ANALOG DEVICES

# HMC338

v03.1007

## GaAs MMIC SUB-HARMONICALLY PUMPED MIXER, 26 - 33 GHz

### Typical Applications

The HMC338 is ideal for:

- General Purpose Applications
- 26 and 33 GHz Microwave Radios
- Up and Down Converter for Point-to-Point Radios
- Satellite Communication Systems

### Features

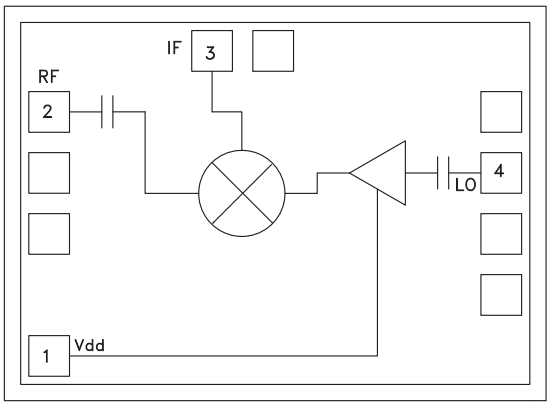
Integrated LO Amplifier: -5 dBm Input

Sub-Harmonically Pumped (x2) LO

High 2LO/RF Isolation: 33 dB

Die Size: 1.32 x 0.97 x 0.1 mm

### Functional Diagram




### General Description

The HMC338 chip is a general purpose sub-harmonically pumped (x2) MMIC mixer with an integrated LO amplifier which can be used as an upconverter or downconverter in the 26 to 33 GHz frequency range. The chip utilizes a GaAs PHEMT technology that results in a small overall chip area of 1.28mm$^2$. The 2LO to RF isolation is excellent eliminating the need for additional filtering. The LO amplifier is a single bias (+3V to +4V) two stage design with only -5 dBm nominal drive requirement. All data is measured with the chip in a 50 ohm test fixture connected via 0.076 mm (3 mil) ribbon bonds of minimal length <0.31 mm (<12 mils).

### Electrical Specifications, $T_A$ = +25° C, As a Function of Vdd

| Parameter | IF = 1 GHz LO = -5 dBm & Vdd = +4V | | | IF = 1 GHz LO = -5 dBm & Vdd = +3V | | | Units |
|---|---|---|---|---|---|---|---|
| | Min. | Typ. | Max. | Min. | Typ. | Max. | |
| Frequency Range, RF | 26 - 33 | | | 27 - 32 | | | GHz |
| Frequency Range, LO | 13 - 16.5 | | | 13.5 - 16 | | | GHz |
| Frequency Range, IF | DC - 2.5 | | | DC - 2.5 | | | GHz |
| Conversion Loss | | 9 | 12 | | 9 | 12 | dB |
| Noise Figure (SSB) | | 9 | 12 | | 9 | 12 | dB |
| 2LO to RF Isolation | 18 | 33 | | 12 | 30 | | dB |
| 2LO to IF Isolation | 30 | 40 | | 25 | 40 | | dB |
| IP3 (Input) | 5 | 11 | | 3 | 9 | | dBm |
| 1 dB Compression (Input) | -5 | 2 | | -5 | 0 | | dBm |
| Supply Current (Idd) | | 28 | 50 | | 25 | 50 | mA |

*Unless otherwise noted, all measurements performed as downconverter, IF= 1 GHz.



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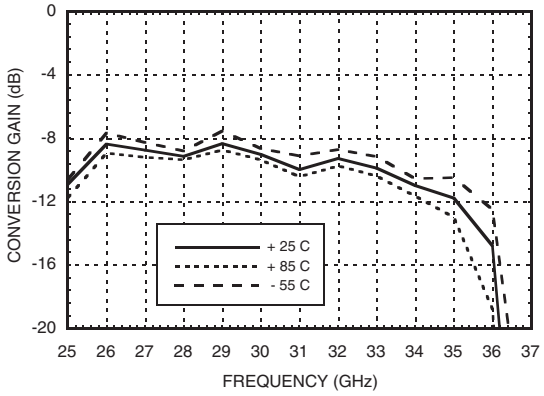
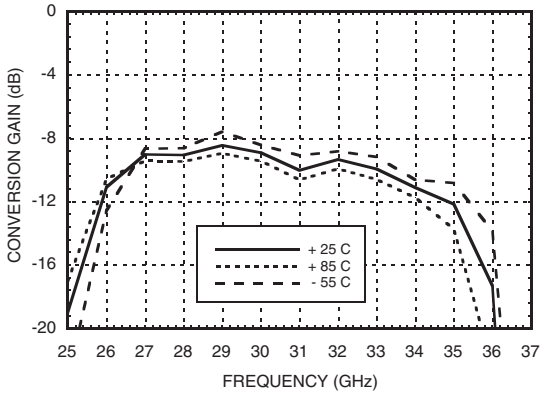
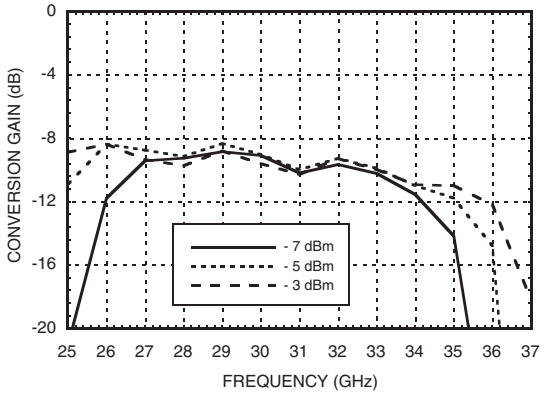
### Conversion Gain vs. Temperature @ LO = -5 dBm, Vdd= +4V



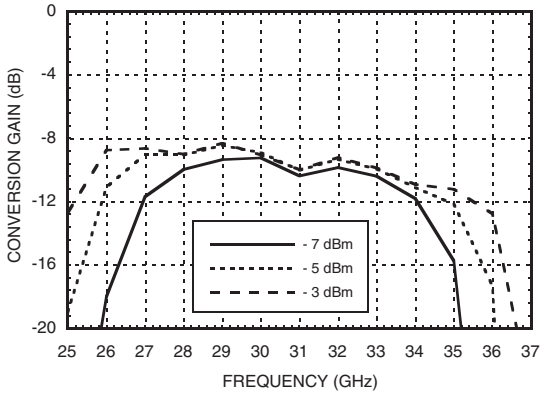

### Conversion Gain vs. Temperature @ LO = -5 dBm, Vdd= +3V



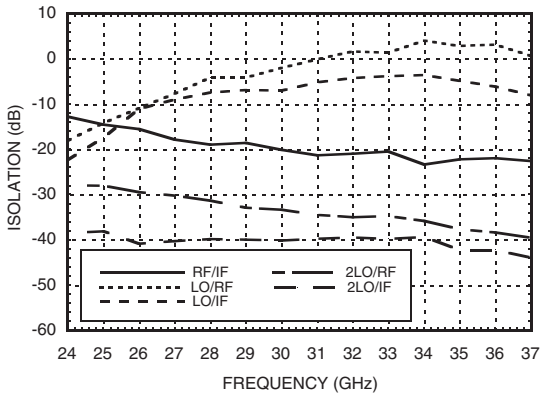

### Conversion Gain vs. LO Drive @ Vdd = +4V



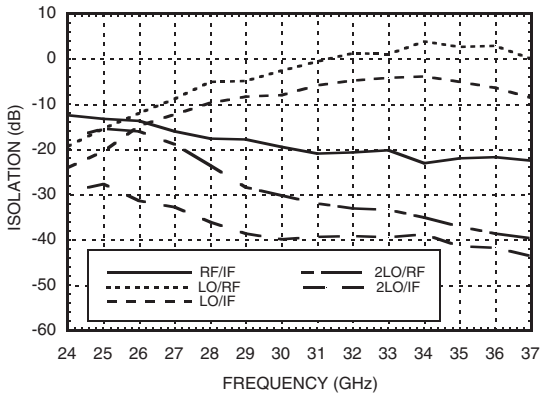

### Conversion Gain vs. LO Drive @ Vdd = +3V




### Isolation @ LO = -5 dBm, Vdd = +4V




### Isolation @ LO = -5 dBm, Vdd = +3V





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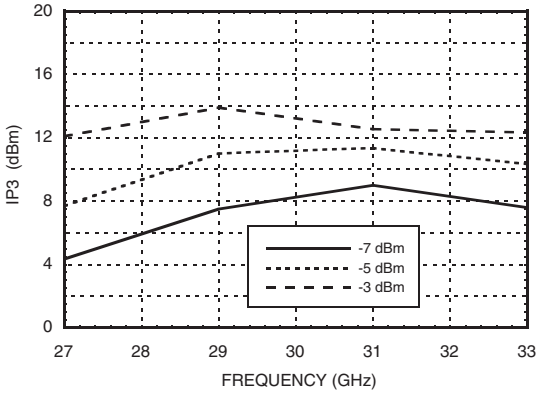
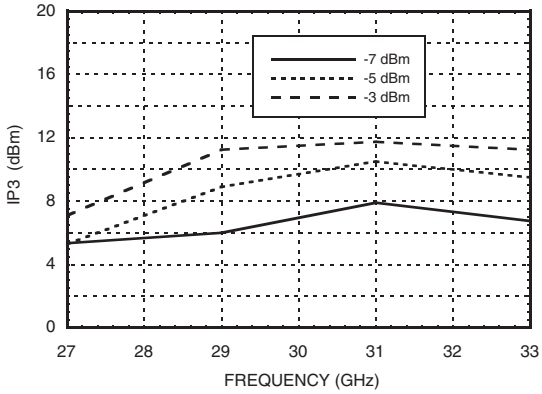
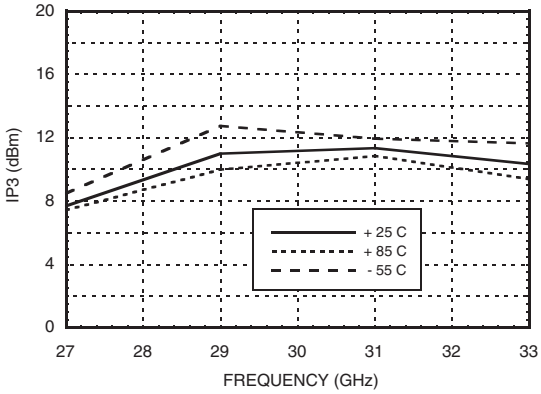
### Input IP3 vs. LO Drive @ Vdd = +4V*



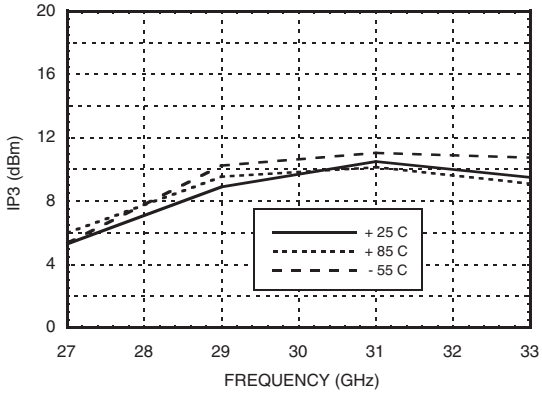

### Input IP3 vs. LO Drive @ Vdd = +3V*



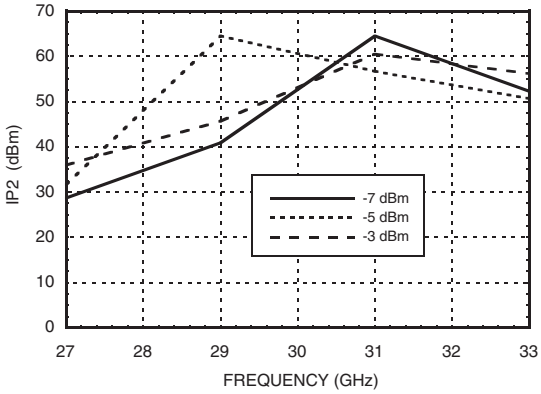

### Input IP3 vs. Temperature @ LO = -5 dBm, Vdd = +4V*



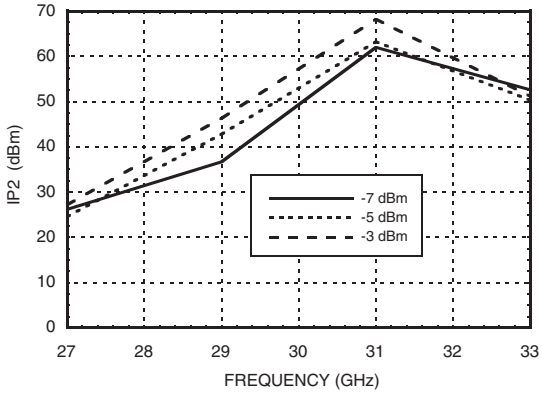

### Input IP3 vs. Temperature @ LO = -5 dBm, Vdd = +3V*




### Input IP2 vs. LO Drive @ Vdd = +4V*




### Input IP2 vs. LO Drive @ Vdd = +3V*




** Two-tone input power = -10 dBm each tone, 1 MHz spacing.*



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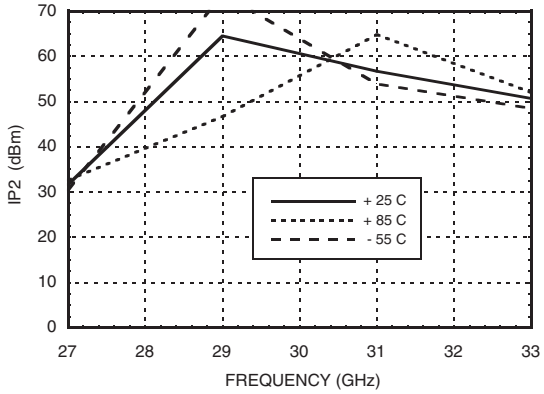
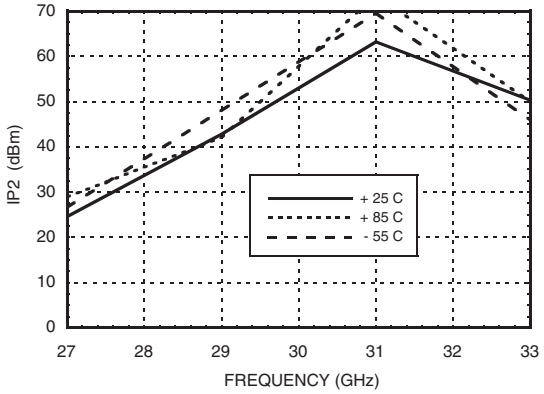
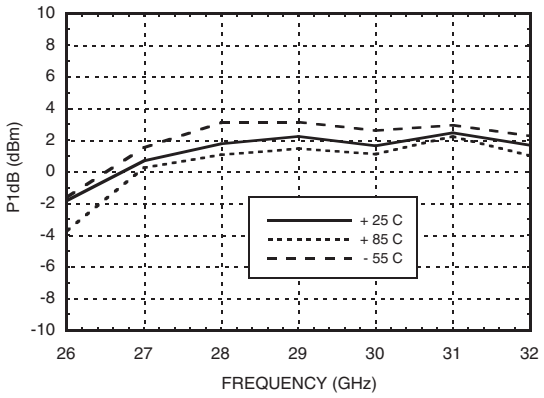
### Input IP2 vs. Temperature @ LO = -5 dBm, Vdd = +4V*



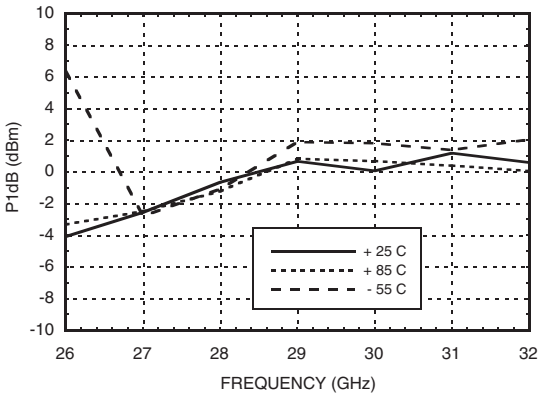

### Input IP2 vs. Temperature @ LO = -5 dBm, Vdd = +3V*



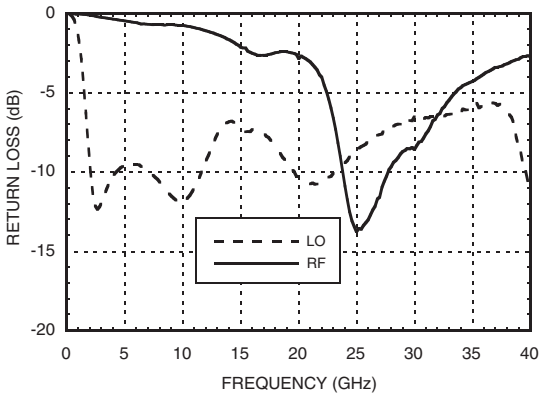

### Input P1dB vs. Temperature @ LO = -5 dBm, Vdd = +4V



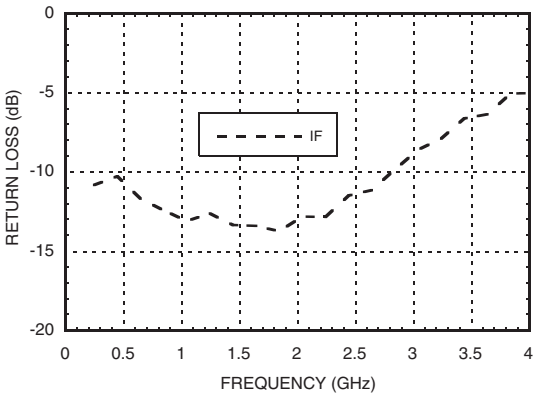

### Input P1dB vs. Temperature @ LO = -5 dBm, Vdd = +3V




### RF & LO Return Loss @ LO = -5 dBm, Vdd = +4V




### IF Return Loss @ LO = -5 dBm, Vdd = +4V




** Two-tone input power = -10 dBm each tone, 1 MHz spacing.*



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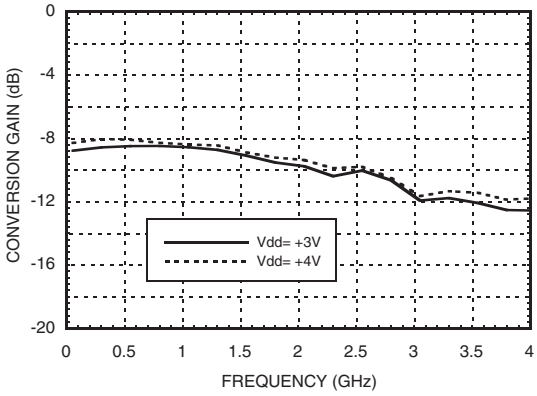
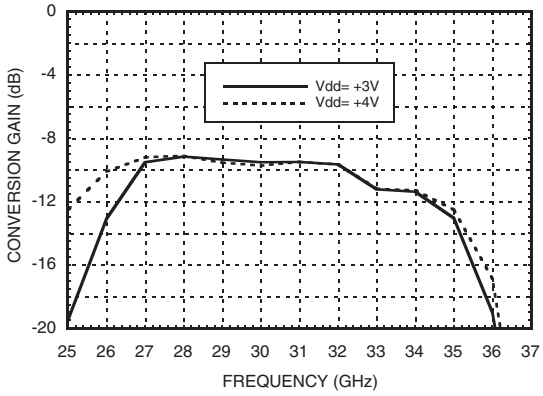
### IF Bandwidth @ LO = -5 dBm




### Upconverter Performance Conversion Gain, LO = -5 dBm, Vdd = +4V




### MxN Spurious @ IF Port, Vdd = +4V

| | nLO | | | | | |
|---|---|---|---|---|---|---|
| mRF | ±5 | ±4 | ±3 | ±2 | ±1 | 0 |
| -3 | | | | | | |
| -2 | 52 | | | | | |
| -1 | 54 | 35 | 53 | | | |
| 0 | | | 4 | 28 | -8 | |
| 1 | | | | X | 51 | 13 |
| 2 | | 58 | 51 | | 42 | |
| 3 | 88 | | | | | |

RF = 31 GHz @ -10 dBm
LO = 15 GHz @ -5 dBm
All values in dBc below IF power level.
Measured as downconverter

### MxN Spurious @ RF Port, Vdd = +4V

| | nLO | | | | | |
|---|---|---|---|---|---|---|
| mIF | ±5 | ±4 | ±3 | ±2 | ±1 | 0 |
| -3 | | | | 49 | | |
| -2 | | | 33 | 55 | 45 | |
| -1 | | | 41 | X | 43 | |
| 0 | | | -5 | 19 | -16 | |
| 1 | | | 44 | X | 40 | 15 |
| 2 | | | 33 | 54 | 36 | 63 |
| 3 | | | | 47 | | 69 |

IF = 1 GHz @ -10 dBm
LO = 15 GHz @ -5 dBm
All values in dBc below RF power level.
Measured as upconverter



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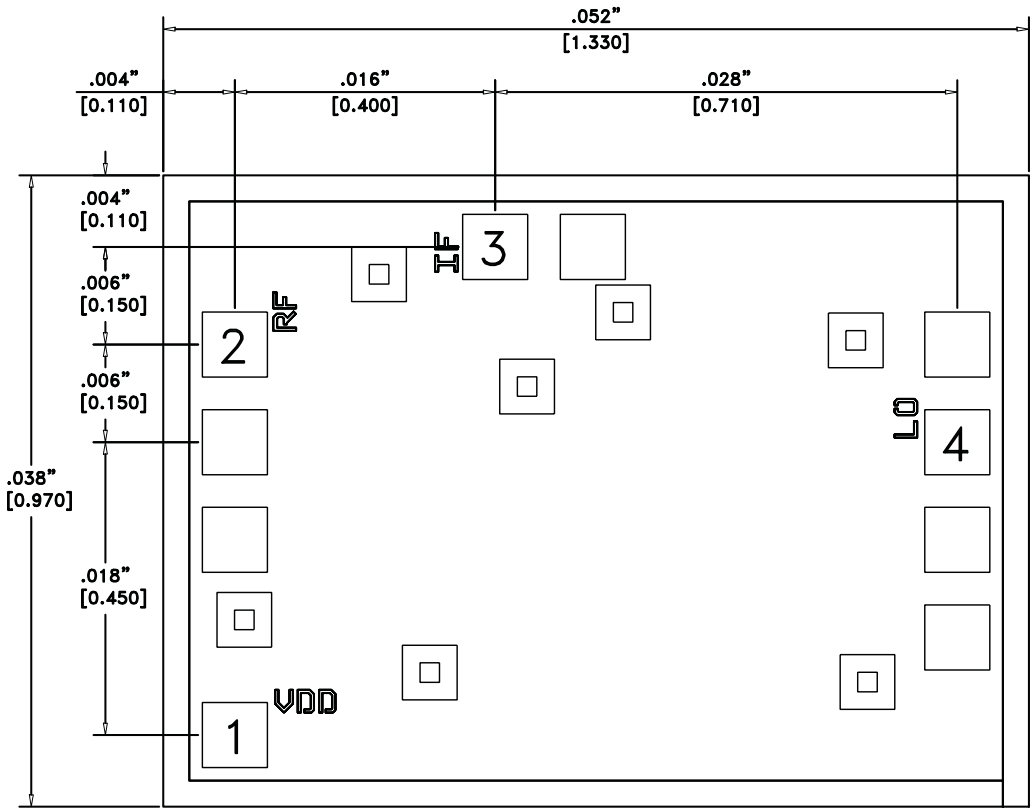
## Absolute Maximum Ratings

| | |
|---|---|
| RF / IF Input (Vdd = +5V) | +13 dBm |
| LO Drive (Vdd = +5V) | +13 dBm |
| Vdd | +5.5 Vdc |
| Continuous Pdiss (Ta = 85 °C) (derate 2.64 mW/°C above 85 °C) | 238 mW |
| Storage Temperature | -65 to +150 °C |
| Operating Temperature | -55 to +85 °C |

ELECTROSTATIC SENSITIVE DEVICE
OBSERVE HANDLING PRECAUTIONS

## Outline Drawing




## Die Packaging Information [1]

| Standard | Alternate |
|---|---|
| GP-2 (Gel Pack) | [2] |

[1] Refer to the "Packaging Information" section for die packaging dimensions.
[2] For alternate packaging information contact Hittite Microwave Corporation.

NOTES:
1. ALL DIMENSIONS IN INCHES (MILLIMETERS)
2. ALL TOLERANCES ARE ±0.001 (0.025)
3. DIE THICKNESS IS 0.004 (0.100) BACKSIDE IS GROUND
4. BOND PADS ARE 0.004 (0.100) SQUARE
5. BOND PAD SPACING, CTR-CTR: 0.006 (0.150)
6. BACKSIDE METALLIZATION: GOLD
7. BOND PAD METALLIZATION: GOLD



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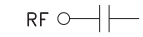
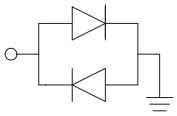
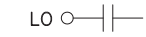
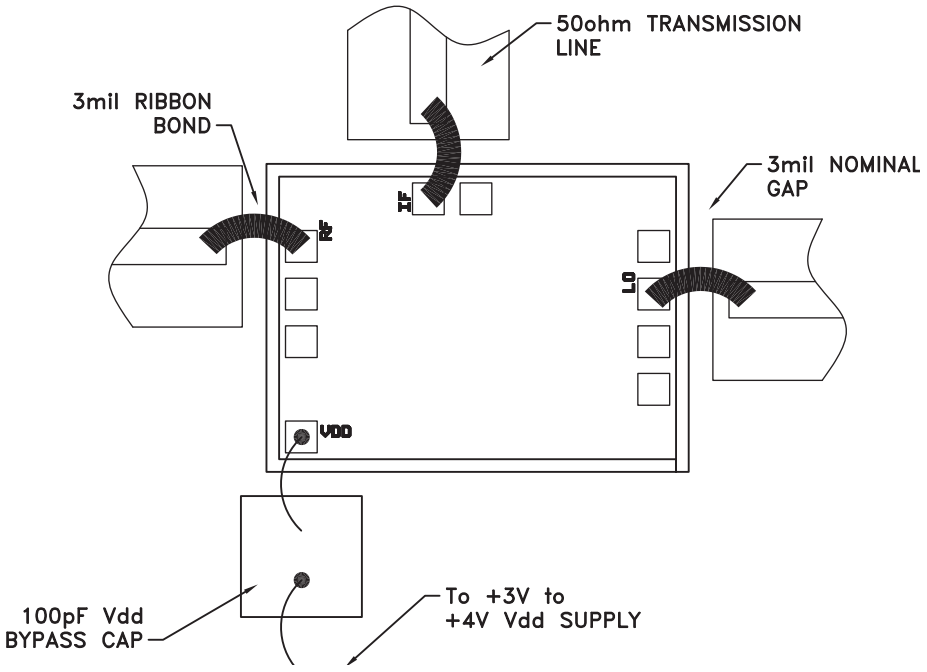
## Pad Descriptions

| Pad Number | Function | Description | Interface Schematic |
|---|---|---|---|
| 1 | Vdd | Power supply for the LO Amplifier. An external RF bypass capacitor of 100 - 330 pF is required. A MIM border capacitor is recommended. The bond length to the capacitor should be as short as possible. The ground side of the capacitor should be connected to the housing ground. | |
| 2 | RF | This pad is AC coupled and matched to 50 Ohm. |   |
| 3 | IF | This pad is DC coupled and should be DC blocked externally using a series capacitor whose value has been chosen to pass the necessary IF frequency range. Any applied DC voltage to this pin will result in die non-function and possible die failure. |  |
| 4 | LO | This pad is AC coupled and matched to 50 Ohm. |   |

## Assembly Diagram



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