

ELECTRONIC TUBE REFERENCE

12SF7GT

Voltage - Radio Detector Converter electronic tube

CONSOLIDATED TECHNICAL DATA
3 SECTIONS
CONSTRUCTION
DIODE-DIODE-PENTODE

GT-envelope pentode with two diodes for receiver amplification, detection, and control-voltage functions. The pentode supplies signal gain while paired diodes permit detector and AVC-related rectification.

GENERAL CHARACTERISTICS

BASE DESIGNATION	7AZ	BASE PINS	8
NOMINAL HEATER	12.6 V / 150 mA	PARALLEL HEATER	– / –
HEATING	Indirect	SERIES OPERATION	Not specified
CATHODE ARRANGEMENT	Separate cathodes	SECTION CONSTRUCTION	Dissimilar

7AZ - TERMINAL PINOUT

TERMINAL	SECTION	ELEMENT	STATUS
PIN1 – SH	A	SH – Internal Shield	CONNECTED
PIN2 – 1G1	A	G1 – Control Grid	CONNECTED
PIN3 – 1G3	A	G3 – Suppressor Grid	CONNECTED
PIN3 – K	A	K – Cathode	CONNECTED
PIN4 – 1G2	A	G2 – Screen Grid	CONNECTED
PIN5 – 2P	B	P – Plate (Anode)	CONNECTED
PIN6 – 1P	A	P – Plate (Anode)	CONNECTED
PIN7 – H	–	H – Heater	CONNECTED
PIN8 – H	–	H – Heater	CONNECTED

SECTION RATINGS

SECTION1 Pentode	
PLATE RESISTANCE	200000 Ω
TRANSCONDUCTANCE	0.001975 S
MAXIMUM PLATE VOLTAGE	300 V
MAXIMUM SCREEN VOLTAGE	100 V
<i>Promoted from printed maximum/characteristic columns; additional published values retained in TUBE_SECTION_PARAMETER.</i>	

SECTION2 Diode	
MAXIMUM SCREEN VOLTAGE	100 V
<i>Promoted from printed maximum/characteristic columns; additional published values retained in TUBE_SECTION_PARAMETER. The chart identifies the repeated detector-diode section(s) but does not publish separate diode electrical ratings on this row.</i>	

SECTION3 Diode	
MAXIMUM SCREEN VOLTAGE	100 V

12SF7GT — Diode Remote-Cutoff Pentode

The **12SF7GT** (also referenced as the **12SF7**) is an octal-base, indirectly heated vacuum tube containing a single diode and a remote-cutoff pentode within a single envelope. It is classified as a diode remote-cutoff pentode or diode amplifier pentode, designed primarily for use in radio receivers where it can perform simultaneous detection, automatic volume control (AVC) or automatic gain control (AGC), and radio-frequency (RF) or intermediate-frequency (IF) amplification.

Physical Specifications and Pin Connections

The 12SF7GT is constructed with a T-9 glass bulb and an 8-pin octal wafer base featuring a metal shell. The tube is designed to be mounted in any position. Its physical dimensions are constrained by the following maximum limits:

- **Maximum Diameter:** 1 5/16 inches
- **Maximum Overall Length:** 3 5/16 inches
- **Maximum Seated Height:** 2 3/4 inches

The tube utilizes the **7AZ** basing arrangement, which provides the following pin connections when viewed from the underside of the base:

Pin Number	Connection
Pin 1	Base Shell, Inter-Pin Shield

Pin Number	Connection
Pin 2	Control Grid (Grid 1)
Pin 3	Suppressor Grid (Grid 3), Internal Shield (S1), and Cathode (K)
Pin 4	Screen Grid (Grid 2)
Pin 5	Diode Plate
Pin 6	Pentode Plate
Pin 7	Heater
Pin 8	Heater

The inclusion of an inter-pin shield connected to Pin 1, along with the internal shield tied to Pin 3, assists in minimizing internal coupling between the diode and pentode sections.

Heater and Cathode Ratings

The 12SF7GT features an emitter-coated unipotential cathode. The heater is designed for operation on either alternating current (AC) or direct current (DC). The electrical ratings for the heater and cathode are:

Parameter	Value
Heater Voltage (AC or DC)	12.6 V
Heater Current	0.15 A
Maximum Heater-Cathode Voltage	90 V

Maximum Ratings

The maximum ratings for the 12SF7GT are interpreted according to the RMA Standard M8-210. These limits represent the absolute boundaries within which the tube must be operated to ensure reliability:

- **Maximum Pentode Plate Voltage:** 300 V
- **Maximum Screen Voltage:** 100 V (some general classifications list up to 150 V)
- **Maximum Screen Supply Voltage:** 300 V
- **Maximum Pentode Plate Dissipation:** 3.5 W
- **Maximum Screen Dissipation:** 0.5 W
- **Minimum Diode Plate Current:** 0.8 mA (with 10 V DC applied directly to the diode plate)

Electrical Characteristics and Typical Operating Points

The pentode section of the 12SF7GT operates as a Class A1 amplifier. The tube's electrical characteristics vary depending on the applied plate and screen voltages. Two typical operating points are established:

Operating Point A (Low Plate Voltage)

- **Plate Voltage:** 100 V
- **Screen Voltage:** 100 V
- **Control Grid Voltage:** -1 V
- **Plate Current:** 12 mA
- **Screen Current:** 3.4 mA
- **Plate Resistance (Approximate):** 0.2 M Ω (200,000 Ω)
- **Transconductance:** 1975 μ mhos
- **Grid Bias for Cutoff ($g_m = 10 \mu$ mhos):** -35 V (approximate)

Operating Point B (High Plate Voltage)

- **Plate Voltage:** 250 V
- **Screen Voltage:** 100 V
- **Control Grid Voltage:** -1 V
- **Plate Current:** 12.4 mA
- **Screen Current:** 3.3 mA
- **Plate Resistance (Approximate):** 0.7 M Ω (700,000 Ω)
- **Transconductance:** 2050 μ mhos
- **Grid Bias for Cutoff ($g_m = 10 \mu$ mhos):** -35 V (approximate)

The remote-cutoff characteristic is demonstrated by the control grid voltage required to reduce the transconductance to a nominal 10 μ mhos. For both operating points, this cutoff bias is approximately -35 V, allowing the tube to handle a wide range of input signal levels without severe cross-modulation or distortion when AGC/AVC bias is applied.

Interelectrode Capacitances

The capacitances of the 12SF7GT are specified both with and without an external shield. When measured with an external shield connected to the cathode, the capacitances are:

- **Control Grid to Cathode:** 5.5 μ pf
- **Pentode Plate to Cathode:** 6.0 μ pf
- **Grid to Pentode Plate (Maximum):** 0.004 μ pf
- **Diode Plate to Pentode Grid 1 (Maximum):** 0.002 μ pf
- **Diode Plate to Pentode Plate:** 1.3 μ pf

Without an external shield, the nominal capacitances remain highly similar, with the control grid-to-cathode (input) capacitance at 5.5 μ pf, pentode plate-to-cathode (output) capacitance at 6.0 μ pf, and grid-

to-pentode plate capacitance at 0.004 μf . The extremely low grid-to-plate capacitance (0.004 μf maximum) is critical for stable high-frequency amplification, preventing unwanted oscillations.

Analysis of Characteristic Curves

Pentode Unit Curves

The transfer characteristics of the pentode unit (at a heater voltage of 12.6 V, plate voltage of 250 V, and screen voltage of 100 V) illustrate the relationship between the control-grid voltage and the resulting plate current (I_b), screen current (I_{c2}), and transconductance (g_m):

- At a control-grid bias of 0 V, the transconductance reaches its peak near 2200 μmhos , with plate current at approximately 14 mA and screen current at 3.5 mA.
- As the control-grid bias is made more negative, the transconductance and currents decrease smoothly. At -10 V bias, the transconductance drops to approximately 500 μmhos , and the plate current falls to about 2.5 mA.
- The curve approaches a gradual cutoff, with transconductance reaching the nominal 10 μmhos limit at approximately -35 V. This extended, non-linear transfer curve is the defining feature of the remote-cutoff design, enabling effective gain control by varying the grid bias.

Diode Unit Curves

The diode unit characteristics show the rectified performance of the diode detector. The curves plot the DC voltage developed by the diode against the rectified current in microamperes for various load resistance values (ranging from 100,000 Ω to 2,000,000 Ω) under different RMS signal input voltages up to 30 V:

- With higher load resistances (such as 1,000,000 Ω or 2,000,000 Ω), the diode develops a higher DC voltage for a given rectified current, showing high detection efficiency.
- With lower load resistances (such as 100,000 Ω), the developed DC voltage is lower for the same rectified current, but the circuit can support higher current levels.
- These curves define the operating boundaries for designing detector and AVC coupling networks, ensuring the diode develops sufficient control voltage to feed back to the pentode's control grid.

Technical Summary

The **12SF7GT** is a versatile, single-ended **diode remote-cutoff pentode** housed in a T-9 glass envelope with an 8-pin octal base. It features a **12.6 V, 0.15 A** heater and a coated unipotential cathode. The pentode section is optimized for Class A1 RF or IF amplification, providing a transconductance of **1975 to 2050 μmhos** and a plate resistance of **0.2 to 0.7 M Ω** under typical operating conditions. Its remote-cutoff characteristic allows for effective gain control with a grid bias range extending down to **-35 V**. The integrated diode unit, combined with internal shielding, provides efficient detection and AVC/AGC generation within a single compact envelope, minimizing external component count and chassis space in classic 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	5.5 pF	Section1
Output capacitance	6 pF	Section1
Grid-to-plate capacitance	0.004 pF	Section1

OTHER		
PARAMETER	PUBLISHED VALUE	CONDITION / NOTE
Plate voltage	100 V	ClassA
Screen voltage	100 V	ClassA
Control-grid voltage	-1 V	ClassA
Plate current	12 mA	ClassA
Screen current	3.4 mA	ClassA

CHARACTERISTIC		
PARAMETER	PUBLISHED VALUE	CONDITION / NOTE
Plate resistance	200000 Ω	Section1
Transconductance	1975 μS	Section1

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