

ELECTRONIC TUBE REFERENCE

12AU7W

Voltage - Dual Triode (similar) electronic tube

CONSOLIDATED TECHNICAL DATA
2 SECTIONS
CONSTRUCTION
TRIODE-TRIODE

12AU7-family medium-mu twin triode, co-designated 6189, intended for low-frequency voltage amplification with the characteristic moderate gain and useful current capability of this family.

GENERAL CHARACTERISTICS

BASE DESIGNATION	9A	BASE PINS	9
NOMINAL HEATER	12.6 V / 150 mA	PARALLEL HEATER	6.3 V / 300 mA
HEATING	Indirect	SERIES OPERATION	Capable
CATHODE ARRANGEMENT	Separate cathodes	SECTION CONSTRUCTION	Similar

9A - TERMINAL PINOUT

TERMINAL	SECTION	ELEMENT	STATUS
PIN1 – 2P	B	P – Plate (Anode)	CONNECTED
PIN2 – 2G1	B	G1 – Control Grid	CONNECTED
PIN3 – 2K	B	K – Cathode	CONNECTED
PIN4 – H	–	H – Heater	CONNECTED
PIN5 – H	–	H – Heater	CONNECTED
PIN6 – 1P	A	P – Plate (Anode)	CONNECTED
PIN7 – 1G1	A	G1 – Control Grid	CONNECTED
PIN8 – 1K	A	K – Cathode	CONNECTED
PIN9 – HCT	–	HCT – Heater Center Tap	CONNECTED

SECTION RATINGS

SECTION1 Triode	
TRANSCONDUCTANCE	0.0022 S
AMPLIFICATION FACTOR	17
MAXIMUM PLATE VOLTAGE	300 V
MAXIMUM PLATE DISSIPATION	2.75 W
Representative section for two electrically identical sections.	

SECTION2 Triode	
TRANSCONDUCTANCE	0.0022 S
AMPLIFICATION FACTOR	17
MAXIMUM PLATE VOLTAGE	300 V
MAXIMUM PLATE DISSIPATION	2.75 W
Second identical physical triode section; added to align rows with SectionCount.	

12AU7W — Miniature Twin Triode Vacuum Tube

The **12AU7W** (also designated as the **12AU7W/6189**) is a miniature twin triode vacuum tube manufactured by Tung-Sol. It features independent, equipotential (indirectly heated) cathodes and is engineered primarily to amplify low-frequency voltage in radio engineering devices.

Physical Dimensions and Pin Configuration

The 12AU7W is constructed in a miniature glass envelope. Its physical dimensions and mechanical specifications are as follows:

- **Maximum Overall Height:** 56.5 mm
- **Envelope Diameter:** 20.5 mm to 22.5 mm (specified as 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:** 36° angular spacing between adjacent pins (8 intervals of 36° for a total of 288° around the pin circle)

The tube utilizes a 9-pin base arrangement. The electrode connections to the external leads are defined as follows:

Lead Designation	Electrode Name
1	Second triode plate
2	Second triode grid

Lead Designation	Electrode Name
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 for flexible power supply configurations using pins 4, 5, and 9.

Heater and Filament Ratings

The 12AU7W heater can be operated in either a parallel or a series configuration, depending on the application requirements:

- **Parallel Connection:**
 - Nominal filament voltage: 6.3 V (allowable range: 6.0 V to 6.6 V)
 - Heater current: 300 mA to 350 mA
- **Series Connection:**
 - Nominal filament voltage: 12.6 V (allowable range: 12.0 V to 13.2 V)
 - Heater current: 150 mA to 175 mA

Electrical Parameters and Operating Characteristics

The nominal electrical parameters for each triode section of the 12AU7W are measured under specific operating conditions. Unless otherwise noted, these parameters are specified at a plate voltage of 250 V, a grid voltage of -8.5 V, and a filament voltage of either 6.3 V or 12.6 V:

- **Plate Current:** 7.8 mA to 13.0 mA
- **Section Matching:** The difference in plate current between the first and second triode sections is tightly controlled, with a maximum allowable difference of $\pm 15\%$.
- **Slope of Characteristic (Transconductance):** 1.7 mA/V to 3.0 mA/V
- **Amplification Factor:** Minimum of 13
- **Grid Reverse Current:** Maximum of 0.2 μ A (measured with a grid circuit resistance of 0.25 M Ω)
- **Cathode-Heater Insulation Resistance:** Minimum of 20 M Ω when subjected to a cathode-heater voltage of ± 200 V.
- **Cutoff Plate Current:** At the beginning of the characteristic, with a grid voltage of -25.0 V and a plate voltage of 250 V, the plate current is restricted to a maximum of 50 μ A.

Limiting Values

To ensure reliable operation and prevent premature failure, the 12AU7W must be operated within its established maximum limiting values:

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	—	22 mA
Plate Power Dissipation (per triode)	—	2.75 W
Grid Circuit Resistance (Fixed Bias)	—	0.25 MΩ
Grid Circuit Resistance (Self-Bias)	—	1.0 MΩ

Characteristic Curves and Behavior

The performance of the 12AU7W is illustrated by its transfer and plate characteristics under a nominal filament voltage (E_f) of 6.3 V:

Transfer Characteristics (I_p vs. E_g)

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

- At a plate voltage of 300 V, the plate current reaches approximately 50 mA as the grid voltage approaches 0 V. The cutoff region begins as the grid voltage is biased more negatively than -14 V.
- At lower plate voltages, such as 200 V, the curve shifts to the right, requiring less negative grid bias (around -10 V to -12 V) to approach cutoff, and producing lower plate current for any given grid voltage compared to the 300 V condition.

Plate Characteristics (I_p vs. E_p)

The plate family of curves plots plate current (I_p) against plate voltage (E_p) for discrete grid bias steps (E_g) ranging from 0 V down to -14 V:

- $E_g = 0$ V: The plate current rises rapidly with plate voltage, exceeding 40 mA before the plate voltage reaches 200 V.
- **Negative Grid Bias Steps:** As the grid bias is made progressively more negative (e.g., -2 V, -4 V, -6 V, -8.5 V, -10 V, -12 V, and -14 V), the curves shift progressively to the right. For example, at a grid bias of -8.5 V, a plate voltage of 250 V yields a nominal plate current within the specified 7.8 mA to 13.0 mA range. At -14 V grid bias, the tube remains cut off or conducts very little current until the plate voltage exceeds approximately 160 V.

These curves demonstrate the tube's capability to handle dynamic signal swings while maintaining predictable control over plate current via grid modulation.

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