

Twin triode designed as a Class-B push-pull power amplifier for battery receivers, with the two triode units operated together to deliver approximately two watts of audio output.

GENERAL CHARACTERISTICS

BASE DESIGNATION	6C	BASE PINS	6
NOMINAL HEATER	2 V / 260 mA	PARALLEL HEATER	– / –
HEATING	Direct	SERIES OPERATION	Not specified
CATHODE ARRANGEMENT	Separate cathodes	SECTION CONSTRUCTION	Similar

SECTION RATINGS

SECTION1 Triode	
MAXIMUM PLATE VOLTAGE	135 V
MAXIMUM CATHODE CURRENT	50 mA
Representative row for identical repeated sections.	

SECTION2 Triode	
MAXIMUM PLATE VOLTAGE	135 V
MAXIMUM CATHODE CURRENT	50 mA
Second physical triode section; identical dual-triode structure per reviewed datasheets.	

19 — Class B Twin Battery Triode Power Amplifier

A direct-heated, dual-section power triode designed for Class B audio amplification in the output stages of battery-operated radio receivers.

Overview

The **19** (also designated as **Type 19** or **RCA-19**) is a twin-triode power amplifier designed specifically for use in the output stage of battery-operated receivers. It contains two high-mu triode units within a single glass envelope, sharing a common filament but having separate external terminals for all other electrodes. This construction allows a single tube to perform the function of a push-pull Class B output stage, delivering approximately 2 watts of audio power.

The electrical characteristics and ratings of the 19 are identical to those of the **1J6G** twin triode, with the sole exception of the filament current rating.

Mechanical Specifications and Base Configurations

The 19 is housed in an ST-12 glass bulb (also referred to as ST 12-D or ST-12 outline). The physical dimensions of the envelope vary slightly across historical specifications:

- **Maximum overall length/height:** 4-3/16 inches to 4-7/16 inches
- **Maximum seated height:** 3-5/8 inches to 3-9/16 inches (with a maximum height of 3-7/8 inches noted in some configurations)
- **Maximum diameter/width:** 1-3/16 inches to 1-9/16 inches

The tube is designed to be mounted in a **vertical position**. In some applications, cushioning of the socket may be desirable to minimize mechanical shock and microphonic noise.

The tube features a small 6-pin base (such as a U.X. base or 6-C base with a maximum diameter of 1.165 inches). The pinout configurations differ between standard documentation and alternative European/specialized listings:

Standard 6-Pin Base Configuration (Bottom View)

In the standard configuration, the pins are assigned as follows:

- **Pin 1:** Filament Positive (F or F+)
- **Pin 2:** Plate of Triode 2 (P2, PT2, or Anode 2)
- **Pin 3:** Grid of Triode 2 (G2, GT2, or Grid 2)
- **Pin 4:** Grid of Triode 1 (G1, GT1, or Grid 1)
- **Pin 5:** Plate of Triode 1 (P1, PT1, or Anode 1)
- **Pin 6:** Filament Negative (F or F-) [Negative filament return]

Alternative 6-Pin Base Configuration (Base Diagram 6-G)

An alternative pinout configuration is documented as follows:

- **Pin 1:** Grid (G)
- **Pin 2:** Plate (P)
- **Pin 3:** Filament (F)
- **Pin 4:** Filament (F)
- **Pin 5:** Plate (P)
- **Pin 6:** Grid (G)

Filament Ratings and Power Supply

The 19 features a coated filament designed for direct-current (DC) battery operation.

- **Filament Voltage:** 2.0 V DC
- **Filament Current:** 0.26 A (or 0.260 A)
- **Filament Supply:** 2-Volt battery operation

Using the nominal filament voltage and current, the filament power consumption can be calculated as:

Filament Power = Filament Voltage $\times$ Filament Current = 2.0 V $\times$ 0.26 A = 0.52 W

Electrical Ratings and Class B Operating Points

The 19 is rated for a maximum plate voltage of **135 V** and a maximum peak plate current of **50 mA** per plate. Under typical Class B power amplifier conditions, the tube operates with a plate-to-plate load resistance of 10,000 ohms. The effective load resistance per plate is calculated as:

Load Resistance per Plate = $\frac{\text{Plate-to-Plate Load Resistance}}{4} = \frac{10,000 \Omega}{4} = 2,500 \Omega$ This calculation represents the load impedance presented to each triode section during its conducting half-cycle in Class B operation.

The tube can be operated with zero grid bias or negative grid bias. Negative bias is advantageous for conserving plate-battery drain, though it results in a slight reduction in maximum power output. The typical operating characteristics at a plate voltage of 135 V are summarized below:

Parameter	Zero Bias (0 V)	Moderate Bias (-3 V)	High Bias (-6 V)
Plate Voltage	135 V	135 V	135 V
Grid Voltage	0 V	-3.0 V	-6.0 V
Zero-Signal Plate Current (Per Plate)	5.0 mA	2.0 mA	0.5 mA
Zero-Signal Plate Current (Total)	10.0 mA	3.4 mA	0.2 mA

Parameter	Zero Bias (0 V)	Moderate Bias (-3 V)	High Bias (-6 V)
Max-Signal Plate Current (Total)	27.0 mA	25.0 mA	22.0 mA
Average Power Input (Grid-to-Grid)	170 mW	130 mW	95 mW
Power Output (Approximate)	2.1 W	1.9 W	1.6 W
Effective Load Resistance (Plate-to-Plate)	10,000 Ω	10,000 Ω	10,000 Ω

Note on current values: The total zero-signal plate current values (10.0 mA, 3.4 mA, and 0.2 mA) represent the combined current of both plates as measured in practical circuits, which may deviate slightly from twice the nominal single-plate current due to minor structural differences or measurement conditions.

For high-power applications, the plate voltage can be increased up to 180 V. Under this condition, an input power of approximately 100 mW yields an output power of 1.6 W.

Driver Stage Requirements and Circuit Configurations

Because Class B operation draws grid current during positive signal excursions, the driver stage must be capable of supplying sufficient power to the grid circuit of the 19 without introducing excessive distortion. To minimize distortion, the driver tube should be operated well below its maximum undistorted Class A rating.

Comparison with Type 30 and Type 49 Drivers

- **Type 30 Driver:** When operated at a plate voltage of 135 V and a grid bias of -9 V, a single Type 30 driver provides insufficient drive power to fully excite the 19. This limits the maximum power output of the 19 to approximately 1.25 W. Increasing the plate voltage of the Type 30 driver is only effective if the preceding detector stage can supply enough voltage to drive the Type 30 to its maximum capacity. Consequently, an additional audio-frequency (AF) stage is typically required.
- **Type 49 Driver:** Utilizing a Type 49 driver allows for higher power output from the 19, but an additional AF stage is still necessary to exceed an output of 1.5 W.

Performance Advantages

The 19 was designed to replace a push-pull pair of Type 30 tubes in battery-operated receivers. A single 19 operating at 135 V plate voltage delivers more power (up to 2.1 W) than a pair of Type 30 tubes operating at 157.5 V. Furthermore, a pair of Type 30 tubes in push-pull previously required a grid bias of approximately -22.5 V and a 180 V high-tension (HT) battery, whereas the 19 requires only 0 V to -6 V bias and a 135 V supply, significantly reducing battery weight and cost.

Graphical Characteristics and Distortion Analysis

The average plate characteristics of each triode unit show plate current versus plate voltage for grid voltages ranging from -6 V to +25 V. In the positive grid region, the curves exhibit typical triode knee behavior at low plate voltages, accompanied by grid current flow. For example, the grid current reaches approximately 12 mA when the grid voltage is driven to +25 V with a plate voltage of 40 V.

Under Class B operating conditions (with a 2.0 V DC filament, 135 V plate voltage, 0 V grid bias, and a 46 V RMS grid-to-grid signal), the relationship between performance and load resistance is characterized by the following:

- **Power Output:** Peaks when the plate-to-plate load resistance is around 8,000 ohms, yielding approximately 2 watts.
- **Harmonic Distortion:** The second and third harmonics vary with load resistance. Under a specific test configuration using a Type 30 driver ($E_b = 135$ V, $E_c = -9.0$ V), an input transformer ratio (N_1/N_2) of 2.66, and a 10,000-ohm plate-to-plate load, the total harmonic distortion is approximately 8% at a driver signal of 6 V RMS. At this maximum driver signal, the power output reaches approximately 1.75 W, and the plate current rises to about 22 mA per triode.

Technical Summary

The **19** is a **Class B twin battery triode power amplifier** featuring two high-mu triode units in a single ST-12 glass envelope. It is designed for the output stage of 2-volt battery-operated receivers, providing a compact and efficient alternative to a push-pull pair of Type 30 tubes. With a common 2.0 V, 0.26 A filament and separate external terminals for all other electrodes, the 19 is capable of delivering up to 2.1 W of audio power into a 10,000-ohm plate-to-plate load. The tube is identical to the 1J6G except for its filament current rating. It can be operated at zero or negative grid bias to balance power output against battery conservation, making it a highly versatile output valve for portable and domestic battery-powered equipment.



SOURCE OPERATING CONDITIONS

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1937 Raytheon Radio Receiving Tubes

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

1937 RAYTHEON RADIO RECEIVING TUBES

Section 1 · Triode

OTHER		
PARAMETER	PUBLISHED VALUE	CONDITION / NOTE
Plate voltage	135 V	ClassB; PushPull; TwoTubes
Grid bias	-6 V	ClassB; PushPull; TwoTubes
No-signal plate current per plate	0.5 mA	ClassB
Load resistance plate-to-plate	10000 ohm	ClassB; PushPull
Power output	1.6 W	ClassB; PushPull
Grid bias	-3 V	ClassB; PushPull; AlternatePoint
Power output	1.9 W	ClassB; PushPull; AlternatePoint
Grid bias	0 V	ClassB; PushPull; AlternatePoint
Power output	2.1 W	ClassB; PushPull; AlternatePoint
Maximum peak plate current per plate	50 mA	PerPlate



SOURCE OPERATING CONDITIONS

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1940 RCA

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1940 RCA

Section 1 · Triode

OTHER		
PARAMETER	PUBLISHED VALUE	CONDITION / NOTE
CLASS B TWIN AMPLIFIER .,	9	CLASS B TWIN AMPLIFIER ., 9/ o
approximately	2 W	approximately 2 watts of audio power. The triode units have separate external
PFILAMENT VOLTAGE (D. C.).-vvvvvininnin,	2 V	PFILAMENT VOLTAGE (D. C.).-vvvvvininnin, 2.0 Volts
FILAMENT CURRENT +..utvsncevnssssonsnenonncns	260 mA	FILAMENT CURRENT +..utvsncevnssssonsnenonncns 0.26 Ampere
PLATE VOLTAGE .. vivvvnrennornsnosrnnarassanens	135 V	PLATE VOLTAGE .. vivvvnrennornsnosrnnarassanens 135 max. Volts
MaxiMUuM SIGNAL PLATE CURRENT (Per plate)	50	MaxiMUuM SIGNAL PLATE CURRENT (Per plate)..... 50 max. Milliamperes
Plate Voltage	135 V	Plate Voltage 00uun 135 135 135 Volts
Grid Voltage cove	0 V	Grid Voltage cove.... -6 -3 0 Volts
Zero-Signal Plate Current (Per plate)	2	Zero-Signal Plate Current (Per plate) 0.5 2 b Milliamperes
(Plate-to-plate) cccvv	10000	(Plate-to-plate) cccvv.... 10000 10000 10000 Ohmas
Average Power Input (Approx.)*	170	Average Power Input (Approx.)*.. 95 130 170 Milliwatts
Power Output (Approximate)	2.1 W	Power Output (Approximate)..... 1.6 1.9 2.1 Watts
the output. A discussion of Class B amplifier features is given on page	20	the output. A discussion of Class B amplifier features is given on page 20.
PLATE VOLTS	-6338 V	PLATE VOLTS 92¢-6338
H Ef=	20 V	H Ef=20 VOLTS OC.
4 Ky PLATE VOLTS=135 GRID VOLTS=-9.0	9 V	4 Ky PLATE VOLTS=135 GRID VOLTS=-9.0
vz	2.66	vz 6"4/ » INPUT TRANSFORMER-VOLTAGE RATIO > <¥=2.66
§- & £ OUTPUT LOAD, PLATE_TO PLATE	10000 ohm	§- & £ OUTPUT LOAD, PLATE_TO PLATE 10000 OHMS
ORIVER SIGNAL VOLTS (Rus)@	5354 V	ORIVER SIGNAL VOLTS (Rus)@ 92C-5354
£\$	52 V	£\$52.0 VOLTS DC.



SOURCE OPERATING CONDITIONS

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1948 Brimar Radio Valve Manual

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1948 BRIMAR RADIO VALVE MANUAL

Section 1 · Triode

APPLICATION		
PARAMETER	PUBLISHED VALUE	CONDITION / NOTE
Battery service	Yes	—



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1950 Sylvania

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1950 SYLVANIA

Section 1 · Triode

OTHER		
PARAMETER	PUBLISHED VALUE	CONDITION / NOTE
Maximum Plate Voltage	135 V	—
Maximum Cathode Current	50 mA	—
Plate Voltage	135 V	ClassB,PushPull,TwoSections
Power Output	2.1 W	ClassB,PushPull,TwoSections
Load Impedance Plate-to-Plate	10000 ohm	ClassB



195X General Electric Essential Characteristics

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195X GENERAL ELECTRIC ESSENTIAL CHARACTERISTICS

Section 1 · Triode

OTHER		
PARAMETER	PUBLISHED VALUE	CONDITION / NOTE
Plate voltage	135 V	ClassB PushPull TwoTubes
Control-grid voltage	0 V	ClassB PushPull TwoTubes
Input signal power	0.17 W	ClassB PushPull TwoTubes
Load resistance plate-to-plate	10000 Ω	ClassB PushPull TwoTubes
Power output	2.15 W	ClassB PushPull TwoTubes



SOURCE DATA APPENDIX

1961 Tung Sol

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1961 TUNG SOL

Section 1 · Triode

OTHER		
PARAMETER	PUBLISHED VALUE	CONDITION / NOTE
Service	Class B power amplifier	PushPull;BatteryReceiver