# HMC666LP4 / 666LP4E

v02.1010

## BiCMOS MMIC MIXER W/ INTEGRATED LO AMPLIFIER, 3.1 - 3.9 GHz

### Typical Applications

The HMC666LP4(E) is Ideal for:

- WiMAX/4G & Fixed Wireless
- Infrastructure & Repeaters
- Transmitters & Receivers
- Test & Measurement Equipment

### Features

High Input IP3: +31 dBm

Low Conversion Loss: 9 dB

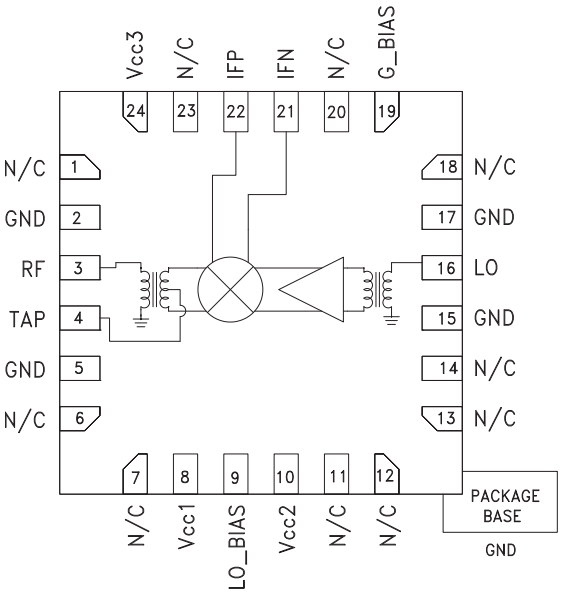
Low LO Drive: 0 dBm

Upconversion & Downconversion Applications

Optimized for low side LO input

24 Lead 4x4mm SMT Package: $16mm^2$

### Functional Diagram




### General Description

The HMC666LP4(E) is a high dynamic range passive MMIC mixer with integrated LO amplifier in a 4x4 SMT QFN package covering 3.1 - 3.9 GHz. Excellent input IP3 performance of +31 dBm for down conversion is provided for WiMAX and fixed wireless applications at an LO drive of 0 dBm. The LO port is optimized for low side LO applications. With an input 1 dB compression of +23 dBm, the RF port will accept a wide range of input signal levels. Conversion loss is 9 dB typical. The DC to 800 MHz IF frequency response will satisfy WiMAX transmit or receive frequency plans. The HMC666LP4(E) is pin for pin compatible with the HMC688LP4(E) which is a 2.0 - 2.7 GHz mixer with LO amplifier.

### Electrical Specifications, $T_A$ = +25° C, IF= 300 MHz, LO= 0 dBm, Vcc=Vcc1, 2, 3 = +5V, G_Bias= +2.5V

| Parameter | Min. | Typ. | Max. | Units |
|---|---|---|---|---|
| Frequency Range, RF | | 3.1 - 3.9 | | GHz |
| Frequency Range, LO | | 2.8 - 3.6 | | GHz |
| Frequency Range, IF | | DC - 800 | | MHz |
| Conversion Loss | | 9 | 12 | dB |
| Noise Figure (SSB) | | 9 | | dB |
| LO to RF Isolation | 21 | 27 | | dB |
| LO to IF Isolation | 22 | 29 | | dB |
| RF to IF Isolation | 34 | 42 | | dB |
| IP3 (Input) | | 31 | | dBm |
| 1 dB Compression (Input) | | 23 | | dBm |
| LO Drive Input Level (Typical) | | -3 to +3 | | dBm |
| Supply Current Icc total | | 162 | 195 | mA |

** Unless otherwise noted all measurements performed as downconverter with low side LO & IF = 300 MHz.*



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# HMC666* PRODUCT PAGE QUICK LINKS

**Last Content Update: 02/23/2017**

## COMPARABLE PARTS

View a parametric search of comparable parts.

## EVALUATION KITS

- HMC666LP4 Evaluation Board

## DOCUMENTATION

**Data Sheet**

- HMC666 Data Sheet

## REFERENCE MATERIALS

**Quality Documentation**

- Package/Assembly Qualification Test Report: LP4, LP4B, LP4C, LP4K (QTR: 2013-00487 REV: 04)
- Semiconductor Qualification Test Report: BiCMOS-A (QTR: 2013-00235)

## DESIGN RESOURCES

- HMC666 Material Declaration
- PCN-PDN Information
- Quality And Reliability
- Symbols and Footprints

## DISCUSSIONS

View all HMC666 EngineerZone Discussions.

## SAMPLE AND BUY

Visit the product page to see pricing options.

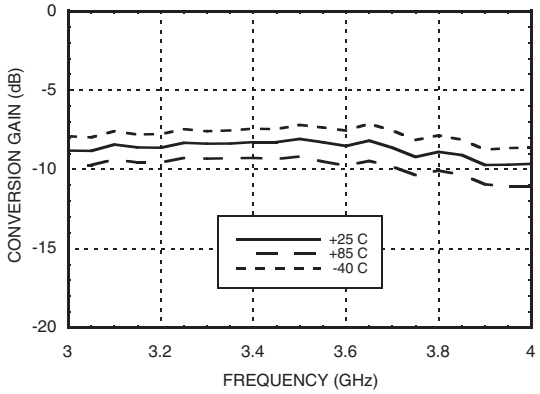
## TECHNICAL SUPPORT

Submit a technical question or find your regional support number.

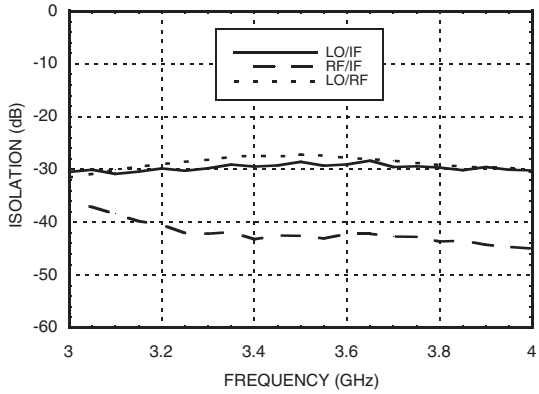
## DOCUMENT FEEDBACK

Submit feedback for this data sheet.

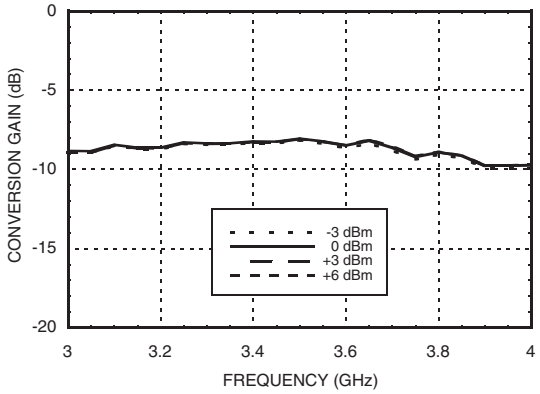
### Conversion Gain vs. Temperature



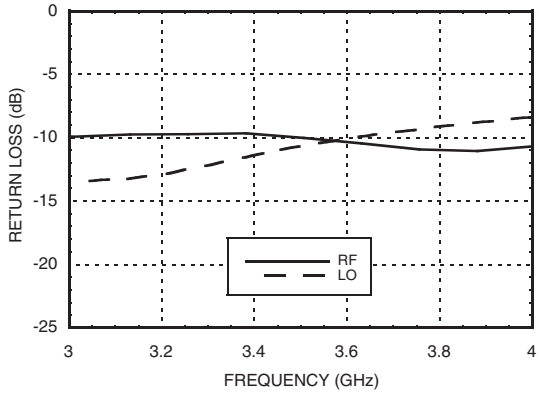

### Isolation



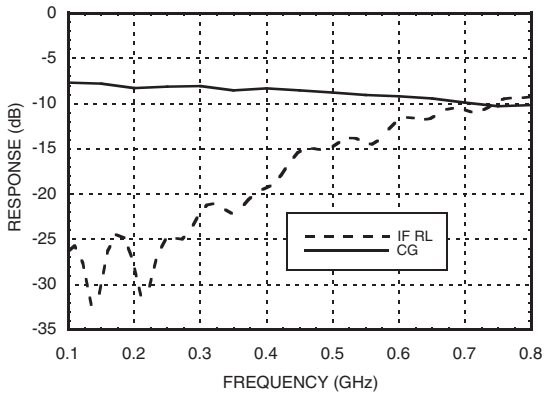

### Conversion Gain vs. LO Drive



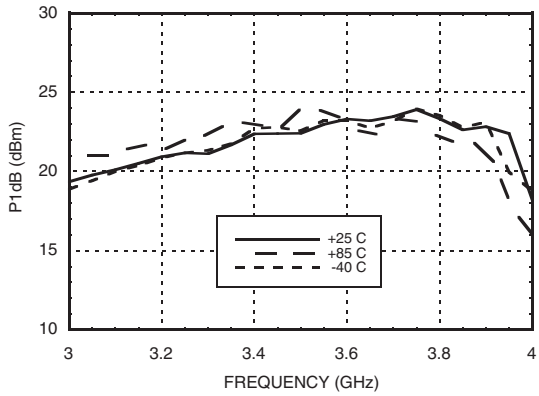

### Return Loss




### IF Bandwidth (LO= 3.2 GHz)




### Input P1dB vs. Temperature





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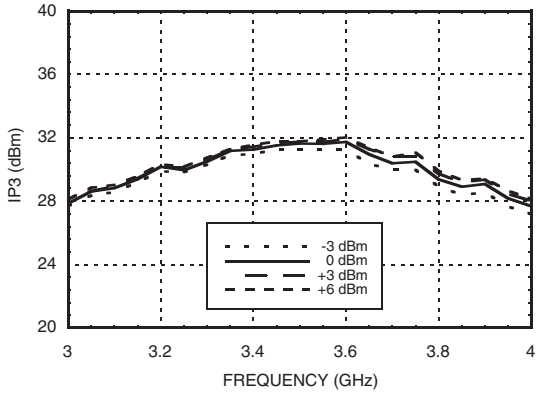
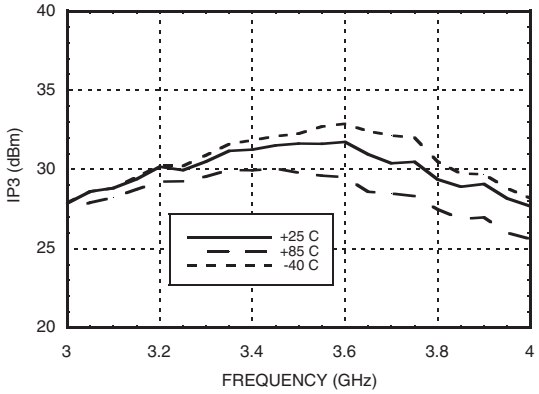
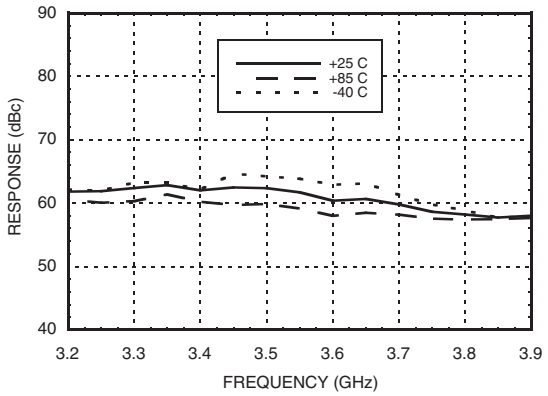
### Input IP3 vs. LO Drive [1]



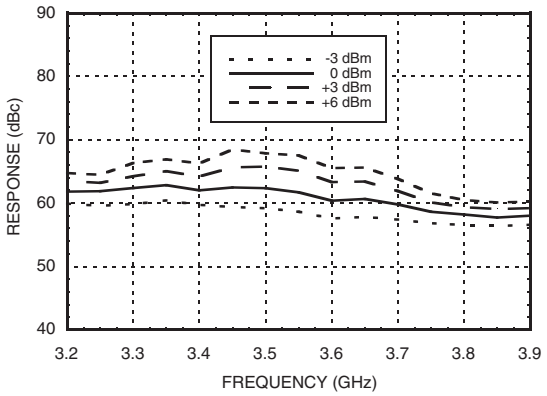

### Input IP3 vs. Temperature [1]



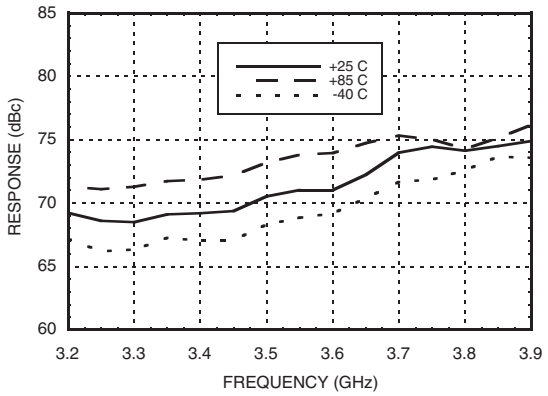

### +2RF -2LO Response vs. Temperature [2]



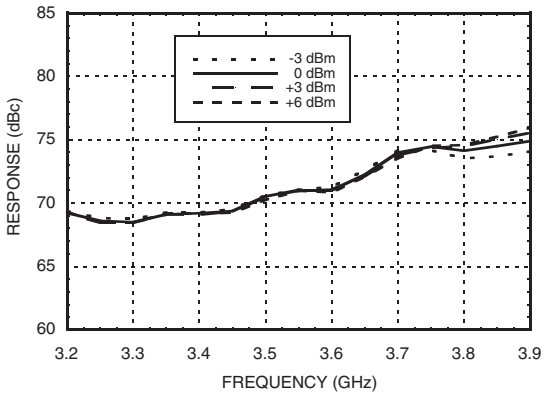

### +2RF -2LO Response vs. LO Drive [2]




### +3RF -3LO Response vs. Temperature [2]




### +3RF -3LO Response vs. LO Drive [2]




[1] Two-tone input power = +10 dBm each tone, 1 MHz spacing. [2] Referenced to RF Input Power at 0 dBm.



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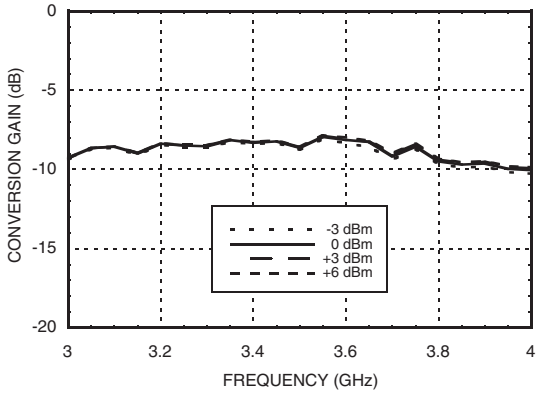
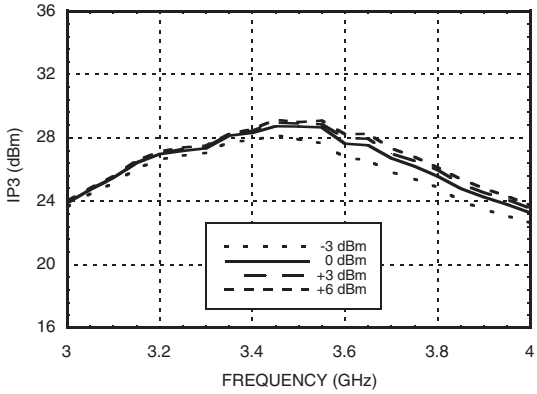
# BiCMOS MMIC MIXER W/ INTEGRATED LO AMPLIFIER, 3.1 - 3.9 GHz

## Upconverter Performance Conversion Gain vs. LO Drive




## Upconverter Performance Input IP3 vs. LO Drive [1]




## Absolute Maximum Ratings

| | |
|---|---|
| RF / IF Input (Vcc1, 2, 3 = +5V) | +23 dBm |
| LO Drive (Vcc1, 2, 3 = +5V) | +10 dBm |
| Vcc1, 2, 3 | 5.5V |
| Channel Temperature | 125 °C |
| Continuous Pdiss (T = 85°C) (derate 36.23 mW/°C above 85°C) | 1.45 W |
| Thermal Resistance (channel to ground paddle) | 27.6 °C/W |
| Storage Temperature | -65 to 150 °C |
| Operating Temperature | -40 to +85 °C |

ELECTROSTATIC SENSITIVE DEVICE
OBSERVE HANDLING PRECAUTIONS

## MxN Spurious @ IF Port

| | nLO | | | | |
|---|---|---|---|---|---|
| mRF | 0 | 1 | 2 | 3 | 4 |
| 0 | xx | 22 | 31 | 35 | 51 |
| 1 | 35 | 0 | 44 | 35 | 69 |
| 2 | 85 | 69 | 57 | 68 | 81 |
| 3 | 105 | 85 | 91 | 67 | 85 |
| 4 | 120 | 120 | 120 | 113 | 108 |

RF Freq. = 3.5 GHz @ 0 dBm
LO Freq. = 3.2 GHz @ 0 dBm
All values in dBc below IF power level (1RF - 1LO).

## Typical Supply Current vs. Vcc

| Vcc1, 2, 3 (V) | Icc total (mA) |
|---|---|
| 4.75 | 149 |
| 5.00 | 162 |
| 5.25 | 174 |

Downconverter will operate over full voltage range shown above.

## Harmonics of LO

| | nLO Spur @ RF Port | | | |
|---|---|---|---|---|
| LO Freq. (GHz) | 1 | 2 | 3 | 4 |
| 2.7 | 31 | 33 | 46 | 55 |
| 2.8 | 30 | 30 | 46 | 60 |
| 2.9 | 28 | 30 | 47 | 59 |
| 3.0 | 28 | 29 | 48 | 55 |
| 3.1 | 27 | 28 | 48 | 53 |
| 3.2 | 27 | 29 | 48 | 70 |
| 3.3 | 27 | 30 | 51 | 58 |
| 3.4 | 28 | 31 | 56 | 52 |
| 3.5 | 28 | 33 | 55 | 48 |
| 3.6 | 29 | 34 | 57 | 45 |
| 3.7 | 30 | 35 | 58 | 46 |

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



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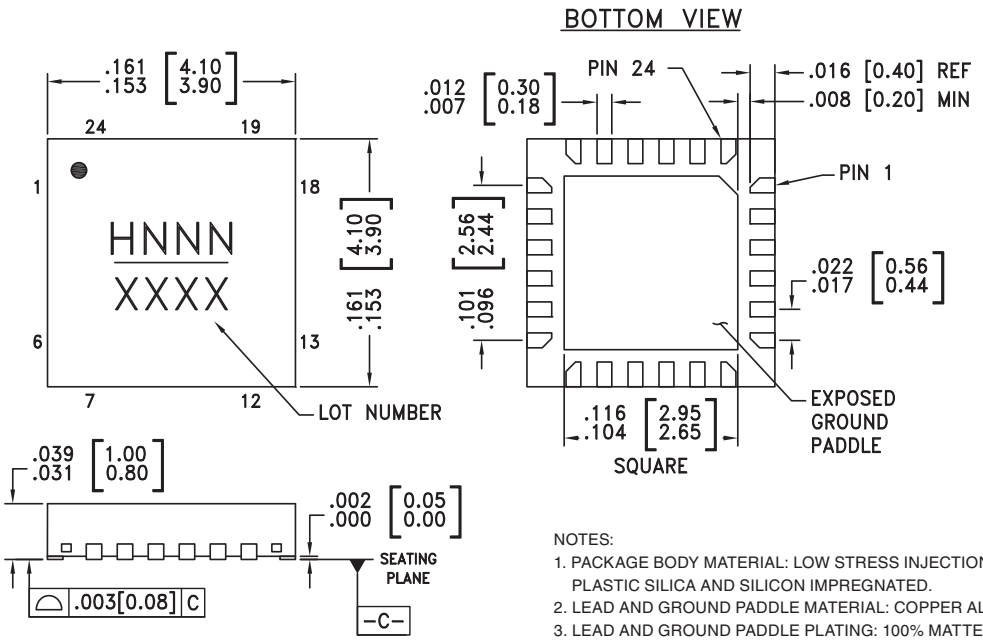
## Outline Drawing




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: 100% MATTE TIN.
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.
9. REFER TO HITTITE APPLICATION NOTE FOR SUGGESTED PCB LAND PATTERN.

## Package Information

| Part Number | Package Body Material | Lead Finish | MSL Rating | Package Marking [3] |
|---|---|---|---|---|
| HMC666LP4 | Low Stress Injection Molded Plastic | Sn/Pb Solder | MSL1 [1] | H666<br>XXXX |
| HMC666LP4E | RoHS-compliant Low Stress Injection Molded Plastic | 100% matte Sn | MSL1 [2] | H666<br>XXXX |

[1] Max peak reflow temperature of 235 °C
[2] Max peak reflow temperature of 260 °C
[3] 4-Digit lot number XXXX



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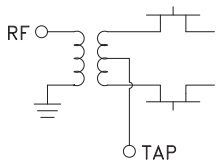
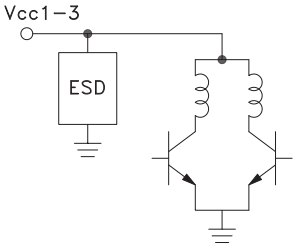
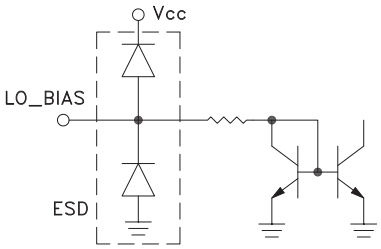
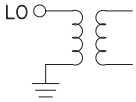
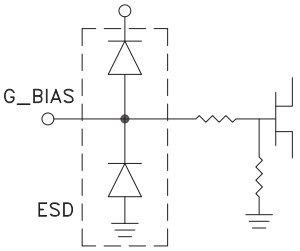
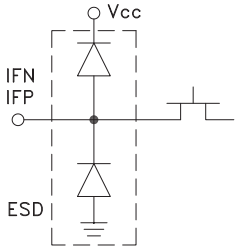
## Pin Descriptions

| Pin Number | Function | Description | Interface Schematic |
|---|---|---|---|
| 1, 6, 7, 11 - 14, 18, 20, 23 | N/C | No connection. These pins may be connected to RF ground. Performance will not be affected. | |
| 2, 5, 15, 17 | GND | Package bottom must be connected to RF/DC ground. |   |
| 3 | RF | This pin is matched single-ended 50 Ohm and DC shorted to ground through a balun. |   |
| 4 | TAP | Short to ground with a zero ohm resistor close to the IC. | |
| 8, 10, 24 | Vcc1, Vcc2, Vcc3 | Power supply voltage. See application circuit for required external components. |   |
| 9 | LO_BIAS | Adjust the LO buffer current through an external resistor. See application circuit for required external components. |   |
| 16 | LO | This pin is matched single-ended 50 Ohm and DC shorted to ground through a balun. |   |
| 19 | G_BIAS | External optional bias. See application circuit for required external components. Apply +2.5V for nominal performance. |   |
| 21, 22 | IFN, IFP | Differential IF input / output pins matched to differential 50 Ohms. For applications not requiring operation to DC an off chip DC blocking capacitor should be used. |   |



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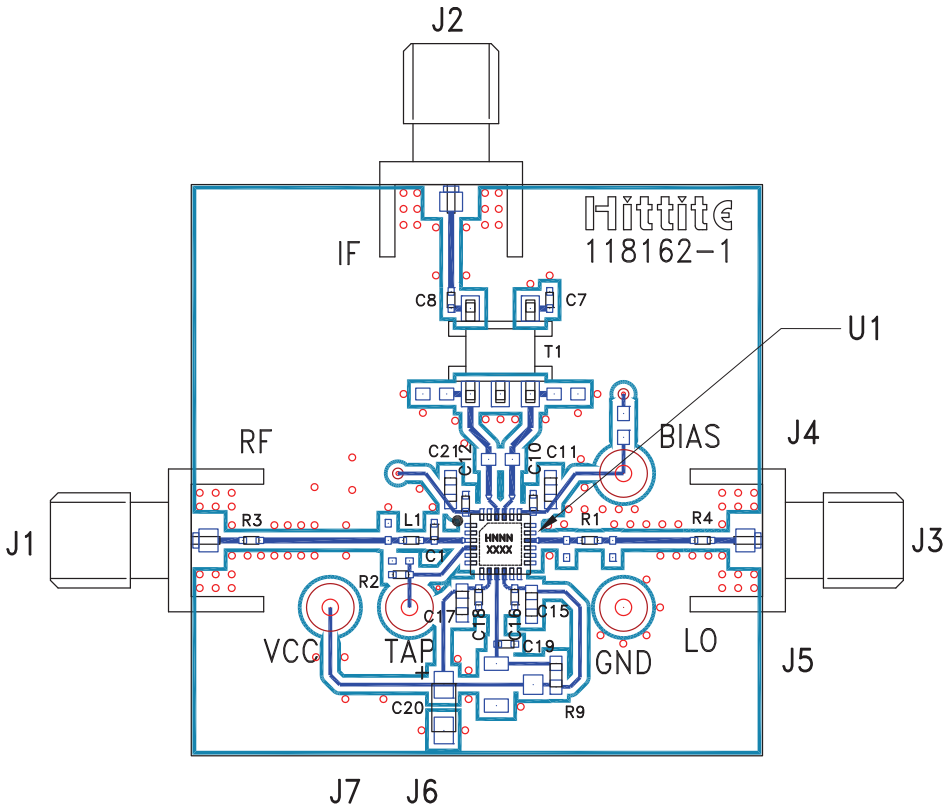
## Evaluation PCB




## List of Materials for Evaluation PCB 120818 [1]

| Item | Description |
|---|---|
| J1 - J3 | SMA Connector |
| J4 - J7 | DC Pin |
| C19 | 22 pF Capacitor, 0402 Pkg. |
| C7, C8 | 10 nF Capacitor, 0402 Pkg. |
| C10, C12, C16, C18 | 1 nF Capacitor, 0402 Pkg. |
| C11, C15, C17, C21 | 0.1 µF Capacitor, 0402 Pkg. |
| C1 | 0.4 pF Capacitor, 0402 Pkg. |
| C20 | 4.7 µF Case A, Tantalum |
| L1 | 2.2 nH Inductor, 0402 Pkg. |
| R1 - R4 | 0 Ohm Resistor, 0402 Pkg. |
| R9 | 200 Ohm Resistor, 0603 Pkg. |
| T1 | 1:1 Transformer - Tyco MABACT0039 |
| U1 | HMC666LP4(E) Double Balanced Mixer |
| PCB [2] | 118162 Evaluation PCB |

[1] Reference this number when ordering complete evaluation PCB

[2] Circuit Board Material: Arlon 25R, FR4

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.



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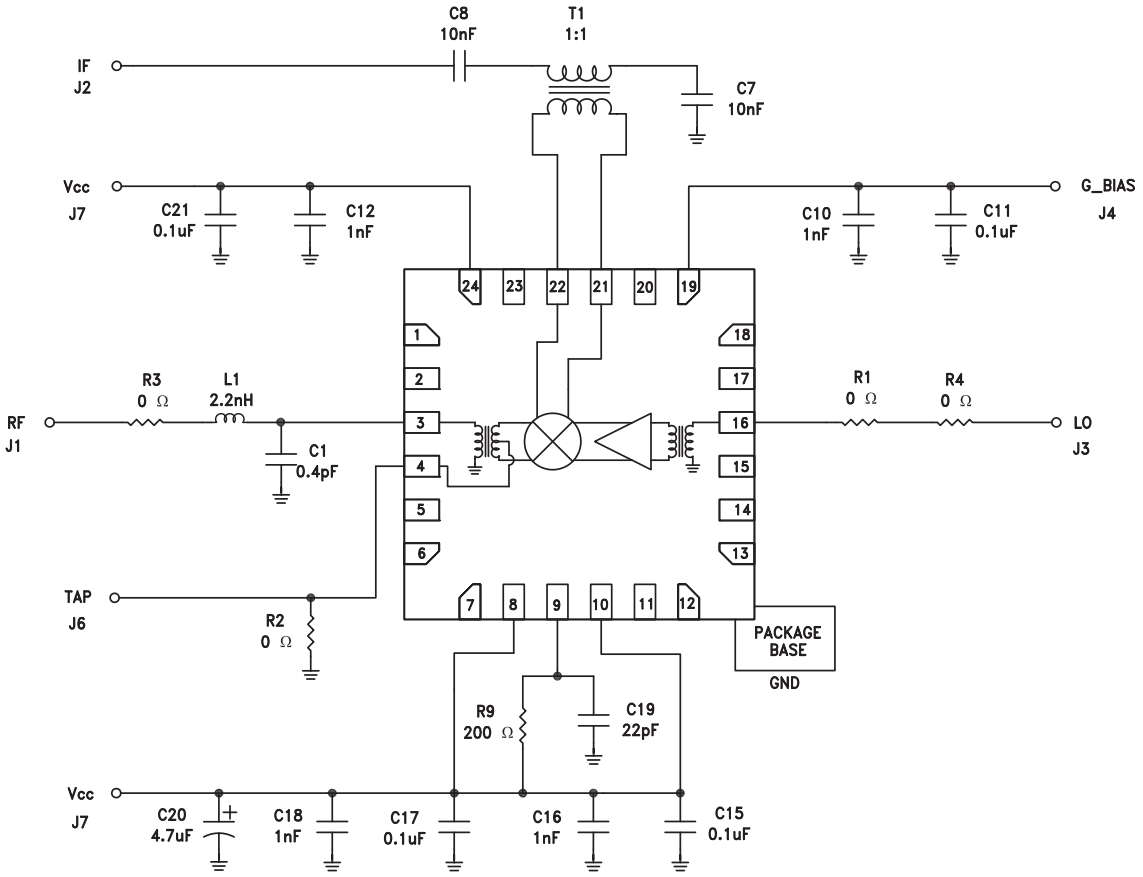
## Application Circuit



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