

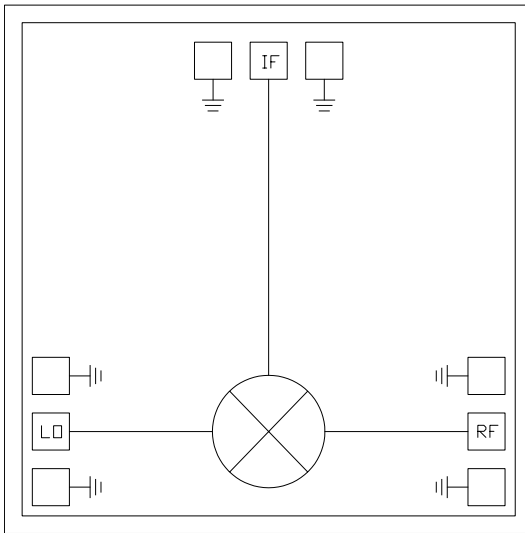
GaAs MMIC DOUBLE-BALANCED MIXER, 1.8 - 5.0 GHz

Typical Applications

The HMC128 is ideal for:

- Microwave & VSAT Radios
- Test Equipment
- Military EW, ECM, C³
- Space Telecom

Functional Diagram



Features

- Conversion Loss: 7 dB
- LO to RF and IF Isolation: >36 dB
- Input IP₃: +18 dBm
- Small Size, No DC Bias Required

General Description

The HMC128 is a miniature double-balanced mixer chip that can be used as an upconverter or downconverter. The device is a passive diode/balun type mixer with high dynamic range. Noise figure is essentially equal to the conversion loss. The mixer can handle larger signal levels than active mixers due to the high third order intercept. MMIC implementation provides exceptional balance in the circuit resulting in high LO/RF and LO/IF isolations. This mixer can operate over a wide LO Drive input of +9 to +15 dBm.

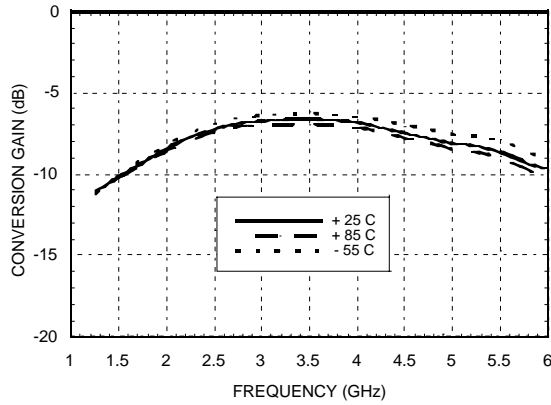
Electrical Specifications, $T_A = +25^\circ\text{C}$, LO Drive = +15 dBm

Parameter	Min.	Typ.	Max.	Units
Frequency Range, RF & LO		1.8 - 5.0		GHz
Frequency Range, IF		DC - 3.0		GHz
Conversion Loss		7	10	dB
Noise Figure (SSB)		7	10	dB
LO to RF Isolation	35	42		dB
LO to IF Isolation	27	36		dB
IP ₃ (Input)	15	18		dBm
IP ₂ (Input)	45	50		dBm
1 dB Gain Compression (Input)	5	10		dBm

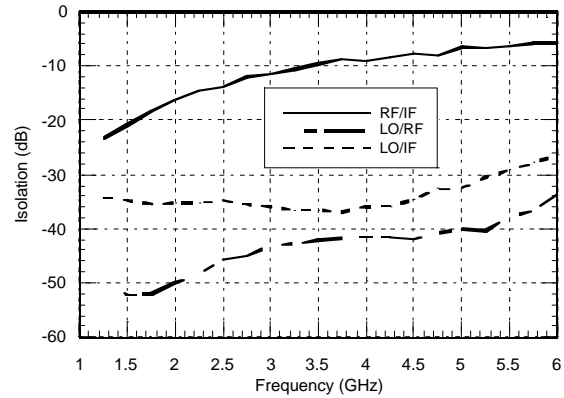
* Unless otherwise noted, all measurements performed as downconverter, IF = 100 MHz

**GaAs MMIC DOUBLE-BALANCED
MIXER, 1.8 - 5.0 GHz**

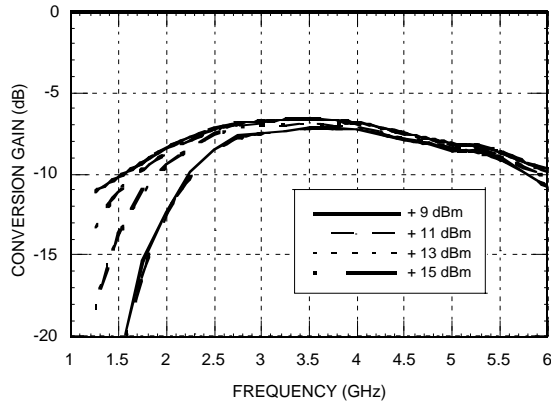
**Conversion Gain vs. Temperature
@ LO = +15 dBm**



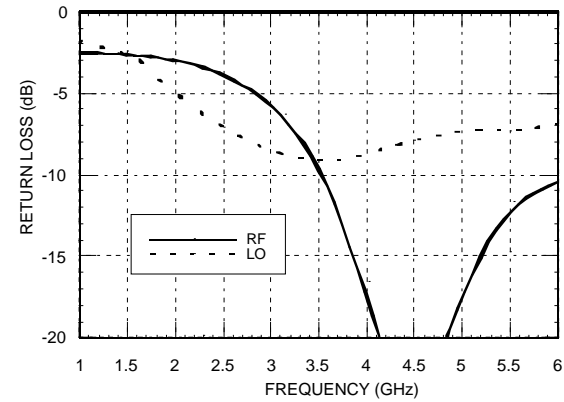
Isolation @ LO = +15 dBm



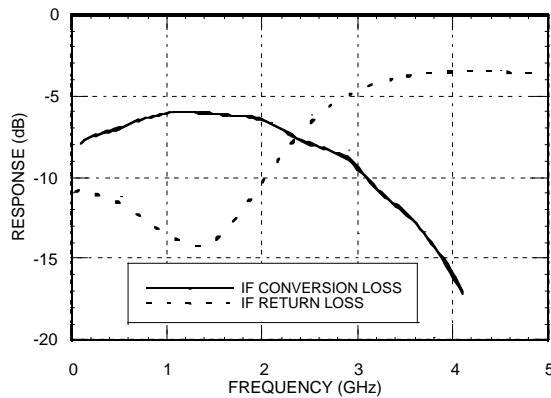
Conversion Gain vs. LO Drive



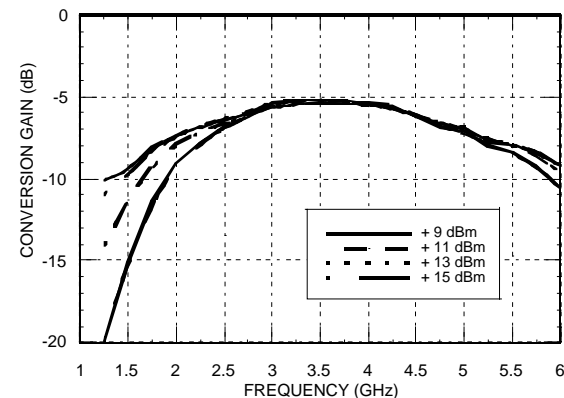
LO and RF Return Loss



IF Bandwidth @ LO = +15 dBm

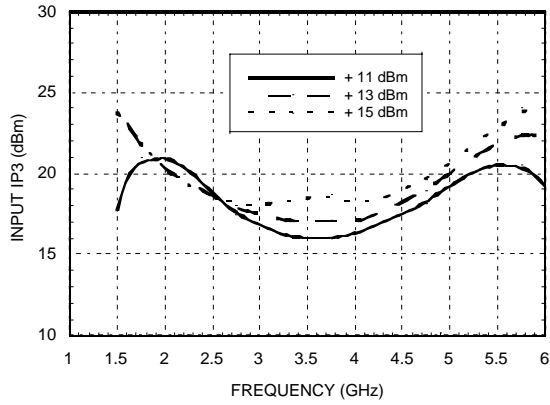


**Upconverter Performance
Conversion Gain vs. LO Drive**

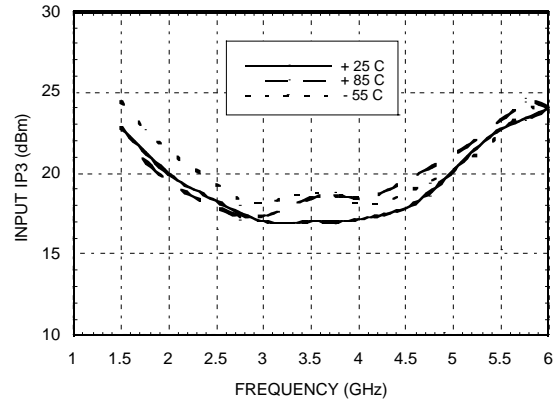


GaAs MMIC DOUBLE-BALANCED MIXER, 1.8 - 5.0 GHz

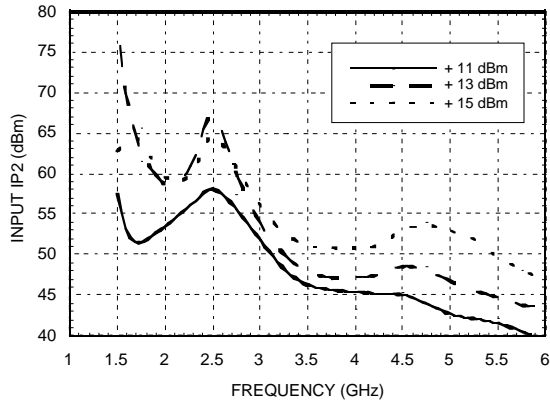
Input IP3 vs. LO Drive



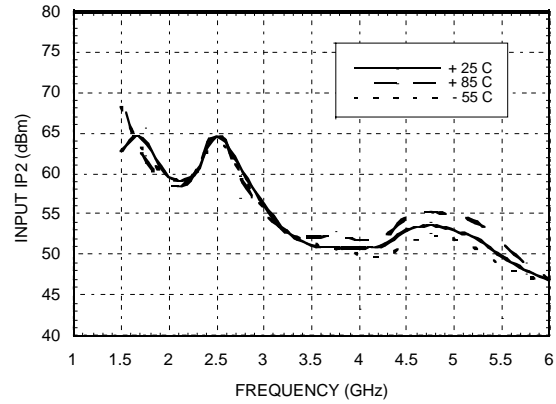
Input IP3 vs. Temperature @ LO = +15 dBm



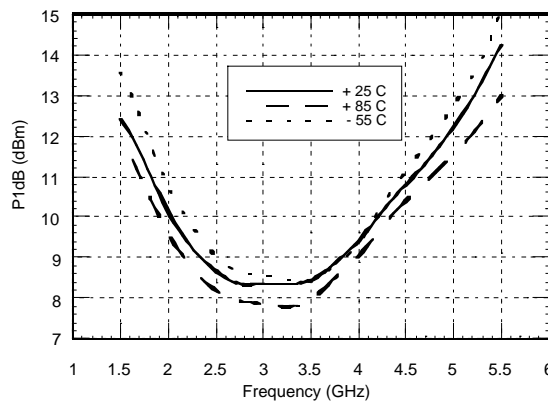
Input IP2 vs. LO Drive



Input IP2 vs. Temperature @ LO = +15 dBm



Input P1dB vs. Temperature @ LO = +15 dBm



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MxN Spurious @ IF Port

mRF	nLO				
	0	1	2	3	4
0	xx	5.6	30.3	11.1	34.5
1	2.8	0	23.3	31.5	29.1
2	62.3	58.6	57.8	60.3	75.8
3	74.3	>85	74.3	65.8	74.3
4	>85	>85	>85	>85	>85

RF Freq.= 3.5 GHz @ -10 dBm
LO Freq.= 3.4 GHz @ +13 dBm
All values in dBc below IF power level.
Measured as downconverter

Harmonics of LO

LO Freq. (GHz)	nLO Spur @ RF Port			
	1	2	3	4
1.5	54	42	54	54
2.0	48	41	50	66
2.5	47	41	44	76
3.5	40	50	52	75
4.5	40	60	51	65
5.5	38	60	46	63

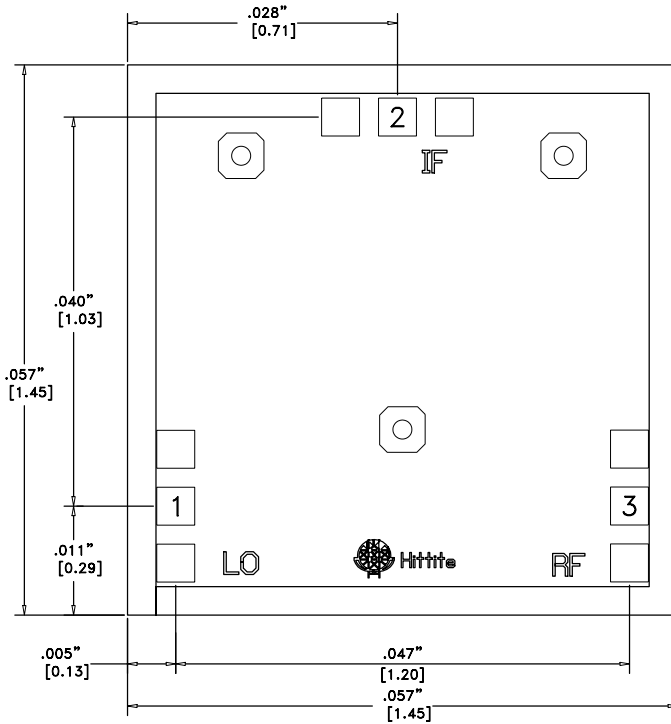
LO = +13 dBm
All values in dBc below input LO level measured at RF port.

Absolute Maximum Ratings

LO Drive	+27 dBm
Storage Temperature	-65 to +150 °C
Operating Temperature	-55 to +85 °C

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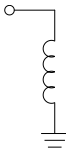
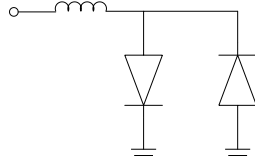
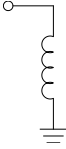

Outline Drawing



NOTES:

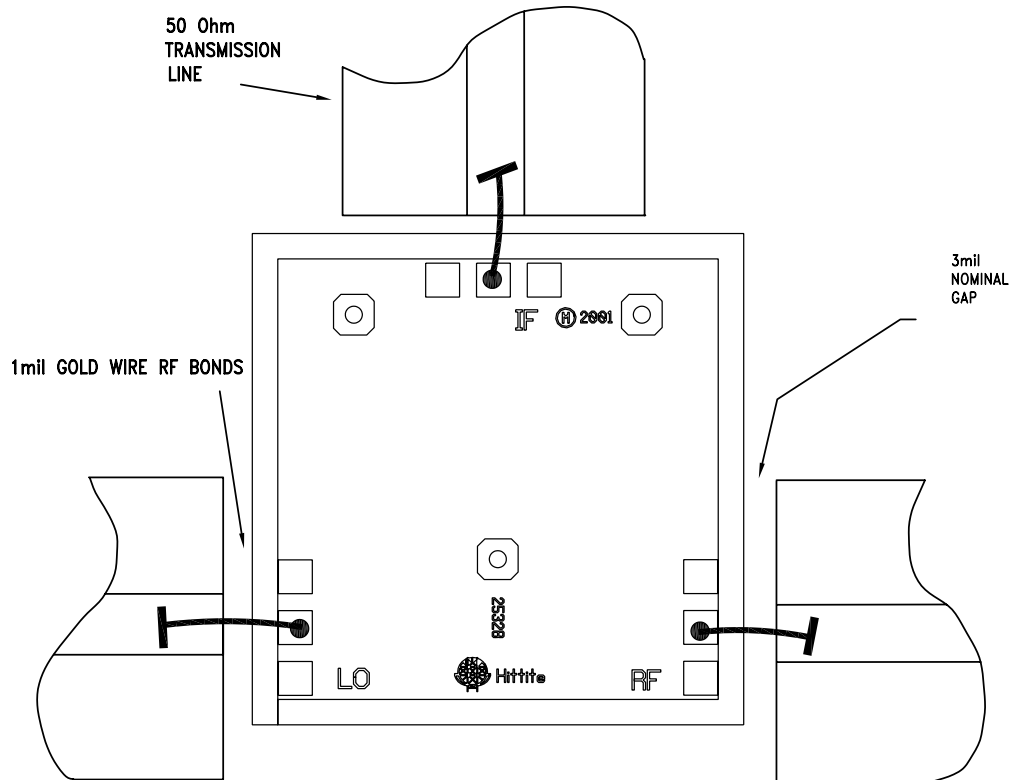
1. ALL DIMENSIONS ARE IN INCHES [MM]
2. BOND PADS ARE .004" SQUARE
3. TYPICAL BOND PAD SPACING CENTER TO CENTER IS .006" EXCEPT AS SHOWN
4. DIE THICKNESS = .004" [100 MM]
5. BACKSIDE METALIZATION: GOLD
6. BACKSIDE METAL IS GROUND
7. BOND PAD METALIZATION: GOLD

Pad Descriptions

Pad Number	Function	Description	Interface Schematic
1	LO	This pin is DC coupled and matched to 50 Ohm from 1.8 to 5.0 GHz.	
2	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 or sink more than 2mA of current or die non-function and possible die failure will result.	
3	RF	This pin is DC coupled and matched to 50 Ohm from 1.8 to 5.0 GHz.	
	GND	The backside of the die must connect to RF ground.	

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Assembly Diagram



Handling Precautions

Follow these precautions to avoid permanent damage.

Cleanliness: Handle the chips in a clean environment. DO NOT attempt to clean the chip using liquid cleaning systems.

Static Sensitivity: Follow ESD precautions to protect against > ± 250V ESD strikes.

Transients: Suppress instrument and bias supply transients while bias is applied. Use shielded signal and bias cables to minimize inductive pick-up.

General Handling: Handle the chip along the edges with a vacuum collet or with a sharp pair of bent tweezers. The surface of the chip has fragile air bridges and should not be touched with vacuum collet, tweezers, or fingers.

Mounting

The chip is back-metallized and can be die mounted with AuSn eutectic preforms or with electrically conductive epoxy. The mounting surface should be clean and flat.

Eutectic Die Attach: A 80/20 gold tin preform is recommended with a work surface temperature of 255 °C and a tool temperature of 265 °C. When hot 90/10 nitrogen/hydrogen gas is applied, tool tip temperature should be 290 °C. DO NOT expose the chip to a temperature greater than 320 °C for more than 20 seconds. No more than 3 seconds of scrubbing should be required for attachment.

Epoxy Die Attach: Apply a minimum amount of epoxy to the mounting surface so that a thin epoxy fillet is observed around the perimeter of the chip once it is placed into position. Cure epoxy per the manufacturer's schedule.

Wire Bonding

Ball or wedge bond with 0.025 mm (1 mil) diameter pure gold wire. Thermosonic wirebonding with a nominal stage temperature of 150 °C and a ball bonding force of 40 to 50 grams or wedge bonding force of 18 to 22 grams is recommended. Use the minimum level of ultrasonic energy to achieve reliable wirebonds. Wirebonds should be started on the chip and terminated on the package or substrate. All bonds should be as short as possible <0.31 mm (12 mils).