

Typical Applications

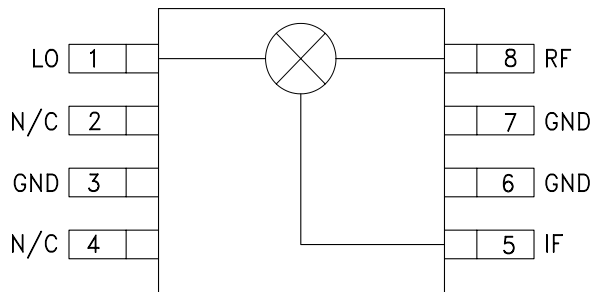
High Dynamic Range Infrastructure:

- GSM, GPRS & EDGE
- CDMA & W-CDMA
- Cable Modem Termination Systems

Features

- +31 dBm Input IP3
- High Side LO
- Ultra Small MSOP8 Package: 14.8mm²
- No External Components

Functional Diagram



General Description

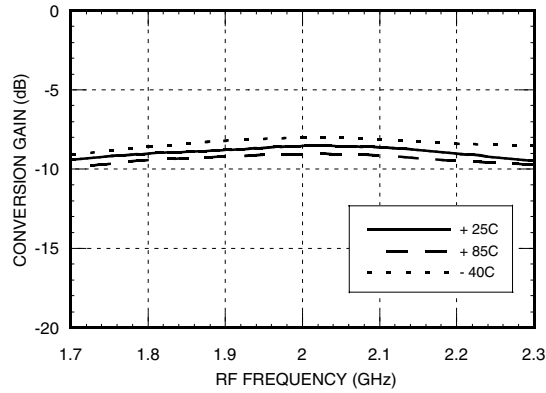
The HMC402MS8 is a high dynamic range passive MMIC mixer in a plastic surface mount 8 lead Mini Small Outline Package (MSOP) covering 1.8 to 2.2 GHz. Excellent input IP3 performance of +31 dBm for down conversion and +27 dBm for up conversion is provided for 2.5G & 3G GSM/CDMA based UMTS or PCS applications at an LO drive of +17dBm. With a 1dB compression of +21 dBm, the RF port will accept a wide range of input signal levels. Conversion loss is 8.5dB typical and LO isolations are maintained at 24 to 30 dB. This miniature single-ended monolithic GaAs FET mixer does not require any external components or bias. The broad 50 to 500 MHz IF frequency response will satisfy many UMTS/PCS transmit or receive frequency plans configured for high side LO. The HMC402MS8 input IP3 performance coupled with its high P1dB rivals traditional active FET mixers while offering a much smaller 14.8mm² standard IC footprint, and no DC bias.

Electrical Specifications, $T_A = 25^\circ\text{C}$, LO = +17 dBm, IF = 300 MHz*

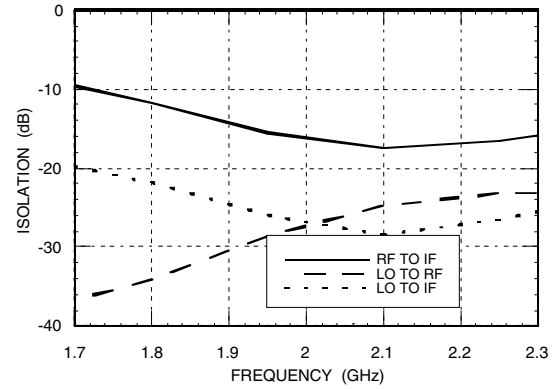
Parameter	Min.	Typ.	Max.	Min.	Typ.	Max.	Units
Frequency Range, RF	1.8 - 2.0		2.0 - 2.2				GHz
Frequency Range, LO	1.85 - 2.5		2.05 - 2.53				GHz
Frequency Range, IF	DC - 500		DC - 330				MHz
Conversion Loss		8.8	10.5		8.5	10.5	dB
Noise Figure (SSB)		8.8	10.5		8.5	10.5	dB
LO to RF Isolation	24	30		21	25		dB
LO to IF Isolation	19	24		24	28		dB
IP3 (Input)	27	30		27	31		dBm
1 dB Gain Compression (Input)	18	21		18	22		dBm
LO Input Drive Level (Typical)	+16 to +18		+16 to +18				dBm

*Unless otherwise noted, all measurements performed as a downconverter with high side LO & IF = 300 MHz.

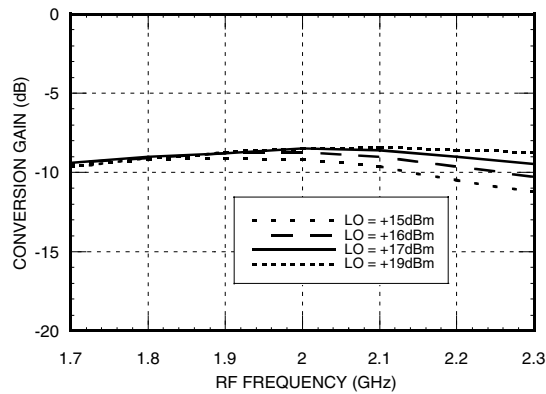
Conversion Gain vs. Temperature @ LO = +17 dBm



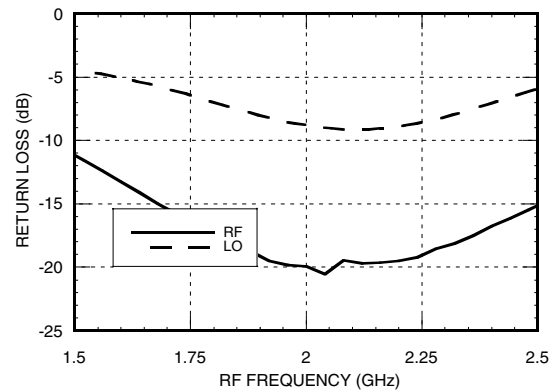
Isolation @ LO = +17 dBm



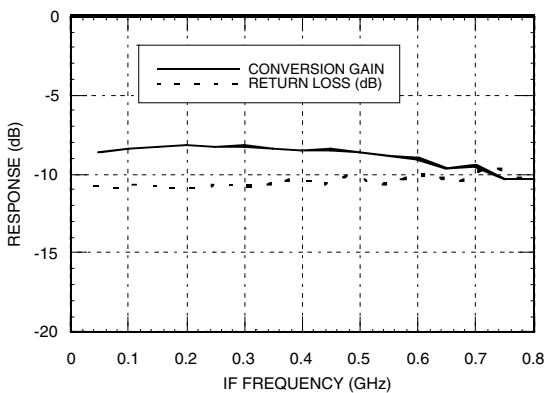
Conversion Gain vs. LO Drive



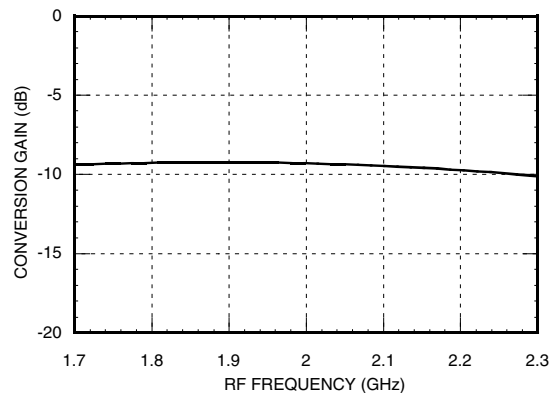
Return Loss @ LO = +17 dBm



IF Bandwidth @ LO = +17 dBm



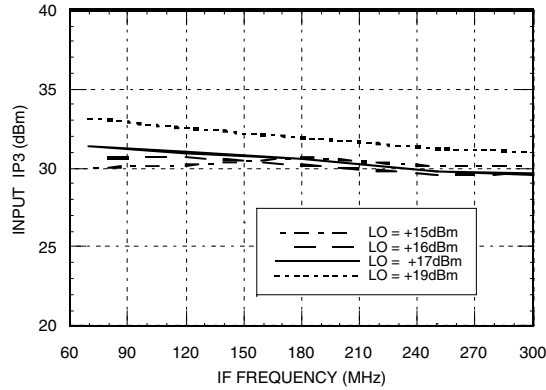
**Unconverter Performance
Conversion Gain @ LO = +17 dBm**



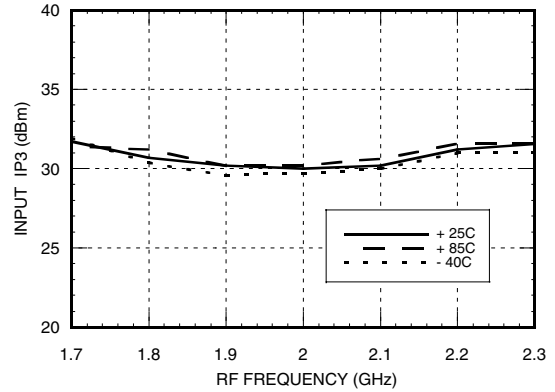
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HIGH IP3 GaAs MMIC MIXER, 1.8 - 2.2 GHz

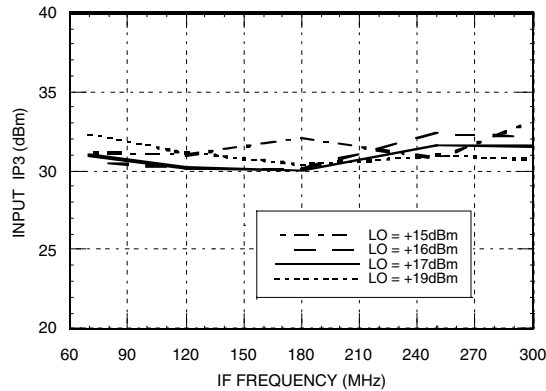
Input IP3 vs. IF Frequency, RF = 1.95 GHz



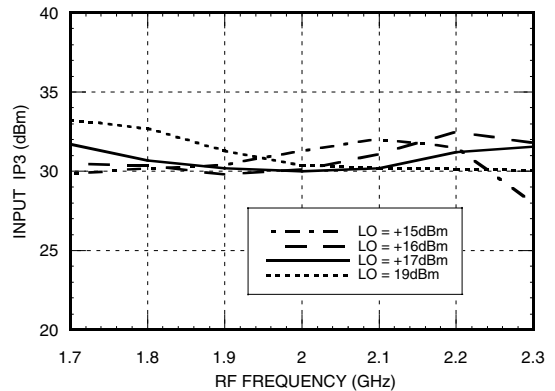
Input IP3 vs. Temperature @ LO = +17 dBm



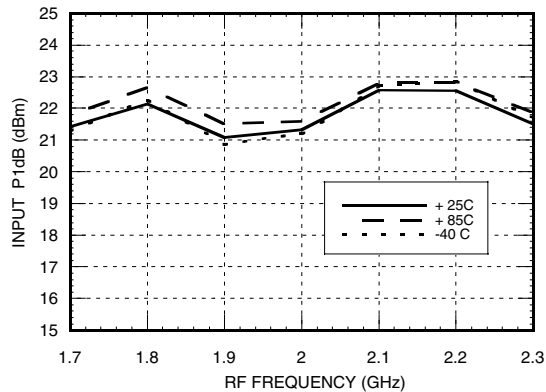
Input IP3 vs. IF Frequency, RF = 2.15 GHz



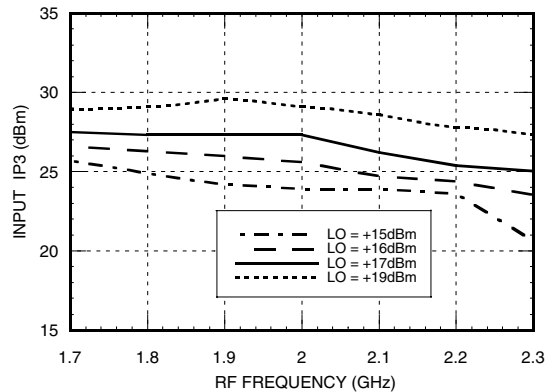
Input IP3 vs. LO Drive



Input P1dB vs. Temperature @ LO = +17 dBm

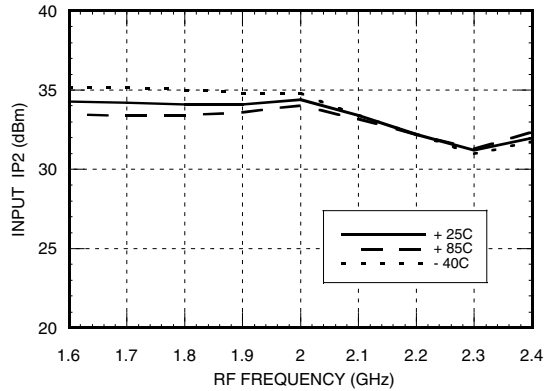


Upconverter IP3 vs. LO Drive, IF = 200 MHz

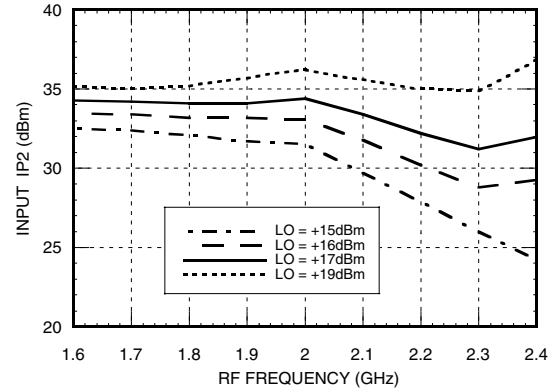


*Unless otherwise noted, all measurements performed as a downconverter with high side LO & IF = 300 MHz.

Input IP2 vs. Temperature @ LO = +17 dBm



Input IP2 vs. LO Drive



MxN Spurious Outputs

mRF	nLO				
	0	1	2	3	4
0	xx	-7	-3	-1	11
1	5	0	27	54	30
2	62	64	48	65	70
3	81	81	82	81	80
4	77	81	80	83	82

RF Freq = 1.9 GHz @ -10 dBm
LO Freq = 2.2 GHz @ +17 dBm
All values in dBc relative to the IF power level.
Measured as a downconverter.

Harmonics of LO

LO Freq (GHz)	nLO Spur @ RF Port			
	1	2	3	4
1.8	40	30	51	57
2	30	29	51	53
2.2	26	32	51	50
2.4	24	36	53	49
2.6	23	43	59	53
2.8	22	41	51	71

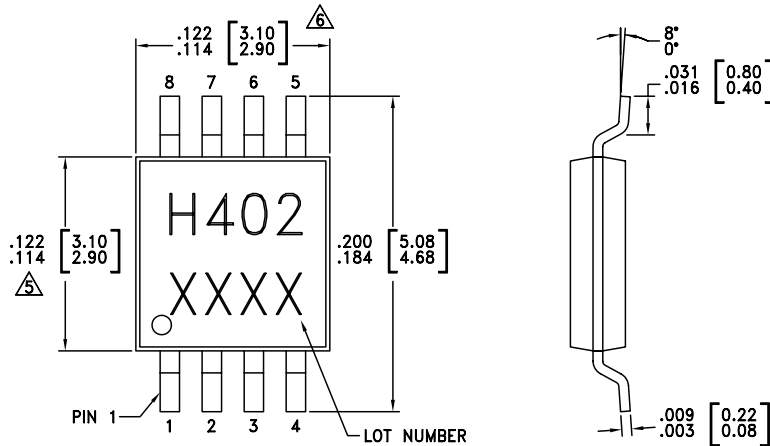
LO = +17 dBm
All values are in dBc below input LO level @ RF port.

Absolute Maximum Ratings

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

*Unless otherwise noted, all measurements performed as a downconverter with high side LO & IF = 300 MHz.

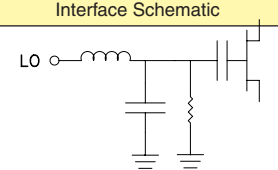

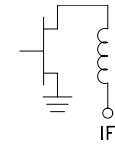
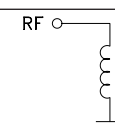
Outline Drawing



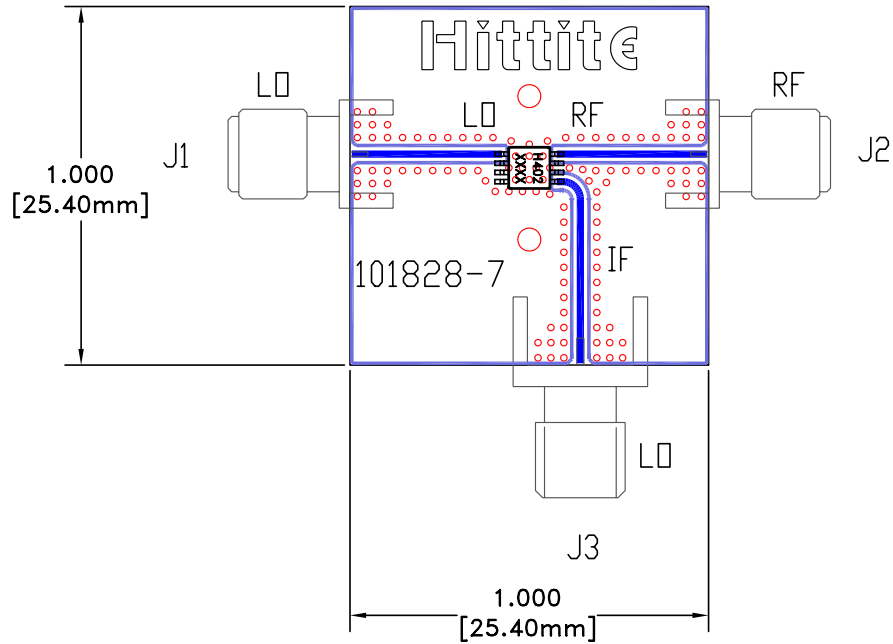
NOTES:

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 MUST BE SOLDERED TO PCB RF GROUND.

Pin Descriptions

Pin Number	Function	Description	Interface Schematic
1	LO	This pin is AC coupled & matched to 50 Ohms from 1.8 to 2.2 GHz. Blocking capacitors are required if line potential is not equal to 0V.	
2, 4	N/C	Not connected.	
3, 6, 7	GND	This pin must be connected to RF ground.	
5	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. Choose value of capacitor to pass IF frequency desired. For operation to DC, this pin must not sink/source more than 40 mA of current or failure may result.	
8	RF Port	This pin is DC coupled & matched to 50 Ohms from 1.8 to 2.2 GHz	

Evaluation PCB



List of Material

Item	Description
J1 - J3	PC Mount SMA RF Connector
U1	HMC402MS8 Mixer
PCB*	101828 Eval 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.