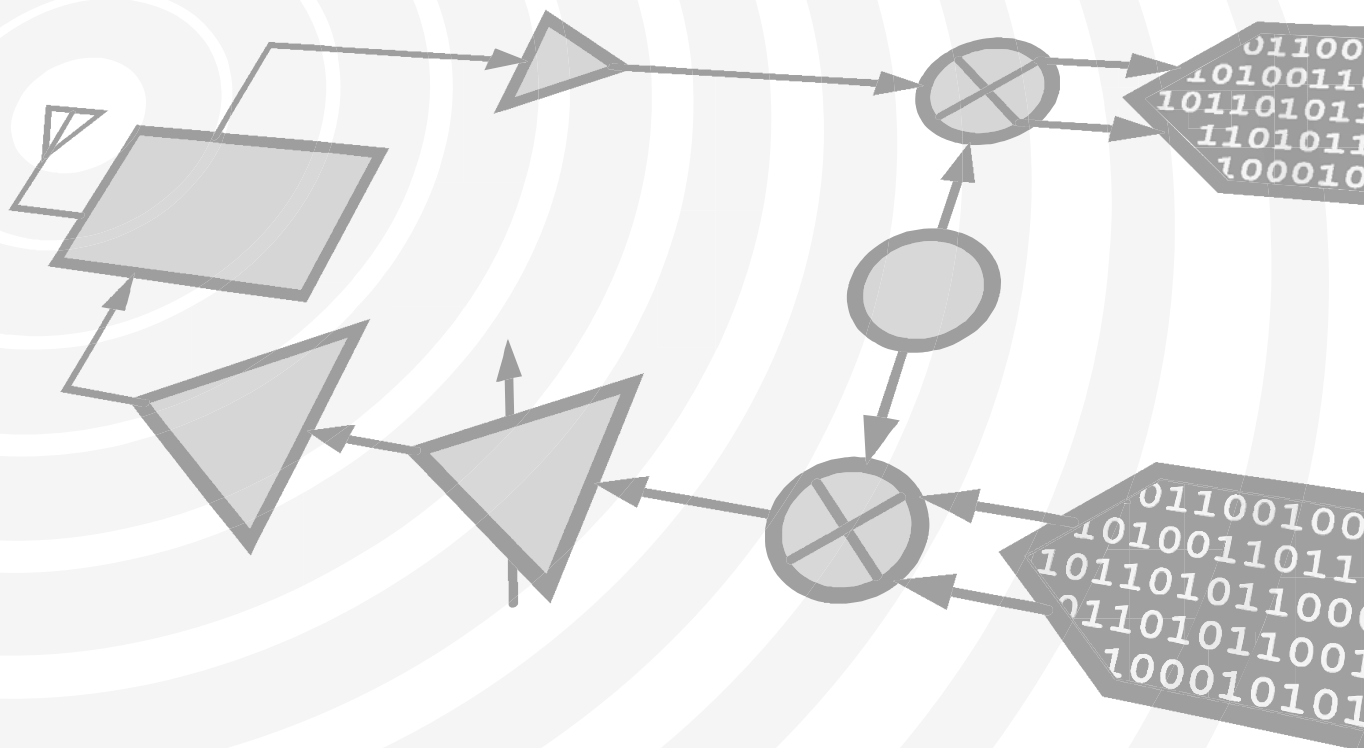




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MICROWAVE CORPORATION v04.0514



# HMC567LC5

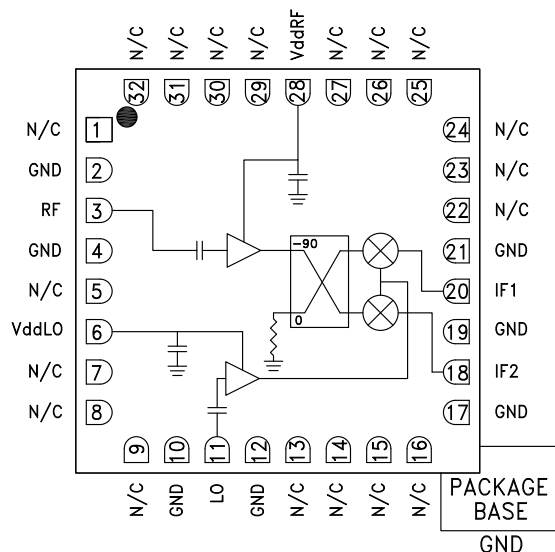
## GaAs MMIC I/Q DOWNCONVERTER 7 - 9 GHz

### Typical Applications

The HMC567LC5 is ideal for:

- Point-to-Point and Point-to-Multi-Point Radio
- EW & ELINT

### Functional Diagram



### Features

- Conversion Gain: 10 dB
- Image Rejection: 35 dB
- LO to RF Isolation: 54 dB
- Noise Figure: 2.5 dB
- Input IP3: +1.5 dBm
- 32 Lead 5x5mm SMT Package: 25mm<sup>2</sup>

### General Description

The HMC567LC5 is a compact GaAs MCM I/Q downconverter in a leadless RoHS compliant SMT package. This device provides a small signal conversion gain of 10 dB with a noise figure of 2.5 dB and 35 dB of image rejection across the frequency band. The HMC567LC5 utilizes an LNA followed by an image reject mixer which is driven by an LO buffer amplifier. The image reject mixer eliminates the need for a filter following the LNA, and removes thermal noise at the image frequency. I and Q mixer outputs are provided and an external 90° hybrid is needed to select the required sideband. The HMC567LC5 is a much smaller alternative to hybrid style image reject mixer downconverter assemblies, and it eliminates the need for wire bonding by allowing the use of surface mount manufacturing techniques.

**Electrical Specifications,  $T_A = +25^\circ\text{C}$ ,  
 $IF = 100\text{ MHz}$ ,  $LO = 0\text{ dBm}$ ,  $V_{ddLO} = 5.0\text{ Vdc}$ ,  $V_{ddRF} = 3.0\text{ Vdc}^*$**

| Parameter                | Min. | Typ.       | Max. | Units |
|--------------------------|------|------------|------|-------|
| Frequency Range, RF      |      | 7 - 9      |      | GHz   |
| Frequency Range, LO      |      | 3.5 - 12.5 |      | GHz   |
| Frequency Range, IF      |      | DC - 3.5   |      | GHz   |
| Conversion Gain (As IRM) | 7    | 10         |      | dB    |
| Noise Figure             |      | 2.5        |      | dB    |
| Image Rejection          | 23   | 35         |      | dB    |
| 1 dB Compression (Input) |      | -4         |      | dBm   |
| LO to RF Isolation       | 43   | 54         |      | dB    |
| LO to IF Isolation       | 20   | 32         |      | dB    |
| IP3 (Input)              |      | +1.5       |      | dBm   |
| Amplitude Balance        |      | $\pm 0.75$ |      | dB    |
| Phase Balance            |      | $\pm 3$    |      | Deg   |
| Total Supply Current     |      | 160        | 195  | mA    |

\*Data taken as IRM with external IF Hybrid

For price, delivery and to place orders: Hittite Microwave Corporation, 2 Elizabeth Drive, Chelmsford, MA 01824

Phone: 978-250-3343 Fax: 978-250-3373 Order On-line at [www.hittite.com](http://www.hittite.com)

Application Support: Phone: 978-250-3343 or [apps@hittite.com](mailto:apps@hittite.com)

Data Taken As IRM With External IF Hybrid

Conversion Gain vs. Temperature

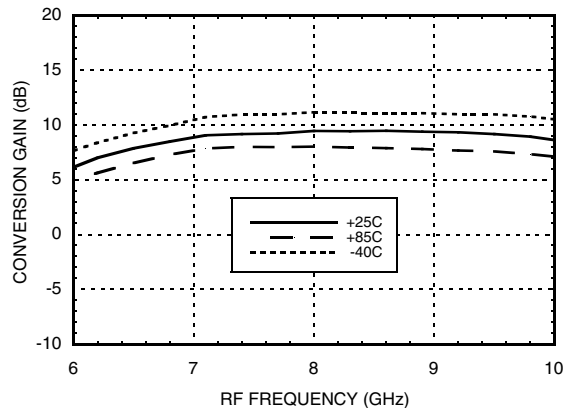
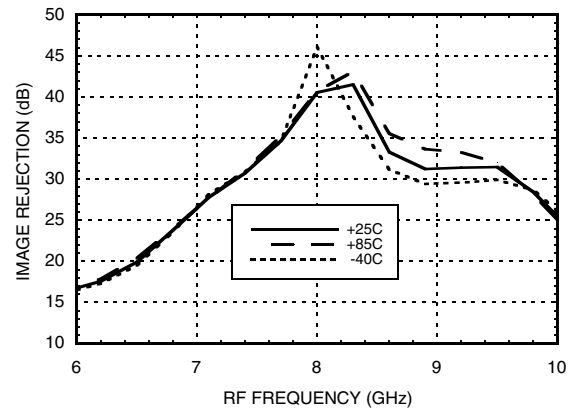
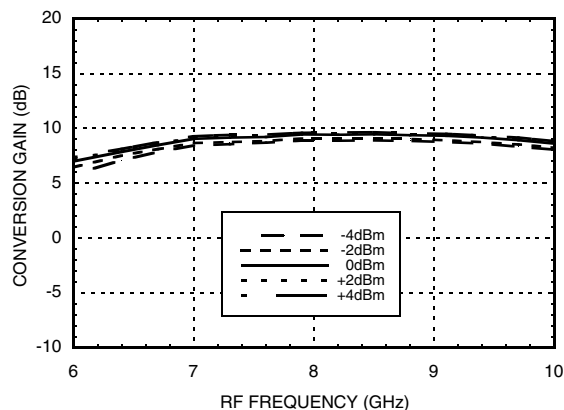


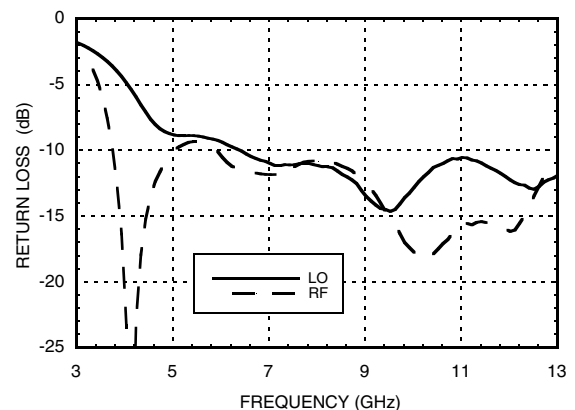
Image Rejection vs. Temperature



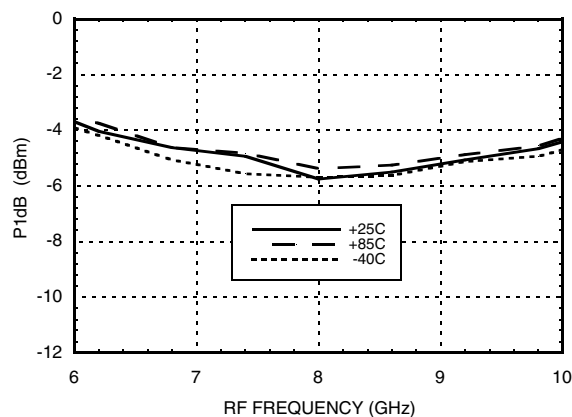
Conversion Gain vs. LO Drive



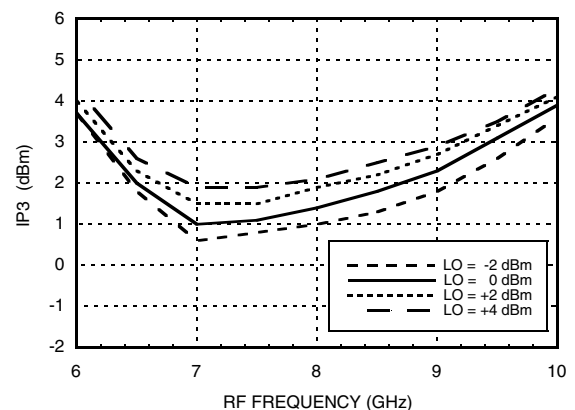
Return Loss



Input P1dB vs. Temperature



Input IP3 vs. LO Drive





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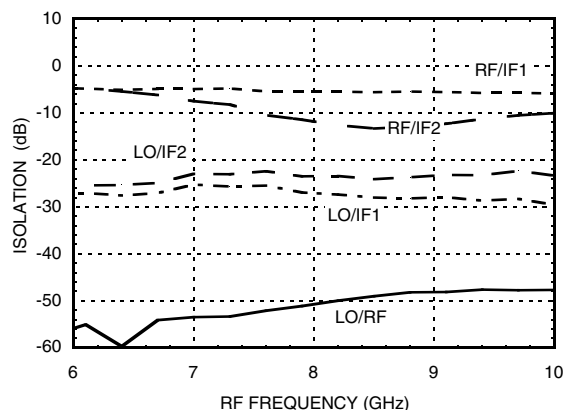


**HMC567LC5**

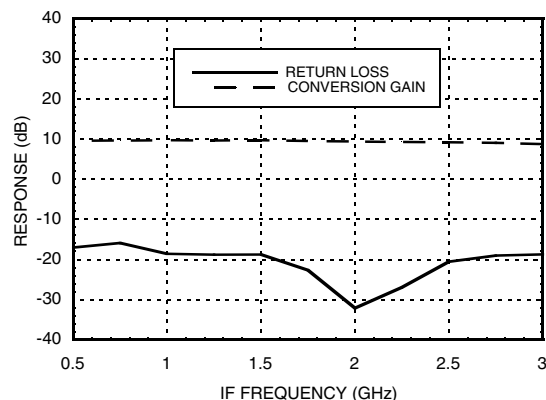
**GaAs MMIC I/Q DOWNCONVERTER**  
**7 - 9 GHz**

**Quadrature Channel Data Taken Without IF Hybrid**

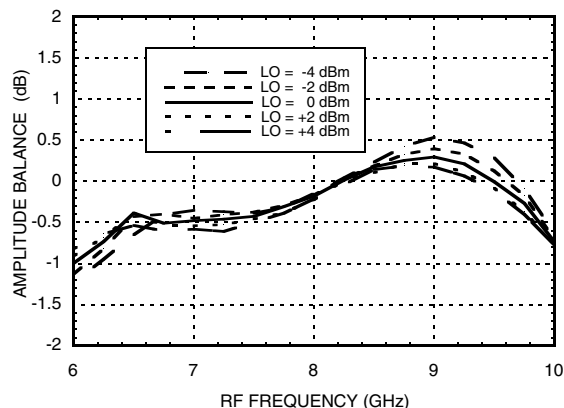
**Isolations**



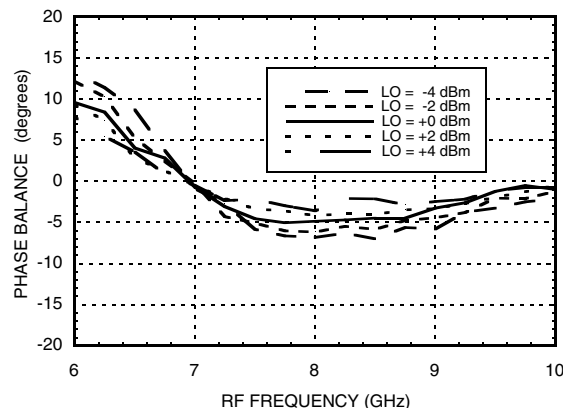
**IF Bandwidth\***



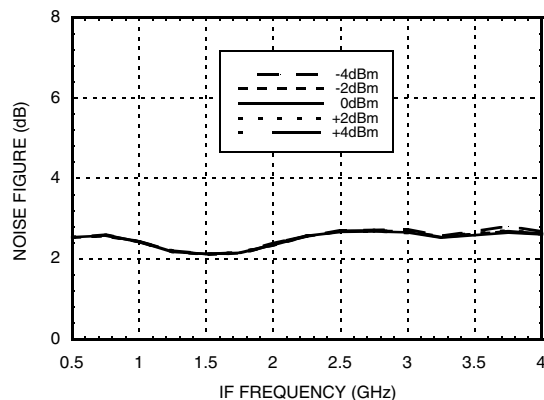
**Amplitude Balance vs. LO Drive**



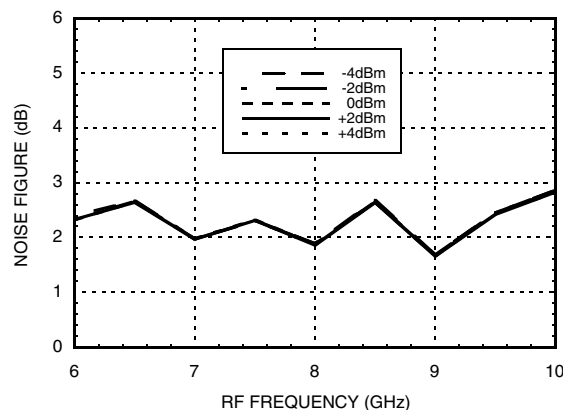
**Phase Balance vs. LO Drive**



**Noise Figure vs. LO Drive,  
LO Frequency = 7.0 GHz**



**Noise Figure vs. LO Drive,  
IF Frequency = 100 MHz**



\* Conversion gain data taken with external IF hybrid, LO frequency fixed at 7.0 GHz and RF varied

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**GaAs MMIC I/Q DOWNCONVERTER**  
**7 - 9 GHz**
**MxN Spurious Outputs**

| mRF | nLO |     |     |     |    |
|-----|-----|-----|-----|-----|----|
|     | 0   | 1   | 2   | 3   | 4  |
| 0   | xx  | 15  | 48  | 42  | 60 |
| 1   | 13  | 0   | 29  | 48  | 66 |
| 2   | 63  | 53  | 59  | 59  | 84 |
| 3   | 79  | 93  | 83  | 52  | 76 |
| 4   | 104 | 103 | 104 | 107 | 97 |

RF = 7.6 GHz @ -20 dBm  
 LO = 7.5 GHz @ +4 dBm  
 Data taken without IF hybrid  
 All values in dBc below IF power level.

**Absolute Maximum Ratings**

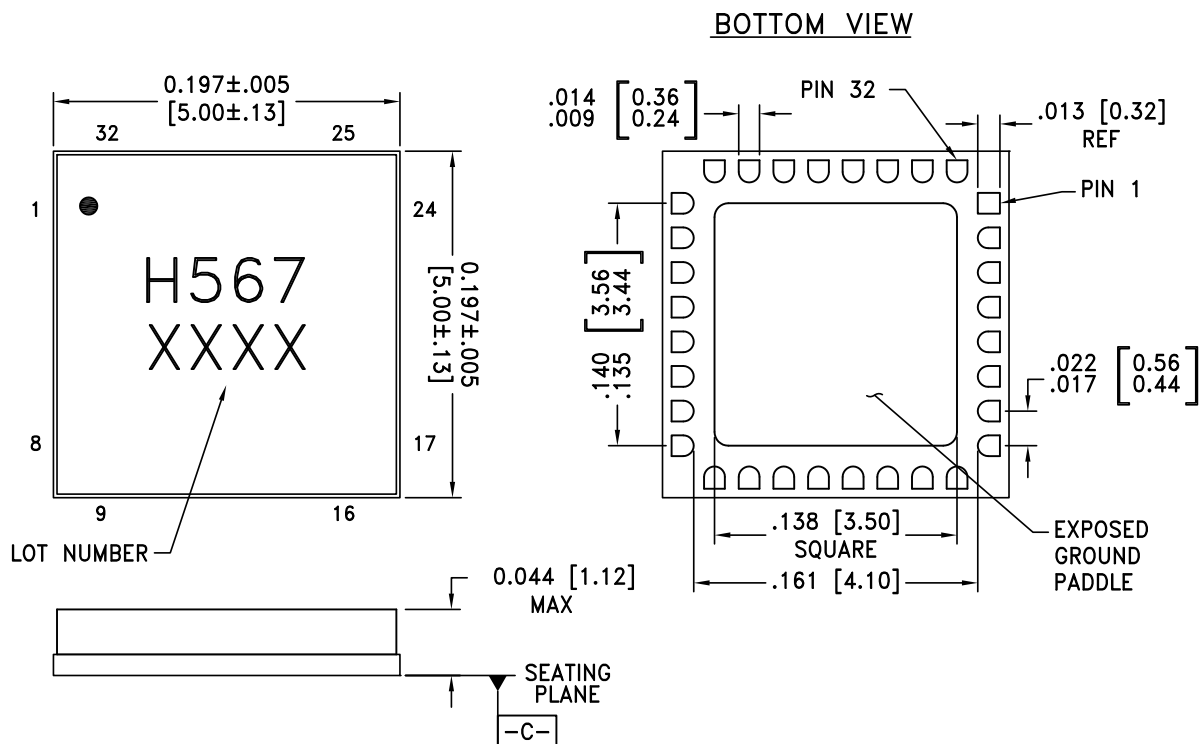
|                                                                         |                |
|-------------------------------------------------------------------------|----------------|
| RF                                                                      | +5 dBm         |
| LO Drive                                                                | +20 dBm        |
| VddRF / VddLO                                                           | 4.0V / 5.5V    |
| Channel Temperature                                                     | 150°C          |
| Continuous P <sub>diss</sub> (T=85°C)<br>(derate 9.56 mW/°C above 85°C) | 508 mW         |
| Thermal Resistance (R <sub>TH</sub> )<br>(channel to package bottom)    | 77 °C/W        |
| Storage Temperature                                                     | -65 to +150 °C |
| Operating Temperature                                                   | -55 to +85 °C  |



**ELECTROSTATIC SENSITIVE DEVICE**  
**OBSERVE HANDLING PRECAUTIONS**



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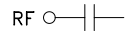
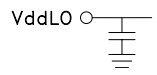
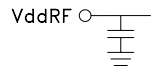
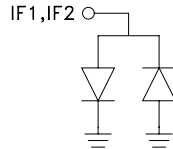
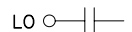
**HMC567LC5****GaAs MMIC I/Q DOWNCONVERTER  
7 - 9 GHz****Outline Drawing****Package Information**

| Part Number | Package Body Material | Lead Finish      | MSL Rating          | Package Marking <sup>[2]</sup> |
|-------------|-----------------------|------------------|---------------------|--------------------------------|
| HMC567LC5   | Alumina, White        | Gold over Nickel | MSL3 <sup>[1]</sup> | H567<br>XXXX                   |

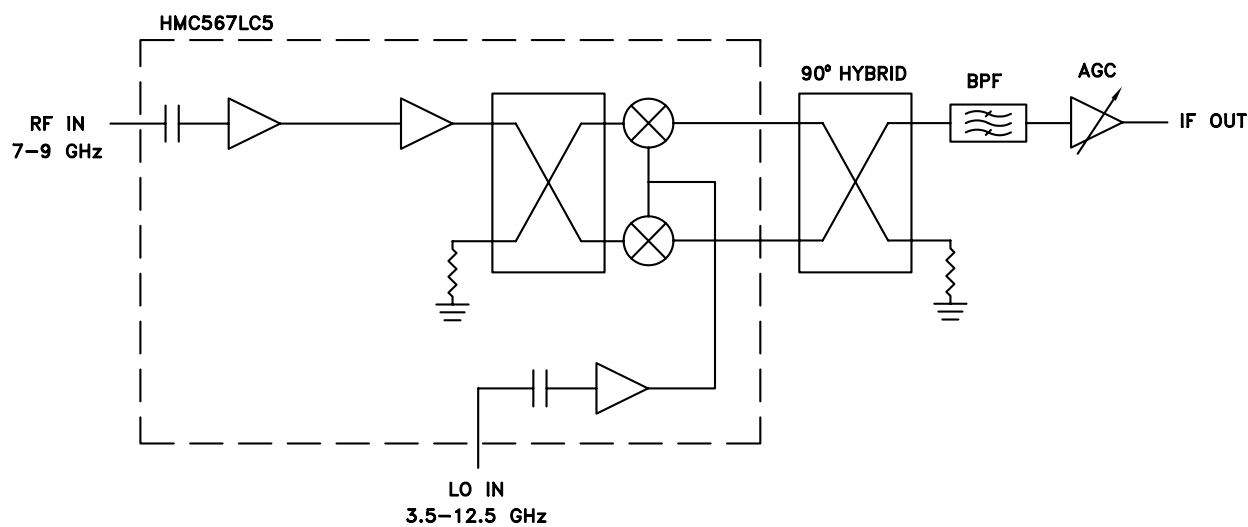
[1] Max peak reflow temperature of 260 °C

[2] 4-Digit lot number XXXX

## Pin Descriptions

| Pin Number                                   | Function | Description                                                                                                                                                                                                                                                                                                                                        | Interface Schematic                                                                   |
|----------------------------------------------|----------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------|
| 1, 5, 7 - 9,<br>13 - 16, 22 - 27,<br>29 - 32 | N/C      | No connection required. These pins may be connected to RF/DC ground without affecting performance.                                                                                                                                                                                                                                                 |                                                                                       |
| 2, 4, 10, 12,<br>17, 19, 21                  | GND      | These pins and ground paddle must be connected to RF/DC ground.                                                                                                                                                                                                                                                                                    |    |
| 3                                            | RF       | This pin is AC coupled and matched to 50 Ohms.                                                                                                                                                                                                                                                                                                     |    |
| 6                                            | VddLO    | Power supply for LO amplifier.<br>100 mA typical, 120 mA maximum.                                                                                                                                                                                                                                                                                  |    |
| 28                                           | VddRF    | Power supply for RF LNA.<br>60 mA typical, 75 mA maximum.                                                                                                                                                                                                                                                                                          |    |
| 18                                           | IF2      | 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 frequency range. For operation to DC, this pin must not sink / source more than 3 mA of current or part non-function and possible failure will result. |   |
| 20                                           | IF1      |                                                                                                                                                                                                                                                                                                                                                    |                                                                                       |
| 11                                           | LO       | This pin is AC coupled and matched to 50 Ohms.                                                                                                                                                                                                                                                                                                     |  |

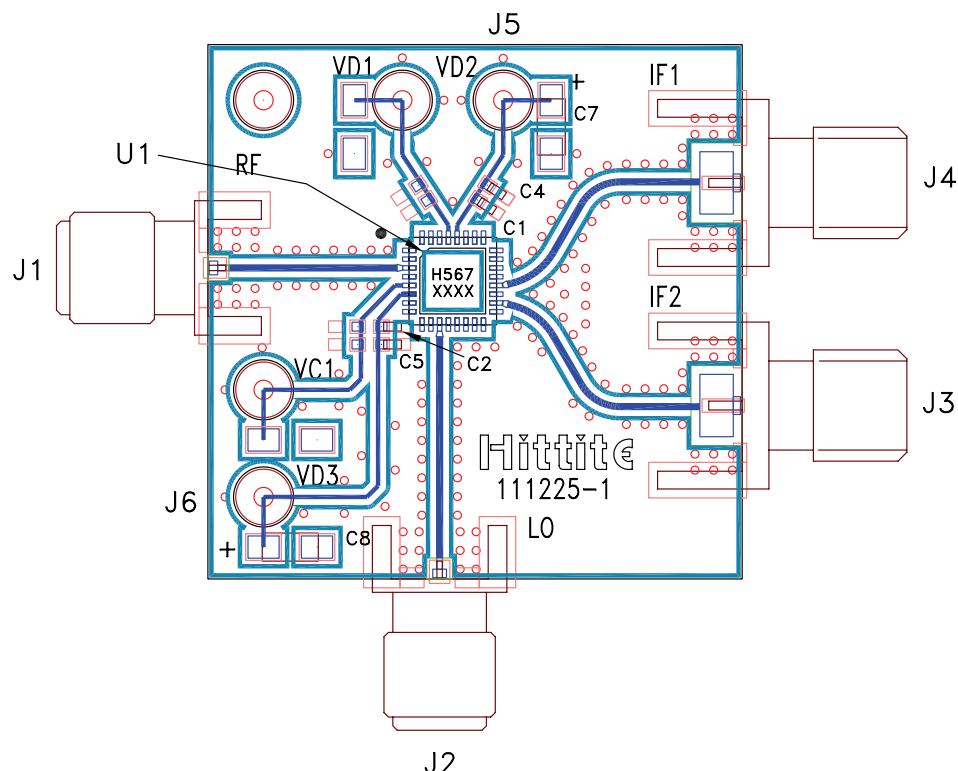
## Typical Application



Note: LSB and USB is determined by GND on Hybrid



# Evaluation PCB



## List of Materials for Evaluation PCB 111239 [1]

| Item     | Description                          |
|----------|--------------------------------------|
| C1, C2   | Capacitor 0402, Pkg. 100pF           |
| C4, C5   | Capacitor 0402, Pkg. 1000pF          |
| C7, C8   | Capacitor, Case A, 2.2uF *(Polarity) |
| J1, J2   | PCB Mount SMA RF Connector, SRI      |
| J3, J4   | PCB Mount SMA Connector, Johnson     |
| J5       | DC Pin, VD2 = VddRF                  |
| J6       | DC Pin, VD3 = VddLO                  |
| VC1, VD1 | N/C                                  |
| U1       | HMC567LC5                            |
| PCB [2]  | 111225 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.



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**HMC567LC5**

**GaAs MMIC I/Q DOWNCONVERTER**  
**7 - 9 GHz**