



ELECTRONIC TUBE REFERENCE

12FK6

Voltage - Triode (under 100V) electronic tube

CONSOLIDATED TECHNICAL DATA

3 SECTIONS

CONSTRUCTION

DIODE-DIODE-TRIODE

Double-diode low-mu triode for detector, AVC, and first audio-amplifier service in automobile receivers. The diodes provide detection and control rectification while the triode offers useful low-voltage 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	6200 Ω
TRANSCONDUCTANCE	0.0012 S
AMPLIFICATION FACTOR	7.4
MAXIMUM PLATE VOLTAGE	16 V
<i>Low-mu triode.</i>	

SECTION2 Diode	
NOMINAL OUTPUT CURRENT	1 mA
<i>Representative of two identical diodes.</i>	

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

12FK6 — Twin Diode-Triode Miniature Vacuum Tube

The **12FK6** is a multi-unit miniature vacuum tube containing a twin-diode section and a low-mu triode section within a single envelope. It is designed specifically for use in electronic equipment where the operating potentials—including heater, plate, and grid voltages—are obtained directly from a nominal 12-volt automotive storage battery. In typical applications, such as automobile radio receivers, the twin-diode section performs AM detection and automatic volume control (AVC) functions, while the triode section serves as the first audio-frequency (AF) voltage amplifier.

Mechanical Specifications and Pin Configuration

The 12FK6 is constructed in a T-5 1/2 glass bulb with a small-button miniature 7-pin base (designated as the **7BT** or **78T** basing arrangement). The tube features a coated unipotential cathode that is common to both the diode and triode sections. It can be mounted and operated in any physical position.

Physical Dimensions

- **Bulb Type:** T-5 1/2
- **Base Type:** E7-1, Miniature Button 7-Pin
- **Maximum Overall Length:** 2-1/8 inches (approx. 54 mm)
- **Maximum Seated Height:** 1-7/8 inches (approx. 47.6 mm)

- **Maximum Diameter:** 3/4 inch (approx. 19 mm)

Pinout Connections

Viewed from the bottom of the tube base, the pin connections are assigned as follows:

Pin Number	Electrode Connection	Symbol
1	Triode Control Grid	G
2	Common Cathode	K
3	Heater	H
4	Heater	H
5	Diode Plate No. 2	<u>P2</u> / <u>D2</u>
6	Diode Plate No. 1	P1 / <u>D1</u>
7	Triode Plate	P / PT

Heater Characteristics and Automotive Design

The heater of the 12FK6 is designed to operate directly from a nominal 12-volt automotive electrical system. Because automotive battery voltages fluctuate depending on the state of charge and generator/alternator operation, the heater is engineered to function reliably across a wide voltage range.

Heater Parameter	Value
Nominal Heater Voltage	12.6 V
Nominal Heater Current	0.15 A (150 mA)
Calculated Heater Power	1.89 W
Permissible Voltage Range	10.0 V to 15.9 V
Supply Type	AC or DC

Because of the wide variations in automotive supply lines, the maximum ratings of the tube incorporate an adequate safety factor to withstand voltage surges up to the 15.9 V limit. However, operating the heaters in series with other vacuum tube heaters is explicitly not recommended.

Electrical Characteristics and Typical Class A Operation

The triode section of the 12FK6 is characterized by a low amplification factor and low plate resistance, optimized for low-voltage operation. The diode sections are designed for signal detection and rectification.

Triode Section Typical Operation

At a typical operating point where the plate voltage is supplied directly from the nominal 12.6 V source, the triode exhibits the following characteristics:

Parameter	Value
Plate Voltage	12.6 V
Grid Supply Voltage	0 V
Grid Resistor (Bypassed)	2.2 M Ω
Plate Current	1.3 mA
Amplification Factor (Γ)	7.4
Plate Resistance (r_p , approx.)	6,200 Ω
Transconductance (g_m)	1,200 Ω mhos
Plate Current at -3 V Grid Bias (approx.)	0.08 mA

Technical Calculation

The relationship between transconductance, plate resistance, and amplification factor is expressed as:

$$\Gamma = g_m \Gamma r_p$$

Using the typical values:

$$0.0012 \text{ S } \Gamma 6,200 \Omega = 7.44$$

This calculated value closely aligns with the published nominal amplification factor of 7.4. Additionally, the typical plate power dissipation under these conditions is calculated as:

$$PD = 12.6 \text{ V } \Gamma 0.0013 \text{ A} = 16.38 \text{ mW}$$

Diode Section Typical Operation

The two diode units are placed around the common cathode structure. Under typical test conditions, each diode unit exhibits the following performance:

- **Diode Current (with 10 V DC applied to each diode):** 2.0 mA

Maximum Ratings and Circuit Limits

The limiting values for the 12FK6 are established under the Design-Center and Design-Maximum rating systems. These ratings represent limits that must not be exceeded under the worst probable operating and environmental conditions.

Rating Parameter	Diode Unit	Triode Unit
Maximum Plate Voltage	16 V	16 V
Maximum Positive Grid Voltage	ΓΓΓΓ	0 V
Maximum Negative Grid Voltage	ΓΓΓΓ	16 V
Maximum Plate Current (Each Unit)	1.0 mA	ΓΓΓΓ
Maximum Peak Heater-Cathode Voltage (Heater Negative)	16 V	16 V
Maximum Peak Heater-Cathode Voltage (Heater Positive)	16 V	16 V
Maximum Grid-Circuit Resistance	ΓΓΓΓ	10 MΓ

Direct Interelectrode Capacitances

The direct interelectrode capacitances of the 12FK6 are measured without the use of an external shield. These values determine the high-frequency performance and input loading characteristics of the triode and diode sections.

Capacitance Parameter	Value
Triode Grid to Triode Plate (cgp)	1.6 ΓΓΓf (pF)
Triode Input: g to (h + k)	1.8 ΓΓΓf (pF)
Triode Output: p to (h + k)	0.7 ΓΓΓf (pF)
Diode Plate No. 1 to Diode Plate No. 2 (cd1-d2)	0.9 ΓΓΓf (pF)

These low capacitance values, particularly the 1.6 pF grid-to-plate capacitance, ensure stable operation in the first audio-frequency amplifier stage without risk of parasitic oscillation, provided proper circuit layout is maintained.

Technical Summary

The **12FK6** is a specialized **7-pin miniature twin diode, low-mu triode** designed for direct operation from 12-volt automotive battery systems. Featuring a **12.6 V, 150 mA heater** capable of withstanding supply variations from **10.0 V to 15.9 V**, it eliminates the need for high-voltage power supplies in car radios. The triode section provides an amplification factor of **7.4**, a transconductance of **1,200 μmhos** , and a plate resistance of **6,200 Ω** at a plate potential of **12.6 V**. The twin-diode sections are rated for a maximum continuous current of **1.0 mA** per unit, making them highly suited for detection and AVC circuits. Operating within a strict **16 V maximum plate and heater-cathode voltage limit**, the 12FK6 represents a highly optimized solution for low-voltage hybrid vacuum tube/transistor automotive receivers of its era.



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
Grid-to-plate capacitance	1.6 pF	—

1961 TUNG SOL

Section 2 · Diode

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

CAPACITANCE		
PARAMETER	PUBLISHED VALUE	CONDITION / NOTE
Diode-to-diode capacitance	0.9 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

OTHER		
PARAMETER	PUBLISHED VALUE	CONDITION / NOTE
HEATER VOLTAGE A	12.6 V	Maximum ratings
MAXIMUM PLATE VOLTAGE	16 V	Maximum ratings
POSITIVE VALUE	0 V	Maximum ratings
NEGATIVE VALUE	16 V	Maximum ratings
HEATER NEGATIVE WITH RESPECT TO CATHODE	16 V	Maximum ratings
HEATER POSITIVE WITH RESPECT TO CATHODE	16 V	Maximum ratings
GRID –CIRCUIT RESISTANCE	10000000 ohm	Maximum ratings
HEATER VOLTAGE	12.6 V	Typical operating conditions; published column 1
HEATER CURRENT	150 mA	Typical operating conditions; published column 1
PLATE VOLTAGE	10 V	Typical operating conditions; published column 1
PLATE VOLTAGE	12.6 V	Typical operating conditions; published column 2
GRID –SUPPLY VOLTAGE	0 V	Typical operating conditions
GRID RESISTOR (BYPASSED)	2200000 ohm	Typical operating conditions
PLATE RESISTANCE (APPROX.)	6 ohm	Typical operating conditions; published column 1
PLATE RESISTANCE (APPROX.)	2 ohm	Typical operating conditions; published column 2
PLATE RESISTANCE (APPROX.)	0 ohm	Typical operating conditions; published column 3
TRAM SC	0 uS	Typical operating conditions; published column 1
TRAM SC	1 uS	Typical operating conditions; published column 2
PLATE CURRENT	2 mA	Typical operating conditions; published column 1
PLATE CURRENT	1 mA	Typical operating conditions; published column 2
GRID BIAS	0 V	Typical operating conditions; published column 1

PARAMETER	PUBLISHED VALUE	CONDITION / NOTE
GRID BIAS	-3 V	Typical operating conditions; published column 2
GRID BIAS	0.08 V	Typical operating conditions; published column 3
Maximum plate voltage	16 V	Published datasheet; promoted section value

CHARACTERISTIC		
PARAMETER	PUBLISHED VALUE	CONDITION / NOTE
Plate resistance	6200 ohm	Published datasheet; promoted section value
Transconductance	0.0012 A/V	Published datasheet; promoted section value
Amplification factor	7.4	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 output current	1 mA	Published datasheet; promoted section value
Maximum plate current	1 mA	Each diode unit