

ELECTRONIC TUBE REFERENCE

12AU7WA

Voltage - Dual Triode (similar) electronic tube

CONSOLIDATED TECHNICAL DATA

2 SECTIONS

CONSTRUCTION

TRIODE-TRIODE

Military-specification 6189/12AU7-family ruggedized medium-mu twin triode for audio amplification, phase inversion, oscillators, and mixers, combining moderate gain with useful current capability.

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	
PLATE RESISTANCE	7700 Ω
TRANSCONDUCTANCE	0.0022 S
AMPLIFICATION FACTOR	17
MAXIMUM PLATE VOLTAGE	300 V
MAXIMUM PLATE DISSIPATION	2.75 W
MAXIMUM CATHODE CURRENT	22 mA
Representative row for electrically identical repeated sections.	

SECTION2 Triode	
PLATE RESISTANCE	7700 Ω
TRANSCONDUCTANCE	0.0022 S
AMPLIFICATION FACTOR	17
MAXIMUM PLATE VOLTAGE	300 V
MAXIMUM PLATE DISSIPATION	2.75 W
MAXIMUM CATHODE CURRENT	22 mA
Second identical physical triode section; added to align rows with SectionCount.	

12AU7WA — Ruggedized Medium-Mu Twin Triode

An industrial and military premium double triode designed for high reliability under severe shock and vibration, featuring independent triode sections and flexible heater configurations.

Overview

The **12AU7WA** (also designated as the **6189/12AU7WA**) is a premium, ruggedized, medium-mu twin triode utilizing a nine-pin miniature button construction. Developed as a high-reliability variant of the prototype **12AU7**, this tube is designed to meet stringent military specifications and critical industrial requirements. It is particularly suited for use in industrial and military airborne equipment where devices are subjected to severe mechanical shock and vibration.

The two triode sections within the envelope are electrically independent, allowing them to be operated simultaneously in entirely different applications. The tube is highly versatile, with documented applications including general-purpose audio-frequency voltage amplification, phase inverter circuits, oscillators, multivibrators, combined oscillator-mixers, and resistance-coupled amplifiers.

Construction, Physical Dimensions, and Base Connections

The 12AU7WA features a T-6 1/2 glass bulb envelope and a miniature button 9-pin base (basing designation **9A**). The tube can be mounted and operated in **any position**.

Physical Dimensions

The physical envelope dimensions are constrained to the following limits:

- **Maximum overall length:** 2 3/16 inches
- **Maximum seated height:** 1 15/16 inches
- **Maximum bulb diameter:** 7/8 inches

Heater and Cathode Design

The tube incorporates coated unipotential cathodes. The heater is designed with a center tap (connected to pin 9), allowing for operation from either a 6.3 V or a 12.6 V power supply, using either AC or DC:

- **Series Operation (12.6 V):** The heater voltage is applied between pin 4 and pin 5. The nominal current draw is **0.15 A**.
- **Parallel Operation (6.3 V):** The heater voltage is applied between pin 9 and pins 4 and 5 connected together. The nominal current draw is **0.3 A**.

Pinout Configuration

Viewed from the bottom of the miniature button base, the pin connections are assigned as follows:

- **Pin 1:** Plate, Triode Unit 2
- **Pin 2:** Grid, Triode Unit 2
- **Pin 3:** Cathode, Triode Unit 2
- **Pin 4:** Heater
- **Pin 5:** Heater
- **Pin 6:** Plate, Triode Unit 1
- **Pin 7:** Grid, Triode Unit 1
- **Pin 8:** Cathode, Triode Unit 1
- **Pin 9:** Heater Center Tap

Electrical Characteristics and Operating Points

The 12AU7WA is manufactured with tight controls on product averages to ensure that critical characteristics—such as plate current, transconductance, and amplification factor—remain well-centered.

Typical Class A1 Operating Conditions

The typical electrical characteristics for each individual triode section under Class A1 amplifier service are documented at two distinct operating points:

Parameter	Operating Point A	Operating Point B
Heater Voltage	12.6 V / 6.3 V	12.6 V / 6.3 V
Heater Current	0.15 A / 0.3 A	0.15 A / 0.3 A
Plate Voltage	100 V	250 V
Grid Voltage	0 V	-8.5 V
Plate Current	11.8 mA	10.5 mA
Plate Resistance (Approx.)	6,500 Ohms	7,700 Ohms
Transconductance	3,100 Hmhos	2,200 Hmhos
Amplification Factor	20	17
Grid Voltage for $I_b = 10$ HA (Approx.)	—	-24 V

Verification of Triode Relationships

The fundamental triode relationship ($H \approx gm \% rp$) can be verified mathematically using the typical operating parameters:

- **Calculation for Operating Point A:**
 - *Inputs:* $gm = 3,100 \text{ Hmhos} = 0.0031 \text{ S}$, $rp = 6,500 \text{ Ohms}$.
 - *Formula:* $H = 0.0031 \text{ S} \% 6,500 \text{ Ohms} = 20.15$.
 - *Result:* This closely aligns with the published typical amplification factor of **20**.
- **Calculation for Operating Point B:**
 - *Inputs:* $gm = 2,200 \text{ Hmhos} = 0.0022 \text{ S}$, $rp = 7,700 \text{ Ohms}$.
 - *Formula:* $H = 0.0022 \text{ S} \% 7,700 \text{ Ohms} = 16.94$.
 - *Result:* This closely aligns with the published typical amplification factor of **17**.

Absolute Maximum Ratings

To ensure reliable operation and prevent premature failure, the following absolute maximum limits must not be exceeded. These ratings apply to each individual section unless otherwise specified:

Rating Parameter	Absolute Maximum Value
Maximum DC Plate Voltage	330 V

Rating Parameter	Absolute Maximum Value
Maximum Plate Dissipation (per plate)	3.0 W
Maximum Heater-Cathode Voltage	%200 V
Maximum Peak DC Cathode Current (each section)	22 mA
Maximum Bulb Temperature	165 °C
Heater Voltage Tolerance	Nominal %10%

Resistance-Coupled Amplifier Performance

The 12AU7WA is highly effective in resistance-coupled voltage amplifier stages. The operating characteristics for a single section under various plate supply voltages (Ebb) and component values are detailed below. In these configurations, the maximum RMS voltage output (Eo) is specified for a limit of 5% Total Harmonic Distortion (THD), and the voltage gain is measured at an output level of 2.0 V RMS.

Rp (Megohms)	Rs (Megohms)	Rg1 (Megohms)	Ebb = 90 V (Rk / Gain / Eo)	Ebb = 180 V (Rk / Gain / Eo)	Ebb = 300 V (Rk / Gain / Eo)
0.10	0.10	0.10	3,300 Ohms / 14 / 13 V	2,200 Ohms / 14 / 26 V	1,800 Ohms / 14 / 40 V
0.10	0.24	0.10	3,600 Ohms / 14 / 16 V	2,700 Ohms / 15 / 33 V	2,200 Ohms / 15 / 51 V
0.24	0.24	0.10	7,500 Ohms / 14 / 16 V	5,100 Ohms / 15 / 30 V	4,300 Ohms / 15 / 44 V
0.24	0.51	0.10	9,100 Ohms / 14 / 19 V	6,800 Ohms / 15 / 39 V	5,100 Ohms / 15 / 54 V
0.51	0.51	0.10	13,000 Ohms / 14 / 16 V	9,100 Ohms / 15 / 36 V	6,800 Ohms / 16 / 40 V
0.51	1.00	0.10	15,000 Ohms / 14 / 19 V	10,000 Ohms / 16 / 32 V	7,500 Ohms / 16 / 45 V
0.24	0.24	10.0	0 Ohms / 15 / 13 V	0 Ohms / 16 / 33 V	0 Ohms / 17 / 46 V
0.24	0.51	10.0	0 Ohms / 16 / 17 V	0 Ohms / 17 / 38 V	0 Ohms / 18 / 62 V
0.51	0.51	10.0	0 Ohms / 16 / 14 V	0 Ohms / 18 / 32 V	0 Ohms / 18 / 53 V

Rp (Megohms)	Rs (Megohms)	Rg1 (Megohms)	Ebb = 90 V (Rk / Gain / Eo)	Ebb = 180 V (Rk / Gain / Eo)	Ebb = 300 V (Rk / Gain / Eo)
0.51	1.00	10.0	0 Ohms / 17 / 18 V	0 Ohms / 18 / 41 V	0 Ohms / 19 / 68 V

Note: For the zero-bias operating points ($R_k = 0$), the generator impedance is negligible. Coupling capacitors should be selected to achieve the desired low-frequency response, and the cathode resistor (R_k) must be adequately bypassed.

Interelectrode Capacitances

The direct interelectrode capacitances of the 12AU7WA are tightly controlled. The values differ slightly depending on whether an external shield is utilized:

Capacitance Parameter	With Shield	Without Shield
Triode Unit 1		
Grid to Plate	1.5 HHF	1.5 HHF
Input	1.8 HHF	1.6 HHF
Output	2.0 HHF	0.40 HHF
Triode Unit 2		
Grid to Plate	1.5 HHF	1.5 HHF
Input	1.8 HHF	1.6 HHF
Output	2.0 HHF	0.32 HHF

Quality Standards, Ruggedization, and Special Testing

To qualify as a premium military-grade component, the 12AU7WA is subjected to rigorous mechanical, environmental, and electrical testing protocols.

Mechanical and Environmental Testing

- **Shock Resistance:** The tube is tested using a specialized shock machine at a hammer angle of 30°, with a heater-to-cathode potential of 100 Vdc (heater positive) and a grid resistor (R_g) of 0.1 Megohm.
- **Vibration Testing:** Low-frequency vibration tests are conducted with a plate load resistance (R_p) of 2,000 Ohms, limiting vibration-induced noise to a maximum of 100 mVac. Variable-frequency vibration tests are also performed under identical load conditions, maintaining the same 100 mVac maximum limit.

- **Low Pressure Voltage Breakdown:** To ensure high-altitude performance, the tube must withstand a minimum of 500 Vac (60 Hz sinusoidal) at an ambient pressure of 55 % 5 mmHg, a temperature of 25 % 5 °C, and 0% humidity without arcing between the anode base pin and adjacent pins.
- **Glass Strain Test:** The physical integrity of the glass envelope is verified by completely submerging the tube in boiling water (97 °C to 100 °C) for 15 seconds, followed by an immediate plunge into cold water (0 % 3 °C).
- **Heater Cycling:** The heater structure is subjected to cyclic thermal stress to verify long-term mechanical stability.

Electrical Limits and Life Testing

Equipment design characteristics are specified under standard test conditions ($E_f = 12.6 \text{ V}$, $E_b = 250 \text{ Vdc}$, $E_c = -8.5 \text{ Vdc}$):

- **Heater Current Limits:** Initial and 500-hour life test limits are constrained between 138 mA and 162 mA.
- **Heater-Cathode Leakage:** At $E_{hk} = 100 \text{ Vdc}$, the leakage current must not exceed %10 HAdc initially and after 500 hours of life testing.
- **Grid Current:** Initial grid current is limited to a maximum of -0.5 HAdc with $R_g = 0.5 \text{ Megohm}$.
- **Plate Current Uniformity:** The initial plate current for an individual section must fall between 6.5 mA and 14.5 mA (with a production average of 9.0 to 12.0 mA). The maximum allowable difference in plate current between the two triode sections is 3.5 mAdc.
- **Transconductance Stability:** Initial transconductance must be between 1,750 and 2,650 Hmhos. After a 500-hour life test, the minimum transconductance must remain above 1,600 Hmhos, and the average change in transconductance must not exceed 15%.
- **Electrode Insulation:** The insulation resistance between the grid and all other electrodes (R_{g-all}), as well as between the plate and all other electrodes (R_{p-all}), must be at least 500 Megohms initially, and must remain above 250 Megohms after the 500-hour life test.
- **Post-Shock and Fatigue End Points:** Following severe shock and fatigue testing, the tube must maintain a minimum transconductance of 2,000 Hmhos (measured at $E_b = 100 \text{ Vdc}$, $E_c = 0$), a maximum low-frequency vibration output of 150 mVac, and a maximum heater-cathode leakage of %30 HAdc.

Technical Summary

The **12AU7WA** is a premium, nine-pin miniature twin triode engineered for high-reliability military and industrial applications. It features a dual-voltage heater (6.3 V / 12.6 V) with a center tap, coated unipotential cathodes, and two independent medium-mu triode units. With an amplification factor of 17 to 20 and a plate dissipation rating of 3.0 Watts per section, it serves as an exceptionally robust alternative to the standard [12AU7](#) prototype. Through rigorous quality controls—including shock, vibration, glass strain, high-altitude breakdown, and 500-hour life testing—the 12AU7WA ensures stable electrical performance and mechanical survivability in the most demanding airborne and industrial environments.

SOURCE OPERATING CONDITIONS

[SOURCE PDF](#)

1960 RCA Industrial and Communications Types

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

1960 RCA INDUSTRIAL AND COMMUNICATIONS TYPES

Section 1 · Triode

CHARACTERISTIC		
PARAMETER	PUBLISHED VALUE	CONDITION / NOTE
HeaterOrFilamentVoltage	12.6 V	—
HeaterOrFilamentCurrent	150 mA	—
MilitarySpecificationDesign	1 boolean	PremiumTube

SOURCE OPERATING CONDITIONS

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 · Triode

OTHER		
PARAMETER	PUBLISHED VALUE	CONDITION / NOTE
Plate Voltage	250 V	ClassA;EachSection
Service	Audio amplifier / phase inverter / oscillator / mixer	—

CHARACTERISTIC		
PARAMETER	PUBLISHED VALUE	CONDITION / NOTE
Plate Current	10.5 mA	ClassA;EachSection

SOURCE OPERATING CONDITIONS

[SOURCE PDF](#)

1966 Tung Sol Electronic Tubes 4 of 4

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

1966 TUNG SOL ELECTRONIC TUBES 4 OF 4

Section 1 · Triode

OTHER		
PARAMETER	PUBLISHED VALUE	CONDITION / NOTE
Heater/filament voltage	12.6 V	—
Heater/filament current	150 mA	—

APPLICATION		
PARAMETER	PUBLISHED VALUE	CONDITION / NOTE
Application summary	Co-designated ruggedized medium-mu twin triode from the 6189 sheet.	

CHARACTERISTIC		
PARAMETER	PUBLISHED VALUE	CONDITION / NOTE
Plate voltage	250 V	—
Plate current	10.5 mA	—
Plate resistance	7700 ohm	—
Transconductance	2200 uS	—
Amplification factor	17	—