

MC12002

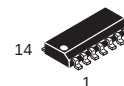
Analog Mixer

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.

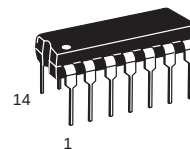
This circuit is designed for use as a balanced mixer in high-frequency wide-band circuits. Other typical applications include suppressed carrier and amplitude modulation, synchronous AM detection, FM detection, phase detection, and frequency doubling, at frequencies up to UHF.

ANALOG MIXER

SEMICONDUCTOR TECHNICAL DATA

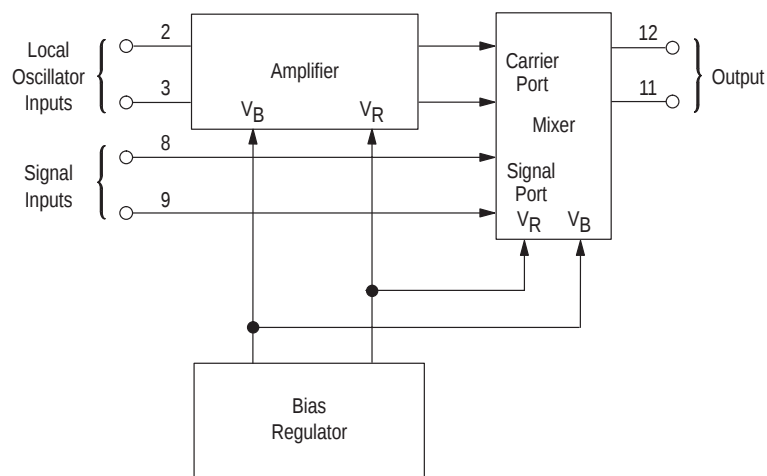


D SUFFIX
PLASTIC PACKAGE
CASE 751A
(SO-14)

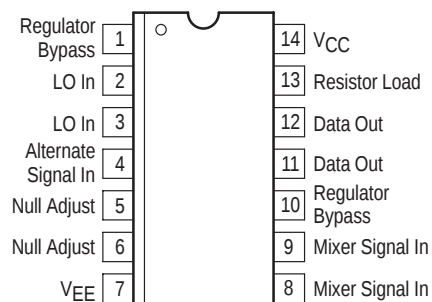


P SUFFIX
PLASTIC PACKAGE
CASE 646

Figure 1. Logic Diagram



PIN CONNECTIONS



(Top View)

ORDERING INFORMATION

Device	Operating Temperature Range	Package
MC12002D	$T_A = -30$ to 85°C	SO-14
MC12002P		Plastic DIP

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			Gnd	
			-30°C		25°C		85°C		Unit	V _{IHmax}	V _{ILmin}	V _{CC}		
			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	
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								Pulse In	Pulse Out	-3.0 V	Gnd	V _{EE}	
		11	—	—	5.0	—	—	—	V/V	2	11	9	14	7
		11	—	—	0.28	—	—	—	V/V	8	11	3	14	7

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

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Figure 2. Analog Mixer Circuit Schematic

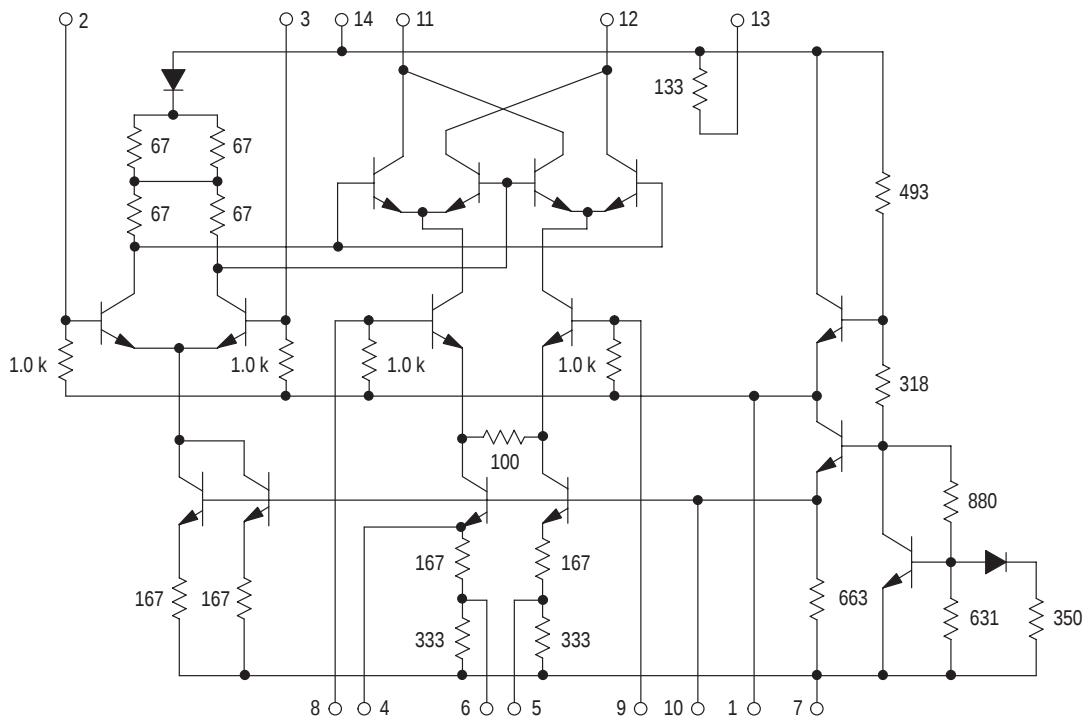
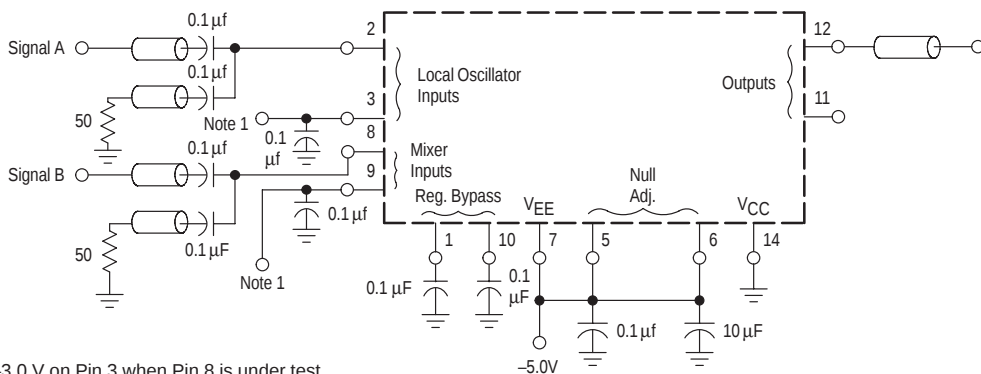


Figure 3. AC Gain Test



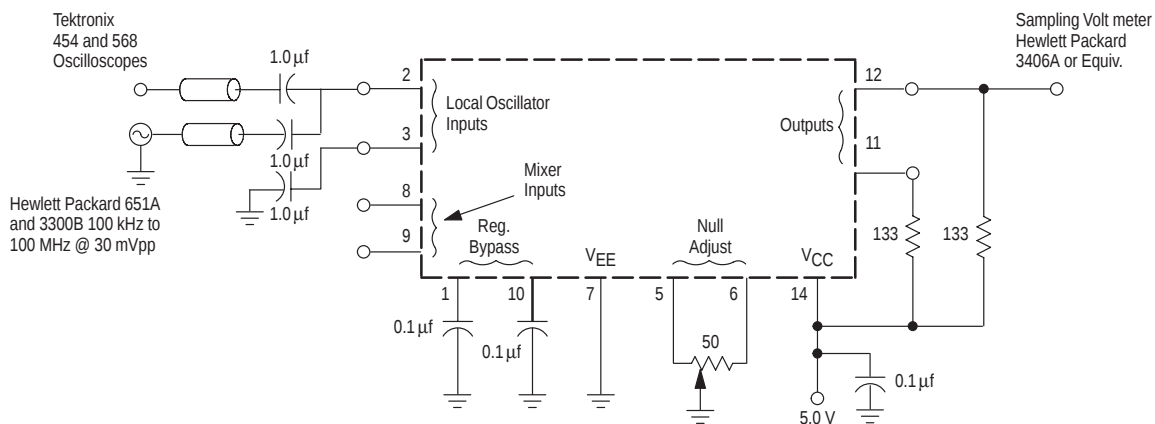
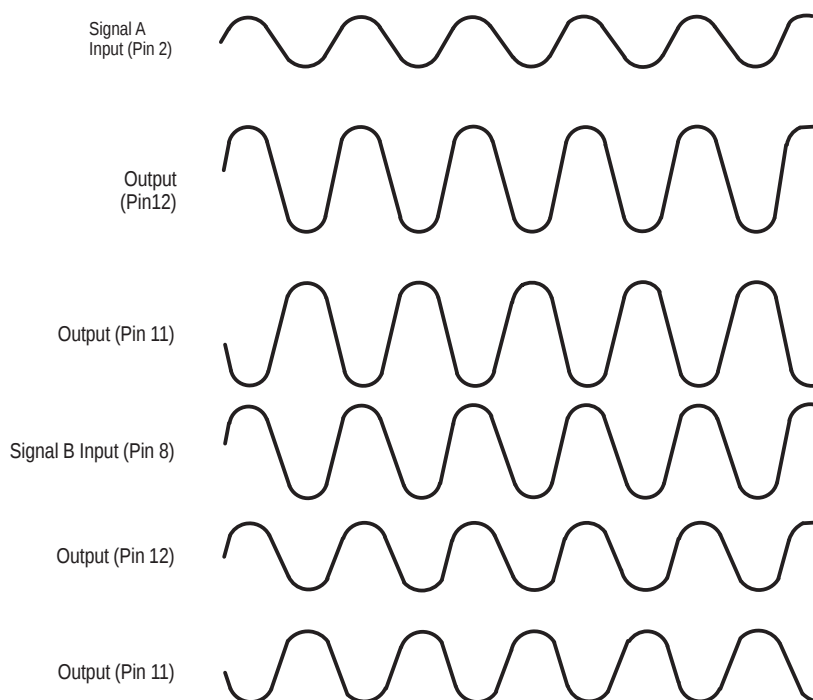
Note 1: $V_{IL} = -3.0\text{ V}$ on Pin 3 when Pin 8 is under test.
 $V_{IL} = -3.0\text{ V}$ on Pin 9 when Pin 2 is under test.

Signal A = 30 mVpp
Signal B = 300 mVpp
Freq. = 100 MHz

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

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Figure 4. Carrier Feedthrough Test Circuits



Note: 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-Ω coaxial cable.

Figure 5. Carrier Feedthrough versus Frequency (Test 1)

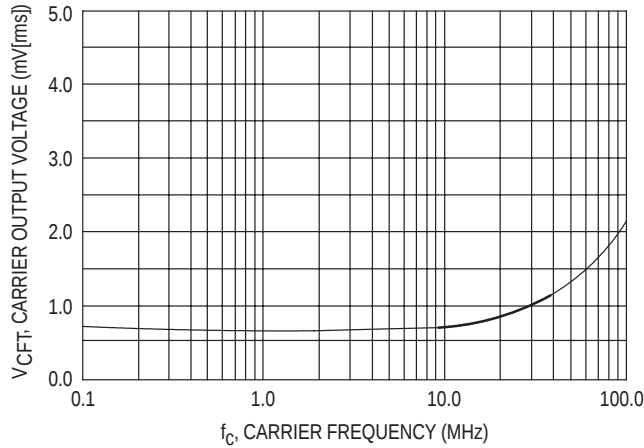


Figure 6. Carrier Feedthrough versus Frequency (Test 2)

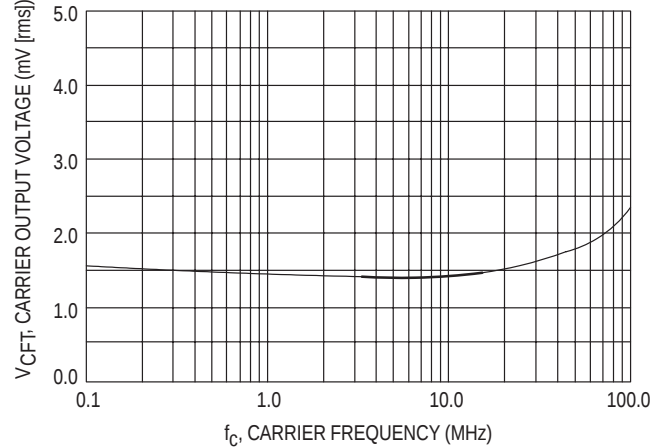
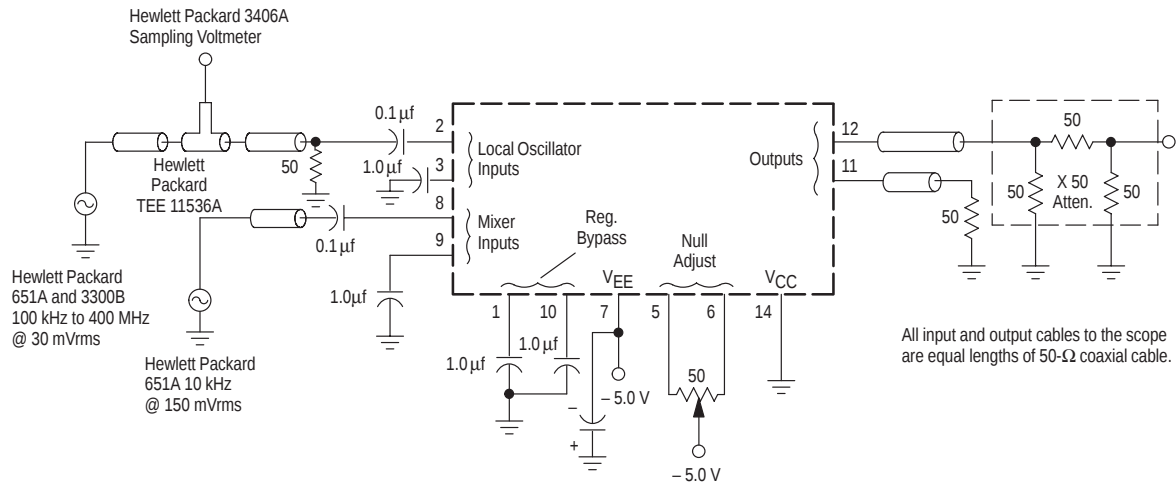


Figure 7. Carrier Suppression Test Circuit



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

Figure 8. Carrier Suppression versus Frequency (Test 1)

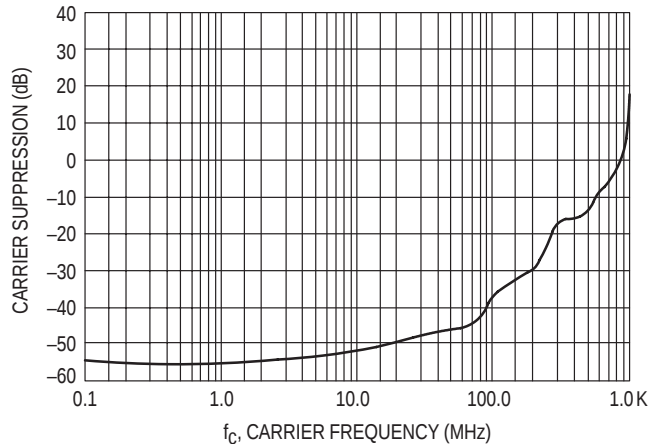


Figure 9. Carrier Suppression versus Frequency (Test 2)

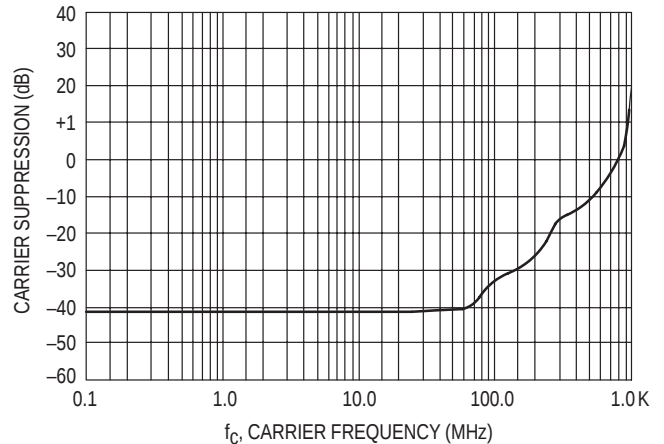
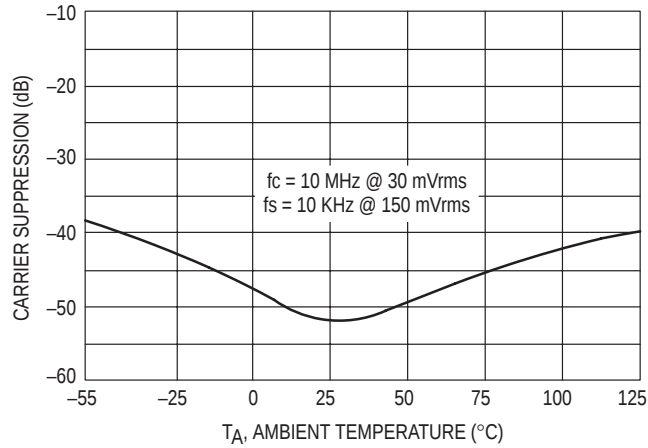
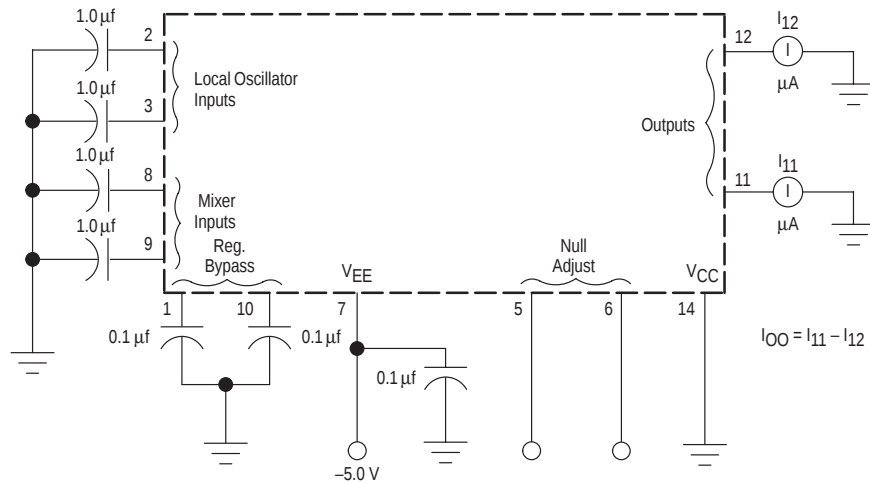


Figure 10. Carrier Suppression versus Temperature

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

Note: Test 1 — Pins 5 and 6 left open
Test 2 — Pins 5 and 6 are tied to -5.0 V

Figure 12. Output Offset Current versus Temperature

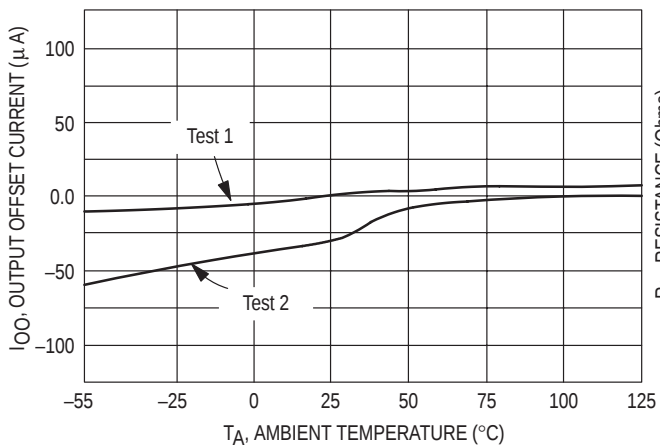
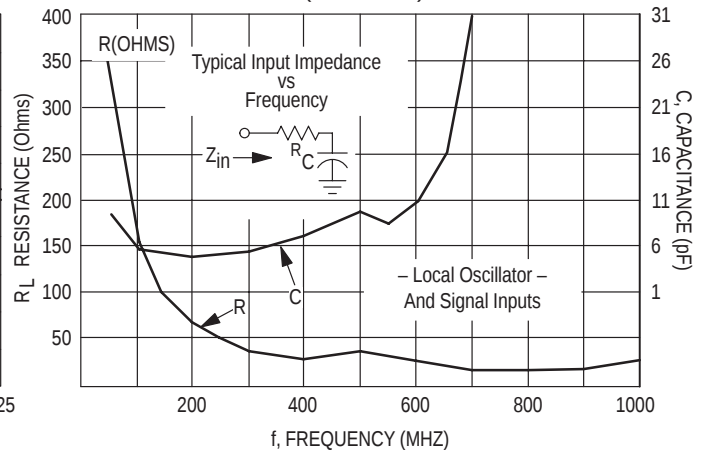


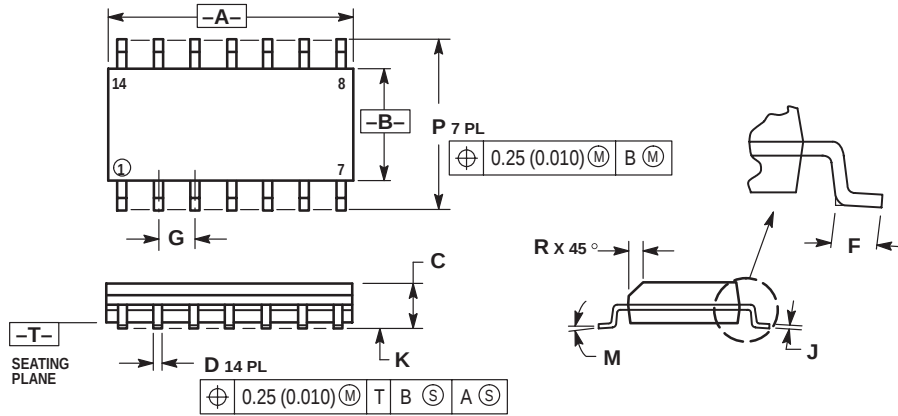
Figure 13. Typical Input Impedance versus Frequency (No Circuit)



MC12002

OUTLINE DIMENSIONS

D SUFFIX PLASTIC PACKAGE CASE 751A-03 ISSUE F

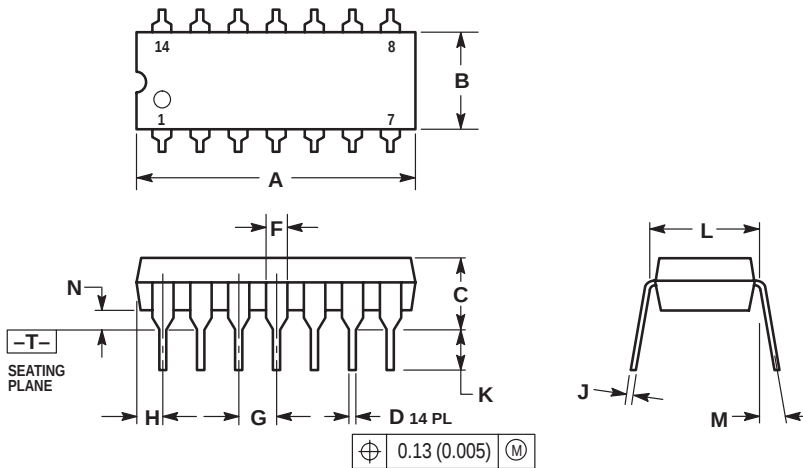


NOTES:

1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
2. CONTROLLING DIMENSION: MILLIMETER.
3. DIMENSIONS A AND B DO NOT INCLUDE MOLD PROTRUSION.
4. MAXIMUM MOLD PROTRUSION 0.15 (0.006) PER SIDE.
5. DIMENSION D DOES NOT INCLUDE DAMBAR PROTRUSION. ALLOWABLE DAMBAR PROTRUSION SHALL BE 0.127 (0.005) TOTAL IN EXCESS OF THE D DIMENSION AT MAXIMUM MATERIAL CONDITION.

DIM	MILLIMETERS		INCHES	
	MIN	MAX	MIN	MAX
A	8.55	8.75	0.337	0.344
B	3.80	4.00	0.150	0.157
C	1.35	1.75	0.054	0.068
D	0.35	0.49	0.014	0.019
F	0.40	1.25	0.016	0.049
G	1.27 BSC		0.050 BSC	
J	0.19	0.25	0.008	0.009
K	0.10	0.25	0.004	0.009
M	0°	7°	0°	7°
P	5.80	6.20	0.228	0.244
R	0.25	0.50	0.010	0.019

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°	—	10°
N	0.015	0.039	0.38	1.01

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