Hittite
MICROWAVE CORPORATION

HMC264

GaAs MMIC SUB-HARMONICALLY PUMPED MIXER 20 - 32 GHz

FEBRUARY 2001

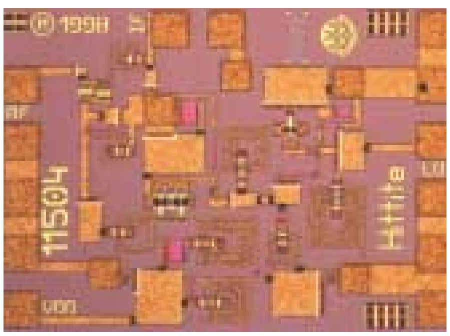
Features

INTEGRATED LO AMPLIFIER: -4dBm INPUT

SUB-HARMONICALLY PUMPED (x2) LO

HIGH 2LO/RF ISOLATION: > 35dB

SMALL SIZE: 0.97mm x 1.32mm



General Description

The HMC264 chip is a sub-harmonically pumped (x2) MMIC mixer with an integrated LO amplifier which can be used as an upconverter or downconverter. The chip utilizes a GaAs PHEMT technology that results in a small overall chip area of 1.28mm^2. The 2LO to RF isolation is excellent eliminating the need for additional filtering. The LO amplifier is a single bias (+3V to +4V) two stage design with only -4dBm nominal drive requirement. This mixer chip is designed to be used in local multi-point distribution (LMDS) systems, microwave point-to-point radios, and SATCOM applications. All data is measured with the chip in a 50 ohm test fixture connected via 0.025 mm (1 mil) diameter wire bonds of minimal length <0.31 mm (<12 mils).

Guaranteed Performance, *As a Function of LO Drive & Vdd, - 55 to + 85 deg C*

Parameter	IF = 1 GHz LO= 0dBm & Vdd = +4V			IF = 1 GHz LO= -4dBm & Vdd = +4V			IF = 1 GHz LO= -4dBm & Vdd = +3V			Units
	Min.	Typ.	Max.	Min.	Typ.	Max.	Min.	Typ.	Max.	
Frequency Range, RF		24 - 32			20 - 30			22 - 29		GHz
Frequency Range LO		12 - 16			10 - 15			10.5 - 14.5		GHz
Frequency Range, IF		DC - 6			DC - 6			DC - 4		GHz
Conversion Loss		10	13		10	12		9	11	dB
Noise Figure (SSB)		10	13		10	12		9	11	dB
2LO to RF Isolation	29	35		29	40		18	22 ~ 30		dB
2LO to IF Isolation	32	40		29	40 ~ 50		25	30		dB
IP3 (Input)	5	13		5	13		3	10		dBm
1 dB Compression (Input)	+3	+6		-3	0 ~ +4		-5	0 ~ +3		dBm
Local Oscillator Drive Level	-8	0	+8	-8	-4	+8	-8	-4	+8	dBm
Supply Voltage (Vdd)	3.75	4.0	4.25	3.75	4.0	4.25	2.75	3.0	3.25	Vdc
Supply Current (Idd)		28	45		28	45		25	40	mA

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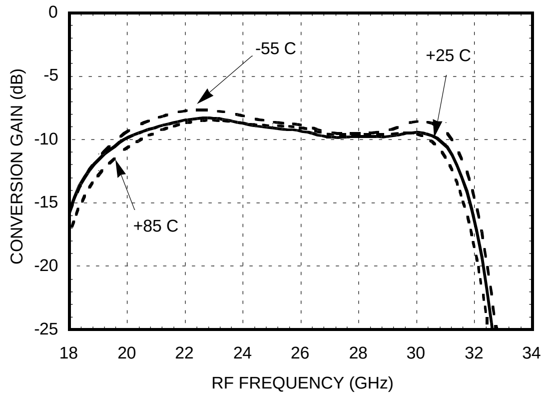
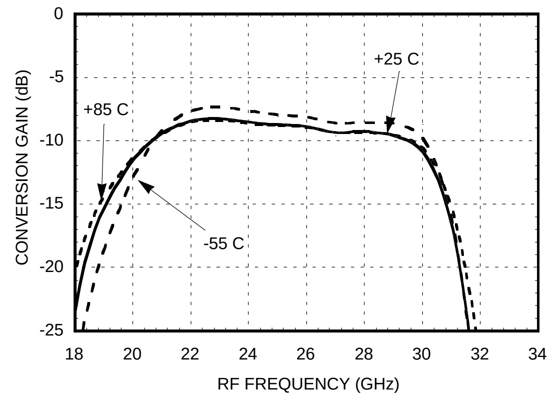
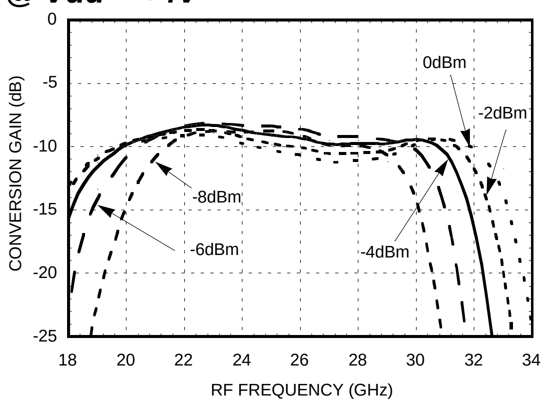
Conversion Gain vs. Temperature @ LO = -4 dBm Vdd= +4V



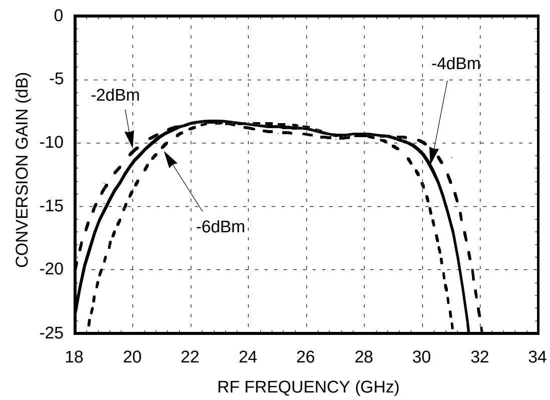
Conversion Gain vs. Temperature @ LO = -4 dBm Vdd= +3V



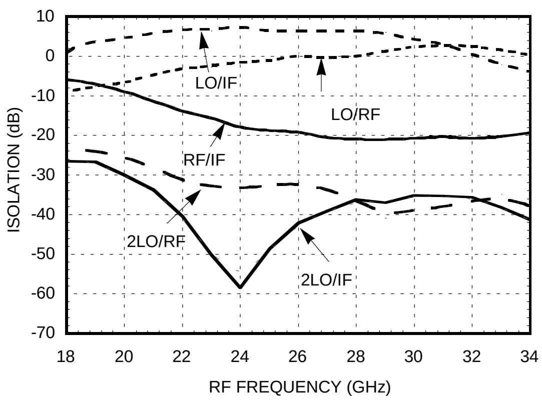
Conversion Gain vs. LO Drive @ Vdd = +4V



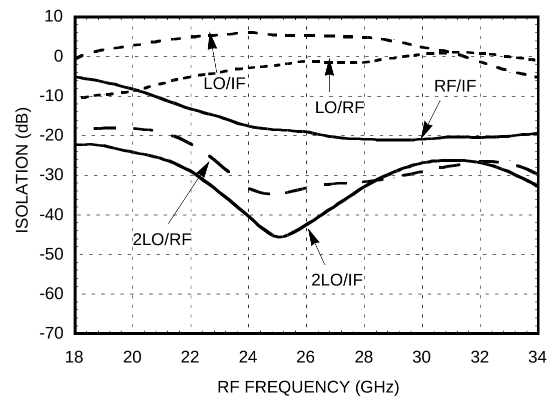
Conversion Gain vs. LO Drive @ Vdd = +3V



Isolation @ LO = -4 dBm Vdd = +4V



Isolation @ LO = -4 dBm Vdd = +3V



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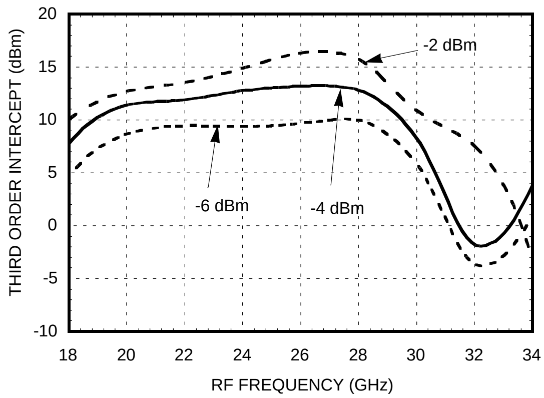
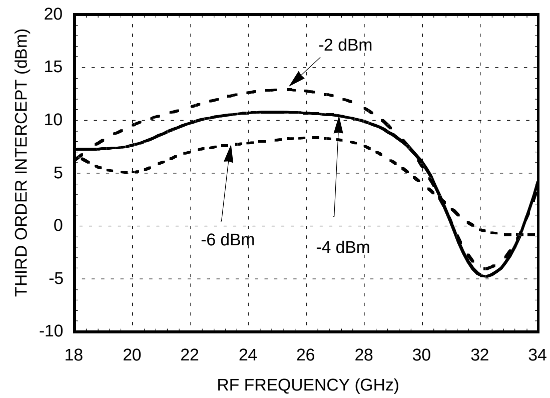
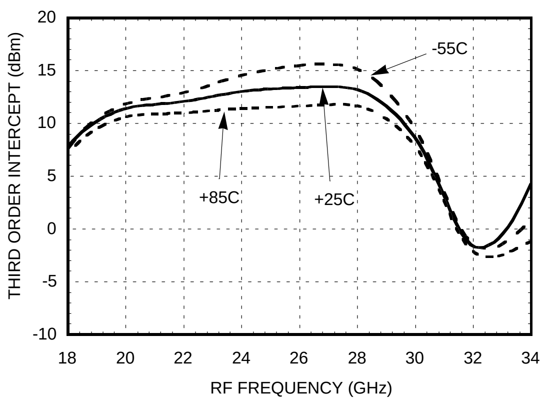
Input IP3 vs. LO Drive @ Vdd = +4V



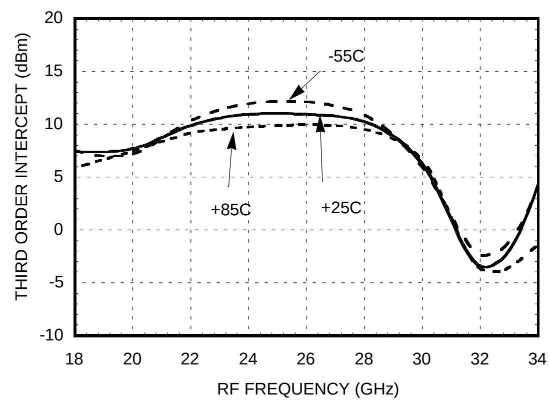
Input IP3 vs. LO Drive @ Vdd = +3V



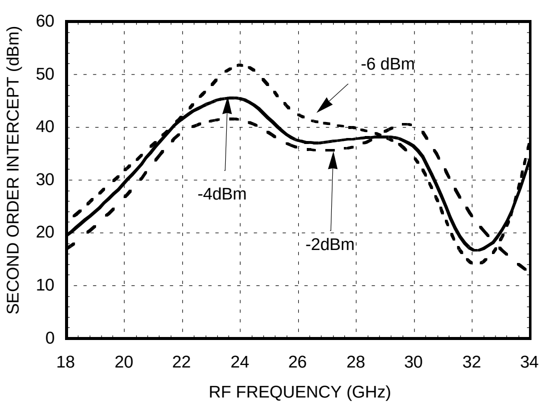
Input IP3 vs. Temperature @ LO = -4 dBm, Vdd = +4V



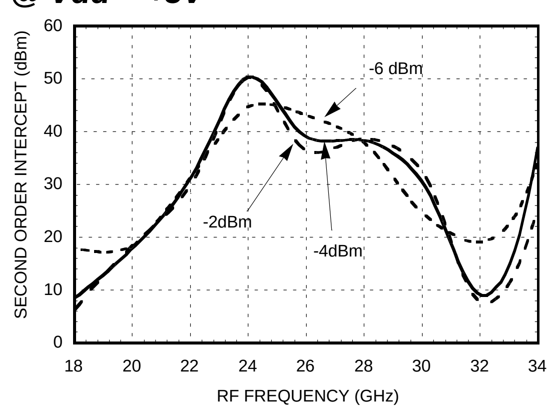
Input IP3 vs. Temperature @ LO = -4 dBm, Vdd = +3V



Input IP2 vs. LO Drive @ Vdd = +4V



Input IP2 vs. LO Drive @ Vdd = +3V



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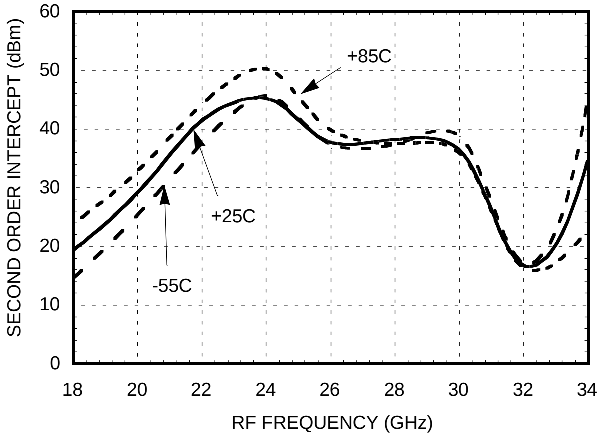
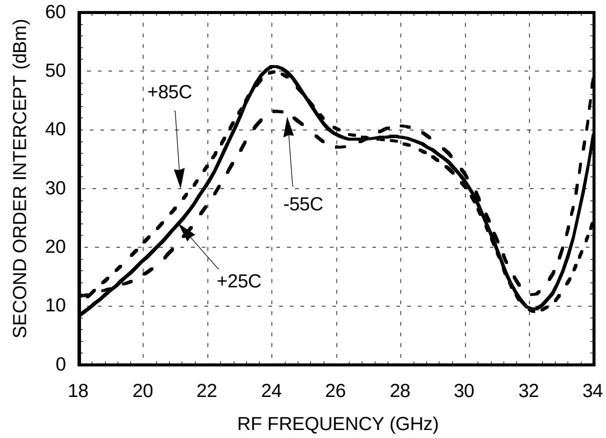
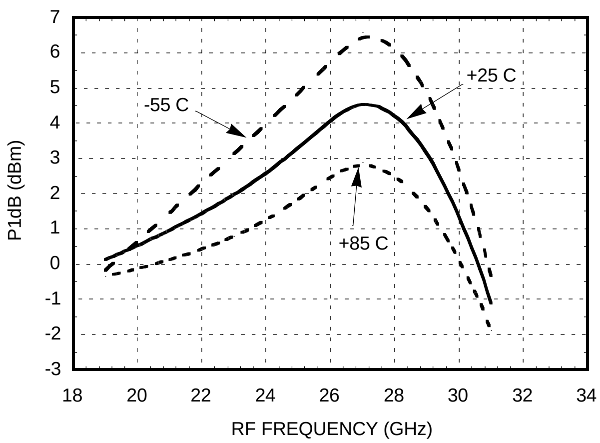
Input IP2 vs. Temperature @ LO = -4 dBm, Vdd = + 4V



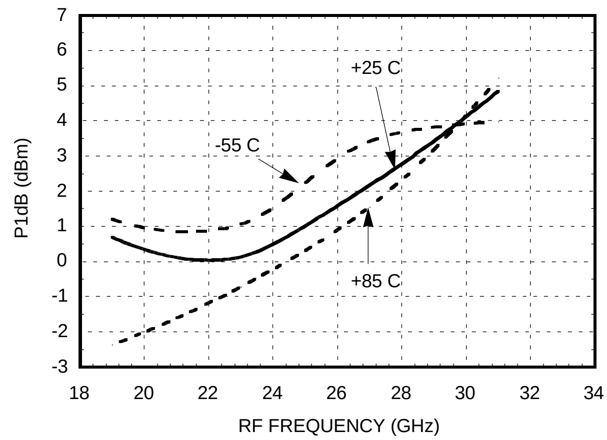
Input IP2 vs. Temperature @ LO = -4 dBm, Vdd = +3V



P1dB vs. Temperature @ LO = -4 dBm, Vdd = +4V



P1dB vs. Temperature @ LO = -4 dBm, Vdd = +3V



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

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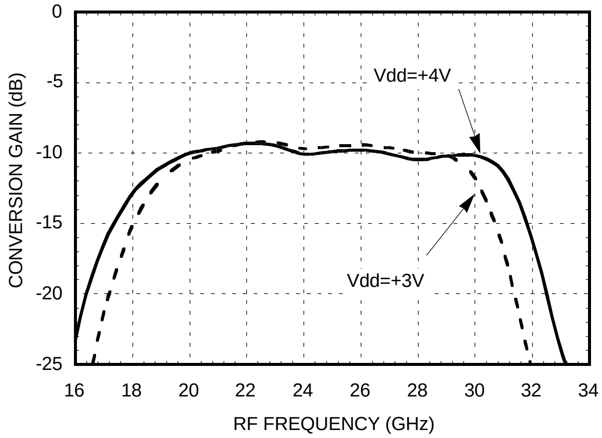
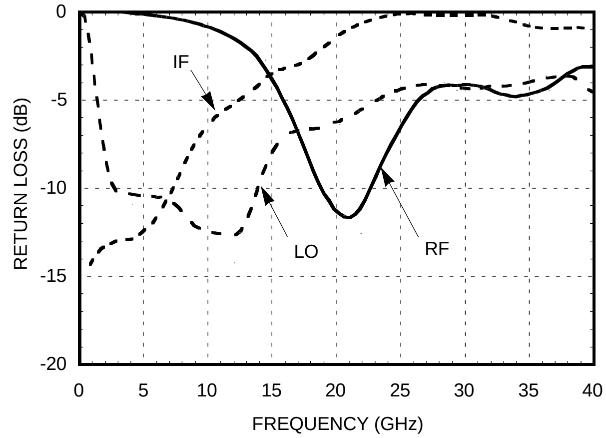
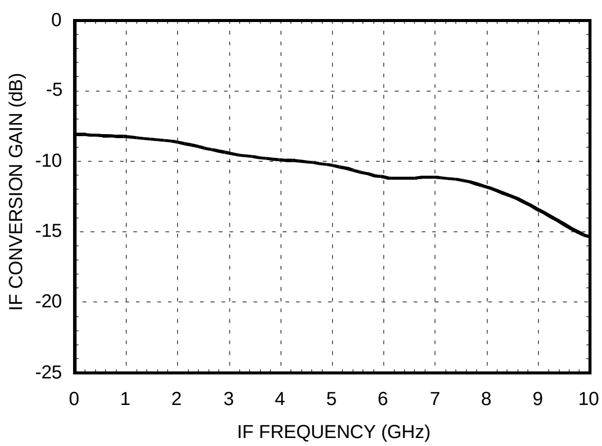
Upconverter Performance Conversion Gain, LO= -4 dBm Vdd = +4V



Return Loss @ LO = -4 dBm, Vdd = +4V



IF Bandwidth @ LO = -4 dBm, Vdd = +4V



MXN Spurious Outputs @ LO Drive = -4 dBm, Vdd = +4V

	nLO					
mRF	± 5	± 4	± 3	± 2	± 1	0
-3						
-2	-36					
-1	-54	-22	-34			
0				-15	+26	
1				X	-30	-10
2		-54	-38	-66		
3	-74	-67				

RF = 30 GHz @ -10 dBm
LO = 13.5 GHz @ -4 dBm
All values in dBc below IF power level

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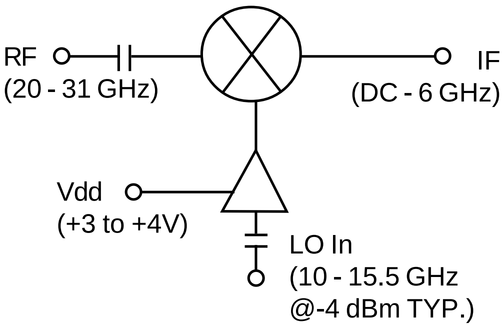
Schematic

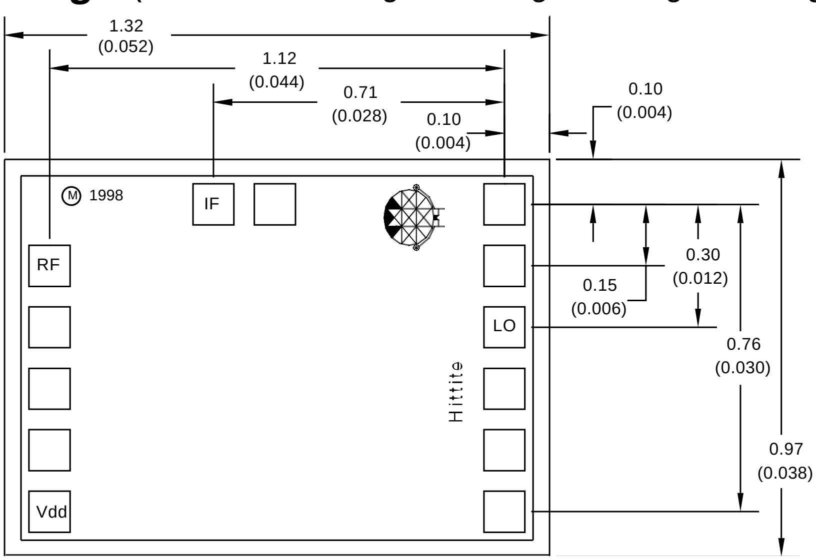


Absolute Maximum Ratings

RF / IF Input (Vdd = +4V)	+13 dBm
LO Drive (Vdd = +4V)	+13 dBm
Vdd	+5.5 Vdc
Storage Temperature	-65 to +150 deg C
Operating Temperature	-55 to +85 deg C

NOTE: A 100pF single layer chip bypass capacitor is recommended on the Vdd port no further than 0.762 mm (30mils) from the HMC264

Outline Drawing *(See Die Handling, Mounting, Bonding Note Page 4 - 130)*



ALL DIMENSION IN MILLIMETERS (INCHES)
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

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MIC Assembly Techniques for HMC264

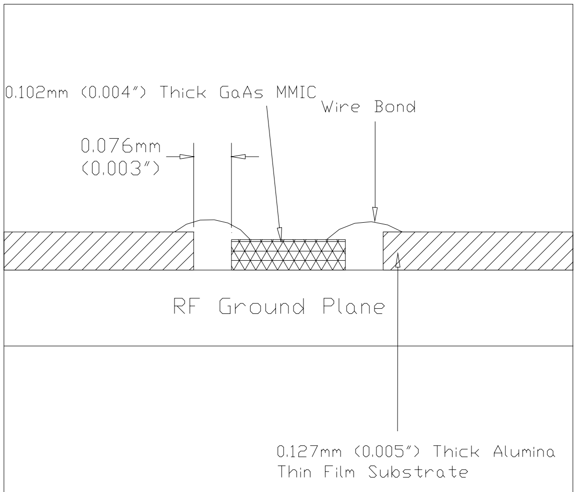

Figure 1.

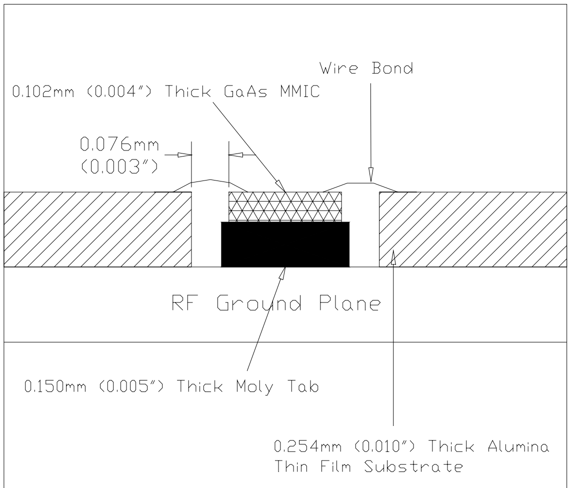

Figure 2.

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 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).

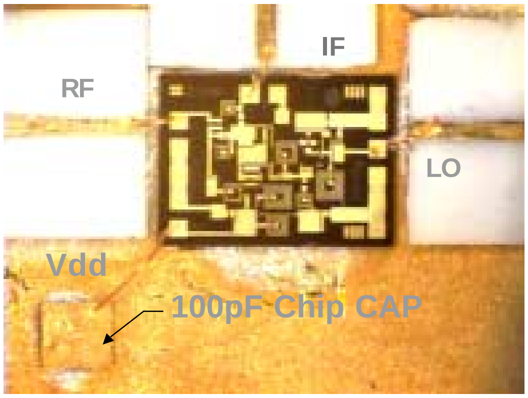

***Figure 3**: Typical HMC264 Assembly*

An RF bypass capacitor should be used on the Vdd input. A 100 pF single layer capacitor (mounted eutectically or by conductive epoxy) placed no further than 0.762mm (30 Mils) from the chip is recommended. The photo in figure 3 shows a typical assembly for the HMC264 MMIC chip.

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

Ball or wedge bond with 0.025 mm (1 mil) diameter pure gold wire. 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).