

ELECTRONIC TUBE REFERENCE

1AN5

Voltage - Pentode Remote Cutoff (single) electronic tube

CONSOLIDATED TECHNICAL DATA

1 SECTION
CONSTRUCTION
PENTODE

Battery variable-mu pentode designed for IF amplification and mixer service. Its controlled transconductance supports automatic-gain-control operation while the low-power filament construction suits portable receiver applications.

GENERAL CHARACTERISTICS

BASE DESIGNATION	—	BASE PINS	7
NOMINAL HEATER	1.4 V / 25 mA	PARALLEL HEATER	— / —
HEATING	Direct	SERIES OPERATION	Not specified
CATHODE ARRANGEMENT	Separate cathodes	SECTION CONSTRUCTION	Similar

SECTION RATINGS

SECTION1 Pentode	
PLATE RESISTANCE	450000 Ω
TRANSCONDUCTANCE	0.00094 S
MAXIMUM PLATE VOLTAGE	120 V
MAXIMUM SCREEN VOLTAGE	90 V
MAXIMUM PLATE DISSIPATION	0.25 W
MAXIMUM SCREEN DISSIPATION	0.15 W
MAXIMUM CATHODE CURRENT	2.5 mA
Rogers/JEDEC 1AN5 directly heated 1.4 V 25 mA filament variable-mu (remote-cutoff) pentode for portable battery receiver IF amplification and multiplicative/additive mixer service. Manufacturer design-center limits plate voltage 120 V, dissipation 0.25 W, screen voltage 90 V, screen dissipation 0.15 W, cathode current 2.5 mA. Typical IF point includes gm 940 μmhos and plate resistance 0.45 MΩ at stated supply and screen bias. Filament may operate at 1.3 V 25 mA under series supply; nominal 1.4 V parallel battery condition retained. Converter-mode conductance is not intrinsic gm.	

1AN5 — Variable-Mu Pentode

The **1AN5** is a variable-mu pentode designed primarily for use in battery-operated AM/FM receivers. It is engineered to perform multiple functions, including intermediate frequency (I.F.) amplification, multiplicative mixing, and additive mixing. Featuring a low-current filamentary cathode, the 1AN5 is optimized for portable applications where power conservation is critical.

Mechanical Design and Pinout

The 1AN5 is housed in a T 5/2 glass bulb with a 5-2 outline and an E7-1 miniature 7-pin base. The tube employs a 7 ES basing configuration and can be mounted in any position.

Physical Dimensions

- **Maximum Diameter:** 3/4"
- **Maximum Overall Height:** 2 1/8"
- **Body Height:** 1 1/2" ± 3/32"
- **Maximum Height to Top of Bulb:** 1 7/8"

Pin Connections

The pinout configuration, as viewed from the bottom of the base, is as follows:

Pin Number	Connection
1	Negative filament (-), internal shield
2	Plate
3	Grid No. 2 (Screen Grid)
4	Grid No. 3 (Suppressor Grid)
5	Negative filament (-), internal shield
6	Grid No. 1 (Control Grid)
7	Positive filament (+)

Filament and Interelectrode Capacitances

The 1AN5 features a coated filamentary cathode designed for low-power operation. It can be powered by either a parallel or series supply:

- **Parallel Supply:** 1.4 V @ 25 mA
- **Series Supply:** 1.3 V @ 25 mA

Direct Interelectrode Capacitances

The direct interelectrode capacitances vary depending on whether the tube is operated in a standard pentode configuration or a triode configuration (where Grid No. 2 and Grid No. 3 are connected directly to the plate).

Capacitance Parameter	Pentode Connection	Triode Connection
Input capacitance	3.7 pF	1.1 pF
Output capacitance	7.5 pF	8.1 pF
Plate to Grid No. 1 (or Plate to Grid)	max. 0.01 pF	2.6 pF
Grid No. 3 to all other elements	5.2 pF	—
Grid No. 1 to Grid No. 3	max. 0.1 pF	—
Grid No. 1 to Grid No. 2	2.5 pF	—

Maximum Ratings (Design Center Values)

To ensure reliable operation and prevent premature degradation, the 1AN5 must be operated within the following design center limits:

- **Supply Voltage:** 120 V (Absolute maximum: 150 V)
- **Plate Voltage:** 120 V
- **Plate Dissipation:** 0.25 W
- **Grid No. 2 Voltage:** 90 V
- **Grid No. 2 Dissipation:** 0.15 W
- **Cathode Current:** 2.5 mA
- **Grid No. 1 Circuit Resistance:** 3 M Ω
- **Grid No. 3 Circuit Resistance:** 1.5 M Ω

Operating Characteristics

The 1AN5 can be configured in several ways depending on the receiver design requirements.

Intermediate Frequency (I.F.) Amplifier Service

In I.F. amplifier applications, Grid No. 3 is connected to 0 V. The operating characteristics are specified for supply voltages of 85 V, 64 V, and 45 V, referenced to the negative filament. The 85 V and 64 V supplies represent typical battery voltages (90 V and 67.5 V, respectively) minus the bias of the output tube.

85 V Supply Conditions

At an 85 V supply, the tube can be operated with either a 33,000 Ω or a 47,000 Ω series resistor for Grid No. 2:

- **With 33,000 Ω Grid No. 2 Resistor:**
 - Grid No. 1 Bias: 0 V (normal) to -5 V (cutoff)
 - Grid No. 2 Voltage: 62 V (at 0 V bias)
 - Plate Current: 1.7 mA (at 0 V bias)
 - Grid No. 2 Current: 700 μ A (at 0 V bias)
 - Transconductance: 940 μ mhos (at 0 V bias) / 10 μ mhos (at -5 V bias)
 - Plate Resistance: 0.45 M Ω (at 0 V bias) / >10 M Ω (at -5 V bias)
 - Amplification Factor (g₂ to g₁): 20
- **With 47,000 Ω Grid No. 2 Resistor:**
 - Grid No. 1 Bias: 0 V (normal) to -5 V (cutoff)
 - Grid No. 2 Voltage: 57 V (at 0 V bias)
 - Plate Current: 1.5 mA (at 0 V bias)
 - Grid No. 2 Current: 595 μ A (at 0 V bias)
 - Transconductance: 900 μ mhos (at 0 V bias) / 10 μ mhos (at -5 V bias)
 - Plate Resistance: 0.525 M Ω (at 0 V bias) / >10 M Ω (at -5 V bias)
 - Amplification Factor (g₂ to g₁): 20

64 V Supply Conditions

At a 64 V supply, the tube can be operated with either a 1,500 Ω or a 4,700 Ω series resistor for Grid No. 2:

- **With 1,500 Ω Grid No. 2 Resistor:**
 - Grid No. 1 Bias: 0 V (normal) to -3.8 V (cutoff)
 - Grid No. 2 Voltage: 63 V (at 0 V bias)
 - Plate Current: 1.7 mA (at 0 V bias)
 - Grid No. 2 Current: 780 μ A (at 0 V bias)
 - Transconductance: 880 μ mhos (at 0 V bias) / 10 μ mhos (at -3.8 V bias)
 - Plate Resistance: 0.25 M Ω (at 0 V bias) / >10 M Ω (at -3.8 V bias)
 - Amplification Factor (g₂ to g₁): 20
- **With 4,700 Ω Grid No. 2 Resistor:**
 - Grid No. 1 Bias: 0 V (normal) to -3.8 V (cutoff)
 - Grid No. 2 Voltage: 61 V (at 0 V bias)
 - Plate Current: 1.6 mA (at 0 V bias)
 - Grid No. 2 Current: 725 μ A (at 0 V bias)
 - Transconductance: 870 μ mhos (at 0 V bias) / 10 μ mhos (at -3.8 V bias)
 - Plate Resistance: 0.27 M Ω (at 0 V bias) / >10 M Ω (at -3.8 V bias)
 - Amplification Factor (g₂ to g₁): 20

45 V Supply Conditions

At a 45 V supply, Grid No. 2 is connected directly to the supply (0 Ω series resistor):

- Grid No. 1 Bias: 0 V (normal) to -2.7 V (cutoff)
- Grid No. 2 Voltage: 45 V
- Plate Current: 0.9 mA (at 0 V bias)
- Grid No. 2 Current: 445 μ A (at 0 V bias)
- Transconductance: 700 μ mhos (at 0 V bias) / 10 μ mhos (at -2.7 V bias)
- Plate Resistance: 0.28 M Ω (at 0 V bias) / >10 M Ω (at -2.7 V bias)
- Amplification Factor (g_2 to g_1): 20

Multiplicative Mixer Service

When used as a multiplicative mixer, the local oscillator voltage is applied to Grid No. 3. The circuit uses a Grid No. 3 resistor of 0.3 M Ω and an oscillator voltage of 12 V (rms). The operating characteristics under these conditions are:

Parameter	85 V Supply	64 V Supply	45 V Supply
Grid No. 2 Series Resistor	47,000 Ω	4,700 Ω	0 Ω
Grid No. 1 Bias	0 V / -4.6 V	0 V / -3.5 V	0 V / -2.4 V
Grid No. 2 Voltage	47 V / —	58 V / —	45 V / —
Plate Current	540 μ A / —	670 μ A / —	420 μ A / —
Grid No. 2 Current	800 μ A / —	1250 μ A / —	795 μ A / —
Conversion Conductance	265 μ mhos / 10 μ mhos	280 μ mhos / 10 μ mhos	250 μ mhos / 10 μ mhos
Plate Resistance	0.50 M Ω / >5 M Ω	0.30 M Ω / >5 M Ω	0.49 M Ω / >5 M Ω

Additive Mixer Service

In additive mixer service, the 1AN5 is operated in a triode connection with Grid No. 2 and Grid No. 3 connected directly to the plate. A grid resistor of 1 M Ω is used across all operating points. The plate series resistor must be bypassed.

Supply Voltage	Plate Series Resistor	Grid Current	Plate Current	Oscillator Voltage (rms)	Conversion Conductance	Plate Resistance
85 V	0 Ω	4.4 μ A	1.9 mA	4.0 V	500 μ mhos	26,000 Ω

Supply Voltage	Plate Series Resistor	Grid Current	Plate Current	Oscillator Voltage (rms)	Conversion Conductance	Plate Resistance
85 V	4,700 Ω	3.8 μ A	1.7 mA	3.5 V	490 μ mhos	26,500 Ω
64 V	0 Ω	3.1 μ A	1.3 mA	3.0 V	465 μ mhos	29,000 Ω
64 V	3,300 Ω	2.5 μ A	1.2 mA	2.5 V	460 μ mhos	28,500 Ω
45 V	0 Ω	2.0 μ A	0.73 mA	2.0 V	405 μ mhos	34,000 Ω
45 V	1,500 Ω	2.0 μ A	0.70 mA	2.0 V	400 μ mhos	35,000 Ω

Application Considerations

When designing receiver circuits utilizing the 1AN5 in the short wave range, special attention must be paid to transit time effects. If automatic gain control (AGC) is applied to the mixer stage, a transit-time-induced current flows to Grid No. 1. This current must be accounted for in the input circuit design to prevent detuning, impedance mismatch, or a reduction in overall receiver sensitivity.

Technical Summary

The **1AN5** is a highly versatile, low-power variable-mu pentode designed for battery-operated AM/FM receivers. It features a dual-rated filament (1.4 V parallel / 1.3 V series) drawing only 25 mA, making it ideal for portable equipment. The tube can be configured as a high-impedance pentode for I.F. amplification and multiplicative mixing, or as a low-impedance triode for additive mixing. Its variable-mu characteristics provide effective AGC action, with transconductance dropping to 10 μ mhos at cutoff. Designers must consider transit-time effects on Grid No. 1 when applying AGC in short wave mixer applications.

SOURCE OPERATING CONDITIONS

[SOURCE PDF](#)

1959 Rogers

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

1959 ROGERS

Section 1 · Pentode

CHARACTERISTICS

PARAMETER	PUBLISHED VALUE	CONDITION / NOTE
Cutoff characteristic	Variable-mu	—

APPLICATION

PARAMETER	PUBLISHED VALUE	CONDITION / NOTE
Application	IF amplifier / mixer	—

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