Advance Information

Low Power Voltage Controlled Oscillator

MC12149

LOW POWER VOLTAGE CONTROLLED OSCILLATOR

The MC12149 VCO is ideal in applications requiring high frequency signal generation at low power. The MC12149 series is specifically designed for ISM band applications at 902–928MHz. Low voltage operation at 3V and low current drain of 14mA typical makes the MC12149 ideal for battery operated handheld systems.

NOTE: The MC12149 is NOT useable as a crystal oscillator.

- Operates Up to 1.3GHz Center Frequency
- Low Power 14mA Typical @ 3.0V Power Supply
- Tuning Voltage Sensitivity 10MHz/V Typical
- Space Efficient 8-Pin SOIC or SSOP Package
- Phase Noise –101dBc/Hz @ 100kHz Offset Typical
- Supply Voltage of 2.7 to 5.5V

D SUFFIX
PLASTIC SOIC PACKAGE
CASE 751-03

SD SUFFIX
PLASTIC SSOP PACKAGE
CASE 940-02

Three VCO outputs are provided on chip. Two open collector outputs at a typical -6dBm output power is available for servicing the receiver IF and transmitter up-converter single endedly or to feed the receiver IF differentially. 50Ω output termination is required for both open collector outputs even if only one side is utilized. A low power VCO output at –11dBm typical output power is also provided for the VCO output required to feedback to the prescaler input of the PLL. Current is minimized in this emitter follower output leg. If additional drive is required for the Q2 output an external resistor can be added parallel from the Q2 pin to ground to increase the output power. Care must be taken not to exceed the maximum allowable current throughout the Q2 output leg; an external resistor should be limited to 350Ω for 3V or 1KΩ for 5V supply voltage. For typical applications where the Q2 VCO signal is sent to the prescaler of the PLL, no external resistor is required.

The VCO is designed for an operating voltage range from a minimum of 2.7V, ideal when minimizing power consumption for battery operated portable applications, up to a maximum supply voltage of 5.5V.

External components required for the MC12149 are: (1) tank circuit (LC network); (2) 50Ω output termination resistor to V_{CC} on each open collector output; and (3) adequate supply voltage bypassing. The tank circuit consists of a high-Q inductor and varactor components. An inductor with a Q of at least 200 at 1GHz is suggested. VCO performance such as center frequency, tuning voltage sensitivity and noise characteristics are dependent on the particular components and configuration of the VCO tank circuit.

MAXIMUM RATINGS*

Symbol	Parameter	Value	Unit
V_{CC}	Power Supply Volatge, Pin 1	-0.5 to +7.0	V
T_A	Operating Temperature Range	–40 to +85	°C
T_{STG}	Storage Temperature Range	-65 to +150	°C
I_O	Maximum Output Current, Pin 8	7.5	mA

* Maximum Ratings are those values beyond which damage to the device may occur. Functional operation should be restricted to the Recommended Operating Conditions.

This document contains information on a new product. Specifications and information herein are subject to change without notice.

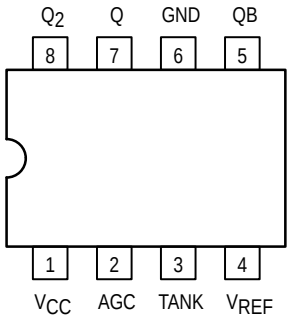
ELECTRICAL CHARACTERISTICS (V_{CC} = 2.7 to 5.5 VDC, T_A = -40°C to +85°C)

Symbol	Characteristic	Min	Typ	Max	Unit
I_{CC}	Supply Current V_{CC} = 3.0V V_{CC} = 5.0V		14 19		mA
P_O	Output Power (50Ω Load), Pins 5 & 7	-10	-6		dBm
P_O	Output Power (High Impedance Load), Pin 8	-16	-11		dBm
T_{stg}	Tuning Voltage Sensitivity		10		MHz/V
F_C	Center Frequency at T_f = 2.5V		TBD		MHz
$\mathcal{L}$(f)	CSR at 25KHz Offset, 1Hz BW		-90		dBc/Hz
$\mathcal{L}$(f)	CSR at 100KHz Offset, 1Hz BW		-101		dBc/Hz
SNR	SNR (Signal-to-Noise Ratio)[1]		45		dB
TR	Tuning Volatge Range	0		5	V
F_{sts} f_{stt}	Frequency Stability Supply Drift Thermal Drift		TBD TBD		KHz/mV KHz/°C

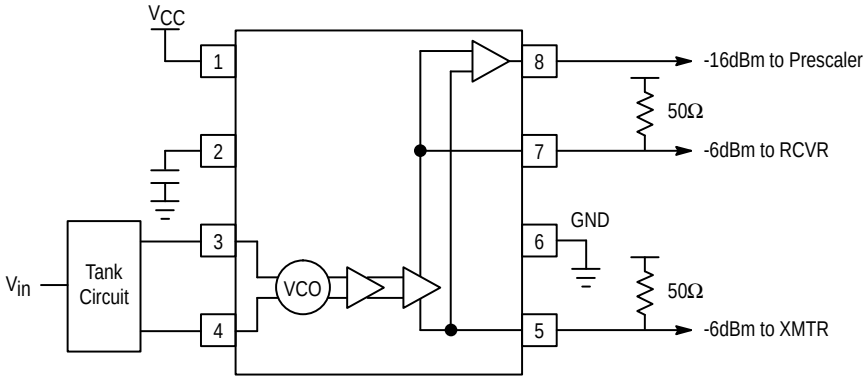
1 SNR without vibration.

PIN NAMES

Pin	Function
V_{CC}	Power Supply
AGC	Automatic Gain Control
TANK	Tank Circuit Input
V_{REF}	Bias Voltage Output
QB	Open Collector Output
GND	Ground
Q	Open Collector Output
Q_2	Low Power Output



Pinout: 8-Lead Plastic Package (Top View)

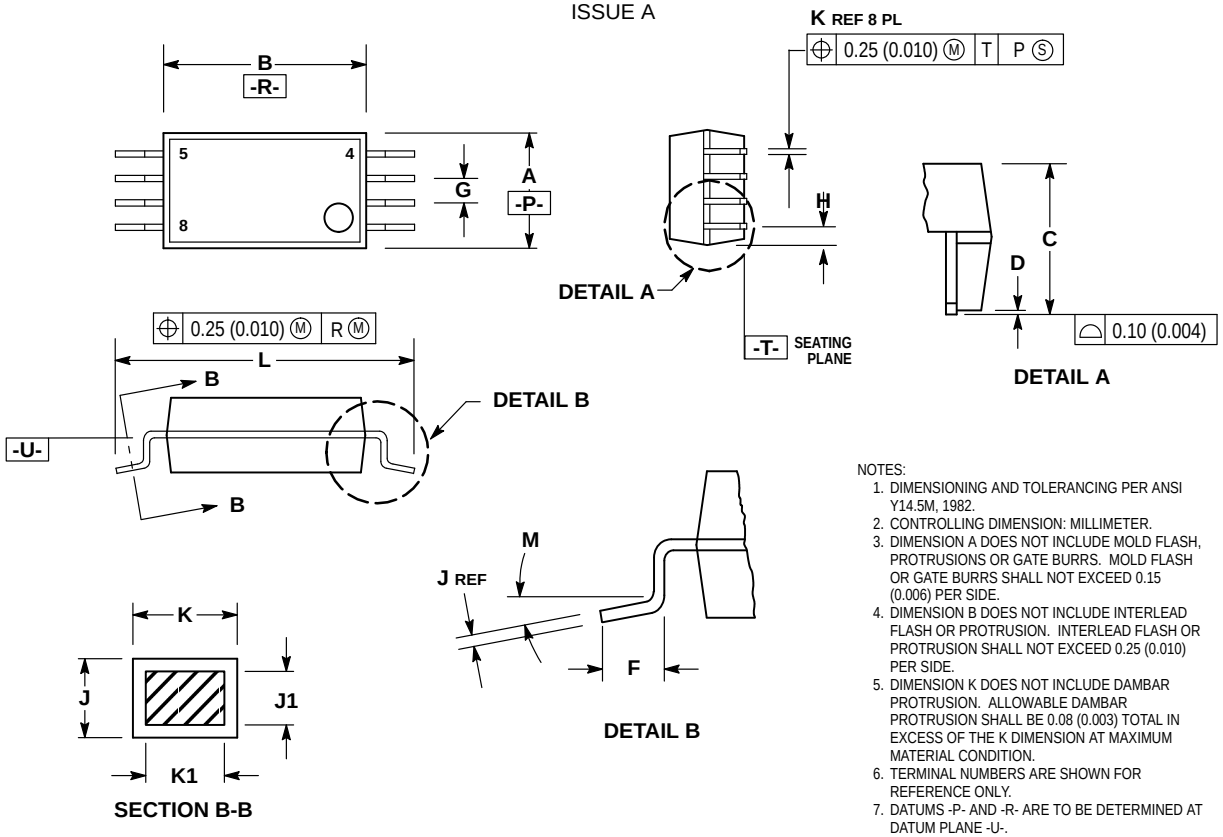


Note: Tank circuit consists of a Hi-Q inductor and varactor components. An inductor with a Q of 200 at 1GHz is suggested.

Figure 1. Block Diagram and Typical Test Circuit
(MC12149 Shown)

OUTLINE DIMENSIONS

SD SUFFIX
PLASTIC SSOP PACKAGE
CASE 940-02
ISSUE A

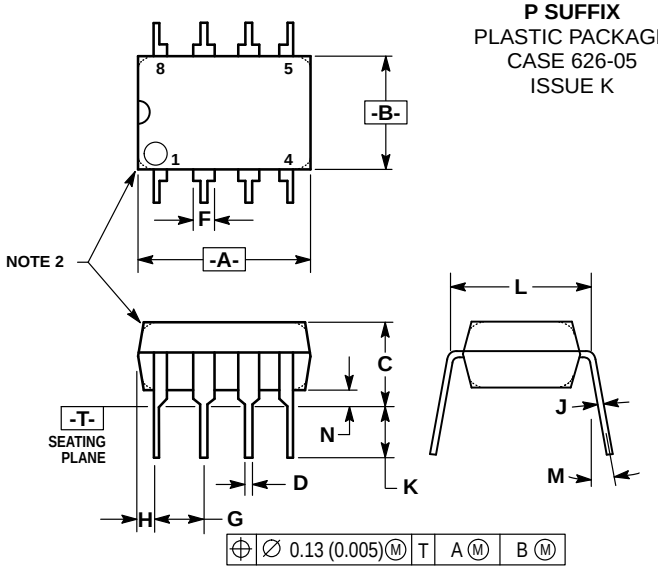


NOTES:
1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
2. CONTROLLING DIMENSION: MILLIMETER.
3. DIMENSION A DOES NOT INCLUDE MOLD FLASH, PROTRUSIONS OR GATE BURRS. MOLD FLASH OR GATE BURRS SHALL NOT EXCEED 0.15 (0.006) PER SIDE.
4. DIMENSION B DOES NOT INCLUDE INTERLEAD FLASH OR PROTRUSION. INTERLEAD FLASH OR PROTRUSION SHALL NOT EXCEED 0.25 (0.010) PER SIDE.
5. DIMENSION K DOES NOT INCLUDE DAMBAR PROTRUSION. ALLOWABLE DAMBAR PROTRUSION SHALL BE 0.08 (0.003) TOTAL IN EXCESS OF THE K DIMENSION AT MAXIMUM MATERIAL CONDITION.
6. TERMINAL NUMBERS ARE SHOWN FOR REFERENCE ONLY.
7. DATUMS -P- AND -R- ARE TO BE DETERMINED AT DATUM PLANE -U-.
8. DIMENSION A AND B ARE TO BE DETERMINED AT DATUM PLANE -U-.
9. CROSS SECTION B-B TO BE DETERMINED AT 0.10 (0.004) TO 0.25 (0.010) FROM THE LEADTIP.

	MILLIMETERS		INCHES	
DIM	MIN	MAX	MIN	MAX
A	2.87	3.13	0.113	0.123
B	5.20	5.38	0.205	0.212
C	1.73	1.99	0.068	0.078
D	0.05	0.21	0.002	0.008
F	0.55	0.95	0.022	0.037
G	0.65 BSC		0.026 BSC	
H	0.50	—	0.020	—
J	0.09	0.20	0.004	0.008
J1	0.09	0.16	0.004	0.006
K	0.22	0.38	0.009	0.015
K1	0.22	0.33	0.009	0.013
L	7.65	7.90	0.301	0.311
M	0°	8°	0°	8°

OUTLINE DIMENSIONS

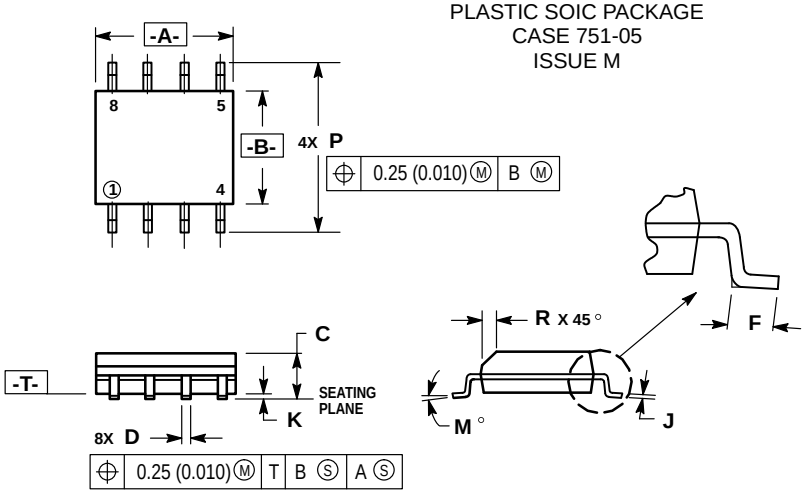
P SUFFIX
PLASTIC PACKAGE
CASE 626-05
ISSUE K



NOTES:
1. DIMENSION L TO CENTER OF LEAD WHEN FORMED PARALLEL.
2. PACKAGE CONTOUR OPTIONAL (ROUND OR SQUARE CORNERS).
3. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.

	MILLIMETERS		INCHES	
DIM	MIN	MAX	MIN	MAX
A	9.40	10.16	0.370	0.400
B	6.10	6.60	0.240	0.260
C	3.94	4.45	0.155	0.175
D	0.38	0.51	0.015	0.020
F	1.02	1.78	0.040	0.070
G	2.54 BSC		0.100 BSC	
H	0.76	1.27	0.030	0.050
J	0.20	0.30	0.008	0.012
K	2.92	3.43	0.115	0.135
L	7.62 BSC		0.300 BSC	
M	—	10°	—	10°
N	0.76	1.01	0.030	0.040

D SUFFIX
PLASTIC SOIC PACKAGE
CASE 751-05
ISSUE M



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.

	MILLIMETERS		INCHES	
DIM	MIN	MAX	MIN	MAX
A	4.80	5.00	0.189	0.196
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	0.18	0.25	0.007	0.009
K	0.10	0.25	0.004	0.009
M	0°	7°	0°	7°
P	5.80	6.20	0.229	0.244
R	0.25	0.50	0.010	0.019

Literature Distribution Centers:
USA: Motorola Literature Distribution; P.O. Box 20912; Phoenix, Arizona 85036.
EUROPE: Motorola Ltd.; European Literature Centre; 88 Tanners Drive, Blakelands, Milton Keynes, MK14 5BP, England.
JAPAN: Nippon Motorola Ltd.; 4-32-1, Nishi-Gotanda, Shinagawa-ku, Tokyo 141 Japan.
ASIA-PACIFIC: Motorola Semiconductors H.K. Ltd.; Silicon Harbour Center, No. 2 Dai King Street, Tai Po Industrial Estate, Tai Po, N.T., Hong Kong.