



ELECTRONIC TUBE REFERENCE

12K3P

Voltage - Pentode Remote Cutoff (single) electronic tube

CONSOLIDATED TECHNICAL DATA

1 SECTION

CONSTRUCTION

PENTODE

Remote-cutoff high-frequency pentode for RF voltage amplification, providing gradual gain reduction for automatic gain-control circuits.

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 Pentode	
TRANSCONDUCTANCE	0.002 S
MAXIMUM PLATE VOLTAGE	330 V
MAXIMUM SCREEN VOLTAGE	140 V
MAXIMUM PLATE DISSIPATION	4.4 W
MAXIMUM SCREEN DISSIPATION	0.44 W
<i>Shuguang 12K3P high-frequency RF voltage-amplifier pentode, indirect heater 12.6 V 150 mA. Manufacturer transconductance 2.0 ± 0.4 mA/V at specified operating conditions (typically anode 250 V, screen 100 V, negative control-grid bias). Maximum anode voltage 330 V, screen voltage 140 V, plate dissipation 4.4 W and screen dissipation 0.44 W. Existing PentodeRemoteCutoff classification preserved per approved scope. Published input/output capacitances and low feedthrough capacitance apply.</i>	

12K3P — Remote-Cutoff High-Frequency Pentode

An indirectly heated, remote-cutoff pentode designed for high-frequency voltage amplification in radio receiving equipment.

Overview

The **12K3P** is a specialized high-frequency pentode featuring an indirectly heated oxide cathode. Designed primarily for high-frequency voltage amplification, this tube is characterized by its remote-cutoff (variable-mu) control grid characteristic. This feature allows the tube to handle a wide range of input signal amplitudes and facilitates effective automatic gain control (AGC) without introducing severe distortion.

The tube operates with a nominal 12.6 V heater supply and is housed in a glass envelope with an octal-style base. Its design incorporates an internal shield and a metal shell ring to minimize interelectrode coupling, which is critical for stable operation in high-frequency amplifier stages.

Construction, Heater, and Pinout

The 12K3P is constructed with a unipotential, indirectly heated oxide cathode. The physical structure is optimized for high-frequency stability, featuring a protective metal shell ring and an internal shield to isolate the sensitive grid structure from external interference and minimize capacitive feedback.

Physical Dimensions

The tube is compact and designed for standard chassis mounting. Its physical dimensions are as follows:

- **Maximum overall height:** 90 mm
- **Maximum seated height:** 76 mm
- **Maximum bulb diameter:** 34 mm

Heater Characteristics

The heater is designed for either AC or DC operation. The nominal ratings and calculated power consumption are:

- **Nominal heater voltage:** 12.6 V
- **Heater current:** 150 ± 12.5 mA
- **Calculated nominal heater power:** 1.89 W (derived from the nominal 12.6 V voltage and 150 mA current)

Pin Connections

The 12K3P utilizes an eight-pin base configuration. Looking at the bottom of the tube, the pin assignments are:

Pin Number	Electrode Connection
1	Metal shell ring and internal shield/barrier
2	Heater
3	Third grid (Suppressor Grid)
4	First grid (Control Grid)
5	Cathode
6	Second grid (Screen Grid)
7	Heater
8	Plate (Anode)

Electrical Characteristics and Typical Operating Point

Under typical operating conditions, the 12K3P provides moderate transconductance and stable plate current. The standard Class A operating point and associated electrical parameters are specified as follows:

Operating Conditions

- **Plate voltage (U_a):** 250 V
- **Second grid voltage ($U_{[g2]}$ (/tubes/G2)):** 100 V
- **Third grid voltage (U_{g3}):** 0 V
- **First grid bias voltage (U_{g1}):** -3 V

Measured Parameters

- **Plate current (I_a):** 9.25 ± 3.25 mA
- **Second grid current ($I_{[g2]}$ (/tubes/G2)):** 2.5 ± 0.9 mA
- **Transconductance (S):** 2 ± 0.4 mA/V (equivalent to 2000 ± 400 μ mhos)

Interelectrode Capacitances

To ensure stability in high-frequency circuits, the 12K3P is designed with extremely low feedback capacitance:

- **Input capacitance:** 6 ± 1.2 pF
- **Output capacitance:** 7 ± 1.8 pF
- **Grid-to-plate (transfer) capacitance:** ≤ 0.007 pF

The exceptionally low grid-to-plate capacitance (not exceeding 0.007 pF) is achieved through the internal shielding connected to Pin 1, which prevents self-oscillation in high-gain high-frequency amplifier stages.

Maximum Ratings

To ensure reliable operation and prevent premature failure, the operating conditions of the 12K3P must be maintained within the following absolute limits:

Parameter	Absolute Limit
Maximum heater voltage	13.8 V
Minimum heater voltage	11.4 V
Maximum plate voltage	330 V
Maximum second grid voltage	140 V
Maximum plate dissipation power	4.4 W
Maximum second grid dissipation power	0.44 W
Maximum heater-to-cathode voltage	100 V

These ratings represent the extreme limits of safe operation. Operating the tube at multiple maximum limits simultaneously may impair performance and reduce service life.

Characteristic Curves and Remote-Cutoff Behavior

The performance of the 12K3P across varying voltage and bias conditions is illustrated by its characteristic curves, which highlight its suitability for automatic gain control applications.

Plate Characteristics

The plate current (I_a) and screen grid current ($I_{g2}(/tubes/G2)$) curves plotted against plate voltage (V_a) demonstrate classic pentode behavior. With the screen grid ($U_{g2}(/tubes/G2)$) held at 100 V and the suppressor grid (U_{g3}) at 0 V:

- At control grid biases (U_{g1}) ranging from 0 V to -15 V, the plate current rises sharply below $V_a = 40$ V and then flattens into a nearly horizontal plateau, indicating high dynamic plate resistance.
- At $U_{g1} = 0$ V, the plate current reaches approximately 16 mA at higher plate voltages.
- The screen grid current ($I_{g2}(/tubes/G2)$), shown as a dashed line for the $U_{g1} = 0$ V condition, starts at approximately 7.5 mA when $V_a = 0$ V and drops to a steady state of about 4.5 mA as the plate voltage increases beyond the knee.

Transfer Characteristics and Transconductance

The transfer curves, plotted at a plate voltage of 250 V and screen grid voltage of 100 V, clearly illustrate the remote-cutoff (variable-mu) characteristic of the control grid:

- **Transconductance (S):** At a nominal bias of -3 V, the transconductance is approximately 2 mA/V. As the negative bias increases, the transconductance decreases gradually rather than cutting off sharply. Even at a bias of -20 V to -30 V, a small but usable transconductance persists, only approaching zero near -40 V.
- **Plate Current (I_a):** The plate current curve follows a similar gradual decay, starting near 24 mA at $U_{g1} = 0$ V, dropping to the nominal 9.25 mA at -3 V, and tapering off slowly to near-zero levels at -40 V.
- **Screen Grid Current ($I_{[g2]}(/tubes/G2)$):** The screen grid current decreases in tandem with the plate current, falling from approximately 5 mA at $U_{g1} = 0$ V to near zero at -40 V.

This gradual reduction in transconductance and plate current over a wide range of negative grid voltages is the defining feature of the remote-cutoff pentode. It allows the stage gain to be controlled smoothly by varying the grid bias (such as via an AGC loop) without causing signal clipping or cross-modulation when strong RF signals are present.

Technical Summary

The **12K3P** is an indirectly heated, remote-cutoff high-frequency pentode featuring a 12.6 V, 150 mA heater and an octal-style base. It is optimized for high-frequency voltage amplification where automatic gain control is required. Under typical operating conditions ($U_a = 250$ V, $U_{[g2]}(/tubes/G2) = 100$ V, $U_{g1} = -3$ V), it exhibits a transconductance of 2 mA/V, a plate current of 9.25 mA, and an exceptionally low grid-to-plate capacitance of ≤ 0.007 pF. With a maximum plate dissipation of 4.4 W and robust internal shielding, the 12K3P provides stable, low-distortion amplification in RF and IF stages.

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 · Pentode

OTHER		
PARAMETER	PUBLISHED VALUE	CONDITION / NOTE
HeaterVoltageNominal	12.6 V	Nominal
HeaterCurrentNominal	150 mA	Nominal
Maximum Plate Voltage	330 V	—
Maximum Screen Voltage	140 V	—
Maximum Plate Dissipation	4.4 W	—
Maximum Screen Dissipation	0.44 W	—

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