



ELECTRONIC TUBE REFERENCE

12EL6

Voltage - Triode (under 100V) electronic tube

CONSOLIDATED TECHNICAL DATA

3 SECTIONS

CONSTRUCTION

DIODE-DIODE-TRIODE

Double-diode high-mu triode for low-voltage automobile-radio detector and voltage-amplifier service. Two diode sections provide detection and rectification while the triode operates effectively from automotive supply voltage.

GENERAL CHARACTERISTICS

BASE DESIGNATION	—	BASE PINS	7
NOMINAL HEATER	12.6 V / 450 mA	PARALLEL HEATER	— / —
HEATING	Indirect	SERIES OPERATION	Not specified
CATHODE ARRANGEMENT	Common cathode	SECTION CONSTRUCTION	Dissimilar

SECTION RATINGS

SECTION1 Diode	
MAXIMUM CATHODE CURRENT	1 mA
<i>Published source values promoted where applicable.</i>	

SECTION2 Diode	
MAXIMUM CATHODE CURRENT	1 mA
<i>Published source values promoted where applicable.</i>	

SECTION3 Triode	
PLATE RESISTANCE	45000 Ω
TRANSCONDUCTANCE	0.0012 S
AMPLIFICATION FACTOR	55
MAXIMUM PLATE VOLTAGE	30 V
MAXIMUM CATHODE CURRENT	20 mA
<i>Published source values promoted where applicable.</i>	

12EL6 — Double Diode High-Mu Triode Miniature Vacuum Tube

The **12EL6** is a miniature double-diode, high-mu triode vacuum tube designed primarily for use as a combined detector and audio voltage amplifier. It is specifically engineered for applications where both the heater and plate voltages are supplied directly from a nominal 12-volt automotive storage battery. This design eliminates the need for a high-voltage B+ power supply, making it highly suitable for mobile and automotive receiver designs.

Construction, Heater, and Physical Characteristics

The 12EL6 is constructed in a 7-pin miniature glass envelope (T-5 1/2 bulb) with a miniature button 7-pin base (E7-1 designation). The tube features a coated unipotential cathode and can be mounted in any position.

The heater is designed to withstand the wide voltage fluctuations typical of automotive electrical systems. While its nominal rating is **12.6 V** at **0.15 A** (150 mA), the heater is designed to operate satisfactorily over a range of **10.0 V to 15.9 V**. The maximum ratings of the tube incorporate an adequate safety factor to ensure reliability under these varying supply conditions.

Pinout and Basing Diagram

The tube uses the **7FB** basing arrangement. The pin connections, viewed from the bottom of the base, are as follows:

Pin	Connection
1	Grid (Triode)
2	Plate (Triode)
3	Heater
4	Heater
5	Diode Plate 2

Pin	Connection
6	Diode Plate 1
7	Cathode

Direct Interelectrode Capacitances

Measured without an external shield, the direct interelectrode capacitances of the 12EL6 are:

Capacitance Parameter	Value
Grid to Plate	1.8 pF
Input: Grid to (Heater + Cathode)	2.2 pF
Output: Plate to (Heater + Cathode)	1.0 pF
Diode Plate to Diode Plate	1.0 pF

Maximum Ratings

The maximum ratings for the 12EL6 are established under the **Design Center System**:

Rating Parameter	Maximum Value
Plate Voltage	30 V
Cathode Current	20 mA
Grid Circuit Resistance	10 MΩ
Average Diode Current	1.0 mA
Heater-Cathode Voltage (Heater negative with respect to cathode)	30 V
Heater-Cathode Voltage (Heater positive with respect to cathode)	30 V

Typical Operating Conditions and Characteristics

Class A1 Amplifier

When operated as a Class A1 amplifier with a low plate voltage supplied directly from a 12-volt system, the typical operating parameters are:

- **Heater Voltage:** 12.6 V

- **Heater Current:** 0.15 A
- **Plate Voltage:** 12.6 V
- **Grid Voltage:** 0 V
- **Plate Current:** 750 μ A
- **Transconductance:** 1200 μ mhos
- **Amplification Factor (μ):** 55
- **Plate Resistance (r_p):** 45,000 Ω

As a mathematical verification of these typical characteristics, the relationship between amplification factor (μ), transconductance (g_m), and plate resistance (r_p) can be calculated. Using the typical Class A1 values of $g_m = 1200 \mu\text{mhos}$ (or 0.0012 S) and $r_p = 45,000 \Omega$:

$$\mu = g_m \times r_p = 0.0012 \text{ S} \times 45,000 \Omega = 54$$

This calculated value closely matches the published nominal amplification factor of 55.

Under test conditions, applying 10 volts to each diode plate results in an average diode current of **2.0 mA** per diode.

Resistance-Coupled Amplifier Service

The 12EL6 is highly effective as a resistance-coupled audio voltage amplifier operating from a low-voltage supply. Typical operating conditions for this service are:

- **Plate Supply Voltage:** 12.6 V
- **Grid Voltage:** Contact potential bias developed across the grid resistor
- **Grid Resistor:** 1.0 M Ω
- **Plate Load Resistor:** 1.0 M Ω
- **Input Capacitor:** 0.02 μ F
- **Output Capacitor:** 0.01 μ F
- **Grid Resistor of Following Stage:** 2.0 M Ω
- **Voltage Gain (at 400 Hz):** 16 (measured at an output voltage of 1.0 V RMS)

Application and Circuit Integration

The primary application of the 12EL6 is in automotive radio receivers, where it performs the dual functions of AM signal detection (via the two diode units) and subsequent audio voltage amplification (via the high-mu triode unit).

Because the plate voltage is limited to a maximum of 30 V (with a typical operating point of 12.6 V), the triode operates with a very low plate current (750 μ A). To achieve a practical voltage gain of 16 in resistance-coupled service, a high-value plate load resistor of 1.0 M Ω is paired with a 1.0 M Ω grid resistor. The grid bias is not supplied by an external voltage or a cathode resistor; instead, it relies on the contact potential developed across the 1.0 M Ω grid resistor.

The average plate characteristics curve shows that at a plate voltage of 12.6 V and zero grid bias ($E_c = 0$ V), the plate current is approximately 0.75 mA, which aligns with the typical Class A1 operating point. The curves illustrate that the tube remains in a functional, relatively linear region even at these extremely low plate potentials, which is essential for minimizing distortion in the first audio stage of automotive receivers.

Technical Summary

The **12EL6** is a **7-pin miniature double-diode, high-mu triode** designed for low-voltage automotive applications. Operating with a **12.6 V, 0.15 A** heater that can tolerate supply variations from **10.0 V to 15.9 V**, the tube is optimized to run its plate directly from a 12 V battery supply. It features an amplification factor of **55**, a plate resistance of **45,000 Ω** , and a transconductance of **1200 μmhos** under typical Class A1 conditions. In resistance-coupled amplifier circuits, it provides a voltage gain of **16** at 400 Hz, making it an efficient and compact solution for combined AM detection and preamplification in mobile receivers.



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 · Diode

OTHER		
PARAMETER	PUBLISHED VALUE	CONDITION / NOTE
Heater voltage	12.6 V	Nominal
Heater current	450 mA	Nominal
Plate voltage	30 V	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 3 · Triode

CHARACTERISTIC		
PARAMETER	PUBLISHED VALUE	CONDITION / NOTE
HEATER VOLTAGEA	12.6 V	HEATER VOLTAGEA 12,6 VOLTS
HEATER NEGATIVE WITH RESPECT TO CATHODE	3 V	HEATER NEGATIVE WITH RESPECT TO CATHODE 3Q VOLTS
HEATER VOLTAGE	12.6 V	HEATER VOLTAGE 12.6 VOLTS
HEATER CURRENT	150 mA	HEATER CURRENT 0.15 AMP.
PLATE VOLTAGE	12.6 V	PLATE VOLTAGE 12.6 VOLTS
AMPLIFICATION FACTOR	55 A	AMPLIFICATION FACTOR 55
PLATE RESISTANCE	45 Ω	PLATE RESISTANCE 45 OQD OHMS
AVERAGE DIODE CURRENT WITH	10 V	AVERAGE DIODE CURRENT WITH 10 VOLTS

PARAMETER	PUBLISHED VALUE	CONDITION / NOTE
HEATER CURRENT	150 mA	HEATER CURRENT 0,15 AMPL
PLATE SUPPLY VOLTAGE	12.6 V	PLATE SUPPLY VOLTAGE 12,6 VOLTS
GRID RESISTOR OF FOLLOWING STAGE	2 Ω	GRID RESISTOR OF FOLLOWING STAGE 2.0 MEGOHMS
VOLTAGE GAIN AT	400 V	VOLTAGE GAIN AT 400 CPSD 16
THE NEATER IS THEREFORE DESIGNED TO OPERATE OVER THE	10 V	THE NEATER IS THEREFORE DESIGNED TO OPERATE OVER THE 10.0 TO 15.9 VOLTAGE RANGE ENCOUNTER EO IN

OTHER		
PARAMETER	PUBLISHED VALUE	CONDITION / NOTE
MAXIMUM CATHODE CURRENT	20 mA	MAXIMUM CATHODE CURRENT 20 MA.
MAXIMUM GRID CIRCUIT RESISTANCE	10 mA	MAXIMUM GRID CIRCUIT RESISTANCE 10 MEGOHMS
MAXIMUM AVERAGE DIODE CURRENT	1 mA	MAXIMUM AVERAGE DIODE CURRENT 1,Q MA.
PLATE LOAD RESISTOR	1 MΩ	PLATE LOAD RESISTOR 1.0 MEGOHM
D MEASURED AT AN OUTPUT VOLTAGE OF	1 V	D MEASURED AT AN OUTPUT VOLTAGE OF 1.0 VOLT RM \$.

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