



ELECTRONIC TUBE REFERENCE

12A4

Power - Triode Single (under 10W) electronic tube

CONSOLIDATED TECHNICAL DATA

1 SECTION
CONSTRUCTION
TRIODE

Indirectly heated triode for general electronic service. Available source material confirms triode construction without establishing a narrower functional application confidently.

GENERAL CHARACTERISTICS

BASE DESIGNATION	—	BASE PINS	9
NOMINAL HEATER	12.6 V / 300 mA	PARALLEL HEATER	6.3 V / 600 mA
HEATING	Indirect	SERIES OPERATION	Capable
CATHODE ARRANGEMENT	Separate cathodes	SECTION CONSTRUCTION	Similar

SECTION RATINGS

SECTION 1 Triode	
TRANSCONDUCTANCE	0.0078 S
AMPLIFICATION FACTOR	20
MAXIMUM PLATE VOLTAGE	450 V
MAXIMUM PLATE DISSIPATION	6.5 W
MAXIMUM CATHODE CURRENT	40 mA
<i>Promoted ratings/characteristics from 12A4.pdf.</i>	

12A4 — High-Perveance Medium-Mu Triode

Overview

The **12A4** is a high-perveance, medium-mu single triode housed in a 9-pin miniature glass envelope. It is specifically designed for use in television receivers and other electronic applications where high peak currents must be developed under low plate supply voltage conditions. Additionally, its high

transconductance makes it highly suitable for wideband or high-frequency circuits requiring high-gain performance.

A primary application of the 12A4 is as a vertical deflection amplifier in television receivers employing large deflection angles and operating with low plate supply potentials. The tube is engineered to withstand relatively high peak positive plate voltage pulses of short duration, which are characteristic of electromagnetic deflection flyback intervals.

In terms of electrical characteristics, the 12A4 is similar to a single section of a [12BH7](#) or [6SN7GT](#) twin triode. However, it features significantly higher power sensitivity and power output. When operated as a vertical deflection amplifier, the 12A4 can deliver approximately 15% more output at a given plate voltage supply compared to those older triode types. This comparison highlights its specialized design, though it does not imply direct pin-for-pin or electrical interchangeability.

Mechanical Design, Basing, and Heater Configuration

The 12A4 is constructed using a miniature glass envelope (T-6-1/2 bulb) with a small button 9-pin base (E9-1). It features a coated unipotential cathode and can be mounted in any physical orientation.

Physical Dimensions

- **Maximum Diameter:** 7/8 inch (approx. 22.2 mm)
- **Maximum Overall Length:** 2-5/8 inches (approx. 66.7 mm)
- **Maximum Seated Height:** 2-3/8 inches (approx. 60.3 mm)

Pin Connections and Basing

The tube utilizes the **JETEC 9-AG** basing arrangement. The terminal connections, viewed from the bottom of the tube, are as follows:

Pin Number	Electrode Connection
1	Cathode
2	Grid
3	Heater Center Tap
4	Heater
5	Heater
6	No Connection
7	Grid
8	No Connection
9	Plate

Notably, the control grid is internally connected to both **Pin 2** and **Pin 7**. This redundant connection can be utilized in circuit layouts to simplify wiring or to provide low-inductance grid grounding. Pins 6 and 8 have no internal connections.

Heater Specifications

The heater is designed with a center tap, allowing for versatile power configurations. It can be operated in series for 12.6 V systems (such as 300 mA series-string television receivers) or in parallel for standard 6.3 V parallel-heater supplies.

- **Series Connection:**
 - Heater Voltage: 12.6 V (AC or DC)
 - Heater Current: 300 mA
- **Parallel Connection:**
 - Heater Voltage: 6.3 V (AC or DC)
 - Heater Current: 600 mA

Heater Power Calculation

- **Input (Series):** $V_h = 12.6 \text{ V}$, $I_h = 0.3 \text{ A}$
 - Power = $12.6 \text{ V} \times 0.3 \text{ A} = 3.78 \text{ W}$
- **Input (Parallel):** $V_h = 6.3 \text{ V}$, $I_h = 0.6 \text{ A}$
 - Power = $6.3 \text{ V} \times 0.6 \text{ A} = 3.78 \text{ W}$

Both configurations result in an identical nominal heater power dissipation of 3.78 W.

Direct Interelectrode Capacitances

The direct interelectrode capacitances of the 12A4 are measured with a close-fitting external shield (specifically identified as shield #315) connected to the cathode and heater:

Capacitance Parameter	Value	Unit
Grid to Plate (g to p)	4.9	$\mu\mu\text{F}$ (pF)
Input (g to $k + h$)	6.7	$\mu\mu\text{F}$ (pF)
Output (p to $k + h$)	3.8	$\mu\mu\text{F}$ (pF)

These capacitance values are critical when designing high-frequency stages or predicting the high-frequency roll-off of voltage amplifiers due to the Miller effect.

Electrical Characteristics and Class A-1 Operation

Under typical Class A-1 operating conditions, the 12A4 functions as a high-transconductance, low-impedance voltage or power amplifier. The typical operating parameters are defined as follows:

Parameter	Typical Value	Unit
Plate Voltage (E_b)	250	V
Grid Voltage (E_c)	-9.0	V
Plate Current (I_b)	21	mA
Transconductance (g_m)	7,800	μmhos (μmho)
Amplification Factor (μ)	20	
Grid Voltage for Cut-off (approx. $I_b = 50 \mu\text{A}$ at $E_b = 500 \text{ V}$)	-33	V

The high transconductance of 7,800 μmhos combined with a plate current of 21 mA at a plate voltage of 250 V demonstrates the high perveance of the 12A4 structure. This allows the tube to pass substantial current and deliver high power sensitivity even when operating with relatively low plate supply voltages.

Maximum Ratings and Design-Center Limits

The maximum ratings for the 12A4 are established under the **Absolute Maximum System** (interpreted according to RMA Standard M8-210). Under this system, the ratings are limiting values above which the serviceability, life, and performance of the tube may be seriously impaired.

The equipment designer is responsible for determining an average design value for each parameter so that these absolute limits are never exceeded under any normal variations in line voltage, component tolerances, or control adjustments.

The table below outlines the maximum ratings for both general Class A-1 Amplifier service and specialized Vertical Deflection Amplifier service:

Rating Parameter	Class A-1 Amplifier	Vertical Deflection Amplifier	Unit
Maximum DC Plate Voltage	450	450	V
Maximum Peak Positive Pulse Plate Voltage	—	1,000	V
Maximum Negative DC Grid Voltage	-50	-50	V
Maximum Peak Negative Pulse Grid Voltage	—	-100	V

Rating Parameter	Class A-1 Amplifier	Vertical Deflection Amplifier	Unit
Maximum Plate Dissipation	6.5	6.5	W
Maximum DC Cathode Current	40	30	mA
Maximum Peak Heater-Cathode Voltage	180	180	V
Maximum Grid Circuit Resistance (Cathode Bias)	2.5	2.5	M Ω
Maximum Grid Circuit Resistance (Fixed Bias)	1.2	1.2	M Ω

Pulse Rating Conditions

The peak positive pulse plate voltage rating of 1,000 V is a specialized limit intended solely for vertical deflection service. It is not a continuous DC rating. This rating is valid only for operation in a standard 525-line, 30-frame television system where the duty cycle of the voltage pulse does not exceed 15% of one scanning cycle (which corresponds to approximately 2.5 milliseconds).

To ensure that the 1,000 V peak limit is not exceeded under any operating condition, the peaking resistor incorporated in the vertical oscillator discharge circuit must be carefully selected.

Vertical Deflection Circuit Operation

When utilized in a practical vertical deflection circuit, the 12A4 operates under dynamic conditions designed to drive electromagnetic deflection yokes. A typical operating example is specified below:

- **DC Plate Voltage:** 250 V
- **Variable Cathode Bias Resistor:** 560 Ω
- **DC Plate Current:** 15 mA
- **Grid Input Voltage (Approximate):**
 - Peak-to-peak sawtooth component: 25 V
 - Negative peaking component: 30 V
- **Plate Output Voltage:**
 - Peak positive pulse component: 450 V
 - Peak-to-peak sawtooth component: 220 V
- **Peak-to-Peak Sawtooth Current in Yoke:** 360 mA (measured in a yoke with an inductance of 50 millihenries)

In this application, the variable cathode resistor allows for adjustment of the vertical linearity and height. The input waveform consists of a combined sawtooth and negative peaking pulse to overcome the inductive reactance of the deflection yoke, resulting in a linear sawtooth current sweep of 360 mA peak-to-peak through the 50 mH yoke.

Technical Summary

The **12A4** is a high-perveance, medium- μ single triode featuring a 9-pin miniature construction (T-6-1/2 bulb, 9-AG basing). It is designed to deliver high peak currents and high transconductance ($7,800, \mu\text{mhos}$) at low plate supply potentials, making it highly effective as a vertical deflection amplifier in television receivers.

The tube features a versatile center-tapped heater that can be operated at 12.6 V (300 mA) in series or 6.3 V (600 mA) in parallel, dissipating a nominal 3.78 W. With a maximum plate dissipation rating of 6.5 W and the ability to withstand short-duration peak positive plate pulses up to 1,000 V, the 12A4 provides a robust and high-output alternative to older triodes like the [12BH7](#) and [6SN7GT](#) in demanding deflection and pulse-handling applications.



SOURCE OPERATING CONDITIONS

[SOURCE PDF](#)

1944 Hytron

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

1944 HYTRON

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CHARACTERISTICS

PARAMETER	PUBLISHED VALUE	CONDITION / NOTE
Heater or filament voltage	6.3 V	Published nominal value
Heater or filament current	600 mA	Published nominal value



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 · Triode

OTHER

PARAMETER	PUBLISHED VALUE	CONDITION / NOTE
Plate Voltage	250 V	ClassA
Plate Current	21 mA	ClassA
Grid Voltage	-9 V	ClassA
Pulse Plate Voltage E	1000 V	—
Max Imum Negative Dc Grid Voltage -H00 =	50 V	—
Pulse Grid Voltagea	-100 V	—
Transconductance	7800 μ S	—
Dc Plate Voltage	250 V	—
Peak-To-Peak Sawtoqth Component	25 V	—

PARAMETER	PUBLISHED VALUE	CONDITION / NOTE
Negative Peaking Component	30 V	—
0c Plate Current	15 mA	—
Peak Positive Pulse Component U5	0 V	—
Peak-To-Peak Sawtooth Component	220 V	—
Cathode Bias Resistor (Variable)	560 ohm	—

CAPACITANCE		
PARAMETER	PUBLISHED VALUE	CONDITION / NOTE
Grid to Plate	4.9 pF	—
Input Capacitance	0.7 pF	—
Output Capacitance	2.8 pF	—