



ELECTRONIC TUBE REFERENCE

12H4

Voltage - Triode (single) electronic tube

CONSOLIDATED TECHNICAL DATA

1 SECTION

CONSTRUCTION

TRIODE

General-purpose medium-mu miniature triode voltage amplifier with dual 6.3/12.6-volt heater capability for flexible series or parallel heater circuits.

GENERAL CHARACTERISTICS

BASE DESIGNATION	7DM	BASE PINS	7
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

SECTION RATINGS

SECTION 1 Triode	
PLATE RESISTANCE	7700 Ω
TRANSCONDUCTANCE	0.0026 S
AMPLIFICATION FACTOR	20
MAXIMUM PLATE VOLTAGE	300 V
MAXIMUM PLATE DISSIPATION	2.5 W
<i>Published source values promoted where applicable.</i>	

12H4 — Miniature Medium-Mu Triode Voltage Amplifier

A miniature, general-purpose, medium-mu triode receiving tube designed for voltage amplification, featuring a flexible series/parallel heater arrangement.

Overview

The **12H4** is a miniature, general-purpose, medium-mu single triode vacuum tube housed in a T-5 1/2 glass envelope with a 7-pin miniature button base. It is primarily designed for low-frequency voltage amplification. A key design feature of the 12H4 is its versatile heater construction, which allows the tube to operate from either a 12.6 V or a 6.3 V power supply, using either AC or DC.

The 12H4 is explicitly noted as not being particularly suited for high-frequency service. Electrically, the tube is identical to the **12G4** except for its basing and heater configuration. It is also highly similar to a single section of the **12SN7GT** or half of a **6SN7GT** octal double triode, making it a compact, single-triode alternative for designs that require the electrical characteristics of those classic medium-mu triodes.

Mechanical Specifications and Pinout

The 12H4 is constructed with a T-5 1/2 glass bulb and a miniature button 7-pin base. It can be mounted and operated in any position. The physical dimensions of the tube are as follows:

Dimension	Value
Maximum Overall Length	2 3/8 inches
Maximum Seated Height	2 1/8 inches
Maximum Diameter	3/4 inch

The tube utilizes the **7DW** basing arrangement. The pin connections, viewed from the bottom of the base, are allocated as follows:

- **Pin 1:** Plate (P)
- **Pin 2:** Heater Tap (HT) / No Connection (NC) / Internal Connection (IC)
- **Pin 3:** Heater (H)
- **Pin 4:** Heater (H)
- **Pin 5:** Plate (P)
- **Pin 6:** Grid (G)
- **Pin 7:** Cathode (K)

Both Pin 1 and Pin 5 are internally connected to the single plate electrode. Regarding Pin 2, manufacturer documentation exhibits minor differences in labeling: Tung-Sol designates Pin 2 as a heater tap (HT) to facilitate dual-voltage operation, whereas Sylvania labels Pin 2 as "NC" (No Connection) or "IC" (Internal Connection) on its diagram, while still showing the heater's physical center tap connected to this pin.

Heater Characteristics

The 12H4 features a coated unipotential cathode and a center-tapped heater. This configuration allows the heater to be wired in either a series or parallel arrangement to match the available supply voltage:

- **Series Operation:** The heater is operated at a nominal **12.6 V** with a current draw of **0.15 A** (150 mA).
- **Parallel Operation:** The heater is operated at a nominal **6.3 V** with a current draw of **0.3 A** (300 mA).
- **Supply Type:** The heater can be energized using either AC or DC.

Electrical Ratings and Capacitances

The maximum ratings for the 12H4 are established under the Design Center System. These limits represent the absolute boundaries within which the tube must be operated to ensure reliability and longevity:

Rating	Value
Maximum Plate Voltage	300 V
Maximum Plate Dissipation	2.5 W
Maximum Heater-Cathode Voltage	□90 V

Direct Interelectrode Capacitances

The direct interelectrode capacitances of the 12H4 vary depending on whether an external shield is employed. The published values compare a shielded condition (using Shield #316 connected directly to the cathode) against an unshielded condition:

Capacitance	With Shield	Without Shield
Grid to Plate	3.4 pF	3.4 pF
Input	2.6 pF	2.4 pF
Output	3.2 pF	0.9 pF

The use of an external shield significantly increases the output capacitance (from 0.9 pF to 3.2 pF) due to the proximity of the shield to the plate structure, while the grid-to-plate capacitance remains unchanged at 3.4 pF.

Typical Operating Conditions and Characteristics

The 12H4 is typically operated as a Class A1 voltage amplifier. The manufacturers document two primary operating points that illustrate the tube's performance under different plate voltages:

Parameter	Operating Point A	Operating Point B
DC Plate Voltage	90 V	250 V
DC Grid Voltage	0 V	-8 V

Parameter	Operating Point A	Operating Point B
Plate Current	10 mA	9 mA
Transconductance	3,000 μ mos	2,600 μ mos
Plate Resistance	6,700 Ω	7,700 Ω
Amplification Factor (μ)	20	20
Grid Voltage for 10 μ A Plate Current (Approx. Cutoff)	-7 V	-18 V

The fundamental triode relationship where the amplification factor is the product of transconductance and plate resistance ($\mu \approx g_m \times r_p$) is demonstrated by these operating points:

- At 90 V: $0.003 \text{ S} \times 6,700\Omega = 20.1 \approx 20$
- At 250 V: $0.0026 \text{ S} \times 7,700\Omega = 20.02 \approx 20$

As the plate voltage is increased from 90 V to 250 V and negative grid bias is applied, the plate resistance rises slightly from 6,700 Ω to 7,700 Ω , while the transconductance decreases from 3,000 μ mos to 2,600 μ mos, maintaining a constant nominal amplification factor of 20.

Analysis of Characteristic Curves

The published average plate and transfer characteristics provide a qualitative look at the behavior of the 12H4 across its operating envelope.

Average Plate Characteristics

The plate characteristics map plate current (I_b) against plate voltage (E_b) for grid bias voltages (E_c) ranging from +6 V down to -30 V.

- In the negative grid region, the curves exhibit a highly linear and evenly spaced distribution, particularly at plate voltages above 100 V, which is characteristic of low-distortion triode operation.
- In the positive grid region ($E_c = +6, +4, +2, 0 \text{ V}$), grid current (I_c) curves are plotted, showing that grid current begins to flow as the grid becomes positive relative to the cathode, which is useful for analyzing grid-loading effects in specialized driving circuits.

Average Transfer Characteristics

The transfer characteristics show the relationship of plate current (I_b), plate resistance (r_p), and amplification factor (μ) against control grid voltage (E_c) under two distinct plate voltage conditions:

1. At a Constant Plate Voltage of 250 V (with $E_f = 6.3 \text{ V}$):

- **Plate Current (I_b):** Rises smoothly from near 0 mA at a grid bias of -18 V (cutoff) up to approximately 30 mA at 0 V bias.

- **Plate Resistance (r_p):** Starts extremely high (near $50\text{ k}\Omega$) near the cutoff region at -16 V , then drops rapidly as the grid bias becomes less negative, stabilizing at approximately $6\text{ k}\Omega$ as the grid bias approaches 0 V .
- **Amplification Factor (μ):** Remains relatively stable across the active region, starting at approximately 15 at -16 V bias and rising gradually to about 22 at 0 V bias.

2. At a Constant Plate Voltage of 100 V (with $E_f = 6.3\text{ V}$):

- **Plate Current (I_b):** Rises from 0 mA at -8 V bias to approximately 11 mA at 0 V bias.
- **Plate Resistance (r_p):** Exhibits a similar steep decline from $50\text{ k}\Omega$ at -6 V bias down to approximately $7\text{ k}\Omega$ at 0 V bias.
- **Amplification Factor (μ):** Rises from about 11 at -8 V bias to approximately 21 at 0 V bias.

These curves demonstrate that the 12H4 maintains its nominal amplification factor of 20 over a wide range of typical operating conditions, while its plate resistance and transconductance are highly dependent on the chosen bias point.

Related Designations and Comparisons

The 12H4 occupies a specific niche as a single-triode miniature equivalent to larger octal types:

- **12G4:** The 12H4 is identical to the 12G4 in its electrical characteristics, differing only in its physical basing and heater arrangement.
- **12SN7GT and 6SN7GT:** The electrical characteristics of the 12H4 are equivalent to a single triode section of the 12SN7GT (or the 6.3 V equivalent 6SN7GT). This relationship allows designers to adapt circuits originally designed for these popular dual triodes to the smaller 7-pin miniature form factor of the 12H4 when only a single triode stage is required.

Technical Summary

The **12H4** is a miniature, 7-pin, medium- μ single triode voltage amplifier featuring a flexible **$12.6\text{ V} / 6.3\text{ V}$** series/parallel heater. It provides an amplification factor of **20**, a transconductance of **2,600 to 3,000 μmhos** , and a plate resistance of **$6,700$ to $7,700\Omega$** under typical Class A operating conditions. With a maximum plate voltage rating of **300 V** and a plate dissipation limit of **2.5 W** , the 12H4 serves as a compact, single-unit equivalent to one section of a 12SN7GT or 6SN7GT, optimized for low-frequency voltage amplification where high-frequency performance is not required.



SOURCE OPERATING CONDITIONS

[SOURCE PDF](#)

1950 Sylvania

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

1950 SYLVANIA

Section 1 · Triode

OTHER		
PARAMETER	PUBLISHED VALUE	CONDITION / NOTE
Heater voltage series	12.6 V	Series
Heater voltage parallel	6.3 V	Parallel



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
Heater voltage	12.6 V	—
Heater current	150 mA	—
Alternate heater voltage	6.3 V	—
Alternate heater current	300 mA	—

CAPACITANCE		
PARAMETER	PUBLISHED VALUE	CONDITION / NOTE
Grid-to-plate capacitance	3.4 pF	—



1966 Tung Sol Electronic Tubes 3 of 4

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

1966 TUNG SOL ELECTRONIC TUBES 3 OF 4
Section 1 · Triode

OTHER		
PARAMETER	PUBLISHED VALUE	CONDITION / NOTE
Plate voltage	250 V	ClassA
Grid voltage	-8 V	ClassA
Plate current	9 mA	ClassA

CHARACTERISTIC		
PARAMETER	PUBLISHED VALUE	CONDITION / NOTE
Transconductance	2600 uS	ClassA
Amplification factor	20	ClassA

CAPACITANCE		
PARAMETER	PUBLISHED VALUE	CONDITION / NOTE
Grid-to-plate capacitance	3.4 pF	WithoutShield
Input capacitance	2.4 pF	WithoutShield
Output capacitance	0.9 pF	WithoutShield

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