CA3002

NOT RECOMMENDED FOR NEW DESIGNS SEE CA3028A, B

May 1990

IF Amplifier

For Use in Communication Equipment

Features:

- *Input resistance - 100 kΩ typ.*
- *Output resistance - 70Ωtyp.*
- *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*
- *IF & video amplifier*
- *AM detector*
- *Schmitt trigger*

The CA3002 integrated-circuit IF amplifier is a balanced differential amplifier that can be used with either a single-ended or a push-pull input and can provide either a direct-coupled or a capacitance-coupled single-ended output. Its applications include RC-coupled IF amplifiers that use the internal silicon output-coupling capacitor, video amplifiers that use an external coupling capacitor, envelope detectors, product detectors, and various trigger circuits.

The CA3002 is supplied in the 10-lead hermetic TO-5 style package.

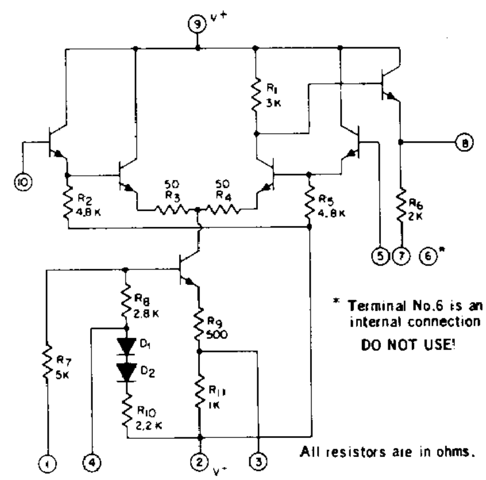

Figure 1 - Schematic diagram.

File Number 123

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 ± 0.79 mm) 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

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

CHARACTERISTICS	SPECIAL TEST CONDITIONS TERMINALS No. 3 & No. 4 NOT CONNECTED UNLESS OTHERWISE NOTED			TEST CIRCUITS Fig.	LIMITS CA3002 Min.	Typ.	Max.	UNITS
STATIC CHARACTERISTICS								
Input Unbalance Voltage V_{IU}				4	–	2.2	–	mV
Input Unbalance Current I_{IU}				5	–	2.2	10	μA
Input Bias Current I_I				5	–	20	36	μA
Quiescent Operating Voltage	MODE	TERMINAL 2	TERMINAL 4					
	A	V_{EE}	NC	7a	–	2.8	–	V
	B	V_{EE}	V_{EE}	8b	–	3.9	–	V
Device Dissipation P_T				4	–	55	–	mW
DYNAMIC CHARACTERISTICS								
Differential Voltage Gain A_{DIF} (Single-Ended Input and Output)	f = 1.75 MHz			10	19	24	–	dB
Bandwith at −3 dB Point BW	–			10	–	11	–	MHz
Maximum Output Voltage Swing V_{OUT}(P-P)	–			10	–	5.5	–	V_{P-P}
Noise Figure NF	f = 1.75 MHz R_S = 1 kΩ			12	–	4	8	dB
Input Impedance Components: Parallel Input Resistance R_{IN}	f = 1.75 MHz			None	–	100k	–	Ω
Parallel Input Capacitance C_{IN}	f = 1.75 MHz			None	–	4	–	pF
Output Resistance R_{OUT}	f = 1.75 MHz			14	–	70	–	Ω
3rd Harmonic Intermodulation Distortion IMD	–			16	−30	−40	–	dB
AGC Range (Maximum Voltage Gain to Complete Cutoff AGC	f = 1.75 MHz			18	60	80	–	dB

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 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 OR CURRENT LIMITS		CONDITIONS	
	NEGATIVE	POSITIVE	TERMINAL	VOLTAGE
1	−8 V	0 V	2, 7 5, 10 9	−8 0 +6
2	−10 V	0 V	1, 5, 10 9	0 +6
3	−8.5 V	0 V	1, 5, 10 7 9	0 −6 +6
4	−8 V	0 V	1, 5, 10 2, 7 9	0 −8 +6
5	−3.5 V	+3.5 V	1, 10 2, 7 9	0 −6 +6
6	INTERNAL CONNECTION DO NOT USE			
7	−12 V	0 V	1, 5, 10 2 9	0 −6 +6
8	20 mA		1, 5, 10 2 9 200 Ω Resistor Between Terminals 7 & 8	0 −6 +6
9	0 V	+10 V	1, 5, 10 2, 3, 7	0 −6
10	−3.5 V	+3.5 V	1, 5 2, 7 9	0 −6 +6
CASE	INTERNALLY CONNECTED TO TERMINAL No.2 (SUBSTRATE) DO NOT GROUND			

STATIC CHARACTERISTICS

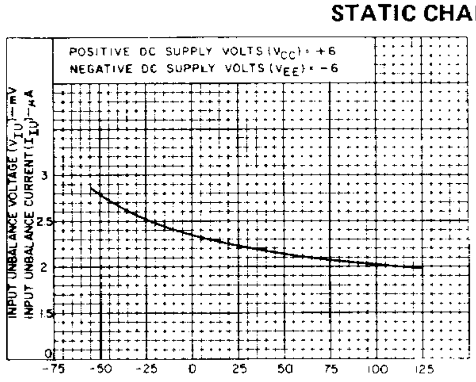

Fig. 2 – Input unbalance voltage & current vs temperature.

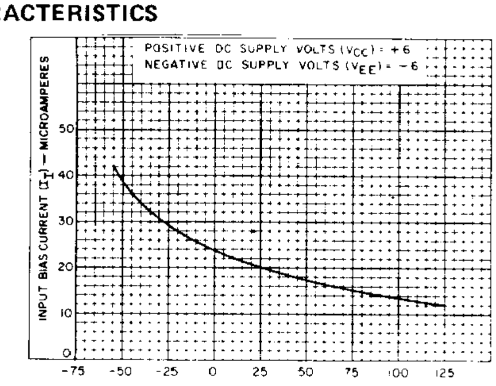

Fig. 3 – Input bias current vs temperature.

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DIFFERENTIAL AMPLIFIERS

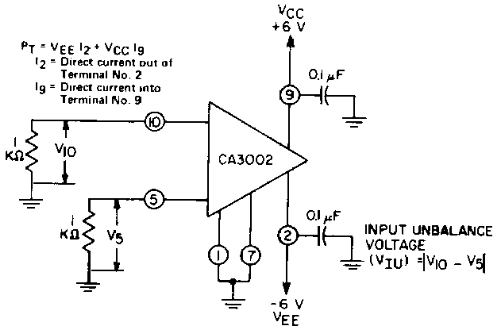


Fig. 4 – Input unbalance voltage and device dissipation test circuit.

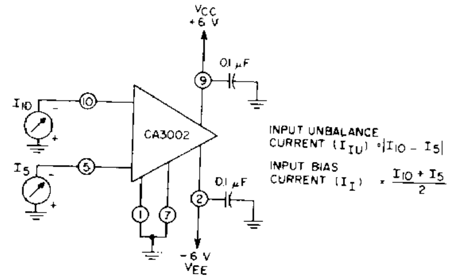


Fig. 5 – Input unbalance current & bias current test circuit.

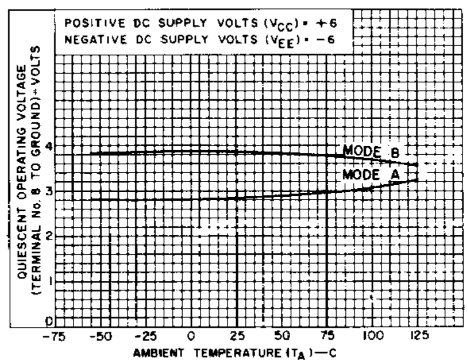


Fig. 6 – Quiescent operating voltage vs temperature.

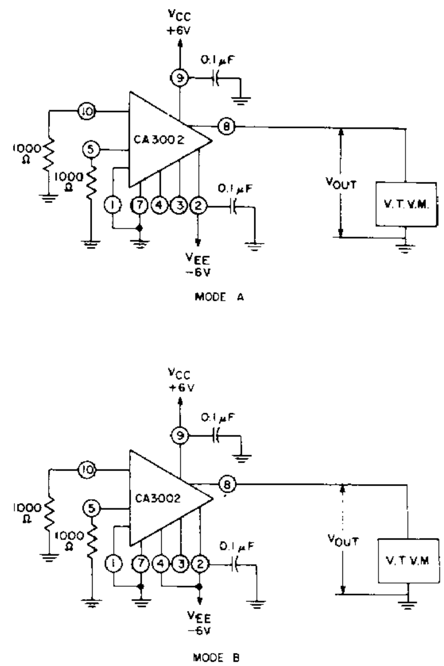


Fig. 7 – Quiescent operating voltage.

DYNAMIC CHARACTERISTICS

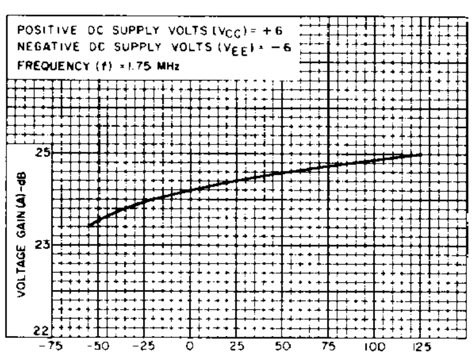


Fig. 8a – Differential voltage gain vs temperature.

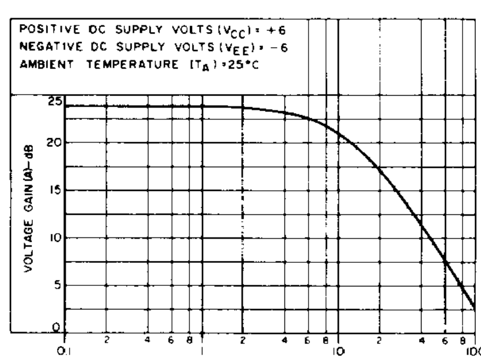


Fig. 8b – Differential voltage gain vs frequency.

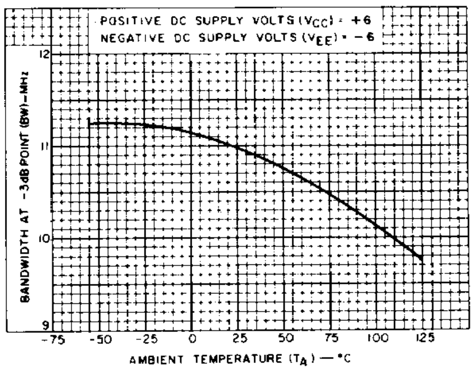


Fig. 9 – Bandwidth of −3 dB point vs temperature.

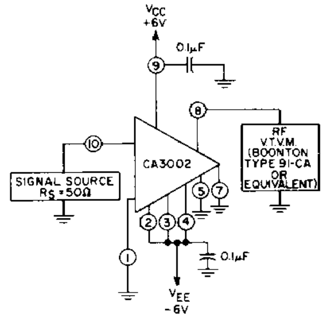


Fig. 10 – Differential voltage gain, −3 dB bandwidth, and maximum output voltage swing.

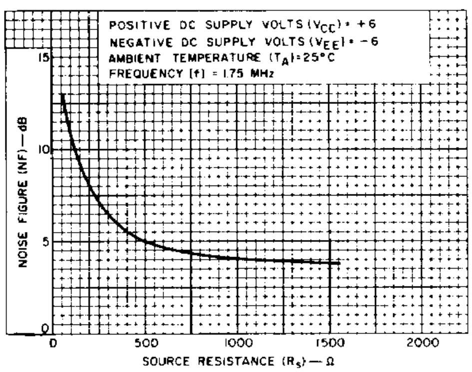
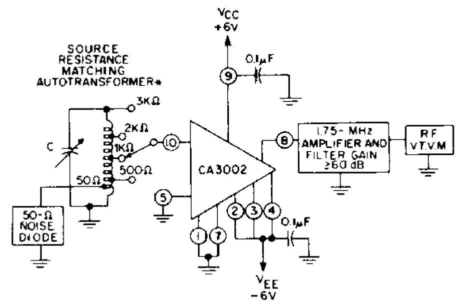


Fig. 11 – Noise figure vs source resistance.



* 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. 12 – Noise figure.

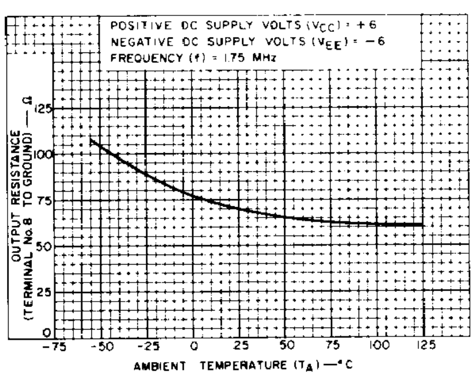


Fig. 13a – Output resistance vs temperature.

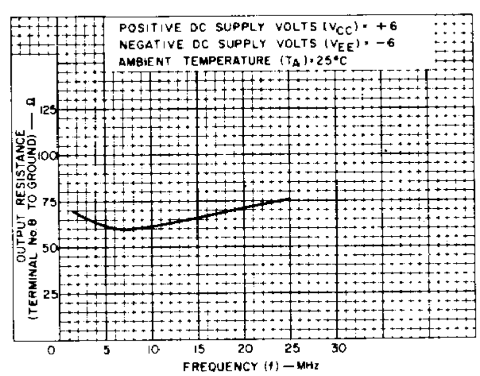


Fig. 13b – Output resistance vs frequency.

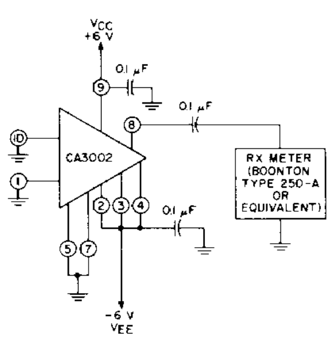


Fig. 14 – Output resistance.

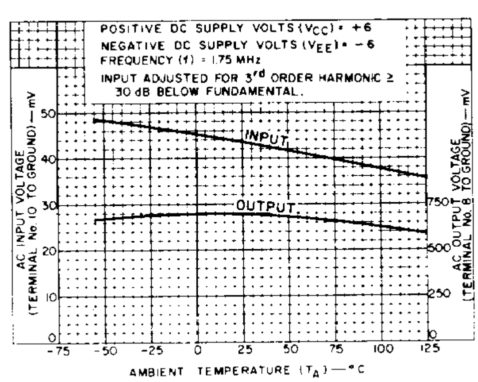
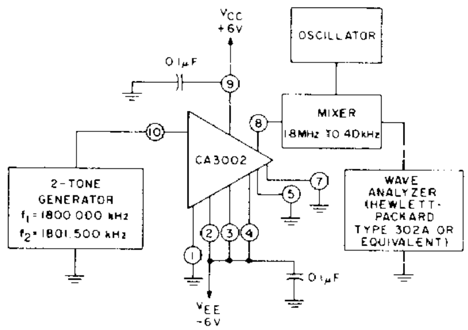


Fig. 15 – Input level for −30 dB intermodulation vs temperature.



1) Increase both input-signal tones until the $2f_2$-f1 and $2f_1$-f2 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. 16 – Intermodulation circuit.

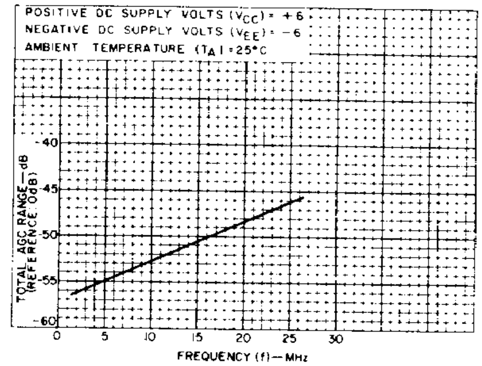
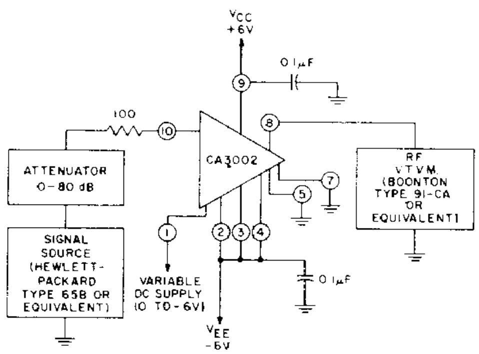


Fig. 17 – AGC range vs frequency.



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. 18 – AGC range.