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Tech Support: support@markimicrowave.com

# MT3-0113LCQG-2

## GaAs MMIC High Dynamic Range Mixer

## DEVICE OVERVIEW

### General Description

The MT3-0113LCQG is a triple balanced passive diode GaAs MMIC mixer offering high dynamic range, low conversion loss, and excellent repeatability. As with all T3 mixers, this mixer offers unparalleled nonlinear performance in terms of IIP3, P1dB, and spurious performance with a flexible LO drive requirement from +11 dBm to +24 dBm. The MT3-0113LCQG is available in a surface-mount outline, or in an SMA connectorized evaluation fixture. The MT3-0113LCQG is a superior alternative to Marki Microwave carrier and packaged T3 mixers, and is form-fit compatible with legacy T3's in the CQ and CQG footprints.

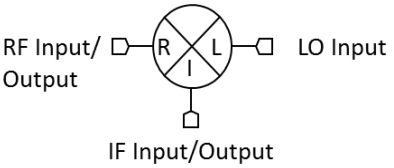

### Features

- Form-Fit Compatible with Legacy CQ and CQG T3 Mixers
- Broadband, Overlapping RF, LO and IF
- Suitable for Up or Down Conversion
- Compatible with Sine or Square-Wave LO
- Square-Wave LO delivers Industry-Leading Spurious, IP3, and P1dB Performance

### Applications

N/A

### Functional Block Diagram




### Part Ordering Options

| Part Number | Description | Package | Green Status | Product Lifecycle | Export Classification |
|---|---|---|---|---|---|
| MT3-0113LCQG-2 | GaAs MMIC High Dynamic Range Mixer | CQG | REACH RoHS | Released | EAR99 |
| EVAL-MT3-0113L | Evaluation Board, GaAs MMIC High Dynamic Range Mixer | EVAL | REACH RoHS | Released | EAR99 |

## Table Of Contents

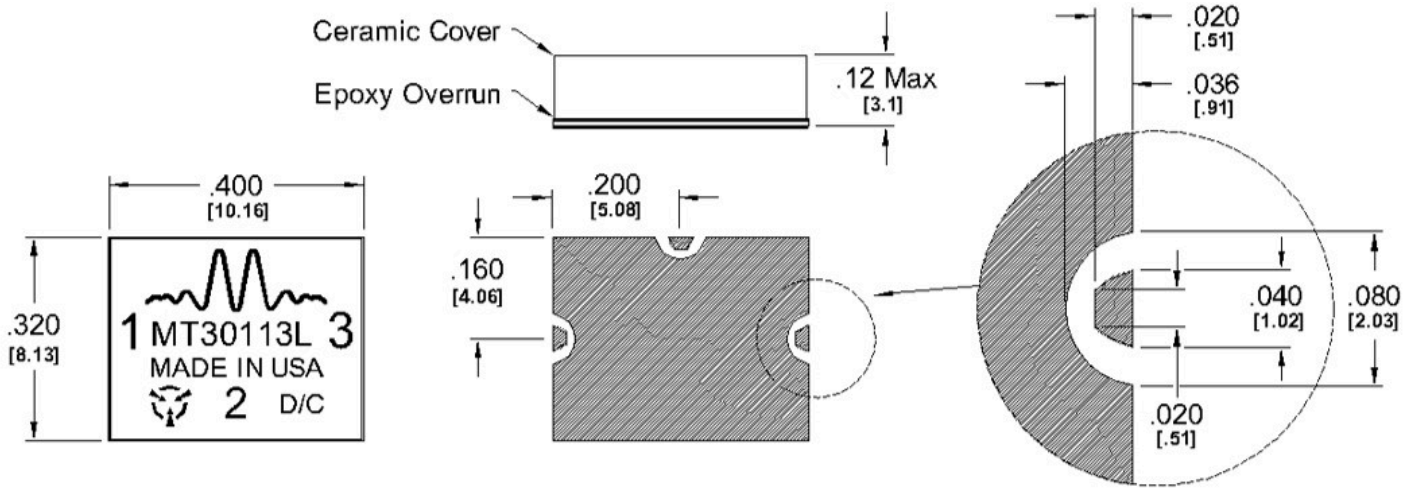


## Revision History

| Revision Code | Revision Date | Comment |
|---|---|---|
| - | 2018-10-01 | Pre-release |
| A | 2019-02-01 | Active - Full Production |
| B | 2020-05-01 | Changed cover to ceramic |
| C | 2026-02-13 | MTTF Table Added |

## Port Configuration and Functions

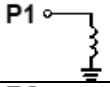
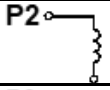
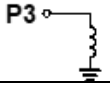
### Port Diagram



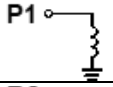
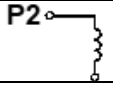
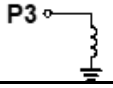

I/O Connections & Ground Plane Finish is Gold Flash, 5 to 10 µ-inches, over Solderable Nickel, 100-200 µ-inches, over Cu.

## Port Functions

#### Configuration A

| Port | Function | Description | DC Equivalent Circuit |
|---|---|---|---|
| Port 1 | LO Input | Port 1 is DC short and AC matched to 50 Ω from 1.5 to 13 GHz. Blocking capacitor is optional. |   |
| Port 2 | IF Input/Output | Port 2 is DC open. Blocking capacitor is optional. |   |
| Port 3 | RF Input / Output | Port 3 is DC short and AC matched to 50 Ω from 1.5 to 13 GHz. Blocking capacitor is optional. |   |

### Configuration B

| Port | Function | Description | DC Equivalent Circuit |
|---|---|---|---|
| Port 1 | RF Input / Output | Port 1 is DC short and AC matched to 50 Ω from 1.5 to 13 GHz. Blocking capacitor is optional. |   |
| Port 2 | IF Input/Output | Port 2 is DC open. Blocking capacitor is optional. |   |
| Port 3 | LO Input | Port 3 is DC short and AC matched to 50 Ω from 1.5 to 13 GHz. Blocking capacitor is optional. |   |

## Specifications

### Absolute Maximum Ratings

| Parameter | Maximum Rating | Unit |
|---|---|---|
| Maximum Operating Temperature | 100 | °C |
| Maximum Storage Temperature | 150 | °C |
| Minimum Operating Temperature | -40 | °C |
| Minimum Storage Temperature | -40 | °C |
| RF Power Handling (RF+LO) | 30 | dBm |

### FIT and MTTF Table

| T (°C) | λ (TIF) | MTTF (hr) | MTTF (yr) |
|---|---|---|---|
| 125 | 6,494.37 | 153,980 | 17.57757 |
| 85 | 644.3396 | 1,551,977 | 177.1663 |
| 55 | 78.70691 | 1.3E+07 | 1,450.384 |
| 40 | 23.6513 | 4.2E+07 | 4,826.595 |
| 25 | 6.297343 | 1.6E+08 | 18,127.53 |

### Package Information

| Parameter | Details | Rating |
|---|---|---|
| Dimensions | - | 10.16 x 8.13 mm |
| Moisture Sensitivity Level | - | MSL 1 |

### Recommended Operating Conditions

| Parameter | Min | Nominal | Max | Unit |
|---|---|---|---|---|
| LO Input Power | 11 | - | 24 | - |

## Electrical Specifications

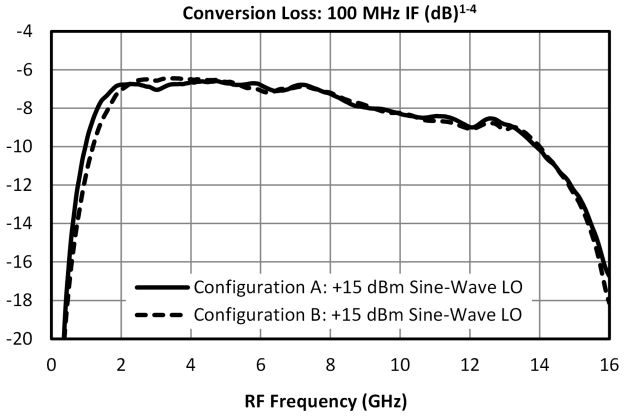
Specifications guaranteed over -40 to +100°C temperature range, measured in a 50Ω system.

| Parameter | Port Configuration | Test Conditions | Min | Typ | Max | Unit |
|---|---|---|---|---|---|---|
| Conversion Loss [1] | A | LO/RF=1.5-13 GHz<br>IF=0.01-0.5 GHz<br>LO Drive Level=15 dBm | - | 7.5 | 10.5 | dB |
| Conversion Loss [2] | A | LO/RF=1.5-13 GHz<br>IF=0.5-7 GHz | - | 10 | - | dB |
| IF Frequency Range | A | - | 0.01 | - | 7 | GHz |
| Input IP3 [3] | A | LO/RF=1.5-13 GHz<br>IF=0.01-7 GHz<br>LO drive level=11-24 dBm | - | 24 | - | dBm |
| LO Frequency Range | A | - | 1.5 | - | 13 | GHz |
| RF Frequency Range | A | - | 1.5 | - | 13 | GHz |
| Conversion Loss [4] | B | LO/RF=1.5-13 GHz<br>IF=0.01-0.5 GHz<br>LO Drive Level=15 dBm | - | 7.5 | - | dB |
| Conversion Loss [5] | B | LO/RF=1.5-13 GHz<br>IF=0.5-7 GHz | - | 10 | - | dB |
| Input IP3 [6] | B | LO/RF=1.5-13 GHz<br>IF=0.01-7 GHz<br>LO drive level=11-24 dBm | - | 23 | - | dBm |
| LO-RF Isolation | - | - | - | 40 | - | dB |

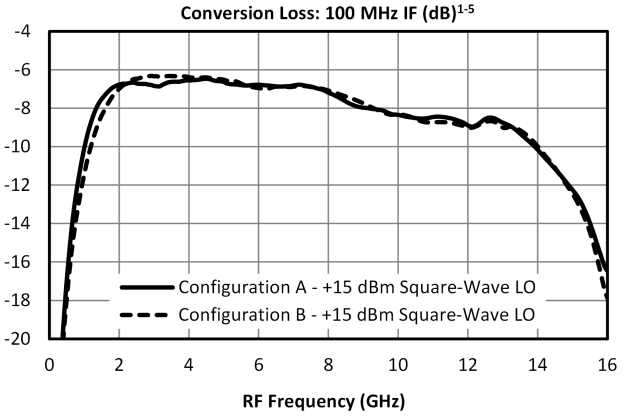
[1][2][4][5] Unless otherwise specified, Conversion Loss and Spurious data is measured with a 100 MHz fixed IF.
[3][6] The typical value is for a +15 dBm Sine-Wave LO. IP3 is dependent on LO drive and waveform. See plots and data sheet notes for more details.

## Typical Performance Plots

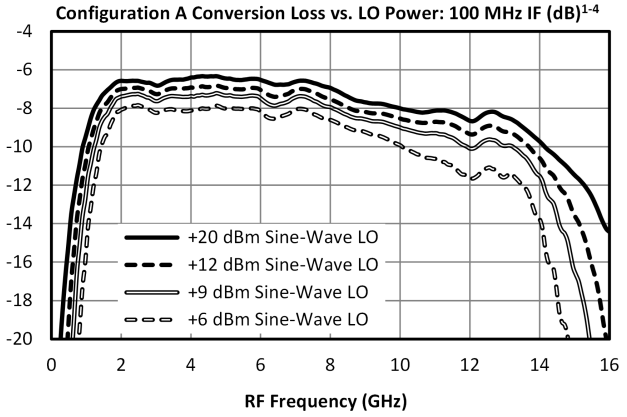
Conversion Loss: 100 MHz IF (dB)[1-4]



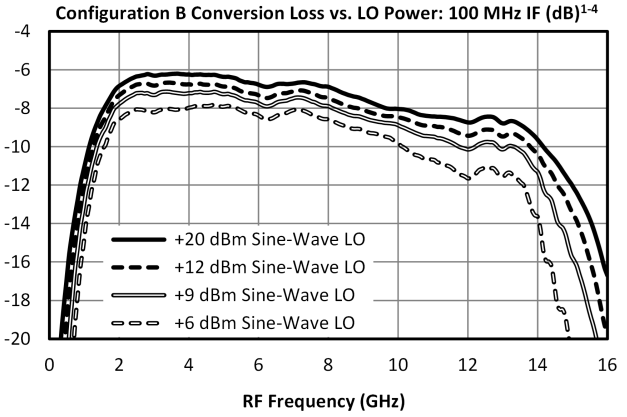

Conversion Loss: 100 MHz IF (dB)[1-5]



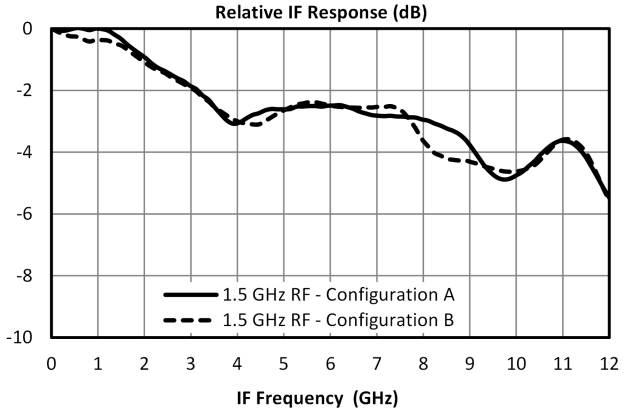

Configuration A Conversion Loss vs. LO Power: 100 MHz IF (dB)[1-4]



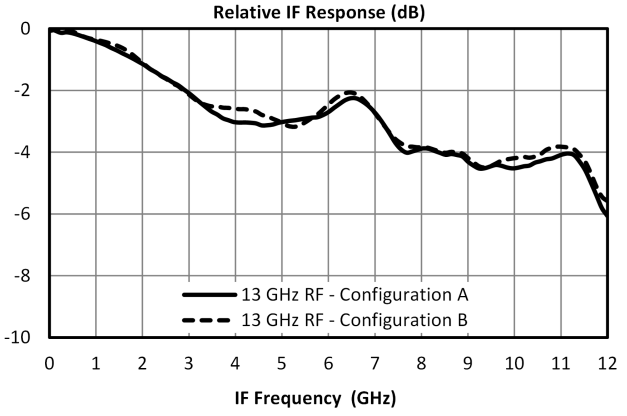

Configuration B Conversion Loss vs. LO Power: 100 MHz IF (dB)[1-4]



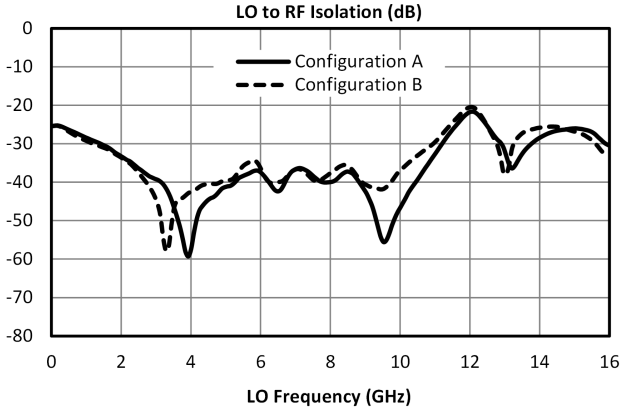

Relative IF Response (dB)



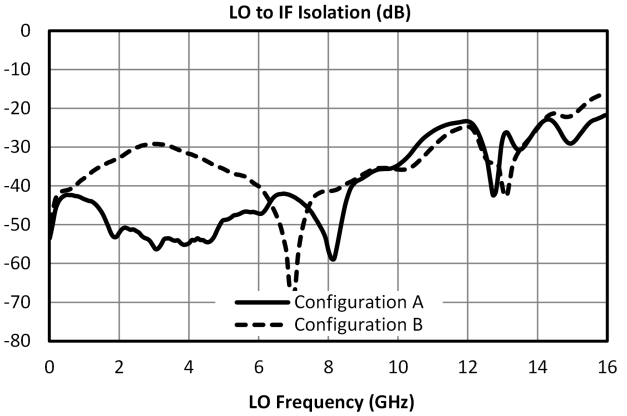

Relative IF Response (dB)



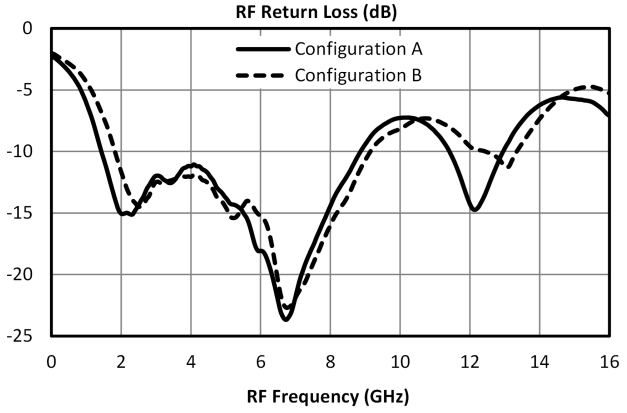

LO to RF Isolation (dB)



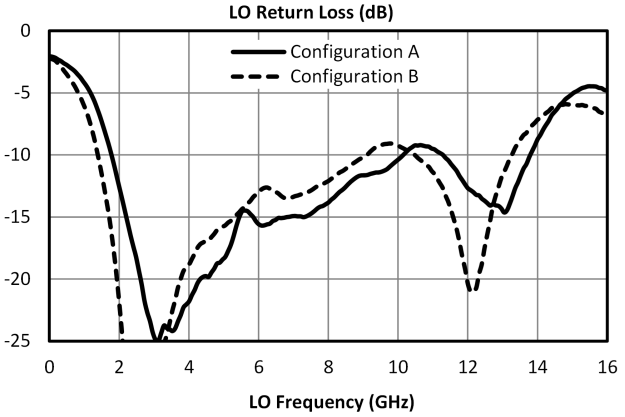

LO to IF Isolation (dB)



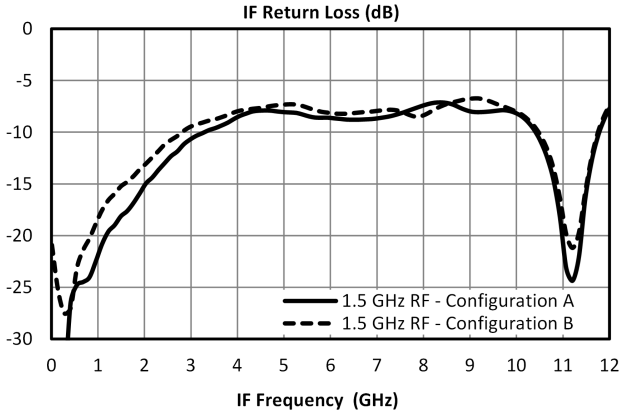
RF Return Loss (dB)



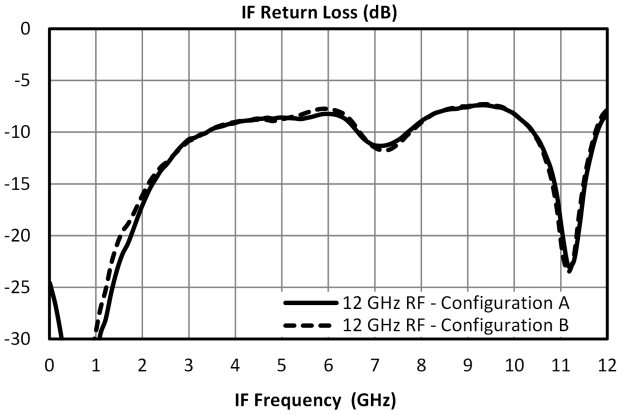

LO Return Loss (dB)



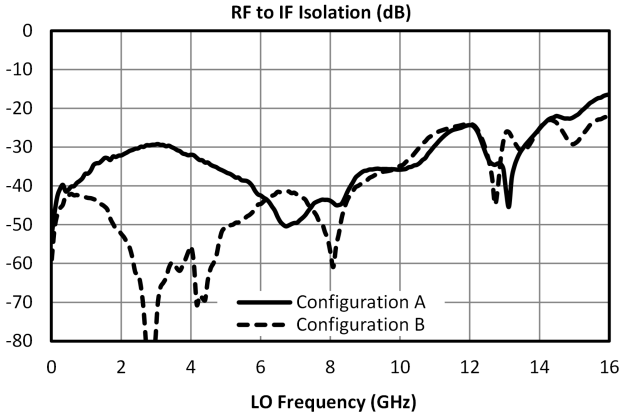

IF Return Loss (dB)



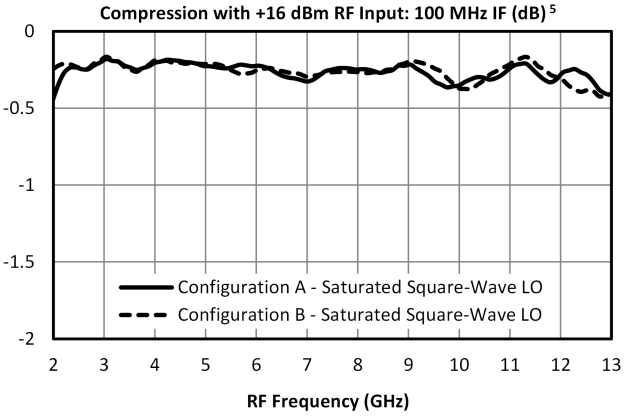

IF Return Loss (dB)



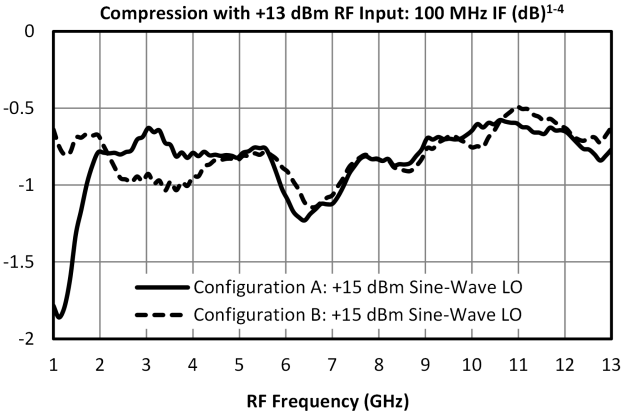

RF to IF Isolation (dB)



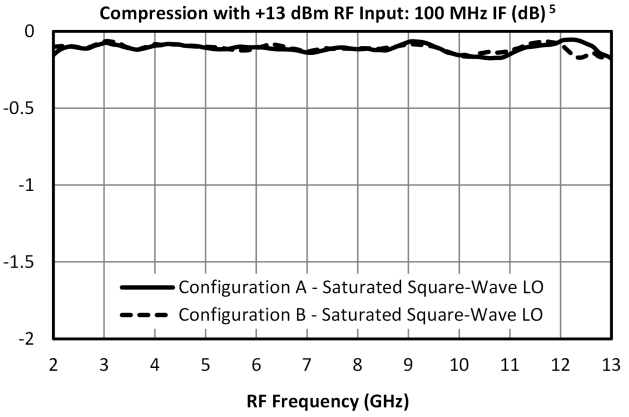

Compression with +16 dBm RF Input: 100 MHz IF (dB) [5]



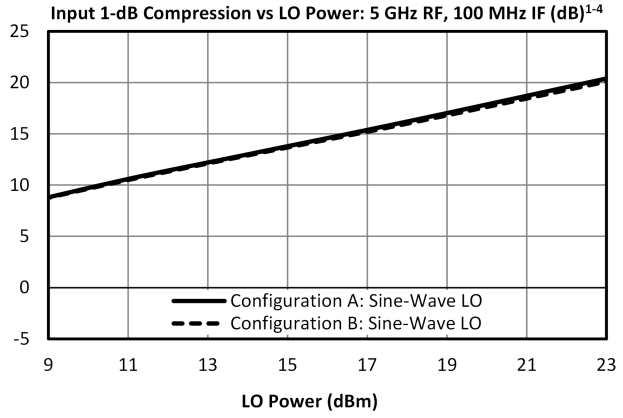

Compression with +13 dBm RF Input: 100 MHz IF (dB) [1-4]



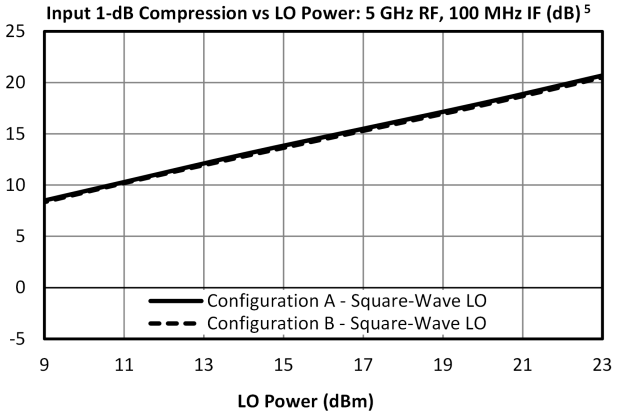

Compression with +13 dBm RF Input: 100 MHz IF (dB) [5]



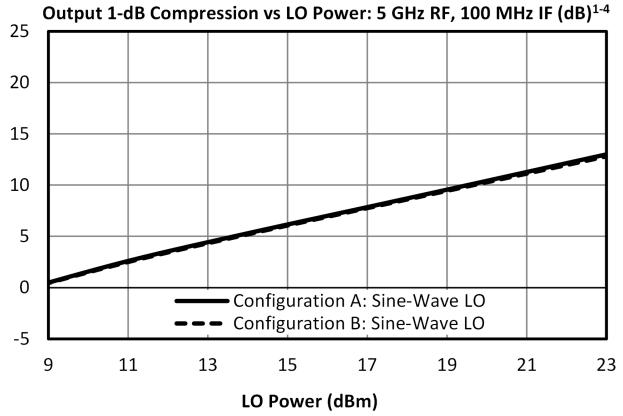
Input 1-dB Compression vs LO Power: 5 GHz RF, 100 MHz IF (dB)[1-4]



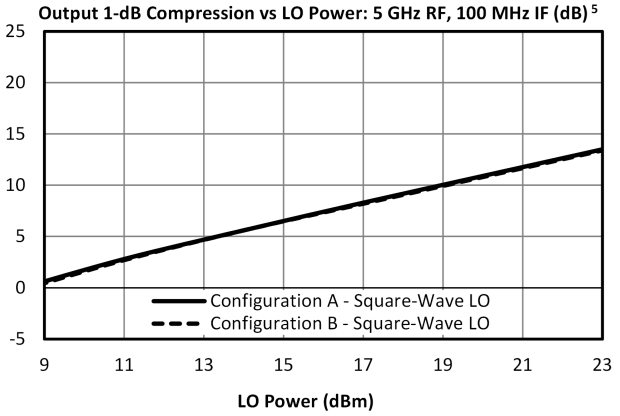

Input 1-dB Compression vs LO Power: 5 GHz RF, 100 MHz IF (dB)[5]



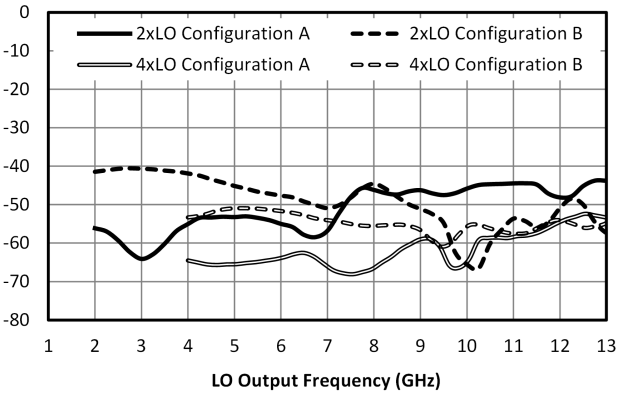

Output 1-dB Compression vs LO Power: 5 GHz RF, 100 MHz IF (dB)[1-4]



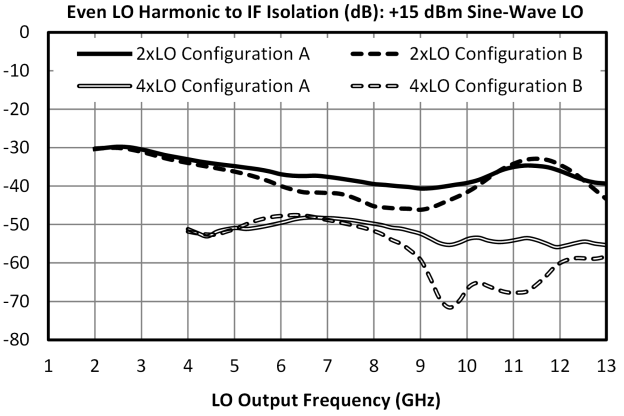

Output 1-dB Compression vs LO Power: 5 GHz RF, 100 MHz IF (dB)[5]



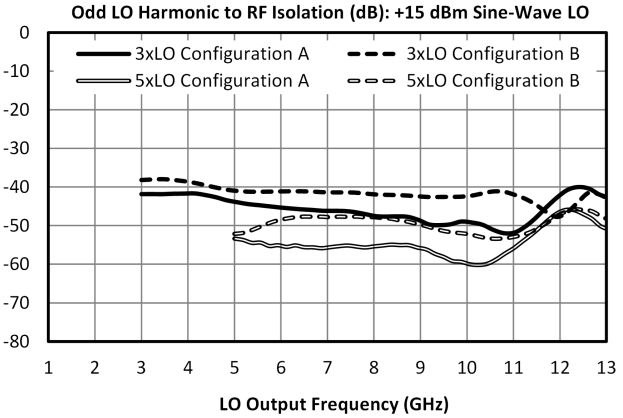

Even LO Harmonic to RF Isolation (dB): +15 dBm Sine-Wave LO



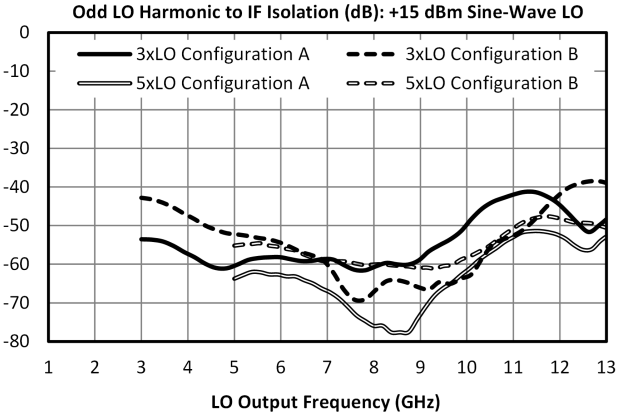

Even LO Harmonic to IF Isolation (dB): +15 dBm Sine-Wave LO



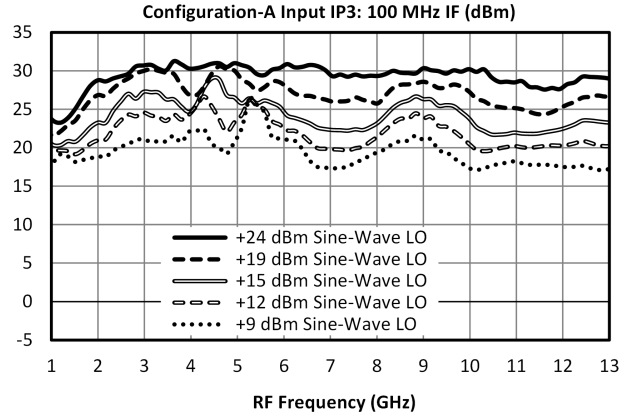

Odd LO Harmonic to RF Isolation (dB): +15 dBm Sine-Wave LO



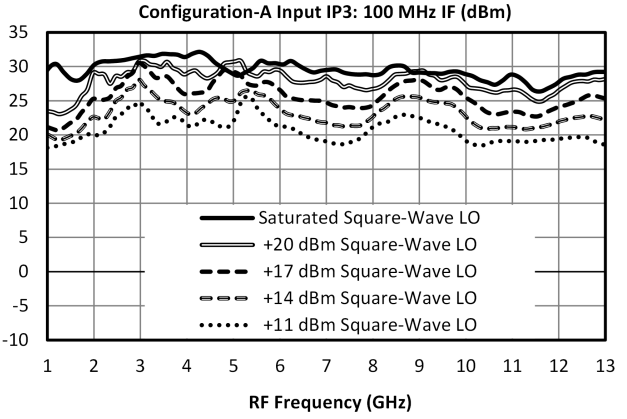

Odd LO Harmonic to IF Isolation (dB): +15 dBm Sine-Wave LO



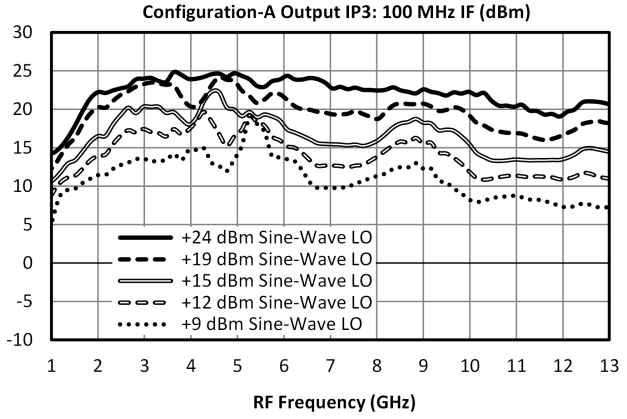
Configuration-A Input IP3: 100 MHz IF (dBm)



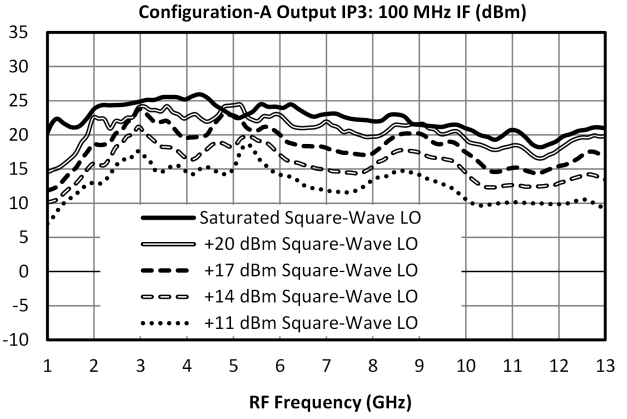

Configuration-A Input IP3: 100 MHz IF (dBm)



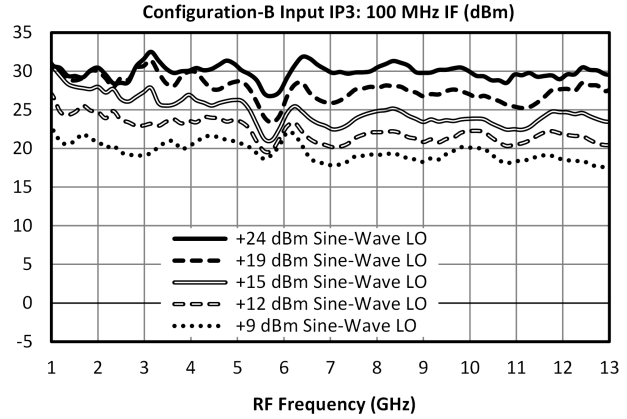

Configuration-A Output IP3: 100 MHz IF (dBm)



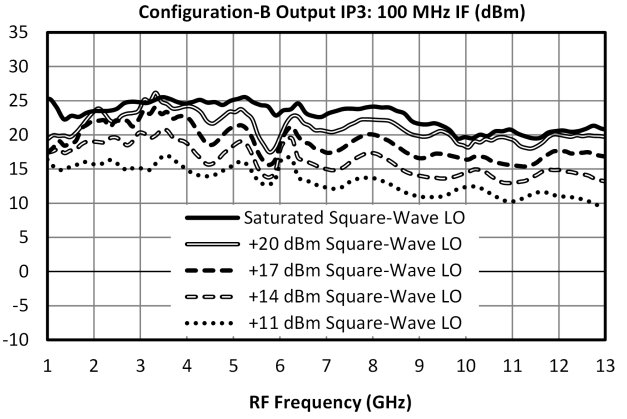

Configuration-A Output IP3: 100 MHz IF (dBm)



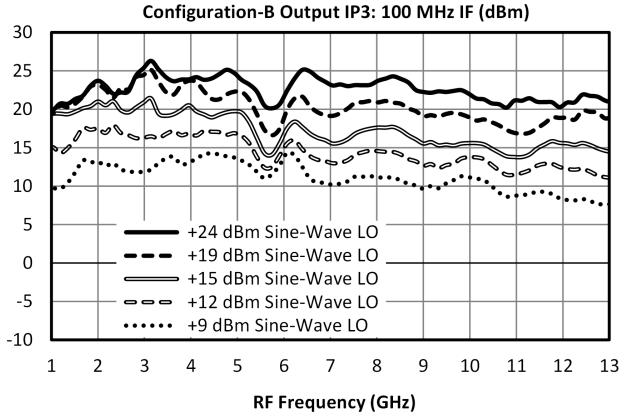

Configuration-B Input IP3: 100 MHz IF (dBm)



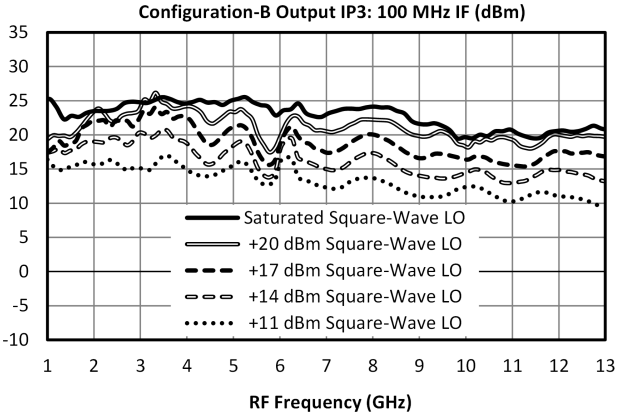

Configuration-B Output IP3: 100 MHz IF (dBm)

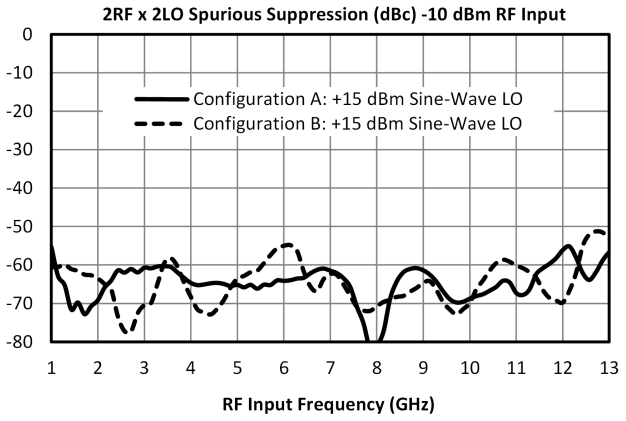


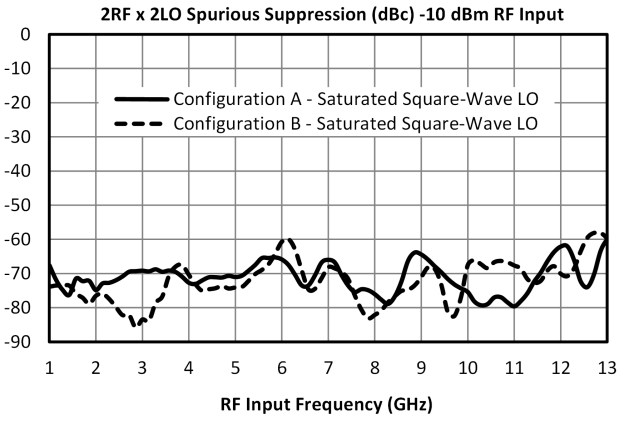

Configuration-B Output IP3: 100 MHz IF (dBm)

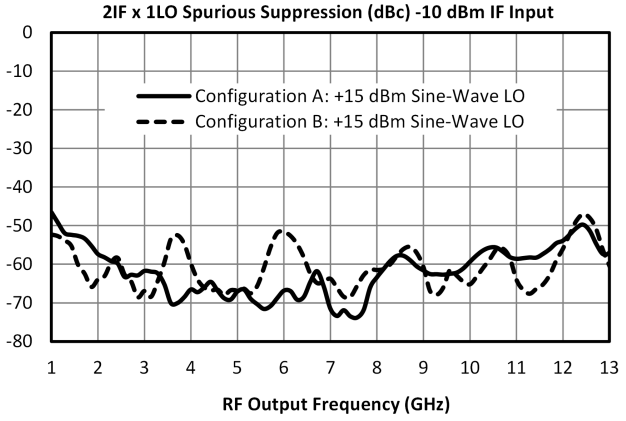


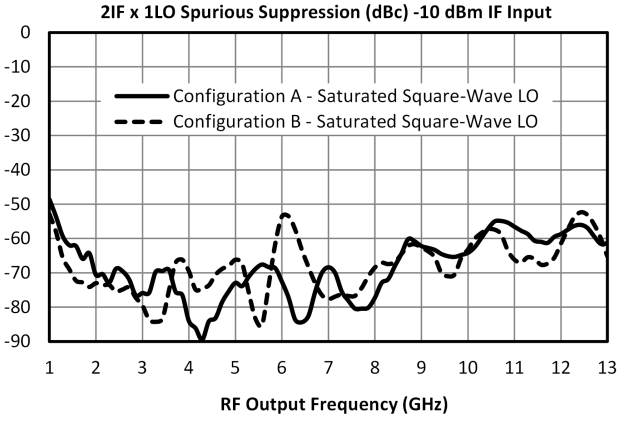

Configuration-B Output IP3: 100 MHz IF (dBm)





## Spur Table

### Downconversion Spurious Suppression

Spurious data is taken by selecting RF and LO frequencies (+mLO+nRF) 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 2RFx2LO spur is 65 dBc for the A configuration for a -10 dBm input with a sine-wave LO, so a -20 dBm RF input creates a spur that is (2-1) x (-10 dB) dB lower, or 75 dBc.

**Typical Downconversion Spurious Suppression (dBc): A Configuration (B Configuration), Sine Wave LO [6]**

| -10 dBm RF Input | 0xLO | 1xLO | 2xLO | 3xLO | 4xLO | 5xLO |
|---|---|---|---|---|---|---|
| 1xRF | 29 (33) | Reference | 42 (43) | 14 (14) | 44 (50) | 26 (27) |
| 2xRF | 63 (65) | 67 (65) | 65 (65) | 70 (67) | 63 (62) | 71 (65) |
| 3xRF | 112 (112) | 74 (74) | 91 (94) | 74 (75) | 92 (96) | 76 (77) |
| 4xRF | 117 (121) | 117 (118) | 114 (113) | 120 (118) | 116 (111) | 120 (117) |
| 5xRF | 152 (146) | 127 (130) | 140 (141) | 125 (127) | 139 (140) | 126 (128) |

**Typical Downconversion Spurious Suppression (dBc): A Configuration (B Configuration), Square Wave LO [6]**

| -10 dBm RF Input | 0xLO | 1xLO | 2xLO | 3xLO | 4xLO | 5xLO |
|---|---|---|---|---|---|---|
| 1xRF | 30 (33) | Reference | 26 (26) | 11 (11) | 25 (25) | 17 (17) |
| 2xRF | 64 (71) | 70 (67) | 71 (72) | 71 (73) | 68 (64) | 73 (73) |
| 3xRF | 112 (113) | 88 (85) | 99 (101) | 86 (87) | 98 (102) | 91 (91) |
| 4xRF | 130 (130) | 127 (127) | 126 (121) | 130 (127) | 129 (130) | 133 (134) |
| 5xRF | 166 (169) | 146 (148) | 151 (146) | 146 (144) | 151 (152) | 151 (151) |

## Upconversion Spurious Suppression

Spurious data is taken by mixing an input within the IF band, with LO frequencies (+mLO+nIF), 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 62 dBc for the A configuration 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) dB lower, or 72 dBc.

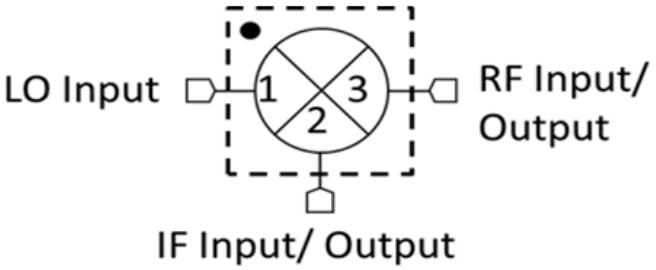
**Typical Upconversion Spurious Suppression (dBc): A Configuration (B Configuration), Sine Wave LO [6]**

| -10 dBm IF Input | 0xLO | 1xLO | 2xLO | 3xLO | 4xLO | 5xLO |
|---|---|---|---|---|---|---|
| 1xIF | 26 (35) | Reference | 40 (46) | 14 (14) | 44 (47) | 25 (26) |
| 2xIF | 70 (63) | 62 (61) | 66 (62) | 62 (61) | 70 (62) | 61 (60) |
| 3xIF | 112 (112) | 72 (72) | 89 (97) | 70 (69) | 88 (96) | 70 (68) |
| 4xIF | 124 (124) | 112 (108) | 121 (112) | 108 (107) | 122 (106) | 104 (104) |
| 5xIF | 145 (137) | 126 (124) | 133 (138) | 118 (117) | 130 (136) | 108 (107) |

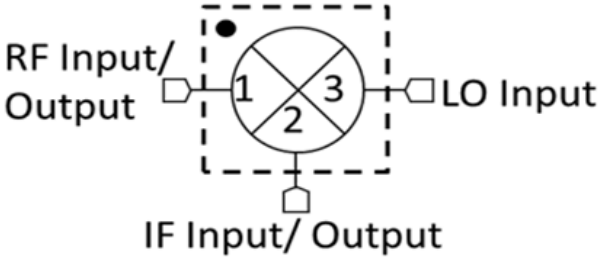
**Typical Upconversion Spurious Suppression (dBc): A Configuration (B Configuration), Square Wave LO [6]**

| -10 dBm IF Input | 0xLO | 1xLO | 2xLO | 3xLO | 4xLO | 5xLO |
|---|---|---|---|---|---|---|
| 1xIF | 28 (35) | Reference | 27 (27) | 11 (11) | 25 (25) | 17 (17) |
| 2xIF | 77 (69) | 69 (68) | 65 (66) | 67 (68) | 64 (66) | 62 (69) |
| 3xIF | 112 (113) | 84 (84) | 97 (98) | 83 (84) | 94 (95) | 82 (83) |
| 4xIF | 135 (138) | 125 (123) | 122 (123) | 129 (130) | 119 (124) | 123 (126) |
| 5xIF | 154 (154) | 146 (146) | 151 (153) | 149 (148) | 151 (152) | 132 (137) |

## Application Information




**Configuration A**



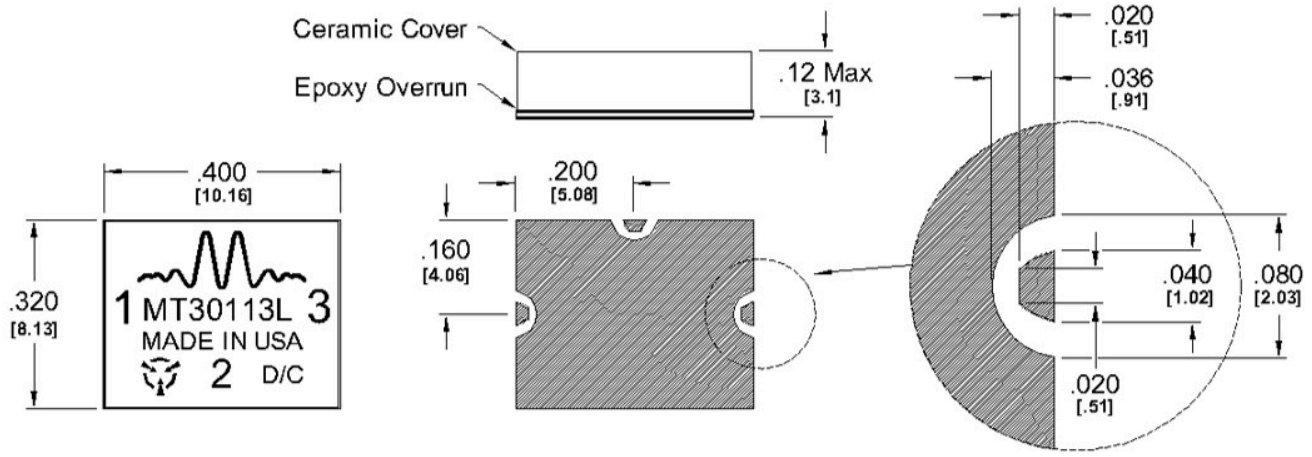

**Configuration B**

Configuration A/B refer to the same part number (MT3-0113LCQG) used in one of two different ways for optimal spurious performance. For the lowest conversion loss, use the mixer in Configuration A (port 1 as the LO input, port 3 as the RF input or output). If you need to use a lower LO drive, use the mixer in Configuration B (port 1 as the RF input or output, port 3 as the LO input). For optimal spurious suppression, experimentation or simulation is required to choose between Configuration A and B.

## Mechanical Data

### Outline Drawing

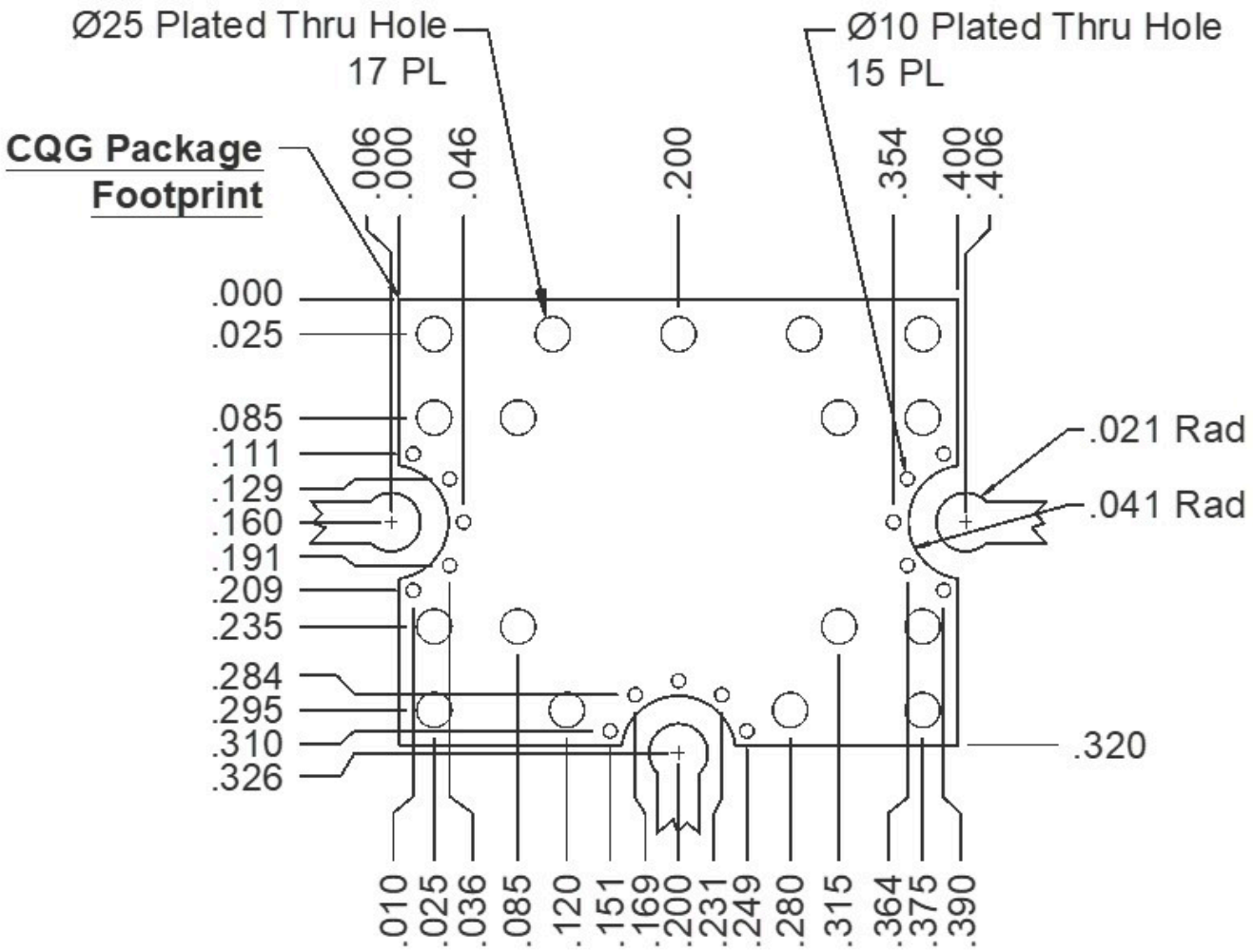
Download : Outline 2D Drawing | Outline 3D Drawing | Outline 3D STP




I/O Connections & Ground Plane Finish is Gold Flash, 5 to 10 µ-inches, over Solderable Nickel, 100-200 µ-inches, over Cu.

## Footprint Image

Download : Footprint Drawing



## Notes

DATA SHEET NOTES:

1. Mixer Conversion Loss Plot IF frequency is 100 MHz unless otherwise specified.

2. Mixer Noise Figure typically measures within 0.5 dB of conversion loss for IF frequencies greater than 5 MHz.

3. Conversion Loss typically degrades less than 0.5 dB at +100°C and improves less than 0.5 dB at -55°C.

4. Unless otherwise specified, sine-wave data is taken with +15 dBm LO drive.

5. The square-wave LO is generated using an ADM-0012-5931SM pre-amplifier and an ADM-0026-5929SM output amplifier. The two amplifiers are biased with +7V, -0.25V. When specified, square-wave output power is the total of the fundamental plus harmonics.
Unspecified square-wave LO (unspecified output power) is generated by saturating the amplifier chain with a +12 dBm input.

6. Specifications are subject to change without notice. Contact Marki Microwave for the most recent specifications and data sheets.

7. Catalog mixer circuits are continually improved. Configuration control requires custom mixer model numbers and specifications.

8. Environmental specifications are currently under evaluation. Contact support for more information.