

### Typical Applications

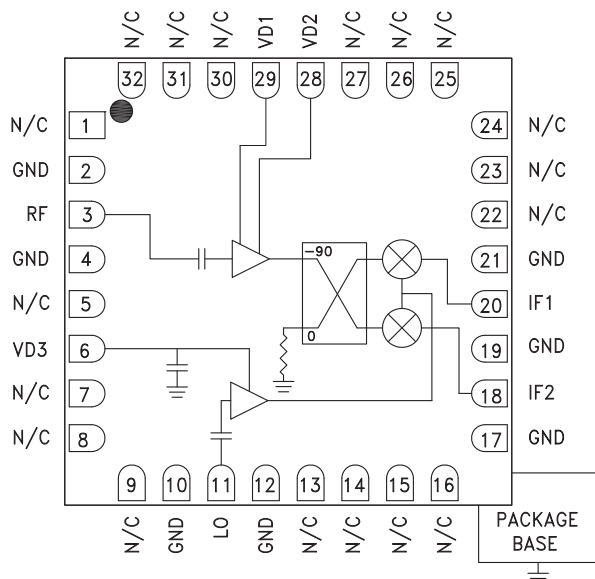
The HMC569LC5 is ideal for:

- Point-to-Point and Point-to-Multi-Point Radio
- Military Radar, EW & ELINT
- Satellite Communications

### Features

- Conversion Gain: 14 dB
- Image Rejection: 32 dB
- LO to RF Isolation: 45 dB
- Noise Figure: 2.5 dB
- Input IP3: -0.5 dBm
- RoHS Compliant 5x5 mm SMT Package

### Functional Diagram



### General Description

The HMC569LC5 is a compact GaAs MCM I/Q downconverter in a leadless RoHS compliant SMT package. This device provides a small signal conversion gain of 14 dB with a noise figure of 2.5 dB and 32 dB of image rejection. The HMC569LC5 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 HMC569LC5 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, $T_A = +25^\circ \text{C}$ , $IF = 100 \text{ MHz}$ , $LO = 0 \text{ dBm}$ , $VD3 = 5.0 \text{ Vdc}$ , $VD1, VD2 = 3.0 \text{ Vdc}^*$

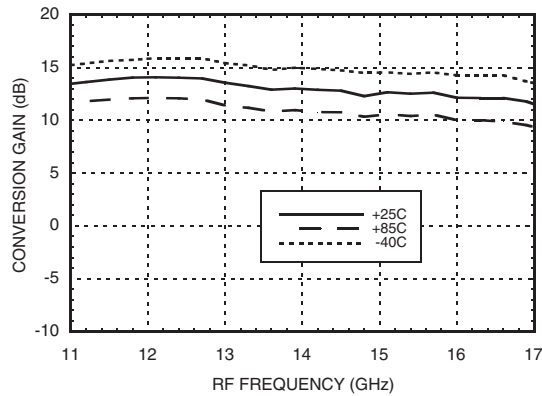
| Parameter                | Min. | Typ.       | Max. | Units |
|--------------------------|------|------------|------|-------|
| Frequency Range, RF      |      | 12 - 16    |      | GHz   |
| Frequency Range, LO      |      | 8.5 - 19.5 |      | GHz   |
| Frequency Range, IF      |      | DC - 3.5   |      | GHz   |
| Conversion Gain (As IRM) | 10   | 14         |      | dB    |
| Noise Figure             |      | 2.5        |      | dB    |
| Image Rejection          | 15   | 32         |      | dB    |
| 1 dB Compression (Input) |      | -7         |      | dBm   |
| LO to RF Isolation       | 30   | 45         |      | dB    |
| LO to IF Isolation       | 20   | 32         |      | dB    |
| IP3 (Input)              |      | -0.5       |      | dBm   |
| Amplitude Balance        |      | 0          |      | dB    |
| Phase Balance            |      | $\pm 10$   |      | Deg   |
| Total Supply Current     |      | 160        | 208  | mA    |

\*Data taken as IRM with external IF Hybrid

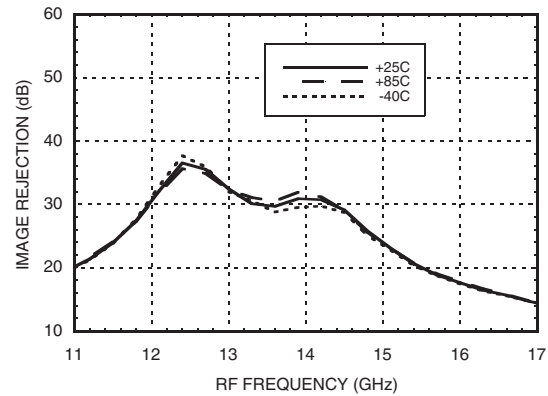
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20 Alpha Road, Chelmsford, MA 01824 Phone: 978-250-3343 Fax: 978-250-3373  
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Data Taken As IRM With External IF Hybrid

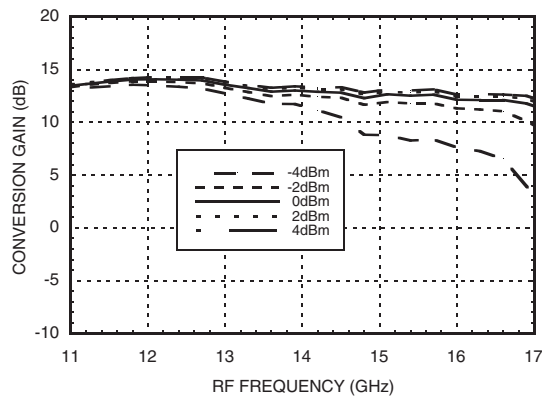
**Conversion Gain vs. Temperature**



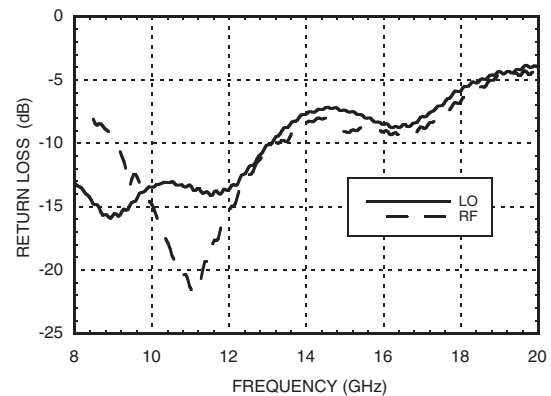
**Image Rejection vs. Temperature**



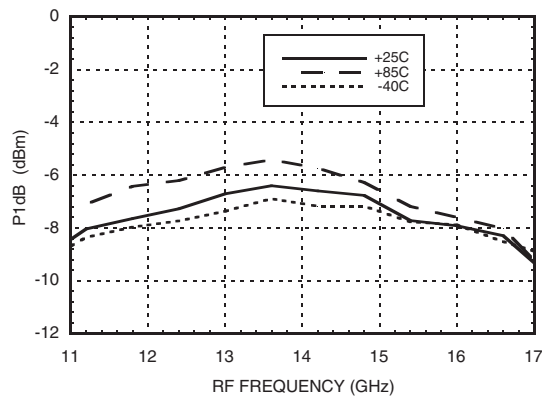
**Conversion Gain vs. LO Drive**



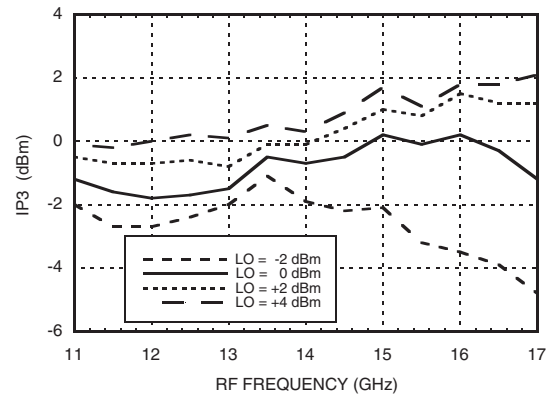
**Return Loss**



**Input P1dB vs. Temperature**

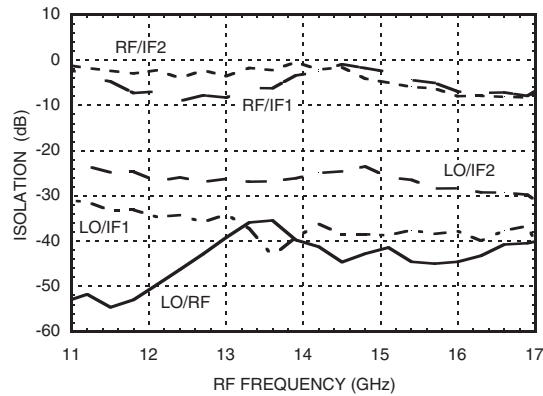


**Input IP3 vs. LO Drive**

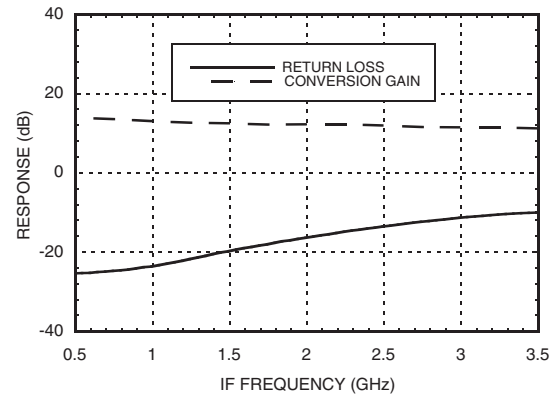


### Quadrature Channel Data Taken Without IF Hybrid

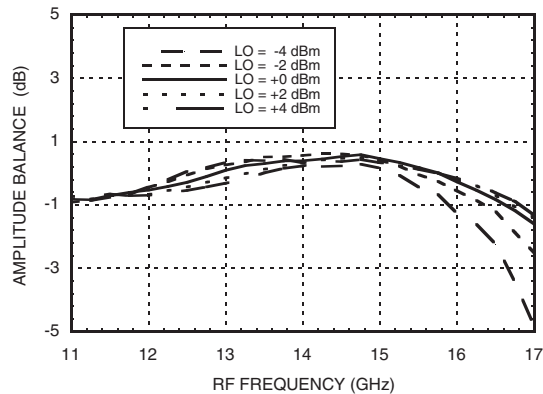
#### Isolations



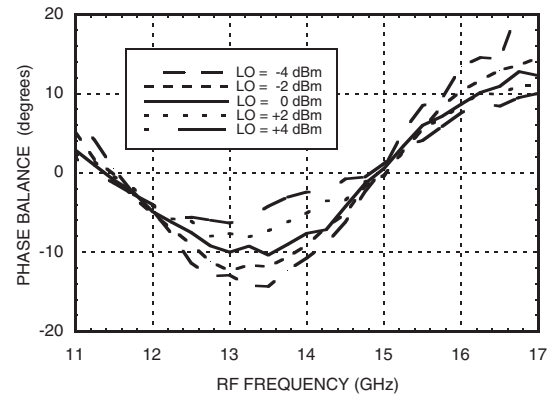
#### IF Bandwidth\*



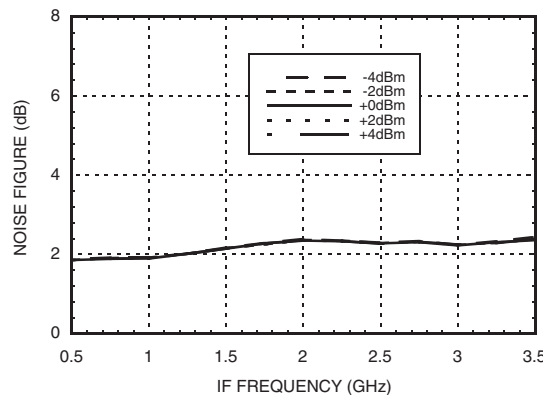
#### Amplitude Balance vs. LO Drive



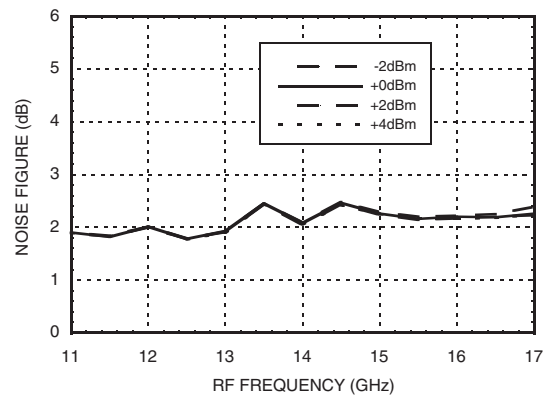
#### Phase Balance vs. LO Drive



#### Noise Figure vs. LO Drive, LO Frequency = 12 GHz



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



\* Conversion gain data taken with external IF hybrid, LO frequency fixed at 12 GHz and RF varied

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#### MxN Spurious Outputs

| mRF | nLO |    |    |    |    |
|-----|-----|----|----|----|----|
|     | 0   | 1  | 2  | 3  | 4  |
| 0   | xx  | 14 | 27 | 41 | 54 |
| 1   | 14  | xx | 13 | 27 | 40 |
| 2   | 27  | 14 | xx | 13 | 27 |
| 3   | 41  | 27 | 14 | xx | 13 |
| 4   | 54  | 41 | 27 | 14 | xx |

RF = 13.6 GHz @ -20 dBm

LO = 13.5 GHz @ 0 dBm

Data taken without IF hybrid

All values in dBc below IF power level.

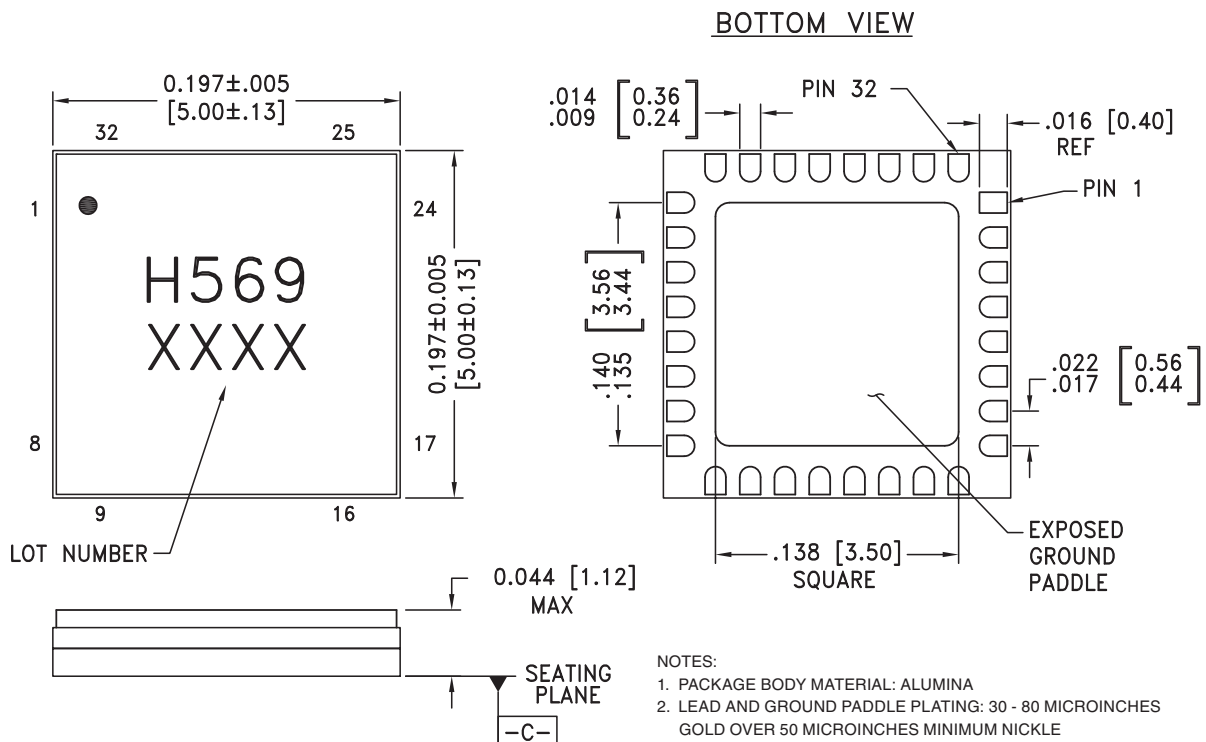
#### Absolute Maximum Ratings

|                                                                      |                |
|----------------------------------------------------------------------|----------------|
| RF                                                                   | +5 dBm         |
| LO Drive                                                             | +20 dBm        |
| VD1, VD2                                                             | 4.0V           |
| VD3                                                                  | 5.5V           |
| Channel Temperature                                                  | 150°C          |
| Continuous Pdiss (T=85°C)<br>(derate 9.56 mW/°C above 85°C)          | 0.65 W         |
| Thermal Resistance (R <sub>TH</sub> )<br>(channel to package bottom) | 71 °C/W        |
| Storage Temperature                                                  | -65 to +150 °C |
| Operating Temperature                                                | -55 to +85 °C  |



ELECTROSTATIC SENSITIVE DEVICE  
OBSERVE HANDLING PRECAUTIONS

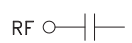
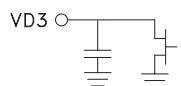
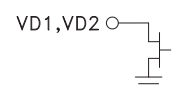
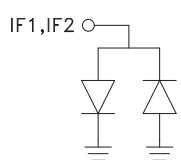
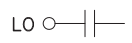
#### Outline Drawing



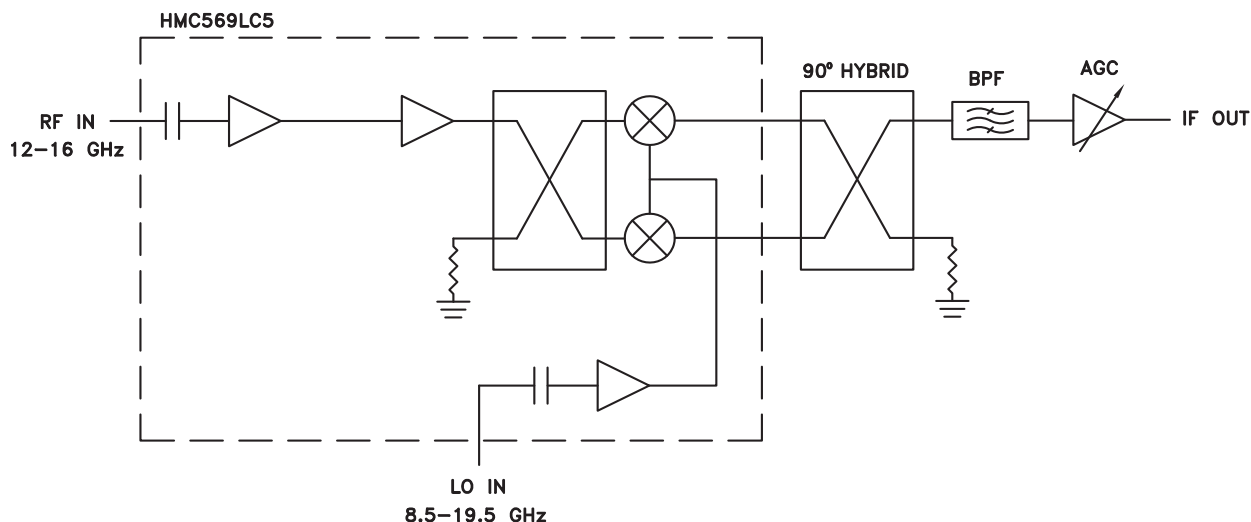
#### NOTES:

1. PACKAGE BODY MATERIAL: ALUMINA
2. LEAD AND GROUND PADDLE PLATING: 30 - 80 MICROINCHES GOLD OVER 50 MICROINCHES MINIMUM NICKLE
3. DIMENSIONS ARE IN INCHES [MILLIMETERS]
4. LEAD SPACING TOLERANCE IS NON-CUMULATIVE
5. PACKAGE WARP SHALL NOT EXCEED 0.05mm DATUM
6. ALL GROUND LEADS AND GROUND PADDLE MUST BE SOLDERED TO PCB RF GROUND

### Pin Descriptions

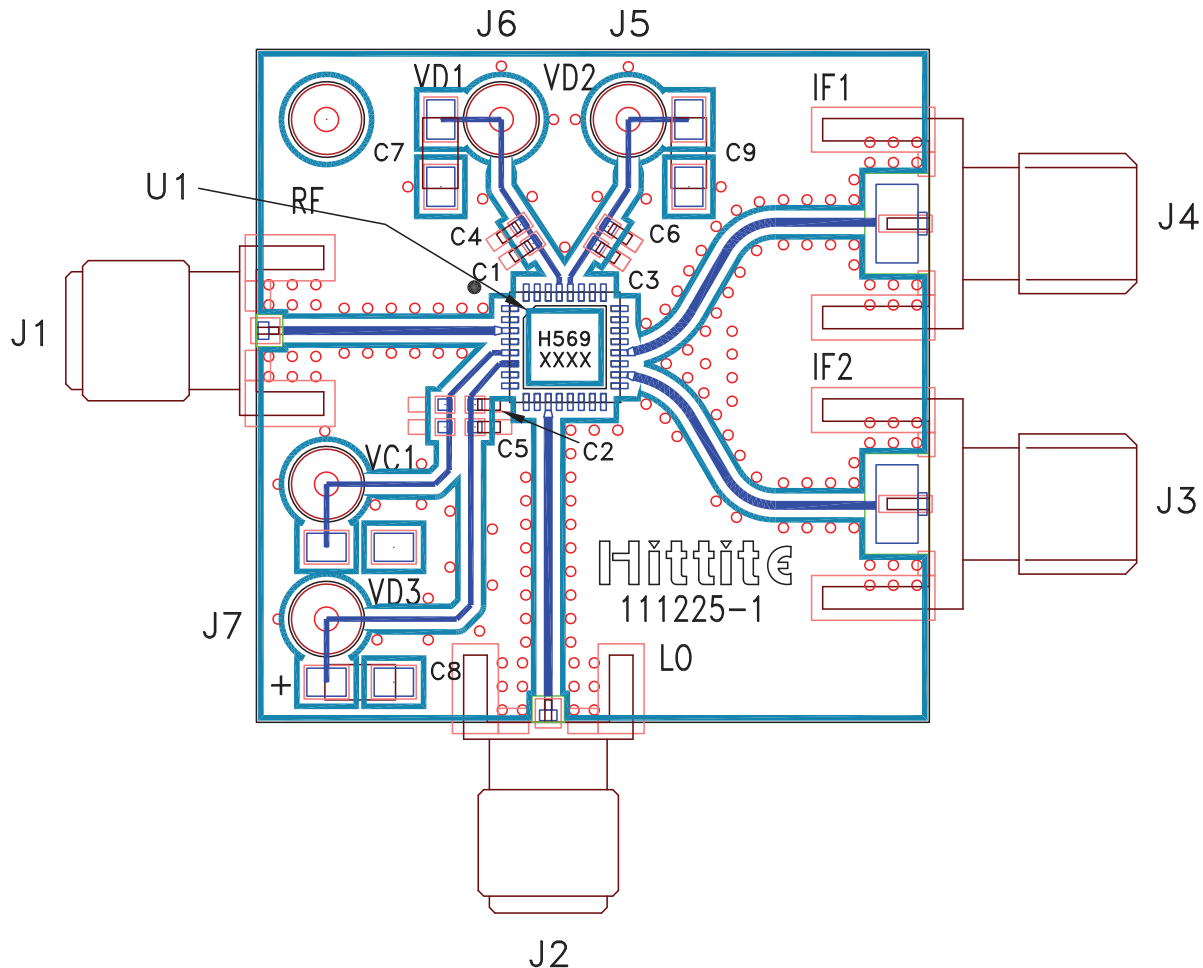
| Pin Number                                   | Function | Description                                                                                                                                                                                                                                                                                                                                        | Interface Schematic                                                                   |
|----------------------------------------------|----------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------|
| 1, 5, 7 - 9,<br>13 - 16, 22 - 27,<br>30 - 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                                            | VD3      | Power supply for LO amplifier.<br>100 mA typical, 120 mA maximum.                                                                                                                                                                                                                                                                                  |    |
| 28, 29                                       | VD1, VD2 | Power supply for RF LNA.<br>60 mA typical, 88 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 111227 <sup>[1]</sup>

| Item       | Description                          |
|------------|--------------------------------------|
| C1, C2, C3 | Capacitor 0402, Pkg. 100pF           |
| C4, C5, C6 | Capacitor 0402, Pkg. 1000pF          |
| C7, C8, C9 | Capacitor, Case A, 2.2uF *(Polarity) |
| J1, J2     | PCB Mount SMA RF Connector, SRI      |
| J3, J4     | PCB Mount SMA Connector, Johnson     |
| J5, J6     | DC Pin                               |
| J7         | DC Pin                               |
| VC1        | N/C                                  |
| U1         | HMC569LC5                            |
| 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 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.