Image Reject Mixer
2.5 - 9.0 GHz

MAMX-011044
Rev. V3

Features

- Passive Mixer - No Bias Required
- Usable as Image Reject Down Converter or as Single Sideband (SSB) Up Converter
- Low Conversion Loss: 7.5 dB
- High Linearity: 22 dBm IIP3
- High Image Rejection: 22 dBc
- Wide IF Bandwidth: DC to 3.5 GHz
- High Isolation
- Package Size: 4 mm 24-Lead QFN
- RoHS* Compliant

Applications

- Test & Measurement, Microwave Radio, and Radar

Description

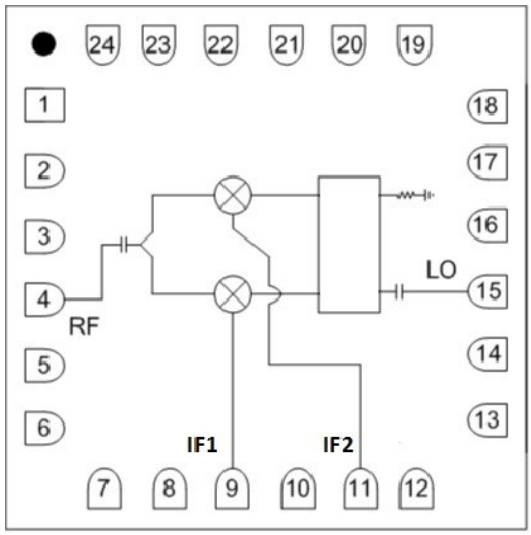
MAMX-011044 is an image-reject passive diode mixer MMIC. The mixer offers low conversion loss, high linearity, high image rejection and a wide IF bandwidth. The image-reject circuit configuration provides excellent port isolation while internal 50 Ω matching simplifies its application.

Ordering Information[1,2]

Part Number	Package
MAMX-011044	Bulk
MAMX-011044-TR0100	100 Piece Reel
MAMX-011044-TR0500	500 Piece Reel
MAMX-011044-SB1	Sample Board

1. Reference Application Note M513 for reel size information.
2. All sample boards include 5 loose parts.

Functional Schematic



Pin Configuration[3]

Pin #	Function
1 - 3, 5, 7, 8, 12 - 14, 16, 18 - 20, 22 - 24	Ground
4	RF
6, 10, 17, 21	No Connection[3]
9	IF1
11	IF2
15	LO
25	Paddle[4]

3. MACOM recommends connecting unused package pins to ground.
4. The exposed pad centered on the package bottom must be connected to RF, DC and thermal ground.

* Restrictions on Hazardous Substances, compliant to current RoHS EU directive.

Electrical Specifications[5]: F_{IF} = 500 MHz, P_{LO} = 18 dBm, T_A = +25°C, Z_0 = 50 Ω

Parameter	Test Conditions	Units	Min.	Typ.	Max.
LO and RF Frequency	—	GHz	2.5	—	9
IF Frequency	—	GHz	0	—	3.5
LO Power	—	dBm	—	18	—
Conversion Loss	2.5 - 3.0 GHz 3.0 - 6.0 GHz 6.0 - 9.0 GHz	dB	—	10.0 7.0 8.5	12.0 9.25 11.0
Input P1dB	—	dBm	—	13	—
Input IP3	P_{RF} = -10 dBm/tone, Δf = 1 MHz	dBm	—	22	—
Input IP2 (Half IF)	—	dBm	—	60	—
LO-to-RF Isolation	—	dB	—	45	—
LO-to-IF Isolation	—	dB	—	45	—
RF-to-IF Isolation	—	dB	—	15	—
Image Rejection	2.5 - 5.5 GHz 5.5 - 9.0 GHz	dBc	17.5 13.0	26 17	—
Amplitude Imbalance	—	dB	—	±1	—
Phase Imbalance	—	°	—	±10	—
RF Return Loss	—	dB	—	6	—
IF Return Loss	—	dB	—	13	—

5. All specifications refer to down-conversion operation with upper sideband selected, unless otherwise noted.

Absolute Maximum Ratings[6,7]

Parameter	Absolute Maximum
LO Power	23 dBm
RF or IF Power	20 dBm
Junction Temperature[8]	+150°C
Operating Temperature	-55°C to +85°C
Storage Temperature	-65°C to +150°C

6. Exceeding any one or combination of these limits may cause permanent damage to this device.
7. MACOM does not recommend sustained operation near these survivability limits.
8. Operating at nominal conditions with $T_J \leq +150°C$ will ensure MTTF > 1 x 10^6 hours. Thermal resistance, Θ_{JC} is 85°C/W.

Handling Procedures

Please observe the following precautions to avoid damage:

Static Sensitivity

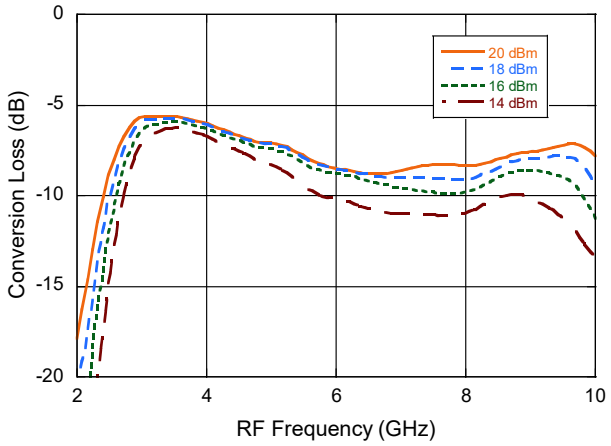
These electronic devices are sensitive to electrostatic discharge (ESD) and can be damaged by static electricity. Proper ESD control techniques should be used when handling these HBM Class 1B devices.

Assembly Information

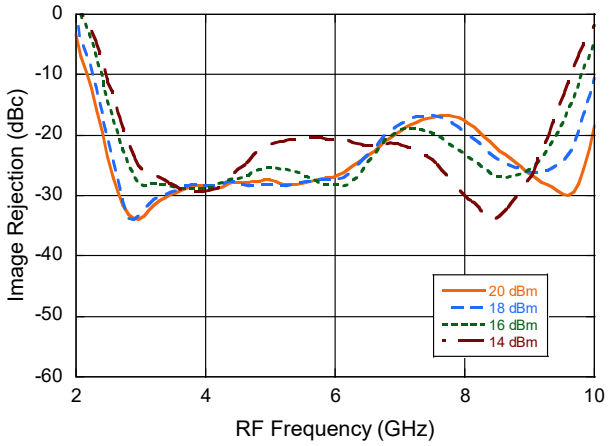
- Do not subject the device to excessive force, especially at elevated temperatures > 60°C.
- No-clean flux is required for assembly. Post SMT washing is not recommended.

Typical Performance Curves: 90° Hybrid @ 500 MHz IF

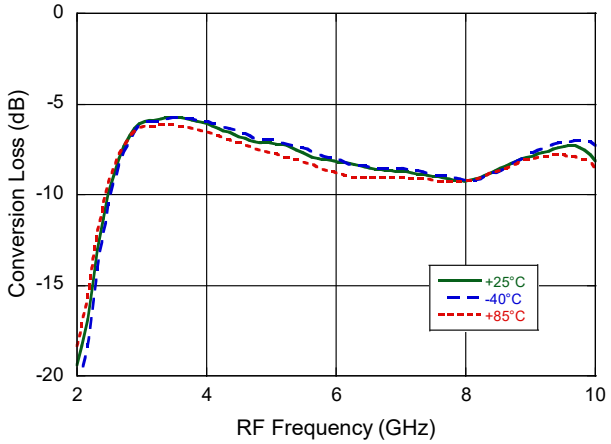
Down Conversion Gain (Upper Side Band) Over LO Drive



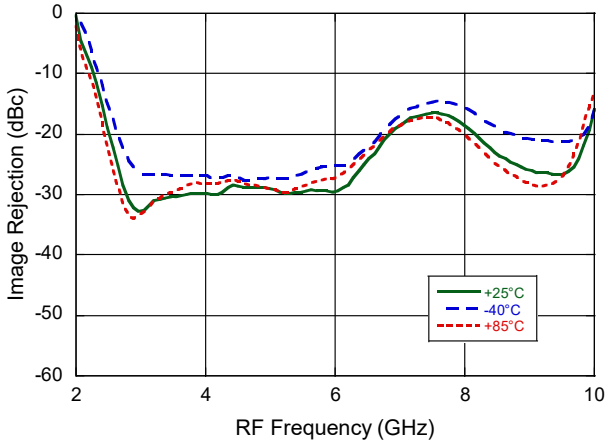
Down Conversion Image Rejection (Upper Side Band) Over LO Drive



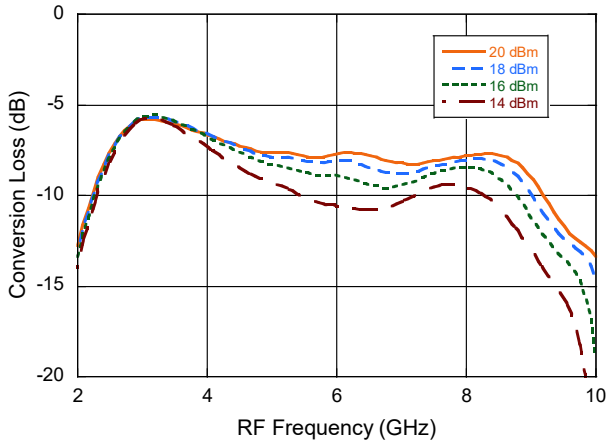
Down Conversion Gain (Upper Side Band) Over Temperature



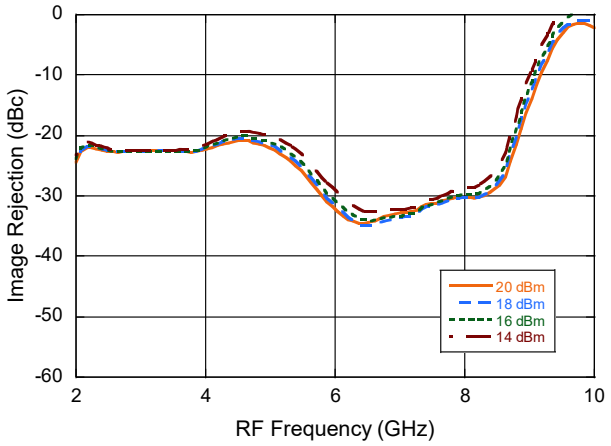
Down Conversion Image Rejection (Upper Side Band) Over Temperature



Down Conversion Gain (Lower Side Band) Over LO Drive

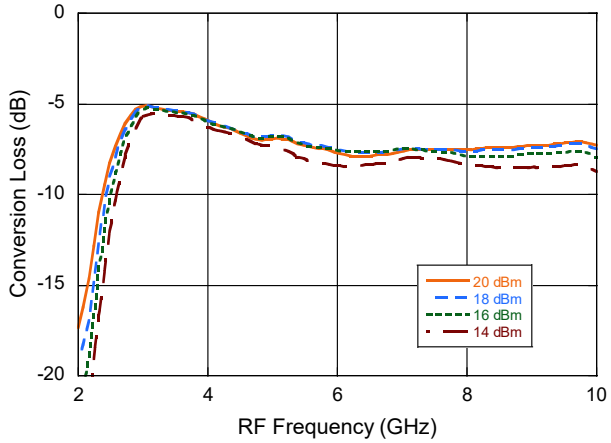


Down Conversion Image Rejection (Lower Side Band) Over LO Drive

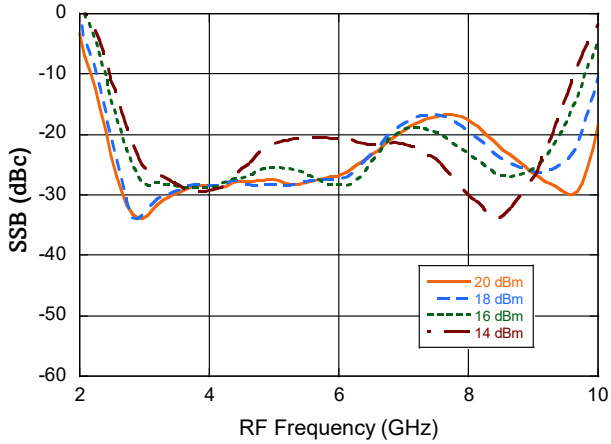


Typical Performance Curves: 90° Hybrid @ 500 MHz IF

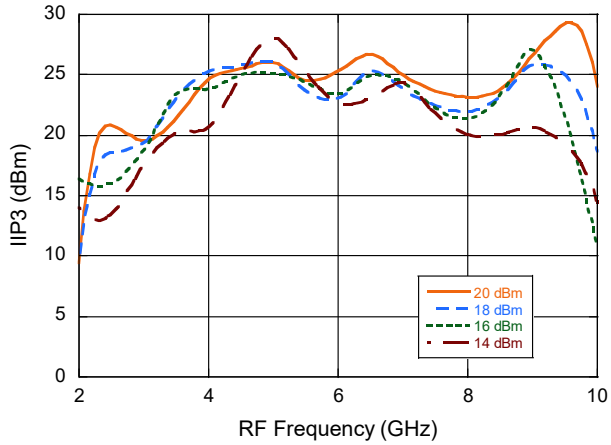
Up Conversion Gain Over LO Drive



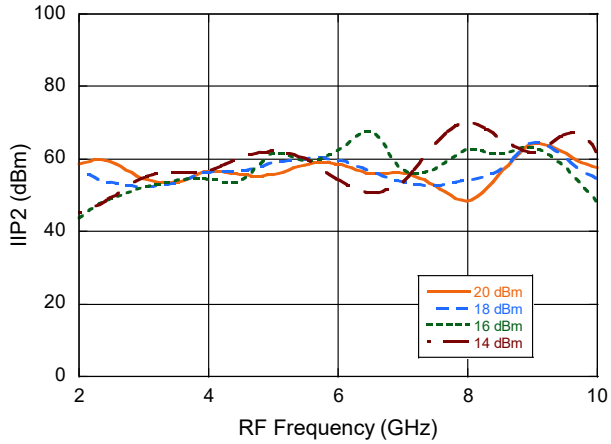
Up Conversion SSB Over LO Drive



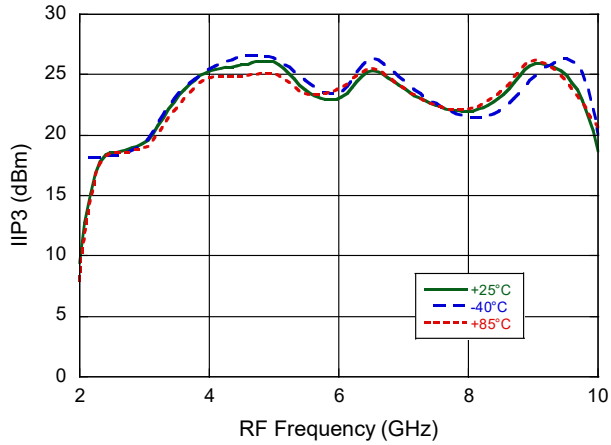
Down Conversion IIP3 Over LO Drive



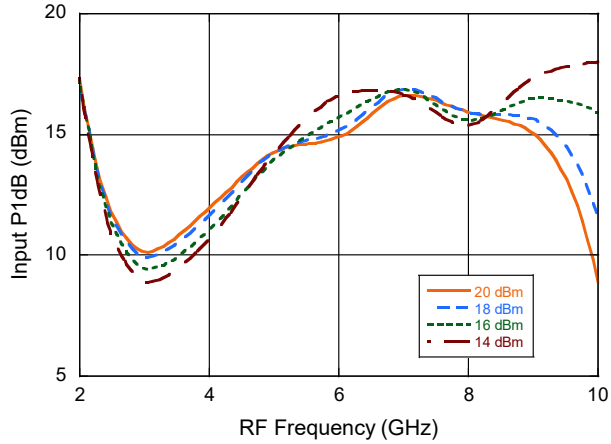
Down Conversion IIP2 (USB) Over LO Drive



Down Conversion IIP3 (USB) Over Temperature

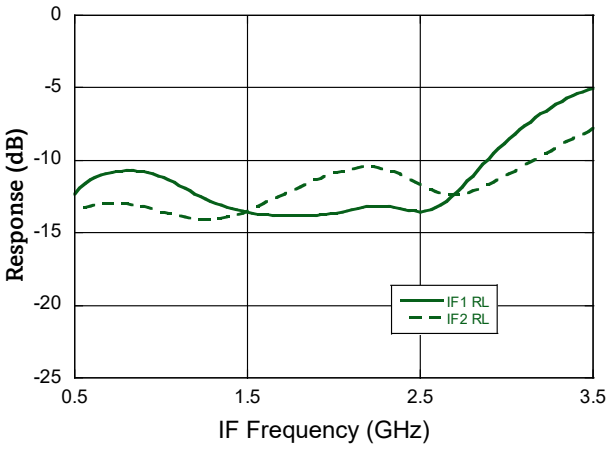


Down Conversion P1dB (USB) Over LO Drive

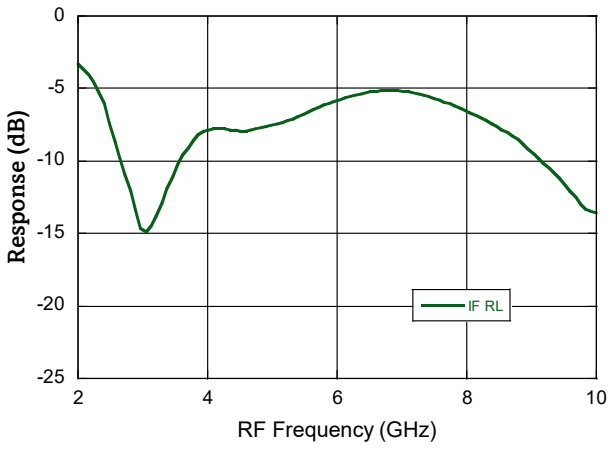


Typical Performance Curves

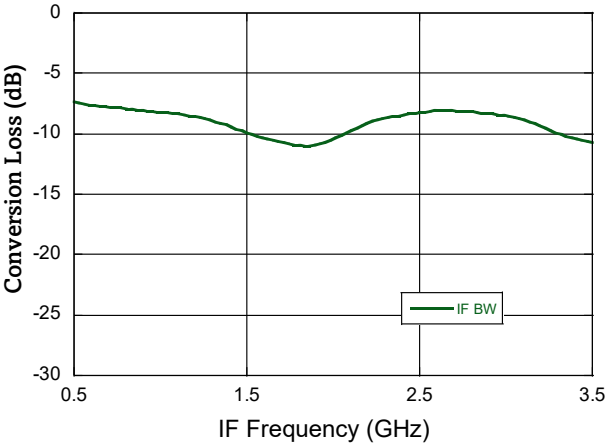
IF Return Loss



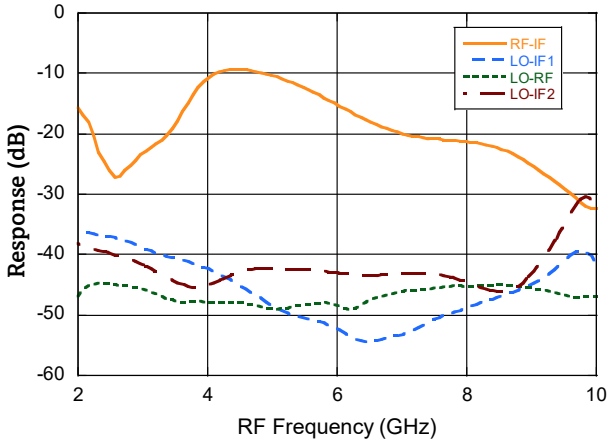
RF Return Loss



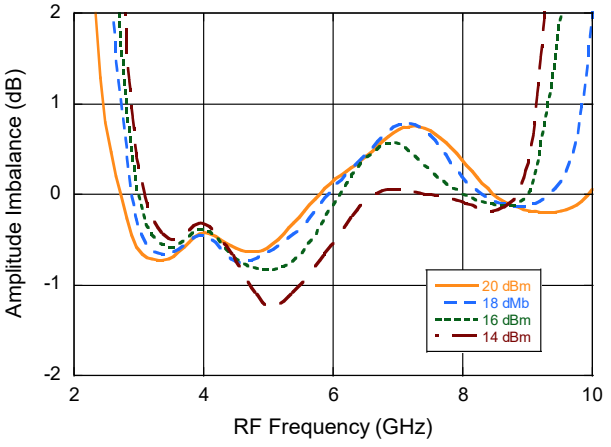
IF Bandwidth



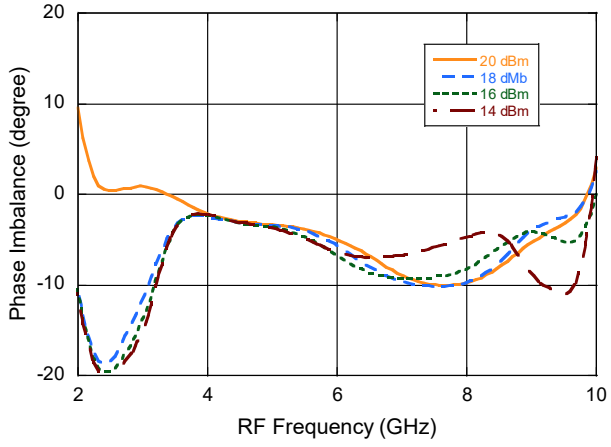
Isolation



Amplitude Imbalance



Phase Imbalance



MxN Spurious Rejection @ IF port

RF 5.5 GHz @ -10 dBm, LO 5 GHz @ +18 dBm
(All values in dBc below the IF output power level)

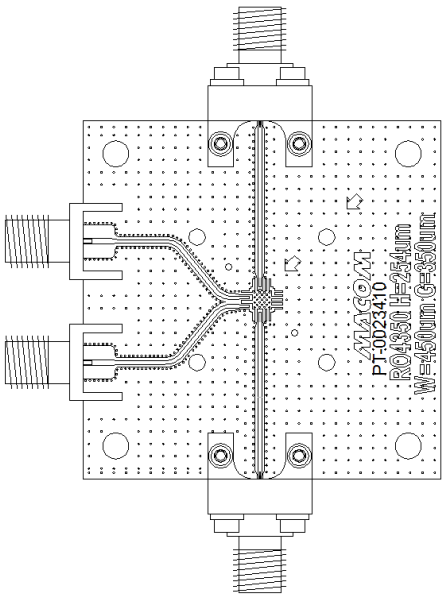
mxRF	nxLO				
	0	**1**	**2**	**3**	**4**
0	X	12	22	10	15
1	4	0	26	80	50
2	X	100	77	80	97
3	88	X	90	80	96
4	X	102	X	105	102

LO Harmonics

LO +18 dBm
(Values in dBc below input LO level measured at RF)

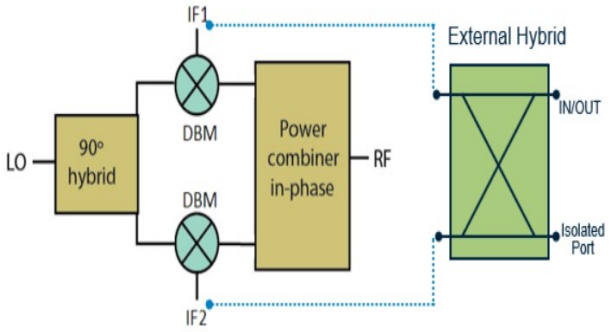
LO GHz	nxLO spur @ RF port			
	1	**2**	**3**	**4**
3.5	48	52	53	69
4.5	47	50	56	68
5.5	46	40	46	70
6.5	46	48	45	73
7.5	47	54	55	51
8.5	46	49	82	60

PCB Layout



- Material: Rogers 4350B
- Dielectric thickness 0.254 mm
- Finished copper thickness 17 microns (0.5 oz) plated to 44 microns +/- 10 microns
- Finish both sides: ENIG, 0.05-0.15 µm gold over 3-6 µm nickel
- DXF available on request

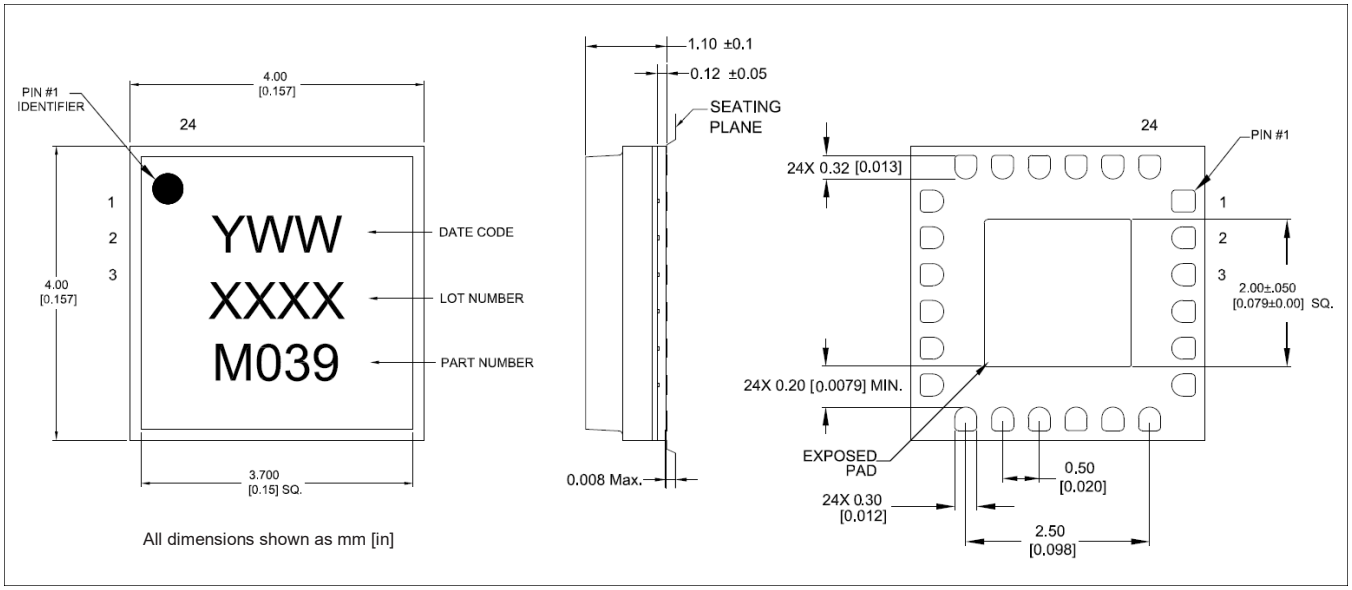
Application Schematic



External Hybrid

- Down conversion and Up conversion data captured with external hybrid 90° coupler part number: ATM PNR H912.
- RF Upper Side Band (USB) mode connect hybrid 0° port to IF1 mixer port, 90° hybrid port to IF2 mixer port.
- RF Lower Side Band (LSB) mode connect hybrid 0° port to IF2 mixer port, 90° hybrid port to IF1 mixer port.

Lead-Free 4 mm 24-Lead AQFN†



† Reference Application Note S2083 for lead-free solder reflow recommendations.
Meets JEDEC moisture sensitivity level 3 requirements.
Plating is NiPdAu