

ELECTRONIC TUBE REFERENCE

12BH7A

Voltage - Dual Triode (similar) electronic tube

CONSOLIDATED TECHNICAL DATA

2 SECTIONS

CONSTRUCTION

TRIODE-TRIODE

Medium-mu twin triode capable of substantially greater current than small-signal high-mu types, used for amplifier, driver, and television deflection service.

GENERAL CHARACTERISTICS

BASE DESIGNATION	9A	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

9A - TERMINAL PINOUT

TERMINAL	SECTION	ELEMENT	STATUS
PIN1 – 2P	B	P – Plate (Anode)	CONNECTED
PIN2 – 2G1	B	G1 – Control Grid	CONNECTED
PIN3 – 2K	B	K – Cathode	CONNECTED
PIN4 – H	–	H – Heater	CONNECTED
PIN5 – H	–	H – Heater	CONNECTED
PIN6 – 1P	A	P – Plate (Anode)	CONNECTED
PIN7 – 1G1	A	G1 – Control Grid	CONNECTED
PIN8 – 1K	A	K – Cathode	CONNECTED
PIN9 – HCT	–	HCT – Heater Center Tap	CONNECTED

SECTION RATINGS

SECTION1 Triode	
PLATE RESISTANCE	5300 Ω
TRANSCONDUCTANCE	0.0031 S
AMPLIFICATION FACTOR	16.5
MAXIMUM PLATE VOLTAGE	300 V
MAXIMUM PLATE DISSIPATION	3.5 W
MAXIMUM CATHODE CURRENT	20 mA
<i>Each identical triode; vertical-deflection service.</i>	

SECTION2 Triode	
PLATE RESISTANCE	5300 Ω
TRANSCONDUCTANCE	0.0031 S
AMPLIFICATION FACTOR	16.5
MAXIMUM PLATE VOLTAGE	300 V
MAXIMUM PLATE DISSIPATION	3.5 W
MAXIMUM CATHODE CURRENT	20 mA
<i>Second physical triode section; electrically identical twin section.</i>	

12BH7A — Medium-Mu Twin Triode Vacuum Tube

An indirectly heated, dual-section miniature valve designed for television deflection circuits, oscillators, phase inverters, and multivibrator applications.

Overview

The **12BH7A** (also designated as **12BH7-A**) is a miniature, medium-mu twin triode containing two independent, high-perveance triode units within a single T-6 1/2 glass envelope. Each triode section is electrically independent except for a shared heater. The tube is designed with a 9-pin miniature button base (Noval) and is highly optimized for television receiver applications.

The primary applications of the 12BH7A include serving as a combined vertical-deflection sweep generator and deflection amplifier, or as a horizontal-deflection oscillator in television receivers. It is also widely utilized in phase-inverter and multivibrator circuits, as well as general-purpose radio frequency (R.F.) and low-frequency amplification.

A key feature of the 12BH7A is its controlled heater warm-up characteristic, which minimizes heater voltage surges when the tube is operated in series-string heater arrangements with other 600 mA

television receiver tubes. This controlled warm-up, along with a controlled cutoff rating, distinguishes the 12BH7A from its predecessor, the standard [12BH7](#), which is otherwise identical.

Construction, Physical Dimensions, and Base

The 12BH7A is constructed with two separate, coated unipotential cathodes. The tube is housed in a T-6 1/2 glass bulb with a small-button 9-pin Noval base (JETEC E9-1). It can be mounted in any physical position.

Physical Dimensions

- **Maximum Diameter:** 0.815 to 0.875 inches (22.0 mm)
- **Maximum Seated Length:** 2.375 inches (51.2 mm)
- **Maximum Overall Length:** 2.625 inches (57.6 mm)
- **Length from Base Seat to Bulb Top (excluding tip):** 2 inches $\pm$ 3/32 inches

Pinout and Terminal Connections

The tube utilizes the **9A** (or JEDEC 9A) basing arrangement. The terminal connections, viewed from the bottom of the base, are assigned as follows:

Pin	Connection
1	Plate (Triode Unit 2)
2	Grid (Triode Unit 2)
3	Cathode (Triode Unit 2)
4	Heater (Triode Unit 2)
5	Heater (Triode Unit 1)
6	Plate (Triode Unit 1)
7	Grid (Triode Unit 1)
8	Cathode (Triode Unit 1)
9	Heater Mid-Tap

Heater Characteristics and Warm-Up Control

The heater of the 12BH7A is designed for flexible operation, allowing for either series or parallel connection depending on the circuit requirements.

Heater Parameter	Series Connection	Parallel Connection
Heater Voltage (AC/DC)	12.6 V	6.3 V
Heater Current	0.3 A (300 mA)	0.6 A (600 mA)
Heater Supply Limits (Voltage)	12.6 V $\pm$ 1.3 V	6.3 V $\pm$ 0.6 V
Heater Supply Limits (Current)	300 mA $\pm$ 20 mA	600 mA $\pm$ 40 mA
Average Warm-up Time	11 seconds	11 seconds

Heater Power Calculation

Using the nominal voltage and current ratings, the heater power consumption is calculated as:

- **Series:** $12.6\text{ V} \times 0.3\text{ A} = 3.78\text{ W}$
- **Parallel:** $6.3\text{ V} \times 0.6\text{ A} = 3.78\text{ W}$

Heater Warm-Up Time Measurement

The controlled heater warm-up time is verified using a standardized test circuit. The warm-up time is defined as the time required for the voltage across the heater terminals to rise from zero to a specified test voltage (V1) under the following conditions:

- **Applied Voltage (E):** 25.0 V (RMS or DC)
- **Total Series Resistance (R):** 31.5 Ohms
- **Heater Test Voltage (V1):** 5.0 V (RMS or DC)
- **Rated Heater Voltage (Ef):** 6.3 V
- **Rated Heater Current (If):** 0.6 A

Heater-Cathode Voltage Ratings

To prevent insulation breakdown between the heater and the cathodes, the following maximum design-center voltage limits must be observed:

- **Heater Negative with Respect to Cathode:** 200 V max (DC and Peak combined)
- **Heater Positive with Respect to Cathode:** 100 V max (DC component), 200 V max (DC and Peak combined)

Electrical Characteristics and Class A1 Operation

Under typical Class A1 amplifier operating conditions for each triode unit, the 12BH7A exhibits the following electrical characteristics:

- **Plate Voltage:** 250 V

- **Grid Voltage:** -10.5 V (some older references list -14 V for a plate current of 4.0 mA)
- **Amplification Factor (μ):** 16.5 to 17
- **Plate Resistance (r_p):** 5300 to 5500 Ohms (approximate)
- **Transconductance (g_m):** 3100 μ mhos (micromhos)
- **Plate Current:** 11.5 mA
- **Grid Voltage for Cutoff:**
 - Approximately -23 V for a plate current of 50 μ s (at 250 V plate voltage)
 - Approximately -17 V for a plate current of 50 μ s (at 150 V plate voltage)
 - Approximately -25 V for a plate current of 10 μ s (at 250 V plate voltage)

Class A1 Amplifier Maximum Ratings (Design-Center Values)

- **Plate Voltage:** 300 V max
- **Negative DC Grid Voltage:** 50 V max
- **Positive DC Grid Voltage:** 0 V max
- **Cathode Current:** 20 mA max
- **Plate Dissipation (Each Plate):** 3.5 W max
- **Plate Dissipation (Both Plates Operating):** 7.0 W max
- **Grid-Circuit Resistance (Fixed Bias):** 0.25 MOhm max
- **Grid-Circuit Resistance (Cathode Bias):** 1.0 MOhm max

Television Deflection and Oscillator Service

The 12BH7A is highly specialized for television sweep circuits. Its ratings are divided into specific categories based on the scanning system requirements (typically a 525-line, 30-frame system).

Comparative Service Ratings (Design-Center Values)

Parameter	Vertical Deflection Amplifier	Vertical Deflection Oscillator	Horizontal Deflection Oscillator
DC Plate Voltage (Max)	450 to 500 V	450 V	450 V
Peak Positive-Pulse Plate Voltage	1350 to 1500 V (Abs. Max)	—	—
Peak Negative-Pulse Grid Voltage (Max)	200 to 250 V	400 V	600 V
DC Grid Voltage (Max)	-50 V	—	—
Peak Cathode Current (Max)	70 mA	70 mA	300 mA

Parameter	Vertical Deflection Amplifier	Vertical Deflection Oscillator	Horizontal Deflection Oscillator
Average Cathode Current (Max)	20 mA	20 mA	20 mA
Plate Dissipation (Each Plate, Max)	3.5 W	3.5 W	3.5 W
Plate Dissipation (Both Plates, Max)	7.0 W	7.0 W	7.0 W
Grid-Circuit Resistance (Max)	2.2 to 2.5 MOhm (Cathode Bias)	2.2 MOhm (Fixed/Cathode Bias)	2.2 MOhm (Fixed/Cathode Bias)

Pulse Duration and Duty Cycle Constraints

For both vertical and horizontal deflection services, the peak pulse ratings are strictly constrained by duty cycle limits:

- **Vertical Deflection:** The pulse duration must not exceed 15% of one vertical scanning cycle, which equates to **2.5 milliseconds** in a 525-line, 30-frame system.
- **Horizontal Deflection:** The pulse duration must not exceed 15% of one horizontal scanning cycle, which equates to **10 microseconds** in a 525-line, 30-frame system.

Circuit Protection Requirements

When operating the 12BH7A in stages utilizing grid-leak bias, an adequate cathode-bias resistor or other protective means must be incorporated. This safeguard protects the triode units from excessive current and subsequent damage in the event of an excitation failure or loss of drive signal.

Interelectrode Capacitances

The direct interelectrode capacitances of the 12BH7A vary depending on whether an external shield is utilized. The following values represent typical measurements for each triode unit:

Capacitance Parameter	With Shield (Shield #315)*	Without Shield
Grid to Plate (Each Unit)	2.4 pF	2.6 pF
Input: Grid to (Heater + Cathode)	3.3 pF	3.2 pF
Output Unit 1: Plate to (Heater + Cathode)	2.0 pF	0.5 pF
Output Unit 2: Plate to (Heater + Cathode)	2.0 pF	0.4 pF

Capacitance Parameter	With Shield (Shield #315)*	Without Shield
Coupling: Plate of Unit 1 to Plate of Unit 2	0.6 pF	0.8 pF

Note: Shield #315 is connected to the cathode of the unit under test.

Technical Summary

The **12BH7A** is a versatile, high-perveance, medium-mu twin triode housed in a 9-pin miniature Noval envelope. It features a dual-voltage heater (12.6 V series / 6.3 V parallel) with a controlled warm-up time of approximately 11 seconds, making it ideal for series-string television receivers. At a typical operating point of 250 V plate voltage and -10.5 V grid bias, each section provides an amplification factor of 16.5 to 17, a transconductance of 3100 μmhos , and a plate resistance of 5300 to 5500 Ohms.

Designed primarily for demanding television deflection applications, the 12BH7A handles high peak positive plate pulses up to 1500 V in vertical deflection amplifier service and peak cathode currents up to 300 mA in horizontal deflection oscillator service. Its independent triode sections, robust pulse capability, and controlled cutoff characteristics make it a highly reliable component for television sweep generators, oscillators, multivibrators, and general-purpose amplifiers.



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
Heater voltage	12.6 V	Nominal
Heater current	300 mA	Nominal
Plate voltage	300450 V	Typical operating conditions



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 · Triode

CHARACTERISTIC		
PARAMETER	PUBLISHED VALUE	CONDITION / NOTE
Heater Voltage	12.6 V	—
Heater Current	300 mA	—
Plate Current	11.5 mA	—
Plate Resistance	5500 ohm	—
Transconductance	3100 uS	—
Amplification Factor	17	—
Grid To Plate Capacitance	2.4 pF	—
Input Capacitance	3.3 pF	—
Output Capacitance	0.5 pF	—

OTHER		
PARAMETER	PUBLISHED VALUE	CONDITION / NOTE
Plate Voltage	250 V	EachUnit
Grid Voltage	-10.5 V	EachUnit
Peak Positive Pulse Plate Voltage	1350 V	VerticalDeflection
PeakNegativeGridVoltage	200 V	VerticalDeflection


SOURCE DATA APPENDIX

SOURCE OPERATING CONDITIONS

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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 PLATE: G TO P	24 pF	Published datasheet; operating column 1
GRID TO PLATE: G TO P	2.6 pF	Published datasheet; operating column 2
INPUT: G TO (H+K)	3.3 pF	Published datasheet; operating column 1
INPUT: G TO (H+K)	3.2 pF	Published datasheet; operating column 2
GRID TO PLATE: G TO P	2.4 pF	Published datasheet; operating column 1

CHARACTERISTIC		
PARAMETER	PUBLISHED VALUE	CONDITION / NOTE
VOLTAGE	6.3 V	Published datasheet; operating column 1
VOLTAGE	12.6 V	Published datasheet; operating column 2
CURRENT	600 mA	Published datasheet; operating column 1
CURRENT	300 mA	Published datasheet; operating column 2
VOLTAGE	0 V	Published datasheet; operating column 1
VOLTAGE	0.6 V	Published datasheet; operating column 3
CURRENT	0 mA	Published datasheet; operating column 1
CURRENT	40 mA	Published datasheet; operating column 3

PARAMETER	PUBLISHED VALUE	CONDITION / NOTE
DC PLATE VOLTAGE	300 V	Published datasheet; operating column 1
DC PLATE VOLTAGE	450 V	Published datasheet; operating column 2
PEAK POSITIVE PULSE PLATE VOLTAGE	1500 V	Published datasheet
PEAK NEGATIVE PULSE GRID VOLTAGE	250 V	Published datasheet
NEGATIVE DC GRID VOLTAGE	-50 V	Published datasheet
CATHODE CURRENT	20 mA	Published datasheet
AVERAGE CATHODE CURRENT	20 mA	Published datasheet
PEAK CATHODE CURRENT	70 mA	Published datasheet

OTHER		
PARAMETER	PUBLISHED VALUE	CONDITION / NOTE
HEATER WARM-UP TIME	11 s	Published datasheet; operating column 1
DC AND PEAK	200 V	Published datasheet
EACH PLATE	3.5 W	Published datasheet; operating column 1
EACH PLATE	3 W	Published datasheet; operating column 2



SOURCE OPERATING CONDITIONS

[SOURCE PDF](#)

1968 General Electric Co

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

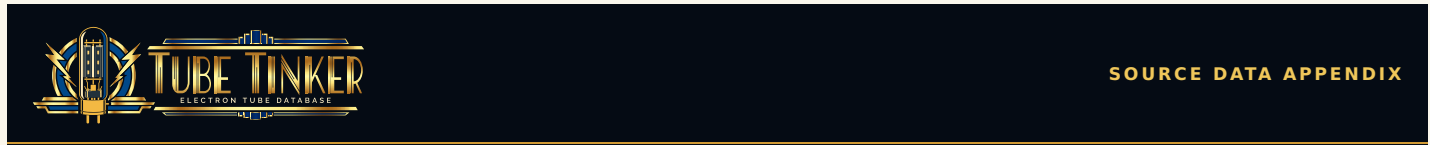
1968 GENERAL ELECTRIC CO

Section 1 · Triode

OTHER		
PARAMETER	PUBLISHED VALUE	CONDITION / NOTE
Peak Positive Pulse Plate Voltage	1500 V	VerticalDeflection
Peak Cathode Current	300 mA	VerticalDeflection

CHARACTERISTIC		
PARAMETER	PUBLISHED VALUE	CONDITION / NOTE
Plate Voltage	250 V	EachSection

PARAMETER	PUBLISHED VALUE	CONDITION / NOTE
Amplification Factor	16.5	EachSection
Plate Resistance	5300 ohm	EachSection
Transconductance	3100 uS	EachSection
Plate Current	11.5 mA	EachSection



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

Section 1 · Triode

CHARACTERISTICS		
PARAMETER	PUBLISHED VALUE	CONDITION / NOTE
'4. Heater arrangement	4	Published value from the filename-designated RCA datasheet block; multiple numbers on one row represent separate limits or heater arrangements.
Voltage – published value 1	12.6 V	Published value from the filename-designated RCA datasheet block; multiple numbers on one row represent separate limits or heater arrangements.
Voltage – published value 2	6.3 V	Published value from the filename-designated RCA datasheet block; multiple numbers on one row represent separate limits or heater arrangements.
Current – published value 1	300 mA	Published value from the filename-designated RCA datasheet block; multiple numbers on one row represent separate limits or heater arrangements.
Current – published value 2	600 mA	Published value from the filename-designated RCA datasheet block; multiple numbers on one row represent separate limits or heater arrangements.
Warm-up time (Average)	11	Published value from the filename-designated RCA datasheet block; multiple numbers on one row represent separate limits or heater arrangements.

PARAMETER	PUBLISHED VALUE	CONDITION / NOTE
Grid to plate – published value 1	2.6	Published value from the filename-designated RCA datasheet block; multiple numbers on one row represent separate limits or heater arrangements.
Grid to plate – published value 2	2.6	Published value from the filename-designated RCA datasheet block; multiple numbers on one row represent separate limits or heater arrangements.
and heater – published value 1	3.2	Published value from the filename-designated RCA datasheet block; multiple numbers on one row represent separate limits or heater arrangements.
and heater – published value 2	3.2	Published value from the filename-designated RCA datasheet block; multiple numbers on one row represent separate limits or heater arrangements.
and heater – published value 1	0.5	Published value from the filename-designated RCA datasheet block; multiple numbers on one row represent separate limits or heater arrangements.
and heater – published value 2	0.4	Published value from the filename-designated RCA datasheet block; multiple numbers on one row represent separate limits or heater arrangements.
plate of unit No.2	8	Published value from the filename-designated RCA datasheet block; multiple numbers on one row represent separate limits or heater arrangements.
Pin 1 -Plate of – published value 1	1	Published value from the filename-designated RCA datasheet block; multiple numbers on one row represent separate limits or heater arrangements.
Pin 1 -Plate of – published value 2	6	Published value from the filename-designated RCA datasheet block; multiple numbers on one row represent separate limits or heater arrangements.
Pin 2 -Grid of – published value 1	2	Published value from the filename-designated RCA datasheet block; multiple numbers on one row represent separate limits or heater arrangements.
Pin 2 -Grid of – published value 2	7	Published value from the filename-designated RCA datasheet block; multiple numbers on one row represent separate limits or heater arrangements.

PARAMETER	PUBLISHED VALUE	CONDITION / NOTE
Pin 3 -Cathode of – published value 1	3	Published value from the filename-designated RCA datasheet block; multiple numbers on one row represent separate limits or heater arrangements.
Pin 3 -Cathode of – published value 2	8	Published value from the filename-designated RCA datasheet block; multiple numbers on one row represent separate limits or heater arrangements.
Pins 4d9 -Heater of – published value 1	4	Published value from the filename-designated RCA datasheet block; multiple numbers on one row represent separate limits or heater arrangements.
Pins 4d9 -Heater of – published value 2	9	Published value from the filename-designated RCA datasheet block; multiple numbers on one row represent separate limits or heater arrangements.

OTHER		
PARAMETER	PUBLISHED VALUE	CONDITION / NOTE
PLATE VOLTAGE	300 V	Published value from the filename-designated RCA datasheet block; multiple numbers on one row represent separate limits or heater arrangements.
Negative bias value	50 V	Published value from the filename-designated RCA datasheet block; multiple numbers on one row represent separate limits or heater arrangements.
Positive bias value	0 V	Published value from the filename-designated RCA datasheet block; multiple numbers on one row represent separate limits or heater arrangements.
CATHODE CURRENT	20 mA	Published value from the filename-designated RCA datasheet block; multiple numbers on one row represent separate limits or heater arrangements.
PLATE DISSIPATION	3.5 mA	Published value from the filename-designated RCA datasheet block; multiple numbers on one row represent separate limits or heater arrangements.



SOURCE DATA APPENDIX

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
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
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
DC Plate Voltage	450 volts	Published value from supplied target entry
Peak Negative-Pulse Grid Voltage	600 volts	Published value from supplied target entry
Peak Cathode Current	300 mA	Published value from supplied target entry
Average Cathode Current	20 mA	Published value from supplied target entry
Grid-Circuit Resistance	2.2 megohms	Published value from supplied target entry
DC Plate Voltage	450 volts	Published value from supplied target entry
Peak Negative-Pulse Grid Voltage	260 volts	Published value from supplied target entry
Peak Cathode Current	70 mA	Published value from supplied target entry

CAPACITANCE		
PARAMETER	PUBLISHED VALUE	CONDITION / NOTE
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

OTHER		
PARAMETER	PUBLISHED VALUE	CONDITION / NOTE
Peak Positive-Pulse Plate Voltage* (Absolute maximum)	1500 volts	Published value from supplied target entry



SOURCE OPERATING CONDITIONS

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2026 JJ Electronic

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

2026 JJ ELECTRONIC

Section 1 · Triode

CHARACTERISTIC		
PARAMETER	PUBLISHED VALUE	CONDITION / NOTE
Transconductance	3100 μS	—