RCA
Solid State
Division

Linear Integrated Circuits

CA3000

DC Amplifier

Monolithic Silicon

- 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
- 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

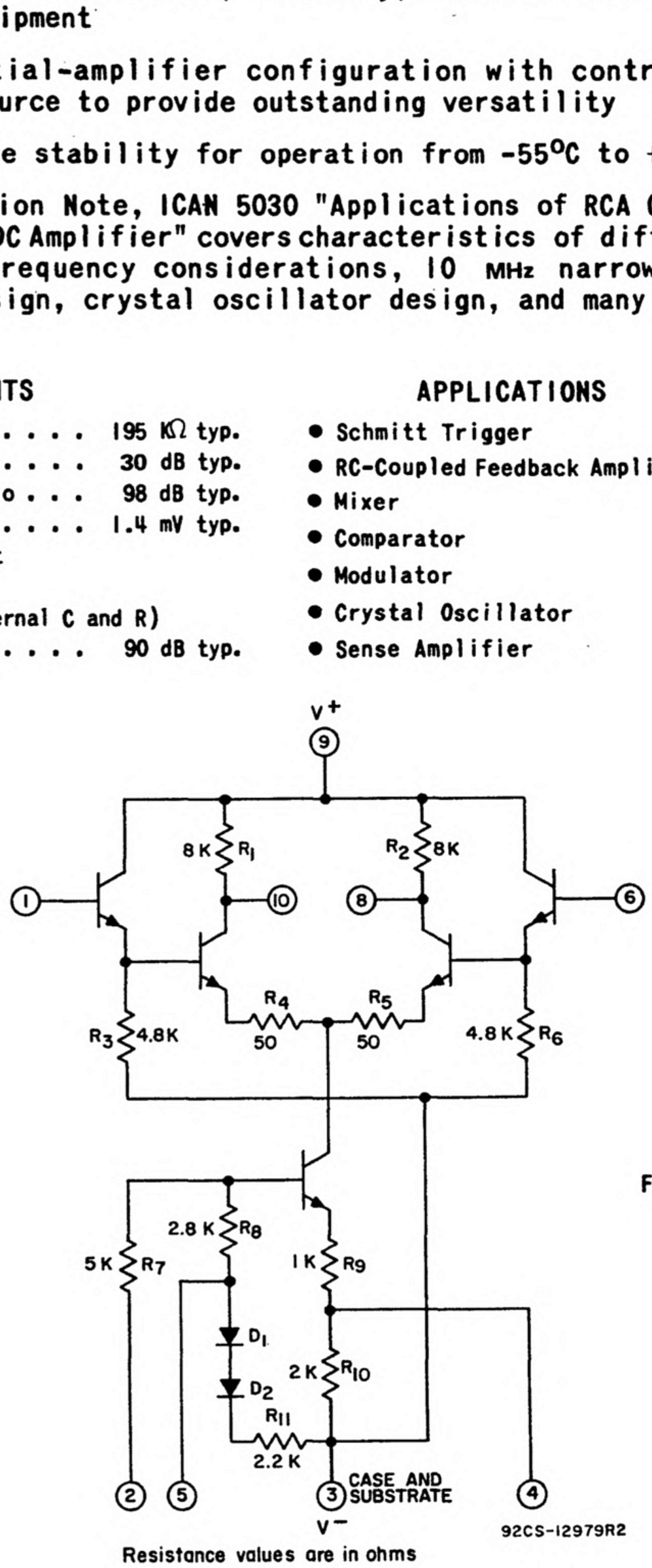


Fig.1 SCHEMATIC DIAGRAM

Resistance values are in ohms

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

Indicated voltage limits for each terminal can be used under specified 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	-2	+2	2 3 6 9	0 -6 0 +6
2	-8	0	1 3 6 9	0 -8 0 +6
3	-10	0	1 2 6 9	0 0 0 +6
4	-8	0	1 2 6 9	0 0 0 +6
5	-6	0	1 2 3 6 9	0 0 -6 0 +6
6	-2	+2	1 2 3 9	0 0 -6 +6
7	NO CONNECTION			
8	0	+6	1 2 3 6	0 0 -6 0
9	0	+10	1 2 3 6	0 0 -6 0
10	0	+6	1 2 3 6	0 0 -6 0
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 ± 0.79 mm) from case for 10 seconds max.	+265°C
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

STATIC CHARACTERISTICS AND TEST CIRCUITS FOR TYPE CA3000

INPUT OFFSET VOLTAGE AND CURRENT vs TEMPERATURE

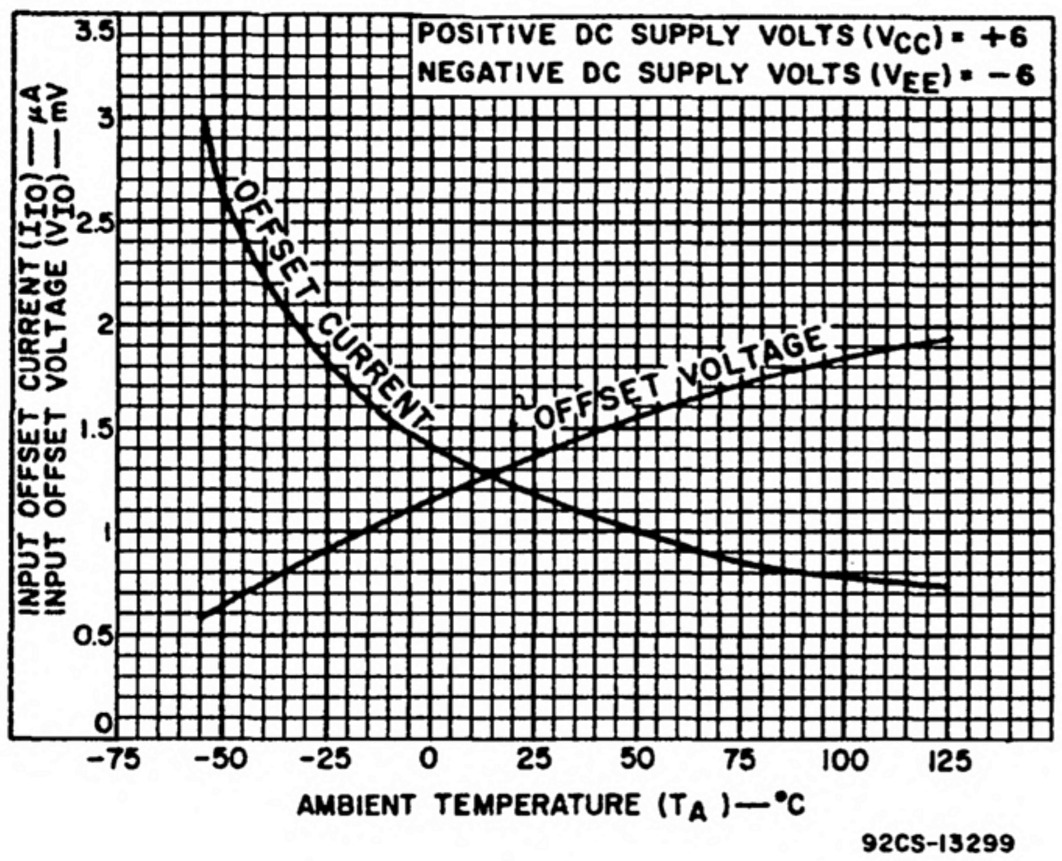


Fig.2

INPUT BIAS CURRENT vs TEMPERATURE

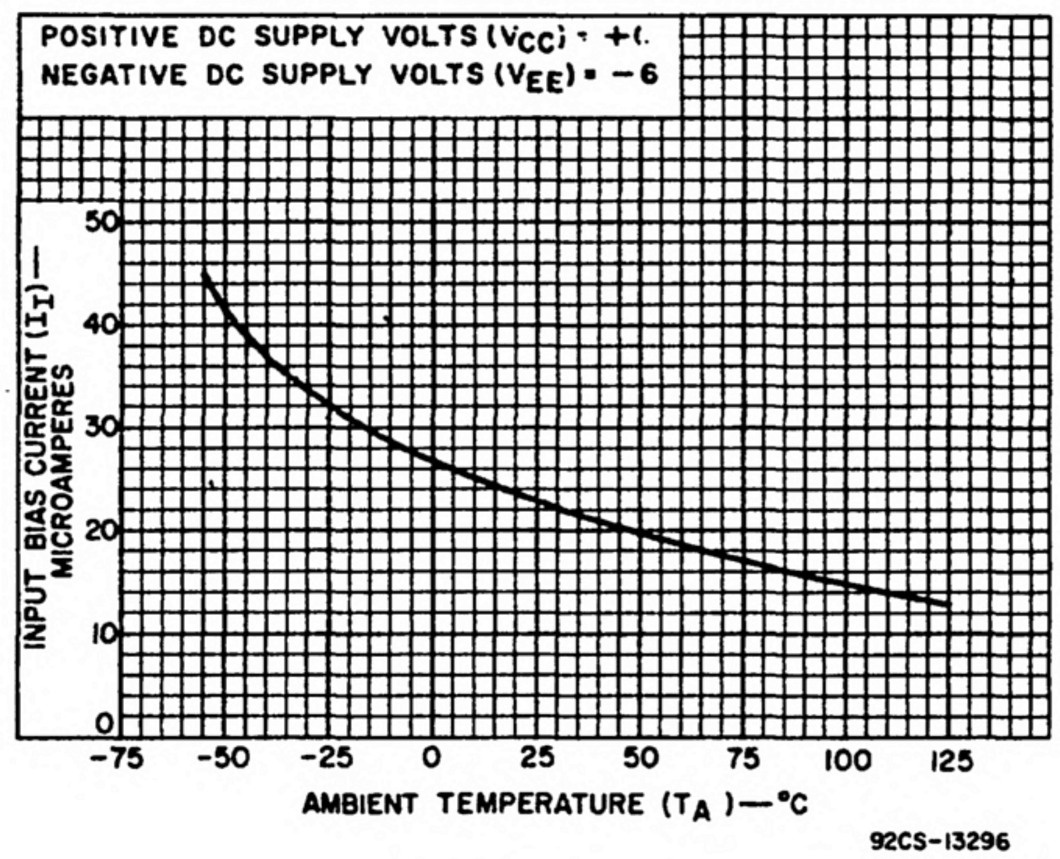


Fig.3

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 CHARAC-TERISTICS 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		9	28	32	-	dB	5
		Double-Ended Output f = 1 kHz		9	-	38	-	dB	5
Bandwidth at -3 dB Point	BW	V_1 = 10 mV, R_s = 1 kΩ			-	650	-	kHz	7
Maximum Output Voltage Swing	$V_{OUT(P-P)}$	f = 1 kHz		9	-	6.4	-	V(P-P)	NONE
Common-Mode Rejection Ratio	CMRR	f = 1 kHz		13	70	98	-	dB	8
Single-Ended Input Impedance	Z_{IN}	f = 1 kHz		15	70K	195K	-	Ω	10
Single-Ended Output Impedance	Z_{OUT}	f = 1 kHz		17	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		20	80	90	-	dB	NONE

QUIESCENT OPERATING VOLTAGE vs TEMPERATURE

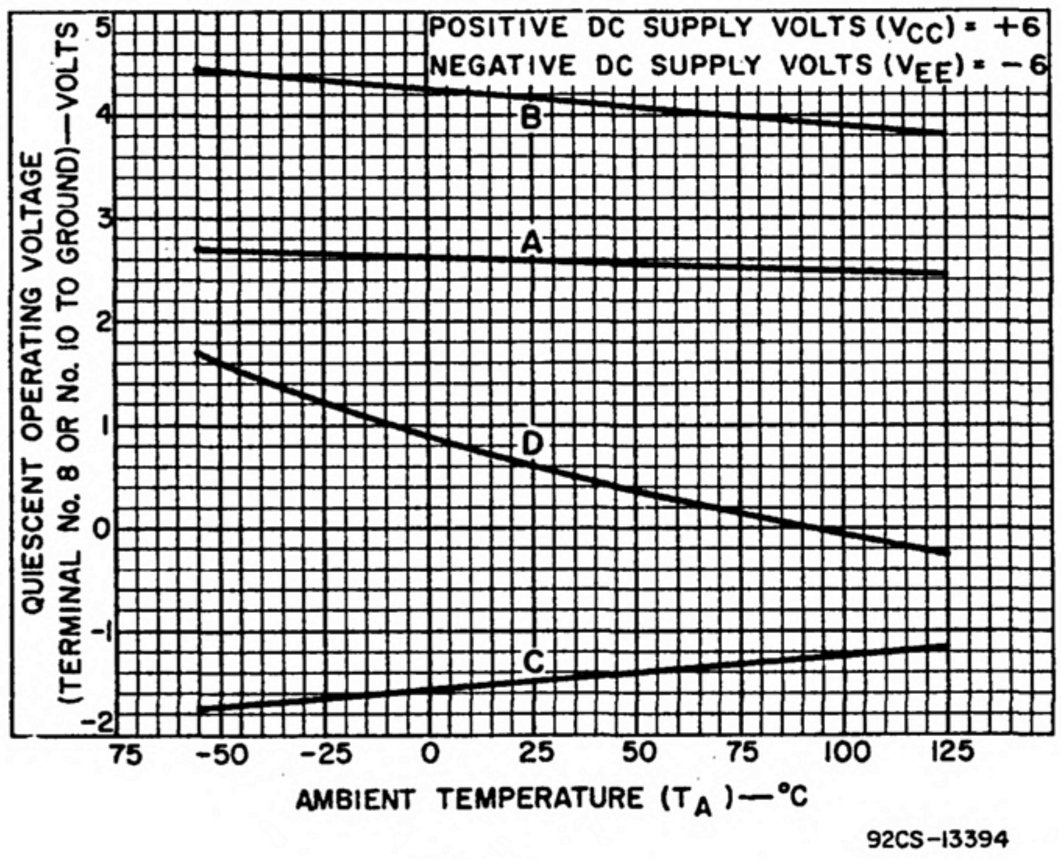


Fig.4

DYNAMIC CHARACTERISTICS AND TEST CIRCUIT FOR TYPE CA3000

DIFFERENTIAL VOLTAGE GAIN vs TEMPERATURE

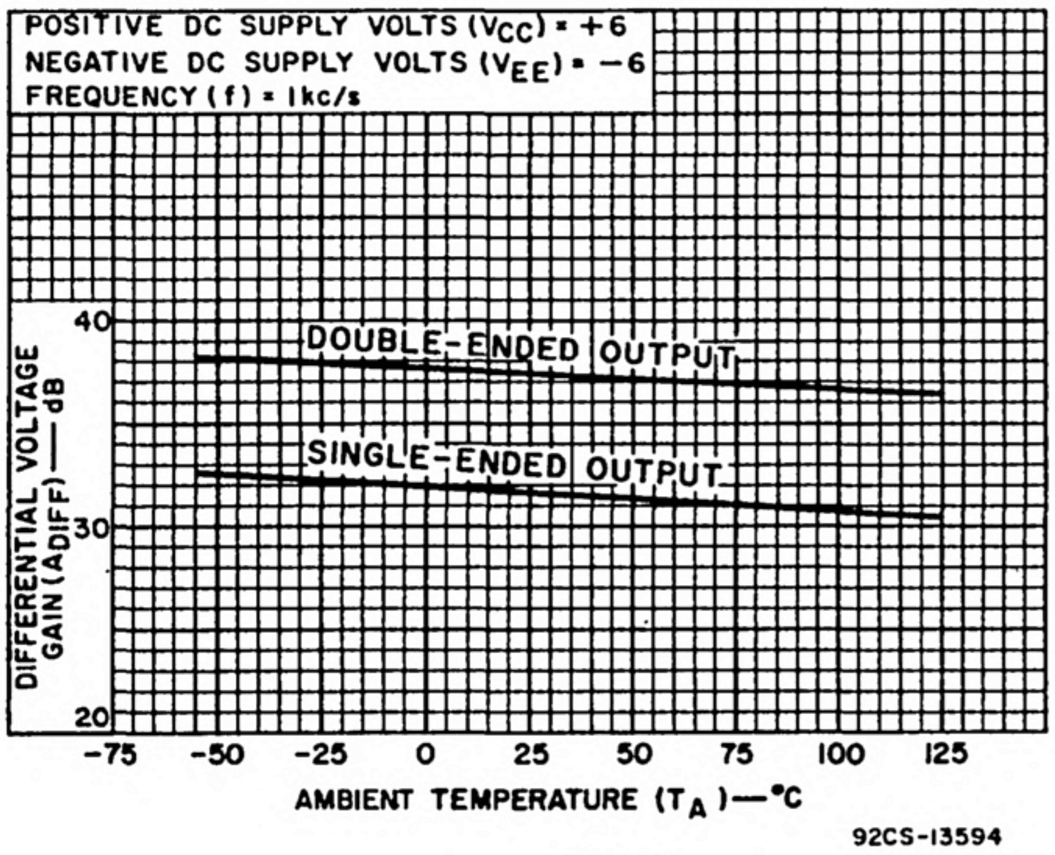


Fig.5

DIFFERENTIAL VOLTAGE GAIN AND MAXIMUM OUTPUT VOLTAGE SWING TEST CIRCUIT

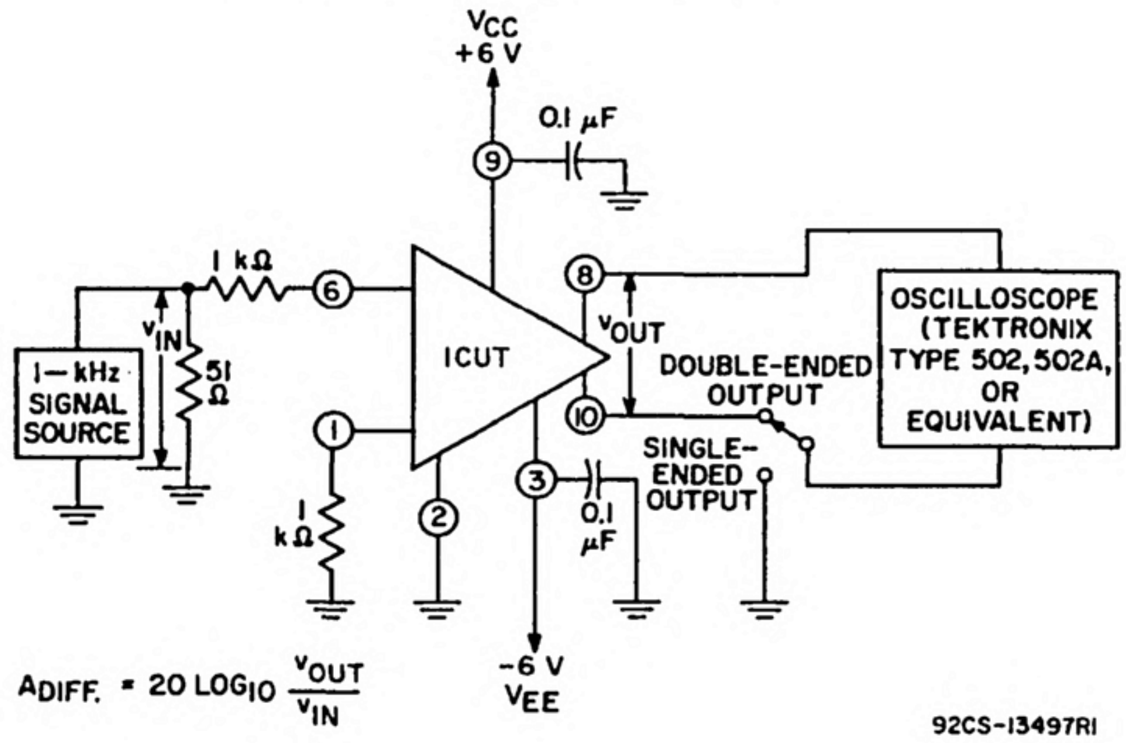


Fig.6

BANDWIDTH AT -3 dB POINT vs TEMPERATURE

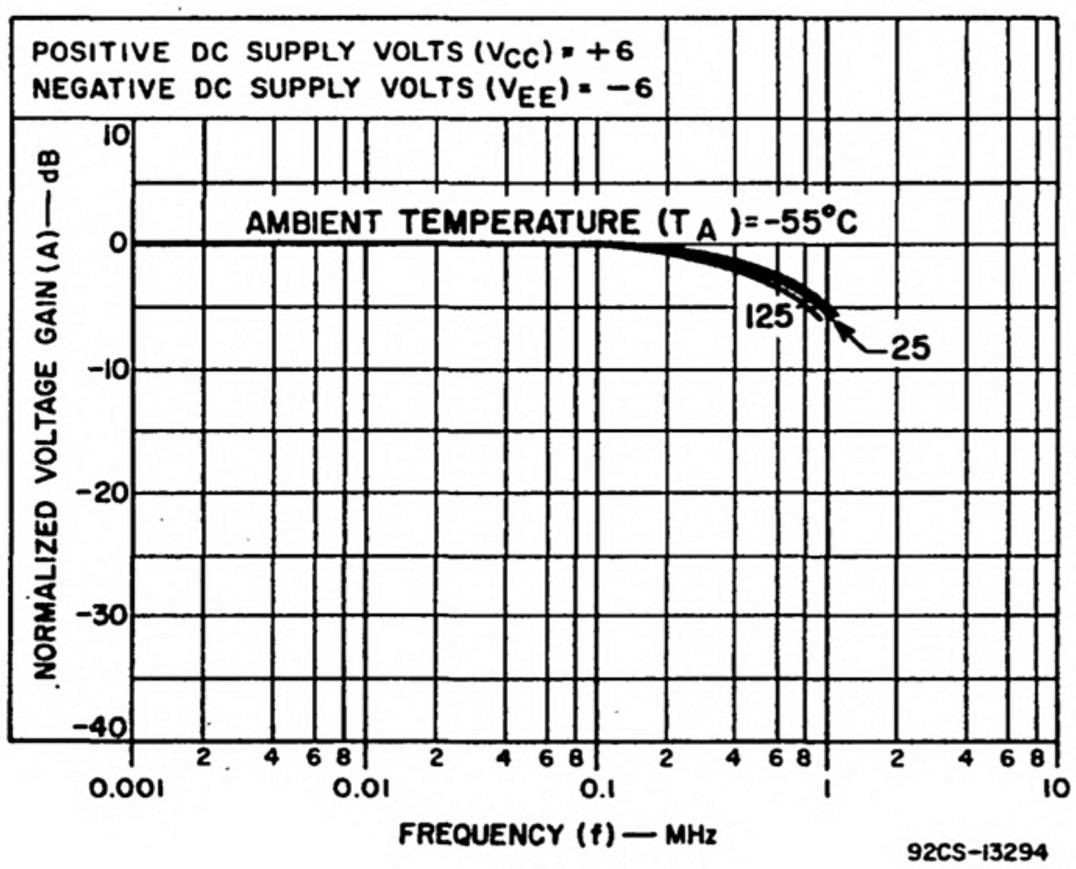


Fig.7

COMMON-MODE REJECTION RATIO vs TEMPERATURE

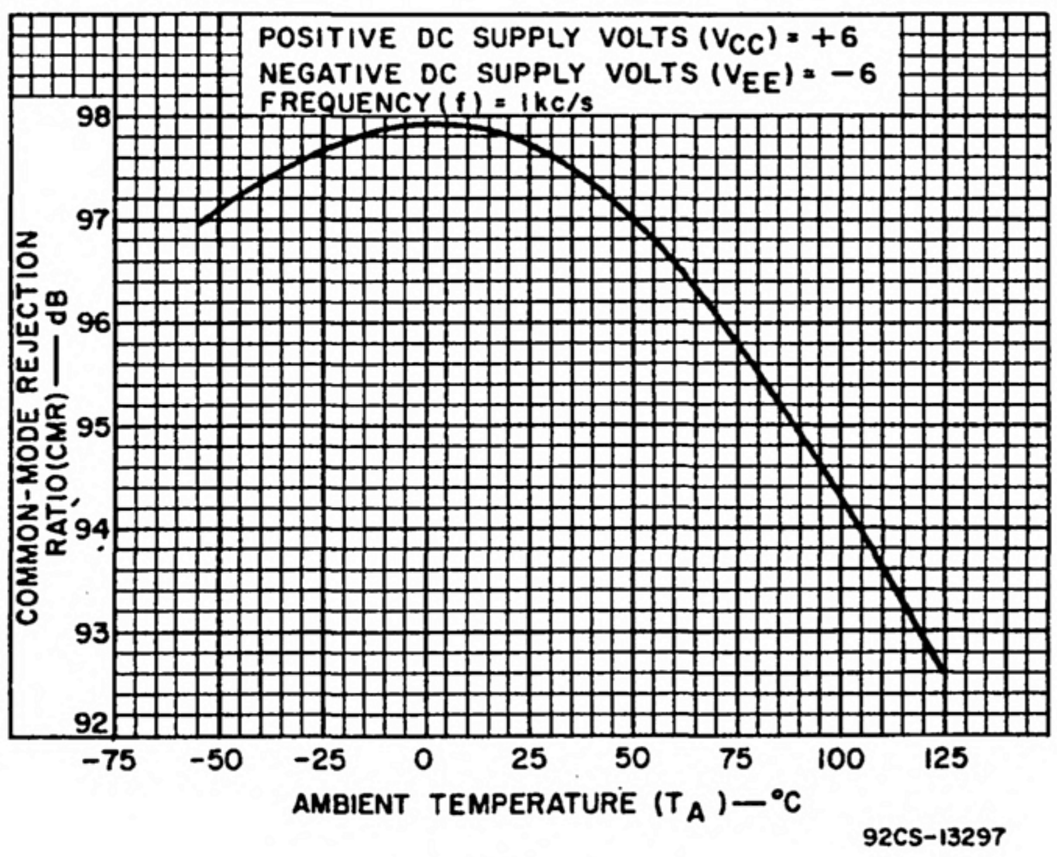
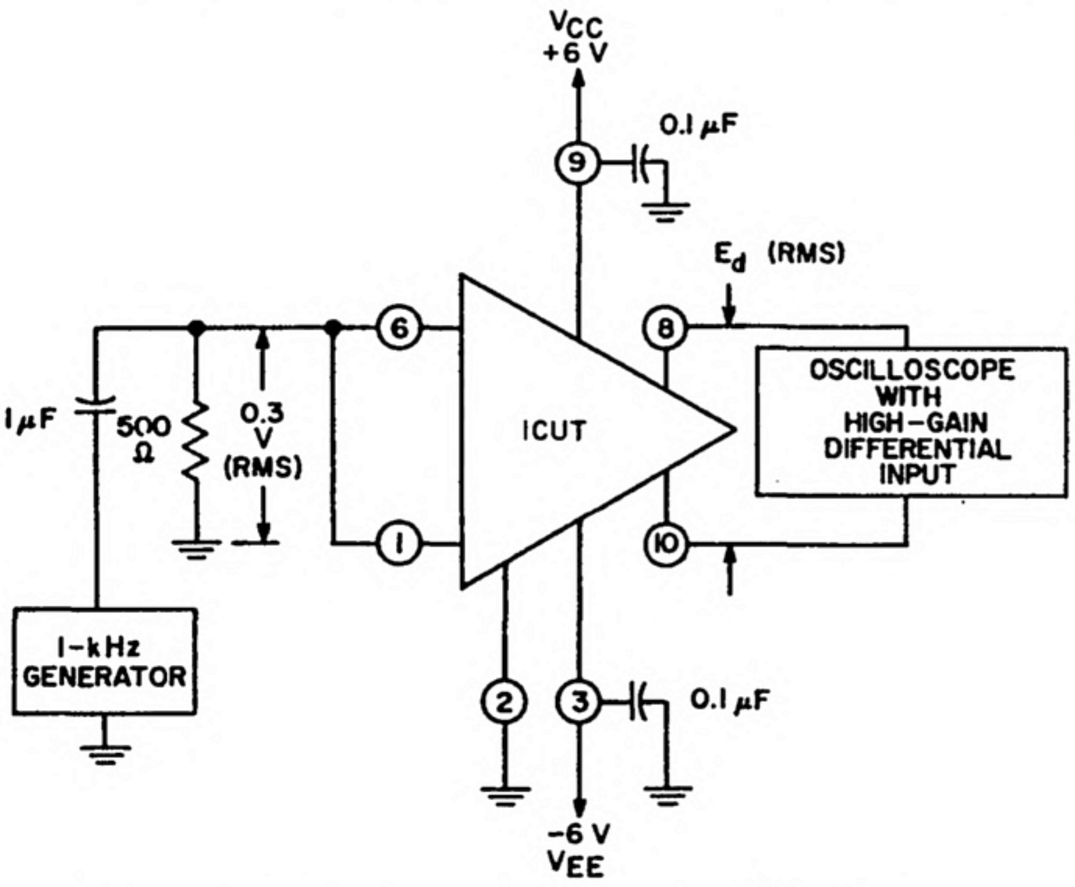


Fig.8

COMMON-MODE REJECTION RATIO TEST CIRCUIT



$$\text{COMMON-MODE REJECTION RATIO (CMR)} = 20 \log \frac{(A^*)(2)(0.3)}{E_d\,(\text{RMS})}$$

*A = SINGLE-ENDED VOLTAGE GAIN AS MEASURED IN CIRCUIT SHOWN IN FIG. 68

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Fig.9

SINGLE-ENDED INPUT IMPEDANCE vs TEMPERATURE

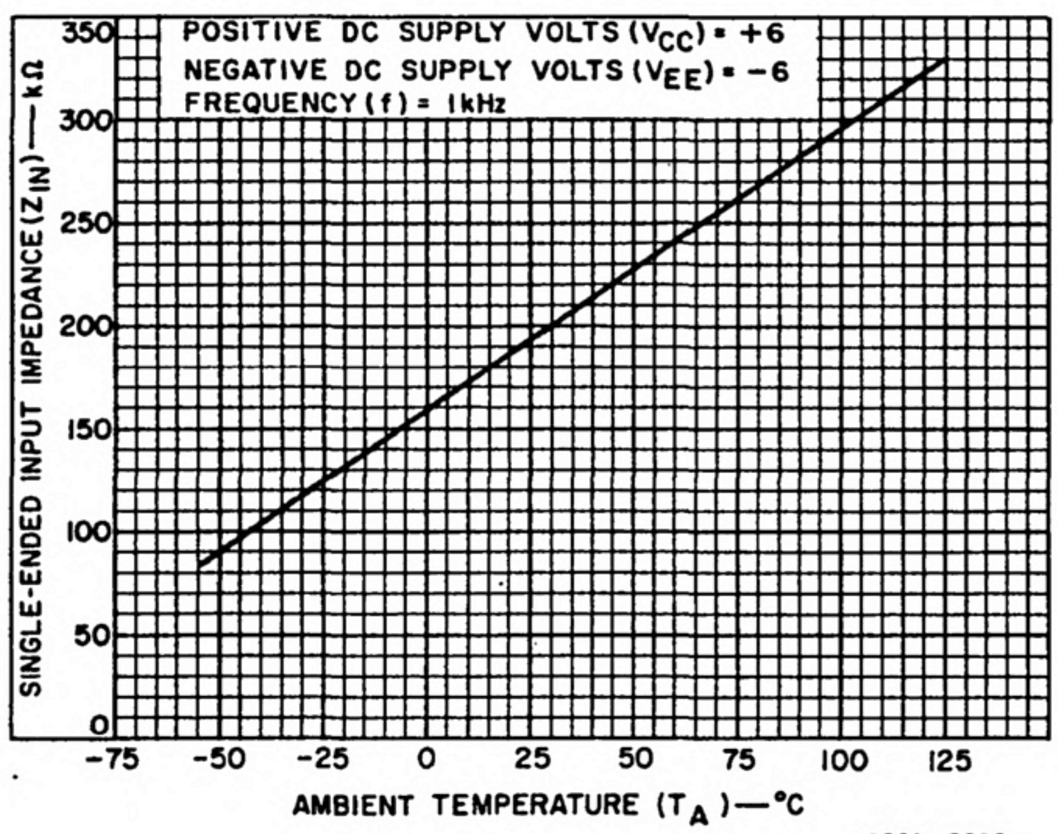
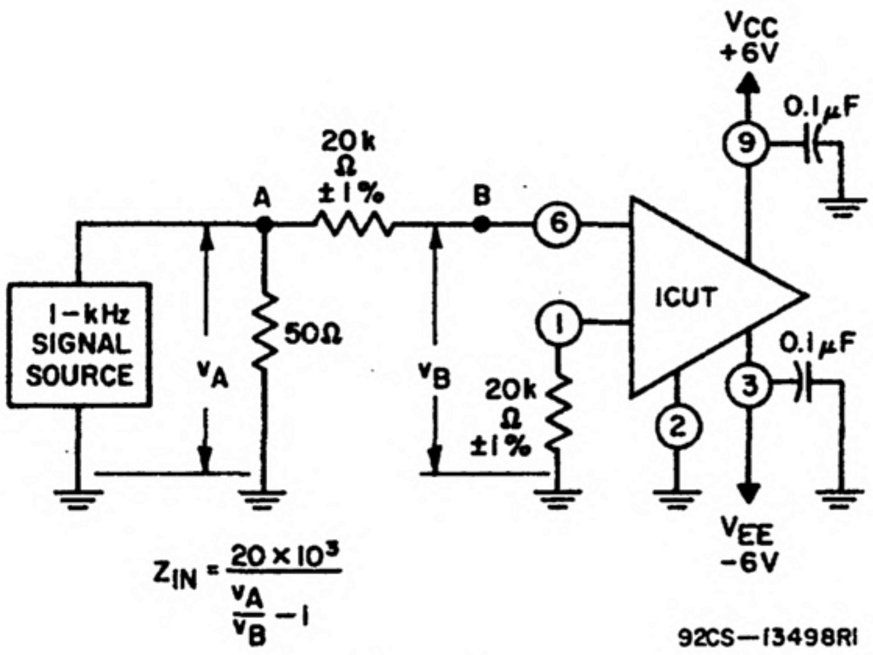


Fig.10

DYNAMIC CHARACTERISTICS AND TEST CIRCUITS FOR TYPE CA3000

SINGLE-ENDED INPUT IMPEDANCE TEST CIRCUIT



$$Z_{IN} = \frac{20 \times 10^3}{\frac{V_A}{V_B} - 1}$$

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Fig. 11

SINGLE-ENDED OUTPUT IMPEDANCE vs TEMPERATURE

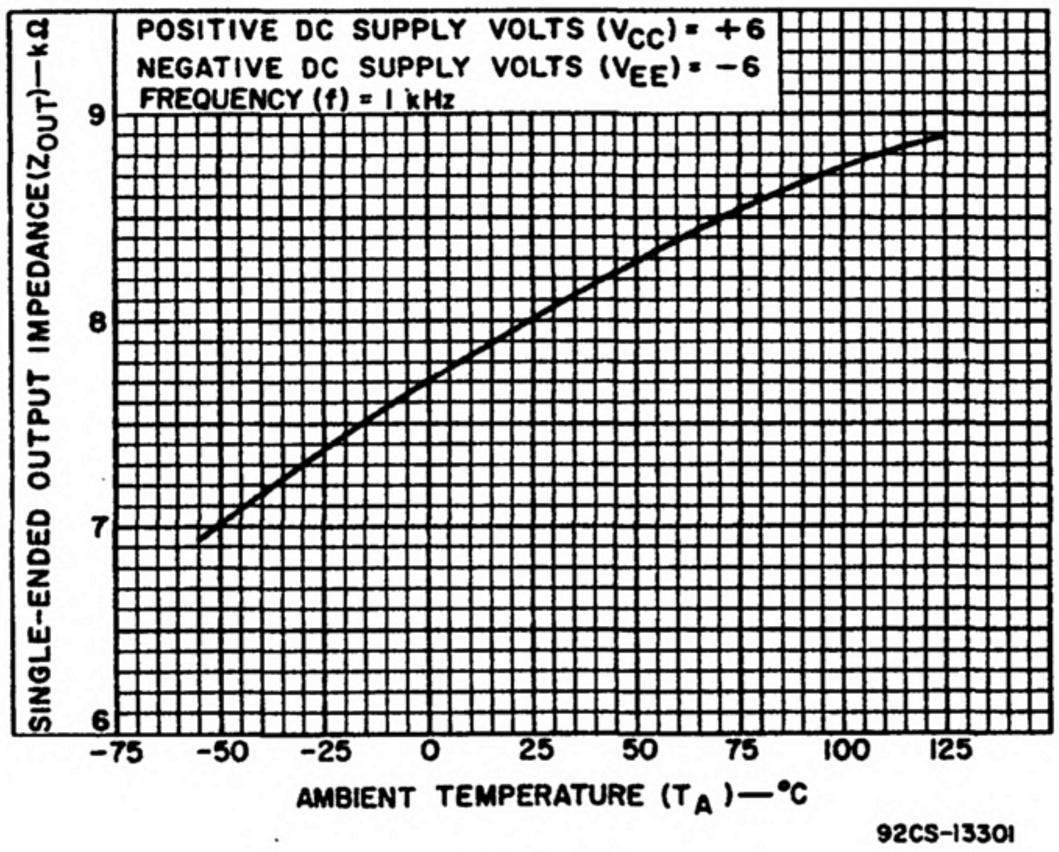

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Fig. 12

SINGLE-ENDED OUTPUT IMPEDANCE TEST CIRCUIT

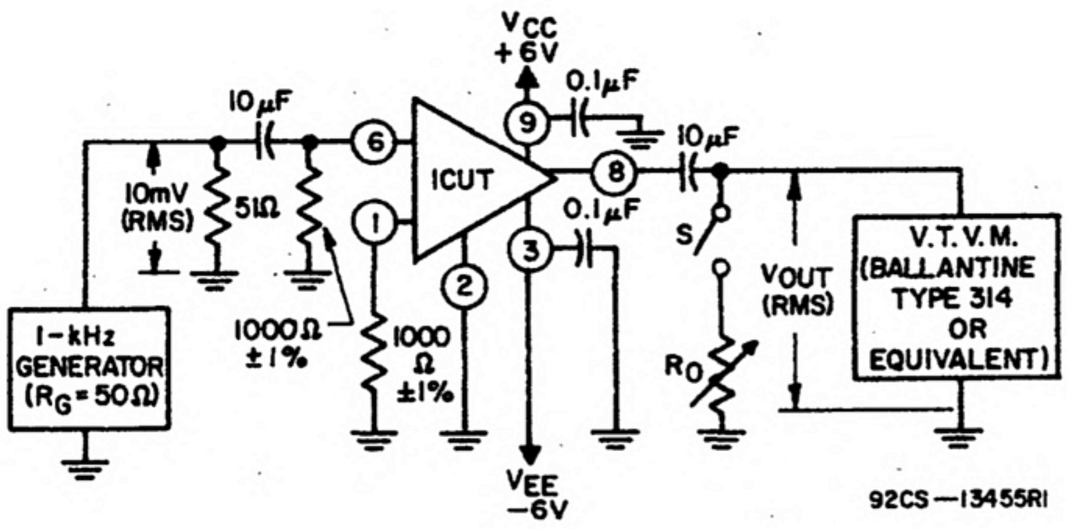

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Fig. 13

TOTAL HARMONIC DISTORTION vs TEMPERATURE

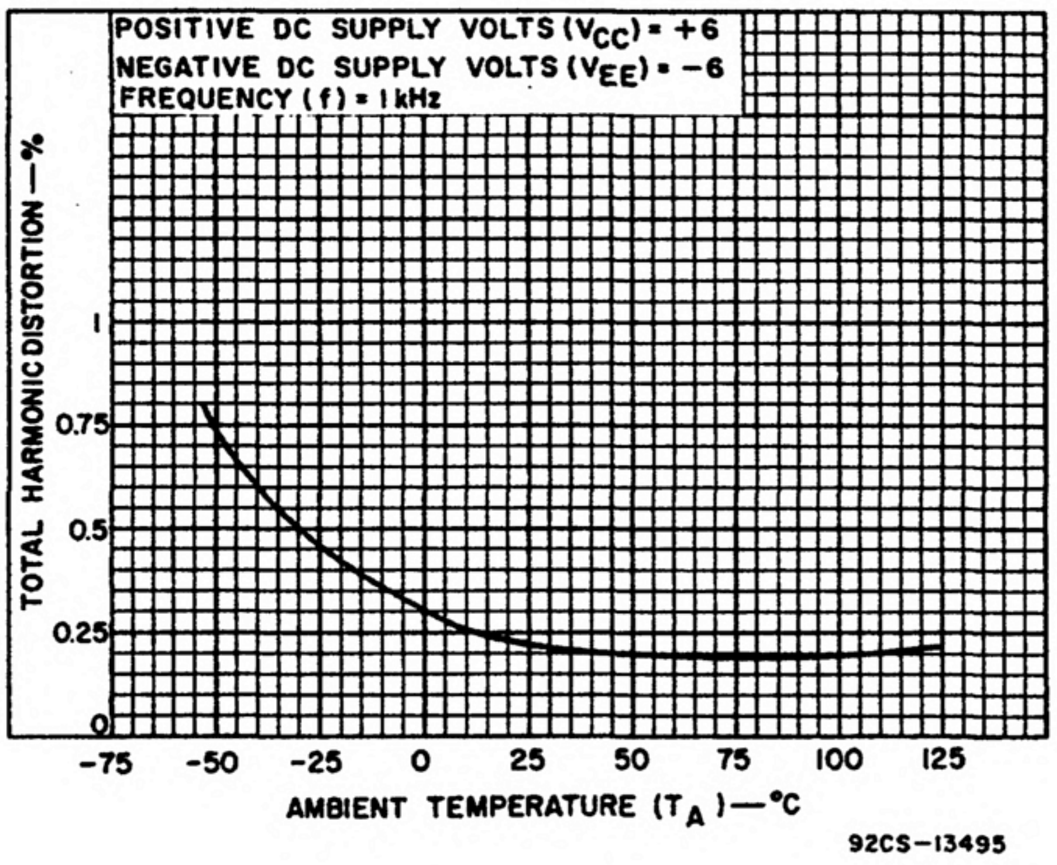

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Fig. 14

AGC RANGE TEST CIRCUIT

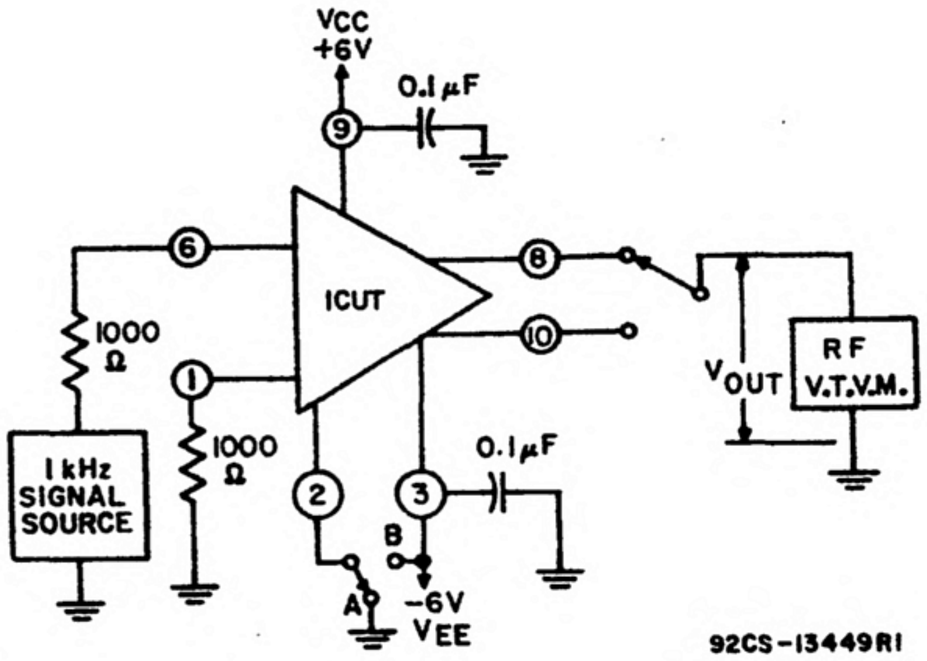

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Fig. 15