



ELECTRONIC TUBE REFERENCE

12A7P

Voltage - Radio Detector Converter electronic tube

CONSOLIDATED TECHNICAL DATA

1 SECTION

CONSTRUCTION

HEPTODE

High-frequency converter tube for oscillator and mixer service in radio receivers. Its multi-grid structure combines local-oscillator generation and frequency conversion within a single receiving tube.

GENERAL CHARACTERISTICS

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

SECTION RATINGS

SECTION 1 Heptode	
MAXIMUM PLATE VOLTAGE	330 V
MAXIMUM SCREEN VOLTAGE	110 V
MAXIMUM PLATE DISSIPATION	1.1 W
MAXIMUM SCREEN DISSIPATION	1.1 W
MAXIMUM CATHODE CURRENT	15.5 mA
<i>Shuguang 12A7P indirectly heated heptode receiver oscillator/converter, nominal heater 12.6 V 0.15 A. Source absolute ratings include maximum anode voltage 330 V, screen grids 2 and 4 voltage 110 V, anode dissipation 1.1 W, screen dissipation 1.1 W and total cathode current 15.5 mA. Typical operation includes 250 V anode, 100 V screen and approximately 3.5 mA anode current; conversion conductance and oscillator conductance are circuit-mode-specific quantities rather than intrinsic static gm. Separate maximum control-grid current must not be used as cathode-current limit.</i>	

12A7P — Heptode Frequency Changer Vacuum

Tube

The **12A7P** is an indirectly heated oxide-cathode heptode (seven-electrode) vacuum tube designed primarily for frequency conversion applications. It functions as a mixer and oscillator (converter) in receiving circuits, utilizing a multi-grid structure to achieve stable frequency translation.

Construction, Physical Dimensions, and Base Connections

The 12A7P features an indirectly heated oxide-coated cathode. The tube is housed in a glass envelope with a maximum overall height of 85 mm, a maximum seated height of 71 mm, and a maximum diameter of 34 mm.

The base utilizes an eight-pin arrangement (with pin 1 omitted or unassigned in the connection diagram) providing the following electrode connections:

Pin	Connection
Pin 2	Heater
Pin 3	Plate (Anode)
Pin 4	Grid 2 and Grid 4
Pin 5	Grid 1
Pin 6	Cathode and Grid 5
Pin 7	Heater
Pin 8	Grid 3

The heater is designed for operation from either an AC or DC supply.

Heater Parameter	Value
Nominal Heater Voltage	12.6 V
Nominal Heater Current	150 ± 12.5 mA

Electrical Characteristics and Operating Points

Under typical operating conditions, the 12A7P is characterized by the following electrical parameters:

Parameter	Value
Plate Voltage	250 V
Grid 2 and Grid 4 Voltage	100 V

Parameter	Value
Grid 3 Voltage	0 V
Plate Current	3.5 ± 1 mA
Grid 2 and Grid 4 Current	9 ± 2.5 mA
Grid 1 Current	0.51 ± 0.13 mA
Grid 3 Reverse Current	≤ 2 μ A
Conversion Transconductance	0.45 ± 0.15 mA/V
Oscillation Transconductance	4.7 ± 1.2 mA/V

Interelectrode Capacitances

The internal capacitances of the tube's electrode structure are specified as follows:

- **Input Capacitance:** 11 ± 3 pF
- **Output Capacitance:** 11 ± 3 pF
- **Cross-path (Transfer) Capacitance:** ≤ 0.7 pF

Maximum Ratings

To ensure reliable operation and prevent damage, the 12A7P must be operated within the following limiting values (absolute maximum or minimum ratings):

Rating Parameter	Limit Value
Maximum Heater Voltage	13.8 V
Minimum Heater Voltage	11.4 V
Maximum Plate Voltage	330 V
Maximum Grid 2 and Grid 4 Voltage	110 V
Maximum Plate Dissipation Power	1.1 W
Maximum Grid 2 and Grid 4 Dissipation Power	1.1 W
Maximum Grid 1 Current	0.5 mA
Maximum Cathode Current	15.5 mA
Maximum Heater-to-Cathode Voltage	100 V

Analysis of Characteristic Curves

The performance of the 12A7P under dynamic conditions is illustrated by its characteristic curves, which detail the relationships between electrode currents, voltages, and transconductance.

Conversion Transconductance vs. Grid 3 Voltage

With the heater set to 12.6 V, the plate at 250 V, Grid 2 and Grid 4 at 100 V, Grid 1 current maintained at 0.5 mA, and a Grid 1 resistor of 20 k Ω , the conversion transconductance (S_C) varies with the bias applied to Grid 3 (U_{g3}):

- The conversion transconductance reaches its peak value of approximately 0.47 mA/V when Grid 3 is biased near -2 V.
- As Grid 3 is biased more negatively, the conversion transconductance decreases steadily, approaching zero as the bias reaches -20 V to -24 V. This characteristic is critical for automatic volume control (AVC) or gain control applications where Grid 3 bias is varied.

Cathode Current and Conversion Transconductance vs. Grid 1 Current

Under similar operating conditions (Heater voltage of 12.6 V, plate voltage of 250 V, Grid 2 and Grid 4 voltage of 100 V, Grid 3 voltage of -2 V, and a Grid 1 resistor of 20 k Ω), the cathode current (I_k) and conversion transconductance (S_C) are evaluated against Grid 1 current (I_{g1}) over a range of 0 to 1.0 mA:

- **Conversion Transconductance (S_C):** Rises continuously from approximately 0.25 mA/V at a Grid 1 current of 0.15 mA, reaching about 0.52 mA/V when Grid 1 current is increased to 0.9 mA.
- **Cathode Current (I_k):** Exhibits a slight dip to approximately 13.5 mA at a Grid 1 current of 0.3 mA, and then rises gradually to about 15 mA as Grid 1 current approaches 0.9 mA.

Technical Summary

The **12A7P** is a specialized heptode frequency changer featuring an indirectly heated oxide cathode, a 12.6 V heater, and an 8-pin base configuration. It is designed to perform frequency mixing and oscillation within a single envelope. With a typical conversion transconductance of 0.45 mA/V and an oscillation transconductance of 4.7 mA/V, it provides the necessary gain and mixing efficiency for converter stages. Designers must adhere to the maximum plate and screen dissipation limits of 1.1 W and ensure that the cathode current does not exceed 15.5 mA.

SOURCE OPERATING CONDITIONS

[SOURCE PDF](#)

198X Shuguang

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

198X SHUGUANG

Section 1 · Heptode

OTHER		
PARAMETER	PUBLISHED VALUE	CONDITION / NOTE
HeaterVoltageNominal	12.6 V	Nominal
HeaterCurrentNominal	150 mA	Nominal
Maximum Plate Voltage	330 V	—
Maximum Screen Voltage	110 V	—
Maximum Plate Dissipation	1.1 W	—
Maximum Screen Dissipation	1.1 W	—

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