

## Image Reject Mixer 12.0-40.0 GHz

Rev. V1

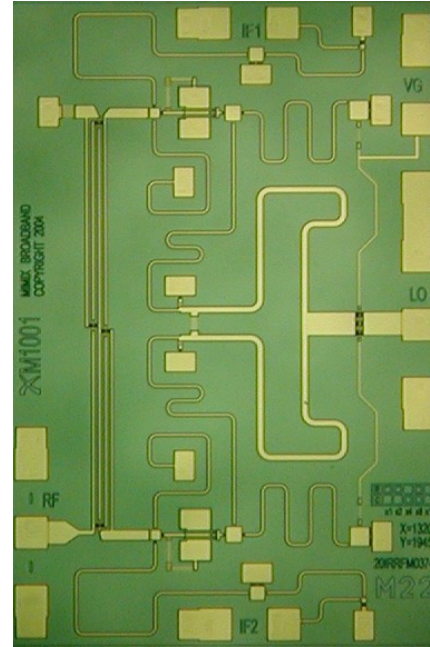
### Features

- 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.

### 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

### Ordering Information

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

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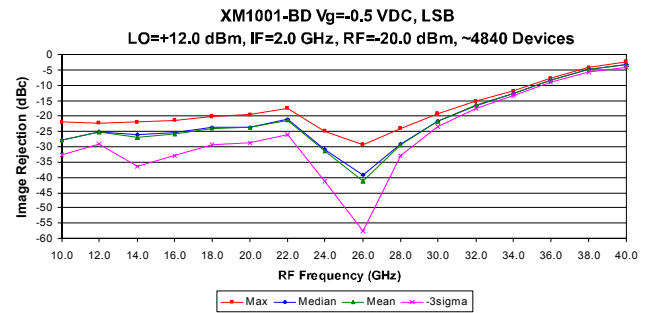
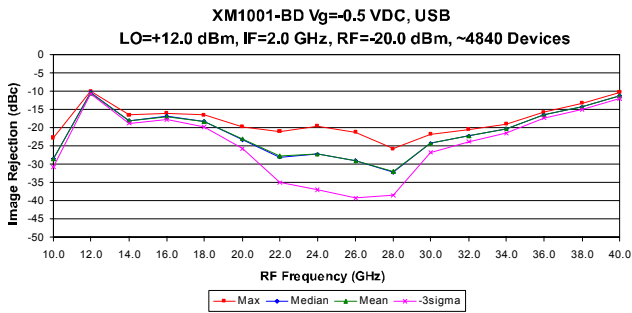
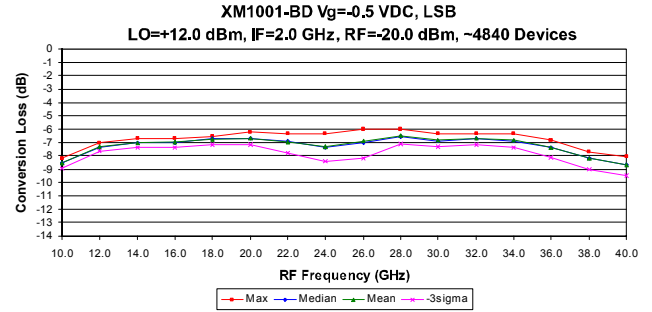
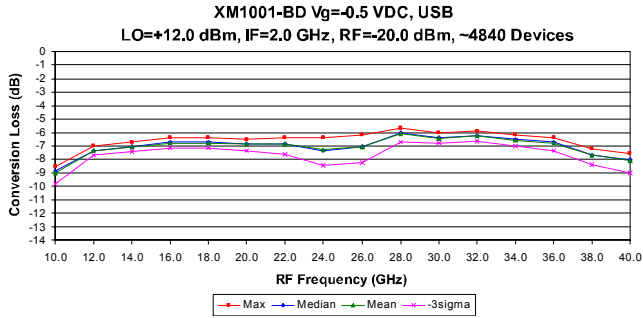
**Electrical Specifications: 12-40 GHz (Upper Side Band) (Ambient Temperature T = 25°C)**

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 <sub>LO</sub> )	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

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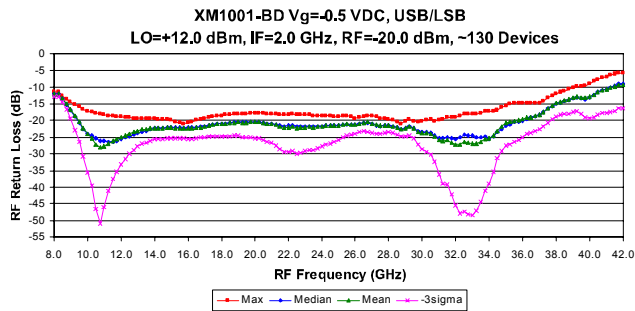
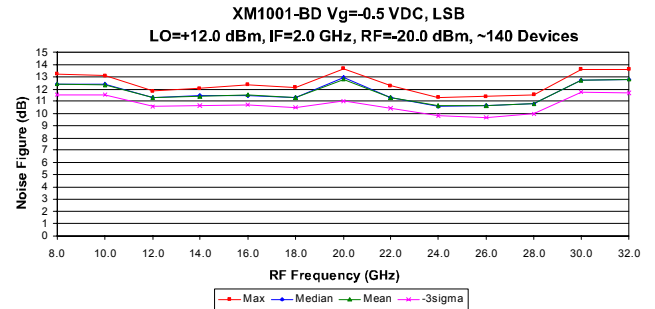
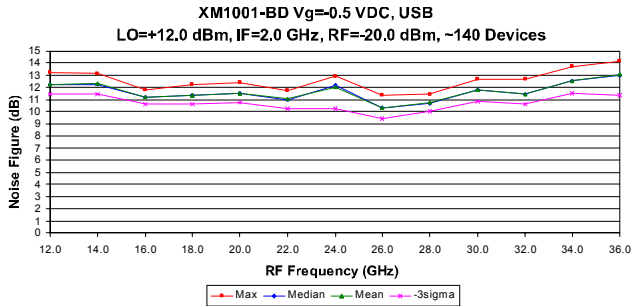
### Typical Performance Curves



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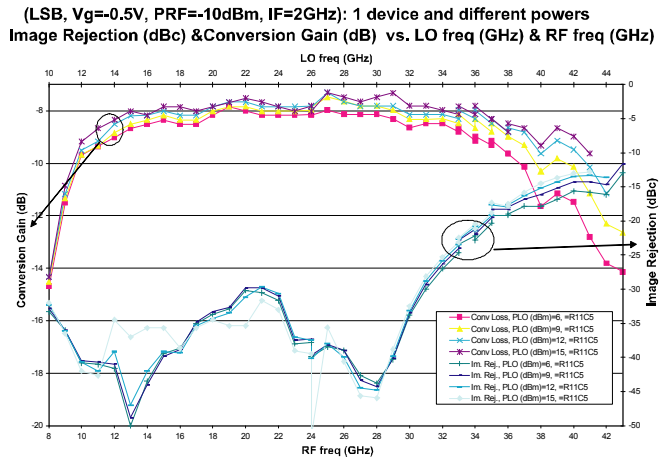
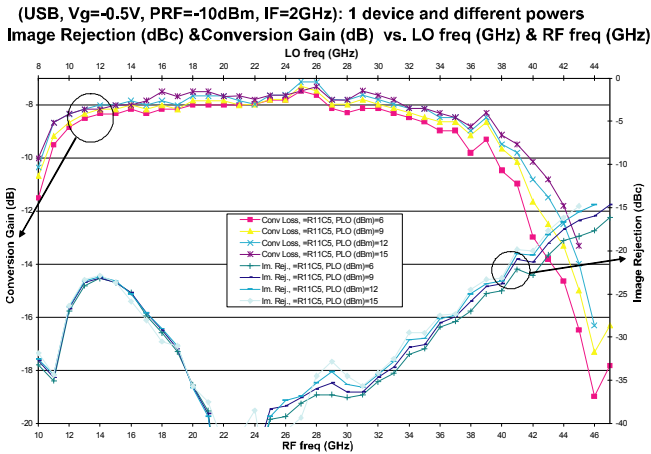
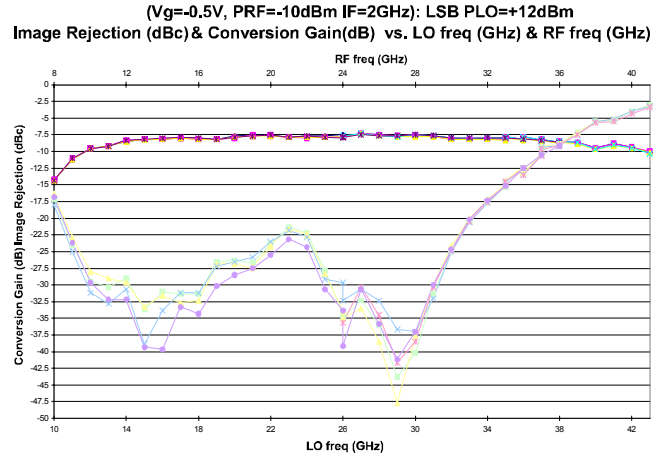
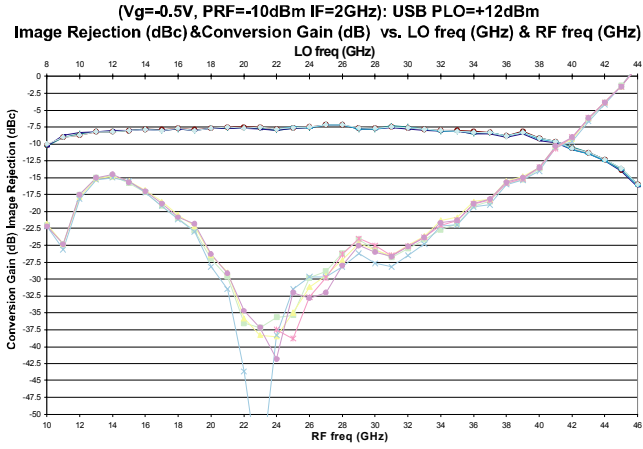
### Typical Performance Curves (cont.)



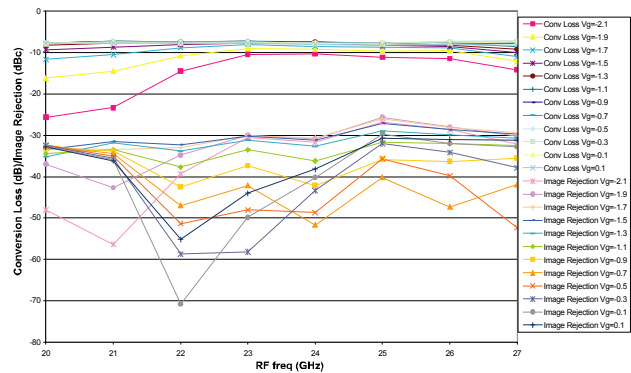
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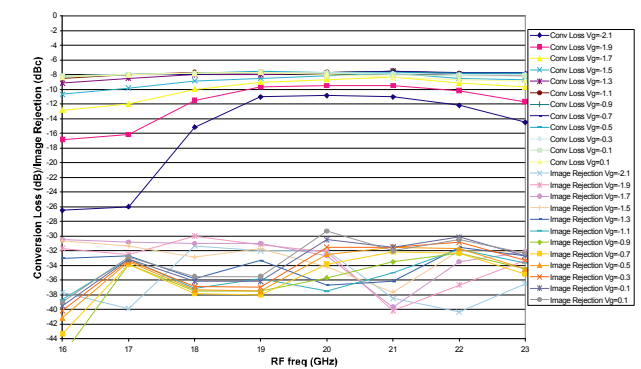
### Typical Performance Curves (cont.)



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

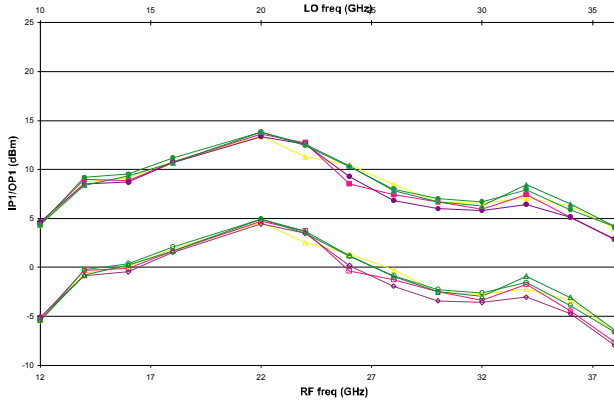


LSB Conversion Gain vs Frequency and for different Vg bias (-2.1V to 0.1V with 0.2V steps) PLO=+12dBm

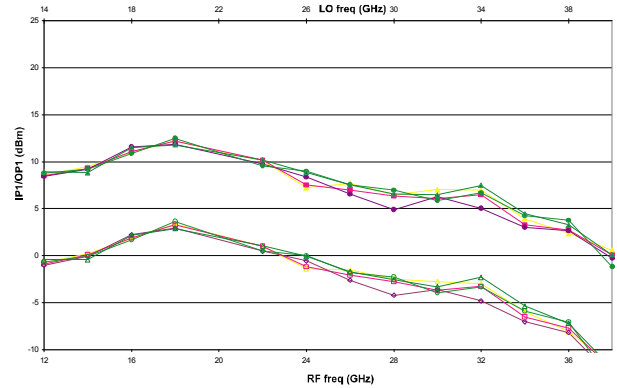


## Typical Performance Curves (cont.)

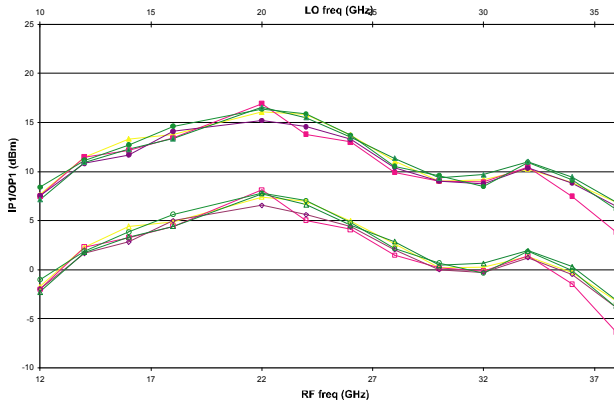
XM1001-BD (Vg=-0.5V, IF=2GHz, USB, PLO=+6dBm): IP1 & OP1 (dBm) vs. RF & LO freq (GHz)



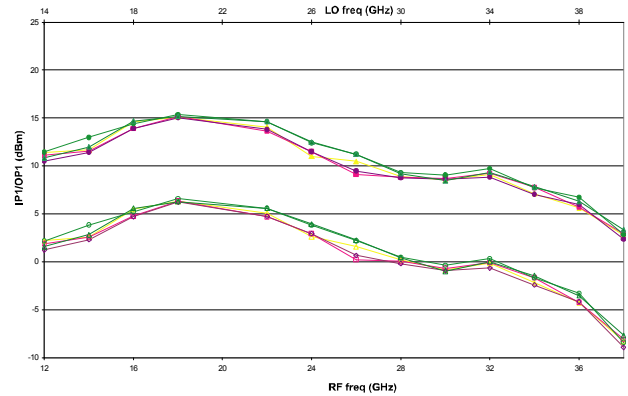
XM1001-BD (Vg=-0.5V, IF=2GHz, LSB, PLO=+6dBm): IP1 & OP1 (dBm) vs. RF & LO freq (GHz)



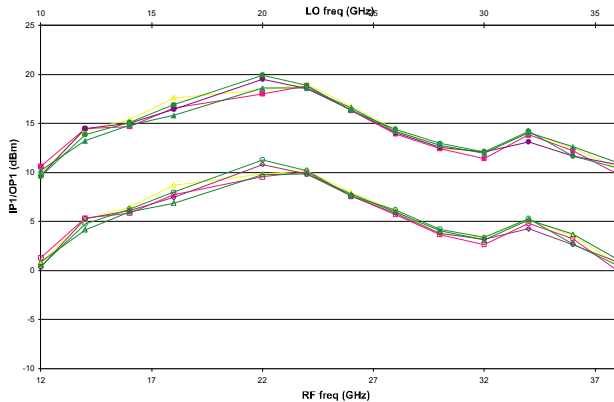
XM1001-BD (Vg=-0.5V, IF=2GHz, USB, PLO=+9dBm): IP1 & OP1 (dBm) vs. RF & LO freq (GHz)



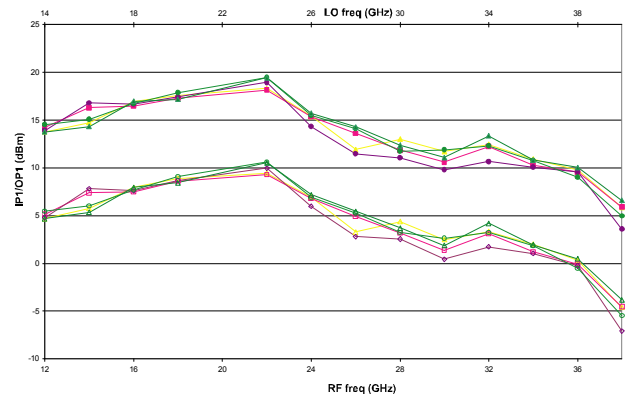
XM1001-BD (Vg=-0.5V, IF=2GHz, LSB, PLO=+9dBm): IP1 & OP1 (dBm) vs. RF & LO freq (GHz)



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)

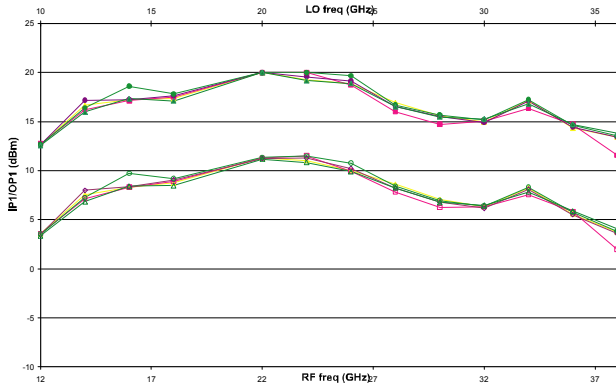


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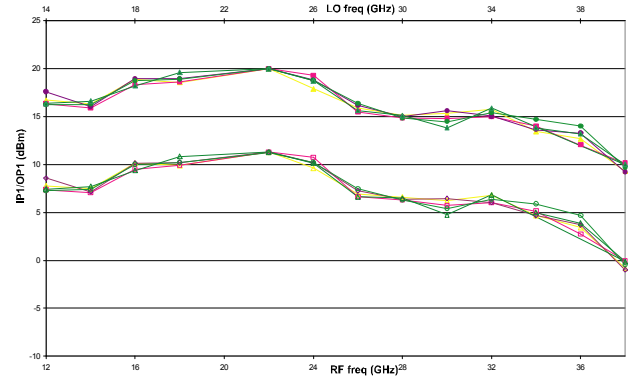
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### Typical Performance Curves (cont.)

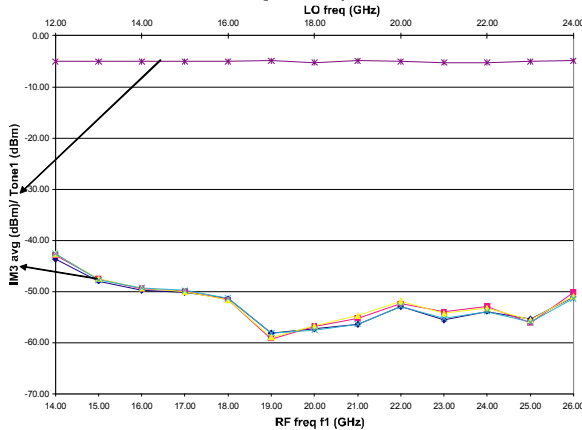
XM1001-BD (Vg=-0.5V, IF=2GHz, USB, PLO=+15dBm):  
IP1 & OP1 (dBm) vs. RF & LO freq (GHz)



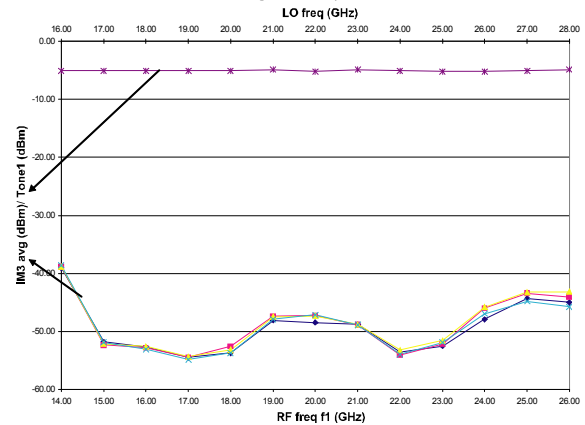
XM1001-BD (Vg=-0.5V, IF=2GHz, LSB, PLO=+15dBm):  
IP1 & OP1 (dBm) vs. RF & LO freq (GHz)



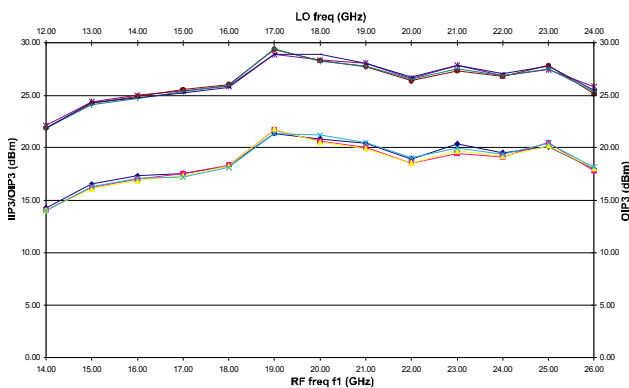
XM1001-BD (Vg=-0.5V, IF=2GHz, LO=+12dBm, IF1-IF2=100MHz, USB, Down Conversion):  
IM3 avg vs RF freq f1



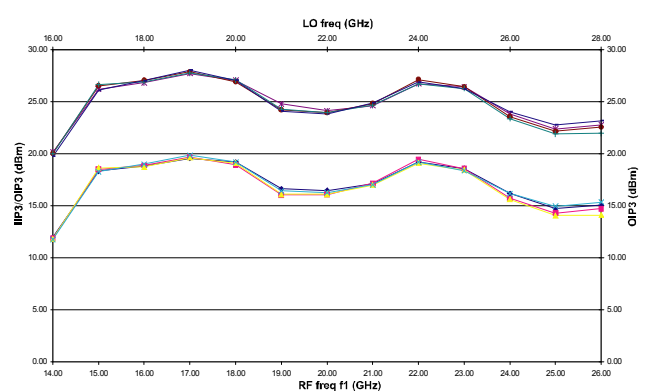
XM1001-BD (Vg=-0.5V, IF=2GHz, LO=+12dBm, IF1-IF2=100MHz, LSB, Down Conversion):  
IM3 avg vs RF freq f1



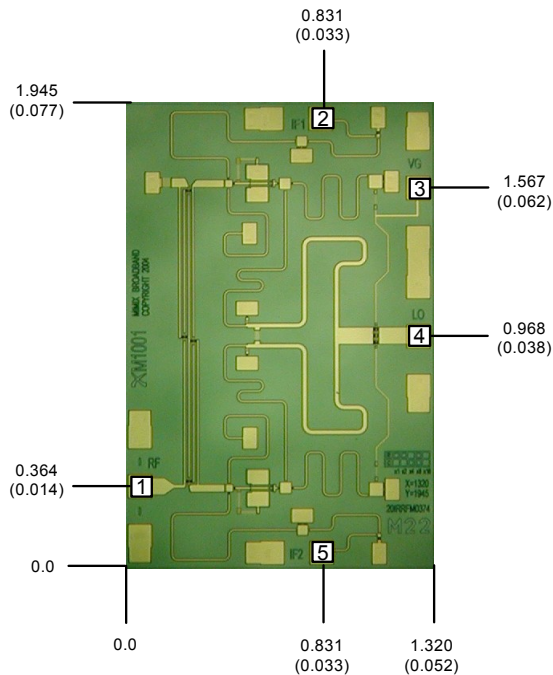
XM1001-BD (Vg=-0.5V, IF=2GHz, LO=+12dBm, IF1-IF2=100MHz, USB, Down Conversion):  
OIP3 avg vs RF freq f1, IIP3 vs RF freq f1



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)

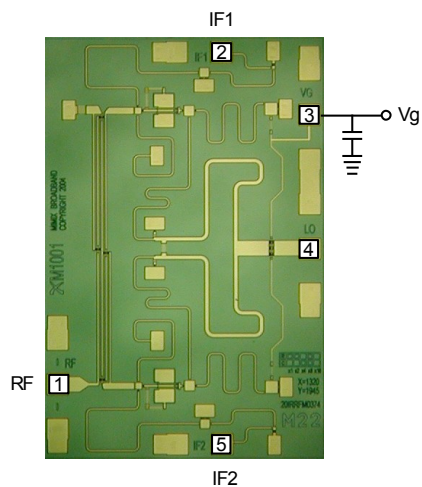
Bond Pad #3 (Vg)

Bond Pad #5 (IF2)

Bond Pad #2 (IF1)

Bond Pad #4 (LO)

## Bias Arrangement



Bypass Capacitors - See App Note [2]



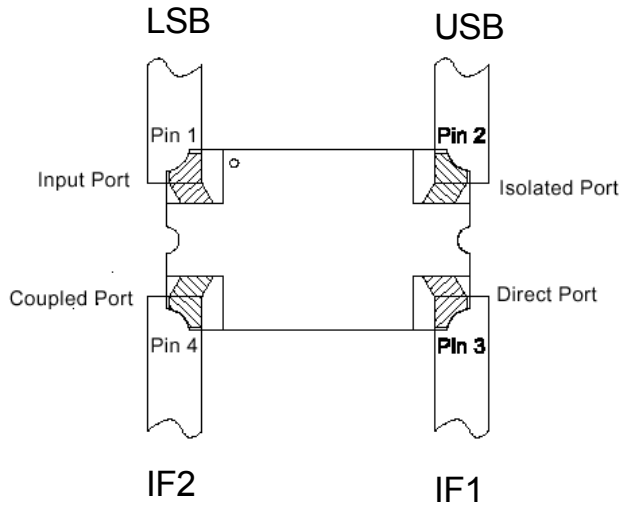
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**App Note [1] Biasing** - As shown in the bonding diagram, the pHEMT mixer devices are operated using a separate gate voltage  $V_{g1}$ . Set  $V_{g1} = -0.5V$  for optimum conversion loss performance.

**App Note [2] Bias Arrangement** - Each DC pad ( $V_{g1}$ ) needs to have DC bypass capacitance ( $\sim 100-200$  pF) as close to the device as possible. Additional DC bypass capacitance ( $\sim 0.01$  uF) is also recommended.

### App Note [3] USB/LSB Selection -

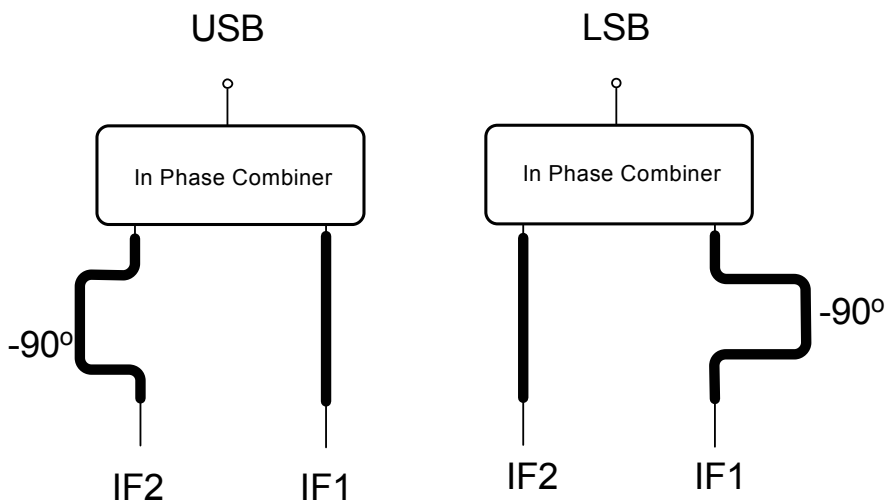


**For Upper Side Band Operation (USB):** With IF1 and IF2 connected to the direct port ( $0^\circ$ ) and coupled port ( $90^\circ$ ) respectively as shown in the diagram, the USB signal will reside on the isolated port. The input port must be loaded with 50 ohms.

**For Lower Side Band Operation (LSB):** With IF1 and IF2 connected to the direct port ( $0^\circ$ ) and coupled port ( $90^\circ$ ) 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.

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