

ELECTRONIC TUBE REFERENCE

12EM6

Power - Tetrode (NOT beam) electronic tube

CONSOLIDATED TECHNICAL DATA

2 SECTIONS

CONSTRUCTION

DIODE-TETRODE

Combined detector diode and power tetrode sharing a common cathode. The tetrode is designed for low-voltage power amplification directly from an automotive battery, while the diode provides signal detection.

GENERAL CHARACTERISTICS

BASE DESIGNATION	9NV	BASE PINS	9
NOMINAL HEATER	12.6 V / 150 mA	PARALLEL HEATER	– / –
HEATING	Indirect	SERIES OPERATION	Not specified
CATHODE ARRANGEMENT	Common cathode	SECTION CONSTRUCTION	Similar

9NV - TERMINAL PINOUT

TERMINAL	SECTION	ELEMENT	STATUS
PIN1	–	G1 – Control Grid	CONNECTED
PIN2	–	K – Cathode	CONNECTED
PIN3	–	G1 – Control Grid	CONNECTED
PIN4	–	H – Heater	CONNECTED
PIN5	–	H – Heater	CONNECTED
PIN6	–	G1 – Control Grid	CONNECTED
PIN7	–	G1 – Control Grid	CONNECTED
PIN8	–	P – Plate (Anode)	CONNECTED
PIN9	–	G1 – Control Grid	CONNECTED

SECTION RATINGS

SECTION1 Diode	
NOMINAL OUTPUT CURRENT	10 mA
<i>Published source values promoted where applicable.</i>	

SECTION2 Tetrode	
PLATE RESISTANCE	41000 Ω
MAXIMUM PLATE VOLTAGE	30 V
MAXIMUM SCREEN VOLTAGE	30 V
MAXIMUM PLATE DISSIPATION	5 W
<i>Published source values promoted where applicable.</i>	

12EM6 — Diode-Tetrode Miniature Vacuum Tube

An indirectly heated, multi-unit miniature tube containing a detector diode and a space-charge or low-voltage tetrode, designed specifically for low-voltage automotive receiver applications.

Overview

The **12EM6** is a multi-unit miniature vacuum tube combining a single detector diode and a tetrode within a single envelope, sharing a common unipotential cathode. It is constructed in a 9-pin miniature glass configuration.

The primary design objective of the 12EM6 is for use in automotive radio receivers where the electrode potentials—specifically the heater, plate, and screen grid (Grid No. 2) voltages—are obtained directly from a nominal 12-volt automotive storage battery. This eliminates the need for a high-voltage vibrator power supply, allowing the tube to operate safely and reliably under the wide voltage fluctuations typical of automotive electrical systems. In these receiver circuits, the diode section serves as an AM detector, while the tetrode section is designed to operate as a Class A1 power amplifier driver.

Construction, Heater, and Pinout

The 12EM6 is housed in a T-6 1/2 glass bulb with a miniature button 9-pin base (E9-1 designation). The physical dimensions include a maximum overall length of 2-3/16 inches (or 2-3/8 inches depending on the specific outline standard), a maximum seated height of 1-15/16 inches, and a maximum bulb diameter of 3/4 inch. The tube can be mounted and operated in any physical position.

The tube features a coated unipotential cathode. The heater is designed to operate directly from an automotive battery system. While its nominal rating is 12.6 V at 0.50 A (500 mA), the heater is specifically engineered to operate satisfactorily across a wide voltage range of 10.0 V to 15.9 V. This wide range

ensures that the tube can withstand the voltage variations encountered during battery charging and discharging cycles in automotive service.

The JEDEC **9HV** basing diagram provides the following pin connections, viewed from the bottom of the tube:

Pin	Connection	Description
1	G1	Grid No. 1 (Control Grid)
2	K	Cathode
3	<u>G2</u>	Grid No. 2 (Screen Grid)
4	H	Heater
5	H	Heater
6	P	Tetrode Plate
7	IC	Internal Connection (Do Not Use)
8	IC	Internal Connection (Do Not Use)
9	Di	Diode Plate

Electrical Characteristics and Ratings

The maximum ratings of the 12EM6 are established under the Design Center System. These limits represent the maximum safe operating conditions that the tube can tolerate without risking premature failure or degraded performance.

Maximum Ratings

Parameter	Rating	Unit
Heater Voltage	12.6	V
Maximum Plate Voltage (Tetrode)	30	V
Maximum Grid No. 2 Voltage	30	V
Maximum Plate Dissipation	0.5	W
Maximum Grid No. 1 Circuit Resistance	15	MΩ

Parameter	Rating	Unit
Maximum Heater-Cathode Voltage (Heater Positive or Negative)	30	V
Maximum Diode / Tetrode Plate Current	10	mA

Note on Plate Current Ratings: Early manufacturer specifications list a maximum "Detector Plate Current" or "Average Diode Current" of 10 mA. Later revisions updated this rating to specify a maximum "Tetrode Plate Current" of 10 mA, reflecting the operational limits of the tetrode section under dynamic conditions.

Typical Characteristics (Class A1 Amplifier)

Under typical test conditions with the electrode potentials supplied directly at a nominal 12.6 V, the tetrode section exhibits the following characteristics:

- **Plate Voltage:** 12.6 V
- **Grid No. 2 Voltage:** 12.6 V
- **Grid No. 1 Resistor (Bypassed):** 2.2 MΩ
- **Plate Current:** 6.0 mA
- **Grid No. 2 Current:** 1.0 mA
- **Transconductance:** 5000 μmhos
- **Plate Resistance (Approximate):** 4000 Ω
- **Average Diode Current (with 10 V DC applied):** 1.0 mA

Under these conditions, the Grid No. 1 bias is developed solely via contact potential across the 2.2 MΩ resistor. With no signal applied, the resulting plate current is approximately 6.0 mA.

Typical Operating Conditions as an AF Driver

When utilized as an audio-frequency (AF) power amplifier driver in automotive receivers, the tetrode section of the 12EM6 is operated with a high-value grid resistor to establish dynamic bias. The typical operating parameters for this service are detailed below:

Parameter	Value	Unit
Plate Voltage	12.6	V
Grid No. 2 Voltage	12.6	V
Grid No. 1 Resistor	15	MΩ
AF Grid No. 1 Voltage (RMS)	1.0	V
AF Signal Source Resistance	200,000	Ω

Parameter	Value	Unit
Plate Current (with signal applied)	2.5	mA
Load Resistance	3500	Ω
Power Output	10	mW
Total Harmonic Distortion	10	%

In this operating configuration, the negative bias voltage on Grid No. 1 is developed across the 15 M Ω grid resistor through a combination of contact potential and Grid No. 1 rectification, which occurs when the specified 1.0 V RMS signal voltage is applied. Under zero-signal conditions, the plate current remains at its nominal value of approximately 6.0 mA, but drops to an average of 2.5 mA when the input signal is applied and rectification bias is established.

Technical Summary

The **12EM6** is a specialized **9-pin miniature diode-tetrode** designed for low-voltage operation in 12-volt automotive radio receivers. By combining an AM detector diode and a high-transconductance tetrode driver in a single envelope, it simplifies circuit design and eliminates the need for high-voltage power supplies. Operating with plate and screen potentials of only 12.6 V, the tetrode section achieves a transconductance of **5000 μ mhos** and a plate resistance of **4000 Ω** . When configured as an AF driver with a 15 M Ω grid leak resistor, it delivers **10 mW** of power output into a 3500 Ω load with 10% total harmonic distortion, making it an efficient and robust solution for mobile receiver designs of its era.



SOURCE OPERATING CONDITIONS

[SOURCE PDF](#)

1950 Sylvania

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

1950 SYLVANIA

Section 1 · Diode

APPLICATION		
PARAMETER	PUBLISHED VALUE	CONDITION / NOTE
Service	Detector	—

1950 SYLVANIA

Section 2 · Tetrode

APPLICATION		
PARAMETER	PUBLISHED VALUE	CONDITION / NOTE
Service	Power amplifier driver	—



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	150 mA	Nominal
Screen voltage	30 V	Typical operating conditions
Plate current	6 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 · Diode

OTHER		
PARAMETER	PUBLISHED VALUE	CONDITION / NOTE
MAXIMUM DETECTOR PLATE CURRENT	10 mA	Maximum ratings
DIODE CURRENT WITH 50 VOLTS APPLIED	1 V	Typical operating conditions
DIODE CURRENT WITH	10 V	Typical operating conditions; published column 1
DIODE CURRENT WITH	1 V	Typical operating conditions; published column 2
Maximum/average diode output current	10 mA	Published datasheet; promoted section value
Maximum detector plate current	10 mA	Detector diode

CHARACTERISTIC		
PARAMETER	PUBLISHED VALUE	CONDITION / NOTE
Diode current at 50 V applied	2 mA	Detector diode

1966 TUNG SOL ELECTRONIC TUBES 2 OF 4

Section 2 · Tetrode

OTHER		
PARAMETER	PUBLISHED VALUE	CONDITION / NOTE
Max	12.6 V	Published datasheet; published column 1
Max	0.5 V	Published datasheet; published column 2
HEATER VOLTAGE	12.6 V	Maximum ratings
M gXIMUM "P	1 V	Maximum ratings; published column 1
M gXIMUM "P	3 V	Maximum ratings; published column 2

PARAMETER	PUBLISHED VALUE	CONDITION / NOTE
M gXIMUM "P	0 V	Maximum ratings; published column 3
MAXIMUM GRID #2 VOLTAGE	3 V	Maximum ratings; published column 1
MAXIMUM GRID #2 VOLTAGE	0 V	Maximum ratings; published column 2
MAXIMUM PLATE DISSIPATION	5 W	Maximum ratings
MAXIMUM GRID #i CIRCUIT RESISTANCE	15000000 ohm	Maximum ratings
HEATER CURRENT	500 mA	Typical operating conditions
GRID #2 VOLTAGE	12.6 V	Typical operating conditions
HEATER VOLTAGE	12.6 V	Typical operating conditions
PLATE CURRENT	6 mA	Typical operating conditions
GRID #2 CURRENT	1 mA	Typical operating conditions
T RANSCONDUCTANCE	5 uS	Typical operating conditions
PLATE RESISTANCE	11 ohm	Typical operating conditions; published column 1
PLATE RESISTANCE	0 ohm	Typical operating conditions; published column 2
THIS TUBE	1 V	Typical operating conditions; published column 1
THIS TUBE	12 V	Typical operating conditions; published column 4
HEATER VOLTAGE	12 V	Maximum ratings
HEATER CURRENT	50 A	Maximum ratings
PLATE VOLTAGE (TETRODE)	12 V	Maximum ratings
GRID #2 VOLTAGE	12.6 V	Maximum ratings
AF SIGNAL SOURCE RESISTANCE Z00	0 ohm	Maximum ratings; published column 1
PLATE CURRENT	25 mA	Maximum ratings
TOTAL HARMONIC DISTORTION	1 percent	Maximum ratings
MAx	12.6 V	Maximum ratings; published column 1
MAx	0.5 V	Maximum ratings; published column 2
HEATER VOLTAGE	126 V	Maximum ratings
MAXIMUM PLATE VOLTAGE (TETRODE)	3 V	Maximum ratings; published column 1
MAXIMUM PLATE VOLTAGE (TETRODE)	0 V	Maximum ratings; published column 2

PARAMETER	PUBLISHED VALUE	CONDITION / NOTE
MAXIMUM PLATE DISSIPATION	0.5 W	Maximum ratings
MAXIMUM GRID #1 CIRCUIT RESISTANCE	15000000 ohm	Maximum ratings
MAXIMUM HEATER CATHODE VOLTAGE *	-3 V	Maximum ratings; published column 1
MAXIMUM HEATER CATHODE VOLTAGE *	0 V	Maximum ratings; published column 2
HEATER VOLTAGE	126 V	Typical operating conditions
PLATE VOLTAGE (TETRODE)	126 V	Typical operating conditions
GRID #1 RESISTOR (BYPASSED)	2200000 ohm	Typical operating conditions
a PLATE CURRENT (	7 mA	Typical operating conditions
i GRID #2 CURRENT	1 mA	Typical operating conditions; published column 1
i GRID #2 CURRENT	0 mA	Typical operating conditions; published column 2
i TRANSCONDUCTANCE μr	0 uS	Typical operating conditions
PLATE RESISTANCE	4 ohm	Typical operating conditions; published column 1
PLATE VOLTAGE (TETR	0 V	Typical operating conditions; published column 1
PLATE VOLTAGE (TETR	12.6 V	Typical operating conditions; published column 2
AF SIGNAL SOURCE RESISTANCE	200 ohm	Typical operating conditions; published column 1
AF SIGNAL SOURCE RESISTANCE	0 ohm	Typical operating conditions; published column 2
PLATE CURRENT	2.5 mA	Typical operating conditions
TOTAL HARMONIC DISTORTION	10 percent	Typical operating conditions
Maximum plate voltage	30 V	Published datasheet; promoted section value
Maximum screen voltage	30 V	Published datasheet; promoted section value
Maximum plate dissipation	0.5 W	Published datasheet; promoted section value

CHARACTERISTIC		
PARAMETER	PUBLISHED VALUE	CONDITION / NOTE
Plate resistance	41000 ohm	Published datasheet; promoted section value



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