



ELECTRONIC TUBE REFERENCE

19D8

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

CONSOLIDATED TECHNICAL
DATA

2 SECTIONS
CONSTRUCTION
HEPTODE-TRIODE

Triode-heptode frequency changer for radio receivers, combining a dedicated oscillator triode with a heptode mixer. Manufacturer literature also permits the heptode to serve independently as an RF or IF amplifier.

GENERAL CHARACTERISTICS

BASE DESIGNATION	—	BASE PINS	9
NOMINAL HEATER	19 V / 100 mA	PARALLEL HEATER	— / —
HEATING	Indirect	SERIES OPERATION	Not specified
CATHODE ARRANGEMENT	Common cathode	SECTION CONSTRUCTION	Dissimilar

SECTION RATINGS

SECTION1 Triode	
PLATE RESISTANCE	19000 Ω
TRANSCONDUCTANCE	0.004 S
AMPLIFICATION FACTOR	22
MAXIMUM PLATE VOLTAGE	250 V
MAXIMUM PLATE DISSIPATION	1.5 W
MAXIMUM CATHODE CURRENT	15 mA
<i>Published ratings and characteristics promoted from the approved German source.</i>	

SECTION2 Heptode	
PLATE RESISTANCE	1000000 Ω
TRANSCONDUCTANCE	0.000775 S
MAXIMUM PLATE VOLTAGE	250 V
MAXIMUM SCREEN VOLTAGE	250 V
MAXIMUM PLATE DISSIPATION	1.5 W
MAXIMUM SCREEN DISSIPATION	1 W
MAXIMUM CATHODE CURRENT	25 mA
Published ratings and characteristics promoted from the approved German source.	

19D8 — Triode Heptode Vacuum Tube

An indirectly heated triode heptode designed primarily for frequency changer applications, where the heptode section can also serve as an RF or IF amplifier.

Overview

The **19D8** (also designated as the **UCH81**) is an indirectly heated triode heptode vacuum tube. It is housed in a glass envelope with a B9A-Noval base and is designed to operate in any mounting position. The tube is primarily utilized as a frequency changer in radio receivers, with the heptode section capable of functioning as a radio-frequency (RF) or intermediate-frequency (IF) amplifier, and the triode section operating as an RF oscillator.

Physical Dimensions and Base Connections

The 19D8 features a compact physical construction with the following maximum dimensions:

- **Maximum overall length:** 67.5 mm
- **Maximum seated height:** 60.5 mm
- **Maximum bulb diameter:** 22.2 mm

The tube utilizes a standard **B9A-Noval** nine-pin base. The pinout configuration is assigned as follows:

Pin	Connection
1	Screen grids <u>g2</u> and g4 (Heptode)
2	Control grid g1 (Heptode)
3	Cathode, suppressor grid g5, and internal shield
4	Heater

Pin	Connection
5	Heater
6	Anode (Heptode)
7	Mixer grid g3 (Heptode)
8	Anode (Triode)
9	Grid (Triode)

Heater and Heater-Cathode Ratings

The heater is designed for series or parallel AC or DC operation, making it suitable for a variety of receiver power supply configurations.

Parameter	Value
Nominal heater voltage	19.0 V
Nominal heater current	0.1 A
Maximum heater-to-cathode voltage	100 V
Maximum heater-to-cathode circuit resistance	20 kΩ

Electrical Characteristics and Maximum Ratings

The 19D8 has separate maximum ratings and electrical characteristics defined for its heptode and triode sections. These limits must be observed to ensure reliable operation.

Heptode Section Ratings

- **Maximum supply voltage:** 550 V
- **Maximum anode voltage:** 250 V
- **Maximum screen grid voltage (Vg2,g4):** 125 V (increases to 200 V if anode current Ia is less than 1 mA)
- **Maximum anode dissipation:** 1.7 W
- **Maximum screen grid dissipation:** 1.0 W
- **Maximum cathode current:** 12.5 mA
- **Maximum control grid voltage (Vg1 at Ig1 = +0.3 μA):** -1.3 V
- **Maximum mixer grid voltage (Vg3 at Ig3 = +0.3 μA):** -1.3 V
- **Maximum control grid-to-cathode resistance (Rg1-k):** 3.0 MΩ
- **Maximum mixer grid-to-cathode resistance (Rg3-k):** 3.0 MΩ (reduced to 20 kΩ if switched without a direct connection between g3 and the triode grid gt)

Triode Section Ratings and Characteristics

- **Maximum anode voltage:** 250 V
- **Maximum anode dissipation:** 0.8 W
- **Maximum mean cathode current:** 6.5 mA
- **Maximum grid voltage ($I_g = +0.3 \mu\text{A}$):** -1.3 V
- **Maximum grid-to-cathode resistance (R_{g-k}):** 3.0 M Ω

Under static Class A conditions ($V_a = 100 \text{ V}$, $V_g = 0 \text{ V}$), the triode section exhibits the following typical characteristics:

- **Anode current (I_a):** 13.5 mA
- **Amplification factor (μ):** 22
- **Transconductance (g_m):** 3.7 mA/V

Typical Operating Conditions

The 19D8 can be configured in several standard operating modes depending on the receiver design requirements.

Heptode Section as an AM Frequency Changer

In this mode, the heptode section acts as a mixer. Typical operating parameters are specified for three supply voltages:

Parameter	Condition A	Condition B	Condition C
Anode and supply voltage ($V_a = V_b$)	100 V	170 V	200 V
Screen grid resistor (R_{g2g4})	10 k Ω	10 k Ω	10 k Ω
Grid resistor (R_{g3gt})	47 k Ω	47 k Ω	47 k Ω
Grid current (I_{g3gt})	115 μA	200 μA	230 μA
Control grid voltage (V_{g1})	-1.2 V	-2.2 V	-2.6 V
Cathode resistor (R_k)	150 Ω	150 Ω	150 Ω
Anode current (I_a)	1.7 mA	3.2 mA	3.7 mA
Screen grid current (I_{g2g4})	3.7 mA	6.8 mA	8.1 mA
Conversion conductance (g_c)	620 $\mu\text{A/V}$	750 $\mu\text{A/V}$	775 $\mu\text{A/V}$

Parameter	Condition A	Condition B	Condition C
Anode resistance (ra)	0.8 MΩ	0.9 MΩ	1.0 MΩ
Equivalent noise resistance (Req)	62 kΩ	70 kΩ	75 kΩ
Grid voltage for 100:1 gc reduction	-14.5 V	-24 V	-28 V

Heptode Section as an IF or RF Amplifier

When used as a straight amplifier, the mixer grid (g3) is held at 0 V.

Parameter	Condition A	Condition B	Condition C
Anode and supply voltage (Va = Vb)	100 V	170 V	200 V
Screen grid resistor (Rg2g4)	18 kΩ	18 kΩ	18 kΩ
Screen grid voltage (Vg2g4)	60 V	100 V	125 V
Mixer grid voltage (g3)	0 V	0 V	0 V
Control grid voltage (Vg1)	-1.2 V	-2.2 V	-2.6 V
Anode current (Ia)	3.4 mA	6.2 mA	7.6 mA
Screen grid current (Ig2g4)	2.2 mA	3.8 mA	4.3 mA
Transconductance (gm)	2.0 mA/V	2.3 mA/V	2.4 mA/V
Anode resistance (ra)	0.5 MΩ	0.6 MΩ	0.6 MΩ
Inner amplification factor (g1 to g2,g4)	20	20	20
Equivalent noise resistance (Req)	5.8 kΩ	8.8 kΩ	9.7 kΩ
Grid voltage for 100:1 gm reduction	-16.5 V	-28 V	-33 V

Triode Section as an RF Oscillator

When operating as the local oscillator in a frequency changer circuit, the triode section is typically configured with the following parameters:

Parameter	Condition A	Condition B	Condition C
Supply voltage (Vb)	100 V	170 V	200 V
Anode resistor (Rat)	15 kΩ	15 kΩ	15 kΩ
Grid resistor (Rgt)	47 kΩ	47 kΩ	47 kΩ
Grid current (Igt)	120 μA	200 μA	240 μA
Anode current (Iat)	2.5 mA	4.5 mA	5.4 mA
Effective transconductance (gm _{eff})	530 μA/V	580 μA/V	580 μA/V

Interelectrode and Inter-Section Capacitances

The internal capacitances of the 19D8 are critical for high-frequency performance and stability. The values are categorized by section and the coupling between sections.

Triode Section Capacitances

- **Input capacitance (C_{in}):** 2.6 pF
- **Output capacitance (C_{out}):** 2.2 pF
- **Grid-to-anode capacitance (C_{a-g}):** 1.0 pF
- **Grid-to-heater capacitance (C_{g-h}):** < 0.02 pF

Heptode Section Capacitances

- **Input capacitance, grid 1 (C_{in(g1)}):** 4.8 pF
- **Input capacitance, grid 3 (C_{in(g3)}):** 6.0 pF
- **Output capacitance (C_{out}):** 7.9 pF
- **Anode-to-grid 1 capacitance (C_{a-g1}):** < 0.01 pF
- **Grid 1-to-heater capacitance (C_{g1-h}):** < 0.02 pF
- **Grid 1-to-grid 3 capacitance (C_{g1-g3}):** < 0.3 pF
- **Grid 3-to-heater capacitance (C_{g3-h}):** < 0.06 pF

Inter-Section Capacitances

- **Heptode anode to triode anode (C_{ah-at}):** 0.20 pF
- **Heptode anode to triode grid (C_{ah-gt}):** < 0.09 pF

- **Heptode anode to combined grid 3 and triode grid (Cah-g3gt):** < 0.35 pF
- **Heptode grid 1 to triode grid (Cg1-gt):** < 0.06 pF
- **Heptode grid 1 to combined triode grid and grid 3 (Cg1-gt,g3):** < 0.17 pF
- **Heptode grid 1 to combined grid 3 and triode grid (Cg1-g3,gt):** < 0.45 pF

Microphony and Operating Considerations

The 19D8 does not require special structural or mounting precautions against microphony under standard operating conditions, provided that the audio output power of the receiver is 50 mW or less, and the input signal voltage is at least 50 mV for the heptode section or at least 25 mV for the triode section.

Characteristic Curves and Design Interpretation

The performance of the 19D8 under dynamic conditions is illustrated by its characteristic relationships:

- **Heptode Characteristics vs. Oscillator Grid Current:** At fixed operating potentials ($V_a = V_b = 200$ V, $R_{g2g4} = 10$ k Ω , $R_{gtg3} = 47$ k Ω , and $V_{g1} = -2.6$ V), parameters such as anode current (I_a), screen grid current (I_{g2g4}), conversion conductance (g_c), anode resistance (r_a), and oscillator voltage (V_{osc}) vary systematically as the oscillator grid current is swept from 0 to 500 μ A.
- **Conversion Conductance vs. Control Grid Voltage (V_{g1}):** The conversion conductance (g_c) is highly dependent on the control grid bias. At supply voltages of 170 V and 200 V, the relationship is plotted across various screen grid voltages ($V_{g2g4} = 50, 100, 150,$ and 200 V), demonstrating the automatic volume control (AVC) or automatic gain control (AGC) capability of the heptode section.

Technical Summary

The **19D8** is a versatile, indirectly heated triode heptode designed for frequency changer and RF/IF amplification duties. Operating with a 19.0 V, 0.1 A heater, it integrates a high-performance heptode section and a triode section within a single B9A-Noval envelope. The heptode section provides excellent conversion and amplification characteristics with robust AGC capabilities, while the triode section serves as an efficient local oscillator. With low inter-section capacitances and minimal microphonic sensitivity under standard operating conditions, the 19D8 is a highly integrated solution for compact receiver designs.

SOURCE OPERATING CONDITIONS

1953 RFT Rundfunk Technik

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

1953 RFT RUNDFUNK TECHNIK

Section 1 · Triode

OTHER		
PARAMETER	PUBLISHED VALUE	CONDITION / NOTE
HeaterVoltageNominal	6.3 V	Nominal
HeaterCurrentNominal	300 mA	Nominal
Maximum Plate Voltage	250 V	—
Maximum Plate Dissipation	1.5 W	—
Maximum Cathode Current	15 mA	—

CHARACTERISTIC		
PARAMETER	PUBLISHED VALUE	CONDITION / NOTE
Transconductance	3800 μ S	Typical
Amplification Factor	22	Typical
Plate Resistance	19000 ohm	Typical

1953 RFT RUNDFUNK TECHNIK

Section 2 · Heptode

OTHER		
PARAMETER	PUBLISHED VALUE	CONDITION / NOTE
HeaterVoltageNominal	6.3 V	Nominal
HeaterCurrentNominal	300 mA	Nominal
Maximum Plate Voltage	300 V	—
Maximum Screen Voltage	250 V	—
Maximum Plate Dissipation	1.5 W	—
Maximum Screen Dissipation	1 W	—
Maximum Cathode Current	25 mA	—

Characteristic		
Parameter	Published Value	Condition / Note
Transconductance	775 μ S	Typical
Plate Resistance	1000000 ohm	Typical



SOURCE DATA APPENDIX

SOURCE OPERATING CONDITIONS

[SOURCE PDF](#)

1961 Ferranti Technical Handbook

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

1961 FERRANTI TECHNICAL HANDBOOK

Section 1 · Triode

Application		
Parameter	Published Value	Condition / Note
Application	Oscillator	—

1961 FERRANTI TECHNICAL HANDBOOK

Section 2 · Heptode

Application		
Parameter	Published Value	Condition / Note
Application	Frequency changer / RF-IF amplifier	—

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