



ELECTRONIC TUBE REFERENCE

10Z3L

Voltage Pentode - Sharp Cutoff (single) electronic tube

CONSOLIDATED TECHNICAL DATA

1 SECTION

CONSTRUCTION

PENTODE

Russian short-characteristic pentode intended for communications and general signal service. Manufacturer documentation specifies a 1,000-hour service-life guarantee and conventional voltage-amplifier operating characteristics.

GENERAL CHARACTERISTICS

BASE DESIGNATION	—	BASE PINS	8
NOMINAL HEATER	10 V / 93 mA	PARALLEL HEATER	— / —
HEATING	Indirect	SERIES OPERATION	Capable
CATHODE ARRANGEMENT	Separate cathodes	SECTION CONSTRUCTION	Similar

SECTION RATINGS

SECTION 1 Pentode	
TRANSCONDUCTANCE	0.0017 S
MAXIMUM PLATE VOLTAGE	250 V
MAXIMUM SCREEN VOLTAGE	225 V
MAXIMUM PLATE DISSIPATION	2 W
MAXIMUM SCREEN DISSIPATION	0.7 W
<i>Russian 10Zh3L communication pentode with indirectly heated oxide cathode and loctal base. Nominal heater 10 V, 93 mA, series-string service. Typical gm approximately 1.7 mA/V; unsupported mu 1 cleared. Max anode voltage 250 V and screen 225 V; anode dissipation 2 W, screen 0.7 W. Higher screen allowance only on switch-on; guaranteed service 1000 h.</i>	

10Z3L — High-Frequency Pentode

The **10Z3L** (Russian: **10Ж3Л**) is an indirectly heated high-frequency pentode designed for use in communication lines and widely used systems. It is optimized for applications where the heater is

connected in series (noted in some translations as series cathode connection). The tube features a glass bulb with an external metal screen, a loctal base, and an indirectly heated oxide-coated cathode.

Mechanical Construction and Environmental Ratings

The 10Z3L is constructed with a glass envelope and is equipped with an external metal screen (shield) for electrical shielding and physical protection. It features an 8-pin loctal (lock-in) base, which provides secure mechanical retention in high-vibration environments.

Physical Dimensions

- **Maximum overall height:** 69 mm
- **Maximum seated height:** 60 mm
- **Bulb diameter:** 20 mm
- **Maximum weight:** 35 g

Environmental and Mechanical Tolerances

The tube is designed to operate reliably under severe environmental and mechanical conditions:

- **Ambient operating temperature range:** -60 °C to +70 °C
- **Relative humidity tolerance:** 95% to 98% at an ambient temperature of +20 °C
- **Vibration resistance:** Tolerates vibration loads up to 2.5 g
- **Impact resistance:** Tolerates multiple impact loads up to 12 g
- **Guaranteed service life:** 1000 hours

Heater and Pinout Configuration

The 10Z3L is equipped with an indirectly heated, oxide-coated cathode. The heater is designed for series-string operation.

Heater Specifications

- **Nominal heater voltage (Uh):** 10 V (permissible range: 8.5 V to 11.6 V)
- **Nominal heater current (Ih):** 93 ± 5 mA (permissible range: 89 mA to 97 mA)

Pin Connections (Loctal Base)

The tube utilizes an 8-pin loctal base with the following pinout configuration (viewed from the bottom of the tube):

- **Pin 1:** Heater (h)
- **Pin 2:** Grid 3 and Shield (g3, s)
- **Pin 3:** Plate / Anode (a)
- **Pin 4:** Grid 3 and Shield (g3, s)

- **Pin 5:** Grid 2 / Screen Grid (g2)
- **Pin 6:** Cathode (k)
- **Pin 7:** Grid 1 / Control Grid (g1)
- **Pin 8:** Heater (h)

Grid 3 (suppressor grid) and the internal shield are internally connected and brought out to both Pin 2 and Pin 4.

Electrical Characteristics and Typical Operation

The typical electrical characteristics of the 10Z3L are measured under the following standard operating conditions:

- **Plate voltage (Ua):** 150 V
- **Screen grid voltage (Ug2):** 75 V
- **Control grid voltage (Ug1):** -2.1 V
- **Suppressor grid voltage (Ug3):** 0 V

Typical Parameters

Under these standard conditions, the tube exhibits the following typical parameters:

- **Plate current (Ia):** 2.3 mA (with a tolerance range of +1.0 mA to -0.9 mA)
- **Screen grid current (Ig2):** 0.55 ± 0.35 mA
- **Transconductance (S):** 1.7 mA/V (with a tolerance range of +0.4 mA/V to -0.5 mA/V)
- **Plate resistance (Ri):**
 - ≥ 0.9 M Ω (for 80% of tubes)
 - ≥ 0.5 M Ω (for the remaining 20% of tubes)
- **Equivalent noise resistance (Reqv):** 4.5 k Ω
- **Cut-off plate current (Iaz):** ≤ 100 μ A (measured at a control grid bias Ug1 = -7 V)

Power Output in Specific Operating Conditions

The tube can deliver a power output (Pk) of ≥ 0.5 W under the following specific test conditions:

- **Total distortion factor (kf):** 10%
- **Plate voltage (Ua):** 250 V
- **Screen grid voltage (Ug2):** 250 V
- **Effective control grid signal voltage (Ug1 eff):** 2.8 V
- **Plate load resistance (Ra):** 35 k Ω
- **Screen grid resistor (Rg2):** 20 k Ω
- **Cathode bias resistor (Rk):** 500 Ω

Interelectrode Capacitances

- **Input capacitance (Cg1k):** 3.7 ± 0.3 pF
- **Output capacitance (Cak):** 4.0 ± 0.35 pF
- **Grid-to-plate capacitance (Cg1a):** ≤ 0.007 pF
- **Anode-to-shield capacitance (Cas):** ≤ 0.007 pF

Maximum Permissible Ratings

To ensure reliable operation and maintain the guaranteed service life, the operating conditions must not exceed the following maximum and minimum limits:

- **Heater voltage (Uh):** 8.5 V (Min) to 11.6 V (Max)
- **Heater current (Ih):** 89 mA (Min) to 97 mA (Max)
- **Plate voltage (Ua):** 250 V (Max)
- **Plate voltage at switch-on (Ua at moment of switching in):** 300 V (Max)
- **Screen grid voltage (Ug2):** 225 V (Max)
- **Screen grid voltage at switch-on (Ug2 at moment of switching in):** 300 V (Max)
- **Plate dissipation (Pa):** 2 W (Max)
- **Screen grid dissipation (Pg2):** 0.7 W (Max)
- **Cathode current (Ik):** 11 mA (Max)
- **Heater-to-cathode voltage (Ukh):** 250 V (Max)
- **Control grid resistor (Rg1):** 1 M Ω (Max)

Characteristic Curves and Analysis

The performance of the 10Z3L is illustrated by several sets of characteristic curves:

Plate Characteristics (Ia vs. Ua)

The plate current (Ia) versus plate voltage (Ua) curves are plotted for a heater voltage of 10 V, a screen grid voltage (Ug2) of 75 V, and suppressor grid voltage (Ug3) of 0 V. The curves are shown for control grid voltages (Ug1) ranging from 0 V down to -4 V in steps of 0.5 V.

- At Ug1 = 0 V, the plate current rises rapidly with plate voltage, leveling off to a saturated plate current of approximately 6.5 mA at plate voltages above 50 V.
- As the control grid bias becomes more negative, the saturation plate current decreases. For example, at Ug1 = -2 V, the plate current levels off at approximately 2.5 mA, and at Ug1 = -4 V, the plate current is nearly cut off (less than 0.5 mA).
- The flat, horizontal nature of these curves in the pentode region (above Ua = 50 V) indicates a very high dynamic plate resistance (Ri), consistent with the typical value of ≥ 0.9 M Ω .

Screen Grid Current Characteristics (I_{g2} vs. U_a)

The screen grid current (I_{g2}) versus plate voltage (U_a) curves are provided under the same conditions ($U_h = 10$ V, $U_{g2} = 75$ V, $U_{g3} = 0$ V).

- At very low plate voltages ($U_a < 25$ V), the screen grid current is at its highest, reaching over 6 mA when $U_{g1} = 0$ V. This is because electrons that would normally reach the plate are intercepted by the screen grid.
- As plate voltage increases, the screen grid current drops sharply and stabilizes at a low value (typically under 1.5 mA for $U_{g1} = 0$ V, and around 0.55 mA at the typical operating point of $U_{g1} = -2.1$ V).

Transfer Characteristics (I_a , I_{g2} vs. U_{g1})

The transfer curves show plate current (I_a , solid lines) and screen grid current (I_{g2} , dashed lines) as a function of control grid voltage (U_{g1}) at $U_h = 10$ V and $U_a = 150$ V. Curves are plotted for two screen grid voltages: $U_{g2} = 75$ V and $U_{g2} = 100$ V.

- For $U_{g2} = 75$ V, the plate current is approximately 2.3 mA at $U_{g1} = -2.1$ V and approaches zero (cut-off) near $U_{g1} = -6$ V.
- Increasing the screen grid voltage to 100 V shifts the transfer curve upward, resulting in higher plate and screen currents for the same control grid bias, and shifting the cut-off point to a more negative grid voltage (around -7 V to -8 V).

Triode-Connected Characteristics (I_a vs. U_a)

When the 10Z3L is triode-connected (with the screen grid and suppressor grid tied to the plate), its characteristics change significantly. The triode-connected curves are plotted at $U_h = 10$ V for control grid voltages (U_{g1}) from 0 V to -14 V in 2 V steps.

- In this configuration, the plate current increases more steeply and linearly with plate voltage, resembling a medium- μ triode.
- At $U_{g1} = 0$ V, the plate current reaches 10 mA at a plate voltage of approximately 100 V.
- At $U_{g1} = -6$ V, a plate voltage of 150 V yields a plate current of approximately 5 mA.
- The triode-connected curves demonstrate that the tube can be effectively utilized as a triode amplifier or driver stage when lower plate resistance and different gain characteristics are desired.

Technical Summary

The **10Z3L** is a robust, high-frequency pentode featuring a loctal base, an external metal screen, and an indirectly heated cathode designed for series heater connection. With a nominal heater rating of 10 V and 93 mA, it is optimized for communication lines and industrial systems operating under demanding environmental conditions. Under typical operating conditions ($U_a = 150$ V, $U_{g2} = 75$ V, $U_{g1} = -2.1$ V), it exhibits a plate current of 2.3 mA, transconductance of 1.7 mA/V, and a high plate resistance of ≥ 0.9 M Ω . Its versatile design allows for standard pentode operation as well as triode-connected configurations, backed by a guaranteed service life of 1000 hours.

SOURCE OPERATING CONDITIONS

[SOURCE PDF](#)

195X Russian

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

195X RUSSIAN

Section 1 · Pentode

CHARACTERISTICS		
PARAMETER	PUBLISHED VALUE	CONDITION / NOTE
Source symbol CBSI	3 h	BaHHs B JIMHMAX CBSI3H B ammaparype UIMPOKOTO lines and in widely used systems with the cathode
Source symbol AroseuHocTs	1000 W	[apantupoBanHas ngoAroseuHocTs 1000 wacos. Service life guarantee: 1000 hr.
Service life	1000 h	[apantupoBanHas ngoAroseuHocTs 1000 wacos. Service life guarantee: 1000 hr.
Source symbol I,	93+5 mA	I, 93+5mA I, 23%)imA R;%) =09 MQ
Published electrical parameter	9 MΩ	I, 93+5mA I, 23%)imA R;%) =09 MQ
Source symbol U,	150 V	U, 150V I, > 100 pA R;%) >05MQ
Source symbol I,	>100 pA	U, 150V I, > 100 pA R;%) >05MQ
Published electrical parameter	>05 MΩ	U, 150V I, > 100 pA R;%) >05MQ
Source symbol Uy,	75 V	Uy, 75V I, 055035 mA ReqV 45 kQ
Source symbol I,	55035 mA	Uy, 75V I, 055035 mA ReqV 45 kQ
Source symbol ReqV	45 kΩ	Uy, 75V I, 055035 mA ReqV 45 kQ
Published electrical parameter	21 V	Uy, −21V P,2) >05W
Published electrical parameter	>05 W	Uy, −21V P,2) >05W
Published electrical parameter	250 V	D IR 100, U,=Uy=250 V, Uy =28V, R,=35kQ, Ry,=20kR,
Published electrical parameter	28 V	D IR 100, U,=Uy=250 V, Uy =28V, R,=35kQ, Ry,=20kR,
Published electrical parameter	35 kΩ	D IR 100, U,=Uy=250 V, Uy =28V, R,=35kQ, Ry,=20kR,

PARAMETER	PUBLISHED VALUE	CONDITION / NOTE
Published electrical parameter	500 Ω	R, =500 Q.
Source symbol Copx	37+03 pF	Copx 37+03 pF Cgra < 0,007 pF
Source symbol Cgra	<0.007 pF	Copx 37+03 pF Cgra < 0,007 pF
Source symbol Che	40035 pF	Che 40035 pF Cn. 0,007 pF
Source symbol Cn.	0.007 pF	Che 40035 pF Cn. 0,007 pF
Source symbol U,	116 V	U, 116V 85V P, 2W
Source symbol V	85 V	U, 116V 85V P, 2W
Source symbol P,	2 W	U, 116V 85V P, 2W
Source symbol I,	97 mA	I, 97 mA 89 mA Pg2 0,7 W
Source symbol mA	89 mA	I, 97 mA 89 mA Pg2 0,7 W
Source symbol Pg2	0.7 W	I, 97 mA 89 mA Pg2 0,7 W
Source symbol U,	250 V	U, 250 V I, 11 mA
Source symbol I,	11 mA	U, 250 V I, 11 mA
Source symbol U,	300 V	U, 300V Uy 250V
Source symbol Uy	250 V	U, 300V Uy 250V
Source symbol Ug2	225 V	Ug2 225V Rgl 1 MQ
Source symbol Rgl	1 MΩ	Ug2 225V Rgl 1 MQ
Published electrical parameter	300 V	Ug,!) 300V
Published electrical parameter	7 A	pZ v 7A I
Published electrical parameter	15 V	/ 15V /
Source symbol y	1 A	y 1A il
Published electrical parameter	10 V	Up=10V — I, U, =10V
Published electrical parameter	75 V	Uy, =75V — I U, =150V
Published electrical parameter	150 V	Uy, =75V — I U, =150V
Source symbol U0	143 V	\ U0 143V {1V ~15V]-2 }2_.5 -3 e JARVINVIN/ANAN AN
Published electrical parameter	1 V	\ U0 143V {1V ~15V]-2 }2_.5 -3 e JARVINVIN/ANAN AN

PARAMETER	PUBLISHED VALUE	CONDITION / NOTE
Published electrical parameter	1 A	7 /1 A ViAV]
Published electrical parameter	0 h	U _{gs} =0 h=