

## GaAs MMIC DOUBLE-BALANCED MIXER 3.5 - 8 GHz

### Typical Applications

The HMC218BMS8GE is ideal for:

- Base stations, Repeaters & Access Points
- WiMAX, WiBro & Fixed Wireless
- Portables & Subscribers
- PLMR, Public Safety & Telematics

### Features

Passive Double-Balanced Topology

Input IP3: +17 dBm

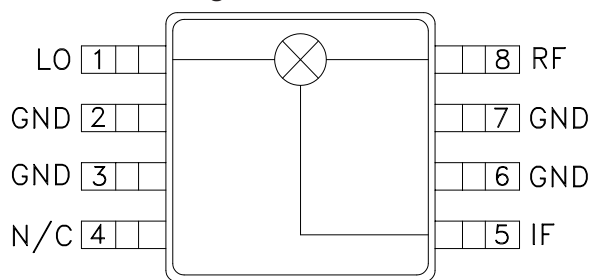
Low Conversion Loss: 7 dB

LO to RF Isolation: 38 dB

LO to IF Isolation: 32 dB

Up-converter & Down-converter Applications

### Functional Diagram



### General Description

The HMC218BMS8GE is an ultra miniature double-balanced mixers in an 8 lead plastic surface mount packages (MSOP). This passive MMIC mixer is constructed of GaAs Schottky diodes and novel planar transformer baluns on the chip. The device can be used as an up-converter, down-converter, bi-phase modulator / demodulator, or phase comparator. This mixer performs well when used as a down-converter from 3.5 to 8 GHz and as an up-converter from 4.5 to 8 GHz. The low conversion loss, high isolation and wide IF bandwidth make this mixer ideal for a variety of Rx and Tx frequency plans.

### Electrical Specifications, $T_A = +25^\circ\text{C}$ , IF = 100 MHz, LO = +13 dBm, LSB <sup>[1]</sup>

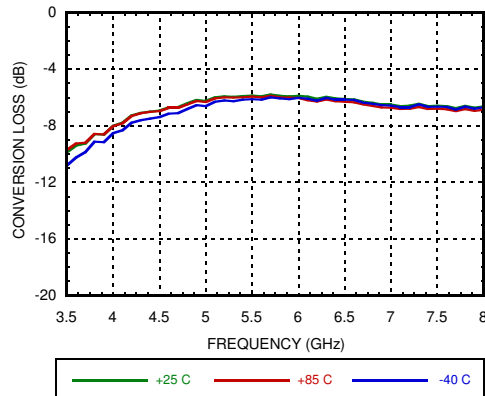
| Parameter                     | Min. | Typ.      | Max. | Min.     | Typ. | Max. | Min.     | Typ. | Max. | Units |
|-------------------------------|------|-----------|------|----------|------|------|----------|------|------|-------|
| Frequency Range, RF           |      | 3.5 - 4.5 |      | 4.5 - 6  |      |      | 6 - 8    |      |      | GHz   |
| Frequency Range, LO           |      | 3.5 - 4.5 |      | 4.5 - 6  |      |      | 6 - 8    |      |      | GHz   |
| Frequency Range, IF           |      | DC - 1.6  |      | DC - 1.6 |      |      | DC - 1.6 |      |      | GHz   |
| Conversion Loss               |      | 9         | 12.5 |          | 7    | 8.5  |          | 7    |      | dB    |
| IP3 (Input)                   | 10   | 13        |      | 12.5     | 17   |      |          | 17   |      | dBm   |
| IP2 (Input)                   |      | 45        |      |          | 45   |      |          | 45   |      | dBm   |
| 1 dB Gain Compression (Input) |      | 10        |      |          | 10   |      |          | 11   |      | dBm   |
| LO to RF Isolation            |      | 42        |      |          | 38   |      |          | 36   |      | dB    |
| LO to IF Isolation            | 20   | 30        |      | 15       | 32   |      |          | 40   |      | dB    |

[1] Unless otherwise noted, all measurements performed as down-converter with high side LO, IF = 100 MHz, RFIN = -10 dBm

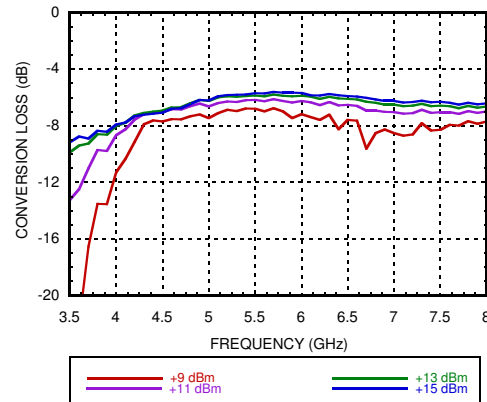
# GaAs MMIC DOUBLE-BALANCED MIXER 3.5 - 8 GHz

## High Side LO, Down-converter Performance, IF = 100 MHz

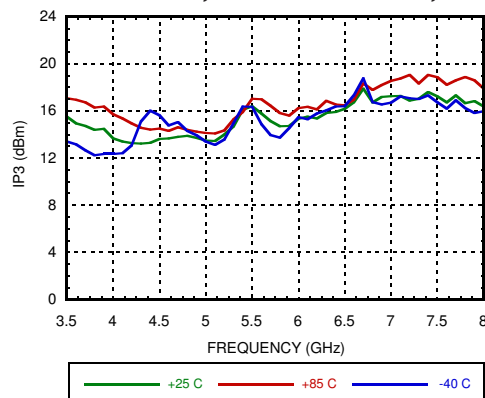
**Conversion Loss vs. Temperature**  
LO = +13 dBm, RFIN = -10 dBm, LSB



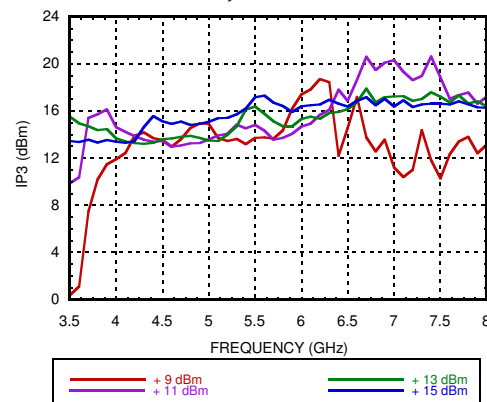
**Conversion Loss vs. LO Drive**  
RFIN = -10 dBm, LSB



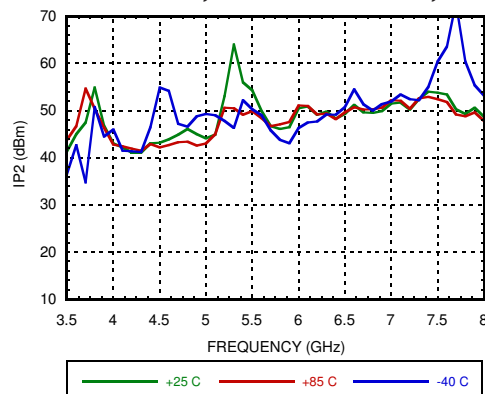
**Input IP3 vs. Temperature**  
LO = +13 dBm, RFIN = -10 dBm, LSB



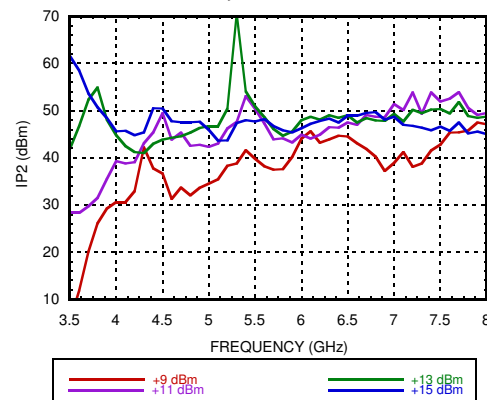
**Input IP3 vs. LO Drive**  
RFIN = -10 dBm, LSB



**Input IP2 vs. Temperature**  
LO = +13 dBm, RFIN = -10 dBm, LSB



**Input IP2 vs. LO Drive**  
RFIN = -10 dBm, LSB

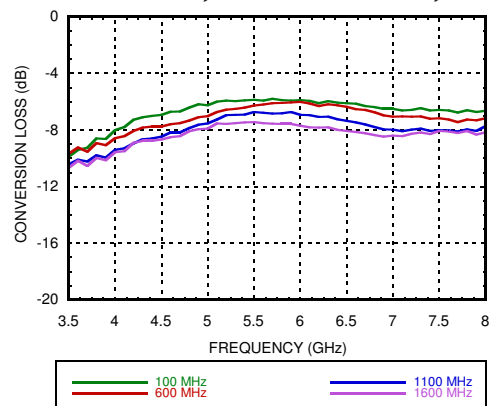


# GaAs MMIC DOUBLE-BALANCED MIXER 3.5 - 8 GHz

## High Side LO, Down-converter Performance, IF = 100 MHz

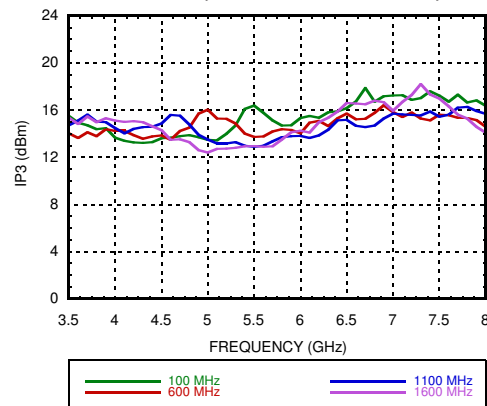
### Conversion Loss vs. IF

LO = +13 dBm, RFIN = -10 dBm, LSB



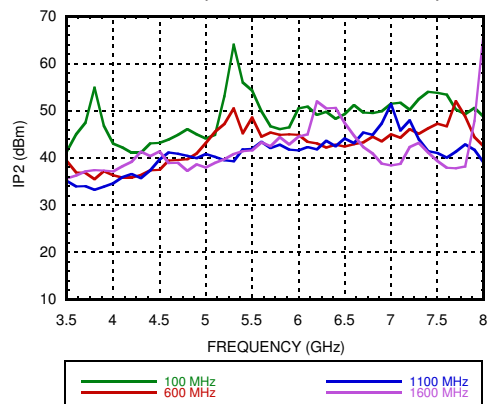
### Input IP3 vs. IF

LO = +13 dBm, RFIN = -10 dBm, LSB



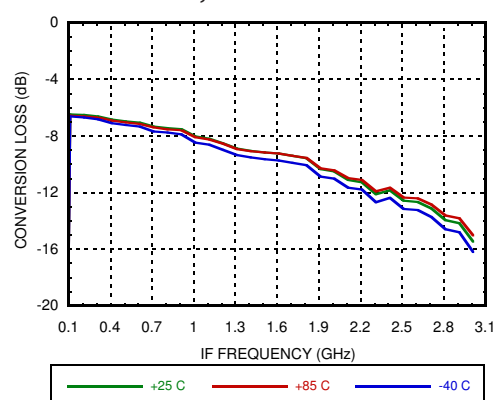
### Input IP2 vs. IF

LO = +13 dBm, RFIN = -10 dBm, LSB



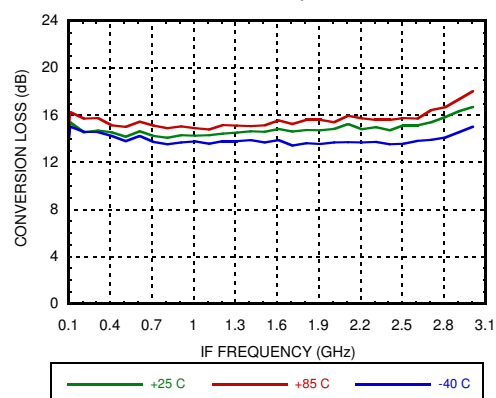
### Conversion Loss over IF Bandwidth

@ LO = 6 GHz, LO Power = +13 dBm, LSB



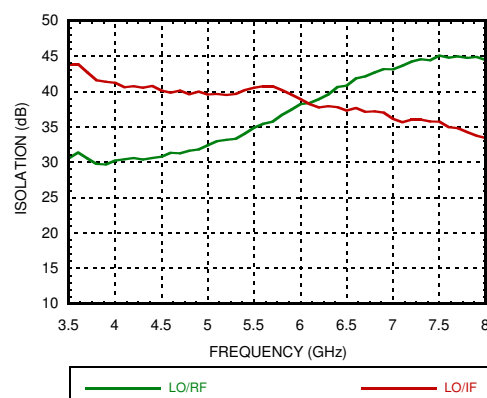
### Input IP3 over IF Bandwidth, LO = 6 GHz

LO Power = +13 dBm, LSB



### LO to RF and LO to IF Isolation

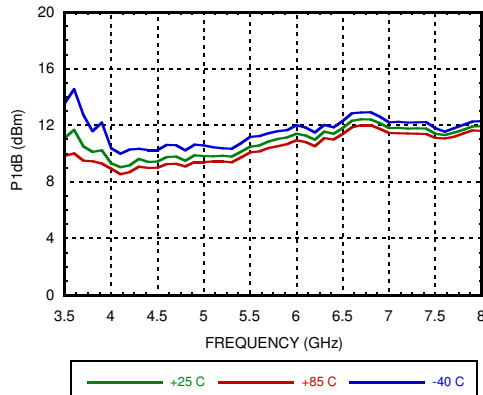
LO Power = +13 dBm



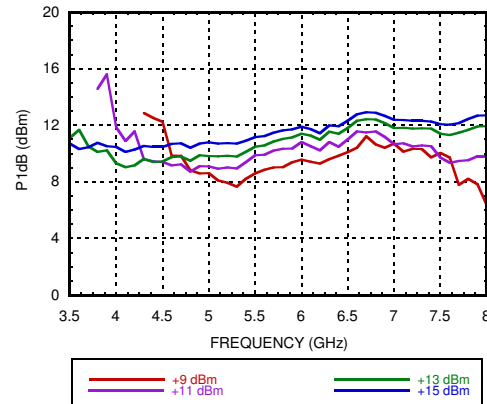
**GaAs MMIC DOUBLE-BALANCED MIXER**  
**3.5 - 8 GHz**

**High Side LO, Down-converter Performance, IF = 100 MHz**

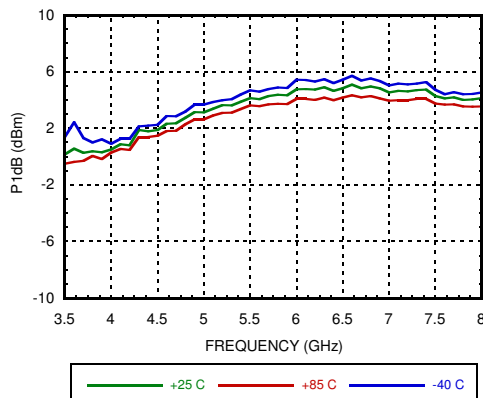
**Input P1dB vs. Temperature**  
LO Power = +13 dBm, IF = 100 MHz



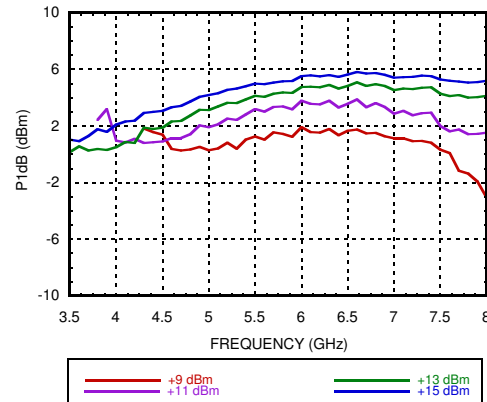
**Input P1dB vs. LO Power**  
IF = 100 MHz,



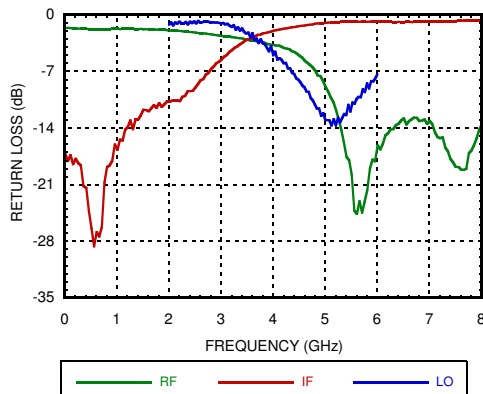
**Output P1dB vs. Temperature**  
LO Power = +13 dBm, IF = 100 MHz



**Output P1dB vs. LO Power**  
IF = 100 MHz



**RF, LO, IF Return Loss @ LO = 4.6GHz**  
LO Power = +13 dBm



**M x N Spurious Outputs, IF = 100 MHz**

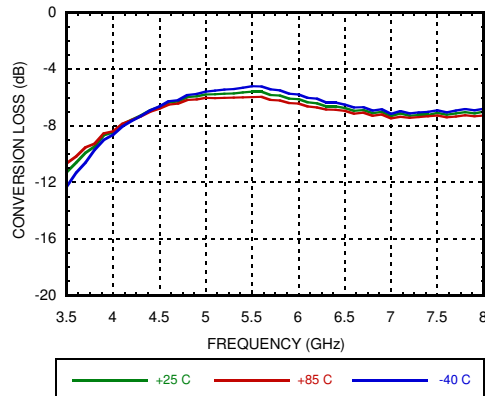
| mRF | nLO  |      |      |      |      |      |
|-----|------|------|------|------|------|------|
|     | 0    | 1    | 2    | 3    | 4    | 5    |
| 0   |      | 3.4  | 32.5 | 25.6 | 52.1 | 11.2 |
| 1   | 13.4 |      | 31.9 | 57.7 | 45.3 | 54.2 |
| 2   | 67.3 | 45.9 | 60.5 | 51.6 | 76.3 | 72.1 |
| 3   | 82.1 | 92.4 | 70.8 | 52   | 73.5 | 93.2 |
| 4   | 86.9 | 90.6 | 93.9 | 75.7 | 88.6 | 82.3 |
| 5   | 84   | 89.2 | 88.3 | 93.4 | 96   | 78.2 |

RF = 5.15 GHz @ -10 dBm  
LO = 5.25 GHz @ +13 dBm  
All values in dBc below IF power level (LO - RF) LSB  
Spur values are (M x RF) - (N x LO)

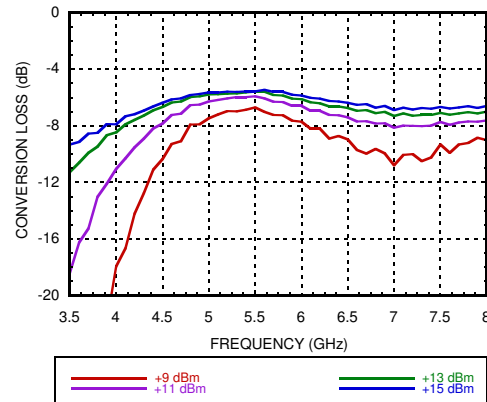
# GaAs MMIC DOUBLE-BALANCED MIXER 3.5 - 8 GHz

## Low Side LO, Up-converter Performance, IF = 100 MHz

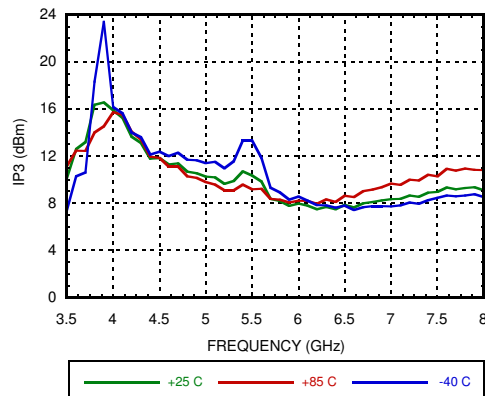
**Conversion Loss vs. Temperature**  
LO = +13 dBm, RFIN = -10 dBm, USB



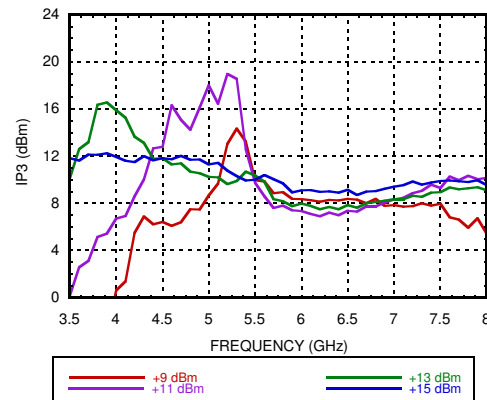
**Conversion Loss vs. LO Drive**  
RFIN = -10 dBm, USB



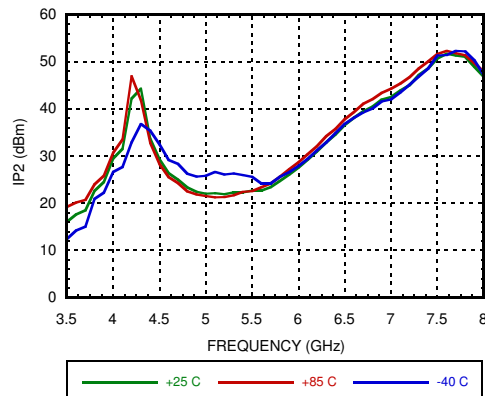
**Input IP3 vs. Temperature**  
LO = +13 dBm, RFIN = -10 dBm, USB



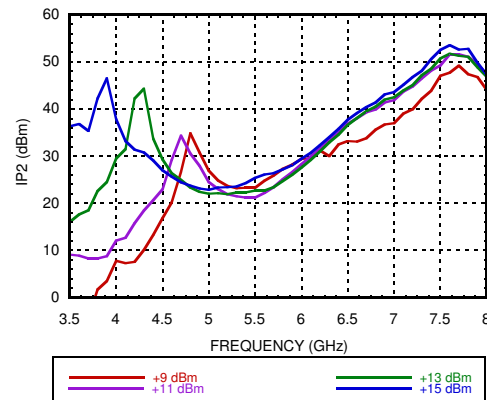
**Input IP3 vs. LO Drive**  
RFIN = -10 dBm, USB



**Input IP2 vs. Temperature**  
LO = +13 dBm, RFIN = -10 dBm, USB



**Input IP2 vs. LO Drive**  
RFIN = -10 dBm, USB

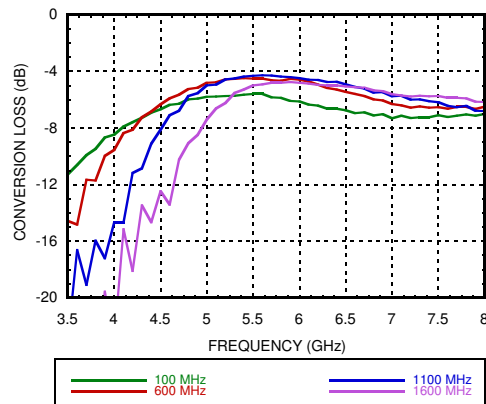


**GaAs MMIC DOUBLE-BALANCED MIXER**  
**3.5 - 8 GHz**

**Low Side LO, Up-converter Performance**

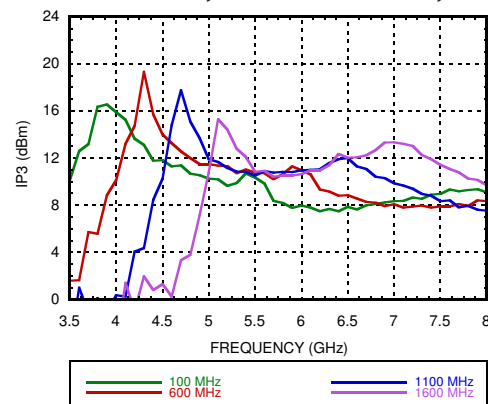
**Conversion Loss vs. IF**

**LO = +13 dBm, RFIN = -10 dBm, USB**



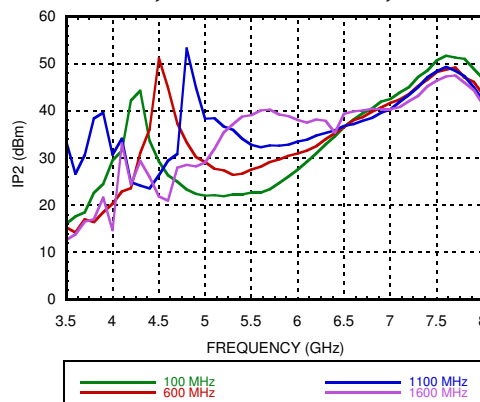
**Input IP3 vs. IF**

**LO = +13 dBm, RFIN = -10 dBm, USB**



**Input IP2 vs. IF**

**LO = +13 dBm, RFIN = -10 dBm, USB**



# GaAs MMIC DOUBLE-BALANCED MIXER 3.5 - 8 GHz

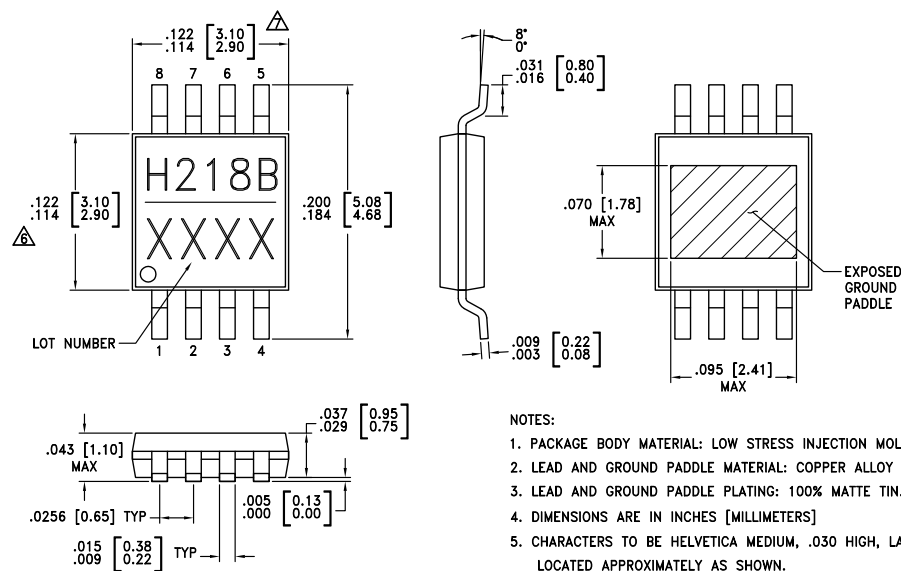
## Absolute Maximum Ratings

|                                                                |                   |
|----------------------------------------------------------------|-------------------|
| RF Power Input                                                 | +13 dBm           |
| LO Power                                                       | +27 dBm           |
| Channel Temperature                                            | 150 °C            |
| Thermal Resistance ( $R_{TH}$ )<br>(junction to ground paddle) | 120 °C/W          |
| Operating Temperature                                          | -40°C to +85°C    |
| Storage Temperature                                            | -65°C to 150°C    |
| ESD Sensitivity (HBM)                                          | 750 V (Class 1B)  |
| ESD Sensitivity (CDM)                                          | 1000 V (Class C5) |



**ELECTROSTATIC SENSITIVE DEVICE  
OBSERVE HANDLING PRECAUTIONS**

## Outline Drawing



### NOTES:

1. PACKAGE BODY MATERIAL: LOW STRESS INJECTION MOLDED PLASTIC. SILICA AND SILICON IMPREGNATED.
2. LEAD AND GROUND PADDLE MATERIAL: COPPER ALLOY
3. LEAD AND GROUND PADDLE PLATING: 100% MATTE TIN.
4. DIMENSIONS ARE IN INCHES [MILLIMETERS]
5. CHARACTERS TO BE HELVETICA MEDIUM, .030 HIGH, LASER OR WHITE INK, LOCATED APPROXIMATELY AS SHOWN.
6. DIMENSION DOES NOT INCLUDE MOLDFLASH OF 0.15mm PER SIDE.
7. DIMENSION DOES NOT INCLUDE MOLDFLASH OF 0.25mm PER SIDE.
8. ALL GROUND LEADS AND GROUND PADDLE MUST BE SOLDERED TO PCB RF GROUND.

## Package Information

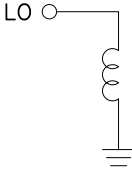
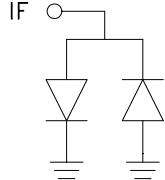
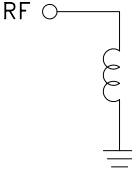
| Part Number  | Package Body Material                              | Lead Finish   | MSL Rating <sup>[2]</sup> | Package Marking <sup>[1]</sup> |
|--------------|----------------------------------------------------|---------------|---------------------------|--------------------------------|
| HMC218BMS8GE | RoHS-compliant Low Stress Injection Molded Plastic | 100% matte Sn | MSL1                      | H218B<br>XXXX                  |

[1] 4-Digit lot number XXXX

[2] Max peak reflow temperature of 260 °C

For price, delivery, and to place orders: Analog Devices, Inc., One Technology Way, P.O. Box 9106, Norwood, MA 02062-9106  
Phone: 781-329-4700 • Order online at [www.analog.com](http://www.analog.com)  
Application Support: Phone: 1-800-ANALOG-D

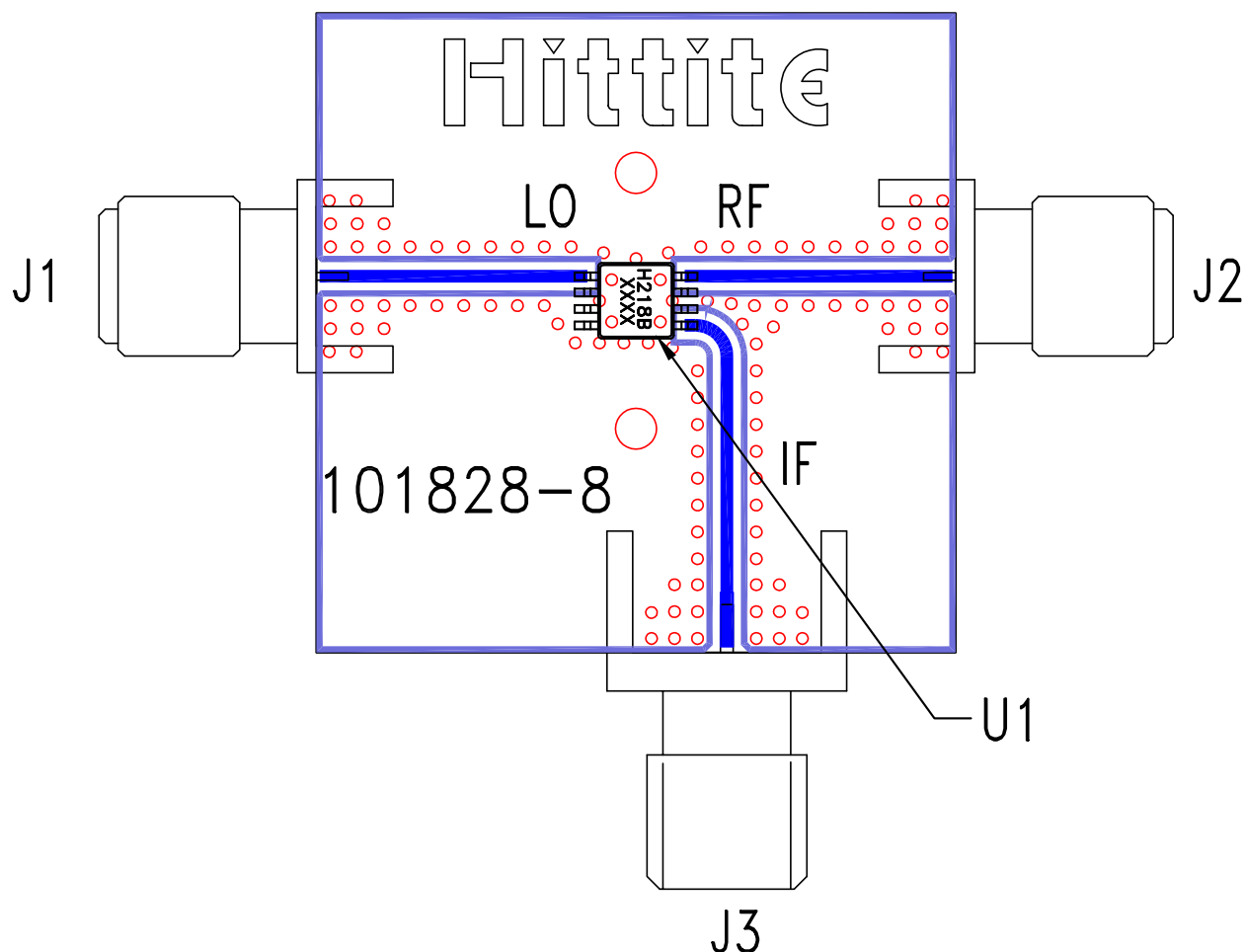
**GaAs MMIC DOUBLE-BALANCED MIXER**  
**3.5 - 8 GHz**
**Pin Descriptions**

| Pin Number | Function | Description                                                                                                                                                                                                                                                                                                                                                  | Pin Schematic                                                                         |
|------------|----------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------|
| 1          | LO       | This pin is DC coupled and matched to 50 Ohms.                                                                                                                                                                                                                                                                                                               |    |
| 2, 3, 6, 7 | GND      | These pins and package bottom must be connected to RF/DC ground.                                                                                                                                                                                                                                                                                             |    |
| 4          | N/C      | No connected required. Pins are not connected internally. However, all data shown herein was measured with these pins connected to RF/DC ground internally.                                                                                                                                                                                                  |                                                                                       |
| 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 2 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.                                                                                                                                                                                                                                                                                                               |  |



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**3.5 - 8 GHz**

**Evaluation PCB**



**List of Material for Evaluation PCB EV1HMC218BMS8G [1]**

| Item    | Description                |
|---------|----------------------------|
| J1, J3  | PCB Mount SMA RF Connector |
| U1      | HMC218BMS8GE               |
| PCB [2] | 101828 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.

***GaAs MMIC DOUBLE-BALANCED MIXER***  
**3.5 - 8 GHz****Notes:**