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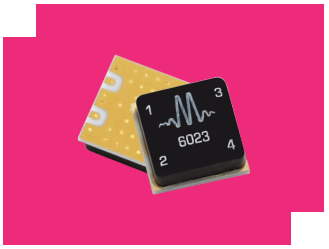
MM1-1850HSM-2

GaAs MMIC Double Balanced Mixer

DEVICE OVERVIEW

General Description

The MM1-1850HSM is a GaAs MMIC double balanced mixer that operates at high frequency in a proprietary surface mount package. MM1-1850HSM is a K/Ka band mixer that works well as both an up and down converter. This mixer offers exceptionally high frequency RF bandwidth for a surface mount mixer and high spurious suppression. The sister MM1-1850SSM is recommended for high linearity applications. The MM1-1850HSM is available in a proprietary 4x4 mm package. Evaluation boards are available.



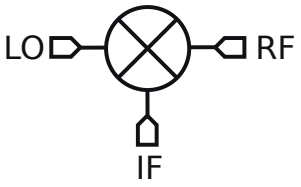
Features

- High Frequency Operation
- High LO to RF isolation
- RoHS Compliant

Applications

- 5G Test Receivers
- Electronic Warfare Scanners
- Recommended Surface Mount Amplifier: AMM-10202PSM

Functional Block Diagram



Part Ordering Options

Part Number	Description	Package	Green Status	Product Lifecycle	Export Classification
MM1-1850HSM-2	GaAs MMIC Double Balanced Mixer	KFN	REACH RoHS	Released	EAR99
EVAL-MM1-1850H	Evaluation Board, GaAs MMIC 18 - 50 GHz Double-balanced Mixer	EVAL	REACH RoHS	Released	EAR99

Table Of Contents

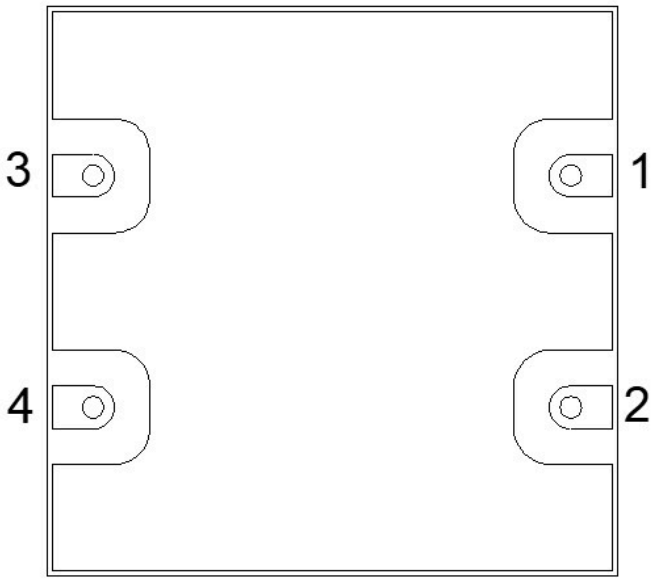
Revision History

Revision Code	Revision Date	Comment
-	2019-05-01	Datasheet Release
A	2019-07-01	Corrected SM Package Dimension Callout

Port Configuration and Functions

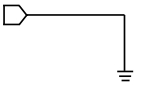
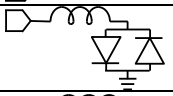
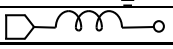
Port Diagram

A bottom-up view of the MM1-1850HSM's SM package outline drawing is shown below. The MM1-1850HSM has the input and output ports given in Port Functions. The MM1-1850HSM can be used in either an up or down conversion. For configuration A, input the LO into pin 1, use pin 3 for the RF, and pin 2 for the IF. For configuration B, input the LO into pin 3, use pin 1 for the RF, and pin 2 for the IF.

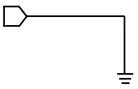
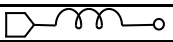
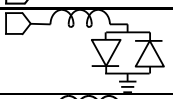
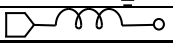


Port Functions

Configuration A

Port	Function	Description	DC Equivalent Circuit
GND	Ground	SM package ground path is provided through the ground paddle.	
Pin 1	LO	Pin 1 is DC open and AC matched to 50 Ohms from 18 to 50 GHz.	
Pin 2	IF	Port 2 is DC coupled to the diodes. Blocking capacitor is optional.	
Pin 3	RF	Pin 3 is DC open and AC matched to 50 Ohms from 18 to 50 GHz	

Configuration B

Port	Function	Description	DC Equivalent Circuit
GND	Ground	SM package ground path is provided through the ground paddle.	
Pin 1	RF	Pin 1 is DC open and AC matched to 50 Ohms from 18 to 50 GHz.	
Pin 2	IF	Port 2 is DC coupled to the diodes. Blocking capacitor is optional.	
Pin 3	LO	Pin 3 is DC open and AC matched to 50 Ohms from 18 to 50 GHz	

Specifications

Absolute Maximum Ratings

The Absolute Maximum Ratings indicate limits beyond which damage may occur to the device. If these limits are exceeded, the device may be inoperable or have a reduced lifetime.

Parameter	Maximum Rating	Unit
Power Handling, at any Port	30	dBm

Package Information

Parameter	Details	Rating
ESD	250 to < 500 Volts	HBM Class 1A
Moisture Sensitivity Level	-	MSL 1

Recommended Operating Conditions

The Recommended Operating Conditions indicate the limits, inside which the device should be operated, to guarantee the performance given in Electrical Specifications Operating outside these limits may not necessarily cause damage to the device, but the performance may degrade outside the limits of the electrical specifications. For limits, above which damage may occur, see Absolute Maximum Ratings.

Parameter	Min	Nominal	Max	Unit
Ambient Temperature	-	25	-	°C
LO Input Power	12	-	22	dBm

Sequencing Requirements

There is no requirement to apply power to the ports in a specific order. However, it is recommended to provide a 50Ω termination to each port before applying power. This is a passive diode mixer that requires no DC bias.

Electrical Specifications

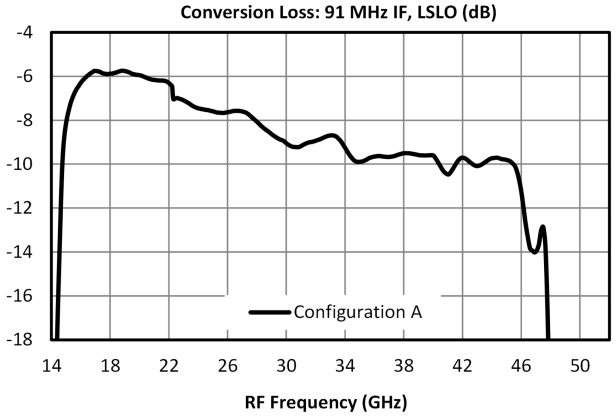
The electrical specifications apply at TA=+25°C in a 50Ω system. Typical data shown is for a down conversion application with a +18dBm sine wave LO input. Specifications shown for configuration A. Configuration B may be suitable for conversions below 45 GHz.

Parameter	Port Configuration	Test Conditions	Min	Typ	Max	Unit
Conversion Loss [1]	-	RF = 18 - 50 GHz LO = 18 - 45 GHz IF = 0.2 - 21 GHz	-	11.5	-	dB
Conversion Loss [2]	-	RF = 18 - 50 GHz LO = 18 - 45 GHz IF = DC - 0.2 GHz	-	8.7	11.5	dB
IF Frequency Range	-	-	0	-	21	GHz
Input 1 dB Gain Compression Point (P1dB)	-	-	-	9	-	dBm
Input IP3	-	RF/LO = 18 - 50 GHz IF = DC - 0.2 GHz	-	17	-	dBm
Isolation, LO to IF	-	IF/LO = 18 - 50 GHz	-	35	-	dB
Isolation, LO to RF	-	RF/LO = 18 - 50 GHz	-	39	-	dB
Isolation, RF to IF	-	RF/IF = 18 - 50 GHz	-	28	-	dB
LO Frequency Range	-	-	18	-	45	GHz
Noise Figure [3]	-	RF = 18 - 50 GHz LO = 18 - 45 GHz IF = DC - 0.2 GHz	-	10	-	dB
Output IP3	-	RF/LO = 18 - 50 GHz IF = DC - 0.2 GHz	-	6	-	dBm
RF Frequency Range	-	-	18	-	50	GHz

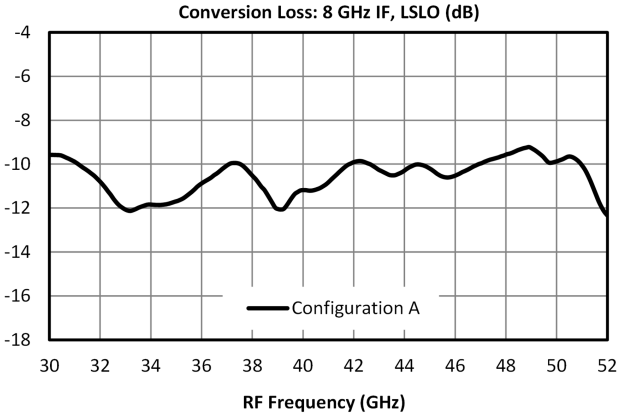
[1][2] Measured as a down converter to a fixed 91MHz IF.
[3] Mixer Noise Figure typically measures within 0.5 dB of conversion loss for IF frequencies greater than 5 MHz.

Typical Performance Plots

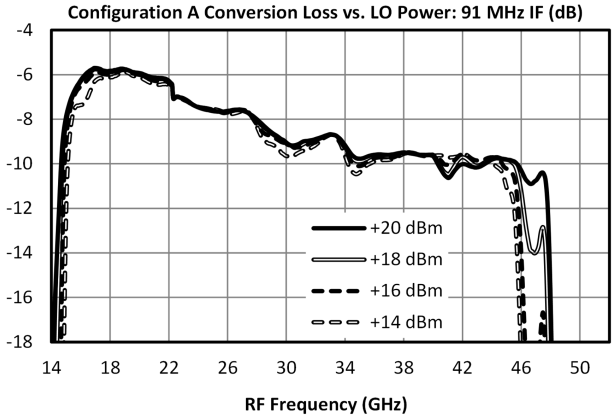
Conversion Loss: 91 MHz IF, LSLO (dB)



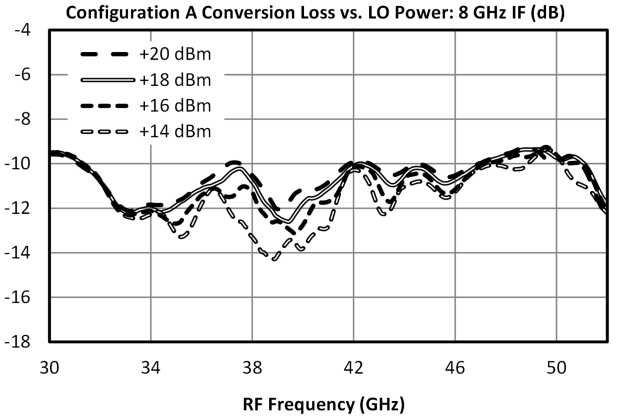
Conversion Loss: 8 GHz IF, LSLO (dB)



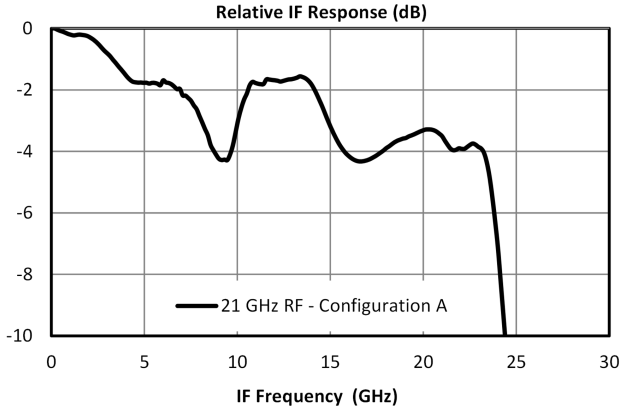
Configuration A Conversion Loss vs. LO Power: 91 MHz IF (dB)



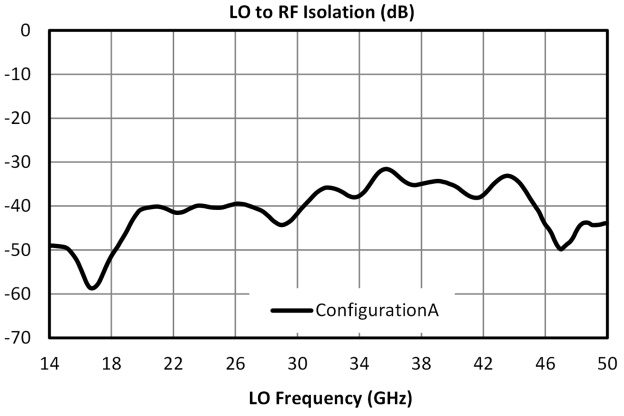
Configuration A Conversion Loss vs. LO Power: 8 GHz IF (dB)



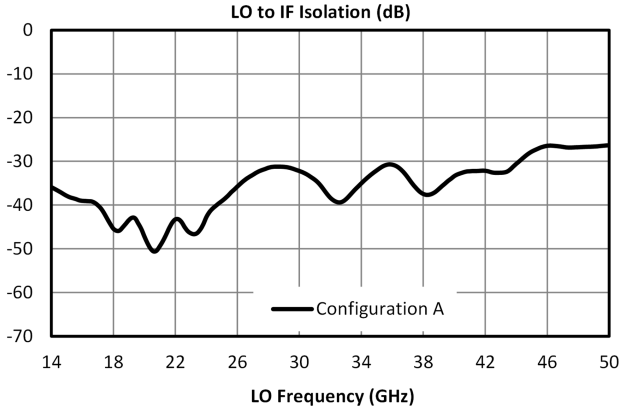
Relative IF Response (dB)



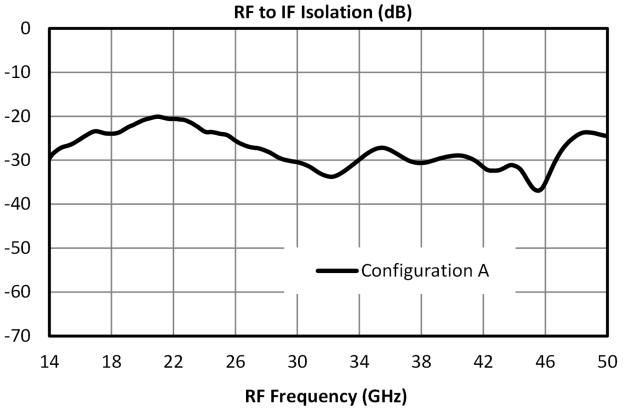
LO to RF Isolation (dB)

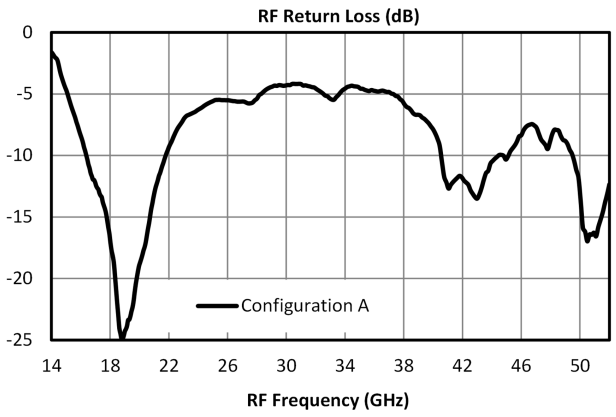


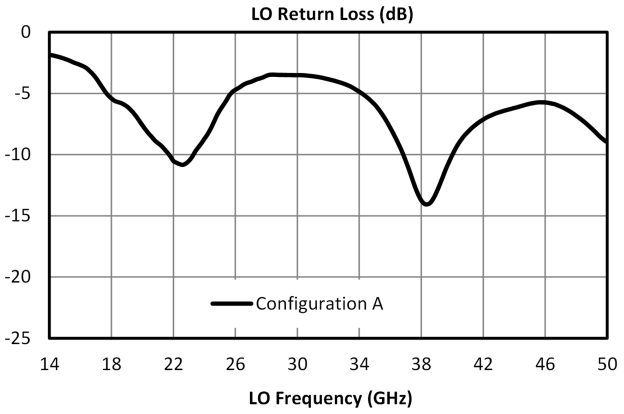
LO to IF Isolation (dB)

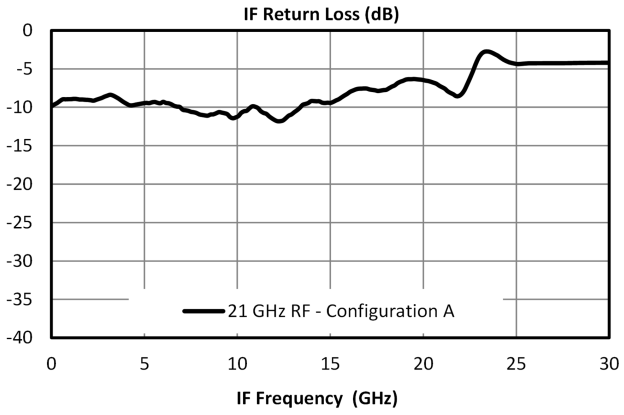


RF to IF Isolation (dB)

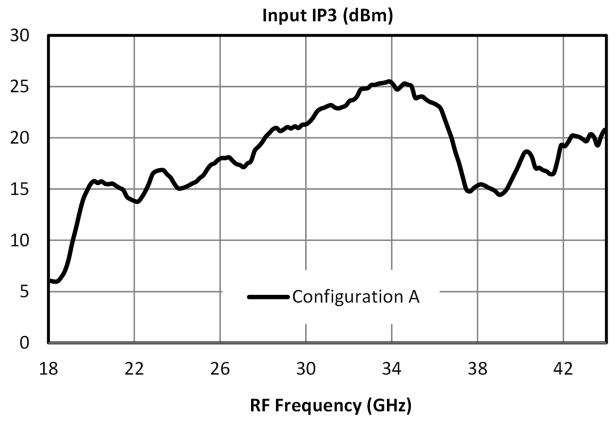


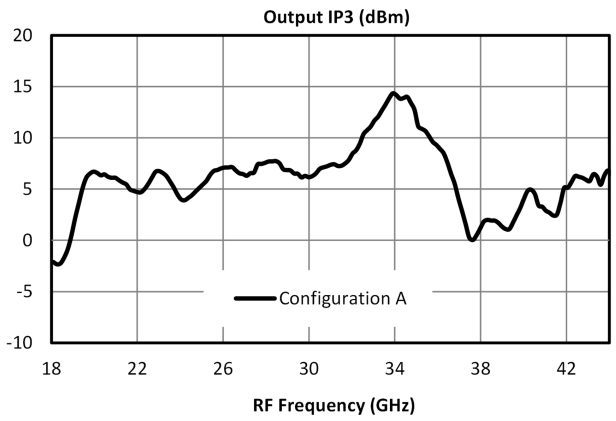




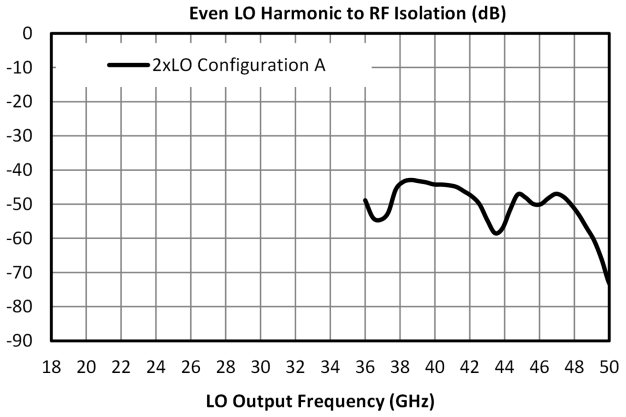


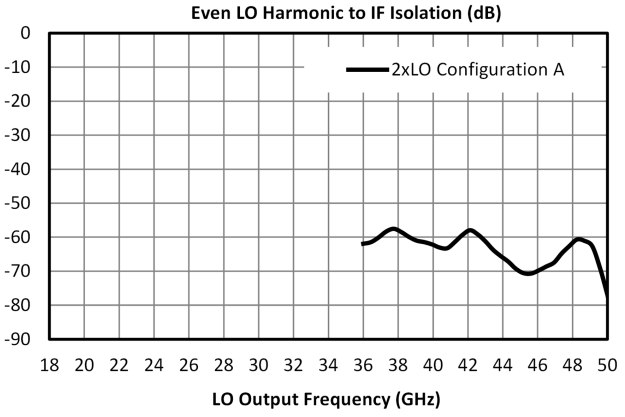
Typical Performance Plots: IP3

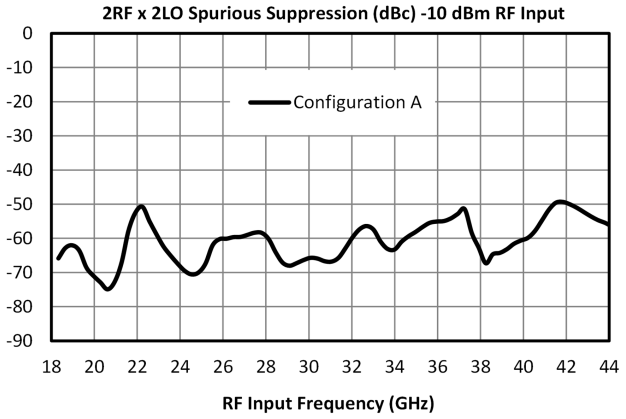


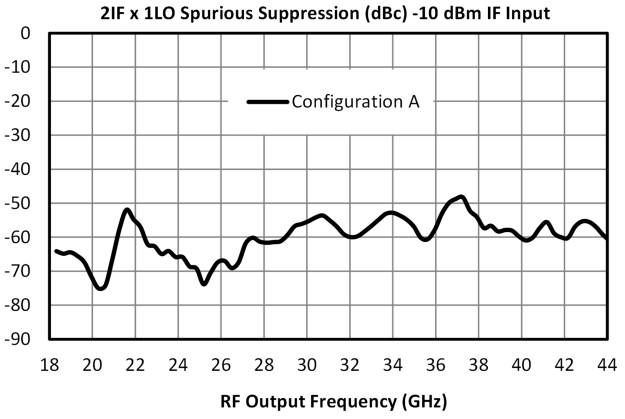


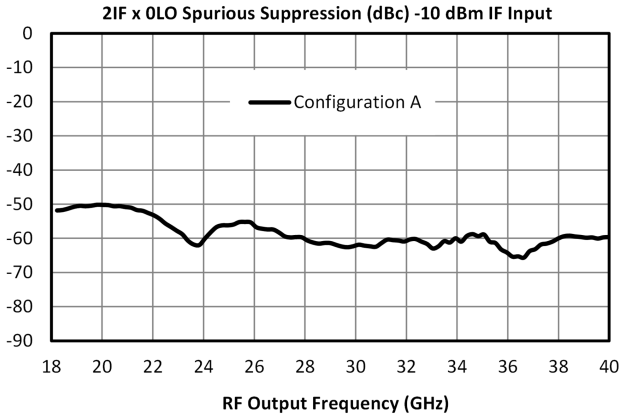
Typical Performance Plots: LO Harmonic Isolation

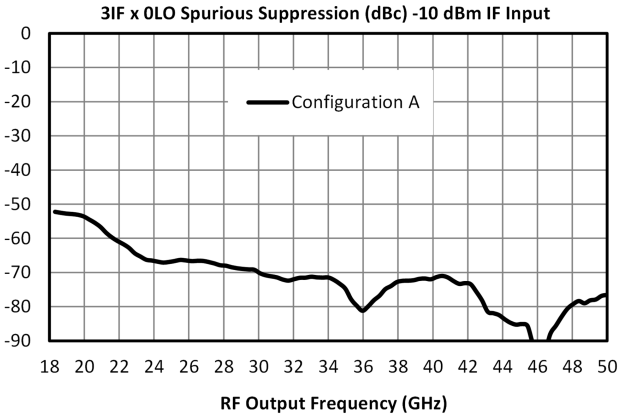












Spur Table

Typical Spurious Performance: Down-Conversion

Typical spurious data is provided by selecting RF and LO frequencies (± m*LO ± n*RF) within the RF/LO bands, to create a spurious output within the IF band. The mixer is swept across the full spurious band and the mean is calculated. The numbers shown in the table below are for a -10 dBm RF input. Spurious suppression is scaled for different RF power levels by (n-1), where "n" is the RF spur order. For example, the 2RF x 2LO spur is 57 dBc for a -10 dBm input, so a -20 dBm RF input creates a spur that is (2-1) x (-10 dB) lower, or 67 dBc. Data is shown for the frequency plan in Typical Performance.

Typical Down-conversion spurious suppression (dBc): Config A

-10 dBm RF Input	0xLO	1xLO	2xLO	3xLO	4xLO	5xLO
1xRF	25	Reference	29	12	NA	NA
2xRF	76	43	57	66	68	NA
3xRF	NA	51	73	73	83	79
4xRF	NA	NA	92	100	112	114
5xRF	NA	NA	NA	109	123	121

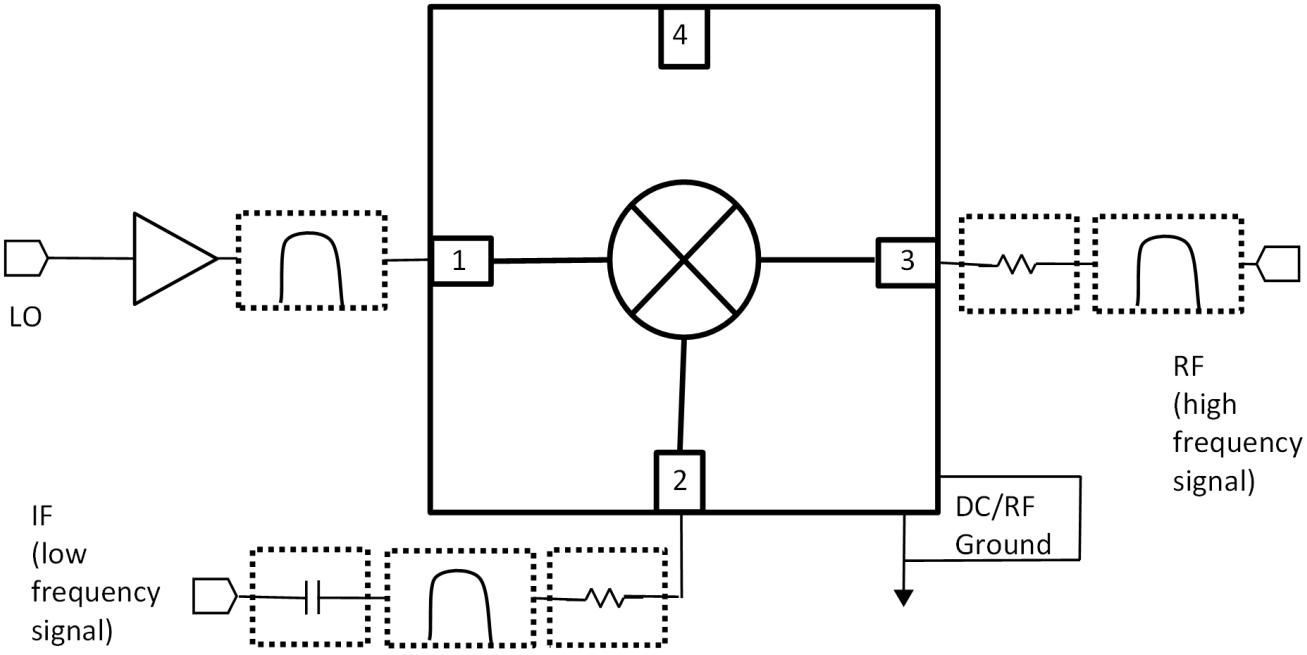
Typical Spurious Performance: Up-Conversion

Typical spurious data is taken by mixing an input within the IF band, with LO frequencies (± m*LO ± n*IF), to create a spurious output within the RF output band. The mixer is swept across the full spurious output band and the mean is calculated. The numbers shown in the table below are for a -10 dBm IF input. Spurious suppression is scaled for different IF input power levels by (n-1), where "n" is the IF spur order. For example, the 2IFx1LO spur is typically 57 dBc for a -10 dBm input with a sine-wave LO, so a -20 dBm IF input creates a spur that is (2-1) x (-10 dB) lower, or 67 dBc. Data is shown for the frequency plan in Typical Performance.

Typical Up-conversion spurious suppression (dBc): Config A

-10 dBm IF Input	0xLO	1xLO	2xLO	3xLO	4xLO	5xLO
1xIF	16	Reference	19	9	NA	NA
2xIF	63	57	57	61	62	NA
3xIF	86	66	73	65	77	66
4xIF	108	102	59	105	98	106
5xIF	116	112	113	115	110	112

Application Circuit



Configuration A

Application Circuit Description

IF Port – Used as input on an upconversion, output on downconversion, or LO port in a band shifting application. Signals should be connected by 50 ohm microstrip or coplanar traces to well matched broadband 50 ohm sources and loads. Blocking capacitor is recommended if DC voltage is present on the line.

RF Port – Used as input on a downconversion, output on upconversion, or output in a band shifting application. Signals should be connected by 50 ohm microstrip or coplanar traces to well matched broadband 50 ohm sources and loads.

Filtering and Matching- Filtering is generally desired for spurious and image removal on the output port of the mixer. Reflective filters can cause out of band signals to reflect back into the mixer and cause conversion loss ripple, erroneous spurs, and other undesired behaviors. To eliminate these problems it is recommend that the filters be placed as close to the output port as possible. If undesired behavior is still observed, a diplexer with one port terminated or a 1-3 dB attenuator may reduce this problem.

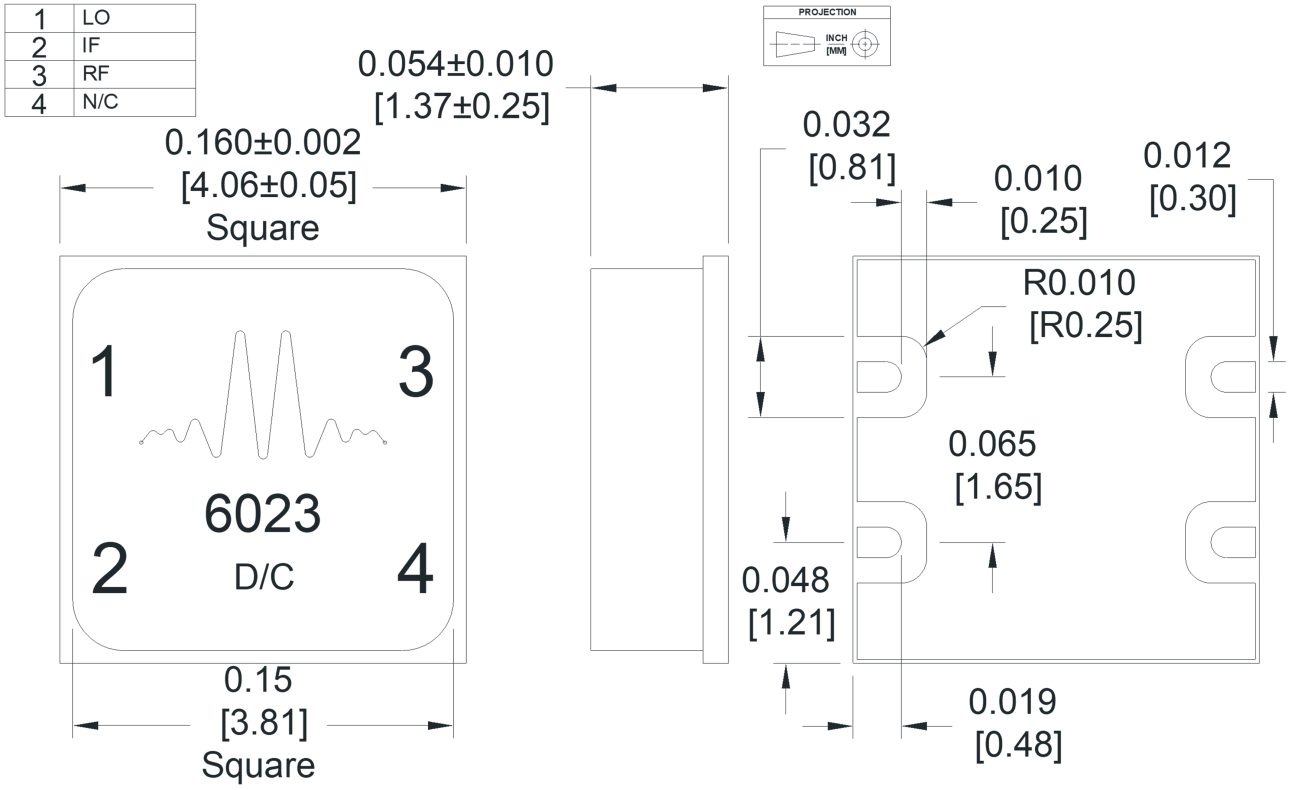
RF Ground – The ground paddle of the QFN should be connected to a low noise RF ground with very low electrical resistance for high frequency operation.

LO Port – The noise floor of the LO input signal should be less than the value of the noise floor plus isolation of the mixer, or a filter is recommended to prevent reduction in dynamic range. An LO amplifier is required if the LO power is below the recommended drive level. It is important to use an amplifier with a broadband 50 ohm match such that it does not reflect spurious signals back into the mixer or other system circuitry.

Mechanical Data

Outline Drawing

Download : Outline 2D Drawing | Outline 3D Drawing | Outline 3D STP

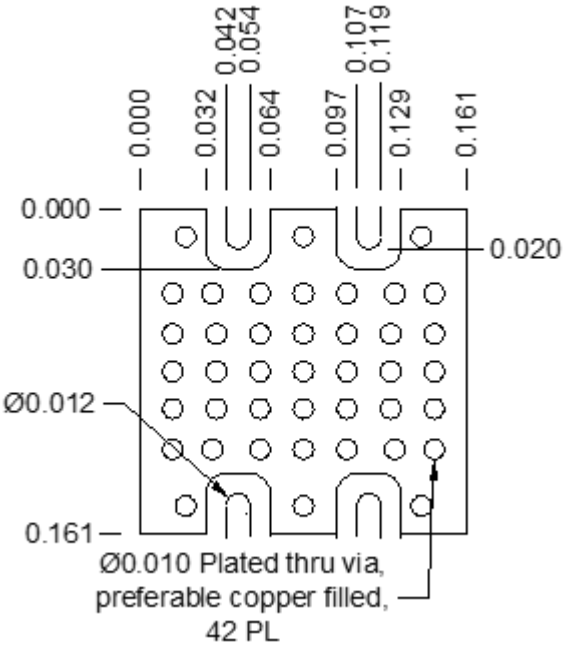


Notes (unless otherwise specified):

1. Substrate and lid material is Ceramic.
2. I/O Leads and Ground Paddle plating is 2uin Au max over 40-80 uin Ni over 433 uin of Ag.
3. All unconnected pins should be connected to PCB RF ground.

Footprint Image

Download : Footprint Drawing



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