

ELECTRONIC TUBE REFERENCE

12SK7GT

Voltage - Pentode Remote Cutoff (single) electronic tube

CONSOLIDATED TECHNICAL DATA

1 SECTION
CONSTRUCTION
PENTODE

Glass-tubular variable-mu pentode for automatic-gain-controlled RF and IF receiver amplification in series-string equipment.

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	800000 Ω
TRANSCONDUCTANCE	0.002 S
MAXIMUM PLATE VOLTAGE	300 V
MAXIMUM SCREEN VOLTAGE	150 V
MAXIMUM PLATE DISSIPATION	4 W
MAXIMUM SCREEN DISSIPATION	0.11 W
<i>Promoted from printed maximum/characteristic columns; additional published values retained in TUBE_SECTION_PARAMETER.</i>	

12SK7GT — Remote-Cutoff RF Pentode

The **12SK7GT** is an indirectly heated, remote-cutoff (variable-mu) pentode designed for use as a radio-frequency (RF) or intermediate-frequency (IF) amplifier in radio receivers. Housed in a T-9 glass envelope with an eight-pin octal base, it is particularly suited for AC/DC receivers where series-string heater operation is employed.

Overview

The 12SK7GT is engineered to operate in stages utilizing automatic volume control (AVC). Its remote-cutoff characteristic allows the tube to handle a wide range of signal voltages with minimal cross-modulation and distortion. The design features a single-ended construction, meaning all electrode connections, including the control grid, are brought out through the base pins, eliminating the need for a top cap.

The electrical characteristics, ratings, and physical dimensions of the 12SK7GT are identical to those of the [6SK7GT](#), with the sole exception of the heater ratings. It is also the glass-envelope equivalent of the metal-shell [12SK7](#).

Construction, Heater, and Basing

The 12SK7GT incorporates a coated unipotential cathode. The heater is designed to operate from either AC or DC power supplies.

Heater Parameter	Value
Nominal Heater Voltage	12.6 V
Nominal Heater Current	0.15 A (150 mA)
Heating Method	Indirect
Cathode Type	Coated unipotential

Physical Dimensions

The tube is housed in a T-9 glass bulb with a small wafer octal 8-pin base (basing designation **8N**). It can be operated in **any mounting position**.

- **Maximum Diameter:** 1.188 inches
- **Maximum Seated Height:** 2.750 inches
- **Maximum Overall Height:** 3.312 inches

Pin Connections

The 8N basing configuration provides the following pin assignments, viewed from the bottom of the tube:

Pin Number	Electrode Connection
Pin 1	Shell / Shield (NC or connected to external shield)
Pin 2	Heater
Pin 3	Grid No. 3 (Suppressor Grid)
Pin 4	Grid No. 1 (Control Grid)
Pin 5	Cathode
Pin 6	Grid No. 2 (Screen Grid)
Pin 7	Heater
Pin 8	Plate (Anode)

In typical applications, Grid No. 3 (Pin 3) is tied directly to the Cathode (Pin 5) at the tube socket.

Electrical Ratings

The maximum ratings for the 12SK7GT are established under the Design Center Rating System (RMA Standard M8-210). These limits represent the maximum values that the tube can safely withstand under normal operating variations:

- **Maximum Plate Voltage:** 300 V
- **Maximum Grid No. 2 (Screen) Supply Voltage:** 300 V
- **Maximum Grid No. 2 Voltage:** See Rating Chart (typically up to 150 V)
- **Maximum Positive DC Grid No. 1 Voltage:** 0 V
- **Maximum Plate Dissipation:** 4.0 W
- **Maximum Grid No. 2 Dissipation:** 0.4 W
- **Maximum Heater-Cathode Voltage:** 90 V

Typical Operating Conditions and Characteristics

The 12SK7GT can be operated under different typical Class A1 amplifier conditions depending on the plate supply voltage. The following table outlines two standard operating points:

Parameter	Operating Point A	Operating Point B
Plate Voltage	100 V	250 V
Grid No. 2 Voltage	100 V	100 V
Grid No. 1 Voltage	-1 V	-3 V
Grid No. 3 Voltage	Connected to Cathode	Connected to Cathode
Plate Current	13 mA	9.2 mA
Grid No. 2 Current	4.0 mA	2.6 mA
Plate Resistance (Approx.)	120,000 Ω	800,000 Ω
Transconductance	2,350 μmhos	2,000 μmhos
Grid No. 1 Voltage for $G_m = 10$ μmhos (Approx.)	-35 V	-35 V

Calculations and Variable-Mu Behavior

The remote-cutoff characteristic is mathematically demonstrated by the relationship between the control grid bias and the transconductance.

- At a grid bias of **-3 V** (Operating Point B), the transconductance is **2,000 μmhos** .
- When the grid bias is increased to **-35 V**, the transconductance drops to **10 μmhos** .

This represents a transconductance reduction ratio calculation of: $\frac{2000 \text{ } \cancel{\mu\text{mhos}}}{10 \text{ } \cancel{\mu\text{mhos}}} = 200$

This wide control range allows the tube to handle strong local signals without overloading, as the AVC circuit can apply a highly negative bias to reduce the stage gain by a factor of 200.

Direct Interelectrode Capacitances

The capacitances of the 12SK7GT vary depending on whether the tube is shielded. When measured with a close-fitting external shield connected to Pin 5, the typical capacitances are:

- **Grid No. 1 to Plate (Max):** 0.005 pF
- **Input (Grid No. 1 to all other electrodes except Plate):** 6.5 pF
- **Output (Plate to all other electrodes except Grid No. 1):** 7.5 pF

For the unshielded metal-shell version (12SK7), the capacitances are:

- **Grid No. 1 to Plate (Max):** 0.003 pF
- **Input:** 6.0 pF
- **Output:** 7.0 pF

The extremely low grid-to-plate capacitance (0.005 pF or less) is essential for preventing Miller-effect feedback, which can cause instability or oscillation in high-gain RF and IF amplifier stages.

Characteristic Curves and Qualitative Interpretation

The relationship between the electrode voltages and currents is illustrated by the tube's characteristic curves:

- **Plate Current vs. Plate Voltage:** The family of curves shows typical pentode behavior. Above a plate voltage of approximately 50 V, the plate current curves become nearly horizontal, indicating that plate current is largely independent of plate voltage and is primarily controlled by the Grid No. 1 and Grid No. 2 voltages.
- **Transconductance vs. Grid No. 1 Voltage:** At a constant plate voltage of 250 V and screen voltage of 100 V, the transconductance curve decreases smoothly and gradually as the control grid bias is made more negative. This gradual slope is the defining feature of the remote-cutoff design, preventing the abrupt cutoff of plate current that occurs in sharp-cutoff pentodes.
- **Transconductance and Plate Resistance vs. Grid No. 2 Voltage:** With a fixed plate voltage of 250 V and a grid bias of -3 V, increasing the screen grid (Grid No. 2) voltage from 25 V to 150 V results in a significant increase in transconductance and plate current, while the plate resistance decreases. This highlights the importance of maintaining a stable screen voltage to preserve the desired gain characteristics.

Related Designations and Comparisons

The **12SK7GT** is part of a family of closely related tubes:

- **6SK7GT / 6SK7:** These tubes share identical electrical ratings, typical operating points, and physical dimensions with the 12SK7GT, but utilize a **6.3 V, 0.3 A** heater.
- **12SK7:** This is the metal-shell version of the 12SK7GT. It shares the same electrical characteristics and 12.6 V heater rating but is housed in a metal envelope rather than glass.
- **12SF7 / 12SF7GT:** While also remote-cutoff pentodes, these types include an internal diode plate, making them distinct from the pure pentode structure of the 12SK7GT.

Direct substitution between these types must take into account the heater voltage differences (12.6 V vs. 6.3 V) and envelope shielding characteristics.

Technical Summary

The **12SK7GT** is an octal-based, remote-cutoff RF pentode featuring a **12.6 V, 0.15 A** heater. It is designed for RF and IF amplification in radio receivers, particularly in AC/DC series-string configurations. With a maximum plate voltage rating of 300 V and a plate dissipation limit of 4.0 W, it provides reliable service under typical operating conditions of 100 V to 250 V on the plate. Its variable-mu design allows for

smooth automatic volume control with a transconductance range extending from 2,000–2,350 μmhos down to 10 μmhos at a grid bias of -35 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

CAPACITANCE		
PARAMETER	PUBLISHED VALUE	CONDITION / NOTE
Input capacitance	6.5 pF	Section1
Output capacitance	7.5 pF	Section1
Grid-to-plate capacitance	0.005 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	13 mA	ClassA
Screen current	4 mA	ClassA

CHARACTERISTIC		
PARAMETER	PUBLISHED VALUE	CONDITION / NOTE
Plate resistance	120000 Ω	Section1
Transconductance	2350 μS	Section1

1961 Ferranti Technical Handbook

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

1961 FERRANTI TECHNICAL HANDBOOK

Section 1 · Pentode

CHARACTERISTICS		
PARAMETER	PUBLISHED VALUE	CONDITION / NOTE
Cutoff characteristic	Variable-mu	—

APPLICATION		
PARAMETER	PUBLISHED VALUE	CONDITION / NOTE
Application	RF / IF amplifier	—



SOURCE DATA APPENDIX

1966 Tung Sol Electronic Tubes 2 of 4

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

1966 TUNG SOL ELECTRONIC TUBES 2 OF 4

Section 1 · Pentode

CAPACITANCE		
PARAMETER	PUBLISHED VALUE	CONDITION / NOTE
GRID TO PLATE	0.003 pF	Interelectrode capacitances; published column 1
GRID TO PLATE	0.005 pF	Interelectrode capacitances; published column 2

OTHER		
PARAMETER	PUBLISHED VALUE	CONDITION / NOTE
HEATER VOLTAGE	6.3 V	Maximum ratings
MAXIMUM HEATER CATHODE VOLTAGE	90 V	Maximum ratings
MAXIMUM PLATE VOLTAGE	300 V	Maximum ratings

PARAMETER	PUBLISHED VALUE	CONDITION / NOTE
MAXIMUM GRID #2 SUPPLY VOLTAGE	300 V	Maximum ratings
MAXIMUM POSITIVE	0 V	Maximum ratings; published column 1
MAXIMUM PLATE DISSIPATION	4 W	Maximum ratings; published column 1
MAXIMUM PLATE DISSIPATION	0 W	Maximum ratings; published column 2
MAXIMUM GRID #2 DISSIPATION	0 W	Maximum ratings; published column 1
MAXIMUM GRID #2 DISSIPATION	11 W	Maximum ratings; published column 2
HEATER VOLTAGE	6 V	Typical operating conditions; published column 1
HEATER CURRENT	0 mA	Typical operating conditions; published column 1
PLATE VOLTAGE	100 V	Typical operating conditions; published column 1
PLATE VOLTAGE	25 V	Typical operating conditions; published column 2
PLATE VOLTAGE	0 V	Typical operating conditions; published column 3
PLATE CURRENT i_p	9.2 mA	Typical operating conditions
GRID #2 CURRENT	11 mA	Typical operating conditions; published column 1
GRID #2 CURRENT	2 mA	Typical operating conditions; published column 2
PLATE RESISTANCE (APPROX.)	12000000 ohm	Typical operating conditions; published column 1
PLATE RESISTANCE (APPROX.)	0 ohm	Typical operating conditions; published column 2
GRID #1 VOLTAGE (APPROX.) FOR G_m	10 uS	Typical operating conditions; published column 1
GRID #1 VOLTAGE (APPROX.) FOR G_m	-35 uS	Typical operating conditions; published column 2
$E_f =$	6.3 V	Typical operating conditions
$E_{cZ} =$	100 V	Typical operating conditions
$E_{ci} =$	0 V	Typical operating conditions; published column 1
PLATE CURRENT (	1 mA	Typical operating conditions; published column 1
PLATE CURRENT (	0 mA	Typical operating conditions; published column 2

PARAMETER	PUBLISHED VALUE	CONDITION / NOTE
$E_q =$	6.3 V	Typical operating conditions
$E_b =$	250 V	Typical operating conditions
E_{C1}	0 V	Typical operating conditions
$E_f =$	2.5 V	Typical operating conditions; published column 2
$E_{\sim i}$	-3 V	Typical operating conditions
E_{o3}	0 V	Typical operating conditions; published column 1
E_{C3}	0 V	Typical operating conditions
Maximum plate voltage	300 V	Published datasheet; promoted section value
Maximum plate dissipation	4 W	Published datasheet; promoted section value
Maximum screen dissipation	0.11 W	Published datasheet; promoted section value

CHARACTERISTIC		
PARAMETER	PUBLISHED VALUE	CONDITION / NOTE
Plate resistance	800000 ohm	Published datasheet; promoted section value
Transconductance	0.002 A/V	Published datasheet; promoted section value

TUBE TINKER

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