0V$). 125
 Transfer; I_b & I_{c2} ($E_b = 250V$). 125
 Transfer; g_m ($E_b = 250V$). 125

APPLICATION

Type 4BC5 is a sharp-cutoff pentode miniature construction. It can be used frequencies up to 400 megacycles and useful in television receivers. See explanation of series-string heaters at screen grid voltage ratings in the APPENDIX.

ENGINEERING DESIGN DATA

4BC8

JUNE 10, 1956

Semiremote cutoff duotriode

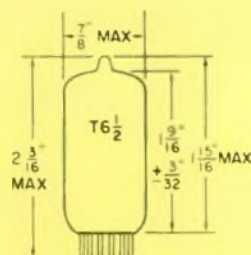
CHARACTERISTIC CURVES

(In curve section following APPENDIX)

Plate	134A
Transfer	134B
Transfer	134C

MECHANICAL DATA

Cathode, coated unipotential	
Bulb	T-6½
Outline	JETEC 6-2
Base	9-pin Miniature (E9-1)
Basing	9AJ
Mounting position	Any



PIN CONNECTIONS

Pin 1	Plate (Sect. 2)
Pin 2	Grid 1 (Sect. 2)
Pin 3	Cathode (Sect. 2)
Pin 4	Heater
Pin 5	Heater
Pin 6	Plate (Sect. 1)
Pin 7	Grid 1 (Sect. 1)
Pin 8	Cathode (Sect. 1)
Pin 9	I. S.

APPLICATION

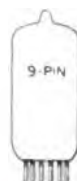
Type 4BC8 is a miniature, medium mu, semi-remote cutoff duotriode. It can be used in gain-controlled vhf cascode amplifier stages for reduction of cross modulation. The heater of this tube is designed for warm-up time controlled 600-ma heater strings.

NOTES

Type 4BC8 is identical to type 6BC8 except for heater characteristics.



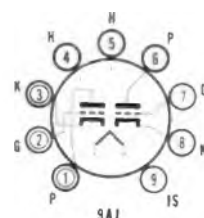
4BC8



Gain controlled vhf cascode amplifier, heater warm-up controlled for series strings

HEATER CHARACTERISTICS

Voltage, a-c or d-c	4.2 volts
Current	600 ma
Peak heater-cathode voltage, max.	
Heater negative to cathode*	200 volts
Heater positive to cathode*	200 volts
Warm-up time	11 sec. average
(See Series-String Heaters section of APPENDIX in CBS Tube Manual)	
*D-c component must not exceed 100 volts max.	



ELECTRICAL DATA

DIRECT INTERELECTRODE CAPACITANCES—Shield

	Section 1†	Section 2†
Grid to plate: g1 to p	1.4	1.4 μmf
Input: g1 to k + h	2.5	2.5 μmf
Output: p to k + h	1.3	1.3 μmf
Heater to cathode: h to k	2.3	2.3 μmf
Coupling: p1 to p2	0.015	0.015 μmf
Coupling: g1 to g2	0.007	0.007 μmf

†JETEC shield 315 connected to cathode.

†Section 1 connects to pins 6, 7, and 8.

MAXIMUM RATINGS (Design center values)▲

Plate voltage*	250 volts
Plate dissipation	2 watts
Cathode current	20 ma
Control-grid circuit resistance	0.5 meg

CHARACTERISTICS AND TYPICAL OPERATION

Class A Amplifier▲

Plate voltage	150 volts
Control-grid voltage	0 volts
Cathode-bias resistor	220 ohms
Transconductance	6200 μmhos
Amplification factor	35
Plate current	10 ma
Control-grid voltage (approx.) for gm = 50 μmhos	~13 volts

NOTES:

▲Each section.

*This rating may be as high as 300 volts maximum under cutoff conditions when the tube is used as a cascode amplifier and the two sections are connected in series.



4BE6



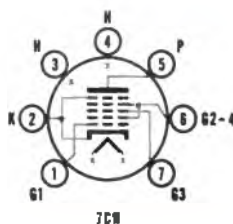
Radio-frequency converter, heater warm-up controlled for series strings

HEATER CHARACTERISTICS

Voltage, a-c or d-c.	4.2 volts
Current	450 ma
Peak heater-cathode voltage, max.	
Heater negative to cathode	200 volts
Heater positive to cathode*	200 volts
Warm-up time	11 secs. average
(See Series-String Heaters section of APPENDIX in CBS Tube Manual).	

*D-c component must not exceed 100 volts max.

Type 4BE6 is identical to types 3BE6 and 6BE6 except for heater characteristics. See type 3BE6 for ratings and operating characteristics.



ENGINEERING DESIGN DATA

4BE6

JUNE 1, 1957

Remote-cutoff heptode

CHARACTERISTIC CURVES

(In curve section following APPENDIX)

Plate, triode connected

Operation; g_2 & h_6 vs. h_1

Transfer; g_2 , h_6 & h_1 vs. E_{c1}

($E_b = 250V$)

Transfer; g_2 , h_6 & h_1 vs. E_{c1}

($E_b = 100V$)

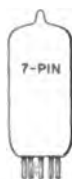
Operation (g_2 vs. h_1)

APPLICATION

Type 4BE6 is designed for use as a mixer and oscillator in superhet circuits for standard broadcast, f-m, or vhf television bands.



4BN6



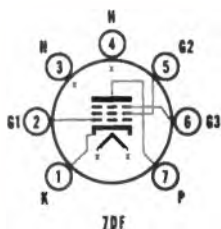
Gated beam tube for f-m discriminator, limiter, and audio amplifier service, heater warm-up controlled for series strings

HEATER CHARACTERISTICS

Voltage, a-c or d-c.	4.2 volts
Current	450 ma
Peak heater-cathode voltage, max.	
Heater negative to cathode	200 volts
Heater positive to cathode*	200 volts
Warm-up time	11 secs. average
(See Series-String Heaters section of APPENDIX in CBS Tube Manual).	

*D-c component must not exceed 100 volts max.

Type 4BN6 is identical to types 3BN6 and 6BN6 except for heater characteristics. See type 3BN6 for ratings and operating characteristics.



4BN6

JUNE 1, 1957

Gated beam pentode

CHARACTERISTIC CURVES

(In curve section following APPENDIX)

Plate ($E_{c2} = 60V$, $E_{c3} = 3.0V$)

Operation

Transfer; E_{c1} vs. h_6 , ΔE_{c1}

Transfer; E_{c1} vs. h_6 , ΔE_{c1}

APPLICATION

Type 4BN6 functions as a combination f-m discriminator, f-m limiter, and audio amplifier in f-m receivers and intercarrier type television receivers. See APPENDIX for explanation of warm-up time controlled series-string circuits and the schematic showing the internal construction of a gated beam tube.

ENGINEERING DESIGN DATA

4BQ7A

JUNE 10, 1956

High-gain, low-noise duotriode

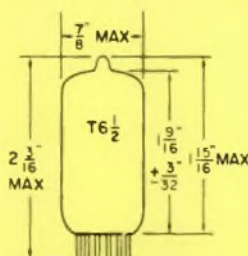
CHARACTERISTIC CURVES

(In curve section following APPENDIX)

Plate	123A
Plate	123B
Operation (Cascode amplifier)	123C
Transfer	123D
Transfer	123E

MECHANICAL DATA

Cathode, coated unipotential	
Bulb	T-6 1/2
Outline	JETEC 6-2
Base	9-pin Miniature (E9-1)
Basing	9AJ
Mounting position	Any



PIN CONNECTIONS

Pin 1	Plate (Sect. 2)
Pin 2	Grid 1 (Sect. 2)
Pin 3	Cathode (Sect. 2)
Pin 4	Heater
Pin 5	Heater
Pin 6	Plate (Sect. 1)
Pin 7	Grid 1 (Sect. 1)
Pin 8	Cathode (Sect. 1)
Pin 9	I. S.

REFERENCES

See explanation of warm-up time controlled series-string heater circuits in APPENDIX.

APPLICATION

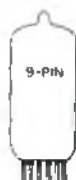
Type 4BQ7A is a miniature, medium-mu duotriode designed for use as the cascode r-f amplifier in tuners or vhf television receivers using a 600-ma series heater string. It features high transconductance and low-noise characteristics.

NOTES

Type 4BQ7A is identical to type 6BQ7A except for heater characteristics.



4BQ7A

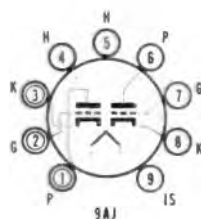


High-gain, low-noise vhf cascode amplifier, heater warm-up controlled for series strings

HEATER CHARACTERISTICS

Voltage, a-c or d-c	4.2 volts
Current	600 ma
Peak heater-cathode voltage, max.	
Heater negative to cathode*	200 volts
Heater positive to cathode*	200 volts
Warm-up time	11 sec. average
(See Series-String Heaters section of APPENDIX in CBS Tube Manual)	

*D-c component must not exceed 100 volts max.



ELECTRICAL DATA

DIRECT INTERELECTRODE CAPACITANCES—Shield†

	Section 1†	Section 2†
Grid to plate: g1 to p1	1.15	1.15 μ f
Input: g1 to k + h + i.s.	2.85	μ f
Output: p to k + h + i.s.	1.35	μ f
Plate to cathode: p to k, max.	0.15	0.15 μ f
Heater to cathode: h to k	2.65	2.70 μ f
Coupling: p1 to p2, max.	0.010	μ f
Coupling: p2 to p1 and g1, max.	0.024	μ f
Grounded grid operation		
Input: k to h + g + i.s.		4.95 μ f
Output: p to h + g + i.s.		2.27 μ f

†JETEC shield 315 connected to cathode.

†Section 1 connects to pins 6, 7, and 8.

MAXIMUM RATINGS (Design center values)‡

Plate voltage*	250 volts
Plate dissipation	2 watts
Cathode current	20 ma
Control-grid circuit resistance	0.5 meg

CHARACTERISTICS AND TYPICAL OPERATION

Class A Amplifier‡

Plate voltage*	150 volts
Cathode-bias resistor	220 ohms
Plate resistance (approx.)	6100 ohms
Transconductance	6400 μ hos
Amplification factor	39
Plate current	9 ma
Control-grid voltage (approx.) for $I_b = 10 \mu$ a	-10 volts

Direct Coupled R-F Grounded Grid Operations

	Section 1†	Section 2†
Plate supply voltage	250	250 volts
Plate voltage	135	115 volts
Control-grid voltage	-1.0	volts
Cathode-bias resistor	100	ohms
Grid resistor		0.5 meg
Plate current	10	10 ma
Control-grid current	0	0 ma
Control-grid voltage (approx.) for $I_b = 10 \mu$ a	-14	volts
Heater-cathode voltage		
Heater negative to cathode	1	125 volts

NOTES:

*Under cutoff conditions, in r-f grounded grid circuits with direct coupled drive, this voltage may be as high as 300 volts.

†Section 1 connects to pins 6, 7, and 8. Section 2 connects to pins 1, 2, and 3.

‡Each section.

‡Section 1 (driver) is directly coupled to Section 2 (driven grounded-grid amplifier).



4BS8

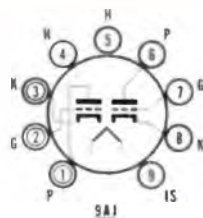


Low-noise vhf cascode amplifier, heater warm-up controlled for series strings

HEATER CHARACTERISTICS

Voltage, a-c or d-c	4.2 volts
Current	600 ma
Peak heater-cathode voltage, max.	
Heater negative to cathode	200 volts
Heater positive to cathode	200 volts
Warm-up time	11 secs. average

(See Series-String Heaters section of APPENDIX in CBS Tube Manual).



ELECTRICAL DATA

DIRECT INTERELECTRODE CAPACITANCES—Shield

	Section 1†	Section 2†
Grid to plate: g1 to p	1.15	1.15
Input: g1 to k + h + i.s.	2.60	
Output: p to k + h + i.s.	1.35	
Plate to cathode: p to k	0.15	0.15 max.
Heater to cathode: h to k	2.60	2.70
Plate (Sect. 1) to plate (Sect. 2)	0.010 max.	
Plate (Sect. 2) to plate and grid (Sect. 1)	0.024 max.	
Grounded grid operation		
Input	4.95	
Output	2.27	

†JETEC shield 315 connected to cathode.

MAXIMUM RATINGS (Design center values)

Plate voltage	150 volts
Plate dissipation	2.0 watts
Cathode current	20 ma
Control-grid circuit resistance*	0.5 meg

CHARACTERISTICS AND TYPICAL OPERATION

Class A Amplifier

Plate voltage	150 volts
Cathode-bias resistor	220 ohms
Plate resistance (approx.)	5000 ohms
Transconductance	7200 μ hos
Amplification factor	36
Plate current	10 ma
Control-grid voltage (approx.) for $I_b = 10 \mu A$	7 volts

Cascode Operation

Plate supply voltage	250 volts
Control-grid voltage	-1.0 volt
Transconductance	10,000 μ hos
Plate current	16 ma
Control-grid voltage (approx.) for $I_b = 10 \mu A$	6.0 volts

NOTES:

*Each unit. †Section 2 only.

†Section 1 connects to pins 6, 7, and 8. Section 2 connects to pins 1, 2, and 3.

ENGINEERING DESIGN DATA

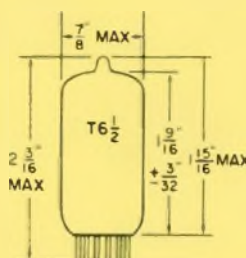
4BS8

NOVEMBER 26, 1956

Medium-mu duotriode

MECHANICAL DATA

Cathode, coated unipotential	
Bulb	T-6½
Outline	JETEC 6-2
Base	Miniature 9-pin (E9-1)
Basing	9AJ
Mounting position	Any



PIN CONNECTIONS

Pin 1	Plate (Sect. 2)
Pin 2	Grid (Sect. 2)
Pin 3	Cathode (Sect. 2)
Pin 4	Heater
Pin 5	Heater
Pin 6	Plate (Sect. 1)
Pin 7	Grid (Sect. 1)
Pin 8	Cathode (Sect. 1)
Pin 9	I. S.

REFERENCES

See explanation of warm-up time controlled series-string heater circuits in APPENDIX.

APPLICATION

Type 4BS8 is a medium-mu duotriode designed for use as a low-noise vhf amplifier for 600 ma series strings. It has high cascode transconductance. Section 2 (pins 1, 2, and 3) is the input section of the cascode circuit.

NOTES

Type 4BS8 is identical to type 6BS8 except for heater characteristics.

4BU8

JUNE 1, 1957

**Sharp-cutoff
duopentode**

CHARACTERISTIC CURVES

(In curve section following APPENDIX)

Plate ($E_{c2} = 67.5V$, $I_{c1} = 0.1$ ma) . . . 176A

Plate ($E_{c2} = 67.5V$, $E_{c3} = 0V$) . . . 176B

Characteristics; I_b , I_{c2} . . . 176C

Characteristics; I_{c2} , I_{c3} vs. E_b . . . 176D

Screen characteristics ($E_{c2} = 67.5V$) . 176E

Transfer, both units ($E_{c3} = 0V$) . . . 176F

Transfer, each unit ($E_{c3} = 0V$) . . . 176G

Transfer, both units ($I_{c1} = 0.1$ ma) . 176H

Transfer, each unit ($I_{c1} = 0.1$ ma) . . 176I

APPLICATION

Type 4BU8 is a sharp-cutoff duopentode designed for use as a combined sync and agc tube in TV receivers.



4BU8



**Combined sync and agc tube for television receivers,
heater warm-up time controlled for series strings**

HEATER CHARACTERISTICS

Voltage, a-c or d-c 4.2 volts

Current 450 ma

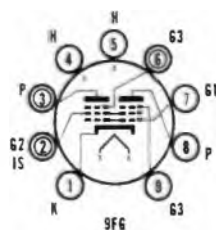
Peak heater-cathode voltage, max.

Heater negative to
cathode 200 volts

Heater positive to
cathode* 200 volts

Warm-up time 11 secs. average
(See Series-String Heaters section of
APPENDIX in CBS Tube Manual).

*D-c component must not exceed 100
volts max.



Type 4BU8 is identical to types 3BU8 and 6BU8 except for heater characteristics. See type 3BU8 for ratings and operating characteristics.



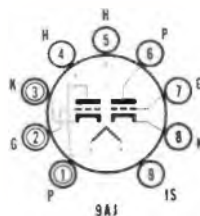
4BX8



Vhf cascode amplifier in TV receivers having low supply voltages, heater warm-up controlled for series strings

HEATER CHARACTERISTICS

Voltage, a-c or d-c.....	4.5 volts
Current.....	600 ma
Peak heater-cathode voltage, max.	
Heater negative to cathode.....	200 volts
Heater positive to cathode*.....	200 volts
Warm-up time.....	11 secs. average
(See Series-String Heaters section of APPENDIX in CBS Tube Manual).	
*D-c component must not exceed 100 volts max.	



ELECTRICAL DATA

DIRECT INTERELECTRODE CAPACITANCES—Shield

	Section 1	Section 2	
Grid to plate: g1 to p.....	1.4	1.4	μf
Plate to cathode: p to k.....	.165	.165	μf
Input: g to h + k + i.s.....		2.4	μf
Input: k to h + g + i.s.††.....	4.9		μf
Output: p to k + h + i.s.....		1.25	μf
Output: p to h + g + i.s.††.....	2.6		μf

††JETEC shield 315 connected to pin 9.

††Read as grounded grid amplifier.

MAXIMUM RATINGS (Design maximum values)

Plate voltage.....	150 volts
Plate dissipation (each plate).....	2.0 watts
Cathode current.....	20 ma
Control-grid circuit resistance.....	0.5 meg

CHARACTERISTICS AND TYPICAL OPERATION

	Cascode Amplifier	Class A Amplifier
Plate voltage.....		65 volts
Plate supply voltage.....	125	volts
Control-grid voltage.....	-0.5	-1.0 volts
Transconductance.....	7500	μmhos
Amplification factor.....		25
Plate current.....	11.0	9.0 ma
Control-grid voltage (approx.) for $I_b = 10 \mu\text{a}$		-7.0 volts

ENGINEERING DESIGN DATA

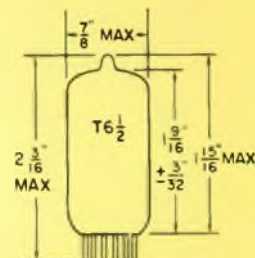
4BX8

JUNE 1, 1957

Duotriode

MECHANICAL DATA

Cathode, coated unipotential	
Bulb.....	T-6½
Outline.....	JETEC 6-2
Base.....	Miniature 9-pin (E9-1)
Basing.....	9AJ
Mounting position.....	Any



PIN CONNECTIONS

Pin 1.....	Plate (Sect. 2)
Pin 2.....	Grid (Sect. 2)
Pin 3.....	Cathode (Sect. 2)
Pin 4.....	Heater
Pin 5.....	Heater
Pin 6.....	Plate (Sect. 1)
Pin 7.....	Grid (Sect. 1)
Pin 8.....	Cathode (Sect. 1)
Pin 9.....	I. S.

REFERENCES

See explanation of warm-up time controlled series-string heater circuits in APPENDIX.

APPLICATION

Type 4BX8 is a miniature duotriode designed for operation as a cascode (vhf) amplifier in television receivers where low supply voltages are employed. Section 2 is the input section in cascode operation.

ENGINEERING DESIGN DATA

4BZ7

JUNE 10, 1956

High-gain, low-noise duotriode

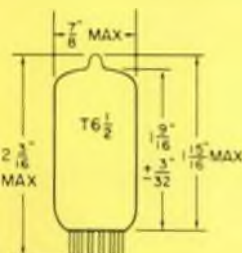
CHARACTERISTIC CURVES

(In curve section following APPENDIX)

Plate.....	135A
Plate.....	135B
Transfer.....	135C
Transfer.....	135D

MECHANICAL DATA

Cathode, coated unipotential:	
Bulb.....	T-6½
Outline.....	JETEC 6-2
Base.....	9-pin Miniature (E9-1)
Basing.....	9A1
Mounting position.....	Any



PIN CONNECTIONS

Pin 1.....	Plate (Sect. 2)
Pin 2.....	Grid 1 (Sect. 2)
Pin 3.....	Cathode (Sect. 2)
Pin 4.....	Heater
Pin 5.....	Heater
Pin 6.....	Plate (Sect. 1)
Pin 7.....	Grid 1 (Sect. 1)
Pin 8.....	Cathode (Sect. 1)
Pin 9.....	Internal Shield

REFERENCES

See explanation of warm-up time controlled series-string heater circuits in APPENDIX.

APPLICATION

Type 4BZ7 is a miniature, medium-mu duotriode for use in low noise vhf amplifier applications and particularly for cascode operation. It features high transconductance and low-noise characteristics.

NOTES

Type 4BZ7 is identical to the 6BZ7 except for heater characteristics.



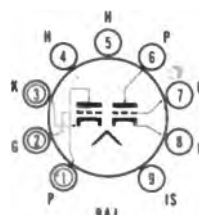
4BZ7



High-gain, low-noise cascode amplifier, heater warm-up controlled for series strings

HEATER CHARACTERISTICS

Voltage, a-c or d-c.....	4.2 volts
Current.....	600 ma
Peak heater-cathode voltage, max.	
Heater negative to cathode*.....	200 volts
Heater positive to cathode*.....	200 volts
Warm-up time.....	11 sec. average
(See Series-String Heaters section of APPENDIX in CBS Tube Manual)	
*D-c component must not exceed 100 volts max.	



ELECTRICAL DATA

DIRECT INTERELECTRODE CAPACITANCES—Shield

	Section 1†	Section 2†
Grid to plate: g1 to p.....	1.2	1.2
Input: g1 to k + h + i.s.....	2.6	2.6
Output: p to k + h + i.s.....	1.2	1.2
Plate to cathode: p to k.....	0.12	0.12
Heater to cathode: h to k.....	2.6	2.7
Coupling: p1 to p2.....	0.010	0.010
Coupling: p2 to p1 + g1, max.....	0.024	0.024
Grounded grid operation		
Input: k to h + g + i.s.....		5.0
Output: p to h + g + i.s.....		2.2

†JETEC shield 315 connected to cathode.

†Section 1 connects to pins 6, 7, and 8.

MAXIMUM RATINGS (Design center values)Δ

Plate voltage.....	250 volts
Plate dissipation.....	2 watts
Cathode current.....	20 ma
Control-grid circuit resistance.....	0.5 meg

CHARACTERISTICS AND TYPICAL OPERATION

Class A AmplifierΔ

Plate voltage.....	150 volts
Cathode-bias resistor.....	220 ohms
Plate resistance (approx.).....	5300 ohms
Transconductance.....	6800 μmhos
Amplification factor.....	36
Plate current.....	10 ma
Cathode-grid voltage (approx.) for $I_b = 100 \mu a$	-7 volts

NOTE:

ΔEach section.

*Under cut-off conditions, in r f grounded circuits with direct coupled drive, the voltage may be as high as 300 volts.



4BZ6

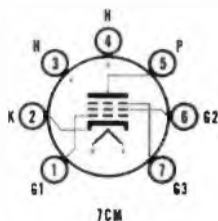


**Pentode i-f amplifier for gain-controlled stages,
heater warm-up controlled for series strings**

HEATER CHARACTERISTICS

Voltage, a-c or d-c	4.2 volts
Current $\pm 6\%$	450 ma
Peak heater-cathode voltage, max.	
Heater negative to cathode	200 volts
Heater positive to cathode*	200 volts
Warm-up time	11 secs. average
(See Series-String Heaters section of Handbook APPENDIX)	
*D-c component must not exceed 100 volts max.	

Type 4BZ6 is identical to types 3BZ6 and 6BZ6 except for heater characteristics. Refer to type 3BZ6 for additional data.



ENGINEERING DESIGN DATA

4BZ6

MARCH 30, 1959

Semiremote-cutoff pentode

CHARACTERISTIC CURVES

(In curve section following APPENDIX)
Screen Grid Rating 100A
Plate ($E_{c2}=150V$) 129A
Transfer ($E_{b1}=200V$, $E_{c2}=150V$) 129B

APPLICATION

Type 4BZ6 is a high gm, semiremote cutoff pentode amplifier designed to function as an agc i-f amplifier in television receivers. Its grid bias characteristic reduces cross modulation caused by strong signals yet provides high amplification for weak signals.



4DE6

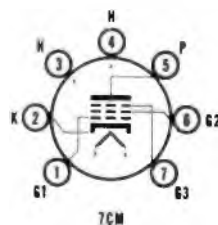


**Controlled cutoff intermediate-frequency amplifier
heater warm-up controlled for series strings**

HEATER CHARACTERISTICS

Voltage, a-c or d-c	4.2 volts
Current	450 ma
Peak heater-cathode voltage, max.	
Heater negative to cathode	200 volts
Heater positive to cathode*	200 volts
Warm-up time	11 secs. average
(See Series-String Heaters section of Handbook APPENDIX)	
*D-c component 100 volts max.	

Type 4DE6 is identical to types 3DE6 and 6DE6 except for heater characteristics. Refer to type 3DE6 for additional data.



4DE6

OCTOBER 30, 1958

Sharp-cutoff pentode

CHARACTERISTIC CURVES

(In curve section following APPENDIX)
Screen Grid Rating 100A

APPLICATION

The 4DE6 is a high gain pentode that has a controlled plate current cutoff for improved agc of television receiver i-f stages.

ENGINEERING DESIGN DATA

4DK6

MARCH 30, 1959

Sharp-cutoff pentode

CHARACTERISTIC CURVES

(In curve section following APPENDIX)

Screen Grid Rating 100A

Transfer: I_p , g_m , I_b , I_{c2} 217A

MECHANICAL DATA

Cathode, coated unipotential

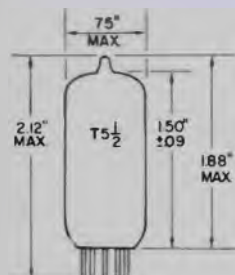
Bulb T-5½

Outline JEDEC 5-2

Base 7-pin Miniature (E7-1)

Basing 7CM

Mounting position Any



PIN CONNECTIONS

Pin 1	Grid 1
Pin 2	Cathode
Pin 3	Heater
Pin 4	Heater
Pin 5	Plate
Pin 6	Grid 2
Pin 7	Grid 3, I. S.

APPLICATION

A wide band, high frequency pentode particularly suited for use as an i-f amplifier tube in television receivers.



4DK6



Pentode amplifier for i-f service in TV receivers,
heater warm-up controlled for series strings

HEATER CHARACTERISTICS

Voltage, a-c or d-c 4.2 volts

Current 450 ma

Peak heater-cathode voltage, max.

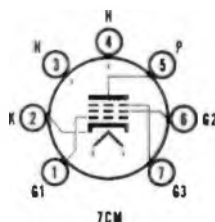
Heater negative to cathode 300 volts

Heater positive to cathode 200 volts

Warm-up time 11 secs. average

(See Series-String Heaters section of APPENDIX in CBS Tube Manual)

• D-c component 100 volts max.



ELECTRICAL DATA

DIRECT INTERELECTRODE CAPACITANCES

Grid to plate: g1 to p, max. 0.020 $\mu\mu\text{f}$

Input: g1 to k + h + g2 + g3 6.3 $\mu\mu\text{f}$

Output: p to k + h + g2 + g3 1.9 $\mu\mu\text{f}$

MAXIMUM RATINGS (Design center values)

Plate voltage 300 volts

Grid 2 voltage See Rating Chart in APPENDIX

Grid 2 supply voltage 300 volts

Grid 1 voltage, positive d-c 0 volts

Plate dissipation 2.0 watts

Grid 2 dissipation 0.5 watt

CHARACTERISTICS AND TYPICAL OPERATION

Class A Amplifier

Plate voltage 125 volts

Grid 3 (suppressor) connect to cathode at socket

Grid 2 (screen) voltage 125 volts

Cathode bias resistor 56 ohms

Plate resistance (approx.) 0.35 meg

Transconductance 9800 μmhos

Plate current 12.0 ma

Grid 2 current 3.8 ma

Grid 1 voltage (approx.) for $I_b = 20 \mu\text{a}$ -6.5 volts

NOTE:

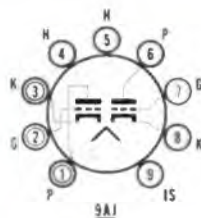
Other heater voltage versions of this tube include types: 3DK6 with a 3.15 volt, 600 ma warm-up controlled heater; 6DK6 with a 6.3 volt, 300 ma heater.

CBS**4BZ8**

**Gain-controlled low-noise vhf cascode amplifier,
heater warm-up controlled for series strings**

HEATER CHARACTERISTICS

Voltage, a-c or d-c.	4.2 volts
Current.	600 ma
Peak heater-cathode voltage, max.	
Heater negative to cathode.	200 volts
Heater positive to cathode.	200 volts
Warm-up time.	11 secs. average
(See Series-String Heaters section of APPENDIX in CBS Tube Manual).	

**ELECTRICAL DATA****DIRECT INTERELECTRODE CAPACITANCES—Shield**

Section 1† Section 2†

Grid to plate: g1 to p.	1.15	μf
Output: p to k + h.	0.15	μf
Plate (Sect. 1) to plate (Sect. 2).	0.10	μf

†JETEC shield 315 connected to cathode.

MAXIMUM RATINGS (Design center values)

Plate voltage.	250 volts
Plate dissipation.	2.2 watts
Cathode current.	20 ma
Control-grid circuit resistance.	0.1 meg

CHARACTERISTICS AND TYPICAL OPERATION**Class A Amplifier (Each Section)**

Plate voltage.	125 volts
Cathode-bias resistor.	100 ohms
Plate resistance (approx.).	5600 ohms
Transconductance.	8000 μmhos
Transconductance, cascode ($E_b = 250V$, $E_{c1} = -0.5V$).	10,000 μmhos
Amplification factor.	45
Plate current.	10 ma
Cathode plate current ($E_b = 250V$, $E_{c1} = -0.5V$).	15 ma
Control-grid voltage (approx.) for gm = 50 μmhos.	-13 volts

NOTES:

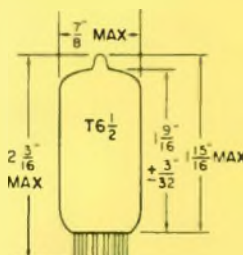
†Section 1 connects to pins 6, 7, and 8. Section 2 connects to pins 1, 2, and 3.

**ENGINEERING
DESIGN DATA****4BZ8**

NOVEMBER 26, 1956

**Semiremote-cutoff
duotriode****MECHANICAL DATA**

Cathode, coated unipotential	
Bulb.	T-6½
Outline.	JETEC 6-2
Base.	Miniature 9-pin (E9-1)
Basing.	9AJ
Mounting position.	Any

**PIN CONNECTIONS**

Pin 1	Plate (Sect. 2)
Pin 2	Grid (Sect. 2)
Pin 3	Cathode (Sect. 2)
Pin 4	Heater
Pin 5	Heater
Pin 6	Plate (Sect. 1)
Pin 7	Grid (Sect. 1)
Pin 8	Cathode (Sect. 1)
Pin 9	I. S.

APPLICATION

Type 4BZ8 is a semiremote-cutoff duotriode designed for application as a gain-controlled, low noise vhf cascode amplifier for 600 ma series-strings. Section 1 (pins 6, 7, and 8) is the input section of the cascode circuit. The 4BZ8 is identical except for heater characteristics.

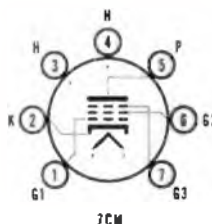
CBS**4CB6**

**Pentode amplifier for r-f or i-f service, heater
warm-up time controlled for series strings**

HEATER CHARACTERISTICS

Voltage, a-c or d-c.	4.2 volts
Current.	450 ma
Peak heater-cathode voltage, max.	
Heater negative to cathode.	300 volts
Heater positive to cathode.*	200 volts
Warm-up time.	11 secs. average
(See Series-String Heaters section of APPENDIX in CBS Tube Manual).	

*D-c component must not exceed 100 volts max.



Type 4CB6 is identical to types 3CB6 and 6CB6 except for heater characteristics. See type 3CB6 for ratings and operating characteristics.

CBS ELECTRON TUBES**4CB6**

JUNE 1, 1957

Sharp-cutoff pentode**CHARACTERISTIC CURVES**

(In curve section following APPENDIX)

Plate ($E_{c2} = 150V$).	130A
Plate ($E_{c2} = E_{c1} = 0V$), ΔE_{c2} .	130B
Transfer ($E_b = 200V$, $E_{c3} = 0V$).	130C
Transfer ($E_b = 200V$, $E_{c3} = 0V$).	130D

APPLICATION

Type 4CB6 is designed for television use as an i-f amplifier in the vicinity of 40 megacycles. It can also be used in vhf television tuners as an r-f amplifier.

ENGINEERING DESIGN DATA

4CX7

NOVEMBER 26, 1956

Medium-mu duotriode

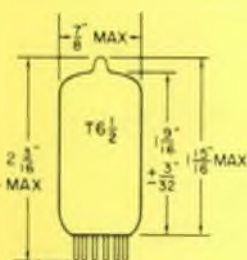
CHARACTERISTIC CURVES

(In curve section following APPENDIX)

Plate	123A
Plate	123B
Characteristics (cascode amplifier)	123C
Transfer	123D
Transfer	123E

MECHANICAL DATA

Cathode	coated unipotential
Bulb	T-6½
Outline	JETEC 6-2
Base	Miniature 9-pin (E9-1)
Basing	9FC
Mounting position	Any



PIN CONNECTIONS

Pin 1	Plate (Sect. 2)
Pin 2	Grid (Sect. 2), I. S.
Pin 3	Cathode (Sect. 2)
Pin 4	Heater
Pin 5	Heater
Pin 6	Plate (Sect. 1)
Pin 7	Grid (Sect. 1)
Pin 8	Cathode (Sect. 1)
Pin 9	Cathode (Sect. 1)

APPLICATION

Type 4CX7 is a medium-mu duotriode designed for application as a low-noise vhf cascode amplifier.

NOTES

Type 4CX7 is the same as 6CX7 except for heater characteristics, and the 6BQ7A except for heater characteristics, capacitances, and cathode (Sect. 1) being connected to pin 9.



4CX7



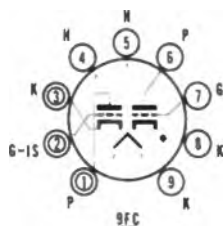
Low-noise vhf cascode amplifier, heater warm-up controlled for series strings

HEATER CHARACTERISTICS

Voltage, a-c or d-c.	4.2 volts
Current	600 ma
Peak heater-cathode voltage, max.	
Heater negative to cathode†	200 volts
Heater positive to cathode*	200 volts
Warm-up time	11 secs. average

(See Series-String Heaters section of APPENDIX in CBS Tube Manual).

*D-c component must not exceed 100 volts max.



ELECTRICAL DATA

DIRECT INTERELECTRODE CAPACITANCES—Shield

	Section 1†	Section 2‡	
Grid to plate: g1 to p	1.2		μf
Input: g1 to k + h	2.4		μf
Output: p to k + h	1.3		μf
Heater to cathode: h to k	2.4	2.2	μf
Plate to cathode: p to k, max.	0.17	0.17	μf
Plate (Sect. 2) to plate and grid (Sect. 1), max.	0.27		μf
Plate (Sect. 1) to plate (Sect. 2), max.	0.17		μf
Grounded grid operation			
Input: k to g + h + i.s.		4.2	μf
Output: p to g + h + i.s.		1.7	μf

†JETEC shield 315 connected to heater unless otherwise specified.

‡JETEC shield 315 connected to ground.

MAXIMUM RATINGS (Design center values) (Each section)

Plate voltage†	250 volts
Plate dissipation	2.0 watts
Cathode current	20 ma
Control-grid circuit resistance	0.5 meg

CHARACTERISTICS AND TYPICAL OPERATION

Class A Amplifier (Each section)

Plate voltage	150 volts
Control-grid voltage	0 volts
Cathode-bias resistor	220 ohms
Transconductance	6400 μmhos
Amplification factor	39
Plate current	9.0 ma
Control-grid voltage (approx.) for $I_b = 10 \mu a$	-10 volts

NOTES:

†Under cutoff conditions when the tube is used as a cascode amplifier, this rating may be as high as 300 volts maximum.

‡Section 1 connects to pins 6, 7, 8, and 9. Section 2 connects to pins 1, 2, and 3.

CBS

5AM8



High-gain i-f amplifier and video detector, heater warm-up controlled for series strings

HEATER CHARACTERISTICS

Voltage, a-c or d-c.	4.7 volts
Current.	600 ma
Peak heater-cathode voltage, max.	
Heater negative to cathode	200 volts
Heater positive to cathode*	200 volts
Warm-up time	11 sec. average
(See Series-String Heaters section of APPENDIX in CBS Tube Manual)	

*D-c component 100 volts max.



ELECTRICAL DATA

DIRECT INTERELECTRODE CAPACITANCES

Pentode	No Shield	Shield†	
Grid to plate: g1 to p, max.	0.015	0.015	μmf
Input: g1 to k + h + g2 + g3	6.0	6.0	μmf
Output: p to k + h + g2 + g3	2.6	3.4	μmf
Diode			
Input: p to k + h	1.7	2.3	μmf
Cathode to heater and plate: k to h + p	3.0	3.0	μmf
Coupling: diode plate to pentode plate	0.10	0.035	μmf
Coupling: diode plate to pentode grid 1	0.006	0.005	μmf
Coupling: diode cathode to pentode plate	0.15	0.15	μmf

†JETEC shield 315 connected to cathode.

MAXIMUM RATINGS (Design center values)

Plate voltage	300 volts
Grid 2 voltage	See Rating Chart in APPENDIX
Grid 2 supply voltage	300 volts
Grid 1 voltage, positive d-c.	0 volts
Grid 3 voltage	0 volts
Plate dissipation	2.8 watts
Grid 2 dissipation	0.5 watt
Grid 1 circuit resistance	
Fixed bias	0.25 meg
Cathode bias	1.0 meg
Diode current for continuous operation	5.0 ma

CHARACTERISTICS AND TYPICAL OPERATION

Class A Amplifier

Plate voltage	200 volts
Grid 3 (suppressor) voltage	0 volts
Grid 2 (screen) voltage	150 volts
Cathode bias resistor	120 ohms
Plate resistance (approx.)	0.6 meg
Transconductance	7000 μmhos
Plate current	11.5 ma
Grid 2 current	2.7 ma
Grid 1 voltage (approx.) for $I_b = 10\mu\text{a}$	-8 volts
Diode plate voltage for diode current = 50 ma*	10 volts

NOTE:

*Test conditions only—Operating conditions must not exceed the design center rating.

ENGINEERING DESIGN DATA

5AM8

JUNE 10, 1956

Sharp cutoff
pentode—high
perveance diode

CHARACTERISTIC CURVES

(In curve section following APPENDIX)

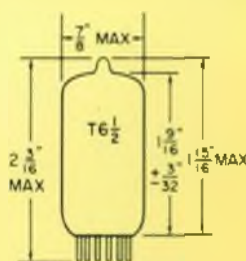
Screen Grid Rating 100A

Plate ($E_c = 100V$) 136A

Transfer ($E_b = 250V$, $E_c = 150V$) 136B

MECHANICAL DATA

Cathode, coated unipotential	
Bulb	T-6½
Outline	JETEC 6-2
Base	9-pin Miniature (ES-1)
Basing	9CY
Mounting position	Any



PIN CONNECTIONS

Pin 1	Pentode Cathode
Pin 2	Pentode Grid 1
Pin 3	Pentode Grid 2
Pin 4	Heater
Pin 5	Heater
Pin 6	Pentode Plate
Pin 7	Diode Cathode
Pin 8	Diode Plate
Pin 9	Pentode Grid 3

REFERENCES

See explanation of warm-up time controlled series-string heater circuits in APPENDIX.

APPLICATION

Type 5AM8 is a miniature diode-pentode designed for application as a combined video detector and last i-f stage in television receivers.

NOTES

Type 5AM8 is identical to type 6AM8 except for heater characteristics.

ENGINEERING DESIGN DATA

5AN8

JUNE 10, 1956

**Medium- μ
duotriode—sharp
cutoff pentode**

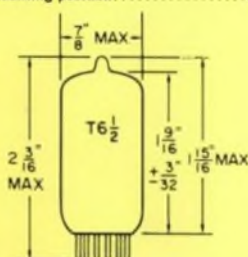
CHARACTERISTIC CURVES

(In curve section following APPENDIX)

Screen Grid Rating	100A
Plate, triode	137A
Transfer, triode	137B
Plate, pentode ($E_{c2} = 150V$)	137C
Transfer, pentode ($E_b = 200V$, $E_{c2} = 150V$)	137D

MECHANICAL DATA

Cathode, coated unipotential	
Bulb	T-6½
Outline	JETEC 6-2
Base	9-pin Miniature (E9-1)
Basing	9DA
Mounting position	Any



PIN CONNECTIONS

Pin 1	Triode Plate
Pin 2	Triode Grid
Pin 3	Triode Cathode
Pin 4	Heater
Pin 5	Heater
Pin 6	Pentode Plate
Pin 7	Pentode Grid 2
Pin 8	Pentode Grid 1
Pin 9	Pentode Grid 3, Pentode Cathode, I. S.

REFERENCES

See explanation of warm-up time controlled series-string heater circuits in APPENDIX.

APPLICATION

Type 5AN8 is a 9-pin miniature, medium- μ triode and sharp-cutoff pentode. The triode section may be used as a sync clipper, sync separator, etc. and the pentode section may be used as an i-f or video amplifier. The heater is designed for 600-ma heater-strings. Each section has its own electrically independent cathode.

NOTES

Type 5AN8 is identical to type 6AN8 except for heater characteristics.



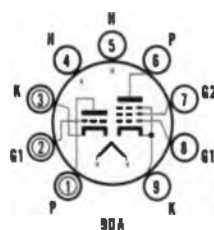
5AN8



Sync clipper, sync separator, etc. and i-f or video amplifier, heater warm-up controlled for series strings

HEATER CHARACTERISTICS

Voltage, a-c or d-c	4.7 volts
Current	600 ma
Peak heater-cathode voltage max.	
Heater negative to cathode	200 volts
Heater positive to cathode	200 volts
Warm-up time	11 sec. average
(See Series-String Heaters section of APPENDIX in CBS Tube Manual)	
*D-c component must not exceed 100 volts max.	



ELECTRICAL DATA

DIRECT INTERELECTRODE CAPACITANCES

Triode Section

Grid to plate: g1 to p	1.5 μf
Input: g1 to k + h	2.0 μf
Output: p to k + h	0.27 μf

Pentode Section

Grid to plate: g1 to p, max.	0.04 μf
Input: g1 to k + h + g2 + g3	7.0 μf
Output: p to k + h + g2 + g3	2.3 μf
Coupling: pentode grid 1 to triode plate	0.006 μf
Coupling: pentode plate to triode grid	0.005 μf
Coupling: pentode plate to triode plate	0.045 μf

MAXIMUM RATINGS (Design center values)

	Triode	Pentode
Plate voltage	300	300 volts
Grid 2 voltage	See Rating Chart in APPENDIX	
Grid 2 supply voltage		300 volts
Grid 1 voltage, positive d-c	0	0 volts
Plate dissipation	2.6	2.0 watts
Grid 2 dissipation		0.5 watt
Grid 1 circuit resistance*		
Fixed bias	0.5	0.25 meg
Self bias	1.0	1.0 meg

CHARACTERISTICS AND TYPICAL OPERATION

Class A Amplifier	Triode	Pentode
Plate supply voltage	200	200 volts
Grid 2 (screen) supply voltage		150 volts
Grid 1 (control-grid) voltage	-6	volts
Cathode-bias resistor		180 ohms
Plate resistance (approx.)	100575	0.30 meg
Transconductance	3300	6200 μ hos
Amplification factor	19	
Plate current	13	9.5 ma
Grid 2 current		2.8 ma
Grid 1 voltage (approx.) for $I_b = 10\mu A$	-19	-8 volts

NOTE:

*If either unit is operating at maximum rated conditions, Grid 1 circuit resistance for both units should not exceed the values given.

CBS ELECTRON TUBES



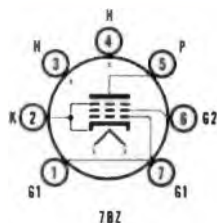
5AQ5



Audio power amplifier, heater warm-up controlled for series strings

HEATER CHARACTERISTICS

Voltage, a-c or d-c	4.7 volts
Current	600 ma
Peak heater-cathode voltage, max.	
Heater negative to cathode	200 volts
Heater positive to cathode*	200 volts
Warm-up time	11 sec. average
(See Series String Heaters section of APPENDIX in CBS Tube Manual)	
*D-c component must not exceed 100 volts max.	



ELECTRICAL DATA

DIRECT INTERELECTRODE CAPACITANCES

Grid to plate: g1 to p	0.4 μf
Input: g1 to k + h + g2 + b.p.	8.0 μf
Output: p to k + h + g2 + b.p.	8.5 μf

MAXIMUM RATINGS (Design center values unless noted)

	Class A Amplifier	Vertical Deflection Amplifier *Triode Connected†
Plate voltage	250	250 volts
Plate voltage, peak positive pulse (absolute max.)	1100	volts
Grid 2 voltage	250	volts
Grid voltage, peak negative		250 volts
Plate dissipation	12	9A watts
Grid 2 dissipation	2	watts
Grid 1 circuit resistance		
Fixed bias	0.1	meg
Self bias	0.5	2.2 meg
Bulb temperature at hottest point	250	250 °C

CHARACTERISTICS AND TYPICAL OPERATION

Class A Amplifier		
Plate voltage	180	250 volts
Grid 2 (screen) voltage	180	250 volts
Grid 1 (control-grid) voltage	-8.5	-12.5 volts
Plate resistance (approx.)	58,000	52,000 ohms
Transconductance	3700	4100 μmhos
Grid 1 input voltage, peak a-f	8.5	12.5 volts
Plate current, zero signal	29	45 ma
Plate current, maximum signal	30	47 ma
Grid 2 current, zero signal	3.0	4.5 ma
Grid 2 current, maximum signal	4.0	7.0 ma
Load resistance impedance	5500	5000 ohms
Total harmonic distortion (approx.)	8	8 %
Power output, maximum signal	2.0	4.5 watts

ENGINEERING DESIGN DATA

5AQ5

JUNE 10, 1956

Beam power pentode

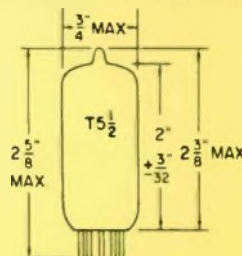
CHARACTERISTIC CURVES

(In curve section following APPENDIX)

Plate ($E_{c2} = 250\text{V}$)	138A
Plate ($E_{c2} = 250\text{V}$)	138B
Plate, Triode Connected	138C
Plate, ΔE_{c2}	138D
Transfer	138E
Operation	138F

MECHANICAL DATA

Cathode, coated unipotential	
Bulb	T-547
Outline	JETEC 5-3
Base	7-pin Miniature (E7-1)
Basing	7BZ
Mounting position	Any



PIN CONNECTIONS

Pin 1	Grid 1
Pin 2	Cathode, B. P.
Pin 3	Heater
Pin 4	Heater
Pin 5	Plate
Pin 6	Grid 2
Pin 7	Grid 1

REFERENCES

For detailed explanation of vertical deflection ratings see APPENDIX.

APPLICATION

The 5AQ5, 6AQ5, and 12AQ5 have high power sensitivity, thus providing high power output with minimum grid-drive requirements. They are equivalent within their ratings to the larger 6V6GT. The 5AQ5 is designed with a 600-ma heater, warm-up time controlled, which can be used for series-string television receivers. The heaters of the 6AQ5 and 12AQ5 can be powered by a-c from a transformer or d-c from an automobile battery. The heater may be connected directly across the 6-volt or 12-volt battery.

Although these tubes are primarily audio power output tubes, they can be used in vertical deflection service in television sweep circuits. In this case, triode connected operation is recommended. Precautions should be taken to insure that the dissipation rating is not exceeded during any line voltage fluctuation, especially if operated with fixed bias.

5AQ5 (cont.)

5AQ5 (cont.)

NOTES

Type 5AQ5 is identical to types 6AQ5 and 12AQ5 except for heater characteristics. Absolute maximum value for peak positive plate-voltage rating. In this case, the combined effect of supply voltage variation, manufacturing variation (including components in the equipment), and adjustment of equipment controls should not cause the rated value to be exceeded.

Class AB Amplifier (Two tube values unless noted)

Plate voltage.....	250 volts
Grid 2 (screen) voltage.....	250 volts
Grid 1 (control-grid) voltage.....	-15 volts
Plate resistance, per tube.....	60,000 ohms
Transconductance, per tube.....	3750 μ hos
Grid-to-grid input voltage, peak a-f.....	30 volts
Plate current, zero signal.....	70 ma
Plate current, maximum signal.....	79 ma
Grid 2 current, zero signal.....	5 ma
Grid 2 current, maximum signal.....	13 ma
Load resistance, plate-to-plate.....	10,000 ohms
Total harmonic distortion (approx.).....	5 %
Power output, maximum signal.....	10 watts

Triode Connected

Plate and grid 2 voltage (p + g2 tied together).....	250 volts
Grid 1 voltage.....	-12.5 volts
Plate resistance (approx.).....	1970 ohms
Amplification factor.....	9.5
Transconductance.....	4800 μ hos
Plate current.....	49.5 ma
Grid 1 voltage (approx.) for $I_b = 0.5$ ma.....	37 volts

NOTES:

*Voltage pulse duration must not exceed 2500 μ s in a 525-line, 30-frame system.

†With screen tied to plate.

▲Tube protection is needed for no-drive conditions if grid resistor bias is used.

5AS4

JULY 10, 1956

Double diode

CHARACTERISTIC CURVES

(In curve section following APPENDIX)

Rating Chart I.....139A

Rating Chart II.....139B

Rating Chart III.....139C

MECHANICAL DATA

5AS4A 5AS4A†

Coated filament		
Bulb.....	ST16	T-12
Outline.....	16-3	12-15
Base		
Medium shell octal		
5-pin.....	B5-15	B5-121
Medium shell octal		
8-pin.....	B8-11	B8-118
Basing.....	5T	
Mounting position†	Vertical	

NOTES

†Horizontal operation is permissible if pins No. 1 and No. 4 are in a vertical plane.

▲See type 5U4G for outline drawing.

♦ See type 6L6GB for outline drawing.



5AS4

5AS4A



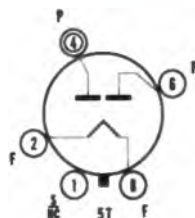
**High-vacuum full-wave power rectifier
with high d-c current output**

FILAMENT CHARACTERISTICS

Voltage, a-c..... 5.0 volts

Current..... 3.0 amp

Types 5AS4 and 5AS4A are identical to type 5U4GB except for type of glass envelope and type of octal base.





5AS8



Detector—video, i-f, or agc amplifier, heater warm-up controlled for series strings

HEATER CHARACTERISTICS

Voltage, a-c or d-c.	4.7 volts
Current	600 ma
Peak heater-cathode voltage, max.	
Heater negative to cathode	200 volts
Heater positive to cathode*	200 volts
Warm-up time	11 sec. average
(See Series-String Heaters section of APPENDIX in CBS Tube Manual)	
*D-c component must not exceed 100 volts max.	

ELECTRICAL DATA

DIRECT INTERELECTRODE CAPACITANCES

Pentode

Grid to plate: g1 to p, max.	0.02 μ f
Input: g1 to k + h + g2 + g3	7.0 μ f
Output: p to k + h + g2 + g3	2.2 μ f
Pentode grid to diode plate, max.	0.005 μ f
Pentode plate to diode cathode, max.	0.15 μ f
Pentode plate to diode plate, max.	0.10 μ f

Diode

Output: p to k + h + i.s.	3.0 μ f
---------------------------	-------------

MAXIMUM RATINGS (Design center values)

Pentode Unit

Plate voltage	300 volts
Grid 3 (suppressor) voltage	0 volts
Grid 2 voltage	See Rating Chart in APPENDIX
Grid 2 supply voltage	300 volts
Grid 1 voltage, positive d-c.	0 volts
Plate dissipation	2.5 watts
Grid 2 dissipation	0.5 watt
Grid 1 circuit resistance	
Fixed bias	0.25 meg
Self bias	1.0 meg

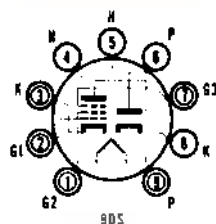
Diode Unit

Peak inverse plate voltage	330 volts
Peak plate current	50 ma
D-c plate current	5 ma

CHARACTERISTICS AND TYPICAL OPERATION

Class A Amplifier

Plate supply voltage	200 volts
Grid 3 (suppressor)	connected to cathode at socket
Grid 2 supply voltage	150 volts
Cathode bias resistor	180 ohms
Plate resistance (approx.)	0.3 meg
Transconductance	6200 μ mhos
Plate current	9.5 ma
Grid 2 current	3.0 ma
Grid 1 voltage (approx.) for $I_b = 10 \mu$ a	-8.0 volts



ENGINEERING DESIGN DATA

5AS8

JUNE 10, 1956

Diode—sharp-cutoff pentode

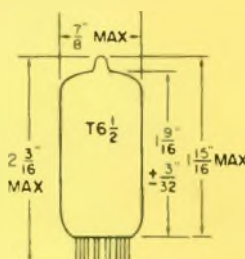
CHARACTERISTIC CURVES

(In curve section following APPENDIX)

Screen Grid Rating	100A
Plate, pentode	137C
Transfer, pentode	137D
Plate, diode	120A

MECHANICAL DATA

Cathode, coated unipotential	
Bulb	T-6 1/2
Outline	JETEC 6-2
Base	9-pin Miniature (E9-1)
Basing	.9DS
Mounting position	Any



PIN CONNECTIONS

Pin 1	Pentode Grid 2
Pin 2	Pentode Grid 1
Pin 3	Pentode Cathode
Pin 4	Heater
Pin 5	Heater
Pin 6	Diode Plate
Pin 7	Pentode Grid 3, I. S.
Pin 8	Diode Cathode
Pin 9	Pentode Plate

REFERENCES

See explanation of warm-up time controlled series-string heater circuits in APPENDIX.

APPLICATION

Type 5AS8 is a combined detector—video, i-f, or agc amplifier, heater warm-up controlled for series-strings.

NOTES

Type 5AS8 is identical to Type 6AS8 except for heater characteristics.

5AT8

FEBRUARY 25, 1957

Medium-mu triode—
sharp cutoff pentode

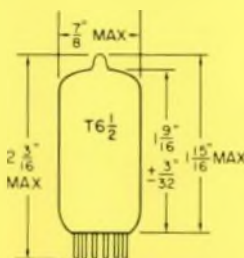
CHARACTERISTIC CURVES

(In curve section following APPENDIX)

Screen Grid Rating	100A
Plate, pentode ($E_{c2} = 150V$)	141A
Plate, triode	141B
Plate, pentode unit (triode connected)	141C
Operation, pentode	141D
Operation, pentode	141E

MECHANICAL DATA

Cathode, coated unipotential	
Bulb	T-6½
Outline	JETEC 6-2
Base	9-pin Miniature (E9-1)
Basing	9DW
Mounting position	Any



PIN CONNECTIONS

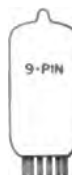
Pin 1	Triode Grid
Pin 2	Triode Plate
Pin 3	Cathode
Pin 4	Heater
Pin 5	Heater
Pin 6	Pentode Plate
Pin 7	Pentode Grid 2
Pin 8	Pentode Grid 3
Pin 9	Pentode Grid 1

REFERENCES

See explanation of warm-up time controlled series-string heater circuits in APPENDIX.



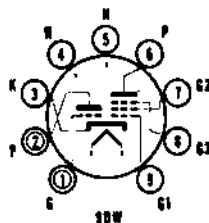
5AT8



Vhf oscillator and mixer, heater warm-up controlled
for series strings

HEATER CHARACTERISTICS

Voltage, a-c or d-c	4.7 volts
Current	600 ma
Peak heater-cathode voltage, max.	
Heater negative to cathode	100 volts
Heater positive to cathode	100 volts
Warm-up time	11 sec. average
(See Series-String Heaters section of APPENDIX in CBS Tube Manual)	
*D-c component must not exceed 100 volts max.	



ELECTRICAL DATA

DIRECT INTERELECTRODE CAPACITANCES

Triode Section	Shields	No Shield	
Grid to plate: g1 to p	1.5	1.5	μf
Input: g1 to k + h	2.4	2.0	μf
Output: p to k + h	1.0	0.5	μf
Pentode Section			
Grid to plate: g1 to p, max.	0.016	0.025	μf
Input: g1 to k + h + g2 + g3	4.7	4.5	μf
Output: p to k + h + g2 + g3	1.6	0.9	μf
Coupling: pentode grid 1 to triode plate	0.04	0.05	μf
Coupling: heater to cathode	6.5*	6.5	μf
Coupling: pentode plate to triode plate	0.007	0.05	μf

Pentode connected as triodeA

Grid 1 to plate: g1 to p	1.3	1.3	μf
Input: g1 to k + h	3.3	3.0	μf
Output: p to k + h	2.5	1.7	μf

*JETEC shield 315 connected to cathode.

*JETEC shield 315 connected to ground.

▲Grid 3 connected to cathode, and grid 2 connected to plate.

MAXIMUM RATINGS (Design center values)

Converter Service	Pentode as Triode Mixer†	Triode Osc.	Pentode Mixer
Plate voltage	250	250	250 volts
Grid 3 voltage			0 volts
Grid 2 voltage	See Rating Chart in APPENDIX		
Grid 2 supply voltage			250 volts
Grid 1 voltage, positive d-c	0	0	0 volts
Grid 1 voltage, negative d-c	40	40	40 volts
Plate dissipation	2.4	1.5	2.0 watts
Grid 2 dissipation			0.4 watt
Grid 1 dissipation		0.5	watt
Cathode current			ma
Grid 1 circuit resistance			
Fixed bias	0.1	0.1	meg
Self bias	0.5	0.5	meg

5AT8 (cont.)

CHARACTERISTICS Class A Amplifier	Pentode Triode Connected	Triode	Pentode
Plate voltage	150 connected to cathode at socket	100	250 volts connected to cathode at socket
Grid 3 (suppressor)	tied to plate		150 volts
Grid 2 (screen) voltage	250	100	200 ohms
Cathode-bias resistor	0.0079	0.0069	0.75 meg
Plate resistance (approx.)	4000	5800	4600 μ hos
Transconductance	42	40	
Amplification factor	7.8	8.5	7.7 ma
Plate current			1.6 ma
Grid 2 current			
Grid 1 voltage (approx.) for $I_b = 10 \mu$ a	-10	-10	-10 volts

TYPICAL OPERATION	Triode at 250 mc Osc.†	Pentode Mixer‡
Plate voltage	150	150 volts
Grid 3 (suppressor)	connected to cathode at socket	150 volts
Grid 2 (screen) voltage		-3.5 volts
Mixer grid 1 supply voltage		2.6 volts
Oscillator voltage, rms at mixer grid 1		0.12 meg
Mixer grid 1 circuit resistance	2700	ohms
Oscillator grid resistor		2100 μ hos
Conversion transconductance	13	6.2 ma
Plate current		1.8 ma
Grid 2 current		2.0 μ a
Grid 1 current		
Oscillator power output	0.5	watt

	Pentode Unit as Triode- Connected Mixer
Plate voltage	150 volts
Grid 1 supply voltage	-3.5 volts
Oscillator voltage, rms at grid 1	2.6 volts
Grid 1 circuit resistance	0.12 meg
Conversion transconductance	2800 μ hos
Plate current	7.8 ma
Grid 1 current	2.0 μ a

NOTES:

†Grid 3 connected to cathode, grid 2 connected to plate.

‡With separate excitation and triode unit grounded.

§In TV or FM receivers it is generally desirable to operate the oscillator with less power input than given in the tabulated data in order to avoid over-excitation and excessive oscillator radiation.

ENGINEERING DESIGN DATA

5AT8 (cont.)

APPLICATION

Type 5AT8 is a combined vhf triode, designed for oscillator service, and vhf pentode, designed for mixer service. A single cathode serves for both sections.

The pentode section will provide performance comparable to that for a 6AG5 mixer and the triode section will provide performance comparable to that for one unit of a 6J6 oscillator in television receivers employing an intermediate frequency in the order of 40 megacycles. The pentode section may be used as either a high-gain pentode mixer or triode-connected mixer depending upon the signal-to-noise ratio required.

NOTES

The 5AT8 has a 600-ma warm-up controlled heater for use in series-strings. Except for the heater characteristic it is identical to the 6AT8.

5AU4

(See chart for seldom-used tubes)

ENGINEERING DESIGN DATA

5AV8

JUNE 10, 1956

**Medium-mu
duotriode—
sharp cutoff pentode**

CHARACTERISTIC CURVES

(In curve section following APPENDIX)

Screen Grid Rating.....	100A
Plate, triode.....	137A
Transfer, triode.....	137B
Plate, pentode ($E_{c2} = 150V$).....	137C
Transfer, pentode ($E_{c1} = 200V$, $E_{c2} = 150V$).....	137D

APPLICATION

Type 5AV8 is a 9-pin miniature, medium-mu triode and sharp-cutoff pentode. The triode section may be used as a sync clipper, sync separator, etc., and the pentode section may be used as an i-f or video amplifier.



5AV8

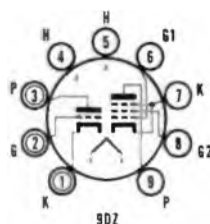


Sync separator or sync clipper, etc. and i-f or video amplifier with heater warm-up controlled for series strings

HEATER CHARACTERISTICS

Voltage, a-c or d-c.....	4.7 volts
Current.....	600 ma
Peak heater-cathode voltage, max.	
Heater negative to cathode.....	200 volts
Heater positive to cathode*.....	200 volts
Warm-up time.....	11 sec. average

(See Series-String Heaters section of APPENDIX in CBS Tube Manual).
*D-c component must not exceed 100 volts max.



DIRECT INTERELECTRODE CAPACITANCES

Triode output: p to k + h.....	0.34 μf
Pentode output: p to k + h + g2 + g3.....	3.0 μf

Type 5AV8 is identical to type 5AN8 except for a different basing diagram and output capacitances. Type 5AV8 uses basing diagram 9DZ.

5AW4

JULY 10, 1956

Double diode

CHARACTERISTIC CURVES

(In curve section following APPENDIX)

Rating Chart I (D-C Output Current) 143A	
Rating Chart II (Rectification Efficiency).....	143B
Rating Chart III (Min. Effective Plate Supply Resistance).....	143C

MECHANICAL DATA

Cathode, coated filament.....	T-12
Bulb.....	As shown
Base.....	Medium shell octal (B5-15)
Basing.....	ST
Mounting position.....	Any



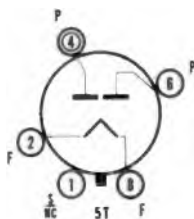
5AW4



High-vacuum, full-wave power rectifier

FILAMENT CHARACTERISTICS

Voltage, a-c or d-c.....	5.0 volts
Current.....	3.7 amp



CBS ELECTRON TUBES

5AW4 (cont.)

ELECTRICAL DATA

MAXIMUM RATINGS (Design center values)

Rectifier Service

Plate voltage, peak inverse	1550 volts
Plate supply voltage, rms (each plate):	
..... RATING CHART I*	550 volts
Output current, d-c. RATING CHART I*	
Plate current, peak steady state (each plate)..... RATING CHART II*	.75 amp
Plate current, peak transient (each plate)..... RATING CHART (II)*	4.0 amp

CHARACTERISTICS

Tube Voltage Drop

Conducting 250 ma (each plate).....	46 volts
-------------------------------------	----------

TYPICAL OPERATION

Full-Wave Rectifier (Capacitor Input Filter)

Plate supply voltage, rms (each plate)†.....	450 volts
Plate supply resistance (each plate).....	153 ohms
Filter input capacitor.....	10 μ f
Output current, d-c.	250 ma
Output voltage at filter input, d-c.	422 volts

TYPICAL OPERATION

Full-Wave Rectifier (Choke Input Filter)

Plate supply voltage, rms (each plate)‡.....	550 volts
Filter input choke.....	10 henrys
Output current, d-c.	250 ma

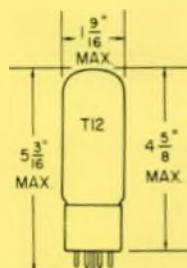
NOTES:

*Rating Charts given in APPENDIX of CBS Tube Manual.

‡The indicated value of a-c plate supply voltage is measured without load.

ENGINEERING DESIGN DATA

5AW4 (cont.)



PIN CONNECTIONS

Pin 1.....	No Connection
Pin 2.....	Filament
Pin 4.....	Plate 2
Pin 6.....	Plate 1
Pin 8.....	Filament

APPLICATION

Type 5AW4 is a full-wave, high-vacuum diode designed for continuous service as a low-voltage rectifier in television receivers.

NOTES

Type 5AW4 is a rugged replacement for the 5U4G. Electrically, type 5AW4 provides greater maximum average and peak currents, yet it is conservatively rated to provide large safety margins. Mechanically, type 5AW4 incorporates many features of transmitting tubes.

5AX4GT • 5AZ4

(See chart for seldom-used tubes)

ENGINEERING DESIGN DATA

5B8

JULY 10, 1956

**Medium-mu
duotriode—
sharp-cutoff pentode**

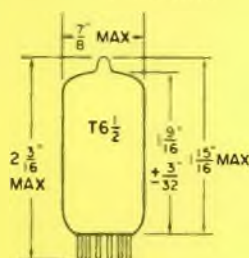
CHARACTERISTIC CURVES

(In curve section following APPENDIX)

Screen Grid Rating	100A
Plate, triode	137A
Transfer, triode	137B
Plate, pentode ($E_{c2} = 150V$)	137C
Transfer, pentode ($E_b = 200V$, $E_{c2} = 150V$)	137D

MECHANICAL DATA

Cathode, coated unipotential	
Bulb	T-6½
Outline	JETEC 6-2
Base	Miniature 9-pin (E9-1)
Basing	9EC
Mounting position	Any



PIN CONNECTIONS

Pin 1	Triode Plate
Pin 2	Triode Grid
Pin 3	Triode Cathode
Pin 4	Heater
Pin 5	Heater
Pin 6	Pentode Plate
Pin 7	Pentode Grid 2
Pin 8	Pentode Grid 1
Pin 9	Pentode Cathode, I. S.

REFERENCES

See explanation of warm-up-time controlled, series-string heater circuits in APPENDIX. Screen grid voltage can be determined by using the JETEC Screen Grid Rating Chart.

APPLICATION

Type 5B8 is a medium-mu triode and sharp-cutoff pentode in one envelope, designed for use in color or black and white television receivers. Its triode section can be used as a sync clipper or sync separator, etc.; the pentode section as an i-f or video amplifier.

NOTES

Type 5B8 is identical to type 5AN8 except for its basing and direct interelectrode capacitances.



5B8

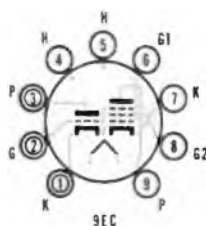


Sync clipper, sync separator, etc. and i-f or video amplifier, heater warm-up controlled for series strings

HEATER CHARACTERISTICS

Voltage, a-c or d-c	4.7 volts
Current	600 ma
Peak heater-cathode voltage, max.	
Heater negative to cathode	200 volts
Heater positive to cathode*	200 volts
Warm-up time	11 secs. average
(See Series-String Heaters section of APPENDIX in CBS Tube Manual)	

*D-c component must not exceed 100 volts max.



ELECTRICAL DATA

DIRECT INTERELECTRODE CAPACITANCES

Triode Section

Grid to plate: g1 to p	1.7	µµf
Input: g1 to k + h + i.s. and pentode g3	1.9	µµf
Output: p to k + h + i.s. and pentode g3	1.4	µµf

Pentode Section

Grid to plate: g1 to p, max.	.032	µµf
Input: g1 to k + h + g2	6.0	µµf
Output: p to k + h + g2 + g3 and triode k	2.6	µµf
Plate to cathode: p to k + g2 + h	.15	µµf
Coupling: pentode grid 1 to triode plate	.0033	µµf
Coupling: pentode plate to triode grid	.0078	µµf
Coupling: pentode plate to triode plate	.060	µµf

MAXIMUM RATINGS (Design center values)

	Triode	Pentode
Plate voltage	300	300 volts
Grid 2 voltage	See Rating Chart in APPENDIX	
Grid 2 supply voltage		300 volts
Grid 1 voltage, positive d-c	0	0 volts
Plate dissipation	2.6	2.0 watts
Grid 2 dissipation		0.5 watt
Grid 1 circuit resistance*		
Fixed bias	0.5	0.25 meg
Self bias	1.0	1.0 meg

CHARACTERISTICS AND TYPICAL OPERATION

Class A Amplifier

	Triode	Pentode
Plate supply voltage	200	200 volts
Grid 2 (screen) supply voltage		150 volts
Grid 1 (control-grid) voltage	-6	volts
Cathode-bias resistor		180 ohms
Plate resistance (approx.)	.00575	0.30 meg
Transconductance	3300	6200 µmhos
Amplification factor	19	
Plate current	13	9.5 ma
Grid 2 current		2.8 ma
Grid 1 voltage (approx.) for $I_b = 10 \mu A$	-19	-8 volts

NOTE:

*If either unit is operating at maximum rated conditions, Grid 1 circuit resistance for both units should not exceed the values given.



5BE8



Triode-pentode for use as a vhf oscillator and mixer,
heater warm-up controlled for series strings

HEATER CHARACTERISTICS

Voltage, a-c or d-c	4.7 volts
Current	600 ma
Peak heater-cathode voltage, max.	
Heater negative to cathode	200 volts
Heater positive to cathode*	200 volts
Warm-up time	11 secs. average
(See Series-String Heaters section of APPENDIX in CBS Tube Manual)	
*D-c component must not exceed 100 volts max.	

ELECTRICAL DATA

DIRECT INTERELECTRODE CAPACITANCES

Triode Section

Grid to plate: g1 to p	1.8 μf
Input: g1 to k + h + pentode g3 + i.s.	2.8 μf
Output: p to k + h + pentode g3 + i.s.	1.5 μf

Pentode Section

Grid to plate: g1 to p, max.	.040 μf
Input: g1 to k + h + g2	4.4 μf
Output: p to k + h + g2 + g3 + triode k + i.s.	2.6 μf
Plate to k + h + g2	.30 μf
Coupling: pentode grid 1 to triode plate	.009 μf
Coupling: triode grid to pentode plate	.010 μf
Coupling: triode plate to pentode plate	.065 μf

MAXIMUM RATINGS (Design center values)

	Triode	Pentode
Plate voltage	300	300 volts
Grid 2 voltage	See Rating Chart in APPENDIX	
Grid 2 supply voltage		300 volts
Grid 1 voltage, positive d-c	0	0 volts
Plate dissipation	2.5	2.8 watts
Grid 2 dissipation		0.5 watt
Grid 1 circuit resistance†		
Fixed bias	0.5	0.25 meg
Self bias	1.0	1.0 meg

CHARACTERISTICS AND TYPICAL OPERATION

Class A Amplifier	Triode	Pentode
Plate voltage	150	250 volts
Grid 2 (screen) voltage		110 volts
Grid 1 (control-grid) voltage	0	0 volts
Cathode-bias resistor	56	68 ohms
Plate resistance (approx.)	.005	0.4 meg
Transconductance	8500	5200 μmhos
Amplification factor	40	
Plate current	18	10 ma
Grid 2 current		3.5 ma
Grid 1 voltage (approx.) for $I_b = 10 \mu\text{a}$	-12	-10 volts

NOTES:

†Stated values should not be exceeded when either section is operating at maximum rated conditions.

‡When reading characteristics of pentode section all triode elements shall be at ground potential. Thus, because of internal connections to pin No. 3, the pentode suppressor will also be at ground.

ENGINEERING DESIGN DATA

5BE8

JULY 10, 1956

Medium-mu triode—
sharp-cutoff pentode

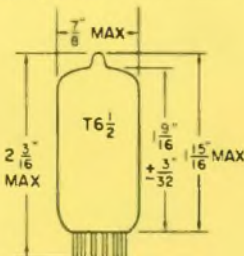
CHARACTERISTIC CURVES

(In curve section following APPENDIX)

Screen Grid Rating	100A
Plate, triode	145A
Transfer, triode; I_b	145B
Characteristics; I_p , g_m , μ	145C
Plate, pentode ($E_{c2} = 110V$)	145D
Transfer, pentode; g_m	145E
Transfer, pentode; I_{c2}	145F
Transfer, pentode; I_b	145G

MECHANICAL DATA

Cathode, coated unipotential	T-6½
Bulb	JETEC 6-2
Outline	Miniature 9-pin (E9-1)
Base	9EG
Basing	Any
Mounting position	Any



PIN CONNECTIONS

Pin 1	Triode Grid 1
Pin 2	Triode Plate
Pin 3	Triode Cathode, Triode Grid 3, Pentode Grid 3, I. S.
Pin 4	Heater
Pin 5	Heater
Pin 6	Pentode Plate
Pin 7	Pentode Grid 2
Pin 8	Pentode Cathode
Pin 9	Pentode Grid 1

APPLICATION

The 5BE8 is a medium-mu triode and sharp-cutoff pentode, both units being contained in a T6½ miniature envelope. It is intended for use as a very-high-frequency oscillator and mixer tube in both television and frequency-modulation receiver front ends.

The pin connections for this tube are unusual. The pentode suppressor grid and internal shield are connected to the triode cathode so that proper grounding of these elements does not interfere with any mixer cathode circuits.

NOTES

Type 5BE8 is identical to the 6BE8 except for heater characteristics. Similar tubes are the 5U8 and 6U8 which have the suppressor grid and shield connected to the pentode cathode.

ENGINEERING DESIGN DATA

5BK7A

JULY 10, 1956

Medium-mu duotriode

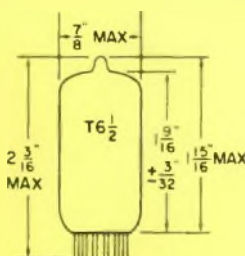
CHARACTERISTIC CURVES

(In curve section following APPENDIX)

Plate	144A
Transfer	144B
Characteristics; I_p , μ , E_m	144C

MECHANICAL DATA

Cathode, coated unipotential	
Bulb	T-6½
Outline	JETEC 6-2
Base	Miniature 9-pin (9A-1)
Basing	9AJ
Mounting position	Any



PIN CONNECTIONS

Pin 1	Plate (Sect. 2)
Pin 2	Grid (Sect. 2)
Pin 3	Cathode (Sect. 2)
Pin 4	Heater
Pin 5	Heater
Pin 6	Plate (Sect. 1)
Pin 7	Grid (Sect. 1)
Pin 8	Cathode (Sect. 1)
Pin 9	I. S. ▼

REFERENCES

See explanation of warm-up time controlled series-string heaters in APPENDIX.

APPLICATION

Type 5BK7A is a medium-mu duotriode designed for vhf cascade amplifier application below 300 mc. It is characterized by a low noise rating, high gain, and internal shielding between the two sections to decrease interelectrode capacitance.

NOTES

Type 5BK7A is identical to 6BK7A except for heater characteristics.

▼ It is recommended that pin 9 be grounded.



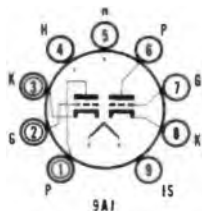
5BK7A



Vhf duotriode for cascade amplifier service,
heater warm-up controlled for series strings

HEATER CHARACTERISTICS

Voltage, a-c or d-c	4.7 volts
Current	600 ma
Peak heater-cathode voltage, max.	
Heater negative to cathode†	200 volts
Heater positive to cathode*	200 volts
Warm-up time	11 secs. average
(See Series-String Heaters section of APPENDIX in CBS Tube Manual)	
*D-c component must not exceed 100 volts max.	



ELECTRICAL DATA

DIRECT INTERELECTRODE CAPACITANCES

	Section 1	Section 2
Grid to plate: g1 to p.	1.8	1.8 μf
Input: g1 to k + h + i.s.	3.0	3.0 μf
Output: p to k + h + i.s.	1.0	0.9 μf
Heater to cathode: h to k.	2.8	3.0 μf
Grid 1 to grid 1: g1 to g1, max.	0.004	μf
Plate to plate: p to p, max.	0.075	μf
Plate to cathode: p to k.	0.22	0.22 μf
Grounded-grid input	6.0	6.0 μf
Grounded-grid output	2.4	2.4 μf

MAXIMUM RATINGS (Design center values)†

Plate voltage	300 volts
Control-grid voltage, negative d-c	50 volts
Plate dissipation	2.7 watts

CHARACTERISTICS AND TYPICAL OPERATION

Class A Amplifier‡

Plate voltage	150 volts
Cathode-bias resistor	56 ohms
Plate resistance (approx.)	4600 ohms
Transconductance	9300 μmhos
Amplification factor	43
Plate current	18 ma
Control-grid voltage (approx.) for $I_b = 10 \mu\text{a}$	-11 volts
Noise figure▲	7 db

NOTES:

†Used as a cascade amplifier with the two sections series-connected, this voltage may be as high as 300 volts maximum under cutoff conditions.

‡Each section.

▲As measured in a cascade amplifier with a balanced 300-ohm input system which operates at a plate supply of 250 volts, plate current of 18 ma, a frequency of 200 mc, a stage bandwidth of 7 mc, and an effective noise bandwidth of 3.5 mc.

CBS

5BQ7A



High-gain, low-noise vhf cascode amplifier

HEATER CHARACTERISTICS

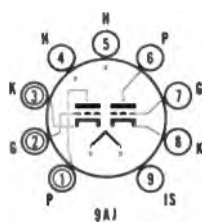
Voltage, a-c or d-c.....	5.6 volts
Current.....	450 ma
Peak heater-cathode voltage, max.	
Heater neg. to cathode.....	200 volts
Heater pos. to cathode.....	200 volts
Warm-up time.....	11 secs. average

(See Series-String Heaters section of APPENDIX in CBS Tube Manual).

*D-c component must not exceed 100 volts max.

†When used as a cascode amplifier, with the two sections series-connected, this voltage may be as high as 300 volts at cutoff conditions.

Type 5BQ7A is identical to types 4BQ7A and 6BQ7A except for heater characteristics. See type 4BQ7A for ratings and operating characteristics.



LL

5BR8



Vhf local oscillator and mixer for fm and TV receivers

HEATER CHARACTERISTICS

Voltage, a-c or d-c.....	4.7 volts
Current.....	600 ma
Peak heater-cathode voltage, max.	
Heater neg. to cathode.....	250 volts
Heater pos. to cathode.....	200 volts
Warm-up time.....	11 secs. average

(See Series-String Heaters section of APPENDIX in CBS Tube Manual).

*D-c component must not exceed 100 volts max.

ELECTRICAL DATA

DIRECT INTERELECTRODE CAPACITANCES

Triode Section	No Shield	Shielded
Grid to plate: g1 to p.....	1.8	1.8 μ f
Input: g1 to k + h.....	2.5	2.5 μ f
Output: p to k + h.....	0.4	1.0 μ f
Cathode to heater (either section).....	3.0	3.0 μ f

Pentode Section

Grid to plate: g1 to p.....	0.015	0.008 μ f
Input: g1 to k + h + g2 + g3 + i.s.....	5.0	5.0 μ f
Output: p to k + h + g2 + g3 + i.s.....	2.6	3.5 μ f

†JETEC shield 315 connected to cathode.

MAXIMUM RATINGS (Design center values)

	Triode	Pentode
Plate voltage.....	300	300 volts
Grid 2 voltage.....	300	300 volts
Grid 1 voltage, positive d-c.....	0	0 volts
Plate dissipation.....	2.7	2.8 watts
Grid 2 dissipation.....	0.5	0.5 watt

CHARACTERISTICS AND TYPICAL OPERATION

	Triode	Pentode
Plate voltage.....	150	250 volts
Grid 3 (suppressor).....	connected to cathode at socket	
Grid 2 (screen) supply voltage.....	110	110 volts
Cathode-bias resistor.....	56	68 ohms
Plate resistance (approx.).....	.005	.40 meg
Transconductance.....	8500	5200 μ ms
Amplification factor.....	40	
Plate current.....	18	10 ma
Grid 2 current.....		3.5 ma
Grid 1 voltage (approx.) for $I_b = 10 \mu$ a.....	-12	-10 volts

CBS ELECTRON TUBES

ENGINEERING
DESIGN DATA

5BQ7A

JUNE 1, 1957

High-gain, low-noise
duotriode

CHARACTERISTIC CURVES

(In curve section following APPENDIX)

Plate.....	123A
Plate.....	123B
Operation (Cascode amplifier).....	123C
Transfer.....	123D
Transfer.....	123E

APPLICATION

Type 5BQ7A is a miniature, medium- μ duotriode designed for use as the cascode r-f amplifier in tuners of vhf television receivers having 450-ma series-strings.

5BR8

NOVEMBER 26, 1956

Medium- μ triode—
sharp-cutoff pentode

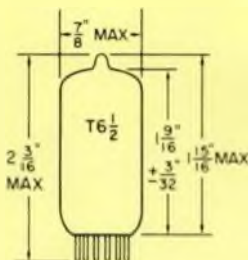
CHARACTERISTIC CURVES

(In curve section following APPENDIX)

Plate, pentode ($E_{c2} = 110V$).....	145D
Transfer, pentode; g_m	145E
Screen Grid Rating.....	100A
Plate, triode.....	145A
Transfer, triode; I_b	145B
Characteristics; I_p , g_m , μ	145C

MECHANICAL DATA

Cathode, coated unipotential	
Bulb.....	T-6 1/2
Outline.....	JETEC 6-2
Base.....	Miniature 9-pin (E9-1)
Base.....	9FA
Mounting position.....	Any



PIN CONNECTIONS

Pin 1.....	Triode Grid
Pin 2.....	Triode Plate
Pin 3.....	Triode Cathode
Pin 4.....	Heater
Pin 5.....	Heater
Pin 6.....	Pentode Plate
Pin 7.....	Pentode Grid 2
Pin 8.....	Pentode Cathode, Grid 3, I. S.
Pin 9.....	Pentode Grid 1

APPLICATION

Type 5BR8 is a combined medium- μ triode and sharp-cutoff pentode with electrically independent cathodes.

Type 5BR8 is identical to type 6BR8 except for heater characteristics; and is similar electrically to the 5U8.

ENGINEERING DESIGN DATA

5CG8

JULY 10, 1956

**Medium-mu triode—
sharp-cutoff pentode**

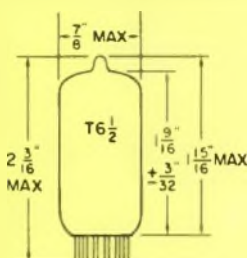
CHARACTERISTIC CURVES

(In curve section following APPENDIX)

Screen Grid Rating	100A
Plate, pentode unit ($E_{c2} = 150V$)	141A
Plate, triode unit	141B
Plate, pentode unit (triode connected)	141C
Operation, pentode unit	141D
Operation, pentode unit	141E

MECHANICAL DATA

Cathode, coated unipotential	
Bulb	T-6½
Outline	JETEC 6-2
Base	Miniature 9-pin (E9-1)
Basing	9GF
Mounting position	Any



PIN CONNECTIONS

Pin 1	Triode Grid
Pin 2	Triode Plate
Pin 3	Cathode
Pin 4	Heater
Pin 5	Heater
Pin 6	Pentode Plate
Pin 7	Pentode Grid 2
Pin 8	Pentode Grid 3, Cathode
Pin 9	Pentode Grid 1

REFERENCES

The ratings and typical operation given for the 5CG8 are for oscillator-mixer service. Methods of measuring conversion transconductance are given in MIL-E-1C, section 4.10.12 or IRE Sds. Electron Tubes, 1950, 7.2.6. Measurement of oscillator performance is given in MIL-E-1C, section 4.10.2 and IRE Sds. Electron Tubes, 1950, 7.2.7.

The heater of the 5CG8 has a warm-up time controlled characteristic which is standard for 600-ma tubes used in series strings. For a complete description of heater warm-up time and the method of measurement see the APPENDIX of this manual.



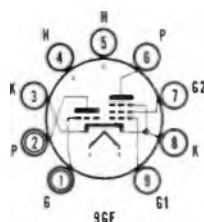
5CG8



**Vhf oscillator and mixer, heater warm-up
controlled for series strings**

HEATER CHARACTERISTICS

Voltage, a-c or d-c	4.7 volts
Current	600 ma
Peak heater-cathode voltage, max.	
Heater negative to cathode	200 volts
Heater positive to cathode*	200 volts
Warm-up time	11 secs. average
(See Series-String Heaters section of APPENDIX in CBS Tube Manual)	
*D-c component must not exceed 100 volts max.	



ELECTRICAL DATA

DIRECT INTERELECTRODE CAPACITANCES

Triode Section	No Shield	Shielded	
Grid to plate: g1 to p, max.	1.5	1.5	$\mu\mu f$
Input: g1 to k + h	2.6	3.0	$\mu\mu f$
Output: p to k + h	0.05	1.0	$\mu\mu f$

Pentode Section

Grid to plate: g1 to p	0.03	0.016	$\mu\mu f$
Input: g1 to k + h + g2 + g3	4.8	5.0	$\mu\mu f$
Output: p to k + h + g2 + g3	0.9	1.6	$\mu\mu f$
Coupling: pentode grid 1 to triode plate, max.	0.04	0.05	$\mu\mu f$
Coupling: pentode plate to triode plate, max.	0.007	0.05	$\mu\mu f$
Heater to cathode: h to k	5.5	5.5*	$\mu\mu f$

*JETEC shield 315 connected to cathode.

*JETEC shield 315 connected to ground.

MAXIMUM RATINGS (Design center values)

Converter Service	Triode as Oscillator	Pentode as Mixer
Plate voltage	250	250 volts
Grid 2 voltage	See Rating Chart in APPENDIX	
Grid 2 supply voltage	250 volts	
Grid 1 voltage, positive d-c	0	0 volts
Grid 1 voltage, negative d-c	40	40 volts
Plate dissipation	1.5	2 watts
Grid 2 dissipation†	0.5 watt	
Grid 2 dissipation‡	See Rating Chart in APPENDIX	
Grid 1 dissipation	0.5	watt
Grid 1 circuit resistance		
Fixed bias	0.1 meg	
Self bias	0.5 meg	

CHARACTERISTICS

	Triode	Pentode
Plate voltage	100	250 volts
Grid 2 (screen) voltage		150 volts
Cathode-bias resistor	100	200 ohms
Plate resistance (approx.)	6900	750,000 ohms
Transconductance	5800	4600 μmhos
Amplification factor	40	
Plate current	8.5	7.7 ma
Grid 2 current		1.6 ma
Grid 1 voltage (approx.) for $I_b = 10 \mu\text{a}$	-10	-10 volts

5CG8 (cont.)

TYPICAL OPERATION

	Triode as 250 mc Oscillator▲	Pentode as Mixer▼
Plate voltage.....	150	150 volts
Grid 2 (screen) voltage.....		150 volts
Mixer grid 1 supply voltage.....		-3.5 volts
Oscillator voltage (rms) at mixer grid 1.....		2.6 volts
Mixer grid 1 (control grid) circuit resistance.....		120,000 ohms
Oscillator grid resistance.....	2700	ohms
Conversion transconductance.....		2100 μ mhos
Plate current.....	13	6.2 ma
Grid 2 (screen) current.....		1.8 ma
Grid 1 (control grid) current.....	3.6	ma
Grid 1 (control grid) current.....		2 μ a
Oscillator power output (approx.).....	0.5	watt

NOTES:

†For grid 2 voltages up to 150 volts.

‡For grid 2 voltages between 150 and 300 volts.

▲In TV and f-m receivers, it is generally desirable to operate the oscillator with less power input than shown in the tabulated data to avoid over-excitation and excessive oscillator radiation.

▼With separate excitation and triode unit grounded.

ENGINEERING DESIGN DATA

5CG8 (cont.)

APPLICATION

Type 5CG8 is a combined vhf triode, designed for oscillator service, and vhf pentode, designed for mixer service. A single cathode serves both sections. The pentode section may be used either as a high-gain pentode mixer or a low-noise triode-connected mixer.

NOTES

Type 5CG8 is identical to type 6CG8, except for heater characteristics. It is also similar to types 5AT8, 5X8, 6AT8 and 6X8.



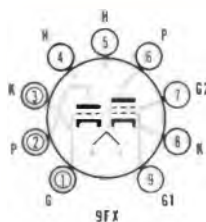
5CL8



Vhf oscillator and mixer, heater warm-up controlled for series strings

HEATER CHARACTERISTICS

Voltage, a-c or d-c.....	4.7 volts
Current.....	600 ma
Peak heater-cathode voltage, max.....	
Heater negative to cathode.....	200 volts
Heater positive to cathode*,.....	200 volts
Warm-up time.....	11 secs. average
(See Series-String Heaters section of APPENDIX in CBS Tube Manual)	
*D-c component must not exceed 100 volts max.	



ELECTRICAL DATA

DIRECT INTERELECTRODE CAPACITANCES

Triode Section	No Shield	Shield†
Grid to plate: g1 to p.....	1.8	1.8 μ fd
Input: g1 to k + h.....	2.7	2.7 μ fd
Output: p to k + h.....	0.4	1.2 μ fd
Heater to cathode: h to k.....	2.5	2.5 μ fd
Tetrode Section		
Grid to plate: g1 to p, max.....	.028	.016 μ fd
Input: g1 to k + h + g2.....	5.0	5.0 μ fd
Output: p to k + h + g2.....	2.0	3.0 μ fd
Heater to cathode: h to k.....	2.5	2.5 μ fd

†JETEC shield 315 connected to cathode.

5CL8

JULY 10, 1956

Medium-mu triode—
sharp-cutoff tetrode

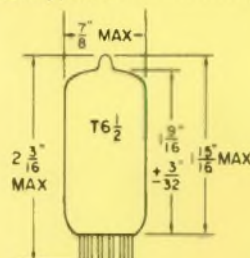
CHARACTERISTIC CURVES

(In curve section following APPENDIX)

Screen Grid Rating.....100A

MECHANICAL DATA

Cathode, coated unipotential.....	T-6½
Bulb.....	JETEC 6-2
Outline.....	Miniature 9-pin (E9-1)
Base.....	9FX
Basing.....	Any
Mounting position.....	Any



PIN CONNECTIONS

Pin 1.....	Triode Grid 1
Pin 2.....	Triode Plate
Pin 3.....	Triode Cathode
Pin 4.....	Heater
Pin 5.....	Heater
Pin 6.....	Tetrode Plate
Pin 7.....	Tetrode Grid 2
Pin 8.....	Tetrode Cathode
Pin 9.....	Tetrode Grid 1

ENGINEERING DESIGN DATA

5CL8 (cont.)

REFERENCES

The 5CL8, as a result of its controlled heater warm-up characteristic, is especially suited for use in television receivers which employ series-connected heaters. When the 5CL8 is used in conjunction with other 600-milliampere types which exhibit essentially the same heater warm-up characteristic, heater voltage surges across the individual tubes are minimized during warm-up period. See explanation of warm-up time controlled series-string heaters in APPENDIX.

APPLICATION

Type 5CL8 is a triode and tetrode in one envelope designed for application as a vhf oscillator-mixer.

NOTES

Type 5CL8 is identical to type 6CL8 except for heater characteristics.

5CL8 (cont.)

MAXIMUM RATINGS (Design center values)

	Triode	Tetrode
Plate voltage.....	300	300 volts
Grid 2 voltage.....	See Rating Chart in APPENDIX	
Grid 2 supply voltage.....		300 volts
Grid 1 voltage, positive d-c.....	0	0 volts
Plate dissipation.....	2.7	2.8 watts
Grid 2 dissipation.....		0.5 watt
Grid 1 circuit resistance		
Fixed bias.....	0.5	0.25 meg
Self bias.....	1.0	1.0 meg

CHARACTERISTICS AND TYPICAL OPERATION

Class A Amplifier	Triode	Tetrode
Plate voltage.....	125	125 volts
Grid 2 (screen) voltage.....		125 volts
Grid 1 (control-grid) voltage.....	0	-1.0 volts
Cathode-bias resistor.....	56	ohms
Plate resistance (approx.).....	.005	0.1 meg
Transconductance.....	8000	5800 μ mhos
Amplification factor.....	40	
Plate current.....	15	12 ma
Grid 2 current.....		4.0 ma
Grid 1 voltage (approx.) for $I_b = 10 \mu$ a.....	-9	-10 volts



5CM6



ENGINEERING DESIGN DATA

5CM6

JUNE 1, 1957

Beam power pentode

General purpose audio power amplifier or vertical deflection amplifier in TV receivers, heater warm-up time controlled for series strings

HEATER CHARACTERISTICS

Voltage, a-c or d-c.	4.7 volts
Current	600 ma
Peak heater-cathode voltage, max.	
Heater negative to cathode	200 volts
Heater positive to cathode*	200 volts
Warm-up time	11 secs. average
(See Series-String Heaters section of APPENDIX in CBS Tube Manual).	
*D-c component must not exceed 100 volts max.	

ELECTRICAL DATA

DIRECT INTERELECTRODE CAPACITANCES

Grid to plate: g1 to p.	0.7 μ f
Input: g1 to k + h + g2 + b.p.	8.0 μ f
Output: p to k + h + g2 + b.p.	8.5 μ f

MAXIMUM RATINGS (Design center values unless noted)

	Class A Amplifier	Vertical Deflection Amplifier*	Pentode	Triode†
Plate voltage	315	315	315	315
Plate voltage, peak pos. (absolute max.)	2000	2000	2000	2000
Grid 2 voltage	285	285	285	285
Grid 1 voltage, peak negative	250	250	250	250
Plate dissipation†	12	8	9	9
Grid 2 dissipation	2.0	1.75	9	9
Cathode current, average		40	40	40
Cathode current, peak		120	120	120
Grid 1 circuit resistance				
Fixed bias	0.1			2.2
Self bias	0.5	2.2		2.2

CHARACTERISTICS AND TYPICAL OPERATION

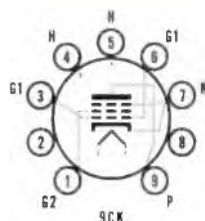
Class A Amplifier	Single Tube	Two Tubes (Push-Pull)
Plate voltage	180	315
Grid 2 (screen) voltage	180	225
Grid 1 (control-grid) voltage	-8.5	-13.0
Plate resistance (approx.)	50,000	80,000
Transconductance	3700	3750
Grid 1 input voltage, peak a-f	8.5	13
Plate current, zero signal	29	34
Plate current, maximum signal	30	35
Grid 2 current, zero signal	3.0	2.2
Grid 2 current, maximum signal	4.0	6.0
Load resistance impedance	5500	8500
Total harmonic distortion (approx.)	8	12
Power output, maximum signal	2.0	5.5

Vertical Deflection Amplifier*	Pentode	Triode
Plate voltage	250	250
Grid 2 (screen) voltage	250	250
Grid 1 (control-grid) voltage	-12.5	-12.5
Plate resistance, per tube	50,000	1960
Transconductance	4100	5000
Plate current	45	49.5
Grid 2 current	4.5	5
Grid 1 bias for $I_b = 0.5$ ma	-37	37
Amplification		9.8

*Voltage pulse duration must not exceed 2500 μ s in a 525-line, 30-frame system.

†Tube protection is needed for no-drive conditions if grid-resistor bias is used.

‡Grid 2 connected to plate. •Plate to plate. ▲Grid to grid.



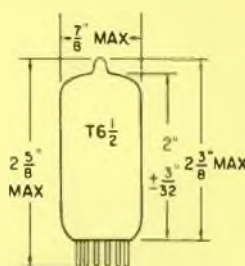
CHARACTERISTIC CURVES

(In curve section following APPENDIX)

Plate ($E_{c2} = 250V$)	138A
Plate ($E_{c2} = 250V$)	138B
Plate, triode connected	138C
Plate; ΔE_{c2} ($E_{c1} = 0V$)	138D
Transfer ($E_b = 250V$)	138E
Operation	138F

MECHANICAL DATA

Cathode, coated unipotential	
Bulb	T-6½
Outline	JETEC 6-3
Base	Miniature 9-pin (E9-1)
Basing	9CK
Mounting position	Any



PIN CONNECTIONS

Pin 1	Grid 2
Pin 2	N. C.
Pin 3	Grid 1
Pin 4	Heater
Pin 5	Heater
Pin 6	Grid 1
Pin 7	Cathode, B. P.
Pin 8	N. C.
Pin 9	Plate

APPLICATION

Type 5CM6 is a beam power pentode designed to operate as an audio power amplifier or vertical deflection amplifier in television receivers. The heater is warm-up time controlled for series strings.

NOTES

Types 6CM6 and 12CM6 are identical to the 5CM6 except for heater characteristics.

ENGINEERING DESIGN DATA

5CM8

JUNE 1, 1957

**High- μ triode—
sharp-cutoff pentode**

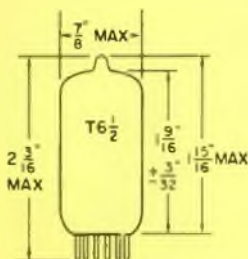
CHARACTERISTIC CURVES

(In curve section following APPENDIX)

Screen Grid Rating.....100A

MECHANICAL DATA

Cathode, coated unipotential
Bulb.....T-6 $\frac{1}{2}$
Outline.....JEDEC 6-2
Base.....Miniature 9-pin (E9-1)
Basing.....9FZ
Mounting position.....Any



PIN CONNECTIONS

Pin 1.....Triode Plate
Pin 2.....Pentode Grid 1
Pin 3.....Pentode Cathode, Grid 3, I. S.
Pin 4.....Heater
Pin 5.....Heater
Pin 6.....Pentode Plate
Pin 7.....Pentode Grid 2
Pin 8.....Triode Cathode
Pin 9.....Triode Grid

APPLICATION

Type 5CM8 is a miniature high- μ triode and sharp-cutoff pentode with a 600-ma warm-up time controlled heater. The pentode section can be used as an i-f, video, or a-c amplifier, or as a reactance tube; the triode section may be used for sync amplifier and clipper applications, etc.



5CM8



**Multipurpose triode-pentode television amplifier,
heater warm-up time controlled for series strings**

HEATER CHARACTERISTICS

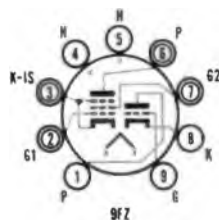
Voltage, a-c or d-c.....4.7 volts
Current.....600 ma
Peak heater-cathode voltage, max.

Heater negative to cathode.....200 volts

Heater positive to cathode*.....200 volts

Warm-up time.....11 secs. average
(See Series-String Heaters section of APPENDIX in CBS Tube Manual).

*D-c component must not exceed 100 volts max.



ELECTRICAL DATA

DIRECT INTERELECTRODE CAPACITANCES

Triode Section

Grid to plate: g1 to p.....1.9 μ f
Input: g1 to k + h.....1.6 μ f
Output: p to k + h.....0.22 μ f

Pentode Section

Grid to plate: g1 to p, max.....0.02 μ f
Input: g1 to k + h + g2 + g3 + i.s.....5.0 μ f
Output: p to k + h + g2 + g3 + i.s.....2.6 μ f
Coupling: pentode grid 1 to triode plate.....0.15 μ f
Coupling: pentode plate to triode grid.....0.01 μ f
Coupling: pentode plate to triode plate.....0.10 μ f

MAXIMUM RATINGS (Design center values)

	Triode	Pentode
Plate voltage.....	300	300 volts
Grid 2 voltage.....	See Rating Chart in APPENDIX	
Grid 2 supply voltage.....		300 volts
Grid 1 voltage, positive d-c.....	0	0 volts
Plate dissipation.....	1.0	2.0 watts
Grid 2 dissipation.....		0.5 watts
Grid 1 circuit resistance		
Fixed bias.....	2.5	meg
Self bias.....	1.0	meg

CHARACTERISTICS AND TYPICAL OPERATION

Class A Amplifier	Triode	Pentode
Plate supply voltage.....	250	200 volts
Grid 3 (suppressor).....	connected to cathode at socket	
Grid 2 (screen) voltage.....		150 volts
Grid 1 (control-grid) voltage.....	-2	0 volts
Cathode-bias resistor.....		180 ohms
Plate resistance (approx.).....	50,000	300,000 ohms
Transconductance.....	2000	6200 μ hos
Amplification factor.....	100	
Plate current.....	1.8	9.5 ma
Grid 2 current.....		2.8 ma
Grid 1 voltage (approx.) for $I_b = 10 \mu$ a.....		-8.0 volts



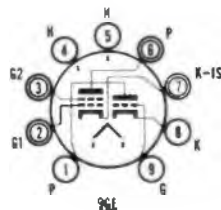
5CQ8



Phase-splitter, sync separator, sync clipper and i-f amplifier or triode local oscillator and pentode mixer

HEATER CHARACTERISTICS

Voltage, a-c or d-c	4.7 volts
Current	600 ma
Peak heater-cathode voltage, max.	
Heater negative to cathode	200 volts
Heater positive to cathode*	200 volts
Warm-up time	11 secs. average
(See Series-String Heaters section of Handbook APPENDIX)	
*D-c component must not exceed 100 volts max.	



ELECTRICAL DATA

DIRECT INTERELECTRODE CAPACITANCES

Triode Section	Shield †	No Shield
Grid to plate: g1 to p	1.8	1.8 μf
Input: g1 to k + h	2.7	2.7 μf
Output: p to k + h	1.2	0.4 μf

Tetrode

Grid to plate: g1 to p, max.	0.015	0.019 μf
Input: g1 to k + h + g2 + i.s.	5.0	5.0 μf
Output: p to k + h + g2 + i.s.	3.3	2.5 μf
Coupling: tetrode plate to triode plate, max.	0.01	0.07 μf
Heater to cathode†	3.0	3.0 μf

†JETEC shield 315 connected to cathode.

†JETEC shield 315 connected to ground.

MAXIMUM RATINGS (Design center values)

	Triode Oscillator	Pentode Mixer
Plate voltage	300	300 volts
Grid 2 voltage	See Rating Chart in APPENDIX	
Grid 2 supply voltage		300 volts
Grid 1 voltage, positive d-c	0	0 volts
Plate dissipation	2.7	2.8 watts
Grid 2 dissipation for E_{c2} less than 150V		0.6 watts
Grid 1 dissipation	0.5	watts
Grid 1 circuit resistance		
Fixed bias	0.5	0.25 meg
Cathode bias	1.0	1.0 meg

CHARACTERISTICS AND TYPICAL OPERATION

Class A Amplifier	Triode	Pentode
Plate supply voltage	125	125 volts
Grid 2 (screen) supply voltage		125 volts
Grid 1 (control-grid) voltage		-1 volts
Cathode-bias resistor	56	ohms
Plate resistance (approx.)	5,000	140,000 ohms
Transconductance	8,000	5,800 μmhos
Amplification factor	40	
Plate current	15	12 ma
Grid 2 current		4.2 ma
Grid 1 voltage (approx.) for $I_b=100\mu\text{a}$	-7	-7 volts

ENGINEERING DESIGN DATA

5CQ8

MARCH 30, 1959

Med-mu triode-sharp-cutoff tetrode

CHARACTERISTIC CURVES

(In curve section following APPENDIX)

Plate, pentode ($E_{c2}=125\text{V}$) 220A

Transfer, pentode ($E_{c1}=125\text{V}$, $E_{c2}=125\text{V}$) 220B

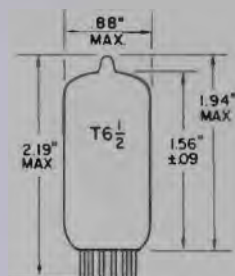
Screen Grid Rating 100A

Plate, triode 145A

Transfer, triode 145B

MECHANICAL DATA

Cathode, coated unipotential	
Bulb	T-64½
Outline	JETEC. 6-2
Base	Miniature 9-pin (E9-1)
Basing	9GE
Mounting position	Any



PIN CONNECTIONS

Pin 1	Triode Plate
Pin 2	Tetrode Grid 1
Pin 3	Tetrode Grid 2
Pin 4	Heater
Pin 5	Heater
Pin 6	Tetrode Plate
Pin 7	Tetrode Cathode, IS
Pin 8	Triode Cathode
Pin 9	Triode Grid

APPLICATION

This tube may be used for a wide variety of applications in television receivers. Its design makes it especially good as a combined oscillator and mixer in VHF tuners. Other circuits in which the pentode section may be used include video i-f amplifiers, sound i-f amplifiers. The triode section may be used either as a sync-clipper-sync-separator, phase splitter, or r-f amplifier.

ENGINEERING DESIGN DATA

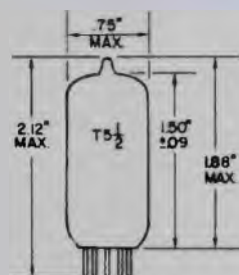
5DH8

MARCH 30, 1959

Sharp-cutoff pentode—high-mu triode

MECHANICAL DATA

Cathode, coated unipotential	
Bulb	T-6½
Outline	JETEC. 6-2
Base	Miniature 9-pin (E9-1)
Basing	9EG
Mounting position	Any



PIN CONNECTIONS

Pin 1	Triode Grid
Pin 2	Triode Plate
Pin 3	Triode Cathode, Pentode G3, I.S.
Pin 4	Heater
Pin 5	Heater
Pin 6	Pentode Plate
Pin 7	Pentode Grid 2
Pin 8	Pentode Cathode
Pin 9	Pentode Grid 1

APPLICATION

The pentode section is intended for use as a video i-f amplifier or as an audio i-f amplifier. The triode section may be used as a vertical oscillator, sync amplifier, sync separator, or sync clipper. The triode section cathode should be grounded because the pentode section suppressor grid is connected to it.



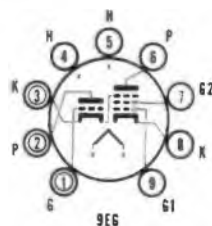
5DH8



TV amplifier, heater warm-up controlled

HEATER CHARACTERISTICS

Voltage, a-c or d-c	5.2 volts
Current	600 ma
Peak heater-cathode voltage, max.	
Heater negative to cathode	200 volts
Heater positive to cathode*	200 volts
Warm-up time	11 secs. average
*D-c component must not exceed 100 volts max.	



ELECTRICAL DATA

DIRECT INTERELECTRODE CAPACITANCES

Triode Section

Grid to plate: g1 to p	1.6 μ f
Input: g1 to k + h + Pg3 + i.s.	2.4 μ f
Output: p to k + h + Pg3 + i.s.	1.4 μ f

Pentode Section

Grid to plate: g1 to p, max.	0.03 μ f
Input: g1 to k + h + g2	6.5 μ f
Plate to Cathode, Screen, and Heater	4.2 μ f
Output: p to k + h + g2 + g3 + Tk + i.s.	2.2 μ f
Coupling: pentode grid 1 to triode plate	0.008 μ f
Coupling: pentode plate to triode grid	0.005 μ f
Coupling: pentode plate to triode plate	0.04 μ f

MAXIMUM RATINGS (Design maximum values)

Class A Amplifier

	Triode	Pentode
Plate voltage	300	300 volts
Grid 2 voltage	See Rating Chart in APPENDIX	
Grid 2 supply voltage		300 volts
Grid 1 voltage, positive d-c	0	0 volts
Plate dissipation	2.0	2.2 watts
Grid 2 dissipation		0.55 watts
Grid 1 circuit resistance		
Fixed bias	0.5	0.25 meg
Cathode bias	1.0	1.0 meg

MAXIMUM RATINGS (Design maximum values)

Vertical Oscillator Service† — Triode Section

Plate voltage, d-c	300 volts
Grid voltage, peak negative	400 volts
Plate dissipation	1.0 watts
Cathode current, d-c	12 ma
Cathode current, peak	35 ma
Grid 1 circuit resistance	
Fixed bias	2.2 meg
Cathode bias	2.2 meg
Grid-leak bias	2.2 meg

CHARACTERISTICS AND TYPICAL OPERATION

Class A Amplifier

	Triode	Pentode
Plate voltage	250	125 volts
Grid 2 (screen) voltage		125 volts
Cathode-bias resistor	390	56 ohms
Plate resistance (approx.)	12,000	150,000 ohms
Transconductance	4,400	8,600 μ mhos
Amplification factor	53	
Plate current	7.3	13.5 ma
Grid 2 current		3.8 ma
Grid 1 voltage (approx.) for $I_b=10 \mu$ a	-10	volts
Grid 1 voltage (approx.) for $I_b=20 \mu$ a		-6 volts

NOTES:

†Voltage pulse duration must not exceed 2500 μ s in a 525-line, 30-frame system.

CBS ELECTRON TUBES



5CZ5



Beam power tube for 110° vertical deflection or audio power amplifier service, heater warm-up controlled for series strings

HEATER CHARACTERISTICS

Voltage, a-c or d-c.....	4.7 volts
Current.....	600 ma
Peak heater-cathode voltage, max.	
Heater negative to cathode.....	200 volts
Heater positive to cathode*.....	200 volts
Warm-up time.....	11 secs. average
(See Series-String Heaters section of APPENDIX in CBS Tube Manual).	

*D-c component must not exceed 100 volts max.

ELECTRICAL DATA

DIRECT INTERELECTRODE CAPACITANCES

Grid to plate: g1 to p, max.....	0.7 μ f
Input: g1 to k + h + g2 + b.p.....	8.0 μ f
Output: p to k + h + g2 + b.p.....	8.5 μ f

MAXIMUM RATINGS (Design center values unless noted)

	Vertical Def. Amp.	Class A Amplifier	P-P Class AB1 Amplifier
Plate voltage, d-c.....	350	350	350 volts
Plate voltage, peak positive pulse (absolute max.).....	2200		volts
Grid 2 voltage.....	285	285	volts
Grid 1 voltage, peak negative.....	-250		volts
Plate dissipation.....	10	12	12 watts
Grid 2 dissipation.....	2	2	2 watts
Cathode current, av.....	40		ma
Cathode current, peak.....	140		ma
Grid 1 circuit resistance			
Fixed bias.....	0.5	0.1	0.1 Δ meg
Self bias.....	1.0	1.0	1.0 Δ meg
Bulb temperature at hottest point	250	250	250 °C

CHARACTERISTICS AND TYPICAL OPERATION

	Class A	Class A, A-F Power	P-P Class AB1, A-F Power
Plate voltage.....	75	200	350 volts
Grid 2 (screen) voltage.....	250	250	280 volts
Grid 1 (control-grid) voltage.....	0	-14	-23.5 Δ volts
Plate resistance (approx).....	73,000	73,000	ohms
Transconductance.....	4800	4800	μ mas
Grid 1 input voltage, peak a-f.....		13	47 Δ volts
Plate current, zero signal.....	130*	46	46 ma
Plate current, maximum signal.....		48	103 ma
Grid 2 current.....	16*	4.6	ma
Grid 2 current, zero signal.....		4.6	3 ma
Grid 2 current, maximum signal.....		8.0	13 ma
Grid 1 bias for $I_b = 100 \mu$ a.....		-35	volts
Load resistance impedance.....		5000	7500 Δ ohms
Total harmonic distortion (approx.).....		10	1 %
Power output, maximum signal.....		5.4	21.5 watts

NOTES:

- †Voltage pulse duration must not exceed 2500 μ s in a 525-line, 30-frame system.
- *Values are measurable by a method involving a recurrent waveform such that plate dissipation and grid 2 input will be kept within their ratings.
- Δ The input coupling network should not introduce excessive resistance into the grid 1 circuit. Transformer or impedance-coupling devices are recommended.
- $\circ$ Grid 1 to grid 1. ∇ Values are for two tubes.
- ϕ Plate to plate.

ENGINEERING DESIGN DATA

5CZ5

JUNE 1, 1957

Beam power pentode

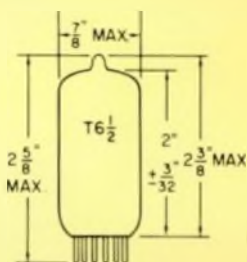
CHARACTERISTIC CURVES

(In curve section following APPENDIX)

Plate ($E_{c1} = 0V$, ΔE_{c2})..... 207ATransfer; I_b ($E_b = 250V$)..... 207BPlate ($E_{c2} = 250V$)..... 207C

MECHANICAL DATA

Cathode, coated unipotential.....	
Bulb.....	T 6 1/2
Outline.....	JETEC 6-3
Base.....	Miniature 9-pin (E9-1)
Basing.....	9MN
Mounting position.....	Any



PIN CONNECTIONS

Pin 1.....	Grid 2
Pin 2.....	N. C.
Pin 3.....	Grid 1
Pin 4.....	Heater
Pin 5.....	Heater
Pin 6.....	Grid 1
Pin 7.....	Cathode (B. P.)
Pin 8.....	I. C.*
Pin 9.....	Plate

*Do not use.

REFERENCES

See explanation of warm-up time controlled series-string heater circuits in APPENDIX.

APPLICATION

Type 5CZ5 is a beam power tube designed for use in 110° vertical deflection amplifier systems. It is also useful in the audio output stages of television and radio receivers.

NOTES

Type 5CZ5 is identical to the 6CZ5 except for heater characteristics.

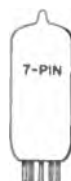
5J6

FEBRUARY 25, 1957

Duotriode



5J6



Vhf oscillator, amplifier, or mixer, heater warm-up controlled for series strings

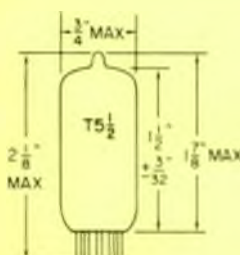
CHARACTERISTIC CURVES

(In curve section following APPENDIX)

Plate.....	146A
Plate.....	146B
Transfer.....	146C
Characteristics, g_m , f_p , μ	146D

MECHANICAL DATA

Cathode, coated unipotential.....	
Bulb.....	T-5½
Outline.....	JETEC S-2
Base.....	Miniature 7-pin (E7-1)
Basing.....	7BF
Mounting position.....	Any



PIN CONNECTIONS

Pin 1.....	Plate (Sect. 2)
Pin 2.....	Plate (Sect. 1)
Pin 3.....	Heater
Pin 4.....	Heater
Pin 5.....	Grid (Sect. 1)
Pin 6.....	Grid (Sect. 2)
Pin 7.....	Cathode

REFERENCES

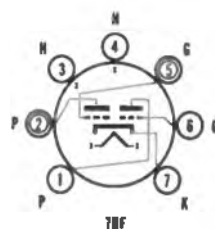
The ratings and typical operation given for the 5J6 are for oscillator-mixer service. Methods of measuring conversion transconductance are given in MIL-E-1C, section 4.10.12 and IRE Stds. Electron Tubes, 1950, 7.2.6. Measurement of oscillator performance is given in MIL-E-1C, section 4.10.2 and IRE Stds. Electron Tubes, 1950, 7.2.7.

The heater of the 5J6 has a warm-up time controlled characteristic in order to minimize heater voltage surges when used in 600-ma heater strings. For a complete description of heater warm-up time and method of measurement, see the APPENDIX of this manual.

HEATER CHARACTERISTICS

Voltage, a-c or d-c.....	4.7 volts
Current.....	600 ma
Peak heater-cathode voltage, max.....	
Heater negative to cathode.....	100 volts
Heater positive to cathode.....	100 volts
Warm-up time.....	11 secs. average
(See Series-String Heaters section of APPENDIX in CBS Tube Manual)	

*D-c component must not exceed 100 volts max.



ELECTRICAL DATA

DIRECT INTERELECTRODE CAPACITANCES

	Section 1		Section 2	
	No Shield	Shield†	No Shield	Shield†
Grid to plate: g1 to p.....	1.6	1.5	1.6	1.5
Input: g1 to k + h.....	2.2	2.6	2.2	2.6
Output: p to k + h.....	0.4	1.6	0.4	1.0

†JETEC shield 316 connected to cathode.

MAXIMUM RATINGS (Design center values)

Class A Amplifier (each section)

Plate voltage.....	300 volts
Control-grid voltage, positive d-c.....	0 volts
Plate dissipation.....	1.5 watts
Control-grid circuit resistance (self bias)†.....	0.5 meg

Class C Oscillator (each section)

Plate voltage.....	300 volts
Control-grid voltage, negative d-c.....	40 volts
Control-grid voltage, positive d-c.....	0 volts
Plate dissipation.....	1.5 watts
Plate input.....	4.5 watts
Plate current.....	15 ma
Grid current.....	8.0 ma

CHARACTERISTICS AND TYPICAL OPERATION

Class A Amplifier (each section)

Plate voltage.....	100 volts
Cathode-bias resistor.....	50 ohms
Plate resistance (approx.).....	7100 ohms
Transconductance.....	5300 μ hos
Amplification factor.....	38
Plate current.....	8.5 ma

Class C Oscillator, R-F Power Amplifier & Oscillator (Both sections push-pull)

Plate voltage.....	150 volts
Grid voltage†.....	-10 volts
Plate current.....	30 ma
Grid current (approx.).....	16 ma
Grid driving power (approx.).....	0.35 watt
Power output (approx.).....	3.5 watts

5J6 (cont.)

Mixer Service[▲]

Plate voltage.....	150 volts
Cathode-bias resistor.....	810 ohms
Oscillator peak voltage.....	3.0 volts
Plate resistance (approx.).....	10,200 ohms
Conversion transconductance.....	1900 μ mhos
Plate current.....	4.8 ma

NOTES:

[†]Under rated maximum conditions total grid circuit resistance should not exceed 0.5 meg. Fixed bias operation is not recommended.

[‡]Obtained by a 625-ohm grid resistor, a 220-ohm cathode resistor or a fixed voltage supply.

[▲]Each section operated separately with grid and plate of opposite sections grounded. The value of the cathode-bias resistor is determined by the total cathode current of both sections.

5T4

(See chart for seldom-used tubes)

ENGINEERING DESIGN DATA

5J6 (cont.)

APPLICATION

The 5J6 is a medium- μ duotriode capable of operating at high frequencies. Either section may be used as an oscillator throughout the vhf region, and the other section may be employed as a mixer. It may be used as a mixer up to 600 mc in a push-pull grid circuit with the plates in parallel.

If operated as a Class C push-pull amplifier at moderate frequencies (up to 50 mc), approximately 3.5 watts power output can be obtained. At 250 mc, approximately 1.0 watt power output can be obtained. Maximum ratings as a Class C oscillator or amplifier are for telegraphy key-down conditions without modulation.

NOTES

Type 5J6 is identical to types 6J6 and 19J6 except for heater characteristics.

ENGINEERING DESIGN DATA

5T8

FEBRUARY 25, 1957

Triple-diode— triode

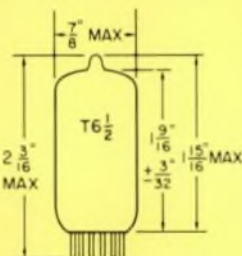
CHARACTERISTIC CURVES

(In curve section following APPENDIX)

Plate, triode	147A
Transfer	147B
Characteristics: f_p , f_m , μ	147C
Operation, diode	147D

MECHANICAL DATA

Cathode, coated unipotential	
Bulb	T-6½
Outline	JETEC 6-2
Base	Miniature 9-pin (E9-1)
Basing	9E
Mounting position	Any



PIN CONNECTIONS

Pin 1	Diode 3 Plate
Pin 2	Diode 2 Plate
Pin 3	Diode 2 Cathode, I. S.
Pin 4	Heater
Pin 5	Heater
Pin 6	Diode 1 Plate
Pin 7	Cathode, I. S.
Pin 8	Triode Grid
Pin 9	Triode Plate

REFERENCES

See explanation of warm-up time controlled series-string heater circuits in APPENDIX. See APPENDIX for R-C amplifier data.

APPLICATION

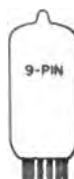
Type 5T8 is a miniature triple-diode and triode in one envelope, designed for application in a-m or f-m receivers as a combined f-m discriminator tube, a-m detector, and audio amplifier.

NOTES

Type 5T8 is identical to the types 6T8 and 19T8 except for heater characteristics.



5T8



Combined a-m, f-m detector and audio amplifier,
heater warm-up controlled for series strings

HEATER CHARACTERISTICS

Voltage, a-c or d-c	4.7 volts
Current	600 ma
Peak heater-cathode voltage, max.	
Heater negative to cathode	100 volts
Heater positive to cathode*	100 volts
Warm-up time	11 secs. average
(See Series-String Heaters section of APPENDIX in CBS Tube Manual)	
*D-c component must not exceed 100 volts max.	



ELECTRICAL DATA

DIRECT INTERELECTRODE CAPACITANCES

	Shield†	No Shield	
Grid to plate: g1 to p	1.7	1.7	μμf
Input: g1 to k + h + i.s.	1.7	1.6	μμf
Output: p to k + h + i.s.	2.5	1.2	μμf
Grid to any diode plate, max.	0.035	0.035	μμf
Diode 1 input	3.9	3.7	μμf
Diode 2 input	3.9Δ	3.7	μμf
Diode 3 input	3.6	3.4	μμf
Diode 2 cathode to all	8.84	7.7	μμf

Δ JETEC shield 315 connected to pin 7

Δ JETEC shield 315 connected to pin 3

Δ JETEC shield 315 connected to pins 4 and 5

MAXIMUM RATINGS (Design center values)

Plate voltage	300 volts
Control-grid voltage, positive d-c	0 volts
Plate dissipation	1.0 watt
Diode current*	5.0 ma

CHARACTERISTICS AND TYPICAL OPERATION

Class A Amplifier

Plate voltage	100	250 volts
Control-grid voltage	-1	-3 volts
Plate resistance (approx.)	54,000	58,000 ohms
Transconductance	1300	1200 μmhos
Amplification factor	70	70
Plate current	0.8	1.0 ma
Diode current (average)†	20	20 ma

NOTES:

*Each diode, continuous operation.

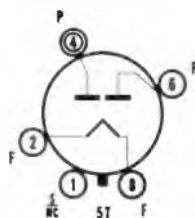
†Each diode with 5.0V d-c applied.



5U4G



High-vacuum full-wave power rectifier



FILAMENT CHARACTERISTICS

Voltage, a-c	5.0 volts
Current	3.0 amp

ELECTRICAL DATA

MAXIMUM RATINGS (Design center values)

Plate voltage, peak inverse	1550 volts
Plate supply voltage, rms (each plate)†	RATING CHART I*
Output current, d-c	RATING CHART I*
Plate current, peak steady state (each plate)	RATING CHART II* 800 ma
Plate current, peak transient (each plate)	RATING CHART III* 4.0 amp

CHARACTERISTICS

Tube Voltage Drop	
Conducting 225 ma (each plate)	44 volts

TYPICAL OPERATION

Full-Wave Rectifier (Capacitor Input Filter)

Plate supply voltage, rms (each plate)†	300	450 volts
Plate supply resistance (each plate)	35	85 ohms
Filter input capacitor	40	40 μ f
Output current, d-c	245	225 ma
Output voltage at filter input, d-c	290	470 volts

TYPICAL OPERATION

Full-Wave Rectifier (Choke Input Filter)

Plate supply voltage, rms (each plate)†	550 volts
Filter input choke	10 henrys
Output current, d-c	225 ma
Output voltage at filter input, d-c	440 volts

NOTES:

*Rating Charts given in APPENDIX of CBS Tube Manual.

†The indicated values of a-c plate supply voltage are measured without load.

ENGINEERING DESIGN DATA

5U4G

JULY 10, 1956

Double diode

CHARACTERISTIC CURVES

(In curve section following APPENDIX)

Rating Chart I (D-C Output Current) 148A

Rating Chart II (Rectification

Efficiency)..... 148B

Rating Chart III (Min. Effective

Plate Supply Resistance)..... 148C

MECHANICAL DATA

Cathode, coated filament

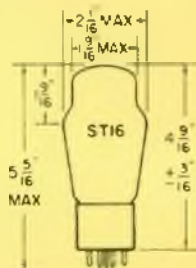
Bulb..... ST16

Outline..... IETEC 16-3

Base..... Medium shell octal (B5-15)

Basing..... ST

Mounting position..... Vertical



PIN CONNECTIONS

Pin 1	No Connection
Pin 2	Filament
Pin 4	Plate 2
Pin 6	Plate 1
Pin 8	Filament

REFERENCES

Rating Charts I, II and III in APPENDIX represent boundary conditions beyond which operation is not permitted. With the aid of simple laboratory measurements and the use of the three charts, any application may be analyzed for proper rectifier type operation.

APPLICATION

Type 5U4G is a filamentary, full-wave, high-vacuum rectifier designed for service in the power supplies of equipment having high current requirements.

NOTES

Type 5U4G is similar to types 5X4G and 5Z3.

†Horizontal operation is permissible if pins 1 and 4 are in a vertical plane.

ENGINEERING DESIGN DATA

5U4GB

5U4GA

JULY 10, 1956

Double diode



5U4GB

5U4GA



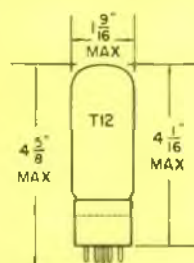
High-vacuum full-wave power rectifier
with high d-c current output

CHARACTERISTIC CURVES (In curve section following APPENDIX)

Rating Chart I (D-C Output Current) 139A
Rating Chart II (Rectification Efficiency) 139B
Rating Chart III (Min. Effective Plate Supply Resistance) 139C

MECHANICAL DATA

	5U4GA	5U4GB
Cathode, coated filament		
Bulb	T-11	T-12
Outline		12-16
Base		
Short medium shell octal	B5-121	
Flared medium shell octal	B5-127	
Short medium shell octal		B5-113
Basing	5T	5T
Mounting position	Vertical	Vertical



PIN CONNECTIONS

Pin 1	N. C.
Pin 2	Filament
Pin 4	Plate 2
Pin 6	Plate 1
Pin 8	Filament

(NOTE: Pins 3, 5, and 7 included on B5-118 with no connections.)

APPLICATION

Type 5U4GB is a filamentary type, full-wave rectifier designed for application in the power supply of television receivers or in other types of equipment which require high current. Although it has a higher output current than the 5U4G, its heater characteristics and basing are identical. 5U4GB has slightly lower ratings.

NOTES

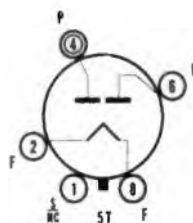
Type 5U4GB curves same as curves for type 5U4G.

Heater characteristics and basing are identical to type 5U4G.

Horizontal operation is permissible if pins 1 and 4 are in a vertical plane.

FILAMENT CHARACTERISTICS

Voltage, a-c or d-c	5.0 volts
Current	3.0 amp



ELECTRICAL DATA

MAXIMUM RATINGS (Design center values)

Rectifier Service†	5U4GA	5U4GB
Plate voltage, peak inverse	1550	1550 volts
Plate supply voltage, rms (each plate)‡	550	550 volts
Output current, d-c	RATING CHART I*	RATING CHART I*
Plate current, peak steady state (each plate)	RATING CHART II*	0.9 1.0 amp
Plate current, peak transient (each plate)	RATING CHART III*	4.3 4.6 amp

CHARACTERISTICS

Tube Voltage Drop

Conducting 225 ma (each plate)	44 volts
Conducting 275 ma (each plate)	50 volts
Conducting 300 ma (each plate)	54 volts

TYPICAL OPERATION

Full-Wave Rectifier (Capacitor Input Filter)

	5U4GA	5U4GB
Plate supply voltage, rms (each plate)‡	300	450 volts
Plate supply resistance (each plate)	21	67 ohms
Filter input capacitor	40	40 µf
Output current, d-c	300	275 ma
Output voltage at filter input, d-c	290	460 volts

TYPICAL OPERATION

Full-Wave Rectifier (Choke Input Filter)

	5U4GA	5U4GB
Plate supply voltage, rms (each plate)‡	550	550 volts
Filter input choke	10	10 henrys
Output current, d-c	250	275 ma
Output voltage at filter input, d-c	440	420 volts

NOTES:

*Rating Charts given in APPENDIX of CBS Tube Manual for 5U4GB.

†For use with sinusoidal supply voltages within the frequency range of 25 to 1000 c.p.s.

‡The indicated value of a-c plate supply voltage is measured without load.

▲Operation for type 5U4GA is identical except for an output current of 275 ma at 300V, and 250 ma at 450V with total R_s of 25 and 67 ohms, respectively.

CBS ELECTRON TUBES



5U8



Vhf oscillator and mixer, heater warm-up time controlled for series strings

HEATER CHARACTERISTICS

Voltage, a-c or d-c.....	4.7 volts
Current.....	600 ma
Peak heater-cathode voltage, max.	
Heater negative to cathode.....	200 volts
Heater positive to cathode*.....	200 volts
Warm-up time.....	11 secs. average
(See Series-String Heaters section of APPENDIX in CBS Tube Manual)	
*D-c component must not exceed 100 volts max.	



ELECTRICAL DATA

DIRECT INTERELECTRODE CAPACITANCES

Triode Section	No Shield	Shielded
Grid to plate: g1 to p.....	1.8	1.8 μ f
Input: g1 to k + h.....	2.5	2.5 μ f
Output: p to k + h.....	0.4	1.0 μ f
Heater to cathode: h to k.....	3.0	3.0 μ f
Pentode Section		
Grid to plate: g1 to p, max.....	0.01	0.006 μ f
Input: g1 to k + h + g2 + g3.....	5.0	5.0 μ f
Output: p to k + h + g2 + g3.....	2.6	3.5 μ f
Heater to cathode: h to k.....	3.0	3.0 μ f
†JETEC shield 315 connected to cathode.		

MAXIMUM RATINGS (Design center values)

	Triode	Pentode
Plate voltage.....	300	300 volts
Grid 2 voltage.....	See Rating Chart in APPENDIX	
Grid 2 supply voltage.....	300	300 volts
Grid 1 voltage, positive d-c.....	0	0 volts
Plate dissipation.....	2.7	2.8 watts
Grid 2 dissipation.....	0.5	0.5 watt

CHARACTERISTICS AND TYPICAL OPERATION

	Triode	Pentode
Plate voltage.....	150	250 volts
Grid 2 (screen) voltage.....	110	110 volts
Cathode-bias resistor.....	56	68 ohms
Plate resistance (approx.).....	5000	400,000 ohms
Transconductance.....	8500	5200 μ mhos
Amplification factor.....	40	
Plate current.....	18	10 ma
Grid 2 current.....		3.5 ma
Grid 1 voltage (approx.) for $I_b = 10 \mu$ a.....	-12	-10 volts

ENGINEERING DESIGN DATA

5U8

JULY 10, 1956

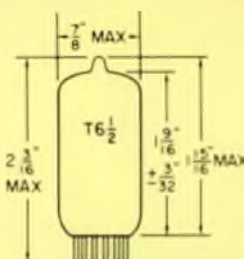
Medium-mu triode—sharp-cutoff pentode

CHARACTERISTIC CURVES (In curve section following APPENDIX)

Screen Grid Rating.....	100A
Plate, triode.....	145A
Transfer, triode, I_b	145B
Characteristics, (p, gm, μ).....	145C
Plate, pentode ($E_{c2} = 110V$).....	145D
Transfer, pentode, gm.....	145E
Transfer, pentode, I_{c2}	145F
Transfer, pentode, I_b	145G

MECHANICAL DATA

Cathode, coated unipotential.....	
Bulb.....	T-6½
Outline.....	JETEC 6-2
Base.....	Miniature 9-pin (E9-1)
Basing.....	9AE
Mounting position.....	Any



PIN CONNECTIONS

Pin 1.....	Triode Plate
Pin 2.....	Pentode Grid 1
Pin 3.....	Pentode Grid 2
Pin 4.....	Heater
Pin 5.....	Heater
Pin 6.....	Pentode Plate
Pin 7.....	Pentode Cathode, Grid 3, 1. S.
Pin 8.....	Triode Cathode
Pin 9.....	Triode Grid

REFERENCES

See explanation of warm-up controlled series-string heaters in APPENDIX.

APPLICATION

Type 5U8 is a miniature medium-mu triode, sharp-cutoff pentode intended primarily for service as a combined triode oscillator and pentode mixer in television and i-m receivers. It is also suitable for a wide variety of general purpose applications in both monochrome and color television receivers.

NOTES

Type 5U8 is identical to type 6U8 except for heater characteristics, and to the 5BE8 except for direct interelectrode capacitances and basing.

ENGINEERING DESIGN DATA

5V4G

5V4GA

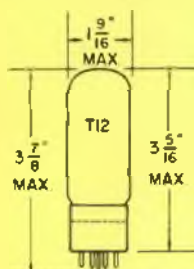
JULY 10, 1956

Double diode

MECHANICAL DATA

5V4G 5V4GA

Cathode, coated unipotential		
Bulb	ST-14	T12
Outline	JETEC 14-3* as shown	
Base		
Medium-shell	B5-15	B5-15
Short-medium-shell	B5-121	B5-121
Basing	5L	5L
Mounting position	Any	Any



PIN CONNECTIONS

Pin 1	N. C.
Pin 2	Heater
Pin 4	Plate 2
Pin 6	Plate 1
Pin 8	Heater, cathode

NOTES

Types 5V4G, GA are identical electrically to the 83V. Mechanically, types 5V4G, and 5V4GA differ only in bulb types. The heater is connected internally to cathode.

*See 5Y3G for outline drawing.

5V6GT

JULY 10, 1956

Beam power pentode

CHARACTERISTIC CURVES (In curve section following APPENDIX)

Plate ($E_{c2}=250V$)	138A
Plate ($E_{c2}=250V$)	138B
Plate, triode connected	138C
Plate, $\Delta E_{c2}(E_{c1}=0V)$	138D
Transfer ($E_b=250V$)	138E
Operation	138F



5V4G

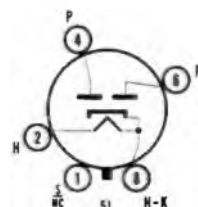
5V4GA

High-vacuum full-wave power rectifier



HEATER CHARACTERISTICS

Voltage, a-c or d-c	5.0 volts
Current	2.0 amp



ELECTRICAL DATA

MAXIMUM RATINGS (Design center values)

Rectifier Service

Plate voltage, peak inverse	1400 volts
Plate current, peak steady state (each plate)	525 ma
Plate current, peak transient (each plate)	3.5 amp

CHARACTERISTICS

Tube Voltage Drop

Conducting 175 ma (each plate)	25 volts
--------------------------------	----------

TYPICAL OPERATION

Full-Wave Rectifier (Capacitor Input Filter)

Plate supply voltage, rms (each plate)	375 volts
Plate supply impedance, min. (each plate)	100 ohms
Filter input capacitor	10 μf
Output current, d-c	175 ma
Output voltage at filter input, d-c	410 volts

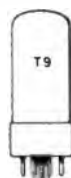
TYPICAL OPERATION

Full-Wave Rectifier (Choke Input Filter)

Plate supply voltage, rms (each plate)	500 volts
Filter input choke	4.0 henrys
Output current, d-c	175 ma
Output voltage at filter input, d-c	410 volts



5V6GT



Audio power amplifier, heater warm-up controlled for series strings

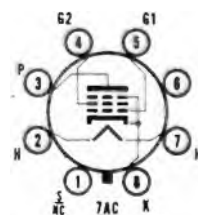
HEATER CHARACTERISTICS

Voltage, a-c or d-c	4.7 volts
Current	600 ma
Peak heater-cathode voltage, max.	

Heater negative to cathode	200 volts
Heater positive to cathode*	200 volts
Warm-up time	11 secs. average

(See Series-String Heaters section of APPENDIX in CBS Tube Manual)

*D-c component must not exceed 100 volts max.





5V3



High-vacuum full-wave rectifier for color TV receivers or other high current equipment

FILAMENT CHARACTERISTICS

Voltage, a-c or d-c	5.0 volts
Current	3.8 amps

ELECTRICAL DATA

MAXIMUM RATINGS (Design maximum values)

Plate voltage, peak inverse	1540 volts
Plate supply voltage, rms (each plate)	550 volts
Plate current, peak steady state (each plate)	1.2 amps
Plate current, peak transient (each plate)	5.5 amps
Output current, d-c	

RATING CHART

CHARACTERISTICS

Tube Voltage Drop	
Conducting 350 ma (each plate)	47 volts

TYPICAL OPERATION

Full-Wave Rectifier (Capacitor Input Filter)

Plate supply voltage, rms (each plate)†	300	425 volts
Plate supply resistance (each plate)	24	56 ohms
Filter input capacitance	40	40 μ f
Output current, d-c	380	350 ma
Output voltage at filter input, d-c	285	430 volts

Full-Wave Rectifier (Choke Input Filter)

Plate supply voltage, rms (each plate)	500 volts
Filter input choke	10 henrys
Output current, d-c	350 ma
Output voltage at filter input	385 volts

NOTE

†A-C plate voltage is measured without load.

ENGINEERING DESIGN DATA

5V3

MARCH 30, 1959

Full-wave rectifier

CHARACTERISTIC CURVES

(In curve section following APPENDIX)

Output current vs. supply volts 221A

Output current vs. rectification eff. (capacitor input) 221B

Plate supply resistance vs. plate supply volts (capacitor input) 221C

MECHANICAL DATA

Cathode, coated filament

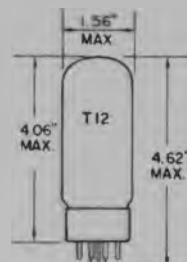
Bulb T-12

Base, short-medium shell octal 8-pin (JEDEC B8-118)

Basing ST

Mounting position Vertical*

*Horizontal operation is permitted if pins 2 and 4 are in a vertical plane.



PIN CONNECTIONS

Pin 1	N.C.
Pin 2	Filament
Pin 4	Plate
Pin 6	Plate
Pin 8	Filament

APPLICATION

Type 5V3 is a full-wave rectifier capable of supplying exceptionally high rectified power for its size. It was primarily designed for color television receivers but its possible applications are many such as in high power stereo sound amplifiers and in industrial equipment requiring up to 500 volts at 350 milliamperes.

5V6GT (cont.)

ELECTRICAL DATA

DIRECT INTERELECTRODE CAPACITANCES

Grid to plate: g1 to p	0.7	μf
Input: g1 to k + h + g2 + b.p.	9.0	μf
Output: p to k + h + g2 + b.p.	7.5	μf

MAXIMUM RATINGS (Design center values unless noted)

Class A Amplifier

Plate voltage	315	volts
Grid 2 voltage	285	volts
Grid 2 supply voltage	315	volts
Plate dissipation*	12	watts
Grid 2 dissipation	2	watts
Grid 1 circuit resistance		
Fixed bias	0.1	meg
Self bias	0.5	meg

Vertical Deflection Amplifier† (triode connected):

Plate voltage	315	volts
Plate voltage, peak positive pulse (absolute max.)	1200	volts
Grid voltage, peak negative	250	volts
Plate dissipation*	9.0	watts
Cathode current, average	35	ma
Cathode current, peak	105	ma
Grid 1 circuit resistance, self bias	2.2	meg

CHARACTERISTICS AND TYPICAL OPERATION

Class A Amplifier (Single Tube)

Plate voltage	180	250	315	volts
Grid 2 (screen) voltage	180	250	225	volts
Grid 1 (control-grid) voltage	-8.5	-12.5	-13.0	volts
Plate resistance (approx.)	50,000	50,000	80,000	ohms
Transconductance	3700	4100	3750	μmhos
Grid 1 input voltage, peak a-f	8.5	12.5	13.0	volts
Plate current, zero signal	29	45	34	ma
Plate current, maximum signal	30	47	35	ma
Grid 2 current, zero signal	3.0	4.5	2.2	ma
Grid 2 current, maximum signal	4.0	7.0	6.0	ma
Load resistance impedance	5500	5000	8500	ohms
Total harmonic distortion (approx.)	8	8	12	%
Power output, maximum signal	2.0	4.5	5.5	watts

Class A Push-Pull Amplifier (Two Tubes)

Plate voltage	250	285	volts
Grid 2 (screen) voltage	250	285	volts
Grid 1 (control-grid) voltage	-15	-19	volts
Grid-to-grid input voltage, peak a-f	30	38	volts
Plate current, zero signal	70	70	ma
Plate current, maximum signal	79	92	ma
Grid 2 current, zero signal	5	4	ma
Grid 2 current, maximum signal	13.0	13.5	ma
Load resistance, plate-to-plate	10,000	8000	ohms
Total harmonic distortion (approx.)	5.0	3.5	%
Power output, maximum signal	10	14	watts

Triode Connected:

Plate and grid 2 voltage (p + g2 tied together)	250	volts
Grid 1 voltage	-12.5	volts
Plate resistance (approx.)	1960	ohms
Transconductance	5000	μmhos
Grid 1 input voltage for $I_b = 0.5$ ma	-36	volts
Amplification factor	9.8	
Plate current	49.5	ma

NOTES:

*Tube protection is needed for no-drive conditions if grid-resistor bias is used.

†Voltage pulse duration must not exceed 2500 μs in a 525-line, 30-frame system.

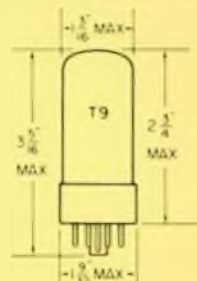
‡Screen tied to plate.

ENGINEERING DESIGN DATA

5V6GT (cont.)

MECHANICAL DATA

Cathode, coated unipotential	
Bulb	T-9
Outline	JETEC 9-11 or 9-41
Base	
Intermediate shell octal	B6-B1 or B7-7
Short intermediate shell octal	B6-B4 or B7-59
Basing	7AC
Mounting position	Any



PIN CONNECTIONS

Pin 1	▲N. C.
Pin 2	Heater
Pin 3	Plate
Pin 4	Grid 2
Pin 5	Grid 1
Pin 7	Heater
Pin 8	Cathode, B. P.

APPLICATION

Type 5V6GT is a beam power pentode capable of supplying high power output with high sensitivity. It may be used either in the audio frequency output stage of radio and television receivers or as a triode-connected vertical deflection amplifier in television receivers. It has ratings for both types of operation. When used as an audio power amplifier, it will supply high power with high efficiency with low third and higher order harmonics.

The 5V6GT has a 600-ma heater with a warm-up control characteristic to be employed in series-heater strings of television receivers. When used with other tubes exhibiting essentially the same heater warm-up characteristics, heater voltage surges across the individual tubes are minimized during the warm-up time.

NOTES

Type 5V6GT is identical to types 6V6GT and 12V6GT except for heater characteristics. The 5V6GT has a miniature tube counterpart, the 5AQ5GT, which has reduced ratings because of its smaller physical size.

▲Pin 1 omitted on bases B6-B1 and B6-B4.

5X8

FEBRUARY 25, 1957

**Medium-mu triode
sharp-cutoff pentode**

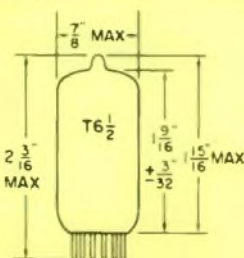
CHARACTERISTIC CURVES

(In curve section following APPENDIX)

Screen Grid Rating.....	100A
Plate, pentode ($E_{c2}=150V$).....	141A
Plate, triode.....	141B
Plate, pentode unit (triode connected).....	141C
Operation, pentode.....	141D
Operation, pentode.....	141E

MECHANICAL DATA

Cathode, coated unipotential.....	
Bulb.....	T-6½
Outline.....	JETEC 6-2
Base.....	Miniature 9-pin (E9-1)
Basing.....	9AK
Mounting position.....	Any



PIN CONNECTIONS

Pin 1.....	Pentode Grid 3
Pin 2.....	Triode Grid
Pin 3.....	Triode Plate
Pin 4.....	Heater
Pin 5.....	Heater
Pin 6.....	Cathode
Pin 7.....	Pentode Grid 1
Pin 8.....	Pentode Grid 2
Pin 9.....	Pentode Plate

REFERENCES

The ratings and typical operation given for the 5X8 are for oscillator-mixer service. Methods of measuring conversion transconductance are given in MIL-E-10, section 4.10.12 or IRE Sds. Electron Tubes, 1950, 7.2.6. Measurement of oscillator performance is given in MIL-E-10, section 4.10.2 and IRE Sds. Electron Tubes, 1950, 7.2.7.

The heater of the 5X8 has a warm-up time controlled characteristic which is standard for 600-ma tubes used in series strings. For a complete description of heater warm-up time and the method of measurement see the APPENDIX of this manual.

5W4/G/GT • 5X3 • 5X4G

(See chart for seldom-used tubes)



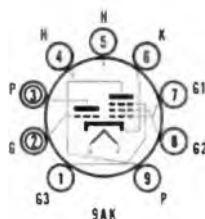
5X8



Vhf oscillator and mixer, heater warm-up controlled for series strings

HEATER CHARACTERISTICS

Voltage, a-c or d-c.....	4.7 volts
Current.....	600 ma
Peak heater-cathode voltage, max.	
Heater negative to cathode.....	100 volts
Heater positive to cathode*.....	100 volts
Warm-up time.....	11 secs. average
(See Series-String Heaters section of APPENDIX in CBS Tube Manual)	
*D-c component must not exceed 100 volts max.	



ELECTRICAL DATA

DIRECT INTERELECTRODE CAPACITANCES

Triode Section	No Shield	Shielded
Grid to plate: g1 to p.....	1.4	1.4 μf
Input: g1 to k + h.....	2.0	2.6 μf
Output: p to k + h.....	0.5	1.0 μf

Pentode Section

Grid to plate: g1 to p.....	0.09	0.06 μf
Input: g1 to k + h + g2 + g3.....	4.3	4.5 μf
Output: p to k + h + g2 + g3.....	0.7	1.4 μf
Coupling: pentode grid 1 to triode plate.....	0.045	0.035 μf
Coupling: pentode plate to triode plate.....	0.040	0.008 μf

*JETEC shield 315 connected to cathode.

MAXIMUM RATINGS (Design center values)

Converter Service	Triode as Oscillator	Pentode as Mixer
Plate voltage.....	250	250 volts
Grid 2 voltage.....	See Rating Chart in APPENDIX	
Grid 2 supply voltage.....		250 volts
Grid 1 voltage, positive d-c.....	0	0 volts
Grid 1 voltage, negative d-c.....	40	40 volts
Plate dissipation.....	1.5	2.0 watts
Grid 2 input.....		0.4 watt
Grid 1 input.....	0.5	watt
Grid 1 circuit resistance		
Fixed bias.....	0.1	0.1 meg
Self bias.....	0.5	0.5 meg

Pentode Section as Triode-Connected Mixer

Plate voltage.....	250 volts
Grid 1 voltage, positive d-c.....	0 volts
Grid 1 voltage, negative d-c.....	40 volts
Plate dissipation.....	2.4 watts

5X8 (cont.)

CHARACTERISTICS

	Triode	Pentode
Plate voltage.....	100	250 volts
Grid 3 (suppressor).....	connected to cathode at socket	
Grid 2 (screen) voltage.....		150 volts
Cathode-bias resistor.....	100	200 ohms
Plate resistance (approx.).....	6900	750,000 ohms
Transconductance.....	5800	4600 μ mhos
Amplification factor.....	40	
Plate current.....	8.5	7.7 ma
Grid 2 current.....		1.6 ma
Grid 1 voltage (approx.) for $I_b = 10 \mu$ a.....	-10	-10 volts

Pentode Section Connected as Triode

Plate voltage.....	150 volts
Grid 3 (suppressor).....	connected to cathode at socket
Grid 2 (screen) voltage.....	connected to plate
Cathode-bias resistor.....	250 ohms
Plate resistance (approx.).....	7900 ohms
Transconductance.....	4000 μ mhos
Amplification factor.....	42
Plate current.....	7.8 ma
Grid 1 voltage (approx.) for $I_b = 10 \mu$ a.....	-10 volts

TYPICAL OPERATION

Triode 250mc oscillator and pentode mixer	Triode ^v	Pentode ^d
Plate voltage.....	150	150 volts
Grid 3 (suppressor).....	connected to cathode at socket	
Grid 2 (screen) voltage.....		150 volts
Mixer grid 1 (control grid) supply voltage.....	-3.5	volts
Oscillator voltage (rms) at mixer grid 1.....	2.6	volts
Mixer grid 1 (control grid) circuit resistance.....	120,000	ohms
Oscillator grid resistor.....	2700	ohms
Conversion transconductance.....		2100 μ mhos
Plate current.....	13	6.2 ma
Grid 2 (screen) current.....		1.8 ma
Grid 1 (control grid) current.....	3.6	ma
Grid 1 (control grid) current.....		2.0 μ a
Oscillator power output (approx.).....	0.5	watt

Pentode Section as Triode-Connected Mixer†

Plate voltage.....	150 volts
Grid 1 (control grid) supply voltage.....	-3.5 volts
Oscillator voltage (rms) at grid 1.....	2.6 volts
Grid 1 (control grid) circuit resistance.....	120,000 ohms
Conversion transconductance.....	2800 μ mhos
Plate current.....	7.8 ma
Grid 1 (control grid) current.....	2.0 μ a

NOTES:

†Grid 3 (suppressor) connected to cathode; Grid 2 (screen) connected to plate.

▼In TV or i-m receivers, it is desirable to operate the oscillator with less power input than given to avoid over-excitation and excessive radiation.

ΔWith separate excitation and triode unit grounded.

5X8 (cont.)

APPLICATION

Type 5X8 is a miniature style, medium- μ triode and sharp-cutoff pentode. It incorporates a cathode that is common to both triode and pentode sections, thus rendering it highly suitable for oscillator-mixer service.

The 5X8 and other tubes in this family provide vhf frequency conversion for i-f stages utilizing a frequency in the order of 40 megacycles. Performance is comparable to that of a 6AG5 mixer and one section of the 6J6 oscillator.

If used in an AM-FM receiver, the triode section may be used as the oscillator for both bands, but the pentode mixer may be pentode connected for a-m and triode connected for i-m band operation if a low-noise figure is desirable.

NOTES

Type 5X8 is identical to type 6X8 except for heater characteristics. Similar, but not identical, types are the 5AT8, 6AT8, 5CG8 and 6CG8.

ENGINEERING DESIGN DATA

5Y3GT

5Y3G

JULY 10, 1956

Double diode

CHARACTERISTIC CURVES

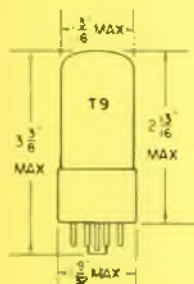
(In curve section following APPENDIX)

Rating Chart	150A
Operating (Capacitor Input)	150B
Operating (Choke Input)	150C

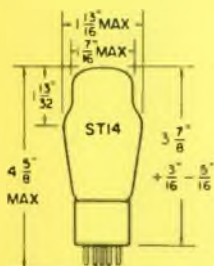
MECHANICAL DATA

Cathode, coated filament	5Y3GT
Bulb	T-9
Outline	JETEC 9-13 or 9-42
Base	
Intermediate shell octal 5-pin (B5-10)	
Short intermediate shell octal 5-pin (B5-62)	
Basing	5T
Mounting position†	Vertical
†Horizontal operation permitted if pins 2 and 4 are in a vertical plane.	

5Y3GT



5Y3G



PIN CONNECTIONS

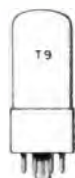
Pin 1	N. C., Shield
Pin 2	Filament
Pin 4	Plate 2
Pin 6	Plate 1
Pin 8	Filament



5Y3GT

5Y3G

High-vacuum full-wave power rectifier



FILAMENT CHARACTERISTICS

Voltage, a-c	5.0 volts
Current	2 amp

ELECTRICAL DATA

MAXIMUM RATINGS (Design center values)

Rectifier Service

Plate voltage, peak inverse	1400 volts
Plate supply voltage, rms (each plate)†	RATING CHART* 500 volts
Output current, d-c	RATING CHART*
Plate current, peak steady state (each plate)	440 ma
Plate current, peak transient (each plate)	2.5 amp

CHARACTERISTICS

Tube Voltage Drop

Conducting 125 ma (each plate)	50 volts
--------------------------------	----------

TYPICAL OPERATION

Full-Wave Rectifier (Capacitor Input Filter)

Plate supply voltage, rms (each plate)†	350 volts
Plate supply resistance (each plate)	50 ohms
Filter input capacitor	20 μ f
Output current, d-c	125 ma
Output voltage at filter input, d-c	360 volts

Full-Wave Rectifier (Choke Input Filter)

Plate supply voltage, rms (each plate)	500 volts
Filter input choke	10 henrys
Output current, d-c	125 ma
Output voltage at filter input, d-c	380 volts

NOTES:

*Rating Charts given in APPENDIX of CBS Tube Manual

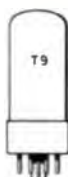
†Plate supply voltage is measured without load.

Type 5Y3G is identical to type 5Y3GT except for bulb style. It has an ST14 bulb with a maximum over-all height of 4 3/8 inches.



5Y4GT

5Y4G • 5Y4GA

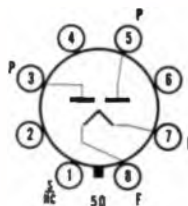


Filamentary type high-vacuum full-wave rectifier

FILAMENT CHARACTERISTICS

Voltage, a-c..... 5.0 volts
 Current..... 2.0 amp

Types 5Y4G, 5Y4GA, and 5Y4GT are electrically identical to type 5Y3GT but have a different basing.



ENGINEERING DESIGN DATA

5Y4GT

5Y4G • 5Y4GA

JULY 10, 1956

Double diode

CHARACTERISTIC CURVES

(In curve section following APPENDIX)

Rating Chart..... 150A

Operation, Capacitor Input..... 150B

Operation, Choke Input..... 150C

MECHANICAL DATA

Coated filament 5Y4G 5Y4GA 5Y4GT

Bulb..... ST-14 T-12 T-9

Outline..... 14-3Δ 9-13 9-42

Base

Medium shell

octal..... B8-11

Short medium

shell octal..... B8-11Δ

Intermediate

shell octal..... B8-6

Short intermediate

shell octal..... B8-58

Basing..... 5Q 5Q 5Q

Mounting position..... Vertical Vertical Vertical

NOTES

†Horizontal operation is permitted if pins 1 and 4 are in a vertical plane.

‡See 5Y3GT for outline drawing.

§See 5Y4GA for outline drawing.

Δ See 5Y3G for outline drawing.



5Z3



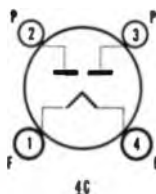
High-vacuum full-wave power rectifier

FILAMENT CHARACTERISTICS

Voltage, a-c or d-c..... 5.0 volts

Current..... 3.0 amp

Type 5Z3 is identical to type 5U4G except for basing and mounting position. Horizontal operation is permissible if pins 1 and 2 are in a vertical plane.



5Z3

JULY 10, 1956

Double diode

CHARACTERISTIC CURVES

(In curve section following APPENDIX)

Rating Chart I..... 148A

Rating Chart II..... 148B

Rating Chart III..... 148C

PIN CONNECTIONS

Pin 1..... Filament

Pin 2..... Plate

Pin 3..... Plate

Pin 4..... Filament

APPLICATION

Type 5Z3 is a filamentary, full-wave, high-vacuum rectifier designed for service in the power supplies of equipment having high current requirements.

5Z4 • 6A3 • 6A4 • 6A5G • 6A6 6A7S • 6A8/G/GT

(See chart for seldom-used tubes)

CBS ELECTRON TUBES

6AB4

SEPTEMBER 10, 1956

High-mu triode



6AB4



Vhf triode for oscillator or grounded-grid amplifier service

CHARACTERISTIC CURVES

(In curve section following APPENDIX)

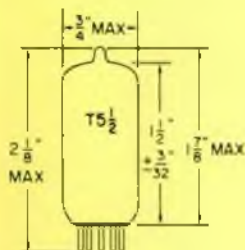
Plate.....151A

Characteristics: r_p , g_m , μ

($E_b = 250V$).....151B

MECHANICAL DATA

Cathode, coated unipotential
Bulb.....T-5½
Outline.....JETEC 5-2
Base.....Miniature 7-pin (E7-1)
Basing.....SCE
Mounting position.....Any



PIN CONNECTIONS

Pin 1.....Plate
Pin 2.....N. C.
Pin 3.....Heater
Pin 4.....Heater
Pin 5.....N. C.
Pin 6.....Grid 1
Pin 7.....Cathode

APPLICATION

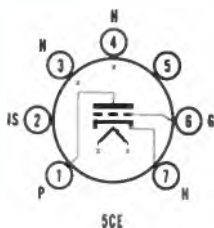
Type 6AB4 is a miniature, high-mu triode designed for use as a grounded-grid r-f amplifier, frequency converter, or oscillator at vhf frequencies.

NOTES

Type 6AB4 is electrically equal to one section of a type 12AT7.

HEATER CHARACTERISTICS

Voltage, a-c or d-c.....6.3 volts
Current.....150 ma
Peak heater-cathode voltage, max.
Heater negative to cathode.....90 volts
Heater positive to cathode.....90 volts



ELECTRICAL DATA

DIRECT INTERELECTRODE CAPACITANCES

	No Shield	Shielded	
Grid to plate: g1 to p.....	1.5	1.5	$\mu\mu f$
Input: g1 to k + h.....	2.2	2.2	$\mu\mu f$
Output: p to k + h.....	0.50	1.4	$\mu\mu f$
Heater to cathode: h to k.....	2.9	2.9	$\mu\mu f$

Grounded grid operation

Plate to cathode: p to k.....	0.24	0.20	$\mu\mu f$
Input: g1 to k + h.....	5.0	5.2	$\mu\mu f$
Output: p to k + h.....	1.7	2.6	$\mu\mu f$

♦JETEC shield 316 connected to cathode.

MAXIMUM RATINGS (Design center values)

Plate voltage.....	300 volts
Control-grid voltage, negative d-c.....	50 volts
Plate dissipation.....	2.5 watts

CHARACTERISTICS AND TYPICAL OPERATION

Class A Amplifier

Plate voltage.....	100	250 volts
Cathode-bias resistor.....	270	200 ohms
Plate resistance (approx.).....	15,000	10,900 ohms
Transconductance.....	4000	5500 μmhos
Amplification factor.....	60	60
Plate current.....	3.7	10 ma
Control-grid voltage (approx.) for $I_b = 10 \mu\text{A}$	-5	-12 volts

6AB5/6N5 • 6AB6G 6AB7/1853 • 6AC5G/GT 6AC6GT

(See chart for seldom-used tubes)



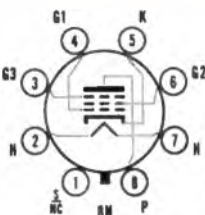
6AC7



High gain amplifier for r-f, i-f, and video stages

HEATER CHARACTERISTICS

Voltage, a-c or d-c.....	6.3 volts
Current.....	450 ma
Peak heater-cathode voltage, max.	
Heater negative to cathode.....	90 volts
Heater positive to cathode.....	90 volts



ELECTRICAL DATA

DIRECT INTERELECTRODE CAPACITANCES—Shield†

Grid to plate: g1 to p, max.....	.015	μmf
Input: g1 to k + h + g2 + g3.....	11.0	μmf
Output: p to k + h + g2 + g3.....	5.0	μmf

†Shell connected to cathode.

MAXIMUM RATINGS (Design center values)

Plate voltage.....	300 volts
Grid 2 voltage.....	150 volts
Grid 2 supply voltage.....	300 volts
Plate dissipation.....	3.02 watts
Grid 2 dissipation.....	0.38 watt
Grid 1 circuit resistance with self bias*	
Fixed screen voltage.....	0.25 meg
Series screen resistor.....	0.5 meg

CHARACTERISTICS AND TYPICAL OPERATION

Class A Amplifier	Condition 1†	Condition 2‡
Plate voltage.....	300	300 volts
Grid 3 (suppressor)Δ.....	0	0 volts
Grid 2 supply voltage.....	150	300 volts
Cathode bias resistor, min.▼.....	160	160 ohms
Screen series resistor.....		60,000 ohms
Plate resistance (approx.).....	1.0	1.0 meg
Transconductance.....	9000	9000 μmhos
Plate current.....	10	10 ma
Grid 2 current.....	2.5	2.5 ma

NOTES:

*For maximum voltage conditions and with cathode bias.

†Sharp cutoff if fixed screen supply is used.

‡Extended cutoff if screen resistor is used.

ΔIn r-f and i-f stages, connect suppressor directly to ground for minimum feedback.

▼Adjusted to give a plate current of 10 ma.

ENGINEERING DESIGN DATA

6AC7

SEPTEMBER 10, 1956

Sharp-cutoff pentode

CHARACTERISTIC CURVES

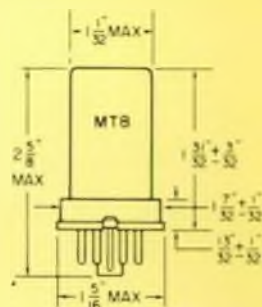
(In curve section following APPENDIX)

Plate ($E_{c2} = 150V$).....152A

Plate, ΔE_{c2} ($E_{c1} = 0V$).....152B

MECHANICAL DATA

Cathode, coated unipotential	
Bulb.....	MT-8
Outline.....	JETEC 8-1
Base.....	Small water 8-pin octal (B8-21)
Basing.....	.8N
Mounting position.....	Any



PIN CONNECTIONS

Pin 1.....	Shell, I. S.
Pin 2.....	Heater
Pin 3.....	Grid 3
Pin 4.....	Grid 1
Pin 5.....	Cathode
Pin 6.....	Grid 2
Pin 7.....	Heater
Pin 8.....	Plate

APPLICATION

Type 6AC7 is a sharp-cutoff high-transconductance pentode intended for service as a wide-band video or r-f amplifier.

NOTES

Type 6AC7 is not recommended for low-level audio-frequency applications unless the heater voltage is obtained from a d-c source. The use of cathode-bias is recommended.

6AD5G/GT • 6AD6G • 6AD7G 6AE5GT • 6AE6G • 6AE7G/GT

(See chart for seldom-used tubes)

ENGINEERING DESIGN DATA

6AF4

6AF4A

Uhf triode

CHARACTERISTIC CURVES

(In curve section following APPENDIX)

Plate.....116A

Transfer; I_a , R_m , μ116B

Characteristics; I_c , ΔE_c116C

APPLICATION

Types 6AF4 and 6AF4A are uhf triode oscillators for use at frequencies up to 1000 megacycles in television tuners.



6AF4

6AF4A

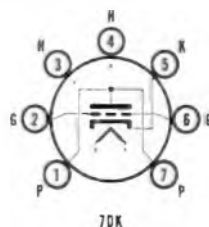
Triode local oscillator for uhf television tuners



HEATER CHARACTERISTICS

Voltage, a-c or d-c..... 6.3 volts

Current..... 225 ma



70K

Types 6AF4 and 6AF4A are identical to types 2AF4 and 2AF4A, respectively except for heater characteristics.

6AF5G • 6AF6G

(See chart for seldom-used tubes)

6AG5

SEPTEMBER 10, 1956

Sharp-cutoff
pentode

CHARACTERISTIC CURVES

(In curve section following APPENDIX)

Screen Grid Rating.....100A

Plate ($E_{c2} = 150V$).....165A

Plate, triode connected.....165B

MECHANICAL DATA

Cathode, coated unipotential

Bulb..... T-5½

Outline..... JETEC 5-2

Base..... Miniature 7-pin (E7-1)

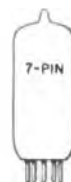
Basing..... 7BD

Mounting position..... Any



6AG5

R-f or i-f pentode amplifier at frequencies
up to about 400 mc



HEATER CHARACTERISTICS

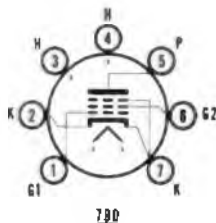
Voltage, a-c or d-c..... 6.3 volts

Current..... 300 ma

Peak heater-cathode voltage, max.

Heater negative to cathode..... 90 volts

Heater positive to cathode..... 90 volts



70D

ELECTRICAL DATA

DIRECT INTERELECTRODE CAPACITANCES

	No Shield	Shield†	
Grid to plate: g1 to p, max.....	0.03	0.02	μuf
Input: g1 to k + h + g2 + g3.....	6.5	6.6	μuf
Output: p to k + h + g2 + g3.....	1.8	3.1	μuf
Triode connection*			
Grid to plate: g1 to p.....	2.5	2.5	μuf
Input: g1 to h + k + g3 + i.s.....	3.6	3.6	μuf
Output: p and g2 to h + k + g3 + i.s.....	3.0	4.3	μuf

†JETEC shield 316 connected to cathode.

CBS ELECTRON TUBES

6AG5 (cont.)

MAXIMUM RATINGS (Design center values)

Plate voltage	300 volts
Grid 2 voltage	See Rating Chart in APPENDIX
Grid 2 supply voltage	300 volts
Grid 1 voltage, positive d-c	0 volts
Plate dissipation	2.0 watts
Grid 2 dissipation	0.5 watts
Plate voltage*	300 volts
Grid 1 voltage, positive d-c*	0 volts
Plate and grid 2 dissipation (total)*	2.5 watts

CHARACTERISTICS AND TYPICAL OPERATION

Class A Amplifier

Plate voltage	100	125	250 volts
Grid 2 (screen) voltage	100	125	150 volts
Cathode bias resistor	180	100	180 ohms
Plate resistance (approx.)	0.6	0.5	0.8 meg
Transconductance	4500	5100	5000 μ mhos
Plate current	4.5	7.2	6.5 ma
Grid 2 current	1.4	2.1	2.0 ma
Grid 1 voltage (approx.) for $I_b = 10 \mu$ a	-5	-6	-8 volts

Class A Amplifier-triode connection*

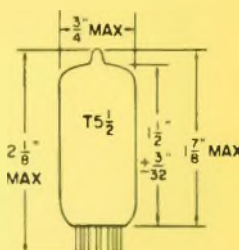
Plate voltage	180	250 volts
Cathode bias resistor	330	820 ohms
Plate resistance, approx.	.008	.01 meg
Amplification factor	45	42
Transconductance	5700	3800 μ mhos
Plate and grid 2 current, total	7	5.5 ma

NOTE:

*Triode connection: grid 2 (screen) tied to plate.

ENGINEERING DESIGN DATA

6AG5 (cont.)



PIN CONNECTIONS

Pin 1	Grid 1
Pin 2	Cathode, Grid 3, I. S.
Pin 3	Heater
Pin 4	Heater
Pin 5	Plate
Pin 6	Grid 2
Pin 7	Cathode, Grid 3, I. S.

APPLICATION

Type 6AG5 is a sharp-cutoff pentode contained in a miniature envelope. It may be used either as an intermediate-frequency amplifier or as a radio-frequency amplifier up to 400 megacycles per second. The 6AG5 has high transconductance and low input and output capacitances. Two cathode leads aid in isolating the input and output circuits if properly used.

NOTES

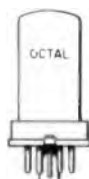
Type 6AG5 is similar to type 6BC5.

6AG6G

(See chart for seldom-used tubes)



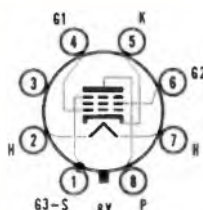
6AG7



**Video power amplifier with high transconductance
and high power sensitivity**

HEATER CHARACTERISTICS

Voltage, a-c or d-c	6.3 volts
Current	650 ma
Peak heater-cathode voltage, max.	
Heater negative to cathode	90 volts
Heater positive to cathode	90 volts



6AG7

JULY 10, 1956

Video power pentode

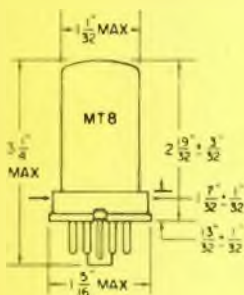
CHARACTERISTIC CURVES

(In curve section following APPENDIX)
Plate ($E_c = 150V$) 153A
Plate, ΔE_c ($E_c = 0V$) 153B

MECHANICAL DATA

Cathode, coated unipotential
Bulb MT-8
Outline JETEC 8-6
Base Small wafer 8-pin octal (B8-21)
Basing 8Y
Mounting position Vertical

6AG7 (cont.)



PIN CONNECTIONS

Pin 1	Shell, Grid 3
Pin 2	Heater
Pin 3	I. S.
Pin 4	Grid 1
Pin 5	Cathode
Pin 6	Grid 2
Pin 7	Heater
Pin 8	Plate

APPLICATION

Type 6AG7 is a power pentode primarily for use in video output amplifier stages. The tube is capable of operating at high plate current levels and exhibits high transconductance and high power sensitivity. It is a metal type which requires an octal socket.

NOTES

It is recommended that miniature tube type 12BY7 be employed in new television receiver designs rather than the 6AG7.

▼ Horizontal operation is permitted if pins 2 and 7 are in a vertical plane.

6AG7 (cont.)

ELECTRICAL DATA

DIRECT INTERELECTRODE CAPACITANCES—Shielded

Grid to plate: g1 to p, max.	0.06 μ f
Input: g1 to k + h + g2 + g3	13.0 μ f
Output: p to k + h + g2 + g3	7.5 μ f
Grid 1 to grid 2 (approx.)	5.8 μ f
Grid 1 to cathode (approx.)	5.2 μ f
Heater to cathode (approx.)	10.7 μ f
*Shell connected to cathode.	

MAXIMUM RATINGS (Design center values)

Plate voltage	300 volts
Grid 2 voltage	300 volts
Grid 1 voltage, positive d-c	0 volts
Plate dissipation	9.0 watts
Grid 2 dissipation	1.5 watts
Grid 1 circuit resistance	
Fixed bias	0.25 meg
Self bias	1.0 meg

CHARACTERISTICS AND TYPICAL OPERATION

Class A Amplifier

Plate voltage	300 volts
Grid 2 (screen) voltage	150 volts
Grid 1 (control-grid) voltage	-3 volts
Grid 1 input voltage, peak a-f	3 volts
Plate current, zero signal	30 ma
Plate current, maximum signal	30.5 ma
Grid 2 current, zero signal	7 ma
Grid 2 current, maximum signal	9 ma
Plate resistance (approx.)	0.13 meg
Transconductance	11,000 μ mhos
Load resistance	10,000 ohms
Total harmonic distortion	7 %
Power output, maximum signal	3 watts

Class A Video Voltage Amplifier (4 mc bandwidth)*

	Grid resistor† bias	Cathode bias
Plate supply voltage	300	300 volts
Grid 2 (screen) voltage	115†	125 ▲
Grid 1 (control-grid) voltage, zero signal	0	-2.0 volts
Grid 1 resistor	.25 to 0.5	meg
Cathode resistor		57 ohms
Grid 1 signal voltage (peak to peak)	4.0	4.0 volts
Plate current, zero signal	45	28 ma
Grid 2 current, zero signal	13	7 ma
Load resistor	3500	3500 ohms
Voltage output (peak to peak)	135	140 volts

NOTES:

*With I. S. (Pin 3) connected to ground.

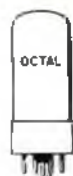
†Intended for use where d-c restoration is accomplished in the grid circuit of the 6AG7.

‡Obtained from a regulated power supply.

▲Obtained from the plate supply voltage through a screen-dropping resistor of 25,000 ohms.



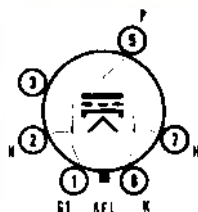
6AH4GT



Vertical-deflection-output amplifier for television

HEATER CHARACTERISTICS

Voltage, a-c or d-c.....	6.3 volts
Current.....	750 ma
Peak heater-cathode voltage, max.	
Heater negative to cathode.....	200 volts
Heater positive to cathode*.....	200 volts
Warm-up time.....	11 secs. average
(See Series-String Heaters section of APPENDIX in CBS Tube Manual)	
*D-c component 100 volts max.	



ELECTRICAL DATA

DIRECT INTERELECTRODE CAPACITANCES

	No Shield	Shield†
Grid to plate: g1 to p.....	4.4	4.2
Input: g1 to k + h.....	7.0	7.5
Output: p to k + h.....	1.7	3.2

†JETEC shield 308 connected to ground.

MAXIMUM RATINGS (Design center values unless noted) Vertical Deflection Amplifier†

Plate voltage, d-c.....	500 volts
Plate voltage, peak pos. (absolute max.).....	2000 volts
Control-grid voltage, peak negative.....	200 volts
Plate dissipation.....	7.5 watts
Cathode current, average.....	60 ma
Cathode current, peak.....	180 ma
Control-grid circuit resistance, fixed bias.....	2.2 meg

AVERAGE CHARACTERISTICS

Plate voltage.....	250	250 volts
Control-grid voltage.....	-33	-23 volts
Plate resistance (approx.).....		1780 ohms
Transconductance.....		4500 μ mhos
Amplification factor.....		8.0
Plate current.....	5.0	30 ma
Grid 1 voltage (approx.) for $I_b = 0.5$ ma.....		-40 volts

TYPICAL OPERATION

Vertical Deflection Amplifier†

Plate voltage.....	240 volts
Control-grid input voltage (approx.)	
Sawtooth component.....	52 volts
Negative peak component.....	87 volts
Cathode-bias resistor.....	1100 ohms
Cathode current, average d-c.....	22 ma
Cathode current, peak to peak.....	62 ma
Plate output voltage (approx.)	
Sawtooth component.....	150 volts
Positive peak component.....	900 volts

NOTES:

†Voltage pulse duration must not exceed 2500 μ s in a 525-line, 30-frame system.

‡Tube protection is needed for no-drive conditions if grid-resistor bias is used.

▲For use in conjunction with a 70° picture tube operating at 15 kv anode voltage.

▼Typical value of total cathode resistance for optimum linearity.

ENGINEERING DESIGN DATA

6AH4GT

SEPTEMBER 10, 1956

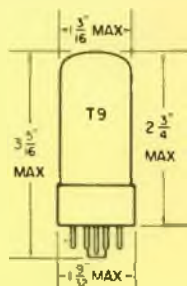
Power triode

CHARACTERISTIC CURVES (In curve section following APPENDIX)

Plate.....154A

MECHANICAL DATA

Cathode, coated unipotential.....	T-9
Bulb.....	JETEC 9-41
Outline.....	Short intermediate shell 6-pin octal (86-60)
Base.....	8EL
Basing.....	Any
Mounting position.....	



PIN CONNECTIONS

Pin 1.....	Grid
Pin 2.....	Heater
Pin 3.....	N. C.
Pin 5.....	Plate
Pin 7.....	Heater
Pin 8.....	Cathode

REFERENCES

See GLOSSARY for detailed information on voltage pulse duration in vertical scanning systems of television receivers.

APPLICATION

Type 6AH4GT is a low- μ triode designed for use as a vertical-deflection amplifier in television receivers. The tube's high permeance makes possible high plate currents at low plate voltages. It is capable of withstanding the high pulse voltages encountered in this application.

Type 6AH4GT is capable of fully deflecting large-deflection-angle picture tubes, when operated from relatively low plate-supply voltages.

6AH6

SEPTEMBER 10, 1956

Sharp-cutoff pentode

CHARACTERISTIC CURVES

(In curve section following APPENDIX)

Plate (E_{b2} = 150V) 155A

Screen Grid Rating 100A

MECHANICAL DATA

Cathode, coated unipotential

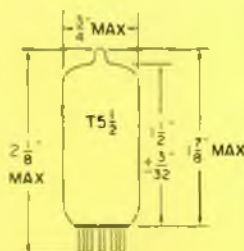
Bulb T-5½

Outline JETEC 5-2

Base Miniature 7-pin (E7-1)

Basing 7CC

Mounting position Any



PIN CONNECTIONS

Pin 1	Grid 1
Pin 2	Grid 3
Pin 3	Heater
Pin 4	Heater
Pin 5	Plate
Pin 6	Grid 2
Pin 7	Cathode

APPLICATION

Type 6AH6 is a sharp-cutoff pentode amplifier used in r-f, i-f or video circuits requiring a wide-band and low impedance output.

6AH5G

(See chart for seldom-used tubes)



6AH6



Sharp-cutoff pentode amplifier for r-f, i-f, or video circuits

HEATER CHARACTERISTICS

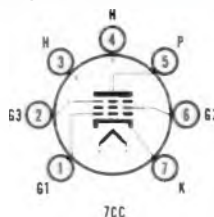
Voltage, a-c or d-c 6.3 volts

Current 450 ma

Peak heater-cathode voltage, max.

Heater negative to cathode 90 volts

Heater positive to cathode 90 volts



ELECTRICAL DATA

DIRECT INTERELECTRODE CAPACITANCES—Shield

Grid to plate: g1 to p, max. 0.020 μ f

Input: g1 to k + h + g2 + g3 10 μ f

Output: p to k + h + g2 + g3 3.6 μ f

*JETEC shield 316 connected to cathode.

MAXIMUM RATINGS (Design center values)

Plate voltage 300 volts

Grid 2 voltage See Rating Chart in APPENDIX

Grid 2 supply voltage 300 volts

Plate dissipation 3.2 watts

Grid 2 dissipation 0.4 watt

Cathode current 13 ma

CHARACTERISTICS AND TYPICAL OPERATION

Class A Amplifier

Plate voltage 300 volts

Grid 3 (suppressor)* connected to cathode at socket

Grid 2 (screen) voltage 150 volts

Cathode bias resistor 160 ohms

Plate resistance (approx.) 0.5 meg

Transconductance 9000 μ mhos

Plate current 10.0 ma

Grid 2 current 2.5 ma

Grid 1 voltage (approx.) for $I_b = 10 \mu$ a -7 volts

NOTE:

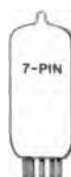
*Grid 3 has very limited control characteristics and is not intended to be used as a control electrode. Its transconductance to the plate is approximately 2 μ mhos and its μ is 0.7 to 1.0.

6AH7GT • 6AJ4 • 6AJ5 • 6AJ7

(See chart for seldom-used tubes)



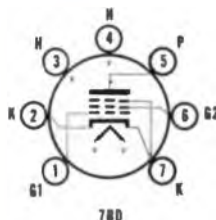
6AK5



**R-f voltage amplifier for frequencies
up to 400 mc**

HEATER CHARACTERISTICS

Voltage, a-c or d-c.	6.3 volts
Current.	175 ma
Peak heater-cathode voltage, max.	
Heater negative to cathode.	120 volts
Heater positive to cathode.	120 volts



ELECTRICAL DATA

DIRECT INTERELECTRODE CAPACITANCES

	No Shield	Shield†	
Grid to plate: g1 to p, max.	0.03	0.02	μmf
Input: g1 to k + h + g2 + g3	4.0	4.0	μmf
Output: p to k + h + g2 + g3	2.1	2.8	μmf

†JETEC shield 316 connected to cathode.

MAXIMUM RATINGS (Design center values)

Plate voltage.	180 volts
Grid 2 voltage.	140 volts
Grid 2 supply voltage.	180 volts
Grid 1 voltage, positive d-c.	0 volts
Plate dissipation.	1.7 watts
Grid 2 dissipation.	0.5 watt
Cathode current.	18 ma

CHARACTERISTICS AND TYPICAL OPERATION

Class A Amplifier

Plate voltage.	120	180 volts
Grid 3 (suppressor).	connected to cathode	at socket
Grid 2 (screen) voltage.	120	120 volts
Cathode bias resistor*.	180	180 ohms
Plate resistance (approx.).	0.3	0.5 meg
Transconductance.	5000	5100 μmhos
Plate current.	7.5	7.7 ma
Grid 2 current.	2.5	2.4 ma
Grid 1 voltage (approx.) for $I_b = 10 \mu\text{a}$.	-8.5	-8.5 volts

NOTE:

*Fixed bias operation is not recommended.

ENGINEERING DESIGN DATA

6AK5

SEPTEMBER 10, 1956

Sharp-cutoff pentode

CHARACTERISTIC CURVES

(In curve section following APPENDIX)

Plate ($E_{c2} = 120\text{V}$)..... 156A

Characteristics, I_b , gm..... 156B

Screen Grid Rating..... 100A

MECHANICAL DATA

Cathode, coated unipotential

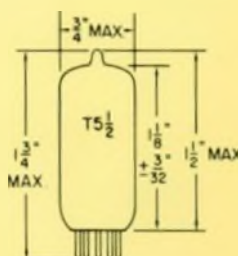
Bulb..... T-5½

Outline..... JETEC 5-1

Base..... Miniature 7-pin (E7-1)

Basing..... 7BD

Mounting position..... Any



PIN CONNECTIONS

Pin 1	Grid 1
Pin 2	Cathode, Grid 3, I. S.
Pin 3	Heater
Pin 4	Heater
Pin 5	Plate
Pin 6	Grid 2
Pin 7	Cathode, Grid 3, I. S.

APPLICATION

High-frequency amplifier often used in wide-band applications. Dual cathode leads help isolate input and output circuits when properly used.

6AK6

SEPTEMBER 10, 1956

Power pentode

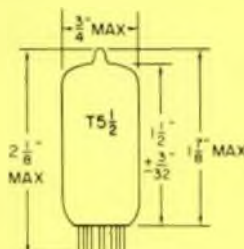
CHARACTERISTIC CURVES

(In curve section following APPENDIX)

Plate ($E_{c2} = 180V$).....157A

MECHANICAL DATA

Cathode, coated unipotential
Bulb.....T-5½
Outline.....JETEC 5-2
Base.....Miniature 7-pin (E7-1)
Basing.....7BK
Mounting position.....Any



PIN CONNECTIONS

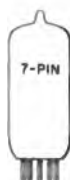
Pin 1.....	Grid 1
Pin 2.....	Grid 3 (Suppressor)
Pin 3.....	Heater
Pin 4.....	Heater
Pin 5.....	Plate
Pin 6.....	Grid 2
Pin 7.....	Cathode

APPLICATION

Type 6AK6 is a miniature power amplifier pentode designed for use in the output stage of compact equipment where power consumption must be kept at a minimum. Its highly effective screen grid may be used to good advantage in power amplifiers where isolation between input and output circuits is desired.



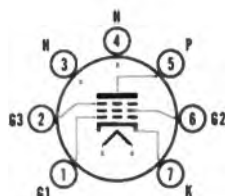
6AK6



Power output amplifier with low heater current

HEATER CHARACTERISTICS

Voltage, a-c or d-c.....	6.3 volts
Current.....	150 ma
Heater-cathode voltage, max. d-c	
Heater negative to cathode.....	100 volts
Heater positive to cathode.....	100 volts



ELECTRICAL DATA

DIRECT INTERELECTRODE CAPACITANCES

Grid to plate: g1 to p.....	0.12	μf
Input: g1 to k + h + g2 + b.p.....	3.6	μf
Output: p to k + h + g2 + b.p.....	4.2	μf

MAXIMUM RATINGS (Design center values)

Plate voltage.....	300 volts
Grid 2 voltage.....	250 volts
Plate dissipation.....	2.75 watts
Grid 2 dissipation.....	.75 watt
Grid circuit resistance	
Fixed bias.....	0.1 meg
Self bias.....	0.5 meg

CHARACTERISTICS AND TYPICAL OPERATION

Class A Amplifier

Plate voltage.....	180 volts
Grid 2 (screen) voltage.....	180 volts
Grid 1 (control-grid) voltage.....	-9 volts
Grid 3 (suppressor).....	connected to cathode at socket
Plate resistance (approx.).....	0.2 ohms
Transconductance.....	2300 μmhos
Grid 1 input voltage, peak a-f.....	9 volts
Plate current, zero signal.....	15 ma
Grid 2 current, zero signal.....	2.5 ma
Load resistance impedance.....	10,000 ohms
Total harmonic distortion (approx.).....	10 %
Power output, maximum signal.....	1.1 watts

6AK7

(See chart for seldom-used tubes)



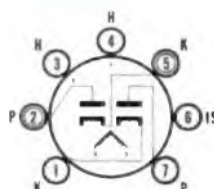
6AL5



A-m, f-m detector, or low-power rectifier

HEATER CHARACTERISTICS

Voltage, a-c or d-c.	6.3 volts
Current	300 ma
Peak heater-cathode voltage, max.	
Heater negative to cathode	330 volts
Heater positive to cathode	330 volts



6BT

Type 6AL5 is identical to type 3AL5 except for heater characteristics.

6AL6G

(See chart for seldom-used tubes)



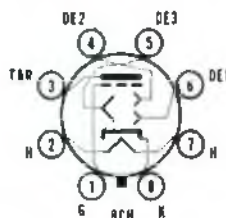
6AL7GT



Tuning indicator controlled by f-m discriminator d-c output

HEATER CHARACTERISTICS

Voltage, a-c or d-c.	6.3 volts
Current	150 ma
Peak heater-cathode voltage, max.	90 volts



MAXIMUM RATINGS (Design center values)

Target voltage, maximum	365 volts
Target voltage, minimum	220 volts

CHARACTERISTICS AND TYPICAL OPERATION

Target voltage	315 volts
Deflection electrodes 1, 2 & 3 voltage	0 volts
Grid voltage*	0 volts
Cathode bias resistor	3300 ohms
Deflection sensitivity (approx.) for first millimeter of deflection†	1.0 mm/volt
Grid voltage (approx.) for fluorescence cutoff	-7.0 volts

NOTES:

*Grid should be connected to cathode when not used for fluorescence control.

†For deflection electrodes 1 and 2.

ENGINEERING DESIGN DATA

6AL5

SEPTEMBER 10, 1956

Duodiode

CHARACTERISTIC CURVES

(In curve section following APPENDIX)

Plate	120A
Operation	120B
Operation	120C

APPLICATION

Type 6AL5 is a miniature duodiode designed for high frequency operation. Each section has a resonant frequency of approximately 700 megacycles. An internal shield connected to pin 6 permits independent operation of each diode.

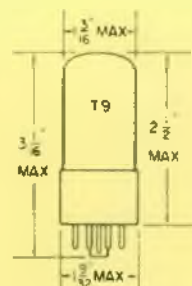
6AL7GT

JANUARY 3, 1957

Electron-ray tube

MECHANICAL DATA

Cathode, coated unipotential	
Bulb	T-9
Outline	JETEC 9-7 or 9-39
Base	Intermediate shell octal (BB-6) or Short intermediate shell octal (BB-46)
Basing	8CH
Mounting position	Any



ENGINEERING DESIGN DATA

6AL7GT (cont.)

PIN CONNECTIONS

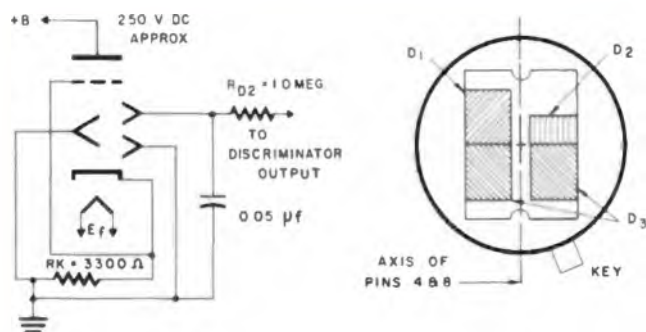
Pin 1	Grid
Pin 2	Heater
Pin 3	Target
Pin 4	Deflection Electrode 2
Pin 5	Deflection Electrode 3
Pin 6	Deflection Electrode 1
Pin 7	Heater
Pin 8	Cathode

APPLICATION

Type 6AL7GT is an electron ray tube designed for use as a tuning indicator controlled by the d-c output of an f-m discriminator or a-v-c from an a-m detector. As an f-m indicator deflection electrodes 1 and 3 are tied to ground with the discriminator output applied to electrode 2. As an a-m indicator electrodes 1, 2, and 3 are tied together.

6AL7GT (cont.)

TYPICAL FM TUNING INDICATOR



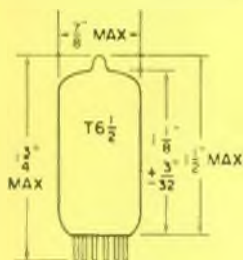
6AM4

SEPTEMBER 10, 1956

High-mu triode

MECHANICAL DATA

Cathode, coated unipotential	
Bulb	T-6 1/2
Outline	JETEC 6-1
Base	Miniature 9-pin (E9-1)
Basing	9BX
Mounting position	Any



PIN CONNECTIONS

Pin 1	Grid 1
Pin 2	Cathode
Pin 3	Grid 1
Pin 4	Grid 1
Pin 5	Plate
Pin 6	Grid 1
Pin 7	Heater
Pin 8	Heater
Pin 9	Grid 1

APPLICATION

The 6AM4 has excellent isolation between input and output circuits along with sharp-cutoff characteristic and high transconductance. Thus, it is suitable for operation over the entire range of vhf and uhf television frequencies.



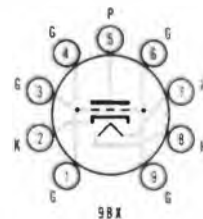
6AM4



Uhf grounded-grid mixer for television tuners

HEATER CHARACTERISTICS

Voltage, a-c or d-c	6.3 volts
Current	225 ma
Peak heater-cathode voltage, max.*	80 volts



ELECTRICAL DATA

DIRECT INTERELECTRODE CAPACITANCES

	No Shield	Shield†
Grid to plate: g1 to p	2.4	2.8
Input: g1 to k + h	4.4	4.6
Output: p to k + h	0.16	0.16

†JETEC shield 315 connected to cathode.

MAXIMUM RATINGS (Design center values)

Plate voltage	200 volts
Control-grid voltage, positive d-c	0 volts
Plate dissipation	2.0 watts

CHARACTERISTICS AND TYPICAL OPERATION

Plate voltage	200 volts
Cathode-bias resistor	100 ohms
Plate resistance (approx.)	.0087 meg
Transconductance	9800 μmhos
Amplification factor	85
Plate current	7.5 ma
Control-grid voltage (approx.) for $I_b = 10 \mu a$	-6.5 volts

NOTES:

*When operated in series d-c with a second tube, heater-cathode voltage may be as high as 250 volts maximum under cutoff conditions when heater is negative to cathode.

†Operation with fixed bias not recommended.

CBS ELECTRON TUBES



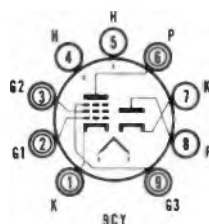
6AM8



High-gain pentode i-f amplifier and high-perveance diode video detector

HEATER CHARACTERISTICS

Voltage, a-c or d-c.....	6.3 volts
Current.....	450 ma
Peak heater-cathode voltage, max.	
Heater negative to cathode.....	200 volts
Heater positive to cathode*.....	200 volts
*D-c component must not exceed 100 volts max.	



Type 6AM8 is identical to type 5AM8 except for heater characteristics.

6AN4 • 6AN5 • 6AN6

(See chart for seldom-used tubes)



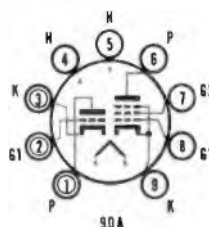
6AN8



Combined sync clipper, sync separator, etc. and i-f or video amplifier for television receivers

HEATER CHARACTERISTICS

Voltage, a-c or d-c.....	6.3 volts
Current.....	450 ma
Peak heater-cathode voltage, max.	
Heater negative to cathode.....	200 volts
Heater positive to cathode*.....	200 volts
*D-c component must not exceed 100 volts max.	



Type 6AN8 is identical to type 5AN8 except for heater characteristics.

ENGINEERING DESIGN DATA

6AM8

JUNE 10, 1956

**Sharp-cutoff
pentode—high
perveance diode**

CHARACTERISTIC CURVES

(In curve section following APPENDIX)

Screen Grid Rating.....100A

Plate ($E_{c2}=100V$).....136A

Transfer ($E_b=250V$, $E_{c2}=150V$).....136B

APPLICATION

Type 6AM8 is a miniature diode, similar to one half of a 6AL5, and a pentode similar to type 6CB6. It is intended for use as a combined video detector and last i-f stage in television receivers.

6AN8

OCTOBER 16, 1956

**Medium-mu
triode—sharp
cutoff pentode**

CHARACTERISTIC CURVES

(In curve section following APPENDIX)

Screen Grid Rating.....100A

Plate, triode.....137A

Transfer, triode.....137B

Plate, pentode ($E_{c2}=150V$).....137C

Transfer, pentode ($E_b=200V$, $E_{c2}=150V$).....137D

APPLICATION

Combination medium-mu triode and high gain pentode for the reduction of tubes in monochrome and color television receivers. Similar types are the 6AS8 and 6AZ8.

ENGINEERING DESIGN DATA

6AQ5

6AQ5A

JUNE 10, 1956

Beam power pentode

CHARACTERISTIC CURVES

(In curve section following APPENDIX)

Plate ($E_{c2} = 250V$)	138A
Plate ($E_{c2} = 250V$)	138B
Plate, triode connected	138C
Plate, ΔE_{c2} ($E_{c1} = 0V$)	138D
Transfer ($E_b = 250V$)	138E
Operation	138F

APPLICATION

The 6AQ5 and 6AQ5A are general-purpose power amplifiers equivalent to the type 6V6GT within ratings. The 6AQ5 and 6AQ5A are also used as a vertical sweep tube in TV receivers. The 6AQ5A has a warm-up time controlled heater for use in 450 ma series-heater strings.

6AQ6

SEPTEMBER 24, 1956

Duodiode—high-mu triode

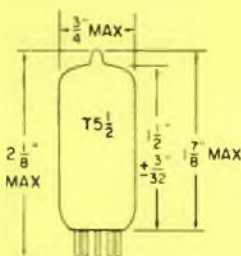
CHARACTERISTIC CURVES

(In curve section following APPENDIX)

Plate	159A
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MECHANICAL DATA

Cathode, coated unipotential	
Bulb	T-5½
Outline	JETEC 5-2
Base	Miniature 7-pin (E7-1)
Basing	7BT
Mounting position	Any



PIN CONNECTIONS

Pin 1	Triode Grid
Pin 2	Cathode
Pin 3	Heater
Pin 4	Heater
Pin 5	Diode Plate 2
Pin 6	Diode Plate 1
Pin 7	Triode Plate

REFERENCES

See the APPENDIX for R-C amplifier data.



6AQ5

6AQ5A



Audio power amplifier or TV vertical deflection amplifier

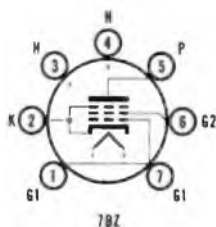
HEATER CHARACTERISTICS

Voltage, a-c or d-c	6.3 volts
Current	450 ma
Peak heater-cathode voltage, max.	
Heater negative to cathode	200 volts
Heater positive to cathode*	200 volts
*D-c component must not exceed 100 volts max.	

6AQ5A

Warm-up time	1½ secs. average
(See Series-String Heaters section of APPENDIX in CBS Tube Manual)	

Types 6AQ5 and 6AQ5A are identical to type 5AQ5 except for heater characteristics.



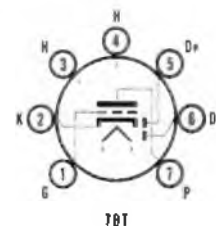
6AQ6



Combined a-m detector, audio voltage amplifier, and avc tube

HEATER CHARACTERISTICS

Voltage, a-c or d-c	6.3 volts
Current	150 ma
Peak heater-cathode voltage, max.	90 volts



ELECTRICAL DATA

DIRECT INTERELECTRODE CAPACITANCES†

Triode Section

Grid to plate: g1 to p	1.8 μ f
Input: g1 to k + h	1.7 μ f
Output: p to k + h	1.5 μ f

†With close fitting shield connected to cathode.

MAXIMUM RATINGS (Design center values)

Triode plate voltage	300 volts
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CHARACTERISTICS AND TYPICAL OPERATION

Class A Amplifier (Triode Unit)

Plate voltage	100	250 volts
Grid 1 (control-grid) voltage	-1	-3 volts
Plate resistance (approx.)	61,000	58,000 ohms
Transconductance	1150	1200 μ hos
Amplification factor	70	70
Plate current	0.8	1.0 ma

Diode Unit—Two diode plates are placed around a cathode, the sleeve of which is common to the triode unit. Diode biasing of the triode unit is not suitable.

6AQ7GT

(See chart for seldom-used tubes)



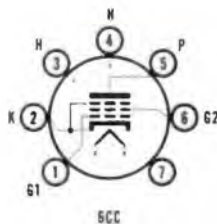
6AR5



Power output audio amplifier having high efficiency

HEATER CHARACTERISTICS

Voltage, a-c or d-c.....	6.3 volts
Current.....	400 ma
Peak heater-cathode voltage, max.	
Heater negative to cathode.....	90 volts
Heater positive to cathode.....	90 volts



ELECTRICAL DATA

MAXIMUM RATINGS (Design center values)

Plate voltage.....	250 volts
Grid 2 voltage.....	250 volts
Plate dissipation.....	8.5 watts
Grid 2 dissipation.....	2.5 watts
Grid circuit resistance	
Fixed bias.....	0.1 meg
Cathode bias.....	0.5 meg

CHARACTERISTICS AND TYPICAL OPERATION

Class A Amplifier

Plate voltage.....	250	250 volts
Grid 2 (screen) voltage.....	250	250 volts
Grid 1 (control grid) voltage.....	-16.5	-18 volts
Plate resistance (approx.).....	65,000	68,000 ohms
Transconductance.....	2400	2300 μ mhos
Grid 1 input voltage, peak a-f.....	16.5	18 volts
Plate current, zero signal.....	34	32 ma
Plate current, maximum signal.....	35	33 ma
Grid 2 current, zero signal.....	5.7	5.6 ma
Grid 2 current, maximum signal.....	10	10 ma
Load resistance impedance.....	7000	7600 ohms
Total harmonic distortion (approx.).....	7	11 %
Power output, maximum signal.....	3.2	3.4 watts

6AR6

(See chart for seldom-used tubes)

ENGINEERING DESIGN DATA

6AR5

OCTOBER 1, 1956

Power pentode

CHARACTERISTIC CURVES

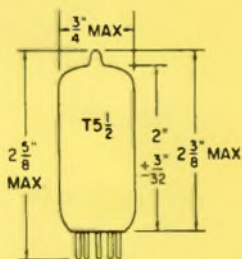
(In curve section following APPENDIX)

Characteristics, I_b , I_{c2}163A

Plate (E_{c2} = 250V).....163B

MECHANICAL DATA

Cathode, coated unipotential
 Buft.....T-5½
 Outline.....JETEC 5-3
 Base.....Miniature 7-pin (E7-1)
 Basing.....6CC
 Mounting position.....Any



PIN CONNECTIONS

Pin 1.....	Grid 1
Pin 2.....	Cathode, Grid 3
Pin 3.....	Heater
Pin 4.....	Heater
Pin 5.....	Plate
Pin 6.....	Grid 2
Pin 7.....	N. C.

APPLICATION

Power pentode for the output stage of automobile and a-c receivers.

NOTES

Type 6AR5 is electrically similar to types 6AK6 and 7B5.

ENGINEERING DESIGN DATA

6AR8

OCTOBER 1, 1956

Sheet beam tube

CHARACTERISTIC CURVES

(In curve section following APPENDIX)

Plate ($E_{c3} = 250V$)..... 161A

Transfer ($E_{b1} = E_{b2} = 250V$)..... 161B

Transfer ($E_{b1} = E_{b2} = E_{c3} = 250V$)..... 161C

MECHANICAL DATA

Cathode, coated unipotential

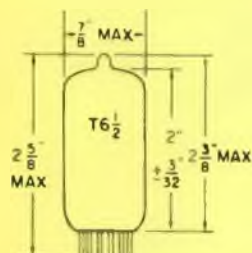
Bulb..... T-5½

Outline..... JETEC 6-3

Base..... Miniature 9-pin (E9-1)

Basing..... 9DP

Mounting position..... Any



PIN CONNECTIONS

Pin 1	Deflector 2
Pin 2	Deflector 1
Pin 3	Accelerator
Pin 4	Heater
Pin 5	Heater, I. S., Focus Electrodes*
Pin 6	Grid 1 (Control)
Pin 7	Cathode
Pin 8	Plate 2
Pin 9	Plate 1

*Connect pin 5 directly to ground.

REFERENCES

See APPENDIX for an explanation of the operating conditions of sheet beam tubes.

APPLICATION

Type 6AR8 is a sheet beam tube designed to operate as a synchronous deflector in color television receivers. Two balanced deflectors direct the electron beam to either of the two plates. The intensity of the beam is varied by a control grid. The need for phase inversion circuits preceding the matrices is eliminated in color TV by using this tube.

NOTES

The 6AR8 should be located in the receiver in such a manner that the effect of stray magnetic fields is avoided.



6AR8

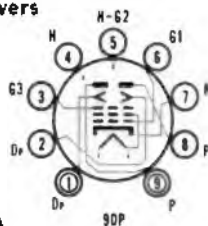


Sheet beam tube used as synchronous detector
in color television receivers

HEATER CHARACTERISTICS

Voltage, a-c or d-c..... 6.3 volts

Current..... 0.3 amp



ELECTRICAL DATA

DIRECT INTERELECTRODE CAPACITANCES

Deflectors 1 and 2 to all, each deflector	4.8	μf
Grid 1 to all except plates	7.5	μf
Plates 1 and 2 to all, each plate	5.0	μf
Grid 1 to deflector 1, max.	0.040	μf
Grid 1 to deflector 2, max.	0.060	μf
Plate 1 to plate 2	0.4	μf
Deflector 1 to deflector 2	0.38	μf

MAXIMUM RATINGS (Design center values)

Plate 1 and plate 2 voltage	300	volts
Accelerator voltage	300	volts
Deflectors 1 and 2 voltage, peak positive	150	volts
Deflectors 1 and 2 voltage, peak negative	150	volts
Grid 1 voltage, positive d-c	0	volts
Plates 1 and 2 dissipation, each plate	2.0	watts
Cathode current, d-c	30	ma
Grid 1 circuit resistance		
Fixed bias	0.1	meg
Self bias	0.25	meg

CHARACTERISTICS

Deflectors Grounded

Plates 1 and 2 voltage, connected together	250	volts
Accelerator voltage	250	volts
Deflectors 1 and 2 voltage	0	volts
Cathode-bias resistor	300	ohms
Plate current, total	10	ma
Accelerator current	0.4	ma
Grid 1 transconductance	4000	μmhos
Grid 1 voltage (approx.) for $I_b = 10 \mu A$	-14	volts

Deflectors Not Grounded

Plates 1 and 2 voltage	250	volts
Accelerator voltage	250	volts
Cathode bias resistor	300	ohms
Deflector switching voltage, maximum*	20	volts
Deflector bias voltage		
for min. deflector switching voltage*	-8	volts
Voltage difference between deflectors		
when $I_{b1} = I_{b2}$ (approx.)	0	volts
Plate 1 current, max. with $E_{d1} = -15V$, $E_{d2} = +15V$	1.0	ma
Plate 2 current, max. with $E_{d1} = +15V$, $E_{d2} = -15V$	1.0	ma
Deflector 1 current,		
max. with $E_{d1} = +25V$, $E_{d2} = -25V$	0.5	ma
Deflector 2 current,		
max. with $E_{d1} = -25V$, $E_{d2} = +25V$	0.5	ma

NOTE:

*Deflector switching voltage is the total voltage change on either deflector with an equal and opposite change on the other deflector required to switch the plate current from one plate to another.



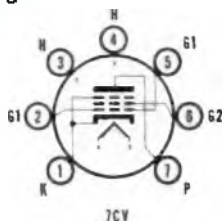
6AS5



Audio power output amplifier giving high output at low B supply voltage

HEATER CHARACTERISTICS

Voltage, a-c or d-c	6.3 volts
Current	800 ma
Peak heater-cathode voltage, max.	
Heater negative to cathode	90 volts
Heater positive to cathode	90 volts



ELECTRICAL DATA

DIRECT INTERELECTRODE CAPACITANCES

Grid to plate: g1 to p	0.6 μ f
Input: g1 to k + h + g2 + b.p.	12 μ f
Output: p to k + h + g2 + b.p.	6.2 μ f

MAXIMUM RATINGS (Design center values)

Plate voltage	150 volts
Grid 2 voltage	117 volts
Plate dissipation	5.5 watts
Grid 2 dissipation	1.0 watt
Grid 1 circuit resistance	
Fixed bias	0.1 meg
Self bias	0.5 meg

CHARACTERISTICS AND TYPICAL OPERATION

Class A Amplifier

Plate voltage	150 volts
Grid 2 (screen) voltage	110 volts
Grid 1 (control-grid) voltage	-8.5 volts
Transconductance	5600 μ hos
Grid 1 input voltage, peak a-f.	8.5 volts
Plate current, zero signal	35 ma
Plate current, maximum signal	36 ma
Grid 2 current, zero signal	2.0 ma
Grid 2 current, maximum signal	6.5 ma
Load resistance impedance	4500 ohms
Total harmonic distortion (approx.)	10 %
Power output, maximum signal	2.2 watts

ENGINEERING DESIGN DATA

6AS5

SEPTEMBER 24, 1956

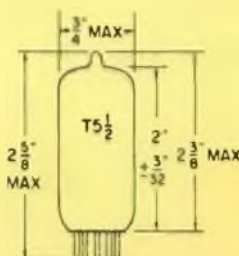
Beam power pentode

CHARACTERISTIC CURVES

(In curve section following APPENDIX)
 Plate ($E_{c2} = 110V$) 195A
 Operation 195B

MECHANICAL DATA

Cathode, coated unipotential
 Bulb T-5½
 Outline JETEC 5-3
 Base Miniature 7-pin (E7-1)
 Basing 7CV
 Mounting position Any



PIN CONNECTIONS

Pin 1	Cathode, B. P.
Pin 2	Grid 1
Pin 3	Heater
Pin 4	Heater
Pin 5	Grid 1
Pin 6	Grid 2
Pin 7	Plate

APPLICATION

Type 6AS5 is a beam power pentode used as an audio power output amplifier where a high output is required under conditions of low plate and screen voltages.

6AS6 • 6AS7G

(See chart for seldom-used tubes)



6AT8

6AT8A



Combined vhf oscillator and mixer for television or a-m/f-m receivers

HEATER CHARACTERISTICS

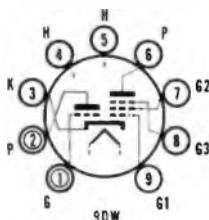
Voltage, a-c or d-c.	6.3 volts
Current.	450 ma
Peak heater-cathode voltage, max.	
Heater negative to cathode	100 volts
Heater positive to cathode*	100 volts

*D-c component must not exceed 100 volts max.

6AT8A

Warm-up time 11 secs. average
(See Series-String Heaters section of APPENDIX in CBS Tube Manual).

Types 6AT8 and 6AT8A are identical to type 5AT8 except for heater characteristics.



6AU4GT

6AU4GTA



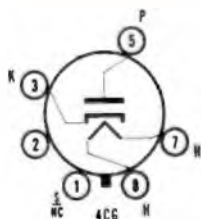
TV damper diode in the horizontal deflection circuit of television receivers

HEATER CHARACTERISTICS

Voltage.	6.3 volts
Current.	1.8 amp
Peak heater-cathode voltage, max.*	
Heater negative to cathode†	4500 volts
Heater positive to cathode*	300 volts

*D-c component must not exceed 900 volts max.

†D-c component must not exceed 100 volts max.



ELECTRICAL DATA

DIRECT INTERELECTRODE CAPACITANCES

Heater to cathode: h to k, max.	4.0 μ f
Cathode to plate-and-heater: k to p + h.	11.5 μ f
Plate to cathode-and-heater: p to k + h.	8.5 μ f

MAXIMUM RATINGS (Design center values unless noted)

TV Damper Service*	6AU4GT	6AU4GTA
Plate voltage, peak inverse.	4500	4500 volts
Plate current, d-c.	175	190 ma
Plate current, peak.	1050	1150 ma
Plate dissipation.	6.0	6.0 watts

AVERAGE CHARACTERISTICS

Tube voltage drop at Ib = 350 ma	25 volts
----------------------------------	----------

NOTES:

*Voltage pulse duration must not exceed 10 μ s in a 525-line, 30-frame system.

†Absolute maximum value.

CBS ELECTRON TUBES

ENGINEERING DESIGN DATA

6AT8

6AT8A

MAY 3, 1957

Medium-mu triode—sharp-cutoff pentode

CHARACTERISTIC CURVES

(In curve section following APPENDIX)

Screen Grid Rating	100A
Plate, pentode ($E_{c2} = 150V$)	141A
Plate, triode unit	141B
Plate, pentode unit (triode connected)	141C
Operation, pentode	141D
Operation, pentode	141E

6AU4GT

6AU4GTA

OCTOBER 17, 1956

Single diode

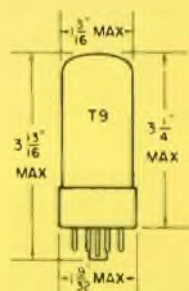
CHARACTERISTIC CURVES

(In curve section following APPENDIX)

Plate	164A
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MECHANICAL DATA

Cathode, coated unipotential	
Bulb	T-9
Outline	JETEC 9-44
Base	Short Int. Shell Octal (B5-85 or B6-60)
Basing	4CG
Mounting position	Any



PIN CONNECTIONS†

Pin 1	N. C.*
Pin 2	I. C. do not use
Pin 3	Cathode
Pin 5	Plate
Pin 7	Heater
Pin 8	Heater

*Pin 1 omitted on base B5-85

†Socket terminals 1, 2, 4, and 6 should not be used.

NOTES

Operation of this tube as a power rectifier is not recommended. The 6AU4GT and 6AU4GTA are identical except for plate current ratings.

ENGINEERING DESIGN DATA

6AU5GT

SEPTEMBER 24, 1956

Beam power pentode

CHARACTERISTIC CURVES

(In curve section following APPENDIX)

Plate: I_b, I_{c2} ($E_{c2} = 150V$)..... 160A

Plate: ΔE_{c2} 160B

MECHANICAL DATA

Cathode, coated unipotential

Bulb..... T-9

Outline..... JETEC 9-11

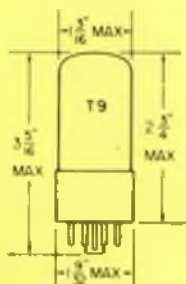
Base

Intermediate shell octal (B6-8)

Short intermediate shell octal (B6-60)

Basing..... 6CK

Mounting position..... Any



PIN CONNECTIONS

Pin 1.....	Grid 1
Pin 2.....	Heater
Pin 3.....	Cathode, Grid 3
Pin 5.....	Plate
Pin 7.....	Heater
Pin 8.....	Grid 2

APPLICATION

Type 6AU5GT is a beam power pentode designed for application as a horizontal deflection amplifier in high efficiency deflection circuits of television receivers where transformer coupling or direct coupling to the deflecting yoke is used.

NOTES

The 6AU5GT is also rated for triode connection in voltage regulator service; $E_b = 300V$ max., $E_{c1} = 0V$ to $-125V$ max., $I_b = 110$ ma, $P_{p+g2} = 10W$ total max.



6AU5GT



Horizontal deflection amplifier used in high-efficiency TV sweep circuits

HEATER CHARACTERISTICS

Voltage, a-c or d-c..... 6.3 volts

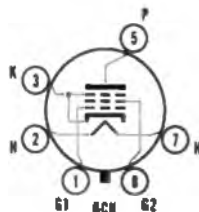
Current..... 1.25 amp

Peak heater-cathode voltage, max.

Heater negative to cathode..... 200 volts

Heater positive to cathode*..... 200 volts

*D-c component must not exceed 100 volts max.



ELECTRICAL DATA

DIRECT INTERELECTRODE CAPACITANCES

Grid to plate: g1 to p..... 0.5 μf

Input: g1 to k + h + g2 + b.p..... 11.3 μf

Output: p to k + h + g2 + b.p..... 7.0 μf

MAXIMUM RATINGS (Design center values unless noted)

Horizontal Deflection Amplifier*

Plate supply voltage, d-c (boost + d-c power supply)..... 550 volts

Plate voltage, peak pos. (absolute max.)..... 5500 volts

Plate voltage, peak negative pulse..... -1250 volts

Grid 2 voltage, d-c..... 200 volts

Grid 1 voltage, peak negative..... -300 volts

Plate dissipation†..... 10 watts

Grid 2 dissipation..... 2.5 watts

Cathode current, average..... 110 ma

Cathode current, peak..... 400 ma

Grid 1 circuit resistance..... 0.47 meg

Bulb temperature at hottest point..... 210 °C

AVERAGE CHARACTERISTICS

Instantaneous values

Plate voltage..... 60 100 115 volts

Grid 2 (screen) voltage..... 175 100 175 volts

Grid 1 (control-grid) voltage..... 0 -4.5 -20 volts

Transconductance..... 5600 $\mu mhos$

Plate current..... 210 ma

Grid 2 current..... 25 ma

Amplification factor..... 5.9

NOTES:

*Voltage pulse duration must not exceed 10 μs in a 525-line, 30-frame system.

†Preferably obtained from a series dropping resistor of sufficient value to limit grid 2 input to rated maximum.

‡Tube protection is needed for no-drive conditions if grid-resistor bias is used.

ΔIn vertical position, base down, and in free space with natural ventilation, hottest point is center of dome just above open end of cathode sleeve.



6AU6

6AU6A



**R-f amplifier, i-f amplifier, f-m limiter,
or audio voltage amplifier**

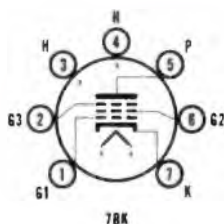
HEATER CHARACTERISTICS

Voltage, a-c or d-c.....	6.3 volts
Current.....	300 ma
Peak heater-cathode voltage, max.	
Heater negative 6AU6A 6AU6	
to cathode.....	200 180 volts
Heater positive	
to cathode*.....	200 100 volts
*D-c component must not exceed 100 volts max.	

6AU6A

Warm-up time..... 11 secs. average
(See Series-String Heaters section of
APPENDIX in CBS Tube Manual).

Types 6AU6 and 6AU6A are identical to types 3AU6 and 4AU6 except for heater ratings.



ENGINEERING DESIGN DATA

6AU6

6AU6A

SEPTEMBER 24, 1956

Sharp-cutoff pentode

CHARACTERISTIC CURVES

(In curve section following APPENDIX)

Screen Grid Rating.....	100A
Plate ($E_{c2} = 100V$).....	121A
Plate ($E_{c2} = 150V$).....	121B
Plate, triode connected.....	121C
Transfer, $I_{b1} - I_{c2}$	121D
Transfer, g_m	121E

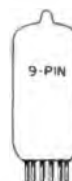
APPLICATION

Type 6AU6 is a miniature sharp-cutoff pentode amplifier capable of high frequency operation. It is identical to the 3AU6 and 4AU6 except for heater characteristics. R-C amplifier data is given in the APPENDIX.



6AU8

6AU8A

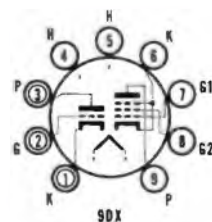


**Combined sync amplifier, separator, or clipper, etc.,
and video or i-f amplifier**

HEATER CHARACTERISTICS

Voltage, a-c or d-c.....	6.3 volts
Current.....	600 ma
Peak heater-cathode voltage, max.	
Heater negative to	
cathode.....	200 volts
Heater positive to	
cathode*.....	200 volts
Warm-up time.....	11 secs. average
(See Series-String Heaters section of APPENDIX in CBS Tube Manual).	

Types 6AU8 and 6AU8A are identical to types 3AU8 and 4AU8 except for heater ratings.



ELECTRICAL DATA

DIRECT INTERELECTRODE CAPACITANCES

Triode Section	6AU8	6AU8A
Grid to plate: g1 to p.....	2.2	2.2 μf
Input: g1 to k + h.....	2.6	2.6 μf
Output: p to k + h.....	0.34	0.34 μf
Pentode Section		
Grid to plate: g1 to p.....	0.044	0.06 μf
Input: g1 to k + h + g2 + g3.....	7.5	7.5 μf
Output: p to k + h + g2 + g3.....	2.4	3.4 μf
Coupling: pentode grid 1		
to triode plate, max.....	0.006	0.006 μf
Coupling: pentode plate		
to triode grid, max.....	0.022	0.022 μf
Coupling: pentode plate to triode plate, max.....	0.12	0.12 μf

6AU8

6AU8A

NOVEMBER 1, 1957

Medium-mu triode— sharp-cutoff pentode

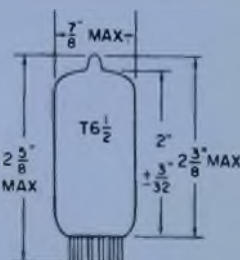
CHARACTERISTIC CURVES

(In curve section following APPENDIX)

Screen Grid Rating.....	100A
Plate, pentode ($E_{c2} = 125V$).....	142A
Plate, pentode ($E_{c2} = 125V$).....	142B
Plate, pentode (ΔE_{c2}).....	142C
Transfer, pentode ($E_b = 200V$).....	142D
Plate, triode.....	142E

MECHANICAL DATA

Cathode, coated unipotential	
Bulb.....	T-6 1/2
Outline.....	JETEC 6-3
Base.....	Miniature 9-pin (E9-1)
Basing.....	9DX
Mounting position.....	Any



CBS ELECTRON TUBES

ENGINEERING DESIGN DATA

6AU8 • 6AU8A (cont.)

PIN CONNECTIONS

Pin 1	Triode Cathode
Pin 2	Triode Grid
Pin 3	Triode Plate
Pin 4	Heater
Pin 5	Heater
Pin 6	Pentode Cathode, Grid 3, I. S.
Pin 7	Pentode Grid 1
Pin 8	Pentode Grid 2
Pin 9	Pentode Plate

APPLICATION

Type 6AU8 is a medium- μ triode and sharp cutoff pentode designed for use in a wide variety of general purpose applications in monochrome and color television. Each section has a separate cathode and is electrically independent. The high quality of the pentode section makes it highly suitable for service as a video amplifier, video i-f amplifier, and sound i-f amplifier. The triode section is designed for use as a sync amplifier, sync separator, sync clipper, or a sweep oscillator. The triode section may also be connected as a diode for video detector applications.

6AU8 • 6AU8A (cont.)

MAXIMUM RATINGS (Design center values)

	Triode	Pentode
Plate voltage	300	300 volts
Grid 2 voltage	See Rating Chart in APPENDIX	
Grid 2 supply voltage		300 volts
Grid 1 voltage, positive d-c.	0	0 volts
Plate dissipation	2.5	3.0 watts
Grid 2 dissipation		1.0 watt
Grid 1 circuit resistance		
Fixed bias	0.5	0.25 meg
Self bias	1.0	1.0 meg

CHARACTERISTICS AND TYPICAL OPERATION

Class A Amplifier	Triode	Pentode
Plate voltage	150	200 volts
Grid 2 (screen) voltage		125 volts
Cathode-bias resistor	150	82 ohms
Plate resistance (approx.)	8200	150,000 ohms
Transconductance	4900	7000 μ mhos
Amplification factor	40	
Plate current	9.0	15 ma
Grid 2 current		3.4 ma
Grid 1 voltage (approx.) for $I_b = 100 \mu$ a	-6.5	-8 volts

6AU8†

Zero bias: with $E_b = 40V$, $E_{c2} = 125V$ (instantaneous values)

Plate current	30 ma
Grid 2 current	10 ma

NOTE:

†Type 6AU8A features a controlled plate knee characteristic.

6AV5GA 6AV5GT

SEPTEMBER 24, 1956

Beam power pentode

CHARACTERISTIC CURVES

(In curve section following APPENDIX)

Plate ($E_{c2} = 100V$)	105A
Plate ($E_{c2} = 150V$)	105B

MECHANICAL DATA

Cathode, coated unipotential	
Bulb	6AV5GA T-11* or T-12
Outline	As shown
Base	9-11 or 9-42
Short medium	B6-112
shell octal	or B6-120
Intermediate shell octal	B6-8
Short int. shell octal	B6-48
Basing	6CK 6CK
Mounting position	Any Any

*Bulb T-11 is identical to the T-12 bulb shown except for having a maximum diameter of $1\frac{1}{16}$ ".



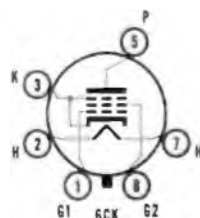
6AV5GA 6AV5GT



Horizontal deflection amplifier for television receiver sweep circuits

HEATER CHARACTERISTICS

Voltage, a-c or d-c	6.3 volts
Current	1.2 amp
Peak heater-cathode voltage, max.	
Heater negative to cathode	200 volts
Heater positive to cathode*	200 volts
*D-c component must not exceed 100 volts max.	



ELECTRICAL DATA

DIRECT INTERELECTRODE CAPACITANCES

	6AV5GA	6AV5GT
Grid to plate: g1 to p	0.5	0.7 μ uf
Input: g1 to k + h + g2 + b.p.	14	14 μ uf
Output: p to k + h + g2 + b.p.	7.0	7.0 μ uf

6AV5GA • 6AV5GT (cont.)

MAXIMUM RATINGS (Design center values unless noted)

Horizontal Deflection Amplifier*

Plate supply voltage, d-c (boost + d-c power supply).....	550 volts
Plate voltage, peak pos. (absolute max.).....	5500 volts
Plate voltage, peak negative pulse.....	1250 volts
Grid 2 voltage, d-c.....	175 volts
Grid 1 voltage, peak negative.....	300 volts
Plate dissipation.....	11 watts
Grid 2 dissipation.....	2.5 watts
Cathode current, average.....	110 ma
Cathode current, peak.....	400 ma
Grid 1 circuit resistance.....	0.47 meg
Bulb temperature at hottest point.....	210 °C

AVERAGE CHARACTERISTICS

Instantaneous values

Plate voltage.....	60	250 volts
Grid 2 (screen) voltage.....	150Δ	150 volts
Grid 1 (control-grid) voltage.....	0	-22.5 volts
Plate resistance (approx.).....		14,500 ohms
Transconductance.....		5900 μmhos
Plate current.....	260	57 ma
Grid 2 current.....	26	2.1 ma
Grid 1 voltage (approx.) for $I_p = 1.0$ ma.....		-43 volts

Triode Connected

Plate and grid 2 voltage (p + g2 tied together).....	150 volts
Grid 1 voltage.....	-22.5 volts
Amplification factor.....	4.3

NOTES:

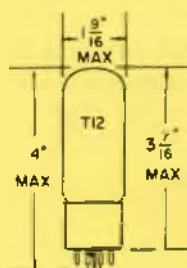
*Voltage pulse duration must not exceed 10 μs in a 525-line, 30-frame system.

†Tube protection is needed for no-drive conditions if grid-resistor bias is used.

ΔApplied for a two second maximum so as not to injure tube.

ENGINEERING DESIGN DATA

6AV5GA • 6AV5GT (cont.)



PIN CONNECTIONS

Pin 1.....	Grid 1
Pin 2.....	Heater
Pin 3.....	Cathode, B. P.
Pin 5.....	Plate
Pin 7.....	Heater
Pin 8.....	Grid 2

NOTES

Types 6AV5GA and 6AV5GT are identical to each other except for capacitances, bases, and bulbs. Other types that differ in heater characteristics are the 12AV5GA and 25AV5GA. Electrically these single ended tubes resemble the 6BQ6GT.



6AV6

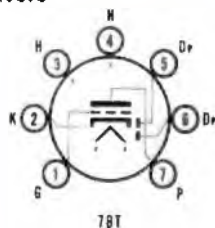


Combined a-m detector, avc, and audio voltage amplifier for radio receivers

HEATER CHARACTERISTICS

Voltage, a-c or d-c.....	6.3 volts
Current.....	300 ma
Peak heater-cathode voltage, max.....	
Heater negative to cathode.....	90 volts
Heater positive to cathode.....	90 volts

Type 6AV6 is identical to type 3AV6 except for heater ratings and heater-cathode voltage ratings.



6AV6

SEPTEMBER 24, 1956

**Duodiode—
high-mu triode**

CHARACTERISTIC CURVES

(In curve section following APPENDIX)

Plate, triode.....	122A
Transfer; r_p , gm, μ.....	122B
Operation (each diode).....	122C

APPLICATION

Type 6AV6 is a miniature, high-mu duodiode—triode designed for use as a a-m detector, avc tube, and audio voltage amplifier. It has a single cathode which serves both the diodes and triode. The 6AV6 may be substituted for the 6AT6 when its higher amplification is advantageous.

ENGINEERING DESIGN DATA

6AW8

6AW8A

SEPTEMBER 24, 1956

**High-mu triode—
sharp-cutoff
pentode**

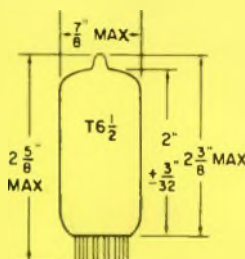
CHARACTERISTIC CURVES

(In curve section following APPENDIX)

Screen Grid Rating	100A
Plate, triode	167A
Plate, pentode	167B
Transfer, triode ($E_b = 200V$)	167C
Transfer, pentode ($E_b = 200V$, $E_{c2} = 150V$)	167D

MECHANICAL DATA

Cathode, coated unipotential	
Bulb	T-6½
Outline	JETEC 6-3
Base	Miniature 9-pin (E9-1)
Basing	.9DX
Mounting position	Any



PIN CONNECTIONS

Pin 1	Triode Cathode
Pin 2	Triode Grid
Pin 3	Triode Plate
Pin 4	Heater
Pin 5	Heater
Pin 6	Pentode Cathode, Grid 3, I. S.
Pin 7	Pentode Grid 1
Pin 8	Pentode Grid 2
Pin 9	Pentode Plate

REFERENCES

The heater of the 6AW8 and 6AW8A has a warm-up time controlled characteristic which is standard for 600-ma tubes used in series strings. For a complete description of heater warm-up time and the method of measurement see the APPENDIX.



6AW8

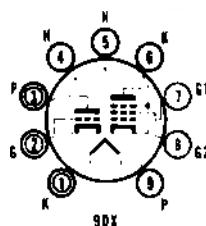
6AW8A



**Combined sync separator and video amplifier,
heater warm-up controlled for series strings**

HEATER CHARACTERISTICS

Voltage, a-c or d-c	6.3 volts
Current	600 ma
Peak heater-cathode voltage, max.	
Heater negative to cathode	200 volts
Heater positive to cathode*	200 volts
Warm-up time	11 secs. average
(See Series-String Heaters section of APPENDIX in CBS Tube Manual).	
*D-c component must not exceed 100 volts max.	



ELECTRICAL DATA

DIRECT INTERELECTRODE CAPACITANCES

Triode Section—6AW8 and 6AW8A	No Shield	Shield†
Grid to plate: g1 to p	2.2	2.2 μf
Input: g1 to k + h	3.2	3.4 μf
Output: p to k + h	0.32	1.7 μf

Pentode Section—6AW8

Grid to plate: g1 to p, max.	0.036	0.030 μf
Input: g1 to k + h + g2 + g3 + i.s.	11.0	11.0 μf
Output: p to k + h + g2 + g3 + i.s.	2.8	3.6 μf
Coupling: pentode grid 1 to triode plate, max.	0.008	0.005 μf
Coupling: pentode plate to triode grid, max.	0.030	0.008 μf
Coupling: pentode plate to triode plate, max.	0.20	0.05 μf

Pentode Section—6AW8A

Grid to plate: g1 to p	0.04	0.03 μf
Input: g1 to k + h + g2 + g3 + i.s.	10.0	10.0 μf
Output: p to k + h + g2 + g3 + i.s.	3.6	4.5 μf
Coupling: pentode grid 1 to triode plate	0.006	0.003 μf
Coupling: pentode plate to triode grid	0.016	0.006 μf
Coupling: pentode plate to triode plate	0.150	0.023 μf

†JETEC shield 315 connected to cathode.

MAXIMUM RATINGS (Design center values)

	Triode	Pentode
Plate voltage	300	300 volts
Grid 2 voltage	See Rating Chart in APPENDIX	
Grid 2 supply voltage	300 volts	
Grid 1 voltage, positive d-c	0 volts	
Grid 1 voltage, negative d-c	50 volts	
Plate dissipation	1.0	3.25 watts
Grid 2 dissipation	1.0 watt	
Grid 1 circuit resistance		
Fixed bias	0.5	0.25 meg
Self bias	1.0	1.0 meg

6AW8 • 6AW8A (cont.)

CHARACTERISTICS AND TYPICAL OPERATION

Class A Amplifier	Triode	Pentode
Plate voltage.....	200	200 volts
Grid 2 (screen) voltage.....	150	150 volts
Grid 1 (control-grid) voltage.....	-2	0 volts
Cathode-bias resistor.....		180 ohms
Plate resistance (approx.).....	10175	0.4 meg
Transconductance.....	4000	9000 μ mhos
Amplification factor.....	70	
Plate current.....	4.0	13 ma
Grid 2 current.....		3.5 ma
Grid 1 voltage (approx.) for $I_b = 10 \mu$ a.....	-5	-10 volts

6AW8A—Instantaneous Values

	Pentode
Plate voltage.....	65 volts
Grid 2 voltage.....	150 volts
Grid 1 voltage.....	0 volts
Plate current.....	42 ma
Grid 2 current.....	12.5 ma

ENGINEERING DESIGN DATA

6AW8 • 6AW8A (cont.)

NOTES

Types 6AW8 and 6AW8A are similar. The 6AW8 pentode features a controlled plate knee characteristic with zero bias characteristics specified to assure maximum video output.



6AX4GT 6AX4GTA 6AX4GTB 12AX4GT 12AX4GTA 12AX4GTB 17AX4GT 25AX4GT



Damper diode for television horizontal sweep circuits

HEATER CHARACTERISTICS

6AX4GT, 6AX4GTA, 6AX4GTB

Voltage, a-c or d-c 6.3 volts
Current 1.2 amp

12AX4GT, 12AX4GTA, 12AX4GTB

Voltage, a-c or d-c 12.6 volts
Current 600 ma

17AX4GT

Voltage, a-c or d-c 16.8 volts
Current 450 ma

25AX4GT

Voltage, a-c or d-c 25.0 volts
Current 300 ma

Peak heater-cathode voltage, max.*

Heater negative to cathode †

AX4GT 4400 volts

AX4GTA 4000 volts

AX4GTB 5000 volts

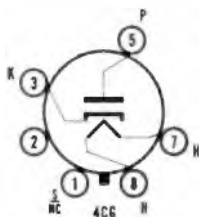
Heater positive to cathode *

▲ Allowable heater voltage 5.6 to 6.9 volts.

♣ Warm-up time 11 secs. average.

♦ D-c component must not exceed 900 volts max.

★ D-c component must not exceed 100 volts max.



ELECTRICAL DATA

DIRECT INTERELECTRODE CAPACITANCES

Heater to cathode: h to k, max. 4.0 μ f
Cathode to plate-and-heater: k to p + h. 8.5 μ f
Plate to cathode-and-heater: p to k + h. 5.0 μ f

MAXIMUM RATINGS (Design center values unless noted)

AX4GT, 12AX4GTA TV Damper Service*

Plate voltage, peak inverse 4400 volts
Plate current, d-c 125 ma
Plate current, peak 750 ma
Plate dissipation 4.8 watts

MAXIMUM RATINGS (Design maximum values)

6AX4GTA, AX4GTB TV Damper Service

Plate voltage, peak inverse 4400 volts
6AX4GTA 5000 volts
AX4GTB 1000 ma
Plate current, peak steady state 165 ma
Plate current, d-c 5.3 watts
Plate dissipation

AVERAGE CHARACTERISTICS

Tube voltage drop at 250 ma. 32 volts

NOTES:

*Voltage pulse duration must not exceed 10 μ s in a 525-line, 30-frame system.

†Absolute maximum value.

ENGINEERING DESIGN DATA

6AX4GT 6AX4GTA 6AX4GTB 12AX4GT 12AX4GTA 12AX4GTB 17AX4GT 25AX4GT

DECEMBER 30, 1959

Single diode

CHARACTERISTICS CURVES (In curve section following APPENDIX)

Plate characteristics 164A

MECHANICAL DATA

Cathode, coated unipotential

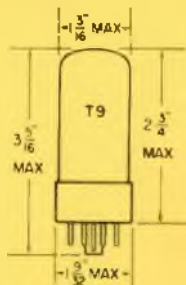
Bulb T-9

Outline JEDEC 9-41

Base Short Int. shell octal 6-pin (B6-60)

Basing 4CG

Mounting position Any



PIN CONNECTIONS†

Pin 1 N. C.
Pin 2 N. C.
Pin 3 Cathode
Pin 5 Plate
Pin 7 Heater

APPLICATION

These types are high voltage single diodes rated for high pulse voltages. They are intended for use as damper tubes in television receivers.

NOTES

†Pins 1, 2, 4 and 6 must not be used as tie points.

Operation of this tube as a power rectifier is not recommended.



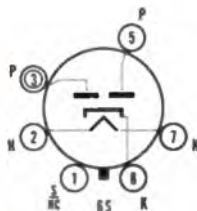
6AX5GT



Full-wave power rectifier for moderate current requirements

HEATER CHARACTERISTICS

Voltage, a-c or d-c.	6.3 volts
Current	1.2 amp
Peak heater-cathode voltage, max.	
Heater negative to cathode	450 volts
Heater positive to cathode	450 volts



ELECTRICAL DATA

MAXIMUM RATINGS (Design center values)

Rectifier Service

Plate voltage, peak inverse	1250 volts
Plate current, peak steady state (each plate)	375 ma
Plate current, hot-switching transient (for 0.2 sec. max.)	2.6 amp

TYPICAL OPERATION

Full-Wave Rectifier (Capacitor Input Filter)

Plate supply voltage, rms (each plate)	350	450 volts
Plate supply impedance (each plate)	50	105 ohms
Filter input capacitance	10	10 μ f
Output voltage at filter input, d-c		
At half-load current of 62.5 ma	395	volts
40.0 ma		540 volts
At full-load current of 125 ma	350	volts
80 ma		490 volts
Voltage regulation (approx.)		
Half-load to full-load current	45	50 volts

Full-Wave Rectifier (Choke Input Filter)

Plate supply voltage, rms (each plate)	700	900 volts
Filter input choke	10	10 henrys
Output voltage at filter input, d-c		
At half-load current of 75 ma	270	volts
62.5 ma		365 volts
At full-load current of 150 ma	250	volts
125 ma		350 volts
Voltage regulation (approx.)		
Half-load to full-load current	20	15 volts

NOTES:

†Higher values may be used but the effective plate supply impedance may have to be increased to prevent exceeding the maximum rating for hot-switching transient plate current.

ENGINEERING DESIGN DATA

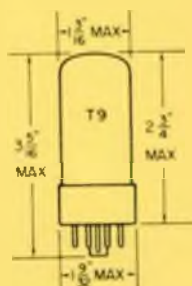
6AX5GT

DECEMBER 30, 1959

Double diode

MECHANICAL DATA

Cathode, coated unipotential	
Bulb	7-9
Outline	JETEC 9-41
Base	Short Int. shell octal (B6-48)
Basing	6S
Mounting position	Any



PIN CONNECTIONS

Pin 1	N. C.
Pin 2	Heater
Pin 3	Plate 2 Diode
Pin 5	Plate 1 Diode
Pin 7	Heater
Pin 8	Cathode

APPLICATION

The 6AX5GT is an indirectly heated full-wave rectifier for service in power supplies with moderate current requirements. Because of the heater-cathode construction, its heating time is the same as that of other heater-cathode types; thus, excessive voltages do not appear across the filter capacitors during the warm-up period.



6AX8



Combined sync separator and video amplifier for TV receivers

HEATER CHARACTERISTICS

Voltage, a-c or d-c.	6.3 volts
Current.	450 ma
Peak heater-cathode voltage, max.	90 volts

ELECTRICAL DATA

DIRECT INTERELECTRODE CAPACITANCES

Triode Section	Shield	
Grid to plate: g1 to p	1.8	μf
Input: g1 to k + h	2.5	μf
Output: p to k + h	1.0	μf
Cathode to heater: k to h (approx.)	3.5	μf

Pentode Section

Grid to plate: g1 to p	0.006	μf
Input: g1 to k + h + g2 + g3	5.0	μf
Output: p to k + h + g2 + g3	3.5	μf
Cathode to heater: k to h (approx.)	3.5	μf

†JETEC shield 315 connected to cathode.

MAXIMUM RATINGS (Design center values)

	Triode	Pentode
Plate voltage	300	300 volts
Grid 2 voltage	See Rating Chart in APPENDIX	
Grid 2 supply voltage		300 volts
Grid 1 voltage, positive d-c	0	0 volts
Plate dissipation	2.7	2.8 watts
Grid 2 dissipation		0.5 watts

CHARACTERISTICS AND TYPICAL OPERATION

	Triode	Pentode
Plate voltage	150	250 volts
Grid 2 (screen) voltage		110 volts
Cathode-bias resistor	56	120 ohms
Plate resistance (approx.)	0.005	0.40 meg
Transconductance	8500	4800 μmhos
Amplification factor	40	
Plate current	18	10 ma
Grid 2 current		3.5 ma
Grid 1 voltage (approx.) for $I_b = 10 \mu\text{a}$	-12	-12 volts

ENGINEERING DESIGN DATA

6AX8

SEPTEMBER 24, 1956

Medium-mu triode—sharp-cutoff pentode

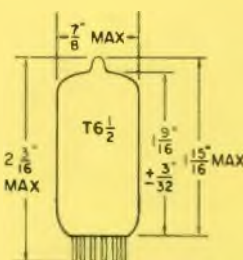
CHARACTERISTIC CURVES

(In curve section following APPENDIX)

Screen Grid Rating	100A
Plate, triode	145A
Transfer, triode; I_b	145B
Characteristics; r_p , g_m , μ	145C
Plate, pentode ($E_{c2} = 110V$)	145D
Transfer, pentode; g_m	145E
Transfer, pentode; I_{c2}	145F
Transfer, pentode; I_b	145G

MECHANICAL DATA

Cathode, coated unipotential	
Bulb	T-6½
Outline	IEC 6-2
Base	Miniature 9-pin (E9-1)
Basing	9AE
Mounting position	Any



PIN CONNECTIONS

Pin 1	Triode Plate
Pin 2	Pentode Grid 1
Pin 3	Pentode Grid 2
Pin 4	Heater
Pin 5	Heater
Pin 6	Pentode Plate
Pin 7	Pentode Cathode, Grid 3, I. S.
Pin 8	Triode Cathode
Pin 9	Triode Grid

APPLICATION

CBS type 6AX8 is a medium-mu triode and sharp-cut-off pentode designed for use as a combined sync separator and video amplifier in TV receivers.

NOTES

Type 6AX8 is similar to type 6U8, the 6AX8 having a lower transconductance.

ENGINEERING DESIGN DATA

6AZ8

SEPTEMBER 24, 1956

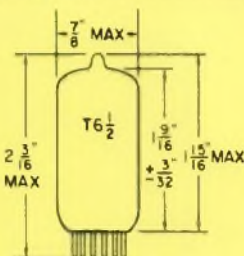
**Medium-mu triode—
semiremote-cutoff
pentode**

CHARACTERISTIC CURVES

(In curve section following APPENDIX)
Screen Grid Rating Chart.....100A
Plate, triode unit.....137A
Transfer, triode unit.....137B
Plate, pentode unit; ($E_{c2} = 150V$).....173A
Transfer, pentode unit; ΔE_{c1} vs.
 g_m173B

MECHANICAL DATA

Cathode, coated unipotential
Bulb.....T-6½
Outline.....JETEC 6-2
Base.....Miniature 9-pin (E9-1)
Basing.....9ED
Mounting position.....Any



PIN CONNECTIONS

Pin 1.....Pentode Plate
Pin 2.....Pentode Grid 2
Pin 3.....Pentode Cathode
Pin 4.....Heater
Pin 5.....Pentode Grid 3, Heater, I, S.
Pin 6.....Pentode Grid 1
Pin 7.....Triode Cathode
Pin 8.....Triode Plate
Pin 9.....Triode Grid

APPLICATION

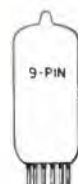
Type 6AZ8 may be used for a wide variety of applications. The pentode unit has a semiremote-cutoff characteristic and a separate cathode base pin connection allowing use of an unbypassed cathode resistor. Grid 3 and I, S, connect to one heater lead. Coupling between the triode unit and pentode unit is virtually eliminated due to basing arrangement and internal design.

NOTE

▲Pin 5 should be grounded along with one side of the heater supply, otherwise grid 3 will operate at heater supply voltage.



6AZ8



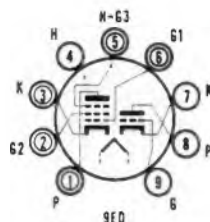
**Triode sync separator, sync clipper, phase splitter,
pentode i-f video amplifier, agc amplifier**

HEATER CHARACTERISTICS

Voltage, a-c or d-c.....6.3 volts
Current.....450 ma
Peak heater-cathode voltage, max.†

Heater negative to cathode.....200 volts
Heater positive to cathode*.....200 volts

*D-c component must not exceed 100 volts max.



ELECTRICAL DATA

DIRECT INTERELECTRODE CAPACITANCES

Triode Section

Grid to plate: g1 to p.....1.7 μf
Input: g1 to k + h + i.s.....2 μf
Output: p to k + h + i.s.....1.7 μf

Pentode Section

Grid to plate: g1 to p, max.....0.02 μf
Input: g1 to k + h + g2 + g3 + i.s.....6.5 μf
Output: p to k + h + g2 + g3 + i.s.....2.2 μf
Coupling: pentode grid 1 to triode plate, max.....0.020 μf
Coupling: pentode plate to triode grid, max.....0.027 μf
Coupling: pentode plate to triode plate, max.....0.045 μf

MAXIMUM RATINGS (Design center values)

Class A Amplifier

	Triode	Pentode
Plate voltage.....	300	300 volts
Grid 2 voltage.....	See Rating Chart in APPENDIX	
Grid 2 supply voltage.....	300 volts	
Grid 1 voltage, positive d-c.....	0	0 volts
Plate dissipation.....	2.6	2 watts
Grid 2 dissipation, up to 150 volts.....	0.5	watt
Grid 2 dissipation, between 150 and 300 volts.....	See Rating Chart in APPENDIX	
Grid 1 circuit resistance; Fixed bias.....	0.5	0.25 meg
Cathode bias.....	1.0	1.0 meg

CHARACTERISTICS AND TYPICAL OPERATION

Class A Amplifier

	Triode	Pentode
Plate supply voltage.....	200	200 volts
Grid 2 (screen) supply voltage.....	150	volts
Grid 1 (control-grid) voltage.....	-6	volts
Cathode-bias resistor.....		180 ohms
Plate resistance (approx.).....	5750	300,000 ohms
Transconductance.....	3300	6000 $\mu mhos$
Amplification factor.....	19	
Plate current.....	13	9.5 ma
Grid 2 current.....		3 ma
Grid 1 voltage (approx.) for $I_b = 10 \mu a$	-19	volts
Grid 1 voltage (approx.) for $g_m = 100 \mu mhos$		-12.5 volts

NOTES:

†Pentode heater-cathode voltage should not exceed value of operating cathode bias because grid 3 is connected to heater, thus grid 3 could be negative with respect to cathode with possible change in tube characteristics.

‡If either unit is operated at maximum rated conditions, grid 1 circuit resistance for both units should not exceed the stated values.

CBS ELECTRON TUBES

6B4G • 6B5 • 6B6G • 6B7 • 6B8 • 6B8G/GT

(See chart for seldom-used tubes)



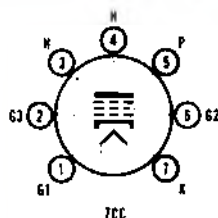
6BA6



Pentode amplifier for gain controlled r-f or i-f stages

HEATER CHARACTERISTICS

Voltage, a-c or d-c.	6.3 volts
Current	300 ma
Peak heater-cathode voltage, max.	
Heater negative to cathode	90 volts
Heater positive to cathode	90 volts



Type 6BA6 is identical to type 3BA6 except for heater characteristics.

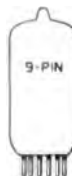
6BA7

(See chart for seldom-used tubes)



6BA8

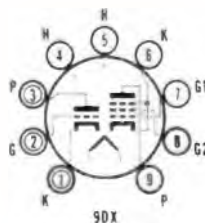
6BA8A



Combined sync separator or sync clipper, etc. and video amplifier, heater warm-up controlled for series strings

HEATER CHARACTERISTICS

Voltage, a-c or d-c.	6.3 volts
Current	600 ma
Peak heater-cathode voltage, max.	
Heater negative to cathode	200 volts
Heater positive to cathode*	200 volts
Warm-up time	11 secs. average
(See Series-String Heaters section of APPENDIX in CBS Tube Manual).	
*D-c component must not exceed 100 volts max.	



ENGINEERING DESIGN DATA

6BA6

OCTOBER 19, 1956

**Remote-cutoff
pentode**

CHARACTERISTIC CURVES

(In curve section following APPENDIX)

Screen Grid Rating	100A
Plate ($E_{c2} = 100V$)	124A
Transfer; I_{c2} ($E_b = 250V$)	124B
Transfer; I_b ($E_b = 250V$)	124C
Transfer; g_m ($E_b = 250V$)	124D

APPLICATION

Type 6BA6 is a miniature, remote-cutoff pentode designed for use as a high gain r-f or i-f amplifier. It features low grid-to-plate capacitance and high transconductance.

6BA8

6BA8A

OCTOBER 18, 1956

**Medium-mu triode—
sharp-cutoff pentode**

CHARACTERISTIC CURVES

(In curve section following APPENDIX)

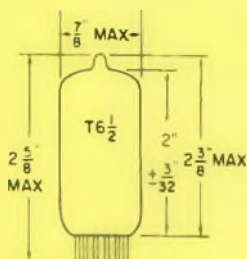
Plate, pentode ($E_{c2} = 150V$)	167B
Transfer, pentode; I_b , I_{c2} , g_m , μ	167D
Screen Grid Rating	100A
Plate, triode	192A
Transfer, triode; I_b , g_m , μ	192B

MECHANICAL DATA

Cathode, coated unipotential	
Bulb	T-6½
Outlines	JETEC 6-3
Base	Miniature 9-pin (E9-1)
Basing	9DX
Mounting position	Any

ENGINEERING DESIGN DATA

6BA8-6BA8A (cont.)



PIN CONNECTIONS

Pin 1	Cathode
Pin 2	Triode Grid 1
Pin 3	Triode Plate
Pin 4	Heater
Pin 5	Heater
Pin 6	Pentode Cathode, Grid 3, I. S.
Pin 7	Pentode Grid 1
Pin 8	Pentode Grid 2
Pin 9	Pentode Plate

APPLICATION

Types 6BA8 and 6BA8A are a combined medium- μ triode and high-gain sharp-cutoff pentode. The triode section is suitable for a wide variety of applications in television receivers such as sync separator or clipper. The pentode unit is especially suitable as a video amplifier and closely resembles the pentode section of type 6AW8.

6BA8-6BA8A (cont.)

ELECTRICAL DATA

DIRECT INTERELECTRODE CAPACITANCES

Triode Section	6BA8		6BA8A	
	Shield	No Shield	Shield	No Shield
Grid to plate: g1 to p	2.2	2.2	2.2	2.2
Input: g1 to k + h	2.7	2.5	2.7	2.5
Output: p to k + h	1.9	0.4	1.9	0.4

Pentode Section

Grid to plate: g1 to p	.030m	.036m	.03	.04
Input: g1 to k + h + g2 + g3 + i.s.	9.5	9.5	10.0	10.0
Output: p to k + h + g2 + g3 + i.s.	3.6	2.8	4.5	3.6

Coupling

Pentode grid 1 to triode plate	.005m	.010m	.003	.006
Pentode plate to triode grid	.012m	.022m	.006	.016
Pentode plate to triode plate	.050m	0.20m	.023	.150

†JETEC shield 315 connected to cathode of section tested.

M=Maximum value.

MAXIMUM RATINGS (Design center values)

	Triode	Pentode
Plate voltage	300	300 volts
Grid 2 voltage	See Rating Chart in APPENDIX	
Grid 2 supply voltage		300 volts
Grid 1 voltage, positive d-c.		0 volts
Grid 1 voltage, negative d-c.		50 volts
Plate dissipation	2.0	3.25 watts
Grid 2 dissipation		1.0 watts
Grid 1 circuit resistance		
Fixed bias	0.5	0.25 meg
Self bias	1.0	1.0 meg

CHARACTERISTICS AND TYPICAL OPERATION

Class A Amplifier	Triode	Pentode
Plate voltage	200	200 volts
Grid 2 (screen) voltage		150 volts
Grid 1 (control-grid) voltage	-8	0 volts
Cathode-bias resistor		180 ohms
Plate resistance (approx.)	6700	400,000 ohms
Transconductance	2700	9000 μ mmhos
Amplification factor	18	
Plate current	8.0	13 ma
Grid 2 current		3.5 ma
Grid 1 voltage (approx.) for $I_b = 10 \mu$ a	-16	-10 volts

6BA8A†

Zero bias: with $E_b = 65V$, $E_{c2} = 150V$ (instantaneous values)

Plate current	42
Grid 2 current	12.5

NOTE:

†Type 6BA8A features a controlled plate knee characteristic.



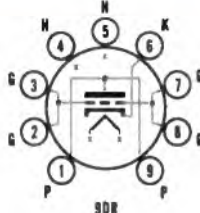
6BC4



Uhf amplifier for cathode drive circuits

HEATER CHARACTERISTICS

Voltage, a-c or d-c.....	6.3 volts
Current.....	225 ma
Peak heater-cathode voltage, max.	
Heater negative to cathode.....	75 volts
Heater positive to cathode.....	75 volts



ELECTRICAL DATA

DIRECT INTERELECTRODE CAPACITANCES

Grid to plate: g1 to p.....	1.6 μ f
Input: g1 to k + h.....	2.9 μ f
Output: p to k + h.....	0.26 μ f
Heater to cathode: h to k.....	2.7 μ f

MAXIMUM RATINGS (Design center values)

Plate voltage.....	250 volts
Plate dissipation.....	2.5 watts
Cathode current.....	25 ma
Control-grid circuit resistance	
Fixed bias.....	not recommended
Self bias.....	0.5 meg

CHARACTERISTICS

Class A Amplifier

Plate supply voltage.....	150 volts
Cathode-bias resistor.....	100 ohms
Plate resistance (approx.).....	4800 ohms
Transconductance.....	10,000 μ hos
Amplification factor.....	48
Plate current.....	14.5 ma
Control-grid voltage (approx.) for $I_b = 10 \mu$ a.....	-10 volts



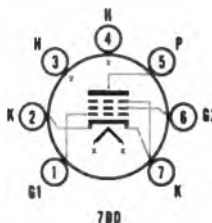
6BC5



R-f or i-f amplifier capable of high frequency operation

HEATER CHARACTERISTICS

Voltage, a-c or d-c.....	6.3 volts
Current.....	300 ma
Peak heater-cathode voltage, max.	
Heater negative to cathode.....	90 volts
Heater positive to cathode.....	90 volts



Type 6BC5 is identical to type 3BC5 except for heater ratings.

ENGINEERING DESIGN DATA

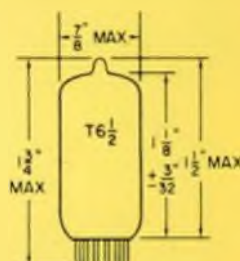
6BC4

SEPTEMBER 24, 1956

Medium-mu triode

MECHANICAL DATA

Cathode, coated unipotential	
Bulb.....	T-6½
Outline.....	IETEC 6-1
Base.....	Miniature 9-pin (E9-1)
Basing.....	9DR
Mounting position.....	Any



PIN CONNECTIONS

Pin 1.....	Plate
Pin 2.....	Grid 1
Pin 3.....	Grid 1
Pin 4.....	Heater
Pin 5.....	Heater
Pin 6.....	Cathode
Pin 7.....	Grid 1
Pin 8.....	Grid 1
Pin 9.....	Plate

6BC5

SEPTEMBER 24, 1956

Sharp-cutoff pentode

CHARACTERISTIC CURVES

(In curve section following APPENDIX)

Screen Grid Rating.....	100A
Plate ($E_{c2} = 150V$).....	125A
Plate, ΔE_{c2} ($E_{c1} = 0V$).....	125B
Transfer; I_b & I_{c2} ($E_b = 250V$).....	125C
Transfer; g_m ($E_b = 250V$).....	125D

APPLICATION

Type 6BC5 is a sharp-cutoff pentode designed for service as a high gain r-f or i-f amplifier. Included in its characteristics are high transconductance and low grid-to-plate capacitance.

ENGINEERING DESIGN DATA

6BC7

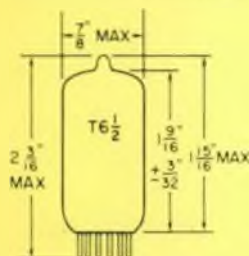
SEPTEMBER 24, 1956

Triple diode

CHARACTERISTIC CURVES
(In curve section following APPENDIX)
Plate characteristics 128A

MECHANICAL DATA

Cathode, coated unipotential
Bulb T-6 1/2
Outline JEDEC 6-2
Base Miniature 9-pin (E9-1)
Basing 9AX
Mounting position Any



PIN CONNECTIONS

Pin 1 Diode 3 Cathode
Pin 2 Diode 3 Plate
Pin 3 I. S.
Pin 4 Heater
Pin 5 Heater
Pin 6 Diode 2 Plate
Pin 7 Diode 2 Cathode
Pin 8 Diode 1 Plate
Pin 9 Diode 1 Cathode

6BC8

JUNE 10, 1956

CHARACTERISTIC CURVES
(In curve section following APPENDIX)
Plate 134A
Transfer 134B
Transfer 134C

APPLICATION

Type 6BC8 is a miniature, semiremote-cutoff duodiode designed for application as a gain controlled vhf cascade amplifier.



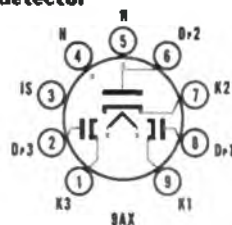
6BC7



D-c restorer for tricolor TV or combined f-m discriminator and a-m detector

HEATER CHARACTERISTICS

Voltage 6.3 volts
Current 450 ma
Peak heater-cathode voltage, max.
Heater negative to cathode 200 volts
Heater positive to cathode 200 volts



ELECTRICAL DATA

DIRECT INTERELECTRODE CAPACITANCES

Plate Diode 1 to all other elements 3.5 μ f
Plate Diode 2 to all other elements 5.5 μ f
Plate Diode 3 to all other elements 3.5 μ f

MAXIMUM RATINGS (Design center values, each section)

Plate voltage, peak inverse 330 volts
Plate current, d-c 12 ma
Plate current, peak 54 ma

AVERAGE CHARACTERISTICS

Plate current, $E_b = 5$ volts
Diode 1 35 ma
Diode 3 35 ma
Plate current, $E_b = 0$ volts
Diode 1 21 μ B
Diode 3 21 μ B
Plate current ratio, $E_b = 5$ volts
Diode 1/Diode 3 1.3 max
Diode 3/Diode 1 1.3 max



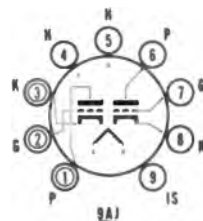
6BC8



Gain-controlled very-high-frequency cascade amplifier for TV tuners

HEATER CHARACTERISTICS

Voltage, a-c or d-c 6.3 volts
Current 400 ma
Peak heater-cathode voltage, max.
Heater negative to cathode* 200 volts
Heater positive to cathode* 200 volts
*D-c component must not exceed 100 volts.



*This rating may be as high as 300 volts under cutoff conditions when the tube is used as a cascode amplifier and the two sections are connected in series.

Type 6BC8 is identical to type 4BC8 except for heater characteristics.



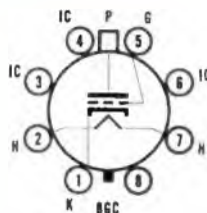
6BD4A



High-voltage regulator for color TV
picture tube anode supplies

HEATER CHARACTERISTICS

Voltage, a-c or d-c	6.3 volts
Current	200 ma
Peak heater-cathode voltage, max.	
Heater negative to cathode	180 volts
Heater positive to cathode	180 volts



ELECTRICAL DATA

DIRECT INTERELECTRODE CAPACITANCES

Grid to plate: g1 to p	0.03 μ f
Input: g1 to k + h	2.6 μ f
Output: p to k + h	1.0 μ f

MAXIMUM RATINGS (Design center values)

Plate voltage, d-c	25,000 volts
Plate supply voltage, unregulated d-c	55,000 volts
Grid voltage, d-c	-125 volts
Grid voltage, peak	-550 volts
Plate current	1.5 ma
Plate dissipation	25 watts
Grid circuit resistance	
With unregulated supply resistance of at least 8 meg	4 meg

TYPICAL OPERATION

Shunt Regulator

Unregulated supply voltage	
with 8 meg. equivalent resistance	29,800 volts
Reference supply voltage with 1K equivalent resistance	500 volts
Transconductance, effective grid to plate	138 μ hos
Plate current at 0 ma load, d-c	1,055 μ a
Plate current at 1 ma load, d-c	100 μ a
Regulated output voltage at 0 ma load, d-c	20,000 volts
Regulated output voltage at 1 ma load, d-c	19,700 volts

ENGINEERING DESIGN DATA

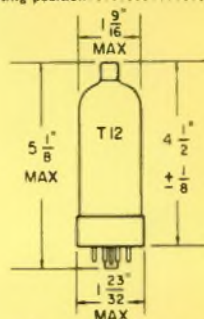
6BD4A

OCTOBER 24, 1956

Beam triode

MECHANICAL DATA

Cathode, coated unipotential	
Bulb	T-12
Outline	As shown
Base	Short jumbo shell with external barriers (B6-73)
Basing	8GC
Cap	JETEC CI-1
Mounting position	Any



PIN CONNECTIONS

Pin 1	Cathode
Pin 2	Heater
Pin 3	N. C.
Pin 5	Grid
Pin 7	Heater
Pin 8	N. C.
Cap	Plate

APPLICATION

Typical operation for the 6BD4A is in high voltage regulator service for color picture tube anode supplies. The 6BD4A replaces type 6BD4.

6BD5GT

(See chart for seldom-used tubes)

ENGINEERING DESIGN DATA

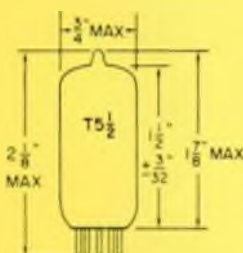
6BD6

SEPTEMBER 24, 1956

Remote-cutoff pentode

MECHANICAL DATA

Cathode, coated unipotential
Bulb T-5½
Outline JEDEC 5-2
Base Miniature 7-pin (E7-1)
Basing 7BK
Mounting position Any



PIN CONNECTIONS

Pin 1 Grid 1
Pin 2 Grid 3, I. S.
Pin 3 Heater
Pin 4 Heater
Pin 5 Plate
Pin 6 Grid 2
Pin 7 Cathode

APPLICATION

The 6BD6 is a miniature version of the 6SK7. It is a remote-cutoff type designed for r-f or i-f amplifier service.



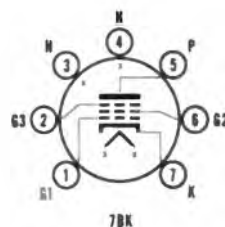
6BD6



Gain controlled radio-frequency or intermediate-frequency amplifier for radio receivers

HEATER CHARACTERISTICS

Voltage, a-c or d-c 6.3 volts
Current 300 ma
Peak heater-cathode voltage, max.
Heater negative to cathode 90 volts
Heater positive to cathode 90 volts



ELECTRICAL DATA

DIRECT INTERELECTRODE CAPACITANCES

	No Shield	Shield†	
Grid to plate: g1 to p, max.	0.005	0.004	μmf
Input: g1 to k + h + g2 + g3 + i.s.	4.3	4.3	μmf
Output: p to k + h + g2 + g3 + i.s.	5.0	5.0	μmf

†JEDEC shield 316 connected to cathode

MAXIMUM RATINGS (Design center values)

Plate voltage	300 volts
Grid 2 voltage	125 volts
Plate dissipation	3.0 watts
Grid 2 dissipation	0.65 watt
Cathode current	14 ma

CHARACTERISTICS AND TYPICAL OPERATION

Class A Amplifier

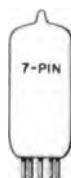
Plate voltage	100	125	250 volts
Grid 3 (suppressor)	connected to cathode at socket		
Grid 2 (screen) voltage	100	125	100 volts
Grid 1 (control-grid) voltage	-1	-3	-3 volts
Plate resistance (approx.)	0.15	0.18	0.8 meg
Transconductance	2550	2350	2000 μmhos
Plate current	13	13	9 ma
Grid 2 current	5	5	3 ma
Grid 1 voltage (approx.) for gm = 10 μmhos	-35	-45	-35 volts

6BD7

(See chart for seldom-used tubes)



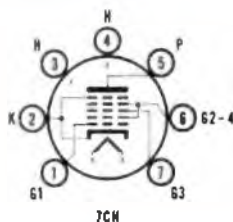
6BE6



Radio-frequency converter in superheterodyne radio receivers

HEATER CHARACTERISTICS

Voltage, a-c or d-c	6.3 volts
Current	300 ma
Peak heater-cathode voltage, max.	
Heater negative to cathode	90 volts
Heater positive to cathode	90 volts



Type 6BE6 is identical to type 3BE6 except for heater ratings.



6BE8

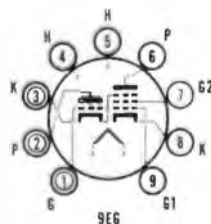
6BE8A



Vhf triode oscillator—pentode mixer for television tuners

HEATER CHARACTERISTICS

Voltage, a-c or d-c	6.3 volts
Current	450 ma
Peak heater-cathode voltage, max.	
Heater negative to cathode	200 volts
Heater positive to cathode*	200 volts
*D-c component must not exceed 100 volts max.	



6BE8A

Warm-up time	11 secs. average
(See Series-String Heaters section of APPENDIX in CBS Tube Manual).	

Types 6BE8 and 6BE8A are identical to type 5BE8 except for heater characteristics.



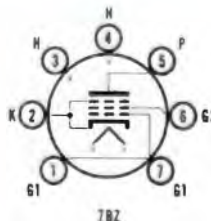
6BF5



Audio power amplifier or TV vertical deflection amplifier

HEATER CHARACTERISTICS

Voltage, a-c or d-c	6.3 volts
Current	1.2 amp
Peak heater-cathode voltage, max.	
Heater negative to cathode	200 volts
Heater positive to cathode*	200 volts
*D-c component must not exceed 100 volts max.	



CBS ELECTRON TUBES

ENGINEERING DESIGN DATA

6BE6

SEPTEMBER 24, 1956

Remote-cutoff heptode

CHARACTERISTIC CURVES

(In curve section following APPENDIX)

Plate (triode connected)	126A
Operation; g_c & $1k$ vs. $1c_1$	126B
Transfer; g_c , $1b$ & $1c_2$ + 4 vs. E_{c3} ($E_b = 250V$)	126C
Transfer; g_c , $1b$ & $1c_2$ + 4 vs. E_{c3} ($E_b = 100V$)	126D
Operation; g_c vs. $1c_1$	126E

APPLICATION

Type 6BE6 is designed to function as a mixer and oscillator in superheterodyne circuits. It is characterized by high conversion gain and good oscillator stability during variations in a-c bias voltage.

6BE8

6BE8A

OCTOBER 24, 1956

Medium-mu triode sharp-cutoff pentode

CHARACTERISTIC CURVES

(In curve section following APPENDIX)

Screen Grid Rating	100A
Plate, triode	145A
Transfer, triode; $1b$	145B
Characteristics; $1p$, $1m$, μ	145C
Plate, pentode ($E_{c2} = 110V$)	145D
Transfer, pentode; g_m	145E

Type 6BE8 is intended for use in television and f-m receivers as a vhf-oscillator-mixer tube.

6BF5

SEPTEMBER 24, 1956

Beam power pentode

CHARACTERISTIC CURVES

(In curve section following APPENDIX)

Plate ($E_{c2} = 110V$)	149A
Transfer ($E_b = 110V$)	149B

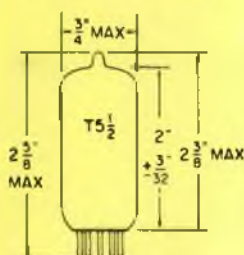
MECHANICAL DATA

Cathode, coated unipotential	
Bulb	T-5½
Outline	JETEC 5:
Base	Miniature 7-pin (E7-1)
Basing	7B1
Mounting position	Am

ENGINEERING DESIGN DATA

6BF5 (cont.)

6BF5 (cont.)



PIN CONNECTIONS

Pin 1	Grid 1
Pin 2	Cathode, Beam Plate
Pin 3	Heater
Pin 4	Heater
Pin 5	Plate
Pin 6	Grid 2
Pin 7	Grid 1

REFERENCE

For explanation of vertical deflection ratings see the APPENDIX.

APPLICATION

CBS type 6BF5 is designed for use in the audio output stage of television and broadcast receivers. Type 6BF5 delivers relatively high power output at low plate and screen voltages and features high sensitivity. When connected as a triode, the 6BF5 may be used as a vertical deflection amplifier in television receivers.

ELECTRICAL DATA

DIRECT INTERELECTRODE CAPACITANCES

Grid to plate: g1 to p.	0.65	Triode Connected	7.5 μf
Input: g1 to k + h + g2 + b.p.	14		7 μf
Output: p to k + h + g2 + b.p.	6		6 μf

MAXIMUM RATINGS (Design center values unless noted)

	Class A Amplifier	Triode Connected*	Vertical Deflection Connected*
Plate voltage, d-c.	250	250 volts	900 volts
Plate voltage, peak pos. (absolute max.).			900 volts
Plate dissipation	5.5	5.01 watts	5.01 watts
Grid 2 dissipation	1.25		1.25 watts
Grid 2 voltage	117	250 volts	250 volts
Grid 1 voltage, peak negative		-250 volts	-250 volts
Cathode current, average		40 ma	40 ma
Cathode current, peak		120 ma	120 ma
Control-grid circuit resistance		2.2 meg	2.2 meg

AVERAGE CHARACTERISTICS AND TYPICAL OPERATION

	Triode Connected	Class A Amplifier
Plate voltage	225	110 volts
Grid 2 voltage	225	110 volts
Grid 1 voltage	-30	-7.5 volts
Grid 1 voltage, peak a-f		7.5 volts
Plate current, zero signal	10	36.0 ma
Plate current, max. signal		39.0 ma
Grid 2 current, zero signal		4.0 ma
Grid 2 current, max. signal		10.5 ma
Plate resistance	2500	12,000 ohms
Transconductance	2700	7500 μmhos
Load resistance		2500 ohms
Power output, max. signal		1.9 watts
Total harmonic distortion (approx.)		10 %
Amplification factor	6.7	
Grid voltage (approx.) for $I_b = 0.5 \text{ ma}$	-40	volts

NOTES:

*Voltage pulse duration must not exceed 2500 μs in a 525-line 30-frame system.

†Tube protection is needed for no-drive conditions if grid-resistor bias is used.

6BF6

JUNE 3, 1957

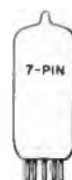
**Duodiode—
medium-mu triode**

MECHANICAL DATA

Cathode, coated unipotential	
Bulb	T-5 1/2
Outline	JETEC 5-2
Base	Miniature 7-pin (E7-1)
Basing	7BT
Mounting position	Any



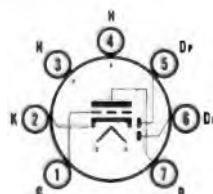
6BF6



**Combined detector, avc, and audio driver tube
in automobile radio receivers**

HEATER CHARACTERISTICS

Voltage, a-c or d-c.	6.3 volts
Current	300 ma
Peak heater-cathode voltage, max.	
Heater negative to cathode	90 volts
Heater positive to cathode	90 volts



7BT

CBS ELECTRON TUBES

6BF6 (cont.)

ELECTRICAL DATA

*DIRECT INTERELECTRODE CAPACITANCES

Triode Section	Shield [†]	No Shield
Grid to plate: g1 to p, max.	2.0	2.0
Input: g1 to k + h.	1.8	1.8
Output: p to k + h.	0.8	1.1
Diode 1 plate to cathode.	0.7	1.4
Diode 2 plate to cathode.	0.1	1.5
Diode 1 plate to triode grid, max.	0.07	0.06
Diode 2 plate to triode grid, max.	0.06	0.05

†JETEC shield 316 connected to cathode

MAXIMUM RATINGS (Design center values)

Plate voltage.	300 volts
Plate dissipation.	2.5 watts
Plate current (for each diode).	1.0 ma

TYPICAL OPERATION

Class A Amplifier with transformer coupling

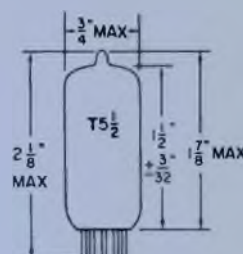
Plate voltage.	250 volts
Grid 1 (control-grid) voltage*	-9 volts
Load resistance.	10,000 ohms
Plate resistance (approx.)	8500 ohms
Transconductance.	1900 μ mhos
Amplification factor.	16
Plate current.	9.5 ma
Power output.	300 mw
Total harmonic distortion.	6.5 %
Diode current with 10 volts d-c applied (each plate).	0.8 ma

NOTES:

*Diode biasing of the triode is not suitable.

ENGINEERING DESIGN DATA

6BF6 (cont.)



PIN CONNECTIONS

Pin 1	Triode Grid
Pin 2	Cathode
Pin 3	Heater
Pin 4	Heater
Pin 5	Diode 2 Plate
Pin 6	Diode 1 Plate
Pin 7	Triode Plate

APPLICATION

Type 6BF6 is primarily used in automobile radio receivers as a combined detector, avc bias tube, and impedance-or transformer-coupled driver stage.

NOTES

Type 6BF6 is identical to type 12BF6 except for heater ratings.

6BF7

(See chart for seldom-used tubes)



6BG6G

6BG6GA

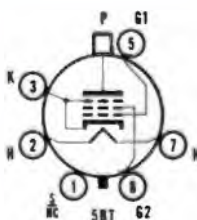


**Horizontal deflection amplifier for
television receiver sweep circuits**

HEATER CHARACTERISTICS

Voltage, a-c or d-c.	6.3 volts
Current.	0.9 amp
Peak heater-cathode voltage, max.	
Heater negative to cathode.	200 volts
Heater positive to cathode*.	200 volts

*D-c component must not exceed 100 volts max.



6BG6G

6BG6GA

NOVEMBER 1, 1957

Beam power pentode

CHARACTERISTIC CURVES

(In curve section following APPENDIX)
 Plate ($E_{c2} = 250V$).....108A
 Plate (ΔE_{c2}).....108B
 Transfer ($E_b = 350V$).....108C
 Transfer ($E_b = 350V$).....108D

6BF6 (cont.)

ELECTRICAL DATA

DIRECT INTERELECTRODE CAPACITANCES

Triode Section	No Shield	Shield [†]	
Grid to plate: g1 to p, max.	1.9	1.9	μf
Input: g1 to k + h.	1.8	1.9	μf
Output: p to k + h.	0.7	1.2	μf
Diode 1 plate to cathode.	1.4	0.7	μf
Diode 2 plate to cathode.	1.5	0.1	μf
Diode 1 plate to triode grid, max.	0.07	0.06	μf
Diode 2 plate to triode grid, max.	0.06	0.05	μf

[†]JETEC shield 316 connected to cathode

MAXIMUM RATINGS (Design center values)

Plate voltage.	300 volts
Plate dissipation.	2.5 watts
Plate current (for each diode).	1.0 ma

TYPICAL OPERATION

Class A Amplifier with transformer coupling

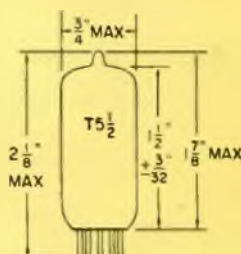
Plate voltage.	250 volts
Grid 1 (control-grid) voltage*.	-9 volts
Load resistance.	10,000 ohms
Plate resistance (approx.).	8500 ohms
Transconductance.	1900 μmhos
Amplification factor.	16
Plate current.	9.5 ma
Power output.	300 mw
Total harmonic distortion.	6.5 %
Diode current with 10 volts d-c applied (each plate).	0.8 ma

NOTES:

*Diode biasing of the triode is not suitable.

ENGINEERING DESIGN DATA

6BF6 (cont.)



PIN CONNECTIONS

Pin 1.	Triode Grid
Pin 2.	Cathode
Pin 3.	Heater
Pin 4.	Heater
Pin 5.	Diode 2 Plate
Pin 6.	Diode 1 Plate
Pin 7.	Triode Plate

APPLICATION

Type 6BF6 is primarily used in automobile radio receivers as a combined detector, avc bias tube, and impedance- or transformer-coupled driver stage.

NOTES

Type 6BF6 is identical to type 12BF6 except for heater ratings.

6BF7

(See chart for seldom-used tubes)



6BG6G

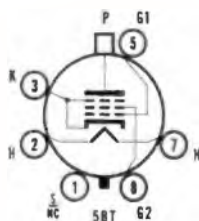
6BG6GA



Horizontal deflection amplifier for
television receiver sweep circuits

HEATER CHARACTERISTICS

Voltage, a-c or d-c.	6.3 volts
Current.	0.9 amp
Peak heater-cathode voltage, max.	
Heater negative to cathode.	200 volts
Heater positive to cathode*.	200 volts
*D-c component must not exceed 100 volts max.	



6BG6G

6BG6GA

SEPTEMBER 24, 1956

Beam power pentode

CHARACTERISTIC CURVES

(In curve section following APPENDIX)

Plate ($E_{c2} = 250\text{V}$)	108A
Plate (ΔE_{c2})	108B
Transfer ($E_b = 350\text{V}$)	108C
Transfer ($E_b = 350\text{V}$)	108D

ENGINEERING DESIGN DATA

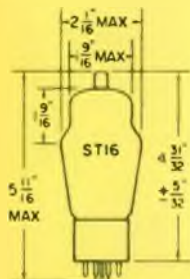
6BG6G • 6BG6GA (cont.)

MECHANICAL DATA

Cathode, coated unipotential

6BG6GA 6BG6G

Bulb	T-12	ST16
Outline	I2-21 □	JETEC 16-5
Base	Medium shell B6-13	
	Short Medium shell B8-110	
Basing	SBT	
Cap	JETEC CI-1	
Mounting position		Vertical, base up or down ▲



PIN CONNECTIONS

Pin 1	N. C.
Pin 2	Heater
Pin 3	Cathode, B. P.
Pin 4	N. C. ■
Pin 5	Grid 1
Pin 6	N. C. ■
Pin 7	Heater
Pin 8	Grid 2
Cap	Plate

APPLICATION

Types 6BG6G and 6BG6GA are designed for service in the horizontal sweep circuit of television receivers. The plate lead is brought out to the top cap for high voltage insulation.

NOTES

- ▲ Horizontal mounting is permitted if pins 2 and 7 are in a vertical plane.
- See outline T-12 given for 6CD6GA.
- Not included on the 6BG6G base.

6BG6G • 6BG6GA (cont.)

ELECTRICAL DATA

DIRECT INTERELECTRODE CAPACITANCES

Grid to plate: g1 to p.	0.34	μμf
Input: g1 to k + h + g2 + b.p.	12	μμf
Output: p to k + h + g2 + b.p.	6.5	μμf

MAXIMUM RATINGS (Design center values unless noted)

Horizontal Deflection Amplifier*

Plate supply voltage, d-c (boost + d-c power supply)	700	volts
Plate voltage, peak pos. (absolute max.)	6600	volts
Plate voltage, peak negative pulse	1500	volts
Grid 2 voltage, d-c	350	volts
Grid 1 voltage	-50	volts
Grid 1 voltage, peak negative	300	volts
Plate dissipation†	20	watts
Grid 2 dissipation	3.2	watts
Cathode current, average	400	ma
Cathode current, peak	110	ma
Grid 1 circuit resistance	0.47	meg
Bulb temperature at hottest point	210	°C

AVERAGE CHARACTERISTICS

Instantaneous values

Plate voltage	60	250	volts
Grid 2 (screen) voltage	250	250	volts
Grid 1 (control-grid) voltage	0	-15	volts
Plate resistance (approx.)		25,000	ohms
Transconductance		6000	μmhos
Plate current	180	75	ma
Grid 2 current	18	4.0	ma
Grid 1 voltage (approx.) for $I_b = 1$ ma		-45	volts
Triode amplification factor (p + g2 tied together)		8	

NOTES:

- *Voltage pulse duration must not exceed 10 μs in a 525-line, 30-frame system.
- †Tube protection is needed for no-drive conditions if grid-resistor bias is used.

6BG7

(See chart for seldom-used tubes)



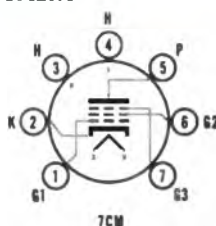
6BH6



Radio frequency amplifier for equipment in which low heater current is important

HEATER CHARACTERISTICS

Voltage, a-c or d-c.	6.3 volts
Current	150 ma
Peak heater-cathode voltage, max.	
Heater negative to cathode	90 volts
Heater positive to cathode	90 volts



ELECTRICAL DATA

DIRECT INTERELECTRODE CAPACITANCES

	No Shield	Shield†	
Grid to plate: g1 to p, max.	0.0035	0.0035	μmf
Input: g1 to k + h + g2 + g3 + i.s.	5.4	5.4	μmf
Output: p to k + h + g2 + g3 + i.s.	4.4	4.4	μmf

†JETEC shield 316 connected to cathode.

MAXIMUM RATINGS (Design center values)

Plate voltage	300 volts
Grid 2 voltage	See Rating Chart in APPENDIX
Grid 2 supply voltage	300 volts
Grid 1 voltage, negative d-c.	50 volts
Grid 1 voltage, positive d-c.	0 volts
Plate dissipation	3.0 watts
Grid 2 dissipation	
For grid 2 voltages up to 150 volts	0.5 watt
For grid 2 voltages between 150 and 300 volts	See Rating Chart in APPENDIX

CHARACTERISTICS AND TYPICAL OPERATION

Class A Amplifier

Plate voltage	100	250 volts
Grid 3 (suppressor)	connected to cathode at socket	
Grid 2 (screen) voltage	100	150 volts
Grid 1 (control-grid) voltage	-1	-1 volts
Plate resistance (approx.)	0.7	1.4 meg
Transconductance	3400	4600 μmhos
Plate current	3.6	7.4 ma
Grid 2 current	1.4	2.9 ma
Grid 1 voltage (approx.) for $i_b = 10 \mu a$	-5	-7.7 volts

ENGINEERING DESIGN DATA

6BH6

SEPTEMBER 24, 1956

Sharp-cutoff pentode

CHARACTERISTIC CURVES

(In curve section following APPENDIX)

Screen Grid Rating: 100A

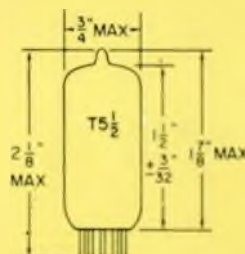
Plate ($E_{c2} = 150V$): 169A

Transfer; g_m ($E_b = 250V$): 169B

Transfer; i_b , i_{c2} ($E_b = 250V$): 169C

MECHANICAL DATA

Cathode, coated unipotential	
Bulb	T-5½
Outline	JETEC 5-2
Base	Miniature 7-pin (E7-1)
Basing	7CM
Mounting position	Any



PIN CONNECTIONS

Pin 1	Grid 1
Pin 2	Cathode
Pin 3	Heater
Pin 4	Heater
Pin 5	Plate
Pin 6	Grid 2
Pin 7	Grid 3, I. S.

APPLICATION

The 6BH6 is used as an r-f amplifier in mobile equipment in which low-heater current drain is important, or in a-c-d-c receivers. It is also employed in high frequency wide band applications.

ENGINEERING DESIGN DATA

6BH8

SEPTEMBER 24, 1956

Medium-mu triode—
sharp-cutoff pentode

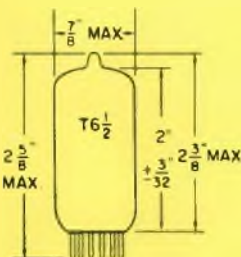
CHARACTERISTIC CURVES

(In curve section following APPENDIX)

Plate, pentode ($E_{c2} = 125V$).....	142A
Plate, pentode ($E_{c2} = 125V$).....	142B
Plate, pentode (ΔE_{c2}).....	142C
Plate, triode.....	170A
Transfer, triode.....	170B
Characteristics, triode; g_m , μ_p , μ	170C

MECHANICAL DATA

Cathode, coated unipotential	
Bulb.....	T-6½
Outline.....	JETEC 6-3
Base.....	Miniature 9-pin (E9-1)
Basing.....	9DX
Mounting position.....	Any



PIN CONNECTIONS

Pin 1.....	Triode Cathode
Pin 2.....	Triode Grid
Pin 3.....	Triode Plate
Pin 4.....	Heater
Pin 5.....	Heater
Pin 6.....	Pentode Cathode, Grid 3, I, S.
Pin 7.....	Pentode Grid 1
Pin 8.....	Pentode Grid 2
Pin 9.....	Pentode Plate

APPLICATION

The 6BH8 may be employed in many combinations of applications in television receivers; e.g., video amplifier, video i-f amplifier, sound i-f amplifier for the pentode section, and sync amplifier, separator or clipper, sweep oscillator for the triode section.



6BH8

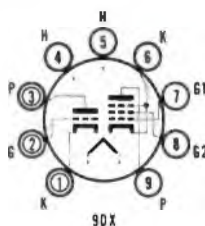


Combined sync separator, clipper, amplifier or
sweep oscillator and i-f or video amplifier

HEATER CHARACTERISTICS

Voltage, a-c or d-c.....	6.3 volts
Current.....	600 ma
Peak heater-cathode voltage, max.	
Heater negative to cathode.....	200 volts
Heater positive to cathode*.....	200 volts
Warm-up time.....	11 secs. average
(See Series-String Heaters section of APPENDIX in CBS Tube Manual).	

*D-c component must not exceed 100 volts max.



ELECTRICAL DATA

DIRECT INTERELECTRODE CAPACITANCES

Triode Section

Grid to plate: g1 to p.....	2.4	$\mu\mu f$
Input: g1 to k + h.....	2.6	$\mu\mu f$
Output: p to k + h.....	0.38	$\mu\mu f$

Pentode Section

Grid to plate: g1 to p.....	0.046	$\mu\mu f$
Input: g1 to k + h + g2 + g3.....	7.0	$\mu\mu f$
Output: p to k + h + g2 + g3.....	2.4	$\mu\mu f$
Coupling: pentode grid 1 to triode plate.....	0.004	$\mu\mu f$
Coupling: pentode plate to triode grid.....	0.016	$\mu\mu f$
Coupling: pentode plate to triode plate.....	0.095	$\mu\mu f$

MAXIMUM RATINGS (Design center values)

	Triode*	Pentode
Plate voltage.....	300	300 volts
Grid 2 supply voltage.....	300	300 volts
Grid 1 voltage, positive d-c.....	0	0 volts
Plate dissipation.....	2.5	3.0 watts
Grid 2 dissipation.....		1.0 watts
Grid 1 circuit resistance		
Fixed bias.....	0.5	0.25 meg
Self bias.....	1.0	1.0 meg

CHARACTERISTICS AND TYPICAL OPERATION

Class A Amplifier

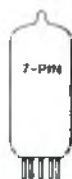
	Triode*	Pentode
Plate voltage.....	150	200 volts
Grid 2 (screen) voltage.....		125 volts
Grid 1 (control-grid) voltage.....	-5.0	volts
Cathode-bias resistor.....		82 ohms
Plate resistance (approx.).....	5150	150,000 ohms
Transconductance.....	3300	7000 μmhos
Amplification factor.....	17	
Plate current.....	9.5	15 ma
Grid 2 current.....		3.4 ma
Grid 1 voltage (approx.) for $I_b = 100 \mu\text{a}$	-14	-8.0 volts

NOTE:

*May be diode connected (grid tied to plate or plate grounded) for video detector use.



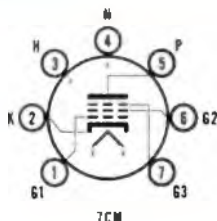
6BJ6



Radio-frequency amplifier for equipment in which
low heater current is important

HEATER CHARACTERISTICS

Voltage, a-c or d-c.	6.3 volts
Current	150 ma
Peak heater-cathode voltage, max.	90 volts



ELECTRICAL DATA

DIRECT INTERELECTRODE CAPACITANCES

	No Shield	Shield†	
Grid to plate: g1 to p, max.	0.0035	0.0035	$\mu\mu\text{f}$
Input: g1 to k + h + g2 + g3	4.5	4.5	$\mu\mu\text{f}$
Output: p to k + h + g2 + g3	5.5	5.5	$\mu\mu\text{f}$

†JETEC shield 316 connected to pins 2 and 7.

MAXIMUM RATINGS (Design center values)

Plate voltage	300 volts
Grid 2 voltage	125 volts
Grid 2 supply voltage	300 volts
Grid 1 voltage, negative d-c.	-50 volts
Grid 1 voltage, positive d-c.	0 volts
Plate dissipation	3.0 watts
Grid 2 dissipation	0.6 watt

CHARACTERISTICS AND TYPICAL OPERATION

Class A Amplifier

Plate voltage	100	250 volts
Grid 3 (suppressor)	connected to cathode at socket	
Grid 2 (screen) voltage	100	100 volts
Grid 1 (control-grid) voltage	1.0	1.0 volts
Plate resistance (approx.)	0.25	1.3 meg
Transconductance	3650	3600 μmhos
Plate current	9.0	9.2 ma
Grid 2 current	3.5	3.3 ma
Grid 1 voltage (approx.) for $g_m = 10 \mu\text{mhos}$	-20	-20 volts



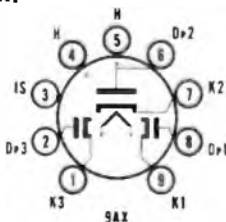
6BJ7



D-c restorer for the separate video signals
in tricolor television

HEATER CHARACTERISTICS

Voltage, a-c or d-c.	6.3 volts
Current	0.45 amp
Peak heater-cathode voltage, max.	
Heater negative to cathode	330 volts
Heater positive to cathode	100 volts



CBS ELECTRON TUBES

ENGINEERING DESIGN DATA

6BJ6

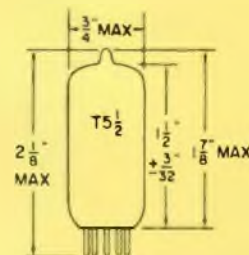
OCTOBER 1, 1956

Remote-cutoff
pentode

CHARACTERISTIC CURVES
(In curve section following APPENDIX)
Plate ($E_{c2} = 100\text{V}$) 171A

MECHANICAL DATA

Cathode, coated unipotential
Bulb T-5½
Outline JETEC 5-2
Base Miniature 7-pin (E7-1)
Basing 7CM
Mounting position Any



PIN CONNECTIONS

Pin 1	Grid 1
Pin 2	Cathode
Pin 3	Heater
Pin 4	Heater
Pin 5	Plate
Pin 6	Grid 2
Pin 7	Grid 3, I. S.

NOTES

Type 6BJ6 is similar electrically to type 6BA6.

6BJ7

OCTOBER 1, 1956

Triple diode

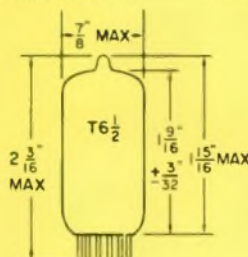
CHARACTERISTIC CURVES
(In curve section following APPENDIX)
Plate 120A
Operation 120B
Operation 120C

ENGINEERING DESIGN DATA

6BJ7 (cont.)

MECHANICAL DATA

Cathode, coated unipotential	
Bulb	T-6½
Outline	JETEC 6-2
Base	Miniature 9-pin (E9-1)
Basing	9AX
Mounting position	Any



PIN CONNECTIONS

Pin 1	Cathode (Sect. 3)
Pin 2	Plate (Sect. 3)
Pin 3	I. S.
Pin 4	Heater
Pin 5	Heater
Pin 6	Plate (Sect. 2)
Pin 7	Cathode (Sect. 2)
Pin 8	Plate (Sect. 1)
Pin 9	Cathode (Sect. 1)

6BK4

OCTOBER 1, 1956

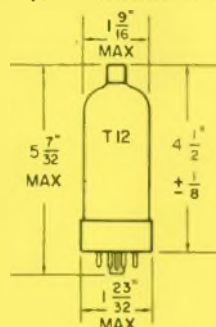
Beam triode

CHARACTERISTIC CURVES

(In curve section following APPENDIX)	
Plate	115A
Transfer	115B

MECHANICAL DATA

Cathode, coated unipotential	
Bulb	T-12
Outline	As shown
Base	Short jumbo shell octal
8-pin with external barriers (B8-71)	
Basing	8GC
Cap	JETEC C1-1
Mounting position	Any



6BJ7 (cont.)

ELECTRICAL DATA

DIRECT INTERELECTRODE CAPACITANCES

Plate 1 to cathode 1 + heater + i.s.	3.0	μf
Plate 2 to cathode 2 + heater + i.s.	2.8	μf
Plate 3 to cathode 3 + heater + i.s.	2.8	μf
Cathode 1 to plate 1 + heater + i.s.	3.8	μf
Cathode 2 to plate 2 + heater + i.s.	4.0	μf
Cathode 3 to plate 3 + heater + i.s.	3.8	μf
Plate 1 to plate 2	0.055	μf
Plate 2 to plate 3	0.036	μf
Plate 3 to plate 1	0.038	μf

MAXIMUM RATINGS (Design center values)

TV D-c Restorer Service

Plate voltage, peak inverse	330	volts
Output current, d-c (each plate)	1.0	ma
Plate current, peak steady state (each plate)	10	ma

CHARACTERISTICS

Tube Voltage Drop

Conducting 10 ma (each plate)	2.7	volts
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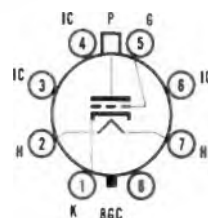
6BK4



High-voltage regulator for color TV
picture tube anode supplies

HEATER CHARACTERISTICS

Voltage, a-c or d-c	6.3	volts
Current	200	ma
Peak heater-cathode voltage, max.		
Heater negative to cathode	225	volts
Heater positive to cathode	not recommended	



ELECTRICAL DATA

DIRECT INTERELECTRODE CAPACITANCES

Grid to plate: g1 to p	0.03	μf
Input: g1 to k + h	2.6	μf
Output: p to k + h	1.0	μf

MAXIMUM RATINGS (Design center values)

Plate voltage, d-c	25,000	volts
Plate supply voltage, unregulated d-c	55,000	volts
Grid voltage, d-c	-125	volts
Grid voltage, peak	-400	volts
Plate current	1.5	ma
Plate dissipation	25	watts
Grid circuit resistance		
For use with flyback transformer high voltage supply	3.0	meg

CBS ELECTRON TUBES

6BK4 (cont.)

CHARACTERISTICS

Grid voltage (1), min.*	-7 volts
Grid voltage (2), max.†	-40 volts
Grid voltage change, max. ‡	9 volts

*With $E_b = 30,000V$ and $I_b = 1$ ma.

†With $E_b = 30,000V$ and $I_b = 0.1$ ma.

‡Difference between grid voltages (1) and (2).



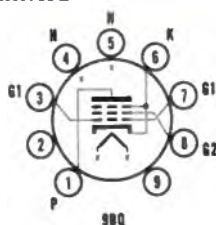
6BK5



General purpose power amplifier for service
where driving voltage is limited

HEATER CHARACTERISTICS

Voltage, a-c or d-c	6.3 volts
Current	1.2 amp
Peak heater-cathode voltage, max.	
Heater negative to cathode	200 volts
Heater positive to cathode*	200 volts
*D-c component must not exceed 100 volts, max.	



ELECTRICAL DATA

DIRECT INTERELECTRODE CAPACITANCES

Grid to plate: g1 to p.	0.6 μf
Input: g1 to k + h + g2 + b.p.	13 μf
Output: p to k + h + g2 + b.p.	5.0 μf

MAXIMUM RATINGS (Design center values)

Plate voltage	250 volts
Grid-2 voltage	250 volts
Grid 1 voltage, peak positive	0 volts
Plate dissipation	9.0 watts
Grid 2 dissipation	2.5 watts
Grid 1 circuit resistance	
Fixed bias	0.1 meg
Self bias	0.5 meg

CHARACTERISTICS AND TYPICAL OPERATION

Class A Amplifier

Plate voltage	250 volts
Grid 2 (screen) voltage	250 volts
Grid 1 (control-grid) voltage	-5.0 volts
Plate resistance (approx.)	100,000 ohms
Transconductance	8500 $\mu mhos$
Grid 1 input voltage, peak a-f.	5.0 volts
Plate current, zero signal	35 ma
Plate current, maximum signal (approx.)	37 ma
Grid 2 current, zero signal	3.5 ma
Grid 2 current, maximum signal (approx.)	10 ma
Load resistance impedance	6500 ohms
Total harmonic distortion (approx.)	7 %
Power output, maximum signal	3.5 watts

ENGINEERING DESIGN DATA

6BK4 (cont.)

PIN CONNECTIONS

Pin 1	Cathode
Pin 2	Heater
Pin 3	I. C. (do not use)
Pin 4	I. C. (do not use)
Pin 5	Grid
Pin 6	I. C. (do not use)
Pin 7	Heater
Pin 8	I. C. (do not use)
Cap.	Plate

APPLICATION

Typical operation in voltage regulated service is very similar to that for the 6792, triode connected operation. The 6792 data may be found in the SPECIAL PURPOSE TUBES section.

6BK5

FEBRUARY 25, 1957

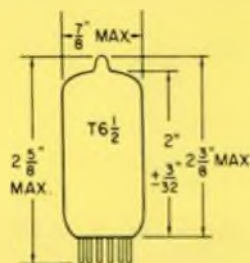
Beam power pentode

CHARACTERISTIC CURVES

(In curve section following APPENDIX)
Plate Characteristics ($E_c = 250V$) 172A
Plate Characteristics (ΔE_c) 172B
Transfer; $I_b (E_b = 250V)$ 172C
Transfer; $I_{c2} (E_b = 250V)$ 172D

MECHANICAL DATA

Cathode, coated unipotential
Bulb T-6½
Outline JETEC 6-3
Base Miniature 9-pin (ES-1)
Basing 9BQ
Mounting position Any



PIN CONNECTIONS

Pin 1	Plate
Pin 2	N. C.
Pin 3	Grid 1
Pin 4	Heater
Pin 5	Heater
Pin 6	Cathode, Grid 3
Pin 7	Grid 1
Pin 8	Grid 2
Pin 9	N. C.

APPLICATION

High power sensitivity, high transconductance, and high plate efficiency are features of this tube. Similar types are the 12BK5 and 250K5.

6BK6

(See chart for seldom-used tubes)

6BK7A

6BK7B

FEBRUARY 25, 1957

**Medium-mu
duotriode**

CHARACTERISTIC CURVES

(In curve section following APPENDIX)

Plate 144A
Transfer 144B
Characteristics, f_p , g_m , μ 144C

APPLICATION

Type 6BK7A is a medium-mu duotriode which is designed for service as a cascode amplifier at vhf. Characteristic features are high gain, low noise, and shielding between sections. A similar type is the 5BK7A.



6BK7A

6BK7B

**Very-high-frequency cascode amplifier
used in TV tuners†**



HEATER CHARACTERISTICS

Voltage, a-c or d-c 6.3 volts
Current 450 ma
Peak heater-cathode voltage, max.
Heater negative to
cathode* 200 volts
Heater positive to
cathode† 200 volts

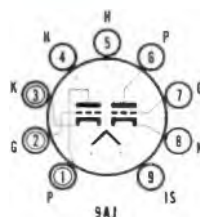
*In series cascode application the grounded stage value can be 300V max. under cutoff conditions.

†D-c component must not exceed 100 volts max.

Types 6BK7A and 6BK7B are identical to type 5BK7A except for heater characteristics.

†Type 6BK7A is a direct replacement for the 6BK7.

‡6BK7B is heater warm-up time controlled to 11 secs. average for use in 450 ma series heater strings.



6BL4

OCTOBER 1, 1956

Single diode

CHARACTERISTIC CURVES

(In curve section following APPENDIX)

Plate characteristics 164A

MECHANICAL DATA

Cathode, coated unipotential
Bulb T-12
Outline JETEC 12-26
Base Short Jumbo Shell Octal (88-71)
Basing 8GB
Mounting position Any



6BL4

**High-voltage half-wave TV damper diode
for horizontal-deflection circuits**

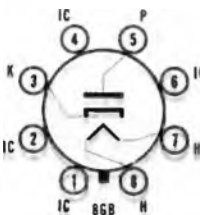


HEATER CHARACTERISTICS

Voltage 6.3 volts
Current 3.0 amps
Peak heater-cathode voltage, max.*
Heater negative to
cathode† 4500 volts
Heater positive to
cathode* 300 volts

†D-c component must not exceed 900 volts max.

*D-c component must not exceed 100 volts max.



6BL4 (cont.)

ELECTRICAL DATA

DIRECT INTERELECTRODE CAPACITANCES

Heater to cathode: h to k	5.0	μf
Cathode to plate-and-heater: k to p + h	16	μf
Plate to cathode-and-heater: p to k + h	11.5	μf

MAXIMUM RATINGS (Design center values unless noted)

TV Dampner Service*

Plate voltage, peak inverse†	4500	volts
Plate current, d-c	200	ma
Plate current, peak	1200	ma
Plate dissipation	8.0	watts

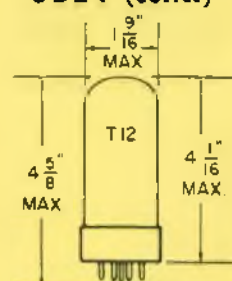
NOTES:

*Voltage pulse duration must not exceed 10 μs in a 525-line, 30-frame system.

†Absolute maximum value.

ENGINEERING DESIGN DATA

6BL4 (cont.)



PIN CONNECTIONS

Pin 1	1. C. ‡
Pin 2	1. C. ‡
Pin 3	Cathode
Pin 4	1. C. ‡
Pin 5	Plate
Pin 6	1. C. ‡
Pin 7	Heater
Pin 8	Heater

NOTES

‡Pins 1, 2, 4 and 6 are not to be used for tie points.



6BL7GT

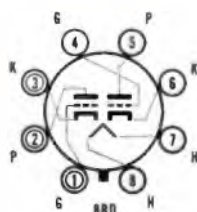


Vertical deflection amplifier and/or oscillator
for television receivers

HEATER CHARACTERISTICS

Voltage, a-c or d-c	6.3	volts
Current	1.5	amp
Peak heater-cathode voltage, max.		
Heater negative to cathode	200	volts
Heater positive to cathode*	200	volts

*D-c component 100 volts max.



ELECTRICAL DATA

DIRECT INTERELECTRODE CAPACITANCES

	Section 1	Section 2
Grid to plate: g1 to p	6.0	6.0 μf
Input: g1 to k + h	4.2	4.6 μf
Output: p to k + h	0.9	0.9 μf

MAXIMUM RATINGS (Design center values unless noted)*

Vertical Deflection Service	Amplifier	Oscillator
Plate voltage, d-c	500	500
Plate voltage, peak pos. (absolute max.)	2000	volts
Plate voltage, peak negative		400
Control-grid voltage, peak negative	250	volts
Plate dissipation (each plate)†	10	10
Plate dissipation (total for both plates)†	12	12
Cathode current, average	60	60
Cathode current, peak	210	210
Control-grid circuit resistance	2.2	2.2

6BL7GT

OCTOBER 30, 1956

Power triode

CHARACTERISTIC CURVES

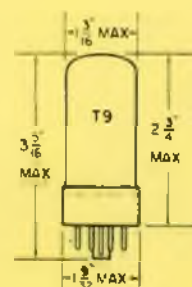
(In curve section following APPENDIX)

Plate.....175A

Transfer.....175B

MECHANICAL DATA

Cathode, coated unipotential	
Bulb.....	T-9
Outline.....	JETEC 9-41
Base.....	Short intermediate shell (B8-58)
Basing.....	8BD
Mounting position	Any



ENGINEERING DESIGN DATA

6BL7GT (cont.)

PIN CONNECTIONS

Pin 1	Grid 2
Pin 2	Plate 2
Pin 3	Cathode 2
Pin 4	Grid 1
Pin 5	Plate 1
Pin 6	Cathode 1
Pin 7	Heater
Pin 8	Heater

APPLICATION

Type 6BL7GT is specially designed for vertical deflection oscillator and amplifier service in television receivers.

6BN4

JUNE 1, 1957

Medium-mu triode

CHARACTERISTIC CURVES

(In curve section following APPENDIX)

Plate	101A
Transfer	101B
Characteristics; f_p , R_m , M	101C

APPLICATION

Type 6BN4 is a miniature medium-mu triode intended primarily for application as an r-f amplifier in vhf television tuners. It is identical to types 2BN4 and 3BN4 except for heater characteristics.

6BN6

OCTOBER 1, 1956

Gated beam pentode

CHARACTERISTIC CURVES

(In curve section following APPENDIX)

Plate ($E_{c2} = 60V$, $E_{c3} = 3.0V$)	127A
Operation	127B
Transfer; E_{c3} vs. I_b , ΔE_{c3}	127C
Transfer; E_{c3} vs. I_b , E_{c3}	127D

APPLICATION

Type 6BN6 in a quadrature-grid circuit performs the combined functions of f-m limiter, f-m discriminator, and audio amplifier.

6BL7GT (cont.)

CHARACTERISTICS

Each Section

Plate voltage	250 volts
Grid voltage	-9 volts
Plate current (1)	40 ma
Transconductance	7000 μ mhos
Amplification factor	15
Plate resistance, approx.	2150 ohms
Plate current (2) at $E_c = -17V$	4.0 ma
Grid voltage, approx., for $I_b = 50 \mu a$	-23 volts

NOTES:

*Voltage pulse duration must not exceed 2500 μs in a 525-line, 30-frame system.

†Tube protection is needed for no-drive conditions if grid-resistor bias is used.



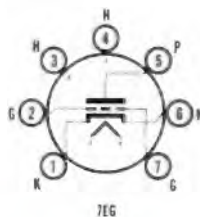
6BN4



R-f amplifier in vhf television tuners

HEATER CHARACTERISTICS

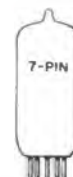
Voltage, a-c or d-c	6.3 volts
Current	200 ma
Peak heater-cathode voltage, max.	
Heater negative to cathode	100 volts
Heater positive to cathode	100 volts



Type 6BN4 is identical to types 2BN4 and 3BN4 except for heater characteristics. See type 2BN4 for ratings and operating characteristics.



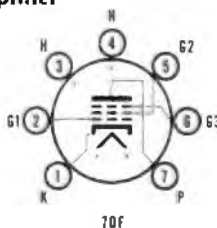
6BN6



Gated-beam tube for service as f-m discriminator, limiter, and audio amplifier

HEATER CHARACTERISTICS

Voltage, a-c or d-c	6.3 volts
Current	300 ma
Peak heater-cathode voltage, max.	
Heater negative to cathode	90 volts
Heater positive to cathode	90 volts



Type 6BN6 is identical to type 3BN6 except for heater ratings.

6BN7

(See chart for seldom-used tubes)

CBS ELECTRON TUBES



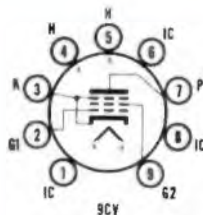
6BQ5



General purpose power amplifier with high power output and high power sensitivity

HEATER CHARACTERISTICS

Voltage, a-c or d-c.....	6.3 volts
Current.....	760 ma
Peak heater-cathode voltage, max.	
Heater negative to cathode.....	100 volts
Heater positive to cathode.....	100 volts



ELECTRICAL DATA

DIRECT INTERELECTRODE CAPACITANCES

Grid to plate: g1 to p, max.....	0.5 μ f
Input: g1 to all.....	10.8 μ f
Output: p to all.....	6.5 μ f
Grid to heater: g1 to h, max.....	0.25 μ f

MAXIMUM RATINGS (Design center values)

Plate voltage.....	300* volts
Plate supply voltage.....	550 volts
Grid 2 voltage.....	300 volts
Grid 2 supply voltage.....	550 volts
Negative grid 1 voltage.....	100 volts
Plate dissipation.....	12* watts
Grid 2 dissipation, average.....	2 watts
Grid 2 dissipation, peak.....	4 watts
Cathode current, average.....	65 ma
Grid 1 voltage for grid current starting point with $I_{g1} = 0.3 \mu$ a.....	-1.3 volts
Grid circuit resistance.....	
Fixed bias.....	0.3 meg
Self bias.....	1.0 meg

CHARACTERISTICS AND TYPICAL OPERATION

Class A Amplifier (Single Tube)

	Triode Connected†	Pentode
Plate voltage.....	250	250 volts
Grid 2 (screen) voltage.....		250 volts
Grid 1 (control-grid) voltage.....		-7.3 volts
Cathode bias resistor.....	270	135 ohms
Plate resistance (approx.).....		38,000 ohms
Transconductance.....		11,300 μ mhos
Grid 1 input voltage, peak a-f.....	9.4	6.0 volts
Plate current, zero signal.....	34	48 ma
Plate current, maximum signal.....	36	49.5 ma
Grid 2 current, zero signal.....		5.5 ma
Grid 2 current, maximum signal.....		10.8 ma
Load resistance impedance.....	3500	5200 ohms
Total harmonic distortion (approx.).....	9	10 %
Power output, maximum signal.....	1.95	5.7 watts
Amplification factor of grid 2 with respect to grid 1 zero signal.....		19

ENGINEERING DESIGN DATA

6BQ5

NOVEMBER 1, 1957

Beam power pentode

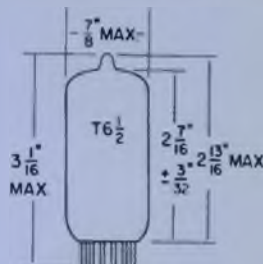
CHARACTERISTIC CURVES

(In curve section following APPENDIX)

Plate ($E_{c2} = 300V$).....	214A
Plate ($E_{c2} = 250V$).....	214B
Plate ($E_{c2} = 210V$).....	214C
Plate—triode connected.....	214D
Operation, Class A ($E_b = E_{c2} = 250V$).....	214E
Operation, Class AB ($E_b = E_{c2} = 300V$).....	214F
Operation, Class AB ($E_b = E_{c2} = 250V$).....	214G

MECHANICAL DATA

Cathode, coated unipotential.....	
Bulb.....	T-6½
Outline.....	As shown
Base.....	9-pin Miniature (E9-1)
Basing.....	9CV
Mounting position.....	Any



PIN CONNECTIONS

Pin 1.....	IC
Pin 2.....	Grid 1
Pin 3.....	Cathode, G3
Pin 4.....	Heater
Pin 5.....	Heater
Pin 6.....	IC
Pin 7.....	Plate
Pin 8.....	IC
Pin 9.....	Grid 2

ENGINEERING DESIGN DATA

6BQ5 (cont.)

APPLICATION

Type 6BQ5 is a miniature beam power featuring extremely high output for its size. It is suitable for equipment needing 6 watts output from a single tube or 17 watts output from 2 tubes in push pull. An additional feature is its very high power sensitivity.

6BQ5 (cont.)

PUSH-PULL AMPLIFIER (Value for two tubes)

	Class AB		Class B		
Plate voltage.....	250	300	250	300	volts
Grid 2 (screen) voltage.....	250	300	250	300	volts
Grid 1 (control-grid) voltage.....			11.6	14.7	volts
Cathode bias resistor.....	130	130			ohms
Grid-to-grid input voltage, peak a-f.....	22.4	28	22.4	28	volts
Plate current, zero signal.....	62	72	20	15	ma
Plate current, maximum signal....	75	92	75	92	ma
Grid 2 current, zero signal.....	7	8	2.2	1.6	ma
Grid 2 current, maximum signal....	15	22	15	22	ma
Load resistance, plate-to-plate...	8000	8000	8000	8000	ohms
Total harmonic distortion (approx.)..	3	4	3	4	%
Power output, maximum signal....	11	17	11	17	watts

NOTES:

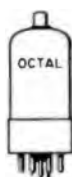
*When the heater and positive voltage are obtained from a storage battery by means of a vibrator, the maximum values of the plate and grid 2 voltages are 250 volts and the plate dissipation is 9 watts.

†Grid 2 connected to plate.



6BQ6GT

6BQ6GA • 6BQ6GTA
6BQ6GTB

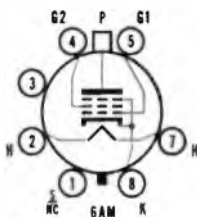


Horizontal deflection amplifier for television receivers

HEATER CHARACTERISTICS

Voltage, a-c or d-c.....	6.3 volts
Current.....	1.2 amp
Peak heater-cathode voltage, max.	
Heater negative to cathode.....	200 volts
Heater positive to cathode*.....	200 volts

*D-c component must not exceed 100 volts max.



ELECTRICAL DATA

DIRECT INTERELECTRODE CAPACITANCES

	6BQ6GT	6BQ6GA	6BQ6GTB
Grid to plate: g1 to p.....	0.6	0.6	0.6 μ f
Input: g1 to k + h + g2 + b.p.....	15	15	15 μ f
Output: p to k + h + g2 + b.p.....	7	7.0	7.0 μ f

MAXIMUM RATINGS (Design center values unless noted)

	6BQ6GTB	6BQ6GA	6BQ6GT
Plate supply voltage, d-c (boost + d-c power supply)....	600	600	550 volts
Plate voltage, peak pos. (absolute max.).....	6000	6000	5500 volts
Plate voltage, peak negative pulse.....	1250	1250	1250 volts
Grid 2 voltage, d-c.....	200	200	175 volts
Grid 1 voltage, peak negative.....	300	300	300 volts
Plate dissipation.....	11	11	11 watts
Grid 2 dissipation.....	2.5	2.5	2.5 watts
Cathode current, av.....	110	110	110 ma
Cathode current, peak.....	400	400	400 ma
Grid 1 circuit resistance.....	0.47	0.47	0.47 meg
Bulb temperature at hottest point			
220°C for 6BQ6GT, 6BQ6GTA, 6BQ6GTB and 6BQ6GA			

AVERAGE CHARACTERISTICS

	6BQ6GTB	6BQ6GA	6BQ6GT	6BQ6GTA
Plate voltage.....	250	250	250	250 volts
Grid 2 (screen) voltage.....	150	150	150	150 volts
Grid 1 (control-grid) voltage.....	-22.5	-22.5	-22.5	-22.5 volts
Plate resistance (approx.).....	14,500	14,500	14,500	14,500 ohms
Transconductance.....	5900	5900	5900	5900 μ mhos
Plate current.....	57	57	55	55 ma
Grid 2 current.....	2.1	2.1	2.1	2.1 ma
Grid 1 voltage (approx.) for $I_b = 1.0$ ma.....	-43	-43	-43	-43 volts

ENGINEERING DESIGN DATA

6BQ6GT

6BQ6GA • 6BQ6GTA

6BQ6GTB

MAY 13, 1957

Beam power pentode

CHARACTERISTIC CURVES

(In curve section following APPENDIX)

Plate ($E_{c2} = 100V$)..... 105A

Plate ($E_{c2} = 150V$)..... 105B

MECHANICAL DATA

Cathode, coated unipotential

Bulb

6BQ6GT, 6BQ6GTA,

6BQ6GTB..... T-9

6BQ6GA..... T-11 or T-12

Outline (JEDEC)

6BQ6GT, 6BQ6GTA,

6BQ6GTB..... 9-49 or 9-50

6BQ6GA..... As shown

Base (JEDEC)

6BQ6GA..... B7-119, B6-122, B5-187,

B7-12, B6-83, B7-111, B6-148

6BQ6GT..... B7-7

6BQ6GT, 6BQ6GTA,

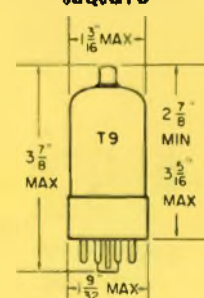
6BQ6GTB..... B7-7, B6-81, B7-59, B6-84

Basing..... 6AM

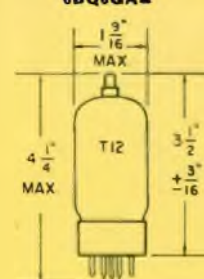
Cap..... JEDEC C1-2, C1-3, C1-33

Mounting position..... Any

6BQ6GT • 6BQ6GTA 6BQ6GTB



6BQ6GA



▲ T-11 outline is identical except for having a maximum diameter of 1 7/8 inches.

ENGINEERING DESIGN DATA

6BQ6GT • 6BQ6GA 6BQ6GTA • 6BQ6GTB (cont.)

PIN CONNECTIONS

Pin 1	N. C.†
Pin 2	Heater
Pin 3	N. C.†
Pin 4	Grid 2
Pin 5	Grid 1
Pin 7	Heater
Pin 8	Cathode, B. P.
Cap.	Plate

†Pin 1 omitted in 6-pin bases and B5-187.

‡Pin 3 omitted on B5-187.

NOTES

Ratings are for operation in a 525-line, 30-frame television system. They are unilaterally interchangeable in the following order: 6BQ6GT, 6BQ6GTA, 6BQ6GA, 6BQ6GTB, not considering the larger bulb size of the 6BQ6GA.

6BQ6GT • 6BQ6GA • 6BQ6GTA • 6BQ6GTB (cont.)

Instantaneous Values

	6BQ6GT	6BQ6GA 6BQ6GT	6BQ6GTA
Plate voltage	60	60	volts
Grid 2 (screen) voltage	150	150	volts
Grid 1 (control-grid) voltage	0	0	volts
Plate current	260	260	ma
Grid 2 current	26	26	ma

Triode Connected

Plate and grid 2 voltage (p + g2 tied together)	150	volts
Grid 1 voltage	-22.5	volts
Amplification factor	4.3	

TYPICAL OPERATION

Horizontal Deflection for 70° Picture Tube

Plate supply voltage (boost + d-c supply)	465	volts
Plate voltage, peak positive (d-c + pulse)	3440	volts
Grid 2 (screen) voltage	140	volts
Grid 1 (control-grid) voltage, d-c	-28	volts
Grid 1 (control-grid) input voltage		
Sawtooth component, peak-to-peak	74	volts
Negative peaking component	18	volts
Plate current, average	83	ma
Grid 2 (screen) current	12.3	ma
Plate dissipation	5.1	watts
Grid 1 resistance	0.33	meg
Anode voltage of CRT	14	kv

NOTES:

*Voltage pulse duration must not exceed 10 μ s in a 525-line, 30-frame system.

†Tube protection is needed for no-drive conditions if grid-resistor bias is used.

6BQ7A

JUNE 10, 1956

Medium- μ
duotriode

CHARACTERISTIC CURVES

(In curve section following APPENDIX)

Plate	123A
Plate	123B
Operation (Cascode amplifier)	123C
Transfer	123D
Transfer	123E

APPLICATION

Type 6BQ7A is a 9-pin miniature, high-gain, low noise duotriode designed for use as the cascode r-f amplifier in tuners of vhf television receivers.



6BQ7A



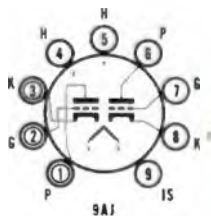
High-gain, low-noise vhf cascode amplifier
in television tuners

HEATER CHARACTERISTICS

Voltage, a-c or d-c	6.3	volts
Current	400	ma
Peak heater-cathode voltage, max.		
Heater negative to cathode*	200	volts
Heater positive to cathode	200	volts

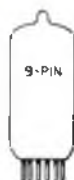
*This may be as high as 300 volts under cutoff conditions in r-f grounded grid circuit with direct coupled drive.

Type 6BQ7A is identical to type 4BQ7A except for heater characteristics.





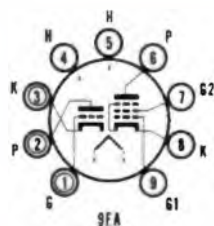
6BR8



Vhf local oscillator and mixer for fm and television receivers

HEATER CHARACTERISTICS

Voltage, a-c or d-c.....	6.3	volts
Current.....	450	ma
Peak heater-cathode voltage, max.		
Heater negative to cathode.....	250	volts
Heater positive to cathode*	200	volts
*D-c component must not exceed 100 volts max.		



Type 6BR8 is identical to type 5BR8 except for heater characteristics.

ENGINEERING DESIGN DATA

6BR8

OCTOBER 30, 1956

Medium-mu triode—sharp-cutoff pentode

CHARACTERISTIC CURVES

(In curve section following APPENDIX)

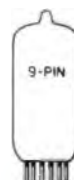
Screen Grid Rating Chart.....	100A
Plate, triode.....	145A
Transfer, triode, I_b	145B
Characteristics, I_p , g_m , μ	145C
Plate, pentode ($E_{c2} = 110V$).....	145D
Transfer, pentode, g_m	145E

APPLICATION

Type 5BR8 is a combined medium-mu triode and sharp-cutoff pentode with electrically independent cathodes. It is designed for service as a vhf local oscillator and mixer for fm or television receivers.



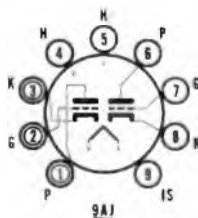
6BS8



Low-noise vhf amplifier for cascode amplifier operation

HEATER CHARACTERISTICS

Voltage, a-c or d-c.....	6.3	volts
Current.....	400	ma
Peak heater-cathode voltage, max.		
Heater negative to cathode.....	200	volts
Heater positive to cathode.....	200	volts



Type 6BS8 is identical to type 4BS8 except for heater characteristics.

6BS8

OCTOBER 30, 1956

Medium-mu duotriode

APPLICATION

Type 6BS8 is a medium-mu duotriode designed for use as a low-noise vhf amplifier with high transconductance. Section 2 (pins 1, 2, and 3) is the input section of the cascode circuit.

6BT6 • 6BU5 • 6BU6

(See chart for seldom-used tubes)

ENGINEERING DESIGN DATA

6BU8

OCTOBER 30, 1956

Double sharp-cutoff pentode

CHARACTERISTIC CURVES

(In curve section following APPENDIX)
Plate ($E_{c2}=67.5V$, $I_{c1}=0.1$ ma).....176A
Plate ($E_{c2}=67.5V$, $E_{c3}=0V$).....176B
Characteristics; I_{b1} , I_{c2} vs. E_{b1}176C
Characteristics; I_{c2} , I_{c3} vs. E_{b1}176D
Screen characteristics ($E_{c3}=67.5V$).....176E
Transfer, both sections ($E_{c3}=0V$).....176F
Transfer, each section ($E_{c3}=0V$).....176G

APPLICATION

Type 6BU8 is a sharp-cutoff double pentode designed for application as a combined sync and agc tube in television receivers. The common grid 1 can be utilized for noise pulse suppression from both circuits.

6BV8

OCTOBER 30, 1956

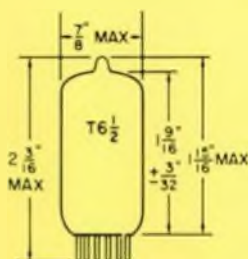
Duodiode—triode

CHARACTERISTIC CURVES

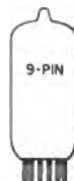
(In curve section following APPENDIX)
Plate, each diode.....120A
Plate, triode.....198A
Characteristics, triode; g_m , r_p , μ198B
Transfer, triode.....198C

MECHANICAL DATA

Cathode, coated unipotential.....T-6½
Bulb.....JETEC 6-2
Outline.....Miniature 9-pin (E9-1)
Base.....Basing.....9FJ
Mounting position.....Any



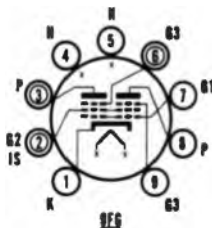
6BU8



**Duopentode for combined sync and
agc in television receivers**

HEATER CHARACTERISTICS

Voltage, a-c or d-c.....6.3 volts
Current.....300 ma
Peak heater-cathode voltage, max.
Heater negative to
cathode.....200 volts
Heater positive to
cathode*.....200 volts
*D-c component must not exceed 100
volts max.



Type 6BU8 is identical to type 3BU8 except for heater characteristics.



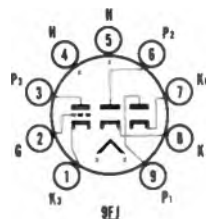
6BV8



**Combined synchronous detector and chrominance
amplifier for color TV receivers**

HEATER CHARACTERISTICS

Voltage, a-c or d-c.....6.3 volts
Current.....600 ma
Peak heater-cathode voltage, max.
Heater negative to
cathode.....200 volts
Heater positive to
cathode*.....200 volts
Warm-up time.....11 secs. average
(See Series-String Heaters section of
APPENDIX in CBS Tube Manual)
*D-c component must not exceed 100
volts max.



ELECTRICAL DATA

DIRECT INTERELECTRODE CAPACITANCES

Triode

Grid to plate: g1 to p.....	2.0	μmf
Input: g1 to k + h.....	3.6	μmf
Output: p to k + h.....	0.4	μmf

Diode

Diode 1 plate to diode 1 cathode and heater.....	2.4	μmf
Diode 2 plate to diode 2 cathode and heater.....	2.4	μmf
Coupling:		
Triode grid to diode 1 plate, max.....	0.03	μmf
Triode grid to diode 2 plate, max.....	0.07	μmf

6BV8 (cont.)

MAXIMUM RATINGS (Design center values)

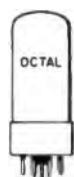
Plate voltage.....	330	volts
Control-grid voltage, positive d-c.....	0	volts
Plate dissipation.....	2.7	watts
Diode current for continuous operation, each diode.....	10	ma
Control-grid circuit resistance		
Fixed bias.....	0.1	meg
Self bias.....	0.5	meg

CHARACTERISTICS AND TYPICAL OPERATION

Plate voltage.....	75	200	volts
Control-grid voltage.....	0		volts
Cathode-bias resistor.....		330	ohms
Plate resistance (approx.).....		5900	ohms
Transconductance.....		5600	μ hos
Amplification factor.....		33	
Plate current.....	14	11	ma
Control-grid voltage (approx.) for $I_b = 100 \mu$ a.....		-11	volts
Average diode current, with 5 volts applied (each diode).....		23	ma



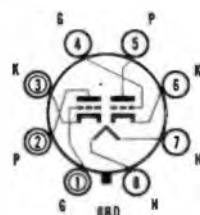
6BX7GT



**Vertical deflection amplifier and/or oscillator
for television receivers**

HEATER CHARACTERISTICS

Voltage, a-c or d-c.....	6.3	volts
Current.....	1.5	amp
Peak heater-cathode voltage, max.		
Heater negative to cathode.....	200	volts
Heater positive to cathode*.....	200	volts
*D-c component 100 volts max.		



ELECTRICAL DATA

DIRECT INTERELECTRODE CAPACITANCES

	Section 1†	Section 2	
Grid to plate: g1 to p.....	4.2	4.0	μ f
Input: g1 to k + h.....	4.4	4.8	μ f
Output: p to k + h.....	1.1	1.2	μ f
Grid to grid.....		0.11	μ f
Plate to plate.....		1.5	μ f

MAXIMUM RATINGS (Design center values unless noted)*

	Oscillator†	Amplifier
Plate voltage, d-c.....	500	500
Plate voltage, peak pos. (absolute max.).....		2000
Plate voltage, peak negative.....	400	250
Plate dissipation (each plate)†.....	10	10
Plate dissipation (total for both plates)†.....	12	12
Cathode current, average.....	60	60
Cathode current, peak.....	180	180
Control-grid circuit resistance, self bias.....	2.2	2.2

ENGINEERING DESIGN DATA

6BV8 (cont.)

PIN CONNECTIONS

Pin 1.....	Triode Cathode
Pin 2.....	Triode Grid
Pin 3.....	Triode Plate
Pin 4.....	Heater
Pin 5.....	Heater
Pin 6.....	Diode 2 Plate
Pin 7.....	Diode 1 Cathode
Pin 8.....	Diode 2 Cathode
Pin 9.....	Diode 1 Plate

REFERENCES

See explanation of warm-up time controlled series-string heater circuits in APPENDIX. See APPENDIX for R-C amplifier data.

APPLICATION

Type 6BV8 is a miniature duodiode and medium- μ triode with a separate plate and cathode for each diode section. It is intended basically for use as a combined synchronous detector and chrominance amplifier in color television receivers.

It may also be used as an i-m detector and audio amplifier.

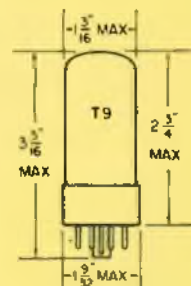
6BX7GT

OCTOBER 30, 1956

Power triode

MECHANICAL DATA

Cathode, coated unipotential.....	
Bulb.....	T-9
Outline.....	JETEC 9-41
Base.....	Short intermediate shell octal (BB-5B)
Basing.....	8BD
Mounting position.....	Any



ENGINEERING DESIGN DATA

6BX7GT (cont.)

PIN CONNECTIONS

Pin 1	Grid (Sect. 2)
Pin 2	Plate (Sect. 2)
Pin 3	Cathode (Sect. 2)
Pin 4	Grid (Sect. 1)
Pin 5	Plate (Sect. 1)
Pin 6	Cathode (Sect. 1)
Pin 7	Heater
Pin 8	Heater

APPLICATION

The 6BX7GT is a high perveance diode which is employed as a combined vertical oscillator and amplifier in television receivers.

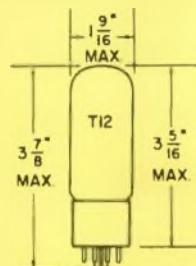
6BY5GA

OCTOBER '30, 1956

Double diode

MECHANICAL DATA

Cathode, coated unipotential	
Bulb	T-12
Outline	JETEC I2-14
Base	Medium shell 7-pin octal (B7-12)
Basing	6CN
Mounting position	Any



PIN CONNECTIONS

Pin 1	Cathode (Sect. 2)
Pin 2	Heater
Pin 3	N. C.
Pin 4	Plate (Sect. 2)
Pin 5	Plate (Sect. 1)
Pin 7	Heater
Pin 8	Cathode (Sect. 1)

REFERENCES

See the APPENDIX for an explanation of television damper diodes.

APPLICATION

Types 6BY5G and 6BY5GA are full-wave rectifiers used in power supplies or in television damper applications.

6BX7GT (cont.)

AVERAGE CHARACTERISTICS

	Instantaneous Values	
Plate voltage	100	250 volts
Control-grid voltage	0	volts
Cathode resistor		390 ohms
Plate resistance (approx.)		1300 ohms
Transconductance		7600 μ mhos
Amplification factor		10
Plate current	80	42 ma
Grid 1 voltage (approx.) for $I_b = 50 \mu$ a		-40 volts

NOTES:

- *Voltage pulse duration must not exceed 2500 μ s in a 525-line, 30-frame system.
- †Tube protection is needed for no-drive conditions if grid-resistor bias is used.
- ‡Oscillator service is recommended for section 1 (Pins 4, 5, and 6).

6BY5G

(See chart for seldom-used tubes)



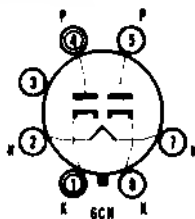
6BY5GA



Full-wave power rectifier or TV damper†

HEATER CHARACTERISTICS

Voltage, a-c or d-c	6.3 volts
Current	1.6 amp
Peak heater-cathode voltage, max.	
Heater negative to cathode	450 volts
Heater positive to cathode	100 volts



ELECTRICAL DATA

MAXIMUM RATINGS (Design center values unless noted) Rectifier and Damper Service*

Plate voltage, peak inverse, absolute max. (each plate)	
Rectifier	1400 volts
Damper	3000 volts
Output current, d-c	175 ma
Plate current, peak steady state (each plate)	0.525 amp

CHARACTERISTICS

Tube Voltage Drop

Conducting 175 ma (each plate)	32 volts
--------------------------------	----------

TYPICAL OPERATION

Full-Wave Rectifier (Capacitor Input Filter)

Plate supply voltage, rms (each plate)	375 volts
Plate supply resistance (each plate)	100 ohms
Filter input capacitor	8.0 μ f
Output current, d-c	175 ma
Output voltage at filter input, d-c	380 volts

NOTES:

- *In damper applications, voltage pulse duration must not exceed 10 μ s in a 525-line, 30-frame system.
- †Type 6BY5G, except for its ST-14 bulb, is identical to type 6BY5GA.

CBS ELECTRON TUBES



6BY6

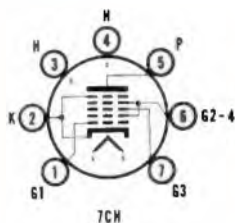


Gated amplifier for service as a sync separator or clipper in color television receivers

HEATER CHARACTERISTICS

Voltage, a-c or d-c.	6.3 volts
Current	300 ma
Peak heater-cathode voltage, max.	
Heater negative to cathode	200 volts
Heater positive to cathode*	200 volts
*D-c component must not exceed 100 volts max.	

Type 6BY6 is identical to type 3BY6 except for heater ratings.



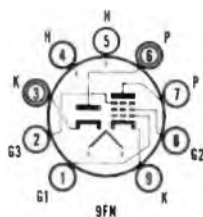
6BY8



R-f and i-f amplifier combined with a diode detector, heater warm-up controlled for series strings

HEATER CHARACTERISTICS

Voltage, a-c or d-c.	6.3 volts
Current	600 ma
Peak heater-cathode voltage, max.	
Heater negative to cathode	200 volts
Heater positive to cathode*	200 volts
Warm-up time	11 secs. average
(See Series-String Heaters section of APPENDIX in CBS Tube Manual).	
*D-c component 100 volts max.	



ELECTRICAL DATA

DIRECT INTERELECTRODE CAPACITANCES—Shield Pentode

Grid to plate: g1 to p, max.	.0035	μ f
Input: g1 to k + h + g2 + g3 + i.s.	5.5	μ f
Output: p to k + h + g2 + g3 + i.s.	5.0	μ f

Diode

Diode plate to all	4.8	μ f
†JETEC shield 315 connected to pentode cathode		

MAXIMUM RATINGS (Design center values)

Pentode

Plate voltage	300 volts
Grid 2 voltage	See Rating Chart in APPENDIX
Grid 2 supply voltage	300 volts
Grid 1 voltage, negative d-c.	-50 volts
Grid 1 voltage, positive d-c.	0 volts
Plate dissipation	3.0 watts
Grid 2 dissipation	0.65 watt

Diode

Plate voltage, peak inverse	430 volts
Plate current, peak	180 ma
D-c current	45 ma

CBS ELECTRON TUBES

ENGINEERING DESIGN DATA

6BY6

OCTOBER 1, 1956

Dual-control heptode

APPLICATION

Type 6BY6 is a miniature, dual-control heptode designed to function as a sync separator or sync clipper in television receivers. Each of the two independent control grids has sharp-cutoff characteristics.

NOTES

For service in 600 ma series-string receivers use the 3BY6 which is identical except for heater ratings.

6BY8

JUNE 1, 1957

High perveance diode—sharp-cutoff pentode

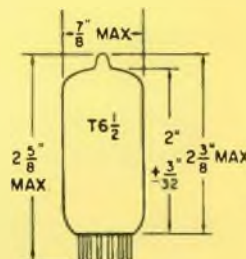
CHARACTERISTIC CURVES

(In curve section following APPENDIX)

Screen Grid Rating	100A
Plate ($E_{c2} = 100V$)	121A
Plate ($E_{c2} = 150V$)	121B
Plate, triode connected	121C
Transfer; i_b & i_{c2}	121D
Transfer; g_m	121E

MECHANICAL DATA

Cathode, coated unipotential	
Bulb	T-6 1/2
Outline	JETEC 6-3
Base	Miniature 9-pin (E9-1)
Basing	.9FN
Mounting position	Any



PIN CONNECTIONS

Pin 1	Pentode Grid 1
Pin 2	Pentode Grid 3, I. S.
Pin 3	Diode Cathode
Pin 4	Heater
Pin 5	Heater
Pin 6	Diode Plate
Pin 7	Pentode Plate
Pin 8	Pentode Grid 2
Pin 9	Pentode Cathode

ENGINEERING DESIGN DATA

6BY8 (cont.)

REFERENCES

See explanation of warm-up time controlled series-string heater circuits in APPENDIX.

APPLICATION

Type 6BY8 is a miniature high permeance diode and sharp-cutoff pentode for use as a limiter or detector and an amplifier.

NOTES

Type 6BY8 has a pentode section similar to the 6AU6.

6BY8 (cont.)

CHARACTERISTICS AND TYPICAL OPERATION

Class A Amplifier—(Pentode Section)

Plate voltage.....	100	250	volts
Grid 3 (suppressor).....	connect to pentode cathode at socket		
Grid 2 (screen) voltage.....	100	150	volts
Cathode bias resistor.....	150	68	ohms
Plate resistance (approx.).....	0.5	1.0	meg
Transconductance.....	3900	5200	μ hos
Plate current.....	5.0	10.6	ma
Grid 2 current.....	2.1	4.3	ma
Grid 1 voltage (approx.) for $I_b = 10 \mu$ a.....	-4.2	-6.5	volts

Diode Section

Average diode current at 10 volts, d-c.....	60	ma
---	----	----

6BZ6

OCTOBER 1, 1956

Semiremote-cutoff pentode

CHARACTERISTIC CURVES

(In curve section following APPENDIX)

Screen Grid Rating.....	100A
Plate ($E_{c1} = 150V$).....	129A
Transfer; ($E_b = 200V$, $E_{c2} = 150V$).....	129B

APPLICATION

Type 6BZ6 is a high gm, semiremote cutoff pentode intended for the application of age. Its grid characteristic reduces cross modulation caused by strong signals.

6BZ7

JUNE 10, 1956

Medium-mu duotriode

CHARACTERISTIC CURVES

(In curve section following APPENDIX)

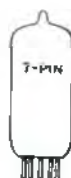
Plate.....	135A
Plate.....	135B
Transfer.....	135C
Transfer.....	135D

APPLICATION

Type 6BZ7 is a duotriode designed for use in low noise vhf amplifier applications and particularly for cascode operation. It features high transconductance and low-noise characteristics.



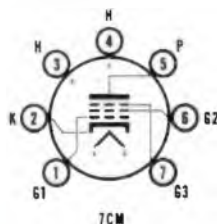
6BZ6



Intermediate-frequency amplifier for
gain-controlled stages in TV receivers

HEATER CHARACTERISTICS

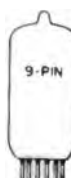
Voltage, a-c or d-c.....	6.3	volts
Current.....	300	ma
Peak heater-cathode voltage, max.		
Heater negative to cathode.....	200	volts
Heater positive to cathode*.....	200	volts
*D-c component must not exceed 100 volts max.		



Type 6BZ6 is identical to type 3BZ6 except for heater ratings.



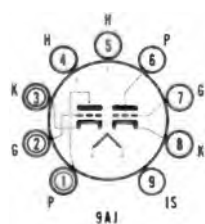
6BZ7



High-gain, low-noise cascode amplifier
in television receivers

HEATER CHARACTERISTICS

Voltage, a-c or d-c.....	6.3	volts
Current.....	400	ma
Peak heater-cathode voltage, max.		
Heater negative to cathode.....	200	volts
Heater positive to cathode*.....	200	volts
*This may be as high as 300 volts under cutoff conditions in r-f grounded grid circuit with direct coupled drive.		
†D-c component must not exceed 100 volts.		

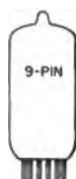


Type 6BZ7 is identical to type 4BZ7 except for heater characteristics.

CBS ELECTRON TUBES



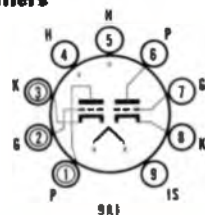
6BZ8



Gain-controlled low-noise vhf cascode amplifier for television tuners

HEATER CHARACTERISTICS

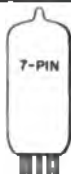
Voltage, a-c or d-c.....	6.3 volts
Current.....	400 ma
Peak heater-cathode voltage, max.	
Heater negative to cathode.....	200 volts
Heater positive to cathode.....	200 volts



Type 6BZ8 is identical to type 4BZ8 except for heater characteristics.



6C4

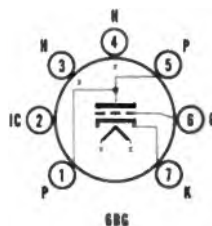


High-frequency oscillator or Class C radio-frequency amplifier

HEATER CHARACTERISTICS

Voltage, a-c or d-c.....	6.3 volts
Current.....	150 ma
Peak heater-cathode voltage, max.	
Heater negative to cathode.....	200 volts
Heater positive to cathode.....	200 volts

*D-c component must not exceed 100 volts max.



ELECTRICAL DATA

DIRECT INTERELECTRODE CAPACITANCES

Grid to plate: g1 to p.....	1.6 μ f
Input: g1 to k + h.....	1.8 μ f
Output: p to k + h.....	1.3 μ f

MAXIMUM RATINGS (Design center values)

	Class C Tele.†	Class A Amp.
Plate voltage.....	300	300 volts
Plate dissipation.....	5.0	3.5 watts
Plate current.....		25 ma
Grid current.....		8.0 ma
Control-grid circuit resistance		
Fixed bias.....	0.25 meg	
Self bias.....	1.0 meg	

CHARACTERISTICS AND TYPICAL OPERATION

	Class C Tele.†	Class A Amp.
Plate voltage.....	300	250 volts
Control-grid voltage.....	-27	-8.5 volts
Plate resistance (approx.).....	6250	7700 ohms
Transconductance.....	3100	2200 μ hos
Amplification factor.....	19.5	17
Plate current.....	25	11.8 ma
Grid current.....	8	ma
Drive power.....	.35	watt
Output.....	5.5	watts

NOTE:

†For use in Class C Telephony operation as an r-f power amplifier and oscillator with typical operation up to 50 megacycles. Approximately 2.5 watts output can be obtained when the 6C4 is operated as a 150 mc oscillator with a 10000 ohm grid resistor at full input.

CBS ELECTRON TUBES

ENGINEERING DESIGN DATA

6BZ8

OCTOBER 30, 1956

Semiremote-cutoff duotriode

APPLICATION

Type 6BZ8 is a semiremote-cutoff duotriode designed for use as a gain-controlled, low-noise vhf cascode amplifier. Section 1 (pins 6, 7, and 8) is the input section of the cascode circuit.

6C4

NOVEMBER 1, 1956

Medium-mu triode

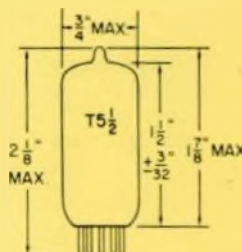
CHARACTERISTIC CURVES

(In curve section following APPENDIX)

Plate.....177A

MECHANICAL DATA

Cathode, coated unipotential
 Bulb.....T-5½
 Outline.....JETEC 5-2
 Base.....Miniature 7-pin (E7-1)
 Basing.....6BG
 Mounting position.....Any



PIN CONNECTIONS

Pin 1.....	Plate
Pin 2.....	I. C.*
Pin 3.....	Heater
Pin 4.....	Heater
Pin 5.....	Plate
Pin 6.....	Grid
Pin 7.....	Cathode

*Do not use.

REFERENCES

See APPENDIX for R-C amplifier data.

APPLICATION

Type 6C4 is a medium-mu triode designed for application as a high-frequency oscillator or class C r-f amplifier. It is electrically similar to one section of a type 12AU7.

ENGINEERING DESIGN DATA

6C5

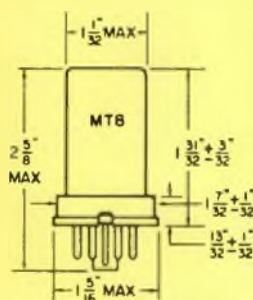
6C5GT

NOVEMBER 1, 1956

Medium-mu triode

MECHANICAL DATA

Cathode, coated		
unipotential	6C5	6C5GT
Bulb	Metal	T-9
Outline, JETEC	8-3	9-12
Base	Small wafer octal (86-23)	
Basing		6Q
Mounting position		Any



PIN CONNECTIONS

Pin 1	Shell, N. C.
Pin 2	Heater
Pin 3	Plate
Pin 5	Grid 1
Pin 7	Heater
Pin 8	Cathode

REFERENCES

See APPENDIX for R-C amplifier data.

APPLICATION

Type 6C5GT is a medium-mu general purpose triode designed for use as an oscillator, amplifier, or detector.



6C5

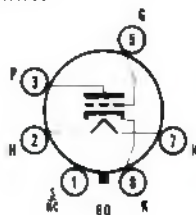
6C5GT



General purpose triode for use as an oscillator, detector, or amplifier

HEATER CHARACTERISTICS

Voltage, a-c or d-c	6.3 volts
Current	300 ma
Peak heater-cathode voltage, max.	90 volts



ELECTRICAL DATA

DIRECT INTERELECTRODE CAPACITANCES

Grid to plate: g1 to p	1.6 μf
Input: g1 to k + h	3.6 μf
Output: p to k + h	11.0 μf

With shell or shield connected to the cathode.

MAXIMUM RATINGS (Design center values)

Plate voltage	300 volts
Control-grid voltage, positive d-c	0 volts
Plate dissipation	2.5 watts

CHARACTERISTICS AND TYPICAL OPERATION

Class A Amplifier

Plate voltage	250 volts
Control-grid voltage	-8.0 volts
Plate resistance (approx.)	10 kilohms
Transconductance	2000 μmhos
Amplification factor	20
Plate current	8.0 ma

6C6 • 6C7 • 6C8G

(See chart for seldom-used tubes)



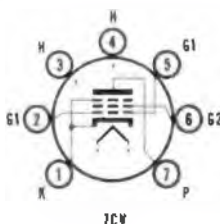
6CA5



**A-f power amplifier with high output
from a low B supply voltage**

HEATER CHARACTERISTICS

Voltage, a-c or d-c.....	6.3 volts
Current.....	1200 ma
Peak heater-cathode voltage, max.	
Heater negative to cathode.....	200 volts
Heater positive to cathode*.....	200 volts
*D-c component must not exceed 100 volts max.	



ELECTRICAL DATA

DIRECT INTERELECTRODE CAPACITANCES

Grid to plate: g1 to p.....	0.5	μf
Input: g1 to k + h + g2 + b.p.....	15.0	μf
Output: p to k + h + g2 + b.p.....	9.0	μf

MAXIMUM RATINGS (Design center values)

Plate voltage.....	130	volts
Grid 2 voltage.....	130	volts
Grid voltage, peak positive.....	0	volts
Plate dissipation.....	5.0	watts
Grid 2 dissipation.....	1.4	watts
Grid circuit resistance		
Fixed bias.....	0.5	meg
Self bias.....	0.5	meg
Bulb temperature at hottest point.....	180	°C

CHARACTERISTICS AND TYPICAL OPERATION

Class A Amplifier

Plate voltage.....	110	125	volts
Grid 2 (screen) voltage.....	110	125	volts
Grid 1 (control-grid) voltage.....	-4.0	-4.5	volts
Plate resistance (approx.).....	16,000	15,000	ohms
Transconductance.....	8100	9200	μmhos
Grid 1 input voltage, peak a-f.....	4.0	4.5	volts
Plate current, zero signal.....	32	37	ma
Plate current, maximum signal.....	31	36	ma
Grid 2 current, zero signal.....	3.5	4.0	ma
Grid 2 current, maximum signal.....	7.5	11.0	ma
Load resistance impedance.....	3500	4500	ohms
Total harmonic distortion (approx.).....	5	6	%
Power output, maximum signal.....	1.1	1.5	watts

ENGINEERING DESIGN DATA

6CA5

NOVEMBER 1, 1957

Beam power pentode

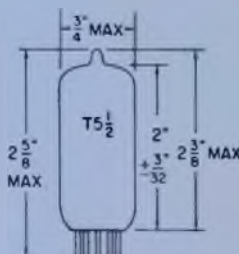
CHARACTERISTIC CURVES

(In curve section following APPENDIX)

Plate ($E_{c2} = 125V$).....	178A
Plate; ΔE_{c2} ($E_{c1} = 0V$).....	178B
Transfer, I_b , I_{c2} ($E_{c1} = 0V$).....	178C
Operation, ($E_b = E_{c2} = 125V$, $E_{c1} = -4.5V$).....	178D
Operation; ($E_b = E_{c2} = 110V$, $E_{c1} = -4.0V$).....	178E

MECHANICAL DATA

Cathode, coated unipotential	
Bulb.....	T-5½
Outline.....	JETEC 5-3
Base.....	Miniature 7-pin (E7-1)
Basing.....	7CV
Mounting position.....	Any



PIN CONNECTIONS

Pin 1.....	Cathode, B, P
Pin 2.....	Grid 1
Pin 3.....	Heater
Pin 4.....	Heater
Pin 5.....	Grid 1
Pin 6.....	Grid 2
Pin 7.....	Plate

APPLICATION

Type 6CA5 is a high sensitivity beam power pentode for the audio power output stage of radio and television receivers. It will provide high output at relatively low plate and screen voltages.

NOTES

Type 6CA5 is identical to types 12CA5 and 25CA5 except for heater characteristics.

ENGINEERING DESIGN DATA

6CB5

6CB5A

NOVEMBER 1, 1956

Beam power pentode

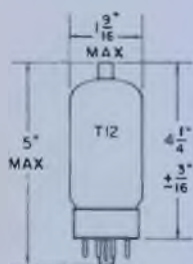
CHARACTERISTIC CURVES

(In curve section following APPENDIX)

Plate ($E_{c2}=150V$) 179A
Plate, ΔE_{c2} ($E_{c1}=0V$) 179B

MECHANICAL DATA

Cathode, coated unipotential	6CB5	6CB5A
Bulb.....	ST-16	T-12
Outline, JETEC.....	16-4	12-21 or 12-36
Base, octal		
Short jumbo with barriers.....	88-71	88-71
Short medium with barriers.....		88-118
Basing.....	8GD	8GD
Cap, JETEC.....	C1-1	C1-1
Mounting position Any		Any



PIN CONNECTIONS

Pin 1.....	Grid 2
Pin 2.....	Heater
Pin 3.....	Cathode, Grid 3
Pin 4.....	Grid 1
Pin 5.....	Grid 1
Pin 6.....	Cathode, Grid 3
Pin 7.....	Heater
Pin 8.....	Grid 2
Cap.....	Plate

APPLICATION

Types 6CB5 and 6CB5A are high perveance beam power tubes designed for service as horizontal deflection amplifiers in tricolor television. Type 6CB5A is unilaterally interchangeable with type 6CB5.



6CB5

6CB5A

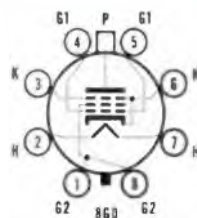
Horizontal deflection amplifier
for tricolor television receivers



HEATER CHARACTERISTICS

Voltage, a-c or d-c.....	6.3 volts
Current.....	2.5 amp
Peak heater-cathode voltage, max. Heater negative to cathode.....	200 volts
Heater positive to cathode*.....	200 volts

*D-c component must not exceed 100 volts max.



ELECTRICAL DATA

DIRECT INTERELECTRODE CAPACITANCES

	6CB5	6CB5A
Grid to plate: g1 to p.....	0.8	0.4 μf
Input: g1 to k + h + g2 + b.p.....	24	22 μf
Output: p to k + h + g2 + b.p.....	10	10 μf

MAXIMUM RATINGS (Design center values unless noted)

Horizontal Deflection Amplifier*	6CB5	6CB5A
Plate supply voltage, d-c (boost + d-c power supply).....	700	800 volts
Plate voltage, peak pos. (absolute max.).....	6800	6800 volts
Plate voltage, peak negative pulse.....	1500	1500 volts
Grid 2 voltage, d-c.....	200	200 volts
Grid 1 voltage, d-c.....	-50	-50 volts
Grid 1 voltage, peak negative.....	200	200 volts
Plate dissipation.....	23	23 watts
Grid 2 dissipation.....	3.6	3.6 watts
Cathode current, average.....	200	220 ma
Cathode current, peak.....	—	770 ma
Grid 1 circuit resistance (grid-resistor bias).....	0.47	0.47 meg
Bulb temperature at hottest point.....	210	220 °C

AVERAGE CHARACTERISTICS

Class A Amplifier	Instantaneous values	
Plate voltage.....	75	175 volts
Grid 2 (screen) voltage.....	150	175 volts
Grid 1 (control-grid) voltage.....	0	-30 volts
Plate resistance (approx.).....		5000 ohms
Transconductance.....		8800 $\mu mhos$
Plate current.....	460	90 ma
Grid 2 current.....	42	6 ma
Grid 1 voltage (approx.) for $I_b = 1.0$ ma.....		-60 volts
Triode amplification factor (g1 + g2 tied together).....		3.8

NOTES:

- *Voltage pulse duration must not exceed 10 μs in a 525-line, 30-frame system.
- †Tube protection is needed for no-drive conditions if grid-resistor bias is used.



6CB6

6CB6A



High gain radio-frequency or Intermediate-frequency amplifier

HEATER CHARACTERISTICS

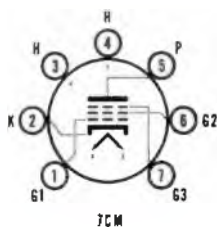
Voltage, a-c or d-c.....	6.3 volts
Current.....	300 ma
Peak heater-cathode voltage, max.	
Heater negative to cathode.....	200 volts
Heater positive to cathode*.....	200 volts

*D-c component must not exceed 100 volts max.

6CB6A

Warm-up time..... 11 secs. average
(See Series-String Heaters section of APPENDIX in CBS Tube Manual).

Types 6CB6 and 6CB6A are identical to type 3CB6 except for heater ratings.



ENGINEERING DESIGN DATA

6CB6

6CB6A

NOVEMBER 1, 1956

Sharp-cutoff pentode

CHARACTERISTIC CURVES

(In curve section following APPENDIX)
Plate ($E_{c2} = 150V$)..... 130A
Plate ($E_{c2} = E_{c1} = 0V$), ΔE_{c2} 130B
Transfer ($E_b = 200V$, $E_{c3} = 0V$)..... 130C
Transfer ($E_b = 200V$, $E_{c3} = 0V$)..... 130D

APPLICATION

Type 6CB6 is designed for television use as an i-f amplifier in the vicinity of 40 megacycles. It may also be used in vhf television tuners as an r-f amplifier.



6CD6G

6CD6GA



High efficiency horizontal deflection amplifier for television receivers

HEATER CHARACTERISTICS

Voltage, a-c or d-c.....	6.3 volts
Current.....	2.5 amp
Peak heater-cathode voltage, max.	
Heater negative to cathode.....	200 volts
Heater positive to cathode*.....	200 volts

*D-c component must not exceed 100 volts max.

ELECTRICAL DATA

DIRECT INTERELECTRODE CAPACITANCES

	6CD6G	6CD6GA
Grid to plate: g1 to p.....	0.8	1.1 μf
Input: g1 to k + h + g2 + b.p.....	24	22 μf
Output: p to k + h + g2 + b.p.....	9.5	8.5 μf

MAXIMUM RATINGS (Design center values unless noted)

	6CD6G	6CD6GA
Plate supply voltage, d-c (boost + d-c power supply).....	700	700 volts
Plate voltage, peak pos. (absolute max.).....	6600	7000 volts
Plate voltage, peak negative pulse.....	1500	1500 volts
Grid 2 voltage, d-c.....	175	175 volts
Grid 1 voltage, peak negative.....	200	200 volts
Plate dissipation.....	15	20 watts
Grid 2 dissipation.....	3.0	3.0 watts
Cathode current, average.....	200	200 ma
Cathode current, peak.....	700	700 ma
Grid 1 circuit resistance.....	0.47	0.47 meg
Bulb temperature at hottest point.....	210	225 °C

CBS ELECTRON TUBES

6CD6G

6CD6GA

NOVEMBER 1, 1956

Beam power pentode

CHARACTERISTIC CURVES

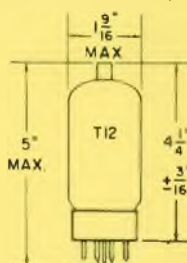
(In curve section following APPENDIX)
Plate ($E_{c2} = 150V$)..... 107A
Plate; ΔE_{c2} ($E_{c1} = 0V$)..... 107B

MECHANICAL DATA

Cathode, coated
unipotential 6CD6G 6CD6GA
Bulb..... ST-16 T-12
Outline..... JEDEC 16-5 As shown
Base, Medium shell Short med. shell
octal..... (B8-13) (B8-110)
Basing..... 5BT 5BT
Cap, JEDEC..... CI-1 CI-1
Mounting position..... Vertical $\uparrow$ Vertical $\uparrow$
 $\uparrow$ Horizontal operation permissible if pins 2 and 7 are vertical.

NOTE

For JEDEC outline 16-5 see type 6BG6G.



ENGINEERING DESIGN DATA

6CD6G • 6CD6GA (cont.)

PIN CONNECTIONS

Pin 1	N. C.
Pin 2	Heater
Pin 3	Cathode, B. P.
Pin 4	N. C.
Pin 5	Grid 1
Pin 6	N. C.
Pin 7	Heater
Pin 8	Grid 2
Cap.	Plate

APPLICATION

Types 6CD6G and 6CD6GA are beam power pentodes designed basically for use as high efficiency horizontal deflection amplifiers in television receivers using large-deflection-angle picture tubes.

NOTES

Types 6CD6G and 6CD6GA are identical except that the latter employs a T-12 bulb and increased maximum ratings for plate dissipation, peak positive plate voltage and bulb temperature.

6CD6G • 6CD6GA (cont.)

AVERAGE CHARACTERISTICS

	Instantaneous values	
Plate voltage	60	175 volts
Grid 2 (screen) voltage	100	175 volts
Grid 1 (control-grid) voltage	0	-30 volts
Plate resistance (approx.)		7200 ohms
Transconductance		7700 μ hos
Plate current	230	75 ma
Grid 2 current	21	5.5 ma
Grid 1 voltage (approx.) for $I_b = 1.0$ ma		-55 volts
Triode amplification factor (p + g2 tied together)		3.9

TYPICAL OPERATION

Horizontal Deflection for 90° Picture Tube

Plate supply voltage	300 volts
Plate voltage, average (boost + d-c supply)	620 volts
Plate voltage, peak positive (d-c + pulse)	5600 volts
Grid 2 (screen) voltage	125 volts
Grid 2 current	16 ma
Grid 1 (control-grid) input voltage	
Sawtooth component	140 volts
Peak to peak	180 volts
Plate current, average	113 ma
Plate current, peak	380 ma
Plate dissipation	11 watts
Anode voltage of CRT	17.2 kv

NOTES:

*Voltage pulse duration must not exceed 10 μ s in a 525-line, 30-frame system.

†Tube protection is needed for no-drive conditions if grid-resistor bias is used.

6CE5

JUNE 10, 1956

Controlled sharp-cutoff pentode

CHARACTERISTIC CURVES

(In curve section following APPENDIX)

Plate ($E_{c2} = 125V$).....197A

Plate ($E_{c1} = 0V$, ΔE_{c2}).....197B

Transfer ($E_b = 125V$).....197C

Transfer ($E_b = 125V$).....197D

APPLICATION

Type 6CE5 is a miniature, controlled, sharp-cutoff pentode intended for application as an r-f or i-f amplifier.



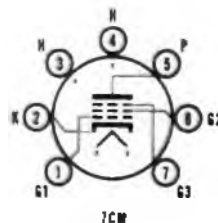
6CE5



Controlled cutoff pentode amplifier for r-f or i-f service

HEATER CHARACTERISTICS

Voltage, a-c or d-c	6.3 volts
Current	300 ma
Peak heater-cathode voltage, max.	
Heater negative to cathode	200 volts
Heater positive to cathode*	200 volts
Warm-up time	11 secs. average
(See Series-String Heaters section of APPENDIX in CBS Tube Manual)	
*D-c component must not exceed 100 volts max.	



Type 6CE5 is identical to type 3CE5 except for different heater characteristics.



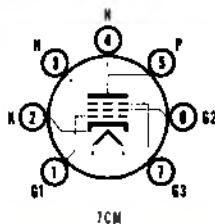
6CF6



Controlled-cutoff pentode for radio-frequency or intermediate-frequency amplifier service

HEATER CHARACTERISTICS

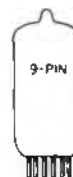
Voltage, a-c or d-c.....	6.3 volts
Current.....	300 ma
Peak heater-cathode voltage, max.	
Heater negative to cathode.....	90 volts
Heater positive to cathode.....	90 volts



Type 6CF6 is identical to type 3CF6 except for heater characteristics. Except for its cutoff characteristic, the 6CF6 is similar to the 6CB6.



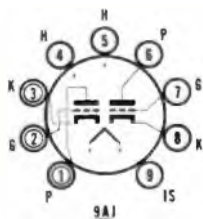
6CG7



Amplifier or TV sweep oscillator, heater warm-up controlled for series strings

HEATER CHARACTERISTICS

Voltage, a-c or d-c.....	6.3 volts
Current.....	600 ma
Peak heater-cathode voltage, max.	
Heater negative to cathode.....	200 volts
Heater positive to cathode.....	200 volts
Warm-up time.....	11 secs. average
(See Series-String Heaters section of APPENDIX in CBS Tube Manual)	
*D-c component must not exceed 100 volts max.	



ELECTRICAL DATA

DIRECT INTERELECTRODE CAPACITANCES

	Section 1	Section 2	
Grid to plate: g1 to p.....	4.0	4.0	μmf
Input: g1 to k + h + i.s.....	2.3	2.3	μmf
Output: p to k + h + i.s.....	2.2	2.2	μmf

ENGINEERING DESIGN DATA

6CF6

NOVEMBER 1, 1956

Controlled sharp-cutoff pentode

CHARACTERISTIC CURVES

(In curve section following APPENDIX)

Plate ($E_{c2} = 160\text{V}$).....130A

Plate ($E_{c1} = E_{c2} = 0\text{V}$), ΔE_{c2}130B

Transfer ($E_b = 200\text{V}$, $E_{c1} = 0\text{V}$).....130C

Transfer ($E_b = 200\text{V}$, $E_{c1} = 0\text{V}$).....130D

APPLICATION

Type 6CF6 can be used as an r-f amplifier through vhf or as an i-f amplifier. This type is derived from the 6CB6 and is designed for improved agc because of the controlled cutoff characteristic.

6CG7

NOVEMBER 1, 1956

Medium-mu duotriode

CHARACTERISTIC CURVES

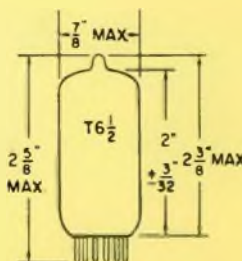
(In curve section following APPENDIX)

Plate.....181A

Characteristics; μ , g_m , f_p181B

MECHANICAL DATA

Cathode, coated unipotential	
Bulb.....	T-6½
Outline.....	JETEC 6-3
Base.....	Miniature 9-pin (E9-1)
Basing.....	9A1
Mounting position.....	Any



ENGINEERING DESIGN DATA

6CG7 (cont.)

PIN CONNECTIONS

Pin 1	Plate (Sect. 2)
Pin 2	Grid (Sect. 2)
Pin 3	Cathode (Sect. 2)
Pin 4	Heater
Pin 5	Heater
Pin 6	Plate (Sect. 1)
Pin 7	Grid (Sect. 1)
Pin 8	Cathode (Sect. 1)
Pin 9	A. S.

REFERENCES

See explanation of warm-up time controlled series-string heater circuits and horizontal and vertical deflection oscillator ratings in APPENDIX. Also, see APPENDIX for R-C amplifier data.

APPLICATION

Type 6CG7 is a medium-mu duodiode designed for application as a vertical or horizontal deflection amplifier in series-string television receivers. It can also be used as a phase inverter or R-C amplifier.

6CG7 (cont.)

MAXIMUM RATINGS (Design center values)*	Class A Amplifier	Horizontal Deflection Oscillator†	Vertical Deflection Oscillator‡
Plate voltage	300	300	300 volts
Control-grid voltage, positive d-c	0		0 volts
Control-grid voltage, peak negative		600	400 volts
Plate dissipation			
Each plate	3.5	3.5	3.5 watts
Both plates	5.0	5.0	5.0 watts
Cathode current			
Average	20	20	20 ma
Peak		300	70 ma
Control-grid circuit resistance			
Fixed bias	1.0	2.2	2.2 meg
Self bias		2.2	2.2 meg

CHARACTERISTICS AND TYPICAL OPERATION

Class A Amplifier*

Plate voltage	90	250 volts
Control-grid voltage	0	-8.0 volts
Plate resistance (approx.)	6700	7700 ohms
Transconductance	3000	2600 μ mhos
Amplification factor	20	20
Plate current	10	9 ma
Plate current for $E_{c1} = -12.5$ volts		1.3 ma
Control-grid voltage (approx.) for $I_b = 10 \mu$ a	-7.0	-18 volts

NOTES:

*Values are for each unit.

†Voltage pulse duration must not exceed 10 μ s in a 525-line, 30-frame system.

‡Voltage pulse duration must not exceed 2500 μ s in a 525-line, 30-frame system.

6CG8

6CG8A

NOVEMBER 1, 1956

**Medium-mu triode—
sharp-cutoff
pentode**

CHARACTERISTIC CURVES

(In curve section following APPENDIX)

Screen Grid Rating	100A
Plate, pentode ($E_{c2} = 150V$)	141A
Plate, triode	141B
Plate, pentode unit (triode connected)	141C
Operation, pentode	141D
Operation, pentode	141E

APPLICATION

Type 6CG8 is a medium-mu triode—sharp-cutoff pentode designed for application as a vhf triode oscillator and pentode mixer for television or a-m and f-m receivers. It is the same as the 6X8 except for basing and capacitances.



6CG8

6CG8A



**Vhf triode oscillator and pentode mixer
for TV or a-m and f-m receivers**

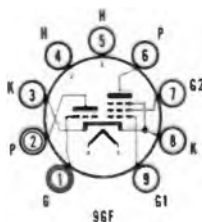
HEATER CHARACTERISTICS

Voltage, a-c or d-c	6.3 volts
Current	450 ma
Peak heater-cathode voltage, max.	
Heater negative to cathode	200 volts
Heater positive to cathode*	200 volts
*D-c component must not exceed 100 volts.	

6CG8A

Warm-up time 11 secs. average
(See Series-String Heaters section of
APPENDIX in CBS Tube Manual).

Types 6CG8 and 6CG8A are identical to type 5CG8 except for heater characteristics.





6CH8



Combined sync separator, clipper or phase splitter and multifunction amplifier, heater warm-up time controlled for series strings

HEATER CHARACTERISTICS

	Triode	Pentode
Voltage, a-c or d-c...	6.3	6.3 volts
Current.....	450	450 ma
Peak heater-cathode voltage, max.		
Heater negative to cathode....	200	▲ volts
Heater positive to cathode....	200*	0 volts
Warm-up time ...	11 secs.	average

(See Series-String Heaters section of APPENDIX in CBS Tube Manual).

*D-c component must not exceed 100 volts max.

▲Not to exceed operating cathode bias to prevent negative grid 3, tied to heater, from affecting characteristics.



ELECTRICAL DATA

DIRECT INTERELECTRODE CAPACITANCES

Triode Section		
Grid to plate: g1 to p.....	1.6	μf
G ₁ to k + h + pentode g3 + i.s.	1.9	μf
Output: p to k + h + pentode g3 + i.s.	1.6	μf

Pentode Section		
Grid to plate: g1 to p, max.....	0.025	μf
Input: g1 to k + h + g2 + g3 + i.s.	7.0	μf
Output: p to k + h + g2 + g3 + i.s.	2.25	μf
Coupling: pentode grid 1 to triode plate.....	0.02	μf
Coupling: pentode plate to triode grid.....	0.005	μf
Coupling: pentode plate to triode plate.....	0.04	μf

MAXIMUM RATINGS (Design center values)

Class A Amplifier	Triode	Pentode
Plate voltage.....	300	300 volts
Grid 2 voltage.....	See Rating Chart in APPENDIX	
Grid 3 voltage, positive.....	0	volts
Grid 2 supply voltage.....	300	volts
Grid 1 voltage, positive d-c.....	0	volts
Plate dissipation.....	2.6	2.0 watts
Grid 2 dissipation		
For E _{c2} up to 150 volts.....		0.5 watts
For E _{c2} between 150 and 300 volts	See Rating Chart in APPENDIX	
Grid 1 circuit resistance*		
Fixed bias.....	0.5	0.25 meg
Self bias.....	1.0	1.0 meg

ENGINEERING DESIGN DATA

6CH8

JUNE 1, 1957

Medium-mu triode—sharp-cutoff pentode

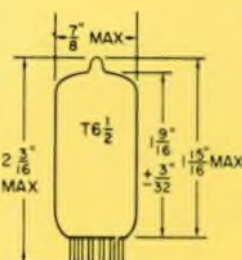
CHARACTERISTIC CURVES

(In curve section following APPENDIX)

Plate, pentode (E _{c2} = 150V).....	205A
Transfer, pentode, g _m , I _b , I _{c2}	205B
Screen Grid Rating.....	100A
Plate, triode.....	205C
Transfer, triode, g _m , I _b , μ.....	205D

MECHANICAL DATA

Cathode, coated unipotential.....	
Bulb.....	T-6½
Outline.....	JETEC 6-2
Base.....	Miniature 9-pin (E9-L)
Basing.....	9FT
Mounting position.....	Any



PIN CONNECTIONS

Pin 1.....	Triode Cathode
Pin 2.....	Pentode Plate
Pin 3.....	Pentode Grid 2
Pin 4.....	Heater
Pin 5.....	Pentode Grid 3, I. S.
Pin 6.....	Pentode Cathode
Pin 7.....	Pentode Grid 1
Pin 8.....	Triode Grid
Pin 9.....	Triode Plate

ENGINEERING DESIGN DATA

6CH8 (cont.)

APPLICATION

Type 6CH8 is a miniature medium- μ triode and sharp-cutoff pentode for color and black and white television circuits. The triode unit, with its relatively high zero bias plate current, is suitable for low frequency oscillator, sync separator, sync clipper, and phase splitter circuits; the pentode unit as an i-f amplifier, video amplifier, agc amplifier, and reactance tube.

6CH8 (cont.)

CHARACTERISTICS AND TYPICAL OPERATION

Class A Amplifier	Triode	Pentode
Plate supply voltage.....	200	200 volts
Grid 3 (suppressor) supply voltage.....		0 volts
Grid 2 (screen) supply voltage.....		150 volts
Grid 1 (control-grid) voltage.....	-6.0	volts
Cathode-bias resistor.....		180 ohms
Plate resistance (approx.).....	5.75	300 kilohms
Transconductance.....	3300	6200 μ mhos
Amplification factor.....	19	
Plate current.....	13	9.5 ma
Grid 2 current.....		2.8 ma
Grid 1 voltage (approx.) for $I_b = 10 \mu$ a.....	-19	-8 volts

NOTES:

*If either unit is operated at maximum rated conditions, grid 1 circuit resistances for both units should not exceed the stated values.



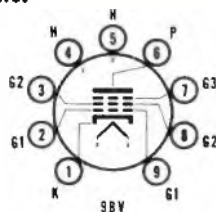
6CL6



Video output amplifier in television receivers
or audio power amplifier

HEATER CHARACTERISTICS

Voltage, a-c or d-c.....	6.3 volts
Current.....	650 ma
Peak heater-cathode voltage, max.	
Heater negative to cathode.....	90 volts
Heater positive to cathode.....	90 volts



ELECTRICAL DATA

DIRECT INTERELECTRODE CAPACITANCES

Grid to plate: g1 to p.....	0.12 μ f
Input: g1 to k + h + g2 + g3 + i.s.....	11.0 μ f
Output: p to k + h + g2 + g3 + i.s.....	5.5 μ f

MAXIMUM RATINGS (Design center values)

Plate voltage.....	300 volts
Grid 2 voltage.....	150 volts
Grid 2 supply voltage.....	300 volts
Grid 1 voltage, peak negative.....	50 volts
Grid 1 voltage, peak positive.....	0 volts
Plate dissipation.....	7.5 watts
Grid 2 dissipation.....	1.7 watts
Grid circuit resistance	
Fixed bias.....	0.1 meg
Self bias.....	0.5 meg
Bulb temperature at hottest point.....	200 °C

CHARACTERISTICS AND TYPICAL OPERATION

Class A Amplifier

Plate voltage.....	250 volts
Grid 3 (suppressor) voltage.....	connected to cathode at socket
Grid 2 (screen) voltage.....	150 volts
Grid 1 (control-grid) voltage.....	-3.0 volts
Plate resistance (approx.).....	9000 ohms
Transconductance.....	11,000 μ mhos
Grid 1 input voltage, peak a-f.....	3.0 volts
Plate current, zero signal.....	30 ma
Plate current, maximum signal.....	31 ma
Grid 2 current, zero signal.....	7.0 ma
Grid 2 current, maximum signal.....	7.2 ma
Grid 1 bias for $I_b = 10 \mu$ a.....	-14 volts
Load resistance impedance.....	7500 ohms
Total harmonic distortion (approx.).....	8 %
Power output, maximum signal.....	2.8 watts

Video Amplifier with 4.0 Mc bandwidth

Plate supply voltage.....	300 volts
Grid 2 (screen) supply voltage.....	300 volts
Grid 3 (suppressor) voltage.....	connected to cathode at socket
Grid 1 (control-grid) voltage.....	-2.0 volts
Grid 2 resistor.....	24,000 ohms
Grid 1 resistor.....	100,000 ohms
Voltage output, peak-to-peak.....	132 volts
Grid-to-grid input voltage, peak a-f.....	3.0 volts
Plate current, zero signal.....	30 ma
Grid 2 current, zero signal.....	7.0 ma
Load resistance, plate-to-plate.....	3900 ohms

ENGINEERING DESIGN DATA

6CL6

NOVEMBER 1, 1956

Power pentode

CHARACTERISTIC CURVES

(In curve section following APPENDIX)

Plate ($E_{c2} = 150V$)..... 182A

Plate; ΔE_{c2} ($E_{c1} = 0V$)..... 182B

Characteristics; g_m with ΔE_{c2} 182C

MECHANICAL DATA

Cathode, coated unipotential

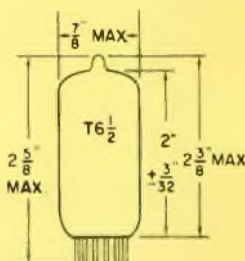
Bulb..... T-6 1/2

Outline..... JETEC 6-3

Base..... Miniature 9-pin (E9-1)

Basing..... 9BV

Mounting position..... Any



PIN CONNECTIONS

Pin 1.....	Cathode
Pin 2.....	Grid 1
Pin 3.....	Grid 2
Pin 4.....	Heater
Pin 5.....	Heater
Pin 6.....	Plate
Pin 7.....	Grid 3, I. S.
Pin 8.....	Grid 2
Pin 9.....	Grid 1

APPLICATION

Type 6CL6 is a power pentode used as a video output amplifier in television receivers and as a wide-band amplifier tube in laboratory or industrial equipment.

ENGINEERING DESIGN DATA

6CL8

NOVEMBER 1, 1956

**Medium- μ
triode—sharp-cutoff
tetrode**

CHARACTERISTIC CURVES
(In curve section following APPENDIX)
Screen Grid Rating ... 100A

APPLICATION

Type 6CL8 is a medium- μ triode and sharp-cutoff tetrode used as a vhf oscillator and mixer in television tuners.



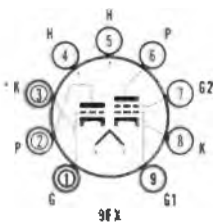
6CL8



**Very-high-frequency oscillator and mixer
used in TV tuners**

HEATER CHARACTERISTICS

Voltage, a-c or d-c. 6.3 volts
Current. 450 ma
Peak heater-cathode voltage, max.
Heater negative to
cathode. 200 volts
Heater positive to
cathode*. 200 volts
Warm-up time. 11 secs. average
(See Series-String Heaters section of
APPENDIX in CBS Tube Manual).
*D-c component must not exceed 100
volts max.



Type 6CL8 is identical to type 5CL8 except for heater characteristics.

6CM6

NOVEMBER 1, 1956

Beam power pentode

CHARACTERISTIC CURVES
(In curve section following APPENDIX)
Plate ($E_{c2} = 250V$) 138A
Plate ($E_{c2} = 250V$) 138B
Plate, triode connected 138C
Plate, ΔE_{c2} ($E_{c1} = 0V$) 138D
Transfer ($E_b = 250V$) 138E
Operation 138F

MECHANICAL DATA

Cathode, coated unipotential
Bulb T-6 1/2
Outline JETEC 6-3
Base Miniature 9-pin (E9-1)
Basing 9CK
Mounting position Any



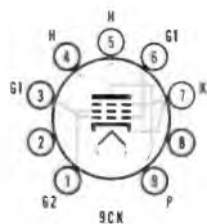
6CM6



**Audio power amplifier or vertical deflection
amplifier in TV receivers**

HEATER CHARACTERISTICS

Voltage, a-c or d-c. 6.3 volts
Current. 450 ma
Peak heater-cathode voltage, max.
Heater negative to
cathode. 200 volts
Heater positive to
cathode*. 200 volts
*D-c component must not exceed 100
volts max.



ELECTRICAL DATA

DIRECT INTERELECTRODE CAPACITANCES

Grid to plate: g1 to p 0.7 μ f
Input: g1 to k + h + g2 + b.p. 8.0 μ f
Output: p to k + h + g2 + b.p. 8.5 μ f

MAXIMUM RATINGS

(Design center values unless noted)

	Class A Amplifier	Vertical Deflection Amplifier*	
		Pentode	Triode†
Plate voltage.	315	315	315 volts
Plate voltage peak pos. (absolute max.).	2000	2000	2000 volts
Grid 2 voltage.	285	285	285 volts
Grid voltage, peak negative.	250	250	250 volts
Plate dissipation†.	12	8	9 watts
Grid 2 dissipation†.	2	1.75	2 watts
Cathode current, average.	40	40	40 ma
Cathode current, peak.	120	120	120 ma
Grid circuit resistance			
Fixed bias.	0.1		meg
Self bias.	0.5	2.2	2.2 meg

CBS ELECTRON TUBES

6CM6 (cont.)

CHARACTERISTICS AND TYPICAL OPERATION

Class A Amplifier

	Single Tube	Two Tubes (Push-Pull)
Plate voltage	180	250 volts
Grid 2 (screen) voltage	180	250 volts
Grid 1 (control-grid) voltage	-8.5	-15.0 volts
Plate resistance (approx.)	50,000	80,000 ohms
Transconductance	3700	3750 μ mhos
Grid 1 input voltage, peak a-f	8.5	13.0
Plate current, zero signal	29	34 ma
Plate current, maximum signal	30	35 ma
Grid 2 current, zero signal	3.0	2.2
Grid 2 current, maximum signal	4.0	6.0
Load resistance impedance	5500	8500 10,000 ohms
Total harmonic distortion (approx.)	8	12 %
Power output, maximum signal	2.0	5.5 10 watts

Vertical Deflection Amplifier*

	Pentode	Triode†
Plate voltage	250	250 volts
Grid 2 (screen) voltage	250	250 volts
Grid 1 (control-grid) voltage	-12.5	-12.5 volts
Plate resistance, per tube	50,000	1960 ohms
Transconductance	4100	5000 μ mhos
Plate current	45	49.5 ma
Grid 2 current	4.5	ma
Grid 1 bias for $I_b = 0.5$ ma	-37	-37 volts
Amplification	9.8	

NOTES:

*Voltage pulse duration must not exceed 2500 μ s in a 525-line, 30-frame system.

†Tube protection is needed for no-drive conditions if grid-resistor bias is used.

‡Grid 2 connected to plate.

§Plate to plate.

▲Grid to grid.

ENGINEERING DESIGN DATA

6CM6 (cont.)

PIN CONNECTIONS

Pin 1	Grid 2
Pin 2	N. C.
Pin 3	Grid 1
Pin 4	Heater
Pin 5	Heater
Pin 6	Grid 1
Pin 7	Cathode, B. P.
Pin 8	N. C.
Pin 9	Plate

APPLICATION

Type 6CM6 is a beam power pentode designed to operate as an audio power amplifier or vertical deflection amplifier in television receivers.



6CM7

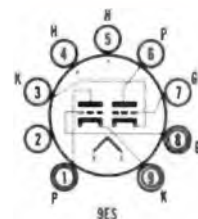


**Combined vertical deflection oscillator and amplifier
with dissimilar sections**

HEATER CHARACTERISTICS

Voltage, a-c or d-c	6.3 volts
Current	600 ma
Peak heater-cathode voltage, max.	
Heater negative to cathode	200 volts
Heater positive to cathode*	200 volts
Warm-up time	11 secs. average
(See Series-String Heaters section of APPENDIX in CBS Tube Manual).	

*D-c component 100 volts max.



ELECTRICAL DATA

DIRECT INTERELECTRODE CAPACITANCES

	Section 1	Section 2	
Grid to plate: g1 to p	3.8	3.0	μ f
Input: g1 to k + h	2.0	3.5	μ f
Output: p to k + h	0.5	0.4	μ f

6CM7

JANUARY 10, 1957

**Medium-mu duo-
triode with dissimilar
sections**

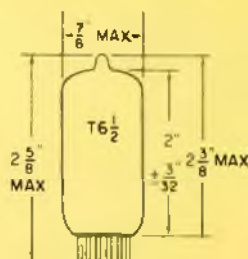
CHARACTERISTIC CURVES

(In curve section following APPENDIX)

Plate, section 1	183A
Characteristics, section 1	183B
Plate, section 2	183C
Characteristics, section 2	183D

MECHANICAL DATA

Cathode, coated unipotential	
Bulb	T-6½
Outline	JETEC 6-3
Base	Miniature 9-pin (E9-1)
Basing	9ES
Mounting position	Any



CBS ELECTRON TUBES

6CM7 (cont.)

MAXIMUM RATINGS

(Design center values unless noted)

Vertical Deflection Service

	Section 1† Oscillator	Section 2† Amplifier
Plate voltage, d-c.....	500	500 volts
Plate voltage, peak pos. (absolute max.).....		2200 volts
Control-grid voltage, peak negative.....	200	200 volts
Plate dissipation.....	1.25	5.5 watts
Cathode current, average.....	15	20 ma
Cathode current, peak.....	70	70 ma
Control-grid circuit resistance		
Fixed bias.....	2.2	1.0 meg
Self bias.....	2.2	2.5 meg

AVERAGE CHARACTERISTICS

Class A Amplifier

	Section 1†	Section 2†
Plate voltage.....	200	250 volts
Control-grid voltage.....	-7.0	-8.0 volts
Plate resistance (approx.).....	10,500	4100 ohms
Transconductance.....	2000	4400 μ mhos
Amplification factor.....	21	18
Plate current.....	5.0	20 ma
Grid 1 voltage (approx.) for $I_b = 10\mu$ a.....	14	volts

NOTES:

*Voltage pulse duration must not exceed 2500 μ s in a 525-line, 30-frame system.

†Section 1 connects to pins 3, 6, and 7. Section 2 connects to pins 1, 8, and 9.

6CM7 (cont.)

PIN CONNECTIONS

Pin 1.....	Plate (Sect. 2)
Pin 2.....	N. C.
Pin 3.....	Cathode (Sect. 1)
Pin 4.....	Heater
Pin 5.....	Heater
Pin 6.....	Plate (Sect. 1)
Pin 7.....	Grid (Sect. 1)
Pin 8.....	Grid (Sect. 2)
Pin 9.....	Cathode (Sect. 2)

REFERENCES

See explanation of warm-up time controlled series-string heater circuits in the APPENDIX.

APPLICATION

Type 6CM7 is a medium- μ duodiode with dissimilar sections designed to operate as a vertical deflection oscillator and amplifier in TV receivers with warm-up time controlled series-string circuits. Section 1 is intended for oscillator service and Section 2 for amplifier service.

6CN7

NOVEMBER 1, 1956

Duodiode—high- μ triode

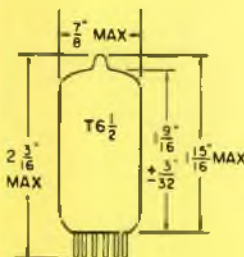
CHARACTERISTIC CURVES

(In curve section following APPENDIX)

Plate, triode.....	147A
Transfer.....	147B
Characteristics; r_p , g_m , μ	147C
Operation.....	147D

MECHANICAL DATA

Cathode, coated unipotential.....	T-6½
Bulb.....	JETEC 6-2
Base.....	Miniature 9-pin (E9-1)
Basing.....	.9EN
Mounting position.....	Any



6CN7



Combined horizontal phase detector and reactance tube in TV, or triode for audio or sync service

HEATER CHARACTERISTICS

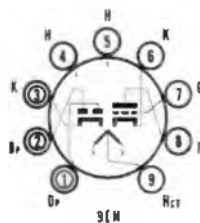
Series Parallel†

Voltage, a-c or d-c.....	6.3	3.15 volts
Current.....	300	600 ma
Peak heater-cathode voltage, max.		
Heater negative to cathode.....	200	200 volts
Heater positive to cathode*.....	200	200 volts

*D-c component must not exceed 100 volts max.

Warm-up time..... 11 secs. average†
(See Series-String Heaters section of APPENDIX in CBS Tube Manual).

†Warm-up time refers only to parallel connection.



ELECTRICAL DATA

DIRECT INTERELECTRODE CAPACITANCES

Triode

Grid to plate: g1 to p.....	1.8	μ fd
Input: g1 to k + h.....	1.5	μ fd
Output: p to k + h.....	0.5	μ fd

Diode

Diode-1 plate to diode cathode and heater.....	3.6	μ fd
Diode-2 plate to diode cathode and heater.....	3.6	μ fd
Triode grid to each diode plate.....	.006	μ fd

6CN7 (cont.)

MAXIMUM RATINGS (Design center values)

Plate voltage.....	300	volts
Control-grid voltage, positive d-c.....	0	volts
Plate dissipation.....	1.0	watt
Diode current for continuous operation, each diode.....	5.0	ma

CHARACTERISTICS AND TYPICAL OPERATION

Class A Amplifier

Plate voltage.....	100	250	volts
Control-grid voltage.....	-1.0	-3.0	volts
Plate resistance (approx.).....	.054	.058	meg
Transconductance.....	1300	1200	μ mhos
Amplification factor.....	70	70	
Plate current.....	0.8	1.0	ma
Average diode current, each diode, with 5.0 volts d-c applied.....	20	ma	



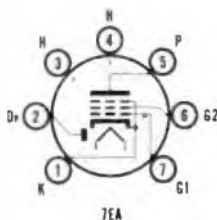
6CR6



Combined detector and automatic volume
controlled audio amplifier

HEATER CHARACTERISTICS

Voltage, a-c or d-c.....	6.3	volts
Current.....	300	ma
Peak heater-cathode voltage, max. Heater negative to cathode.....	100	volts
Heater positive to cathode.....	100	volts



ELECTRICAL DATA

MAXIMUM RATINGS (Design center values)

Plate voltage.....	300	volts
Grid 2 voltage.....	150	volts
Grid voltage, positive d-c.....	0	volts
Plate dissipation.....	2.5	watts
Grid 2 dissipation.....	0.3	watt
Grid 1 circuit resistance.....	1.0	meg

CHARACTERISTICS AND TYPICAL OPERATION

Class A Amplifier

Plate voltage.....	250	volts
Grid 2 (screen) voltage.....	100	volts
Grid 1 (control-grid) voltage.....	-2.0	volts
Plate resistance (approx.).....	0.8	meg
Transconductance.....	2200	μ mhos
Plate current.....	9.6	ma
Grid 2 current.....	2.6	ma
Grid 1 voltage (approx.) for $g_m = 10 \mu$ mhos.....	-32	volts
Average diode current with 10 volts, d-c applied.....	2.0	ma

CBS ELECTRON TUBES

ENGINEERING DESIGN DATA

6CN7 (cont.)

PIN CONNECTIONS

Pin 1.....	Diode-2 Plate
Pin 2.....	Diode-1 Plate
Pin 3.....	Diode Cathode, I. S.
Pin 4.....	Heater
Pin 5.....	Heater
Pin 6.....	Triode Cathode
Pin 7.....	Triode Grid
Pin 8.....	Triode Plate
Pin 9.....	Heater C. T.

REFERENCES

See explanation of warm-up time controlled series-string heater circuits in APPENDIX. See APPENDIX for R-C amplifier data.

6CR6

NOVEMBER 1, 1956

Diode—remote-cutoff
pentode

CHARACTERISTIC CURVES

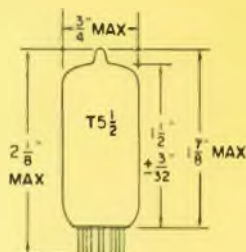
(In curve section following APPENDIX)

Plate ($E_{c2} = 100V$).....184A

Transfer ($E_b = 150V$, $E_{c2} = 100V$).....184B

MECHANICAL DATA

Cathode, coated unipotential.....	T-5½
Bulb.....	Outline
Outline.....	JETEC 5-2
Base.....	Miniature 7-pin (E7-L)
Basing.....	7EA
Mounting position.....	Any



PIN CONNECTIONS

Pin 1.....	Cathode, Grid 3
Pin 2.....	Diode Plate
Pin 3.....	Heater
Pin 4.....	Heater
Pin 5.....	Plate
Pin 6.....	Grid 2
Pin 7.....	Grid 1

REFERENCES

See APPENDIX for R-C amplifier data.

ENGINEERING DESIGN DATA

6CS6

JUNE 10, 1956

Dual control heptode

CHARACTERISTIC CURVES

(In curve section following APPENDIX)

Plate ($E_{c2+4}=30V$, $E_{c1}=0V$) 131A

Plate ($E_{c2+4}=30V$, $E_{c3}=0V$) 131B

Transfer ($E_{c1}=100V$, $E_{c2+4}=30V$,
 $E_{c3}=0V$) 131C

Transfer ($E_{c1}=100V$, $E_{c2+4}=30V$,
 $E_{c3}=0V$) 131D

Characteristics ($E_{c2+4}=30V$,
 $E_{c1}=0V$) 131E

APPLICATION

Type 6CS6 is a miniature, dual-control heptode designed for use as a sync separator and sync clipper.



6CS6



Heptode sync separator and clipper in television receivers

HEATER CHARACTERISTICS

Voltage, a-c or d-c 6.3 volts

Current 300 ma

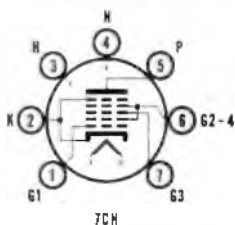
Peak heater-cathode voltage, max.

Heater negative to cathode 200 volts

Heater positive to cathode* 200 volts

*D-c component must not exceed 100 volts.

Type 6CS6 is identical to type 3CS6 except for heater characteristics.



6CS7

NOVEMBER 1, 1956

Duotriode with dissimilar units

CHARACTERISTIC CURVES

(In curve section following APPENDIX)

Plate, section 1 185A

Characteristics, section 1 185B

Plate, section 2 185C

Characteristics, section 2 185D

MECHANICAL DATA

Cathode, coated unipotential

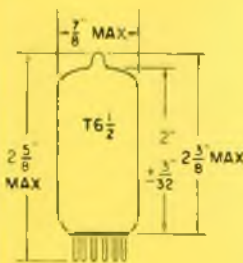
Bulb T-6 1/2

Outline JEDEC 6-3

Base Miniature 9-pin (E9-1)

Facing 9EF

Mounting position Any



6CS7



TV vertical deflection amplifier and/or oscillator, heater warm-up controlled for series strings

HEATER CHARACTERISTICS

Voltage, a-c or d-c 6.3 volts

Current 600 ma

Peak heater-cathode voltage, max.

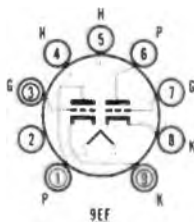
Heater negative to cathode 200 volts

Heater positive to cathode* 200 volts

Warm-up time 11 secs. average

(See Series-String Heaters section of APPENDIX in CBS Tube Manual).

*D-c component 100 volts max.



ELECTRICAL DATA

DIRECT INTERELECTRODE CAPACITANCES

	Section 1†	Section 2
Grid to plate: g1 to p	2.6	2.6 μf
Input: g1 to k + h	1.8	3.0 μf
Output: p to k + h	0.5	0.5 μf

MAXIMUM RATINGS (Design center values unless noted)

	Section 1	Section 2
	Oscillator†	Amplifier
Plate voltage, d-c	500	500 volts
Plate voltage, peak pos. (absolute max.)		2200 volts
Control-grid voltage, peak negative	400	250 volts
Plate dissipation†	1.25	6.5 watts
Cathode current, average	20	30 ma
Cathode current, peak	70	105 ma
Control-grid circuit resistance	2.2	2.2 meg

CBS ELECTRON TUBES

6CS7 (cont.)

AVERAGE CHARACTERISTICS

	Oscillator	Amplifier
Plate voltage.....	250	250 volts
Control-grid voltage.....	-8.5	-10.5 volts
Plate resistance.....	7700	3450 ohms
Transconductance.....	2200	4500 μ hos
Amplification factor.....	17	15.6
Plate current.....	10.5	19.0 ma
Plate current for $E_c = -16$ volts.....		3.0 ma
Grid 1 voltage (approx.) for $I_b = 10 \mu$ a.....	-24	volts
Grid 1 voltage (approx.) for $I_b = 50 \mu$ a.....	-22	volts

NOTES:

*Triode section 1 connects to pins 6, 7, and 8; triode section 2 connects to pins 1, 3, and 9.

*Voltage pulse duration must not exceed 2500 μ s in a 525-line, 30-frame system.

†Tube protection is needed for no-drive conditions if grid-resistor bias is used.



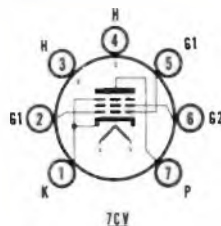
6CU5



Audio output tube for television receivers
with low plate supply voltage

HEATER CHARACTERISTICS

Voltage, a-c or d-c.....	6.3 volts
Current.....	1.2 amp
Peak heater-cathode voltage, max. Heater negative to cathode.....	200 volts
Heater positive to cathode.....	200 volts



ELECTRICAL DATA

DIRECT INTERELECTRODE CAPACITANCES

Grid to plate: g1 to p.....	0.7	μ f
Input: g1 to k + h + g2 + b.p.....	13.2	μ f
Output: p to k + h + g2 + b.p.....	8.6	μ f

MAXIMUM RATINGS (Design center values)

Plate voltage.....	135	volts
Grid 2 voltage.....	117	volts
Grid 1 voltage, positive.....	0	volts
Plate dissipation.....	6.0	watts
Grid 2 dissipation.....	1.25	watts
Grid 1 circuit resistance.....		
Fixed bias.....	0.1	meg
Self bias.....	0.5	meg
Bulb temperature at hottest point.....	220	$^{\circ}$ C

CHARACTERISTICS AND TYPICAL OPERATION

Class A Amplifier

Plate voltage.....	120	volts
Grid 2 (screen) voltage.....	110	volts
Grid 1 (control-grid) voltage.....	-8	volts
Plate resistance (approx.).....	10,000	ohms
Transconductance.....	7500	μ hos
Grid 1 input voltage, peak a-f.....	8.0	volts
Plate current, zero signal.....	49	ma
Plate current, maximum signal.....	50	ma
Grid 2 current, zero signal.....	4	ma
Grid 2 current, maximum signal.....	8.5	ma
Load resistance impedance.....	2500	ohms
Total harmonic distortion (approx.).....	10	%
Power output, maximum signal.....	2.3	watts

CBS ELECTRON TUBES

ENGINEERING DESIGN DATA

6CS7 (cont.)

PIN CONNECTIONS

Pin 1.....	Plate (Sect. 2)
Pin 2.....	N. C.
Pin 3.....	Grid (Sect. 2)
Pin 4.....	Heater
Pin 5.....	Heater
Pin 6.....	Plate (Sect. 1)
Pin 7.....	Grid (Sect. 1)
Pin 8.....	Cathode (Sect. 1)
Pin 9.....	Cathode (Sect. 2)

REFERENCES

See explanation of warm-up time controlled series-string heater circuits and vertical deflection ratings in APPENDIX.

6CU5

JUNE 1, 1957

Beam power pentode

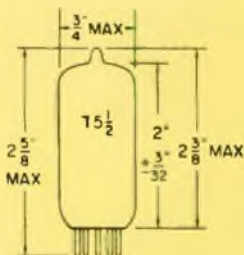
CHARACTERISTIC CURVES

(In curve section following APPENDIX)

Plate ($E_{c2} = 110V$).....	191A
Characteristics.....	191B

MECHANICAL DATA

Cathode, coated unipotential.....	
Bulb.....	T-5 $\frac{1}{2}$
Outline.....	JEDEC 5-3
Base.....	Miniature 7-pin (E7-1)
Basing.....	7CV
Mounting position.....	Any



PIN CONNECTIONS

Pin 1.....	Cathode, B. P.
Pin 2.....	Grid 1
Pin 3.....	Heater
Pin 4.....	Heater
Pin 5.....	Grid 1
Pin 6.....	Grid 2
Pin 7.....	Plate

APPLICATION

Type 6CU5 is a beam power tube designed for use in the audio output stage of television receivers. Provided with high-power sensitivity and high efficiency at low plate and screen voltages, it is capable of supplying relatively high power output.

6CU6

JUNE 10, 1957

Beam power pentode

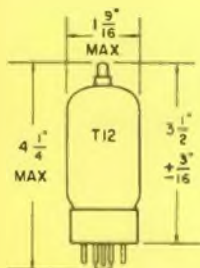
CHARACTERISTIC CURVES

(In curve section following APPENDIX)

Plate ($E_c = 100V$)	105A
Plate ($E_c = 150V$)	105B

MECHANICAL DATA

Cathode, coated unipotential	
Bulb	T-11A or T-12
Outline	See outline
Base	B7-119 or B6-122, B7-12 or B6-83, B7-111 or B6-148
Basing	6AM
Cap.	JETEC C1-2, C1-3, C1-33
Mounting position	Any



▲T-11 outline is identical to T-12 except for a maximum diameter of $1\frac{1}{16}$ inches.

PIN CONNECTIONS

Pin 1	N. C.
Pin 2	Heater
Pin 3	N. C.
Pin 4	Grid 2
Pin 5	Grid 1
Pin 7	Heater
Pin 8	Cathode
Cap.	Plate

APPLICATION

Type 6CU6 was designed as a durable sweep tube similar to the 6BQ6GT. Its operating range as a horizontal sweep tube is between that for types 6BQ6GT and the 6DQ6.



6CU6

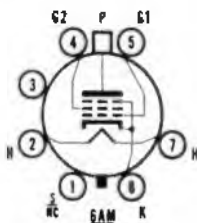


Horizontal deflection amplifier for TV receivers

HEATER CHARACTERISTICS

Voltage, a-c or d-c	6.3 volts
Current	1.2 amp
Peak heater-cathode voltage, max.	
Heater negative to cathode	200 volts
Heater positive to cathode*	200 volts

*D-c component must not exceed 100 volts max.



ELECTRICAL DATA

DIRECT INTERELECTRODE CAPACITANCES

Grid to plate: g1 to p	0.6 μf
Input: g1 to k + h + g2 + b.p.	15.0 μf
Output: p to k + h + g2 + b.p.	7.0 μf

MAXIMUM RATINGS (Design center values unless noted) Horizontal Deflection Amplifier*

Plate supply voltage, d-c (boost + d-c power supply)	600 volts
Plate voltage, peak pos. (absolute max.)	6000 volts
Plate voltage, peak negative pulse	1250 volts
Grid 2 voltage, d-c	200 volts
Grid 1 voltage, peak negative	300 volts
Plate dissipation†	11 watts
Grid 2 dissipation	2.5 watts
Cathode current, average	110 ma
Cathode current, peak	400 ma
Grid 1 circuit resistance	.47 meg
Bulb temperature at hottest point	220 °C

AVERAGE CHARACTERISTICS

	Instantaneous values	
Plate voltage	60	250 volts
Grid 2 (screen) voltage	150	150 volts
Grid 1 (control-grid) voltage	0	-22.5 volts
Plate resistance (approx.)		14,500 ohms
Transconductance		5900 $\mu mhos$
Plate current	260	57 ma
Grid 2 current	26	2.1 ma
Grid 1 voltage (approx.) for $I_b = 1.0$ ma		-43 volts

Triode Connected

Plate and grid 2 voltage (p + g2 tied together)	150 volts
Grid 1 voltage	-22.5 volts
Amplification factor	4.3

TYPICAL OPERATION

Horizontal Deflection for 70" Picture Tube*

Plate supply voltage (boost + d-c supply)	465 volts
Plate voltage, peak positive (d-c + pulse)	3440 volts
Grid 2 (screen) voltage	140 volts
Grid 1 (control-grid) voltage, d-c	-28 volts
Grid 1 (control-grid) input voltage	
Negative peaking component	18 volts
Peak to peak	74 volts
Plate current	83 ma
Grid 2 current	2.3 ma
Plate dissipation	5.1 watts
Grid 1 resistance	0.33 meg
Anode voltage of CRT	14 kv

NOTES:

*Voltage pulse duration must not exceed 10 μs in a 525-line, 30-frame system.

†Tube protection is needed for no-drive conditions if grid-resistor bias is used.



6CU8



Sync clipper, sync separator, etc. and i-f or video amplifier,
heater warm-up controlled for series strings

HEATER CHARACTERISTICS

Voltage, a-c or d-c	6.3 volts
Current	450 ma
Peak heater-cathode voltage max.	
Heater negative to cathode	200 volts
Heater positive to cathode	200 volts
Warm-up time	11 secs. average
(See Series-String Heaters section of APPENDIX in CBS Tube Manual)	
*D-c component must not exceed 100 volts max.	

ELECTRICAL DATA

DIRECT INTERELECTRODE CAPACITANCES

Triode Section

Grid to plate: g1 to p.	1.6 μf
Input: g1 to k + h + pentode g3 + i.s.	1.9 μf
Output: p to k + h + pentode g3 + i.s.	1.6 μf

Pentode Section

Grid to plate: g1 to p, max.	0.025 μf
Input: g1 to k + h + g2 + g3 + triode k + i.s.	7.0 μf
Output: p to k + h + g2 + g3 + triode k + i.s.	2.4 μf
Coupling: pentode grid 1 to triode plate	0.02 μf
Coupling: pentode plate to triode grid	0.005 μf
Coupling: pentode plate to triode plate	0.04 μf

MAXIMUM RATINGS (Design center values)

	Triode	Pentode
Plate voltage	300	300 volts
Grid 2 voltage	See Rating Chart in APPENDIX	
Grid 2 supply voltage	300	300 volts
Grid 1 voltage, positive d-c	0	0 volts
Plate dissipation	2.6	2.0 watts
Grid 2 dissipation		0.5 watt
Grid 1 circuit resistance*		
Fixed bias	0.5	0.25 meg
Self bias	1.0	1.0 meg

CHARACTERISTICS AND TYPICAL OPERATION

Class A Amplifier	Triode	Pentode
Plate supply voltage	200	200 volts
Grid 2 (screen) supply voltage		150 volts
Grid 1 (control-grid) voltage	-6	volts
Cathode-bias resistor		180 ohms
Plate resistance (approx.)	0.00575	0.30 meg
Transconductance	3300	6200 μmhos
Amplification factor	19	
Plate current	13	9.5 ma
Grid 2 current		2.8 ma
Grid 1 voltage (approx.) for $I_b = 10\mu\text{a}$	-19	-8 volts

NOTE:

*If either unit is operating at maximum rated conditions, Grid 1 circuit resistance for both units should not exceed the values given.

ENGINEERING DESIGN DATA

6CU8

JUNE 1, 1958

Medium- μ
triode—sharp
cutoff pentode

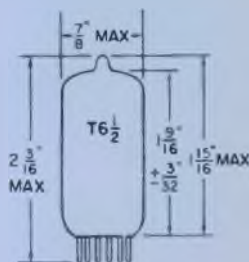
CHARACTERISTIC CURVES

(In curve section following APPENDIX)

Screen Grid Rating	100A
Plate, triode	137A
Transfer, triode	137B
Plate, pentode ($E_{c2} = 150\text{V}$)	137C
Transfer, pentode ($E_b = 200\text{V}$, $E_{c2} = 150\text{V}$)	137D

MECHANICAL DATA

Cathode, coated unipotential	
Bulb	T-6 1/2
Outline	JETEC 6-2
Base	9-pin Miniature (E9-1)
Basing	9GM
Mounting position	Any



PIN CONNECTIONS

Pin 1	Triode Cathode, Pentode Grid 3, & I. S.
Pin 2	Pentode Plate
Pin 3	Pentode Grid 2
Pin 4	Heater
Pin 5	Heater
Pin 6	Pentode Cathode
Pin 7	Pentode Grid 1
Pin 8	Triode Grid
Pin 9	Triode Plate

APPLICATION

Type 6CU8 is a medium- μ triode and sharp-cutoff pentode in one envelope. The triode section may be used as a sync clipper, sync separator, etc., and the pentode section may be used as an i-f amplifier or video amplifier. Grid 3 of the pentode unit is internally connected to the triode cathode which facilitates the use of an unbypassed pentode cathode for stabilization. The basing arrangement virtually eliminates coupling between triode and pentode units.

ENGINEERING DESIGN DATA

6CX8

JUNE 1, 1958

Medium-mu triode sharp-cutoff pentode

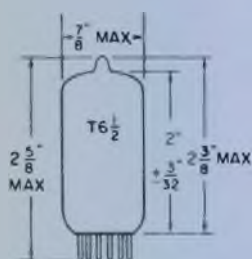
CHARACTERISTIC CURVES

(In curve section following APPENDIX)

Screen Grid Rating 100A

MECHANICAL DATA

Cathode, coated unipotential
Bulb.....T-6½
Outline.....JETEC 6-3
Base.....9-pin Miniature (E9-1)
Basing.....9DX
Mounting position.....Any



PIN CONNECTIONS

Pin 1.....Triode Cathode
Pin 2.....Triode Grid
Pin 3.....Triode Plate
Pin 4.....Heater
Pin 5.....Heater
Pin 6.....Pentode Cathode, Grid 3, I. S.
Pin 7.....Pentode Grid 3
Pin 8.....Pentode Grid 2
Pin 9.....Pentode Plate

APPLICATION

Type 6CX8 is a medium-mu triode and sharp-cutoff pentode in one envelope for use in a wide variety of applications in monochrome and color television. Each section has a separate cathode and is electrically independent of the other section.



6CX8



Combined sync amplifier, sync separator, or sync clipper,
etc., and video or i-f amplifier

HEATER CHARACTERISTICS

Voltage, a-c or d-c.....6.3 volts
Current.....750 ma
Peak heater-cathode voltage, max.

Heater negative to cathode.....200 volts

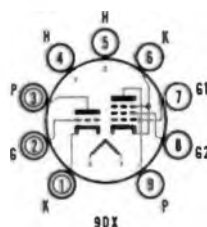
Heater positive to cathode*.....200 volts

Warm-up time.....11 secs. average

(See Series-String Heaters section of

APPENDIX in CBS Tube Manual)

*D-c component must not exceed 100 volts max.



ELECTRICAL DATA

DIRECT INTERELECTRODE CAPACITANCES

Triode Section

Grid to plate: g1 to p.....4.4 μf
Input: g1 to k + h.....2.2 μf
Output: p to k + h.....0.38 μf

Pentode Section

Grid to plate: g1 to p.....0.06 μf
Input: g1 to k + h + g2 + g3.....9.0 μf
Output: p to k + h + g2 + g3.....4.4 μf
Coupling: pentode grid 1 to triode plate, max......005 μf
Coupling: pentode plate to triode grid, max......018 μf
Coupling: pentode plate to triode plate, max.....0.17 μf

MAXIMUM RATINGS (Design maximum values)

	Triode	Pentode
Plate voltage.....	330	330 volts
Grid 2 voltage.....	See Rating Chart in APPENDIX	
Grid 2 supply voltage.....	330	volts
Grid 1 voltage, positive d-c.....	0	0 volts
Plate dissipation.....	2.0	5.0 watts
Grid 2 dissipation.....		1.1 watts
Grid 1 circuit resistance		
Fixed bias.....	0.5	0.25 meg
Self bias.....	1.0	1.0 meg

CHARACTERISTICS AND TYPICAL OPERATION

	Triode	Pentode
Plate voltage.....	150	200 40 volts
Grid 2 (screen) voltage.....		125 125 volts
Grid 1 (control-grid) voltage.....		0† volts
Cathode-bias resistor.....	150	68 ohms
Plate resistance (approx.).....	8700	70,000 ohms
Transconductance.....	4600	10,000 μmhos
Amplification factor.....	40	
Plate current.....	9.2	24 40 ma
Grid 2 current.....		5.2 15.5 ma
Grid 1 voltage (approx.) for I _b = 100 μa.....	-50	-8.5 volts

NOTE:

†Applied for short interval of two seconds maximum to prevent damage to the tube.



6CY5

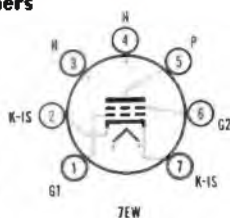


**Tetrode voltage amplifier for r-f service in
VHF television tuners**

HEATER CHARACTERISTICS

Voltage, a-c or d-c.....	6.3 volts
Current.....	200 ma
Peak heater-cathode voltage, max.	
Heater negative to cathode.....	100 volts
Heater positive to cathode.....	100 volts

Type 6CY5 is identical to type 2CY5, 3CY5, and 4CY5 except for heater characteristics. Refer to type 2CY5 for characteristics and ratings.



ENGINEERING DESIGN DATA

6CY5

JUNE 1, 1958

Sharp-cutoff tetrode

CHARACTERISTIC CURVES

(In curve section following APPENDIX)

Transfer: r_p , g_m , b_1 , b_2 216A

Hot input impedance..... 216B

APPLICATION

Designed for better operation of VHF television tuners, providing maximum gain-to-noise ratio. Operation is permissible with low plate and screen voltages. It has a high input impedance for a favorable gain-bandwidth factor.

ENGINEERING DESIGN DATA

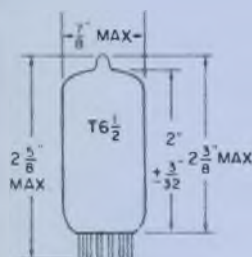
6CY7

JUNE 1, 1958

Medium-mu duo- triode with dissimilar sections

MECHANICAL DATA

Cathode, coated unipotential
Bulb..... T-6½
Outline..... JEDEC 6-3
Base..... Miniature 9-pin (E9-1)
Basing..... 9EF
Mounting position..... Any



PIN CONNECTIONS

Pin 1..... Plate (Section 2)
Pin 2..... I. C., Do not use
Pin 3..... Grid (Section 2)
Pin 4..... Heater
Pin 5..... Heater
Pin 6..... Plate (Section 1)
Pin 7..... Grid (Section 1)
Pin 8..... Cathode (Section 1)
Pin 9..... Cathode (Section 2)

APPLICATION

Type 6CY7 is a medium-mu duotriode with dissimilar sections designed to operate as a vertical deflection oscillator and amplifier in TV receivers. Section one is intended for oscillator service and section two for amplifier service.

NOTE

For 600 milliamperere series-string heater circuits use type 6CY7.



6CY7

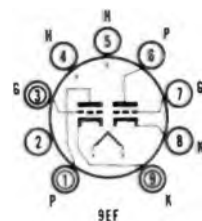


Dissimilar duotriode for TV deflection oscillator
and amplifier applications

HEATER CHARACTERISTICS

Voltage, a-c or d-c..... $6.3 \pm 10\%$ volts
Current..... 750 ma
Peak heater-cathode voltage, max.
Heater negative to cathode..... 200 volts
Heater positive to cathode*..... 200 volts

*D-c component must not exceed 100 volts max.



ELECTRICAL DATA

DIRECT INTERELECTRODE CAPACITANCES

	Section 1	Section 2
Grid to plate: g1 to p.....	1.8	4.4 μf
Input: g1 to k + h.....	1.5	5.0 μf
Output: p to k + h.....	0.30	1.0 μf

MAXIMUM RATINGS (Design maximum values)

Vertical Deflection Service*	Section 1† Oscillator	Section 2† Amplifier
Plate voltage, d-c.....	350	350 volts
Plate voltage, peak positive pulse.....		1800 volts
Control-grid voltage, peak negative d-c.....	400	250 volts
Plate dissipation.....	1.0	5.5 watts
Cathode current, d-c.....		35 ma
Cathode current, peak.....		120 ma
Control-grid circuit resistance		
Fixed bias.....	2.2	meg
Cathode bias.....	2.2	2.2 meg

CHARACTERISTICS

	Section 1† Oscillator	Section 2† Amplifier
Plate voltage.....	250	60 150 volts
Control-grid voltage.....	-3.0	0 volts
Cathode-bias resistor.....		620 ohms
Plate resistance (approx.).....	52,000	920 ohms
Transconductance.....	1300	5400 μmhos
Amplification factor.....	68	5.0
Plate current.....	1.2	80 30 ma
Control-grid voltage (approx.) for $I_b = 200 \mu\text{a}$		-40 volts
Control-grid voltage (approx.) for $I_b = 10 \mu\text{a}$	-5.5	
Plate current (approx.) for $I_c = -30 \text{ volts}$		3.5 ma

NOTES:

†Section 1 connects to pins 6, 7, and 8. Section 2 connects to pins 1, 3, and 9.

*Voltage pulse duration must not exceed 2500 μs in a 525-line, 30-frame system.

†Tube protection is needed for no drive conditions if grid leak bias is used.



6CX7



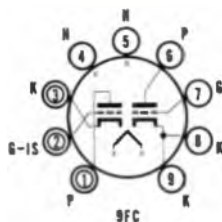
**Low-noise very high frequency amplifier for
cascode operation**

HEATER CHARACTERISTICS

Voltage, a-c or d-c.....	6.3 volts
Current.....	400 ma
Peak heater-cathode voltage, max.	
Heater negative to cathode†.....	200 volts
Heater positive to cathode*.....	200 volts
*D-c component must not exceed 100 volts max.	

†Under cutoff conditions when the tube is used as a cascode amplifier, this rating may be as high as 300 volts maximum.

Type 6CX7 is identical to type 4CX7 except for heater characteristics.



ENGINEERING DESIGN DATA

6CX7

NOVEMBER 26, 1956

**Medium-mu
duotriode**

CHARACTERISTIC CURVES

(In curve section following APPENDIX)

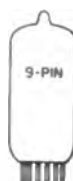
Plate.....	123A
Plate.....	123B
Characteristics (cascode amplifier).....	123C
Transfer.....	123D
Transfer.....	123E

APPLICATION

Type 6CX7 is a medium-mu duotriode for application as a low-noise vhf cascode amplifier.



6CZ5



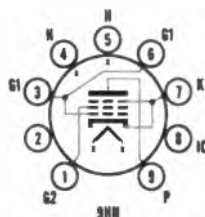
**Beam power tube for 110° vertical deflection or audio
power amplifier service, heater warm-up controlled
for series strings**

HEATER CHARACTERISTICS

Voltage, a-c or d-c.....	6.3 volts
Current.....	450 ma
Peak heater-cathode voltage, max.	
Heater negative to cathode.....	200 volts
Heater positive to cathode*.....	200 volts
Warm-up time.....	11 secs. average
(See Series-String Heaters section of APPENDIX in CBS Tube Manual).	

*D-c component must not exceed 100 volts max.

Type 6CZ5 is identical to type 5CZ5 except for heater characteristics. See type 5CZ5 for ratings and operating characteristics.



6CZ5

JUNE 1, 1957

Beam power pentode

CHARACTERISTIC CURVES

(In curve section following APPENDIX)

Plate ($E_{c1} = 0V, \Delta E_{c2}$).....	207A
Transfer; I_b ($E_b = 250V$).....	207B
Plate ($E_{c2} = 250V$).....	207C

APPLICATION

Beam power tube with high sensitivity and high efficiency, capable of providing high power output with low supply voltages.

6D5G • 6D6 • 6D7 • 6D8/G

(See chart for seldom-used tubes)

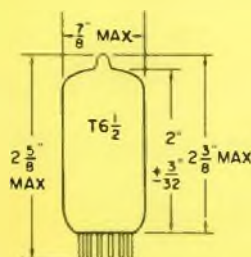
6DA7

JUNE 1, 1957

**Duotriode with
dissimilar sections**

MECHANICAL DATA

Cathode, coated unipotential
Bulb.....T-6½
Outline.....JETEC 6-3
Base.....Miniature 9-pin (E9-1)
Basing.....9EF
Mounting position.....Any



PIN CONNECTIONS

Pin 1.....Plate (Sect. 2)
Pin 2.....N. C.
Pin 3.....Grid (Sect. 2)
Pin 4.....Heater
Pin 5.....Heater
Pin 6.....Plate (Sect. 1)
Pin 7.....Grid (Sect. 1)
Pin 8.....Cathode (Sect. 1)
Pin 9.....Cathode (Sect. 2)

APPLICATION

Type 6DA7 is a miniature duotriode with dissimilar sections, section one is for vertical oscillator service; section two is for vertical amplifier service.



6DA7

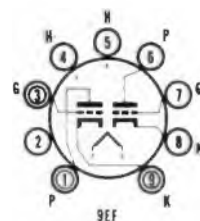


**Combined vertical amplifier and oscillator for
TV receivers**

HEATER CHARACTERISTICS

Voltage, a-c or d-c.....6.3 volts
Current.....1.0 amp
Peak heater-cathode voltage, max.
Heater negative to
cathode.....200 volts
Heater positive to
cathode*.....200 volts

*D-c component must not exceed 100 volts max.



ELECTRICAL DATA

DIRECT INTERELECTRODE CAPACITANCES

	Section 1	Section 2
Grid to plate: g1 to p.....	2.3	6.9 μf
Input: g1 to k + h.....	2.0	5.5 μf
Output: p to k + h.....	0.415	0.82 μf

MAXIMUM RATINGS (Design center values)

Plate voltage.....	300	500 volts
Plate voltage, peak positive pulse.....		1800 volts
Control-grid voltage, peak negative d-c.....	-400	-400 volts
Control-grid voltage, negative d-c.....	-50	-50 volts
Plate dissipation.....	2.0	6.0 watts
Cathode current.....	20	40 ma
Control-grid circuit resistance, self bias.....		2.2 meg

CHARACTERISTICS AND TYPICAL OPERATION

	Section 1	Section 2
Plate voltage.....	250	150 volts
Control-grid voltage.....	-8	-17.5 volts
Plate resistance (approx.).....	7700	1100 ohms
Transconductance.....	2600	5700 μmhos
Amplification factor.....	20	6.3
Zero bias plate current for $E_b = 60$ volts.....		80 ma
Control-grid voltage (approx.) for $I_b = 0.5$ ma.....		-42 volts
Control-grid voltage (approx.) for $g_m = 30 \mu\text{mhos}$ and $I_b = 50 \mu\text{a}$	-16.5	volts

NOTES:

†Voltage pulse duration must not exceed 2500 μs in a 525-line, 30-frame system.



6DA4



**TV damper diode for horizontal deflection circuits,
heater warm-up time controlled for series-string circuits**

HEATER CHARACTERISTICS

Voltage 6.3 volts
Current 1.2 amp

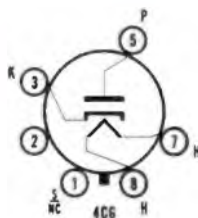
Peak heater-cathode voltage, max.

Heater negative to cathode* 4400 volts

Heater positive to cathode* 300 volts

*D-c component must not exceed 900 volts max.

*D-c component must not exceed 100 volts max.



Type 6DA4 is identical to type 12D4 except for heater characteristics. Refer to 12D4 for other data.

ENGINEERING DESIGN DATA

6DA4

DECEMBER 30, 1959

Single diode

MECHANICAL DATA

Cathode, coated unipotential
Bulb T-9
Outline JEDEC 9-11 or 9-41
Base B5-82, B6-8, B5-85, B6-60
Basing 4CG
Mounting position Any

PIN CONNECTIONS

Pin 1	I.C.
Pin 2	I.C.
Pin 3	Cathode
Pin 5	Plate
Pin 7	Heater
Pin 8	Heater



6DK6



**Pentode amplifier for i-f service in TV receivers,
heater warm-up controlled for series strings**

HEATER CHARACTERISTICS

Voltage, a-c or d-c 6.3 volts
Current 300 ma

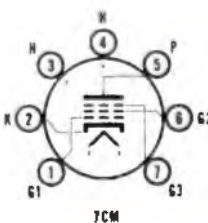
Peak heater-cathode voltage, max.

Heater negative to cathode 300 volts

Heater positive to cathode* 200 volts

Warm-up time 11 secs. average
(See Series-String Heaters section of
APPENDIX in CBS Tube Manual)

*D-c component 100 volts max.



Type 6DK6 is identical to type 3DK6 except for heater characteristics. Refer to 3DK6 for other data.

6DK6

DECEMBER 30, 1959

Sharp cutoff pentode

CHARACTERISTIC CURVES

(In curve section following APPENDIX)

Screen Grid Rating 100A
Transfer; r_p , g_m , l_b , l_{c2} 217A

MECHANICAL DATA

Cathode, coated unipotential
Bulb T-5½
Outline JEDEC 5-2
Base 7-pin miniature (E7-1)
Basing 7 CM
Mounting position Any

PIN CONNECTIONS

Pin 1	Grid 1
Pin 2	Cathode
Pin 3	Heater
Pin 4	Heater
Pin 5	Plate
Pin 6	Grid 2
Pin 7	Grid 3

APPLICATION

Type 6DK6 is a wide band high frequency pentode particularly suited for use as an i-f amplifier tube in television receivers.



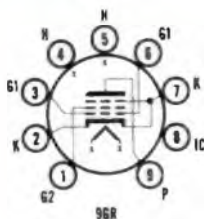
6DB5



Vertical deflection amplifier for scanning wide-angle picture tubes or audio power amplifier

HEATER CHARACTERISTICS

Voltage, a-c or d-c.	6.3 volts
Current	1.2 amps
Peak heater-cathode voltage, max.	
Heater negative to cathode	200 volts
Heater positive to cathode*	200 volts
*D-c component must not exceed 100 volts max.	



ELECTRICAL DATA

DIRECT INTERELECTRODE CAPACITANCES

Grid to plate: g1 to p	0.5 μf
Input: g1 to k + h + g2 + b.p.	15 μf
Output: p to k + h + g2 + b.p.	9 μf

MAXIMUM RATINGS (Design center values unless noted) Vertical Deflection Amplifier*

Plate voltage	300 volts
Plate voltage, peak pos. (absolute max.)	2000 volts
Grid 2 voltage, d-c	150 volts
Grid 1 voltage, peak negative	250 volts
Plate dissipation†	10 watts
Grid 2 dissipation	1.25 watts
Cathode current, average	55 ma
Cathode current, peak	200 ma
Grid 1 circuit resistance	
Fixed bias	0.1 meg
Self bias ($R_k = 100$ ohms minimum)	2.2 meg

AVERAGE CHARACTERISTICS

Class A Amplifier

Plate voltage	110	200 volts
Grid 2 (screen) voltage	110	125 volts
Grid 1 (control-grid) voltage	-7.5	volts
Cathode bias resistor		180 ohms
Plate resistance (approx.)	13,000	28,000 ohms
Transconductance	8000	8000 μmhos
Grid 1 input voltage, peak a-f	7.5	8.5 volts
Plate current, zero signal	49	46 ma
Plate current, maximum signal	50	47 ma
Grid 2 current, zero signal	4.0	2.2 ma
Grid 2 current, maximum signal	10	8.5 ma
Load resistance impedance	2000	4000 ohms
Total harmonic distortion (approx.)	10	10 %
Power output, maximum signal	2.1	3.8 watts

Triode Connected

Plate and grid 2 voltage (p + g2 tied together)	225 volts
Grid 1 voltage	-30 volts
Plate resistance	1500 ohms
Transconductance	3800 μmhos

ENGINEERING DESIGN DATA

6DB5

JUNE 1, 1957

Beam power pentode

CHARACTERISTIC CURVES

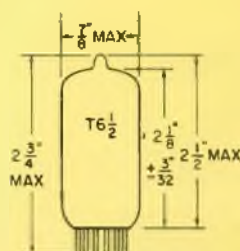
(In curve section following APPENDIX)

Plate ($E_{c2} = 125\text{V}$) 106A

Plate, triode connected 106B

MECHANICAL DATA

Cathode, coated unipotential	
Bulb	T-6½
Outline	As shown
Base	Miniature 9-pin (E9-1)
Basing	9GR
Mounting position	Any



PIN CONNECTIONS

Pin 1	Grid 2
Pin 2	Cathode, B. P.
Pin 3	Grid 1
Pin 4	Heater
Pin 5	Heater
Pin 6	Grid 1
Pin 7	Cathode, B. P.
Pin 8	I. C.*
Pin 9	Plate

*Do not use.

ENGINEERING DESIGN DATA

6DB5 (cont.)

APPLICATION

Type 6DB5 is a 9-pin miniature beam power pentode designed for use as a vertical deflection amplifier to scan 90° and 110° picture tubes at low B+ supply voltages.

NOTES

Type 6DB5 is identical to type 12DB5 except for heater characteristics.

6DB5 (cont.)

Vertical Deflection Amplifier

Plate supply voltage.....	125 volts
Plate voltage, peak positive (approx.).....	720 volts
Grid 2 (screen) supply voltage.....	125 volts
Cathode bias resistor.....	100 ohms
Grid 1 (control-grid) input voltage	
Sawtooth component.....	18 volts
Peak to peak.....	18 volts
Cathode current, average d-c.....	40 ma
Cathode current, peak to peak.....	108 ma
Plate dissipation.....	5.25 watts
Plate output voltage	
Sawtooth component.....	190 volts
Peak to peak (approx.).....	685 volts

NOTES:

*Voltage pulse duration must not exceed 2500 μ s in a 525-line, 30-frame system.

†Tube protection is needed for no-drive conditions if grid-resistor bias is used.

6DB6

(See chart for seldom-used tubes)



6DC6

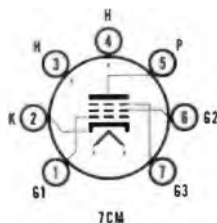


**Gain-controlled i-f or r-f amplifier
for color television receivers**

HEATER CHARACTERISTICS

Voltage, a-c or d-c.	6.3 volts
Current.	300 ma
Peak heater-cathode voltage, max.	
Heater negative to cathode.	200 volts
Heater positive to cathode*.	200 volts

*D-c component must not exceed 100 volts max.



ELECTRICAL DATA

DIRECT INTERELECTRODE CAPACITANCES

Grid to plate: g1 to p, max.	0.02 μ f
Input: g1 to k + h + g2 + g3 + i.s.	6.5 μ f
Output: p to k + h + g2 + g3 + i.s.	2.0 μ f

MAXIMUM RATINGS (Design center values)

Plate voltage	300 volts
Grid 3 (suppressor) voltage	0 volts
Grid 2 voltage	See Rating Chart in APPENDIX
Grid 2 supply voltage	300 volts
Grid 1 voltage, positive d-c	0 volts
Plate dissipation	2.0 watts
Grid 2 dissipation	0.5 watt
Grid 1 circuit resistance	
Fixed bias	0.25 meg
Self bias	1.0 meg

CHARACTERISTICS AND TYPICAL OPERATION

Class A Amplifier

Plate voltage	200 volts
Grid 3 (suppressor)	connected to cathode at socket
Grid 2 (screen) voltage	150 volts
Plate resistance (approx.)	0.5 meg
Transconductance	5500 μ hos
Plate current	9.0 ma
Grid 2 current	3.0 ma
Grid 1 voltage (approx.) for $g_m = 50 \mu$ hos	-12.5 volts

ENGINEERING DESIGN DATA

6DC6

NOVEMBER 1, 1957

Semiremote-cutoff pentode

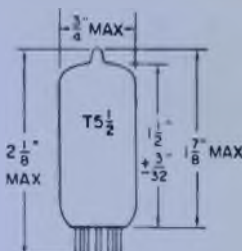
CHARACTERISTIC CURVES

(In curve section following APPENDIX)

Screen Grid Rating	100A
Plate ($E_{a2} = 250V$)	186A
Characteristics; g_m ($E_b = 200V$)	186B

MECHANICAL DATA

Cathode, coated unipotential	
Bulb	T-5½
Outline	JETEC 5-2
Base	Miniature 7-pin (E7-1)
Basing	7CM
Mounting position	Any



PIN CONNECTIONS

Pin 1	Grid 1
Pin 2	Cathode
Pin 3	Heater
Pin 4	Heater
Pin 5	Plate
Pin 6	Grid 2
Pin 7	Grid 3, 1, S.

APPLICATION

Type 6DC6 is a semiremote-cutoff pentode for operation in television receivers as a gain-controlled i-f or r-f amplifier.

ENGINEERING DESIGN DATA

6DE6

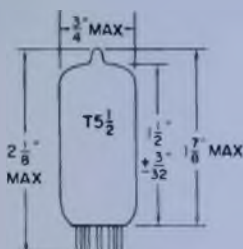
OCTOBER 1, 1956

Sharp-cutoff pentode

CHARACTERISTIC CURVES
(In curve section following APPENDIX)
Screen Grid Rating.....100A

MECHANICAL DATA

Cathode, coated unipotential
Bulb.....T-5½
Outline.....JETEC S-2
Base.....Miniature 7-pin (E7-1)
Basing.....7CM
Mounting position.....Any



PIN CONNECTIONS

Pin 1.....Grid 1
Pin 2.....Cathode
Pin 3.....Heater
Pin 4.....Heater
Pin 5.....Plate
Pin 6.....Grid 2
Pin 7.....Grid 3, I. S.

APPLICATION

The 6DE6 is a high gain pentode that has a controlled plate current cutoff for improved age of television receiver i-f stages.

6DG6GT

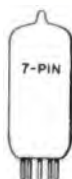
JUNE 1, 1957

Beam power pentode

CHARACTERISTIC CURVES
(In curve section following APPENDIX)
Plate ($E_{c2} = 110V$).....174A
Plate ($E_{c2} = 110V$).....174B
Plate; ΔE_{c2} ($E_{c1} = 0V$).....174C
Transfer.....174D
Plate, triode connected.....174E
Transfer, triode connected.....174F
Operation.....174G



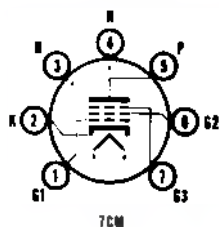
6DE6



Controlled cutoff intermediate-frequency amplifier

HEATER CHARACTERISTICS

Voltage, a-c or d-c.....6.3 volts
Current.....300 ma
Peak heater-cathode voltage, max.
Heater negative to cathode.....200 volts
Heater positive to cathode*.....200 volts
*D-c component 100 volts max.



ELECTRICAL DATA

DIRECT INTERELECTRODE CAPACITANCES

	No Shield	Shield†	
Grid to plate: g1 to p, max.....	0.025	.015	μμf
Input: g1 to k + h + g2 + g3 + i.s.....	6.5	6.5	μμf
Output: p to k + h + g2 + g3 + i.s.....	2.0	3.0	μμf

†JETEC shield 316 connected to cathode.

MAXIMUM RATINGS (Design maximum values)

Plate voltage.....	330 volts
Grid 2 voltage.....	See Rating Chart in APPENDIX
Grid 2 supply voltage.....	330 volts
Grid 1 voltage, positive d-c.....	0 volts
Plate dissipation.....	2.3 watts
Grid 2 dissipation.....	0.55 watts

CHARACTERISTICS AND TYPICAL OPERATION

Class A Amplifier

Plate voltage.....	125 volts
Grid 3 (suppressor).....	connected to cathode at socket
Grid 2 (screen) voltage.....	125 volts
Cathode bias resistor.....	56 ohms
Plate resistance (approx.).....	0.25 meg
Transconductance.....	8000 μmhos
Plate current.....	15.5 ma
Grid 2 current.....	4.2 ma
Grid 1 voltage (approx.) for $I_b = 20 \mu A$	-9 volts
Grid 1 voltage for $g_m = 700 \mu mhos$, $R_b \approx 0$	-5.5 volts



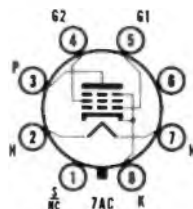
6DG6GT



Audio output amplifier

HEATER CHARACTERISTICS

Voltage, a-c or d-c.....6.3 volts
Current.....1.2 amps
Peak heater-cathode voltage, max.
Heater negative to cathode.....90 volts
Heater positive to cathode.....90 volts



Type 6DG6GT is identical to type 6W6GT except for heater characteristics, maximum $E_b = 200$ volts, and maximum $E_{c2} = 125V$ and no vertical amplifier ratings.

CBS ELECTRON TUBES



6DN6

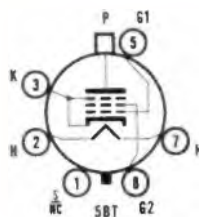


**Horizontal deflection amplifier for TV receivers
having low B supply voltage**

HEATER CHARACTERISTICS

Voltage, a-c or d-c	6.3 volts
Current	2.5 amp
Peak heater-cathode voltage, max.	
Heater negative to cathode	200 volts
Heater positive to cathode*	200 volts

*D-c component must not exceed 100 volts max.



ELECTRICAL DATA

DIRECT INTERELECTRODE CAPACITANCES

Grid to plate: g1 to p	0.8 μ f
Input: g1 to k + h + g2 + b.p.	22 μ f
Output: p to k + h + g2 + b.p.	11.5 μ f

MAXIMUM RATINGS (Design center values unless noted)

Horizontal Deflection Amplifier*

Plate supply voltage, d-c (boost + d-c power supply)	700 volts
Plate voltage, peak pos. (absolute max.)	6600 volts
Plate voltage, peak negative pulse	1500 volts
Grid 2 voltage, d-c	175 volts
Grid 1 voltage, peak negative	200 volts
Plate dissipation†	15 watts
Grid 2 dissipation	3.0 watts
Cathode current, average	200 ma
Cathode current, peak	700 ma
Grid 1 circuit resistance	0.47 meg
Bulb temperature at hottest point	225 °C

AVERAGE CHARACTERISTICS

	Instantaneous values	
Plate voltage	50	125 volts
Grid 2 (screen) voltage	100	125 volts
Grid 1 (control-grid) voltage	0	-18 volts
Plate resistance (approx.)		4000 ohms
Transconductance		9000 μ mhos
Plate current	240	70 ma
Grid 2 current	30	6.3 ma
Grid 1 voltage (approx.) for $t_b = 0.5$ ma		-36 volts
Triode amplification factor (p + g2 tied together)		4.35

NOTES:

*Voltage pulse duration must not exceed 10 μ s in a 525-line, 30-frame system.

†Tube protection is needed for no-drive conditions if grid-resistor bias is used.

ENGINEERING DESIGN DATA

6DN6

DECEMBER 30, 1959

Beam power pentode

CHARACTERISTICS CURVES

(In curve section following APPENDIX)

Plate ($E_{c2} = 100V$)

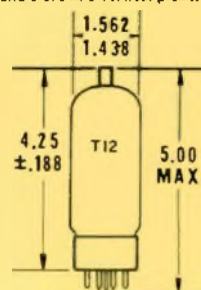
Plate, ΔE_{c2} ($E_{c1} = 0V$)

Transfer; ΔE_{c2} ($E_b = 125V$)

MECHANICAL DATA

Cathode, coated unipotential	
Bulb	T-12
Outline	JETEC 12-21
Base	Short medium shell 8-pin octal (B8-118)
Basing	SBT
Cap.	JETEC C1-1
Mounting position	Vertical

Horizontal operation permitted if pins 1 and 3 are in a vertical plane.



PIN CONNECTIONS

Pin 1	N. C.
Pin 2	Heater
Pin 3	Cathode, B. P.
Pin 4	N. C.
Pin 5	Grid 1
Pin 6	N. C.
Pin 7	Heater
Pin 8	Grid 2
Cap.	Plate

APPLICATION

Type 6DN6 is a beam power pentode designed for use in TV receivers. It is a horizontal deflection amplifier with a low-voltage, high-current characteristic at zero bias designed for low B supply operation.

NOTES

Type 6DN6 is identical to type 25DN6 except for heater characteristics.



6DQ6 12DQ6
6DQ6A 12D6QA
6DQ6B 12DQ6B



**High efficiency horizontal deflection amplifier
for television receivers**

HEATER CHARACTERISTICS

6DQ6, 6DQ6A, 6DQ6B

Voltage, a-c or d-c 6.3 volts
 Current 1.2 amp

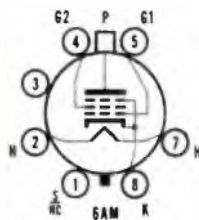
12DQ6A, 12DQ6A+, 12DQ6B+

Voltage, a-c or d-c 12.6 volts
 Current 600 ma

Peak heater-cathode voltage, max.
 Heater neg. to cathode 200 volts
 Heater pos. to cathode ★ 200 volts

★D-c component must not exceed 100 volts max.

▲Warm-up time 11 secs. average.



ELECTRICAL DATA

DIRECT INTERELECTRODE CAPACITANCES

Grid to plate: g1 to p 0.55 μf
 Input: g1 to k + h + g2 + b.p. 15 μf
 Output: p to k + h + g2 + b.p. 7 μf

MAXIMUM RATINGS (Design center values unless noted)

Horizontal Deflection Amplifier*	DQ6	DQ6A
Plate supply voltage, d-c (boost + d-c power supply).....	550	700 volts
Plate voltage, peak pos. (absolute max.)...	6000	6000 volts
Plate voltage, peak negative pulse	1375	1375 volts
Grid 2 voltage, d-c	175	200 volts
Grid 1 voltage, d-c	—	—50 volts
Grid 1 voltage, peak negative	300	300 volts
Plate dissipation†	15	15 watts
Grid 2 dissipation	2.5	3 watts
Cathode current, average	120	140 ma
Cathode current, peak	440	440 ma
Grid 1 circuit resistance	0.47	1.0† meg
Bulb temperature at hottest point	220	220 °C

ENGINEERING DESIGN DATA

6DQ6 6DQ6A
6DQ6B 12DQ6
12DQ6A 12DQ6B

DECEMBER 30, 1959

Beam power pentode

CHARACTERISTICS CURVES

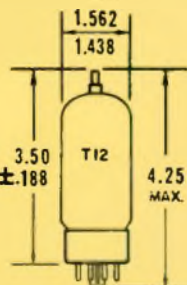
(In curve section following APPENDIX)

Plate ($E_{c2} = 100\text{V}$) 109A

Plate ($E_{c2} = 150\text{V}$) 109B

MECHANICAL DATA

Cathode, coated unipotential
 Bulb T-12
 Outline As shown
 Base (87-119)
 Basing 6AM
 Cap. JETEC
 DQ6 C1-3 or C1-33
 DQ6A, DQ6B C1-3
 Mounting position Any



PIN CONNECTIONS

Pin 1 N. C.
 Pin 2 Heater
 Pin 3 N. C.
 Pin 4 Grid 2
 Pin 5 Grid 1
 Pin 7 Heater
 Pin 8 Cathode, B. P.
 Cap. Plate

ENGINEERING DESIGN DATA

6DQ6 6DQ6A 6DQ6B 12DQ6 12DQ6A 12DQ6B (cont.)

APPLICATION

These types are high permeance tubes for the horizontal sweep of television picture tubes. Designed with a large reserve of power capability, they will fully sweep picture tubes with deflection angles in excess of 90 degrees. In addition, the higher heater voltage versions have controlled heater warm-up for series string applications.

6DQ6 • 12DQ6 (cont.)

MAXIMUM RATINGS (Design maximum values)

Horizontal Deflection Amplifier*

	DQ6B
Plate supply voltage, d-c (boost + d-c power supply)...	770 volts
Plate voltage, peak positive pulse	6500 volts
Plate voltage, peak negative pulse	1500 volts
Grid 2 voltage, d-c	220 volts
Grid 1 voltage, d-c	-55 volts
Grid 1 voltage, peak negative	330 volts
Plate dissipation†	17.5 watts
Grid 2 dissipation	3.5 watts
Cathode current, average	175 ma
Cathode current, peak	550 ma
Grid 1 circuit resistance	1.0 meg
Bulb temperature at hottest point	220°C

AVERAGE CHARACTERISTICS

Instantaneous values

Plate voltage	60	250 volts
Grid 2 (screen) voltage	150	150 volts
Grid 1 (control-grid) voltage	0	-22.5 volts
Plate resistance (approx.)		20,000 ohms
Transconductance		
DQ6A, DQ6B	6600	μmhos
DQ6	6000	μmhos
Plate current	300	75 ma
Grid 2 current	27	2.4 ma
Grid 1 voltage (approx.) for $I_b = 1$ ma		
DQ6A, DQ6B	-46	volts
DQ6	-50	volts

Triode Connected

Plate and grid 2 voltage (p + g2 tied together)	150 volts
Grid 1 voltage	-22.5 volts
Amplification factor	4.1

NOTES:

*Voltage pulse duration must not exceed 10 μs in a 525-line, 30-frame system.

†Tube protection is needed for no-drive conditions if grid-resistor bias is used.

‡Grid resistor-bias operation.



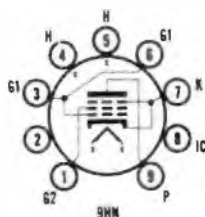
6DT5



**Vertical deflection amplifier for television receivers
employing a 110° picture tube**

HEATER CHARACTERISTICS

Voltage, a-c or d-c	6.3 volts
Current	1.2 amp
Peak heater-cathode voltage, max.	
Heater negative to cathode	200 volts
Heater positive to cathode	200 volts



ELECTRICAL DATA

DIRECT INTERELECTRODE CAPACITANCES

Grid to plate: g1 to p	0.57 μ mf
Input: g1 to k + h + g2 + b.p.	12.5 μ mf
Output: p to k + h + g2 + b.p.	4.9 μ mf

MAXIMUM RATINGS (Design maximum values unless noted)

Vertical Deflection Amplifier*

Plate voltage	315 volts
Plate voltage, peak pos. (absolute max.)	2200 volts
Grid 2 voltage, d-c	285 volts
Grid 1 voltage, peak negative	-250 volts
Plate dissipation†	9.0 watts
Grid 2 dissipation	2.0 watts
Cathode current, average	55 ma
Cathode current, peak	190 ma
Grid 1 circuit resistance	
Fixed bias	0.5 meg
Cathode bias	1.0 meg

AVERAGE CHARACTERISTICS

	Instantaneous Values‡		
Plate voltage	60	75	250 volts
Grid 2 (screen) voltage	150	250	250 volts
Grid 1 (control-grid) voltage	0	0	-16.5 volts
Transconductance			6200 μ mhos
Plate current	100	180‡	38 ma
Grid 2 current	15	35‡	2.0 ma
Grid 1 voltage (approx.) for $I_b=100\mu$ a			-35 volts

NOTES:

*Voltage pulse duration must not exceed 2500 μ s in a 525-line, 30-frame system.

†Tube protection is needed for no-drive conditions if grid-resistor bias is used.

‡Measured with a re-current waveform to keep plate and grid 2 dissipation within ratings.

§Applied for a maximum of 2 seconds.

ENGINEERING DESIGN DATA

6DT5

DECEMBER 30, 1959

**Beam power
pentode**

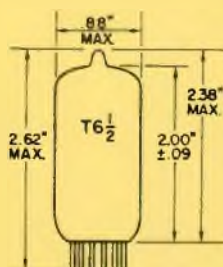
CHARACTERISTICS CURVES

(In curve section following APPENDIX)

Plate.....273A

MECHANICAL DATA

Cathode, coated unipotential	
Bulb	T-6½
Outline	JETEC 6-3
Base	Miniature 9-pin (E9-1)
Basing	9HN
Mounting position	Any



PIN CONNECTIONS

Pin 1	Grid 2
Pin 2	NC
Pin 3	Grid 1
Pin 4	Heater
Pin 5	Heater
Pin 6	Grid 1
Pin 7	Cathode, Grid 3
Pin 8	IC (Do not use)
Pin 9	Plate

APPLICATION

This is a 9-pin beam power pentode designed for service as a vertical deflection output amplifier in television receivers with 110° deflection angle picture tube and a 250 volt B+ supply.

6DT6

DECEMBER 30, 1959

Sharp-cutoff pentode

CHARACTERISTICS CURVES

(In curve section following APPENDIX)

Screen Grid Rating	100A
Plate ($E_{c2} = 100V$, $E_{c3} = 0V$)	188A
Characteristics; I_{b1} , I_{c2} ($E_{c1} = 100V$, $E_{c3} = 0V$)	188B
Plate ($E_{c2} = 100V$, $E_{c1} = 0V$)	188C
Characteristics; I_{c2} ($E_{c2} = 100V$, $E_{c1} = 0V$)	188D
Transfer; I_{b1} , I_{c2} ($E_b = 150V$, $E_{c2} = 100V$)	188E
Transfer; I_{b1} , I_{c2} ($E_b = 150V$, $E_{c2} = 100V$, $E_{c1} = 0V$)	188F

APPLICATION

Type 6DT6 is a sharp-cutoff pentode designed to operate as a dual control tube for i-m detectors or audio amplifiers and gain-controlled amplifiers. It is often used in a locked-oscillator—quadrature-grid circuit, a description of which is in the APPENDIX.



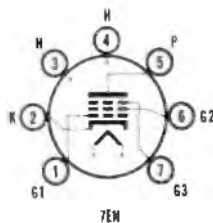
6DT6



Dual controlled pentode for i-m detector and limiter, mixer, or gain-controlled amplifier use

HEATER CHARACTERISTICS

Voltage, a-c or d-c	6.3 volts
Current	300 ma
Peak heater-cathode voltage, max.	
Heater negative to cathode	200 volts
Heater positive to cathode*	200 volts
*D-c component must not exceed 100 volts max.	



Type 6DT6 is identical to type 3DT6 except for heater characteristics.



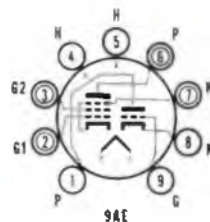
6EA8



Vhf oscillator and mixer, heater warm-up time controlled for series strings

HEATER CHARACTERISTICS

Voltage, a-c or d-c	6.3 volts
Current	450±6% ma
Peak heater-cathode voltage, max.	
Heater negative to cathode	200 volts
Heater positive to cathode*	200 volts
Warm-up time	11 secs. average
(See Series-String Heaters section of Handbook APPENDIX)	
*D-c component must not exceed 100 volts max.	



ELECTRICAL DATA

DIRECT INTERELECTRODE CAPACITANCES

	Shield*	No Shield	
Triode Section			
Grid to plate: g1 to p	1.7	1.7	μuf
Input: g1 to k + h	3.2	3.0	μuf
Output: p to k + h	1.1	0.3	μuf
Heater to cathode, each section	3.0	3.0	μuf
Pentode Section			
Grid to plate: g1 to p, max.	0.01	0.02	μuf
Input: g1 to k + h + g2 + g3	5.0	5.0	μuf
Output: p to k + h + g2 + g3	3.4	2.6	μuf
♦JETEC shield 315 connected to cathode unless noted otherwise.			
▼JETEC shield 315 connected to ground			

MAXIMUM RATINGS (Design maximum values)

	Triode	Pentode	
Plate voltage	330	330	volts
Grid 2 voltage	See Rating Chart in APPENDIX		
Grid 2 supply voltage		330	volts
Grid 1 voltage, positive d-c	0	0	volts
Plate dissipation	3.0	3.1	watts
Grid 2 dissipation		0.55	watts

CHARACTERISTICS AND TYPICAL OPERATION

	Triode	Pentode	
Class A Amplifier			
Plate voltage	150	125	volts
Grid 2 (screen) voltage		125	volts
Grid 1 (control-grid) voltage		-1.0	volts
Cathode-bias resistor	56		ohms
Plate resistance (approx.)	5000	80,000	ohms
Transconductance	8500	6,400	μmhos
Amplification factor	40		
Plate current	18	12	ma
Grid 2 current		4.0	ma
Grid 1 voltage (approx.) for $I_b=10\mu a$	12	-9	volts

ENGINEERING DESIGN DATA

6EA8

DECEMBER 30, 1959

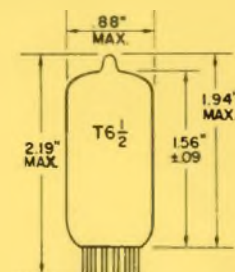
Med-mu triode — sharp-cutoff pentode

CHARACTERISTIC CURVE

Screen Grid Rating 100A

MECHANICAL DATA

Cathode, coated unipotential	
Bulb	T-6½
Outline	JETEC 6-2
Base	Miniature 9-pin (E9-1)
Basing	9AE
Mounting position	Any



PIN CONNECTIONS

Pin 1	Triode Plate
Pin 2	Pentode Grid 1
Pin 3	Pentode Grid 2
Pin 4	Heater
Pin 5	Heater
Pin 6	Pentode Plate
Pin 7	Pentode Cathode, Grid 3
Pin 8	Triode Cathode
Pin 9	Triode Grid

REFERENCES

Full explanation of the Screen Grid Rating Chart and Series-String Heater warm-up time test are given in the Handbook APPENDIX.

APPLICATION

The 6EA8 is intended primarily for service as a combined triode oscillator and pentode mixer in television tuners. Each section has an independent cathode. Its heater is warm-up time controlled to enable use in 450 ma series connected heater strings.



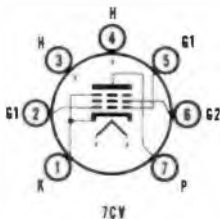
6EH5



General-purpose power amplifier for radio, TV, and phonographs

HEATER CHARACTERISTICS

Voltage, a-c or d-c	6.3 volts
Current	1.2 amp
Peak heater-cathode voltage, max.	
Heater negative to cathode	200 volts
Heater positive to cathode*	200 volts
*D-c component must not exceed 100 volts max.	



ELECTRICAL DATA

DIRECT INTERELECTRODE CAPACITANCES

Grid to plate: g1 to p	0.65 μ mf
Input: g1 to k + h + g2 + g3	17 μ mf
Output: p to k + h + g2 + g3	9 μ mf

MAXIMUM RATINGS (Design center values)

Plate voltage	135 volts
Grid 2 voltage	117 volts
Grid voltage, peak positive	0 volts
Plate dissipation	5 watts
Grid 2 dissipation	1.75 watts
Grid circuit resistance	
Fixed bias	0.1 meg
Cathode bias	0.5 meg
Bulb temperature at hottest point	220 °C

CHARACTERISTICS AND TYPICAL OPERATION

Plate supply voltage	110 volts
Grid 2 (screen) supply voltage	115 volts
Cathode bias resistor	62 ohms
Plate resistance (approx.)	11,000 ohms
Transconductance	14,600 μ mhos
Grid 1 input voltage, peak a-f	3 volts
Plate current, zero signal	42 ma
Plate current, maximum signal	42 ma
Grid 2 current, zero signal	11.5 ma
Grid 2 current, maximum signal	14.5 ma
Load resistance impedance	3000 ohms
Total harmonic distortion (approx.)	7 %
Power output, maximum signal	1.4 watts

ENGINEERING DESIGN DATA

6EH5

MARCH 30, 1959

Power pentode

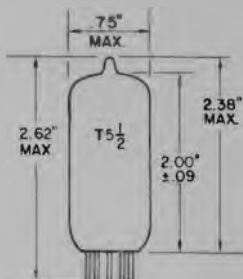
CHARACTERISTIC CURVES

(In curve section following APPENDIX)

Plate Characteristics ($E_{b2} = 115$ volts)	218A
Operation, Load vs. Distortion and Output	218B

MECHANICAL DATA

Cathode, coated unipotential	
Bulb	T-5 1/2
Outline	JETEC 5-3
Base	(E7-1)
Basing	7CV
Mounting position	Any



PIN CONNECTIONS

Pin 1	Cathode, Grid 3
Pin 2	Grid 1
Pin 3	Heater
Pin 4	Heater
Pin 5	Grid 1
Pin 6	Grid 2
Pin 7	Plate

APPLICATION

For the audio output stage of radio and television receivers and phonographs. It has an extremely high power sensitivity to provide good output from low driving voltage, even when powered by very low plate and screen voltages.

ENGINEERING DESIGN DATA

6EH8

MARCH 30, 1959

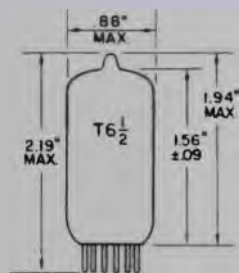
Med-mu triode— sharp-cutoff pentode

CHARACTERISTIC CURVE

Screen Grid Rating 100A

MECHANICAL DATA

Cathode, coated unipotential
Bulb T-6½
Outline JETEC 6-2
Base Miniature 9-pin (E9-1)
Basing 9JG
Mounting position Any



PIN CONNECTIONS

Pin 1	Cathodes, Grid 3, I.S.
Pin 2	Triode Grid
Pin 3	Triode Plate
Pin 4	Heater
Pin 5	Heater
Pin 6	Cathodes, Grid 3, I.S.
Pin 7	Pentode Grid 1
Pin 8	Pentode Grid 2
Pin 9	Pentode Plate

REFERENCES

Full explanation of the Screen Grid Rating Chart and Series-String Heater warm-up time test are given in the Handbook APPENDIX.

APPLICATION

The 6EH8 is intended primarily for service as a combined triode oscillator and pentode mixer in television tuners. Its heater is warm-up time controlled to enable use in 450ma series connected heater strings.



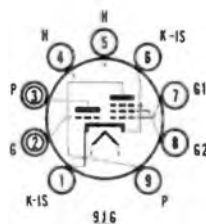
6EH8



Vhf oscillator and mixer, heater warm-up time
controlled for series strings

HEATER CHARACTERISTICS

Voltage, a-c or d-c 6.3 volts
Current 450 ma
Peak heater-cathode voltage, max.
Heater negative to cathode 200 volts
Heater positive to cathode 200 volts
Warm-up time 11 secs. average
(See Series-String Heaters section of Handbook APPENDIX)
*D-c component must not exceed 100 volts max.



ELECTRICAL DATA

DIRECT INTERELECTRODE CAPACITANCES

Triode Section	Shield ♦	No Shield
Grid to plate: g1 to p	1.8	1.8 μ f
Input: g1 to k + h + Pk + Pg3 + i.s.	2.8	2.8 μ f
Output: p to k + h + Pk + Pg3 + i.s.	2.2	1.7 μ f
Pentode Section		
Grid to plate: g1 to p, max.	.012	.020 μ f
Input: g1 to k + h + g2 + g3 + Tk + i.s.	4.8	4.8 μ f
Output: p to k + h + g2 + g3 + Tk + i.s.	3.2	2.4 μ f
Cathode to heater: h to Tk + Pk + Pg1 + Pg3 + i.s.	8.5	8.5 μ f
♦JETEC shield 315 connected to cathode.		

MAXIMUM RATINGS (Design maximum values)

	Triode	Pentode
Plate voltage	300	300 volts
Grid 2 voltage	See Rating Chart in APPENDIX	
Grid 2 supply voltage		300 volts
Grid 1 voltage, positive d-c	0	0 volts
Plate dissipation	2.5	2.8 watts
Grid 2 dissipation		0.5 watts
Grid 1 circuit resistance		
Fixed bias	0.5	0.25 meg
Self bias	1.0	1.0 meg

CHARACTERISTICS AND TYPICAL OPERATION

Class A Amplifier	Triode	Pentode	
Plate voltage	125	100	125 volts
Grid 2 (screen) voltage		70	125 volts
Grid 1 (control-grid) voltage	-1.0	0	-1.0 volts
Plate resistance (approx.)			0.17 meg
Transconductance	7500	6500	6000 μ mhos
Amplification factor	40		
Plate current	13.5		12.0 ma
Grid 2 current			4.0 ma
Grid 1 voltage (approx.) for $I_b=20\mu$ a	-9		volts



**6EM5
8EM5**



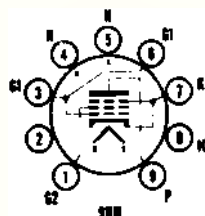
Vertical deflection amplifier in television receivers

HEATER CHARACTERISTICS

6EM5	
Voltage, a-c or d-c	6.3 volts
Current	800 ma
8EM5	
Voltage, a-c or d-c	8.4 volts
Current	600 ma

Peak heater-cathode voltage, max.	
Heater neg. to cathode	200 volts
Heater pos. to cathode*	200 volts
Warm-up time	11 secs. average

*D-c component must not exceed 100 volts max.



ELECTRICAL DATA

DIRECT INTERELECTRODE CAPACITANCES

Grid 1 to plate: g1 to p	0.7	$\mu\mu\text{f}$
Input: g1 to k + h + g2 + g3	10	$\mu\mu\text{f}$
Output: p to k + h + g2 + g3	5.1	$\mu\mu\text{f}$

MAXIMUM RATINGS (Design center values, except as noted)

Plate voltage	315	volts
Plate voltage, peak positive pulse, absolute maximum*	2200	volts
Grid 2 voltage	285	volts
Grid 1 voltage, peak negative pulse	250	volts
Cathode current, average	60	ma
Cathode current, peak	210	ma
Grid 2 power input	1.5	watts
Plate dissipation	10	watts
Bulb temperature at hottest point	250	*C

CHARACTERISTICS AND TYPICAL OPERATION

Class A Amplifier

Plate voltage	60	250	volts
Grid 2 voltage	250	250	volts
Grid 1 voltage	0	-18	volts
Amplification factor,			
Grid 1 to grid 2		8.7	
Transconductance		5100	μhmhos
Plate current	180†	40	ma
Grid 2 current	30†	3	ma
Grid 1 voltage, approx. for $I_b = 0.2$ ma		-37	volts
Grid 1 circuit resistance, max.			
Fixed bias		2.2	meg.
Cathode bias		2.2	meg.

NOTES:

*Voltage pulse duration must not exceed 2500 μs in a 525 line, 30 frame system.

†May be measured using a recurrent waveform such that the plate and grid 2 dissipation ratings are not exceeded.

ENGINEERING DESIGN DATA

**6EM5
8EM5**

DECEMBER 30, 1959

**Beam power
pentode**

CHARACTERISTIC CURVES

(In curve section following APPENDIX)

Plate ($E_{c2} = 250\text{V.}$)

Plate ($E_{c1} = 0\text{V.}$, ΔE_{c2})

Transfer ($E_b = 250\text{V.}$)

MECHANICAL DATA

Cathode, coated unipotential

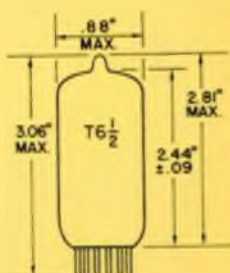
Bulb

Outline

Base

Basing

Mounting position



PIN CONNECTIONS

Pin 1	Grid 2
Pin 2	N.C.
Pin 3	Grid 1
Pin 4	Heater
Pin 5	Heater
Pin 6	Grid 1
Pin 7	Cathode, Grid 3
Pin 8	I.C.*
Pin 9	Plate

*Do not use.

APPLICATION

These beam-power pentodes in 9-pin miniature envelopes are designed for service as vertical deflection amplifiers in television receivers employing 110° deflection angle picture tubes.

6DQ6 • 6DQ6A (cont.)

MAXIMUM RATINGS (Design center values unless noted)

Horizontal Deflection Amplifier*	6DQ6	6DQ6A
Plate supply voltage, d-c (boost + d-c power supply).....	550	700 volts
Plate voltage, peak pos. (absolute max.)....	6000	6000 volts
Plate voltage, peak negative pulse.....	1375	1375 volts
Grid 2 voltage, d-c.....	175	200 volts
Grid 1 voltage, d-c.....	—	—50 volts
Grid 1 voltage, peak negative.....	300	300 volts
Plate dissipation†.....	15	15 watts
Grid 2 dissipation.....	2.5	3 watts
Cathode current, average.....	120	140 ma
Cathode current, peak.....	440	440 ma
Grid 1 circuit resistance.....	0.47	1.0‡ meg
Bulb temperature at hottest point.....	220	220 °C

AVERAGE CHARACTERISTICS

	Instantaneous values	
Plate voltage.....	60	250 volts
Grid 2 (screen) voltage.....	150	150 volts
Grid 1 (control-grid) voltage.....	0	—22.5 volts
Plate resistance (approx.).....	20,000	ohms
Transconductance		
6DQ6A.....	6600	μmhos
6DQ6.....	6000	μmhos
Plate current.....	300	75 ma
Grid 2 current.....	27	2.4 ma
Grid 1 voltage (approx.) for $I_b = 1$ ma		
6DQ6A.....	—46	volts
6DQ6.....	—50	volts

Triode Connected

Plate and grid 2 voltage (p + g2 tied together).....	150 volts
Grid 1 voltage.....	—22.5 volts
Amplification factor.....	4.1

TYPICAL OPERATION

Horizontal Deflection for 70° Picture Tube*

Plate supply voltage (boost + d-c supply).....	465 volts
Plate voltage, peak positive (d-c + pulse).....	3440 volts
Grid 2 (screen) voltage.....	140 volts
Grid 1 (control-grid) voltage, d-c.....	—28 volts
Grid 1 (control-grid) input voltage	
Sawtooth component, peak to peak.....	74 volts
Negative peaking component.....	18 volts
Plate current.....	83 ma
Grid 2 (screen) current.....	12.3 ma
Plate dissipation.....	5.1 watts
Grid 1 resistance.....	0.33 meg
Anode voltage of CRT.....	14 kv

NOTES:

*Voltage pulse duration must not exceed 10 μs in a 525-line, 30-frame system.

†Tube protection is needed for no-drive conditions if grid-resistor bias is used.

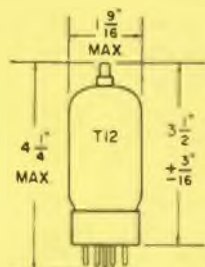
‡Grid resistor-bias operation.

ENGINEERING DESIGN DATA

6DQ6 • 6DQ6A (cont.)

MECHANICAL DATA

Cathode, coated unipotential	
Bulb.....	T-12
Outline.....	As shown
Base.....	(B7-119)
Basing.....	6AM
Cap. JETEC	
6DQ6.....	CI-3 or CI-33
6DQ6A.....	CI-3
Mounting position.....	Any



PIN CONNECTIONS

Pin 1.....	N. C.
Pin 2.....	Heater
Pin 3.....	N. C.
Pin 4.....	Grid 2
Pin 5.....	Grid 1
Pin 7.....	Heater
Pin 8.....	Cathode, B. P.
Cap.....	Plate

APPLICATION

The 6DQ6 and 6DQ6A are high perveance tubes for the horizontal sweep of television picture tubes. Designed with a large reserve of power capability, they will fully sweep picture tubes with deflection angles in excess of 90 degrees.

**6E5 • 6E6 • 6E7 • 6F4 • 6F5/G/
GT • 6F6/G/GT • 6F7/S • 6F8G
6G5 • 6G6G • 6H4/GT • 6H5**

(See chart for seldom-used tubes)

ENGINEERING DESIGN DATA

6H6GT

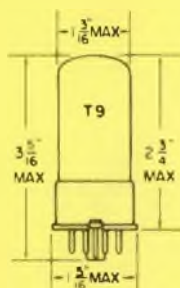
6H6

NOVEMBER 26, 1956

Duodiode

MECHANICAL DATA

Cathode, coated unipotential	6H6	6H6GT
Bulb	MT-8	T-9
Outline, JETEC	8-5	9-12
Base, JETEC	67-22	67-143
Basing	7Q	7Q
Mounting position	Any	Any



PIN CONNECTIONS

Pin 1	Shell, N. C.
Pin 2	Heater
Pin 3	Plate (Sect. 2)
Pin 4	Cathode (Sect. 2)
Pin 5	Plate (Sect. 1)
Pin 7	Heater
Pin 8	Cathode (Sect. 1)

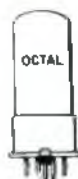
APPLICATION

Types 6H6 and 6H6GT are duodiodes designed to function as r-f detectors, phase detectors, or low-power rectifiers.



6H6GT

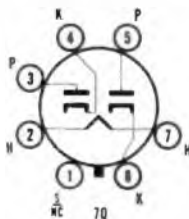
6H6



R-f detector, phase detector, or low power rectifier

HEATER CHARACTERISTICS

Voltage, a-c or d-c	6.3 volts
Current	0.3 amp
Peak heater-cathode voltage, max.	330 volts



ELECTRICAL DATA

DIRECT INTERELECTRODE CAPACITANCES	6H6	6H6GT
Plate (Sect. 1) to cathode (Sect. 1)	3.0	3.0 μf
Plate (Sect. 2) to cathode (Sect. 2)	3.4	4.0 μf
Plate (Sect. 1) to plate (Sect. 2)	0.10	0.10 μf

MAXIMUM RATINGS (Design center values)

Rectifier Service

Plate voltage, peak inverse	420 volts
Plate supply voltage, rms (each plate)*	150 volts
Output current, d-c*	8 ma
Plate current, peak steady state (each plate)	48 ma
Plate supply impedance, total effective (each plate)*	40 ohms

Voltage Doubler

Half-Wave Full-Wave

Plate voltage, rms	117	117 volts
Plate supply impedance, total effective	30	15 ohms
Output current, d-c	8.0	8.0 ma

NOTE:

*Ratings are for half-wave connection.

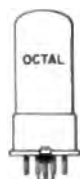
6J4

(See chart for seldom-used tubes)



6H6GT

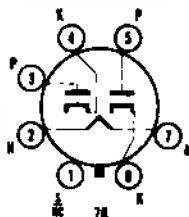
6H6



R-f detector, phase detector, or low power rectifier

HEATER CHARACTERISTICS

Voltage, a-c or d-c.....	6.3 volts
Current	0.3 amp
Peak heater-cathode voltage, max.....	330 volts



ELECTRICAL DATA

DIRECT INTERELECTRODE CAPACITANCES	6H6	6H6GT
Plate (Sect. 1) to cathode (Sect. 1).....	3.0	3.0 μf
Plate (Sect. 2) to cathode (Sect. 2).....	3.4	4.0 μf
Plate (Sect. 1) to plate (Sect. 2).....	0.10	0.10 μf

MAXIMUM RATINGS (Design center values)

Rectifier Service	
Plate voltage, peak inverse.....	420 volts
Plate supply voltage, rms (each plate)*.....	150 volts
Output current, d-c*.....	8 ma
Plate current, peak steady state (each plate).....	48 ma
Plate supply impedance, total effective (each plate)*.....	40 ohms

Voltage Doubler	Half-Wave	Full-Wave
Plate voltage, rms.....	117	117 volts
Plate supply impedance, total effective.....	30	15 ohms
Output current, d-c.....	8.0	8.0 ma

NOTE:

*Ratings are for half-wave connection.

ENGINEERING DESIGN DATA

6H6GT

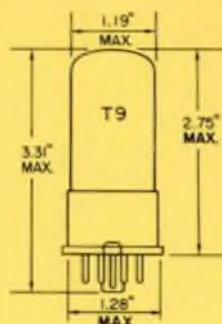
6H6

DECEMBER 30, 1959

Duodiode

MECHANICAL DATA

Cathode, coated	6H6	6H6GT
unipotential	MT-8	T-9
Bulb.....	8-5	9-12
Outline, JETEC.....	87-22	87-143
Base, JETEC.....	7Q	7Q
Mounting position.....	Any	Any



PIN CONNECTIONS

Pin 1.....	Shell, N. C.
Pin 2.....	Heater
Pin 3.....	Plate (Sect. 2)
Pin 4.....	Cathode (Sect. 2)
Pin 5.....	Plate (Sect. 1)
Pin 6.....	Heater
Pin 7.....	Cathode (Sect. 1)
Pin 8.....	Cathode (Sect. 1)

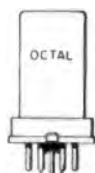
APPLICATION

Types 6H6 and 6H6GT are duodiodes designed to function as r-f detectors, phase detectors, or low-power rectifiers.



6J5

6J5GT



Audio voltage amplifier, phase inverter,
or general purpose amplifier

HEATER CHARACTERISTICS

Voltage, a-c or d-c.	6.3 volts
Current	300 ma
Peak heater-cathode voltage, max.	
Heater negative to cathode	90 volts
Heater positive to cathode	90 volts

ELECTRICAL DATA

DIRECT INTERELECTRODE CAPACITANCES

	6J5	6J5GT
Grid to plate: g1 to p.	3.4	3.8 μf
Input: g1 to k + h.	3.4	4.2 μf
Output: p to k + h.	3.6	5.0 μf

†JTEC shield 308 connected to cathode.

MAXIMUM RATINGS (Design center values)

Plate voltage.	300 volts
Control-grid voltage.	0 volts
Plate dissipation.	2.5 watts
Cathode current.	20 ma
Control-grid circuit resistance.	1.0 meg

CHARACTERISTICS AND TYPICAL OPERATION

Class A Amplifier

Plate voltage.	90	250 volts
Control-grid voltage.	0	-8 volts
Plate resistance (approx.)	6700	7700 ohms
Transconductance	3000	2600 μmhos
Amplification factor	20	20
Plate current.	10	9 ma



6J6

6J6A



Very high frequency oscillator, amplifier, or mixer

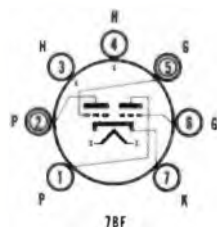
HEATER CHARACTERISTICS

Voltage, a-c or d-c.	6.3 volts
Current	450 ma
Peak heater-cathode voltage, max.	
Heater negative to cathode	100 volts
Heater positive to cathode	100 volts

6J6A

Warm-up time . . . 11 secs. average
(See Series-String Heaters section of
APPENDIX in CBS Tube Manual).

Types 6J6 and 6J6A are identical to types 5J6 and 19J6 except for heater characteristics. See 5J6 for characteristics and ratings.



ENGINEERING DESIGN DATA

6J5

6J5GT

NOVEMBER 26, 1956

Medium-mu triode

CHARACTERISTIC CURVES

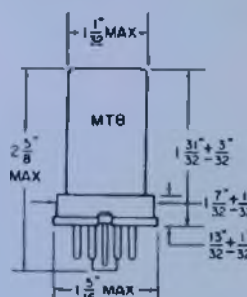
(In curve section following APPENDIX)

Plate 1B1A

Characteristics; μ , g_m , f_p 1B1B

MECHANICAL DATA

Cathode, coated unipotential	6J5	6J5GT
Bulb	MT-8	T-9
Outline, JETEC	8-3	9-12
Base, JETEC	B6-23	B6-23
Basing	.6Q	.6Q
Mounting position	Any	Any



PIN CONNECTIONS

Pin 1.	6J5—Shell
	6J5GT—Base Sleeve
Pin 2.	Heater
Pin 3.	Plate
Pin 5.	Grid 1
Pin 7.	Heater
Pin 8.	Cathode

REFERENCES

See APPENDIX for R-C amplifier data.

6J6

6J6A

NOVEMBER 1, 1957

Medium-mu
duotriode

CHARACTERISTIC CURVES

(In curve section following APPENDIX)

Plate 146A

Plate 146B

Transfer 146C

Characteristics; g_m , f_p , μ 146D

ENGINEERING DESIGN DATA

Class A Push-Pull Amplifier (Values for two tubes)	Fixed Bias	Cathode Bias
Plate voltage.....	285	285 volts
Grid 2 (screen) voltage.....	285	285 volts
Grid 1 (control-grid) voltage.....	-25.5	volts
Cathode bias resistor.....		400 ohms
Grid-to-grid input voltage, peak a-f.....	51	51 volts
Plate current, zero signal.....	55	55 ma
Plate current, maximum signal.....	72	61 ma
Grid 2 current, zero signal.....	9	9 ma
Grid 2 current, maximum signal.....	17	13 ma
Load resistance, plate-to-plate.....	12,000	12,000 ohms
Total harmonic distortion (approx.).....	6	4 %
Power output, maximum signal.....	10.5	9.8 watts

Triode Connected

Plate and grid 2 voltage (p + g2 tied together).....	250	volts
Grid 1 voltage.....	-18	volts
Plate resistance.....	2500	ohms
Transconductance.....	2700	μ mbas
Plate current, zero signal.....	37.5	ma
Amplification factor.....	6.8	
Grid voltage (approx.) for $i_b = 0.5$ ma.....	-48	volts

NOTES:

*Triode connected; grid 2 tied to plate.

†Voltage pulse duration must not exceed 2500 μ s in a 525-line, 30-frame system.

6K6GT (cont.)

REFERENCES

For explanation of Design Center Rating System and Absolute Maximum Rating System refer to the APPENDIX. Rating systems for electron tubes are also covered under RETMA Engineering Standard MR-210.

APPLICATION

The 6K6GT is a high efficiency power pentode intended for audio output amplifier service. It is also used as a triode connected (screen tied to plate) vertical sweep output amplifier in television receivers. It is capable of moderate power output with small signal input and is used with either single tube or push-pull circuits.



6K7

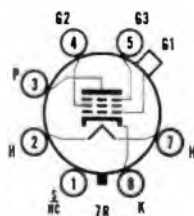


6K7G • 6K7GT

Gain controlled i-f or r-f amplifier for radio receivers

HEATER CHARACTERISTICS

Voltage, a-c or d-c.....	6.3	volts
Current.....	300	ma



ELECTRICAL DATA

DIRECT INTERELECTRODE CAPACITANCES

	6K7	6K7A	6K7GT	
Grid to plate: g1 to p, max.....	0.005	0.007	0.005	μf
Input: g1 to k + h + g2 + g3.....	7.0	5.0	4.6	μf
Output: p to k + h + g2 + g3.....	12	12	12	μf

†With shell connected to cathode.

▲With close-fitting shield connected to cathode.

6K7

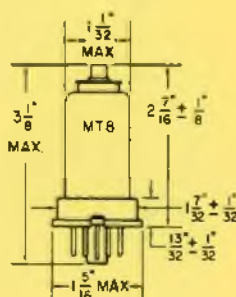
6K7G • 6K7GT

NOVEMBER 26, 1956

Remote-cutoff pentode

MECHANICAL DATA

Cathode, coated unipotential			
	6K7	6K7G	6K7GT
Bulb.....	MT-8	ST-12	T-9
Outline,			
JETEC.....	8-4	12-8	9-18
Base,			
JETEC.....	B7-22	B7-1	B7-26
Basing.....	7R	7R	7R
Cap.....	C1-1	C1-2 or C1-3	C1-3
Mounting			
position.....	Any	Any	Any



ENGINEERING DESIGN DATA

6K7 • 6K7G • 6K7GT (cont.)

PIN CONNECTIONS

Pin 1.....	6K7—Shell
	6K7G—N. C.
	6K7GT—Base Sleeve
Pin 2.....	Heater
Pin 3.....	Plate
Pin 4.....	Grid 2
Pin 5.....	Grid 3
Pin 7.....	Heater
Pin 8.....	Cathode
Cap.....	Grid 1

APPLICATION

Types 6K7, 6K7G, and 6K7GT are remote cutoff-pentodes designed for operation as gain controlled i-f or r-f amplifiers in radio receivers.

6K8

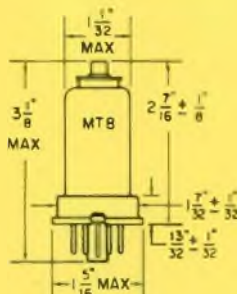
6K8G • 6K8GT

NOVEMBER 26, 1956

Triode-hexode converter

MECHANICAL DATA

Cathode, coated unipotential			
Bulb.....	6K8 MT-8	6K8G ST-12	6K8GT T-9
Outline, JETEC.....	8-2	12-8	9-24
Base, JETEC.....	B8-21	B8-1	B8-26
Basing.....	8K	8K	8K
Cap.....	CI-4	CI-3	CI-3
Mounting position.....	Any	Any	Any



6K7 • 6K7G • 6K7GT (cont.)

MAXIMUM RATINGS (Design center values)

Plate voltage.....	300 volts
Grid 2 voltage.....	125 volts
Grid 2 supply voltage.....	300 volts
Grid voltage.....	0 volts
Plate dissipation.....	2.75 watts
Grid 2 dissipation.....	0.35 watt

CHARACTERISTICS AND TYPICAL OPERATION

Class A Amplifier

Plate voltage.....	100	250	250 volts
Grid 3 (suppressor).....	connected to cathode at socket		
Grid 2 (screen) voltage.....	100	100	125 volts
Grid 1 (control-grid) voltage.....	-1.0	-3.0	-3.0 volts
Plate resistance (approx.).....	0.15	0.8	0.6 meg
Transconductance.....	1650	1450	1650 μ mhos
Plate current.....	9.5	7.0	10.5 ma
Grid 2 current.....	2.7	1.7	2.6 ma
Grid 1 voltage (approx.) for $g_m = 2 \mu$ mhos.....	-38.5	-42.5	-52.5 volts



6K8

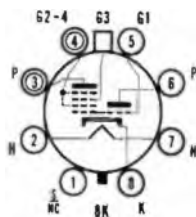
6K8G • 6K8GT



Combined triode oscillator and hexode mixer
in radio receivers

HEATER CHARACTERISTICS

Voltage, a-c or d-c.....	6.3 volts
Current.....	300 ma



ELECTRICAL DATA

MAXIMUM RATINGS (Design center values)

Hexode plate voltage.....	300 volts
Hexode grid 2 and 4 voltage.....	150 volts
Hexode grid 2 and 4 supply voltage.....	300 volts
Hexode grid 3 voltage, negative d-c.....	0 volts
Triode plate voltage.....	125 volts
Hexode grid 2 and 4 dissipation.....	0.7 watt
Hexode plate dissipation.....	0.75 watt
Triode plate dissipation.....	0.75 watt
Cathode current, total.....	16 ma

6K8 • 6K8G • 6K8GT (cont.)

CHARACTERISTICS AND TYPICAL OPERATION

Converter Service (Separate excitation)

Hexode plate voltage.....	100	250 volts
Hexode screen (grids 2 & 4) voltage.....	100	100 volts
Hexode control-grid (grid 3) voltage.....	-3	-3 volts
Hexode plate resistance (approx.).....	0.4	0.6 meg
Hexode plate current.....	2.3	2.5 ma
Hexode screen current.....	6.2	6.0 ma
Triode plate voltage.....	100	100 volts
Triode grid resistor.....	50,000	50,000 ohms
Triode plate current.....	3.8	3.8 ma
Triode grid and hexode grid 1 current.....	0.15	0.15 ma
Conversion transconductance.....	325	350 μ hos
Conversion transconductance with hexode grid 3 bias = -30 volts (approx.).....	2	2 μ hos
Cathode current, total.....	12.5	12.5 ma

Oscillator Characteristics, Not Oscillating

Plate voltage.....	100 volts
--------------------	-----------

ENGINEERING DESIGN DATA

6K8 • 6K8G 6K8GT (cont.)

PIN CONNECTIONS

Pin 1.....	6K8—Shell
	6K8G—N. C.
	6K8GT—Shell
Pin 2.....	Heater
Pin 3.....	Hexode Plate
Pin 4.....	Hexode Grids 2 & 4
Pin 5.....	Hexode Grid 1 & Triode Grid
Pin 6.....	Triode Plate
Pin 7.....	Heater
Pin 8.....	Cathode
Cap.....	Hexode Grid 3

APPLICATION

Types 6K8, 6K8G, and 6K8GT are triode-hexode converters designed to operate in radio receivers as combined oscillators and hexodes.

6L5G

(See chart for seldom-used tubes)



6L6

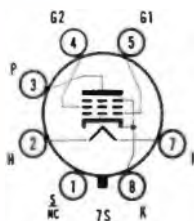
6L6G • 6L6GA
6L6GB



Audio output tube with high power, high sensitivity, and high efficiency

HEATER CHARACTERISTICS

Voltage, a-c or d-c.....	6.3 volts
Current.....	900 ma
Peak heater-cathode voltage, max.....	180 volts



ELECTRICAL DATA

DIRECT INTERELECTRODE CAPACITANCES

Grid to plate: g1 to p.....	0.4 μ f
Input: g1 to k + h + g2 + b.p.....	10 μ f
Output: p to k + h + g2 + b.p.....	12 μ f

6L6

6L6G • 6L6GA
6L6GB

OCTOBER 1, 1956

Beam power pentode

CHARACTERISTIC CURVES

(In curve section following APPENDIX)

Plate ($E_{c2}=250V$)..... 180A

Plate, ΔE_{c2} 180B

Plate Characteristics,

Triode Connected..... 180C

Operation, Load vs. Distortion and

Output..... 180D

MECHANICAL DATA

Cathode, coated unipotential

Bulb..... 6L6 6L6G 6L6GA 6L6GB

Outline,..... M7-10 ST-16 ST-14 T-12

Base,..... JETEC..... 10-1 16-3 14-3 12-15

Base,..... JETEC..... B7-22 B7-12 B7-12 B7-11

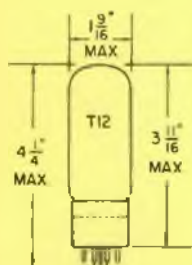
or B7-119

Basing..... 7S 7S 7S 7S

Mounting position, Any Any Any Any

ENGINEERING DESIGN DATA

6L6 • 6L6G 6L6GA • 6L6GB (cont.)



PIN CONNECTIONS

Pin 1	N. C.
Pin 2	Heater
Pin 3	Plate
Pin 4	Grid 2
Pin 5	Grid 1
Pin 7	Heater
Pin 8	Cathode, B. P.

APPLICATION

Type 6L6G and its counterparts are high efficiency beam power tubes which furnish considerable power for their size. Very little power is taken by the screen because of the beam plate suppressor action.

Elimination of second harmonic distortion can be accomplished by push-pull operation, single tube with negative feedback, or preceding single tube with out-of-phase second harmonic generation.

NOTE

Transformer or impedance coupling is recommended and the grid resistance should be kept low.

6L6 • 6L6G • 6L6GA • 6L6GB (cont.)

MAXIMUM RATINGS (Design center values)

	Triode connected*	Pentode
Plate voltage	275	360 volts
Grid 2 voltage	275	270 volts
Plate dissipation	19	19 watts
Grid 2 dissipation		2.5 watts
Grid circuit resistance		
Fixed bias	0.1	0.1 meg
Self bias	0.5	0.5 meg

CHARACTERISTICS AND TYPICAL OPERATION

Class A Amplifier	Triode*	Pentode
Plate voltage	250	300
Grid 2 voltage	250	200
Grid 1 voltage	-20	-12.5
Plate resistance	1700	22,500
Transconductance	4700	6000
Grid 1 input voltage, peak a-f	20	14
Plate current, zero signal	40	72
Plate current, max. signal	44	79
Grid 2 current, zero signal	—	5
Grid 2 current, max. signal	—	7.3
Load resistance impedance	5000	2500
Total harmonic distortion	5	10
Power output, max. signal	1.4	6.5

Push-Pull Amplifier (Values for two tubes)

	Class A1	Class A61	Class A62
Plate voltage	250	270	360
Grid 2 voltage	250	270	225
Grid 1 voltage	-16	-17.5	-22.5
Plate resistance, per tube	24,500	23,500	
Transconductance, per tube	5500	5700	
Grid-to-grid input voltage, peak a-f	32	35	45
Plate current, zero signal	120	134	88
Plate current, max. signal	140	155	132
Grid 2 current, zero signal	10	11	5
Grid 2 current, max. signal	16	17	15
Load resistance, plate-to-plate	5000	5000	6600
Total harmonic distortion	2	2	2
Power output	14.5	17.5	26.5

*Grid 2 tied to plate



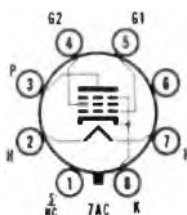
6L6GC



Audio output tube with high power,
high sensitivity, and high efficiency

HEATER CHARACTERISTICS

Voltage, a-c or d-c	6.3 volts
Current	900 ma
Peak heater-cathode voltage, max.	
Heater negative to cathode	200 volts
Heater positive to cathode	200 volts



ELECTRICAL DATA

DIRECT INTERELECTRODE CAPACITANCES

Grid 1 to plate: g1 to p	0.6 μ f
Input: g1 to k + h + g2 + b.p.	10 μ f
Output: p to k + h + g2 + b.p.	6.5 μ f

MAXIMUM RATINGS (Design maximum values)

	Triode† Connected	Pentode Connected
Plate voltage	450	500 volts
Grid 2 voltage		450† volts
Plate dissipation	30	30 watts
Grid 2 dissipation		5.0 watts
Grid 1 circuit resistance		
Fixed bias	0.1	0.1 meg
Cathode bias	0.5	0.5 meg

CHARACTERISTICS AND TYPICAL OPERATION

Class A Amplifier (See 6L6GB)

Push-Pull Class A amplifier (See 6L6GB)

Push-Pull Class AB1 Amplifier (Values for two tubes)

See also 6L6GB

Plate voltage	450 volts
Grid 2 voltage	400 volts
Grid 1 voltage	-37 volts
Grid to grid input voltage, Peak a-f.	70 volts
Plate current, zero signal	116 ma
Plate current, maximum signal	210 ma
Grid 2 current, zero signal	5.6 ma
Grid 2 current, maximum signal	22 ma
Load resistance, plate to plate	5600 ohms
Total harmonic distortion	1.8%
Power output	55 watts

Push-Pull Class AB2 Amplifier (See 6L6GB)

NOTES:

†Grid 2 tied to plate.

‡500 volts when screens are connected to taps on plate winding of output transformer.

ENGINEERING DATA

6L6GC

DECEMBER 30, 1959

Beam power pentode

CHARACTERISTIC CURVES

(In curve section following APPENDIX)

Plate: ($E_{c2} = 250V$) 180A

Plate, ΔE_{c2} 180B

Plate Characteristics, Triode Connected 180C

Operation, Load vs. Distortion 180D

and Output 180D

MECHANICAL DATA

Cathode, coated unipotential

Bulb T-12

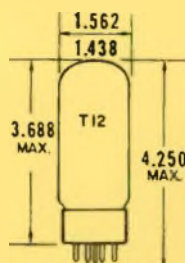
Outline JEDEC 12-15

Base JEDEC B6-148, B6-122,

B7-111, B7-119, B7-12

Basing 7AC

Mounting position Any



PIN CONNECTIONS

Pin 1	N.C.
Pin 2	Heater
Pin 3	Plate
Pin 4	Grid 2
Pin 5	Grid 1
Pin 7	Heater
Pin 8	Cathode, B.P.

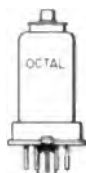
APPLICATION

Type 6L6GC has the same characteristics as type 6L6GB, but it has higher ratings.



6L7

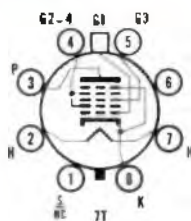
6L7G



Dual control heptode for r-f mixer or automatic volume expander circuits

HEATER CHARACTERISTICS

Voltage, a-c or d-c. 6.3 volts
Current 300 ma



ELECTRICAL DATA

MAXIMUM RATINGS (Design center values)

	Class A ₁ Amplifier	Mixer
Plate voltage	300	300 volts
Grid 2 and 4 voltage	100	150 volts
Screen dissipation	1.0	1.5 watts
Plate dissipation	1.5	1.0 watts

CHARACTERISTICS AND TYPICAL OPERATION

Class A₁ Amplifier

Plate voltage	250	volts
Grid 2 and 4 (screen grid) voltage	100	volts
Grid 1 and 3 (control-grid) voltage	-3.0	volts
Plate resistance	0.6	meg
Transconductance (grid 1 to plate)	1100	μmhos
Transconductance with g ₁ and g ₃ = -15 volts	5.0	μmhos
Plate current	5.3	ma
Screen current	6.5	ma

Mixer

Plate voltage	250	250* volts
Grid 2 and 4 (screen grid) voltage	100	150* volts
Grid 1 (signal-grid) voltage	-3.0	-6.0* volts
Grid 3 (oscillator-grid) voltage	-10.0	-15.0 volts
Grid 3 voltage, peak	12	18 volts
Plate resistance	>1	>1 meg
Conversion transconductance	375	350 μmhos
Conversion transconductance	5.0Δ	5.0Δ μmhos
Plate current	2.4	3.3 ma
Screen current	7.1	9.2 ma

NOTES:

*These values are recommended for multi-range receiver applications.

†D-c resistance in grid 3 circuit should not exceed 50,000 ohms.

ΔGrid 1 bias = -30 volts.

ΔGrid 1 bias = -45 volts.

ENGINEERING DESIGN DATA

6L7

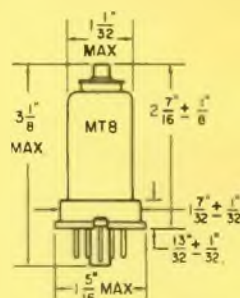
6L7G

NOVEMBER 26, 1956

Dual-control heptode

MECHANICAL DATA

Cathode, coated unipotential	6L7	6L7G
Bulb	MT-8	ST-12
Outline, JETEC	8-4	12-8
Base, JETEC	B7-21	B7-1
Basing	7T	7T
Cap	CI-4	CI-2 or CI-3
Mounting position	Any	Any



PIN CONNECTIONS

Pin 1	6L7—Shell 6L7G—N. C.
Pin 2	Heater
Pin 3	Plate
Pin 4	Grid 2 & 4
Pin 5	Grid 3
Pin 7	Heater
Pin 8	Cathode & Grid 5
Cap	Grid 1

APPLICATION

Types 6L7 and 6L7G are dual-control heptodes designed for use in r-f mixer or automatic volume expander circuits.

6N4 • 6N6G

(See chart for seldom-used tubes)

ENGINEERING DESIGN DATA

6N7

6N7GT

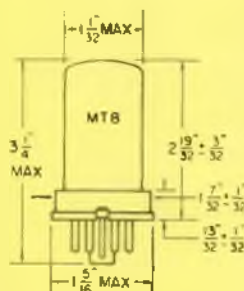
NOVEMBER 26, 1956

Power duotriode

CHARACTERISTIC CURVES
(In curve section following APPENDIX)
Plate 193A

MECHANICAL DATA

Cathode, coated unipotential	6N7	6N7GT
Bulb	MT-8	T-9
Outline, JETEC	8-6	9-11
Base, JETEC	88-21	88-6
Basing	8B	8B
Mounting position	Any	Any



PIN CONNECTIONS

Pin 1	6N7—Shell
Pin 2	6N7GT—N. C.
Pin 3	Heater
Pin 4	Plate (Sect. 2)
Pin 5	Grid (Sect. 2)
Pin 6	Grid (Sect. 1)
Pin 7	Plate (Sect. 1)
Pin 8	Heater
Pin 9	Cathode

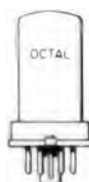
APPLICATION

Types 6N7 and 6N7GT are duotriodes designed for use as push-pull class B power amplifiers.



6N7

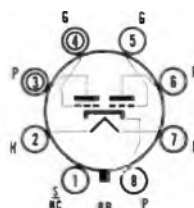
6N7GT



Push-pull class B triode power amplifier

HEATER CHARACTERISTICS

Voltage, a-c or d-c	6.3 volts
Current	800 ma



ELECTRICAL DATA

MAXIMUM RATINGS (Design center values)

	Class A Amplifier (Driver)*	Class B Power Amplifier
Plate voltage, d-c	300	300 volts
Plate dissipation (each plate)	1.0	5.5 watts
Plate current, peak (each plate)		125 ma

CHARACTERISTICS AND TYPICAL OPERATION Class B Power Amplifier

Plate voltage	300	300 volts
Control-grid voltage	0	0 volts
Grid-to-grid voltage, peak a-f	58	82 volts
D-c plate current, zero signal	35	35 ma
D-c plate current, maximum signal	70	70 ma
Grid current, peak (each unit)	20	22 ma
Plate supply impedance	0	1000 ohms
Grid circuit impedance, effective (each unit)	0	516† ohms
Load resistance, effective (plate-to-plate)	8000	8000 ohms
Total harmonic distortion	4	8 %
Third harmonic distortion	3.5	7.5 %
Fifth harmonic distortion	1.5	2.5 %
Power output, maximum signal	10	10 watts

Class A Amplifier (Driver)*

Plate voltage	250	294 volts
Control-grid voltage	~5.0	~6.0 volts
Plate resistance	11,300	11,000 ohms
Transconductance	3100	3200 μmhos
Plate current	6.0	7.0 ma
Plate load resistance	between 20,000 and 40,000	ohms
Amplification factor	35	35
Power output (approx.)	400	400 mw

NOTES:

* Both grids and plates connected together at socket.

† Consists of 500 ohms effective resistance and 50 mh leakage reactance.

6P5GT • 6P7G • 6Q4 6Q6/G/6T7G

(See chart for seldom-used tubes)

CBS ELECTRON TUBES



6Q7

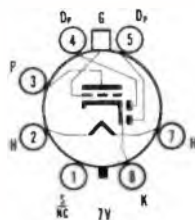
6Q7G • 6Q7GT



**Combined detector, avc, and audio amplifier
for a-m radio receivers**

HEATER CHARACTERISTICS

Voltage, a-c or d-c.....	6.3 volts
Current.....	300 ma
Peak heater-cathode voltage, max.....	90 volts



ELECTRICAL DATA

MAXIMUM RATINGS (Design center values)

Plate voltage.....	300 volts
Diode current (min.) with 10 volts applied to each plate.....	0.8 ma
Diode current (max.), each plate, continuous operation.....	1.0 ma

CHARACTERISTICS AND TYPICAL OPERATION*

Class A Amplifier (Triode Unit)

Plate voltage.....	100	250 volts
Control-grid voltage.....	-1.0	-3.0 volts
Plate resistance (approx.).....	.058	.058 meg
Transconductance.....	1200	1200 μ mhos
Amplification factor.....	70	70
Plate current.....	0.8	1.0 ma

NOTES:

*The two diode plates are placed around the cathode and are independent of the triode unit except for the common cathode.

6R6G • 6R7/G/GT • 6R8

(See chart for seldom-used tubes)

CBS ELECTRON TUBES

ENGINEERING DESIGN DATA

6Q7

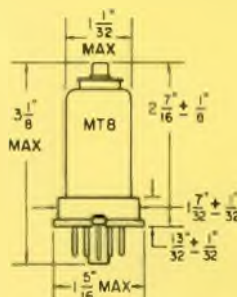
6Q7G • 6Q7GT

NOVEMBER 26, 1956

Duodiode—high-mu triode

MECHANICAL DATA

	6Q7	6Q7G	6Q7GT
Cathode, coated unipotential			
Bulb.....	MT-8	ST-12	T-9
Outline, JETEC.....	8-4	12-8	9-18
Base, JETEC.....	B7-22	B7-4	B7-22
Basing.....	7V	7V	7V
Cap.....	C1-4	C1-3	C1-3
Mounting position.....	Any	Any	Any



PIN CONNECTIONS

Pin 1.....	6Q7—Shell
	6Q7G—N. C.
	6Q7GT—B. S.
Pin 2.....	Heater
Pin 3.....	Triode Plate
Pin 4.....	Diode 2 Plate
Pin 5.....	Diode 1 Plate
Pin 7.....	Heater
Pin 8.....	Cathode
Cap.....	Triode Grid

REFERENCES

See APPENDIX for R-C amplifier data.

APPLICATION

Types 6Q7, 6Q7G, and 6Q7GT are duodiode—high-mu triodes designed to operate as combined detectors, avc, and audio amplifiers in a-m radio receivers.

ENGINEERING DESIGN DATA

6S4

6S4A

NOVEMBER 26, 1956

Medium-mu power triode

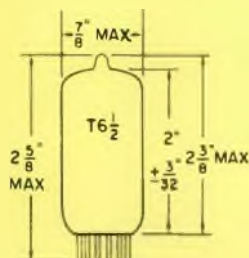
CHARACTERISTIC CURVES

(In curve section following APPENDIX)

Plate 189A
Transfer 189B

MECHANICAL DATA

Cathode, coated unipotential
Bulb T-6½
Outline JETEC 6-3
Base Miniature 9-pin (E9-1)
Basing 9AC
Mounting position Any



PIN CONNECTIONS

Pin 1 I. C.
Pin 2 Cathode
Pin 3 Grid 1
Pin 4 Heater
Pin 5 Heater
Pin 6 Grid 1
Pin 7 I. C.
Pin 8 I. C.
Pin 9 Plate

APPLICATION

Types 6S4 and 6S4A are medium-mu triodes designed for use as vertical deflection output amplifiers in television receivers.

NOTES

These types are identical to each other except that the 6S4A is heater warm-up time controlled.



6S4

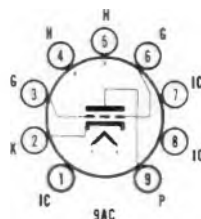
6S4A

Vertical deflection output amplifier
for television receivers



HEATER CHARACTERISTICS

Voltage, a-c or d-c 6.3 volts
Current 600 ma
Peak heater-cathode voltage, max.
Heater negative to cathode 200 volts
Heater positive to cathode* 200 volts
Warm-up time† 11 secs. average
(See Series-String Heaters section of APPENDIX In CBS Tube Manual).
*D-c component 100 volts max.
†Applies only to 6S4A



ELECTRICAL DATA

DIRECT INTERELECTRODE CAPACITANCES

Grid to plate: g1 to p 2.6 μ f
Input: g1 to k + h 4.2 μ f
Output: p to k + h 0.9 μ f

MAXIMUM RATINGS (Design center values unless noted)*

Plate voltage, d-c 500 volts
Plate voltage, peak pos. (absolute max.) 2200 volts
Control-grid voltage, peak negative pulse 250 volts
Plate dissipation 7.5 watts
Cathode current, average 30 ma
Cathode current, peak 105 ma
Control-grid circuit resistance, cathode bias 2.2 meg

AVERAGE CHARACTERISTICS

Class A Amplifier

Plate voltage 250 volts
Control-grid voltage -8.0 volts
Plate resistance (approx.) 3600 ohms
Transconductance 4500 μ mas
Amplification factor 16
Plate current 26 ma
Grid 1 voltage (approx.) for $I_b = 50 \mu$ a -23 volts
Plate current (approx.) for $E_{c1} = -15$ volts 4.5 ma

NOTES:

*Voltage pulse duration must not exceed 2500 μ s in a 525-line, 30-frame system.

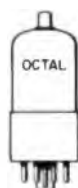
6S7/G

(See chart for seldom-used tubes)

CBS ELECTRON TUBES



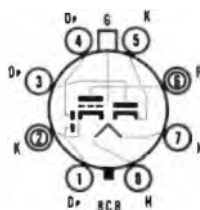
6S8GT



Combined a-m, f-m detector and audio amplifier

HEATER CHARACTERISTICS

Voltage, a-c or d-c.....	6.3 volts
Current.....	300 ma
Peak heater-cathode voltage, max.	
Heater negative to cathode.....	90 volts
Heater positive to cathode.....	90 volts



ELECTRICAL DATA

MAXIMUM RATINGS (Design center values)

Plate voltage.....	300 volts
Plate dissipation.....	0.5 watt
Plate current (each diode).....	1.0 ma

CHARACTERISTICS AND TYPICAL OPERATION

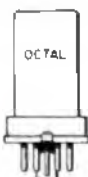
Class A Amplifier

Plate voltage.....	50	100	250	volts
Control-grid voltage.....	0	-1	-2	volts
Control-grid resistor.....	10	—	—	meg
Plate resistance (approx.).....	.285	.11	.091	meg
Transconductance.....	300	900	1100	μmhos
Amplification factor.....	85	100	100	
Plate current.....	.07	0.4	0.9	ma



6SA7

6SA7G • 6SA7GT

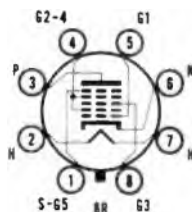


Pentagrid converter for radio receivers

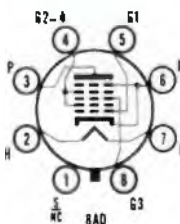
HEATER CHARACTERISTICS

Voltage, a-c or d-c.....	6.3 volts
Current.....	300 ma

6SA7



6SA7G • 6SA7GT



CBS ELECTRON TUBES

ENGINEERING DESIGN DATA

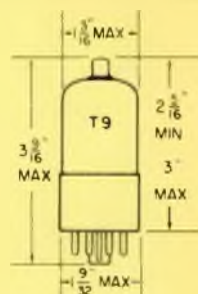
6S8GT

NOVEMBER 26, 1956

Triple-diode—high-mu triode

MECHANICAL DATA

Cathode, coated unipotential.....	T-9
Bulb.....	JETEC 9-23
Outline.....	Intermediate shell octal (B8-58)
Base.....	8CB
Basing.....	C1-3
Cap.....	Any
Mounting position.....	Any



PIN CONNECTIONS

Pin 1.....	Diode 3 Plate
Pin 2.....	Triode & Diode 2 & 3 Cathode
Pin 3.....	Diode 1 Plate
Pin 4.....	Diode 2 Plate
Pin 5.....	Diode 1 Cathode
Pin 6.....	Triode Plate
Pin 7.....	Heater
Pin 8.....	Heater
Cap.....	Triode Grid

6SA7

6SA7G • 6SA7GT

DECEMBER 10, 1956

Pentagrid converter

CHARACTERISTIC CURVES

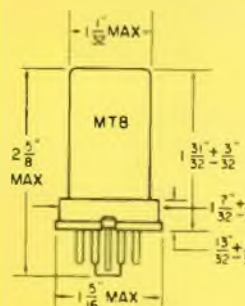
(In curve section following APPENDIX)
 Operation, separate excitation.....190A
 Operation, self excitation.....190B

MECHANICAL DATA

Cathode, coated unipotential.....	6SA7G	6SA7GT
Bulb.....	MT-8	T-9
Outline, JETEC.....	8-1	9-11
Base, JETEC.....	B8-21	(B8-6)
Basing.....	8R	8AD
Mounting position.....	Any	Any

ENGINEERING DESIGN DATA

6SA7 • 6SA7G 6SA7GT (cont.)



PIN CONNECTIONS

Pin 1	6SA7—Shell, Grid 5
	6SA7G/GT—N. C.
Pin 2	Heater
Pin 3	Plate
Pin 4	Grid 2, Grid 4
Pin 5	Grid 1
Pin 6	6SA7—Cathode
	6SA7G/GT—Cathode, Grid 5
Pin 7	Heater
Pin 8	Grid 3

APPLICATION

Types 6SA7, 6SA7G, and 6SA7GT are pentagrid converters designed for super-heterodyne circuits. They are similar to the miniature 6BE6. Construction is such that changes in signal grid voltage do not effect cathode current and cathode space charge.

6SA7 • 6SA7G • 6SA7GT (cont.)

ELECTRICAL DATA

MAXIMUM RATINGS (Design center values)

Plate voltage	300 volts
Grid 2 and 4 voltage	100 volts
Grid 2 and 4 supply voltage	300 volts
Grid 3 voltage, negative d-c	50 volts
Grid 3 voltage, positive d-c	0 volts
Grid 2 dissipation	1.0 watt
Plate dissipation	1.0 watt
Cathode current, total	14 ma

CHARACTERISTICS AND TYPICAL OPERATION

Converter Service (Separate excitation)	Self Excitation*		Separate Excitation	
Plate voltage	100	250	100	250 volts
Grid 3 (signal grid) voltage	0	0	-2	-2 volts
Grid 2 and 4 (oscillator anode) voltage	100	100	100	100 volts
Grid 1 (oscillator grid) resistor	20,000	20,000	20,000	20,000 ohms
Plate resistance (approx.)	0.5	1.0	0.5	1.0 meg
Conversion transconductance	425	450	425	450 μ mhos
Cathode current, total	12.3	12.5	12.3	12.5 ma
Plate current	3.3	3.5	3.3	3.5 ma
Grid 2 and 4 (oscillator anode) current	8.5	8.5	8.5	8.5 ma
Grid 1 (oscillator grid) current	0.5	0.5	0.5	0.5 ma
Conversion transcon- ductance with $E_{c3} = -35V$	2	2	2	2 μ mhos

NOTES:

*Values are approximate and are for a Hartley circuit having a feedback of about 2 volts peak in the cathode circuit.

6SB7Y

(See chart for seldom-used tubes)

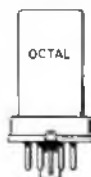
6SC7

DECEMBER 10, 1956

High-mu duotriode



6SC7



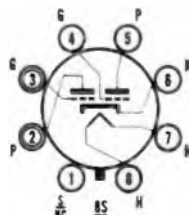
Audio voltage amplifier or phase inverter

MECHANICAL DATA

Cathode, coated unipotential	MY-8
Bulb	JETEC 8-1
Outline	Small water octal (BB-21)
Base	.8S
Mounting position	Any

HEATER CHARACTERISTICS

Voltage, a-c or d-c	6.3 volts
Current	300 ma
Peak heater-cathode voltage, max.	
Heater negative to cathode	90 volts
Heater positive to cathode	90 volts



CBS ELECTRON TUBES

6SC7 (cont.)

ELECTRICAL DATA

DIRECT INTERELECTRODE CAPACITANCES†

	Section 1	Section 2
Grid to plate: g1 to p.....	2.0	2.0 $\mu\mu\text{f}$
Input: g1 to k + h + shell.....	2.0	2.0 $\mu\mu\text{f}$
Output: p to k + h + shell.....	3.0	3.0 $\mu\mu\text{f}$

†With pin 1 connected to pin 6.

MAXIMUM RATINGS (Design center values)

Plate voltage.....	250 volts
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CHARACTERISTICS AND TYPICAL OPERATION Class Amplifier (Each section)

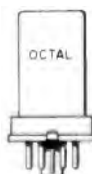
Plate voltage.....	250 volts
Control-grid voltage.....	-2.0 volts
Plate resistance (approx.).....	.053 meg
Transconductance.....	1325 μmhos
Amplification factor.....	70
Plate current.....	2.0 ma

6SD7GT • 6SE7GT • 6SF5/GT 6SF7

(See chart for seldom-used tubes)



6SG7 6SG7GT



Radio frequency or intermediate frequency amplifier
capable of high frequency operation

HEATER CHARACTERISTICS

Voltage, a-c or d-c.....	6.3 volts
Current.....	300 ma
Peak heater-cathode voltage, max. Heater negative to cathode.....	90 volts
Heater positive to cathode.....	90 volts

ELECTRICAL DATA

DIRECT INTERELECTRODE CAPACITANCES†

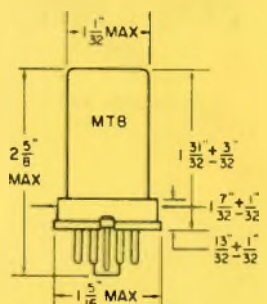
Grid to plate: g1 to p, max.....	0.003 $\mu\mu\text{f}$
Input: g1 to k + h + g2 + g3.....	8.5 $\mu\mu\text{f}$
Output: p to k + h + g2 + g3.....	7.0 $\mu\mu\text{f}$

†Shell connected to cathode.

CBS ELECTRON TUBES

ENGINEERING DESIGN DATA

6SC7 (cont.)



PIN CONNECTIONS

Pin 1.....	Shell
Pin 2.....	Plate (Sect. 2)
Pin 3.....	Grid (Sect. 2)
Pin 4.....	Grid (Sect. 1)
Pin 5.....	Plate (Sect. 1)
Pin 6.....	Cathode
Pin 7.....	Heater
Pin 8.....	Heater

REFERENCES

See APPENDIX for R-C amplifier data.

APPLICATION

Type 6SC7 is a high- μ duotriode designed for operation as an audio voltage amplifier or phase inverter. It is sometimes used in audio preamplifiers.

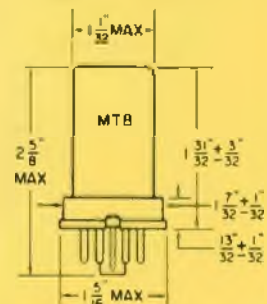
6SG7 6SG7GT

DECEMBER 10, 1956

Remote-cutoff
pentode

MECHANICAL DATA

Cathode, coated unipotential.....	6SG7	6SG7GT
Butt.....	MT-8	T-9
Outline, JETEC.....	8-1	9-12
Base, JETEC.....	88-21	88-26
Basing.....	88K	88K
Mounting position.....	Any	Any



ENGINEERING DESIGN DATA

6SG7-6SG7GT (cont.)

PIN CONNECTIONS

Pin 1	6SG7—Shell
	6SG7GT—h, C
Pin 2	Heater
Pin 3	Cathode
Pin 4	Grid 1
Pin 5	Cathode
Pin 6	Grid 2
Pin 7	Heater
Pin 8	Plate

APPLICATION

Types 6SG7 and 6SG7GT are semiremote-cutoff pentodes with high transconductance and low grid 1 to plate capacitance.

6SG7-6SG7GT (cont.)

MAXIMUM RATINGS (Design center values)

Plate voltage	300 volts
Grid 2 voltage	200 volts
Grid 2 supply voltage	300 volts
Grid 1 voltage	0 volts
Plate dissipation	3.0 watts
Grid 2 dissipation	0.6 watt

CHARACTERISTICS AND TYPICAL OPERATION

Class A Amplifier

Plate voltage	100	250	250	volts
Grid 3 (suppressor)	connected to cathode at socket			
Grid 2 (screen) voltage	100	125	150	volts
Grid 1 (control-grid) voltage	-1.0	-1.0	-2.5	volts
Plate resistance (approx.)	0.25	0.9	>1.0	meg
Transconductance	4100	4700	4000	μ mhos
Plate current	8.2	11.8	9.2	ma
Grid 2 current	3.2	4.4	3.4	ma
Grid 1 voltage (approx.) for $g_m = 40 \mu$ mhos	-11.5	-14	-17.5	volts

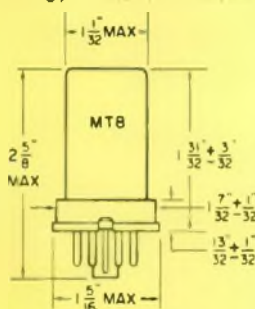
6SH7

DECEMBER 10, 1956

Sharp-cutoff pentode

MECHANICAL DATA

Cathode, coated unipotential	
Bulb	MT-8
Outline	JETEC 8-1
Base	Small wafer octal (88-21)
Basing	8BK
Mounting position	Any



PIN CONNECTIONS

Pin 1	Shell
Pin 2	Heater
Pin 3	Cathode
Pin 4	Grid 1
Pin 5	Cathode
Pin 6	Screen
Pin 7	Heater
Pin 8	Plate



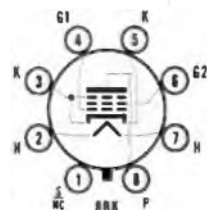
6SH7



R-f or i-f amplifier and f-m limiter capable of high frequency operation

HEATER CHARACTERISTICS

Voltage, a-c or d-c	6.3 volts
Current	300 ma
Peak heater-cathode voltage, max.	
Heater negative to cathode	90 volts
Heater positive to cathode	90 volts



ELECTRICAL DATA

DIRECT INTERELECTRODE CAPACITANCES†

Grid to plate: g1 to p, max.	0.003 μ f
Input: g1 to k + h + g2 + g3	8.5 μ f
Output: p to k + h + g2 + g3	7.0 μ f

†With shell connected to cathode.

MAXIMUM RATINGS (Design center values)

Plate voltage	300 volts
Grid 2 voltage	150 volts
Grid 2 supply voltage	300 volts
Grid 1 voltage	0 volts
Plate dissipation	3.0 watts
Grid 2 dissipation	0.7 watt

6SH7 (cont.)

CHARACTERISTICS AND TYPICAL OPERATION

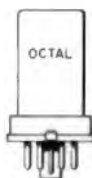
Class A Amplifier

Plate voltage	100	250 volts
Grid 2 (screen) voltage	100	150 volts
Grid 1 (control-grid) voltage	-1	-1 volts
Plate resistance (approx.)	0.35	0.9 meg
Transconductance	4000	4900 μ ms
Plate current	5.3	10.8 ma
Grid 2 current	2.1	4.1 ma
Grid 1 voltage (approx.) for $I_b = 10 \mu$ a	-4.0	-5.5 volts



6SJ7

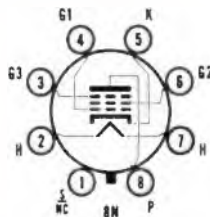
6SJ7GT



R-f amplifier, biased detector, or audio amplifier

HEATER CHARACTERISTICS

Voltage, a-c or d-c	6.3 volts
Current	300 ma
Peak heater-cathode voltage, max.	
Heater negative to cathode	90 volts
Heater positive to cathode	90 volts



ELECTRICAL DATA

DIRECT INTERELECTRODE CAPACITANCES

	6SJ7	6SJ7GT
Grid to plate: g1 to p, max.	0.005	0.005 μ f
Input: g1 to k + h + g2 + g3	6.0	7.0 μ f
Output: p to k + h + g2 + g3	7.0	7.0 μ f

†Shell connected to cathode.

‡JETEC shield 308 connected to cathode.

MAXIMUM RATINGS (Design center values)

Plate voltage	300 volts
Grid 2 voltage	125 volts
Grid 2 supply voltage	300 volts
Grid 1 voltage, positive d-c	0 volts
Plate dissipation	2.5 watts
Grid 2 dissipation	0.7 watt

CHARACTERISTICS AND TYPICAL OPERATION

Class A Amplifier

Plate voltage	100	250 volts
Grid 3 (suppressor)	connected to cathode at socket	
Grid 2 (screen) voltage	100	100 volts
Grid 1 (control-grid) voltage	-3	-3 volts
Plate resistance (approx.)	0.7	1.0 meg
Transconductance	1575	1650 μ ms
Plate current	2.9	3.0 ma
Grid 2 current	0.9	0.8 ma
Grid 1 voltage (approx.) for $I_b = 10 \mu$ a	-8	-8 volts

ENGINEERING DESIGN DATA

6SH7 (cont.)

APPLICATION

Type 6SH7 is a sharp-cutoff pentode for use in high frequency and wide-band applications, and for i-m limiters. It has a double cathode connection for reduction of cathode circuit coupling.

6SJ7

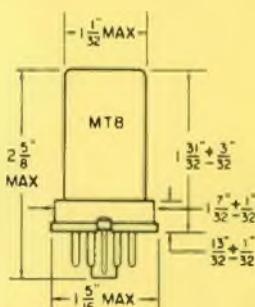
6SJ7GT

DECEMBER 10, 1956

Sharp-cutoff pentode

MECHANICAL DATA

Cathode, coated		
unipotential	6SJ7	6SJ7GT
Bulb	MT-8	T-9
Outline, JETEC	8-1	9-12
Base, JETEC	B8-21	B8-26
Basing	8N	8N
Mounting position	Any	Any



PIN CONNECTIONS

Pin 1	6SJ7—Shell
Pin 2	6SJ7GT—Base Sleeve
Pin 3	Heater
Pin 4	Grid 3
Pin 5	Grid 1
Pin 6	Cathode
Pin 7	Grid 2
Pin 8	Heater
Pin 9	Plate

REFERENCE

R-C amplifier data is given in the APPENDIX.

APPLICATION

Types 6SJ7 and 6SJ7GT are sharp-cutoff pentodes used in making general purpose applications.

6SL7GT (cont.)

ELECTRICAL DATA

DIRECT INTERELECTRODE

CAPACITANCES — Shields

	Section 1	Section 2	
Grid to plate: g1 to p	2.8	2.8	μf
Input: g1 to k + h	3.0	3.4	μf
Output: p to k + h	3.8	3.2	μf

*JTEC shield 308 connected to cathode.

MAXIMUM RATINGS (Design center values)

Plate voltage	300 volts
Control-grid voltage, positive d-c	0 volts
Plate dissipation	1.0 watt

CHARACTERISTICS AND TYPICAL OPERATION

Class A Amplifier

Plate voltage	250 volts
Control-grid voltage	-2.0 volts
Plate resistance (approx.)	44,000 ohms
Transconductance	1600 μmhos
Amplification factor	70
Plate current	2.3 ma



6SN7GT

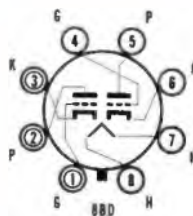
6SN7GTA • 6SN7GTB



TV sweep oscillator and vertical amplifier;
phase inverter and R-C amplifier

HEATER CHARACTERISTICS

Voltage, a-c or d-c	6.3 volts
Current	600 ma
Peak heater-cathode voltage, max.	
Heater negative to cathode	200 volts
Heater positive to cathode*	200 volts
Warm-up time, 6SN7GTB only,	
11 secs. average (See Series-String Heaters section of APPENDIX in CBS Tube Manual).	
*D-c component 100 volts max.	



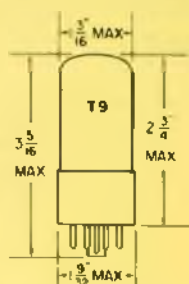
ELECTRICAL DATA

DIRECT INTERELECTRODE CAPACITANCES

	6SN7GT		6SN7GTA & 6SN7GTB		
	Section 1	Section 2	Section 1	Section 2	
Grid to plate: g1 to p	3.8	4.0	4.0	3.8	μf
Input: g1 to k + h	2.8	3.0	2.2	2.6	μf
Output: p to k + h	0.8	1.2	0.7	0.7	μf

ENGINEERING DESIGN DATA

6SL7GT (cont.)



PIN CONNECTIONS

Pin 1	Grid 1 (Sect. 2)
Pin 2	Plate (Sect. 2)
Pin 3	Cathode (Sect. 2)
Pin 4	Grid 1 (Sect. 1)
Pin 5	Plate (Sect. 1)
Pin 6	Cathode (Sect. 1)
Pin 7	Heater
Pin 8	Heater

REFERENCE

See APPENDIX for R-C amplifier data.

6SN7GT

6SN7GTA • 6SN7GTB

DECEMBER 10, 1956

Medium- μ
duotriode

CHARACTERISTIC CURVES

(In curve section following APPENDIX)

Plate 181A

Characteristics; μ , g_m , r_p 181B

MECHANICAL DATA

Cathode, coated unipotential

Bulb T-9

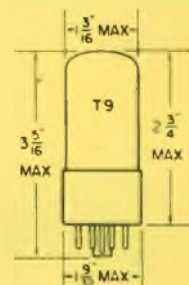
Outline JETEC 9-11 or 9-4

Base Inter- or short inter. shell octal

(88-6 or B8-58)

Basing 8BD

Mounting position Any



CBS ELECTRON TUBES

ENGINEERING DESIGN DATA

6SN7GT • 6SN7GTA 6SN7GTB (cont.)

PIN CONNECTIONS

Pin 1	Grid 1 (Sect. 2)
Pin 2	Plate (Sect. 2)
Pin 3	Cathode (Sect. 2)
Pin 4	Grid 1 (Sect. 1)
Pin 5	Plate (Sect. 1)
Pin 6	Cathode
Pin 7	Heater
Pin 8	Heater

REFERENCES

See APPENDIX for R-C amplifier data. Heater warm-up time control for type 6SN7GTB is explained in the Series-string Heater section of the APPENDIX.

APPLICATION

Types 6SN7GT, 6SN7GTA, and 6SN7GTB are medium- μ duotriodes with independent sections for application as combined TV sweep oscillators and vertical deflection amplifiers, multivibrators, phase inverters, and R-C amplifiers. They are identical to each other except that the 6SN7GT has lower plate voltages and dissipation ratings, and the 6SN7GTB is heater warm-up time controlled for series-string operation.

6SQ7

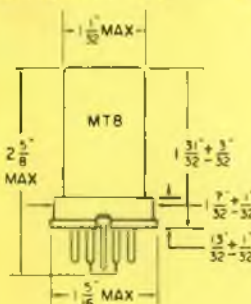
6SQ7G • 6SQ7GT

DECEMBER 10, 1956

**Duodiode—
high- μ triode**

MECHANICAL DATA

	6SQ7	6SQ7G/GT
Cathode, coated unipotential	6SQ7	6SQ7G/GT
Bulb	MT-8	T-9
Outline, JEDEC	8-1	9-12
Base, JEDEC	B8-21	B8-26
Basing	8Q	8Q
Mounting position	Any	Any



6SQ7 • 6SQ7G • 6SQ7GT (cont.)

MAXIMUM RATINGS (Design center values)

Plate voltage.....	300 volts
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CHARACTERISTICS AND TYPICAL OPERATION

Class A Amplifier

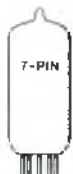
Plate voltage.....	100	250 volts
Control-grid voltage.....	-1.0	-2.0 volts
Plate resistance (approx.).....	0.11	.085 meg
Transconductance.....	925	1175 μ mos
Amplification factor.....	100	100
Plate current.....	0.5	1.1 ma

6SR7GT • 6SS7 • 6ST7 6SU7GT • 6SV7 • 6SZ7

(See chart for seldom-used tubes)



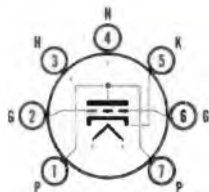
6T4



Local oscillator in ultra-high-frequency tuners

HEATER CHARACTERISTICS

Voltage, a-c or d-c.....	6.3 volts
Current.....	225 ma
Peak heater-cathode voltage, max.	
Heater negative to cathode.....	50 volts
Heater positive to cathode*.....	50 volts
*D-c component must not exceed 25 volts max.	



7DK

ELECTRICAL DATA

DIRECT INTERELECTRODE CAPACITANCES

	No Shield	Shield [†]	
Grid to plate: g1 to p.....	1.7	1.7	μ f
Input: g1 to k + h.....	3.3	2.9	μ f
Output: p to k + h.....	1.8	0.25	μ f
Heater to cathode: h to k*.....	2.9	3.0	μ f
Grid to cathode: g1 to k*.....	2.6	2.6	μ f
Plate to cathode: p to k*.....	0.18	0.20	μ f

Grounded grid operation

Input.....	5.7	5.5	μ f
Output.....	3.4	1.8	μ f

[†]JETEC shield 316 connected to cathode.

*Measured between specified elements only. When external shield is used, it should be grounded.

MAXIMUM RATINGS (Design center values)

Plate voltage.....	200 volts
Plate dissipation.....	3.5 watts
Cathode current.....	30 ma

CBS ELECTRON TUBES

ENGINEERING DESIGN DATA

6SQ7 • 6SQ7G 6SQ7GT (cont.)

PIN CONNECTIONS

Pin 1.....	6SQ7—Shell
	6SQ7G GT—Base Sleeve
Pin 2.....	Triode Grid
Pin 3.....	Cathode
Pin 4.....	Diode 2 Plate
Pin 5.....	Diode 1 Plate
Pin 6.....	Triode Plate
Pin 7.....	Heater
Pin 8.....	Heater

APPLICATION

Types 6SQ7, 6SQ7G, and 6SQ7GT are duodiode—high mu triodes designed to function as combined detectors, avc, and audio amplifier tubes.

6T4

DECEMBER 10, 1956

Low-mu uhf triode

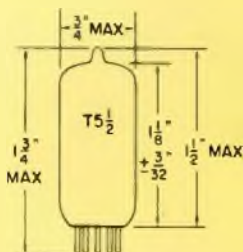
CHARACTERISTIC CURVES

(In curve section following APPENDIX)

Plate.....	117A
Plate.....	117B
Transfer ($E_b = 80V$).....	117C

MECHANICAL DATA

Cathode, coated unipotential	
Bulb.....	T-5 1/2
Outline.....	JETEC 5-1
Base.....	Miniature 7-pin (E7-1)
Basing.....	7DK
Mounting position.....	Any



6T4 (cont.)

PIN CONNECTIONS

Pin 1	Plate
Pin 2	Grid 1
Pin 3	Heater
Pin 4	Heater
Pin 5	Cathode
Pin 6	Grid 1
Pin 7	Plate

APPLICATION

Type 6T4 is a low- μ triode designed for oscillator service to 950 mc.

6T4 (cont.)

CHARACTERISTICS

Plate voltage	80 volts
Cathode-bias resistor	150 ohms
Plate resistance (approx.)	1860 ohms
Transconductance	7000 μ mhos
Amplification factor	13
Plate current	18 ma
Control-grid voltage (approx.) for $I_b = 50 \mu$ a	-15 volts

TYPICAL OPERATION

Oscillator at 950 Mc

Plate voltage	80 volts
Control-grid voltage (self-bias)	-4.0 volts
Control-grid resistance	10,000 ohms
Plate current	18 ma
Control-grid current	400 μ a

6T8

6T8A

DECEMBER 10, 1956

Triple diode—triode

CHARACTERISTIC CURVES

(In curve section following APPENDIX)

Plate, triode	147A
Transfer	147B
Characteristics; F_o , B_m , μ	147C
Operation, diode	147D

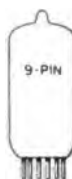
APPLICATION

Type 6T8 is a triple diode—triode used in detector-amplifier service in combination am/fm radio receivers. Diode 1 is used for a-m detection, and diodes 2 and 3 for f-m detection. See APPENDIX for R-C Amplifier Data.



6T8

6T8A



Combined a-m, f-m detector and audio voltage amplifier

HEATER CHARACTERISTICS

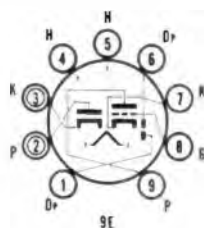
Voltage, a-c or d-c	6.3 volts
Current	450 ma
Peak heater-cathode voltage, max.	
Heater negative	6T8A 6T8
to cathode	100 200 volts
Heater positive	
to cathode	100 200* volts

6T8A

Warm-up time 11 secs. average
(See Series-String Heaters section of APPENDIX in CBS Tube Manual).

*D-c component must not exceed 100 volts max.

Types 6T8 and 6T8A are identical to types 5T8 and 19T8 except for heater characteristics. See 5T8 for additional data.



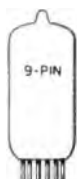
6U4GT • 6U5 • 6U6GT • 6U7G

(See chart for seldom-used tubes)



6U8

6U8A



Vhf triode oscillator and pentode mixer for TV tuners

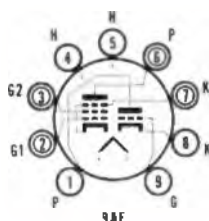
HEATER CHARACTERISTICS

Voltage, a-c or d-c	6.3 volts
Current	450 ma
Peak heater-cathode voltage, max.	
Heater negative to cathode	200 volts
Heater positive to cathode*	200 volts
*D-c component must not exceed 100 volts max.	

6U8A

Warm-up time	11 secs. average
(See Series-String Heaters section of APPENDIX in CBS Tube Manual).	

Types 6U8 and 6U8A are identical to type 5U8 except for heater characteristics.



6V3A



Damping diode in television horizontal sweep circuits§

HEATER CHARACTERISTICS

Voltage	6.3 volts
Current	1.75 amps
Peak heater-cathode voltage, max.*	
Heater negative to cathode†	6750 volts
Heater positive to cathode*	300 volts
*D-c component must not exceed 750 volts absolute max.	
*D-c component must not exceed 100 volts max.	

ELECTRICAL DATA

DIRECT INTERELECTRODE CAPACITANCES

Heater to cathode: h to k, max.	1.5 μ mf
Cathode to plate-and-heater: k to p + h	9.0 μ mf
Plate to cathode-and-heater: p to k + h	8.0 μ mf

MAXIMUM RATINGS (Design center values unless noted)

TV Dampener Service*▲

Plate voltage, peak inverse†	6000 volts
Plate current, d-c	135 ma
Plate current, peak	800 ma
Plate dissipation	2.7 watts

AVERAGE CHARACTERISTICS

Tube voltage drop at 250 ma	19 volts
-----------------------------	----------

NOTES:

§Type 6V3A is a replacement for type 6V3 which is identical except for bulb length.

*Voltage pulse duration must not exceed 10 μ s in a 525-line, 30-frame system.

▲Operation as a power rectifier of 6V3A is not recommended.

†Absolute maximum value.

ENGINEERING DESIGN DATA

6U8

6U8A

DECEMBER 10, 1956

Medium-mu triode—sharp-cutoff pentode

CHARACTERISTIC CURVES

(In curve section following APPENDIX)

Screen Grid Rating	100A
Plate, triode	145A
Transfer, triode; I_b	145B
Characteristics, I_p , g_m , μ	145C
Plate, pentode ($E_{c2} = 110V$)	145D
Transfer, pentode, g_m	145E
Transfer, pentode; I_{c2}	145F
Transfer, pentode; I_a	145G

6V3A

DECEMBER 10, 1956

Single diode

MECHANICAL DATA

Cathode, coated unipotential	
Bulb	T-6½
Outline	See drawing
Base	Miniature 9-pin (E9-L)
Basing	9BD
Cap.	Skirted miniature (C1-2)
Mounting position	Any



PIN CONNECTIONS

Pin 1	N. C.
Pin 2	Plate
Pin 3	N. C.
Pin 4	Heater
Pin 5	Heater
Pin 6	N. C.
Pin 7	Plate
Pin 8	N. C.
Pin 9	Plate
Cap.	Cathode

6V6GT

6V6 • 6V6GTA

DECEMBER 10, 1956

Beam power pentode

CHARACTERISTIC CURVES

(In curve section following APPENDIX)

Plate ($E_{c2} = 250V$)	138A
Plate ($E_{c2} = 250V$)	138B
Plate, triode connected	138C
Plate, ΔE_{c2} ($E_{c1} = 0V$)	138D
Transfer ($E_b = 250V$)	138E
Operation	138F

APPLICATION

Type 6V6GT is a beam power pentode capable of supplying high power output with high sensitivity. It may be used either in the audio output stage of radio and television receivers or as a triode connected vertical deflection amplifier in television receivers.

6W4GT

DECEMBER 10, 1956

Single diode

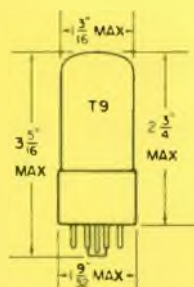
CHARACTERISTIC CURVES

(In curve section following APPENDIX)

Plate	164A
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MECHANICAL DATA

Cathode, coated unipotential	
Bulb	T-9
Outline	JETEC 9-11
Base	Intermediate shell octal (B6-6)
Basing	4CG
Mounting position	Any



6V5G

(See chart for seldom-used tubes)



6V6GT

6V6 • 6V6GTA



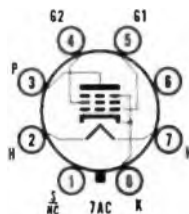
**Audio power amplifier with high output
and high sensitivity**

HEATER CHARACTERISTICS

Voltage, a-c or d-c	6.3 volts
Current	450 ma

6V6GTA

Warm-up time 11 secs. average
(See Series-String Heaters section of
APPENDIX in CBS Tube Manual).



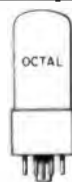
Types 6V6GT and 6V6GTA are identical to type 5V6GT except for heater characteristics. Type 6V6 is identical to the 6V6GT except that it has a metal envelope, JETEC outline 8-6.

6V7G • 6V8

(See chart for seldom-used tubes)



6W4GT



**Damper diode in horizontal sweep circuits
of television receivers**

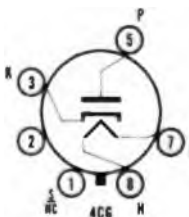
HEATER CHARACTERISTICS

Voltage	6.3 volts
Current	1.2 amps
Peak heater-cathode voltage, max.*	

Heater negative to cathode†	2300 volts
Heater positive to cathode*	300 volts

†D-c component must not exceed 500 volts absolute max.

*D-c component must not exceed 100 volts max.



ELECTRICAL DATA

DIRECT INTERELECTRODE CAPACITANCES

Heater to cathode: h to k, max.	7.0	μf
Cathode to plate-and-heater: k to p + h	13	μf
Plate to cathode-and-heater: p to k + h	6.0	μf

6W4GT (cont.)

MAXIMUM RATINGS (Design center values unless noted)

TV Dampener Service*

Plate voltage, peak inverse†	3850	volts
Plate current, d-c	125	ma
Plate current, peak	75C	ma
Plate dissipation	3.5	watts

AVERAGE CHARACTERISTICS

Tube voltage drop at 250 ma	21	volts
-----------------------------	----	-------

NOTES:

*Voltage pulse duration must not exceed 10 μ s in a 525-line, 30-frame system.

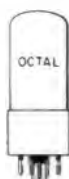
†Absolute maximum value.

6W5G

(See chart for seldom-used tubes)



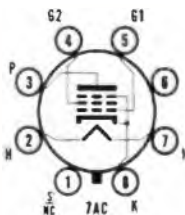
6W6GT



Audio output amplifier or television
vertical deflection amplifier

HEATER CHARACTERISTICS

Voltage, a-c or d-c	6.3	volts
Current	1.2	amp
Peak heater-cathode voltage, max.		
Heater negative to cathode	200	volts
Heater positive to cathode*	200	volts
*D-c component must not exceed 100 volt max.		



ELECTRICAL DATA

DIRECT INTERELECTRODE CAPACITANCES

Grid to plate: g1 to p	0.8	μ f
Input: g1 to k + h + g2 + b.p.	15.0	μ f
Output: p to k + h + g2 + b.p.	9.0	μ f

MAXIMUM RATINGS (Design center values unless noted)

Class A Vert. Deflection Amp.*

	Amplifier	Pentode	Triode†	
Plate voltage	300	300	300	volts
Plate voltage, peak pos (absolute max.)	1500	1200	1200	volts
Grid 2 voltage	150	150	150	volts
Grid 1 voltage, peak negative		250	250	volts
Plate dissipation	10	7.0	7.5†	watts
Grid 2 dissipation	1.25	1.0		watts
Cathode current, average		60	60	ma
Cathode current, peak		180	180	ma
Grid 1 circuit resistance				
Fixed bias	0.1			meg
Cathode bias	0.5	2.2	2.2	meg

CBS ELECTRON TUBES

ENGINEERING DESIGN DATA

6W4GT (cont.)

PIN CONNECTIONS*

Pin 1	Shield	N. C.
Pin 2		N. C.
Pin 3		Cathode
Pin 5		Plate
Pin 7		Heater
Pin 8		Heater

▲Socket terminals 1, 2, 4, and 6 should not be used as tie points.

APPLICATION

Type 6W4GT is a damper diode designed to operate in the horizontal sweep circuits of television receivers. It has high permeability and is capable of handling high pulse voltages.

6W6GT

DECEMBER 10, 1956

Beam power pentode

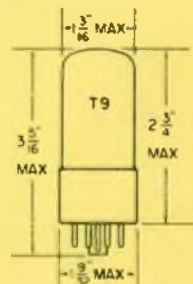
CHARACTERISTIC CURVES

(In curve section following APPENDIX)

Plate ($E_{c2} = 110V$)	174A
Plate ($E_{c2} = 110V$)	174B
Plate; $\Delta E_{c2} (E_{c1} = 0V)$	174C
Transfer	174D
Plate, triode connected	174E
Transfer, triode connected	174F
Operation	174G

MECHANICAL DATA

Cathode, coated unipotential	
Bulb	T-9
Outline	JETEC 9-11 or 9-41
Base	B6-81 or B7-7, B6-84 or B7-59
Basing	7AC
Mounting position	Any



ENGINEERING DESIGN DATA

6W6GT(cont.)

PIN CONNECTIONS

Pin 1	N. C.
Pin 2	Heater
Pin 3	Plate
Pin 4	Grid 2
Pin 5	Grid 1
Pin 6	N. C.
Pin 7	Heater
Pin 8	Cathode

Pin 1 omitted on bases B6-B1 and B6-B4.

APPLICATION

Type 6W6GT is suitable for use either as an audio output amplifier or television vertical output sweep amplifier, in the latter service triode or pentode connection is permissible.

NOTES

Type 12W6GT and 25W6GT are identical to the 6W6GT except for heater characteristics which are described under these respective tube type numbers.

6W6GT (cont.)

CHARACTERISTICS AND TYPICAL OPERATION

Class A Amplifier (Single tube)

Plate voltage	110	200 volts
Grid 2 (screen) voltage	110	125 volts
Grid 1 (control-grid) voltage	-7.5	volts
Cathode bias resistor		180 ohms
Plate resistance (approx.)	13,000	28,000 ohms
Transconductance	8000	8000 μ mhos
Grid 1 input voltage, peak a-f	7.5	8.5 volts
Plate current, zero signal	49	46 ma
Plate current, maximum signal	50	47 ma
Grid 2 current, zero signal	4.0	2.2 ma
Grid 2 current, maximum signal	10	8.5 ma
Load resistance impedance	2000	4000 ohms
Total harmonic distortion (approx.)	10	10 %
Power output, maximum signal	2.1	3.8 watts

Triode Connected Characteristics†

Plate voltage	225	volts
Grid 1 (control-grid) voltage	-30	volts
Plate resistance (approx.)	1600	ohms
Transconductance	3800	μ mhos
Amplification factor	6.2	
Grid 1 voltage for $I_b = 0.5$ ma	-42	volts
Plate current	22	ma

NOTES:

*Voltage pulse duration must not exceed 2500 μ s in a 525-line, 30-frame system.

†Tube protection is needed for no-drive conditions, if grid-resistor bias is used.

‡Triode connected with screen tied to plate.

6X4

DECEMBER 10, 1956

Double diode

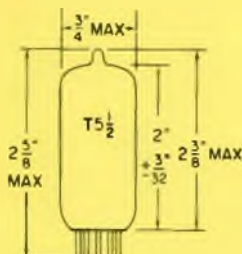
CHARACTERISTIC CURVES

(In curve section following APPENDIX)

Rating Chart I	168A
Rating Chart II	168B
Rating Chart III	168C

MECHANICAL DATA

Cathode, coated unipotential	
Bulb	T-5½
Outline	JETEC 5-3
Base	Miniature 7-pin (E7-1)
Basing	SBS
Mounting position	Any



6W7G

(See chart for seldom-used tubes)



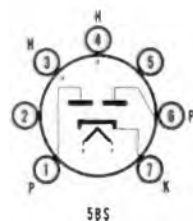
6X4



Full-wave power rectifier for automobile
and a-c operated radios

HEATER CHARACTERISTICS

Voltage, a-c or d-c	6.3	volts
Current	0.6	amp
Peak heater-cathode voltage, max.		
Heater negative to cathode	450	volts
Heater positive to cathode	100	volts



ELECTRICAL DATA

MAXIMUM RATINGS (Design center values)

Rectifier Service

Plate voltage, peak inverse	1250	volts
Plate supply voltage, rms (each plate)		
Output current, d-c	RATING CHART I*	
Plate current, peak steady state (each plate)	RATING CHART II*	210 ma
Plate current, peak transient (each plate)	RATING CHART III*	1.0 amp

CBS ELECTRON TUBES

6X4 (cont.)

CHARACTERISTICS

Tube Voltage Drop

Conducting 70 ma (each plate).....	22 volts
------------------------------------	----------

TYPICAL OPERATION

Full-Wave Rectifier (Capacitor Input Filter)

Plate supply voltage, rms (each plate).....	325 volts
Plate supply impedance (each plate).....	525 ohms
Filter input capacitor.....	10 μ f
Output current, d-c.....	70 ma
Output voltage at filter input, d-c.....	
At half-load current.....	365 volts
At full-load current.....	310 volts
Percentage regulation.....	15 %

Full-Wave Rectifier (Choke Input Filter)

Plate supply voltage, rms (each plate).....	450 volts
Filter input choke.....	10 henrys
Output current, d-c.....	70 ma
Output voltage at filter input, d-c.....	
At half-load current.....	395 volts
At full-load current.....	365 volts
Percentage regulation.....	2.5 %

NOTES:

*Rating Charts given in APPENDIX.

6X5GT

(See chart for seldom-used tubes)



6X8

6X8A



Combined vhf oscillator and mixer used in TV tuners

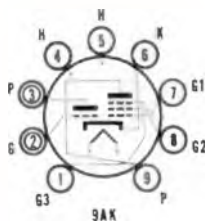
HEATER CHARACTERISTICS

Voltage, a-c or d-c.....	6.3 volts
Current.....	450 ma
Peak heater-cathode voltage, max.	
Heater negative to cathode.....	100 volts
Heater positive to cathode*.....	100 volts
*D-c component must not exceed 100 volts max.	

6X8A

Warm-up time..... 11 secs. average
(See Series-String Heaters section of APPENDIX in CBS Tube Manual).

Types 6X8 and 6X8A are identical to type 5X8 except for heater characteristics. Similar but not identical types are the 5AT8, 6AT8, 5CG8 and 6CG8.



6X8

6X8A

DECEMBER 10, 1956

Medium-mu
triode—sharp-cutoff
pentode

CHARACTERISTIC CURVES

(In curve section following APPENDIX)

Screen Grid Rating.....	100A
Plate, pentode ($E_{c2} = 150V$).....	141A
Plate, triode.....	141B
Plate, pentode unit (triode connected).....	141C
Operation, pentode.....	141D
Operation, pentode.....	141E

APPLICATION

Type 6X8 is a medium-mu triode—sharp-cutoff pentode designed for use as a vhf oscillator-mixer in television and f-m receivers.

6Y3G • 6Y5/V

(See chart for seldom-used tubes)

CBS ELECTRON TUBES

ENGINEERING DESIGN DATA

6X4 (cont.)

PIN CONNECTIONS

Pin 1.....	Plate (Sect. 1)
Pin 2.....	N. C.
Pin 3.....	Heater
Pin 4.....	Heater
Pin 5.....	N. C.
Pin 6.....	Plate (Sect. 2)
Pin 7.....	Cathode

APPLICATION

Type 6X4 is a duodiode designed to operate as a full-wave rectifier for automobile and a-c operated radios. The 6X4 is for 6-volt automobile battery systems, and the 12X4 is for 12-volt systems.

6Y6GA

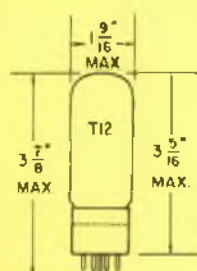
6Y6G

DECEMBER 10, 1956

Beam power pentode

MECHANICAL DATA

Cathode, coated unipotential		
	6Y6G	6Y6GA
Bulb	ST-14	T-12
Outline, JETEC	14-3	12-14
Base	87-11	(B7-12 or B7-119)
Basing	7S	7S
Mounting position	Any	Any



PIN CONNECTIONS

Pin 1	N. C.
Pin 2	Heater
Pin 3	Plate
Pin 4	Grid 3
Pin 5	Grid 2
Pin 7	Heater
Pin 8	Cathode

APPLICATION

Types 6Y6G and 6Y6GA are beam power pentodes designed to operate as audio output amplifiers in equipment with low B+ voltage. Because of their low plate resistance they are sometimes used in other low-voltage high-current applications such as clippers and pass tubes.



6Y6GA

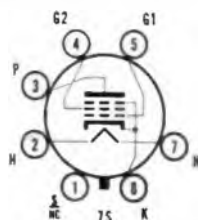
6Y6G



Audio output amplifier in equipment with low B+ voltage

HEATER CHARACTERISTICS

Voltage, a-c or d-c	6.3 volts
Current	1.25 amp
Peak heater-cathode voltage, max.	
Heater negative to cathode	180 volts
Heater positive to cathode	180 volts



ELECTRICAL DATA

DIRECT INTERELECTRODE CAPACITANCES

Grid to plate: g1 to p	0.66 μ f
Input: g1 to k + h + g2 + b.p.	12 μ f
Output: p to k + h + g2 + b.p.	7.5 μ f

MAXIMUM RATINGS (Design center values)

Plate voltage	200 volts
Grid 2 voltage	See Rating Chart in APPENDIX
Grid 2 supply voltage	200 volts
Plate dissipation	12.5 watts
Grid 2 dissipation	1.75 watts
Grid 1 circuit resistance	
Fixed bias	0.1 meg
Self bias	0.5 meg

CHARACTERISTICS AND TYPICAL OPERATION

Class A Amplifier

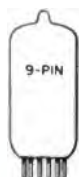
Plate voltage	135	200 volts
Grid 2 (screen) voltage	135	135 volts
Grid 1 (control-grid) voltage	-13.5	-14 volts
Plate resistance (approx.)	9300	18,300 ohms
Transconductance	7000	7100 μ mhos
Grid 1 input voltage, peak a-f	13.5	14 volts
Plate current, zero signal	58	61 ma
Plate current, maximum signal	60	66 ma
Grid 2 current, zero signal	3.5	2.2 ma
Grid 2 current, maximum signal	11.5	9 ma
Load resistance impedance	2000	2600 ohms
Total harmonic distortion (approx.)	3.6	6 %
Power output, maximum signal	10	10 watts

**6Y7G•6Z3•6Z4•6Z4/84•6Z5
6Z5/12Z5•6Z7G•6ZY5G•7A4
7A5•7A6•7A7•7A8•7AB7
7AD7•7AF7•7AG7•7AH7•7AJ7**

(See chart for seldom-used tubes)



7AU7



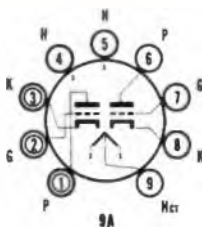
**TV sweep oscillator and vertical amplifier
or phase inverter, heater warm-up time
controlled for series strings**

HEATER CHARACTERISTICS

	Series	Parallel†
Voltage, a-c or d-c	7.0	3.5 volts
Current	300	600 ma
Peak heater-cathode voltage, max.		
Heater negative to cathode		200 volts
Heater positive to cathode*		200 volts
Warm-up time	11 secs. average	

(See Series-String Heaters section of APPENDIX in CBS Tube Manual).

*D-c component 100 volts max.



ELECTRICAL DATA

DIRECT INTERELECTRODE CAPACITANCES

	No Shield	Shield‡
Grid to plate: g1 to p	1.5	1.5 μf
Input: g1 to k + h	1.6	1.8 μf
Output: p to k + h		
Section 1	0.40	2.0 μf
Section 2	0.32	2.0 μf

‡JETEC shield 315 connected to cathode.

MAXIMUM RATINGS

(Design center values unless noted)*

	Class A Amplifier	Vertical Deflection Amplifier*
Plate voltage, d-c	300	300 volts
Plate voltage, peak pos. (absolute max.)		1200 volts
Control-grid voltage, peak negative		250 volts
Plate dissipation (each plate)†	2.75	2.75 watts
Cathode current, average	20	20 ma
Cathode current, peak		60 ma
Control-grid circuit resistance		
Fixed bias	0.25	meg
Cathode bias	1.0	meg

Vertical Deflection Oscillator* Horizontal Deflection Oscillator†

Plate voltage	300	300 volts
Plate dissipation (each plate)	2.75	2.75 watts
Control-grid voltage, peak negative	400	600 volts
Cathode current, average	20	20 ma
Cathode current, peak	60	300 ma
Control-grid circuit resistance	2.2	2.2 megs

CHARACTERISTICS AND TYPICAL OPERATION

Class A Amplifier*

Plate voltage	100	250 volts
Control-grid voltage	0	-8.5 volts
Plate resistance (approx.)	6500	7700 ohms
Transconductance	3100	2200 μmhos
Amplification factor	20	17
Plate current	11.8	10.5 ma
Grid 1 voltage (approx.) for $I_b = 10 \mu\text{A}$		-24 volts

NOTES:

*Voltage pulse duration must not exceed 2500 μs in a 525-line, 30-frame system.

†Voltage pulse duration must not exceed 10 μs in a 525-line, 30-frame system.

‡Tube protection is needed for no-drive conditions if grid-resistor bias is used.

■Each section.

ENGINEERING DESIGN DATA

7AU7

DECEMBER 22, 1956

**Medium-mu
duotriode**

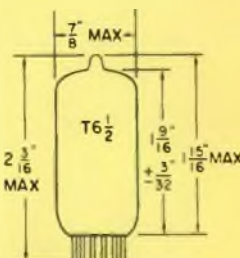
CHARACTERISTIC CURVES

(In curve section following APPENDIX)

Plate 177A

MECHANICAL DATA

Cathode, coated unipotential	
Bulb	T-6½
Outline	JETEC 6-2
Base	Miniature 9-pin (E9-1)
Basing	.9A
Mounting position	Any



PIN CONNECTIONS

Pin 1	Plate (Sect. 2)
Pin 2	Grid 1 (Sect. 2)
Pin 3	Cathode (Sect. 2)
Pin 4	Heater
Pin 5	Heater
Pin 6	Plate (Sect. 1)
Pin 7	Grid 1 (Sect. 1)
Pin 8	Cathode (Sect. 1)
Pin 9	Heater Center-Tap

REFERENCES

See APPENDIX for R-C amplifier data and explanation of heater warm-up time controlled series-strings.

APPLICATION

Type 7AU7 is a medium-mu duotriode that may be used in a wide variety of applications such as in oscillators, multi-vibrators, phase inverters, and TV vertical output amplifiers. It is identical to the 12AU7A except for heater characteristics, having non-microphonic mechanically rigid construction.

ENGINEERING DESIGN DATA

7B4•7B5•7B6•7B7•7B8•7C4
7C5•7C6•7C7•7E5•7E6•7E7
7F7•7F8•7G7•7G8•7H7•7J7
7K7•7L7•7N7•7Q7•7R7•7S7
7T7•7V7•7W7•7Y4•7Y6•7X7/
XXFM•7Z4

(See chart for seldom-used tubes)

8AU8

JUNE 1, 1957

**Medium-mu triode—
sharp-cutoff pentode**

CHARACTERISTIC CURVES (In curve section following APPENDIX)

Screen Grid Rating	100A
Plate, pentode ($E_{c2} = 125V$)	142A
Plate, pentode ($E_{c2} = 125V$)	142B
Plate, pentode (ΔE_{c2})	142C
Transfer, pentode ($E_b = 200V$)	142D
Plate, triode	142E

APPLICATION

Type 8AU8 is a medium-mu triode and sharp-cutoff pentode designed for a wide variety of applications in monochrome and color television. Each section has a separate cathode and is electrically independent.

8BA8A

JUNE 1, 1957

**Medium-mu triode—
sharp-cutoff pentode**

CHARACTERISTIC CURVES (In curve section following APPENDIX)

Screen Grid Rating	100A
Plate, pentode ($E_{c2} = 150V$)	167B
Transfer, pentode; I_b , I_{c2} , g_m , r_p	167C
Plate, triode	192A
Transfer, triode; r_p , g_m , μ	192B

APPLICATION

Type 8BA8A is a combined medium-mu triode and high-gain, sharp-cutoff pentode. The triode section is suitable for a wide variety of applications in television receivers such as sync separators or clippers. The pentode unit is especially suitable as a video amplifier and closely resembles the pentode section of type 6AW8.



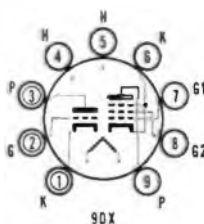
8AU8



**Combined sync amplifier, separator, or clipper, etc., and
video or i-f amplifier, heater warm-up time
controlled for series strings**

HEATER CHARACTERISTICS

Voltage, a-c or d-c	8.4 volts
Current	450 ma
Peak heater-cathode voltage, max.	
Heater negative to cathode	200 volts
Heater positive to cathode*	200 volts
Warm-up time	11 secs. average (See Series-String Heaters section of APPENDIX in CBS Tube Manual).
*D-c component must not exceed 100 volts max.	



Type 8AU8 is identical to type 6AU8 except for heater characteristics. See type 6AU8 for ratings and operating characteristics.



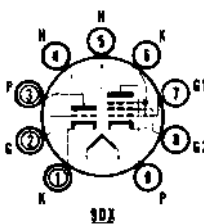
8BA8A



**Combined sync separator or sync clipper, etc., and
video amplifier, heater warm-up time controlled
for series strings**

HEATER CHARACTERISTICS

Voltage, a-c or d-c	8.4 volts
Current	450 ma
Peak heater-cathode voltage, max.	
Heater negative to cathode	200 volts
Heater positive to cathode*	200 volts
Warm-up time	11 secs. average (See Series-String Heaters section of APPENDIX in CBS Tube Manual).
*D-c component must not exceed 100 volts max.	



Type 8BA8A is identical to type 6BA8A except for heater characteristics. See type 6BA8A for ratings and operating characteristics.

CBS ELECTRON TUBES



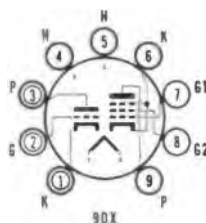
8AW8A



**Combined sync separator and video amplifier,
heater warm-up controlled for series strings**

HEATER CHARACTERISTICS

Voltage, a-c or d-c	8.4 volts
Current	450 ma
Peak heater-cathode voltage, max.	
Heater negative to cathode	200 volts
Heater positive to cathode	200 volts
Warm-up time	11 secs. average
(See Series-String Heaters section of Handbook APPENDIX)	
*D-c component must not exceed 100 volts max.	



ELECTRICAL DATA

DIRECT INTERELECTRODE CAPACITANCES

Triode Section	No Shield	Shield
Grid to plate: g1 to p	2.2	2.2 μf
Input: g1 to k + h	3.2	3.4 μf
Output: p to k + h	0.32	1.7 μf

Pentode Section

Grid to plate: g1 to p	0.04	0.03 μf
Input: g1 to k + h + g2 + g3 + i.s.	10.0	10.0 μf
Output: p to h + k + g2 + g3 + i.s.	3.6	4.5 μf
Coupling: pentode grid 1 to triode plate	0.006	0.003 μf
Coupling: pentode plate to triode grid	0.016	0.006 μf
Coupling: pentode plate to triode plate	0.150	0.023 μf

†JTEC shield 315 connected to cathode.

MAXIMUM RATINGS (Design center values)

	Triode	Pentode
Plate voltage	300	300 volts
Grid 2 voltage	See Rating Chart in APPENDIX	
Grid 2 supply voltage		300 volts
Grid 1 voltage, positive d-c		0 volts
Grid 1 voltage, negative d-c		50 volts
Plate dissipation	1.0	3.25 watts
Grid 2 dissipation		1.0 watt
Grid 1 circuit resistance		
Fixed bias	0.5	0.25 meg
Self bias	1.0	1.0 meg

CHARACTERISTICS AND TYPICAL OPERATION

Class A Amplifier	Triode	Pentode
Plate voltage	200	200 volts
Grid 2 (screen) voltage		150 volts
Grid 1 (control-grid) voltage	-2	0 volts
Cathode-bias resistor		180 ohms
Plate resistance (approx.)	0.0175	0.4 meg
Transconductance	4000	9000 μmhos
Amplification factor	70	
Plate current	4.0	13 ma
Grid 2 current		3.5 ma
Grid 1 voltage (approx.) for $I_b = 10 \mu\text{a}$	-5	-10 volts

Except for heater ratings, the 8AW8A is identical to the 6AW8 and 6AW8A.

ENGINEERING DESIGN DATA

8AW8A

MARCH 30, 1959

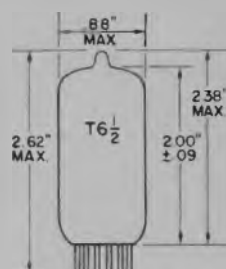
**High-mu triode—
sharp-cutoff
pentode**

CHARACTERISTICS CURVES (In curve section following APPENDIX)

Screen Grid Rating	100A
Plate, triode	167A
Plate, pentode	167B
Transfer, triode ($E_b = 200\text{V}$)	167C
Transfer, pentode ($E_b = 200\text{V}$, $E_{c2} = 150\text{V}$)	167D

MECHANICAL DATA

Cathode, coated unipotential	
Bulb	T-6½
Outline	JETEC 6-3
Base	Miniature 9-pin (E9-1)
Basing	.9DX
Mounting position	Any



PIN CONNECTIONS

Pin 1	Triode Cathode
Pin 2	Triode Grid
Pin 3	Triode Plate
Pin 4	Heater
Pin 5	Heater
Pin 6	Pentode Cathode, Grid 3, I. S.
Pin 7	Pentode Grid 1
Pin 8	Pentode Grid 2
Pin 9	Pentode Plate

REFERENCES

The heater of the 8AW8A has a warm-up time controlled characteristic which is standard for 450ma tubes used in series strings. For a complete description of heater warm-up time and the method of measurement see the APPENDIX.

ENGINEERING DESIGN DATA

8CX8

MARCH 30, 1959

Medium-mu triode sharp-cutoff pentode

CHARACTERISTIC CURVES

(In curve section following APPENDIX)

Screen Grid Rating 100A

MECHANICAL DATA

Cathode, coated unipotential
Bulb T-6V₂
Outline JETEC 6-3
Base 9-pin Miniature (E9-1)
Basing 90X
Mounting position Any

APPLICATION

Type 8CX8 is a medium-mu triode and sharp-cutoff pentode in one envelope for use in a wide variety of applications in monochrome and color television. Each section has a separate cathode and is electrically independent of the other section.



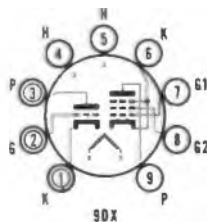
8CX8



Combined sync amplifier, sync separator, or sync clipper, etc., and video or i-f amplifier

HEATER CHARACTERISTICS

Voltage, a-c or d-c 8.0 volts
Current 600 ma
Peak heater-cathode voltage, max.
Heater negative to cathode 200 volts
Heater positive to cathode* 200 volts
Warm-up time 11 secs. average
(See Series-String Heaters section of Handbook APPENDIX)
*D-c component must not exceed 100 volts max.



Except for heater ratings, 8CX8 is identical to 6CX8. Refer to type 6CX8 for other data.

10DE7

OCTOBER 30, 1958

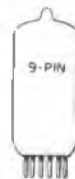
Duotriode with dissimilar sections

APPLICATION

Type 10DE7 is a miniature duotriode with dissimilar sections. Section 1 is intended for use as a vertical deflection oscillator, and Section 2 is intended for use as a vertical deflection amplifier.



10DE7



Television vertical deflection amplifier and oscillator

HEATER CHARACTERISTICS

Voltage, a-c or d-c 9.7 volts
Current 600 ma
Peak heater-cathode voltage, max.
Heater negative to cathode 200 volts
Heater positive to cathode* 200 volts
*D-c component must not exceed 100 volts max.



Type 10DE7 is identical to type 6DE7 except for heater characteristics. Refer to the 6DE7 for other data.

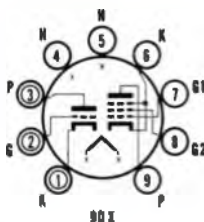
CBS**8BH8**

Combined sync separator, clipper, amplifier, or sweep oscillator, and i-f or video amplifier

HEATER CHARACTERISTICS

Voltage, a-c or d-c.....	8.4 volts
Current.....	450 ma
Peak heater-cathode voltage, max.	
Heater negative to cathode.....	200 volts
Heater positive to cathode*.....	200 volts
Warm-up time.....	11 secs. average
*D-c component must not exceed 100 volts max.	

Type 8BH8 is identical to type 6BH8 except for heater characteristics. See type 6BH8 for ratings and operating characteristics.

**ENGINEERING
DESIGN DATA****8BH8**

JUNE 1, 1957

Medium-mu triode—sharp-cutoff pentode

CHARACTERISTIC CURVES

(In curve section following APPENDIX)

Plate, pentode ($E_{c2} = 125V$).....	142A
Plate, pentode ($E_{c2} = 125V$).....	142B
Plate, pentode (ΔE_{c2}).....	142C
Plate, triode.....	170A
Transfer, triode.....	170B
Characteristics, triode; gm, μ , r_p	170C

APPLICATION

Type 8BH8 is a general purpose television receiving tube. It contains a sharp-cutoff pentode and medium-mu triode in one envelope. Except for electrical characteristics of the triode section, the 8BH8 is identical to the 8AU8. The triode section has a lower μ than that of the 8AU8.

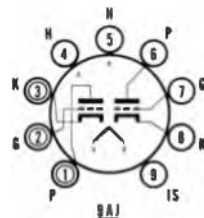
CBS**8CG7**

Amplifier or television sweep oscillator, heater warm-up time controlled for series strings

HEATER CHARACTERISTICS

Voltage, a-c or d-c.....	8.4 volts
Current.....	850 ma
Peak heater-cathode voltage, max.	
Heater negative to cathode.....	200 volts
Heater positive to cathode*.....	200 volts
Warm-up time.....	11 secs. average
*D-c component must not exceed 100 volts max.	

Type 8CG7 is identical to type 6CG7 except for heater characteristics. See type 6CG7 for ratings and operating characteristics.

**8CG7**

JUNE 1, 1957

Medium-mu duotriode

CHARACTERISTIC CURVES

(In curve section following APPENDIX)

Plate.....	181A
Characteristics; μ , gm, r_p	181B

APPLICATION

Type 6CG7 is a medium-mu duotriode designed for use as a vertical or horizontal sweep oscillator in series-string television receivers. It can also be used as a phase inverter or R-C amplifier. Except for heater, this tube is electrically equivalent to type 6SN7GTB.

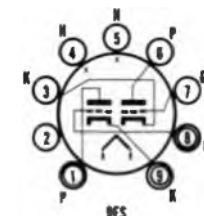
CBS**8CM7**

Combined vertical deflection oscillator and amplifier with dissimilar sections

HEATER CHARACTERISTICS

Voltage, a-c or d-c.....	8.4 volts
Current.....	450 ma
Peak heater-cathode voltage, max.	
Heater negative to cathode.....	200 volts
Heater positive to cathode*.....	200 volts
Warm-up time.....	11 secs. average
*D-c component must not exceed 100 volts max.	

Type 8CM7 is identical to type 6CM7 except for heater characteristics. See type 6CM7 for ratings and operating characteristics.

**8CM7**

JUNE 1, 1957

Medium-mu duotriode with dissimilar sections

CHARACTERISTIC CURVES

(In curve section following APPENDIX)

Plate, section 1.....	183A
Characteristics, section 1.....	183B
Plate, section 2.....	183C
Characteristics, section 2.....	183D

APPLICATION

Type 8CM7 is a medium-mu duotriode with dissimilar sections designed to operate as a vertical deflection oscillator and amplifier in TV receivers with warm-up time controlled series-string heaters. Section 1 is intended for blocking oscillator service and section 2 for amplifier service.

ENGINEERING DESIGN DATA

8CN7

JUNE 1, 1957

Duodiode—high-mu triode

CHARACTERISTIC CURVES

(In curve section following APPENDIX)

Plate, triode	147A
Transfer	147B
Characteristics; f_p , g_m , μ	147C
Operation	147D

NOTES

Type 8CN7 is a miniature duodiode—high-mu triode with separate cathodes for each section. The triode section is electrically identical to the triode section of the 6T8.



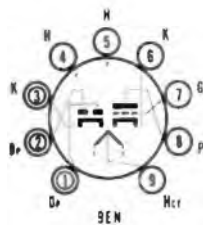
8CN7



Combined horizontal phase detector and reactance tube in TV, or triode for audio or sync service

HEATER CHARACTERISTICS

	Series	Parallel
Voltage, a-c or d-c	8.4	4.2 volts
Current	225	450 ma
Peak heater-cathode voltage, max.		
Heater negative to cathode	200	200 volts
Heater positive to cathode*	200	200 volts
Warm-up time	11 secs.	average
*D-c component must not exceed 100 volts max.		



Type 8CN7 is identical to type 6CN7 except for heater characteristics. See type 6CN7 for ratings and operating characteristics.

8CS7

JUNE 1, 1957

Duotriode with dissimilar units

CHARACTERISTIC CURVES

(In curve section following APPENDIX)

Plate, section 1	185A
Characteristics, section 1	185B
Plate, section 2	185C
Characteristics, section 2	185D

APPLICATION

Type 8CS7 is a duotriode with dissimilar units designed for use as a TV vertical deflection amplifier and oscillator. It features a warm-up time controlled series-string heater.



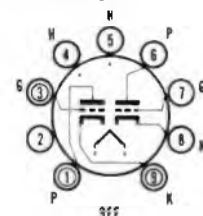
8CS7



TV vertical deflection amplifier and oscillator, heater warm-up time controlled for series strings

HEATER CHARACTERISTICS

Voltage, a-c or d-c	8.4 volts
Current	450 ma
Peak heater-cathode voltage, max.	
Heater negative to cathode	200 volts
Heater positive to cathode*	200 volts
Warm-up time	11 secs.
*D-c component must not exceed 100 volts max.	



Type 8CS7 is identical to type 6CS7 except for heater characteristics.

8SN7GTB

JUNE 1, 1957

Medium-mu duotriode

CHARACTERISTIC CURVES

(In curve section following APPENDIX)

Plate	181A
Characteristics	181B

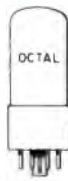
APPLICATION

Type 8SN7GTB is a medium-mu duotriode with independent sections for application as a combined TV sweep oscillator and vertical deflection amplifier, multivibrator, phase inverter, and R-C amplifier.

See APPENDIX for R-C amplifier data.



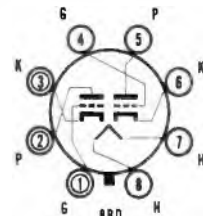
8SN7GTB



TV sweep oscillator and vertical amplifier; phase inverter and R-C amplifier

HEATER CHARACTERISTICS

Voltage, a-c or d-c	8.4 volts
Current	450 ma
Peak heater-cathode voltage, max.	
Heater negative to cathode	200 volts
Heater positive to cathode*	200 volts
Warm-up time	11 secs.
*D-c component must not exceed 100 volts max.	



Type 8SN7GTB is identical to type 6SN7GTB except for heater characteristics. See type 6SN7GTB for ratings and operating characteristics.

CBS ELECTRON TUBES



8EM5



**Vertical deflection amplifier for television receivers
employing 110° deflection angle picture tubes**

This type is identical to type 6EM5 except for heater characteristics and ratings. This type features controlled heater warm-up for use in 600 ma series strings.

See type 6EM5 for complete technical data.



9AU7



TV sweep oscillator and vertical amplifier or phase inverter

HEATER CHARACTERISTICS

Series Parallel

Voltage, a-c or d-c	9.4	4.7	volts
Current	225	450	ma

Peak heater-cathode voltage, max.

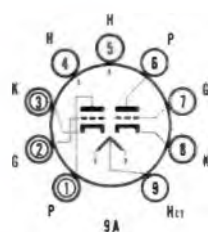
Heater negative to cathode 200 volts

Heater positive to cathode* 200 volts

Warm-up time 11 secs. average

*D-c component must not exceed 100 volts max.

Type 9AU7 is identical to types 7AU7, 12AU7 and 12AU7A except for heater characteristics. See type 7AU7 for ratings and characteristics.



ENGINEERING DESIGN DATA

9AU7

JUNE 1, 1957

Medium-mu duotriode

CHARACTERISTIC CURVES
(In curve section following APPENDIX)
Plate 177A

APPLICATION

Type 9AU7 is a medium-mu duotriode that may be used in a wide variety of applications such as in oscillators, multi-vibrators, phase inverters, and vertical output amplifiers. It is identical to 7AU7, 12AU7, and 12AU7A except for heater characteristics.



9CL8



Vhf oscillator and mixer, heater warm-up time controlled for series strings

HEATER CHARACTERISTICS

Voltage, a-c or d-c	9.5	volts
Current	300	ma

Peak heater-cathode voltage, max.

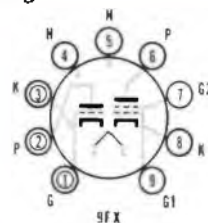
Heater negative to cathode 200 volts

Heater positive to cathode* 200 volts

Warm-up time 11 secs. average

*D-c component must not exceed 100 volts max.

Type 9CL8 is identical to types 5CL8 and 6CL8 except for heater characteristics. See type 5CL8 for ratings and operating characteristics.



9CL8

JUNE 1, 1957

Medium-mu triode—sharp-cutoff tetrode

CHARACTERISTIC CURVES
(In curve section following APPENDIX)
Screen Grid Rating 100A

APPLICATION

Type 9CL8 is a medium-mu triode—sharp-cutoff tetrode used as a vhf oscillator and mixer. It features a warm-up time controlled series-string heater.



9U8A



Vhf oscillator and mixer, heater warm-up time controlled for series strings

HEATER CHARACTERISTICS

Voltage, a-c or d-c	9.45	volts
Current	300	ma

Peak heater-cathode voltage, max.

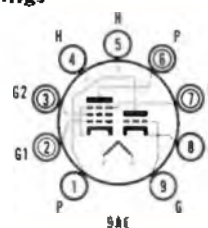
Heater negative to cathode 200 volts

Heater positive to cathode* 200 volts

Warm-up time 11 secs. average

*D-c component must not exceed 100 volts max.

Type 9U8A is identical to types 5U8 and 6U8 except for heater characteristics. See type 5U8 for ratings and operating characteristics.



9U8A

JUNE 1, 1957

Medium-mu triode—sharp-cutoff pentode

CHARACTERISTIC CURVES
(In curve section following APPENDIX)
Screen Grid Rating 100A

Plate, triode 145A

Transfer, triode, I_b 145B

Characteristics, I_p , g_m , μ 145C

Plate, pentode ($E_{c2} = 110V$) 145D

Transfer, pentode, g_m 145E

Transfer, pentode, I_{c2} 145F

Transfer, pentode, I_b 145G

APPLICATION

Type 9U8A is a miniature, medium-mu triode, sharp-cutoff pentode intended primarily for service as a combined triode oscillator and pentode mixer in television and f-m receivers, and for general purpose usage in monochrome and color TV.

ENGINEERING DESIGN DATA

9X8

JUNE 1, 1957

Medium-mu triode— sharp-cutoff pentode

CHARACTERISTIC CURVES

(In curve section following APPENDIX)

Screen Grid Rating	100A
Plate, pentode ($E_{c2} = 150V$)	141A
Plate, triode	141B
Plate, pentode (triode connected)	141C
Operation, pentode	141D
Operation, pentode	141E

APPLICATION

Type 9X8 is a medium-mu triode—sharp-cutoff pentode for use as a vhf oscillator and mixer. It incorporates a cathode common to both sections, thus making it highly suitable for oscillator-mixer service. This tube can provide vhf conversion for i-f stages in the order of 40 megacycles.



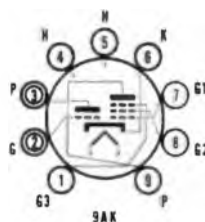
9X8



Vhf oscillator and mixer, heater warm-up time controlled for series strings

HEATER CHARACTERISTICS

Voltage, a-c or d-c	9.5 volts
Current	300 ma
Peak heater-cathode voltage, max.	
Heater negative to cathode	200 volts
Heater positive to cathode*	200 volts
Warm-up time	11 secs. average
(See Series-String Heaters section of APPENDIX in CBS Tube Manual).	
*D-c component must not exceed 100 volts max.	



Type 9X8 is identical to types 5X8 and 6X8 except for heater characteristics. Similar, but not identical types, are the 5AT8, 6AT8, 5CG8 and 6CG8. See type 5X8 for ratings and operating characteristics.

10

(See chart for seldom-used tubes)

10C8

JUNE 1, 1957

Hi-mu triode pentode

CHARACTERISTIC CURVES

(In curve section following APPENDIX)

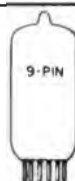
Screen Grid Rating	100A
Plate, triode section	204A
Transfer, triode section	204B
Characteristics, triode section; r_p , g_m , μ	204C
Plate, pentode section (triode connected)	204D
Plate, pentode section ($E_{c1} = 0V$, ΔE_{c2})	204E
Plate, pentode section ($E_{c2} = 135V$)	204F
Transfer, pentode section (g_m , E_{c1})	204G
Transfer, pentode section (I_b , E_{c2})	204H
Transfer, pentode section (I_{c2} , E_{c1})	204I

MECHANICAL DATA

Cathode, coated unipotential	
Bulb	T-6½
Outline	JETEC 6-2
Base	Miniature 9-pin (E9-1)
Basing	90A
Mounting position	Any



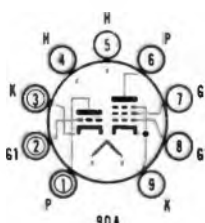
10C8



Vertical oscillator, voltage amplifier or sync triode and a general purpose pentode amplifier, warm-up time controlled for series strings

HEATER CHARACTERISTICS

Voltage, a-c or d-c	10.5 volts
Current	600 ma
Peak heater-cathode voltage, max.	
Heater negative to cathode	200 volts
Heater positive to cathode*	200 volts
Warm-up time	11 secs. average
(See Series-String Heaters section of APPENDIX in CBS Tube Manual).	
*D-c component must not exceed 100 volts max.	



ELECTRICAL DATA

DIRECT INTERELECTRODE CAPACITANCES

Triode Section

Grid to plate: g1 to p	1.6 $\mu\mu f$
Input: g1 to k + h	2.4 $\mu\mu f$
Output: p to k + h	0.2 $\mu\mu f$

Pentode Section

Grid to plate: g1 to p	0.04 $\mu\mu f$
Input: g1 to k + h + g2 + g3	7.0 $\mu\mu f$
Output: p to k + h + g2 + g3	2.0 $\mu\mu f$
Coupling: pentode grid 1 to triode plate, max.	0.008 $\mu\mu f$
Coupling: pentode plate to triode grid, max.	0.006 $\mu\mu f$
Coupling: pentode plate to triode plate, max.	0.06 $\mu\mu f$

CBS ELECTRON TUBES

10C8 (cont.)

MAXIMUM RATINGS (Design maximum values)

Class A Amplifier	Triode	Pentode
Plate voltage, d-c	300	300 volts
Grid 2 voltage	See Rating Chart in APPENDIX	
Grid 2 supply voltage		300 volts
Grid 1 voltage, positive d-c	0	0 volts
Plate dissipation	2.0	2.2 watts
Grid 2 dissipation		0.55 watts
Grid 1 circuit resistance		
Fixed bias	0.5	0.25 meg
Self bias	1.0	1.0 meg

Vertical Oscillator and Amplifier†

AmplifierΔ	Oscillator▽
Plate voltage, d-c	300
Plate voltage, peak positive pulse	1000
Grid 1 voltage, peak negative	250
Plate dissipation	2.5*
Cathode current, d-c	18
Cathode current, peak	55
Grid 1 circuit resistance	
Fixed bias	2.2
Cathode bias	2.2
Grid-leak bias	2.2

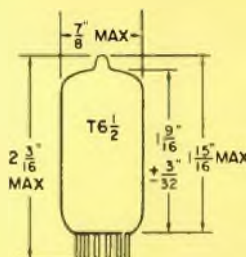
CHARACTERISTICS AND TYPICAL OPERATION

	PentodeΔ	Pentode	Triode
Plate voltage	135	135	250 volts
Grid 2 (screen) voltage		135	volts
Grid 1 (control-grid) voltage	0		volts
Cathode-bias resistor		100	390 ohms
Plate resistance (approx.)		190,000	12,000 ohms
Transconductance		8000	4400 μmhos
Amplification factor	40		53
Plate current	33	11.5	7.3 ma
Grid 2 current		3.2	ma
Grid 1 voltage (approx.) for $I_b = 10 \mu a$			-10 volts
Grid 1 voltage (approx.) for $I_b = 50 \mu a$			-6 volts

NOTES:

- †Voltage pulse duration must not exceed 2500 μs in 525-line, 30-frame system.
 *Tube protection is needed for no-drive conditions if grid-resistor bias is used.
 ‡So as not to damage tube, apply for a maximum of 2 seconds.
 ΔPentode section triode connected.
 ▲Triode section.

10C8 (cont.)



PIN CONNECTIONS

Pin 1	Triode Plate
Pin 2	Triode Grid
Pin 3	Triode Cathode
Pin 4	Heater
Pin 5	Heater
Pin 6	Pentode Plate
Pin 7	Pentode Grid 2
Pin 8	Pentode Grid 1
Pin 9	Pentode Cathode, Grid 3, I. S.

APPLICATION

Type 10C8 is a miniature triode-pentode with a warm-up time controlled heater for use in compact 300 ma series-string television receivers. Provides high performance from low d-c supply voltages.



10DA7

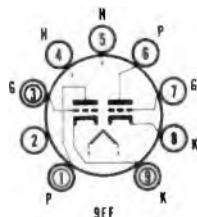


Combined vertical amplifier and oscillator for TV receivers

HEATER CHARACTERISTICS

Voltage, a-c or d-c	10.5 volts
Current	600 ma
Peak heater-cathode voltage, max.	
Heater negative to cathode	200 volts
Heater positive to cathode*	200 volts
Warm-up time	11 secs. average
*D-c component must not exceed 100 volts max.	

Type 10DA7 is identical to type 6DA7 except for heater characteristics. See type 6DA7 for ratings and operating characteristics.



10DA7

JUNE 1, 1957

Duotriode with dissimilar sections

APPLICATION

Type 10DA7 is a miniature duotriode with dissimilar sections; section one is for vertical oscillator application, section two is for vertical amplifier service.

ENGINEERING DESIGN DATA

11C5

JUNE 1, 1957

Beam power pentode

CHARACTERISTIC CURVES

(In curve section following APPENDIX)

Plate: I_{b1} , I_{c2} ($E_{c2} = 110V$) 195A

Operation ($E_b = E_{c2} = 110V$) 195B

APPLICATION

Type 11C5 is a beam power pentode designed for operation as a power amplifier in 450 ma series-string TV receivers. It has high sensitivity and provides high audio power output.



11C5



Beam power amplifier for a-c/d-c television receivers,
heater warm-up time controlled for
series string operation

HEATER CHARACTERISTICS

Voltage, a-c or d-c 11.6 volts

Current 450 ma

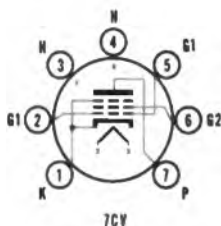
Peak heater-cathode voltage, max.

Heater negative to
cathode 180 volts

Heater positive to
cathode 180 volts

Warm-up time 11 secs. average

(See Series-String Heaters section of
APPENDIX in CBS Tube Manual).



Type 11C5 is identical to type 35C5 except for heater characteristics.
See type 35C5 for ratings and operating characteristics.

12 • 12A/112A • 12A4 • 12A5 12A6/GT • 12A7 • 12A8/GT

(See chart for seldom-used tubes)

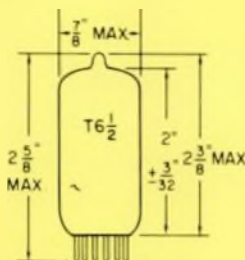
12AB5

DECEMBER 22, 1956

Beam power pentode

MECHANICAL DATA

Cathode, coated unipotential
Bulb T-6 1/2
Outline JETEC 6-3
Base Miniature 9-pin (E9-1)
Basing 9EU
Mounting position Any

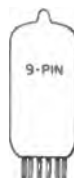


PIN CONNECTIONS

Pin 1	Grid 2
Pin 2	N. C.
Pin 3	Grid 1
Pin 4	Heater
Pin 5	Heater
Pin 6	Grid 1
Pin 7	Grid 3, Cathode
Pin 8	Grid 2
Pin 9	Plate



12AB5



Audio power amplifier for automobile radios
powered by a 12-volt battery

HEATER CHARACTERISTICS

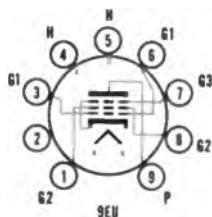
Voltage, a-c or d-c 12.6 volts

Current 200 ma

Heater-cathode voltage, max.

Heater negative to
cathode, d-c 200 volts

Heater positive to
cathode, d-c 100 volts



ELECTRICAL DATA

DIRECT INTERELECTRODE CAPACITANCES

Grid to plate: g1 to p.....	0.7 μf
Input: g1 to k + h + g2 + b.p.....	8.0 μf
Output: p to k + h + g2 + b.p.....	8.5 μf

MAXIMUM RATINGS (Design center values)

Plate voltage.....	315 volts
Grid 2 voltage.....	285 volts
Plate dissipation.....	12 watts
Grid 2 dissipation.....	2 watts
Grid circuit resistance	
Fixed bias.....	0.1 meg
Cathode bias.....	0.5 meg
Bulb temperature at hottest point.....	250 °C

CBS ELECTRON TUBES

12AB5 (cont.)

CHARACTERISTICS AND TYPICAL OPERATION

Class A Amplifier (Single Tube)

Plate voltage	250	250 volts
Grid 2 (screen) voltage	200	250 volts
Grid 1 (control-grid) voltage	—12.5	volts
Cathode bias resistor	270	ohms
Plate resistance (approx.)	0	50,000 ohms
Transconductance	4000	4100 μ hos
Grid 1 input voltage, peak a-f	10.5	12.5 volts
Plate current, zero signal	33.5	45.0 ma
Plate current, maximum signal	36.0	47 ma
Grid 2 current, zero signal	1.6	4.5 ma
Grid 2 current, maximum signal	3.2	7.0 ma
Load resistance impedance	6000	5000 ohms
Power output, maximum signal	3.3	4.5 watts

NOTE:

*Heater is designed to be powered from a 12-volt battery in automotive service, and will operate over a range of 10.0 to 15.9 volts encountered in this service. Maximum ratings provide for an adequate safety factor to withstand the wide variation in supply voltages.

ENGINEERING DESIGN DATA

12AB5 (cont.)

APPLICATION

Type 12AB5 is an audio power amplifier for automobile radios powered by a 12-volt battery.

CBS

12AC6



**I-f or r-f amplifier for 12-volt A and B supply
automobile radios**

HEATER CHARACTERISTICS*

Voltage, a-c or d-c	12.6 volts
Current	150 ma
Peak heater-cathode voltage, max.	
Heater negative to cathode	30 volts
Heater positive to cathode	30 volts

ELECTRICAL DATA

DIRECT INTERELECTRODE CAPACITANCES

	No Shield	Shield†	
Grid to plate: g1 to p, max.	0.005	0.004	μ f
Input: g1 to k + h + g2 + g3	4.3	4.3	μ f
Output: p to k + h + g2 + g3	5.0	5.0	μ f

†JTEC shield 316 connected to cathode.

MAXIMUM RATINGS (Design center values)

Plate voltage	30 volts
Grid 2 voltage	30 volts
Cathode current	20 ma
Grid 1 circuit resistance	10 meg

CHARACTERISTICS AND TYPICAL OPERATION

Class A Amplifier

Plate voltage	12.6 volts
Grid 3 (suppressor)	connected to cathode at socket
Grid 2 (screen) voltage	12.6 volts
Grid 1 (control-grid) voltage	0 volts
Plate resistance (approx.)	0.5 meg
Transconductance†	730 μ hos
Plate current	550 μ a
Grid 2 current	28 μ a
Grid 3 voltage (approx.) for $g_{m1} = 10 \mu$ hos, $E_{c1} = 0V$	—4.7 volts
Grid 1 voltage (approx.) for $g_{m1} = 10 \mu$ hos, $E_{c1} = 0V$	—7.2 volts

NOTES:

*Type 12AC6 is intended for use in automobile receivers operated from a nominal 12-volt battery. Design of the tube is such that the heater will operate satisfactorily over the range from 10 volts to 15.9 volts, and that the maximum ratings provide a safety factor for the wide voltage variation encountered in this type of supply.

† $R_{c1} = 2.2$ meg.

‡From grid 1 to plate.

12AC6

JUNE 1, 1957

**12-volt remote-cutoff
pentode**

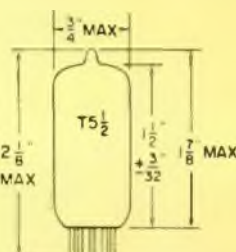
CHARACTERISTIC CURVES

(In curve section following APPENDIX)

Plate	199A
Transfer	199B

MECHANICAL DATA

Cathode, coated unipotential	
Bulb	T-5½
Outline	JTEC 5-2
Base	Miniature 7-pin (E7-1)
Basing	7BK
Mounting position	Any



PIN CONNECTIONS

Pin 1	Grid 1
Pin 2	Grid 3, I. S.
Pin 3	Heater
Pin 4	Heater
Pin 5	Plate
Pin 6	Grid 2
Pin 7	Cathode

APPLICATION

Type 12AC6 is a remote-cutoff pentode designed for use as an i-f or r-f amplifier in hybrid automobile radios. The heater, plate, and screen voltages are supplied directly from a 12-volt battery.

ENGINEERING DESIGN DATA

12AD6

JUNE 1, 1957

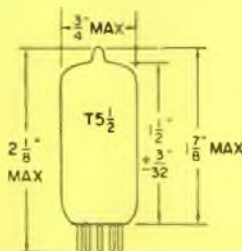
12-volt pentagrid converter

CHARACTERISTIC CURVES

(In curve section following APPENDIX)
Characteristics, conversion gain, ...200A

MECHANICAL DATA

Cathode, coated unipotential
Bulb T-5½
Outline 5-2
Base Miniature 7-pin (E7-1)
Basing 7CM
Mounting position Any



PIN CONNECTIONS

Pin 1 Grid 1
Pin 2 Cathode, Grid 5
Pin 3 Heater
Pin 4 Heater
Pin 5 Plate
Pin 6 Grid 2 & 4
Pin 7 Grid 3

APPLICATION

Type 12AD6 is a miniature pentagrid converter used as a combined oscillator-mixer for 12-volt A and B supply automobile superheterodyne radio receivers. It is suitable for hybrid designs in which a transistor is used in the power output stage.



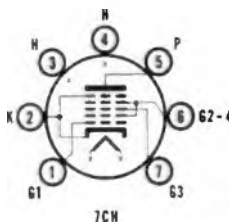
12AD6



Combined oscillator-mixer for 12-volt A and B supply automobile radios

HEATER CHARACTERISTICS*

Voltage, a-c or d-c 12.6 volts
Current 150 ma
Peak heater-cathode voltage, max.
Heater negative to cathode 30 volts
Heater positive to cathode 30 volts



ELECTRICAL DATA

DIRECT INTERELECTRODE CAPACITANCES

	No Shield	Shield†	
Signal grid to mixer plate: g3 to p, max.	0.30	0.25	μf
R-f input: g3 to all others	8.0	8.0	μf
Mixer output: p to all others	8.0	13.0	μf
Oscillator input: g1 to all others	5.5	5.5	μf
Oscillator output: k to h + g2 & 4 + g3 + p	15	20	μf
Oscillator grid to cathode: g1 to k + g5	3.0	3.0	μf
Oscillator grid to mixer plate: g1 to p, max.	0.1	0.05	μf
Oscillator grid to signal grid: g1 to g3, max.	0.15	0.15	μf

†JETEC shield 316 connected to cathode.

MAXIMUM RATINGS (Design center values)

Plate voltage	30 volts
Grid 2 and 4 voltage	30 volts
Grid 2 and 4 supply voltage	30 volts
Grid 3 voltage, negative d-c	-30 volts
Grid 3 voltage, positive d-c	0 volts
Cathode current	20 ma
Grid 3 circuit resistance	10 meg

CHARACTERISTICS AND TYPICAL OPERATION

Converter Service (Self excitation)

Plate voltage	12.6 volts
Grid 3 (signal grid) voltage	0 volts
Grid 2 and 4 (oscillator anode) voltage	12.6 volts
Grid 1 (oscillator grid) resistance	33,000 ohms
Grid 3 resistance	2.2 meg
Grid 1 (oscillator grid) voltage, rms	1.6 volts
Plate resistance (approx.)	1.0 meg
Conversion transconductance	260 μmhos
Cathode current	2000 μa
Plate current	450 μa
Grid 2 and 4 (oscillator anode) current	1500 μa
Grid 1 (oscillator grid) current	50 μa
Grid 3 voltage (approx.) for $g_c = 5 \mu\text{mhos}$	-2.2 volts
Grid 3 voltage (approx.) for $g_c = 20 \mu\text{mhos}$	-1.8 volts

Oscillator Characteristics, Not Oscillating

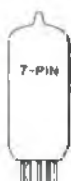
Grid 3 voltage	0 volts
Grid 2 and 4 (connected to plate) voltage	12.6 volts
Grid 1 (oscillator grid) voltage	0 volts
Transconductance between grid 1, and grids 2 & 4 connected to plate	3800 μmhos
Amplification factor between grid 1, and grid 2 & 4 connected to plate	9.0
Cathode current	5.0 ma
Grid 1 voltage (approx.) for $I_b = 10 \mu\text{a}$	-4.0 volts

NOTE:

*Type 12AD6 is intended for use in automobile radios operated from a nominal 12-volt battery. Design of the tube is such that the heater will operate satisfactorily over the range from 10 volts to 15.9 volts, and that the maximum ratings provide a safety factor for the wide voltage variation encountered in this type of supply.



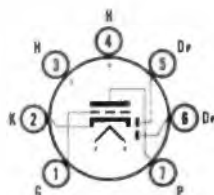
12AE6A



**Combined detector—a-f voltage amplifier for 12-volt
A and B supply automobile radios**

HEATER CHARACTERISTICS*

Voltage, a-c or d-c.....	12.6 volts
Current.....	150 ma
Peak heater-cathode voltage, max.	
Heater negative to cathode.....	30 volts
Heater positive to cathode.....	30 volts



ELECTRICAL DATA

DIRECT INTERELECTRODE CAPACITANCES

Grid to plate: g1 to p.....	2.0 μ f
Input: g1 to k + h.....	1.8 μ f
Output: p to k + h.....	1.1 μ f
Diode 1 to diode 2.....	0.9 μ f

MAXIMUM RATINGS (Design center values)

Plate voltage.....	30 volts
Cathode current.....	20 ma
Control-grid circuit resistance.....	10 meg
Diode current, average.....	1.0 ma

CHARACTERISTICS AND TYPICAL OPERATION

Class A Amplifier—Triode Unit

Plate voltage.....	12.6 volts
Control-grid voltage.....	0 volts
Plate resistance (approx.).....	13,000 ohms
Transconductance.....	1300 μ mhos
Amplification factor.....	16.7
Plate current.....	1.0 ma

Diode Units

Average diode current with 10 volts applied, each diode.....	2.0 ma
--	--------

Resistance Coupled Amplifier

Plate supply voltage.....	14.4 volts
Control-grid voltage.....	0 volts
Plate load resistor.....	.47 meg
Control-grid resistor.....	2.2 meg
Input capacitor.....	.01 μ f
Output capacitor.....	.01 μ f
Grid resistor of following stage.....	2.2 meg
Signal source impedance, max.....	1000 ohms
Voltage gain at 400 cps (measured at an output voltage of 1 volt, rms).....	10

NOTE:

* 12AE6A is intended for use in automobile receivers operated from a nominal 12-volt battery. Design of the tube is such that the heater will operate satisfactorily over the range from 10 volts to 15.9 volts, and that the maximum ratings provide a safety factor for the wide voltage variations encountered in this type of supply.

ENGINEERING DESIGN DATA

12AE6A

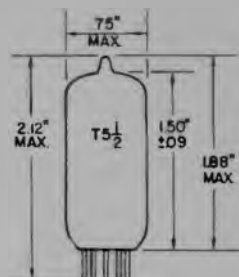
MARCH 30, 1959

Duodiode-triode

CHARACTERISTIC CURVES
(In curve section following APPENDIX)
Plate Characteristics..... 226A

MECHANICAL DATA

Cathode, coated unipotential.....	
Bulb.....	T-5 1/2
Outline.....	JETEC 5-2
Base.....	Miniature 7-pin (E7-1)
Basing.....	7BT
Mounting position.....	Any



PIN CONNECTIONS

Pin 1.....	Grid 1
Pin 2.....	Cathode
Pin 3.....	Heater
Pin 4.....	Heater
Pin 5.....	Diode 2 Plate
Pin 6.....	Diode 1 Plate
Pin 7.....	Triode Plate

APPLICATION

12AE6A is a miniature duodiode-triode used as a detector—a. f. voltage amplifier in 12-volt A and B supply automobile radios. It is suitable for hybrid designs in which a transistor is used for the power output stage.

ENGINEERING DESIGN DATA

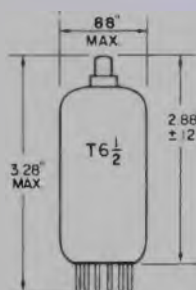
12AF3

MARCH 30, 1959

Single diode

MECHANICAL DATA

Cathode, coated unipotential
Bulb T-6½
Outline JETEC 6-8
Base Miniature 9-pin (E9-1)
Basing 9CB
Mounting position Any



PIN CONNECTIONS

Pin 1	1C*
Pin 2	1C*
Pin 3	1C*
Pin 4	Heater
Pin 5	Heater
Pin 6	1C*
Pin 7	1C*
Pin 8	1C*
Pin 9	Plate
Top Cap	Cathode

*Internal connection — Do not use as tie point.

APPLICATION

The 12AF3 is designed for damper tube service in series-string TV receivers employing direct drive horizontal circuit. It is designed to withstand high voltage pulses of line frequency between cathode and both heater and plate elements.



12AF3



Damper diode for television horizontal sweep circuits, warm-up controlled for series-strings

HEATER CHARACTERISTICS

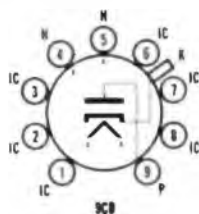
Voltage, a-c or d-c 12.6 volts
Current 600 ma
Peak heater-cathode voltage, max.*†
Heater negative to cathode† 4500 volts
Heater positive to cathode† 300 volts
Warm-up time 11 secs. average
(See Series-String Heaters section of Handbook APPENDIX)

*Voltage pulse duration must not exceed 10µs in a 525-line, 30-frame system.

†Design maximum value.

•D-c component must not exceed 1000 volts max.

*D-c component must not exceed 100 volts max.



ELECTRICAL DATA

DIRECT INTERELECTRODE CAPACITANCES

Heater to cathode: h to k	2.8 µuf
Cathode to plate-and-heater: k to p + h	9.0 µuf
Plate to cathode-and-heater: p to k + h	6.0 µuf

MAXIMUM RATINGS (Design maximum values)

TV Damper Service*

Plate voltage, peak inverse	4500 volts
Plate current, d-c	185 ma
Plate current, peak steady state	750 ma
Plate dissipation	6.0 watts
Bulb temperature at hottest point	210 °C

AVERAGE CHARACTERISTICS

Tube voltage drop at 340 ma	30 volts
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NOTES:

*Voltage pulse duration must not exceed 10µs in a 525-line, 30-frame system.

†Design maximum value.

Type 12AF3 is identical to type 6AF3 except for heater characteristics.



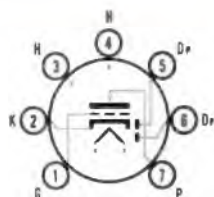
12AE6



**Combined detector—a-f voltage amplifier for 12-volt
A and B supply automobile radios**

HEATER CHARACTERISTICS*

Voltage, a-c or d-c.....	12.6 volts
Current.....	150 ma
Peak heater-cathode voltage, max. Heater negative to cathode.....	30 volts
Heater positive to cathode.....	30 volts



ELECTRICAL DATA

DIRECT INTERELECTRODE CAPACITANCES

Grid to plate: g1 to p.....	2.0 μf
Input: g1 to k + h.....	1.8 μf
Output: p to k + h.....	1.1 μf
Diode 1 to diode 2.....	0.9 μf

MAXIMUM RATINGS (Design center values)

Plate voltage.....	30 volts
Cathode current.....	20 ma
Control-grid circuit resistance.....	10 meg
Diode current, average.....	1.0 ma

CHARACTERISTICS AND TYPICAL OPERATION

Class A Amplifier—Triode Unit

Plate voltage.....	12.6 volts
Control-grid voltage.....	0 volts
Plate resistance (approx.).....	15,000 ohms
Transconductance.....	1000 μmhos
Amplification factor.....	15
Plate current.....	750 μa

Diode Units

Average diode current with 10 volts applied, each diode...	2.0 ma
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Resistance Coupled Amplifier

Plate supply voltage.....	14.4 volts
Control-grid voltage.....	0 volts
Plate load resistor.....	.47 meg
Control-grid resistor.....	2.2 meg
Input capacitor.....	.01 μf
Output capacitor.....	.01 μf
Grid resistor of following stage.....	2.2 meg
Signal source impedance, max.....	1000 ohms
Voltage gain at 400 cps (measured at an output voltage of 1 volt, rms).....	10

NOTE:

*Type 12AE6 is intended for use in automobile receivers operated from a nominal 12-volt battery. Design of the tube is such that the heater will operate satisfactorily over the range from 10 volts to 15.9 volts and that the maximum ratings provide a safety factor for the wide voltage variations encountered in this type of supply.

ENGINEERING DESIGN DATA

12AE6

JUNE 1, 1957

Duodiode-triode

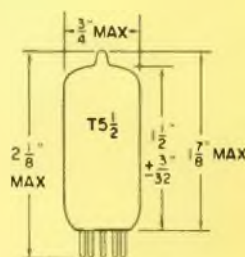
CHARACTERISTIC CURVES

(In curve section following APPENDIX)

Plate Characteristics.....	201A
Transfer Characteristics.....	201B

MECHANICAL DATA

Cathode, coated unipotential	
Bulb.....	T-5 1/4
Outline.....	JETEC 5-2
Base.....	Miniature 7-pin (E7-1)
Basing.....	7BT
Mounting position.....	Any



PIN CONNECTIONS

Pin 1.....	Grid 1
Pin 2.....	Cathode
Pin 3.....	Heater
Pin 4.....	Heater
Pin 5.....	Diode 2 Plate
Pin 6.....	Diode 1 Plate
Pin 7.....	Triode Plate

APPLICATION

Type 12AE6 is a miniature duodiode-triode used as a detector—a. f. voltage amplifier in 12-volt A and B supply automobile radios. It is suitable for hybrid designs in which a transistor is used for the power output stage.

ENGINEERING DESIGN DATA

12AF6

DECEMBER 22, 1956

12-volt pentode

CHARACTERISTIC CURVES

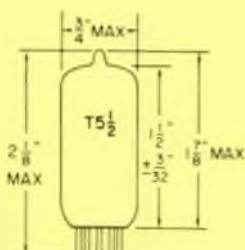
(In curve section following APPENDIX)

Plate ($E_c = 12.6V$) 110A

Transfer ($E_c = 12.6V$, $E_b = 12.6V$) 110B

MECHANICAL DATA

Cathode, coated unipotential
Bulb T-5½
Outline JETEC 5-2
Base Miniature 7-pin (E7-1)
Basing 7BK
Mounting position Any



PIN CONNECTIONS

Pin 1 Grid 1
Pin 2 Grid 3, I. S.
Pin 3 Heater
Pin 4 Heater
Pin 5 Plate
Pin 6 Grid 2
Pin 7 Cathode

APPLICATION

Type 12AF6 is a miniature pentode used as an r-f or i-f amplifier for 12-volt A and B supply automobile radios; Plate and screen supply voltages may be obtained directly from the 12-volt battery.



12AF6



R-f or i-f amplifier for 12-volt A and B supply automobile radios

HEATER CHARACTERISTICS

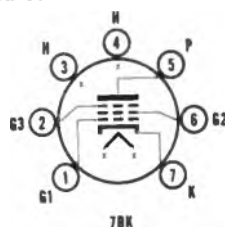
Voltage, a-c or d-c 12.6 volts

Current 150 ma

Peak heater-cathode voltage, max.

Heater negative to cathode 16 volts

Heater positive to cathode 16 volts



ELECTRICAL DATA

DIRECT INTERELECTRODE CAPACITANCES

Grid to plate: g1 to p, max. 0.006 μf

Input: g1 to k + h + g2 + g3 5.5 μf

Output: p to k + h + g2 + g3 4.8 μf

MAXIMUM RATINGS (Design center values)

Plate voltage 16 volts

Grid 2 voltage 16 volts

Grid voltage, positive d-c 0 volts

Grid 1 circuit resistance 2.2 meg

CHARACTERISTICS AND TYPICAL OPERATION

Class A Amplifier

Plate voltage 12.6 volts

Grid 3 (suppressor) connected to cathode at socket

Grid 2 (screen) voltage 12.6 volts

Grid 1 (control-grid) supply voltage 0 volts

Grid 1 resistor (by passed) 2.2 meg

Plate resistance (approx.) 0.3 meg

Transconductance 1250 μmhos

Plate current8 ma

Grid 2 current3 ma

Grid 1 voltage (approx.) for $g_m = 40 \mu\text{mhos}$ -2.7 volts

NOTE:

*Type 12AF6 is intended for use in automobile radios operated from a nominal 12-volt battery. Design of the tube is such that the heater will operate satisfactorily over the range from 10 volts to 15.9 volts, and that the maximum ratings provide a safety factor for the wide voltage variation encountered in this type of supply.

12AH6 • 12AH7GT

(See chart for seldom-used tubes)



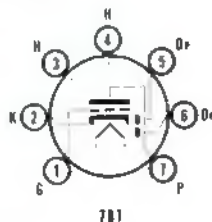
12AJ6



**Combined detector—a-1 voltage amplifier for 12-volt
A and B supply automobile radios**

HEATER CHARACTERISTICS

Voltage, a-c or d-c	12.6 volts
Current	150 ma
Peak heater-cathode voltage, max.	
Heater negative to cathode	30 volts
Heater positive to cathode	30 volts



ELECTRICAL DATA

DIRECT INTERELECTRODE CAPACITANCES

Grid to plate: g1 to p	2.0 μf
Input: g1 to k + h	2.2 μf
Output: p to k + h	0.8 μf
Diode 1 to diode 2	0.9 μf

MAXIMUM RATINGS (Design center values)

Plate voltage	30 volts
Cathode current	20 ma
Control-grid circuit resistance	10 meg
Diode current, average	1.0 ma

CHARACTERISTICS AND TYPICAL OPERATION

Class A Amplifier

Plate voltage	12.6 volts
Control-grid voltage	0 volts
Plate resistance (approx.)	45,000 ohms
Transconductance	1200 μmhos
Amplification factor	55
Plate current	750 μa

Diode Units

Average diode current with 10 volts applied, each diode	2.0 ma
---	--------

Resistance Coupled Amplifier

Plate supply voltage	12.6 volts
Control-grid voltage	0 volts
Plate load resistor	1.0 meg
Control-grid resistor	1.0 meg
Input capacitor	0.02 μf
Output capacitor	0.01 μf
Grid resistor of following stage	2.0 meg
Voltage gain at 400 cps (measured at an output voltage of 1 volt, rms)	16

NOTES:

*Type 12AJ6 is intended for use in automobile receivers operated from a nominal 12-volt battery. Design of the tube is such that the heater will operate satisfactorily over the range from 10 volts to 15.9 volts, and that the maximum ratings provide a safety factor for the wide voltage variations encountered in this type of supply.

ENGINEERING DESIGN DATA

12AJ6

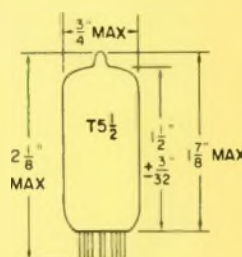
JUNE 1, 1957

Duodiode-triode

CHARACTERISTIC CURVES
(In curve section following APPENDIX)
Plate Characteristics 202A

MECHANICAL DATA

Cathode, coated unipotential
Bulb T-5½
Outline JETEC 5-2
Base Miniature 7-pin (E7-1)
Basing 7BT
Mounting position Any



PIN CONNECTIONS

Pin 1	Grid 1
Pin 2	Cathode
Pin 3	Heater
Pin 4	Heater
Pin 5	Diode 2 Plate
Pin 6	Diode 1 Plate
Pin 7	Triode Plate

APPLICATION

Type 12AJ6 is a miniature duodiode-triode used as a combined detector—a. 1. voltage amplifier in 12-volt A and B supply automobile radios. It is suitable for use in hybrid designs in which a transistor is used in the power output stage.

**ENGINEERING
DESIGN DATA**

12AL5

DECEMBER 22, 1956

Duodiode

CHARACTERISTIC CURVES

(In curve section following APPENDIX)

Plate 120A
Operation 120B
Operation 120C

APPLICATION

Type 12AL5 is a miniature duodiode designed for high frequency operation. Each section has a resonant frequency of 700 megacycles. An internal shield connected to pin 6 permits independent operation of each diode.



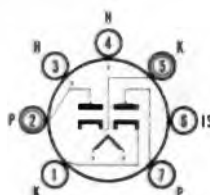
12AL5



**R-f detector in f-m and television circuits or
low power rectifier**

HEATER CHARACTERISTICS

Voltage, a-c or d-c 12.6 volts
Current 150 ma
Peak heater-cathode voltage, max.
Heater negative to cathode 330 volts
Heater positive to cathode 330 volts

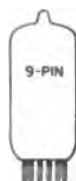


6BT

Type 12AL5 is identical to types 3AL5 and 6AL5 except for heater characteristics. See type 3AL5 for ratings and characteristics.



12AL8



Combined detector or voltage amplifier and space charge grid power amplifier for 12-volt A and B supply automobile radio receivers

HEATER CHARACTERISTICS*

Voltage, a-c or d-c.....	12.6 volts
Current.....	550 ma
Peak heater-cathode voltage, max.	
Heater negative to cathode.....	30 volts
Heater positive to cathode.....	30 volts



ELECTRICAL DATA

DIRECT INTERELECTRODE CAPACITANCES

Triode Section

Grid to plate: g1 to p.....	5.7 μ f
Input: g1 to k + h.....	1.8 μ f
Output: p to k + h.....	0.4 μ f

Tetrode Section

Grid to plate: g2 to p.....	14 μ f
Input: g2 to k + h + g1.....	13 μ f
Output: p to k + h + g1.....	1.6 μ f
Coupling: tetrode grid 2 to triode grid 1.....	.01 μ f

MAXIMUM RATINGS (Design center values)

	Tetrode	Triode
Plate voltage.....	30	30 volts
Grid 1 voltage, positive d-c (absolute max.).....	16	volts
Grid 2 voltage, negative d-c.....	20	volts
Grid 2 circuit resistance.....	10	meg
Cathode current.....	20	ma
Grid 1 circuit resistance.....	10	meg

CHARACTERISTICS AND TYPICAL OPERATION

Class A Amplifier (Single Tube)

	Triode	Tetrode
Plate voltage.....	12.6	12.6 volts
Grid 1 (space-charge grid) voltage.....		12.6 volts
Grid 1 triode (control grid) voltage.....	-0.9†	volts
Grid 2 tetrode (control grid) voltage.....		-0.5† volts
Plate resistance.....	13,000	480 ohms
Amplification factor.....	13	7.24
Transconductance.....	1000	15,000 μ hos
Plate current.....	0.5	40 ma
Grid 1 (space-charge grid) current.....		75 ma

Resistance-Coupled Amplifier (Single Tube)

Plate (space-charge grid and heater) supply voltage.....	12.6 volts
A-1 signal voltage.....	.18 volts
Plate current (tetrode).....	8.0 ma
Grid 1 (space-charge grid) current.....	75 ma
Load resistance (tetrode).....	800 ohms
Total harmonic distortion.....	10 %
Power output.....	40 mw

NOTES:

*Type 12AL8 is intended for use in automobile receivers operated from a nominal 12-volt battery. Design of the tube is such that the heater will operate satisfactorily over the range from 10 volts to 15.9 volts, and that the maximum ratings provide a safety factor for the wide voltage variations encountered in this type of supply.

†Average contact potential developed across a 2.2 megohm grid resistor.

‡From grid 2 to plate.

§Grid 1 space-charge grid. Grid 2 control-grid.

ENGINEERING DESIGN DATA

12AL8

NOVEMBER 1, 1957

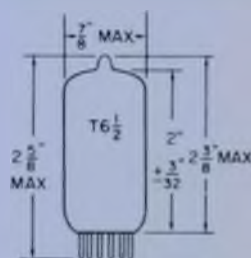
12-volt triode-tetrode

CHARACTERISTICS CURVES

Plate, Triode Δ E_{c1}	215A
Plate, Triode Δ E_{c2}	215B
Plate, Triode.....	215C

MECHANICAL DATA

Cathode, coated unipotential.....	
Bulb.....	T-6½
Outline.....	JEDEC 6-3
Base.....	Miniature 9-pin (E9-1)
Basing.....	9GS
Mounting position.....	Any



PIN CONNECTIONS

Pin 1.....	Triode Plate
Pin 2.....	Tetrode Grid 2
Pin 3.....	Tetrode Grid 1
Pin 4.....	Heater
Pin 5.....	Heater
Pin 6.....	Tetrode Plate
Pin 7.....	Tetrode Cathode
Pin 8.....	Triode Grid
Pin 9.....	Triode Cathode

APPLICATION

Type 12AL8 is a miniature triode-tetrode with separate cathodes used as a triode detector or voltage amplifier and tetrode power amplifier for 12-volt plate and space-charge grid supply automobile radios. The tetrode section provides sufficient drive for transistor output stage in hybrid automobile radios.

ENGINEERING DESIGN DATA

12AQ5

JUNE 10, 1956

Beam power pentode

CHARACTERISTIC CURVES

(In curve section following APPENDIX)

Plate ($E_{c2} = 250V$).....	138A
Plate ($E_{c2} = 250V$).....	138B
Plate, triode connected.....	138C
Plate, ΔE_{c2} ($E_{c1} = 0V$).....	138D
Transfer ($E_b = 250V$).....	138E
Operation.....	138F

APPLICATION

A general-purpose power amplifier that can be used in the audio power output stage of radio receivers. The 12AQ5 is used primarily in automobile receivers operating from a 12-volt storage battery.



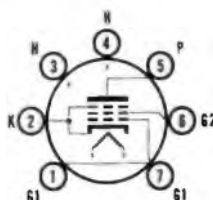
12AQ5



General-purpose power amplifier for a-c operated and 12-volt automobile receivers

HEATER CHARACTERISTICS

Voltage, a-c or d-c.....	12.6 volts
Current.....	225 ma



7B1

Type 12AQ5 is identical to types 5AQ5 and 6AQ5 except for heater characteristics. See type 5AQ5 for ratings and characteristics.

12AT6

DECEMBER 22, 1956

Duodiode— high-mu triode

APPLICATION

Type 12AT6 is a duodiode—high-mu triode used primarily in ac/dc radio receivers with 150 ma series heater strings. Refer to APPENDIX for R-C amplifier data.



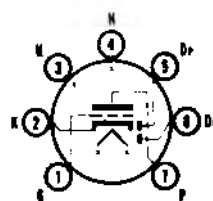
12AT6



Combined detector, audio amplifier, and automatic-volume-control tube

HEATER CHARACTERISTICS

Voltage, a-c or d-c.....	12.6 volts
Current.....	150 ma
Peak heater-cathode voltage, max.	
Heater negative to cathode.....	90 volts
Heater positive to cathode.....	90 volts



7B1

Type 12AT6 is identical to type 6AT6 except for heater ratings.

CBS

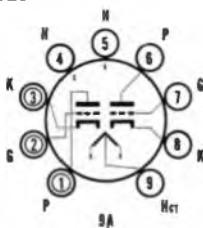
12AT7



Frequency converter or cathode-driven amplifier in the vhf bands

HEATER CHARACTERISTICS

	Series	Parallel
Voltage, a-c or d-c.....	12.6	6.3 volts
Current.....	150	300 ma
Peak heater-cathode voltage, max.		
Heater negative to cathode.....	90	90 volts
Heater positive to cathode.....	90	90 volts



ELECTRICAL DATA

DIRECT INTERELECTRODE CAPACITANCES

	Section 1	Section 2
Grid to plate: g1 to p.....	1.5	1.5 μ f
Input: g1 to k + h.....	2.2	2.2 μ f
Output: p to k + h.....	0.5	0.4 μ f
Grid (Sect. 1) to grid (Sect. 2).....	.005	.005 μ f
Plate (Sect. 1) to plate (Sect. 2).....	0.4	0.4 μ f
Heater to cathode.....	2.4	2.4 μ f
Grounded-grid operation		
Plate to cathode.....	0.2	0.2 μ f
Input.....	4.6	4.6 μ f
Output.....	1.8	1.8 μ f

MAXIMUM RATINGS (Design center values)A

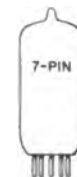
Plate voltage.....	300 volts
Plate dissipation.....	2.5 watts

CHARACTERISTICS AND TYPICAL OPERATION

Class A AmplifierA

Plate voltage.....	100	180	250 volts
Control-grid voltage.....	-1.0	-1.0	-2.0 volts
Cathode-bias resistor.....	270	90	200 ohms
Plate resistance (approx.).....	15,000	9400	10,900 ohms
Transconductance.....	4000	6000	5500 μ mhos
Amplification factor.....	60	62	60
Plate current.....	3.7	11.0	10.0 ma
Control-grid voltage (approx.) for $I_b = 10 \mu$ a.....	-5	-8	-12 volts

A Each section.

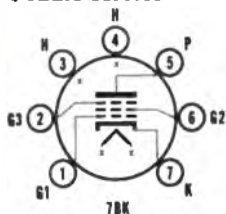

CBS

12AU6

R-f or i-f amplifier used in a-c/d-c radio service

HEATER CHARACTERISTICS

Voltage, a-c or d-c.....	12.6 volts
Current.....	150 ma
Peak heater-cathode voltage, max.	
Heater negative to cathode.....	180 volts
Heater positive to cathode.....	100 volts



Type 12AU6 is identical to types 3AU6 and 6AU6 except for heater characteristics. See type 3AU6 for ratings and characteristics.

CBS ELECTRON TUBES

ENGINEERING DESIGN DATA

12AT7

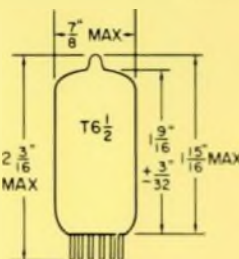
DECEMBER 22, 1956

High-mu duotriode

CHARACTERISTIC CURVES
(In curve section following APPENDIX)
Plate..... 118A

MECHANICAL DATA

Cathode, coated unipotential
Bulb..... T-6 1/2
Outline..... JETEC 6-2
Base..... Miniature 9-pin (E9-1)
Basing..... 9A
Mounting position..... Any



PIN CONNECTIONS

Pin 1..... Plate (Sect. 2)
Pin 2..... Grid 1 (Sect. 2)
Pin 3..... Cathode
Pin 4..... Heater
Pin 5..... Heater
Pin 6..... Plate (Sect. 1)
Pin 7..... Grid 1 (Sect. 1)
Pin 8..... Cathode (Sect. 1)
Pin 9..... Heater Center Tap

APPLICATION

Type 12AT7 is a miniature high-mu duotriode used as a frequency converter at frequencies below 300 megacycles. It is also suitable for grounded-grid amplifiers. Type 12AT7 is like type 12AZ7 except for capacitances and heater ratings.

12AU6

DECEMBER 22, 1956

Sharp-cutoff pentode

CHARACTERISTIC CURVES
(In curve section following APPENDIX)
Screen Grid Rating..... 100A
Plate ($E_{c2} = 100V$)..... 121A
Plate ($E_{c2} = 150V$)..... 121B
Plate, triode connected..... 121C
Transfer: I_b, I_{c2} 121D
Transfer: g_m 121E

NOTE

See APPENDIX for R-C amplifier data.

12AU7

12AU7A

DECEMBER 22, 1956

**Medium- μ
duotriode**

CHARACTERISTIC CURVES

(In curve section following APPENDIX)

Plate.....177A

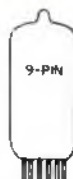
APPLICATION

Types 12AU7 and 12AU7A are medium- μ duotriodes which may be used in a wide variety of applications such as in oscillators, multivibrators, phase, inverters, and TV vertical output amplifiers. See APPENDIX for R-C amplifier data.



12AU7

12AU7A



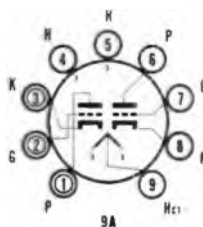
**TV sweep oscillator and vertical amplifier
or phase inverter**

HEATER CHARACTERISTICS

Voltage,	Series	Parallel
a-c or d-c	12.6	6.3 volts
Current	150	300 ma
Peak heater-cathode voltage, max.		
Heater negative to cathode		200 volts
Heater positive to cathode*		200 volts

*D-c component 100 volts max.

Types 12AU7 and 12AU7A are identical electrically to type 7AU7 except for heater characteristics. The 12AU7A has improved mechanical rigidity and is less subject to microphonics.



12AV5GA

DECEMBER 22, 1956

Beam power pentode

CHARACTERISTIC CURVES

(In curve section following APPENDIX)

Plate (E_{c2} = 100V).....105A

Plate (E_{c2} = 150V).....105B

APPLICATION

Type 12AV5GA is a beam power pentode designed for operation as a horizontal deflection amplifier in television receivers where it is desirable to have single ended tube construction.



12AV5GA



**Horizontal deflection amplifier for television
receiver sweep circuits**

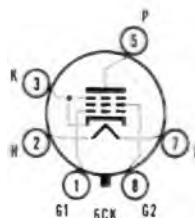
HEATER CHARACTERISTICS

Voltage, a-c or d-c	12.6 volts
Current	600 ma
Peak heater-cathode voltage, max.	
Heater negative to cathode	200 volts
Heater positive to cathode*	200 volts
Warm-up time	11 secs. average

(See Series-String Heaters section of APPENDIX in CBS Tube Manual).

*D-c component must not exceed 100 volts max.

Type 12AV5GA is identical to types 6AV5GA and 25AV5GA except for heater characteristics. See 6AV5GA for ratings and characteristics.





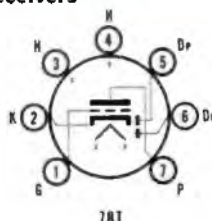
12AV6



**Detector, avc, and audio amplifier for ac/dc
or 12-volt automobile receivers**

HEATER CHARACTERISTICS

Voltage, a-c or d-c.....	12.6 volts
Current.....	150 ma
Peak heater-cathode voltage, max.	
Heater negative to cathode.....	90 volts
Heater positive to cathode.....	90 volts



Type 12AV6 is identical to types 3AV6 and 6AV6 except for heater characteristics. See type 3AV6 for ratings and characteristics.



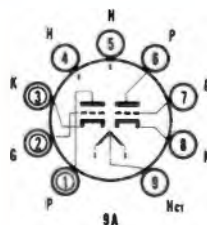
12AV7



Radio frequency converter or audio frequency amplifier

HEATER CHARACTERISTICS

	Series	Parallel
Voltage, a-c or d-c.....	12.6	6.3 volts
Current.....	225	450 ma
Peak heater-cathode voltage, max.		
Heater negative to cathode.....	90	90 volts
Heater positive to cathode.....	90	90 volts



ELECTRICAL DATA

DIRECT INTERELECTRODE CAPACITANCES

	Section 1		Section 2		
	No Shield	Shield	No Shield	Shield	
Grid to plate: g1 to p.....	1.9	1.9	1.9	1.9	$\mu\mu\text{f}$
Input: g1 to k + h.....	3.1	3.2	3.1	3.2	$\mu\mu\text{f}$
Output: p to k + h.....	0.5	1.3	0.4	1.6	$\mu\mu\text{f}$
Plate to cathode:					
p to k.....	0.24	0.24	0.24	0.23	$\mu\mu\text{f}$
Plate to grid and heater: p to g1 + h.....	2.0		2.0		$\mu\mu\text{f}$
Cathode to grid and heater: k to g + h.....	6.9		6.9		$\mu\mu\text{f}$
Cathode to heater:					
k to h.....	3.8	4.0	3.8	4.0	$\mu\mu\text{f}$
Plate to grid, heater, and external shield: p to g1 + h + e.s.....	2.8		3.2		$\mu\mu\text{f}$
Cathode to grid, heater, and external shield: k to g1 + h + e.s.....	7.0		7.0		$\mu\mu\text{f}$

†JETEC shield 315 connected to cathode.

ENGINEERING DESIGN DATA

12AV6

DECEMBER 30, 1959

**Duodiode—
high-mu triode**

CHARACTERISTICS CURVES

(In curve section following APPENDIX)

Plate.....	122A
Transfer; r_p , g_m , μ	122B
Operation (each diode).....	122C

APPLICATION

Type 12AV6 is a miniature duodiode—high-mu triode designed for use as a combined detector, avc tube, and audio amplifier. Its principal applications are in a-c/d-c radio receivers of the 150 ma series string type and automobile radio receivers operated from a 12-volt storage battery. See APPENDIX for R-C amplifier data.

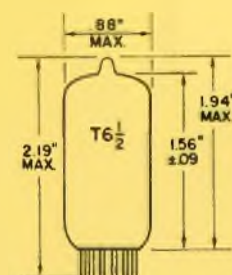
12AV7

DECEMBER 30, 1959

**Medium-mu
duotriode**

MECHANICAL DATA

Cathode, coated unipotential	
Bulb.....	T-6½
Outline.....	JETEC 6-2
Base.....	Miniature 9-pin (E9-1)
Basing.....	9A
Mounting position.....	Any



ENGINEERING DESIGN DATA

12AV7 (cont.)

PIN CONNECTIONS

Pin 1	Plate (Sect. 2)
Pin 2	Grid 1 (Sect. 2)
Pin 3	Cathode (Sect. 2)
Pin 4	Heater
Pin 5	Heater
Pin 6	Plate (Sect. 1)
Pin 7	Grid 1 (Sect. 1)
Pin 8	Cathode (Sect. 1)
Pin 9	Heater Center Tap

APPLICATION

Type 12AV7 is a medium-mu duotriode designed for operation as a frequency converter or audio amplifier.

12AV7 (cont.)

MAXIMUM RATINGS (Design center values)▲

Plate voltage	300 volts
Control-grid voltage, negative d-c	-50 volts
Plate dissipation	2.7 watts

CHARACTERISTICS AND TYPICAL OPERATION

Class A Amplifier▲

Plate supply voltage	100	150 volts
Cathode-bias resistor	120	56 ohms
Plate resistance (approx.)	6100	4800 ohms
Transconductance	6100	8500 μ mhos
Amplification factor	37	41
Plate current	9	18 ma
Control-grid voltage (approx.) for $I_b = 10 \mu$ a	-9	-12 volts

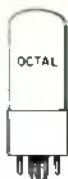
▲Each section.



12AX4GT

12AX4GTA

12XA4GTB



Damper diode for television horizontal sweep circuits

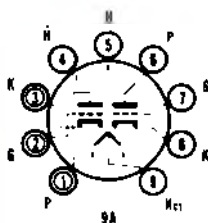
These types are identical to the 6AX4GT family of types except for heater characteristics, and maximum ratings. These types are designed for use in 300 ma series strings. In addition, types 12AX4GTA and 12AX4GTB feature controlled heater warm-up.

See type 6AX4GT for complete technical data.

CBS**12AX7****Phase inverter or resistance-coupled audio amplifier****HEATER CHARACTERISTICS**

Voltage	Series	Parallel
a-c or d-c	12.6	6.3 volts
Current	150	300 ma
Peak heater-cathode voltage, max.		
Heater negative to cathode	200	200 volts
Heater positive to cathode*	200	200 volts

*D-c component must not exceed 100 volts max.

**ELECTRICAL DATA****DIRECT INTERELECTRODE CAPACITANCES**

	Section 1	Section 2
Grid to plate: g1 to p	1.7	1.7 $\mu\mu\text{f}$
Input: g1 to k + h	1.6	1.6 $\mu\mu\text{f}$
Output: p to k + h	0.46	0.34 $\mu\mu\text{f}$

MAXIMUM RATINGS (Design center values)A

Plate voltage	300 volts
Control-grid voltage, negative d-c	50 volts
Control-grid voltage, positive d-c	0 volts
Plate dissipation	1.0 watt

CHARACTERISTICS AND TYPICAL OPERATION**Class A AmplifierA**

Plate voltage	100	250 volts
Control-grid voltage	-1	-2 volts
Plate resistance (approx.)	.08	.0625 meg
Transconductance	1250	1600 μmhos
Amplification factor	100	100
Plate current	0.5	1.2 ma

A Each section.

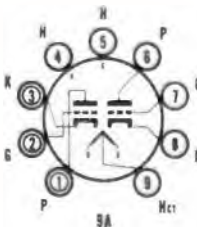
12AY7

(See chart for seldom-used tubes)

CBS**12AZ7****Frequency converter or cathode driven amplifier in the vhf bands****HEATER CHARACTERISTICS**

Voltage	Series	Parallel
a-c or d-c	12.6	6.3 volts
Current	225	450 ma
Peak heater-cathode voltage, max.		
Heater negative to cathode	200	200 volts
Heater positive to cathode*	200	200 volts

*D-c component must not exceed 100 volts max.

**CBS ELECTRON TUBES****ENGINEERING
DESIGN DATA****12AX7**

DECEMBER 22, 1956

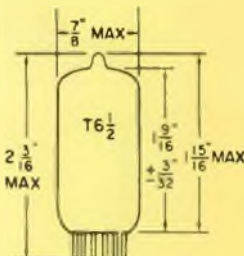
High-mu duotriode**CHARACTERISTIC CURVES**

(In curve section following APPENDIX)

Plate	122A
Transfer; T_p , T_m , μ	122B
Operation	122C

MECHANICAL DATA

Cathode, coated unipotential	
Bulb	T-6½
Outline	JETEC 6-2
Base	Miniature 9-pin (E9-1)
Basing	9A
Mounting position	Any

**PIN CONNECTIONS**

Pin 1	Plate (Sect. 2)
Pin 2	Grid 1 (Sect. 2)
Pin 3	Cathode (Sect. 2)
Pin 4	Heater
Pin 5	Heater
Pin 6	Plate (Sect. 1)
Pin 7	Grid (Sect. 1)
Pin 8	Cathode (Sect. 1)
Pin 9	Heater Center Tap

REFERENCES

See APPENDIX for A-C amplifier data.

12AZ7

DECEMBER 22, 1956

High-mu duotriode**CHARACTERISTIC CURVES**

(In curve section following APPENDIX)

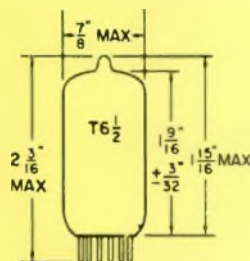
Plate	118A
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MECHANICAL DATA

Cathode, coated unipotential	
Bulb	T-6½
Outline	JETEC 6-2
Base	Miniature 9-pin (E9-1)
Basing	9A
Mounting position	Any

ENGINEERING DESIGN DATA

12AZ7 (cont.)



PIN CONNECTIONS

Pin 1	Plate (Sect. 2)
Pin 2	Grid 1 (Sect. 2)
Pin 3	Cathode (Sect. 2)
Pin 4	Heater (Sect. 2)
Pin 5	Heater (Sect. 1)
Pin 6	Plate (Sect. 1)
Pin 7	Grid 1 (Sect. 1)
Pin 8	Cathode (Sect. 1)
Pin 9	Heater Center Tap

APPLICATION

Type 12AZ7 is a high- μ duotriode designed for use as a frequency converter at frequencies below 300 mc. It is also suitable for grounded-grid amplifiers. Type 12AZ7 is like type 12AT7 except for capacitances and heater ratings.

12AZ7 (cont.)

ELECTRICAL DATA

DIRECT INTERELECTRODE CAPACITANCES

Grid Drive	Section 1		Section 2		
	No Shield	Shield $\dagger$	No Shield	Shield $\dagger$	
Grid to plate: g1 to p...	1.9	1.9	1.9	1.9	$\mu\mu\text{f}$
Input: g1 to k + h...	3.1	3.2	3.1	3.2	$\mu\mu\text{f}$
Output: p to k + h...	0.5	1.3	0.4	1.6	$\mu\mu\text{f}$
Heater to cathode...	3.8	4.0	3.8	4.0	$\mu\mu\text{f}$

Cathode Drive

Plate to cathode:					
p to k...	0.24	0.23	0.24	0.23	$\mu\mu\text{f}$
Cathode to grid and heater: k to g1 + h...	6.9	7.0	6.9	7.0	$\mu\mu\text{f}$
Plate to grid and heater: p to g1 + h...	2.0	2.8	2.0	3.2	$\mu\mu\text{f}$

$\dagger$ JETEC shield 315 connected to cathode.

MAXIMUM RATINGS (Design center values) Δ

Plate voltage	300 volts
Control-grid voltage, negative d-c	50 volts
Plate dissipation	2.5 watts
Control-grid circuit resistance	
Fixed bias	0.25 meg
Self bias	1.0 meg

CHARACTERISTICS AND TYPICAL OPERATION

Class A Amplifier Δ

Plate supply voltage	100	250 volts
Cathode-bias resistor	270	200 ohms
Plate resistance (approx.)	15,000	10,900 ohms
Transconductance	4000	5500 μmhos
Amplification factor	60	60
Plate current	3.7	10 ma
Control-grid voltage (approx.) for $I_b = 10 \mu\text{a}$	-5	-12 volts

Δ Each section.

12B4

12B4A

FEBRUARY 25, 1957

Low- μ power triode

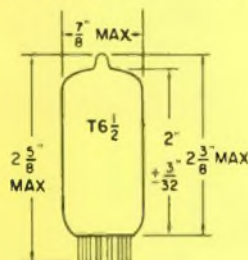
CHARACTERISTIC CURVES

(In curve section following APPENDIX)

Plate..... 119A

MECHANICAL DATA

Cathode, coated unipotential
Bulb..... T-6 $\frac{1}{2}$
Outline..... JETEC 6-3
Base..... Miniature 9-pin (E9-1)
Basing..... 9AG
Mounting position..... Any



12B4

12B4A



Vertical deflection output amplifier for television receivers

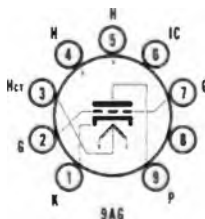
HEATER CHARACTERISTICS

Voltage	Series	Parallel
a-c or d-c	12.6	6.3 volts
Current	300	600 ma
Peak heater-cathode voltage, max.		
Heater negative to cathode	200 volts	
Heater positive to cathode*	200 volts	

*D-c component 100 volts max.

12B4A

Warm-up time..... 11 secs. average
(See Series-String Heaters section of APPENDIX in CBS Tube Manual).



ELECTRICAL DATA

DIRECT INTERELECTRODE CAPACITANCES—Shield $\dagger$

Grid to plate: g1 to p...	4.0	$\mu\mu\text{f}$
Input: g1 to k + h...	6.2	$\mu\mu\text{f}$
Output: p to k + h...	4.2	$\mu\mu\text{f}$

$\dagger$ JETEC shield 315 connected to cathode.

CBS ELECTRON TUBES

12B4 • 12B4A (cont.)

MAXIMUM RATINGS (Design center values unless noted)	Vertical Deflection Amplifier ^Δ	Class A Amplifier
Plate voltage, d-c.....	550	550 volts
Plate voltage, peak pos. (absolute max.).....	1000	volts
Control-grid voltage, peak negative.....	250	volts
Plate dissipation.....	5.5	5.5 watts
Cathode current, average.....	30	ma
Cathode current, peak.....	105	ma
Control-grid circuit resistance.....		
Fixed bias.....	0.47	meg
Self bias.....	2.2	2.2 meg

CHARACTERISTICS AND TYPICAL OPERATION

Class A Amplifier

Plate voltage.....	150	volts
Control-grid voltage.....	-17.5	volts
Plate resistance (approx.).....	1030	ohms
Transconductance.....	6300	μmhos
Amplification factor.....	6.5	
Plate current.....	34	ma
Plate current for $E_{c1} = -23$ volts.....	9.6	ma
Grid 1 voltage (approx.) for $I_b = 200$ μA.....	-32	volts

NOTES:

- ▲Voltage pulse duration must not exceed 2500 μs in a 525-line, 30-frame system.
- Tube protection is needed for no-drive conditions if grid-resistor bias is used.

12B7 • 12B8GT

(See chart for seldom-used tubes)



12BA6

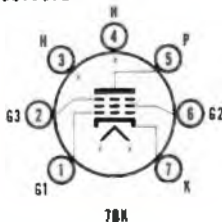


R-f or i-f amplifier in a-c/d-c receivers
or 12-volt automobile receivers

HEATER CHARACTERISTICS

Voltage, a-c.....	12.6	volts
Current.....	150	ma
Peak heater-cathode voltage, max.....		
Heater negative to cathode.....	90	volts
Heater positive to cathode.....	90	volts

Type 12BA6 is identical to types 3BA6 and 6BA6 except for heater characteristics. See type 3BA6 for complete ratings and characteristics.



12BA7

(See chart for seldom-used tubes)

CBS ELECTRON TUBES

ENGINEERING DESIGN DATA

12B4 • 12B4A (cont.)

PIN CONNECTIONS

Pin 1.....	Cathode
Pin 2.....	Grid 1
Pin 3.....	Heater Center Tap
Pin 4.....	Heater
Pin 5.....	Heater
Pin 6.....	I. C.
Pin 7.....	Grid 1
Pin 8.....	N. C.
Pin 9.....	Plate

REFERENCES

See explanation of warm-up time controlled series-string heater circuits in APPENDIX.

APPLICATION

Types 12B4 and 12B4A are low-mu triodes for application as vertical deflection output amplifiers. They are identical to each other except for heater characteristics.

12BA6

DECEMBER 22, 1956

Remote-cutoff
pentode

CHARACTERISTIC CURVES

(In curve section following APPENDIX)

Screen Grid Rating.....	100A
Plate ($E_{c2} = 100V$).....	124A
Transfer; I_{c2} ($E_b = 250V$).....	124B
Transfer; I_b ($E_b = 250V$).....	124C
Transfer; g_m ($E_b = 250V$).....	124D

APPLICATION

Type 12BA6 is a miniature, remote-cutoff pentode designed for use as a high gain r-f or i-f amplifier. It features low grid-to-plate capacitance and high transconductance. Its principal applications are in a-c/d-c radio receivers of the 150 ma series string type and automobile radio receivers operating from a 12-vol storage battery.

ENGINEERING DESIGN DATA

12BD6

DECEMBER 22, 1956

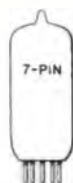
Remote-cutoff pentode

APPLICATION

Type 12BD6 is a remote-cutoff pentode for use as a gain-controlled r-f or i-f amplifier in a-c/d-c radios of the 150 ma series-string type or 12-volt automobile radio equipment.



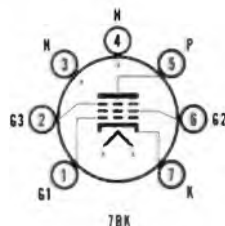
12BD6



Gain-controlled r-f or i-f amplifier for a-c/d-c
or 12-volt automobile radio equipment

HEATER CHARACTERISTICS

Voltage, a-c or d-c	12.6 volts
Current	150 ma
Peak heater-cathode voltage, max.	
Heater negative to cathode	90 volts
Heater positive to cathode	90 volts



Type 12BD6 is identical to type 6BD6 except for heater characteristics.

12BE6

DECEMBER 22, 1956

Remote-cutoff heptode

CHARACTERISTIC CURVES

(In curve section following APPENDIX)

Plate (triode connected)	126A
Operation, g_c & I_b vs. I_{c1}	126B
Transfer, g_c , I_b & I_{c2+4} vs. E_{c3} ($E_b = 250V$)	126C
Transfer, g_c , I_b & I_{c2+4} vs. E_{c3} ($E_b = 100V$)	126D
Operation	126E

APPLICATION

Type 12BE6 is designed to operate as a mixer and oscillator in superheterodyne circuits in both standard and i-m bands. Its principal applications are in a-c/d-c radio receivers of the 150 ma series-string type and automobile radio receivers operating on a 12-volt storage battery.



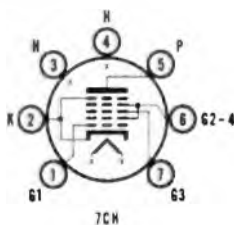
12BE6



Radio frequency converter in a-c/d-c receivers or
12-volt automobile radios

HEATER CHARACTERISTICS

Voltage, a-c or d-c	12.6 volts
Current	150 ma
Peak heater-cathode voltage, max.	
Heater negative to cathode	90 volts
Heater positive to cathode	90 volts



Type 12BE6 is identical to types 3BE6 and 6BE6 except for heater characteristics. See type 3BE6 for ratings and characteristics.

12BF6

DECEMBER 22, 1956

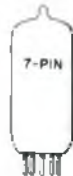
Duodiode— medium-mu triode

APPLICATION

Type 12BF6 is a miniature duodiode—medium-mu triode for use as a detector, avc, and audio tube used primarily in 12-volt automobile radio receivers.



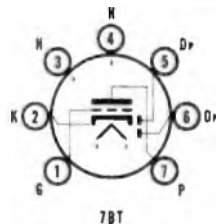
12BF6



Detector, avc, and audio tube for 12-volt
automobile radio receivers

HEATER CHARACTERISTICS

Voltage, a-c or d-c	12.6 volts
Current	150 ma
Peak heater-cathode voltage, max.	
Heater negative to cathode	90 volts
Heater positive to cathode	90 volts



Type 12BF6 is identical to type 6BF6 except for heater characteristics.

CBS ELECTRON TUBES



12BH7

12BH7A



Combined sweep oscillator and vertical output amplifier

HEATER CHARACTERISTICS

	Series	Parallel
Voltage, a-c or d-c.....	12.6	6.3 volts
Current.....	300	600 ma
Peak heater-cathode voltage, max.		
Heater neg. to cathode....	200	volts
Heater pos. to cathode*	200	volts

*D-c component must not exceed 100 volts max.

12BH7A

Warm-up time..... 11 secs. average

ELECTRICAL DATA

DIRECT INTERELECTRODE CAPACITANCES

	Section 1		Section 2	
	Shield†	No Shield	Shield†	No Shield
Grid to plate:				
g1 to p.....	2.4	2.4	2.4	2.4
Input: g1 to k + h.....	3.3	3.3	3.3	3.3
Output: p to k + h.....	2.0	0.8	2.0	0.8
Coupling: plate to plate (shield).....	0.6†			
Coupling: plate to plate (no shield)....	0.9			

†JETEC shield 315 connected to cathode.

MAXIMUM RATINGS

(Design center values unless noted)

	Vertical Deflection Amplifier†	Class A Amplifier
Plate voltage, d-c.....	500	300 volts
Plate voltage, peak pos. (absolute max.)...	1485	volts
Plate voltage, peak negative.....	-50	-50 volts
Control-grid voltage, peak negative pulse (absolute max.).....	220	volts
Plate dissipation (each plate).....	3.85	3.5 watts
Plate dissipation (total for both plates).....		6.0 watts
Cathode current, average (each section).....	20	20 ma
Control-grid circuit resistance		
Fixed bias.....	1.0	1.0 meg
Self bias.....	2.5	2.5 meg

AVERAGE CHARACTERISTICS

Class A Amplifier

Plate voltage.....	250 volts
Control-grid voltage.....	-10.5 volts
Transconductance (each unit).....	3100 μ hos
Amplification factor.....	17.0
Plate current (each unit).....	11.5 ma

12BH7A

Grid 1 voltage (approx.) for $I_b = 50 \mu$ a and $E_b = 150$ volts... -17 volts

12BH7

Grid 1 voltage (approx.) for $I_b = 100 \mu$ a and $E_b = 250$ volts... -22 volts

CHARACTERISTICS AND TYPICAL OPERATION

Vertical Deflection Amplifier†

Plate voltage.....	350 volts
Control-grid input voltage	
Negative peak component.....	32 volts
Peak to peak.....	25 volts
Cathode-bias resistor.....	560 ohms
Plate current.....	16 ma
Plate output voltage	
Peak positive pulse component.....	670 volts
Peak to peak.....	230 volts
Sweep height (16RP4 or 16TP4 with 14kv on anode)...	10½ inches

NOTES:

†Voltage pulse duration must not exceed 2500 μ s in a 525-line, 30-frame system.

CBS ELECTRON TUBES

ENGINEERING DESIGN DATA

12BH7

12BH7A

FEBRUARY 25, 1957

Medium- μ duotriode

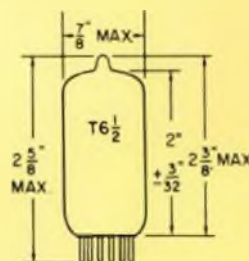
CHARACTERISTIC CURVES

(In curve section following APPENDIX)

Plate..... 104A

MECHANICAL DATA

Cathode, coated unipotential
 Bulb..... T-6½
 Outline..... JETEC 6-3
 Base..... Miniature 9-pin (E9-1)
 Basing..... 9A
 Mounting position..... Any



PIN CONNECTIONS

Pin 1.....	Plate (Sect. 2)
Pin 2.....	Grid 1 (Sect. 2)
Pin 3.....	Cathode (Sect. 2)
Pin 4.....	Heater
Pin 5.....	Heater
Pin 6.....	Plate (Sect. 1)
Pin 7.....	Grid (Sect. 1)
Pin 8.....	Cathode (Sect. 1)
Pin 9.....	Heater Center Tap

REFERENCES

See APPENDIX for explanation of heater warm-up time controlled series-string circuits as applied to type 12BH7A.

APPLICATION

Types 12BH7 and 12BH7A are medium- μ duotriodes designed for application as sweep oscillators and vertical output amplifiers in television receivers. These types are identical except for cutoff values and heater ratings.

12BK5

DECEMBER 22, 1956

Beam power amplifier

CHARACTERISTIC CURVES

(In curve section following APPENDIX)

Plate ($E_{c2} = 250V$)	172A
Plate (ΔE_{c2})	172B
Transfer; I_b ($E_b = 250V$)	172C
Transfer; I_{c2} ($E_b = 250V$)	172D

APPLICATION

Type 12BK5 is a beam power pentode with extremely high sensitivity and transconductance. It furnishes full power output from very small input signals.



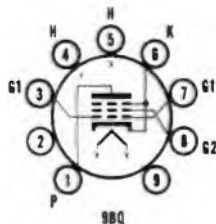
12BK5



**Audio power amplifier suitable for small driving voltages,
heater warm-up controlled for series strings**

HEATER CHARACTERISTICS

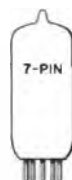
Voltage, a-c or d-c	12.6 volts
Current	600 ma
Peak heater-cathode voltage, max.	
Heater negative to cathode	200 volts
Heater positive to cathode*	200 volts
Warm-up time	11 secs. average
(See Series-String Heaters section of APPENDIX in CBS Tube Manual).	
*D-c component 100 volts max.	



Type 12BK5 is identical to types 6BK5, 25BK5, and 50BK5 except for heater ratings. See type 6BK5 for ratings and characteristics.



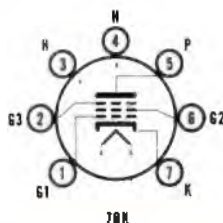
12BL6



**i-f or r-f amplifier for 12-volt A and B supply
automobile radios**

HEATER CHARACTERISTICS*

Voltage, a-c or d-c.....	12.6 volts
Current.....	150 ma
Peak heater-cathode voltage, max. Heater negative to cathode.....	30 volts
Heater positive to cathode.....	30 volts



ELECTRICAL DATA

DIRECT INTERELECTRODE CAPACITANCES—Shield †

Grid to plate: g1 to p, max.....	.006 μf
Input: g1 to k + h + g2 + g3.....	5.5 μf
Output: p to k + h + g2 + g3.....	4.8 μf

†JETEC shield 316 connected to cathode.

MAXIMUM RATINGS (Design center values)

Plate voltage.....	30 volts
Grid 2 voltage.....	30 volts
Cathode current.....	20 ma
Grid 1 circuit resistance.....	10 meg

CHARACTERISTICS AND TYPICAL OPERATION

Class A Amplifier

Plate voltage.....	12.6 volts
Grid 3 (suppressor).....	connected to cathode at socket
Grid 2 (screen) voltage.....	12.6 volts
Grid 1 (control-grid) voltage.....	-0.65 volts
Plate resistance (approx.).....	0.5 meg
Transconductance Δ	1350 μmhos
Plate current.....	1350 μa
Grid 2 current.....	500 μa
Grid 1 & 3 voltage (approx.) for $g_m\Delta = 10 \mu\text{mhos}$	-5.0 volts
Grid 1 voltage (approx.) for $g_m\Delta = 10 \mu\text{mhos}$	-6.0 volts

NOTES:

*Type 12BL6 is intended for use in automobile receivers operated from a nominal 12-volt battery. Design of the tube is such that the heater will operate satisfactorily over the range from 10 volts to 15.9 volts, and that the maximum ratings provide a safety factor for the wide voltage variation encountered in this type of supply.

†Average contact potential developed across a 2.2 megohm grid resistor.

Δ From grid 1 to plate.

ENGINEERING DESIGN DATA

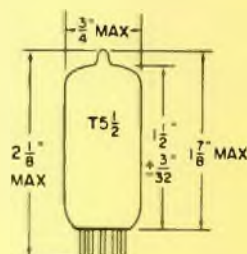
12BL6

JUNE 1, 1957

**12-volt sharp-cutoff
pentode**

MECHANICAL DATA

Cathode, coated unipotential	
Bulb.....	T-5½
Outline.....	JETEC 5-2
Base.....	Miniature 7-pin (E7-1)
Basing.....	7BK
Mounting position.....	Any



PIN CONNECTIONS

Pin 1.....	Grid 1
Pin 2.....	Grid 3, I. S.
Pin 3.....	Heater
Pin 4.....	Heater
Pin 5.....	Plate
Pin 6.....	Grid 2
Pin 7.....	Cathode

APPLICATION

Type 12BL6 is a miniature sharp-cutoff pentode used as an i-f or r-f amplifier in 12-volt A and B supply automobile radios. It is suitable for hybrid type radios in which the power output stage employs a transistor.

ENGINEERING DESIGN DATA

12BQ6GT

12BQ6GA • 12BQ6GTA
12BQ6GTB

JANUARY 2, 1957

Beam power pentode

CHARACTERISTIC CURVES

(In curve section following APPENDIX)

Plate ($E_{c2} = 100V$)..... 105A

Plate ($E_{c2} = 150V$)..... 105B

APPLICATION

These types are beam power pentodes used as horizontal deflection amplifiers in television receivers with 600-ma series string heaters. Types 12BQ6GA, 12BQ6GTA, and 12BQ6GTB have warm-up time control characteristic to minimize heater string voltage surges during initial turn on.



12BQ6GT

12BQ6GA • 12BQ6GTA
12BQ6GTB



**Horizontal deflection amplifier for television receivers,
600-ma series string types**

HEATER CHARACTERISTICS

Voltage, a-c or d-c..... 12.6 volts

Current..... 600 ma

Peak heater-cathode voltage, max.

Heater negative to

cathode..... 200 volts

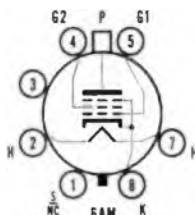
Heater positive to

cathode*..... 200 volts

Warm-up time..... 11 secs. average†

(See Series-String Heaters section of
APPENDIX in CBS Tube Manual).

*D-c component must not exceed 100
volts max.



Types 12BQ6GA, 12BQ6GT, 12BQ6GTA and 12BQ6GTB are identical to their 6-volt prototypes, respectively, except for heater characteristics.

†Refers to all types except 12BQ6GT.



12BR7

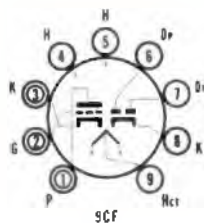


Combined horizontal phase detector and sync separator

HEATER CHARACTERISTICS

Voltage, a-c or d-c.	Series	Parallel
Current	12.6	6.3 volts
Peak heater-cathode voltage, max.	225	450 ma
Heater negative to cathode	200	200 volts
Heater positive to cathode*	200	200 volts

*D-c component must not exceed 100 volts max.



ELECTRICAL DATA

DIRECT INTERELECTRODE CAPACITANCES—Shield† Triode Unit

Grid to plate: g1 to p	1.9	μf
Input: g1 to k + h	2.8	μf
Output: p to k + h	1.0	μf

Diode Unit

Input (each diode)	2.0	μf
--------------------	-----	----

†JETEC shield 315 connected to cathode.

MAXIMUM RATINGS (Design center values)

Plate voltage	300 volts
Control-grid voltage, negative d-c	-50 volts
Plate dissipation	2.5 watts
Diode peak inverse voltage	300 volts
Diode peak current	60 ma

CHARACTERISTICS AND TYPICAL OPERATION

Class A Amplifier

Plate voltage	100	250 volts
Cathode-bias resistor	270	200 ohms
Plate resistance (approx.)	15,000	10,900 ohms
Transconductance	4000	5500 μmhos
Amplification factor	60	60
Plate current	3.7	10 ma
Control-grid voltage (approx.) for $I_b = 10 \mu A$	-5	-12 volts
Average diode current with 5 volts d-c applied to each section		17 ma

ENGINEERING DESIGN DATA

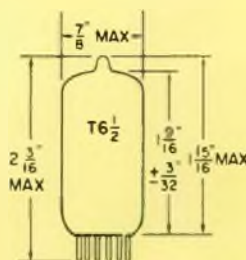
12BR7

JANUARY 2, 1957

Duodiode—high- μ
triode

MECHANICAL DATA

Cathode, coated unipotential	
Bulb	T-6½
Outline	JETEC 6-2
Base	Miniature 9-pin (E9-1)
Basing	9CF
Mounting position	Any



PIN CONNECTIONS

Pin 1	Triode Plate
Pin 2	Grid 1
Pin 3	Triode Cathode
Pin 4	Heater
Pin 5	Heater
Pin 6	Diode 1 Plate
Pin 7	Diode 2 Plate
Pin 8	Cathode (D1 & D2), Shield
Pin 9	Heater Center Tap

NOTE

Triode section is electrically similar to one section of a 12AT7.

ENGINEERING DESIGN DATA

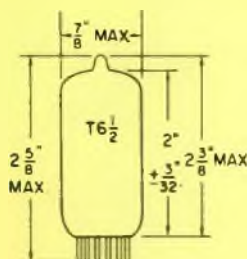
12BV7

JANUARY 2, 1957

Sharp-cutoff pentode

MECHANICAL DATA

Cathode, coated unipotential
Bulb..... T-6½
Outline..... JETEC 6-3
Base..... Miniature 9-pin (E9-1)
Basing..... 9BF
Mounting position..... Any



PIN CONNECTIONS

Pin 1..... Cathode
Pin 2..... Grid 1
Pin 3..... Grid 3, I. S.
Pin 4..... Heater
Pin 5..... Heater
Pin 6..... Heater Center Tap
Pin 7..... Plate
Pin 8..... Grid 2
Pin 9..... Grid 3, I. S.

APPLICATION

The 12BV7 is similar in characteristics and application to type 12BY7. However, it has higher transconductance and lower plate resistance to provide more output with low supply voltages.



12BV7

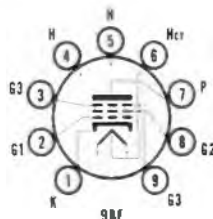


High-output video amplifier for television receivers
with low plate-supply voltage

HEATER CHARACTERISTICS

Voltage,	Series	Parallel
a-c or d-c.....	12.6	6.3 volts
Current.....	300	600 ma
Peak heater-cathode voltage, max.		
Heater negative to cathode.....	200	200 volts
Heater positive to cathode*.....	200	200 volts

*D-c component 100 volts max.



ELECTRICAL DATA

DIRECT INTERELECTRODE CAPACITANCES

Grid to plate: g1 to p, max.....	0.055	μf
Input: g1 to k + h + g2 + g3.....	11.0	μf
Output: p to k + h + g2 + g3.....	3.0	μf

MAXIMUM RATINGS (Design center values)

Plate voltage.....	300	volts
Grid 2 voltage.....	175	volts
Grid 1 voltage, negative d-c.....	50	volts
Plate dissipation.....	6.25	watts
Grid 2 dissipation.....	1.0	watt
Grid 1 circuit resistance		
Fixed bias.....	0.25	meg
Self bias.....	1.0	meg

CHARACTERISTICS AND TYPICAL OPERATION

Class A Amplifier

Plate voltage.....	250	volts
Grid 3 (suppressor).....	connected to cathode at socket	
Grid 2 (screen) voltage.....	150	volts
Cathode bias resistor.....	68	ohms
Plate resistance (approx.).....	85,000	ohms
Transconductance.....	13,000	μmhos
Plate current.....	27	ma
Grid 2 current.....	6.0	ma
Grid 1 voltage (approx.) for $I_b = 20 \mu a$	-12	volts



12BY7

12BY7A



**High transconductance video output amplifier
for television receivers**

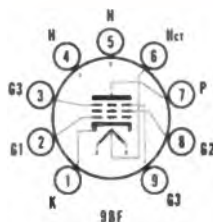
HEATER CHARACTERISTICS

Voltage,	Series	Parallel
a-c or d-c.....	12.6	6.3 volts
Current.....	300	600 ma
Peak heater-cathode voltage, max.		
Heater negative to cathode.....		200 volts
Heater positive to cathode*.....		200 volts

12BY7A

Warm-up time..... 11 secs. average
(See Series-String Heaters section of
APPENDIX in CBS Tube Manual.)

*D-c component must not exceed 100
volts max.



ELECTRICAL DATA

DIRECT INTERELECTRODE CAPACITANCES

	12BY7
Grid to plate: g1 to p, max.....	.063
Input: g1 to k + h + g2 + g3 + i.s.....	10.7
Output: p to k + h + g2 + g3 + i.s.....	4.0

	12BY7A
	.063 μ f
	10.2 μ f
	3.5 μ f

MAXIMUM RATINGS

(Design center values)

	12BY7
Plate voltage.....	300
Grid 2 voltage.....	180
Grid 1 voltage, negative d-c.....	-50
Grid 1 voltage, positive d-c.....	0
Plate dissipation.....	6.0
Grid 2 dissipation.....	1.1
Grid 1 circuit resistance	
Fixed bias.....	0.25
Self bias.....	1.0

12BY7A

	300 volts
	180 volts
	-50 volts
	0 volts
	6.5 watts
	1.1 watts
	0.25 meg
	1.0 meg

CHARACTERISTICS AND TYPICAL OPERATION

Class A Amplifier

	12BY7
Plate voltage.....	250
Grid 3 (suppressor).....	connected to cathode at socket
Grid 2 (screen) voltage.....	180
Cathode bias resistor.....	100
Plate resistance (approx.).....	90,000
Transconductance.....	12,000
Plate current.....	24
Grid 2 current.....	5.0
Grid 1 voltage (approx.) for $i_b = 20 \mu$ a.....	-8
Amplification factor (g1 to g2).....	31.5

12BY7A

	250 volts
	180 volts
	100 ohms
	93,000 ohms
	11,000 μ mhos
	26 ma
	5.75 ma
	-11.6 volts
	28.5

ENGINEERING DESIGN DATA

12BY7

12BY7A

FEBRUARY 25, 1957

**High transcon-
ductance pentode**

CHARACTERISTIC CURVES

(In curve section following APPENDIX)

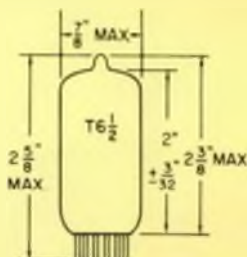
Plate ($E_{c2} = 180V$)..... 103A

Plate ($E_{c2} = 75V$)..... 103B

Transfer ($E_{c2} = 180V$)..... 103C

MECHANICAL DATA

Cathode, coated unipotential	
Bulb.....	T-6 1/2
Outline.....	JETEC 5-3
Base.....	Miniature 9-pin (E9-1)
Basing.....	9BF
Mounting position.....	Any



PIN CONNECTIONS

Pin 1.....	Cathode
Pin 2.....	Grid 1
Pin 3.....	Grid 3, I. S.
Pin 4.....	Heater
Pin 5.....	Heater
Pin 6.....	Heater Center Tap
Pin 7.....	Plate
Pin 8.....	Grid 2
Pin 9.....	Grid 3, I. S.

APPLICATION

Types 12BY7 and 12BY7A are high transconductance pentodes that were designed for operation as video amplifiers in television receivers. They are also useful as wide band amplifiers, pulse amplifiers, and in other applications that require high power sensitivity and high transconductance.

ENGINEERING DESIGN DATA

12BZ7

JANUARY 2, 1957

Hi-mu duotriode

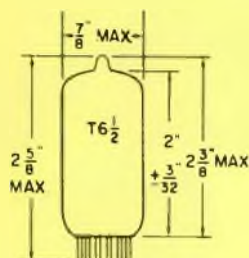
CHARACTERISTIC CURVES

(In curve section following APPENDIX)

Plate.....102A

MECHANICAL DATA

Cathode, coated unipotential
Bulb.....T-6½
Outline.....JETEC 6-3
Base.....Miniature 9-pin (E9-1)
Basing.....9A
Mounting position.....Any



PIN CONNECTIONS

Pin 1.....Plate (Sect. 2)
Pin 2.....Grid 1 (Sect. 2)
Pin 3.....Cathode (Sect. 2)
Pin 4.....Heater
Pin 5.....Heater
Pin 6.....Plate (Sect. 1)
Pin 7.....Grid 1 (Sect. 1)
Pin 8.....Cathode (Sect. 1)
Pin 9.....Heater Center Tap

APPLICATION

Type 12BZ7 is a high-mu duotriode designed for application as a sync separator and sync clipper for television receivers in which the primary "B" voltage is limited.

12C5

JANUARY 10, 1957

Beam power pentode

CHARACTERISTIC CURVES

(In curve section following APPENDIX)

Plate ($E_{c2} = 110V$).....191A

Operation ($E_b = E_{c2} = 110V$).....191B

MECHANICAL DATA

Cathode, coated unipotential
Bulb.....T-5½
Outline.....JETEC 5-3
Base.....Miniature 7-pin (E7-1)
Basing.....7CV
Mounting position.....Any



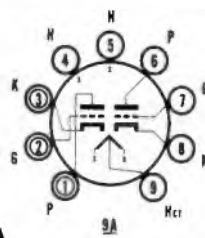
12BZ7



Sync separator and clipper for television receivers

HEATER CHARACTERISTICS

Voltage, a-c or d-c	Series	Parallel
12.6	6.3 volts	
Current	300	600 ma
Peak heater-cathode voltage, max.	180	180 volts



ELECTRICAL DATA

DIRECT INTERELECTRODE CAPACITANCES

	Section 1	Section 2
Grid to plate: g1 to p.....	2.5	2.5
Input: g1 to k + h.....	6.5	6.5
Output: p to k + h.....	0.7	0.55
Plate (Sect. 1) to plate (Sect. 2).....	1.3	

MAXIMUM RATINGS (Design center values)

Plate voltage.....	300 volts
Control-grid voltage, negative d-c.....	50 volts
Control-grid voltage, positive d-c.....	0 volts
Plate dissipation.....	1.5 watts
Control-grid circuit resistance (for contact potential bias).....	5.0 meg

CHARACTERISTICS AND TYPICAL OPERATION

Class A Amplifier

Plate voltage.....	250 volts
Control-grid voltage.....	-2.0 volts
Plate resistance (approx.).....	31,800 ohms
Transconductance.....	3200 μ hos
Amplification factor.....	100
Plate current.....	2.5 ma



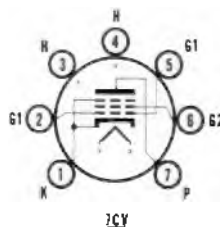
12C5



Audio power output tube, heater warm-up controlled for series strings

HEATER CHARACTERISTICS

Voltage, a-c or d-c.....	12.6 volts
Current.....	600 ma
Peak heater-cathode voltage, max.	
Heater negative to cathode.....	300 volts
Heater positive to cathode.....	200 volts
Warm-up time.....	11 secs. average
(See Series-String Heaters section of APPENDIX in CBS Tube Manual).	
†D-c component must not exceed	200 volts max.
*D-c component must not exceed	100 volts max.



CBS ELECTRON TUBES

12C5 (cont.)

ELECTRICAL DATA

DIRECT INTERELECTRODE CAPACITANCES

Grid to plate: g1 to p.....	0.55	μf
Input: g1 to k + h + g2 + b.p.....	13	μf
Output: p to k + h + g2 + b.p.....	9.0	μf

MAXIMUM RATINGS (Design center values)

Plate voltage.....	135	volts
Grid 2 voltage.....	117	volts
Plate dissipation.....	5.5	watts
Grid 2 dissipation.....	1.25	watts
Grid 1 circuit resistance.....		
Fixed bias.....	0.1	meg
Self bias.....	0.5	meg
Bulb temperature at hottest point.....	250	$^{\circ}\text{C}$

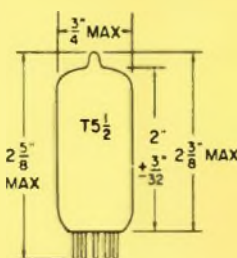
CHARACTERISTICS AND TYPICAL OPERATION

Class A Amplifier

Plate voltage.....	110	volts
Grid 2 (screen) voltage.....	110	volts
Grid 1 (control-grid) voltage.....	-7.5	volts
Plate resistance (approx.).....	10,000	ohms
Transconductance.....	7500	μmhos
Grid 1 input voltage, peak a-f.....	7.5	volts
Plate current, zero signal.....	49	ma
Plate current, maximum signal.....	50	ma
Grid 2 current, zero signal.....	4.0	ma
Grid 2 current, maximum signal.....	8.5	ma
Load resistance impedance.....	2500	ohms
Total harmonic distortion (approx.).....	9	%
Power output, maximum signal.....	1.9	watts

ENGINEERING DESIGN DATA

12C5 (cont.)



PIN CONNECTIONS

Pin 1.....	Cathode, B. P.
Pin 2.....	Grid 1
Pin 3.....	Heater
Pin 4.....	Heater
Pin 5.....	Grid 1
Pin 6.....	Grid 2
Pin 7.....	Plate

APPLICATION

Type 12C5 is a beam power pentode designed for operation as an audio power output tube. Its heater is warm-up time controlled for series-string operation. Except for its heater characteristics, it is identical to types 25C5 and 50C5.

12C8

(See chart for seldom-used tubes)



12CA5

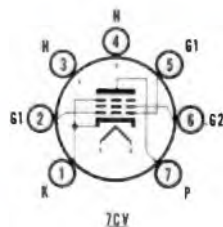


A-f power amplifier with high output from a low B supply voltage, heater warm-up controlled for series strings

HEATER CHARACTERISTICS

Voltage, a-c or d-c.....	12.6	volts
Current.....	600	ma
Peak heater-cathode voltage, max.		
Heater negative to cathode.....	300	volts
Heater positive to cathode.....	200	volts
Warm-up time.....	11	secs. average
(See Series-String Heaters section of APPENDIX in CBS Tube Manual).		
*D-c component must not exceed 200 volts max.		
†D-c component must not exceed 100 volts max.		

Type 12CA5 is identical to type 6CA5 except for heater characteristics and a maximum grid 1 circuit resistance (fixed bias) rating of 0.1 megohm.



12CA5

NOVEMBER 1, 1956

Beam power pentode

CHARACTERISTIC CURVES

(In curve section following APPENDIX)	
Plate ($E_{c2} = 125\text{V}$).....	178A
Plate; ΔE_{c2} ($E_{c1} = 0\text{V}$).....	178B
Transfer; I_b , I_{c2} ($E_{c1} = 0\text{V}$).....	178C
Operation; ($E_b = E_{c2} = 125\text{V}$, $E_{c1} = -4.5\text{V}$).....	178D
Operation; ($E_b = E_{c2} = 110\text{V}$, $E_{c1} = -4.0\text{V}$).....	178E

APPLICATION

Type 12CA5 is a beam pentode designed to function as an a-f power amplifier with high output from a low B supply. It is identical to types 6CA5 and 25CA5 except for its heater characteristics and grid 1 circuit resistance.

ENGINEERING DESIGN DATA

12CM6

JANUARY 2, 1957

Beam power pentode

CHARACTERISTIC CURVES

(In curve section following APPENDIX)

Plate ($E_c = 250V$)	138A
Plate ($E_c = 250V$)	138B
Plate (Iridium connected)	138C
Plate; ΔE_c ($E_c = 0V$)	138D
Transfer ($E_b = 250V$)	138E
Operation	138F

APPLICATION

Type 12CM6 is a beam power pentode designed for use as an audio power amplifier in 12-volt automobile radio receivers.



12CM6

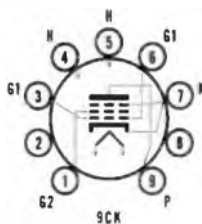


Audio power amplifier for 12-volt
automobile radio receivers

HEATER CHARACTERISTICS

Voltage, a-c or d-c	12.6 volts
Current	225 ma
Peak heater-cathode voltage, max.	
Heater negative to cathode	200 volts
Heater positive to cathode*	200 volts

*D-c component must not exceed 100 volts max.



Type 12CM6 is identical to type 6CM6 except for heater characteristics.

12CN5

JUNE 1, 1957

12-volt sharp-cutoff pentode

CHARACTERISTIC CURVES

(In curve section following APPENDIX)

Plate	208A
Transfer; E_c vs. gm	208B

MECHANICAL DATA

Cathode, coated unipotential	
Bulb	T-5 1/2
Outline	JETEC 5-3
Base	Miniature 7-pin (E7-1)
Basing	7CV
Mounting position	Any



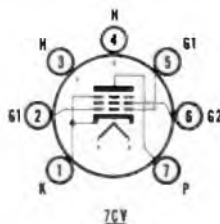
12CN5



Pentode voltage amplifier for rf-if service in
12-volt A and B supply automobile radios

HEATER CHARACTERISTICS*

Voltage, a-c or d-c	12.6 volts
Current	450 ma
Peak heater-cathode voltage, max.	
Heater negative to cathode	16 volts
Heater positive to cathode	16 volts



ELECTRICAL DATA

DIRECT INTERELECTRODE CAPACITANCES

	No Shield	Shield†	μf
Grid to plate: g1 to p, max.	0.25	0.20	

†JETEC shield 316 connected to cathode.

MAXIMUM RATINGS (Design center values)

Plate voltage	16 volts
Grid 2 voltage	16 volts
Grid 1 voltage, positive d-c	0 volts
Grid 1 circuit resistance	2.2 meg

CHARACTERISTICS AND TYPICAL OPERATION

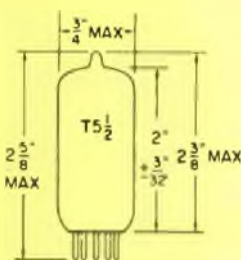
Class A Amplifier

Plate voltage	12.6 volts
Grid 3 (suppressor)	connect to cathode at socket
Grid 2 (screen) voltage	12.6 volts
Grid 1 (control-grid) voltage	0 volts
Grid 1 resistor (bypassed)	2.2 meg
Plate resistance (approx.)	40,000 ohms
Transconductance	3800 μmhos
Plate current	4.5 ma
Grid 2 current	3.5 ma

NOTE:

*This tube is intended for use in automobile radios operated from a nominal 12-volt battery. Design of the tube is such that the heater will operate satisfactorily over the range from 10 volts to 15.9 volts, and that the maximum ratings provide a safety factor for the wide voltage variation encountered in this type of supply.

CBS ELECTRON TUBES

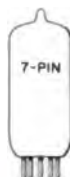


PIN CONNECTIONS

Pin 1	Cathode, Grid 3
Pin 2	Grid 1
Pin 3	Heater
Pin 4	Heater
Pin 5	Grid 1
Pin 6	Grid 2
Pin 7	Plate

APPLICATION

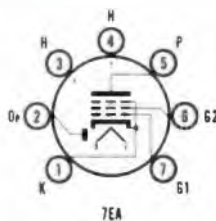
Type 12CN5 is a miniature pentode used as an i-f amplifier in 12-volt A and B supply automobile radios. This tube is suitable for hybrid radios where the output stage employs a transistor.

CBS**12CR6**

**Combined detector and automatic
volume controlled audio amplifier**

HEATER CHARACTERISTICS

Voltage, a-c or d-c.....	12.6 volts
Current.....	150 ma
Peak heater-cathode voltage, max.....	100 volts



7EA

Type 12CR6 is identical to type 6CR6 except for heater ratings.

12CS5 • 12CS6

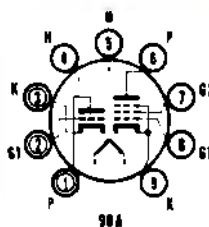
(See chart for seldom-used tubes)

CBS**12CT8**

**Combined video amplifier and sync separator,
amplifier, or clipper, heater warm-up controlled
for series strings**

HEATER CHARACTERISTICS

Voltage, a-c or d-c.....	12.6 volts
Current.....	600 ma
Peak heater-cathode voltage, max.	
Heater negative to cathode.....	200 volts
Heater positive to cathode*.....	200 volts
Warm-up time.....	11 secs. average (See Series-String Heaters section of APPENDIX in CBS Tube Manual).
*D-c component must not exceed 100 volts max.	



9BA

ELECTRICAL DATA**DIRECT INTERELECTRODE CAPACITANCES****Triode Section**

Grid to plate: g1 to p.....	2.2	μf
Input: g1 to k + h.....	2.4	μf
Output: p to k + h.....	0.19	μf

Pentode Section

Grid to plate: g1 to p.....	0.044	μf
Input: g1 to k + h + g2 + g3.....	7.5	μf
Output: p to k + h + g2 + g3.....	2.4	μf
Coupling: pentode grid 1 to triode plate, max.....	0.010	μf
Coupling: pentode plate to triode grid, max.....	0.016	μf
Coupling: pentode plate to triode plate, max.....	0.16	μf

CBS ELECTRON TUBES**ENGINEERING
DESIGN DATA****12CR6**

JANUARY 2, 1957

**Diode—remote-
cutoff pentode**

CHARACTERISTIC CURVES

(In curve section following APPENDIX)

Plate ($E_c = 100V$).....184A

Transfer ($E_b = 150V$, $E_c = 100V$).....184B

APPLICATION

Type 12CR6 is a single diode—remote-
cutoff pentode designed for use as a com-
bined detector and automatic volume
controlled audio amplifier in automobile
radio receivers.

12CT8

JUNE 1, 1957

**12-volt sharp-cutoff
pentode**

CHARACTERISTIC CURVES

(In curve section following APPENDIX)

Screen Grid Rating.....100A

Plate, pentode ($E_c = 125V$).....142A

Plate, pentode ($E_c = 125V$).....142B

Plate, pentode (ΔE_c).....142C

Transfer, pentode ($E_b = 200V$).....142D

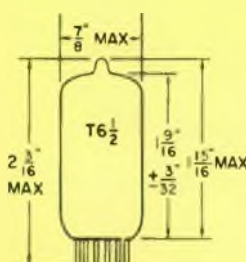
Plate, triode.....142E

MECHANICAL DATA

Cathode, coated unipotential	
Bulb.....	T-6½
Outline.....	JETEC 6-2
Base.....	Miniature 9-pin (E9-1)
Basing.....	9DA
Mounting position.....	Any

ENGINEERING DESIGN DATA

12CT8 (cont.)



PIN CONNECTIONS

Pin 1.....	Triode Plate
Pin 2.....	Triode Grid
Pin 3.....	Triode Cathode
Pin 4.....	Heater
Pin 5.....	Heater
Pin 6.....	Pentode Plate
Pin 7.....	Pentode Grid 2
Pin 8.....	Pentode Grid 1
Pin 9.....	Pentode Cathode, Grid 3, I. S.

APPLICATION

Type 12CT8 is a miniature pentode video amplifier and triode sync amplifier or clipper combined in one envelope. It is suitable for operation with low d-c supply voltage. The 12CT8 characteristics are identical to those of the 6AU6, except for heater.

12CU6

JANUARY 2, 1957

Beam power pentode

CHARACTERISTIC CURVES

(In curve section following APPENDIX)
Plate ($E_{c2} = 100V$)..... 105A
Plate ($E_{c2} = 150V$)..... 105B

APPLICATION

Type 12CU6 is a beam power pentode designed for use as a horizontal deflection amplifier in television receivers.

12CT8 (cont.)

MAXIMUM RATINGS (Design Maximum values)

	Triode	Pentode
Plate voltage.....	300	300 volts
Grid 2 voltage.....	See Rating Chart in APPENDIX	
Grid 2 supply voltage.....		300 volts
Grid 1 voltage, positive d-c.....	0	0 volts
Plate dissipation.....	2.5	2.75 watts
Grid 2 dissipation.....		0.9 watts
Grid 1 circuit resistance		
Fixed bias.....	0.5	0.25 meg
Self bias.....	1.0	1.0 meg

CHARACTERISTICS AND TYPICAL OPERATION

Class A Amplifier	Triode	Pentode
Plate voltage.....	150	200 volts
Grid 2 (screen) voltage.....		125 volts
Cathode-bias resistor.....	150	82 ohms
Plate resistance (approx.).....		150kilohms
Transconductance.....	4900	7000 μ mhos
Amplification factor.....	40	
Plate current.....	9.0	15 ma
Grid 2 current.....		3.4 ma
Grid 1 voltage (approx.) for $I_b = 100 \mu$ a.....	-6.5	-8.0 volts



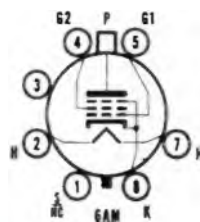
12CU6



Horizontal deflection amplifier in television receivers,
heater warm-up time controlled for series strings

HEATER CHARACTERISTICS

Voltage, a-c or d-c.....	12.6 volts
Current.....	600 ma
Peak heater-cathode voltage, max.	
Heater negative to cathode.....	200 volts
Heater positive to cathode*.....	200 volts
Warm-up time.....	11 secs. average
(See Series-String Heaters section of APPENDIX in CBS Tube Manual).	
*D-c component must not exceed 100 volts max.	



Type 12CU6 is identical to type 6CU6 except for heater characteristics.



12CU5

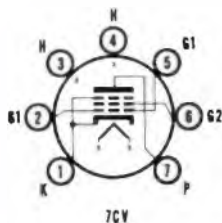


Audio output for television receivers with low plate supply voltage

HEATER CHARACTERISTICS

Voltage, a-c or d-c.....	12.6 volts
Current.....	600 ma
Peak heater-cathode voltage, max.	
Heater negative to cathode	200 volts
Heater positive to cathode	200 volts
*D-c component must not exceed 100 volts max.	
Warm-up time.....	11 secs. average
(See Series-String Heaters section of APPENDIX in CBS Tube Manual.)	

Type 12CU5 is identical to type 6CU5 except for heater characteristics.



ENGINEERING DESIGN DATA

12CU5

NOVEMBER 1, 1957

Beam Power Pentode

CHARACTERISTIC CURVES

(In curve section following APPENDIX)

Plate (E_{b2} = 110V)..... 191A

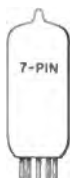
Characteristics..... 191B

APPLICATION

Type 12CU5 is a beam power tube designed for use in the audio output stage of television receivers. Provided with high power sensitivity and high efficiency at low plate and screen voltage, it is capable of supplying relatively high power output. It is very similar to type 12C5.



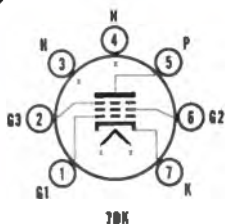
12CX6



**R-f amplifier for 12-volt A and B supply
automobile radios**

HEATER CHARACTERISTICS*

Voltage, a-c or d-c.....	12.6 volts
Current.....	150 ma
Peak heater-cathode voltage, max.	
Heater negative to cathode.....	30 volts
Heater positive to cathode.....	30 volts



ELECTRICAL DATA

DIRECT INTERELECTRODE CAPACITANCES

Grid to plate: g1 to p, max.....	0.05 μ f
Input: g1 to k + h + g2 + g3.....	7.6 μ f
Output: p to k + h + g2 + g3.....	6.2 μ f

MAXIMUM RATINGS (Design maximum values)

Plate voltage.....	33 volts
Grid 2 voltage.....	33 volts
Grid voltage, positive d-c.....	0 volts
Grid 1 circuit resistance.....	10 meg

CHARACTERISTICS AND TYPICAL OPERATION

Class A Amplifier	
Plate voltage.....	12.6 volts
Grid 2 (screen) voltage.....	12.6 volts
Grid 1 (control-grid) voltage†.....	
Grid 1 resistor.....	2.2 meg
Plate resistance (approx.).....	40,000 ohms
Transconductance△.....	3100 μ hos
Plate current.....	3.0 ma
Grid 2 current.....	1.4 ma
Grid 1 voltage (approx.) for $I_b = 10 \mu$ a.....	-4.5 volts

NOTES:

*Type 12CX6 is intended for use in automobile radios operated from a nominal 12-volt battery. Design of the tube is such that the heater will operate satisfactorily over the range from 10 to 15.9 volts, and that the maximum ratings provide a safety factor for the wide voltage variations encountered in this type of supply.

†Contact potential developed across specified grid resistor.

△Signal applied in series with 1.0 μ f grid leak capacitor.

ENGINEERING DESIGN DATA

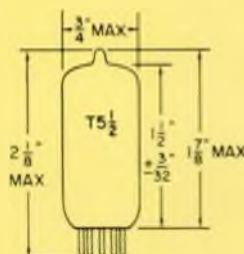
12CX6

JUNE 1, 1957

**Sharp-cutoff
12-volt pentode**

MECHANICAL DATA

Cathode, coated unipotential	
Bulb.....	T-5½
Outline.....	JETEC 5-2
Base.....	Miniature 7-pin (E7-1)
Basing.....	.7BK
Mounting position.....	Any



PIN CONNECTIONS

Pin 1.....	Grid 1
Pin 2.....	Grid 3
Pin 3.....	Heater
Pin 4.....	Heater
Pin 5.....	Plate
Pin 6.....	Grid 2
Pin 7.....	Cathode

APPLICATION

Type 12CX6 is a miniature sharp-cutoff pentode used as an r-f amplifier in 12-volt A and B supply automobile radios. It is suitable for hybrid radios in which a transistor is employed in the power output stage.

ENGINEERING DESIGN DATA

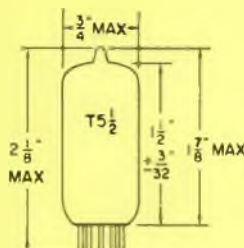
12CY6

JUNE 1, 1957

12-volt sharp-cutoff pentode

MECHANICAL DATA

Cathode, coated unipotential
Bulb.....T-5½
Outline.....JETEC S-2
Base.....Miniature 7-pin (E7-1)
Basing.....7BK
Mounting position.....Any



PIN CONNECTIONS

Pin 1.....Grid 1
Pin 2.....Grid 2
Pin 3.....Heater
Pin 4.....Heater
Pin 5.....Plate
Pin 6.....Grid 2
Pin 7.....Cathode

APPLICATION

Type 12CY6 is a miniature sharp-cutoff pentode used as an r-f amplifier in 12-volt A and B supply automobile radios. This tube is suitable for use in hybrid radios in which a transistor is used in the power output stage.



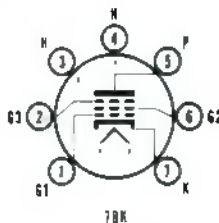
12CY6



**R-f amplifier for 12-volt A and B supply
automobile radios**

HEATER CHARACTERISTICS*

Voltage, a-c or d-c.....12.6 volts
Current.....200 ma
Peak heater-cathode voltage, max.
Heater negative to cathode.....30 volts
Heater positive to cathode.....30 volts



ELECTRICAL DATA

DIRECT INTERELECTRODE CAPACITANCES

Grid to plate: g1 to p, max.....0.18 μ f
Input: g1 to k + h + g2 + g3.....8.5 μ f
Output: p to k + h + g2 + g3.....4.0 μ f

MAXIMUM RATINGS (Design maximum values)

Plate voltage.....33 volts
Grid 2 voltage.....33 volts
Grid 1 circuit resistance.....10 meg

CHARACTERISTICS AND TYPICAL OPERATION

Class A Amplifier

Plate voltage.....12.6 volts
Grid 2 (screen) voltage.....12.6 volts
Grid 1 (control-grid) voltage.....0 volts
Grid 1 resistor.....2.2 meg
Plate resistance (approx.).....14 meg
Transconductance.....3250 μ mhos
Plate current.....1.6 ma
Grid 2 current.....0.4 ma
Grid 1 voltage (approx.) for $i_b = 10 \mu$ a.....-3.0 volts

NOTE:

*Type 12CY6 is intended for use in automobile radios operated from a nominal 12-volt battery. Design of the tube is such that the heater will operate satisfactorily over the range from 10 volts to 15.9 volts, and that the maximum ratings provide a safety factor for the wide voltage variation encountered in this type of supply.



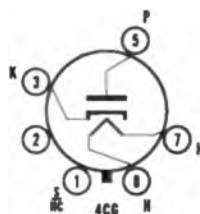
12D4



**TV damper diode for horizontal deflection circuits,
heater warm-up time controlled for series-string circuits**

HEATER CHARACTERISTICS

Voltage.....	12.6 volts
Current.....	0.6 amps
Peak heater-cathode voltage, max. Heater negative to cathode.....	4400 volts
Heater positive to cathode*.....	300 volts
Warm-up time.....	11 secs. average (See Series-String Heaters section of APPENDIX in CBS Tube Manual).
†D-c component must not exceed	900 volts max.
*D-c component must not exceed	100 volts max.



ELECTRICAL DATA

DIRECT INTERELECTRODE CAPACITANCES

Heater to cathode: h to k.....	3.0	μm†
Cathode to plate-and-heater: k to p + hA.....	8.0	μm†
Plate to cathode-and-heater: p to k + hA.....	6.0	μm†

MAXIMUM RATINGS (Design maximum values unless noted) TV Damper Service*

Plate voltage, peak inverse.....	4400	volts
Plate current, d-c.....	155	ma
Plate current, d-c (design center).....	145	ma
Plate current, peak.....	900	ma
Plate dissipation.....	5.5	watts

AVERAGE CHARACTERISTICS

Tube voltage drop at 250 ma.....	22	volts
----------------------------------	----	-------

NOTES:

*Voltage pulse duration must not exceed 10 μs in a 525-line, 30-frame system.

†Absolute maximum value.

A Tie unused pins and metal parts to heater.

ENGINEERING DESIGN DATA

12D4

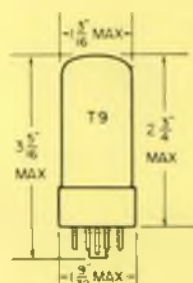
JUNE 1, 1957

Single diode

MECHANICAL DATA

Cathode, coated unipotential	T-9
Bulb.....	JETEC 9-11 or 9-41
Outline.....	B5-82, B5-8, B5-85, B5-60
Basing.....	4CG
Mounting position.....	Any

■ Pin 1 omitted.



PIN CONNECTIONS

Pin 1.....	I, C ‡
Pin 2.....	I, C ‡
Pin 3.....	Cathode
Pin 5.....	Plate
Pin 7.....	Heater
Pin 8.....	Heater

‡ Do not use

APPLICATION

Type 12D4 is a damper diode for horizontal deflection circuits whose heater is warm-up time controlled for use in 600 ma series-strings.

ENGINEERING DESIGN DATA

12DB5

JUNE 1, 1957

Beam power pentode

CHARACTERISTIC CURVES

(In curve section following APPENDIX)

Plate (E_{c2} = 125V) 209A

Plate, triode connected 209B

APPLICATION

Type 12DB5 is a 9-pin miniature beam power pentode designed for use as a vertical deflection amplifier at 125 volts B+ supply.

12DF5

JUNE 1, 1957

Double diode

CHARACTERISTIC CURVES

(In curve section following APPENDIX)

Rating Chart I (D-C Output Current) 140A

Rating Chart II (Rectification Efficiency) 140B

Rating Chart III (Min. Effective Plate Supply Resistance) 140C

MECHANICAL DATA

Cathode, coated unipotential

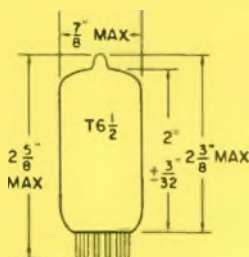
Bulb T-6 1/2

Outline JETEC 6-3

Base Miniature 9-pin (E9-1)

Basing 98S

Mounting position Any



PIN CONNECTIONS

Pin 1	Diode 2 Plate
Pin 2	N. C.
Pin 3	Diode 2 Cathode
Pin 4	Heater
Pin 5	Heater
Pin 6	Diode 1 Plate
Pin 7	N. C.
Pin 8	Diode 1 Cathode
Pin 9	Heater Center Tap

APPLICATION

Type 12DF5 is a miniature, cathode type full-wave rectifier featuring a center tapped cathode, and relatively high output current capabilities.



12DB5



Vertical deflection amplifier for TV receivers

HEATER CHARACTERISTICS

Voltage, a-c or d-c 12.6 volts

Current 600 ma

Peak heater-cathode voltage, max.

Heater negative to cathode 200 volts

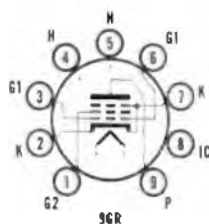
Heater positive to cathode* 200 volts

Warm-up time 11 secs, average

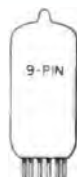
(See Series-String Heaters section of APPENDIX in CBS Tube Manual).

*D-c component must not exceed 100 volts max.

Type 12DB5 is identical to type 6DB5 except for heater characteristics.



12DF5



Full-wave power rectifier

HEATER CHARACTERISTICS

Series Parallel

Voltage, a-c or d-c 12.6 6.3 volts

Current 0.45 0.90 amp

Peak heater-cathode voltage

A-c, rms 225 volts

D-c 450 volts

ELECTRICAL DATA

MAXIMUM RATINGS (Design center values)

Rectifier Service

Plate voltage, peak inverse 1275 volts

Plate supply voltage, rms

(each plate) RATING CHART I* 450 volts

Output current, d-c RATING CHART I*

Plate current, peak steady state

(each plate) RATING CHART II* 0.35 amp

Plate current, peak transient

(each plate) RATING CHART III* 2.0 amp

CHARACTERISTICS

Tube Voltage Drop

Conducting 100 ma (each plate) 40 volts

TYPICAL OPERATION

Full-Wave Rectifier (Capacitor Input Filter)

Plate supply voltage, rms (each plate) 325 volts

Plate supply resistance (each plate) 82 ohms

Filter input capacitor 40 μ f

Output current, d-c 100 ma

Output voltage at filter input, d-c 330 volts

Full-Wave Rectifier (Choke Input Filter)

Plate supply voltage, rms (each plate) 450 volts

Filter input choke 10 henrys

Output current, d-c 100 ma

Output voltage at filter input, d-c 360 volts

NOTES:

*Rating Charts given in APPENDIX of CBS Tube Manual.

†A-c plate voltage is measured without load.



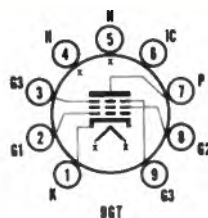
12DK5



**i-f or r-f amplifier for 12-volt A and B supply
automobile radios**

HEATER CHARACTERISTICS*

Voltage, a-c or d-c.....	12.6 volts
Current.....	300 ma
Peak heater-cathode voltage, max.	
Heater negative to cathode	16 volts
Heater positive to cathode.	16 volts



ELECTRICAL DATA

DIRECT INTERELECTRODE CAPACITANCES—Shield†

Grid to plate: g1 to p, max.....	.045 μ f
Input: g1 to k + h + g2 + g3.....	9.5 μ f
Output: p to k + h + g2 + g3.....	2.65 μ f

†JTEC shield 315 connected to cathode

MAXIMUM RATINGS (Design maximum values)

Plate voltage.....	16 volts
Grid 2 voltage.....	16 volts
Grid voltage, positive d-c.....	0 volts

CHARACTERISTICS AND TYPICAL OPERATION

Class A Amplifier

Plate voltage.....	12.6 volts
Grid 3 (suppressor).....	0 volts
Grid 2 (screen) voltage.....	12.6 volts
Plate resistance (approx.).....	0.1 meg
Transconductance.....	3300 μ mhos
Plate current.....	2.0 ma
Grid 2 current.....	0.65 ma
Grid 1 voltage (approx.) for $I_b = 10 \mu$ a.....	2.5 volts
Grid leak resistor (bypassed).....	2.2 meg

NOTE:

*Type 12DK5 is intended for use in automobile radios operated from a nominal 12-volt battery. Design of the tube is such that the heater will operate satisfactorily over the range from 10 to 15.9 volts, and that the maximum ratings provide a safety factor for the wide voltage variations encountered in this type of supply.

ENGINEERING DESIGN DATA

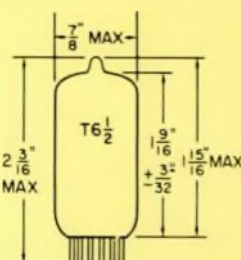
12DK5

JUNE 1, 1957

**12-volt sharp-cutoff
pentode**

MECHANICAL DATA

Cathode, coated unipotential.....	T-6½
Bulb.....	JETEC 6-2
Outline.....	Miniature 9-pin (E9-1)
Base.....	9GT
Basing.....	Any
Mounting position.....	Any



PIN CONNECTIONS

Pin 1.....	Cathode
Pin 2.....	Grid 1
Pin 3.....	Grid 3
Pin 4.....	Heater
Pin 5.....	Heater
Pin 6.....	I. C.
Pin 7.....	Plate
Pin 8.....	Grid 2
Pin 9.....	Grid 3

APPLICATION

Type 12DK5 is a miniature pentode used as an i-f or r-f amplifier in 12-volt A and B supply automobile radios. It is suitable for use in hybrid designs in which a transistor is employed in the power output stage.



12DM5



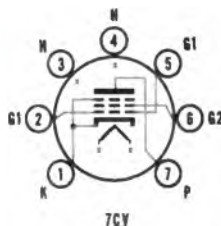
Beam power audio output amplifier

HEATER CHARACTERISTICS

Voltage, a-c or d-c.....	12.6 volts
Current.....	450 ma
Peak heater-cathode voltage, max.	
Heater negative to cathode.....	200 volts
Heater positive to cathode*.....	200 volts
Warm-up time.....	11 secs. average

(See Series-String Heaters section of APPENDIX in CBS Tube Manual).

*D-c component must not exceed 100 volts max.



12DM5

JUNE 1, 1957

Beam power pentode

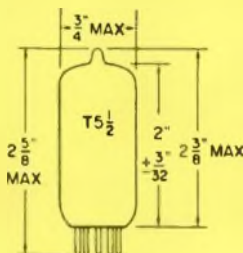
MECHANICAL DATA

Cathode, coated unipotential.....	T-5½
Bulb.....	JETEC 5-3
Outline.....	Miniature 7-pin (E7-1)
Base.....	7CV
Basing.....	Any
Mounting position.....	Any

CBS ELECTRON TUBES

ENGINEERING DESIGN DATA

12DM5 (cont.)



PIN CONNECTIONS

Pin 1.....	Cathode, B, P.
Pin 2.....	Grid 1
Pin 3.....	Heater
Pin 4.....	Heater
Pin 5.....	Grid 1
Pin 6.....	Grid 2
Pin 7.....	Plate

REFERENCES

See APPENDIX for explanation of Series-String Heaters.

APPLICATION

Type 12DM5 is a miniature beam power pentode for application as an audio power output tube in receivers having a 450 ma series-string heater circuit. The heater is warm-up time controlled. It will provide adequate audio output with a low B supply voltage.

12DQ6 12DQ6A

JANUARY 2, 1957

Beam power pentode

CHARACTERISTIC CURVES

(In curve section following APPENDIX)

Plate ($E_{c2}=100V$)..... 109A

Plate ($E_{c2}=150V$)..... 109B

APPLICATION

Types 12DQ6 and 12DQ6A are high permeance tubes for the horizontal sweep of television picture tubes. Designed with a large reserve of power capability, they will fully sweep picture tubes with deflection angles in excess of 90 degrees.

12DM5 (cont.)

ELECTRICAL DATA

DIRECT INTERELECTRODE CAPACITANCES

Grid to plate: g1 to p.....	0.55	μf
Input: g1 to k + h + g2 + b.p.....	13	μf
Output: p to k + h + g2 + b.p.....	9.0	μf

MAXIMUM RATINGS (Design center values)

Plate voltage.....	135	volts
Grid 2 voltage.....	117	volts
Plate dissipation.....	5.5	watts
Grid 1 circuit resistance		
Fixed bias.....	0.1	meg
Self bias.....	0.5	meg
Bulb temperature at hottest point.....	250	$^{\circ}C$

CHARACTERISTICS AND TYPICAL OPERATION

Class A Amplifier

Plate voltage.....	110	volts
Grid 2 (screen) voltage.....	110	volts
Plate resistance (approx.).....	14,000	ohms
Transconductance.....	7500	$\mu mhos$
Grid 1 input voltage, peak a-f.....	7.5	volts
Plate current, zero signal.....	49	ma
Plate current, maximum signal.....	50	ma
Grid 2 current, zero signal.....	4.0	ma
Grid 2 current, maximum signal.....	8.5	ma
Load resistance impedance.....	2500	ohms
Total harmonic distortion (approx.).....	9	%
Power output, maximum signal.....	1.9	watts



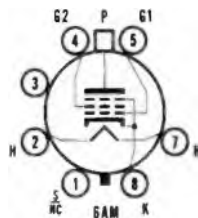
12DQ6 12DQ6A



High efficiency horizontal deflection amplifier for
television receivers, heater warm-up controlled
for series strings

HEATER CHARACTERISTICS

Voltage, a-c or d-c.....	12.6	volts
Current.....	600	ma
Peak heater-cathode voltage, max.		
Heater negative to		
cathode.....	200	volts
Heater positive to		
cathode*.....	200	volts
Warm-up time.....	11	secs. average
(See Series-String Heaters section of APPENDIX in CBS Tube Manual).		
*D-c component must not exceed 100 volts max.		



Types 12DQ6 and 12DQ6A are identical to type 6DQ6 and 6DQ6A respectively, except for heater characteristics.

12F5GT

(See chart for seldom-used tubes)



12DQ6 12DQ6A 12DQ6B



**High efficiency horizontal deflection amplifier
for television receivers, heater warm-up controlled
for series strings**

These types are identical to the 6DQ6 family of types except for heater characteristics and ratings. These types are designed for use in 600 ma series strings, and feature controlled heater warm-up.

See type 6DQ6 for complete technical data.



12DL8



Combined detector and space-charge amplifier for 12-volt A and B supply automobile radios

HEATER CHARACTERISTICS

Voltage, a-c or d-c*	12.6 volts
Current	550 ma
Peak heater-cathode voltage, max.	
Heater negative to cathode	30 volts
Heater positive to cathode	30 volts

ELECTRICAL DATA

DIRECT INTERELECTRODE CAPACITANCES

Tetrode Section

Grid to plate: g2 to p	14 μ f
Input: g2 to g1 + k + h	12 μ f
Output: p to g1 + k + h	1.3 μ f

Diode Section

Diode 1 input (p to k + h)	1.6 μ f
Diode 2 input (p to k + h)	1.6 μ f
Diode 1 to diode 2	0.03 μ f
Coupling: (Diode 1 plate to tetrode grid 2, max.)	0.02 μ f
(Diode 2 plate to tetrode grid 2 max.)	0.006 μ f

MAXIMUM RATINGS (Design center values except as noted)

Plate voltage	30 volts
Grid 1 voltage, positive (absolute maximum)	16 volts
Grid 2 voltage, negative	-20 volts
Grid 2 circuit resistance	10 meg
Average diode current	5 ma

CHARACTERISTICS AND TYPICAL OPERATION

Class A Amplifier

Plate voltage	12.6	12.6 volts
Grid 2 (control grid) voltage	-0.5†	-2.0▲ volts
Grid 1 (space-charge grid) voltage	12.6	12.6 volts
Amplification factor (grid 2 to plate)	7.2	ohms
Plate resistance	480	ohms
Transconductance (grid 2 to plate)	15,000	μ hos
Grid 2 input voltage, peak a-f	2.5	volts
A-f signal source resistance	100,000	ohms
Plate current	40	8.0 ma
Grid 1 (space-charge grid) current	75	75 ma
Load resistance impedance		800 ohms
Total harmonic distortion (approx.)		10
Power output, maximum signal		40 mw
Diode units (two), diode current with 10.0 volts applied (each diode)		3 ma

NOTES:

*Type 12DL8 is intended for use in automobile radios operated from a nominal 12-volt battery. Design of the tube is such that the heater will operate satisfactorily over the range from 10.0 volts to 15.9 volts, and that the maximum ratings provide a safety factor for the wide voltage variation encountered in this type of supply.

†Average bias developed across a 2.2 meg. resistor.

▲Measured across a 2.2 meg. resistor by grid 2 rectification with a zero plate signal equal to approximately 40 ma.

◆Grid 1 space-charge grid. Grid 2 control-grid.

ENGINEERING DESIGN DATA

12DL8

SEPTEMBER 1, 1957

12-volt diode-tetrode

CHARACTERISTIC CURVES

(In curve section following APPENDIX)

Plate Characteristics, ΔE_{c1} 211A

Plate Characteristics, ΔE_{c2} 211B

MECHANICAL DATA

Cathode, coated unipotential

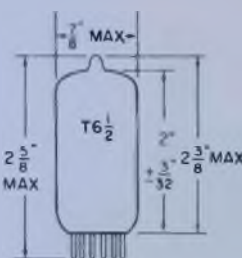
Bulb..... T-6½

Outline..... JETEC 6-3

Base..... Miniature 9-pin (E9-1)

Basing..... SHR

Mounting position..... Any



PIN CONNECTIONS

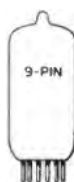
Pin 1	Diode 2 Plate
Pin 2	Tetrode Cathode
Pin 3	Tetrode Grid 1
Pin 4	Heater
Pin 5	Heater
Pin 6	Tetrode Plate
Pin 7	Tetrode Grid 2
Pin 8	Diodes Cathode and Shield
Pin 9	Diode 1 Plate

APPLICATION

Type 12DL8 is a combined duo diode and space charged grid tetrode with independent cathodes in the 9-pin miniature construction. The diode section is intended for detector use and the tetrode section for use as a power amplifier to drive a transistor output stage where the heater, plate, and space charged grid potentials are obtained directly from a 12-volt battery.



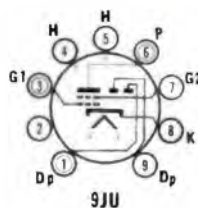
12DS7 12DS7A



Combined detector, avc rectifier, and space-charge-grid type audio driver for 12 volt A and B supply automotive radios

HEATER CHARACTERISTICS*

Voltage, a-c or d-c	12.6 volts
Current	400 ma
Peak heater-cathode voltage, max.	
Heater negative to cathode	16 volts
Heater positive to cathode	16 volts



ELECTRICAL DATA

DIRECT INTERELECTRODE CAPACITANCES

12DS7A 12DS7

Grid 2 (control grid) to plate: g1 to p	13.8	12.5 μf
Input: g2 to h + k + g1	12.7	13 μf
Output: p to h + k + g1	2.2	2.0 μf

Diode Section

Diode plate 1 to cathode and heater	0.5	0.5 μf
Diode plate 2 to cathode and heater	0.5	0.5 μf

Coupling

Grid 2 to any diode plate	0.3	0.15 μf
Diode plate 1 to diode plate 2	0.1	0.1 μf

MAXIMUM RATINGS (Design center values)

12DS7A 12DS7

Plate voltage	16	16 volts
Grid 1 voltage (space charge grid)		
absolute maximum	16	16 volts
Grid 2 (control grid) voltage, negative	16	16 volts
Grid 2 circuit resistance	10	10 meg
Diode current for continuous operation, Each diode	5.0	5.0 ma

CHARACTERISTICS

Class A Amplifier

12DS7A 12DS7

Plate voltage	12.6	12.6 volts
Grid 1 (space charge grid) voltage	12.6	12.6 volts
Grid 2 resistor	2.2	2.2 meg
Plate current	35	40 ma
Grid 1 current	75	75 ma
Transconductance	19,000	15,000 μmhos
Amplification factor	9.1	7.2
Plate resistance (approx.)	500	480 ohms
Average diode current, with 10 volts d-c applied, each diode	3.0	3.0 ma

ENGINEERING DESIGN DATA

12DS7 12DS7A

DECEMBER 30, 1959

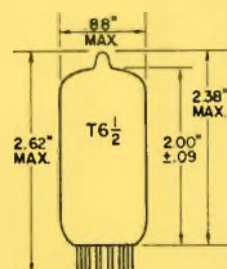
Twin diode - power tetrode

CHARACTERISTIC CURVES

(In curve section following APPENDIX)
Plate 227A
Characteristics 227B

MECHANICAL DATA

Cathode, coated unipotential
Bulb T-6 1/2
Outline JEDEC 6-3
Base JEDEC E9-1
Basing 9JU
Mounting position Any



PIN CONNECTIONS

Pin 1	Plate (Diode 2)
Pin 2	N.C.
Pin 3	Grid 1 (Tetrode)
Pin 4	Heater
Pin 5	Heater
Pin 6	Plate (Tetrode)
Pin 7	Grid 2 (Tetrode)
Pin 8	Cathode
Pin 9	Plate (Diode 1)

ENGINEERING DESIGN DATA

12DS7 12DS7A

APPLICATION

Types 12DS7 and 12DS7A contain two diodes and a space charge grid tetrode in one miniature envelope. They are intended for use in hybrid automotive radio receivers in which the audio output stage is transistorized. The diode sections may be used as the second detector and avc rectifier. The tetrode section may be used as the audio driver. The tetrode features high control grid to plate transconductance and low plate resistance.

12DS7 12DS7A (cont.)

TYPICAL OPERATION

Driver for transistor audio power output stage

	12DS7A		12DS7		
	Self Bias	Cathode Bias	Self Bias	Cathode Bias	
Heater voltage	12.6	12.0	12.6	12.6	volts
Plate supply voltage		11.2		12.6	volts
Plate voltage	12.6	†	12.6	†	volts
Grid 2 voltage‡	-2.5	0	-2.0	0	volts
		(supply)		(supply)	
Grid 2 resistor	2.2	1.8	2.2	1.8	meg
Grid 1 supply voltage		11.2		12.6	volts
Grid 1 voltage	12.6		12.6		volts
Cathode resistor		18		18	ohms
Peak a-f voltage	2.5	4.25	2.5	2.85	volts
A-f signal source resistance	0.22	3.3	0.1	3.3	meg
Plate current					
Zero signal (approx.)	35	20	40	23	ma
Maximum signal	11	7	8	13	ma
Grid 1 current	80	58	75	77	ma
Load resistance	700	1250	800	1250	ohms
Total harmonic distortion at power output of 2.5 mw		5			%
Total harmonic distortion	10		10	8	%
Power output, max. signal	45	10	40	10	mwatts

NOTES:

*This tube is intended for automotive radios operated from a nominal 12 volt battery. Design of the tube will allow the heater to operate satisfactorily over the range from 10.0 to 15.9 volts. The maximum ratings of this tube provide an adequate safety factor for the wide variations encountered in automotive supply voltages.

†Average contact potential bias developed across a specified grid resistor.

‡For cathode bias operation, the plate voltage is obtained from the indicated plate supply through a series 100-henry choke having a d-c resistance of 150 ohms.



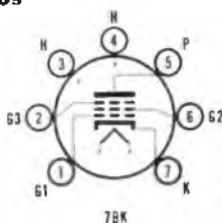
12DZ6



**i-f amplifier for 12-volt A and B supply
automobile radios**

HEATER CHARACTERISTICS

Voltage, a-c or d-c	12.6 volts
Current	190 ma
Peak heater-cathode voltage, max.	
Heater negative to cathode	16 volts
Heater positive to cathode	16 volts



ELECTRICAL DATA

DIRECT INTERELECTRODE CAPACITANCES

	Unshielded
Grid to plate: g1 to p, max.	0.15 μ f
Input: g1 to k + h + g2 + g3	9.5 μ f
Output: p to k + h + g2 + g3	4.0 μ f

MAXIMUM RATINGS (Design maximum values)

Plate voltage	16 volts
Grid 2 voltage	16 volts
Grid 1 voltage, positive d-c	0 volts
Grid 1 circuit resistance	12 meg

CHARACTERISTICS AND TYPICAL OPERATION

Class A Amplifier

Plate voltage	12.6 volts
Grid 3 (suppressor)	connect to cathode at socket
Grid 2 (screen) voltage	12.6 volts
Grid 1 Resistor (Bypassed)	10.0 meg
Plate resistance (approx.)	30,000 ohms
Transconductance	3,600 μ mhos
Plate current	5.3 ma
Grid 2 current	2.6 ma
Grid 1 voltage (approx.) for $g_m=10\mu$ mhos	-19 volts

NOTE:

*This tube is intended for automotive radios operated from a nominal 12-volt battery. Design of the tube will allow heater to operate satisfactorily over the range from 10.0 volts to 15.9 volts. The maximum ratings of this tube provide an adequate safety factor for the wide variations encountered in automotive supply voltages.

ENGINEERING DESIGN DATA

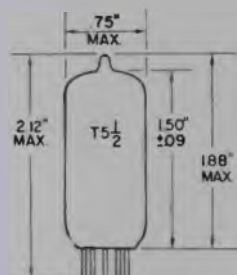
12DZ6

MARCH 30, 1959

12 Volt pentode

MECHANICAL DATA

Cathode, coated unipotential	
Bulb	T-5 1/2
Outline	JETEC 5-2
Base	Miniature 7-pin (E7-1)
Basing	7BK
Mounting position	Any



PIN CONNECTIONS

Pin 1	Grid 1
Pin 2	Grid 3, I.S.
Pin 3	Heater
Pin 4	Heater
Pin 5	Plate
Pin 6	Grid 2
Pin 7	Cathode

APPLICATION

The 12DZ6, used as an r-f amplifier in automobile radio receivers, is especially designed to operate with its plate and screen voltages supplied directly from a 12-volt storage battery.

ENGINEERING DESIGN DATA

12EG6

MARCH 30, 1959

12-6 volt B+ heptode

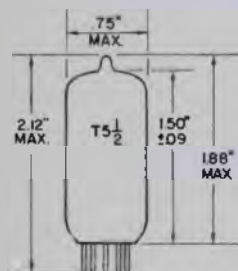
CHARACTERISTIC CURVES

(In curve section following APPENDIX)

Plate.....	224A
Plate.....	224B
Plate.....	224C

MECHANICAL DATA

Cathode, coated unipotential	
Bulb.....	T-5½
Outline.....	JETEC 5-2
Base.....	Miniature 7-pin (E7-1)
Basing.....	7CH
Mounting position	Any



PIN CONNECTIONS

Pin 1.....	Grid 1
Pin 2.....	Cathode, Grid 5
Pin 3.....	Heater
Pin 4.....	Heater
Pin 5.....	Plate
Pin 6.....	Grids 2 & 4
Pin 7.....	Grid 3

REFERENCES

Notes on the measurement of Direct Interelectrode Capacitances are given in the Handbook APPENDIX.

APPLICATION

The 12EG6 is intended as an r-f amplifier with two control grids to reduce back biasing of the AVC line with large r-f signals.



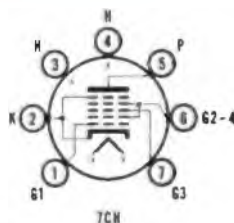
12EG6



**Dual control r-f amplifier for 12-volt A and B
supply automobile radios**

HEATER CHARACTERISTICS

Voltage, a-c or d-c	12.6 volts
Current.....	150 ma
Peak heater-cathode voltage, max.	
Heater negative to cathode.....	30 volts
Heater positive to cathode.....	30 volts



ELECTRICAL DATA

DIRECT INTERELECTRODE CAPACITANCES—With Shield†

Grid 3 to plate: g3 to p, max.	0.25	μuf
Grid 3 input: g3 to all others.....	6.5	μuf
Output: p to all others.....	12	μuf
Grid 1 input: g1 to all except p.....	5.7	μuf
Grid 1 to cathode: g1 to k + g5.....	3.2	μuf
Grid 1 to plate: g1 to p, max.	0.04	μuf
Grid 1 to Grid 3: g1 to g3, max.	0.15	μuf

♦External shield JTEC 316 connected to pin 2.

MAXIMUM RATINGS (Design center values)

Plate voltage.....	30	volts
Grid 2 and 4 voltage.....	30	volts
Grid 2 and 4 supply voltage.....	30	volts
Grid 3 voltage, negative d-c.....	30	volts
Grid 3 voltage, positive d-c.....	0	volts
Grid 3 circuit resistance.....	10	meg
Cathode current, total.....	20	ma

CHARACTERISTICS AND TYPICAL OPERATION

Heptode Connected

Plate voltage.....	12.6	volts
Grid 3 (signal grid) voltage.....	-0.8†	volts
Grid 2 and 4 (oscillator anode) voltage.....	12.6	volts
Grid 1 (oscillator grid) voltage.....	-0.8‡	volts
Plate resistance (approx.).....	0.15	meg
Transconductance, grid 3 to plate.....	800	μmhos
Plate current.....	0.4	ma
Grid 2 and 4 (oscillator anode) current.....	2.4	ma
Grid 1 voltage and grid 3 voltage† (approx.) for gm=10μmhos.....	-3.0	volts

NOTES:

†Provided by grid 1 voltage through a suitable grid 3 resistor.

‡Average bias developed across a 2.2 megohm resistor.

★This tube is intended for automotive radios operated from a nominal 12-volt battery. Design of the tube will allow the heater to operate satisfactorily over the range from 10.0 volts to 15.9 volts. The maximum ratings of this tube provide an adequate safety factor for the wide variations encountered in automotive supply voltages.



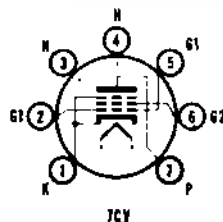
12EH5



General-purpose power amplifier for radio,
TV, and phonographs

HEATER CHARACTERISTICS

Voltage, a-c or d-c	12.6 volts
Current	0.6 amp
Peak heater-cathode voltage, max.	
Heater negative with respect to cathode	300 volts
Heater positive with respect to cathode	200 volts
Warm-up time	11 sec. average
(See Series-String Heaters section of the Handbook APPENDIX)	
*D-c component must not exceed 100 volts max.	



ELECTRICAL DATA

DIRECT INTERELECTRODE CAPACITANCES

Grid to plate g1 to p	0.65 μ f
Input: g1 to k + h + g2 + g3	17 μ f
Output: p to k + h + g2 + g3	9 μ f

MAXIMUM RATINGS (Design center values)

Plate voltage	135 volts
Grid 2 voltage	117 volts
Grid voltage, peak positive	0 volts
Plate dissipation	5 watts
Grid 2 dissipation	1.75 watts
Grid circuit resistance	
Fixed bias	0.1 meg
Cathode bias	0.5 meg
Bulb temperature at hottest point	220 °C

CHARACTERISTICS AND TYPICAL OPERATION

Plate supply voltage	110 volts
Grid 2 (screen) supply voltage	115 volts
Cathode bias resistor	62 ohms
Plate resistance (approx.)	11,000 ohms
Transconductance	14,600 μ mhos
Grid 1 input voltage, peak a-f	3 volts
Plate current, zero signal	42 ma
Plate current, maximum signal	42 ma
Grid 2 current, zero signal	11.5 ma
Grid 2 current, maximum signal	14.5 ma
Load resistance impedance	3000 ohms
Total harmonic distortion (approx.)	7 %
Power output, maximum signal	1.4 watts

ENGINEERING DESIGN DATA

12EH5

MARCH 30, 1959

Power pentode

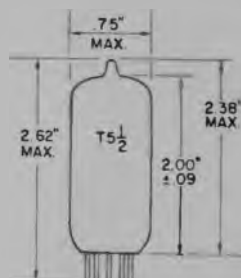
CHARACTERISTIC CURVES

(In curve section following APPENDIX)

Plate Characteristics ($E_{b1} = 115$ volts)	218A
Operation, Load vs. Distortion and Output	218B

MECHANICAL DATA

Cathode, coated unipotential	
Bulb	T-5 1/2
Outline	JETEC 5-3
Base	(E7-1)
Basing	7CV
Mounting position	Any



PIN CONNECTIONS

Pin 1	Cathode, Grid 3
Pin 2	Grid 1
Pin 3	Heater
Pin 4	Heater
Pin 5	Grid 1
Pin 6	Grid 2
Pin 7	Plate

APPLICATION

For the audio output stage of radio and television receivers and phonographs. It has an extremely high power sensitivity to provide good output from low driving voltage, even when powered by very low plate and screen voltages.

ENGINEERING DESIGN DATA

12EK6

MARCH 30, 1959

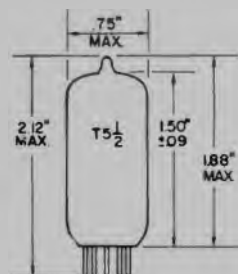
CHARACTERISTICS CURVES

(In curve section following APPENDIX)

Plate..... 225A
Transfer..... 225B

MECHANICAL DATA

Cathode, coated unipotential
Bulb..... T-5½
Outline..... JEDEC 5-2
Base..... Miniature 7-pin (E7-1)
Basing..... 7BK
Mounting position..... Any



PIN CONNECTIONS

Pin 1.....	Grid 1
Pin 2.....	Grid 3
Pin 3.....	Heater
Pin 4.....	Heater
Pin 5.....	Plate
Pin 6.....	Grid 2
Pin 7.....	Cathode

APPLICATION

The 12EK6, a sharp cutoff pentode whose heater, plate, and screen grid potentials are supplied directly from a 12-volt storage battery, is used as a VHF R-F or IF amplifier.



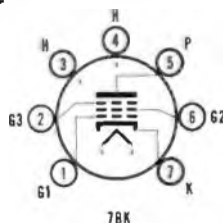
12EK6



**Sharp cutoff pentode voltage amplifier for
VHF rf-if service**

HEATER CHARACTERISTICS

Voltage, a-c or d-c.....	12.6 volts
Current.....	190 ma
Peak heater-cathode voltage, max.	
Heater negative to cathode.....	16 volts
Heater positive to cathode.....	16 volts



ELECTRICAL DATA

DIRECT INTERELECTRODE CAPACITANCES

Grid to plate: g1 to p, max.....	0.032 μ f
Input: g1 to k + h + g2 + g3.....	10 μ f
Output: p to k + h + g2 + g3.....	5.5 μ f

MAXIMUM RATINGS (Design maximum values)

Plate voltage.....	16 volts
Grid 2 voltage.....	16 volts
Grid 1 voltage, positive d-c.....	0 volts
Grid 1 circuit resistance.....	10 meg

CHARACTERISTICS AND TYPICAL OPERATION

Class A Amplifier

Plate voltage.....	12.6 volts
Grid 3 (suppressor).....	connect to cathode at socket
Grid 1 voltage†.....	
Grid 2 (screen) voltage.....	12.6 volts
Grid 1 resistor.....	2.2 meg
Plate resistance (approx.).....	40,000 meg
Transconductance.....	4,200 μ mhos
Plate current.....	4.4 ma
Grid 2 current.....	2 ma
Grid 1 voltage (approx.) for $I_b=10\mu$ a.....	-4 volts

NOTES:

†Average contact potential developed across specified resistance.

*This tube is intended for automotive radios operated from a nominal 12-volt battery. Design of the tube will allow the heater to operate satisfactorily over the range from 10.0 volts to 15.9 volts. The maximum ratings of this tube provide an adequate safety factor for the wide variations encountered in automotive supply voltages.



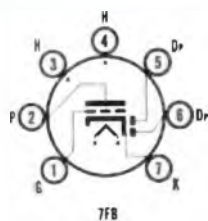
12EL6



**Combined detector—a-f voltage amplifier for 12-volt
A and B supply automobile radios**

HEATER CHARACTERISTICS

Voltage, a-c or d-c*	12.6 volts
Current	150 ma
Peak heater-cathode voltage, max.	
Heater negative to cathode	30 volts
Heater positive to cathode	30 volts



ELECTRICAL DATA

DIRECT INTERELECTRODE CAPACITANCES—Unshielded

Grid to plate: g1 to p	1.8 μf
Input: g1 to h + k	2.2 μf
Output: p to h + k	1.0 μf
Diode 1 to diode 2	1.0 μf

MAXIMUM RATINGS (Design center values)

Plate voltage	30 volts
Cathode current	20 ma
Control grid circuit resistance	10 meg
Diode current, average	1.0 ma

CHARACTERISTICS AND TYPICAL OPERATION

Class A Amplifier

Plate voltage	12.6 volts
Control grid voltage†	0 volts
Plate current	750 μa
Transconductance	1200 μmhos
Amplification factor	55
Plate resistance, (approx.)	45,000 ohms
Average diode current with 10 volts d-c applied (each diode)‡	2.0 ma

Resistance Coupled Amplifier

Plate supply voltage	12.6 volts
Control grid voltage†	0 volts
Plate load resistor	1.0 meg
Control grid resistor	1.0 meg
Input capacitor	0.02 μf
Output capacitor	0.01 μf
Grid resistor of following stage	2.0 meg
Voltage gain at 400 cps (measured at an output voltage of 1 volt, rms)	16 volts

NOTES:

*Type 12EL6 is intended for use in automobile radios operated from a nominal 12-volt battery. Design of the tube is such that the heater will operate satisfactorily over the range from 10 volts to 15.9 volts, and that the maximum ratings provide a safety factor for the wide voltage variation encountered in this type of supply.

†Test condition only.

‡Contact potential developed across specified grid resistor.

ENGINEERING DESIGN DATA

12EL6

NOVEMBER 1, 1957

Duodiode-triode

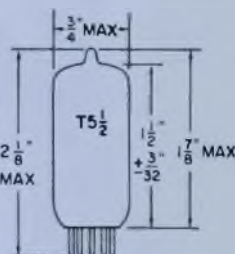
CHARACTERISTIC CURVES

(In curve section following APPENDIX)

Plate.....212A

MECHANICAL DATA

Cathode, coated unipotential
 Bulb.....T-5½
 Outline.....JETEC 5-2
 Base.....Miniature (E7-L)
 Basing.....7FB
 Mounting position.....Any



PIN CONNECTIONS

Pin 1	Grid 1
Pin 2	Triode Plate
Pin 3	Heater
Pin 4	Heater
Pin 5	Diode 2 Plate
Pin 6	Diode 1 Plate
Pin 7	Cathode

APPLICATION

Type 12EL6 is a miniature duodiode and high mu triode combined to be used as a combined detector—a-f voltage amplifier in 12-volt A and B supply automobile radios.

ENGINEERING DESIGN DATA

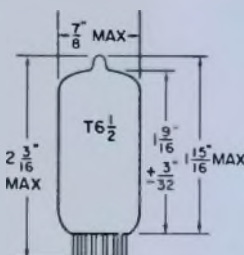
12EM6

NOVEMBER 1, 1957

Diode-power tetrode

MECHANICAL DATA

Cathode, coated unipotential
Bulb..... T-6½
Outline..... JETEC 6-2
Base..... 9-pin Miniature (E9-1)
Basing..... 9HV
Mounting position..... Any



PIN CONNECTIONS

Pin 1..... Tetrode Grid 1
Pin 2..... Cathode
Pin 3..... Tetrode Grid 2
Pin 4..... Heater
Pin 5..... Heater
Pin 6..... Tetrode Plate
Pin 7..... Internal Connection
Pin 8..... Internal Connection
Pin 9..... Diode Plate

APPLICATION

The 12EM6 is a diode-power tetrode for use in automobile receivers where the heater and plate voltages are obtained directly from a 12-volt battery. Its principal application is as the AM detector and driver to the transistor output stage.



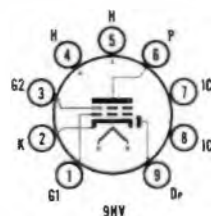
12EM6



**Combined detector—a-f voltage amplifier for 12-volt
A and B supply automobile radios**

HEATER CHARACTERISTICS

Voltage, a-c or d-c..... 12.6 volts
Current..... 500 ma
Peak heater-cathode voltage, max.
Heater negative to
cathode..... 30 volts
Heater positive to
cathode..... 30 volts



ELECTRICAL DATA

MAXIMUM RATINGS (Design center values)

Plate voltage..... 30 volts
Grid 2 voltage..... 30 volts
Plate dissipation..... 0.5 watts
Grid 1 circuit resistance..... 15 meg
Detector plate current..... 10 ma

CHARACTERISTICS AND TYPICAL OPERATION

Plate voltage..... 12.6 volts
Grid 2 (screen) voltage..... 12.6 volts
Grid 1 resistor (bypassed)..... 2.2 meg
Plate resistance..... 4000 ohms
Transconductance..... 5000 μmhos
Plate current..... 6.0 ma
Grid 2 current..... 1.0 ma
Diode current with 10 volts applied..... 1.0 ma

Class A Amplifier

Plate voltage..... 12.6 volts
Grid 2 voltage..... 12.6 volts
Grid 1 voltage..... 0 volts
A-f signal source resistance..... 200,000 ohms
A-f grid voltage, rms..... 1.0 volts
Load resistance..... 3500 ohms
Plate current..... 2.5 ma
Power output..... 10 mw
Total harmonic distortion..... 10 %

NOTES:

*Type 12EM6 is intended for automotive radios operated from a nominal 12-volt battery. Design of the tube is such that the heater will operate satisfactorily over the range from 10.0 volts to 15.9 volts and that the maximum ratings provide a safety factor for the wide voltage variation encountered in this type of supply.

†Obtained by grid 1 rectification with a 15 megohm resistor. The zero signal plate current is approximately 6.0 ma.



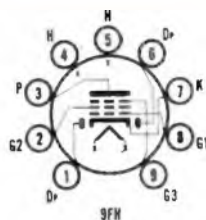
12F8



**Combined detector—a-f voltage amplifier for 12-volt
A and B supply automobile radios**

HEATER CHARACTERISTICS*

Voltage, a-c or d-c.....	12.6 volts
Current.....	150 ma
Peak heater-cathode voltage, max.	
Heater negative to cathode.....	30 volts
Heater positive to cathode.....	30 volts



ELECTRICAL DATA

DIRECT INTERELECTRODE CAPACITANCES

Grid to plate: g1 to p, max.....	.06 μ f
Input: g1 to k + h + g2 + g3.....	4.5 μ f
Output: p to k + h + g2 + g3.....	3.0 μ f
Diode 1 to diode 2.....	0.3 μ f

MAXIMUM RATINGS (Design center values)

Plate voltage.....	30 volts
Grid 2 voltage.....	30 volts
Grid voltage, positive d-c.....	0 volts
Diode current, average.....	1.0 ma
Grid 1 circuit resistance.....	10 meg

CHARACTERISTICS AND TYPICAL OPERATION

Class A Amplifier

Plate voltage.....	12.6 volts
Grid 3 (suppressor).....	connected to cathode at socket
Grid 2 (screen) voltage.....	12.6 volts
Grid 1 (control-grid) voltage.....	0 volts
Plate resistance (approx.).....	.35 meg
Transconductance.....	1000 μ mhos
Plate current.....	1.0 ma
Grid 2 current.....	0.38 ma
Grid 1 voltage (approx.) for $g_m = 10 \mu$ mhos.....	-5.0 volts
Average diode current with 10 volts, d-c, applied.....	2.0 ma

NOTE:

*Type 12F8 is intended for use in automobile radios operated from a nominal 12-volt battery. Design of the tube is such that the heater will operate satisfactorily over the range from 10 volts to 15.9 volts, and that the maximum ratings provide a safety factor for the wide voltage variation encountered in this type of supply.

ENGINEERING DESIGN DATA

12F8

JUNE 1, 1957

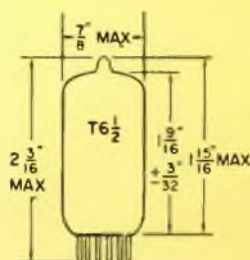
**12-volt sharp-cutoff
pentode**

CHARACTERISTIC CURVES (In curve section following APPENDIX)

Plate.....	203A
Transfer.....	203B

MECHANICAL DATA

Cathode, coated unipotential.....	
Bulb.....	T-6 1/2
Outline.....	JETEC 6-2
Base.....	Miniature 9-pin (E9-1)
Basing.....	9FH
Mounting position.....	Any



PIN CONNECTIONS

Pin 1.....	Diode 2 Plate
Pin 2.....	Grid 2
Pin 3.....	Pentode Plate
Pin 4.....	Heater
Pin 5.....	Heater
Pin 6.....	Diode 1 Plate
Pin 7.....	Cathode
Pin 8.....	Grid 1
Pin 9.....	Grid 3

APPLICATION

Type 12F8 is a miniature duodiode—remote cutoff pentode used as a combined detector and a-f voltage amplifier in 12-volt A and B supply automobile radios. Designed for the application of a-c voltage to the control grid resulting in overall receiver a-c.

12G4 • 12H4 • 12H6

(See chart for seldom-used tubes)

ENGINEERING DESIGN DATA

12J5GT

JANUARY 2, 1957

Medium-mu triode

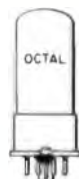
CHARACTERISTIC CURVES
(In curve section following APPENDIX)
Plate.....181A
Characteristics; μ , g_m , r_p181B

APPLICATION

Type 12J5GT is a medium-mu triode designed for operation as an audio voltage amplifier or phase inverter. See APPENDIX for R-C amplifier data.



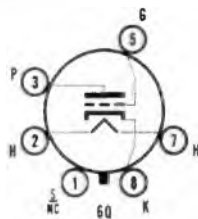
12J5GT



Audio voltage amplifier or phase inverter and
general purpose triode amplifier

HEATER CHARACTERISTICS

Voltage, a-c or d-c.....	12.6 volts
Current.....	150 ma
Peak heater-cathode voltage, max.	
Heater negative to cathode.....	90 volts
Heater positive to cathode.....	90 volts



Type 12J5GT is identical to type 6J5GT except for heater characteristics.

12J7G/GT

(See chart for seldom-used tubes)

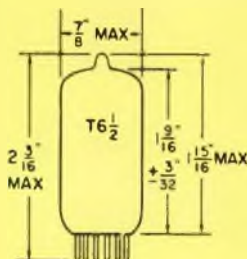
12J8

JUNE 3, 1957

12-volt
duodiode-tetrode

MECHANICAL DATA

Cathode, coated unipotential
Bulb.....T-6½
Outline.....JETEC 6-2
Base.....Miniature 9-pin (E9-1)
Basing.....9GC
Mounting position.....Any



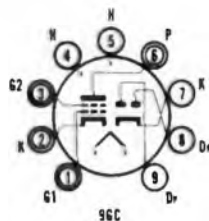
12J8



Detector and power amplifier driver for 12-volt
A and B supply automobile radios

HEATER CHARACTERISTICS*

Voltage, a-c or d-c.....	12.6 volts
Current.....	325 ma
Peak heater-cathode voltage, max.	
Heater negative to cathode.....	30 volts
Heater positive to cathode.....	30 volts



ELECTRICAL DATA

DIRECT INTERELECTRODE CAPACITANCES

Tetrode grid to plate: g1 to p.....	0.70	μf
Tetrode input: g1 to Tk + h + g2.....	10.5	μf
Tetrode output: p to Tk + h + g2.....	4.4	μf
Diode 1 plate to tetrode grid 1, max.....	0.04	μf
Diode 2 plate to tetrode grid 1, max.....	0.015	μf

MAXIMUM RATINGS (Design center values)

Plate voltage.....	30 volts
Grid 2 voltage.....	30 volts
Average diode current, each diode.....	5.0 ma
Grid 1 circuit resistance.....	10 meg

CBS ELECTRON TUBES



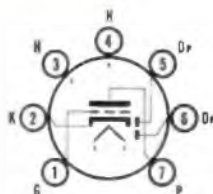
12FM6



**Combined detector—a-f voltage amplifier for 12-volt
A and B supply automobile radios**

HEATER CHARACTERISTICS

Voltage, a-c or d-c	12.6 volts
Current	150 ma
Peak heater-cathode voltage, max.	
Heater negative to cathode	30 volts
Heater positive to cathode	30 volts



ELECTRICAL DATA

DIRECT INTERELECTRODE CAPACITANCES—Unshielded

Grid to plate: g1 to p	1.7	μf
Input: g1 to h + k	2.7	μf
Output: p to h + k	1.7	μf
Diode 1 to diode 2	1.1	μf

MAXIMUM RATINGS (Design center values)

Plate voltage	30	volts
Grid 2 voltage	30	volts
Cathode current	20	ma
Grid 1 circuit resistance	10	meg
Diode current, average	1.0	ma

CHARACTERISTICS AND TYPICAL OPERATION

Class A₁ amplifier—triode unit

Plate voltage	12.6	12.6	volts
Grid voltage	0		volts
Grid resistor	0	2.2	megohms
Plate current	1.8	1.0	ma
Transconductance	2400	1300	μmhos
Plate resistance	5600	7700	ohms
Amplification factor	13.5	10	
Diode current (average) with 10 volts applied to each plate		2.0	ma

ENGINEERING DESIGN DATA

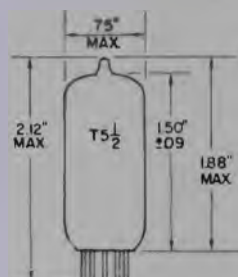
12FM6

MARCH 30 1959

Duodiode--triode

MECHANICAL DATA

Cathode, coated unipotential	
Bulb	T-5 1/2
Outline	JEDEC 5-2
Base	Miniature 7-pin (E7-1)
Basing	7BT
Mounting position	Any



PIN CONNECTIONS

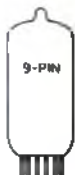
Pin 1	Grid
Pin 2	Cathode
Pin 3	Heater
Pin 4	Heater
Pin 5	Diode 2 Plate
Pin 6	Diode 1 Plate
Pin 7	Triode Plate

APPLICATION

Type 12FM6 is a miniature duodiode and high μ triode in one envelope to be used as a combined detector — a-f voltage amplifier in 12-volt A and B supply automobile radios.



12FR8



Combined i-f amplifier, a-f amplifier, and second detector for 12-volt A and B supply automotive radios

HEATER CHARACTERISTICS*

Voltage	12.6 volts
Current	0.32 amp
Peak heater-cathode voltage, max.	16 volts

ELECTRICAL DATA

DIRECT INTERELECTRODE CAPACITANCES

Triode Section

Grid to plate: g1 to p	1.7	μf
Input: g1 to k + h	2.6	μf
Output: p to k + h	2.0	μf

Pentode Section

Grid 1 to plate: g1 to p, max.	0.15	μf
Input: g1 to k + h + g2 + g3 + i.s.	8.5	μf
Output: p to k + h + g2 + g3 + i.s.	5.5	μf

Coupling

Pentode grid 1 to triode grid, max.	.012	μf
Pentode grid 1 to diode plate, max.	.004	μf
Triode grid to diode plate, max.	.17	μf
Triode plate to diode plate	.8	μf

MAXIMUM RATINGS (Design center values)

	Triode	Pentode
Plate voltage	16	16 volts
Grid 2 voltage		16 volts
Grid 2 supply voltage		16 volts
Grid 1 circuit resistance	10	10 meg
Diode plate current		5 ma

CHARACTERISTICS AND TYPICAL OPERATION

Class A Amplifier

	Triode	Pentode
Plate voltage	12.6	12.6 volts
Grid 2 voltage		12.6 volts
Grid 1 voltage	-0.6†	-0.7† volts
Plate current	1.0	1.9 ma
Grid 2 current		0.7 ma
Transconductance	1200	2700 μmhos
Plate resistance, approx.		0.4 meg
Amplification factor	10	
Grid 1 voltage for transconductance of 30 μmhos		-2.8 volts
Grid voltage for plate current of 10 μA	-3.5	volts

Plate current at $E_b = 10\text{V}$	2	ma.
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NOTES:

*This tube is intended for automotive radios operated from a nominal 12-volt battery. Design of the tube will allow the heater to operate satisfactorily over the range from 10.0 volts to 15.9 volts. The maximum ratings of this tube provide an adequate safety factor for the wide variations encountered in automotive supply voltages.

†Average bias developed across a 2.2 megohm resistor.

ENGINEERING DESIGN DATA

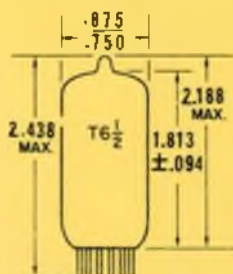
12FR8

DECEMBER 30, 1959

Diode - Triode - Pentode

MECHANICAL DATA

Cathode, coated unipotential	
Bulb	T-6½
Outline	As shown
Base	Miniature 9-pin (E9-1)
Basing	12FR8
Mounting position	Any



PIN CONNECTIONS

Pin 1	Triode Grid
Pin 2	Triode and Diode Cathode
Pin 3	Pentode Grid 1
Pin 4	Heater
Pin 5	Heater, Pentode Cathode, Pentode Grid 3, Shield
Pin 6	Pentode Grid 2
Pin 7	Pentode Plate
Pin 8	Diode Plate
Pin 9	Triode Plate

APPLICATION

Type 12FR8 is a 9-pin miniature tube having pentode, triode, diode sections in one envelope. It is intended for service as the i-f amplifier, audio driver, and second detector in 12 volt A and B supply automotive radios.



12FX8



Combined r-f amplifier and frequency converter for automotive radio receivers operating from 12-volt A and B supplies

HEATER CHARACTERISTICS*

Voltage	12.6 volts
Current	300 ma
Peak heater-cathode voltage, max.	16 volts

ELECTRICAL DATA

DIRECT INTERELECTRODE CAPACITANCES

Heptode

Mixer grid to plate: g3 to p, max.	0.28	μmf
Mixer grid to osc. grid: g3 to g1, max.	0.10	μmf
R-f input: g3 to all others	6.0	μmf
Mixer output: p to all except g3	5.0	μmf
Oscillator input: g1 to all except plate	5.0	μmf
Oscillator grid to cathode: g1 to k	3.0	μmf
Oscillator output: k to h + g2 & 4 + g3 + p	8.5	μmf
Oscillator grid to plate: g1 to p, max.	0.13	μmf

Triode

Grid to plate: g to p	1.3	μmf
Input: g1 to k + h	2.2	μmf
Output: p to k + h	.48	μmf

Coupling

Triode grid to mixer grid, max.	0.1	μmf
Triode plate to mixer grid, max.	.15	μmf
Triode plate to heptode plate, max.	.15	μmf

MAXIMUM RATINGS (Design center values)

	Heptode	Triode
Plate voltage	16	16 volts
Grids 2 & 4 voltage	16	16 volts
Grids 2 & 4 supply voltage	16	16 volts
Grid 3 voltage, negative d-c	16	16 volts
Grid 3 voltage, positive	0	0 volts
Control grid circuit resistance	10	10 meg

CHARACTERISTICS AND TYPICAL OPERATION

Converter Service (Self excitation)

	Heptode†	Triode
Plate voltage	12.6	12.6 volts
Grid 3 (signal grid) voltage†	.5	volts
Grids 2 & 4 (screen) voltage	12.6	volts
Grid 1 (oscillator grid) voltage	1.6	volts
Grid 1 (triode) voltage†		— .8 volts
Plate resistance	0.5	meg
Conversion transconductance	300	μmhos
Transconductance		1400 μmhos
Amplification factor		10
Plate current	0.29	1.3 ma
Grid 2 current	1.25	ma
Grid voltage for $I_b = 10 \mu\text{A}$, approx.		— 3.2 volts
Grid 3 voltage for $g_c = 10 \mu\text{mhos}$, approx.	— 3.0	volts

ENGINEERING DESIGN DATA

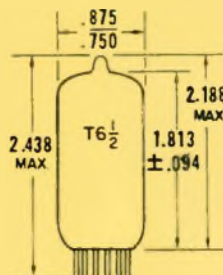
12FX8

DECEMBER 30, 1959

Triode - heptode

MECHANICAL DATA

Cathode, coated unipotential
Bulb T-6 1/2
Outline As shown
Base Miniature 9-pin (E9-1)



PIN CONNECTIONS

Pin 1	Heptode Grids 2 & 4
Pin 2	Heptode Grid 1
Pin 3	Heptode Plate
Pin 4	Heater
Pin 5	Heater
Pin 6	Triode Cathode
Pin 7	Heptode Cathode, Shield, and Grid 5
Pin 8	Triode Plate
Pin 9	Heptode Grid 3

APPLICATION

Type 12FX8 is intended for service in automotive superheterodyne receivers as a combined triode r-f amplifier and frequency converter where plate, screen and heater potentials are obtained directly from an automotive battery.

12FX8 (cont.)

CHARACTERISTICS AND TYPICAL OPERATION

Heptode Oscillator Characteristics, Not Oscillating	Triode
Grid 3 voltage	0 volts
Grid 1 (oscillator grid) voltage	0 volts
Grids 2 & 4 connected to plate	12.6 volts
Transconductance between grid 1 and grids 2 & 4 connected to plate	3800 μ mhos
Amplification factor between grid 1 and grids 2 & 4 connected to plate	9.0
Cathode current	5.0 ma
Grid 1 voltage (approx.) for $I_b = 10 \mu$ a	-4.5 volts

NOTES:

*This tube is intended for automotive radios operated from a nominal 12-volt battery. Design of the tube will allow the heater to operate satisfactorily over the range from 10.0 volts to 15.9 volts. The maximum ratings of this tube provide an adequate safety factor for the wide variations encountered in automotive supply voltages.

†Average bias developed across a 2.2 megohm resistor.

‡Converter service self excitation, screen feedback. Oscillator grid resistor 33,000 ohms.



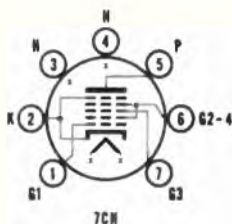
12GA6



Pentagrid converter for 12 volt A and B supply radios

HEATER CHARACTERISTICS*

Voltage, a-c or d-c	12.6 volts
Current	150 ma
Peak heater-cathode voltage, max.	
Heater negative to cathode	16 volts
Heater positive to cathode	16 volts



ELECTRICAL DATA

DIRECT INTERELECTRODE CAPACITANCES

	No Shield	Shield †
Signal grid to mixer plate: g3 to p, max.	0.3	0.25
RF input: g3 to all others	8.0	8.0
Mixer output: p to all others	8.0	13
Oscillator input: g1 to all	5.0	5.0
Oscillator output: k to h + g2 & 4 + g3 + p	15	20
Oscillator grid to cathode: g1 to k + g5	2.5	2.5
Oscillator grid to mixer plate: g1 to p, max.	0.1	0.05
Oscillator grid to signal grid: g1 to g3, max.	0.15	0.15

† JEDEC shield 316 connected to cathode.

MAXIMUM RATINGS (Design maximum values)

Plate voltage	16	volts
Grid 2 and 4 voltage	16	volts
Grid 3 voltage, negative d-c	16	volts
Grid 3 voltage, positive d-c	0	volts
Grid 3 circuit resistance	10	meg

CHARACTERISTICS AND TYPICAL OPERATION

Converter Service (Self excitation)

Plate voltage	12.6	volts
Grid 3 (signal grid) voltage	0	volts
Grid 2 and 4 (oscillator anode) voltage	12.6	volts
Grid 1 (oscillator grid) resistance	33000	ohms
Grid 3 resistance (bypassed)	2.2	meg
Grid 1 (oscillator grid) voltage, rms	1.6	volts
Plate resistance (approx.)	1.0	meg
Conversion transconductance	140	μmhos
Plate current	300	μa
Grid 2 and 4 (oscillator anode) current	800	μa
Grid 1 (oscillator grid) current	60	μa
Grid 3 voltage (approx.) for $g_c = 5 \mu\text{mhos}$	-3	volts
Grid 3 voltage (approx.) for $g_c = 20 \mu\text{mhos}$	-2.5	volts

Oscillator Characteristics, Not Oscillating

Plate voltage	12.6	volts
Grid 3 voltage	0	volts
Grid 2 and 4 (Connected to plate) voltage	12.6	volts
Grid 1 (Oscillator grid) voltage	0	volts
Transconductance between grid 1 and grids 2 and 4 connected to plate	2400	μmhos
Amplification factor between grid 1, and grids 2 and 4 connected to plate	9.0	
Cathode current	3.6	ma
Grid 1 voltage (approx.) for $I_b = 10 \mu\text{a}$	-3.3	volts

NOTE:

*This tube is intended for automotive radios operated from a nominal 12-volt battery. Design of the tube will allow the heater to operate satisfactorily over the range from 10.0 volts to 15.9 volts. The maximum ratings of this tube provide an adequate safety factor for the wide variations encountered in automotive supply voltages.

CBS ELECTRON TUBES

ENGINEERING DESIGN DATA

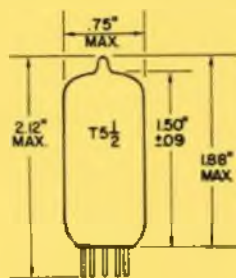
12GA6

DECEMBER 30, 1959

12-volt pentagrid converter

MECHANICAL DATA

Cathode, coated unipotential	
Bulb	T-5½
Outline	5-2
Base	Miniature 7-pin (E7-1)
Basing	7CH
Mounting position	Any



PIN CONNECTIONS

Pin 1	Grid 1
Pin 2	Cathode, Grid 5
Pin 3	Heater
Pin 4	Heater
Pin 5	Plate
Pin 6	Grids 2 and 4
Pin 7	Grid 3

APPLICATION

Type 12GA6 is a miniature pentagrid converter used as a combined oscillator-mixer for 12 volt A and B supply automotive superheterodyne radio receivers. It is suitable for hybrid designs in which a transistor is used in the power output stage.

12J8 (cont.)

TYPICAL OPERATION

Class A Driver Amplifier

Plate voltage	12.6 volts
Grid 2 (screen) voltage	12.6 volts
Grid 1 (control-grid) voltage	0 volts
Grid 1 resistor	2.2 meg
Plate resistance (approx.)	6000 ohms
Transconductance	5500 μ mhos
Grid 1 input voltage, a-f (rms)	1.6 volts
Plate current, zero signal	12 ma
Grid 1 resistor bypass capacitor	1.0 μ f
Grid 2 current, zero signal	1.5 ma
Load resistance impedance	2700 ohms
Total harmonic distortion (approx.)	5 %
Power output, maximum signal	20 mw
Average diode 1 current at 5.0 volts d-c	8.5 ma
Average diode 2 current at 5.0 volts d-c	12.0 ma

NOTE:

*Type 12J8 is intended for use in automobile radios operated from a nominal 12-volt battery. Design of the tube is such that the heater will operate satisfactorily over the range from 10.0 volts to 15.9 volts, and that the maximum ratings provide a safety factor for the wide voltage variation encountered in this type of supply.



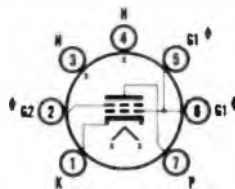
12K5



Space-charge power amplifier driver for 12-volt
A and B supply automobile radios

HEATER CHARACTERISTICS

Voltage, a-c or d-c	12.6 volts
Current	400 ma
Peak heater-cathode voltage, max.	
Heater negative to cathode	30 volts
Heater positive to cathode	30 volts



ELECTRICAL DATA

7FD

MAXIMUM RATINGS (Design center values)

Plate voltage	30 volts
Grid 1 (space-charge) voltage, positive d-c (absolute max.)	16 volts
Grid 1 supply voltage	30 volts
Grid 2 (control-grid) voltage, negative d-c	-20 volts
Grid 2 circuit resistance	10 meg

CHARACTERISTICS AND TYPICAL OPERATION

Class A Driver

Plate voltage	12.6	12.6 volts
Grid 2 (control-grid) voltage	-2.0	-0.5 volts
Grid 1 (space-charge grid) voltage	12.6	12.6 volts
Plate resistance		480 ohms
Transconductance (grid 2 to plate)		15,000 μ mhos
Amplification (grid 2 to plate)		7.2
Peak a-f grid 2 voltage	2.5	volts
A-f signal source resistance	100,000	ohms
Load resistance	800	ohms
Plate current	8.0	40 ma
Grid 1 current	75	75 ma
Power output	40	mw
Total harmonic distortion	10	%

NOTES:

*Type 12K5 is intended for use in automobile radios operated from a nominal 12-volt battery. Design of the tube is such that the heater will operate satisfactorily over the range from 10.0 volts to 15.9 volts, and that the maximum ratings provide a safety factor for the wide voltage variation encountered in this type of supply.

†Average bias developed across a 2.2 meg. resistor.

▲Measured across a 2.2 meg. resistor by grid 2 rectification with a zero plate signal equal to approximately 40 ma.

◆Grid 1 space-charge grid. Grid 2 control-grid.

CBS ELECTRON TUBES

ENGINEERING DESIGN DATA

12J8 (cont.)

PIN CONNECTIONS

Pin 1	Grid 1
Pin 2	Tetrode Cathode
Pin 3	Grid 2
Pin 4	Heater
Pin 5	Heater
Pin 6	Tetrode Plate
Pin 7	Diode 1 and 2 Cathode
Pin 8	Diode 2 Plate
Pin 9	Diode 1 Plate

APPLICATION

Type 12J8 is a miniature duodiode-tetrode designed for use in 12-volt A and B supply automobile radio receivers. It is suitable for the detector and driver stages in hybrid radios in which a transistor is employed in the power output stage.

12K5

NOVEMBER 1, 1957

Space charge tetrode

CHARACTERISTIC CURVES

(In curve section following APPENDIX)

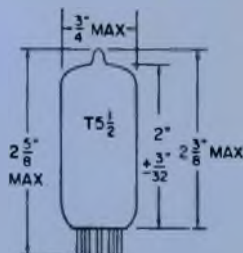
Plate ($E_{c1} = 12.6V$) 194A

Plate ($E_{c2} = 0V$) 194B

Transfer ($E_{c1} = 12.6V$) 194C

MECHANICAL DATA

Cathode, coated unipotential	
Bulb	T-5½
Outline	JETEC 5-3
Base	Miniature 7-pin (E7-1)
Basing	7FD
Mounting position	Any



PIN CONNECTIONS

Pin 1	Cathode
Pin 2	Grid 2
Pin 3	Heater
Pin 4	Heater
Pin 5	Grid 1
Pin 6	Grid 1
Pin 7	Plate

APPLICATION

Type 12K5 is a space charge tetrode for use as a power amplifier transistor driver in hybrid type automobile radio in which the B plus supply is obtained directly from a 12-volt storage battery.

12K7G/GT • 12K8/GT

(See chart for seldom-used tubes)

12L6GT

JANUARY 2, 1957

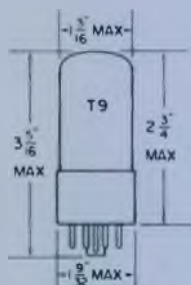
Beam power pentode

CHARACTERISTIC CURVES

(In curve section following APPENDIX)
Plate ($E_{c2} = 120V$)..... 162A
Plate; ΔE_{c2} ($E_{c1} = 0V$)..... 162B
Operation; Po, Distortion..... 162C

MECHANICAL DATA

Cathode, coated unipotential
Bulb..... T-9
Outline..... JEDEC 9-11 or 9-41
Base..... Intermediate shell
octal (B6-81 or B7-7) or Short inter-
mediate shell octal (B6-84 or B7-59)
Basing..... 7AC
Mounting position..... Any



PIN CONNECTIONS

Pin 1.....	N. C.
Pin 2.....	Heater
Pin 3.....	Plate
Pin 4.....	Grid 2
Pin 5.....	Grid 1
Pin 7.....	Heater
Pin 8.....	Cathode, B. P.

APPLICATION

Type 12L6GT is a beam power pentode designed for use as an audio power output stage in television receivers employing 600-ma series-string heaters.



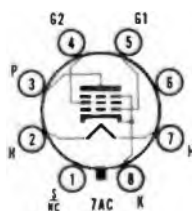
12L6GT



**Audio power output tube in TV receivers,
heater warm-up time controlled for series strings**

HEATER CHARACTERISTICS

Voltage, a-c or d-c..... 12.6 volts
Current..... 600 ma
Peak heater-cathode voltage, max.
Heater negative to cathode..... 300 volts
Heater positive to cathode..... 200 volts
Warm-up time..... 11 secs. average
(See Series-String Heaters section of APPENDIX in CBS Tube Manual).
*D-c component must not exceed 100 volts max.



ELECTRICAL DATA

MAXIMUM RATINGS (Design center values)

Plate voltage.....	200 volts
Grid 2 voltage.....	125 volts
Plate dissipation.....	10 watts
Grid 2 dissipation.....	1.25 watts
Grid 1 circuit resistance	
Fixed bias.....	0.1 meg
Self bias.....	0.5 meg

CHARACTERISTICS AND TYPICAL OPERATION

Class A Amplifier

Plate voltage.....	110	200 volts
Grid 2 (screen) voltage.....	110	125 volts
Grid 1 (control-grid) voltage.....	-7.5	volts
Cathode bias resistor.....		180 ohms
Plate resistance (approx.).....	13,000	28,000 ohms
Transconductance.....	8000	8000 μ mhos
Grid 1 input voltage, peak a-f.....	7.5	8.5 volts
Plate current, zero signal.....	49	46 ma
Plate current, maximum signal.....	50	47 ma
Grid 2 current, zero signal.....	4.0	2.2 ma
Grid 2 current, maximum signal.....	10	8.5 ma
Load resistance impedance.....	2000	4000 ohms
Power output, maximum signal.....	2.1	3.8 watts
Total harmonic distortion.....	10	10 %

12L6GT (cont.)

CHARACTERISTICS AND TYPICAL OPERATION

Class A Amplifier

Plate voltage.....	110	200 volts
Grid 2 (screen) voltage.....	110	125 volts
Grid 1 (control-grid) voltage.....	-7.5	volts
Cathode bias resistor.....		180 ohms
Plate resistance (approx.).....	13,000	28,000 ohms
Transconductance.....	8000	8000 μ mhos
Grid 1 input voltage, peak a-f.....	7.5	8.5 volts
Plate current, zero signal.....	49	46 ma
Plate current, maximum signal.....	50	47 ma
Grid 2 current, zero signal.....	4.0	2.2 ma
Grid 2 current, maximum signal.....	10	8.5 ma
Load resistance impedance.....	2000	4000 ohms
Power output, maximum signal.....	2.1	3.8 watts

ENGINEERING DESIGN DATA

12L6GT (cont.)

PIN CONNECTIONS

Pin 1.....	N. C.
Pin 2.....	Heater
Pin 3.....	Plate
Pin 4.....	Grid 2
Pin 5.....	Grid 1
Pin 7.....	Heater
Pin 8.....	Cathode, B. P.

APPLICATION

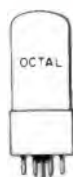
Type 12L6GT is a beam power pentode designed for use as an audio power output stage in television receivers employing 600-ma series-string heaters.

12L8GT • 12Q7G/GT • 12S8

(See chart for seldom-used tubes)



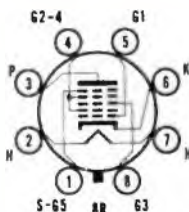
12SA7GT



Pentagrid converter for radio receivers

HEATER CHARACTERISTICS

Voltage, a-c or d-c.....	12.6 volts
Current.....	150 ma
Peak heater-cathode voltage, max.....	90 volts



Type 12SA7GT is identical to type 6SA7GT except for heater characteristics.

12SA7GT

JANUARY 2, 1957

Heptode

CHARACTERISTICS CURVES

(In curve section following APPENDIX)
Operation, separate excitation.....190A
Operation, self excitation.....190B

APPLICATION

Type 12SA7GT is a heptode for operation as a pentagrid converter in radio receivers.

12SC7 • 12SF5/GT • 12SF7

(See chart for seldom-used tubes)

**ENGINEERING
DESIGN DATA**

12SG7

JANUARY 2, 1957

Remote-cutoff pentode

APPLICATION

Type 12SG7 is a remote-cutoff pentode used as an r-f or i-f amplifier in wideband applications.



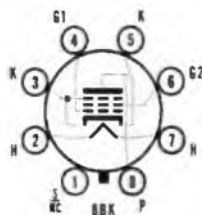
12SG7



R-f or i-f amplifier in wideband applications

HEATER CHARACTERISTICS

Voltage, a-c or d-c.....	12.6 volts
Current.....	150 ma
Peak heater-cathode voltage, max.	
Heater negative to cathode.....	90 volts
Heater positive to cathode.....	90 volts



Type 12SG7 is identical to type 6SG7 except for heater characteristics.

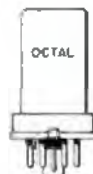
12SH7 • 12SJ7/GT

(See chart for seldom-used tubes)



12SK7

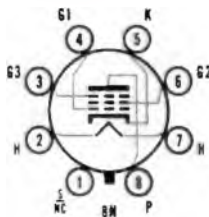
12SK7GT



Gain controlled r-f or i-f amplifier in radio receivers

HEATER CHARACTERISTICS

Voltage, a-c or d-c.....	12.6 volts
Current.....	150 ma



Types 12SK7 and 12SK7GT are identical to types 6SK7 and 6SK7GT, respectively except for heater characteristics.

12SK7

12SK7GT

JANUARY 2, 1957

Remote-cutoff pentode

APPLICATION

Types 12SK7 and 12SK7GT are remote-cutoff pentodes designed for operation as gain controlled r-f or i-f amplifiers in radio receivers. They are employed in a-c-d-c receivers with 150-ma series-string heaters.

12SL7GT

(See chart for seldom-used tubes)



12SN7GT

12SN7GTA



General purpose amplifier, phase inverter or oscillator

HEATER CHARACTERISTICS

Voltage, a-c or d-c..... 12.6 volts
Current..... 300 ma

12SN7GTA

Warm-up time..... 11 secs. average
(See Series-String Heaters section of
APPENDIX in CBS Tube Manual).



Type 12SN7GT is identical to type 6SN7GT except for heater characteristics. Type 12SN7GTA is identical to type 6SN7GTB except for heater characteristics.

ENGINEERING DESIGN DATA

12SN7GT

12SN7GTA

JANUARY 2, 1957

**Medium-mu
duotriode**

CHARACTERISTIC CURVES

(In curve section following APPENDIX)

Plate..... 181A

Characteristics, μ , gm, r_p 181B

APPLICATION

Type 12SN7GT is a medium-mu duotriode designed for operation as a general purpose amplifier or oscillator. For R-C amplifier data see APPENDIX.



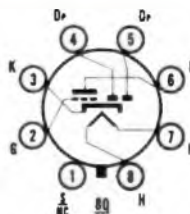
12SQ7GT



Combined detector, avc, and audio amplifier

HEATER CHARACTERISTICS

Voltage, a-c or d-c..... 12.6 volts
Current..... 150 ma
Peak heater-cathode
voltage, max..... 90 volts



Type 12SQ7GT is identical to type 6SQ7GT except for heater characteristics.

12SQ7GT

JANUARY 2, 1957

**Duodiode—high-mu
triode**

APPLICATION

Type 12SQ7GT is a duodiode—high-mu triode designed for operation as a combined detector, avc, and audio amplifier. See APPENDIX for R-C amplifier data. It is employed in a-c/d-c radio receivers.

12SR7

(See chart for seldom-used tubes)

CBS ELECTRON TUBES

ENGINEERING DESIGN DATA

12V6GT

FEBRUARY 25, 1957

Beam power pentode

CHARACTERISTIC CURVES

(In curve section following APPENDIX)

Plate ($E_{c2} = 250V$).....	138A
Plate ($E_{c2} = 250V$).....	138B
Plate, triode connected.....	138C
Plate; ΔE_{c2} ($E_{c1} = 0V$).....	138D
Transfer ($E_b = 250V$).....	138E
Operation.....	138F

APPLICATION

Type 12V6GT is a beam power pentode designed for operation as the audio power output amplifier in 12-volt system automobile radios.

12W6GT

FEBRUARY 25, 1957

Beam power pentode

CHARACTERISTIC CURVES

(In curve section following APPENDIX)

Plate ($E_{c2} = 110V$).....	174A
Plate ($E_{c2} = 110V$).....	174B
Plate; ΔE_{c2} ($E_{c1} = 0V$).....	174C
Transfer.....	174D
Plate, triode connected.....	174E
Transfer, triode connected.....	174F
Operation.....	174G

APPLICATION

Type 12W6GT is a beam power pentode used as an audio output amplifier or vertical deflection amplifier in warm-up time controlled series-string heater type television receivers.

12X4

FEBRUARY 25, 1957

Double diode

CHARACTERISTIC CURVES

(In curve section following APPENDIX)

Rating Chart I.....	168A
Rating Chart II.....	168B
Rating Chart III.....	168C

APPLICATION

Type 12X4 is a diode used as a full wave rectifier for 12-volt system automobile receivers.



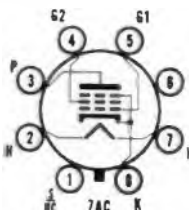
12V6GT



Audio power output amplifier for
12-volt system automobile radios

HEATER CHARACTERISTICS

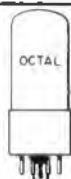
Voltage, a-c or d-c.....	12.6 volts
Current.....	225 ma
Peak heater-cathode voltage, max.	
Heater negative to cathode.....	100 volts
Heater positive to cathode*.....	100 volts
*D-c component must not exceed 100 volts max.	



Type 12V6GT is identical to type 6V6GT except for heater characteristics.



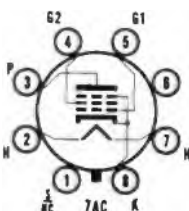
12W6GT



Audio output amplifier or vertical deflection amplifier,
heater warm-up controlled for series strings

HEATER CHARACTERISTICS

Voltage, a-c or d-c.....	12.6 volts
Current.....	600 ma
Peak heater-cathode voltage, max.	
Heater negative to cathode*.....	300 volts
Heater positive to cathode.....	200 volts
Warm-up time.....	11 secs. average
(See Series-String Heaters section of APPENDIX in CBS Tube Manual).	
*D-c component must not exceed 200 volts max.	
†D-c component must not exceed 100 volts max.	



Type 12W6GT is identical to type 6W6GT except for heater characteristics.



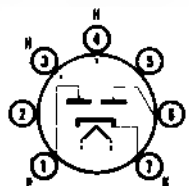
12X4



Full-wave rectifier for 12-volt system automobile receivers

HEATER CHARACTERISTICS

Voltage, a-c or d-c.....	12.6 volts
Current.....	300 ma
Peak heater-cathode voltage, max.	
Heater negative to cathode.....	450 volts
Heater positive to cathode.....	100 volts



Type 12X4 is identical to type 6X4 except for heater characteristics.

CBS ELECTRON TUBES



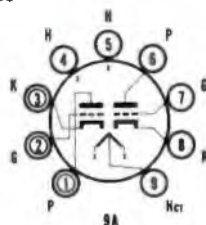
12U7



General purpose duotriode amplifier for 12-volt
A and B supply radios

HEATER CHARACTERISTICS

Voltage*	12.6 volts
Current	150 ma
Peak heater-cathode voltage, max.	
Heater negative to cathode	30 volts
Heater positive to cathode	30 volts



ELECTRICAL DATA

DIRECT INTERELECTRODE CAPACITANCES

	Section 1		Section 2		
	No Shield	Shield†	No Shield	Shield†	
Grid to plate: g1 to p...	1.5	1.5	1.5	1.5	μf
Input g1 to h + k...	1.6	1.8	1.6	1.8	μf
Output: p to h + k...	0.40	2.0	0.32	2.0	μf

†JETEC shield 315 connected to cathode.

MAXIMUM RATINGS (Design center value)

Plate voltage	30 volts
Cathode current	15 ma
Control grid circuit resistance	
Fixed bias	0.25 meg
Cathode bias	1.0 meg

CHARACTERISTICS AND TYPICAL OPERATION

Class A Amplifier

Plate voltage	12.6 volts
Grid voltage	0 volts
Plate resistance (approx.)	12,500 ohms
Transconductance	1600 μmhos
Amplification factor	20
Plate current	1.0 ma
Grid 1 voltage (approx.) for $I_b = 10 \mu a$	-1.5 volts

NOTE:

*Type 12U7 is intended for use in automobile radios operated from a nominal 12-volt battery. Design of the tube is such that the heater will operate satisfactorily over the range from 10 to 15.9 volts, and that the maximum ratings provide a safety factor for the wide voltage variations encountered in this type of supply.

ENGINEERING DESIGN DATA

12U7

NOVEMBER 1, 1957

Medium-mu duotriode

CHARACTERISTIC CURVES

(In curve section following APPENDIX)

Plate.....213A

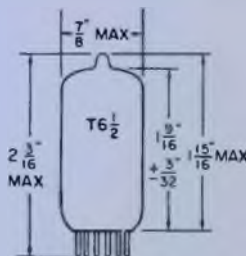
Transfer.....213B

MECHANICAL DATA

Cathode coated unipotential	
Bulb.....T-635	
Outline.....JETEC 6-2	
Base.....Miniature 9-pin (E9-1)	
Basing.....9A	
Mounting position.....Any	

PIN CONNECTIONS

Pin 1	Plate (Sect. 2)
Pin 2	Grid (Sect. 2)
Pin 3	Cathode (Sect. 2)
Pin 4	Heater
Pin 5	Heater
Pin 6	Plate (Sect. 1)
Pin 7	Grid (Sect. 1)
Pin 8	Cathode (Sect. 1)
Pin 9	Heater Center Tap

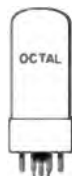


APPLICATION

The 12U7 is a medium-mu duotriode for use as a general purpose triode where the heater and plate potential may be obtained directly from a 12-volt automobile battery. Its principal application is for relay trigger and first stage audio amplifier in automatic tuning hybrid automobile radios.



17AX4GT



Damper diode for television horizontal sweep circuit

HEATER CHARACTERISTICS

Voltage, a-c or d-c..... 16.8 volts
Current..... 450 ma
Peak heater-cathode voltage, max.*

Heater negative to cathode†..... 4400 volts
Heater positive to cathode*..... 300 volts

Warm-up time..... 11 secs. average
(See Series-String Heaters section of APPENDIX in CBS Tube Manual).

*D-c component must not exceed 900 volts max.

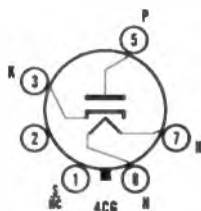
*D-c component must not exceed 100 volts max.

†Absolute maximum value

Type 17AX4GT is identical to types 6AX4GT, 12AX4GT, and 25AX4GT except for heater characteristics. See type 6AX4GT for ratings and operating characteristics.

NOTE:

*Voltage pulse duration must not exceed 10 μ s in a 525-line, 30 frame system.



ENGINEERING DESIGN DATA

17AX4GT

NOVEMBER 1, 1957

Single diode

CHARACTERISTIC CURVES
(In curve section following APPENDIX)
Plate characteristics..... 164A

APPLICATION

Type 17AX4GT is a damper diode for television horizontal sweep circuits, with a heater that is warm-up time controlled for 450 ma series-string operation.

**12Z3 • 12Z5 • 13DE7 • 14A4
14A5 • 14A7 • 14AF7/XXD • 14B6
14B8 • 14C5 • 14C7 • 14E6 • 14E7
14F7 • 14F8 • 14H7 • 14J7 • 14N7
14Q7 • 14R7 • 14S7 • 14W7 • 14X7
14Y4 • 14Z3 • 15 • 16 • 16B**

(See chart for seldom-used tubes)



17AV5GA

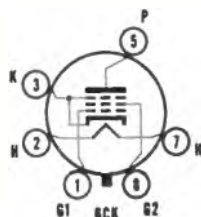


**Horizontal deflection amplifier in TV receiver
sweep circuits, heater warm-up time controlled
for series strings**

HEATER CHARACTERISTICS

Voltage, a-c or d-c.....	16.8 volts
Current.....	450 ma
Peak heater-cathode voltage, max.	
Heater negative to cathode.....	200 volts
Heater positive to cathode*.....	200 volts
Warm-up time.....	11 secs. average
*D-c volts must not exceed 100 volts, max.	

Type 17AV5GA is identical to types 6AV5GA, 12AV5GA, and 25AV5GA except for heater characteristics. See type 6AV5GA for ratings and operating characteristics.



17CA5

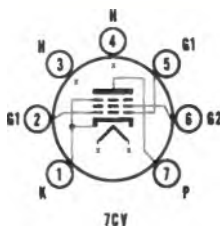


**A-f power amplifier with high output from a low
B supply voltage, heater warm-up time controlled
for series strings**

HEATER CHARACTERISTICS

Voltage, a-c or d-c.....	16.8 volts
Current.....	450 ma
Peak heater-cathode voltage, max.	
Heater negative to cathode*.....	200 volts
Heater positive to cathode†.....	300 volts
Warm-up time.....	11 secs. average
*D-c component must not exceed 100 volts max.	
†D-c component must not exceed 200 volts max.	

Type 17CA5 is identical to type 12CA5 except for heater ratings, and to 6CA5 and 25CA5 except for a maximum grid 1 circuit resistance (fixed bias) rating of 0.1 megohm and heater ratings. See type 6CA5 for ratings and operating characteristics.



17AV5GA

JUNE 1, 1957

Beam power pentode

CHARACTERISTIC CURVES
(In curve section following APPENDIX)

Plate ($E_{c2} = 100V$).....	105A
Plate ($E_{c2} = 150V$).....	105B

APPLICATION

Type 17AV5GA is a horizontal deflection amplifier for use in television receiver sweep circuits, with a heater that is warm-up time controlled for 450-ma series-string operation.

17CA5

JUNE 1, 1957

Beam power pentode

CHARACTERISTIC CURVES
(In curve section following APPENDIX)

Plate ($E_{c2} = 125V$).....	178A
Plate, ΔE_{c2} ($E_{c1} = 0V$).....	178B
Transfer; I_b, I_{c2} ($E_{c1} = 0V$).....	178C
Operation; ($E_b = E_{c2} = 125V$, $E_{c1} = -4.5V$).....	178D
Operation; $E_b = E_{c2} = 110V$, $E_{c1} = -4.0V$	178E

APPLICATION

Type 17CA5 is a beam power pentode designed to function as an a-f power amplifier with high output from a low B supply. It is suitable for small portable television receivers having a 450-ma. heater-string and a-c, d-c B plus supply.

ENGINEERING DESIGN DATA

17CU5

JUNE 1, 1957

Beam power pentode

CHARACTERISTIC CURVES
(In curve section following APPENDIX)
Plate ($E_{c2} = 110V$)..... 191A
Characteristics..... 191B

APPLICATION

Type 17CU5 is a beam power pentode for the audio output stage of television receivers. Designed with high power sensitivity and high efficiency at low plate and screen voltages, it is capable of providing relatively high power output.



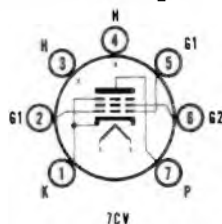
17CU5



**Audio output power tube for television receivers,
heater warm-up time controlled for series strings**

HEATER CHARACTERISTICS

Voltage, a-c or d-c.....	16.8 volts
Current.....	450 ma
Peak heater-cathode voltage, max.	
Heater negative to cathode.....	200 volts
Heater positive to cathode.....	200 volts
Warm-up time.....	11 secs. average



Type 17CU5 is identical to type 6CU5 except for heater characteristics.

17DQ6

17DQ6A

JUNE 1, 1957

Beam power pentode

CHARACTERISTIC CURVES
(In curve section following APPENDIX)
Plate ($E_{c2} = 100V$)..... 109A
Plate ($E_{c2} = 150V$)..... 109B

APPLICATION

Type 17DQ6 and 17DQ6A are high performance tubes for the horizontal sweep of television picture tubes. Designed with a large reserve of power capability, they will fully sweep picture tubes having deflection angles in excess of 90 degrees.



17DQ6

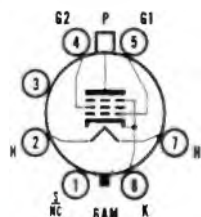
17DQ6A



**High efficiency horizontal deflection amplifier for
television receivers**

HEATER CHARACTERISTICS

Voltage, a-c or d-c.....	16.8 volts
Current.....	450 ma
Peak heater-cathode voltage, max.	
Heater negative to cathode.....	200 volts
Heater positive to cathode.....	200 volts
Warm-up time.....	11 secs. average



Type 17DQ6 is identical to type 6DQ6 except for heater characteristics; type 17DQ6A is identical to type 6DQ6A. See types 6DQ6 and 6DQ6A for ratings and operating characteristics.

17H3

JUNE 1, 1957

Single diode

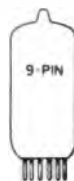
CHARACTERISTIC CURVES
(In curve section following APPENDIX)
Plate..... 209A

MECHANICAL DATA

Cathode, coated unipotential
Bulb..... T-6½
Outline..... JETEC 6-3
Base..... Miniature 9-pin (E9-1)
Basing..... 9FK
Mounting position..... Any



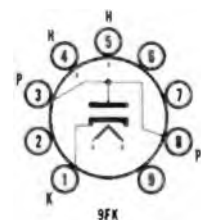
17H3



**TV damper diode for horizontal deflection circuits,
warm-up time controlled for series strings**

HEATER CHARACTERISTICS

Voltage, a-c or d-c.....	17.5 volts
Current.....	300 ma
Peak heater-cathode voltage, max.*	
Heater negative to cathode.....	2000 volts
Heater positive to cathode.....	200 volts
Warm-up time.....	11 secs. average
*D-c component must not exceed 500 volts max.	
*D-c component must not exceed 100 volts max.	



CBS ELECTRON TUBES



17D4



**TV damper diode for horizontal deflection circuits,
heater warm-up time controlled for series-string circuits**

HEATER CHARACTERISTICS

Voltage* 16.8 volts
Current 0.45 amp

Peak heater-cathode voltage, max.

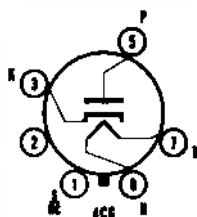
Heater negative to cathode† 4400 volts

Heater positive to cathode* 300 volts

Warm-up time 11 secs. average
(See Series-String Heaters section of APPENDIX in CBS Tube Manual).

*D-c component must not exceed 900 volts max.

*D-c component must not exceed 100 volts max.



ELECTRICAL DATA

DIRECT INTERELECTRODE CAPACITANCES

Heater to cathode: h to k 3.0 μ f
Cathode to plate-and-heater: k to p + h Δ 8.0 μ f
Plate to cathode-and-heater: p to k + h Δ 6.0 μ f

MAXIMUM RATINGS (Design maximum values unless noted)

TV Damper Service*

Plate voltage, peak inverse 4400 volts
Plate current, d-c 155 ma
Plate current, d-c (design center) 145 ma
Plate current, peak 900 ma
Plate dissipation 5.5 watts

AVERAGE CHARACTERISTICS

Tube voltage drop at 250 ma 22 volts

NOTES:

*Voltage pulse duration must not exceed 10 μ s in a 525-line, 30-frame system.

†Absolute maximum value.

Δ Tie unused pins and metal parts to heater.

Type 17D4 is identical to type 12D4 except for heater characteristics.

ENGINEERING DESIGN DATA

17D4

MARCH 30, 1959

Single diode

CHARACTERISTIC CURVES

(In curve section following APPENDIX)

Average plate 222 A

MECHANICAL DATA

Cathode, coated unipotential

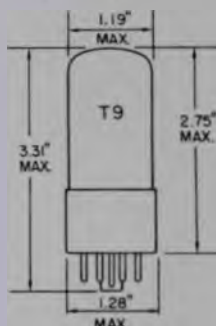
Bulb T-9

Outline JEDEC 9-11 or 9-41

Base B5-82, B6-8, B5-85, B6-80

Basing 4CG

Mounting position Any



PIN CONNECTIONS

Pin 1 I.C.
Pin 2 I.C.
Pin 3 Cathode
Pin 5 Plate
Pin 7 Heater
Pin 8 Heater



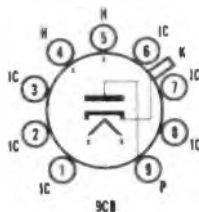
6AF3



Damper diode for television horizontal sweep circuits

HEATER CHARACTERISTICS

Voltage	6.3±10% volts
Current	1.2 amps
Peak heater-cathode voltage, max.*†	
Heater negative to cathode*	4500 volts
Heater positive to cathodes*	300 volts
*D-c component must not exceed 1000 volts max.	
*D-c component must not exceed 100 volts max.	



ELECTRICAL DATA

DIRECT INTERELECTRODE CAPACITANCES

Heater to cathode: h to k	2.8 μf
Cathode to plate-and-heater: k to p + h	9.0 μf
Plate to cathode-and-heater: p to k + h	6.0 μf

MAXIMUM RATINGS (Design maximum values)

TV Damper Service*

Plate voltage, peak inverse	4500 volts
Plate current, d-c	185 ma
Plate current, peak steady state	750 ma
Plate dissipation	6.0 watts
Bulb temperature at hottest point	210 °C

AVERAGE CHARACTERISTICS

Tube voltage drop at 340 ma	30 volts
-----------------------------	----------

NOTES:

*Voltage pulse duration must not exceed 10μs in a 525-line, 30-frame system.

†Design maximum value.

ENGINEERING DESIGN DATA

6AF3

MARCH 30, 1959

Single diode

MECHANICAL DATA

Cathode, coated unipotential	
Bulb	T-6½
Outline	JETEC 6-8
Base	Miniature 9-pin (E9-1)
Basing	9CB
Mounting position	Any



PIN CONNECTIONS

Pin 1	1C*
Pin 2	1C*
Pin 3	1C*
Pin 4	Heater
Pin 5	Heater
Pin 6	1C*
Pin 7	1C*
Pin 8	1C*
Pin 9	Plate
Top Cap	Cathode

*Internal connection — Do not use as tie point.

APPLICATION

The 6AF3 is designed to withstand high voltage pulses of line frequency between cathode and both heater and plate elements such as normally encountered in "direct drive" circuits.



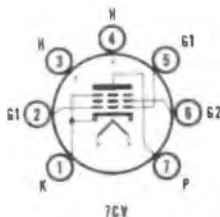
25EH5



General-purpose power amplifier for radio,
TV, and phonographs

HEATER CHARACTERISTICS

Voltage, a-c or d-c	25 volts
Current	0.3 amp
Peak heater-cathode voltage, max.	
Heater negative with respect to cathode	200 volts
Heater positive with respect to cathode*	200 volts
*D-c component must not exceed 100 volts max.	



ELECTRICAL DATA

DIRECT INTERELECTRODE CAPACITANCES

Grid to plate: g1 to p	0.65 μ f
Input: g1 to k + h + g2 + g3	17 μ f
Output: p to k + h + g2 + g3	9 μ f

MAXIMUM RATINGS (Design center values)

Plate voltage	135 volts
Grid 2 voltage	117 volts
Grid voltage, peak positive	0 volts
Plate dissipation	5 watts
Grid 2 dissipation	1.75 watts
Grid circuit resistance	
Fixed bias	0.1 meg
Cathode bias	0.5 meg
Bulb temperature at hottest point	220 °C

CHARACTERISTICS AND TYPICAL OPERATION

Plate supply voltage	110 volts
Grid 2 (screen) supply voltage	115 volts
Cathode bias resistor	62 ohms
Plate resistance (approx.)	11,000 ohms
Transconductance	14,600 μ mhos
Grid 1 input voltage, peak a-f	3 volts
Plate current, zero signal	42 ma
Plate current, maximum signal	42 ma
Grid 2 current, zero signal	11.5 ma
Grid 2 current, maximum signal	14.5 ma
Load resistance impedance	3000 ohms
Total harmonic distortion (approx.)	7 %
Power output, maximum signal	1.4 watts

ENGINEERING DESIGN DATA

25EH5

MARCH 30, 1959

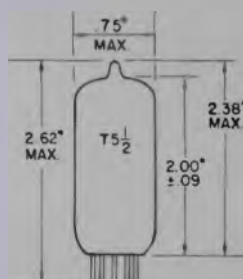
Power pentode

CHARACTERISTIC CURVES (In curve section following APPENDIX)

Plate Characteristics ($E_b = 115$ volts)	218A
Operation, Load vs. Distortion and Output	218B

MECHANICAL DATA

Cathode, coated unipotential	
Bulb	T-5 1/2
Outline	JETEC 5-3
Base	(E7-1)
Basing	7CV
Mounting position	Any

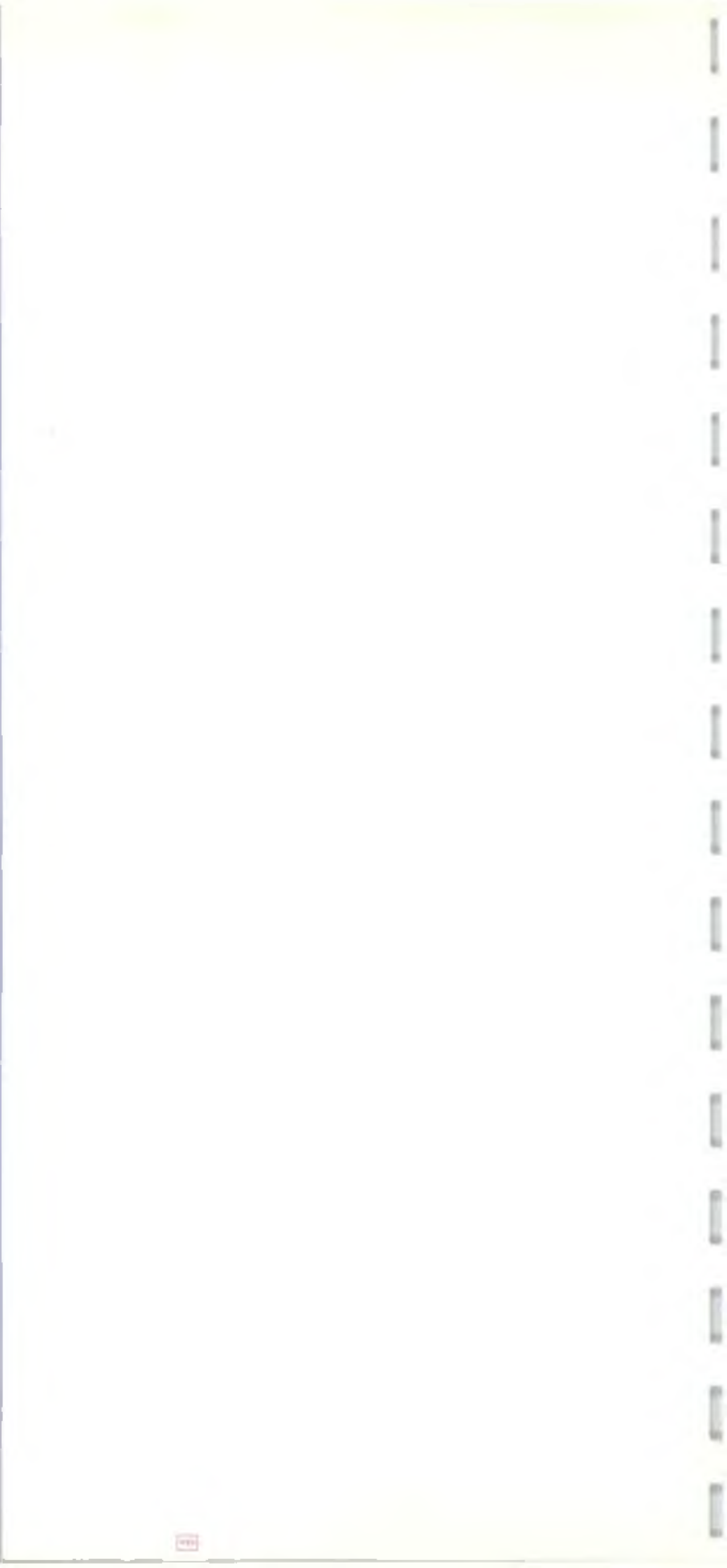


PIN CONNECTIONS

Pin 1	Cathode, Grid 3
Pin 2	Grid 1
Pin 3	Heater
Pin 4	Heater
Pin 5	Grid 1
Pin 6	Grid 2
Pin 7	Plate

APPLICATION

For the audio output stage of radio and television receivers and phonographs. It has an extremely high power sensitivity to provide good output from low driving voltage, even when powered by very low plate and screen voltages.



17H3 (cont.)

ELECTRICAL DATA

DIRECT INTERELECTRODE CAPACITANCES

Heater to cathode: h to k.....	2.0	μf
Cathode to plate-and-heater: k to p + h.....	5.5	μf
Plate to cathode-and-heater: p to k + h.....	4.0	μf

MAXIMUM RATINGS (Design maximum values unless noted)

TV Dampener Service*

Plate voltage, peak inverse.....	2000	volts
Plate current, d-c.....	75	ma
Plate current, peak steady-state.....	450	ma
Plate dissipation.....	3.0	watts

AVERAGE CHARACTERISTICS

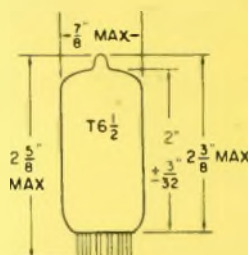
Tube voltage drop at 140 ma.....	22	volts
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NOTE:

*Voltage pulse duration must not exceed 10 μs in a 525-line, 30-frame system.

ENGINEERING DESIGN DATA

17H3 (cont.)



PIN CONNECTIONS

Pin 1.....	Cathode
Pin 2.....	N. C.
Pin 3.....	Plate
Pin 4.....	Heater
Pin 5.....	Heater
Pin 6.....	N. C.
Pin 7.....	N. C.
Pin 8.....	Plate
Pin 9.....	N. C.

APPLICATION

Type 17H3 is a miniature half-wave diode with a heater that is warm-up time controlled, designed for use as a damping diode in the horizontal deflection circuit of series-string television receivers.



17L6GT



Audio power output tube in TV receivers, heater warm-up time controlled for series strings

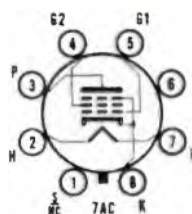
HEATER CHARACTERISTICS

Voltage, a-c or d-c.....	16.8	volts
Current.....	450	ma
Peak heater-cathode voltage, max.		
Heater negative to cathode.....	300	volts
Heater positive to cathode*.....	200	volts
Warm-up time.....	11	secs. average

(See Series-String Heaters section of APPENDIX in CBS Tube Manual).

*D-c component must not exceed 100 volts max.

Type 17L6GT is identical to types 12L6GT, 25L6GT, and 50L6GT except for heater characteristics. See type 12L6GT for ratings and operating characteristics.



17L6GT

JUNE 1, 1957

Beam power pentode

CHARACTERISTIC CURVES

(In curve section following APPENDIX)

Plate ($E_{c2} = 110\text{V}$).....162A

Plate; ΔE_{c2} ($E_{c1} = 0\text{V}$).....162B

Operation; P_o , Distortion.....162C

APPLICATION

Type 17L6GT is a beam power pentode designed as an audio power output tube in TV receivers with warm-up time controlled 450-ma series-string circuits.

18

(See chart for seldom-used tubes)

CBS ELECTRON TUBES

ENGINEERING DESIGN DATA

18A5

JUNE 1, 1957

Beam power pentode

CHARACTERISTIC CURVES

(In curve section following APPENDIX)

Plate (ΔE_{c2}) 206A

Plate ($E_{c2} = 125V$) 206B

Transfer; E_{c1} & I_b ($E_b = 200V$) 206C

Transfer; E_{c1} & I_{c2} ($E_b = 200V$) 206D

MECHANICAL DATA

Cathode, coated unipotential

Bulb T-9

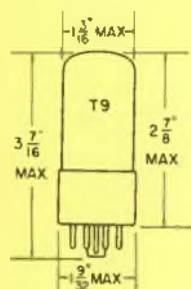
Outline JEDEC 9-15 or 9-43

Base, intermediate shell octal (B6-8) or

short intermediate shell octal (B6-60)

Basing 6CK

Mounting position Any



PIN CONNECTIONS

Pin 1	Grid 1
Pin 2	Heater
Pin 3	Cathode, B. P.
Pin 5	Plate
Pin 7	Heater
Pin 8	Grid 2

APPLICATION

Type 18A5 is a beam power pentode designed for use as a horizontal deflection amplifier in heater warm-up time controlled series-string circuits. It is especially suited to small portable a-c/d-c TV receivers.



18A5



**Horizontal deflection amplifier for TV receivers,
heater warm-up time controlled for series string circuits**

HEATER CHARACTERISTICS

Voltage, a-c or d-c 18.5 volts

Current 0.30 amp

Peak heater-cathode voltage, max.

Heater negative to

cathode 200 volts

Heater positive to

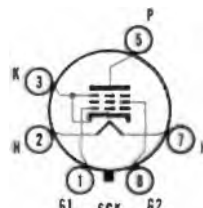
cathode* 200 volts

Warm-up time 11 secs. average

(See Series-String Heaters section of

APPENDIX in CBS Tube Manual).

*D-c component must not exceed 100 volts max.



ELECTRICAL DATA

DIRECT INTERELECTRODE CAPACITANCES

Grid to plate: g1 to p 0.7 μf

Input: g1 to k + h + g2 + b.p. 13.0 μf

Output: p to k + h + g2 + b.p. 7.0 μf

MAXIMUM RATINGS (Design maximum values unless noted)

Horizontal Deflection Amplifier*

Plate supply voltage, d-c (boost + d-c power supply) ... 350 volts

Plate voltage, peak pos. (absolute max.) 3000 volts

Plate voltage, peak negative pulse 600 volts

Grid 2 voltage, d-c 160 volts

Grid 1 voltage, peak negative 250 volts

Plate dissipation† 9.0 watts

Grid 2 dissipation 2.5 watts

Cathode current, average 90 ma

Cathode current, peak 310 ma

Grid 1 circuit resistance 1.0 meg

Bulb temperature at hottest point 190 °C

AVERAGE CHARACTERISTICS

Plate voltage 60 200 volts

Grid 2 (screen) voltage 125 125 volts

Grid 1 (control-grid) voltage 0‡ -17 volts

Plate resistance (approx.) 27,000 ohms

Transconductance 4800 $\mu mhos$

Plate current 165 40 ma

Grid 2 current 15 1.1 ma

Grid 1 voltage (approx.) for $I_b = 1.0$ ma -36 volts

Triode Connected

Plate and grid 2 voltage (p + g2 tied together) 125 volts

Grid 1 voltage -17 volts

Amplification factor 4.6

NOTES:

*Voltage pulse duration must not exceed 10 μs in a 525-line, 30-frame system.

†Tube protection is needed for no-drive conditions if grid-resistor bias is used.

‡Applied only for 2 seconds maximum so as not to damage tube.



19AU4GT

19AU4GTA



Damper diode in horizontal deflection circuits of TV receivers, heater warm-up controlled for series strings

HEATER CHARACTERISTICS

Voltage, a-c or d-c.....	18.9 volts
Current.....	600 ma
Peak heater-cathode voltage, max.	
Heater negative to cathode.....	4500 volts
Heater positive to cathode*.....	300 volts

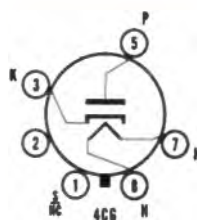
19AU4GTA

Warm-up time..... 11 secs. average
(See Series-String Heaters section of APPENDIX in CBS Tube Manual).

†D-c component must not exceed 900 volts.

*D-c component must not exceed 100 volts.

Types 19AU4GT and 19AU4GTA are identical to types 6AU4GT and 6AU4GTA, respectively, except for heater characteristics.



19AU4GT

19AU4GTA

JANUARY 3, 1957

Single diode

CHARACTERISTIC CURVES

(In curve section following APPENDIX)

Plate..... 164A

APPLICATION

Types 19AU4GT and 19AU4GTA are damper diodes in the horizontal deflection circuits of television receivers with series-string circuits. The heater of both types is controlled for warm-up time to reduce destructive voltage surges in the heater string.



19BG6G

19BG6GA



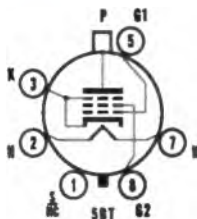
Horizontal deflection amplifier for television receiver sweep circuits

HEATER CHARACTERISTICS

Voltage, a-c or d-c.....	18.9 volts
Current.....	300 ma
Peak heater-cathode voltage, max.	
Heater negative to cathode.....	200 volts
Heater positive to cathode*.....	200 volts

*D-c component must not exceed 100 volts, max.

Types 19BG6G and 19BG6GA are identical to types 6BG6G and 6BG6GA, respectively, except for heater characteristics.



19BG6G

19BG6GA

JANUARY 3, 1957

Beam power pentode

CHARACTERISTIC CURVES

(In curve section following APPENDIX)

Plate ($E_{c2} = 250V$)..... 108A

Plate (ΔE_{c2})..... 108B

Transfer ($E_b = 350V$)..... 108C

Transfer ($E_b = 350V$)..... 108D

APPLICATION

Types 19BG6G and 19BG6GA are designed for service in the horizontal sweep circuit of television receivers. Their plate leads are brought out to the top cap for high voltage insulation.

19C8

(See chart for seldom-used tubes)

19J6

JANUARY 3, 1957

**Medium- μ
duotriode**

CHARACTERISTIC CURVES

(In curve section following APPENDIX)

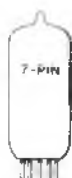
Plate.....	146A
Plate.....	146B
Transfer.....	146C
Characteristics, g_m , f_p , μ	146D

APPLICATION

Type 19J6 is a medium- μ duotriode capable of operating at high frequencies. Either section may be used as an oscillator in the vhf region, while the other may be operated as a mixer. With its plates in parallel in a push-pull grid circuit, it can function up to 600 mc as a mixer.



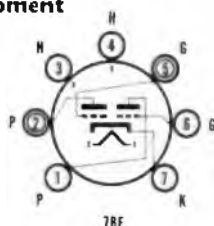
19J6



**Vhf oscillator, amplifier, or mixer used in
series string heater equipment**

HEATER CHARACTERISTICS

Voltage, a-c or d-c.....	18.9 volts
Current.....	150 ma
Peak heater-cathode voltage, max.	
Heater negative to cathode.....	90 volts
Heater positive to cathode.....	90 volts



Type 19J6 is identical to type 5J6 and 6J6 except for heater characteristics. See type 5J6 for ratings and characteristics.



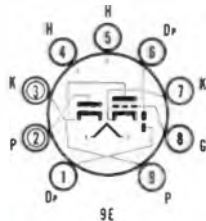
19T8



Combined a-m, f-m detector and audio amplifier

HEATER CHARACTERISTICS

Voltage, a-c or d-c.....	18.9 volts
Current.....	150 ma
Peak heater-cathode voltage, max.	
Heater negative to cathode.....	90 volts
Heater positive to cathode.....	90 volts



Type 19T8 is identical to type 5T8 and 6T8 except for heater characteristics. See type 5T8 for ratings and characteristics.

19T8

JANUARY 3, 1957

Triple diode—triode

CHARACTERISTIC CURVES

(In curve section following APPENDIX)

Plate, triode.....	147A
Transfer.....	147B
Characteristics; f_p , g_m , μ	147C
Operation, diode.....	147D

APPLICATION

Type 19T8 is a triple diode—triode designed to function as a combined a-m, f-m detector and audio voltage amplifier.

19V8 • 19X8 • 20 • 22 • 24A • 25 25A6/G/GT • 25A7GT 25AC5GT

(See chart for seldom-used tubes)



25AV5GT

25AV5GA



Horizontal deflection amplifier for television receiver sweep circuits

HEATER CHARACTERISTICS

Voltage, a-c or d-c. 25.0 volts
Current. 300 ma

Peak heater-cathode voltage, max.

Heater negative to cathode 200 volts

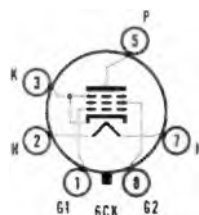
Heater positive to cathode*. 200 volts

*D-c component must not exceed 100 volts max.

25AV5GA

Warm-up time 11 secs. average
(See Series-String Heaters section of APPENDIX in CBS Tube Manual).

Types 25AV5GA and 25AV5GT are identical to types 6AV5GA and 6AV5GT, respectively, except for heater characteristics.



ENGINEERING DESIGN DATA

25AV5GT

25AV5GA

JANUARY 3, 1957

Beam power pentode

CHARACTERISTIC CURVES

(In curve section following APPENDIX)

Plate ($E_{c2} = 100V$) 105A

Plate ($E_{c2} = 150V$) 105B

APPLICATION

Types 25AV5GA and 25AV5GT are horizontal deflection amplifiers designed for operation in 300-ma series-string heater television receivers.



25AX4GT



Damper diode for television horizontal sweep circuits

HEATER CHARACTERISTICS

Voltage, a-c or d-c. 25.0 volts
Current. 300 ma

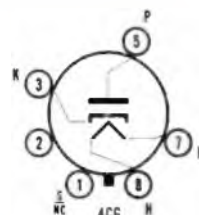
Peak heater-cathode voltage, max.*

Heater negative to cathode 4000 volts

Heater positive to cathode 100 volts

*Voltage pulse duration must not exceed 10 μ s in a 525 line, 30-frame system.

Type 25AX4GT is identical to types 6AX4GT and 12AX4GT except for heater characteristics. See type 6AX4GT for ratings and characteristics.



25AX4GT

JANUARY 3, 1957

Single diode

CHARACTERISTIC CURVES

(In curve section following APPENDIX)

Plate 164A

APPLICATION

Type 25AX4GT is a single, indirectly heated half-wave rectifier intended for use in television horizontal sweep circuits as the damper diode.

25B5 • 25B6G • 25B8

(See chart for seldom-used tubes)

ENGINEERING DESIGN DATA

25BK5

JANUARY 3, 1957

Beam power pentode

CHARACTERISTIC CURVES

In curve section following APPENDIX)

Plate ($E_{c2} = 250V$).....	172A
Plate (ΔE_{c2}).....	172B
Transfer; I_b ($E_b = 250V$).....	172C
Transfer; I_{c2} ($E_b = 250V$).....	172D

APPLICATION

Type 25BK5 is a beam power pentode designed for use as an audio power amplifier where driving voltage is limited.



25BK5

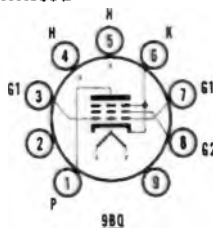


General purpose power amplifier for service where driving voltage is limited

HEATER CHARACTERISTICS

Voltage, a-c or d-c.....	25 volts
Current.....	300 ma
Peak heater-cathode voltage, max.	
Heater negative to cathode.....	100 volts
Heater positive to cathode*.....	100 volts

*D-c component must not exceed 100 volts max.



Type 25BK5 is identical to types 6BK5, 12BK5, and 50BK5 except for heater characteristics. See type 6BK5 for ratings and characteristics.

25BQ6GT

25BQ6GA • 25BQ6GTB

JANUARY 3, 1957

Beam power pentode

CHARACTERISTIC CURVES

In curve section following APPENDIX)

Plate ($E_{c2} = 100V$).....	105A
Plate ($E_{c2} = 150V$).....	105B

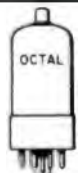
APPLICATION

These types are beam power pentodes used as horizontal deflection amplifiers in television receivers with 300-ma series-heating heater circuits. For 600-ma series-heating types 12BQ6GA, 12BQ6GT, or 25BQ6GTB can be used.



25BQ6GT

25BQ6GA • 25BQ6GTB

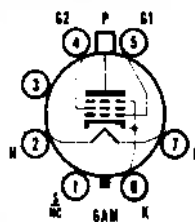


Horizontal deflection amplifier for television receivers

HEATER CHARACTERISTICS

Voltage, a-c or d-c.....	25.0 volts
Current.....	300 ma
Peak heater-cathode voltage, max.	
Heater negative to cathode.....	200 volts
Heater positive to cathode*.....	200 volts

*D-c component must not exceed 100 volts max.



Types 25BQ6GA, 25BQ6GT, and 25BQ6GTB are identical to types 6BQ6GA, 6BQ6GT, and 6BQ6GTB, respectively, except for heater characteristics.

25C5

JANUARY 10, 1957

Beam power pentode

CHARACTERISTIC CURVES

In curve section following APPENDIX)

Plate ($E_{c2} = 110V$).....	191A
Plate ($E_{c2} = 110V$).....	191B

APPLICATION

Type 25C5 is a beam power pentode designed for operation as an audio frequency power output tube in a-c/d-c radio receivers, except for its heater characteristics, it is identical to types 12C5 and 50C5.



25C5

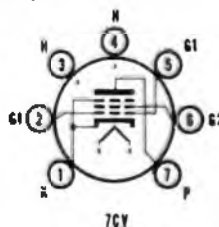


Audio power output amplifier in a-c/d-c receivers

HEATER CHARACTERISTICS

Voltage, a-c or d-c.....	25 volts
Current.....	300 ma
Peak heater-cathode voltage, max.	
Heater negative to cathode.....	200 volts
Heater positive to cathode*.....	200 volts

*D-c component must not exceed 100 volts max.



Type 25C5 is identical to types 12C5 and 50C5 except for heater characteristics. See type 12C5 for ratings and characteristics.

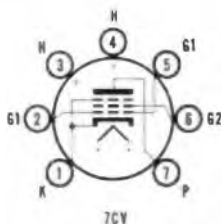
CBS ELECTRON TUBES

CBS**25CA5**

**A-f power amplifier with high output from
a low B supply voltage**

HEATER CHARACTERISTICS

Voltage, a-c or d-c.....	25.0 volts
Current.....	300 ma
Peak heater-cathode voltage, max.	
Heater negative to cathode.....	200 volts
Heater positive to cathode*.....	200 volts
*D-c component must not exceed 100 volts max.	



Type 25CA5 is identical to type 6CA5 and 12CA5 except for heater characteristics. See type 6CA5 for ratings and characteristics.

**ENGINEERING
DESIGN DATA****25CA5**

NOVEMBER 1, 1956

Beam power pentode**CHARACTERISTIC CURVES**

(In curve section following APPENDIX)

Plate ($E_{c2} = 125V$).....178APlate; ΔE_{c2} ($E_{c1} = 0V$).....178BTransfer; I_b, I_{c2} ($E_{c1} = 0V$).....178COperation; ($E_b = E_{c2} = 125V$) $E_{c1} = -4.5V$178DOperation; ($E_b = E_{c2} = 110V$) $E_{c1} = -4.0V$178E**APPLICATION**

Type 25CA5 is a beam power pentode designed to function as an a-f power amplifier with high output from a low B supply. It is identical to types 6CA5 and 12CA5 except for heater characteristics.

CBS**25CD6G**
25CD6GA
25CD6GB


**High efficiency horizontal deflection amplifier for
television receivers, heater warm-up controlled
for series strings**

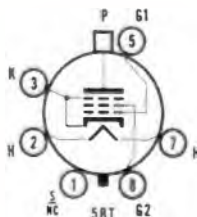
HEATER CHARACTERISTICS

Voltage, a-c or d-c.....	25.0 volts
Current.....	600 ma
Peak heater-cathode voltage, max.	
Heater negative to cathode.....	200 volts
Heater positive to cathode*.....	200 volts
*D-c component must not exceed 100 volts max.	

25CD6GA and 25CD6GB

Warm-up time 11 secs. average
(See Series-String Heaters section of
APPENDIX in CBS Tube Manual).

Types 25CD6G and 25CD6GA are identical to type 6CD6G except for heater characteristics. Type 25CD6GB is identical to type 6CD6GA except for heater characteristics.

**25CD6G**
25CD6GA
25CD6GB

JANUARY 3, 1957

Beam power pentode**CHARACTERISTIC CURVES**

(In curve section following APPENDIX)

Plate ($E_{c2} = 150V$).....107APlate; E_{c2} ($E_{c1} = 0V$).....107B**APPLICATION**

These types are beam power pentodes designed basically for use as high efficiency horizontal deflection amplifiers in television receivers having large-deflection-angle picture tubes. They are intended for series heater strings, but the 25CD6GA and 25CD6GB have controlled warm-up time to minimize heater voltage surges in the string when used with other controlled tubes.

ENGINEERING DESIGN DATA

25CU6

JANUARY 3, 1957

Beam power pentode

CHARACTERISTIC CURVES

(In curve section following APPENDIX)

Plate ($E_{c2} = 100V$) 105A

Plate ($E_{c2} = 150V$) 105B

APPLICATION

Type 25CU6 is a beam power pentode used as a horizontal deflection output tube in television receivers having series-string circuits.



25CU6



Horizontal deflection output tube for television receivers with 300-ma series string heater circuits

HEATER CHARACTERISTICS

Voltage, a-c or d-c 25.0 volts

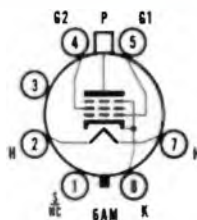
Current 300 ma

Peak heater-cathode voltage, max.

Heater negative to cathode 200 volts

Heater positive to cathode* 200 volts

*D-c component must not exceed 100 volts max.



Type 25CU6 is identical to types 6CU6 and 12CU6 except for heater characteristics. See type 6CU6 for ratings and characteristics.

25D8GT

(See chart for seldom-used tubes)

25DN6

JANUARY 3, 1957

Beam power pentode

CHARACTERISTIC CURVES

(In curve section following APPENDIX)

Plate ($E_{c2} = 100V$) 187A

Plate; ΔE_{c2} ($E_{c1} = 0V$) 187B

Transfer; ΔE_{c2} ($E_b = 125V$) 187C

APPLICATION

Type 25DN6 is a beam power pentode designed to operate as a horizontal deflection amplifier in receivers that have extremely low B+ voltage supply. Its controlled warm-up time will minimize destructive heater voltage surges when used with other tubes having the same warm-up characteristic.



25DN6



Horizontal deflection amplifier with low-voltage, high-current characteristics, heater warm-up controlled for series strings

HEATER CHARACTERISTICS

Voltage, a-c or d-c 25.0 volts

Current 600 ma

Peak heater-cathode voltage, max.

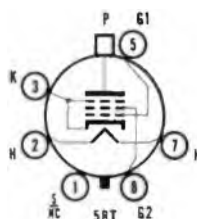
Heater negative to cathode 200 volts

Heater positive to cathode* 200 volts

Warm-up time 11 secs. average

(See Series-String Heaters section of APPENDIX in CBS Tube Manual).

*D-c component 100 volts max.



Type 25DN6 is identical to type 6DN6 except for heater characteristics.

CBS**25DQ6**

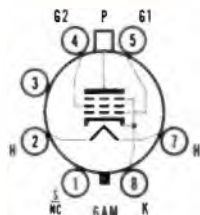
Horizontal deflection output amplifier with extremely high power sensitivity and high permeance

HEATER CHARACTERISTICS

Voltage, a-c or d-c	25.0 volts
Current	300 ma
Peak heater-cathode voltage, max.	
Heater negative to cathode	200 volts
Heater positive to cathode*	200 volts

*D-c component must not exceed 100 volts, max.

Type 25DQ6 is identical to types 6DQ6 and 12DQ6 except for heater characteristics. See type 6DQ6 for ratings and characteristics.

**CBS****25EC6**

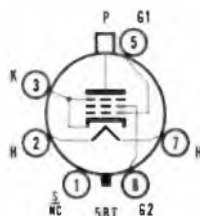
110° horizontal deflection amplifier for TV receivers, heater warm-up time controlled for series strings

HEATER CHARACTERISTICS

Voltage, a-c or d-c	25 volts
Current	0.6 amp
Peak heater-cathode voltage, max.	
Heater negative to cathode	200 volts
Heater positive to cathode*	200 volts
Warm-up time	11 secs. average

(See Series-String Heaters section of APPENDIX in CBS Tube Manual).

*D-c component must not exceed 100 volts max.

**ELECTRICAL DATA****DIRECT INTERELECTRODE CAPACITANCES**

Grid to plate: g1 to p	0.6	μf
Input: g1 to k + h + g2 + b.p.	24	μf
Output: p to k + h + g2 + b.p.	10	μf

MAXIMUM RATINGS (Design maximum values unless noted)**Horizontal Deflection Amplifier***

Plate supply voltage, d-c (boost + d-c power supply)	700 volts
Plate voltage, peak positive pulse	7000 volts
Plate voltage, peak negative pulse	1500 volts
Grid 2 voltage, d-c	175 volts
Grid 1 voltage, peak negative	300 volts
Plate dissipation†	10 watts
Grid 2 dissipation	4.0 watts
Cathode current, average	200 ma
Cathode current, peak	700 ma
Grid 1 circuit resistance, grid leak bias	1.5 meg
Bulb temperature at hottest point	225 °C

CBS ELECTRON TUBES**ENGINEERING DESIGN DATA****25DQ6**

JANUARY 3, 1957

Beam power pentode

CHARACTERISTIC CURVES
(In curve section following APPENDIX)
Plate ($E_{c2} = 100V$) 109A
Plate ($E_{c2} = 150V$) 109B

APPLICATION

Type 25DQ6 is a beam power pentode designed for operation as a horizontal deflection output amplifier in television receivers with 300-ma series heater circuits.

25EC6

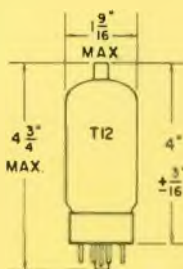
JUNE 1, 1957

Beam power pentode

CHARACTERISTIC CURVES
(In curve section following APPENDIX)
Plate ($E_{c2} = 135V$) 210A
Plate; ΔE_{c2} ($E_{c1} = 0V$) 210B
Transfer I_{c2} 210C
Transfer I_{c2} 210D

MECHANICAL DATA

Cathode, coated unipotential
Bulb T-12
Outline See outline drawing
Base Short medium shell octal (B8-110)
Basing 5BT
Cap JETEC C1-1
Mounting position Any

**PIN CONNECTIONS**

Pin 1	N. C.
Pin 2	Heater
Pin 3	Cathode, B. P.
Pin 4	N. C.
Pin 5	Grid 1
Pin 6	N. C.
Pin 7	Heater
Pin 8	Grid 2
Cap.	Plate

ENGINEERING DESIGN DATA

25EC6 (cont.)

REFERENCE

See explanation of warm-up time controlled series-string heaters in APPENDIX.

APPLICATION

Type 25EC6 is a beam power pentode designed for use as a horizontal deflection amplifier in TV receivers using 110° picture tubes. It features a warm-up time controlled heater. It has electrical characteristics similar to type 25CD6GB.

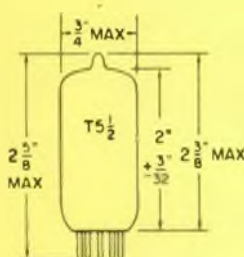
25F5

JUNE 1, 1957

Beam power pentode

MECHANICAL DATA

Cathode, coated unipotential
Bulb..... T-5½
Outline..... JEDEC 5-3
Base..... Miniature 7-pin (E7-1)
Basing..... 7CV
Mounting position..... Any



PIN CONNECTIONS

Pin 1..... Cathode
Pin 2..... Grid 1
Pin 3..... Heater
Pin 4..... Heater
Pin 5..... Grid 1
Pin 6..... Grid 2
Pin 7..... Plate

APPLICATION

Type 25F5 is a miniature beam power pentode designed for use as a power amplifier having high efficiency and sensitivity at the plate and screen voltages normally present in a-c/d-c receivers.

25EC6 (cont.)

AVERAGE CHARACTERISTICS

Plate voltage.....	60	135 volts
Grid 2 (screen) voltage.....	135	135 volts
Grid 1 (control-grid) voltage.....	0†	-22.5 volts
Plate resistance (approx.).....		4700 ohms
Transconductance.....		7500 μ hos
Plate current.....	350	70 ma
Grid 2 current.....	40	4.5 ma
Grid 1 voltage (approx.) for $I_b = 1.0$ ma.....		-42 volts
Triode amplification factor (μ + g2 tied together).....		3.8

NOTES:

*Voltage pulse duration must not exceed 10 μ s in a 525-line, 30-frame system.

†Tube protection is needed for no-drive conditions if grid-resistor bias is used.

‡Applied only for two seconds maximum so as not to damage tube.



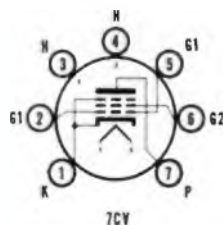
25F5



Beam power amplifier for a-c/d-c radio receivers

HEATER CHARACTERISTICS

Voltage, a-c or d-c.....	25 volts
Current.....	150 ma
Peak heater-cathode voltage, max.	
Heater negative to cathode.....	200 volts
Heater positive to cathode*.....	200 volts
*D-c component must not exceed 100 volts max.	



ELECTRICAL DATA

DIRECT INTERELECTRODE CAPACITANCES

Grid to plate: g1 to p.....	0.57 μ f
Input: g1 to k + h + g2 + b.p.....	12.0 μ f
Output: p to k + h + g2 + b.p.....	6.0 μ f

MAXIMUM RATINGS (Design center values)

Plate voltage.....	135 volts
Grid 2 voltage.....	117 volts
Plate dissipation.....	4.5 watts
Grid 1 circuit resistance	
Fixed bias.....	0.1 meg
Self bias.....	0.5 meg

CHARACTERISTICS AND TYPICAL OPERATION

Class A Amplifier	Single tube	Two tubes (Push pull)
Plate voltage.....	110	110 volts
Grid 2 (screen) voltage.....	110	110 volts
Grid 1 (control-grid) voltage.....	-7.5	-8.0 volts
Plate resistance (approx.).....	16,000	ohms
Transconductance.....	5800	μ hos
Grid 1 input voltage, peak a-f.....	7.5	16½ volts
Plate current, zero signal.....	36	70 ma
Plate current, maximum signal.....	37	78 ma
Grid 2 current, zero signal.....	3.0	7.5 ma
Grid 2 current, maximum signal.....	7.0	13.6 ma
Load resistance impedance.....	2500	4500 ohms
Total harmonic distortion (approx.).....	10	2.6 %
Power output, maximum signal.....	1.2	2.9 watts

NOTE:

†Grid to grid.



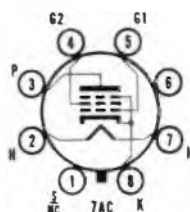
25L6GT



Audio power output amplifier

HEATER CHARACTERISTICS

Voltage, a-c or d-c.....	25.0 volts
Current.....	300 ma
Peak heater-cathode voltage, max.	
Heater negative to cathode.....	200 volts
Heater positive to cathode*.....	200 volts
*D-c component must not exceed 100 volts max.	



Type 25L6GT is identical to types 12L6GT and 50L6GT except for heater characteristics. See type 12L6GT for ratings and characteristics.

ENGINEERING DESIGN DATA

25L6GT

JANUARY 3, 1957

Beam power pentode

CHARACTERISTICS CURVES

(In curve section following APPENDIX)

Plate ($E_{c2} = 110V$).....162A

Plate; E_{c2} , ($E_{c1} = 0V$).....162B

Operation; P_o , Distortion.....162C

APPLICATION

Type 25L6GT is a beam power pentode designed for operation in the audio frequency power output stage of a-c/d-c radio receivers and series-string television receivers.

25N6G • 25Y5

(See chart for seldom-used tubes)

ENGINEERING DESIGN DATA

25W4GT

JANUARY 3, 1957

Single diode

CHARACTERISTIC CURVES
(In curve section following APPENDIX)
Plate $\dots\dots\dots$ 164A

APPLICATION

Type 25W4GT is a damper diode used in the horizontal sweep circuits of television receivers employing 300-ma series heater strings



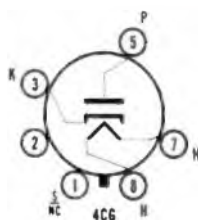
25W4GT



**Damper diode in horizontal sweep circuits
of television receivers**

HEATER CHARACTERISTICS

Voltage, a-c or d-c $\dots\dots\dots$ 25.0 volts
Current $\dots\dots\dots$ 300 ma
Peak heater-cathode voltage, max.†
Heater negative to cathode $\dots\dots\dots$ 500 volts
Heater positive to cathode* $\dots\dots\dots$ 200 volts
*D-c component must not exceed 100 volts, max.
†Voltage pulse duration must not exceed 10 μ s in a 525, 30-frame system.



Type 25W4GT is identical to type 6W4GT except for heater characteristics and capacitances. Direct interelectrode capacitances are not specified by RETMA for the 25W4GT.

25W6GT • 25Z5

(See chart for seldom-used tubes)

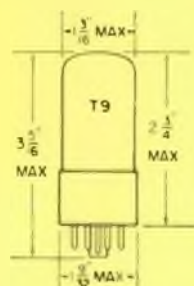
25Z6GT

JANUARY 10, 1957

Double diode

MECHANICAL DATA

Cathode, coated unipotential
Bulb $\dots\dots\dots$ T-9
Outline $\dots\dots\dots$ JETEC 9-11
Base $\dots\dots$ Intermediate shell octal (B7-6)
Basing $\dots\dots\dots$ 7Q
Mounting position $\dots\dots\dots$ Any



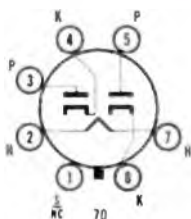
25Z6GT



H-w rectifier or voltage doubler for a-c/d-c receivers

HEATER CHARACTERISTICS

Voltage, a-c or d-c $\dots\dots\dots$ 25.0 volts
Current $\dots\dots\dots$ 0.3 amp
Peak heater-cathode voltage, max. $\dots\dots\dots$ 350 volts



ELECTRICAL DATA

MAXIMUM RATINGS (Design center values)

Rectifier or Doubler Service

Plate voltage, peak inverse $\dots\dots\dots$ 700 volts
Output current, d-c $\dots\dots\dots$ 0.075 amp
Plate current, peak steady state (each plate) $\dots\dots\dots$ 0.45 amp

CHARACTERISTICS

Tube Voltage Drop

Conducting 150 ma (each plate) $\dots\dots\dots$ 22 volts

TYPICAL OPERATION

Half-Wave Rectifier (Capacitor Input Filter)

Plate supply voltage, rms (each plate) $\dots\dots\dots$ 117 $\dots\dots\dots$ 235 volts
Plate supply resistance (each plate)† $\dots\dots\dots$ 15 $\dots\dots\dots$ 100 ohms
Filter input capacitor $\dots\dots\dots$ 16 $\dots\dots\dots$ 16 μ f
Output current, d-c (each plate) $\dots\dots\dots$ 75 $\dots\dots\dots$ 75 ma
Output voltage at filter input, d-c $\dots\dots\dots$ 115 $\dots\dots\dots$ 255 volts

CBS ELECTRON TUBES

25Z6GT (cont.)

TYPICAL OPERATION

Voltage Doubler

	Half-Wave	Full-Wave
Plate supply voltage, rms (each plate)	117	117 volts
Filter input capacitor	16	16 μ f
Plate supply impedance (each plate)	30	15 ohms
Output current, d-c	75	75 ma
Output voltage at filter input, d-c		250 volts
At half-load current of 37.5 ma		205 volts
At full-load current of 75 ma		

NOTES:

*As a half-wave rectifier the two sections may be used separately or in parallel.

†When filter capacitors larger than 40 μ f are used it may be necessary to increase plate supply resistance above the value given.

ENGINEERING DESIGN DATA

25Z6GT (cont.)

PIN CONNECTIONS

Pin 1	Heater
Pin 2	Plate (Sect. 2)
Pin 3	Cathode (Sect. 2)
Pin 4	Cathode (Sect. 1)
Pin 5	Plate (Sect. 1)
Pin 6	Heater

APPLICATION

Type 25Z6GT is used in a-c d-c receivers as the power rectifier. Having separate cathodes for its two sections, it may be used in voltage doubler circuits.

**26 • 26A6 • 26A7 • 26C6 • 26D6
27 • 28Z5 • 30 • 31 • 32 • 32L7GT
33 • 34 • 35/51 • 35A5**

(See chart for seldom-used tubes)



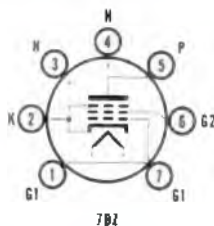
35B5



Beam power amplifier for a-c/d-c radio receivers

HEATER CHARACTERISTICS

Voltage, a-c or d-c	35 volts
Current	150 ma
Peak heater-cathode voltage, max.	
Heater negative to cathode	180 volts
Heater positive to cathode	180 volts



Type 35B5 is identical to type 35C5 except for basing and direct interelectrode capacitances.

DIRECT INTERELECTRODE CAPACITANCES

Grid to plate: g1 to p	0.7 μ f
Input: g1 to k + h + g2 + b.p.	12 μ f
Output: p to k + h + g2 + b.p.	9 μ f

35B5

JANUARY 10, 1957

Beam power pentode

CHARACTERISTICS CURVES

(In curve section following APPENDIX)

Plate, b_1 , b_2 ($E_{c2} = 110V$) 195A

Operation ($E_b = E_{c2} = 110V$) 195B

APPLICATION

Type 35B5 is a beam power pentode for use as a power amplifier in a-c d-c radio receivers. It is identical to type 35C5 except for basing and direct interelectrode capacitances, and electrically similar to type 35L6.

ENGINEERING DESIGN DATA

35C5

JANUARY 10, 1957

Beam power pentode

CHARACTERISTIC CURVES

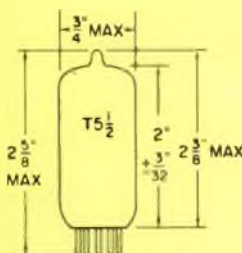
(In curve section following APPENDIX)

Plate, I_b , I_{c2} ($E_{c2}=110V$)..... 195A

Operation ($E_b=E_{c2}=110V$)..... 195B

MECHANICAL DATA

Cathode, coated unipotential
Bulb..... T-5½
Outline..... JETEC 5-3
Base..... Miniature 7-pin (E7-1)
Basing..... 7CV
Mounting position..... Any



PIN CONNECTIONS

Pin 1..... Cathode, B. P.
Pin 2..... Grid 1
Pin 3..... Heater
Pin 4..... Heater
Pin 5..... Grid 1
Pin 6..... Grid 2
Pin 7..... Plate

APPLICATION

Type 35C5 is a beam power pentode designed for operation as a power amplifier in a-c/d-c radio receivers. It is electrically similar to type 35L6, and identical to type 35B5 except for basing and direct inter-electrode capacitances. It has high sensitivity and provides high audio power output in a-c/d-c radio service.

35L6GT

JANUARY 10, 1957

Beam power pentode

CHARACTERISTIC CURVES

(In curve section following APPENDIX)

Plate, I_b , I_{c2} ($E_{c2}=110V$)..... 195A

Operation ($E_b=E_{c2}=110V$)..... 195B

Operation ($E_b=200V$, $E_{c2}=110V$)..... 196A



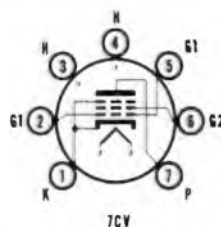
35C5



Beam power amplifier for a-c/d-c radio receivers

HEATER CHARACTERISTICS

Voltage, a-c or d-c..... 35 volts
Current..... 150 ma
Peak heater-cathode voltage, max.
Heater negative to cathode 180 volts
Heater positive to cathode 180 volts



ELECTRICAL DATA

DIRECT INTERELECTRODE CAPACITANCES

Grid to plate: g1 to p..... 0.60 μf
Input: g1 to k + h + g2 + b.p..... 12 μf
Output: p to k + h + g2 + b.p..... 9.0 μf

MAXIMUM RATINGS (Design center values)

Plate voltage..... 135 volts
Grid 2 voltage..... 117 volts
Plate dissipation..... 4.5 watts
Grid 2 dissipation..... 1.0 watts
Grid 1 circuit resistance
Fixed bias..... 0.1 meg
Self bias..... 0.5 meg
Bulb temperature at hottest point..... 250 °C

CHARACTERISTICS AND TYPICAL OPERATION

Class A Amplifier

Plate voltage..... 110 volts
Grid 2 (screen) voltage..... 110 volts
Grid 1 (control-grid) voltage..... -7.5 volts
Transconductance..... 5800 $\mu mhos$
Grid 1 input voltage, peak a-f..... 7.5 volts
Plate current, zero signal..... 40 ma
Plate current, maximum signal..... 41 ma
Grid 2 current, zero signal..... 3 ma
Grid 2 current, maximum signal..... 7 ma
Load resistance impedance..... 2500 ohms
Total harmonic distortion (approx.)..... 10 %
Power output, maximum signal..... 1.5 watts



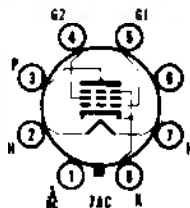
35L6GT



Beam power amplifier for a-c/d-c radio receivers

HEATER CHARACTERISTICS

Voltage, a-c or d-c..... 35.0 volts
Current..... 150 ma
Peak heater-cathode voltage, max..... 90 volts



CBS ELECTRON TUBES

35L6GT (cont.)

ELECTRICAL DATA

MAXIMUM RATINGS (Design center values)

Plate voltage	200 volts
Grid 2 voltage	125 volts
Plate dissipation	8.5 watts
Grid 2 dissipation	1.0 watts
Grid circuit resistance	
Fixed bias	0.1 meg
Self bias	0.5 meg

CHARACTERISTICS AND TYPICAL OPERATION

Class A Amplifier

Plate voltage	110	200 volts
Grid 2 (screen) voltage	110	125 volts
Grid 1 (control-grid) voltage	-7.5	0 volts
Cathode bias resistor	0	180 ohms
Plate resistance (approx.)	14,000	34,000 ohms
Transconductance	5800	6100 μ mhos
Grid 1 input voltage, peak a-f	7.5	8.0 volts
Plate current, zero signal	40	43 ma
Plate current, maximum signal	41	43 ma
Grid 2 current, zero signal	3.0	2.0 ma
Grid 2 current, maximum signal	7.0	5.5 ma
Load resistance impedance	2500	5000 ohms
Total harmonic distortion (approx.)	10	10 %
Power output, maximum signal	1.5	3.0 watts



35W4

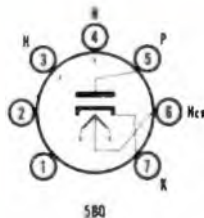


Half-wave rectifier for a-c/d-c radio receivers

HEATER CHARACTERISTICS

Voltage, a-c or d-c*	35 volts
Current*	150 ma
Peak heater-cathode voltage, max.	
Heater negative to cathode	330 volts
Heater positive to cathode	330 volts

*Value given for operation without panel lamp. For values with panel lamp, refer to Typical Operation.



ELECTRICAL DATA

MAXIMUM RATINGS (Design center values)

Half-Wave Rectifier Service

Plate voltage, peak inverse	330 volts
Plate current, peak steady state	600 ma
Output current, d-c	
With panel lamp but no shunting resistor	60 ma
With panel lamp and a shunting resistor*	90 ma
Without panel lamp	100 ma
Panel lamp voltage, rms	
When panel lamp fails	15 volts

CHARACTERISTICS

Tube Voltage Drop

Conducting 200 ma at plate	18 volts
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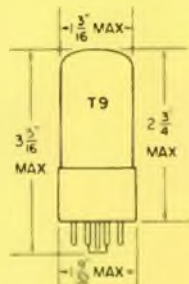
CBS ELECTRON TUBES

ENGINEERING DESIGN DATA

35L6GT (cont.)

MECHANICAL DATA

Cathode, coated unipotential	
Bulb	T-9
Outline	JETEC 9-11 or 9-41
Base	Short or intermediate shell octal (B7-58 or B7-6)
Basing	7AC
Mounting position	Any



PIN CONNECTIONS

Pin 1	N. C.
Pin 2	Heater
Pin 3	Plate
Pin 4	Grid 2
Pin 5	Grid 1
Pin 7	Heater
Pin 8	Cathode, Grid 3

APPLICATION

Type 35L6GT is a beam power pentode designed for use as a power amplifier in a-c d-c radio receivers. Electrically, it is similar to type 35C5.

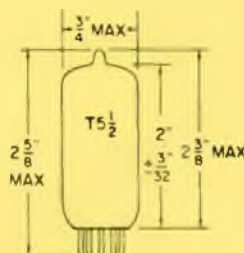
35W4

JANUARY 10, 1957

Single diode

MECHANICAL DATA

Cathode, coated unipotential	
Bulb	T-5 1/2
Outline	JETEC 5-3
Base	Miniature 7-pin (E7-1)
Basing	5BQ
Mounting position	Any



ENGINEERING DESIGN DATA

35W4 (cont.)

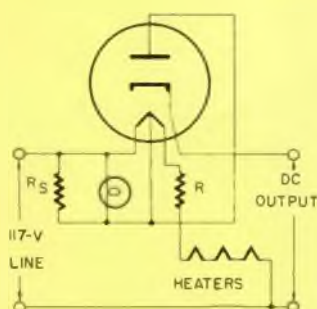
PIN CONNECTIONS[▲]

Pin 1	 N. C.
Pin 2	 N. C.
Pin 3	 Heater
Pin 4	 Heater
Pin 5	 Plate
Pin 6	 Heater Tap
Pin 7	 Cathode

▲Panel lamp heater section is between pins 4 & 6.

APPLICATION

Type 35W4 is a half-wave rectifier for a-c d-c radio receivers. The diagram below shows the circuit and values when a panel lamp is used.



With the panel lamp connected as shown above, the drop across R_s and all heaters (with panel lamp) should equal 117 volts at 150 ma. The shunting resistor R_s is required when d-c output current exceeds 60 ma. Values of R_s for d-c output currents greater than 60 ma are given in tabulated data.

35Z5GT

JANUARY 10, 1957

Single diode

CHARACTERISTIC CURVES

(In curve section following APPENDIX)
Operation.....166A

MECHANICAL DATA

Cathode, coated unipotential
Bulb.....T-9
Outline.....JETEC 9-11 or 9-41
Base.....Intermediate shell octal (B6-8) or
Short intermediate shell octal (B6-4B)
Basing.....6AD
Mounting position.....Any

35W4 (cont.)

TYPICAL OPERATION

Capacitor Input Filter with No. 40 or No. 47 Panel Lamp

Heater voltage (pin 3 to pin 4)	32	32	32	32	volts
Heater tap voltage (pin 4 to pin 6)	5.5	5.5	5.5	5.5	volts
Heater current (between pins 3 and 6)	150	150	150	150	ma
Plate supply voltage, rms	117	117	117	117	volts
Filter input capacitor	40	40	40	40	μ f
Plate supply impedance	15	15	15	15	ohms
Panel lamp shunting resistor	300	150	100	100	ohms
Output current, d-c	60	70	80	80	ma

Capacitor Input without Panel Lamp†

Heater voltage (pin 3 to pin 4)	35	volts
Heater tap voltage (pin 4 to pin 6)	7.5	volts
Heater current (between pins 3 and 4)	150	ma
Plate supply voltage, rms	117	volts
Filter input capacitor	40	μ f
Plate supply impedance	15	ohms
Output current, d-c	100	ma
Output voltage at filter input, d-c		
At half-load current of 50 ma	140	volts
At full-load current of 100 ma	120	volts
Voltage regulation (approx.)		
Half-load to full-load current	20	volts

MAXIMUM CIRCUIT VALUES

Panel lamp shunting resistor*	
For d-c output current of 70 ma	800 ohms
For d-c output current of 80 ma	400 ohms
For d-c output current of 90 ma	250 ohms

NOTES:

*Required when d-c output current exceeds 60 ma.

†Plate current must not flow through tap section.

35Y4 • 35Z3

(See chart for seldom-used tubes)



35Z5GT

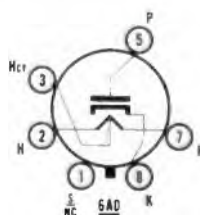


Half-wave rectifier for a-c/d-c radio receivers

HEATER CHARACTERISTICS

Voltage, a-c or d-c*	35	volts
Current*	150	ma
Peak heater-cathode voltage		
Heater negative to cathode	350	volts
Heater positive to cathode	350	volts

*Value given for operation without panel lamp. For values with panel lamp, refer to Typical Operation.



CBS ELECTRON TUBES

35Z5GT (cont.)

ELECTRICAL DATA

MAXIMUM RATINGS

With
No. 40 or
No. 47
Panel Lamp

Plate voltage, peak inverse	700	volts
Plate supply voltage, rms	235	volts
Plate current, peak steady state	600	ma
Output current, d-c		
With panel lamp but no shunting resistor	60	ma
With panel lamp and a shunting resistor	90	ma
Without panel lamp	100	ma
Panel lamp voltage, rms		
When panel lamp fails	15	volts
Panel lamp shunting resistor		
For d-c output current of 70 ma	800	ohms
For d-c output current of 80 ma	400	ohms
For d-c output current of 90 ma	250	ohms

CHARACTERISTICS

Tube Voltage Drop

Conducting 200 ma at plate	18	volts
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TYPICAL OPERATION

Capacitor Input Filter with No. 40 or No. 47 Panel Lamp

Heater voltage (pin 2 to pin 7)	32	32	32	32	volts
Heater tap voltage (pin 2 to pin 3)	5.5	5.5	5.5	5.5	volts
Heater current (between pins 3 and 7)	150	150	150	150	ma
Plate supply voltage, rms	117	117	117	117	volts
Filter input capacitor	40	40	40	40	μ f
Plate supply impedance	15	15	15	15	100 ohms
Panel lamp shunting resistor	300	150	100		ohms
Output current, d-c	60	70	80	90	ma

Capacitor Input without Panel Lamp†

Heater voltage (pin 2 to pin 7)	35	35	volts
Heater tap voltage (pin 2 to pin 3)	7.5	7.5	volts
Heater current (between pin 3 and 7)	150	150	ma
Plate supply voltage, rms	117	117	volts
Filter input capacitor	40	40	μ f
Plate supply impedance	15	15	100 ohms
Output voltage at filter input, d-c			
At half-load current of 50 ma	140	280	volts
At full-load current of 100 ma	120	235	volts
Difference in voltage regulation	20	45	volts
Percentage regulation	14	16	%
Output current, d-c	100	100	ma

MAXIMUM CIRCUIT VALUES

Panel lamp shunting resistor		
For d-c output current of 70 ma	800	ohms
For d-c output current of 80 ma	400	ohms
For d-c output current of 90 ma	250	ohms

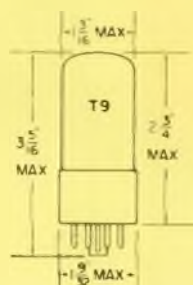
NOTES:

†Required when d-c output current exceeds 60 ma.

*Plate current must not flow through tap section.

ENGINEERING DESIGN DATA

35Z5GT (cont.)



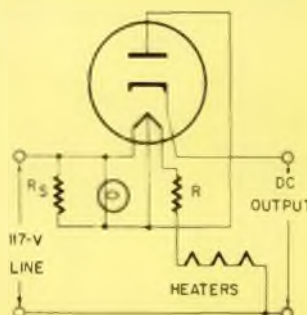
PIN CONNECTIONS

Pin 1	N.C.
Pin 2	Heater
Pin 3	Heater Center Tap
Pin 4	Plate
Pin 5	Heater
Pin 6	Heater
Pin 7	Heater
Pin 8	Cathode
Pin 9	Cathode

▲Panel lamp heater section is between pins 2 & 3.

APPLICATION

Type 35Z5GT is a single diode used as a half-wave rectifier for a-c-d-c radio receivers. The diagram below shows the circuit and values when a panel lamp is used.



With the panel lamp connected as shown above, the drop across R and all heaters (with panel lamp) should equal 117 volts at 150 ma. The shunting resistor R_s is required when d-c output current exceeds 60 ma. Values of R_s for d-c output currents greater than 60 ma are given in the tabulated data.

35Z6GT•36•37•38•39/44•40
40Z5/45Z5GT•41•42•43•44
45•45A•45Z3•46•47•48•49
50•50A5•50AX6G

(See chart for seldom-used tubes)

ENGINEERING DESIGN DATA

50B5

JANUARY 10, 1957

Beam power pentode

CHARACTERISTIC CURVES

(In curve section following APPENDIX)

Plate ($E_{c2} = 110V$).....191A

Operation ($E_b = E_{c2} = 110V$).....191B

NOTES

Type 50B5 is a beam power pentode designed for use as an audio power output amplifier in a-c/d-c receivers. It belongs to the family types consisting of the 12C5, 25C5, 35B5, 35C5, and 50B5. They are miniature types with bulb specifications as given under the 12C5 data.



50B5



Beam power amplifier for a-c/d-c radio receivers

HEATER CHARACTERISTICS

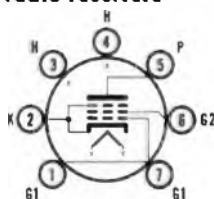
Voltage, a-c or d-c..... 50 volts

Current..... 150 ma

Peak heater-cathode voltage, max.

Heater negative to cathode 90 volts

Heater positive to cathode 90 volts



7BZ

Type 50B5 is identical to type 50C5 except for basing, and to type 12C5 except for basing and heater characteristics. See type 12C5 for ratings and characteristics.

50C5

FEBRUARY 25, 1957

Beam power pentode

CHARACTERISTIC CURVES

(In curve section following APPENDIX)

Plate ($E_{c2} = 110V$).....191A

Operation ($E_b = E_{c2} = 110V$).....191B

NOTES

Type 50C5 is a beam power pentode designed for operation as an audio frequency power output tube. Except for its heater characteristics, it is identical to types 12C5 and 25C5. They are miniature types with bulb specifications as given under the 12C5 data.



50C5



Audio power output amplifier in a-c/d-c receivers

HEATER CHARACTERISTICS

Voltage, a-c or d-c..... 50 volts

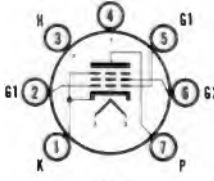
Current..... 150 ma

Peak heater-cathode voltage, max.

Heater negative to cathode..... 200 volts

Heater positive to cathode*..... 200 volts

*D-c component must not exceed 100 volts max.



12CV

Type 50C5 is identical to type 12C5 and 25C5 except for heater characteristics and capacitances. See type 12C5 for ratings and characteristics.

50C6G

(See chart for seldom-used tubes)



50L6GT



Beam power amplifier for a-c/d-c radio receivers

HEATER CHARACTERISTICS

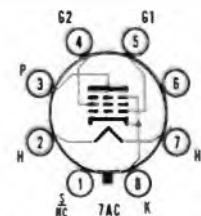
Voltage, a-c or d-c..... 50.0 volts

Current..... 150 ma

Peak heater-cathode voltage, max.

Heater negative to cathode 90 volts

Heater positive to cathode 90 volts



Type 50L6GT is identical to types 12L6GT and 25L6GT except for heater characteristics. See type 12L6GT for ratings and characteristics.

50L6GT

JANUARY 10, 1957

Beam power pentode

CHARACTERISTIC CURVES

(In curve section following APPENDIX)

Plate ($E_{c2} = 110V$).....162A

Plate; E_{c2} ($E_{c1} = 0V$).....162B

Operation; P_o , Distortion.....162C

NOTES

Type 50L6GT is a beam power pentode designed for operation in audio frequency power output stages. Mechanical data is the same as for type 12L6GT.

CBS ELECTRON TUBES



50DC4

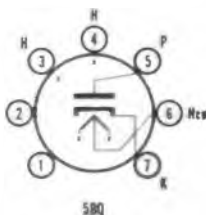


Half-wave power rectifier for a-c/d-c equipment

HEATER CHARACTERISTICS

Voltage, a-c or d-c ¹	50 volts
Tap voltage ²	7.5 volts
Current ³	0.15 amp
Peak heater-cathode voltage, max.	
Heater negative to cathode	330 volts
Heater positive to cathode	330 volts

¹Operation without panel lamp.



ELECTRICAL DATA

MAXIMUM RATINGS (Design maximum values)

Rectifier Service

Plate voltage, peak inverse	330 volts
Output current, d-c	
Without panel lamp	120 ma
With panel lamp and shunting resistor	110 ma
With panel lamp and no shunting resistor	70 ma
Plate current, peak steady state	0.72 amp
Heater tap voltage when panel lamp fails, rms	16.5 volts

CHARACTERISTIC

Tube Voltage Drop

Conducting 240 ma	21 volts
-------------------	----------

TYPICAL OPERATION

Half-wave Rectifier with Panel Lamp No. 40 or No. 47¹

Heater voltage (pin 3 to pin 4)	45	45	45	45 volts
Heater tap voltage (pin 4 to pin 6)	5.5	5.5	5.5	5.5 volts
Heater current between pins 3 and 6	150	150	150	150 ma
A-c plate supply voltage, rms	117	117	117	117 volts
Filter input capacitor	40	40	40	40 μ f
Total effective plate supply impedance	15	15	15	15 ohms
Panel lamp shunting resistor	450	200	100	75 ohms
D-c output current	70	80	90	100 ma

Half-wave Rectifier without Panel Lamp

Heater voltage (pin 3 to 4)	50 volts
Heater tap voltage (pin 4 to 6)	7.5 volts
Heater current between pins 3 and 4	150 ma
A-c plate supply voltage, rms	117 volts
Filter input capacitor	40 μ f
Total effective plate supply impedance	15 ohms
D-c output current	110 ma
D-c output voltage at filter input, approx.	
For d-c output current of 55 ma	130 volts
For d-c output current of 110 ma	110 volts

¹Typical current same as for tube type 35W4.

ENGINEERING DESIGN DATA

50DC4

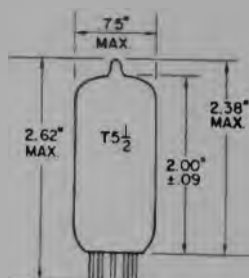
MARCH 30, 1959

Single diode

CHARACTERISTIC CURVES
(In curve section following APPENDIX)
Average plate 219A

MECHANICAL DATA

Cathode, coated unipotential	
Bulb	T-5 $\frac{1}{2}$
Outline	JETEC 5-3
Base	Miniature 7-pin (E7-1)
Basing	5BQ
Mounting position	Any



PIN CONNECTIONS

Pin 1	NC
Pin 2	NC
Pin 3	Heater
Pin 4	Heater
Pin 5	Plate
Pin 6	Heater tap
Pin 7	Cathode

APPLICATION

This miniature half-wave rectifier is designed for use in line-operated equipment having series-connected heaters. The heater is tapped to permit operation of a panel lamp.

ENGINEERING DESIGN DATA

50EH5

MARCH 30, 1959

Power pentode

CHARACTERISTIC CURVES

(In curve section following APPENDIX)

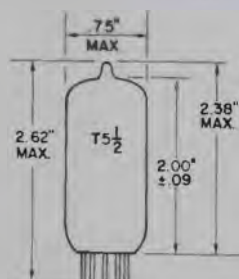
Plate Characteristics

($E_{b2} = 115$ volts) 218A

Operation, Load vs. Distortion
and Output 218B

MECHANICAL DATA

Cathode, coated unipotential	T-542
Bulb	JETEC 5-3
Outline	(E7-1)
Base	7CV
Basing	Any
Mounting position	Any



PIN CONNECTIONS

Pin 1	Cathode, Grid 3
Pin 2	Grid 1
Pin 3	Heater
Pin 4	Heater
Pin 5	Grid 1
Pin 6	Grid 2
Pin 7	Plate

APPLICATION

For the audio output stage of radio and television receivers and phonographs. It has an extremely high power sensitivity to provide good output from low driving voltage, even when powered by very low plate and screen voltages.



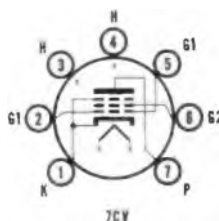
50EH5



General-purpose power amplifier for radio,
TV, and phonographs

HEATER CHARACTERISTICS

Voltage, a-c or d-c	50 volts
Current	0.15 amp
Peak heater-cathode voltage, max.	
Heater negative with respect to cathode	200 volts
Heater positive with respect to cathode	200 volts
*D-c component must not exceed 100 volts max.	



ELECTRICAL DATA

DIRECT INTERELECTRODE CAPACITANCES

Grid to plate: g1 to p	0.65 μ f
Input: g1 to k + h + g2 + g3	17 μ f
Output: p to k + h + g2 + g3	9 μ f

MAXIMUM RATINGS (Design center values)

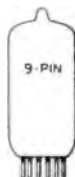
Plate voltage	135 volts
Grid 2 voltage	117 volts
Grid voltage, peak positive	0 volts
Plate dissipation	5 watts
Grid 2 dissipation	1.75 watts
Grid circuit resistance	
Fixed bias	0.1 meg
Cathode bias	0.5 meg
Bulb temperature at hottest point	220 °C

CHARACTERISTICS AND TYPICAL OPERATION

Plate supply voltage	110 volts
Grid 2 (screen) supply voltage	115 volts
Cathode bias resistor	62 ohms
Plate resistance (approx.)	11,000 ohms
Transconductance	14,600 μ mhos
Grid 1 input voltage, peak a-f	3 volts
Plate current, zero signal	42 ma
Plate current, maximum signal	42 ma
Grid 2 current, zero signal	11.5 ma
Grid 2 current, maximum signal	14.5 ma
Load resistance impedance	3000 ohms
Total harmonic distortion (approx.)	7 %
Power output, maximum signal	1.4 watts



50FY8



**Combined triode and beam power pentode
for low-cost stereo systems**

HEATER CHARACTERISTICS

Voltage, a-c or d-c	50 volts
Current	150 ma
Peak heater-cathode voltage, maximum	
Heater negative to cathode	200 volts
Heater positive to cathode*	200 volts
D-c component not to exceed 100 volts maximum.	

ELECTRICAL DATA

MAXIMUM RATINGS (Design maximum values)

	Triode Section	Pentode Section
Plate voltage	150	150 volts
Grid 2 voltage	—	150 volts
Plate dissipation	1	10 watts
Grid 2 dissipation	—	3 watts
Grid 1 circuit resistance		
Fixed bias	1.0	0.5 megohm
Cathode bias	3.0	1.0 megohm

AVERAGE CHARACTERISTICS

Class A Amplifier, Each Section

	Triode Section	Pentode Section
Plate voltage	125	125 volts
Grid 2 voltage	—	125 volts
Grid 1 voltage	—1.5	— volts
Cathode bias resistor	—	110 ohms
Plate resistance (approx.)	17000	5000 ohms
Transconductance	2700	7500 umhos
Plate current, zero signal	2.5	70 ma
Plate current, maximum signal	—	55 ma
Grid 2 current, zero signal	—	10 ma
Grid 2 current, maximum signal	—	24 ma
Load resistance	—	2000 ohms
Power output at 10% max. distortion	—	3 watts
Amplification factor	46	—

TYPICAL OPERATION IN CBS SIMPLEX STEREO AMPLIFIER (As Shown)

	Each Triode	Push-Pull Pentodes	
Plate supply voltage	125	125	volts
Grid 2 supply	—	125	volts
Grid 2 resistor, each pentode	—	1000	ohms
Cathode bias resistor	1800	56	ohms
Load resistance	220,000	4000 P to P	ohms
Required each triode input AF voltage for 6.0 watts output	0.3	—	Vrms
Stereo Power output	—	6.0	watts



ENGINEERING DESIGN DATA

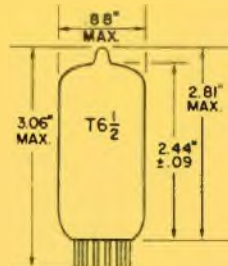
50FY8

DECEMBER 30, 1959

Triode-pentode

MECHANICAL DATA

Cathode, coated unipotential	
Base	E9-1
Bulb	T-6 1/2
Outline	JEDEC 6-4
Seated height	2.81 inches
Overall length	3.06 inches
Mounting position	Any
Basing	9EX



PIN CONNECTIONS

Pin 1	Triode grid
Pin 2	Pentode cathode and b.p.
Pin 3	Pentode grid 1
Pin 4	Heater
Pin 5	Heater
Pin 6	Pentode plate
Pin 7	Pentode grid 2
Pin 8	Triode cathode
Pin 9	Triode plate

APPLICATION

The 50FY8, combining a triode voltage amplifier and a pentode power output tube in one envelope, can be used with a second 50FY8 in the CBS Laboratories modified simplex amplifier circuit as shown to give a truly economical two tube stereo system. Operating from a Columbia twin-ceramic SC-2 stereo cartridge, the triode section drives the beam pentode to at least 2.7 watts output and up to 3.5 watts output with 10% distortion (approx.).

CBS ELECTRON TUBES

* STEREO CARTRIDGE

$.02\mu f$

1MEG

1.8K

220K

+125V

$.1\mu f$

470K

56 Ω

100

1K

T₁

+125V

T₂

T₁ - PRIMARY = 4000 Ω C.T.
 ~ SECONDARY (ONE SIDE TO C.T.) = VOICE COIL IMPEDANCE OF ONE SPEAKER
 T₂ - PRIMARY = 1000 Ω
 ~ SECONDARY (ONE SIDE TO C.T.) = VOICE COIL IMPEDANCE OF ONE SPEAKER

T₁ - PRIMARY = 4000 Ω C.T.

-- SECONDARY (ONE SIDE TO C.T.)=VOICE COIL IMPEDANCE OF ONE SPEAKER

T₂ - PRIMARY = 1000 Ω

- SECONDARY = $\frac{1}{2}$ VOICE COIL IMPEDANCE OF ONE SPEAKER

* CBS OUT-OF-PHASE "CO" CARTRIDGE

**50X6 • 50Y6G • 50Y7GT
50Z7GT • 51 • 51S • 52 • 53 • 55
55S • 56 • 56AS • 57 • 57AS • 58
58AS • 59 • 64 • 64A • 65 • 65A • 67
67A • 68 • 68A • 70A7GT • 70L7GT
71 • 71A • 71B • 75 • 76 • 78 • 79 • 80
81 • 82V • 84/6Z4 • 85 • 85AS • 88
89 • 89Y • 95 • 96 • 117L7GT
117N7GT • 117P7GT
117Z4GT**

(See chart for seldom-used tubes)



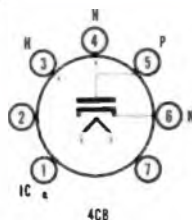
117Z3



**Half-wave power rectifier used in 3-way
portable radio receivers**

HEATER CHARACTERISTICS

Voltage, a-c or d-c	117 volts
Current	.04 amp
Peak heater-cathode voltage, max.	
Heater negative to cathode	175 volts
Heater positive to cathode	100 volts



ELECTRICAL DATA

MAXIMUM RATINGS (Design center values)

Rectifier Service	
Plate voltage, peak inverse	330 volts
Plate current, peak steady state	.54 amp
Plate current, peak transient	1.8 amp

TYPICAL OPERATION

Half-Wave Rectifier	
Plate supply voltage, rms	117 volts
Output current, d-c	90 ma

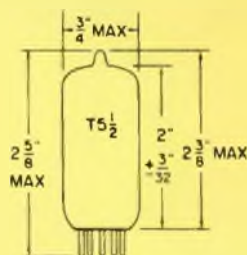
117Z3

JANUARY 10, 1957

Single diode

MECHANICAL DATA

Cathode, coated unipotential	
Bulb	T-5½
Outline	JETEC 5-3
Base	Miniature 7-pin (E7-1)
Basing	4CB
Mounting position	Any



PIN CONNECTIONS

Pin 1	I. C.*
Pin 2	N. C.
Pin 3	Heater
Pin 4	Heater
Pin 5	Plate
Pin 6	Cathode
Pin 7	N. C.

*Do not use as tie point.

APPLICATION

Type 117Z3 is a single diode designed for use as a half-wave rectifier for power-line heater operation. Its primary application is in receivers for either a-c/d-c power line or battery operation.

ENGINEERING DESIGN DATA

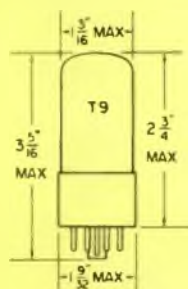
117Z6GT

JANUARY 10, 1957

Double diode

MECHANICAL DATA

Cathode, coated unipotential
Bulb T-9
Outline JETEC 9-11
Base Intermediate shell octal (B8-6)
Basing 7Q
Mounting position Any



PIN CONNECTIONS

Pin 1 N. C.
Pin 2 Heater
Pin 3 Diode 2 Plate
Pin 4 Diode 2 Cathode
Pin 5 Diode 1 Plate
Pin 6 Heater
Pin 7 Diode 1 Cathode
Pin 8 Diode 1 Cathode

APPLICATION

Type 117Z6GT is a duodiode designed for operation as a voltage doubler or rectifier with power-line heater operation.



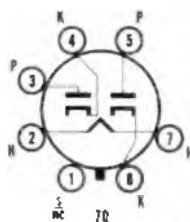
117Z6GT



Full-wave voltage doubler with power-line voltage heater rating

HEATER CHARACTERISTICS

Voltage, a-c or d-c 117 volts
Current075 amp
Peak heater-cathode voltage, max. 350 volts



ELECTRICAL DATA

MAXIMUM RATINGS (Design center values)

Rectifier or Doubler Service

Plate voltage, peak inverse 700 volts
Output current, d-c 60 amp
Plate current, peak steady state (each plate) 36 amp

TYPICAL OPERATION

Half-Wave Rectifier (Capacitor Input Filter)*

Plate supply voltage, rms (each plate)	117	150	235	volts
Plate supply resistance (each plate)	15	40	100	ohms
Filter input capacitor	40	40	40	μ f
Output current, d-c	60	60	60	ma

TYPICAL OPERATION

Voltage Doubler

Half-Wave Full-Wave

	Half-Wave	Full-Wave	
Plate supply voltage, rms	117	117	volts
Filter input capacitor	40	40	μ f
Output current, d-c	60	60	ma
Plate supply resistance (each plate)	30	15	ohms

NOTES:

*In half-wave rectifier service, the two units may be used separately or in parallel

182B/482B • 183/483 • 210T
401 • 484 • 950 • 951 • 5642
9002 • 9003 • 9006

(See chart for seldom-used tubes)



6146



Very-high-frequency beam power tube

HEATER CHARACTERISTICS

Voltage, a-c or d-c	6.3 ± 10% volts
Current	1.25 amp
Peak heater-cathode voltage, max.	
Heater negative to cathode	135 volts
Heater positive to cathode	135 volts

GENERAL ELECTRICAL DATA

DIRECT INTERELECTRODE CAPACITANCES (No shield and base sleeve connected to ground)

Grid 1 to plate: g1 to p, max.	0.22	μf
Input: g1 to k + h + g2 + b.p.	13.5	μf
Output: p to k + h + g2 + b.p.	8.5	μf

CHARACTERISTICS

Plate voltage	200 volts
Grid 2 (screen) voltage	200 volts
Plate current	100 ma
Transconductance	7000 μmhos
Amplification factor for grid 2 to grid 1	4.5

A-F POWER AMPLIFIER & MODULATOR

MAXIMUM RATINGS (Absolute values)

Triode Connected, Class AB ₁	CCS†	ICAS‡
Plate voltage, d-c	400	400 volts
Plate current, maximum signal d-c▲	90	90 ma
Plate input, maximum signal▲	35	35 watts
Plate dissipation▲	20	25 watts
Grid 1 circuit resistance, maximum▼		
Fixed bias	0.1	0.1 meg
Cathode bias	0.5	0.5 meg

TYPICAL OPERATION

Triode Connected, Class AB₁, two tubes

	CCS†	ICAS‡
Plate voltage, d-c	250	400
Grid 1 voltage, d-c	-50	-100
A-f input voltage, peak g1 to g1	100	200
Plate current, zero signal d-c	120	40
Plate current, max. signal d-c	125	100
Load resistance, plate-to-plate	5000	8000
Drive, maximum signal (approx.)	0	0
Power output, max. signal (approx.)	10	22

MAXIMUM RATINGS (Absolute values)

	Class AB ₂		Class AB ₁	
Class AB ₁ and Class AB ₂	CCS†	ICAS‡	CCS†	ICAS‡
Plate voltage, d-c	600	750	600	750
Grid 2 (screen) voltage, d-c	250	250	250	250
Plate current, max. sig., d-c▲	125	135	125	135
Plate input, max. sig.▲	62.5	62.5	60	85
Grid 2 input, max. sig.▲	3	3	3	3
Plate dissipation▲	20	25	20	25
Grid 1 circuit resistance▼				
Fixed bias	0.03	0.03	0.1	0.1
Cathode bias	Not recommended	Not recommended	Not recommended	Not recommended

ENGINEERING DESIGN DATA

6146

JUNE 1, 1958

Beam power amplifier

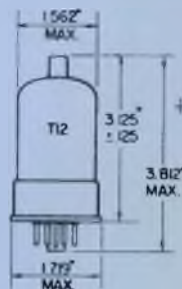
CHARACTERISTIC CURVES

(In curve section following APPENDIX)

Plate ($E_{c2} = 200$ V)	2000A
Plate ($E_{c2} = 150$ V)	2000B
Plate, triode connected	2000C
Max. ratings vs. frequency	2000D
Characteristics;	
$I_{c1}, I_{c2} (E_{c2} = 200$ V)	2000E
Characteristics;	
$I_{c1}, I_{c2} (E_{c2} = 150$ V)	2000F

MECHANICAL DATA

Cathode, coated unipotential	
Overall length	3 1/4 ± 1/4 inches
Seated height	3 1/4 ± 1/4 inches
Maximum diameter	1 1/2 inches
Bulb	T-12
Cap	Small (JEDEC C1-1)
Base, Large-micanol-wafer octal 8-pin with sleeve (JEDEC B8-86)	
Basing	.8EC
Bulb temperature at hottest point, max.	220° C



PIN CONNECTIONS

Pin 1	Cathode, Grid 3, I. S.
Pin 2	Heater
Pin 3	Grid 2
Pin 4	Cathode, Grid 3, I. S.
Pin 5	Grid 1
Pin 6	Cathode, Grid 3, I. S.
Pin 7	Heater
Pin 8	Base Sleeve
Cap	Plate

A-F POWER AMPLIFIER & MODULATOR

6146 (cont.)

APPLICATION

Type 6146 is a high efficiency r-f beam pentode that may be used for the final r-f amplifier in mobile equipment operating at frequencies up to 175 megacycles or for buffer stages in higher powered transmitters. It also enjoys service as an audio modulator, as a pair of 6146's will furnish up to 130 watts output with only .04 watts of drive in class AB₂ operation (ICAS).

The 6146 features a low-loss phenolic base, small size, rigid construction, hard glass envelope, low input capacitance and low output capacitance. Therefore, excellent and stable performance is assured.

Its low capacitance permits parallel operation of two tubes up to about 30 mc, thus making convenient pi-network output circuitry practical at twice the power of a single tube. From 30 mc to 175 mc single tube or push-pull circuitry is suggested. For operation above 60 mc, a reduction in maximum ratings should be observed by referring to the rating chart given.

Push-pull circuits at very high frequencies are advantageous in that the output capacitances are in series, thus improving the L to C ratio. Also push-pull has the advantage of low parasitic capacitances, low radiation, and simple construction.

Use of the efficient 6146 keeps power consumption as low as possible and the tube complement small.

Limiting Values

Absolute-Maximum rating values are given in the technical data which are limiting values of operating and environmental conditions. They should not be exceeded under the most probable conditions.

These values are chosen by the tube manufacturer to provide acceptable serviceability, taking no responsibility for equipment variations, environmental variations, and the effects of changes in operating conditions due to variations in tube characteristics.

The equipment manufacturer should design so that at any time throughout life, no absolute maximum rating is exceeded under the conditions listed above.

Absolute-Maximum ratings for transmitting tubes are divided into two sets of data to meet diversified design requirements. Continuous Commercial Service (CCS) is defined as that type of service in which long tube life and reliability of performance under continuous operating conditions are the prime consideration. Intermittent Commercial and Amateur Service (ICAS) is defined to include the many applications where transmitter design factors of minimum size, light weight, and maximum power output are more important than long tube life. Amateur service is usually of an "on" and "off" nature, otherwise, the term intermittent refers to operating conditions where no "on" period exceeds 5 minutes and is followed by an "off" or standby-period of at least the same or greater duration.

TYPICAL OPERATION

Class AB₁ Amplifier, two tubes

	CCS†			ICAS‡	
Plate voltage, d-c	400	500	600	600	750 volts
Grid 2 voltage, d-c	190	185	180	200	195 volts
Grid 1 voltage, d-c					
Fixed bias	-40	-40	-45	-50	-50 volts
G1 to g1 voltage, peak a-f	80	80	90	100	100 volts
Plate current, d-c zero sig.	63	57	26	28	23 volts
Plate current, d-c max. sig.	228	215	200	229	220 ma
Grid 2 current, d-c zero sig.	2.5	2	1	1	1 ma
Grid 2 current, d-c max. sig.	25	25	23	27	26 ma
Load resistance, p to p	4000	5500	7000	6000	8000 ohms
Drive, max. sig. (approx.)	0	0	0	0	0 watts
Power output, max. sig. (approx.)	55	70	82	95	120 watts

TYPICAL OPERATION

Class AB₂ Amplifier, two tubes

	CCS†			ICAS‡	
Plate voltage, d-c	400	500	600	600	750 volts
Grid 2 voltage, d-c	175	175	165	190	165 volts
Grid 1 voltage, d-c	-41	-44	-44	-48	-46 volts
G1 to g1 voltage, peak a-f	95	102	97	109	108 volts
Plate current, d-c zero sig.	33	27	22	28	22 ma
Plate current, d-c max. sig.	232	242	207	270	240 ma
Grid 2 current, d-c zero sig.	1.1	0.7	0.6	1.2	0.3 ma
Grid 2 current, d-c max. sig.	18	18	17	20	20 ma
Grid 1 current, d-c max. sig.	1.6	1.9	1.1	2	2.6 ma
Load resistance, p to p	3700	4600	6800	5000	7400 ohms
Drive, max. sig. (approx.)	0.2	0.3	0.2	0.03	0.04 watt
Power output, max. sig. (approx.)	62	83	90	113	131 watts

NOTES:

†Continuous Commercial Service.

‡Intermittent Commercial and Amateur Service.

▲Averaged over any audio frequency sine-wave form.

▼Input coupling network should be of low resistance. Transformer or impedance coupling devices are recommended.

¶Preferably obtained from a separate source or from a voltage divider on the plate supply. For class AB₂ operation the driver stage should be capable of supplying the specified driving power at low distortion. In class AB₂ operation at less than maximum ratings the grid 1 circuit resistance may be as high as 0.1 megohm.

CLASS C R-F POWER AMPLIFIER

MAXIMUM RATINGS (Absolute values)

	Plate Mod. Telephony		Telegraphy* and FM Telephony	
	CCS†	ICAS‡	CCS†	ICAS‡
Plate voltage, d-c	480	600	600	750 volts
Grid 2 voltage, d-c	250	250	250	250 volts
Grid 1 voltage, d-c	-150	-150	-150	-150 volts
Plate current, d-c	117	125	140	150 ma
Grid 1 current, d-c	3.5	4.0	3.5	4.0 ma
Plate input	45	67.5	67.5	90 watts
Grid 2 input	2	2	3	3 watts
Plate dissipation	13.3	16.7	20	25 watts
Grid 1 circuit resistance	30,000	30,000	30,000	30,000 ohms

TYPICAL OPERATION

Plate Modulated Telephony

	CCS†		ICAS‡	
Plate voltage, d-c	400	475	600	volts
Grid 2 voltage, d-c	150	135	150	volts
From a series resistor of	33,000	51,000	56,000	ohms
Grid 1 voltage	-87	-77	-87	volts
From a grid resistor of	27,000	27,000	27,000	ohms
Grid 1 voltage, peak r-f	107	95	107	volts
Plate current, d-c	112	94	112	ma
Grid 2 current, d-c	7.8	6.4	7.8	ma
Grid 1 current, d-c (approx.)	3.4	2.8	3.4	ma
Driving power (approx.)	0.4	0.3	0.4	watt
Power output (approx.)	32	34	52	watts

CLASS C R-F POWER AMPLIFIER

TYPICAL OPERATION

Telegraphy and FM Telephony up to 60 Mc

	CCS†		ICAS‡	
Plate voltage, d-c.....	500	600	600	750 volts
Grid 2 voltage, d-c.....	170	150	180	160 volts
From a series resistor of 36,000	51,000	43,000	56,000	ohms
Grid 1 voltage, d-c.....	-66	-58	-71	-62 volts
From a grid resistor of 27,000	20,000	24,000	20,000	ohms
From a cathode resistor of 470	470	430	470	ohms
Grid 1 voltage, peak r-f.....	84	73	91	79 volts
Plate current, d-c.....	135	112	150	120 ma
Grid 2 current, d-c.....	9	9	10	11 ma
Grid 1 current, d-c (approx.).....	2.5	2.8	2.8	3.1 ma
Driving power (approx.).....	0.2	0.2	0.3	0.2 watt
Power output (approx.).....	48	52	66	70 watts

Telegraphy and FM Telephony up to 60 Mc

	CCS†		ICAS‡	
Plate voltage, d-c.....	320	400	400	volts
Grid 2 voltage, d-c.....	180	190	190	volts
From a series resistor of 13,000	13,000	20,000	20,000	ohms
Grid 1 voltage, d-c.....	-51	-54	-54	volts
From a grid resistor of 27,000	27,000	24,000	24,000	ohms
From a cathode resistor of 330	330	330	330	ohms
Grid 1 voltage, peak r-f.....	64	68	68	volts
Plate current, d-c.....	140	150	150	ma
Grid 2 current, d-c.....	10	10.4	10.4	ma
Grid 1 current, d-c (approx.).....	2	2.2	2.2	ma
Driving Power (approx.).....	3	3	3	watts
Power Output (approx.).....	25	35	35	watts

NOTES:

†Continuous Commercial Service.

‡Intermittent Commercial and Amateur Service.

▲Carrier conditions per tube for use with a 1.0 maximum modulation factor.

★Oscillator or amplifier service. Key-down conditions per tube without modulation. Amplitude modulation essentially negative may be used if the positive peak of the audio frequency envelope does not exceed 115% of the carrier conditions.

□ For operation at less than maximum ratings the grid circuit resistance may be as high as 100,000 ohms. If bias developed by grid current is not sufficient then cathode bias or fixed bias must be used.

△ Obtained preferably from a separate source modulated with the plate supply, or from the modulated plate supply through a series resistor.

● Obtained from grid 1 resistor or grid 1 resistor combined with either a fixed supply or cathode resistor.

▼ From a separate source or plate supply voltage with a voltage divider, or through a series resistor in a stage that is not keyed. Voltage must not exceed 400 volts under key-up conditions.

§ Obtained from a fixed supply, by grid resistor, by cathode resistor, or by combination methods.

Bulb Temperature

The bulb temperature given under mechanical data is an absolute maximum value that should never be exceeded. Temperature measurements should be made during the longest intended duty cycle with the tube operating in a completely assembled transmitter, with all covers and shields in place, and operating at maximum output under highest ambient temperature conditions.

Temperature may be easily measured by means of temperature sensitive paint such as Templog, made by Templog Corp., 11 West 25th Street, New York 10, N. Y.

Screen Grid voltage and supply

Screen grid current is very sensitive to the plate load. Operation without load can cause the screen current to rise to an excessive value that will damage the tube. If the screen is supplied from a separate source, care should be exercised that plate voltage is applied at all times when screen voltage is present. Screen grid voltage obtained from the plate supply should be through a voltage divider or through a series resistor with provision that the screen dissipation will not rise above maximum ratings at any time. A clamp tube is suggested for complete tube protection during operation and transmitter adjustments.

ENGINEERING DESIGN DATA

6216

JUNE 1, 1958

High perveance beam tube

CHARACTERISTIC CURVES

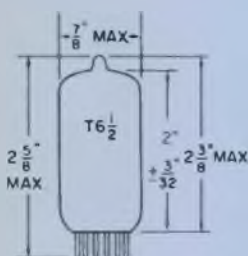
(In curve section following APPENDIX)

Plate ($E_c = 100$ V).....2003A

Plate (triode connected).....2002B

MECHANICAL DATA

Cathode, coated unipotential
Bulb.....T-6½
Base.....9-pin Miniature
Maximum diameter..... $\frac{1}{8}$ inches
Maximum overall height.....2½ inches
Maximum seated height.....2½ inches
Mounting position.....Any
Shock.....40°



PIN CONNECTIONS

Pin 1.....Plate
Pin 2.....Grid 1
Pin 3.....Cathode
Pin 4.....Heater
Pin 5.....Heater
Pin 6.....Plate
Pin 7.....Grid 2
Pin 8.....Cathode
Pin 9.....No connection

APPLICATION

The CBS Type 6216 has an extremely low tube drop and very high plate resistance. For this reason, it out-performs such tubes as the 6W6GT and 50CS in applications where high circuit efficiency is required. The mechanical design of the tube is such that it can withstand shocks up to 625G. It is also extremely resistant to the vibrations encountered in high-speed military aircraft. Applications for the 6216 include the following:

- Series pass tube in regulated power supplies
- Power Switch to drive teletype-writers or d-c wire lines
- Screen Grid clamper for protecting Class C-operated beam pentode tubes
- Keyer tube for CW radio transmitters
- Pulse output tube
- Cathode follower in digital printers
- Magnet control tube
- Flip-flop driver for computer logic matrix
- Magnetic drum write amplifiers
- Servo power amplifiers
- Passive switching applications



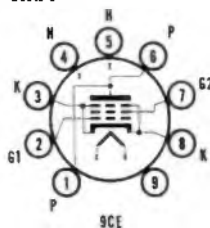
6216



Reliable pass tube, power switch,
damper, or filter reactor tube

HEATER CHARACTERISTICS

Heater voltage a-c or d-c.....6.3 volts
Heater current.....1.2 amps
Maximum heater-cathode voltage.....150 volts



ELECTRICAL DATA

DIRECT INTERELECTRODE CAPACITANCES

Grid to plate: (g1 to p) max.....0.370 μ f
Input: g1 to (h + k + g2 + g3 + b.p. + b.s. + i.s.).....13.25 μ f
Output: p to (h + k + g2 + g3 + b.p. + b.s. + i.s.).....6.7 μ f

MAXIMUM RATINGS (Design center values)

Plate voltage.....300 volts
Grid 2 voltage.....200 volts
Grid 1 voltage, positive d-c.....0 volts
Plate dissipation.....10 watts
Grid 2 dissipation.....2.0 watts
Cathode current.....110 ma
Grid 1 circuit resistance
Fixed bias.....0.1 meg
Self bias.....0.5 meg
Bulb temperature at hottest point.....210 °C

AVERAGE CHARACTERISTICS

Plate voltage.....100 volts
Grid 2 voltage.....100 volts
Grid 1 voltage.....-3 volts
Grid 1 resistor.....0.1 meg
Plate resistance (approx.).....18,500 ohms
Transconductance.....12,500 μ mhos
Plate current.....72 ma
Grid 2 current.....3 ma
Grid 1 voltage (approx.) for $I_b = 50 \mu$ a.....-25 volts

TYPICAL OPERATION

Class A Audio Amplifier

Plate voltage.....200 volts
Grid 2 (screen) voltage.....100 volts
Grid 1 (control grid) voltage.....-6 volts
Grid 1 voltage, peak a-f.....6 volts
Plate current, zero signal.....47 ma
Plate current, maximum signal.....51 ma
Grid 2 current, zero signal.....2.0 ma
Grid 2 current, maximum signal.....4.0 ma
Plate resistance.....38,800 ohms
Transconductance.....8800 μ mhos
Load resistance.....4500 ohms
Total harmonic distortion.....10 %
Maximum signal power output.....3.8 watts

Class C Oscillator—Amplifier to 50 Mc

Plate voltage.....300 volts
Grid 2 voltage.....150 volts
Grid 1 voltage.....-50 volts
or grid resistor of.....22,000 ohms
Grid 1 voltage, peak r-f.....65 volts
Plate current.....63 ma
Grid 2 current.....8.0 ma
Grid 1 current.....2.0 ma
Grid 1 driving power (approx.).....0.3 watts
Useful power output.....8.8 watts

CBS ELECTRON TUBES

CBS

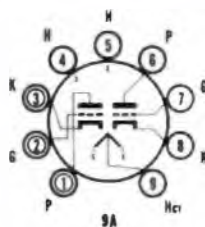
6955



Square-wave modulator, blocking oscillator, multivibrator, and general purpose duotriode

HEATER CHARACTERISTICS

	Series	Parallel	
Voltage, a-c	12.6 $\pm$ 12%	6.3 $\pm$ 12%	volts
Current	175	350	ma
Peak heater-cathode voltage, max.			
Heater negative to cathode	90	90	volts
Heater positive to cathode	90	90	volts



ELECTRICAL DATA

DIRECT INTERELECTRODE CAPACITANCES

	Section 1	Section 2
Grid to plate: g1 to p	1.4	1.4
Input: g1 to k + h	1.5	1.5
Output: p to k + h	0.5	0.4
Coupling plate 1 to plate 2	0.8	

MAXIMUM RATINGS (Continuous commercial service values)

Pulse Modulator†	
Plate supply voltage, d-c	400 volts
Control grid supply voltage, d-c	250 volts
Peak positive grid voltage, d-c	200 volts
Peak grid current	0.9 amp
Peak plate current	1.25 amp
Peak cathode current	2.2 amp
Grid dissipation	0.60 watts
Plate dissipation	1.35 watts
Bulb temperature	165 °C

MAXIMUM RATINGS (Design center values)

Class A Amplifier	
Plate voltage	300 volts
Plate dissipation	2.75 watts
Cathode current	20 ma
Control-grid circuit resistance	
Fixed bias	0.25 meg
Self bias	1.0 meg
Bulb temperature	165 °C

CHARACTERISTICS AND TYPICAL OPERATION

Pulse Modulator	
Plate supply voltage, d-c	300 volts
Grid supply voltage, d-c	-25 volts
Peak positive grid voltage	150 volts
Peak plate current	0.9 amp
Peak grid current	0.7 amp
Plate load resistance (noninductive)	75 ohms
Grid resistance (noninductive)	2400 ohms
Minimum cathode preheating	10 sec

Class A Amplifier	
Plate voltage	100
Control-grid voltage	0
Plate resistance (approx.)	5800
Transconductance	3500
Amplification factor	21.3
Plate current	13.0
Control-grid voltage (approx.) for $I_b = 10 \mu A$	-22 volts
Control-grid voltage (approx.) for $g_m = 2350 \mu mhos$	8.5 volts

NOTE:

†Duty Factor = .0035; pulse width = 1.5 microseconds; pulse repetition rate = 2300 pps

SPECIAL TESTS AND RATINGS

Warm-up time to 80% of stabilized current	10 sec. max.
Environmental Tests	
Temperature cycling	-62°C to 100°C
Vibration resonance at 10g	500 cps. max.

CBS ELECTRON TUBES

ENGINEERING
DESIGN DATA

6955

JUNE 1, 1958

Pulse duotriode

CHARACTERISTIC CURVES

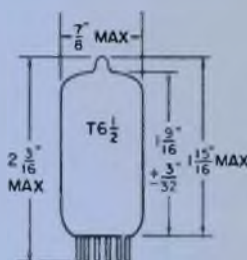
(In curve section following APPENDIX)

Plate ($E_c = -25$ volts) ... 2001A

Plate and grid current ... 2001B

MECHANICAL DATA

Cathode, coated unipotential	
Bulb	T-6½
Outline	JETEC 6-2
Base	9-pin miniature (E9-1)
Basing	9A
Mounting position	Any



PIN CONNECTIONS

Pin 1	Plate (Sect. 2)
Pin 2	Grid (Sect. 2)
Pin 3	Cathode (Sect. 2)
Pin 4	Heater
Pin 5	Heater
Pin 6	Plate (Sect. 1)
Pin 7	Grid (Sect. 1)
Pin 8	Cathode (Sect. 1)
Pin 9	Heater Center Tap

APPLICATION

The CBS 6955 is a modern tube for modern electronic circuits serving the special equipments of this advanced era.

Automation and control require high reliability and sureness of operation. The 6955 may be depended upon for these qualifications. It will consistently provide full 2 amperes peak current at a 10 microsecond pulse rate. Reliability under unfavorable environment is insured by an ambient range of -62°C to 100°C and special resonant vibration testing at frequencies up to 500 cycles per second.

An additional feature of the 6955, that is advantageous in equipment normally "off" and requiring quick response when turned "on," is its fast emission warm-up time rated at 80% of maximum output in 10 seconds from "turn-on."

The principal use of the CBS 6955 is in blocking oscillator service where high emission capability is needed in a short time for high peak power. Other suggested circuits for this pulse tube are all kinds of timer circuits, including multivibrator, pulse squarer, and cathode follower.



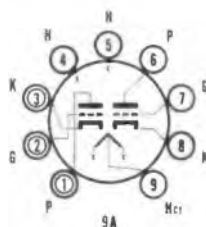
7025



Low noise, low hum phase inverter or resistance-coupled audio amplifier

HEATER CHARACTERISTICS

	Series	Parallel
Voltage, a-c or d-c	12.6	6.3 volts
Current	150	300 ma
Peak heater-cathode voltage, max.		
Heater negative to cathode	200	200 volts
Heater positive to cathode*	200	200 volts
*D-c component must not exceed 100 volts max.		



The 7025 is identical to type 12AX7 except for the low noise and hum voltage of the 7025 as shown in the measured values below:

EQUIVALENT NOISE AND HUM VOLTAGE

Referred to Grid, Each Unit

Average value, rms **1.8 μ volts**

Conditions of measurement: Parallel heater connection, 6.3V a-c; grounded heater-transformer center-tap; $E_{b1}=250V$; $R_1=10k$; $R_k=2700\Omega$, bypassed by 100 μ f; $R_g=0$; amplifier frequency range of 25 to 10,000 cps.

Maximum value, rms **7 μ volts**

Conditions of measurement: same as for "average value" except R_k is unbypassed, $R_k=50,000$ ohms.

ENGINEERING DESIGN DATA

7025

MARCH 30, 1959

High-mu duotriode

CHARACTERISTIC CURVES

(In curve section following APPENDIX)

Plate.....122A

Transfer; $(\mu, g_m, \mu).....122B$

Operation.....122C

MECHANICAL DATA

Cathode, coated unipotential

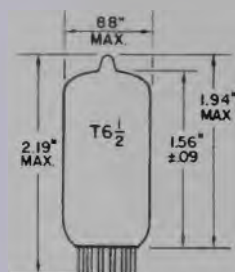
Bulb.....T-6 $\frac{1}{2}$

Outline.....JETEC 6-2

Base.....Miniature 9-pin (E9-1)

Basing.....9A

Mounting position.....Any



PIN CONNECTIONS

Pin 1.....Plate (Sect. 2)

Pin 2.....Grid 1 (Sect. 2)

Pin 3.....Cathode (Sect. 2)

Pin 4.....Heater

Pin 5.....Heater

Pin 6.....Plate (Sect. 1)

Pin 7.....Grid (Sect. 1)

Pin 8.....Cathode (Sect. 1)

Pin 9.....Heater Center Tap

REFERENCES

See APPENDIX for R-C amplifier data.

ENGINEERING DESIGN DATA

7247

MARCH 30, 1959

Hi-fi duotriode

CHARACTERISTIC CURVES (In curve section following APPENDIX)

Section 1

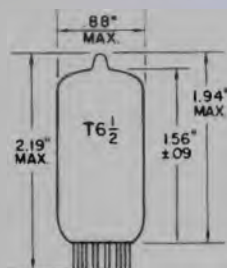
Plate.....122A
Transfer; r_p , g_m , μ122B

Section 2

Plate.....177A

MECHANICAL DATA

Cathode, coated unipotential
Bulb.....T-6½
Outline.....JETEC 6-2
Base.....Miniature 9-pin (E9-1)
Basing.....9A
Mounting position.....Any



PIN CONNECTIONS

Pin 1.....Plate (Sect. 2)
Pin 2.....Grid 1 (Sect. 2)
Pin 3.....Cathode
Pin 4.....Heater
Pin 5.....Heater
Pin 6.....Plate (Sect. 1)
Pin 7.....Grid 1 (Sect. 1)
Pin 8.....Cathode (Sect. 1)
Pin 9.....Heater Center Tap

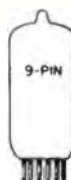
APPLICATIONS

The CBS-Hytron 7247 is a dissimilar section duotriode, designed to combine in one tube the first and second stage of audio preamplification in hi-fi disc or tape equipment. Special techniques are employed in the manufacture of the 7247 so that, in operation, hum and microphonism will be minimized.

Section one is a hi- μ triode characterized by and tested for low hum and noise output, being similar to one section of type 7025. It is intended as the input amplifier in low-level audio applications. Section two is a medium- μ triode, similar to type 6C4, which is suitable cathode follower or large signal phase inverter service.



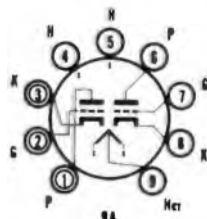
7247



Low noise, low hum first preamplifier and a second preamplifier combined for hi-fi equipment.

HEATER CHARACTERISTICS

	Series	Parallel
Voltage, a-c or d-c	12.6	6.3 $\pm 10\%$ volts
Current	150	300 ma
Peak heater-cathode voltage, max.		
Heater negative to cathode	200	200 volts
Heater positive to cathode*	200	200 volts
*D-c component must not exceed 100 volts max.		



ELECTRICAL DATA

DIRECT INTERELECTRODE CAPACITANCES

	Section 1†		Section 2‡	
	No Shield	Shield	No Shield	Shield
Grid to plate: g1 to p	1.7	1.7	1.4	1.4 μ mf
Input: g1 to k + h	1.6	1.8	1.8	2.0 μ mf
Output: p to k + h	0.37	2.2	.33	1.6 μ mf

MAXIMUM RATINGS (Design maximum values)

	Section 1†	Section 2‡
Plate voltage	330	330 volts
Control-grid voltage, negative d-c	-55	-55 volts
Control-grid voltage, positive d-c	0	0 volts
Cathode current, average	—	22 ma
Plate dissipation	1.2	3.0 watt
Control-grid circuit resistance		
Fixed bias	15.0	0.5 meg
Cathode bias	—	1.0 meg

CHARACTERISTICS AND TYPICAL OPERATION

Class A Amplifier

	Section 1†	
Plate voltage	100	250 volts
Control-grid voltage	-1	-2 volts
Plate resistance (approx.)	80,000	62,500 meg
Transconductance	1250	1600 μ mhos
Amplification factor	100	100
Plate current	0.5	1.2 ma

Class A Amplifier

	Section 2‡	
Plate voltage	100	250 volts
Control-grid voltage	0	-8.5 volts
Plate resistance (approx.)	6500	7700 ohms
Transconductance	3100	2200 μ mhos
Amplification factor	20	17
Plate current	11.8	10.5 ma
Grid 1 voltage (approx.) for $I_b = 10 \mu$ a		-24 volts

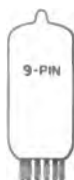
NOTES:

†Section 1 connects to pins 6, 7, and 8.

‡Section 2 connects to pins 1, 2, and 3.



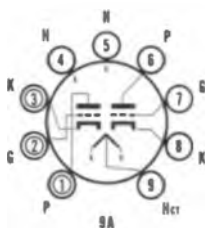
7025



Low noise, low hum phase inverter or resistance-coupled audio amplifier

HEATER CHARACTERISTICS

	Series	Parallel
Voltage, a-c or d-c	12.6	6.3 volts
Current	150	300 ma
Peak heater-cathode voltage, max.		
Heater negative to cathode	200	200 volts
Heater positive to cathode*	200	200 volts
*D-c component must not exceed 100 volts max.		



The 7025 is identical to type 12AX7 except for the low noise and hum voltage of the 7025 as shown in the measured values below:

EQUIVALENT NOISE AND HUM VOLTAGE

Referred to Grid, Each Unit

Average value, rms

1.8 μ volts

Conditions of measurement: Parallel heater connection, 6.3V a-c; grounded heater-transformer center-tap; $E_{bb}=250V$; $R_L=10k$; $R_K=2700\Omega$, bypassed by 100 μ f; $R_g=0$; amplifier frequency range of 25 to 10,000 cps.

Maximum value, rms

7 μ volts

Conditions of measurement: same as for "average value" except R_K is unbypassed, $R_g=50,000$ ohms.

ENGINEERING DESIGN DATA

7025

MARCH 30, 1959

High-mu duotriode

CHARACTERISTIC CURVES

(In curve section following APPENDIX)

Plate.....122A

Transfer; I_p , gm. μ122B

Operation.....122C

MECHANICAL DATA

Cathode, coated unipotential

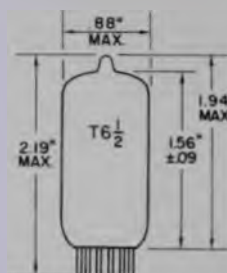
Bulb.....T-6 $\frac{1}{2}$

Outline.....JETEC 6-2

Base.....Miniature 9-pin (E9-1)

Basing.....9A

Mounting position.....Any



PIN CONNECTIONS

Pin 1.....	Plate (Sect. 2)
Pin 2.....	Grid 1 (Sect. 2)
Pin 3.....	Cathode (Sect. 2)
Pin 4.....	Heater
Pin 5.....	Heater
Pin 6.....	Plate (Sect. 1)
Pin 7.....	Grid (Sect. 1)
Pin 8.....	Cathode (Sect. 1)
Pin 9.....	Heater Center Tap

REFERENCES

See APPENDIX for A-C amplifier data.

ENGINEERING DESIGN DATA

7247

MARCH 30, 1959

Hi-fi duotriode

CHARACTERISTIC CURVES (In curve section following APPENDIX)

Section 1

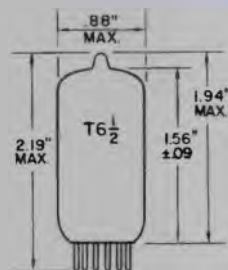
Plate.....122A
Transfer; I_p , G_m , μ122B

Section 2

Plate.....177A

MECHANICAL DATA

Cathode, coated unipotential
Bulb.....T-6½
Outline.....JETEC 6-2
Base.....Miniature 9-pin (E9-1)
Basing.....9A
Mounting position.....Any



PIN CONNECTIONS

Pin 1.....Plate (Sect. 2)
Pin 2.....Grid 1 (Sect. 2)
Pin 3.....Cathode
Pin 4.....Heater
Pin 5.....Heater
Pin 6.....Plate (Sect. 1)
Pin 7.....Grid 1 (Sect. 1)
Pin 8.....Cathode (Sect. 1)
Pin 9.....Heater Center Tap

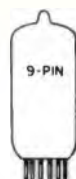
APPLICATIONS

The CBS-Hytron 7247 is a dissimilar section duotriode, designed to combine in one tube the first and second stage of audio preamplification in hi-fi disc or tape equipment. Special techniques are employed in the manufacture of the 7247 so that, in operation, hum and microphonism will be minimized.

Section one is a hi-mu triode characterized by and tested for low hum and noise output, being similar to one section of type 7025. It is intended as the input amplifier in low-level audio applications. Section two is a medium-mu triode, similar to type 6C4, which is suitable cathode follower or large signal phase inverter service.



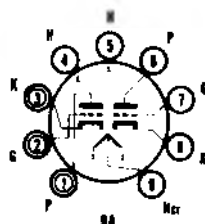
7247



Low noise, low hum first preamplifier and a second preamplifier combined for hi-fi equipment.

HEATER CHARACTERISTICS

	Series	Parallel
Voltage, a-c or d-c	12.6	6.3 ± 10% volts
Current	150	300 ma
Peak heater-cathode voltage, max.		
Heater negative to cathode	200	200 volts
Heater positive to cathode*	200	200 volts
*D-c component must not exceed 100 volts max.		



ELECTRICAL DATA

DIRECT INTERELECTRODE CAPACITANCES

	Section 1†		Section 2‡	
	No Shield	Shield	No Shield	Shield
Grid to plate: g1 to p...	1.7	1.7	1.4	1.4 μ f
Input: g1 to k + h.....	1.6	1.8	1.8	2.0 μ f
Output: p to k + h.....	0.37	2.2	.33	1.6 μ f

MAXIMUM RATINGS (Design maximum values)

	Section 1†	Section 2‡
Plate voltage.....	330	330 volts
Control-grid voltage, negative d-c.....	-55	-55 volts
Control-grid voltage, positive d-c.....	0	0 volts
Cathode current, average.....	—	22 ma
Plate dissipation.....	1.2	3.0 watt
Control-grid circuit resistance		
Fixed bias.....	15.0	0.5 meg
Cathode bias.....	—	1.0 meg

CHARACTERISTICS AND TYPICAL OPERATION

Class A Amplifier

	Section 1†	
Plate voltage.....	100	250 volts
Control-grid voltage.....	-1	-2 volts
Plate resistance (approx.).....	80,000	62,500 meg
Transconductance.....	1250	1600 μ mhos
Amplification factor.....	100	100
Plate current.....	0.5	1.2 ma

Class A Amplifier

	Section 2‡	
Plate voltage.....	100	250 volts
Control-grid voltage.....	0	-8.5 volts
Plate resistance (approx.).....	6500	7700 ohms
Transconductance.....	3100	2200 μ mhos
Amplification factor.....	20	17
Plate current.....	11.8	10.5 ma
Grid 1 voltage (approx.) for $I_b = 10 \mu$ a.....		-24 volts

NOTES:

†Section 1 connects to pins 6, 7, and 8.

‡Section 2 connects to pins 1, 2, and 3

SELDOM-USED RECEIVING TUBES

Tube types rarely encountered by the engineer and generally not recommended for new equipment. Some types will find limited use in new equipment because they uniquely apply to special applications. More complete data on these or other types not given full treatment will be supplied upon request.

Table I	Diodes
Table II	Detector-Amplifiers or Rectifier-Amplifiers
Table III	General Purpose Triodes
Table IV	Voltage Amplifiers
Table V	Converters and Mixers
Table VI	Audio Power Amplifiers
Table VII	TV Deflection Power Amplifiers
Table VIII	Indicators (tuning eye)

TYPE	TABLE	TYPE	TABLE	TYPE	TABLE	TYPE	TABLE
00	III	1H5GT	II	2S 4S	I	6AF5G	VIII
00A	III	1H6G GT	II	2V2	I	6AG6G	VI
01	III	1J5G	VI	2V3G	I	6AH5G	VI
01A	III	1J6G GT	VI	2W3 GT	I	6AH7GT	III
01AA	III	1L6	V	2Z2, G84	I	6AJ4	III
01B	III	1LA4 E	VI	3A5	III	6AJ5	IV
1A3	I	1LA6	V	3A8GT	II	6AJ7	IV
1A4P	IV	1LB4	VI	3B7, 1291	VI	6AK7	VI
1A4T	IV	1LB6	V	3C6	III	6AN4	III
1A5G GT	VI	1LC5	IV	3D6	VI	6AN5	VI
1A6	V	1LC6	V	3E5	VI	6AN6	I
1AB5	IV	1LD5	II	3E6	IV	6AQ7GT	II
1AF4	IV	1LE3	III	3LE4	VI	6AR6	VI
1AF5	II	1LF3	III	3LF4	VI	6AS6	IV
1B4 9S1	IV	1LG5	IV	5AU4	I	6AS7G	III
1B4P	IV	1LH4	II	5AX4GT	I	6AX6G	I
1B4T	IV	1LN5	IV	5A24	I	6B4G	VI
1B5 25S	IV	1N5GT	IV	5T4	I	6B5	VI
1B6	IV	1N6G	II	5W4 G GT	I	6B6G	II
1B7G GT	V	1P5G GT	IV	5X3	I	6B7	II
1B8GT	II	1Q5GT G	VI	5X4G	I	6B8 G GT	II
1C5G GT	VI	1Q6	II	5Z4	I	6BA7	V
1C6	V	1R4	I	6A3	VI	6BD5GT	VII
1C7G	V	1S4	VI	6A4	VI	6BD7	II
1C8	V	1SA6GT	IV	6A5G	VI	6BF7	III
1D5GP GT	IV	1SB6GT	II	6A6	VI	6BG7	III
1D7G	V	1T5GT	VI	6A7	V	6BK6	II
1D8GT	II	1U6	V	6A8 G GT	V	6BN7	VII
1E4 G	III	1V4	I	6AB5 6N5	VIII	6BU5	IV
1E5GP	IV	1W4	VI	6AB6G	VI	6BV5G	I
1E5G GT	IV	2A3	VI	6AB7 1853	IV	6C5	IV
1E7G/GT	VI	2A3H	VI	6AC5G GT	VI	6C7	II
1F4	VI	2A5	VI	6AC6GT	VI	6C8G	III
1F5G	VI	2A6	II	6AD5G GT	III	6D5G	VI
1F6	II	2A7	V	6AD6G	VIII	6D6	IV
1F7G GM/GV	II	2A7S	V	6AD7G	VI	6D7	IV
1G4G GT	III	2B7	II	6AE5GT	III	6D8 G	V
1G5G GT	VI	2B7S	II	6AE6G	III	6DB6	IV
1G6G GT	VI	2E5	VIII	6AE7G GT	III	6E5	VIII
1H4G GT	III	2G5	VIII	6AF5G	III	6E6	VI

SELDOM-USED RECEIVING TUBES (cont.)

TYPE	TABLE	TYPE	TABLE	TYPE	TABLE	TYPE	TABLE
6E7	IV	7B4	III	14A7	IV	45	VI
6F4	III	7B5	VI	14AF7	III	45A	VI
6F5/G GT	III	7B6	II	14B6	II	45Z3	I
6F6G/GT	VI	7B7	IV	14B8	V	46	VI
6F7/S	II	7B8	V	14C5	VI	47	VI
6F8G	III	7C4	I	14C7	IV	48	VI
6G5 6H5	VIII	7C5	VI	14E6	II	49	VI
6G6G	VI	7C6	II	14E7	III	50	VI
6H4	I	7C7	IV	14F7	III	50A5	VI
6H4GT	I	7E5	III	14F8	III	50AX6G	I
6H5	VIII	7E6	II	14M7	IV	50C6G	VI
6J4	III	7E7	II	14J7	V	50X6	I
6J7G GT	IV	7F7	III	14N7	III	50Y6GT	I
6J8G	V	7F8	III	14Q7	V	50Y7GT	I
6K4	III	7G7	IV	14R7	II	50Z7GT	I
6K5G GT	III	7G8	IV	14S7	V	51	IV
6L5G	III	7H7	IV	14W7	IV	51S	IV
6N4	III	7J7	V	14X7	II	52	VI
6N6G	VI	7K7	II	14Y4	I	53	VI
6P5GT	III	7L7	IV	14Z3	I	55	II
6P7G	II	7M7	III	15	IV	55S	II
6Q6 G	II	7Q7	V	16B	I	56	III
6Q7 G GT	II	7R7	II	16B	I	56AS	III
6R6G	IV	7S7	V	18	VI	57	IV
6R7 G GT	II	7T7	IV	19	VI	57AS	IV
6R8	II	7V7	IV	19C8	II	58	IV
6S7G	IV	7W7	IV	19V8	II	58AS	IV
6SB7Y	V	7Y4	I	19X8	V	59	VI
6SC5	III	7X6	I	20	VI	64	IV
6SD7GT	IV	7X7	II	22	IV	64A	IV
6SE7GT	IV	7Z4	I	24A	IV	65	IV
6SF5 GT	III	10	VI	25	II	65A	IV
6SF7	II	11	III	25A6/G GT	VI	67	III
6SR7GT	II	12	III	25A7GT	VI	67A	III
6SS7	IV	12A 112A	VI	25AC5GT	VI	68	VI
6ST7	II	12A4	VII	25B5	VI	68A	VI
6SU7GT	III	12A5	VI	25B6G	VI	70A7GT	VI
6SV7	II	12A6 GT	VI	25B8	II	70L7GT	VI
6SZ7	II	12A7	VI	25C6G	VI	71	VI
6T5	VIII	12A8GT	V	25D8GT	II	71A	VI
6T6	II	12AH6	IV	25N6	VI	71B	VI
6T7G 6Q6G	II	12AH7GT	III	25W6 GT	VI	75	II
6U4GT	I	12AW6	IV	25Y5	I	76	III
6U5	VIII	12AY7	III	25Z5	I	77	IV
6U6GT	VI	12B7	IV	26	III	78	IV
6U7G	IV	12B8GT	II	26A6	IV	79	VI
6V5G GT	VI	12BA7	V	26A7	VI	80	VI
6V7G	II	12CB	II	26C6	II	81	I
6V8	II	12CS5	VI	26D6	V	82	I
6W5G	I	12CS6	IV	27	III	82V	I
6W7G	IV	12FSGT	III	28Z5	I	84/6Z4	I
6X5GT	I	12G4	III	30	III	85	II
6Y3G	I	12H4	III	31	VI	85AS	I
6Y5 V	I	12H6	I	32	IV	88	I
6Y7G	VI	12J7G GT	IV	32L7GT	VI	89/89Y	VI
6Z3	I	12K7G GT	IV	33	VI	95	VI
6Z4	I	12K8 GT	V	34	IV	96	I
6Z4 84	I	12L8GT	VI	35 51	IV	117L7 M7GT	VI
6Z5 12Z5	I	12O7G GT	II	35A5	VI	117N7GT	VI
6Z7G	VI	12S8	II	35Y4	I	117P7GT	VI
6ZY5G	I	12SC7	III	35Z3	I	117Z4GT	I
7A4	III	12SF5 GT	III	35Z6G	I	182B 482B	VI
7A5	VI	12SF7	II	36	IV	183 483	VI
7A6	I	12SM7	IV	37	III	210T	VI
7A7	IV	12SJ7 GT	IV	38	VI	401	III
7A8	V	12SL7GT	III	39 44	IV	484	III
7AB7	IV	12SR7	II	40	III	950	VI
7AD7	IV	12Z3	I	40Z5 45Z5GT	I	951	IV
7AF7	III	12Z5	I	41	VI	5642	I
7AG7	IV	13	I	42	VI	9002	III
7AH7	IV	14A4	III	43	VI	9003	IV
7AJ7	IV	14A5	VI	44	IV	9006	I

TABLE I.

CBS

DIODES

	DESCRIPTION				CONSTRUCTION		CATHODE		MAX. RATINGS		SERVICE		AVERAGE CHARACTERISTICS AND TYPICAL OPERATION						
TYPE	CLASS*	NEAREST EQUIVALENT	BASING	BASE & PINS	HTR./FIL.	VOLTS	AMPERES	PEAK INVERSE VOLTS	PEAK PLATE MA	APPLICATION	PLATE SUPPLY VOLTS. RMS (EACH PLATE)	MIN. PLATE SUPPLY IMPEDANCE Ω	INPUT CAPACITOR μ F	MIN. INPUT CHOKER H	VOLTAGE DROP EACH SECTION (V. at MA.)	OUTPUT VOLTAGE AT FILTER INPUT	D.C. OUTPUT, MA	TYPE	
1A3	S	1R4	5AP	Min.-7	Fil.	1.4	0.15	330	5.0	HF Detector & Rectifier	117	0	2.0	—	—	—	0.5	1A3	
1R4	S	1A3	4AH	Loctal	Fil.	1.4	0.15	—	—	HF Detector & Rectifier	117	—	—	—	8 at 2.0	—	1	1R4	
1V	S	6Z3	4G	Small-4	Htr.	6.3	0.3	1000	270.0	Half-Wave Rectifier	117 150 325	0 30 75	— — —	— — —	20 at 90.0 — —	— — —	45 45 45	1V	
2S/4S	D		5D	Small-5	Htr.	2.5	1.35	—	—	Detector	50	Approx. 40 ma per plate				—	50	2S/4S	
2V2	S		8FV	Octal	Fil.	2.5 1.25	0.2 0.4	15,000 21,000 30,000	80.0 80.0 —	High Voltage Rectifier	— — —	— — —	— — —	— — —	150 at 7.0	— — —	2.0 1.0 0.2	2V2	
2V3G	S		4Y	Octal	Fil.	2.5	5.0	16,500	12.0	H-W Rectifier	6000	—	—	—	—	—	2.0	2V3G	
2W3, GT	S	2Z2/G84	4X	Octal	Fil.	2.5	1.50	—	—	H-W Rectifier	350	Capacitor input to filter				—	55	2W3, GT	
2Z2/G84	S	2W3GT	4B	Medium-4	Fil.	2.5	1.50	—	—	H-W Rectifier	350	—	—	—	—	—	50	2Z2/G84	
5AU4	D		5T	Octal	Fil.	5.0	4.5	1400	1075	F-W Power Rectifier	300 400 500	30 50 —	40 40 —	— — 10	50 at 350 — —	275 395 395	350 325 325	5AU4	
5AX4GT	D		5T	Octal	Fil.	5.0	2.5	1400	525	F-W Power Rectifier	350 500	50 —	10 —	— 10	— —	330 375	175 175	5AX4GT	
5AZ4	D	5Y3GT	5T	Octal	Fil.	5.0	2.0	1400	400	F-W Power Rectifier	350 500	50 —	20 —	— 10	60 at 125 60 at 125	360 380	125 125	5AZ4	
5T4	D	5U4GB	5T	Octal	Fil.	5.0	2.0	1550	675	F-W Power Rectifier	450 550	150 —	— —	— 3	— —	— —	225 225	5T4	

*S=Single diode. D=Duodiode. T=Triode diode.

	DESCRIPTION			CONSTRUCTION		CATHODE		MAX. RATINGS		SERVICE	AVERAGE CHARACTERISTICS AND TYPICAL OPERATION							
TYPE	CLASS*	NEAREST EQUIVALENT	BASING	BASE & PINS	HTR./FIL.	VOLTS	AMPERES	PEAK INVERSE VOLTS	PEAK PLATE MA	APPLICATION	PLATE SUPPLY VOLTS, RMS (EACH PLATE)	MIN. PLATE SUPPLY IMPEDANCE, Ω	INPUT CAPACITOR, μ F	MIN. INPUT CHOKER, H	VOLTAGE DROP EACH SECTION, CV. (at MA.)	OUTPUT VOLTAGE AT FILTER INPUT	D-C OUTPUT, MA	TYPE
5W4, G, GT	D	5Y4GT	5T	Octal	Fil.	5.0	1.5	1400	300	F-W Power Rectifier	350 500	> 25 —	— —	— 6	45 at 100 45 at 100	— —	100 100	5W4, G, GT
5X3	D		4C	Medium-4	Fil.	5.0	2.0	—	—	F-W Power Rectifier	400 1275	Choke or Capacitor input to filter Choke or Capacitor input to filter					110 30	5X3
5X4G	D	5U4GB	5Q	Octal	Fil.	5.0	3.0	1550	675	F-W Power Rectifier	450 550	75 —	40 —	— 3	50 at 225 —	— —	225 225	5X4G
5Z4	D		5L	Octal	Htr.	5.0	2.0	1400	375	F-W Power Rectifier	350 500	30 —	40 —	— 5	20 at 125 —	— —	125 125	5Z4
6AN6	D		7BJ	Min.-7	Htr.	6.3	0.2	210	45	Detector	75	—	—	—	9 at 6.6	—	3.3	6AN6
6AX6G	D	6A3	7Q	Octal	Htr.	6.3	2.5	1250 2000	600 600	F-W Rectifier Damper	350 350	145 —	40 —	—	21 at 250 —	350 —	250 —	6AX6G
6BY5G	D		6CN	Octal	Htr.	6.3	1.6	1400 2500	525 525	Rectifier Damper	375 —	100 —	8.0 —	—	32 at 175 —	380 —	175 —	6BY5G
6H4, GT	S	6H6GT	5AF	Octal	Htr.	6.3	0.15	—	—	Detector	100	—	—	—	—	—	4.0	6H4, GT
6U4GT	D	6W4GT	4CG	Octal	Htr.	6.3	1.2	1375	660	H-W Rectifier	350	145	20	—	21 at 250	335	125	6U4GT
6W5G	D	6X6G	6S	Octal	Htr.	6.3	0.9	—	—	F-W Rectifier	325 450	Capacitor input to filter Choke input to filter					90 90	6W5G
6X5GT	D	6Y5/V	6S	Octal	Htr.	6.3	0.6	1250	210	F-W Power Rectifier	325 450	150 —	40 —	— 10	— 22 at 70	— —	70 70	6X5GT
6Y3G	S		4AC	Octal	Htr.	6.3	0.7	14,000	100	H-W Rectifier	5000	Choke or Capacitor input to filter					7.5	6Y3G
6Y5/V	D	6X5GT	6J	Small-6	Htr.	6.3	0.8	1500	—	F-W Rectifier	350	Capacitor input to filter					50	6Y5/V
6Z3	S	1V	4G	Small-4	Htr.	6.3	0.3	—	—			Same as 1V						6Z3

TABLE I. (continued) Diodes

		DESCRIPTION		CONSTRUCTION		CATHODE		MAX. RATINGS		SERVICE	AVERAGE CHARACTERISTICS AND TYPICAL OPERATION							
TYPE	CLASS*	NEAREST EQUIVALENT	BASING	BASE & PINS	HTR./FIL.	VOLTS	AMPERES	PEAK INVERSE VOLTS	PEAK PLATE MA	APPLICATION	PLATE SUPPLY VOLTS, RMS (EACH PLATE)	MIN. PLATE SUPPLY IMPEDANCE, Ω	INPUT CAPACITOR, μ F	MIN. INPUT CHOKE, H	VOLTAGE DROP EACH SECTION (V, μ MA)	OUTPUT VOLTAGE AT FILTER INPUT	D-C OUTPUT, MA	TYPE
6Z4, 6Z4/84	D	6X5GT	5D	Small-5	Htr.	6.3	0.5	— 1250	— 180	F-W Power Rectifier	325 450			Capacitor input to filter Choke input to filter			60 60	6Z4, 6Z4/84
6Z5/12Z5	D		6K	Small-6	Htr.	6.3	0.8	—	—	F-W Power Rectifier	230			Capacitor input to filter			60	6Z5/12Z5
6ZY5G	D	6Y5 V	6S	Octal	Htr.	6.3	0.3	1250	120	F-W Power Rectifier	325 450	225 —	— 13.5	— —	— —	40 40		6ZY5G
7A6	D	6H6GT	7AJ	Loctal	Htr.	6.3	0.15	420	48	Detector & H-W Rectifier	117 150	15 40	— —	11 at 16 11 at 16	— —	8 8		7A6
7C4	S	9006	4AH	Loctal	Htr.	6.3	0.15	—	—	Detector & H-W Rectifier	117	Resonant Frequency = 900 Mc				—	5	7C4
7X6	D		7AJ	Loctal	Htr.	6.3	1.2	700	450	H-W Power Rectifier	117 150	15 40	16 16	— —	22 at 150 22 at 150	— —	75 75	7X6
7Y4	D	6X5GT	5AB	Loctal	Htr.	6.3	0.5	1250	210	F-W Power Rectifier	325 450	150 —	40 —	10 —	22 at 70 22 at 70	— —	70 70	7Y4
7Z4	D	6X5GT	5AB	Loctal	Htr.	6.3	0.9	1250	300	F-W Power Rectifier	325 450	75 —	40 —	6 —	40 at 100 40 at 100	— —	100 100	7Z4
12H6	D	12AL5	7Q	Octal	Htr.	12.6	0.15	150	—	Detector & H-W Rectifier	150	15	—	—	—	—	8	12H6
12Z3	S		4G	Small-4	Htr.	12.6	0.3	700	330	H-W Power Rectifier	117 150 235	0 30 75	Capacitor input to filter				55 55 55	12Z3
12Z5	D		6K	Octal	Htr.	12.6	0.3	—	—	Same as 6Z5/12Z5								12Z5
13	D		6C	Medium-4	Htr.	5.0	2.0	1400	440	F-W Power Rectifier	350 500	50 —	20 —	10 —	50 at 125 50 at 125	360 380	125 125	13

*S = Single diode. D = Duodiode. T = Triple diode.

TABLE I. (continued) Diodes

	DESCRIPTION			CONSTRUCTION		CATHODE		MAX. RATINGS		SERVICE		AVERAGE CHARACTERISTICS AND TYPICAL OPERATION							
TYPE	CLASS*	NEAREST EQUIVALENT	BASING	BASE & PINS	HTR./FIL.	VOLTS	AMPERES	PEAK INVERSE VOLTS	PEAK PLATE MA	APPLICATION	PLATE SUPPLY VOLTS, RMS (EACH PLATE)	MIN PLATE SUPPLY IMPEDANCE, Ω	INPUT CAPACITOR, μ F	MIN. INPUT CHOKE, H	VOLTAGE DROP EACH SECTION (V. at MA.)	OUTPUT VOLTAGE AT FILTER INPUT	D-C OUTPUT, MA	TYPE	
14Y4	D		5AB	Loctal	Htr.	12.6	0.3	—	—	Same as 7Y4								14Y4	
14Z3	S		4G	Small-4	Htr.	12.6	0.3	—	—	—	250	—	—	—	—	—	60	14Z3	
16, 16B	S	8J	4B	Small-4	Htr.	7.5	1.25	2000	500	H-W Power Rectifier	700	—	—	—	—	—	85	16, 16B	
25Y5	D	25Z5 25Z6GT	6E	Small-6	Htr.	25.0	0.3	700	—	H-W Power Rectifier	235	0	—	—	—	—	75	25Y5	
25Z5	D	25Z6	6E	Small-6	Htr.	25.0	0.3	700	450	H-W Rectifier Doubler	235 H-W 117 F-W 117	100 30 15	16 16 16	— — —	22 at 150 — —	— 75 75	75	25Z5	
28Z5	D		6B1	Loctal	Htr.	28.0	0.24	—	—	F-W Power Rectifier	325 450	Capacitor input to filter Choke input to filter 6.0			—	—	100 100	28Z5	
35Y4	S	35Z5GT 40Z5/45Z5GT	5AL	Loctal	Htr.	35.0	0.15	700	600	H-W Power Rectifier	235 235 117	100 100 15	40 40 40	With panel lamp — 18 at 200	— 235 120	60 100 100	35Y4		
35Z3	S	35W4, 35Y4 35Z4, 35Z5GT	4Z	Loctal	Htr.	35.0	0.15	700	600	H-W Power Rectifier	117 235	15 100	40 40	— —	— 18 at 200	120 235	100 100	35Z3	
35Z6G	D		7Q	Octal	Htr.	35.0	0.3	—	—	H-W Rectifier Doubler	117 235	— —	— —	— —	— —	110 110	35Z6G		
40Z5/45Z5GT	S	35Z5GT	6AD	Octal	Htr.	45.0	0.15	—	Same as 35Y4								40Z5/45Z5GT		
45Z3	S		5AM	Min.-7	Htr.	45.0	0.075	350	390	H-W Rectifier	117	15	40	—	23 at 130	—	65	45Z3	
50AX6G	D		7Q	Octal	Htr.	50.0	0.3	1250 2000	600 600	F-W Rectifier Damper	350	145	40	—	21 at 250	—	250	50AX6G	
50X6	D	50Y7GT 50Z7GT	7AJ	Loctal	Htr.	50.0	0.15	700	450	H-W Rectifier Doubler	235 H-W 117 F-W 117	100 30 15	16 16 16	— — —	— 22 at 150 —	— 75 75	75	50X6	

TABLE I. (continued) Diodes

		DESCRIPTION		CONSTRUCTION		CATHODE		MAX. RATINGS		SERVICE	AVERAGE CHARACTERISTICS AND TYPICAL OPERATION							
TYPE	CLASS*	NEAREST EQUIVALENT	BASING	BASE & PINS	HTR./FIL.	VOLTS	AMPERES	PEAK INVERSE VOLTS	PEAK PLATE MA	APPLICATION	PLATE SUPPLY VOLTS, RMS (EACH PLATE)	MIN. PLATE SUPPLY IMPEDANCE, Ω	INPUT CAPACITOR, μ F	MIN. INPUT CHOKE, H	VOLTAGE DROP EACH SECTION (V. at MA.)	OUTPUT VOLTAGE AT FILTER INPUT	D-C OUTPUT, MA	TYPE
50Y6GT	D	50Z7GT	7Q	Octal	Htr.	50.0	0.15	700	450	H-W Rectifier Doubler	235 H-W 117 F-W 117	100 30 15	40 40 40	— — —	— — 22 at 150	— — —	75 75 75	50Y6GT
50Y7GT	D	50Y6GT	8AN	Octal	Htr.	50.0	0.15	235 117	450 450	H-W Rectifier Doubler	150 235 117	40 100 15	40 40 40	— — Lamp shunt = 250 Ω	22 at 150 — —	— 65 65	65 65 65	50Y7GT
50Z7GT	D	50Y6GT	8AN	Octal	Htr.	50.0	0.15	—	—	H-W Rectifier Doubler	235 117	100 15	40 40	— Lamp shunt = 250 Ω	22 at 150 —	— 65	65	50Z7GT
80	D	5Y3GT	4C	Medium-4	Fil.	5.0	2.0	1400	400	F-W Rectifier	350 500	50 —	10 —	— 10	60 at 125 60 at 125	350 390	125 125	80
81	S		4B	Medium-4	Fil.	7.5	1.25	2000	500	H-W Rectifier	700	—	4	20	—	—	85	81
82/82V	D		4C	Medium-4	Fil.	2.5	3.0	1550	600	F-W Mercury Rectifier	450 550	50 —	40 —	— 6	15 at 115 —	— 115	115 115	82/82V
84/6Z4	D		5D	Small-5	Htr.	6.3	0.5	1250	180	F-W Power Rectifier	325 450	65 —	40 —	— 10	20 at 60 —	— 60	60 60	846/Z4
88	D		4C	Medium-4	Fil.	5.0	2.0	—	—	F-W Power Rectifier	450	—	—	—	—	—	125	88
96	S		4G	Small-4	Htr.	10.0	0.5	—	—	H-W Power Rectifier	350	—	—	—	—	—	100	96
117Z4GT	S	117Z6GT	5AA	Octal	Htr.	117.0	0.04	350	540	H-W Rectifier	117	30	C input	—	22 at 180	—	90	117Z4GT
5642	S		5642	Submin.-2	Fil.	1.25	0.2	10,000	12	TV High V. Rectifier	3600	—	—	—	—	—	2	5642
9006	S		6BH	Min.-7	Htr.	6.3	0.15	750	15	UMF Detector	270	100	—	—	—	—	5	9006

*S=Single diode. D=Duodiode. T=Triode diode.

TABLE II.

CBS

DETECTOR AMPLIFIERS (Diode and Triode, Tetrode, or Pentode Combined)

	DESCRIPTION				CONSTR.	CATHODE		MAX. RATINGS		SERVICE		AVERAGE CHARACTERISTICS AND TYPICAL OPERATION										
TYPE	CLASS*	NEAREST EQUIVALENT	BASING	BASE & PINS	HTF./FIL.	VOLTS	AMPERES	PLATE VOLTS	SCREEN VOLTS	APPLICATION	PLATE VOLTS	SCREEN VOLTS	GRID VOLTS	PLATE RESISTANCE	TRANSCONDUCTANCE μMHOS	AMP. FACTOR	PLATE MA	SCREEN MA	AV. DIODE MA AT APPLIED VOLTS	TYPE		
1AF5	D+P	1S5	6AU	Min.-7	Fil.	1.4	0.025	110	110	A-F Class A	67.5 90	67.5 90	0	230K 200K	550 600	—	0.7 1.1	0.25 0.4	0.7 at 10 0.7 at 10	1AF5		
1B5/25S	D+D+T	1H6GT	6M	Small-6	Fil.	2.0	0.06	—	—	A-F Class A	135	—	—3.0	35K	575	20	0.8	—	—	1B5/25S		
1B8GT	D+T+P	1D8GT	8AJ	Octal	Fil.	1.4	0.10	—	—	Triode Class A Pentode Class A	90 90	— 90	0 —6.0	240K R _L = 14K	275 1150	— P _o = 21W	0.15 6.3	— 1.4	—	1B8GT		
1D8GT	D+T+P	1B8GT	8AJ	Octal	Fil.	1.4	0.10	—	—	Triode Class A Pentode Class A	90 90	— 90	0 —9.0	43.5K 200K	575 925	25 —	1.1 5.0	— 1.0	—	1D8GT		
1F6	D+D+P	1F7G	6W	Small-6	Fil.	2.0	0.06	—	—	R-F Class A A-F Class A	180 135	67.5 135	—1.5 —1.0	1000K 250K	650 R _{ez} = 1.0 meg	650 VG-48	2.0 .42	0.6 —	—	1F6		
1F7G, H, V	D+D+P	1F6	7AD 7AF	Octal	Fil.	2.0	0.06	Same as 1F6												1F7G, H, V		
1H5GT	D+T	1LH4	5Z	Octal	Fil.	1.4	0.05	110	—	A-F Class A	90	R _e = 1.0 meg	0	240K	275	65	0.15	—	0.5 at 10	1H5GT		
1H6G, GT	D+D+T	1B5/25S	7AA	Octal	Fil.	2.0	0.06	—	—	A-F Class A	135	—	—3	35K	575	20	0.8	—	—	1H6G, GT		
1LD5	D+P		6AX	Loctal	Fil.	1.4	0.05	110	50	A-F Class A	45 90	45 45	0 0	900K 450K	550 575	—	0.55 0.6	0.12 0.1	0.5 at 10 0.5 at 10	1LD5		
1LH4	D+T	1H5GT	5AG	Loctal	Fil.	2.0	0.06	Same as 1H5GT												1LH4		
1N6G	D+P		7AM	Octal	Fil.	1.4	0.05	—	—	Power Class A	90	90	—4.5	R _L = 25K	800	P _a = .1W	3.1	0.6	—	1N6G		
1Q6	D+P		8CD	Sub-min.-8	Fil.	1.25	0.04	—	—	A-F Class A	30 67.5	30 67.5	0 0	500K 400K	330 600	—	0.33 1.6	0.09 0.4	—	1Q6		
1SB6GT	D+P	1LD5	8BE	Octal	Fil.	1.4	0.05	—	—	A-F Class A	45 90	45 67.5	0 0	900K 700K	500 665	—	0.6 1.45	0.16 0.38	—	1SB6GT		

TABLE II. (continued) Detector Amplifiers

	DESCRIPTION				CONSTR.		CATHODE		MAX. RATINGS		SERVICE		AVERAGE CHARACTERISTICS AND TYPICAL OPERATION									
TYPE	CLASS*	NEAREST EQUIVALENT	BASING	BASE & PINS	HTR./FIL.	VOLTS	AMPERES	PLATE VOLTS	SCREEN VOLTS	APPLICATION	PLATE VOLTS	SCREEN VOLTS	GRID VOLTS	PLATE RESISTANCE	TRANSCONDUCTANCE μMHOS	AMP. FACTOR	PLATE MA	SCREEN MA	AV. DIODE MA AT APPLIED VOLTS	TYPE		
2A6	D+D+T		6G	Small-6	Htr.	2.5	0.8	250	—	A-F Class A	250	—	—2.0	91K	1100	100	0.9	—	0.8 at 10	2A6		
2B7, S	D+D+P		7D	Small-7	Htr. Htr.	2.5 2.5	0.8 0.8	300	125	A-F Class A	250 250	125 100	—3.0 —3.0	650K 800K	1125 1000	730 800	9.0 6.0	2.3 1.5	0.8 at 10	2B7, S		
3A8GT	D+T+P		8AS	Octal	Htr.	1.4 2.8	0.1 0.05	110 110	—	Triode Class A Pentode Class A	90 90	— 90	0 0	200K 800K	325 750	65 —	0.2 1.5	— 0.5	0.5 at 10 —	3A8GT		
6AQ7GT	D+D+T		8CK	Octal	Htr.	6.3	0.5	250	—	A-F Class A	250	—	—2	44K	1600	70	2.3	—	—	6AQ7GT		
6B6G	D+D+T	6Q7GT	7V	Octal	Htr.	6.3	0.3			Same as 2A6										6B6G		
6B7	D+D+P	6B8GT	7D	Small-7	Htr.	6.3	0.30	300	125	A-F Class A	100 250	100 125	—3.0 —3.0	300K 600K	950 1125	—	5.8 9.0	1.7 2.3	0.8 at 10 —	6B7		
6B8, G, GT	D+D+P	6B7	8E	Octal	Htr.	6.3	0.30	300 300	125 —	A-F Class A	250 250	125 —	—3.0 —3.0	600K 600K	1125 1325	—	9.0 10.0	2.3 2.3	0.8 at 10 —	6B8, G, GT		
6BD7	D+D+T		9Z	Min.-9	Htr.	6.3	0.23	—	—	A-F Class A	250	—	—3.0	58K	1200	70	1.0	—	—	6BD7		
6BK6	D+D+T		7BT	Min.-7	Htr.	6.3	0.3	300	—	A-F Class A	100 250	—	—1.0 —2.0	80K 62.5K	1250 1600	100 100	0.5 1.2	— —	— —	6BK6		
6C7	D+D+T	6SR7GT	7G	Small-7	Htr.	6.3	0.3	—	—	A-F Class A	250	—	—9.0	16K	—	20	4.5	—	—	6C7		
6F7, S	T+P	6P7G	7E	Small-7	Htr.	6.3	0.3	—	—	Triode Class A Pentode Class A	100 250	— 100	—3.0 —3.0	16K 850K	500 1100	8.5 900	3.5 6.5	— 1.5	— —	6F7, S		
6P7G	T+P	6F7	7U	Octal	Htr.	6.3	0.3			Same as 6F7										6P7G		
6Q6, G	D+T		6Y	Octal	Htr.	6.3	0.15	—	—	A-F Class A	250	—	—3.0	61K	1050	65	1.2	—	—	6Q6, G		

*Class Code:

D+P = Diode-pentode.

D+T+P = Diode-triode-pentode.

D+T = Diode-triode.

D+D+T = Duodiode-triode.

D+D+P = Duodiode-pentode.

T+P = Triode-pentode.

TABLE II. (continued) Detector Amplifiers

	DESCRIPTION			CONSTR.		CATHODE		MAX. RATINGS		SERVICE		AVERAGE CHARACTERISTICS AND TYPICAL OPERATION									
TYPE	CLASS*	NEAREST EQUIVALENT	BIASING	BASE & PINS	HTL/FIL	VOLTS	AMPERES	PLATE VOLTS	SCREEN VOLTS	APPLICATION	PLATE VOLTS	SCREEN VOLTS	GRID VOLTS	PLATE RESISTANCE	TRANSCONDUCTANCE μMHMS	AMP. FACTOR	PLATE MA	SCREEN MA	AV. DIODE MA AT APPLIED VOLTS	TYPE	
6Q7, G, GT	D+D+T		7V	Octal	Htr.	6.3	0.3	300	—	A-F Class A	100 250	—	—1.0 —3.0	58K 58K	1200 1200	70 70	0.8 1.0	— —	0.8 at 10	6Q7, G, GT	
6R7, G, GT	D+D+T	6SR7GT	7V	Octal	Htr.	6.3	0.3	250	—	A-F Class A	250	—	—9.0	8.5K	1900	16	9.5	—	—	6R7, G, GT	
6R8	D+D+D+T		9E	Min.-9	Htr.	6.3	0.45	250 <i>R_{g1} = 1 meg</i>	—	A-F Class A	250	—	—9.0	8.5K	1900	16	9.5	<i>R_{g2} = 10000Ω</i>	—	6R8	
6SF7	D+P	6SV7	7AZ	Octal	Htr.	6.3	0.3	300	100	A-F Class A	100 250	100 100	—1.0 —1.0	200K 700K	1975 2050	— —	12.0 12.4	3.4 3.3	— —	6SF7	
6SR7GT	D+D+T	6R7GT	8Q	Octal	Htr.	6.3	0.3	250	—	A-F Class A	250	—	—9.0	8.5K	1900	16	9.5	—	—	6SR7GT	
6ST7	D+D+T	6T7G	8Q	Octal	Htr.	6.3	0.15			Same as 6SR7GT										6ST7	
6SV7	D+P		7AZ	Octal	Htr.	6.3	0.3	300	150	A-F Class A	100 250	100 150	—1.0 —1.0	700K 1500K	2600 3600		3.7 7.5	1.4 2.8	15 at 10 15 at 10	6SV7	
6SZ7	D+D+T	6SQ7GT	8Q	Octal	Htr.	6.3	0.15	—	—	A-F Class A	100 250	—	—1.0 —3.0	61K 58K	1150 1200	70 70	0.8 1.0	— —	— —	6SZ7	
6T6	D+D+T		6Z	Octal	Htr.	6.3	0.45	—	—	A-F Class A	250	100	—1.0	1000K	5500	—	10.0	2.0	—	6T6	
6T7G/6Q6G	D+D+T	6ST7	7V	Octal	Htr.	6.3	0.15	—	—	A-F Class A	100 250	—	—1.5 —3.0	95K 62K	680 1050	65 65	0.3 1.2	— —	— —	6T7G/6Q6G	
6V7G	D+D+T	85	7V	Octal	Htr.	6.3	0.3	—	—	A-F Class A	135 180 250	— — —	—10.5 —13.5 —20.0	11K 8.5K 7.5K	750 975 1100	8.3 8.3 8.3	3.7 6.0 8.0	— — —	— — —	6V7G	
6V8	D+D+D+T		9AH	Min.-9	Htr.	6.3	0.45	300	—	A-F Class A	100 250	— —	—1.0 —3.0	54K 58K	1300 1200	70 70	0.8 1.0	— —	<i>D₂ & D₃ 40 at 5 D₁ 2 at 10</i>	6V8	

TABLE II. (continued) Detector Amplifiers

TYPE	DESCRIPTION				CONSTR.		CATHODE			MAX. RATINGS	SERVICE		AVERAGE CHARACTERISTICS AND TYPICAL OPERATION										TYPE
	CLASS*	NEAREST EQUIVALENT	BASING	BASE & PINS	HTR./FIL.	VOLTS	AMPERES	PLATE VOLTS	SCREEN VOLTS	APPLICATION	PLATE VOLTS	SCREEN VOLTS	GRID VOLTS	PLATE RESISTANCE	TRANS-CONDUCTANCE μMHOS	AMP. FACTOR	PLATE MA	SCREEN MA	AV. DIODE MA AT APPLIED VOLTS				
7B6	D+D+T	6B6G 6Q7GT	8W	Loctal	Htr.	6.3	0.3	300	—	A-F Class A	100 250	—	—1.0 —2.0	110K 91K	900 1100	100 100	0.4 0.9	—	2 at 10 —	7B6			
7C6	D+D+T		8W	Loctal	Htr.	6.3	0.15	300	—	A-F Class A	100 250	—	0 —1.0	100K 100K	850 1000	85 100	1.0 1.3	—	2 at 10	7C6			
7E6	D+D+T		8W	Loctal	Htr.	6.3	0.3	300	—	A-F Class A	100 250	—	—3.0 —9.0	11K 8.5K	1500 1900	16.5 16.0	3.9 9.5	—	0.8 at 10	7E6			
7E7	D+D+P		8AE	Loctal	Htr.	6.3	0.3	300	100	R-F Class A	100 250	100 100	—1.0 —3.0	150K 700K	1600 1300	—	10.0 7.5	2.7 1.6	—	7E7			
7K7	D+D+T		8BF	Loctal	Htr.	6.3	0.3	300	—	A-F Class A	250	—	—2.0	44K	1600	70	2.3	—	—	7K7			
7R7	D+D+P		8AE	Loctal	Htr.	6.3	0.3	250	—	A-F Class A	100 250	100 100	—1.0 —1.0	350K 1000K	3000 3200	—	5.5 5.7	2.2 2.1	2 at 10 —	7R7			
7X7	D+D+T		8BZ	Loctal	Htr.	6.3	0.3	300	—	FM Detector A-F Class A	100 250	—	0 —1.0	85K 67K	1000 1500	85 100	1.2 1.9	—	1 at 5 —	7X7			
12B8GT	T+P		8T	Octal	Htr.	12.6	0.3	—	—	Triode Class A Pentode Class A	90 90	— 90	0 —3.0	37K 200K	2400 1800	90 —	2.8 7.0	— 2.0	—	12B8GT			
12C8	D+D+P		8E	Octal	Htr.	12.6	0.15	Same as 6B8												12C8			
12Q7, G, GT	D+D+T	14B6	7V	Octal	Htr.	12.6	0.15	Same as 6Q7 • 6Q7G • 6Q7GT												12Q7, G, GT			
12S8	D+D+D+T		8CB	Octal	Htr.	12.6	0.15	300	—	A-F Class A	100 250	—	—1.0 —2.0	110K 91K	900 1100	100 100	0.4 0.9	—	2.5 at 10 —	12S8			
12SF7	D+P		7AZ	Octal	Htr.	12.6	0.015	—		Same as 6SF7										12SF7			
12SR7	D+D+T		8Q	Octal	Htr.	12.6	0.15	—		Same as 6SR7GT										12SR7			

*Class Code:

D+P = Diode-pentode.

D+T+P = Diode-triode-pentode.

D+D+T = Duodiode-triode.

D+T = Diode-triode.

D+D+P = Duodiode-pentode.

T+P = Triode-pentode.

TABLE II. (continued) Detector Amplifiers

	DESCRIPTION				CONSTR.	CATHODE		MAX. RATINGS	SERVICE	AVERAGE CHARACTERISTICS AND TYPICAL OPERATION												
TYPE	CLASS*	NEAREST EQUIVALENT	BASING	BASE & PINS	HTR./FIL.	VOLTS	AMPERES	PLATE VOLTS	SCREEN VOLTS	APPLICATION	PLATE VOLTS	SCREEN VOLTS	GRID VOLTS	PLATE RESISTANCE	TRANSCONDUCTANCE μMHOS	AMP. FACTOR	PLATE MA	SCREEN MA	AV. DIODE MA AT APPLIED VOLTS	TYPE		
14B6	D+D+T	12Q7GT	8W	Loctal	Htr.	12.6	0.15	—	Same as 7B6													14B6
14E6	D+D+T		8W	Loctal	Htr.	12.6	0.15	—	Same as 7E6													14E6
14E7	D+D+P		8AE	Loctal	Htr.	12.6	0.15	—	Same as 7E7													14E7
14R7	D+D+P		8AE	Loctal	Htr.	12.6	0.15	—	Same as 7R7													14R7
14X7	D+D+T		8BZ	Loctal	Htr.	12.6	0.15	—	Same as 7X7													14X7
19C8	D+D+D+T	9E	Min.-9	Htr.	18.9	0.15	—	—	A-F Class A	100	—	—1.0	80K	1250	100	0.5	—	—	19C8			
19V8	D+D+D+T	9AH	Min.-9	Htr.	18.9	0.15	—	—	A-F Class A	100 250	—	—1.0 —3.0	54K 58K	1300 1200	70 70	0.8 1.0	—	—	19V8			
25	D+D+T	6M	Small-6	Fil.	2.0	0.06	—	Same as 105/25S													25	
25B8	T+P	8T	Octal	Htr.	25.0	0.15	—	—	Triode Class A Pentode Class A	100 100	— 100	—1.0 —3.0	75K 185K	1500 2000	112.5 370	0.6 7.6	— 2.0	— —	25B8			
25D8GT	D+T+P	8AF	Octal	Htr.	25.0	0.15	—	—	R-F Class A	100 100	— 100	—1.0 —3.0	91K 200K	1100 1900	100 —	0.5 8.5	— 2.7	— —	25D8GT			
26C6	D+D+T	7BT	Min.-7	Htr.	26.5	0.07	Same as 7E6													26C6		
55, S	D+D+T	6G	Small-6	Htr.	2.5	1.0	Same as 6V7G													55, S		
75	D+D+T	6G	Small-6	Htr.	6.3	0.3	Same as 2A6													75		
85	D+D+T	6G	Small-6	Htr.	6.3	0.3	Same as 6V7G													85		
85AS	D+D+T	6G	Small-6	Htr.	6.3	0.3	—	—	A-F Class A	250	—	—9.0	16K	1250	20	4.5	—	—	85AS			

*Class Code:

D+P = Diode-pentode.

D+T+P = Diode-triode-pentode.

D+D+T = Duodiode-triode.

D+T = Diode-triode.

D+D+P = Duodiode-pentode.

T+P = Triode-pentode.

TABLE III.

CBS

TRIODES—GENERAL PURPOSE (Single and Double Triodes)

DESCRIPTION		CONSTRUCTION		CATHODE		MAX. RATINGS		SERVICE		AVERAGE CHARACTERISTICS AND TYPICAL OPERATION							
TYPE	CLASS*	NEAREST EQUIVALENT	BASING	BASE	HTB./FIL.	VOLTS	AMPERES	PLATE VOLTS	PLATE WATTS	APPLICATION	PLATE VOLTS	GRID VOLTS	PLATE RESISTANCE	TRANSCONDUCTANCE μmhos	AMP. FACTOR (μ _a)	PLATE MA	TYPE
00			4D	Medium-4	Fil.	5.0	1.0	—	—	Detector	45	—	30K	660	20	1.5	00
00A		01A	4D	Medium-4	Fil.	5.0	0.25	—	—	Detector	45	0	30K	660	20	1.5	00A
01	S		4D	Medium-4	Fil.	5.0	1.0	—	—	Detector Class A Amp.	90	—4.5	11K	725	8	2.5	01
01A	S	00A 01B	4D	Medium-4	Fil.	5.0	0.25	—	—	Detector Class A Amp.	90	—4.5	11K	725	8	2.5	01A
01AA	S	01A	4D	Medium-4	Fil.	5.0	0.25	—	—	Detector Class A Amp.	90	—4.5	94K	850	8	3.2	01AA
01B	S	01A	4D	Medium-4	Fil.	5.0	.125	—	—	Detector Class A Amp.	90	—4.5	11K	725	8	2.5	01B
1E4G	S	1E5GP 1E5GT	5S	Octal	Fil.	1.4	0.05	110	—	Detector Class A Amp.	90 90	0 —3	11K 19K	1300 760	14.5 14.5	4.5 1.4	1E4G
1G4G, GT	S		5S	Octal	Fil.	1.4	0.05	110	—	Detector Class A Amp.	90	—6.0	10K	825	8.8	2.3	1G4G, GT
1H4G, GT	D		5S	Octal	Fil.	2.0	0.06	—	—	Class A Amplifier*	90 135 180	—4.5 —9.0 —13.5	11K 10K 10.3K	850 900 900	9.3 9.3 9.3	2.5 3.0 3.1	1H4G, GT
1LE3	S		4AA	Loctal	Fil.	1.4	0.05	Same as 1E4G								1LE3	
1LF3	S		4AA	Loctal	Fil.	1.4	0.05	Same as 1E4G								1LF3	
3A5	D		7BC	Min.-7	Fil.	1.4 2.8	0.27 0.11	135	0.5	Class A Amp.*	90	—2.5	8.3K	1800	15	3.7	3A5
3C6	D	3B7/1291	7BW	Loctal	Fil.	1.4 2.8	0.10 0.05	—	—	Detector Amplifier*	90 90	0 0	11K 12K	1300 1300	14.5 14.1	4.5 3.2	3C6

†Self bias cathode resistor.

‡Conversion Transconductance.

*Each unit.

*Class Code: S—Single triode.

D—Duotriode.

TABLE III. (continued) Triodes—General Purpose

		DESCRIPTION		CONSTRUCTION		CATHODE		MAX. RATINGS		SERVICE	AVERAGE CHARACTERISTICS AND TYPICAL OPERATION						
TYPE	CLASS*	NEAREST EQUIVALENT	BASING	BASE	HTR./FIL.	VOLTS	AMPERES	PLATE VOLTS	PLATE WATTS	APPLICATION	PLATE VOLTS	GRID VOLTS	PLATE RESISTANCE	TRANSCONDUCTANCE μmhos	AMP. FACTOR (μ)	PLATE MA	TYPE
6AD5G, GT	S	6F5GT	6Q	Octal	Htr.	6.3	0.3	—	—	Class A Amp.	250	—2.0	66K	1500	100	0.9	6AD5G, GT
6AE5GT	S	6AF5G	6Q	Octal	Htr.	6.3	0.3	300	2.5	Class A Amp.	95	—15.0	3.5K	1200	4.2	7.0	6AE5GT
6AE6G	D		7AH	Octal	Htr.	6.3	0.15	—	—	Remote Cutoff Class A Amp.* Sharp Cutoff Class A Amp.*	250 250 250 250	—1.5 —35.0 —1.5 —9.5	25K — 35K —	1000 — 950 —	25.0 — 33.0 —	6.5 0.01 4.5 0.01	6AE6G
6AE7G, GT	D		7AX	Octal	Htr.	6.3	0.50	—	—	Twin-input Driver*	250	—13.5	9.3K	1500	14	5.0	6AE7G, GT
6AF5G	S		6Q	Octal	Htr.	6.3	0.3	—	—	Class A Amp.	180	—18.0	4.9K	1500	7.4	7.0	6AF5G
6AH7GT	D		8BE	Octal	Htr.	6.3	0.3	180	1.5	Class A Amp.	100 180	—3.6 —6.5	10.3K 8.4K	1550 1900	16 16	3.7 7.6	6AH7GT
6AJ4	S	6AM4	9BX	Min.-7	Htr.	6.3	0.225	—	—	UHF Amplifier	125	68†	4.2K	10000	42	16	6AJ4
6AN4	S	6AM4	7DK	Min.-7	Htr.	6.3	0.225	300	4	UHF Class A UHF Mixer	200 125	100† 270†	— E _{acc} = 1.4	10000 2900†	70 —	13.0 7.0	6AN4
6AS7G	D		8BD	Octal	Htr.	6.3	2.5	250	13.0*	D-C Amp.*	135	250†	280	7000	2.0	125	6AS7G
6BF7	D	6BG7	8DG	Submin.-8	Htr.	6.3	—	300	1.0*	Class A Amp.* Mixer	100 150	50† 820†	7.1K 10K	5300 1900†	38 E _{acc} = 2.1	8.5 4.8	6BF7
6BG7	D	6BF7	8DG	Submin.-8	Htr.	6.3	0.3	—	—	Same as 6BF7							6BG7
6C8G	D		8G	Octal	Htr.	6.3	0.3	—	—	Class A Amp.*	250	—4.5	22.5K	1600	36	3.2	6C8G
6F4	S		7BR	Acorn	Htr.	6.3	0.225	—	—	Class A Amp.	80	150†	2.9K	5800	17.0	13.0	6F4
6F5, G, GT	S	6SF5GT	5M	Octal	Htr.	6.3	0.3	300	—	Class A Amp.	100 250	—1.0 —2.0	85K 85K	1150 1500	100 100	0.4 0.9	6F5, G, GT

TABLE III. (continued) Triodes—General Purpose

	DESCRIPTION				CONSTRUCTION		CATHODE			MAX. RATINGS		SERVICE		AVERAGE CHARACTERISTICS AND TYPICAL OPERATION					
TYPE	CLASS*	NEAREST EQUIVALENT	BASING	BASE	HTR. FIL.	VOLTS	AMPERES	PLATE VOLTS	PLATE WATTS	APPLICATION	PLATE VOLTS	GRID VOLTS	PLATE RESISTANCE	TRANSCONDUCTANCE μmhos	AMP. FACTOR (μ)	PLATE MA	TYPE		
6F8G	D	6SN7GT	8G	Octal	Htr.	6.3	0.6	300	2.5*	Class A Amp.*	90 250	0 —8.0	6.7K 7.7K	3000 2600	20 20	10.0 9.0	6F8G		
6J4	S		7BQ	Min.-7	Htr.	6.3	0.4	150	2.25	UHF Amplifier	100 150	100† 100†	— —	11000 12000	55 55	10.0 15.0	6J4		
6K4	S		6K4	Submin.-5	Htr.	6.3	0.15	—	—	R-F Amplifier	200	—8.0	4650	3450	16	11.5	6K4		
6K5G, GT	S	6F5GT	5V	Octal	Htr.	6.3	0.3	—	—	Class A Amp.	250	—3.0	50K	1400	70	1.10	6K5G, GT		
6L5G	S		6Q	Octal	Htr.	6.3	0.15	250	—	Class A Amp.	135 250	—5.0 —9.0	11.3K 9K	1500 1900	17 17	3.5 8.0	6L5G		
6N4	S	6C4	7CA	Min.-7	Htr.	6.3	0.2	180	3.0	UHF Amplifier	180	—3.5	5.4K	6000	32	12.0	6N4		
6P5GT	S		6Q	Octal	Htr.	6.3	0.3	250	1.25	Class A Amp.	100 250	—5.0 —13.5	2K 9.5K	1150 1450	13.8 13.8	2.5 5.0	6P5GT		
6Q4	S		9S	Min.-9	Htr.	6.3	0.48	—	—	R-F Amplifier	250	—1.0	—	12000	80	15	6Q4		
6SF5, GT	S	6F5GT	6AB	Octal	Htr.	6.3	0.3	300	—	Class A Amp.	250	—2.0	66K	1500	100	0.9	6SF5, GT		
6SU7GT	D	6SL7GT	8BD	Octal	Htr.	6.3	0.3	—	—	Class A Amp.*	250	—2.0	44K	1600	70	2.3	6SU7GT		
7A4	S	7N7	5AC	Octal	Htr.	6.3	0.3	—	—	Class A Amp.*	90 250	0 —8.0	6.7K 7.7K	3000 2600	20 20	10.0 9.0	7A4		
7AF7	D		8AC	Octal	Htr.	6.3	0.3	300	2.5*	Class A Amp.*	100 100 250	0 —3.0 —10.0	6.5K 8.4K 7.6K	2600 1900 2100	17 16 16	10.8 5.0 9.0	7AF7		
7B4	S		5AC	Octal	Htr.	6.3	0.3	Same as 6SF5									7B4		
7E5	S		8BN	Octal	Htr.	6.3	0.15	250	4.0	Class A Amp.	180	—3.0	12K	3000	36	5.5	7E5		

†Self bias cathode resistor. ‡Conversion Transconductance. *Each unit. *Class Code: S=Single triode. D=Duotriode.

TABLE III. (continued) Triodes—General Purpose

	DESCRIPTION				CONSTRUCTION		CATHODE		MAX. RATINGS		SERVICE		AVERAGE CHARACTERISTICS AND TYPICAL OPERATION						
TYPE	CLASS*	NEAREST EQUIVALENT	BASING	BASE	HTR. FIL.	VOLTS	AMPERES	PLATE VOLTS	PLATE WATTS	APPLICATION	PLATE VOLTS	GRID VOLTS	PLATE RESISTANCE	TRANSCONDUCTANCE μmhos	AMP. FACTOR (μ)	PLATE MA	TYPE		
7F7	D	6SL7	8AC	Loctal	Htr.	6.3	0.3	300	1.0*	Class A Amp.*	100 250	—1.0 —2.0	62K 44K	1125 1600	70 70	0.65 2.3	7F7		
7F8	D		8BW	Loctal	Htr.	6.3	0.3	300	1.75*	Class A Amp.*	250	500†	—	3300	48	6.0	7F8		
7N7	D	6SN7GT	8AC	Loctal	Htr.	6.3	0.6	300	2.5*	Class A Amp.*	90 250	0 —8.0	6.7K 7.7K	3000 2600	20 20	10.0 9.0	7N7		
11	S		4F	Medium-4	Fil.	1.1	0.25	—	—	Detector Class A Amp.	90 135	—4.5 —10.5	15.5K 15K	425 440	6.6 6.6	2.5 3.0	11		
12	S		4D	Medium-4	Fil.	1.1	0.25	—	Same as 11								12		
12AH7GT	D		88E	Octal	Htr.	12.6	0.15	—	Same as 6AH7GT								12AH7GT		
12AY7	D		9A	Min.-9	Htr.	12.6 6.3	0.15 0.3	300 —	1.5* →	Low Noise Class A Amp.*	150 250	—4.0 2700†	— R _L = 20K	1750 C _k = 40μf	40 R _e = 100K	3.0 V _G = 12.5	12AY7		
12F5GT	S	12SF5GT	5M	Octal	Htr.	12.6	0.15	—	Same as 6F5								12F5GT		
12G4	S	12H4	6BG	Min.-7	Htr.	12.6	0.15	300	2.5	Class A Amp.	90 250	0 —8.0	— —	3000 2600	20.0 20.0	10.0 9.0	12G4		
12H4	S	12AU7	7DW	Min.-7	Htr.	12.6 6.3	0.15 0.3	300 —	2.5 —	Class A Amp.	90 250	0 —8.0	— —	3000 2600	20.0 2.0	10.0 9.0	12H4		
12SC7	D		8S	Octal	Htr.	12.6	0.15	250	—	Class A Amp.	250	—2.0	53K	1325	70	2.0	12SC7		
12SF5, GT	S		6AB	Octal	Htr.	12.6	0.15	—	Same as 6SF5 • 6SF5GT								12SF5, GT		
12SL7GT	D		8BD	Octal	Htr.	12.6	0.15	300	1.0*	Class A Amp.*	250	—2.0	44K	1600	70.0	2.3	12SL7GT		
14A4	S	14N7	5AC	Loctal	Htr.	12.6	0.15	—	Same as 7A4								14A4		

TABLE III. (continued) Triodes—General Purpose

	DESCRIPTION				CONSTRUCTION		CATHODE			MAX. RATINGS		SERVICE		AVERAGE CHARACTERISTICS AND TYPICAL OPERATION							
TYPE	CLASS*	NEAREST EQUIVALENT	BASING	BASE	HTR./FIL.	VOLTS	AMPERES	PLATE VOLTS	PLATE WATTS	APPLICATION	PLATE VOLTS	GRID VOLTS	PLATE RESISTANCE	TRANSCONDUCTANCE μmhos	AMP. FACTOR (μ)	PLATE MA	TYPE				
14AF7	D		8AC	Loctal	Htr.	12.6	0.15	—	Same as 7AF7							14AF7					
14F7	D	12SL7	8AC	Loctal	Htr.	12.6	0.15	Same as 7F7							14F7						
14FB	D		8BW	Loctal	Htr.	12.6	0.15	Same as 7FB							14FB						
14N7	D	12SN7GT	8AC	Loctal	Htr.	12.6	0.30	Same as 7N7							14N7						
26	S		4D	Octal	Fil.	1.5	1.05	180	—	R-F Amplifier Class A	90 135 180	—7.0 —10.0 —14.5	8.9K 7.6K 7.3K	935 1100 1150	8.3 8.3 8.3	2.9 5.5 6.2	26				
27	S	37, 76	5A	Octal	Htr.	2.5	1.75	275	—	Detector Class A Amp.	90 135 180	—6.0 —9.0 —13.5	11K 9K 9K	820 1000 1000	9 9 9	2.7 4.5 5.0	27				
30	S	1H4GT	4D	Octal	Fil.	2.0	0.06	180	—	Detector Class A Amp.	90 135 180	—4.5 —9.0 —13.5	11K 10.3K 10.3K	850 900 900	9.3 9.3 9.3	2.5 3.0 3.1	30				
37	S	76, 27	5A	Octal	Htr.	6.3	0.3	250	—	Detector Class A Amp.	90 135 180	—6.0 —9.0 —13.5	11.5K 10K 10.2K	800 925 900	9.2 9.2 9.2	2.5 4.1 4.3	37				
40	S		4D	Octal	Fil.	5.0	0.25	—	—	Class A Amp.	135 180	—1.5 —3.0	150K 150K	200 200	30 30	0.2 0.2	40				
56	S		5A	Octal	Htr.	2.5	1.0	—	—	Detector Class A Amp.	100 250 100 250	—8.0 —20.0 —5.0 —13.5	Bias for $I_b = 0.2$ ma, no signal				12K 9.5K	1150 1450	13.8 13.8	2.5 5.0	56
56AS	S	37, 56	5A	Octal	Htr.	6.3	0.40	Same as 56							56AS						

†Self bias cathode resistor. ‡Conversion Transconductance. *Each unit. *Class Code: S=Single triode. D=Duetriode.

TABLE III. (continued) Triodes—General Purpose

DESCRIPTION		CONSTRUCTION		CATHODE		MAX. RATINGS		SERVICE		AVERAGE CHARACTERISTICS AND TYPICAL OPERATION							
TYPE	CLASS*	NEAREST EQUIVALENT	BASING	BASE	HTR./FIL.	VOLTS	AMPERES	PLATE VOLTS	PLATE WATTS	APPLICATION	PLATE VOLTS	GRID VOLTS	PLATE RESISTANCE	TRANSCONDUCTANCE μmhos	AMP. FACTOR (μ)	PLATE MA	TYPE
67, A	S		5A	Octal	Htr.	6.3	0.40	—	—	Detector Amp.	180	—13.5	10.2K	—	9.2	4.3	67, A
76	S	6C5GT	5A	Octal	Htr.	6.3	0.3	250	—	Detector Class A Amp.	100 250 100 250	—8.0 —20.0 —5.0 —13.5	Bias for $I_b = 0.2$ ma, no signal				76
													12K 9.5K	1150 1450	13.8 13.8	2.5 5.0	
401	S		4D	Octal	Htr.	3.0	1.35	—	—	Detector Class A Amp.	90	—3.0	9.5K	1000	9.5	5.0	401
484	S		5A	Octal	Htr.	2.8	1.6	—	—	Detector Class A Amp.	180	—9.0	9.3K	1350	12.5	6.0	484
9002	S		7BS	Min.-7	Htr.	6.3	0.15	250	1.6	Class A Amp.	250	—7.0	11.4K	2200	25	6.3	9002

†Self bias cathode resistor. ‡Conversion Transconductance. *Each unit. *Class Code: S = Single triode. D = Duotriode.

TABLE IV.

CBS

VOLTAGE AMPLIFIERS (Tetrodes, Pentodes and Heptodes)

		DESCRIPTION			CONSTR.	CATHODE			MAX. RATINGS			SERVICE		AVERAGE CHARACTERISTICS AND TYPICAL OPERATION										
TYPE	CLASS*	NEAREST EQUIVALENT	BASING	BASE & PINS	HTR./FIL.	VOLTS	AMPERES	PLATE VOLTS	SCREEN VOLTS	PLATE WATTS	SCREEN WATTS	APPLICATION	PLATE VOLTS	SCREEN VOLTS	GRID 1 VOLTS	CATHODE RES. OHMS & MISCELLANEOUS	PLATE RESISTANCE MEG. (APPROXIMATE)	TRANSCONDUCTANCE μmhos	PLATE MA	SCREEN MA	GRID VOLTS (APPROX.) FOR CUTOFF	TYPE		
1A4P	P	1D5GT 1E5GT	4M	Small-4	Fil.	2.0	0.06	180	67.5	—	—	R-F Amp. Class A	135 180	67.5 67.5	—3.0 —3.0	— —	1.0 1.0	625 725	2.2 2.3	0.9 0.8	—15 —15	1A4P		
1A4T	TE		4K	Small-4	Fil.	2.0	0.06	180	67.5	—	—	R-F Amp. Class A	135 180	67.5 67.5	—3.0 —3.0	— —	0.35 0.6	625 650	2.2 2.2	0.7 0.7	— —	1A4T		
1AB5	P		5BF	Loctal	Fil.	1.2	0.13	—	—	—	—	R-F Amp.	90 150	90 150	0 —1.5	— —	0.275 0.12	1100 1350	3.5 6.8	0.8 2.0	— —	1AB5		
1AF4	P	1U4	6AR	Min.-7	Fil.	1.4	0.025	110	90	—	—	R-F Amp. Class A	67.5 90.0	67.5 90.0	0 0	— —	2.0 1.8	925 1050	1.2 1.8	0.3 0.55	—2.8 —3.8	1AF4		
1B4P	P	951 1E5GT	4M	Small-4	Fil.	2.0	0.06	180	67.5	—	—	R-F Amp. Class A	90 180	67.5 67.5	—3.0 —3.0	— —	1.0 1.5	600 650	1.6 1.7	0.7 0.6	—8.0 —8.0	1B4P		
1B4T	TE	951 1E5GT	4K	Small-4	Fil.	2.0	0.06	—	—	—	—	R-F Amp. Class A	180	67.5	—3.0	—	1.0	650	1.75	0.4	—	1B4T		
1B6	P		7AK	Min.-7	Fil.	1.4	0.05	—	—	—	—	R-F Amp. Class A	90	67.5	—1.5	—	0.8	750	1.5	0.8	—	1B6		
1D5GP	P	1A4P	5Y	Octal	Fil.	2.0	0.06	Same as 1A4P															1D5GP	
1D5GT	TE	1A4T	5R	Octal	Fil.	2.0	0.06	Same as 1A4T															1D5GT	
1E5GP	P	1D5GP	5Y	Octal	Fil.	2.0	0.06	—	—	—	—	R-F Amp. Class A	135 180	67.5 67.5	—3.0 —3.0	— —	1.5 1.5	560 650	1.6 1.7	0.7 0.6	— —8.0	1E5GP		
1E5G, GT	TE	1E5GP	5R	Octal	Fil.	2.0	0.06	—	—	—	—	R-F Amp. Class A	180	67.5	—3.0	—	1.2	650	1.7	0.4	—	1E5G, GT		
1LC5	P		7AO	Loctal	Htr.	1.4	.05	110	45	—	—	R-F Amp. Class A	45 90	45 45	0 0	$R_{g1}=1.0\text{meg } .7$ $R_{g2}=1.0\text{meg } 1.5$	750 775	1.1 1.15	0.35 0.30	—3.4 —3.4	1LC5			

†Triode connected, screen and suppressor tied to plate.

‡Each section.

*Class Code: H=Heptode.

P=Pentode.

TE=Tetrode.

TABLE IV. (continued) Voltage Amplifiers

	DESCRIPTION				CONSTR.		CATHODE				MAX. RATINGS		SERVICE		AVERAGE CHARACTERISTICS AND TYPICAL OPERATION									
TYPE	CLASS*	NEAREST EQUIVALENT	BASING	BASE & PINS	HTR./FIL.	VOLTS	AMPERES	PLATE VOLTS	SCREEN VOLTS	PLATE WATTS	SCREEN WATTS	APPLICATION	PLATE VOLTS	SCREEN VOLTS	GRID 1 VOLTS	CATHODE RES. OHMS & MISCELLANEOUS	PLATE RESISTANCE MEG. (APPROXIMATE)	TRANSCONDUCTANCE μmhos	PLATE MA	SCREEN MA	GRID VOLTS (APPROX.) FOR CUTOFF	TYPE		
1LG5	P		7AO	Loctal	Fil.	1.4	0.05	110	110	—	—	R-F Amp. Class A	90 90	90 45	-1.5 0	$R_{g1} = 2.0\text{meg}$ $R_{g2} = 2.0\text{meg} > 1.0$	1150 800	3.7 1.7	0.9 0.4	-19 -10		1LG5		
1LN5	P	1LC5 1N5GT	7AO	Loctal	Fil.	1.4	0.05	110	110	—	—	R-F Amp. Class A	90	90	0	—	1.1	800	1.6	0.35	-4.5		1LN5	
1N5GT	P	1LN5	5Y	Octal	Fil.	1.4	0.05	110	110	—	—	R-F Amp. Class A	90	90	0	—	1.5	750	1.2	0.3	-3.2 -4.0		1N5GT	
1P5G, GT	P	1N5GT 1T4	5Y	Octal	Fil.	1.4	0.05	110	110	—	—	R-F Amp. Class A	90	90	0	—	.8	750	2.3	0.7	-12		1P5G, GT	
1SA6GT	P	1N5GT	6BD	Octal	Fil.	1.4	0.05	—	—	—	—	R-F Amp.	45 67.5 90	45 67.5 67.5	0 0 0	— — —	.7 .6 .8	750 950 970	1.1 2.4 2.45	0.3 0.7 0.68	— — —		1SA6GT	
3E6	P		7CJ	Loctal	Fil.	1.4 2.8	0.1 .050	110 110	110 110	— —	— —	R-F Amp. Class A	90 90	90 90	0	$R_{g1} = 2.0\text{meg}$ $R_{g2} = 2.0\text{meg}$	0.25 0.325	2000 1700	4.2 2.9	1.7 1.2	-5.5 -4.0		3E6	
6AB7/1053	P	6AC7	8N	Octal	Htr.	6.3	0.45	300	200	3.75	0.65	R-F Amp. Class A	300 300	200 200	-3.0 3.0	— $R_{g2} = .3\text{meg}$	.7 .7	5000 5000	12.5 12.5	3.2 3.2	-15 -22.5		6AB7/1053	
6AJ5	P		7BD	Min.-7	Htr.	6.3	0.175	180	140	1.7	0.5	Class A	28	28	-1	—	.1	2500	2.7	1.0	-4.5		6AJ5	
6AJ7	P	6AC7	8N	Octal	Htr.	6.3	0.45	300	150	3.02	0.38	Class A	300	150	$E_{c3} = 0$	160	1.0	9000	10.0	2.5	—		6AJ7	
6AS6	P		7CM	Min.-7	Htr.	6.3	0.175	180	140	1.7	.75	R-F Amp. Class A	120 120	120 120	-2.0 -2.0	$E_{c3} = -3$ $E_{c3} = 0$	— .11	1850 3200	3.6 5.2	4.8 3.5	-10 -7.5		6AS6	
6BU5	P	6BD4A	8FP	Octal	Htr.	6.3	0.15	20000	100	20	0.1	TV High Voltage Regulator	20000 20000	70 70	-3.4 -2.4	$E_{c3} = 0$	— —	— —	0.55 1.0	— 0.4	— -6.5		6BU5	

TABLE IV. (continued) Voltage Amplifiers

	DESCRIPTION				CONSTR.		CATHODE				MAX. RATINGS		SERVICE	AVERAGE CHARACTERISTICS AND TYPICAL OPERATION									
TYPE	CLASS*	NEAREST EQUIVALENT	BASING	BASE & PINS	HTR. FIL.	VOLTS	AMPERES	PLATE VOLTS	SCREEN VOLTS	PLATE WATTS	SCREEN WATTS	APPLICATION	PLATE VOLTS	SCREEN VOLTS	GRID 1 VOLTS	CATHODE RES. OHMS & MISCELLANEOUS	PLATE RESISTANCE MEG. (APPROXIMATE)	TRANSCONDUCTANCE μ mhos	PLATE MA	SCREEN MA	GRID VOLTS (APPROX.) FOR CUTOFF	TYPE	
6C6	P	77	6F	Octal	Htr.	6.3	0.3	300 250†	125 —	0.75 1.75†	0.1 —	Class/Pentode A (Triode)†	100 250 180 250	100 100 — —	—3.0 —3.0 —5.3 —8.0	— — — — $\mu = 20$ $\mu = 20$	1.0 1.0 .011 .011	1185 1225 1800 1900	2.0 2.0 5.3 6.5	0.5 0.5 — —	—7 —7 — —	6C6	
6D6	P	6K7GT	6F	Small-6	Htr.	6.3	0.3	300	100	2.25	0.25	R-F Amp. Class A	100 250	100 100	—3.0 —3.0	— — 0.25 0.8	1500 1600	8.0 8.2	2.2 2.0	—50 —50	6D6		
6D7	P	6E7	7H	Small-7	Htr.	6.3	0.3	Same as 6C6												6D7			
6DB6	P		7CM	Min.-7	Htr.	6.3	0.3	300	150	3.0	1.0	Class A	150	150	—1.0	G_2 Volts = —3	.05	g_m $G_1 = 2050$ $G_2 = 1000$	5.8	6.6	$G_1 = 6.5$ $G_2 = 9.5$	6DB6	
6E7	P	6D6	7H	Small-7	Htr.	6.3	0.3	Same as 6D6												6E7			
6J7, G, GT	P	6C6 6D6	7R	Octal	Htr.	6.3	0.3	300 250†	125 —	0.75 1.75†	0.10 —	Class/Pentode A (Triode)†	100 250 180 250	100 100 — —	—3.0 —3.0 —5.3 —8.0	— — — — $\mu = 20$ $\mu = 20$	1.0 1.0 .0110 .0105	1185 1225 1800 1900	2.0 2.0 5.3 6.5	0.5 0.5 — —	—7 —7 — —	6J7, G, GT	
6R6G	P		6AW	Octal	Htr.	6.3	0.3	—	—	—	—	R-F Amp. Class A	250	100	—3.0	—	.8	1450	7.0	1.7	—	6R6G	
6S7G	P	6SS7	7R	Octal	Htr.	6.3	0.15	300	100	2.25	0.25	R-F Amp. Class A	135 250	67.5 100	—3.0 —3.0	— — 3.0 1.0	1250 1750	3.7 8.5	0.9 2.0	—25 —38.5	6S7G		
6SD7GT	P		8N	Octal	Htr.	6.3	0.3	300	125	4	.4	R-F Amp. Class A	100 250 250	100 100 125	—2.0 —2.0 —2.0	— — — 0.25 1.0 0.7	3350 3000 4250	5.7 6.0 9.5	2.0 1.9 3.0	—11 —11 —27	6SD7GT		
6SE7GT	P	6SJ7GT	8N	Octal	Htr.	6.3	0.3	—	—	—	—	R-F Amp. Class A	100 250	100 100	—1.0 —1.5	— — 0.25 1.0	3100 3400	5.5 4.5	2.4 1.5	— —	6SE7GT		
6SS7	P	6SG7GT 6W7G	8N	Octal	Htr.	6.3	0.15	300	100	2.25	0.35	R-F Amp. Class A	100 250	100 100	—1.0 —3.0	— — 0.12 1.0	1930 1850	12.2 9.0	3.1 2.0	—35 —35	6SS7		

†Triode connected, screen and suppressor tied to plate.

‡Each section.

*Class Code: H = Heptode.

P = Pentode.

TE = Tetrode.

TABLE IV. (continued) Voltage Amplifiers

	DESCRIPTION				CONSTR.		CATHODE				MAX. RATINGS		SERVICE		AVERAGE CHARACTERISTICS AND TYPICAL OPERATION										
TYPE	CLASS*	NEAREST EQUIVALENT	BASING	BASE & PINS	HTR. FIL.	VOLTS	AMPERES	PLATE VOLTS	SCREEN VOLTS	PLATE WATTS	SCREEN WATTS	APPLICATION	PLATE VOLTS	SCREEN VOLTS	GRID 1 VOLTS	CATHODE RES. OHMS & MISCELLANEOUS	PLATE RESISTANCE MEG. (APPROXIMATE)	TRANSCONDUCTANCE μ mhos	PLATE MA	SCREEN MA	GRID VOLTS (APPROX.) FOR CUTOFF	TYPE			
6U7G	P	6SK7GT	7R	Octal	Mtr.	6.3	0.3	300	100	2.25	0.25	R-F Amp. Class A	100 250	100 100	-3.0 -3.0	$E_{c3}=0$ $E_{c3}=0$	0.25 0.8	1500 1600	8.0 8.2	2.2 2.0	— —	6U7G			
6W7G	P		7R	Octal	Mtr.	6.3	0.15	—	—	—	—	R-F Amp. Class A	250	100	-3.0	—	1.5	1225	2.0	0.5	—	6W7G			
7A7	P	6SK7 7B7	8V	Loctal	Mtr.	6.3	0.3	300	125	4.0	0.4	R-F Amp. Class A	100 250	100 100	-1.0 -3.0	60 260	0.12 0.8	2350 2000	13.0 9.2	4.0 2.6	-35 -35	7A7			
7AB7	P		8B0	Loctal	Mtr.	6.3	0.15	300	100	1.2	0.15	R-F Amp Class A	250	100	-2.0	—	0.5	1800	4.0	1.3	-9	7AB7			
7AD7	P	6AG7	8V	Loctal	Mtr.	6.3	0.6	300	300	10.0	1.2	Video Class A	300	150	-3.0	68	0.3	9500	28.0	7.0	—	7AD7			
7AG7	P	6SH7	8V	Loctal	Mtr.	6.3	0.15	300	300	2.0	0.75	R-F Amp Class A	100 250	100 250	-1.0 0	— 250	1.0 1.0	2600 4200	1.6 6.0	0.5 2.0	-3.5 -10.0	7AG7			
7AH7	P		8V	Loctal	Mtr.	6.3	0.15	300	300	2.0	0.7	Class A	250	250	—	250	1.0	3300	6.8	1.9	-20	7AH7			
7AJ7	P		8V	Loctal	Mtr.	6.3	0.3	300	100	1.0	0.1	Class A	100 250	100 100	-1.0 -3.0	130 100	0.4 1.0	2275 1575	5.7 2.2	1.8 0.7	— —	7AJ7			
7B7	P	6SK7 7A7	8V	Loctal	Mtr.	6.3	0.15	300	100	2.25	0.25	R-F Amp. Class A	100 250	100 100	-3.0 -3.0	300 300	0.3 0.75	1675 1750	8.2 8.5	1.8 1.7	-40 -40	7B7			
7C7	P	6SJ7	8V	Loctal	Mtr.	6.3	0.3	300	100	1.0	0.1	Class A	100 250	100 100	-1.0 -3.0	130 1000	0.4 1.0	2275 1575	5.7 2.2	1.8 0.7	-7 -7	7C7			
7G7	P		8V	Loctal	Mtr.	6.3	0.45	300	100	1.5	0.3	R-F Amp. Class A	250	100	-2.0	$E_{c3}=0$	0.8	4500	6.0	2.0	-7	7G7			
7G8	TE+TE		8BV	Loctal	Mtr.	6.3	0.3	300	100	1.5	0.1	R-F Amp. Class A	250	100	-2.5	—	0.225	2100	4.5	0.8	-11	7G8			
7H7	P	6AB7	8V	Loctal	Mtr.	6.3	0.3	300	150	2.5	0.5	R-F Amp. Class A	100 250	100 150	-1.5 0	— 180	0.35 0.8	4000 4000	7.5 10.0	2.6 3.2	-12 -19	7H7			

TABLE IV. (continued) Voltage Amplifiers

		DESCRIPTION			CONSTR		CATHODE			MAX. RATINGS			SERVICE		AVERAGE CHARACTERISTICS AND TYPICAL OPERATION													
TYPE	CLASS*	NEAREST EQUIVALENT		BASING	BASE & PINS		HTR./FIL.		VOLTS	AMPERES		PLATE VOLTS	SCREEN VOLTS	PLATE WATTS	SCREEN WATTS	APPLICATION	PLATE VOLTS	SCREEN VOLTS	GRID 1 VOLTS	CATHODE RES. OHMS & MISCELLANEOUS		PLATE RESISTANCE MEG. (APPROXIMATE)	TRANSCONDUCTANCE μmhos		PLATE MA	SCREEN MA	GRID VOLTS (APPROX.) FOR CUTOFF	TYPE
7L7	P	6SE7	8V	Loctal	Htr.	6.3	0.3	300	125	4.0	0.4	R-F Amp. Class A	100 250	100 100	-1.0 -1.5	125 250	0.1 1.0	3000 3100	5.5 4.5	2.4 1.5	-6 -6							7L7
7T7	P		8V	Loctal	Htr.	6.3	0.3	300	150	3.0	0.7	R-F Amp. Class A	100 250	100 150	-1.0 -1.0	— —	0.35 0.9	4000 4900	5.3 10.8	2.1 4.1	-4.0 -5.5							7T7
7V7	P	7W7	8V	Loctal	Htr.	6.3	0.45	300	150	4.0	0.8	R-F Amp. Class A	300 300	150 $E_{c2}=300$	— $R_{g2}=40K$	160 160	0.3 0.3	5800 5800	10.0 10.0	3.9 3.9	-8 -16							7V7
7W7	P	7V7	8BJ	Loctal	Htr.	6.3	0.45	300	150	4.0	0.8	R-F Amp. Class A	300 300	150 $E_{c2}=300$	— $R_{g2}=40K$	160 160	0.3 0.3	5800 5800	10.0 10.0	3.9 3.9	-8 -16							7W7
12AH6	P	6AH6	7BK	Min.-7	Htr.	12.6	0.225	300	150	3.2	0.4	Class Pentode A {Triode†	300 150	150 —	$E_{c1}=0$ $E_{c3}=0$	160 160	500K 3.6K	9000 11000	10.0 12.5	2.5 $\mu=40$	-7.0 -7.0							12AH6
12AW6	P	12AU6	7CM	Min.-7	Htr.	12.6	0.15	300 300†	150 —	2.0 2.5†	0.5 —	Class Pentode A {Triode†	100 250 180 250	100 150 — —	— — — —	100 200 350 825	0.3 0.8 7.9K 11K	4750 5000 5700 3800	5.5 7.0 7.0 5.5	1.6 2.0 $\mu=45$ $\mu=42$	-5.0 -8.0 — —							12AW6
12B7	P	14A7	8V	Loctal	Htr.	12.6	0.15	Same as 7A7																	12B7			
12CS6	H	6CS6	7CH	Min.-7	Htr.	12.6	0.15	300	100	1.0	1.0	Class A	100 100	30 30	0 -1.0	$E_{c1}=-1$ $E_{c3}=0$	0.7 1.0	1250 950	0.8 0.75	4.0 1.1	— —							12CS6
12J7, G, GT	P	12SJ7	7R	Octal	Htr.	12.6	0.15	Same as 6J7																	12J7, G, GT			
12K7G, GT	P		7R	Octal	Htr.	12.6	0.15	300	125	2.75	0.35	R-F Amp. Class A	100 250	100 125	-1.0 -3.0	$E_{c1}=0$ $E_{c3}=0$	0.15 0.6	1650 1650	9.5 10.5	2.7 2.6	-38.5 -52.5							12K7G, GT
12SH7	P	6SH7	8BK	Octal	Htr.	12.6	0.15	300	150	3.0	0.7	R-F Amp. Class A	100 250	100 150	-1.0 -1.0	— —	0.35 0.90	4000 4900	5.3 10.8	2.1 4.1	-4.0 -5.5							12SH7

†Triode connected, screen and suppressor tied to plate.

‡Each section.

*Class Code: H—Heptode.

P—Pentode.

TE—Tetrode.

TABLE IV. (continued) Voltage Amplifiers

		DESCRIPTION				CONSTR.		CATHODE				MAX. RATINGS		SERVICE		AVERAGE CHARACTERISTICS AND TYPICAL OPERATION																		
TYPE	CLASS*	NEAREST EQUIVALENT		BASING	BASE & PINS		HTR./FIL.	VOLTS	AMPERES	PLATE VOLTS		SCREEN VOLTS	PLATE WATTS		SCREEN WATTS	APPLICATION	PLATE VOLTS		SCREEN VOLTS		GRID 1 VOLTS	CATHODE RES. OHMS & MISCELLANEOUS		PLATE RESISTANCE MEG. (APPROXIMATE)		TRANSCONDUCTANCE μmhos		PLATE MA		SCREEN MA		GRID VOLTS (APPROX.) FOR CUTOFF		TYPE
12SJ7, GT	P	6SJ7	8N	Octal	Htr.	12.6	0.15	300 250	100 —	2.5 2.5	0.4 —	R-F Amp. (Pentode Class Triode) A	100 250 250	100 100 —	—3.0 —3.0 —8.5	— — —	0.7 1.0 7.6K	1575 1650 2500	2.9 3.0 9.2	0.9 0.8 $\mu=19$	—8.0 —8.0 —			12SJ7, GT										
14A7	P	12B7	8V	Loctal	Htr.	12.6	0.15	Same as 7A7														14A7												
14C7	P	12B7	8V	Loctal	Htr.	12.6	0.15	Same as 7C7														14C7												
14H7	P		8V	Loctal	Htr.	12.6	0.15	Same as 7H7														14H7												
14W7	P		8B1	Loctal	Htr.	12.6	0.225	Same as 7W7														14W7												
15	P		5F	Small-5	Htr.	2.0	0.22	—	—	—	—	R-F Amp. Class A	67.5 135	67.5 67.5	—1.5 —1.5	— —	0.63 0.8	710 750	1.85 1.85	0.3 0.3	— —			15										
22	TE		4K	Medium-4	Fil.	3.3	0.132	—	—	—	—	R-F Amp. Class A	135	67.5	—1.5	—	0.25	500	3.7	1.3	—			22										
24A	TE	58	5E	Small-5	Htr.	2.5	1.75	275	90	—	—	R-F Amp. Class A	180 250	90 90	—3.0 —3.0	— —	0.4 0.6	1000 1050	4.0 4.0	1.7 1.7	— —			24A										
26A6	P		7BK	Min.-7	Htr.	26.5	0.07	—	—	—	—	R-F Amp.	26.5 250	26.5 250	0 —	$R_{g1}=2\text{ meg}$ 125	0.25 1.0	2000 4000	1.7 10.5	0.7 4.0	— —			26A6										
32	TE		4K	Medium-4	Fil.	2.0	0.06	180	67.5	—	—	R-F Amp. Class A	135 180	67.5 67.5	—3.0 —3.0	— —	0.95 1.2	640 650	1.7 1.7	0.4 0.4	— —			32										
34	P		4M	Medium-4	Fil.	2.0	0.06	180	67.5	—	—	R-F Amp. Class A	67.5 135 180	67.5 67.5 67.5	—3.0 —3.0 —3.0	— — —	0.4 0.6 1.0	560 600 620	2.7 2.8 2.8	1.1 1.0 1.0	—22.5 —22.5 —22.5			34										
35/51	TE		5E	Medium-5	Htr.	2.5	1.75	250	90	—	—	R-F Amp. Class A	180 250	90 90	—3.0 —3.0	— —	0.3 0.4	1020 1050	6.3 6.5	2.5 2.5	—40 —40			35/51										

TABLE IV. (continued) Voltage Amplifiers

		DESCRIPTION			CONSTR.		CATHODE		MAX. RATINGS			SERVICE		AVERAGE CHARACTERISTICS AND TYPICAL OPERATION									
TYPE	CLASS*	NEAREST EQUIVALENT	BASING	BASE & PINS	HTR. FIL.	VOLTS	AMPERES	PLATE VOLTS	SCREEN VOLTS	PLATE WATTS	SCREEN WATTS	APPLICATION	PLATE VOLTS	SCREEN VOLTS	GRID 1 VOLTS	CATHODE RES. OHMS & MISCELLANEOUS	PLATE RESISTANCE MEG. (APPROXIMATE)	TRANSCONDUCTANCE μmhos	PLATE MA	SCREEN MA	GRID VOLTS (APPROX.) FOR CUTOFF	TYPE	
36	TE	6C6	5E	Small-5	Htr.	6.3	0.3	250	90	—	—	R-F Amp. Class A Detector	135 180 250 250	67.5 90 90 90	—1.5 —3.0 —3.0 —6.0	— — — Adjust I_b to 0.1 ma, no signal. $R_c = 0.25$ meg.	0.475 0.50 0.55 —	1000 1050 1080 —	2.8 3.1 3.2 1.7	— — — —	— — — —	36	
39/44	P	6D6 78	5F	Small-5	Htr.	6.3	0.3	250	90	—	—	R-F Amp. Class A	90 180 250	90 90 90	—3.0 —3.0 —3.0	— — —	0.375 0.75 1.0	960 1000 1050	5.6 5.8 5.8	1.6 1.4 1.4	— — —	39/44	
44	P		5F	Small-5	Htr.	6.3	0.3	Same as 39/44														44	
51, S	TE		5E	Small-5	Htr.	2.5	1.75	Same as 35, 51														51, S	
57	P		6F	Small-6	Htr.	2.5	1.0	300	125	0.75	0.1	Class A Amp. Detector	100 250 250	100 100 100	—3.0 —3.0 —4.3 approx.	— — Adjust I_b to 0.1 ma, no signal	1.0 1.0 —	1185 1225 —	2.0 2.0 —	0.5 0.5 —	—7.0 —7.0 —	57	
57AS	P	6C6, 77	5A	Small-5	Htr.	6.3	0.4	Same as 57														57AS	
58	P		6F	Small-6	Htr.	2.5	1.0	300	100	2.25	0.25	R-F Amp. Class A	100 250	100 100	—3.0 —3.0	$E_{c2} = 0$ $E_{c3} = 0$	0.25 0.8	1500 1600	8.0 8.2	2.2 2.0	—50 —50	58	
58AS	P		6F	Small-6	Htr.	2.5	1.0	Same as 58														58AS	
64, A	TE		5E	Small-5	Htr.	6.3	0.4	—	—	—	—	R-F Amp. Class A	180	90	—3.0	—	0.5	1050	3.1	1.5	—	64, A	
65, A	TE		5E	Small-5	Htr.	6.3	0.4	—	—	—	—	R-F Amp. Class A	180	90	—3.0	—	0.75	1000	4.5	1.3	—	65, A	
77	P	6C6 6J7	6F	Small-6	Htr.	6.3	0.3	300	100	.75	.10	Detector Class A Amp.	100 250	60 100	—1.5 —3.0	$E_{c2} = 0$ $E_{c3} = 0$	0.6 1.0	1100 1250	1.7 2.3	0.4 0.5	—5.5 —7.5	77	

†Triode connected, screen and suppressor tied to plate.

‡Each section.

*Class Code: H = Heptode.

P = Pentode.

TE = Tetrode.

TABLE IV. (continued) Voltage Amplifiers

DESCRIPTION				CONSTR.		CATHODE			MAX. RATINGS			SERVICE		AVERAGE CHARACTERISTICS AND TYPICAL OPERATION									
TYPE	CLASS*	NEAREST EQUIVALENT	BASING	BASE & PINS	HTR./FIL.	VOLTS	AMPERES	PLATE VOLTS	SCREEN VOLTS	PLATE WATTS	SCREEN WATTS	APPLICATION	PLATE VOLTS	SCREEN VOLTS	GRID 1 VOLTS	CATHODE RES. OHMS & MISCELLANEOUS	PLATE RESISTANCE MEG. (APPROXIMATE)	TRANSCONDUCTANCE μmhos	PLATE MA	SCREEN MA	GRID VOLTS (APPROX.) FOR CUTOFF	TYPE	
78	P	6D6	6F	Small-6	Htr.	6.3	0.3	300	250	2.75	0.35	R-F Amp. Class A	100 250 250	100 100 125	-1.0 -3.0 -3.0	$E_{c3}=0$ $E_{c3}=0$ $E_{c3}=0$	0.15 0.8 0.6	1650 1450 1650	9.5 7.0 10.5	2.7 1.7 2.6	-38 -42 -52	78	
951	TE	1B4T 1B4P	4K	Medium-4	Fil.	2.0	0.6	—	—	—	—	Class A Amp.	180	67.5	-3.0	—	1.2	650	1.7	0.4	—	951	
9003	P		7BD	Min.-7	Htr.	6.3	0.15	250	100	1.7	0.3	R-F Amp. Class A	250	100	-3.0	—	0.7	1800	6.7	2.7	-35	9003	

†Triode connected, screen and suppressor tied to plate.

‡Each section.

*Class Code: H=Heptode.

P=Pentode.

TE=Tetrode.

TABLE V.

CBS

CONVERTERS AND MIXERS

	DESCRIPTION				CONSTR.	CATHODE			MAXIMUM RATINGS					AVERAGE CHARACTERISTICS AND TYPICAL OPERATION													
TYPE	CLASS*	NEAREST EQUIVALENT	BASING	BASE & PINS	HTR./FIL.	VOLTS	AMPERES	PLATE VOLTS	SCREEN VOLTS	OSC. ANODE VOLTS	OSC. ANODE VOLTS	SCREEN WATTS	CATHODE MA	PLATE VOLTS	SCREEN VOLTS	SIG. GRID VOLTS	OSC. ANODE VOLTS	OSC. GRID VOLTS	PLATE RES., MEG.	CONVERSION TRANS. μ MHOS	CATHODE MA	PLATE MA	SCREEN MA	OSC. ANODE MA	OSC. GRID MA	TYPE	
1A6	H	1C6 1C7G	6L	Small-6	Fil.	2.0	0.06	—	—	—	—	—	135 180	67.5 67.5	—3.0 —3.0	135 180	—	0.4 0.5	275 300	—	1.8 1.5	2.1 2.0	2.0 2.5	—	—	1A6	
1B7G, GT	H	1A7GT 1L6	7Z	Octal	Fil.	1.4	0.1	—	—	—	—	—	90	45	0	90	0.2	0.35	350	—	1.5	1.3	1.6	.035	—	1B7G, GT	
1C6	H	—	6L	Small-6	Fil.	2.0	0.12	180	67.5	135	0.4	0.2	9.0	135 180	67.5 67.5	—3.0 —3.0	135 180	0.5 0.5	0.6 0.7	300 325	7.1 7.7	1.3 1.5	2.5 2.0	3.1 4.0	0.2 0.2	1C6	
1C7G	H	1C6 1D7G	7Z	Octal	Fil.	2.0	0.12	Same as 1C6					Same as 1C6								—	—	1C7G				
1C8	H	—	8CH	Submin.-8	Fil.	1.25	0.04	—	—	—	—	—	30	30	0	—	0.1	0.3	100	—	0.32	0.75	—	.030	—	1C8	
1D7G	H	1A6	7Z	Octal	Fil.	2.0	0.06	—	—	—	—	—	135 180	67.5 67.5	—3.0 —3.0	135 135	.05 .05	0.4 0.5	275 300	6.2 6.2	1.2 1.3	2.5 2.4	2.3 2.3	0.2 0.2	—	1D7G	
1L6	H	1U6	7DC	Min.-7	Fil.	1.4	0.05	110	65	110	—	—	4.0	90	45	0	90	0.2	0.65	300	2.35	0.5	0.6	1.2	.035	1L6	
1LA6	H	1A7GT 1L6	7AK	Loctal	Fil.	1.4	0.05	90	55	90	—	—	3.0	90	45	0	90	0.2	0.75	250	2.4	0.55	0.6	1.2	.035	1LA6	
1LB6	H	—	8AX	Loctal	Fil.	1.4	0.05	—	—	—	—	—	90	67.5	0	—	—	0.2	100	—	0.4	2.2	—	—	—	1LB6	
1LC6	H	—	7AK	Loctal	Fil.	1.4	0.05	90	35	45	—	—	3.0	45 90	35 35	0 0	45 45	0.2 0.2	0.65 0.3	250 275	2.9 2.9	0.7 0.7	0.75 0.7	1.4 1.4	.035 .035	1LC6	
1U6	H	1L6	7DC	Min -7	Fil.	1.4	0.025	110	65	110	—	—	4.0	65 90	45 45	0 0	67.5 90	0.2 0.2	0.5 0.5	280 300	2.3 2.4	0.5 0.6	0.7 0.6	1.0 1.1	0.028 0.028	1U6	
2A7/S	H	—	7C	Small-7	Fil.	2.5	0.8	300	100	200	0.75	0.3	14.0	100 250	50 10.0	—1.5 —3.0	100 250*	.05 .05	0.6 0.36	360 550	4.6 10.6	1.1 3.5	1.3 2.7	2.0 4.0	0.25 0.4	2A7/S	
6A7	H	6AB 6K8	7C	Small-7	Htr.	6.3	0.3	Same as 2A7/S																—	—	6A7	

*H=Heptode. T+M=Triode and Heptode. T+MX=Triode and Hexode. T+P=Triode and Pentode.

TABLE V. (continued) Converters and Mixers

	DESCRIPTION				CONSTR.		CATHODE		MAXIMUM RATINGS						AVERAGE CHARACTERISTICS AND TYPICAL OPERATION													
TYPE	CLASS*	NEAREST EQUIVALENT	BASING	BASE & PINS	HTR./FIL.	VOLTS	AMPERES	PLATE VOLTS	SCREEN VOLTS	OSC. ANODE VOLTS	OSC. ANODE WATTS	SCREEN WATTS	CATHODE MA	PLATE VOLTS	SCREEN VOLTS	SIG. GRID VOLTS	OSC. ANODE VOLTS	OSC. GRID VOLTS	PLATE RES., MEG.	CONVERSION TRANS. μ MHOS	CATHODE MA	PLATE MA	SCREEN MA	OSC. ANODE MA	OSC. GRID MA	TYPE		
6A8, G, GT	H	6A7S 6K8GT	8A	Octal	Htr.	6.3	0.3	Same as 2A7/S																	6A8, G, GT			
6BA7	H	6SB7Y	8CT	Min.-9	Htr.	6.3	0.3	300	100	—	—	1.5	22	100 250	100 100	—1.0 —1.0	—	.02 .02	0.5 1.0	900 950	14.2 14.2	3.6 3.9	10.2 10.0	—	0.35* 0.35*	6BA7		
6D8, G	H	7A8 6K8	8A	Octal	Htr.	6.3	0.15	300	100	200	0.75	0.3	13	135 250	67.5 100	—3.0 —3.0	135 250*	.05 .05	0.4 0.4	325 550	6.4 10.8	1.5 3.5	1.7 2.6	3.0 4.3	0.2 0.4	6D8, G		
6J8G	T+H	7J7	8H	Octal	Htr.	6.3	0.3	250	100	150	1.25	—	14	100 250	100 100	—3.0 —3.0	100 250*	.05 .05	0.9 4.0	250 250	—	1.4 1.3	3.0 2.9	3.0 5.0	0.3 0.4	6J8G		
6SB7Y	H	6BA7	8R	Octal	Htr.	6.3	0.3	300	100	—	2.0	1.5	22	100 250	100 100	—1.0 —1.0	—	.02 .02	0.5 1.0	900 950	14.2 14.2	3.6 3.8	10.2 10.0	—	0.35 0.35	6SB7Y		
7A8	H	6A7 6A8 7B8	8U	Loctal	Htr.	6.3	0.15	300	200	200	0.75	0.3	13	100 250	75 100	—3.0 —3.0	100* 250*	.05 .05	0.65 0.7	375 550	7.5 10.8	1.8 3.0	2.7 3.2	2.3 4.2	0.2 0.4	7A8		
7B8	H	6J8G 6K8	8X	Loctal	Htr.	6.3	0.3	300	100	200	.75	0.3	14	100 250	50 100	—1.5 —3.0	100 —	.05 .05	0.6 0.36	360 550	4.6 10.6	1.1 3.5	1.3 2.7	2.0 4.0	—	7B8		
7J7	T+H	6A8 6K8	8BL	Loctal	Htr.	6.3	0.3	300 150	100 Triode	— —	1.25 —	— —	14 —	100 250 150	100 100 —	—3.0 —3.0 —3.0	100 250 Triode	.05 .05 .05	0.5 1.5 .0107	280 290 GM=1400	7.7 9.6 6.6	1.5 1.4 —	2.6 2.8 —	3.2 5.0 —	0.3 0.4 —	7J7		
7Q7	H	6SA7	8AL	Loctal	Htr.	6.3	0.3	300	100	—	—	1.0	14	100 250	100 100	—2.0 —2.0	—	.02 .02	0.5 1.0	525 550	12.3 12.5	3.3 3.5	8.5 8.5	—	0.5 0.5	7Q7		
7S7	T+H	6K8 7J7	8BL	Loctal	Htr.	6.3	0.3	300 175	100 —	Heptode Triode	0.4 —	— —	14 —	100 250	100 100	—2.0 —2.0	100 250*	.05 .05	0.5 1.25	500 525	8.2 10.2	1.9 1.8	3.0 3.0	3.0 5.0	.03 .04	7S7		
12A8, G, GT	H		8A	Octal	Htr.	12.6	0.15	Same as 2A7/S																	12A8, G, GT			
12BA7	H		8CT	Min.-9	Htr.	12.6	0.15	Same as 6BA7																	12BA7			

TABLE V. (continued) Converters and Mixers

	DESCRIPTION				CONSTR.		CATHODE				MAXIMUM RATINGS						AVERAGE CHARACTERISTICS AND TYPICAL OPERATION													
TYPE	CLASS*	NEAREST EQUIVALENT	BASING	BASE & PINS	HTR./FIL.	VOLTS	AMPERES	PLATE VOLTS	SCREEN VOLTS	OSC. ANODE VOLTS	OSC. ANODE VOLTS	SCREEN WATTS	CATHODE MA	PLATE VOLTS	SCREEN VOLTS	SIG. GRID VOLTS	OSC. ANODE VOLTS	OSC. GRID VOLTS	PLATE RES., MEG.	CONVERSION TRANS. μ MHOS	CATHODE MA	PLATE MA	SCREEN MA	OSC. ANODE MA	OSC. GRID MA	TYPE				
12K8, GT	T+HX	8K	Octal	Htr.	12.6	0.15	300	150	125	0.75	0.7	16	100 250	100 100	-3.0 -3.0	100 100	.05 .05	0.4 0.6	325 350	12.5 12.5	2.3 2.5	6.2 6.0	3.8 3.8	0.15 0.15		12K8, GT				
14B8	H	8X	Loctal	Htr.	12.6	0.15	Same as 7B8																		14B8					
14J7	T+H	8BL	Loctal	Htr.	12.6	0.15	Same as 7J7																		14J7					
14Q7	H	8AL	Loctal	Htr.	12.6	0.15	Same as 7Q7																		14Q7					
14S7	T+H	8BL	Loctal	Htr.	12.6	0.15	Same as 7S7																		14S7					
19X8	T+P	6X8	9AK	Min.-9	Htr.	18.9	0.15	250	250	250	1.5	0.4	—	150 250 20.5	150 100 26.5	— -3.5 —	150 Pentode Section 0.0027	Triode Section at 250 MC 0.75 2100	— 6.2 1.8	455 475 270	— 2.5 0.45	2.8 3.0 —	8.0 7.8 —	— 1.6 0.1	13 E _g = 2.6V	3.6	19X8			
26D6	H	7CH	Min.-7	Htr.	26.5	0.07	300	100	—	1.0	1.0	14	100 250 20.5	100 100 26.5	-1.5 -1.5 -0.5	— — —	.020 .020 .020	0.5 1.0 —	455 475 270	— 2.5 0.45	2.8 3.0 —	8.0 7.8 —	— 1.6 0.1	— — —	— — —	26D6				

*H = Heptode. T+H = Triode and Heptode. T+HX = Triode and Hexode. T+P = Triode and Pentode.

TABLE VI.

CBS

AUDIO POWER AMPLIFIERS (Triodes, Tetrodes, and Pentodes)

		DESCRIPTION				CONSTR.		CATHODE		MAXIMUM RATINGS		SERVICE	AVERAGE CHARACTERISTICS AND TYPICAL OPERATION																
TYPE	CLASS*	NEAREST EQUIVALENT	BASING	BASE & PINS	HTR. FIL.	VOLTS		AMPERES		PLATE VOLTS	SCREEN VOLTS	PLATE WATTS	SCREEN WATTS	APPLICATION	PLATE VOLTS	SCREEN VOLTS	GRID VOLTS	TRANSCONDUCTANCE μMHOS	PEAK SIGNAL VOLTAGE	PLATE MA. ZERO SIGNAL	PLATE MA. MAX. SIGNAL	SCREEN MA. ZERO SIGNAL	SCREEN MA. MAX. SIGNAL	TRIODE MA. MAX. SIG.	LOAD RESISTANCE	MAX. AMP. FACTOR	MAX. OUTPUT WATTS	DISTORTION %	TYPE
1A5G, GT	P	1LA4 1LB4	6X Octal	Fil.	1.4	0.05	110	110	$I_b = 6.0\text{ma}$	Class A	85 90	85 90	-4.5 -4.5	800 850	4.5 4.5	3.5 4.0	3.5 4.0	0.7 0.8	1.0 1.1	—	25K 25K	.100 .135	10.0 7.0	1A5G, GT					
1C5G, GT	P	1S4	6X Octal	Fil.	1.4	0.10	110	110	Zero Signal $I_b = 12\text{ma}$	Class A	83 90	83 90	-7.0 -7.5	1500 1550	7.0 7.5	7.0 7.5	7.3 7.8	1.6 1.6	3.5 3.5	—	9K 8K	.200 .240	10.0 10.0	1C5G, GT					
1E7G, GT	P+P		8C Octal	Fil.	2.0	0.24	135	135	1.5 0.5	Class A Class A, P-P	90 135	90 135	-3.0 -7.5	1150 —	3.0 15.0	3.8 7.0	— 10.5	1.1 2.0	— 3.5	—	20K 24K	.110 .575	5.5 5.5	1E7G, GT					
1F4	P	1F5G	5K Octal	Fil.	2.0	0.12	180	180	0.75 1.75	Class A Class AB, P-P	90 135 180	90 135 180	-3.0 -4.5 -7.5	1400 1700 —	3.0 4.5 15.0	4.0 8.0 19.0	— — 21.0	1.1 — 5.5	— — 7.0	—	20K 16K 20K	.110 .310 1.25	6.0 5.0 4.5	1F4					
1F5G	P	1F4	6X Octal	Fil.	2.0	0.12	Same as 1F4				Same as 1F4															1F5G			
1G5G, GT	P	1J5G	7AB Octal	Fil.	2.0	0.12	—	—	—	Class A	90 135	90 135	-6.0 -13.5	1500 1550	—	8.7 9.7	—	3.0 3.6	—	—	8K 9K	.250 .550	—	1G5G, GT					
1G6G, GT	T+T		7AB Octal	Fil.	1.4	0.10	110	—	$I_p = 20\text{ma}$	Class A Class B, P-P	90 90	—	0 0	675 —	— 48	1.0 2.0	— 11.0	— $I_{c1} = 6\text{ma}$	— —	30.0 —	12K 12K	.675 .350	— 4.0	1G6G, GT					
1J5G	P		6X Octal	Fil.	2.0	0.12	—	—	—	Class A	135	135	-16.5	1000	—	7.0	—	1.8	—	—	13.5K	.450	—	1J5G					
1J6G, GT	T+T	19	7AB Octal	Fil.	2.0	0.24	—	—	—	Class B, P-P Class A	135 135 135	— — —	0 -3.0 -6.0	— — —	5.0 3.4 0.2	50 — —	— — —	— — —	Pin = 17W — 30.0	10K 10K 10K	2.1 1.9 1.6	— — —	1J6G, GT						
1LA4/E	P		5AD Octal	Fil.	1.4	0.05	Same as 1A5G/GT				Same as 1A5G/GT															1LA4/E			
1LB4	P		5AD Octal	Fil.	1.4	0.05	110	110	Zero Signal $I_b = 6\text{ma}$	Class A	90 45	90 45	-9.0 -4.5	925 650	9.0 4.5	5.0 1.6	— —	1.0 0.3	— —	— —	12K 20K	.200 .035	10.0 10.0	1LB4					
1Q5G, GT	BP	1A5GT	6AF Octal	Fil.	1.4	0.10	110	110	Zero Signal $I_b = 12\text{ma}$	Class A	90 85	90 85	-4.5 -5.0	2200 1950	4.5 5.0	9.5 7.0	— —	1.3 0.8	— —	— —	8K 9K	.270 .250	6.0 5.5	1Q5G, GT					
1S4	P	3S4	7AV Min.-7	Fil.	1.4	0.10	90	67.5	Zero Signal $I_b = 9.0\text{ma}$	Class A	45 67.5 90	45 67.5 67.5	-4.5 -7.0 -7.0	1250 1550 1575	4.5 7.0 7.0	3.8 7.2 7.4	— — —	0.8 1.5 1.4	— — —	— — —	8K 5K 8K	.065 0.18 0.27	12.0 10.0 12.0	1S4					

TABLE VI. (continued) Audio Power Amplifiers

	DESCRIPTION				CONSTR.		CATHODE		MAXIMUM RATINGS		SERVICE		AVERAGE CHARACTERISTICS AND TYPICAL OPERATION															
TYPE	CLASS*	NEAREST EQUIVALENT	BASING	BASE & PINS	HTR. FIL.	VOLTS	AMPERES	PLATE VOLTS	SCREEN VOLTS	PLATE WATTS	SCREEN WATTS	APPLICATION	PLATE VOLTS	SCREEN VOLTS	GRID VOLTS	TRANS-CONDUCTANCE μMHOS	PEAK SIGNAL VOLTS†	PLATE MA. ZERO SIGNAL	PLATE MA. MAX. SIGNAL	SCREEN MA. ZERO SIGNAL	SCREEN MA. MAX. SIGNAL	TRIODE AMP. SIG.	LOAD RESISTANCE‡	MAX. OUTPUT WATTS	DISTORTION %	TYPE		
1T5GT	P	1C5GT 1Q5GT	6X Octal	Fil.	1.4	0.05	110	110	Zero Signal $I_{k1} = 7.3\text{ma}$	Class A	90	90	—6.0	1150	—	6.5	6.5	0.8	1.5	—	14K	.170	7.5	1T5GT				
1W4	P		5BZ Min.-7	Fil.	1.4	.050	110	110	$I_{k1} = 6.0\text{ma}$ $R_{g1} = 1.0\text{ meg}$	Class A	45 67.5 90	45.0 67.5 90	—4.5 —6.0 —9.0	650 875 925	4.5 6.0 9.0	1.6 3.8 5.0	—	0.2	—	—	—	20K 16K 12K	.035 .100 .200	10.0 10.0 10.0	1W4			
2A3	T	45	4D Medium-4	Fil.	2.5	2.5	300	—	15	—	Class A Class AB, P-P Class AB, P-P	250 300 300	— — —	—45.0 —62.0 780*	5250 — —	— — —	60.0 — —	— — —	— — —	— — —	4.2 3K 5K	2.5K 15.0 10.0	3.5 2.5 5.0	2A3				
2A3H	T	2A3	4D Medium-4	Htr.	2.5	2.5	Same as 2A3																2A3H					
2A5	P		6B Medium-6	Htr.	2.5	1.75	375	285	11.0	3.75	Class A	250 285	250 285	—16.5 —20.0	2500 2550	16.5 20.0	34.0 38.0	36.0 40.0	6.5 7.0	10.5 13.0	—	7K 7K	3.2 4.8	8.0 9.0	2A5			
3B7/1291	T+T		7BE Octal	Fil.	1.4 2.8	0.22 0.11	180 180	$I_{k1} = 15\text{ma}$ $I_{k2} = 15\text{ma}$	2.7 2.7	$I_{c1} = 4\text{ma}$ $I_{c2} = 2.7\text{ma}$	Class AB ₂ , P-P Class AB ₂ , P-P	90 135	— —	0 0	1850 1900	23 19	10.4 18.2	21.0 22.0	$I_{c1} = 3.6\text{ma}$ $I_{c2} = 2.7\text{ma}$	20 20	8K 16K	1.0 1.5	8.0 8.0	3B7/1291				
3D6	BP		6BA Octal	Fil.	1.4 2.8	0.22 0.11	180 135	4.5	0.9	Class A	90 135 150	90 90 90	—4.5 —4.5 —4.5	2400 2400 2400	4.5 4.5 4.5	9.5 9.8 9.9	8.5 9.8 10.2	1.6 1.2 1.0	3.2 2.0 1.8	— — —	8K 12K 14K	.27 .50 .60	5 5 5	3D6				
3E5	BP	3V4	6BX Min.-7	Fil.	1.4 2.8	.05 .025	110 110	$I_{k1} = 8\text{ma}$	Class A Series fil.	90	90	90	90	—8.0	1100	8.0	5.5	—	1.5	—	—	8K	.175	11.0	3E5			
3LE4	P	3LF4	6BA Octal	Fil.	1.4 2.8	0.1 .05	— —	— —	— —	Class A	90 90	90 90	—9.0 —9.0	1600 1750	— —	9.0 10.0	— —	1.8 2.0	— —	— —	— —	6K 6K	.300 .325	— —	3LE4			
3LF4	BP	3LE4 3V4	6BB Octal	Fil.	1.4 2.8	0.1 .05	110 110	$I_{k1} = 6\text{ma}$	Class A Series fil.	110	110	110	110	—6.6	2000	5.1	8.5	—	1.1	—	—	8K	.330	8.5	3LF4			

*Cathode resistor in ohms.

†Grid-to-grid voltage in push-pull operation.

‡Triode connected, screen tied to plate.

§Plate-to-plate load in push-pull operation.

P-P Push-pull operation, two tubes or both sections of double unit tubes. Values for both tubes or sections.

*Class code: BP=Beam pentode. D+P=Diode and pentode. P=Pentode. T=Triode. T+T=Duotriode. TE=Tetrode. T+P=Triode and pentode.

TABLE VI. (continued) Audio Power Amplifiers

	DESCRIPTION				CONSTR.		CATHODE		MAXIMUM RATINGS				SERVICE		AVERAGE CHARACTERISTICS AND TYPICAL OPERATION														
TYPE	CLASS*	NEAREST EQUIVALENT	BASING	BASE & PINS	HTR./FIL.	VOLTS	AMPERES	PLATE VOLTS	SCREEN VOLTS	PLATE WATTS	SCREEN WATTS	APPLICATION	PLATE VOLTS	SCREEN VOLTS	GRID VOLTS	TRANSCONDUCTANCE μMHOS	PEAK SIGNAL VOLTS†	PLATE MA. ZERO SIGNAL	PLATE MA. MAX. SIGNAL	SCREEN MA. ZERO SIGNAL	SCREEN MA. MAX. SIGNAL	TRIODE AMP. MAX. SIG.	LOAD RESISTANCE‡	MAX. OUTPUT WATTS	DISTORTION %	TYPE			
6A3	T	6A5G 6B4G	4D	Medium-4	Fil.	6.3 1.0	250	—	—	—	—	Class A Class AB, P-P	250 325 325	— — —	—45 —68 860‡	5250 — —	60 80 80	— — —	— — —	— — —	4.2 — —	2.5K 3K 5K	3.2 15 10	5.0 2.5 5.0	—	6A3			
6A4	P	6K6GT	5B	Medium-5	Fil.	6.3 0.30 6.3 0.30	—	—	—	—	—	Class A	135 180	135 180	—9.0 —12.0	2100 2500	— —	13.0 22.0	— —	2.8 3.9	— —	— —	8K	0.7 1.5	—	—	6A4		
6A5G	T	6A3 6B4G	6T	Octal	Htr.	6.3 1.0	—	—	—	—	—	Class A	250	0	—45.0	5250	—	60.0	—	0	—	4.2	2.5K	3.75	—	—	6A5G		
6A6	T+T	6N7GT	7B	Medium-7	Htr.	6.3 0.8	300 300	— —	1.0 5.5	—	—	Class A Driver Class B, P-P	250 300 300	— — —	—5.0 0 0	3100 — —	— 58 82	6.0 35 35	— 70 70	— — —	— — —	35 — —	30K 8K 8K	— 10.0 10.0	— 4.0 8.0	—	6A6		
6AB6G	T+T	6N6G	7AU	Octal	Htr.	6.3 0.50	—	—	—	—	—	Direct input Coupled output	250 250	— —	0 —	— —	— —	— —	5.0 34.0	— —	— —	— —	8K	3.5	—	—	6AB6G		
6AC5G, GT	T		6Q	Octal	Htr.	6.3 0.4	250	—	10	—	—	Characteristics Class B, P-P	250 250	— —	+13 0	3400 —	— 70.0	32 5.0	— —	— —	— —	125 —	R _o = 36.7K 10K	— 8.0	—	—	6AC5G, GT		
6AC6GT	T+T		7AU	Octal	Htr.	6.3 1.10	—	—	—	—	—	Class A Driver	180	—	0	3000	—	45+7	—	—	—	54.0	4K	3.8	—	—	6AC6GT		
6AD7G	T+P	6BQ6	8AY	Octal	Htr.	6.3 0.85	—	—	—	—	—	T Class A P Class A	250 250	— 250	25.0 16.5	325 2500	— —	4.0 34.0	— —	6.5 —	— —	6 —	7K	3.2	—	—	6AD7G		
6AG6G	P		7S	Octal	Htr.	6.3 1.25	—	—	—	—	—	Class A	250	250	—6.0	10000	—	30.0	—	6.0	—	—	8.4K	3.8	—	—	6AG6G		
6AH5G	BP	6L6GB	6AP	Octal	Htr.	6.3 0.90	360	270	19	2.5	—	Class A	350	250	—18.0	5200	18.0	54.0	66.0	2.5	7.0	—	4.2K	10.8	15.0	—	6AH5G		
6AK7	P	6AG7	8Y	Octal	Htr.	6.3 0.65	—	—	—	—	—	Class A	300	150	—3.0	11000	18.0	30.0	—	7.0	—	—	1K	3.0	—	—	6AK7		
6AN5	P	6AQ5A	7BD	Min.-7	Htr.	6.3 0.45	120 300	120 300	4.2 1.7	1.4 0.56	—	Class A	120	120	120‡	8000	—	35.0	—	12.0	—	—	2.5K	1.3	—	—	6AN5		

TABLE VI. (continued) Audio Power Amplifiers

	DESCRIPTION			CONSTR.	CATHODE		MAXIMUM RATINGS				SERVICE	AVERAGE CHARACTERISTICS AND TYPICAL OPERATION															
TYPE	CLASS*	NEAREST EQUIVALENT	BASING	BASE & PINS	HTR. FIL.	VOLTS	AMPERES	PLATE VOLTS	SCREEN VOLTS	PLATE WATTS	SCREEN WATTS	APPLICATION	PLATE VOLTS	SCREEN VOLTS	GRID VOLTS	TRANSCONDUCTANCE μMHOS	PEAK SIGNAL VOLTS‡	PLATE MA. ZERO SIGNAL	SCREEN MA. MAX. SIGNAL	SCREEN MA. ZERO SIG.	TRIODE AMP. MAX. SIG.	LOAD RESISTANCE§	MAX. OUTPUT WATTS	DISTORTION %	TYPE		
6AR6	BP		6BQ Octal	Htr.	6.3	1.20	565	300	19	3.2	Class A† Class A		200 250	— 250	—12.5 —22.5	6000 5400	— —	90.0 77.0	— —	5.0 —	— —	— —	— —	— —	6AR6		
6B4G	T	6A5G	5S Octal										Same as 6A3														6B4G
6B5	T+T	6AB6G	6AS Medium-6	Htr.	6.3	0.8	—	—	—	—	—	Class A input/output	300 300	— —	0 —	— 2400	15 —	8.0 45.0	— —	— —	— —	7K 4.0	4.0 5.0	— —	6B5		
6D5G	T		6Q Octal	Htr.	6.3	0.7	—	—	—	—	—	Class A	275	—	—40	—	—	—	31.0	—	—	4.7	7.2K	1.4	—	6D5G	
6E6	T+T		7B Medium-7	Htr.	6.3	0.6	—	—	—	—	—	Class A*	180 250	— —	—20.0 —27.5	— 1700	— —	11.5 18.0	— —	— —	6.0 6.0	15K 14K	.75 1.6	— —	6E6		
6F6, G, GT	P	42	7S Octal	Htr.	6.3	0.7	375 350	285 —	11.0 Total = 10W†	3.75	—	Class A Class A Class AB, P-P Class AB, P-P†	285 250 375 350	285 250 250 —	—20.0 —16.5 —26.0 —38.0	2550 2500 — —	20.0 16.5 82.0 23.0	38.0 34.0 34.0 48.0	40.0 36.0 82.0 92	7.0 6.5 5.0 —	13.0 10.5 19.5 —	— — — —	7K 7K 10K 6K	4.0 3.2 18.5 13.0	9.0 8.0 3.5 2.0	6F6, G, GT	
6G6G	P	6K6GT	7S Octal	Htr.	6.3	0.15	180	180	2.75	0.50	Class A Class A†		180 135 180	180 135 —	—9.0 —6.0 —12.0	2300 2100 2000	9.0 6.0 12.0	15.0 11.5 11.0	— — —	2.5 2.0 —	— — —	400 360 9.5	10K 12K 12K	1.1 0.6 0.25	10.0 7.5 5.0	6G6G	
6N6G	T+T	6B5	7AU Octal										Same as 6B5														6N6G
6U6GT	BP		7S Octal	Htr.	6.3	0.75	200	135	11.0	2.0	Class A		110 135 200	110 135 135	—10.5 —13.5 —14.0	5600 6200 6200	10.5 13.5 14.0	44.5 55.0 55.0	47.0 60.0 62.0	4.0 5.0 3.0	11.0 15.0 13.0	— — —	2K 2K 3K	2.0 3.3 5.5	10.0 10.0 10.0	6U6GT	
6V5G, GT	BP		6AO Octal	Htr.	6.3	0.45	—	—	—	—	—	Class A	315	225	—13.0	3750	13.0	34.0	—	6.0	—	—	8.5K	5.5	—	6V5G, GT	
6Y7G	T+T	6N7	8B Octal	Htr.	6.3	0.6	—	—	—	—	—	Class B, P-P	250	—	0	—	—	21.0	—	—	—	—	14K	8.0	—	6Y7G	

†Cathode resistor in ohms.

‡Grid-to-grid voltage in push-pull operation.

†Triode connected, screen tied to plate.

‡Plate-to-plate load in push-pull operation.

P-P Push-pull operation, two tubes or both sections of double unit tubes. Values for both tubes or sections.

*Class code: BP=Beam pentode. D+P=Diode and pentode. P=Pentode. T=Triode. T+T=Duotriode. TE=Tetrode. T+P=Triode and pentode.

TABLE VI. (continued) Audio Power Amplifiers

	DESCRIPTION				CONSTR.	CATHODE				MAXIMUM RATINGS				SERVICE		AVERAGE CHARACTERISTICS AND TYPICAL OPERATION														
TYPE	CLASS*	NEAREST EQUIVALENT	BASING	BASE & PINS	HTR./FIL.	VOLTS	AMPERES	PLATE VOLTS	SCREEN VOLTS	PLATE WATTS	SCREEN WATTS	APPLICATION	PLATE VOLTS	SCREEN VOLTS	GRID VOLTS	TRANSCONDUCTANCE μMHOS	PEAK SIGNAL VOLTS [†]	PLATE MA. ZERO SIGNAL	SCREEN MA. MAX. SIGNAL	SCREEN MA. ZERO SIG.	TRIODE AMP. MAX. SIG.	LOAD RESISTANCE [‡]	MAX. OUTPUT WATTS	DISTORTION %	TYPE					
6Z7G	T+T		8B Small-8	Htr.	6.3	0.3	180	—	8.0	—	Class B, P-P	135 180	—	0 0	9000 12000	—	6.0 8.4	—	—	—	—	15K 12K	4.2 1.5	—	6Z7G					
7A5	BP	6Y6G	6AA Octal	Htr.	6.3	0.75	125	125	5.5	1.2	Class A	110	110	—7.5	5800	7.5	40.0	41.0	3.0	7.0	—	2.5K	1.5	10.0	7A5					
7B5	P	6K6GT 42	6AE Octal	Htr.	6.3	0.4	315	285	8.5	2.8	Class A	100 250 315	100 250 250	—7.0 —18.0 —21.0	1500 2300 2100	7.0 18.0 21.0	9.0 32.0 25.5	9.5 33.0 28.0	1.6 5.5 4.0	3.0 10.0 9.0	—	12K 7.6K 9K	.35 3.4 4.5	11.0 11.0 15.0	7B5					
7C5	BP	6V6GT	6AA Octal	Htr.	6.3	0.45	315	285	12.0	2.0	Class A	180 250 315	180 250 225	—8.5 —12.5 —13.0	3700 4100 3750	8.5 12.5 13.0	29.0 45.0 34.0	30.0 47.0 35.0	3.0 4.5 2.2	4.0 7.0 6.0	—	5.5K 5K 8.5K	2.0 4.5 5.5	8.0 8.0 12.0	7C5					
10	T		4D Medium-4	Fil.	7.5	1.25	—	—	—	—	Class A	350 425	—	—32.0 —40.0	1550 1600	35	16.0 18.0	—	—	—	8.0 8.0	11K 10.2K	0.9 1.6	—	10					
12A/112A	T		4D Medium-4	Fil.	5.0	0.25	—	—	—	—	Class A	90 135	—	—4.5 —9.0	1600 1700	—	5.0 6.2	—	—	—	8.5 8.5	5.4K 5.1K	.035 .13	—	12A/112A					
12A5	P		7F Small-7	Htr.	6.3 12.6	0.6 0.3	—	—	—	—	Class A	100 180	100 180	—15.0 —25.0	1700 2400	—	17.0 45.0	—	3.0 8.0	—	—	4.5K 3.3K	0.8 3.4	—	12A5					
12A6, GT	BP	14A5	7S Octal	Htr.	12.6	0.15	—	—	—	—	Class A	250	250	—12.5	3000	—	30.0	—	3.5	—	—	7.5K	2.5	—	12A6, GT					
12A7	D+P		7K Octal	Htr.	12.6	0.3	—	—	—	—	H-W Rectifier Class A	135	135	A-C Volts per plate (RMS) = 125 Max. —13.5				975	—	9.0	—	D-C output current = 30 ma Max. 2.5 — 100 13.5K 0.55 —				12A7				
12CS5	BP	12W6GT	9CK Octal	Htr.	12.6	0.6	300	150	10	1.25	Class A	110 200 225	110 125 —	—7.5 180 [†] —30	8000 8000 3800	7.5 8.5 —	49.0 46.0 22.0	50.0 47.0 ([†] 6 ₁ Volts for I _b = 0.5 ma = —42)	4.0 2.2 —	10.0 8.5 —	—	2K 4K —	2.1 3.8 —	10 10 —	12CS5					
12L8GT	P+P		8BU Octal	Htr.	12.6	0.15	—	—	—	—	Class A	110 180	110 180	—5.5 —9.0	1680 2150	—	6.1 13.0	—	1.3 2.8	—	—	14K 10K	.3 1.0	—	12L8GT					
14A5	BP	12A6GT	6AA Octal	Htr.	12.6	0.15	300	300	7.5	1.5	Class A	250	250	—12.5	3000	12.5	30.0	32.0	3.5	5.5	—	7.5K	2.8	7	14A5					
14C5	BP	12V6	6AA Octal	Htr.	12.6	0.225	—					Same as 7C5															14C5			

TABLE VI. (continued) Audio Power Amplifiers

	DESCRIPTION				CONSTR.	CATHODE		MAXIMUM RATINGS				SERVICE		AVERAGE CHARACTERISTICS AND TYPICAL OPERATION														
TYPE	CLASS*	NEAREST EQUIVALENT	BASING	BASE & PINS	HTR. FIL.	VOLTS	AMPERES	PLATE VOLTS	SCREEN VOLTS	PLATE WATTS	SCREEN WATTS	APPLICATION	PLATE VOLTS	SCREEN VOLTS	GRID VOLTS	TRANSCONDUCTANCE μMHOS	PEAK SIGNAL VOLTS ¹	PLATE MA. ZERO SIGNAL	SCREEN MA. MAX. SIGNAL	SCREEN MA. ZERO SIG.	TRIODE MA. MAX. SIG.	LOAD RESISTANCE	AMP. FACTOR	MAX. OUTPUT WATTS	DISTORTION %	TYPE		
18	P	12V6	6B	Medium-6	Htr.	14.0	0.3	—	Same as 6F6G 6F6GT															18				
19	T+T	1J6GT	6C	Octal	Fil.	2.0	0.26	—	Same as 1J6G 1J6GT															19				
20	T		4D	Small-4	Fil.	3.3	0.132	—	—	—	—	Class A	90 135	—	—16.5 —22.5	450 600	—	2.8 6.0	—	—	—	3.5 3.5	9.6K 6.5K	.05 .13	—	20		
25A6, G, GT	P		7S	Octal	Htr.	25.0	0.3	160	135	5.3	1.9	Class A	95 160	95 120	—15.0 —18.0	2000 2375	—	20.0 33.0	—	4.0 6.5	—	—	4.5K 5K	0.9 2.2	—	25A6, G, GT		
25A7GT	D+P	32L7GT	8F	Octal	Htr.	25.0	0.3	117	117	2.25	0.8	H-W Rectifier Class A	A-C 100	plate volts (RMS) = 117 —15.0	1800	—	D-C output = 75 ma 20.5	—	4.0	—	—	4.5K	0.77	9	25A7GT			
25AC5GT	T		6Q	Octal	Htr.	25.0	0.3	180	—	10	—	Class A 6AE5GT Driver	110	—	+15.0	3800	c ₁ = 45.0 —	—	—	58 —	2K —	2.0	10	25AC5GT				
																6AE5GT R _e = 1.0 meg	22	7.0	6AE5GT characteristics direct coupled to 25AC5GT									
25B5	T+T	25N6	6D	Octal	Htr.	25.0	0.3	—	—	—	—	Direct input Coupled output	110 110	—	0	2300	—	7.0 45	—	—	—	—	2K	2.0	10	25B5		
25B6G	P	25W6	7S	Octal	Htr.	25.0	0.3	—	—	—	—	Class A	105 200	105 135	—16.0 —23.0	4800 5000	—	48.0 62.0	—	2.0 1.8	—	—	1.7K 2.5K	2.4 7.1	—	25B6G		
25C6G	BP		7S	Octal	Htr.	25.0	0.3	200	135	12.5	1.75	Class A	135 200	135 135	—13.5 —14.0	7000 7100	13.5 14.0	58.0 61.0	60.0 66.0	3.5 2.2	11.5 9.0	—	2K 2.6K	3.6 6.0	10 10	25C6G		
25N6	T+T	25B5	7W	Octal	Htr.	25.0	0.3	—	Same as 25B5															25N6				
25W6GT	BP		7AC	Octal	Htr.	25.0	0.3	300	150	10.0	1.25	Class A	110 200	110 125	—7.5 180	8000 8000	7.5 8.5	49.0 46.0	50.0 47.0	4.0 2.2	10.8 8.5	—	2K 4K	2.1 3.8	10 10	25W6GT		

*Cathode resistor in ohms.

†Grid-to-grid voltage in push-pull operation.

‡Triode connected, screen tied to plate.

§Plate-to-plate load in push-pull operation.

P-P Push-pull operation, two tubes or both sections of double unit tubes. Values for both tubes or sections.

*Class code: BP = Beam pentode. D+P = Diode and pentode. P = Pentode. T = Triode. T+T = Duotriode. TE = Tetrode. T+P = Triode and pentode.

TABLE VI. (continued) Audio Power Amplifiers

	DESCRIPTION				CONSTR.		CATHODE		MAXIMUM RATINGS				SERVICE		AVERAGE CHARACTERISTICS AND TYPICAL OPERATION													
TYPE	CLASS*	NEAREST EQUIVALENT	BASING	BASE & PINS	HTR./FIL.	VOLTS	AMPERES	PLATE VOLTS	SCREEN VOLTS	PLATE WATTS	SCREEN WATTS	APPLICATION	PLATE VOLTS	SCREEN VOLTS	GRID VOLTS	TRANSCONDUCTANCE μMHOS	PEAK SIGNAL VOLTS	PLATE MA. ZERO SIGNAL	PLATE MA. MAX. SIGNAL	SCREEN MA. ZERO SIGNAL	SCREEN MA. MAX. SIG.	TRIODE AMP. SIG.	LOAD RESISTANCE	MAX. OUTPUT FACTOR	MAX. OUTPUT WATTS	DISTORTION %	TYPE	
26A7	BP		8BU Octal	Htr.	26.5	0.6	50	50	2	0.5	Class A Class AB, P-P	26.5 26.5	26.5 26.5	-4.5 -7.0	5700 —	4.5 14	20.0 19.0	20.5 30.0	1.9 2.0	5.5 8.5	— —	1.5K 2.5K	0.2 0.5	7 5	—	26A7		
31	T		4D Medium-4	Fil.	2.0	0.13	—	—	—	—	Class A	135 180	— —	-22.5 -30.0	925 1050	— —	8.0 12.3	— —	— —	3.8 3.8	7K 5.7K	.185 .375	— —	— —	—	31		
32L7GT	D+BP	25A7GT	8Z Octal	Htr.	32.5	0.3	—	—	—	—	Class A H-W Rectifier	90	90 Plate volts — 125, RMS	-5.0 —	4800 —	—	27.0	—	2.0 Output current — 60 ma	—	2.6K —	1.0	—	—	—	32L7GT		
33	P	950	5K Medium-5	Htr.	2.0	0.26	180	180	—	—	Class A	135 180	135 180	-13.5 -18.0	1450 1700	—	14.5 22.0	—	3.0 5.0	—	70 90	7K 6K	0.7 1.4	7 7	—	33		
35A5	BP		6AA Octal	Htr.	35.0	0.15	200	117	8.5	1.0	Class A	110 200	110 110	7.5 -8.0	5800 5900	7.5 8.0	40.0 41.0	41.0 44.0	3.0 2.0	7.0 7.0	— —	2.5K 4.5K	1.5 3.3	10 10	—	35A5		
38	P		5F Small-5	Htr.	6.3	0.3	250	250	—	—	Class A	100 250	100 250	-9.0 -25.0	875 1200	— —	7.0 22.0	— —	1.2 3.8	— —	120 120	15K 10K	0.27 2.5	8 8	—	38		
41	P	6K6GT	6B Medium-6	Htr.	6.3	0.4	Same as 7B5																41					
42	P	6F6GT	6B Medium-6	Htr.	6.3	0.7	Same as 6F6G																42					
43	P	25A6GT	6B Medium-6	Htr.	25	0.3	Same as 25A6																43					
45	T		4D Medium-4	Fil.	2.5	1.5	275	—	—	—	Class A Class AB, P-P	180 250 275 275	— — — —	-31.5 -50.0 -56.0 -68.0	2125 2175 2050 —	— — — —	31.0 34.0 36.0 28.0	— — — 38.0	— — — —	3.5 3.5 3.5 —	2.7K 3.9K 4.6K 3.2K	0.825 1.6 2.0 18.0	— — — 5	—	45			
45A	T		4D Medium-4	Fil.	2.5	1.5	—	—	—	—	Class A	325	—	-68.0	2370	—	43.0	—	—	—	3.5	3.2K	3.0	—	—	45A		
46	TE		5C Medium-5	Fil.	2.5	1.75	400	—	10	—	Class A Class B, P-P	250 300	G ₂ to P G ₁ to G ₂	-33 0	2350 —	— —	22.0 8.0	— —	— —	— —	5.6 —	6.4K 5.2K	1.25 16.0	— —	—	46		
47	P	2A5	5B Medium-5	Fil.	2.5	1.75	250	—	—	—	Class A	250	250	-16.5	2500	—	31.0	—	6.0	—	150	7K	2.7	6	—	47		

TABLE VI. (continued) Audio Power Amplifiers

	DESCRIPTION				CONSTR.		CATHODE		MAXIMUM RATINGS			SERVICE		AVERAGE CHARACTERISTICS AND TYPICAL OPERATION															
TYPE	CLASS*	NEAREST EQUIVALENT	BASING	BASE & PINS	HTR./FIL.	VOLTS	AMPERES	PLATE VOLTS	SCREEN VOLTS	PLATE WATTS	SCREEN WATTS	APPLICATION	PLATE VOLTS	SCREEN VOLTS	GRID VOLTS	TRANSCONDUCTANCE μMHOS	PEAK SIGNAL VOLTS	PLATE MA. ZERO SIGNAL	SCREEN MA. MAX. SIGNAL	SCREEN MA. ZERO SIG.	TRIODE MA. MAX. SIG.	LOAD RESISTANCE	MAX. AMP. FACTOR	MAX. OUTPUT WATTS	DISTORTION %	TYPE			
48	TE		6A	Medium-5	Htr.	30.0	0.4	—	—	—	—	Class A	95 125	95 100	—20.0 —22.5	3900 3900	—	52.0 52.0	—	12.0 12.0	—	15.6 43	1.5K 1.5K	2.0 3.0	—	—	48		
49	Duo grid T		5C	Medium-5	Fil.	2.0	0.12	—	—	—	—	Class A Class B, P-P	135 135 180	G ₂ to P —	—20.0 0 0	1125 — 70 70	6.0 2.6 4.0	—	—	—	—	4.7 11K 12K	0.170 2.3 3.5	—	—	49			
50	T		4D	Medium-4	Fil.	7.5	1.25	—	—	—	—	Class A	300 350 400 450	—	—54.0 —63.0 —70.0 —84.0	1900 2000 2100 2100	35.0 45.0 55.0 55.0	—	—	—	—	3.8 3.8 3.8 3.8	4.6K 4.1K 3.67K 4.35K	1.6 2.4 3.4 4.6	—	—	50		
50A5	BP	50B5	6AA	Octal	Htr.	50.0	0.15	200	117	10	1.25	Class A	110 200	110 110	—7.5 —8.0	—	7.5 8.0	49.0 50.0	50.0 55.0	4.0 1.5	11.0 6.0	—	2K 3K	2.2 4.7	10 10	—	50A5		
50C6G	BP		7AC	Octal	Htr.	50.0	0.15	200	135	12.5	1.75	Class A	135 200	135 135	—13.5 —14.0	7000 7100	13.5 14.0	58.0 61.0	60.0 66.0	3.5 2.2	11.5 9.0	—	2K 2.6K	3.6 6.0	10 10	—	50C6G		
52	Duo grid T		5C	Medium-5	Fil.	6.3	0.3	300	—	5.5	—	Class A Class B, P-P	110 180	G ₂ to P G ₁ to G ₂	0 0	3000 —	—	43.0 3.0	—	—	—	—	5.2 10K	2K 5.0	1.5 5.0	—	52		
53	T+T		7B	Medium-7	Htr.	2.5	2.0	300	—	5.5	—	Same as 5A5															53		
59	P	47 2A5	7A	Medium-7	Htr.	2.5	2.0	—	—	—	—	Class A Class B†	P250 300 400	250 G ₂ to G ₁ & G ₁ to P	—18.0 0 0	2500 — —	—	35.0 26.0 26.0	—	9.0 — —	—	—	—	6K 4.6K 6K	3.0 15.0 20.0	—	—	59	
68, A	P		5E	Medium-5	Htr.	6.3	0.4	—	—	—	—	Class A	135	90	—13.5	1400	—	14.0	—	3.0	—	—	7.5K	0.65	—	—	68, A		
70A7GT	D+BP	70L7GT	8AB	Octal	Htr.	70.0	0.15	—	—	—	—	Class A H-W Rectifier	110	110 Plate volts = 125 RMS	—7.5 —	5800 —	—	40.0	—	3.0	—	—	2.5K	1.5	—	—	70A7GT		
70L7GT	D+BP	70A7GT	8AA	Octal	Htr.	70.0	0.15	117	117	5.0	1.0	Class A H-W Rectifier	110	110 Plate Volts = 117 RMS	—7.5 —	7500 —	—	40.0	—	3.0	—	—	2K	1.8	—	—	70L7GT		
															Output current = 70 ma										Capacitor input to filter				

*Cathode resistor in ohms.

†Grid-to-grid voltage in push-pull operation.

‡Triode connected, screen tied to plate.

§Plate-to-plate load in push-pull operation.

P-P Push-pull operation, two tubes or both sections of double unit tubes. Values for both tubes or sections.

*Class code: BP—Beam pentode. D+P—Diode and pentode. P—Pentode. T—Triode. T+T—Duotriode. TE—Tetrode. T+P—Triode and pentode.

TABLE VI. (continued) Audio Power Amplifiers

	DESCRIPTION				CONSTR.		CATHODE				MAXIMUM RATINGS				SERVICE		AVERAGE CHARACTERISTICS AND TYPICAL OPERATION													
TYPE	CLASS*	NEAREST EQUIVALENT		BASING	BASE & PINS		HTR. FIL.		VOLTS	AMPERES	PLATE VOLTS	SCREEN VOLTS	PLATE WATTS	SCREEN WATTS	APPLICATION	PLATE VOLTS	SCREEN VOLTS	GRID VOLTS	TRANSCONDUCTANCE μMHOS	PEAK SIGNAL VOLTS	PLATE MA. ZERO SIGNAL	SCREEN MA. MAX. SIGNAL	SCREEN MA. ZERO SIG.	TRIODE MA. MAX. SIG.	LOAD RESISTANCE	MAX. AMP. FACTOR	MAX. OUTPUT WATTS	DISTORTION %	TYPE	
71	T		4D	Medium-4	Fil.	5.0	0.25	—	—	—	—	Class A	180	—	—40.5	1700	—	20.0	—	—	—	—	3.0	4.8K	0.79	5		71		
71A	T		4D	Medium-4	Fil.	5.0	0.25	—	—	—	—	Class A	90 135 180	— — —	—16.5 —27.0 —40.5	1400 1650 1700	— — —	10.0 17.3 20.0	— — —	— — —	— — —	3.0 3.0 3.0	3K 3K 4.8K	0.125 0.4 0.79	5 5 5		71A			
71B	T		4D	Medium-4	Fil.	5.0	0.25	—	—	—	—	Same as 71A														71B				
79	T+T	6A6	6H	Small-6	Htr.	6.3	0.6	250	—	11.5	—	Class B, P-P	180 250	— —	0 0	— —	7.6 10.6	Pin = .38W Pin = .38W		7K 14K	5.5 8.0	— —					79			
89/89Y	P		6F	Small-6	Htr.	6.3	0.4	250	250	—	—	Class A Class A Class B, P-P	250 250 180	— 250 —	—31.0 —25.0 0	1800 1800 —	— — —	32.0 G ₂ & G ₃ tied to P 32.0 G ₂ to K 6.0 G ₃ to P		4.7 125 —	5.5K 6.75K 9.4K	0.9 3.4 3.5	5 9 —			89/89Y				
95	P		6B	Medium-6	Htr.	2.5	1.75	—	—	—	—	Class A	315	315	—22.0	2300	—	42.0	—	8.0	—	—	7K	5.0	—			95		
117L7/GT	D+BP	117N7GT 117P7GT	8AO	Octal	Htr.	117	0.09	117	117	6.0	1.0	Class A H-W Rectifier	105	105	—5.2	5300	5.2	43.0	43.0	4.0	5.5	—	4K	0.85	5			117L7/GT		
														Plate Volts = 117 RMS Output current = 75 ma Capacitor input to filter																
117N7GT	D+BP	117P7GT	8AV	Octal	Htr.	117	0.09	117	117	5.5	1.0	Class A H-W Rectifier	100	100	—6.0	7000	6.0	51.0	—	5.0	—	—	3K	1.2	6			117N7GT		
														Plate Volts = 117 RMS Output current = 75 ma Plate supply impedance = 15 Ω																
117P7GT	D+BP	117L7GT	8AV	Octal	Htr.	117	0.09	Same as 117L7/M7GT														117P7GT								
182B/482B	T	71A 183/483	4D	Medium-4	Fil.	5.0	1.25	—	—	—	—	Class A	250	—	—35.0	2000	—	20.0	—	—	—	5.0	4.5K	1.35	—			182B/482B		
183/483	T		4D	Medium-4	Fil.	5.0	1.25	—	—	—	—	Class A	250	—	—65.0	1500	—	20.0	—	—	—	3.0	4.5K	1.8	—			183/483		
210T	T	10	4D	Medium-4	Fil.	7.5	1.25	Same as 10														210T								
950	P	33	5K	Medium-5	Fil.	2.0	0.125	—	—	—	—	Class A	135	135	—16.5	1000	—	7.0	—	2.0	—	125	13.5K	0.575	—			950		

*Cathode resistor in ohms.

†Grid-to-grid voltage in push-pull operation.

‡Triode connected, screen tied to plate.

§Plate-to-plate load in push-pull operation.

P-P Push-pull operation, two tubes or both sections of double unit tubes. Values for both tubes or sections.

*Class code: BP=Beam pentode. D+P=Diode and pentode. P=Pentode. T=Triode. T+T=Duotriode. TE=Tetrode. T+P=Triode and pentode.

TABLE VII.

CBS

TV DEFLECTION POWER AMPLIFIERS (Power Triodes, Tetrodes, and Pentodes)

	DESCRIPTION				CONSTR.		CATHODE		MAXIMUM RATINGS										SERVICE		AVERAGE CHARACTERISTICS AND TYPICAL OPERATION				
TYPE	CLASS*	NEAREST EQUIVALENT	BASING	BASE & PINS	HTR./FIL.	VOLTS	AMPERES	PLATE SUPPLY VOLTS	PEAK POS. PLATE VOLTS*	PEAK NEG. PLATE VOLTS*	PEAK GRID VOLTS	SCREEN VOLTS	PLATE WATTS	SCREEN WATTS	AVERAGE CATHODE MA	PEAK CATHODE MA	APPLICATION	PLATE VOLTS	SCREEN VOLTS	GRID VOLTS	TRANSCONDUCTANCE μMHOS	PLATE MA	SCREEN MA	PLATE RES., OHMS	TYPE
6BD5GT	BP	6BQ6GTA	6CK	Octal	Htr.	6.3	0.9	325	4000	—	—200	325	10	3	100	300	Class A Amp. Horiz. Amp.	200 310	200 310	—12.0	5000	Cathode Current = 90 ma Peak surge e_b = —50V peak E_b = 2500V			6BD5GT
6BN7	T+T		9AJ	Min.-9	Htr.	6.3	0.75	400†	1500□	—	—50†	—	7.5□ 1.5*	—	—	—	Class A Amp. □ Class A Amp. * Vert. Amp. □ Vert. Osc. *	250 320 360 360	— — — —	—15.0 —1.0 —15pk —	5500 2000 — —	24 5.0 21 .2	— — — —	2200 14000 RK = 330 ohms —	6BN7
12A4	TE	12BH7 12AU7	9AG	Min.-9	Htr.	12.6 6.3	0.3 0.6	450 450	— 1000	— —	— —250	— —	6.0 5.9	— —	40 30	— 105	Class A Amp. Vert. Amp.	250 —	— —	—9.0 —	8000 —	12.5 —	— —	2500 —	12A4

†Each section *Absolute Maximum

□ Section 1

* Section 2

*T+T = Double Triode. TE = Tetrode. BP = Beam Pentode.

TABLE VIII.

CBS

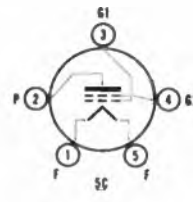
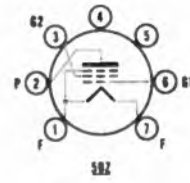
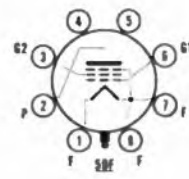
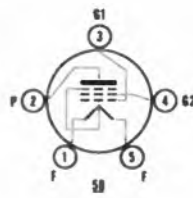
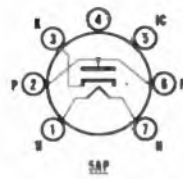
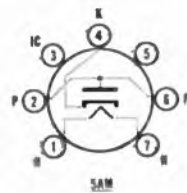
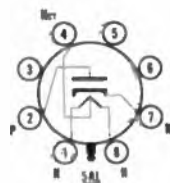
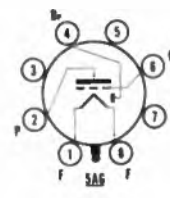
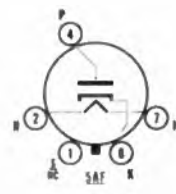
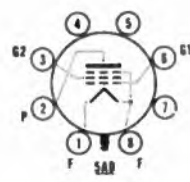
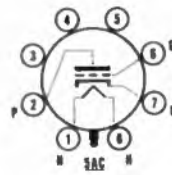
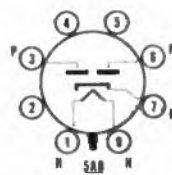
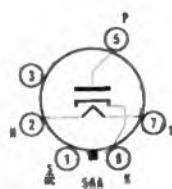
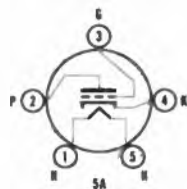
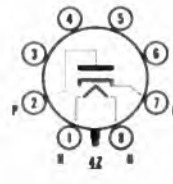
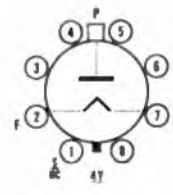
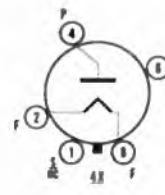
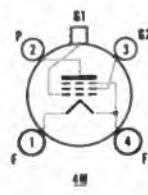
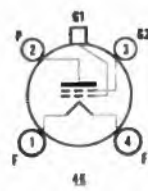
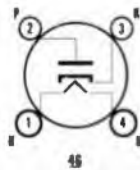
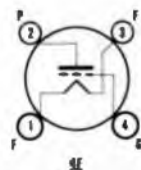
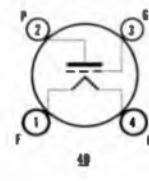
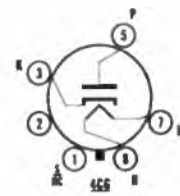
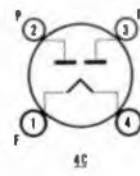
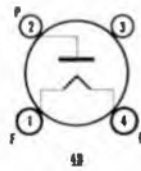
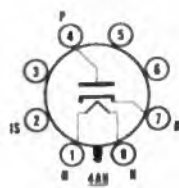
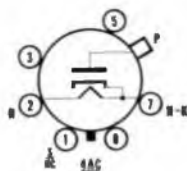
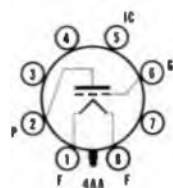
INDICATORS (Tuning Eyes)

	DESCRIPTION				CONSTR.	CATHODE				MAXIMUM RATINGS			AVERAGE CHARACTERISTICS AND TYPICAL OPERATION							
TYPE	CLASS*	NEAREST EQUIVALENT	BASING	BASE & PINS	HTR./FIL.	VOLTS	AMPERES	MAXIMUM	TARGET VOLTS		CONTROL ELECTRODE VOLTS	SUPPLY VOLTS	TARGET VOLTS	ANODE MA (ZERO BIAS)	TARGET MA (ZERO BIAS)	SERIES ANODE RESISTOR, MEG.	GRID VOLTS (OPEN)	GRID VOLTS (CLOSED)	TYPE	
2E5	T	2G5	6R	Small-6	Htr.	2.5	0.8	250	125	250	200 250	200 250	0.19† 0.24†	3.0† 4.0†	1.0 1.0	0 0	—6.5 —8.0	2E5		
2G5	T	2E5	6R	Small-6	Htr.	2.5	0.8	250	100	250	100 200 250	100 200 250	0.19 0.19 0.24	1.0† 3.0† 4.0†	0.5 1.0 1.0	0 0 0	—8.0 —18.5 —22.0	2G5		
6AB5/6N5	T		6R	Small-6	Htr.	6.3	0.15	180	100	180	135	135	0.5†	2.0†	0.25	0	—10	6AB5/6N5		
6AD6G	T		7AG	Octal	Htr.	6.3	0.15	—	—	—	100 150	100 150	—	—	—	23 50	45 75	6AD6G		
6AF6G	T		7AG	Octal	Htr.	6.3	0.15	250	125	250	100 135 250	100 135 250	— — —	— — —	— — —	0 0 0	60 81 155	6AF6G		
6E5	T	6T5 6U5/6G5	6R	Small-6	Htr.	6.3	0.3	250	125	250	200 250	200 250	0.19 0.24	3.0† 4.0†	1.0 1.0	0 0	—6.5 —8.0	6E5		
6G5/6H5	T	6U5/6G5	6R	Small-6	Htr.	6.3	0.3	—	—	—	250 100	250 100	0.24 0.19	4.0 1.0	1.0 0.5	0 0	—22.0 —8.0	6G5/6H5		
6H5	T	6U5/6G5	6R	Small-6	Htr.	6.3	0.3	Same as 6G5/6H5										6H5		
6T5	T	6U5/6G5	6R	Small-6	Htr.	6.3	0.3	Same as 6G5/6H5										6T5		
6U5	T	6E5	6R	Small-6	Htr.	6.3	0.2	Same as 6G5/6H5										6U5		

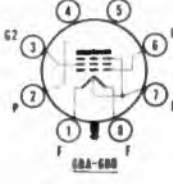
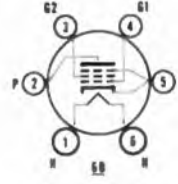
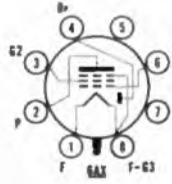
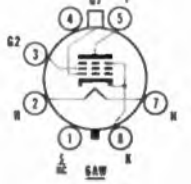
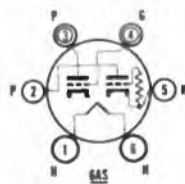
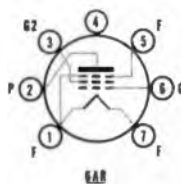
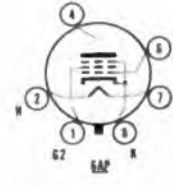
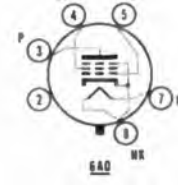
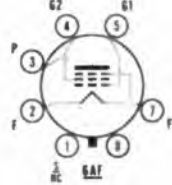
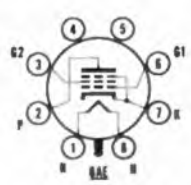
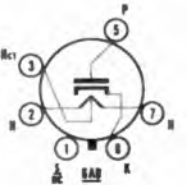
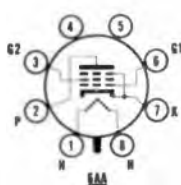
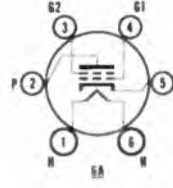
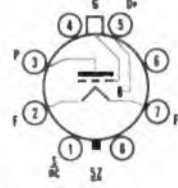
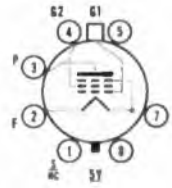
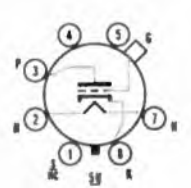
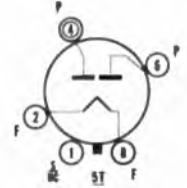
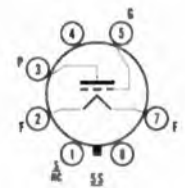
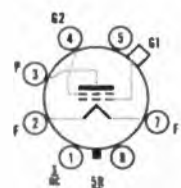
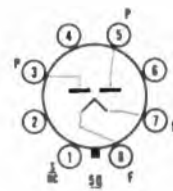
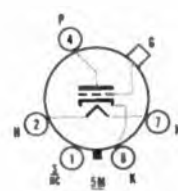
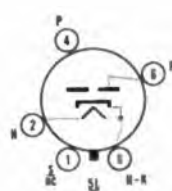
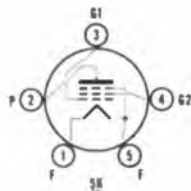
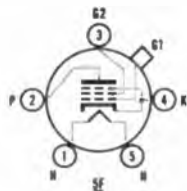
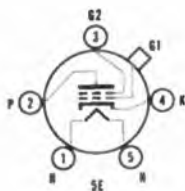
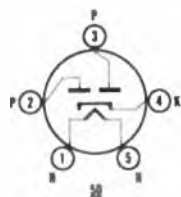
*T = Triode.

†Subject to wide variations.

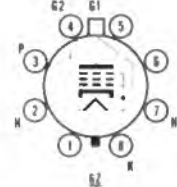
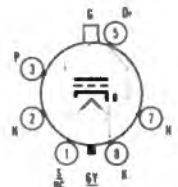
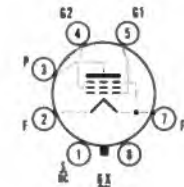
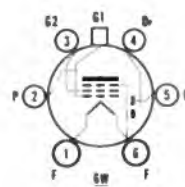
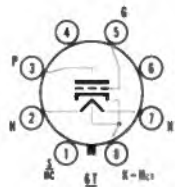
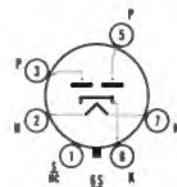
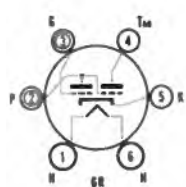
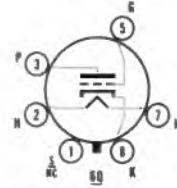
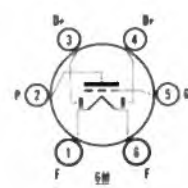
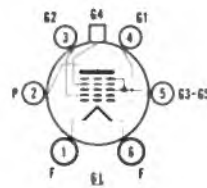
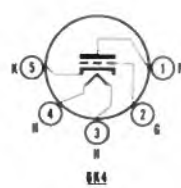
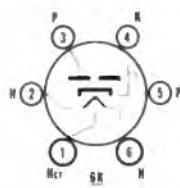
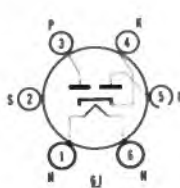
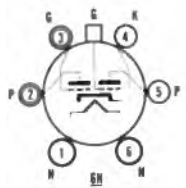
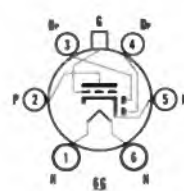
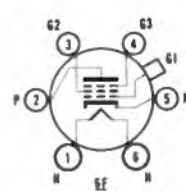
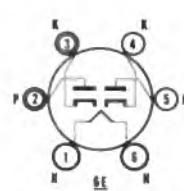
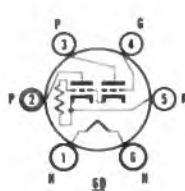
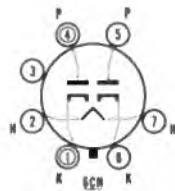
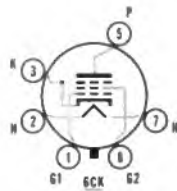
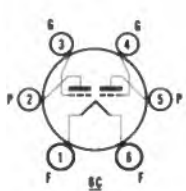
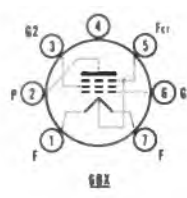
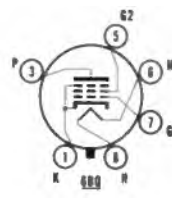
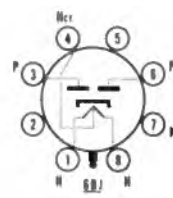
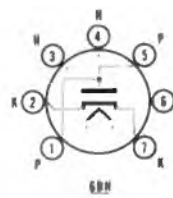
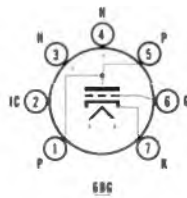
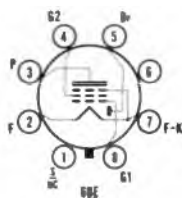
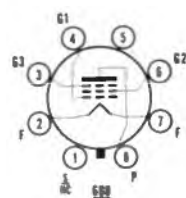
BASING DIAGRAMS FOR SELDOM-USED TUBE REFERENCE GUIDE



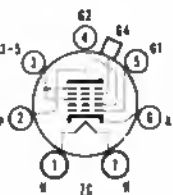
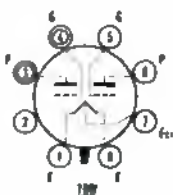
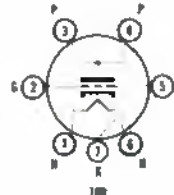
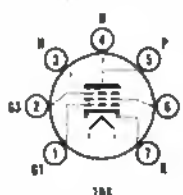
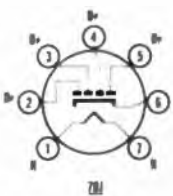
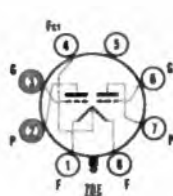
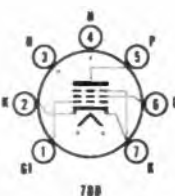
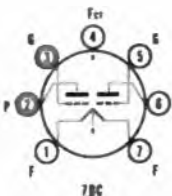
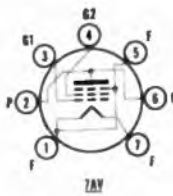
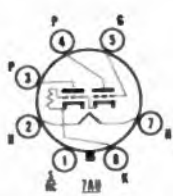
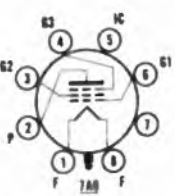
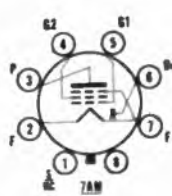
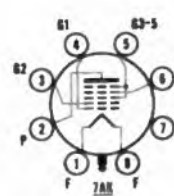
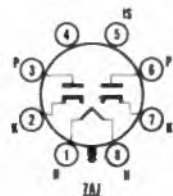
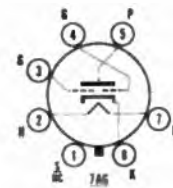
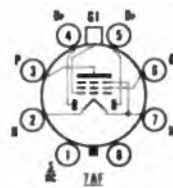
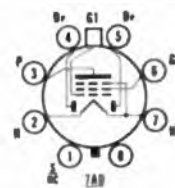
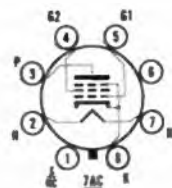
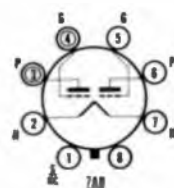
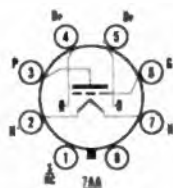
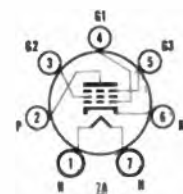
BASING DIAGRAMS FOR SELDOM-USED TUBE REFERENCE GUIDE



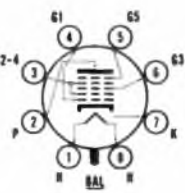
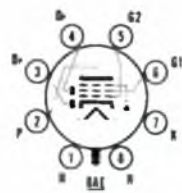
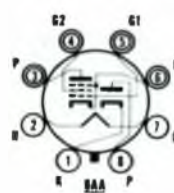
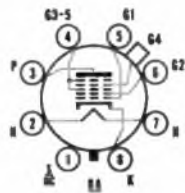
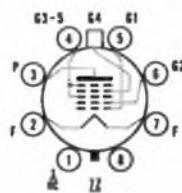
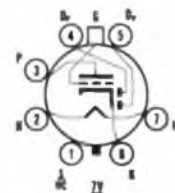
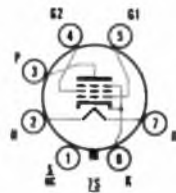
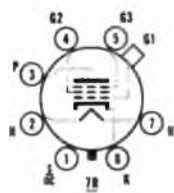
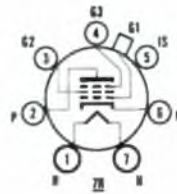
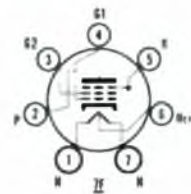
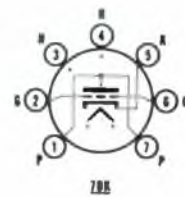
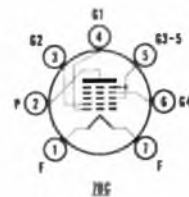
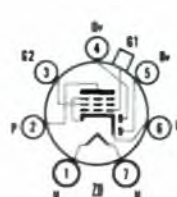
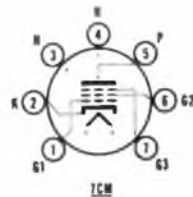
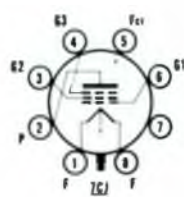
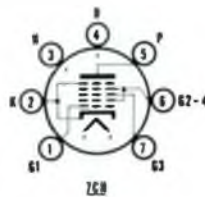
BASING DIAGRAMS FOR SELDOM-USED TUBE REFERENCE GUIDE



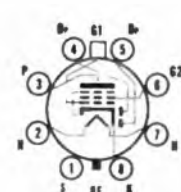
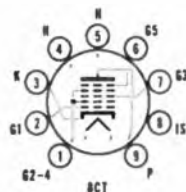
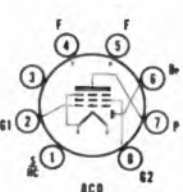
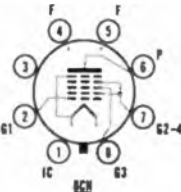
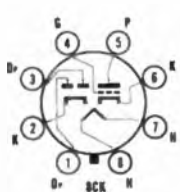
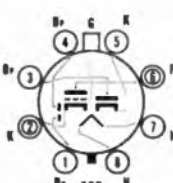
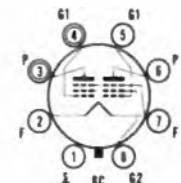
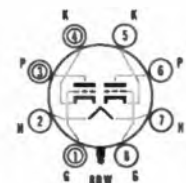
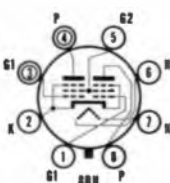
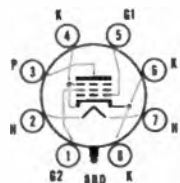
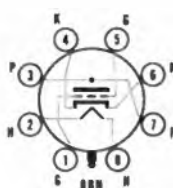
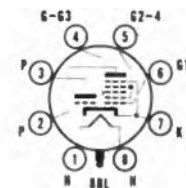
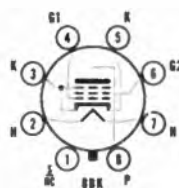
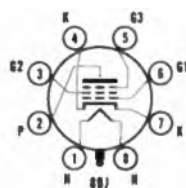
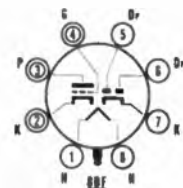
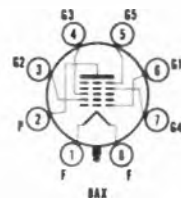
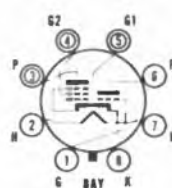
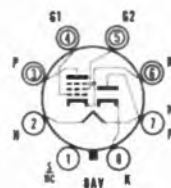
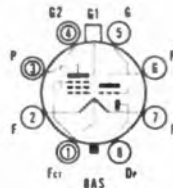
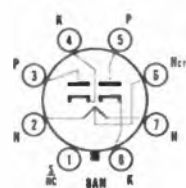
BASING DIAGRAMS FOR SELDOM-USED TUBE REFERENCE GUIDE



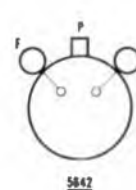
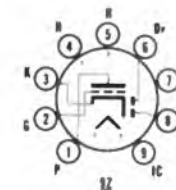
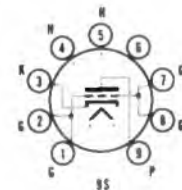
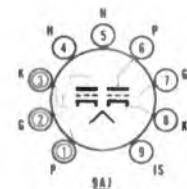
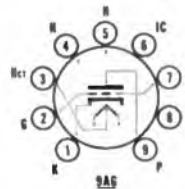
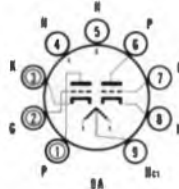
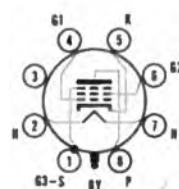
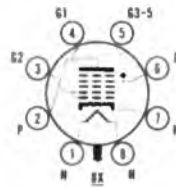
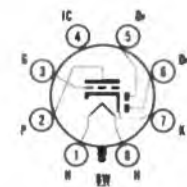
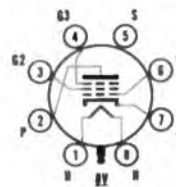
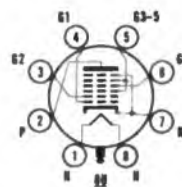
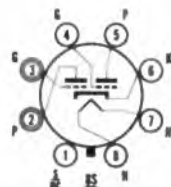
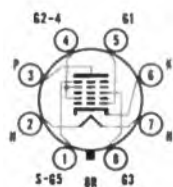
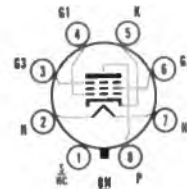
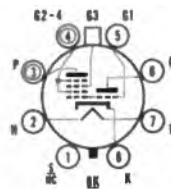
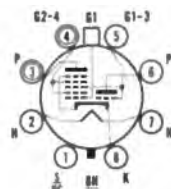
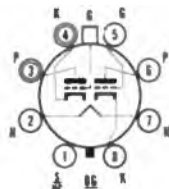
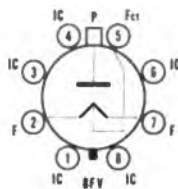
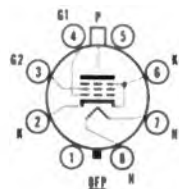
BASING DIAGRAMS FOR SELDOM-USED TUBE REFERENCE GUIDE



BASING DIAGRAMS FOR SELDOM-USED TUBE REFERENCE GUIDE



BASING DIAGRAMS FOR SELDOM-USED TUBE REFERENCE GUIDE





PICTURE TUBES

(Numerical-Alphabetical Order)

These tubes are selected for being in current demand. Other types can be found in the complete Picture Tube Reference Guide following this section.



PICTURE TUBES



PICTURE TUBES



8DP4



RECTANGULAR PICTURE TUBE

Electrostatic focus . . . spherical face . . . gray filter-glass faceplate . . . 90° deflection . . . external conductive coating

HEATER CHARACTERISTICS

Voltage	6.3 volts
Current, $\pm 10\%$	0.6 amperes

ELECTRICAL DATA

Focusing method	Electrostatic
Deflecting method	Magnetic
Deflection angles (approximate)	
Horizontal	85 degrees
Vertical	68 degrees
Diagonal	90 degrees

MAXIMUM RATINGS (Design center values)

	Grid Drive Δ	Cathode Drive Δ	
Anode voltage, d-c	8000	8000	volts
Grid 4 voltage, d-c	-500 to +500	-500 to +500	volts
Grid 2 voltage, d-c		400	volts
Grid 1 voltage			
Negative bias, d-c	100	0	volts
Positive bias, d-c	0	100	volts
Negative peak	130	2	volts
Positive peak	2	130	volts
Peak heater-cathode voltage:			
Heater negative to cathode			
During warm-up time			
15 seconds max.	410	410	volts
After equipment warm-up period	180	180	volts
Heater positive to cathode	180	180	volts

TYPICAL OPERATING CONDITIONS

	Grid Drive Δ	Cathode Drive Δ	
Anode voltage	6000	6000	volts
Grid 4 (focusing electrode) voltage*	+15 to +315	+15 to +315	volts
Grid 2 voltage	150	150	volts
Grid 1 voltage for cutoff†	-13 to -35	14 to 30	volts
Ion-trap current‡, JETEC coil No. 117	31	31	ma
Ion-trap magnet strength‡	31	31	gausses

MAXIMUM CIRCUIT VALUE

Grid 1 circuit resistance	1.5 meg
---------------------------	---------

NOTES:

*With the combined Grid 1 bias voltage and video-signal voltage adjusted to give an anode current of 100 microamperes for a $5\frac{1}{2}$ " x 7" raster.

†Visual extinction of focused raster.

‡As measured with single-field beam bender.

▲Grid drive conditions measured with respect to cathode. Cathode drive conditions measured with respect to grid 1.

CAUTION: Shielding for X-rays is recommended for personal protection at close range if this tube is operated in excess of 16,000 volts or over Maximum Rated Anode Voltage, whichever is less. Safety glass covering tube's faceplate is usually sufficient.

CBS PICTURE TUBES

ENGINEERING DESIGN DATA

8DP4

NOVEMBER 26, 1956

DIRECT INTERELECTRODE CAPACITANCES

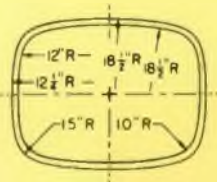
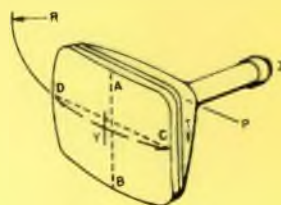
Cathode to all other electrodes	5.0 μ f
Grid 1 to all other electrodes	6.0 μ f
External conductive coating to anodes:	
Maximum	350 μ f
Minimum	200 μ f

OPTICAL DATA

Phosphor	No. 4
Fluorescence color	White
Persistence	Medium
Faceplate	Gray filter-glass
Light transmission at center (neutral density filter) approx.	80%

MECHANICAL DATA

Over-all length (Y-Z)	$10\frac{1}{16} \pm \frac{1}{32}$ inches
Greatest dimension of bulb:	
Height (A-B)	$6\frac{1}{16} \pm \frac{1}{32} - \frac{1}{32}$ inches
Width (C-D)	$7\frac{1}{16} \pm \frac{1}{32} - \frac{1}{32}$ inches
Diagonal	$8\frac{1}{16} \pm \frac{1}{32} - \frac{1}{32}$ inches
Neck length (Z-P)*	$6\frac{1}{2} \pm \frac{1}{16}$ inches
Neck diameter	$1\frac{1}{16} \pm \frac{1}{32}$ inches
Face curvature, height and width (radius R)	27 inches
Bulb contact to ref. line (T-P)*	$1\frac{1}{16} \pm \frac{1}{32}$ inches
Min. useful screen dimensions:	
Diagonal	$7\frac{1}{16}$ inches
Height by width	$5\frac{1}{2} \times 7\frac{1}{4}$ inches
Area	35.5 sq. in.
Bulb contact, recessed sm. cavity cap	(J1-21)
Base, dwarf shell duodecal 6-pin (86-158)	
Bulb contact J1-21 aligns with vacant position of pin 6	$\pm 30^\circ$



NOTES

◆ Contains 2 inch by 2 inch contact area located 90° ccw from anode contact as viewed from base and $2 \pm \frac{1}{4}$ inches above reference line.

* Reference line P determined by JETEC gauge No. 116.

ENGINEERING DESIGN DATA

10ABP4

NOVEMBER 29, 1956

DIRECT INTERELECTRODE CAPACITANCES

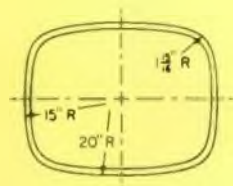
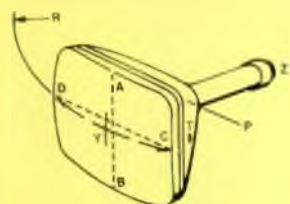
Cathode to all other electrodes	5.0 $\mu\mu\text{f}$
Grid 1 to all other electrodes	6.0 $\mu\mu\text{f}$
External conductive coating to anode†	
Maximum	.850 $\mu\mu\text{f}$
Minimum	.400 $\mu\mu\text{f}$

OPTICAL DATA

Phosphor	No. 4
Fluorescence color	White
Persistence	Medium
Faceplate	Clear filter-glass

MECHANICAL DATA

Over-all length (Y-Z)	11½ inches
Greatest dimension of bulb:	
Height (A-B)	7¼ + ¼ - ¼ inches
Width (C-D)	9¾ + ¼ - ¼ inches
Diagonal	10¾ + ¼ - ¼ inches
Neck length (Z-P)*	6½ ± ¼ inches
Neck diameter	1⅞ ± ⅛ inches
Face curvature, height and width (radius R)	17½ inches
Bulb contact to ref.	
Line (T-P)*	2 ± ½ inches
Min. useful screen dimensions:	
Diagonal	9⅞ inches
Height by width	6⅞ x 8¾ inches
Area	53.5 sq. in.
Bulb contact, recessed sm.	
cavity cap.	(J1-21)
Base, sm. shell duodecal 6-pin	(B6-63)
Bulb contact J1-21 aligns with vacant position of pin 6	±30°



NOTES

- * Contains 2 inch by 2 inch contact area located 90° ccw from anode contact as viewed from base and 2 ± ¼ inches above reference line.
- * Reference line P determined by JETEC gauge No. 116.

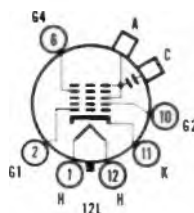


10ABP4



RECTANGULAR PICTURE TUBE

Electrostatic focus . . . spherical
face . . . clear filter-glass faceplate
. . . 90° deflection . . . external con-
ductive coating



HEATER CHARACTERISTICS

Voltage	6.3 volts
Current, ±10%	0.6 amperes

ELECTRICAL DATA

Focusing method	Electrostatic
Deflecting method	Magnetic
Deflection angles (approximate)	
Horizontal	85 degrees
Diagonal	90 degrees

MAXIMUM RATINGS (Design center values)

Anode voltage, d-c	12,000 volts
Grid 4 (focusing electrode) voltage, d-c	-500, +1000 volts
Grid 2 voltage, d-c	500 volts
Grid 1 voltage, d-c	
Negative bias value, d-c	140 volts
Positive bias value, d-c	0 volts
Positive peak value	2 volts
Peak heater-cathode voltage:	
Heater negative to cathode	
During warm-up period of 15 seconds max.	410 volts
After equipment warm-up period	180 volts
Heater positive to cathode	180 volts

TYPICAL OPERATING CONDITIONS

Anode voltage	7500 volts
Grid 4 (focusing electrode) voltage*	0 to 500 volts
Grid 2 voltage	300 volts
Grid 1 voltage for cutoff†	-38 to -62 volts
Ion-trap magnet strength‡, (approx.)	32 gauss

MAXIMUM CIRCUIT VALUE

Grid 1 circuit resistance	1.5 megohms
---------------------------	-------------

NOTES:

- *With the combined Grid 1 bias voltage and video-signal voltage adjusted to give an anode current of 100 microamperes for a 8¼" x 6⅞" raster.
- †Visual extinction of focused raster.
- ‡Heppner Model No. E437.

CAUTION: Shielding for X-rays is recommended for personal protection at close range if this tube is operated in excess of 16,000 volts or over Maximum Rated Anode Voltage, whichever is less. Safety glass covering tube's faceplate is usually sufficient.



8JP4

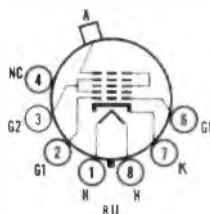


ALUMINIZED LONG-LIFE 110° TEST PICTURE TUBE*

Electrostatic self focus . . . no external conductive coating . . . no ion trap . . . aluminized screen . . . 110-degree magnetic deflection

HEATER CHARACTERISTICS

Heater voltage 6.3 volts
Heater current 600 ma



ELECTRICAL DATA

Focusing method Self
Deflection method Magnetic
Deflection angles (approx.)
Horizontal 105 degrees
Vertical 87 degrees
Diagonal 110 degrees

MAXIMUM RATINGS (Design center values)

Anode voltage, d-c 20,000 volts
Grids 2 and 4 voltage, d-c 500 volts
Grid 1 voltage
Negative bias value, d-c 140 volts
Positive bias value, d-c 0 volts
Positive peak value 2 volts
Peak heater-cathode voltage
Heater negative to cathode
During warm-up period of 15 secs max. 410 volts
After warm-up period 180 volts
Heater positive to cathode 180 volts

TYPICAL OPERATING CONDITIONS

Anode voltage 16,000 volts
Grid 2 voltage 300 volts
Grid 1 voltage for cutoff -35 to -72 volts

MAXIMUM CIRCUIT VALUE

Grid 1 circuit resistance 1.5 meg

NOTES:

- †Visual extinction of focused raster.
*Instructions on the use of this tube are contained in CBS-Hytron bulletin E-292.

CAUTION: Shielding for X-rays is recommended for personal protection at close range if this tube is operated in excess of 16,000 volts or over Maximum Rated Anode voltage, whichever is less.

ENGINEERING DESIGN DATA

8JP4

JUNE 1, 1958

DIRECT INTERELECTRODE CAPACITANCES

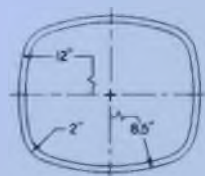
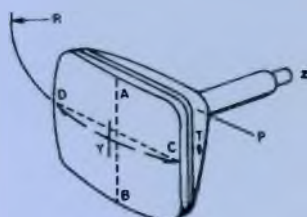
Cathode to all other electrodes . . . 5 $\mu\mu$
Grid 1 to all other electrodes 6 $\mu\mu$

OPTICAL DATA

Phosphor P4
Fluorescence color White
Persistence Short-Medium
Faceplate Gray filter glass
Light transmission at center of neutral density filter 80%

MECHANICAL DATA

Overall length (Y-Z) . . . 8 1/4 $\pm$ 1/8 inches
Bulb dimensions
Height (A-B) 6 1/4 $\pm$ 1/8 inches
Width (C-D) 8 1/4 $\pm$ 1/8 inches
Diagonal 8 7/8 $\pm$ 1/8 inches
Neck length (Z-P) . . . 5 1/4 $\pm$ 1/8 inches
Neck diameter 1 1/4 inches
Face curvature, height and width (radius R) 11 inches
Bulb contact to ref. line (T-P) 1 1/4 $\pm$ 1/8 inches
Min. useful screen dimensions
Height by width 5 1/4 x 7 1/2 inches
Bulb contact, recessed small cavity cap JETEC J1-21
Base JETEC B7-183
Basing 8JL
Bulb contact aligns with pin number 4 $\pm 30^\circ$



NOTE

*Reference line P determined by JETEC gauge No. 126.





8XP4

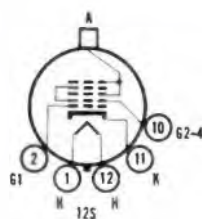


TELEVISION CHECK TUBE

Electrostatic self focusing . . .
spherical face . . . gray filter-glass
faceplate . . . 90° deflection

HEATER CHARACTERISTICS

Voltage 6.3 volts
Current (approx.) 0.6 amperes



ELECTRICAL DATA

Focusing method	Electrostatic
Deflecting method	Magnetic
Deflection angles (approximate)	
Horizontal	85 degrees
Vertical	68 degrees
Diagonal	90 degrees

MAXIMUM RATINGS (Absolute maximum values)

Anode voltage, d-c	22,000 volts
Grid 2 (and grid 4) voltage, d-c	550 volts
Grid 1 voltage	
Negative bias, d-c	155 volts
Negative peak	220 volts
Positive bias, d-c	0 volts
Positive peak	2 volts
Peak heater-cathode voltage	
Heater negative to cathode	
During warm-up period of 15 seconds max.	450 volts
After equipment warm-up period	200 volts
Heater positive to cathode	200 volts

TYPICAL OPERATING CONDITIONS

Anode voltage, d-c	16,000 volts
Grid 2 (and grid 4) voltage, d-c	300 volts
Grid 1 voltage for cutoff, d-c	-28 to -72 volts

MAXIMUM CIRCUIT VALUE

Grid 1 circuit resistance	1.5 meg
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NOTE:

Visual extinction of focused raster.

ENGINEERING DESIGN DATA

8XP4

NOVEMBER 1, 1957

DIRECT INTERELECTRODE CAPACITANCES

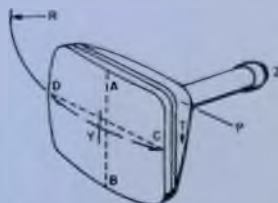
Cathode to all other electrodes 5 $\mu\mu\text{f}$
Grid 1 to all other electrodes 6 $\mu\mu\text{f}$

OPTICAL DATA

Phosphor P4
Fluorescence color White
Persistence Short to medium
Faceplate Gray filter-glass
Light transmission at center
(approx.) 80%

MECHANICAL DATA

Over-all length (Y-Z) $11\frac{1}{16} \pm \frac{1}{16}$ inches
Greatest dimension of bulb:
Height (A-B) $6\frac{1}{16} \pm \frac{1}{16}$ inches
Width (C-D) $7\frac{1}{4} \pm \frac{1}{16}$ inches
Diagonal $8\frac{1}{16} \pm \frac{1}{16}$ inches
Neck length (Z-P) $7\frac{1}{4} \pm \frac{1}{16}$ inches
Neck diameter $1\frac{1}{4} \pm \frac{1}{16}$ inches
Face curvature, height and width
(radius R) 27 inches
Bulbs contact to ref.
line (T-P) $1\frac{1}{4} \pm \frac{1}{16}$ inches
Min. useful screen dimensions:
Diagonal $7\frac{1}{4}$ inches
Height by width $5\frac{3}{8} \times 7\frac{1}{16}$ inches
Area 35.5 sq. in.
Bulb contact, recessed sm.
cavity cap (11-21)
Base, dwarf shell duodecal
6 pin (85-57)
Bulb contact aligns with vacant
position of pin 6 $\pm 30^\circ$



NOTES

Reference line P determined by JETEC
gauge No. 116.

ENGINEERING DESIGN DATA

10ABP4

NOVEMBER 1, 1957

DIRECT INTERELECTRODE CAPACITANCES

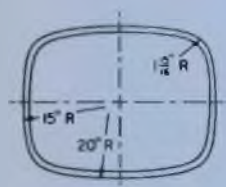
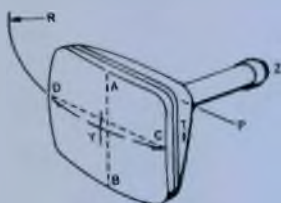
Cathode to all other electrodes	5.0 $\mu\mu\text{f}$
Grid 1 to all other electrodes	6.0 $\mu\mu\text{f}$
External conductive coating to anode:	
Maximum	850 $\mu\mu\text{f}$
Minimum	400 $\mu\mu\text{f}$

OPTICAL DATA

Phosphor	No. 4
Fluorescence color	White
Persistence	Medium
Faceplate	Clear filter-glass

MECHANICAL DATA

Over-all length (Y-Z)	11 1/2 inches
Greatest dimension of bulb:	
Height (A-B)	7 1/2 + 1/4 - 1/8 inches
Width (C-D)	9 1/4 + 1/4 - 1/8 inches
Diagonal	10 1/2 + 1/4 - 1/8 inches
Neck length (Z-P)*	6 1/2 + 1/4 - 1/8 inches
Neck diameter	1 1/8 + 1/16 - 1/32 inches
Face curvature, height and width (radius R)	17 1/2 inches
Bulb contact to ref.	
Line (T-P)*	2 + 1/4 - 1/8 inches
Min. useful screen dimensions:	
Diagonal	9 1/4 inches
Height by width	6 1/8 x 8 1/8 inches
Area	53.5 sq. in.
Bulb contact, recessed sm.	
cavity cap.	(J1-Z1)
Base, sm. shell duodecal 8-pin.	(86-63)
Bulb contact J1-Z1 aligns with vacant position of pin 6	$\pm 30^\circ$



NOTES

- Contains 2 inch by 2 inch contact area located 90° ccw from anode contact as viewed from base and 2 + 1/4 inches above reference line.
- Reference line P determined by JETEC gauge No. 116.

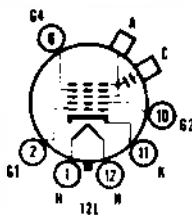


10ABP4



RECTANGULAR PICTURE TUBE

Electrostatic focus . . . spherical
face . . . clear filter-glass faceplate
. . . 90° deflection . . . external con-
ductive coating



HEATER CHARACTERISTICS

Voltage	6.3 volts
Current, $\pm 10\%$	0.6 amperes

ELECTRICAL DATA

Focusing method	Electrostatic
Deflecting method	Magnetic
Deflection angles (approximate)	
Horizontal	85 degrees
Diagonal	90 degrees

MAXIMUM RATINGS (Design center values)

Anode voltage, d-c	12,000 volts
Grid 4 (focusing electrode) voltage, d-c	-500, +1000 volts
Grid 2 voltage, d-c	500 volts
Grid 1 voltage, d-c	
Negative bias value, d-c	140 volts
Positive bias value, d-c	0 volts
Positive peak value	2 volts
Peak heater-cathode voltage:	
Heater negative to cathode	
During warm-up period of 15 seconds max.	410 volts
After equipment warm-up period	180 volts
Heater positive to cathode	180 volts

TYPICAL OPERATING CONDITIONS

Anode voltage	7500 volts
Grid 4 (focusing electrode) voltage*	0 to 500 volts
Grid 2 voltage	300 volts
Grid 1 voltage for cutoff†	-38 to -62 volts
Ion-trap magnet strength‡, (approx.)	32 gauss

MAXIMUM CIRCUIT VALUE

Grid 1 circuit resistance	1.5 megohms
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NOTES:

- *With the combined Grid 1 bias voltage and video-signal voltage adjusted to give an anode current of 100 microamperes for a 8 1/4" x 6 1/4" raster.
- †Visual extinction of focused raster.
- ‡Heppner Model No. E437.

CAUTION: Shielding for X-rays is recommended for personal protection at close range if this tube is operated in excess of 16,000 volts or over Maximum Rated Anode Voltage, whichever is less. Safety glass covering tube's faceplate is usually sufficient.

10ABP4A • 10ABP4B

Type 10ABP4A has an aluminized screen and type 10ABP4B has a faceplate light transmission (neutral density filter) of 81%, otherwise they are identical to the 10ABP4.



10BP4A

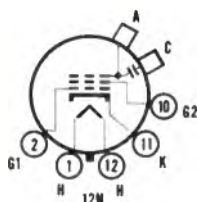


ROUND PICTURE TUBE

**Magnetic focus . . . spherical face
 . . . gray filter-glass faceplate . . .
 50° deflection . . . external con-
 ductive coating**

HEATER CHARACTERISTICS

Voltage 6.3 volts
 Current, $\pm 10\%$ 0.6 amperes



ELECTRICAL DATA

Focusing method Magnetic
 Deflecting method Magnetic
 Deflection angle (approximate) 50 degrees

MAXIMUM RATINGS (Design center values)

Anode voltage, d-c 12,000 volts
 Grid 2 voltage, d-c 410 volts
 Grid 1 voltage, d-c
 Negative bias value, d-c 125 volts
 Positive bias value, d-c 0 volts
 Positive peak value 2 volts
 Peak heater-cathode voltage:
 Heater negative to cathode
 During warm-up period of 15 seconds max. 410 volts
 After equipment warm-up period 125 volts
 Heater positive to cathode 125 volts

TYPICAL OPERATING CONDITIONS

Anode voltage 9000 volts
 Grid 2 voltage 250 volts
 Grid 1 voltage for cutoff -22 to 58 volts
 Focusing coil current, approx.* 110 ma
 Ion-trap current†, JETEC coil No. 108 120 ma
 Ion-trap magnet strength‡, (approx.) 33 gauss

MAXIMUM CIRCUIT VALUE

Grid 1 circuit resistance 1.5 megohms

NOTES:

*For JETEC focus coil 106, or equivalent, 3.25" from reference line with E_{c1} and E_{c2} sig adjusted for brightness of 20 FL on a 6" x 8" area.

†Visual extinction of focused raster.

‡As measured with double-field beam bender.

CAUTION: Shielding for X-rays is recommended for personal protection at close range if this tube is operated in excess of 16,000 volts or over Maximum Rated Anode Voltage, whichever is less. Safety glass covering tube's faceplate is usually sufficient.

ENGINEERING DESIGN DATA

10BP4A

NOVEMBER 20, 1956

Similar Types
 10BP4 10BP4C 10BP4D

DIRECT INTERELECTRODE CAPACITANCES

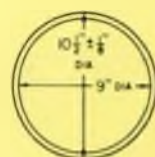
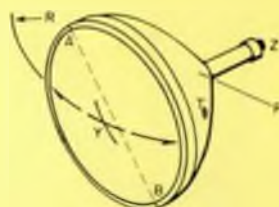
Cathode to all other electrodes . . . 5.0 μf
 Grid 1 to all other electrodes . . . 6.0 μf
 External conductive coating to anode†:
 Maximum 2500 μf
 Minimum 500 μf

OPTICAL DATA

Phosphor No. 4
 Fluorescence color White
 Persistence Medium
 Faceplate Gray filter-glass
 Light transmission at center
 (neutral density filter) approx. 70%

MECHANICAL DATA

Over-all length (Y-Z) . . . 17% $\pm 1/8$ inches
 Greatest diameter (A-B) 10% $\pm 1/8$ inches
 Neck length (Z-P)* . . . 9% $\pm 1/8$ inches
 Neck diameter . . . 1 1/8 $\pm 1/8$ inches
 Face curvature, height and width
 (radius R) 42 inches
 Bulb contact to ref.
 line (T-P)* 2 1/8 $\pm 1/8$ inches
 Min. useful screen dimensions:
 Diameter 9 inches
 Bulb contact, recessed sm.
 cavity cap. (J1-21)
 Base, sm. shell duodecal 5-pin . . . (B5-57)
 Bulb contact J1-21 aligns with
 vacant position of pin 3 . . . $\pm 30^\circ$



NOTES

† Contains 2 inch by 2 inch contact area located 90° ccw from anode contact as viewed from base and 2 $\pm 1/8$ inches above reference line.

* Reference line P determined by JETEC gauge No. 112.

ENGINEERING DESIGN DATA

12LP4A

NOVEMBER 29, 1956

Similar Type 12LP4

DIRECT INTERELECTRODE CAPACITANCES

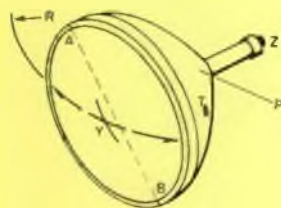
Cathode to all other electrodes	5.0 μ f
Grid 1 to all other electrodes	6.0 μ f
External conductive coating to anode†	
Maximum	3000 μ f
Minimum	750 μ f

OPTICAL DATA

Phosphor	No. 4
Fluorescence color	White
Persistence	Medium
Faceplate	Gray filter-glass
Light transmission at center (neutral density filter) approx.	74%

MECHANICAL DATA

Over-all length (Y-Z)	18½ ± ¼ inches
Greatest diameter (A-B)	12½ ± ¼ inches
Neck length (Z-P)♦	7½ ± ¼ inches
Neck diameter	1½ ± ¼ inches
Face curvature, height and width (radius R)	40 inches
Bulb contact to ref. line (T-P)★	3 ± ¼ inches
Min. useful screen dimensions:	
Diameter	11 inches
Bulb contact, recessed sm. cavity cap	(J1-21)
Base, sm. shell duodecal 5-pin	(B5-57)
Bulb contact J1-21 aligns with vacant position of pin 3	±30°



NOTES

- ♦ Contains 2 inch by 2 inch contact area located 90° ccw from anode contact as viewed from base and 2 ± ¼ inches above reference line.
- ★ Reference line P determined by JETEC gauge No. 112.



12LP4A

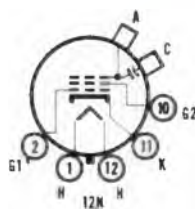


ROUND PICTURE TUBE

Magnetic focus . . . spherical face
. . . gray filter-glass faceplate . . .
54° deflection . . . external con-
ductive coating

HEATER CHARACTERISTICS

Voltage	6.3 volts
Current, ±10%	0.6 amperes



ELECTRICAL DATA

Focusing method	Magnetic
Deflecting method	Magnetic
Deflection angle (approximate)	54 degrees

MAXIMUM RATINGS (Design center values)

Anode voltage, d-c	12,000 volts
Grid 2 voltage, d-c	410 volts
Grid voltage, d-c	
Negative bias value, d-c	125 volts
Positive bias value, d-c	0 volts
Positive peak value	2 volts
Peak heater-cathode voltage:	
Heater negative to cathode	
During warm-up period of 15 seconds max.	410 volts
After equipment warm-up period	140 volts
Heater positive to cathode	140 volts

TYPICAL OPERATING CONDITIONS

Anode voltage	11,000 volts
Grid 2 voltage	250 volts
Grid 1 voltage for cutoff†	-22 to -68 volts
Focusing coil current, approx.*	110 ma
Ion-trap current‡, JETEC coil No. 108	120 ma
Ion-trap magnet strength‡, (approx.)	33 gauss

MAXIMUM CIRCUIT VALUE

Grid 1 circuit resistance	1.5 megohms
---------------------------	-------------

NOTES:

- *For JETEC focus coil 106, or equivalent, 3.25" from reference line with E_{c1} and E_{c1+12} adjusted for brightness of 20 FL on a 7½" x 10" area.
- †Visual extinction of focused raster.
- ‡As measured with double-field beam Bender.

CAUTION: Shielding for X-rays is recommended for personal protection at close range if this tube is operated in excess of 16,000 volts or over Maximum Rated Anode Voltage, whichever is less. Safety glass covering tube's faceplate is usually sufficient.



14BP4

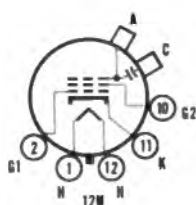


RECTANGULAR PICTURE TUBE

Magnetic focus . . . spherical face
 . . . gray filter-glass faceplate . . .
 70° deflection . . . external conductive coating

HEATER CHARACTERISTICS

Voltage 6.3 volts
 Current, $\pm 10\%$ 0.6 amperes



ELECTRICAL DATA

Focusing method Magnetic
 Deflecting method Magnetic
 Deflection angles (approximate)
 Horizontal 65 degrees
 Vertical 50 degrees
 Diagonal 70 degrees

MAXIMUM RATINGS (Design center values)

Anode voltage, d-c 14,000 volts
 Grid 2 voltage, d-c 410 volts
 Grid 1 voltage, d-c
 Negative bias value, d-c 125 volts
 Positive bias value, d-c 0 volts
 Positive peak value 2 volts
 Peak heater-cathode voltage:
 Heater negative to cathode
 During warm-up period of 15 seconds max. 410 volts
 After equipment warm-up period 125 volts
 Heater positive to cathode 125 volts

TYPICAL OPERATING CONDITIONS

Anode voltage 11,000 volts
 Grid 2 voltage 250 volts
 Grid 1 voltage for cutoff -22 to -58 volts
 Focusing coil current, approx.* 110 ma
 Ion-trap current†, JETEC coil No. 111 120 ma
 Ion-trap magnet strength‡, (approx.) 33 gauss

MAXIMUM CIRCUIT VALUE

Grid 1 circuit resistance 1.5 megohms

NOTES:

*For JETEC focus coil 106, or equivalent, 3.00" from reference line with E_{c1} and E_{c2} adjusted for brightness of 20 FL on a $8\frac{1}{2}" \times 11\frac{1}{2}"$ area.
 †Visual extinction of focused raster.
 ‡As measured with single-field beam bender.

CAUTION: Shielding for X-rays is recommended for personal protection at close range if this tube is operated in excess of 16,000 volts or over Maximum Rated Anode Voltage, whichever is less. Safety glass covering tube's faceplate is usually sufficient.

CBS PICTURE TUBES

ENGINEERING DESIGN DATA

14BP4

NOVEMBER 29, 1956

Similar Type
14CP4*

DIRECT INTERELECTRODE CAPACITANCES

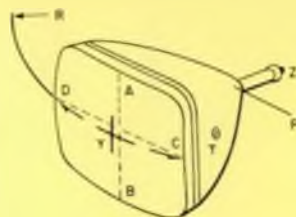
Cathode to all other electrodes . . . 5.0 μf
 Grid 1 to all other electrodes . . . 6.0 μf
 External conductive coating to anode†
 Maximum 2000 μf
 Minimum 500 μf

OPTICAL DATA

Phosphor No. 4
 Fluorescence color White
 Persistence Medium
 Faceplate Gray filter-glass
 Light transmission at center
 (neutral density filter) approx. 75%

MECHANICAL DATA

Over-all length (Y-Z) $16\frac{3}{4} \pm \frac{1}{8}$ inches
 Greatest dimension of bulb:
 Height (A-B) $9\frac{1}{8} \pm \frac{1}{8}$ inches
 Width (C-D) $12\frac{1}{2} \pm \frac{1}{8}$ inches
 Diagonal $13\frac{1}{8} \pm \frac{1}{8}$ inches
 Neck length (Z-P)* $7\frac{1}{2} \pm \frac{1}{8}$ inches
 Neck diameter $1\frac{1}{8} \pm \frac{1}{16}$ inches
 Face curvature, height and width
 (radius R) 27 inches
 Bulb contact to ref. line
 (T-P)* $2\frac{1}{2} \pm \frac{1}{8}$ inches
 Min. useful screen dimensions:
 Diagonal 12½ inches
 Height by width $8\frac{3}{4} \times 11\frac{1}{8}$ inches
 Bulb contact, recessed sm.
 cavity cap (J1-21)
 Base, sm. shell duodecal 5-pin (B5-57)
 Bulb contact J1-21 aligns with
 vacant position of pin 6 $\pm 30^\circ$



NOTES:

- * May be branded 14BP4/14CP4
- Contains 2 inch by 2 inch contact area located 90° ccw from anode contact as viewed from base and $2\frac{1}{2}$ inches above reference line.
- ▲ Reference line P determined by JETEC gauge No. 110.

ENGINEERING DESIGN DATA

14CP4

NOVEMBER 29, 1956

Similar Type
14BP4*

DIRECT INTERELECTRODE CAPACITANCES

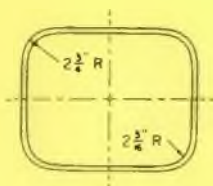
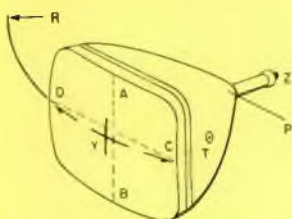
Cathode to all other electrodes	5.0 $\mu\mu\text{f}$
Grid 1 to all other electrodes	6.0 $\mu\mu\text{f}$
External conductive coating to anode†	
Maximum	2000 $\mu\mu\text{f}$
Minimum	750 $\mu\mu\text{f}$

OPTICAL DATA

Phosphor	No. 4
Fluorescence color	White
Persistence	Medium
Faceplate	Gray filter-glass
Light transmission at center (neutral density filter) approx.	76%

MECHANICAL DATA

Over-all length (Y-Z)	16 $\frac{1}{4}$ $\pm$ $\frac{1}{16}$ inches
Greatest dimension of bulb:	
Height (A-B)	9 $\frac{3}{4}$ $\pm$ $\frac{1}{16}$ inches
Width (C-D)	12 $\frac{1}{4}$ $\pm$ $\frac{1}{16}$ inches
Diagonal	13 $\frac{1}{4}$ $\pm$ $\frac{1}{16}$ inches
Neck length (Z-P)*	7 $\frac{1}{2}$ $\pm$ $\frac{1}{16}$ inches
Neck diameter	1 $\frac{1}{4}$ $\pm$ $\frac{1}{16}$ inches
Face curvature, height and width (radius R)	27 inches
Bulb contact to ref. line (T-P)*	2 $\frac{1}{4}$ $\pm$ $\frac{1}{16}$ inches
Min. useful screen dimensions:	
Diagonal	12 $\frac{1}{4}$ inches
Height by width	8 $\frac{1}{2}$ x 11 $\frac{1}{2}$ inches
Bulb contact, recessed sm. cavity cap.	(J1-21)
Base, sm. shell duodecal 5-pin	(B5-57)
Bulb contact J1-21 aligns with vacant position of pin 6	$\pm 30^\circ$



NOTES

- * May be branded 14BP4-14CP4.
- † Contains 2 inch by 2 inch contact area located 90° ccw from anode contact as viewed from base and 2 $\frac{3}{4}$ inches above reference line.
- * Reference line P determined by JETEC gauge No. 110.

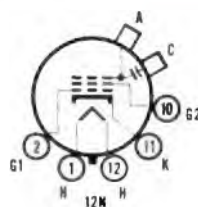


14CP4



RECTANGULAR PICTURE TUBE

Magnetic focus . . . spherical face
. . . gray filter-glass faceplate . . .
70° deflection . . . external conductive coating



HEATER CHARACTERISTICS

Voltage	6.3 volts
Current, $\pm 10\%$	0.6 amperes

ELECTRICAL DATA

Focusing method	Magnetic
Deflecting method	Magnetic
Deflection angles (approximate)	
Horizontal	65 degrees
Vertical	50 degrees
Diagonal	70 degrees

MAXIMUM RATINGS (Design center values)

Anode voltage, d-c	14,000 volts
Grid 2 voltage, d-c	410 volts
Grid 1 voltage, d-c	
Negative bias value, d-c	125 volts
Positive bias value, d-c	0 volts
Positive peak value	2 volts
Peak heater-cathode voltage:	
Heater negative to cathode	
During warm-up period of 15 seconds max.	410 volts
After equipment warm-up period	150 volts
Heater positive to cathode	150 volts

TYPICAL OPERATING CONDITIONS

Anode voltage	12,000 volts
Grid 2 voltage	250 volts
Grid 1 voltage for cutoff†	-22 to -58 volts
Focusing coil current, approx.*	105 ma
Ion-trap‡, JETEC coil No. 111	
Ion-trap magnet strength‡, (approx.)	32 gaussess

MAXIMUM CIRCUIT VALUE

Grid 1 circuit resistance	1.5 megohms
---------------------------	-------------

NOTES:

- *For JETEC focus coil 109, or equivalent, 3.0" from reference line with E_{c1} and E_{c150} adjusted for brightness of 35 FL on a 8 $\frac{1}{2}$ " x 11 $\frac{1}{2}$ " area.
- †Visual extinction of focused raster.
- ‡As measured with single-field beam bender.

CAUTION: Shielding for X-rays is recommended for personal protection at close range if this tube is operated in excess of 16,000 volts or over Maximum Rated Anode Voltage, whichever is less. Safety glass covering tube's faceplate is usually sufficient.

CBS

14QP4



RECTANGULAR PICTURE TUBE

Electrostatic focus . . . spherical face . . . gray filter-glass faceplate . . . 70° deflection . . . external conductive coating

HEATER CHARACTERISTICS

Voltage	6.3	volts
Current, $\pm 10\%$	0.6	amperes

ELECTRICAL DATA

Focusing method	Electrostatic
Deflecting method	Magnetic
Deflection angles (approximate)	
Horizontal	65 degrees
Vertical	50 degrees
Diagonal	70 degrees

MAXIMUM RATINGS (Design center values)

Anode voltage, d-c	11,000 volts
Grid 4 (focusing electrode) voltage, d-c	-500, +1000 volts
Grid 2 voltage, d-c	500 volts
Grid 1 voltage, d-c	
Negative bias value, d-c	180 volts
Positive bias value, d-c	0 volts
Positive peak value	2 volts
Peak heater-cathode voltage:	
Heater negative to cathode	
During warm-up period of 15 seconds max.	410 volts
After equipment warm-up period	180 volts
Heater positive to cathode	180 volts

TYPICAL OPERATING CONDITIONS

Anode voltage	9000 volts
Grid 4 (focusing electrode) voltage	-50 to +250 volts
Grid 2 voltage	250 volts
Grid 1 voltage for cutoff†	-24 to -64 volts
Ion-trap current‡, JETEC coil No. 117	24 ma
Ion-trap magnet strength‡, (approx.)	27 gauss

CIRCUIT VALUES

Grid 1 circuit resistance, maximum	1.5 megohms
Grid 2 circuit resistance, minimum*	0.1 megohms
Focusing electrode circuit resistance, minimum*	0.1 megohms

NOTES:

*With the combined Grid 1 bias voltage and video-signal voltage adjusted to give an anode current of 100 microamperes for a $8\frac{1}{2}'' \times 11\frac{1}{4}''$ raster.

†Visual extinction of focused raster.

‡As measured with single-field beam bender.

■Protective resistance is advisable to prevent tube damage. One resistor may be common to grids 2 and 4.

CAUTION: Shielding for X-rays is recommended for personal protection at close range if this tube is operated in excess of 16,000 volts or over Maximum Rated Anode Voltage, whichever is less. Safety glass covering tube's faceplate is usually sufficient.

14QP4A

SILVER VISION PICTURE TUBE

Type 14QP4A has an aluminized screen, otherwise it is identical to the 14QP4.

CBS PICTURE TUBES

ENGINEERING
DESIGN DATA

14QP4

NOVEMBER 26, 1956

DIRECT INTERELECTRODE
CAPACITANCES

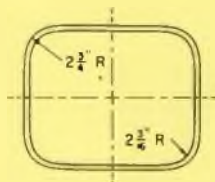
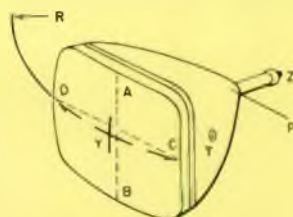
Cathode to all other electrodes	5.0 μf
Grid 1 to all other electrodes	6.0 μf
External conductive coating to anode†	
Maximum	1000 μf
Minimum	600 μf

OPTICAL DATA

Phosphor	No. 4
Fluorescence color	White
Persistence	Medium
Faceplate	Gray filter-glass
Light transmission at center (neutral density filter) approx.	76%

MECHANICAL DATA

Over-all length (Y-Z)	16 $\frac{1}{2}$ $\pm$ $\frac{1}{8}$ inches
Greatest dimension of bulb:	
Height (A-B)	9 $\frac{1}{4}$ $\pm$ $\frac{1}{8}$ inches
Width (C-D)	12 $\frac{1}{4}$ $\pm$ $\frac{1}{8}$ inches
Diagonal	13 $\frac{1}{4}$ $\pm$ $\frac{1}{8}$ inches
Neck length (Z-P)*	6 $\frac{1}{2}$ inches
Neck diameter	1 $\frac{1}{4}$ $\pm$ $\frac{1}{8}$ inches
Face curvature, height and width (radius R)	27 inches
Bulb contact to ref. line (T-P)*	2 $\frac{1}{4}$ $\pm$ $\frac{1}{8}$ inches
Min. useful screen dimensions:	
Diagonal	12 $\frac{1}{4}$ inches
Height by width	8 $\frac{1}{4}$ $\times$ 11 $\frac{1}{4}$ inches
Bulb contact, recessed sm. cavity cap.	(J1-21)
Base, sm. shell duodecal 6-pin	(B6-63)
Bulb contact J1-21 aligns with vacant position of pin 6	$\pm 30^\circ$



NOTES

◆ Contains 2 inch by 2 inch contact area located 90° ccw from anode contact as viewed from base and $2\pm\frac{1}{4}$ inches above reference line.

★ Reference line P determined by JETEC gauge No. 110.

ENGINEERING DESIGN DATA

14RP4

NOVEMBER 29, 1956

DIRECT INTERELECTRODE CAPACITANCES

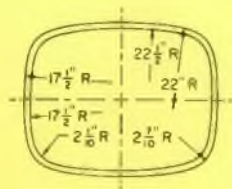
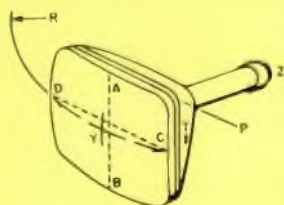
Cathode to all other electrodes	6.0 μf
Grid 1 to all other electrodes	5.0 μf
External conductive coating to anodes	
Maximum	750 μf
Minimum	500 μf

OPTICAL DATA

Phosphor	No. 4
Fluorescence color	White
Persistence	Medium
Faceplate	Gray filter-glass
Light transmission at center (neutral density filter) approx.	.78%

MECHANICAL DATA

Over-all length (Y-Z)	14 $\frac{1}{16}$ $\pm$ $\frac{1}{16}$ inches
Greatest dimension of bulb:	
Height (A-B)	10 $\frac{1}{16}$ $\pm$ $\frac{1}{16}$ inches
Width (C-D)	13 $\frac{1}{16}$ $\pm$ $\frac{1}{16}$ inches
Diagonal	14 $\pm$ $\frac{1}{16}$ inches
Neck length (Z-P)*	6 $\frac{1}{16}$ $\pm$ $\frac{1}{16}$ inches
Neck diameter	17 $\frac{1}{16}$ $\pm$ $\frac{1}{16}$ inches
Face curvature, height and width (radius R)	24 inches
Bulb contact to ref.	
Line (T-P)*	2 $\frac{1}{16}$ $\pm$ $\frac{1}{16}$ inches
Min. useful screen dimensions:	
Diagonal	13 $\frac{1}{16}$ inches
Height by width	9 $\frac{1}{16}$ x 12 $\frac{1}{16}$ inches
Area	106 sq. in.
Bulb contact, recessed sm. cavity cap.	(J1-21)
Base, sm. shell duodecal 6-pin	(B6-63)
Bulb contact J1-21 aligns with vacant position of pin 6	$\pm 30^\circ$



NOTES

- * Contains 2 inch by 2 inch contact area located 90° ccw from anode contact as viewed from base and 2 $\pm$ $\frac{1}{16}$ inches above reference line.
- * Reference line P determined by JETEC gauge No. 116.

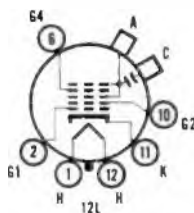


14RP4



RECTANGULAR PICTURE TUBE

Electrostatic focus . . . spherical
face . . . gray filter-glass faceplate
. . . 90° deflection . . . external
conductive coating



HEATER CHARACTERISTICS

Voltage	6.3 volts
Current, $\pm 10\%$	0.6 amperes

ELECTRICAL DATA

Focusing method	Electrostatic
Deflecting method	Magnetic
Deflection angles (approximate)	
Horizontal	85 degrees
Vertical	68 degrees
Diagonal	90 degrees

MAXIMUM RATINGS

(Design center values)	Grid Drive Δ	Cathode Drive Δ
Anode voltage, d-c	14,000	14,000 volts
Grid 4 voltage, d-c	-500 to +500	-500 to +500 volts
Grid 2 voltage, d-c	400	400 volts
Grid 1 voltage		
Negative bias, d-c	110	0 volts
Positive bias, d-c	0	110 volts
Negative peak	160	2 volts
Positive peak	2	160 volts
Peak heater-cathode voltage:		
Heater negative to cathode		
During warm-up time		
15 seconds max.	410	410 volts
After equipment warm-up period	180	180 volts
Heater positive to cathode	180	180 volts

TYPICAL OPERATING CONDITIONS

	Grid Drive Δ	Cathode Drive Δ
Anode voltage	10,000	10,000 volts
Grid 4 (focusing electrode) voltage*	-50 to +350	-50 to +350 volts
Grid 2 voltage	300	300 volts
Grid 1 voltage for cutoff†	-26 to -70	26 to 59 volts
Ion-trap current‡, JETEC coil No. 117	36	36 ma
Ion-trap magnet strength‡	36	36 gauss

MAXIMUM CIRCUIT VALUE

Grid 1 circuit resistance	1.5 meg
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NOTES:

- *With the combined Grid 1 bias voltage and video-signal voltage adjusted to give an anode current of 100 microamperes on a 8 $\frac{3}{4}$ " x 11" raster.
- †Visual extinction of focused raster.
- ‡As measured with single-field beam bender.
- ▲Grid drive conditions measured with respect to cathode, Cathode drive conditions measured with respect to grid 1.

CAUTION: Shielding for X-rays is recommended for personal protection at close range if this tube is operated in excess of 16,000 volts or over Maximum Rated Anode Voltage, whichever is less. Safety glass covering tube's faceplate is usually sufficient.

14RP4A

SILVER VISION PICTURE TUBE

Type 14RP4A has an aluminized screen, otherwise it is identical to the 14RP4.



16AEP4

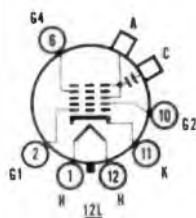


RECTANGULAR PICTURE TUBE

Electrostatic focus . . . spherical face . . . gray filter-glass faceplate . . . 70° deflection . . . external conductive coating

HEATER CHARACTERISTICS

Voltage	6.3 volts
Current, $\pm 10\%$	0.6 amperes



ELECTRICAL DATA

Focusing method	Electrostatic
Deflecting method	Magnetic
Deflection angles (approximate)	
Horizontal	65 degrees
Vertical	50 degrees
Diagonal	70 degrees

MAXIMUM RATINGS (Design center values)

Anode voltage, d-c	16,000 volts
Grid 2 voltage, d-c	410 volts
Grid 1 voltage, d-c	
Negative bias value, d-c	125 volts
Positive bias value, d-c	0 volts
Positive peak value	2 volts
Peak heater-cathode voltage:	
Heater negative to cathode	
During warm-up period of 15 seconds max.	410 volts
After equipment warm-up period	125 volts
Heater positive to cathode	125 volts

TYPICAL OPERATING CONDITIONS

Anode voltage	12,000 to 14,000 volts
Grid 4 (focusing electrode) voltage*	-64 to +350 volts
Grid 2 voltage	300 volts
Grid 1 voltage for cutoff†	-28 to -72 volts
Ion-trap current‡, JETEC coil No. 111	75 ma
Ion-trap magnet strength‡, (approx.)	35 gauss

MAXIMUM CIRCUIT VALUE

Grid 1 circuit resistance	1.5 megohms
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NOTES:

*With the combined Grid 1 bias voltage and video-signal voltage adjusted to give an anode current of 100 microamperes for a $10\frac{1}{2}'' \times 13\frac{1}{2}''$ raster.

†Visual extinction of focused raster.

‡As measured with single-field beam bender.

CAUTION: Shielding for X-rays is recommended for personal protection at close range if this tube is operated in excess of 16,000 volts or over Maximum Rated Anode Voltage, whichever is less. Safety glass covering tube's faceplate is usually sufficient.

CBS PICTURE TUBES

ENGINEERING DESIGN DATA

16AEP4

NOVEMBER 29, 1956

DIRECT INTERELECTRODE CAPACITANCES

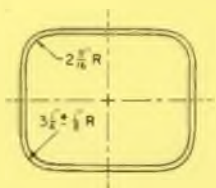
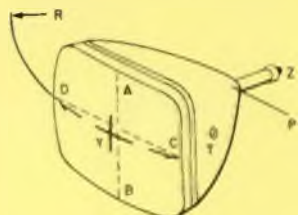
Cathode to all other electrodes	5.0 μf
Grid 1 to all other electrodes	6.5 μf
External conductive coating to anode†	
Maximum	1500 μf
Minimum	750 μf

OPTICAL DATA

Phosphor	No. 4
Fluorescence color	White
Persistence	Medium
Faceplate	Gray filter-glass
Light transmission at center (neutral density filter) approx.	70%

MECHANICAL DATA

Over-all length (Y-Z)	18 $\frac{1}{4} \pm \frac{1}{8}$ inches
Greatest dimension of bulb:	
Height (A-B)	11 $\frac{1}{4} \pm \frac{1}{8}$ inches
Width (C-D)	14 $\frac{1}{4} \pm \frac{1}{8}$ inches
Diagonal	16 $\frac{1}{4} \pm \frac{1}{8}$ inches
Neck length (Z-P)*	7 $\frac{1}{2} \pm \frac{1}{16}$ inches
Neck diameter	1 $\frac{1}{8} \pm \frac{1}{16}$ inches
Face curvature, height and width (radius R)	27 inches
Bulb contact to ref. line (T-P)*	3 $\frac{3}{8} \pm \frac{1}{8}$ inches
Min. useful screen dimensions:	
Diagonal	14 $\frac{1}{4}$ inches
Height by width	10 $\frac{1}{2} \times 13 \frac{1}{2}$ inches
Bulb contact, recessed sm. cavity cap.	(J1-21)
Base, sm. shell duodecal 6-pin	(B6-63)
Bulb contact J1-21 aligns with vacant position of pin 3	$\pm 10^\circ$



NOTES

† Contains 2 inch by 2 inch contact area located 90° ccw from anode contact as viewed from base and $2\frac{1}{4}$ inches above reference line.

* Reference line P determined by JETEC gauge No. 110.

ENGINEERING DESIGN DATA

16AP4A

NOVEMBER 29, 1956

Similar Types
16AP4 16EP4

DIRECT INTERELECTRODE CAPACITANCES

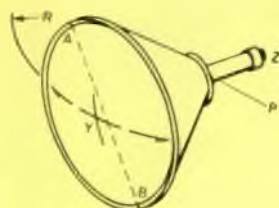
Cathode to all other electrodes... 5.0 μF
Grid 1 to all other electrodes... 6.0 μF

OPTICAL DATA

Phosphor..... No. 4
Fluorescence color..... White
Persistence..... Medium
Faceplate
16AP4..... Clear glass
16AP4A..... Gray filter-glass
Light transmission at center (neutral
density filter) approx. 55% to 85%

MECHANICAL DATA

Over-all length (Y-Z)..... $22\frac{1}{4} \pm \frac{1}{8}$ inches
Greatest diameter (A-B) $15\frac{1}{4} \pm \frac{1}{8}$ inches
Neck length (Z-P)..... $7\frac{1}{4} \pm \frac{1}{8}$ inches
Neck diameter..... $1\frac{1}{4} \pm \frac{1}{8}$ inches
Face curvature, height and width
(radius R)..... 27 inches
Min. useful screen dimensions:
Diameter..... $14\frac{1}{4}$ inches
Base, sm. shell duodecal 5-pin... (B5-57)
or 7-pin... (B7-51)
Bulb contact—rim of metal cone



NOTES

* Reference line P determined by JETEC gauge No. 112.

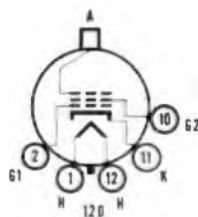


16AP4A*



ROUND PICTURE TUBE

Magnetic focus... spherical face
... 53° deflection... metal-cone
envelope... gray filter-glass face-
plate



HEATER CHARACTERISTICS

Voltage..... 6.3 volts
Current, $\pm 10\%$ 0.6 amperes

ELECTRICAL DATA

Focusing method..... Magnetic
Deflecting method..... Magnetic
Deflection angle (approximate)..... 53 degrees

MAXIMUM RATINGS (Design center values)

Anode voltage, d-c..... 14,000 volts
Grid 2 voltage, d-c..... 410 volts
Grid 1 voltage, d-c..... 125 volts
Negative bias value, d-c..... 0 volts
Positive bias value, d-c..... 2 volts
Peak heater-cathode voltage:
Heater negative to cathode.....
During warm-up period of 15 seconds max. 410 volts
After equipment warm-up period..... 140 volts
Heater positive to cathode..... 140 volts

TYPICAL OPERATING CONDITIONS

Anode voltage..... 12,000 volts
Grid 2 voltage..... 300 volts
Grid 1 voltage for cutoff..... -28 to -72 volts
Focusing coil current, approx.*..... 80 ma
Ion-trap current†, JETEC coil No. 108..... 99 ma
Ion-trap magnet strength‡, (approx.)..... 35 gauss

MAXIMUM CIRCUIT VALUE

Grid 1 circuit resistance..... 1.5 megohms

NOTES:

*For JETEC focus coil No. 109, or equivalent, 3" from reference line with E_{c1} and E_{c1a1} adjusted for brightness of 30 ft on a 10" x 13 3/4" area.

†Visual extinction of focused raster.

‡As measured with double-field beam bender.

*Type 16AP4 has a clear glass faceplate.

CAUTION: Shielding for X-rays is recommended for personal protection at close range if this tube is operated in excess of 16,000 volts or over Maximum Rated Anode Voltage, whichever is less. Safety glass covering tube's faceplate is usually sufficient.



16DP4A

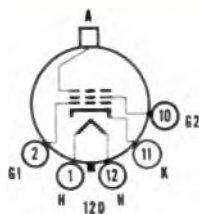


ROUND PICTURE TUBE

Magnetic focus . . . spherical face
 . . . gray filter-glass faceplate . . .
 60° deflection

HEATER CHARACTERISTICS

Voltage 6.3 volts
 Current, $\pm 10\%$ 0.6 amperes



ELECTRICAL DATA

Focusing method Magnetic
 Deflecting method Magnetic
 Deflection angle (approximate) 60 degrees

MAXIMUM RATINGS (Design center values)

Anode voltage, d-c 15,000 volts
 Grid 2 voltage, d-c 410 volts
 Grid 1 voltage, d-c
 Negative bias value, d-c 125 volts
 Positive bias value, d-c 0 volts
 Positive peak value 2 volts
 Peak heater-cathode voltage:
 Heater negative to cathode
 During warm-up period of 15 seconds max. 410 volts
 After equipment warm-up period 125 volts
 Heater positive to cathode 125 volts

TYPICAL OPERATING CONDITIONS

Anode voltage 9,000 to 12,000 volts
 Grid 2 voltage 250 volts
 Grid 1 voltage for cutoff -27 to -63 volts
 Focusing coil current, approx.* 115 ma
 Ion-trap current†, JETEC coil No. 108 110 ma
 Ion-trap magnet strength‡ (approx.) 35 gauss

MAXIMUM CIRCUIT VALUE

Grid 1 circuit resistance 1.5 megohms

NOTES:

*For JETEC focus coil No. 109, or equivalent, 3.25" from reference line with E_{c1} and E_{c101g} adjusted for brightness of 20 FL on a $10\frac{1}{4}'' \times 14\frac{1}{2}''$ area.

†Visual extinction of focused raster.

‡As measured with double-field beam bender.

CAUTION: Shielding for X-rays is recommended for personal protection at close range if this tube is operated in excess of 16,000 volts or over Maximum Rated Anode Voltage, whichever is less. Safety glass covering tube's faceplate is usually sufficient.

ENGINEERING DESIGN DATA

16DP4A

NOVEMBER 29, 1956

Similar Types
 16DP4 16JP4A

DIRECT INTERELECTRODE CAPACITANCES

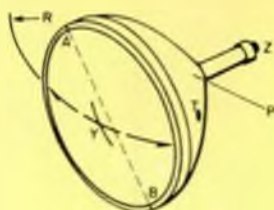
Cathode to all other electrodes . . . 5.0 μf
 Grid 1 to all other electrodes . . . 6.0 μf

OPTICAL DATA

Phosphor No. 4
 Fluorescence color White
 Persistence Medium
 Faceplate Gray filter-glass
 Light transmission at center
 (neutral density filter) approx. . . 70%

MECHANICAL DATA

Over-all length (Y-Z) $20\frac{1}{2} \pm \frac{1}{4}$ inches
 Greatest diameter (A-B) $15\frac{1}{2} \pm \frac{1}{4}$ inches
 Neck length (Z-P)* $7\frac{1}{2} \pm \frac{1}{4}$ inches
 Neck diameter $1\frac{1}{4} \pm \frac{1}{16}$ inches
 Face curvature, height and width
 (radius R) $56\frac{1}{2}$ inches
 Bulb contact to ref.
 line (T-P)* $5\frac{1}{2} \pm \frac{1}{4}$ inches
 Min. useful screen dimensions:
 Diameter 14 $\frac{1}{2}$ inches
 Bulb contact, recessed sm.
 cavity cap. (J1-21)
 Base, sm. shell duodecal 5-pin . . . (B5-57)
 Bulb contact J1-21 aligns with vacant
 position of pin 3 $\pm 10^\circ$



NOTES

* Reference line P determined by JETEC gauge No. 112.

ENGINEERING DESIGN DATA

16GP4

NOVEMBER 29, 1956

Similar Types
16GP4A 16GP4B

DIRECT INTERELECTRODE CAPACITANCES

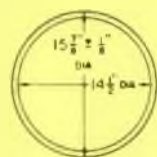
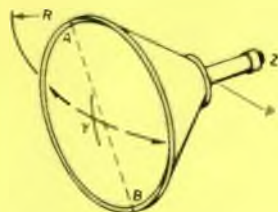
Cathode to all other electrodes... 5.0 μf
Grid 1 to all other electrodes... 6.0 μf

OPTICAL DATA

Phosphor..... No. 4
Fluorescence color..... White
Persistence..... Medium
Faceplate..... Gray filter-glass
Light transmission at center (neutral
density filter) approx... 55% to 85%

MECHANICAL DATA

Over-all length (Y-Z)... $17\frac{1}{16} \pm \frac{3}{16}$ inches
Greatest diameter (A-B)... $15\frac{1}{8} \pm \frac{1}{16}$ inches
Neck length (Z-P)*... $6\frac{1}{8} \pm \frac{1}{16}$ inches
Neck diameter... $1\frac{1}{16} \pm \frac{1}{16}$ inches
Face curvature, height and width
(radius R)..... 40 inches
Min. useful screen dimensions:
Diameter..... $14\frac{1}{2}$ inches
Base, sm. shell duodecal S-pin (B5-S7)
Bulb contact—rim of metal cone



NOTES

* Reference line P determined by JETEC
gauge No. 110.



16GP4

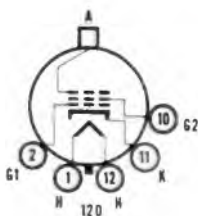


ROUND PICTURE TUBE

Magnetic focus... spherical face
... gray filter-glass faceplate...
70° deflection... metal-cone enve-
lope

HEATER CHARACTERISTICS

Voltage..... 6.3 volts
Current, $\pm 10\%$ 0.6 amperes



ELECTRICAL DATA

Focusing method..... Magnetic
Deflecting method..... Magnetic
Deflection angle (approximate)..... 70 degrees

MAXIMUM RATINGS (Design center values)

Anode voltage, d-c..... 14,000 volts
Grid 2 voltage, d-c..... 410 volts
Grid 1 voltage, d-c..... 125 volts
Negative bias value, d-c..... 0 volts
Positive bias value, d-c..... 2 volts
Peak heater-cathode voltage:
Heater negative to cathode..... 410 volts
During warm-up period of 15 seconds max..... 150 volts
After equipment warm-up period..... 150 volts
Heater positive to cathode..... 150 volts

TYPICAL OPERATING CONDITIONS

Anode voltage..... 12,000 volts
Grid 2 voltage..... 300 volts
Grid 1 voltage for cutoff..... -28 to -72 volts
Focusing coil current, approx.*..... 100 ma
Ion-trap current†, JETEC coil No. 117..... 35 ma
Ion-trap magnet strength‡, (approx.)..... 35 gauss

MAXIMUM CIRCUIT VALUE

Grid 1 circuit resistance..... 1.5 megohms

NOTES:

*For JETEC focus coil No. 109, or equivalent, 3" from reference line with E_{c1} and E_{c2} adjusted for brightness of 30 FL on a $10'' \times 13\frac{1}{2}''$ area.

†Visual extinction of focused raster.

‡As measured with single-field beam bender.

CAUTION: Shielding for X-rays is recommended for personal protection at close range if this tube is operated in excess of 16,000 volts or over Maximum Rated Anode Voltage, whichever is less. Safety glass covering tube's faceplate is usually sufficient.

16GP4B

Type 16GP4B has frosted gray filter-glass faceplate, otherwise it is identical to the 16GP4.



- ◆ Contains 2 inch by 2 inch contact area located 90° ccw from anode contact as viewed from base and $2 \pm \frac{1}{4}$ inches above reference line.
- ★ Reference line P determined by JETEC gauge No. 112.

ENGINEERING DESIGN DATA

16KP4

NOVEMBER 29, 1956

Similar Types

16KP4A* 16RP4B
16RP4A 16TP4

DIRECT INTERELECTRODE CAPACITANCES

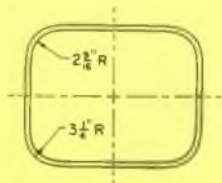
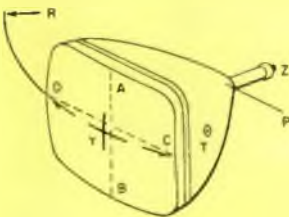
Cathode to all other electrodes... 5.0 μ f
Grid 1 to all other electrodes... 6.0 μ f
External conductive coating to anode:
Maximum... 1500 μ f
Minimum... 750 μ f

OPTICAL DATA

Phosphor... No. 4
Fluorescence color... White
Persistence... Medium
Faceplate... Gray filter-glass
Light transmission at center
(neutral density filter) approx. .66%

MECHANICAL DATA

Over-all length (Y-Z)... 18 $\pm$ 1/4 inches
Greatest dimension of bulb:
Height (A-B)... 1 1/4 $\pm$ 1/4 inches
Width (C-D)... 1 1/4 $\pm$ 1/4 inches
Diagonal... 1 6/8 $\pm$ 1/4 inches
Neck length (Z-P)*... 3/4 $\pm$ 1/4 inches
Neck diameter... 1 1/4 $\pm$ 1/4 inches
Face curvature, height and width
(radius R)... 27 inches
Bulb contact to ref.
line (T-P)*... 7/8 $\pm$ 1/4 inches
Min. useful screen dimensions:
Diagonal... 1 1/4 inches
Height by width... 10 1/4 $\times$ 13 1/4 inches
Area... 131 sq. in.
Bulb contact, recessed sm.
cavity cap... (J1-21)
Base, sm. shell duodecal 5-pin... (B5-57)
Bulb contact J1-21 aligns with vacant
position of pin 6... $\pm$ 30°



NOTES

- * May be branded 16RP4A/16KP4A.
- † May be branded 16RP4/16KP4.
- ‡ Contains 2 inch by 2 inch contact area located 90° ccw from anode contact as viewed from base and 2 $\pm$ 1/4 inches above reference line.
- * Reference line P determined by JETEC gauge No. 110.

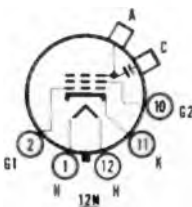


16KP4



RECTANGULAR PICTURE TUBE

Magnetic focus . . . spherical face
. . . gray filter-glass faceplate . . .
70° deflection . . . external conductive coating



HEATER CHARACTERISTICS

Voltage... 6.3 volts
Current, $\pm$ 10%... 0.6 amperes

ELECTRICAL DATA

Focusing method... Magnetic
Deflecting method... Magnetic
Deflection angles (approximate)
Horizontal... 65 degrees
Vertical... 50 degrees
Diagonal... 70 degrees

MAXIMUM RATINGS (Design center values)

Anode voltage, d-c... 16,000 volts
Grid 2 voltage, d-c... 410 volts
Grid 1 voltage, d-c...
Negative bias value, d-c... 125 volts
Positive bias value, d-c... 0 volts
Positive peak value... 2 volts
Peak heater-cathode voltage:
Heater negative to cathode...
During warm-up period of 15 seconds max. 410 volts
After equipment warm-up period... 150 volts
Heater positive to cathode... 150 volts

TYPICAL OPERATING CONDITIONS

Anode voltage... 14,000 volts
Grid 2 voltage... 300 volts
Grid 1 voltage for cutoff... -28 to 72 volts
Focusing coil current, approx.*... 108 ma
Ion-trap current†, JETEC coil No. 111... 75 ma
Ion-trap magnet strength‡, (approx.)... 35 gauss

MAXIMUM CIRCUIT VALUE

Grid 1 circuit resistance... 1.5 megohms

NOTES:

- *For JETEC focus coil No. 109, or equivalent, 3.0" from reference line with E_{c1} and E_{c2} adjusted for brightness of 35 FL on a 10 1/4" $\times$ 13 1/4" area.
- †Visual extinction of focused raster.
- ‡As measured with single-field beam bender.

CAUTION: Shielding for X-rays is recommended for personal protection at close range if this tube is operated in excess of 16,000 volts or over Maximum Rated Anode Voltage, whichever is less. Safety glass covering tube's faceplate is usually sufficient.

16KP4A

SILVER VISION PICTURE TUBE

Type 16KP4A has an aluminized screen, otherwise it is identical to the 16KP4.



16LP4A

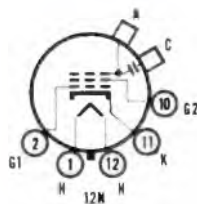


ROUND PICTURE TUBE

Magnetic focus . . . spherical face
 . . . gray filter-glass faceplate . . .
 52° deflection . . . external con-
 ductive coating

HEATER CHARACTERISTICS

Voltage.....	6.3 volts
Current, $\pm 10\%$	0.6 amperes



ELECTRICAL DATA

Focusing method.....	Magnetic
Deflecting method.....	Magnetic
Deflection angle (approximate).....	52 degrees

MAXIMUM RATINGS (Design center values)

Anode voltage, d-c.....	16,000 volts
Grid 2 voltage, d-c.....	410 volts
Grid 1 voltage, d-c.....	
Negative bias value, d-c.....	125 volts
Positive bias value, d-c.....	0 volts
Positive peak value.....	2 volts
Peak heater-cathode voltage:	
Heater negative to cathode.....	
During warm-up period of 15 seconds max.....	410 volts
After equipment warm-up period.....	125 volts
Heater positive to cathode.....	125 volts

TYPICAL OPERATING CONDITIONS

Anode voltage.....	12,000 volts
Grid 2 voltage.....	300 volts
Grid 1 voltage for cutoff†.....	-28 to -72 volts
Focusing coil current, approx.*.....	110 ma
Ion-trap current†, JETEC coil No. 108.....	120 ma
Ion-trap magnet strength†, (approx.).....	35 gauss

MAXIMUM CIRCUIT VALUE

Grid 1 circuit resistance.....	1.5 megohms
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NOTES:

*For JETEC focus coil No. 109, or equivalent, 3.25" from reference line with E_{c1} and E_{c2} adjusted for brightness of 20 FL on a 10 1/4" x 14 1/2" area.

†Visual extinction of focused raster.

‡As measured with double-field beam bender.

CAUTION: Shielding for X-rays is recommended for personal protection at close range if this tube is operated in excess of 16,000 volts or over Maximum Rated Anode Voltage, whichever is less. Safety glass covering tube's faceplate is usually sufficient.

ENGINEERING DESIGN DATA

16LP4A

NOVEMBER 29, 1956

Similar Types
 16LP4 16ZP4*

DIRECT INTERELECTRODE CAPACITANCES

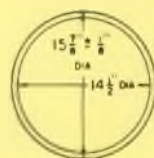
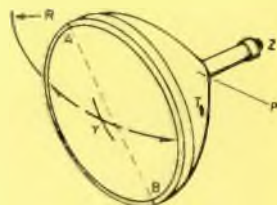
Cathode to all other electrodes.....	5.0 μf
Grid 1 to all other electrodes.....	6.0 μf
External conductive coating to anode.....	
Maximum.....	2000 μf
Minimum.....	750 μf

OPTICAL DATA

Phosphor.....	No. 4
Fluorescence color.....	White
Persistence.....	Medium
Faceplate.....	Gray filter-glass
Light transmission at center (neutral density filter) approx.....	65%

MECHANICAL DATA

Over-all length (Y-Z).....	22 1/4 $\pm$ 1/4 inches
Greatest diameter (A-B).....	15 1/4 $\pm$ 1/4 inches
Neck length (Z-P)*.....	7 1/4 $\pm$ 1/4 inches
Neck diameter.....	1 1/4 $\pm$ 1/16 inches
Face curvature, height and width (radius R).....	.56 1/8 inches
Bulb contact to ref. line (T-P)*.....	7 3/4 $\pm$ 1/8 inches
Min. useful screen dimensions:	
Diameter.....	14 1/2 inches
Bulb contact, recessed sm.....	
Cavity cap.....	(J1-21)
Base, sm, shell duodecal 5-pin.....	(B5-57)
Bulb contact J1-21 aligns with vacant position of pin 3.....	$\pm 10^\circ$



NOTES

- * Sometimes branded 16LP4A 16ZP4.
- † Contains 2 inch by 2 inch contact area located 90° ccw from anode contact as viewed from base and $2 \pm 1/4$ inches above reference line.
- * Reference line P determined by JETEC gauge No. 112.

ENGINEERING DESIGN DATA

16RP4

NOVEMBER 29, 1956

Similar Types
16RP4A* 16KP4B
16KPA 16TP4

DIRECT INTERELECTRODE CAPACITANCES

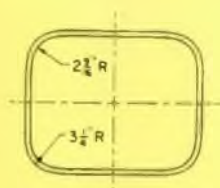
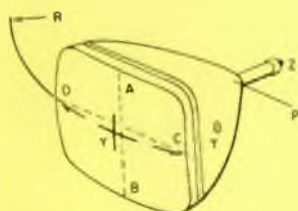
Cathode to all other electrodes	5.0 μ mf
Grid 1 to all other electrodes	6.0 μ mf
External conductive coating to anode†	
Maximum	1500 μ mf
Minimum	750 μ mf

OPTICAL DATA

Phosphor	No. 4
Fluorescence color	White
Persistence	Medium
Faceplate	Gray filter-glass
Light transmission at center (neutral density filter) approx.	66%

MECHANICAL DATA

Over-all length (Y-Z)	18 $\frac{1}{2}$ $\pm$ $\frac{1}{8}$ inches
Greatest dimension of bulb	
Height (A-B)	11 $\frac{1}{2}$ $\pm$ $\frac{1}{16}$ inches
Width (C-D)	14 $\frac{1}{2}$ $\pm$ $\frac{1}{16}$ inches
Diagonal	16 $\frac{1}{2}$ $\pm$ $\frac{1}{8}$ inches
Neck length (Z-P)*	7 $\frac{1}{16}$ inches
Neck diameter	1 $\frac{1}{16}$ $\pm$ $\frac{1}{16}$ inches
Face curvature, height and width (radius R)	27 inches
Bulb contact to ref. line (T-P)*	3 $\frac{1}{2}$ $\pm$ $\frac{1}{8}$ inches
Min. useful screen dimensions:	
Diagonal	14 $\frac{1}{2}$ inches
Height by width	10 $\frac{1}{2}$ x 13 $\frac{1}{2}$ inches
Bulb contact, recessed sm. cavity cap	(J1-21)
Base, sm. shell duodecal 5-pin	(B5-51)
Bulb contact J1-21 aligns with vacant position of pin 6	$\pm$ 30°



NOTES

- * May be branded 16RP4A, 16KP4A.
- † May be branded 16RP4, 16KP4.
- ‡ Contains 2 inch by 2 inch contact area located 90° ccw from anode contact as viewed from base and 2 $\pm$ $\frac{1}{8}$ inches above reference line.
- * Reference line P determined by JETEC gauge No. 110.

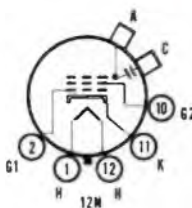


16RP4



RECTANGULAR PICTURE TUBE

Magnetic focus . . . spherical face
. . . gray filter-glass faceplate . . .
70° deflection . . . external conductive coating



HEATER CHARACTERISTICS

Voltage	6.3 volts
Current, $\pm$ 10%	0.6 amperes

ELECTRICAL DATA

Focusing method	Magnetic
Deflecting method	Magnetic
Deflection angles (approximately)	
Horizontal	65 degrees
Vertical	50 degrees
Diagonal	70 degrees

MAXIMUM RATINGS (Design center values)

Anode voltage, d-c	16,000 volts
Grid 2 voltage, d-c	410 volts
Grid 1 voltage, d-c	
Negative bias value, d-c	125 volts
Positive bias value, d-c	0 volts
Positive peak value	2 volts
Peak heater-cathode voltage:	
Heater negative to cathode	
During warm-up period of 15 seconds max.	410 volts
After equipment warm-up period	150 volts
Heater positive to cathode	150 volts

TYPICAL OPERATING CONDITIONS

Anode voltage	12,000 volts
Grid 2 voltage	300 volts
Grid 1 voltage for cutoff	-28 to -72 volts
Focusing coil current, approx.*	110 ma
Ion-trap current†, JETEC coil No. 108	120 ma
Ion-trap magnet strength‡, (approx.)	35 gauss

MAXIMUM CIRCUIT VALUE

Grid 1 circuit resistance	1.5 megohms
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NOTES:

*For JETEC focus coil No. 109, or equivalent, 3.5" from reference line with E_{c1} and E_{c2} adjusted for brightness of 30 FL on a 10 $\frac{1}{2}$ " x 13 $\frac{1}{2}$ " area.

†Visual extinction of focused raster.

‡As measured with single-field beam bender.

CAUTION: Shielding for X-rays is recommended for personal protection at close range if this tube is operated in excess of 16,000 volts or over Maximum Rated Anode Voltage, whichever is less. Safety glass covering tube's faceplate is usually sufficient.

16RP4A

SILVER VISION PICTURE TUBE

Type 16RP4A has an aluminized screen, otherwise it is identical to the 16RP4.

CBS PICTURE TUBES

CBS

16TP4

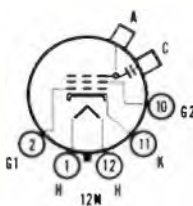


RECTANGULAR PICTURE TUBE

Magnetic focus . . . spherical face
 . . . gray filter-glass faceplate . . .
 70° deflection . . . external con-
 ductive coating

HEATER CHARACTERISTICS

Voltage . . . 6.3 volts
 Current, $\pm 10\%$. . . 0.6 amperes



ELECTRICAL DATA

Focusing method	Magnetic
Deflecting method	Magnetic
Deflection angles (approximate)	
Horizontal	66 degrees
Vertical	50 degrees
Diagonal	70 degrees

MAXIMUM RATINGS (Design center values)

Anode voltage, d-c	14,000 volts
Grid 2 voltage, d-c	410 volts
Grid 1 voltage, d-c	
Negative bias value, d-c	125 volts
Positive bias value, d-c	0 volts
Positive peak value	2 volts
Peak heater-cathode voltage:	
Heater negative to cathode	
During warm-up period of 15 seconds max.	410 volts
After equipment warm-up period	150 volts
Heater positive to cathode	150 volts

TYPICAL OPERATING CONDITIONS

Anode voltage	12,000 volts
Grid 2 voltage	300 volts
Grid 1 voltage for cutoff†	-28 to -72 volts
Focusing coil current, approx.*	99 ma
Ion-trap current‡, JETEC coil No. 111	75 ma
Ion-trap magnet strength‡, (approx.)	35 gauss

MAXIMUM CIRCUIT VALUE

Grid 1 circuit resistance 1.5 megohms

NOTES:

*For JETEC focus coil No. 109, or equivalent, 3.0" from reference line with E_{c1} and E_{c2} adjusted for brightness of 35 FL on a $1\frac{1}{2}" \times 10\frac{1}{4}"$ area.

†Visual extinction of focused raster.

‡As measured with single-field beam bender.

CAUTION: Shielding for X-rays is recommended for personal protection at close range if this tube is operated in excess of 16,000 volts or over Maximum Rated Anode Voltage, whichever is less. Safety glass covering tube's faceplate is usually sufficient.

ENGINEERING
DESIGN DATA

16TP4

NOVEMBER 29, 1956

Similar Type
16RP4DIRECT INTERELECTRODE
CAPACITANCES

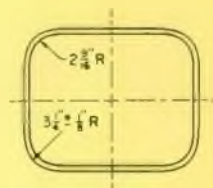
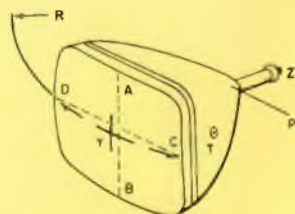
Cathode to all other electrodes . . . 5.0 μf
 Grid 1 to all other electrodes . . . 6.0 μf
 External conductive coating to anode:
 Maximum 2000 μf
 Minimum 750 μf

OPTICAL DATA

Phosphor No. 4
 Fluorescence color White
 Persistence Medium
 Faceplate Gray filter-glass
 Light transmission at center
 (neutral density filter) approx. 72%

MECHANICAL DATA

Over-all length (Y-Z) . . . $18\frac{1}{4} \pm \frac{1}{4}$ inches
 Greatest dimension of bulb:
 Height (A-B) . . . $11\frac{1}{2} \pm \frac{1}{4}$ inches
 Width (C-D) . . . $14\frac{1}{4} \pm \frac{1}{4}$ inches
 Diagonal . . . $16\frac{1}{4} \pm \frac{1}{4}$ inches
 Neck length (Z-P)* . . . 6 inches
 Neck diameter . . . $1\frac{1}{4} \pm \frac{1}{4}$ inches
 Face curvature, height and width
 (radius R) . . . 27 inches
 Bulb contact to ref.
 line (T-P)* . . . $3\frac{3}{4} \pm \frac{1}{4}$ inches
 Min. useful screen dimensions:
 Diagonal . . . 14 inches
 Height by width . . . $10\frac{1}{4} \times 13\frac{1}{4}$ inches
 Bulb contact, recessed sm.
 cavity cap. (J1-21)
 Base, sm. shell duodecal 5-pin . . . (B5-57)
 Bulb contact J1-21 aligns with vacant
 position of pin 6 . . . $\pm 30^\circ$



NOTES

♦ Contains 2 inch by 2 inch contact area located 90° ccw from anode contact as viewed from base and $2 \pm \frac{1}{4}$ inches above reference line.

* Reference line P determined by JETEC gauge No. 110.

ENGINEERING DESIGN DATA

16WP4A

NOVEMBER 29, 1956

Similar Type
16WP4

DIRECT INTERELECTRODE CAPACITANCES

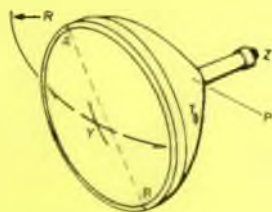
Cathode to all other electrodes . . . 5.0 μf
Grid 1 to all other electrodes . . . 6.0 μf
External conductive coating to anode:
Maximum . . . 1500 μf
Minimum . . . 750 μf

OPTICAL DATA

Phosphor . . . No. 4
Fluorescence color . . . White
Persistence . . . Medium
Faceplate . . . Gray filter-glass
Light transmission at center
(neutral density filter) approx. 65%

MECHANICAL DATA

Over-all length (Y-Z) . . . 17 $\frac{1}{2}$ $\pm$ $\frac{1}{8}$ inches
Greatest diameter (A-B) . . . 15 $\frac{1}{2}$ $\pm$ $\frac{1}{8}$ inches
Neck length (Z-P) . . . 7 $\frac{1}{2}$ $\pm$ $\frac{1}{8}$ inches
Neck diameter . . . 1 $\frac{1}{8}$ $\pm$ $\frac{1}{16}$ inches
Face curvature, height and width
(radius R) . . . 56 $\frac{1}{16}$ inches
Bulb contact to rel.
line (T-P) . . . 2 $\frac{1}{2}$ $\pm$ $\frac{1}{8}$ inches
Min. useful screen dimensions:
Diameter . . . 14 $\frac{1}{2}$ inches
Bulb contact, recessed sm.
cavity cap. . . (J1-21)
Base, sm. shell duodecal 5-pin . . . (B5-57)
Bulb contact J1-21 aligns with vacant
position of pin 6 . . . $\pm$ 30°



NOTES

† Contains 2 inch by 2 inch contact area located 90° ccw from anode contact as viewed from base and 2 $\pm$ $\frac{1}{8}$ inches above reference line.

* Reference line P determined by JETEC gauge No. 110.



16WP4A

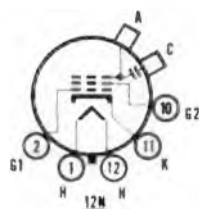


ROUND PICTURE TUBE

Magnetic focus . . . spherical face
. . . gray filter-glass faceplate . . .
70° deflection . . . external conductive coating

HEATER CHARACTERISTICS

Voltage . . . 6.3 volts
Current, $\pm$ 10% . . . 0.6 amperes



ELECTRICAL DATA

Focusing method . . . Magnetic
Deflecting method . . . Magnetic
Deflection angle (approximate) . . . 70 degrees

MAXIMUM RATINGS (Design center values)

Anode voltage, d-c . . . 16,000 volts
Grid 2 voltage, d-c . . . 410 volts
Grid 1 voltage, d-c . . . 125 volts
Negative bias value, d-c . . . 0 volts
Positive bias value, d-c . . . 2 volts
Peak heater-cathode voltage:
Heater negative to cathode . . . 410 volts
During warm-up period of 15 seconds max. . . 125 volts
After equipment warm-up period . . . 125 volts
Heater positive to cathode . . . 125 volts

TYPICAL OPERATING CONDITIONS

Anode voltage . . . 12,000 volts
Grid 2 voltage . . . 250 volts
Grid 1 voltage for cutoff . . . -22 to -58 volts
Focusing coil current, approx. . . 110 ma
Ion-trap current†, JETEC coil No. 108 . . . 120 ma
Ion-trap magnet strength‡, (approx.) . . . 35 gauss

MAXIMUM CIRCUIT VALUE

Grid 1 circuit resistance . . . 1.5 megohms

NOTES:

*For JETEC focus coil No. 109, or equivalent, 3.25" from reference line with E_{cl} and E_{coil} adjusted for brightness of 20 FL on a 10 $\frac{1}{4}$ " x 14 $\frac{1}{2}$ " area.

†Visual extinction of focused raster.

‡As measured with double-field beam bender.

CAUTION: Shielding for X-rays is recommended for personal protection at close range if this tube is operated in excess of 16,000 volts or over Maximum Rated Anode Voltage, whichever is less. Safety glass covering tube's faceplate is usually sufficient.

16ZP4

Type 16ZP4 has less external conductive coating capacitance, otherwise it is identical to the 16LP4A.

DIRECT INTERELECTRODE CAPACITANCES

External Conductive Coating* to Anode:
Maximum . . . 1500 μf
Minimum . . . 750 μf

*Contains 2-inch x 2-inch contact area located 90° ccw from anode contact as viewed from base and 2 $\pm$ $\frac{1}{8}$ inches above reference line.

CBS PICTURE TUBES



17ATP4

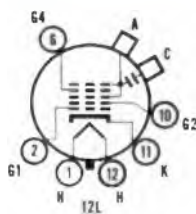


RECTANGULAR PICTURE TUBE

Electrostatic focus . . . spherical face . . . gray filter-glass faceplate . . . 90° deflection . . . external conductive coating

HEATER CHARACTERISTICS

Voltage	6.3 volts
Current, $\pm 10\%$	0.6 amperes



ELECTRICAL DATA

Focusing method	Electrostatic
Deflecting method	Magnetic
Deflection angles (approximate)	
Horizontal	80 degrees
Vertical	65 degrees
Diagonal	90 degrees

MAXIMUM RATINGS (Design center values)

Anode voltage, d-c	16,000 volts
Grid 4 (focusing electrode) voltage, d-c	-500, +1000 volts
Grid 2 voltage, d-c	500 volts
Grid 1 voltage, d-c	
Negative bias value, d-c	125 volts
Positive bias value, d-c	0 volts
Positive peak value	2 volts
Peak heater-cathode voltage:	
Heater negative to cathode	
During warm-up period of 15 seconds max.	410 volts
After equipment warm-up period	180 volts
Heater positive to cathode	180 volts

TYPICAL OPERATING CONDITIONS

Anode voltage	12,000 volts
Grid 4 (focusing electrode) voltage*	-50 to +265 volts
Grid 2 voltage	300 volts
Grid 1 voltage for cutoff†	-28 to -72 volts
Ion-trap magnet strength‡, (approx.)	34 gauss

MAXIMUM CIRCUIT VALUE

Grid 1 circuit resistance	1.5 megohms
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NOTES:

*With the combined Grid 1 bias voltage and video-signal voltage adjusted to give an anode current of 100 microamperes on a 10 1/4" x 14 1/4" raster.

†Visual extinction of focused raster.

‡As measured with double-field beam bender.

CAUTION: Shielding for X-rays is recommended for personal protection at close range if this tube is operated in excess of 16,000 volts or over Maximum Rated Anode Voltage, whichever is less. Safety glass covering tube's faceplate is usually sufficient.

17ATP4A

SILVER VISION PICTURE TUBE

Type 17ATP4A has an aluminized screen, otherwise it is identical to the 17ATP4.

CBS PICTURE TUBES

ENGINEERING DESIGN DATA

17ATP4

NOVEMBER 30, 1956

Similar Types
17AVP4A* 17AVP4*

DIRECT INTERELECTRODE CAPACITANCES

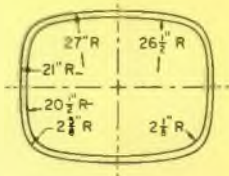
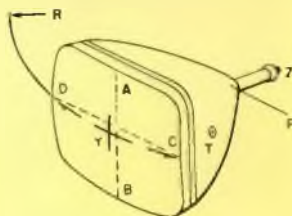
Cathode to all other electrodes	5.0 $\mu\mu\text{f}$
Grid 1 to all other electrodes	6.0 $\mu\mu\text{f}$
External conductive coating to anode†	
Maximum	1500 $\mu\mu\text{f}$
Minimum	750 $\mu\mu\text{f}$

OPTICAL DATA

Phosphor	No. 4
Fluorescence color	White
Persistence	Short
Faceplate	Gray filter-glass
Light transmission at center	
(neutral density filter) approx.	66%

MECHANICAL DATA

Over-all length (Y-Z)	16 1/2 $\pm$ 1/8 inches
Greatest dimension of bulb:	
Height (A-B)	12 1/4 $\pm$ 1/8 inches
Width (C-D)	15 1/4 $\pm$ 1/8 inches
Diagonal	16 1/4 $\pm$ 1/8 inches
Neck length (Z-P)*	6 1/2 $\pm$ 1/8 inches
Neck diameter	1 1/8 $\pm$ 1/16 inches
Face curvature, height and width (radius R)	27 inches
Bulb contact to rel.	
line (T-P)*	3 1/4 $\pm$ 1/8 inches
Min. useful screen dimensions:	
Diagonal	15 1/4 inches
Height by width	10 1/4 x 14 1/4 inches
Bulb contact, recessed sm.	
cavity cap.	(11-21)
Base, sm. shell duodecal 6-pin	(B6-63)
Bulb contact J1-21 aligns with vacant position of pin 6	$\pm 30^\circ$



NOTES

- * May be branded 17AVP4/17AVP4A.
- † May be branded 17ATP4/17ATP4A.
- ‡ Contains 2 inch by 2 inch contact area located 90° ccw from anode contact as viewed from base and 2 1/4 inches above reference line.
- * Reference line P determined by JETEC gauge No. 116.

ENGINEERING DESIGN DATA

17AVP4

NOVEMBER 30, 1956

Similar Types

17AVP4A* 17ATP4*
17ATP4A

DIRECT INTERELECTRODE CAPACITANCES

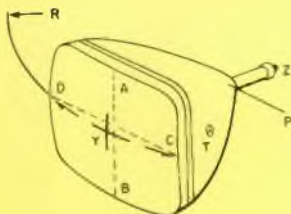
Cathode to all other electrodes... 5.0 μf
Grid 1 to all other electrodes... 6.0 μf
External conductive coating to anode:
Maximum... 1500 μf
Minimum... 1200 μf

OPTICAL DATA

Phosphor... No. 4
Fluorescence color... White
Persistence... Short
Faceplate... Gray filter-glass
Light transmission at center
(neutral density filter) approx. 74%

MECHANICAL DATA

Over-all length (Y-Z)... $15\frac{1}{2} \pm \frac{1}{8}$ inches
Greatest dimension of bulb:
Height (A-B)... $12\frac{1}{2} \pm \frac{1}{8}$ inches
Width (C-D)... $15\frac{1}{2} \pm \frac{1}{8}$ inches
Diagonal... $16\frac{1}{2} \pm \frac{1}{8}$ inches
Neck length (Z-P)*... $6\frac{1}{2} \pm \frac{1}{8}$ inches
Neck diameter... $1\frac{1}{8} \pm \frac{1}{16}$ inches
Face curvature, height and width
(radius R)... 27 inches
Bulb contact to ref.
line (T-P)*... $3\frac{3}{4} \pm \frac{1}{8}$ inches
Min. useful screen dimensions:
Diagonal... $15\frac{1}{16}$ inches
Height by width... $11\frac{1}{4} \times 14\frac{1}{4}$ inches
Area... 149 sq. in.
Bulb contact, recessed sm.
cavity cap... (J1-21)
Base, sm. shell duodecal 6-pin... (B6-63)
Bulb contact J1-21 aligns with vacant
position of pin 6... $\pm 30^\circ$



NOTES

- * May be branded 17AVP4A, 17ATP4A.
- † May be branded 17AVP4, 17ATP4.
- ‡ Contains 2 inch by 2 inch contact area located 90° ccw from anode contact as viewed from base and $2\frac{1}{4}$ inches above reference line.
- * Reference line P determined by JETEC gauge No. 116.

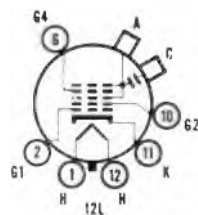


17AVP4



RECTANGULAR PICTURE TUBE

Electrostatic focus . . . spherical
face . . . gray filter-glass faceplate
. . . 90° deflection . . . external
conductive coating



HEATER CHARACTERISTICS

Voltage... 6.3 volts
Current, $\pm 10\%$... 0.6 amperes

ELECTRICAL DATA

Focusing method... Electrostatic
Deflecting method... Magnetic
Deflection angles (approximate)
Horizontal... 85 degrees
Vertical... 68 degrees
Diagonal... 90 degrees

MAXIMUM RATINGS (Design center values)

Anode voltage, d-c... 16,000 volts
Grid 4 (focusing electrode) voltage, d-c... -500, +1000 volts
Grid 2 voltage, d-c... 500 volts
Grid 1 voltage, d-c...
Negative bias value, d-c... 140 volts
Negative peak value... 200 volts
Positive bias value, d-c... 0 volts
Positive peak value... 2 volts
Peak heater-cathode voltage:
Heater negative to cathode
During warm-up period of 15 seconds max... 410 volts
After equipment warm-up period... 180 volts
Heater positive to cathode... 180 volts

TYPICAL OPERATING CONDITIONS

Anode voltage... 12,000 volts
Grid 4 (focusing electrode) voltage*... -48 to +264 volts
Grid 2 voltage... 300 volts
Grid 1 voltage for cutoff... -28 to -72 volts
Ion-trap current†, JETEC coil No. 117... 30 ma
Ion-trap magnet strength‡, (approx.)... 30 gauss

MAXIMUM CIRCUIT VALUE

Grid 1 circuit resistance... 1.5 megohms

NOTES:

- *With the combined Grid 1 bias voltage and video-signal voltage adjusted to give an anode current of 100 microamperes on a $10\frac{1}{2}'' \times 14\frac{1}{4}''$ raster.
- †Visual extinction of focused raster.
- ‡As measured with single-field beam bender.

CAUTION: Shielding for X-rays is recommended for personal protection at close range if this tube is operated in excess of 16,000 volts or over Maximum Rated Anode Voltage, whichever is less. Safety glass covering tube's faceplate is usually sufficient.

17AVP4A

SILVER VISION PICTURE TUBE

Type 17AVP4A has an aluminized screen, otherwise it is identical to the 17AVP4.

CBS PICTURE TUBES



17BP4A



RECTANGULAR PICTURE TUBE

Magnetic focus . . . spherical face
 . . . gray filter-glass faceplate . . .
 70° deflection . . . external conductive coating

HEATER CHARACTERISTICS

Voltage	6.3 volts
Current, $\pm 10\%$	0.6 amperes

ELECTRICAL DATA

Focusing method	Magnetic
Deflecting method	Magnetic
Deflection angles (approximate)	
Horizontal	65 degrees
Vertical	50 degrees
Diagonal	70 degrees

MAXIMUM RATINGS (Design center values)

Anode voltage, d-c	16,000 volts
Grid 2 voltage, d-c	410 volts
Grid 1 voltage, d-c	
Negative bias value, d-c	125 volts
Positive bias value, d-c	0 volts
Positive peak value	2 volts
Peak heater-cathode voltage:	
Heater negative to cathode	
During warm-up period of 15 seconds max.	410 volts
After equipment warm-up period	150 volts
Heater positive to cathode	150 volts

TYPICAL OPERATING CONDITIONS

Anode voltage	12,000 volts
Grid 2 voltage	300 volts
Grid 1 voltage for cutoff	-28 to -72 volts
Focusing coil current, approx.*	100 ma
Ion-trap, JETEC coil No. 111	
Ion-trap magnet strength, (approx.)	35 gauss

MAXIMUM CIRCUIT VALUE

Grid 1 circuit resistance	1.5 megohms
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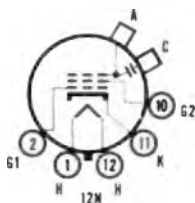
NOTES:

*For JETEC focus coil No. 109, or equivalent, 3.00" from reference line with E_{c1} and E_{c112g} adjusted for brightness of 30 FL on a $10\frac{1}{4}" \times 14\frac{1}{4}"$ area.

†Visual extinction of focused raster.

‡As measured with single-field beam bendes.

CAUTION: Shielding for X-rays is recommended for personal protection at close range if this tube is operated in excess of 16,000 volts or over Maximum Rated Anode Voltage, whichever is less. Safety glass covering tube's faceplate is usually sufficient.



ENGINEERING DESIGN DATA

17BP4A

NOVEMBER 30, 1956

Similar Types	
17BP4	17BP4B
17BP4C	17JP4

DIRECT INTERELECTRODE CAPACITANCES

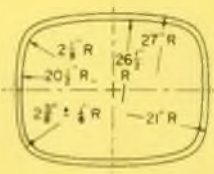
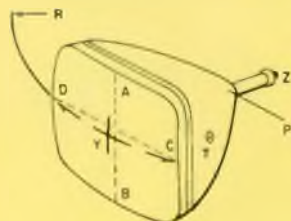
Cathode to all other electrodes	5.0 $\mu\mu$
Grid 1 to all other electrodes	6.0 $\mu\mu$
External conductive coating to anode†	
Maximum	1500 $\mu\mu$
Minimum	750 $\mu\mu$

OPTICAL DATA

Phosphor	No. 4
Fluorescence color	White
Persistence	Medium
Faceplate	Gray filter-glass
Light transmission at center	
(neutral density filter) approx.	.74%

MECHANICAL DATA

Over-all length (Y-Z)	$19\frac{1}{4} \pm \frac{1}{8}$ inches
Greatest dimension of bulb:	
Height (A-B)	$12\frac{1}{4} \pm \frac{1}{8}$ inches
Width (C-D)	$15\frac{1}{4} \pm \frac{1}{8}$ inches
Diagonal	$16\frac{1}{2} \pm \frac{1}{8}$ inches
Neck length (Z-P)*	$7\frac{1}{2} \pm \frac{1}{8}$ inches
Neck diameter	$1\frac{1}{8} \pm \frac{1}{16}$ inches
Face curvature, height and width	
(radius R)	27 inches
Bulb contact to ref. line (T-P)*	$4\frac{1}{2} \pm \frac{1}{8}$ inches
Min. useful screen dimensions:	
Diagonal	$15\frac{1}{8}$ inches
Height by width	$11\frac{1}{2} \times 14\frac{3}{16}$ inches
Area	149 sq. in.
Bulb contact, recessed sm. cavity cap.	(11-21)
Base, sm. shell duodecal 5-pin	(B5-57)
Bulb contact J1-21 aligns with vacant position of pin 6	$\pm 30^\circ$



NOTES

- † Contains 2 inch by 2 inch contact area located 90° ccw from anode contact as viewed from base and $2\frac{1}{2}$ inches above reference line.
- * Reference line P determined by JETEC gauge No. 110.

17BP4B

SILVER VISION PICTURE TUBE

Type 17BP4B has an aluminized screen, otherwise it is identical to the 17BP4A.

CBS PICTURE TUBES

ENGINEERING DESIGN DATA

17CP4

NOVEMBER 30, 1956

Similar Types 17CP1A

DIRECT INTERELECTRODE CAPACITANCES

Cathode to all other electrodes... 5.0 $\mu\mu\text{f}$
Grid 1 to all other electrodes... 6.0 $\mu\mu\text{f}$

OPTICAL DATA

Phosphor... No. 4
Fluorescence color... White
Persistence... Medium
Faceplate... Gray frosted filter-glass
Light transmission at center (neutral density filter) approx... 55% to 85%

MECHANICAL DATA

Over-all length (Y-Z)... 19 inches
Greatest dimension of bulb:
Height (A-B)... $12\frac{1}{4} \pm \frac{1}{8}$ inches
Width (C-D)... $15\frac{1}{16} \pm \frac{1}{16}$ inches
Diagonal... $16\frac{1}{16} \pm \frac{1}{16}$ inches
Neck length (Z-P)*... $7\frac{1}{16} \pm \frac{1}{16}$ inches
Neck diameter... $1\frac{1}{16} \pm \frac{1}{16}$ inches
Face curvature, height and width (radius R)... 30 inches
Min. useful screen dimensions:
Diagonal... $15\frac{1}{4}$ inches
Height by width... $10\frac{1}{16} \times 14\frac{1}{16}$ inches
Bulb contact... Rim of metal cone



NOTES

* Reference line P determined by JETEC gauge No. 110.

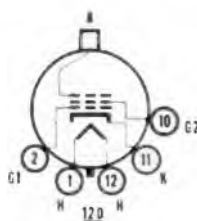


17CP4



RECTANGULAR PICTURE TUBE

Magnetic focus... spherical face
... gray frosted filter-glass face-plate
... 70° deflection... metal cone



HEATER CHARACTERISTICS

Voltage... 6.3 volts
Current, $\pm 10\%$... 0.6 amperes

ELECTRICAL DATA

Focusing method	Magnetic
Deflecting method	Magnetic
Deflection angles (approximate)	
Horizontal	65 degrees
Vertical	50 degrees
Diagonal	70 degrees

MAXIMUM RATINGS (Design center values)

Anode voltage, d-c	16,000 volts
Grid 2 voltage, d-c	410 volts
Grid 1 voltage, d-c	
Negative bias value, d-c	125 volts
Positive bias value, d-c	0 volts
Positive peak value	2 volts
Peak heater-cathode voltage:	
Heater negative to cathode	
During warm-up period of 15 seconds max.	410 volts
After equipment warm-up period	180 volts
Heater positive to cathode	180 volts

TYPICAL OPERATING CONDITIONS

Anode voltage	12,000 volts
Grid 2 voltage	300 volts
Grid 1 voltage for cutoff	-28 to -72 volts
Focusing coil current, approx.*	96 ma
Ion-trap current†, JETEC coil No. 111	75 ma
Ion-trap magnet strength‡, (approx.)	45 gauss

MAXIMUM CIRCUIT VALUE

Grid 1 circuit resistance	1.5 megohms
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NOTES:

* For JETEC focus coil No. 109, or equivalent, 3.00" from reference line with E_{c1} and E_{c2} adjusted for brightness of 30 ft on a $10\frac{1}{16} \times 14\frac{1}{16}$ area.

† Visual extinction of focused raster.

‡ As measured with single-field beam bender.

CAUTION: Shielding for X-rays is recommended for personal protection at close range if this tube is operated in excess of 16,000 volts or over Maximum Rated Anode Voltage, whichever is less. Safety glass covering tube's faceplate is usually sufficient.



17GP4

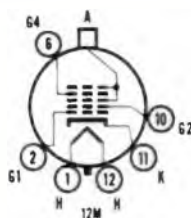


RECTANGULAR PICTURE TUBE

Electrostatic focus . . . spherical
face . . . frosted filter-glass face-
plate . . . 70° deflection . . . metal
cone

HEATER CHARACTERISTICS

Voltage.....	6.3 volts
Current, $\pm 10\%$	0.6 amperes



ELECTRICAL DATA

Focusing method.....	Electrostatic
Deflecting method.....	Magnetic
Deflection angles (approximate)	
Horizontal.....	66 degrees
Vertical.....	50 degrees
Diagonal.....	70 degrees

MAXIMUM RATINGS (Design center values)

Anode voltage, d-c.....	16,000 volts
Grid 4 (focusing electrode) voltage, d-c.....	5,000 volts
Grid 2 voltage, d-c.....	500 volts
Grid 1 voltage, d-c.....	
Negative bias value, d-c.....	125 volts
Positive bias value, d-c.....	0 volts
Positive peak value.....	2 volts
Peak heater-cathode voltage:	
Heater negative to cathode.....	
During warm-up period of 15 seconds max.....	410 volts
After equipment warm-up period.....	180 volts
Heater positive to cathode.....	180 volts

TYPICAL OPERATING CONDITIONS

Anode voltage.....	12,000 volts
Grid 4 (focusing electrode) voltage.....	2040 to 2760 volts
Grid 2 voltage.....	300 volts
Grid 1 voltage for cutoff.....	-28 to -72 volts
Ion-trap current†, JETEC coil No. 117.....	35 ma
Ion-trap magnet strength‡, (approx.).....	35 gauss

MAXIMUM CIRCUIT VALUE

Grid 1 circuit resistance.....	1.5 megohms
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NOTES:

- †Visual extinction of focused raster.
‡As measured with single-field beam bender.

CAUTION: Shielding for X-rays is recommended for personal protection at close range if this tube is operated in excess of 16,000 volts or over Maximum Rated Anode Voltage, whichever is less. Safety glass covering tube's faceplate is usually sufficient.

CBS PICTURE TUBES

ENGINEERING DESIGN DATA

17GP4

NOVEMBER 30, 1956

DIRECT INTERELECTRODE CAPACITANCES

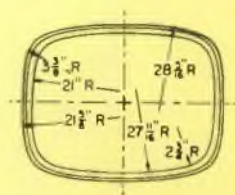
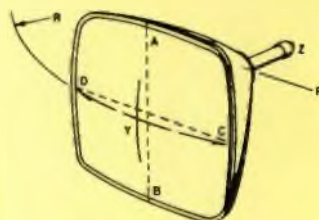
Cathode to all other electrodes . . . 5.0 μmf
Grid 1 to all other electrodes . . . 6.0 μmf

OPTICAL DATA

Phosphor..... No. 4
Fluorescence color..... White
Persistence..... Short
Faceplate..... Frosted filter-glass
Light transmission at center (neutral
density filter) approx . . . 55% to 85%

MECHANICAL DATA

Over-all length (Y-Z)..... 19 1/8 inches
Greatest dimension of bulb:
Height (A-B)..... 12 1/4 $\pm$ 1/8 inches
Width (C-D)..... 15 3/16 $\pm$ 1/8 inches
Diagonal..... 16 1/2 $\pm$ 1/8 inches
Neck length (Z-P)*..... 7 1/2 $\pm$ 1/8 inches
Neck diameter..... 1 1/4 $\pm$ 1/8 inches
Face curvature, height and width
(radius R)..... 30 inches
Min. useful screen dimensions:
Diagonal..... 15 1/4 inches
Height by width..... 10 1/4 $\times$ 14 1/2 inches
Base, sm. shell duodecal 6-pin . . . (B6-63)
Bulb contact..... Rim of metal cone



NOTES

- * Reference line P determined by JETEC
gauge No. 110.

ENGINEERING DESIGN DATA

17HP4

NOVEMBER 30, 1956

Similar Types

17MP4A 17HP4B
17RP4* 17KP4

DIRECT INTERELECTRODE CAPACITANCES

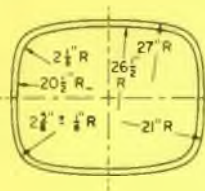
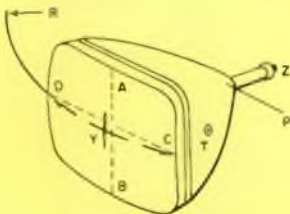
Cathode to all other electrodes... 5.0 μ f
Grid 1 to all other electrodes... 6.0 μ f
External conductive coating to anode†:
Maximum... 1500 μ f
Minimum... 750 μ f

OPTICAL DATA

Phosphor... No. 4
Fluorescence color... White
Persistence... Medium
Faceplate... Gray filter-glass
Light transmission at center
(neutral density filter) approx. 74%

MECHANICAL DATA

Over-all length (Y-Z)... 1.91 $\pm$ 0.01 inches
Greatest dimension of bulb:
Height (A-B)... 1.24 $\pm$ 0.01 inches
Width (C-D)... 1.54 $\pm$ 0.01 inches
Diagonal... 1.64 $\pm$ 0.01 inches
Neck length (Z-P)*... 7.4 $\pm$ 0.1 inches
Neck diameter... 1.14 $\pm$ 0.01 inches
Face curvature, height and width
(radius R)... 27 inches
Bulb contact to ref.
line (T-P)*... 4.4 $\pm$ 0.01 inches
Min. useful screen dimensions:
Diagonal... 1.54 inches
Height by width... 1.14 $\times$ 1.44 inches
Area... 1.49 sq. in.
Bulb contact, recessed sm.
cavity cap... (J1-21)
Base, sm. shell duodecal 6-pin... (B6-63)
Bulb contact J1-21 aligns with vacant
position of pin 6... $\pm$ 30°



NOTES

- * May be branded 17HP4/17RP4.
- † Contains 2 inch by 2 inch contact area located 90° ccw from anode contact as viewed from base and 2 $\pm$ 1/4 inches above reference line.
- * Reference line P determined by JETEC gauge No. 110.

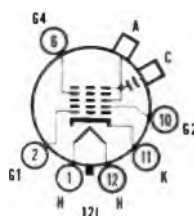


17HP4



RECTANGULAR PICTURE TUBE

Electrostatic focus... spherical
face... gray filter-glass faceplate
... 70° deflection... external con-
ductive coating



HEATER CHARACTERISTICS

Voltage... 6.3 volts
Current, $\pm$ 10%... 0.6 amperes

ELECTRICAL DATA

Focusing method... Electrostatic
Deflecting method... Magnetic
Deflection angles (approximate)
Horizontal... 65 degrees
Vertical... 50 degrees
Diagonal... 70 degrees

MAXIMUM RATINGS (Design center values)

Anode voltage, d-c... 16,000 volts
Grid 4 (focusing electrode) voltage, d-c... -500, +1000 volts
Grid 2, voltage, d-c... 500 volts
Grid 1 voltage, d-c... 125 volts
Negative bias value, d-c... 0 volts
Positive bias value, d-c... 2 volts
Positive peak value... 2 volts
Peak heater-cathode voltage:
Heater negative to cathode... 410 volts
During warm-up period of 15 seconds max... 180 volts
After equipment warm-up period... 180 volts
Heater positive to cathode... 180 volts

TYPICAL OPERATING CONDITIONS

Anode voltage... 14,000 volts
Grid 4 (focusing electrode) voltage*... -56 to +310 volts
Grid 2 voltage... 300 volts
Grid 1 voltage for cutoff†... -28 to -72 volts
Ion-trap current‡, JETEC coil No. 117... 37 ma
Ion-trap magnet strength‡, (approx.)... 37 gauss

MAXIMUM CIRCUIT VALUE

Grid 1 circuit resistance... 1.5 megohms

NOTES:

- *With the combined Grid 1 bias voltage and video-signal voltage adjusted to give an anode current of 100 microamperes for a 10 $\frac{1}{2}$ " $\times$ 14 $\frac{1}{2}$ " raster.
- †Visual extinction of focused raster.
- ‡As measured with single-field beam bender.

CAUTION: Shielding for X-rays is recommended for personal protection at close range if this tube is operated in excess of 16,000 volts or over Maximum Rated Anode Voltage, whichever is less. Safety glass covering tube's faceplate is usually sufficient.

17HP4B

SILVER VISION PICTURE TUBE

Type 17HP4B has an aluminized screen, otherwise it is identical to the 17HP4.

CBS PICTURE TUBES

ENGINEERING DESIGN DATA

17LP4

NOVEMBER 30, 1956

Similar Types
17LP4A 17VP4*

DIRECT INTERELECTRODE CAPACITANCES

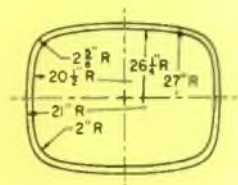
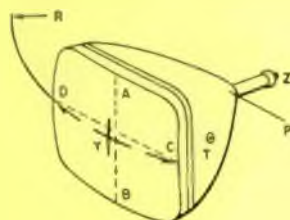
Cathode to all other electrodes	5.0 $\mu\mu\text{f}$
Grid 1 to all other electrodes	6.0 $\mu\mu\text{f}$
External conductive coating to anode†	
Maximum	1500 $\mu\mu\text{f}$
Minimum	750 $\mu\mu\text{f}$

OPTICAL DATA

Phosphor	No. 4
Fluorescence color	White
Persistence	Medium
Faceplate	Gray filter-glass
Light transmission at center (neutral density filter) approx.	66%

MECHANICAL DATA

Over-all length (Y-Z)	19 $\frac{1}{4}$ $\pm$ $\frac{1}{8}$ inches
Greatest dimension of bulb:	
Height (A-B)	12 $\frac{1}{4}$ $\pm$ $\frac{1}{8}$ inches
Width (C-D)	15 $\frac{1}{4}$ $\pm$ $\frac{1}{8}$ inches
Diagonal	16 $\frac{1}{4}$ $\pm$ $\frac{1}{8}$ inches
Neck length (Z-P)*	7 $\frac{1}{2}$ $\pm$ $\frac{1}{8}$ inches
Neck diameter	1 $\frac{1}{8}$ $\pm$ $\frac{1}{16}$ inches
Face curvature, width (radius R)	27 inches
Bulb contact to ref. line (T-P)*	4 $\frac{1}{2}$ $\pm$ $\frac{1}{8}$ inches
Min. useful screen dimensions:	
Diagonal	15 $\frac{1}{16}$ inches
Height by width	10 $\frac{1}{4}$ x 14 $\frac{1}{4}$ inches
Bulb contact, recessed sm. cavity cap	(J1-21)
Base, sm. shell duodecal 6-pin	(B6-63)
Bulb contact J1-21 aligns with vacant position of pin 6	$\pm 30^\circ$



NOTES

- * May be branded 17LP4, 17VP4.
- † Contains 2 inch by 2 inch contact area located 90° ccw from anode contact as viewed from base and 2 $\frac{1}{4}$ inches above reference line.
- * Reference line P determined by JETEC gauge No. 110.

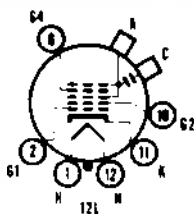


17LP4



RECTANGULAR PICTURE TUBE

Electrostatic focus . . . cylindrical
face . . . gray filter-glass faceplate
. . . 70° deflection . . . external con-
ductive coating



HEATER CHARACTERISTICS

Voltage	6.3 volts
Current, $\pm 10\%$	0.6 amperes

ELECTRICAL DATA

Focusing method	Electrostatic
Deflecting method	Magnetic
Deflection angles (approximate)	
Horizontal	65 degrees
Vertical	50 degrees
Diagonal	70 degrees

MAXIMUM RATINGS (Design center values)

Anode voltage, d-c	16,000 volts
Grid 4 (focusing electrode) voltage, d-c	-500, +1,000 volts
Grid 2 voltage, d-c	500 volts
Grid 1 voltage, d-c	
Negative bias value, d-c	140 volts
Negative peak value	200 volts
Positive bias value, d-c	0 volts
Positive peak value	2 volts
Peak heater-cathode voltage:	
Heater negative to cathode	
During warm-up period of 15 seconds max.	410 volts
After equipment warm-up period	180 volts
Heater positive to cathode	180 volts

TYPICAL OPERATING CONDITIONS

Anode voltage	12,000 volts
Grid 4 (focusing electrode) voltage*	-48 to +260 volts
Grid 2 voltage	300 volts
Grid 1 voltage for cutoff†	-28 to -72 volts
Ion-trap current‡, JETEC coil No. 111	70 ma
Ion-trap magnet strength‡, (approx.)	35 gauss

MAXIMUM CIRCUIT VALUE

Grid 1 circuit resistance	1.5 megohms
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NOTES:

- *With the combined Grid 1 bias voltage and video-signal voltage adjusted to give an anode current of 100 microamperes for a 10 $\frac{1}{4}$ x 14 $\frac{1}{4}$ raster.
- †Visual extinction of focused raster.
- ‡As measured with single-field beam bender.

CAUTION: Shielding for X-rays is recommended for personal protection at close range if this tube is operated in excess of 16,000 volts or over Maximum Rated Anode Voltage, whichever is less. Safety glass covering tube's faceplate is usually sufficient.

17LP4A

SILVER VISION PICTURE TUBE

Type 17LP4A has an aluminized screen, otherwise it is identical to the 17LP4.

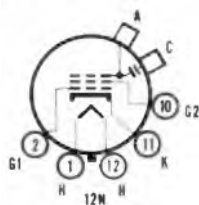
CBS PICTURE TUBES

CBS**17QP4****RECTANGULAR PICTURE TUBE**

Magnetic focus . . . cylindrical face
 . . . gray filter-glass faceplate . . .
 70° deflection . . . external conduc-
 tive coating

HEATER CHARACTERISTICS

Voltage 6.3 volts
 Current, $\pm 10\%$ 0.6 amperes

**ELECTRICAL DATA**

Focusing method	Magnetic
Deflecting method	Magnetic
Deflection angles (approximate)	
Horizontal	65 degrees
Vertical	50 degrees
Diagonal	70 degrees

MAXIMUM RATINGS (Design center values)

Anode voltage, d-c	16,000 volts
Grid 2 voltage, d-c	410 volts
Grid 1 voltage, d-c	
Negative bias value, d-c	125 volts
Positive bias value, d-c	0 volts
Positive peak value	2 volts
Peak heater-cathode voltage:	
Heater negative to cathode	
During warm-up period of 15 seconds max.	410 volts
After equipment warm-up period	150 volts
Heater positive to cathode	150 volts

TYPICAL OPERATING CONDITIONS

Anode voltage	12,000 volts
Grid 2 voltage	300 volts
Grid 1 voltage for cutoff	-28 to -72 volts
Focusing coil current, approx.*	100 ma
Ion-trap current†, JETEC coil No. 111	70 ma
Ion-trap magnet strength‡, (approx.)	35 gauss

MAXIMUM CIRCUIT VALUE

Grid 1 circuit resistance 1.5 megohms

NOTES:

*For JETEC focus coil No. 109, or equivalent, 3.00" from reference line with E_{c1} and E_{c2} adjusted for brightness of 30 FL on a $10\frac{1}{4} \times 14\frac{1}{4}$ " area.

†Visual extinction of focused raster.

‡As measured with single-field beam bender.

CAUTION: Shielding for X-rays is recommended for personal protection at close range if this tube is operated in excess of 16,000 volts or over Maximum Rated Anode Voltage, whichever is less. Safety glass covering tube's faceplate is usually sufficient.

17QP4A**SILVER VISION PICTURE TUBE**

Type 17QP4A has an aluminized screen, otherwise it is identical to the 17QP4.

CBS PICTURE TUBES**ENGINEERING
DESIGN DATA****17QP4**

NOVEMBER 30, 1956

Similar Types
 17QP4A 17SP4

**DIRECT INTERELECTRODE
CAPACITANCES**

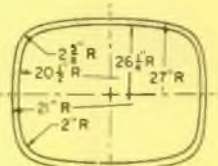
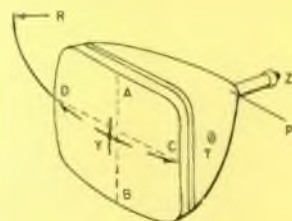
Cathode to all other electrodes . . . 5.0 μf
 Grid 1 to all other electrodes . . . 6.0 μf
 External conductive coating to anode:
 Maximum 1500 μf
 Minimum 750 μf

OPTICAL DATA

Phosphor No. 4
 Fluorescence color White
 Persistence Medium
 Faceplate Gray filter-glass
 Light transmission at center
 (neutral density filter) approx. 66%

MECHANICAL DATA

Over-all length (Y-Z) . . . $19\frac{1}{4} \pm \frac{1}{8}$ inches
 Greatest dimension of bulb:
 Height (A-B) . . . $12\frac{1}{4} \pm \frac{1}{8}$ inches
 Width (C-D) . . . $15\frac{1}{4} \pm \frac{1}{8}$ inches
 Diagonal . . . $16\frac{1}{4} \pm \frac{1}{8}$ inches
 Neck length (Z-P)* . . . $7\frac{1}{4} \pm \frac{1}{8}$ inches
 Neck diameter . . . $1\frac{1}{8} \pm \frac{1}{16}$ inches
 Face curvature, width
 (radius R) 27 inches
 Bulb contact to ref.
 line (T-P)* . . . $4\frac{1}{4} \pm \frac{1}{8}$ inches
 Min. useful screen dimensions:
 Diagonal . . . $15\frac{1}{4}$ inches
 Height by width . . . $10\frac{1}{4} \times 14\frac{1}{4}$ inches
 Bulb contact, recessed sm.
 cavity cap. (J1-21)
 Base sm. shell duodecal 5-pin (B5-57)
 Bulb contact J1-21 aligns with vacant
 position of pin 6 $\pm 30^\circ$

**NOTES**

† Contains 2 inch by 2 inch contact area located 90° ccw from anode contact as viewed from base and $2\frac{1}{4}$ inches above reference line.

* Reference line P determined by JETEC gauge No. 110.

ENGINEERING DESIGN DATA

17TP4

NOVEMBER 30, 1956

DIRECT INTERELECTRODE CAPACITANCES

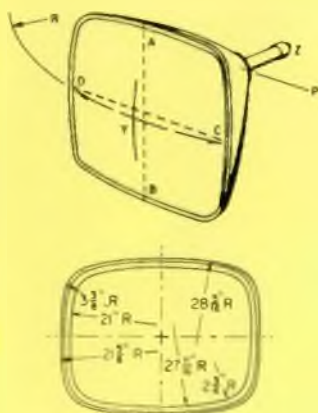
Cathode to all other electrodes... 5.0 μf
Grid 1 to all other electrodes... 6.0 μf

OPTICAL DATA

Phosphor... No. 4
Fluorescence color... White
Persistence... Medium
Faceplate... Frosted filter-glass
Light transmission at center (neutral
density filter) approx... 55% to 85%

MECHANICAL DATA

Over-all length (Y-Z)... 19 $\frac{1}{16}$ inches
Greatest dimension of bulb:
Height (A-B)... 12 $\frac{1}{4}$ $\pm$ $\frac{1}{16}$ inches
Width (C-D)... 15 $\frac{1}{16}$ $\pm$ $\frac{1}{16}$ inches
Diagonal... 16 $\frac{1}{16}$ $\pm$ $\frac{1}{16}$ inches
Neck length (Z-P)*... 7 $\frac{1}{2}$ $\pm$ $\frac{1}{16}$ inches
Neck diameter... 1 $\frac{1}{16}$ $\pm$ $\frac{1}{16}$ inches
Face curvature, height and width
(radius R)... 30 inches
Min. useful screen dimensions:
Diagonal... 15 $\frac{1}{4}$ inches
Height by width... 10 $\frac{1}{16}$ $\pm$ 14 $\frac{1}{16}$ inches
Base, sm. shell duodecal 6-pin... (B6-63)
Bulb contact... Rim of metal cone



NOTES

* Reference line P determined by JETEC
gauge No. 110.



17TP4

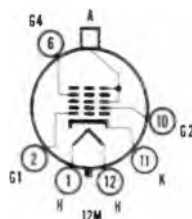


RECTANGULAR PICTURE TUBE

Electrostatic focus... spherical
face... frosted filter-glass faceplate
... 70° deflection... metal cone

HEATER CHARACTERISTICS

Voltage... 6.3 volts
Current, $\pm 10\%$... 0.6 amperes



ELECTRICAL DATA

Focusing method... Electrostatic
Deflecting method... Magnetic
Deflection angles (approximate)
Horizontal... 65 degrees
Vertical... 50 degrees
Diagonal... 70 degrees

MAXIMUM RATINGS (Design center values)

Anode voltage, d-c... 16,000 volts
Grid 4 (focusing electrode) voltage, d-c... -500, +1000 volts
Grid 2 voltage, d-c... 500 volts
Grid 1 voltage, d-c...
Negative bias value, d-c... 125 volts
Positive bias value, d-c... 0 volts
Positive peak value... 2 volts
Peak heater-cathode voltage:
Heater negative to cathode
During warm-up period of 15 seconds max... 410 volts
After equipment warm-up period... 180 volts
Heater positive to cathode... 180 volts

TYPICAL OPERATING CONDITIONS

Anode voltage... 14,000 volts
Grid 4 (focusing electrode) voltage*... -55 to +300 volts
Grid 2 voltage... 300 volts
Grid 1 voltage for cutoff... -28 to -72 volts
Ion-trap current†, JETEC coil No. 111... 70 ma
Ion-trap magnet strength‡, (approx.)... 45 gauss

MAXIMUM CIRCUIT VALUE

Grid 1 circuit resistance... 1.5 megohms

NOTES:

*With the combined Grid 1 bias voltage and video-signal voltage adjusted to give an anode current of 100 microamperes for a 11" x 14 $\frac{1}{4}$ " raster.

†Visual extinction of focused raster.

‡As measured with single-field beam bender.

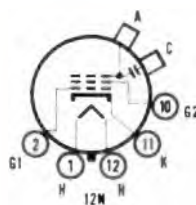
CAUTION: Shielding for X-rays is recommended for personal protection at close range if this tube is operated in excess of 16,000 volts or over Maximum Rated Anode Voltage, whichever is less. Safety glass covering tube's faceplate is usually sufficient.

CBS**17YP4****RECTANGULAR PICTURE TUBE**

Magnetic focus . . . cylindrical face
 . . . gray filter-glass faceplate . . .
 70° deflection . . . external conductive coating

HEATER CHARACTERISTICS

Voltage 6.3 volts
 Current, $\pm 10\%$ 0.6 amperes

**ELECTRICAL DATA**

Focusing method	Magnetic
Deflecting method	Magnetic
Deflection angles (approximate)	
Horizontal	65 degrees
Vertical	50 degrees
Diagonal	70 degrees

MAXIMUM RATINGS (Design center values)

Anode voltage, d-c	18,000 volts
Grid 2 voltage, d-c	500 volts
Grid 1 voltage, d-c	
Negative bias value, d-c	140 volts
Negative peak value	200 volts
Positive bias value, d-c	0 volts
Positive peak value	2 volts
Peak heater-cathode voltage:	
Heater negative to cathode	
During warm-up period of 15 seconds max.	410 volts
After equipment warm-up period	150 volts
Heater positive to cathode	150 volts

TYPICAL OPERATING CONDITIONS

Anode voltage	16,000 volts
Grid 2 voltage	300 volts
Grid 1 voltage for cutoff†	-28 to -72 volts
Focusing coil current, approx.*	100 ma
Ion-trap magnet strength‡, (approx.)	45 gauss

MAXIMUM CIRCUIT VALUE

Grid 1 circuit resistance	1.5 megohms
-------------------------------------	-------------

NOTES:

*For JETEC focus coil No. 109, or equivalent, 3.00" from reference line with E_{c1} and E_{c1a} adjusted for brightness of 20 FL on a $10\frac{1}{4}" \times 14\frac{1}{4}"$ area.

†Visual extinction of focused raster.

‡As measured with single-field beam bender.

CAUTION: Shielding for X-rays is recommended for personal protection at close range if this tube is operated in excess of 16,000 volts or over Maximum Rated Anode Voltage, whichever is less. Safety glass covering tube's faceplate is usually sufficient.

**ENGINEERING
DESIGN DATA****17YP4**

NOVEMBER 30, 1956

**DIRECT INTERELECTRODE
CAPACITANCES**

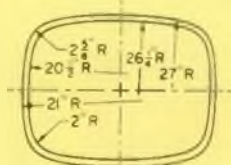
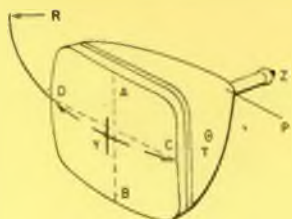
Cathode to all other electrodes	5.0 μf
Grid 1 to all other electrodes	6.0 μf
External conductive coating to anode†	
Maximum	1500 μf
Minimum	500 μf

OPTICAL DATA

Phosphor	No. 4
Fluorescence color	White
Persistence	Medium
Faceplate	Gray filter-glass
Light transmission at center (neutral density filter) approx.	66%

MECHANICAL DATA

Over-all length (Y-Z)	$19\frac{1}{16} \pm \frac{1}{16}$ inches
Greatest dimension of bulb	
Height (A-B)	$12\frac{1}{2} \pm \frac{1}{16}$ inches
Width (C-D)	$15\frac{1}{4} \pm \frac{1}{16}$ inches
Diagonal	$16\frac{1}{8} \pm \frac{1}{16}$ inches
Neck length (Z-P)*	$7\frac{1}{2} \pm \frac{1}{16}$ inches
Neck diameter	$1\frac{1}{16} \pm \frac{1}{16}$ inches
Face curvature, width (radius R)	27 inches
Bulb contact to ref. line (T-P)*	$4\frac{1}{2} \pm \frac{1}{16}$ inches
Min. useful screen dimensions:	
Diagonal	15 inches
Height by width	$10\frac{1}{2} \times 14\frac{1}{4}$ inches
Bulb contact, recessed sm. cavity cap.	(J1-21)
Base, sm. shell duodecal 5-pin (B5-57) Bulb contact J1-21 aligns with vacant position of pin 6	$\pm 30^\circ$

**NOTES**

◆ Contains 2 inch by 2 inch contact area located 90° ccw from anode contact as viewed from base and $2\frac{1}{4}$ inches above reference line.

★ Reference line P determined by JETEC gauge No. 110.

ENGINEERING DESIGN DATA

19AP4A

NOVEMBER 30, 1956

Similar Types
19AP4 19AP4B
19AP4C 19AP4D

DIRECT INTERELECTRODE CAPACITANCES

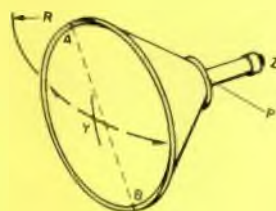
Cathode to all other electrodes... 5.0 μf
Grid 1 to all other electrodes... 7.0 μf

OPTICAL DATA

Phosphor... No. 4
Fluorescence color... White
Persistence... Medium
Faceplate... Gray filter-glass
Light transmission at center (neutral
density filter) approx. 55% to 85%

MECHANICAL DATA

Over-all length (Y-Z)... $21\frac{1}{2} \pm \frac{1}{8}$ inches
Greatest diameter (A-B) $18\frac{1}{2} \pm \frac{1}{8}$ inches
Neck length (Z-P)*... $7\frac{1}{4} \pm \frac{1}{8}$ inches
Neck diameter... $1\frac{1}{16} \pm \frac{1}{16}$ inches
Face curvature, height and width
(radius R)... 28 inches
Min. useful screen dimensions:
Diameter... $17\frac{3}{8}$ inches
Base, sm. shell duodecal-5-pin (B5-57)
Bulb contact... Rim of metal cone



NOTES

* Reference line P determined by JETEC
gauge No. 112.



19AP4A

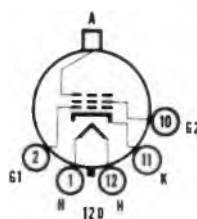


ROUND PICTURE TUBE

Magnetic focus... spherical face
... gray filter-glass faceplate...
66° deflection... metal cone

HEATER CHARACTERISTICS

Voltage... 6.3 volts
Current, $\pm 10\%$... 0.6 amperes



ELECTRICAL DATA

Focusing method... Magnetic
Deflecting method... Magnetic
Deflection angle (approximate)... 66 degrees

MAXIMUM RATINGS (Design center values)

Anode voltage, d-c... 16,000 volts
Grid 2 voltage, d-c... 410 volts
Grid 1 voltage, d-c... 125 volts
Negative bias value, d-c... 0 volts
Positive bias value, d-c... 2 volts
Peak heater-cathode voltage:
Heater negative to cathode...
During warm-up period of 15 seconds max... 410 volts
After equipment warm-up period... 150 volts
Heater positive to cathode... 150 volts

TYPICAL OPERATING CONDITIONS

Anode voltage... 12,000 volts
Grid 2 voltage... 300 volts
Grid 1 voltage for cutoff... -28 to -72 volts
Focusing coil current, approx.*... 140 ma
Ion-trap current†, JETEC coil No. 111... 75 ma
Ion-trap magnet strength‡, (approx.)... 45 gauss

MAXIMUM CIRCUIT VALUE

Grid 1 circuit resistance... 1.5 megohms

NOTES:

*For JETEC focus coil No. 109, or equivalent, 3.00" from reference line with E_{c1} and E_{c1a} adjusted for brightness of 18 FL on a $11\frac{1}{4} \times 15\frac{1}{4}$ " area.
†Visual extinction of focused raster.
‡As measured with single-field beam bender.

CAUTION: Shielding for X-rays is recommended for personal protection at close range if this tube is operated in excess of 16,000 volts or over Maximum Rated Anode Voltage, whichever is less. Safety glass covering tube's faceplate is usually sufficient.

19AP4B

Type 19AP4B has frosted gray filter-glass faceplate, otherwise it is identical to the 19AP4A.



20CP4

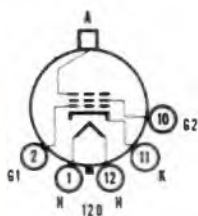


RECTANGULAR PICTURE TUBE

Magnetic focus . . . spherical face
 . . . gray filter-glass faceplate . . .
 70° deflection

HEATER CHARACTERISTICS

Voltage	6.3	volts
Current, $\pm 10\%$	0.6	amperes



ELECTRICAL DATA

Focusing method	Magnetic
Deflecting method	Magnetic
Deflection angles (approximate)	
Horizontal	66 degrees
Vertical	50 degrees
Diagonal	70 degrees

MAXIMUM RATINGS (Design center values)

Anode voltage, d-c	18,000 volts
Grid 2 voltage, d-c	410 volts
Grid 1 voltage, d-c	
Negative bias value, d-c	125 volts
Positive bias value, d-c	0 volts
Positive peak value	2 volts
Peak heater-cathode voltage:	
Heater negative to cathode	
During warm-up period of 15 seconds max.	410 volts
After equipment warm-up period	150 volts
Heater positive to cathode	150 volts

TYPICAL OPERATING CONDITIONS

Anode voltage	12,000 volts
Grid 2 voltage	300 volts
Grid 1 voltage for cutoff†	-28 to -72 volts
Focusing coil current, approx.*	100 ma
Ion-trap current‡, JETEC coil No. 117	36 ma
Ion-trap magnet strength‡, (approx.)	36 gauss

MAXIMUM CIRCUIT VALUE

Grid 1 circuit resistance	1.5 megohms
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NOTES:

*For JETEC focus coil No. 109, or equivalent, 3.00" from reference, line with E_{c1} and E_{c1s1g} adjusted for brightness of 30 Ft. on a $12\frac{1}{4} \times 17$ " area.

†Visual extinction of focused raster.

‡As measured with single-field beam bender.

CAUTION: Shielding for X-rays is recommended for personal protection at close range if this tube is operated in excess of 16,000 volts or over Maximum Rated Anode Voltage, whichever is less. Safety glass covering tube's faceplate is usually sufficient.

ENGINEERING DESIGN DATA

20CP4

NOVEMBER 30, 1956

Similar Types	
20DP4*	20CP4A*
20DP4A	20CP4B

DIRECT INTERELECTRODE CAPACITANCES

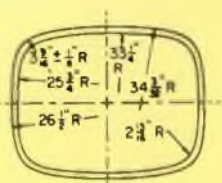
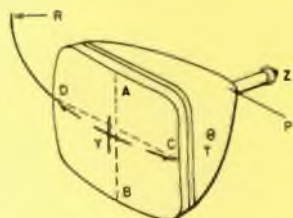
Cathode to all other electrodes	5.0 μmf
Grid 1 to all other electrodes	6.0 μmf

OPTICAL DATA

Phosphor	No. 4
Fluorescence color	White
Persistence	Medium
Faceplate	Gray filter-glass
Light transmission at center (neutral density filter) approx.	66%

MECHANICAL DATA

Over-all length (Y-Z)	21 $\frac{1}{4} \pm \frac{1}{8}$ inches
Greatest dimension of bulb:	
Height (A-B)	14 $\frac{1}{16} \pm \frac{1}{8}$ inches
Width (C-D)	18 $\frac{1}{16} \pm \frac{1}{8}$ inches
Diagonal	20 $\frac{1}{8} \pm \frac{1}{8}$ inches
Neck length (Z-P)*	7 $\frac{1}{8} \pm \frac{1}{8}$ inches
Neck diameter	1 $\frac{1}{8} \pm \frac{1}{8}$ inches
Face curvature, height and width (radius R)	.40 inches
Bulb contact to ref. line (T-P)*	6 $\frac{1}{2} \pm \frac{1}{2}$ inches
Min. useful screen dimensions:	
Diagonal	18 $\frac{3}{8}$ inches
Height by width	12 $\frac{3}{8} \times 17$ inches
Bulb contact, recessed sm. cavity cap.	(J1-21)
Base, sm. shell duodecal 5-pin	(B5-57)
Bulb contact J1-21 aligns with vacant position of pin 6	$\pm 30^\circ$



NOTES

- May be branded 20CP4/20DP4.
- May be branded 20CP4A/20DP4A.
- ★ Reference line P determined by JETEC gauge No. 110.



20CP4A



RECTANGULAR PICTURE TUBE

Type 20CP4A has an external conductive coating, otherwise it is identical to the 20CP4.

NOTE

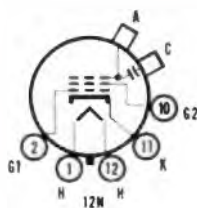
For engineering design data refer to type 20CP4 on preceding page.

DIRECT INTERELECTRODE CAPACITANCES

External Conductive Coating* to Anode:

Maximum..... 1500 μf

Minimum..... 500 μf



*Contains 2-inch x 2-inch contact area located 90° ccw from anode contact as viewed from base and $2 \pm \frac{1}{4}$ inches above reference line.

20CP4B

SILVER VISION PICTURE TUBE

Type 20CP4B has an aluminized screen, otherwise it is identical to the 20CP4.

20CP4D

SILVER VISION PICTURE TUBE

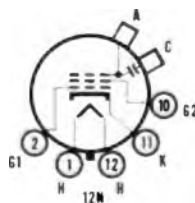
Type 20CP4D has an aluminized screen and an external conductive coating, otherwise it is identical to the 20CP4.

DIRECT INTERELECTRODE CAPACITANCES

External Conductive Coating* to Anode:

Maximum..... 1500 μf

Minimum..... 500 μf



*Contains 2-inch x 2-inch contact area located 90° ccw from anode contact as viewed from base and $2 \pm \frac{1}{4}$ inches above reference line.



20DP4

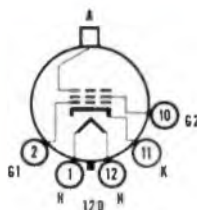


RECTANGULAR PICTURE TUBE

Magnetic focus . . . spherical face
 . . . gray filter-glass faceplate . . .
 70° deflection

HEATER CHARACTERISTICS

Voltage, 6.3 volts
 Current, $\pm 10\%$ 0.6 amperes



ELECTRICAL DATA

Focusing method Magnetic
 Deflecting method Magnetic
 Deflection angles (approximate)
 Horizontal 65 degrees
 Vertical 50 degrees
 Diagonal 70 degrees

MAXIMUM RATINGS (Design center values)

Anode voltage, d-c 18,000 volts
 Grid 2 voltage, d-c 410 volts
 Grid 1 voltage, d-c
 Negative bias value, d-c 125 volts
 Positive bias value, d-c 0 volts
 Positive peak value 2 volts
 Peak heater-cathode voltage:
 Heater negative to cathode
 During warm-up period of 15 seconds max. 410 volts
 After equipment warm-up period 150 volts
 Heater positive to cathode 150 volts

TYPICAL OPERATING CONDITIONS

Anode voltage 12,000 volts
 Grid 2 voltage 300 volts
 Grid 1 voltage for cutoff† -28 to -72 volts
 Focusing coil current, approx.* 95 ma
 Ion-trap current‡, JETEC coil No. 111 75 ma
 Ion-trap magnet strength‡, (approx.) 35 gauss

MAXIMUM CIRCUIT VALUE

Grid 1 circuit resistance 1.5 megohms

NOTES:

*For JETEC focus coil No. 109, or equivalent, 3.00" from reference line with E_{c1} and E_{c11g} adjusted for brightness of 30 FL on a $12\frac{3}{4} \times 17$ " area.

†Visual extinction of focused raster.

‡As measured with single-field beam bender.

CAUTION: Shielding for X-rays is recommended for personal protection at close range if this tube is operated in excess of 16,000 volts or over Maximum Rated Anode Voltage, whichever is less. Safety glass covering tube's faceplate is usually sufficient.

CBS PICTURE TUBES

ENGINEERING DESIGN DATA

20DP4

DECEMBER 5, 1956

Similar Types
 20CP4* 20DP4A*
 20CP4A 20DP4B

DIRECT INTERELECTRODE CAPACITANCES

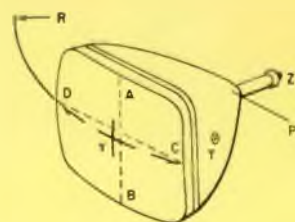
Cathode to all other electrodes . . . 5.0 μ F
 Grid 1 to all other electrodes 6.0 μ F

OPTICAL DATA

Phosphor No. 4
 Fluorescence color White
 Persistence Medium
 Faceplate Gray filter-glass
 Light transmission at center
 (neutral density filter) approx. 66%

MECHANICAL DATA

Over-all length (Y-Z) $21\frac{1}{2} \pm \frac{1}{8}$ inches
 Greatest dimension of bulb:
 Height (A-B) $14\frac{1}{8} \pm \frac{1}{8}$ inches
 Width (C-D) $18\frac{1}{8} \pm \frac{1}{8}$ inches
 Diagonal $20\frac{1}{2} \pm \frac{1}{8}$ inches
 Neck length (Z-P)* $7\frac{1}{8} \pm \frac{1}{8}$ inches
 Neck diameter $1\frac{1}{8} \pm \frac{1}{16}$ inches
 Face curvature, height and width
 (radius R) 40 inches
 Bulb contact to ref.
 line (T-P)* $6\frac{1}{2} \pm \frac{1}{8}$ inches
 Min. useful screen dimensions:
 Diagonal 18 $\frac{1}{2}$ inches
 Height by width $12\frac{1}{2} \times 17$ inches
 Area 214 sq. in.
 Bulb contact, recessed sm.
 cavity cap (J1-21)
 Base, sm. shell duodecal 5-pin. (B5-57)
 Bulb contact J1-21 aligns with vacant
 position of pin 6 $\pm 30^\circ$



NOTES

- * May be branded 20CP4/20DP4.
- May be branded 20CP4A/20DP4A.
- ★ Reference line P determined by JETEC gauge No. 110.



20DP4A



RECTANGULAR PICTURE TUBE

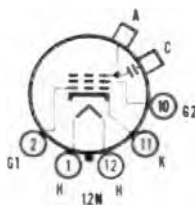
NOTE

For engineering design data refer to type 20DP4 on preceding page.

Type 20DP4A has an external conductive coating, otherwise it is identical to the 20DP4.

DIRECT INTERELECTRODE CAPACITANCES

External Conductive Coating* to Anode:
Maximum 1500 $\mu\mu\text{f}$
Minimum 500 $\mu\mu\text{f}$



*Contains 2-inch x 2-inch contact area located 90° ccw from anode contact as viewed from base and $2\pm\frac{1}{4}$ inches above reference line.

20DP4B

SILVER VISION PICTURE TUBE

Type 20DP4B has an aluminized screen, otherwise it is identical to the 20DP4.

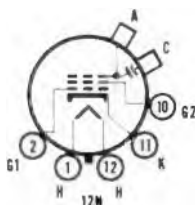
20DP4C

SILVER VISION PICTURE TUBE

Type 20DP4C has an aluminized screen and an external conductive coating, otherwise it is identical to the 20DP4.

DIRECT INTERELECTRODE CAPACITANCES

External Conductive Coating* to Anode:
Maximum 1500 $\mu\mu\text{f}$
Minimum 500 $\mu\mu\text{f}$



*Contains 2-inch x 2-inch contact area located 90° ccw from anode contact as viewed from base and $2\pm\frac{1}{4}$ inches above reference line.



20HP4

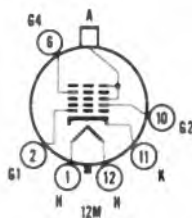


RECTANGULAR PICTURE TUBE

Electrostatic focus . . . spherical
face . . . gray filter-glass faceplate
. . . 70° deflection

HEATER CHARACTERISTICS

Voltage	6.3 volts
Current, $\pm 10\%$	0.6 amperes



ELECTRICAL DATA

Focusing method	Electrostatic
Deflecting method	Magnetic
Deflection angles (approximate)	
Horizontal	66 degrees
Vertical	50 degrees
Diagonal	70 degrees

MAXIMUM RATINGS (Design center values)

Anode voltage, d-c	16,000 volts
Grid 4 (focusing electrode) voltage, d-c	-500, +1000 volts
Grid 2 voltage, d-c	500 volts
Grid 1 voltage, d-c	
Negative bias value, d-c	125 volts
Positive bias value, d-c	0 volts
Positive peak value	2 volts
Peak heater-cathode voltage:	
Heater negative to cathode	
During warm-up period of 15 seconds max.	410 volts
After equipment warm-up period	180 volts
Heater positive to cathode	180 volts

TYPICAL OPERATING CONDITIONS

Anode voltage	14,000 volts
Grid 4 (focusing electrode) voltage*	-56 to 310 volts
Grid 2 voltage	300 volts
Grid 1 voltage for cutoff†	-28 to -72 volts
Ion-trap current‡, JETEC coil No. 111	85 ma

MAXIMUM CIRCUIT VALUE

Grid 1 circuit resistance	1.5 megohms
---------------------------	-------------

NOTES:

*With the combined Grid 1 bias voltage and video-signal voltage adjusted to give an anode current of 100 microamperes on a 12½" x 17" raster.

†Visual extinction of focused raster.

‡As measured with single-field beam bender.

CAUTION: Shielding for X-rays is recommended for personal protection at close range if this tube is operated in excess of 16,000 volts or over Maximum Rated Anode Voltage, whichever is less. Safety glass covering tube's faceplate is usually sufficient.

ENGINEERING DESIGN DATA

20HP4

NOVEMBER 30, 1956

Similar Types

20HP4A	20HP4B
20HP4C	20HP4D
20LP4	20MP4

DIRECT INTERELECTRODE CAPACITANCES

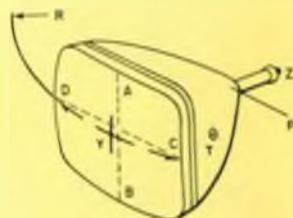
Cathode to all other electrodes	5.0 μf
Grid 1 to all other electrodes	6.0 μf

OPTICAL DATA

Phosphor	No. 4
Fluorescence color	White
Persistence	Medium
Faceplate	Gray filter-glass
Light transmission at center (neutral density filter) approx.	66%

MECHANICAL DATA

Over-all length (Y-Z)	21¼ $\pm$ ¼ inches
Greatest dimension of bulb:	
Height (A-B)	14½ $\pm$ ¼ inches
Width (C-D)	18½ $\pm$ ¼ inches
Diagonal	20½ $\pm$ ¼ inches
Neck length (Z-P)*	7½ $\pm$ ⅜ inches
Neck diameter	1¼ $\pm$ ⅛ inches
Face curvature, height and width (radius R)	40 inches
Bulb contact to ref. line (T-P)*	5% $\pm$ ½ inches
Min. useful screen dimensions:	
Diagonal	18½ inches
Height by width	12½ x 17 inches
Area	210 sq. in.
Bulb contact, recessed sm. cavity cap.	(J1-21)
Base, sm. shell dodecad 6-pin, (B6-63)	
Bulb contact J1-21 aligns with vacant position of pin 6	$\pm 30^\circ$



NOTES

* Reference line P determined by JETEC gauge No. 110.



20HP4A



RECTANGULAR PICTURE TUBE

Type 20HP4A has an external conductive coating, otherwise it is identical to the 20HP4.

NOTE

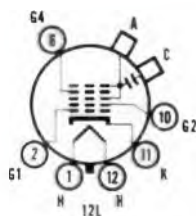
For engineering design data refer to type 20HP4 on preceding page.

DIRECT INTERELECTRODE CAPACITANCES

External Conductive Coating* to Anode:

Maximum..... 1500 μf

Minimum..... 500 μf



*Contains 2-inch x 2-inch contact area located 90° ccw from anode contact as viewed from base and $2 \pm \frac{1}{4}$ inches above reference line.

20HP4C

SILVER VISION PICTURE TUBE

Type 20HP4C has an aluminized screen, otherwise it is identical to the 20HP4.

20HP4D

SILVER VISION PICTURE TUBE

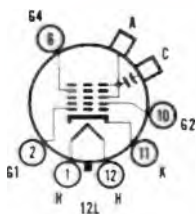
Type 20HP4D has an aluminized screen and an external conductive coating, otherwise it is identical to the 20HP4.

DIRECT INTERELECTRODE CAPACITANCES

External Conductive Coating* to Anode:

Maximum..... 1500 μf

Minimum..... 500 μf



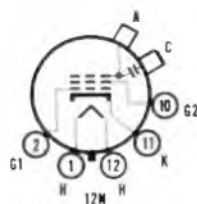
*Contains 2-inch x 2-inch contact area located 90° ccw from anode contact as viewed from base and $2 \pm \frac{1}{4}$ inches above reference line.

CBS**21ACP4****RECTANGULAR PICTURE TUBE**

Magnetic focus . . . spherical face
 . . . gray filter-glass faceplate . . .
 90° deflection . . . external conductive coating

HEATER CHARACTERISTICS

Voltage	6.3 volts
Current, $\pm 10\%$	0.6 amperes

**ELECTRICAL DATA**

Focusing method	Magnetic
Deflecting method	Magnetic
Deflection angles (approximate)	
Horizontal	85 degrees
Vertical	68 degrees
Diagonal	90 degrees

MAXIMUM RATINGS (Design center values)

Anode voltage, d-c	20,000 volts
Grid 2 voltage, d-c	500 volts
Grid 1 voltage, d-c	
Negative bias value, d-c	140 volts
Negative peak value	200 volts
Positive bias value, d-c	0 volts
Positive peak value	2 volts
Peak heater-cathode voltage:	
Heater negative to cathode	
During warm-up period of 15 seconds max.	410 volts
After equipment warm-up period	180 volts
Heater positive to cathode	180 volts

TYPICAL OPERATING CONDITIONS

Anode voltage	16,000 volts
Grid 2 voltage	300 volts
Grid 1 voltage for cutoff†	-28 to -72 volts
Focusing coil current, approx.*	117 ma
Ion-trap current‡, JETEC coil No. 117	40 ma
Ion-trap magnet strength‡, (approx.)	40 gauss

MAXIMUM CIRCUIT VALUE

Grid 1 circuit resistance	1.5 megohms
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NOTES:

*For JETEC focus coil No. 109, or equivalent, 3.00" from reference line with E_{c1} and E_{c1s} adjusted for brightness of 30 FL on a $15'' \times 19\frac{1}{2}''$ area.

†Visual extinction of focused raster.

‡As measured with single-field beam bender.

CAUTION: Shielding for X-rays is recommended for personal protection at close range if this tube is operated in excess of 16,000 volts or over Maximum Rated Anode Voltage, whichever is less. Safety glass covering tube's faceplate is usually sufficient.

21ACP4A**SILVER VISION PICTURE TUBE**

Type 21ACP4A has an aluminized screen, otherwise it is identical to the 21ACP4.

CBS PICTURE TUBES**ENGINEERING
DESIGN DATA****21ACP4**

DECEMBER 4, 1956

Similar Types
21ACP4A 21AMP4A
21AMP4 21AQP4

**DIRECT INTERELECTRODE
CAPACITANCES**

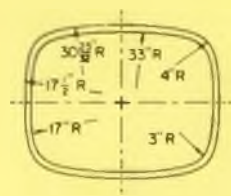
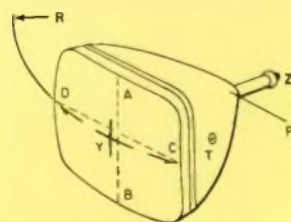
Cathode to all other electrodes	5.0 μf
Grid 1 to all other electrodes	6.0 μf
External conductive coating to anodes	2500 μf
Maximum	2500 μf
Minimum	2000 μf

OPTICAL DATA

Phosphor	No. 4
Fluorescence color	White
Persistence	Medium
Faceplate	Gray filter-glass
Light transmission at center (neutral density filter) approx.	74%

MECHANICAL DATA

Over-all length (Y-Z)	20 $\pm \frac{1}{16}$ inches
Greatest dimension of bulb:	
Height (A-B)	16 $\pm \frac{1}{16}$ inches
Width (C-D)	20 $\pm \frac{1}{16}$ inches
Diagonal	21 $\pm \frac{1}{16}$ inches
Neck length (Z-P)*	7 $\pm \frac{1}{16}$ inches
Neck diameter	1 $\frac{1}{16} \pm \frac{1}{16}$ inches
Face curvature, height and width (radius R)	33 inches
Bulb contact to ref. line (T-P)*	4 $\pm \frac{1}{16}$ inches
Min. useful screen dimensions:	
Diagonal	20 $\frac{1}{16}$ inches
Height by width	15 $\frac{1}{16} \times 19 \frac{1}{16}$ inches
Area	262 sq. in.
Bulb contact, recessed sm. cavity cap	(J1-21)
Base, sm. shell duodecal 5-pin (B5-57)	
Bulb contact J1-21 aligns with vacant position of pin 6	$\pm 30^\circ$

**NOTES**

- ◆ Contains 2 inch by 2 inch contact area located 90° ccw from anode contact as viewed from base and $2 \pm \frac{1}{16}$ inches above reference line.
- * Reference line P determined by JETEC gauge No. 116.

ENGINEERING DESIGN DATA

21ALP4

DECEMBER 3, 1955

Similar Types

21ALP4A 21ALP4B
21ANP4 21ATP4

DIRECT INTERELECTRODE CAPACITANCES

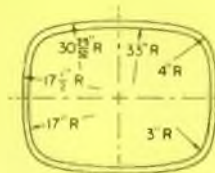
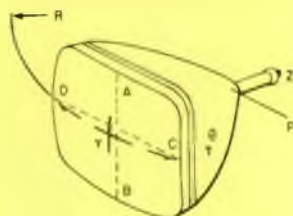
Cathode to all other electrodes . . . 5.0 μmf
Grid 1 to all other electrodes . . . 6.0 μmf
External conductive coating to anodes:
Maximum . . . 750 μmf
Minimum . . . 500 μmf

OPTICAL DATA

Phosphor . . . No. 4
Fluorescence color . . . White
Persistence . . . Medium
Faceplate . . . Gray filter-glass
Light transmission at center
(neutral density filter) approx. 74%

MECHANICAL DATA

Over-all length (Y-Z) . . . $20 \pm \frac{1}{16}$ inches
Greatest dimension of bulb:
Height (A-B) . . . $16 \frac{1}{16} \pm \frac{1}{16}$ inches
Width (C-D) . . . $20 \frac{1}{16} \pm \frac{1}{16}$ inches
Diagonal . . . $21 \frac{1}{16} \pm \frac{1}{16}$ inches
Neck length (Z-P)* . . . $7 \frac{1}{16} \pm \frac{1}{16}$ inches
Neck diameter . . . $1 \frac{1}{16} \pm \frac{1}{16}$ inches
Face curvature, height and width
(radius R) . . . 33 inches
Bulb contact to ref.
line (T-P)* . . . $4 \frac{1}{16} \pm \frac{1}{16}$ inches
Min. useful screen dimensions:
Diagonal . . . 20% inches
Height by width . . . $15 \frac{1}{16} \times 19 \frac{1}{16}$ inches
Area . . . 262 sq. in.
Bulb contact, recessed sm.
cavity cap . . . (11-21)
Base, sm. shell duodecal 5-pin (B5-56)
Bulb contact J1-21 aligns with vacant
position of pin 6 . . . $\pm 30^\circ$



NOTES

- Contains 2 inch by 2 inch contact area located 90° ccw from anode contact as viewed from base and $2 \pm \frac{1}{16}$ inches above reference line.
- Reference line P determined by JETEC gauge No. 116.



21ALP4

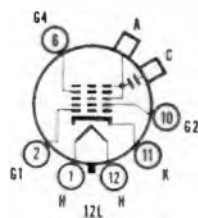


RECTANGULAR PICTURE TUBE

Electrostatic focus . . . spherical
face . . . gray filter-glass faceplate
. . . 90° deflection . . . external con-
ductive coating

HEATER CHARACTERISTICS

Voltage . . . 6.3 volts
Current, $\pm 10\%$. . . 0.6 amperes



ELECTRICAL DATA

Focusing method . . . Electrostatic
Deflecting method . . . Magnetic
Deflection angles (approximate)
Horizontal . . . 85 degrees
Vertical . . . 68 degrees
Diagonal . . . 90 degrees

MAXIMUM RATINGS (Design center values)

Anode voltage, d-c . . . 18,000 volts
Grid 4 (focusing electrode) voltage, d-c . . . -500, +1000 volts
Grid 2 voltage, d-c . . . 500 volts
Grid 1 voltage, d-c . . .
Negative bias value, d-c . . . 140 volts
Negative peak value . . . 200 volts
Positive bias value, d-c . . . 0 volts
Positive peak value . . . 2 volts
Peak heater-cathode voltage:
Heater negative to cathode . . .
During warm-up period of 15 seconds max. . . 410 volts
After equipment warm-up period . . . 180 volts
Heater positive to cathode . . . 180 volts

TYPICAL OPERATING CONDITIONS

Anode voltage . . . 14,000 volts
Grid 4 (focusing electrode) voltage* . . . -55 to +300 volts
Grid 2 voltage . . . 300 volts
Grid 1 voltage for cutoff . . . -28 to -72 volts
Ion-trap magnet strength†, (approx.) . . . 40 gauss

MAXIMUM CIRCUIT VALUE

Grid 1 circuit resistance . . . 1.5 megohms

NOTES:

- *With the combined Grid 1 bias voltage and video-signal voltage adjusted to give an anode current of 100 microamperes on a $15'' \times 19 \frac{1}{16}''$ raster.
- †Visual extinction of focused raster.
- ‡As measured with single-field beam bender.

CAUTION: Shielding for X-rays is recommended for personal protection at close range if this tube is operated in excess of 16,000 volts or over Maximum Rated Anode Voltage, whichever is less. Safety glass covering tube's faceplate is usually sufficient.

21ALP4A

SILVER VISION PICTURE TUBE

Type 21ALP4A has an aluminized screen, otherwise it is identical to the 21ALP4.

CBS PICTURE TUBES

21ALP4B

SILVER VISION PICTURE TUBE

Type 21ALP4B has Maximum Anode Voltage, d-c (Design Center Values) of 20,000 volts; otherwise it is identical to the 21ALP4A.



21AMP4



RECTANGULAR PICTURE TUBE

Magnetic focus . . . spherical face
 . . . gray filter-glass faceplate . . .
 90° deflection . . . external conductive coating

HEATER CHARACTERISTICS

Voltage	6.3	volts
Current, $\pm 10\%$	0.6	amperes

ELECTRICAL DATA

Focusing method	Magnetic
Deflecting method	Magnetic
Deflection angles (approximate)	
Horizontal	85 degrees
Vertical	68 degrees
Diagonal	90 degrees

MAXIMUM RATINGS (Design center values)

Anode voltage, d-c	18,000 volts
Grid 2 voltage, d-c	500 volts
Grid 1 voltage, d-c	
Negative bias value, d-c	140 volts
Negative peak value	200 volts
Positive bias value, d-c	0 volts
Positive peak value	2 volts
Peak heater-cathode voltage:	
Heater negative to cathode	
During warm-up period of 15 seconds max.	410 volts
After equipment warm-up period	180 volts
Heater positive to cathode	180 volts

TYPICAL OPERATING CONDITIONS

Anode voltage	16,000 volts
Grid 2 voltage	300 volts
Grid 1 voltage for cutoff	-28 to -72 volts
Focusing coil current, approx.*	100 ma
Ion-trap current†, JETEC coil No. 111	95 ma
Ion-trap magnet strength‡, (approx.)	45 gauss

MAXIMUM CIRCUIT VALUE

Grid 1 circuit resistance	1.5 megohms
---------------------------	-------------

NOTES:

*For JETEC focus coil No. 109, or equivalent, 3.00" from reference line with E_{c1} and E_{c2} adjusted for brightness of 30 FL on a 15" x 19 1/2" area.

†Visual extinction of focused raster.

‡As measured with single-field beam bender.

CAUTION: Shielding for X-rays is recommended for personal protection at close range if this tube is operated in excess of 16,000 volts or over Maximum Rated Anode Voltage, whichever is less. Safety glass covering tube's faceplate is usually sufficient.

CBS PICTURE TUBES

ENGINEERING DESIGN DATA

21ALP4B

DECEMBER 3, 1956

21AMP4

DECEMBER 3, 1956

Similar Types
 21AMP4A* 21ACP4A
 21ACP4B 21AQP4

DIRECT INTERELECTRODE CAPACITANCES

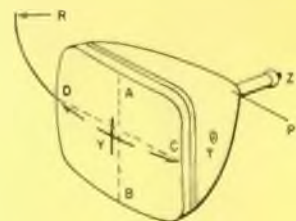
Cathode to all other electrodes	5.0 μf
Grid 1 to all other electrodes	6.0 μf
External conductive coating to anode	
Maximum	2500 μf
Minimum	2000 μf

OPTICAL DATA

Phosphor	No. 4
Fluorescence color	White
Persistence	Medium
Faceplate	Gray filter-glass
Light transmission at center (neutral density filter) approx.	74%

MECHANICAL DATA

Over-all length (Y-Z)	20 $\pm$ 1/16 inches
Greatest dimension of bulb:	
Height (A-B)	16 $\pm$ 1/16 inches
Width (C-D)	20 $\pm$ 1/16 inches
Diagonal	21 $\pm$ 1/16 inches
Neck length (Z-P)*	7 $\pm$ 1/16 inches
Neck diameter	1 1/16 $\pm$ 1/16 inches
Face curvature, height and width (radius R)	33 inches
Bulb contact to ref. line (T-P)*	4 $\pm$ 1/16 inches
Min. useful screen dimensions:	
Diagonal	20 $\pm$ 1/16 inches
Height by width	15 1/16 x 19 1/16 inches
Area	262 sq. in.
Bulb contact, recessed sm. cavity cap.	(J1-21)
Base, sm. shell duodecal 5-pin (B5-57)	
Bulb contact J1-21 aligns with vacant position of pin 6	$\pm 30^\circ$



ENGINEERING DESIGN DATA

21AMP4 (cont.)

NOTES

- * May be branded 21AMP4A, 21ACP4A
- May be branded 21AMP4, 21ACP4
- ◆ Contains 2 inch by 2 inch contact area located 90° ccw from anode contact as viewed from base and $2\pm\frac{1}{4}$ inches above reference line.
- ★ Reference line P determined by JETEC gauge No. 116

21AP4

DECEMBER 3, 1956

DIRECT INTERELECTRODE CAPACITANCES

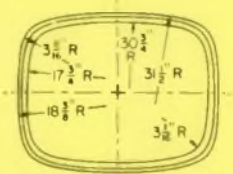
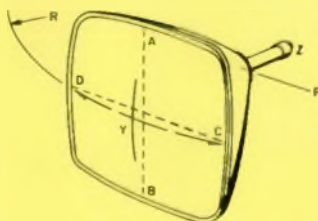
Cathode to all other electrodes... 5.0 μfd
Grid 1 to all other electrodes... 6.0 μfd

OPTICAL DATA

Phosphor... No. 4
Fluorescence color... White
Persistence... Medium
Faceplate... Frosted filter-glass
Light transmission at center (neutral density filter) approx... 55% to 85%

MECHANICAL DATA

Over-all length (Y-Z)... 22 $\frac{1}{2}$ inches
Greatest dimension of bulb:
Height (A-B)... 15 $\frac{1}{4}$ inches
Width (C-D)... 19 $\frac{1}{2}$ inches
Diagonal... 20 $\frac{1}{4}$ inches
Neck length (Z-P)*... 7 $\frac{1}{2}$ inches
Neck diameter... 1 $\frac{1}{4}$ inches
Face curvature, height and width (radius R)... 33 inches
Min. useful screen dimensions:
Diagonal... 19 $\frac{1}{4}$ inches
Height by width 13 $\frac{1}{4}$ x 18 $\frac{1}{4}$ inches
Base, sm. shell duodecal 5-pin (85-57)
Bulb contact... Rim of metal cone



NOTES

- ★ Reference line P determined by JETEC gauge No. 110.

21AMP4A

SILVER VISION PICTURE TUBE

Type 21AMP4A has an aluminized screen, otherwise it is identical to the 21AMP4.



21AP4

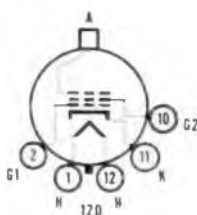


RECTANGULAR PICTURE TUBE

Magnetic focus... spherical face
... frosted filter-glass faceplate
... metal cone... 70° deflection

HEATER CHARACTERISTICS

Voltage... 6.3 volts
Current, $\pm 10\%$... 0.6 amperes



ELECTRICAL DATA

Focusing method... Magnetic
Deflecting method... Magnetic
Deflection angles (approximate)
Horizontal... 66 degrees
Vertical... 50 degrees
Diagonal... 70 degrees

MAXIMUM RATINGS (Design center values)

Anode voltage, d-c... 18,000 volts
Grid 2 voltage, d-c... 500 volts
Grid 1 voltage, d-c...
Negative bias value, d-c... 125 volts
Positive bias value, d-c... 0 volts
Positive peak value... 2 volts
Peak heater-cathode voltage:
Heater negative to cathode...
During warm-up period of 15 seconds max... 410 volts
After equipment warm-up period... 180 volts
Heater positive to cathode... 180 volts

TYPICAL OPERATING CONDITIONS

Anode voltage... 14,000 volts
Grid 2 voltage... 300 volts
Grid 1 voltage for cutoff... -28 to -72 volts
Focusing coil current, approx... 104 ma
Ion-trap current†, JETEC coil No. 111... 90 ma
Ion-trap magnet strength†, (approx.)... 45 gauss

MAXIMUM CIRCUIT VALUE

Grid 1 circuit resistance... 1.5 megohms

NOTES:

- *For JETEC focus coil No. 109, or equivalent, 3.00" from reference line with E_{c1} and E_{c1+2} adjusted for brightness of 30 FL on a 13 $\frac{1}{4}$ " x 18 $\frac{1}{4}$ " area.
- †Visual extinction of focused raster.
- ‡As measured with single-field beam bender.

CAUTION: Shielding for X-rays is recommended for personal protection at close range if this tube is operated in excess of 16,000 volts or over Maximum Rated Anode Voltage, whichever is less. Safety glass covering tube's faceplate is usually sufficient.

CBS PICTURE TUBES

CBS**21ATP4****RECTANGULAR PICTURE TUBE**

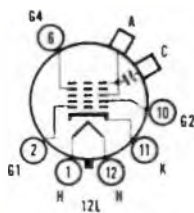
Electrostatic focus... spherical face
... gray filter-glass faceplate...
90° deflection... external conductive coating... aluminized screen

HEATER CHARACTERISTICS

Voltage	6.3 volts
Current, $\pm 10\%$	0.6 amperes

ELECTRICAL DATA

Focusing method	Electrostatic
Deflecting method	Magnetic
Deflection angles (approximate)	
Horizontal	85 degrees
Vertical	68 degrees
Diagonal	90 degrees

**MAXIMUM RATINGS (Design center values)**

Anode voltage, d-c	18,000 volts
Grid 4 (focusing electrode) voltage, d-c	-500, +1000 volts
Grid 2 voltage, d-c	500 volts
Grid 1 voltage, d-c	
Negative bias value, d-c	140 volts
Negative peak value	200 volts
Positive bias value, d-c	0 volts
Positive peak value	2 volts
Peak heater-cathode voltage:	
Heater negative to cathode	
During warm-up period of 15 seconds max.	410 volts
After equipment warm-up period	180 volts
Heater positive to cathode	180 volts

TYPICAL OPERATING CONDITIONS

Anode voltage	16,000 volts
Grid 4 (focusing electrode) voltage*	-64 to +350 volts
Grid 2 voltage	300 volts
Grid 1 voltage for cutoff†	-28 to -72 volts
Ion-trap magnet strength‡, (approx.)	35 gauss

MAXIMUM CIRCUIT VALUE

Grid 1 circuit resistance	1.5 megohms
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NOTES:

*With the combined Grid 1 bias voltage and video-signal voltage adjusted to give an anode current of 100 microamperes on a 15" x 19 1/2" raster.

†Visual extinction of focused raster.

‡As measured with single-field beam bender.

CAUTION: Shielding for X-rays is recommended for personal protection at close range if this tube is operated in excess of 16,000 volts or over Maximum Rated Anode Voltage, whichever is less. Safety glass covering tube's faceplate is usually sufficient.

21ATP4A**SILVER VISION PICTURE TUBE**

Type 21ATP4A has Maximum Anode Voltage, d-c (Design Center Value) of 20,000 volts, otherwise it is identical to the 21ATP4.

CBS PICTURE TUBES**ENGINEERING
DESIGN DATA****21ATP4**

DECEMBER 4, 1956

Similar Types
21ATP4A 21ALP4

**DIRECT INTERELECTRODE
CAPACITANCES**

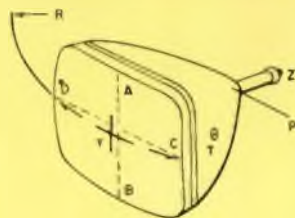
Cathode to all other electrodes	5.0 μmf
Grid 1 to all other electrodes	6.0 μmf
External conductive coating to anodes	
Maximum	1500 μmf
Minimum	1200 μmf

OPTICAL DATA

Phosphor	No. 4
Fluorescence color	White
Persistence	Medium
Faceplate	Gray filter-glass
Light transmission at center (neutral density filter) approx.	74%

MECHANICAL DATA

Over-all length (Y-Z)	20 $\pm$ 3/8 inches
Greatest dimension of bulb:	
Height (A-B)	16 1/4 $\pm$ 1/8 inches
Width (C-D)	20 1/4 $\pm$ 1/8 inches
Diagonal	21 1/4 $\pm$ 1/8 inches
Neck length (Z-P)*	7 1/2 $\pm$ 1/8 inches
Neck diameter	1 1/4 $\pm$ 1/8 inches
Face curvature, height and width (radius R)	33 inches
Bulb contact to ref. line (T-P)*	4 1/4 $\pm$ 1/8 inches
Min. useful screen dimensions:	
Diagonal	20 1/2 inches
Height by width	15 1/4 x 19 1/8 inches
Area	262 sq. in.
Bulb contact, recessed sm. cavity cap.	(J1-21)
Base, sm. shell duodecal 6-pin	(B6-63)
Bulb contact J1-21 aligns with vacant position of pin 6	$\pm 30^\circ$

**NOTES**

◆ Contains 2 inch by 2 inch contact area located 90° ccw from anode contact as viewed from base and 2 $\pm$ 1/4 inches above reference line.

★ Reference line P determined by JETEC gauge No. 116.

ENGINEERING DESIGN DATA

21AUP4

DECEMBER 4, 1956

Similar Types
21AUP4A* 21AVP4
21YP4 21ARP4

DIRECT INTERELECTRODE CAPACITANCES

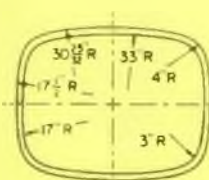
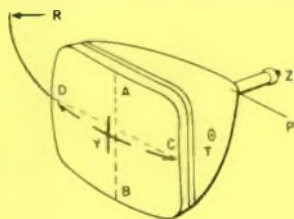
Cathode to all other electrodes	5.0 μf
Grid 1 to all other electrodes	6.0 μf
External conductive coating to anode†	
Maximum	2500 μf
Minimum	2000 μf

OPTICAL DATA

Phosphor	No. 4
Fluorescence color	White
Persistence	Medium
Faceplate	Gray filter-glass
Light transmission at center (neutral density filter) approx.	74%

MECHANICAL DATA

Over-all length (Y-Z)	20 $\pm$ 1/8 inches
Greatest dimension of bulb:	
Height (A-B)	16 $\pm$ 1/4 inches
Width (C-D)	20 $\pm$ 1/4 inches
Diagonal	21 $\pm$ 1/4 inches
Neck length (Z-P)*	7 $\pm$ 1/4 inches
Neck diameter	1 1/4 $\pm$ 1/16 inches
Face curvature, height and width (radius R)	33 inches
Bulb contact to ref. line (T-P)*	4 $\pm$ 1/4 inches
Min. useful screen dimensions:	
Diagonal	20 $\pm$ inches
Height by width	15 1/2 $\times$ 19 1/4 inches
Area	262 sq. in.
Bulb contact, recessed sm. cavity cap	(J1-21)
Base, sm. shell duodecal 6-pin	(B6-63)
Bulb contact J1-21 aligns with vacant position of pin 6	$\pm$ 30°



NOTES

- * May be branded 21AUP4B/A.
- † Contains 2 inch by 2 inch contact area located 90° ccw from anode contact as viewed from base and 2 $\pm$ 1/4 inches above reference line.
- * Reference line P determined by JETEC gauge No. 110.

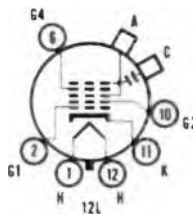


21AUP4



RECTANGULAR PICTURE TUBE

Electrostatic focus . . . spherical face . . . gray filter-glass faceplate . . . 72° deflection . . . external conductive coating



HEATER CHARACTERISTICS

Voltage	6.3 volts
Current, $\pm$ 10%	0.6 amperes

ELECTRICAL DATA

Focusing method	Electrostatic
Deflecting method	Magnetic
Deflection angles (approximate)	
Horizontal	67 degrees
Vertical	53 degrees
Diagonal	72 degrees

MAXIMUM RATINGS (Design center values)

Anode voltage, d-c	18,000 volts
Grid 4 (focusing electrode) voltage, d-c	-500, +1000 volts
Grid 2 voltage, d-c	500 volts
Grid 1 voltage, d-c	
Negative bias value, d-c	140 volts
Negative peak value	200 volts
Positive bias value, d-c	0 volts
Positive peak value	2 volts
Peak heater-cathode voltage:	
Heater negative to cathode	
During warm-up period of 15 seconds max	410 volts
After equipment warm-up period	180 volts
Heater positive to cathode	180 volts

TYPICAL OPERATING CONDITIONS

Anode voltage	14,000 volts
Grid 4 (focusing electrode) voltage*	-55 to +300 volts
Grid 2 voltage	300 volts
Grid 1 voltage for cutoff†	-28 to -72 volts
Ion-trap current‡, JETEC coil No. 117	40 ma
Ion-trap magnet strength‡, (approx.)	40 gauss

MAXIMUM CIRCUIT VALUE

Grid 1 circuit resistance	1.5 megohms
---------------------------	-------------

NOTES:

- *With the combined Grid 1 bias voltage and video-signal voltage adjusted to give an anode current of 100 microamperes on a 15" $\times$ 19 1/4" raster.
- †Visual extinction of focused raster.
- ‡As measured with single-field beam bender.

CAUTION: Shielding for X-rays is recommended for personal protection at close range if this tube is operated in excess of 16,000 volts or over Maximum Rated Anode Voltage, whichever is less. Safety glass covering tube's faceplate is usually sufficient.

21AUP4A

SILVER VISION PICTURE TUBE

Type 21AUP4A has an aluminized screen, otherwise it is identical to the 21AUP4.

CBS PICTURE TUBES

21AVP4A

SILVER VISION PICTURE TUBE

Type 21AVP4A has an aluminized screen, otherwise it is identical to the 21AVP4.

21AWP4

DECEMBER 4, 1956

DIRECT INTERELECTRODE CAPACITANCES

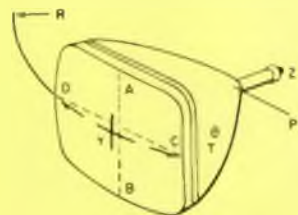
Cathode to all other electrodes	5.0 μf
Grid 1 to all other electrodes	6.0 μf
External conductive coating to anode:	
Maximum	1500 μf
Minimum	1200 μf

OPTICAL DATA

Phosphor	No. 4
Fluorescence color	White
Persistence	Medium
Faceplate	Gray filter-glass
Light transmission at center (neutral density filter) approx.	74%

MECHANICAL DATA

Over-all length (Y-Z)	23 1/2 $\pm$ 1/4 inches
Greatest dimension of bulb:	
Height (A-B)	16 1/2 $\pm$ 1/4 inches
Width (C-D)	20 1/2 $\pm$ 1/4 inches
Diagonal	21 1/2 $\pm$ 1/4 inches
Neck length (Z-P)*	7 1/2 $\pm$ 1/4 inches
Neck diameter	1 1/4 $\pm$ 1/16 inches
Face curvature, height and width (radius R)	33 inches
Bulb contact to ref. line (T-P)*	7 1/2 $\pm$ 1/4 inches
Min. useful screen dimensions:	
Diagonal	20 1/2 inches
Height by width	15 1/4 x 19 1/4 inches
Area	262 sq. in.
Bulb contact, recessed sm. cavity cap	(J1-21)
Base, sm. shell duodecal 5-pin	(85-57)
Bulb contact J1-21 aligns with vacant position of pin 6	$\pm$ 30°



21AVP4B

SILVER VISION PICTURE TUBE

Type 21AVP4B has a Maximum Anode Voltage, d-c (Design Center Value) of 20,000 volts, otherwise it is identical to the 21AVP4A.

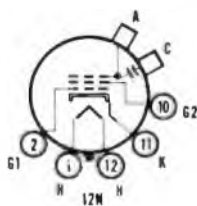


21AWP4



RECTANGULAR PICTURE TUBE

Magnetic focus . . . spherical face
. . . gray filter-glass faceplate . . .
72° deflection . . . external conduc-
tive coating . . . aluminized screen



HEATER CHARACTERISTICS

Voltage	6.3 volts
Current, $\pm$ 10%	0.6 amperes

ELECTRICAL DATA

Focusing method	Magnetic
Deflecting method	Magnetic
Deflection angles (approximate)	
Horizontal	68 degrees
Vertical	53 degrees
Diagonal	72 degrees

MAXIMUM RATINGS (Design center values)

Anode voltage, d-c	18,000 volts
Grid 2 voltage, d-c	500 volts
Grid 1 voltage, d-c	
Negative bias value, d-c	140 volts
Negative peak value	200 volts
Positive bias value, d-c	0 volts
Positive peak value	2 volts
Peak heater-cathode voltage:	
Heater negative to cathode	
During warm-up period of 15 seconds max.	410 volts
After equipment warm-up period	180 volts
Heater positive to cathode	180 volts

TYPICAL OPERATING CONDITIONS

Anode voltage	16,000 volts
Grid 2 voltage	300 volts
Grid 1 voltage for cutoff†	-28 to -72 volts
Focusing coil current, approx.*	108 ma
Ion-trap current†, JETEC coil No. 117	40 ma
Ion-trap magnet strength†, (approx.)	40 gauss

21AWP4 (cont.)

MAXIMUM CIRCUIT VALUE

Grid 1 circuit resistance..... 1.5 megohms

NOTES:

*For JETEC focus coil No. 109, or equivalent, 3.00" from reference line with E_{c1} and E_{c2} adjusted for brightness of 20 FL on a 15" x 19 1/2" area.

†Visual extinction of focused raster.

‡As measured with single-field beam bender.

CAUTION: Shielding for X-rays is recommended for personal protection at close range if this tube is operated in excess of 16,000 volts or over Maximum Rated Anode Voltage, whichever is less. Safety glass covering tube's faceplate is usually sufficient.

ENGINEERING DESIGN DATA

21AWP4 (cont.)

NOTES

♦ Contains 2 inch by 2 inch contact area located 90° ccw from anode contact as viewed from base and 2 ± 1/4 inches above reference line.

* Reference line P determined by JETEC gauge No. 110.

21EP4A

DECEMBER 4, 1956

Similar Types
21EP4 21EP4B

DIRECT INTERELECTRODE CAPACITANCES

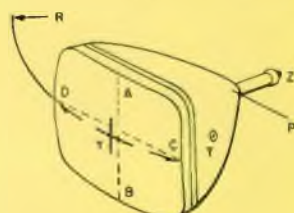
Cathode to all other electrodes..... 5.0 μ f
Grid 1 to all other electrodes..... 6.0 μ f
External conductive coating to anode:
Maximum..... 750 μ f
Minimum..... 500 μ f

OPTICAL DATA

Phosphor..... No. 4
Fluorescence color..... White
Persistence..... Short
Faceplate..... Gray filter-glass
Light transmission at center
(neutral density filter) approx. 66%

MECHANICAL DATA

Over-all length (Y-Z)..... 23 ± 1/4 inches
Greatest dimension of bulb:
Height (A-B)..... 15 1/4 ± 1/4 inches
Width (C-D)..... 20 1/4 ± 1/4 inches
Diagonal..... 21 1/2 ± 1/4 inches
Neck length (Z-P)*..... 7 1/2 ± 1/4 inches
Neck diameter..... 1 1/4 ± 1/4 inches
Face curvature, width
(radius R)..... 35 inches
Bulb contact to ref.
line (T-P)*..... 7 1/4 ± 1/4 inches
Min. useful screen dimensions:
Diagonal..... 20 1/4 inches
Height by width..... 13 1/4 x 19 1/4 inches
Bulb contact, recessed sm.
cavity cap..... (J1-21)
Base, sm. shell duodecal 5-pin..... (B5-57)
Bulb contact J1-21 aligns with vacant
position of pin 6..... ± 30°



21EP4A



RECTANGULAR PICTURE TUBE

Magnetic focus... cylindrical face
... gray filter-glass faceplate...
70° deflection... external conductive coating

HEATER CHARACTERISTICS

Voltage..... 6.3 volts
Current, ±10%..... 0.6 amperes

ELECTRICAL DATA

Focusing method..... Magnetic
Deflecting method..... Magnetic
Deflection angles (approximate)
Horizontal..... 65 degrees
Vertical..... 50 degrees
Diagonal..... 70 degrees

MAXIMUM RATINGS (Design center values)

Anode voltage, d-c..... 18,000 volts
Grid 2 voltage, d-c..... 500 volts
Grid 1 voltage, d-c.....
Negative bias value, d-c..... 125 volts
Positive bias value, d-c..... 0 volts
Positive peak value..... 2 volts
Peak heater-cathode voltage:
Heater negative to cathode.....
During warm-up period of 15 seconds max..... 410 volts
After equipment warm-up period..... 150 volts
Heater positive to cathode..... 150 volts

TYPICAL OPERATING CONDITIONS

Anode voltage..... 12,000 volts
Grid 2 voltage..... 300 volts
Grid 1 voltage for cutoff..... -28 to -72 volts
Focusing coil current, approx.*..... 95 ma
Ion-trap current†, JETEC coil No. 111..... 70 ma
Ion-trap magnet strength‡, (approx.)..... 35 gauss

MAXIMUM CIRCUIT VALUE

Grid 1 circuit resistance..... 1.5 megohms

CBS PICTURE TUBES

ENGINEERING DESIGN DATA

21EP4A (cont.)

NOTES

- Contains 2 inch by 2 inch contact area located 90° ccw from anode contact as viewed from base and $2\pm\frac{1}{16}$ inches above reference line.
- Reference line P determined by JETEC gauge No. 110.

21EP4A (cont.)

NOTES:

- *For JETEC focus coil No. 109, or equivalent, 3.00" from reference line with E_{c1} and E_{c2} adjusted for brightness of 30 FL on a $13\frac{1}{4}" \times 19\frac{1}{4}"$ area.
- †Visual extinction of focused raster.
- ‡As measured with single-field beam bender.

CAUTION: Shielding for X-rays is recommended for personal protection at close range if this tube is operated in excess of 16,000 volts or over Maximum Rated Anode Voltage, whichever is less. Safety glass covering tube's faceplate is usually sufficient.

21EP4B

SILVER VISION PICTURE TUBE

Type 21EP4B has an aluminized screen, otherwise it is identical to the 21EP4A.



21FP4



RECTANGULAR PICTURE TUBE

21FP4

DECEMBER 4, 1956

Similar Types
21FP4A 21FP4C

DIRECT INTERELECTRODE CAPACITANCES

Cathode to all other electrodes ... 5.0 μmf
Grid 1 to all other electrodes ... 6.0 μmf

OPTICAL DATA

Phosphor ... No. 4
Fluorescence color ... White
Persistence ... Medium
Faceplate ... Gray filter-glass
Light transmission at center
(neutral density filter) approx. 65%

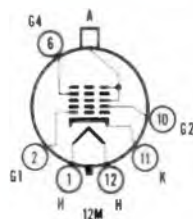
MECHANICAL DATA

Over-all length (Y-Z) ... $23\pm\frac{1}{16}$ inches
Greatest dimension of bulb:
Height (A-B) ... $15\frac{1}{16}\pm\frac{1}{16}$ inches
Width (C-D) ... $20\frac{1}{16}\pm\frac{1}{16}$ inches
Diagonal ... $21\frac{1}{16}\pm\frac{1}{16}$ inches
Neck length (Z-P)* ... $7\frac{1}{16}\pm\frac{1}{16}$ inches
Neck diameter ... $1\frac{1}{16}\pm\frac{1}{16}$ inches
Face curvature, width
(radius R) ... 35 inches
Bulb contact to ref.
line (T-P)* ... $7\frac{1}{16}\pm\frac{1}{16}$ inches
Min. useful screen dimensions:
Diagonal ... $20\frac{1}{16}$ inches
Height by width ... $13\frac{1}{16}\times 19\frac{1}{16}$ inches
Bulb contact, recessed sm.
cavity cap. ... (J1-21)
Base, sm. shell duodecal 5-pin ... (B5-57)
Bulb contact J1-21 aligns with
vacant position of pin 6 ... $\pm 30^\circ$

Electrostatic focus ... cylindrical
face ... gray filter-glass faceplate
... 70° deflection

HEATER CHARACTERISTICS

Voltage ... 6.3 volts
Current, $\pm 10\%$... 0.6 amperes



ELECTRICAL DATA

Focusing method ...	Electrostatic
Deflecting method ...	Magnetic
Deflection angles (approximate)	
Horizontal ...	65 degrees
Vertical ...	50 degrees
Diagonal ...	70 degrees

MAXIMUM RATINGS (Design center values)

Anode voltage, d-c ...	18,000 volts
Grid 4 (focusing electrode) voltage, d-c ...	-500, +1000 volts
Grid 2 voltage, d-c ...	500 volts
Grid 1 voltage, d-c ...	
Negative bias value, d-c ...	125 volts
Positive bias value, d-c ...	0 volts
Positive peak value ...	2 volts
Peak heater-cathode voltage:	
Heater negative to cathode ...	
During warm-up period of 15 seconds max. ...	410 volts
After equipment warm-up period ...	150 volts
Heater positive to cathode ...	150 volts

TYPICAL OPERATING CONDITIONS

Anode voltage ...	14,000 volts
Grid 4 (focusing electrode) voltage ...	-56 to +310 volts
Grid 2 voltage ...	300 volts
Grid 1 voltage for cutoff ...	-28 to -72 volts
Ion-trap beam bender†, JETEC coil No. 111 ...	
Ion trap magnet strength‡, (approx.) ...	35 gauss

CBS PICTURE TUBES

21FP4 (cont.)

MAXIMUM CIRCUIT VALUE

Grid 1 circuit resistance..... 1.5 megohms

NOTES:

*With the combined Grid 1 bias voltage and video-signal voltage adjusted to give an anode current of 100 microamperes on a 12½" x 17" raster.

†Visual extinction of focused raster.

‡Single-field beam bender.

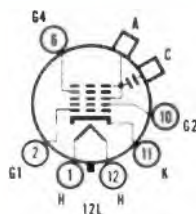
CAUTION: Shielding for X-rays is recommended for personal protection at close range if this tube is operated in excess of 16,000 volts or over Maximum Rated Anode Voltage, whichever is less. Safely glass covering tube's faceplate is usually sufficient.

21FP4A

Type 21FP4A has external conductive coating, otherwise it is identical to the 21FP4.

DIRECT INTERELECTRODE CAPACITANCES

External Conductive Coating* to Anode:
Maximum..... 750 μpF
Minimum..... 500 μpF



*Contains 2-inch x 2-inch contact area located 90° ccw from anode contact as viewed from base and 2 ± ¼ inches above reference line.

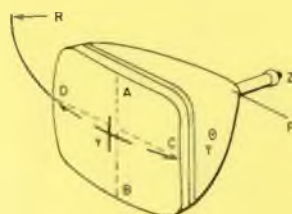
21FP4C

SILVER VISION PICTURE TUBE

Type 21FP4C has an aluminized screen, otherwise it is identical to the 21FP4A.

ENGINEERING DESIGN DATA

21FP4 (cont.)



NOTES

- † Contains 2 inch by 2 inch contact area located 90° ccw from anode contact as viewed from base and 2 ± ¼ inches above reference line.
- * Reference line P determined by JETEC gauge No. 110.



21MP4

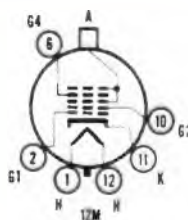


RECTANGULAR PICTURE TUBE

Electrostatic focus . . . spherical
face . . . frosted filter-glass faceplate . . . 70° deflection . . . metal cone

HEATER CHARACTERISTICS

Voltage..... 6.3 volts
Current, ±10%..... 0.6 amperes



21MP4

DECEMBER 3, 1956

DIRECT INTERELECTRODE CAPACITANCES

Cathode to all other electrodes..... 5.0 μpF
Grid 1 to all other electrodes..... 6.0 μpF

OPTICAL DATA

Phosphor..... No. 4
Fluorescence color..... White
Persistence..... Medium
Faceplate..... Frosted filter-glass
Light transmission at center
(neutral density filter) approx. 66%

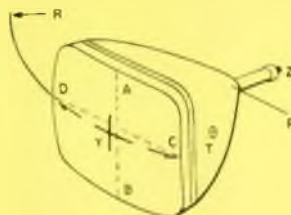
CBS PICTURE TUBES

ENGINEERING DESIGN DATA

21MP4 (cont.)

MECHANICAL DATA

Over-all length (Y-Z)	22½ inches
Greatest dimension of bulb:	
Height (A-B)	15½ ± ¼ inches
Width (C-D)	19½ ± ¼ inches
Diagonal	20½ ± ¼ inches
Neck length (Z-P)*	7½ ± ¼ inches
Neck diameter	1½ ± ¼ inches
Face curvature, height and width (radius R)	33 inches
Min. useful screen dimensions:	
Diagonal	19½ inches
Height by width	13½ × 18½ inches
Base, sm. shell duodecal 6-pin (B6-63)	
Bulb contact	Rim of metal cone



NOTES

- * Reference line P determined by JETEC gauge No. 110.

21WP4

DECEMBER 3, 1956

Similar Types
21WP4A 21ZP4

DIRECT INTERELECTRODE CAPACITANCES

Cathode to all other electrodes	5.0 μf
Grid 1 to all other electrodes	6.0 μf
External conductive coating to anode*	
Maximum	750 μf
Minimum	500 μf

OPTICAL DATA

Phosphor	No. 4
Fluorescence color	White
Persistence	Medium
Faceplate	Gray filter-glass
Light transmission at center (neutral density filter) approx.	.73%

21MP4 (cont.)

ELECTRICAL DATA

Focusing method	Electrostatic
Deflecting method	Magnetic
Deflection angles (approximate)	
Horizontal	66 degrees
Vertical	50 degrees
Diagonal	70 degrees

MAXIMUM RATINGS (Design center values)

Anode voltage, d-c	16,000 volts
Grid 4 (focusing electrode) voltage, d-c	-500, +1000 volts
Grid 2 voltage, d-c	500 volts
Grid 1 voltage, d-c	
Negative bias value, d-c	125 volts
Positive bias value, d-c	0 volts
Positive peak value	2 volts
Peak heater-cathode voltage:	
Heater negative to cathode	
During warm-up period of 15 seconds max.	410 volts
After equipment warm-up period	180 volts
Heater positive to cathode	180 volts

TYPICAL OPERATING CONDITIONS

Anode voltage	14,000 volts
Grid 4 (focusing electrode) voltage	-55 to +300 volts
Grid 2 voltage	300 volts
Grid 1 voltage for cutoff†	-28 to -72 volts
Ion-trap current‡, JETEC coil No. 117	37 ma
Ion-trap magnet strength‡, (approx.)	37 gauss

MAXIMUM CIRCUIT VALUE

Grid 1 circuit resistance	1.5 megohms
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NOTES:

- † Visual extinction of focused raster.
‡ As measured with single-field beam bender

CAUTION: Shielding for X-rays is recommended for personal protection at close range if this tube is operated in excess of 16,000 volts or over Maximum Rated Anode Voltage, whichever is less. Safety glass covering tube's faceplate is usually sufficient.



21WP4



RECTANGULAR PICTURE TUBE

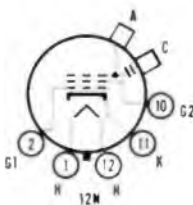
Magnetic focus . . . spherical face
. . . gray filter-glass faceplate . . .
70° deflection . . . external conductive coating

HEATER CHARACTERISTICS

Voltage	6.3 volts
Current, ±10%	0.6 amperes

ELECTRICAL DATA

Focusing method	Magnetic
Deflecting method	Magnetic
Deflection angles (approximate)	
Horizontal	66 degrees
Vertical	50 degrees
Diagonal	70 degrees



CBS PICTURE TUBES

21WP4 (cont.)

MAXIMUM RATINGS (Design center values)

Anode voltage, d-c.....	18,000 volts
Grid 2 voltage, d-c.....	500 volts
Grid 1 voltage, d-c.....	
Negative bias value, d-c.....	125 volts
Positive bias value, d-c.....	0 volts
Positive peak value.....	2 volts
Peak heater-cathode voltage:	
Heater negative to cathode.....	
During warm-up period of 15 seconds max.....	410 volts
After equipment warm-up period.....	180 volts
Heater positive to cathode.....	180 volts

TYPICAL OPERATING CONDITIONS

Anode voltage.....	16,000 volts
Grid 2 voltage.....	300 volts
Grid 1 voltage for cutoff.....	-28 to -72 volts
Focusing coil current, approx.*.....	100 ma
Ion-trap current†, JETEC coil No. 117.....	35 ma
Ion-trap magnet strength‡, (approx.).....	35 gauss

MAXIMUM CIRCUIT VALUE

Grid 1 circuit resistance.....	1.5 megohms
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NOTES:

- *For JETEC focus coil No. 109, or equivalent, 3.25" from reference line with E_{c1} and E_{c2} adjusted for brightness of 30 FL on a 12½" x 17" area
 †Visual extinction of focused raster.
 ‡As measured with single-field beam bender.

CAUTION: Shielding for X-rays is recommended for personal protection at close range if this tube is operated in excess of 16,000 volts or over Maximum Rated Anode Voltage whichever is less. Safety glass covering tube's faceplate is usually sufficient

21WP4A

SILVER VISION PICTURE TUBE

Type 21WP4A has an aluminized screen, otherwise it is identical to the 21WP4.



21XP4

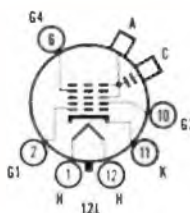


RECTANGULAR PICTURE TUBE

Electrostatic focus . . . spherical
 face . . . gray filter-glass faceplate
 . . . 70° deflection . . . external conductive coating

HEATER CHARACTERISTICS

Voltage.....	6.3 volts
Current, ±10%.....	0.6 amperes



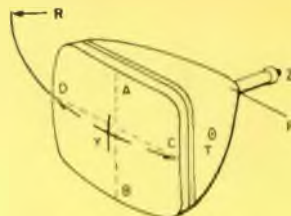
CBS PICTURE TUBES

ENGINEERING DESIGN DATA

21WP4 (cont.)

MECHANICAL DATA

Over-all length (Y-Z).....	22½ ± ½ inches
Greatest dimension of bulb:	
Height (A-B).....	14½ ± ½ inches
Width (C-D).....	18½ ± ½ inches
Diagonal.....	20½ ± ½ inches
Neck length (Z-P)*.....	7½ ± ½ inches
Neck diameter.....	1½ ± ½ inches
Face curvature, height and width (radius R).....	40 inches
Bulb contact to ref line (T-P)*.....	7½ ± ½ inches
Min. useful screen dimensions:	
Diagonal.....	19½ inches
Height by width.....	13½ x 17½ inches
Area.....	224 sq. in.
Bulb contact, recessed sm. cavity cap.....	(J1-21)
Base, sm. shell duodecal 5-pin.....	(B5-57)
Bulb contact J1-21 aligns with vacant position of pin 6.....	±30°



NOTES

- † Contains 2 inch by 2 inch contact area located 90° ccw from anode contact as viewed from base and 2 ± ¼ inches above reference line
 ★ Reference line P determined by JETEC gauge No. 110.

21XP4

DECEMBER 3, 1956

Similar Types
 21XP4A 20HP4D

DIRECT INTERELECTRODE CAPACITANCES

Cathode to all other electrodes.....	5.0 μmfd
Grid 1 to all other electrodes.....	6.0 μmfd
External conductive coating to anodes:	
Maximum.....	2500 μmfd
Minimum.....	2000 μmfd

OPTICAL DATA

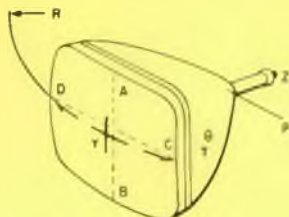
Phosphor.....	No. 4
Fluorescence color.....	White
Persistence.....	Medium
Faceplate.....	Gray filter-glass
Light transmission at center (neutral density filter) approx. 73%	

ENGINEERING DESIGN DATA

21XP4 (cont.)

MECHANICAL DATA

Over-all length (Y-Z)	22 $\frac{1}{16}$ $\pm$ $\frac{1}{16}$ inches
Greatest dimension of bulb	
Height (A-B)	14 $\frac{1}{16}$ $\pm$ $\frac{1}{16}$ inches
Width (C-D)	18 $\frac{1}{16}$ $\pm$ $\frac{1}{16}$ inches
Diagonal	20 $\frac{1}{16}$ $\pm$ $\frac{1}{16}$ inches
Neck length (Z-P) *	7 $\frac{1}{16}$ $\pm$ $\frac{1}{16}$ inches
Neck diameter	1 $\frac{1}{16}$ $\pm$ $\frac{1}{16}$ inches
Face curvature, height and width (radius R)	40 inches
Bulb contact to ref. line (T-P) *	7 $\frac{1}{16}$ $\pm$ $\frac{1}{16}$ inches
Min. useful screen dimensions:	
Diagonal	19 $\frac{1}{16}$ inches
Height by width	13 $\frac{1}{16}$ x 17 $\frac{1}{16}$ inches
Area	224 sq. in.
Bulb contact, recessed sm. cavity cap	(J1-21)
Base, sm. shell duodecal 6-pin	(86-63)
Bulb contact J1-21 aligns with vacant position of pin 6	$\pm 30^\circ$



NOTES

- Contains 2 inch by 2 inch contact area located 90° ccw from anode contact as viewed from base and $\pm 2\frac{1}{4}$ inches above reference line.
- Reference line P determined by JETEC gauge No. 110.

21YP4

DECEMBER 3, 1956

Similar Types
21YP4A 21AUP4

DIRECT INTERELECTRODE CAPACITANCES

Cathode to all other electrodes	5.0 μ f
Grid 1 to all other electrodes	6.0 μ f
External conductive coating to anode:	
Maximum	750 μ f
Minimum	500 μ f

21XP4 (cont.)

ELECTRICAL DATA

Focusing method	Electrostatic
Deflecting method	Magnetic
Deflection angles (approximate)	
Horizontal	66 degrees
Vertical	50 degrees
Diagonal	70 degrees

MAXIMUM RATINGS (Design center values)

Anode voltage, d-c	18,000 volts
Grid 4 (focusing electrode) voltage, d-c	-500, +1000 volts
Grid 2 voltage, d-c	500 volts
Grid 1 voltage, d-c	
Negative bias value, d-c	125 volts
Positive bias value, d-c	0 volts
Positive peak value	2 volts
Peak heater-cathode voltage:	
Heater negative to cathode	
During warm-up period of 15 seconds max.	410 volts
After equipment warm-up period	180 volts
Heater positive to cathode	180 volts

TYPICAL OPERATING CONDITIONS

Anode voltage	16,000 volts
Grid 4 (focusing electrode) voltage *	-64 to +352 volts
Grid 2 voltage	300 volts
Grid 1 voltage for cutoff	-28 to -72 volts
Ion-trap current [†] , JETEC coil No. 117	35 ma
Ion-trap magnet strength [‡] , (approx.)	35 gauss

MAXIMUM CIRCUIT VALUE

Grid 1 circuit resistance	1.5 megohms
-------------------------------------	-------------

NOTES:

- *With the combined Grid 1 bias voltage and video-signal voltage adjusted to give an anode current of 100 microamperes on a 12 $\frac{1}{2}$ " x 17" raster
- †Visual extinction of focused raster.
- ‡As measured with single-field beam bender.

CAUTION: Shielding for X-rays is recommended for personal protection at close range if this tube is operated in excess of 16,000 volts or over Maximum Rated Anode Voltage, whichever is less. Safety glass covering tube's faceplate is usually sufficient.

21XP4A

SILVER VISION PICTURE TUBE

Type 21XP4A has an aluminized screen, otherwise it is identical to the 21XP4.



21YP4

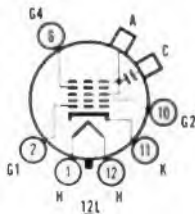


RECTANGULAR PICTURE TUBE

Electrostatic focus . . . spherical
face . . . gray filter-glass faceplate
. . . 70 deflection . . . external con-
ductive coating

HEATER CHARACTERISTICS

Voltage	6.3 volts
Current, $\pm 10\%$	0.6 amperes



CBS PICTURE TUBES

21YP4 (cont.)

ELECTRICAL DATA

Focusing method	Electrostatic
Deflecting method	Magnetic
Deflection angles (approximate)	
Horizontal	65 degrees
Vertical	50 degrees
Diagonal	70 degrees

MAXIMUM RATINGS (Design center values)

Anode voltage, d-c	18,000 volts
Grid 4 (focusing electrode) voltage, d-c	-500, +1000 volts
Grid 2 voltage, d-c	500 volts
Grid 1 voltage, d-c	
Negative bias value, d-c	140 volts
Negative peak value	200 volts
Positive bias value, d-c	0 volts
Positive peak value	2 volts
Peak heater-cathode voltage:	
Heater negative to cathode	
During warm-up period of 15 seconds max.	410 volts
After equipment warm-up period	180 volts
Heater positive to cathode	180 volts

TYPICAL OPERATING CONDITIONS

Anode voltage	14,000 volts
Grid 4 (focusing electrode) voltage	-55 to +300 volts
Grid 2 voltage	300 volts
Grid 1 voltage for cutoff	-28 to -72 volts
Ion-trap current; JETEC coil No. 117	40 ma
Ion-trap magnet strength; (approx.)	40 gauss

MAXIMUM CIRCUIT VALUE

Grid 1 circuit resistance	1.5 megohms
---------------------------	-------------

NOTES:

*With the combined Grid 1 bias voltage and video-signal voltage adjusted to give an anode current of 100 microamperes on a $14\frac{1}{16}$ " x $19\frac{1}{16}$ " raster.

†Visual extinction of focused raster.

‡As measured with single-field beam bender.

CAUTION: Shielding for X-rays is recommended for personal protection at close range if this tube is operated in excess of 16,000 volts or over Maximum Rated Anode Voltage, whichever is less. Safety glass covering tube's faceplate is usually sufficient.

21YP4A

SILVER VISION PICTURE TUBE

Type 21YP4A has an aluminized screen, otherwise it is identical to the 21YP4.

ENGINEERING DESIGN DATA

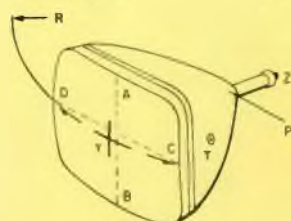
21YP4 (cont.)

OPTICAL DATA

Phosphor	No. 4
Fluorescence color	White
Persistence	Medium
Faceplate	Gray filter-glass
Light transmission at center (neutral density filter) approx.	75%

MECHANICAL DATA

Over-all length (Y-Z)	$23\pm\frac{1}{16}$ inches
Greatest dimension of bulb:	
Height (A-B)	$15\frac{1}{16}\pm\frac{1}{16}$ inches
Width (C-D)	$20\frac{1}{16}\pm\frac{1}{16}$ inches
Diagonal	$21\frac{1}{16}\pm\frac{1}{16}$ inches
Neck length (Z-P)*	$7\frac{1}{2}\pm\frac{1}{16}$ inches
Neck diameter	$1\frac{1}{16}\pm\frac{1}{16}$ inches
Face curvature, height and width (radius R)	40 inches
Bulb contact to ref. line (T-P)*	$7\frac{1}{2}\pm\frac{1}{16}$ inches
Min. useful screen dimensions:	
Diagonal	20 inches
Height by width	$14\frac{1}{16}\times 19\frac{1}{16}$ inches
Area	248 sq. in.
Bulb contact, recessed sm. cavity cap.	(J1-21)
Base, sm. shell duodecal 6-pin	(B6-63)
Bulb contact J1-21 aligns with vacant position of pin 6	$\pm 30^\circ$



NOTES

- † Contains 2 inch by 2 inch contact area located 90° ccw from anode contact as viewed from base and $2\pm\frac{1}{16}$ inches above reference line
- * Reference line P determined by JETEC gauge No. 110.

ENGINEERING DESIGN DATA

21ZP4A

DECEMBER 3, 1956

Similar Types
21ZP4 21ZP4B

DIRECT INTERELECTRODE CAPACITANCES

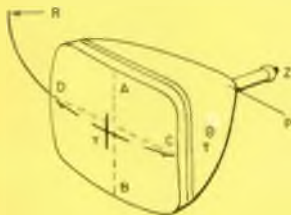
Cathode to all other electrodes	5.0 $\mu\mu\text{f}$
Grid 1 to all other electrodes	6.0 $\mu\mu\text{f}$
External conductive coating to anode†	
Maximum	750 $\mu\mu\text{f}$
Minimum	500 $\mu\mu\text{f}$

OPTICAL DATA

Phosphor	No. 4
Fluorescence color	White
Persistence	Medium
Faceplate	Gray filter-glass
Light transmission at center (neutral density filter) approx.	75%

MECHANICAL DATA

Over-all length (Y-Z)	23 1/2 $\pm$ 1/16 inches
Greatest dimension of bulb:	
Height (A-B)	15 1/4 $\pm$ 1/16 inches
Width (C-D)	20 1/4 $\pm$ 1/16 inches
Diagonal	21 3/32 $\pm$ 1/16 inches
Neck length (Z-P)*	7 1/2 $\pm$ 1/16 inches
Neck diameter	1 1/16 $\pm$ 1/16 inches
Face curvature, height and width (radius R)	40 inches
Bulb contact to ref. line (T-P)*	7 1/2 $\pm$ 1/16 inches
Min. useful screen dimensions:	
Diagonal	20 inches
Height by width	14 1/16 x 19 1/16 inches
Area	248 sq. in.
Bulb contact, recessed sm. cavity cap.	(J1-21)
Base, sm. shell duodecal 5-pin	(85-56)
Bulb contact J1-21 aligns with vacant position of pin 6	$\pm$ 30°



NOTES

- † Contains 2 inch by 2 inch contact area located 90° ccw from anode contact as viewed from base and 2 $\pm$ 1/4 inches above reference line.
- * Reference line P determined by JETEC gauge No. 110.

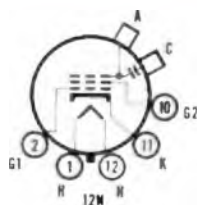


21ZP4A



RECTANGULAR PICTURE TUBE

Magnetic focus - - - spherical face
... gray filter-glass faceplate ...
70° deflection ... external conductive coating



HEATER CHARACTERISTICS

Voltage	6.3 volts
Current, $\pm$ 10%	0.6 amperes

ELECTRICAL DATA

Focusing method	Magnetic
Deflecting method	Magnetic
Deflection angles (approximate)	
Horizontal	65 degrees
Vertical	50 degrees
Diagonal	70 degrees

MAXIMUM RATINGS (Design center values)

Anode voltage, d-c	18,000 volts
Grid 2 voltage, d-c	500 volts
Grid 1 voltage, d-c	
Negative bias value, d-c	140 volts
Negative peak value	200 volts
Positive bias value, d-c	0 volts
Positive peak value	2 volts
Peak heater-cathode voltage:	
Heater negative to cathode	
During warm-up period of 15 seconds max.	410 volts
After equipment warm-up period	180 volts
Heater positive to cathode	180 volts

TYPICAL OPERATING CONDITIONS

Anode voltage	16,000 volts
Grid 2 voltage	300 volts
Grid 1 voltage for cutoff†	-28 to -72 volts
Focusing coil current, approx.*	100 ma
Ion-trap current‡, JETEC coil No. 111	95 ma
Ion-trap magnet strength‡, (approx.)	45 gauss

MAXIMUM CIRCUIT VALUE

Grid 1 circuit resistance	1.5 megohms
---------------------------	-------------

NOTES:

- *For JETEC focus coil No. 109, or equivalent, 3.00" from reference line with E_{c1} and E_{c2} adjusted for brightness of 30 FL on a 14 1/16" x 19 1/16" area
- †Visual extinction of focused raster.
- ‡As measured with single-field beam bender.

CAUTION: Shielding for X-rays is recommended for personal protection at close range if this tube is operated in excess of 16,000 volts or over Maximum Rated Anode Voltage, whichever is less. Safety glass covering tube's faceplate is usually sufficient.

21ZP4B

SILVER VISION PICTURE TUBE

Type 21ZP4B has an aluminized screen, otherwise it is identical to the 21ZP4A.

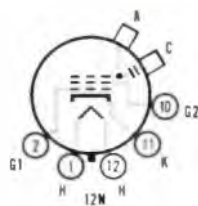
CBS PICTURE TUBES

CBS**24ADP4****RECTANGULAR PICTURE TUBE**

Magnetic focus . . . spherical face
 . . . gray filter-glass faceplate . . .
 90° deflection . . . external conduc-
 tive coating . . . aluminized screen

HEATER CHARACTERISTICS

Voltage 6.3 volts
 Current, $\pm 10\%$ 0.6 amperes

**ELECTRICAL DATA**

Focusing method Magnetic
 Deflecting method Magnetic
 Deflection angles (approximate)
 Horizontal 85 degrees
 Vertical 68 degrees
 Diagonal 90 degrees

MAXIMUM RATINGS (Absolute maximum values)

Anode voltage, d-c 24,200 volts
 Grid 2 voltage, d-c 660 volts
 Grid 1 voltage, d-c
 Negative bias value, d-c 155 volts
 Negative peak value 220 volts
 Positive bias value, d-c 0 volts
 Positive peak value 2 volts
 Peak heater-cathode voltage:
 Heater negative to cathode
 During warm-up period of 15 seconds max. 450 volts
 After equipment warm-up period 200 volts
 Heater positive to cathode 200 volts

TYPICAL OPERATING CONDITIONS

Anode voltage 18,000 volts
 Grid 2 voltage 300 volts
 Grid 1 voltage for cutoff -28 to -72 volts
 Focusing coil current, approx.* 125 ma
 Ion-trap current†, JETEC coil No. 117 32 ma
 Ion-trap magnet strength‡, (approx.) 36 gauss

MAXIMUM CIRCUIT VALUE

Grid 1 circuit resistance 1.5 megohms

NOTES:

*For JETEC focus coil No. 109, or equivalent, 3.00" from reference line with E_{c1} and E_{c2} sig. adjusted for brightness of 30 FL on a $16\frac{1}{8}'' \times 21\frac{1}{16}''$ area

†Visual extinction of focused raster.

‡As measured with single-field beam bender.

CAUTION: Shielding for X-rays is recommended for personal protection at close range if this tube is operated in excess of 16,000 volts or over Maximum Rated Anode Voltage, whichever is less. Safety glass covering tube's faceplate is usually sufficient.

**ENGINEERING
DESIGN DATA****24ADP4**

DECEMBER 5, 1956

**DIRECT INTERELECTRODE
CAPACITANCES**

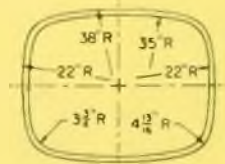
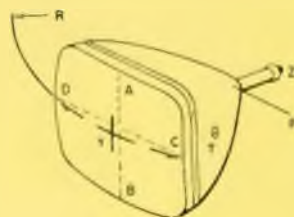
Cathode to all other electrodes $5.0 \mu\mu$
 Grid 1 to all other electrodes $6.0 \mu\mu$
 External conductive coating to anode:
 Maximum $2500 \mu\mu$
 Minimum $2000 \mu\mu$

OPTICAL DATA

Phosphor No. 4
 Fluorescence color White
 Persistence Medium
 Faceplate Gray filter-glass
 Light transmission at center
 (neutral density filter) approx. 75%

MECHANICAL DATA

Over-all length (Y-Z) $21\frac{1}{2} \pm \frac{1}{8}$ inches
 Greatest dimension of bulb:
 Height (A-B) $18\frac{1}{16} \pm \frac{1}{16}$ inches
 Width (C-D) $22\frac{1}{16} \pm \frac{1}{16}$ inches
 Diagonal $24 \pm \frac{1}{16}$ inches
 Neck length (Z-P)* $7\frac{1}{2} \pm \frac{1}{16}$ inches
 Neck diameter $1\frac{1}{16} \pm \frac{1}{16}$ inches
 Face curvature, height and width
 (radius R) 40 inches
 Bulb contact to ref.
 line (T-P)† $5\frac{1}{4} \pm \frac{1}{16}$ inches
 Min. useful screen dimensions:
 Diagonal $22\frac{1}{16}$ inches
 Height by width $16\frac{1}{2} \times 21\frac{1}{16}$ inches
 Area 332 sq. in.
 Bulb contact, recessed sm.
 cavity cap. (J1-21)
 Base, sm. shell duodecal 5-pin (B5-57)
 Bulb contact J1-21 aligns with vacant
 position of pin 6 $\pm 30^\circ$

**NOTES**

♦ Contains 2 inch by 2 inch contact area located 90° ccw from anode contact as viewed from base and $2 \pm \frac{1}{4}$ inches above reference line.

*Reference line P determined by JETEC gauge No. 116.

ENGINEERING DESIGN DATA

24CP4A

DECEMBER 5, 1956

Similar Types
24TP4* 24VP4

DIRECT INTERELECTRODE CAPACITANCES

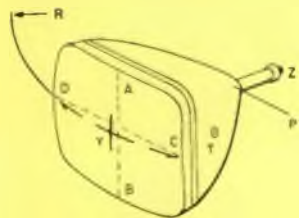
Cathode to all other electrodes	5.0 μpF
Grid 1 to all other electrodes	6.0 μpF
External conductive coating to anode†	
Maximum	2500 μpF
Minimum	2000 μpF

OPTICAL DATA

Phosphor	No. 4
Fluorescence color	White
Persistence	Medium
Faceplate	Gray filter-glass
Light transmission at center (neutral density filter) approx.	75%

MECHANICAL DATA

Over-all length (Y-Z)	2 1/4 $\pm$ 1/8 inches
Greatest dimension of bulb:	
Height (A-B)	1 7/8 $\pm$ 1/8 inches
Width (C-D)	2 1/8 $\pm$ 1/8 inches
Diagonal	2 4/8 $\pm$ 1/8 inches
Neck length (Z-P)*	7/8 $\pm$ 1/8 inches
Neck diameter	1 1/8 $\pm$ 1/8 inches
Face curvature, height and width (radius R)	40 inches
Bulb contact to ref.	
line (T-P)*	5 1/4 $\pm$ 1/8 inches
Min. useful screen dimensions:	
Diagonal	2 1/8 inches
Height by width	1 6/8 $\times$ 2 1/8 inches
Area	332 sq. in.
Bulb contact, recessed sm. cavity cap.	(J1-21)
Base, sm. shell duodecal 6-pin	(B6-63)
Bulb contact J1-21 aligns with vacant position of pin 6.	$\pm$ 30°



NOTES

- * May be branded 24TP4, 24CP4A.
- † Contains 2 inch by 2 inch contact area located 90° ccw from anode contact as viewed from base and 2 $\pm$ 1/8 inches above reference line.
- * Reference line P determined by JETEC gauge No. 116.

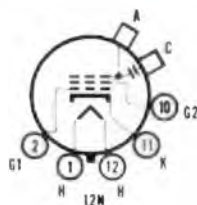


24CP4A



RECTANGULAR PICTURE TUBE

Magnetic focus . . . spherical face
. . . gray filter-glass faceplate . . . 90°
deflection . . . external conductive
coating . . . aluminized screen



HEATER CHARACTERISTICS

Voltage	6.3 volts
Current, $\pm$ 10%	0.6 amperes

ELECTRICAL DATA

Focusing method	Magnetic
Deflecting method	Magnetic
Deflection angles (approximate)	
Horizontal	85 degrees
Vertical	68 degrees
Diagonal	90 degrees

MAXIMUM RATINGS (Design center values)

Anode voltage, d-c	20,000 volts
Grid 2 voltage, d-c	500 volts
Grid 1 voltage, d-c	
Negative bias value, d-c	140 volts
Negative peak value	200 volts
Positive bias value, d-c	0 volts
Positive peak value	2 volts
Peak heater-cathode voltage:	
Heater negative to cathode	
During warm-up period of 15 seconds max.	410 volts
After equipment warm-up period	180 volts
Heater positive to cathode	180 volts

TYPICAL OPERATING CONDITIONS

Anode voltage	16,000 volts
Grid 2 voltage	300 volts
Grid 1 voltage for cutoff†	-28 to -72 volts
Focusing coil current, approx.*	105 ma
Ion-trap current‡, JETEC coil No. 111	85 ma

MAXIMUM CIRCUIT VALUE

Grid 1 circuit resistance	1.5 megohms
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NOTES:

*For JETEC focus coil No. 109, or equivalent, 3.00" from reference line with E_{c1} and E_{c2} adjusted for brightness of 25 fL on a 1 1/4" $\times$ 2 1/8" area.

†Visual extinction of focused raster.

‡As measured with single-field beam bender.

CAUTION: Shielding for X-rays is recommended for personal protection at close range if this tube is operated in excess of 16,000 volts or over Maximum Rated Anode Voltage, whichever is less. Safety glass covering tube's faceplate is usually sufficient.



24DP4A

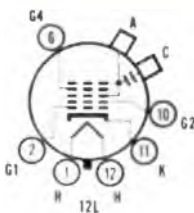


RECTANGULAR PICTURE TUBE

Electrostatic focus...spherical face
... gray filter-glass faceplate ...
90° deflection ... external conduc-
tive coating ... aluminized screen

HEATER CHARACTERISTICS

Voltage	6.3 volts
Current, $\pm 10\%$	0.6 amperes



ELECTRICAL DATA

Focusing method	Electrostatic
Deflecting method	Magnetic
Deflection angles (approximate)	
Horizontal	85 degrees
Vertical	68 degrees
Diagonal	90 degrees

MAXIMUM RATINGS (Design center values)

Anode voltage, d-c	20,000 volts
Grid 4 (focusing electrode) voltage, d-c	-500, +1000 volts
Grid 2 voltage, d-c	500 volts
Grid 1 voltage, d-c	
Negative bias value, d-c	140 volts
Negative peak value	200 volts
Positive bias value, d-c	0 volts
Positive peak value	2 volts
Peak heater-cathode voltage:	
Heater negative to cathode	
During warm-up period of 15 seconds max.	410 volts
After equipment warm-up period	180 volts
Heater positive to cathode	180 volts

TYPICAL OPERATING CONDITIONS

Anode voltage	16,000 volts
Grid 4 (focusing electrode) voltage*	-64 to +350 volts
Grid 2 voltage	300 volts
Grid 1 voltage for cutoff†	-28 to -72 volts
Ion-trap current‡, JETEC coil No. 117	33 ma
Ion-trap magnet strength‡ (approx.)	33 gauss

MAXIMUM CIRCUIT VALUE

Grid 1 circuit resistance	1.5 megohms
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NOTES:

- *With the combined Grid 1 bias voltage and video-signal voltage adjusted to give an anode current of 100 microamperes on a $16\frac{1}{8}'' \times 21\frac{1}{8}''$ raster.
- †Visual extinction of focused raster.
- ‡As measured with single-field beam bender.

CAUTION: Shielding for X-rays is recommended for personal protection at close range if this tube is operated in excess of 16,000 volts or over Maximum Rated Anode Voltage, whichever is less. Safety glass covering tube's faceplate is usually sufficient.

ENGINEERING DESIGN DATA

24DP4A

DECEMBER 5, 1956

Similar Types
24DP4 24YP4

DIRECT INTERELECTRODE CAPACITANCES

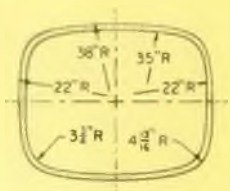
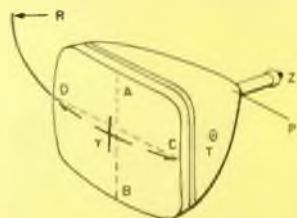
Cathode to all other electrodes	5.0 $\mu\mu\text{f}$
Grid 1 to all other electrodes	6.0 $\mu\mu\text{f}$
External conductive coating to anodes	2400 $\mu\mu\text{f}$
Maximum	
Minimum	2000 $\mu\mu\text{f}$

OPTICAL DATA

Phosphor	No. 4
Fluorescence color	White
Persistence	Medium
Faceplate	Gray filter-glass
Light transmission at center (neutral density filter) approx.	75%

MECHANICAL DATA

Over-all length (Y-Z)	21 $\pm$ $\frac{1}{8}$ inches
Greatest dimension of bulb:	
Height (A-B)	18 $\frac{1}{16} \pm \frac{1}{16}$ inches
Width (C-D)	22 $\frac{1}{16} \pm \frac{1}{16}$ inches
Diagonal	24 $\pm \frac{1}{8}$ inches
Neck length (Z-P)*	7 $\frac{1}{2} \pm \frac{1}{16}$ inches
Neck diameter	1 $\frac{1}{16} \pm \frac{1}{16}$ inches
Face curvature, height and width (radius R)	.40 inches
Bulb contact to ref. line (T-P)*	5 $\frac{1}{4} \pm \frac{1}{8}$ inches
Min. useful screen dimensions:	
Diagonal	22 $\frac{1}{16}$ inches
Height by width	16 $\frac{1}{2} \times 21 \frac{1}{8}$ inches
Area	332 sq. in.
Bulb contact, recessed sm. cavity cap.	(J1-21)
Base, sm. shell duodecal 6-pin	(B6-63)
Bulb contact J1-21 aligns with vacant position of pin 6	$\pm 30^\circ$



NOTES

- * Contains 2 inch by 2 inch contact area located 90° ccw from anode contact as viewed from base and $2 \pm \frac{1}{8}$ inches above reference line.
- * Reference line P determined by JETEC gauge No. 116.

ENGINEERING DESIGN DATA

24TP4

DECEMBER 5, 1956

Similar Types

24CP4A* 24VP4
24QP4 24XP4

DIRECT INTERELECTRODE CAPACITANCES

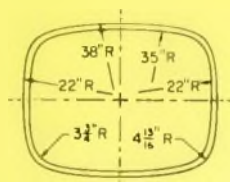
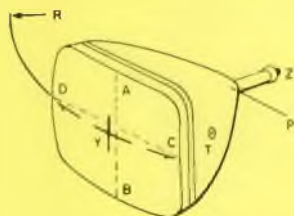
Cathode to all other electrodes	5.0 $\mu\mu\text{f}$
Grid 1 to all other electrodes	6.0 $\mu\mu\text{f}$
External conductive coating to anode	
Maximum	2500 $\mu\mu\text{f}$
Minimum	250 $\mu\mu\text{f}$

OPTICAL DATA

Phosphor	No. 4
Fluorescence color	White
Persistence	Medium
Faceplate	Gray filter-glass
Light transmission at center (neutral density filter) approx.	72%

MECHANICAL DATA

Over-all length (Y-Z)	21 $\frac{1}{2}$ $\pm$ $\frac{1}{8}$ inches
Greatest dimension of bulb:	
Height (A-B)	18 $\frac{1}{16}$ $\pm$ $\frac{1}{8}$ inches
Width (C-D)	22 $\frac{1}{16}$ $\pm$ $\frac{1}{8}$ inches
Diagonal	24 $\pm$ $\frac{1}{8}$ inches
Neck length (Z-P)*	7 $\frac{1}{2}$ $\pm$ $\frac{1}{8}$ inches
Neck diameter	1 $\frac{1}{16}$ $\pm$ $\frac{1}{8}$ inches
Face curvature, height and width (radius R)	.40 inches
Bulb contact to ref. line (T-P)*	5 $\frac{1}{2}$ $\pm$ $\frac{1}{8}$ inches
Min. useful screen dimensions:	
Height by width	17 $\frac{1}{8}$ $\times$ 21 $\frac{1}{8}$ inches
Area	320 sq. in.
Bulb contact, recessed sm. cavity cap.	(J1-21)
Base, sm. shell duodecal 5-pin	(B5-57)
Bulb contact J1-21 aligns with vacant position of pin 6	$\pm 30^\circ$



NOTES

- * May be branded 24TP4/24CP4A.
- † Contains 2 inch by 2 inch contact area located 90° ccw from anode contact as viewed from base and 2 $\pm$ $\frac{1}{8}$ inches above reference line.
- * Reference line P determined by JETEC gauge No. 116.

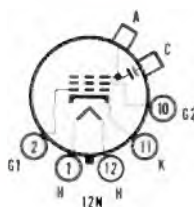


24TP4



RECTANGULAR PICTURE TUBE

Magnetic focus . . . spherical face
. . . gray filter-glass faceplate . . .
90° deflection . . . external conductive
coating . . . aluminized screen



HEATER CHARACTERISTICS

Voltage	6.3 volts
Current, $\pm 10\%$	0.6 amperes

ELECTRICAL DATA

Focusing method	Magnetic
Deflecting method	Magnetic
Deflection angles (approximate)	
Horizontal	85 degrees
Vertical	68 degrees
Diagonal	90 degrees

MAXIMUM RATINGS (Design center values)

Anode voltage, d-c	20,000 volts
Grid 2 voltage, d-c	500 volts
Grid 1 voltage, d-c	
Negative bias value, d-c	125 volts
Positive bias value, d-c	0 volts
Positive peak value	2 volts
Peak heater-cathode voltage:	
Heater negative to cathode	
During warm-up period of 15 seconds max.	410 volts
After equipment warm-up period	180 volts
Heater positive to cathode	180 volts

TYPICAL OPERATING CONDITIONS

Anode voltage	14,000 volts
Grid 2 voltage	300 volts
Grid 1 voltage for cutoff†	-28 to -72 volts
Focusing coil current, approx.*	110 ma
Ion-trap current†, JETEC coil No. 117	36 ma
Ion-trap magnet strength†, (approx.)	36 gauss

MAXIMUM CIRCUIT VALUE

Grid 1 circuit resistance	1.5 megohms
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NOTES:

- †Visual extinction of focused raster.
- †As measured with single-field beam bender.

CAUTION: Shielding for X-rays is recommended for personal protection at close range if this tube is operated in excess of 16,000 volts or over Maximum Rated Anode Voltage, whichever is less. Safety glass covering tube's faceplate is usually sufficient.



24VP4A



RECTANGULAR PICTURE TUBE

Magnetic focus . . . spherical face
 . . . gray filter-glass faceplate . . .
 90° deflection . . . external conduc-
 tive coating . . . aluminized screen

HEATER CHARACTERISTICS

Voltage 6.3 volts
 Current, $\pm 10\%$ 0.6 amperes

ELECTRICAL DATA

Focusing method Magnetic
 Deflecting method Magnetic
 Deflection angles (approximate)
 Horizontal 85 degrees
 Vertical 68 degrees
 Diagonal 90 degrees

MAXIMUM RATINGS (Design center values)

Anode voltage, d-c 22,000 volts
 Grid 2 voltage, d-c 600 volts
 Grid 1 voltage, d-c
 Negative bias value, d-c 165 volts
 Negative peak value 240 volts
 Positive bias value, d-c 0 volts
 Positive peak value 2 volts
 Peak heater-cathode voltage:
 Heater negative to cathode
 During warm-up period of 15 seconds max. 410 volts
 After equipment warm-up period 180 volts
 Heater positive to cathode 180 volts

TYPICAL OPERATING CONDITIONS

Anode voltage 20,000 volts
 Grid 2 voltage 300 volts
 Grid 1 voltage for cutoff† -28 to -72 volts
 Focusing coil current, approx. * 125 ma
 Ion-trap current†, JETEC coil No. 111 135 ma
 Ion-trap magnet strength†, (approx.) 40 gauss

MAXIMUM CIRCUIT VALUE

Grid 1 circuit resistance 1.5 megohms

NOTES:

*For JETEC focus coil No. 109, or equivalent, 3.00" from reference line with E_{c1} and E_{c1s1} adjusted for brightness of 20 FL on a $16\frac{1}{16}" \times 21\frac{1}{16}"$ area.
 †Visual extinction of focused raster.
 ‡As measured with single-field beam bender.

CAUTION: Shielding for X-rays is recommended for personal protection at close range if this tube is operated in excess of 16,000 volts or over Maximum Rated Anode Voltage, whichever is less. Safety glass covering tube's faceplate is usually sufficient.

24YP4

SILVER VISION PICTURE TUBE

Type 24YP4 has an external conductive coating of 2000 to 2500 μf capacitance, otherwise it is identical to the 24DP4A.

CBS PICTURE TUBES

ENGINEERING DESIGN DATA

24VP4A

DECEMBER 5, 1956

Similar Types

24VP4 24CP4
 24QP4 24TP4

DIRECT INTERELECTRODE CAPACITANCES

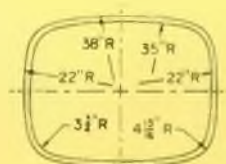
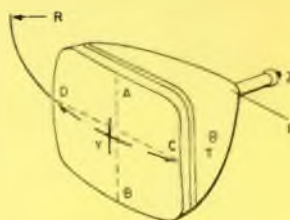
Cathode to all other electrodes 50 μf
 Grid 1 to all other electrodes 60 μf
 External conductive coating to anode:
 Maximum 2500 μf
 Minimum 2000 μf

OPTICAL DATA

Phosphor No. 4
 Fluorescence color White
 Persistence Medium
 Faceplate Gray filter-glass
 Light transmission at center
 (neutral density filter) approx. 75%

MECHANICAL DATA

Over-all length (Y-Z) $21\frac{1}{4} \pm \frac{1}{8}$ inches
 Greatest dimension of bulb
 Height (A-B) $18\frac{1}{16} \pm \frac{1}{16}$ inches
 Width (C-D) $22\frac{1}{4} \pm \frac{1}{8}$ inches
 Diagonal $24 \pm \frac{1}{8}$ inches
 Neck length (Z-P) $7\frac{1}{2} \pm \frac{1}{16}$ inches
 Neck diameter $1\frac{1}{16} \pm \frac{1}{16}$ inches
 Face curvature, height and width
 (radius R) 40 inches
 Bulb contact to ref.
 line (T-P) $5\frac{1}{4} \pm \frac{1}{8}$ inches
 Min. useful screen dimensions:
 Diagonal $22\frac{1}{16} \pm \frac{1}{16}$ inches
 Height by width $16\frac{1}{2} \times 21\frac{1}{16}$ inches
 Area 332 sq. in.
 Bulb contact, recessed sm.
 cavity cap. (11-21)
 Base, sm. shell duodecal 5-pin (85-57)
 Bulb contact J1-21 aligns with vacant
 position of pin 6 $\pm 30^\circ$



NOTES

- † Contains 2 inch by 2 inch contact area located 90° ccw from anode contact as viewed from base and $2 \pm \frac{1}{4}$ inches above reference line.
- * Reference line P determined by JETEC gauge No. 116.

ENGINEERING DESIGN DATA

27EP4

DECEMBER 5, 1956

Similar Types
27RP4 27LP4

DIRECT INTERELECTRODE CAPACITANCES

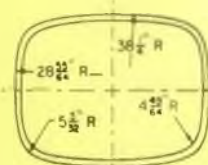
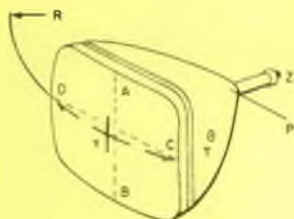
Cathode to all other electrodes... 5.0 μf
Grid 1 to all other electrodes... 6.0 μf

OPTICAL DATA

Phosphor... No. 4
Fluorescence color... White
Persistence... Medium
Faceplate... Gray filter-glass
Light transmission at center
(neutral density filter) approx. 66%

MECHANICAL DATA

Over-all length (Y-Z)... $23\frac{1}{16} \pm \frac{1}{16}$ inches
Greatest dimension of bulb:
Height (A-B)... $20\frac{5}{16} \pm \frac{1}{16}$ inches
Width (C-D)... $25\frac{5}{16} \pm \frac{1}{16}$ inches
Diagonal... $26\frac{1}{16} \pm \frac{1}{16}$ inches
Neck length (Z-P)*... $7\frac{1}{16} \pm \frac{1}{16}$ inches
Neck diameter... $1\frac{1}{16} \pm \frac{1}{16}$ inches
Face curvature, height and width
(radius R)... 40 inches
Bulb contact to ref.
line (T-P)*... $6\frac{1}{16} \pm \frac{1}{16}$ inches
Min. useful screen dimensions:
Diagonal... 25 $\frac{1}{16}$ inches
Height by width... $18\frac{1}{2} \times 24$ inches
Bulb contact, recessed sm.
cavity cap... (J1-21)
Base, sm. shell duodecal 5-pin (B5-57)
Bulb contact J1-21 aligns with vacant
position of pin 6... $\pm 30^\circ$



NOTES

* Reference line P determined by JETEC gauge No. 116.



27EP4

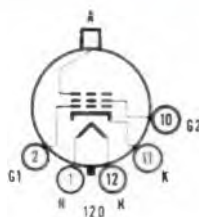


RECTANGULAR PICTURE TUBE

Magnetic focus... spherical face
... gray filter-glass faceplate...
90° deflection... aluminized screen

HEATER CHARACTERISTICS

Voltage... 6.3 volts
Current, $\pm 10\%$... 0.6 amperes



ELECTRICAL DATA

Focusing method... Magnetic
Deflecting method... Magnetic
Deflection angles (approximate):
Horizontal... 85 degrees
Vertical... 68 degrees
Diagonal... 90 degrees

MAXIMUM RATINGS (Design center values)

Anode voltage, d-c... 20,000 volts
Grid 2 voltage, d-c... 500 volts
Grid 1 voltage, d-c...
Negative bias value, d-c... 125 volts
Positive bias value, d-c... 0 volts
Positive peak value... 2 volts
Peak heater-cathode voltage:
Heater negative to cathode...
During warm-up period of 15 seconds max... 410 volts
After equipment warm-up period... 180 volts
Heater positive to cathode... 180 volts

TYPICAL OPERATING CONDITIONS

Anode voltage... 16,000 volts
Grid 2 voltage... 300 volts
Grid 1 voltage for cutoff... -28 to -72 volts
Focusing coil current, approx.*... 105 ma
Ion-trap current†, JETEC coil No. 111... 85 ma

MAXIMUM CIRCUIT VALUE

Grid 1 circuit resistance... 1.5 megohms

NOTES:

*For JETEC focus coil No. 109, or equivalent, 3.00" from reference line with E_{ci} and E_{co} adjusted for brightness of 20 FL on a 18 1/2" x 24" area.

†Visual extinction of focused raster.

‡As measured with single-field beam bender.

CAUTION: Shielding for X-rays is recommended for personal protection at close range if this tube is operated in excess of 16,000 volts or over Maximum Rated Anode Voltage, whichever is less. Safety glass covering tube's faceplate is usually sufficient.

27RP4

SILVER VISION PICTURE TUBE

Type 27RP4 has external conductive coating, otherwise it is identical to the 27EP4. See type 24VP4A for basing.

DIRECT INTERELECTRODE CAPACITANCES

External Conductive Coating* to Anode:
Maximum... 750 μf
Minimum... 500 μf

*Contains 2-inch x 2-inch contact area located 90° ccw from anode contact as viewed from base and $2 \pm \frac{1}{16}$ inches above reference line.

CBS PICTURE TUBES



PICTURE TUBE REFERENCE GUIDE

Contains all picture tubes for television,
including color picture tubes.

CBS PICTURE TUBES

WILL



PICTURE TUBE REFERENCE GUIDE





TELEVISION PICTURE TUBES (Color Types)

	GENERAL DESCRIPTION										RATINGS†		TYPICAL OPERATION			
TYPE	FACE PLATE (SEE NOTES)	ENVELOPE	DEFLECTION ANGLE‡	FOCUSING	CONVERGENCE	BASING	MAX. OVER-ALL LENGTH (IN.)	MAX. DIAMETER OF HT. X WD. (IN.)	CAPACITANCE OF BULB COATING (pF)	ANODE VOLTS	GRID 2 VOLTS	ANODE VOLTS	FOCUSING VOLTS*	GRID 2 VOLTS	CONVERGENCE VOLTS‡	TYPE
15GP22	C, S, Ro, A	Glass	45°	Electro.	Electro.	15GP22	26¼	15%	1500-3000	20,000	500	20,000	2400 to 3800	140 to 315	8500 to 10,200	15GP22
15HP22	C, S, Ro, A	Glass	45°	Electro.	Electro.	15HP22	26¼	15%	1500-2500	20,000	500	20,000	3100	240	9300	15HP22
19TP22	C, S, Ro, A	Glass	60°	Electro.	Electro.	19TP22	24¾	20-4, 5	1500-3000	22,000	500	20,000	1950 to 3250	200	8500 to 10,200	19TP22
19VP22	C, S, Ro, A	Glass	62°	Electro.	Magnetic	14W	26¼	20 7/8	1500-3000	27,000	500	25,000	6500 to 8000	150 to 330	—	19VP22
21AXP22	C, S, Ro, A	Metal	70°	Electro.	Magnetic	14W	25¼	21¼	—	25,000	800	25,000	3800 to 5300	140 to 310	—	21AXP22
21AXP22A	C, S, Ro, A	Metal	70°	Electro.	Magnetic	14AH	25¼	21¼	—	25,000	800	25,000	3800 to 5300	130 to 370	—	21AXP22A

NOTES:

All tubes in this section contain three electron-beam sources with heater ratings of 6.3 volts and 1.8 amperes total current (heaters electrically paralleled within the tube). The screens of the tubes are of the tri-color (red, green, and blue), phosphor-dot type.

All tubes in this section are magnetically deflected.

Face-Plate Code: C—clear, G—gray, Ro—round, S—spherical.

*For each of the three electron-beam sources. ‡Does not include the dynamic convergence component.

§ Horizontal deflection angle is given.

†Design-center values.



TELEVISION PICTURE TUBES (Monochrome Types)

TYPE	GENERAL DESCRIPTION										RATINGS†		TYPICAL OPERATION		
	FACE-PLATE (SEE NOTES)	ENVELOPE	DEFLECTION ANGLES	FOCUSING	BASING	MAX. OVER-ALL LENGTH (IN.)	MAX. DIAMETER OF HT. X WD. (IN.)	CAPACITANCE OF BULB COATING (p.p.f.)	ION TRAP MAGNET	ANODE VOLTS	GRID 2 VOLTS	ANODE VOLTS	FOCUSING VOLTS	GRID 2 VOLTS	TYPE
3NP4	C, S, Ro, A	Glass	42°	Magnetic	5BV	10½	2½½	275-375	None	25,000	—	24,000	—	—	3NP4
5ACP4	C, S, Ro, A	Glass	53°	Electro.	8EQ	11½	5½½	No Coating	None	18,000	410	12,000	0	250	5ACP4
5AXP4	C, S, Ro	Glass	53°	Auto-Electro.	12S	11	5½½	No Coating	None	18,000	500	14,000	—	300	5AXP4
5AZP4	C, S, Ro, A	Glass	50°	Electro.	12AA	12½½	5½	No Coating	None	40,000	400	36,000	6650 to 8100	200	5AZP4
5FP4A	C, S, Ro	Glass	53°	Magnetic	5AN	11½	5½½	No Coating	None	8000	410	6,000	—	250	5FP4A
5QP4	C, S, Ro, A	Glass	53°	Magnetic	5AN	11½	5½½	No Coating	None	12,000	410	10,000	—	300	5QP4
5QP4A	C, S, Ro, A	Glass	53°	Magnetic	5AN	11½	5½½	No Coating	None	12,000	700	10,000	—	300	5QP4A
5TP4	C, S, Ro, A	Glass	50°	Electro.	12C	12½	5½	100-500	None	27,000	350	27,000	4900	200	5TP4
7AP4	C, S, Ro	Glass	55°	Electro.	5AJ	13½	7½	No Coating	None	3500	No Grid	3500	675	—	7AP4
7CP4	C, S, Ro	Glass	57°	Electro.	8BQ	13½½	7½	No Coating	None	8000	410	6000	1140	250	7CP4
7DP4	C, S, Ro	Glass	50°	Electro.	12R	14½½	7½½	400-1500	Double	8000	410	6000	1200 to 1650	250	7DP4
7HP4	C, S, Ro	Glass	50°	Magnetic	12N	13½	7½½	500	Double	8800	450	6000	—	250	7HP4
7NP4	C, S, Ro, A	Glass	35°	Electro.	14N	20½	7½½	No Coating	None	80,000	600	75,000	15K to 17K	400-600	7NP4
7QP4	C, S, Ro	Glass	52°	Magnetic	12D	13½	7½½	No Coating	Single	10,000	410	8000	—	300	7QP4
7RP4	C, S, Ro, A	Glass	50°	Magnetic	12D	14½½	7½½	No Coating	None	12,000	410	9000	—	250	7RP4
7TP4	C, S, Ro, A	Glass	50°	Electro.	12Q	13½	7½½	No Coating	None	12,000	410	10,000	1170 to 1590	200	7TP4
7WP4	C, S, Ro, A	Glass	35°	Electro.	14N	20½	7½½	Has Coating	None	80,000	600	75,000	16K to 18K	400-600	7WP4

8AP4	C, S, Ro	Metal	54°	Magnetic	12M	14%	8 ¹¹ / ₁₆	—	Single	9000	No Grid	7000	—	—	8AP4
8AP4A	G, S, Ro	Metal	54°	Magnetic	12M	14%	8 ¹¹ / ₁₆	—	Single	9000	No Grid	7000	—	—	8AP4A
8DP4	G, S, Re	Glass	85°	Electro.	12AB	10%	6 ¹ / ₂ x 7 ¹⁵ / ₁₆	250-350	Single	8,000	300	6,000	15 to 315	150	8DP4
8XP4	G, S, Re	Glass	85°	Self Electro.	12S	11%	6 ¹ / ₂ x 7 ¹⁵ / ₁₆	No Coating	None	22,000	550	16,000	—	300	8XP4
9AP4	C, S, Ro	Glass	40°	Electro.	6AL	21%	9%	No Coating	None	7000	250	7000	1190 to 1790	250	9AP4
9CP4	C, S, Ro	Glass	—	Magnetic	4AF	15%	9	No Coating	None	7000	No Grid	7000	—	—	9CP4
10ABP4	C, S, Re	Glass	85°	Electro.	12L	11%	7 ³ / ₈ x 9%	400-850	Single	12,000	500	7500	0 to +500	300	10ABP4
10ABP4A	C, S, Re, A	Glass	85°	Electro.	12L	11%	7 ³ / ₈ x 9%	400-850	Single	12,000	500	7500	0 to +500	300	10ABP4A
10ABP4B	C, S, Re, A	Glass	85°	Electro.	12L	11%	7 ³ / ₈ x 9%	400-850	Single	12,000	500	7500	0 to +500	300	10ABP4B
10ABP4C	C, S, Re, A	Glass	85°	Electro.	12L	11%	7 ³ / ₈ x 9%	400-850	Single	12,000	500	7500	0 to +500	300	10ABP4C
10ADP4*	G, S, Re	Glass	85°	Electro.	12L	11%	7 ³ / ₈ x 9%	400-850	Single	12,000	500	7500	0 to +500	300	10ADP4*
10AEP4*	C, S, Re, A	Glass	85°	Electro.	12L	11%	7 ³ / ₈ x 9%	400-850	Single	12,000	500	7500	0 to +500	300	10AEP4*
10BP4	C, S, Ro	Glass	50°	Magnetic	12N	18	10%	500-2500	Double	10,000	410	9000	—	250	10BP4
10BP4A	G, S, Ro	Glass	50°	Magnetic	12N	18	10%	500-2500	Double	10,000	410	9000	—	250	10BP4A
10BP4C	C, S, Ro, A	Glass	50°	Magnetic	12N	18	10%	500-2500	Single	10,000	410	9000	—	250	10BP4C
10BP4D	G, S, Ro, A	Glass	50°	Magnetic	12N	18	10%	500-2500	Single	10,000	410	9000	—	250	10BP4D
10CP4	C, S, Ro	Glass	50°	Magnetic	12M	17	10%	500	Double	12,000	450	9000	—	250	10CP4
10DP4	C, S, Ro, A	Glass	50°	Electro.	12M	18	10%	No Coating	None	10,000	410	9000	2900	250	10DP4
10EP4	C, S, Ro	Glass	50°	Magnetic	12N	18	10%	Has Coating	Double	12,000	410	8000	—	250	10EP4
10FP4	C, S, Ro, A	Glass	50°	Magnetic	12N	18	10%	500-2500	None	12,000	410	9000	—	250	10FP4
10FP4A	G, S, Ro, A	Glass	54°	Magnetic	12N	18	10%	500-2500	None	12,000	410	9000	—	250	10FP4A
10MP4	C, S, Ro	Glass	52°	Magnetic	12G	17%	10 ¹ / ₁₆	500-2500	Double	10,000	No Grid	9000	—	—	10MP4
10MP4A	G, S, Ro	Glass	52°	Magnetic	12G	17%	10 ¹ / ₁₆	500-2500	Double	10,000	No Grid	9000	—	—	10MP4A

NOTES: All tubes in this section have heater ratings of 6.3 volts and 0.6 ampere unless marked *, indicating 0.45 ampere current. Only tubes that are magnetically deflected are included.

Face-Plate Code: C—clear, Cy—cylindrical, F—frosted, G—gray, Re—rectangular, Ro—round, S—spherical, T—treated, A—aluminized.

† Design-center values.

* Internal magnetic unit to be used with external tubular magnetic shield.

‡ For rectangular tubes, the horizontal deflection angle is given.

* Has heater current of 0.45 ampere.

Television Picture Tubes (continued)

TYPE	GENERAL DESCRIPTION									RATINGS†			TYPICAL OPERATION		
	FACE-PLATE (SEE NOTES)	ENVELOPE	DEFLECTION ANGLE	FOCUSING	BASING	MAX. OVER-ALL LENGTH (IN.)	MAX. DIAMETER OF HT. X WD. (IN.)	CAPACITANCE OF BULB COATING (μuf)	ION TRAP MAGNET	ANODE VOLTS	GRID 2 VOLTS	ANODE VOLTS	FOCUSING VOLTS*	GRID 2 VOLTS	TYPE
10RP4	C. S. Ro. A	Glass	50°	Electro.	12L	16%	10%	750-1500	None	16,000	500	12,000 14,000	-48 to +260 -55 to +300	300 300	10RP4
10SP4	G. S. Ro. A	Glass	50°	Electro.	12M	17	10%	No Coating	None	14,000	410	12,000 14,000	1400 to 1900 1640 to 2225	200 200	10SP4
12AP4	C. S. Ro	Glass	40°	Electro.	6AL	25%	12½	No Coating	None	7000	300	7000	1190 to 1790	250	12AP4
12CP4	C. S. Ro	Glass	—	Magnetic	4AF	18%	12½	No Coating	None	7000	No Grid	7000	—	—	12CP4
12JP4	C. S. Ro	Glass	50°	Magnetic	12D	18	12½	No Coating	None	12,000	410	10,000	—	250	12JP4
12KP4	C. S. Ro. A	Glass	54°	Magnetic	12N	18	12½	500-2500	None	12,000	410	11,000	—	250	12KP4
12KP4A	G. S. Ro. A	Glass	54°	Magnetic	12N	18	12½	500-2500	None	12,000	410	11,000	—	250	12KP4A
12LP4	C. S. Ro	Glass	54°	Magnetic	12N	19%	12½	750-3000	Double	12,000	410	11,000	—	250	12LP4
12LP4A	G. S. Ro	Glass	54°	Magnetic	12N	19%	12½	750-3000	Double	12,000	410	11,000	—	250	12LP4A
12LP4C	G. S. Ro. A	Glass	54°	Magnetic	12N	19%	12½	750-3000	Double	12,000	410	11,000	—	250	12LP4C
12QP4	C. S. Ro	Glass	55°	Magnetic	12D	17½	12½	No Coating	Single	12,000	410	10,000	—	250	12QP4
12QP4A	G. S. Ro	Glass	55°	Magnetic	12D	17½	12½	No Coating	Single	12,000	410	10,000	—	250	12QP4A
12RP4	C. S. Ro	Glass	56°	Magnetic	12D	18	12½	No Coating	Single	12,000	410	10,000	—	250	12RP4
12TP4	C. S. Ro	Glass	54°	Magnetic	12D	19%	12½	No Coating	Double	12,000	410	11,000	—	250	12TP4
12UP4	C. S. Ro	Metal	54°	Magnetic	12D	19	12½	—	Double	12,000	410	11,000	—	250	12UP4
12UP4A	G. S. Ro	Metal	54°	Magnetic	12D	19	12½	—	Double	12,000	410	11,000	—	250	12UP4A

12UP4B	G, T, S, Ro	Metal	54°	Magnetic	12D	19	12½	—	Single	12,000	410	11,000	—	250	12UP4B
12VP4	C, S, Ro	Glass	55°	Magnetic	12G	18½	12½	750-3000	Double	12,000	No Grid	11,000	—	—	12VP4
12VP4A	G, S, Ro	Glass	55°	Magnetic	12G	18½	12½	750-3000	Double	12,000	No Grid	11,000	—	—	12VP4A
12WP4	G, S, Ro	Glass	55°	Magnetic	9CH	18	12½	750-2000	Single	12,000	No Grid	10,000	—	—	12WP4
12XP4	G, S, Ro	Glass	55°	Magnetic	—	18½	12½	2000	Not Ind.	9000	350	8000	—	250	12XP4
12YP4	C, S, Ro	Glass	54°	Auto-Electro.	12N	19½	12½	750-3000	Single	12,000	410	11,000	—	250	12YP4
12ZP4	C, S, Ro, A	Glass	54°	Magnetic	12N	18	12½	500-2000	Single	12,000	410	11,000	—	250	12ZP4
12ZP4A	G, S, Ro, A	Glass	54°	Magnetic	12N	18	12½	500-2000	Single	12,000	410	11,000	—	250	12ZP4A
14ACP4	G, S, Re, A	Glass	85°	Electro.	12L	14½	10½ x 13½	800-1200	Single	14,000	200	10,000	-50 to +350	125	14ACP4
14AEP4	G, S, Re, A	Glass	80°	Electro.	12L	13½	10½ x 13½	800-1200	None	14,000	200	10,000	-50 to +350	110	14AEP4
14AJP4	G, S, Re, A	Glass	105°	Electro.	8HR	11½	11 x 13½	500-850	Single	11,000	500	9,000	-100 to +400	250	14AJP4
14ARP4	S, Re, A	Glass	85°	Electro.	12L	13½	10½ x 13½	800-1200	None	14,000	70	10,000	-50 to +350	50	14ARP4
14ASP4	G, S, Re, A	Glass	105°	Electro.	8HR	11½	11 x 13½	500-850	None	14,000	500	12,000	-50 to +350	300	14ASP4
14BP4	G, S, Re	Glass	65°	Magnetic	12N	17½	9½ x 12½	500-2000	Single	14,000	410	11,000	—	250	14BP4
14BP4A	G, T, S, Re	Glass	65°	Magnetic	12N	17½	9½ x 12½	500-2000	Single	14,000	410	11,000	—	250	14BP4A
14CP4	G, S, Re	Glass	65°	Magnetic	12N	17½	9½ x 12½	750-2000	Single	14,000	410	12,000	—	300	14CP4
14DP4	G, S, Re	Glass	65°	Magnetic	12D	17½	9½ x 12½	No Coating	Double	14,000	410	11,000	—	250	14DP4
14EP4	G, S, Re	Glass	65°	Magnetic	12N	16½	9½ x 12½	750-2000	Single	14,000	410	12,000	—	300	14EP4
14FP4	G, S, Re	Glass	65°	Magnetic	12D	16½	9½ x 12½	No Coating	Single	14,000	410	—	—	—	14FP4
14GP4	F, G, S, Re	Glass	65°	Electro.	12L	17½	9½ x 12½	750-2000	Single	14,000	500	12,000	2170 to 2940	300	14GP4
14HP4	G, S, Re	Glass	65°	Electro.	12L	17½	9½ x 12½	750-2000	Single	14,000	410	12,000	-48 to +264	300	14HP4
14KP4	C, S, Ro	Glass	65°	Magnetic	12N	16½	9½ x 12½	500-2000	Single	10,000	380	9000	—	250	14KP4
14KP4A	G, S, Re	Glass	65°	Magnetic	12N	16½	9½ x 12½	1200	Single	14,000	410	12,000	—	250	14KP4A
14NP4	G, S, Re	Glass	80°	Electro.	12L	14½	10½ x 13½	800-1200	Single	14,000	500	10,000	-50 to +350	250	14NP4

All tubes in this section have heater ratings of 6.3 volts and 0.6 ampere unless marked *, indicating 0.45 ampere current. Only tubes that are magnetically deflected are included.

Face-Plate Code: C—clear, Cy—cylindrical, F—frosted, G—gray, Re—rectangular, Ro—round, S—spherical, T—treated, A—aluminized.

† Design-center values.

* Internal magnetic unit to be used with external tubular magnetic shield.

‡ For rectangular tubes, the horizontal deflection angle is given.

* Has heater current of 0.45 ampere.

Television Picture Tubes (continued)

TYPE	GENERAL DESCRIPTION										RATINGS†		TYPICAL OPERATION		
	FACE-PLATE (SEE NOTES)	ENVELOPE	DEFLECTION ANGLES	FOCUSING	BASING	MAX. OVER-ALL LENGTH (IN.)	MAX. DIAMETER OF HT. X WD. (IN.)	CAPACITANCE OF BULB COATING (μF)	ION TRAP MAGNET	ANODE VOLTS	GRID 2 VOLTS	ANODE VOLTS	FOCUSING VOLTS	GRID 2 VOLTS	TYPE
14NP4A	G. S. Re. A	Glass	80°	Electro.	12L	14½	10½ ₁₆ x 13½ ₁₆	800-1200	Single	14,000	500	10,000	-50 to +350	250	14NP4A
14QP4	G. S. Re	Glass	65°	Electro.	12L	16½ ₃₂	9½ x 12½ ₁₆	600-1000	Single	11,000	500	9000	-50 to +250	250	14QP4
14QP4A	G. S. Re. A	Glass	65°	Electro.	12L	16½ ₃₂	9½ x 12½ ₁₆	600-1000	Single	11,000	500	9000	-50 to +250	250	14QP4A
14RP4	G. S. Re	Glass	85°	Electro.	12L	14½	10½ ₁₆ x 13½ ₁₆	800-1200	Single	14,000	400	10,000	-50 to +350	300	14RP4
14RP4A	G. S. Re. A	Glass	85°	Electro.	12L	14½	10½ ₁₆ x 13½ ₁₆	800-1200	Single	14,000	400	10,000	-50 to +350	300	14RP4A
14SP4	G. S. Re. A	Glass	79°	Electro.	12L	14¾ ₁₆	10½ ₁₆ x 13½ ₁₆	900-1200	Single	14,000	500	12,000	-48 to +264	300	14SP4
14UP4	G. S. Re. A	Glass	65°	Magnetic	12D	17½ ₃₂	9½ x 12½ ₁₆	No Coating	None	14,000	500	12,000	—	300	14UP4
14WP4	G. S. Re. A	Glass	85°	Electro.	12L	13¾ ₁₆	10½ ₁₆ x 13½ ₁₆	800-1200	None	14,000	500	12,000	-50 to +350	300	14WP4
14XP4*	G. S. Re	Glass	79°	Electro.	12L	14½	10½ ₁₆ x 13½ ₁₆	1100-1500	Single	15,000	400	12,000	-50 to +350	300	14XP4*
14XP4A*	G. S. Re. A	Glass	79°	Electro.	12L	14½	10½ ₁₆ x 13½ ₁₆	1100-1500	Single	15,000	400	12,000	-50 to +350	300	14XP4A*
14ZP4	G. S. Re. A	Glass	85°	Electro.	12L	13¾ ₁₆	10½ ₁₆ x 13½ ₁₆	800-1200	None	14,000	450	12,000	0 to +450	300	14ZP4
15AP4	C. S. Ro	Glass	52°	Magnetic	12D	20¾	15¾	No Coating	None	15,000	410	12,000	—	250	15AP4
15CP4	C. S. Ro	Glass	50°	Magnetic	12D	21¾	15¾	No Coating	Double	15,000	410	9000-15,000	—	250	15CP4
15DP4	C. S. Ro	Glass	57°	Magnetic	12D	20¾	15¾	No Coating	Single	15,000	410	13,000	—	250	15DP4
15EP4	C. S. Ro	Glass	52°	Magnetic	—	22¾	15¾ ₁₆	500-2000	Not Ind.	10,000	380	9000	—	250	15EP4
16AP4	C. S. Ro	Metal	53°	Magnetic	12D	22¾	16	—	Double	14,000	410	9000-12,000	—	300	16AP4
16AP4A	G. S. Ro	Metal	53°	Magnetic	12D	22¾	16	—	Double	14,000	410	12,000	—	300	16AP4A

16AP4B	G, F, S, Ro	Metal	53°	Magnetic	12D	22%	16	—	Double	14,000	410	12,000	—	300	16AP4B
16ABP4	G, S, Re	Glass	65°	Auto-Electro.	12N	19%	11½ x 14%	750-1500	Single	16,000	500	12,000-14,000	—	300	16ABP4
16ACP4	C, S, Ro	Glass	60°	Auto-Electro.	12N	21%	16	2000	Single	14,000	410	12,000-13,000	—	250	16ACP4
16AEP4	G, S, Re	Glass	65°	Electro.	12L	19%	11½ x 14%	750-1500	Single	16,000	410	12,000-14,000	-64 to +350	300	16AEP4
16AFP4	C, Cy, Re, A	Glass	65°	Electro.	12L	19½%	11½ x 14%	Has Coating	None	16,000	410	12,000	0	250	16AFP4
16CP4	C, S, Ro	Glass	52°	Magnetic	12D	21%	15½%	No Coating	Double	15,000	410	12,000	—	250	16CP4
16DP4	C, S, Ro	Glass	60°	Magnetic	12D	21	16	No Coating	Double	15,000	410	9000-12,000	—	250	16DP4
16DP4A	G, S, Ro	Glass	60°	Magnetic	12D	21	16	No Coating	Double	15,000	410	9000-12,000	—	250	16DP4A
16EP4	C, S, Ro	Metal	60°	Magnetic	12D	20	16	—	Double	14,000	410	12,000	—	300	16EP4
16EP4A	G, S, Ro	Metal	60°	Magnetic	12D	20	16	—	Double	14,000	410	12,000	—	300	16EP4A
16EP4B	G, T, S, Ro	Metal	60°	Magnetic	12D	20	16	—	Single	14,000	410	12,000	—	300	16EP4B
16FP4	C, S, Ro	Glass	62°	Magnetic	12D	20%	16%	No Coating	Single	16,000	410	12,000	—	300	16FP4
16GP4	G, S, Ro	Metal	70°	Magnetic	12D	17½%	16	—	Single	14,000	410	12,000	—	300	16GP4
16GP4A	C, S, Ro	Metal	70°	Magnetic	12D	17½%	16	—	Single	14,000	410	12,000	—	300	16GP4A
16GP4B	G, F, S, Ro	Metal	70°	Magnetic	12D	17½%	16	—	Single	14,000	410	12,000	—	300	16GP4B
16GP4C	C, F, S, Ro	Metal	70°	Magnetic	12D	17½%	16	—	Single	14,000	410	12,000	—	300	16GP4C
16HP4	C, S, Ro	Glass	60°	Magnetic	12N	21%	16	1500-3500	Double	14,000	410	12,000	—	300	16HP4
16HP4A	G, S, Ro	Glass	60°	Magnetic	12N	21%	16	1500-3500	Double	14,000	410	12,000	—	300	16HP4A
16JP4	C, S, Ro	Glass	60°	Magnetic	12N	21%	16%	750-2000	Double	14,000	410	11,000	—	250	16JP4
16JP4A	G, S, Ro	Glass	60°	Magnetic	12N	21%	16%	750-2000	Double	14,000	410	11,000	—	250	16JP4A
16KP4	G, S, Re	Glass	65°	Magnetic	12N	19%	11½ x 14%	750-1500	Single	16,000	410	12,000-16,000	—	300	16KP4
16KP4A	G, S, Re, A	Glass	65°	Magnetic	12N	19%	11½ x 14%	750-1500	Single	16,000	410	14,000	—	300	16KP4A
16LP4	C, S, Ro	Glass	52°	Magnetic	12N	22%	16	1500-3500	Double	14,000	410	12,000	—	300	16LP4
16LP4A	G, S, Ro	Glass	52°	Magnetic	12N	22%	16	750-2000	Double	14,000	410	12,000-14,000	—	300	16LP4A

NOTES: All tubes in this section have heater ratings of 3 volts and 0.6 ampere unless marked *, indicating 0.45 ampere current. Only tubes that are magnetically deflected are included.

Face-Plate Code: C—clear, Cy—cylindrical, F—frosted, G—gray, Re—rectangular, Ro—round, S—spherical, T—treated, A—aluminized.

† Design-center values.

* Internal magnetic unit to be used with external tubular magnetic shield.

‡ For rectangular tubes, the horizontal deflection angle is given.

* Has heater current of 0.45 ampere.

Television Picture Tubes (continued)

TYPE	GENERAL DESCRIPTION											RATINGS†		TYPICAL OPERATION	
	FACE-PLATE (SEE NOTES)	ENVELOPE	DEFLECTION ANGLE	FOCUSING	BASING	MAX. OVER-ALL LENGTH (IN.)	MAX. DIAMETER OF HT. X WD. (IN.)	CAPACITANCE OF BULB COATING (μmf)	ION TRAP MAGNET	ANODE VOLTS	GRID 2 VOLTS	ANODE VOLTS	GRID 2 VOLTS	FOCUSING VOLTS	GRID 2 VOLTS
16MP4	C. S. Ro	Glass	60°	Magnetic	12N	22½	16½	1500-3500	Double	14,000	410	12,000	—	300	16MP4
16MP4A	G. S. Ro	Glass	60°	Magnetic	12N	22½	16½	1500-3500	Double	14,000	410	12,000	—	300	16MP4A
16QP4	G. S. Re	Glass	65°	Magnetic	12D	19½	11½ x 14½	No Coating	Double	16,000	410	14,000	—	250	16QP4
16RP4	G. S. Re	Glass	65°	Magnetic	12N	19½	11½ x 14½	750-1500	Single	16,000	410	12,000-16,000	—	300	16RP4
16RP4A	G. S. Re, A	Glass	65°	Magnetic	12N	19½	11½ x 14½	750-1500	Single	16,000	410	12,000-16,000	—	300	16RP4A
16SP4	C. S. Ro	Glass	70°	Magnetic	12N	17½	16	1500-3500	Double	14,000	410	12,000	—	300	16SP4
16SP4A	G. S. Ro	Glass	70°	Magnetic	12N	17½	16	1500-3500	Double	14,000	400	12,000	—	300	16SP4A
16TP4	G. S. Re	Glass	65°	Magnetic	12N	18½	11½ x 14½	750-2000	Single	14,000	410	12,000-14,000	—	300	16TP4
16UP4	G. S. Re	Glass	65°	Magnetic	12D	18½	11½ x 14½	No Coating	Single	15,000	410	12,000	—	300	16UP4
16VP4	G. S. Ro	Glass	70°	Magnetic	12D	17½	16	No Coating	Single	15,000	410	12,000	—	250	16VP4
16WP4	G. S. Ro	Glass	70°	Magnetic	12D	18½	16	No Coating	Double	15,000	410	12,000	—	250	16WP4
16WP4A	G. S. Ro	Glass	70°	Magnetic	12N	18½	16	750-1500	Double	16,000	410	12,000-16,000	—	250	16WP4A
16XP4	G. S. Re	Glass	65°	Magnetic	12D	19½	11½ x 14½	No Coating	Double	15,000	410	12,000	—	250	16XP4
16YP4	G. S. Re	Glass	70°	Magnetic	12N	17½	16	750-2000	Single	14,000	410	12,000	—	300	16YP4
16ZP4	G. S. Ro	Glass	52°	Magnetic	12N	22½	16	750-1500	Double	16,000	410	12,000	—	300	16ZP4
17AP4	G. S. Re	Glass	65°	Magnetic	12N	19	12½ x 15½	750-2000	Single	16,000	410	12,000	—	300	17AP4
17ASP4	C. S. Re	Glass	65°	Magnetic	12N	19½	12½ x 15½	1100	Single	14,000	410	12,000	—	250	17ASP4

17ATP4	G, S, Re	Glass	85°	Electro.	12L	16%	12½ x 15½	750-1500	Single	16,000	500	14,000 12,000	-55 to +300 -50 to +265	300 300	17ATP4
17ATP4A	G, S, Re, A	Glass	85°	Electro.	12L	16%	12½ x 15½	750-1500	Single	16,000	500	14,000 12,000	-55 to +300 -50 to +265	300 300	17ATP4A
17AVP4	G, S, Re	Glass	85°	Electro.	12L	16	12½½ x 15½½	1200-1500	Single	16,000	500	12,000	-48 to +264	300	17AVP4
17AVP4A	G, S, Re, A	Glass	85°	Electro.	12L	16	12½½ x 15½½	1200-1500	Single	16,000	500	12,000	-48 to +264	300	17AVP4A
17BP4	G, S, Re	Glass	65°	Magnetic	12D	19%	12½ x 15½	No Coating	Single	16,000	410	12,000	—	300	17BP4
17BP4A	G, S, Re	Glass	65°	Magnetic	12N	19%	12½½ x 15½½	750-1500	Single	16,000	410	12,000	—	300	17BP4A
17BP4B	G, S, Re, A	Glass	65°	Magnetic	12N	19%	12½ x 15½	750-1500	Single	16,000	410	14,000	—	250	17BP4B
17BP4C	G, T, S, Re	Glass	65°	Magnetic	12N	19%	12½½ x 15½	750-1500	Single	16,000	410	12,000	—	300	17BP4C
17BJP4	G, S, Re, A	Glass	80°	Electro.	12L	14½½	12½ x 15½	1200-1500	None	16,000	500	14,000	-55 to +300	300	17BJP4
17BKP4*	G, S, Re	Glass	85°	Electro.	12L	16	12½½ x 15½	1200-1500	Single	16,000	500	14,000	-56 to +310	300	17BKP4*
17BKP4A*	G, S, Re, A	Glass	85°	Electro.	12L	16	12½½ x 15½	1200-1500	Single	16,000	500	14,000	-56 to +310	300	17BKP4A*
17BMP4	G, S, Re, A	Glass	80°	Electro.	12L	16	12½ x 15½	750-1500	Single	18,000	200	12,000	-50 to +265	110	17BMP4
17BNP4	G, S, Re, A	Glass	80°	Electro.	12L	15	12½ x 15½	750-1500	None	18,000	200	12,000	-50 to +350	110	17BNP4
17BSP4*	G, S, Re, A	Glass	85°	Electro.	12L	14%	12½½ x 15½	1200-1500	None	16,000	500	14,000	-50 to +350	300	17BSP4*
17BUP4	G, S, Re, A	Glass	85°	Electro.	12L	15%	12½½ x 15½	1200-1500	Single	20,000	500	12,000	-48 to +264	300	17BUP4
17BVP4	G, S, Re, A	Glass	105°	Electro.	7FA	13½%	12.85 x 15.725	1000-1500	Single	17,600	550	14,000	-50 to +350	300	17BVP4
17BZP4	G, S, Re, A	Glass	105°	Electro.	8HR	12½½	12½ x 15½	800-1500	None	16,000	500	14,000	0 to 400	300	17BZP4
17CP4	G, F, S, Re	Metal	66°	Magnetic	12D	19	12½ x 16½½	—	Single	16,000	410	12,000	—	300	17CP4
17CP4A	G, S, Re	Metal	66°	Magnetic	12D	19	12½ x 16½½	—	Single	16,000	410	12,000 14,000	—	300 300	17CP4A
17CDP4*	G, S, Re, A	Glass	105°	Electro.	8HR	12½½	12½ x 15½	800-1500	None	16,000	500	14,000	0 to 400	300	17CDP4*
17CEP4*	G, S, Re, A	Glass	85°	Electro.	12L	15%	12½ x 15½	1200-1500	None	16,000	500	14,000	-50 to +350	300	17CEP4*
17CFP4	G, S, Re, A	Glass	85°	Electro.	12L	15%	12½ x 15½	1200-1500	None	16,000	500	14,000	-50 to +350	300	17CFP4

NOTES: All tubes in this section have heater ratings of 6.3 volts and 0.6 ampere unless marked *, indicating 0.45 ampere current. Only tubes that are magnetically deflected are included.

Face-Plate Code: C—clear, Cy—cylindrical, F—frosted, G—gray, Re—rectangular, Ro—round, S—spherical, T—treated, A—aluminized.

† Design-center values.

‡ Internal magnetic unit to be used with external tubular magnetic shield.

§ For rectangular tubes, the horizontal deflection angle is given.

*Has heater current of 0.45 ampere.

Television Picture Tubes (continued)

TYPE	GENERAL DESCRIPTION											RATINGS†		TYPICAL OPERATION		
	FACE-PLATE (SEE NOTES)	ENVELOPE	DEFLECTION ANGLE	FOCUSING	BASING	MAX. OVER-ALL LENGTH (IN.)	MAX. DIAMETER or HT. x WD. (IN.)	CAPACITANCE OF BULB COATING (μmF)	ION TRAP MAGNET	ANODE VOLTS	GRID 2 VOLTS	ANODE VOLTS	GRID 2 VOLTS	FOCUSING VOLTS	GRID 2 VOLTS	TYPE
17FP4	G. S. Re	Glass	65°	Electro.	12L	19½	12½ x 15½	500-750	Single	18,000	410	12,000 16,000	2300 to 3100 3100 to 4100	300 300		17FP4
17FP4A	G. S. Re	Glass	65°	Electro.	12L	19½	12½ x 15½	750-2000	Single	18,000	410	12,000	2300 to 3100	300		17FP4A
17GP4	G. F. S. Re	Metal	66°	Electro.	12M	19½	12½ x 16½	—	Single	16,000	500	12,000	2290 to 3100	300		17GP4
17HP4	G. S. Re	Glass	65°	Electro.	12L	19½	12½ x 15½	750-1500	Single	16,000	500	14,000-16,000	-56 to +310	300		17HP4
17HP4A	G. T. S. Re	Glass	65°	Electro.	12L	19½	12½ x 15½	750-1500	Single	16,000	500	14,000-16,000	-56 to +310	300		17HP4A
17HP4B	G. S. Re, A	Glass	65°	Electro.	12L	19½	12½ x 15½	750-1500	Single	16,000	500	14,000	-56 to +310	300		17HP4B
17JP4	G. S. Re	Glass	65°	Magnetic	12N	19½	12½ x 15½	500-750	Single	18,000	410	16,000	—	300		17JP4
17KP4	G. S. Re	Glass	65°	Auto-Electro.	12D	19½	12½ x 15½	1000-1500	Single	16,000	500	12,000	—	300		17KP4
17KP4A	G. S. Re, A	Glass	65°	Auto-Electro.	12D	19½	12½ x 15½	1000-1500	Single	16,000	500	12,000	—	300		17KP4A
17LP4	G. Cy. Re	Glass	65°	Electro.	12L	19½	12½ x 15½	750-2000	Single	16,000	500	12,000	-48 to +260	300		17LP4
17LP4A	G. Cy. Re, A	Glass	65°	Electro.	12L	19½	12½ x 15½	750-1500	Single	16,000	500	14,000	-56 to +310	300		17LP4A
17QP4	G. Cy. Re	Glass	65°	Magnetic	12N	19½	12½ x 15½	750-2000	Single	16,000	410	12,000	—	300		17QP4
17QP4A	G. Cy. Re, A	Glass	65°	Magnetic	12N	19½	12½ x 15½	750-1500	Single	18,000	500	14,000	—	300		17QP4A
17RP4	G. S. Re	Glass	66°	Electro.	12L	19½	12½ x 15½	750-1500	Single	16,000	500	14,000	-56 to +308	300		17RP4

17RP4C	G, S, Re, A	Glass	66°	Electro.	12L	19 $\frac{1}{16}$	12 $\frac{1}{2}$ x 15 $\frac{1}{2}$	750-1500	Single	16,000	500	14,000	-56 to +308	300	17RP4C
17SP4	G, Cy, Re	Glass	66°	Auto-Electro.	12N	19 $\frac{1}{16}$	12 $\frac{1}{2}$ x 15 $\frac{1}{2}$	500-750	Single	14,000	410	12,000	—	250	17SP4
17TP4	G, F, S, Ro	Metal	66°	Electro.	12M	19 $\frac{1}{16}$	12 $\frac{1}{2}$ x 16 $\frac{1}{16}$	—	Single	16,000	500	14,000 16,000	-55 to +300 -65 to +350	300 300	17TP4
17UP4	G, Cy, Re	Glass	70°	Magnetic	12N	19 $\frac{1}{16}$	12 $\frac{1}{2}$ x 15 $\frac{1}{2}$	750-1500	Single	14,000	410	12,000	—	250	17UP4
17VP4	G, Cy, Re	Glass	66°	Electro.	12L	19 $\frac{1}{16}$	12 $\frac{1}{2}$ x 15 $\frac{1}{2}$	750-1500	Single	16,000	500	14,000	-56 to +310	300	17VP4
17VP4B	G, Cy, Re, A	Glass	66°	Electro.	12L	19 $\frac{1}{16}$	12 $\frac{1}{2}$ x 15 $\frac{1}{2}$	750-1500	Single	16,000	500	14,000	—	300	17VP4B
17YP4	G, Cy, Re	Glass	65°	Magnetic	12N	19 $\frac{1}{16}$	12 $\frac{1}{2}$ x 15 $\frac{1}{2}$	500-750	Single	18,000	500	16,000	—	300	17YP4
19AP4	C, S, Ro	Metal	66°	Magnetic	12D	22	18 $\frac{1}{2}$	—	Single	16,000	410	12,000	—	300	19AP4
19AP4A	G, S, Ro	Metal	66°	Magnetic	12D	22	18 $\frac{1}{2}$	—	Single	16,000	410	12,000	—	300	19AP4A
19AP4B	G, F, S, Ro	Metal	66°	Magnetic	12D	22	18 $\frac{1}{2}$	—	Single	16,000	410	12,000	—	300	19AP4B
19AP4C	G, S, Ro, A	Metal	66°	Magnetic	12D	22	18 $\frac{1}{2}$	—	Single	16,000	410	15,000	—	300	19AP4C
19AP4D	C, F, S, Ro	Metal	66°	Magnetic	12D	22	18 $\frac{1}{2}$	—	Single	16,000	410	15,000	—	300	19AP4D
19DP4	C, S, Ro	Glass	66°	Magnetic	12N	21 $\frac{1}{2}$	19	750-2500	Double	17,000	410	13,000	—	250	19DP4
19DP4A	G, S, Ro	Glass	66°	Magnetic	12N	21 $\frac{1}{2}$	19	750-2500	Double	17,000	410	13,000	—	250	19DP4A
19EP4	G, S, Re	Glass	65°	Magnetic	12D	21 $\frac{1}{2}$	13 $\frac{1}{2}$ x 17 $\frac{1}{2}$	No Coating	Single	19,000	410	13,000	—	250	19EP4
19FP4	G, S, Ro	Glass	66°	Magnetic	12D	22 $\frac{1}{2}$	19	No Coating	Double	19,000	410	13,000	—	250	19FP4
19GP4	G, S, Ro	Glass	66°	Magnetic	12D	21 $\frac{1}{2}$	19	No Coating	Single	19,000	410	13,000	—	250	19GP4
19JP4	G, S, Re	Glass	66°	Magnetic	12D	21 $\frac{1}{2}$	13 $\frac{1}{16}$ x 17 $\frac{1}{16}$	No Coating	Single	18,000	410	12,000	—	300	19JP4
19QP4	G, S, Re	Glass	66°	Electro.	12L	21 $\frac{1}{2}$	13 $\frac{1}{16}$ x 17 $\frac{1}{16}$	500-750	Single	18,000	410	12,000	-50 to +350	300	19QP4
20BP4	C, S, Ro	Glass	54°	Magnetic	12D	28 $\frac{1}{2}$	20 $\frac{1}{2}$	No Coating	None	16,500	750	10,000-15,000	—	250	20BP4
20CP4	G, S, Re	Glass	66°	Magnetic	12D	21 $\frac{1}{16}$	15 $\frac{1}{16}$ x 18 $\frac{1}{16}$	No Coating	Single	18,000	410	12,000	—	300	20CP4

NOTES: All tubes in this section have heater ratings of 6.3 volts and 0.6 ampere unless marked *, indicating 0.45 ampere current. Only tubes that are magnetically deflected are included.

Face-Plate Code: C—clear, Cy—cylindrical, F—frosted, G—gray, Re—rectangular, Ro—round, S—spherical, T—treated, A—aluminized.

† Design-center values.

* Internal magnetic unit to be used with external tubular magnetic shield.

§ For rectangular tubes, the horizontal deflection angle is given.

* Has heater current of 0.45 ampere.

Television Picture Tubes (continued)

		GENERAL DESCRIPTION									RATINGS†		TYPICAL OPERATION		
TYPE	FACE-PLATE (SEE NOTES)	ENVELOPE	DEFLECTION ANGLES	FOCUSING	BASING	MAX. OVER-ALL LENGTH (IN.)	MAX. DIAMETER OF HT. X WD. (IN.)	CAPACITANCE OF BULB COATING (pμF)	ION TRAP MAGNET	ANODE VOLTS	GRID 2 VOLTS	ANODE VOLTS	FOCUSING VOLTS	GRID 2 VOLTS	TYPE
20CP4A	G, S, Re	Glass	66°	Magnetic	12N	21 ¹ / ₁₆	15 ¹ / ₁₆ x 18 ¹ / ₁₆	500-750	Single	18,000	410	12,000	—	300	20CP4A
20CP4B	G, S, Re, A	Glass	66°	Magnetic	12D	21 ¹ / ₁₆	15 ¹ / ₁₆ x 18 ¹ / ₁₆	No Coating	Single	18,000	410	12,000	—	300	20CP4B
20CP4C	G, T, S, Re	Glass	66°	Magnetic	12D	21 ¹ / ₁₆	15 ¹ / ₁₆ x 18 ¹ / ₁₆	No Coating	Single	18,000	410	14,000-18,000	—	300	20CP4C
20CP4D	G, S, Re, A	Glass	66°	Magnetic	12N	21 ¹ / ₁₆	15 ¹ / ₁₆ x 18 ¹ / ₁₆	500-750	Single	18,000	410	12,000	—	300	20CP4D
20DP4	G, S, Re	Glass	65°	Magnetic	12D	21 ³ / ₁₆	15 ¹ / ₁₆ x 18 ¹ / ₁₆	No Coating	Single	18,000	410	12,000	—	300	20DP4
20DP4A	G, S, Re	Glass	65°	Magnetic	12N	21 ³ / ₁₆	15 ¹ / ₁₆ x 18 ¹ / ₁₆	500-750	Single	18,000	410	12,000	—	300	20DP4A
20DP4B	G, S, Re, A	Glass	66°	Magnetic	12D	22 ³ / ₁₆	15 ¹ / ₁₆ x 18 ¹ / ₁₆	No Coating	Single	18,000	410	16,000	—	300	20DP4B
20DP4C	G, S, Re, A	Glass	66°	Magnetic	12N	22 ³ / ₁₆	15 ¹ / ₁₆ x 18 ¹ / ₁₆	500-750	Single	18,000	410	16,000	—	300	20DP4C
20FP4	G, S, Re	Glass	66°	Electro.	12M	22 ³ / ₁₆	15 ¹ / ₁₆ x 18 ¹ / ₁₆	No Coating	Single	18,000	410	12,000	2300 to 3200	300	20FP4
20GP4	G, S, Re	Glass	66°	Electro.	12L	22 ³ / ₁₆	15 ¹ / ₁₆ x 18 ¹ / ₁₆	500-750	Single	18,000	500	14,000	2750 to 3740	300	20GP4
20HP4	G, S, Re	Glass	66°	Electro.	12M	22 ³ / ₁₆	15 ¹ / ₁₆ x 18 ¹ / ₁₆	No Coating	Single	16,000	500	14,000	-56 to +310	300	20HP4
20HP4A	G, S, Re	Glass	66°	Electro.	12L	22 ³ / ₁₆	15 ¹ / ₁₆ x 18 ¹ / ₁₆	750-1500	Single	16,000	500	14,000	-56 to +310	300	20HP4A
20HP4B	G, T, S, Re	Glass	66°	Electro.	12M	22 ³ / ₁₆	15 ¹ / ₁₆ x 18 ¹ / ₁₆	No Coating	Single	16,000	500	14,000	-56 to +310	300	20HP4B
20HP4C	G, S, Re, A	Glass	66°	Electro.	12M	22 ³ / ₁₆	15 ¹ / ₁₆ x 18 ¹ / ₁₆	No Coating	Single	16,000	500	14,000	-56 to +310	300	20HP4C

20HP4D	G, S, Re, A	Glass	66°	Electro.	12L	22½	15½ x 18½	570-1500	Single	16,000	500	14,000	-56 to +310	300	20HP4D
20JP4	G, S, Re	Glass	65°	Auto-Electro.	12P	22½	15½ x 18½	500-750	Single	18,000	500	12,000	—	300	20JP4
20LP4	G, S, Re	Glass	66°	Electro.	12L	22½	15½ x 18½	750-1500	Single	16,000	500	14,000	0	300	20LP4
20MP4	G, S, Re	Glass	65°	Electro.	12L	22½	15½ x 18½	500-750	Single	16,000	500	14,000	-55 to +300	300	20MP4
21AP4	G, F, S, Re	Metal	66°	Magnetic	12D	22½	15½ x 19½	—	Single	18,000	500	14,000-18,000	—	300	21AP4
21ACP4	G, S, Re	Glass	85°	Magnetic	12N	20½	16½ x 20½	2000-2500	Single	20,000	500	16,000	—	300	21ACP4
21ACP4A	G, S, Re, A	Glass	85°	Magnetic	12N	20½	16½ x 20½	2000-2500	Single	20,000	500	16,000	—	300	21ACP4A
21AFP4	G, S, Re	Glass	65°	Electro.	12M	23½	15½ x 20½	No Coating	Single	18,000	500	16,000	-64 to +350	300	21AFP4
21ALP4	G, S, Re	Glass	85°	Electro.	12L	20½	16½ x 20½	500-750	Single	18,000	500	14,000	-55 to +300	300	21ALP4
21ALP4A	G, S, Re, A	Glass	85°	Electro.	12L	20½	16½ x 20½	500-750	Single	18,000	500	14,000	-55 to +300	300	21ALP4A
21ALP4B	G, S, Re, A	Glass	85°	Electro.	12L	20½	16½ x 20½	500-750	Single	20,000	500	14,000	-55 to +300	300	21ALP4B
21AMP4	G, S, Re	Glass	85°	Magnetic	12N	20½	16½ x 20½	2000-2500	Single	18,000	500	16,000	—	300	21AMP4
21AMP4A	G, S, Re, A	Glass	85°	Magnetic	12N	20½	16½ x 20½	2000-2500	Single	18,000	500	16,000	—	300	21AMP4A
21AMP23A	G, S, Re, A	Glass	85°	Magnetic	12N	20½	16½ x 20½	500-750	Single	18,000	500	16,000	—	300	21AMP23A
21ANP4	G, S, Re	Glass	85°	Electro.	12M	20½	16½ x 20½	No Coating	Single	18,000	500	14,000	-55 to +300	300	21ANP4
21ANP4A	G, S, Re, A	Glass	85°	Electro.	12M	20½	16½ x 20½	No Coating	Single	18,000	500	14,000	-55 to +300	300	21ANP4A
21AQP4	G, S, Re	Glass	85°	Magnetic	12D	20½	16½ x 20½	No Coating	Single	18,000	500	16,000	—	300	21AQP4
21AQP4A	G, S, Re, A	Glass	85°	Magnetic	12D	20½	16½ x 20½	No Coating	Single	18,000	500	16,000	—	300	21AQP4A
21ARP4	G, S, Re	Glass	65°	Int. Magnetic*	12N	23½	15½ x 20½	500-750	Internal	20,000	500	16,000	—	300	21ARP4
21ARP4A	G, S, Re, A	Glass	65°	Int. Magnetic*	12N	23½	15½ x 20½	500-750	None	20,000	500	16,000	—	300	21ARP4A
21ASP4	G, S, Re	Glass	66°	Electro.	12M	22½	15½ x 18½	No Coating	Single	18,000	410	16,000	-64 to +352	300	21ASP4

NOTES: All tubes in this section have heater ratings of 6.3 volts and 0.5 ampere unless marked *, indicating 0.45 ampere current. Only tubes that are magnetically deflected are included.

Face-Plate Code: C—clear, Cy—cylindrical, F—frosted, G—gray, Re—rectangular, Ro—round, S—spherical, T—treated, A—aluminized.

† Design-center values.

* Internal magnetic unit to be used with external tubular magnetic shield.

‡ For rectangular tubes, the horizontal deflection angle is given.

* Has heater current of 0.45 ampere.

Television Picture Tubes (continued)

TYPE	GENERAL DESCRIPTION										RATINGS†		TYPICAL OPERATION		
	FACE-PLATE (SEE NOTES)	ENVELOPE	DEFLECTION ANGLES	FOCUSING	BASING	MAX. OVER-ALL LENGTH (IN.)	MAX. DIAMETER OF HT. X WD. (IN.)	CAPACITANCE OF BULB COATING (pμf)	ION TRAP MAGNET	ANODE VOLTS	GRID 2 VOLTS	ANODE VOLTS	FOCUSING VOLTS	GRID 2 VOLTS	TYPE
21ATP4	G. S. Re. A	Glass	85°	Electro.	12L	20 3/4	16 1/16 x 20 1/16	1200-1500	Single	18,000	500	16,000	-64 to +350	300	21ATP4
21ATP4A	G. S. Re. A	Glass	85°	Electro.	12L	20 3/4	16 1/16 x 20 1/16	1200-1500	Single	20,000	500	16,000	-64 to +350	300	21ATP4A
21ATP4B	G. S. Re	Glass	85°	Electro.	12L	20 3/4	16 1/16 x 20 3/4	1200-1500	Single	18,000	500	16,000	-64 to +350	300	21ATP4B
21AUP4	G. S. Re	Glass	67°	Electro.	12L	23 1/2	16 1/2 x 20 3/4	500-750	Single	18,000	500	18,000	-72 to +396	300	21AUP4
21AUP4A	G. S. Re. A	Glass	67°	Electro.	12L	23 1/2	16 1/2 x 20 3/4	500-750	Single	18,000	500	18,000	-72 to +396	300	21AUP4A
21AUP4B	G. S. Re. A	Glass	67°	Electro.	12L	23 1/2	16 1/2 x 20 3/4	500-750	Single	20,000	500	18,000	-72 to +396	300	21AUP4B
21AVP4	G. S. Re	Glass	67°	Electro.	12L	23 1/2	16 1/2 x 20 3/4	1200-1500	Single	18,000	500	18,000	-72 to +396	300	21AVP4
21AVP4A	G. S. Re. A	Glass	67°	Electro.	12L	23 1/2	16 1/2 x 20 3/4	1200-1500	Single	18,000	500	18,000	-72 to +396	300	21AVP4A
21AVP4B	G. S. Re. A	Glass	67°	Electro.	12L	23 1/2	16 1/2 x 20 3/4	1200-1500	Single	20,000	500	18,000	-72 to +396	300	21AVP4B
21AWP4	G. S. Re. A	Glass	67°	Magnetic	12N	23 1/2	16 1/16 x 20 1/16	750-1500	Single	18,000	500	16,000	—	300	21AWP4
21AYP4	G. S. Re	Glass	66°	Electro.	12L	22 3/4	15 1/16 x 18 1/16	750-1500	Single	18,000	410	16,000	-64 to +352	300	21AYP4
21BAP4	G. S. Re	Glass	85°	Electro.	12L	20 3/4	16 1/2 x 20 3/4	2000-2500	None	20,000	500	16,000	0 to 500	300	21BAP4
21BCP4	G. S. Re. A	Glass	65°	Electro.	12L	23 1/2	15 1/16 x 20 3/4	500-750	None	20,000	500	16,000	+50 to +550	300	21BCP4
21BDP4	G. S. Re. A	Glass	67°	Electro.	12L	23 1/2	16 1/2 x 20 3/4	500-750	None	20,000	500	16,000	+50 to +550	300	21BDP4

21BNP4	G, S, Re, A	Glass	85°	Electro.	12L	20%	16½ x 20%	2000-2500	None	20,000	500	16,000	0 to 500	300	21BNP4
21BSP4	G, S, Re, A	Glass	85°	Magnetic	12M	20%	16½ x 20%	2000-2500	Single	20,000	500	16,000	—	300	21BSP4
21BTP4	G, S, Re, A	Glass	85°	Electro.	12L	20%	16½ x 20%	2000-2500	Single	20,000	500	16,000	-64 to +352	300	21BTP4
21CBP4	G, S, Re, A	Glass	85°	Electro.	12L	18%	16½ x 20%	2200-2900	None	18,000	500	14,000	-55 to +300	300	21CBP4
21CBP4A	G, S, Re, A	Glass	85°	Electro.	12L	18%	16½ x 20%	2200-2900	None	20,000	500	16,000	0 to +450	300	21CBP4A
21CDP4*	G, S, Re	Glass	85°	Electro.	12L	20%	16½ x 20%	2000-2500	Single	20,000	500	16,000	-64 to +352	300	21CDP4*
21CDP4A*	G, S, Re, A	Glass	85°	Electro.	12L	20%	16½ x 20%	2000-2500	Single	20,000	500	16,000	-64 to +352	300	21CDP4A*
21CEP4	G, S, Re, A	Glass	106°	Electro.	8HR	14%	16½ x 20%	2000-2500	None	18,000	500	16,000	0 to +400	400	21CEP4
21CGP4	G, S, Re, A	Glass	85°	Electro.	12L	20%	16½ x 20%	2000-2500	Single	20,000	200	14,000	-55 to +300	110	21CGP4
21CHP4	G, S, Re, A	Glass	85°	Electro.	12L	18%	16½ x 21½	2000-2500	None	20,000	200	14,000	-50 to +350	110	21CHP4
21CKP4*	G, S, Re, A	Glass	85°	Electro.	12L	18%	16½ x 20%	2000-2500	None	20,000	500	16,000	-50 to +350	300	21CKP4*
21CVP4	G, S, Re, A	Glass	85°	Electro.	12L	20%	16½ x 20%	2000-2500	None	20,000	550	16,000	-64 to +352	300	21CVP4
21CWP4	G, S, Re, A	Glass	85°	Electro.	12L	20%	16½ x 20%	2000-2500	Single	22,000	550	16,000	-64 to +352	300	21CWP4
21DP4	G, F, S, Re	Metal	66°	Electro.	12M	22%	15½ x 19½	—	Single	18,000	500	14,000-18,000	2750 to 3740	300	21DP4
21EP4	G, Cy, Re	Glass	65°	Magnetic	12D	23%	15½ x 20½	No Coating	Single	18,000	500	16,000	—	300	21EP4
21EP4A	G, Cy, Re	Glass	65°	Magnetic	12N	23%	15½ x 20½	500-750	Single	18,000	500	16,000	—	300	21EP4A
21EP4B	G, Cy, Re, A	Glass	65°	Magnetic	12N	23%	15½ x 20½	500-750	Single	18,000	500	16,000	—	300	21EP4B
21FP4	G, Cy, Re	Glass	65°	Electro.	12M	23%	15½ x 20½	No Coating	Single	18,000	500	14,000	-56 to +308	300	21FP4
21FP4A	G, Cy, Re	Glass	65°	Electro.	12L	23%	15½ x 20½	500-750	Single	18,000	500	14,000	-56 to +308	300	21FP4A
21FP4C	G, Cy, Re, A	Glass	65°	Electro.	12L	23%	15½ x 20½	500-750	Single	18,000	500	14,000	-56 to +310	300	21FP4C
21JP4	G, Cy, Re	Glass	67°	Int. Magnetic	12N	23½	15½ x 20½	500-750	Internal	20,000	500	14,000	—	300	21JP4
21JP4A	G, Cy, Re, A	Glass	67°	Int. Magnetic	12N	23½	15½ x 20½	500-750	Internal	20,000	500	14,000	—	300	21JP4A

NOTES: All tubes in this section have heater ratings of 6.3 volts and 0.6 ampere unless marked *, indicating 0.45 ampere current. Only tubes that are magnetically deflected are included.

Face-Plate Code: C—clear, Cy—cylindrical, F—frosted, G—gray, Re—rectangular, Ro—round, S—spherical, T—treated, A—aluminized.

† Design-center values.

• Internal magnetic unit to be used with external tubular magnetic shield.

§ For rectangular tubes, the horizontal deflection angle is given.

* Has heater current of 0.45 ampere.

Television Picture Tubes (continued)

TYPE	GENERAL DESCRIPTION										RATINGS†		TYPICAL OPERATION		
	FACE-PLATE (SEE NOTES)	ENVELOPE	DEFLECTION ANGLES	FOCUSING	BASING	MAX. OVER-ALL LENGTH (IN.)	MAX. DIAMETER OF HT. X WD. (IN.)	CAPACITANCE OF BULB COATING (pfd)	ION TRAP MAGNET	ANODE VOLTS	GRID 2 VOLTS	ANODE VOLTS	FOCUSING VOLTS	GRID 2 VOLTS	TYPE
21KP4	G. Cy. Re	Glass	65°	Auto-Electro.	12D	23 3/4	15 1/16 x 21 1/32	No Coating	Single	18,000	410	14,000	—	300	21KP4
21KP4A	G. Cy. Re	Glass	65°	Auto-Electro.	12P	23 3/4	15 1/16 x 20 3/4	500-750	Single	18,000	500	12,000	—	300	21KP4A
21MP4	G. F. S. Re	Metal	66°	Electro.	12M	22 3/4	15 3/16 x 19 7/32	—	Single	16,900	500	14,000-16,000	-55 to +300	300	21MP4
21WP4	G. S. Re	Glass	66°	Magnetic	12N	22 3/4	15 1/16 x 18 1/16	500-750	Single	18,000	500	16,000	—	300	21WP4
21WP4A	G. S. Re. A	Glass	66°	Magnetic	12N	22 1/16	15 1/16 x 18 1/16	500-750	Single	18,000	500	16,000	—	300	21WP4A
21XP4	G. S. Re	Glass	66°	Electro.	12L	22 1/16	15 1/16 x 18 1/16	2000-2500	Single	18,000	500	16,000	-64 to +352	300	21XP4
21XP4A	G. S. Re. A	Glass	66°	Electro.	12L	22 1/16	15 1/16 x 18 1/16	2000-2500	Single	18,000	500	16,000	-64 to +352	300	21XP4A
21YP4	G. S. Re	Glass	65°	Electro.	12L	23 3/4	15 3/4 x 20 1/16	500-750	Single	18,000	500	14,000 18,000	-55 to +300 -72 to +396	300 300	21YP4
21YP4A	G. S. Re. A	Glass	65°	Electro.	12L	23 3/4	15 1/16 x 20 3/4	500-750	Single	18,000	500	16,000	-64 to +350	300	21YP4A
21ZP4	G. S. Re	Glass	65°	Magnetic	12D	23 3/4	15 3/4 x 20 1/16	No Coating	Single	18,000	500	12,000	—	300	21ZP4
21ZP4A	G. S. Re	Glass	65°	Magnetic	12N	23 3/4	15 1/16 x 20 3/4	500-750	Single	18,000	500	16,000	—	300	21ZP4A
21ZP4B	G. S. Re. A	Glass	67°	Magnetic	12N	23 1/32	15 1/16 x 20 3/4	500-750	Single	18,000	500	16,000	—	300	21ZP4B
22AP4	G. S. Ro	Metal	70°	Magnetic	12D	23 3/4	21 1/16	—	Single	19,000	410	14,000	—	300	22AP4
22AP4A	G. S. Ro	Metal	70°	Magnetic	12D	23 3/4	21 1/16	—	Single	19,000	410	14,000	—	300	22AP4A
24AP4	G. S. Ro	Metal	70°	Magnetic	12D	24 1/16	24 3/4	—	Single	16,000	410	15,000	—	300	24AP4
24AP4A	G. S. Ro. A	Metal	70°	Magnetic	12D	24 1/16	24 3/4	—	Single	16,000	410	15,000	—	300	24AP4A
24AP4B	G. T. S. Ro	Metal	70°	Magnetic	12D	24 1/16	24 3/4	—	Single	16,000	410	15,000	—	300	24AP4B

24ADP4	G, S, Re, A	Glass	85°	Magnetic	12N	21½	18½ ₁₆ x 22½ ₁₆	2000-2500	Single	22,000	600	18,000	—	300	24ADP4
24AHP4	G, S, Re, A	Glass	105°	Electro.	8HR	15½ ₁₆	18½ ₁₆ x 22½ ₁₆	2000-2500	None	20,000	500	16,000	-50 to +350	300	24AHP4
24BP4	G, S, Ro	Metal	70°	Electro.	12M	24¾	24¾	—	Single	16,000	500	14,000	-56 to +310	300	24BP4
24CP4	G, S, Re	Glass	85°	Magnetic	12N	21½	18½ ₁₆ x 22½ ₁₆	2000-2500	Single	20,000	500	18,000	—	300	24CP4
24CP4A	G, S, Re, A	Glass	85°	Magnetic	12N	21½	18½ ₁₆ x 22½ ₁₆	2000-2500	Single	20,000	500	16,000	—	300	24CP4A
24DP4	G, S, Re	Glass	85°	Electro.	12L	21½	18½ ₁₆ x 22½ ₁₆	2000-2500	Single	20,000	500	18,000	-72 to +400	300	24DP4
24DP4A	G, S, Re, A	Glass	85°	Electro.	12L	21½	18½ ₁₆ x 22½ ₁₆	2000-2500	Single	20,000	500	16,000	-64 to +350	300	24DP4A
24QP4	G, S, Ro	Glass	85°	Magnetic	12N	21½	18½ ₁₆ x 22½ ₁₆	500-750	Single	18,000	500	16,000	—	300	24QP4
24TP4	G, S, Re, A	Glass	85°	Magnetic	12N	21½	18½ ₁₆ x 22½ ₁₆	250-750	Single	20,000	500	14,000	—	300	24TP4
24VP4	G, S, Re	Glass	87°	Magnetic	12N	21½	18½ ₁₆ x 22½ ₁₆	2000-2500	Single	22,000	600	20,000	—	300	24VP4
24VP4A	G, S, Re, A	Glass	87°	Magnetic	12N	21½	18½ ₁₆ x 22½ ₁₆	2000-2500	Single	22,000	600	20,000	—	300	24VP4A
24XP4	G, S, Re	Glass	85°	Magnetic	12D	21½	18½ x 22½	No Coating	Single	20,000	500	18,000	—	300	24XP4
24YP4	G, S, Re, A	Glass	85°	Electro.	12L	21½	18½ ₁₆ x 22½ ₁₆	2000-2500	Single	20,000	500	16,000	-64 to +350	300	24YP4
24ZP4	G, S, Re, A	Glass	85°	Electro.	12L	21½	18½ ₁₆ x 22½ ₁₆	2000-2500	None	20,000	500	16,000	0 to 500	300	24ZP4
27AP4	G, T, S, Re	Metal	85°	Electro.	12M	22¾	20½ ₁₆ x 25¾	—	Single	18,000	500	15,000	-60 to +300	300	27AP4
27EP4	G, S, Re, A	Glass	85°	Magnetic	12D	23¾	20½ ₁₆ x 25½ ₁₆	No Coating	Single	20,000	500	16,000	—	300	27EP4
27GP4	G, S, Ro	Glass	85°	Magnetic	12D	23¾	20½ ₁₆ x 25½ ₁₆	No Coating	Single	22,500	500	16,000	—	300	27GP4
27LP4	G, S, Ro, A	Glass	85°	Magnetic	12N	24½ ₁₆	20½ ₁₆ x 25½ ₁₆	250-400	Single	22,000	600	20,000	—	300	27LP4
27MP4	G, F, S, Re	Metal	85°	Magnetic	12D	22¾	20½ x 25½ ₁₆	—	Single	18,000	500	16,000-18,000	—	300	27MP4
27NP4	G, S, Re	Glass	85°	Magnetic	12N	23¾	20½ ₁₆ x 25½ ₁₆	500-750	Single	18,000	500	16,000	—	300	27NP4
27RP4	G, S, Re, A	Glass	85°	Magnetic	12N	23¾	20½ ₁₆ x 25½ ₁₆	500-750	Single	20,000	500	16,000	—	300	27RP4
27SP4	G, S, Re, A	Glass	85°	Electro.	12L	23¾	20½ ₁₆ x 25½ ₁₆	500-750	Single	20,000	500	18,000	-72 to +396	300	27SP4
27UP4	G, S, Re	Glass	85°	Electro.	12L	23¾	20½ ₁₆ x 25½ ₁₆	500-750	Single	20,000	500	16,000	0 to 396	300	27UP4
30BP4	G, S, Ro	Metal	90°	Magnetic	12D	24½ ₁₆	30¾	—	Single	30,000	410	22,000	—	300	30BP4

NOTES: All tubes in this section have heater ratings of 6.3 volts and 0.6 ampere unless marked *, indicating 0.45 ampere current. Only tubes that are magnetically deflected are included.

Face-Plate Code: C—clear, Cy—cylindrical, F—frosted, G—gray, Re—rectangular, Ro—round, S—spherical, T—treated, A—aluminized.

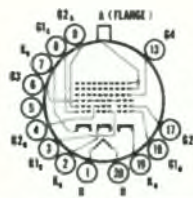
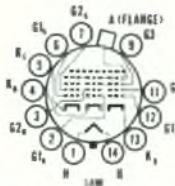
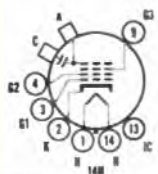
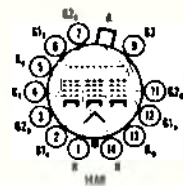
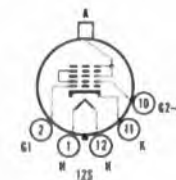
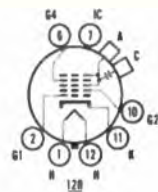
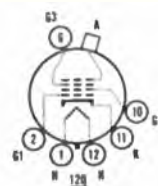
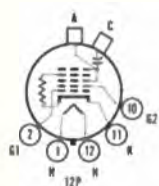
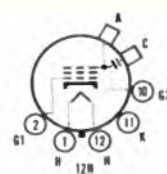
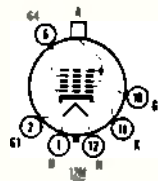
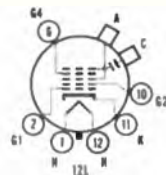
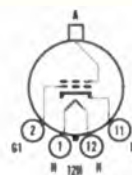
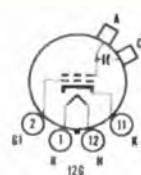
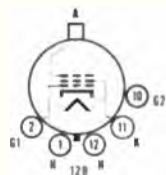
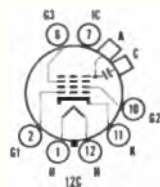
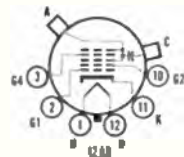
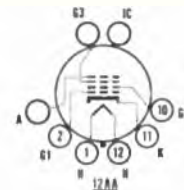
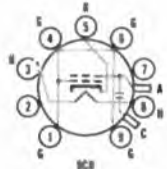
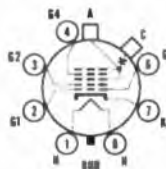
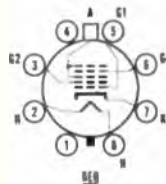
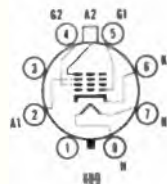
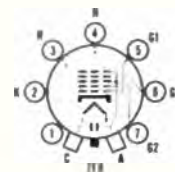
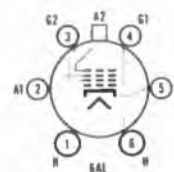
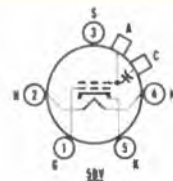
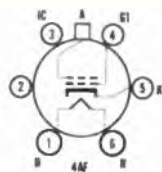
† Design-center values.

* Internal magnetic unit to be used with external tubular magnetic shield.

‡ For rectangular tubes, the horizontal deflection angle is given.

* Has heater current of 0.45 ampere.

BASING DIAGRAMS FOR PICTURE TUBE REFERENCE GUIDE



15 GP 22
15 MP 22
15 TP 22



SEMICONDUCTORS

Including Crystal Diode Reference Guide of all popular diodes, for television and industry: germanium diodes, silicon diodes, and silicon power rectifiers.

Complete RETMA data on transistors, made by CBS-Hytron, in numerical order.



SEMICONDUCTORS


CBS

GERMANIUM AND SILICON DIODES

Type	Outline Drawing	Peak Reverse Voltage	MAXIMUM RATING, 25°C ambient				ELECTRICAL CHARACTERISTICS, 25°C ambient						Description
			Operating Reverse Voltage	Forward Current, ma			Minimum Forward Current at 1V ma	Maximum Reverse Current					
				Average	Recurrent Peak	Surge 1 sec.		Volts	μA	Volts	μA		
1N34 *	A & B	75	60	40	150	500	5.0	-10	50	-50	500	General Purpose	
1N34A	A & B	75	60	50	150	500	5.0	-10	30	-50	500	General Purpose	
1N35 "	"	75	60	50	150	500	7.5 Δ	-10	10			Matched Pair	
1N38 1N38A *	A & B	120	100	50	150	500	4.0	-3	6	-100	500	High Reverse Voltage, JAN	
1N39 1N39A	B	225	200	50	150	200	5.0	-100	200	-200	800	High Reverse Voltage	
1N40 °	D	75	60	40	150	500	12.75 at 1.5V Δ	-10	100	-50	850	Quad Demodulator	
1N42 °	D	125	100	50	150	500	12.75 at 1.5V Δ	-3	6	-100	625	Quad Demodulator	
1N48	A & B	85	70	50	150	400	4.0	-50	833			General Purpose Detector	
1N51	B	50	40	25	100	300	2.5	-50	1660			General Purpose	
1N52	A & B	85	70	50	150	400	4.0	-50	150			General Purpose	
1N54	A & B	50	35	40	150	300	5.0	-10	10			General Purpose	
1N54A	A & B	75	50	50	150	500	5.0	-10	7	-50	60	General Purpose	
1N55 1N55A *	A & B	170	150	50	150	500	4.0	-100	300	-150	500	Gen. Purpose, High Reverse Voltage	
1N58	A & B	190	150	50	150	500	5.0	-150	500			Gen. Purpose, High Reverse Voltage	
1N56 1N56A *	A & B	50	40	60	200	1000	15.0	-30	300			High Conduction	
1N58 1N58A	A & B	120	100	50	150	500	5.0	-100	600			High Reverse Voltage	
1N60	A	30	25	50	150	500	3.0			-10	67	Video Detector	
1N63	A & B	125	100	50	150	400	4.0	-50	50			General Purpose	
1N64	A & B	20	15							-10	200	Video Detector	
1N65	A & B	85	70	50	150	400	2.5	-50	200			General Purpose	
1N67 1N67A *	A & B	100	80	35	100	500	4.0	-5	5	-50	50	Gen. Purpose, High Reverse Resistance	
1N68A	A	130	100	35	100	500	3.0	-100	625			Gen. Purpose, High Reverse Voltage	
1N69	B	75	60	40	125	400	5.0	-10	30	-50	500	General Purpose, JAN	
1N70	B	125	100	30	90	350	3.0	-10	25	-50	300	General Purpose, JAN	
1N71 °	D	50	40	60	200	1000	15.0 Δ	-30	300			Quad, High Conductance Bridge Ckt.	

Type	Outline Drawing	Peak Reverse Voltage	MAXIMUM RATING, 25°C ambient				ELECTRICAL CHARACTERISTICS, 25°C ambient						Description
			Operating Reverse Voltage	Forward Current, ma			Minimum forward Current at +1V ma	Maximum Reverse Current					
				Average	Recurrent Peak	Surge 1 sec.		Volts	μA	Volts	μA		
1N73	D	75	60	22.5	60	100	15 at 1.3 to 1.7VΔ	-10	50			Quad, Bridge Circuit	
1N74*	D	75	60	22.5	60	100	15 at 1.2 to 1.8VΔ	-10	50			Quad, Bridge Circuit	
1N75	A & B	125	100	50	150	400	2.5	-50	50			General Purpose	
1N81	B	50	40	30	90	350	3.0	-10	10			General Purpose, JAN	
1N82†	B & C		5				Designed for efficient low-noise mixer operation from 470 to 890 mc					Silicon — UHF Mixer	
1N82A†	B & C		5				Designed for efficient low-noise mixer operation from 470 to 890 mc					Silicon — UHF Mixer	
1N90	A	75	60	40	150	500	5.0	-50	800			General Purpose	
1N111†	A	70	60	50	150	500	5.0	-10	25	-50	125	Computer	
1N112†	A	70	60	50	150	500	5.0	-10	50	-50	250	Computer	
1N113†	A	70	60	50	150	500	2.5	-10	25	-50	125	Computer	
1N114†	A	70	60	50	150	500	2.5	10	50	50	250	Computer	
1N115†	A	70	60	50	150	500	2.5	10	100	50	500	Computer	
1N119†	A	75	60	50	150	500	5.0	-10	25	10	125	Computer, Fast Recovery Time	
1N120†	A	75	60	50	150	500	5.0	-10	50	-10	250	Computer, Fast Recovery Time	
1N126	A	75	60	30	90	350	5.0	10	50	50	300	General Purpose, JAN	
1N127	A	125	100	30	90	300	3.0	-10	25	-50	200	General Purpose	
1N128	A	50	40	30	90	300	3.0	-10	10			General Purpose, JAN	
1N198 or 25°C	A	100	80	30	90	300	4.0	-10	10	-50	40	High Temp., High Reverse Resistance	
or 75°C		100	60	30	90	300	5.0	-10	75	-50	250	High Temp., High Reverse Resistance	
1N497	A	25	20	80	250		100	20	20			Bonded Junction	
1N498	A	50	40	80	250		100	40	25			Bonded Junction	
1N499	A	65	50	80	250		100	50	30			Bonded Junction	
1N500	A	75	60	80	250		100	60	40			Bonded Junction	
1N501	A	100	80	80	250		100	80	40			Bonded Junction	
1N502	A	125	100	80	250		100	100	40			Bonded Junction	

*Special package

†Units are tested for noise figure in instruments designed to correlate with customer applications.

‡Characteristics are for each diode.

§Reverse characteristics measured at 55°C.

¶Characteristics Curves in Curve Section.

Type Curve No.
 1N34 1000
 1N38A 1001
 1N55 1002
 1N56 1003
 1N67 1004

Δ Matching 1N35 — Current at +1.0V matched within 10%.

1N40, 1N42 — Resistance of diodes in each pair matched within 3% at +1.5V.

1N71 — Current of all four diodes matched within 1ma at +1.0V.

1N73 — Resistance of diodes in each pair matched within 2% at +15.0 ma d-c.

1N74 — Resistance of diodes in each pair matched within 6.7% at +15.0 ma d-c.

CBS

INDIUM-BONDED DIODES

CBS-Hytron Type	MAXIMUM RATINGS AT 25°C *				ELECTRICAL CHARACTERISTICS AT 25°C					Description
	Peak Reverse Voltage	Operating Reverse Voltage	Forward Current, ma		Minimum Forward Current at 1 V, ma	Maximum Reverse Current				
			Average	Recurrent Peak		µa	at Volts	µa	at Volts	
1N95	—75	—60	30	100	10	800	—50			General Purpose
1N96	—75	—60	30	100	20	800	—50			General Purpose
1N97	—100	—80	30	100	10	8	—5	100	—50	High Voltage
1N98	—100	—80	30	100	20	8	—5	100	—50	High Voltage
1N99	—100	—80	30	100	10	5	—5	50	—50	High Reverse Resistance, High Voltage
1N100	—100	—80	30	100	20	5	—5	50	—50	High Reverse Resistance, High Voltage
1N107	—15	—10	80	250	150	200	—10			High Conductance
1N108	—60	—50	50	160	50	200	—50			General Purpose
1N117	—75	—60	30	100	10	100	—50			General Purpose
1N118	—75	—60	30	100	20	100	—50			General Purpose
1N270	—75	—60	90	325	200	75	—10, 75°C	100	—50	High Conductance, High Temperature
1N273	—30	—20	80	250	100	20	20			High Conductance
1N276	—75	—60	40	150	40	20	—10	100	—50	Reverse Recovery = 80Kt, I.B.M.-W.
1N277	—125	—100	50	160	100	75	—10, 75°C	250	—50, 75°C	High Voltage, High Temperature
1N278	—60	—50	30	100	20	125	—50, 75°C			High Temperature
1N279	—35	—20	50	160	100	200	—20			High Conductance
1N281	—75	—60	75	225	100	30	—10	500	—50	High Conductance
1N283	—20	—10	80	250	200	20	—10			High Conductance
1N287	—60	—40	70	220	20	1500	—50			General Purpose
1N288	—85	—70	85	250	40	350	—50			General Purpose
1N289	—85	—70	70	220	20	50	—50			High Reverse Resistance
1N291	—120	—100	50	160	40	100	—100			High Reverse Resistance, High Voltage
1N292	—75	—60	80	250	100	200	—50			General Purpose
1N298	—85	—70	50	160	30@2V	250	—40, 50°C			General Purpose
1N447	—50	—30	30	100	25	20	—10	60	—30	General Purpose

* Measured in the JETEC 14.5-1 (Modified IBM-Y) Test Circuit. $I_F = 5$ ma, $I_R = -40$ V, $t = 0.3$ sec, $R_L = 2$ KΩ

Δ Measured in the JETEC 14.5-1 (Modified IBM-Y) Test Circuit. $I_F = 5$ ma, $I_R = -10$ V, $R_L = 6.2$ KΩ

* The dissipation rating at 25°C is 80 mw, which should be derated 1.33 mw per °C increase of ambient temperature.

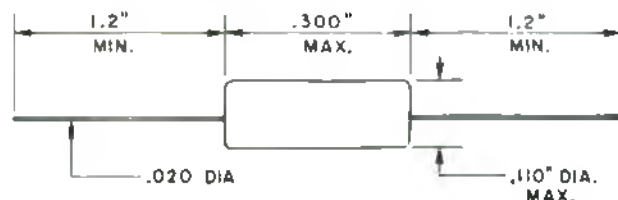
CHARACTERISTIC CURVES

Forward, High Conductance...1017 A

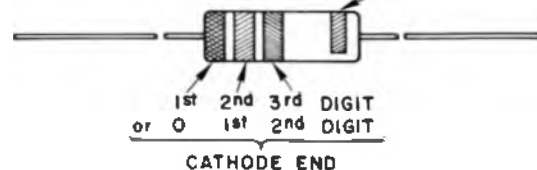
Reverse, 1N457...1017 B

Reverse, 1N500...1017 C

OUTLINE GLASS-ENCASED DIODE



MANUFACTURING CODE



COLOR CODE FOR GLASS DIODES

EIA standard color code bands are placed on the cathode end of all CBS-Hytron subminiature glass diodes. The three-band color code reads from left to right and indicates the figures following the "1N" prefix.

INDIUM-BONDED DIODES (CONT'D)

CBS-Hytron Type	MAXIMUM RATINGS AT 25°C *				ELECTRICAL CHARACTERISTICS AT 25°C					Description
	Peak Reverse Voltage	Operating Reverse Voltage	Forward Current, ma		Minimum Forward Current at +1V, ma	Maximum Reverse Current				
			Average	Recurrent Peak		μ A	at Volts	μ A	at Volts	
1N448	-120	-100	30	100	25	30	-30	100	-100	High Reverse Resistance, High Voltage
1N449	-50	-30	50	160	30	10	-10	30	-30	High Reverse Resistance, High Voltage
1N450	-120	-100	50	160	50	30	-30	100	-100	High Reverse Resistance, High Voltage
1N452	-50	-30	80	250	100	30	-30			High Reverse Resistance, High Conductance
1N453	-120	-100	80	250	100	30	-30	100	-100	High Reverse Resistance, Voltage & Conductance
1N454	-75	-50	80	250	200	30	-50			High Conductance, High Reverse Resistance
1N497	-30	-20	80	250	100	20	-20			High Conductance, High Reverse Resistance
1N498	-50	-40	80	250	100	25	-40			High Conductance, High Reverse Resistance
1N499	-65	-50	80	250	100	30	-50			High Conductance, High Reverse Resistance
1N500	-75	-60	80	250	100	40	-60			High Conductance, High Reverse Resistance
1N501	-100	-80	80	250	100	40	-80			High Conductance, Voltage & Reverse Resistance
1N502	-125	-100	80	250	100	50	-100			High Conductance, Voltage & Reverse Resistance
1N631	-70	-60	40	190	100	20	-10	120	-60	Reverse Recovery $\approx$ 80K τ , IBM - W
1N632	-70	-60	30	100	7.5	20	-10	120	-60	Reverse Recovery $\approx$ 50K τ , IBM - Y
1N633	-100	-80	40	190	150	40	-20	180	-90	Reverse Recovery $\approx$ 25K τ , IBM - Z
1N634	-115	-100	40	190	50	45	-45	100	-100	High Voltage, High Reverse Resistance
1N699	-105 at 70°C	-80	80	250	100	250	-75, 70°C			Reverse Recovery $\approx$ 50K τ , Burroughs H
1N770		-20	40	125	5@0.42V 15@0.50V	40	-10, 40°C			Reverse (15K at 0.35 μ sec) Recovery (50K at 0.7 μ sec) Δ
LD-70	-15	-12	30	100	100	100	-12			High Conductance
LD-71	-15	-12	30	100	2@0.4V	25	-12			General Purpose
LD-123	-35	-20	75	225	100	70	-20			High Conductance
LD-125	-75	-60	30	100	10	30	-10	500	-50	General Purpose
LD-130	-60	-50	80	250	200	15	-15	50	-50	High Conductance, High Reverse Resistance
LD-134	-40	-10	70	220	10 at 0.35V to 0.45V	5	-10	60	-10, 65°C	High Conductance, High Reverse Resistance
LD-141	-80	-60	30	100	20	100	-10			General Purpose
LD-142		-100	80	250	200	500	-100			High Voltage, High Conductance
LD-143	-75	-60	30	100	40	100	-50			General Purpose

† Measured in the JEDEC 14.5-1 (Modified IBM-Y) Test Circuit. $I_F = 5$ ma, $E_B = -40$ V, $t = 0.3$ μ sec, $R_L = 2$ Ω

‡ Measured in the JEDEC 14.5-1 (Modified IBM-Y) Test Circuit. $I_F = 5$ ma, $E_B = -10$ V, $R_L = 6.3$ Ω

* The dissipation rating at 25°C is 80 mw, which should be derated 1.33 mw per °C increase of ambient temperature.

CHARACTERISTIC CURVES

Forward, High Conductance... 1017 A

Reverse, 1N497... 1017 B

Reverse, 1N500... 1017 C



POINT-CONTACT DIODES

Type	Outline Drawing	MAXIMUM RATINGS, 25°C ambient					ELECTRICAL CHARACTERISTICS, 25°C ambient					Description
		Peak Reverse Voltage	Operating Reverse Voltage	Forward Current, ma			Minimum Forward Current at +1V ma	Maximum Reverse Current				
				Average $\uparrow$	Recurrent Peak	Surge 1 sec.		Volts	μ A	Volts	μ A	
1N34	A & B	75	60	40	150	500	5.0	-10	50	-50	500	General Purpose
1N34A	A & B	75	60	50	150	500	5.0	-10	30	-50	500	General Purpose
1N35*	A	75	60	50	150	500	7.5 Δ	-10	10			Matched Pair
1N38, 1N38A, 1N38B	A & B	120	100	50	150	500	4.0 to 25.0	-3	6	-100	500	High Reverse Voltage
	B	225	200	50	150	200	5.0	-100	65	-200	325	High Reverse Voltage
1N40*	D	75	60	40	150	500	12.75 at 1.5V Δ	-10	50	-50	600	Quad Demodulator
1N42*	D	125	100	50	150	500	12.75 at 1.5V Δ	-3	6	-100	625	Quad Demodulator
1N48	A & B	85	70	50	150	400	4.0	-50	833			General Purpose Detector
1N51	A & B	50	40	25	100	300	2.3	-50	1640			General Purpose
1N52	A & B	85	70	50	150	400	4.0	-50	150			General Purpose
1N54	A & B	50	35	40	150	500	5.0	-10	10			General Purpose
1N54A	A & B	75	50	50	150	500	5.0	-10	7			General Purpose
1N55, 1N55A	B	170	150	50	150	500	4.0	-100	300	-150	500	Gen. Purpose, High Reverse Voltage
1N55B	A	190	150	30	150	500	5.0	-150	500			Gen. Purpose, High Reverse Voltage
1N56, 1N56A	A & B	50	40	60	200	1000	15.0	-30	300			High Conduction
1N58, 1N58A	A & B	120	100	50	150	500	5.0	-100	600			High Reverse Voltage
1N60	A	30	25	30	150	500	3.0			-10	67	Video Detector
1N63	A & B	125	100	50	150	400	4.0	-50	50			General Purpose
1N64	A & B	20	15							-10	200	Video Detector
1N65	A & B	85	70	50	150	400	2.5	-50	200			General Purpose

(Units are tested for noise figure in instruments designed to correlate with customer applications.)

*Characteristics are for each diode.

All reverse characteristics measured at 55°C.

(All glass point-contact diodes are rated at 30 mA for 80 mW dissipation. Currents given over 30 mA are for the plastic case.

Δ Matching 1N35—Current at +1.0V matched within 10%.

1N40, 1N42—Resistance of diodes in each pair matched within 3 Ω at +1.5V.

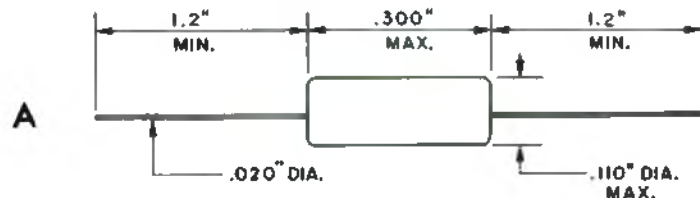
1N71—Current of all four diodes matched within 1 ma at +1.0V.

1N73—Resistance of diodes in each pair matched within 2 Ω at +15.0 ma d-c.

1N74—Resistance of diodes in each pair matched within 6.7 Ω at +15.0 ma d-c.

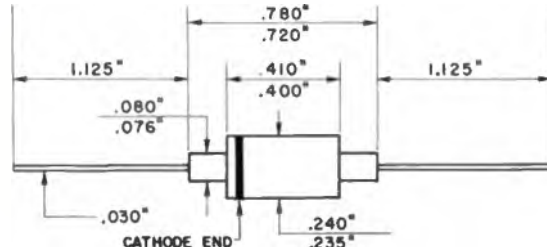
PHYSICAL TYPES AVAILABLE

GLASS-ENCASED DIODE



EIA standard color code bands are placed on the cathode end of all CBS-Hytron subminiature glass diodes. The three-band color code reads from left to right and indicates the figures following the "1N" prefix.

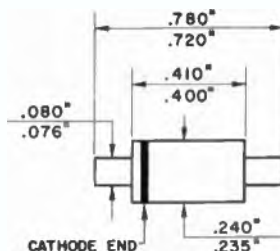
PLASTIC CASE DIODE



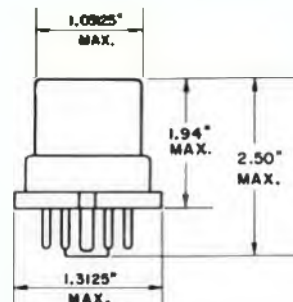
PHYSICAL TYPES AVAILABLE

C

PLASTIC CASE DIODE ... CLIP-IN TYPE



QUAD WITH STANDARD
OCTAL BASE WILL BE
SUPPLIED FOR ANY CBS DIODE



D

POINT-CONTACT DIODES (CONT'D)

Type	Outline Drawing	MAXIMUM RATINGS, 25°C ambient					ELECTRICAL CHARACTERISTICS, 25°C ambient					Description
		Peak Reverse Voltage	Operating Reverse Voltage	Forward Current, ma			Minimum Forward Current at +1V ma	Maximum Reverse Current				
				Average $\uparrow$	Recurrent Peak	Surge 1 sec.		Volts	μ A	Volts	μ A	
1N67, 1N67A 1N68A 1N69, 1N69A 1N70, 1N70A 1N71*	A & B A B B D	100 130 75 125 50	80 100 60 100 40	35 30 40 30 60	100 100 125 90 200	500 500 400 350 1000	4.0 3.0 5.0 to 25.0 3.0 to 25.0 15.0 Δ	-5 -100 -10 -10 -30	5 625 30 25 300	-50 -50 -50 -50	50 500 300	Gen. Purpose, High Reverse Resistance Gen. Purpose, High Reverse Voltage General Purpose General Purpose Quad, High Conductance Bridge Ckt.
1N73* 1N74* 1N75 1N81, 1N81A	D O A & B B	75 75 125 50	60 60 100 40	22.5 22.5 50 30	60 60 150 90	100 100 400 350	15 at 1.3 to 1.7V Δ 15 at 1.2 to 1.8V Δ 2.5 3.0 to 25.0	-10 -10 -50 -10	50 50 50 10			Quad, Bridge Circuit Quad, Bridge Circuit General Purpose General Purpose
1N82A† 1N90	A, B & C A	75 60	5 40	40	Designed for efficient low-noise mixer operation from 470 to 890 mc 150 500					5.0 -50 800		Silicon—UHF Mixer General Purpose
1N116 1N126, 1N126A 1N127, 1N127A	A A A	75 75 125	60 60 100	30 30 30	— 90 90	— 350 300	5.0 5.0 to 25.0 3.0 to 25.0	— -10 -10	— 50 25	-50 -50 -50	100 300 200	High Resistance, Gen. Purpose General Purpose, JAN General Purpose, JAN
1N128 1N191‡ 1N192‡ 1N198 at 25°C at 75°C 1N636	A A A A A A	50 105 80 100 60 60	40 70 55 80 60 45	30 50 50 30 30	90 150 150 90	300 500 500 300	3.0 5.0 5.0 4.0 5.0 2.5	-10 -10 -10 -10 -10 -10	10 25 50 10 75 10	-50 -50 -50 -50 -50	125 250 40 250	General Purpose, JAN Computer, Fast Recovery Time (IBM Type F) Computer, Fast Recovery Time (IBM Type G) High Temp., High Reverse Resistance, JAN High Resistance, Gen. Purpose

(Units are tested for noise figure in instruments designed to correlate with customer applications.

*Characteristics are for each diode.

†Reverse characteristics measured at 55°C.

‡All glass point-contact diodes are rated at 30 mA for 80 mW dissipation. Currents given over 30 mA are for the plastic case.

Δ Matching 1N35—Current at +1.0V matched within 10%.

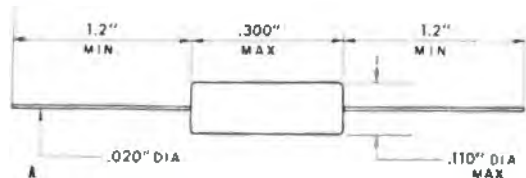
1N40, 1N42—Resistance of diodes in each pair matched within 30 Ω at +1.5V.

1N71—Current of all four diodes matched within 1 ma at +1.0V.

1N73—Resistance of diodes in each pair matched within 20 Ω at +15.0 ma d-c.

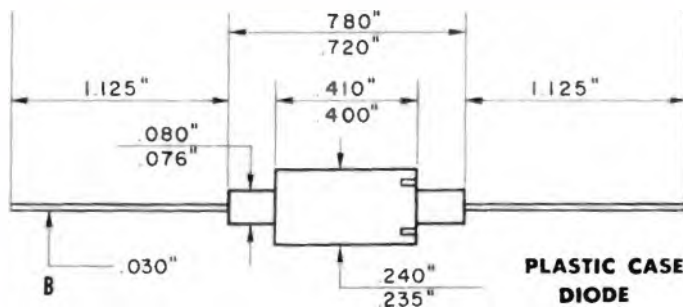
1N74—Resistance of diodes in each pair matched within 670 Ω at +15.0 ma d-c.

PHYSICAL TYPES AVAILABLE FOR GERMANIUM AND SILICON DIODES

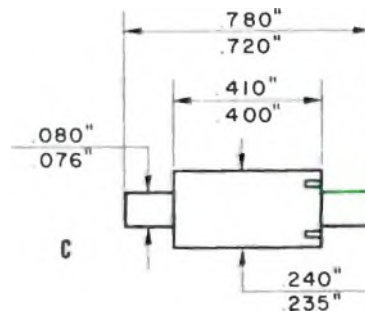


**GLASS-ENCASED
DIODE**

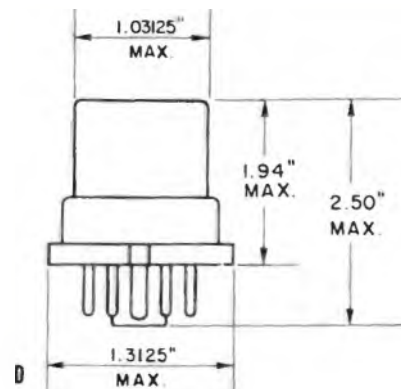
*RETMA standard color coded for identification. Three bands reading from cathode end indicate the numbers after the prefix "1N"; e.g., 1N497. (UMF silicon diodes excepted; the cathode is the crystal, the anode is the whisker.) A fourth band is the manufacturing date code.



**PLASTIC CASE
DIODE**



**GLASS-FILLED
PLASTIC CASE DIODE
... CLIP-IN TYPE**



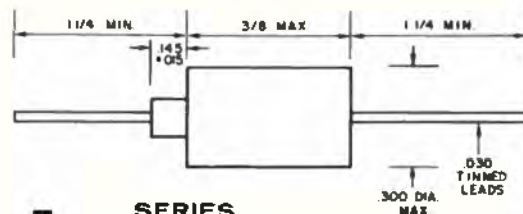
**QUAD WITH STANDARD
OCTAL BASE WILL BE
SUPPLIED FOR ANY CBS DIODE**



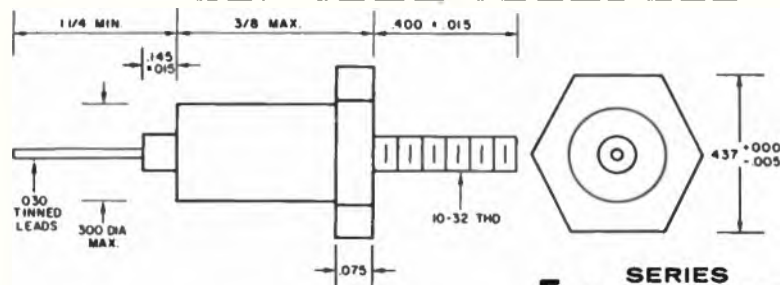
SILICON POWER RECTIFIERS

TYPE	Outline Drawing	ABSOLUTE MAXIMUM RATINGS					TYPICAL CHARACTERISTICS AT 125°C	
		Forward Current 25°C (Amp)	Peak Reverse Voltage at 125°C	Peak Min. Reverse Voltage at 25°C	Diss. at 25°C	Derating mw/°C rise	Forward Volts = 1.0 at 500ma (all units)	
							Reverse Current at Reverse Volts	
1N503	E	1/2	50	60	0.8W	8mw	0.5 ma	25V
1N504	E	1/2	100	120	0.8W	8mw	0.5 ma	50V
1N505	E	1/2	200	240	0.8W	8mw	0.5 ma	100V
1N506	E	1/2	300	360	0.8W	8mw	0.5 ma	150V
1N507	E	1/2	400	480	0.8W	8mw	0.25ma	200V
1N508	E	1/2	600	720	0.8W	8mw	0.25ma	300V
1N519	F	1.25	50	60	5W	50mw	0.5 ma	25V
1N520	F	1.25	100	120	5W	50mw	0.5 ma	50V
1N521	F	1.25	200	240	5W	50mw	0.5 ma	100V
1N522	F	1.25	300	360	5W	50mw	0.5 ma	150V
1N523	F	1.25	400	480	5W	50mw	0.25ma	200V
1N524	F	1.25	600	720	5W	50mw	0.25ma	300V

PHYSICAL TYPES AVAILABLE



E SERIES
1N503-1N508



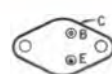
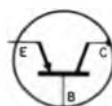
F SERIES
1N519-1N524

CBS

2N155



PNP power transistor . . .
metal case with plug-in leads for
automobile receivers . . . used for
audio power output stages,
servo amplifiers, d-c converter,
and magnetic coil driver



ELECTRICAL DATA

RATINGS, ABSOLUTE MAXIMUM, AT 25°C

Collector to base voltage, V_{CB}	-30 volts
Emitter to base voltage, V_{EB}	-15 volts
Collector current, continuous, I_C	-3 amp
Dissipation total, P	8.5 watts
Operating temperature, T_J	-40 to +85 °C
Storage temperature, T_{stg}	-40 to +85 °C

DESIGN CHARACTERISTICS

	Min.	LIMITS Distribution Center	Max.
Collector cutoff current; I_{CBO} at $V_{CB} = -30V$, $I_E = 0$			
Case temperature 25°C			1.0 mAdc
Case temperature 50°C			2.0 mAdc
Case temperature 85°C			10 mAdc
Collector cutoff current; I_{CES} at $V_{CB} = -30V$			
Case temperature 25°C			0.42 mAdc
Emitter cutoff current; I_{EBO} at $V_{EB} = -15V$, $I_C = 0$			
Case temperature 25°C	0.6		0.5 mAdc
Case temperature 50°C			1.0 mAdc
Case temperature 85°C			5.0 mAdc
Power gain, PG at 25°C	30		db
Current gain, B at 25°C			
$I_C = 0.25A$		45	
$I_C = 0.50A$	24	40	
$I_C = 1.00A$		32	
Saturation voltage; V_S at $I_C = 1.0A$, 25°C	0.47		0.65 Vdc
Input voltage, V_{BE} at 25°C			
$I_C = 0.25A$		0.34	Vdc
$I_C = 0.50A$		0.47	0.70 Vdc
$I_C = 1.00A$		0.60	Vdc
Thermal resistance, θ at 25°C			3 °C/w
Derating per °C temp. increase Δ	0.14		watts
Alpha cutoff frequency;			
f_{α} at $V_C = 2V$, $I_C = 0.25A$	145	180	kc

TYPICAL OPERATIONS AT 25°C (one unit, common emitter)

Class A Amplifier

Collector supply voltage, V_{CC}	-14 Vdc
Collector current, I_C	~360 mAdc
Base current, I_B	-8 mAdc
Base to emitter voltage, V_{BE}	-0.32 Vdc
Dissipation, zero signal, P	4.4 watts
Input resistance, R_{in}	20 ohms
Load resistance, R_L	30 ohms
Power output, P_{out}	2 watts
Power input, P_{in}	1 mw
Power gain, PG	33 db
Distortion, D	5 %

ENGINEERING
DESIGN DATA

2N155

DECEMBER 28, 1956

PNP alloy junction
germanium transistor

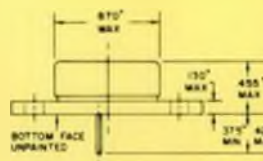
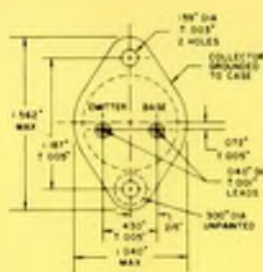
CHARACTERISTICS CURVES
(In curve section following APPENDIX)

Collector, I_C vs V_{CE}	1009A
Base, V_{BE} vs I_B	1011A
Large Signal Current Amplification	
Factor vs Collector Current	1011B
Typical Collector Saturation	1011C

MECHANICAL DATA

Case material*	Metal
Case height, max.	0.455 inch
Flange length, minor axis,	
max.	1.040 inch
Flange length, major axis,	
max.	1.562 inches
Mounting hole diameter	
(2 holes)	0.159 ± 0.003 inch
Lead diameter	0.040 ± 0.001 inch
Lead length, min.	0.375 inch
Lead length, max.	0.425 inch

* For maximum heat transfer the collector is internally attached to the can's copper base block. It is recommended that the unit be bolted to a metal chassis or equivalent for cooling.



APPLICATION

CBS type 2N155 is primarily used in the power output stage of transistor automobile receivers, either singly or in push-pull operation. A major application is in hybrid radios using tubes and transistor operating directly from the 12-volt storage battery.

2N155 (cont.)

PUSH-PULL CLASS B AMPLIFIER

Collector supply voltage, V_{CC}	-14 Vdc
Collector current, zero signal, I_C	-50 mAdc
Collector current, max. signal, I_C	-500 mAdc
Peak collector current, I_C	-1.5 Adc
Base current, zero signal, I_B	-1 mAdc
Base current, max. signal, I_B	-13 mAdc
Dissipation, zero signal, P_D	0.7 watt
Dissipation, max. signal, P_D	1.6 watts
Input resistance, R_{in}	40 ohms
Load resistance (collector to collector), R_L	32 ohms
Power output†, P_{out}	9 watts
Power input‡, P_{in}	30 mw
Power gain‡, PG	25 db
Distortion, D	8 %

SWITCHING APPLICATION *

Collector supply voltage, V_{CC}	-14 Vdc
Collector load resistance, R_L	6.5 ohms
Collector current "OFF," I_C	-0.2 mAdc
Collector current "ON," I_C	-2 Adc
Base voltage "OFF," V_B	+1.5 Vdc
Base voltage "ON," V_B	-1.0 Vdc
Base current "ON," I_B	-100 mAdc
Dissipation "ON," P_D	2 watts
Switch power, P_S	26 watts
Control power, P_C	100 mw
Power gain, PG	25 db

NOTES:

- IRE symbols used throughout. See APPENDIX for symbol definition.
- ▼ Bolted directly to a 6" x 6" x 1/4" aluminum sheet (75 sq. in. radiating surface)
 - a. 7.25 watts max. with a 0.0015" mica washer treated with DC200 silicone oil between the transistor and the heat sink (75 sq. in. radiating surface)
 - b. 1.5 watts max. in free air.
- ▲ Under mounting conditions listed in previous note.
 - a. 0.12 watt under conditions of note ▼a
 - b. 0.024 watt under conditions of note ▼b.

† P_G = Power output

available input power
(from a 12 ohm generator)

where $I_C = 0.5 \text{ Adc}$, $R_L = 30 \text{ ohms}$

‡ Both units

★ Use of an efficient heat radiator for operation at these conditions is imperative.



2N156
2N158
2N158A



PNP power transistor . . .
metal case for bolt type mounting
. . . used for low speed switching,
servo motor controls, and audio
or sawtooth oscillators

ELECTRICAL DATA

RATINGS, ABSOLUTE MAXIMUM AT 25°C

	2N156	2N158	2N158A
Collector to base voltage, V_{CB}	-30	-60	-80Vdc
Collector to emitter voltage, V_{CE}	-30	-60	-60Vdc
Emitter to base voltage, V_{EB}	-15	-30	-30Vdc
Collector Current, I_C	3	3	3A
Dissipation, P.....	20	20	20W
Operating and Junction Temperature, T_j	-65 to +85°C		

TEST CHARACTERISTICS AT 25°C

	Type	LIMITS	
		Min.	Max.
Collector Cutoff Current, I_{CBO} ..			
$V_{CB} = -80Vdc$	2N158A	—	1.0 mAdc
$V_{CB} = -60Vdc$	2N158	—	1.0 mAdc
$V_{CB} = -30Vdc$	2N156	—	1.0 mAdc
Collector Cutoff Current, I_{CES}			
$V_{CB} = -60Vdc$	2N158	—	1.5 mAdc
$V_{CB} = -60Vdc$	2N158A	—	1.5 mAdc
$V_{CB} = -30Vdc$	2N156	—	1.5 mAdc
Emitter Cutoff Current, I_{EBO}			
$V_{EB} = -30Vdc$	2N158	—	0.5 mAdc
$V_{EB} = -30Vdc$	2N158A	—	0.5 mAdc
$V_{EB} = -15Vdc$	2N156	—	0.5 mAdc
Collector to Emitter Breakdown Voltage, BV_{CEO}			
$I_C = 250$ mAdc.....	2N158A	60	— Vdc
Base Current, I_B			
$I_C = 500$ mAdc,			
$V_{CE} = -2.0Vdc$	2N156	—	20 mAdc
$I_C = 500$ mAdc,			
$V_{CE} = -2.0Vdc$	2N158	—	24 mAdc
$I_C = 500$ mAdc,			
$V_{CE} = -2.0Vdc$	2N158A	—	24 mAdc
Base Voltage, V_{BE}			
$I_C = 500$ mAdc,			
$V_{CE} = -2.0Vdc$	2N156	—	0.70 Vdc
$I_C = 500$ mAdc,			
$V_{CE} = -2.0Vdc$	2N158	—	0.85 Vdc
$I_C = 500$ mAdc,			
$V_{CE} = -2.0Vdc$	2N158A	—	0.85 Vdc
Saturation Voltage, $V_{CE}(SAT)$			
$I_C = 1Adc$, $I_B = 150$ mA.....	all	—	0.75 Vdc

DESIGN CHARACTERISTICS

	Type	LIMITS	
		Min.	Max.
Collector Cutoff Current, I_{CBO}			
$V_{CB} = -80Vdc$, $T_A = 85°C$...	2N158A	—	10 mAdc
$V_{CB} = -60Vdc$, $T_A = 85°C$...	2N158	—	10 mAdc
$V_{CB} = -30Vdc$, $T_A = 85°C$...	2N156	—	10 mAdc
Thermal Resistance, θ	all	—	3 °C/W
Cutoff Frequency, $f_{\alpha e}$			
$I_C = 0.5A$, $V_{CE} = -2V$	all	4	— Kc



ENGINEERING DESIGN DATA

2N156
2N158
2N158A

MARCH 30, 1959

**PNP germanium
power transistors**

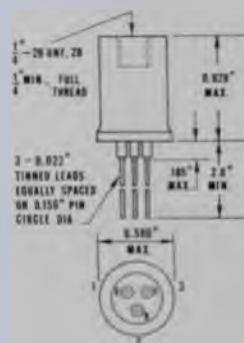
CHARACTERISTIC CURVES

2N156 2N158
2N156 2N158A

Collector, I_C vs I_{CE}	1009	1010A
Base, V_{BE} vs I_B	1011A	1011A
Large Signal Amplification Factor vs Collector Current (I_B vs I_C).....	1011B	1011B
Typical Collector Saturation.....	1011C	1011C

MECHANICAL DATA

Case material.....Metal
Maximum case length.....0.828 inch
Maximum case diameter.....0.580 inch
Lead diameter.....0.022 inch
Minimum lead length.....2.000 inches



LEAD COLOR CODE

Emitter.....red lead
Base.....white lead
Collector, grounded to case.....black lead

APPLICATION

CBS types 2N156, 2N158 and 2N158A are power transistors that may be used in a wide variety of applications. They are used in automation devices to operate relays, to control servo motors and magnetic amplifiers. Other uses include low speed switching, oscillation, and audio power amplification.



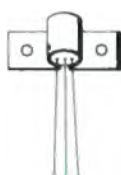
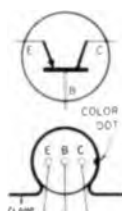


2N180 2N181



PNP general purpose transistor
... high gain ... low-to-medium
power ... low noise ... for **2N180**
Class A and B stages, preamplifiers,
and low-frequency flip-flop circuits

2N181



ELECTRICAL DATA

RATINGS, ABSOLUTE MAXIMUM, AT 25°C

	2N180	2N181
Collector to base voltage, d-c	-30	-30 volts
Dissipation, total in free air	150	250 mw
Derating per °C ambient temp. increase	3	5 mw
Operating temperature, junction	-50 to +75	°C
Storage temperature	-50 to +85	°C

TYPICAL CHARACTERISTICS AT 25°C

Collector peak reverse voltage, emitter open	-40	-40 volts
Collector current, emitter open at -30V	-10	-10 μ A
Collector current, base open at -10V	-0.3	-0.3 mA
Emitter peak reverse voltage, collector open	-30	-30 volts
Emitter reverse current, collector open at -20V	-8	-8 μ A

Low Frequency Small Signal Parameters

Collector voltage, V_{CE}	-6	-6 volts
Emitter current, I_E	1.0	1.0 mA
Frequency	270	270 c.p.s.
Base-collector current amplification, β	60	60
Emitter-collector current amplification, β_{ec} or h_{fb}	0.985	0.985
Alpha cut-off frequency, F_{α}	700	700 kc
Emitter input resistance, output shorted, h_{ie}	32	32 ohms
Collector output conductance, input open, h_{ob}	0.5	0.5 μ mhos
Collector-emitter feedback voltage ratio, h_{rb}	4×10^{-4}	4×10^{-4}
Collector capacitance, at 500 kc	25	25 μ f
Noise figure	12	12 db

Large Signal Low Frequency Parameters

Base-collector current amplification, $B = I_C/I_B$		
$I_B = 0.1$ ma, $V_C = -1V$	70	70
$I_B = 1.0$ ma, $V_C = -1V$	50	50
Base input resistance, $R_i = V_B/I_B$		
$I_B = 0.1$ ma, $V_C = -1V$	2000	2000 ohms
$I_B = 1.0$ ma, $V_C = -1V$	500	500 ohms
Saturation resistance, R_s	2.5	2.5 ohms

CBS SEMICONDUCTORS

ENGINEERING DESIGN DATA

2N180 2N181

DECEMBER 29, 1956

**PNP alloy junction
germanium transistor**

CHARACTERISTICS CURVES

(In curve section following APPENDIX)

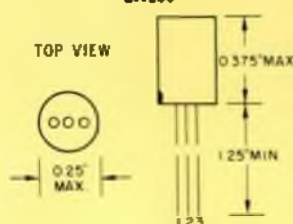
Collector, I_C vs V_{CE}	1012A
Base, V_{BE} vs I_C	1012B
Transient Switching	1012C

MECHANICAL DATA

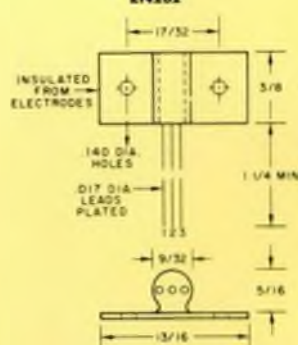
	2N180	2N181
Case material	Metal	Metal
Maximum case length	0.375	1/4 inch
Max. case diameter	0.25	5/16 inch
Max. clamp length		1 1/8 inch
Lead diameter	.017	.017 inch
Minimum lead length	1.25	1.25 inches

2N180

TOP VIEW



2N181



LEAD COLOR CODE

Count from Red Dot

1. Collector
2. Base
3. Emitter

APPLICATION

CBS types 2N180 and 2N181 are for general-purpose low-frequency use. They are especially suitable in the output stage of portable radio receivers. Other applications are: computer switches, servo amplifiers, low frequency oscillators, low-impedance microphone amplifiers, and high-gain audio amplifiers.



2N182
2N183
2N184



NPN high frequency transistors
... low base resistance
providing fast response ...
for switching, flip-flop, and
bilateral circuits

ELECTRICAL DATA

RATINGS, ABSOLUTE MAXIMUM, AT 25°C

	2N182	2N183	2N184
Collector to base voltage.....	25	25	25 volts
Emitter to base voltage.....	15	15	15 volts
Total dissipation.....	100	100	100 mw
Derate approx. 2 mw per °C increase of ambient temperature			
Operating junction temperature.....	-50°C to 75°C		
Storage temperature.....	-50°C to 85°C		

TYPICAL ELECTRICAL CHARACTERISTICS AT 25°C

Static and Large Signal Parameters

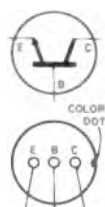
Collector peak reverse voltage with emitter open.....	30	30	30 volts
Collector reverse current at 10 volts with emitter open.....	3	3	3 μ A
Emitter peak reverse voltage with collector open.....	20	20	20 volts
Emitter reverse current at 5 volts with collector open.....	3	3	3 μ A
Current amplification, common emitter, $B = \frac{I_c}{I_b}$			
at $I_b = 0.1$ ma, $V_{CE} = 1$ volt.....	20	35	60
$I_b = 0.5$ ma, $V_{CE} = 1$ volt.....	25	50	100
Base-emitter voltage, V_{BE}			
at $I_b = 0.1$ ma, $V_{CE} = 1$ volt.....	0.18	0.18	0.18 volts
$I_b = 0.5$ ma, $V_{CE} = 1$ volt.....	0.27	0.31	0.35 volts
Saturation resistance, $R_s = \frac{V_s}{I_c}$			
at $I_c = 50$ ma.....	3	3	3 ohms

Transient Responses

Collector output current, I_c	10	10	10 ma
Base input turn-on current, I_{bi}	1	1	1 ma
Base input turn-off current, I_{bo}	1	1	1 ma
Rise time, t_r	0.7	0.5	0.30 μ s
Fall time, t_f	0.5	0.30	0.2 μ s
Storage time, t_s	0.8	0.7	0.6 μ s

Low-Frequency Small Signal Parameters*

	2N182	2N183	2N184
Collector voltage, V_{CE}	6	6	6 volts
Emitter current, I_E	-1	-1	-1 ma
Frequency.....	270	270	270 c.p.s.
Emitter to collector current amplification, a or h_{fe}	.96	0.975	0.983
Base to collector current amplification, β or h_{re}	25	40	60
Emitter resistance, r_e	27	27	27 ohms
Base resistance, r_b	1	1.5	2.5 K
Collector resistance, r_c	2	2	2 meg



ENGINEERING DESIGN DATA

2N182
2N183
2N184

DECEMBER 28, 1956

**NPN alloy junction
germanium transistor**

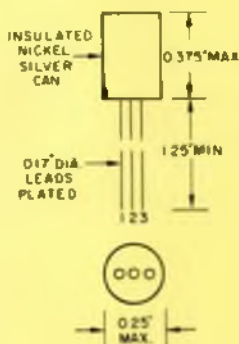
CHARACTERISTICS CURVES

(In curve section following APPENDIX)

Low voltage, I_c vs V_{CE}	1008A
Base, V_{BE} vs I_b	1008B
Switching transient response.....	1008C
Collector, I_c vs V_{CE}	
2N182.....	1005A
2N183.....	1006A
2N184.....	1007A

MECHANICAL DATA

Case material.....	Metal
Maximum case length.....	0.375 inch
Maximum case diameter.....	0.25 inch
Lead diameter.....	0.017 inch
Minimum lead length.....	1.25 inches



LEAD COLOR CODE

Count from Red Dot

1. Collector
2. Base
3. Emitter

APPLICATION

CBS types 2N182, 2N183, and 2N184 are suitable for high current, short-pulse application. They may also be used in radio frequency applications such as r-f, v-f, and oscillator stages of radio receivers. They are recommended for magnetic core gates and flip-flop circuits.

ENGINEERING DESIGN DATA

2N182-2N183-2N184 (cont.)

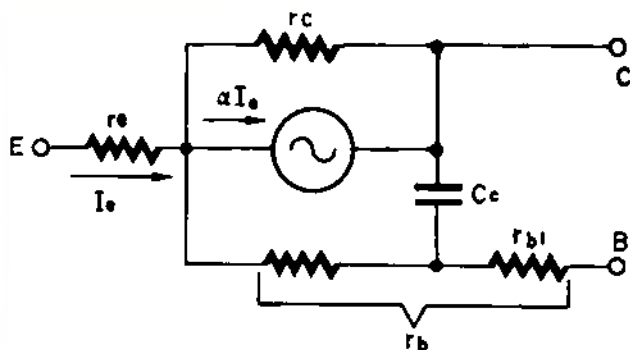
High-Frequency Small Signal Parameters*

	2N182	2N183	2N184
Collector voltage, V_{CC}	6	6	6 volts
Emitter current, I_E	-1	-1	-1 ma
Frequency	455	455	455 kc
Alpha cutoff frequency, $f_{\alpha co}$	2.5-5	5-10	10 mc
Collector capacitance, C_c	10	10	10 μ f
Base resistance, ohmic, r_b	160	180	240 ohms

NOTES:

• Small Signal Equivalent Circuit shown below

SMALL SIGNAL EQUIVALENT CIRCUIT

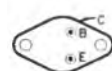
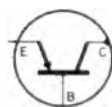


2N255
2N256



PNP power transistor

... metal case with plug in type leads ... designed for radio amateurs and experimenters use† ... used in power output stage of portable phonograph and mobile public address systems



ELECTRICAL DATA

RATINGS, ABSOLUTE MAXIMUM, AT 25°C

	2N255	2N256
Collector to base voltage, d-c	-15	-30 volts
Emitter to base voltage, d-c	-15	-30 volts
Collector current, steady state d-c	-3	-3 amp
Dissipation, total in free air	1.5	1.5 watts
Derating per °C ambient temp. increase	.024	.024 watt
Dissipation, total with heat radiator	6.25	.625 watts
Derating per °C ambient temp. increase	0.1	0.1 watt
Operating temperature, junction	-40 to 85	°C
Storage temperature	-40 to 85	°C

TYPICAL CHARACTERISTICS AT 25°C

Collector current.....	-500	-500	ma
Collector voltage.....	-6	-12	volts
Base resistance.....		9 to 24	ohms
Alpha cutoff frequency, $F_{\alpha c o}$	200	200	kc
Collector to base current amplification, d.c.....		30 to 50	
Saturation voltage, $V_{S1}, I_C = 1.0$ amp.....	0.5	0.5	volts
Operating temp. gradient, junction and surface of copper base.....	3		$^{\circ}\text{C}/\text{w}$

TYPICAL OPERATION AT 25°C⁰

Class A Amplifier (one unit, common emitter connected)

Collector supply voltage	-7	-14	volts
Collector to emitter voltage, d-c	-6	-12	volts
Collector current, d-c	-500	-500	ma
Base to emitter voltage, d-c	0.4	0.6	volts
Base current, d-c	-10 to -16		ma
Input resistance	10 to 25		ohms
Load resistance	14	28	ohms
Power output	1	2	watts
Total harmonic distortion	5 to 7		%
Power input	2 to 10		mW
Power gain	19 to 26	22 to 29	db

Push-Pull Class B Amplifier (common emitter connected)

Values for each unit	2N255	2N256	
Collector supply voltage V_{CC}	-7	-14	volts
Collector current, zero signal	-50	-50	ma
Collector current, max. signal	-500	-500	ma
Peak collector current	-1500	-1500	ma
Base current, zero signal	-0.5 to -1.5		ma
Base current, max. signal	-10 to -16		ma
Dissipation, max. signal	0.8	1.6	watts
Input resistance		18 to 48	ohms
Load resistance	4		8 ohms
Power output	5	10	watts
Power input		25 to 150	mw
Power gain	12 to 20	15 to 23	db

ENGINEERING DESIGN DATA

2N255
2N256

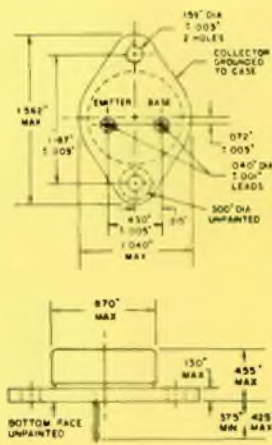
DECEMBER 28, 1956

**PNP alloy Junction
germanium transistor**

MECHANICAL DATA

Case material*	Metal
Case height, max.	0.455 inch
Flange length, minor axis, max.	1.040 inch
Flange length, major axis, max.	1.562 inch
Mounting hole diameter (2 holes)	0.159 ± 0.003 inch
Lead diameter	0.040 ± 0.001 inch
Lead length, min.	0.375 inch
Lead length, max.	0.425 inch

* For maximum heat transfer the collector is internally attached to the can's copper base block. It is recommended that the unit be bolted to a metal chassis or equivalent for cooling.



APPLICATION

These transistors are derived from CBS type 2N155 for experimental use only. Type 2N155 is recommended to equipment manufacturers.

2N255-2N256 (cont.)

NOTES:

● These are peak values; the 2N255 and 2N256 should be operated from 6 and 12-volt batteries, respectively.

▲ When operated within maximum rated power dissipation using a 6" x 6" x 1/4" aluminum heat radiator, the temperature should not exceed 151°F (66°C) on the surface of the case.

■ Use of an efficient heat radiator for operation at these conditions is imperative.

▽ The supply voltages given for the 2N255 and 2N256 are those used in mobile operation, nominally -6 and -12 volts, respectively.

□ Values for both units.

† For circuits of various experimental applications send for CBS-Hytron booklet PA-16.

CBS**2N356**

**NPN high frequency computer
transistor high mobility electron
flow . . . providing fast response . . .
for switching and flip-flop circuits . . .
TO-9 package**

**ELECTRICAL DATA****RATINGS, ABSOLUTE MAXIMUM AT 25°C**

Collector to base voltage, V_{CB0}	20 Vdc
Emitter to base voltage, V_{EB0}	20 Vdc
Collector to emitter voltage, V_{CE0}	18 Vdc
Total dissipation, P_{tot}	100 mW
Derating per °C increase in ambient temperature	1.67 mW
Operating and storage temperature, T_j	-55°C to +85°C

ELECTRICAL CHARACTERISTICS AT 25°C

Static Parameters	Min.	Mode	Max.
Collector cutoff current, I_{CBO}			
$V_{CB} = 20$ V			25 μ Adc
$V_{CB} = 5$ V			5 μ Adc
Emitter cutoff current, I_{EBO}			
$V_{EB} = 20$ V			25 μ Adc
$V_{EB} = 5$ V			5 μ Adc
Collector breakdown voltage, BV_{CEO}			
$I_C = 600$ μ A	18		Vdc
Collector breakdown voltage, BV_{CEB}			
$I_C = 600$ μ A, $V_{EB} = 1.5$ V, $R_B = 62$ K Ω	20		Vdc
Emitter punch-thru current, I_E			
$V_{CB} = 20$ V			25 μ Adc
Current gain, h_{FE}			
$I_C = 100$ mA, $V_{CE} = .25$ V	20	30	50
Input voltage, V_{BE}			
$I_C = 100$ mA, $V_{CE} = .25$ V		.6	.8 Vdc
Saturation voltage, $V_{CE}(SAT)$			
$I_C = 100$ mA, $I_B = 10$ mA			.20 Vdc

Small Signal Parameters

Current gain, h_{FE}			
$V_{CE} = 5$ V, $I_C = 1$ mA		30	
Frequency cutoff, $f_{\alpha\beta}$			
$V_{CE} = 5$ V, $I_C = 1$ mA		3	mc
Collector capacitance, C_C			
$V_{CE} = 5$ V, $I_C = 1$ mA, $f = 1$ mc		14	μ fd

Typical Switching Characteristics (Note 1)

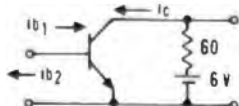
Rise time, t_r	1.0	2.0	μ s
Storage time, t_s	0.3	0.7	μ s
Fall time, t_f	1.0	2.0	μ s

Environmental

Hermetic seal — detergent and water at 60 psi for 1/2 hour.
Drop — 30 inches to maple block, 3 drops.
Shock — 500 g, 7 ms.
Vibration — 10 g, 100-1000 cps.
Lead bend — 3-180 degree bends on leads.

NOTE 1:

Turn-on current $ib_1 = 5$ mA
Turn-off current $ib_2 = -2$ mA
Collector current $I_C = 100$ mA

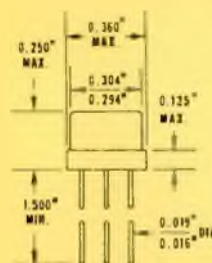
**ENGINEERING
DESIGN DATA****2N356**

DECEMBER 30, 1959

**NPN junction
germanium transistor**

MECHANICAL DATA

JEDEC outline	TO-9
JEDEC base	E3-51
Case material	metal
Maximum case length	0.250 inch
Maximum case diameter	0.360
Minimum lead length	1.5
Lead diameter	0.017

**MECHANICAL
CONSIDERATIONS**

These CBS-Hytron high frequency transistors have a welded package which conforms to the JEDEC, TO-9 outline. This welded construction reduces any contamination on the transistor to a minimum, thus insuring a high degree of reliability in performance. They are also equipped with flexible, plated leads that are designed for connection by soldering, welding or socketing.

The over-all dimension of the hermetically sealed can is less than 3/4 inch by 3/4 inch. All three leads are insulated.

No special requirement need be met in mounting these transistors except that care should be exercised to keep the junction temperature below 85°C (185°F).

2N356A

DECEMBER 30, 1959



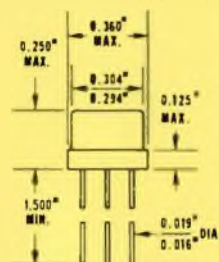
2N356A



**NPN high frequency computer
transistor high mobility electron
flow . . . providing fast response . . .
for switching and flip-flop circuits . . .
TO-9 package**

MECHANICAL DATA

JEDEC outline	TO-9
JEDEC base	E3-51
Case material	metal
Maximum case length	0.250 inch
Maximum case diameter	0.360
Minimum lead length	1.5
Lead diameter	0.017



MECHANICAL CONSIDERATIONS

CBS Electronics high frequency transistors have a welded package which conforms to the JEDEC, TO-9 outline. This welded construction reduces any contamination on the transistor to a minimum, thus insuring a high degree of reliability in performance. They are also equipped with flexible, plated leads that are designed for connection by soldering, welding or socketing. The base is connected to the case to provide greater dissipation.

No special requirement need be met in mounting these transistors except that care should be exercised to keep the junction temperature below 100°C (212°F).

APPLICATION

The CBS Electronics type 2N356A is designed for use in medium speed switching circuits of both industrial and military computers. At 100 mA collector current the 2N356A has a gain of 20-50.

ELECTRICAL DATA

RATINGS: ABSOLUTE MAXIMUM, AT 25°C

Collector to base voltage, V_{CB0}	30 Vdc
Collector to emitter voltage, V_{CE0}	20 Vdc
Emitter to base voltage, V_{EB0}	20 Vdc
Dissipation, P_T	150 mw
Operating and Storage Temperature, T_J	-65 to +100°C

ELECTRICAL CHARACTERISTICS AT 25°C

Static Characteristics

Collector Cutoff Current, I_{C0}

$V_{CB} = 5$ Vdc

$V_{CB} = 30$ Vdc

Emitter Cutoff Current, I_{E0}

$V_{EB} = 5$ Vdc

$V_{EB} = 20$ Vdc

C-E Breakdown Voltage, BV_{CEO}

$I_C = 600$ μ A

Current Gain, h_{FE}

$I_C = 100$ mA, $V_{CE} = 0.25$ Vdc

$I_E = 1$ mA, $V_{CB} = 0.25$ Vdc

Input Voltage, V_{BE}

$I_C = 100$ mA, $V_{CE} = 0.25$ Vdc

$I_E = 1$ mA, $V_{CB} = 0.25$ Vdc

Collector to emitter voltage, BV_{EBO}

$I_C = 10$ μ A, $V_{CB} = 1.5$ Vdc, $R_{TH} = 62$ K Ω

Reach thru voltage, V_{RTR}

$V_{CB} = 1.5$ Vdc, $R_{TH} = 62$ K Ω

LIMITS

Min.	Max.
—	5 μ A
—	25 μ A
—	5 μ A
—	25 μ A
20	— Vdc
20	50 —
30	— —
—	0.8 Vdc
—	0.4 Vdc
25	— Vdc
30	— Vdc

Switching Characteristics (see note 1)

Delay and Rise time, t_d and t_r

Storage time, t_s

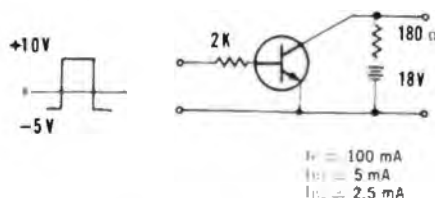
Fall time, t_f

—	2.1 μ sec
—	0.5 μ sec
—	1.2 μ sec

ENVIRONMENTAL

This transistor meets the environmental test of MIL-S-19500B for Moisture Resistance, Vibration, Temperature Cycling, Soldering, Constant Acceleration and Lead Fatigue.

Note 1



Pulse Width = 5 μ sec, PRR = 1 kc

by
No spec
in mounting
that care should
junction temperat



2N357



**NPN high frequency computer
transistor high mobility electron
flow . . . providing fast response . . .
for switching and flip-flop circuits . . .
TO-9 package**



ELECTRICAL DATA

RATINGS, ABSOLUTE MAXIMUM AT 25°C

Collector to base voltage, V_{CB0}	20 Vdc
Emitter to base voltage, V_{EB0}	20 Vdc
Collector to emitter voltage, V_{CE0}	15 Vdc
Total dissipation, P	100 mW
Derating per °C increase in ambient temperature	1.67 mW
Operating and storage temperature, T_j	-55° C to +85° C

ELECTRICAL CHARACTERISTICS AT 25°C

	Min.	LIMITS Mode	Max.
Static Parameters			
Collector cutoff current, I_{CBO}			25 μ Adc
$V_{CB} = 20$ V			5 μ Adc
$V_{EB} = 5$ V			
Emitter cutoff current, I_{EBO}			25 μ Adc
$V_{EB} = 20$ V			5 μ Adc
$V_{CB} = 5$ V			
Collector breakdown voltage, BV_{CEO}			Vdc
$I_C = 600$ μ A	15		
Collector breakdown voltage, BV_{CES}			Vdc
$I_C = 600$ μ A, $I_B = -25$ μ A	18		
Emitter punch-thru current, I_E			25 μ Adc
$V_{CB} = 20$ V			
Current gain, h_{FE}			
$I_C = 100$ mA, $V_{CB} = .25$ V	20	30	50
Input voltage, V_{BE}			
$I_C = 200$ mA, $V_{CB} = .25$ V		.7	1.0
Saturation voltage, $V_{CE(SAT)}$			.20 Vdc
$I_C = 200$ mA, $I_B = 20$ mA			
Small Signal Parameters			
Current gain, h_{FE}			45
$V_{CB} = 5$ V, $I_C = 1$ mA			
Frequency cutoff, $f_{\alpha\beta}$			6 mc
$V_{CB} = 5$ V, $I_C = 1$ mA			
Collector capacitance, C_c			14 pF
$V_{CB} = 5$ V, $I_C = 1$ mA, $f = 1$ mc			

Typical Switching Characteristics (Note 1)

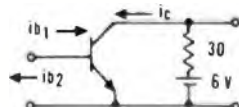
Rise time, t_r	0.6	1.2	μ s
Storage time, t_s	0.3	0.7	μ s
Fall time, t_f	0.6	1.2	μ s

Environmental

Hermetic seal — detergent and water at 60 psi for 1/2 hour.
Drop — 30 inches to maple block, 3 drops.
Shock — 500 g, 7 ms.
Vibration — 10 g, 100-1000 cps.
Lead bend — 3-180 degree bends on leads.

NOTE 1:

Turn-on current $i_{B1} = 10$ mA
Turn-off current $i_{B2} = -3$ mA
Collector current $I_C = 200$ mA



ENGINEERING DESIGN DATA

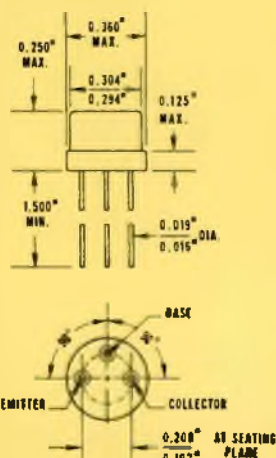
2N357

DECEMBER 30, 1959

**NPN junction
germanium
transistor**

MECHANICAL DATA

JEDEC outline	TO-9
JEDEC base	E3-51
Case material	metal
Maximum case length	0.250 inch
Maximum case diameter	0.360
Minimum lead length	1.5
Lead diameter	0.017



MECHANICAL CONSIDERATIONS

CBS Electronics high frequency transistors have a welded package which conforms to the JEDEC, TO-9 outline. This welded construction reduces any contamination on the transistor to a minimum, thus insuring a high degree of reliability in performance. They are also equipped with flexible, plated leads that are designed for connection by soldering, welding or socketing.

The over-all dimension of the hermetically sealed can is less than 1/4 inch by 1/4 inch. All three leads are insulated.

No special requirement need be made in mounting these transistors that care should be exercised junction temperature below

ENGINEERING DESIGN DATA

2N358

DECEMBER 30, 1959

NPN junction germanium transistor



2N358



**NPN high frequency computer
transistor high mobility electron
flow . . . providing fast response . . .
for switching and flip-flop circuits . . .
TO-9 package**

ELECTRICAL DATA

RATINGS, ABSOLUTE MAXIMUM AT 25°C

Collector to base voltage, V_{CB0}	20 Vdc
Emitter to base voltage, V_{EB0}	20 Vdc
Collector to emitter voltage, V_{CE0}	18 Vdc
Total dissipation, P	100 mW
Derating per °C increase in ambient temperature	1.67 mW
Operating and storage temperature, T_j	-55° C to +85° C

ELECTRICAL CHARACTERISTICS AT 25°C

	LIMITS		
	Min.	Mode	Max.
Static Parameters			
Collector cutoff current, I_{CBO}			
$V_{CB} = 20$ V			25 μ Adc
$V_{CB} = 5$ V			5 μ Adc
Emitter cutoff current, I_{EBO}			
$V_{EB} = 20$ V			25 μ Adc
$V_{EB} = 5$ V			5 μ Adc
Collector breakdown voltage, BV_{CBO}			
$I_C = 600$ μ A	12		Vdc
Collector breakdown voltage, BV_{CEA}			
$I_C = 600$ μ A, $I_E = -25$ μ A	15		Vdc
Emitter punch-thru current, I_E			
$V_{CB} = 15$ V			25 μ Adc
Current gain, h_{FE}			
$I_C = 300$ mA, $V_{CE} = 25$ V	20	30	50
Input voltage, V_{BE}			
$I_C = 300$ mA, $V_{CE} = 25$ V		9	1.25 Vdc
Saturation voltage, $V_{CE}(SAT)$			
$I_C = 300$ mA, $I_E = 30$ mA			.20 Vdc
Small Signal Parameters			
Current gain, h_{FE}			
$V_{CE} = 5$ V, $I_C = 1$ mA		60	
Frequency cutoff, $f_{\alpha\beta}$			
$V_{CE} = 5$ V, $I_C = 1$ mA		9	mc
Collector capacitance, C_C			
$V_{CB} = 5$ V, $I_C = 1$ mA, $f = 1$ mc		14	μ s/f

Small Signal Parameters

Current gain, h_{FE}			
$V_{CE} = 5$ V, $I_C = 1$ mA		60	
Frequency cutoff, $f_{\alpha\beta}$			
$V_{CE} = 5$ V, $I_C = 1$ mA		9	mc
Collector capacitance, C_C			
$V_{CB} = 5$ V, $I_C = 1$ mA, $f = 1$ mc		14	μ s/f

Typical Switching Characteristics (Note 1)

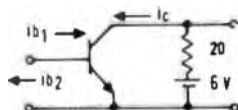
Rise time, t_r	0.4	0.8	μ s
Storage time, t_s	0.5	1.0	μ s
Fall Time, t_f	0.6	1.2	μ s

Environmental

Hermetic seal—detergent and water at 60 psi for 1/2 hour.
Drop—30 inches to maple block, 3 drops.
Shock—500 g, 7 ms.
Vibration—10 g, 100-1000 cps.
Lead bend—3-180 degree bends on leads.

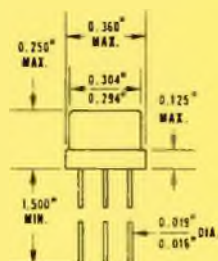
NOTE 1:

Turn on current $i_{B1} = 15$ mA
Turn-off current $i_{B2} = -5$ mA
Collector current $I_C = 300$ mA



MECHANICAL DATA

JEDEC outline	TO-9
JEDEC base	E3-51
Case material	metal
Maximum case length	0.250 inch
Maximum case diameter	0.360
Minimum lead length	1.5
Lead diameter	0.017



MECHANICAL CONSIDERATIONS

CBS Electronics high frequency transistors have a welded package which conforms to the JEDEC, TO-9 outline. This welded construction reduces any contamination on the transistor to a minimum, thus insuring a high degree of reliability in performance. They are also equipped with flexible, plated leads that are designed for connection by soldering, welding or socketing.

The over-all dimension of the hermetically sealed can is less than 1/4 inch.

Special requirement need be met for these transistors except be exercised to keep the temperature below 85°C (185°F).



2N385



NPN high frequency computer transistor
high mobility electron flow . . .
providing fast response . . . for switching
and flip-flop circuits . . . TO-9 package

ELECTRICAL DATA

RATINGS, ABSOLUTE MAXIMUM AT 25°C

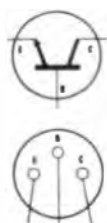
Collector to base voltage, BV_{CBO}	25 Vdc
Collector to emitter voltage, BV_{CEO}	25 Vdc
Emitter to base voltage, BV_{EBO}	15 Vdc
Total dissipation, P	150 mW
Derating per °C increase in ambient temperature.....	2 mW
Operating and storage temperature, T_j	-55°C to +100°C

ELECTRICAL CHARACTERISTICS AT 25°C

Static Parameters	LIMITS		Units
	Min.	Mode Max.	
Collector cutoff current, I_{CBO} $V_{CB} = 25$ V.....		6	35 μ Adc
Collector cutoff current, I_{CEX} $V_{CB} = 25$ V, $R_{BK} = 10$ K.....		50	400 μ Adc
Emitter cutoff current, I_{EBO} $V_{EB} = 15.0$ V.....		6	30 μ Adc
Current gain, h_{FE} $I_C = 30$ mA, $V_{CE} = 0.75$ V.....	30	60	110
$I_C = 200$ mA, $V_{CE} = 0.75$ V.....	20	40	
Input voltage, V_{AK} $I_C = 200$ mA, $I_B = 10$ mA.....		1.0	1.5 Vdc
Frequency cutoff, $f_{\alpha b}$ $I_C = 1.0$ mA, $V_C = 6.0$ V.....	4.0	6.0	mc

Environmental

Hermetic seal — detergent and water at 60 psi for ½ hour.
 Drop — 30 inches to maple block, 3 drops.
 Shock — 500 g, 7 ms.
 Vibration — 10 g, 100-1000 cps.
 Lead bend — 3-180 degree bends on leads.



ENGINEERING DESIGN DATA

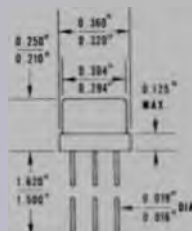
2N385

MARCH 30, 1959

NPN junction
germanium transistor

MECHANICAL DATA

JETEC outline.....TO-9
 JETEC base.....E3-51
 Case material.....metal
 Maximum case length.....0.250 inch
 Maximum case diameter.....0.360 inch
 Minimum lead length.....1.5 inches
 Lead diameter.....0.017 inch



MECHANICAL CONSIDERATIONS

These CBS-Hytron high frequency transistors have a welded package which conforms to the JETEC, TO-9 outline. This welded construction reduces any contamination on the transistor to a minimum, thus insuring a high degree of reliability in performance. They are also equipped with flexible, plated leads that are designed for connection by soldering, welding or socketing. The base is connected to the case to provide greater dissipation.

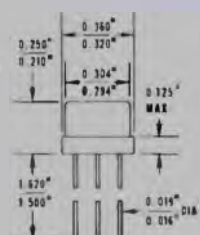
ENGINEERING DESIGN DATA

2N388

MARCH 30, 1959

MECHANICAL DATA

JETEC outline.....TO-9
JETEC base.....E3-51
Case material.....metal
Maximum case length.....0.250 inch
Maximum case diameter.....0.360 inch
Minimum lead length.....1.5 inches
Lead diameter.....0.017 inch



MECHANICAL CONSIDERATIONS

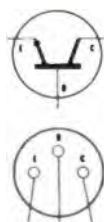
These CBS-Hytron high frequency transistors have a welded package which conforms to the JETEC, TO-9 outline. This welded construction reduces any contamination on the transistor to a minimum, thus insuring a high degree of reliability in performance. They are also equipped with flexible, plated leads that are designed for connection by soldering, welding or socketing. The base is connected to the case to provide greater dissipation.



2N388



NPN high frequency computer transistor
high mobility electron flow . . .
providing fast response . . . for switching
and flip-flop circuits . . . TO-9 package



ELECTRICAL DATA

RATINGS, ABSOLUTE MAXIMUM AT 25°C

Collector to base voltage, V_{CB} 25 Vdc
Emitter to base voltage, V_{EB} 15 Vdc
Collector to emitter voltage, V_{CE} 20 Vdc
Total Dissipation, P 150 mW
Derating per °C increase in ambient temperature..... 2 mW
Operating and storage temperature, T_j -55° C to +100° C

ELECTRICAL CHARACTERISTICS AT 25°C

	Min.	LIMITS Mode	Max.	
Static Parameters				
Collector cutoff current, I_{CBO}				
$V_{CB} = 20$ V		6	20	μ Adc
$V_{CB} = 1.0$ V		2	5	μ Adc
Emitter cutoff current, I_{EBO}				
$V_{EB} = 15$ V		6	10	μ Adc
$V_{EB} = 1.0$ V		2	5	μ Adc
Collector cutoff current, I_{CER}				
$V_{CE} = 20$ V, $V_{EB} = 5$ V, $R_{EB} = 5000$ ohms		5	50	μ Adc
Current gain, h_{FE}				
$V_{CE} = 1.0$ V, $I_C = 30$ mA	60	110	180	
$V_{CE} = .75$ V, $I_C = 200$ mA	30	80		
Input voltage, V_{BE}				
$I_C = 200$ mA, $I_B = 10$ mA		1.0	1.5	Vdc
Collector capacitance, C_c				
$V_C = 6.0$ V, $I_C = 1.0$ mA, $f = 2$ mc		15	20	μ uf
Alpha cutoff frequency, $f_{\alpha B}$				
$V_{CB} = 6$ V, $I_C = 1$ ma		8		mc

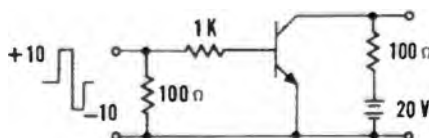
Typical Switching Characteristics (Note 1)

Rise time, t_r	0.6	1.0	μ s
Fall time, t_f	0.4	0.7	μ s
Storage time, t_s	0.4	0.7	μ s

Environmental

Hermetic seal — detergent and water at 60 psi for 1/2 hour,
Drop — 30 inches to maple block, 3 drops.
Shock — 500 g, 7 ms.
Vibration — 10 g, 100-1000 cps.
Lead bend — 3-180 degree bends on leads.

NOTE 1:



CBS SEMICONDUCTORS



2N438
2N439
2N440



NPN high frequency transistors
... low base resistance
providing fast response ...
for switching, flip-flop, and
bilateral circuits



ELECTRICAL DATA

RATINGS, ABSOLUTE MAXIMUM, AT 25°C

	2N438	2N439	2N440
Collector to base voltage, V_{CB}	30	30	30
Emitter to base voltage, V_{EB}	25	25	25
Total dissipation	100	100	100
Derate approx. 2 mw per °C increase of ambient temperature			
Operating junction temperature	-50°C to 85°C		
Storage temperature	-50°C to 85°C		

ELECTRICAL CHARACTERISTICS AT 25°C Static and Large Signal Parameters

	Type	LIMITS		
		Min.	Mode	Max.
Cutoff Collector Current, I_{CBO} $V_{CB} = 25V$	all		1.5	10 μ Adc
Cutoff Collector Current, I_{CBO} $V_{CB} = 6V, T_A = 75^\circ C$	all			150 μ Adc
Cutoff Emitter Current, I_{EBO} $V_{EB} = 25V$	all		1.5	10 μ Adc
Cutoff Emitter Current, I_{EBO} $V_{EB} = 6V, T_A = 75^\circ C$	all			150 μ Adc
Collector-Base Breakdown Voltage, $BV_{CBO}, I_C = 100 \mu A$	all	30		Vdc
LIMITS				
Collector-Emitter Breakdown Voltage, $BV_{CEO}, I_C = 300 \mu A$	2N438	25		Vdc
	2N439	20		Vdc
	2N440	15		Vdc
Current Gain — D.C., h_{FE} $I_C = 50 mA, V_{CE} = 1.0V$	2N438	20	25	—
	2N439	30	45	—
	2N440	40	70	—
Input Voltage, V_{EB} $I_C = 50 mA, V_{CE} = 1.0V$	2N438		0.37	Vdc
	2N439		0.32	Vdc
	2N440		0.27	Vdc
Saturation Resistance, R_s $I_C = 50 mA$	all	3		5 ohms

Typical Switching Characteristics†

Parameter	2N438	2N439	2N440
Rise time, t_r	0.7	0.5	0.3 μ sec
Fall time, t_f	0.5	0.3	0.2 μ sec
Storage time, t_s	0.8	0.7	0.6 μ sec

Low Frequency, small signal parameters†

Parameter	Type	LIMITS		
		Min.	Mode	Max.
Current Gain, common emitter, h_{ie}	2N438	15	25	
	2N439	15	35	
	2N440	15	65	
Input Resistance, common base, h_{ib}	all		27	ohms
Input Resistance, common emitter, h_{ie}	2N438		1.0	K ohms
	2N439		1.5	K ohms
	2N440		2.5	K ohms

CBS SEMICONDUCTORS

ENGINEERING DESIGN DATA

2N438
2N439
2N440

NOVEMBER 1, 1957

**NPN alloy junction
germanium transistor**

CHARACTERISTIC CURVES (In curve section following APPENDIX)

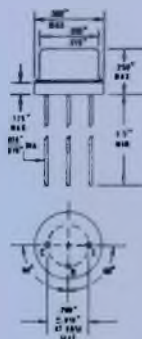
Collector, I_C vs V_{CE}	1013A
2N438	1013A
2N439	1014A
2N440	1015A
Low voltage, I_C vs V_{BE}	1016A
Base, V_{BE} vs I_B	1016B
Switching transient response	1016C

MECHANICAL DATA

JETEC outline	TO-5†
JETEC base	E3-44†
Case material	Metal
Maximum case length	0.250 inch
Maximum case diameter	0.360 inch
Lead diameter	0.017 inch
Minimum lead length	1.500 inches

NOTE

†Meets outline dimensions without index tab



MECHANICAL CONSIDERATIONS

These CBS high-frequency transistors have a welded package which conforms to the JETEC outline TO-5. This welded construction reduces any contamination on the transistor to a minimum, thus insuring a high degree of reliability in performance. They are also equipped with flexible, gold-plated leads that are designed for connection by soldering, welding or socketing.

Mechanically, the three types are identical. The over-all dimension of the hermetically sealed can is less than 1/4 inch by 1/2 inch. All three leads are insulated, electrically, from the can.

No special requirement need be met in mounting them except that care should be exercised to keep the junction temperature below 85°C (185°F).

ENGINEERING DESIGN DATA

2N438 • 2N439 2N440 (cont.)

SWITCHING TIME OF TRANSISTORS

In switching applications, it is important to have fast and uniform switching transients for high-speed transistor operation. The switching transients are described by rise time, fall time, and storage time.

These periods are defined as follows: with a pulse applied to the transistor input, the rise time is the time during which the output pulse increases from 10% to 90% of its final maximum amplitude; the storage time is that between the end of the input pulse and the point at which the output pulse has decreased to 90% of its maximum amplitude; the fall time is the time during which the output pulse is decreasing from 90% to 10% of its maximum amplitude.

The waveforms of the input and output currents, as well as the circuit in which they are measured, are shown in Characteristic Curve 1016C. With a fixed maximum collector current limited by a resistor, the rise time depends upon the magnitude of the turn-on current i_{b1} , and the fall time is contingent upon the magnitude of the turn-off current i_{b2} . The storage time depends upon both i_{b1} and i_{b2} .

The measured results of the switching times of the 2N438, 2N439, and 2N440 with 10 ma maximum collector current are plotted against base currents. These curves give the orders of magnitude of the switching times.

2N438 • 2N439 • 2N440 (cont.)

High Frequency, small signal parameters*

	Type	LIMITS			
		Min.	Mode	Max.	
Cutoff Frequency, f_{cb}	2N438	2.5			Mc/s
	2N439	5.0			Mc/s
	2N440	10.0			Mc/s
Collector Capacitance, C_c	all	9	15		$\mu\mu\text{f}$
Extrinsic base resistance, r_b'	2N438	180			ohms
	2N439	220			ohms
	2N440	300			ohms
Collector base time constant, $r_b' C_c$	2N438	2000			μSEC
	2N439	2300			μSEC
	2N440	3000			μSEC
Power Gain, unilateralized, PG	2N438	29			
	2N439	32			
	2N440	35			

NOTES:

$I_{IC} = 10 \text{ mA}$, $i_{b1} = 1 \text{ mA}$, $i_{b2} = 1 \text{ mA}$

$V_{CE} = 6.0 \text{ Vdc}$, $I_E = 1.0 \text{ mA}$, $f = 270 \text{ Mc/s}$

* $V_{CE} = 6.0 \text{ Vdc}$, $I_E = 1.0 \text{ mA}$, $f = 455 \text{ Kc/s}$

APPLICATION EXAMPLES

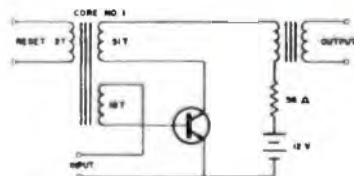
The high-current, short-pulse applications of transistors are numerous and their potentials can be illustrated by considering a transistor-core gate.

The basic transistor magnetic-core gate circuit shown can be explained as follows: If a pulse is applied to the reset winding, Core 1 is demagnetized or reset. Consequently, there will be coupling between the collector and base windings.

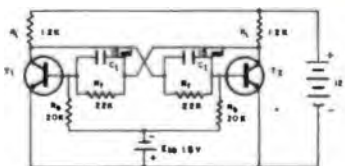
When an input pulse is applied, regenerative action causes a large pulse output and magnetizes Core 1 to saturation. Without further resetting, since the core is now saturated, the collector and base windings are not coupled. There will be no output pulse as there is no response to an input pulse.

Several transistor core gates can be connected in cascade to construct a shift register . . . binary counter or scales . . . decade counter or logic circuits, etc. The high-current pulse operation of transistors can also be used to drive magnetic heads for writing and reading.

CBS transistor 2N439 or 2N440 in a magnetic-core gate circuit. Each input pulse disables the circuit by a saturable magnetic core. It must then be reset before responding to another input pulse.



A typical flip-flop circuit using a pair of CBS 2N439's. This circuit resembles closely the Eccles-Jordan flip-flop vacuum tube circuit. The circuit has two stable states, transistor T_1 "on" and T_2 "off," and vice versa. The cross coupling capacitors C_1 permit triggering from one state to the other.



$$R_L \approx \frac{E_{CC}}{I_{C \text{ "on"}}} \quad \text{The coupling resistor } R_T = \frac{BR_b h_{FE}}{R_{b1} I_{C \text{ "on"}} E_{BBB}}$$

$$\text{where } h_{FE} = \frac{I_{C \text{ "on"}}}{I_{b \text{ "on"}}}$$





2N634
2N635
2N636



**NPN high frequency computer
transistor high mobility electron
flow . . . providing fast response . . .
for switching and flip-flop circuits . . .
TO-9 package**



ELECTRICAL DATA

RATINGS, ABSOLUTE MAXIMUM AT 25°C

Collector to base voltage, V_{CB}	20 Vdc
Collector to emitter voltage, V_{CE}	20 Vdc
Emitter to base voltage, V_{EB}	15 Vdc
Total Dissipation, P_T	150 mW
Derating per °C increase in ambient temperature	2.5 mW
Operating and storage temperature, T_J	-65 to +85°C

ELECTRICAL CHARACTERISTICS AT 25°C

	Type	Min.	Max.	Units
Collector Cutoff Current, I_{CBO}				
$V_{CB} = 5$ Vdc	all	—	5	μ Adc
$V_{CB} = 20$ Vdc	all	—	15	μ Adc
Emitter Cutoff Current, I_{EBO}				
$V_{EB} = 15$ Vdc	all	—	10	μ Adc
Collector-Emitter Breakdown Voltage				
$I_C = 600 \mu$ Adc, $R_{FE} = 10 K\Omega$	2N634, 635	20	—	Vdc
$I_C = 600 \mu$ Adc, $R_{FE} = 10 K\Omega$	2N636	15	—	Vdc
Current Gain, h_{FE}				
$I_C = 200$ mAdc, $V_{CE} = 0.75$ Vdc	2N636	35	—	—
	2N635	25	—	—
	2N634	15	—	—
Alpha Cutoff Frequency, f_{α}				
$I_C = 1$ mAdc, $V_{CB} = 5$ Vdc	2N636	15	—	Mc
	2N635	10	—	Mc
	2N634	5	—	Mc

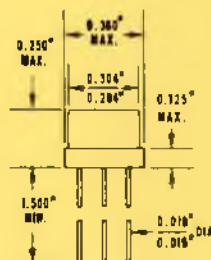
ENGINEERING DESIGN DATA

2N634
2N635
2N636

DECEMBER 30, 1959

MECHANICAL DATA

JEDEC outline	TO-9
JEDEC base	E3-51
Case material	metal
Maximum case length	0.250 inch
Maximum case diameter	0.360
Minimum lead length	1.5
Lead diameter	0.017



MECHANICAL CONSIDERATIONS

CBS Electronics high frequency transistors have a welded package which conforms to the JEDEC, TO-9 outline. This welded construction reduces any contamination on the transistor to a minimum, thus insuring a high degree of reliability in performance. They are also equipped with flexible, plated leads that are designed for connection by soldering, welding or socketing. The base is connected to the case to provide greater dissipation.





2N440 2N440A



NPN high frequency computer transistor
high mobility electron flow . . .
providing fast response . . . for switching
and flip-flop circuits . . . TO-9 package



ELECTRICAL DATA

RATINGS, ABSOLUTE MAXIMUM AT 25°C

	2N440	2N440A
Collector to base voltage, V_{CB}	30	30 Vdc
Emitter to base voltage, V_{EB}	25	25 Vdc
Collector to emitter voltage, V_{CE}	15	15 Vdc
Total dissipation, P	100	150 mW
Derating per °C increase in ambient temperature	1.7	2.5 mW
Operating and storage temperature, T_j	-55 to +85° C	

ELECTRICAL CHARACTERISTICS AT 25°C

	LIMITS		
	Min.	Mode	Max.
Static Parameters			
Collector cutoff current, I_{CBO} $V_{CB} = 25$ V		2	10 μ Adc
Collector cutoff current, I_{CBO} $V_{CB} = 6$ V, $T_A = 75^\circ$ C			150 μ Adc
Emitter cutoff current, I_{EBO} $V_{EB} = 25$ V		2	10 μ Adc
Emitter cutoff current, I_{EBO} $V_{EB} = 6$ V, $T_A = 75^\circ$ C			150 μ Adc
Collector-base breakdown voltage, BV_{CBO} $I_C = 100$ μ A			30 Vdc
Collector-emitter breakdown voltage, BV_{CEO} $I_C = 300$ μ A			15 Vdc
Current gain, h_{FE} $I_C = 50$ mA, $V_{CE} = 1.0$ V	40	70	
Input voltage, V_{BE} $I_C = 50$ mA, $V_{CE} = 1.0$ V		.27	.7 Vdc
Saturation resistance, R_s $I_C = 50$ mA, $I_B = 2.5$ mA		3	5 ohms

Typical Switching Characteristics†

Rise time, t_r	.3	μ S
Fall time, t_f	.2	μ S
Storage time, t_s	.6	μ S

Low Frequency, Small Signal Parameters†

Current gain, h_{FE}	65	
Input resistance, h_{ib}	27	ohms
Input resistance, h_{ie}	2500	ohms

High Frequency, Small Signal Parameters†

Cutoff frequency, f_{cb}	10.0	mc
Collector capacitance, C_c	9	μ f
Collector base time constant, $\tau_b C_c$	3000	μ f
Extrinsic base resistance, r_b'	300	ohms

Environmental

Hermetic seal — detergent and water at 60 psi for 1/2 hour.
 Drop — 30 inches to maple block, 3 drops.
 Shock — 500 g, 7 ms.
 Vibration — 10 g, 100-1000 cps.
 Lead bend — 3-180 degree bends on leads.

† $V_{CB} = 6.0$ Vdc, $I_E = 1.0$ mA, $f = 270$ cps.
 ‡ $V_{CB} = 6.0$ Vdc, $I_E = 1.0$ mA, $f = 455$ kc.

♦ Turn-on current $i_{B1} = 1$ mA.
 Turn-off current $i_{B2} = 1$ mA.
 Collector current $I_C = 10$ mA.
 See curve 1016C for Measuring Circuit

ENGINEERING DESIGN DATA

2N440 2N440A

MARCH 30, 1959

**NPN junction
germanium transistor**

CHARACTERISTIC CURVES

(In curve section following APPENDIX)
 Collector, I_C vs V_{CE} 1015A
 Low voltage, I_C vs V_{BE} 1016A
 Base input, V_{BE} vs I_B 1016B
 Switching transient response 1016C

MECHANICAL DATA

(is identical to type 2N438)

SWITCHING TIME OF TRANSISTORS

In switching applications, it is important to have fast and uniform switching transients for high-speed transistor operation. The switching transients are described by rise time, fall time, and storage time.

These periods are defined as follows: with a pulse applied to the transistor input, the rise time is the time during which the output pulse increases from 10% to 90% of its final maximum amplitude; the fall time is the time during which the output pulse is decreasing from 90% to 10% of its maximum amplitude. Some transistors also specify a period of delay time. Delay time is the time between the start of the applied pulse and the point at which the output pulse increases to 10% of its maximum amplitude.

The waveforms of the input and output currents, as well as the circuit in which they are measured, are shown in Characteristic Curve 1016C. With a fixed maximum collector current limited by a resistor, the rise time depends upon the magnitude of the turn-on current i_{B1} , and the fall time is contingent upon the magnitude of the turn-off current, i_{B2} . The storage time depends upon both i_{B1} and i_{B2} .

The measured results of the switching times of the transistors with 10 mA maximum collector current are plotted against base currents. These curves give the orders of magnitude of the switching times.

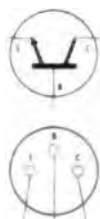


2N1090 2N1091



NPN high frequency computer transistors high mobility electron flow . . . providing fast response . . . for switching and flip-flop circuits . . .

TO-9 package



ELECTRICAL DATA

RATINGS: ABSOLUTE MAXIMUM, AT 25°C

	2N1090	2N1091	
Collector to base voltage, V_{CB}	25	25	Vdc
Collector to emitter voltage, V_{CE}	18	15	Vdc
Emitter to base voltage, V_{EB}	20	20	Vdc
Dissipation, P_T	120	120	mW
Junction & Storage Temperature, T_J	-65 to +85		°C

ELECTRICAL CHARACTERISTICS AT 25°C

	2N1090		2N1091		
Collector Cutoff Current, I_{CBO} $V_{CB} = 12$ Vdc	Min.	Max.	Min.	Max.	μ Adc
Emitter Cutoff Current, I_{EBO} $V_{EB} = 5$ Vdc	—	8	—	8	μ Adc
Collector to base breakdown voltage, BV_{CB0} $I_C = 25$ μ Adc	—	5	—	5	Vdc
Collector to emitter breakdown voltage, BV_{CE0} $I_E = 600$ μ Adc	25	—	25	—	Vdc
Collector to emitter breakdown voltage, BV_{CE0} $I_E = 600$ μ Adc	18	—	15	—	Vdc
Collector to emitter breakdown voltage, BV_{CE0} $I_E = 600$ μ Adc	15	—	12	—	Vdc
Emitter to base breakdown voltage, BV_{EB0} $I_E = 25$ μ Adc	20	—	20	—	Vdc
Current Gain, h_{FE} $I_E = 20$ mAdc	30	—	40	—	—
$V_{CE} = 0.2$ Vdc	—	—	—	—	—
$I_E = 200$ mAdc	20	—	30	—	—
$V_{CE} = 0.3$ Vdc	—	—	—	—	—
Input Voltage, V_{BE} $I_E = 20$ mAdc	—	0.4	—	0.35	Vdc
$I_E = 200$ mAdc	—	1.5	—	1.1	Vdc
$I_E = 10$ mAdc	—	—	—	—	—
Cutoff Frequency, f_{cutoff} $I_E = 1$ mAdc, $V_{CE} = 6$ Vdc	5	—	10	—	Mc
Stored base charge, Q_s $I_E = 20$ mAdc	—	1600	—	—	μ coulombs
$I_E = 1.33$ mAdc	—	—	—	—	—
$I_E = 20$ mAdc	—	—	—	1000	μ coulombs
$I_E = 1.0$ mAdc	—	—	—	—	—

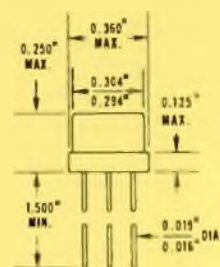
ENGINEERING DESIGN DATA

2N1090 2N1091

NOVEMBER 2, 1959

MECHANICAL DATA

JEDEC outline	TO-9
JEDEC base	E3-51
Case material	metal
Maximum case length	0.250 inch
Maximum case diameter	0.360
Minimum lead length	1.5
Lead diameter	0.017



MECHANICAL CONSIDERATIONS

CBS Electronics high frequency transistors have a welded package which conforms to the JEDEC, TO-9 outline. This welded construction reduces any contamination on the transistor to a minimum, thus insuring a high degree of reliability in performance. They are also equipped with flexible, plated leads that are designed for connection by soldering, welding or socketing. The base is connected to the case to provide greater dissipation.

APPLICATION

The CBS Electronics types 2N1090 and 2N1091 are designed for use in high current switching circuits of both industrial and military computers. At 200 mA collector current they have a minimum gain of 20 and 30, respectively.



2N1433
2N1434
2N1435



PNP power transistor . . .
metal case with stud for direct
mounting . . . used for low speed
switching, servo motor controls,
power amplifiers and converters

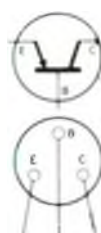
ELECTRICAL DATA

RATINGS: ABSOLUTE MAXIMUM, AT 25°C

Collector to base voltage, V_{CB}	-80 Vdc
Collector to emitter voltage, V_{CE}	-50 Vdc
Emitter to base voltage, V_{EB}	-28 Vdc
Collector current, I_C	3.5 Adc
Dissipation, P_T , @ $T_r = 71^\circ\text{C}$	12 W
Junction temperature, T_J	-65 to +95°C

ELECTRICAL CHARACTERISTICS AT 25°C

	Type	LIMITS		
		Min.	Max.	
Collector Cutoff Current, I_{CBO}				
at $V_{CB} = -2V$	all	—	0.1	mAdc
at $V_{CB} = -28V$	all	—	1.0	mAdc
at $V_{CB} = -80V$	all	—	2.0	mAdc
Emitter Cutoff Current, I_{EBO}				
at $V_{EB} = -2V$	all	—	0.15	mAdc
at $V_{EB} = -28V$	all	—	2.0	mAdc
Floating Potential, V_{FSP}				
at $V_{CB} = -60V$, $R_{BK} = 1\text{ M}\Omega$	all	—	0.3	Vdc
at $V_{CB} = -80V$, $R_{BK} = 1\text{ M}\Omega$	all	—	1.5	Vdc
Collector-Emitter Breakdown Voltage, BV_{CEO} at $I_C = 300\text{ mAdc}$	all	50	—	Vdc
Current Gain, h_{FE}				
at $I_C = 2\text{ Adc}$, $V_{CE} = -2\text{ Vdc}$	2N1433	20	50	—
	2N1434	45	115	—
	2N1435	30	75	—
Input Voltage, V_{BE}				
at $I_C = 2\text{ Adc}$, $V_{CE} = -2\text{ Vdc}$	2N1433	—	3.3	Vdc
	2N1434	—	1.8	Vdc
	2N1435	1	2.5	Vdc
Saturation Voltage, $V_{BE(sat)}$				
at $I_C = 2\text{ Adc}$, $I_B = 200\text{ mAdc}$	2N1433	—	1.5	Vdc
	2N1434	—	0.6	Vdc
	2N1435	—	1.0	Vdc
Frequency Cutoff, $f_{\alpha\beta}$				
at $I_C = 100\text{ mAdc}$, $V_{CE} = -4\text{ Vdc}$	all	200	—	KC
Thermal Resistance, θ_{JA}	all	—	2	°C/W
Power Conductance, C_P				
at $I_C = 2\text{ Adc}$, $V_{CE} = -2\text{ Vdc}$	2N1435	35	105	mho
Input Resistance, h_{ie}				
at $I_C = 2\text{ Adc}$, $V_{CE} = -2\text{ Vdc}$	2N1435	27	54	ohm



ENGINEERING DESIGN DATA

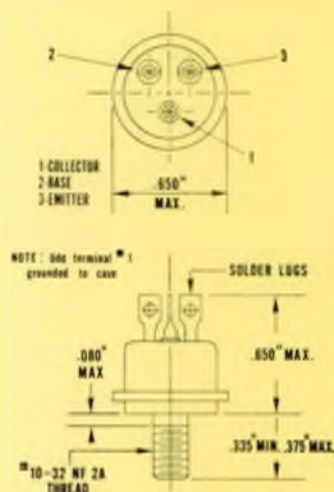
2N1433
2N1434
2N1435

DECEMBER 20, 1959

PNP germanium power
transistors

MECHANICAL DATA

Case material	metal
Maximum case length	0.650 inch
Maximum case diameter	0.650 inch
Stud size	#10-32 NF 2A
Stud length	0.335 to 0.375 inch

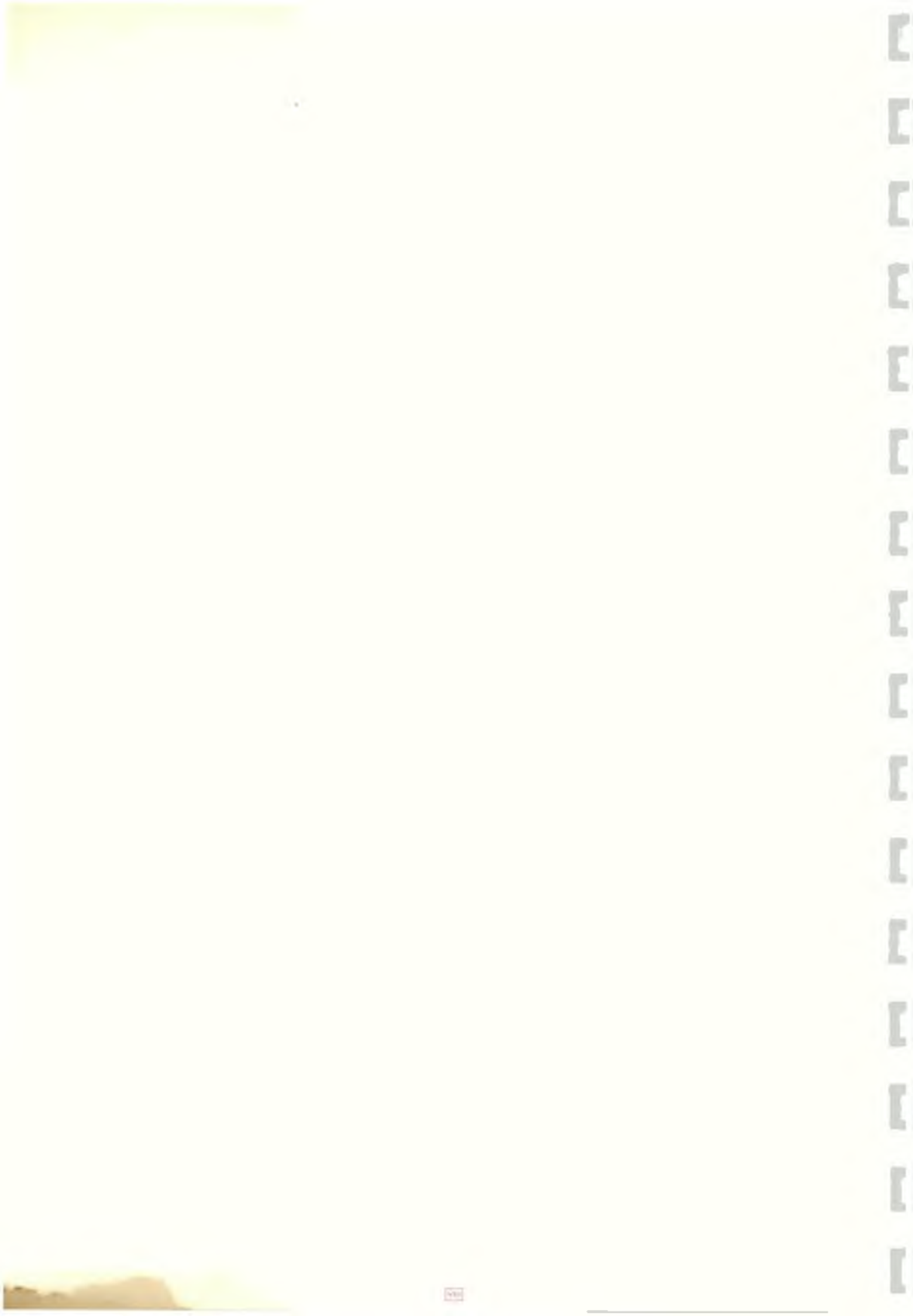


MECHANICAL CONSIDERATIONS

CBS Electronics Industrial power transistors have a welded package which conforms to the JEDEC, TO-10 outline. This welded construction reduces any contamination on the transistor to a minimum, thus insuring a high degree of reliability in performance. They are also equipped with plated lug terminals for connection by soldering or welding.

APPLICATION

The CBS Electronics types 2N1433, 2N1434, and 2N1435 are PNP, germanium, alloy-junction transistors hermetically sealed in a welded metal package, conforming to the TO-10 outline. They are designed for use in power amplifiers, power converters, and regulators and in low speed switching circuits.





2N306
2N444 2N445
2N446 2N447



NPN high frequency computer transistors
high mobility electron flow . . .
providing fast response . . . for switching
and flip-flop circuits . . . TO-9 package



CBS Switching Transistors 2N444, 2N445, 2N446, 2N447, and 2N306 are germanium NPN alloy junction transistors. Types 2N444, 2N445, 2N446, and 2N447 are particularly suited to small-signal amplifier and high-speed switching applications. A-c current gain and alpha-cutoff frequency increase progressively with the type numbers. Type 2N306 is designed especially for low-frequency, general-purpose applications.

ADVANTAGES:

All five (5) of these new CBS NPN Switching Transistors give superior reliability. This is achieved by ruggedized construction, special processing, and hermetic sealing in the welded JEDEC TO-9 package.

Examples of special processing include thorough bake-out to stabilize gain, and advanced surface chemistry techniques to seal out moisture and contamination. All of this special processing, and also electrical testing and the packaging, are carried on in special dry-boxes filled with a dry nitrogen atmosphere.

MECHANICAL CONSIDERATIONS:

These CBS Electronics high frequency transistors have a welded package which conforms to the JEDEC, TO-9 outline. They are also equipped with flexible, plated leads that are designed for connection by soldering, welding or socketing. All leads insulated from case.

The over-all dimension of the hermetically sealed can is less than 1/4 inch by 3/8 inch.

No special requirement need be met in mounting these transistors except that care should be exercised to keep the junction temperature below 85°C (185°F).

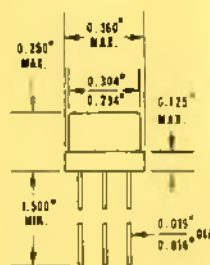
ENGINEERING DESIGN DATA

2N306
2N444
2N445
2N446
2N447

DECEMBER 30, 1959

MECHANICAL DATA

JEDEC outline	TO-9
JEDEC base	E3-51
Case material	metal
Maximum case length	0.250 inch
Maximum case diameter	0.360
Minimum lead length	1.5
Lead diameter	0.017



2N306-2N444-2N445-2N446-2N447 (cont.)

RATINGS, ABSOLUTE MAXIMUM AT 25°C		2N444	2N445	2N446	2N447	2N306
Collector to base voltage, V_{CB}	Vdc	15	15	15	15	20
Collector to emitter voltage, V_{CE}	Vdc	15	12	10	6	12
Emitter to base voltage, V_{EB}	Vdc	10	10	10	10	-
Collector current, I_C	mA	100	100	100	100	100
Dissipation, P_T	mW	100	100	100	100	50
Storage temperature, T_{stg}	- 65°C to +85°C					
CHARACTERISTICS at 25°C						
Collector Cutoff Current, I_{CBO} , max. $V_{CB} = 10$ Vdc $V_{CB} = 20$ Vdc	μA μA	6 -	6 -	6 -	6 -	- 200
Emitter Cutoff Current, I_{EBO} , max. $V_{EB} = 4$ Vdc	μA	3	3	3	3	-
Collector - Base Breakdown Voltage, BV_{CBO} , min. $I_C = 25 \mu A$	Vdc	15	15	15	15	-
Collector - Emitter Breakdown Voltage, BV_{CEO} , min. $I_C = 600 \mu A$	Vdc	15	12	10	6	12
Emitter - Base Breakdown Voltage, BV_{EBO} , min. $I_E = 25 \mu A$	Vdc	10	10	10	10	-
Current Gain, h_{fe} , min. $I_E = 1$ mA, $V_{CE} = 4.5$ V, $f = 1$ Kc		10	20	30	50	16
Cutoff - Frequency, fh_{fb} , min. $I_E = 1$ mA, $V_{CB} = 4.5$ Vdc	mc	0.5	2	5	9	0.55



2N312
2N556 2N1000
2N558 2N1012



NPN high frequency computer transistors
high mobility electron flow . . .
providing fast response . . . for switching
and flip-flop circuits . . . TO-9 package

CBS Switching Transistors 2N556, 2N558, 2N1000, 2N1012, and 2N312 are germanium NPN alloy junction transistors. Types 2N556 and 2N558 are intended for computer switching applications. They differ in collector voltage, current gain, and alpha-cutoff frequency ratings. Types 2N1000 and 2N1012 are designed especially for high-speed computer switching. They feature a collector voltage rating of 40 volts. They differ in current gain and alpha-cutoff frequency. Type 2N312 is intended for low-power switching applications in the audio and ultrasonic frequency spectrum.

ADVANTAGES:

All five (5) of these new CBS NPN Switching Transistors give superior reliability. This is achieved by ruggedized construction, special processing, and hermetic sealing in the welded JEDEC TO-9 package.

Examples of special processing include thorough bake-out to stabilize gain, and advanced surface chemistry techniques to seal out moisture and contamination. All of this special processing, and also electrical testing and the packaging, are carried on in special dry-boxes filled with a dry nitrogen atmosphere.

MECHANICAL CONSIDERATIONS:

These CBS Electronics high frequency transistors have a welded package which conforms to the JEDEC, TO-9 outline. They are also equipped with flexible, plated leads that are designed for connection by soldering, welding or socketing. Types 2N1000 and 2N1012 have their base lead connected to the case for improved dissipation. Types 2N312, 2N556, and 2N558 have all leads insulated from the case.

The over-all dimension of the hermetically sealed can is less than 1/4 inch by 3/8 inch.

No special requirement need be met in mounting these transistors except that care should be exercised to keep the junction temperature below 85°C (185°F).

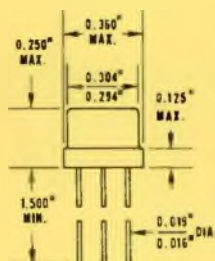
ENGINEERING DESIGN DATA

2N312
2N556
2N558
2N1000
2N1012

DECEMBER 30, 1959

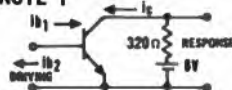
MECHANICAL DATA

JEDEC outline	TO-9
JEDEC base	E3-51
Case material	metal
Maximum case length	0.250 Inch
Maximum case diameter	0.360
Minimum lead length	1.5
Lead diameter	0.017

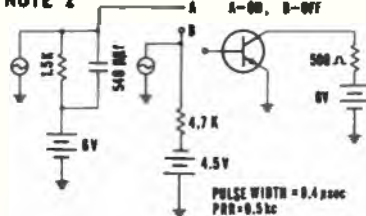
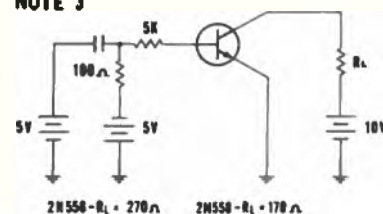


CBS**NPN GERMANIUM SWITCHING TRANSISTORS**

RATINGS, ABSOLUTE MAX. AT 25°C	UNIT	2N556		2N558		2N1000		2N1012		2N312	
C-B Voltage, V_{CB}	Vdc	25		15		40		40		15	
C-E Voltage, V_{CE}	Vdc	20		10		30		22		15	
E-B Voltage, V_{EB}	Vdc	10		10		40		35		6	
Dissipation, P_T	mW	100		100		150		150		100	
Storage Temperature, T_{stg}		-65°C to +85°C									
CHARACTERISTICS AT 25°C											
		2N556		2N558		2N1000		2N1012		2N312	
Collector Cutoff Current I_{CBO} , max. High Temperature	μA	-	-	-	-	$V_{CB} = 40Vdc$	15	$V_{CB} = 5Vdc$	5	-	-
	μA	-	-	-	-	-	-	$V_{CB} = 40Vdc$ $T_A = 75^\circ C$	200	$V_{CB} = 15Vdc$ $T_A = 65^\circ C$	60
Emitter Cutoff Current I_{EBO} , max. High Temperature	μA	$V_{EB} = 10Vdc$	25	$V_{EB} = 10Vdc$	25	$V_{EB} = 40Vdc$	15	$V_{EB} = 5Vdc$	5	-	-
	μA	-	-	-	-	-	-	$V_{EB} = 35Vdc$ $T_A = 75^\circ C$	200	$V_{EB} = 6Vdc$ $T_A = 65^\circ C$	60
Collector - Emitter Breakdown Voltage, min.	Vdc	$I_C = 25\mu A$ $V_{BB}/R_B = 5V/SK\Omega$	$BV_{CEX} = 20$	$I_C = 25\mu A$ $V_{BB}/R_B = 5V/SK\Omega$	$BV_{CEX} = 10$	$I_C = 300\mu A$ -	$BV_{CES} = 30$	$I_C = 600\mu A$ -	$BV_{CEO} = 22$	$I_C = 600\mu A$ -	$BV_{CEO} = 15$
Current Gain h_{FE} , min.		$I_B = 1mA$ $V_{CE} = 0.2Vdc$	35 - 70	$I_C = 60mA$ $V_{CE} = 0.2Vdc$	60	$I_C = 10mA$ $V_{CE} = 0.5Vdc$	40	$I_C = 100mA$ $V_{CE} = 0.5Vdc$	40	$I_C = 10mA$ $V_{CE} = 5Vdc$	25 - 75
		$I_C = 150mA$ $V_{CE} = 0.3Vdc$	15	$I_C = 200mA$ $V_{CE} = 0.3Vdc$	20	$I_C = 100mA$ $V_{CE} = 0.5Vdc$	25	-	-	-	-
Input Voltage V_{BE} , max.	Vdc	$I_C = 35mA$ $I_B = 1mA$	0.4	$I_C = 60mA$ $I_B = 1mA$	0.4	$I_C = 10mA$ $V_{CE} = 0.5Vdc$	0.25	$I_C = 100mA$ $V_{CE} = 0.5Vdc$	0.7	-	-
	Vdc	$I_C = 150mA$ $I_B = 10mA$	1.0	$I_C = 200mA$ $I_B = 10mA$	1.0	$I_C = 100mA$ $V_{CE} = 0.5Vdc$	0.8	-	-	-	-
Saturation Voltage V_{CE} (sat), max.	Vdc	$I_C = 200mA$ $I_B = 40mA$	0.5	$I_C = 200mA$ $I_B = 40mA$	0.75	$I_C = 100mA$ $I_B = 5mA$	0.25	$I_C = 100mA$ $I_B = 10mA$	0.20	$I_C = 10mA$ $I_B = 1mA$	0.075
Frequency Cutoff $f_{\alpha f}$, min.	mc	-	-	-	-	$I_E = 1mA$ $V_{CB} = 6Vdc$	7	$I_E = 1mA$ $V_{CB} = 5Vdc$	3	-	-
Switching Time, max.	t_r	μsec	3.5	3.5	0.7	0.15	-				
	t_d	μsec	2.0	2.0	0.7	0.2	-				
	t_f	μsec	2.0	2.0	0.3	0.2	-				
			Note 3	Note 3	Note 1	Note 2	-				

NOTE 1

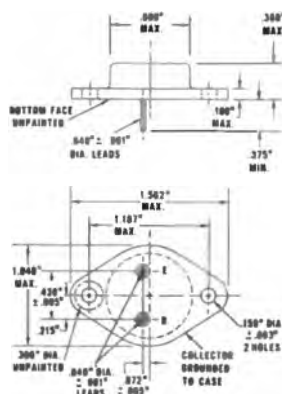
$I_{B1} = I_{B2} = 2.5mA$
 $I_C = 50mA$
 $V_{CC} = 16Vdc$
 PULSE WIDTH = 5 μsec
 PRR = 1Kc

NOTE 2**NOTE 3**

CBS**PNP POWER TRANSISTORS****2N297 • 2N297A****MECHANICAL DATA**

JEDEC outline TO-3
 JEDEC base E3--42
 Case material ♦ Metal
 Maximum case length 1.562 inches
 Maximum case diameter 0.800 inch
 Lead diameter $0.04 \pm .001$ inch
 Minimum lead length 0.375 inch

♦ For maximum heat transfer, the collector is internally attached to copper base block.

**APPLICATION**

The 2N297 and 2N297A are PNP germanium power transistors in a standard automotive style case (TO-3). They are designed for operation from 24 volt battery or 28 volt aircraft supplies, and are intended for use in audio amplifiers, servo amplifiers, and small motor controllers.

RATINGS, ABSOLUTE MAXIMUM AT 25°C	UNITS	2N297	2N297A
Collector to base voltage, V_{CB}	Vdc	60	60
Collector to emitter voltage, V_{CE}	Vdc	50	50
Emitter to base voltage, V_{EB}	Vdc	15	15
Collector current, I_C	Adc	3	3
Power dissipation, PT	W	25	35
Storage temperature, T_{stg}	°C	-65 to +85	-65 to +95

2N297 • 2N297A (cont.)

CHARACTERISTICS AT 25°C		2N297	2N297A
Collector Cutoff Current, I_{CBO} , max. $V_{CB} = -6 \text{ Vdc}$ $V_{CB} = -60 \text{ Vdc}$ $V_{CB} = -30 \text{ Vdc}$, $T_A = 71^\circ\text{C}$	μAdc mA dc mA dc	200 3 -	200 3 6
Emitter Cutoff Current, I_{EBO} , max. $V_{EB} = -6 \text{ Vdc}$ $V_{EB} = -40 \text{ Vdc}$	μAdc mA dc	200 -	- 3
Collector-Emitter Breakdown Voltage, BV_{CES} , min. $I_C = 300 \text{ mA}$	Vdc	-	50
Collector-Emitter Breakdown Voltage, BV_{CEO} , min. $I_C = 300 \text{ mA}$	Vdc	-	40
Floating Potential, V_{EBF} , max. $V_{CB} = -60 \text{ Vdc}$	mVdc	180	180
Current Gain, h_{FE} $I_C = 500 \text{ mA dc}$, $V_{CE} = -2 \text{ Vdc}$ $I_C = 2 \text{ A dc}$, $V_{CE} = -2 \text{ Vdc}$	- -	25-100 12-40	40-100 20 min
Base Voltage, V_{BE} $I_C = 500 \text{ mA dc}$, $V_{CE} = -2 \text{ Vdc}$ $I_C = 2 \text{ A dc}$, $V_{CE} = -2 \text{ Vdc}$	Vdc Vdc	.28-.55 .67-2	- 1.5 max
Frequency Cutoff, $f_{\alpha b}$, min. $I_C = 500 \text{ mA dc}$, $V_{CE} = -2 \text{ Vdc}$	Kc	6	5
Thermal Resistance, θ , max.	$^\circ\text{C/W}$	3	2

Package: TO-3



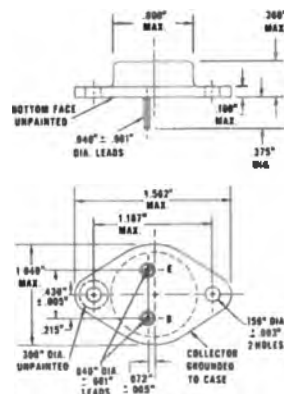
PNP POWER TRANSISTORS

2N301 • 2N301A

MECHANICAL DATA

JEDEC outline	TO-3
JEDEC base	E3--42
Case material♦	Metal
Maximum case length	1.562 inches
Maximum case diameter	0.800 inch
Lead diameter	0.04±.001 inch
Minimum lead length	0.375 inch

♦ For maximum heat transfer, the collector is internally attached to copper base block.



APPLICATION

CBS 2N301 and 2N301A are germanium alloy-junction power transistors. They are designed specifically for use in Class A output stages of a-f amplifiers, particularly in automobile radio receivers. They are also useful in Class B push-pull amplifier stages of such equipment.

RATINGS, ABSOLUTE MAXIMUM AT 25°C	UNITS	2N301	2N301A
Collector to base voltage, V_{CB}	Vdc	40	60
Collector to emitter voltage, V_{CE}	Vdc	32	32
Emitter to base voltage, V_{EB}	Vdc	12	12
Collector current, I_C	Adc	3	3
Power dissipation, P_T at 80°C	W	11	11
Storage temperature, T_{stg}	°C	-65 to +91	-65 to +91

2N301 • 2N301A (cont.)

CHARACTERISTICS AT 25°C		2N301	2N301A
Collector Cutoff Current, I_{CBO} , max. $V_{CB} = -0.5 \text{ Vdc}$ $V_{CB} = -30 \text{ Vdc}$ $V_{CB} = -40 \text{ Vdc}$ $V_{CB} = -60 \text{ Vdc}$	μAdc mAdc mAdc mAdc	100 3 5 -	100 3 - 5
Emitter Cutoff Current, I_{EBO} , max. $V_{EB} = -12 \text{ Vdc}$	mAdc	2	2
Collector-Emitter Breakdown Voltage, BV_{CES} , min. $I_C = 300 \text{ mAdc}$	Vdc	32	32
Reach Thru Voltage, V_{RT} , min.	Vdc	40	60
Current Gain, h_{FE} , min. $I_C = 700 \text{ mAdc}$, $V_{CE} = -1.5 \text{ V}$	-	30	30
Thermal Resistance, θ , max.	$^{\circ}\text{C/W}$	2	2

Package: TO-3

CBS

COMPLEMENTARY POWER TRANSISTOR PAIRS

This new line of CBS Complementary Pairs of NPN and PNP Power Transistors, in the popular diamond package, opens a whole field of economical circuits for the design engineer. Their use in complementary push-pull Class B circuits eliminates the need for input and output transformers, resulting not only in lower cost and improved frequency response, but reduction of size and weight (miniaturization), ease of applying negative feedback, and reduction of distortion and undesirable voltage surges.

Other uses of these complementary pairs are in balanced modulators and collector-coupled multivibrators.

USES IN COMPLEMENTARY CLASS B OUTPUT STAGES:

For The Entertainment Field:

Audio amplifiers of table-model radios and automobile receivers.

Output stages of portable phonographs, hi-fi amplifiers, and stereo amplifiers.

Provide direct coupling to the vertical yoke without de-centering current in TV vertical deflection system.

For The Industrial Field:

Control amplifiers for automatic and semi-automatic machinery.

Output stages of mobile public address and electronic megaphone amplifiers.

Receiver audio amplifiers of mobile and marine two-way radio systems for police cars, fire engines, taxis, trucks, and small boats.

Radio receivers and intercom systems in commercial aircraft.

For The Military Field:

Control power amplifiers of guided missiles and rockets.
Audio amplifiers of military mobile and portable communications receivers.

Aircraft radio receivers and intercom systems.

Voltage regulators.

Computers, servo-amplifiers.

ENGINEERING DESIGN DATA

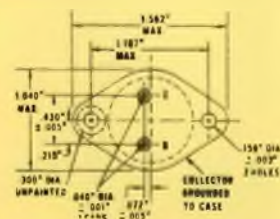
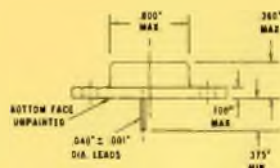
DECEMBER 30, 1959

COMPLEMENTARY PAIRS OF GERMANIUM ALLOY JUNCTION POWER TRANSISTORS

NPN TYPES	PNP TYPES
2N326	2N1291
2N1292	2N1291
2N1294	2N1293
2N1296	2N1295
2N1298	2N1297

MECHANICAL DATA

JEDEC outline	TO-3
JEDEC base	E3 — 42
Case material	♦ Metal
Maximum case length	1.550 inches
Maximum case diameter	0.782 inch
Lead diameter	0.04 ± .001 inch
Minimum lead length	0.375 inch
♦ For maximum heat transfer, the collector is internally attached to copper base block.	



COMPLEMENTARY POWER TRANSISTOR PAIRS (cont.)

RATINGS, ABSOLUTE MAXIMUM AT 25°C	Units	NPN	2N326		2N1292		2N1294		2N1296		2N1298	
		PNP	2N1291		2N1291		2N1293		2N1295		2N1297	
Collector to base voltage, V_{CB} ■	Vdc		35		35		60		80		100	
Collector to emitter voltage, V_{CE} ■	Vdc		30		30		45		60		80	
Emitter to base voltage, V_{EB} ■	Vdc		15		15		15		15		15	
Collector current, I_C	Adc		3		3		3		3		3	
Dissipation, P_T *	W		7		20		20		20		20	
Junction temperature, T_j	°C		-65 to +85									
CHARACTERISTICS AT 25°C			Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.
Collector Cutoff Current, I_{CBO} $V_{CB} = V_{CB}(\text{max.})$ ■	mAdc		-	1.5	-	1.5	-	2	-	3	-	4
C-E Breakdown Voltage, BV_{CES} ■ $I_C = 10$ mAdc	Vdc		-	-	30	-	45	-	60	-	80	-
Emitter Cutoff Current, I_{EBO} $V_{EB} = 15$ Vdc. ■	mAdc		-	1.5	-	1.5	-	2	-	3	-	4
Current Gain, h_{FE} $I_C = 0.5$ Adc, $V_{CE} = 2$ Vdc ■			30	-	30	-	30	-	30	-	30	-
Base Voltage, V_{BE} ■ $I_C = 0.5$ Adc, $V_{CE} = 2$ Vdc ■	Vdc		-	1.0	-	1.0	-	1.1	-	1.2	-	1.2
Saturation Voltage, $V_{CE}(\text{sat})$ ■ $I_C = 1$ Adc, $I_b = 135$ mAdc	Vdc		-	1	-	1	-	1	-	1	-	1
Thermal Resistance, θ	°C/W		-	8	-	3	-	3	-	3	-	3

■ Polarity NPN positive, PNP negative.

* 25°C base mounting temperature.