



ELECTRONIC TUBE REFERENCE

12AX7WB

Voltage - Dual Triode (similar) electronic tube

CONSOLIDATED TECHNICAL DATA

2 SECTIONS

CONSTRUCTION

TRIODE-TRIODE

Ruggedized high-mu twin triode intended for dependable high-gain voltage-amplifier service, including audio amplification, phase inversion, and related control circuits.

GENERAL CHARACTERISTICS

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

SECTION RATINGS

SECTION1 Triode	
TRANSCONDUCTANCE	0.0016 S
AMPLIFICATION FACTOR	100
MAXIMUM PLATE VOLTAGE	300 V
MAXIMUM PLATE DISSIPATION	1 W
MAXIMUM CATHODE CURRENT	8 mA
Representative section for two electrically identical sections.	

SECTION2 Triode	
TRANSCONDUCTANCE	0.0016 S
AMPLIFICATION FACTOR	100
MAXIMUM PLATE VOLTAGE	300 V
MAXIMUM PLATE DISSIPATION	1 W
MAXIMUM CATHODE CURRENT	8 mA
Second physical triode section; electrically identical twin section.	

12AX7WB — Miniature Twin Triode Vacuum Tube

An indirectly heated, dual-section miniature receiving valve designed for low-frequency voltage amplification in radio engineering devices.

Overview

The **12AX7WB** (also designated as **12AX7WB/7025**) is a miniature twin triode vacuum tube featuring equipotential (indirectly heated) cathodes. It is engineered specifically to amplify low-frequency voltage in various radio engineering applications. The device integrates two independent triode systems within a single compact glass envelope, sharing a common heater arrangement designed to support both series and parallel filament connections.

Physical Dimensions and Pin Configuration

The 12AX7WB is constructed in a miniature glass envelope with a 9-pin base arrangement. The physical dimensions and mechanical specifications of the tube are detailed below:

Dimension Parameter	Value
Maximum overall height	56.5 mm
Envelope diameter	22.5 mm (with a -2 mm tolerance)
Pin circle diameter	12 mm
Pin diameter	1.0 mm (with a tolerance of +0.03 mm to -0.07 mm)
Pin spacing	8 intervals of 36° (288° total)

Pinout and Electrode Connections

The base connections, viewed from the bottom of the tube, correspond to the following electrode assignments:

Pin Number	Electrode Connection
1	Second triode plate
2	Second triode grid
3	Second triode cathode
4	Heater
5	Heater
6	First triode plate
7	First triode grid
8	First triode cathode
9	Heater center-tap

The heater configuration utilizes pins 4, 5, and 9, allowing the filaments of the two triode sections to be wired in either series or parallel depending on circuit requirements.

Electrical Parameters and Operating Conditions

The electrical characteristics of the 12AX7WB are specified under defined test conditions. Unless otherwise noted, these parameters are measured at a plate voltage of 250 V and a grid bias voltage of -1.5 V.

Heater Ratings

The tube's heater can be operated in two configurations:

- **Parallel Connection (6.3 V nominal):** Requires a filament voltage range of 6.0 V to 6.6 V, resulting in a heater current draw between 300 mA and 340 mA.
- **Series Connection (12.6 V nominal):** Requires a filament voltage range of 12.0 V to 13.2 V, resulting in a heater current draw between 150 mA and 170 mA.

Heater Power Calculation: Using the nominal midpoint values of the heater specifications, the power consumption is calculated as follows:

- For parallel connection: $6.3\text{ V} \times 0.32\text{ A} = \mathbf{2.016\text{ W}}$
- For series connection: $12.6\text{ V} \times 0.16\text{ A} = \mathbf{2.016\text{ W}}$ These calculations demonstrate that the nominal power consumption of the heater remains identical in both wiring configurations.

Active Characteristics (per Triode Section)

At the standard operating point (plate voltage of 250 V, grid voltage of -1.5 V, and filament voltage of 6.3 V or 12.6 V):

- **Plate Current:** 1.2 mA to 3.0 mA
- **Transconductance (Slope of Characteristic):** Minimum of 1.4 mA/V
- **Amplification Factor (μ):** 95 to 125
- **Grid Reverse Current:** Maximum of 0.2 μ A (measured with a grid circuit resistance of 1.0 M Ω)
- **Section Matching:** The difference in plate current between the first and second triode sections is a maximum of $\pm 40\%$.

Cutoff and Insulation Parameters

- **Cutoff Plate Current (Beginning of Characteristic):** Maximum of 20 μ A, measured at a grid bias of -5.5 V (with plate voltage at 250 V).
- **Cathode-to-Heater Insulation Resistance:** Minimum of 20 M Ω , evaluated at a cathode-to-heater voltage of ± 200 V.

Limiting Values and Maximum Ratings

To ensure reliable operation and prevent premature failure, the operating conditions of the 12AX7WB must be maintained within the following absolute limits:

Parameter	Minimum Limit	Maximum Limit
Filament voltage (parallel connection)	6.0 V	6.6 V
Filament voltage (series connection)	12.0 V	13.2 V
Plate voltage	—	300 V
Cathode-to-heater voltage	—	± 200 V
Cathode current	—	10 mA
Power dissipation at the plate of each triode	—	1.0 W
Grid circuit resistance (fixed bias)	—	1.0 M Ω
Grid circuit resistance (self-bias)	—	2.2 M Ω
Temperature at the most heated part of the envelope	—	368 K

Characteristic Curves and Graphical Analysis

The performance of the 12AX7WB is illustrated by two primary sets of characteristic curves, both plotted at a nominal filament voltage of 6.3 V:

Plate Current vs. Grid Voltage ($I_p = f(E_g)$)

This transfer characteristic shows the relationship between plate current and grid bias voltage across three distinct plate voltages: 200 V, 250 V, and 300 V.

- At a plate voltage of 250 V, the curve demonstrates a typical operating current of approximately 2.0 mA at a grid bias of -1.5 V, which lies comfortably within the specified nominal range of 1.2 mA to 3.0 mA.
- As the grid bias is made more negative, the plate current decreases. The cutoff region (where plate current approaches zero) occurs near -5.5 V, which aligns with the specified maximum cutoff current of 20 μ A at this bias point.
- Higher plate voltages shift the transfer curve to the left, requiring a more negative grid voltage to achieve the same plate current or cutoff.

Plate Current vs. Plate Voltage ($I_p = f(E_p)$)

This family of plate curves plots plate current against plate voltage for grid bias steps from 0 V to -3.5 V in 0.5 V increments.

- At a grid voltage of 0 V, the plate current rises rapidly with plate voltage, reaching approximately 3.5 mA at a plate voltage of 100 V.
- Successive negative increments of grid voltage shift the curves to the right, illustrating the high amplification factor (95 to 125) of the tube, where small changes in grid voltage require large changes in plate voltage to maintain a constant plate current.
- The curves provide the graphical basis for determining load lines, output voltage swing, and distortion characteristics in low-frequency voltage amplifier designs.

Technical Summary

The **12AX7WB/7025** is a high-mu, miniature twin triode designed for low-frequency voltage amplification. Featuring independent triode sections with separate cathodes and a versatile heater arrangement (supporting 6.3 V parallel or 12.6 V series operation), it offers an amplification factor of 95 to 125 and a minimum transconductance of 1.4 mA/V. With a maximum plate voltage rating of 300 V, a plate dissipation limit of 1.0 W per section, and a maximum envelope temperature of 368 K, the 12AX7WB provides stable and reliable performance in radio engineering and audio amplification applications.