



ELECTRONIC TUBE REFERENCE

1AG4

Power - Pentode (NOT beam) electronic tube

CONSOLIDATED TECHNICAL DATA

1 SECTION

CONSTRUCTION

PENTODE

Subminiature directly heated power pentode for compact battery-operated receiver output stages.

GENERAL CHARACTERISTICS

BASE DESIGNATION	512AX	BASE PINS	7
NOMINAL HEATER	1.25 V / 40 mA	PARALLEL HEATER	– / –
HEATING	Direct	SERIES OPERATION	Not specified
CATHODE ARRANGEMENT	Separate cathodes	SECTION CONSTRUCTION	Similar

SECTION RATINGS

SECTION1 Pentode	
PLATE RESISTANCE	180000 Ω
TRANSCONDUCTANCE	0.001 S
MAXIMUM PLATE VOLTAGE	90 V
MAXIMUM SCREEN VOLTAGE	90 V
MAXIMUM CATHODE CURRENT	4 mA
<i>Promoted from the printed condensed-manual maximum/characteristic columns; operating-point values are retained in TUBE_SECTION_PARAMETER.</i>	

1AG4 — Subminiature Power Pentode

A subminiature, filament-type power pentode designed for use in the output stage of battery-operated receivers.

Overview

The **1AG4** is a subminiature, filament-type power pentode designed primarily for use in the output stage of battery-operated receivers. It features a compact, space-saving design with a coated filament and is engineered to deliver efficient audio power amplification at low operating voltages. The tube is housed in a subminiature T-2x3 glass envelope and can be mounted in any position.

Physical and Mechanical Construction

The 1AG4 is constructed using a subminiature T-2x3 glass bulb. Its physical dimensions are characterized by:

- **Maximum overall length:** 1.5 inches (1-1/2 inches)
- **Maximum width:** 0.285 inches
- **Maximum thickness/depth:** 0.385 inches
- **Minimum lead length:** 1.5 inches

The tube does not have a conventional rigid base; instead, it features five flexible tinned leads with a diameter of 0.016 inches and a center-to-center spacing of 0.048 inches. A colored (or red) dot is located on the envelope adjacent to Lead 1 to facilitate orientation during installation.

Installation and Mounting

The flexible leads of the 1AG4 offer versatile mounting options:

- They can be soldered or welded directly to circuit components in compact or printed-circuit layouts.
- Alternatively, the leads can be cut to a length of 0.20 inches for insertion into standard subminiature sockets.

Grid #3 (Suppressor Grid) Construction

In several configurations of the 1AG4, Grid #3 is composed of two separate deflector plates. These plates are not internally tied to a single common point but are instead connected to separate external leads, typically shared with the filament terminals.

Lead Configurations and Pinouts

Because different manufacturers and standards define the terminal connections for the 1AG4 differently, multiple pinout configurations are documented. When viewing the tube from the bottom, the following lead arrangements are encountered:

Configuration A (Terminal Connection 5J / Similar)

In this arrangement, Lead 1 is adjacent to the colored dot:

- **Lead 1:** Grid #1 (Control Grid)
- **Lead 2:** Filament (-)

- **Lead 3:** Filament (+) and Grid #3 (Deflector Plate 1)
- **Lead 4:** Grid #2 (Screen Grid)
- **Lead 5:** Plate and Grid #3 (Deflector Plate 2)

Configuration B (Base 512-AX)

This configuration utilizes a flat, in-line arrangement from left to right:

- **Pin 1:** Filament (-)
- **Pin 2:** Plate
- **Pin 3:** Grid #2 (Screen Grid)
- **Pin 4:** Grid #1 (Control Grid)
- **Pin 5:** Filament (+)

Configuration C

Another documented arrangement with the red dot adjacent to Lead 1:

- **Lead 1:** Plate
- **Lead 2:** Grid #2 (Screen Grid)
- **Lead 3:** Filament (+) and Grid #3 (Deflector Plate 1)
- **Lead 4:** Grid #1 (Control Grid)
- **Lead 5:** Filament (-) and Grid #3 (Deflector Plate 2)

Configuration D

An alternative bottom-view arrangement:

- **Lead 1:** Filament (+) and Grid #3 (Deflector Plate 1)
- **Lead 2:** Grid #1 (Control Grid)
- **Lead 3:** Filament (-) and Grid #3 (Deflector Plate 2)
- **Lead 4:** Grid #2 (Screen Grid)
- **Lead 5:** Plate

Filament Ratings

The 1AG4 utilizes a directly heated, coated filament designed for low-power battery operation.

- **Filament Voltage:** 1.25 V (AC or DC)
- **Filament Current:** Nominally rated at **0.04 A (40 mA)**, though some specifications document a current of **0.4 A**.

Maximum Ratings (Design Center System)

To ensure reliable operation and prevent premature failure, the following maximum limits must be observed:

- **Filament Voltage (DC):** 1.25 V
- **Maximum Plate Voltage:** 90 V
- **Maximum Grid #2 (Screen) Voltage:** 90 V
- **Maximum Cathode Current (Zero Signal):** 4 mA

Typical Operating Conditions and Electrical Characteristics

The 1AG4 is typically operated as a Class A1 (or Class A) audio power amplifier. The documented typical operating points are as follows:

Parameter	Typical Value (Point A)	Typical Value (Point B)
Filament Voltage (DC)	1.25 V	1.25 V
Filament Current	40 mA	40 mA
Plate Voltage	41.4 V	45 V
Grid #2 (Screen) Voltage	41.4 V	41.4 V
Grid #1 (Control Grid) Voltage	-3.6 V	-3.6 V
Peak AF Grid #1 Voltage	3.6 V	—
Zero-Signal Plate Current	2.4 mA	2.4 mA
Zero-Signal Grid #2 Current	0.6 mA	0.6 mA
Plate Resistance (r_p)	0.18 M Ω (180,000 Ω)	0.18 M Ω (180,000 Ω)
Transconductance (g_m)	1,000 μ mhos	1,000 μ mhos
Load Resistance	12,000 Ω	12,000 Ω
Total Harmonic Distortion (Approx.)	12%	—
Power Output	35 mW	35 mW

Performance Curves and Qualitative Analysis

Plate Characteristics (Pentode Connection)

When plotted at a filament voltage (E_f) of 1.25 V and a screen grid voltage (E_{c2}) of 41.4 V, the plate current (I_b) curves for control grid voltages (E_{c1}) (/tubes/C1) ranging from 0 V to -6.0 V (in 1 V steps) reveal the following:

- The 'knee' of the plate current curves occurs sharply between **15 V and 25 V** plate voltage. Above this region, plate current remains relatively constant with increasing plate voltage, demonstrating typical pentode behavior.
- The screen grid current (I_{c2}) curves (plotted for grid bias values such as 0 V, -2 V, and -4 V) show a sharp rise at low plate voltages (specifically below 15 V), which is characteristic of the partition of current between the plate and screen when the plate potential falls below the screen potential.

Triode-Connected Characteristics

The 1AG4 can also be evaluated in a triode configuration where Grid #2 is tied directly to the plate. Under these conditions (with $E_f = 1.25$ V DC), the plate characteristics are plotted for control grid voltages (E_{c1}) (/tubes/C1) from 0 V to -5 V over a plate voltage range of 0 to 50 V. This configuration provides a lower plate resistance and triode-like transfer curves, suitable for alternative circuit designs.

Power Output and Distortion vs. Load Resistance

The performance of the 1AG4 as an output stage is highly dependent on the selected load resistance. Under typical operating conditions ($E_f = 1.25$ V, E_{c1} (/tubes/C1) = -3.6 V, $E_{sig} = 2.55$ V AC, and $E_{c2} = 41.4$ V), two distinct performance trends are documented:

1. Resonant/Tuned Minimum Distortion Trend:

- Power output peaks broadly at approximately **35 mW to 36 mW** near a load resistance of **12,000 Ω to 15,000 Ω** .
- Total Harmonic Distortion (THD) reaches a distinct minimum of approximately **12% to 12.5%** near **11,000 Ω to 13,000 Ω** load resistance.
- The distortion rises significantly on either side of this optimum load, reaching approximately **19% to 20%** at low load resistances (2,500 Ω to 5,000 Ω) and **15% to 16%** at a high load resistance of 20,000 Ω .

2. Monotonic Distortion Trend:

- Power output similarly peaks near **35 mW to 36 mW** at approximately **12,000 Ω** .
- However, in this alternative characterization, the Total Harmonic Distortion increases monotonically with load resistance. It starts at a low value of approximately **6%** at a 4,000 Ω load and rises steadily to approximately **18%** at a 20,000 Ω load.

These differing curves highlight the importance of load matching in battery-operated output stages to balance power transfer against acceptable distortion limits.

Technical Summary

The **1AG4** is a subminiature, filament-type power pentode designed for the output stage of battery-operated receivers. Operating with a **1.25 V** filament supply, it draws a low current of **40 mA** (with some specifications noting **0.4 A**). It is capable of delivering **35 mW** of audio power output into a **12,000 Ω** load when operated at a plate and screen voltage of **41.4 V** and a grid bias of **-3.6 V**.

Its physical construction features a T-2x3 glass envelope with five flexible leads, allowing for direct soldering or socket mounting. Due to variations in manufacturing standards, multiple lead configurations (including the 5J and 512-AX arrangements) exist, requiring careful verification of the specific pinout during circuit design. With a maximum plate and screen rating of **90 V**, the 1AG4 remains a classic example of highly efficient, low-voltage subminiature tube design for portable applications.



SOURCE OPERATING CONDITIONS

[SOURCE PDF](#)

1938 Raytheon

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

1938 RAYTHEON

Section 1 · Pentode

CHARACTERISTICS

PARAMETER	PUBLISHED VALUE	CONDITION / NOTE
Grid #	2 volts	Grid #2 Voltage volts



SOURCE OPERATING CONDITIONS

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195X General Electric Essential Characteristics

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

195X GENERAL ELECTRIC ESSENTIAL CHARACTERISTICS

Section 1 · Pentode

OTHER

PARAMETER	PUBLISHED VALUE	CONDITION / NOTE
Plate voltage	41.4 V	ClassA
Screen voltage	41.4 V	ClassA
Control-grid voltage	-3.6 V	ClassA
Plate current	2.4 mA	ClassA
Screen current	0.6 mA	ClassA
Load resistance	12000 Ω	ClassA
Power output	0.035 W	ClassA

CHARACTERISTIC		
PARAMETER	PUBLISHED VALUE	CONDITION / NOTE
Plate resistance	180000 Ω	ClassA
Transconductance	1000 μS	ClassA



SOURCE DATA APPENDIX

SOURCE OPERATING CONDITIONS

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195X Raytheon Special Purpose Tubes

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

195X RAYTHEON SPECIAL PURPOSE TUBES

Section 1 · Pentode

OTHER		
PARAMETER	PUBLISHED VALUE	CONDITION / NOTE
Plate voltage	41.4 V	—
Grid 1 voltage	-3.6 V	—
Grid 2 voltage	41.4 V	—
Plate current	2.4 mA	—
Grid 2 current	0.6 mA	—
Power output	35 mW	—
Load resistance	12000 ohm	—

CHARACTERISTIC		
PARAMETER	PUBLISHED VALUE	CONDITION / NOTE
Plate resistance	180000 ohm	—
Transconductance	1000 μS	—



SOURCE DATA APPENDIX

1961 Tung Sol

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1961 TUNG SOL

Section 1 · Pentode

OTHER		
PARAMETER	PUBLISHED VALUE	CONDITION / NOTE
Plate voltage	41.4 V	ClassA
Power output	35 mW	ClassA



SOURCE DATA APPENDIX

1966 Tung Sol Electronic Tubes 1 of 4

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1966 TUNG SOL ELECTRONIC TUBES 1 OF 4

Section 1 · Pentode

OTHER		
PARAMETER	PUBLISHED VALUE	CONDITION / NOTE
Filament voltage	1.25 V	—
Filament current	40 mA	—
Plate voltage	41.4 V	ClassA
Screen voltage	41.4 V	ClassA
Grid voltage	-3.8 V	ClassA
Power output	50 mW	ClassA

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