

MC12002

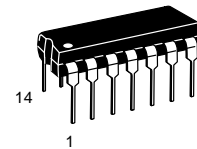
Analog Mixer

The MC12002 is a double balanced analog mixer, including an input amplifier feeding the mixer carrier port and a temperature compensated bias regulator. The input circuits for both the amplifier and mixer are differential amplifier circuits. The on-chip regulator provides all of the required biasing.

This circuit is designed for use as a balanced mixer in high-frequency wide-band circuits. Other typical applications include suppressed carrier and amplitude modulation, synchronous AM detection, FM detection, phase detection, and frequency doubling, at frequencies up to UHF.

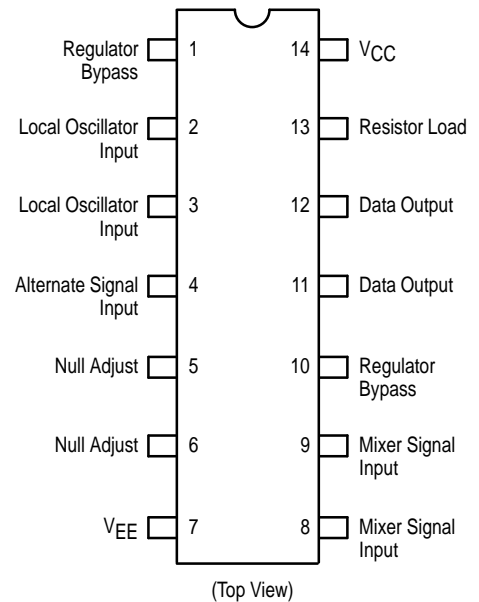
ANALOG MIXER

SEMICONDUCTOR TECHNICAL DATA



P SUFFIX
PLASTIC PACKAGE
CASE 646

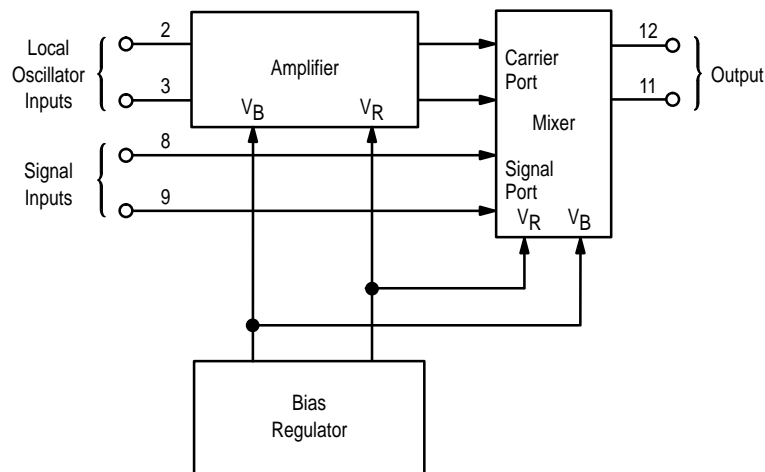
PIN CONNECTIONS



ORDERING INFORMATION

Device	Operating Temperature Range	Package
MC12002P	$T_A = -30^\circ$ to $+85^\circ\text{C}$	Plastic

Figure 1. Logic Diagram



MC12002

ELECTRICAL CHARACTERISTICS

										TEST VOLTAGE VALUES				
										Volts				
										V _{IHmax}	V _{ILmin}	V _{CC}		
										+2.9	+2.0	+5.0		
Characteristic	Symbol	Pin Under Test	Test Limits						VOLTAGE APPLIED TO PINS LISTED BELOW					
			-30°C		+25°C		+85°C		Unit	V _{IHmax}	V _{ILmin}	V _{CC}	Gnd	
			Min	Max	Min	Max	Min	Max						
Power Supply Drain	I _{CC}	14	—	—	—	16	—	—	mAdc	—	—	11,12,14	5,6,7	
Input Current	I _{inH}	2	—	—	—	0.75	—	—	mAdc	2	—	11,12,14	5,6,7	
		3	—	—	—	0.75	—	—	mAdc	3	—	11,12,14	5,6,7	
		8	—	—	—	0.75	—	—	mAdc	8	—	11,12,14	5,6,7	
		9	—	—	—	0.75	—	—	mAdc	9	—	11,12,14	5,6,7	
	I _{inL}	2	—	—	-0.7	—	—	—	mAdc	—	2	11,12,14	5,6,7	
		3	—	—	-0.7	—	—	—	mAdc	—	3	11,12,14	5,6,7	
		8	—	—	-0.7	—	—	—	mAdc	—	8	11,12,14	5,6,7	
		9	—	—	-0.7	—	—	—	mAdc	—	9	11,12,14	5,6,7	
Output Current	I _{O1}	11	—	—	0.7	1.3	—	—	mAdc	—	—	11,12,14	7	
		12	—	—	0.7	1.3	—	—	mAdc	—	—	11,12,14	7	
	I _{O2}	11	—	—	2.1	3.9	—	—	mAdc	—	—	11,12,14	5,6,7	
		12	—	—	2.1	3.9	—	—	mAdc	—	—	11,12,14	5,6,7	
	I _{out}	11	—	—	4.2	7.8	—	—	mAdc	2,9	—	11,12,14	5,6,7	
		11	—	—	4.2	7.8	—	—	mAdc	3,8	—	11,12,14	5,6,7	
		12	—	—	4.2	7.8	—	—	mAdc	2,8	—	11,12,14	5,6,7	
		12	—	—	4.2	7.8	—	—	mAdc	3,9	—	11,12,14	5,6,7	
Differential Current	ΔI _{O1}	11,12	-100	+100	-100	+100	-100	+100	μAdc	—	—	11,12,14	7	
	ΔI _{O2}	11,12	-200	+200	-200	+200	-200	+200	μAdc	—	—	11,12,14	5,6,7	
Bias Voltage	V _{Bias}	1	2.33	2.53	2.32	2.52	2.3	2.5	Vdc	—	—	11,12,14	5,6,7	
		4	390	590	400	600	410	610	mVdc	—	—	11,12,14	5,6,7	
		5	275	415	285	425	295	435	mVdc	—	—	11,12,14	7	
		6	275	415	285	425	295	435	mVdc	—	—	11,12,14	7	
		10	1.26	1.46	1.185	1.385	1.105	1.305	Vdc	—	—	11,12,14	5,6,7	
AC Gain (See Figure 1) (Frequency = 100 MHz) *Note	A _v	11	—	—	5.0	—	—	—	V/V	Pulse In 2	Pulse Out 11	-3.0 V 9	Gnd 14	V _{EE} 7
		11	—	—	0.28	—	—	—	V/V	8	11	3	14	7

NOTE: *Note: AC Gain is a function of collector load impedance.

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Figure 2. Analog Mixer Circuit Schematic

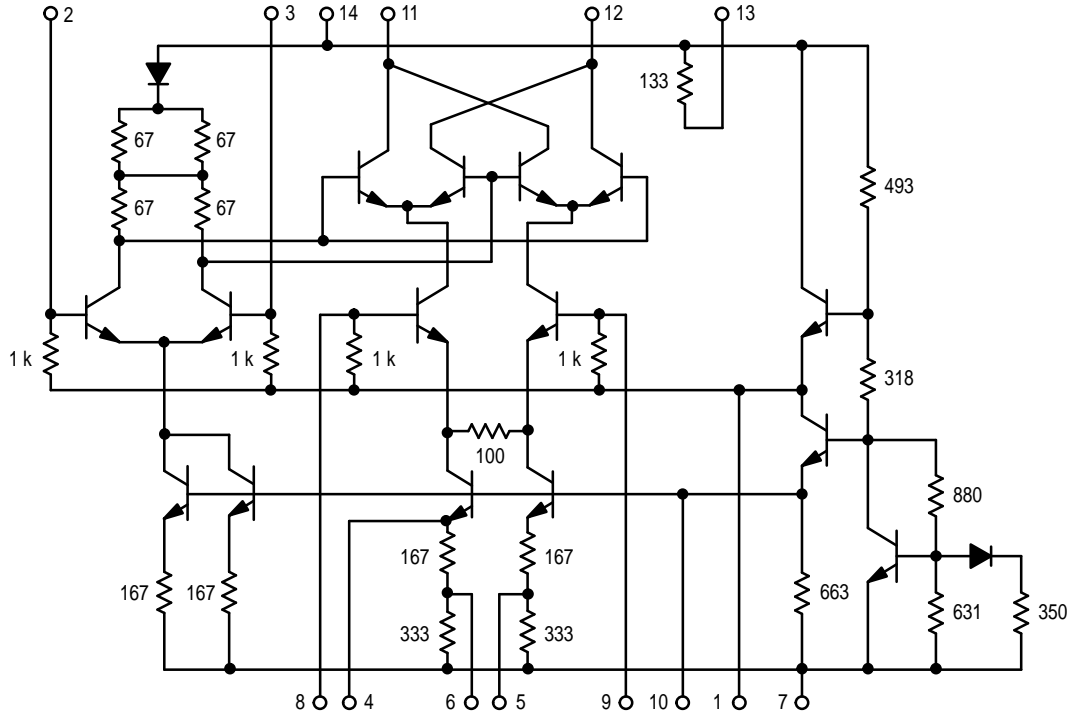
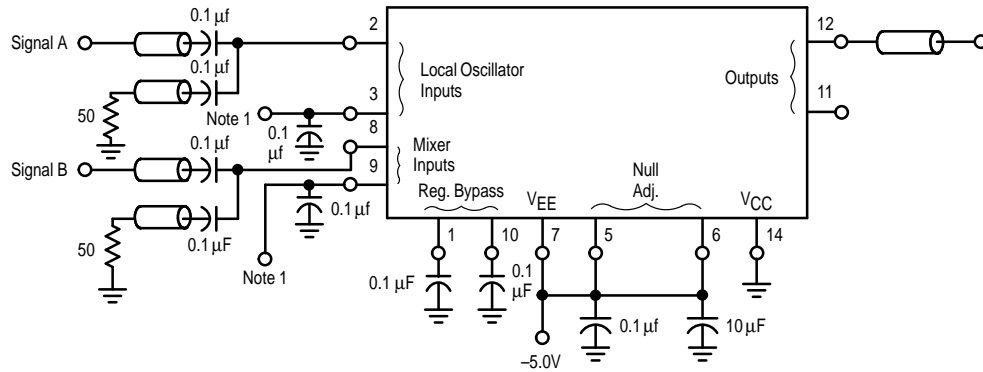


Figure 3. AC Gain Test



Note 1:

$V_{IL} = -3.0\text{ V}$ on pin 3 when pin 8 is under test.
 $V_{IL} = -3.0\text{ V}$ on pin 9 when pin 2 is under test.

Signal A = 30 mVpp

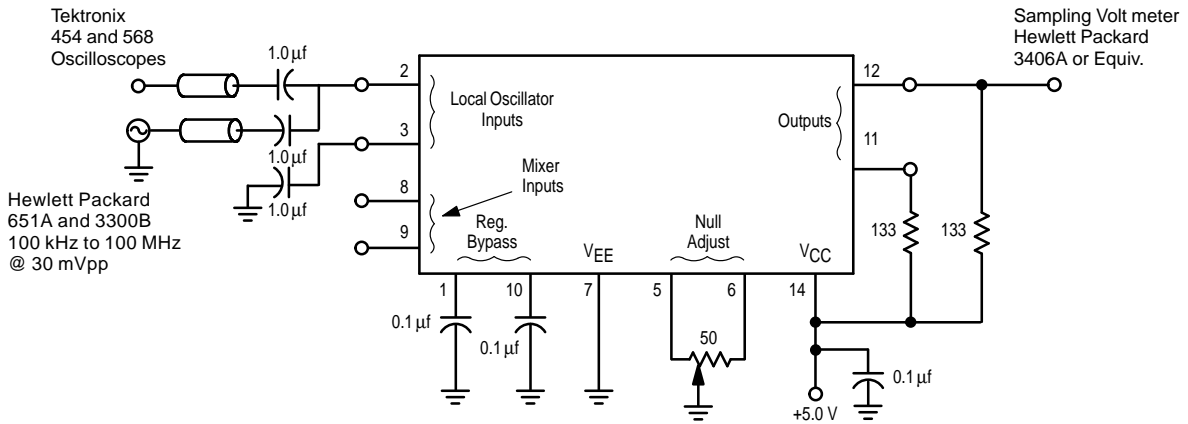
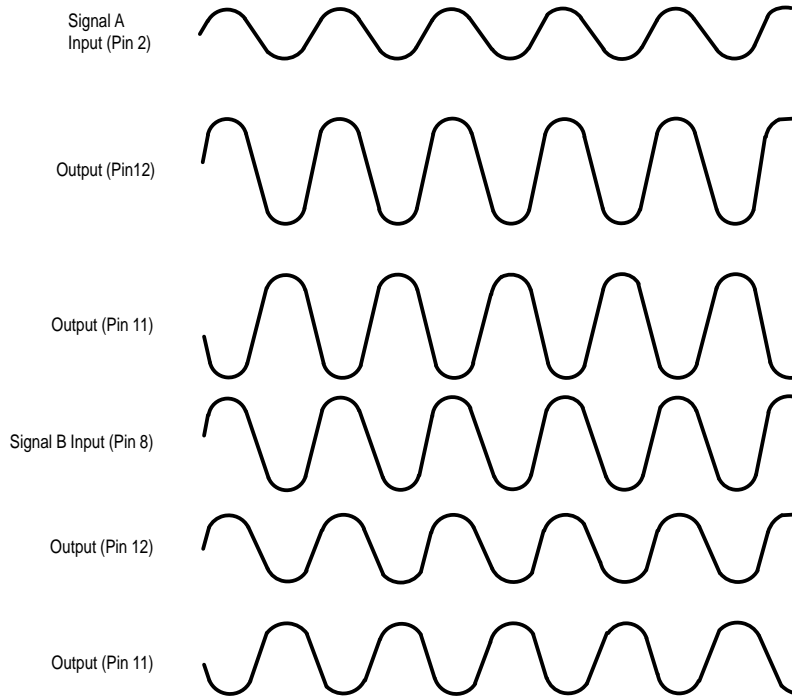
Signal B = 300 mVpp

Freq. = 100 MHz

All input and output cables to the scope are equal lengths of 50-ohm coaxial cable. The unused output is connected to a 50-ohm resistor to ground.

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Figure 4. Carrier Feedthrough Test Circuits



Notes:

- Test 1 – Adjust potentiometer for carrier null at $f_c = 100$ kHz.
- Test 2 – Connect pins 5 and 6 to Gnd.

All Input and output cables to the scope are equal lengths of 50-ohm coaxial cable.

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Figure 5. Carrier Feedthrough versus Frequency (Test 1)

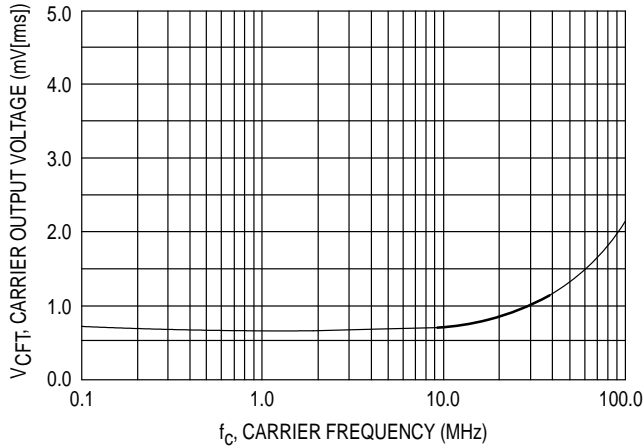


Figure 6. Carrier Feedthrough versus Frequency (Test 2)

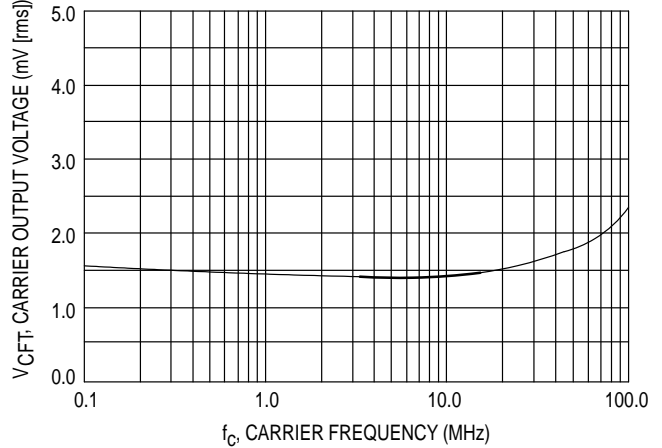
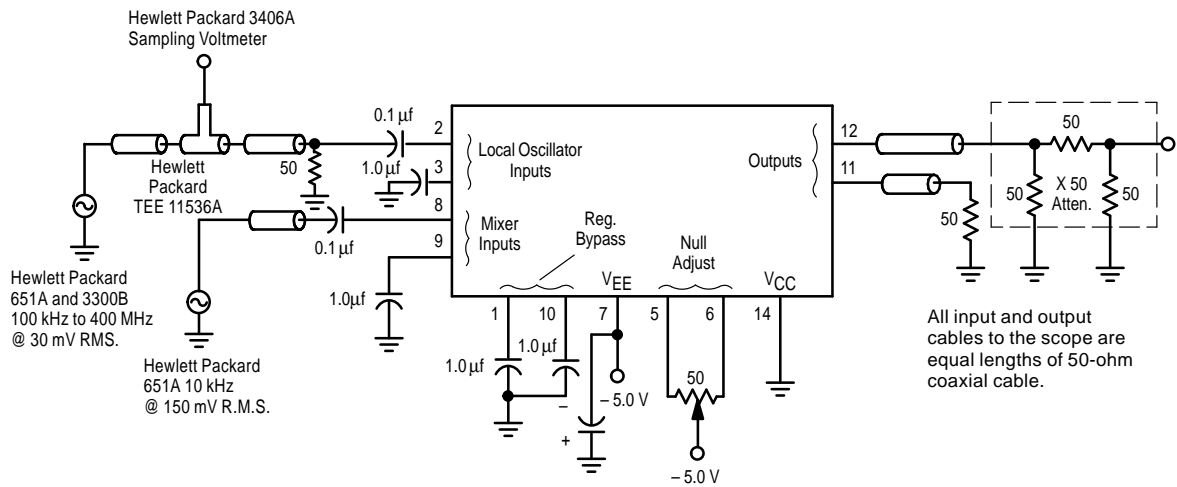


Figure 7. Carrier Suppression Test Circuit



- Notes:
- Test 1 – Adjust potentiometer for carrier null @ $f_c = 100$ kHz
 - Test 2 – Connect pins 5 and 6 to -5.0 volts
 - Test 3 – Adjust potentiometer for carrier null @ 25°C

Figure 8. Carrier Suppression versus Frequency (Test 1)

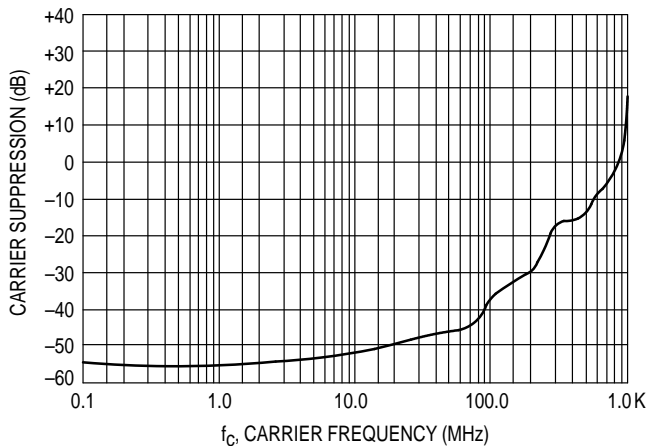
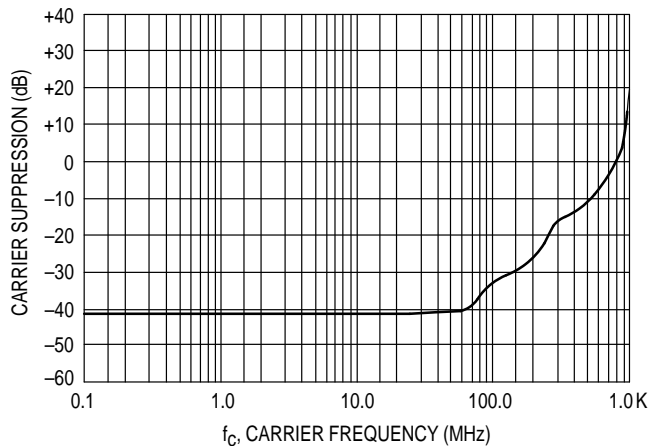


Figure 9. Carrier Suppression versus Frequency (Test 2)



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Figure 10. Carrier Suppression versus Temperature

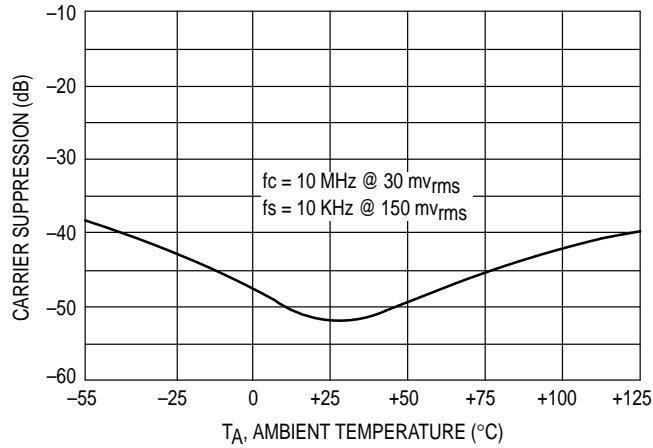
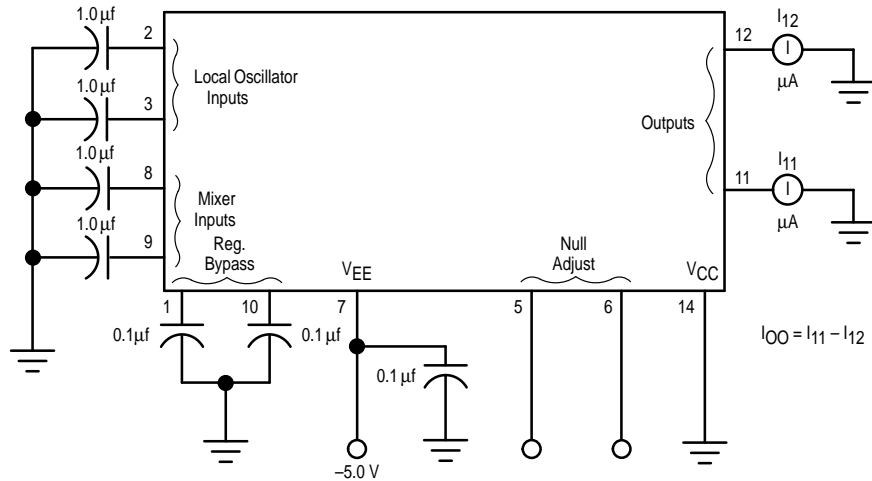


Figure 11. Output Offset Current (I_{OO}) versus Temperature



Notes:
 Test 1 – Pins 5 and 6 left open
 Test 2 – Pins 5 and 6 are tied to -5.0 volts

Figure 12. Output Offset Current versus Temperature

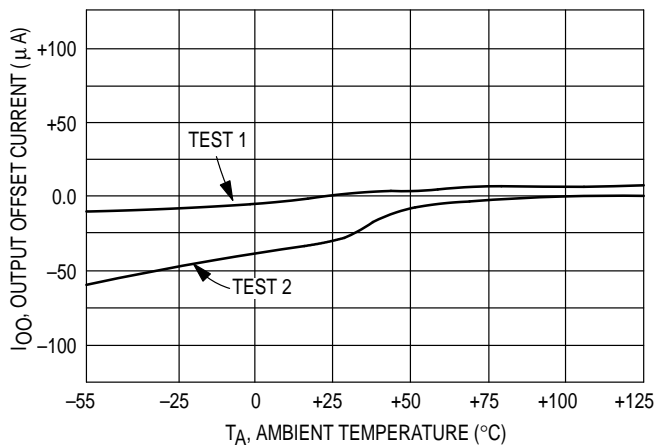
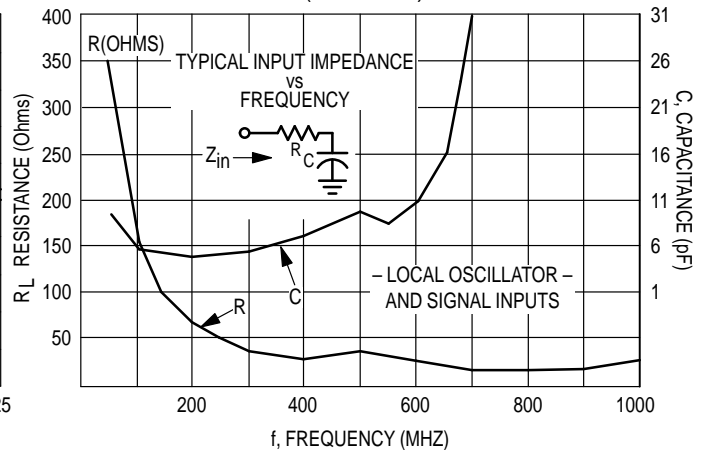


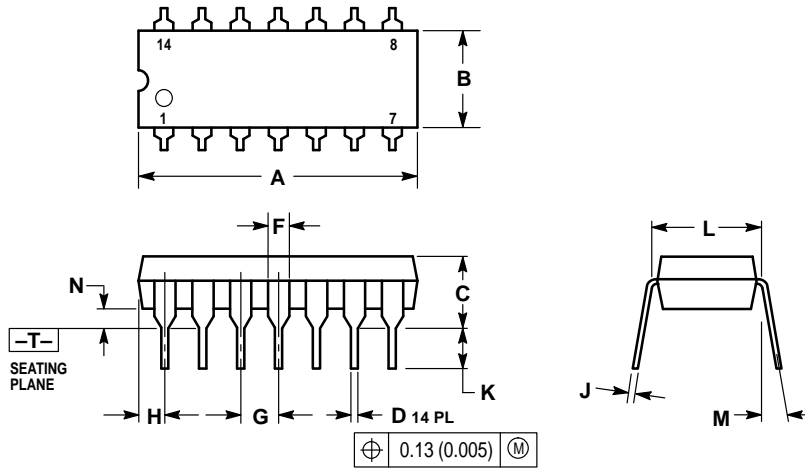
Figure 13. Typical Input Impedance versus Frequency (No Circuit)



MC12002

OUTLINE DIMENSIONS

P SUFFIX
 PLASTIC PACKAGE
 CASE 646-06
 ISSUE M




NOTES:

1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
2. CONTROLLING DIMENSION: INCH.
3. DIMENSION L TO CENTER OF LEADS WHEN FORMED PARALLEL.
4. DIMENSION B DOES NOT INCLUDE MOLD FLASH.
5. ROUNDED CORNERS OPTIONAL.

DIM	INCHES		MILLIMETERS	
	MIN	MAX	MIN	MAX
A	0.715	0.770	18.16	18.80
B	0.240	0.260	6.10	6.60
C	0.145	0.185	3.69	4.69
D	0.015	0.021	0.38	0.53
F	0.040	0.070	1.02	1.78
G	0.100 BSC		2.54 BSC	
H	0.052	0.095	1.32	2.41
J	0.008	0.015	0.20	0.38
K	0.115	0.135	2.92	3.43
L	0.290	0.310	7.37	7.87
M	—		10°	
N	0.015	0.039	0.38	1.01

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