



ELECTRONIC TUBE REFERENCE

12DF7

Voltage - Dual Triode (similar) electronic tube

CONSOLIDATED TECHNICAL DATA

2 SECTIONS

CONSTRUCTION

TRIODE-TRIODE

High-mu twin triode intended for low-level audio preamplifier service, with operating data for resistance-coupled Class-A amplification and characteristics optimized for small signals.

GENERAL CHARACTERISTICS

BASE DESIGNATION	—	BASE PINS	9
NOMINAL HEATER	12.6 V / 150 mA	PARALLEL HEATER	6.3 V / 300 mA
HEATING	Indirect	SERIES OPERATION	Capable
CATHODE ARRANGEMENT	Separate cathodes	SECTION CONSTRUCTION	Similar

SECTION RATINGS

SECTION1 Triode	
PLATE RESISTANCE	62500 Ω
TRANSCONDUCTANCE	0.0016 S
AMPLIFICATION FACTOR	100
MAXIMUM PLATE VOLTAGE	300 V
MAXIMUM PLATE DISSIPATION	1 W
Representative row for identical repeated diode/triode sections.	

SECTION2 Triode	
PLATE RESISTANCE	62500 Ω
TRANSCONDUCTANCE	0.0016 S
AMPLIFICATION FACTOR	100
MAXIMUM PLATE VOLTAGE	300 V
MAXIMUM PLATE DISSIPATION	1 W
Second physical triode section; electrically identical twin section.	

12DF7 — Low-Microphonics High-Mu Twin Triode

An indirectly heated, dual-section miniature receiving valve designed for low-level input voltage amplification, low-microphonic audio preamplifiers, and tape recorder input stages.

Overview

The **12DF7** is a 9-pin miniature twin triode vacuum tube designed specifically for service as a low-level input voltage amplifier. It is particularly suited for tape recorders and high-quality audio preamplifiers. The 12DF7 is engineered as a low-microphonics version of the **12AX7** and can be utilized as a direct replacement for that type. The device features two independent triode sections with coated unipotential cathodes housed in a T-6 1/2 glass envelope.

Mechanical Specifications and Pin Connections

The 12DF7 is constructed with a small button 9-pin base (basing designation 9A) and can be operated in any mounting position. Its physical dimensions are characterized by the following limits:

- **Maximum overall length:** 2 3/16 inches
- **Maximum seated height:** 1 15/16 inches
- **Maximum diameter:** 7/8 inch

The 9A base pinout configuration, viewed from the bottom of the tube, provides independent connections for each triode section alongside a center-tapped heater:

Pin Number	Element Connection
Pin 1	Plate (Section 2)
Pin 2	Grid (Section 2)
Pin 3	Cathode (Section 2)
Pin 4	Heater

Pin Number	Element Connection
Pin 5	Heater
Pin 6	Plate (Section 1)
Pin 7	Grid (Section 1)
Pin 8	Cathode (Section 1)
Pin 9	Heater Center Tap

Heater and Cathode Characteristics

The 12DF7 is equipped with coated unipotential cathodes. The heater is designed for versatile operation, allowing for either series or parallel supply configurations using AC or DC power:

- **Series Operation:** When operated in series, a nominal heater voltage of **12.6 V** is applied across Pin 4 and Pin 5. The nominal heater current is **0.15 A**.
- **Parallel Operation:** For parallel operation, Pin 4 and Pin 5 are connected together, and the heater voltage of **6.3 V** is applied between this junction and Pin 9 (the center tap). The nominal heater current in this configuration is **0.3 A**.

Using these values, the calculated heater power consumption for both configurations is:

- **Series Heater Power (Calculated):** $12.6\text{ V} * 0.15\text{ A} = 1.89\text{ W}$
- **Parallel Heater Power (Calculated):** $6.3\text{ V} * 0.3\text{ A} = 1.89\text{ W}$

Direct Interelectrode Capacitances

The direct interelectrode capacitances of the two triode sections are highly symmetrical, with minor variations in output capacitance. These values are measured without an external shield:

Capacitance Parameter	Section 1	Section 2	Unit
Grid to Plate	1.4	1.4	pF
Input	1.6	1.6	pF
Output	0.4	0.3	pF

Maximum Ratings

The maximum ratings for the 12DF7 are established under the Design Center system. These limits apply to each individual triode section:

- **Maximum Plate Voltage:** 300 V

- **Maximum Heater-Cathode Voltage:** 180 V
- **Maximum Positive DC Grid Voltage:** 0 V
- **Maximum Negative DC Grid Voltage:** -50 V
- **Maximum Plate Dissipation (per section):** 1 W

Typical Operating Conditions (Class A1)

Under typical Class A1 amplifier operation, each triode section exhibits high voltage amplification capabilities. The operating characteristics are documented at two distinct plate voltage points:

Parameter	Operating Point I	Operating Point II	Unit
Plate Voltage	100	250	V
Grid Voltage	-1	-2	V
Amplification Factor (mu)	100	100	—
Plate Resistance (rp)	70,000	55,000	Ohms
Transconductance (gm)	1,250	1,600	umhos
Plate Current (Ib)	0.5	1.2	mA

Resistance-Coupled Amplifier Design

The 12DF7 is highly suited for resistance-coupled voltage amplifier service. Operating data is provided for various plate load resistors (R_p), grid resistors of the following stage (R_s), and supply voltages (E_{bb}).

The typical circuit configuration utilizes an input signal (E_{sig}) coupled via a capacitor (C) to the grid resistor (R_{g1}). The cathode is biased using a cathode resistor (R_k), which must be adequately bypassed. The output voltage (E_o) is taken from the plate through a coupling capacitor (C) and developed across the following stage's grid resistor (R_s).

Alternatively, zero-bias operation can be implemented by setting $R_k = 0$ and utilizing a high-value grid resistor ($R_{g1} = 10$ Megohms). In all cases, the coupling capacitors (C) must be selected to achieve the desired low-frequency response.

The table below outlines representative operating points for cathode-bias and zero-bias configurations across three supply voltages ($E_{bb} = 90$ V, 180 V, and 300 V). The output voltage E_o represents the maximum RMS voltage output at 5% total harmonic distortion, and the voltage gain is measured at an output level of 2.0 V RMS.

Cathode-Bias Operation ($R_{g1} = 0.1$ Megohms)

R_p (Meg)	R_s (Meg)	$E_{bb} = 90$ V			$E_{bb} = 180$ V			$E_{bb} = 300$ V		
		R_k (Ohms)	Gain	E_o (V)	R_k (Ohms)	Gain	E_o (V)	R_k (Ohms)	Gain	E_o (V)
0.10	0.10	1,700	31	5.0	1,000	40	15	760	43	30
0.10	0.24	2,000	38	6.9	1,100	46	20	900	50	40
0.24	0.24	3,500	43	6.5	2,000	54	18	1,600	58	37
0.24	0.51	3,900	49	8.6	2,300	59	24	1,800	64	47
0.51	0.51	7,100	50	7.4	4,300	62	19	3,100	66	39
0.51	1.00	7,800	53	9.1	4,800	64	24	3,600	69	46

Zero-Bias Operation ($R_{g1} = 10$ Megohms, $R_k = 0$ Ohms)

R_p (Meg)	R_s (Meg)	$E_{bb} = 90$ V		$E_{bb} = 180$ V		$E_{bb} = 300$ V	
		Gain	E_o (V)	Gain	E_o (V)	Gain	E_o (V)
0.24	0.24	37	3.9	53	15	62	32
0.24	0.51	44	5.4	60	19	67	41
0.51	0.51	44	5.0	61	17	69	35
0.51	1.00	49	6.4	66	21	71	41

Analysis of Characteristic Curves

The performance of each triode section is further illustrated by its characteristic curves:

- **Plate Characteristics:** The relationship between plate current and plate voltage is plotted for grid voltages (E_c) ranging from 0 V down to -5.0 V. These curves show that at a given grid bias, the plate current increases in a non-linear fashion as plate voltage rises. For example, at $E_c = 0$ V, the plate current rises steeply, reaching approximately 3 mA near 160 V plate potential.
- **Dynamic Parameters vs. Grid Voltage:** The curves for plate resistance (r_p), transconductance (g_m), and amplification factor (μ) are plotted against grid voltage for plate potentials of 100 V, 200 V, and 300 V.

- The **amplification factor (μ)** remains remarkably stable, staying very close to 100 across the entire grid bias range from 0 V to -4 V.
- The **transconductance (g_m)** exhibits a downward trend as the grid bias becomes more negative. At 100 V plate potential, g_m starts near 1,500 μ hos at zero bias and falls below 500 μ hos as the grid approaches -2.5 V.
- The **plate resistance (r_p)** increases significantly as the grid bias is made more negative, reflecting the decreasing plate current and transconductance.

Technical Summary

The **12DF7** is a high- μ , low-microphonics twin triode housed in a T-6 1/2 miniature glass envelope with a 9-pin base. It is designed as a low-noise, low-microphonics replacement for the [12AX7](#), making it ideal for high-gain, low-level audio input stages. The tube features a center-tapped heater that can be operated in series (12.6 V, 0.15 A) or parallel (6.3 V, 0.3 A). With an amplification factor of 100, a maximum plate voltage rating of 300 V, and a plate dissipation limit of 1 W per section, the 12DF7 provides excellent voltage gain and low-noise performance in both cathode-biased and zero-biased resistance-coupled amplifier configurations.



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

CHARACTERISTIC		
PARAMETER	PUBLISHED VALUE	CONDITION / NOTE
PlateResistanceAtLowerCurrent	70000 ohm	—
TransconductanceAtLowerCurrent	1250 uS	—

OTHER		
PARAMETER	PUBLISHED VALUE	CONDITION / NOTE
Service	Low-level audio preamplifier	—



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
Plate resistance at 100 V	70000 ohm	ClassA1
Transconductance at 100 V	1250 μS	ClassA1
Plate current at 100 V	0.5 mA	ClassA1

OTHER		
PARAMETER	PUBLISHED VALUE	CONDITION / NOTE
Plate voltage	250 V	ClassA1

PARAMETER	PUBLISHED VALUE	CONDITION / NOTE
Grid voltage	-2 V	ClassA1
Plate current	1.2 mA	ClassA1
Maximum heater-cathode voltage	180 V	EachSection