

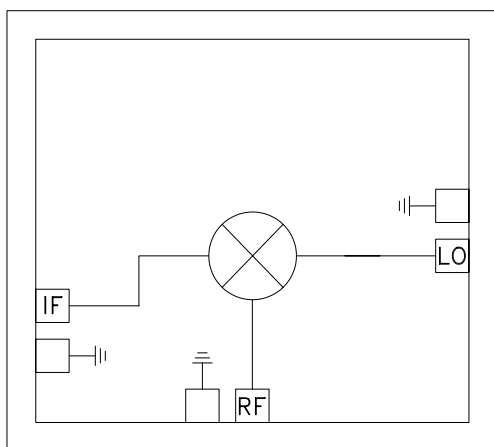
GaAs MMIC SUB-HARMONICALLY PUMPED MIXER, 20 - 40 GHz

Typical Applications

The HMC266 is ideal for:

- 23, 26, & 38 GHz Point to Point Radios
- LMDS
- SATCOM

Functional Diagram



Features

Input IP3: Up to +17 dBm

Sub-Harmonically Pumped (x2) LO

Small Size: 1.32mm x 1.47mm

General Description

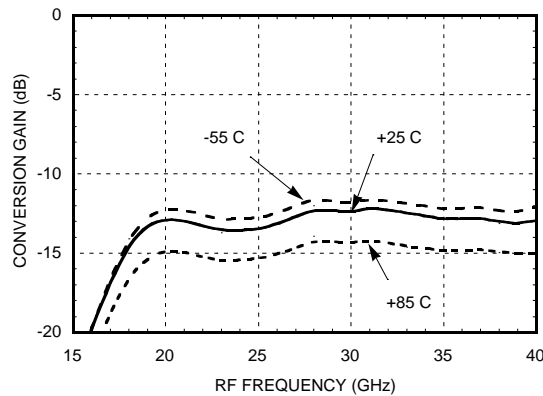
The HMC266 chip is a broadband GaAs MMIC sub-harmonically pumped (x2) balanced passive mixer which can be used as an upconverter or downconverter in a small overall chip area of 1.9 mm². The 2LO to RF isolation is excellent eliminating the need for additional filtering. All data is with the chip in a 50 ohm test fixture connected via 0.076 mm (3 mil) ribbon bonds of minimal length <0.31 mm (<12 mils). These devices are much smaller and more reliable than hybrid diode mixer designs.

Electrical Specifications, $T_A = +25^\circ\text{C}$, LO Drive = +12 dBm

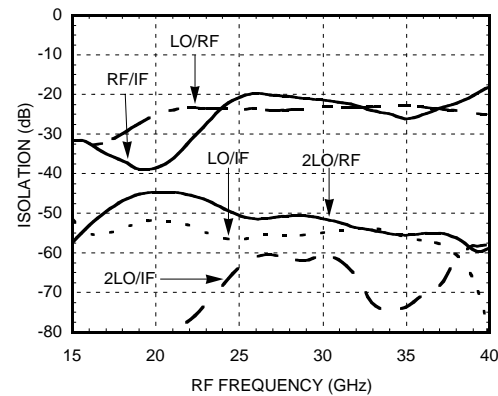
Parameter	IF = 1 GHz			Units
	Min.	Typ.	Max.	
Frequency Range, RF	20 - 40			GHz
Frequency Range, LO	10 - 20			GHz
Frequency Range, IF	1 - 3			GHz
Conversion Loss		12	16	dB
Noise Figure (SSB)		12	16	dB
2LO to RF Isolation	42	52		dB
LO to RF Isolation	20	24		dB
2LO to IF Isolation	50	60		dB
RF to IF Isolation	16	22		dB
LO to IF Isolation	48	55		dB
IP3 (Input)	10	13		dBm
1 dB Compression (Input)	0	+4		dBm

GaAs MMIC SUB-HARMONICALLY PUMPED MIXER, 20 - 40 GHz

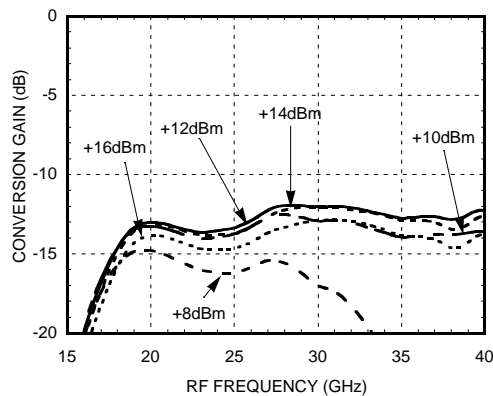
Conversion Gain vs. Temperature @ LO = +12 dBm



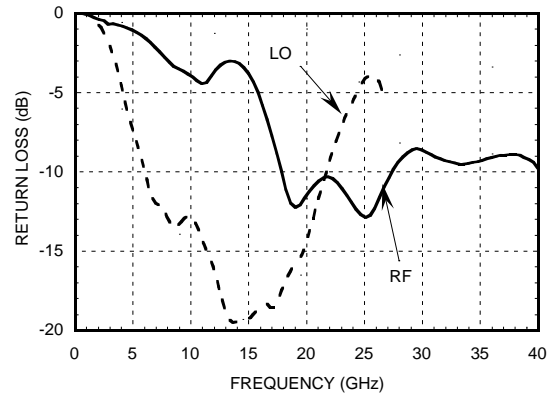
Isolation @ LO = +12 dBm



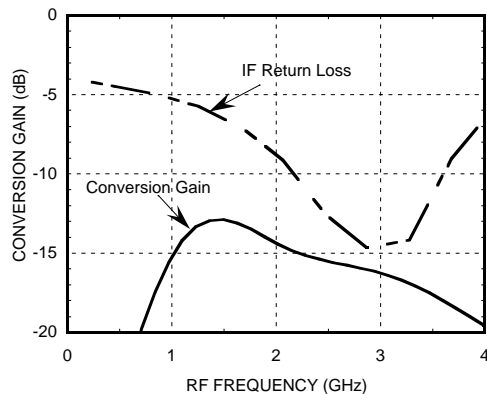
Conversion Gain vs. LO Drive



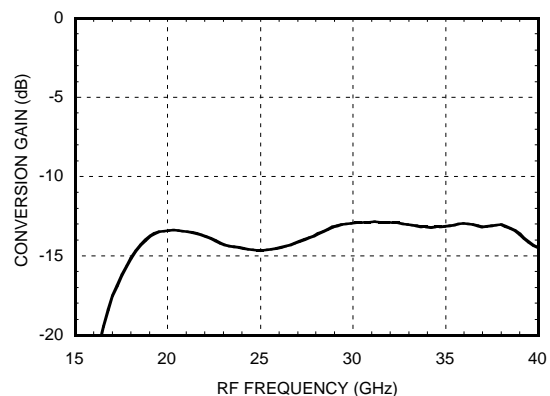
Return Loss @ LO = +12 dBm



IF Bandwidth @ LO = +12 dBm

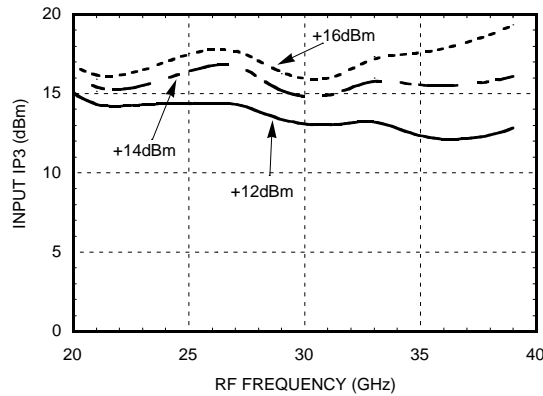


**Upconverter Performance
Conversion Gain @ LO = +12 dBm**

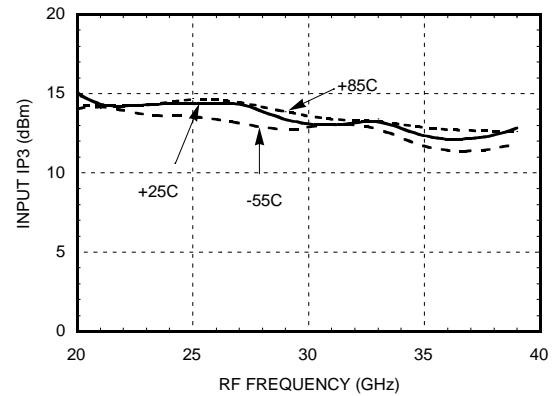


GaAs MMIC SUB-HARMONICALLY PUMPED MIXER, 20 - 40 GHz

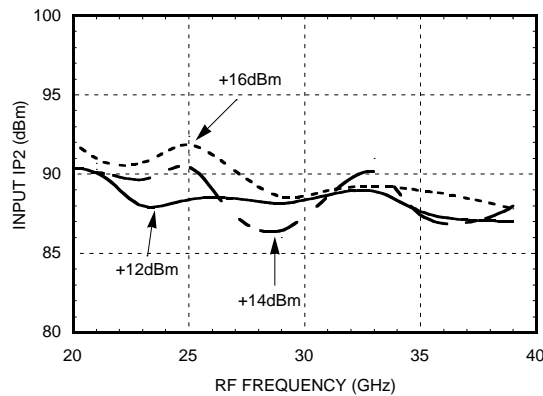
Input IP3 vs. LO Drive



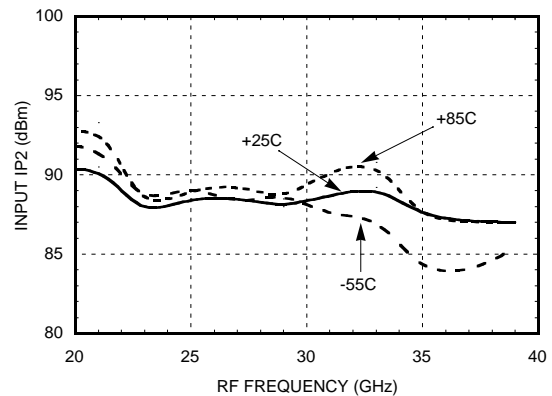
Input IP3 vs. Temperature @ LO = +12 dBm



Input IP2 vs. LO Drive



Input IP2 vs. Temperature @ LO = +12 dBm

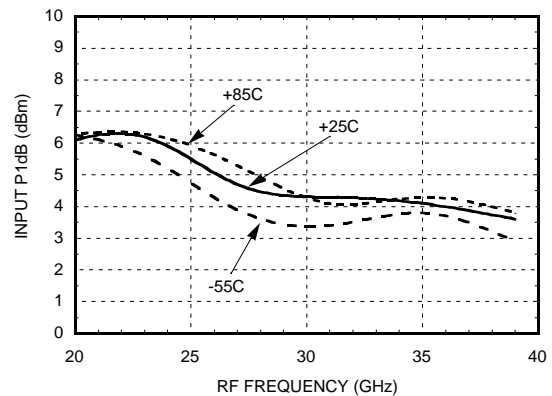


MxN Spurious Outputs as a Down Converter

	nLO					
mRF	±5	±4	±3	±2	±1	0
-3						
-2	67					
-1	50	29	70			
0			1	23	19	
1				x	63	6
2		63	79	66		
3		69				

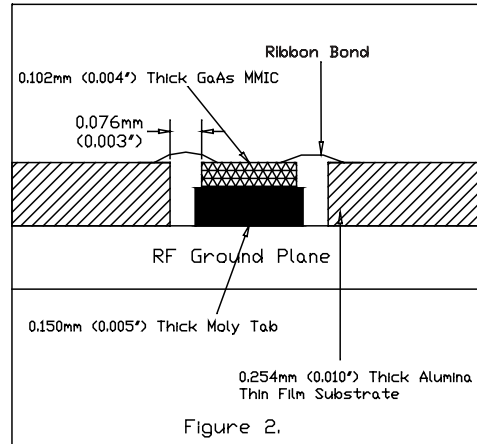
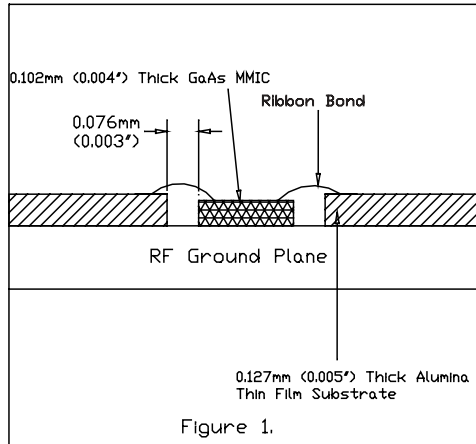
RF = 27 GHz @ -10 dBm
LO = 13 GHz @ +12 dBm drive level
All values in dBc below IF power level

P1dB vs. Temperature @ LO = +12 dBm



GaAs MMIC SUB-HARMONICALLY PUMPED MIXER, 20 - 40 GHz

MMIC Assembly Techniques



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 ribbon of 0.076 mm x 0.013 mm (3 mil x 0.5 mil) of minimal length <0.31 mm (<12 mils) is recommended to minimize inductance on the RF ports.

**GaAs MMIC SUB-HARMONICALLY
PUMPED MIXER, 20 - 40 GHz****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 $> \pm 250V$ 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

Ribbon bond with 0.076 mm x 0.013 mm (3 mil x 0.5 mil) size recommended. 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 <0.31mm (12 mils).