



ELECTRONIC TUBE REFERENCE

1AK5

Voltage - Pentode or Tetrode (under 100V) electronic tube

CONSOLIDATED TECHNICAL DATA

2 SECTIONS

CONSTRUCTION

DIODE-PENTODE

Directly heated diode and sharp-cutoff pentode combination designed for low-voltage Class-A amplifier service in battery-operated equipment.

GENERAL CHARACTERISTICS

BASE DESIGNATION	1AJ5	BASE PINS	—
NOMINAL HEATER	1.25 V / 200 mA	PARALLEL HEATER	— / —
HEATING	Direct	SERIES OPERATION	Not specified
CATHODE ARRANGEMENT	Separate cathodes	SECTION CONSTRUCTION	Dissimilar

SECTION RATINGS

SECTION1 Diode

No fixed ratings recorded.

Promoted from the printed condensed-manual maximum/characteristic columns; operating-point values are retained in TUBE_SECTION_PARAMETER. The condensed chart identifies a diode section but gives no separate diode limiting ratings.

SECTION2 Pentode

PLATE RESISTANCE	400000 Ω
TRANSCONDUCTANCE	0.00028 S
AMPLIFICATION FACTOR	10
MAXIMUM PLATE VOLTAGE	90 V
MAXIMUM SCREEN VOLTAGE	90 V

Promoted from the printed condensed-manual maximum/characteristic columns; operating-point values are retained in TUBE_SECTION_PARAMETER.

1AK5 — Subminiature Diode-Pentode

The **1AK5** is a subminiature, filament-type diode-pentode designed for applications requiring extreme economy of space, weight, and battery drain. It combines a sharp-cutoff pentode and a single diode within a compact glass envelope, making it highly suitable for portable or compact equipment.

Physical Construction and Lead Configuration

The 1AK5 is constructed in a subminiature T-2X3 glass envelope. It features flexible terminal leads that can be soldered or welded directly into circuits, or cut to a length of 0.20" for use with standard subminiature sockets.

Physical Dimensions and Mounting

- **Envelope Type:** T-2X3 Glass
- **Mounting Position:** Any
- **Maximum Width:** 0.285" × 0.385"
- **Maximum Height:** 1.50"
- **Lead Length:** 1.5" minimum
- **Lead Spacing:** 0.048" center-to-center
- **Lead Identification:** A red dot is located adjacent to Lead 1.

Terminal Connections and Pinout

The 1AK5 is documented with two closely related lead/pin connection schemes.

Under the **1AJ5 base connection** diagram, the pinout is:

- **Pin 1:** Filament Negative (F−), Grid 3 (G3)
- **Pin 2:** Plate (P)
- **Pin 3:** Grid 2 (G2)
- **Pin 4:** Diode Plate (DP)
- **Pin 5:** Grid 1 (G1)
- **Pin 6:** Filament Positive (F+)

Under the alternative **flexible lead configuration**, the connections are:

- **Lead 1:** Pentode Plate
- **Lead 2:** Grid #2 (Screen Grid)
- **Lead 3:** Diode Plate
- **Lead 4:** Filament, Negative; Grid #3 (comprised of two separate deflector plates, one connected to Lead 4, the other to Lead 6)
- **Lead 5:** Grid #1 (Control Grid)
- **Lead 6:** Filament, Positive; Grid #3

Filament and Electrical Ratings

The filament is designed for direct-current (DC) operation. The ratings reflect its low-power design:

- **Filament Voltage (DC):** 1.25 V
- **Filament Current:** 20 mA (also documented as 0.2 A in some specifications)

Maximum Ratings

The maximum ratings for the 1AK5 are established under both Absolute Maximum and Design Center systems:

- **Maximum Plate Voltage:** 90 V
- **Maximum Screen (Grid #2) Voltage:** 90 V
- **Maximum Total Cathode Current:** 1.0 mA
- **Maximum Continuous Diode Current:** 0.75 mA

The diode plate is physically located at the negative end of the filament.

Interelectrode Capacitances

The direct interelectrode capacitances of the 1AK5 vary slightly depending on whether an external shield is employed.

Measured Without External Shield

- **Input:** 2.0 pF
- **Output:** 2.7 pF
- **Grid-to-Plate:** 0.10 pF (with '+' indicating plate-to-plate capacitance)

Measured With Close-Fitting Shield (Connected to Lead 4)

- **Grid to Plate (g_1 to p):** 0.10 pF maximum
- **Input (g_1 to $f + g_2 + g_3$):** 2.0 pF (approximate)
- **Output (p to $f + g_2 + g_3$):** 2.7 pF (approximate)

Typical Operating Conditions

Class A / Class A1 Amplifier

When operated as a standard Class A amplifier, the typical operating parameters are as follows:

- **Filament Voltage:** 1.25 V DC
- **Filament Current:** 20 mA
- **Plate Voltage:** 45 V
- **Grid #2 (Screen) Voltage:** 45 V

- **Grid #1 (Control Grid) Voltage:** 0 V (returned through a 5 MΩ resistor)
- **Plate Current:** 0.5 mA
- **Screen Current:** 0.2 mA
- **Plate Resistance:** 0.4 MΩ (400,000 Ω)
- **Transconductance:** 280 μmhos
- **Minimum Diode Current (with 10 V DC):** 1.5 mA

Resistance-Coupled Amplifier

The 1AK5 can be configured as a high-gain resistance-coupled amplifier. A typical operating point yields an approximate voltage gain of **40**:

- **Plate Supply Voltage:** 45 V
- **Grid #2 Supply Voltage:** 45 V
- **Grid #1 Voltage:** 0 V (with a 5 MΩ grid resistor)
- **Load Resistance:** 1 MΩ
- **Series Grid #2 Resistor:** 5 MΩ
- **Grid #2 Bypass Condenser:** 0.1 μF
- **Grid #1 Resistor (following stage):** 10 MΩ
- **Approximate Voltage Gain:** 40

Characteristic Curves and Behavior

The average transfer and plate characteristics of the 1AK5 illustrate its performance as a sharp-cutoff pentode:

- **Transconductance vs. Grid Bias:** At a filament voltage of 1.25 V and screen voltage of 45 V, the transconductance (g_m) rises from near 0 μmhos at a control grid voltage ($E_{c1}(/tubes/C1)$) of -4.0 V to approximately 300 μmhos at $E_{c1}(/tubes/C1) = 0$ V.
- **Plate Current vs. Grid Bias:** Under the same conditions, the plate current (I_b) rises to approximately 500 μA (0.5 mA) at $E_{c1}(/tubes/C1) = 0$ V.
- **Plate Characteristics:** The plate current curves plotted for grid voltages from 0 V to -3.0 V (in 0.5 V steps) display a typical pentode knee occurring around 15 V to 20 V, above which the plate current remains relatively constant with increasing plate voltage.

Technical Summary

The **1AK5** is a subminiature, filament-type diode-pentode designed for low-power, space-constrained applications. Operating with a 1.25 V DC filament, it functions as a sharp-cutoff pentode and a single diode. With typical plate and screen voltages of 45 V, it provides a transconductance of 280 μmhos and a plate resistance of 0.4 MΩ, making it capable of achieving a voltage gain of approximately 40 in resistance-coupled amplifier circuits. Its flexible leads and tiny T-2X3 glass envelope make it highly versatile for compact, battery-operated designs.

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 · Diode

OTHER		
PARAMETER	PUBLISHED VALUE	CONDITION / NOTE
Filament Voltage (dc)	1.25 volts	Filament Voltage (dc) 1.25 volts
Plate Voltage	90 volts	Plate Voltage 90 volts
Grid #	90 volts	Grid #2 Voltage 90 volts
Total Cathode Current V	0 ma	Total Cathode Current V.0 ma.
Diode Current for Continuous Operation ϕ	4321 ma	Diode Current for Continuous Operation ϕ 0.75 ma. 65 4321

CHARACTERISTICS		
PARAMETER	PUBLISHED VALUE	CONDITION / NOTE
Filament Voltage (dc)	1.25 volts	Filament Voltage (dc) 1.25 volts
Filament Current	20 ma	Filament Current 20 ma.
Plate Voltage	45 volts	Plate Voltage 45 volts
Grid ¥	45 volts	Grid ¥2 Voltage 45 volts
Grid #	0 volts	Grid #1 Voltage & 0 volts
Plate Current	0.5 ma	Plate Current 0.5 ma.
Grid #	0.2 ma	Grid #2 Current 0.2 ma.
Minimum Diode Current with	1.5 volts	Minimum Diode Current with 10 volts DC 4 1.5 ma.
Filament Voltage {dc}	1.25 volts	Filament Voltage {dc} 1.25 volts
Filament Current	20 ma	Filament Current 20 ma.
Plate Supply Voltage	45 volts	Plate Supply Voltage 45 volts
Geid #	45 volts	Geid #2 Supply Voltage 45 volts
Grid #] Voltage &	0 volts	Grid #] Voltage & 0 volts
Load Resistance	1 meg	Load Resistance 1 meg.

PARAMETER	PUBLISHED VALUE	CONDITION / NOTE
Series Grid #	5 meg	Series Grid #2 Resistor 5 meg.
Grid #	10 meg	Grid #1 Resistor { following tube) 10 meg.
Plate or Grid #	2 Ma	Plate or Grid #2 Current - Ma,



SOURCE DATA APPENDIX

SOURCE OPERATING CONDITIONS

[SOURCE PDF](#)

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 2 · Pentode

CAPACITANCE		
PARAMETER	PUBLISHED VALUE	CONDITION / NOTE
Input capacitance	2 pF	Section2
Output capacitance	2.7 pF	Section2
Grid-to-plate capacitance	0.1 pF	Section2

OTHER		
PARAMETER	PUBLISHED VALUE	CONDITION / NOTE
Plate voltage	45 V	ClassA
Screen voltage	45 V	ClassA
Plate current	0.5 mA	ClassA
Screen current	0.2 mA	ClassA

CHARACTERISTIC		
PARAMETER	PUBLISHED VALUE	CONDITION / NOTE
Plate resistance	400000 Ω	ClassA
Transconductance	280 μS	ClassA

TUBE TINKER

An independent reference for electronic tubes, vacuum tubes, and their source documents.

