



ELECTRONIC TUBE REFERENCE

12DS7A

Voltage Pentode or Tetrode (under 100V) electronic tube

CONSOLIDATED TECHNICAL DATA

3 SECTIONS

CONSTRUCTION

DIODE-DIODE-TETRODE

Improved automobile-radio diode-tetrode combining two detector diodes with a high-transconductance space-charge-grid audio driver for transistorized output stages operating from a 12.6 V supply.

GENERAL CHARACTERISTICS

BASE DESIGNATION	—	BASE PINS	9
NOMINAL HEATER	12.6 V / 400 mA	PARALLEL HEATER	— / —
HEATING	Indirect	SERIES OPERATION	Not specified
CATHODE ARRANGEMENT	Separate cathodes	SECTION CONSTRUCTION	Dissimilar

SECTION RATINGS

SECTION1 Diode*No fixed ratings recorded.**Representative row for two identical diode units.***SECTION2** Tetrode

PLATE RESISTANCE	500 Ω
TRANSCONDUCTANCE	0.019 S
AMPLIFICATION FACTOR	9.1
MAXIMUM PLATE VOLTAGE	16 V
MAXIMUM SCREEN VOLTAGE	16 V
<i>Space-charge-grid tetrode audio-driver section; grid #2 functions as control grid and grid #1 as space-charge grid.</i>	

No fixed ratings recorded.

Added approved missing physical diode section row.

12DS7A — Space-Charge-Grid Twin Diode-Tetrode

An indirectly heated, miniature twin diode and high-perveance power tetrode of the space-charge-grid type, designed for low-voltage automotive and hybrid receiver applications.

Overview

The **12DS7A** is a multi-unit miniature vacuum tube containing two independent diode units and a high-perveance power tetrode in a single envelope. It is specifically designed for use in "hybrid" automobile receivers, where both the tube and transistor electrode voltages are obtained directly from a nominal 12-volt automotive storage battery.

To operate effectively at such low supply voltages, the tetrode section utilizes a space-charge-grid configuration. In this mode, the first grid is operated at a positive potential to overcome the space charge near the cathode, allowing substantial plate current and high transconductance to be achieved with plate potentials of less than 16 volts. The tube is designed to withstand the wide variations in supply voltage (from 10.0 to 15.9 volts) typically encountered in automotive electrical systems.

Construction, Heater, and Pinout

The 12DS7A features a unipotential coated cathode and a heater designed for either AC or DC operation. The physical structure is housed in a T-6 1/2 glass bulb with a small-button noval 9-pin base. The tube can be mounted and operated in any position.

Physical Parameter	Value
Nominal Heater Voltage	12.6 V
Nominal Heater Current	0.4 A
Calculated Heater Power	5.04 W
Maximum Overall Length	2 5/8 inches
Maximum Seated Height	2 3/8 inches
Maximum Bulb Diameter	7/8 inches

The **9JU** basing arrangement provides the following pin connections, viewed from the bottom of the tube:

Pin	Connection
1	Grid #1 (Space-charge grid, G1)
2	Diode Plate #2 (<u>P2</u>)
3	No Connection (NC)
4	Heater (H)
5	Heater (H)
6	Diode Plate #1 (P1)
7	Cathode (K)
8	Plate (P)
9	Grid #2 (Control grid, <u>G2</u>)

Direct Interelectrode Capacitances

The direct interelectrode capacitances of the 12DS7A, measured without an external shield, are as follows:

Tetrode Unit

- **Grid #2 to Plate:** 13.8 μF
- **Grid #2 to Grid #1, Heater & Cathode:** 12.7 μF
- **Plate to Grid #1, Heater & Cathode:** 2.2 μF

Diode Units

- **Diode Plate #1 to Diode Cathode & Heater:** 0.5 μF
- **Diode Plate #2 to Diode Cathode & Heater:** 0.5 μF
- **Diode Plate #1 to Diode Plate #2:** 0.1 μF
- **Tetrode Grid #2 to Diode Plate #1:** 0.3 μF
- **Tetrode Grid #2 to Diode Plate #2:** 0.3 μF

Design Maximum Ratings

The maximum ratings for the 12DS7A are established under the Design Maximum System. These limits must not be exceeded under the worst-case operating conditions of supply voltage, signal input, and component tolerances.

Tetrode Unit — Audio Driver Service

- **Heater Voltage:** 12.6 V (designed for a 10.0 to 15.9 V operating range)

- **Maximum Plate Voltage:** 16 V
- **Maximum Grid #2 (Control-Grid) Negative Bias:** -16 V
- **Maximum Grid #1 (Space-Charge-Grid) Voltage:** 16 V
- **Maximum Peak Heater-Cathode Voltage (Heater negative to cathode):** 16 V
- **Maximum Peak Heater-Cathode Voltage (Heater positive to cathode):** 16 V

Diode Units (Each Unit)

- **Maximum Plate Current:** 5 mA
- **Maximum Peak Heater-Cathode Voltage (Heater negative to cathode):** 16 V
- **Maximum Peak Heater-Cathode Voltage (Heater positive to cathode):** 16 V

Electrical Characteristics and Class A1 Operation

In typical Class A1 amplifier service, the space-charge grid (Grid #1) is tied directly to the positive supply voltage, while the control grid (Grid #2) is biased slightly negative. This configuration yields an exceptionally high transconductance for a low-voltage device.

Parameter	Value
Plate Voltage	12.6 V
Grid #1 (Space-Charge-Grid) Voltage	12.6 V
Grid #2 (Control-Grid) Voltage	-0.5 V
Plate Resistance (approx.)	500 Ω
Amplification Factor (Grid #2 to Plate)	9.1
Transconductance (Grid #2 to Plate)	19,000 μmhos
Plate Current	35 mA
Grid #1 Current	75 mA

Note: The Grid #2 control voltage of -0.5 V in this typical operating point is developed across a 2.2 Megohm resistor.

Typical Operating Applications as an Audio Driver

The primary application of the 12DS7A tetrode section is as a driver for a transistorized audio-frequency (AF) power-output stage. Two distinct typical operating configurations are documented for this service:

Low-Voltage Choke-Coupled Driver Configuration

In this operating mode, the plate voltage is supplied through a high-inductance choke to maximize the AC voltage swing available to the following transistor stage.

- **Plate Supply Voltage:** 11.2 V
- **Plate Voltage:** 11.2 V (obtained through a series 100 Henry choke with a DC resistance of 150 Ω)
- **Grid #1 Supply Voltage:** 11.2 V
- **Grid #2 Supply Voltage:** 0 V
- **Grid #2 Resistor:** 1.8 M Ω
- **Cathode Resistor:** 18 Ω
- **Peak AF Grid #2 Supply Voltage (approx., from 3.3 M Ω source):** 4.25 V
- **Plate Current (Zero Signal):** 20 mA
- **Plate Current (Indicated Signal):** 7 mA
- **Grid #1 Current:** 58 mA
- **Load Resistance:** 1250 Ω
- **Total Harmonic Distortion (at 2.5 mW output):** 5%
- **Indicated Signal Power Output:** 10 mW

Direct 12.6 V Driver Configuration with Rectified Bias

This configuration operates directly from a 12.6 V supply and utilizes signal rectification to establish the control-grid operating bias.

- **Plate Voltage:** 12.6 V
- **Grid #1 Voltage:** 12.6 V
- **Grid #2 Voltage (obtained by rectification through a 2.2 M Ω resistor):** -2.5 V
- **Peak AF Grid #2 Voltage (approx., from 0.22 M Ω source):** 2.5 V
- **Plate Current (Zero Signal):** 35 mA
- **Plate Current (Maximum Signal):** 11 mA
- **Grid #1 Current:** 80 mA
- **Load Resistance:** 700 Ω
- **Total Harmonic Distortion:** 10%
- **Maximum Signal Power Output:** 45 mW
- **Maximum Grid #2 Circuit Resistance:** 10 M Ω

Diode Units

The two diode units contained within the 12DS7A are designed for AM detection and automatic volume control (AVC) functions. They share the common unipotential cathode with the tetrode section but are otherwise independent.

Under typical operating conditions, each diode unit is capable of delivering a plate current of **3 mA** when a plate voltage of **10 V** is applied.

Technical Summary

The **12DS7A** is a specialized **9-pin miniature twin diode-tetrode** designed specifically for low-voltage hybrid automotive applications. By employing a **space-charge-grid (Grid #1)** operated at a positive potential, the tetrode section achieves an extremely high transconductance of **19,000 μmhos** and a low plate resistance of **500 Ω** at a plate potential of only **12.6 V**. This unique design allows the tube to serve as an effective audio driver for transistorized power-output stages, operating directly from a standard 12-volt vehicle battery without the need for a high-voltage vibrator power supply.



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 2 · Tetrode

OTHER		
PARAMETER	PUBLISHED VALUE	CONDITION / NOTE
Service	Audio driver for transistorized output stage	—
AutomotiveSupplyVoltage	12.6 V	—



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 · Diode

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

CHARACTERISTIC		
PARAMETER	PUBLISHED VALUE	CONDITION / NOTE
Diode plate-to-cathode-and-heater capacitance	0.5 pF	EachDiode

1966 TUNG SOL ELECTRONIC TUBES 2 OF 4

OTHER		
PARAMETER	PUBLISHED VALUE	CONDITION / NOTE
Plate voltage	12.6 V	ClassA1;AudioDriver
Control-grid bias across 2.2 Mohm resistor	-0.5 V	ClassA1;AudioDriver
Space-charge-grid voltage	12.6 V	ClassA1;AudioDriver
Plate current	36 mA	ClassA1;AudioDriver
Maximum control-grid negative bias magnitude	16 V	TetrodeSection
Maximum space-charge-grid voltage	16 V	TetrodeSection