

ELECTRONIC TUBE REFERENCE

12AT7W

Voltage - Dual Triode (similar) electronic tube

CONSOLIDATED TECHNICAL DATA

2 SECTIONS

CONSTRUCTION

TRIODE-TRIODE

12AT7-family medium-high-mu twin triode, co-designated 6201, intended for low-frequency voltage amplification and applications requiring the familiar 12AT7 electrical characteristic set.

GENERAL CHARACTERISTICS

BASE DESIGNATION	—	BASE PINS	—
NOMINAL HEATER	6.3 V / 300 mA	PARALLEL HEATER	6.3 V / 300 mA
HEATING	Indirect	SERIES OPERATION	Capable
CATHODE ARRANGEMENT	Separate cathodes	SECTION CONSTRUCTION	Similar

SECTION RATINGS

SECTION1 Triode	
TRANSCONDUCTANCE	0.0055 S
AMPLIFICATION FACTOR	60
MAXIMUM PLATE VOLTAGE	300 V
MAXIMUM PLATE DISSIPATION	2.5 W
Representative section for two electrically identical sections.	

SECTION2 Triode	
TRANSCONDUCTANCE	0.0055 S
AMPLIFICATION FACTOR	60
MAXIMUM PLATE VOLTAGE	300 V
MAXIMUM PLATE DISSIPATION	2.5 W
Second identical physical triode section; added to align rows with SectionCount.	

12AT7W / 6201 — Miniature Twin Triode Vacuum Tube

The **12AT7W** (also designated as the **12AT7W/6201**) is a miniature, indirectly heated twin triode vacuum tube designed primarily for the amplification of low-frequency voltages in radio engineering and electronic devices. Featuring two independent triode sections with separate equipotential cathodes, the tube is housed in a compact glass envelope with a nine-pin base.

Physical Construction and Pin Configuration

The 12AT7W is constructed in a miniature glass envelope with a maximum overall height of 56.5 mm and an envelope diameter of 22.5 mm (with a tolerance of -2 mm). The base features a nine-pin arrangement with a pin circle diameter of 12 mm. The individual pins have a nominal diameter of 1.0 mm (with a tolerance of +0.03 mm to -0.07 mm) and are spaced at 36-degree angular intervals.

The internal electrodes are connected to the base pins according to the following arrangement:

Pin Number	Electrode Connection
1	Plate of the second triode
2	Grid of the second triode
3	Cathode of the second triode
4	Heater
5	Heater
6	Plate of the first triode
7	Grid of the first triode
8	Cathode of the first triode
9	Heater

The heater configuration utilizes pins 4, 5, and 9, allowing the tube to be operated with either a series or parallel filament supply.

Heater and Electrical Parameters

The 12AT7W can be configured for two different heater operating modes depending on the supply arrangement:

- Parallel Connection:** Operated at a nominal filament voltage of 6.3 V (with an allowable range of 6.0 V to 6.6 V). Under this condition, the heater current draws between 340 mA and 370 mA.

- **Series Connection:** Operated at a nominal filament voltage of 12.6 V (with an allowable range of 12.0 V to 13.2 V). Under this condition, the heater current draws between 170 mA and 185 mA.

Standard Operating Parameters

The nominal electrical characteristics for each triode section, measured at a plate voltage of 250 V and a grid bias of -2.0 V (using either a 6.3 V or 12.6 V heater supply), are specified as follows:

Parameter	Minimum	Maximum	Unit
Plate Current	7.0	16.0	mA
Transconductance (Slope of Characteristic)	4.1	6.8	mA/V
Amplification Factor (μ)	45	—	—
Grid Back Current	—	0.5	μ A
Plate Current at Cutoff (at $E_g = -12.0$ V)	—	60	μ A
Cathode-to-Heater Insulation Resistance (at ± 200 V)	20	—	M Ω

To ensure balanced operation in push-pull or dual-channel applications, the plate current difference between the first and second triode sections is tightly controlled, with a maximum allowable variation of $\pm 25\%$ under standard operating conditions. The grid back current limit of 0.5 μ A is specified with a grid circuit resistance of 0.25 M Ω .

Limiting Values and Operating Constraints

To ensure reliable operation and prevent premature degradation of the tube, the operating conditions must be maintained within the following absolute limiting values:

Parameter	Limit Value	Unit
Maximum Plate Voltage	330	V
Maximum Cathode-to-Heater Voltage	± 200	V
Maximum Plate Dissipation (per triode section)	3.25	W
Maximum Cathode Current	18	mA

Parameter	Limit Value	Unit
Maximum Grid Circuit Resistance (Fixed Bias)	0.25	MΩ
Maximum Grid Circuit Resistance (Self-Bias)	1.0	MΩ

The distinction between fixed bias and self-bias grid resistance limits is critical for circuit design. Under fixed bias, the maximum resistance is restricted to 0.25 MΩ to prevent thermal runaway caused by grid emission, whereas self-bias operation permits a higher resistance of up to 1.0 MΩ due to the stabilizing effect of the cathode resistor.

Characteristic Curves and Analysis

The operational behavior of the 12AT7W is characterized by two primary sets of curves: transfer characteristics and plate characteristics.

Transfer Characteristics (I_p vs. E_g)

The transfer curves illustrate the relationship between plate current (I_p) and grid voltage (E_g) at constant plate voltages (E_p) of 200 V, 250 V, and 300 V:

- At a plate voltage of 250 V, the plate current decreases smoothly as the grid is biased more negatively, approaching cutoff near -12.0 V where the current drops below 60 μA.
- Higher plate voltages shift the transfer curve to the left, requiring a more negative grid bias to achieve the same plate current or to reach cutoff. For instance, at a plate voltage of 300 V, the triode conducts more heavily at any given grid voltage compared to its operation at 200 V.

Plate Characteristics (I_p vs. E_p)

The plate family of curves plots plate current (I_p) against plate voltage (E_p) for discrete grid bias steps from 0 V to -3.5 V in 0.5 V increments:

- The curves demonstrate a typical triode profile, where plate current rises continuously with increasing plate voltage.
- At $E_g = 0$ V, the tube conducts heavily, reaching a plate current of approximately 15 mA at a plate voltage of around 150 V.
- Applying a negative grid bias shifts the conduction threshold to higher plate voltages. For example, with a grid bias of -2.0 V, the plate current remains near zero until the plate voltage exceeds approximately 60 V, after which it rises, passing through the nominal operating point of 7.0 to 16.0 mA at 250 V.

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