

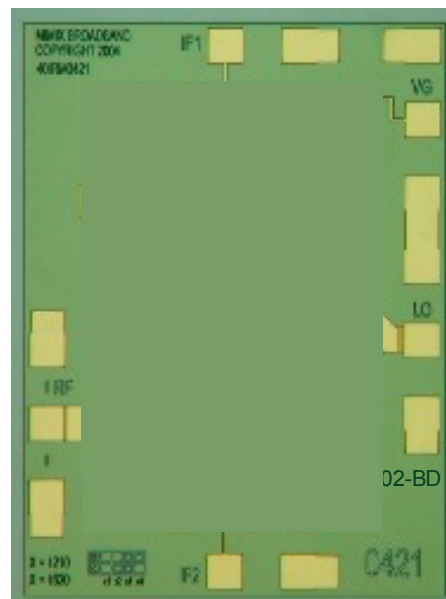
## Features

- Fundamental Image Reject Mixer
- 7.0 dB Conversion Loss
- 20.0 dB Image Rejection
- +24 dBm Input Third Order Intercept
- 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 34.0-46.0 GHz GaAs MMIC fundamental image reject mixer can be used as an up- or down-converter. The device has a conversion loss of 7.0 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
XM1002-BD-000V	"V" - vacuum release gel paks
XM1002-BD-EV1	evaluation module

**Electrical Specifications: 34-46 GHz (Upper Side Band) (Ambient Temperature T = 25°C)**

Parameter	Units	Min.	Typ.	Max.
Frequency Range (RF) Lower Side Band	GHz	34.0	-	46.0
Frequency Range (LO)	GHz	30.0	-	50.0
Frequency Range (IF)	GHz	DC	-	4.0
RF Return Loss (S11)	dB	-	18.0	-
IF Return Loss (S22)	dB	-	10.0	-
LO Return Loss (S33)	dB	-	8.0	-
Conversion Loss (S21)	dB	-	7.0	8.0
LO Input Drive (P <sub>LO</sub> )	dBm	-	+12.0	-
Image Rejection	dBc	15.0	20.0	-
Isolation LO/RF	dB	-	11.0	-
Isolation LO/IF	dB	-	30.0	-
Isolation RF/IF	dB	-	30.0	-
Input Third Order Intercept (IIP3)	dBm	-	+24.0	-
Gate Bias Voltage (Vg1)	VDC	-2.0	-0.5	+0.1

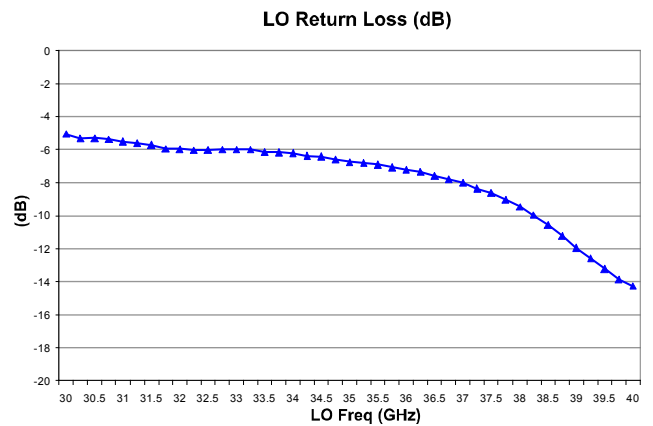
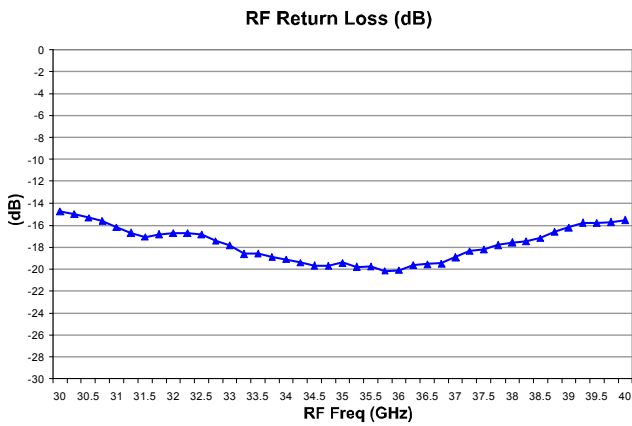
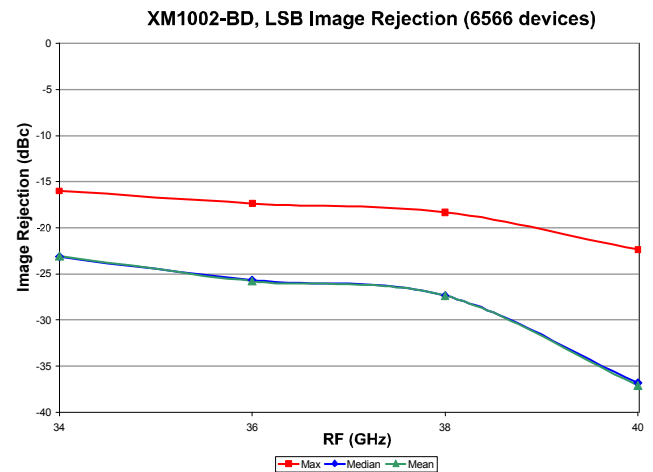
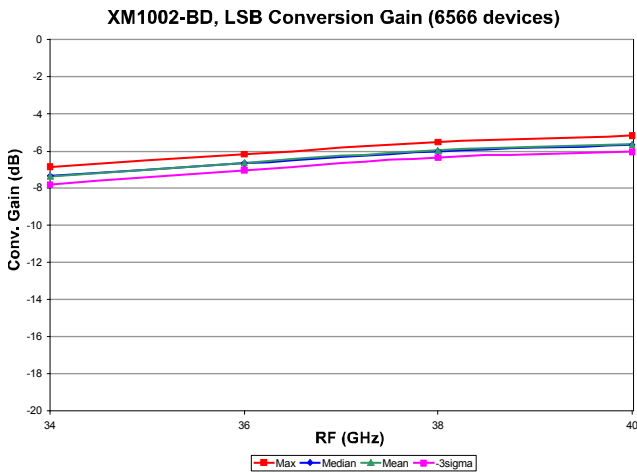
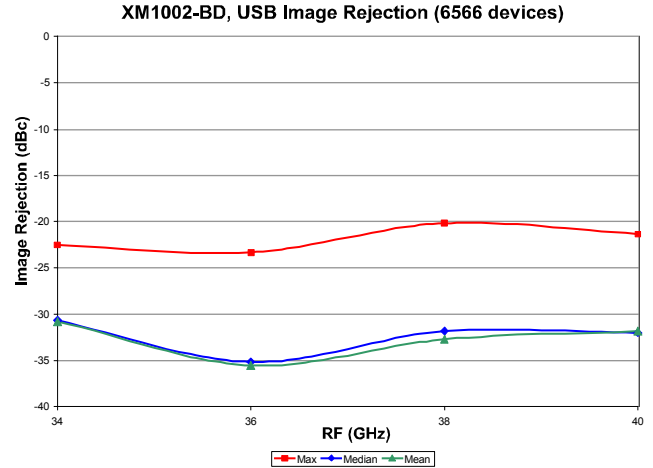
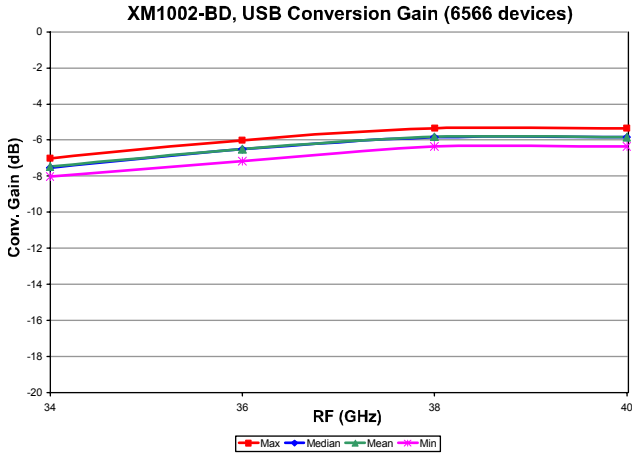
### Handling Procedures

Please observe the following precautions to avoid damage:

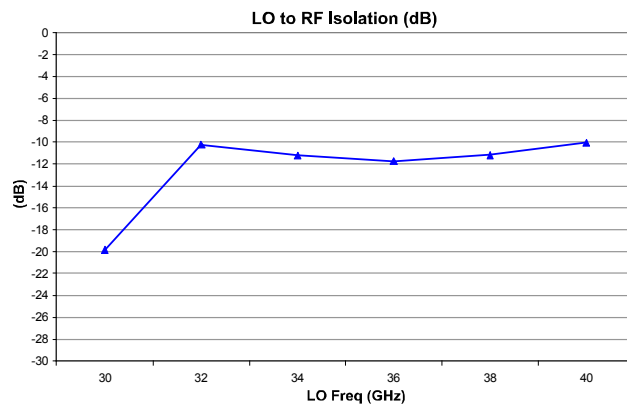
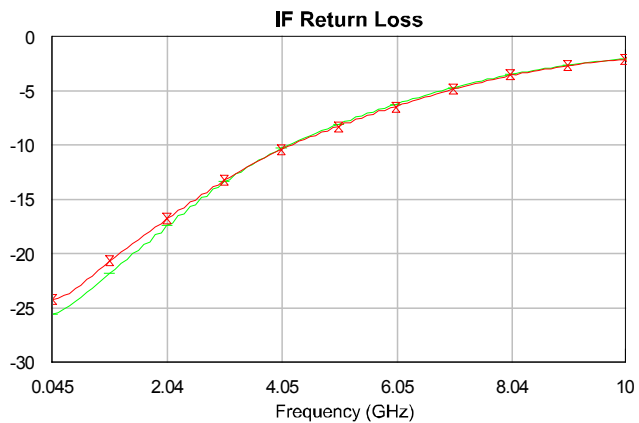
### Static Sensitivity

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.

## Typical Performance Curves



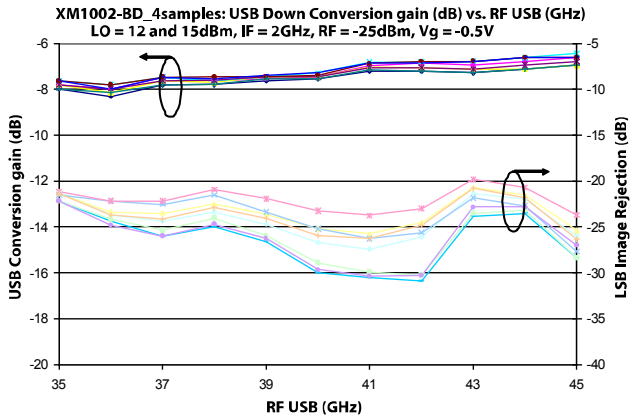
## Typical Performance Curves (cont.)



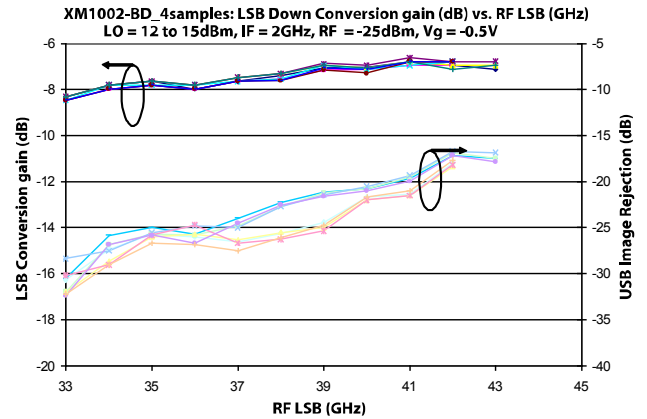
## Image Reject Mixer 34 - 46 GHz

Rev. V1

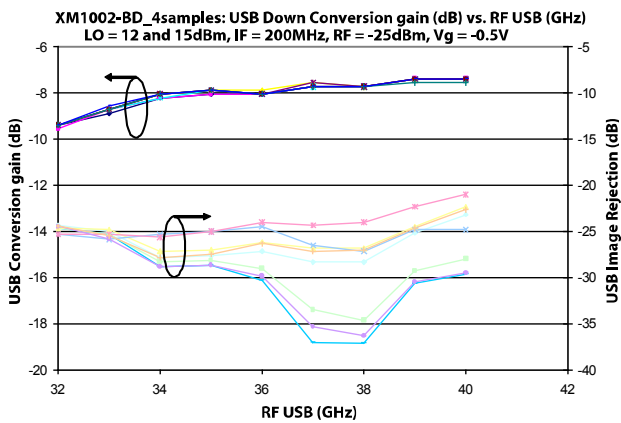
### Typical Performance Curves (cont.)



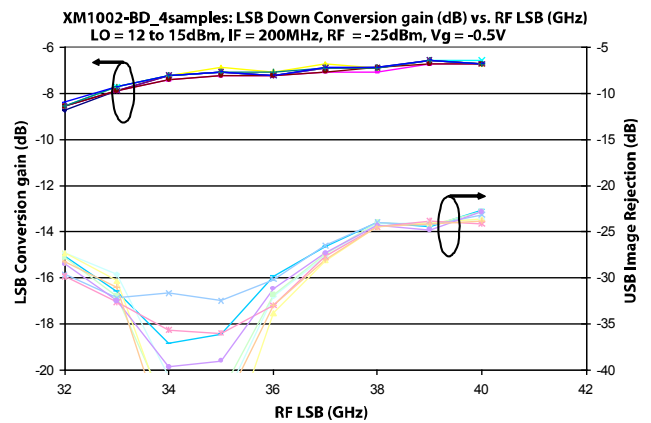
IF=2 GHz



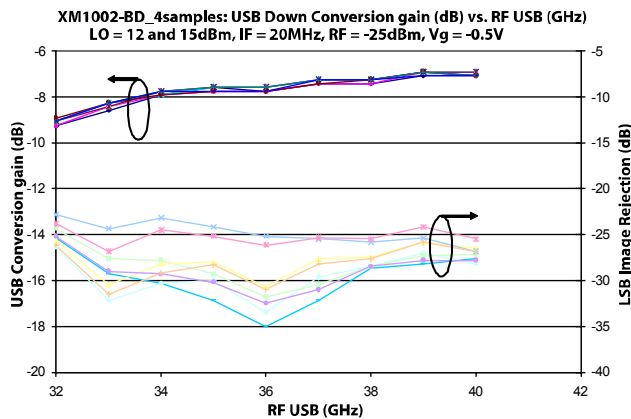
IF=2 GHz



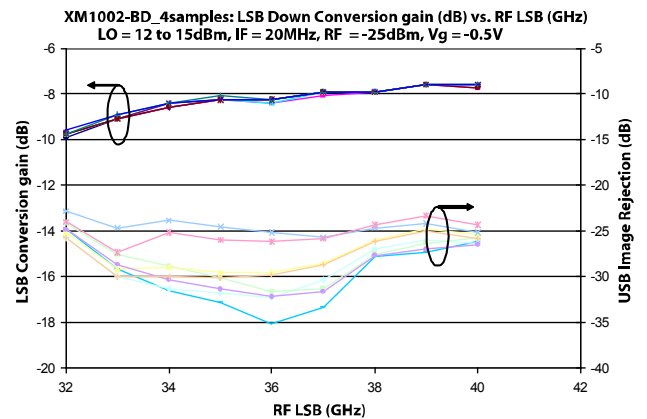
IF=200 MHz



IF=200 MHz



IF=20 MHz



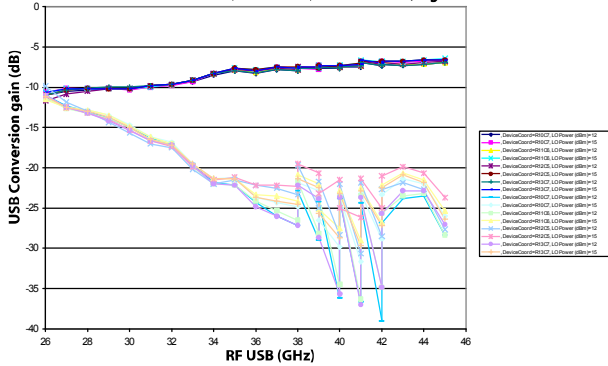
IF=20 MHz

## Image Reject Mixer 34 - 46 GHz

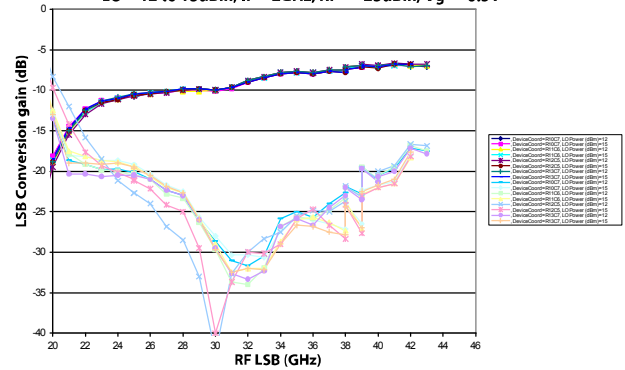
Rev. V1

### Typical Performance Curves (cont.)

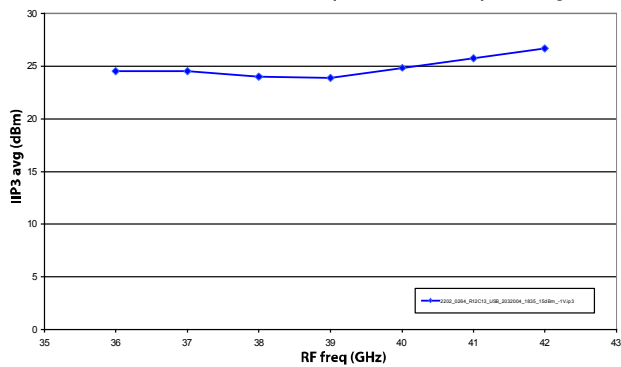
XM1002-BD\_4samples: USB Down Conversion gain (dB) vs. RF USB (GHz)  
LO = 12 and 15dBm, IF = 2GHz, RF = -25dBm, Vg = -0.5V



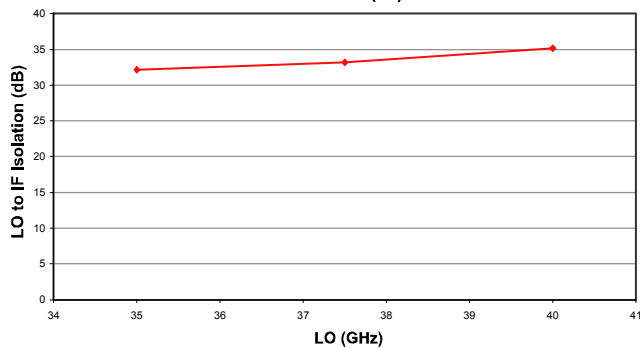
XM1002-BD\_4samples: LSB Down Conversion gain (dB) vs. RF LSB (GHz)  
LO = 12 to 15dBm, IF = 2GHz, RF = -25dBm, Vg = -0.5V



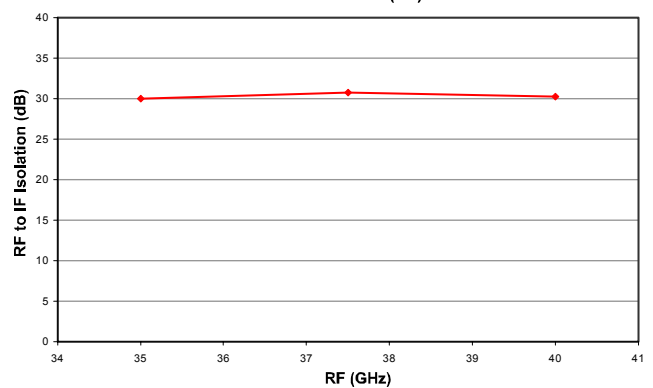
XM1002-BD\_3\_samples: IIP3 (dBm) in USB down-conversion vs. RF freq  
LO = 15dBm, IF = 2GHz, IFout = -14dBm per Tone, 100MHz separation, Vg = -0.8V



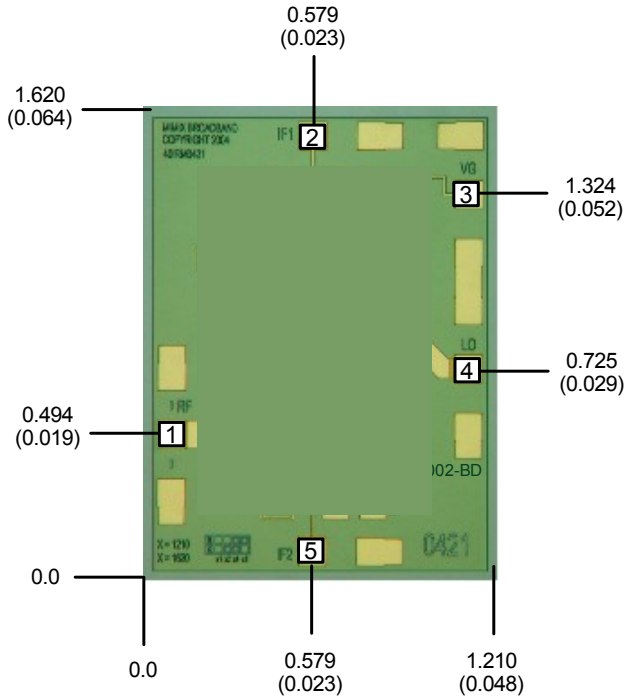
LO to IF Isolation (dB)



RF to IF Isolation (dB)



## Mechanical Drawing

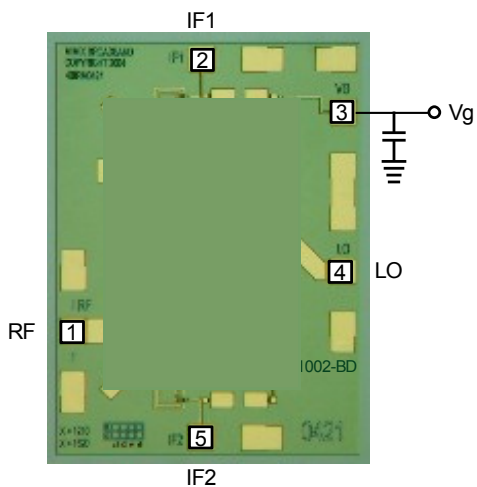


Units: millimeters (inches) Bond pad dimensions are shown to center of bond pad.  
Thickness: 0.110 +/- 0.010 (0.0043 +/- 0.0004), Backside is ground, Bond Pad/Backside Metallization: Gold  
All Bond Pads are 0.100 x 0.100 (0.004 x 0.004).

Bond pad centers are approximately 0.109 (0.004) from the edge of the chip.  
Dicing tolerance: +/- 0.005 (+/- 0.0002). Approximate weight: 1.215 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]

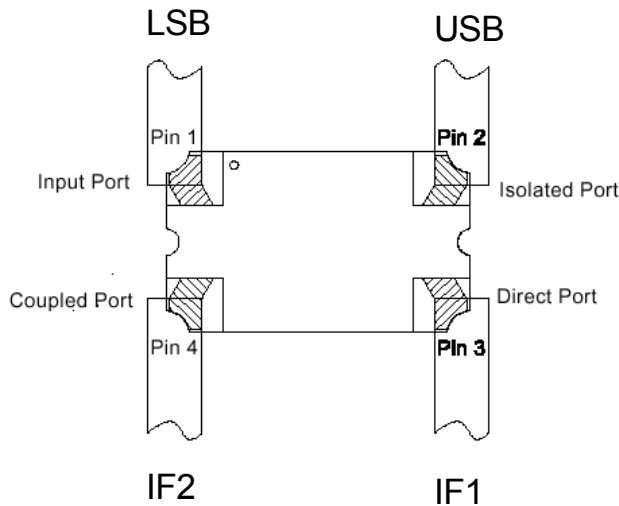
## Image Reject Mixer 34 - 46 GHz

Rev. V1

**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:

