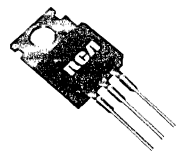
RCA
Solid State
Division

Power Transistors
RCA1C10
RCA1C11



JEDEC TO-220AB H-1535R1

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.

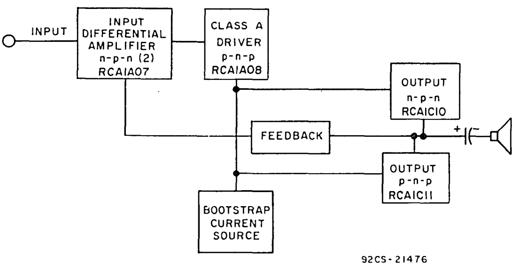


Fig. 1— Block diagram and transistor complement for 12-watt true-complementary-symmetry audio amplifier.

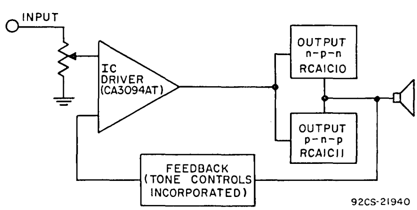


Fig.2— Block diagram and transistor complement for 12-watt true-complementary-symmetry audio amplifier with integrated-circuit driver.

MAXIMUM RATINGS, *Absolute-Maximum Values:*

		RCA1C10	RCA1C11	
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}) = 100Ω	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°C		40	40	W
At case temperatures above 25°C		← See Fig. 3 →		
TEMPERATURE RANGE:				
Storage & Operating (Junction)		← –65 to 150 →		°C
PIN TEMPERATURE (During Soldering):				
At distances ≥1/32 in. (0.8 mm) from case for 10 s max.		← 230 →		°C

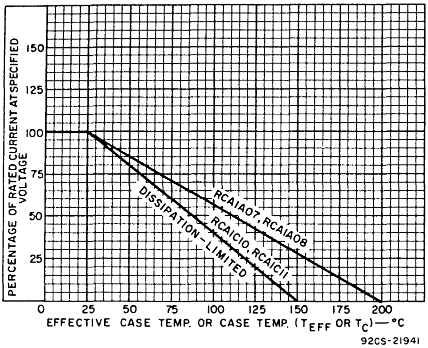


Fig.3 – Derating curves for all types.

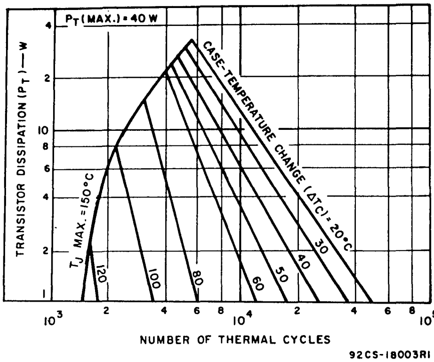


Fig.4 – Thermal-cycling ratings for RCA1C10 and RCA1C11.

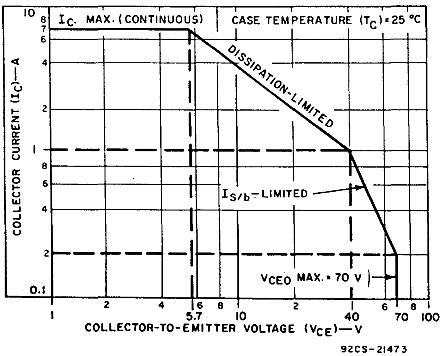


Fig.5 – Maximum operating areas for RCA1C10.

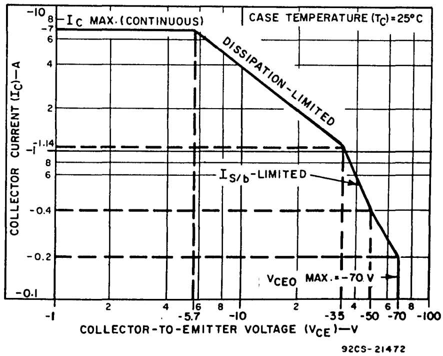


Fig.6 – Maximum operating areas for RCA1C11.

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

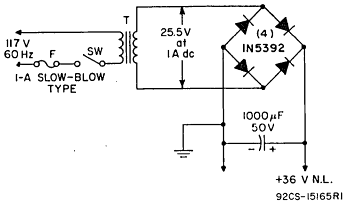
Lead 1 — Base
Lead 2 — Collector
Lead 3 — Emitter
Mounting Flange — Collector

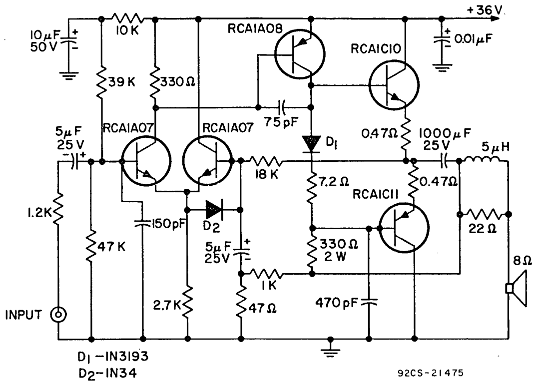
Type RCA1C11
Package: JEDEC TO-220AB
Construction: Silicon p-n-p, epitaxial base

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

CHARACTERISTIC	SYMBOL	TEST CONDITIONS	LIMITS MIN.	LIMITS MAX.	UNITS
Collector Cutoff Current: With external base-to-emitter resistance (R_{BE})	I_{CER}	V_{CE} = −35 V, R_{BE} = 100Ω	–	−10	μA
Emitter Cutoff Current: With collector open	I_{EBO}	V_{EB} = −5 V	–	−1	mA
Collector-to-Emitter Voltage: With base open	V_{CEO}	I_C = −0.1 A, I_B = 0	−40	–	V
Collector-to-Emitter Voltage: With external base-to-emitter resistance (R_{BE})	V_{CER}	I_C = −0.1 A, R_{BE} = 100Ω	−50	–	V
Gain Bandwidth Product	f_T	V_{CE} = −4 V, I_C = −0.5 A	10	–	MHz
DC Forward-Current Transfer Ratio	h_{FE}	I_C = −1.5 A, V_{CE} = −4 V	50	250	
Collector-to-Emitter Saturation Voltage	$V_{CE}(sat)$	I_C = −1.5 A, I_B = −0.075 A	–	−1	V
Base-to-Emitter Voltage	V_{BE}	I_C = −1.5 A, V_{CE} = −4 V	–	−1.5	V
Second-Breakdown Collector Current: With base forward biased	$I_{S/b}$	V_{CE} = −20 V, t = 0.4 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 µF 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°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)	12 W
Typical power (16-Ω load)	6.5 W
Music power (8-Ω load, at 5% THD with regulated supply)	15 W
Dynamic power (8-Ω 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%
Sensitivity:	
At continuous power-output rating	600 mV
Hum and Noise:	
Below continuous power output:	
Input shorted	90 dB
Input open	70 dB
Input Resistance	23 kΩ

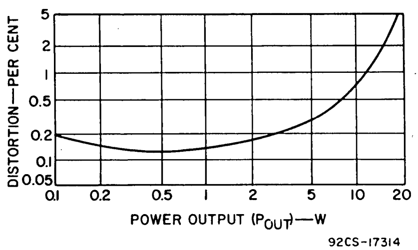


Fig.8—Distortion vs. power output.

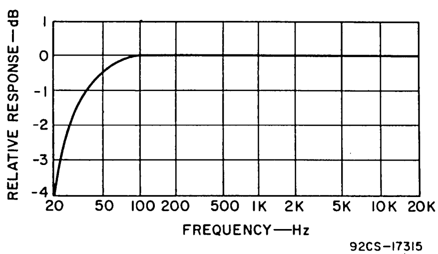
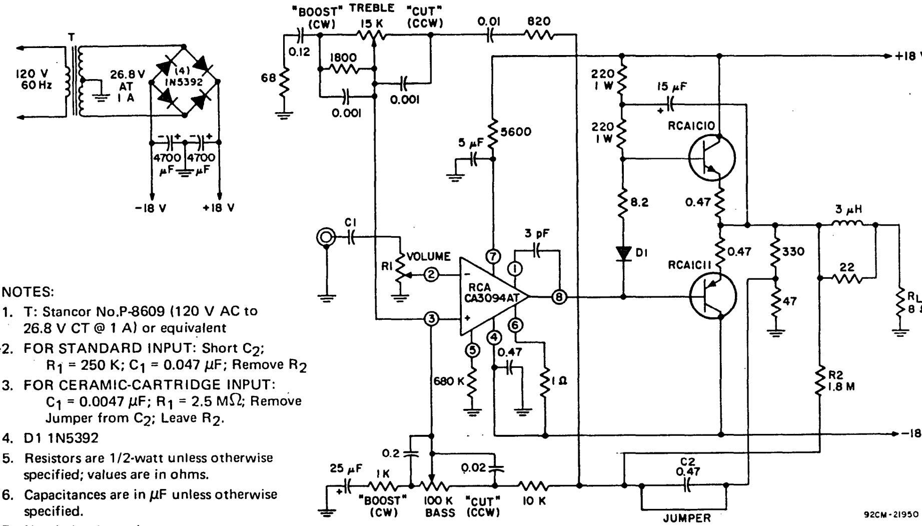


Fig.9—Response curve.



NOTES:
1. T: Stancor No.P-8609 (120 V AC to 26.8 V CT @ 1 A) or equivalent
2. FOR STANDARD INPUT: Short C_2; R_1 = 250 K; C_1 = 0.047 μF; Remove R_2
3. FOR CERAMIC-CARTRIDGE INPUT: C_1 = 0.0047 μF; R_1 = 2.5 MΩ; Remove Jumper from C_2; Leave R_2.
4. D1 1N5392
5. Resistors are 1/2-watt unless otherwise specified; values are in ohms.
6. Capacitances are in μF unless otherwise specified.
7. Non-inductive resistors.

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_A = 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

Total Harmonic Distortion:
- 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%

Sensitivity:
- At continuous power-output rating (tone controls flat) ..... 100 mV

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

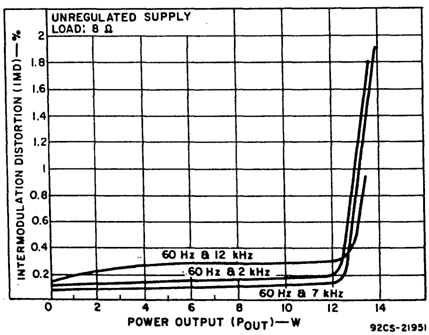


Fig.11—Intermodulation distortion vs. power output.

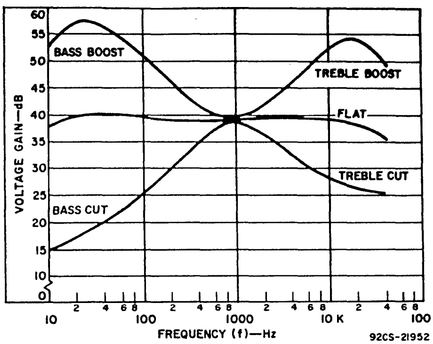


Fig.12—Voltage gain vs. frequency.