

ELECTRONIC TUBE REFERENCE

# 13P1P

Power - Pentode Single (NOT beam) (under 10W) electronic tube

CONSOLIDATED TECHNICAL DATA

1 SECTION  
CONSTRUCTION  
PENTODE

Output pentode designed for low-frequency power amplification. Manufacturer documentation identifies it as a dedicated audio-frequency power tube rather than a small-signal voltage amplifier.

## GENERAL CHARACTERISTICS

|                     |                   |                      |               |
|---------------------|-------------------|----------------------|---------------|
| BASE DESIGNATION    | —                 | BASE PINS            | —             |
| NOMINAL HEATER      | 13 V / 150 mA     | PARALLEL HEATER      | — / —         |
| HEATING             | Indirect          | SERIES OPERATION     | Not specified |
| CATHODE ARRANGEMENT | Separate cathodes | SECTION CONSTRUCTION | Similar       |

## SECTION RATINGS

|                                                   |       |
|---------------------------------------------------|-------|
| SECTION1 Pentode                                  |       |
| MAXIMUM PLATE VOLTAGE                             | 110 V |
| MAXIMUM SCREEN VOLTAGE                            | 80 V  |
| MAXIMUM PLATE DISSIPATION                         | 6 W   |
| MAXIMUM SCREEN DISSIPATION                        | 1 W   |
| Published limits promoted from translated source. |       |

# 13P1P — Low-Voltage Output Pentode

An indirectly heated, low-voltage output pentode designed for low-frequency power amplification in compact or battery-operated equipment.

# Overview

The **13P1P** is a specialized power output pentode designed for low-frequency (audio) power amplification. It is characterized by its ability to operate at exceptionally low anode and screen grid voltages, with a nominal operating point of only **26 V**. This makes the tube highly suitable for low-voltage applications where conventional high-voltage power supplies are impractical or undesirable.

The tube features an indirectly heated oxide cathode, a high transconductance of **7.5 mA/V**, and a relatively low internal plate resistance of **1500 Ω**. It is capable of delivering a minimum output power of **220 mW** under nominal operating conditions.

## Construction, Heater, and Pin Connections

The 13P1P is constructed with an indirectly heated oxide cathode (□□□□□□□□). The heater is designed to be powered by either an AC or DC source.

### Heater Characteristics and Limits

| Parameter               | Value       |
|-------------------------|-------------|
| Nominal Heater Voltage  | 13 V        |
| Nominal Heater Current  | 750 ± 60 mA |
| Calculated Heater Power | 9.75 W      |
| Maximum Heater Voltage  | 14.3 V      |
| Minimum Heater Voltage  | 11.7 V      |

*Heater Power Calculation:*  $\text{Power} = \text{Voltage} \times \text{Current} = 13\text{ V} \times 0.75\text{ A} = 9.75\text{ W}$

### Physical Dimensions

The tube is housed in a glass envelope with the following physical limits:

- **Maximum Overall Length:** 90 mm
- **Maximum Seated Height:** 76 mm
- **Maximum Bulb Diameter:** 34 mm

### Pinout and Electrode Connections

The tube utilizes an eight-pin base configuration. The pin connections, viewed from the underside of the base, are assigned as follows:

| Pin Number | Electrode Connection              |
|------------|-----------------------------------|
| Pin 1      | <i>Not connected / Unassigned</i> |

| Pin Number | Electrode Connection                        |
|------------|---------------------------------------------|
| Pin 2      | Heater (□□)                                 |
| Pin 3      | Plate and Grid 3 / Suppressor Grid (□□□□□□) |
| Pin 4      | Grid 2 / Screen Grid (□□□□)                 |
| Pin 5      | Grid 1 / Control Grid (□□□□)                |
| Pin 6      | No Connection (□□)                          |
| Pin 7      | Heater (□□)                                 |
| Pin 8      | Cathode (□□)                                |

The suppressor grid (Grid 3) is internally tied to the plate (anode) at Pin 3, simplifying external circuit wiring.

## Electrical Characteristics and Typical Operating Point

The 13P1P is optimized for low-voltage operation. Its typical Class A operating parameters are defined at a nominal supply voltage of 26 V:

| Parameter                                     | Value              |
|-----------------------------------------------|--------------------|
| Plate Voltage ( $U_a$ )                       | 26 V               |
| Second Grid Voltage ( $U_{[g2]}$ (/tubes/G2)) | 26 V               |
| First Grid Voltage ( $U_{g1}$ )               | 0 V                |
| Plate Current ( $I_a$ )                       | $42 \pm 10$ mA     |
| Second Grid Current ( $I_{[g2]}$ (/tubes/G2)) | $\leq 4$ mA        |
| Transconductance ( $g_m$ )                    | $7.5 \pm 1.5$ mA/V |
| Internal Resistance ( $r_p$ )                 | 1500 $\Omega$      |
| Output Power ( $P_o$ )                        | $\geq 220$ mW      |

## Interelectrode Capacitances

The internal capacitances of the tube electrodes are specified as follows:

- **Input Capacitance ( $C_{in}$ ):**  $15.5 \pm 2.5$  pF
- **Output Capacitance ( $C_{out}$ ):**  $10.5 \pm 2.5$  pF
- **Feedback / Transfer Capacitance ( $C_{gp}$ ):**  $\leq 2.5$  pF

# Maximum Ratings

To ensure reliable operation and prevent damage to the tube, the following absolute maximum limits must be observed:

| Parameter                                                             | Absolute Maximum Value |
|-----------------------------------------------------------------------|------------------------|
| Maximum Plate Voltage ( $U_a \text{ max}$ )                           | 110 V                  |
| Maximum Second Grid Voltage ( $U_{[g2]}(/tubes/G2) \text{ max}$ )     | 80 V                   |
| Maximum Plate Dissipation ( $P_a \text{ max}$ )                       | 6 W                    |
| Maximum Second Grid Dissipation ( $P_{[g2]}(/tubes/G2) \text{ max}$ ) | 1 W                    |
| Maximum Heater-to-Cathode Voltage ( $U_{fk} \text{ max}$ )            | 100 V                  |

## Performance Curves and Circuit Design

The electrical behavior of the 13P1P is further illustrated by its characteristic curves, which assist in selecting appropriate load lines and bias points.

### Plate Characteristics ( $I_a$ vs. $U_a$ )

The plate family curves show the relationship between plate current ( $I_a$ ) and plate voltage ( $U_a$ ) for various control grid voltages ( $U_{g1}$ ) ranging from +5 V down to -14 V, with the screen grid voltage ( $U_{[g2]}(/tubes/G2)$ ) fixed at 26 V.

- At the nominal bias of  $U_{g1} = 0$  V and  $U_a = 26$  V, the plate current is approximately 42 mA.
- Driving the control grid positive (up to +5 V) increases the plate current significantly, exceeding 80 mA, though this operating region introduces grid current.
- Applying negative bias reduces the plate current, with cutoff occurring near -14 V under low plate voltage conditions.

An additional set of curves details the plate current at  $U_{g1} = 0$  V for different screen grid voltages ( $U_{[g2]}(/tubes/G2) = 16$  V, 26 V, 36 V, 46 V). This highlights that the screen grid voltage exerts strong control over the overall current capacity of the tube, with higher screen voltages shifting the entire plate current curve upward.

### Transfer Characteristics ( $I_a, I_{g2}$ vs. $U_{g1}$ )

The transfer curves plot plate current ( $I_a$ ) and screen grid current ( $I_{[g2]}(/tubes/G2)$ ) against control grid voltage ( $U_{g1}$ ) at a constant plate voltage of 26 V, for screen voltages of 16 V, 26 V, 36 V, and 46 V.

- The slope of these curves represents the transconductance ( $g_m$ ). At higher screen voltages (such as 46 V), the transconductance is higher, and the plate current rises more steeply as  $U_{g1}$  approaches 0 V.
- The screen grid current ( $I_{[g2]}(/tubes/G2)$ ) remains a small fraction of the plate current across the operating range, typically staying well below the 4 mA limit at the nominal 26 V operating point.

## Output Power and Distortion vs. Load Resistance

The relationship between output power ( $P_{sc}$ ), distortion ( $K_f$ ), and load resistance ( $R_a$ ) is documented at  $U_f = 13$  V,  $U_a = 26$  V, and  $U_{[g2]}(/tubes/G2) = 26$  V:

- **Output Power ( $P_{sc}$ ):** The output power rises as the load resistance increases from 200  $\Omega$ , reaching a peak of approximately 300 mW at a load resistance ( $R_a$ ) of around 900 to 1000  $\Omega$ .
- **Distortion ( $K_f$ ):** The distortion factor reaches a minimum of approximately 6% at a load resistance of 600  $\Omega$ , where the output power is about 260 mW. As the load resistance increases beyond 600  $\Omega$ , the distortion rises, reaching approximately 12% at 800  $\Omega$  and continuing to increase to around 20% as the load approaches 1200  $\Omega$ .
- **Design Trade-off:** For optimum performance, a designer must balance output power against distortion. A load resistance of 600  $\Omega$  provides the lowest distortion (6%) with a slight reduction in output power (260 mW), whereas a load of 900  $\Omega$  maximizes power output (300 mW) at the expense of higher distortion (around 16%).

## Technical Summary

The **13P1P** is an indirectly heated, low-voltage output pentode designed for low-frequency power amplification. Featuring a 13 V heater and optimized for operation at a nominal plate and screen voltage of 26 V, it provides a unique solution for low-voltage tube circuitry. With a transconductance of  $7.5 \text{ mA/V}$ , an internal resistance of 1500  $\Omega$ , and a maximum plate dissipation of 6 W, the 13P1P can deliver over 220 mW of audio output power into a typical load of 600 to 1000  $\Omega$ . Its pinout integrates the suppressor grid internally with the plate on Pin 3, simplifying circuit layout.

## 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       | 13 V            | Nominal          |
| HeaterCurrentNominal       | 150 mA          | Nominal          |
| Maximum Plate Voltage      | 110 V           | —                |
| Maximum Screen Voltage     | 80 V            | —                |
| Maximum Plate Dissipation  | 6 W             | —                |
| Maximum Screen Dissipation | 1 W             | —                |