



ELECTRONIC TUBE REFERENCE

12AT7WCEH

Voltage - Dual Triode (similar) electronic tube

CONSOLIDATED TECHNICAL DATA

2 SECTIONS

CONSTRUCTION

TRIODE-TRIODE

Modern WC/EH 12AT7-family twin triode for low-frequency voltage amplification, retaining medium-high gain and transconductance suited to audio preamplifier and driver circuits.

GENERAL CHARACTERISTICS

BASE DESIGNATION	—	BASE PINS	—
NOMINAL HEATER	6.3 V / 355 mA	PARALLEL HEATER	6.3 V / 355 mA
HEATING	Indirect	SERIES OPERATION	Capable
CATHODE ARRANGEMENT	Separate cathodes	SECTION CONSTRUCTION	Similar

SECTION RATINGS

SECTION1 Triode	
TRANSCONDUCTANCE	0.00545 S
AMPLIFICATION FACTOR	45
MAXIMUM PLATE VOLTAGE	300 V
MAXIMUM PLATE DISSIPATION	2.5 W
<i>Representative section for two electrically identical triodes.</i>	

SECTION2 Triode	
TRANSCONDUCTANCE	0.00545 S
AMPLIFICATION FACTOR	45
MAXIMUM PLATE VOLTAGE	300 V
MAXIMUM PLATE DISSIPATION	2.5 W
<i>Second identical physical triode section; added to align rows with SectionCount.</i>	

12AT7WCEH — Miniature Twin Triode Vacuum Tube

The **12AT7WCEH** is a miniature twin triode vacuum tube featuring equipotential (indirectly heated) cathodes. It is designed primarily for the amplification of low-frequency voltage in radio engineering devices. The tube integrates two independent triode sections within a single compact glass envelope, sharing a common heater arrangement that supports both series and parallel operation.

Physical Dimensions and Pin Configuration

The 12AT7WCEH is housed in a miniature glass envelope with a 9-pin base. The physical dimensions and pin layout are precisely specified to ensure proper mechanical fit and electrical connection:

- **Maximum Height:** 56.5 mm
- **Envelope Diameter:** 22.5 mm (with a tolerance of -2 mm, resulting in a range of 20.5 mm to 22.5 mm)
- **Pin Circle Diameter:** 12 mm
- **Pin Diameter:** 1.0 mm (with a tolerance of +0.03 mm to -0.07 mm)
- **Pin Spacing:** 36° angular spacing between adjacent pins, spanning a total of 288° (8 × 36°) around the base, leaving a gap for indexing.

The electrode connections to the external pins are designated as follows:

Lead Designation	Electrode Name
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

The heater is tapped, allowing connection to pins 4, 5, and 9 to accommodate different supply configurations.

Heater and Cathode Characteristics

The 12AT7WCEH is designed with equipotential cathodes and a versatile heater filament that can be wired for either parallel or series operation depending on the available supply voltage.

- **Parallel Connection:** When configured for parallel operation, the nominal filament voltage is **6.3 V** (with an allowable range of **6.0 V to 6.6 V**). Under this condition, the heater current is between **340 mA and 370 mA**.
- **Series Connection:** When configured for series operation, the nominal filament voltage is **12.6 V** (with an allowable range of **12.0 V to 13.2 V**). Under this condition, the heater current is between **170 mA and 185 mA**.

The insulation between the heater and the cathode is rated to withstand a maximum voltage of **±200 V**. Under these conditions, the cathode-to-heater insulation resistance is a minimum of **20 MΩ** (measured at a filament voltage of either 6.3 V or 12.6 V).

Electrical Parameters and Operating Points

The electrical characteristics of the 12AT7WCEH are measured under specific test conditions, typically with a plate voltage of 250 V and a negative grid bias of 2.0 V. The nominal parameters for each triode section are detailed below:

Parameter	Test Conditions	Minimum	Maximum
Plate Current	$U_f = 6.3 \text{ V or } 12.6 \text{ V}$, $U_p = 250 \text{ V}$, $U_g = -2.0 \text{ V}$	7.0 mA	16.0 mA
Slope of Characteristic (Transconductance)	$U_f = 6.3 \text{ V or } 12.6 \text{ V}$, $U_p = 250 \text{ V}$, $U_g = -2.0 \text{ V}$	4.1 mA/V	6.8 mA/V
Amplification Factor (μ)	$U_f = 6.3 \text{ V or } 12.6 \text{ V}$, $U_p = 250 \text{ V}$, $U_g = -2.0 \text{ V}$	45	—
Grid Back Current	$U_f = 6.3 \text{ V or } 12.6 \text{ V}$, $U_p = 250 \text{ V}$, $U_g = -2.0 \text{ V}$, $R_g = 0.25 \text{ M}\Omega$	—	0.5 μA
Plate Current Difference (Between Sections)	$U_f = 6.3 \text{ V or } 12.6 \text{ V}$, $U_p = 250 \text{ V}$, $U_g = -2.0 \text{ V}$	—	±40%
Cutoff Plate Current	$U_f = 6.3 \text{ V or } 12.6 \text{ V}$, $U_p = 250 \text{ V}$, $U_g = -12.0 \text{ V}$	—	60 μA

The plate current difference limit of $\pm 40\%$ indicates the maximum allowable mismatch between the first and second triode sections within a single envelope under nominal operating conditions. The cutoff plate current parameter defines the beginning of the characteristic, showing that the plate current is suppressed to 60 μA or less when the grid is biased to -12.0 V at a plate voltage of 250 V.

Limiting Values and Operating Constraints

To ensure reliable operation and prevent premature degradation of the tube, circuit designs must adhere to the following maximum limiting values:

- **Maximum Plate Voltage:** 330 V
- **Maximum Cathode Current:** 18 mA
- **Maximum Plate Power Dissipation (per triode):** 3.25 W
- **Maximum Cathode-to-Heater Voltage:** ± 200 V
- **Maximum Grid Circuit Resistance:**
 - *Fixed Bias:* 0.25 M Ω
 - *Self-Bias:* 1.0 M Ω

The distinction between fixed bias and self-bias grid resistance is critical: self-bias operation allows for a higher grid circuit resistance (up to 1.0 M Ω) because the cathode resistor provides negative feedback that helps stabilize the operating point against variations in grid current.

Characteristic Curves and Behavior

The operational behavior of the 12AT7WCEH is illustrated by its transfer and plate characteristics:

Transfer Characteristics (I_p vs. E_g)

The relationship between plate current (I_p) and grid voltage (E_g) is documented at a filament voltage of 6.3 V for three distinct plate voltages: 200 V, 250 V, and 300 V.

- At a plate voltage of 300 V, the plate current reaches approximately 30 mA when the grid voltage approaches 0 V. The cutoff region is reached as the grid voltage becomes more negative, with the current dropping near zero as the grid voltage approaches -3.5 V.
- At lower plate voltages (200 V and 250 V), the curves shift to the right, requiring less negative grid bias to achieve cutoff and exhibiting lower plate current for any given grid voltage. For example, at $E_p = 200$ V, the plate current is approximately 16 mA at $E_g = 0$ V.

Plate Characteristics (I_p vs. E_p)

The plate family of curves plots plate current (I_p) against plate voltage (E_p) for grid bias steps from 0 V down to -3.5 V in 0.5 V increments (at $E_f = 6.3$ V):

- **$E_g = 0$ V Curve:** The plate current rises rapidly with plate voltage, exceeding 30 mA before the plate voltage reaches 300 V.

- **Negative Grid Bias Curves:** As the grid bias is made progressively more negative (-0.5 V, -1.0 V, -1.5 V, etc.), the curves shift to the right. This shift demonstrates that a higher plate voltage is required to initiate and maintain plate current. For instance, at a grid bias of -3.5 V, plate current only begins to flow significantly as the plate voltage exceeds approximately 120 V, reaching about 10 mA at a plate voltage of 300 V.

These curves demonstrate the tube's capability to operate over a wide range of plate voltages and currents, facilitating its application in various low-frequency voltage amplifier configurations.

Technical Summary

The **12AT7WCEH** is a versatile, high-gain miniature twin triode designed for low-frequency voltage amplification. It features independent triode sections with separate cathodes, allowing for flexible circuit topologies. The heater can be operated at either **6.3 V** (parallel) or **12.6 V** (series), drawing **340-370 mA** or **170-185 mA** respectively.

With an amplification factor of at least **45** and a transconductance (slope) ranging from **4.1 to 6.8 mA/V** under nominal conditions, the tube provides significant voltage gain. Designers must respect the maximum limits, including a plate voltage limit of **330 V**, a cathode current limit of **18 mA**, and a plate dissipation limit of **3.25 W** per triode, while selecting appropriate grid circuit resistance based on the biasing method.

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