

ELECTRONIC TUBE REFERENCE

12EA6

Voltage - Pentode or Tetrode (under 100V) electronic tube

CONSOLIDATED TECHNICAL DATA

1 SECTION
CONSTRUCTION
PENTODE

Remote-cutoff miniature pentode for low-voltage RF/IF amplification in hybrid automobile radios using direct 12 V electrical-system supplies.

GENERAL CHARACTERISTICS

BASE DESIGNATION	7BK	BASE PINS	7
NOMINAL HEATER	12.6 V / 175 mA	PARALLEL HEATER	– / –
HEATING	Indirect	SERIES OPERATION	Not specified
CATHODE ARRANGEMENT	Separate cathodes	SECTION CONSTRUCTION	Similar

7BK - TERMINAL PINOUT

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

SECTION RATINGS

SECTION1 Pentode	
PLATE RESISTANCE	32000 Ω
TRANSCONDUCTANCE	0.0038 S
MAXIMUM PLATE VOLTAGE	16 V
MAXIMUM SCREEN VOLTAGE	16 V
MAXIMUM PLATE DISSIPATION	2 W
<i>Promoted from published ratings/characteristics tables; additional operating points and capacitances retained in TUBE_SECTION_PARAMETER.</i>	

12EA6 — Miniature RF and IF Pentode

The **12EA6** is a miniature pentode of 7-pin construction designed specifically for use as a radio-frequency (RF) or intermediate-frequency (IF) amplifier in automobile radio receivers. It is engineered to operate with its plate and screen voltages supplied directly from a 12-volt automotive storage battery, eliminating the need for high-voltage power supplies in mobile applications.

Construction, Mechanical Specifications, and Pinout

The 12EA6 features a glass envelope of T-5 1/2 construction and a miniature button 7-pin base (designated E7-1 or EIA 7BK). The tube utilizes a coated unipotential cathode and can be mounted in any position.

Physical Dimensions

- **Maximum Overall Length:** 2 1/8 inches
- **Maximum Seated Height:** 1 7/8 inches
- **Maximum Diameter:** 3/4 inch

Pin Connections

The 7-pin miniature base configuration (7BK) provides the following terminal connections, viewed from the bottom of the tube:

Pin Number	Connection
Pin 1	Grid Number 1 (Control Grid)
Pin 2	Internal Shield and Grid Number 3 (Suppressor Grid)
Pin 3	Heater
Pin 4	Heater

Pin Number	Connection
Pin 5	Plate
Pin 6	Grid Number 2 (Screen Grid)
Pin 7	Cathode

Heater Characteristics

The heater of the 12EA6 is designed for operation on either AC or DC power. Because the tube is intended for automotive environments, its heater ratings reflect the wide voltage variations typical of vehicle electrical systems.

- **Nominal Heater Voltage:** 12.6 V
- **Nominal Heater Current:** 0.175 A to 0.190 A

Automotive Service Considerations

When operated from a nominal 12-volt automotive storage battery, the heater voltage must be maintained within strict absolute limits. Under no circumstances should the heater voltage drop below 10.0 volts or exceed 15.9 volts. While extreme variations within this range can be tolerated for short periods, continuous operation near these limits impacts performance and longevity:

- **Low Heater Voltage:** Results in a sacrifice in tube performance.
- **High Heater Voltage:** Reduces life expectancy.
- **Reliability Improvement:** Equipment reliability can be significantly increased by implementing improved supply-voltage regulation.

Maximum Ratings

The maximum ratings for the 12EA6 are interpreted under the Design-Center System or the Design-Maximum System, depending on the manufacturer's specification. These values represent the limiting boundaries within which satisfactory tube life and performance can be expected.

Parameter	Rating Value	Rating System
Maximum Plate Voltage	16 V	Design-Center / Design-Maximum
Maximum Screen Voltage	16 V	Design-Center / Design-Maximum
Maximum Positive DC Grid-Number 1 Voltage	0 V	Design-Center / Design-Maximum

Parameter	Rating Value	Rating System
Maximum Heater-Cathode Voltage (Heater Positive)	16 V	Design-Center / Design-Maximum
Maximum Heater-Cathode Voltage (Heater Negative)	16 V	Design-Center / Design-Maximum
Maximum Grid-Number 1 Circuit Resistance	10 M Ω / 12 M Ω	Design-Center / Design-Maximum
Maximum Grid-Number 3 Circuit Resistance	10 M Ω	Design-Center

Typical Operating Conditions and Characteristics

In typical Class A1 amplifier service, the 12EA6 operates with low electrode potentials, matching the nominal voltage of a 12-volt battery system.

- **Plate Voltage:** 12.6 V
- **Screen Voltage:** 12.6 V
- **Suppressor Voltage (Grid-Number 3):** 0 V (connected to Pin 2)
- **Grid-Number 1 Resistor (Bypassed):** 10 M Ω
- **Plate Resistance (Approximate):** 32,000 Ω
- **Transconductance:** 3,800 μ mhos (micromhos)
- **Plate Current:** 3.2 mA
- **Screen Current:** 1.4 mA
- **Grid-Number 1 Voltage (Approximate, for $I_b = 10 \mu$ A):** -3.4 V

Direct Interelectrode Capacitances

The direct interelectrode capacitances of the 12EA6 are measured without an external shield:

- **Grid-Number 1 to Plate (Maximum):** 0.04 μ F
- **Input (Grid-Number 1 to Cathode, Heater, Screen Grid, Suppressor Grid, and Internal Shield):** 11 μ F
- **Output (Plate to Cathode, Heater, Screen Grid, Suppressor Grid, and Internal Shield):** 4.0 μ F

Analysis of Characteristic Curves

The published characteristic curves for the 12EA6 illustrate its behavior under low-voltage operating conditions:

Average Plate Characteristics

The plate characteristics plot plate current (I_b) and screen current (I_{c2}) against plate voltage (V_b) for various control grid voltages (V_{g1} ranging from 0 V down to -3.0 V), with the screen grid voltage (E_{c2}) held at 12.6 V and the suppressor grid (E_{c3}) at 0 V.

- At very low plate voltages (below 5 V), the plate current rises sharply.
- Above approximately 10 V, the plate current curves flatten out, demonstrating the high dynamic plate resistance characteristic of a pentode, even at these low operating voltages.
- The screen current (I_{c2}) remains relatively stable across the normal plate voltage operating range, typically around 1.4 mA under nominal conditions.

Average Transfer Characteristics

The transfer characteristics show plate current (I_b), screen current (I_{c2}), and transconductance (G_m) as a function of Grid-Number 1 voltage (V_{g1}) from -5 V to 0 V, with plate and screen voltages at 12.6 V.

- The transconductance (G_m) peaks near 3,800 μmhos at $V_{g1} = 0$ V and falls smoothly as the grid bias becomes more negative.
- The plate current (I_b) approaches cutoff (defined as $I_b = 10 \mu\text{A}$) at approximately -3.4 V, showing a remote-cutoff or semi-remote-cutoff characteristic suitable for automatic volume control (AVC) or automatic gain control (AGC) applications in receiver circuits.

Technical Summary

The **12EA6** is a specialized, indirectly heated miniature pentode designed for low-voltage RF and IF amplification in 12-volt automotive radio receivers. Housed in a T-5 1/2 glass envelope with a 7-pin miniature button base, it operates with plate and screen voltages supplied directly from a vehicle's battery. Under typical Class A1 operating conditions at 12.6 V, the tube exhibits a transconductance of 3,800 μmhos , a plate resistance of approximately 32,000 Ω , and a plate current of 3.2 mA. Its design-maximum ratings restrict plate and screen voltages to 16 V, and its heater is optimized to withstand the voltage fluctuations of automotive electrical systems.



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	16 V	Typical operating conditions
Screen voltage	16 V	Typical operating conditions
Plate current	3.2 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

CHARACTERISTIC		
PARAMETER	PUBLISHED VALUE	CONDITION / NOTE
GRID #	1 mA	GRID #1 TO PLATE (MAX.) 0.04 μ f
HEATER VOLTAGE	12.6 V	HEATER VOLTAGE 12.6A VOLTS
HEATER POSITIVE WITH RESPECT TO CATHODE	16 V	HEATER POSITIVE WITH RESPECT TO CATHODE 16 VOLTS
HEATER NEGATIVE WITH RESPECT TO CATHODE	16 V	HEATER NEGATIVE WITH RESPECT TO CATHODE 16 VOLTS
MAX I'M UM GRID #	3 mA	MAX I'M UM GRID #3 C-IRCUIT RESISTANCE *

PARAMETER	PUBLISHED VALUE	CONDITION / NOTE
HEATER VOLTAGE BE LESS THAN	10 V	HEATER VOLTAGE BE LESS THAN 10.0 VOLTS OR MORE THAN 15.9 V. THESE EXTREME VARIATIONS IN
HEATER VOLTAGE MAY BE TOLERATED' FOR SHORT PERIOD	5 V	HEATER VOLTAGE MAY BE TOLERATED' FOR SHORT PERIODS: HOWEVER~ OPERATION AT OR NEAR THESE
HEATER CURRENT	190 mA	HEATER CURRENT 0.19G ~ AMP.
PLATE VOLTAGE	12.6 V	PLATE VOLTAGE 12.6 VOLTS
SCREEN VOLTAGE	12.6 V	SCREEN VOLTAGE 12.6 VOLTS
GRID #1 RESISTOR (BYPASSED)	10 MΩ	GRID #1 RESISTOR (BYPASSED) 10 MEGOHMS
PLATE RESISTANCE (APPROX.)	32 Ω	PLATE RESISTANCE (APPROX.) 32 000 OHMS
PLATE CURRENT	3.2 mA	PLATE CURRENT 3.2 MA.
GRID #	1 V	GRID #1 VOLTAGE (APPROX.)

OTHER		
PARAMETER	PUBLISHED VALUE	CONDITION / NOTE
MAXIMUM PLATE VOLTAGE]	6 V	MAXIMUM PLATE VOLTAGE]6 VOLTS
MAXIMUM SCREEN VOLTAGE	16 V	MAXIMUM SCREEN VOLTAGE 16 VOLTS
MAXIMUM POSITIVE DC GRID #	1 V	MAXIMUM POSITIVE DC GRID #1 VOLTAGE 0 VOLTS
MAXIMUM GRID #	1 mA	MAXIMUM GRID #1. CIRCUIT RESISTANCE 1Ω MEGOHMS


SOURCE DATA APPENDIX

SOURCE OPERATING CONDITIONS

[SOURCE PDF](#)

1968 General Electric Co

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

1968 GENERAL ELECTRIC CO

Section 1 · Pentode

OTHER		
PARAMETER	PUBLISHED VALUE	CONDITION / NOTE
Plate Current	3.2 mA	ClassA
Screen Current	1.4 mA	ClassA

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