



ELECTRONIC TUBE REFERENCE

10LD13

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

CONSOLIDATED TECHNICAL
DATA

3 SECTIONS

CONSTRUCTION

DIODE-DIODE-TRIODE

Double-diode high-mu triode combining detector and voltage-amplifier functions in radio receivers. Two diodes provide signal or control-voltage rectification while the triode supplies substantial subsequent voltage gain.

GENERAL CHARACTERISTICS

BASE DESIGNATION	—	BASE PINS	—
NOMINAL HEATER	13 V / 100 mA	PARALLEL HEATER	— / —
HEATING	Indirect	SERIES OPERATION	Not specified
CATHODE ARRANGEMENT	Separate cathodes	SECTION CONSTRUCTION	Dissimilar

SECTION RATINGS

SECTION1 Diode

No fixed ratings recorded.

Published ratings and characteristics promoted where clearly stated; identical repeated sections compressed when applicable.

SECTION2 Diode

No fixed ratings recorded.

Physical diode section added in approved section-structure reconciliation.

SECTION3 Triode	
TRANSCONDUCTANCE	0.0014 S
AMPLIFICATION FACTOR	75
MAXIMUM PLATE VOLTAGE	250 V
MAXIMUM PLATE DISSIPATION	1 W
MAXIMUM CATHODE CURRENT	5 mA
<i>Published ratings and characteristics promoted where clearly stated; identical repeated sections compressed when applicable.</i>	

10LD13 — Double Diode Triode Vacuum Tube

An indirectly heated, miniature-based double diode triode designed for audio-frequency voltage amplification, AM detection, and automatic gain control (AGC) in series-heater mains receivers.

Overview

The **10LD13** (also designated as the **10LD13/UBC81**) is a miniature-based, indirectly heated double diode triode vacuum tube. It is designed specifically for use in AC/DC mains-powered AM radio receivers that employ series-connected heater strings. The tube combines a high-mu triode section for audio-frequency voltage amplification with two independent diode sections suitable for AM detection and automatic gain control (AGC) functions. It is manufactured by Thorn-AEI Radio Valves & Tubes Ltd. under the Mazda brand.

Physical Construction, Base, and Pin Connections

The 10LD13 is housed in a miniature glass envelope utilizing a standard 9-pin **Noval (B9A)** base. The physical dimensions of the tube are compact, making it suitable for space-constrained receiver designs:

- **Maximum Overall Length:** 67.5 mm
- **Maximum Seated Height:** 60.5 mm
- **Maximum Diameter:** 22.2 mm
- **Approximate Net Weight:** 0.5 oz (1/2 oz)
- **Approximate Packed Weight:** 0.75 oz (3/4 oz)

The tube's mounting position is completely **unrestricted**, allowing for flexible physical layouts within a chassis. For physical installation, the recommended valve holder is the Ediswan Clix type VH599/901 series.

The Noval base pinout configuration, viewed from the free end of the pins, is defined as follows:

Pin	Connection	Symbol
1	Triode Anode	a

Pin	Connection	Symbol
2	Control Grid	g
3	Cathode	k
4	Heater	h
5	Heater	h
6	Diode 1	a'd
7	Internal Shield	s
8	Diode 2	a''d
9	Internal Connection	IC

An internal shield is connected to Pin 7 to minimize capacitive coupling between the sections. For AM receiver applications, the manufacturer specifies that **Diode Pin 8 (Diode 2) should be used for detection**.

Electrical Ratings and Triode Characteristics

The 10LD13 is designed for series-heater operation, drawing a constant current. Its heater and maximum electrical ratings are:

- **Heater Current (I_h):** 0.1 A
- **Heater Voltage (V_h):** 13.0 V
- **Maximum Anode Voltage (Triode) ($V_{a(max)}$):** 250 V
- **Maximum Anode Dissipation (Triode) ($P_{a(max)}$):** 1.0 W
- **Maximum Cathode Current ($I_{k(max)}$):** 5.0 mA
- **Maximum Mean Diode Current ($I_{ad(max)}$):** 0.8 mA
- **Maximum Heater-to-Cathode Voltage ($V_{h-k(max)}$):** 150 V r.m.s. (measured with respect to the higher potential heater pin)

Under typical Class A triode operating conditions, the tube exhibits the following characteristics:

- **Anode Voltage (V_a):** 100 V
- **Grid Voltage (V_g):** -0.7 V
- **Anode Current (I_a):** 0.8 mA
- **Amplification Factor (μ):** 75
- **Mutual Conductance (g_m):** 1.4 mA/V

Using the fundamental triode relationship $r_p = \mu/g_m$, the calculated internal plate resistance (r_p) at this specific operating point is approximately **53.6 k Ω** .

Inter-electrode Capacitances

The inter-electrode capacitances of the 10LD13 are documented under two distinct measurement conditions to assist designers in accounting for circuit board and socket stray capacitances:

- Holder Capacity Balanced Out (\u00a77):** Represents the intrinsic capacitances of the tube itself.
- Total Capacity with Holder (\u00a721):** Includes the capacitance of a standard B9A ceramic holder without a skirt or radial shield (specifically Plessey holder type CP180014/1).

In these measurements, "Earth" denotes the electrodes of any second valve section and the remaining earthy potential electrodes of the section under measurement, with the heater and internal shield joined directly to the cathode.

Capacitance Parameter	Symbol	Balanced Out (\u00a77)	With Ceramic Holder (\u00a721)
Grid to Earth (Input)	c_{in}	2.3 pF	3.1 pF
Anode to Earth (Output)	c_{out}	2.4 pF	3.2 pF
Anode to Grid	$c_{a,g}$	1.9 pF	2.1 pF
Diode 1 to Earth	$c_{a'd-E}$	1.8 pF	2.8 pF
Diode 2 to Earth	$c_{a''d-E}$	1.9 pF	2.8 pF
Diode 1 to Diode 2	$c_{a'd-a''d}$	0.29 pF	0.31 pF
Grid to Diode 1	$c_{g-a'd}$	0.0019 pF	0.0033 pF
Grid to Diode 2	$c_{g-a''d}$	0.0021 pF	0.0040 pF
Anode to Diode 1	$c_{a-a'd}$	0.0051 pF	0.0065 pF
Anode to Diode 2	$c_{a-a''d}$	0.018 pF	0.027 pF

The extremely low grid-to-diode and anode-to-diode capacitances (typically less than 0.03 pF) demonstrate the effectiveness of the internal shielding, which prevents high-frequency signal leakage from the detector stage back into the sensitive triode grid circuit.

Typical Operating Conditions as a Resistance-Coupled A.F. Amplifier

The triode section of the 10LD13 is highly optimized for resistance-coupled audio-frequency voltage amplification. The operating characteristics vary depending on whether cathode self-bias or grid-current bias is employed.

1. Cathode Self-Bias Configuration

In this configuration, a cathode resistor (R_k) provides the necessary negative grid bias. The following table outlines typical performance across three supply voltages ($V_{a(b)}$) and two anode load resistances (R_a):

Parameter	$R_a = 100\text{ k}\Omega$	$R_a = 100\text{ k}\Omega$	$R_a = 100\text{ k}\Omega$	$R_a = 220\text{ k}\Omega$	$R_a = 220\text{ k}\Omega$	$R_a = 220\text{ k}\Omega$
Supply Voltage ($V_{a(b)}$)	100 V	150 V	200 V	100 V	150 V	200 V
Grid Resistance of Following Stage (R_{g1})	330 k	330 k	330 k	680 k	680 k	680 k
Cathode Self-Bias Resistor (R_k)	3.3 k	2.2 k	2.2 k	5.6 k	3.9 k	3.9 k
Anode Current (I_a)	0.27 mA	0.48 mA	0.63 mA	0.16 mA	0.27 mA	0.37 mA
Voltage Amplification	36.5	41.5	42.0	41.5	49.0	48.5
RMS Output Voltage (V_{out}) *	6.0 V	13.5 V	25.5 V	6.0 V	14.0 V	28.5 V
Second Harmonic Distortion	4.5%	4.5%	6.5%	4.0%	4.0%	5.5%
Third Harmonic Distortion	<0.1%	<0.1%	<0.1%	<0.1%	<0.1%	<0.1%

* Note: Output voltage is measured at the threshold of 0.5 μ A grid current.

2. Grid-Current Bias Configuration

Grid-current bias (or contact potential bias) eliminates the cathode resistor and bypass capacitor, grounding the cathode directly. The grid is biased via a high-value grid leak resistor (typically 10 M\Omega), and the input signal source (Z_s) is coupled through a 0.05 \u03bcF capacitor.

Case A: Zero-Impedance Signal Source ($Z_s = 0 \Omega$)

When driven by a low-impedance source, the stage achieves higher voltage gain and very low distortion at moderate output levels:

Parameter	$R_a = 100 \text{ k}\Omega$	$R_a = 100 \text{ k}\Omega$	$R_a = 100 \text{ k}\Omega$	$R_a = 220 \text{ k}\Omega$	$R_a = 220 \text{ k}\Omega$	$R_a = 220 \text{ k}\Omega$
Supply Voltage ($V_{a(b)}$)	100 V	150 V	200 V	100 V	150 V	200 V
Grid Resistance of Following Stage (R_{g1})	330 k\Omega	330 k\Omega	330 k\Omega	680 k\Omega	680 k\Omega	680 k\Omega
Anode Current (I_a)	0.34 mA	0.66 mA	1.02 mA	0.20 mA	0.37 mA	0.56 mA
Voltage Amplification	39.0	44.5	48.0	44.5	51.0	54.5
RMS Output Voltage (V_{out}) *	4.0 V	8.5 V	13.0 V	5.5 V	11.5 V	16.5 V
RMS Output Voltage (V_{out}) **	7.0 V	15.0 V	22.5 V	9.0 V	18.0 V	27.5 V
Third Harmonic Distortion ***	<0.1%	<0.1%	<0.1%	<0.1%	<0.1%	<0.1%

** Measured at 2.5% Second Harmonic Distortion. ** Measured at 5.0% Second Harmonic Distortion. *** Measured at the 2.5% Second Harmonic Distortion output level.*

Case B: High-Impedance Signal Source ($Z_s = 200\text{ k}\Omega$)

When driven by a high-impedance source (such as a preceding detector stage), the loading effect reduces the overall voltage amplification and introduces a small amount of third-harmonic distortion:

Parameter	$R_a = 100\text{ k}\Omega$	$R_a = 100\text{ k}\Omega$	$R_a = 100\text{ k}\Omega$	$R_a = 220\text{ k}\Omega$	$R_a = 220\text{ k}\Omega$	$R_a = 220\text{ k}\Omega$
Supply Voltage ($V_{a(b)}$)	100 V	150 V	200 V	100 V	150 V	200 V
Grid Resistance of Following Stage (R_{g1})	330 k	330 k	330 k	680 k	680 k	680 k
Anode Current (I_a)	0.34 mA	0.66 mA	1.02 mA	0.20 mA	0.37 mA	0.56 mA
Voltage Amplification	32.0	36.5	39.5	36.5	42.5	44.5
RMS Output Voltage (V_{out}) *	8.5 V	17.5 V	26.0 V	11.0 V	21.5 V	32.0 V
Third Harmonic Distortion *	2.5%	3.0%	3.0%	2.5%	2.5%	3.0%

** Measured at 2.5% Second Harmonic Distortion.*

Technical Summary

The **10LD13** (or **10LD13/UBC81**) is a highly integrated **Noval-based double diode triode** designed for series-run AC/DC AM receivers. Operating with a **13.0 V, 0.1 A** heater, it provides a high-mu triode section ($\mu = 75$, $g_m = 1.4\text{ mA/V}$) and two independent diodes, with Diode 2 (Pin 8) specifically recommended for detection.

The tube is capable of delivering voltage gains up to **54.5** in grid-current bias configurations or up to **49.0** in cathode self-bias configurations, while maintaining exceptionally low third-harmonic distortion (often under 0.1%). With its robust maximum anode voltage rating of **250 V** and comprehensive internal shielding, the 10LD13 serves as an efficient, space-saving solution for combined detection, AGC, and pre-amplification stages in classic receiver designs.

SOURCE OPERATING CONDITIONS

[SOURCE PDF](#)

1973 Mazda Valves Binder 2

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

1973 MAZDA VALVES BINDER 2

Section 1 · Diode

CHARACTERISTICS		
PARAMETER	PUBLISHED VALUE	CONDITION / NOTE
Heater or filament voltage	13 V	Published nominal value
Heater or filament current	100 mA	Published nominal value

1973 MAZDA VALVES BINDER 2

Section 3 · Triode

CHARACTERISTICS		
PARAMETER	PUBLISHED VALUE	CONDITION / NOTE
Heater or filament voltage	13 V	Published nominal value
Heater or filament current	100 mA	Published nominal value
Transconductance	1400 μ S	Published operating characteristic

OTHER		
PARAMETER	PUBLISHED VALUE	CONDITION / NOTE
Maximum plate dissipation	1 W	Published maximum rating

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