XM1001-BD

Image Reject Mixer
12.0-40.0 GHz

Rev. V1

Features

- Fundamental Image Reject Mixer
- 8.0 dB Conversion Loss
- 20.0 dB Image Rejection
- +25.0 dBm Input Third Order Intercept (IIP3)
- 100% On-Wafer RF Testing
- 100% Visual Inspection to MIL-STD-883 Method 2010
- RoHS* Compliant and 260°C Reflow Compatible

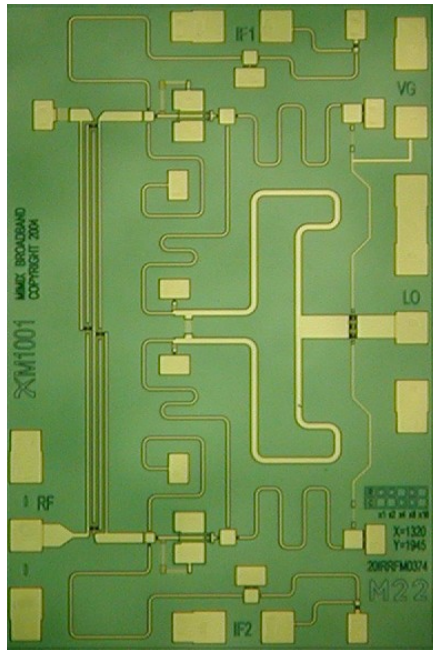
Description

M/A-COM Tech's 12.0-40.0 GHz GaAs MMIC fundamental image reject mixer can be used as an up- or down-converter. The device has a conversion loss of 8.0 dB with a 20.0 dB image rejection across the band. I and Q mixer outputs are provided and an external 90 degree hybrid is required to select the desired sideband. This MMIC uses M/A-COM Tech's GaAs PHEMT device model technology, and is based upon electron beam lithography to ensure high repeatability and uniformity. The chip has surface passivation to protect and provide a rugged part with backside via holes and gold metallization to allow either a conductive epoxy or eutectic solder die attach process. This device is well suited for Millimeter-wave Point-to-Point Radio, LMDS, SATCOM and VSAT applications.

Ordering Information

Part Number	Package
XM1001-BD-000V	"V" - vacuum release gel paks
XM1001-BD-EV1	evaluation module

Chip Device Layout



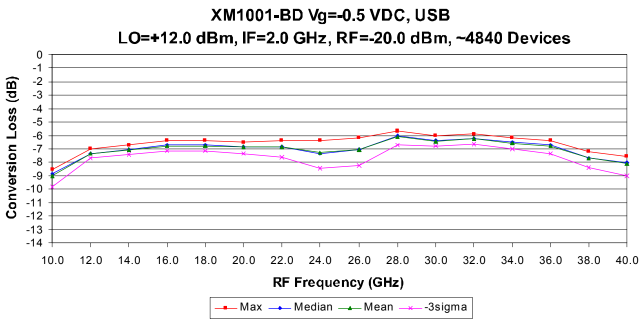
Absolute Maximum Ratings

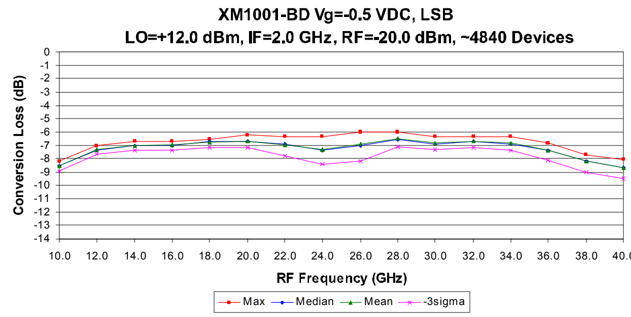
Parameter	Absolute Max.
Gate Bias Voltage (Vg)	+0.3 VDC
Input Power (RF Pin)	+20.0 dBm
Input Power (IF Pin)	+20.0 dBm
Storage Temperature (Tstg)	-65 °C to +165 °C
Operating Temperature (Ta)	-55 °C to +125 °C

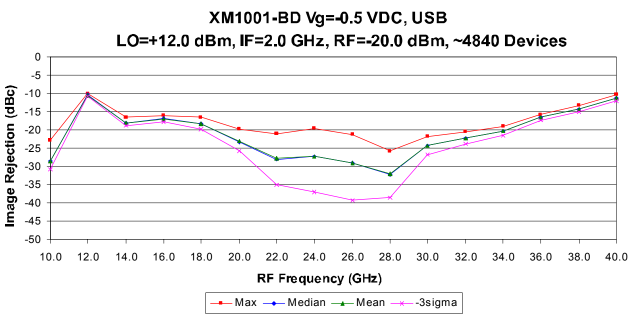
Electrical Specifications: 12-40 GHz (Upper Side Band) (Ambient Temperature T = 25°C)

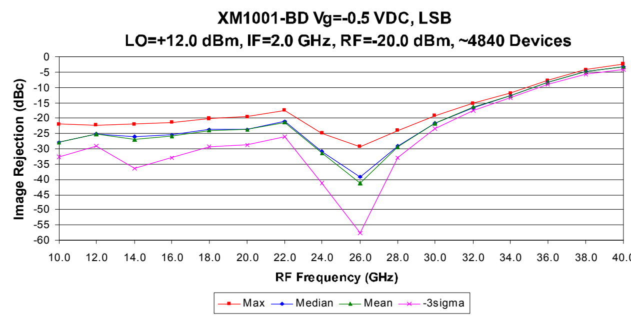
Parameter	Units	Min.	Typ.	Max.
Frequency Range (RF) Lower Side Band	GHz	12.0	-	38.0
Frequency Range (LO)	GHz	8.0	-	42.0
Frequency Range (IF)	GHz	DC	-	4.0
RF Return Loss (S11)	dB	-	10.0	-
IF Return Loss (S22)	dB	-	TBD	-
LO Return Loss (S33)	dB	-	TBD	-
Conversion Loss (S21)	dB	-	8.0	-
LO Input Drive (P_{LO})	dBm	-	+12.0	-
Image Rejection	dBc	-	20.0	-
Isolation LO/RF	dB	-	16.0	-
Isolation LO/IF	dB	-	TBD	-
Isolation RF/IF	dB	-	TBD	-
Input Third Order Intercept (IIP3)	dBm	-	+25.0	-
Gate Bias Voltage (Vg1)	VDC	-2.0	-0.5	+0.1

Typical Performance Curves

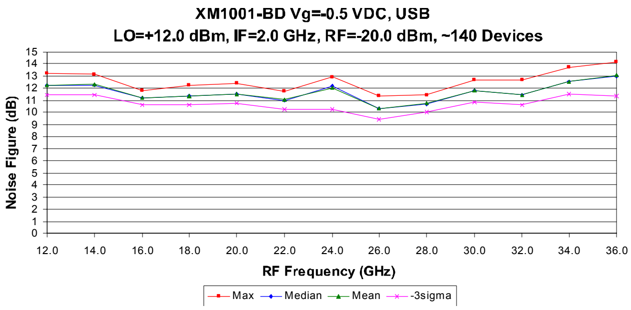


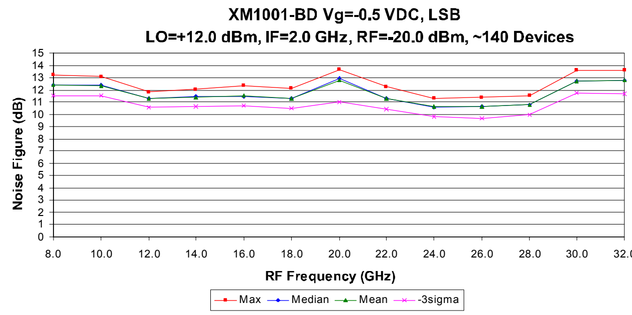


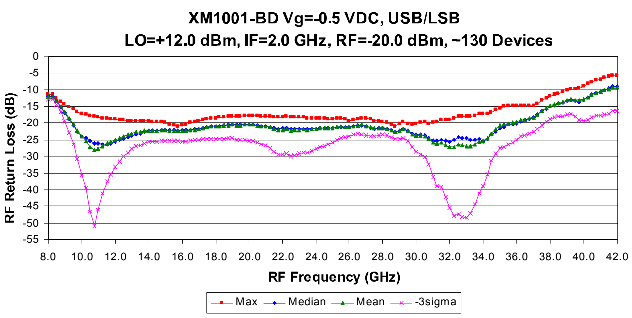




Typical Performance Curves (cont.)

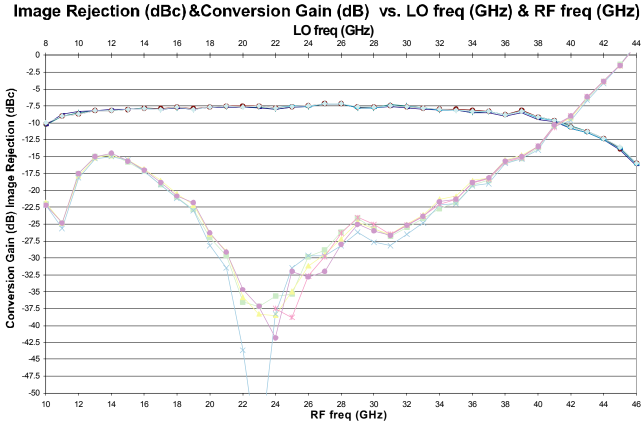




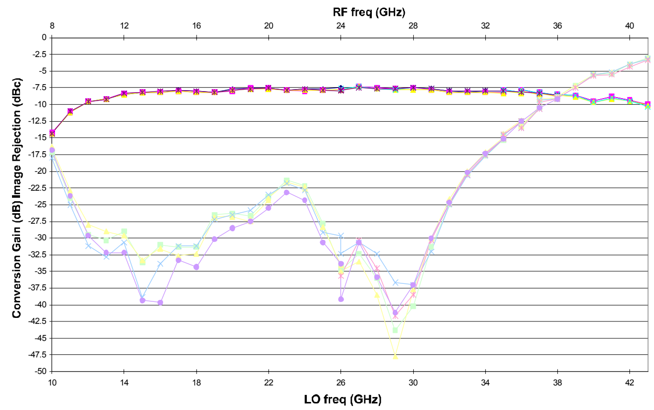


Typical Performance Curves (cont.)

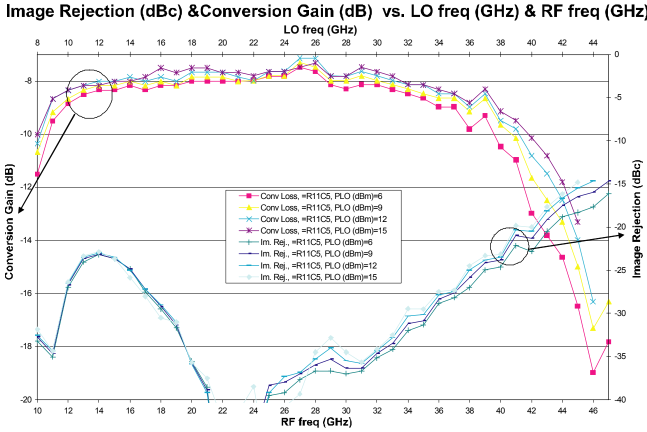
(Vg=-0.5V, PRF=-10dBm IF=2GHz): USB PLO=+12dBm
Image Rejection (dBc)&Conversion Gain (dB) vs. LO freq (GHz) & RF freq (GHz)



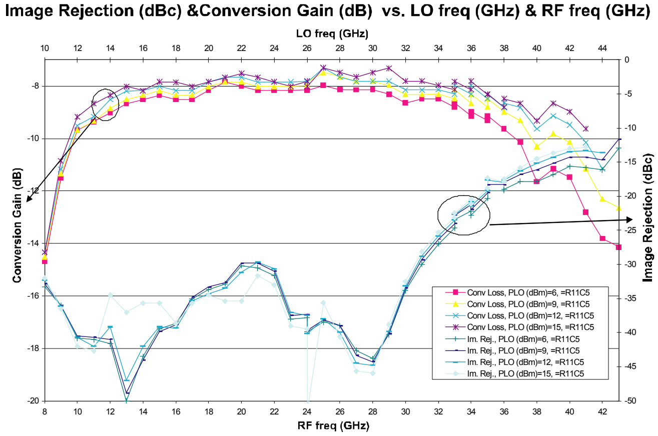
(Vg=-0.5V, PRF=-10dBm IF=2GHz): LSB PLO=+12dBm
Image Rejection (dBc)& Conversion Gain(dB) vs. LO freq (GHz) & RF freq (GHz)



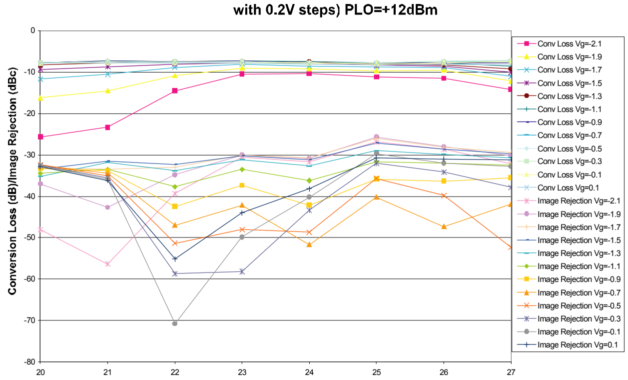
(USB, Vg=-0.5V, PRF=-10dBm, IF=2GHz): 1 device and different powers
Image Rejection (dBc) &Conversion Gain (dB) vs. LO freq (GHz) & RF freq (GHz)



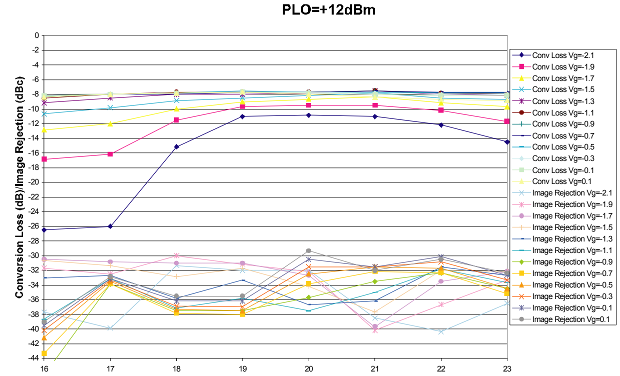
(LSB, Vg=-0.5V, PRF=-10dBm, IF=2GHz): 1 device and different powers
Image Rejection (dBc) &Conversion Gain (dB) vs. LO freq (GHz) & RF freq (GHz)



USB Conversion Gain/Image Rejection vs Frequency and for differents Vg bias (-2.1V to 0.1V with 0.2V steps) PLO=+12dBm

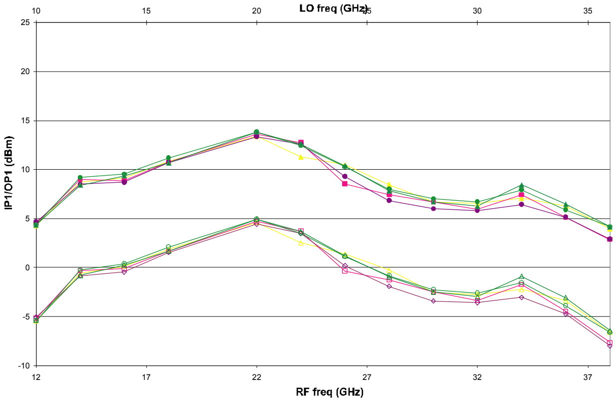


LSB Conversion Gain vs Frequency and for differents Vg bias (-2.1V to 0.1V with 0.2V steps) PLO=+12dBm

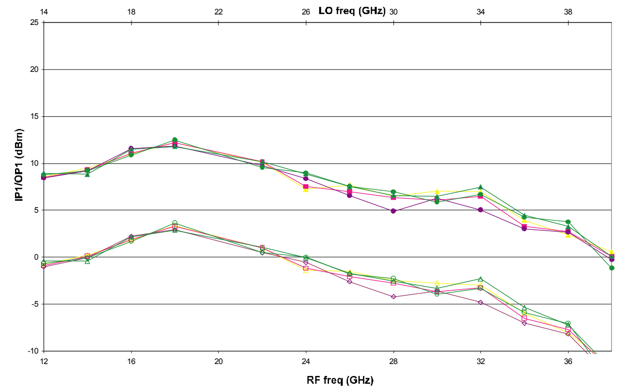


Typical Performance Curves (cont.)

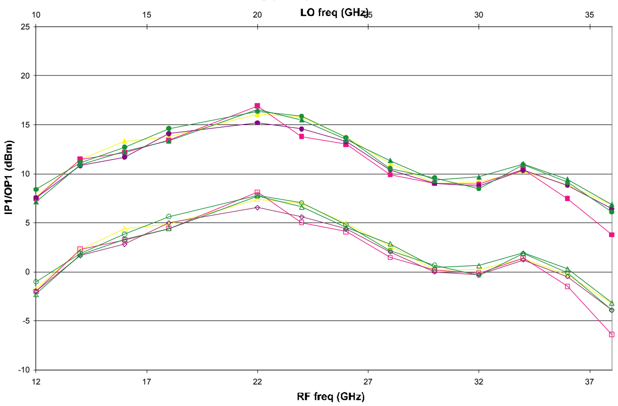
XM1001-BD (Vg=-0.5V, IF=2GHz, USB, PLO=+6dBm): IP1 & OP1 (dBm) vs. RF & LO freq (GHz)



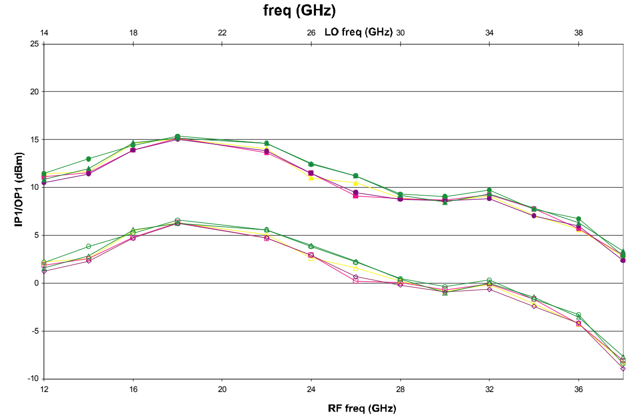
XM1001-BD (Vg=-0.5V, IF=2GHz, LSB, PLO=+6dBm): IP1 & OP1 (dBm) vs. RF & LO freq (GHz)



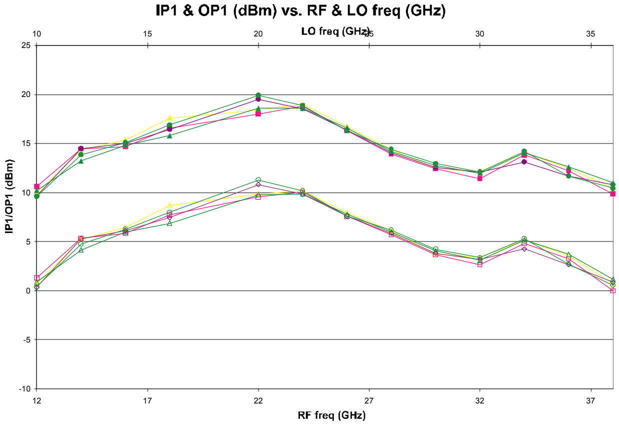
XM1001-BD (Vg=-0.5V, IF=2GHz, USB, PLO=+9dBm): IP1 & OP1 (dBm) vs. RF & LO freq (GHz)



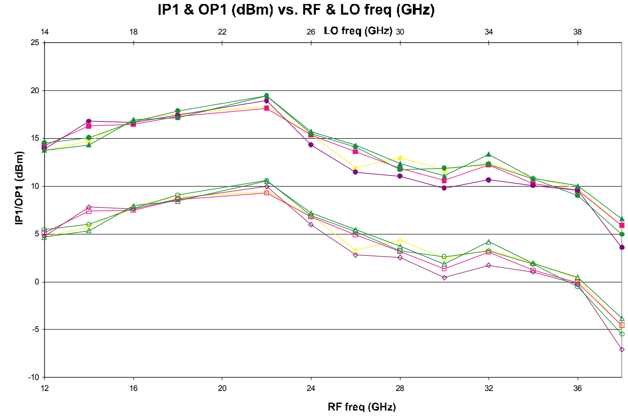
XM1001-BD (Vg=-0.5V, IF=2GHz, LSB, PLO=+9dBm): IP1 & OP1 (dBm) vs. RF & LO freq (GHz)



XM1001-BD (Vg=-0.5V, IF=2GHz, USB, PLO=+12dBm): IP1 & OP1 (dBm) vs. RF & LO freq (GHz)

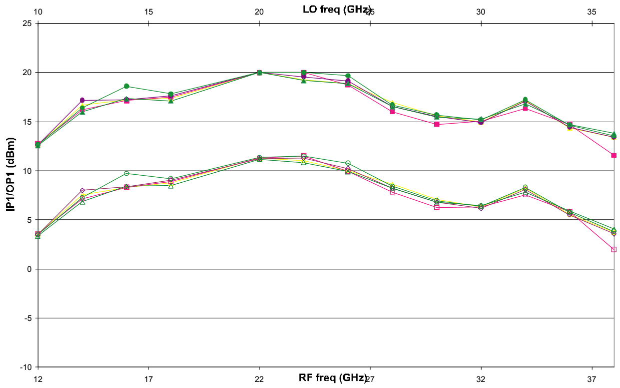


XM1001-BD (Vg=-0.5V, IF=2GHz, LSB, PLO=+12dBm): IP1 & OP1 (dBm) vs. RF & LO freq (GHz)

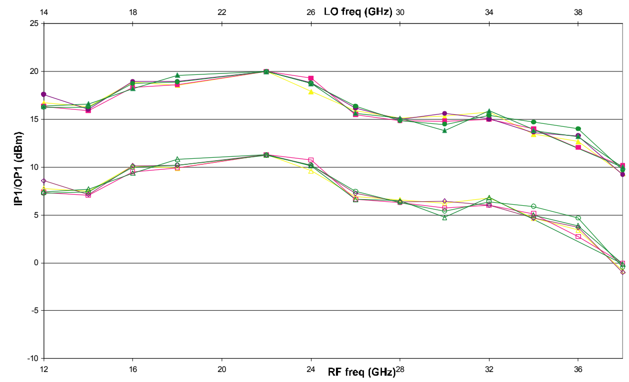


Typical Performance Curves (cont.)

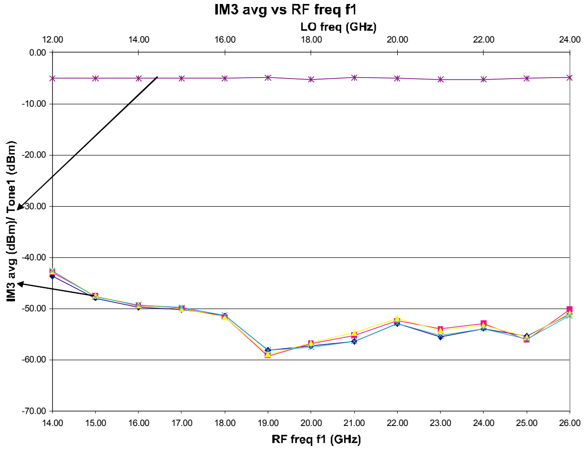
XM1001-BD (Vg=-0.5V, IF=2GHz, USB, PLO=+15dBm): IP1 & OP1 (dBm) vs. RF & LO freq (GHz)



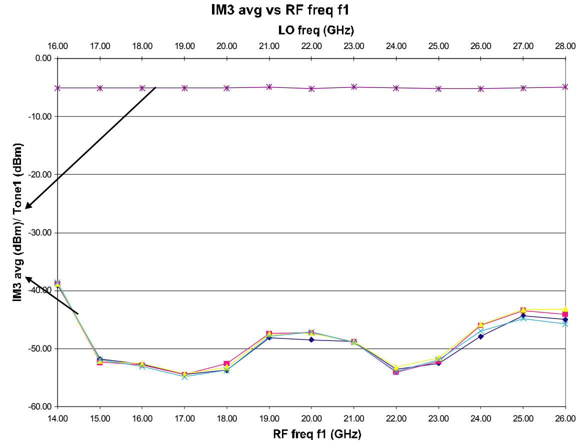
XM1001-BD (Vg=-0.5V, IF=2GHz, LSB, PLO=+15dBm): IP1 & OP1 (dBm) vs. RF & LO freq (GHz)



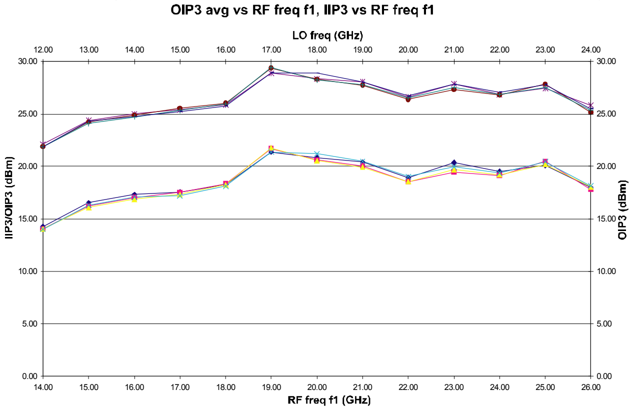
XM1001-BD (Vg=-0.5V, IF=2GHz, LO=+12dBm, IF1-IF2=100MHz, USB, Down Conversion): IM3 avg vs RF freq f1



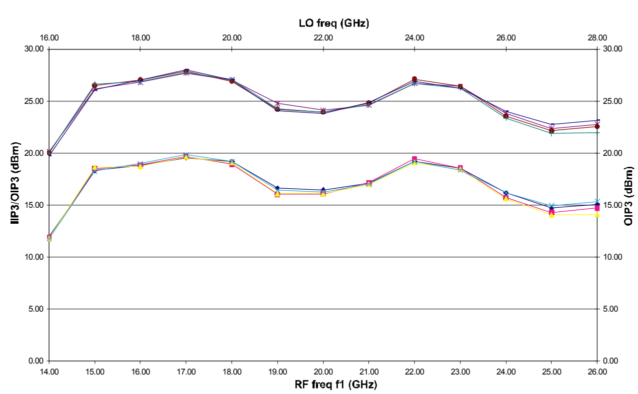
XM1001-BD (Vg=-0.5V, IF=2GHz, LO=+12dBm, IF1-IF2=100MHz, LSB, Down Conversion): IM3 avg vs RF freq f1



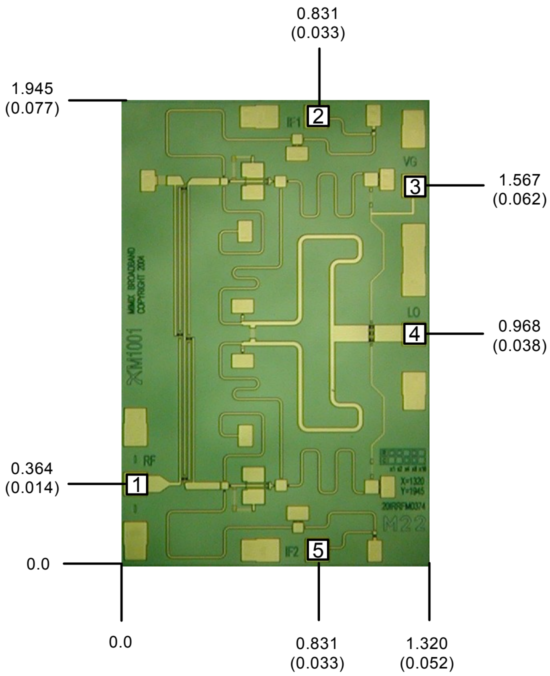
XM1001-BD (Vg=-0.5V, IF=2GHz, LO=+12dBm, IF1-IF2=100MHz, USB, Down Conversion): OIP3 avg vs RF freq f1, IIP3 vs RF freq f1



XM1001-BD (Vg=-0.5V, IF=2GHz, LO=+12dBm, IF1-IF2=100MHz, LSB, Down Conversion): OIP3 avg vs RF freq f1, IIP3 vs RF freq f1



Mechanical Drawing

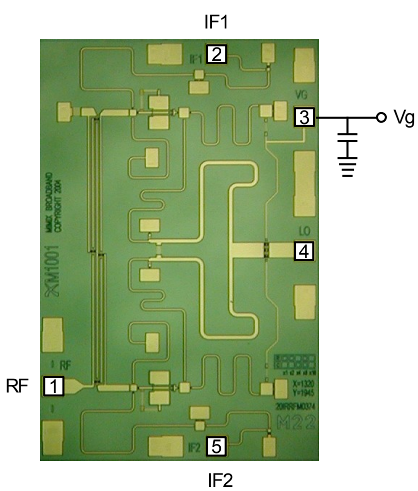


(Note: Engineering designator is 20IRRFM0374)

Units: millimeters (inches) Bond pad dimensions are shown to center of bond pad.
Thickness: 0.110 +/- 0.010 (0.0043 +/- 0.0004), Backside is ground, Bond Pad/Backside Metallization: Gold
All Bond Pads are 0.100 x 0.100 (0.004 x 0.004).
Bond pad centers are approximately 0.109 (0.004) from the edge of the chip.
Dicing tolerance: +/- 0.005 (+/- 0.0002). Approximate weight: 1.592 mg.

Bond Pad #1 (RF)	Bond Pad #3 (Vg)	Bond Pad #5 (IF2)
Bond Pad #2 (IF1)	Bond Pad #4 (LO)	

Bias Arrangement

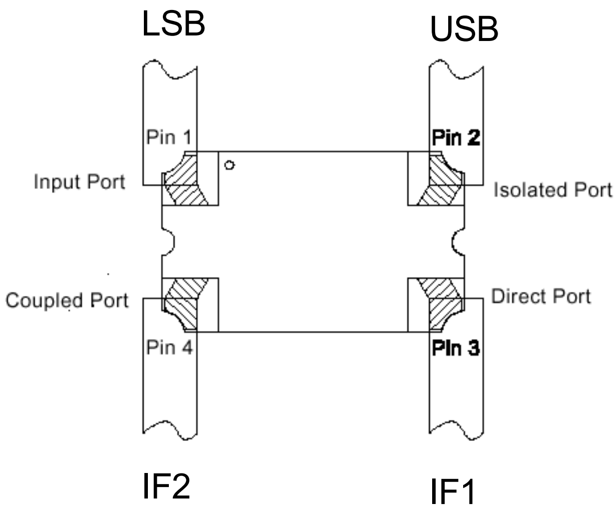


Bypass Capacitors - See App Note [2]

App Note [1] Biasing - As shown in the bonding diagram, the pHEMT mixer devices are operated using a separate gate voltage Vg1. Set Vg1=-0.5V for optimum conversion loss performance.

App Note [2] Bias Arrangement - Each DC pad (Vg1) needs to have DC bypass capacitance (~100-200 pF) as close to the device as possible. Additional DC bypass capacitance (~0.01 uF) is also recommended.

App Note [3] USB/LSB Selection -

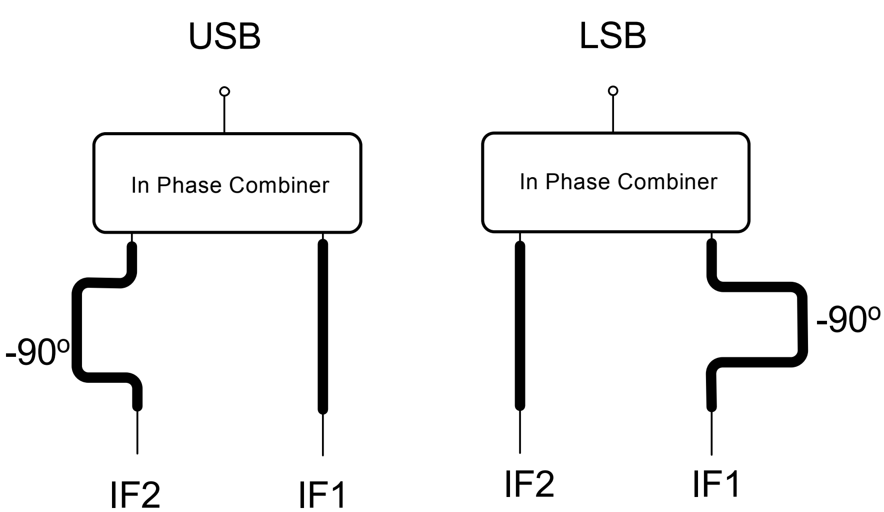


For Upper Side Band Operation (USB): With IF1 and IF2 connected to the direct port (0º) and coupled port (90º) respectively as shown in the diagram, the USB signal will reside on the isolated port. The input port must be loaded with 50 ohms.

For Lower Side Band Operation (LSB): With IF1 and IF2 connected to the direct port (0º) and coupled port (90º) respectively as shown in the diagram, the LSB signal will reside on the input port. The isolated port must be loaded with 50 ohms.

Note: The coupled port can be used as an alternative input but the port location of the Coupled and Direct ports reverse.

An alternate method of Selection of USB or LSB:



Handling Procedures

Please observe the following precautions to avoid damage:

Static Sensitivity

Gallium Arsenide Integrated Circuits are sensitive to electrostatic discharge (ESD) and can be damaged by static electricity. Proper ESD control techniques should be used when handling these class 2 devices.