

ELECTRONIC TUBE REFERENCE

12FM6

Voltage - Triode (under 100V) electronic tube

CONSOLIDATED TECHNICAL DATA

3 SECTIONS

CONSTRUCTION

DIODE-DIODE-TRIODE

Double-diode medium-mu triode for detector and audio voltage-amplifier service in low-voltage automobile receivers. Two diodes handle detection and control rectification while the triode provides moderate gain and strong current drive.

GENERAL CHARACTERISTICS

BASE DESIGNATION	7BT	BASE PINS	7
NOMINAL HEATER	12.6 V / 150 mA	PARALLEL HEATER	– / –
HEATING	Indirect	SERIES OPERATION	Not specified
CATHODE ARRANGEMENT	Common cathode	SECTION CONSTRUCTION	Dissimilar

7BT - TERMINAL PINOUT

TERMINAL	SECTION	ELEMENT	STATUS
PIN1 – 1G1	A	G1 – Control Grid	CONNECTED
PIN2 – K	A	K – Cathode	CONNECTED
PIN3 – H	–	H – Heater	CONNECTED
PIN4 – H	–	H – Heater	CONNECTED
PIN5 – 2P	B	P – Plate (Anode)	CONNECTED
PIN6 – 3P	C	P – Plate (Anode)	CONNECTED
PIN7 – 1P	A	P – Plate (Anode)	CONNECTED

SECTION RATINGS

SECTION1 Triode	
PLATE RESISTANCE	5600 Ω
TRANSCONDUCTANCE	0.0024 S
AMPLIFICATION FACTOR	13.5
MAXIMUM PLATE VOLTAGE	30 V
MAXIMUM CATHODE CURRENT	20 mA
<i>Medium-mu triode section; published ratings/characteristics promoted where applicable.</i>	

SECTION2 Diode	
NOMINAL OUTPUT CURRENT	1 mA
<i>Representative identical-diode row</i>	

SECTION3 Diode	
<i>No fixed ratings recorded.</i>	
<i>Added approved missing physical diode section row.</i>	

12FM6 — Duplex-Diode Triode Vacuum Tube

A miniature, duplex-diode triode designed for combined detector, automatic volume control (AVC) rectifier, and transistor driver or audio-frequency (AF) voltage amplifier applications in automobile receivers.

Overview

The **12FM6** is a multi-unit miniature vacuum tube containing a double detector diode and a medium-mu triode within a single T-5 1/2 glass envelope. The tube is specifically designed for operation in mobile environments, such as automotive receivers, where the heater and plate potentials are obtained directly from a nominal 12-volt storage battery.

The triode section is intended for use as an audio-frequency voltage amplifier or transistor driver, operating into low-impedance loads. The two diode sections share a common unipotential cathode with the triode, providing detection and AVC rectification functions in a single compact envelope.

Construction, Heater, and Pinout

The 12FM6 features a coated unipotential cathode shared by both the triode and the two diode units. It is housed in a T-5 1/2 glass bulb with a miniature button 7-pin base (EIA 7BT or E7-1). The tube can be mounted and operated in any position.

Heater Characteristics

The heater is designed to operate directly from a 12-volt automotive electrical system. Because automotive battery voltages fluctuate significantly depending on the state of charge and generator/alternator operation, specific operating limits are defined for reliability.

Heater Parameter	Value
Nominal Heater Voltage (AC or DC)	12.6 V
Nominal Heater Current	0.15 A
Minimum Permissible Heater Voltage (Automobile Service)	10.0 V
Maximum Permissible Heater Voltage (Automobile Service)	15.9 V

Under no circumstances should the heater voltage fall outside the 10.0 V to 15.9 V range when used in automobile service. Operation at or near these extreme limits involves a sacrifice in performance at low heater voltage and a reduction in life expectancy at high heater voltage. Improved supply-voltage regulation is recommended to maximize equipment reliability.

Terminal Connections and Basing

The 12FM6 uses the EIA 7BT basing arrangement. Viewed from the bottom of the tube, the pin connections are as follows:

Pin Number	Electrode Connection
1	Triode Grid
2	Cathode (Common)
3	Heater
4	Heater
5	Diode Number 2 Plate
6	Diode Number 1 Plate
7	Triode Plate

Physical Dimensions

- **Maximum Overall Length:** 2 1/8 inches
- **Maximum Seated Height:** 1 7/8 inches
- **Maximum Diameter:** 3/4 inch
- **Envelope Type:** T-5 1/2 Glass

- **Base Type:** Miniature Button 7-Pin

Direct Interelectrode Capacitances

The capacitances of the 12FM6 electrodes are measured without an external shield:

Capacitance Parameter	Value
Triode Grid to Plate (G to P)	1.7 uuf
Triode Input: G to (H + K)	2.7 uuf
Triode Output: P to (H + K)	1.7 uuf
Diode Plate to Diode Plate	1.1 uuf

Electrical Characteristics and Typical Class A Operation

The triode section of the 12FM6 is optimized for low-voltage operation, specifically with a plate potential of 12.6 V. Two typical Class A operating points are documented, illustrating the performance of the triode under different biasing methods:

Parameter	Point A (Zero Bias)	Point B (Grid Resistor Bias)
Heater Voltage	12.6 V	12.6 V
Heater Current	0.15 A	0.15 A
Heater Potential	12.6 V	12.6 V
Plate Potential	12.6 V	12.6 V
Grid Potential	0 V	—
Grid Resistor	0 Ohms	2.2 Megohms
Plate Current	1.8 mA	1.0 mA
Transconductance	2400 umhos	1300 umhos
Plate Resistance (approx.)	5600 Ohms	7700 Ohms
Amplification Factor	13.5	10

Diode Characteristics

The two diode units are designed for detection and AVC rectification. Under typical operating conditions, each diode exhibits the following characteristic:

- **Average Diode Current:** 2.0 mA with 10 Volts DC applied to the diode plate.

Maximum Ratings

The maximum ratings for the 12FM6 are established under the Design-Center System. These ratings are limiting values of operating and environmental conditions applicable to a bogey tube and should not be exceeded under normal conditions.

Rating Parameter	Design-Center Value
Maximum Plate Voltage	30 V
Maximum DC Cathode Current	20 mA
Maximum Heater-Cathode Voltage (Heater Positive)	30 V
Maximum Heater-Cathode Voltage (Heater Negative)	30 V
Maximum Grid Circuit Resistance	10 Megohms
Maximum Continuous Diode Current (Each Diode)	1.0 mA

Circuit Applications and Performance Curves

The 12FM6 is uniquely tailored for hybrid automotive receiver designs of the late 1950s, where vacuum tubes operated alongside transistors. In these circuits, the 12FM6 performs the functions of AM detection and AVC voltage generation, while its triode section serves as a voltage amplifier or driver stage to feed a power transistor output stage. Because the plate voltage is supplied directly from the 12-volt vehicle battery, the need for a high-voltage vibrator power supply is eliminated.

Average Plate Characteristics

The plate characteristics of the triode section demonstrate its capability at very low plate voltages (0 to 50 V). With a grid resistor of 2.2 Megohms (bypassed) and the heater operated at its rated value, the plate current varies smoothly with plate voltage across different grid bias voltages:

- At a plate voltage of 12.6 V and zero grid bias, the plate current is approximately 1.8 mA.
- As the grid is biased more negatively, the plate current decreases, reaching cutoff near -3.0 V to -4.0 V depending on the plate voltage.

Average Transfer Characteristics

The transfer curves illustrate the relationship between the grid supply voltage and the triode's dynamic parameters at a constant plate voltage of 12.6 V:

- **Transconductance:** Peaks near 1300 to 1400 umhos as the grid supply voltage approaches 0 V, and drops off as the grid is biased negatively.
- **Plate Resistance:** Increases from approximately 5600 Ohms at zero bias to over 20000 Ohms as the grid bias approaches -2.0 V.
- **Amplification Factor:** Remains relatively stable, ranging from approximately 10 to 13.5 across the primary operating region.
- **Plate Current:** Follows a typical triode transfer curve, tapering to zero near -3.0 V grid bias.



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	—
Heater current	150 mA	—

CAPACITANCE		
PARAMETER	PUBLISHED VALUE	CONDITION / NOTE
Input capacitance	2.7 pF	—

1961 TUNG SOL

Section 2 · Diode

OTHER		
PARAMETER	PUBLISHED VALUE	CONDITION / NOTE
Maximum average diode current	1 mA	EachDiode

CAPACITANCE		
PARAMETER	PUBLISHED VALUE	CONDITION / NOTE
Diode-to-diode capacitance	1.1 pF	—



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 · Triode

CHARACTERISTIC		
PARAMETER	PUBLISHED VALUE	CONDITION / NOTE
CATHODE. -THE TRIODE SECTION	1 A	Published datasheet; published column 1
Plate resistance	5600 ohm	Published datasheet; promoted section value
Transconductance	0.0024 A/V	Published datasheet; promoted section value
Amplification factor	13.5	Published datasheet; promoted section value

OTHER		
PARAMETER	PUBLISHED VALUE	CONDITION / NOTE
HEATER VOLTAGE	1 V	Maximum ratings; published column 1
HEATER VOLTAGE	6 V	Maximum ratings; published column 2
MAXIMUM PLATE VOLTAGE	3 V	Maximum ratings; published column 1
MAXIMUM PLATE VOLTAGE	0 V	Maximum ratings; published column 2
MAXIMUM CATHODE CURRENT	2 mA	Maximum ratings; published column 1
MAXIMUM CATHODE CURRENT	0 mA	Maximum ratings; published column 2
HEATER VOLTAGE	12 V	Typical operating conditions; published column 1
HEATER VOLTAGE	1 V	Typical operating conditions; published column 2
HEATER CURRENT	150 mA	Typical operating conditions; published column 1
HEATER POTENTIAL	12 V	Typical operating conditions; published column 1
PLATE POTENTIAL	1 V	Typical operating conditions; published column 1
PLATE POTENTIAL	12 V	Typical operating conditions; published column 2
GRID POTENTIAL	0 V	Typical operating conditions
GRID RESISTOR	0 ohm	Typical operating conditions
PLATE CURRENT Z, \$	1 mA	Typical operating conditions; published column 1
PLATE CURRENT Z, \$	0 mA	Typical operating conditions; published column 2
TRANSCONDUCTANCE '	2400 uS	Typical operating conditions; published column 1

PARAMETER	PUBLISHED VALUE	CONDITION / NOTE
TRANSCONDUCTANCE	1300 μ S	Typical operating conditions; published column 2
PLATE RESISTANCE	5600 ohm	Typical operating conditions; published column 1
PLATE RESISTANCE	7700 ohm	Typical operating conditions; published column 2
PLATE RESISTANCE	0 ohm	Typical operating conditions; published column 3
Maximum plate voltage	30 V	Published datasheet; promoted section value
Maximum cathode current	20 mA	Published datasheet; promoted section value

1966 TUNG SOL ELECTRONIC TUBES 2 OF 4

Section 2 · Diode

OTHER		
PARAMETER	PUBLISHED VALUE	CONDITION / NOTE
MAXIMUM AVERAGE DIODE CURRENT	1 mA	Maximum ratings
Maximum/average diode output current	1 mA	Published datasheet; promoted section value

CHARACTERISTIC		
PARAMETER	PUBLISHED VALUE	CONDITION / NOTE
Average diode current at 10 V applied	2 mA	Each diode

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