

# Preliminary Data

# CA3131EM, CA3132EM

## 5-Watt Audio Amplifiers

With Integral Heat Sink

RCA-CA3131EM and CA3132EM are audio amplifiers with integral preamplifier stages on single integrated-circuit monolithic chips.

Utilizing a uniquely designed package with an integral heat sink, these devices can provide a power-output signal in excess of five watts at an ambient temperature of 25°C.

The CA3131EM employs an internal feedback network that sets the over-all gain of the amplifier to typically 48 dB.

The CA3132EM omits the internal feedback network. This arrangement offers the circuit designer a wide latitude in the choice of an external feedback network more suitable to a specific application.

Both types are encapsulated in a 16-lead dual-in-line plastic package with 4 center leads removed.

The CA3131EM and CA3132EM are electrically equivalent to and pin compatible with types SN78013 and SN78023, respectively.

### Determining External Component Values (Refer to Figs. 2 & 3)

The dc quiescent output voltage is set by the voltage at Terminal 1. This voltage, in turn, is set by the internal voltage at Terminal 2 less  $I_1$  (input current, fixed by  $R_A + R_B$ , for O4). The voltage at Terminal 2 is set slightly above half the supply voltage to allow for the voltage drop across  $R_A + R_B$ . Filter  $R_3C_3$  attenuates any ac ripple injected from the supply line and prevents positive feedback to Terminal 1. The rejection of supply voltage is a direct function of the filter attenuation. The input impedance of the audio amplifiers is a function of the closed-loop gain and the magnitude of the Q8 current. In practice the input impedance is well above 1 megohm. The input signal, applied through C2, sees an impedance equivalent to the resistance of  $R_A$  connected in parallel with the amplifier input impedance. Hence, the value of  $R_A$  in most cases is dominant in establishing the input signal impedance.

The value of C1 depends on the regulation of the power supply. It is possible for the amplifier to work with a value of C1 as low as 0.1  $\mu$ F to attenuate high-frequency signals in the supply line. Ideally, C1 should be placed as near Terminal 10 as possible. An electrolytic capacitor should be used for C1 if the power supply is poorly regulated to avoid ripple at the output.

Capacitor C6 at Terminal 15 provides over-all compensation. If a 1000-pF capacitor is used for C6, then the first breakpoint for a 46-dB closed-loop gain occurs at 200 kHz. Higher capacitance values will cause the constant current from Q10 to charge C6 on the positive voltage swing and thus limit the slew rate at high-signal levels. Because p-n-p transistor Q19 has a lower gain-bandwidth product ( $f_T$ ) than the n-p-n transistors, C7 is connected to Terminal 9 to compensate for gain losses occurring in the negative voltage swings.

The use of the filter networks C8 and  $R_D$  at the output Terminal 6 is a standard requirement for class B audio outputs

### MAXIMUM RATINGS, Absolute-Maximum Values:

SUPPLY VOLTAGE, $V^+$	28 V
CONTINUOUS OUTPUT POWER, $P_O$ (with $R_L = 8 \Omega$ and $V^+ = 24 V$ )	8 W RMS
MINIMUM RECOMMENDED LOAD IMPEDANCE, $R_L$	8 $\Omega$
AMBIENT OPERATING TEMPERATURE, $T_A$ (at 6 W RMS Output Power)	70 °C
STORAGE TEMPERATURE RANGE	-55 to +150 °C

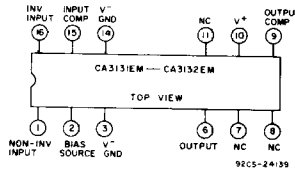


Fig. 1—Terminal assignment of the CA3131EM and CA3132EM.

driving reactive speaker loads. Capacitor C8 compensates for the speaker inductance and  $R_D$  limits the current surges through C8.

The value of the coupling capacitor C9 to the load determines the low-frequency response of the amplifier.

### Closed-Loop Gain

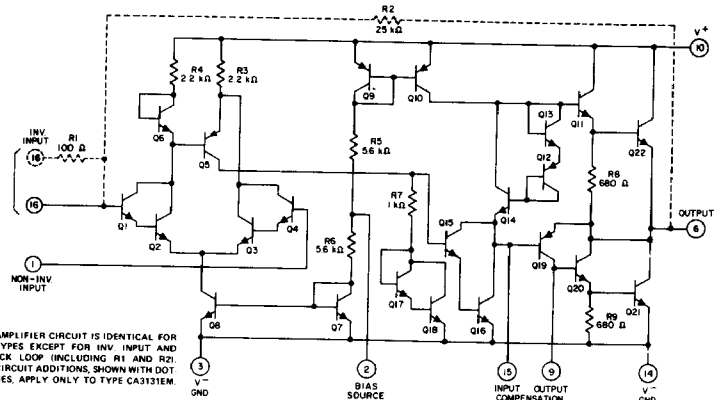
The closed-loop gain for either type is set by the ratio  $(R1 + R2)/R1$ . These resistors are included in the CA3131EM circuit and are external when used with the CA3132EM. In either type, the low-frequency value (-3 dB point) is reached when the impedance of C5 equals the value of R1.

### Features:

- Power Output: 4 W min., 5 W typ.
- Complete amplifier including: preamplifier stages, power-output amplifier, and integral heat sink
- High power-supply rejection ratio
- Operating voltage:  $V^+ = 24 V$  typ.
- Available with internal feedback (CA3131EM) or without feedback (CA3132EM)

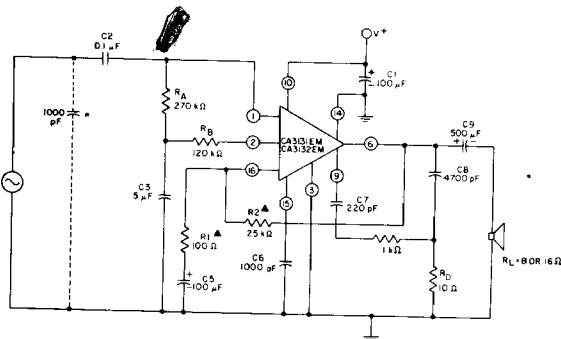
### ELECTRICAL CHARACTERISTICS at $T_A = 25^\circ C$ , $V^+ = 24 V$

Characteristic	Symbol	Conditions	Values		Unit
			Min.	Typ.	
Input Impedance	$Z_i$		200k	-	$\Omega$
Power Output	$P_O$	At clipping onset	4	-	W
		$R_L = 8 \Omega$	3	-	W
Closed-Loop Gain - CA3131EM	A	$f = 1 \text{ kHz}$	46	48	dB
Supply Current	$I^+$	Zero signal	-	10	mA
Total Harmonic Distortion	THD	$P_O = 50 \text{ mW} - 4 \text{ W}$ , $R_L = 8 \Omega$	-	1	%
			$P_O = 50 \text{ mW} - 3 \text{ W}$ , $R_L = 15 \Omega$	-	1
Noise Voltage	$V_n$	$f = 20 \text{ Hz} - 20 \text{ kHz}$	-	1.5	mV RMS



NOTE: AMPLIFIER CIRCUIT IS IDENTICAL FOR BOTH TYPES EXCEPT FOR INV. INPUT AND FEEDBACK LOOP INCLUDING R1 AND R2; THESE CIRCUIT ADDITIONS, SHOWN WITH DOTTED LINES, APPLY ONLY TO TYPE CA3131EM.

Fig. 2—Schematic diagram of types CA3131EM and CA3132EM.



\* A 1000-pF capacitor is required if input has an open circuit.

▲ External resistors R1 and R2 are used only with the CA3132EM. When testing the CA3131EM, omit R1 and R2 and connect the (+) termination of C5 to Terminal 16.

Fig. 3—Test circuit for types CA3131EM and CA3132EM.

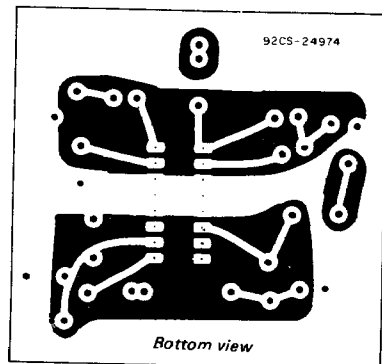


Fig. 4—Printed-circuit board (actual size) containing the test circuit, shown in Fig. 3, for the CA3131EM.