

BIPOLAR ANALOG INTEGRATED CIRCUIT

μ PC1223C

FM MULTIPLEX STEREO DEMODULATOR

DESCRIPTION

μ PC1223C is a silicon monolithic integrated circuit designed for FM multiplex stereo demodulator employing PLL (phase-locked-loop) circuit and suitable for Hi-Fi stereo FM tuner.

It employs chopper demodulator, so that it can obtain low distortion and high S/N ratio.

It contains 19 kHz, 38 kHz canceller circuit to reduce carrier leak and ultrasonic frequency rejection reaches 82 dB.

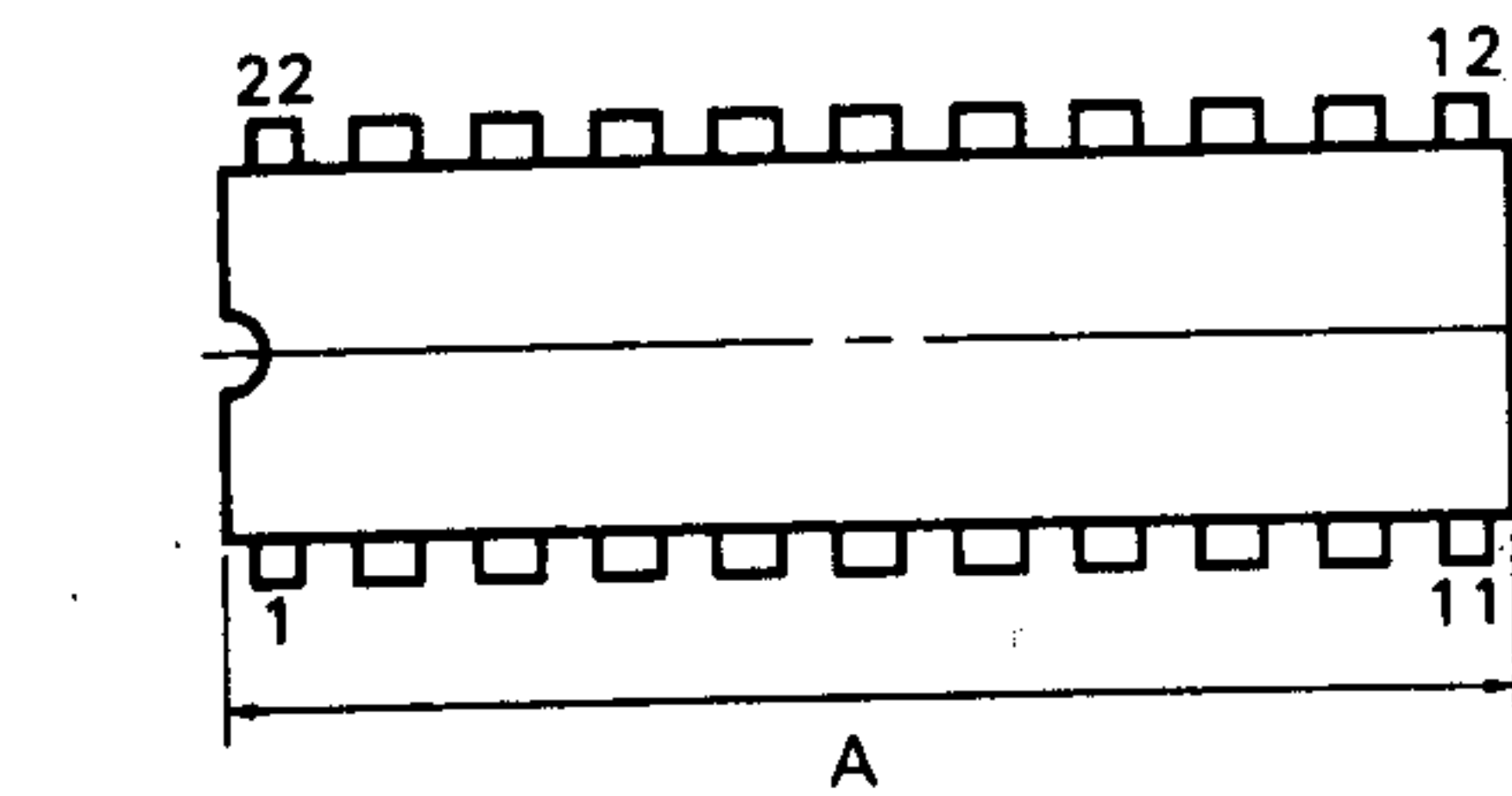
It contains a preamplifier as an input stage, PLL circuit (VCO, phase detector, LPF, frequency divider, DC-amp.), stereo demodulator (chopper demodulation), stereo indicator driver, stereo-monaural switcher, VCO stop switcher, 19 kHz and 38 kHz canceller (possible to cancel sine wave and triangle wave) and muting circuit.

It is in 22 Pin plastic Dual-In-Line package (DIP).

FEATURES

- Low distortion.
 - T.H.D. (mono) = 0.006 % TYP. (f = 1 kHz)
 - T.H.D. st (L+R) = 0.015 % TYP. (f = 1 kHz)
- High signal to noise ratio.
 - S/N = 97 dB TYP. ($V_{in} = 400 \text{ mV}_{r.m.s.}$, f = 400 Hz, IHF-A)
- It contains 19 kHz and 38 kHz canceller (adjustment free for 38 kHz cancelling).
 - 19 kHz rej. = 82 dB TYP. (sine wave cancelling)
 - 19 kHz rej. = 56 dB TYP. (triangle wave cancelling)
 - 38 kHz rej. = 62 dB TYP. (19 kHz sine wave canceling using 38 kHz BPF)
- Possible to adjust L-ch and R-ch separation level minutely with an external VR independently.
 - Sep. = 63 dB TYP. (f = 1 kHz)
- It contains stereo-monaural switcher and VCO stop function.
 - fixed monaural $3.9 \text{ V} \leq V_{13} < 6.2 \text{ V}$
 - VCO stop $7.8 \text{ V} \leq V_{13}$
- Wide allowable input level range.
 - $V_{in} (\text{MAX.}) = 1.3 \text{ V}_{r.m.s.}$ (monaural, f = 400 Hz, T.H.D. = 0.1 %)
- It contains muting circuit.
 - MUTE(ATT.) = 52 dB TYP. (connect 14 Pin to GND refer to output level at $V_{in} = 400 \text{ mV}_{r.m.s.}$)

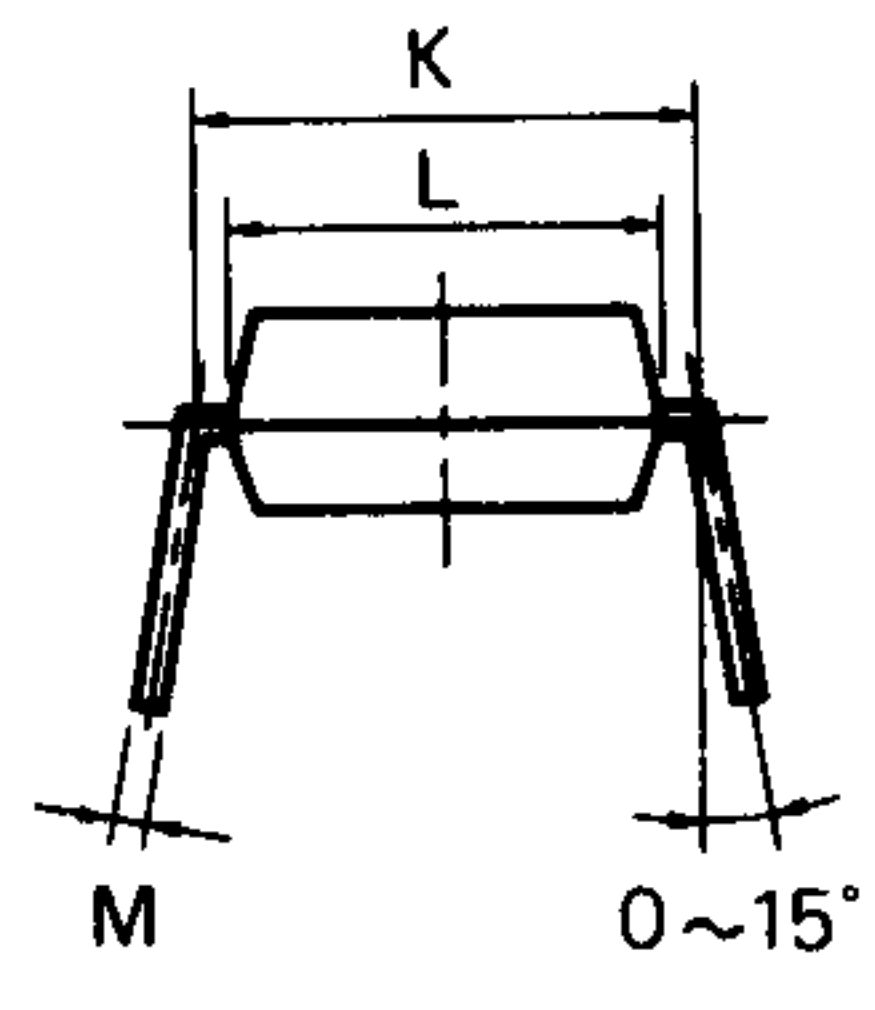
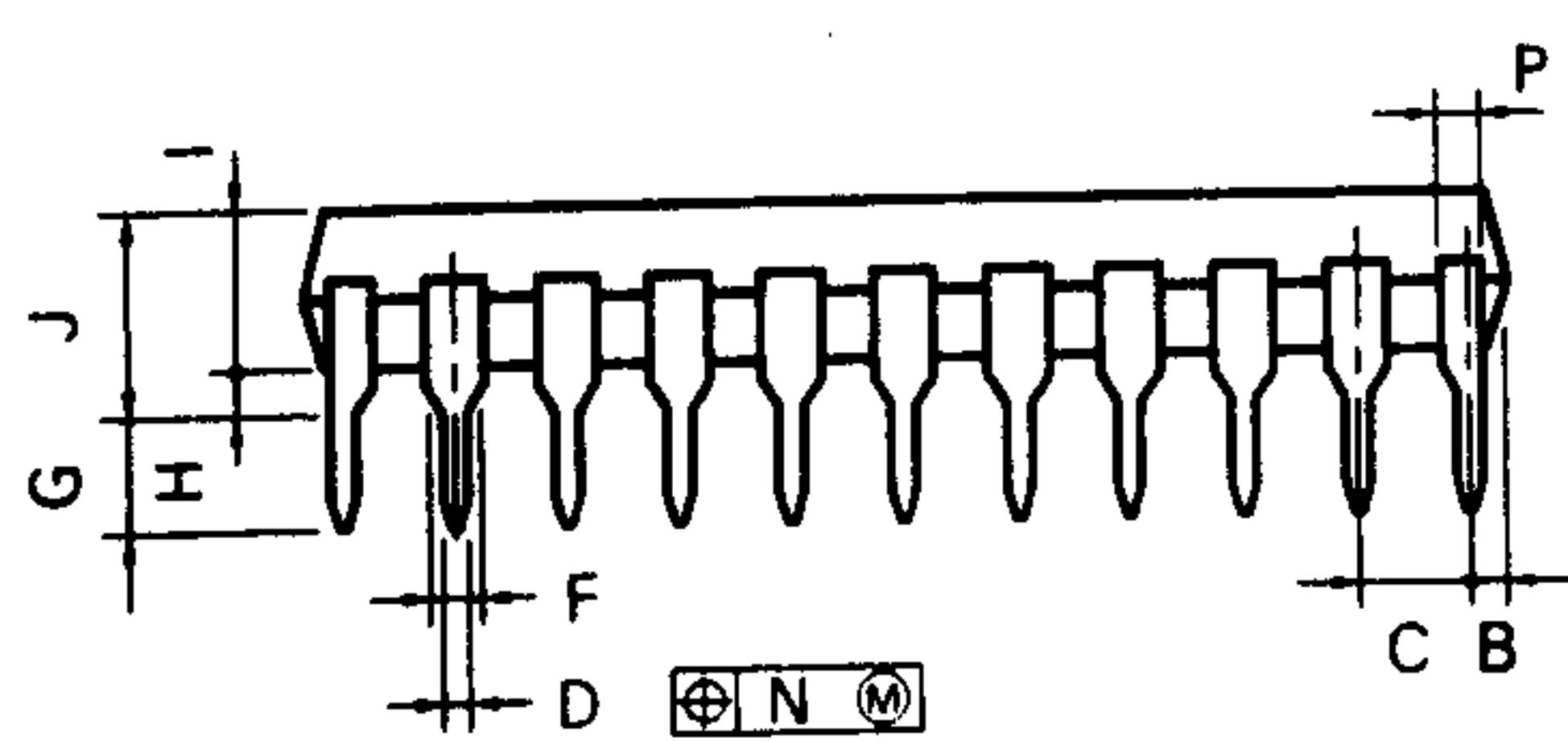
22PIN PLASTIC DIP (400 mil)



NOTES

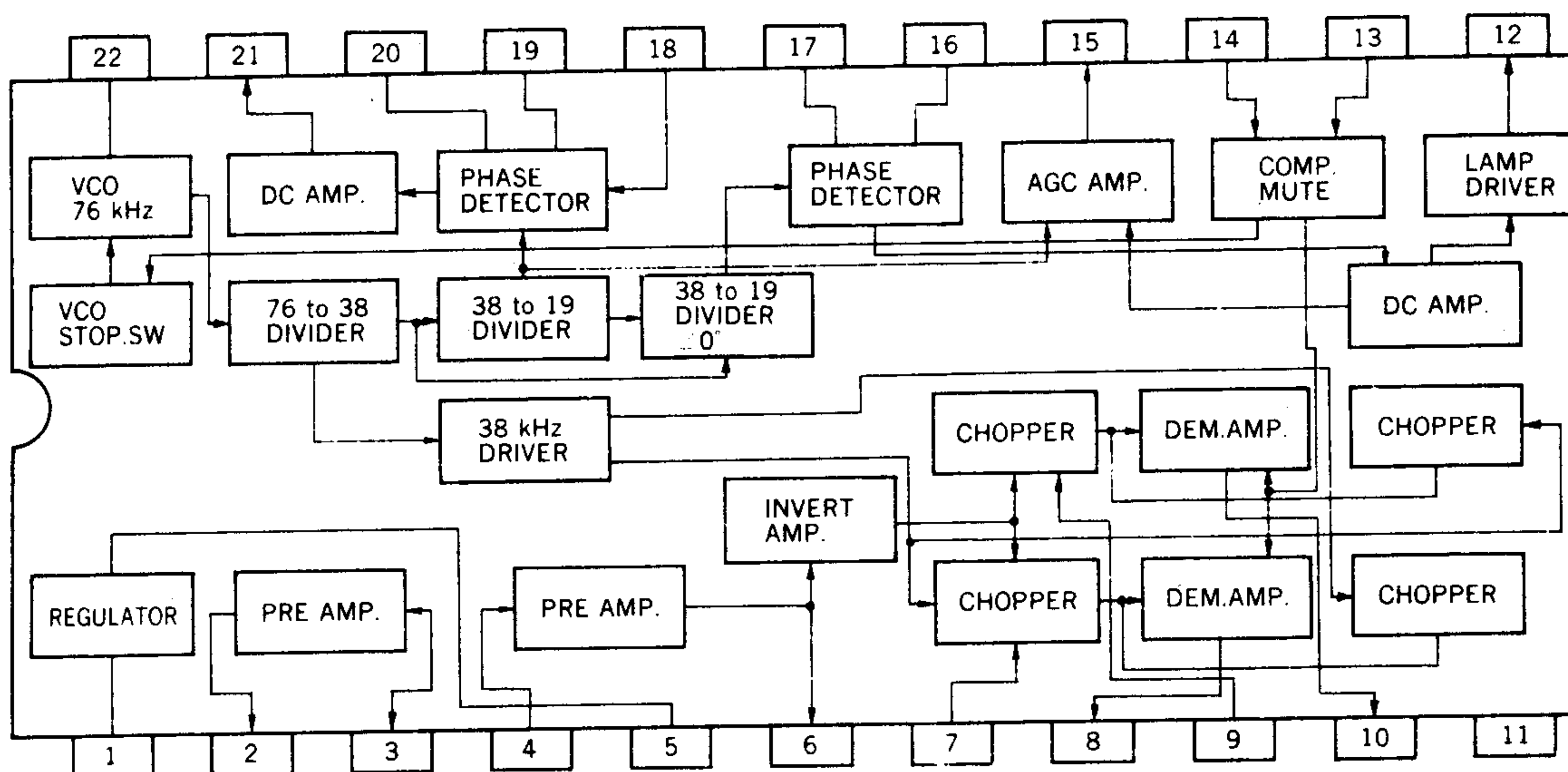
- 1) Each lead centerline is located within 0.25 mm (0.01 inch) of its true position (T.P.) at maximum material condition.
- 2) Item "K" to center of leads when formed parallel.

ITEM	MILLIMETERS	INCHES
A	27.94 MAX.	1.100 M
B	1.27 MAX.	0.050 M
C	2.54 (T.P.)	0.100 (T)
D	0.50 ^{+0.10}	0.020 ⁸
F	1.2 MIN.	0.047 M
G	3.5 ^{+0.3}	0.138 ¹⁰
H	0.51 MIN.	0.020 M
I	4.31 MAX.	0.170 M
J	5.72 MAX.	0.226 M
K	10.16 (T.P.)	0.400 (T)
L	8.6	0.339
M	0.25 ^{+0.08}	0.010 ⁸
N	0.25	0.01
P	0.8 MIN.	0.031 M



P22C-100-400B

BLOCK DIAGRAM



TERMINAL CONNECTION

NO.	CONNECTION	NO.	CONNECTION
1	VCC	12	ST. LAMP INDICATOR
2	PRE AMP. OUTPUT 1	13	ST-MONO SW & VCO STOP
3	RPE AMP. INPUT 1	14	MUTING SW
4	PRE AMP. INPUT 2	15	19 kHz CANCEL
5	BYPASS	16	LPF
6	PRE AMP. OUTPUT 2	17	LPF
7	POST AMP. INPUT	18	FILTER INPUT
8	L-ch OUTPUT	19	LPF
9	POST AMP. INPUT	20	LPF
10	R-ch OUTPUT	21	LPF
11	GND	22	OSC RC NETWORK

ABSOLUTE MAXIMUM RATINGS (T_a = 25 °C)

Supply Voltage	V _{CC}	16	V
Lamp Current	I _L	75	mA
Power Dissipation	P _D	680	mW (T _a = 70 °C)
Operating Temperature	T _{opt}	-20 to +70	°C
Storage Temperature	T _{stg}	-40 to +125	°C

RECOMMENDED OPERATING CONDITION (T_a = 25 °C)

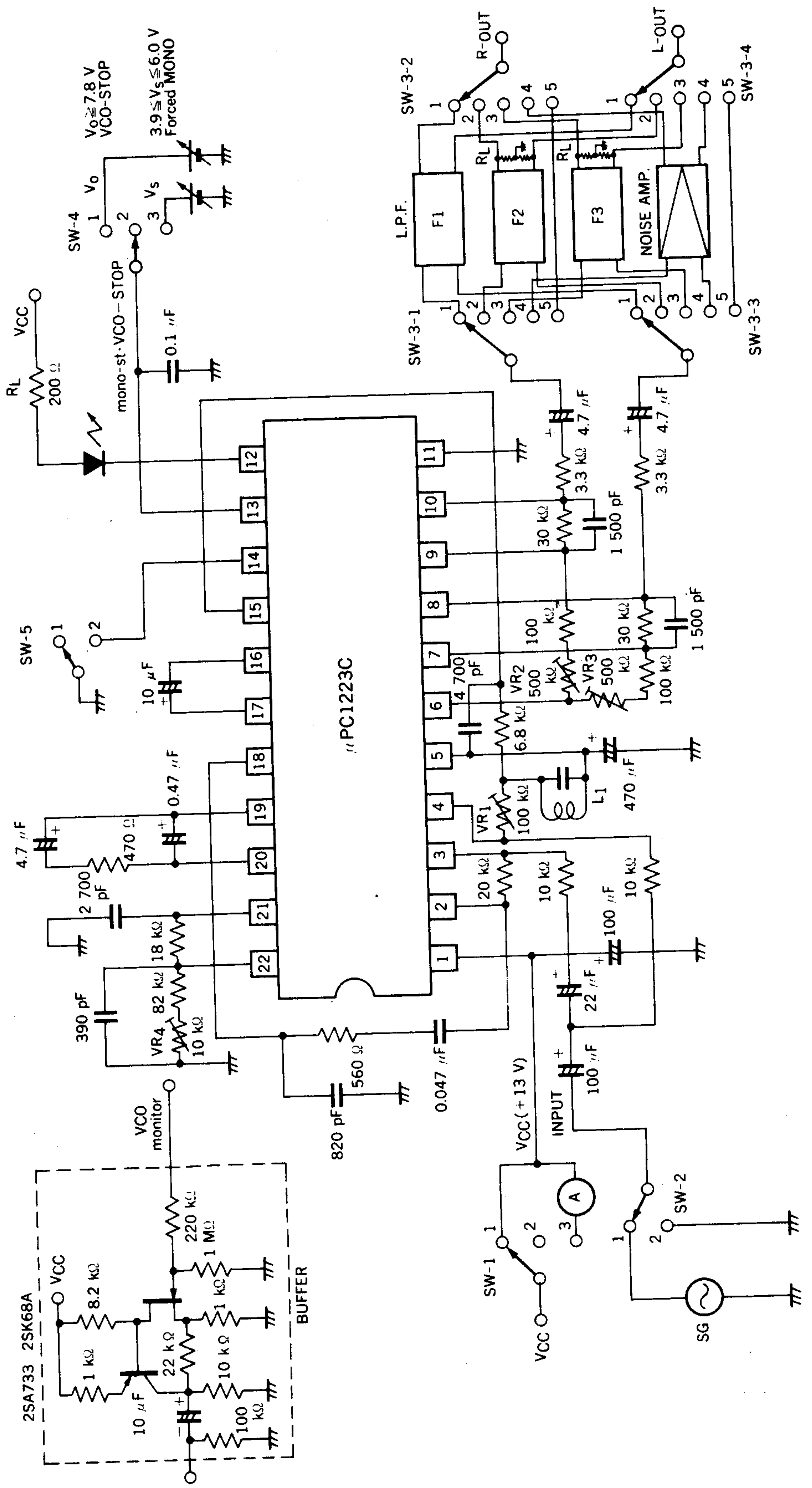
Operating Supply Voltage	13	V
Supply Voltage Range	9 to 15	V

ELECTRICAL CHARACTERISTICS (T_a = 25 °C unless otherwise noted)

V_{CC} = 13 V, f = 400 Hz, V_{in} (L+R) = 360 mV_{r.m.s.}, Pilot = 36 mV_{r.m.s.}, Sine Wave Cancel)

CHARACTERISTIC	SYMBOL	MIN.	TYP.	MAX.	UNIT	TEST CONDITION
Supply Current	I _{CC}	15	23	36	mA	No Signal
Channel Separation	Sep.	42	48	—	dB	f = 100 Hz
		50	63	—	dB	f = 1 kHz
		48	55	—	dB	f = 10 kHz
Voltage Gain	A _v	6.5	9	11.5	dB	MONO V _{in} = 400 mV _{r.m.s.}
Channel Balance 1	C.B.	-0.8	0	+0.8	dB	MONO V _{in} = 400 mV _{r.m.s.}
Channel Balance 2	C.B.	-0.8	0	+0.8	dB	ST. V _{in} (L+R) = 360 mV _{r.m.s.}
Total Harmonic Distortion Monaural	T.H.D. 1	—	0.015	0.03	%	MONO f = 100 Hz
	T.H.D. 2	—	0.006	0.02	%	MONO f = 1 kHz
	T.H.D. 3	—	0.012	0.03	%	MONO f = 10 kHz
Total Harmonic Distortion Stereo	T.H.D. 4	—	0.03	0.06	%	f = 100 Hz
	T.H.D. 5	—	0.015	0.03	%	f = 1 kHz
	T.H.D. 6	—	0.06	0.15	%	f = 10 kHz
Stop Level for Lamp "ON"	L-on	7	13	20	V _{r.m.s.}	Pilot Only
Stop Level for Lamp "OFF"	L-off	5	11	—	V _{r.m.s.}	
Temperature Range	C.R.	±1.5	±3	—	%	Pilot = 36 mV _{r.m.s.}
Resonance Frequency Rejection	19 kHz	72	82	—	dB	Pilot = 36 mV _{r.m.s.}
	38 kHz	52	62	—	dB	Pilot = 36 mV _{r.m.s.} BPF
SCA Rejection	SCA rej.	74	84	—	dB	Pilot = 36 mV, SCA = 36 mV
Maximum Input Level	V _{in}	0.9	1.3	—	V _{r.m.s.}	T.H.D. = 0.1 % MONO
Signal to Noise Ratio	S/N	90	97	—	dB	R _g = 0, IHF-A, MONO
Quiescent Monaural Voltage	V _s	3.9	—	6.0	V	Lamp "OFF", #13 Voltage
STOP Voltage	V _o	7.8	—	V _{CC}	V	VCO "Stop", #13 Voltage
Stopping Attenuator	MUTatt	45	52	—	dB	#14 to GND

TEST CIRCUIT FOR ELECTRICAL CHARACTERISTICS



SWITCH POSITION

MEASUREMENT	SW-1	SW-2	SW-3	SW-4	SW-5	CONDITION
CIRCUIT CURRENT	3	2	—	2	1	No Signal
VOLTAGE GAIN	1	1	5	2	1	$V_{in} = 400 \text{ mV}$, Without LPF
ULTRASONIC FREQUENCY REJECTION (19 kHz)	1	1	2	2	1	$V_{L+R} = 360 \text{ mV}$, Pilot = 36 mV ⇒ Pilot only
ULTRASONIC FREQUENCY REJECTION (38 kHz)	1	1	3	2	1	$V_{L+R} = 360 \text{ mV}$, Pilot = 36 mV ⇒ Pilot only
SIGNAL TO NOISE RATIO	1	1→2	4	2	1	$V_{in} = 400 \text{ mV}$, $f = 400 \text{ Hz}$, BL-5AW (LPF), IHF-A
STEREO-MONAUROAL SWITCHING VOLTAGE	1	1	—	3	—	At Indicator Lamp "off", #13 Terminal Voltage
VCO STOP VOLTAGE	1	—	—	1	—	At VCO "Stop", #13 Terminal Voltage
MUTING ATTENUATION	1	1	1	—	1→2	$V_{in} = 400 \text{ mV}$, #14 Terminal ⇒ GND
OTHER MEASUREMENTS	1	1	1	2	1	

- F1; BL-5AW (19 kHz CUT)
- F2; BL-12BL (19 kHz THROUGH)
- F3; BL-1HF (38 kHz THROUGH)
- L1; 1970 (19 kHz COIL)
- NOISE AMP.; FLAT AMP. $A_v = 20 \text{ dB}$

ADJUSTMENT OF VCO FREE RUNNING FREQUENCY (VR₄)

Adjust VR₄, semi-fixed potentiometer, until VCO frequency reaches 76 kHz.

NOTE: Measurement of VCO frequency use the high input impedance and low capacitance amplifier, whose gain is larger than 30 dB.

Make a point of measurement within 0.59 inch around VR₄, or make total harmonic distortion least when the modulation frequency is 150 Hz at ONLY MODE.

ADJUSTMENT OF 19 kHz's CANCELER (VR₁, L₁)

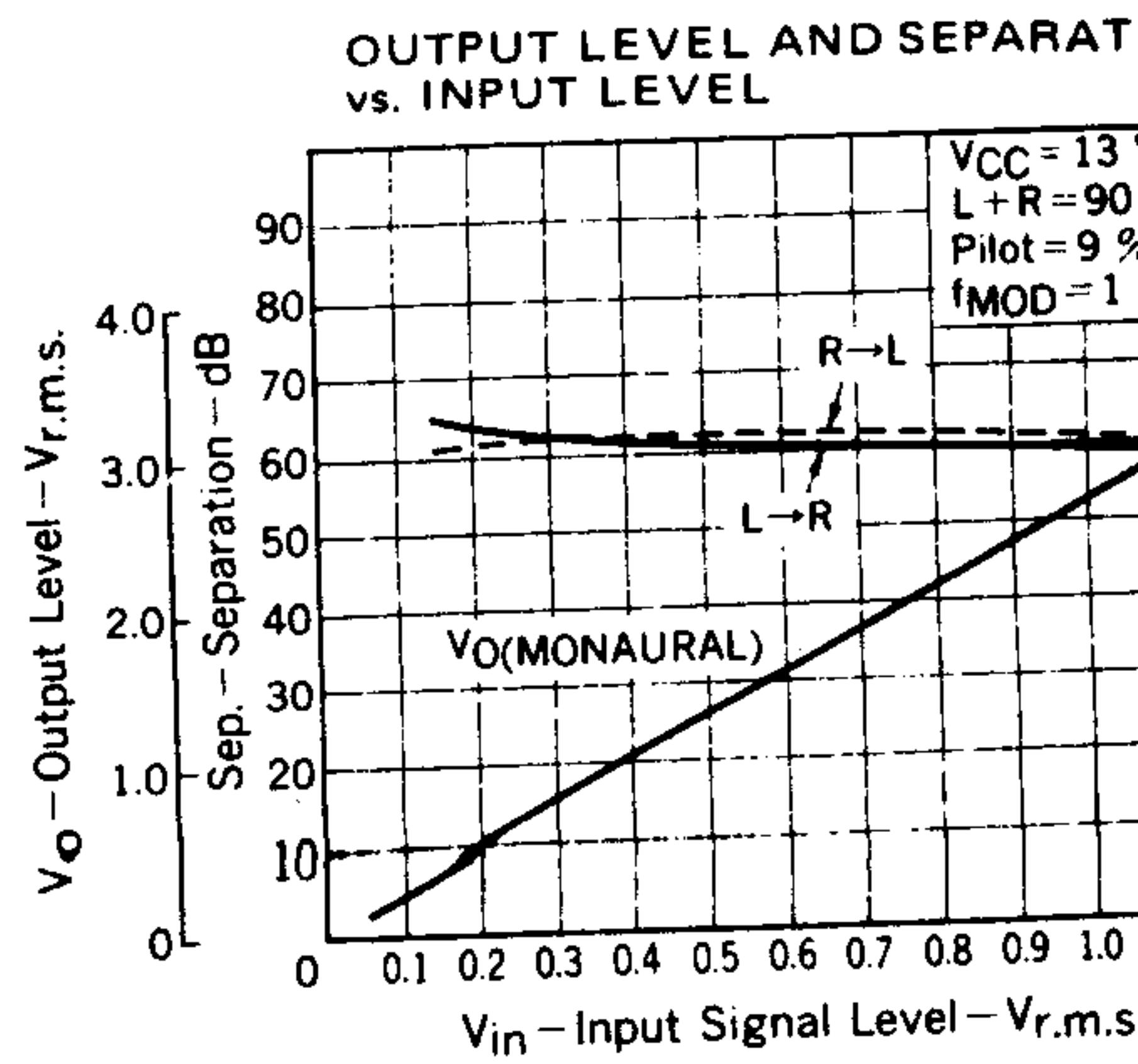
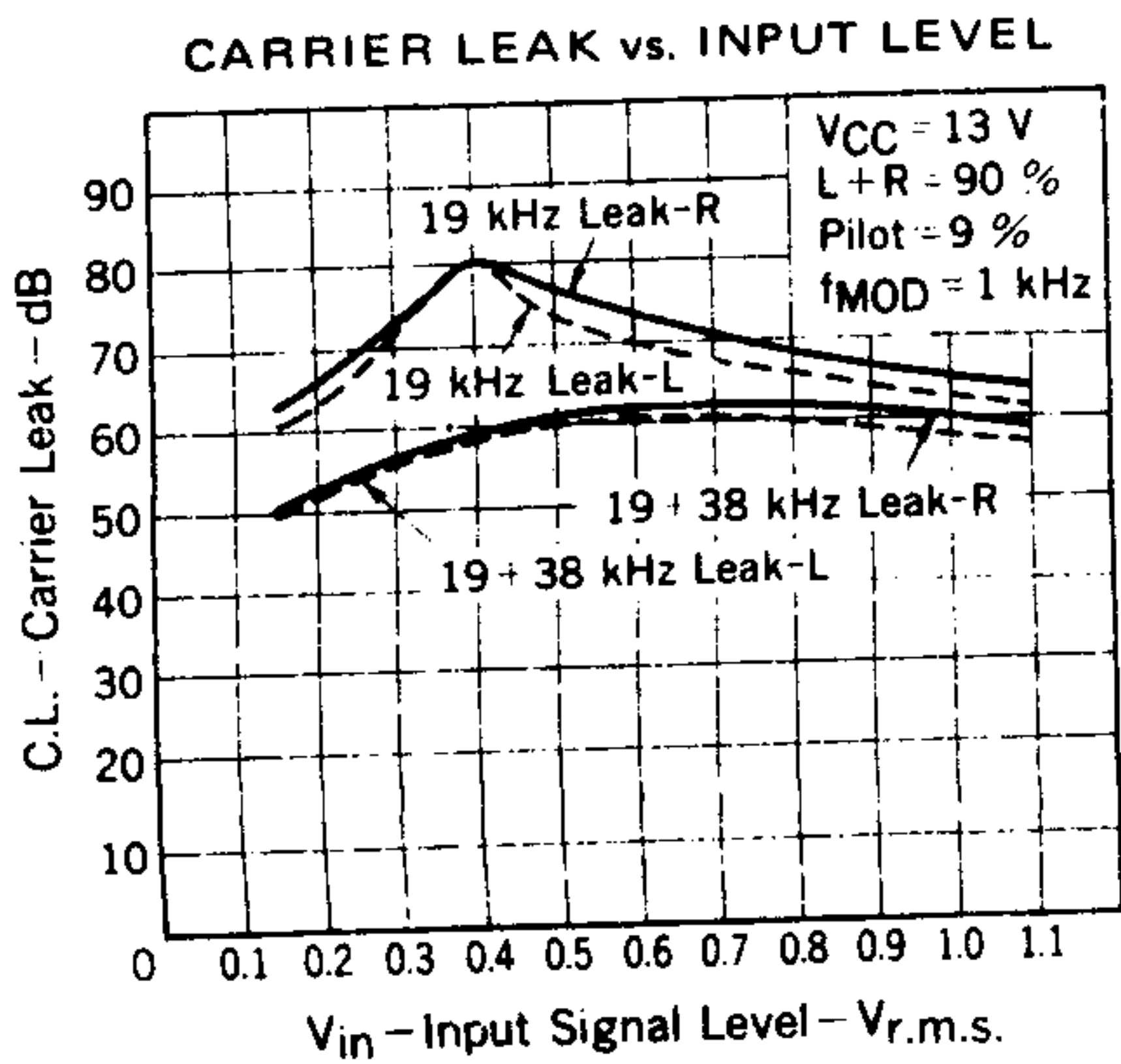
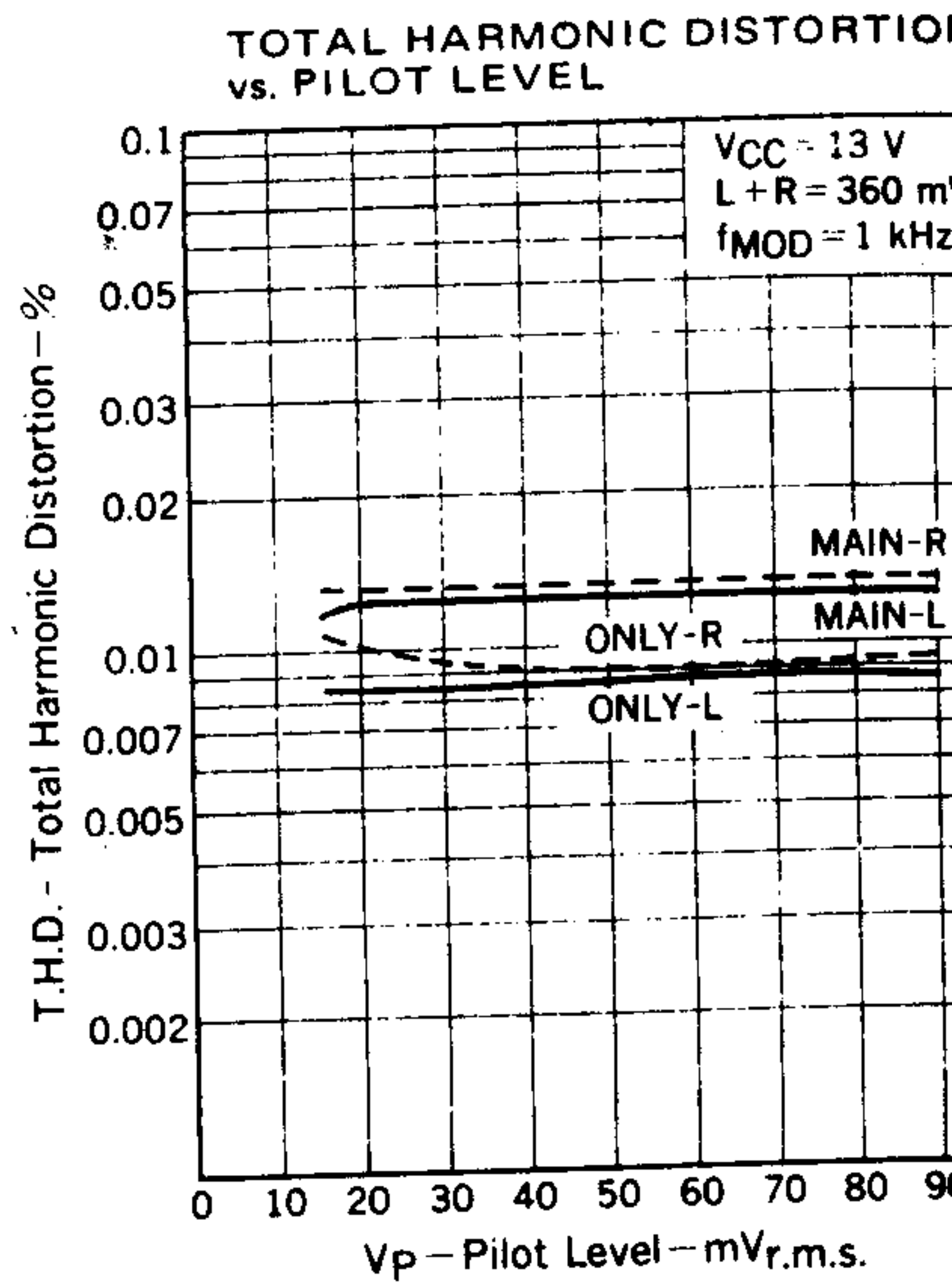
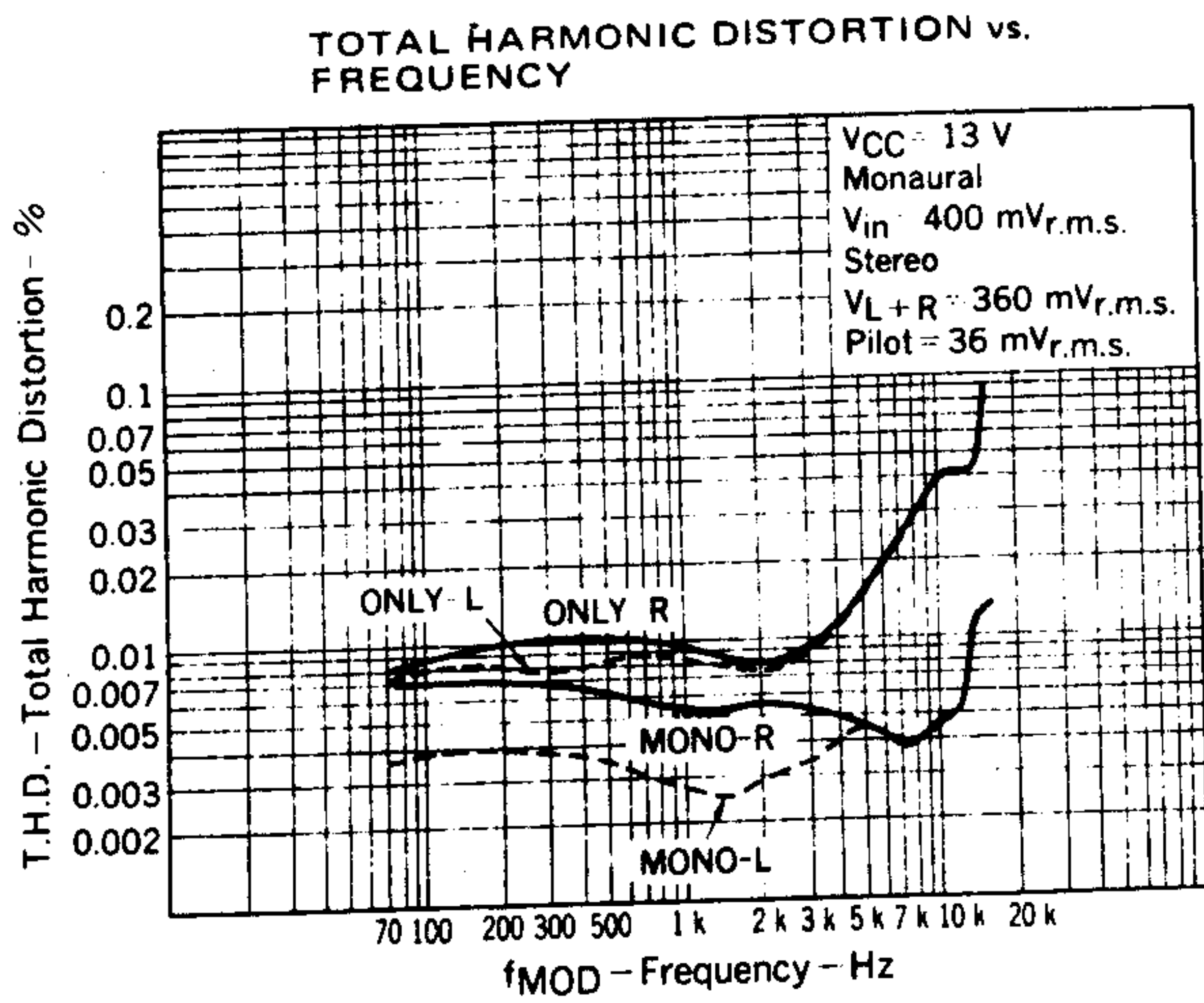
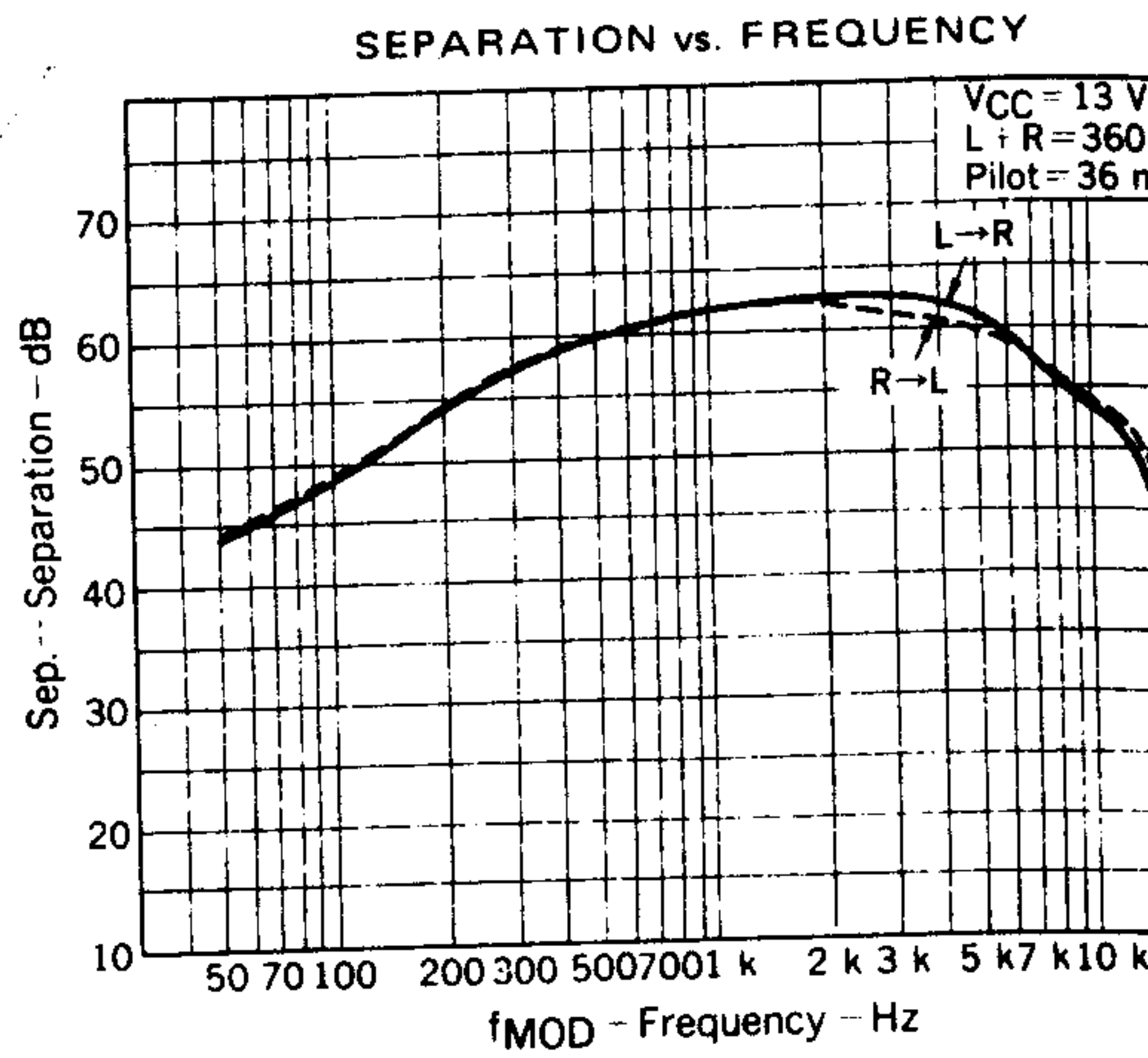
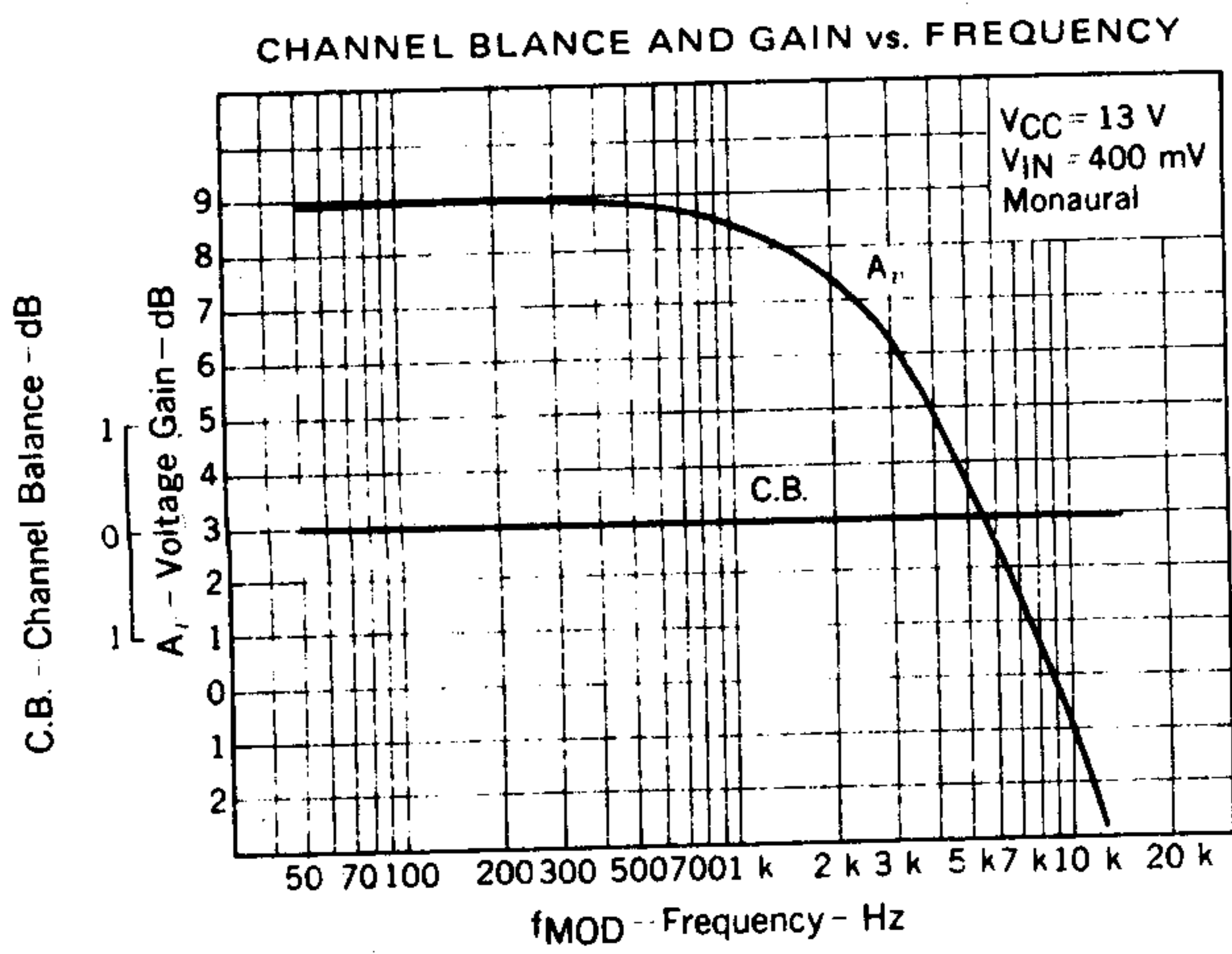
1. Adjust VR₁, semi-fixed potentiometer, until both L-ch output and R-ch output reach the minimum and also level (19 kHz).
2. Adjust L₁, phase coil of 19 kHz, until both L-ch output and R-ch output reach the least and also same level.
3. Repeat 1 and 2 a few times, the canceler level of both L-ch output and R-ch output reaches the same.

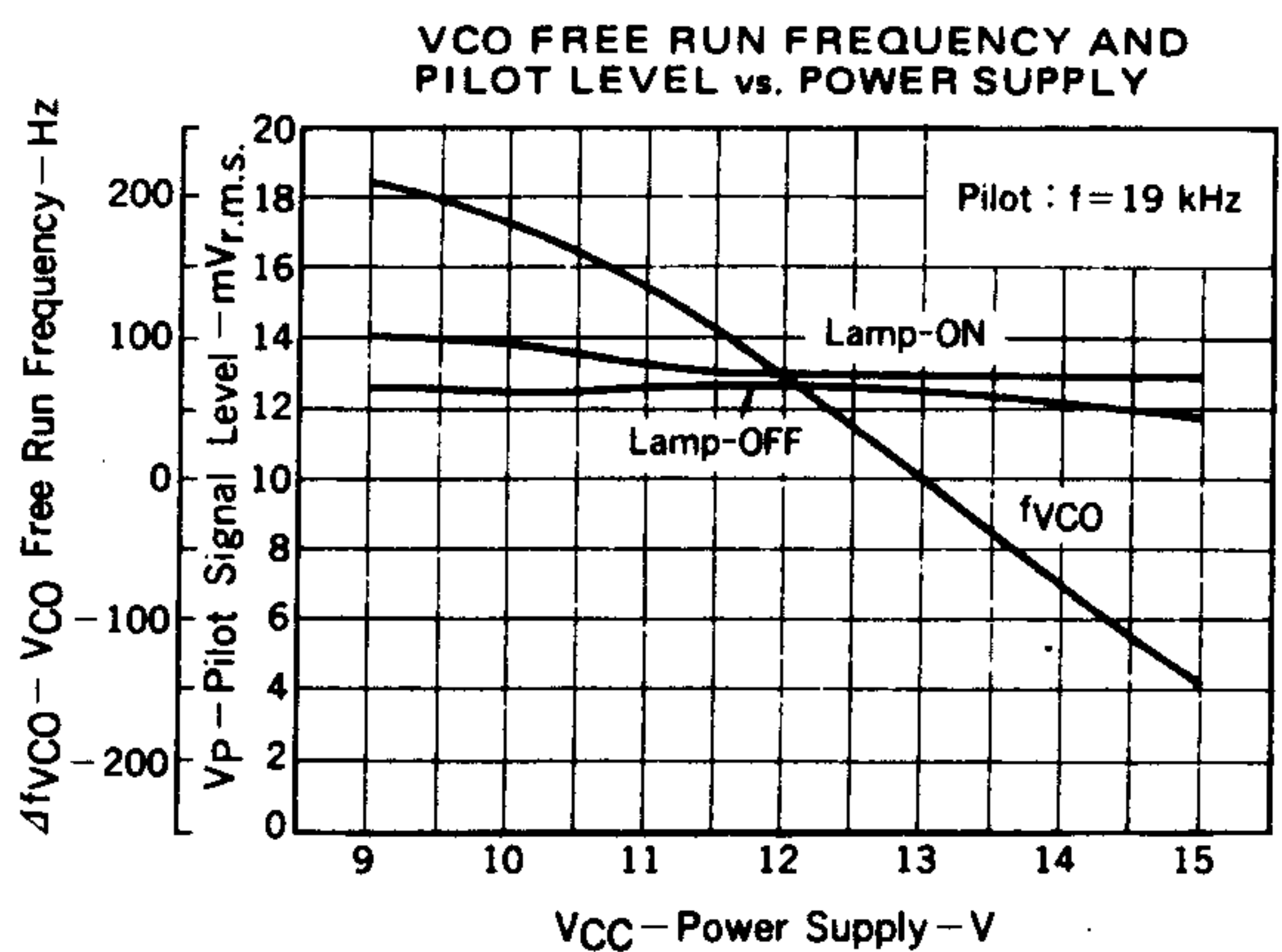
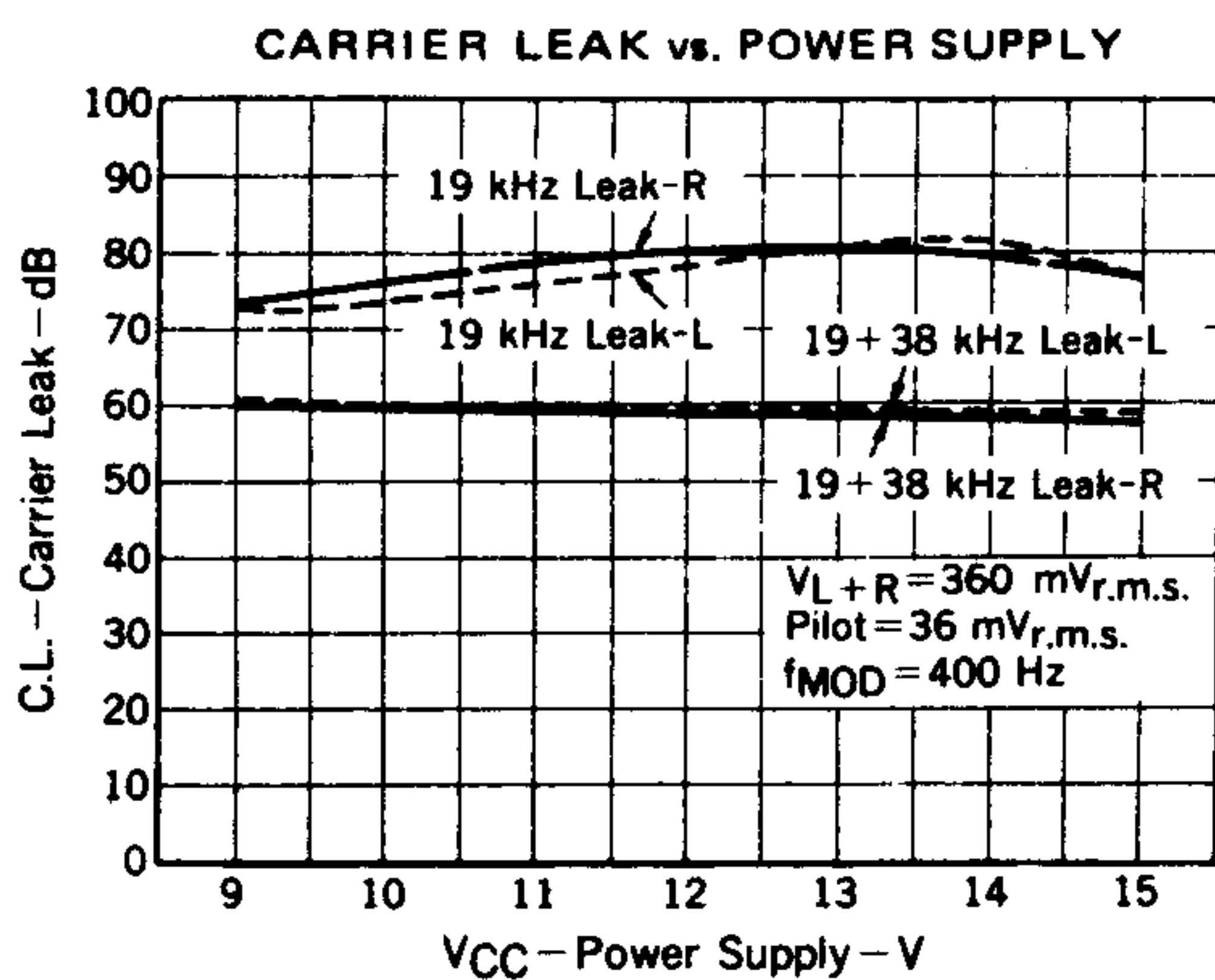
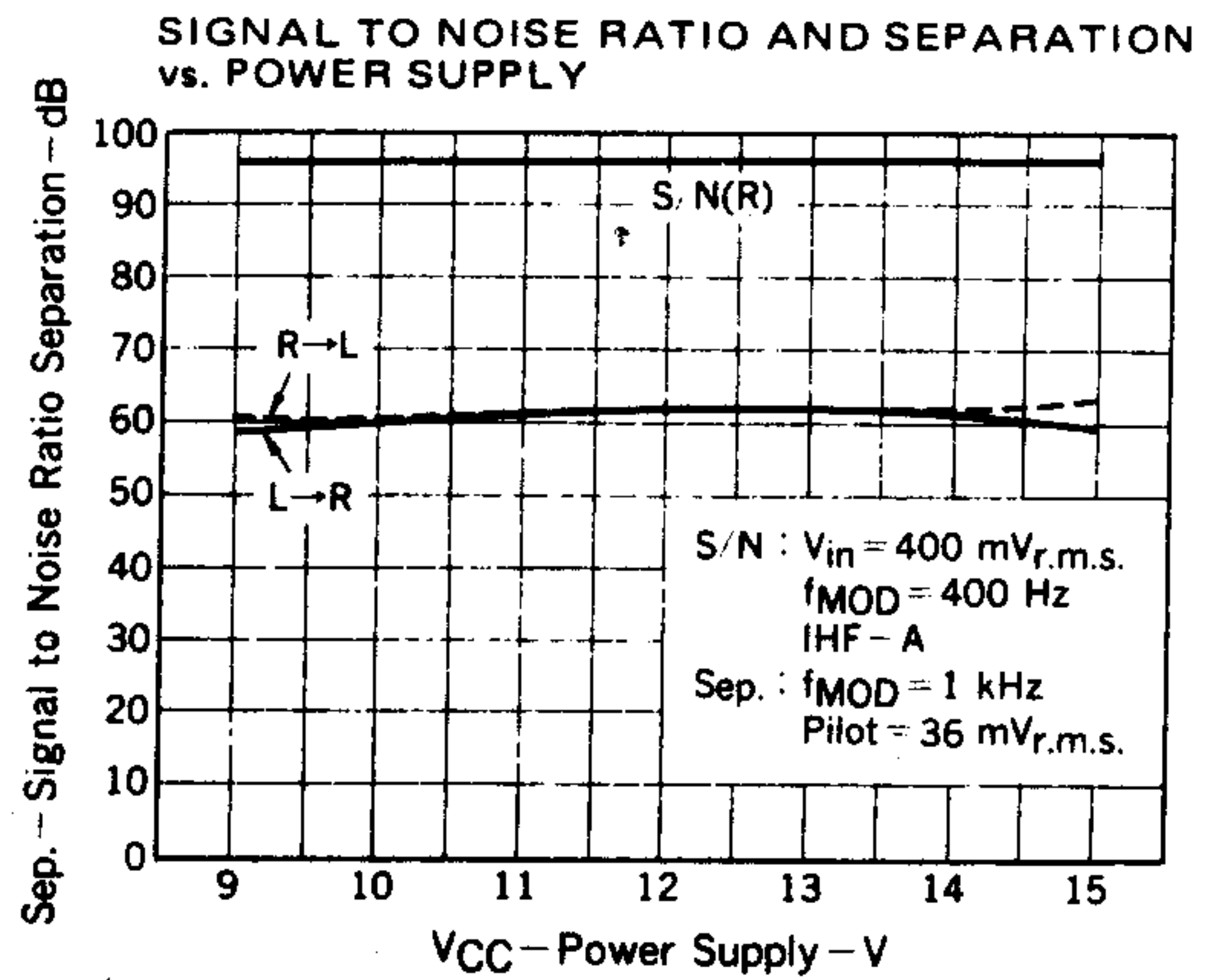
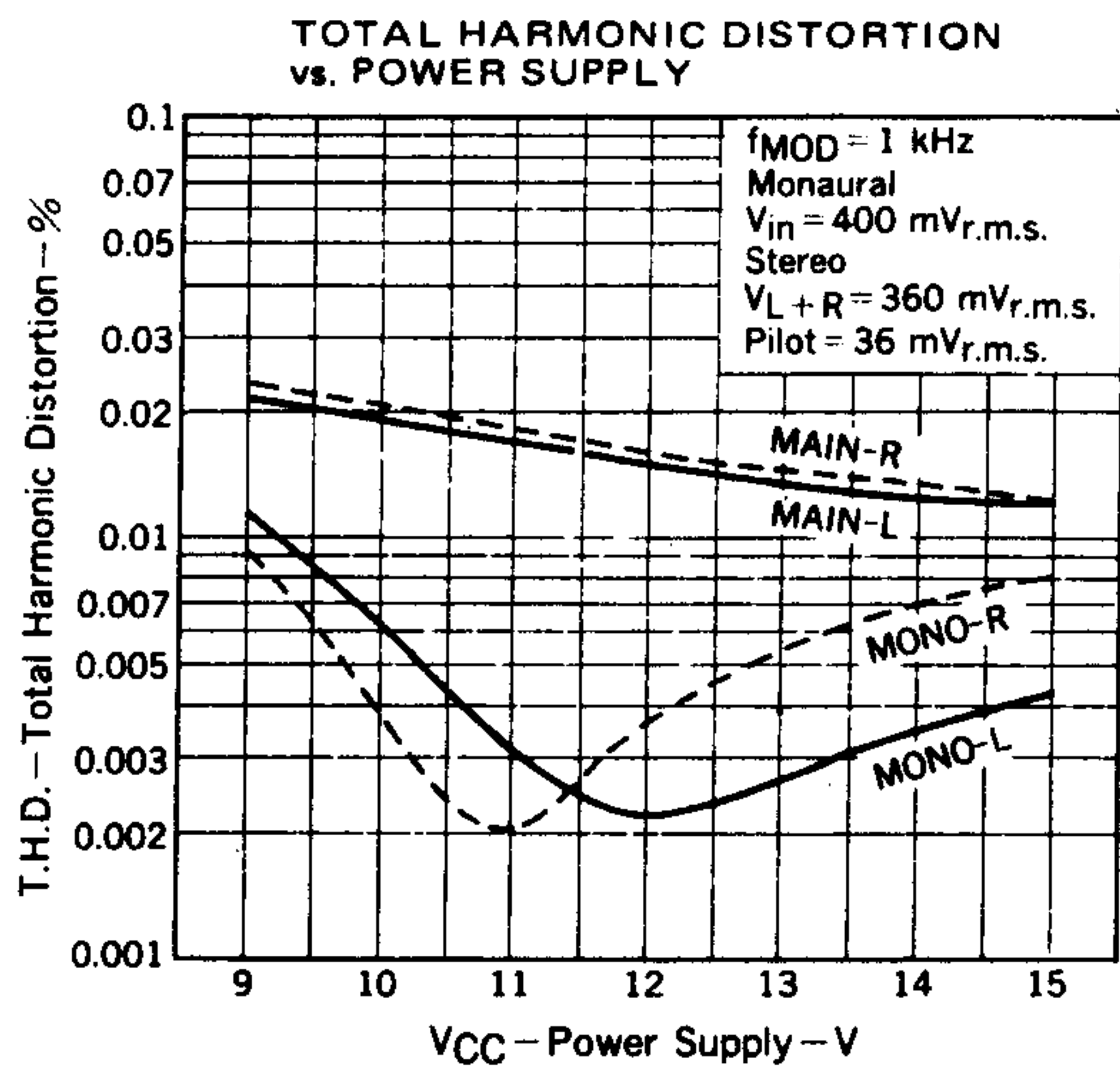
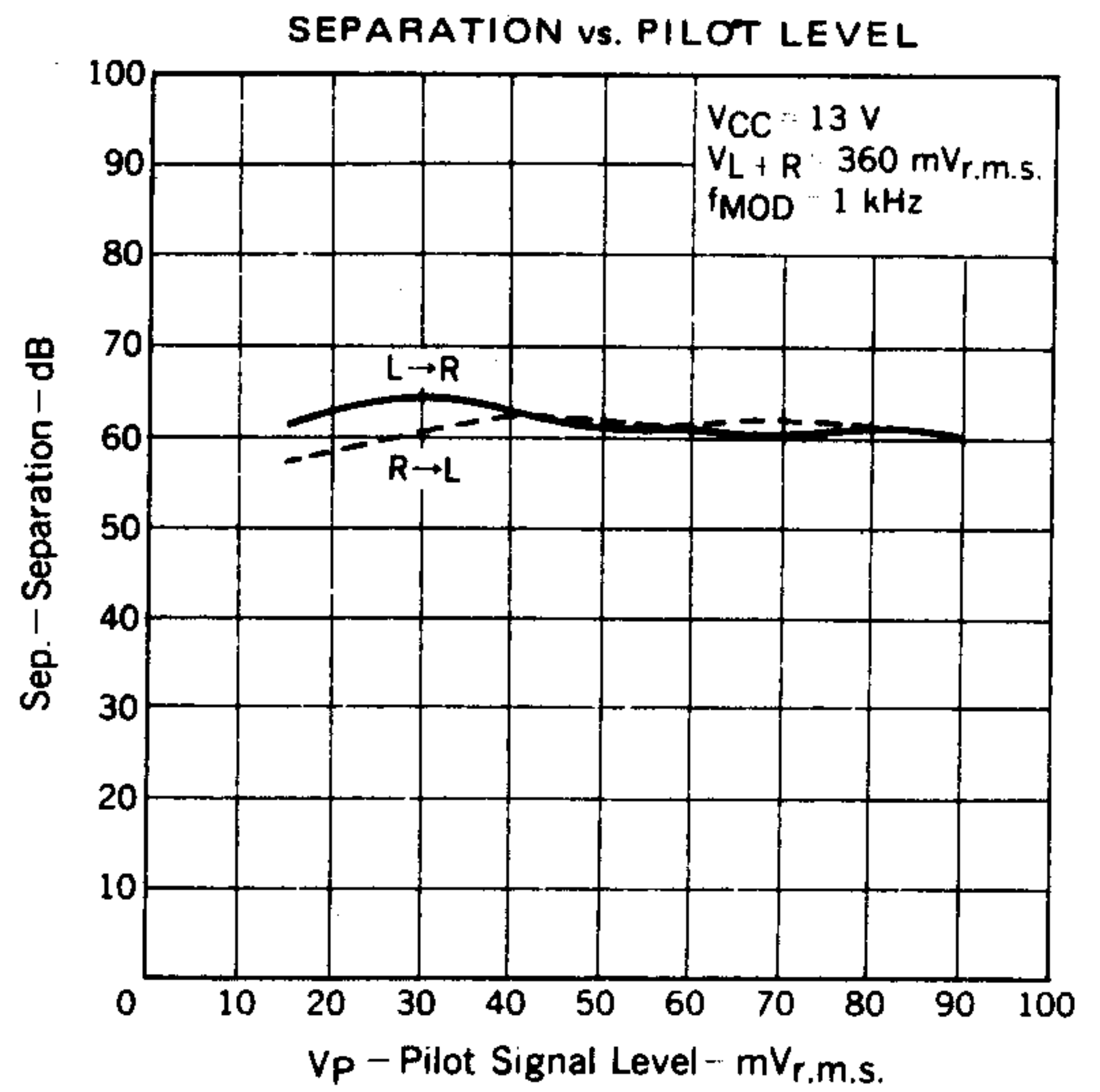
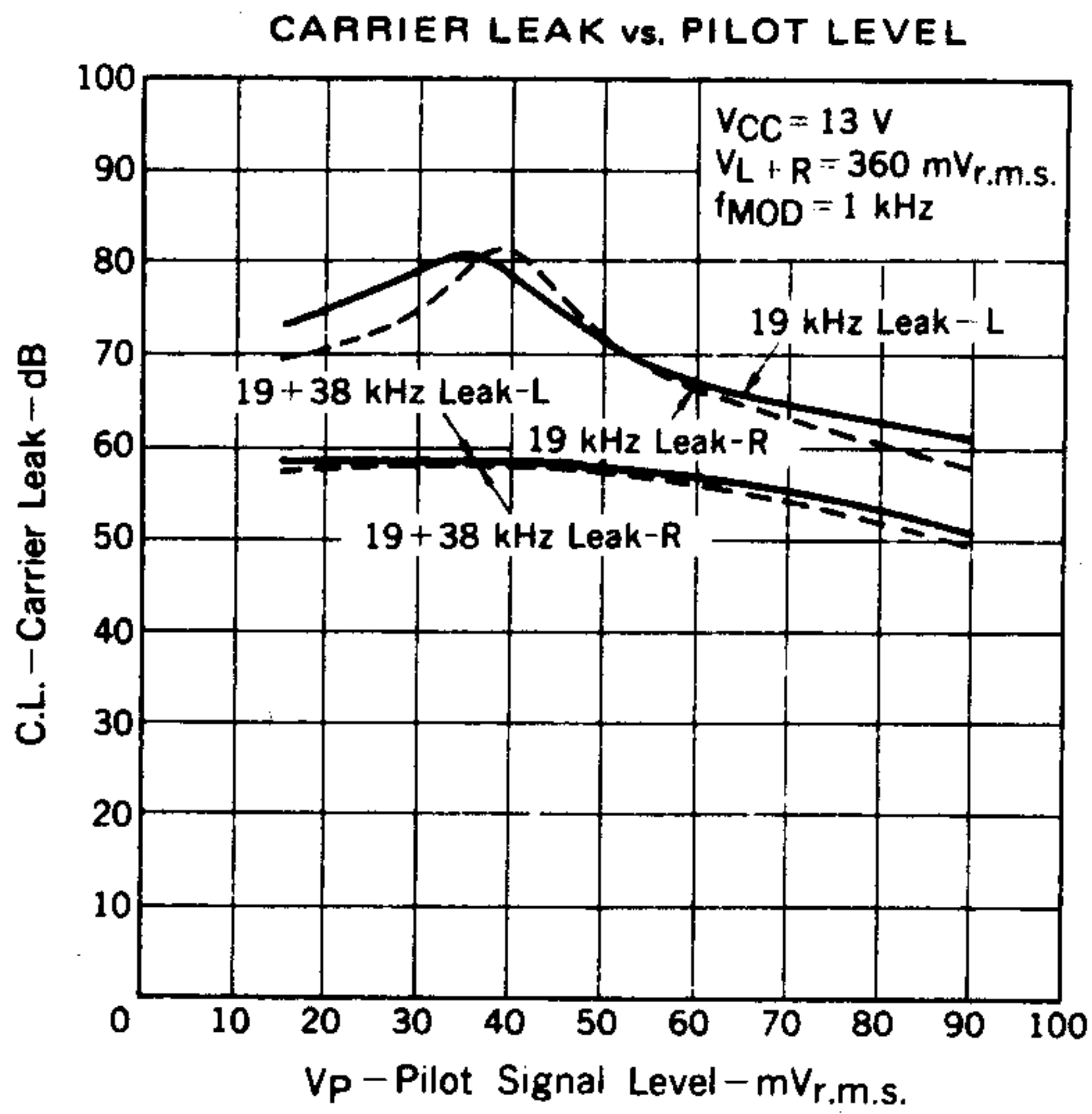
ADJUSTMENT OF SEPARATION (VR₂, VR₃)

Separation can be adjusted independently with VR₂ and VR₃. Adjust them until the separation of L-ch and R-ch reaches the same level.

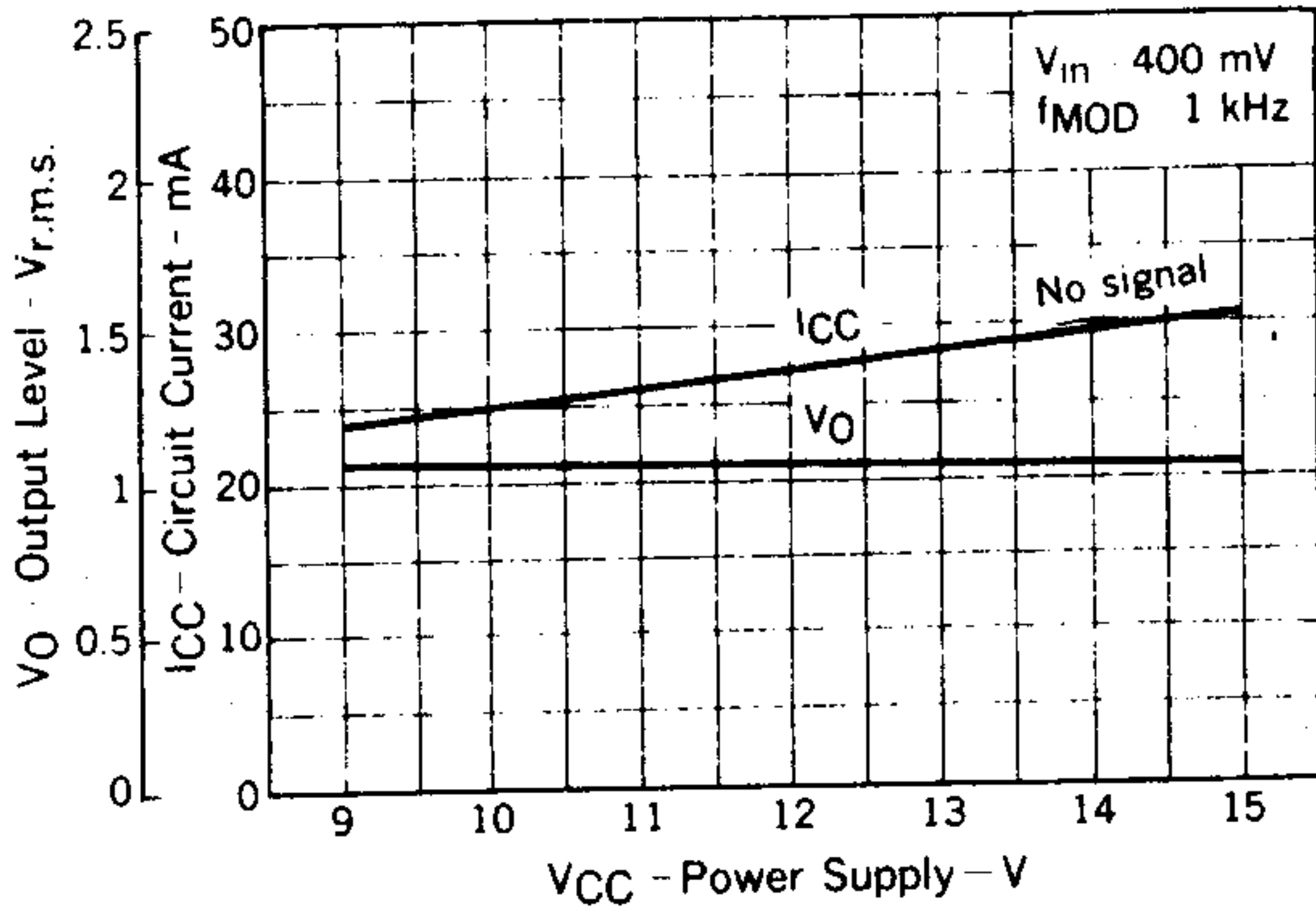
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TYPICAL CHARACTERISTICS (T_a = 25 °C)

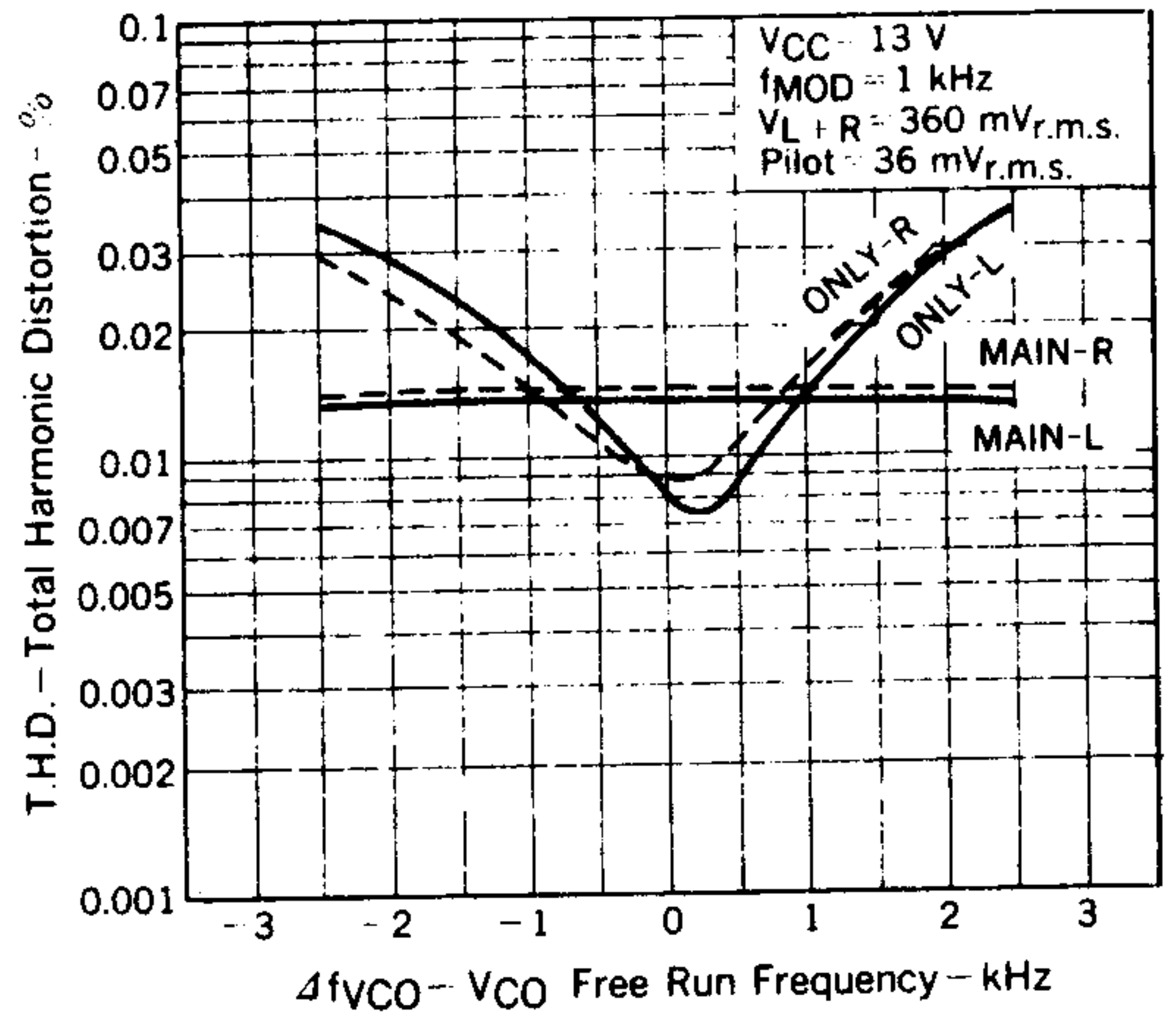




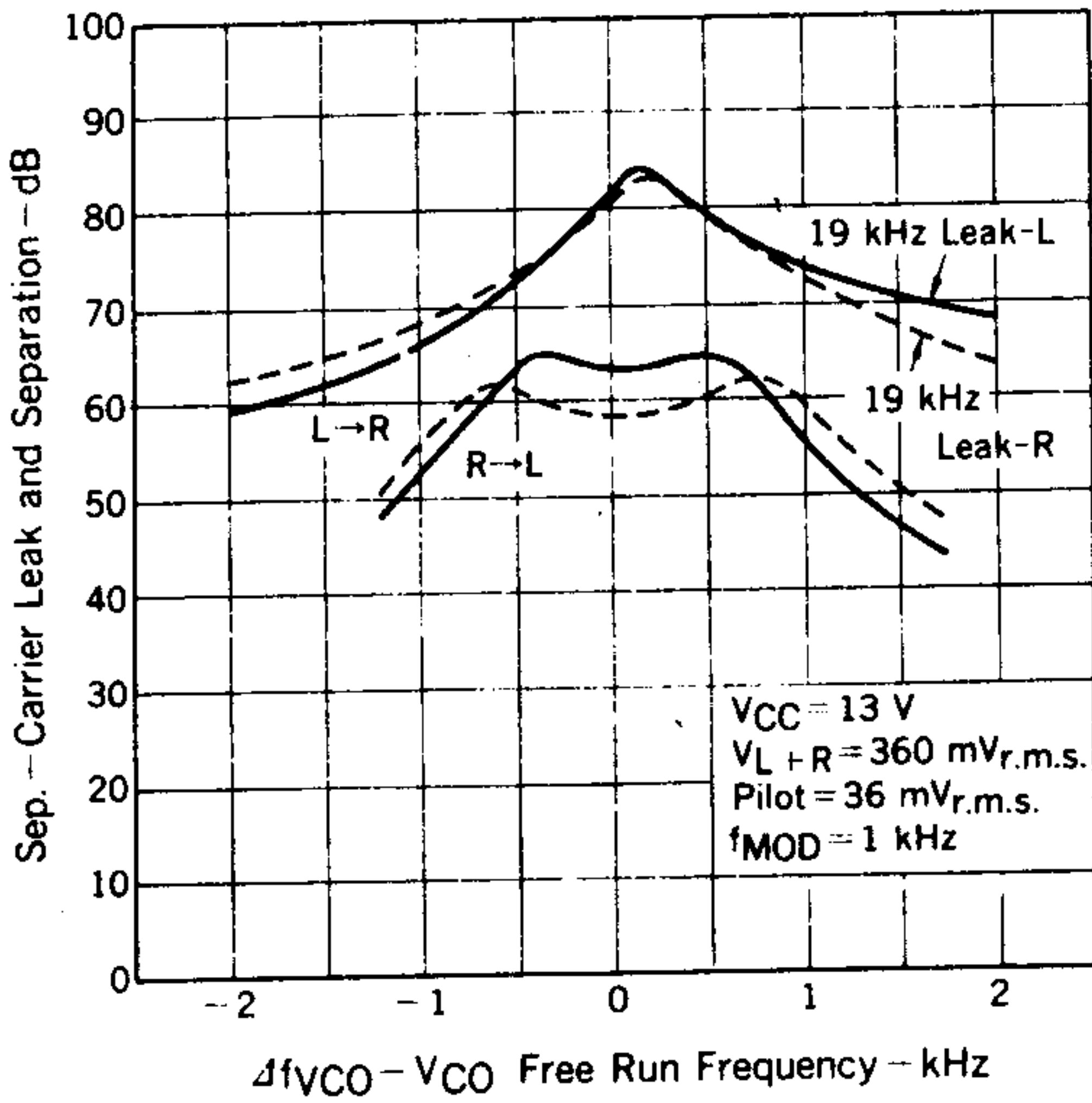
OUTPUT LEVEL AND CIRCUIT CURRENT vs. POWER SUPPLY



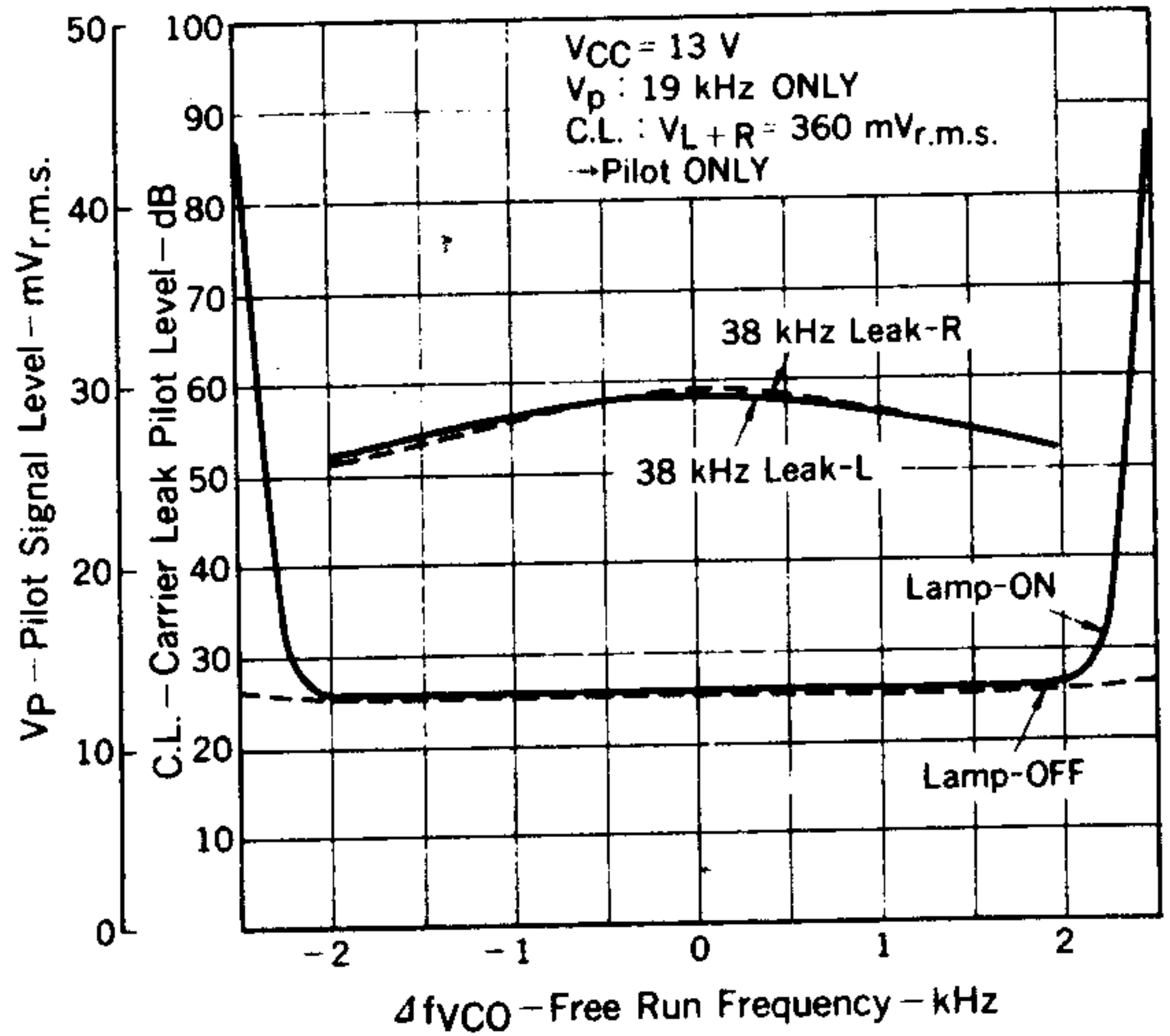
TOTAL HARMONIC DISTORTION vs. VCO FREE RUN FREQUENCY



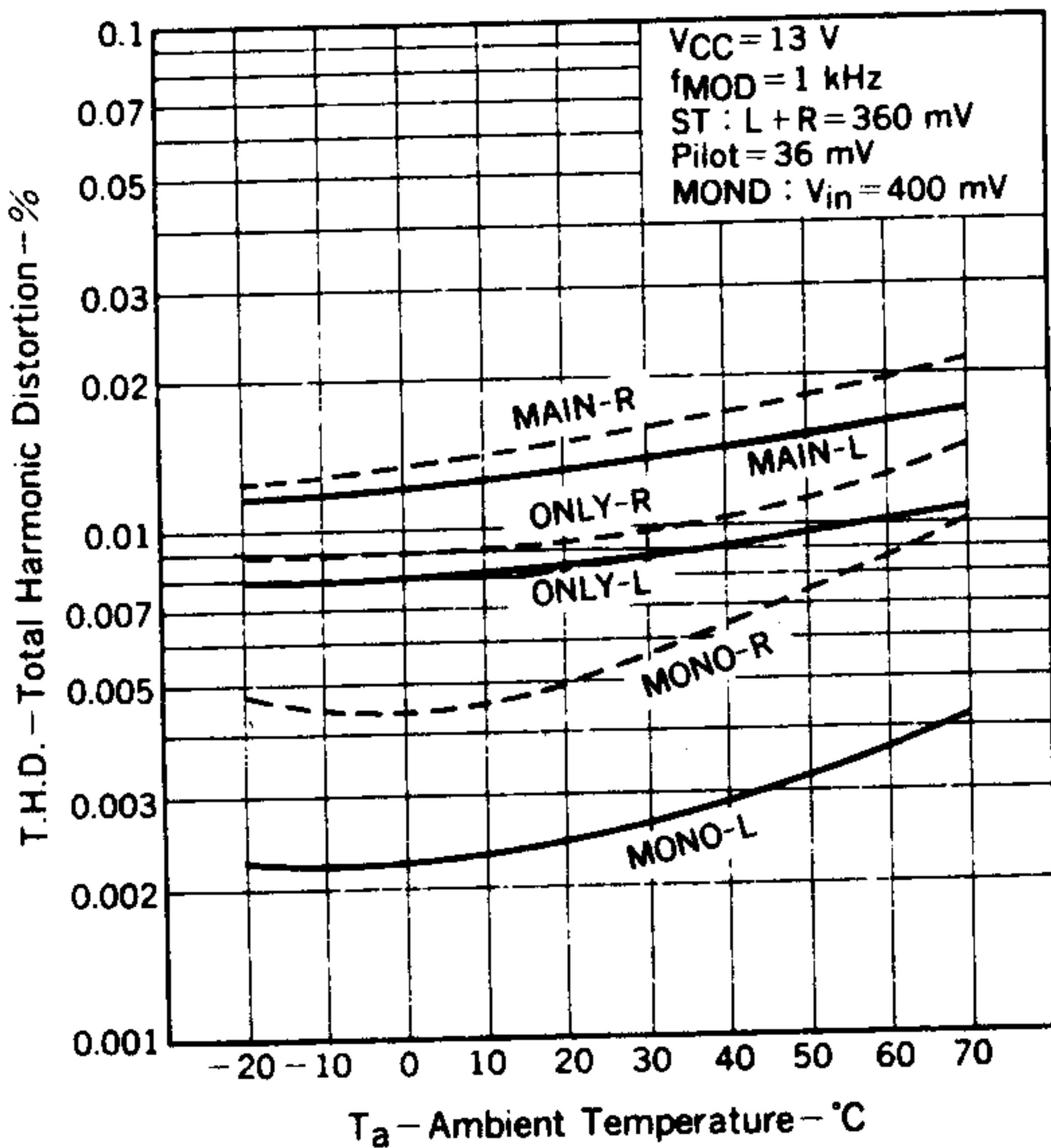
CARRIER LEAK AND SEPARATION vs. VCO FREE RUN FREQUENCY



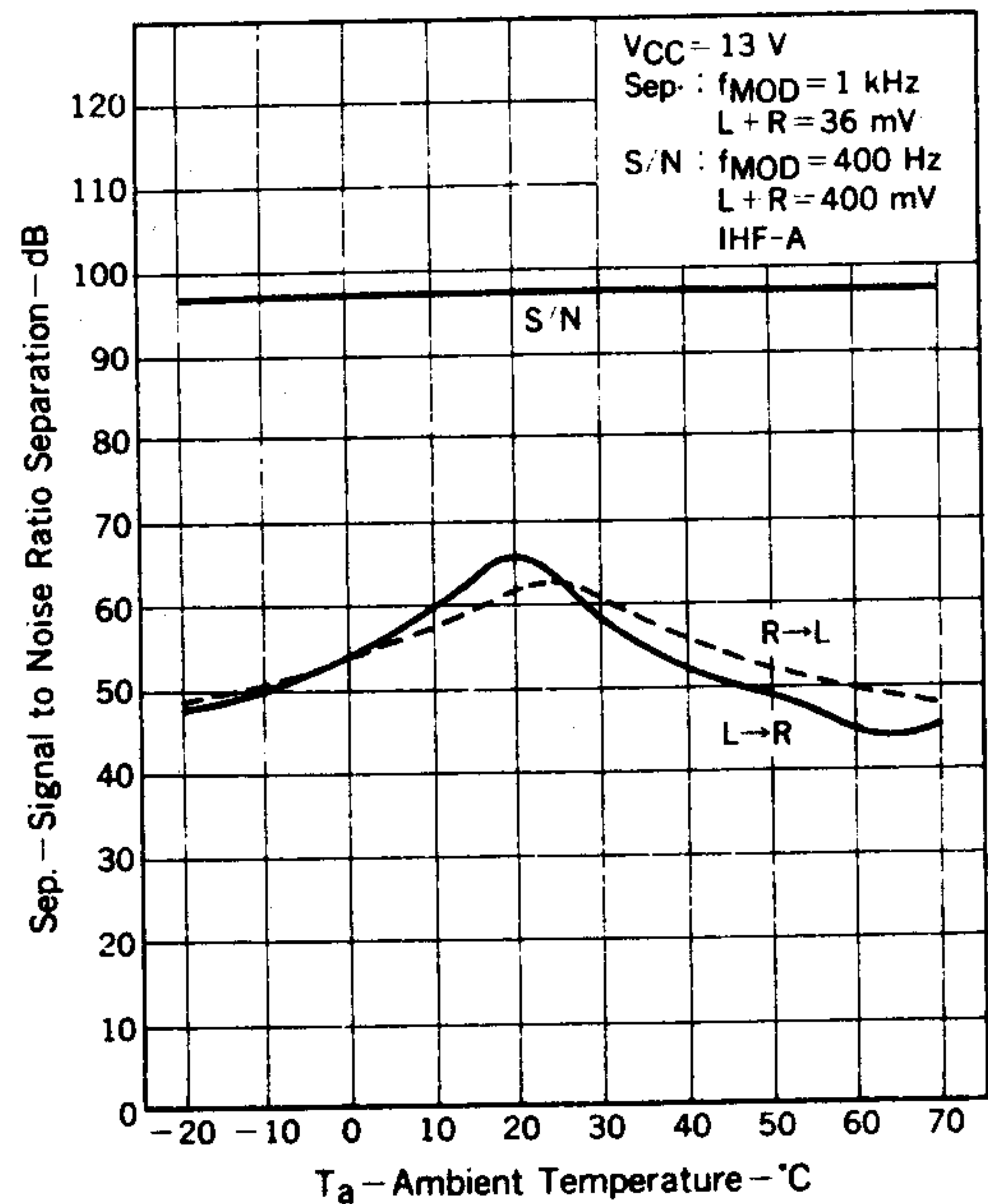
PILOT LEVEL AND CARRIER LEAK vs. VCO FREE RUN FREQUENCY



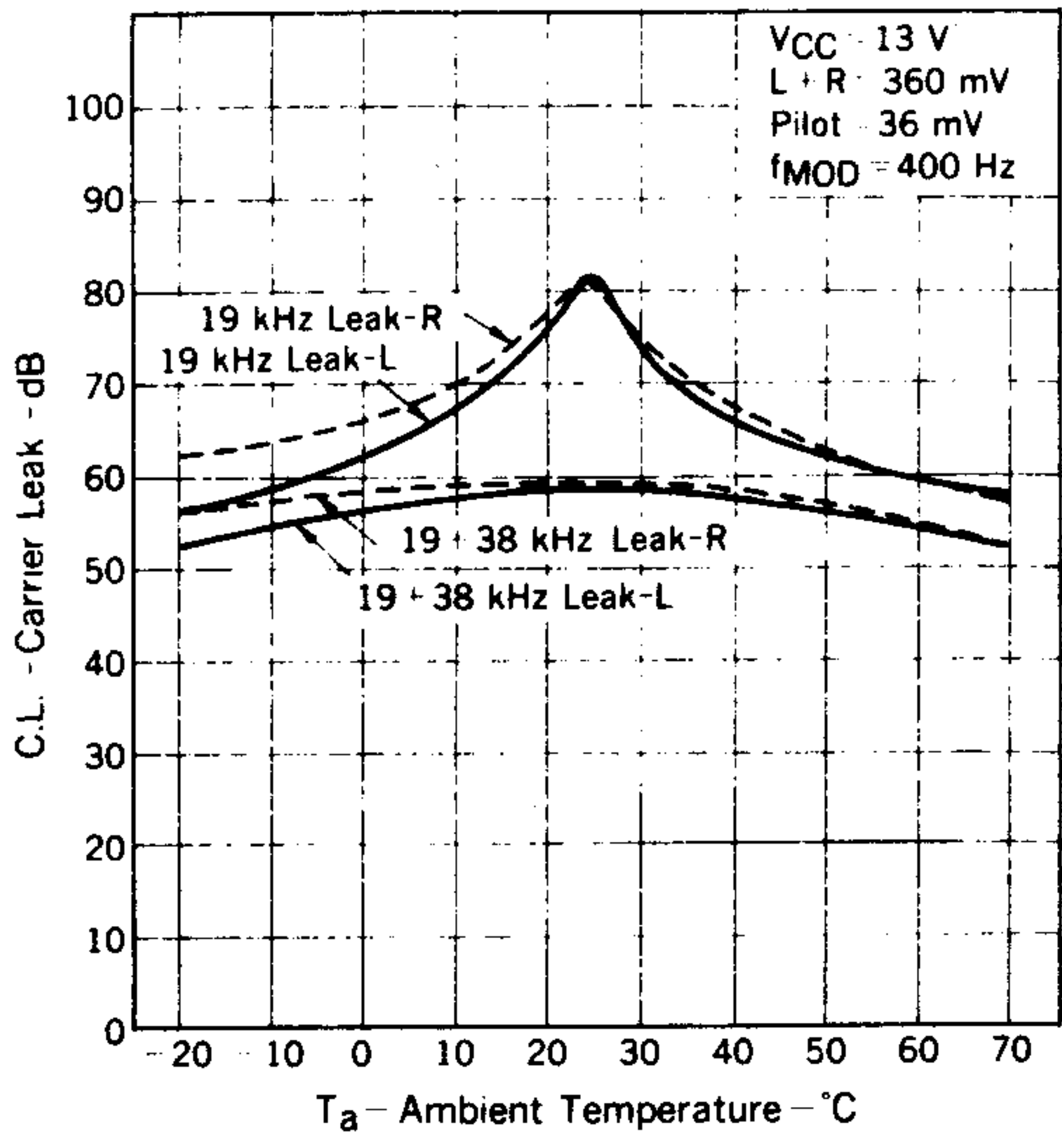
TOTAL HARMONIC DISTORTION vs. AMBIENT TEMPERATURE



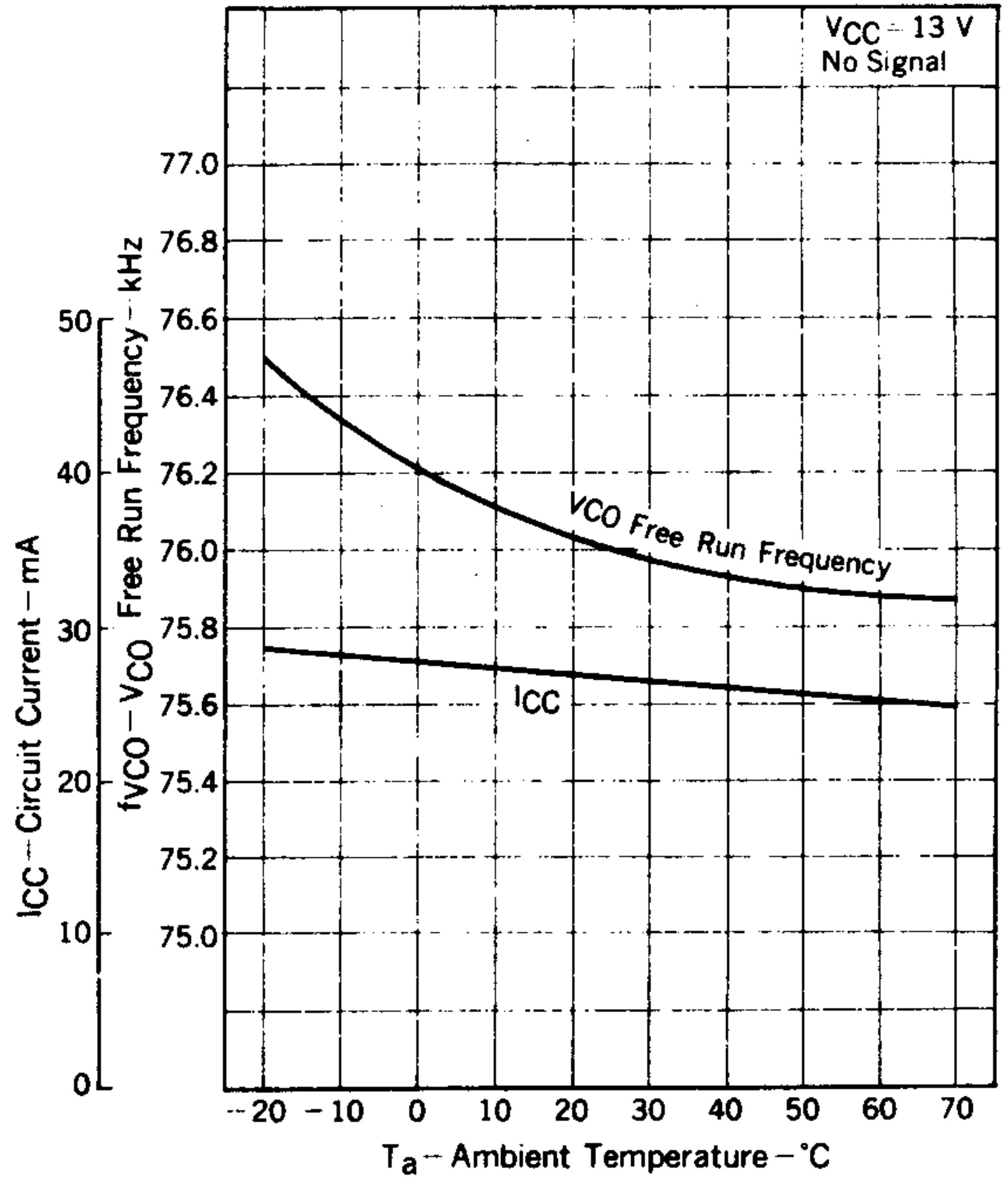
SIGNAL TO NOISE RATIO AND SEPARATION vs. AMBIENT TEMPERATURE



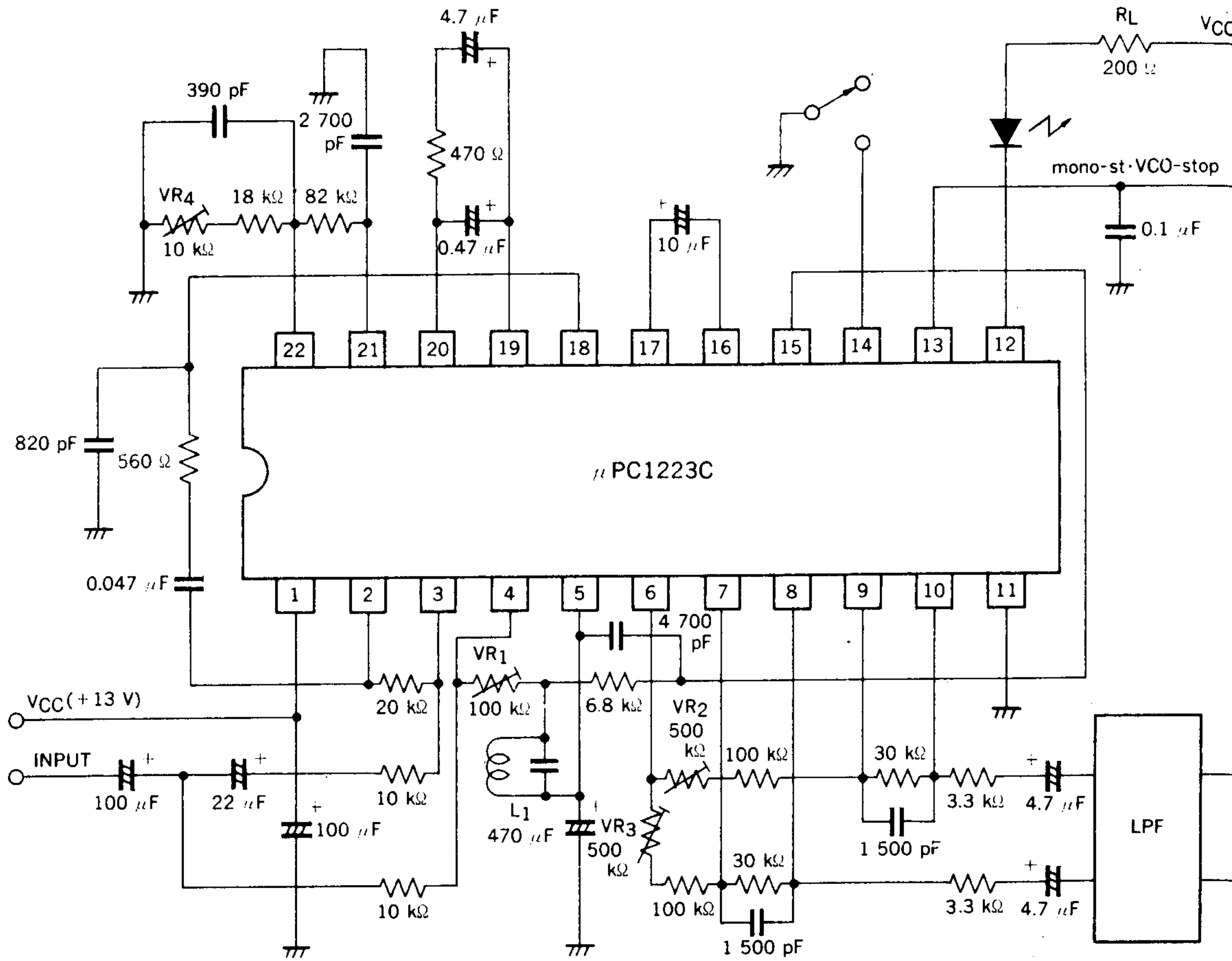
CARRIER LEAK vs. AMBIENT TEMPERATURE



VCO FREE RUN FREQUENCY AND CIRCUIT CURRENT vs. AMBIENT TEMPERATURE

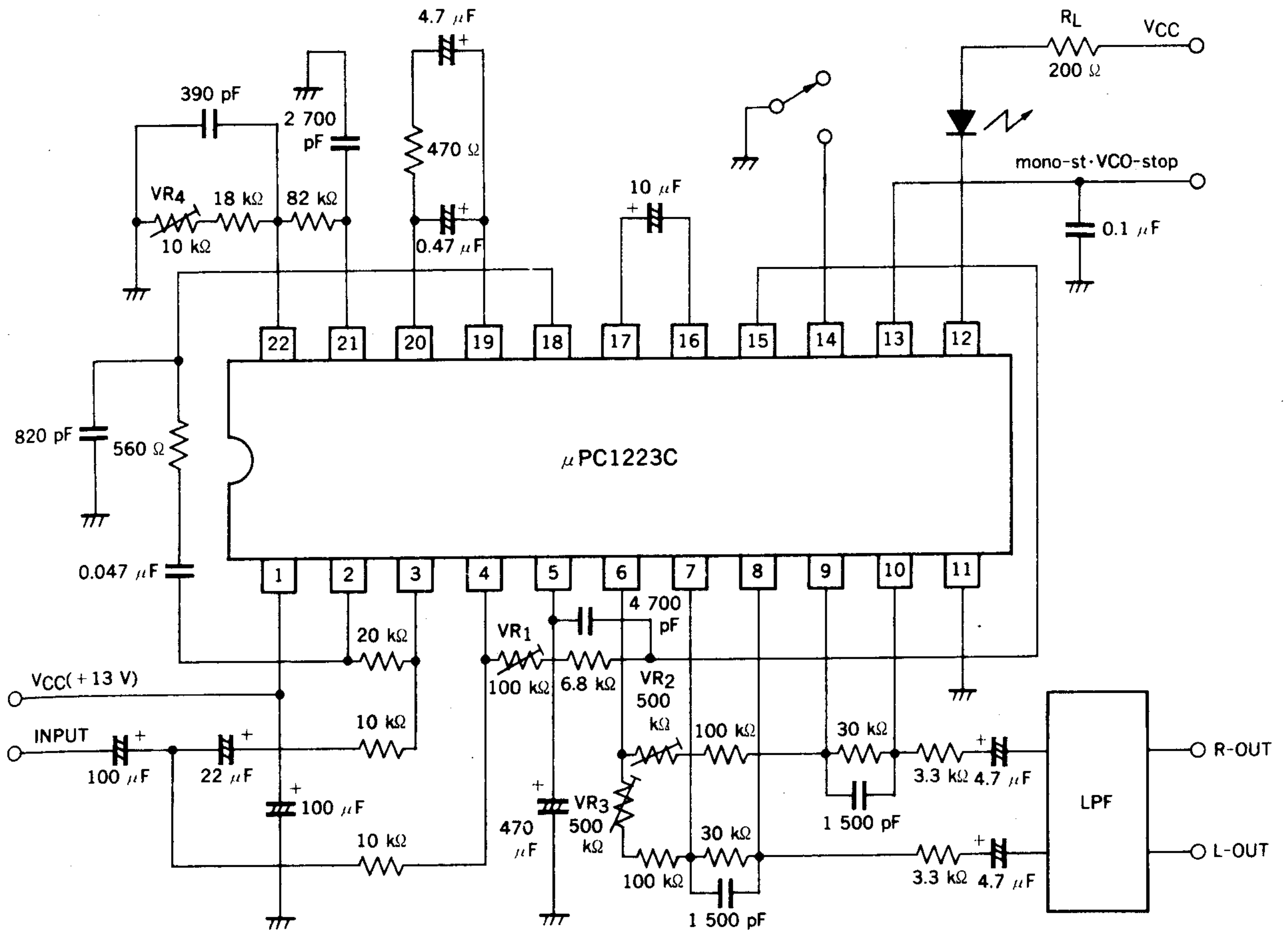


APPLICATION CIRCUIT 1 (Sine wave cancelling)

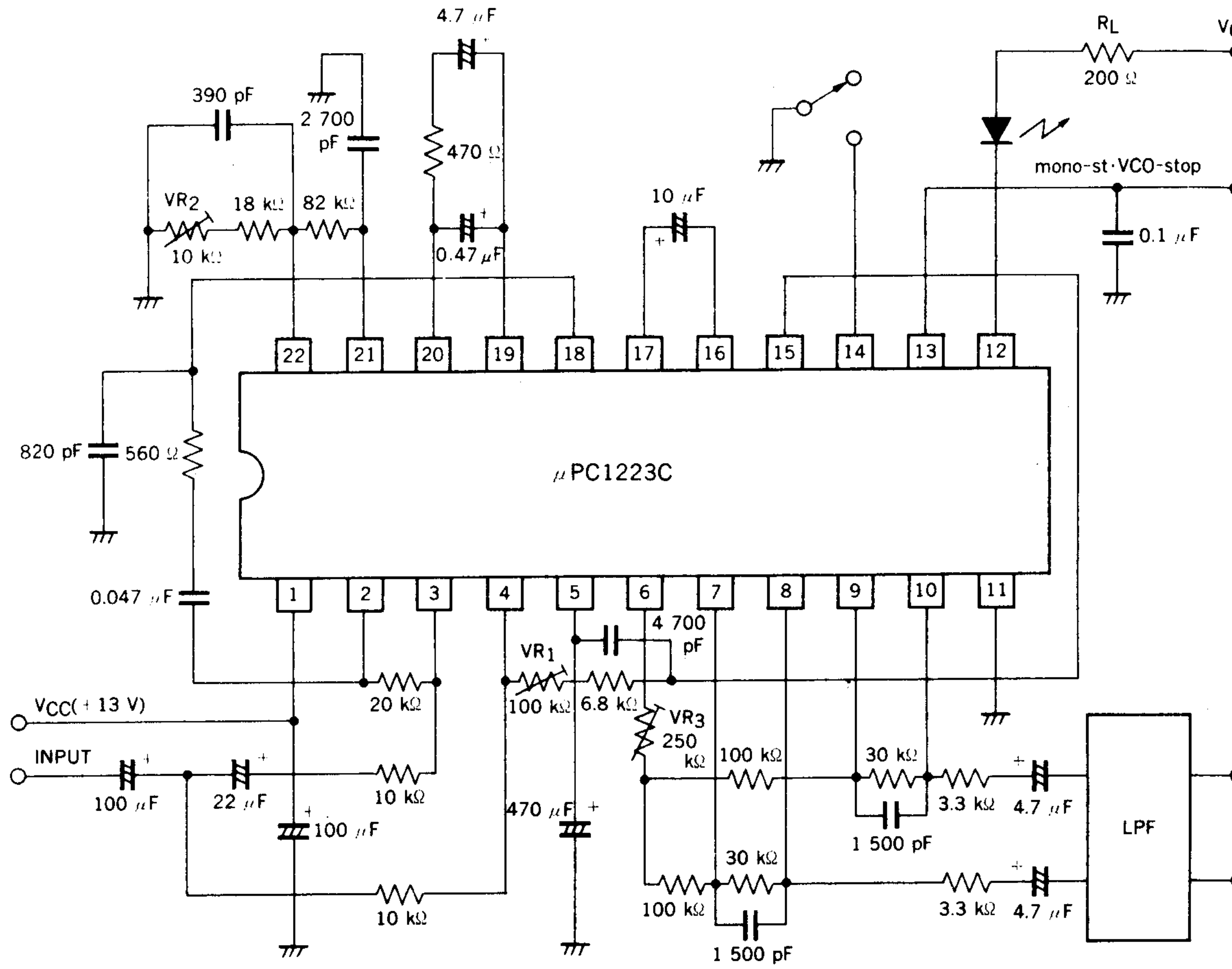


- VR₁ ; 19 kHz Cancel Adj.
- VR₄ ; 76 kHz OSC Adj.
- VR_{2, 3} ; Sep. Adj.
- LPF ; BL-5AW (19 kHz Cut)
- L₁ ; 1970 (19 kHz Coil) (KORIN GIKEN C)

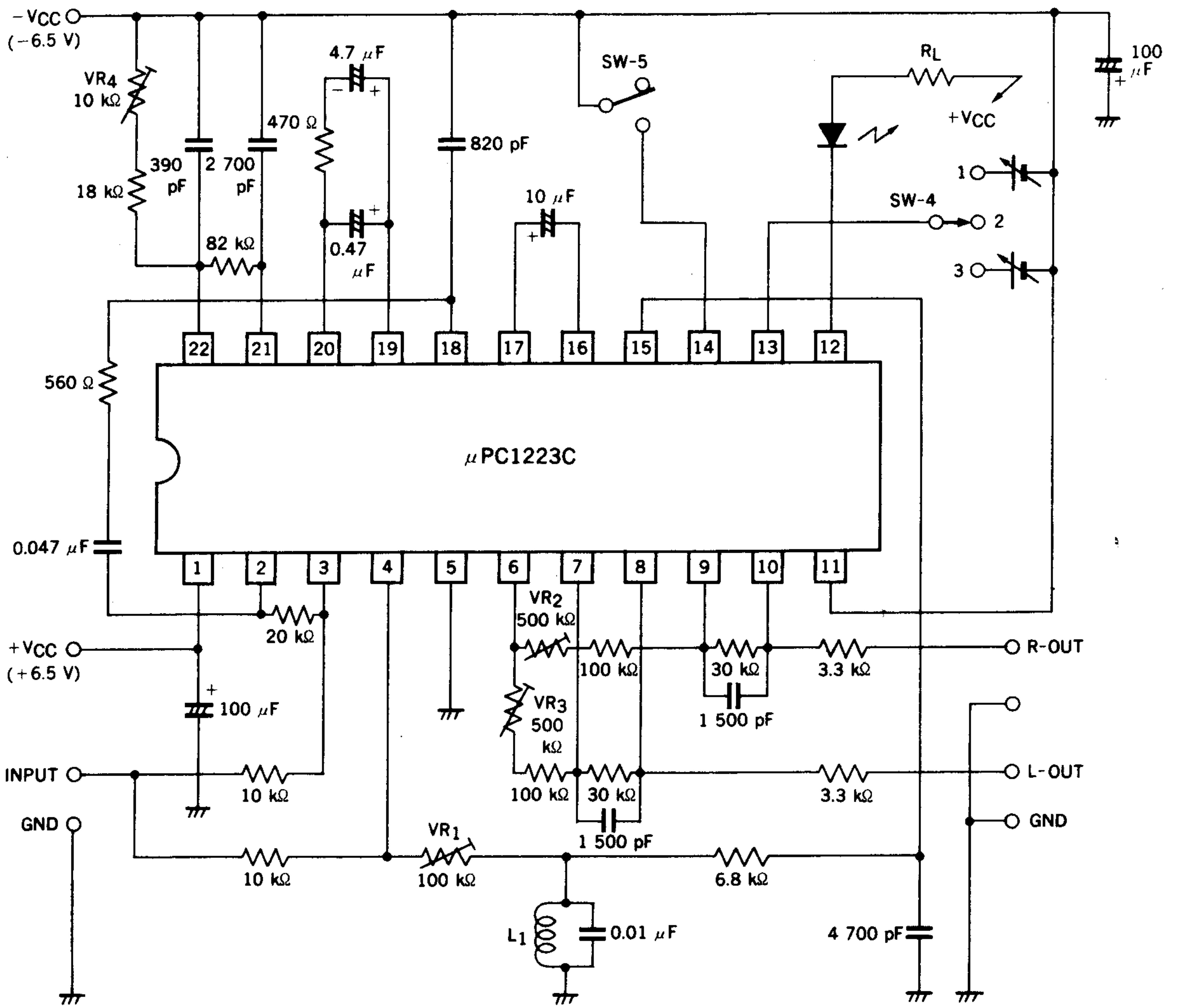
APPLICATION CIRCUIT 2 (Triangle cancelling)



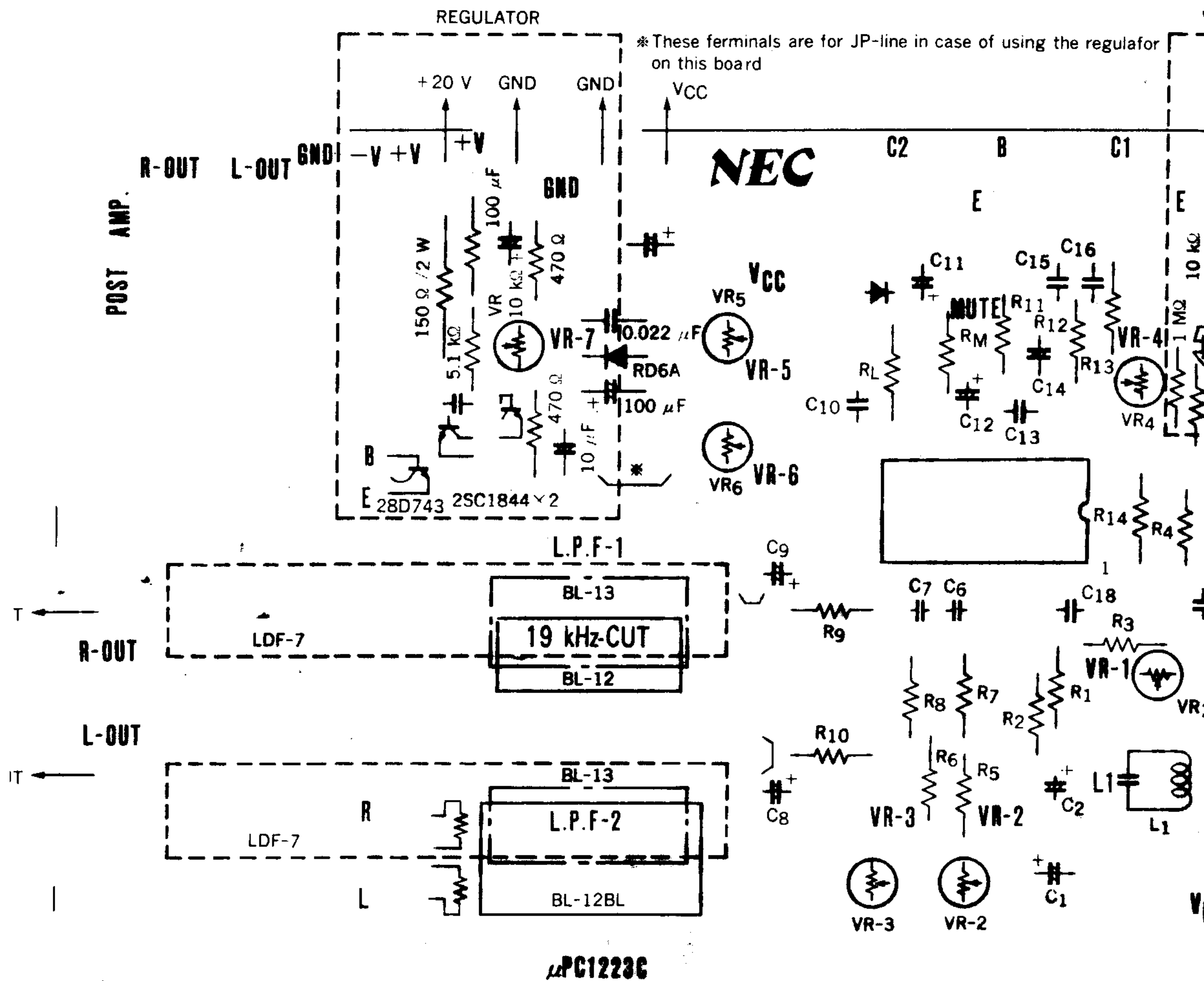
APPLICATION CIRCUIT 3 (Separation adjustment by single potentiometer)



APPLICATION CIRCUIT 4 (Split supply)



PRINTED CIRCUIT BOARD COMPONENT ARRANGEMENT (Copper foil side)



μPC1223C

- | | | | |
|--------------------------|---|---------------------------|--|
| R ₁ : 10 kΩ | R ₁₁ : 470 Ω | C ₁ : 100 μF | C ₁₁ : 10 μF |
| R ₂ : 10 kΩ | R ₁₂ : 82 kΩ | C ₂ : 22 μF | C ₁₂ : 10 μF |
| R ₃ : 20 kΩ | R ₁₃ : 18 kΩ | C ₃ : 100 μF | C ₁₃ : 0.47 μF |
| R ₄ : 6.8 kΩ | R ₁₄ : 560 Ω | C ₄ : 470 μF | C ₁₄ : 4.7 μF |
| R ₅ : 100 kΩ | R _L : Lamp protecting resistor | C ₅ : 4 700 pF | C ₁₅ : 2 700 pF |
| R ₆ : 100 kΩ | VR ₁ : 19 kHz cancel adj. | C ₆ : 1 500 pF | C ₁₆ : 390 pF Polystyrene capacitor |
| R ₇ : 30 kΩ | VR ₂ : L-ch sep. adj. | C ₇ : 1 500 pF | C ₁₇ : 820 pF |
| R ₈ : 30 kΩ | VR ₃ : R-ch sep. adj. | C ₈ : 4.7 μF | C ₁₈ : 0.047 μF |
| R ₉ : 3.3 kΩ | VR ₄ : VCO adj. | C ₉ : 4.7 μF | |
| R ₁₀ : 3.3 kΩ | VR ₅ : Fixed monaural voltage adj. | C ₁₀ : 0.1 μF | |
| | VR ₆ : VCO STOP voltage adj. | | |
| | | | LPF : BL-12 |
| | | | BL-12BL } (KOR) |
| | | | BL-13 |
| | | | LDF-7 } (TOK) |
| | | | L ₁ : 1970 or 2790 with capacitor |
| | | | 19 kHz Rej. coil (KORIN GIKEN C) |

Note: impossible to use LPF (BL-5AW)

PRINTED CIRCUIT BOARD (Copper foil side)

