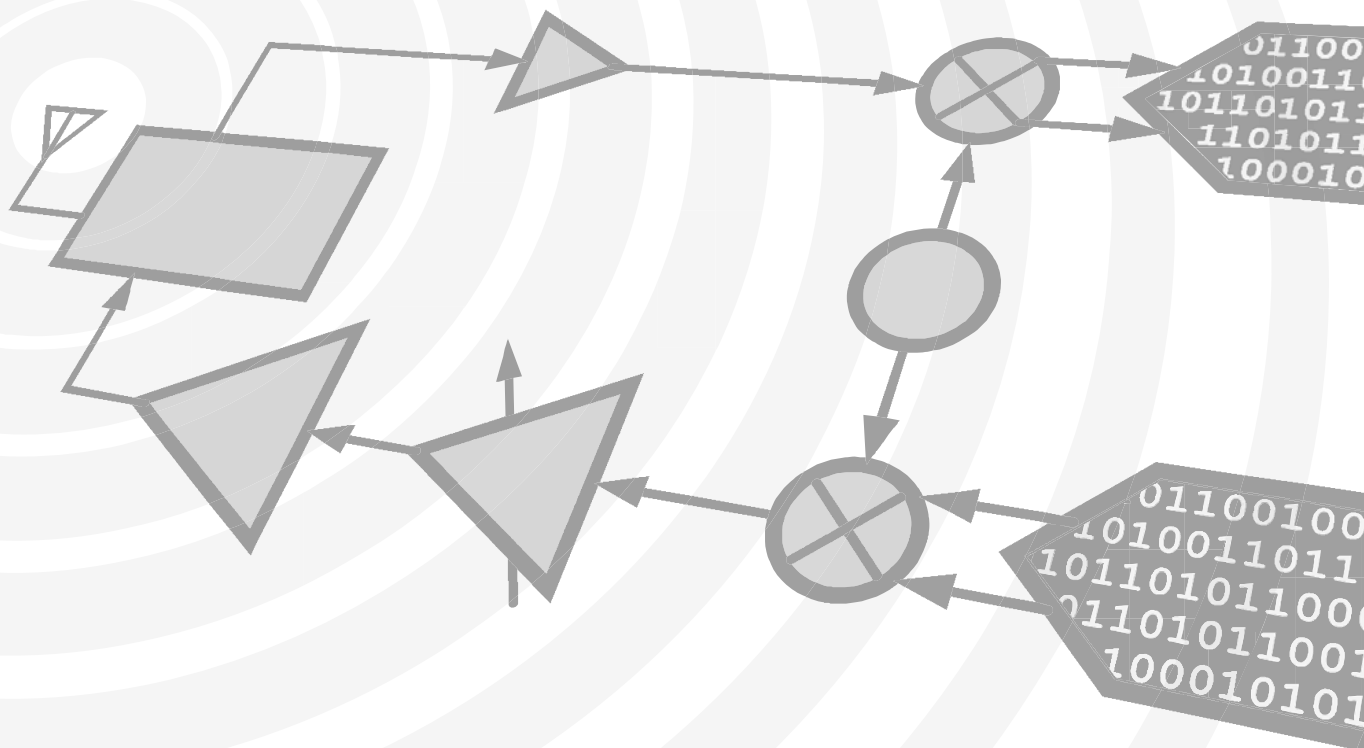


Analog Devices Welcomes Hittite Microwave Corporation

NO CONTENT ON THE ATTACHED DOCUMENT HAS CHANGED



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HMC551LP4 / 551LP4E

GaAs MMIC MIXER w/ INTEGRATED LO AMPLIFIER, 0.8 - 1.2 GHz

Typical Applications

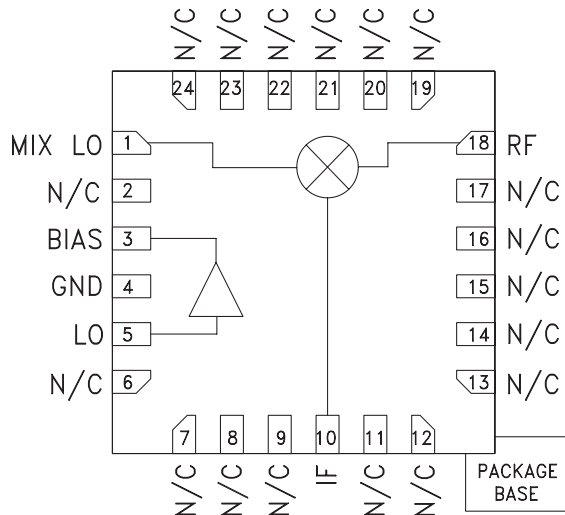
The HMC551LP4 / HMC551LP4E is ideal for Wireless Infrastructure Applications:

- Cellular / 3G Infrastructure
- Base Stations & Repeaters
- GSM, CDMA & W-CDMA
- PLMR & ISM

Features

- Input IP3: +27 dBm
- Low Input LO Drive: -4 to +4 dBm
- LO to RF Isolation: 27 dB
- Low Conversion Loss: 8 dB
- Single Supply: +5V @ 62 mA
- 24 Lead 4x4mm QFN Package: 9 mm²

Functional Diagram



General Description

The HMC551LP4 & HMC551LP4E are high linearity, double balanced Converter ICs that operate from 0.8 to 1.2 GHz and deliver a +27 dBm input third order intercept point. The LO amplifier output and high dynamic range mixer input are positioned so that an external LO filter can be placed in series between them. The converter provides 27 dB of LO to RF isolation and is ideal for upconverter and down-converter applications. The IC operates from a single +5V supply consuming 62 mA of current and accepts a LO drive level of -4 to +4 dBm. The design requires no external baluns and supports IF frequencies between DC and 300 MHz. The HMC551LP4(E) are pin for pin compatible with the HMC552LP4(E) which operate from 1.6 to 3.0 GHz.

Electrical Specifications, $T_A = +25^\circ \text{C}$, LO = 0 dBm, Vcc = +5V, R1 = 18 Ohms, IF = 100 MHz*

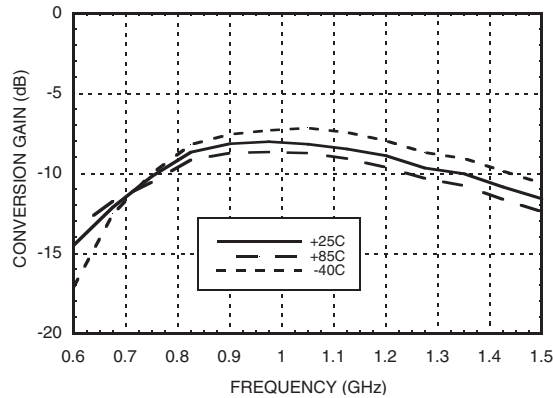
| Parameter | Min. | Typ. | Max. | Units |
|--------------------------------|-----------|------|------|-------|
| Frequency Range, RF, LO | 0.8 - 1.2 | | | GHz |
| Frequency Range, IF | DC - 300 | | | MHz |
| Conversion Loss | | 8 | 10 | dB |
| Noise Figure (SSB) | | 8 | | dB |
| LO to RF Isolation | 20 | 27 | | dB |
| LO to IF Isolation | 12 | 17 | | dB |
| IP3 (Input) | | 27 | | dBm |
| 1 dB Compression (Input) | | 17 | | dBm |
| LO Drive Input Level (Typical) | -4 to +4 | | | dBm |
| Supply Current (Icc) | | 62 | | mA |

*Unless otherwise noted, all measurements performed as a downconverter configured as shown in application circuit.

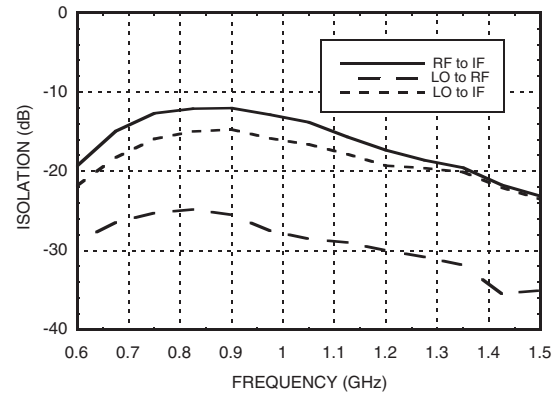
HMC551LP4 / 551LP4E

GaAs MMIC MIXER w/ INTEGRATED LO AMPLIFIER, 0.8 - 1.2 GHz

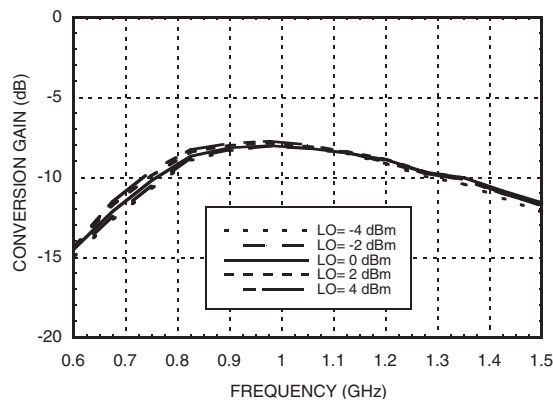
**Conversion Gain
vs. Temperature @ LO = 0 dBm**



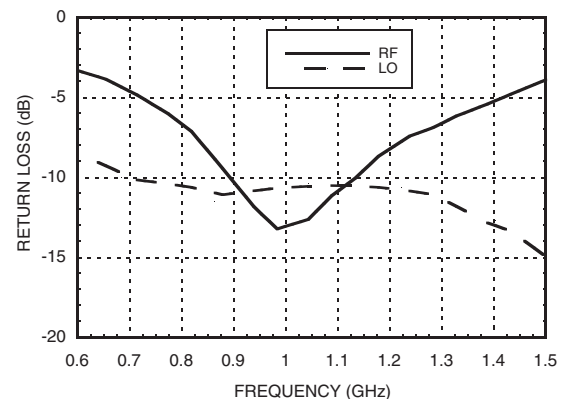
Isolation @ LO = 0 dBm



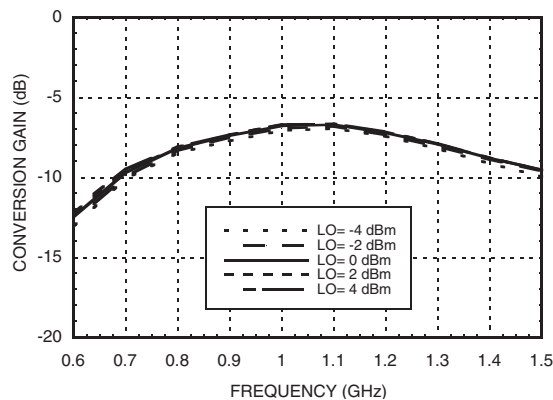
Conversion Gain vs. LO Drive



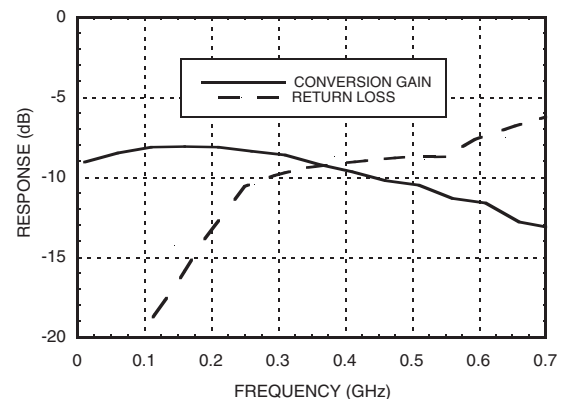
Return Loss @ LO = 0 dBm



**Upconverter Performance
Conversion Gain vs. LO Drive**



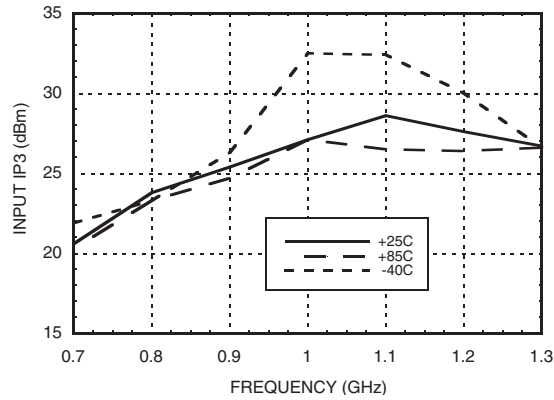
IF Bandwidth @ LO = 0 dBm



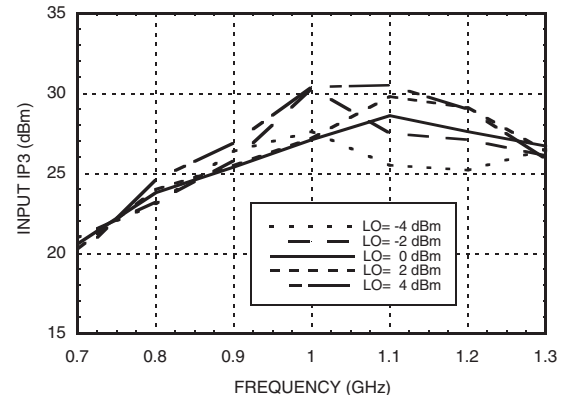
10

MIXERS - SINGLE & DOUBLE BALANCED - SMT

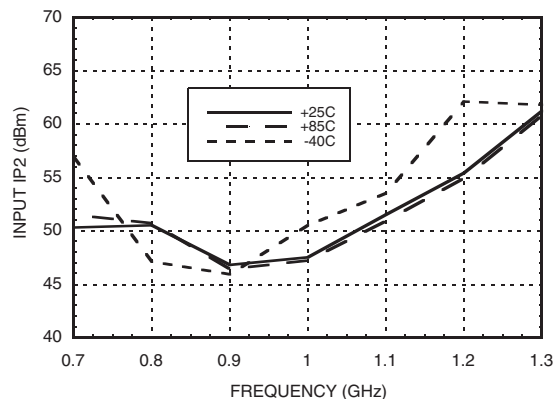
Input IP3 vs. Temperature @ LO = 0 dBm



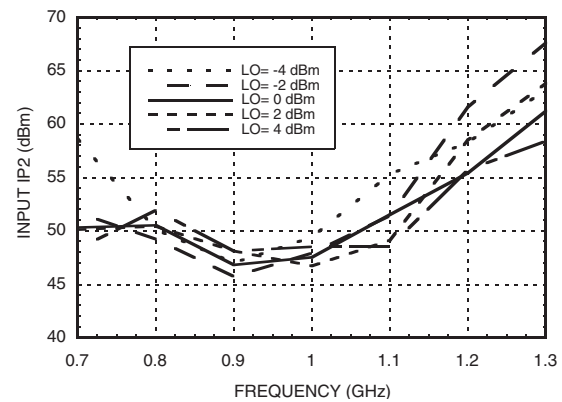
Input IP3 vs. LO Drive



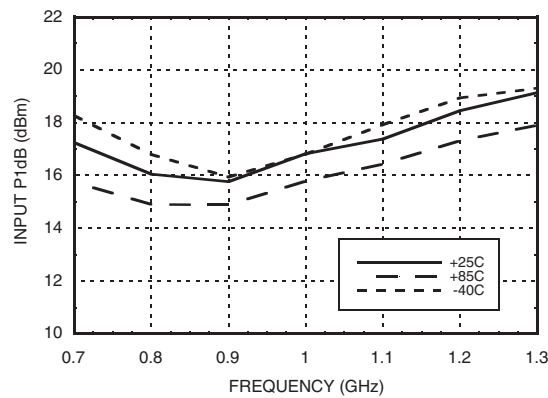
Input IP2 vs. Temperature @ LO = 0 dBm



Input IP2 vs. LO Drive



Input P1dB vs. Temperature @ LO = 0 dBm





MICROWAVE CORPORATION

v02.1210



HMC551LP4 / 551LP4E

GaAs MMIC MIXER w/ INTEGRATED LO AMPLIFIER, 0.8 - 1.2 GHz

MxN Spurious @ IF Port

| mRF | nLO | | | | |
|-----|-----|-----|-----|-----|-----|
| | 0 | 1 | 2 | 3 | 4 |
| 0 | xx | -3 | 33 | 21 | 21 |
| 1 | 4 | 0 | 13 | 35 | 45 |
| 2 | 81 | 68 | 63 | 60 | 74 |
| 3 | 87 | 102 | 85 | 74 | 71 |
| 4 | 106 | 96 | 102 | 103 | 103 |

RF Freq. = 0.9 GHz @ -10 dBm
LO Freq. = 0.8 GHz @ 0 dBm
All values in dBc relative to the IF power level.

Harmonics of LO

| LO Freq. (GHz) | nLO Spur @ RF Port | | | |
|----------------|--------------------|----|----|----|
| | 1 | 2 | 3 | 4 |
| 0.7 | 24 | 21 | 34 | 40 |
| 0.8 | 25 | 22 | 34 | 49 |
| 0.9 | 27 | 23 | 38 | 57 |
| 1.0 | 28 | 23 | 43 | 45 |
| 1.1 | 29 | 24 | 43 | 54 |
| 1.2 | 30 | 25 | 37 | 61 |

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

Typical Supply Current

| Vcc | Icc (mA) |
|------|----------|
| +5.0 | 62 mA |

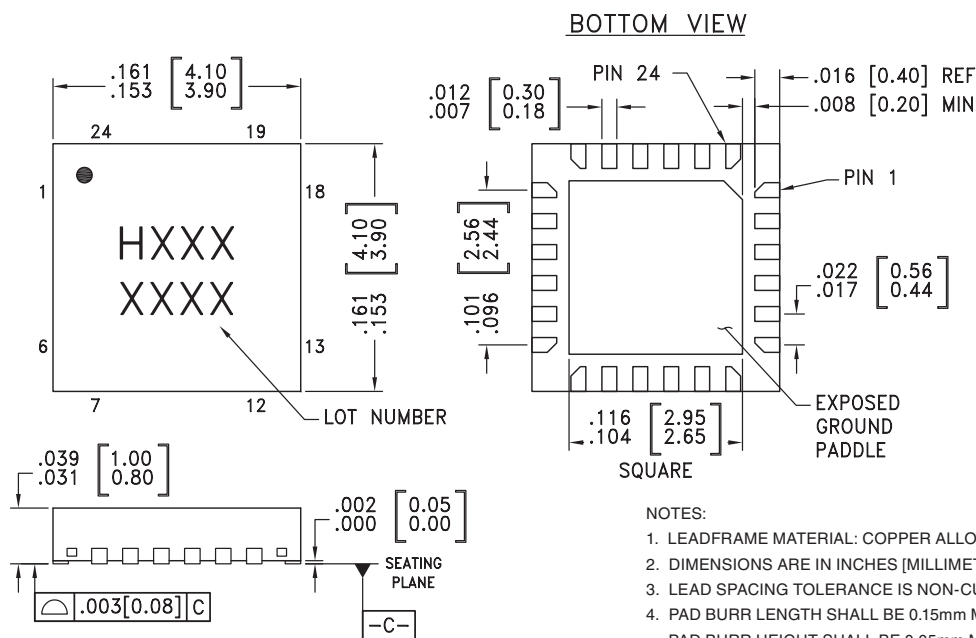
Absolute Maximum Ratings

| | |
|--|---------------|
| RF / IF Input (Vcc= +5V) | +31 dBm |
| LO Drive (Vcc= +5V) | +10 dBm |
| BIAS | +7 Vdc |
| Junction Temperature | 150°C |
| Continuous P _{diss} (T = 85°C) (derate 9.5 mW/°C above 85°C) | 0.6 W |
| Thermal Resistance (junction to ground paddle) | 105.6 °C/W |
| Storage Temperature | -65 to +150°C |
| Operating Temperature | -40 to +85°C |
| ESD Sensitivity (HBM) | Class 1C |



ELECTROSTATIC SENSITIVE DEVICE
OBSERVE HANDLING PRECAUTIONS

Outline Drawing



NOTES:

1. LEADFRAME MATERIAL: COPPER ALLOY
2. DIMENSIONS ARE IN INCHES [MILLIMETERS]
3. LEAD SPACING TOLERANCE IS NON-CUMULATIVE.
4. PAD BURR LENGTH SHALL BE 0.15mm MAXIMUM.
5. PAD BURR HEIGHT SHALL BE 0.05mm MAXIMUM.
6. PACKAGE WARP SHALL NOT EXCEED 0.05mm.
7. ALL GROUND LEADS AND GROUND PADDLE MUST BE SOLDERED TO PCB RF GROUND.
8. REFER TO HITTITE APPLICATION NOTE FOR SUGGESTED L AND PATTERN

Package Information

| Part Number | Package Body Material | Lead Finish | MSL Rating | Package Marking ^[3] |
|-------------|--|---------------|---------------------|--------------------------------|
| HMC551LP4 | Low Stress Injection Molded Plastic | Sn/Pb Solder | MSL1 ^[1] | H551 XXXX |
| HMC551LP4E | RoHS-compliant Low Stress Injection Molded Plastic | 100% matte Sn | MSL1 ^[2] | <u>H551</u> XXXX |

[1] Max peak reflow temperature of 235 °C

[2] Max peak reflow temperature of 260 °C

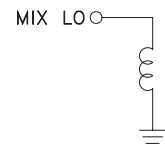
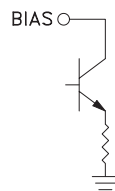

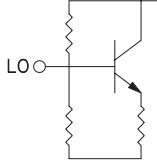
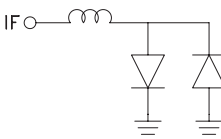
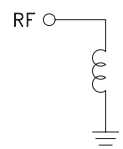
[3] 4-Digit lot number XXXX

For price, delivery and to place orders: Hittite Microwave Corporation, 20 Alpha Road, Chelmsford, MA 01824

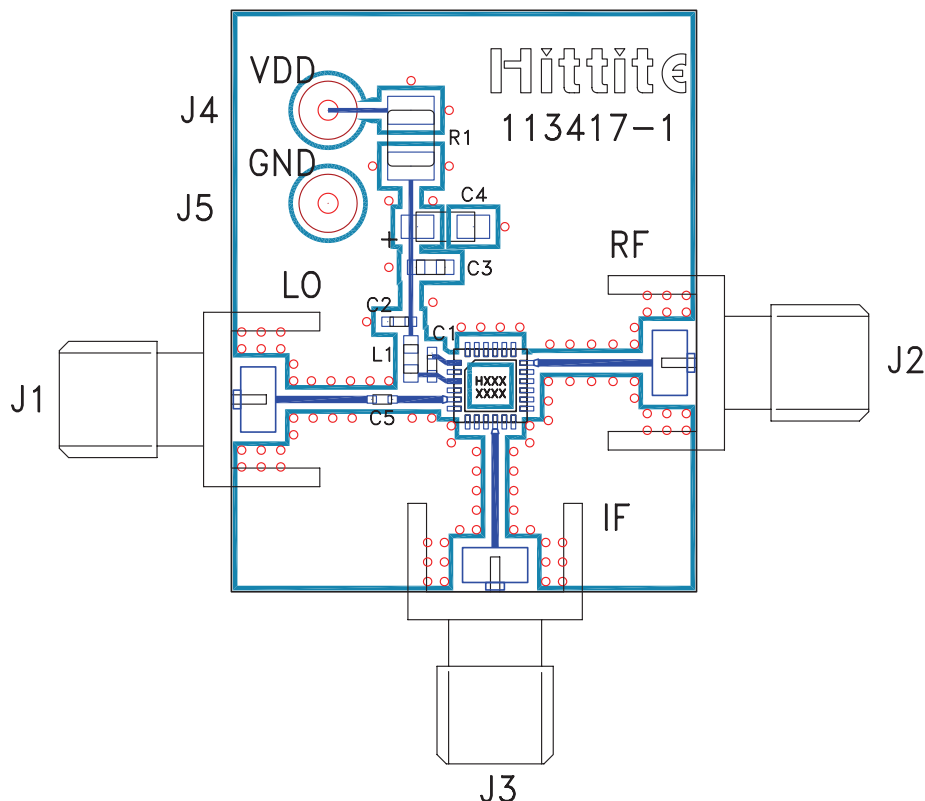
Phone: 978-250-3343 Fax: 978-250-3373 Order On-line at www.hittite.com

Application Support: Phone: 978-250-3343 or apps@hittite.com

Pin Descriptions

| Pin Number | Function | Description | Interface Schematic |
|-------------------------------|----------|--|---|
| 1 | MIX LO | This pin is DC coupled and matched to 50 Ohms. An off chip DC blocking capacitor is required. |  |
| 2, 6 - 9, 11 - 17, 19 - 24 | N/C | No connection. These pins may be connected to RF ground. Performance will not be affected. | |
| 3 | BIAS | Power supply for the LO amplifier Bias resistor is required. Three external bypass capacitors are recommended for optimum performance, as illustrated in the application circuit. |  |
| 4 | GND | Backside of package has exposed metal ground paddle that must also be connected to ground. |  |
| 5 | LO | This pin is DC coupled and matched to 50 Ohms from 0.8 to 1.2 GHz. An off chip DC blocking capacitor is required. |  |
| 10 | IF | This pin is DC coupled. For applications not requiring operation to DC, this port should be DC blocked externally using a series capacitor whose value has been chosen to pass the necessary IF frequency range. For operation to DC, this pin must not source/sink more than 18 mA of current or die non-function and possible die failure will result. |  |
| 18 | RF | This pin is DC coupled and matched to 50 Ohms. |  |

Evaluation PCB



List of Materials for Evaluation PCB 113419 ^[1]

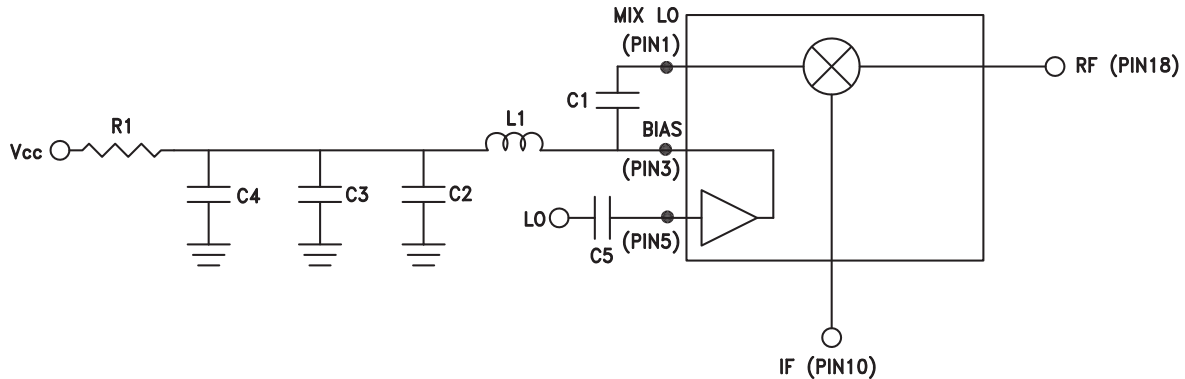
| Item | Description |
|------------|-------------------------------------|
| J1 - J3 | PCB Mount SMA RF Connector |
| J4, J5 | DC Pin |
| C1, C2, C5 | 100 pF Chip Capacitor, 0402 Pkg. |
| C3 | 1000 pF Chip Capacitor, 0603 Pkg. |
| C4 | 2.2 μ F Capacitor, Tantalum |
| L1 | 56 nH Chip Inductor, 0603 Pkg. |
| R1 | 18 Ohm Resistor, 1210 1/8 watt Pkg. |
| U1 | HMC551LP4 / HMC551LP4E |
| PCB [2] | 113417 Evaluation Board |

[1] Reference this number when ordering complete evaluation PCB

[2] Circuit Board Material: Rogers 4350

The circuit board used in the 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) | |
|---|-------------|
| C3 | 1000 pF |
| C4 | 2.2 μ F |
| C1, C2, C5 | 100 pF |
| L1 | 56 nH |
| R1 | 18 Ohms |

Note:

Select R1 to achieve I_{cc} by using equation below, $R1 \geq 18$ Ohms.

$$I_{cc} = (V_s - 3.8) / R1$$

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