HMC381LP6

HIGH IP3 RFIC DUAL DOWNCONVERTER, 1.7 - 2.2 GHz

Typical Applications

The HMC381LP6 is ideal for Wireless Infrastructure Applications:

- GSM, GPRS & EDGE
- CDMA & W-CDMA
- PHS & PDC

Features

+27 dBm Input IP3

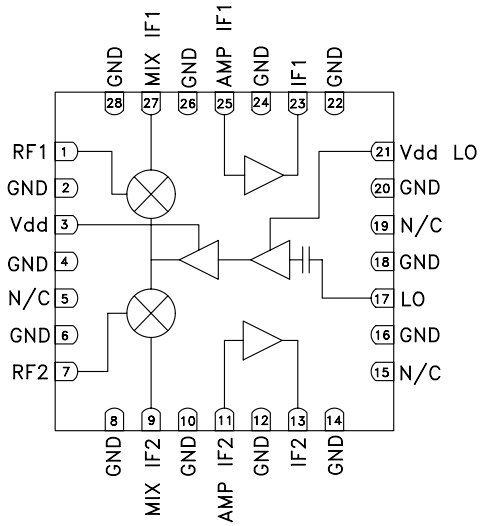
Low Single Input LO Drive: 0 dBm

9 dB Conversion Gain

12 dB Noise Figure

Single Positive Supply: +5V @ 260 mA

Functional Diagram



General Description

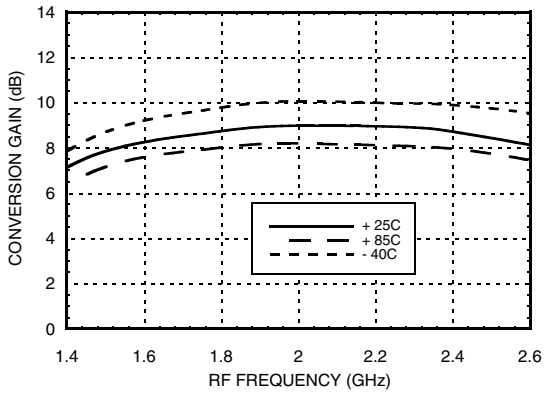
The HMC381LP6 is a high linearity Dual Down Converter Receiver IC that operates from 1.7 - 2.2 GHz and delivers a +27dBm input third order intercept point for UMTS & PHS applications. The passive mixer outputs and high dynamic range IF amplifier inputs are positioned so that an external IF filter can be placed in series between them. The converter provides a gain of 9 dB and 12 dB typical single side band noise figure. The IC operates from a positive +5V rail consuming 260 mA of current while requiring a LO drive level of only -4 to +4 dBm. The design requires no external baluns and supports IF frequencies between 50 and 300 MHz.

Electrical Specifications, T_A = +25° C, LO = 0 dBm, Vdd = 5V, IF = 250 MHz*

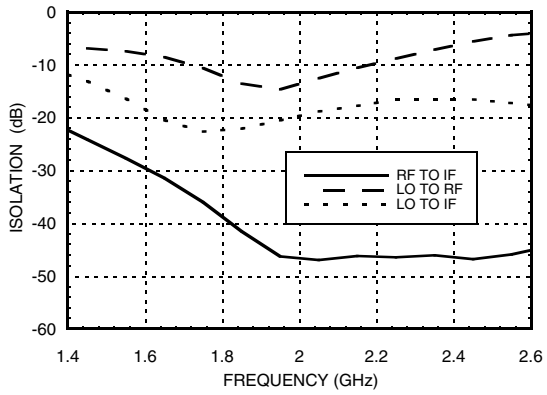
Parameter	Min.	Typ.	Max.	Min.	Typ.	Max.	Units
Frequency Range, RF		1.7 - 2.0			2.0 - 2.2		GHz
Frequency Range, LO		1.4 - 2.3			1.7 - 2.5		GHz
Frequency Range, IF		50 - 300			50 - 300		MHz
Conversion Gain	6.5	8.5		7	9		dB
Noise Figure (SSB)		12			12.5		dB
LO to RF Isolation		11			11		dB
LO to IF Isolation	16	20		14	18		dB
RF to IF Isolation	30	40		40	46		dB
IP3 (Input)	23	26		24	27		dBm
1 dB Compression (Input)		12			12		dBm
Branch Isolation		50			52		dB
LO Drive Input Level (Typical)		-4 to +4			-4 to +4		dBm
Supply Current (Idd for LO & IF) (IF bias resistor= 4.7 Ohms)		260			260		mA

** Unless otherwise noted all measurements with low side LO & IF = 250 MHz.*

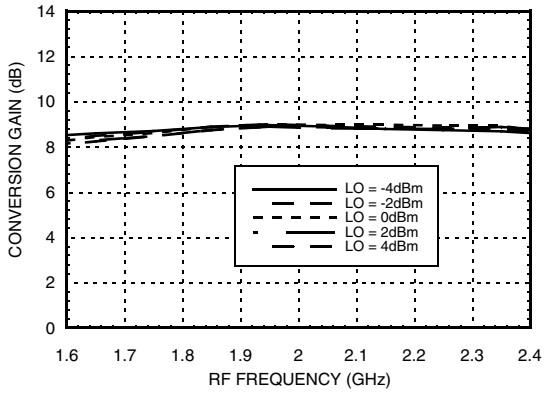
Conversion Gain vs. Temperature @ LO = 0 dBm



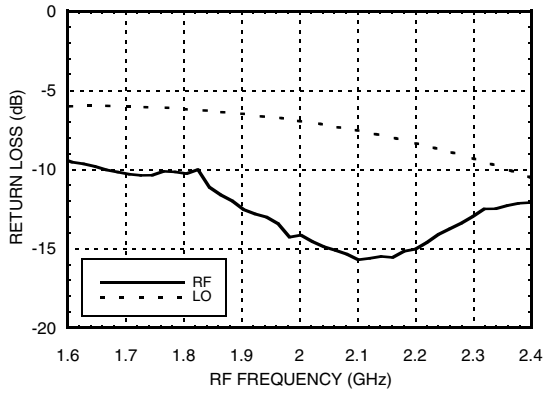
Isolation @ LO = 0 dBm



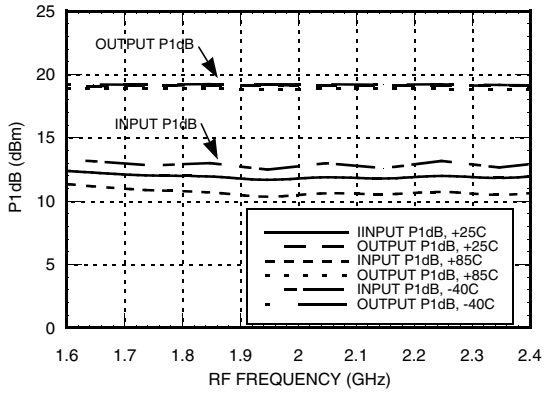
Conversion Gain vs. LO Drive



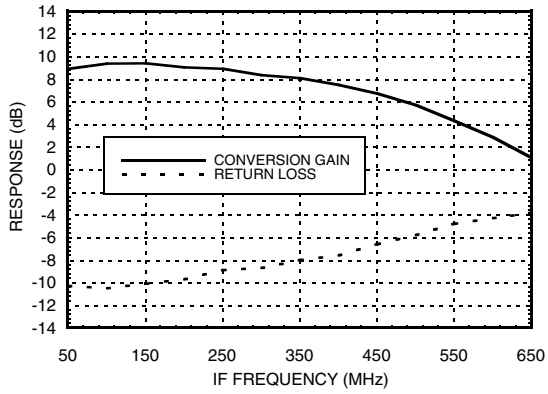
Return Loss @ LO = 0 dBm



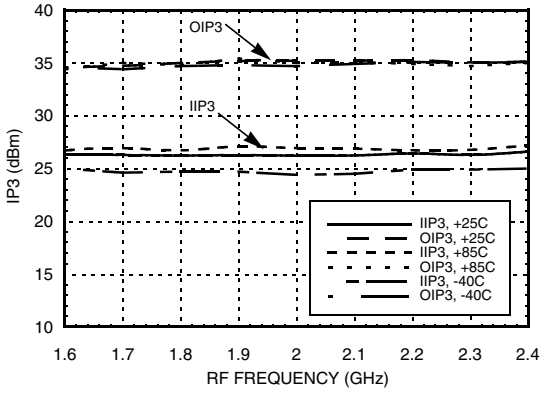
P1dB vs. Temperature @ LO = 0 dBm



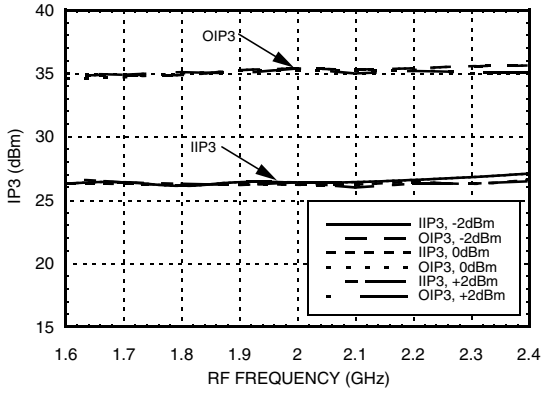
IF Bandwidth @ LO = -5 dBm



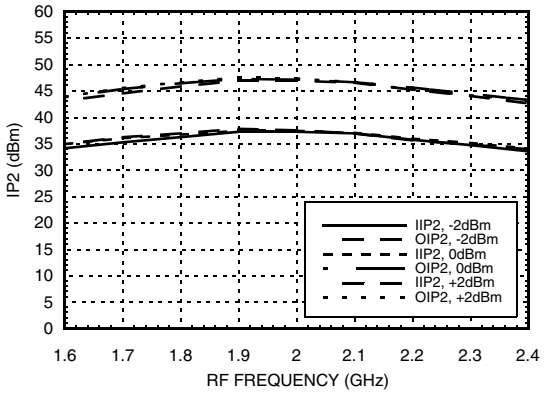
Input and Output IP3 vs. Temperature @ LO = 0 dBm



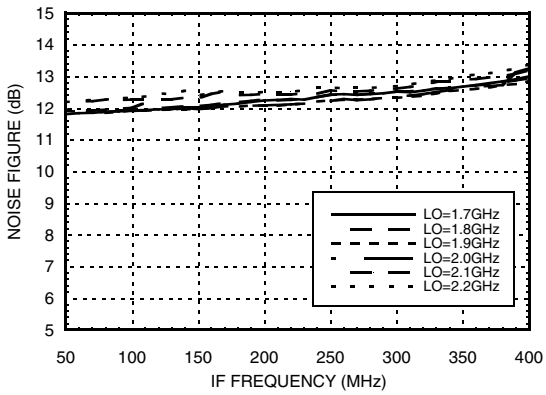
Input and Output IP3 vs LO Drive



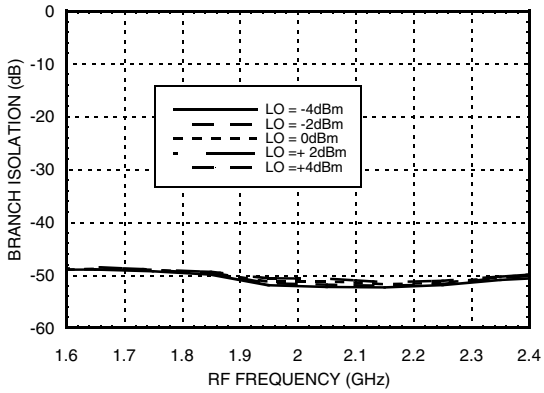
Input and Output IP2 vs. LO Drive



Noise Figure vs. IF Frequency



Branch Isolation RF1 - IF2 vs. LO Drive



For price, delivery, and to place orders, please contact Hittite Microwave Corporation:
12 Elizabeth Drive, Chelmsford, MA 01824 Phone: 978-250-3343 Fax: 978-250-3373
Order Online at www.hittite.com

MxN Spurious @ IF Port

	nLO				
mRF	0	1	2	3	4
0	xx	21	52	40	48
1	54	0	57	82	88
2	95	79	53	84	94
3	94	94	95	72	95
4	94	95	94	95	95

RF Freq. = 1.9 GHz @ -10 dBm
LO Freq. = 1.65 GHz @ 0 dBm
All values in dBc relative to the IF power level.

Harmonics of LO

	nLO Spur @ RF Port			
LO Freq. (GHz)	1	2	3	4
1.4	25	46	41	54
1.5	26	42	42	50
1.6	29	40	43	48
1.7	28	41	46	45
1.8	28	40	47	44
1.9	28	37	49	45

LO = 0 dBm
All values in dBc below input LO level measured at RF port.

Typical Supply Current vs. Vdd

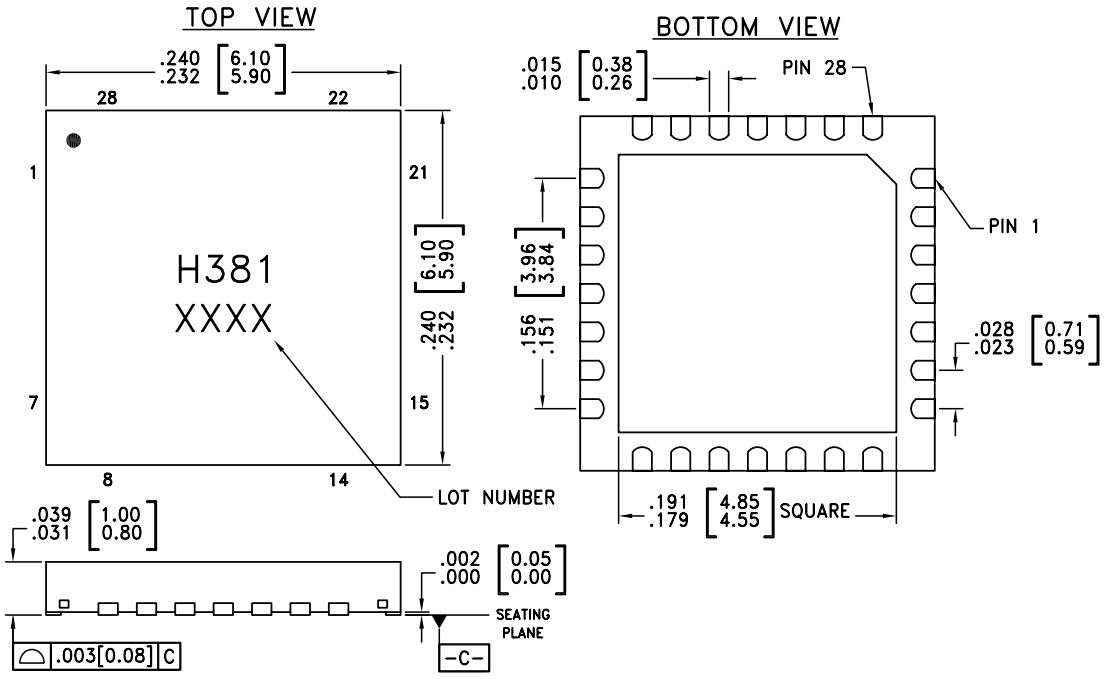
Vdd (LO + IF)	Idd (mA)
+4.5	190
+5.0	260
+5.5	340

Downconverter will operate over full voltage range shown above.

Absolute Maximum Ratings

RF / IF Input (Vdd= +5V)	+13 dBm
LO Drive (Vdd= +5V)	+15 dBm
Vdd (LO or IF)	+7 Vdc
Channel Temperature	150°C
Continuous Pdiss (T = 85°C) (derate 25.5 mW/°C above 85°C)	1.64 W
Thermal Resistance (junction to ground paddle)	39.6 °C/W
Storage Temperature	-65 to +150°C
Operating Temperature	-40 to +85°C

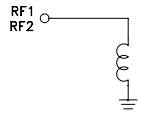
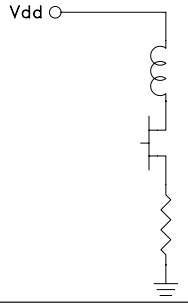
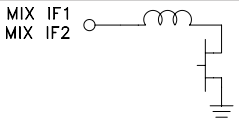
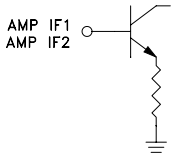
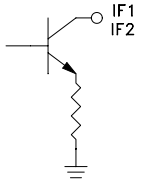
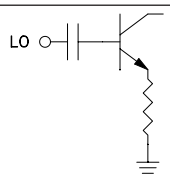
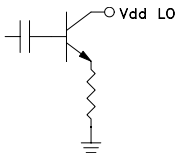
Outline Drawing



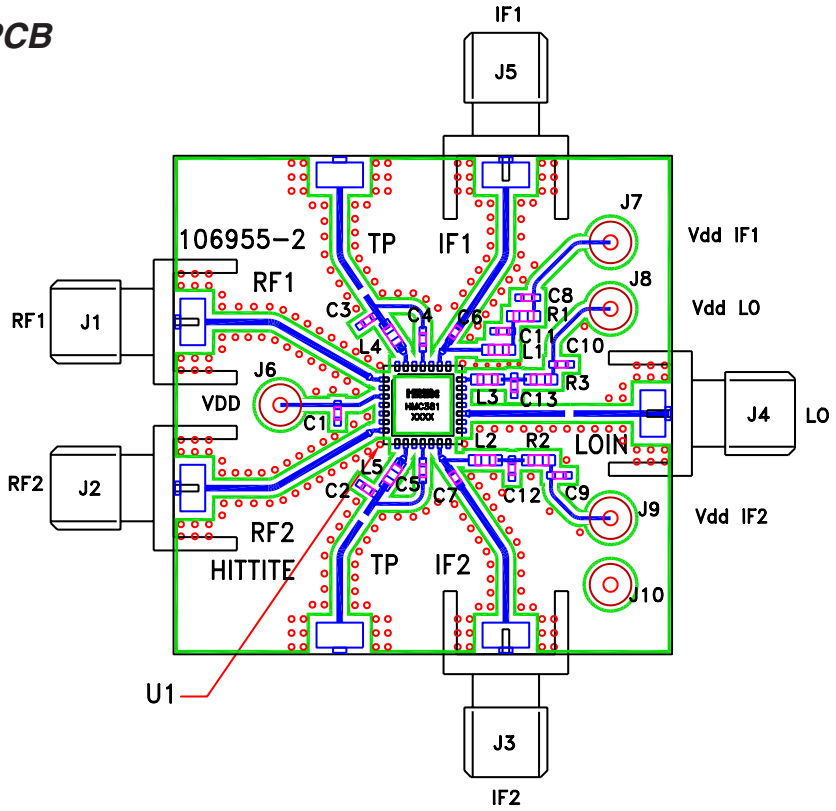
NOTES:

1. PACKAGE BODY MATERIAL: LOW STRESS INJECTION MOLDED PLASTIC SILICA AND SILICON IMPREGNATED.
2. LEAD AND GROUND PADDLE MATERIAL: COPPER ALLOY
3. LEAD AND GROUND PADDLE PLATING: Sn/Pb SOLDER
4. DIMENSIONS ARE IN INCHES [MILLIMETERS]
5. LEAD SPACING TOLERANCE IS NON-CUMULATIVE.
6. PAD BURR LENGTH SHALL BE 0.15mm MAX. PAD BURR HEIGHT SHALL BE 0.25mm MAX.
7. PACKAGE WARP SHALL NOT EXCEED 0.05mm.
8. ALL GROUND LEADS AND GROUND PADDLE MUST BE SOLDERED TO PCB RF GROUND.

Pin Descriptions

Pin Number	Function	Description	Interface Schematic
1, 7	RF1, RF2	These pins are DC coupled and matched to 50 Ohms from 1.7 - 2.2 GHz.	
2, 4, 6, 8, 10, 12, 14, 16, 18, 20, 22, 24, 26, 28	GND	Backside of package has exposed metal ground slug that must also be connected to ground.	
3	Vdd	Power supply for the second stage LO amplifier. One external bypass capacitor (1,000 pF) is required.	
5, 15, 19	N/C	No connection. These pins may be connected to RF ground. Performance will not be affected.	
9, 27	MIX IF2, MIX IF1	IF output from the mixers. This pin is DC coupled to the mixer. A low pass filter and blocking capacitor are required between mixer IF port and IF amplifier. (See application circuit).	
11, 25	AMP IF2, AMP IF1	Inputs to the IF amplifiers. A low pass filter and blocking capacitor are required between mixer IF port and IF amplifier. (See application circuit).	
13, 23	IF2, IF1	Outputs of the IF amplifiers and bias ports for the IF amplifiers. A pull up inductor, resistor, and bypass capacitors are required. (See application circuit).	
17	LO	This pin is AC coupled and matched to 50 Ohms from 1.7 to 2.2 GHz.	
21	Vdd LO	Bias voltage for the first stage of the LO amplifier. A pull up inductor, resistor, and bypass capacitors are required. (See application circuit).	

Evaluation PCB



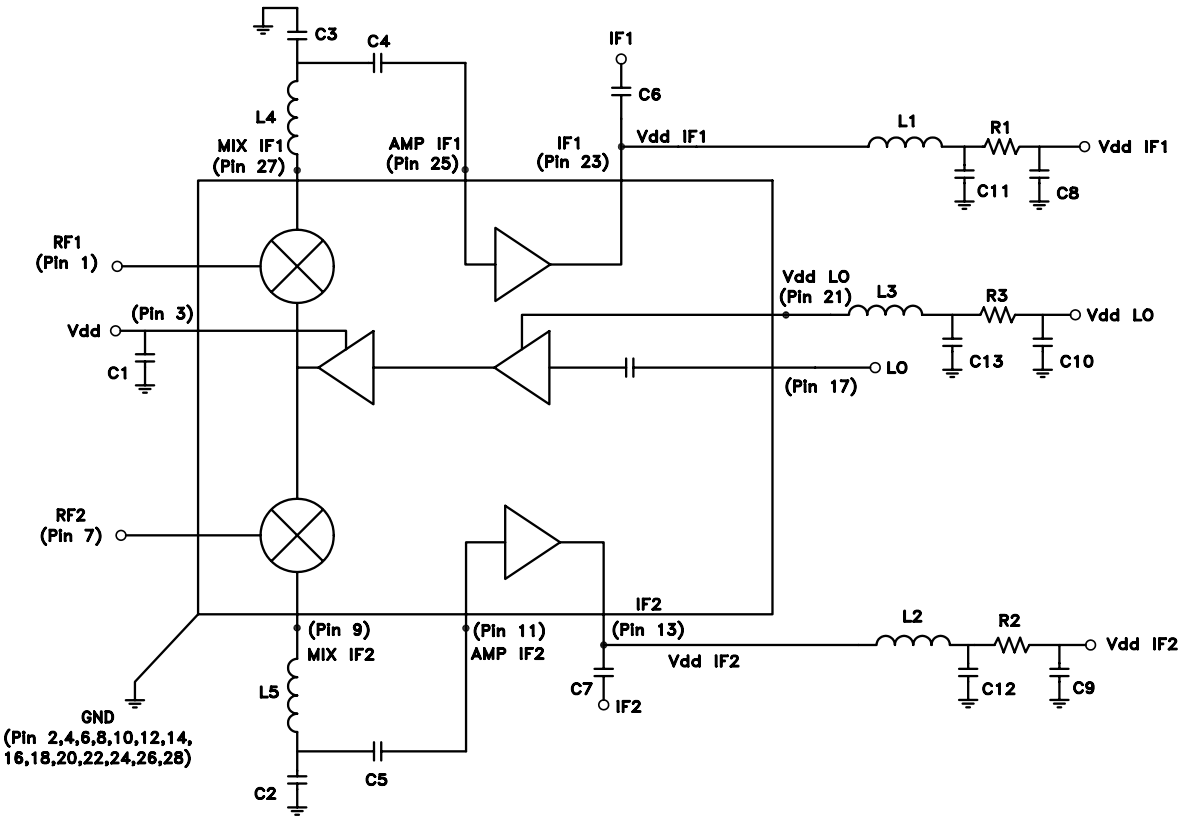
List of Material for Evaluation PCB 106971*

Item	Description
J1 - J5	PC Mount SMA RF Connector
J6 - J10	DC Pins
C1, C4 - C10	1000 pF Chip Capacitor, 0402 Pkg.
C2, C3	7 pF Chip Capacitor, 0402 Pkg.
C11, C12, C13	100 pF Chip Capacitor, 0402 Pkg.
L1, L2	220 nH Chip Inductor, 0603 Pkg.
L3	22 nH Chip Inductor, 0603 Pkg.
L4, L5	27 nH Chip Inductor, 0603 Pkg.
R1, R2	4.7 Ohm Resistor, 0603 Pkg.
R3	22 Ohm Resistor, 0603 Pkg.
U1	HMC381LP6
PCB**	106955 Evaluation Board
** Circuit Board Material: Rogers 4350	

* Reference this number when ordering complete evaluation PCB.

The circuit board used in the final application should use RF circuit design techniques. Signal lines should have 50 ohm impedance while the package ground leads and exposed paddle should be connected directly to the ground plane similar to that shown. A sufficient number of VIA holes should be used to connect the top and bottom ground planes. The evaluation circuit board shown is available from Hittite upon request.

Application Circuit



Recommended Components Values (IF = DC - 300 MHz)	
C1, C4 - C10	1000 pF
C2, C3	7 pF
C11, C12, C13	100 pF
L1, L2	220 nH
L3	22 nH
L4, L5	27 nH
R1, R2	4.7 Ohm
R3	22 Ohm

Note: L4, C3 and L5, C2 form low pass filters. C4 and C5 are DC blocks.