

ELECTRONIC TUBE REFERENCE

12SG7

Voltage Pentode - Remote Cutoff (single) electronic tube

CONSOLIDATED TECHNICAL DATA

1 SECTION
CONSTRUCTION
PENTODE

Semi-remote-cutoff high-transconductance pentode for RF/IF voltage amplification with controlled gain and reduced high-frequency cathode coupling.

GENERAL CHARACTERISTICS

BASE DESIGNATION	8BK	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

8BK - 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
PIN3 – K	A	K – Cathode	CONNECTED
PIN4 – G1	A	G1 – Control Grid	CONNECTED
PIN5 – G3	A	G3 – Suppressor 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	900000 Ω
TRANSCONDUCTANCE	0.0047 S
MAXIMUM PLATE VOLTAGE	330 V
MAXIMUM SCREEN VOLTAGE	220 V
MAXIMUM PLATE DISSIPATION	3.3 W
MAXIMUM SCREEN DISSIPATION	0.66 W
<i>Promoted from printed maximum/characteristic columns; additional published values retained in TUBE_SECTION_PARAMETER.</i>	

12SG7 — Semi-Remote Cut-Off Pentode Voltage Amplifier

The **12SG7** is a semi-remote cut-off pentode voltage amplifier designed for high-gain radio-frequency (RF) and intermediate-frequency (IF) amplification. Housed in a metal envelope with an octal base, it features high transconductance, exceptionally low grid-to-plate capacitance, and a dual cathode connection. This dual cathode design is engineered to reduce the undesirable effects of common cathode circuit coupling in high-frequency applications.

The tube is the 12.6-volt heater counterpart to the [6SG7](#) and [6SG7GT](#) series, sharing identical electrical characteristics apart from its heater ratings.

Construction, Heater, and Pinout

The 12SG7 is constructed with an **MT-8 metal shell** and a small wafer 8-pin phenolic octal base (basing designation **8BK** or **B5-21**). It features a coated unipotential cathode and can be mounted in any position.

Heater Specifications

The heater is designed for operation from either AC or DC sources:

- Nominal Heater Voltage: 12.6 V
- Nominal Heater Current: 0.15 A (150 mA)
- Calculated Heater Power: 1.89 W (calculated as 12.6 V multiplied by 0.15 A)

Terminal Connections and Basing Diagram

The 12SG7 utilizes an 8-pin octal base with the following pin assignments (viewed from the bottom of the base):

- **Pin 1:** Metal Shell and Internal Shield
- **Pin 2:** Heater

- **Pin 3:** Cathode and 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 dual cathode connection is split between Pin 3 and Pin 5. Pin 3 also internally connects to Grid Number 3 (the suppressor grid), while Pin 5 provides an independent cathode terminal. This configuration allows the input and output return circuits to be isolated, minimizing common-impedance coupling at high frequencies.

Direct Interelectrode Capacitances

When measured with the metal shell and internal shield connected to the cathode, the 12SG7 exhibits extremely low feedback capacitance:

- Grid to Plate (G_1 to P) Maximum: 0.003 μF
- Input (G_1 to $H + K$ & $G_3 + G_2$): 8.5 μF
- Output (P to $H + K$ & $G_3 + G_2$): 7.0 μF

Maximum Ratings

The maximum ratings for the 12SG7 are interpreted according to the RMA Standard M8-210. The limits are specified under both the Design Center and Absolute Maximum rating systems:

Parameter	Design Center Limit	Absolute Maximum Limit	Unit
Maximum Plate Voltage	300	330	Volts
Maximum Grid Number 2 (Screen) Voltage	200	220	Volts
Maximum Grid Number 2 Supply Voltage	300	330	Volts
Control Grid Bias Voltage (Grid #1)	Never Positive	Never Positive	—
Minimum External Grid #1 Voltage	0	0	Volts

Parameter	Design Center Limit	Absolute Maximum Limit	Unit
Maximum Plate Dissipation	3.0	3.3	Watts
Maximum Grid Number 2 Dissipation	0.60	0.66	Watt
Maximum D-C Heater-Cathode Voltage	90	100	Volts

Typical Operating Conditions and Characteristics

The 12SG7 can be operated under several standard Class A_1 amplifier conditions. The table below outlines three typical operating points:

Parameter	Operating Point A	Operating Point B	Operating Point C
Plate Voltage	100 V	250 V	250 V
Grid Number 2 (Screen) Voltage	100 V	125 V	150 V
Grid Number 1 (Control Grid) Voltage	-1 V	-1 V	-2.5 V
Self-Bias Resistor	90 Ω	60 Ω	190 Ω
Plate Resistance (Approx.)	0.25 M Ω	0.9 M Ω	> 1.0 M Ω
Transconductance	4100 μ mhos	4700 μ mhos	4000 μ mhos
Plate Current	8.2 mA	11.8 mA	9.2 mA
Grid Number 2 Current	3.2 mA	4.4 mA	3.4 mA
Grid #1 Voltage for $G_m = 40 \mu$ mhos (Approx.)	-11.5 V	-14 V	-17.5 V

Characteristic Curves and Behavior

The average plate characteristics and transfer curves illustrate the performance of the 12SG7 under various bias and screen voltage conditions.

Plate and Screen Current Characteristics

At a fixed screen voltage (E_{c2}) of 100 V and heater voltage of 12.6 V:

- With a control grid bias ($E_{c1}(/tubes/C1)$) of 0 V, the plate current (I_b) rises rapidly with plate voltage, kneeing around 50 V and leveling off to a maximum of approximately 12.5 mA.
- As the control grid bias is made more negative (from -0.5 V down to -7.0 V), the plate current curves shift downward. For example, at $E_{c1}(/tubes/C1) = -2.0$ V, the plate current levels off at approximately 4.5 mA.
- Screen current (I_{c2}), represented by dashed lines, follows a similar knee behavior but at lower current levels, peaking near 5.0 mA at $E_{c1}(/tubes/C1) = 0$ V and dropping as negative bias increases.

Transconductance and Cut-Off Behavior

The transfer characteristics demonstrate the semi-remote cut-off nature of the 12SG7:

- At a plate voltage of 250 V, the transconductance (G_m) is highly dependent on both the screen voltage and the control grid bias.
- With a screen voltage of 150 V, the transconductance peaks near 5000 μmhos at low negative grid bias and tapers off smoothly, requiring approximately -17.5 V of grid bias to reduce the transconductance to 40 μmhos .
- When utilizing a 30,000-ohm series screen resistor connected to a 250 V supply, the screen voltage drops dynamically as screen current increases. This produces a more gradual, linearized transconductance curve, which is highly beneficial for automatic volume control (AVC) or automatic gain control (AGC) circuits.

Related Designations

The **12SG7** is directly related to the **6SG7** and **6SG7GT** vacuum tubes. These tubes share identical internal structures, electrode configurations, capacitances, and typical operating characteristics. The sole distinction lies in the heater rating: the 12SG7 operates at **12.6 V, 0.15 A**, whereas the **6SG7** and **6SG7GT** operate at **6.3 V, 0.3 A**.

Technical Summary

The **12SG7** is an octal-based, metal-envelope, semi-remote cut-off pentode designed for RF and IF voltage amplification. It features a 12.6 V, 150 mA heater, a dual cathode connection for reduced common-impedance coupling, and extremely low grid-to-plate feedback capacitance (0.003 μpF maximum). With typical transconductance values ranging from 4000 to 4700 μmhos and a plate resistance up to over 1.0 M Ω , it provides stable, high-gain amplification. Its semi-remote cut-off characteristic allows for effective gain control via grid bias variation, making it a versatile component in receiver designs.

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

CAPACITANCE		
PARAMETER	PUBLISHED VALUE	CONDITION / NOTE
Input capacitance	8.5 pF	Section1
Output capacitance	7 pF	Section1
Grid-to-plate capacitance	0.003 pF	Section1

OTHER		
PARAMETER	PUBLISHED VALUE	CONDITION / NOTE
Plate voltage	250 V	ClassA
Screen voltage	150 V	ClassA
Control-grid voltage	-2.5 V	ClassA
Plate current	9.2 mA	ClassA
Screen current	3.4 mA	ClassA
Plate voltage	250 V	ClassA
Screen voltage	125 V	ClassA
Control-grid voltage	-1 V	ClassA
Plate current	11.8 mA	ClassA
Screen current	4.4 mA	ClassA

CHARACTERISTIC		
PARAMETER	PUBLISHED VALUE	CONDITION / NOTE
Plate resistance	1000000 Ω	Section1
Transconductance	4000 μS	Section1
Plate resistance	900000 Ω	Section1
Transconductance	4700 μS	Section1



SOURCE OPERATING CONDITIONS

[SOURCE PDF](#)

1961 Tung Sol

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

1961 TUNG SOL

Section 1 · Pentode

OTHER		
PARAMETER	PUBLISHED VALUE	CONDITION / NOTE
Heater voltage	12.6 V	Nominal



SOURCE OPERATING CONDITIONS

[SOURCE PDF](#)

1966 Tung Sol Electronic Tubes 3 of 4

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

1966 TUNG SOL ELECTRONIC TUBES 3 OF 4

Section 1 · Pentode

OTHER		
PARAMETER	PUBLISHED VALUE	CONDITION / NOTE
Typical plate voltage	100 V	ClassA
Typical screen voltage	100 V	ClassA
Typical control-grid voltage	-1 V	ClassA
Typical plate current	4.2 mA	ClassA
Typical screen current	3.2 mA	ClassA
Screen supply maximum voltage	300 V	ClassA
Maximum plate voltage	300 V	PromotedValue
Maximum screen voltage	200 V	PromotedValue
Maximum plate dissipation	3 W	PromotedValue
Maximum screen dissipation	0.6 W	PromotedValue

CAPACITANCE		
PARAMETER	PUBLISHED VALUE	CONDITION / NOTE
Grid-to-plate capacitance	0.003 pF	—
Input capacitance	8.5 pF	—
Output capacitance	7 pF	—

CHARACTERISTICS		
PARAMETER	PUBLISHED VALUE	CONDITION / NOTE
Plate resistance	250000 ohm	PromotedValue
Transconductance	0.0041 A/V	PromotedValue



SOURCE DATA APPENDIX

SOURCE OPERATING CONDITIONS

SOURCE PDF

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	250 V	—
Typical Screen Voltage	125 V	—