

MRFIC1505/MRFIC1505A Integrated GPS Downconverter

1.575 GHz GPS DOWNCONVERTER

This integrated circuit is intended for GPS receiver applications. The dual conversion design is implemented in Motorola's low-cost, high-performance MOSAIC 5. silicon bipolar process and is packaged in a low-cost surface mount LQFP-48 package. In addition to the mixers, a VCO, PLL, Crystal Oscillator, A/D converter and a loop filter are integrated on-chip. Output IF is nominally 4.1 MHz.

- 105 dB Typical Conversion Gain
- 2.7 V Operation
- 28 mA Typical Current Consumption
- Low-Cost, Low-Profile Plastic LQFP Package

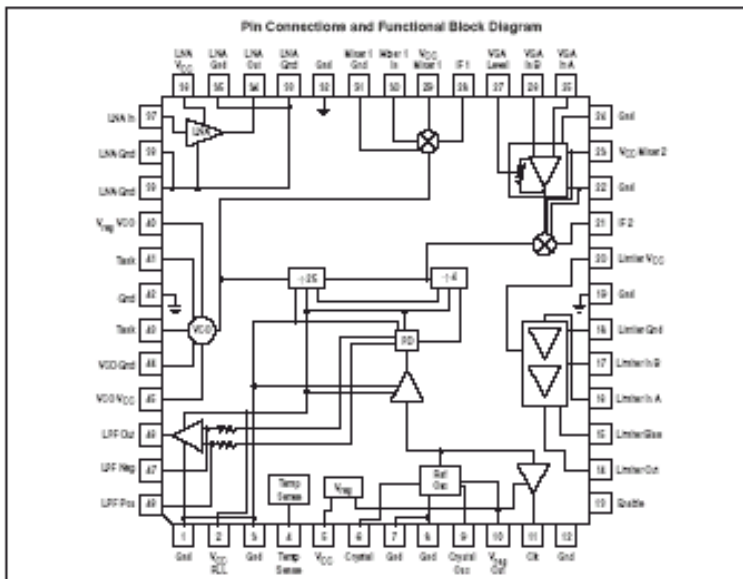
MOSAIC 5 is a trademark of Motorola, Inc.

Ordering Information

Device	Operating Temperature Range	Package
MRFIC1505R2	$T_A = -40$ to 85°C	LQFP-48
MRFIC1505AR2	$T_A = -40$ to 85°C	LQFP-48



Plastic Package
 Case 932
 (LQFP-48)



Maximum Ratings

Rating	Symbol	Value	Unit
DC Supply Voltage	V_{DD}	5.0	Vdc
DC Supply Current	I_{DD}	60	mA
Operating Ambient Temperature	T_A	-40 to 85	°C
Storage Temperature Range	T_{stg}	-65 to 150	°C
Lead Soldering Temperature Range	–	260	°C

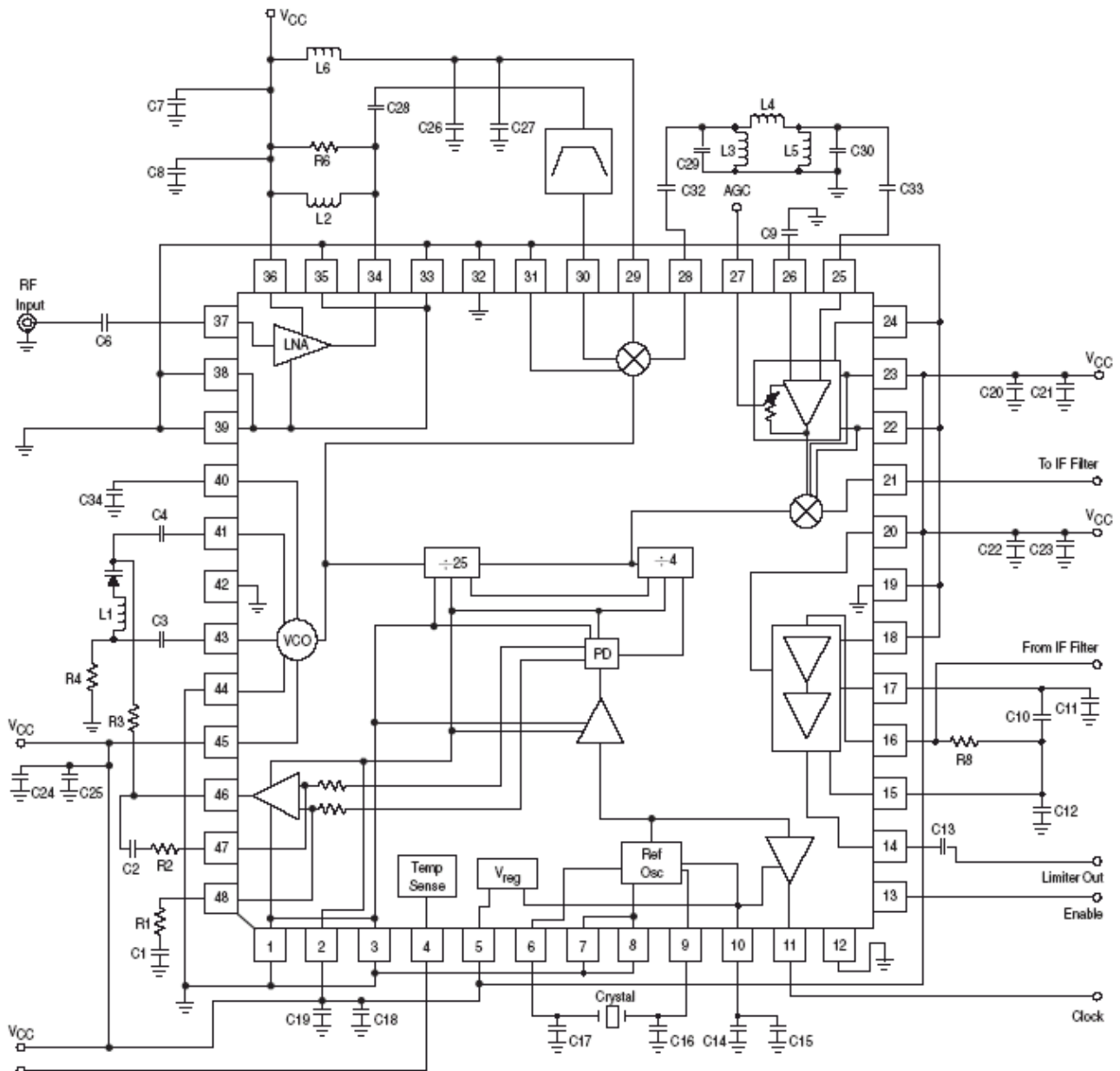
Note: Maximum Ratings are those values beyond which damage to the device may occur. Functional operation should be restricted to the limits in the Electrical Characteristics tables.

Electrical Characteristics (VCC = 2.7 to 3.3 V; TA = -40 to 85°C; Enable = 2.7 V unless otherwise noted)

Characteristic	Symbol	Min	Typ	Max	Unit
Total Device					
Supply Voltage	V_{CC}	2.7	3.0	3.3	V
Supply Current (TA = 25°C, VCC = 2.7 V, Enable = 2.7V)	I_{CC}	–	28	36	mA
Supply Current (TA = 25°C, VCC = 2.7 V, Enable = 2.7V)	I_{CC}	–	2.0	4.0	mA
RF Amplifier					
RF Input Frequency	f_{in}	–	1575.42	–	MHz
Input Impedance	Z_{in}	–	50	–	Ω
Input VSWR	$VSWR_{in}$	–	2.0	–	–
Gain	G	13	15	–	dB
Noise Figure	NF	–	2.0	–	dB
1.0 dB Compression (Measured at Output)	P_{1dB}	–	1.0	–	dBm
First Mixer					
Input Frequency	f_{in}	–	1575.42	–	MHz
Gain	G	10	14	–	dB
Noise Figure	NF	–	13	–	dB
1.0 dB compression (Measured at Output)	P_{1dB}	–	-13	–	dBm
First Local Oscillator Frequency	f_{LO1}	–	1636.8	–	MHz
First Intermediate Frequency	f_{IF1}	–	61.38	–	MHz
LO Leakage at IF Port	–	–	-40	–	dBm
LO Leakage at RF Port	–	–	-50	–	dBm
Output Impedance	Z_{out}	–	50	–	Ω
First IF Amplifier and Second Mixer					
Input Frequency	f_{in}	–	61.38	–	MHz
Input Impedance	Z_{in}	–	230	–	Ω
Output Impedance	Z_{out}	–	50	–	Ω
Second Local Oscillator Frequency	f_{LO2}	–	65.47	–	MHz
Second Intermediate Frequency	f_{IF2}	–	4.092	–	MHz
LO Leakage at IF Port	–	–	-40	–	dBm
Gain	G	40	43	–	dB
Cascaded Noise Figure	NF	–	9.3	–	dB
1.0 dB Compression Point (Measured at Output)	P_{1dB}	–	-13	–	dBm
Limiting Amplifier					
Second Intermediate Frequency	f_{IF2}	–	4.092	–	MHz
Input Signal Level	–	4.0	11	31	Mv
Output Voltage Swing (into 10 pF 100 k Ω)	V_{out}	800	–	–	mVpp
DC Output Level	–	–	1.4	–	V
Gain	G	–	50	–	dB
Reference Oscillator					
Reference Frequency	f_r	–	16.368	–	MHz
Reference Frequency Input Level (Crystal Output Pin)	–	–	500	–	mVpp

Electrical Characteristics (VCC = 2.7 to 3.3 V; TA = -40 to 85°C; Enable = 2.7 V unless otherwise noted)

Characteristic	Symbol	Min	Typ	Max	Unit
Reference Oscillator Output Voltage Level (Into 15 pf 10 kΩ)	–	750	–	–	mVpp
Reference Clock Input Drive Level	–	400	800	1500	mVpp
PLL					
First Local Oscillator Frequency	f _{LO1}	–	1636.8	–	MHz
Second Local Oscillator Frequency	f _{LO2}	–	65.47	–	MHz
VCO C/N (at 10 kHz Offset)	–	–	-80	–	dBc/Hz
VCO Gain (TBD Varactor)	–	–	200	–	MHz/V
Enable					
Enable Active Level	–	0.8 x V _{CC}	V _{CC}	–	V
Disable Active Level	–	–	0	0.2 x V _{CC}	V
Voltage Regulator					
Regulator Output Voltage (V _{CC} = 2.7 to 3.3 V, I _{out} = 3.0 mA)	V _O	2.1	2.3	2.5	V
MRFC505 Temperature Sense Specs					
Temperature Sensor Output Voltage @ 25°C	–	1.2	1.28	1.375	V
Temperature Sensor Slope over Temperature	–	–	5.0	–	mV/°C
MRFC505A Temperature Sense Specs					
Temperature Sensor Output Voltage @ 25°C	–	1.270	1.395	1.463	V
Temperature Sensor Slope over Temperature	–	–	5.0	–	mV/°C



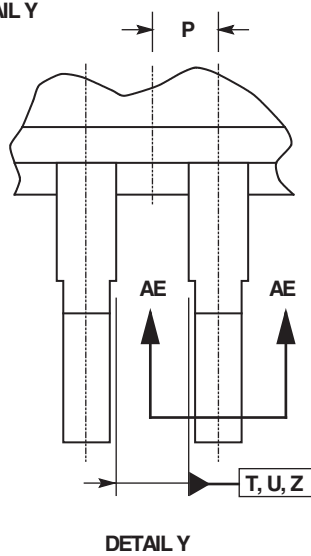
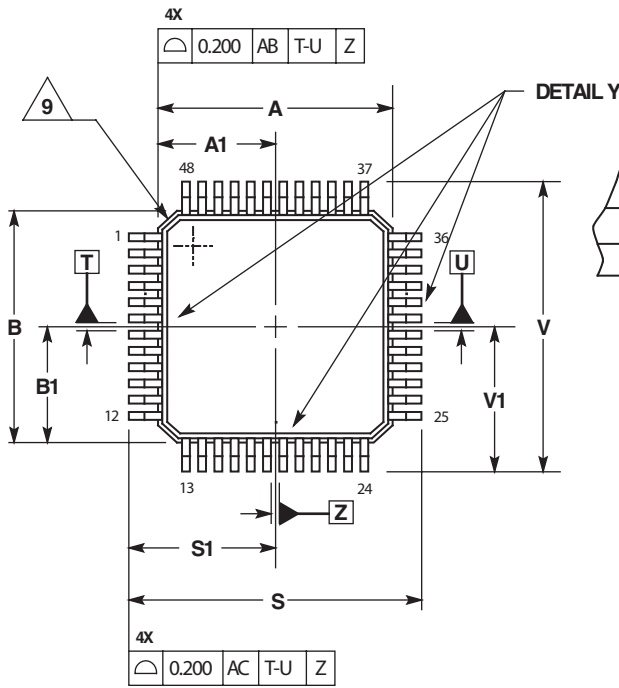
Temp Sense	C1, C2	220 pF	C29, C30	91 pF
	C3, C4	1.7 pF	C32, C33	1.0 nF
	C6	10 pF	L1	10 nH
	C7, C14, C18, C20, C22, C24, C34	0.01 μ F	L2	3.9 nH
	C8, C15, C19, C21, C23, C25, C27	1000 pF	L3, L5	82 nH
	C9	1.0 μ F	L4	0.62 μ H
	C10, C11, C12	1.0 nF	L6	TBD
	C13	2.7 nF	R1, R2, R4	10 k
	C16, C17	27 pF	R3	2 k
	C26	470 pF	R6	1.2 k
	C28	0.6 pF	R8	5.0 k

NOTES: 1. R8 must be set to match your 2nd IF filter impedance.
 2. Layout of capacitors C10, C11, C12 is critical for stability of Limiter.

Figure 1 Applications Schematic (1636.8 MHz LO)

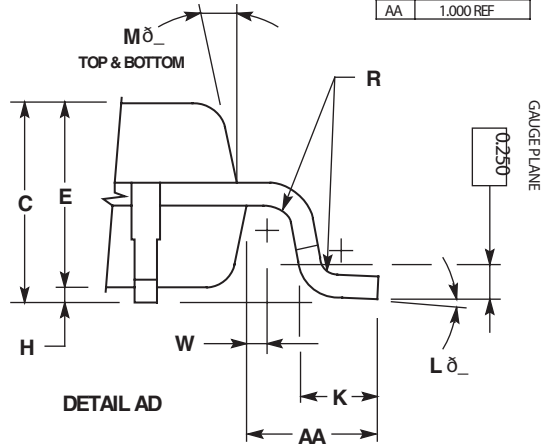
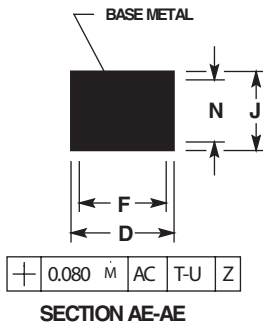
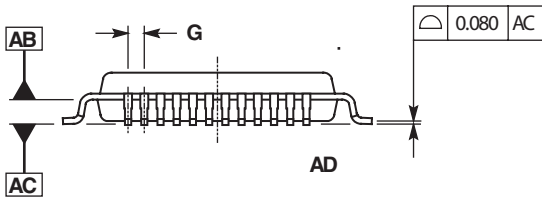
Outline Dimensions

PLASTIC PACKAGE
CASE 932-03
(LQFP-48)
ISSUE F



- NOTEDIMENSIONING AND TOLERANCING PER ASME
- 3 DIMENSION A1 IS THE DIAMETER OF LEAD AND IS COINCIDENT WITH THE LEAD WHERE THE LEAD EXITS THE PLASTIC BODY AT
 - 4 DIMENSION A1 SHOULD BE DETERMINED AT
 - 5 DIMENSION V1 SHOULD BE DETERMINED AT
 - 6 DIMENSIONS A AND B DO NOT INCLUDE MOLD PROTRUSION. ALLOWABLE PROTRUSION IS 0.250 PER SIDE. DIMENSIONS A AND B DO INCLUDE MOLD MISMATCH AND ARE
 - 7 DIMENSIONS C AND D DO NOT INCLUDE DAVBAR PROTRUSION. DAVBAR PROTRUSION SHALL NOT CAUSE THE D DIMENSION TO EXCEED
 - 8 MINIMUM SOLDER PLATE THICKNESS SHALL BE
 - 9 EXAMPLE: CHAMFER OF EACH CORNER IS OPTIONAL

DIM	MILLIMETERS	
	MIN	MAX
A	7.000	BSC
A1	3.500	BSC
B	7.000	BSC
B1	3.500	BSC
C	1.400	1.600
D	0.170	0.270
E	1.350	1.450
F	0.170	0.230
G	0.500 BSC	
H	0.050	0.150
J	0.090	0.200
K	0.500	0.700
L	0	7 δ
M	12 REF	
N	0.090	0.160
P	0.250 BSC	
R	0.150	0.250
S	9.000 BSC	
S1	4.500 BSC	
V	9.000 BSC	
V1	4.500 BSC	
W	0.200 REF	
AA	1.000 REF	



NOTES

NOTES

How to Reach Us:

Home Page:

www.freescale.com

E-mail:

support@freescale.com

USA/Europe or Locations Not Listed:

Freescale Semiconductor
Technical Information Center, CH370
1300 N. Alma School Road
Chandler, Arizona 85224
+1-800-521-6274 or +1-480-768-2130
support@freescale.com

Europe, Middle East, and Africa:

Freescale Halbleiter Deutschland GmbH
Technical Information Center
Schatzbogen 7
81829 Muenchen, Germany
+44 1296 380 456 (English)
+46 8 52200080 (English)
+49 89 92103 559 (German)
+33 1 69 35 48 48 (French)
support@freescale.com

Japan:

Freescale Semiconductor Japan Ltd.
Technical Information Center
3-20-1, Minami-Azabu, Minato-ku
Tokyo 106-0047, Japan
0120 191014 or +81 3 3440 3569
support.japan@freescale.com

Asia/Pacific:

Freescale Semiconductor Hong Kong Ltd.
Technical Information Center
2 Dai King Street
Tai Po Industrial Estate
Tai Po, N.T., Hong Kong
+800 2666 8080
support.asia@freescale.com

For Literature Requests Only:

Freescale Semiconductor Literature Distribution Center
P.O. Box 5405
Denver, Colorado 80217
1-800-441-2447 or 303-675-2140
Fax: 303-675-2150
LDCForFreescaleSemiconductor@hibbertgroup.com

Information in this document is provided solely to enable system and software implementers to use Freescale Semiconductor products. There are no express or implied copyright licenses granted hereunder to design or fabricate any integrated circuits or integrated circuits based on the information in this document.

Freescale Semiconductor reserves the right to make changes without further notice to any products herein. Freescale Semiconductor makes no warranty, representation or guarantee regarding the suitability of its products for any particular purpose, nor does Freescale Semiconductor assume any liability arising out of the application or use of any product or circuit, and specifically disclaims any and all liability, including without limitation consequential or incidental damages. "Typical" parameters that may be provided in Freescale Semiconductor data sheets and/or specifications can and do vary in different applications and actual performance may vary over time. All operating parameters, including "Typicals", must be validated for each customer application by customer's technical experts. Freescale Semiconductor does not convey any license under its patent rights nor the rights of others. Freescale Semiconductor products are not designed, intended, or authorized for use as components in systems intended for surgical implant into the body, or other applications intended to support or sustain life, or for any other application in which the failure of the Freescale Semiconductor product could create a situation where personal injury or death may occur. Should Buyer purchase or use Freescale Semiconductor products for any such unintended or unauthorized application, Buyer shall indemnify and hold Freescale Semiconductor and its officers, employees, subsidiaries, affiliates, and distributors harmless against all claims, costs, damages, and expenses, and reasonable attorney fees arising out of, directly or indirectly, any claim of personal injury or death associated with such unintended or unauthorized use, even if such claim alleges that Freescale Semiconductor was negligent regarding the design or manufacture of the part.



Freescale™ and the Freescale logo are trademarks of Freescale Semiconductor, Inc. All other product or service names are the property of their respective owners.

© Freescale Semiconductor, Inc. 2004. All rights reserved.