

# Silicon PNP Transistor

## **RCA1C11**

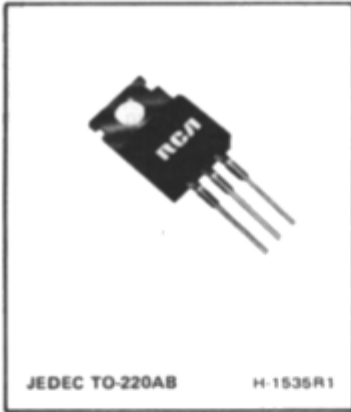
Power Transistor

40V / 7A

# DATASHEET

OEM –RCA

Source: RCA Databook 1975



## Silicon Transistors for 12-Watt True-Complementary-Symmetry Audio Amplifiers

RCA1C10 and RCA1C11 are n-p-n and p-n-p epitaxial-base silicon power transistors, respectively, especially characterized for audio-output service. To enhance circuit economics, they are provided in the JEDEC TO-220AB version of the VERSAWATT plastic package.

The 12-watt audio-amplifier circuit shown in Figs. 1 and 7 uses RCA1C10 and RCA1C11 as output devices in conjunction with three discrete transistors, two diodes, and a single 36-volt power supply; the amplifier output is capacitively coupled to an 8-ohm speaker. The choice of a true-complementary-symmetry output stage provides excellent fidelity for a low-cost system.

The 12-watt amplifier circuit shown in Figs. 2 and 10 uses

RCA1C10 and RCA1C11 discrete transistors, an integrated circuit, one diode, and a 36-volt split power supply; the amplifier output is directly coupled to an 8-ohm speaker. The integrated circuit-true-complementary-symmetry combination provides a high-quality, low-cost amplifier.

The RCA CA3094AT integrated circuit provides sufficient drive current for the complementary-symmetry output stage. Tone controls, bass and treble, with functions of "boost" and "cut" are incorporated into the feedback loop of the amplifier, resulting in excellent signal-to-noise ratio and freedom from distortion. Ratings and characteristics of type CA3094AT are given in RCA data bulletin File 598.

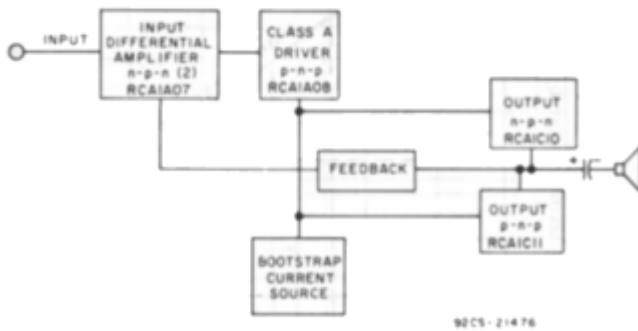


Fig. 1— Block diagram and transistor complement for 12-watt true-complementary-symmetry audio amplifier.

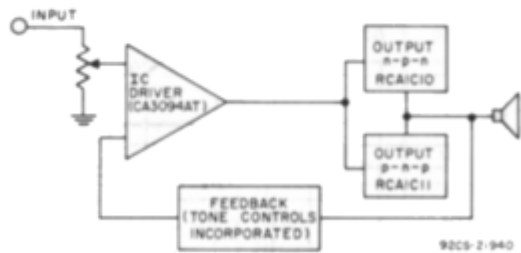


Fig. 2— Block diagram and transistor complement for 12-watt true-complementary-symmetry audio amplifier with integrated-circuit driver.

**MAXIMUM RATINGS, Absolute-Maximum Values:**

COLLECTOR-TO-BASE VOLTAGE .....	$V_{CBO}$	40	-40	V
COLLECTOR-TO-EMITTER VOLTAGE:				
With base open .....	$V_{CEO}$	40	-40	V
With external base-to-emitter resistance ( $R_{BE}$ ) = 100 $\Omega$ .....	$V_{CER}$	50	-50	V
EMITTER-TO-BASE VOLTAGE .....	$V_{EBO}$	5	-5	V
COLLECTOR CURRENT .....	$I_C$	7	-7	A
BASE CURRENT .....	$I_B$	3	-3	A
TRANSISTOR DISSIPATION:	$P_T$			
At case temperatures up to 25 $^{\circ}$ C .....		40	40	W
At case temperatures above 25 $^{\circ}$ C .....		← See Fig. 3 →		
TEMPERATURE RANGE:				
Storage & Operating (Junction) .....		← -65 to 150 →		$^{\circ}$ C
PIN TEMPERATURE (During Soldering):				
At distances $\geq$ 1/32 in. (0.8 mm) from case for 10 s max. ....		← 230 →		$^{\circ}$ C

	RCA1C10	RCA1C11	
$V_{CBO}$	40	-40	V
$V_{CEO}$	40	-40	V
$V_{CER}$	50	-50	V
$V_{EBO}$	5	-5	V
$I_C$	7	-7	A
$I_B$	3	-3	A
$P_T$			
At case temperatures up to 25 $^{\circ}$ C	40	40	W
At case temperatures above 25 $^{\circ}$ C	← See Fig. 3 →		
Storage & Operating (Junction)	← -65 to 150 →		$^{\circ}$ C
Pin Temperature (During Soldering)			
At distances $\geq$ 1/32 in. (0.8 mm) from case for 10 s max.	← 230 →		$^{\circ}$ C

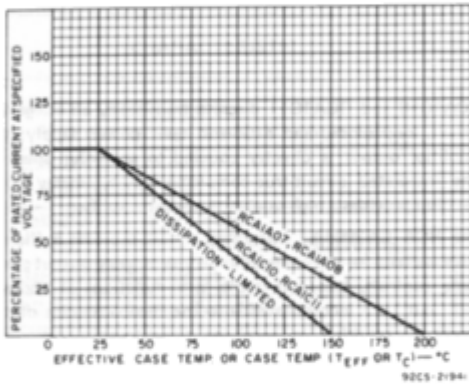


Fig. 3 - Derating curves for all types.

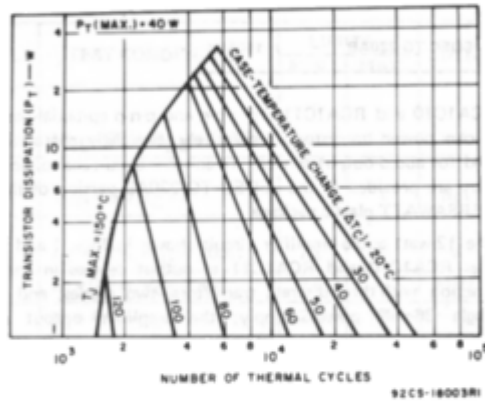


Fig. 4 - Thermal-cycling ratings for RCA1C10 and RCA1C11.

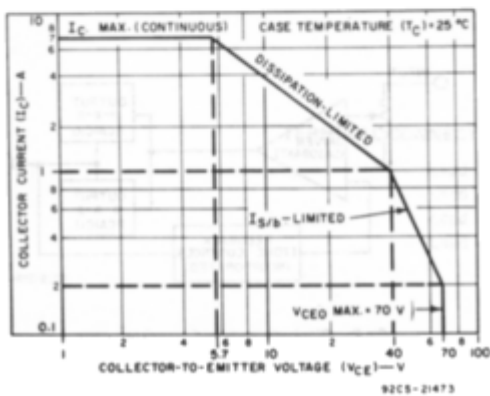


Fig. 5 - Maximum operating areas for RCA1C10.



Fig. 6 - Maximum operating areas for RCA1C11.

File No. 642 \_\_\_\_\_ RCA1C10, RCA1C11

**Type RCA1C10**

Package: JEDEC TO-220AB

Construction: Silicon n-p-n, epitaxial-base

ELECTRICAL CHARACTERISTICS, At Case Temperature ( $T_C$ ) = 25°C Unless Otherwise Specified

CHARACTERISTIC	SYMBOL	TEST CONDITIONS	LIMITS		UNITS
			MIN.	MAX.	
Collector Cutoff Current: With external base-to-emitter resistance ( $R_{BE}$ )	$I_{CER}$	$V_{CE} = 35 \text{ V}, R_{BE} = 100\Omega$	–	10	$\mu\text{A}$
Emitter Cutoff Current: With collector open	$I_{EBO}$	$V_{EB} = 5 \text{ V}$	–	1	mA
Collector-to-Emitter Voltage: With base open	$V_{CEO}$	$I_C = 0.1 \text{ A}, I_B = 0$	40	–	V
Collector-to-Emitter Voltage: With external base-to-emitter resistance ( $R_{BE}$ )	$V_{CER}$	$I_C = 0.1 \text{ A}, R_{BE} = 100\Omega$	50	–	V
Gain Bandwidth Product	$f_T$	$V_{CE} = 4 \text{ V}, I_C = 0.5 \text{ A}$	4	–	MHz
DC Forward-Current Transfer Ratio	$h_{FE}$	$I_C = 1.5 \text{ A}, V_{CE} = 4 \text{ V}$	50	250	
Collector-to-Emitter Saturation Voltage	$V_{CE(sat)}$	$I_C = 1.5 \text{ A}, I_B = 0.075 \text{ A}$	–	1	V
Base-to-Emitter Voltage	$V_{BE}$	$I_C = 1.5 \text{ A}, V_{CE} = 4 \text{ V}$	–	1.5	V
Second-Breakdown Collector Current: With base forward biased	$I_{S/b}$	$V_{CE} = 20 \text{ V}, t = 0.4 \text{ s}$	2	–	A

For characteristics curves and test conditions, refer to published data for prototype 2N6292 (File 542).

**TERMINAL CONNECTIONS FOR  
TYPES RCA1C10, RCA 1C11**

- Lead 1 – Base
- Lead 2 – Collector
- Lead 3 – Emitter
- Mounting Flange – Collector

**Type RCA1C11**

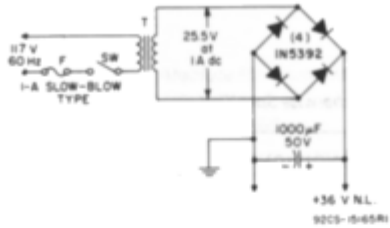
Package: JEDEC TO-220AB

Construction: Silicon p-n-p, epitaxial base

ELECTRICAL CHARACTERISTICS, At Case Temperature ( $T_C$ ) = 25°C Unless Otherwise Specified

CHARACTERISTIC	SYMBOL	TEST CONDITIONS	LIMITS		UNITS
			MIN.	MAX.	
Collector Cutoff Current: With external base-to-emitter resistance ( $R_{BE}$ )	$I_{CER}$	$V_{CE} = -35 \text{ V}, R_{BE} = 100\Omega$	–	–10	$\mu\text{A}$
Emitter Cutoff Current: With collector open	$I_{EBO}$	$V_{EB} = -5 \text{ V}$	–	–1	mA
Collector-to-Emitter Voltage: With base open	$V_{CEO}$	$I_C = -0.1 \text{ A}, I_B = 0$	–40	–	V
Collector-to-Emitter Voltage: With external base-to-emitter resistance ( $R_{BE}$ )	$V_{CER}$	$I_C = -0.1 \text{ A}, R_{BE} = 100\Omega$	–50	–	V
Gain Bandwidth Product	$f_T$	$V_{CE} = -4 \text{ V}, I_C = -0.5 \text{ A}$	10	–	MHz
DC Forward-Current Transfer Ratio	$h_{FE}$	$I_C = -1.5 \text{ A}, V_{CE} = -4 \text{ V}$	50	250	
Collector-to-Emitter Saturation Voltage	$V_{CE(sat)}$	$I_C = -1.5 \text{ A}, I_B = -0.075 \text{ A}$	–	–1	V
Base-to-Emitter Voltage	$V_{BE}$	$I_C = -1.5 \text{ A}, V_{CE} = -4 \text{ V}$	–	–1.5	V
Second-Breakdown Collector Current: With base forward biased	$I_{S/b}$	$V_{CE} = -20 \text{ V}, t = 0.4 \text{ s}$	–2	–	A

For characteristics curves and test conditions, refer to published data for prototype 2N6107 (File 488).



NOTES:

1. T: Thordarson 23V118, Stancor TP4, Triad F-93X, or equivalent (for Stereo Amplifiers).
2. Resistors are 1/2-watt unless otherwise specified; values are in ohms.
3. Capacitances are in  $\mu\text{F}$  unless otherwise specified.
4. Non-inductive resistors.

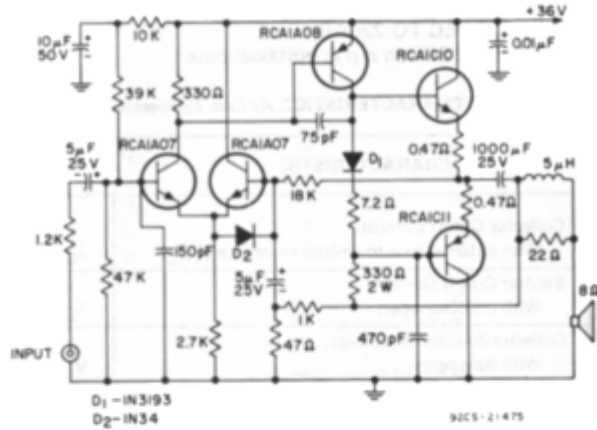


Fig.7— 12-watt amplifier circuit featuring complementary-symmetry output.

TYPICAL PERFORMANCE DATA  
For 12-Watt Audio Amplifier Circuit

Measured at a line voltage of 120 V,  $T_A = 25^\circ\text{C}$ , and a frequency of 1 kHz, unless otherwise specified.

Power:

Rated power (8- $\Omega$ load, at rated distortion) . . . . .	12 W
Typical power (4- $\Omega$ load) . . . . .	12 W
Typical power (16- $\Omega$ load) . . . . .	6.5 W
Music power (8- $\Omega$ load, at 5% THD with regulated supply) . . . . .	15 W
Dynamic power (8- $\Omega$ load, at 1% THD with regulated supply) . . . . .	13 W
Total Harmonic Distortion:	
Rated distortion . . . . .	1.0%

IM Distortion:

10 dB below continuous power output at 60 Hz and 7 kHz (4:1) . . . . .	1.5%
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Sensitivity:

At continuous power-output rating . . . . .	600 mV
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Hum and Noise:

Below continuous power output:	
Input shorted . . . . .	90 dB
Input open . . . . .	70 dB
Input Resistance . . . . .	23 k $\Omega$

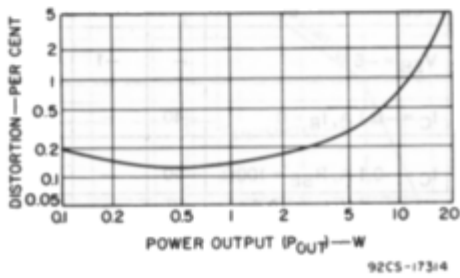


Fig.8—Distortion vs. power output.

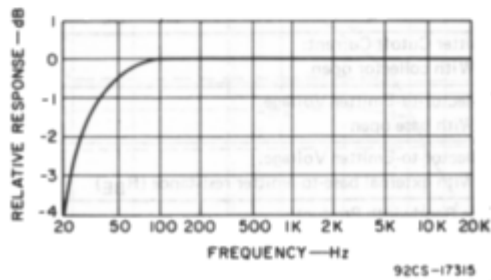


Fig.9—Response curve.

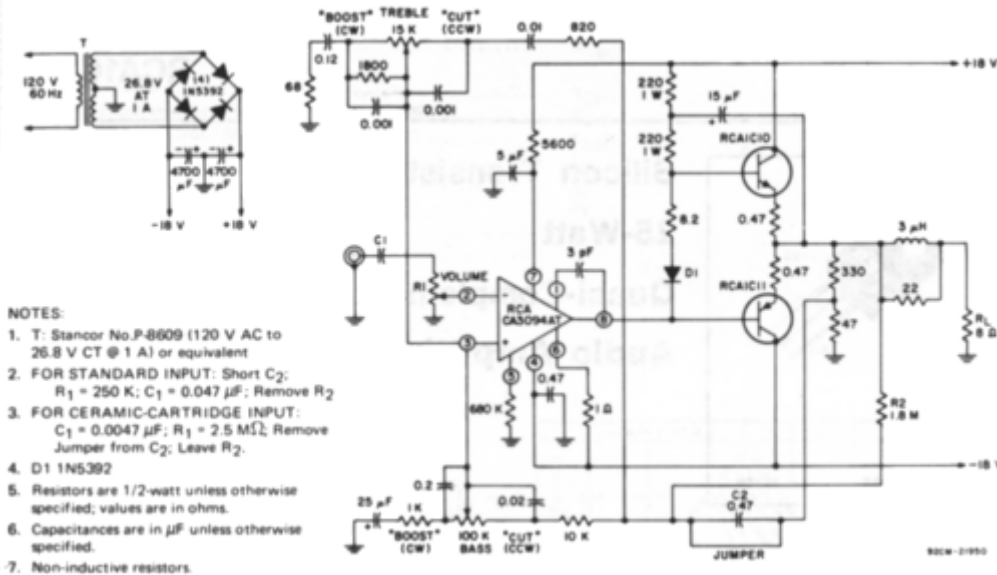


Fig.10—12-watt amplifier circuit featuring an integrated-circuit driver and a true-complementary-symmetry output stage.

**TYPICAL PERFORMANCE DATA  
For 12-Watt Audio Amplifier Circuit**

Measured at a line voltage of 120 V, T<sub>A</sub> = 25°C, and a frequency of 1 kHz, unless otherwise specified.

**Power:**

Rated power (8-Ω load, at rated distortion) . . . . .	12 W
Typical power (4-Ω load) . . . . .	9 W
Typical power (16-Ω load) . . . . .	6.5 W
Music power (8-Ω load, at 5% THD with regulated supply) . . . . .	15 W
<b>Total Harmonic Distortion:</b>	
Rated distortion . . . . .	1.0%
Typical at 1 W . . . . .	0.05%

**IM Distortion:**

10 dB below continuous power output at 60 Hz and 2 kHz (4:1) . . . . .	0.2%
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**Sensitivity:**

At continuous power-output rating (tone controls flat) . . . . .	100 mV
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**Hum and Noise:**

Below continuous power output:	
Input open . . . . .	83 dB
Input resistance . . . . .	250 kΩ
Voltage Gain . . . . .	40 dB
Tone Control Range . . . . .	See Fig.12

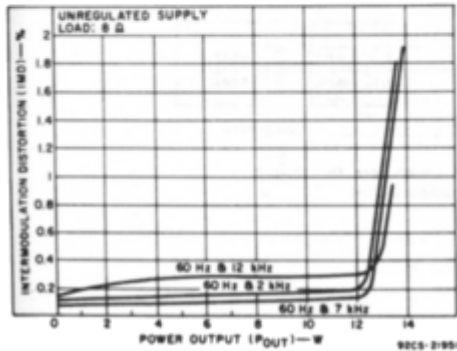


Fig.11—Intermodulation distortion vs. power output.

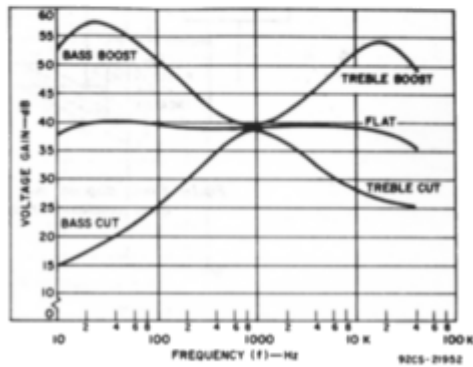


Fig.12—Voltage gain vs. frequency.