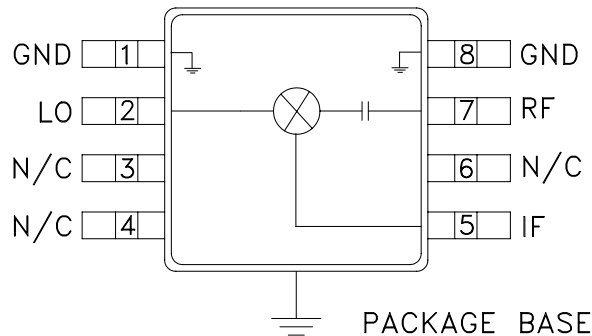


### Typical Applications

The HMC412MS8G is ideal for:

- Long Haul Radio Platforms
- Microwave Radio
- VSAT

### Functional Diagram



### Features

- Conversion Loss: 8.0 dB
- Noise Figure: 8.0 dB
- Input IP3: 17 dBm
- No External Components
- MSOP8G SMT Package

### General Description

The HMC412MS8G is a passive double balanced mixer that operates between 9.0 GHz and 15 GHz. The HMC412MS8G operates with LO drive levels between +9 dBm and +13 dBm, and provides 8 dB conversion loss across the entire specified frequency band. This mixer requires no external components or bias.

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

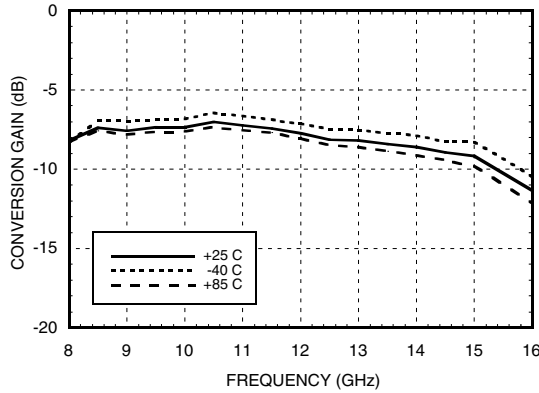
Parameter	IF = 1.45 GHz LO = +13 dBm			Units
	Min.	Typ.	Max.	
Frequency Range, RF & LO	9.0 - 15.0			GHz
Frequency Range, IF	DC - 2.5			GHz
Conversion Loss		8	11	dB
Noise Figure (SSB)		8	11	dB
LO to RF Isolation	30	40 - 50		dB
LO to IF Isolation	33	40 - 50		dB
RF to IF Isolation	8	17		dB
IP3 (Input)	14	17		dBm
1 dB Compression (Input)	7	9.5		dBm

\* Unless otherwise noted, all measurements performed as downconverter, IF= 1.45 GHz.

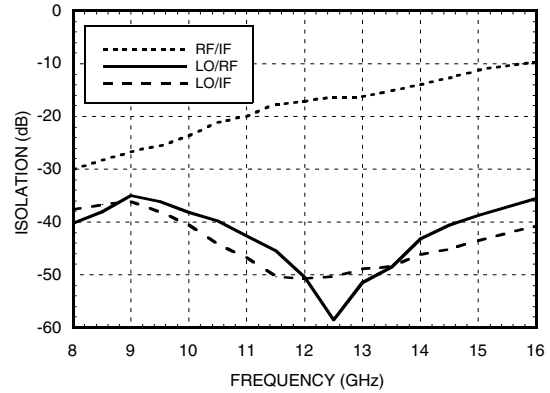
# HMC412MS8G

## DOUBLE-BALANCED MIXER, 9.0 - 15.0 GHz

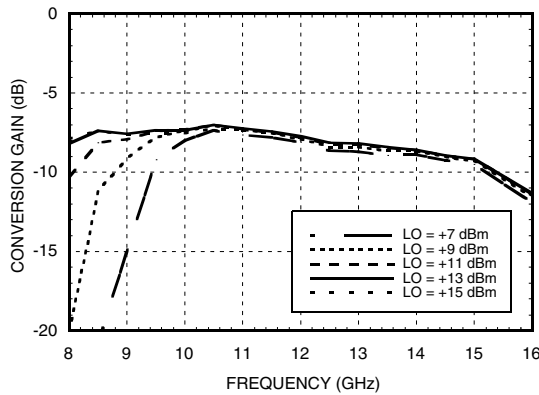
**Conversion Gain vs.  
Temperature @ LO = +13 dBm**



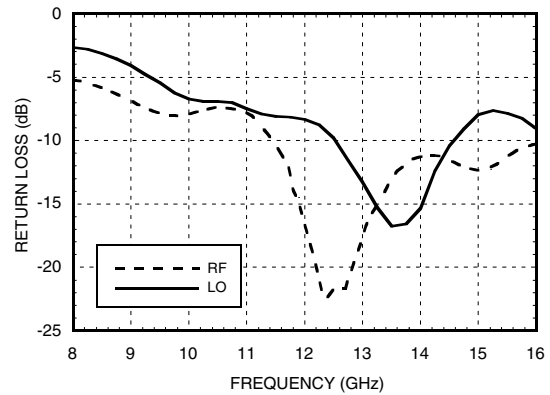
**Isolation @ LO = +13 dBm**



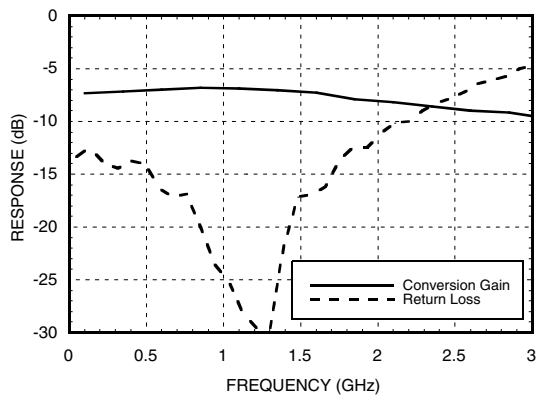
**Conversion Gain vs. LO Drive**



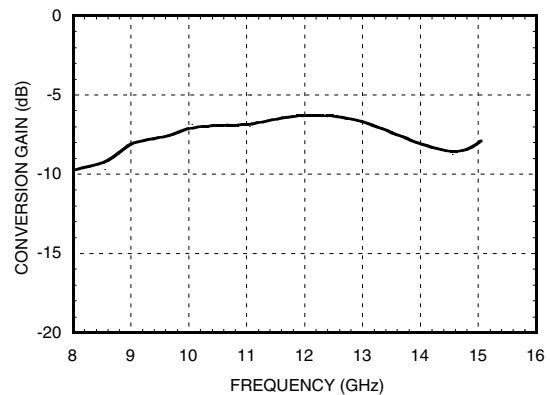
**Return Loss @ LO = +13 dBm**



**IF Bandwidth @ LO = +13 dBm**



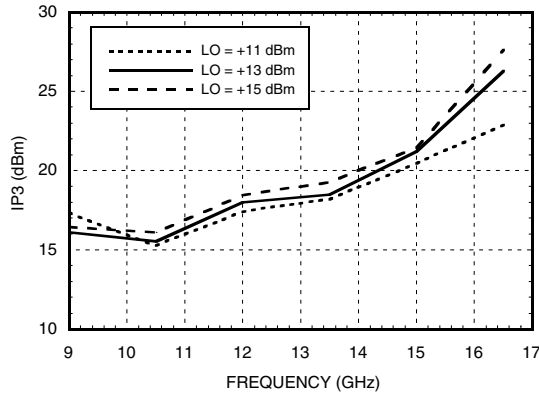
**Upconverter Performance  
Conversion Gain @ LO = +13 dBm**



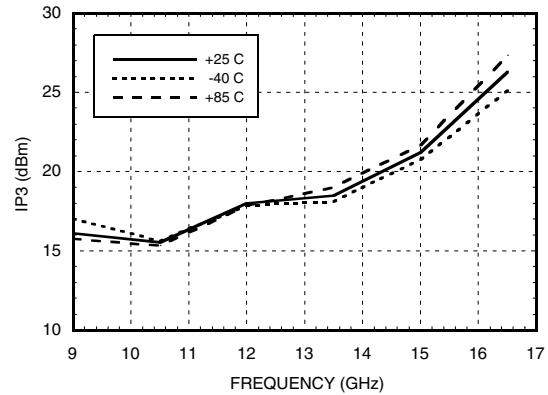
# HMC412MS8G

## DOUBLE-BALANCED MIXER, 9.0 - 15.0 GHz

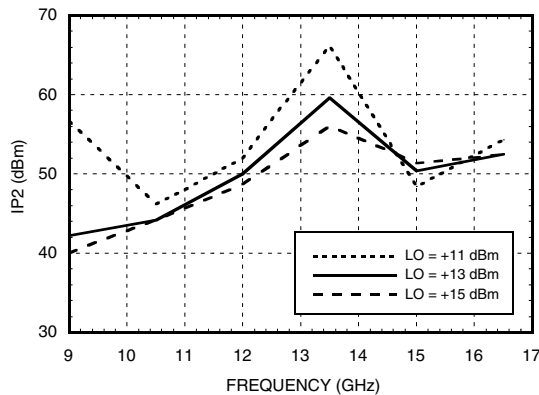
**Input IP3 vs. LO Drive\***



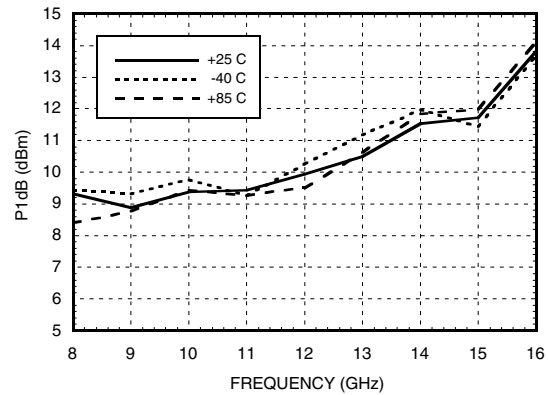
**Input IP3 vs. Temperature @ LO = +13 dBm\***



**Input IP2 vs. LO Drive \***



**Input P1dB vs. Temperature @ LO = +13 dBm**



**MxN Spurious @ IF Port**

mRF	nLO				
	0	1	2	3	4
0	XX	16	27	38	N/A
1	7	0	>85	57	56
2	78	>85	72	71	>85
3	>85	>85	>85	78	>85
4	N/A	>85	>85	>85	>85

RF = 14.45 GHz @ -10 dBm  
LO = 13 GHz @ +13 dBm  
All values in dBc relative to the IF.  
Measured as downconverter.

**Harmonics of LO**

LO Freq. (GHz)	nLO Spur @ RF Port			
	1	2	3	4
9	36	30	58.3	70.5
10.5	34.8	31.3	35.7	57.5
12	49.5	44.5	65.2	68.7
13.5	48.7	58.8	69	N/A
15	39.2	74.5	64	N/A
16.5	34	61.3	60.3	N/A

LO = +13 dBm  
All values in dBc below input LO level @ RF port.

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

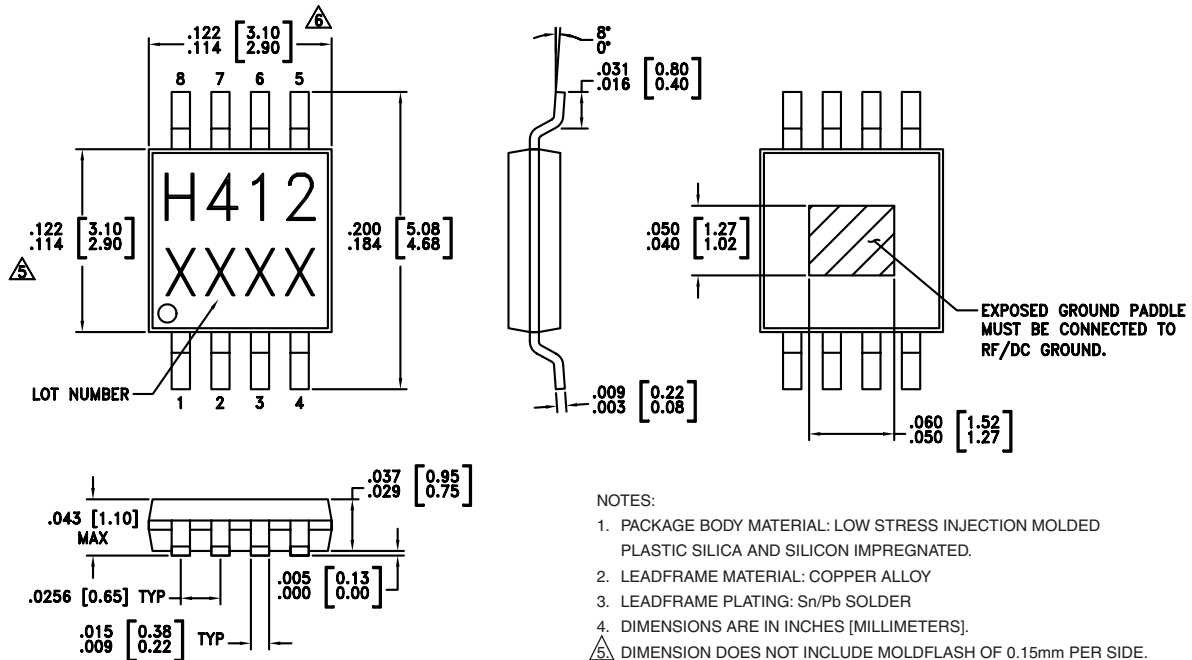
# HMC412MS8G

## DOUBLE-BALANCED MIXER, 9.0 - 15.0 GHz

### Absolute Maximum Ratings

RF / IF Input (Vdd = +3V)	+27 dBm
LO Drive (Vdd = +3V)	+27 dBm
IF DC Current	±4 mA
Storage Temperature	-65 to +150 °C
Operating Temperature	-55 to +85 °C

### Outline Drawing




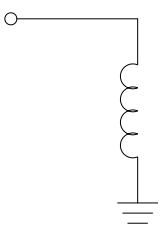
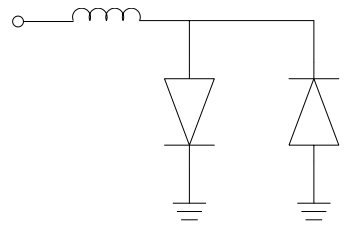
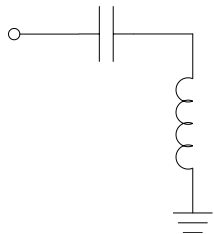
NOTES:

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

# HMC412MS8G

## DOUBLE-BALANCED MIXER, 9.0 - 15.0 GHz

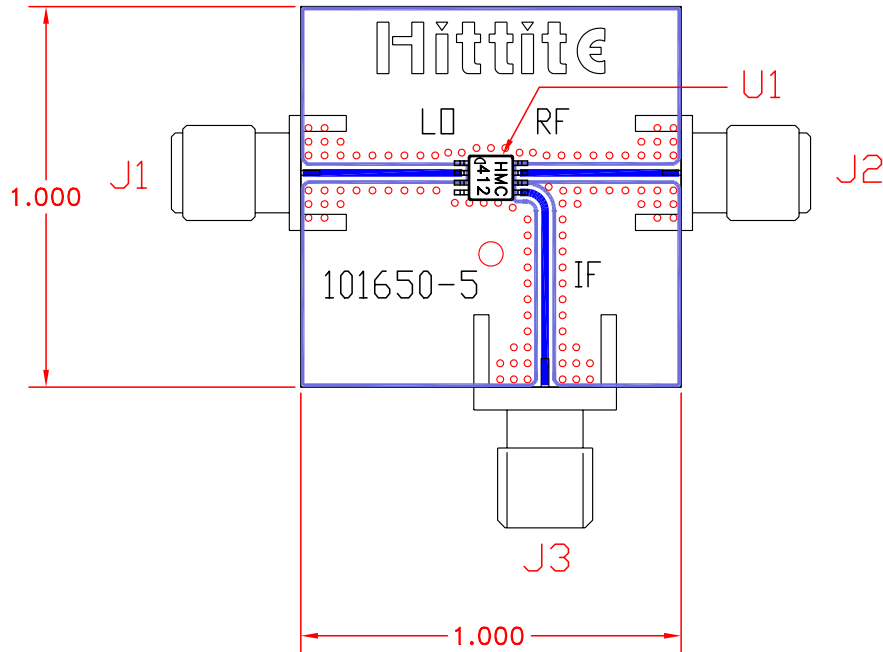
### Pin Descriptions

Pin Number	Function	Description	Interface Schematic
1, 8	GND	Ground: Pin must connect to RF ground.	
2	LO Port	LO Port: This pin is DC coupled and matched to 50 Ohm from 9.5 - 15.0 GHz.	
3, 4, 6	N/C	Not Connected	
5	IF Port	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 whose values has been chosen to pass the necessary IF frequency range. For operation to DC, this pin must not source/sink more than 4mA of current or die non-function and possible die failure will result.	
7	RF Port	RF Port: This pin is AC coupled and matched to 50 Ohm from 9.5 - 15.0 GHz.	

# HMC412MS8G

## DOUBLE-BALANCED MIXER, 9.0 - 15.0 GHz

### Evaluation PCB



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MIXERS - SMT

### List of Material

Item	Description
J1 - J2	PC Mount SMA RF Connector, SRI
J3	PC Mount SMA Connector, Johnson
U1	HMC412MS8G Mixer
PCB*	101650 Evaluation Board
* 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.