

ELECTRONIC TUBE REFERENCE

12EC8

Voltage Pentode or Tetrode (under 100V) electronic tube

CONSOLIDATED TECHNICAL DATA

2 SECTIONS

CONSTRUCTION

PENTODE-TRIODE

Medium-mu triode and sharp-cutoff pentode combination for signal amplification and general electronic service.

GENERAL CHARACTERISTICS

BASE DESIGNATION	9FA	BASE PINS	9
NOMINAL HEATER	12.6 V / 225 mA	PARALLEL HEATER	– / –
HEATING	Indirect	SERIES OPERATION	Not specified
CATHODE ARRANGEMENT	Common cathode	SECTION CONSTRUCTION	Dissimilar

9FA - TERMINAL PINOUT

TERMINAL	SECTION	ELEMENT	STATUS
PIN1	B	G1 – Control Grid	CONNECTED
PIN2	B	P – Plate (Anode)	CONNECTED
PIN3	B	K – Cathode	CONNECTED
PIN4	–	H – Heater	CONNECTED
PIN5	–	H – Heater	CONNECTED
PIN6	A	P – Plate (Anode)	CONNECTED
PIN7	A	G2 – Screen Grid	CONNECTED
PIN8	A	G3 – Suppressor Grid	CONNECTED
PIN8	A	K – Cathode	CONNECTED
PIN8	–	IS – Internal Screen	CONNECTED

SECTION RATINGS

SECTION1 Triode	
PLATE RESISTANCE	6000 Ω
TRANSCONDUCTANCE	0.0067 S
AMPLIFICATION FACTOR	40
MAXIMUM PLATE VOLTAGE	16 V
<i>Published source values promoted where applicable.</i>	

SECTION2 Pentode	
PLATE RESISTANCE	300000 Ω
TRANSCONDUCTANCE	0.006 S
MAXIMUM PLATE VOLTAGE	16 V
<i>Published source values promoted where applicable.</i>	

12EC8 — Miniature Triode-Pentode Vacuum Tube

An indirectly heated, multi-unit miniature vacuum tube containing a medium-mu triode and a sharp-cutoff pentode, designed for low-voltage automotive applications.

Overview

The **12EC8** is a multi-unit miniature vacuum tube incorporating a medium-mu triode and a sharp-cutoff pentode within a single envelope. It is specifically designed for low-voltage operation in automotive receivers, where the heater, plate, and screen grid (Grid No. 2) potentials are supplied directly from a nominal 12-volt automotive storage battery. In these applications, the tube typically functions as a combined VHF oscillator and mixer.

By eliminating the need for a high-voltage power supply, the 12EC8 enables simplified, cost-effective, and reliable mobile receiver designs. The tube is housed in a T-6 1/2 glass envelope with a 9-pin miniature button base.

Construction, Heater, and Physical Characteristics

The 12EC8 features coated unipotential cathodes for both the triode and pentode sections. Although both sections share a common heater, they have separate cathode connections, allowing independent biasing and circuit configurations.

The heater is designed to operate directly from a nominal 12-volt automotive battery. Because automotive electrical systems experience significant voltage fluctuations during operation and charging, the heater is engineered to operate reliably over a wide voltage range.

Heater Parameter	Value
Nominal Heater Voltage	12.6 V
Heater Voltage Range (Automotive Service)	10.0 to 15.9 V
Nominal Heater Current	0.225 A (225 mA)
Heating Method	Indirect
Cathodes	Separate, coated, unipotential

The physical dimensions and mechanical configuration of the tube are standardized as follows:

- **Bulb Type:** T-6 1/2 glass
- **Base Type:** E9-1, Miniature Button 9-Pin
- **Basing Designation:** 9FA
- **Outline Drawing:** 6-2
- **Mounting Position:** Any

Pinout and Basing Configuration

The 9FA basing arrangement provides independent connections for the triode and pentode electrodes. The pentode's suppressor grid (Grid No. 3) and internal shield are internally tied to its cathode. The pin connections, viewed from the bottom of the tube base, are:

Pin Number	Connection
1	Triode Grid (G)
2	Triode Plate (P)
3	Triode Cathode (K)
4	Heater (H)
5	Heater (H)
6	Pentode Plate (P)
7	Pentode Grid No. 2 (<u>G2</u> / Screen Grid)
8	Pentode Cathode, Grid No. 3, Internal Shield (K + G3 + I.S.)
9	Pentode Grid No. 1 (G1 / Control Grid)

Electrical Characteristics and Typical Operation

The 12EC8 is optimized for operation at extremely low plate and screen potentials, with typical operating points established at a supply voltage of 12.6 V. Under these conditions, the triode section provides moderate gain and low plate resistance, while the pentode section provides high plate resistance and sharp-cutoff characteristics.

Parameter	Triode Section	Pentode Section
Plate Supply Voltage	12.6 V	12.6 V
Grid No. 2 (Screen) Voltage	—	12.6 V
Grid No. 1 (Control Grid) Voltage	0 V	0 V
Grid No. 1 Resistor	4,700 Ω	33,000 Ω
Plate Current	2.4 mA	0.66 mA
Grid No. 2 Current	—	0.28 mA
Transconductance	4,700 μmhos	2,000 μmhos
Amplification Factor (μ)	25	—
Plate Resistance (Approx.)	6,000 Ω	750,000 Ω
Grid No. 1 Voltage for $I_b = 10 \mu\text{A}$ (Approx.)	-2.2 V	-1.6 V

The typical operating points demonstrate the use of grid-resistor biasing (contact potential biasing) to establish stable operating currents at low supply voltages. The inclusion of a 4,700-ohm resistor in the triode grid circuit and a 33,000-ohm resistor in the pentode grid circuit prevents excessive plate and screen currents while maintaining high transconductance.

Maximum Ratings (Design-Maximum System)

The maximum ratings for the 12EC8 are established under the Design-Maximum System. These ratings represent limiting values of operating and environmental conditions that should not be exceeded under the worst probable conditions in a bogey device.

Rating	Triode Section	Pentode Section
Maximum Plate Voltage	16 V	16 V
Maximum Grid No. 2 Voltage	—	16 V
Maximum Grid No. 1 Circuit Resistance	1.0 M Ω	1.0 M Ω

Rating	Triode Section	Pentode Section
Maximum Heater-Cathode Voltage (Heater Negative)	16 V	16 V
Maximum Heater-Cathode Voltage (Heater Positive)	16 V	16 V

The low maximum voltage ratings (16 V) reflect the specialized design of the tube for direct automotive battery operation. These limits must not be exceeded, and the circuit must be designed to accommodate the maximum battery charging voltage (up to 15.9 V) safely.

Interelectrode Capacitances

Direct interelectrode capacitances are measured without an external shield. These values are critical for VHF oscillator and mixer applications to ensure stable frequency control and minimize unwanted coupling between stages.

Triode Section

- **Grid to Plate:** 1.7 μF
- **Input (g to h+k):** 2.6 μF
- **Output (p to h+k):** 0.4 μF
- **Heater to Cathode:** 2.6 μF

Pentode Section

- **Grid No. 1 to Plate (Max.):** 0.02 μF
- **Input (g1 to h+k+g2+g3+I.S.):** 4.6 μF
- **Output (p to h+k+g2+g3+I.S.):** 2.6 μF
- **Heater to Cathode:** 2.6 μF

Transfer Characteristics and Circuit Implications

The transfer characteristics of the 12EC8 illustrate the behavior of both sections under low-voltage conditions, particularly highlighting the effect of grid-leak resistance on plate and screen currents.

In the pentode section, with a plate and screen supply of 12.6 V, the control grid voltage strongly influences both plate current and screen current. At zero external bias:

- Without a grid resistor, the plate current is approximately 1.4 mA, and the screen current is approximately 0.5 mA.
- With a typical grid resistor of 33,000 ohms, the contact potential bias shifts the operating point, reducing the plate current to approximately 0.66 mA and the screen current to approximately 0.28 mA.

- The sharp-cutoff characteristic is evident as the plate current approaches the cutoff region (10 μ A) at approximately -1.6 V.

In the triode section, operating with a plate supply of 12.6 V:

- Without a grid resistor, the plate current at zero bias is approximately 3.0 mA.
- With a 4,700-ohm grid resistor, the plate current is reduced to approximately 2.4 mA.
- The triode section exhibits a more gradual cutoff, reaching the 10 μ A threshold at approximately -2.2 V.

These characteristics show that the 12EC8 relies on grid-current biasing to maintain optimal operating points without requiring external negative bias supplies, making it highly compatible with simple automotive receiver topologies.

Technical Summary

The **12EC8** is a specialized **9-pin miniature triode-pentode** designed for direct operation from a **12-volt automotive battery**. It combines a medium-mu triode and a sharp-cutoff pentode in a single T-6 1/2 glass envelope. Both sections feature separate coated unipotential cathodes and are optimized for a maximum plate and screen potential of **16 V**.

With a nominal heater rating of **12.6 V at 0.225 A**, the tube is engineered to withstand the wide voltage variations (10.0 to 15.9 V) typical of automotive electrical systems. Its primary application as a combined VHF oscillator and mixer is supported by low interelectrode capacitances and stable low-voltage transfer characteristics, making it a key component in high-efficiency, low-voltage mobile radio designs.



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 · Triode

OTHER		
PARAMETER	PUBLISHED VALUE	CONDITION / NOTE
Heater voltage	12.6 V	Nominal
Heater current	225 mA	Nominal
Screen voltage	12.6 V	Typical operating conditions
Plate current	2.40.66 mA	Typical operating conditions

1961 TUNG SOL

Section 2 · Pentode

OTHER		
PARAMETER	PUBLISHED VALUE	CONDITION / NOTE
Heater voltage	12.6 V	Nominal
Heater current	225 mA	Nominal
Screen voltage	12.6 V	Typical operating conditions
Plate current	2.40.66 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 2 · Pentode

CHARACTERISTIC		
PARAMETER	PUBLISHED VALUE	CONDITION / NOTE
GRID #	1 mA	GRID #1 TO PLATE (MAX.) 0.02 μ f
HEATER VOLTAGE A	12.6 V	HEATER VOLTAGE A 12,6 12.6 VOLTS
HEATER NEGATIVE WITH RESPECT TO CATHODE]	6 V	HEATER NEGATIVE WITH RESPECT TO CATHODE] 6 VOLTS
HEATER POSITIVE WITH RESPECT TO CATHODE	16 V	HEATER POSITIVE WITH RESPECT TO CATHODE 16 VOLTS
THE HEATER IS TNER EFORE DESIGNED TO OPERATE OVER THE	10 V	THE HEATER IS TNER EFORE DESIGNED TO OPERATE OVER THE 10.0 TO 15.9 VOLTAGE RANGE ENCOUNTERED IN
HEATER VOLTAGE	12 V	HEATER VOLTAGE 12.Fj 12.5 VOLTS
HEATER CURRENT	225 A	HEATER CURRENT .225 ,225 AMP.
PLATE SUPPLY VOLTAGE L2.h	12 V	PLATE SUPPLY VOLTAGE L2.h 12.h VOLTS
GRID #	2 V	GRID #2 VOLTAGE 12.6 VOLTS
GRID #	1 V	GRID #1 VOLTAGE O O
GRID #	1 Ω	GRID #1 RESISTOR 4 700 33 000 OHMS
PLATE CURRENT	2.4 mA	PLATE CURRENT 2.4 0.66 MA.
GRID #	2 mA	GRID #2 CURRENT 0.2H MA.
AMPLIFICATION FACTOR	2 A	AMPLIFICATION FACTOR 2S
PLATE RESISTANCE (APPROX.) ~J 000	75 Ω	PLATE RESISTANCE (APPROX.) ~J 000 750 000 OHMS
GRID #i VOLTAGE FOR Ib =	10 V	GRID #i VOLTAGE FOR Ib = 10 μ A (APPROX.) —2.2 —1.h VOLTS

OTHER		
PARAMETER	PUBLISHED VALUE	CONDITION / NOTE
MAXIMUM PLATE VOLTAGE	16 V	MAXIMUM PLATE VOLTAGE 16 16 VOLTS
MAXIMUM GRID #	1 V	MAXIMUM GRID #1 VOLTAGE 16 VOLTS
MAXIMUM GRID #	1 mA	MAXIMUM GRID #1 CIRCUIT RESISTANCE 1.0 1.0 MEGOHM