

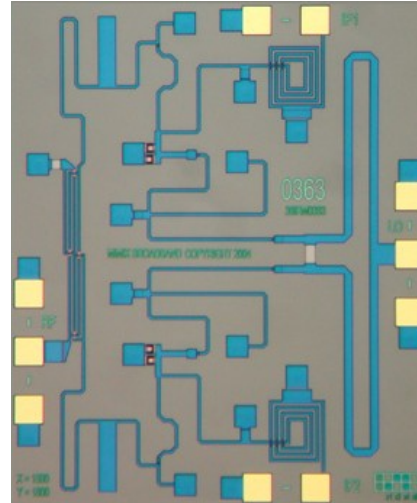
## Features

- Sub-harmonic Image Reject Mixer
- GaAs HBT Technology
- 9.0 dB Conversion Loss
- 18.0 dB Image Rejection
- 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 32.0-42.0 GHz GaAs MMIC sub-harmonic image reject mixer can be used as an up- or down-converter. The device has a conversion loss of 9.0 dB with 18.0 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 HBT 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.
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
XM1003-BD-000V	"V" - vacuum release gel paks
XM1003-BD-EV1	evaluation module

**Image Reject Mixer**  
**32.0-42.0 GHz**

Rev. V1

**Electrical Specifications: 34-42 GHz (Upper Side Band) (Ambient Temperature T = 25°C)**

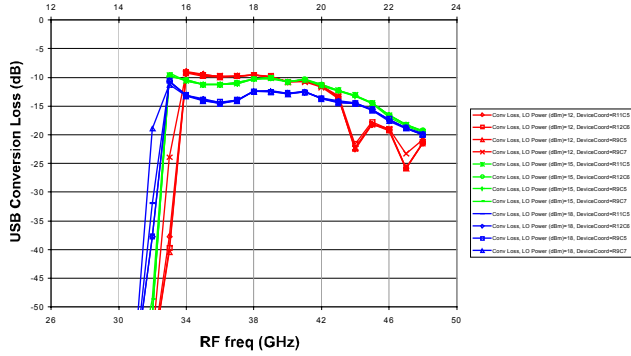
Parameter	Units	Min.	Typ.	Max.
Frequency Range (RF) Lower Side Band	GHz	32.0	-	42.0
Frequency Range (LO)	GHz	15.0	-	23.0
Frequency Range (IF)	GHz	DC	-	4.0
RF Return Loss (S11)	dB	-	10.0	-
IF1/IF2 Return Loss (S22)	dB	-	TBD	-
LO Return Loss (S33)	dB	-	TBD	-
Conversion Loss (S21)	dB	-	9.0	-
LO Input Drive (P <sub>LO</sub> )	dBm	-	+12.0	-
Image Rejection	dBc	-	18.0	-
Isolation LO/RF	dBc	-	-40.0	-
Isolation LO/IF	dB	-	TBD	-
Isolation RF/IF	dB	-	TBD	-
Input Third Order Intercept (IIP3)	dBm	-	+14.0	-

## Image Reject Mixer 32.0-42.0 GHz

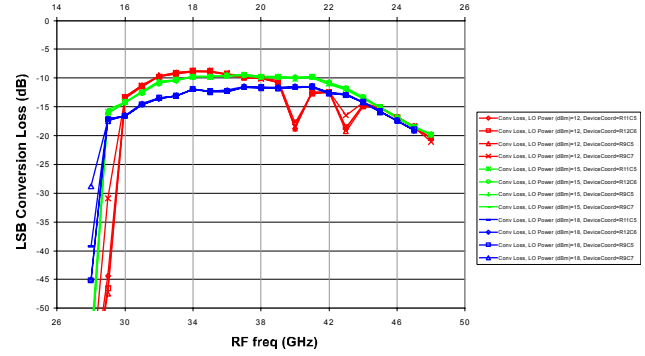
Rev. V1

### Typical Performance Curves (Down Conversion)

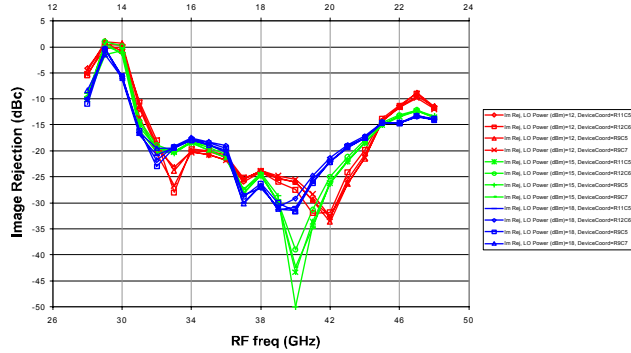
XM1003-BD (USB, down conversion, IF=2GHz, PRF=-20dBm, PLO=+12, 15 & 18dBm): USB Conversion Loss (dB) vs. RF freq (GHz)  
LO freq (GHz)



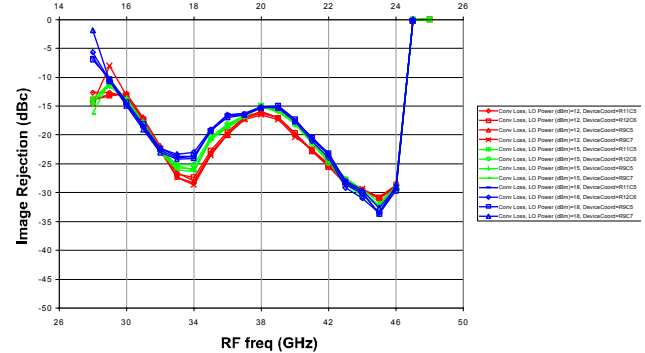
XM1003-BD (LSB, down conversion, IF=2GHz, PRF=-20dBm, PLO=+12, 15 & 18dBm): LSB Conversion Loss (dB) vs. RF freq (GHz)  
LO freq (GHz)



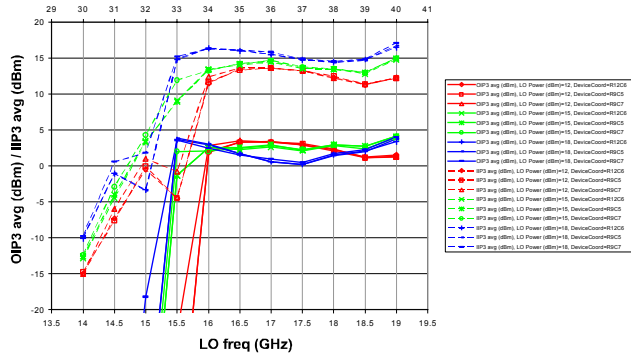
XM1003-BD (USB, down conversion, IF=2GHz, PRF=-20dBm, PLO=+12, 15 & 18dBm): Image Rejection (dBc) vs. RF freq (GHz)  
LO freq (GHz)



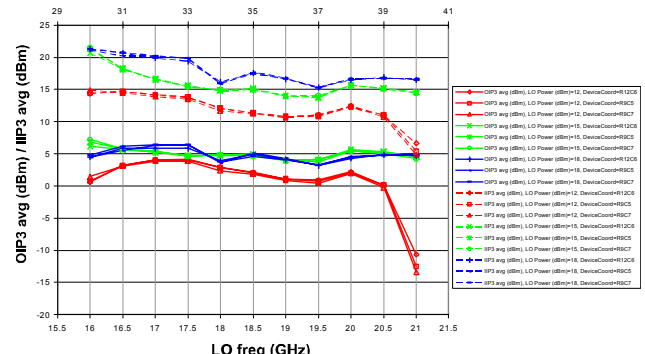
XM1003-BD (LSB, down conversion, IF=2GHz, PRF=-20dBm, PLO=+12, 15 & 18dBm): Image Rejection (dBc) vs. RF freq (GHz)  
LO freq (GHz)



XM1003-BD (USB, Down Conversion, IF=2GHz, IF1-IF2=100MHz, PRF=-15dBm, LO=12, 15 & 18 dBm): OIP3 avg (dBm) vs. LO freq (GHz), IIP3 avg (dBm) vs. RF freq (GHz)



XM1003-BD (LSB, Down Conversion, IF=2GHz, IF1-IF2=100MHz, PRF=-15dBm, LO=12, 15 & 18 dBm): OIP3 avg (dBm) vs. LO freq (GHz), IIP3 avg (dBm) vs. RF freq (GHz)

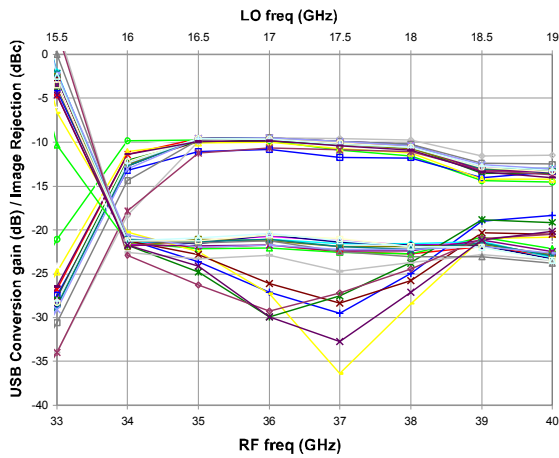


## Image Reject Mixer 32.0-42.0 GHz

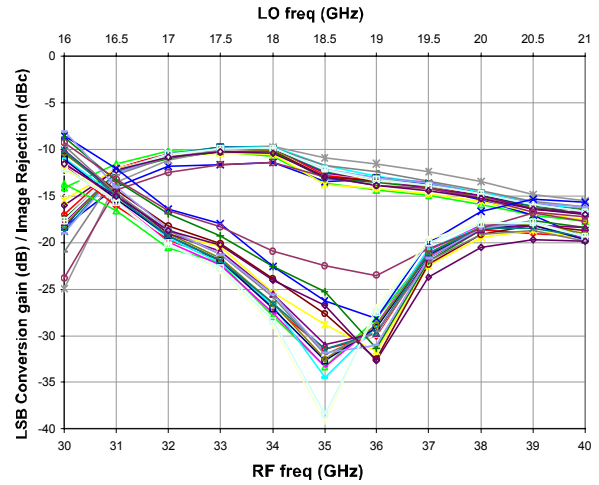
Rev. V1

### Typical Performance Curves (Up Conversion)

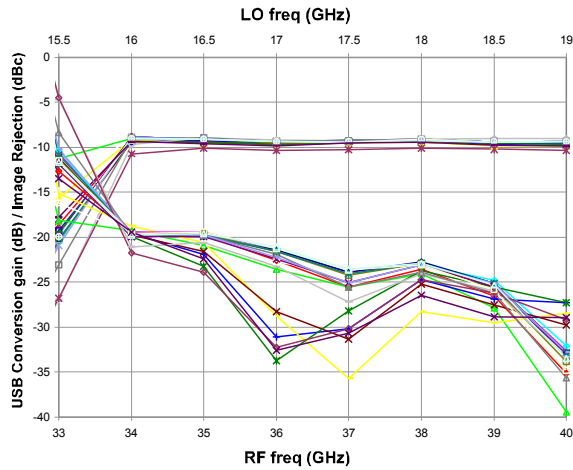
XM1003-BD (Up conversion, P1F=-15dBm, IF=2GHz, USB, PLO=+9dBm):  
USB Conversion gain (dB) & Image Rejection (dBc) vs. RF freq (GHz) & LO freq (GHz)



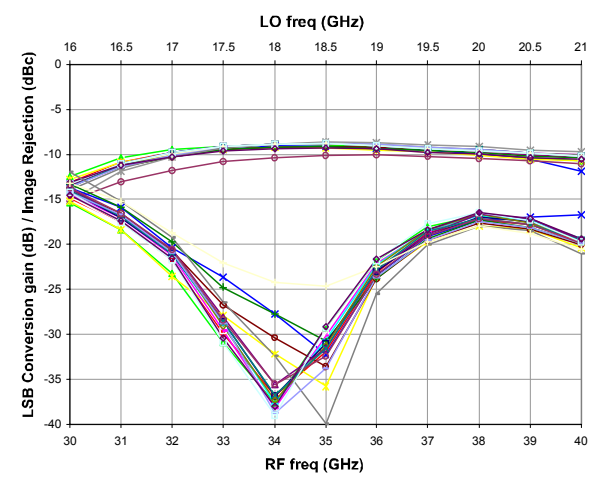
XM1003-BD (Up conversion, P1F=-15dBm, IF=2GHz, LSB, PLO=+9dBm):  
USB Conversion gain (dB) & Image Rejection (dBc) vs. RF freq (GHz) & LO freq (GHz)



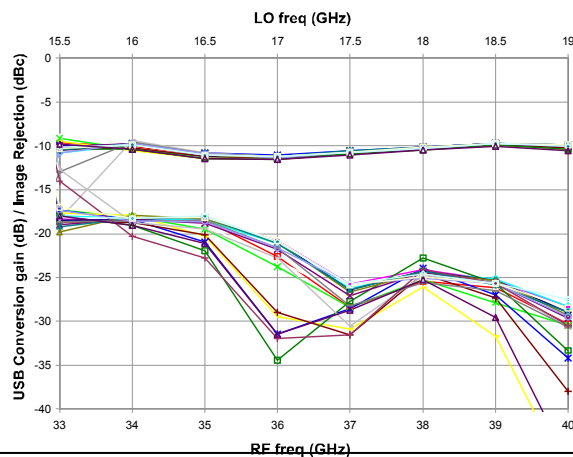
XM1003-BD (Up conversion, P1F=-15dBm, IF=2GHz, USB, PLO=+12dBm):  
USB Conversion gain (dB) & Image Rejection (dBc) vs. RF freq (GHz) & LO freq (GHz)



XM1003-BD (Up conversion, P1F=-15dBm, IF=2GHz, LSB, PLO=+12dBm):  
USB Conversion gain (dB) & Image Rejection (dBc) vs. RF freq (GHz) & LO freq (GHz)



XM1003-BD (Up conversion, P1F=-15dBm, IF=2GHz, USB, PLO=+15dBm):  
USB Conversion gain (dB) & Image Rejection (dBc) vs. RF freq (GHz) & LO freq (GHz)

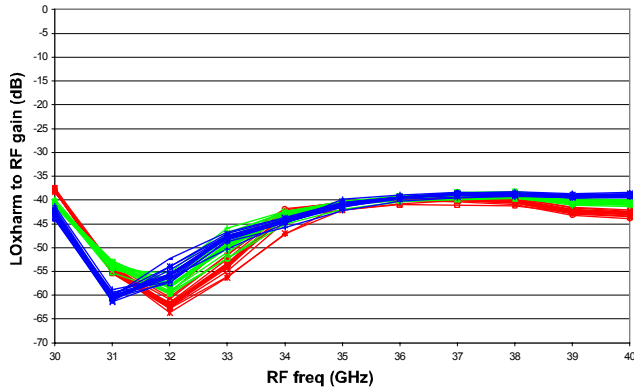


## Image Reject Mixer 32.0-42.0 GHz

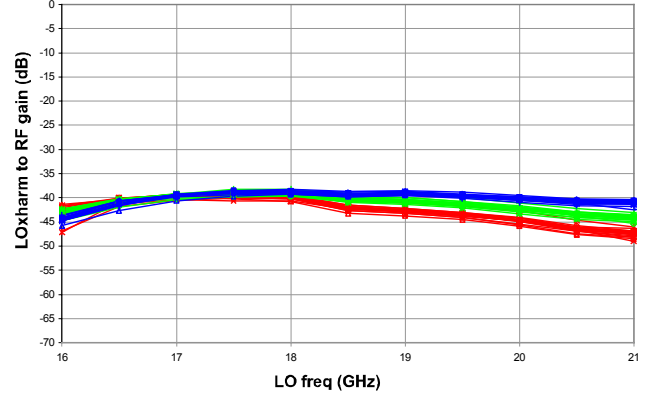
Rev. V1

### Typical Performance Curves (Up Conversion) (cont.)

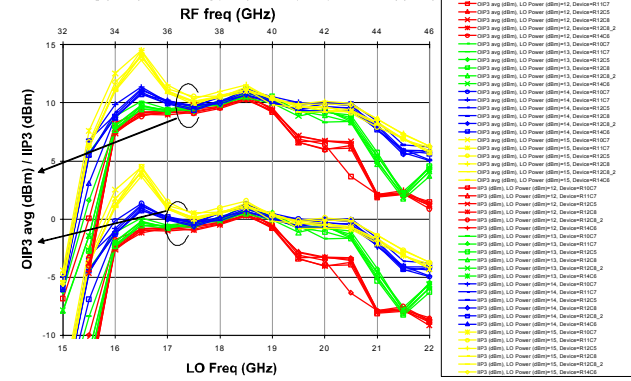
XM1003-BD (Up conversion, PIF=-15dBm, IF=2GHz, USB, PLO=+9,+12 and +15dBm): LOxharm to RF gain (dB) vs. RF freq (GHz)



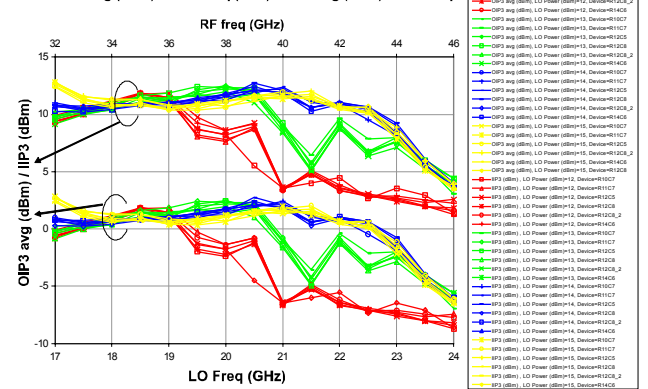
XM1003-BD (LSB, Up conversion, PIF=-15dBm, IF=2GHz, LSB, PLO=+9,+12 and 15dBm): LOxharm to RF gain (dB) vs. LO freq (GHz)



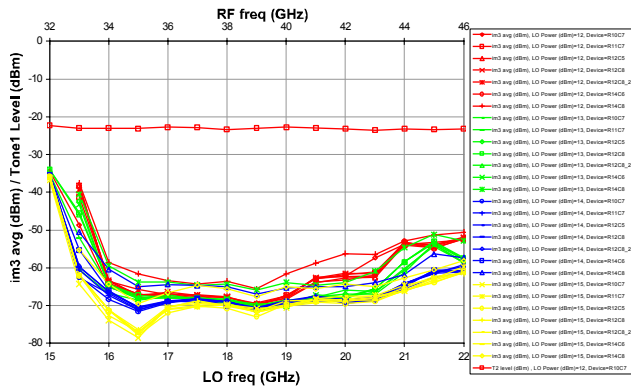
XM1003-BD (Up Conv, IF=2GHz, IF1-IF2=0.1GHz, USB, Pout=-23dBm): OIP3 avg (dBm) vs. LO freq (GHz) & IIP3 (dBm) vs RF freq (GHz)



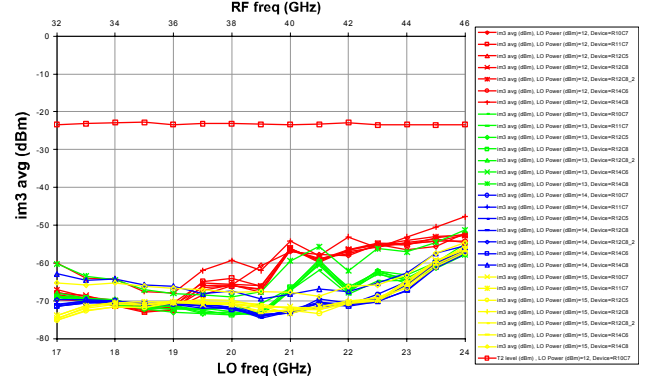
XM1003-BD (Up Conv, IF=2GHz, IF1-IF2=0.1GHz, LSB, Pout=-23dBm): OIP3 avg (dBm) vs. LO freq (GHz) & IIP3 avg (dBm) vs RF freq (GHz)



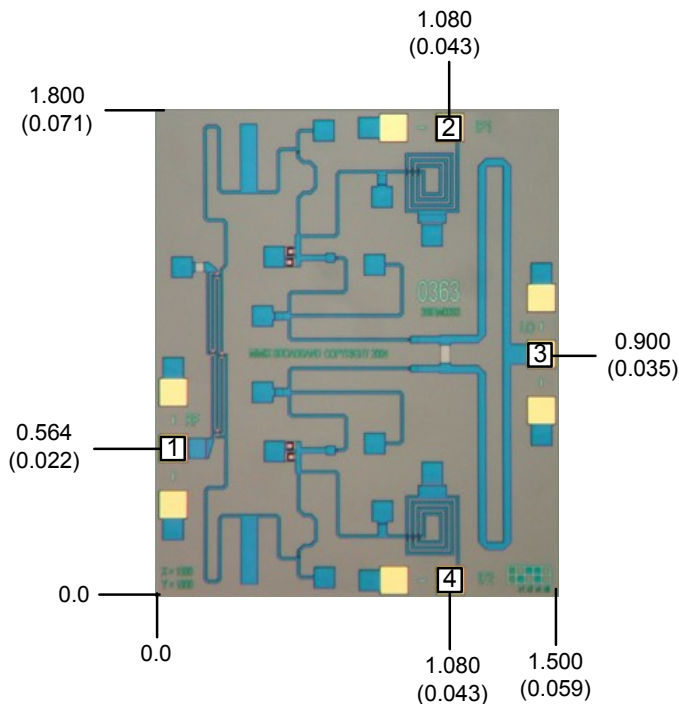
XM1003-BD (Up Conv, IF=2GHz, IF1-IF2=0.1GHz, USB, Pout=-23dBm): im3 avg (dBm) vs. LO freq (GHz) & RF level (dBm) vs RF Freq (GHz)



XM1003-BD (Up Conv, IF=2GHz, IF1-IF2=0.1GHz, LSB, Pout=-23dBm): im3 avg (dBm) vs. LO freq (GHz) & RF level (dBm) vs RF Freq (GHz)



## Mechanical Drawing



(Note: Engineering designator is 38IRM0363)

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).

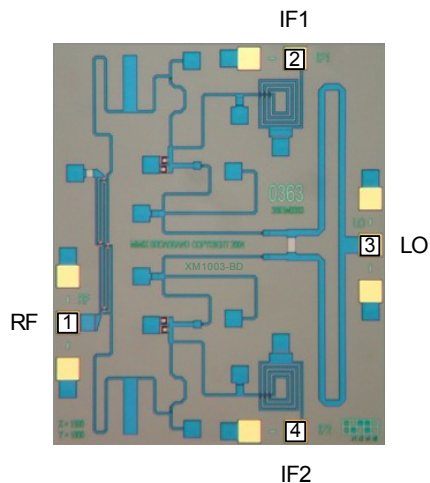
Bond pad centers are approximately 0.109 (0.004) from the edge of the chip.

Dicing tolerance: +/- 0.005 (+/- 0.0002). Approximate weight: 1.674 mg.

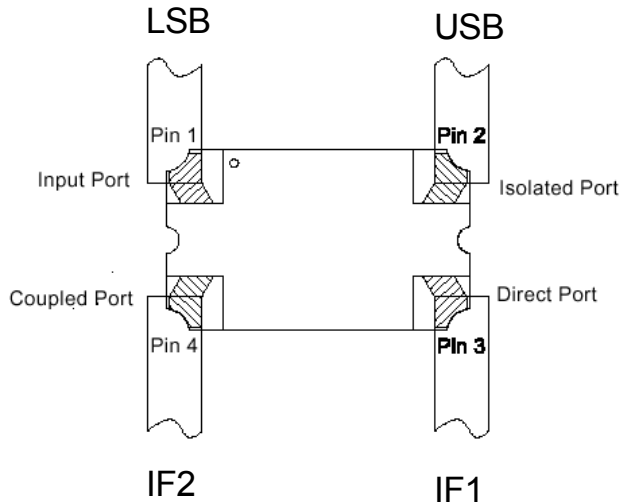
Bond Pad #1 (RF)  
Bond Pad #2 (IF1)

Bond Pad #3 (LO)  
Bond Pad #4 (IF2)

## Bias Arrangement



**App Note [1] USB/LSB Selection -**

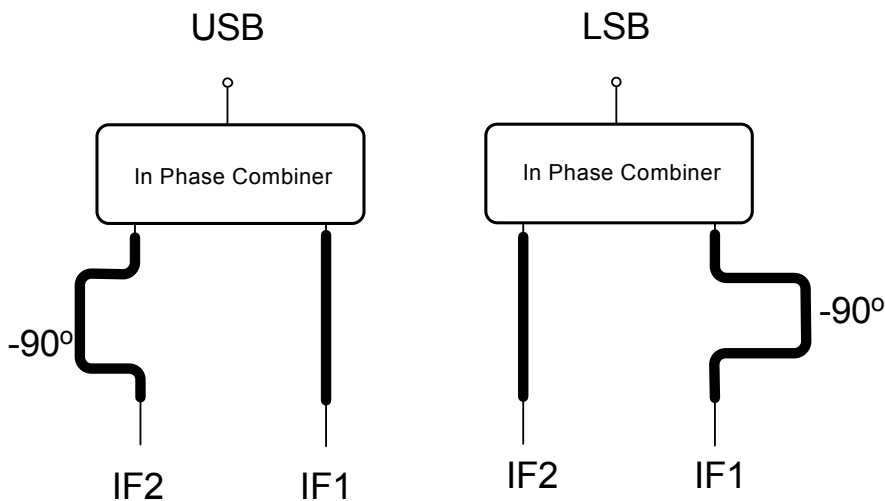


**For Upper Side Band Operation (USB):** With IF1 and IF2 connected to the direct port ( $0^\circ$ ) and coupled port ( $90^\circ$ ) respectively as shown in the diagram, the USB signal will reside on the isolated port. The input port must be loaded with 50 ohms.

**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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