

ELECTRONIC TUBE REFERENCE

12J8

Voltage - Pentode or Tetrode (under 100V) electronic tube

CONSOLIDATED TECHNICAL DATA

3 SECTIONS

CONSTRUCTION

DIODE-DIODE-TETRODE

Low-voltage double-diode tetrode developed for automobile receivers, combining detector functions with a tetrode amplifier optimized for direct operation from a 12 V battery supply.

GENERAL CHARACTERISTICS

BASE DESIGNATION	9BG	BASE PINS	9
NOMINAL HEATER	12.6 V / 325 mA	PARALLEL HEATER	– / –
HEATING	Indirect	SERIES OPERATION	Not specified
CATHODE ARRANGEMENT	Common cathode	SECTION CONSTRUCTION	Dissimilar

9BG - TERMINAL PINOUT

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

SECTION RATINGS

SECTION1 Tetrode	
PLATE RESISTANCE	6000 Ω
TRANSCONDUCTANCE	0.0055 S
MAXIMUM PLATE VOLTAGE	30 V
MAXIMUM SCREEN VOLTAGE	30 V
Second-page characteristics visually verified.	

SECTION2 Diode	
No fixed ratings recorded.	
Representative of two identical diode sections.	

SECTION3 Diode	
No fixed ratings recorded.	
Physical diode section added in approved section-structure reconciliation.	

12J8 — Double-Diode-Tetrode and High-Frequency Pentode

Overview

The designation **12J8** represents two entirely distinct vacuum tube designs depending on the manufacturing origin and regional nomenclature:

1. An American miniature double-diode-tetrode designed by Tung-Sol, engineered specifically for low-voltage operation in automobile receivers.
2. A Soviet metal-envelope high-frequency pentode with a short characteristic curve, originally designated in Cyrillic as **12Ж8** (transliterated as 12Zh8 or 12J8), designed for high-voltage intermediate- and high-frequency voltage amplification.

While both tubes share a nominal 12.6 V heater rating, they differ fundamentally in their electrode configurations, physical construction, electrical ratings, and intended applications. The American variant is optimized for low-voltage hybrid car radios operating directly from a 12-volt battery, whereas the Soviet variant is a ruggedized, high-voltage pentode designed for conventional high-frequency amplification in demanding environments.

The Miniature Double-Diode-Tetrode Variant (Tung-Sol 12J8)

Construction, Physical Dimensions, and Pinout

The low-voltage 12J8 is a miniature double-diode-tetrode housed in a T-6 1/2 glass bulb with a miniature button 9-pin base (9GC). It features a coated unipotential cathode and is designed to operate in any mounting position.

The physical dimensions of this variant are:

- **Maximum overall length:** 2 3/16 inches (approx. 55.6 mm)
- **Maximum seated height:** 1 15/16 inches (approx. 49.2 mm)
- **Maximum diameter:** 7/8 inches (approx. 22.2 mm)

The 9GC base pinout, viewed from the bottom of the tube, is configured as follows:

- **Pin 1:** Grid #1 (G1)
- **Pin 2:** Cathode (K)
- **Pin 3:** Grid #2 (G2)
- **Pin 4:** Heater (H)
- **Pin 5:** Heater (H)
- **Pin 6:** Plate (P)
- **Pin 7:** Cathode (K)
- **Pin 8:** Diode Plate #2 (P2)
- **Pin 9:** Diode Plate #1 (P1)

Heater and Low-Voltage Ratings

This tube is specifically designed for automotive service where it is powered directly from a nominal 12.0 V battery source. To accommodate the voltage fluctuations of automotive electrical systems, the heater is engineered to operate reliably over a wide range from 10.0 V to 15.9 V.

The electrical ratings, interpreted according to the Design Center System, are:

- **Nominal Heater Voltage:** 12.6 V
- **Nominal Heater Current:** 0.325 A
- **Calculated Heater Power:** $12.6 \text{ V} \times 0.325 \text{ A} = 4.095 \text{ W}$ (calculation)
- **Maximum Heater-Cathode Voltage (Heater positive or negative with respect to cathode):** 30 V
- **Maximum Plate Voltage:** 30 V
- **Maximum Grid #2 Voltage:** 30 V
- **Maximum Grid #1 Resistance:** 10 MΩ
- **Maximum Average Diode Current (each diode):** 5.0 mA

Typical Operating Conditions and Characteristics

In typical automotive receiver applications, the tetrode section operates at low voltages matching the battery supply, eliminating the need for a high-voltage B+ inverter. Typical operating parameters are:

- **Heater Voltage:** 12.6 V
- **Heater Current:** 0.325 A
- **Grid #1 Voltage:** 0 V
- **Grid #2 Voltage:** 12.6 V
- **Grid #1 Resistor:** 2.2 M Ω
- **Grid #1 Resistor Bypass Condenser:** 1.0 μ F
- **Transconductance:** 5500 μ mhos
- **Plate Resistance (approx.):** 6000 Ω
- **Zero Signal Plate Current:** 12 mA
- **Zero Signal Grid #2 Current:** 1.5 mA
- **AF Grid #1 Voltage (RMS):** 1.6 V
- **Load Resistance:** 2700 Ω
- **Maximum Signal Power Output:** 20 mW
- **Total Harmonic Distortion:** 5%
- **Average #1 Diode Current (at 5 V DC):** 8.5 mA
- **Average #2 Diode Current (at 5 V DC):** 12.0 mA

Interelectrode Capacitances

The direct interelectrode capacitances of the tetrode and diode sections, measured without an external shield, are:

- **Grid to Plate:** 0.70 pF
- **Input (G1 to H+TK+G2):** 10.5 pF
- **Output (P to H+TK+G2):** 4.4 pF
- **Diode #2 Plate to Tetrode Grid #1 (max):** 0.015 pF
- **Diode #1 Plate to Tetrode Grid #1 (max):** 0.04 pF

The Metal-Envelope High-Frequency Pentode Variant (Soviet 12Ж8 / 12Zh8)

Construction, Environmental Durability, and Pinout

The Soviet 12Ж8 (transliterated as 12J8) is a high-frequency pentode with a short characteristic curve. It is enclosed in a rugged metal case with an octal base and utilizes an indirectly heated, oxide-coated cathode. This tube is designed for high reliability under harsh environmental and mechanical conditions:

- **Ambient Temperature Range:** -60 °C to +70 °C

- **Relative Humidity Resistance:** 95% to 98% at +20 °C
- **Mechanical Vibration Resistance:** up to 6 g
- **Maximum Weight:** 42 grams
- **Guaranteed Service Life:** 2000 hours

The physical dimensions of this variant are:

- **Maximum overall height:** 67 mm
- **Maximum base diameter:** 33 mm
- **Maximum bulb diameter:** 27 mm

The octal base pinout, viewed from the bottom, is configured as follows:

- **Pin 1:** Metal Envelope / Shield (b)
- **Pin 2:** Heater (h)
- **Pin 3:** Grid #3 / Suppressor Grid (g3)
- **Pin 4:** Grid #1 / Control Grid (g1)
- **Pin 5:** Cathode (k)
- **Pin 6:** Grid #2 / Screen Grid (g2)
- **Pin 7:** Heater (h)
- **Pin 8:** Plate / Anode (a)

Heater and High-Voltage Ratings

Unlike the low-voltage automotive variant, the 12Ж8 operates at standard high-voltage levels. Its ratings are:

- **Nominal Heater Voltage:** 12.6 V (permissible range: 11.3 V to 13.9 V)
- **Nominal Heater Current:** 150 ± 15 mA
- **Calculated Heater Power:** $12.6 \text{ V} \times 0.150 \text{ A} = 1.89 \text{ W}$ (calculation)
- **Maximum Plate Voltage:** 330 V
- **Maximum Grid #2 Voltage:** 140 V
- **Maximum Plate Dissipation (Pa):** 2.8 W
- **Maximum Grid #2 Dissipation (Pg2):** 0.7 W
- **Maximum Heater-Cathode Voltage (Ukh):** 100 V

Electrical Characteristics and Operating Points

The typical high-voltage operating point for the pentode section is defined as:

- **Plate Voltage (Ua):** 250 V
- **Grid #2 Voltage (Ug2):** 100 V
- **Grid #1 Voltage (Ug1):** -3 V
- **Grid #3 Voltage (Ug3):** 0 V
- **Plate Current (Ia):** 3 ± 1 mA

- **Grid #2 Current (Ig2):** 0.8 ± 0.4 mA
- **Transconductance (S):** 1.65 ± 0.35 mA/V
- **Grid #1 Reverse Current (at Ug1 = -10 V):** ≤ 30 μ A

Interelectrode Capacitances

The interelectrode capacitances of the 12Ж8 are:

- **Input Capacitance (Cg1k):** 6 ± 1.1 pF
- **Output Capacitance (Cak):** 7 ± 1.8 pF
- **Grid-to-Plate Capacitance (Cg1a):** ≤ 0.005 pF

Characteristic Curves and Interpretation

The behavior of the 12Ж8 is illustrated by several characteristic curves:

- **Triode Connection (Ia = f(Ua)):** When configured as a triode (with screen and suppressor grids tied to the plate), the plate current rises smoothly with plate voltage. At Ug1 = 0 V, the plate current reaches approximately 40 mA at Ua = 200 V.
- **Pentode Plate Characteristics (Ia, Ig2 = f(Ua)):** Under standard pentode operation (Ug2 = 100 V, Ug3 = 0 V), the plate current curves exhibit a sharp knee below 50 V, above which the current remains highly stable. At Ug1 = 0 V, the plate current saturates at approximately 8 mA, while the screen current (Ig2) remains below 2 mA.
- **Transfer Characteristics (Ia, Ig2 = f(Ug1)):** These curves show the control grid's influence at different screen voltages (Ug2 = 75 V, 100 V, 125 V). Higher screen voltages shift the cutoff point to the left (towards more negative grid voltages) and increase the overall transconductance.
- **Suppressor Grid Control (Ia = f(Ug3)):** At Ua = 250 V, Ug2 = 100 V, and Ug1 = -3 V, the suppressor grid (Grid #3) can be used to control plate current. A negative voltage applied to Grid #3 reduces plate current, achieving complete cutoff near -80 V.

Technical Summary

The designation **12J8** represents two distinct technologies:

Parameter	Tung-Sol 12J8 (Double-Diode-Tetrode)	Soviet 12Ж8 / 12Zh8 (HF Pentode)
Envelope Type	Glass (T-6 1/2)	Metal
Base Type	Miniature Button 9-Pin (9GC)	Octal
Nominal Heater Voltage	12.6 V (10.0 V to 15.9 V range)	12.6 V (11.3 V to 13.9 V range)
Nominal Heater Current	0.325 A	0.150 A
Calculated Heater Power	4.095 W	1.89 W

Parameter	Tung-Sol 12J8 (Double-Diode-Tetrode)	Soviet 12Ж8 / 12Zh8 (HF Pentode)
Maximum Plate Voltage	30 V	330 V
Maximum Grid #2 Voltage	30 V	140 V
Typical Plate Current	12 mA	3 mA
Transconductance	5500 μ mhos	1650 μ mhos (1.65 mA/V)
Primary Application	Low-voltage automotive receivers	HF/IF voltage amplification

These two variants must never be confused or substituted for one another, as their physical bases, operating voltages, and internal structures are completely incompatible. The American 12J8 is a specialized low-voltage hybrid-era component, while the Soviet 12Ж8 is a ruggedized, high-voltage pentode designed for conventional RF/IF amplification.

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 · Tetrode

OTHER		
PARAMETER	PUBLISHED VALUE	CONDITION / NOTE
Heater voltage	12.6 V	—
Heater current	325 mA	—
Maximum signal power output	20 mW	—

CAPACITANCE		
PARAMETER	PUBLISHED VALUE	CONDITION / NOTE
Grid-to-plate capacitance	0.7 pF	—

1961 TUNG SOL

Section 2 · Diode

OTHER		
PARAMETER	PUBLISHED VALUE	CONDITION / NOTE
Maximum average diode current	5 mA	EachDiode

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