

ELECTRONIC TUBE REFERENCE

13FD7

Power - TV Vertical Output electronic tube

CONSOLIDATED TECHNICAL DATA

2 SECTIONS

CONSTRUCTION

TRIODE-TRIODE

Dissimilar dual triode containing high- and low-mu sections for combined television vertical-deflection oscillator and amplifier service. The power section is rated for 10 W plate dissipation and demanding pulsed output operation.

GENERAL CHARACTERISTICS

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

9HF - TERMINAL PINOUT

TERMINAL	SECTION	ELEMENT	STATUS
PIN1	B	P – Plate (Anode)	CONNECTED
PIN2	B	G1 – Control Grid	CONNECTED
PIN3	B	G3 – Suppressor Grid	CONNECTED
PIN4	–	H – Heater	CONNECTED
PIN5	–	H – Heater	CONNECTED
PIN6	A	P – Plate (Anode)	CONNECTED
PIN7	A	G1 – Control Grid	CONNECTED
PIN8	A	K – Cathode	CONNECTED
PIN9	B	K – Cathode	CONNECTED

SECTION RATINGS

SECTION1 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
<i>high-mu</i>	

SECTION2 Triode	
PLATE RESISTANCE	1000 Ω
TRANSCONDUCTANCE	0.007 S
AMPLIFICATION FACTOR	6
MAXIMUM PLATE VOLTAGE	330 V
MAXIMUM PLATE DISSIPATION	10 W
MAXIMUM CATHODE CURRENT	50 mA
<i>low-mu</i>	

13FD7 — Dissimilar Double Triode Vacuum Tube

The **13FD7** is a miniature, dissimilar double triode vacuum tube designed for use in television receivers. It contains two electrically independent and distinct triode units within a single glass envelope: a high-mu triode (Unit No. 1) and a low-mu triode (Unit No. 2). The tube is primarily designed to serve as a combined vertical-deflection oscillator and vertical-deflection amplifier in television receivers operating under 525-line, 30-frame systems.

The 13FD7 is identical to the [6FD7](#) and [10FD7](#) except for its heater ratings and heater warm-up characteristics.

Construction, Physical Specifications, and Basing

The 13FD7 is constructed with a 9T-9 glass envelope (also designated as a T9 outline) and utilizes a button 9-pin base (E9-68). It requires a miniature 9-contact socket.

The physical dimensions of the tube are as follows:

- **Maximum Diameter:** 1.188 inches
- **Maximum Seated Height:** 2.620 inches

- **Maximum Overall Height:** 2.900 inches

The tube employs the **9HF** basing diagram, which provides the following pin connections (viewed from the bottom of the base):

- **Pin 1:** Plate of Unit No. 2 (Low-Mu Amplifier)
- **Pin 2:** Grid of Unit No. 2 (Low-Mu Amplifier)
- **Pin 3:** Grid of Unit No. 2 (Low-Mu Amplifier)
- **Pin 4:** Heater
- **Pin 5:** Heater
- **Pin 6:** Plate of Unit No. 1 (High-Mu Oscillator)
- **Pin 7:** Grid of Unit No. 1 (High-Mu Oscillator)
- **Pin 8:** Cathode of Unit No. 1 (High-Mu Oscillator)
- **Pin 9:** Cathode of Unit No. 2 (Low-Mu Amplifier)

Heater Characteristics and Ratings

The heater of the 13FD7 is designed for series-string or parallel operation in television receivers. It has the following electrical specifications:

- **Heater Voltage (AC/DC):** 13.0 V
- **Heater Current:** 0.450 A (with a tolerance of ± 0.030 A)
- **Average Heater Warm-up Time:** 11 seconds

For comparison, the related [6FD7](#) operates at a heater voltage of 6.3 V and a current of 0.925 A, while the [10FD7](#) operates at 9.7 V and 0.600 A.

Heater-Cathode Voltage Limits

To prevent insulation breakdown, the voltage difference between the heater and the cathodes must be kept within the following design-maximum limits:

- **Heater Negative with Respect to Cathode:** 200 V maximum (total DC and peak)
- **Heater Positive with Respect to Cathode:** 100 V maximum DC, 200 V maximum (total DC and peak)

Electrical Characteristics and Class A1 Operation

The two triode sections of the 13FD7 have highly dissimilar electrical characteristics, optimized for their respective roles as oscillator and power amplifier.

Unit No. 1 (High-Mu Triode)

Unit No. 1 is characterized by high amplification factor and high plate resistance, making it suitable for voltage amplification and oscillation. Under typical Class A1 operating conditions, its characteristics are:

- **Plate Voltage:** 250 V
- **Grid No. 1 Voltage:** -3 V

- **Amplification Factor:** 64
- **Plate Resistance (Approximate):** 40,000_Ω
- **Transconductance:** 1,600 _μmhos
- **Plate Current:** 1.4 to 1.5 mA
- **Grid Voltage for Plate Current of 10 _μA (Approximate):** -5.5 V

Unit No. 2 (Low-Mu Triode)

Unit No. 2 is a low-impedance, high-current triode designed for power amplification. Its typical Class A1 characteristics are:

- **Plate Voltage:** 150 V
- **Grid No. 1 Voltage:** -17.5 V
- **Amplification Factor:** 6.0
- **Plate Resistance (Approximate):** 800_Ω
- **Transconductance:** 7,500 _μmhos
- **Plate Current:** 40 mA
- **Grid Voltage for Plate Current of 100 _μA (Approximate):** -40 V
- **Transconductance at Plate Current of 1.0 mA:** 500 _μmhos
- **Plate Current at Grid Voltage of -25 V (Approximate):** 6 mA

An additional instantaneous operating point is specified for Unit No. 2 to illustrate its peak current capability:

- **Plate Voltage:** 60 V
- **Grid No. 1 Voltage:** 0 V
- **Plate Current:** 95 mA (measured using a recurrent waveform method to prevent exceeding the maximum ratings of the tube)

Vertical-Deflection Service Ratings

When operated as a combined vertical-deflection oscillator and vertical-deflection amplifier in a 525-line, 30-frame television system, the 13FD7 must be operated within the following Design-Maximum ratings:

Rating Parameter	Unit No. 1 (Oscillator)	Unit No. 2 (Amplifier)
DC Plate Voltage	330 V max	330 V max
Peak Positive-Pulse Plate Voltage	—	1,500 V max
Peak Negative-Pulse Grid Voltage	400 V max	250 V max
Peak Cathode Current	70 mA max	175 mA max

Rating Parameter	Unit No. 1 (Oscillator)	Unit No. 2 (Amplifier)
Average Cathode Current	20 mA max	50 mA max
Plate Dissipation	1.5 W max	10 W max

Operating Conditions and Circuit Values

- **Grid-Circuit Resistance:** For both Unit No. 1 and Unit No. 2, the maximum grid-circuit resistance is **2.2 megohms** under either grid-resistor-bias or cathode-bias (self-bias) operation.
- **Pulse Duration Limit:** For the peak ratings of Unit No. 2, the pulse duration must not exceed 15% of a vertical scanning cycle (equivalent to 2.5 milliseconds in a standard system).
- **Grid Leak Bias Protection:** In stages operating with grid leak bias, an adequate bias resistor or other suitable means is required to protect the tube from damage in the event that excitation is lost.

Interelectrode Capacitances

The direct interelectrode capacitances of the 13FD7 are measured without an external shield. The approximate values for each section are:

- **Unit No. 1 (High-Mu Triode):**
 - Grid to Plate: 4.5 pF
 - Input (Grid to Cathode and Heater): 2.2 pF
 - Output (Plate to Cathode and Heater): 0.40 pF
- **Unit No. 2 (Low-Mu Triode):**
 - Grid to Plate: 10 pF
 - Input (Grid to Cathode and Heater): 6.5 pF
 - Output (Plate to Cathode and Heater): 0.2 pF to 1.2 pF (depending on measurement standards and definitions)

Technical Summary

The **13FD7** is a versatile, 9-pin miniature dissimilar double triode designed specifically for television vertical deflection circuits. It combines a high-mu triode (Unit No. 1, $\mu = 64$) for oscillator service and a high-dissipation, low-impedance triode (Unit No. 2, $r_p \approx 800$, $P_d = 10$ W) for vertical output amplification. Operating with a 13.0 V, 450 mA heater, it is well-suited for series-string heater chains. By integrating these two highly specialized triode units into a single compact envelope, the 13FD7 provides an efficient and space-saving solution for television receiver designs.

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 parent 6FD7.
Plate Dissipation	1.5 W	Inherited from explicitly referenced parent 6FD7.

CHARACTERISTICS		
PARAMETER	PUBLISHED VALUE	CONDITION / NOTE
Plate Resistance	40000 Ω	Inherited from explicitly referenced parent 6FD7.
Transconductance	1500 μS	Inherited from explicitly referenced parent 6FD7.
Amplification Factor	60	Inherited from explicitly referenced parent 6FD7.

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 parent 6FD7.
Plate Dissipation	10 W	Inherited from explicitly referenced parent 6FD7.

CHARACTERISTICS		
PARAMETER	PUBLISHED VALUE	CONDITION / NOTE
Plate Resistance	1000 Ω	Inherited from explicitly referenced parent 6FD7.

PARAMETER	PUBLISHED VALUE	CONDITION / NOTE
Transconductance	7000 μS	Inherited from explicitly referenced parent 6FD7.
Amplification Factor	6	Inherited from explicitly referenced parent 6FD7.



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 1 · Triode

CHARACTERISTIC		
PARAMETER	PUBLISHED VALUE	CONDITION / NOTE
Heater Voltage (ae/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	-17.5 volts	Published value from supplied target entry
Amplification Factor	64	Published value from supplied target entry
Plate Resistance (Approx.)	800 ohms	Published value from supplied target entry
Transconductance	7500	Published value from supplied target entry
Plate Current	40 mA	Published value from supplied target entry
For plate current of	5.5 volts	Published value from supplied target entry
For plate current of	40	Published value from supplied target entry
Transconductance, For plate current of	1 mA	Published value from supplied target entry
Plate Current, For grid voltage of	6 volts	Published value from supplied target entry
DC Plate Voltage	330 volts	Published value from supplied target entry
Peak Cathode Current	175 mA	Published value from supplied target entry
Average Cathode Current	50 mA	Published value from supplied target entry

PARAMETER	PUBLISHED VALUE	CONDITION / NOTE
Plate Dissipation	10 watts	Published value from supplied target entry
Heater Voltage (ac/dc)	6.3 volts	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
Grid to Plate	10 PF	Published value from supplied target entry
Grid to Cathode and Heater	6.5 PF	Published value from supplied target entry
Grid to Plate	1.8 pF	Published value from supplied target entry
Grid to Cathode, Pentode Grid No	3 pF	Published value from supplied target entry
Plate to Cathode, Pentode Grid No	1.9 pF	Published value from supplied target entry
Plate to Cathode, Grid No	2	Published value from supplied target entry
Heater to Cathode, and Pentode Grid No	6 pF	Published value from supplied target entry