

ELECTRONIC TUBE REFERENCE

10DE7

Power - TV Vertical Output electronic tube

CONSOLIDATED TECHNICAL DATA

2 SECTIONS

CONSTRUCTION

TRIODE-TRIODE

Dissimilar dual triode for television vertical deflection, pairing an oscillator triode with a low-resistance power section rated for high positive plate pulses in vertical-output service.

GENERAL CHARACTERISTICS

BASE DESIGNATION	9HF	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

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	8750 Ω
TRANSCONDUCTANCE	0.002 S
AMPLIFICATION FACTOR	17.5
MAXIMUM PLATE VOLTAGE	330 V
MAXIMUM PLATE DISSIPATION	1.6 W
MAXIMUM CATHODE CURRENT	22 mA
<i>Triode No. 1; vertical-deflection oscillator.</i>	

SECTION2 Triode	
PLATE RESISTANCE	925 Ω
TRANSCONDUCTANCE	0.0065 S
AMPLIFICATION FACTOR	6
MAXIMUM PLATE VOLTAGE	275 V
MAXIMUM PLATE DISSIPATION	7 W
MAXIMUM CATHODE CURRENT	60 mA
<i>Triode No. 2; vertical-deflection amplifier.</i>	

10DE7 — Dissimilar Double Triode Vacuum Tube

An indirectly heated, miniature dual-section tube designed as a combined vertical-deflection oscillator and vertical-deflection amplifier in television receivers.

Overview

The **10DE7** is a miniature, dissimilar double triode containing two electrically independent and highly distinct triode sections within a single T-6 1/2 glass envelope. The two sections are optimized for entirely different roles in television deflection circuits:

- **Unit No. 1** is a medium-mu triode designed to operate as a blocking oscillator in vertical-deflection circuits.
- **Unit No. 2** is a low-mu, high-current triode designed to operate as a vertical-deflection amplifier.

The tube features a 9-pin miniature button base and an indirectly heated cathode system. Its heater is specifically designed for series-string television receivers, incorporating controlled warm-up characteristics to minimize voltage surges during start-up.

Physical Construction, Base, and Pinout

The 10DE7 is housed in a standard T-6 1/2 glass bulb. It utilizes a 9-pin miniature button base (designated E9-1) with a **9HF** basing arrangement. The physical dimensions of the tube are as follows:

- **Maximum overall height:** 2.625 inches (2 5/8")
- **Maximum seated height:** 2.375 inches (2 3/8")
- **Maximum diameter:** 0.875 inches (7/8")

The tube can be mounted and operated in **any position**.

The pin connections, viewed from the bottom of the base, are assigned as follows:

- **Pin 1:** Plate (Unit No. 2)
- **Pin 2:** Grid (Unit No. 2)
- **Pin 3:** Grid (Unit No. 2)
- **Pin 4:** Heater
- **Pin 5:** Heater
- **Pin 6:** Plate (Unit No. 1)
- **Pin 7:** Grid (Unit No. 1)
- **Pin 8:** Cathode (Unit No. 1)
- **Pin 9:** Cathode (Unit No. 2)

The double connection to the grid of Unit No. 2 (Pins 2 and 3) helps reduce input impedance and provides flexibility in circuit layout.

Heater Characteristics and Thermal Control

The 10DE7 heater is designed for series-string operation in television receivers. It has controlled thermal characteristics to ensure that heater voltage surges during the warm-up cycle are minimized, provided it is operated in series with other heaters having similar controlled warm-up characteristics.

Heater Parameter	Value
Nominal Heater Voltage (AC/DC)	9.7 V
Nominal Heater Current	0.6 A (600 mA)
Average Heater Warm-up Time	11 seconds
Heating Method	Indirectly heated, coated unipotential cathode

Heater-Cathode Voltage Ratings

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

- **Heater negative with respect to cathode:** 200 V (total DC and peak)

- **Heater positive with respect to cathode:** 100 V DC, with a maximum total DC and peak limit of 200 V

Electrical Characteristics and Class A Operation

Because the 10DE7 is a dissimilar double triode, the two sections exhibit highly contrasting electrical characteristics. Unit No. 1 is optimized for voltage amplification and oscillation, whereas Unit No. 2 is optimized for power amplification.

The typical Class A1 amplifier characteristics for each section are:

Parameter	Unit No. 1 (Oscillator)	Unit No. 2 (Amplifier)
Plate Voltage	250 V	150 V
Grid Voltage (Grid No. 1)	-11 V	-17.5 V
Amplification Factor (μ)	17.5	6.0
Plate Resistance (r_p , approx.)	8,750 Ω	925 Ω
Transconductance (g_m)	2,000 μ mhos	6,500 μ mhos
Plate Current	5.5 mA	35 mA
Grid Voltage for Plate Current of 10 μ A	-20 V	—
Grid Voltage for Plate Current of 50 μ A	—	-44 V
Plate Current at $E_c = -24$ VDC	—	10 mA
Zero-Bias Plate Current (Instantaneous, $E_b = 60$ V, $E_c = 0$ V)	—	80 mA

The relationship between transconductance, plate resistance, and amplification factor can be verified via calculation.

Calculation for Unit No. 1: $\mu \approx g_m \times r_p = 0.002 \text{ S} \times 8,750 \Omega = 17.5$

Calculation for Unit No. 2: $\mu \approx g_m \times r_p = 0.0065 \text{ S} \times 925 \Omega = 6.01$

These calculations align precisely with the published nominal amplification factors.

Vertical-Deflection Service and Maximum Ratings

The primary application of the 10DE7 is in television receivers operating under a 525-line, 30-frame system. In this service, Unit No. 1 operates as a vertical-deflection blocking oscillator, and Unit No. 2 operates as a vertical-deflection amplifier.

The maximum ratings are defined under the Design-Maximum (or Design-Center) rating systems:

Rating Parameter	Unit No. 1 (Oscillator)	Unit No. 2 (Amplifier)
Maximum DC Plate Voltage	330 V	275 V
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 to 60 mA
Maximum Plate Dissipation	1.5 W	7.0 W
Maximum Grid-Circuit Resistance (Self-Bias)	2.2 M Ω	2.2 M Ω

Pulse and Bias Constraints

- **Pulse Duration:** For vertical-deflection service, the peak pulse ratings are valid only if the pulse duration does not exceed 15% of a vertical scanning cycle, which equates to a maximum of 2.5 milliseconds.
- **Grid-Leak Bias Protection:** When operating a stage with grid-leak bias, an adequate cathode-bias resistor or other protective means must be incorporated to safeguard the tube against excessive current in the event that excitation is lost.

Interelectrode Capacitances

The direct interelectrode capacitances of the 10DE7 are measured without an external shield. The approximate values for each section are:

Capacitance Parameter	Unit No. 1	Unit No. 2
Grid to Plate (C_{gp})	4.0 pF	8.5 pF
Input: Grid to (Cathode + Heater)	2.2 pF	5.5 pF

Capacitance Parameter	Unit No. 1	Unit No. 2
Output: Plate to (Cathode + Heater)	0.52 pF	1.0 pF

The higher capacitances of Unit No. 2 reflect its larger physical electrode structure, which is necessary to support its higher current and power dissipation capabilities.

Average Plate Characteristics and Curve Interpretation

The average plate characteristics of the two sections highlight their distinct design goals:

- Unit No. 1 (Oscillator Section):** The plate curves show a family of grid bias lines from $E_{c1}(/tubes/C1) = 0\text{ V}$ down to -20 V . At a plate voltage of 250 V , the plate current varies smoothly from approximately 25 mA at zero bias down to zero near -20 V . The relatively high plate resistance is indicated by the moderate slope of the plate current lines.
- Unit No. 2 (Amplifier Section):** The plate curves for this section exhibit much steeper slopes, reflecting its low plate resistance ($925\text{ }\Omega$). The grid bias lines span from $E_{c1}(/tubes/C1) = 0\text{ V}$ down to -60 V . At a plate voltage of 150 V , the plate current can exceed 100 mA at low bias levels, demonstrating the high peak-current capability required to drive vertical-deflection coils.

Related Designations and Heater Variants

The 10DE7 belongs to a family of identical dissimilar double triodes that differ only in their heater ratings. These variants are designed to accommodate different power supply configurations:

- 6DE7:** Designed for parallel heater circuits, requiring a heater voltage of **6.3 V** at a current of **0.9 A** (900 mA).
- 13DE7:** Designed for series-string circuits, requiring a heater voltage of **13.0 V** at a current of **0.45 A** (450 mA), with an 11-second warm-up time.
- 19DE7:** Designed for series-string circuits, requiring a heater voltage of **19.4 V** at a current of **0.3 A** (300 mA), with an 11-second warm-up time.

While these tubes share identical internal structures, electrical characteristics, and pinouts, they are not direct plug-in substitutions for one another unless the heater supply circuit is modified to match the specific heater voltage and current requirements.

Technical Summary

The **10DE7** is a versatile, **9-pin miniature dissimilar double triode** designed for television vertical-deflection systems. It integrates a medium-mu oscillator (Unit No. 1) and a low-mu, high-current power amplifier (Unit No. 2) in a single T-6 1/2 glass envelope. With a **9.7 V, 0.6 A** heater featuring controlled warm-up characteristics, it is optimized for series-string television receivers. By providing two highly specialized triode units with separate cathodes, the 10DE7 delivers an efficient, space-saving solution for generating and amplifying vertical-deflection signals.



SOURCE OPERATING CONDITIONS

1950 Sylvania

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

1950 SYLVANIA

Section 1 · Triode

OTHER		
PARAMETER	PUBLISHED VALUE	CONDITION / NOTE
Peak Negative Pulse Grid Voltage	400 V	Oscillator section

1950 SYLVANIA

Section 2 · Triode

OTHER		
PARAMETER	PUBLISHED VALUE	CONDITION / NOTE
Peak Positive Pulse Plate Voltage	1500 V	Amplifier section; absolute maximum
Peak Negative Pulse Grid Voltage	250 V	Amplifier section



SOURCE OPERATING CONDITIONS

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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 · Triode

OTHER		
PARAMETER	PUBLISHED VALUE	CONDITION / NOTE
Service	Vertical deflection oscillator	Section1
Heater Warmup Time	11 s	—

1961 TUNG SOL

Section 2 · Triode

OTHER		
PARAMETER	PUBLISHED VALUE	CONDITION / NOTE
Service	Vertical deflection amplifier	Section2



SOURCE DATA APPENDIX

SOURCE OPERATING CONDITIONS

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1966 Tung Sol Electronic Tubes 2 of 4

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

1966 TUNG SOL ELECTRONIC TUBES 2 OF 4

Section 1 · Triode

OTHER		
PARAMETER	PUBLISHED VALUE	CONDITION / NOTE
Plate voltage	250 V	Section1;VerticalOscillator
Plate current	5.5 mA	Section1;VerticalOscillator
Peak negative grid voltage	400 V	Section1;VerticalOscillator

CHARACTERISTIC		
PARAMETER	PUBLISHED VALUE	CONDITION / NOTE
Heater warm-up time	11 s	WholeTube

1966 TUNG SOL ELECTRONIC TUBES 2 OF 4

Section 2 · Triode

OTHER		
PARAMETER	PUBLISHED VALUE	CONDITION / NOTE
Plate voltage	150 V	Section2;VerticalDeflection
Plate current	35 mA	Section2;VerticalDeflection
Peak positive pulse plate voltage	1500 V	Section2;VerticalDeflection
Peak negative grid voltage	250 V	Section2;VerticalDeflection



SOURCE DATA APPENDIX

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 Warm-up Time (Average) –	11 s	Characteristic;PublishedValue1
Heater Warm-up Time (Average) –	11 s	Characteristic;PublishedValue2
Peak value	200 V	Characteristic;PublishedValue1
Peak value	200 V	Characteristic;PublishedValue2
Peak value	200 V	Characteristic;PublishedValue3
Average value	100 V	Characteristic;PublishedValue1
Average value	100 V	Characteristic;PublishedValue2
Average value	100 V	Characteristic;PublishedValue3
Plate Voltage	250 V	Characteristic;PublishedValue1
Plate Voltage	150 V	Characteristic;PublishedValue2
Grid Voltage	-11 V	Characteristic;PublishedValue1
Grid Voltage	-17.5 V	Characteristic;PublishedValue2
Plate Resistance (Approx.)	8750 ohm	Characteristic;PublishedValue1
Plate Resistance (Approx.)	925 ohm	Characteristic;PublishedValue2
Transconductance	2000 uS	Characteristic;PublishedValue1
Transconductance	6500 uS	Characteristic;PublishedValue2
Plate Current	5.5 mA	Characteristic;PublishedValue1
Plate Current	35 mA	Characteristic;PublishedValue2
Plate Current for grid voltage of	24 V	Characteristic;PublishedValue1
Plate Current for grid voltage of	-20 V	Characteristic;PublishedValue2
– –	10 mA	Characteristic
Grid Voltage (Approx.) for plate current of	10 uA	Characteristic

PARAMETER	PUBLISHED VALUE	CONDITION / NOTE
Grid Voltage (Approx.) for plate current of	50 V	Characteristic
Plate Resistance	8750 ohm	Section1
Transconductance	2000 uS	Section1
Amplification Factor	17.5	Section1

CAPACITANCE		
PARAMETER	PUBLISHED VALUE	CONDITION / NOTE
Grid to Plate	4 pF	Capacitance;PublishedValue1
Grid to Plate	8.5 pF	Capacitance;PublishedValue2
Plate to Cathode and Heater	0.52 pF	Capacitance;PublishedValue1
Plate to Cathode and Heater	1 pF	Capacitance;PublishedValue2

OTHER		
PARAMETER	PUBLISHED VALUE	CONDITION / NOTE
DC Plate Voltage	330 V	MaximumRating;PublishedValue1
DC Plate Voltage	275 V	MaximumRating;PublishedValue2
Peak Positive-Pulse Plate Voltage* –	1500 V	MaximumRating
Peak Negative-Pulse Grid Voltage	400 V	MaximumRating;PublishedValue1
Peak Negative-Pulse Grid Voltage	250 V	MaximumRating;PublishedValue2
Peak Cathode Current "	175 mA	MaximumRating
Average Cathode Current	22 mA	MaximumRating;PublishedValue1
Average Cathode Current	60 mA	MaximumRating;PublishedValue2
Plate Dissipation	1.6 W	MaximumRating;PublishedValue1
Plate Dissipation	7 W	MaximumRating;PublishedValue2
For grid-resistor bias or cathode-bias operation	2.2 megohm	MaximumCircuitValue;PublishedValue1
For grid-resistor bias or cathode-bias operation	2.2 megohm	MaximumCircuitValue;PublishedValue2
PLATE	92 V	MaximumCircuitValue
Maximum Plate Voltage	330 V	Section1
Maximum Plate Dissipation	1.6 W	Section1
Maximum Cathode Current	22 mA	Section1

OTHER		
PARAMETER	PUBLISHED VALUE	CONDITION / NOTE
Maximum Plate Voltage	275 V	Section2
Maximum Plate Dissipation	7 W	Section2
Maximum Cathode Current	175 mA	Section2

CHARACTERISTIC		
PARAMETER	PUBLISHED VALUE	CONDITION / NOTE
Plate Resistance	925 ohm	Section2
Transconductance	6500 uS	Section2
Amplification Factor	6	Section2

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and their source documents.

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