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# M9-0942INV

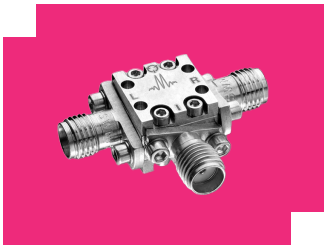
## Double-Balanced Mixers



## DEVICE OVERVIEW

### General Description

M9 mixers double balanced mixers are hybrid assemblies that offer ultra-broadband RF, LO and IF bandwidths. M9 mixers have generally been replaced with MM1 mixers with superior performance, repeatability, and availability. M9 mixers are still used in legacy systems and where an MM1 mixer is not available.



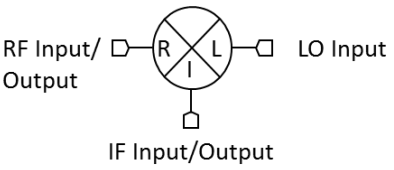
### Features

- LO/RF 9.0 to 42.0 GHz
- IF 1.0 to 22.0 GHz
- 10 dB Typical Conversion Loss
- Ultra-Broadband RF, LO, and IF
- 2.40 mm Connectors

### Applications

N/A

### Functional Block Diagram



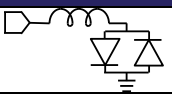
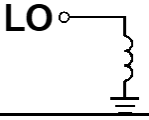
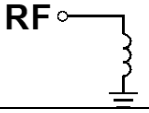

### Part Ordering Options

| Part Number | Description | Package | Connectors | Green Status | Product Lifecycle | Export Classification | Recommended Replacement |
|---|---|---|---|---|---|---|---|
| M9-0942LNV-2 | Double-Balanced Mixers | NV | Standard | Consult Factory | Not Recommended for New Design | EAR99 | MM1-1044LS |
| M9-0942INV | Double-Balanced Mixers | NV | Standard | Consult Factory | Not Recommended for New Design | EAR99 | MM1-1044HS |
| M9-0942LNV | Double-Balanced Mixers | NV | Standard | Non-RoHS | Not Recommended for New Design | EAR99 | MM1-1044LS |

## Table Of Contents

## Port Configuration and Functions

### Port Functions

| Port | Function | Connector Type | Description | Equivalent Circuit for Package |
|---|---|---|---|---|
| IF | IF | 2.92F | The IF port is DC coupled to ground and AC matched to 50 Ohms from 1 to 22 GHz. Blocking capacitor is optional. |  |
| LO | LO | 2.4F | The LO port is DC coupled to ground and AC matched to 50 Ohms from 9 to 42 GHz. Blocking capacitor is optional. |  |
| RF | RF | 2.4F | The RF port is DC coupled to ground and AC matched to 50 Ohms from 9 to 42 GHz. Blocking capacitor is optional. |  |

## Specifications

### Absolute Maximum Ratings

| Parameter | Maximum Rating | Unit |
|---|---|---|
| IF DC Current | 1 | Amp |
| LO DC Current | 1 | Amp |
| Maximum Operating Temperature | 100 | °C |
| Maximum Storage Temperature | 125 | °C |
| Minimum Operating Temperature | -55 | °C |
| Minimum Storage Temperature | -65 | °C |
| RF DC Current | 1 | Amp |
| RF Power Handling (RF+LO), 100°C | 20 | dBm |
| RF Power Handling (RF+LO), 25°C | 23 | dBm |

### Package Information

| Parameter | Details | Rating |
|---|---|---|
| ESD | < 250 Volts | HBM Class 0 |
| Weight | Package name: NV | 11g |
| Dimensions | - | 11.94 x 11.94 mm |

### Recommended Operating Conditions

| Parameter | Min | Nominal | Max | Unit |
|---|---|---|---|---|
| LO Input Power | 14 | - | 18 | - |
| LO Input Power | 14 | - | 18 | - |

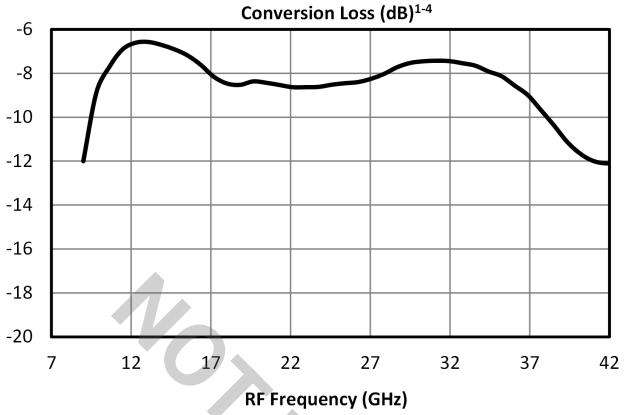
## Electrical Specifications

Specifications guaranteed from -55 to +100°C, measured in a 50-Ohm system.

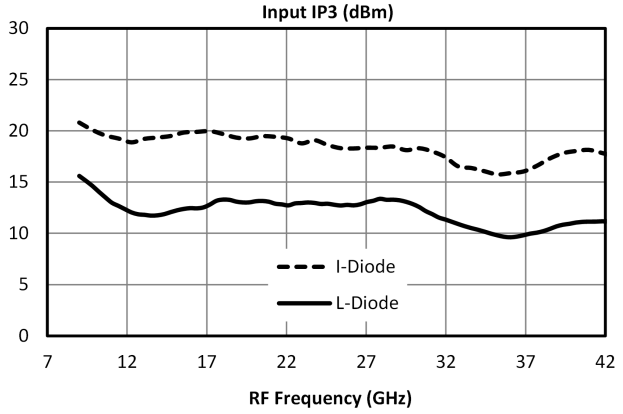
| Parameter | Test Conditions | Min | Typ | Max | Unit |
|---|---|---|---|---|---|
| Conversion Loss | LO/RF=9-42 GHz<br>IF=1-22 GHz | - | 9 | 16 | dB |
| Input 1 dB Compression | LO/RF=9-42 GHz<br>LO drive level, I Diode Option=14-18 dBm | - | 6 | - | dBm |
| IF Frequency Range | - | 1 | - | 22 | GHz |
| Input IP3 | - | - | 12 | - | dBm |
| Isolation, LO to RF | - | - | 28 | - | dB |
| RF Frequency Range | - | 9 | - | 42 | GHz |

## Typical Performance Plots

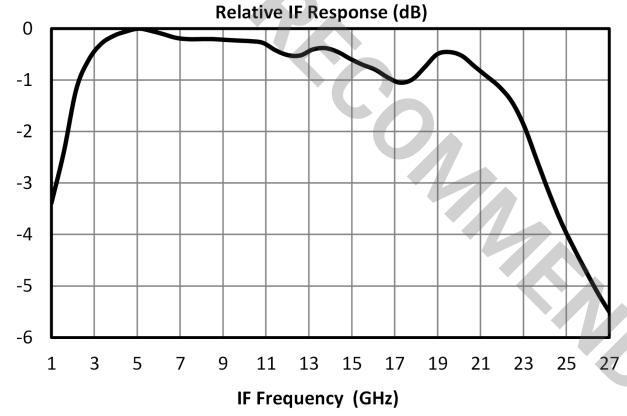
Conversion Loss (dB)[1-4]



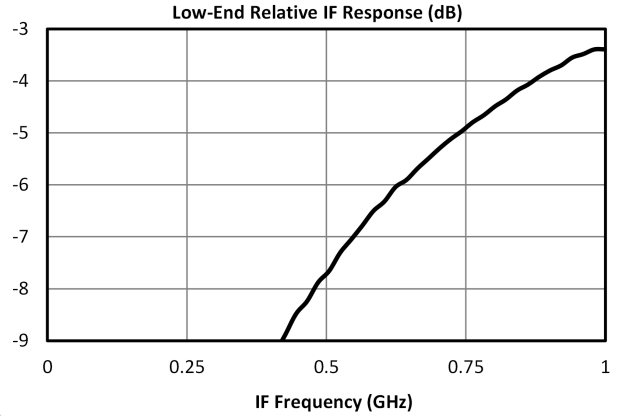

Input IP3 (dBm)



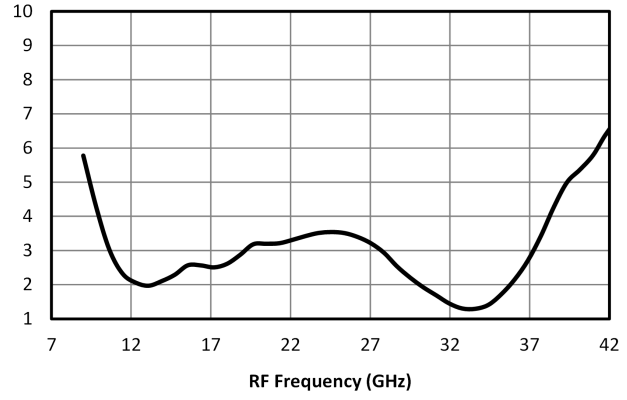

Relative IF Response (dB)



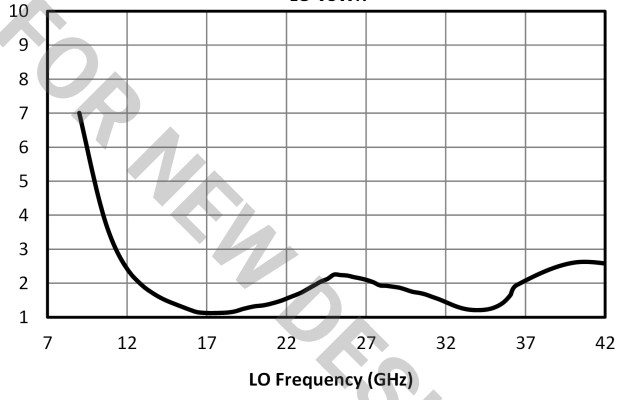

Low-End Relative IF Response (dB)



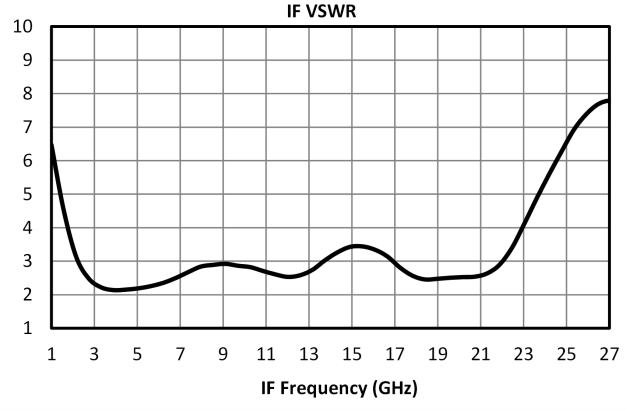

RF VSWR



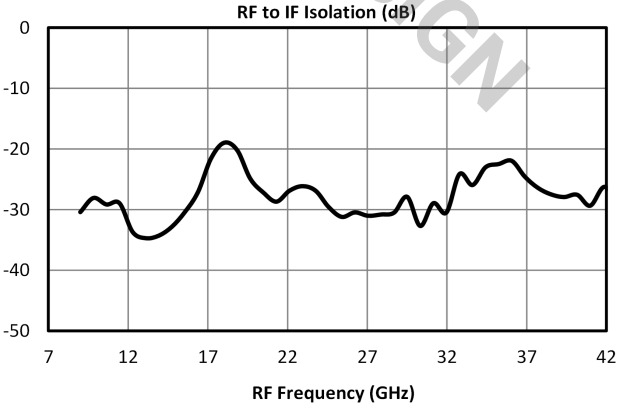

LO VSWR

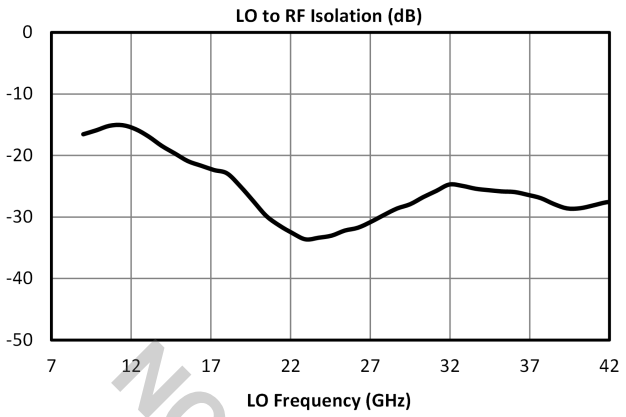


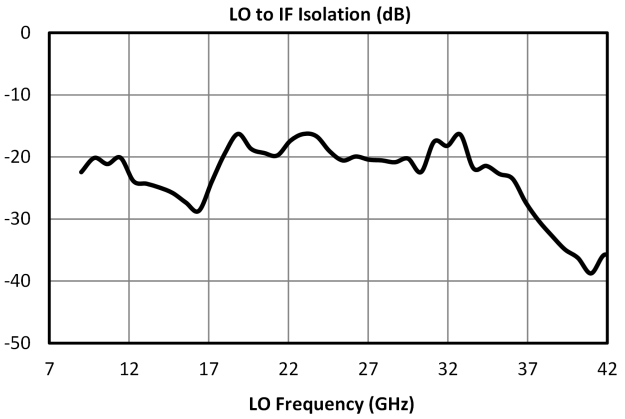

IF VSWR

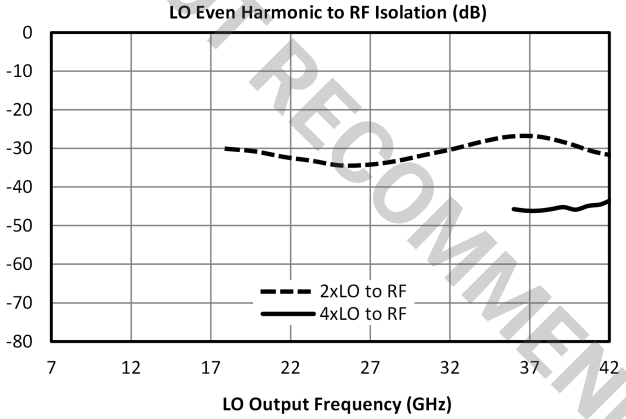


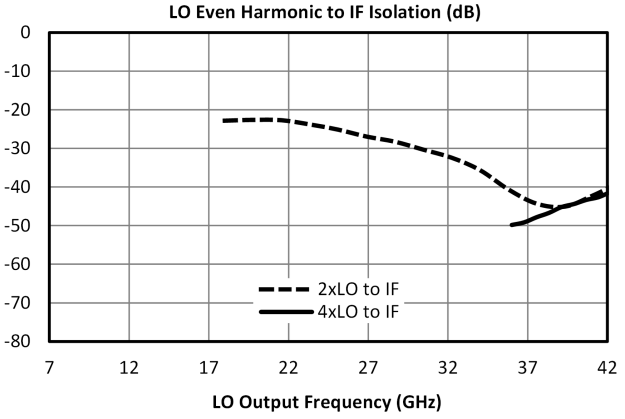

RF to IF Isolation (dB)

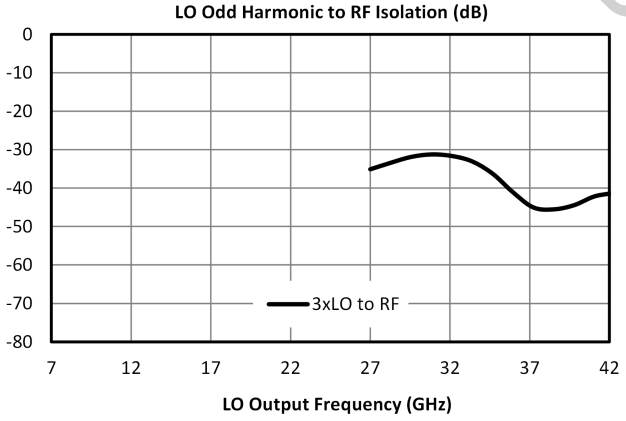


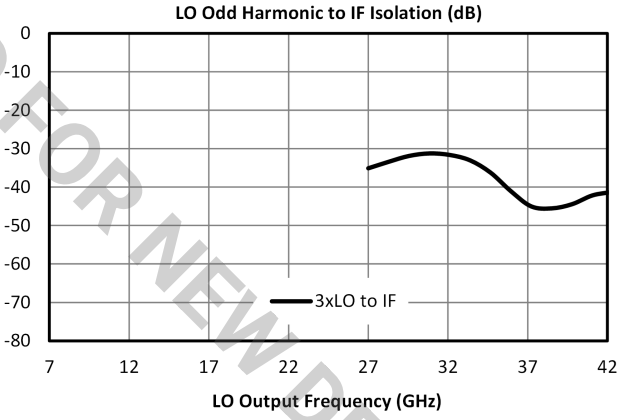


## Spur Table

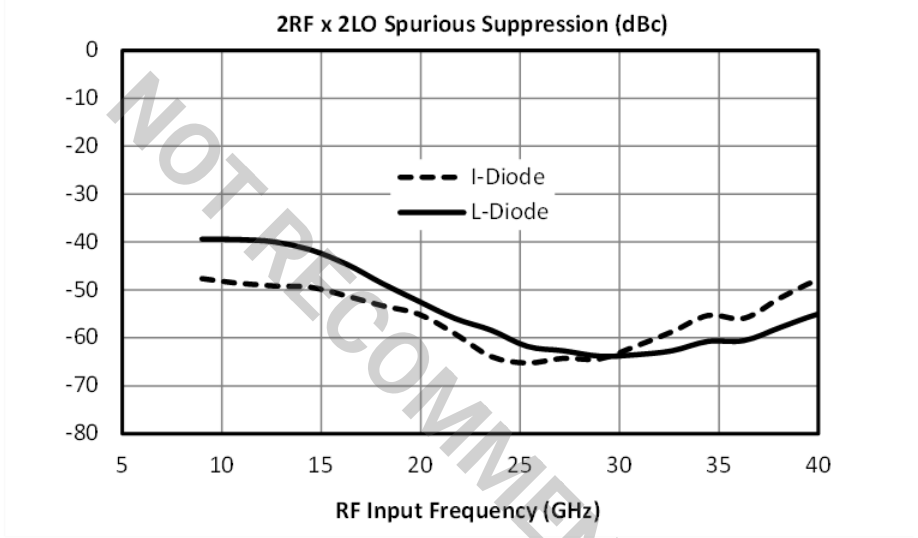
### Downconversion Spurious Suppression

Spurious data is taken by selecting RF and LO frequencies (+mLO+nRF) within the 9 to 42 GHz RF/LO bands, which create a 2.0 GHz IF spurious output. The mixer is swept across the 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 55 dBc for a -10 dBm input (I-Diode), so a -20 dBm RF input creates a spur that is (2-1) x (-10 dB) dB lower, or 65 dBc.

**Typical Downconversion Spurious Suppression (dBc): I-Diode (L-Diode) [5]**

| -10 dBm RF Input | 0xLO | 1xLO | 2xLO | 3xLO | 4xLO | 5xLO |
|---|---|---|---|---|---|---|
| 0xRF | ---------- | See LO to IF Isolation and LO Harmonic to IF Isolation Plots (Page 3) | | | | |
| 1xRF | 18 (18) | Reference | 30 (30) | 14 (13) | 32 (32) | 22 (27) |
| 2xRF | 56 (52) | 56 (55) | 55 (52) | 59 (49) | 54 (42) | 60 (53) |
| 3xRF | 79 (78) | 53 (50) | 77 (72) | 66 (58) | 84 (72) | 66 (56) |
| 4xRF | 105 (105) | 90 (92) | 94 (84) | 100 (89) | 100 (87) | 106 (91) |
| 5xRF | 117 (115) | 104 (101) | 114 (106) | 106 (89) | 118 (107) | 111 (98) |

A sample downconversion spurious sweep is shown below. An LO which is 2.0 GHz higher than the RF is used to create a 2.0 GHz reference IF. A second LO is used to create a 2x2 spurious IF, also at 2.0 GHz (1.0 GHz fundamental IF). The difference between these two output levels is the spurious suppression in dBc. The mean value across the 9 to 40 GHz RF input band is the number shown in the table above.




**Downconversion 2RFx2LO Spurious Data Example:**

RF Input: 9 to 40 GHz @ -10 dBm
**LO for Reference: 11 to 42 GHz**
**LO for Spurious: 10 to 41 GHz**
IF Output: 2.0 GHz

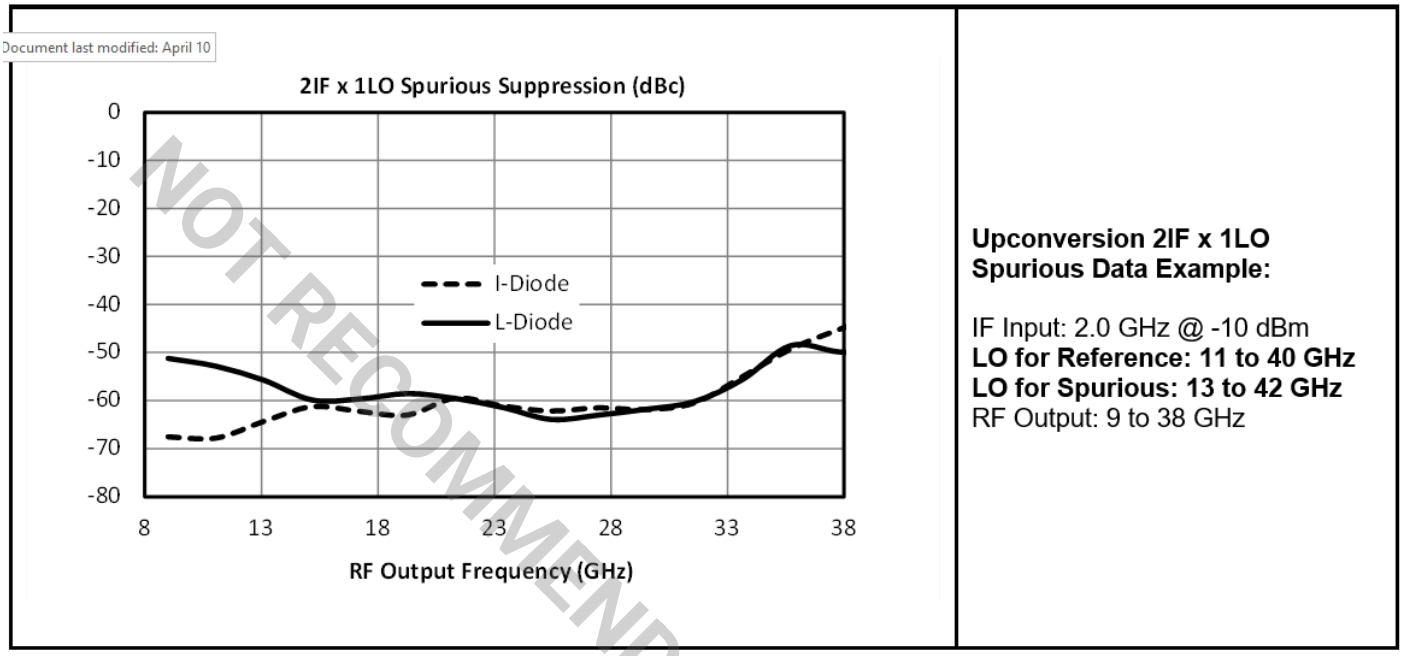
### Upconversion Spurious Suppression

Spurious data is taken by mixing a 2.0 GHz IF with LO frequencies (+mLO+nIF) which create an RF within the 9 to 42 GHz RF band. The mixer is swept across the 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 (I-Diode), so a -20 dBm IF input creates a spur that is (2-1) x (-10 dB) dB lower, or 67 dBc.

**Typical Upconversion Spurious Suppression (dBc): I-Diode (L-Diode) [5]**

| -10 dBm IF Input | 0xLO | 1xLO | 2xLO | 3xLO | 4xLO | 5xLO |
|---|---|---|---|---|---|---|
| 0xIF | ---------- | See LO to RF Isolation and LO Harmonic to RF Isolation Plots (Page 3) | | | | |
| 1xIF | 18 (20) | Reference | 27 (26) | 12 (11) | 31 (33) | 36 (30) |
| 2xIF | 57 (50) | 57 (58) | 56 (60) | 54 (44) | 50 (55) | 52 (48) |
| 3xIF | 90 (81) | 77 (68) | 87 (76) | 68 (61) | 79 (72) | 72 (69) |
| 4xIF | 116 (98) | 109 (106) | 110 (98) | 100 (94) | 101 (92) | 95 (83) |
| 5xIF | 127 (126) | 123 (119) | 129 (122) | 118 (109) | 118 (108) | 113 (102) |

A sample upconversion spurious sweep is shown below. A 2.0 GHz reference IF input is used to create an RF output that is 2.0 GHz below the LO input (LO-IF=RF). A second LO (2.0 GHz higher) is combined with the same 2.0 GHz IF input (LO-2xIF=RF) to create the same 9 to 38 GHz RF output band. The difference between these two output levels is the spurious suppression in dBc. The mean value across the RF output band is the number shown in the table above.



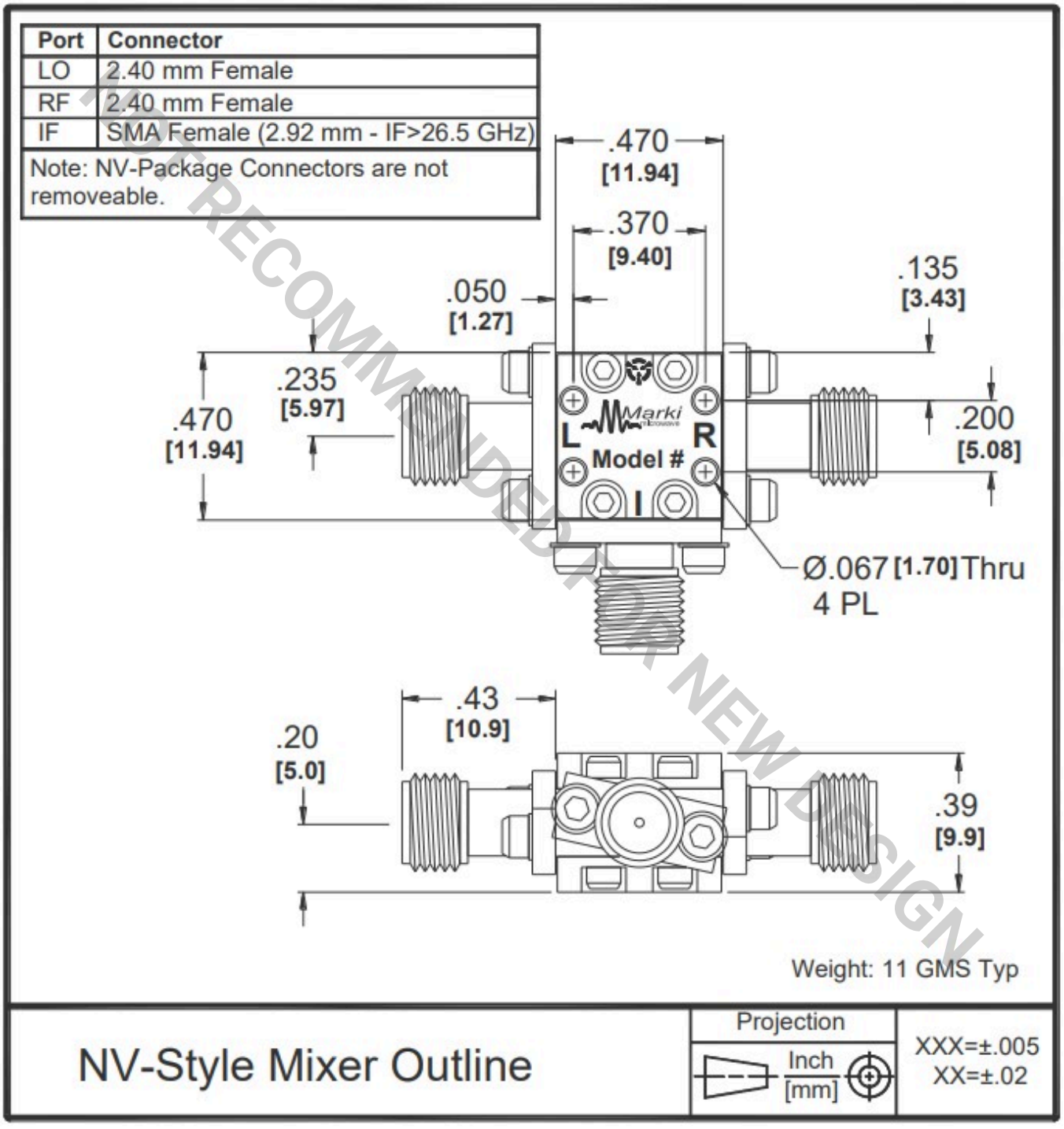

**Upconversion 2IF x 1LO Spurious Data Example:**

IF Input: 2.0 GHz @ -10 dBm
**LO for Reference: 11 to 40 GHz**
**LO for Spurious: 13 to 42 GHz**
RF Output: 9 to 38 GHz

## Mechanical Data

### Outline Drawing

Download : Outline 3D Drawing | Outline 3D STP



## Notes

DATA SHEET NOTES:
1. Mixer Conversion Loss Plot IF frequency is 4.0 GHz.
2. Mixer Noise Figure typically measures within 0.5 dB of conversion loss.
3. Conversion Loss typically degrades less than 0.5 dB for LO drives 2 dB below the lowest and 3 dB above highest nominal LO drive levels.
4. Conversion Loss typically degrades less than 0.5 dB at +100°C and improves less than 0.5 dB at -55°C.
5. Unless otherwise specified, L-diode data is taken with +11 dBm LO drive, and I-diode data is taken with +16 dBm drive.
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.



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