

ELECTRONIC TUBE REFERENCE

12AT6

Voltage - Triode (with diode, heptode or hexode) electronic tube

CONSOLIDATED TECHNICAL DATA

3 SECTIONS
CONSTRUCTION
DIODE-DIODE-TRIODE

Double-diode high-mu triode widely used for radio detection, AVC generation, and audio voltage amplification. Paired diodes handle detection and control-voltage rectification while the triode supplies subsequent gain.

GENERAL CHARACTERISTICS

BASE DESIGNATION	7BT	BASE PINS	7
NOMINAL HEATER	12.6 V / 150 mA	PARALLEL HEATER	– / –
HEATING	Indirect	SERIES OPERATION	Not specified
CATHODE ARRANGEMENT	Common cathode	SECTION CONSTRUCTION	Dissimilar

7BT - TERMINAL PINOUT

TERMINAL	SECTION	ELEMENT	STATUS
PIN1 – 1G1	A	G1 – Control Grid	CONNECTED
PIN2 – K	A	K – Cathode	CONNECTED
PIN3 – H	–	H – Heater	CONNECTED
PIN4 – H	–	H – Heater	CONNECTED
PIN5 – 2P	B	P – Plate (Anode)	CONNECTED
PIN6 – 3P	C	P – Plate (Anode)	CONNECTED
PIN7 – 1P	A	P – Plate (Anode)	CONNECTED

SECTION RATINGS

SECTION1 Diode	
<i>No fixed ratings recorded.</i>	
<i>Published promoted fields populated semantically; identical repeated sections compressed.</i>	

SECTION2 Triode	
PLATE RESISTANCE	54000 Ω
TRANSCONDUCTANCE	0.0013 S
AMPLIFICATION FACTOR	70
MAXIMUM PLATE VOLTAGE	300 V
MAXIMUM PLATE DISSIPATION	0.5 W
<i>Published promoted fields populated semantically; identical repeated sections compressed.</i>	

SECTION3 Diode	
<i>No fixed ratings recorded.</i>	
<i>Second physical detector diode; duplicated from identical diode section.</i>	

12AT6 — Twin-Diode High-Mu Triode

Overview

The **12AT6** is a miniature, seven-pin multi-unit vacuum tube containing a high-mu triode and two independent diodes sharing a common cathode. It is designed for use as a combined detector, amplifier, and automatic volume control (AVC) tube in automobile and AC-operated radio receivers. The triode section is engineered to provide an output voltage swing sufficient to drive most beam power output tubes to full power.

The 12AT6 is electrically identical to the [6AT6](#) except for its heater ratings, which are configured for 12.6-volt operation rather than 6.3-volt operation.

Mechanical Construction and Pinout

The 12AT6 is constructed in a T-5 1/2 glass envelope with a miniature button 7-pin base (JETEC E7-1, outline 5-2 or 5C). It features a coated unipotential cathode that is common to both the triode and the two diode units. The tube can be mounted in any position.

Physical Dimensions

- Maximum Diameter:** 0.750 inches

- **Maximum Seated Height:** 1.875 inches (1-7/8")
- **Maximum Overall Height:** 2.125 inches (2-1/8")

Pin Connections (7BT Basing)

The 7BT basing arrangement provides the following connections, viewed from the bottom of the tube:

- **Pin 1:** Triode Grid (GT)
- **Pin 2:** Cathode (K) (Common to triode and diode units)
- **Pin 3:** Heater (H)
- **Pin 4:** Heater (H)
- **Pin 5:** Diode Plate No. 2 (PD2)
- **Pin 6:** Diode Plate No. 1 (PD1)
- **Pin 7:** Triode Plate (PT)

Heater and Electrical Ratings

The heater is designed for operation from either AC or DC power supplies. The maximum ratings are interpreted according to the Design-Center System (or Design Maximum Rating System).

Heater Specifications

- **Heater Voltage (AC/DC):** 12.6 V (with some early documentation noting 12.5 V)
- **Heater Current:** 0.15 A (150 mA)
- **Maximum Heater-Cathode Voltage:** 90 V (heater positive or negative with respect to cathode)

Triode Unit Maximum Ratings

- **Maximum Plate Voltage:** 300 V
- **Maximum Plate Dissipation:** 0.5 W
- **Maximum Positive DC Grid Voltage:** 0 V

Diode Units Maximum Ratings

- **Maximum Continuous Diode Current (Each Unit):** 1.0 mA

Electrical Characteristics and Class A1 Operation

At typical operating points, the triode unit functions as a high- μ Class A1 amplifier. The amplification factor remains constant at 70, while plate resistance and transconductance vary with the applied plate and grid voltages.

Typical Triode Operating Points

- **Operating Point A:**

- Plate Voltage: 100 V
- Grid Voltage: -1 V
- Amplification Factor: 70
- Plate Resistance: 54,000,
- Transconductance: 1,300 %mhos
- Plate Current: 0.8 mA

- **Operating Point B:**

- Plate Voltage: 250 V
- Grid Voltage: -3 V
- Amplification Factor: 70
- Plate Resistance: 58,000,
- Transconductance: 1,200 %mhos
- Plate Current: 1.0 mA

Diode Unit Characteristics

The two diode plates are positioned around the common cathode sleeve. Under test conditions with 10 V DC applied, each diode unit exhibits an average plate current of 2.0 mA (with some early specifications defining a minimum limit of 0.8 mA).

Resistance-Coupled Amplifier Application

The triode unit of the 12AT6 is commonly employed as a resistance-coupled audio-frequency voltage amplifier. Typical operating parameters for this configuration are detailed below:

- **Plate Supply Voltage:** 90 V | 250 V
- **Control Grid Voltage:** 0 V | 0 V
- **Plate Load Resistor:** 0.22 M (220,000,) | 0.47 M (470,000,)
- **Control Grid Resistor:** 10 M | 10 M
- **Input Coupling Condenser:** 0.01 %F | 0.01 %F
- **Output Coupling Condenser:** 0.01 %F | 0.01 %F
- **Grid Resistor of Following Stage:** 0.47 M (470,000,) | 0.47 M (470,000,)
- **Maximum Signal Source Impedance:** 1,000, | 1,000,
- **Total Harmonic Distortion:** 5% | 5%
- **Peak Output Voltage:** 8 V | 34 V
- **Voltage Gain (at 400 Hz):** 35 | 46

These operating points demonstrate that higher plate supply voltages combined with larger plate load resistors yield significantly higher peak output voltage swings (increasing from 8 V to 34 V) and higher voltage gains (increasing from 35 to 46) while maintaining distortion at 5%.

Interelectrode Capacitances

The direct interelectrode capacitances of the 12AT6 vary slightly depending on whether an external shield is utilized. When a shield (such as JETEC No. 316) is connected to the cathode (Pin 2), the output capacitance increases due to the shielding effect.

- **Triode Grid to Triode Plate:** 2.0 pF (with or without shield; some early sheets list 2.1 pF unshielded)
- **Triode Grid to Cathode and Heater (Input):** 2.2 pF (with or without shield; some early sheets list 2.3 pF unshielded)
- **Triode Plate to Cathode and Heater (Output):** 1.2 pF (shielded) | 0.8 pF (unshielded; some early sheets list 1.1 pF)
- **Diode Plate No. 2 to Triode Grid (Max):** 0.04 pF (with or without shield; some early sheets list 0.025 pF)
- **Diode Plate No. 1 to Triode Grid (Max):** 0.07 pF (unshielded)
- **Diode Plate No. 2 to Heater and Cathode:** 0.95 pF (unshielded)
- **Diode Plate No. 1 to Heater and Cathode:** 0.66 pF (unshielded)

Characteristic Curves and Interpretation

The average plate characteristics of the triode unit show the relationship between plate voltage and plate current across a range of grid bias voltages from 0 V to -7 V. The curves illustrate that the triode operates linearly over a wide voltage range, which is essential for low-distortion audio amplification.

For the diode units, the rectified characteristics show the DC voltage developed across various load resistors (ranging from 0.1 M to 2.0 M) as a function of the rectified microamperes and the applied RMS signal input (up to 30 V). These curves assist in designing detector and AVC circuits, allowing engineers to determine the appropriate load resistance to optimize rectified output voltage and linearity.

Related Designations and Comparisons

The **12AT6** is part of a family of double-diode high-mu triodes. It is identical to the **6AT6** except for its heater rating (12.6 V, 0.15 A for the 12AT6 versus 6.3 V, 0.3 A for the **6AT6**).

In terms of application and general electrical characteristics (excluding heater ratings and base configurations), the 12AT6 is somewhat similar to older octal and loctal types, including the **6Q7**, **6Q7GT**, **6SQ7**, **6SQ7GT**, **7B6**, and **7C6**. However, these similarities do not imply direct physical or electrical interchangeability due to differences in basing, physical size, and specific operating parameters.

SOURCE OPERATING CONDITIONS

[SOURCE PDF](#)

1975 RCA RC30

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

1975 RCA RC30

Section 1 · Diode

OTHER		
PARAMETER	PUBLISHED VALUE	CONDITION / NOTE
Heater Voltage (ac/dc) 6.3	12.6 V	Published in approved 6AT6 target entry; Section2
Heater Current 0.3	150 mA	Published in approved 6AT6 target entry; Section2
Triode Grid to Triode Plate	2 pF	Published in approved 6AT6 target entry; Section2
Triode Grid to Cathode and Heater	2.2 pF	Published in approved 6AT6 target entry; Section2
Triode Plate to Cathode and Heater	0.8 pF	Published in approved 6AT6 target entry; Section2
Plate Voltage	300 V	Published in approved 6AT6 target entry; Section2
Plate Dissipation	0.5 W	Published in approved 6AT6 target entry; Section2
Grid Voltage, Positive-bias value	0 V	Published in approved 6AT6 target entry; Section2
Plate Voltage 100	250 V	Published in approved 6AT6 target entry; Section2
Grid Voltage -1	-3 V	Published in approved 6AT6 target entry; Section2
Plate Resistance 54000	58000 Ω	Published in approved 6AT6 target entry; Section2
Transconductance 1300	1200 μS	Published in approved 6AT6 target entry; Section2
Plate Current 0.8	1 mA	Published in approved 6AT6 target entry; Section2
frequency in the order of	40 MHz	Published in approved 6AT6 target entry; Section2

Section 2 · Triode

OTHER		
PARAMETER	PUBLISHED VALUE	CONDITION / NOTE
Heater Voltage (ac/dc) 6.3	12.6 V	Published in approved 6AT6 target entry; Section1
Heater Current 0.3	150 mA	Published in approved 6AT6 target entry; Section1
Triode Grid to Triode Plate	2 pF	Published in approved 6AT6 target entry; Section1
Triode Grid to Cathode and Heater	2.2 pF	Published in approved 6AT6 target entry; Section1
Triode Plate to Cathode and Heater	0.8 pF	Published in approved 6AT6 target entry; Section1
Plate Voltage	300 V	Published in approved 6AT6 target entry; Section1
Plate Dissipation	0.5 W	Published in approved 6AT6 target entry; Section1
Grid Voltage, Positive-bias value	0 V	Published in approved 6AT6 target entry; Section1
Plate Voltage 100	250 V	Published in approved 6AT6 target entry; Section1
Grid Voltage -1	-3 V	Published in approved 6AT6 target entry; Section1
Plate Resistance 54000	58000 Ω	Published in approved 6AT6 target entry; Section1
Transconductance 1300	1200 μS	Published in approved 6AT6 target entry; Section1
Plate Current 0.8	1 mA	Published in approved 6AT6 target entry; Section1
frequency in the order of	40 MHz	Published in approved 6AT6 target entry; Section1

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