



ELECTRONIC TUBE REFERENCE

12EZ6

Voltage Pentode - Sharp Cutoff (single) electronic tube

CONSOLIDATED TECHNICAL DATA

1 SECTION

CONSTRUCTION

PENTODE

Seven-pin miniature sharp-cutoff pentode designed for low-voltage amplifier service from automotive battery supplies. It combines fixed-gain signal amplification with operating conditions suited to vehicle electrical systems.

GENERAL CHARACTERISTICS

BASE DESIGNATION	THE	BASE PINS	7
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	
PLATE RESISTANCE	300000 Ω
TRANSCONDUCTANCE	0.006 S
MAXIMUM PLATE VOLTAGE	330 V
MAXIMUM SCREEN VOLTAGE	330 V
MAXIMUM PLATE DISSIPATION	2 W
MAXIMUM CATHODE CURRENT	10 mA
Sharp-cutoff pentode section; published ratings/characteristics promoted where applicable.	

12EZ6 — Sharp-Cutoff Miniature Pentode

An indirectly heated, sharp-cutoff miniature pentode designed for RF and IF amplifier service in mobile and automotive applications where electrode potentials are derived directly from a 12-volt battery system.

Overview

The **12EZ6** is a miniature sharp-cutoff pentode constructed with a unipotential cathode in a 7-pin miniature glass envelope. It is specifically engineered for use as a radio-frequency (RF) or intermediate-frequency (IF) amplifier in electronic equipment where the heater, plate, and screen grid (Grid #2) potentials are obtained directly from a nominal 12-volt automotive battery.

By operating all electrodes—including the plate and screen grid—at the low voltages typical of automotive electrical systems, the 12EZ6 eliminates the need for a high-voltage vibrator power supply or step-up transformer. The tube's design incorporates safety factors that allow it to withstand the wide voltage fluctuations characteristic of automotive battery charging systems.

Physical Construction and Basing

The 12EZ6 is housed in a **T-5 1/2** glass bulb with a miniature button **7-pin base**. It is designed to operate in **any mounting position**.

Physical Dimensions

- **Maximum Overall Length:** 2 1/8 inches (2.125 in)
- **Maximum Seated Height:** 1 7/8 inches (1.875 in)
- **Maximum Diameter:** 3/4 inch (0.75 in)

Pin Connections

The bottom view of the miniature button 7-pin base provides the following electrode connections:

Pin Number	Connection
Pin 1	Grid #1 (Control Grid)
Pin 2	Cathode
Pin 3	Heater
Pin 4	Heater
Pin 5	Plate
Pin 6	Grid #2 (Screen Grid)
Pin 7	Grid #3 (Suppressor Grid) / Internal Shield

Note: Grid #3 is designed to be connected directly to the cathode at the socket.

Heater and Automotive Power Supply Considerations

The heater of the 12EZ6 is designed to operate directly from a nominal 12-volt automotive battery source. Because automotive battery voltages vary significantly depending on whether the engine is running and

the battery is charging, the heater is specifically rated to operate over a wide voltage range.

- **Nominal Heater Voltage:** 12.6 V (AC or DC)
- **Nominal Heater Current:** 0.175 A
- **Operational Heater Voltage Range:** 10.0 V to 15.9 V
- **Cathode Type:** Coated unipotential

The maximum ratings of the tube are established with an adequate safety factor to ensure reliable operation and longevity despite the wide variations in supply voltage encountered in automotive service.

Direct Interelectrode Capacitances

The 12EZ6 features low interelectrode capacitances, which are critical for stable operation in high-frequency RF and IF amplifier stages. The direct interelectrode capacitances, measured without an external shield, are:

Capacitance Parameter	Value
Grid #1 to Plate (Maximum)	0.008 μF
Input (Grid #1 to all other electrodes except Plate)	7.8 μF
Output (Plate to all other electrodes except Grid #1)	5.5 μF

The extremely low grid-to-plate capacitance (0.008 μF maximum) minimizes feedback from the plate circuit to the grid circuit, reducing the risk of parasitic oscillation in high-gain amplifier stages.

Maximum Ratings (Design Center System)

The following maximum ratings are interpreted according to the Design Center System. These limits represent the maximum values that the tube can withstand under typical operating conditions without compromising reliability.

Parameter	Rating	Unit
Heater Voltage	12.6	Volts
Maximum Heater-Cathode Voltage	± 30	Volts
Maximum Plate Voltage	30	Volts
Maximum Grid #2 (Screen Grid) Voltage	30	Volts
Maximum Cathode Current	10	mA

Parameter	Rating	Unit
Maximum Grid #1 Circuit Resistance	10	Megohms

The low maximum plate and screen grid voltage ratings (30 V) reflect the tube's optimization for direct battery operation, contrasting sharply with conventional vacuum tubes that require hundreds of volts on these electrodes.

Typical Operating Conditions and Characteristics

The 12EZ6 is characterized for Class A1 amplifier service at two distinct operating points, representing a nominal battery voltage (12.6 V) and a typical charging-system voltage (14.0 V).

Parameter	12.6 V Operating Point	14.0 V Operating Point	Unit
Heater Voltage	12.6	14.0	Volts
Heater Current	0.175	0.175	Amp.
Plate Voltage	12.6	14.0	Volts
Grid #3 Voltage	0	0	Volts
Grid #2 Voltage	12.6	14.0	Volts
Grid #1 Voltage	-0.7	-0.8	Volts
Plate Current	1.9	2.3	mA
Grid #2 Current	0.7	0.85	mA
Plate Resistance (Approx.)	0.40	0.30	Megohms
Transconductance	2700	3000	μ mhos
Grid #1 Voltage for $I_b = 50 \mu A$	-2.6	-2.8	Volts
Grid #1 & Grid #3 Voltage for $G_m = 30 \mu$ mhos	-2.8	-3.0	Volts

Note: The Grid #1 bias voltages of -0.7 V and -0.8 V represent average bias values developed across a 2.2 Megohm grid resistor.

Analysis of Characteristic Curves

The published characteristic curves for the 12EZ6 illustrate plate current (in milliamperes) plotted against plate voltage (from 0 to 20 volts) under two primary operating conditions:

1. Operation at $E_f = E_{c2} = 12.6 \text{ V}$

With the heater and screen grid set to 12.6 volts and Grid #1 biased via a 2.2 Megohm grid resistor (R_{g1}):

- At $E_{g1} = -0.5 \text{ V}$, the plate current rises rapidly below 5 volts and plateaus at approximately 2.3 mA for plate voltages above 10 V.
- As the negative bias on Grid #1 increases, the plate current drops significantly. At $E_{g1} = -1.0 \text{ V}$, the plateau current is approximately 1.1 mA.
- At $E_{g1} = -1.5 \text{ V}$, the current plateaus near 0.4 mA.
- For bias levels of -2.0 V, -2.5 V, and -3.0 V, the plate current is suppressed to near-zero levels, demonstrating the sharp-cutoff characteristic of the control grid.

2. Operation at $E_f = E_{c2} = 14.0 \text{ V}$

With the heater and screen grid operating at 14.0 volts (representing active automotive charging conditions):

- At $E_{g1} = -0.5 \text{ V}$, the plate current rises to a plateau of approximately 3.0 mA above 10 V plate voltage.
- At $E_{g1} = -1.0 \text{ V}$, the plate current plateaus at approximately 1.6 mA.
- At $E_{g1} = -1.5 \text{ V}$, the plateau current is approximately 0.7 mA.
- The cutoff behavior remains sharp, with plate current approaching zero as Grid #1 bias reaches -2.5 V to -3.0 V.

These curves confirm typical pentode behavior, where the plate current is highly independent of plate voltage once the "knee" voltage (around 5 volts) is exceeded. This flat characteristic is responsible for the high plate resistance (0.30 to 0.40 Megohms) and high voltage gain achievable in RF and IF amplifier stages.

Technical Summary

The **12EZ6** is a specialized **7-pin miniature sharp-cutoff pentode** designed for **low-voltage automotive RF and IF amplifier service**. Operating with a nominal **12.6 V heater** that draws **0.175 A**, the tube is optimized to run its heater, plate, and screen grid directly from a 12-volt vehicle battery.

At its nominal 12.6 V operating point, the 12EZ6 exhibits a transconductance of **2700 μmhos** , a plate resistance of **0.40 Megohms**, and a plate current of **1.9 mA**. When the automotive system is charging (raising the supply to 14.0 V), the transconductance increases to **3000 μmhos** and plate current rises to **2.3 mA**. With its extremely low grid-to-plate capacitance of **0.008 μpF** and robust design capable of withstanding supply variations from **10.0 V to 15.9 V**, the 12EZ6 provides stable, reliable high-frequency amplification in mobile receiver designs without requiring high-voltage power conversion.



SOURCE OPERATING CONDITIONS

[SOURCE PDF](#)

1961 Tung Sol

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

1961 TUNG SOL

Section 1 · Pentode

OTHER		
PARAMETER	PUBLISHED VALUE	CONDITION / NOTE
Heater voltage	12.6 V	Nominal
Heater current	150 mA	Nominal
Plate voltage	30 V	Typical operating conditions
Screen voltage	30 V	Typical operating conditions
Plate current	1.92.3 mA	Typical operating conditions



SOURCE OPERATING CONDITIONS

[SOURCE PDF](#)

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

OTHER		
PARAMETER	PUBLISHED VALUE	CONDITION / NOTE
PIN MINIATURE CONSTRUCTION	1 A	Published datasheet; published column 1
PIN MINIATURE CONSTRUCTION	0 mA	Published datasheet; published column 4
HEATER VOLTAGE	126 V	Maximum ratings
MAXIMUM HEATER-CATHODE VOLTAGE t3	0 V	Maximum ratings
MAXIMUM PLATE VOLTAGE	3 V	Maximum ratings; published column 1
MAXIMUM PLATE VOLTAGE	0 V	Maximum ratings; published column 2

PARAMETER	PUBLISHED VALUE	CONDITION / NOTE
MAXIMUM GRID #2 VOLTAGE	3 V	Maximum ratings; published column 1
MAXIMUM GRID #2 VOLTAGE	0 V	Maximum ratings; published column 2
MAXIMUM CATHODE CURRENT	10 mA	Maximum ratings
MAXIMUM GRID #1 CIRCUIT RESISTANCE	10000000 ohm	Maximum ratings
HEATER VOLTAGE	12.6 V	Typical operating conditions; published column 1
HEATER VOLTAGE	140 V	Typical operating conditions; published column 2
HEATER CURRENT	175 A	Typical operating conditions; published column 1
PLATE VOLTAGE	126 V	Typical operating conditions; published column 1
PLATE VOLTAGE	14 V	Typical operating conditions; published column 2
GRID #1 VOLTAGE S	0 V	Typical operating conditions; published column 1
GRID #2 VOLTAGE	126 V	Typical operating conditions; published column 1
GRID #2 VOLTAGE	14 V	Typical operating conditions; published column 2
PLATE CURRENT	1.9 mA	Typical operating conditions; published column 1
PLATE CURRENT	2.3 mA	Typical operating conditions; published column 2
GRID #2 CURRENT	0.7 mA	Typical operating conditions; published column 1
GRID #2 CURRENT	0 mA	Typical operating conditions; published column 2
PLATE RESISTANCE	40000000 ohm	Typical operating conditions; published column 1
PLATE RESISTANCE	300000 ohm	Typical operating conditions; published column 2
TRANSCONDUCTANCE C	2700 uS	Typical operating conditions; published column 1
TRANSCONDUCTANCE C	3000 uS	Typical operating conditions; published column 2
GRID #1 VOLTAGE FOR	1 uS	Typical operating conditions; published column 1

PARAMETER	PUBLISHED VALUE	CONDITION / NOTE
GRID #i VOLTAGE FOR	50 uS	Typical operating conditions; published column 2
GRID #i VOLTAGE FOR	-2.6 uS	Typical operating conditions; published column 3
GRID #i VOLTAGE FOR	-2.8 uS	Typical operating conditions; published column 4
GRID #i	6 uS	Typical operating conditions; published column 1
GRID #i	0 uS	Typical operating conditions; published column 2
GRID #i	-2 uS	Typical operating conditions; published column 3
GRID #i	-3 uS	Typical operating conditions; published column 4
THIS TUBE	15 V	Typical operating conditions; published column 1
THIS TUBE	1 V	Typical operating conditions; published column 2
THIS TUBE	12 V	Typical operating conditions; published column 4
THIS SERVICE. THE MA%	1 mA	Typical operating conditions; published column 1
THIS SERVICE. THE MA%	0 mA	Typical operating conditions; published column 2
D AVERAGE BIAS DEVELOPED ACROSS A	2200000 ohm	Typical operating conditions; published column 1
D AVERAGE BIAS DEVELOPED ACROSS A	0 ohm	Typical operating conditions; published column 2
Et =	12.6 V	Typical operating conditions
E~Z	12.6 V	Typical operating conditions
Rgi	2200000 ohm	Typical operating conditions
Eq =	14 V	Typical operating conditions
E~Z	14 V	Typical operating conditions
Rqi	2200000 ohm	Typical operating conditions
Maximum plate voltage	30 V	Published datasheet; promoted section value
Maximum screen voltage	30 V	Published datasheet; promoted section value
Maximum cathode current	10 mA	Published datasheet; promoted section value

CAPACITANCE		
PARAMETER	PUBLISHED VALUE	CONDITION / NOTE
GRID TO PLATE (MAX.)	8 pF	Interelectrode capacitances

CHARACTERISTIC		
PARAMETER	PUBLISHED VALUE	CONDITION / NOTE
Plate resistance	300000 ohm	Published datasheet; promoted section value
Transconductance	0.003 A/V	Published datasheet; promoted section value