NEC ELECTRON DEVICE

BIPOLAR ANALOG INTEGRATED CIRCUIT

μPC1197C

FM MULTIPLEX STEREO DEMODULATOR
SILICON MONOLITHIC BIPOLAR INTEGRATED CIRCUIT

DESCRIPTION

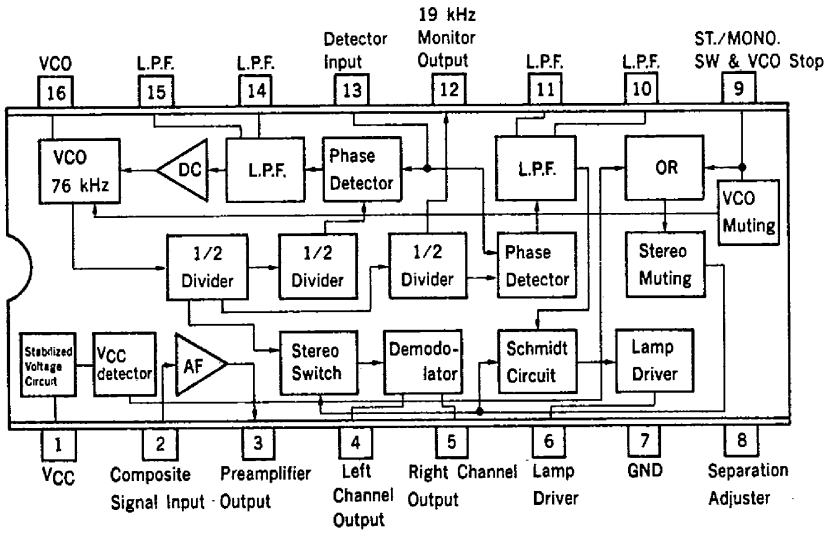
The μPC1197C is a silicon monolithic integrated circuit for FM multiplex demodulator designed for stereo cassette tape recorder with radio receiver, car stereo and car radio operated at a low supply voltage.

The circuit consists of a voltage control oscillator (VCO) for a demodulator and a phase locked loop (PLL), phase comparators, low pass filters (LPF), frequency dividers and a DC amplifier. It also contains accessory circuits such as separation adjustor stereo-monaural switcher, VCO stopper and stereo-monaural switcher in depressed supply voltage.

FEATURES

- No coil is needed due to PLL (Phase Locked Loop) system. The absence of coil, essential component in conventional systems, enable to reduce the number of external components and save manpower for adjustments.
- The circuit provides stability in a wide range of power supply voltage. (V_{CC} = 4 to 16 V)
- A stereo/monaural switch can be controlled by a DC voltage obtained from IF signal by smoothing. It is also designed to provide very small shock noise generated when the stereo/monaural is switched.
- VCO, an unnecessary function for AM reception, can be stopped simply by connecting the control terminal to the power supply. (V_{CC} – 3.0 V)
- When the power supply voltage is depressed the mode is forced to shift to monaural. (Forced monaural reception; V_{CC} – 3.5 V)
- Separation adjustment terminal enables to adjust optimum channel separation.

BLOCK DIAGRAM



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ABSOLUTE MAXIMUM RATINGS (Ta = 25 °C)

Power Supply Voltage	V_{CC}	16	V
Allowable Power Dissipation	P_D	350*	mW
Operational Temperature	T_{opt}	−20 to + 75	°C
Storage Temperature	T_{stg}	−40 to + 125	°C

*Ta = 75 °C

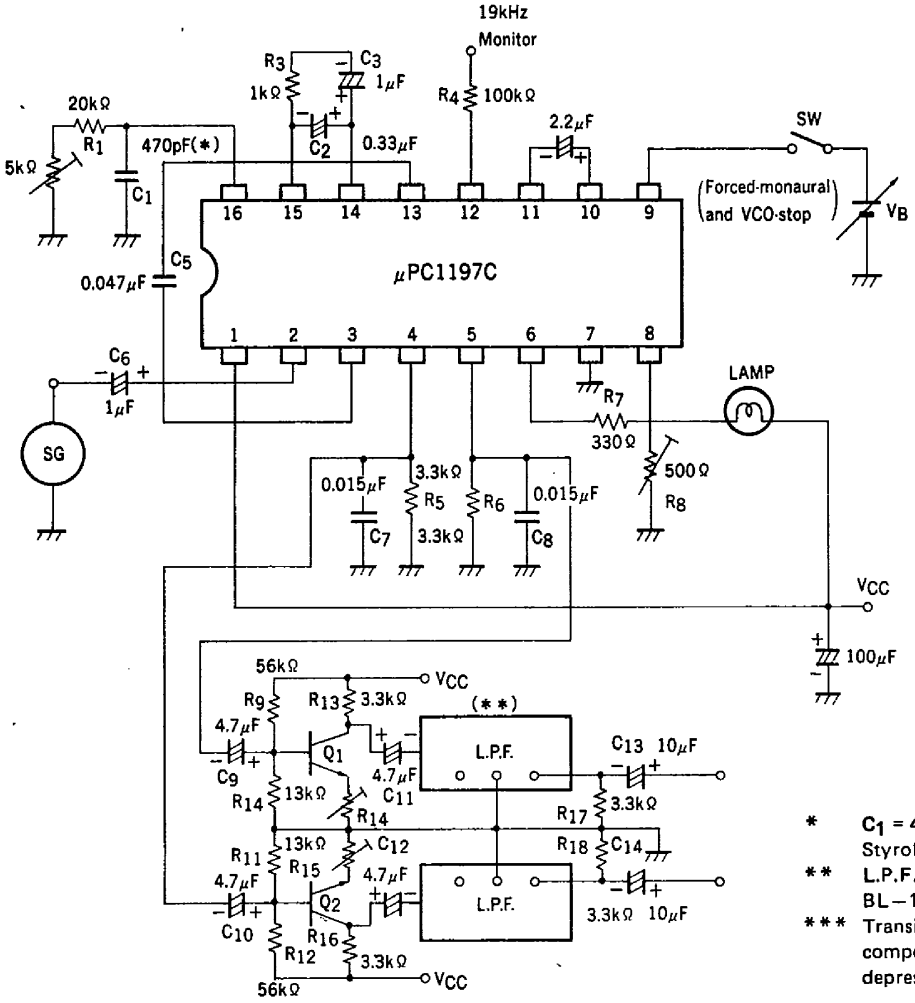
RECOMMENDED OPERATION CONDITIONS (Ta = 25 °C)

Supply Voltage Range	V_{CC}	4 to 16 V
Operating Voltage	V_{CC}	9 V

ELECTRICAL CHARACTERISTICS (Ta = 25 °C, V_{CC} = 9 V, v_i = 200 mV, L = 45 %, R = 45 %, Pilot = 10 %)

CHARACTERISTIC	SYMBOL	MIN.	TYP.	MAX.	UNIT	CONDITION
Circuit Current	I_{CC}		12		mA	Without signal
Separation	Sep.	30	45		dB	f = 100 Hz
		40	55		dB	f = 1 kHz
		30	45		dB	f = 10 kHz
Monaural Total Harmonic Distortion	T.H.D.		0.3	0.5	%	monaural V_{in} = 200 mV
Stereo Total Harmonic Distortion	T.H.D.		0.2	0.5	%	stereo pilot = 20 mV
Output Voltage	V_O		170		mV	V_i = 200 mV
Channel Balance	Ch. B.	−2	0	2	dB	monaural V_i = 200 mV
Lamp-on Level	LAMP-ON		8		mV	pilot signal
Lamp Hysteresis	Hys. (LAMP)		4		dB	pilot signal
Capture Range	C.R.		±4		%	pilot = 20 mV
Ultrasonic Frequency Rejection	Rej (19)		35		dB	pilot = 20 mV
	Rej (38)		45		dB	pilot = 20 mV
SCA Rejection ratio	Rej (SCA)		70		dB	$\frac{\text{pilot}}{\text{composite}} = \frac{1}{10}$, $\frac{\text{SCA}}{\text{composite}} = \frac{1}{10}$,
Signal to Noise Ratio	S/N		86		dB	V_i = 200 mV
Allowed Maximum Input Level	Vi (MAX)		500		mV	T.H.D. ≦ 2%
Forced-monaural Level	V (MONO)		0.7		V	#9 terminal
VCO-stop level	V (STOP)		3.0		V	#9 terminal
Stereo-monaural Switch-over Voltage	V_{CC} (MONO)		3.5		V	Supply Voltage

TEST CIRCUIT



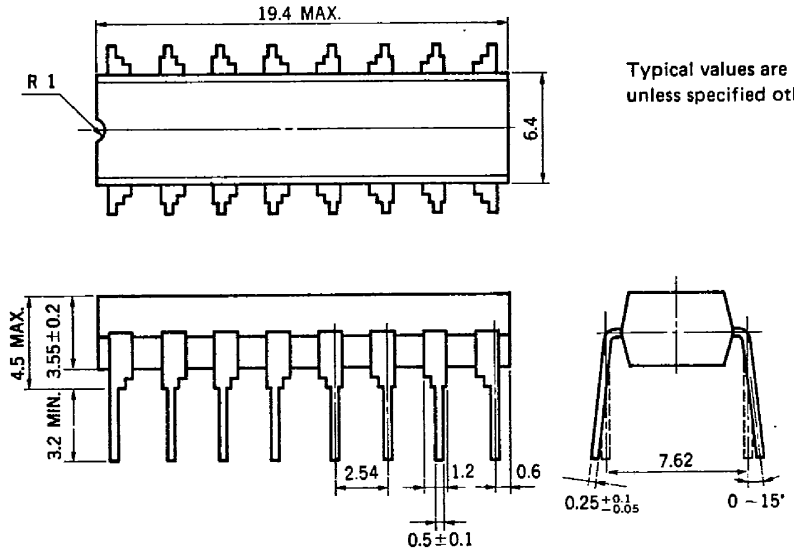
* C_1 = 470 pF Styrol Capacitor

** L.P.F. BL−13 (K.K. KORIN)

*** Transistors Q_1 and Q_2 compensate the gain depression through LPF's

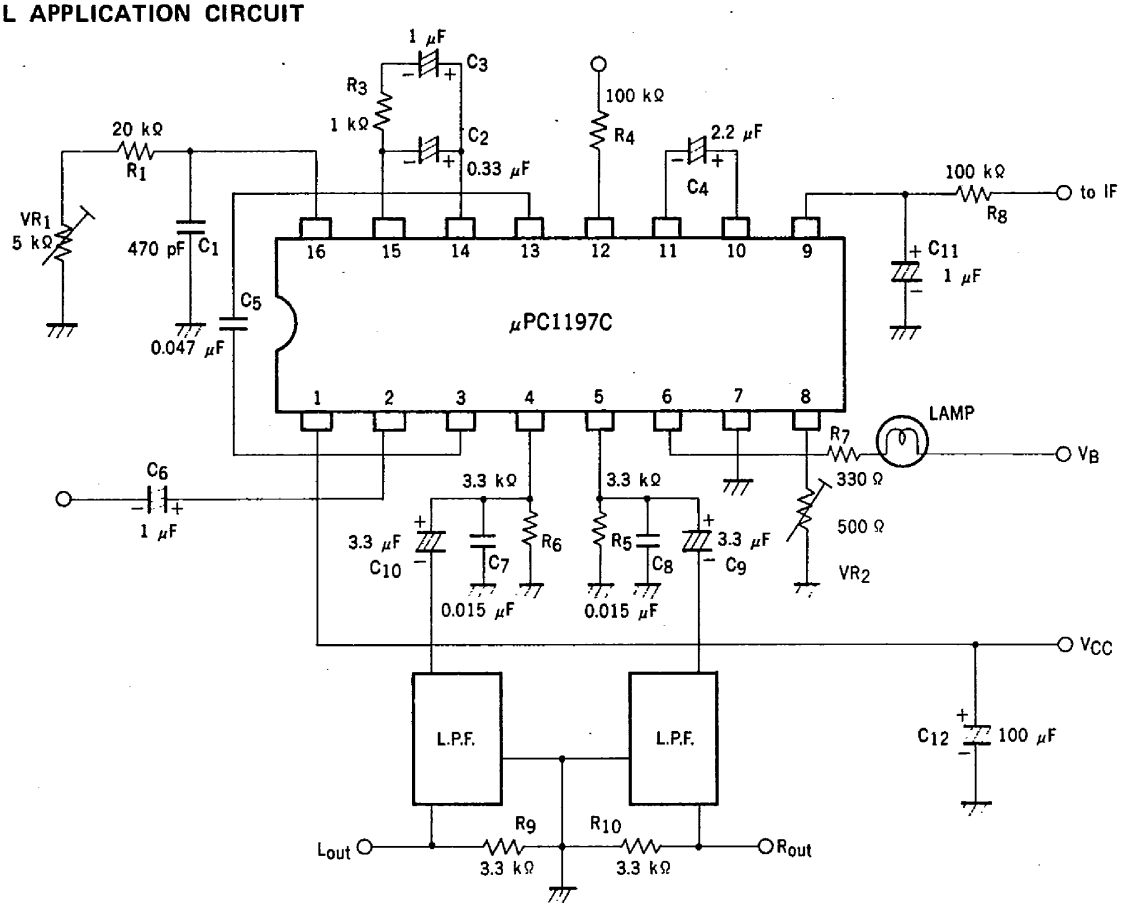
PACKAGE DIMENSIONS

in millimeters (inches)



Typical values are shown unless specified otherwise.

TYPICAL APPLICATION CIRCUIT



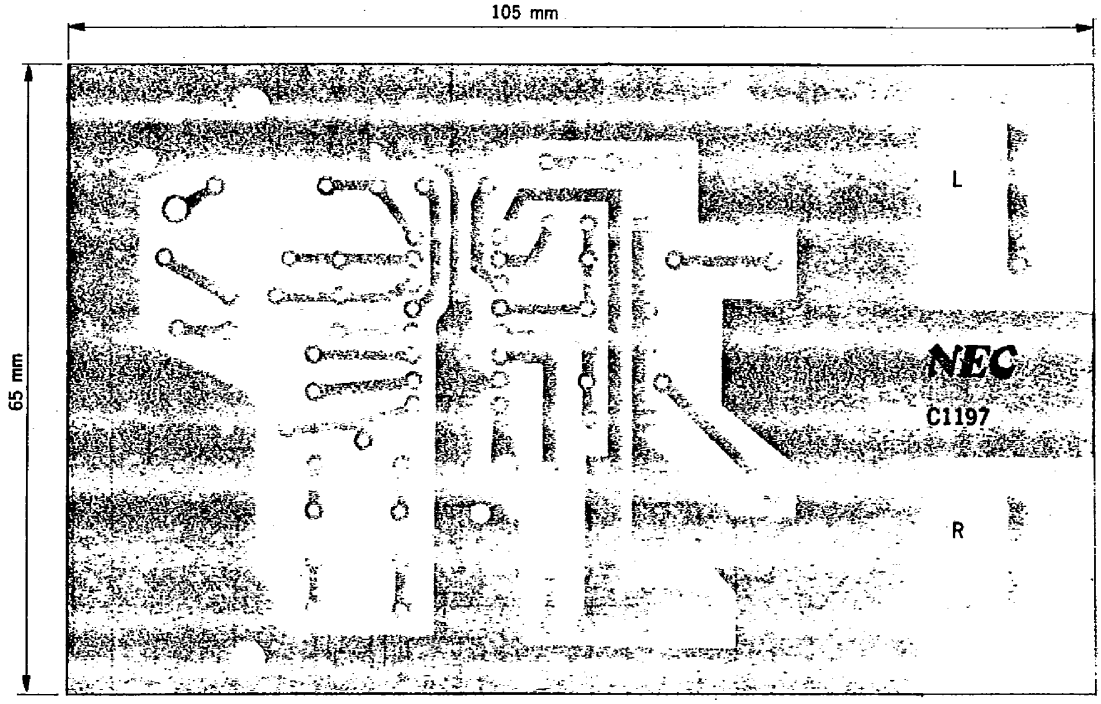
PRECAUTIONS NEEDED IN APPLICATIONS

(1) The μPC1197C is designed to have a temperature coefficient which is equivalent to that of styrol capacitors.

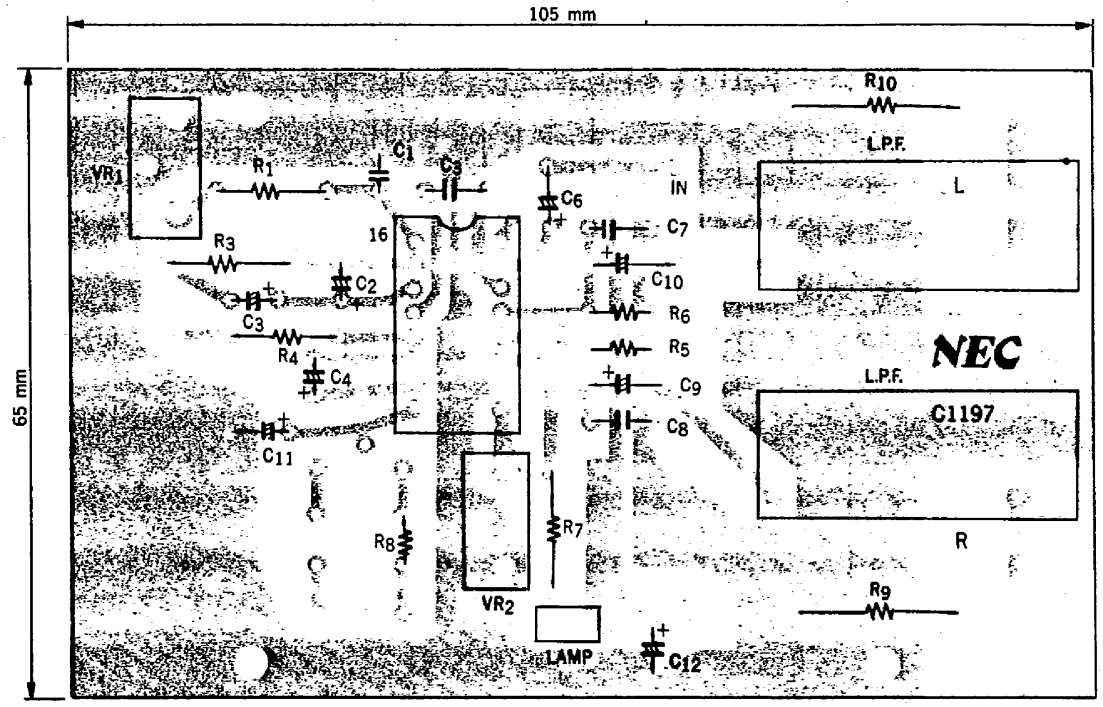
(2) Terminal #9 is provided for forced-monaural switching and VCO stop. If a voltage of 0.7 volt or more is applied to the terminal, the operation is switched over to monaural and if a voltage of 3 volts or more is applied, VCO is stopped. For a power supply voltage higher than 10 volts, insert a resistance satisfying the following formula between the power supply and terminal #9.

1.1 $[V_{CC}(MAX)-10] = R = 2[V_{CC}(MIN)-4]$ (kΩ), where $V_{CC}(MAX)$ and $V_{CC}(MIN)$ and lower limits of power supply voltage that satisfy the voltage regulation sequirement, respectively.

TYPICAL CIRCUIT BOARD ARRANGEMENT (VIEW OF PRINTED WIRING)

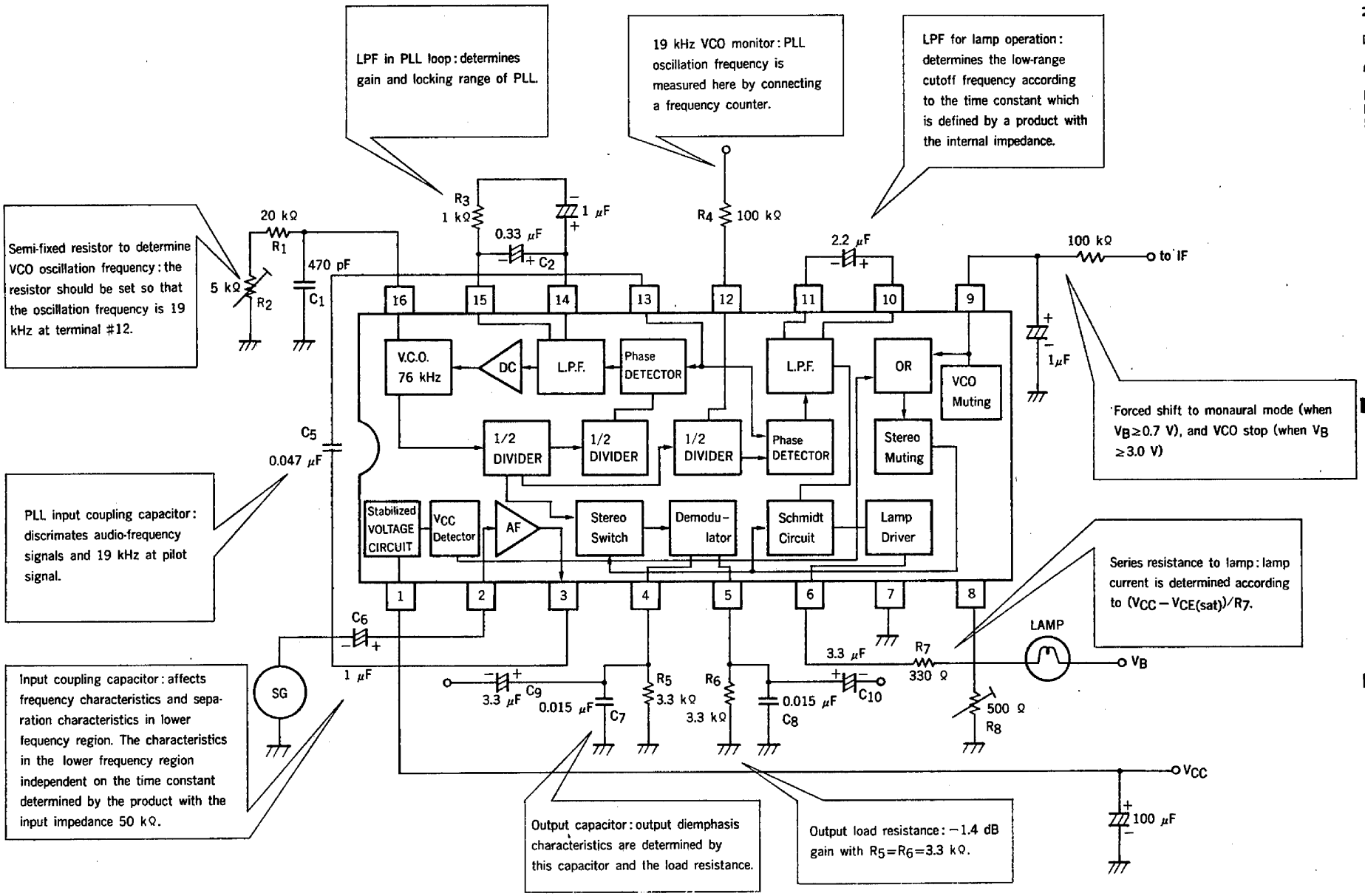


TYPICAL PARTS LOADING (TYPICAL APPLICATION)



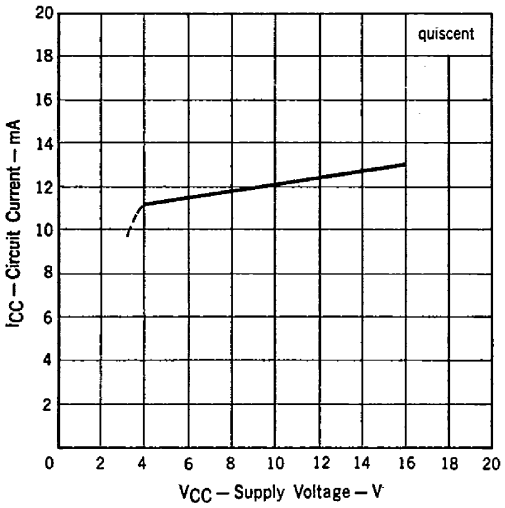
R_1 = 18 kΩ	R_7 = 330 Ω	C_1 = 470 pF (Styrol Capacitor)	C_7 = 0.015 μF
VR_1 = 5 kΩ	R_8 = 100 kΩ	C_2 = 0.33 μF	C_8 = 0.015 μF
R_3 = 1 kΩ	R_9 = 3.3 kΩ	C_3 = 1 μF	C_9 = 3.3 μF
R_4 = 100 kΩ	R_{10} = 3.3 kΩ	C_4 = 2.2 μF	C_{10} = 3.3 μF
R_5 = 3.3 kΩ		C_5 = 0.047 μF	C_{11} = 1 μF
R_6 = 3.3 kΩ		C_6 = 1 μF	C_{12} = 100 μF

DESCRIPTION OF EXTERNALLY LOADED COMPONENT PARTS

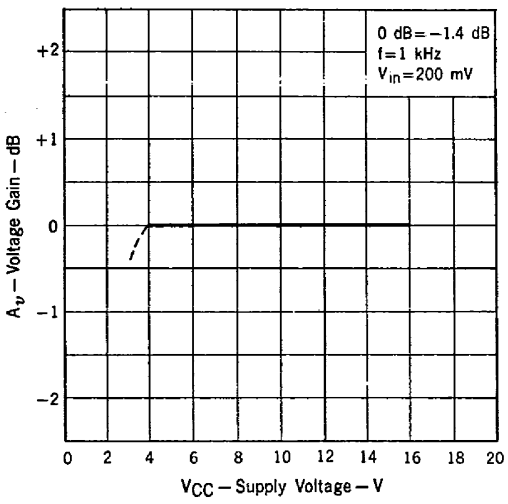


TYPICAL CHARACTERISTICS

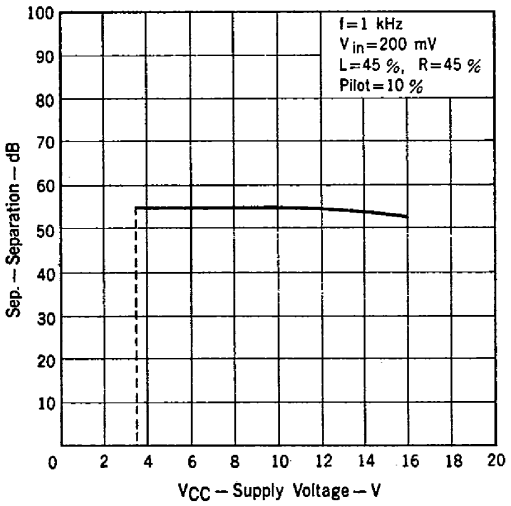
CIRCUIT CURRENT vs. SUPPLY VOLTAGE



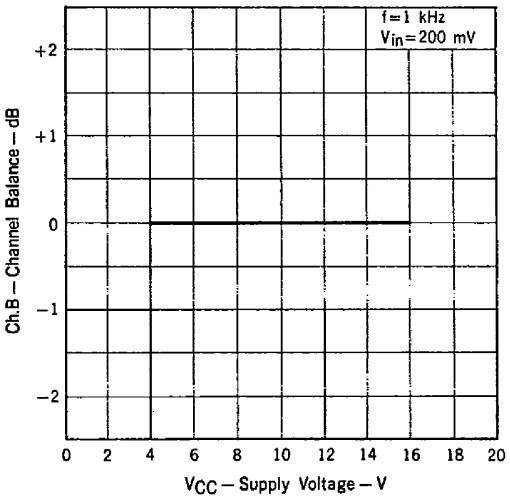
VOLTAGE GAIN vs. SUPPLY VOLTAGE (Monaural)



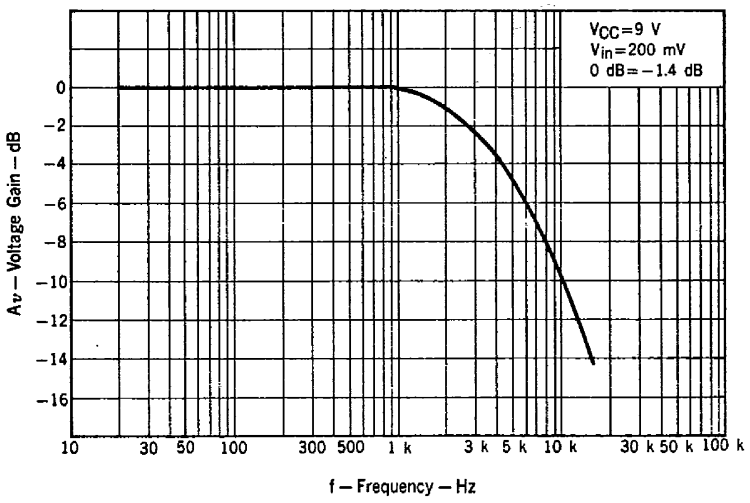
SEPARATION vs. SUPPLY VOLTAGE (Stereo)



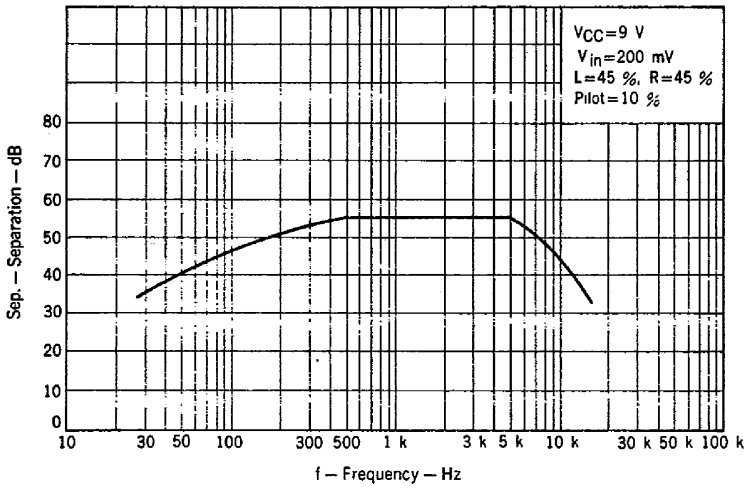
CHANNEL BALANCE vs. SUPPLY VOLTAGE (Monaural)



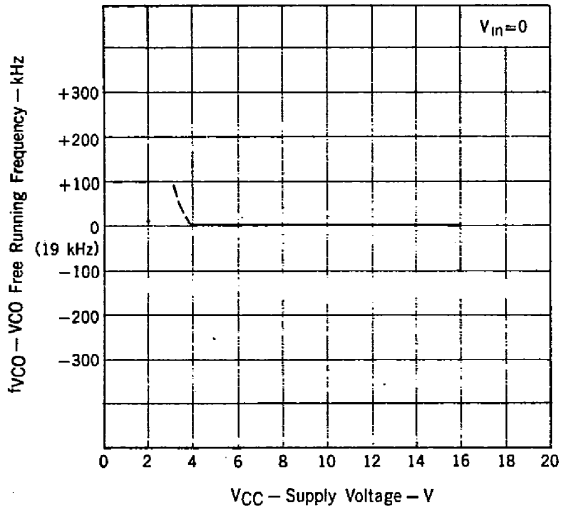
VOLTAGE GAIN vs. FREQUENCY (Monaural)



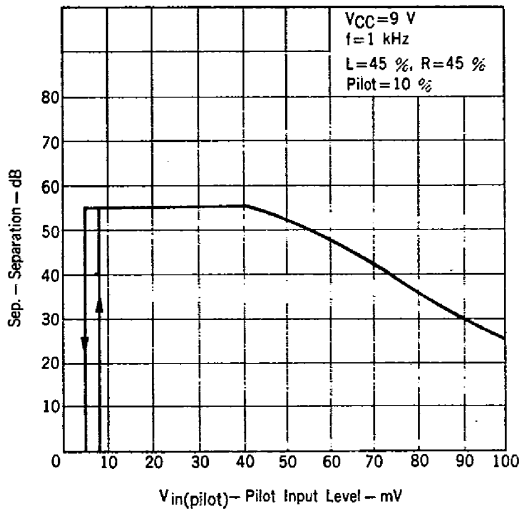
SEPARATION vs. FREQUENCY (Stereo)



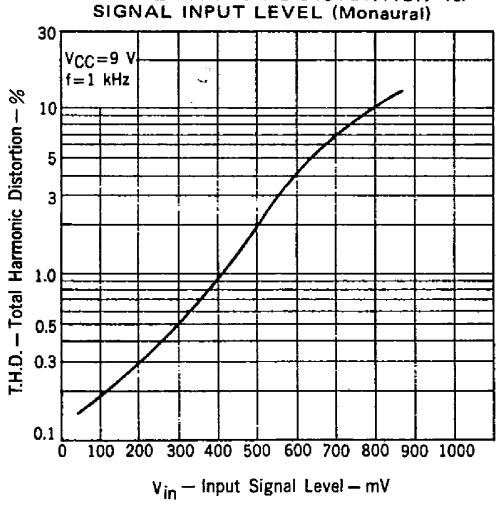
VCO FREE RUNNING FREQUENCY vs. SUPPLY VOLTAGE



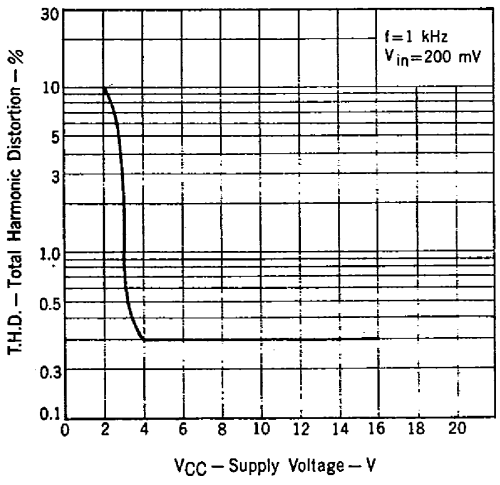
SEPARATION vs. PILOT INPUT LEVEL (Stereo)



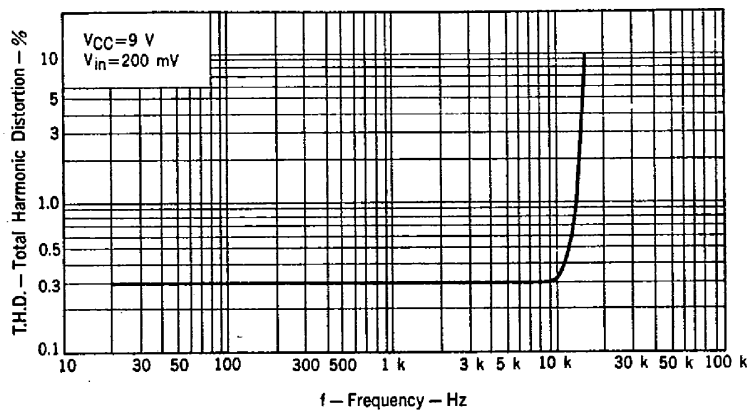
TOTAL HARMONIC DISTORTION vs. SIGNAL INPUT LEVEL (Monaural)



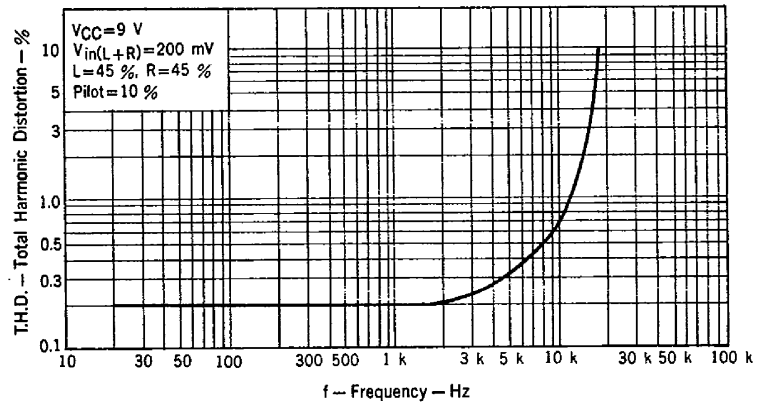
TOTAL HARMONIC DISTORTION vs. SUPPLY VOLTAGE (Monaural)



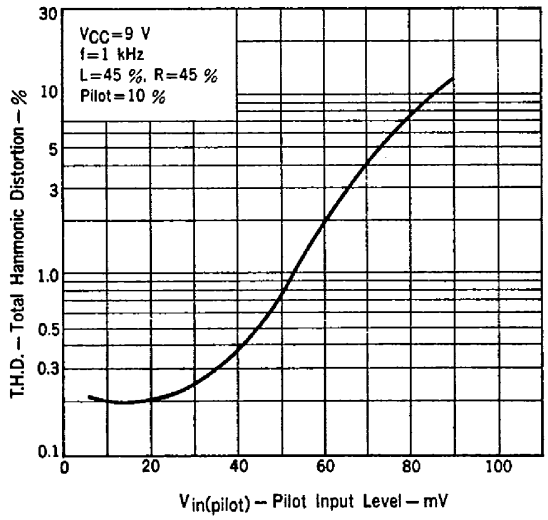
TOTAL HARMONIC DISTORTION vs. FREQUENCY (Monaural)



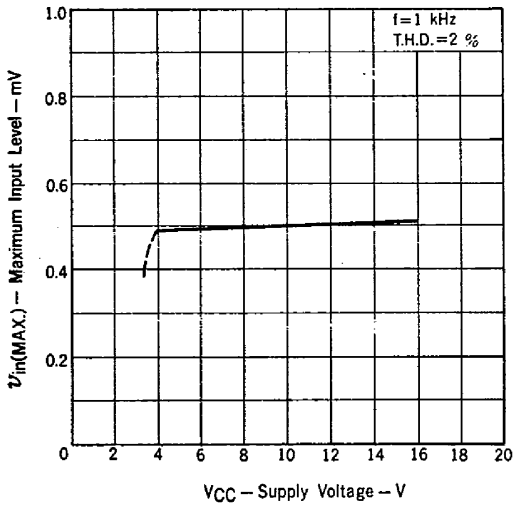
TOTAL HARMONIC DISTORTION vs. FREQUENCY (Stereo)



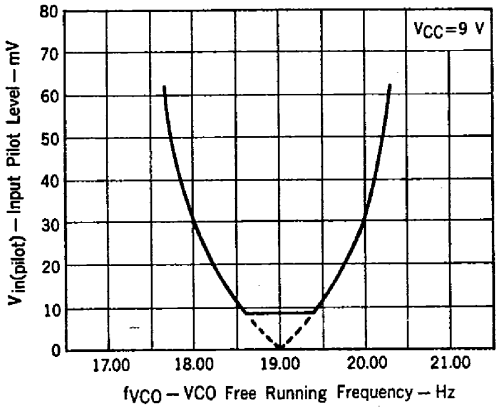
TOTAL HARMONIC DISTORTION vs. PILOT INPUT LEVEL (Stereo)



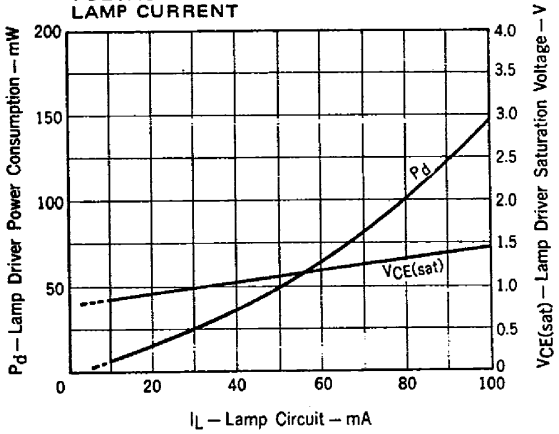
MAXIMUM INPUT LEVEL vs. SUPPLY VOLTAGE (Monaural)



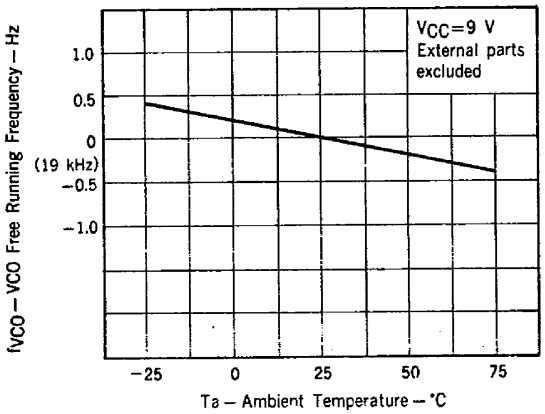
CAPTURE RANGE



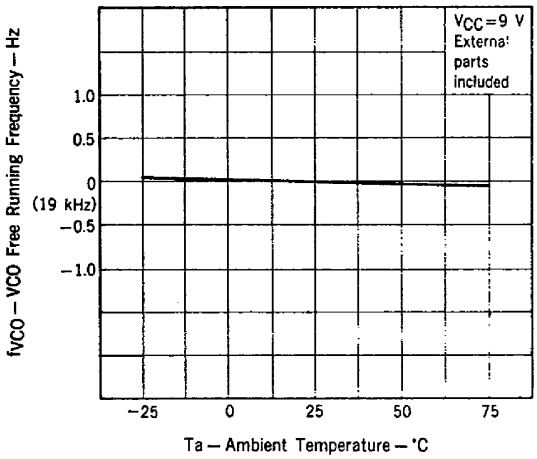
POWER DISSIPATION AND SATURATION VOLTAGE OF LAMP DRIVER vs. LAMP CURRENT



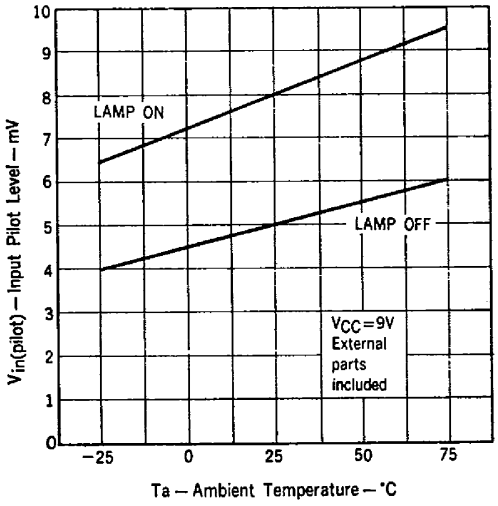
VCO FREE RUNNING FREQUENCY vs. AMBIENT TEMPERATURE



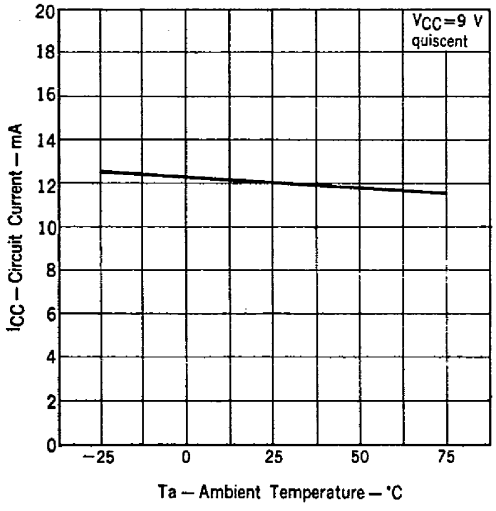
VCO FREE RUNNING FREQUENCY vs. AMBIENT TEMPERATURE



INPUT PILOT LEVEL (LAMP ON–OFF) vs. AMBIENT TEMPERATURE



CIRCUIT CURRENT vs. AMBIENT TEMPERATURE



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IC – 1410
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Printed in Japan