

ELECTRONIC TUBE REFERENCE

12B4A

Power - TV Vertical Output electronic tube

CONSOLIDATED TECHNICAL DATA

1 SECTION
CONSTRUCTION
TRIODE

Low-mu power triode designed primarily for television vertical-deflection output service. It combines 5.5 W plate dissipation with substantial pulse-voltage and peak-current capability suited to the demanding vertical-output stage.

GENERAL CHARACTERISTICS

BASE DESIGNATION	9AG	BASE PINS	9
NOMINAL HEATER	12.6 V / 300 mA	PARALLEL HEATER	6.3 V / 600 mA
HEATING	Indirect	SERIES OPERATION	Capable
CATHODE ARRANGEMENT	Separate cathodes	SECTION CONSTRUCTION	Similar

9AG - TERMINAL PINOUT

TERMINAL	SECTION	ELEMENT	STATUS
PIN1 – K	A	K – Cathode	CONNECTED
PIN2 – G1	A	G1 – Control Grid	CONNECTED
PIN3 – HCT	–	HCT – Heater Center Tap	CONNECTED
PIN4 – H	–	H – Heater	CONNECTED
PIN5 – H	–	H – Heater	CONNECTED
PIN7 – G1	A	G1 – Control Grid	CONNECTED
PIN9 – P	A	P – Plate (Anode)	CONNECTED

SECTION RATINGS

SECTION1 Triode	
PLATE RESISTANCE	1030 Ω
TRANSCONDUCTANCE	0.0063 S
AMPLIFICATION FACTOR	6.5
MAXIMUM PLATE VOLTAGE	550 V
MAXIMUM PLATE DISSIPATION	5.5 W
MAXIMUM CATHODE CURRENT	30 mA
<i>Vertical-deflection triode; pulse ratings parameterized.</i>	

12B4A — Low-Mu High-Perveance Triode

Overview

The **12B4A** (also written as **12B4-A**) is a miniature, low-mu, high-perveance single triode designed primarily for service as a vertical-deflection amplifier in television receivers. The tube features high plate current capabilities at relatively low plate voltages and is engineered to withstand the high-amplitude positive pulse voltages typically encountered in vertical-deflection circuits.

In addition, the 12B4A exhibits a controlled heater warm-up characteristic, making it particularly suited for television receivers employing series-connected heater strings. When operated in series with other 600-milliamperre tubes possessing similar controlled warm-up times, heater voltage surges across individual tubes are minimized during the initial warm-up cycle. Except for this controlled heater thermal characteristic, the electrical and physical characteristics of the 12B4A are identical to those of the standard [12B4](#).

Mechanical Specifications and Pinout

The 12B4A is constructed in a T-6 1/2 glass envelope and utilizes a Small-Button Noval 9-pin base (JETEC No. E9-1). The tube requires a standard miniature 9-contact socket and can be mounted in any position.

Its physical dimensions are as follows:

- **Maximum Overall Length:** 2-5/8 inches
- **Maximum Seated Length:** 2-3/8 inches
- **Length from Base Seat to Bulb Top (excluding tip):** 2 inches $\pm$ 3/32 inch
- **Maximum Diameter:** 7/8 inch

The tube uses the **9AG** basing arrangement, viewed from the bottom of the base. The pin connections are assigned as follows:

Pin	Connection
Pin 1	Cathode
Pin 2	Grid
Pin 3	Heater Mid-Tap
Pin 4	Heater
Pin 5	Heater
Pin 6	No Connection
Pin 7	Grid
Pin 8	No Connection
Pin 9	Plate

The control grid is internally connected to both Pin 2 and Pin 7, providing dual terminal access. The heater is center-tapped at Pin 3, allowing for either series or parallel heater supply configurations.

Heater and Warm-Up Characteristics

The 12B4A features a coated unipotential cathode. The heater is designed for versatile operation, supporting both series and parallel electrical connections:

- **Series Connection:** Under series operation, the heater voltage is **12.6 V** (AC or DC) at a nominal current of **0.3 A** (or 0.300 A).
- **Parallel Connection:** Under parallel operation, the heater voltage is **6.3 V** (AC or DC) at a nominal current of **0.6 A** (or 0.600 A).

The average heater warm-up time is **11 seconds**. The control of heater thermal characteristics is specifically applied to the 600-milliampere (parallel) heater connection.

Heater warm-up time is defined as the time required for the voltage across the heater terminals to reach 80% of its rated value when a voltage of four times the rated heater voltage (25 V, RMS or DC) is applied to a test circuit. This test circuit consists of the tube heater connected in series with a resistance equal to three times the nominal heater operating resistance (31.5 ohms), with the target test voltage across the heater being 5.0 V (RMS or DC).

Electrical Characteristics and Class A1 Operation

At typical operating points, the 12B4A exhibits low plate resistance and high transconductance, reflecting its high-perveance design. The direct interelectrode capacitances, measured without an external shield, are approximately:

- **Grid to Plate (G to P):** 4.8 pF
- **Input (Grid to Cathode and Heater):** 5.0 pF

- **Output (Plate to Cathode and Heater):** 1.5 pF

The tube's electrical characteristics under Class A1 amplifier conditions are documented at two distinct operating points:

Parameter	Operating Point A	Operating Point B
Plate Voltage	150 V	150 V
Grid Voltage	-17.5 V	-23 V
Amplification Factor (μ)	6.5	—
Plate Resistance (r_p)	1030 Ω	—
Transconductance (g_m)	6300 μmhos	—
Plate Current (I_b)	34 mA	9.6 mA
Grid Voltage for $I_b = 200 \mu\text{A}$ (approx.)	-32 V	—

The fundamental triode relationship can be mathematically illustrated using the values from Operating Point A: $\mu \approx g_m \times r_p$ Substituting the typical values: $0.0063 \text{ S} \times 1030 \Omega = 6.489$ This calculated value closely aligns with the published nominal amplification factor of 6.5.

Vertical-Deflection Amplifier Service

When utilized as a vertical-deflection amplifier in a 525-line, 30-frame television system, the 12B4A is subjected to demanding pulse conditions. The maximum ratings for this service are defined under the Design-Center system (except where noted):

- **DC Plate Voltage:** 550 max. volts
- **Peak Positive-Pulse Plate Voltage (Absolute Maximum):** 1000 max. volts. This is an absolute limit that must not be exceeded under any circumstances. The pulse duration is restricted to a maximum of 15% of one vertical scanning cycle, which corresponds to 2.5 milliseconds (or 2.6 milliseconds).
- **Peak Negative-Pulse Grid Voltage:** 250 max. volts
- **Peak Cathode Current:** 105 max. milliamperes
- **Average Cathode Current:** 30 max. milliamperes
- **Plate Dissipation:** 5.5 max. watts
- **Maximum Grid-Circuit Resistance (Cathode Bias):** 2.2 max. megohms

In stages operating with grid-leak bias, the tube must be protected against the absence of excitation. An adequate cathode-bias resistor or other suitable protective means is required to prevent excessive plate dissipation and cathode current if the drive signal is lost.

Maximum Ratings and Circuit Values (Class A1)

For general Class A1 amplifier service, the maximum ratings (Design-Center Values) and circuit limits are:

- **Plate Voltage:** 550 max. volts
- **Grid Voltage, Negative-bias value:** 50 max. volts
- **Plate Dissipation:** 5.5 max. watts
- **Maximum Grid-Circuit Resistance:**
 - For fixed-bias operation: 0.47 max. megohm
 - For cathode-bias operation: 2.2 max. megohms
- **Heater-Cathode Voltage:**
 - Heater negative with respect to cathode (Total DC and Peak): 200 max. volts
 - Heater positive with respect to cathode (Total DC and Peak): 200 max. volts, provided the DC component does not exceed 100 volts.

Analysis of Characteristic Curves

The average plate and transfer characteristics of the 12B4A illustrate its high-perveance design and low- μ behavior:

- **Average Plate Characteristics:** The plate-current-versus-plate-voltage curves demonstrate that the 12B4A can conduct high currents at low plate potentials. For instance, at zero grid bias ($E_c = 0$ V), the plate current rises rapidly, exceeding 80 mA before the plate voltage reaches 100 V. The curves are bounded by a dashed boundary representing the 5.5-watt plate dissipation limit. At more negative grid biases, the curves shift to the right, showing a gradual and linear control characteristic typical of a low- μ triode.
- **Average Transfer Characteristics:** The transfer curves plot plate current against grid voltage for various plate voltages ranging from 50 V to 550 V. These curves show that at a typical plate voltage of 150 V, the plate current is cut off (approaching zero) near a grid bias of -32 V, which matches the typical characteristic value of -32 V for a 200 μ A plate current. At the maximum rated plate voltage of 550 V, the grid voltage required to achieve cutoff shifts to approximately -100 V. The relatively wide grid voltage swing required to control the plate current is a direct consequence of the low amplification factor ($\mu = 6.5$).

Technical Summary

The **12B4A** is a miniature, low- μ , high-perveance triode housed in a 9-pin T-6 1/2 glass envelope with a 9AG basing configuration. It is designed primarily for vertical-deflection amplifier service in television receivers, where it handles high peak currents at low plate voltages and withstands peak positive-pulse plate voltages up to 1000 V. The tube features a controlled heater warm-up time of 11 seconds for 600 mA series-string applications, and can be operated with either a 12.6 V / 0.3 A series heater or a 6.3 V / 0.6 A parallel heater. With an amplification factor of 6.5, a low plate resistance of approximately 1030 ohms, and a plate dissipation rating of 5.5 watts, the 12B4A provides robust performance in both Class A1 amplifier and vertical-deflection circuits.



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 · Triode

OTHER

PARAMETER	PUBLISHED VALUE	CONDITION / NOTE
Peak Cathode Current	105 mA	—
Service	Vertical deflection output	—



SOURCE OPERATING CONDITIONS

[SOURCE PDF](#)

1966 Tung Sol Electronic Tubes 2 of 4

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

1966 TUNG SOL ELECTRONIC TUBES 2 OF 4

Section 1 · Triode

CAPACITANCE

PARAMETER	PUBLISHED VALUE	CONDITION / NOTE
GRID TO PLATEN G TO P	4.8 pF	Published datasheet
INPUT: G TO (H}K)	5 pF	Published datasheet

CHARACTERISTIC

PARAMETER	PUBLISHED VALUE	CONDITION / NOTE
HEATER VOLTAGE (PARALLEL CONNECTION)	6.3 V	Published datasheet; operating column 1
HEATER VOLTAGE (PARALLEL CONNECTION) (	3 V	Published datasheet
PLATE VOLTAGE	150 V	Published datasheet
GRID VOLTAGE	-17.5 V	Published datasheet

PARAMETER	PUBLISHED VALUE	CONDITION / NOTE
PLATE CURRENT	34 mA	Published datasheet
PLATE RESISTANCE (APPROX.) Z	30 ohm	Published datasheet; operating column 1
PLATE RESISTANCE (APPROX.) Z	0 ohm	Published datasheet; operating column 2
PLATE CURRENT E C =	-2 mA	Published datasheet; operating column 1
PLATE CURRENT E C =	9 mA	Published datasheet; operating column 2
GRID VOLTAGE (APPROX.) FOR I b =	200 V	Published datasheet; operating column 1
GRID VOLTAGE (APPROX.) FOR I b =	-3 V	Published datasheet; operating column 2
Plate resistance	2030 ohm	Published datasheet; promoted section value
Transconductance	0.0063 A/V	Published datasheet; promoted section value
Amplification factor	12.8	Published datasheet; promoted section value

OTHER		
PARAMETER	PUBLISHED VALUE	CONDITION / NOTE
TOTAL DC AND PEAK Z00	200 V	Published datasheet
MAXIMUM PLATE VOLTAGE	550 V	Published datasheet; operating column 1
(ABSOLUTE MAXIMUM)	1000 V	Published datasheet
MAXIMUM PLATE DISSIPATION	55 W	Published datasheet; operating column 1
MAXIMUM PLATE DISSIPATION	8 W	Published datasheet; operating column 3
MAXIMUM PEAK NEGATIVE GRID VOLTAGE	250 V	Published datasheet
MAXIMUM AVERAGE CATHODE CURRENT	30 mA	Published datasheet
FIXED BIAS	0.47 Mohm	Published datasheet
CATHODE BIAS	2.2 Mohm	Published datasheet; operating column 1
HEATER WARM- UP TIME (APPROX.)*	110 s	Published datasheet
TRANSCONDUCTANCE	6 uS	Published datasheet; operating column 1
TRANSCONDUCTANCE	300 uS	Published datasheet; operating column 2
Maximum cathode current	30 mA	Published datasheet; promoted section value



SOURCE DATA APPENDIX

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
Section 1 · Triode

OTHER		
PARAMETER	PUBLISHED VALUE	CONDITION / NOTE
Peak Positive Pulse Plate Voltage	1200 V	VerticalDeflection

CHARACTERISTIC		
PARAMETER	PUBLISHED VALUE	CONDITION / NOTE
Plate Voltage	150 V	VerticalDeflection
Amplification Factor	6.5	VerticalDeflection
Plate Resistance	1030 ohm	VerticalDeflection
Transconductance	6300 uS	VerticalDeflection
Plate Current	34 mA	VerticalDeflection



SOURCE DATA APPENDIX

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
Section 1 · Triode

CHARACTERISTICS		
PARAMETER	PUBLISHED VALUE	CONDITION / NOTE
Heater voltage series	12.6 V	SeriesHeater
Heater current series	300 mA	SeriesHeater
Heater voltage parallel	6.3 V	ParallelHeater
Heater current parallel	600 mA	ParallelHeater
Heater warm-up time	11 s	Average
Plate voltage	150 V	ClassA1

PARAMETER	PUBLISHED VALUE	CONDITION / NOTE
Grid voltage	-17.5 V	ClassA1
Amplification factor	6.5	ClassA1
Plate resistance	1030 ohm	ClassA1
Transconductance	6300 μ S	ClassA1
Plate current	34 mA	ClassA1

OTHER		
PARAMETER	PUBLISHED VALUE	CONDITION / NOTE
Maximum plate voltage	550 V	ClassA1
Maximum negative grid bias	50 V	ClassA1
Maximum plate dissipation	5.5 W	ClassA1
Peak heater-cathode voltage	200 V	—
Peak positive-pulse plate voltage	1000 V	VerticalDeflectionAmplifier
Peak negative-pulse grid voltage	250 V	VerticalDeflectionAmplifier
Peak cathode current	105 mA	VerticalDeflectionAmplifier
Average cathode current	30 mA	VerticalDeflectionAmplifier

CAPACITANCE		
PARAMETER	PUBLISHED VALUE	CONDITION / NOTE
Grid-to-plate capacitance	4.8 pF	—
Grid-to-cathode-and-heater capacitance	5 pF	—
Plate-to-cathode-and-heater capacitance	1.5 pF	—



SOURCE DATA APPENDIX

SOURCE OPERATING CONDITIONS

[SOURCE PDF](#)

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 · Triode

CHARACTERISTIC		
PARAMETER	PUBLISHED VALUE	CONDITION / NOTE
Plate Voltage	330 volts	Published value from supplied target entry
Grid Voltage, Negative-bias value	55 volts	Published value from supplied target entry
Plate Dissipation	2.5 watts	Published value from supplied target entry
Heater Voltage	6.3 volts	Published value from supplied target entry
Heater Current	0.6 ampere	Published value from supplied target entry
Heater Warm-up Time	11 seconds	Published value from supplied target entry
Plate Voltage	550 volts	Published value from supplied target entry
Grid Voltage, Negative-bias value	50 volts	Published value from supplied target entry
Plate Dissipation	5.5 watts	Published value from supplied target entry
Plate Voltage	150 volts	Published value from supplied target entry
Grid Voltage	-17.5 volts	Published value from supplied target entry
Amplification Factor	6.5	Published value from supplied target entry
Plate Resistance (Approx.)	1030 ohms	Published value from supplied target entry
Transconductance	6300	Published value from supplied target entry
Plate Current	34	Published value from supplied target entry
Grid Voltage (Approx.) for plate current of	-32 volts	Published value from supplied target entry
DC Plate Voltage	550 volts	Published value from supplied target entry
Peak Negative-Pa Ise Grid Voltage	250 volts	Published value from supplied target entry
Peak Cathode Current	105 mA	Published value from supplied target entry
Average Cathode Current	30 mA	Published value from supplied target entry
Plate Dissipation	6.6 watts	Published value from supplied target entry
Grid-Circuit Resistance, for cathode-bias operation	2.2 megohms	Published value from supplied target entry
Heater Voltage (ac/dc)	6.3 volts	Published value from supplied target entry
Heater Current	0.6 ampere	Published value from supplied target entry
Heater Warm-up Time (Average)	11 seconds	Published value from supplied target entry
Plate Voltage	300 volts	Published value from supplied target entry

PARAMETER	PUBLISHED VALUE	CONDITION / NOTE
Cathode Current	20 mA	Published value from supplied target entry
Plate Voltage	250 volts	Published value from supplied target entry
Grid Voltage	-10.5 volts	Published value from supplied target entry
Amplification Factor	16.5	Published value from supplied target entry
Plate Resistance (Approx.)	5300 ohms	Published value from supplied target entry
Transconductance	3100 umhos	Published value from supplied target entry
Plate Current	11.5 mA	Published value from supplied target entry
Grid Voltage (Approx.) for plate current of	50 volts	Published value from supplied target entry

CAPACITANCE		
PARAMETER	PUBLISHED VALUE	CONDITION / NOTE
Grid to Plate	4.8 pF	Published value from supplied target entry
Grid to Cathode and Heater	5 pF	Published value from supplied target entry
Plate to Cathode and Heater	-5 pF	Published value from supplied target entry
Direct Intei-electrode Capacitances (Approx.) : Unit No.1 Unit No	2	Published value from supplied target entry
Grid to Plate	2.6 pF	Published value from supplied target entry
Grid to Cathode and Heater	3.2 pF	Published value from supplied target entry
Plate to Cathode and Heater	0.4 PF	Published value from supplied target entry

TUBE TINKER

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