



ELECTRONIC TUBE REFERENCE

12DE8

Voltage Pentode or Tetrode (under 100V) electronic tube

CONSOLIDATED TECHNICAL DATA

2 SECTIONS

CONSTRUCTION

DIODE-PENTODE

Low-voltage diode-pentode for automobile-radio RF or IF amplification and detection. Both sections operate effectively from the vehicle's approximately 12.6 V supply without conventional high-voltage B-plus.

GENERAL CHARACTERISTICS

BASE DESIGNATION	—	BASE PINS	9
NOMINAL HEATER	12.6 V / 200 mA	PARALLEL HEATER	— / —
HEATING	Indirect	SERIES OPERATION	Not specified
CATHODE ARRANGEMENT	Separate cathodes	SECTION CONSTRUCTION	Dissimilar

SECTION RATINGS

SECTION1 Diode*No fixed ratings recorded.**Independent detector diode section.***SECTION2** Pentode

PLATE RESISTANCE	300000 Ω
TRANSCONDUCTANCE	0.0015 S
MAXIMUM PLATE VOLTAGE	30 V
MAXIMUM SCREEN VOLTAGE	30 V
<i>Remote-cutoff low-voltage pentode for RF/IF amplification from automotive battery supply.</i>	

12DE8 — Diode-Pentode Miniature Vacuum

Tube

The **12DE8** is a multi-unit miniature vacuum tube containing a remote cut-off pentode and a single diode in a single envelope. Designed with independent unipotential cathodes, this 9-pin miniature device is engineered primarily for radio frequency (RF) or intermediate frequency (IF) amplifier service in mobile applications. Specifically, its electrical design allows the heater, plate, and screen grid (grid number 2) to operate directly from a nominal 12-volt automotive battery system.

Construction, Heater, and Pin Connections

The 12DE8 is constructed in a T-6 1/2 glass bulb with a miniature button 9-pin base. It features coated unipotential cathodes for both the pentode and diode sections, which are electrically independent of each other. The tube can be mounted and operated in any physical position.

Physical Dimensions

- **Maximum Overall Length:** 2 3/16 inches
- **Maximum Seated Height:** 1 15/16 inches
- **Maximum Diameter:** 7/8 inch

Heater Characteristics

The heater is designed to withstand the wide voltage variations typical of automotive electrical systems. While its nominal rating is 12.6 volts, it is specifically engineered to operate reliably over a supply range of 10.0 to 15.9 volts.

Parameter	Value
Nominal Heater Voltage	12.6 V
Nominal Heater Current	0.200 A
Heater Supply Type	AC or DC
Operational Voltage Range	10.0 to 15.9 V

Pinout Configuration

The bottom view of the 9-pin miniature base provides the following electrode connections:

Pin Number	Connection
Pin 1	Grid Number 1 (G1) — Pentode Control Grid
Pin 2	Cathode 1 (K1) — Pentode Cathode
Pin 3	Heater (H)

Pin Number	Connection
Pin 4	Heater (H)
Pin 5	Plate 2 (<u>P2</u>) — Diode Plate
Pin 6	Internal Shield (IS) / Grid Number 3 (G3)
Pin 7	Grid Number 2 (<u>G2</u>) — Pentode Screen Grid
Pin 8	Cathode 2 (K2) — Diode Cathode
Pin 9	Plate 1 (P1) — Pentode Plate

Direct Interelectrode Capacitances

The 12DE8's internal structure exhibits specific capacitances that influence its high-frequency performance. The following values are measured directly without an external shielding canopy:

Capacitance Parameter	Value
Pentode Grid #1 to Plate (Maximum)	0.006 μF
Pentode Input	5.5 μF
Pentode Output	5.7 μF
Diode Input	3.7 μF
Diode Output	5.7 μF
Coupling: Diode Plate to Pentode Grid (Maximum)	0.018 μF
Coupling: Diode Plate to Pentode Plate (Maximum)	0.012 μF
Coupling: Diode Cathode to Pentode Grid (Maximum)	0.13 μF
Coupling: Diode Cathode to Pentode Plate (Maximum)	0.0016 μF

These low coupling capacitances between the diode and pentode sections minimize unwanted signal transfer and crosstalk when the two sections are operated in separate circuits.

Ratings and Operating Conditions

The maximum ratings for the 12DE8 are established under the Design Center System. These limits ensure an adequate safety factor to protect the tube against the voltage fluctuations common in automotive

battery service.

Maximum Ratings

Rating Parameter	Limit Value
Heater Voltage	12.6 V
Maximum Heater-Cathode Voltage	± 30 V
Maximum Plate Voltage	30 V
Maximum Grid #2 (Screen Grid) Voltage	30 V
Maximum Cathode Current	20 mA
Maximum Grid #1 Circuit Resistance	10 M Ω
Maximum Average Diode Current	5 mA

Typical Operating Conditions and Characteristics

In typical Class A1 amplifier operation, the pentode section is biased using a high-value grid resistor to develop an average operating bias.

Parameter	Value
Heater Voltage	12.6 V
Heater Current	0.200 A
Plate Voltage	12.6 V
Grid #3 (Suppressor Grid) Voltage	0 V (connected to cathode at socket)
Grid #2 (Screen Grid) Voltage	12.6 V
Grid #1 (Control Grid) Voltage	-0.80 V (average bias developed across a 2.2 M Ω resistor)
Plate Current	1300 μ A (1.3 mA)
Grid #2 Current	500 μ A (0.5 mA)
Plate Resistance (Approximate)	0.3 M Ω
Transconductance (Grid #1 to Plate)	1500 μ mhos
Grid #1 Voltage for Transconductance of 10 μ mhos (Approximate)	-6.0 V
Diode Current (with 5 V applied to diode plate)	20 mA

Analysis of Pentode Characteristics

The pentode section of the 12DE8 features a remote cut-off characteristic, which is highly beneficial for automatic gain control (AGC) in RF and IF stages. Under typical operating conditions with a screen grid voltage of 12.6 V and suppressor grid at 0 V, the plate current varies smoothly as a function of control grid bias:

- At a control grid voltage (E_{c1}) of 0 V, the plate current reaches its peak, rising rapidly with plate voltage and leveling off to approximately 3.0 mA at plate potentials above 15 V.
- As the control grid is biased more negatively, the plate current decreases. At $E_{c1} = -0.5$ V, the plate current levels off near 1.8 mA.
- At $E_{c1} = -1.0$ V, the plate current is restricted to approximately 1.0 mA.
- Further negative bias continues to reduce the plate current and transconductance, with the plate current dropping below 0.5 mA at $E_{c1} = -2.0$ V.
- The transconductance is reduced to a nominal value of 10 μmhos when the control grid voltage reaches approximately -6.0 V, demonstrating the extended cut-off range of the pentode structure.

This remote cut-off behavior allows the stage gain to be controlled over a wide dynamic range of input signal levels without introducing severe distortion.

Technical Summary

The **12DE8** is a specialized 9-pin miniature diode-pentode designed for low-voltage automotive applications. By combining a remote cut-off pentode and an independent diode within a single T-6 1/2 envelope, it provides a compact solution for RF and IF amplification alongside detection or AGC functions. Its heater is optimized to operate directly from a nominal 12-volt battery, tolerating variations from 10.0 to 15.9 volts. With a maximum plate and screen rating of 30 volts, the 12DE8 is tailored for hybrid or low-voltage receiver designs where high-voltage plate supplies are unavailable.



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 2 · Pentode

OTHER		
PARAMETER	PUBLISHED VALUE	CONDITION / NOTE
Plate Voltage	12.6 V	AutomotiveBatteryService
Heater Current	200 mA	—



SOURCE OPERATING CONDITIONS

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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 · Diode

OTHER		
PARAMETER	PUBLISHED VALUE	CONDITION / NOTE
Maximum average diode current	5 mA	DiodeSection

CHARACTERISTIC		
PARAMETER	PUBLISHED VALUE	CONDITION / NOTE
Diode current at 5 V applied	20 mA	DiodeSection

1966 TUNG SOL ELECTRONIC TUBES 2 OF 4

Section 2 · Pentode

OTHER		
PARAMETER	PUBLISHED VALUE	CONDITION / NOTE
Plate voltage	12.6 V	RFIF

PARAMETER	PUBLISHED VALUE	CONDITION / NOTE
Screen voltage	12.6 V	RFIF
Plate current	1.3 mA	RFIF
Screen current	0.5 mA	RFIF
Maximum heater-cathode voltage	30 V	WholeTube

CHARACTERISTIC		
PARAMETER	PUBLISHED VALUE	CONDITION / NOTE
Grid 1 voltage for 10 μ S transconductance	-6 V	RFIF