



ELECTRONIC TUBE REFERENCE

10LZ8

Voltage - Triode Pentode electronic tube

CONSOLIDATED TECHNICAL DATA

2 SECTIONS

CONSTRUCTION

PENTODE-TRIODE

Television triode-pentode combining sync-separator, sync-clipper, and phase-inverter triode functions with video-amplifier pentode service.

GENERAL CHARACTERISTICS

BASE DESIGNATION	9DX	BASE PINS	9
NOMINAL HEATER	10.5 V / 450 mA	PARALLEL HEATER	– / –
HEATING	Indirect	SERIES OPERATION	Not specified
CATHODE ARRANGEMENT	Separate cathodes	SECTION CONSTRUCTION	Dissimilar

9DX - TERMINAL PINOUT

TERMINAL	SECTION	ELEMENT	STATUS
PIN1 – 2K	B	K – Cathode	CONNECTED
PIN2 – 2G1	B	G1 – Control Grid	CONNECTED
PIN3 – 2P	B	P – Plate (Anode)	CONNECTED
PIN4 – H	–	H – Heater	CONNECTED
PIN5 – H	–	H – Heater	CONNECTED
PIN6 – 1G3	A	G3 – Suppressor Grid	CONNECTED
PIN6 – IS	A	IS – Internal Screen	CONNECTED
PIN6 – 1K	A	K – Cathode	CONNECTED
PIN7 – 1G1	A	G1 – Control Grid	CONNECTED
PIN8 – 1G2	A	G2 – Screen Grid	CONNECTED
PIN9 – 1P	A	P – Plate (Anode)	CONNECTED

SECTION RATINGS

SECTION1 Pentode	
PLATE RESISTANCE	150000 Ω
TRANSCONDUCTANCE	0.0095 S
AMPLIFICATION FACTOR	60
MAXIMUM PLATE VOLTAGE	225 V
MAXIMUM SCREEN VOLTAGE	160 V
MAXIMUM PLATE DISSIPATION	4.5 W
MAXIMUM SCREEN DISSIPATION	2 W
<i>Published maximum ratings, characteristics, typical operation, and capacitance material reviewed.</i>	

SECTION2 Triode	
PLATE RESISTANCE	52000 Ω
TRANSCONDUCTANCE	0.0021 S
AMPLIFICATION FACTOR	110
MAXIMUM PLATE VOLTAGE	300 V
MAXIMUM PLATE DISSIPATION	1 W
<i>Published maximum ratings, characteristics, typical operation, and capacitance material reviewed.</i>	

10LZ8 — High-Mu Triode and Sharp-Cutoff Pentode

Overview

The **10LZ8** (also designated as **10JA8/10LZ8**) is a miniature multi-unit vacuum tube containing a high-mu triode and a sharp-cutoff pentode in a single envelope. It is designed primarily for use in color and black-and-white television receiver applications. In these circuits, the triode section is typically employed as a sync separator, sync clipper, or phase inverter, while the pentode section is optimized for service as a video amplifier. The triode section is also suitable for general-purpose voltage amplification.

The tube features a 10.5-volt heater designed for series-string heater circuits, requiring a nominal current of 0.45 amperes. It is housed in a standard T-6 1/2 glass envelope with a miniature 9-pin button base, utilizing the 9DX basing arrangement.

Mechanical Specifications and Pinout

The 10LZ8 is constructed in a T-6 1/2 glass envelope and utilizes a small button 9-pin base (E9-1). It can be mounted and operated in any position.

The physical dimensions of the tube are as follows:

- **Maximum Diameter:** 0.875 inches (22.2 mm)
- **Minimum Diameter:** 0.750 inches (19.1 mm)
- **Maximum Seated Height:** 2.375 inches (60.3 mm)
- **Maximum Overall Length:** 2.625 inches (66.7 mm)

The tube requires a standard miniature 9-contact socket. The **9DX** basing diagram provides the following pin connections, viewed from the underside of the base:

Pin Number	Connection
1	Triode Cathode
2	Triode Grid
3	Triode Plate
4	Heater
5	Heater
6	Pentode Cathode, Grid Number 3 (Suppressor Grid), and Internal Shield
7	Pentode Grid Number 1 (Control Grid)
8	Pentode Grid Number 2 (Screen Grid)
9	Pentode Plate

Heater Characteristics and Ratings

The 10LZ8 is designed with an indirectly heated, coated unipotential cathode structure. The heater is intended for operation in series-string heater chains, with controlled warm-up characteristics to minimize voltage surges across other tubes in the string during start-up.

Heater Parameter	Value
Nominal Heater Voltage (AC or DC)	10.5 V
Nominal Heater Current	0.45 A (450 mA)
Average Heater Warm-up Time	11 seconds

Heater-Cathode Voltage Limits

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

- **Heater Negative with Respect to Cathode:**
 - Total DC and Peak Voltage: 200 V max
- **Heater Positive with Respect to Cathode:**
 - DC Component: 100 V max
 - Total DC and Peak Voltage: 200 V max
- **Alternative Rating System Limits:** Some specifications define these limits as a peak value of ± 200 V max and an average value of 100 V max.

Electrical Characteristics and Operating Points

Because the 10LZ8 contains two highly distinct tube structures, its electrical characteristics are documented separately for each section. Multiple operating points are established depending on the specific application and supply voltages.

Triode Section

The triode section is a high-mu unit. Depending on the operating point, its amplification factor ranges from 60 to 110, and its plate resistance varies significantly.

Parameter	Operating Point A	Operating Point B	Operating Point C	Operating Point D
Plate Voltage	135 V	200 V	200 V	250 V
Grid-No. 1 Voltage	-2 V	-2 V	-2 V	-2 V
Amplification Factor (μ)	60	70	75	110
Plate Resistance (r_p)	39,000 Ω	19,000 Ω	18,700 Ω	52,000 Ω
Transconductance (g_m)	1,550 μmhos	3,700 μmhos	4,000 μmhos	2,100 μmhos
Plate Current (I_b)	1.0 mA	3.5 mA	2.6 mA	1.1 mA
Cutoff Grid Voltage (Approx.)	-4.8 V (at $I_b = 10$ μA)	-7.0 V (at $I_b = 10$ μA)	-4.0 V (at $I_b = 30$ μA)	-3.6 V (at $I_b = 10$ μA)

Pentode Section

The pentode section is a sharp-cutoff unit designed for high transconductance and high plate current capability at low plate voltages, which is highly beneficial for video amplifier service.

Parameter	Point A	Point B	Point C	Point D	Point E	Point F	Point G
Plate Voltage	30 V	135 V	200 V	30 V	30 V	200 V	35 V
Screen (Grid-No. 2) Voltage	135 V	135 V	135 V	140 V	140 V	140 V	100 V
Grid-No. 1 Voltage	0 V	-1.5 V	-1.5 V	0 V	-1.0 V	-2.0 V	0 V
Plate Resistance (r_p)	—	66,000 Ω	70,000 Ω	—	—	150,000 Ω	—
Transconductance (g_m)	—	12,600 μhos	14,000 μhos	—	11,000 μhos	9,500 μhos	—
Plate Current (I_b)	32 mA*	17 mA	18 mA	30 mA	16 mA	12 mA	48 mA
Screen Current (I_{c2})	14 mA*	4.2 mA	4.0 mA	13.5 mA	9.5 mA	2.5 mA	12.5 mA
Cutoff Grid Voltage (Approx.)	—	-5.0 V (at $I_b = 10 \mu\text{A}$)	-5.0 V (at $I_b = 10 \mu\text{A}$)	—	-4.0 V (at $I_b = 500 \mu\text{A}$)	-4.2 V (at $I_b = 500 \mu\text{A}$)	—

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Note: Measured using a recurrent waveform method to avoid exceeding the maximum ratings of the tube.

An additional operating point with cathode bias is specified for the pentode section:

- **Plate Voltage:** 200 V
- **Screen Voltage:** 100 V
- **Cathode-Bias Resistor:** 82 Ω
- **Plate Resistance:** 60,000 Ω
- **Transconductance:** 19,000 μhos
- **Plate Current:** 16.5 mA
- **Screen Current:** 2.8 mA
- **Grid-No. 1 Voltage for $I_b = 500 \mu\text{A}$:** -5.5 V

Maximum Ratings and Circuit Constraints

The maximum ratings of the 10LZ8 are defined under the Design-Maximum Rating System. These ratings are limiting values of operating and environmental conditions and should not be exceeded under the worst probable conditions.

Because different manufacturers and specifications list slightly different maximum limits, these are presented as ranges or distinct sets of ratings:

Rating Parameter	Triode Section	Pentode Section
Plate Voltage (Max.)	300 V to 330 V	225 V to 330 V
Screen (Grid-No. 2) Supply Voltage (Max.)	—	330 V
Screen (Grid-No. 2) Voltage (Max.)	—	160 V (or see rating curves)
Positive DC Grid-No. 1 Voltage (Max.)	0 V	0 V
Plate Dissipation (Max.)	1.0 W to 1.5 W	4.0 W to 5.0 W
Screen Dissipation (Max.)	—	1.5 W to 2.0 W

Grid-No. 1 Circuit Resistance Limits

To prevent thermal runaway and maintain bias stability, the maximum resistance in the control grid circuit must be restricted based on the bias method employed:

- **Fixed-Bias Operation:**
 - Triode Section: 0.5 M Ω max
 - Pentode Section: 0.25 M Ω to 0.5 M Ω max
- **Cathode-Bias Operation:**
 - Triode Section: 1.0 M Ω max
 - Pentode Section: 1.0 M Ω max

Interelectrode Capacitances

The direct interelectrode capacitances of the 10LZ8 are measured without an external shield. The values vary slightly across different manufacturing specifications:

Triode Section Capacitances

- **Grid to Plate (T_g to T_p):** 3.6 pF to 4.0 pF
- **Input (T_g to $h + T_k + P_k + P_{g3} + IS$):** 2.6 pF to 2.8 pF

- **Output (T_p to $h + T_k + P_k + P_{g3} + IS$):** 2.6 pF to 3.0 pF

Pentode Section Capacitances

- **Grid-No. 1 to Plate (P_{g1} to P_p):** 0.075 pF to 0.10 pF (maximum value of 0.10 pF)
- **Input (P_{g1} to $h + P_k + P_{[g2]}(/tubes/G2) + P_{g3} + IS$):** 9.5 pF to 12.0 pF
- **Output (P_p to $h + P_k + P_{[g2]}(/tubes/G2) + P_{g3} + IS$):** 4.4 pF

Inter-Section Capacitances

Because both sections reside in close proximity within the same envelope, small parasitic capacitances exist between the triode and pentode elements:

- **Grid-No. 1 to Triode Plate:** 0.005 pF max
- **Plate to Triode Grid:** 0.018 pF max
- **Plate to Triode Plate:** 0.17 pF max

(Note: "IS" refers to the internal shield, "h" to the heater, "k" to the cathode, "g" to the grid, and "p" to the plate).

Analysis of Characteristic Curves

The published characteristic curves for the 10LZ8 illustrate the behavior of both sections under various operating conditions:

Pentode Section Curves

- **Plate Characteristics:** The plate current (I_b) versus plate voltage curves show a sharp knee at low plate voltages (typically below 50 V), which is characteristic of a sharp-cutoff pentode. Above the knee, the plate current remains relatively constant with increasing plate voltage, indicating high plate resistance. At a screen voltage (E_{c2}) of 140 V and grid-No. 1 voltage ($E_{[c1]}(/tubes/C1)$) of 0 V, the plate current reaches approximately 35 mA.
- **Transfer Characteristics:** The curves of plate current and screen current versus grid-No. 1 voltage (at a plate voltage of 200 V) demonstrate the sharp-cutoff nature of the control grid. The transconductance (g_m) curve peaks at around 15,000 μmhos near $E_{[c1]}(/tubes/C1) = 0$ V for a screen voltage of 160 V, and drops rapidly as the grid bias becomes more negative, reaching near-zero values around -5 V.

Triode Section Curves

- **Plate Characteristics:** The triode plate current versus plate voltage curves exhibit a typical exponential rise. At $E_c = 0$ V, the plate current rises steeply, reaching 5 mA at approximately 180 V.
- **Transfer Characteristics:** The curves of plate current versus grid voltage for various plate voltages (from 50 V to 300 V) show that the triode behaves as a high- μ device, requiring only a few volts of negative bias to completely cut off plate current. For example, at a plate voltage of 250 V, the plate current is cut off at approximately -3.6 V.

- **Average Characteristics:** The curves of amplification factor (μ), plate resistance (r_p), and transconductance (g_m) plotted against plate current show that the triode's amplification factor remains relatively stable between 100 and 120 for plate currents above 1.5 mA (at $E_b = 250$ V). In contrast, the plate resistance decreases and transconductance increases as plate current rises, which is typical for triode voltage amplifiers.

Technical Summary

The **10LZ8** is a versatile, space-saving **miniature triode-pentode** designed for television receiver applications. It combines a **high-mu triode** (with an amplification factor up to 110) and a **high-transconductance, sharp-cutoff pentode** (with transconductance up to 19,000 μmhos) in a single T-6 1/2 glass envelope.

Operating from a **10.5 V, 0.45 A** heater supply with controlled warm-up characteristics, the tube is optimized for series-string heater configurations. Its 9DX basing arrangement provides independent connections for almost all electrodes, with the pentode's cathode, suppressor grid, and internal shield sharing a common pin (Pin 6) to minimize lead inductance and simplify layout.

By offering two distinct, high-performance stages in a single 9-pin envelope, the 10LZ8 serves as an efficient solution for video amplification, sync separation, sync clipping, and phase inversion in television circuitry.

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 · Pentode

OTHER		
PARAMETER	PUBLISHED VALUE	CONDITION / NOTE
Plate Voltage	30 V	—
Plate Voltage	5 V	—
Plate Voltage	5 V	—
Plate Voltage	-55811 V	—
Screen Voltage	4 V	—
ScreenDissipation	4 W	—
Plate Current	30 mA	—
Plate Current	-55611 mA	—
Screen Current	13.5 mA	—
Transconductance	4 uS	—
Plate Resistance	4 ohm	—
Grid Voltage	10 V	—
Plate Voltage	200 V	AverageCharacteristics
Screen Voltage	140 V	AverageCharacteristics

CAPACITANCE		
PARAMETER	PUBLISHED VALUE	CONDITION / NOTE
GridtoPlateCapacitance	3.8 pF	—

CHARACTERISTIC		
PARAMETER	PUBLISHED VALUE	CONDITION / NOTE
Plate Current	12 mA	AverageCharacteristics
Screen Current	2.5 mA	AverageCharacteristics

1968 GENERAL ELECTRIC CO

Section 2 · Triode

OTHER		
PARAMETER	PUBLISHED VALUE	CONDITION / NOTE
Plate Voltage	250 V	AverageCharacteristics

CHARACTERISTIC		
PARAMETER	PUBLISHED VALUE	CONDITION / NOTE
Plate Current	1.1 mA	AverageCharacteristics



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
Heater Voltage (ac/dc)	10.5 volts	Published value from supplied target entry
Heater Current	0.45 ampere	Published value from supplied target entry
Heater Warm-up Time	11 seconds	Published value from supplied target entry
Plate Voltage	330 volts	Published value from supplied target entry
Grid-No	330 volts	Published value from supplied target entry
Grid-No	300	Published value from supplied target entry
Grid-No.1 (Control-Grid) Voltage, Positive-bias value	0 volts	Published value from supplied target entry
Plate Dissipation	5 watts	Published value from supplied target entry
Grid-No	2	Published value from supplied target entry
For Grid-No	165 volts	Published value from supplied target entry
For Grid-No	300 volts	Published value from supplied target entry
Plate Voltage	200	Published value from supplied target entry
Grid-No	135 volts	Published value from supplied target entry
Grid-No.1 Voltage	-1.5 volts	Published value from supplied target entry

PARAMETER	PUBLISHED VALUE	CONDITION / NOTE
Amplification Factor	70	Published value from supplied target entry
Plate Resistance M0	70000 ohms	Published value from supplied target entry
Transconductance	14000	Published value from supplied target entry
Plate Current	18 mA	Published value from supplied target entry
Grid-No	4	Published value from supplied target entry
for plate current of	-5 volts	Published value from supplied target entry
(ac/dc),	0.45 amperes	Published value from supplied target entry
Plate Voltage	200 volts	Published value from supplied target entry
Grid-No	150 volts	Published value from supplied target entry
Grid-No.1 Voltage	0 volts	Published value from supplied target entry
Amplification Factor	46	Published value from supplied target entry
Plate Current	24 mA	Published value from supplied target entry
Grid-No	18 mA	Published value from supplied target entry
Grid Voltage (Approx.) for plate current of	-4.8	Published value from supplied target entry
Grid-No	1	Published value from supplied target entry

CAPACITANCE		
PARAMETER	PUBLISHED VALUE	CONDITION / NOTE
Grid to Plate	4 PF	Published value from supplied target entry
Grid to Cathode, Pentode Cathode, Heater, Pentode Grid No	3	Published value from supplied target entry
Plate to Cathode. Pentode Cathode, Heater, Pentode Grid No	3	Published value from supplied target entry
Plate to Cathode, Heater, Grid No	3	Published value from supplied target entry
Plate to Triode Grid	0.018 PF	Published value from supplied target entry
Plate to Triode Plate	0.17 PF	Published value from supplied target entry

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