



ELECTRONIC TUBE REFERENCE

12AL5

Voltage - Radio Detector Converter electronic tube

CONSOLIDATED TECHNICAL DATA

2 SECTIONS

CONSTRUCTION

DIODE-DIODE

Twin-diode receiving tube for detector, discriminator, and general signal-rectification applications. Two independent diode sections make it useful for matched or complementary detection and control-voltage functions.

GENERAL CHARACTERISTICS

BASE DESIGNATION	E7-1	BASE PINS	7
NOMINAL HEATER	12.6 V / 150 mA	PARALLEL HEATER	– / –
HEATING	Indirect	SERIES OPERATION	Not specified
CATHODE ARRANGEMENT	Separate cathodes	SECTION CONSTRUCTION	Similar

SECTION RATINGS

SECTION1 Diode	
PEAK INVERSE VOLTAGE	330 V
NOMINAL OUTPUT CURRENT	9 mA
PEAK FORWARD CURRENT	54 mA
FORWARD VOLTAGE DROP	10 V
MAXIMUM HEATER-CATHODE VOLTAGE	330 V
Representative of both identical diode sections; half-wave rectifier values are per plate.	

SECTION2 Diode	
No fixed ratings recorded.	
Second physical diode; duplicated from identical diode section.	

12AL5 — High-Perveance Twin Diode

A miniature, high-perveance double diode designed for detector service in frequency modulation (FM) and television circuits, automatic-volume-control (AVC) rectifiers, and low-power half-wave rectification.

Overview

The **12AL5** is a miniature seven-pin twin diode containing two independent, high-perveance diode units within a single T-5 1/2 glass envelope. The independent construction of each diode section allows them to be operated separately, connected in parallel for increased current capacity, or configured in a full-wave arrangement.

Due to its high-perveance design, the 12AL5 exhibits low internal voltage drop and high operating efficiency, making it highly effective as an AM or FM detector, particularly in ratio detector circuits for AC-operated receivers. Additionally, the tube is designed to operate at high frequencies, with each diode unit possessing a resonant frequency of approximately 700 MHz (megacycles per second).

Construction, Base, and Pinout

The 12AL5 is constructed with coated unipotential cathodes and an internal shield to minimize coupling between the two diode sections. The tube is housed in a T-5 1/2 glass bulb and utilizes a small-button miniature 7-pin base. It can be mounted and operated in any physical position.

Physical Dimensions

- **Maximum Diameter:** 0.750 inches
- **Maximum Seated Height:** 1.500 inches
- **Maximum Overall Height:** 1.750 inches

Pin Connections (Basing Diagram 6BT)

Viewed from the bottom of the tube, the 7-pin miniature base connections are assigned as follows:

Pin Number	Connection	Description
1	KD1	Cathode, Diode Unit 1
2	PD2	Plate, Diode Unit 2
3	H	Heater
4	H	Heater
5	KD2	Cathode, Diode Unit 2
6	IS	Internal Shield
7	PD1	Plate, Diode Unit 1

Heater Characteristics and Family Variations

The 12AL5 belongs to a family of identical twin diodes that differ only in their heater ratings. The heater is designed for operation on either AC or DC power.

Parameter	<u>3AL5</u>	<u>6AL5</u>	12AL5
Heater Voltage (AC/DC)	3.15 V	6.3 V (±10%)	12.6 V
Heater Current	0.60 A	0.30 A	0.15 A
Heater Warm-up Time	11 seconds	—	—

The 3AL5 variant features a controlled heater warm-up time of approximately 11 seconds, specifically designed to minimize voltage surges across individual tubes when employed in series-connected heater strings (such as in television receivers with 600 mA series circuits).

Direct Interelectrode Capacitances

The internal shield of the 12AL5, when properly grounded, provides excellent isolation between the two diode sections. The direct interelectrode capacitances vary depending on whether an external shield is utilized. The values below represent the capacitances for each section:

Capacitance Parameter	Unshielded	Shielded (with External Shield)*
Plate Input (Plate to Cathode + Heater + Internal Shield)	2.5 pF	3.2 pF
Cathode Input (Cathode to Plate + Heater + Internal Shield)	3.4 pF	3.6 pF
Plate-to-Plate Coupling (Maximum)	0.068 pF	0.025 to 0.026 pF

Note: Shielded values are measured using an external shield (such as No. 316) connected directly to Pin 6 (Internal Shield).

Maximum Ratings

The maximum ratings for the 12AL5 are established under the Design-Center or Design-Maximum Rating Systems. These limits must not be exceeded under any operating conditions.

Rating Parameter	Value	Unit
Peak Inverse Plate Voltage	330	Volts
Peak Plate Current (Per Plate)	54	mA
DC Output Current (Per Plate)	9.0	mA
AC Plate Voltage (Per Plate, RMS)	117	Volts
Minimum Total Effective Plate Supply Impedance (Per Plate)	300	Ohms

Heater-Cathode Voltage Limits

- **Maximum Peak Heater-Cathode Voltage:** 330 Volts
- **Heater Negative with Respect to Cathode (Total DC + Peak):** 330 Volts max.
- **Heater Positive with Respect to Cathode (DC Component):** 100 Volts max.
- **Heater Positive with Respect to Cathode (Total DC + Peak):** 200 Volts max.

Typical Operation and Characteristics

When operated as a low-power half-wave rectifier (with the units used either separately or in parallel), the typical operating parameters are:

- **AC Plate Voltage per Plate (RMS):** 117 Volts
- **Minimum Total Effective Plate Supply Impedance per Plate:** 300 Ohms
- **Average Output Current per Plate:** 9.0 mA
- **Tube Voltage Drop:** 10 Volts DC at a plate current (I_b) of 60 mA

This low voltage drop (10 V at 60 mA) is a direct consequence of the tube's high perveance, enabling efficient rectification and signal detection with minimal signal loss.

Analysis of Characteristic Curves

The published performance curves for the 12AL5 illustrate two primary operational aspects:

Average Plate Characteristics

The plate current versus DC plate voltage curve demonstrates the high-perveance nature of the diode. The curve shows a rapid, non-linear rise in plate current as plate voltage increases from zero. At a plate potential of approximately 5.0 Volts DC, the plate current reaches 25 mA. When the plate potential is

increased to 10.0 Volts DC, the current rises to approximately 60 mA. This steep curve indicates a low internal plate resistance during conduction.

Half-Wave Rectification Characteristics

The rectification curves plot the DC developed voltage against the rectified microamperes for a single diode unit operating under rated filament conditions. With an RMS signal input of up to 30 Volts, the developed DC voltage is shown as a function of various load resistance values ranging from 0.1 Megohm to 2.0 Megohms:

- **Low Load Resistance (e.g., 0.1 Megohm):** Results in higher rectified current (microamperes) but a lower developed DC voltage for a given AC input.
- **High Load Resistance (e.g., 2.0 Megohms):** Restricts the rectified current to very low levels but maximizes the developed DC voltage, approaching the peak value of the AC input signal.

These curves allow designers to select the optimum load resistance for detector and AVC circuits to balance signal voltage recovery against circuit loading.

Technical Summary

The **12AL5** is a **miniature, 7-pin twin diode** featuring **two independent high-perveance sections** with a common **12.6 V, 0.15 A heater**. It is electrically identical to the [6AL5](#) and [3AL5](#) except for its heater configuration. With a resonant frequency of **700 MHz**, low internal capacitance, and a low voltage drop of **10 V at 60 mA**, the 12AL5 is optimized for high-frequency detection, ratio detectors, and low-current power supply rectification in television and FM receiver designs.



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 1 · Diode

OTHER		
PARAMETER	PUBLISHED VALUE	CONDITION / NOTE
DC Output Current	9 mA	EachPlate



SOURCE OPERATING CONDITIONS

[SOURCE PDF](#)

1965 Westinghouse Data Book

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

1965 WESTINGHOUSE DATA BOOK

Section 1 · Diode

CHARACTERISTIC		
PARAMETER	PUBLISHED VALUE	CONDITION / NOTE
Heater Voltage	12.6 V	—
Heater Current	150 mA	—
ResonantFrequencyApproximate	700 MHz	—
Plate To Cathode Capacitance	3.2 pF	—
CathodeToPlateCapacitance	3.6 pF	—

OTHER		
PARAMETER	PUBLISHED VALUE	CONDITION / NOTE
PeakInverseVoltageMaximum	330 V	EachDiode
PeakPlateCurrentMaximum	54 mA	EachDiode
DCOutputCurrentMaximum	9 mA	EachDiode
ACVoltagePerPlateRMS	117 V	HalfWaveRectifier

PARAMETER	PUBLISHED VALUE	CONDITION / NOTE
MinimumPlateSupplyImpedance	300 ohm	EachPlate



SOURCE OPERATING CONDITIONS

[SOURCE PDF](#)

1966 Tung Sol Electronic Tubes 2 of 4

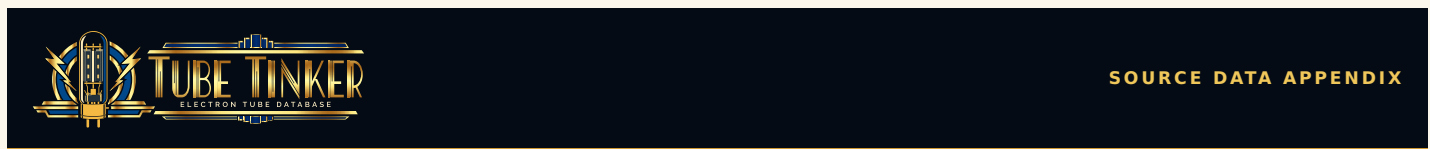
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1966 TUNG SOL ELECTRONIC TUBES 2 OF 4

Section 1 · Diode

OTHER		
PARAMETER	PUBLISHED VALUE	CONDITION / NOTE
Maximum peak inverse voltage	330 V	EachDiode
Maximum AC plate voltage RMS	117 V	EachDiode
Maximum steady-state peak plate current	54 mA	EachDiode
Maximum DC output current	9 mA	EachDiode

CAPACITANCE		
PARAMETER	PUBLISHED VALUE	CONDITION / NOTE
Plate input capacitance	2.5 pF	WithoutShield
Plate input capacitance	3.2 pF	WithShield
Plate-to-plate coupling capacitance	0.068 pF	WithoutShield



SOURCE OPERATING CONDITIONS

1968 General Electric Co

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

1968 GENERAL ELECTRIC CO

OTHER		
PARAMETER	PUBLISHED VALUE	CONDITION / NOTE
HeaterOrFilamentVoltageNominal	12.6 V	—
HeaterOrFilamentCurrentNominal	150 mA	—
Maximum Peak Inverse Voltage	330 V	—
NominalDCOutputCurrent	9 mA	—
PeakForwardCurrent	54 mA	—
Maximum Heater Cathode Voltage	330 V	—
ACPlateSupplyVoltagePerPlateRMS	117 V	HalfWave

CHARACTERISTIC		
PARAMETER	PUBLISHED VALUE	CONDITION / NOTE
Forward Voltage Drop	10 V	—

CAPACITANCE		
PARAMETER	PUBLISHED VALUE	CONDITION / NOTE
Plate To Cathode Heater Shield Capacitance	3.2 pF	—



SOURCE DATA APPENDIX

SOURCE OPERATING CONDITIONS

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1971 RCA HB3 Binder 5 of 7

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

1971 RCA HB3 BINDER 5 OF 7

OTHER		
PARAMETER	PUBLISHED VALUE	CONDITION / NOTE
Heater voltage	6.3 V	Nominal Inherited from explicitly referenced 6AL5 parent type.
Heater current	300 mA	Nominal Inherited from explicitly referenced 6AL5 parent type.
Maximum peak inverse plate voltage	275 V	Promoted published value Inherited from explicitly referenced 6AL5 parent type.

PARAMETER	PUBLISHED VALUE	CONDITION / NOTE
PEAK INVERSE PLATE VOLTAGE	275 V	Maximum Ratings, Design-Maximum Values: Inherited from explicitly referenced 6AL5 parent type.
PEAK PLATE CURRENT	60 mA	Maximum Ratings, Design-Maximum Values: Inherited from explicitly referenced 6AL5 parent type.
DC PLATE CURRENT	10 mA	Maximum Ratings, Design-Maximum Values: Inherited from explicitly referenced 6AL5 parent type.
Heater negative with respect to cathode	275 V	Maximum Ratings, Design-Maximum Values: Inherited from explicitly referenced 6AL5 parent type.
Heater positive with respect to cathode	100 V	Maximum Ratings, Design-Maximum Values: Inherited from explicitly referenced 6AL5 parent type.
Heater Voltage	6.3 V	Characteristics: Inherited from explicitly referenced 6AL5 parent type.
much as	35 V	Characteristics: Inherited from explicitly referenced 6AL5 parent type.
volts	7.5 V	Characteristics: Inherited from explicitly referenced 6AL5 parent type.

CHARACTERISTIC		
PARAMETER	PUBLISHED VALUE	CONDITION / NOTE
Peak forward/plate current	60 mA	Promoted published value Inherited from explicitly referenced 6AL5 parent type.
Nominal/DC output current	10 mA	Promoted published value Inherited from explicitly referenced 6AL5 parent type.
Voltage	20 V	Inherited from explicitly referenced 6AL5 parent type.
Current at	0.3 V	Inherited from explicitly referenced 6AL5 parent type.
Plate Voltage	10 V	Characteristics: Inherited from explicitly referenced 6AL5 parent type.
Plate Current	60 mA	Characteristics: Inherited from explicitly referenced 6AL5 parent type.
135 volts positive with respect to cathode, and all other	135 V	Characteristics: Inherited from explicitly referenced 6AL5 parent type.

SOURCE OPERATING CONDITIONS

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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

CAPACITANCE		
PARAMETER	PUBLISHED VALUE	CONDITION / NOTE
Plate to cathode/heater/shield	2.5 pF	—
Cathode to plate/heater/shield	3.4 pF	—
Plate-to-plate coupling	0.068 pF	—

OTHER		
PARAMETER	PUBLISHED VALUE	CONDITION / NOTE
Peak inverse plate voltage	330 V	MaximumRating
Peak plate current	54 mA	MaximumRating
AC plate voltage per plate	117 V	HalfWaveRectifier
Average output current per plate	9 mA	HalfWaveRectifier
Minimum total effective plate-supply impedance per plate	300 ohm	HalfWaveRectifier

TUBE TINKER

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