Hittite
MICROWAVE CORPORATION

HMC292

GaAs MMIC DOUBLE-BALANCED MIXER 18 - 32 GHz

FEBRUARY 2001 v01.1000

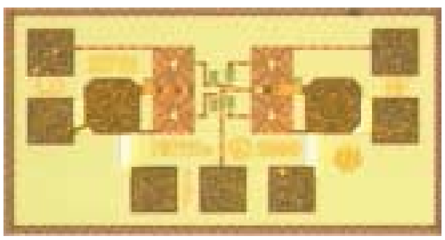
Features

INPUT IP3: +19 dBm

LO/RF ISOLATION: 33 to 43 dB

PASSIVE : NO DC BIAS REQ'D

SMALL SIZE: 0.89 mm x 1.04 mm



General Description

The HMC292 chip is a miniature passive double-balanced mixer which can be used as an upconverter or downconverter from 18 - 32 GHz in a small chip area of 0.93 mm^2. Excellent isolations are provided by on-chip baluns, which require 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. All data is measured with the chip in a 50 ohm test fixure connected via 0.025 mm (1 mil) diameter wire bonds of minimal length <0.31 mm (<12 mils).

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

Parameter	LO = +13 dBm			LO = +13 dBm			
	Min.	Typ.	Max.	Min.	Typ.	Max.	Units
Frequency Range, RF & LO		20 - 30			18 - 32		GHz
Frequency Range, IF		DC - 8			DC - 8		GHz
Conversion Loss		7.5	9		8	10	dB
Noise Figure (SSB)		7.5	9		8	10	dB
LO to RF Isolation	31	38		30	36		dB
LO to IF Isolation	33	40		30	40		dB
RF to IF Isolation	20	25		17	25		dB
IP3 (Input)	17	19		15	19		dBm
IP2 (Input)	45	50		42	50		dBm
1dB Gain Compression (Input)	8	12		8	12		dBm
Local Oscillator Drive Level		8 ~ 15			8 ~ 15		dBm

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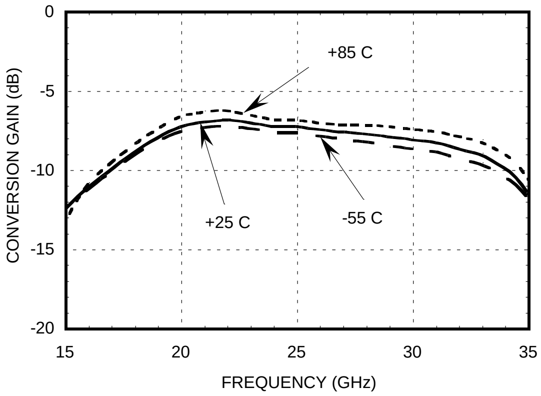
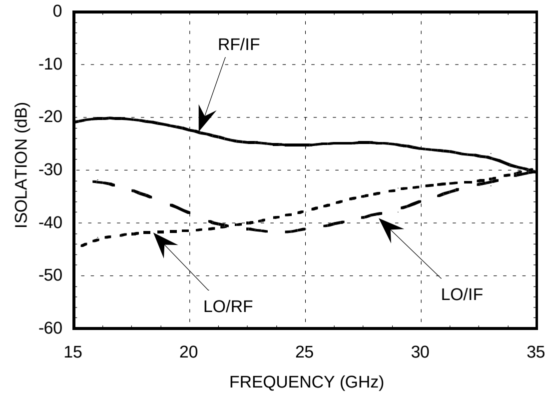
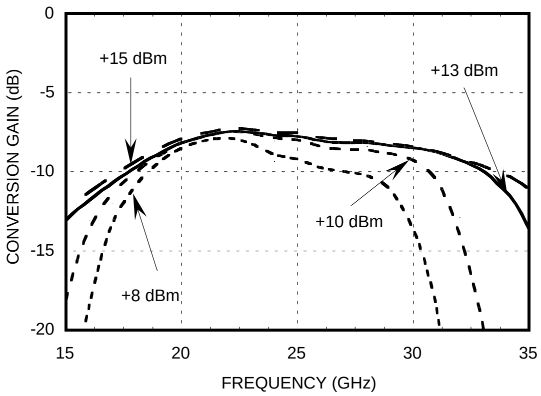
Conversion Gain vs. Temperature @ LO = +13 dBm



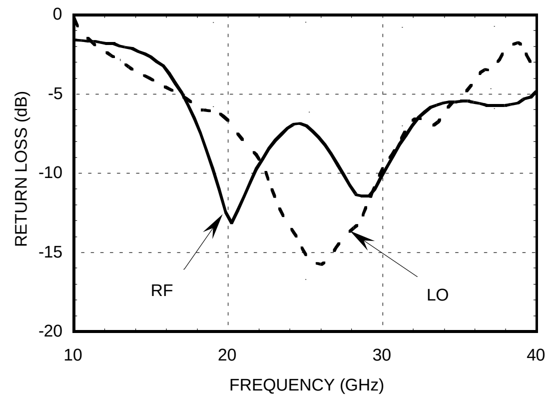
Isolation @ LO = +13 dBm



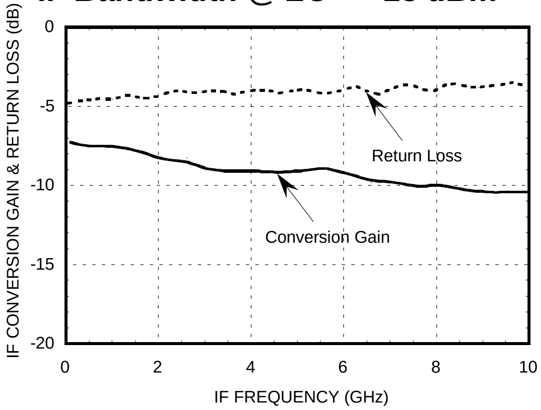
Conversion Gain vs. LO Drive



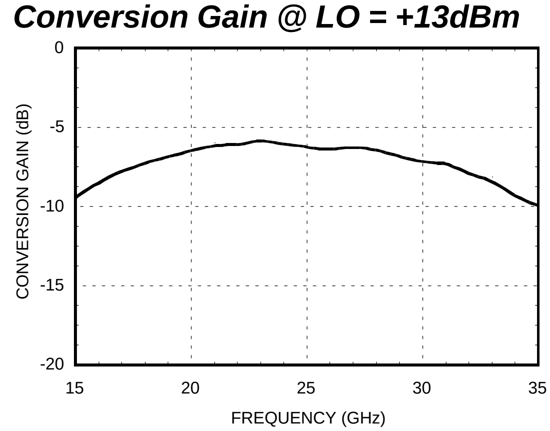
RF & LO Return Loss @ LO = +13 dBm



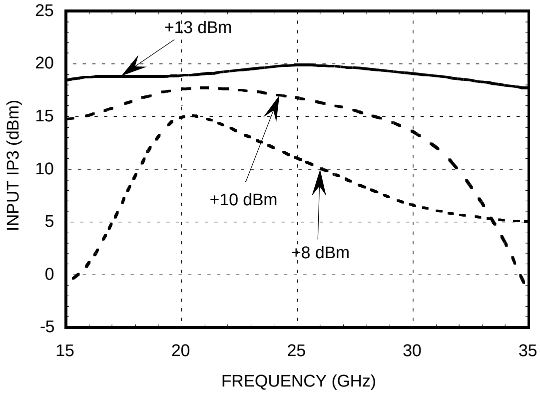
IF Bandwidth @ LO = +13 dBm



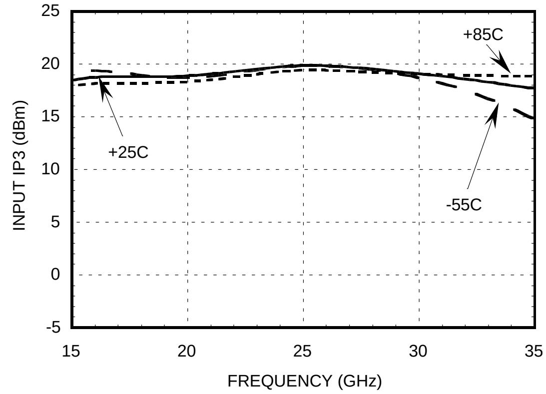
Upconverter Performance Conversion Gain @ LO = +13dBm



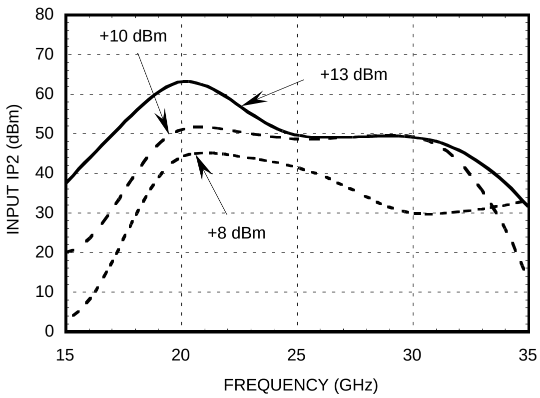
Input IP3 vs. LO Drive



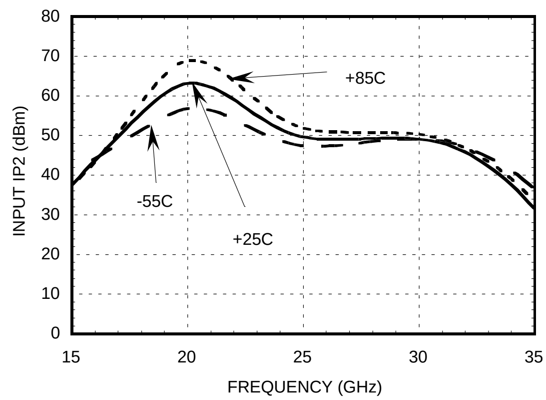
Input IP3 vs. Temperature @ LO = +13 dBm



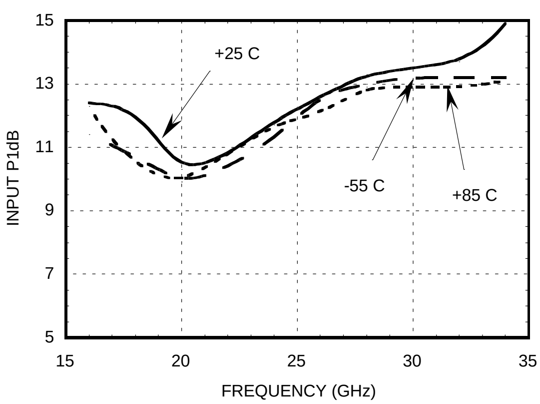
Input IP2 vs. LO Drive



Input IP2 vs. Temperature @ LO = +13 dBm



Input P1dB vs. Temperature @ LO = +13 dBm



MXN Spurious Outputs

	nLO				
mRF	0	1	2	3	4
0	xx	11			
1	17	0	39		
2		70	77	76	
3			93	69	86
4			>110	>110	>110

RF= 21 GHz @ -10 dBm
LO= 22 GHz @ +13 dBm
All values in dBc below the IF power level

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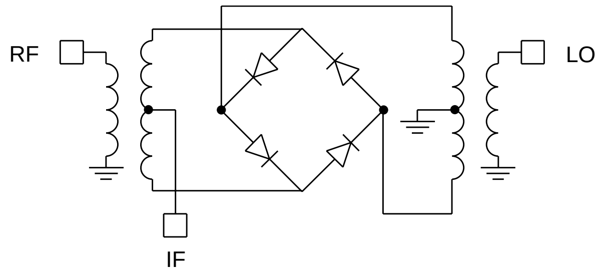
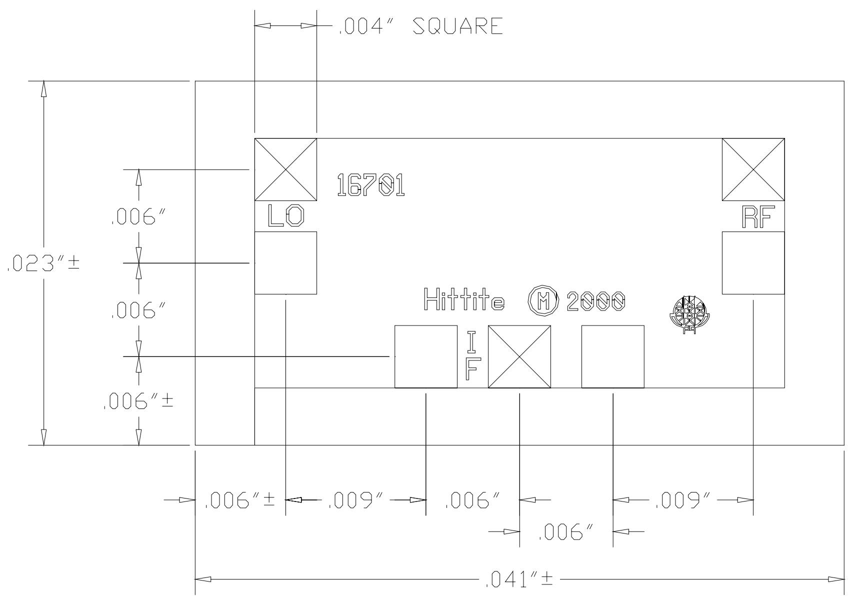
Schematic



Absolute Maximum Ratings

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

Outline Drawing (See Handling Mounting Bonding Note Page 4-174)



Backside of chip is ground. Connections are required for bondpads marked with "X".

ALL DIMENSIONS ARE IN INCHES
DIE THICKNESS IS .004"
BOND PADS ARE .004" SQUARE
BOND PAD SPACING CENTER TO CENTER IS .006" TYPICAL
BACKSIDE METALIZATION: GOLD
BOND PAD METALIZATION: GOLD

MIC Assembly Techniques for HMC292

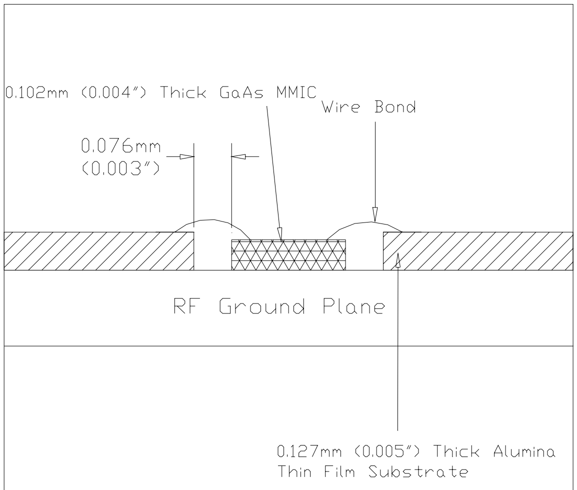


Figure 1.

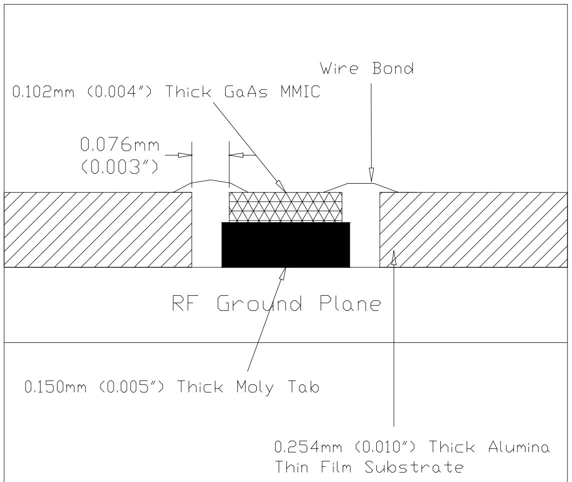


Figure 2.

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 bond wire length. Typical die-to-substrate spacing is 0.076mm (3 mils). Gold wire of 0.025 mm(1 mil) diameter 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 ≥ ± 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).