MRFIC1505
Rev. 1, 08/2004

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

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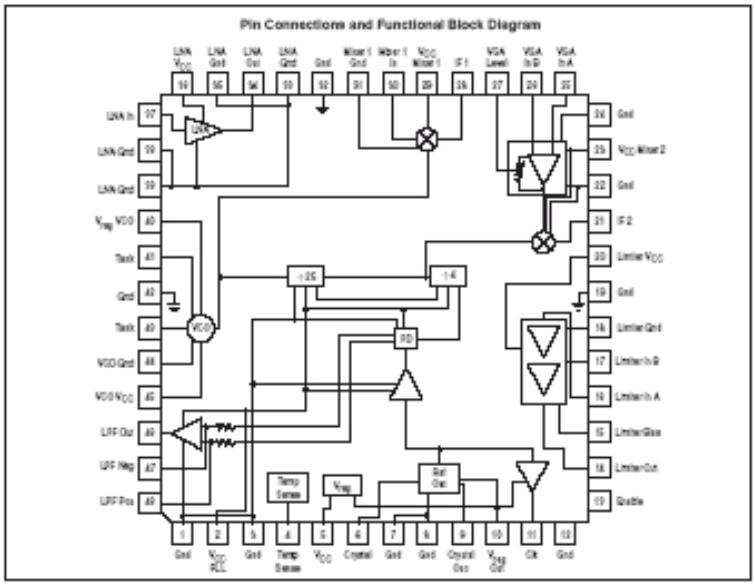
Ordering Information

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)



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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

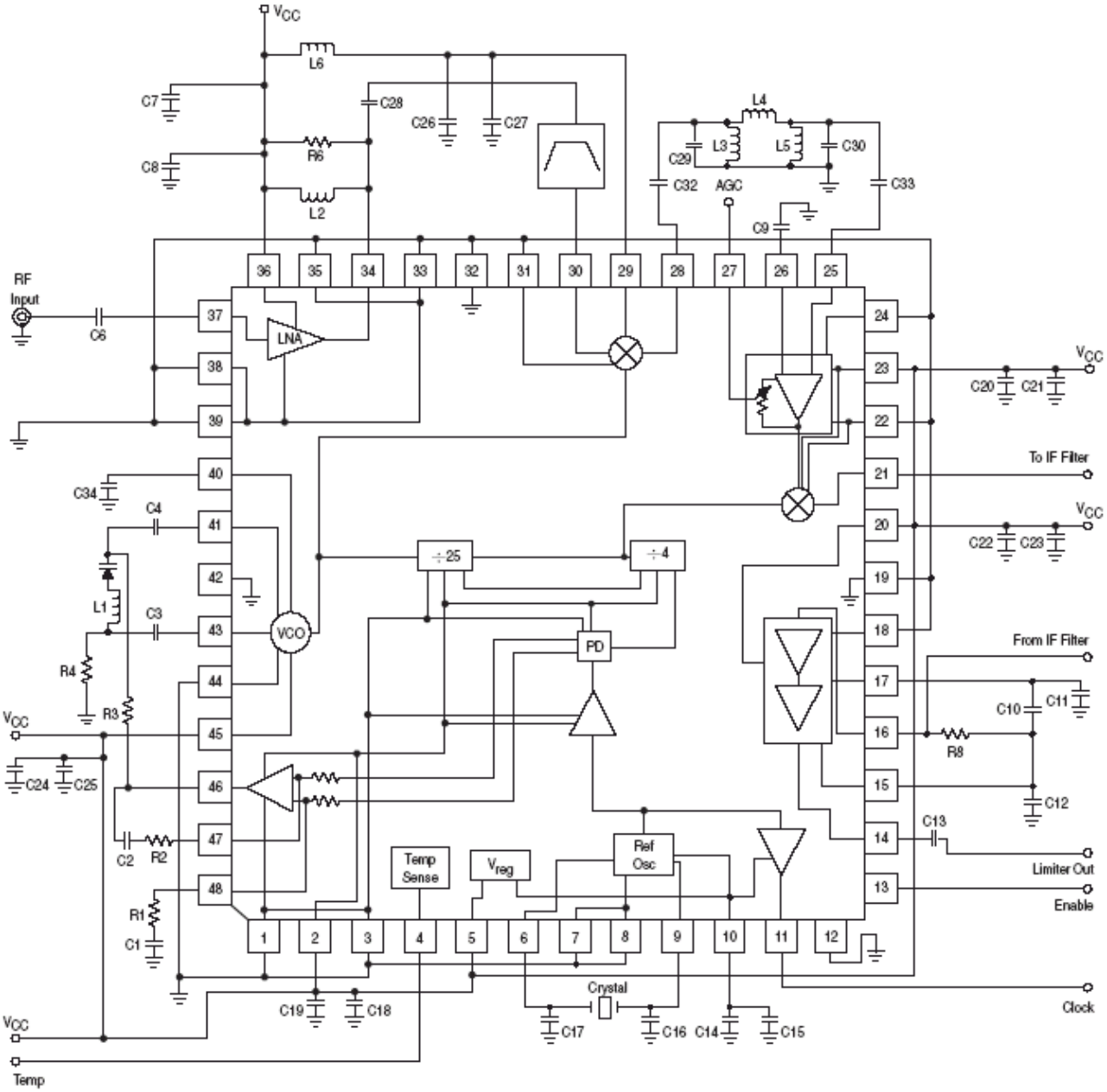
Note: Maximum Ratings are those values beyond which damage to the device may occur. Functional operation should be restricted to the limits in the Electrical Characteristics tables.

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 Frequenc	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 ll100 kΩ	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 II 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
MRFIC505 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
MRFIC505A 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



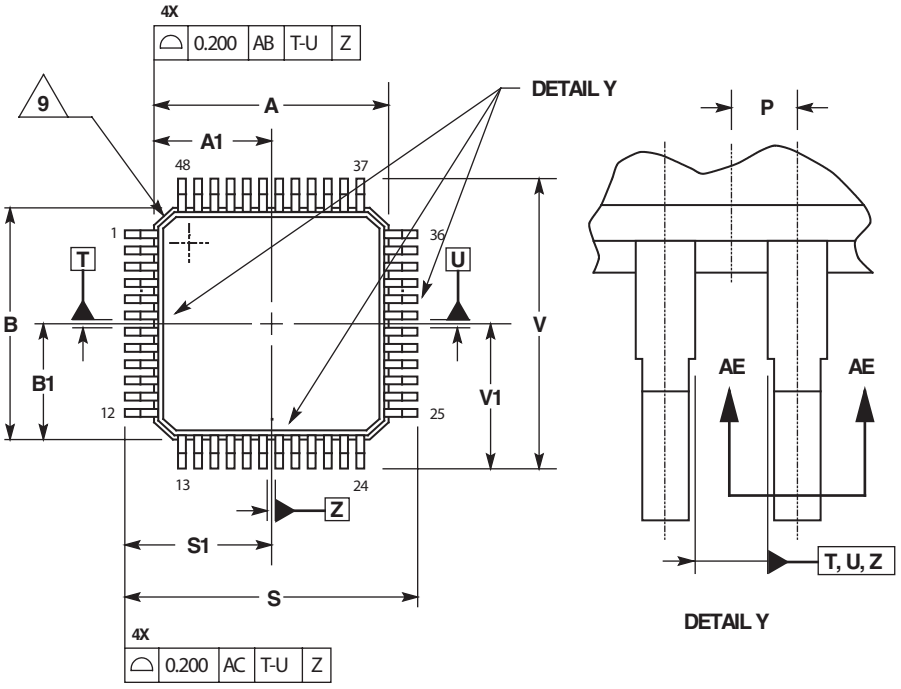
C1, C2	220 pF	C29, C30	91 pF
C3, C4	1.7 pF	C32, C33	1.0 nF
C6	10 pF	L1	10 nH
C7, C14, C18, C20, C22, C24, C34	0.01 µF	L2	3.9 nH
C8, C15, C19, C21, C23, C25, C27	1000 pF	L3, L5	82 nH
C9	1.0 µF	L4	0.62 µH
C10, C11, C12	1.0 npF	L6	TBD
C13	2.7 nF	R1, R2, R4	10 k
C16, C17	27 pF	R3	2 k
C26	470 pF	R6	1.2 k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



NOTES:
1. DIMENSIONING AND TOLERANCING PER ASME
2. CONTROLLING DIMENSION: MILLIMETER.
3. DATUM PLANE -AB- IS LOCATED AT BOTTOM OF LEAD AND IS COINCIDENT WITH THE LEAD WHERE THE LEAD EXITS THE PLASTIC BODY AT
4. DATUMS -T-, -U-, AND -Z- TO BE DETERMINED AT
5. DIMENSIONS A AND B TO 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. DIMENSION D DOES NOT INCLUDE DAMBAR PROTRUSION. DAMBAR PROTRUSION SHALL NOT CAUSE THE D DIMENSION TO EXCEED
8. MINIMUM SOLDER PLATE THICKNESS SHALL BE
9. EXACT SHAPE OF EACH CORNER IS OPTIONAL.

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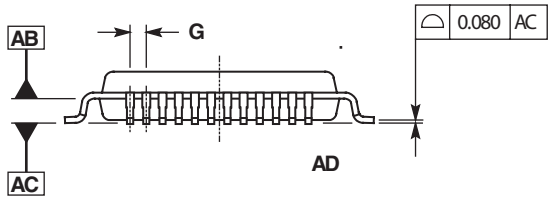
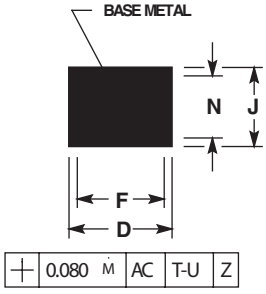
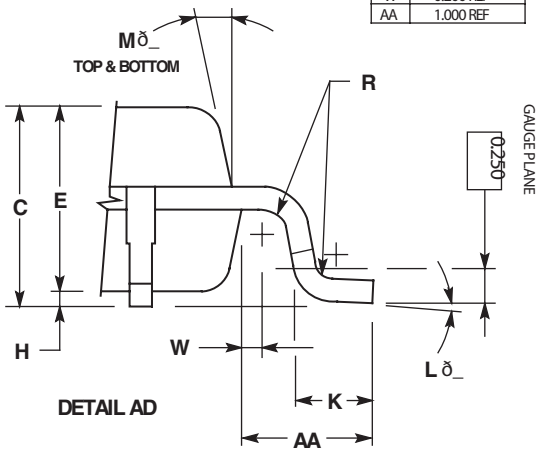
DIM	MILLIMETERS MIN	MAX
A	7.000 BSC	
A1	3.500 BSC	
B	7.000 BSC	
B1	3.500 BSC	
C	1.400	1.600
D	0.170	0.270
E	1.350	1.450
F	0.170	0.230
G	0.500 BSC	
H	0.050	0.150
J	0.090	0.200
K	0.500	0.700
L	0 ð	7 ð
M	12 ð REF	
N	0.090	0.160
P	0.250 BSC	
R	0.150	0.250
S	9.000 BSC	
S1	4.500 BSC	
V	9.000 BSC	
V1	4.500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







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MRFIC1505
Rev. 1
08/2004