MICROWAVE CORPORATION

GaAs MMIC DOUBLE-BALANCED MIXER 25 - 40 GHz

FEBRUARY 2001

v00.1200

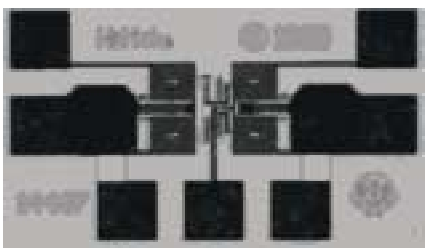
Features

Passive: No DC Bias Required

Input IP3 : +19 dBm

LO/RF Isolation: 38 to 42 dB

Small Size: 0.47 mm^2



General Description

The HMC329 chip is a miniature passive double balanced mixer which can be used as an upconverter or downconverter from 25 - 40 GHz in a small chip area of 0.84 mm x 0.55 mm. Excellent isolations are provided by on-chip baluns, and the chip requires no external components and no DC bias. The mixer chip is designed to be used in Local Multi- Point Distribution Systems (LMDS), microwave point to point radios, and SATCOM applications. Measurements were made with the chip mounted and ribbon bonded into in a 50-ohm microstrip test fixture that contains 5-mil alumina substrates between the chip and K-connectors. Measured data includes the parasitic effects of the assembly. RF connections to the chip were made with 0.076 mm (3-mil) ribbon bond with minimal length <0.31mm (<12 mil).

Guaranteed Performance, *LO Drive= +13 dBm, - 55 to + 85 deg C*

Parameter	LO = +13 dBm			Units
	Min.	Typ.	Max.	
Frequency Range, RF & LO		26 - 40		GHz
Frequency Range, IF		DC - 8		GHz
Conversion Loss		9.5	11.5	dB
Noise Figure (SSB)		9.5	11.5	dB
LO to RF Isolation	38	42		dB
LO to IF Isolation	25	35		dB
RF to IF Isolation	21	28		dB
IP3 (Input)	16	19		dBm
IP2 (Input)	45	55		dBm
1 dB Compression (Input)	8	11		dBm
Local Oscillator Drive Level		9 ~ 15		dBm

12 Elizabeth Drive, Chelmsford, MA 01824 Phone: 978-250-3343 Fax: 978-250-3373 Web Site: www.hittite.com

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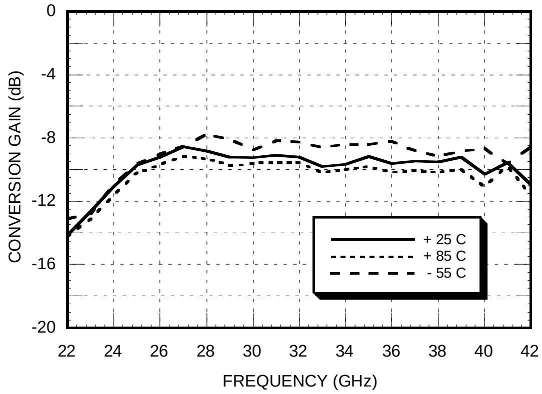
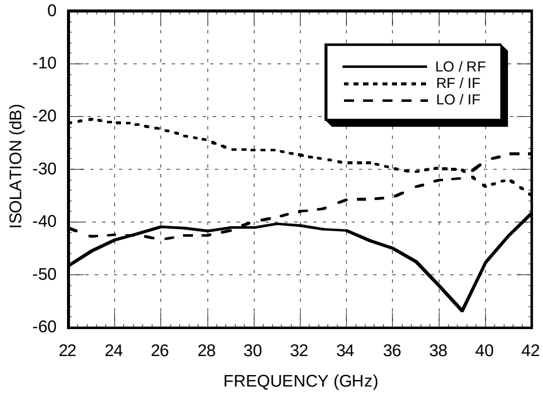
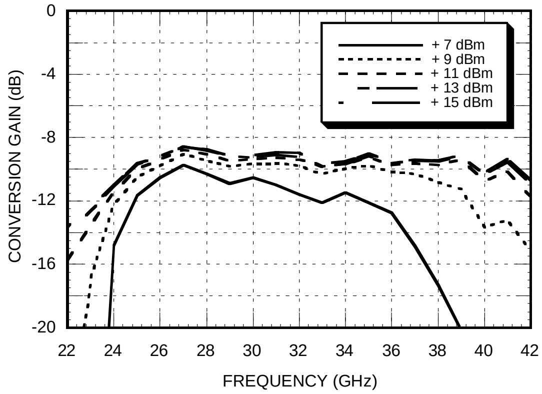
Conversion Gain vs. Temperature @ LO= +13 dBm



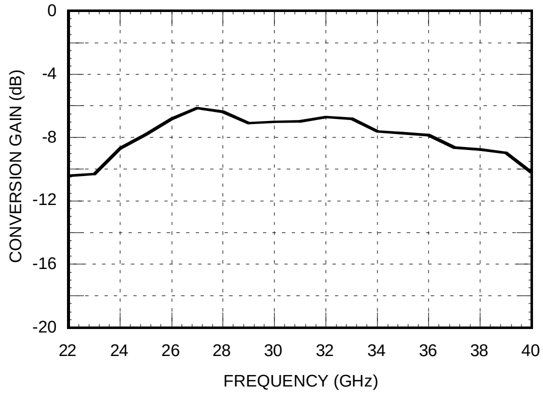
Isolation @ LO = +13 dBm



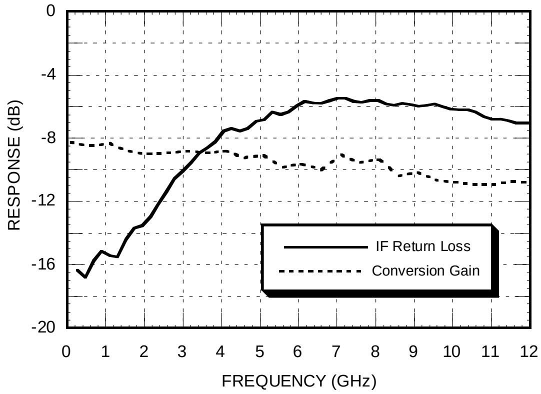
Conversion Gain vs. LO Drive



Upconverter Performance Conversion Gain @ LO= +13 dBm



IF Bandwidth @ LO= +13 dBm



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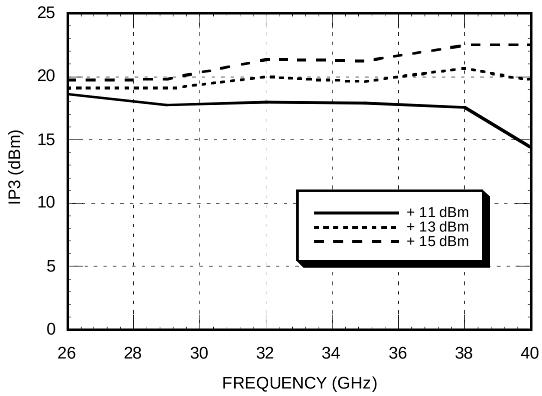
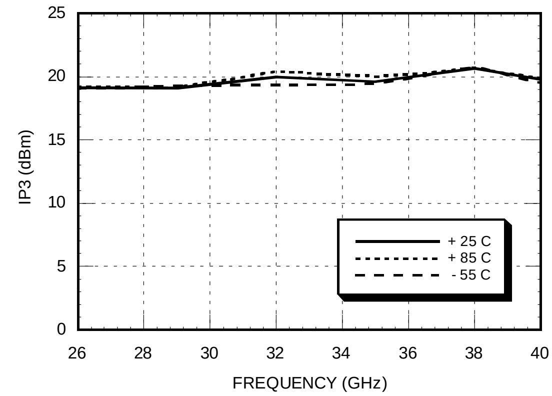
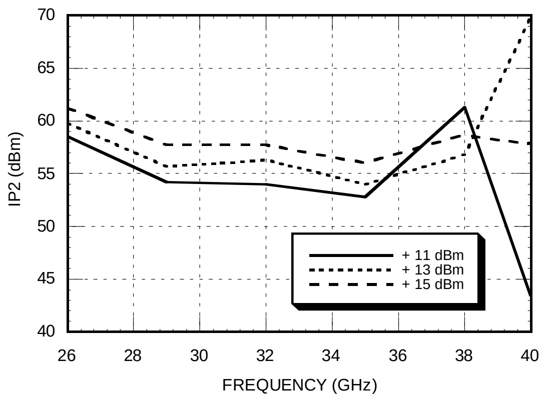
Input IP3 vs. LO Drive



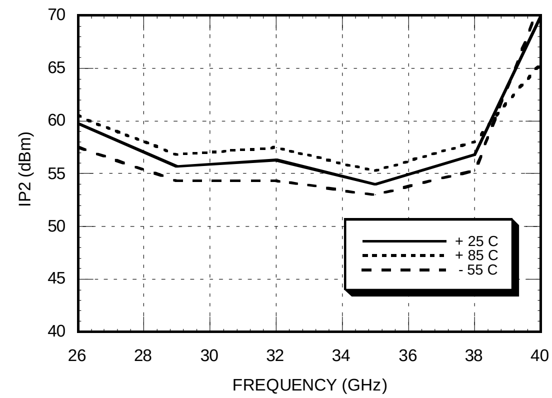
Input IP3 vs. Temperature @ LO= +13 dBm



Input IP2 vs. LO Drive



Input IP2 vs. Temperature @ LO= +13 dBm

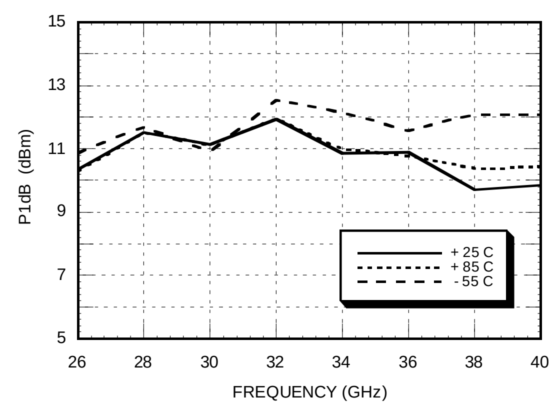


MXN Spurious Outputs as a Down Converter

	nLO				
mRF	0	1	2	3	4
0	xx	7			
1	19	0	41		
2		69	57	67	
3			74	69	71
4				74	74

RF= 31 GHz @ -10 dBm
LO= 32 GHz @ +13 dBm
All values in dBc below the IF output power level.

Input P1dB vs. Temperature @ LO = +13 dBm



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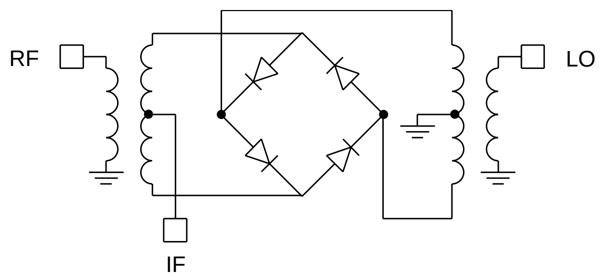
Schematic

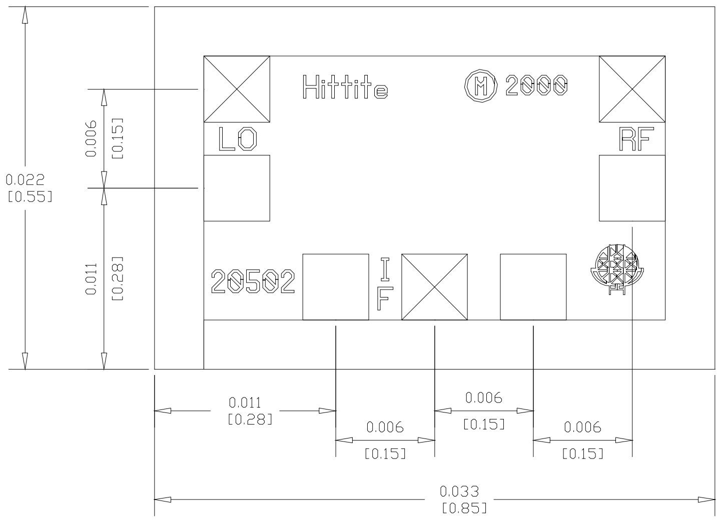


Absolute Maximum Ratings

RF/IF Input	+13 dBm
LO Drive	+27 dBm
IF DC Current	±2 mA
Storage Temperature	-65 to +150 deg C
Operating Temperature	-55 to +125 deg C

Outline Drawing

(See Die Handling, Mounting, Bonding Note Page 4-202)



Backside of chip is ground. Connections are not required for unlabeled bondpads.

ALL DIMENSION IN INCHES (MILLIMETERS)
ALL TOLERANCES ARE ±0.025 (0.001)
DIE THICKNESS IS 0.100 (0.004) BACKSIDE IS GROUND
BOND PADS ARE 0.100 (0.004) SQUARE
BOND PAD SPACING, CTR-CTR: 0.150 (0.006)
BACKSIDE METALLIZATION : GOLD
BOND PAD METALLIZATION : GOLD

MIC Assembly Techniques for HMC329

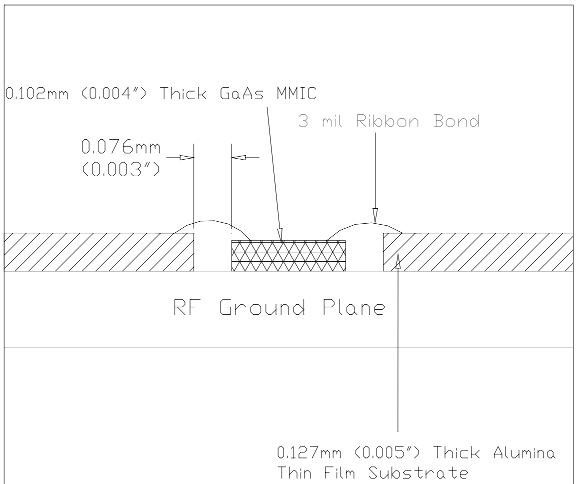


Figure 1.

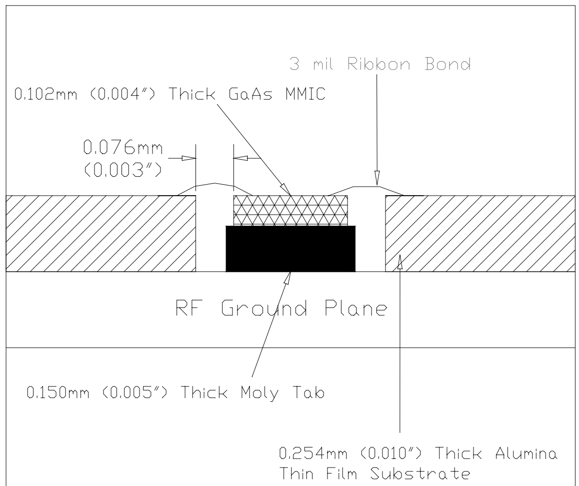


Figure 2.

Mounting & Bonding Techniques for Millimeterwave GaAs MMICs

The die should be attached directly to the ground plane eutectically or with conductive epoxy (see HMC general Handling, Mounting, Bonding Note).

50 Ohm Microstrip transmission lines on 0.127mm (5 mil) thick alumina thin film substrates are recommended for bringing RF to and from the chip (Figure 1). If 0.254mm (10 mil) thick alumina thin film substrates must be used, the die should be raised 0.150mm (6 mils) so that the surface of the die is coplanar with the surface of the substrate. One way to accomplish this is to attach the 0.102mm (4 mil) thick die to a 0.150mm (6 mil) thick molybdenum heat spreader (moly-tab) which is then attached to the ground plane (Figure 2).

Microstrip substrates should be brought as close to the die as possible in order to minimize ribbon bond length. Typical die-to-substrate spacing is 0.076mm (3 mils). Gold ribbon of 0.075 mm (3 mil) width and minimal length <0.31 mm (<12 mils) is recommended to minimize inductance on RF, LO & IF ports.

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 $\geq$ ± 250V ESD strikes (*see page 8 - 2*).
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 deg. C and a tool temperature of 265 deg. C. When hot 90/10 nitrogen/hydrogen gas is applied, tool tip temperature should be 290 deg. C.
DO NOT expose the chip to a temperature greater than 320 deg. 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

Wire bonds of 0.025 mm (1 mil) diameter are recommended. Thermosonic wirebonding with a nominal stage temperature of 150 deg. 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).