

ELECTRONIC TUBE REFERENCE

12AE7

Voltage - Triode (under 100V) electronic tube

CONSOLIDATED TECHNICAL DATA
2 SECTIONS
CONSTRUCTION
TRIODE-TRIODE

Low-voltage dissimilar dual triode containing medium- and low-mu sections, designed to operate from unusually low plate supplies and provide useful gain and current drive.

GENERAL CHARACTERISTICS

BASE DESIGNATION	9A	BASE PINS	9
NOMINAL HEATER	12.6 V / 450 mA	PARALLEL HEATER	– / –
HEATING	Indirect	SERIES OPERATION	Not specified
CATHODE ARRANGEMENT	Separate cathodes	SECTION CONSTRUCTION	Dissimilar

9A - TERMINAL PINOUT

TERMINAL	SECTION	ELEMENT	STATUS
PIN1 – 2P	B	P – Plate (Anode)	CONNECTED
PIN2 – 2G1	B	G1 – Control Grid	CONNECTED
PIN3 – 2K	B	K – Cathode	CONNECTED
PIN4 – H	–	H – Heater	CONNECTED
PIN5 – H	–	H – Heater	CONNECTED
PIN6 – 1P	A	P – Plate (Anode)	CONNECTED
PIN7 – 1G1	A	G1 – Control Grid	CONNECTED
PIN8 – 1K	A	K – Cathode	CONNECTED
PIN9 – HCT	–	HCT – Heater Center Tap	CONNECTED

SECTION RATINGS

SECTION1 Triode	
PLATE RESISTANCE	3150 Ω
TRANSCONDUCTANCE	0.004 S
AMPLIFICATION FACTOR	13
MAXIMUM PLATE VOLTAGE	16 V
MAXIMUM PLATE DISSIPATION	1 W
<i>Published promoted fields populated semantically; identical repeated sections compressed.</i>	

SECTION2 Triode	
PLATE RESISTANCE	985 Ω
TRANSCONDUCTANCE	0.0065 S
AMPLIFICATION FACTOR	6.4
MAXIMUM PLATE VOLTAGE	16 V
MAXIMUM PLATE DISSIPATION	1 W
<i>Published promoted fields populated semantically; identical repeated sections compressed.</i>	

12AE7 — Dissimilar Double Triode Vacuum Tube

A miniature, low-mu, dissimilar double triode designed for low-voltage operation as a driver tube in hybrid automobile radio receivers.

Overview

The **12AE7** is a specialized miniature double triode containing two electrically independent and dissimilar triode sections within a single T-6 1/2 glass envelope. It is designed specifically for use in hybrid automotive radio receivers where both the heater and plate voltages are supplied directly from a nominal 12-volt vehicle storage battery.

Unlike conventional double triodes that feature identical sections, the 12AE7 incorporates two distinct triode designs optimized for different roles in the audio driver stage. Section 1 is a medium-mu triode intended for general-purpose voltage amplification, while Section 2 is a low-mu, low-resistance triode designed to act as a driver for a transistor power amplifier stage. The tube features a 9-pin miniature base with a center-tapped heater, allowing flexible installation and reliable operation under the wide voltage fluctuations typical of automotive electrical systems.

Mechanical Design, Heater, and Base Connections

The 12AE7 is constructed in a T-6 1/2 glass bulb with a small button 9-pin base (E9-1 designation). The tube features coated unipotential cathodes and can be mounted in any position.

Heater Characteristics

The heater is designed to operate directly from a nominal 12.6 V automotive supply. Because automotive battery voltages fluctuate during charging and discharging, the heater is engineered to operate satisfactorily over a wide range from 10.0 V to 15.9 V. The maximum ratings are designed to provide a safety factor to accommodate these variations.

Heater Parameter	Value
Nominal Heater Voltage	12.6 V
Nominal Heater Current	0.45 A (±10%)
Heating Method	Indirect
Cathodes	Coated, unipotential
Heater Center Tap	Pin 9

Pinout and Basing Diagram

The tube utilizes the **9A** basing arrangement. The two triode sections are electrically independent, with separate cathode, grid, and plate connections. The heater is center-tapped at pin 9, allowing for potential balanced or split heater configurations.

Pin Number	Connection
1	Plate (Section 2)
2	Grid (Section 2)
3	Cathode (Section 2)
4	Heater
5	Heater
6	Plate (Section 1)
7	Grid (Section 1)
8	Cathode (Section 1)
9	Heater Center Tap

Section 1 is connected to pins 6, 7, and 8, while Section 2 is connected to pins 1, 2, and 3.

Electrical Characteristics and Typical Operating Points

The primary distinguishing feature of the 12AE7 is its dissimilar triode design. Under typical Class A1 operating conditions, both sections are operated with a plate voltage of 12.6 V, but they utilize different grid leak resistors to establish bias via contact potential.

Typical Class A1 Operating Conditions

Parameter	Section 1 (Medium-Mu)	Section 2 (Low-Mu)
Plate Voltage	12.6 V	12.6 V
Grid Leak Resistor	1.5 M Ω	1.0 M Ω
Plate Current	1.9 mA	7.5 mA
Transconductance	4,000 μ mhos	6,500 μ mhos
Amplification Factor (μ)	13.0	6.4
Plate Resistance (Approx.)	3,150–3,250 Ω	985 Ω

The bias for each section is developed as an average contact potential bias across the specified grid leak resistor. Section 1 exhibits a higher amplification factor (13.0) and higher plate resistance (approximately 3,150 to 3,250 Ω), making it suitable for voltage pre-amplification. Section 2 features a much lower plate resistance (985 Ω) and higher plate current (7.5 mA), enabling it to deliver the higher current drive required to interface with a power transistor output stage.

Maximum Ratings

The maximum ratings for the 12AE7 are established under the Design-Center Rating System. These limits apply to each individual section unless otherwise specified and must be respected to ensure reliable operation and longevity.

Rating Parameter	Maximum Limit
Plate Voltage	16.0 V
Positive DC Grid Voltage	0 V
Plate Dissipation (per section)	1.0 W
Grid Circuit Resistance	1.5 M Ω
Heater-Cathode Voltage (Heater Negative)	16.0 V
Heater-Cathode Voltage (Heater Positive)	16.0 V

The low maximum plate voltage rating of 16.0 V reflects the tube's optimization for direct connection to 12-volt automotive electrical systems, eliminating the need for a high-voltage vibrator power supply.

Interelectrode Capacitances

Direct interelectrode capacitances are measured without an external shield. These values describe the capacitive coupling between electrodes within each independent section:

Capacitance Parameter	Section 1	Section 2
Grid to Plate	3.9 μF	3.4 μF
Input: g to (h+k)	4.7 μF	4.2 μF
Output: p to (h+k)	0.75 μF	0.85 μF

These low capacitances ensure stable operation within the audio frequency range and prevent unwanted high-frequency feedback or oscillation in compact automotive receiver layouts.

Application Guidelines

The 12AE7 was specifically developed for "hybrid" car radios of the late 1950s. In these designs, vacuum tubes operated directly from the 12-volt battery supply for the RF, IF, and driver stages, while a power transistor was used for the final audio output stage to drive the speaker. This hybrid approach eliminated the expensive, bulky, and electrically noisy high-voltage vibrator power supplies previously required to generate 100V to 250V plate voltages.

In a typical application:

- **Section 1 (Medium-Mu):** Functions as a general-purpose voltage amplifier or pre-amplifier stage. It accepts the low-level audio signal from the detector stage and provides initial voltage gain. The high grid leak resistance of 1.5 M Ω allows the stage to develop contact potential bias without loading the preceding stage.
- **Section 2 (Low-Mu):** Functions as the low-impedance driver stage. Because power transistors of that era required significant current drive rather than just voltage swing, Section 2's low plate resistance (985 Ω) and high plate current (7.5 mA) make it ideal for driving the base of the power transistor directly or through a coupling transformer.

By combining these two dissimilar triodes into a single 9-pin envelope, designers of automotive radios could minimize chassis space and component count while achieving efficient, low-voltage audio amplification.

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 · Triode

OTHER		
PARAMETER	PUBLISHED VALUE	CONDITION / NOTE
Plate voltage	12.6 V	Section1
Plate current	1.9 mA	Section1

1966 TUNG SOL ELECTRONIC TUBES 2 OF 4

Section 2 · Triode

OTHER		
PARAMETER	PUBLISHED VALUE	CONDITION / NOTE
Plate voltage	12.6 V	Section2
Plate current	7.5 mA	Section2