CA3000

DC Amplifier

- Designed for use in Communication, Telemetry, Instrumentation, and Data-Processing Equipment
- Balanced differential-amplifier configuration with controlled constant-current source to provide outstanding versatility
- Built-in temperature stability for operation from -55°C to +125°C
- 10-Lead hermetic TO-5 style package
- Companion Application Note, ICAN 5030 "Applications of RCA CA3000 Integrated Circuit DC Amplifier" covers characteristics of different operating modes, frequency considerations, 10 MHz narrow band tuned amplifier design, crystal oscillator design, and many other application aids

HIGHLIGHTS

- Input Impedance . . . . . 195 KΩ typ.
- Voltage Gain. . . . . 30 dB typ.
- Common-Mode Rejection Ratio . . . 98 dB typ.
- Input Offset Voltage. . . . . 1.4 mV typ.
- Push-Pull Input and Output
- Frequency Capability
  DC to 30 MHz (with external C and R)
- Wide AGC Range. . . . . 90 dB typ.

APPLICATIONS

- Schmitt Trigger
- RC-Coupled Feedback Amplifier
- Mixer
- Comparator
- Modulator
- Crystal Oscillator
- Sense Amplifier

ABSOLUTE-MAXIMUM VOLTAGE LIMITS

at T_{FA} = 25°C

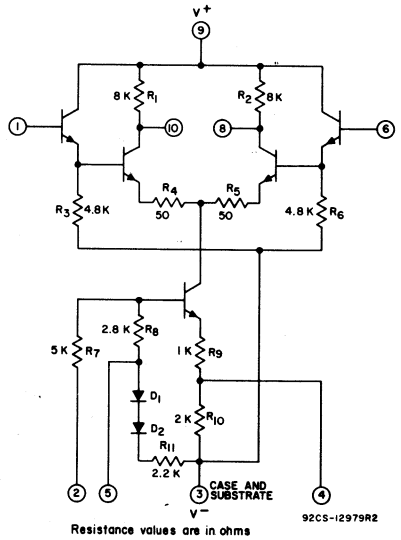
OPERATING-TEMPERATURE RANGE . . −55°C to +125°C
STORAGE-TEMPERATURE RANGE . . . −65°C to +150°C
LEAD-TEMPERATURE (During Soldering):
At distance 1/16 ± 1/32 inch (1.59 ± 0.79 mm) from case for 10 seconds max. . . . . +265°C

MAXIMUM POWER SUPPLY VOLTAGE — 16 or ±8 V

MAXIMUM SINGLE-ENDED INPUT-SIGNAL VOLTAGE . . ±4 V
MAXIMUM COMMON-MODE INPUT-SIGNAL VOLTAGE . . ±2 V
MAXIMUM DEVICE DISSIPATION:
From −55°C to 85°C. . . . . 450 mW
Above 85°C . . . . . Derate 5 mW/°C

ELECTRICAL CHARACTERISTICS, at T_{FA} = 25°C, V_{CC} = +6V, V_{EE} = -6V, unless otherwise specified

CHARACTERISTICS	SYMBOLS	SPECIAL TEST CONDITIONS Terminals No.4 & No.5 Not Connected Unless Specified		TEST CIRCUITS	LIMITS TYPE CA3000				TYPICAL CHARACTERISTICS CURVES
				Fig.	Min.	Typ.	Max.	Units	Fig.
STATIC CHARACTERISTICS									
Input Offset Voltage	V_{IO}				-	1.4	5	mV	2
Input Offset Current	I_{IO}				-	1.2	10	μA	2
Input Bias Current	I_{IB}				-	23	36	μA	3
Quiescent Operating Voltage	V_8 or V_{IO}	TERMINALS 4	5						
		NC	NC		-	2.6	-	V	4
		NC	VEE		-	4.2	-	V	4
		VEE	NC		-	-1.5	-	V	4
		VEE	VEE		-	0.6	-	V	4
Device Dissipation	P_D	NC	NC		-	30	-	mW	NONE
DYNAMIC CHARACTERISTICS									
Differential Voltage Gain Single-Ended Input	A_{DIFF}	Single-Ended Output f = 1 kHz		6	28	32	-	dB	5
		Double-Ended Output f = 1 kHz		6	-	38	-	dB	5
Bandwidth at -3 dB Point	BW	V_i = 10 mV, R_s = 1 kΩ			-	650	-	kHz	7
Maximum Output Voltage Swing	$V_{OUT(P-P)}$	f = 1 kHz		6	-	6.4	-	V(P-P)	NONE
Common-Mode Rejection Ratio	CMRR	f = 1 kHz		9	70	98	-	dB	8
Single-Ended Input Impedance	Z_{IN}	f = 1 kHz		11	70K	195K	-	Ω	10
Single-Ended Output Impedance	Z_{OUT}	f = 1 kHz		13	5.5K	8K	10.5K	Ω	12
Total Harmonic Distortion	THD	R_S=1kΩ f = 1 kHz	V_O=42V_{p-p}		-	0.2	5	%	14
AGC Range (Maximum Voltage Gain to Complete Cutoff)	AGC	f = 1 kHz		15	80	90	-	dB	NONE



Resistance values are in ohms

Fig.1 SCHEMATIC DIAGRAM

STATIC CHARACTERISTICS FOR TYPE CA3000

INPUT OFFSET VOLTAGE AND CURRENT vs TEMPERATURE

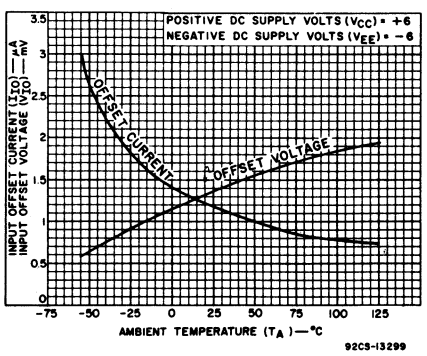


Fig.2

INPUT BIAS CURRENT vs TEMPERATURE

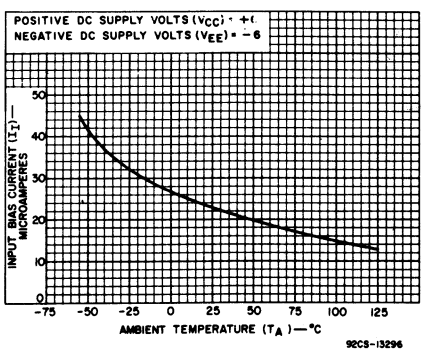


Fig.3

QUIESCENT OPERATING VOLTAGE vs TEMPERATURE

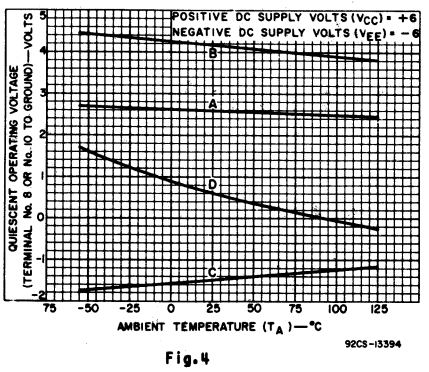


Fig.4

CA3000

DYNAMIC CHARACTERISTICS AND TEST CIRCUIT FOR TYPE CA3000

DIFFERENTIAL VOLTAGE GAIN vs TEMPERATURE

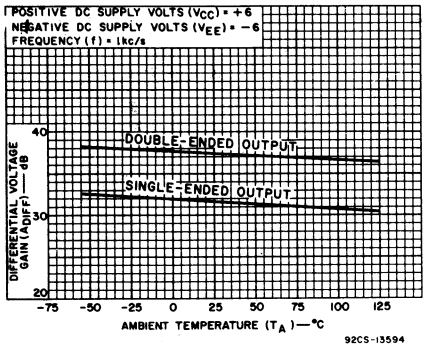


Fig.5

DIFFERENTIAL VOLTAGE GAIN AND MAXIMUM OUTPUT VOLTAGE SWING TEST CIRCUIT

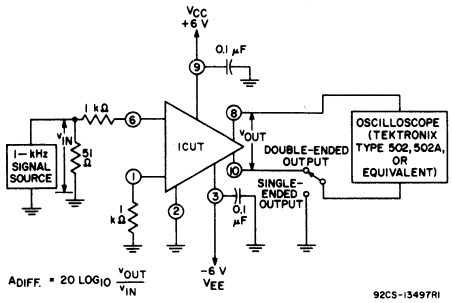


Fig.6

BANDWIDTH AT -3 dB POINT vs TEMPERATURE

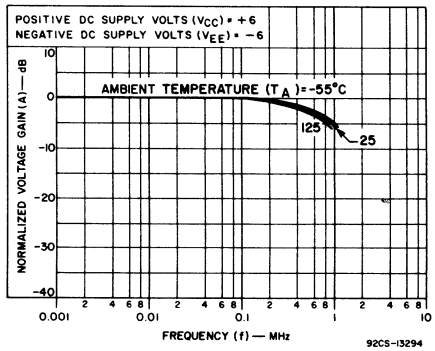


Fig.7

COMMON-MODE REJECTION RATIO vs TEMPERATURE

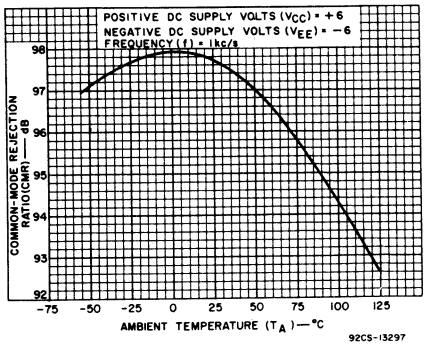


Fig.8

COMMON-MODE REJECTION RATIO TEST CIRCUIT

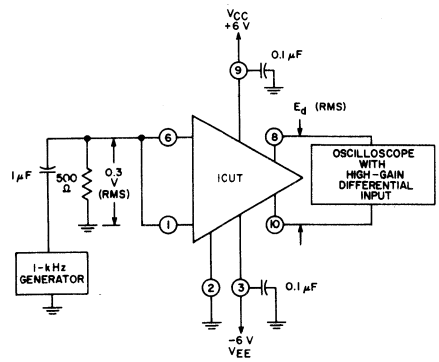


Fig.9

SINGLE-ENDED INPUT IMPEDANCE vs TEMPERATURE

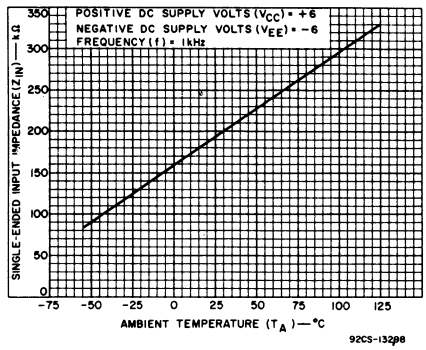


Fig.10

SINGLE-ENDED INPUT IMPEDANCE TEST CIRCUIT

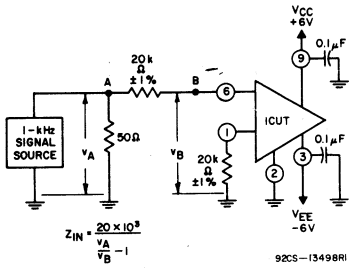


Fig.11

SINGLE-ENDED OUTPUT IMPEDANCE vs TEMPERATURE

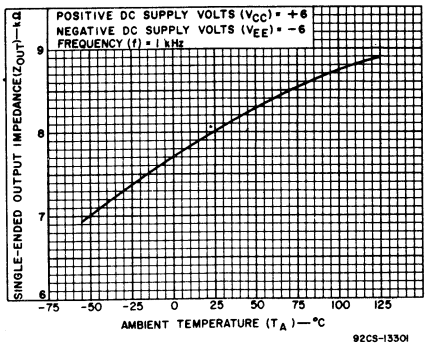


Fig.12

SINGLE-ENDED OUTPUT IMPEDANCE TEST CIRCUIT

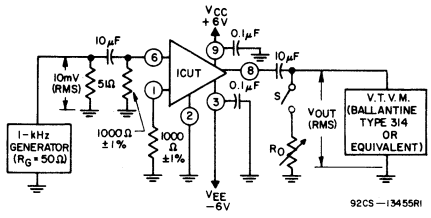


Fig.13

TOTAL HARMONIC DISTORTION vs TEMPERATURE

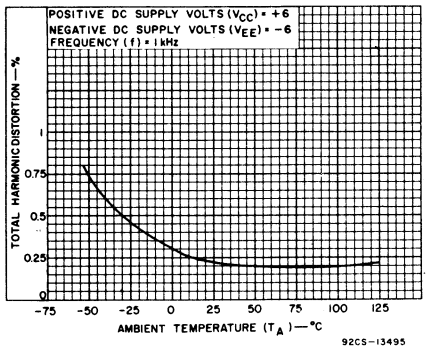


Fig.14

AGC RANGE TEST CIRCUIT

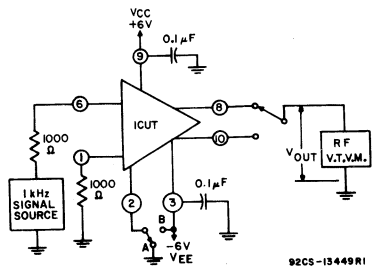


Fig.15

CA3001

Video and Wide-band Amplifier

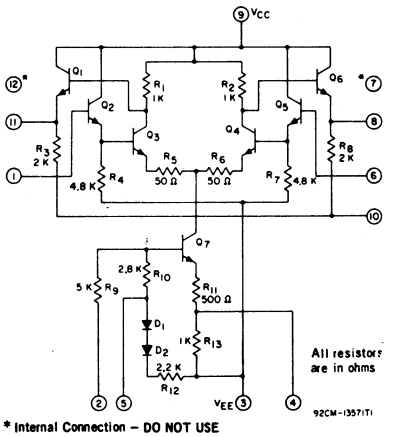
- Designed for use in Video Systems and Communication Equipment
- Balanced differential amplifier configuration with controlled constant-current source provides outstanding versatility
- 12-Lead Hermetic TO-5 Style Package
- Built-in temperature stability for operation from -55°C to +125°C
- Emitter follower input & output
- Companion Application Note ICAN5038 "Application of the RCA-CA3001 Integrated-Circuit Video Amplifier", covers different operating modes, gain control, distortion, swing capability, 3 stage amplifier design, and a Schmitt trigger study.

HIGHLIGHTS

- Push-Pull Input & Output
- AGC Range ..... 60 dB typ.
- Bandwidth ..... 29 MHz
- Input Resistance ..... 150 kΩ typ.
- Output Resistance ..... 45 Ω typ.
- Voltage Gain ..... 19 dB typ.
- Input Offset Voltage .... 1.5 mV typ.

APPLICATIONS

- Schmitt Trigger
- Mixer
- Modulator
- DC, IF, & Video Amplifier



* Internal Connection – DO NOT USE

Fig.1 - Schematic Diagram.

ABSOLUTE-MAXIMUM VOLTAGE AND CURRENT LIMITS at T_A = 25°C

Indicated voltage or current limits for each terminal can be applied under the specified conditions for other terminals.
All Voltages are with respect to ground (common terminal of Positive and Negative DC Supplies).

TERMINAL	VOLTAGE OR CURRENT LIMITS		CONDITIONS	
	NEGATIVE	POSITIVE	TERMINAL	VOLTAGE
1	-2.5	+2.5	2, 6 3, 10 9	0 -6 +6
2	-8.5	0	1, 6 3, 10 9	0 -8.5 +6
3	-10	0	1, 2, 6 9 10	0 +6 -6
4	-8.5	0	1, 2, 6 9 10	0 +6 -6
5	-6	0	1, 2, 6 3, 10 9	0 -6 +6
6	-2.5	+2.5	1, 2 3, 10 9	0 -6 +6
7	INTERNAL CONNECTION DO NOT USE			

TERMINAL	VOLTAGE OR CURRENT LIMITS		CONDITIONS	
	NEGATIVE	POSITIVE	TERMINAL	VOLTAGE
8	25 mA		1, 2, 6, 10 3 9 200-Ω RESISTOR CONNECTED BETWEEN TERMINALS No.8 & No.10	0 -6 +6
9	0	+10	1, 2, 6, 10 3	0 -6
10	-10	0	1, 2, 6 3 9	0 -6 +6
11	25 mA		1, 2, 6, 10 3 9 200-Ω RESISTOR CONNECTED BETWEEN TERMINALS No.10 & No.11	0 -6 +6
12	INTERNAL CONNECTION DO NOT USE			
CASE	INTERNALLY CONNECTED TO TERMINAL No.3 (SUBSTRATE) DO NOT GROUND			

OPERATING TEMPERATURE RANGE	-55°C to +125°C
STORAGE TEMPERATURE RANGE	-65°C to +150°C
LEAD TEMPERATURE (During Soldering):	
At distance 1/16 ± 1/32 inch (1.59 ± 0.79mm) from case for 10 seconds max.	+265°C
MAXIMUM SINGLE-ENDED INPUT-SIGNAL VOLTAGE	± 4 V
MAXIMUM COMMON-MODE INPUT-SIGNAL VOLTAGE	± 2.5 V
MAXIMUM DEVICE DISSIPATION:	
-55 to 85°C	450 mW
Above 85°C	Derate linearly 5 mW/°C

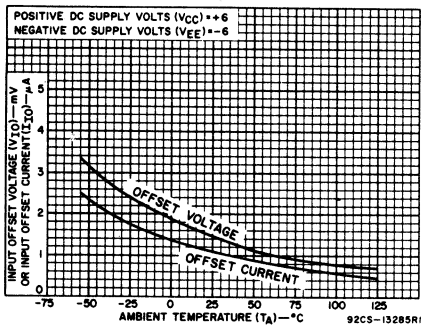


Fig.2 - Input offset voltage and current vs. temperature.

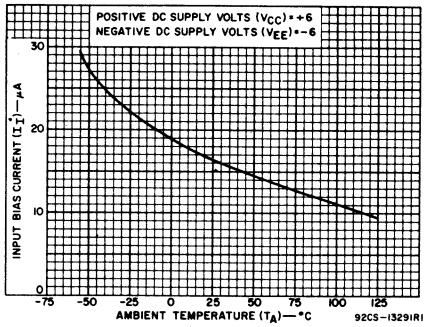


Fig.3 - Input bias current vs. temperature.

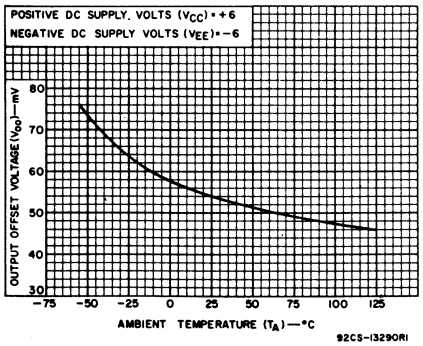


Fig. 4 - Output offset voltage vs. temperature.

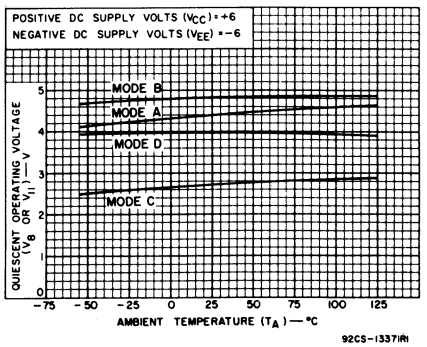


Fig. 5 - Quiescent operating voltage vs. temperature.

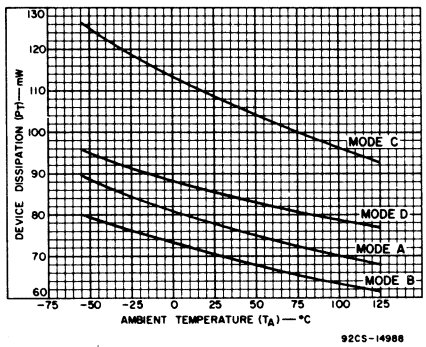


Fig. 6 - Device dissipation vs. temperature.

CA3001

ELECTRICAL CHARACTERISTICS, AT T_A = 25°C, V_{CC} = +6 V, V_{EE} = −6 V

CHARACTERISTICS (See Page 2 for Definitions of Terms)	SYMBOLS	SPECIAL TEST CONDITIONS Terminals No.4 and No.5 Not Connected Unless Specified	TEST CIRCUITS	LIMITS TYPE CA3001				TYPICAL CHARACTERISTICS CURVES
			Fig.	Min.	Typ.	Max.	Units	Fig.
STATIC CHARACTERISTICS:								
Input Offset Voltage	V_{IO}		12	-	1.5	-	mV	2
Input Offset Current	I_{IO}		13	-	1	10	μA	2
Input Bias Current	I_I		13	-	16	36	μA	3
Output Offset Voltage	V_{OO}	R_S = 1 kΩ		-	54	300	mV	4
Quiescent Operating Voltage	V_8 OR V_{11}	TERMINALS MODE 4 5						
		A NC NC		3.8	4.4	5	V	5
		B NC V_{EE}		-	4.8	-	V	5
		C V_{EE} NC		-	2.7	-	V	5
		D V_{EE} V_{EE}		-	4	-	V	5
Device Dissipation	P_D	A NC NC		60	78	120	mW	6
		B NC V_{EE}		-	71	-	mW	6
		C V_{EE} NC		-	110	-	mW	6
		D V_{EE} V_{EE}		-	86	-	mW	6
DYNAMIC CHARACTERISTICS:								
Differential Voltage Gain (Single-ended input and output)	A_{DIFF}	f = 1.75 MHz f = 20 MHz		16 10	19 14	- -	dB dB	7, 8
Bandwidth at -3 dB Point	BW	R_S = 50Ω		16	29	-	MHz	NONE
Maximum Output Voltage Swing	$V_{OUT(P-P)}$	R_S = 50Ω f = 1.75 MHz		-	5	-	V_{P-P}	NONE
Noise Figure	NF	f = 1.75 MHz, R_S = 1 KΩ	11	-	5	8	dB	
		f = 11.7 MHz, R_S = 1 KΩ	11	-	7.7	-	dB	9
Common-Mode Rejection Ratio	CMRR	f = 1 KHz		70	88	-	dB	10
Input Impedance Components:								
Parallel Input Resistance	R_{IN}	f = 1.75 MHz		50	140	-	KΩ	11
Parallel Input Capacitance	C_{IN}	f = 1.75 MHz		-	3.4	7	pF	11
Output Resistance	R_{OUT}	f = 1.75 MHz		-	45	70	Ω	NONE
AGC Range (Maximum voltage gain to complete cutoff)	AGC	f = 1.75 MHz		55	60	-	dB	NONE

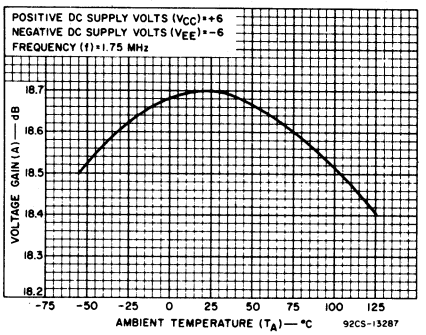


Fig. 7 - Differential voltage gain vs. temperature.

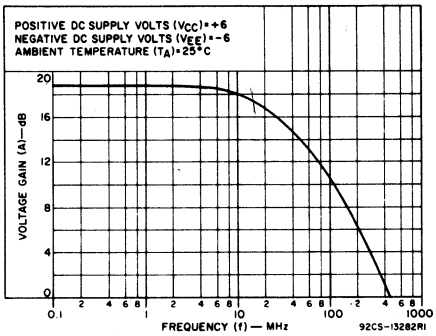


Fig. 8 - Differential voltage gain vs. frequency.

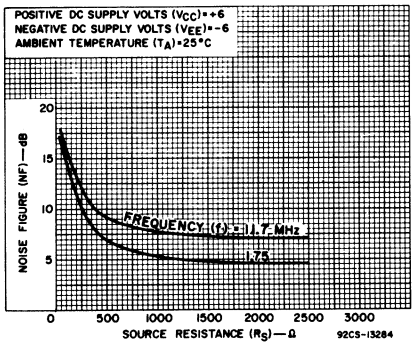


Fig. 9 - Noise figure vs. source resistance and frequency.

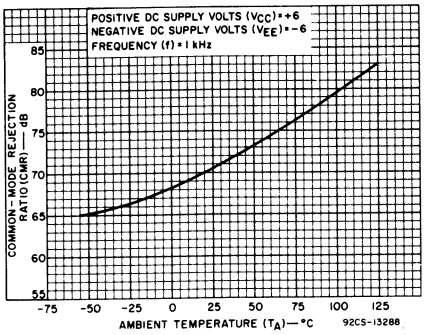


Fig. 10 - Common-mode rejection ratio vs. temperature.

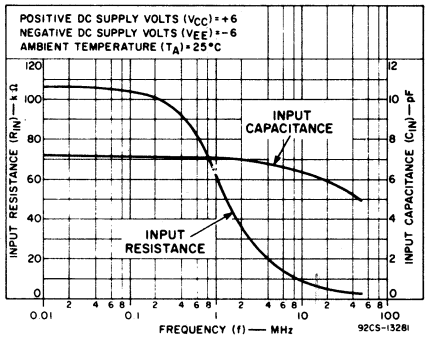
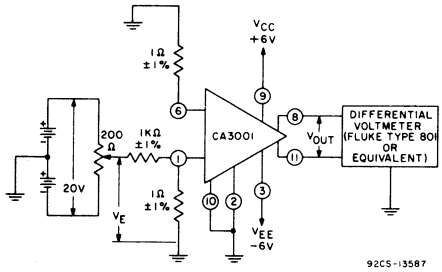


Fig. 11 - Input impedance components vs. frequency.

CA3001



1. Adjust V_E for V_{OUT}(DC) = 0 ± 0.1 V 2. Measure V_E and record input offset voltage (V_{IO}) in mV as $V_{IO} = \frac{V_E}{1000}$

Fig. 12 - Input offset voltage test circuit.

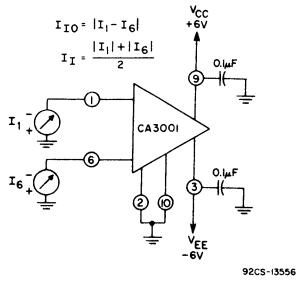
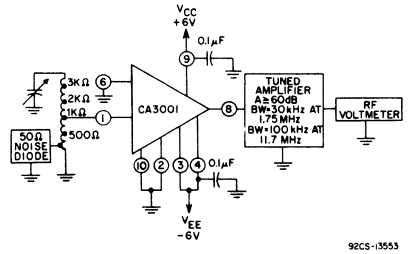


Fig. 13 - Input offset current and input bias current test circuit.



* Separate tuned input circuits are used for 1.75 MHz and 11.7 MHz. Source-resistance matching taps adjusted with circuit tuned to resonance and with 50-ohm resistor connected to simulate noise diode.

Fig. 14 - Noise figure test circuit.

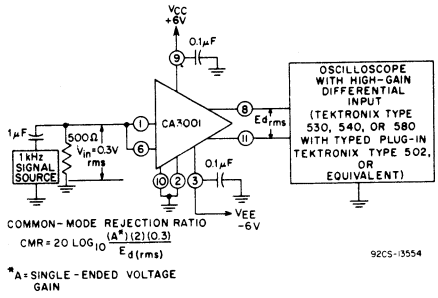


Fig. 15 - Common-mode rejection ratio test circuit.

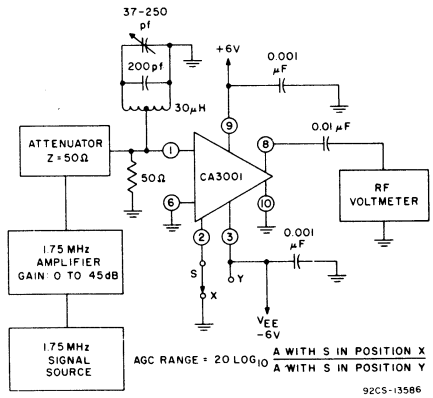


Fig. 16 - AGC range test circuit.

CA3002

IF Amplifier

- Designed for use in Communication Equipment
- Balanced differential amplifier configuration with controlled constant-current source provides outstanding versatility
- 10-Lead hermetic TO-5 style package
- Built-in temperature stability for operation from -55°C to +125°C
- Companion Application Note ICAN-5036 "Application of the RCA-3002 Integrated-Circuit IF Amplifier" covers different operating modes, cross modulation, gain control, 4-stage amplifier design, and an envelope and product detector analysis.

HIGHLIGHTS

- Input Resistance . . . . . 100 kΩ typ.
- Output Resistance . . . . . 70 Ω typ.
- Voltage Gain . . 24 dB typ. @ 1.75 MHz
- Push-Pull Input, Single-Ended Output
- -3 dB Bandwidth . . . . . 11 MHz typ.
- AGC Range . . . . . 80 dB typ.
- Useful Frequency Range DC to . . 15 MHz

APPLICATIONS

- Product Detector
- AM Detector
- IF & Video Amplifier
- Schmitt Trigger

ABSOLUTE-MAXIMUM VOLTAGE AND CURRENT LIMITS, at T_A = 25°C

COMMON-MODE INPUT SIGNAL VOLTAGE	±2 V
MAXIMUM POWER SUPPLY VOLTAGE	16 V or ±8 V
OPERATING-TEMPERATURE RANGE	-55°C to +125°C
STORAGE-TEMPERATURE RANGE	-65°C to +150°C
LEAD TEMPERATURE (During Soldering):	
At distance 1/16 ± 1/32 inch (1.59 ± 0.79mm) from case for 10 seconds max.	+265°C
MAXIMUM INPUT-SIGNAL VOLTAGE	± 4 V
MAXIMUM DEVICE DISSIPATION:	
-55 to 85°C	450 mW
Above 85°C	Derate linearly 5 mW/°C

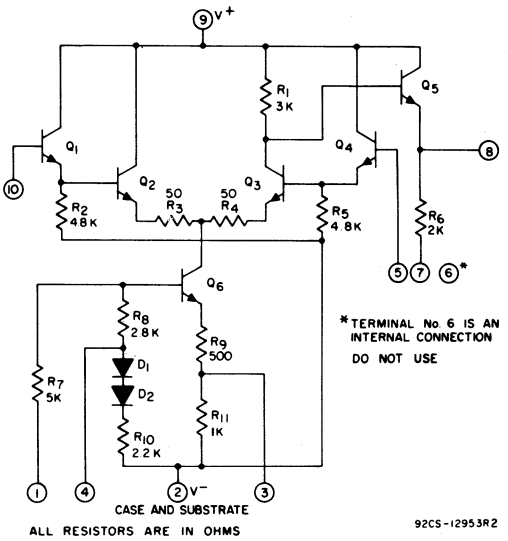


Fig. 1 — Schematic diagram.

STATIC CHARACTERISTICS AND TEST CIRCUITS

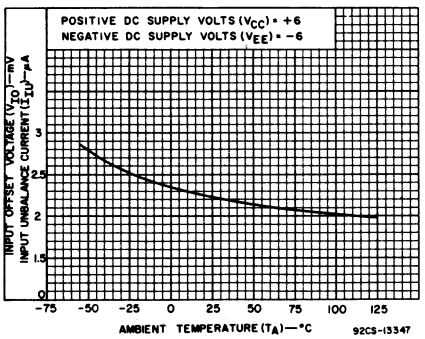


Fig.2 - Input unbalance voltage & current vs temperature.

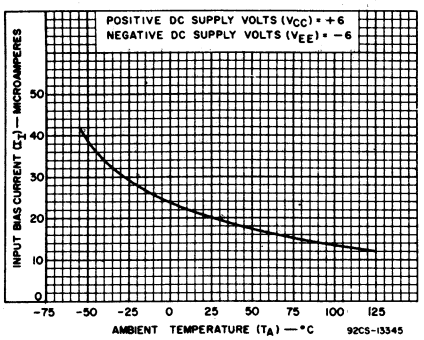


Fig.3 - Input bias current vs temperature.

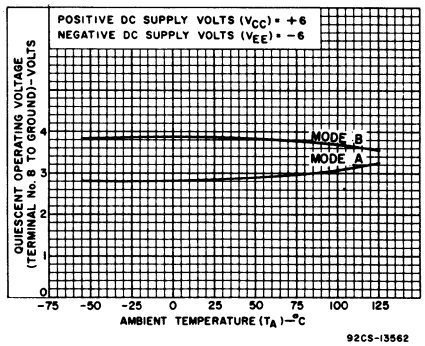


Fig.4 - Quiescent operating voltage vs temperature.

STATIC CHARACTERISTICS AND TEST CIRCUITS

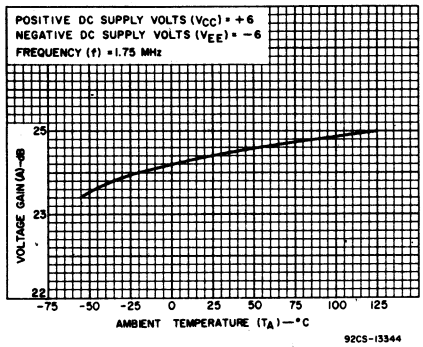


Fig. 5a - Differential voltage gain vs temperature.

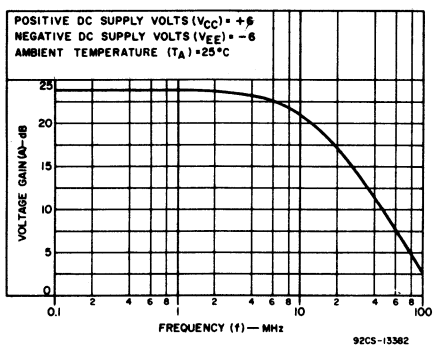


Fig. 5b - Differential voltage gain vs frequency.

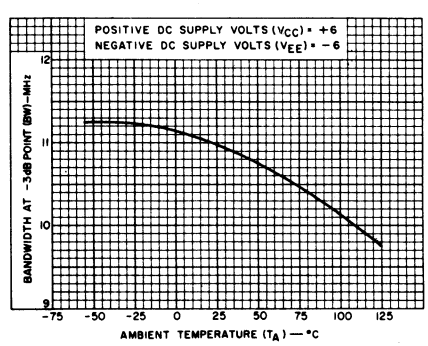


Fig. 6 - Bandwidth at -3 dB point vs temperature.

CA3002

ELECTRICAL CHARACTERISTICS, at T_A = 25°C, V_{CC} = +6 V, V_{EE} = -6 V

CHARACTERISTICS	SYMBOLS	SPECIAL TEST CONDITIONS TERMINALS No.3 & No.4 NOT CONNECTED UNLESS OTHERWISE NOTED	TEST CIRCUITS	LIMITS CA3002				TYPICAL CHARACTERISTICS CURVES
			Fig.	Min.	Typ.	Max.	Units	Fig.
STATIC CHARACTERISTICS:								
Input Offset Voltage	V_{IO}		4	-	2.2	-	mV	2
Input Unbalance Current	I_{IU}			-	2.2	10	μA	2
Input Bias Current	I_I			-	20	36	μA	3
Quiescent Operating Voltage		MODE A: Terminal 2 = V_{EE}, Terminal 4 = NC		-	2.8	-	V	4
		MODE B: Terminal 2 = V_{EE}, Terminal 4 = V_{EE}		-	3.9	-	V	4
Device Dissipation	P_T			-	55	-	mW	None
DYNAMIC CHARACTERISTICS:								
Differential Voltage Gain (Single-Ended Input and Output)	A_{DIFF}	V_{IN} = 10 mV, f = 1.75 MHz, R_S = 50Ω		19	24	-	dB	5 & 15
Bandwidth at -3 dB Point	BW	R_S = 50Ω, V_{IN} = 10 mV		-	11	-	MHz	6
Maximum Output Voltage Swing	$V_{OUT(P-P)}$	-		-	5.5	-	V_{P-P}	None
Noise Figure	NF	f = 1.75 MHz R_S = 1 kΩ	8	-	4	8	dB	7
Input Impedance Components: Parallel Input Resistance	R_{IN}	f = 1.75 MHz	None	-	100k	-	Ω	None
Parallel Input Capacitance	C_{IN}	f = 1.75 MHz	None	-	4	-	pF	None
Output Resistance	R_{OUT}	f = 1.75 MHz	14	-	70	-	Ω	9a & 9b
AGC Range (Maximum Voltage Gain to Complete Cutoff	AGC	f = 1.75 MHz	13	60	80	-	dB	12

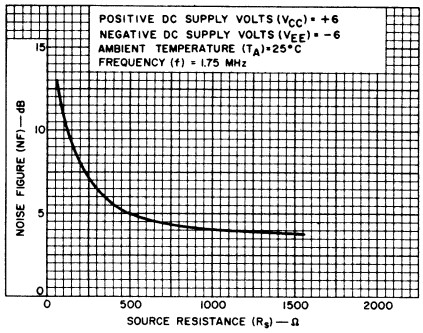
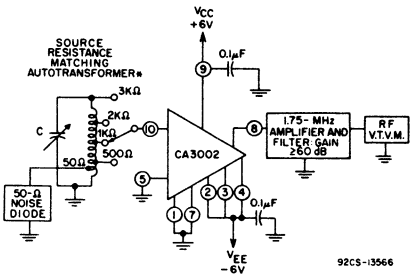


Fig. 7 - Noise figure vs source resistance.



*Taps are adjusted to provide indicated equivalent values of R_S with tank tuned to resonance at 1.75 MHz, and a 50-Ω resistor connected to simulate the noise diode.

Fig. 8 - Noise figure.

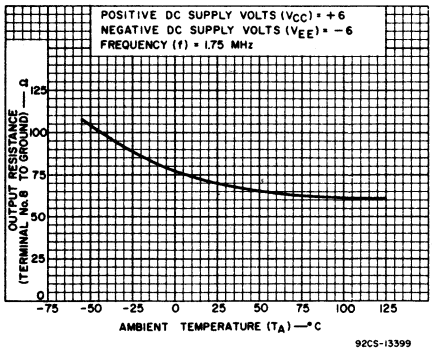


Fig. 9a - Output resistance vs temperature.

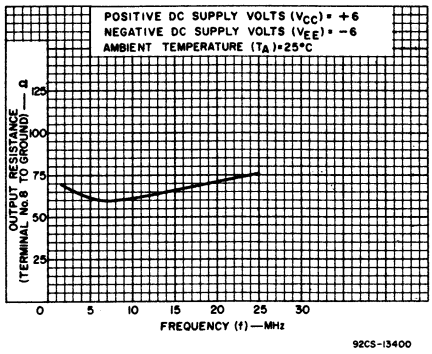


Fig. 9b - Output resistance vs frequency.

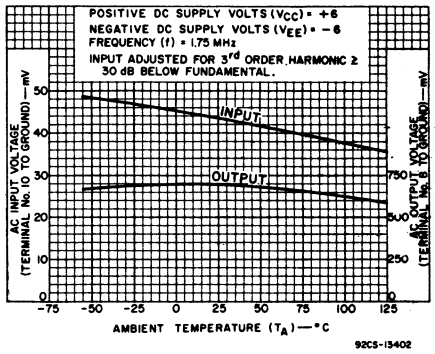
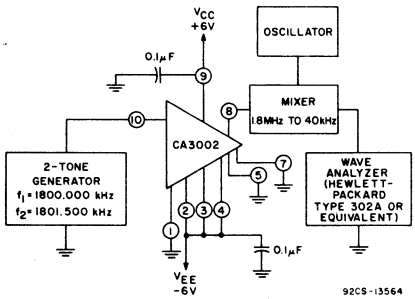


Fig. 10 - Input level for — 30 dB intermodulation vs. temperature



1) Increase both input-signal tones until the $2f_2$-f_1 and $2f_1$-f_2 output-signal voltages are 30 dB below the f_1 and f_2 output-signal voltages.
2) Measure rms values of the input and output signal voltages.
3) The measured input signal voltage is that value when the 3rd-harmonic intermodulation products are 30 dB below the fundamental outputs.

Fig. 11 - Intermodulation Test Circuit.

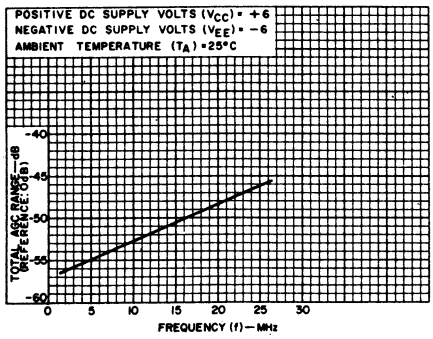
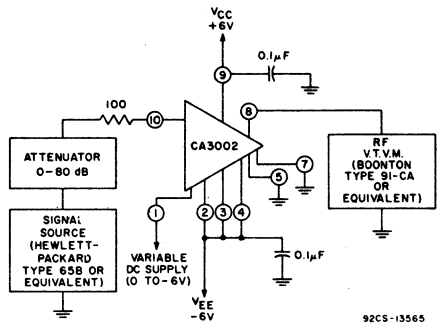


Fig. 12 - AGC range vs frequency.



1) Set attenuator at 80 dB attenuation.
2) Set variable dc supply voltage at 0 V.
3) Increase signal input voltage until RF V.T.V.M. indicates 5 mV output.
4) Set variable dc supply voltage at -6 V.
5) Adjust attenuator until RF V.T.V.M. again indicates 5 mV output.
6) Change in attenuator setting in dB is total AGC Range.

Fig. 13 - AGC range.

CA3004

RF Amplifier

- Designed for use in Communications Equipment
- Balanced Differential-Amplifier Configuration with Controlled Constant-Current Source Provides Unexcelled Versatility
- 12-Lead Hermetic TO-5 Style Package
- Built-in Temperature Stability for Operation from -55° C to +125° C
- Similar to RCA CA3005 and CA3006, plus Emitter-Degeneration Resistors to Provide More Linear Transfer Characteristic and Increased Input-Signal Handling Capability
- Companion Application Note ICAN 5022 "Application of RCA CA3004, CA3005, and CA3006 Integrated Circuit RF Amplifiers", covers characteristics of different operating modes, noise performance, cross-modulation, mixer, AGC, limiter, detector, and amplifier design considerations.
- Push-Pull Input and Output
- Wide and Narrow-Band Amplifier
- AGC
- Detector
- Operation from DC to 100 Mc/s
- Mixer
- Limiter
- Modulator
- RF, IF, and Video Frequency Capability

ABSOLUTE-MAXIMUM VOLTAGE LIMITS, at T_{FA} = 25°C

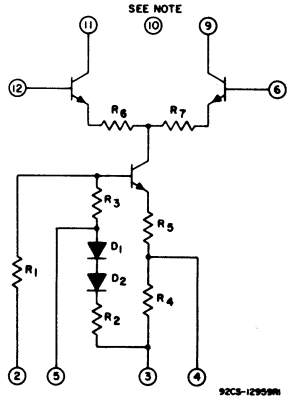
Voltage limits shown for each terminal can be applied under the indicated circuit conditions for other terminals. All voltages are with respect to GROUND (common terminal of Positive and Negative DC Supplies)

TERMINAL	VOLTAGE LIMITS		CONDITIONS	
	NEGATIVE	POSITIVE	TERMINAL	VOLTAGE
1	NO CONNECTION			
2	-9.5	0	6 12 3 9 10 11	0 0 -9.5 +6 +6 +6
3	-12	0	2 6 9 10 11 12	0 0 +6 +6 +6 0
4	-12	0	2 6 9 10 11 12	0 0 +6 +6 +6 0
5	-6	0	2,6,12 3 9 10 11	0 -6 +6 +6 +6
6	-3.5	+3.5	2 3 9 10 11 12	0 -6 +6 +6 +6 0

TERMINAL	VOLTAGE LIMITS		CONDITIONS	
	NEGATIVE	POSITIVE	TERMINAL	VOLTAGE
7	NO CONNECTION			
8	NO CONNECTION			
9	0	+12	2 3 6 10 11 12	0 -6 0 +6 +6 0
10	0	+12	2 3 6 9 11 12	0 -6 0 +6 +6 0
11	0	+12	2 3 6 10 11 12	0 -6 0 +6 +6 0
12	-3.5	+3.5	2 3 6 9 10 11	0 -6 0 +6 +6 +6
CASE	INTERNALLY CONNECTED TO TERMINAL NO.3 (SUBSTRATE) DO NOT GROUND			

OPERATING-TEMPERATURE RANGE	-55°C to +125°C
STORAGE-TEMPERATURE RANGE	-65°C to +150°C
LEAD TEMPERATURE (During Soldering) At distance 1/16 ± 1/32 inch (1.59 ± 0.79mm) from case for 10 seconds max.	+265°C
MAXIMUM SINGLE-ENDED INPUT-SIGNAL VOLTAGE	±3.5 V
MAXIMUM COMMON-MODE INPUT-SIGNAL VOLTAGE	-2.5 V, +3.5 V
MAXIMUM DEVICE DISSIPATION	300 mW

SCHEMATIC DIAGRAM FOR CA3004



NOTE: Connect Terminal No. 10 to most positive dc supply voltage used for circuit.

Fig. 1

TYPICAL STATIC CHARACTERISTICS AND TEST CIRCUITS FOR TYPE CA3004 (Figs. 2 to 8)

INPUT OFFSET VOLTAGE AND CURRENT VS TEMPERATURE

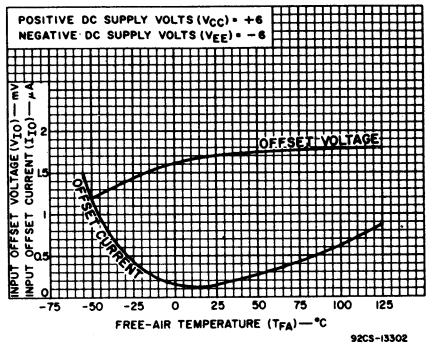


Fig. 2

INPUT BIAS CURRENT VS TEMPERATURE

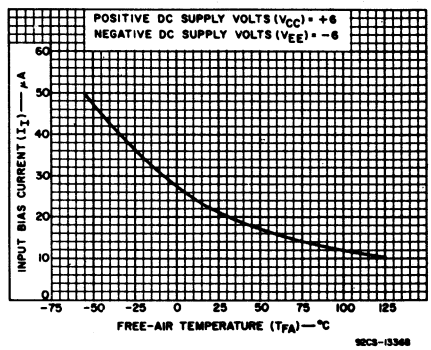


Fig. 3

CA3004

ELECTRICAL CHARACTERISTICS, at T_{FA} = 25° C, V_{CC} = +6V, V_{EE} = -6 V unless otherwise specified

CHARACTERISTICS	SYMBOLS	SPECIAL TEST CONDITIONS Terminals No.4 and No.5 Open Unless Otherwise Specified		TEST CIRCUIT	LIMITS TYPE CA3004				TYPICAL CHARACTERISTICS CURVES
				Fig.	Min.	Typ.	Max.	Units	Fig.
STATIC CHARACTERISTICS									
Input Offset Voltage	V_{IO}			Fig.4	–	1.7	5	mV	Fig.2
Input Offset Current	I_{IO}			Fig.5	–	0.125	5	μA	Fig.2
Input Bias Current	I_I			Fig.5	–	21	40	μA	Fig.3
Quiescent Operating Current	I_9 or I_{11}	TERMINALS 4	5						
		NC	NC	Fig.8	–	1	–	mA	Fig.6
		V_{EE}	NC	Fig.8	–	2.7	–	mA	Fig.6
		NC	V_{EE}	Fig.8	–	0.45	–	mA	Fig.6
		V_{EE}	V_{EE}	Fig.8	–	1.25	–	mA	Fig.6
Quiescent Operating Current Ratio	I_9/I_{11}	-		Fig.8	–	1.1	–	–	Fig.7
Device Dissipation	P_T			Fig.8	–	26	–	mW	NONE
DYNAMIC CHARACTERISTICS									
Power Gain	G_P	f = 100 Mc/s		Fig.11	10	12	–	dB	Fig.9
Noise Figure	NF	f = 100 Mc/s		Fig.11	–	6.3	9	dB	Fig.10
Common Mode Rejection Ratio	CMR	f = 1 Kc/s		Fig.13	–	98	–	dB	Fig.12
AGC Range (Max. Voltage Gain to Complete Cutoff)	AGC	f = 1.75 Mc/s		Fig.14	-60	–	–	dB	NONE

INPUT OFFSET VOLTAGE TEST CIRCUIT

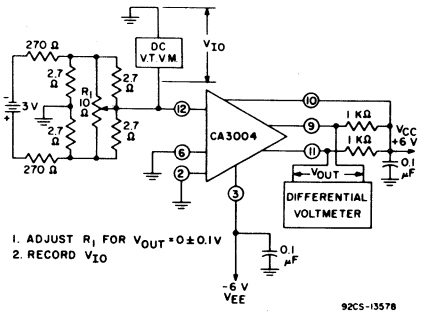


Fig.4

INPUT OFFSET CURRENT AND BIAS CURRENT TEST CIRCUIT

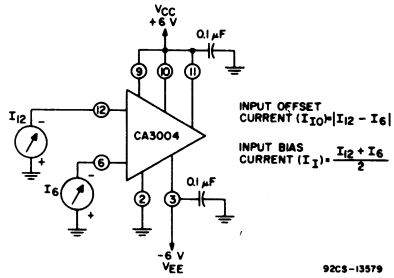


Fig.5

QUIESCENT OPERATING CURRENT VS TEMPERATURE

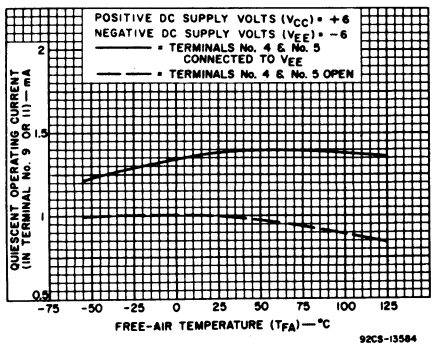


Fig.6

DEFINITIONS OF TERMS

Input Offset Voltage

The difference in the dc voltages which must be applied to the input terminals to obtain equal quiescent operating voltages (zero output offset voltage) at the output terminals.

Input Offset Current

The difference in the currents at the two input terminals when the quiescent operating voltages at the two output terminals are equal.

Input Bias Current

The average value (one-half the sum) of the currents at the two input terminals when the quiescent operating voltages at the two output terminals are equal.

Quiescent Operating Current

The average (dc) value of the current in either output terminal.

Quiescent Operating Current Ratio

The ratio of the Quiescent operating currents in the two output terminals.

Device Dissipation

The total power drain of the device with no signal applied and no external load current.

Power Gain

The ratio of the signal power developed at the output of the device to the signal power applied to the input, expressed in dB.

Noise Figure

The ratio of the total noise power of the device and a resistive signal source to the noise power of the signal source alone, the signal source representing a generator of zero impedance in series with the source resistance.

Common-Mode Rejection Ratio

The ratio of the full differential voltage gain to the common-mode voltage gain.

Common-Mode Voltage Gain

The ratio of the signal voltages developed between the two output terminals to the signal voltage applied to the two input terminals connected in parallel for ac.

Differential Voltage Gain

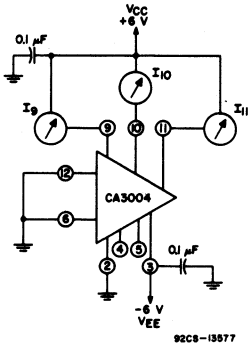
The ratio of the change in output voltage at either output terminal with respect to ground, to a change in input voltage at either input terminal with respect to ground, with the other input terminal at ac ground.

AGC Range

The total change in voltage gain (from maximum gain to complete cutoff) which may be achieved by application of the specified range of dc voltage to the AGC input terminal of the device.

TEST CIRCUIT FOR TYPE CA3004

QUIESCENT OPERATING CURRENT, QUIESCENT OPERATING CURRENT RATIO, AND DEVICE DISSIPATION TEST CIRCUIT



$P_T = V_{CC}(I_9 + I_{10} + I_{11}) + V_{EE} I_3$

Fig.8

QUIESCENT OPERATING CURRENT RATIO VS TEMPERATURE

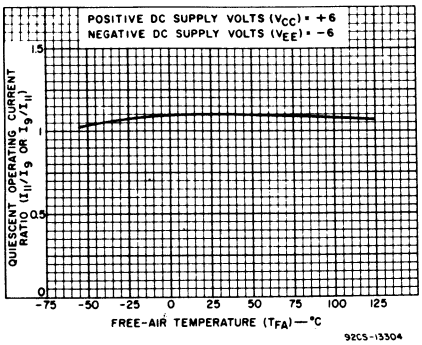


Fig.7

CA3004

TYPICAL DYNAMIC CHARACTERISTICS AND TEST CIRCUITS FOR TYPE CA3004 (Figs. 9 to 14)

POWER GAIN VS FREQUENCY

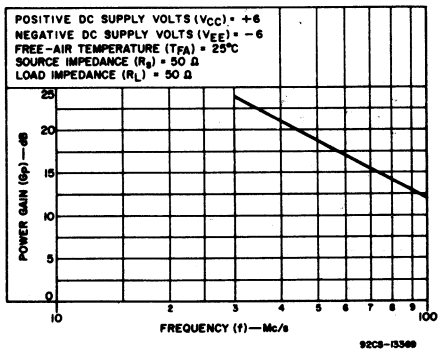


Fig. 9

NOISE FIGURE VS FREQUENCY

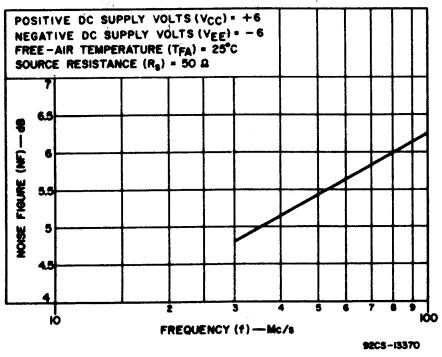


Fig. 10

100 Mc/s POWER GAIN AND NOISE FIGURE TEST CIRCUIT

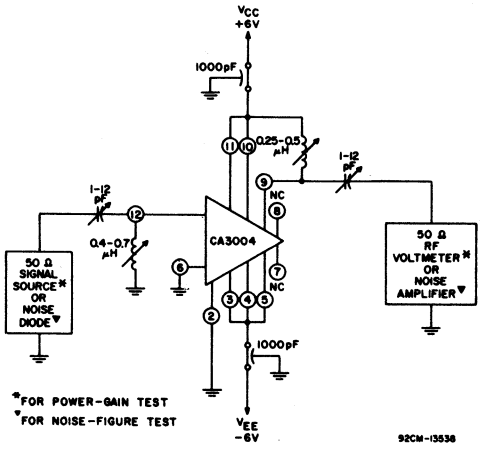


Fig. 11

COMMON-MODE REJECTION RATIO VS TEMPERATURE

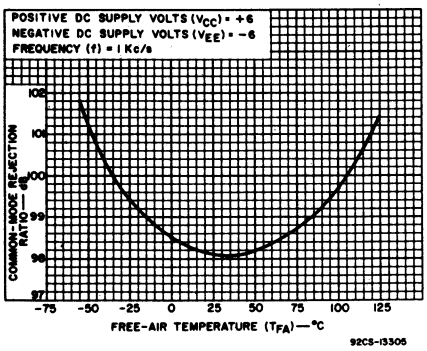


Fig. 12

COMMON-MODE REJECTION RATIO TEST CIRCUIT

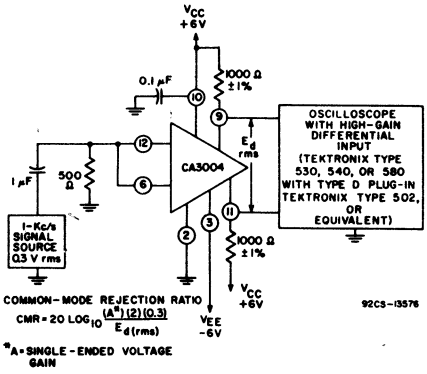


Fig. 13

AGC RANGE TEST CIRCUIT

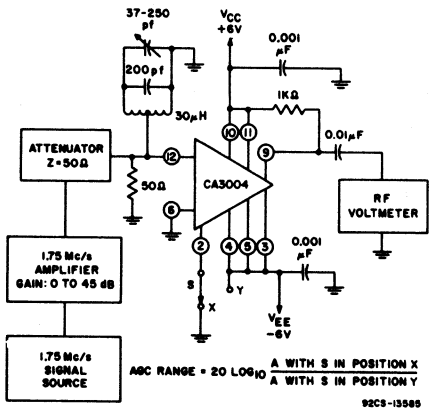


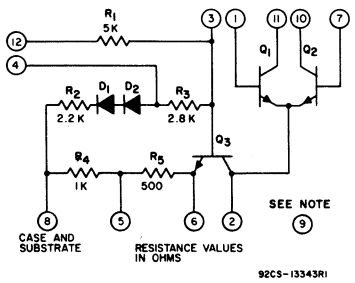
Fig. 14

CA3005, CA3006

RF Amplifiers

- Designed for use in Communications Equipment
- Balanced Differential Amplifier Configuration with Controlled Constant-Current Source to Provide Unexcelled Versatility
- 12-Lead Hermetic TO-5 Style Package.
- Built-in Temperature Stability for Operation from -55° C to +125° C
- Companion Application Note, ICAN 5022 "Application of RCA CA3004, CA3005, and CA3006 Integrated Circuit RF Amplifiers", covers characteristics of different operating modes, noise performance, cross-modulation, mixer, AGC limiter, detector, and amplifier design considerations.
- Push-Pull Input and Output
- Wide and Narrow Band Amplifier
- AGC
- Detector
- RF, IF, and Video Frequency Capability
- Operation from DC to 100 MHz
- Mixer
- Limiter
- Modulator
- Cascode Amplifier

SCHEMATIC DIAGRAM FOR CA3005 AND CA3006



NOTE: Connect Terminal No.9 to most positive dc supply voltage used for circuit.

Fig.1

ABSOLUTE-MAXIMUM VOLTAGE LIMITS, at T_{FA} = 25°C

Voltage limits shown for each terminal can be applied under the indicated voltage conditions for other terminals.
All voltages are with respect to GROUND (common terminal of Positive and Negative DC Supplies)

TERMINAL	VOLTAGE LIMITS		CONDITIONS	
	NEGATIVE	POSITIVE	TERMINAL	VOLTAGE
1	-3.5	+3.5	7	0
			8	-6
			9	+6
			10	+6
			11	+6
			12	0
2	TEST POINT: DO NOT APPLY VOLTAGE FROM EXTERNAL SOURCE			
3	-9.5	0	1	0
			7	0
			8	-9.5
			9	+6
			10	+6
			11	+6
			12	0
4	-6	0	1	0
			7	0
			8	- 6
			9	+6
			10	+6
			11	+6
			12	0
5	-12	0	1	0
			7	0
			9	+6
			10	+6
			11	+6
			12	0
6	-6	0	1	0
			7	0
			9	+6
			10	+6
			11	+6
			12	-6
7	-3.5	+3.5	1	0
			8	-6
			9	+6
			10	+6
			11	+6
			12	0

TERMINAL	VOLTAGE LIMITS		CONDITIONS	
	NEGATIVE	POSITIVE	TERMINAL	VOLTAGE
8	-12	0	1	0
			7	0
			9	+6
			10	+6
			11	+6
			12	0
9	0	+12	1	0
			7	0
			8	-6
			10	+6
			11	+6
			12	0
10	0	+12	1	0
			7	0
			8	-6
			9	+6
			11	+6
			12	0
11	0	+12	1	0
			7	0
			8	-6
			9	+6
			10	+6
			12	0
12	-9.5	0	8	-9.5
			9	+6
			10	+6
			11	+6
CASE	Internally connected to Terminal No.8 (substrate) DO NOT GROUND			

OPERATING-TEMPERATURE RANGE . . . . . -55°C to +125°C

STORAGE-TEMPERATURE RANGE . . . . . -65°C to +150°C

LEAD TEMPERATURE (During Soldering)
At distance 1/16 ± 1/32 inch (1.59 ± 0.79mm) from case for 10 seconds max. . . . . +265°C

MAXIMUM SINGLE-ENDED INPUT-SIGNAL VOLTAGE . . . . . ±3.5 V

MAXIMUM COMMON-MODE INPUT-SIGNAL VOLTAGE . . . . . -2.5 V, +3.5 V

MAXIMUM DEVICE DISSIPATION . . . . . 300 mW

INPUT OFFSET VOLTAGE AND CURRENT

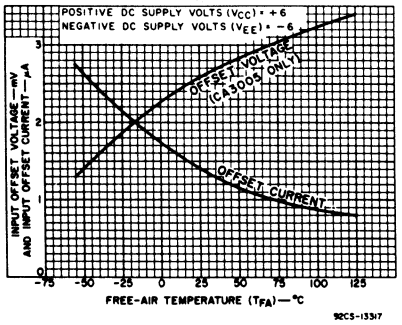


Fig.2

INPUT OFFSET VOLTAGE TEST CIRCUIT

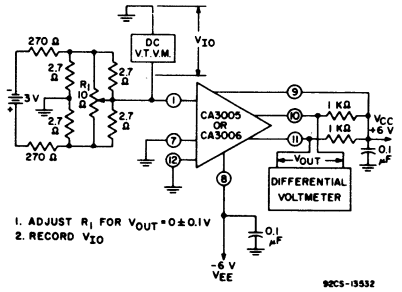


Fig.3

INPUT BIAS CURRENT

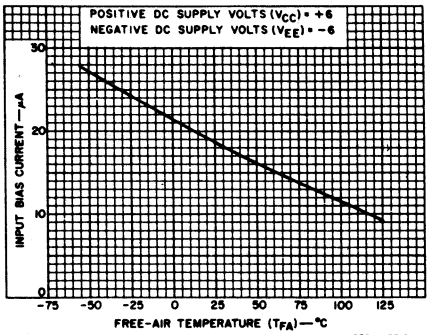


Fig.4

CA3005, CA3006

ELECTRICAL CHARACTERISTICS, at T_A = 25° C, V_{CC} = +6V, V_{EE} = -6V

CHARACTERISTICS	SYMBOLS	SPECIAL TEST CONDITIONS Terminals No.3,4,5, and 6 Not Connected Except Where Noted	TEST CIRCUITS	LIMITS TYPE CA3005			LIMITS TYPE CA3006				TYPICAL CHARACTERISTICS CURVES
			Fig.	Min.	Typ.	Max.	Min.	Typ.	Max.		Fig.
STATIC CHARACTERISTICS											
Input Offset Voltage	V_{IO}		Fig.3	–	2.6	5	–	0.8	1	mV	Fig.2
Input Offset Current	I_{IO}		Fig.4	–	1.4	–	–	1.4	–	μA	Fig.2
Input Bias Current	I_{IB}		Fig.4	–	19	40	–	19	40	μA	Fig.5
Quiescent Operating Current	I_{10} or I_{11}	TERMINALS 4 / 5: NC / NC	Fig. 10	–	1	–	–	1	–	mA	Fig.6
		NC / -VEE	Fig. 10	–	2.7	–	–	2.7	–	mA	NONE
		-VEE / NC	Fig. 10	–	0.45	–	–	0.45	–	mA	NONE
		-VEE / -VEE	Fig. 10	–	1.25	–	–	1.25	–	mA	Fig.6
Quiescent Operating Current Ratio	$\frac{I_{10}}{I_{11}}$		Fig. 10	–	1.05	–	–	1.05	–	–	Fig.7
Device Dissipation	P_T		Fig. 10	–	26	–	–	26	–	mW	NONE
DYNAMIC CHARACTERISTICS											
Power Gain	G_p	f = 100 MHz, Cascode Configuration	Fig. 11	16	20	–	16	20	–	dB	Fig.9
		f = 100 MHz, Differential-Ampl. Configuration	Fig.12	14	16	–	14	16	–	dB	Fig.11
Noise Figure	NF	f = 100 MHz, Cascode Configuration	Fig. 11	–	7.8	9	–	7.8	9	dB	Fig.13
		f = 100 MHz, Differential Ampl. Configuration	Fig.12	–	7.8	9	–	7.8	9	dB	Fig.14
Common-Mode Rejection Ratio	CMR	f = 1 kHz		–	101	–	–	101	–	dB	Fig.15
AGC Range (Max. Voltage Gain to Complete Cutoff)	AGC	f = 1.75 MHz		-60	–	–	-60	–	–	dB	NONE

QUIESCENT OPERATING CURRENT

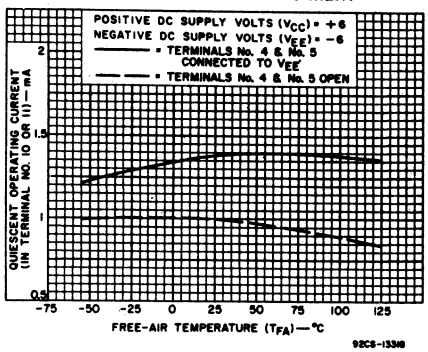


Fig. 5

QUIESCENT OPERATING CURRENT RATIO

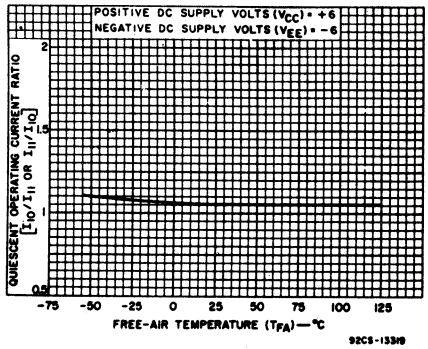


Fig. 6

100-Mc/s NOISE FIGURE VS. V_{EE} (CASCODE CONFIGURATION)

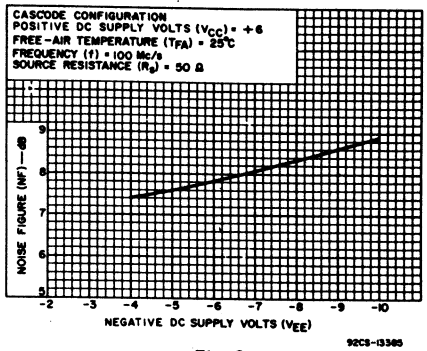


Fig. 9

POWER-GAIN (CASCODE CONFIGURATION)

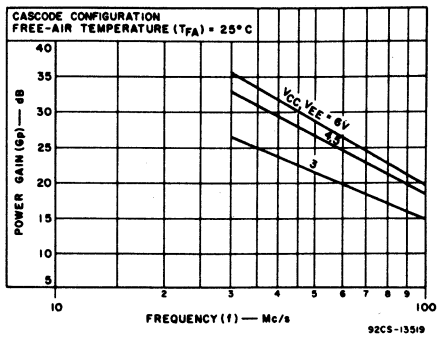


Fig. 7

POWER-GAIN (DIFFERENTIAL-AMPLIFIER CONFIGURATION)

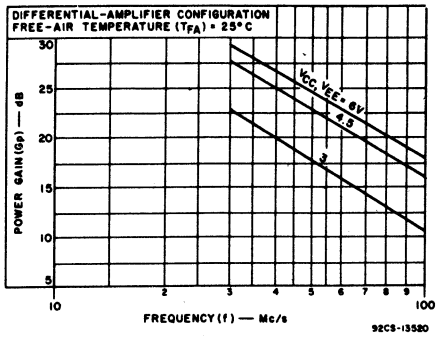
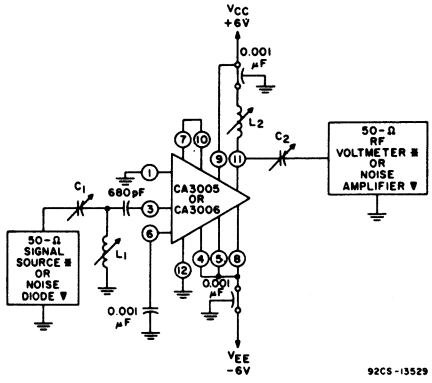


Fig. 8

NOISE FIGURE AND POWER GAIN TEST CIRCUIT (CASCODE CONFIGURATION)



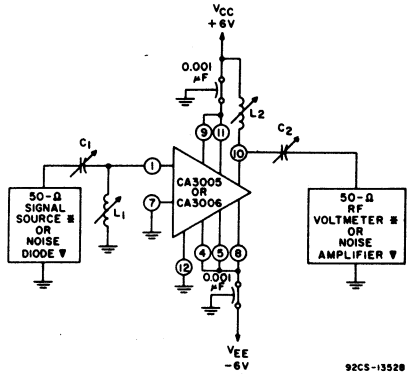
f Mc/s	C_1 pF	C_2 pF	L_1 μH	L_2 μH
30	14-150	5-40	0.3-0.6	0.8-1.4
100	5-40	5-40	0.07-0.12	0.15-0.3

* FOR POWER-GAIN TEST

▼ FOR NOISE-FIGURE TEST

Fig. 10

NOISE FIGURE AND POWER-GAIN TEST CIRCUIT (DIFFERENTIAL AMPLIFIER CONFIGURATION)



f Mc/s	C_1 pF	C_2 pF	L_1 μH	L_2 μH
30	5-40	1.5-20	1.2-2	1.2-2
100	1-12	1-12	0.4-0.7	0.25-0.5

* FOR POWER-GAIN TEST

▼ FOR NOISE-FIGURE TEST

Fig. 11

100 Mc/s NOISE FIGURE VS. V_{EE} (DIFFERENTIAL AMPLIFIER CONFIGURATION)

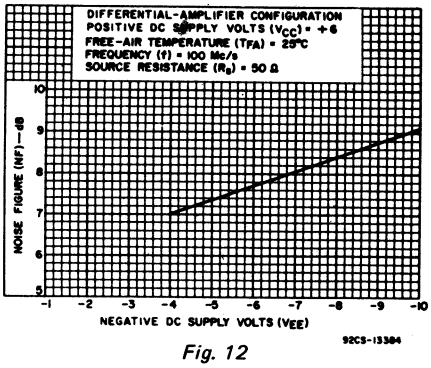


Fig. 12

CA3005, CA3006

COMMON-MODE-REJECTION RATIO

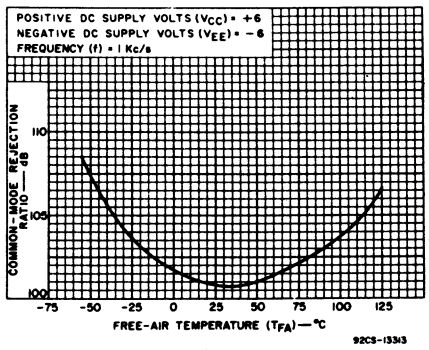


Fig. 13

COMMON–MODE-REJECTION RATIO
TEST CIRCUIT

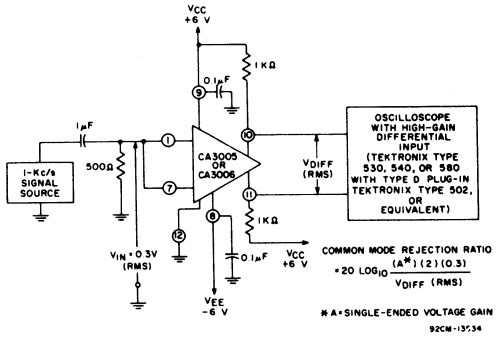


Fig. 14

AGC RANGE TEST CIRCUIT

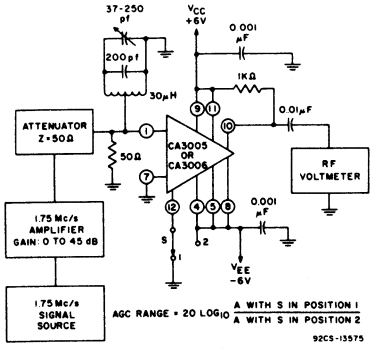


Fig. 15

CA3007

AF Amplifier

- Designed for use in Sound Systems and Communication Equipment
- Balanced differential-amplifier configuration with controlled constant-current source provides for both audio amplification and phase inversion
- Built-in temperature stability for operation from -55°C to +125°C
- Eliminates need for audio driver transformer
- Companion Application Note, ICAN 5037 "Application of the RCA-CA3007 Integrated Circuit Audio Driver" covers design of a dual supply audio driver in a direct-coupled audio amplifier, and a single supply audio driver in a capacitor-coupled audio amplifier
- Supplied in the hermetic 12-lead TO-5 style package

HIGHLIGHTS

- Input Impedance . . . . 4 kΩ typ.
- Output Impedance . . . 60 Ω typ.
- Power Gain . . . . . 22 dB typ.
- Push-Pull Input & Output
- Direct Coupling to Class B Audio Output Stage

APPLICATIONS

- Audio Amplifier
- Audio Driver

OPERATING-TEMPERATURE RANGE	-55°C to +125°C
STORAGE-TEMPERATURE RANGE	-65°C to +150°C
LEAD TEMPERATURE (During Soldering) At distance 1/16 ± 1/32 inch (1.59 ± 0.79mm) from case for 10 seconds max.	+265°C
MAXIMUM SINGLE-ENDED INPUT-SIGNAL VOLTAGE	±2.5 V
MAXIMUM COMMON-MODE INPUT-SIGNAL VOLTAGE	±2.5 V
MAXIMUM DEVICE DISSIPATION	300 mW

ELECTRICAL CHARACTERISTICS, at T_{FA} = 25°C, V_{CC} = +6 V, V_{EE} = -6 V,

CHARACTERISTICS	SYMBOLS	SPECIAL TEST CONDITIONS Pin 4 Not Connected Unless Otherwise Noted	TEST CIRCUITS	LIMITS TYPE CA3007				TYPICAL CHARACTERISTICS CURVES
			Fig.	Min.	Typ.	Max.	Units	Fig.
STATIC CHARACTERISTICS								
Input Unbalance Voltage	V_{IU}		3	–	0.57	5	mV	2
Input Unbalance Current	I_{IU}		3	–	0.57	5	μA	2
Input Bias Current	I_I		3	–	11	34	μA	4
Quiescent Operating Voltage	V_8 or V_{10}		3	–	0.87	–	V	5
Device Dissipation	P_T		3	–	30	–	mW	NONE
DYNAMIC CHARACTERISTICS								
Power Gain	G_P	f = 1 Kc/s	6	20	22	–	dB	NONE
Total Harmonic Distortion	THD	f = 1 Kc/s	6	–	0.28	–	%	NONE
Input Impedance	Z_{IN}	f = 1 Kc/s	7	–	4K	–	Ω	NONE
Common-Mode Rejection Ratio	CMR	f = 1 Kc/s	9(A) 9(B)	–	77	–	dB	8

SCHEMATIC DIAGRAM

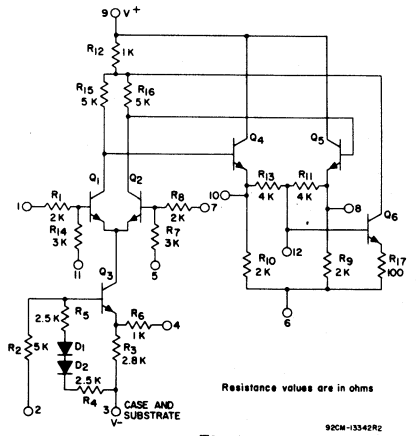


Fig.1

TYPICAL STATIC CHARACTERISTICS AND TEST CIRCUIT FOR CA3007

INPUT UNBALANCE VOLTAGE AND CURRENT vs TEMPERATURE

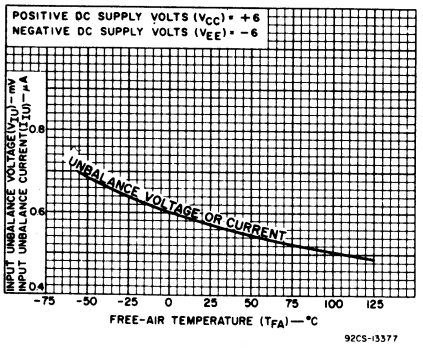
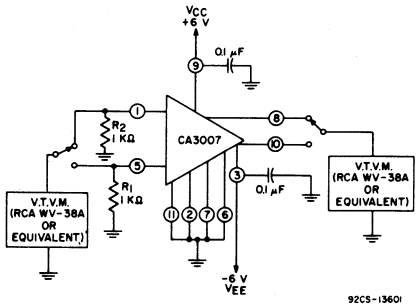


Fig.2

INPUT UNBALANCE VOLTAGE & CURRENT, INPUT BIAS CURRENT, QUIESCENT OPERATING VOLTAGE, AND DEVICE DISSIPATION TEST CIRCUIT



R_1 and R_2 matched to ±1%.

$P_T = V_{CC}I_9 + V_{EE}I_3$

I_9 = Direct Current into Terminal No.9

I_3 = Direct Current out of Terminal No.3

Fig.3

INPUT BIAS CURRENT vs TEMPERATURE

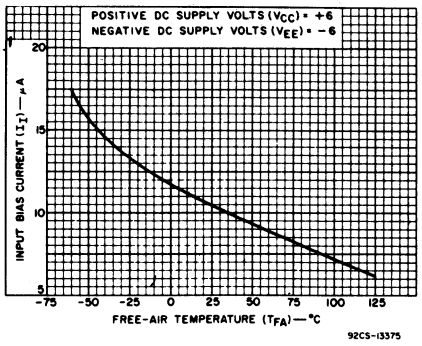


Fig.4

QUIESCENT OPERATING VOLTAGE vs TEMPERATURE

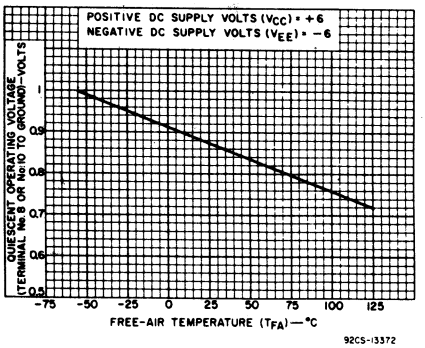


Fig.5

CA3007

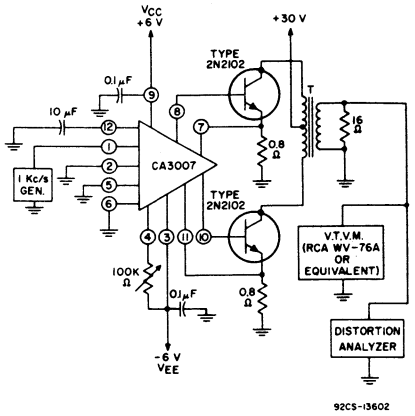
ABSOLUTE-MAXIMUM VOLTAGE LIMITS, at T_A = 25° C

Indicated voltage limits for each terminal can be applied under the specified operating conditions for other terminals. All voltages are with respect to ground (-V_{CC}, +V_{EE}, or common terminal of Positive and Negative DC supplies).

TERMINAL	VOLTAGE LIMITS		CONDITIONS	
	NEGATIVE	POSITIVE	TERMINAL	VOLTAGE
1	-2.5	+2.5	2	0
			3	-6
			6	0
			7	0
			9	+6
			11	0
2	-8	0	3	-8
			6	0
			7	0
			9	+6
			11	0
3	-10	0	6	0
			7	0
			9	+6
			11	0
4	-8.5	0	6	0
			7	0
			9	+6
			11	0
5	-2.5	+2.5	2	0
			3	-6
			6	0
			7	0
			9	+6
			11	0
6	-3	0	2	0
			3	-6
			7	0
			9	+6
			11	0
7	-2.5	+2.5	1	0
			2	0
			3	-6
			5	0
			6	0
			9	+6
8	-2	0	2	0
			3	-6
			6	0
			7	0
			9	+6
			11	0
9	0	+10	2	0
			3	-6
			6	0
			7	0
			11	0
10	-2	0	2	0
			3	-6
			6	0
			7	0
			9	+6
			11	0
11	-2.5	+2.5	1	0
			2	0
			3	-6
			6	0
			7	0
			9	+6
12	-2	0	2	0
			3	-6
			6	0
			7	0
			9	+6
			11	0
CASE	INTERNALLY CONNECTED TO TERMINAL No.3 (SUBSTRATE) DO NOT GROUND			

TYPICAL DYNAMIC CHARACTERISTIC AND TEST CIRCUITS FOR CA3007

POWER GAIN AND TOTAL HARMONIC DISTORTION TEST CIRCUIT



T (Output Transformer):
Primary Impedance = 2000 Ω C.T.
Secondary Impedance = 16 Ω
Efficiency = 45% approx.
(STANCOR TYPE TA-10 OR EQUIVALENT)

Fig.6

INPUT IMPEDANCE TEST CIRCUIT

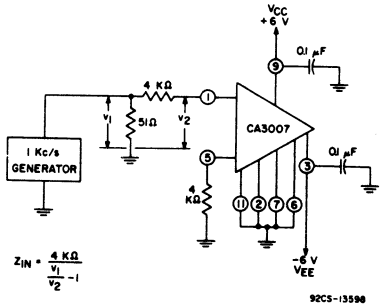


Fig.7

COMMON-MODE REJECTION RATIO vs TEMPERATURE

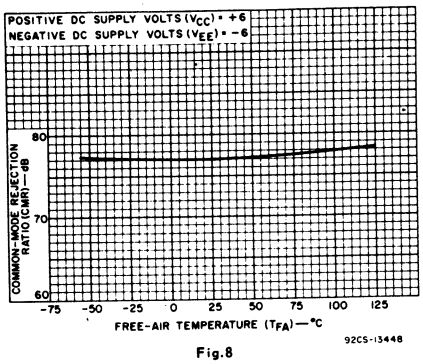
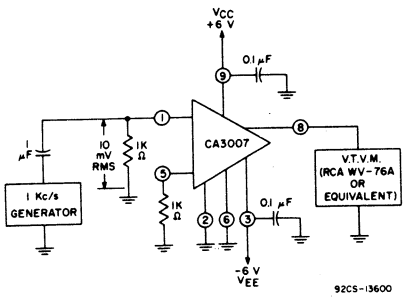
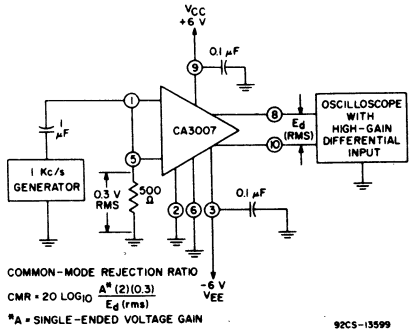


Fig.8

COMMON-MODE REJECTION-RATIO TEST CIRCUITS



(A) Single-Ended Differential Voltage Gain



(B) Common-Mode Voltage Gain

Fig.9