

ELECTRONIC TUBE REFERENCE

13GF7A

Power - TV Vertical Output electronic tube

CONSOLIDATED TECHNICAL DATA

2 SECTIONS

CONSTRUCTION

TRIODE-TRIODE

Novar dissimilar dual triode for combined television vertical-deflection oscillator and amplifier service. It pairs a small-signal oscillator section with a low-mu 10 W power section designed for high pulse-voltage operation.

GENERAL CHARACTERISTICS

BASE DESIGNATION	—	BASE PINS	9
NOMINAL HEATER	13 V / 450 mA	PARALLEL HEATER	— / —
HEATING	Indirect	SERIES OPERATION	Not specified
CATHODE ARRANGEMENT	Separate cathodes	SECTION CONSTRUCTION	Dissimilar

SECTION RATINGS

SECTION1 Triode	
PLATE RESISTANCE	760 Ω
TRANSCONDUCTANCE	0.0072 S
AMPLIFICATION FACTOR	6
MAXIMUM PLATE VOLTAGE	330 V
MAXIMUM PLATE DISSIPATION	11 W
MAXIMUM CATHODE CURRENT	175 mA
Reference/equivalence-only sparse-source exception: Section 1 high-mu triode; ratings/characteristics not reproduced.	

SECTION2 Triode	
PLATE RESISTANCE	40000 Ω
TRANSCONDUCTANCE	0.0015 S
AMPLIFICATION FACTOR	60
MAXIMUM PLATE VOLTAGE	330 V
MAXIMUM PLATE DISSIPATION	1.5 W
MAXIMUM CATHODE CURRENT	20 mA
Reference/equivalence-only sparse-source exception: Section 2 low-mu high-perveance triode; ratings/characteristics not reproduced.	

13GF7A — Dissimilar Double Triode

The **13GF7A** (also designated as **13GF7-A**) is a Novar-type dissimilar double triode designed for use in television receivers as a combined vertical-deflection oscillator and vertical-deflection amplifier. It contains two electrically independent, highly distinct triode units within a single T-9 glass envelope. Unit No. 1 is a high-mu triode intended for service as a vertical-deflection oscillator, while Unit No. 2 is a low-mu, high-perveance triode designed to operate as a vertical-deflection amplifier.

Construction, Physical Dimensions, and Basing

The 13GF7A is constructed using a **T-9 glass bulb** and features a **9-pin Novar button base** (E9-89 designation) with a 0.687-inch pin circle. The physical construction includes an exhaust tip located on the base of the tube.

The physical dimensions of the tube are:

- **Maximum Diameter:** 1.188 inches
- **Maximum Seated Height:** 2.000 inches
- **Maximum Overall Height:** 2.380 inches

The tube requires a standard **novar 9-contact socket**. The basing arrangement is designated as **9QD**, which provides the following pin connections (viewed from the bottom of the tube):

Pin	Connection
1	Cathode, Unit No. 1 (K_{T1})
2	Grid, Unit No. 2 ($GT2$)
3	Cathode, Unit No. 2 ($KT2$)
4	Heater (H)
5	Heater (H)

Pin	Connection
6	Plate, Unit No. 2 (P_{T2})
7	No Connection (NC)
8	Plate, Unit No. 1 (P_{T1})
9	Grid, Unit No. 1 (G_{T1})

The cathodes of both triode units are **coated unipotential** types. They are electrically independent, allowing separate biasing and circuit configurations for the oscillator and amplifier sections.

Heater Characteristics and Ratings

The heater of the 13GF7A is designed for series-string operation in television receivers. It has controlled warm-up characteristics to ensure reliable operation in series circuits.

Heater Parameter	Value
Nominal Heater Voltage (AC or DC)	13.0 V
Nominal Heater Current	0.450 $\pm$ 0.030 A
Average Warm-up Time	11 seconds
Maximum Peak Heater-Cathode Voltage	$\leq$ 200 V
Maximum Average Heater-Cathode Voltage	100 V

Calculations and Design Considerations

- **Heater Power Calculation:** Using the nominal voltage of 13.0 V and nominal current of 0.45 A, the calculated heater power is: $13.0 \text{ V} \times 0.45 \text{ A} = 5.85 \text{ W}$
- **Warm-up Time Definition:** The average heater warm-up time of 11 seconds is defined as the time required for the voltage across the heater to reach 80% of its bogey value (10.4 V) when 4 times the bogey heater voltage (52.0 V) is applied to a circuit consisting of the heater in series with a resistance equal to 3 times the bogey heater resistance. This series resistance is calculated as: $3 \times \frac{13.0 \text{ V}}{0.45 \text{ A}} = 86.67 \Omega$

Equipment designers must design the receiver circuitry so that the heater current is centered at the bogey value of 0.45 A, with supply variations restricted to maintain the current within the specified $\pm 0.030 \text{ A}$ tolerance.

Interelectrode Capacitances

The direct interelectrode capacitances of the two dissimilar triode units are approximately as follows (measured without an external shield):

Capacitance Parameter	Unit No. 1 (Oscillator)	Unit No. 2 (Amplifier)
Grid to Plate	4.6 pF	9.0 pF
Grid to Cathode and Heater	2.4 pF	6.5 pF
Plate to Cathode and Heater	0.26 pF	1.4 pF

The higher capacitances of Unit No. 2 reflect its larger, high-perveance structure designed for power amplification.

Class A1 Amplifier Characteristics

The two triode units exhibit highly dissimilar electrical characteristics, optimized for their respective roles. Typical Class A1 operating points and characteristics for each unit are:

Parameter	Unit No. 1 (High-Mu)	Unit No. 2 (Low-Mu)
Plate Voltage	250 V	150 V
Grid Voltage	-3 V	-20 V
Amplification Factor (μ)	64	5.4
Plate Resistance (r_p , approx.)	40,000 Ω	750 Ω
Transconductance (g_m)	1,600 μmhos	7,200 μmhos
Plate Current	1.4 mA	50 mA

Additional Operating Characteristics

- **Unit No. 1 Cutoff:** The grid voltage required to reduce the plate current to approximately 10 μA is -5.5 V.
- **Unit No. 2 Cutoff:** The grid voltage required to reduce the plate current to approximately 100 μA is -45 V.
- **Unit No. 2 Peak Current Capability:** At a plate voltage of 60 V and zero grid voltage, Unit No. 2 conducts a plate current of 95 mA. At a grid voltage of -28 V, the plate current is 10 mA.

Vertical-Deflection Service Ratings

The 13GF7A is rated under the Design-Maximum system for operation in a 525-line, 30-frame television system. The maximum ratings for each unit in this service are:

Rating (Design-Maximum Values)	Unit No. 1 (Oscillator)	Unit No. 2 (Amplifier)
Maximum DC Plate Voltage	330 V	330 V

Rating (Design-Maximum Values)	Unit No. 1 (Oscillator)	Unit No. 2 (Amplifier)
Maximum Peak Positive-Pulse Plate Voltage	—	1,500 V*
Maximum Peak Negative-Pulse Grid Voltage	400 V	250 V
Maximum Peak Cathode Current	77 mA	175 mA
Maximum Average Cathode Current	22 mA	50 mA
Maximum Plate Dissipation	1.5 W	11 W

This is an Absolute Maximum rating. The pulse duration must not exceed 15% of a vertical scanning cycle (equivalent to 2.5 milliseconds).

Maximum Circuit Values

- **Grid-Circuit Resistance:** For either grid-resistor-bias or cathode-bias operation, the maximum allowable grid-circuit resistance is **2.2 megohms** for both Unit No. 1 and Unit No. 2.

Related Designations and Curves

The 13GF7A is part of a family of identical-characteristic tubes with different heater ratings, which includes the **6GF7A** (6.3 V, 0.985 A) and the **10GF7A** (9.7 V, 0.6 A). These "A" suffix versions are identical to the older **6GF7**, **10GF7**, and **13GF7** except for their physical construction, which features a shorter bulb and an exhaust tip on the base.

For average plate characteristic curves, designers are directed to refer to the curves of the **6DR7** (for Unit No. 1) and the **6EM7** (for Unit No. 2), as the electrical characteristics of the respective units are identical to those types.

Technical Summary

The **13GF7A** is a Novar-type, dissimilar double triode designed for television vertical-deflection applications. It integrates a high- μ oscillator triode (Unit No. 1, $\mu = 64$) and a low- μ , high-perveance power amplifier triode (Unit No. 2, $\mu = 5.4$) in a single T-9 envelope. Operating from a **13 V, 0.45 A** series-string heater with controlled warm-up, the tube provides a compact and efficient solution for vertical deflection circuits in both color and black-and-white television receivers.



SOURCE OPERATING CONDITIONS

[SOURCE PDF](#)

1968 General Electric Co

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

1968 GENERAL ELECTRIC CO

Section 1 · Triode

CHARACTERISTIC		
PARAMETER	PUBLISHED VALUE	CONDITION / NOTE
Heater Warm-up Time	11 s	Average



SOURCE OPERATING CONDITIONS

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1971 RCA HB3 Binder 5 of 7

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

1971 RCA HB3 BINDER 5 OF 7

Section 1 · Triode

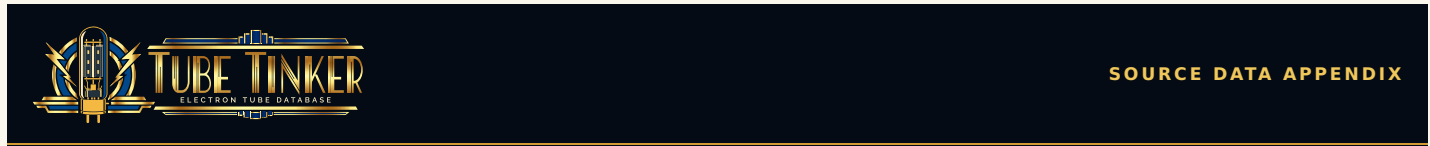
OTHER		
PARAMETER	PUBLISHED VALUE	CONDITION / NOTE
Maximum Plate Voltage	330 V	Inherited from explicitly referenced parent 6GF7A.
Plate Dissipation	10 W	Inherited from explicitly referenced parent 6GF7A.

CHARACTERISTICS		
PARAMETER	PUBLISHED VALUE	CONDITION / NOTE
Plate Resistance	1000 Ω	Inherited from explicitly referenced parent 6GF7A.
Transconductance	7000 μS	Inherited from explicitly referenced parent 6GF7A.
Amplification Factor	6	Inherited from explicitly referenced parent 6GF7A.

Section 2 · Triode

OTHER		
PARAMETER	PUBLISHED VALUE	CONDITION / NOTE
Maximum Plate Voltage	330 V	Inherited from explicitly referenced parent 6GF7A.
Plate Dissipation	1.5 W	Inherited from explicitly referenced parent 6GF7A.

CHARACTERISTICS		
PARAMETER	PUBLISHED VALUE	CONDITION / NOTE
Plate Resistance	40000 Ω	Inherited from explicitly referenced parent 6GF7A.
Transconductance	1500 μS	Inherited from explicitly referenced parent 6GF7A.
Amplification Factor	60	Inherited from explicitly referenced parent 6GF7A.



SOURCE OPERATING CONDITIONS

[SOURCE PDF](#)

1975 RCA RC30

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

1975 RCA RC30

Section 2 · Triode

CHARACTERISTIC		
PARAMETER	PUBLISHED VALUE	CONDITION / NOTE
Grid-No.1 Circuit Resistance	1 megohm	Published value from supplied target entry
Heater Voltage (ac/dc)	13 volts	Published value from supplied target entry
Heater Current	0.45 ampere	Published value from supplied target entry
Heater Warm-up Time (Average)	11 seconds	Published value from supplied target entry
Plate Voltage	150 volts	Published value from supplied target entry
Grid Voltage	-20 volts	Published value from supplied target entry
Amplification Factor	5.4	Published value from supplied target entry
Plate Resistance (Approx.)	760 ohms	Published value from supplied target entry

PARAMETER	PUBLISHED VALUE	CONDITION / NOTE
Transconductance	7200	Published value from supplied target entry
For plate current of	5.5 volts	Published value from supplied target entry
For plate current of	-45 volts	Published value from supplied target entry
Plate Current	50	Published value from supplied target entry
For plate voltage of	95 volts	Published value from supplied target entry
For grid voltage of	10 volts	Published value from supplied target entry
DC Plate Voltage	330 volts	Published value from supplied target entry
Peak Negative-Pulse Grid Voltage	400	Published value from supplied target entry
Peak Cathode Current	175 mA	Published value from supplied target entry
Average Cathode Current	60 mA	Published value from supplied target entry
Plate Dissipation	11 watts	Published value from supplied target entry
Heater Voltage (ac/dc)	9.45 volts	Published value from supplied target entry
Heater Current	0.3 ampere	Published value from supplied target entry
Plate Voltage	125 volts	Published value from supplied target entry
Grid-No	125 volts	Published value from supplied target entry
Grid-No	-1 volts	Published value from supplied target entry
Amplification Factor	46	Published value from supplied target entry
Plate Resistance (Approx.)	200000 ohms	Published value from supplied target entry
Transconductance	7500 mhos	Published value from supplied target entry
Plate Current	12 mA	Published value from supplied target entry
Grid-No	4 mA	Published value from supplied target entry
Plate Voltage	350 volts	Published value from supplied target entry
Grid-No	330 volts	Published value from supplied target entry
Peak Cathode Current	300 mA	Published value from supplied target entry
Average Cathode Current	20 mA	Published value from supplied target entry
Plate Dissipation	2.5 watts	Published value from supplied target entry
Grid-No	0.55 watt	Published value from supplied target entry

CAPACITANCE		
PARAMETER	PUBLISHED VALUE	CONDITION / NOTE
Direct Interelectrode Capacitances (Approx.) : Unit No.1 Unit No	2	Published value from supplied target entry

PARAMETER	PUBLISHED VALUE	CONDITION / NOTE
Grid to Plate	9 pF	Published value from supplied target entry
Grid to Cathode and Heater	6.5 pF	Published value from supplied target entry
Plate to Cathode and Heater	1.4 pF	Published value from supplied target entry
Grid to Plate	1.7 pF	Published value from supplied target entry
Grid to Cathode, Heater, Pentode Grid No	3	Published value from supplied target entry
Plate to Cathode, Heater, Pentode Grid No	3	Published value from supplied target entry
Heater to Cathode	3 pF	Published value from supplied target entry
Plate to Cathode, Heater, Grid No	3	Published value from supplied target entry
Heater to Cathode, Grid No	3 pF	Published value from supplied target entry

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