



ELECTRONIC TUBE REFERENCE

12AX3

Rectifier - Damper Diode electronic tube

CONSOLIDATED TECHNICAL DATA

1 SECTION

CONSTRUCTION

RECTIFIER

High-voltage television damper diode designed for horizontal-deflection circuits, with approximately 5 kV peak-inverse rating, high pulse current, and controlled heater warm-up.

GENERAL CHARACTERISTICS

BASE DESIGNATION	12BE	BASE PINS	12
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	5.3 W
PEAK INVERSE VOLTAGE	5000 V
NOMINAL OUTPUT CURRENT	165 mA
PEAK FORWARD CURRENT	1 A
FORWARD VOLTAGE DROP	32 V
MAXIMUM HEATER-CATHODE VOLTAGE	5000 V
WARM-UP TIME	11 s
TV damping diode.	

12AX3 — Half-Wave Vacuum Rectifier

An indirectly heated, single-diode compactron designed for damper service in the horizontal-deflection circuits of television receivers.

Overview

The **12AX3** is a compactron (duodecar) type half-wave vacuum rectifier engineered specifically for use as a damping diode in television receiver horizontal-deflection circuits. It features a coated unipotential cathode and is housed in a T-9 glass envelope with a 12-pin button base. The device is rated for operation in standard 525-line, 30-frame television scanning systems. Except for its heater voltage, current, and controlled warm-up characteristics, the 12AX3 is electrically identical to the [6AX3](#) and [17AX3](#).

Mechanical Design and Pin Configuration

The 12AX3 utilizes a compactron T-9 glass bulb construction with a 12-pin button base (E12-70 designation). The physical dimensions of the tube are:

- **Maximum Diameter:** 1.188 inches
- **Maximum Seated Height:** 2.250 inches
- **Maximum Overall Height:** 2.596 to 2.625 inches

The tube can be mounted in any position. Because it is a power-handling device, adequate ventilation must be provided in equipment designs to prevent thermal damage.

The basing arrangement (JEDEC 12BL or 12FX) provides the following pin connections, viewed from the bottom of the tube:

- **Pin 1:** Heater (H)
- **Pin 2:** No Connection (NC)
- **Pin 3:** No Connection (NC)
- **Pin 4:** Plate (P)
- **Pin 5:** Internal Connection (IC) — *Do not use as a tie point*
- **Pin 6:** Internal Connection (IC) — *Do not use as a tie point*
- **Pin 7:** Cathode (K)
- **Pin 8:** Internal Connection (IC) — *Do not use as a tie point*
- **Pin 9:** Internal Connection (IC) — *Do not use as a tie point*
- **Pin 10:** Plate (P)
- **Pin 11:** No Connection (NC)
- **Pin 12:** Heater (H)

The internal connections (pins 5, 6, 8, and 9) must not be used as circuit tie points to prevent internal voltage breakdown or parasitic effects.

Heater Specifications and Controlled Warm-Up

The 12AX3 features an indirectly heated, coated unipotential cathode. The heater is designed for series-string or parallel operation with the following characteristics:

- **Nominal Heater Voltage:** 12.6 V (AC or DC)
- **Nominal Heater Current:** 0.6 A (600 mA)

- **Heater Current Tolerance:** 600 $\pm$ 40 mA (for current-series operation)
- **Heater Voltage Tolerance:** 12.6 $\pm$ 1.2 V (at 0.600 A)
- **Average Heater Warm-Up Time:** 11 seconds

Equipment designers must ensure that the heater current is centered at the specified bogey value of 0.6 A, with supply variations restricted to maintain the current within the specified tolerance.

The controlled heater warm-up time of 11 seconds is defined as the time required for the voltage across the heater to reach 80% of its rated value (10.08 V) after applying 4 times the rated heater voltage (50.4 V) to a circuit consisting of the tube heater in series with a resistance equal to 3 times the nominal heater operating resistance.

Direct Interelectrode Capacitances

The direct interelectrode capacitances of the 12AX3 are measured without an external shield. Typical values are:

- **Cathode to Plate and Heater [K to (P + H)]:** 7.5 pF
- **Plate to Cathode and Heater [P to (K + H)]:** 5.5 pF
- **Heater to Cathode [H to K]:** 2.8 pF

Damper Service Ratings and Operating Limits

The 12AX3 is rated under the Design-Maximum Rating System for TV damper service in a 525-line, 30-frame system. The maximum ratings are:

- **Peak Inverse Plate Voltage:** 5000 V (The pulse duration must not exceed 15% of a horizontal scanning cycle, which corresponds to 10 microseconds).
- **Peak Plate Current:** 1000 mA
- **Average Plate Current:** 165 mA
- **Plate Dissipation:** 5.3 W
- **Maximum Heater-Cathode Voltage (Heater Negative with respect to Cathode):**
 - DC Component: 900 V
 - Total DC and Peak: 5000 V
- **Maximum Heater-Cathode Voltage (Heater Positive with respect to Cathode):**
 - DC Component: 100 V
 - Total DC and Peak: 300 V

Electrical Characteristics and Curve Analysis

In typical operation, the tube exhibits a low internal voltage drop, which is critical for maintaining high efficiency in television horizontal-deflection systems.

- **Tube Voltage Drop:** 32 V at a DC plate current of 250 mA.

The relationship between plate voltage and plate current is illustrated by the tube's characteristic curve. At low plate potentials, the current rises rapidly:

- At **10 V** plate potential, the plate current is approximately **70 mA**.
- At **20 V** plate potential, the plate current is approximately **150 mA**.
- At **40 V** plate potential, the plate current is approximately **350 mA**.
- At **60 V** plate potential, the plate current is approximately **630 mA**.
- At **67 V** plate potential, the plate current reaches approximately **750 mA**.

This steep curve indicates a low dynamic plate resistance, allowing the tube to conduct heavily during the flyback period with minimal power loss.

Related Designations

The 12AX3 belongs to a family of identical damper diodes that differ only in their heater ratings:

- **6AX3**: Designed for 6.3 V, 1.2 A heater supplies.
- **17AX3**: Designed for 16.8 V, 0.45 A heater supplies.

Additionally, the 12AX3 shares similar electrical ratings (such as 5000 V peak inverse voltage, 5.3 W plate dissipation, and a 32 V drop at 250 mA) with octal-based damper tubes like the **12AX4GTB** and **12AX4GTA**. However, these octal types use a different physical construction (octal T-9 bulb with a 5-pin base and 4CG basing) and have slightly different capacitances (e.g., heater-to-cathode capacitance of 4.0 pF for the **12AX4GTB** compared to 2.8 pF for the 12AX3).

Technical Summary

The **12AX3** is a compactron-type, half-wave vacuum rectifier designed for TV damper service. Operating with a 12.6 V, 0.6 A heater and featuring an average warm-up time of 11 seconds, it provides reliable high-voltage performance. With a peak inverse plate voltage rating of 5000 V, a peak plate current capability of 1000 mA, and a low forward voltage drop of 32 V at 250 mA, the 12AX3 is optimized for the demanding environment of television horizontal-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
Service	Television damper 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

OTHER

PARAMETER	PUBLISHED VALUE	CONDITION / NOTE
Peak inverse plate voltage	5000 V	TVDamperService
Plate dissipation	5.3 W	TVDamperService
Steady state peak plate current	1000 mA	TVDamperService
DC output current	165 mA	TVDamperService
Heater warm-up time	11 s	—

CHARACTERISTIC

PARAMETER	PUBLISHED VALUE	CONDITION / NOTE
Tube voltage drop at 250 mA	32 V	TVDamperService

CAPACITANCE		
PARAMETER	PUBLISHED VALUE	CONDITION / NOTE
Cathode-to-plate-and-heater capacitance	7.5 pF	—
Plate-to-cathode-and-heater capacitance	5.5 pF	—
Heater-to-cathode capacitance	2.8 pF	—



SOURCE DATA APPENDIX

SOURCE OPERATING CONDITIONS

[SOURCE PDF](#)

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 plate voltage	5000 V	DamperService
Peak plate current	1000 mA	DamperService
DC plate current	165 mA	DamperService
Plate dissipation	5.3 W	DamperService

CHARACTERISTICS		
PARAMETER	PUBLISHED VALUE	CONDITION / NOTE
Tube voltage drop at 250 mA	32 V	DamperService
Heater voltage nominal	12.6 V	—
Heater current	600 mA	—
Heater warm-up time	11 s	Average



SOURCE DATA APPENDIX

1975 RCA RC30

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

1975 RCA RC30

Section 1 · Rectifier

CHARACTERISTIC		
PARAMETER	PUBLISHED VALUE	CONDITION / NOTE
Plate Current	15 mA	Published value from supplied target entry
Grid-No	3.5 mA	Published value from supplied target entry
Grid-No	1	Published value from supplied target entry
Heater Voltage (ac/dc)	16.8 volts	Published value from supplied target entry
Heater Current	0.45 amperes	Published value from supplied target entry
Heater Warm-up Time (Average)	11 seconds	Published value from supplied target entry
Peak Inverse Plate Voltage#	5000 volts	Published value from supplied target entry
Peak Plate Current	1000 mA	Published value from supplied target entry
Average Plate Current	165 mA	Published value from supplied target entry
Plate Dissipation	5.3 watts	Published value from supplied target entry
Tube Voltage Drop for plate current of	32 mA	Published value from supplied target entry
Heater Voltage (ac/dc)	16.8	Published value from supplied target entry
Heater Current	0.45 amperes	Published value from supplied target entry
Heater Warm-up Time (Average)	11 seconds	Published value from supplied target entry

CAPACITANCE		
PARAMETER	PUBLISHED VALUE	CONDITION / NOTE
Plate to Cathode and Heater	5.5 pF	Published value from supplied target entry
Cathode to Plate and Heater	7.5 pF	Published value from supplied target entry
Heater to Cathode	2.8 pF	Published value from supplied target entry
Cathode to Plate and Heater	8.5 pF	Published value from supplied target entry
Plate to Cathode and Heater	5 pF	Published value from supplied target entry
Heater to Cathode	4 pF	Published value from supplied target entry