



ELECTRONIC TUBE REFERENCE

18F24

Voltage - Pentode High Frequency (single) electronic tube

CONSOLIDATED TECHNICAL DATA

1 SECTION

CONSTRUCTION

PENTODE

High-slope RF pentode designed for RF, IF, and wideband amplifier service. Tesla documentation identifies it as a high-frequency signal-amplification tube suited to circuits requiring substantial transconductance and broad bandwidth.

GENERAL CHARACTERISTICS

BASE DESIGNATION	—	BASE PINS	8
NOMINAL HEATER	18 V / 165 mA	PARALLEL HEATER	— / —
HEATING	Indirect	SERIES OPERATION	Not specified
CATHODE ARRANGEMENT	Separate cathodes	SECTION CONSTRUCTION	Similar

SECTION RATINGS

SECTION 1 Pentode	
TRANSCONDUCTANCE	0.01 S
MAXIMUM PLATE VOLTAGE	250 V
MAXIMUM SCREEN VOLTAGE	250 V
MAXIMUM PLATE DISSIPATION	4 W
MAXIMUM SCREEN DISSIPATION	0.45 W
MAXIMUM CATHODE CURRENT	20 mA
<i>Published ratings and characteristics promoted where clearly stated; identical repeated sections compressed where applicable.</i>	

18F24 — RF High-Slope Pentode

An indirectly heated, high-slope pentode designed for radio frequency (RF), intermediate frequency (IF), and wideband amplifier applications.

Overview

The **18F24** is a specialized high-slope pentode engineered primarily for high-frequency amplification. Its design features high mutual conductance (transconductance) and very low feedback capacitance, making it highly suitable for RF, IF, and wideband amplifier stages. The tube incorporates an indirectly heated cathode requiring an 18 V heater supply and is housed in an envelope with a 9-pin base.

Mechanical Design and Pinout

The 18F24 is constructed in a physical size designated as **Size L 3** and utilizes a standard **9-pin base**. The pin configuration is designed to optimize high-frequency performance by providing multiple connections for critical electrodes, which helps minimize lead inductance. Specifically, both the cathode and the suppressor grid are allocated two pins each.

The pin connections, viewed from the underside of the base, are assigned as follows:

Pin	Electrode Connection
1	g3 (Suppressor Grid)
2	g2 (Screen Grid)
3	g1 (Control Grid)
4	f (Heater)
5	f (Heater)
6	k (Cathode)
7	a (Anode)
8	k (Cathode)
9	g3 (Suppressor Grid)

The redundant connections for the cathode (pins 6 and 8) and the suppressor grid (pins 1 and 9) allow for low-impedance grounding paths, which are essential for maintaining stability and preventing unwanted oscillations in high-slope RF and wideband circuits.

Heater and Cathode Characteristics

The 18F24 features an **indirectly heated cathode** designed for series or parallel heater chains. The electrical specifications for the heater are:

Parameter	Value
Heater Voltage (U _f)	18 V
Heater Current (I _f)	0.165 A

Parameter	Value
Calculated Heater Power	2.97 W

The calculated heater power is derived directly from the nominal operating parameters ($18\text{ V} \times 0.165\text{ A} = 2.97\text{ W}$). The maximum allowable potential difference between the cathode and the heater ($U_{k/f}$) is rated at **50 V**, which must be respected in circuit designs where the cathode is elevated above ground potential.

Electrical Characteristics and Class A RF Operation

The 18F24 is characterized by its high mutual conductance (slope) of **10 mA/V**, which allows for high voltage gain in wideband and RF stages. The static characteristics and typical Class A RF amplifier operating conditions are identical:

Parameter	Typical Value
Anode Voltage (U_a)	250 V
Suppressor Grid Voltage (U_{g3})	0 V
Screen Grid Voltage (U_{g2})	200 V
Control Grid Voltage (U_{g1})	-2 V
Cathode Resistor (R_k)	120 Ω
Anode Current (I_a)	15 mA
Screen Grid Current (I_{g2})	2.1 mA
Mutual Conductance (S)	10 mA/V
Internal Resistance (R_i)	0.3 M Ω

Circuit Calculations and Operating Analysis

- Under these typical Class A operating conditions, several key circuit parameters can be calculated:
- Total Cathode Current (I_k):** $I_k = I_a + I_{g2} = 15\text{ mA} + 2.1\text{ mA} = 17.1\text{ mA}$ This total current flows through the cathode self-bias resistor.
 - Cathode Bias Resistor Verification:** Using the calculated cathode current of 17.1 mA and the target control grid bias of -2 V, the required cathode resistor is: $R_k = |U_{g1}| / I_k = 2\text{ V} / 17.1\text{ mA} \approx 117\text{ }\Omega$ This calculated value closely aligns with the recommended standard value of **120 Ω** .
 - Anode Dissipation (P_a):** $P_a = U_a \times I_a = 250\text{ V} \times 15\text{ mA} = 3.75\text{ W}$ This operating dissipation is within the maximum limit of 4 W.
 - Screen Grid Dissipation (P_{g2}):** $P_{g2} = U_{g2} \times I_{g2} = 200\text{ V} \times 2.1\text{ mA} = 0.42\text{ W}$ This operating dissipation is within the maximum limit of 0.45 W.

Cut-off Characteristics

The tube exhibits a sharp cut-off characteristic. When the control grid voltage (U_{g1}) is biased down to **-7 V**, the anode current (I_{az}) is reduced to less than **0.5 mA**, allowing for effective automatic gain control (AGC) or gating functions.

Maximum Ratings

To ensure reliable operation and prevent premature failure, the 18F24 must be operated within its absolute maximum ratings. These limits should not be exceeded under worst-case operating conditions:

- **Cold Anode Voltage (U_{a0}):** 400 V (maximum voltage when the tube is cold and not conducting)
- **Anode Voltage (U_a):** 250 V
- **Anode Dissipation (W_a):** 4 W
- **Screen Grid Voltage (U_{g2}):** 250 V
- **Screen Grid Dissipation (W_{g2}):** 0.45 W
- **Cathode Current (I_k):** 20 mA
- **Control Grid Resistor (R_{g1}):** 0.5 M Ω
- **Voltage between Cathode and Heater ($U_{k/f}$):** 50 V

The typical operating cathode current of 17.1 mA operates at approximately 85.5% of the absolute maximum cathode current rating of 20 mA, representing a robust design margin.

Interelectrode Capacitances

For high-frequency and wideband applications, the internal capacitances of the tube are critical parameters that dictate input loading, output loading, and high-frequency stability. The 18F24 features the following interelectrode capacitances:

- **Input Capacitance (C_{g1}):** 10.5 pF
- **Output Capacitance (C_a):** 5.9 pF
- **Feedback Capacitance ($C_{a/g1}$):** < 0.035 pF

The extremely low feedback capacitance (less than 0.035 pF) is a key design feature of this high-slope pentode. It minimizes the Miller effect, preventing the amplification of input capacitance and ensuring excellent stability in high-gain RF and IF amplifier stages without the need for complex neutralization circuits.

Technical Summary

The **18F24** is a high-performance **RF high-slope pentode** featuring an **18 V, 0.165 A indirectly heated heater** and a **9-pin base** (Size L 3). It is optimized for **RF, IF, and wideband amplification** where high gain and stability are paramount.

At its typical operating point ($U_a = 250$ V, $U_{g2} = 200$ V), the tube delivers a high mutual conductance of **10 mA/V** and an internal resistance of **0.3 M Ω** , while drawing **15 mA** of anode current. Its physical

design utilizes dual pin connections for both the cathode and suppressor grid to minimize parasitic inductance, and its internal structure achieves an exceptionally low feedback capacitance of **< 0.035 pF**. Designers must adhere to the maximum ratings, including a **4 W anode dissipation** limit, a **20 mA cathode current** limit, and a **50 V heater-to-cathode voltage** limit, to ensure stable and reliable operation in high-frequency circuitry.



SOURCE OPERATING CONDITIONS

[SOURCE PDF](#)

1969 Tesla Manual of Electronic Tubes

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

1969 TESLA MANUAL OF ELECTRONIC TUBES

Section 1 · Pentode

CHARACTERISTICS		
PARAMETER	PUBLISHED VALUE	CONDITION / NOTE
Heater voltage	18 V	Published nominal value
Heater current	100 mA	Published nominal value
Transconductance	10000 μ S	Published operating characteristic

OTHER		
PARAMETER	PUBLISHED VALUE	CONDITION / NOTE
Application	RF, IF, wideband amplifier	Printed source application

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