



## DOUBLE-BALANCED MIXER, 9 - 15 GHz

### Typical Applications

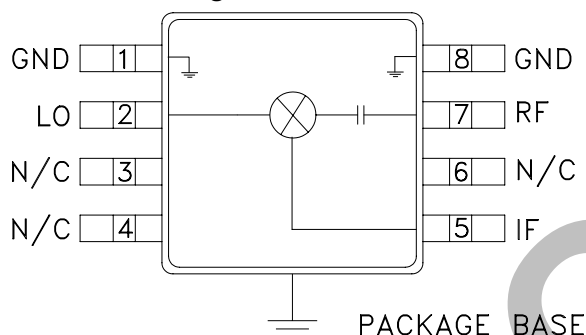
The HMC412AMS8G / HMC412AMS8GE is ideal for:

- Long Haul Radio Platforms
- Microwave Radio
- VSAT

### Features

Conversion Loss: 8 dB  
Noise Figure: 8 dB  
Input IP3: 19 dBm  
No External Components  
MSOP8G SMT Package

### Functional Diagram



### General Description

The HMC412AMS8G & HMC412AMS8GE are passive double balanced mixers that operate between 9.0 GHz and 15 GHz. The HMC412AMS8G(E) operate 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, $T_A = +25^\circ \text{C}$ , $IF = 1.45 \text{ GHz}$ , $LO = +13 \text{ dBm}$ <sup>[1]</sup>

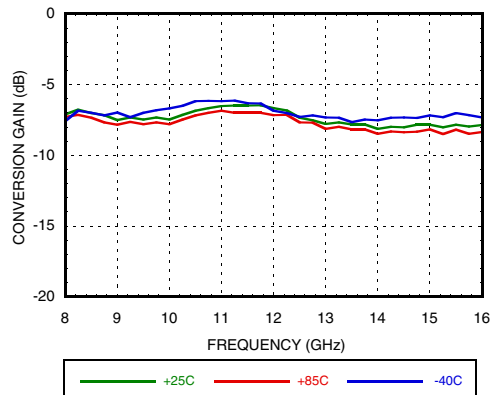
Parameter	Min.	Typ.	Max.	Units
Frequency Range, RF & LO		9.0 - 15.0		GHz
Frequency Range, IF		DC - 2.5		GHz
Conversion Loss		8	11	dB
Noise Figure (SSB)		8		dB
LO to RF Isolation		44		dB
LO to IF Isolation	33	42		dB
RF to IF Isolation		30		dB
IP3 (Input)		19		dBm
1 dB Compression (Input)		11.5		dBm

[1] Unless otherwise noted, all measurements performed as downconverter,  $IF = 1.45 \text{ GHz}$ .

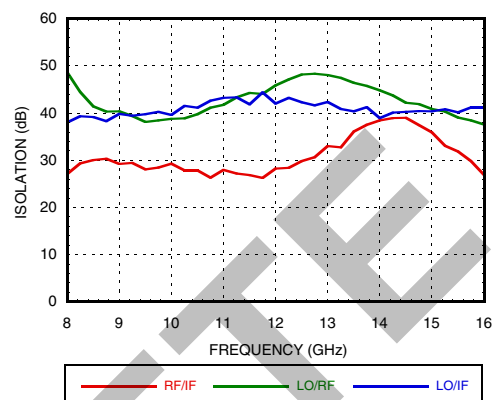


**DOUBLE-BALANCED  
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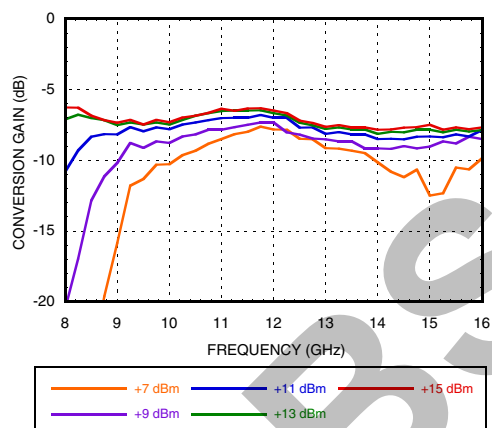
**Conversion Gain vs.  
Temperature @ LO = +13 dBm**



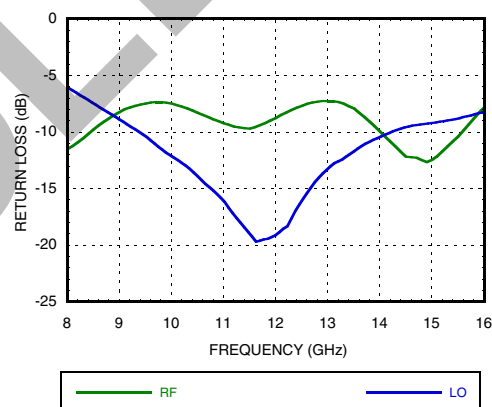
**Isolation @ LO = +13 dBm**



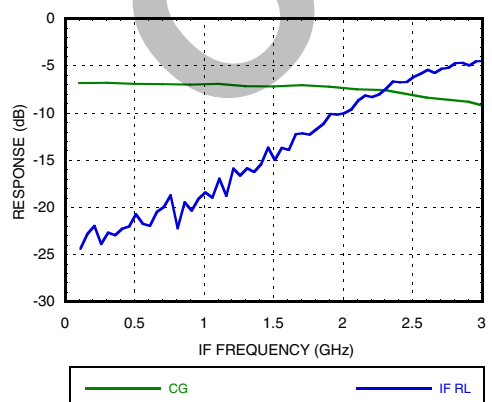
**Conversion Gain vs. LO Drive**



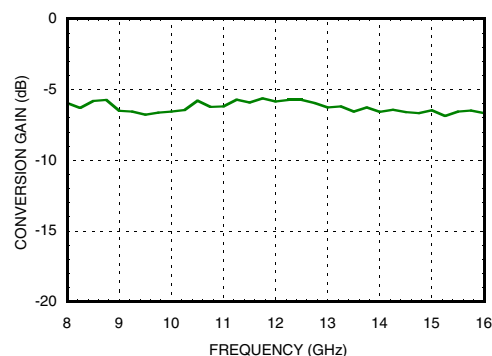
**Return Loss @ LO = +13 dBm**

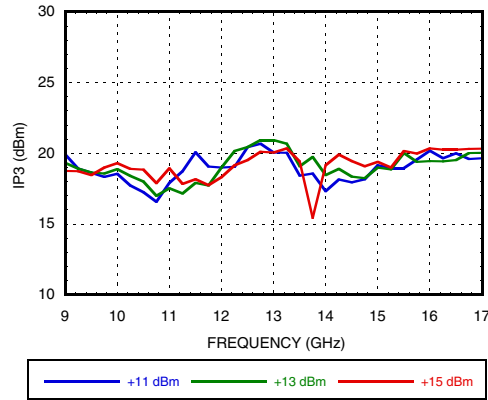
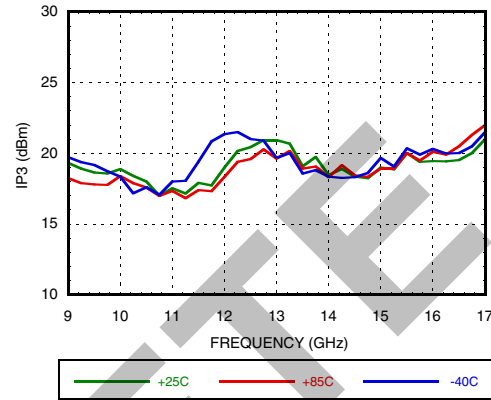
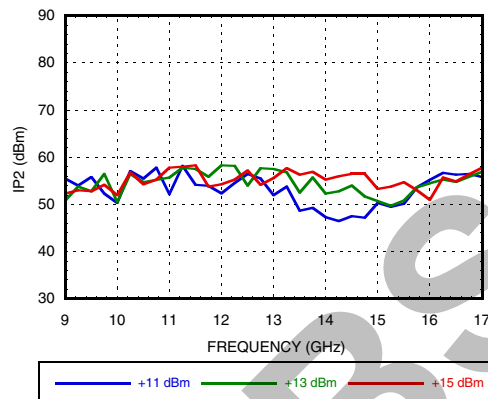
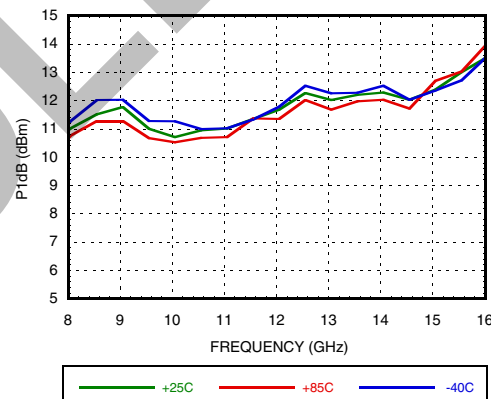


**IF Bandwidth @ LO = +13 dBm**



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




**DOUBLE-BALANCED  
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**Input IP3 vs. LO Drive [1]**

**Input IP3 vs.  
Temperature @ LO = +13 dBm [1]**

**Input IP2 vs. LO Drive [1]**

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

**MxN Spurious @ IF Port**

mRF	nLO				
	0	1	2	3	4
0	xx	9	28	41	N/A
1	34	0	38	37	41
2	>85	>85	71	>85	>85
3	>85	>85	>85	>85	>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	41	33	56	55
10.5	44	45	57	71
12	47	52	52	N/A
13.5	43	60	60	N/A
15	37	63	55	N/A
16.5	32	67	50	N/A

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

[1] Two-tone input power = -10 dBm each tone, 1 MHz spacing.



## v02 0614

### Absolute Maximum Ratings

RF/IF Input	+24 dBm
LO Drive	+24 dBm
Channel Temperature	150 °C
IF DC current	± 4mA
Continuous P <sub>diss</sub> ( T = 85°C) (derate 4.3mW / ° C above 85 °C	280 mW
Thermal Resistance (channel to ground paddle)	230.5 °C/W
Storage Temperature	-65 to + 150 °C
Operating Temperature	-55 to + 85 °C
ESD Sensitivity (HBM)	Class 1A



ELECTROSTATIC SENSITIVE DEVICE  
OBSERVE HANDLING PRECAUTIONS

The mechanical drawings of the HNNNA-XXXX package include the following views and dimensions:

- Top View:** Shows the package footprint with dimensions: .122 [3.10] / .114 [2.90] for pin pitch, .200 [5.08] / .184 [4.68] for body width, and .070 [1.78] MAX for the central area. A note indicates: "EXPOSED GROUND PADDLE MUST BE CONNECTED TO RF/DC GROUND."
- Side View:** Shows the package height with dimensions: .037 [0.95] / .029 [0.75] for the top, .043 [1.10] MAX for the body, .0256 [0.65] TYP for the base, and .005 [0.13] / .000 [0.00] for the bottom. A note indicates: "LOT NUMBER" on the side.
- Detail View:** Shows the pin dimensions with dimensions: .031 [0.80] / .016 [0.40] for the pin, .009 [0.22] / .003 [0.08] for the pin base, and .015 [0.38] / .009 [0.22] TYP for the pin spacing.

## Package Information

Part Number	Package Body Material	Lead Finish	MSL Rating	Package Marking <sup>[3]</sup>
HMC412AMS8G	Low Stress Injection Molded Plastic	Sn/Pb Solder	MSL1 <sup>[1]</sup>	H412A XXXX
HMC412AMS8GE	RoHS-compliant Low Stress Injection Molded Plastic	100% matte Sn	MSL1 <sup>[2]</sup>	<u>H412A</u> XXXX

[1] Max peak reflow temperature of 235 °C


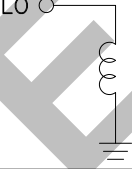
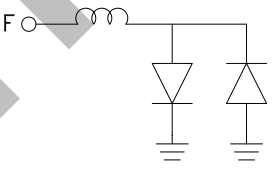
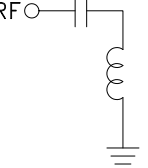
[2] Max peak reflow temperature of 260 °C

[3] 4-Digit lot number XXXX

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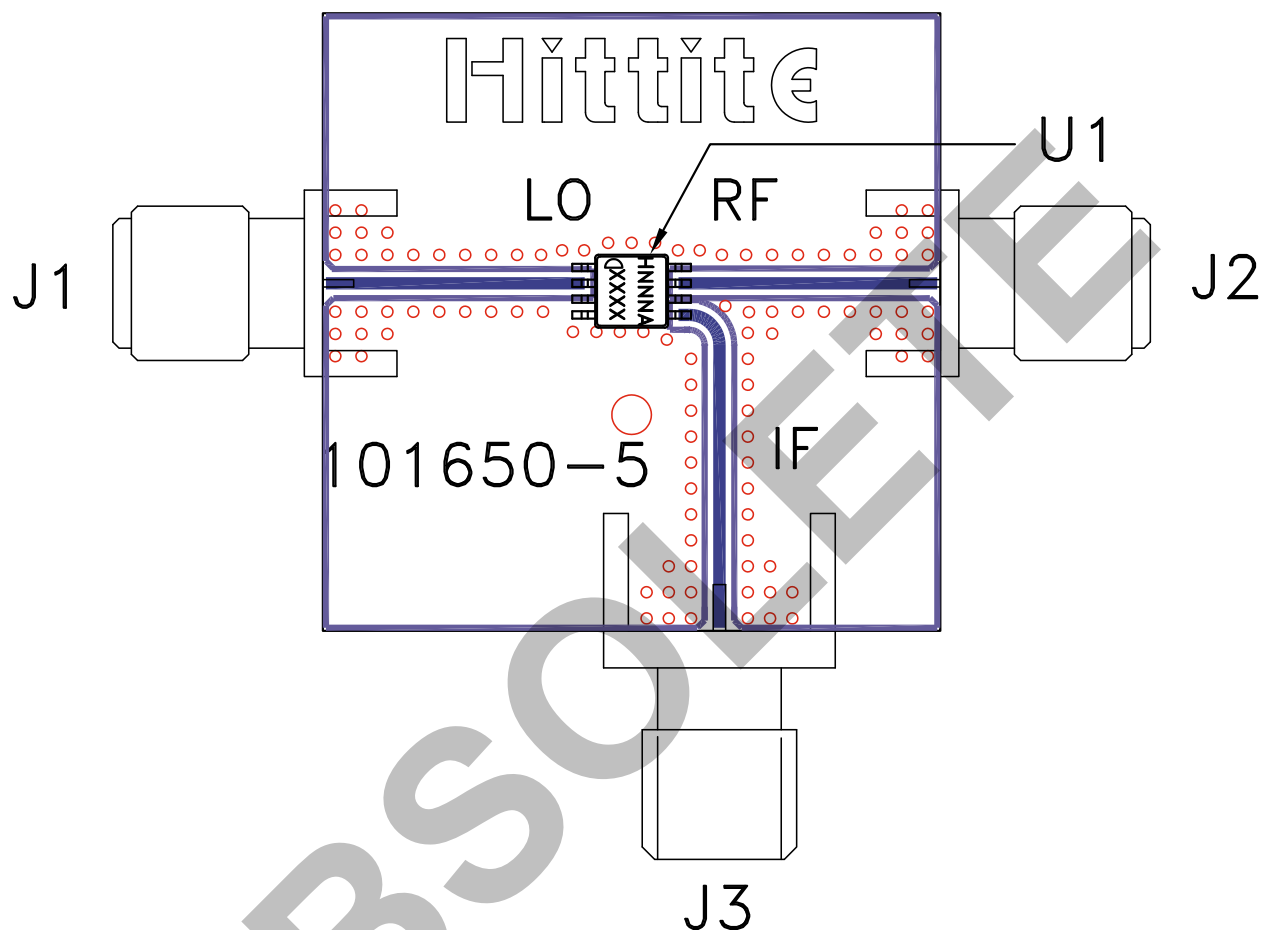

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**Pin Descriptions**

Pin Number	Function	Description	Pin Schematic
1, 8	GND	These pins and the exposed ground paddle must be connected to RF ground.	
2	LO	This pin is DC coupled and matched to 50 Ohms.	
3, 4, 6	N/C	These pins are not connected 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 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	This pin is AC coupled and matched to 50 Ohms.	



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**Evaluation PCB**



**List of Materials for Evaluation PCB 103350 [1]**

Item	Description
J1 - J2	PCB Mount SMA RF Connector, SRI
J3	PCB Mount SMA Connector, Johnson
U1	HMC412AMS8G / HMC412AMS8GE Mixer
PCB [2]	101650 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.