

ELECTRONIC TUBE REFERENCE

12FX8A

Voltage - Triode (with diode, heptode or hexode) electronic tube

CONSOLIDATED TECHNICAL DATA

2 SECTIONS
CONSTRUCTION
HEPTODE-TRIODE

Low-voltage triode-heptode for automobile-radio RF amplification and frequency conversion. The triode provides front-end RF gain while the heptode integrates oscillator and mixer functions from the 12.6 V supply.

GENERAL CHARACTERISTICS

BASE DESIGNATION	9KV	BASE PINS	9
NOMINAL HEATER	12.6 V / 270 mA	PARALLEL HEATER	– / –
HEATING	Indirect	SERIES OPERATION	Not specified
CATHODE ARRANGEMENT	Separate cathodes	SECTION CONSTRUCTION	Dissimilar

9KV - TERMINAL PINOUT

TERMINAL	SECTION	ELEMENT	STATUS
PIN1	A	G2 – Screen Grid	CONNECTED
PIN1	A	G4 – Fourth Grid	CONNECTED
PIN2	A	G1 – Control Grid	CONNECTED
PIN3	A	P – Plate (Anode)	CONNECTED
PIN4	–	H – Heater	CONNECTED
PIN5	B	K – Cathode	CONNECTED
PIN5	–	H – Heater	CONNECTED
PIN6	B	G1 – Control Grid	CONNECTED
PIN7	A	G5 – Fifth Grid	CONNECTED
PIN7	A	K – Cathode	CONNECTED
PIN7	–	IS – Internal Screen	CONNECTED
PIN8	B	P – Plate (Anode)	CONNECTED

TERMINAL	SECTION	ELEMENT	STATUS
PIN9	A	G3 – Suppressor Grid	CONNECTED

SECTION RATINGS

SECTION1 Heptode		
PLATE RESISTANCE		500000 Ω
TRANSCONDUCTANCE		0.0003 S
MAXIMUM PLATE VOLTAGE		16 V
MAXIMUM SCREEN VOLTAGE		16 V
<i>Heptode converter section; published ratings/characteristics promoted where applicable.</i>		

SECTION2 Triode		
TRANSCONDUCTANCE		0.0014 S
AMPLIFICATION FACTOR		10
MAXIMUM PLATE VOLTAGE		16 V
<i>Triode RF-amplifier section; published ratings/characteristics promoted where applicable.</i>		

12FX8A — Low-Voltage Triode-Heptode Vacuum Tube

The **12FX8A** is a miniature multi-unit vacuum tube containing a triode and a heptode section within a single envelope. It is specifically designed for use in automobile radio receivers where plate, screen, and grid voltages are supplied directly from a 12-volt storage battery. In this application, the triode section functions as a radio-frequency (RF) amplifier, while the heptode section serves as a frequency converter.

The 12FX8A is unilaterally interchangeable with the [12FX8](#). The primary distinction between the two types is that the 12FX8A incorporates an additional control on the conversion-conductance cutoff characteristic of the heptode section.

Physical and Mechanical Specifications

The 12FX8A is constructed in a miniature T-6 1/2 glass bulb with a small button 9-pin base (E9-1). The tube is designed to operate in any mounting position.

Physical Dimensions

- **Maximum Overall Length:** 2.438 inches (2 7/16 inches)
- **Maximum Seated Height:** 2.188 inches (2 3/16 inches)

- **Seated Height Range:** 1.812 ± 0.094 inches
- **Maximum Diameter:** 0.875 inches (7/8 inches)

Terminal Connections and Basing

The tube utilizes the **JEDEC 9KV** basing arrangement. The pin connections, viewed from the bottom of the base, are as follows:

- **Pin 1:** Heptode Grid Numbers 2 and 4 (Screen Grid)
- **Pin 2:** Heptode Grid Number 1 (Oscillator Grid)
- **Pin 3:** Heptode Plate
- **Pin 4:** Heater
- **Pin 5:** Heater and Triode Cathode
- **Pin 6:** Triode Grid
- **Pin 7:** Heptode Cathode, Grid Number 5, and Internal Shield
- **Pin 8:** Triode Plate
- **Pin 9:** Heptode Grid Number 3 (Signal Grid)

Heater Characteristics and Supply Limits

The 12FX8A contains two coated unipotential cathodes. The heater is designed to operate from a nominal 12.6-volt supply, but because it is intended for automotive service, it must withstand the voltage fluctuations of a vehicle's electrical system.

Parameter	Value
Nominal Heater Voltage (AC or DC)	12.6 V
Nominal Heater Current	0.27 A (270 mA)

Heater Supply Limits

When operated in automobile service from a nominal 12-volt source, the heater voltage must be maintained within strict limits to ensure reliable operation and acceptable tube life:

- **Minimum Heater Voltage:** 10.0 V
- **Maximum Heater Voltage:** 15.9 V

Extreme variations within this range may be tolerated for short periods. However, continuous operation near these absolute limits degrades performance at the low end and significantly reduces life expectancy at the high end. Improving supply-voltage regulation is highly recommended to maximize equipment reliability.

Heater-Cathode Voltage Ratings

- **Heater Positive with Respect to Cathode (Maximum):** 16 V

- **Heater Negative with Respect to Cathode (Maximum):** 16 V

Maximum Ratings (Design-Center Values)

The maximum ratings for the 12FX8A are established under the Design-Center system. These values represent limiting operating and environmental conditions for a nominal ("bogey") tube and should not be exceeded under normal operating conditions.

Rating	Value
Heptode Plate Voltage	16 V
Heptode Screen-Supply Voltage	16 V
Heptode Screen Voltage	16 V
Heptode Positive DC Grid #3 Voltage	0 V
Heptode Negative DC Grid #3 Voltage	16 V
Triode Plate Voltage	16 V
Heptode Grid #3 Circuit Resistance	10 M Ω
Triode Grid-Circuit Resistance	10 M Ω

Typical Operating Characteristics

The 12FX8A is optimized for low-voltage operation, with typical operating points established at a nominal plate and screen supply of 12.6 V.

Average Characteristics (Class A Amplifier / Converter Service)

Parameter	Heptode Section	Triode Section
Plate Voltage	12.6 V	12.6 V
Screen Voltage	12.6 V	—
Grid #3 Voltage	0.5 V*	—
Grid #3 Resistance	2.2 M Ω	—
Grid #1 Voltage (RMS)	1.6 V	—
Grid #1 Resistance	0.033 M Ω	2.2 M Ω
Grid Voltage	—	0.8 V**
Plate Resistance (Approx.)	0.5 M Ω	—

Parameter	Heptode Section	Triode Section
Conversion Transconductance	300 μmhos	—
Transconductance	—	1400 μmhos
Amplification Factor	—	10
Plate Current	0.29 mA	1.3 mA
Screen Current	1.25 mA	—

** Voltage developed across a 2.2 M Ω Grid #3 resistor.* *** Voltage developed across a 2.2 M Ω Grid resistor.*

Cutoff Characteristics

- **Heptode Grid #3 Voltage (Approximate):**
 - For a conversion transconductance (G_C) of 10 μmhos : -3.0 V
 - For a conversion transconductance (G_C) of 1.0 μmhos : -8.0 V
- **Triode Grid Voltage (Approximate):**
 - For a plate current (I_b) of 10 μA : -3.2 V

Heptode Oscillator Characteristics (Not Oscillating)

The heptode section can be evaluated under non-oscillating conditions with the screen connected directly to the plate:

- **Plate Voltage:** 12.6 V
- **Screen (Connected to Plate) Voltage:** 12.6 V
- **Grid #3 Voltage:** 0 V
- **Grid #1 Voltage:** 0 V
- **Amplification Factor (between Grid #1 and Grids #2 & #4 connected to plate):** 9
- **Transconductance (between Grid #1 and Grids #2 & #4 connected to plate):** 3600 μmhos
- **Cathode Current:** 4.4 mA
- **Grid #1 Voltage (Approximate, for $I_b = 10 \mu\text{A}$):** -4.5 V

Direct Interelectrode Capacitances

These capacitance values are measured directly without an external shield.

Heptode Section Capacitances

- **Grid #3 to Plate (max):** 0.28 pF
- **Grid #3 to Grid #1 (max):** 0.12 pF

- **RF Input (Grid #3 to Heater, Triode Cathode, Heptode Cathode, Grid #1, Grids #2 & #4, Grid #5, Plate, and Internal Shield):** 6.0 pF
- **Oscillator Input (Grid #1 to Heater, Triode Cathode, Heptode Cathode, Grids #2 & #4, Grid #3, Grid #5, Plate, and Internal Shield):** 5.0 pF
- **Mixer Output (Plate to Heater, Triode Cathode, Heptode Cathode, Grid #1, Grids #2 & #4, Grid #3, Grid #5, and Internal Shield):** 5.0 pF
- **Grid #1 to Cathode (Grid #1 to Heptode Cathode, Grid #5, and Internal Shield):** 3.0 pF
- **Oscillator Output (Heptode Cathode to Heater, Triode Cathode, Grids #2 & #4, Grid #3, and Plate):** 17 pF
- **Grid #1 to Plate (max):** 0.16 pF

Triode Section Capacitances

- **Grid to Plate:** 1.3 pF
- **Input (Grid to Triode Cathode and Heater):** 2.2 pF
- **Output (Plate to Triode Cathode and Heater):** 0.25 pF

Inter-Section Capacitances

- **Triode Grid to Heptode Grid #3 (max):** 0.01 pF
- **Triode Plate to Heptode Grid #3 (max):** 0.18 pF
- **Triode Plate to Heptode Plate (max):** 0.20 pF



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 · Heptode

OTHER		
PARAMETER	PUBLISHED VALUE	CONDITION / NOTE
Heater voltage	12.6 V	—
Heater current	270 mA	—

CHARACTERISTIC		
PARAMETER	PUBLISHED VALUE	CONDITION / NOTE
Conversion transconductance	300 μ S	Converter
Oscillator transconductance	3600 μ S	NotOscillating

CAPACITANCE		
PARAMETER	PUBLISHED VALUE	CONDITION / NOTE
RF input capacitance	6 pF	—

1961 TUNG SOL

Section 2 · Triode

CAPACITANCE		
PARAMETER	PUBLISHED VALUE	CONDITION / NOTE
Grid-to-plate capacitance	1.3 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 · Heptode

CAPACITANCE		
PARAMETER	PUBLISHED VALUE	CONDITION / NOTE
GRID #3 TO PLATE: (HG} TO HP) MAX	0.28 pF	Interelectrode capacitances
GRID #3 TO GRID #i: (HG3 TO HGi), MAX	0.12 pF	Interelectrode capacitances
HP+	1 pF	Interelectrode capacitances; published column 1
HP+	5 pF	Interelectrode capacitances; published column 2
MIXER	0 pF	Interelectrode capacitances; published column 1
MIXER	2 pF	Interelectrode capacitances; published column 2
MIXER	4 pF	Interelectrode capacitances; published column 3
MIXER	1 pF	Interelectrode capacitances; published column 4
GRID #i TO CATHODE: HGi TO (HK+HG5+	1 pF	Interelectrode capacitances; published column 1
GRID #i TO CATHODE: HGi TO (HK+HG5+	3 pF	Interelectrode capacitances; published column 2
GRID #i TO PLATE: (HG1 TO HP) MAX	0.16 pF	Interelectrode capacitances
GRID TO PLATE: (TG TO TP)	1.3 pF	Interelectrode capacitances
DESIGN MA%	1 mA	Interelectrode capacitances; published column 1
DESIGN MA%	2 mA	Interelectrode capacitances; published column 2
AVERAGE CHARACTERISTICS	12.6 V	Interelectrode capacitances; published column 1
AVERAGE CHARACTERISTICS	27 V	Interelectrode capacitances; published column 2
AVERAGE CHARACTERISTICS	0 V	Interelectrode capacitances; published column 3
WHEN USED	1 V	Interelectrode capacitances; published column 1
WHEN USED	12 V	Interelectrode capacitances; published column 2

PARAMETER	PUBLISHED VALUE	CONDITION / NOTE
S NOU	10 V	Interelectrode capacitances; published column 1
S NOU	1 V	Interelectrode capacitances; published column 2
S NOU	0 V	Interelectrode capacitances; published column 4
HEATER POSITIVE WITH RESPECT TO CATHODE	16 V	Interelectrode capacitances
HEATER NEGATIVE WITH RESPECT TO CATHODE	16 V	Interelectrode capacitances

OTHER		
PARAMETER	PUBLISHED VALUE	CONDITION / NOTE
HEPTODE PLATE VOLTAGE	16 V	Maximum ratings
HEPTODE SCREEN –SUPPLY VOLTAGE	16 V	Maximum ratings
HEPTODE SCREEN VOLTAGE	16 V	Maximum ratings
HEPTODE POSITIVE DC GRID #3 VOLTAGE	0 V	Maximum ratings
HEPTODE NEGATIVE	0 V	Maximum ratings; published column 1
HEPTODE NEGATIVE	16 V	Maximum ratings; published column 2
HEPTODE GRID #3 CIRCUIT RESISTANCE	10000000 ohm	Maximum ratings
PLATE VOLTAGE	12.6 V	Typical operating conditions; published column 1
SCREEN VOLTAGE	12.6 V	Typical operating conditions
GRID #3 VOLTAGE	0 V	Typical operating conditions
GRID #i VOLTAGE, RMS	1.6 V	Typical operating conditions
GRID #i RESISTANCE	33000 ohm	Typical operating conditions; published column 1
GRID #i RESISTANCE	2200000 ohm	Typical operating conditions; published column 2
GRID VOLTAGE	0 V	Typical operating conditions
PLATE RESISTANCE, APPROX	500000 ohm	Typical operating conditions
CONVERSION TRANSCONDUCTANCE	3 uS	Typical operating conditions; published column 1
CONVERSION TRANSCONDUCTANCE	0 uS	Typical operating conditions; published column 2

PARAMETER	PUBLISHED VALUE	CONDITION / NOTE
TRANSCONDUCTANCE	1400 μS	Typical operating conditions
PLATE CURRENT	0.29 mA	Typical operating conditions; published column 1
PLATE CURRENT	1.3 mA	Typical operating conditions; published column 2
SCREEN CURRENT	125 mA	Typical operating conditions
GC =	10 μS	Typical operating conditions; published column 1
GC =	-3 μS	Typical operating conditions; published column 2
Gc =	1 μS	Typical operating conditions; published column 1
Gc =	0 μS	Typical operating conditions; published column 2
PLATE VOLTAGE	1 V	Typical operating conditions; published column 1
PLATE VOLTAGE	2.6 V	Typical operating conditions; published column 2
GRID #} VOLTAGE	0 V	Typical operating conditions
GRID ~	1 V	Typical operating conditions; published column 1
GRID ~	0 V	Typical operating conditions; published column 2
TRANSCONDUCTANCE D	3600 μS	Typical operating conditions
CATHODE CURRENT	4.4 mA	Typical operating conditions
Maximum plate voltage	16 V	Published datasheet; promoted section value
Maximum screen voltage	16 V	Published datasheet; promoted section value

CHARACTERISTIC		
PARAMETER	PUBLISHED VALUE	CONDITION / NOTE
Plate resistance	500000 ohm	Published datasheet; promoted section value
Conversion transconductance	300 μS	Heptode converter

Section 2 · Triode

OTHER		
PARAMETER	PUBLISHED VALUE	CONDITION / NOTE
DIRECTLY FROM A	12 V	Published datasheet; published column 1
DIRECTLY FROM A	1 V	Published datasheet; published column 2
TRIODE PLATE VOLTAGE	16 V	Maximum ratings
TRIODE GRID –CIRCUIT RESISTANCE	10000000 ohm	Maximum ratings
Maximum plate voltage	16 V	Published datasheet; promoted section value

CAPACITANCE		
PARAMETER	PUBLISHED VALUE	CONDITION / NOTE
TRIODE GRID TO HEPTODE GRID #3: (TG TO HG3), MAX	0.01 pF	Interelectrode capacitances
TRIODE PLATE TO HEPTODE GRID #3: (TP TU HG3), MAX	0.18 pF	Interelectrode capacitances
TRIODE PLATE TO HEPTODE PLATE: (TP TO HP), MAX	0.2 pF	Interelectrode capacitances

CHARACTERISTIC		
PARAMETER	PUBLISHED VALUE	CONDITION / NOTE
Transconductance	0.0014 A/V	Published datasheet; promoted section value
Amplification factor	10	Published datasheet; promoted section value

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