

ELECTRONIC TUBE REFERENCE

10GF7

Power - TV Vertical Output electronic tube

CONSOLIDATED TECHNICAL DATA

2 SECTIONS

CONSTRUCTION

TRIODE-TRIODE

Dissimilar dual triode specifically intended for television vertical-deflection oscillator and amplifier service, combining a high-gain section with a low-mu, high-dissipation output section.

GENERAL CHARACTERISTICS

BASE DESIGNATION	—	BASE PINS	9
NOMINAL HEATER	9.7 V / 600 mA	PARALLEL HEATER	— / —
HEATING	Indirect	SERIES OPERATION	Not specified
CATHODE ARRANGEMENT	Separate cathodes	SECTION CONSTRUCTION	Dissimilar

SECTION RATINGS

SECTION1 Triode	
PLATE RESISTANCE	40000 Ω
TRANSCONDUCTANCE	0.0027 S
AMPLIFICATION FACTOR	46
MAXIMUM PLATE VOLTAGE	330 V
MAXIMUM PLATE DISSIPATION	2 W
high-mu	

SECTION2 Triode	
PLATE RESISTANCE	1000 Ω
TRANSCONDUCTANCE	0.007 S
AMPLIFICATION FACTOR	6.4
MAXIMUM PLATE VOLTAGE	330 V
MAXIMUM PLATE DISSIPATION	11 W
<i>low-mu</i>	

10GF7 — Double Dissimilar Triode Vacuum Tube

An indirectly heated, double dissimilar triode of the Novar type, designed for vertical-deflection oscillator and amplifier applications in color television receivers.

Overview

The **10GF7** is a Novar-type double dissimilar triode containing two electrically independent, highly distinct triode sections within a single glass envelope. Section 1 is a high-mu triode intended for vertical-deflection oscillator service, while Section 2 is a low-mu, high-perveance triode designed for vertical-deflection amplifier service.

The tube features a nominal **9.7 V, 0.6 A** heater with a controlled warm-up time for use in series-heater strings. The **10GF7A** is a subsequent variant that is electrically identical to the 10GF7 but features a shorter bulb and a modified base with an exhaust tip.

Construction, Physical Dimensions, and Shorter "A" Variant

The 10GF7 and **10GF7A** are constructed in a T-9 glass envelope using a 9-pin Novar button base. The physical dimensions and base designations differ between the original and the "A" suffix versions:

Physical Parameter	10GF7	10GF7A
Construction	Novar T-9	Novar T-9
Base	Novar Button 9 Pin, E9-75	Novar Button 9 Pin, E9-89 (Exhaust Tip on Base)
Basing Diagram	9QD	9QD
Maximum Diameter	1.188 inches	1.188 inches
Maximum Seated Height	2.620 inches	2.000 inches

Physical Parameter	10GF7	<u>10GF7A</u>
Maximum Overall Height	3.000 inches	2.380 inches

The 10GF7A is identical to the 10GF7 in all electrical characteristics, ratings, and pin connections, differing only in its shorter bulb and the presence of an exhaust tip on the base (E9-89 base configuration).

Heater and Basing Configuration

The 10GF7 and 10GF7A are designed for series-string heater applications. The heater has a controlled warm-up time to ensure reliable operation in series circuits.

Heater Parameter	Value
Heater Voltage (AC or DC)	9.7 V
Heater Current	0.600 ± 0.040 A
Calculated Heater Power	5.82 W
Average Warm-up Time	11 seconds

Heater-Cathode Voltage Ratings

To prevent insulation breakdown between the heater and the independent cathodes, the following maximum voltage limits must be observed:

- **Heater Negative with Respect to Cathode:**
 - Total DC and Peak: **200 Volts**
- **Heater Positive with Respect to Cathode:**
 - DC: **100 Volts**
 - Total DC and Peak: **200 Volts**

Pinout (9QD Basing)

The 9QD basing arrangement provides independent connections for the two triode sections, viewed from the underside of the base:

- **Pin 1:** Cathode, Section 1 (**1K**)
- **Pin 2:** Grid, Section 2 (**2G**)
- **Pin 3:** Cathode, Section 2 (**2K**)
- **Pin 4:** Heater (**H**)
- **Pin 5:** Heater (**H**)
- **Pin 6:** Plate, Section 2 (**2P**)
- **Pin 7:** No Connection (**NC**)

- **Pin 8:** Plate, Section 1 (1P)
- **Pin 9:** Grid, Section 1 (1G)

Section 1 electrodes connect to Pins 1, 8, and 9, while Section 2 electrodes connect to Pins 2, 3, and 6.

Electrical Characteristics and Typical Operation

The two triode sections of the 10GF7 are highly dissimilar, optimized for their respective roles in vertical deflection circuitry. Section 1 is a high- μ voltage amplifier, whereas Section 2 is a low- μ , high-current power amplifier.

Direct Interelectrode Capacitances (Unshielded)

The internal capacitances of each section, measured without an external shield, are:

Capacitance Parameter	Section 1 (Oscillator)	Section 2 (Amplifier)
Grid to Plate	4.6 pF	9.0 pF
Input: g to $(h + k)$	2.4 pF	6.5 pF
Output: p to $(h + k)$	0.26 pF	1.4 pF

Typical Class A Operating Points

The typical operating characteristics for each section are specified at different voltage and bias points:

Parameter	Section 1 (Oscillator)	Section 2 (Amplifier)
Plate Voltage	250 V	150 V
Grid No. 1 Voltage	-3 V	-20 V
Plate Current	1.4 mA	50 mA
Transconductance	1600 μ mhos	7200 μ mhos
Amplification Factor (μ)	64	5.4
Plate Resistance (Approx.)	40,000 Ω	750 Ω
Grid Voltage for $I_b = 10 \mu$ A (Approx.)	-5.5 V	—
Grid Voltage for $I_b = 100 \mu$ A (Approx.)	—	-45 V
Plate Current at $E_c = -28$ VDC (Approx.)	—	10 mA

Mathematical Verification of Triode Parameters

The fundamental triode relationship is defined as: $\mu = g_m \times r_p$

- **Section 1 Calculation:** $g_m = 1600 \mu\text{mhos} = 0.0016 \text{ S}$ $r_p = 40,000 \Omega$ $\mu = 0.0016 \text{ S} \times 40,000 \Omega = 64$
This calculated value matches the published amplification factor of **64** exactly.
- **Section 2 Calculation:** $g_m = 7200 \mu\text{mhos} = 0.0072 \text{ S}$ $r_p = 750 \Omega$ $\mu = 0.0072 \text{ S} \times 750 \Omega = 5.4$ This calculated value matches the published amplification factor of **5.4** exactly.

Instantaneous Plate Knee Values (Section 2)

For high-swing deflection service, the perveance of Section 2 is characterized at the plate knee:

- **Plate Voltage (E_b):** 60 V
- **Grid Voltage (E_c):** 0 V
- **Plate Current (I_b):** 95 mA

Design Maximum Ratings

The ratings of the 10GF7 are established under the Design Maximum Rating System. Because the two sections perform entirely different functions, their maximum ratings are specified independently:

Rating Parameter	Section 1 (Oscillator)	Section 2 (Amplifier)
DC Plate Voltage (Max.)	330 V	330 V
Peak Positive Pulse Plate Voltage (Abs. Max.)	—	1500 V
Peak Negative Pulse Grid Voltage (Max.)	400 V	250 V
Plate Dissipation (Max.)	1.5 W	10 W
Average Cathode Current (Max.)	22 mA	50 mA
Peak Cathode Current (Max.)	77 mA	175 mA
Grid Circuit Resistance (Self Bias) (Max.)	2.2 M Ω	2.2 M Ω

Rating Conditions and Pulse Limits

1. **Pulse Duty Cycle:** For operation in a 525-line, 30-frame television system, the duty cycle of the voltage pulse must not exceed **15% of one scanning cycle**.
2. **Grid-Leak Bias Protection:** In stages operating with grid-leak bias, an adequate cathode-bias resistor or other suitable means is required to protect the tube from excessive current in the absence

of excitation.

Related Designations and Heater Variations

The 10GF7 and [10GF7A](#) belong to a family of identical double dissimilar triodes that differ only in their heater configurations:

- [6GF7](#) / [6GF7A](#): Designed for parallel heater circuits, operating at **6.3 V** with a current of **985 mA** (warm-up time is not specified).
- [10GF7](#) / [10GF7A](#): Designed for series-string heater circuits, operating at **9.7 V** with a current of **600 mA** and a controlled **11-second** warm-up time.
- [13GF7](#) / [13GF7A](#): Designed for series-string heater circuits, operating at **13.0 V** with a current of **450 mA** and a controlled **11-second** warm-up time.

Additionally, the [10EM7](#) is a related dual triode with a high-mu and low-mu unit, sharing the same heater ratings (**9.7 V, 600 mA, 11-second warm-up**) but representing a different tube design (derived from the [6EM7](#)).

Technical Summary

The [10GF7](#) and [10GF7A](#) are **Novar-type double dissimilar triodes** designed for vertical deflection oscillator and amplifier service in color television receivers. Featuring a **9.7 V, 600 mA** heater with an **11-second average warm-up time**, they are optimized for series-string power supplies.

Section 1 provides a high-mu ($\mu = 64$) oscillator element with a plate dissipation rating of **1.5 W**, while Section 2 provides a high-perveance, low-mu ($\mu = 5.4$) power amplifier capable of handling peak positive plate pulses up to **1500 V** and dissipating up to **10 W**. The "A" variant offers identical electrical performance in a more compact T-9 envelope with a seated height of **2.000 inches** and an exhaust tip on the base.

SOURCE OPERATING CONDITIONS

1940 RCA

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

1940 RCA

Section 1 · Triode

CHARACTERISTICS		
PARAMETER	PUBLISHED VALUE	CONDITION / NOTE
Heater voltage	9.7 V	Published nominal value
Heater current	600 mA	Published nominal value
Transconductance	2700 μ S	Published operating characteristic
Amplification factor	46	Published operating characteristic

OTHER		
PARAMETER	PUBLISHED VALUE	CONDITION / NOTE
Maximum plate dissipation	2 W	Published maximum or stated design maximum
Application	Vertical-deflection oscillator and amplifier	Television

1940 RCA

Section 2 · Triode

CHARACTERISTICS		
PARAMETER	PUBLISHED VALUE	CONDITION / NOTE
Heater voltage	9.7 V	Published nominal value
Heater current	600 mA	Published nominal value
Transconductance	7000 μ S	Published operating characteristic
Amplification factor	6.4	Published operating characteristic

OTHER		
PARAMETER	PUBLISHED VALUE	CONDITION / NOTE
Maximum plate dissipation	11 W	Published maximum or stated design maximum

SOURCE OPERATING CONDITIONS

[SOURCE PDF](#)

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 6-volt parent type
Plate Dissipation	1.5 W	Inherited from explicitly referenced 6-volt parent type

CHARACTERISTICS		
PARAMETER	PUBLISHED VALUE	CONDITION / NOTE
Transconductance	1500 μ S	Inherited from explicitly referenced 6-volt parent type
Amplification Factor	60	Inherited from explicitly referenced 6-volt parent type

1971 RCA HB3 BINDER 5 OF 7

Section 2 · Triode

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

CHARACTERISTICS		
PARAMETER	PUBLISHED VALUE	CONDITION / NOTE
Transconductance	7000 μ S	Inherited from explicitly referenced 6-volt parent type
Amplification Factor	6	Inherited from explicitly referenced 6-volt parent type