

ELECTRONIC TUBE REFERENCE

12BZ6

Voltage - Pentode Remote Cutoff (single) electronic tube

CONSOLIDATED TECHNICAL DATA
1 SECTION
CONSTRUCTION
PENTODE

Semiremote-cutoff pentode developed for gain-controlled television video-IF amplification, combining high transconductance with stable wideband AGC operation.

GENERAL CHARACTERISTICS

BASE DESIGNATION	7CM	BASE PINS	7
NOMINAL HEATER	12.6 V / 150 mA	PARALLEL HEATER	– / –
HEATING	Indirect	SERIES OPERATION	Not specified
CATHODE ARRANGEMENT	Separate cathodes	SECTION CONSTRUCTION	Similar

7CM - TERMINAL PINOUT

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

SECTION RATINGS

SECTION1 Pentode	
PLATE RESISTANCE	260000 Ω
TRANSCONDUCTANCE	0.008 S
MAXIMUM PLATE VOLTAGE	330 V
MAXIMUM SCREEN VOLTAGE	330 V
MAXIMUM PLATE DISSIPATION	2.3 W
MAXIMUM SCREEN DISSIPATION	0.55 W
<i>12-V heater variant; promoted electrical fields carried from the explicitly referenced 6BZ6 parent datasheet already present in the project corpus. Additional 12-V heater data remains source-specific.</i>	

12BZ6 — Semi-Remote-Cutoff Pentode

The **12BZ6** is a miniature, semi-remote-cutoff pentode designed primarily for use as an automatic gain-controlled (AGC) intermediate-frequency (IF) amplifier in both color and black-and-white television receivers. It is specifically engineered for service in television receivers employing 150 mA series-connected heater strings.

Except for its heater ratings and controlled warm-up characteristics, the 12BZ6 is electrically identical to the 6BZ6. Its semi-remote-cutoff characteristic allows it to handle a wide range of signal amplitudes with reduced cross-modulation and distortion when AGC bias is applied.

Physical Construction and Pinout

The 12BZ6 is constructed in a miniature T-5 1/2 glass envelope with a 7-pin miniature button base (designated JEDEC E7-1, outline JEDEC 5-2). The tube utilizes the **7CM** basing arrangement, which provides the following pin connections when viewed from the bottom:

Pin	Connection
Pin 1	Grid No. 1 (Control Grid)
Pin 2	Cathode
Pin 3	Heater
Pin 4	Heater
Pin 5	Plate
Pin 6	Grid No. 2 (Screen Grid)
Pin 7	Grid No. 3 (Suppressor Grid) / Internal Shield

The physical dimensions of the tube are standardized to ensure compatibility with compact high-frequency chassis layouts:

- **Maximum Diameter:** 0.750 inches
- **Maximum Seated Height:** 1.875 inches
- **Maximum Overall Height:** 2.125 inches

The tube is designed to operate reliably in **any mounting position**.

Heater Characteristics

The 12BZ6 features an indirectly heated, coated unipotential cathode. The heater is designed for series-string operation, and its thermal characteristics are tightly controlled to minimize voltage surges across the heater during the receiver's warm-up cycle. This protection is effective when the tube is operated in series with other heaters having similar controlled warm-up characteristics.

Heater Parameter	Value
Nominal Heater Voltage (AC or DC)	12.6 V
Heater Voltage Tolerance	±10%
Nominal Heater Current	0.15 A (150 mA)
Heating Method	Indirect
Cathode Type	Coated, unipotential

Heater Power Calculation: Using the nominal heater voltage (12.6 V) and nominal heater current (0.15 A):
 Heater Power = 12.6 V × 0.15 A = 1.89 W

Heater-Cathode Voltage Ratings

To prevent insulation breakdown and minimize hum or leakage, maximum heater-cathode voltage limits must be strictly observed:

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

Maximum Ratings (Design-Maximum System)

The ratings of the 12BZ6 are established under the Design-Maximum Rating System. These are limiting values that must not be exceeded under the worst probable operating conditions, including supply-voltage variations, component tolerances, and environmental changes.

Parameter	Maximum Rating
Plate Voltage	330 V
Grid No. 3 (Suppressor Grid) Voltage, Positive Value	0 V
Grid No. 2 (Screen Grid) Supply Voltage	330 V
Grid No. 2 Voltage	See rating curve
Grid No. 1 (Control Grid) Voltage, Positive-Bias Value	0 V
Plate Dissipation	2.3 W
Grid No. 2 Input (for Grid No. 2 voltages up to 165 V)	0.55 W
Grid No. 2 Input (for Grid No. 2 voltages between 165 V and 330 V)	See rating curve

Maximum Circuit Values

To maintain bias stability and prevent thermal runaway, the maximum resistance in the Grid No. 1 circuit is restricted based on the biasing method:

- **For Fixed-Bias Operation:** 0.25 megohm maximum
- **For Cathode-Bias Operation:** 1.0 megohm maximum

Typical Operating Conditions and Characteristics

In typical Class A1 amplifier service, the 12BZ6 is operated with Grid No. 3 and its internal shield tied directly to the cathode at the socket. Under these conditions, the tube exhibits high transconductance and moderate plate resistance:

- **Plate Supply Voltage:** 125 V
- **Grid No. 2 Supply Voltage:** 125 V
- **Grid No. 3 (Suppressor Grid):** Connected to cathode at socket (Pin 7 to Pin 2)
- **Cathode-Bias Resistor:** 56 ohms
- **Plate Resistance (Approximate):** 0.26 megohm
- **Transconductance:** 8000 μmhos
- **Plate Current:** 14 mA
- **Grid No. 2 Current:** 3.6 mA
- **Grid No. 1 Voltage (Approximate) for transconductance of 50 μmhos :** -19 V
- **Grid No. 1 Voltage (Approximate) for transconductance of 700 μmhos (at zero cathode resistance):** -4.5 V

Direct Interelectrode Capacitances

The high-frequency performance of the 12BZ6 is heavily influenced by its internal capacitances. The tube's design includes an internal shield to minimize feedback capacitance between the control grid and the plate. The capacitances vary depending on whether an external shield is employed:

Capacitance Parameter	With External Shield	Without External Shield
Grid No. 1 to Plate (Max)	0.015 pF	0.025 pF
Input: G1 to (H + K + <u>G2</u> + G3 + IS)	7.0 pF	7.0 pF
Output: P to (H + K + <u>G2</u> + G3 + IS)	3.0 pF	2.0 pF

Note: External shield is connected directly to the cathode at the socket.

Characteristic Curves and Qualitative Analysis

The published characteristic curves for the 12BZ6 illustrate its performance under varying electrical conditions:

Plate Characteristics

The plate current versus plate voltage curves, plotted at a screen grid voltage of 150 V, display typical pentode behavior. Above a low-voltage knee (approximately 50 to 75 V depending on bias), the plate current curves flatten out, indicating high dynamic plate resistance. As the control grid voltage is stepped from 0 V down to -6 V, the plate current decreases in a controlled, non-linear fashion, demonstrating the semi-remote-cutoff characteristic.

Transfer Characteristics

The transfer curves plot plate current and screen grid current against control grid voltage at a plate voltage of 200 V and screen voltage of 150 V. The curves show that plate current falls gradually as the negative grid bias increases. The transition is smooth, allowing automatic gain control circuits to smoothly adjust the stage gain without abrupt cutoff. The plate current approaches near-zero levels (cutoff) at approximately -19 V.

Transconductance and Plate Resistance

Curves of transconductance and plate resistance versus control grid voltage show that transconductance falls from its nominal high value of 8000 μmhos down to 50 μmhos as the grid bias sweeps from 0 V to -19 V. Concurrently, the plate resistance rises significantly as the tube is biased toward cutoff, which is typical of remote-cutoff and semi-remote-cutoff RF pentodes.

Grid No. 2 Rating Curve

The screen grid rating curve defines the boundary of safe operation for Grid No. 2. It plots the permissible Grid No. 2 input (expressed as a percentage of the maximum 0.55 W rating) against the Grid No. 2 voltage (expressed as a percentage of the maximum 330 V supply voltage rating). The curve shows that full dissipation is permitted up to a certain voltage threshold, beyond which the allowable input power must be derated linearly to zero as the voltage approaches the maximum supply limit.

Related Designations and Comparisons

The 12BZ6 belongs to a family of identical pentodes that differ only in their heater configurations to accommodate different power supply topologies:

- **6BZ6 (and the dual-designated 6BZ6/6JH6):** Designed for standard 6.3 V parallel heater circuits, drawing 0.3 A.
- **3BZ6:** Designed for 3.15 V, 0.6 A series-string heater circuits with controlled warm-up.
- **4BZ6:** Designed for 4.2 V, 0.45 A series-string heater circuits with controlled warm-up.

While these tubes share identical internal electrode structures, capacitances, and Class A1 electrical characteristics, they are not direct plug-in substitutes for one another due to these incompatible heater requirements.

Technical Summary

The **12BZ6** is a high-transconductance, semi-remote-cutoff pentode housed in a 7-pin miniature glass envelope. Operating with a 12.6 V, 150 mA heater, it is optimized for series-string television IF and AGC amplifier stages. At a typical operating point of 125 V on the plate and screen, it provides a transconductance of 8000 μmhos , a plate current of 14 mA, and an approximate plate resistance of 0.26 megohm. Its controlled heater warm-up characteristics, low grid-to-plate feedback capacitance (0.015 pF with shield), and smooth AGC control characteristics make it a highly effective component in classic television receiver designs.

SOURCE OPERATING CONDITIONS

[SOURCE PDF](#)

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 · Pentode

OTHER		
PARAMETER	PUBLISHED VALUE	CONDITION / NOTE
Heater voltage	12.6 V	Nominal
Heater current	150 mA	Nominal
Screen voltage	125 V	Typical operating conditions
Plate current	14 mA	Typical operating conditions

SOURCE OPERATING CONDITIONS

[SOURCE PDF](#)

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 · Pentode

CHARACTERISTIC		
PARAMETER	PUBLISHED VALUE	CONDITION / NOTE
Grid-to-plate capacitance with shield	0.015 pF	WholeTube
Input capacitance	7 pF	WholeTube
Output capacitance with shield	3 pF	WholeTube
Grid 1 voltage for 50 μ S transconductance	-19 V	ClassA1
Transconductance at $E_{c1}=-4.5$ V	700 μ S	ClassA1

OTHER		
PARAMETER	PUBLISHED VALUE	CONDITION / NOTE
Plate voltage	125 V	ClassA1
Screen voltage	125 V	ClassA1
Cathode bias resistor	56 ohm	ClassA1
Plate current	14 mA	ClassA1
Screen current	3.6 mA	ClassA1
Maximum screen supply voltage	330 V	WholeTube



SOURCE DATA APPENDIX

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.

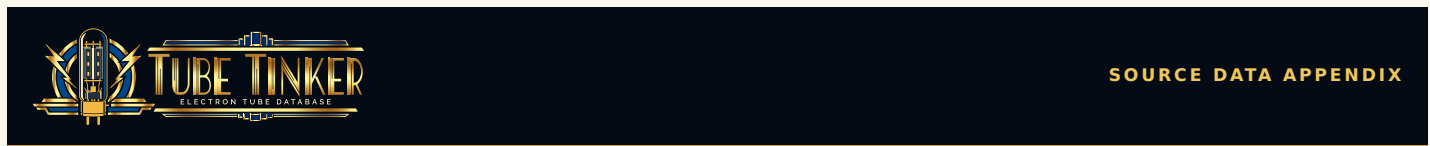
1971 RCA HB3 BINDER 5 OF 7

Section 1 · Pentode

CHARACTERISTICS		
PARAMETER	PUBLISHED VALUE	CONDITION / NOTE
Voltage (AC or DC) – published value 1	12.6 V	Published value from the filename-designated RCA datasheet block; multiple numbers on one row represent separate limits or heater arrangements.
Voltage (AC or DC) – published value 2	3 V	Published value from the filename-designated RCA datasheet block; multiple numbers on one row represent separate limits or heater arrangements.
Voltage (AC or DC) – published value 3	10 V	Published value from the filename-designated RCA datasheet block; multiple numbers on one row represent separate limits or heater arrangements.
Current	150 mA	Published value from the filename-designated RCA datasheet block; multiple numbers on one row represent separate limits or heater arrangements.
Heater voltage	12.6 V	Nominal heater rating
Heater current	150 mA	Nominal heater rating

PARAMETER	PUBLISHED VALUE	CONDITION / NOTE
Plate resistance	260000 ohm	InheritedFromReferencedParent 6BZ6
Transconductance	8000 uS	InheritedFromReferencedParent 6BZ6

OTHER		
PARAMETER	PUBLISHED VALUE	CONDITION / NOTE
Maximum plate voltage	330 V	InheritedFromReferencedParent 6BZ6
Maximum screen-grid voltage	330 V	InheritedFromReferencedParent 6BZ6
Maximum plate dissipation	2.3 W	InheritedFromReferencedParent 6BZ6



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 · Pentode

OTHER		
PARAMETER	PUBLISHED VALUE	CONDITION / NOTE
Peak Plate Current	180 mA	Published in approved 12BZ6 target entry; Section1
Heater Voltage (ac/dc) 3.15 4.2 6.3	12.6 V	Published in approved 12BZ6 target entry; Section1
Heater Current 0.6 0.45 0.3	150 mA	Published in approved 12BZ6 target entry; Section1
age)	11 seconds	Published in approved 12BZ6 target entry; Section1
Plate Voltage	330 V	Published in approved 12BZ6 target entry; Section1
Grid No.3 (Suppressor-Grid) Voltage, Positive value	0 V	Published in approved 12BZ6 target entry; Section1
Grid-No.2 (Screen-Grid) Supply Voltage	330 V	Published in approved 12BZ6 target entry; Section1
Grid-No.1 (Control-Grid) Voltage, Positive-bias value	0 V	Published in approved 12BZ6 target entry; Section1
Plate Dissipation	2.3 W	Published in approved 12BZ6 target entry; Section1

PARAMETER	PUBLISHED VALUE	CONDITION / NOTE
For grid-No. 2 voltages up to	165 V	Published in approved 12BZ6 target entry; Section1
For grid-No. 2 voltages up to 165 volts	0.55 W	Published in approved 12BZ6 target entry; Section1
For grid-No.2 voltages between 165 and	330 V	Published in approved 12BZ6 target entry; Section1
For fixed-bias operation	0.25 MΩ	Published in approved 12BZ6 target entry; Section1
For cathode-bias operation	1 MΩ	Published in approved 12BZ6 target entry; Section1

CHARACTERISTIC		
PARAMETER	PUBLISHED VALUE	CONDITION / NOTE
Plate Supply Voltage	125 V	Published in approved 12BZ6 target entry; Section1
Grid-No.2 Supply Voltage	125 V	Published in approved 12BZ6 target entry; Section1
Cathode-Bias Resistor	56 Ω	Published in approved 12BZ6 target entry; Section1
Plate Resistance (Approx.)	0.26 MΩ	Published in approved 12BZ6 target entry; Section1
Grid-No.1 Voltage (Approx.) for transconductance of	50 μS	Published in approved 12BZ6 target entry; Section1
Grid-No.1 Voltage (Approx.) for transconductance of 50 /imhos	-3.6 V	Published in approved 12BZ6 target entry; Section1
Grid-No.1 Voltage (Approx.) for transconductance of	700 μS	Published in approved 12BZ6 target entry; Section1
Heater Voltage (ac/dc)	6.3 V	Published in approved 12BZ6 target entry; Section1
Heater Current	150 mA	Published in approved 12BZ6 target entry; Section1

TUBE TINKER

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