

## HIGH IP3 GaAs MMIC MIXER with INTEGRATED LO AMPLIFIER, 1.7 - 2.2 GHz

### Typical Applications

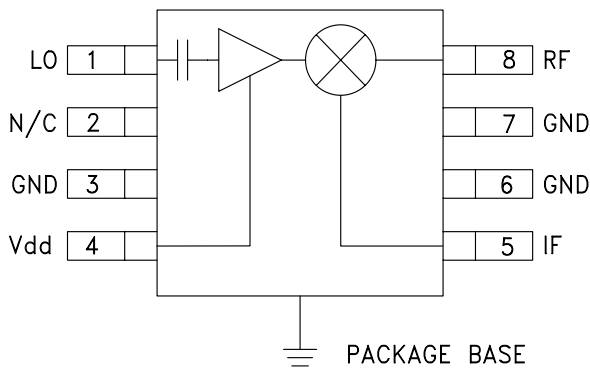
High Dynamic Range Infrastructure:

- GSM, GPRS & EDGE
- CDMA & W-CDMA
- Cable Modem Termination Systems

### Features

- +34 dBm Input IP3
- Conversion Loss: 9 dB
- Low LO Drive: -2 to +4 dBm
- Single Positive Supply: 5V @ 45 mA
- Ultra Small MSOP Package: 14.8mm<sup>2</sup>

### Functional Diagram



### General Description

The HMC485MS8G is a high dynamic range passive MMIC mixer with an integrated LO amplifier in a plastic surface mount 8 lead Mini Small Outline Package (MSOP) covering 1.7 to 2.2 GHz. Excellent input IP3 performance of +34 dBm for down conversion and +27 dBm for up conversion is provided for 2.5G & 3G GSM/CDMA based UMTS or PCS applications at an LO drive of 0 dBm. With an input 1 dB compression of +19 dBm, the RF port will accept a wide range of input signal levels. Conversion loss is 9.2 dB typical. The 50 to 300 MHz IF frequency response will satisfy many UMTS/PCS transmit or receive frequency plans configured for low side LO. The HMC485MS8G input IP3 performance coupled with its high P1dB rivals traditional active FET mixers while offering a much smaller 14.8mm<sup>2</sup> standard IC footprint.

### Electrical Specifications, $T_A = +25^\circ\text{C}$ , LO = 0 dBm, IF = 200 MHz\*, Vdd = 5V

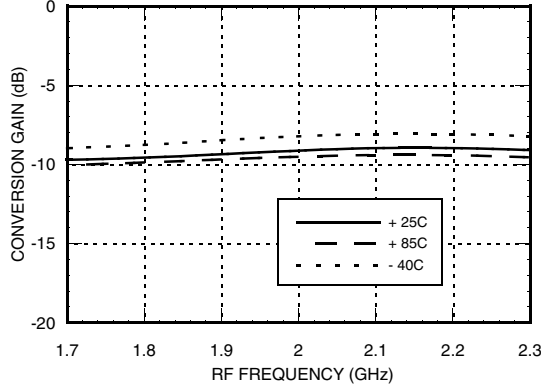
| Parameter                      | Min. | Typ.       | Max. | Min.       | Typ. | Max. | Min.       | Typ. | Max. | Units |
|--------------------------------|------|------------|------|------------|------|------|------------|------|------|-------|
| Frequency Range, RF            |      | 1.7 - 1.8  |      | 1.8 - 2.0  |      |      | 2.0 - 2.2  |      |      | GHz   |
| Frequency Range, LO            |      | 1.4 - 1.75 |      | 1.5 - 1.95 |      |      | 1.7 - 2.15 |      |      | GHz   |
| Frequency Range, IF            |      | 50 - 300   |      | 50 - 300   |      |      | 50 - 300   |      |      | MHz   |
| Conversion Loss                |      | 9.8        | 11   |            | 9.2  | 10.5 |            | 9    | 10   | dB    |
| Noise Figure (SSB)             |      | 9.8        |      |            | 9.2  |      |            | 9    |      | dB    |
| LO to RF Isolation             |      | 12         |      |            | 8    |      |            | 5    |      | dB    |
| LO to IF Isolation             |      | 7          |      |            | 10   |      |            | 13   |      | dB    |
| IP3 (Input)                    | 27   | 31         |      | 29         | 34   |      | 29         | 33   |      | dBm   |
| 1 dB Gain Compression (Input)  | 16   | 19         |      | 17         | 20   |      | 17         | 21   |      | dBm   |
| LO Input Drive Level (Typical) |      | -2 to +4   |      | -2 to +4   |      |      | -2 to +4   |      |      | dBm   |
| Supply Current                 |      | 45         |      |            | 45   |      |            | 45   |      | mA    |

\*Unless otherwise noted, all measurements performed as a downconverter, with low side LO & IF = 200 MHz.

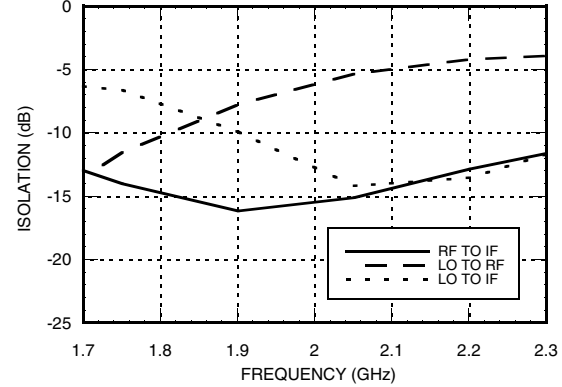
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## HIGH IP3 GaAs MMIC MIXER with INTEGRATED LO AMPLIFIER, 1.7 - 2.2 GHz

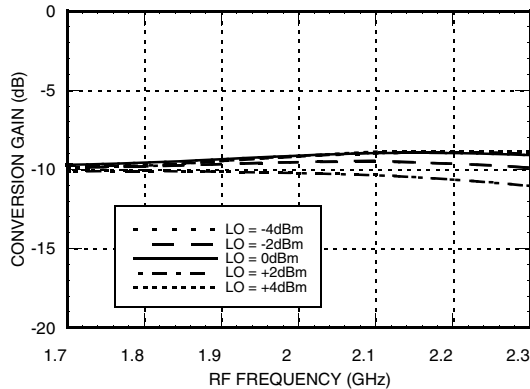
**Conversion Gain vs. Temperature @ LO = 0 dBm**



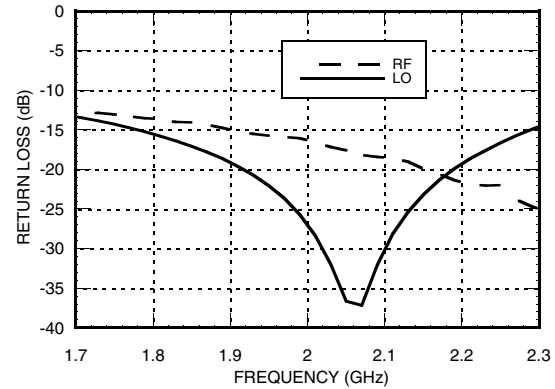
**Isolation @ LO = 0 dBm**



**Conversion Gain vs. LO Drive**

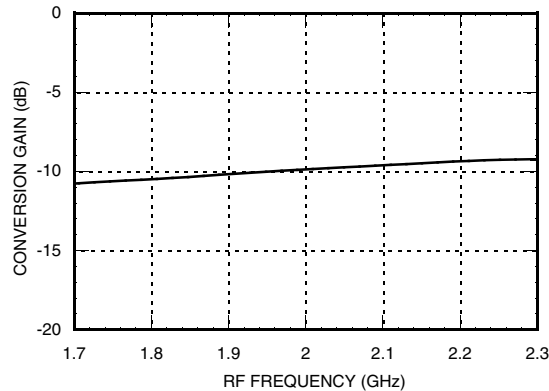


**Return Loss @ LO = 0 dBm**

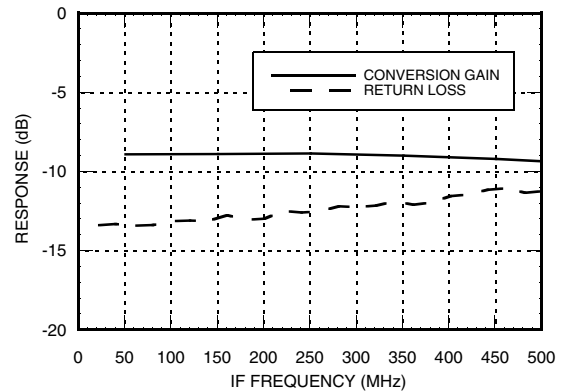


**Upconverter Performance**

**Conversion Gain @ LO = 0 dBm**



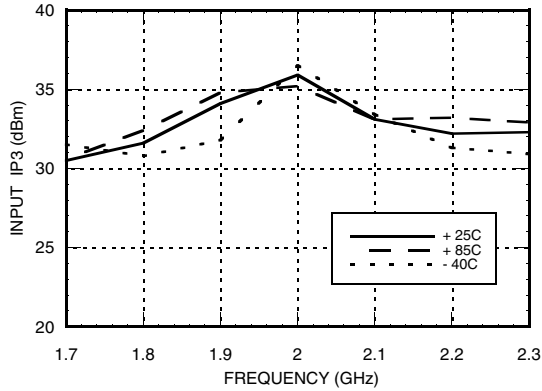
**IF Bandwidth @ LO = 0 dBm**



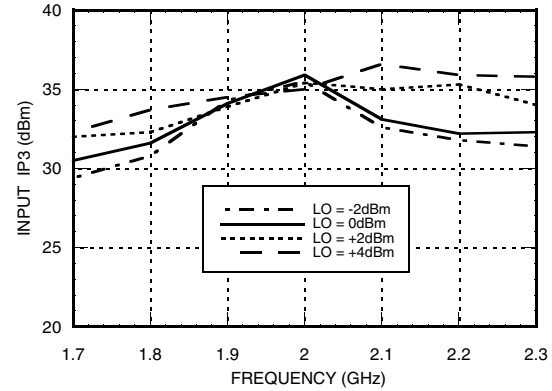
\*Unless otherwise noted, all measurements performed as a downconverter, with low side LO & IF = 200 MHz.

## HIGH IP3 GaAs MMIC MIXER with INTEGRATED LO AMPLIFIER, 1.7 - 2.2 GHz

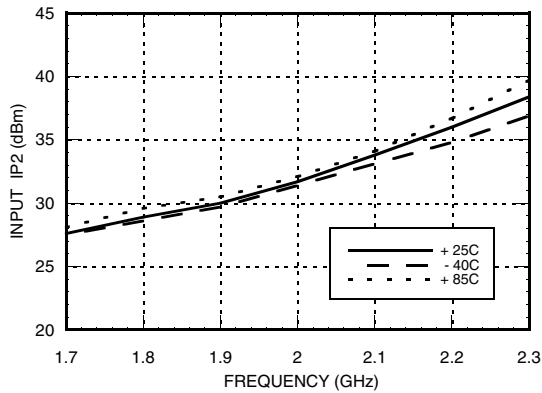
**Input IP3 vs. Temperature @ LO= 0 dBm**



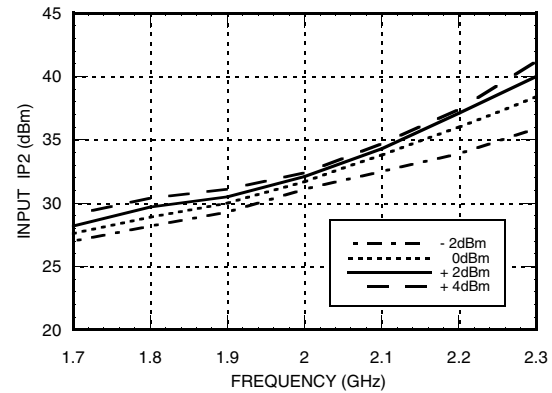
**Input IP3 vs. LO Drive**



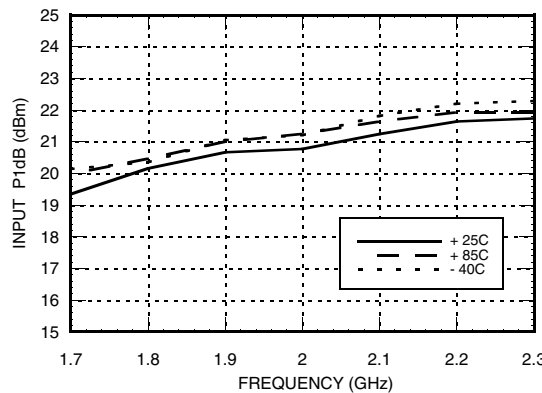
**Input IP2 vs. Temperature @ LO= 0 dBm**



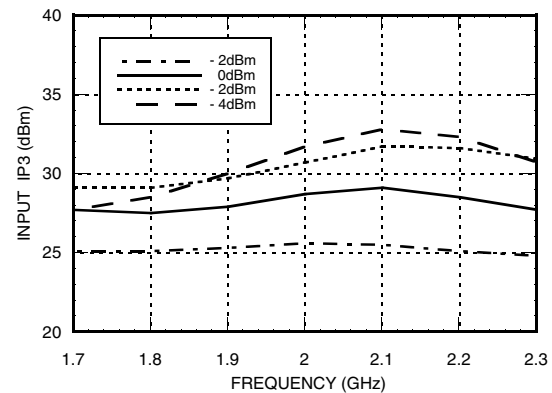
**Input IP2 vs. LO Drive @ IF= 200 MHz**



**Input P1dB vs. Temperature @ LO= 0 dBm**

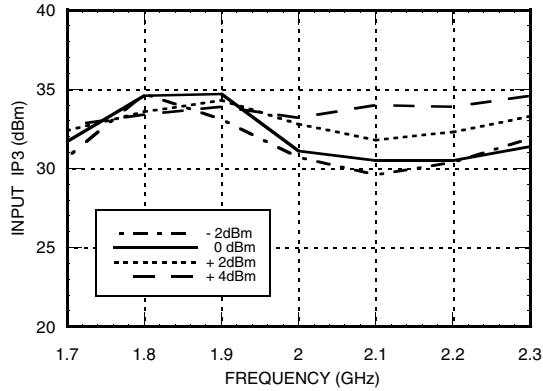


**Upconverter IP3 vs. LO Drive, IF= 200 MHz**

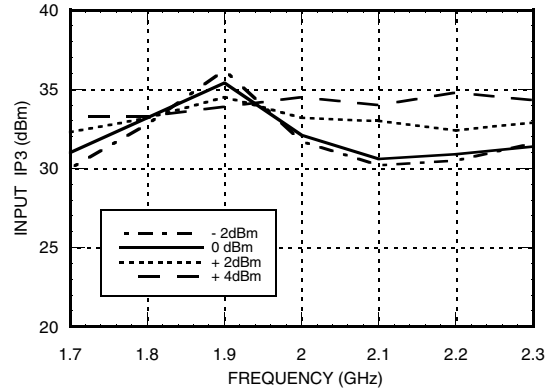


## HIGH IP3 GaAs MMIC MIXER with INTEGRATED LO AMPLIFIER, 1.7 - 2.2 GHz

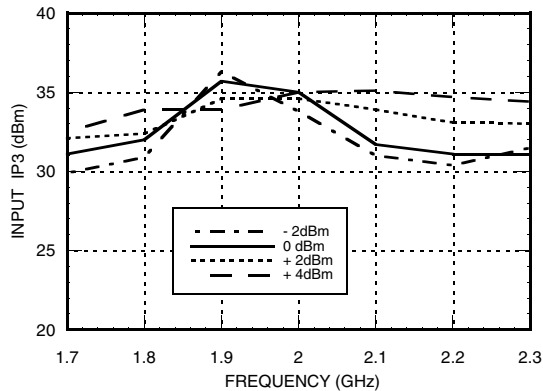
**Input IP3 vs. LO Drive, IF= 70 MHz**



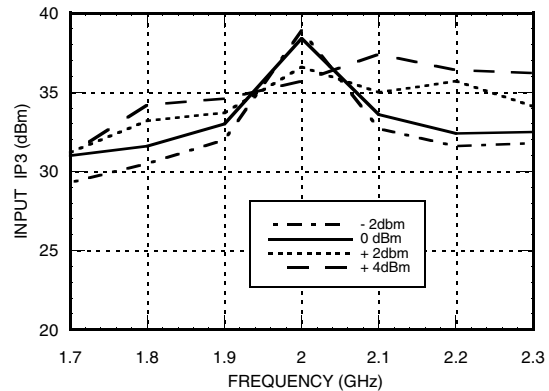
**Input IP3 vs. LO Drive, IF= 120 MHz**



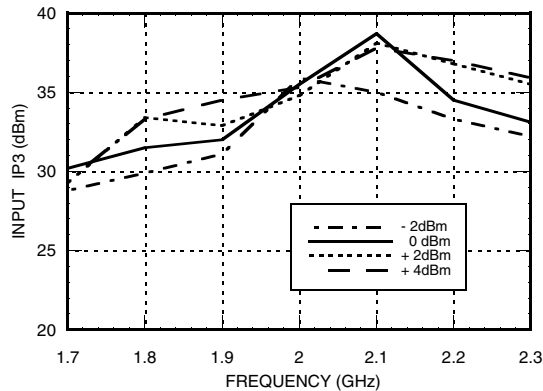
**Input IP3 vs. LO Drive, IF= 170 MHz**



**Input IP3 vs. LO Drive, IF= 247 MHz**



**Input IP3 vs. LO Drive, IF= 297 MHz**



## HIGH IP3 GaAs MMIC MIXER with INTEGRATED LO AMPLIFIER, 1.7 - 2.2 GHz

### MxN Spurious Outputs

| mRF | nLO |     |    |    |    |
|-----|-----|-----|----|----|----|
|     | 0   | 1   | 2  | 3  | 4  |
| 0   | xx  | -1. | 19 | 15 | 15 |
| 1   | 4   | 0   | 30 | 25 | 44 |
| 2   | 54  | 69  | 39 | 56 | 55 |
| 3   | 75  | 82  | 83 | 74 | 72 |
| 4   | 78  | 82  | 83 | 83 | 82 |

RF Freq = 1.9 GHz @ 0dBm  
LO Freq = 1.7 GHz @ 0 dBm  
All values in dBc Relative to the IF power level.

### Harmonics of LO

| LO Freq GHz | nLO Spur at RF Port |    |    |    |
|-------------|---------------------|----|----|----|
|             | 1                   | 2  | 3  | 4  |
| 1.5         | 19                  | 15 | 35 | 24 |
| 1.6         | 17                  | 15 | 33 | 24 |
| 1.7         | 14                  | 14 | 29 | 23 |
| 1.8         | 10                  | 15 | 25 | 24 |
| 1.9         | 8                   | 20 | 22 | 23 |
| 2           | 6                   | 20 | 22 | 24 |

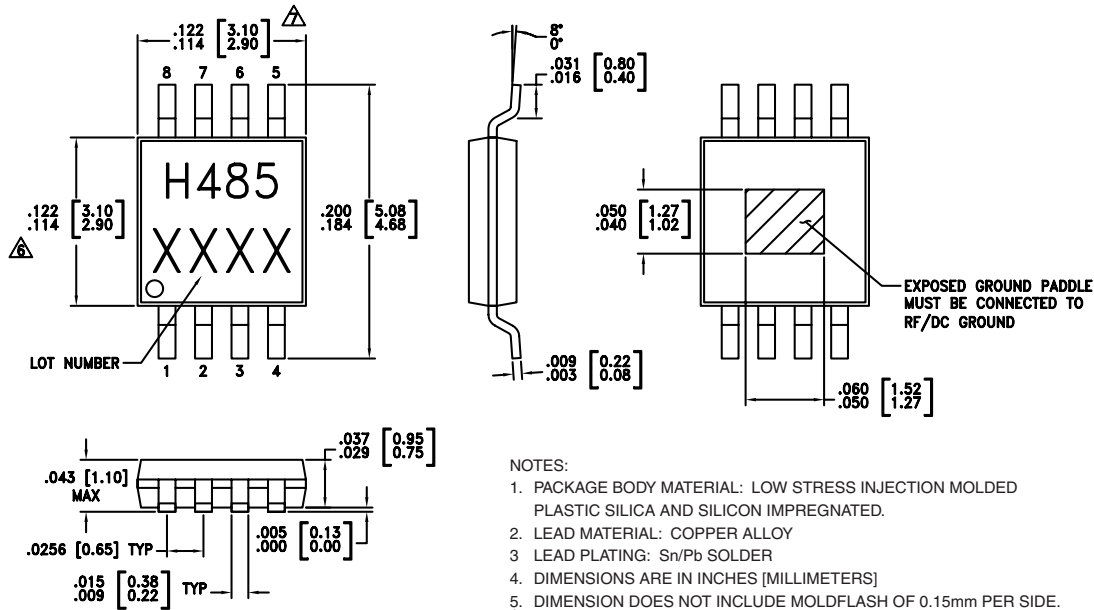
LO power = 0dBm  
All values in dBc below input LO level measured at RF port.

## HIGH IP3 GaAs MMIC MIXER with INTEGRATED LO AMPLIFIER, 1.7 - 2.2 GHz

### Absolute Maximum Ratings

|   |                |
|---|----------------|
| RF/IF Input   | +27 dBm        |
| LO Drive  | +10 dBm        |
| Bias Supply (Vdd)   | +7 Vdc         |
| Channel Temperature   | 150 °C         |
| Continuous Pdiss (T = 85°C)<br>(Derate 13.2 mW/°C above 85°C) | 0.85 W         |
| Storage Temperature   | -65 to +150 °C |
| Operating Temperature   | -40 to +85 °C  |
| IF DC Current   | ±40 mA         |

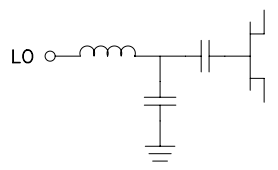

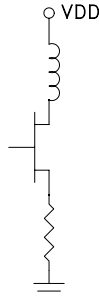
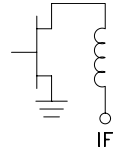
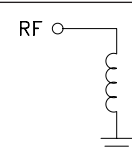
### Outline Drawing



- NOTES:
1. PACKAGE BODY MATERIAL: LOW STRESS INJECTION MOLDED PLASTIC SILICA AND SILICON IMPREGNATED.
  2. LEAD MATERIAL: COPPER ALLOY
  3. LEAD PLATING: Sn/Pb SOLDER
  4. DIMENSIONS ARE IN INCHES [MILLIMETERS]
  5. DIMENSION DOES NOT INCLUDE MOLDFLASH OF 0.15mm PER SIDE.
- ⚠ DIMENSION DOES NOT INCLUDE MOLDFLASH OF 0.25mm PER SIDE.
- ⚠ ALL GROUND LEADS AND GROUND PADDLE MUST BE SOLDERED TO THE PCB RF GROUND

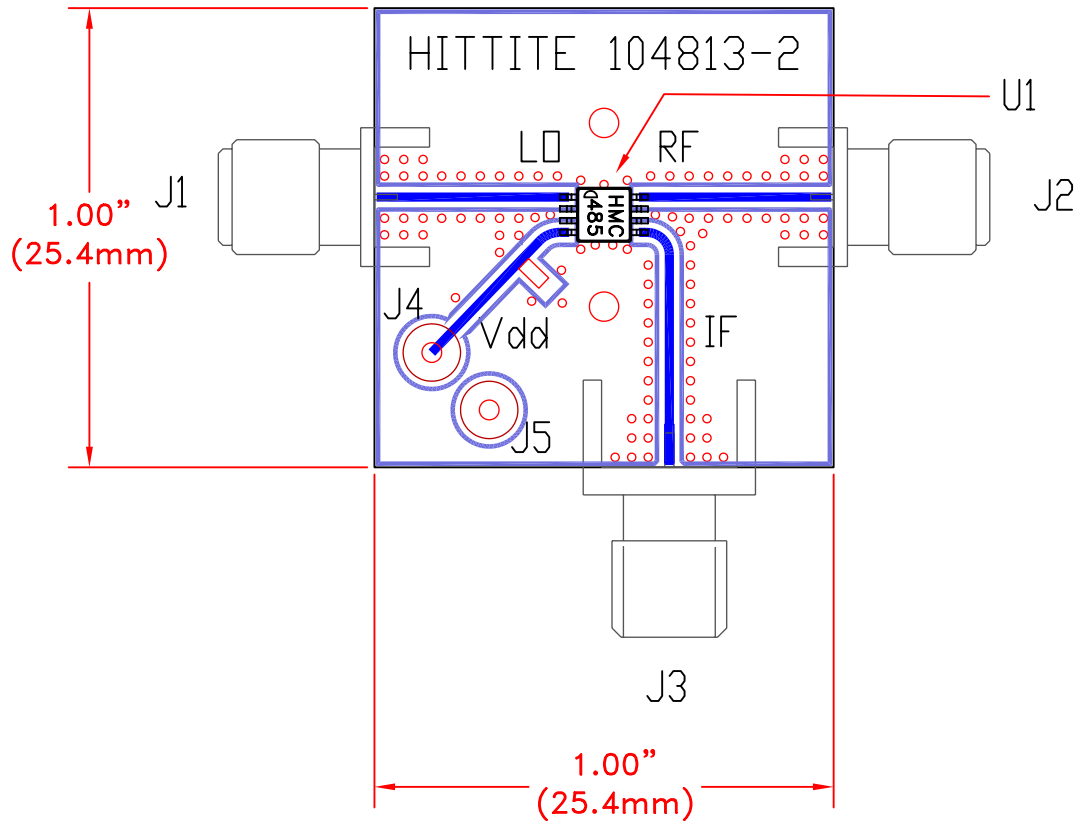
## HIGH IP3 GaAs MMIC MIXER with INTEGRATED LO AMPLIFIER, 1.7 - 2.2 GHz

### Pin Descriptions

| Pin Number | Function | Description   | Interface Schematic   |
|------------|----------|---|---|
| 1          | LO       | This pin is AC coupled & matched to 50 Ohms from 1.4 to 2.2 GHz.  |    |
| 2          | N/C      | Not connected.  |   |
| 3, 6, 7    | GND      | This pin must be connected to RF ground.  |    |
| 4          | Vdd      | Power supply for LO amplifier.<br>An external RF bypass capacitor is required.  |   |
| 5          | IF Port  | This pin is DC coupled. For applications not requiring operation to DC this port should be DC blocked externally using a series capacitor. Choose value of capacitor to pass IF frequency desired. For operation to DC, this pin must not sink/source more than 40 mA of current or failure may result. |  |
| 8          | RF Port  | This pin is DC coupled & matched to 50 Ohm from 1.7 to 2.2 GHz  |  |

## HIGH IP3 GaAs MMIC MIXER with INTEGRATED LO AMPLIFIER, 1.7 - 2.2 GHz

### Evaluation PCB



### List of Material

| Item                                  | Description                          |
|---------------------------------------|--------------------------------------|
| J1 - J3                               | PC Mount SMA RF Connector            |
| J4 - J5                               | DC Pin                               |
| C1                                    | 10,000 pF Chip Capacitor, 0603 Pkg.  |
| U1                                    | HMC485MS8G Mixer                     |
| PCB*                                  | 104813 Evaluation Board, 1.0" x 1.0" |
| * 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.