

ELECTRONIC TUBE REFERENCE

12SJ7

Voltage - Pentode Sharp Cutoff (single) electronic tube

CONSOLIDATED TECHNICAL DATA

1 SECTION
CONSTRUCTION
PENTODE

RF pentode with documented pentode and triode-connected Class A operation. Its signal-amplifier characteristics suit RF and general voltage-amplifier stages requiring a sharp-cutoff transfer characteristic.

GENERAL CHARACTERISTICS

BASE DESIGNATION	8N	BASE PINS	8
NOMINAL HEATER	12.6 V / 150 mA	PARALLEL HEATER	– / –
HEATING	Indirect	SERIES OPERATION	Not specified
CATHODE ARRANGEMENT	Separate cathodes	SECTION CONSTRUCTION	Similar

8N - TERMINAL PINOUT

TERMINAL	SECTION	ELEMENT	STATUS
PIN1 – SH	A	SH – Internal Shield	CONNECTED
PIN2 – H	–	H – Heater	CONNECTED
PIN3 – G3	A	G3 – Suppressor Grid	CONNECTED
PIN4 – G1	A	G1 – Control Grid	CONNECTED
PIN5 – K	A	K – Cathode	CONNECTED
PIN6 – G2	A	G2 – Screen Grid	CONNECTED
PIN7 – H	–	H – Heater	CONNECTED
PIN8 – P	A	P – Plate (Anode)	CONNECTED

SECTION RATINGS

SECTION1 Pentode	
PLATE RESISTANCE	700000 Ω
TRANSCONDUCTANCE	0.001575 S
MAXIMUM PLATE VOLTAGE	330 V
MAXIMUM SCREEN VOLTAGE	140 V
MAXIMUM PLATE DISSIPATION	2.75 W
MAXIMUM SCREEN DISSIPATION	0.44 W
MAXIMUM CATHODE CURRENT	6 mA
<i>Promoted from printed maximum/characteristic columns; additional published values retained in TUBE_SECTION_PARAMETER.</i>	

12SJ7 — Sharp-Cutoff Pentode

The **12SJ7** is a sharp-cutoff pentode designed for use as a radio-frequency amplifier, biased detector, or high-gain audio-frequency amplifier. It is also characterized as a triple-grid detector amplifier. In properly designed circuits, it can also serve as a radio-frequency oscillator or mixer tube. The 12SJ7 is electrically identical to the [6SJ7](#) and [6SJ7GT](#), with the exception of its heater characteristics and capacitance ratings. It is available in both a metal shell envelope (12SJ7) and a glass bulb envelope ([12SJ7GT](#)).

Construction, Physical Dimensions, and Base Pinout

The tube features a coated unipotential cathode. It is designed with an 8-pin octal base. The metal shell version (12SJ7) utilizes a small wafer octal 8-pin phenolic base (basing designation B6-21 or MT-8), while the glass bulb version ([12SJ7GT](#)) utilizes a T-9 glass envelope with a small wafer octal 8-pin base featuring a metal sleeve.

The physical dimensions of the two variants are as follows:

- **Metal Shell (12SJ7):** Maximum overall height of 2-5/8 inches (or up to 2-11/16 inches depending on the manufacturer), maximum seated height of 2-1/16 inches, and a maximum diameter of 1-5/16 inches.
- **Glass Bulb ([12SJ7GT](#)):** Maximum overall height of 3-5/16 inches, maximum seated height of 2-3/4 inches, and a maximum diameter of 1-5/16 inches.

The tube can be mounted in any position. The terminal connections, viewed from the bottom of the base (using the 8N or RMA BN basing diagram), are assigned as follows:

- Pin 1: Shell and Internal Shield
- Pin 2: Heater
- Pin 3: Grid Number 3 (Suppressor Grid)
- Pin 4: Grid Number 1 (Control Grid)
- Pin 5: Cathode

- Pin 6: Grid Number 2 (Screen Grid)
- Pin 7: Heater
- Pin 8: Plate

The heater is designed to operate on either alternating current (AC) or direct current (DC) with a nominal voltage of 12.6 volts and a current of 0.15 amperes (150 mA).

Electrical Characteristics and Operating Points

The 12SJ7 can be operated in either a pentode connection or a triode connection (where the screen grid and suppressor grid are tied directly to the plate).

Class A Pentode Connection

Under typical Class A pentode operating conditions, the suppressor grid (Grid 3) is tied to the cathode at the socket terminal. Typical characteristics at two different plate voltage operating points are:

Parameter	Operating Point A	Operating Point B
Plate Voltage	100 V	250 V
Screen (Grid 2) Voltage	100 V	100 V
Control Grid (Grid 1) Voltage	-3 V	-3 V
Cathode Bias Resistor	—	1,000 Ω
Plate Current	2.9 mA	3.0 mA
Screen Current	0.9 mA	0.8 mA
Plate Resistance (Approx.)	0.7 M Ω	1.0 to 1.5 M Ω
Transconductance (Mutual Conductance)	1,575 μ mhos	1,650 μ mhos
Control Grid Voltage (for cathode current cut-off)	-9 V	-9 V

Class A Triode Connection

When configured as a triode (with Grid 2 and Grid 3 connected to the plate), the typical operating characteristics are:

Parameter	Operating Point C	Operating Point D
Plate Voltage	180 V	250 V
Control Grid Bias Voltage	-6 V	-8.5 V

Parameter	Operating Point C	Operating Point D
Amplification Factor	19	19
Plate Resistance	8,250 Ω	7,600 Ω
Transconductance	2,300 μmhos	2,500 μmhos
Plate Current	6.0 mA	9.2 mA

Maximum Ratings

The maximum ratings of the 12SJ7 depend on the connection type and the rating system applied (Design Center vs. Absolute).

Pentode Connection Ratings

- **Plate Voltage:** 300 V (Design Center / RMA), 330 V (Absolute)
- **Screen (Grid 2) Voltage:** 125 V (Design Center / RMA), 140 V (Absolute)
- **Screen Supply Voltage:** 300 V (Design Center / RMA), 330 V (Absolute)
- **Grid Bias Voltage:** Must never be positive
- **Plate Dissipation:** 2.0 W (RMA) to 2.50 W (Design Center) / 2.75 W (Absolute)
- **Screen Dissipation:** 0.3 W (RMA) to 0.40 W (Design Center) / 0.44 W (Absolute)
- **D-C Heater-Cathode Voltage:** 90 V (Design Center), 100 V (Absolute)

Triode Connection Ratings

- **Plate Voltage:** 250 V (Design Center), 275 V (Absolute)
- **Grid Bias Voltage:** Must never be positive
- **Plate Dissipation:** 2.50 W (Design Center), 2.75 W (Absolute)
- **D-C Heater-Cathode Voltage:** 90 V (Design Center), 100 V (Absolute)

In circuits where the cathode is not directly connected to the heater, the potential difference between the heater and cathode should be kept as low as possible, and must not exceed 100 volts under any conditions. A direct connection between the heater and cathode is recommended.

Interelectrode Capacitances

Capacitances vary depending on whether the tube is a metal shell (12SJ7) or glass bulb ([12SJ7GT](#)) type, and whether it is wired in a pentode or triode configuration.

Pentode Connection (with shell and internal shield connected to cathode)

- **Grid to Plate (Max):** 0.005 pF (both 12SJ7 and [12SJ7GT](#))
- **Input:** 6.0 pF (12SJ7), 6.3 pF ([12SJ7GT](#))

- **Output:** 7.0 pF (12SJ7), 10.0 pF ([12SJ7GT](#))

Triode Connection (with Grid 2 and Grid 3 connected to plate)

- **Grid to Plate:** 2.8 pF
- **Grid to Cathode:** 3.4 pF
- **Plate to Cathode:** 11 pF

Resistance-Coupled Amplifier Operation

The 12SJ7 is highly suited for resistance-coupled audio amplifier service. Under these conditions, the d-c resistance in the grid circuit should not exceed 1.0 megohm under rated maximum conditions. The following table outlines typical operating parameters for a pentode-connected resistance-coupled stage at various plate supply voltages (E_{bb}):

Plate Supply (E_{bb})	Plate Load (R_p)	Grid Resistor (R_g)	Cathode Resistor (R_k)	Screen Resistor (R_{sg})	Voltage Gain	Max Output (E_o RMS)
90 V	0.10 M Ω	0.10 M Ω	820 Ω	0.27 M Ω	40	19 V
90 V	0.24 M Ω	0.24 M Ω	1,600 Ω	0.68 M Ω	72	20 V
90 V	0.51 M Ω	0.51 M Ω	3,800 Ω	1.50 M Ω	95	21 V
180 V	0.10 M Ω	0.10 M Ω	620 Ω	0.33 M Ω	48	49 V
180 V	0.24 M Ω	0.24 M Ω	910 Ω	0.75 M Ω	95	40 V
180 V	0.51 M Ω	0.51 M Ω	1,800 Ω	1.60 M Ω	153	42 V
300 V	0.10 M Ω	0.10 M Ω	430 Ω	0.43 M Ω	55	69 V
300 V	0.24 M Ω	0.24 M Ω	750 Ω	0.91 M Ω	108	82 V
300 V	0.51 M Ω	0.51 M Ω	1,200 Ω	2.00 M Ω	182	70 V

Note: E_o represents the maximum RMS voltage output for five percent (5%) total harmonic distortion. The value of the grid resistor of the following stage (R_{g1}) is non-critical for these operating points.

Characteristic Curves and Interpretation

The plate characteristics of the 12SJ7 in its pentode connection show that above a low plate voltage "knee" (around 30 to 50 volts), the plate current (I_b) remains nearly constant as plate voltage increases. This flat response indicates an extremely high plate resistance (ranging from 0.7 to 1.5 megohms depending on operating conditions).

In contrast, the triode-connected plate characteristics display a series of steep, upward-sloping curves. This behavior reflects a much lower plate resistance (7,600 to 8,250 ohms) and a moderate amplification

factor of 19.

The transfer characteristics plot transconductance (g_m), plate current (I_b), and screen current (I_{c2}) against the control grid voltage (E_{c1})(/tubes/C1). At a plate voltage of 250 V and screen voltage of 100 V, the transconductance peaks near 1,650 μmhos at a grid bias of -3 V and falls smoothly toward zero as the grid bias is made more negative, reaching complete plate current cutoff at approximately -9 V.

Related Designations

The 12SJ7 belongs to a family of 12.6-volt octal-base tubes. It is electrically identical to the 6.3-volt [6SJ7](#) and [6SJ7GT](#) except for its heater requirements (which require 12.6 V at 0.15 A instead of 6.3 V at 0.3 A) and minor capacitance variations. Other related 12.6-volt octal tubes designed for complementary functions in receiver circuits include:

- [12SK7](#) / [12SK7-GT](#): A remote-cutoff (vari-mu) RF pentode.
- [12SQ7](#) / [12SQ7-GT](#): A double-diode high-mu triode.
- [12SA7](#) / [12SA7-GT](#): A pentagrid converter.
- [12SL7GT](#): A high-mu twin triode.
- [12SN7GT](#) / [12SN7GTA](#): A medium-mu twin triode.



SOURCE OPERATING CONDITIONS

[SOURCE PDF](#)

1948 Brimar Radio Valve Manual

Published test conditions and operating points. Values on this page are preserved as reported by this source.

1948 BRIMAR RADIO VALVE MANUAL

Section 1 · Pentode

CHARACTERISTICS		
PARAMETER	PUBLISHED VALUE	CONDITION / NOTE
Anode Voltage	250 V	—
Anode Current	3 mA	—
Screen Voltage	100 V	—
Screen Current	0.8 mA	—
Control Grid Voltage	-3 V	—
Cathode Bias Resistor	1000 ohm	—
Control Grid Cutoff Voltage	-9 V	—



SOURCE OPERATING CONDITIONS

[SOURCE PDF](#)

195X General Electric Essential Characteristics

Published test conditions and operating points. Values on this page are preserved as reported by this source.

195X GENERAL ELECTRIC ESSENTIAL CHARACTERISTICS

Section 1 · Pentode

OTHER		
PARAMETER	PUBLISHED VALUE	CONDITION / NOTE
Plate voltage	250 V	ClassA;PentodeConnection
Screen voltage	100 V	ClassA;PentodeConnection
Control-grid voltage	-3 V	ClassA;PentodeConnection
Plate current	3 mA	ClassA;PentodeConnection

PARAMETER	PUBLISHED VALUE	CONDITION / NOTE
Screen current	0.8 mA	ClassA;PentodeConnection
Plate voltage	250 V	ClassA;TriodeConnection
Control-grid voltage	-8.5 V	ClassA;TriodeConnection
Plate current	9.2 mA	ClassA;TriodeConnection

CHARACTERISTIC		
PARAMETER	PUBLISHED VALUE	CONDITION / NOTE
Plate resistance	1000000 Ω	PentodeConnection
Transconductance	1650 μS	PentodeConnection
Plate resistance	7600 Ω	TriodeConnection
Transconductance	2500 μS	TriodeConnection
Amplification factor	19	TriodeConnection


SOURCE DATA APPENDIX

SOURCE OPERATING CONDITIONS

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1968 General Electric Co

Published test conditions and operating points. Values on this page are preserved as reported by this source.

1968 GENERAL ELECTRIC CO

Section 1 · Pentode

OTHER		
PARAMETER	PUBLISHED VALUE	CONDITION / NOTE
Typical Plate Voltage	100 V	PentodeConnection
Typical Screen Voltage	100 V	PentodeConnection

CHARACTERISTIC		
PARAMETER	PUBLISHED VALUE	CONDITION / NOTE
Triode-Connection Plate Resistance	7600 Ohm	TriodeConnection
Triode-Connection Amplification Factor	19	TriodeConnection

SOURCE OPERATING CONDITIONS

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1971 RCA HB3 Binder 5 of 7

Published test conditions and operating points. Values on this page are preserved as reported by this source.

1971 RCA HB3 BINDER 5 OF 7

Section 1 · Pentode

OTHER		
PARAMETER	PUBLISHED VALUE	CONDITION / NOTE
Heater voltage	12.6 V	—
Heater current	150 mA	—
Plate voltage	250 V	ClassA
Screen voltage	100 V	ClassA
Grid voltage	-3 V	ClassA
Plate current	3 mA	ClassA
Screen current	1 mA	ClassA
Maximum plate voltage	300 V	—
Maximum screen voltage	100 V	—

CHARACTERISTIC		
PARAMETER	PUBLISHED VALUE	CONDITION / NOTE
Plate resistance	1000000 ohm	ClassA
Transconductance	1650 uS	ClassA

CAPACITANCE		
PARAMETER	PUBLISHED VALUE	CONDITION / NOTE
Grid-to-plate capacitance	0.015 pF	—

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