

ELECTRONIC TUBE REFERENCE

12AF3

Rectifier - Damper Diode electronic tube

CONSOLIDATED TECHNICAL DATA

1 SECTION
CONSTRUCTION
RECTIFIER

Indirectly heated diode designed for television horizontal-deflection damper service, with high heater-cathode insulation, roughly 5 kV peak-inverse capability, and substantial pulse-current handling.

GENERAL CHARACTERISTICS

BASE DESIGNATION	9CB	BASE PINS	9
NOMINAL HEATER	12.6 V / 600 mA	PARALLEL HEATER	– / –
HEATING	Indirect	SERIES OPERATION	Not specified
CATHODE ARRANGEMENT	Separate cathodes	SECTION CONSTRUCTION	Similar

9CB - TERMINAL PINOUT

TERMINAL	SECTION	ELEMENT	STATUS
PIN1 – IC	–	–	IC
PIN2 – IC	–	–	IC
PIN3 – IC	–	–	IC
PIN4 – H	–	H – Heater	CONNECTED
PIN5 – H	–	H – Heater	CONNECTED
PIN6 – IC	–	–	IC
PIN7 – IC	–	–	IC
PIN8 – IC	–	–	IC
PIN9 – P	A	P – Plate (Anode)	CONNECTED
CAP1 – K	A	K – Cathode	CONNECTED

SECTION RATINGS

SECTION1 Rectifier	
MAXIMUM PLATE DISSIPATION	6 W
PEAK INVERSE VOLTAGE	5000 V
NOMINAL OUTPUT CURRENT	175 mA
PEAK FORWARD CURRENT	800 mA
FORWARD VOLTAGE DROP	7 V
MAXIMUM HEATER-CATHODE VOLTAGE	4500 V
WARM-UP TIME	11 s
Published promoted fields populated semantically; identical repeated sections compressed.	

12AF3 — Half-Wave Vacuum Rectifier

The **12AF3** is a miniature, indirectly heated half-wave vacuum rectifier designed specifically for damper service in the horizontal-deflection circuits of television receivers. It is particularly suited for receivers employing a series heater-string arrangement. The tube is engineered to withstand high-voltage pulses of line frequency between its cathode and both the heater and plate elements, which are typical in "direct drive" deflection circuits.

The 12AF3 is electrically identical to the **6AF3** except for its heater ratings. While the **6AF3** is designed for parallel heater circuits with a 6.3 V, 1.2 A heater, the 12AF3 is designed for series strings, operating at a nominal heater voltage of 12.6 V and a current of 0.6 A, with a controlled heater warm-up time.

Construction, Physical Dimensions, and Basing

The 12AF3 is constructed in a T-6 1/2 glass bulb envelope (skirted miniature style) with a button 9-pin miniature base (E9-1) and a C1-1 top cap. The physical dimensions of the tube are:

- **Maximum Diameter:** 0.875 inches
- **Maximum Seated Height:** 3.000 inches
- **Maximum Overall Height:** 3.281 inches (3 33/32" max)

The tube features a unipotential coated cathode and can be operated in **any mounting position**. Adequate ventilation is highly recommended, as is typical for power-handling tubes of this class.

Pinout and Socket Connections

The tube utilizes the **9CB** basing arrangement, requiring a miniature 9-contact socket. The pin connections, viewed from the bottom of the base, are as follows:

Pin	Connection
1	Cathode (K)

Pin	Connection
2	Internal Connection (IC)
3	Internal Connection (IC)
4	Heater (H)
5	Heater (H)
6	Internal Connection (IC)
7	Internal Connection (IC)
8	Internal Connection (IC)
9	Plate (P)

Socket terminals 1, 2, 3, 6, 7, and 8 should not be used as circuit tie points.

Heater Characteristics and Warm-Up

The heater of the 12AF3 is designed for series-string operation with AC or DC supply.

- **Heater Voltage:** 12.6 V
- **Heater Current:** 0.6 A (600 mA) $\pm$ 6%
- **Heater Warm-up Time (Average):** 11.0 seconds

Heater Power Calculation

Using the nominal heater voltage and current, the nominal heater power consumption can be calculated as follows: $\text{Power} = \text{Voltage} \times \text{Current} = 12.6 \text{ V} \times 0.6 \text{ A} = 7.56 \text{ W}$

The heater warm-up time is specifically controlled for service in series-connected heater strings. It is defined as the time required for the voltage across the heater to reach 80% of its rated voltage (10.08 V) after applying four times the rated heater voltage (50.4 V) to a test circuit consisting of the tube heater connected in series with a resistance equal to three times the nominal heater operating resistance.

Electrical Characteristics and Typical Operation

As a half-wave rectifier, the primary electrical characteristic of interest is the tube's internal voltage drop during conduction. The voltage drop varies slightly depending on the operating conditions:

- At a conducting plate current of **340 mA**, the average tube voltage drop is **30 Volts**.
- At a conducting plate current of **350 mA**, the average tube voltage drop is **25 Volts**.

Direct Interelectrode Capacitances

The approximate direct interelectrode capacitances, measured without an external shield, are:

- **Heater to Cathode (H to K):** 2.8 pF
- **Cathode to Plate and Heater [K to (P + H)]:** 9.0 pF
- **Plate to Cathode and Heater [P to (K + H)]:** 6.0 pF

Design-Maximum Ratings

The ratings of the 12AF3 are interpreted according to the **Design-Maximum System**. Under this system, the equipment designer must design the circuit so that these limiting values are not exceeded under the worst probable operating conditions (including supply-voltage variations, component tolerances, control adjustments, load variations, and environmental conditions) with a "bogie" tube.

For damper service in a 525-line, 30-frame television system, the maximum ratings are:

Parameter	Design-Maximum Rating
Peak Inverse Plate Voltage	4500 V
Maximum DC Plate Current	185 mA
Maximum Steady State Peak Plate Current	750 mA
Maximum Plate Dissipation	6.0 W
Maximum Bulb Temperature (at hottest point)	210 °C to 220 °C

Heater-Cathode Voltage Ratings

Because the tube is subjected to high-voltage pulses in horizontal-deflection damper service, the heater-cathode insulation is highly rated:

- **Heater Negative with respect to Cathode:**
 - **DC Limit:** 1000 V
 - **Total DC and Peak (Pulse):** 4500 V
- **Heater Positive with respect to Cathode:**
 - **DC Limit:** 100 V
 - **Total DC and Peak (Pulse):** 300 V

Pulse Duty Cycle Restriction

For operation in television receivers (525-line, 30-frame system), the duty cycle of the high-voltage pulses must not exceed **15% of one horizontal scanning cycle** (which corresponds to approximately 10 microseconds).

Comparison with Related Types

The **12AF3** is directly related to the **6AF3**. The two tubes share identical physical dimensions, basing (9CB), socket requirements, and electrical ratings for damper service. They differ solely in their heater parameters:

- **6AF3**: Designed for parallel heater circuits, requiring **6.3 V** at **1.2 A** (1200 mA).
- **12AF3**: Designed for series heater strings, requiring **12.6 V** at **0.6 A** (600 mA) with a controlled **11-second** warm-up time.

Technical Summary

The **12AF3** is a miniature, 9-pin half-wave vacuum rectifier designed for horizontal-deflection damper service in television receivers. It features a T-6 1/2 glass envelope, a 9CB base configuration, and a unipotential cathode. With a heater rated at 12.6 V and 0.6 A, it is optimized for series-string heater circuits and features a controlled 11-second warm-up time. The tube is rated for a maximum peak inverse plate voltage of 4500 V, a maximum DC plate current of 185 mA, and a maximum plate dissipation of 6.0 W. Its robust heater-cathode insulation allows it to withstand peak negative pulses up to 4500 V, making it highly reliable in demanding direct-drive television deflection circuits.



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 · Rectifier

OTHER		
PARAMETER	PUBLISHED VALUE	CONDITION / NOTE
Peak Inverse Plate Voltage	4700 V	DamperService



SOURCE OPERATING CONDITIONS

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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 · Rectifier

OTHER		
PARAMETER	PUBLISHED VALUE	CONDITION / NOTE
Maximum heater-cathode voltage, heater negative DC	1000 V	DamperService
Maximum heater-cathode voltage, heater negative total DC and peak	4500 V	DamperService
Maximum heater-cathode voltage, heater positive DC	100 V	DamperService
Maximum heater-cathode voltage, heater positive total DC and peak	300 V	DamperService
Maximum bulb temperature	210 C	WholeTube

Characteristic		
Parameter	Published Value	Condition / Note
Tube voltage drop at 340 mA	7 V	InstantaneousPlateCurrent=340mA



SOURCE DATA APPENDIX

SOURCE OPERATING CONDITIONS

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1971 RCA HB3 Binder 5 of 7

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

1971 RCA HB3 BINDER 5 OF 7

Section 1 · Rectifier

Other		
Parameter	Published Value	Condition / Note
Peak Inverse Voltage	5000 V	—
DC Output Current	175 mA	—
Peak Forward Current	800 mA	—
Peak Heater-Cathode Voltage	900 V	—
Warm-up Time	11 s	—

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