# HMC787LC3B

## GaAs MMIC FUNDAMENTAL MIXER, 3 - 10 GHz



### Typical Applications

The HMC787LC3B is ideal for:

- WiMAX Infrastructure
- Microwave Radio
- ISM & UWB Radios
- Test Equipment & Sensors
- Military End-Use

### Features

Passive Double-Balanced Topology

High LO/RF Isolation: 55 dB

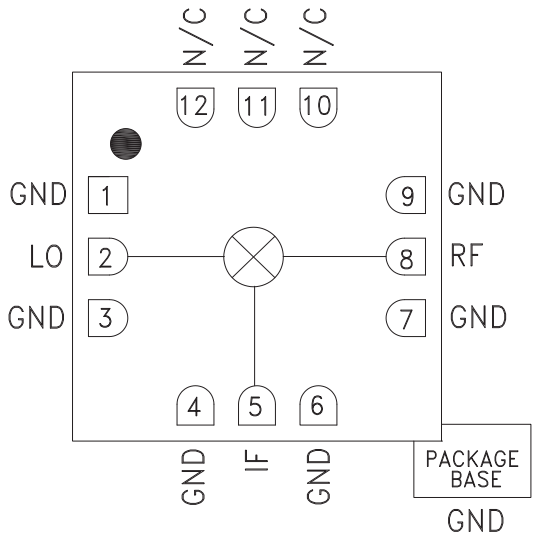
Low Conversion Loss: 9 dB

Wide IF Bandwidth: DC - 4 GHz

No External Matching Required

12 Lead 3x3 mm SMT Package: 9 $mm^2$

### Functional Diagram




### General Description

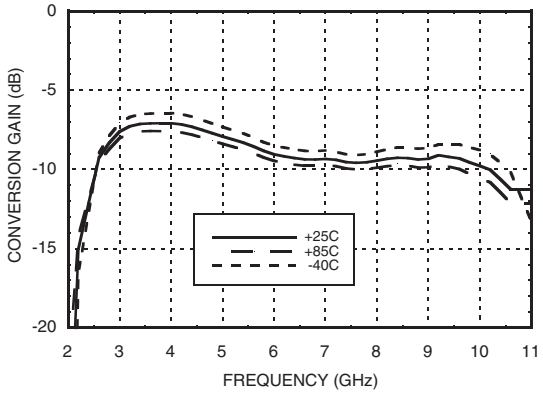
The HMC787LC3B is a general purpose double balanced mixer in a leadless RoHS compliant SMT package that can be used as an upconverter or downconverter between 3 and 10 GHz. This mixer is fabricated in a GaAs MESFET process, and requires no external components or matching circuitry. The HMC787LC3B provides excellent LO to RF and LO to IF isolation due to optimized balun structures and operates with LO drive level of +17 dBm. The ceramic SMT package eliminates the need for wire bonding, and is compatible with high volume surface mount manufacturing techniques.

### Electrical Specifications, $T_A$ = +25° C, IF= 100 MHz, LO= +17 dBm*

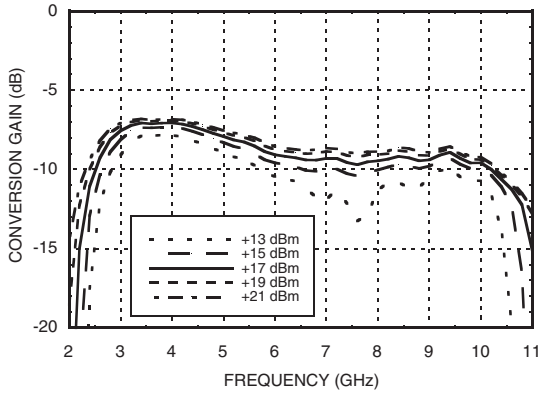
| Parameter | Min. | Typ. | Max. | Units |
|---|---|---|---|---|
| Frequency Range, RF & LO | | 3 - 10 | | GHz |
| Frequency Range, IF | | DC - 4 | | GHz |
| Conversion Loss | | 9 | 11.5 | dB |
| Noise Figure (SSB) | | 9 | | dB |
| LO to RF Isolation | | 55 | | dB |
| LO to IF Isolation | 35 | 42 | | dB |
| RF to IF Isolation | 13 | 20 | | dB |
| IP3 (Input) | | 23 | | dBm |
| IP2 (Input) | | 70 | | dBm |
| 1 dB Gain Compression (Input) | | 15 | | dBm |

*Unless otherwise noted, all measurements performed as downconverter, IF= 100 MHz.

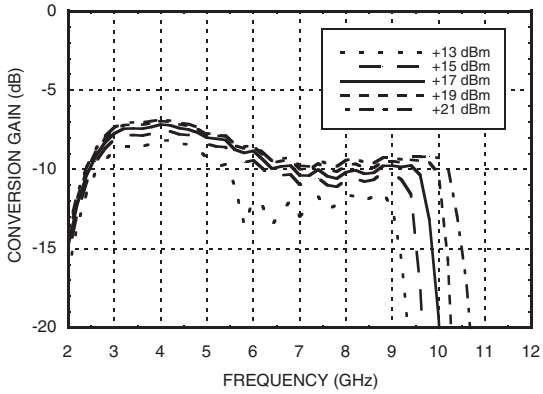
### Conversion Gain vs. Temperature @ LO = +17 dBm, IF Frequency = 100 MHz



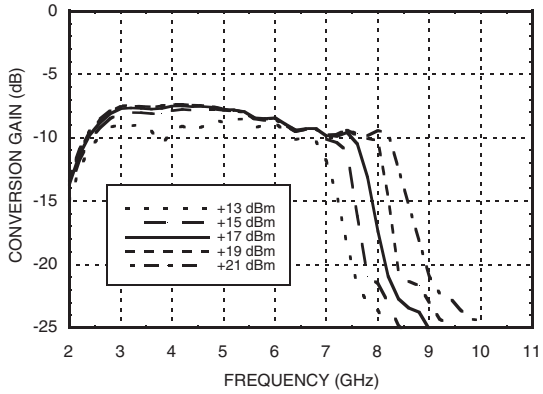

### Conversion Loss vs. LO Drive @ LO = +17 dBm, IF Frequency = 100 MHz



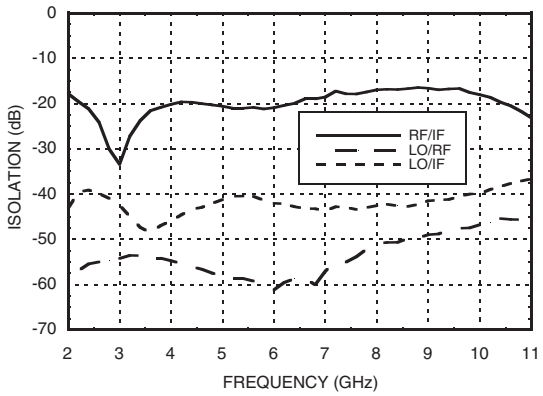

### Conversion Gain vs. LO Drive, LSB IF Frequency = 1100 MHz



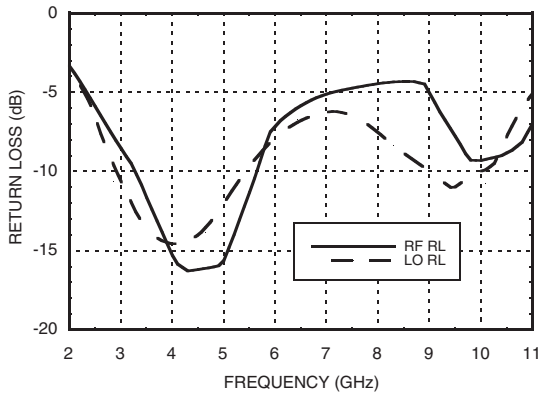

### Conversion Loss vs. LO Drive, LSB IF Frequency = 3100 MHz



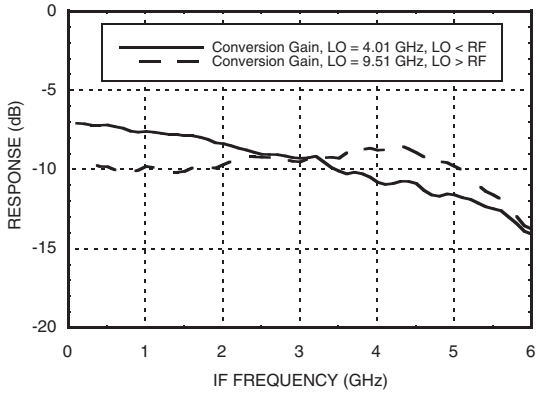

### Isolation @ LO = +17 dBm



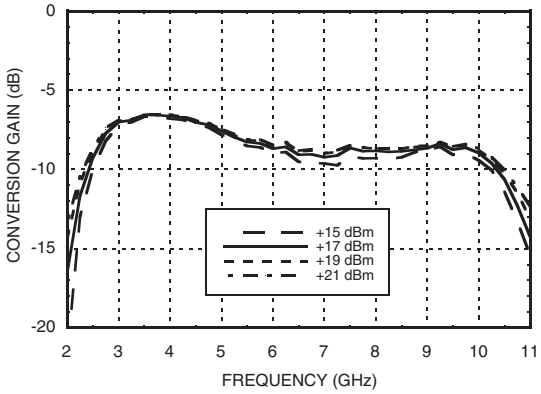

### Return Loss @ LO = +17 dBm



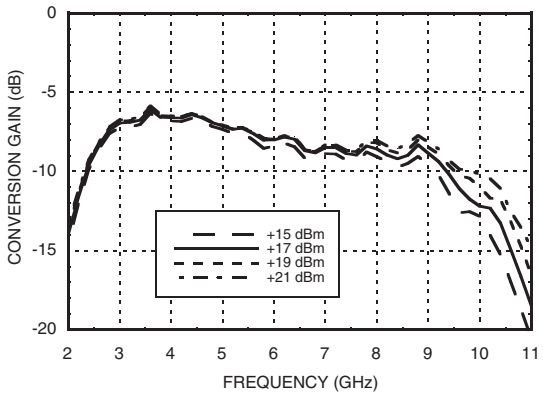
### IF Bandwidth @ LO = +17 dBm



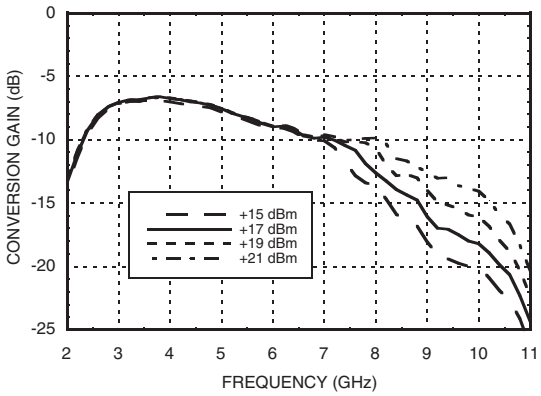

### Upconverter Performance Conversion Gain vs. LO Drive, IF Frequency 100 MHz



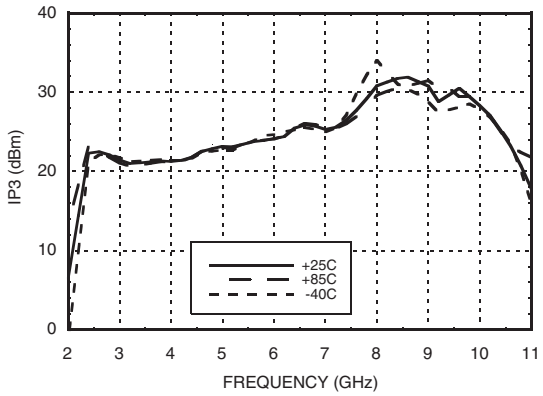

### Upconverter Performance Conversion Gain vs. LO Drive LSB, IF Frequency 1100 MHz



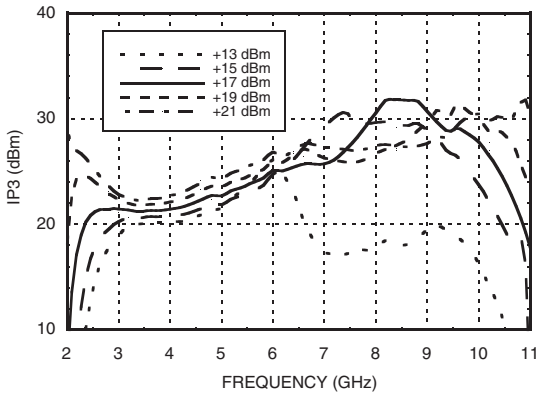

### Upconverter Performance Conversion Gain vs. LO Drive LSB, IF Frequency 3100 MHz




### Input IP3 vs. Temperature @ LO = +17 dBm *, IF Frequency = 100 MHz

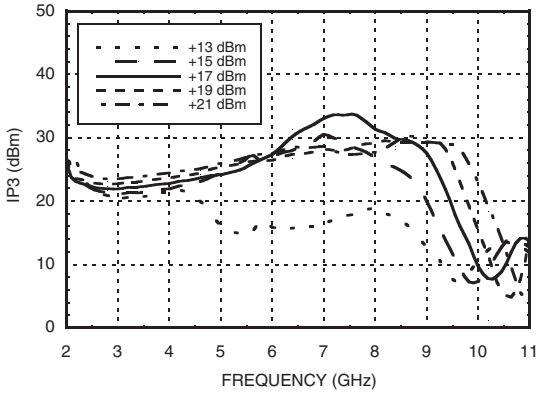



### Input IP3 vs. LO Drive*, IF Frequency = 100 MHz

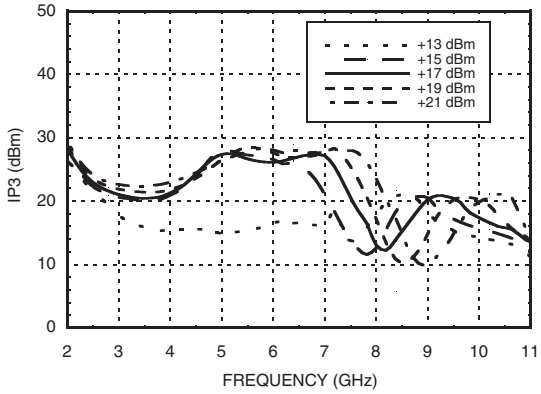



** Two-tone input power = -10 dBm each tone, 1 MHz spacing.*

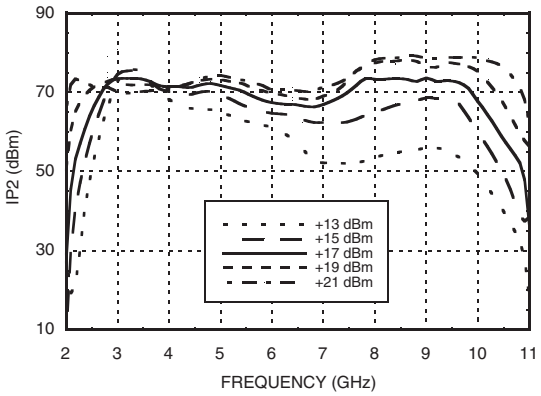
### Input IP3 vs. LO Drive* LSB, IF Frequency = 1100 MHz



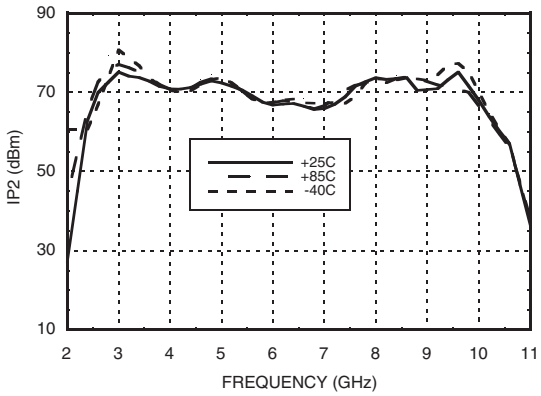

### Input IP3 vs. LO Drive* LSB, IF Frequency = 3100 MHz



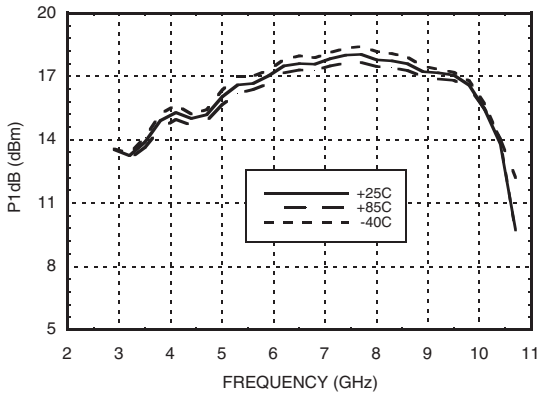

### Input IP2 vs. LO Drive *




### Input IP2 vs. Temperature @ LO = +17 dBm *




### Input P1dB vs. Temperature @ LO = +17 dBm




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

### MxN Spurious Outputs

| | nLO | | | | |
|---|---|---|---|---|---|
| mRF | 0 | 1 | 2 | 3 | 4 |
| 0 | xx | 16 | 38 | 34 | 54 |
| 1 | 23 | 0 | 37 | 23 | 38 |
| 2 | 92 | 73 | 89 | 71 | 85 |
| 3 | 77 | 66 | 68 | 62 | 71 |
| 4 | xx | xx | xx | 108 | 115 |

RF = 3.1 GHz @ -5 dBm
LO = 3 GHz @ +17 dBm
All values in dBc below the IF output power level.

### MxN Spurious Outputs

| | nLO | | | | |
|---|---|---|---|---|---|
| mRF | 0 | 1 | 2 | 3 | 4 |
| 0 | xx | 13 | 34 | 55 | 73 |
| 1 | 24 | 0 | 32 | 41 | 68 |
| 2 | 86 | 72 | 86 | 80 | 102 |
| 3 | 80 | 58 | 94 | 83 | 99 |
| 4 | xx | xx | xx | xx | xx |

RF = 3.1 GHz @ -5 dBm
LO = 6.1 GHz @ +17 dBm
All values in dBc below the IF output power level.

### MxN Spurious Outputs

| | nLO | | | | |
|---|---|---|---|---|---|
| mRF | 0 | 1 | 2 | 3 | 4 |
| 0 | xx | 15 | 37 | 29 | 49 |
| 1 | 12 | 0 | 29 | 14 | 49 |
| 2 | 89 | 77 | 89 | 78 | 97 |
| 3 | 103 | 85 | 102 | 83 | 88 |
| 4 | 107 | xx | xx | xx | xx |

RF = 6.1 GHz @ -5 dBm
LO = 3.1 GHz @ +17 dBm
All values in dBc below the IF output power level.

### MxN Spurious Outputs

| | nLO | | | | |
|---|---|---|---|---|---|
| mRF | 0 | 1 | 2 | 3 | 4 |
| 0 | xx | 11 | 33 | 56 | 61 |
| 1 | 11 | 0 | 32 | 54 | 59 |
| 2 | 88 | 69 | 79 | 67 | 93 |
| 3 | 105 | 101 | 84 | 72 | 89 |
| 4 | 108.45 | xx | xx | xx | xx |

RF = 6.1 GHz @ -5 dBm
LO = 6 GHz @ +17 dBm
All values in dBc below the IF output power level.

### MxN Spurious Outputs

| | nLO | | | | |
|---|---|---|---|---|---|
| mRF | 0 | 1 | 2 | 3 | 4 |
| 0 | xx | 11 | 27 | 45 | 60 |
| 1 | 7 | 0 | 45 | 43 | 61 |
| 2 | 91 | 74 | 82 | 87 | 96 |
| 3 | 105 | 89 | 99 | 83 | 85 |
| 4 | xx | xx | xx | xx | xx |

RF = 10.1 GHz @ -5 dBm
LO = 7.1 GHz @ +17 dBm
All values in dBc below the IF output power level.

### MxN Spurious Outputs

| | nLO | | | | |
|---|---|---|---|---|---|
| mRF | 0 | 1 | 2 | 3 | 4 |
| 0 | xx | 7 | 35 | 47 | 69 |
| 1 | 7 | 0 | 27 | 55 | 84 |
| 2 | 91 | 76 | 83 | 73 | 105 |
| 3 | 109 | 98 | 87 | 80 | 88 |
| 4 | xx | xx | xx | xx | 86 |

RF = 10.1 GHz @ -5 dBm
LO = 10 GHz @ +17 dBm
All values in dBc below the IF output power level.

## Absolute Maximum Ratings

| | |
|---|---|
| RF / IF Input | +26 dBm |
| LO Drive | +26 dBm |
| Channel Temperature | 150 °C |
| Continuous Pdiss (T = 85 °C) (derate 11.4 mW/°C above 85 °C) | 0.74 mW |
| Thermal Resistance (channel to ground paddle) | 87.7 °C/W |
| Storage Temperature | -65 to +150 °C |
| Operating Temperature | -40 to +85 °C |

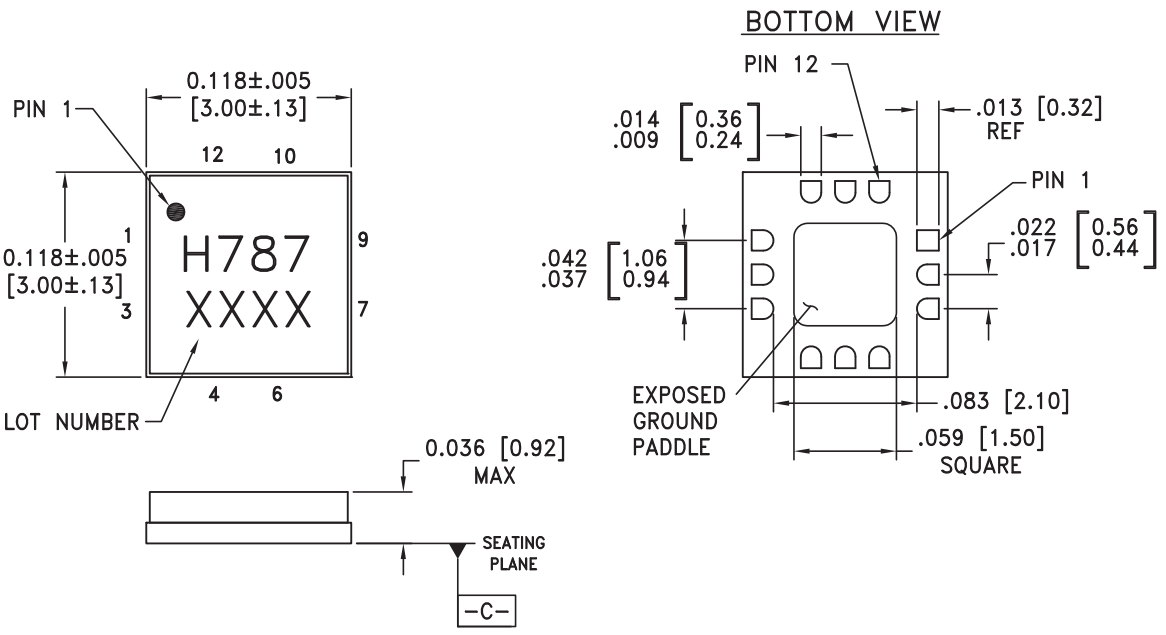
## Harmonics of LO

| | nLO Spur @ RF Port | | | |
|---|---|---|---|---|
| LO Freq. (GHz) | 1 | 2 | 3 | 4 |
| 3 | 56 | 53 | 71 | 73 |
| 6 | 61 | 58 | 77 | 87 |
| 10 | 46 | 62 | 84 | 73 |

LO = +17 dBm
All values in dBc below input LO level measured at RF port.

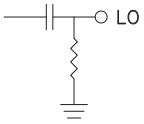
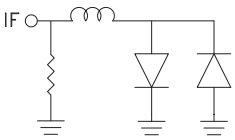
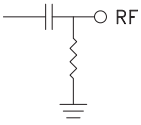
ELECTROSTATIC SENSITIVE DEVICE
OBSERVE HANDLING PRECAUTIONS

## Outline Drawing

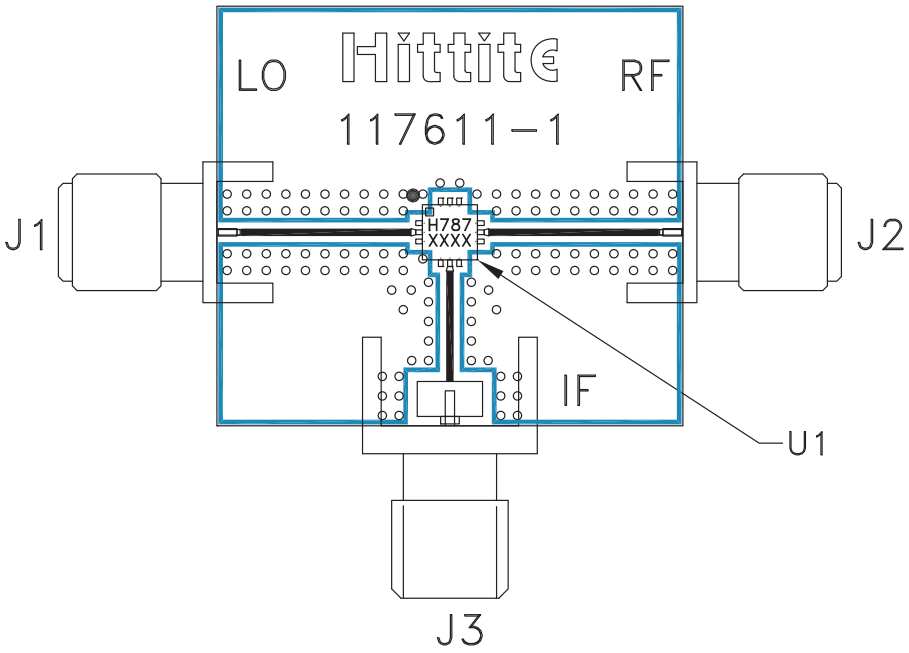



NOTES:
1. PACKAGE BODY MATERIAL: ALUMINA.
2. LEAD AND GROUND PADDLE PLATING:
   30-80 MICROINCHES GOLD OVER 50 MICROINCHES MINIMUM NICKEL.
3. DIMENSIONS ARE IN INCHES (MILLIMETERS).
4. LEAD SPACING TOLERANCE IS NON-CUMULATIVE.
5. CHARACTERS TO BE HELVETICA MEDIUM, .025 HIGH, BLACK INK, OR LASER MARK LOCATED APPROX. AS SHOWN.
6. PACKAGE WARP SHALL NOT EXCEED 0.05MM DATUM – C –
7. ALL GROUND LEADS AND GROUND PADDLE MUST BE SOLDERED TO PCB RF GROUND.
8. CLASSIFIED AS MOISTURE SENSITIVITY LEVEL (MSL) 1.

## Pin Descriptions

| Pin Number | Function | Description | Interface Schematic |
|---|---|---|---|
| 1, 3, 4, 6, 7, 9 | GND | Package bottom must also be connected to RF/DC ground. |   |
| 2 | LO | This pin is DC coupled and matched to 50 Ohms. |   |
| 5 | 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 or sink more than 8 mA of current or part non-function and possible part failure will result. |   |
| 8 | RF | This pin is DC coupled and matched to 50 Ohms. |   |
| 10, 11, 12 | N/C | The pins are not connected internally; however, all data shown herein was measured with these pins connected to RF/DC ground externally. | |

### Evaluation PCB




### List of Materials for Evaluation PCB 109952 [1]

| Item | Description |
|---|---|
| J1 - J2 | SRI SMA Connector |
| J3 | Johnson SMA Connector |
| U1 | HMC787LC3B Mixer |
| PCB [2] | 117611 Evaluation PCB |

[1] Reference this number when ordering complete evaluation PCB

[2] Circuit Board Material: Arlon 25 RF

The circuit board used in this 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.