



ELECTRONIC TUBE REFERENCE

13EM7

Power - TV Vertical Output electronic tube

CONSOLIDATED TECHNICAL DATA

2 SECTIONS

CONSTRUCTION

TRIODE-TRIODE

Dissimilar dual triode for combined television vertical-deflection oscillator and amplifier service. The high-mu oscillator section is paired with a low-mu power section having 10 W plate dissipation and strong pulse-current capability.

GENERAL CHARACTERISTICS

BASE DESIGNATION	8B0	BASE PINS	8
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	40000 Ω
TRANSCONDUCTANCE	0.0014 S
AMPLIFICATION FACTOR	57
MAXIMUM PLATE VOLTAGE	330 V
MAXIMUM PLATE DISSIPATION	1.5 W
MAXIMUM CATHODE CURRENT	22 mA
WARM-UP TIME	11 s
Published promoted fields populated semantically; identical repeated sections compressed.	

SECTION2 Triode	
PLATE RESISTANCE	750 Ω
TRANSCONDUCTANCE	0.0072 S
AMPLIFICATION FACTOR	5.4
MAXIMUM PLATE VOLTAGE	330 V
MAXIMUM PLATE DISSIPATION	10 W
MAXIMUM CATHODE CURRENT	50 mA
WARM-UP TIME	11 s
<i>Published promoted fields populated semantically; identical repeated sections compressed.</i>	

13EM7 — Dissimilar Double Triode Vacuum Tube

The **13EM7** is a glass octal-type vacuum tube containing two dissimilar triode units in a single envelope. It is designed primarily for use in television receivers as a combined vertical-deflection oscillator and vertical-deflection amplifier. Unit No. 1 is a high-mu triode intended for vertical-deflection oscillator service, while Unit No. 2 is a low-mu triode designed for vertical-deflection amplifier service.

Construction, Physical Dimensions, and Pinout

The 13EM7 is constructed in a T-9 glass bulb with a short intermediate shell 8-pin octal base (JEDEC B8-58, outline JEDEC 9-37). The tube can be mounted and operated in any position.

Physical Dimensions

- **Maximum Diameter:** 1.188 inches
- **Maximum Seated Height:** 2.313 inches
- **Maximum Overall Height:** 2.875 inches

Heater Characteristics

The tube features a coated unipotential cathode. The heater can be operated on either AC or DC.

- **Heater Voltage:** 13.0 V
- **Heater Current:** 0.45 A (450 mA)
- **Average Heater Warm-up Time:** 11 seconds

Basing and Pin Connections

The 13EM7 uses the **8BD** basing diagram. The pin assignments, viewed from the bottom of the base, are as follows:

Pin	Symbol	Connection
Pin 1	2G	Grid, Unit No. 2 (Low-Mu)
Pin 2	2P	Plate, Unit No. 2 (Low-Mu)
Pin 3	2K	Cathode, Unit No. 2 (Low-Mu)
Pin 4	1G	Grid, Unit No. 1 (High-Mu)
Pin 5	1P	Plate, Unit No. 1 (High-Mu)
Pin 6	1K	Cathode, Unit No. 1 (High-Mu)
Pin 7	H	Heater
Pin 8	H	Heater

Unit No. 1 (the high-mu oscillator section) is connected to pins 4, 5, and 6. Unit No. 2 (the low-mu amplifier section) is connected to pins 1, 2, and 3.

Electrical Characteristics and Class A1 Operation

The two triode sections of the 13EM7 have highly dissimilar electrical characteristics, optimized for their respective roles as oscillator and power amplifier.

Direct Interelectrode Capacitances

The approximate direct interelectrode capacitances, measured without an external shield, are:

Capacitance Parameter	Unit No. 1 (High-Mu)	Unit No. 2 (Low-Mu)
Grid to Plate	4.8 pF	10 pF
Input: Grid to (Cathode + Heater)	2.2 pF	7.0 pF
Output: Plate to (Cathode + Heater)	0.6 pF	1.8 pF

Class A1 Amplifier Characteristics

At typical operating points, the characteristics of each section are as follows:

Parameter	Unit No. 1 (Oscillator)	Unit No. 2 (Amplifier)
Plate Voltage	250 V	150 V
Grid Voltage	-3 V	-20 V

Parameter	Unit No. 1 (Oscillator)	Unit No. 2 (Amplifier)
Amplification Factor	64 to 68	5.4
Plate Resistance (Approx.)	40,000 ohms	750 ohms
Transconductance	1,600 μ mhos	7,200 μ mhos
Plate Current	1.4 mA	50 mA

Additional Operating Points and Knee Values

- **Unit No. 1 Low-Current Cutoff:** The grid voltage required to reduce the plate current to 10 μ A is approximately -5.5 V.
- **Unit No. 2 Low-Current Cutoff:** The grid voltage required to reduce the plate current to 100 μ A is approximately -45 V.
- **Unit No. 2 Plate Current at -28 V Grid Bias:** Approximately 10 mA.
- **Unit No. 2 Instantaneous Plate Knee Values:** At a plate voltage of 60 V and zero grid voltage, the plate current is 95 mA.

Maximum Ratings and Circuit Values

The maximum ratings are interpreted according to the Design-Maximum System (except where noted as Design-Center or Absolute Maximum) for operation in a 525-line, 30-frame television system.

Vertical-Deflection Service Ratings

Rating Parameter	Unit No. 1 (Oscillator)	Unit No. 2 (Amplifier)
Maximum DC Plate Voltage	330 V	330 V
Maximum Peak Positive-Pulse Plate Voltage	—	1500 V (Abs. Max)
Maximum Peak Negative-Pulse Grid Voltage	400 V	250 V
Maximum Plate Dissipation	1.5 W	10 W
Maximum Average Cathode Current	22 mA	50 mA
Maximum Peak Cathode Current	77 mA	175 mA
Maximum Grid-Circuit Resistance (Self/Cathode Bias)	2.2 M Ω	2.2 M Ω

Rating Parameter	Unit No. 1 (Oscillator)	Unit No. 2 (Amplifier)
Maximum Grid-Circuit Resistance (Fixed Bias)	—	2.2 MΩ

Note on Pulse Ratings: For the peak pulse ratings, the pulse duration must not exceed 15% of a vertical scanning cycle (equivalent to 2.5 milliseconds in a standard system).

Heater-Cathode Voltage Limits

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

Circuit Considerations

In stages operating with grid-leak bias, an adequate cathode bias resistor or other suitable means is required to protect the tube in the absence of excitation.

Related Designations and Comparisons

The **13EM7** is part of a family of dissimilar double triodes. It shares identical internal structures and electrical characteristics with the **6EM7** (which uses a 6.3 V, 0.925 A heater) and the **10EM7** (which uses a 9.7 V, 0.6 A heater).

Additionally, the designation **13EM7/15EA7** or **13EM7/15EAY** represents the same 13.0 V heater device, where the "**15EA7**" or "**15EAY**" suffix reflects alternative nomenclature for the same electrical and physical structure.

For the average plate characteristics of Unit No. 1, reference is made to the characteristics of Unit No. 1 of the **6DR7** (or **13DR7**), which shares similar high-mu triode behavior.

Technical Summary

The **13EM7** is an octal-based, dissimilar double triode designed for television vertical-deflection circuits. It integrates a high-mu oscillator triode (Unit No. 1: $\mu \approx 64\text{--}68$, $g_m \approx 1,600 \mu\text{mhos}$) and a low-mu power amplifier triode (Unit No. 2: $\mu \approx 5.4$, $g_m \approx 7,200 \mu\text{mhos}$, plate dissipation $\leq 10 \text{ W}$) within a single T-9 envelope. Operating with a 13.0 V, 450 mA heater, the 13EM7 provides a compact, single-tube solution for generating and amplifying vertical deflection signals in television receivers.



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 2 · Triode

CHARACTERISTIC		
PARAMETER	PUBLISHED VALUE	CONDITION / NOTE
Section2AmplificationFactor	5.4	Section2



SOURCE OPERATING CONDITIONS

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1966 Tung Sol Electronic Tubes 3 of 4

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

1966 TUNG SOL ELECTRONIC TUBES 3 OF 4

Section 1 · Triode

OTHER		
PARAMETER	PUBLISHED VALUE	CONDITION / NOTE
Typical plate voltage	250 V	VerticalDeflection
Typical plate current	2.4 mA	VerticalDeflection
Maximum peak cathode current	70 mA	VerticalDeflection
Maximum plate voltage	330 V	PromotedValue
Maximum plate dissipation	1.5 W	PromotedValue
Maximum cathode current	22 mA	PromotedValue

CHARACTERISTICS		
PARAMETER	PUBLISHED VALUE	CONDITION / NOTE
Plate resistance	40000 ohm	PromotedValue
Transconductance	0.0016 A/V	PromotedValue
Amplification factor	64	PromotedValue

Section 2 · Triode

OTHER		
PARAMETER	PUBLISHED VALUE	CONDITION / NOTE
Typical plate voltage	150 V	VerticalDeflection
Typical plate current	50 mA	VerticalDeflection
Maximum peak cathode current	175 mA	VerticalDeflection
Maximum peak positive pulse plate voltage	1500 V	VerticalDeflection
Maximum plate voltage	330 V	PromotedValue
Maximum plate dissipation	10 W	PromotedValue
Maximum cathode current	50 mA	PromotedValue

CHARACTERISTICS		
PARAMETER	PUBLISHED VALUE	CONDITION / NOTE
Plate resistance	750 ohm	PromotedValue
Transconductance	0.0072 A/V	PromotedValue
Amplification factor	5.4	PromotedValue



SOURCE DATA APPENDIX

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.

Section 1 · Triode

OTHER		
PARAMETER	PUBLISHED VALUE	CONDITION / NOTE
Maximum Plate Voltage	330 V	Inherited from explicitly referenced parent 6EM7.
Plate Dissipation	1.5 W	Inherited from explicitly referenced parent 6EM7.

CHARACTERISTICS		
PARAMETER	PUBLISHED VALUE	CONDITION / NOTE
Plate Resistance	40000 Ω	Inherited from explicitly referenced parent 6EM7.
Transconductance	1500 μS	Inherited from explicitly referenced parent 6EM7.
Amplification Factor	60	Inherited from explicitly referenced parent 6EM7.

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 6EM7.
Plate Dissipation	10 W	Inherited from explicitly referenced parent 6EM7.

CHARACTERISTICS		
PARAMETER	PUBLISHED VALUE	CONDITION / NOTE
Plate Resistance	1000 Ω	Inherited from explicitly referenced parent 6EM7.
Transconductance	7000 μS	Inherited from explicitly referenced parent 6EM7.
Amplification Factor	6	Inherited from explicitly referenced parent 6EM7.



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SOURCE DATA APPENDIX

SOURCE OPERATING CONDITIONS

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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 (ac/dc)	13 volts	Published value from supplied target entry

PARAMETER	PUBLISHED VALUE	CONDITION / NOTE
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	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.)	750 ohms	Published value from supplied target entry
Transconductance	7200 mhos	Published value from supplied target entry
Plate Current, for plate voltage of	60 volts	Published value from supplied target entry
Plate Current, for grid voltage of	-28 volts	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
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
Plate Dissipation	10 watts	Published value from supplied target entry
Grid-Circuit Resistance: Unit No.1 Unit No	2	Published value from supplied target entry
Heater Voltage (ac/dc)	6.3 volts	Published value from supplied target entry
Heater Current	0.2 ampere	Published value from supplied target entry

CAPACITANCE		
PARAMETER	PUBLISHED VALUE	CONDITION / NOTE
Direct Intel-electrode 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	7 pF	Published value from supplied target entry
Plate to Cathode and Heater	1.8 pF	Published value from supplied target entry
Grid to Plate	1 PF	Published value from supplied target entry
Plate to Cathode and Heater	2.6 PF	Published value from supplied target entry
Grid to Cathode and Heater	1 PF	Published value from supplied target entry



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