

Four Independent AC Amplifiers

For Low-Noise and General AC Applications
In Industrial Service

FEATURES

- Four AC amplifiers on a common substrate
 - Independently accessible inputs and outputs
 - Operates from single-ended supply
- EACH AMPLIFIER
- Noise figure at 1 kHz..... 2 dB typ.
 - High voltage gain 53 dB min.
 - High input resistance 90 k Ω typ.
 - Undistorted output voltage 2 V rms min.
 - Output Impedance 1 k Ω typ.
 - Open-loop bandwidth 300 kHz typ.

The RCA CA3048 is a silicon monolithic integrated circuit consisting of four independent identical AC amplifiers which can operate from a single-ended power supply.

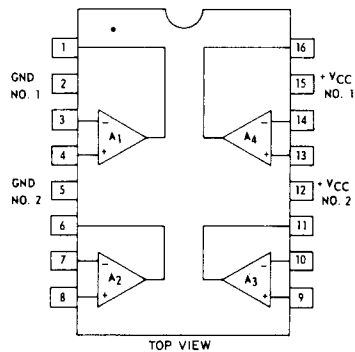
The amplifiers include internal DC bias and feedback to provide temperature-stabilized operation. They may be used in a wide variety of AC applications in which operational amplifiers have previously been used.

Each high gain amplifier has a high impedance non-inverting input, and a lower impedance inverting input for the application of feedback. Two power-supply terminals and two ground terminals are provided to reduce internal and external coupling between amplifiers.

The CA3048 is supplied in a 16-lead dual-in-line plastic package.

APPLICATIONS

- Multi-channel or cascade operation
- Low-level preamplifiers
- Equalizers
- Linear signal mixers
- Tone generators
- Multivibrators
- AC integrators



92CS-15470R2

Fig.1 - Block diagram for CA3048.

CA3048

ABSOLUTE-MAXIMUM RATINGS at $T_A = 25^\circ\text{C}$:

DISSIPATION:

At $T_A = 55^\circ\text{C}$ 750 mWAbove $T_A = 55^\circ\text{C}$ Derate linearly at 7.7 mW/ $^\circ\text{C}$

TEMPERATURE RANGE:

Operating -40°C to $+85^\circ\text{C}$ Storage -65°C to $+150^\circ\text{C}$

POWER SUPPLY VOLTAGE +16 V

AC INPUT VOLTAGE 0.5 V rms

MAXIMUM VOLTAGE RATINGS

The following chart gives the range of voltages which can be applied to the terminals listed vertically with respect to the terminals listed horizontally. For example, the voltage range between vertical terminal 2 and horizontal terminal 4 is +2 to -3.6 volts.

TERM- INAL No.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
1		+16 0	*	*	*	*	*	*	*	*	*	*	*	*	0 -16	*
2			*	+2 -3.6	0	*	*	+2 -3.6	-3.6	*	*	+16 0	+2 -3.6	*	+16 0	0 -16
3				+5 -5	*	*	*	*	*	*	*	*	*	*	*	*
4					+3.6 -2	*	*	*	*	*	*	*	*	*	*	*
5						0 -16	*	+2 -3.6	+2 -3.6	*	0 -16	+16 0	+2 -3.6	*	+16 0	*
6							*	*	*	*	*	*	0 -16	*	*	*
7								+5 -5	*	*	*	*	*	*	*	*
8									*	*	*	*	*	*	*	*
9										+5 -5	*	*	*	*	*	*
10											*	*	*	*	*	*
11												*	*	*	*	*
12													0 -16	*	*	*
13														+5 -5	*	*
14															*	*
15																+16 0
16																

* Voltages are not normally applied between these terminals.
 Voltages appearing between these terminals will be safe if the
 specified limits between all other terminals are not exceeded.

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ELECTRICAL CHARACTERISTICS at $T_A = 25^\circ\text{C}$

CHARACTERISTICS	SYMBOLS	TEST CONDITIONS	TEST CIR- CUIT	LIMITS CA3048			UNITS	TYPICAL CHARAC- TERISTICS CURVES	
			FIG.	MIN.	TYP.	MAX.		FIG.	
STATIC									
Current drain per amplifier pair	I _{I2} or I _{I5}	V _{CC} = +12V	3	9.5	13.5	17.5	mA	4,5	
DC Voltage at Output Terminals	V _{I1} , V _{I6} , V _{I11} , V _{I16}	V _{CC} = +12V	3	6.1	6.9	8.1	V	-	
DC Voltage at Feedback Terminals	V _{I3} , V _{I7} , V _{I10} , V _{I14}	V _{CC} = +12V	3	1.7	2.0	2.3	V	-	
DC Voltage at Input Terminals	V _{I4} , V _{I8} , V _{I9} , V _{I13}	V _{CC} = +12V	3	2.2	2.5	2.8	V	-	
DYNAMIC (Characteristics given are for each amplifier with no AC feedback)									
Open-Loop Gain	A _{OL}	V _{CC} = +12V E _{IN} = 2mV f = 10 kHz	6	53	58	-	dB	7,8	
Output Voltage Swing	V _{O(rms)}	V _{CC} = +12V f = 1 kHz THD = 5%	6	2.0	2.4	-	V	-	
Open-Loop -3dB Bandwidth	BW	V _{CC} = +12V E _{IN} = 2mV	6	250	300	-	kHz	9	
Total Harmonic Distortion	THD	V _{CC} = +12V, f = 1 kHz E _{OUT} = 2V rms	6	-	0.65	-	%	10	
Input Resistance	R _{IN}	OPEN LOOP Terminals 3, 7, 10, and 14 are by- passed to ground f = 1 kHz	-	-	90	-	kΩ	-	
Input Capacitance	C _{IN}	f = 1 MHz	-	-	9	-	pF	-	
Output Resistance	R _{OUT}	Terminals 3, 7, 10 and 14 are by- passed to ground	-	-	1	-	kΩ	-	
Output Capacitance	C _{OUT}	f = 1 MHz	-	-	18	-	pF	-	
Feedback Capacitance (Output to non- inverting Input)	C _{FB}	V _{CC} = +12V f = 1 MHz	-	-	<0.1	-	pF	-	
Broad-Band Output Noise Voltage	EN	V _{CC} = +12V R _S = 10 kΩ A = 40 dB Equivalent Noise BW = 50 kHz	11	-	0.3	1	mV	-	
Output Noise Voltage "Weighted"	EN(WT)		12	-	0.5	2.2	mV	-	
Noise Figure	NF (R _S = 5 kΩ)	f =	10 Hz	-	-	10	-	dB	-
			100 Hz	-	-	5.8	-	dB	
			1 kHz	-	-	2	-	dB	
			10 kHz	-	-	1.1	-	dB	
			100 kHz	-	-	0.6	-	dB	
Inter-Amplifier Audio Separation "Cross Talk"		V _{CC} = +12V f = 1 kHz 0 dB = 0.78V	13	-	<-45	-	dB	-	
Inter-Amplifier Capacitance (Any amplifier output to any other amplifier input)	C	V _{CC} = +12V f = 1 MHz	-	-	<0.02	-	pF	-	

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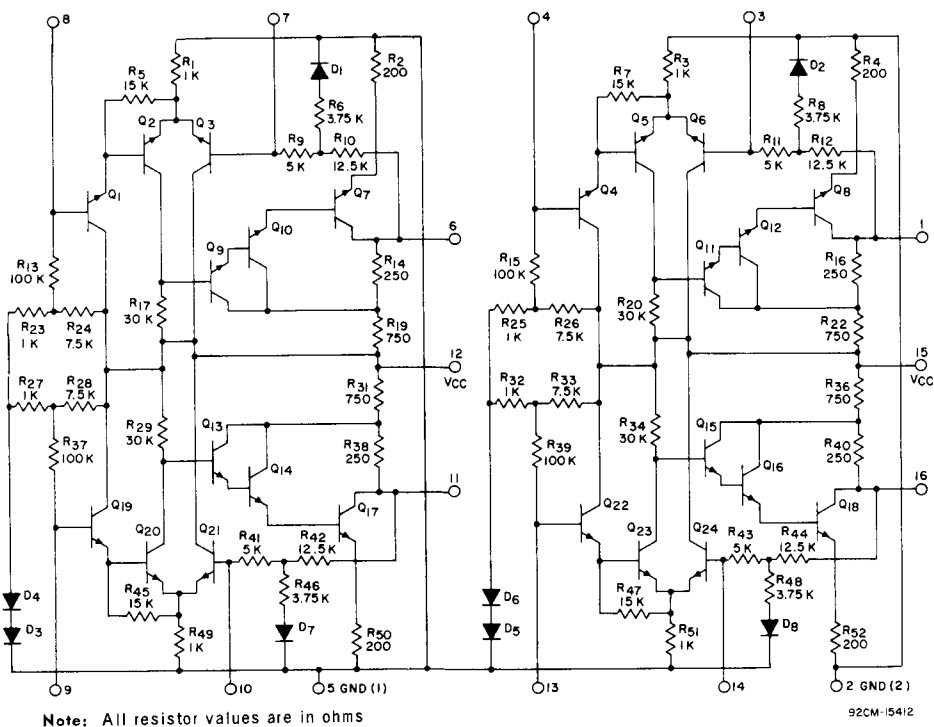


Fig.2 - Schematic diagram for CA3048.

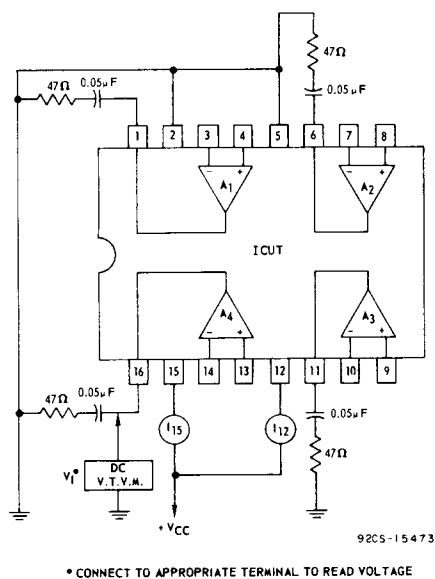


Fig.3 - Test circuit for measurement of collector supply voltage and currents.

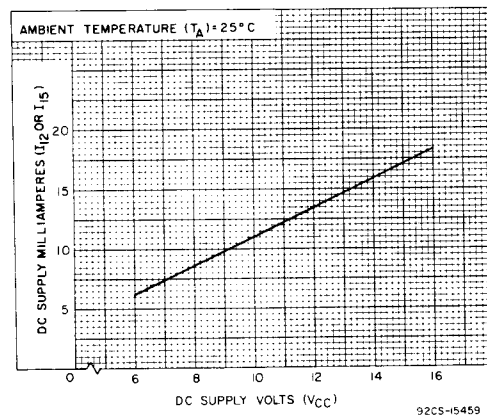


Fig.4 - Typical DC supply current vs supply voltage.

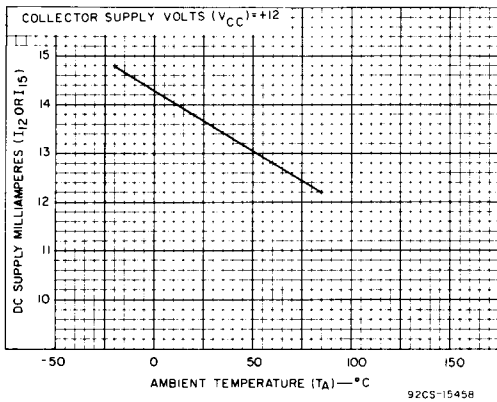


Fig. 5 - Typical DC supply current vs ambient temperature.

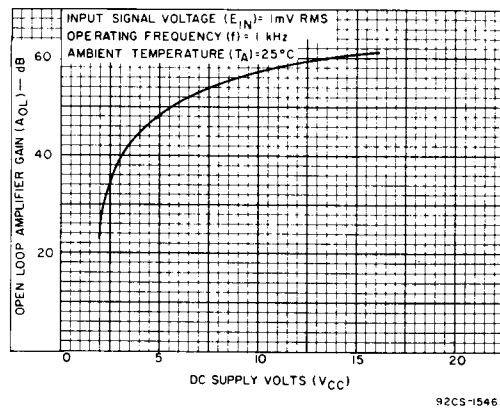
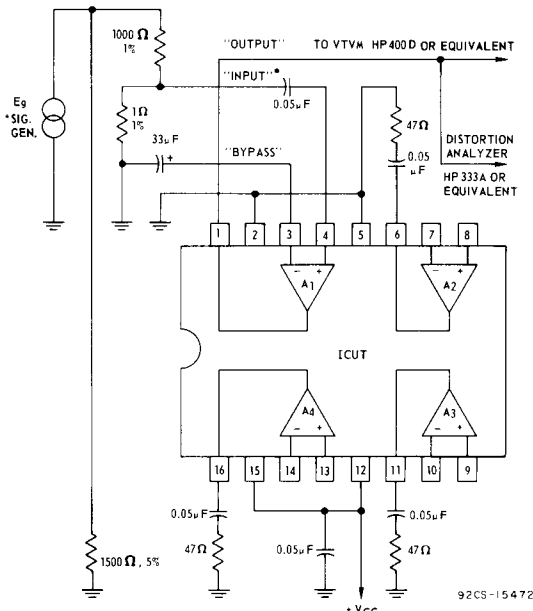


Fig. 7 - Typical amplifier gain vs DC supply voltage.



* Sig. Gen. should be a low distortion type (0.2% THD or less) HP206A or equivalent.

● Adjustment of E_g to 2 volts will make $E_s = 2$ mV.

Test Circuit shows Amplifier #1 under test, to test Amplifiers 2, 3, or 4; Connect terminals as shown in Table.

AMPLIFIER	TERMINALS		
	OUTPUT	INPUT	BYPASS
1	1	4	3
2	6	8	7
3	11	9	10
4	16	13	14

Fig. 6 - Test circuit for measurement of distortion, open-loop gain and bandwidth characteristics.

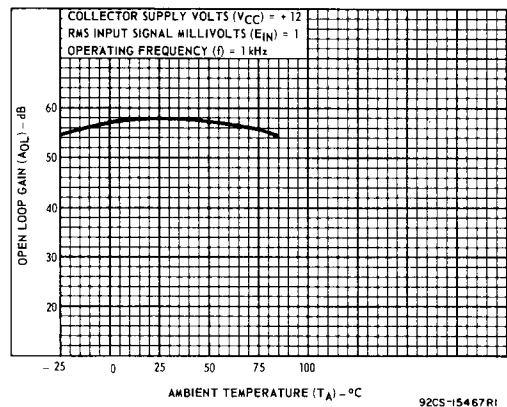


Fig. 8 - Typical open-loop gain vs ambient temperature.

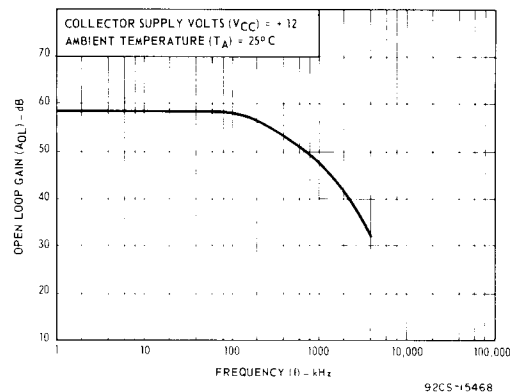


Fig. 9 - Typical open-loop gain vs frequency.

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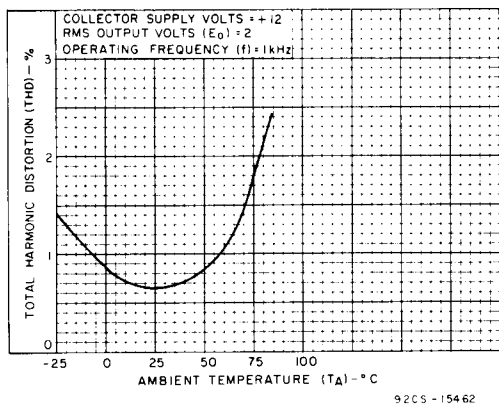
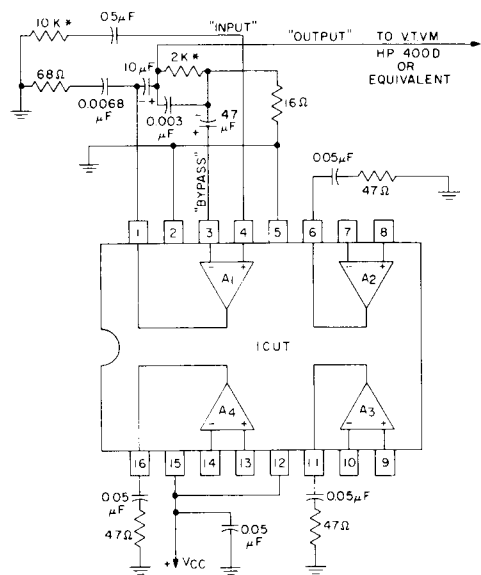


Fig.10 - Typical total harmonic distortion vs ambient temperature.



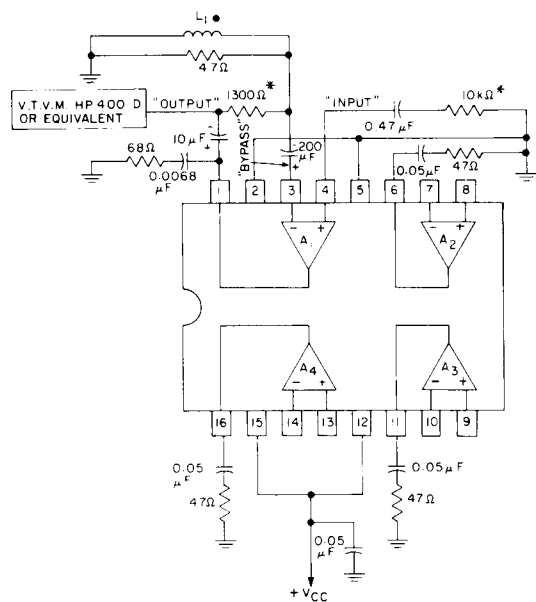
* RESISTORS ARE METAL FILM TYPE, 1%

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To test Amplifiers 1, 2, 3, or 4, connect terminals as shown in Table.

AMPLIFIER	TERMINALS		
	OUTPUT	INPUT	BYPASS
1	1	4	3
2	6	8	7
3	11	9	10
4	16	13	14

Fig.11 - Test circuit for measurement of broadband noise characteristic.



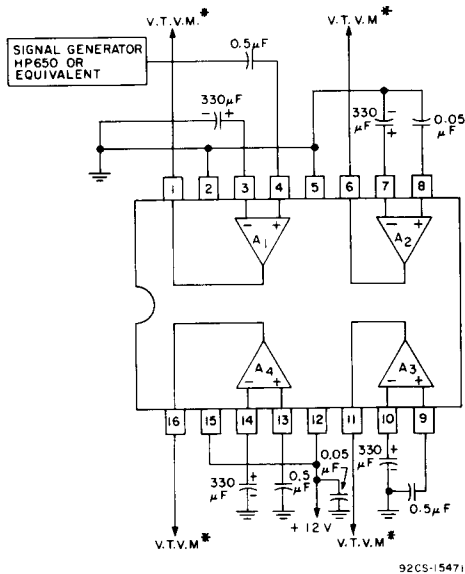
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● L_1 - 2.5 millihenry inductor, dc resistance 0.3 ohms or less.

* Resistors metal film type, 1%. To test amplifiers, connect terminals as shown in Table.

AMPLIFIER	TERMINALS		
	OUTPUT	INPUT	BYPASS
1	1	4	3
2	6	8	7
3	11	9	10
4	16	13	14

Fig.12 - Test circuit for measurement of "weighted" output noise voltage characteristic.



* V.T.V.M. - Hewlett-Packard Model 400D or equivalent.

Procedure:

1. Adjust Signal Generator for 0 dB output at reference terminal.
2. Read voltage at other output terminals (Figure shows terminal #1 used as reference).

Fig. 13 - Test circuit for measurement of inter-amplifier audio separation "cross talk" characteristic.

OPERATING CONSIDERATIONS

Economical Gain Control

The CA3048 is designed to permit flexibility in the methods by which amplifier gain can be controlled. Fig. 14 shows a curve of the gain of an amplifier when the internal resistive feedback of the device is used in conjunction with an external resistor. Although measured gain of various amplifiers will not be uniform, because of tolerances of internal resistances, this method is very economical and easy to apply.

Stability

The CA3048, as in other devices having high gain-bandwidth product, requires some attention to circuit layout, design, and construction to achieve stability.

Should the CA3048 be left unterminated, socket capacitance alone will provide sufficient feedback to cause high frequency oscillations; therefore, all test circuits in this data bulletin include loading networks that provide stability under all conditions.

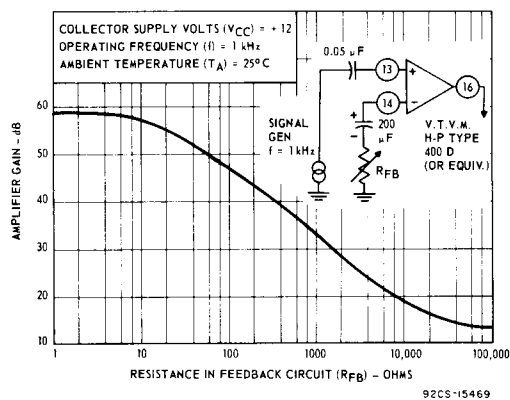


Fig. 14 - Typical amplifier gain vs feedback resistance.