

# HMC304MS8 / 304MS8E

## GaAs MMIC HIGH IP3 SINGLE-BALANCED SMT MIXER, 1.7 - 3 GHz

### Typical Applications

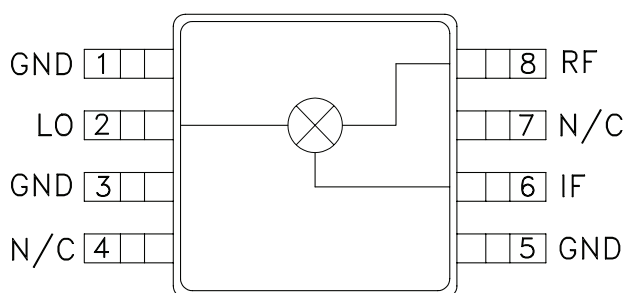
The HMC304MS8 / HMC304MS8E is ideal for:

- PCS & 3G
- 2.4 GHz ISM
- MMDS

### Features

- High Dynamic Range: +30 dBm IIP3
- No External Components or Bias Required
- LO/Rf Isolation: 30 dB
- Ultra Small MSOP8 Package: 14.8 mm<sup>2</sup>

### Functional Diagram



### General Description

The HMC304MS8 & HMC304MS8E are passive high IP3 mixers in 8 lead plastic surface mount Mini Small Outline Packages (MSOP). This miniature single balanced MMIC mixer is constructed of GaAs Schottky diodes and novel planar transformer baluns on the chip while not requiring any external components. The RF port is balanced via the MMIC balun while the LO port is connected directly to the diodes. LO isolations are typically 20 to 30 dB. Excellent input IP3 performance of +27 to +32 dBm make the HMC304MS8 & HMC304MS8E ideal for high dynamic range applications.

### Electrical Specifications\*, $T_A = +25^\circ \text{C}$

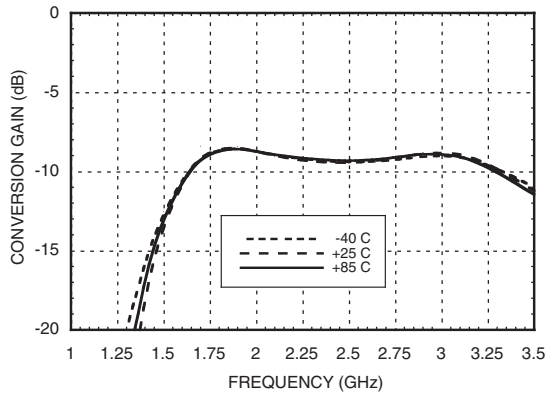
| Parameter                     | LO = +17 dBm<br>IF = 100 MHz |      |      | LO = +17 dBm<br>IF = 100 MHz |      |      | Units |
|-------------------------------|------------------------------|------|------|------------------------------|------|------|-------|
|                               | Min.                         | Typ. | Max. | Min.                         | Typ. | Max. |       |
| Frequency Range, RF & LO      | 1.7 - 3.0                    |      |      | 2.2 - 2.7                    |      |      | GHz   |
| Frequency Range, IF           | DC - 0.8                     |      |      | DC - 0.8                     |      |      | GHz   |
| Conversion Loss               |                              | 9    | 11   |                              | 9    | 10.5 | dB    |
| Noise Figure (SSB)            |                              | 9    | 11   |                              | 9    | 10.5 | dB    |
| LO to RF Isolation            | 20                           | 30   |      | 23                           | 32   |      | dB    |
| LO to IF Isolation            | 12                           | 20   |      | 17                           | 25   |      | dB    |
| IP3 (Input)                   | 25                           | 30   |      | 27                           | 32   |      | dBm   |
| 1 dB Gain Compression (Input) | 15                           | 19   |      | 18                           | 19.5 |      | dBm   |

\*Specifications are for downconverter performance. Similar results are achieved when using mixer as an upconverter with a resulting input IP3 of 5dB less.

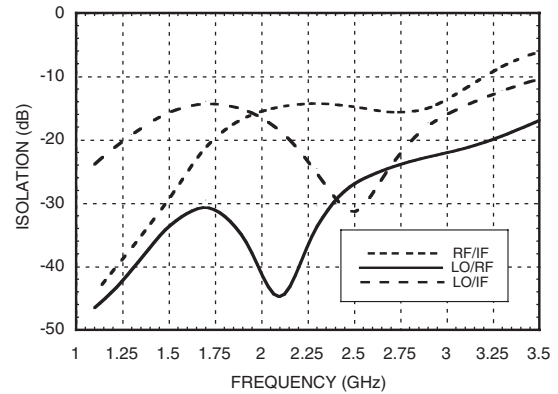
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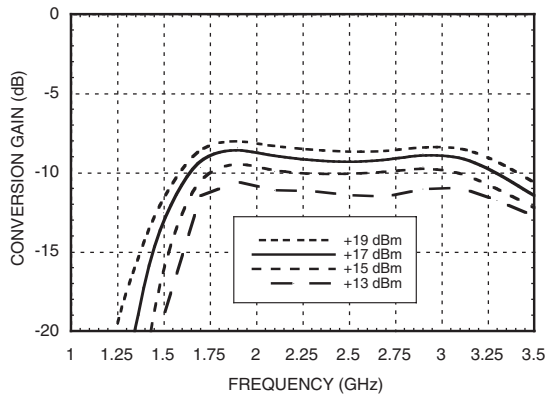
**Conversion Gain vs. Temperature @ LO = +17 dBm**



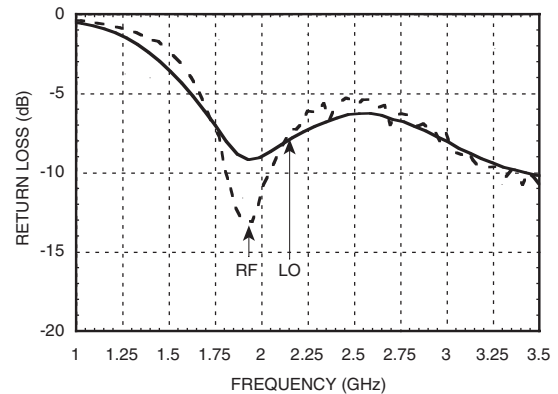
**Isolation @ LO = +17 dBm**



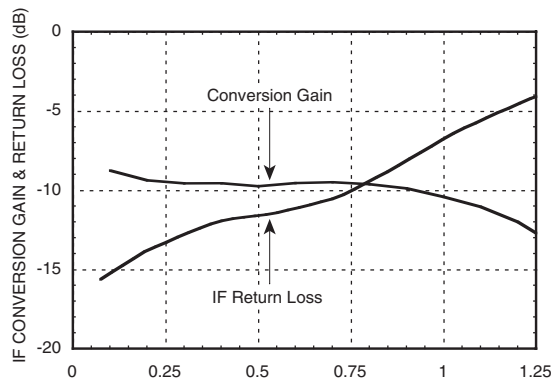
**Conversion Gain vs. LO Drive**



**Return Loss @ LO = +17 dBm**



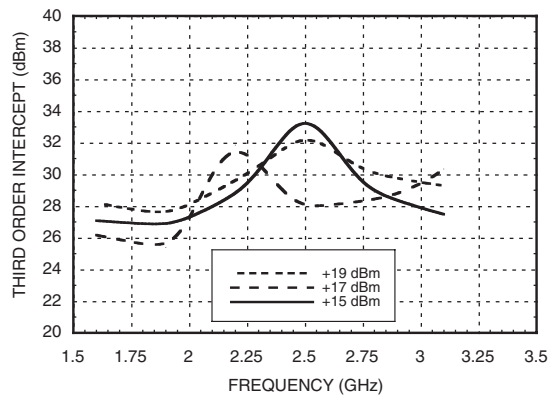
**If Bandwidth @ LO = +17 dBm**



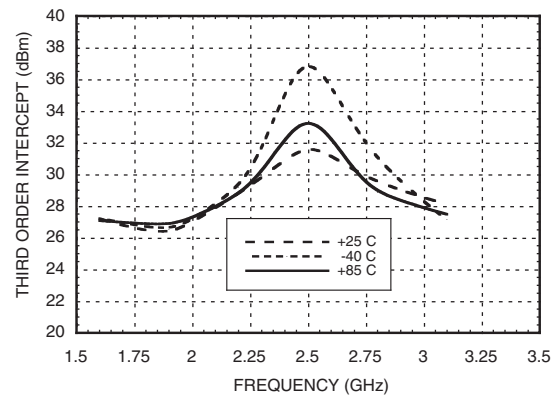
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### GaAs MMIC HIGH IP3 SINGLE-BALANCED SMT MIXER, 1.7 - 3 GHz

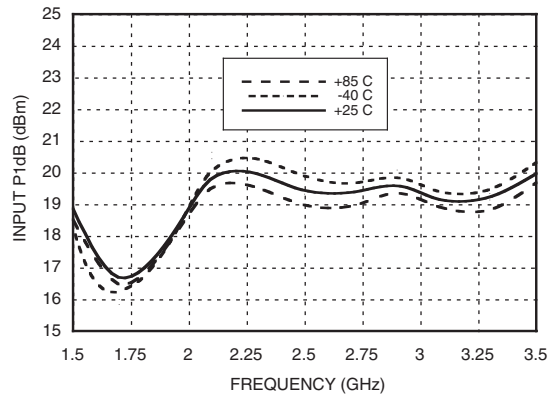
**Input IP3 vs. LO Drive**



**Input IP3 vs. Temperature @ LO = +17dBm**



**P1dB vs. Temperature @ LO = +17 dBm**



**MxN Spurious Outputs**

| mRF | nLO  |      |      |      |      |
|-----|------|------|------|------|------|
|     | 0    | 1    | 2    | 3    | 4    |
| 0   | xx   | -20  | -11  | 2    | 7    |
| 1   | 10   | 0    | 32   | 29   | 31   |
| 2   | 50   | 61   | 62   | 52   | 59   |
| 3   | 89   | 90   | 93   | 85   | 81   |
| 4   | >107 | >107 | >107 | >107 | >107 |

RF = 2 GHz @ -10 dBm  
LO = 1.9 GHz @ +17 dBm  
All values in dBc relative to the IF power level.

**Harmonics of LO**

| LO Frequency (GHz) | nLO Spur at RF Port |    |    |    |
|--------------------|---------------------|----|----|----|
|                    | 1                   | 2  | 3  | 4  |
| 1.5                | 34                  | 18 | 32 | 49 |
| 1.9                | 34                  | 18 | 32 | 48 |
| 2.3                | 32                  | 22 | 36 | 58 |
| 2.7                | 25                  | 26 | 39 | 73 |
| 3.1                | 23                  | 29 | 35 | 64 |
| 3.6                | 17                  | 31 | 36 | 57 |

LO = +17 dBm  
Values in dBc below input LO level measured at the RF port.

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**GaAs MMIC HIGH IP3 SINGLE-BALANCED SMT MIXER, 1.7 - 3 GHz**

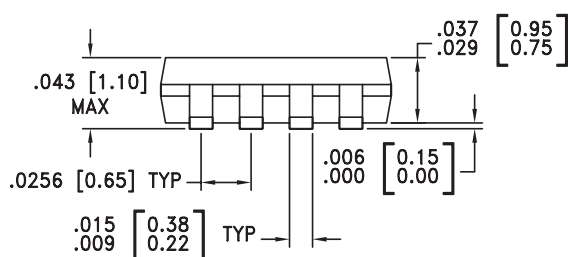
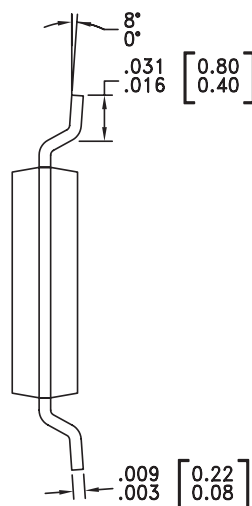
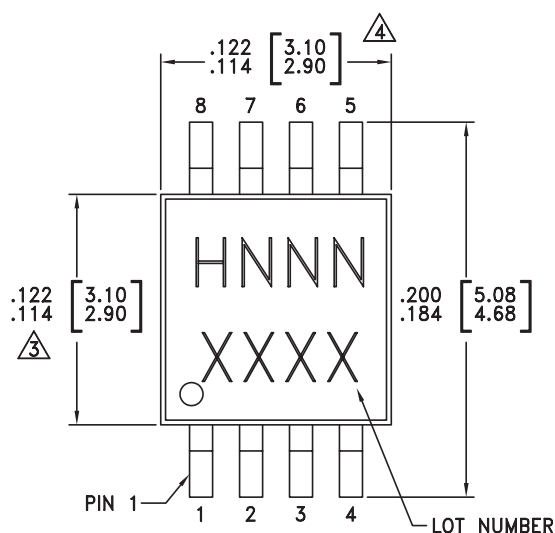
### Absolute Maximum Ratings

|                         |                |
|-------------------------|----------------|
| RF / IF Input           | +27 dBm        |
| LO Drive                | +27 dBm        |
| DC Current into IF Port | ±9 mA          |
| Storage Temperature     | -65 to +150 °C |
| Operating Temperature   | -40 to +85 °C  |



ELECTROSTATIC SENSITIVE DEVICE  
OBSERVE HANDLING PRECAUTIONS

### Outline Drawing



#### NOTES:

1. LEADFRAME MATERIAL: COPPER ALLOY
2. DIMENSIONS ARE IN INCHES [MILLIMETERS]
3. DIMENSION DOES NOT INCLUDE MOLDFLASH OF 0.15mm PER SIDE.
4. DIMENSION DOES NOT INCLUDE MOLDFLASH OF 0.25mm PER SIDE.
5. ALL GROUND LEADS MUST BE SOLDERED TO PCB RF GROUND.

### Package Information

| Part Number | Package Body Material                              | Lead Finish   | MSL Rating          | Package Marking <sup>[3]</sup> |
|-------------|----------------------------------------------------|---------------|---------------------|--------------------------------|
| HMC304MS8   | Low Stress Injection Molded Plastic                | Sn/Pb Solder  | MSL1 <sup>[1]</sup> | H304<br>XXXX                   |
| HMC304MS8E  | RoHS-compliant Low Stress Injection Molded Plastic | 100% matte Sn | MSL1 <sup>[2]</sup> | H304<br>XXXX                   |

[1] Max peak reflow temperature of 235 °C

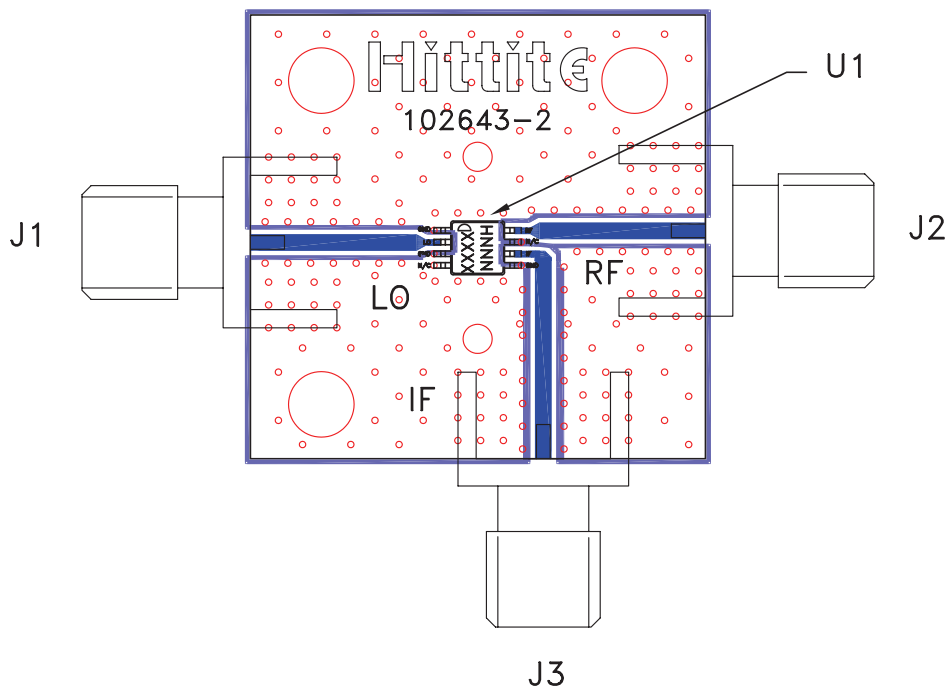
[2] Max peak reflow temperature of 260 °C

[3] 4-Digit lot number XXXX

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**GaAs MMIC HIGH IP3 SINGLE-BALANCED SMT MIXER, 1.7 - 3 GHz**

### Recommended PCB Layout



### List of Materials for Evaluation PCB 102781 <sup>[1]</sup>

| Item       | Description                  |
|------------|------------------------------|
| J1, J2, J3 | PCB Mount SMA RF Connector   |
| U1         | HMC304MS8 / HMC304MS8E Mixer |
| PCB [2]    | 102643 Eval 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 should be connected directly to the ground plane similar to that shown below. A sufficient number of VIA holes should be used to connect the top and bottom ground planes. The evaluation circuit board as shown is available from Hittite upon request.



v01.0705

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**Notes:**

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MIXERS - SMT