



## GaAs MMIC MIXER w/ INTEGRATED LO AMPLIFIER, 1.2 - 2.6 GHz

### Typical Applications

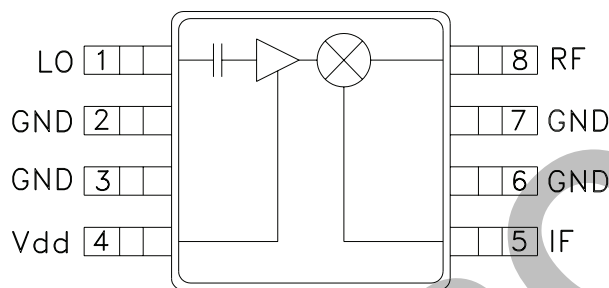
The HMC422MS8 / HMC422MS8E is ideal for:

- MMDS & ISM
- Wireless Local Loop
- WirelessLAN
- Cellular Infrastructure

### Features

- Integrated LO Amplifier w/  $P_{diss} < 100$  mW
- Conversion Loss / Noise Figure: 8 dB
- Low LO Drive: 0 dBm
- Input IP3: +15 dBm
- Single Positive Supply: 3V, 30 mA

### Functional Diagram



### General Description

The HMC422MS8 & HMC422MS8E are double balanced mixer ICs with integrated LO amplifiers. This mixer can operate as an upconverter or downconverter between 1.2 GHz and 2.6 GHz. With the integrated LO amplifier, the mixer requires an LO drive level of only 0 dBm, and requires only 30mA from a single positive +3V rail. The mixer has 8 dB of conversion loss, an input P1dB of +8 dBm and an input third order intercept point of +15 dBm at 2 GHz.

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

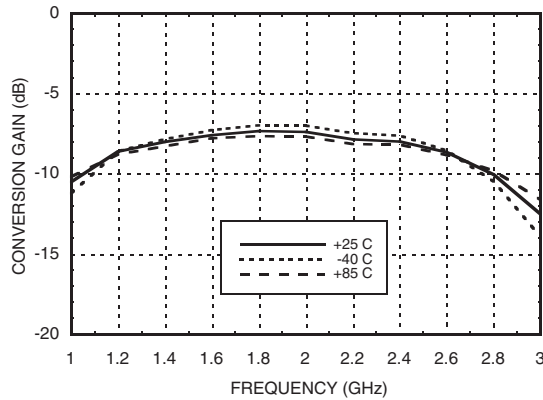
| Parameter                         | IF = 100 MHz<br>LO = 0 dBm & Vdd = 3V |         |      | Units |
|-----------------------------------|---------------------------------------|---------|------|-------|
|                                   | Min.                                  | Typ.    | Max. |       |
| Frequency Range, RF & LO          | 1.2 - 2.6                             |         |      | GHz   |
| Frequency Range, IF               | DC - 1                                |         |      | GHz   |
| Conversion Loss                   |                                       | 8       | 10.5 | dB    |
| Noise Figure (SSB)                |                                       | 8       | 10.5 | dB    |
| LO to RF Isolation                | 23                                    | 30      |      | dB    |
| LO to IF Isolation                | 9                                     | 15 - 20 |      | dB    |
| RF to IF Isolation                | 9                                     | 15 - 20 |      | dB    |
| IP3 (Input)                       | 12                                    | 15      |      | dBm   |
| 1 dB Compression (Input)          | 5                                     | 8       |      | dBm   |
| Supply Current (I <sub>dd</sub> ) |                                       | 37      |      | mA    |

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

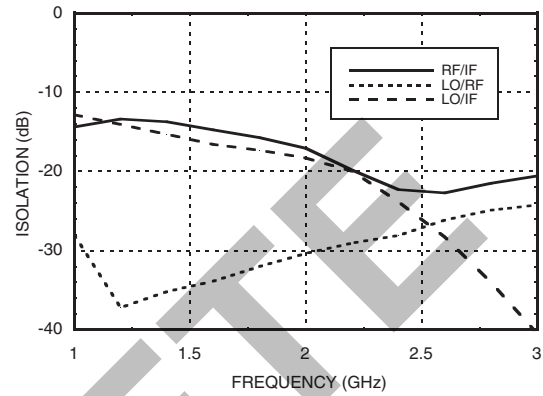
**GaAs MMIC MIXER w/ INTEGRATED  
LO AMPLIFIER, 1.2 - 2.6 GHz**



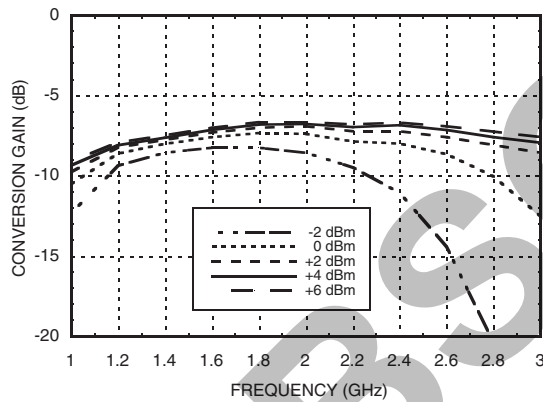
**Conversion Gain  
vs. Temperature @ LO = 0 dBm**



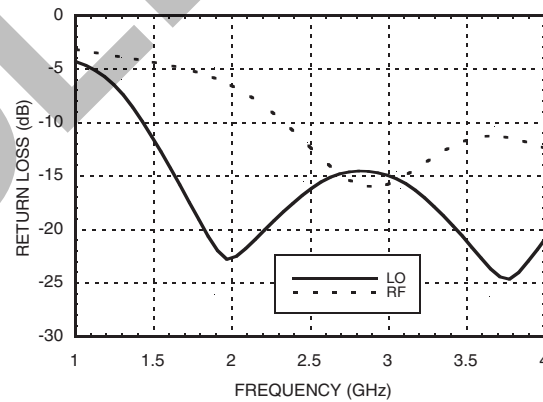
**Isolation @ LO = 0 dBm**



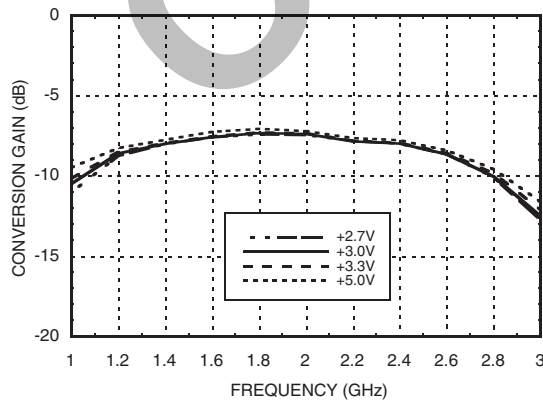
**Conversion Gain vs. LO Drive**



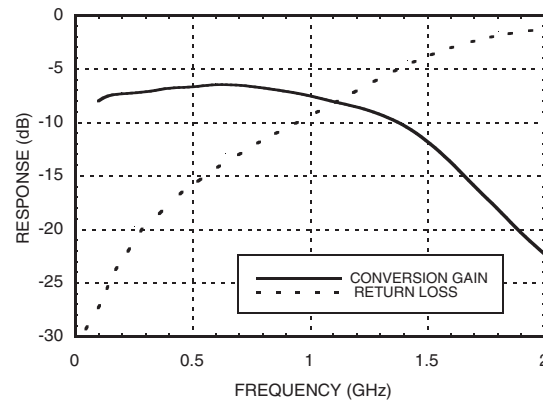
**Return Loss @ LO = 0 dBm**



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



**IF Bandwidth @ LO = 0 dBm**



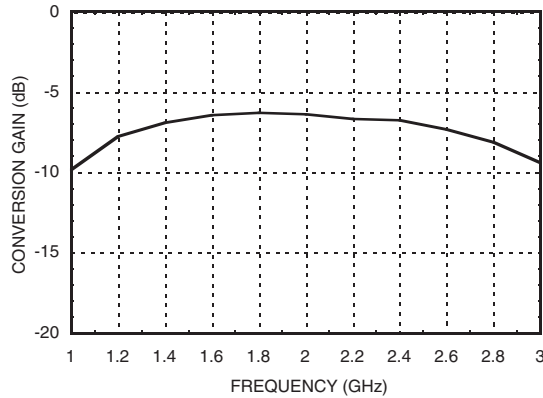
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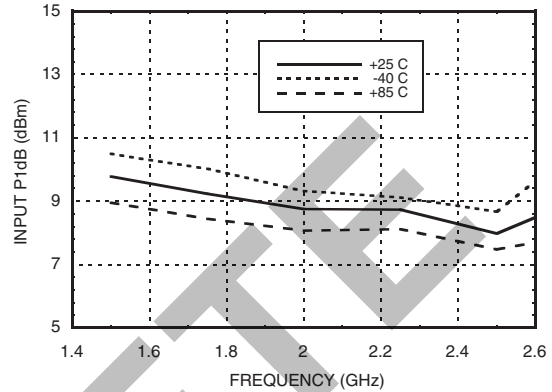
**GaAs MMIC MIXER w/ INTEGRATED LO AMPLIFIER, 1.2 - 2.6 GHz**



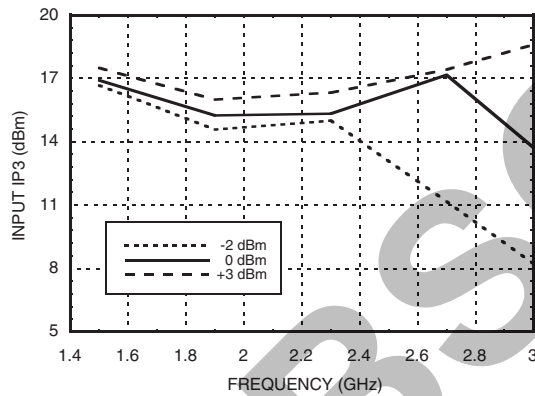
**Upconverter Performance  
Conversion Gain @ LO = 0 dBm**



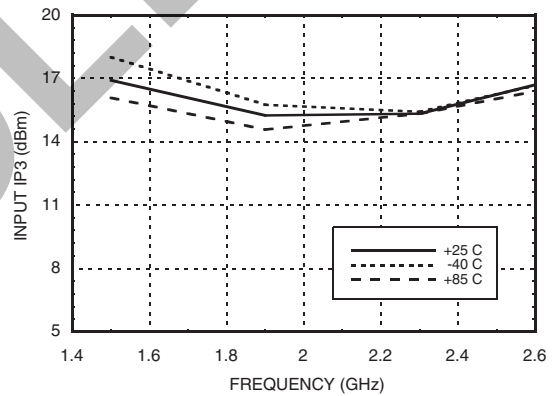
**Input P1dB vs.  
Temperature @ LO = 0 dBm**



**Input IP3 vs. LO Drive\***



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



**MxN Spurious @ IF Port**

| mRF | nLO |     |     |     |     |
|-----|-----|-----|-----|-----|-----|
|     | 0   | 1   | 2   | 3   | 4   |
| 0   | XX  | 2   | 22  | 26  | 41  |
| 1   | 10  | 0   | 27  | 48  | 57  |
| 2   | 66  | 60  | 64  | 53  | 73  |
| 3   | >85 | >85 | 83  | 69  | 80  |
| 4   | >85 | >85 | >85 | >85 | >85 |

RF = 2.1 GHz @ -10 dBm  
LO = 2 GHz @ 0 dBm  
All values in dBc relative to the IF power level.

**Harmonics of LO**

| LO Freq. (GHz) | nLO Spur @ RF Port |    |    |    |
|----------------|--------------------|----|----|----|
|                | 1                  | 2  | 3  | 4  |
| 1.5            | 33                 | 14 | 38 | 35 |
| 1.75           | 30                 | 16 | 39 | 44 |
| 2              | 29                 | 17 | 45 | 47 |
| 2.25           | 27                 | 20 | 50 | 52 |
| 2.5            | 25                 | 26 | 49 | 61 |
| 3              | 22                 | 37 | 69 | 72 |

LO = 0 dBm  
All values in dBc below input LO level @ RF port.

\* Two-tone input power = 0 dBm each tone, 1 MHz spacing.

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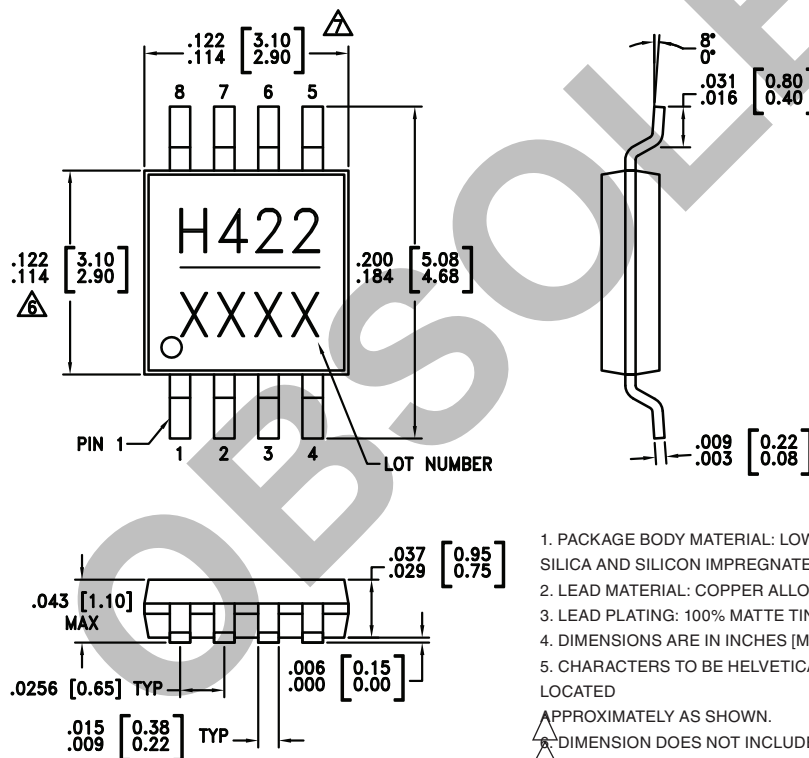
### Absolute Maximum Ratings

|  |                |
|--|----------------|
| RF / IF Input (Vdd = +3V)                                    | +13 dBm        |
| LO Drive (Vdd = +3V)   | +13 dBm        |
| Vdd  | +7 Vdc         |
| IF DC Current  | ±10 mA         |
| Channel Temperature (Tc)                                     | 150 °C         |
| Continuous Pdiss (T = 85°C)<br>(Derate 5.8 mW/°C above 85 C) | 0.38 W         |
| Storage Temperature  | -65 to +150 °C |
| Operating Temperature  | -40 to +85 °C  |
| ESD Sensitivity (HBM)  | Class 1A       |



ELECTROSTATIC SENSITIVE DEVICE  
OBSERVE HANDLING PRECAUTIONS

### Outline Drawing



1. PACKAGE BODY MATERIAL: LOW STRESS INJECTION MOLDED PLASTIC SILICA AND SILICON IMPREGNATED.
2. LEAD MATERIAL: COPPER ALLOY
3. LEAD 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          | Package Marking <sup>[3]</sup> |
|-------------|--|---------------|---------------------|--------------------------------|
| HMC422MS8   | Low Stress Injection Molded Plastic                | Sn/Pb Solder  | MSL1 <sup>[1]</sup> | H422<br>XXXX                   |
| HMC422MS8E  | RoHS-compliant Low Stress Injection Molded Plastic | 100% matte Sn | MSL1 <sup>[2]</sup> | H422<br>XXXX                   |

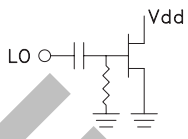

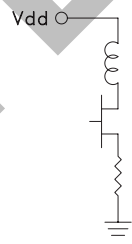
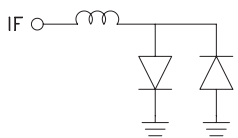
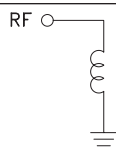
[1] Max peak reflow temperature of 235 °C

[2] Max peak reflow temperature of 260 °C

[3] 4-Digit lot number XXXX

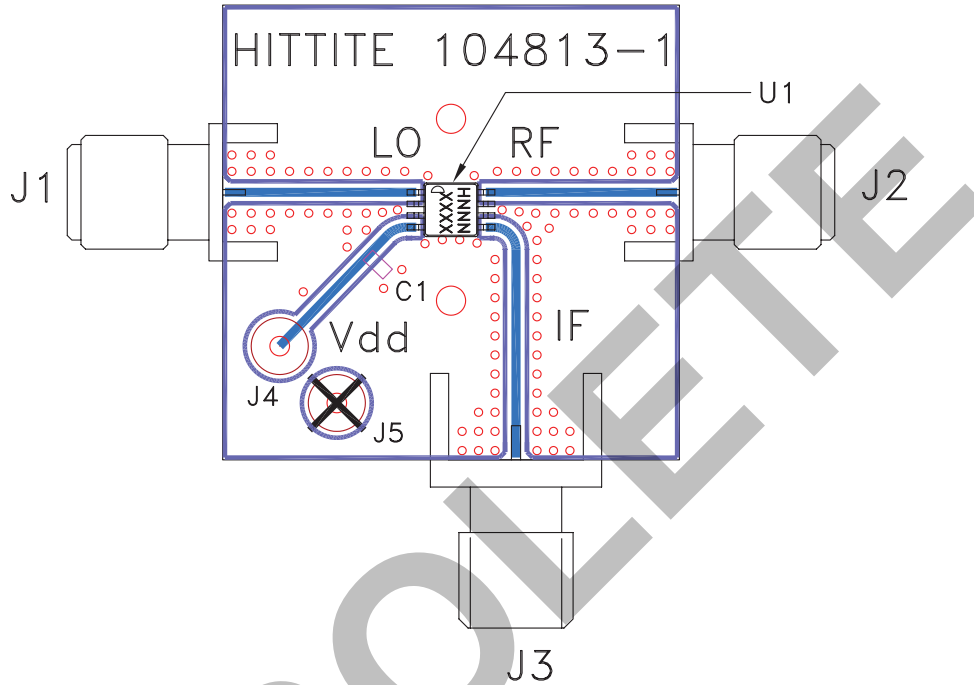


### Pin Descriptions

| Pin Number | Function | Description  | Interface Schematic   |
|------------|----------|--|---|
| 1          | LO       | This pin is AC coupled and matched to 50 Ohms.   |    |
| 2, 3, 6, 7 | GND      | Pins must connect to RF ground.  |    |
| 4          | Vdd      | Power supply for the LO Amplifier. One external RF bypass capacitor (10,000 pF) is required.   |    |
| 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/sink more than 10 mA of current or die non-function and possible die failure will result. |   |
| 8          | RF       | This pin is DC coupled and matched to 50 Ohms.   |  |



### Evaluation PCB



### List of Materials for Evaluation PCB 105188 [1]

| Item    | Description                        |
|---------|------------------------------------|
| J1 - J3 | PCB Mount SMA RF Connector         |
| J4 - J5 | DC Pin                             |
| C1      | 10k pF Chip Capacitor, 0603 Pkg.   |
| U1      | HMC422MS8 / HMC422MS8E Mixer       |
| PCB [2] | 104813 Evaluation PCB, 1.0" x 1.0" |

[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 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.