



ELECTRONIC TUBE REFERENCE

12DK7

Voltage Pentode or Tetrode (under 100V) electronic tube

CONSOLIDATED TECHNICAL DATA

3 SECTIONS

CONSTRUCTION

DIODE-DIODE-TETRODE

Low-voltage automobile-radio combination tube with two detector/AVC diodes and a tetrode amplifier designed to operate directly from a nominal 12.6 V vehicle supply.

GENERAL CHARACTERISTICS

BASE DESIGNATION	—	BASE PINS	9
NOMINAL HEATER	12.6 V / 500 mA	PARALLEL HEATER	— / —
HEATING	Indirect	SERIES OPERATION	Not specified
CATHODE ARRANGEMENT	Common cathode	SECTION CONSTRUCTION	Dissimilar

SECTION RATINGS

SECTION1 Diode

No fixed ratings recorded.

Representative row for two detector/AVC diode units.

SECTION2 Tetrode

PLATE RESISTANCE	4000 Ω
TRANSCONDUCTANCE	0.005 S
MAXIMUM PLATE VOLTAGE	30 V
MAXIMUM SCREEN VOLTAGE	30 V

Space-charge-grid power tetrode for 12.6 V plate/screen operation.

No fixed ratings recorded.

Added approved missing physical diode section row.

12DK7 — Double Diode-Tetrode Vacuum Tube

Overview

The **12DK7** is a multi-unit miniature vacuum tube containing a combined detector diode, an automatic volume control (AVC) diode, and a space-charge or power-amplifier tetrode within a single envelope. All three sections share a common, coated unipotential cathode.

Designed primarily for automotive receiver applications, the 12DK7 is engineered to operate its heater, plate, and screen grid (Grid #2) potentials directly from a nominal 12-volt automotive battery system. This design eliminates the need for a high-voltage vibrator power supply, allowing for more compact and efficient car radio designs.

Construction, Heater, and Physical Specifications

The 12DK7 is housed in a standard T-5 1/2 glass bulb (with early tentative specifications also noting T-6 1/2 configurations) and utilizes a miniature button 9-pin base. The physical dimensions of the tube are compact, facilitating space-saving layouts in automotive dashboards:

- **Maximum Overall Length:** 2 3/8 inches
- **Maximum Seated Height:** 2 1/8 inches (noted as up to 2 3/16 inches in early design specifications)
- **Maximum Diameter:** 3/4 inches
- **Mounting Position:** Any

Heater Characteristics

The heater of the 12DK7 is specifically designed to withstand the wide voltage fluctuations inherent in automotive electrical systems. While its nominal rating is 12.6 V, it is engineered to operate reliably over a range of 10.0 to 15.9 V. This wide operating range ensures that the tube continues to function safely and effectively during battery charging or under heavy electrical loads.

Heater Parameter	Value
Nominal Heater Voltage	12.6 V
Nominal Heater Current	0.50 A
Calculated Heater Power	6.30 W
Heater Supply	AC or DC

Heater Parameter	Value
Operating Voltage Range	10.0 to 15.9 V
Cathode Type	Coated, unipotential, common to all sections

Calculation: The nominal heater power is calculated as: $\text{Power} = \text{Voltage} \times \text{Current} = 12.6 \text{ V} \times 0.50 \text{ A} = 6.30 \text{ W}$

Pinout and Basing Diagram

The tube uses a 9-pin miniature base designated as JEDEC 9MZ (with early documentation referencing JEDEC 9HZ). The bottom-view pin connections are arranged as follows:

Pin Number	Connection	Description
1	G1	Tetrode Control Grid (Grid #1)
2	K	Common Cathode
3	<u>G2</u>	Tetrode Screen Grid (Grid #2)
4	H	Heater
5	H	Heater
6	<u>D2</u>	Diode #2 (Detector/AVC)
7	P	Tetrode Plate
8	IC	Internal Connection (Do not use)
9	<u>D1</u>	Diode #1 (Detector/AVC)

Electrical Ratings

The maximum ratings for the 12DK7 are established under the Design Center System. These limits represent the maximum values that the manufacturer permits, and they incorporate safety factors to ensure reliable operation under the voltage variations typical of automotive battery systems.

Parameter	Maximum Rating
Heater Voltage	12.6 V
Maximum Plate Voltage (Tetrode)	30 V
Maximum Grid #2 Voltage	30 V
Maximum Plate Dissipation	0.5 W

Parameter	Maximum Rating
Maximum Grid #1 Circuit Resistance	15 MΩ
Maximum Heater-Cathode Voltage	±30 V
Maximum Tetrode Plate Current	10 mA

Typical Operating Conditions and Characteristics

The 12DK7 operates with very low electrode voltages, allowing the tetrode plate and screen grid to run directly off the nominal 12.6 V supply.

Static Class A1 Amplifier Characteristics

Under typical static (no-signal) conditions, the tetrode and diode sections exhibit the following characteristics:

Parameter	Value
Plate Voltage (Tetrode)	12.6 V
Grid #2 Voltage	12.6 V
Grid #1 Resistor (Bypassed)	2.2 MΩ
Plate Current	6.0 mA
Grid #2 Current	1.0 mA
Transconductance	5,000 μmhos
Plate Resistance	4,000 Ω
Diode Current (with 10 V applied)	1.0 mA

Calculations:

- Static Plate Dissipation:** Plate Dissipation = Plate Voltage × Plate Current = 12.6 V × 0.006 A = 0.0756 W (75.6 mW) This is well within the maximum plate dissipation rating of 0.5 W.
- Static Grid #2 Dissipation:** Grid #2 Dissipation = Grid #2 Voltage × Grid #2 Current = 12.6 V × 0.001 A = 0.0126 W (12.6 mW)

Dynamic Class A1 Amplifier Operation (With Signal)

When operating as an active signal amplifier, Grid #1 bias is developed dynamically via grid rectification through a high-value grid resistor. The typical operating parameters under these conditions are:

Parameter	Value
Plate Voltage (Tetrode)	12.6 V
Grid #2 Voltage	12.6 V
Grid #1 Voltage	Developed via grid rectification (15 MΩ resistor)
Grid #1 Signal Voltage	1.0 VRMS
Signal Source Resistance	200,000 Ω
Load Resistance	3,500 Ω
Signal Plate Current (Maximum)	2.5 mA
Power Output (Maximum)	10 mW
Total Harmonic Distortion	10%

Under zero-signal conditions in this dynamic configuration, the plate current remains at approximately 6.0 mA. The maximum power output of 10 mW is achieved with a total harmonic distortion of 10%, which is typical for low-voltage space-charge driver stages in hybrid automotive receivers.

Technical Summary

The **12DK7** is a specialized **double diode-tetrode** vacuum tube designed for low-voltage automotive applications. By combining a detector diode, an AVC diode, and a power-amplifier tetrode with a common unipotential cathode, it consolidates multiple receiver functions into a single 9-pin miniature envelope.

With its heater and tetrode electrodes optimized for direct operation from a nominal 12.6 V battery supply, the 12DK7 eliminates the need for high-voltage power generation in car radios. It features a transconductance of **5,000 μmhos** and a plate resistance of **4,000 Ω** under typical operating conditions, delivering up to **10 mW** of power output into a 3,500 Ω load. The robust heater design, rated to withstand voltages from 10.0 to 15.9 V, ensures stable performance despite the electrical fluctuations of automotive environments.



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
Plate Voltage	12.6 V	AutomotiveBatteryService

CHARACTERISTIC		
PARAMETER	PUBLISHED VALUE	CONDITION / NOTE
TransconductancePublished	5000 uS	—



SOURCE OPERATING CONDITIONS

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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

CHARACTERISTIC		
PARAMETER	PUBLISHED VALUE	CONDITION / NOTE
Diode current at 10 V applied	1 mA	EachDiode

1966 TUNG SOL ELECTRONIC TUBES 2 OF 4

Section 2 · Tetrode

OTHER		
PARAMETER	PUBLISHED VALUE	CONDITION / NOTE
Plate voltage	12.6 V	ClassA1
Grid 2 voltage	12.6 V	ClassA1

PARAMETER	PUBLISHED VALUE	CONDITION / NOTE
Grid 1 resistor bypassed	2.2 Mohm	ClassA1
Plate current	6 mA	ClassA1
Grid 2 current	1 mA	ClassA1
Load resistance	3500 ohm	ClassA1
Signal power output maximum	1 mW	ClassA1