



ELECTRONIC TUBE REFERENCE

12DM4A

Rectifier - Damper Diode electronic tube

CONSOLIDATED TECHNICAL DATA

1 SECTION
CONSTRUCTION
RECTIFIER

Indirectly heated half-wave rectifier designed for television horizontal-deflection damper service, with high heater-cathode insulation and approximately 5 kV inverse-voltage capability.

GENERAL CHARACTERISTICS

BASE DESIGNATION	—	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

SECTION RATINGS

SECTION 1 Rectifier	
MAXIMUM PLATE DISSIPATION	6.5 W
PEAK INVERSE VOLTAGE	5000 V
NOMINAL OUTPUT CURRENT	200 mA
PEAK FORWARD CURRENT	1.2 A
FORWARD VOLTAGE DROP	35 V
MAXIMUM HEATER-CATHODE VOLTAGE	900 V
WARM-UP TIME	11 s
<i>Published Westinghouse ratings, characteristics, capacitances, pulse/deflection data, and typical operating conditions promoted where applicable; additional values retained as parameters.</i>	

12DM4A — Half-Wave Vacuum Diode

Overview

The **12DM4A** is an octal-based, indirectly-heated half-wave rectifier designed specifically for use as a damper diode in the horizontal deflection circuits of television receivers. Housed in a T-9 glass envelope, this tube is engineered to withstand the high-voltage pulses and demanding thermal conditions characteristic of television damper service.

The 12DM4A belongs to a family of structurally similar damping diodes, sharing identical electrical and mechanical designs with the [6DM4A](#) and [17DM4A](#) except for their heater ratings. Additionally, the 12DM4A is identical to the older [12DM4](#) but features uprated plate current capabilities, allowing for improved performance in demanding deflection systems.

Heater Characteristics and Series-String Design

The 12DM4A is specifically optimized for television receivers utilizing series-connected heater strings, where the picture tube heater and other tube heaters are wired in series. To prevent damaging voltage surges across individual heaters during startup, the 12DM4A features a closely controlled heater warm-up characteristic. When combined with other tubes designed with the same nominal heater current rating, the voltage distribution across the string remains balanced during the warm-up phase.

Heater Parameter	Value
Nominal Heater Voltage	12.6 V
Nominal Heater Current	600 mA (0.60 A)
Heater Supply Limits (Current Operation)	600 ± 40 mA
Heater Warm-up Time	11 seconds

The nominal heater power consumption can be calculated as follows: $\text{Heater Power} = \text{Heater Voltage} \times \text{Heater Current} = 12.6 \text{ V} \times 0.60 \text{ A} = 7.56 \text{ W}$

Heater Warm-up Time Definition

The controlled warm-up time of 11 seconds is defined under standardized test conditions. Specifically, it is the time required for the voltage across the heater to reach 80% of its rated value (10.08 V) after applying four times the rated heater voltage (50.4 V) to a test circuit. This test circuit consists of the tube heater connected in series with an external resistance equal to three times the nominal heater operating resistance at its rated operating temperature.

Physical Construction and Basing

The 12DM4A is constructed using a T-9 glass bulb mated to a 5-pin octal base. Depending on the manufacturer, the base may be configured as an intermediate-shell octal base (JEDEC B5-85) or a short intermediate-shell octal base (JEDEC B5-147). The tube can be operated in any mounting position.

Physical Dimensions

- **Maximum Overall Length:** 3.812 inches (3-13/16")
- **Maximum Seated Height:** 3.250 inches (3-1/4")
- **Maximum Bulb Diameter:** 1.188 inches (1-3/16")
- **Maximum Base Diameter:** 1.281 inches (1-9/32")

Basing and Socket Considerations

The tube utilizes the **JEDEC 4CG** basing arrangement, viewed from the bottom of the tube:

Pin Number	Connection
Pin 1	No Pin (Internal Connection / Stem Lead)
Pin 2	Internal Connection (IC)
Pin 3	Cathode (K)
Pin 4	No Pin
Pin 5	Plate (P)
Pin 6	No Pin (Internal Connection / Stem Lead)
Pin 7	Heater (H)
Pin 8	Heater (H)

Because of the high voltages present in horizontal deflection circuits, specific precautions must be observed regarding the socket connections:

- **No-Pin Positions:** Although the base does not have physical pins at positions 1, 4, and 6, positions 1 and 6 contain internal connections that terminate in stem leads inside the tube envelope.
- **Pin 2 Connection:** Base terminal position 2 has a physical pin that may be connected to an internal stem lead.
- **Arcover Prevention:** Due to the close physical proximity of these internal stem leads to the socket pin clips when the tube is seated, socket terminals 1, 2, 4, and 6 must **never** be used as circuit tie points. To minimize the risk of voltage breakdown and arcover in both the tube base and the socket, it is highly recommended to physically remove the socket clips for positions 1, 2, 4, and 6 from the damper tube socket.

Electrical Ratings and Damper Service

The ratings of the 12DM4A are defined under the Design Maximum System (EIA Standard RS-239). These limits must not be exceeded under the worst-case operating conditions of line voltage, component tolerances, and signal variation.

Damper Service Maximum Ratings

The primary application of the 12DM4A is horizontal damper service. The maximum ratings for this service are:

Parameter	Design Maximum Limit
Peak Inverse Voltage	5000 V
Peak Plate Current	1200 mA
DC Plate Current	200 mA
Plate Dissipation	6.5 W

Heater-Cathode Voltage Ratings

Because the cathode of a damper diode is subjected to high-amplitude pulse voltages during the horizontal retrace interval, the insulation between the heater and cathode is highly robust. The maximum allowable heater-cathode voltages are:

- **Heater Negative with Respect to Cathode:**
 - DC Limit: 900 V
 - Total DC and Peak Limit: 5000 V
- **Heater Positive with Respect to Cathode:**
 - DC Limit: 100 V
 - Total DC and Peak Limit: 300 V

Television System Operating Conditions

The pulsed ratings for damper service are specified for operation in a standard **525-line, 30-frame television system** (as described in the Federal Communications Commission's Standards of Good Engineering Practice for Television Broadcasting Stations). Under these operating conditions:

- The duty cycle of the horizontal voltage pulse must not exceed **15% of one scanning cycle**.
- In a standard 525-line, 30-frame system, 15% of one horizontal scanning cycle corresponds to a maximum pulse duration of **10 microseconds**.

Operating Characteristics and Plate Curves

Under typical operating conditions, the 12DM4A exhibits a low internal voltage drop, which maximizes efficiency in the horizontal deflection circuit.

- **Typical Tube Voltage Drop:** 35 Volts at a forward plate current (I_b) of 400 mA.

Direct Interelectrode Capacitances

The direct capacitances of the tube electrodes, measured without an external shield, are:

- **Heater to Cathode:** 4.0 pF
- **Plate to Cathode (and Heater):** 8.5 pF
- **Cathode to Plate and Heater:** 11.5 pF

Average Plate Characteristics

The average plate characteristics curve illustrates the relationship between forward plate voltage and plate current. The tube begins conducting at very low plate voltages.

- At **10 V** on the plate, the current is approximately 75 mA.
- At **20 V**, the current rises to approximately 175 mA.
- At **30 V**, the current reaches approximately 310 mA.
- At **35 V** (the typical rating point), the current is exactly 400 mA.
- At **50 V**, the current increases to approximately 680 mA.
- At **70 V**, the current exceeds 1000 mA (1.0 A), demonstrating the high emission capability of the coated unipotential cathode under peak load conditions.

The curve is non-linear, showing a typical space-charge-limited diode characteristic where the current increases more rapidly at higher plate voltages before approaching emission limits.

Related Designations and Comparisons

The 12DM4A is part of a family of damper diodes designed for different heater configurations:

- **6DM4A:** Designed for parallel heater circuits or 1.2 A series strings, requiring a heater supply of **6.3 V $\pm$ 10% at 1.2 A**.
- **17DM4A:** Designed for 450 mA series heater strings, requiring a heater supply of **16.8 V at 0.45 $\pm$ 0.03 A**.
- **12DM4:** An earlier version of the tube. While the 12DM4A shares the same physical dimensions, basing, and heater characteristics as the 12DM4, the "A" suffix denotes uprated plate current capabilities (higher peak and DC plate current limits), making the 12DM4A a superior choice for high-power deflection circuits.

These tubes are not directly interchangeable without modifying the heater supply circuit, except where the heater ratings are identical.

Technical Summary

The **12DM4A** is a specialized, indirectly-heated half-wave vacuum diode designed for television horizontal damper service. It features a **12.6 V, 600 mA** heater with a controlled **11-second warm-up time** optimized for series-string receiver designs. Utilizing a **JEDEC 4CG** 5-pin octal base and a **T-9** glass envelope, the tube is rated for a peak inverse voltage of **5000 V**, a peak plate current of **1200 mA**, and a DC plate current of **200 mA**. Its low internal voltage drop of **35 V at 400 mA** and high heater-cathode insulation (up to **5000 V peak**) make it highly reliable in high-voltage pulse environments.



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
Service	Television horizontal-deflection damper	—
Heater Warmup Time	11 s	—



SOURCE OPERATING CONDITIONS

1965 Sylvania Electronic Tubes Vol3

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

1965 SYLVANIA ELECTRONIC TUBES VOL3

Section 1 · Rectifier

OTHER		
PARAMETER	PUBLISHED VALUE	CONDITION / NOTE
Peak inverse voltage	5000 V	—
Peak plate current	1200 mA	—
DC plate current	200 mA	—

CAPACITANCE		
PARAMETER	PUBLISHED VALUE	CONDITION / NOTE
Heater-to-cathode capacitance	4 pF	—
Plate-to-cathode/heater capacitance	8.5 pF	—



SOURCE OPERATING CONDITIONS

[SOURCE PDF](#)

1965 Westinghouse Data Book

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

1965 WESTINGHOUSE DATA BOOK

Section 1 · Rectifier

OTHER		
PARAMETER	PUBLISHED VALUE	CONDITION / NOTE
Peak inverse voltage maximum	5000 V	—
DC output/plate current maximum	200 mA	—
Heater-cathode voltage maximum	900 V	—

APPLICATION		
PARAMETER	PUBLISHED VALUE	CONDITION / NOTE
Application	Television damping diode	—



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 · Rectifier

CHARACTERISTIC		
PARAMETER	PUBLISHED VALUE	CONDITION / NOTE
Heater-to-cathode capacitance	4 pF	WholeTube
Plate-to-cathode capacitance	8.6 pF	WholeTube
Cathode-to-plate-and-heater capacitance	11.5 pF	WholeTube

OTHER		
PARAMETER	PUBLISHED VALUE	CONDITION / NOTE
Maximum heater-cathode voltage, heater negative DC	900 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

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