



ELECTRONIC TUBE REFERENCE

1A7GT

Voltage - Radio Detector Converter electronic tube

CONSOLIDATED TECHNICAL DATA

1 SECTION
CONSTRUCTION
HEPTODE

Battery or receiving-tube frequency converter combining local-oscillator and mixer action for superheterodyne radio service. Its multi-grid structure provides frequency conversion while minimizing component count and, in battery types, filament power.

GENERAL CHARACTERISTICS

BASE DESIGNATION	7Z	BASE PINS	8
NOMINAL HEATER	1.4 V / 50 mA	PARALLEL HEATER	– / –
HEATING	Direct	SERIES OPERATION	Not specified
CATHODE ARRANGEMENT	Separate cathodes	SECTION CONSTRUCTION	Similar

SECTION RATINGS

SECTION 1 Heptode	
PLATE RESISTANCE	600000 Ω
TRANSCONDUCTANCE	0.00025 S
MAXIMUM PLATE VOLTAGE	110 V
MAXIMUM SCREEN VOLTAGE	60 V
MAXIMUM CATHODE CURRENT	4 mA
<i>Pentagrid converter. Transconductance is conversion transconductance.</i>	

1A7GT — Battery Heptode Pentagrid Converter

The **1A7GT** (also designated as **1A7G**, **1A7-G**, and **1A7-GT**) is a battery-operated heptode (pentagrid) self-oscillating frequency changer designed for use in battery-powered all-wave radio receivers. It functions as a pentagrid converter, combining the roles of mixer and local oscillator within a single envelope to perform frequency conversion at frequencies up to 15 Mc/s.

Physical Construction and Filament Ratings

The 1A7GT features a tubular (T-type) glass envelope topped with a metal cap (top cap) for the control grid connection. On the 1A7GT variant, Pin 1 is internally connected to the metal shell of the base to provide shielding.

The physical dimensions of the 1A7GT are:

- **Maximum overall height:** 2-7/8 inches
- **Maximum diameter:** 1-5/16 inches

The tube is equipped with a directly heated filament designed for low-power battery operation. The filament is rated for DC operation with the following specifications:

Parameter	Value
Filament Voltage	1.4 V DC
Filament Current	0.05 A (50 mA)

Base Configurations and Pinouts

The 1A7GT is designed with an octal base, but two distinct pinout configurations are documented depending on the specific base connection standard used.

Standard Octal Base Configuration

In this configuration, the pin connections viewed from the bottom of the tube are as follows:

Pin	Connection
Pin 1	No Connection (NC) / Connected to metal shell
Pin 2	Filament positive (F+)
Pin 3	Anode (Plate)
Pin 4	Screen Grids (g_3 , g_5)
Pin 5	Oscillator Grid (g_1)
Pin 6	Oscillator Anode (g_2)
Pin 7	Filament negative (F-)
Pin 8	No Connection (NC)
Top Cap	Control Grid (g_4 / Signal-Input Grid)

7Z Base Connection Configuration

An alternative 7Z base connection configuration defines the pinout as follows:

Pin	Connection
Pin 1	Filament negative (F-)
Pin 2	Plate (P)
Pin 3	Grids 3 and 5 (Screen)
Pin 4	Grid 1 (Oscillator Grid)
Pin 5	Grid 2 (Oscillator Plate / Anode Grid)
Pin 7	Filament positive (F+)
Top Cap	Grid 4 (Signal-Input Grid)

In both configurations, Grids 3 and 5 (g_3 and g_5) are internally connected to function as the screen grid, Grid 4 (g_4) serves as the signal-input control grid, Grid 1 (g_1) acts as the oscillator grid, and Grid 2 (g_2) functions as the oscillator anode (or oscillator plate / anode grid).

Electrical Characteristics and Operating Points

The 1A7GT can be operated under different typical conditions depending on whether the screen grids are supplied through a series dropping resistor or directly from a fixed voltage source.

Operating Point A: Screen Series Resistor Supply

Under this operating condition, the screen grids are supplied from a 90 V source through a series resistor:

- **Anode Voltage:** 90 V
- **Anode Current:** 0.55 mA
- **Screen Supply Voltage:** 90 V
- **Screen Series Resistor:** 70,000 Ω
- **Screen Current:** 0.6 mA
- **Oscillator Anode Voltage:** 90 V
- **Oscillator Anode Current:** 1.2 mA
- **Oscillator Grid (g_1) Resistor:** 200,000 Ω (0.2 M Ω)
- **Oscillator Grid Current:** 0.035 mA
- **Control Grid (g_4) Voltage:** 0 V
- **Anode Impedance:** 0.6 M Ω
- **Conversion Conductance:** 0.25 mA/V (250 μ mhos)

Operating Point B: Direct Screen Voltage Supply

Under this operating condition, the screen grids are connected directly to a lower fixed voltage:

- **Plate (Anode) Voltage:** 90 V
- **Screen Voltage:** 45 V
- **Negative Grid Voltage (Control Grid):** 0 V
- **Plate Current:** 0.6 mA
- **Screen Current:** 0.7 mA
- **Plate Resistance (R_p):** Approximately 600,000 Ω (0.6 M Ω)
- **Conversion Transconductance (g_c):** 250 μ mhos
- **Oscillator Plate Voltage:** 90 V
- **Oscillator Grid Current:** 1.2 mA

Maximum Ratings

To ensure reliable operation and prevent premature failure, the operating voltages and currents must be kept within the following maximum limits:

Parameter	Maximum Value
Anode Voltage	90 V to 110 V
Screen (g_3, g_5) Voltage	55 V to 60 V
Oscillator Anode (g_2) Voltage	90 V
Total Cathode Current	3 mA

The variation in maximum anode and screen voltage limits reflects different rating standards, with anode voltage limits ranging from 90 V to 110 V, and screen voltage limits ranging from 55 V to 60 V.

Interelectrode Capacitances

The interelectrode capacitances of the 1A7GT, measured with a close-fitting shield connected to the negative filament terminal (Pin 7), are as follows:

- **R.F. Input (Control Grid to all other electrodes):** 7.5 pF
- **I.F. Output (Anode to all other electrodes):** 10 pF
- **Oscillator Input (Oscillator Grid to all except Oscillator Anode):** 3.2 pF
- **Oscillator Output (Oscillator Anode to all except Oscillator Grid):** 4.0 pF
- **Control Grid to Oscillator Grid:** 0.12 pF
- **Control Grid to Anode:** 0.4 pF
- **Control Grid to Oscillator Anode:** 0.25 pF
- **Oscillator Grid to Oscillator Anode:** 1.5 pF

These capacitances are critical for determining the tuning range and stability of the local oscillator and mixer stages in all-wave receiver designs.

Performance Curves and Application Notes

The conversion conductance (g_c) of the 1A7GT is highly dependent on the oscillator grid (g_1) current. When operated with a 1.4 V filament supply, an anode voltage of 90 V, a screen voltage of 45 V, and an oscillator anode voltage of 90 V supplied via a 70,000 Ω resistor through a 200,000 Ω grid leak, the conversion conductance exhibits the following behavior:

- At a very low oscillator grid current of 0.01 mA, the conversion conductance starts at approximately 0.16 mA/V (160 μ mhos).
- As the grid current increases, the conversion conductance rises and reaches a peak of approximately 0.27 mA/V (270 μ mhos) when the grid current is between 0.04 mA and 0.05 mA.
- Beyond this peak, further increases in grid current cause a gradual decline in conversion conductance, dropping to approximately 0.21 mA/V (210 μ mhos) at a grid current of 0.1 mA.

This characteristic demonstrates that optimizing the local oscillator drive to maintain the oscillator grid current between 0.04 mA and 0.05 mA is essential for achieving maximum conversion gain.

The 1A7GT is designed specifically for battery-operated receivers and provides satisfactory performance across all broadcast and shortwave bands up to a frequency of 15 Mc/s.

Technical Summary

The **1A7GT** is an octal-based, directly heated pentagrid converter designed for battery-operated all-wave radio receivers. Operating with a highly efficient **1.4 V, 0.05 A** DC filament, it combines the functions of a mixer and local oscillator in a single envelope. It features a typical conversion conductance of **0.25 mA/V (250 μ mhos)** and a high plate resistance of **0.6 M Ω** under typical operating conditions with an anode voltage of **90 V**. With its low power consumption, compact physical dimensions, and reliable operation up to **15 Mc/s**, the 1A7GT was a standard frequency-changer solution for portable and farm radio designs of its era.



SOURCE OPERATING CONDITIONS

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1948 Brimar Radio Valve Manual

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

1948 BRIMAR RADIO VALVE MANUAL

Section 1 · Heptode

APPLICATION		
PARAMETER	PUBLISHED VALUE	CONDITION / NOTE
Service	Frequency changer	—



SOURCE OPERATING CONDITIONS

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1958 Brimar Radio Valve No 7

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

1958 BRIMAR RADIO VALVE NO 7

Section 1 · Heptode

OTHER		
PARAMETER	PUBLISHED VALUE	CONDITION / NOTE
Plate Voltage	90 V	—
Plate Current	0.55 mA	—
Screen Supply Voltage	90 V	—
Screen Current	0.6 mA	—
Oscillator Anode Voltage	90 V	—
Oscillator Anode Current	1.2 mA	—

CHARACTERISTIC		
PARAMETER	PUBLISHED VALUE	CONDITION / NOTE
Plate Resistance	600000 ohm	—
Conversion Conductance	250 μ S	—

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 · Heptode

OTHER		
PARAMETER	PUBLISHED VALUE	CONDITION / NOTE
Plate voltage	90 V	Converter
Screen voltage	45 V	Converter
Grid voltage	0 V	Converter
Plate current	0.6 mA	Converter
Screen current	0.7 mA	Converter
Oscillator current	0.035 mA	Converter
Oscillator grid resistor	200000 ohm	Converter
Oscillator plate voltage	90 V	Converter
Oscillator plate current	1.2 mA	Converter

SOURCE OPERATING CONDITIONS

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 · Heptode

OTHER		
PARAMETER	PUBLISHED VALUE	CONDITION / NOTE
Anode-grid voltage	110 V	—

CHARACTERISTIC		
PARAMETER	PUBLISHED VALUE	CONDITION / NOTE
Conversion transconductance	250 μ S	ConverterService

CAPACITANCE		
PARAMETER	PUBLISHED VALUE	CONDITION / NOTE
Grid 4 to plate	0.5 pF	—

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