

# Double-Balanced Mixer

## 18 - 46 GHz



MAMX-011074

Rev. V2

### Features

- Low Conversion Loss: 7 - 9 dB
- High Linearity: 20 dBm IIP3
- Wide IF Bandwidth: DC to 20 GHz
- High Isolation
- Lead-Free 3 mm, 12-lead PQFN package
- RoHS\* Compliant

### Applications

- Test & Measurement
- Microwave Radio
- Radar

### Description

MAMX-011074 is a GaAs double-balanced passive diode mixer housed in a lead-free 3 mm, 12-lead QFN package. The mixer offers low conversion loss, high linearity and a wide IF bandwidth. The double-balanced circuit configuration provides excellent port isolation while internal 50  $\Omega$  matching simplifies its application.

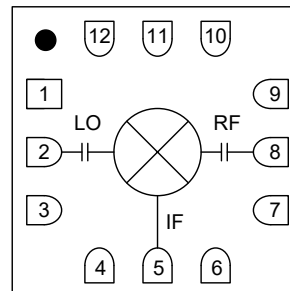
This mixer is well suited for applications such as test and measurement, microwave radio and radar.

### Ordering Information<sup>1,2</sup>

| Part Number        | Package                     |
|--------------------|-----------------------------|
| MAMX-011074        | Bulk                        |
| MAMX-011074-TR0500 | 500 Piece Reel <sup>1</sup> |
| MAMX-011074-SB1    | Sample Board <sup>2</sup>   |

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

### Functional Schematic



### Pin Configuration

| Pin #       | Function         |
|-------------|------------------|
| 1,3,4,6,7,9 | GND              |
| 2           | LO               |
| 5           | IF               |
| 8           | RF               |
| 10 - 12     | NC <sup>3</sup>  |
| 13          | GND <sup>4</sup> |

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.

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### Electrical Specifications<sup>5</sup>: $F_{IF} = 1 \text{ GHz}$ , $P_{LO} = 16 \text{ dBm}$ , $T_A = +25^\circ\text{C}$ , $Z_0 = 50 \Omega$

| Parameter           | Test Conditions  | Units | Min. | Typ.           | Max.               |
|---------------------|--|-------|------|----------------|--------------------|
| LO and RF Frequency | —  | GHz   | 18   | —              | 46                 |
| IF Frequency        | —  | GHz   | 0    | —              | 20                 |
| LO Power            | —  | dBm   | —    | 16             | —                  |
| Conversion Loss     | 18 - 24 GHz<br>24 - 40 GHz<br>40 - 46 GHz                    | dB    | —    | 9<br>7<br>7    | 12.5<br>12<br>10.5 |
| Input P1dB          | 18 - 24 GHz<br>24 - 40 GHz<br>40 - 46 GHz                    | dBm   | —    | 10<br>12<br>10 | —                  |
| Input IP3           | $P_{RF} = -10 \text{ dBm/tone}$ , $\Delta f = 1 \text{ MHz}$ | dBm   | —    | 20             | —                  |
| Input IP2           | $P_{RF} = -10 \text{ dBm/tone}$ , $\Delta f = 1 \text{ MHz}$ | dBm   | —    | 50             | —                  |
| LO-to-RF Isolation  | 18 - 46 GHz  | dB    | —    | 35             | —                  |
| LO-to-IF Isolation  | 18 - 24 GHz<br>24 - 40 GHz<br>40 - 46 GHz                    | dB    | —    | 40<br>40<br>40 | —                  |
| RF-to-IF Isolation  | 18 - 24 GHz<br>24 - 40 GHz<br>40 - 46 GHz                    | dB    | —    | 9<br>30<br>35  | —                  |
| RF Return Loss      | RF = 40 GHz  | dB    | —    | 10             | —                  |
| IF Return Loss      | IF = 1 GHz   | dB    | —    | 12             | —                  |

5. All specifications refer to down-conversion operation, unless otherwise noted.

### Absolute Maximum Ratings<sup>6,7</sup>

| Parameter                         | Absolute Maximum |
|-----------------------------------|------------------|
| LO Power                          | 23 dBm           |
| RF or IF Power                    | 20 dBm           |
| Junction Temperature <sup>8</sup> | +150°C           |
| Operating Temperature             | -55°C to +85°C   |
| Storage Temperature               | -65°C to +150°C  |

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

### 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 devices with the following JEDEC rating:

HBM Class 1B  
CDM Class 3C

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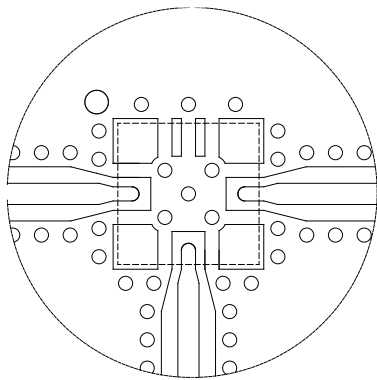
### MxN Spurious Rejection at IF Port (dBc IF)

RF = 24 GHz @ -10 dBm

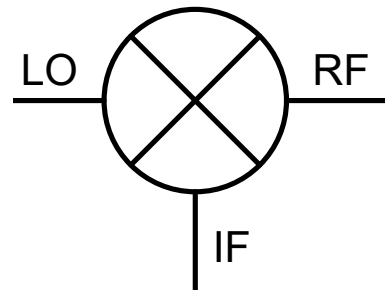
LO = 23 GHz @ +16 dBm

| mxRF | nxLO |    |    |    |    |
|------|------|----|----|----|----|
|      | 0    | 1  | 2  | 3  | 4  |
| 0    | x    | 4  | 44 | x  | x  |
| 1    | 7    | 0  | 64 | 47 | x  |
| 2    | 68   | 61 | 60 | 70 | 71 |
| 3    | x    | x  | 83 | x  | 34 |
| 4    | x    | x  | x  | x  | 99 |

### PCB Layout



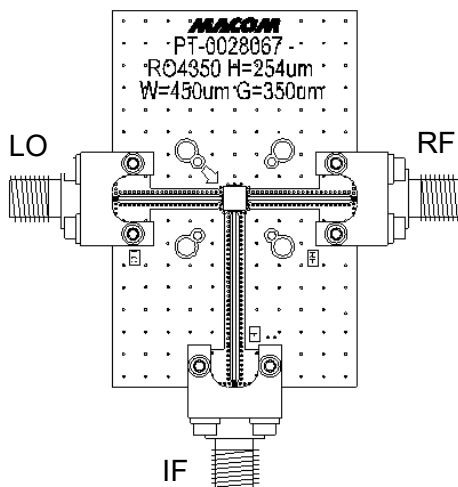
### Application Schematic



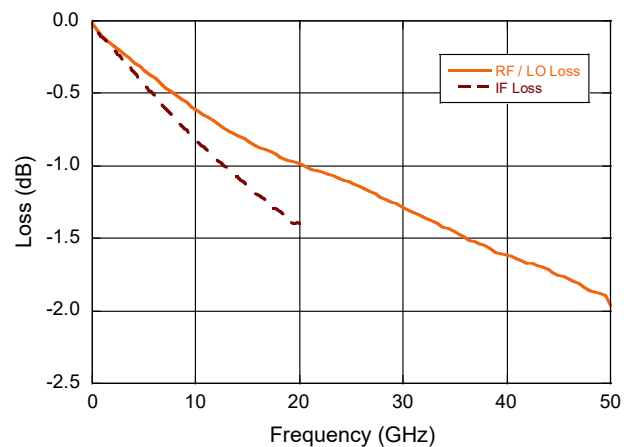
DXF available on request based on 10 mil RO4350 substrate.

No external parts required for operation of MAMX-011074.

### Evaluation Board

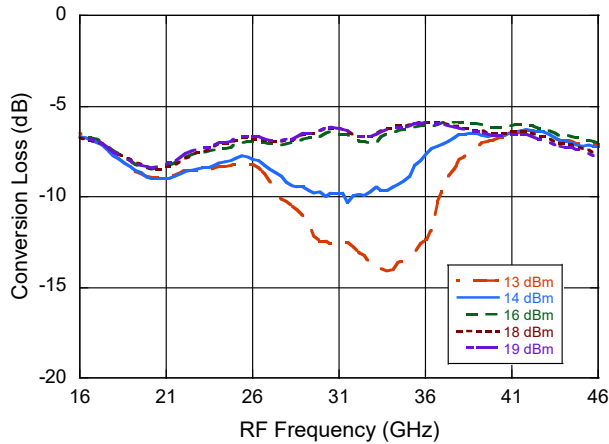


### Evaluation Board Losses

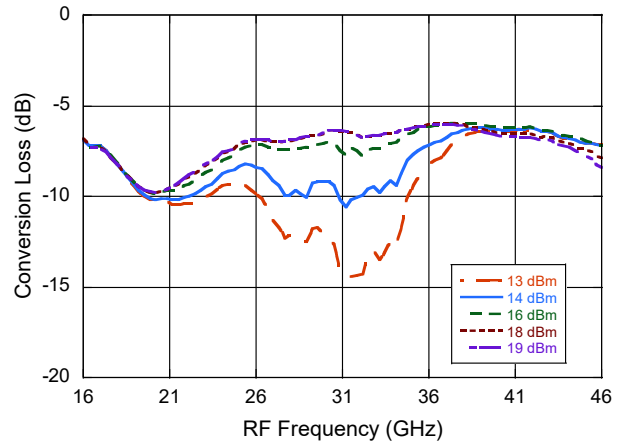


### Typical Performance Curves

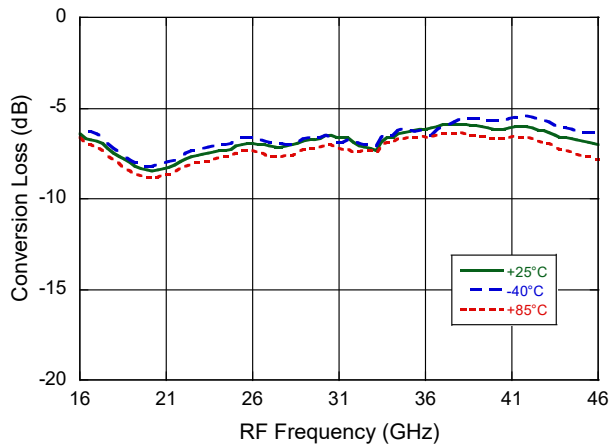
**Conversion Loss USB (Down Conversion)**  
@ +25°C,  $I_F = 1$  GHz



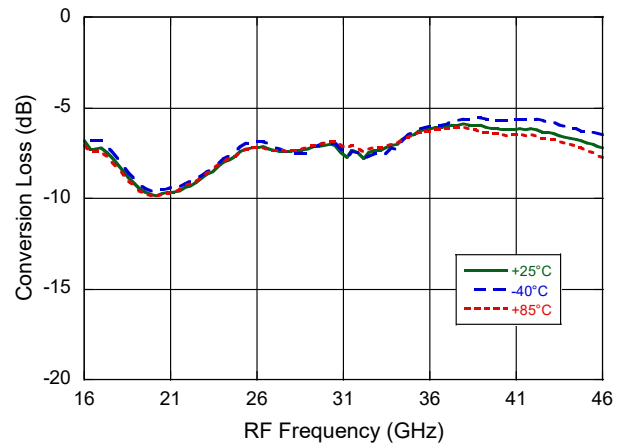
**Conversion Loss LSB (Down Conversion)**  
@ +25°C,  $I_F = 1$  GHz



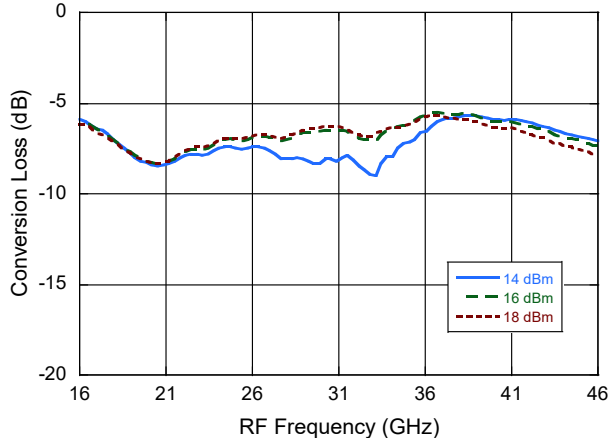
**Conversion Loss USB Over Temperature**  
@  $P_{LO} = 16$  dBm,  $I_F = 1$  GHz



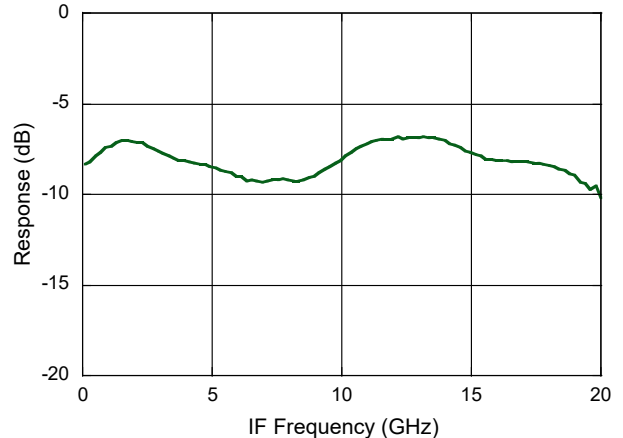
**Conversion Loss LSB Over Temperature**  
@  $P_{LO} = 16$  dBm,  $I_F = 1$  GHz



**Conversion Loss USB (Up Conversion)**  
@ +25°C,  $I_F = 1$  GHz

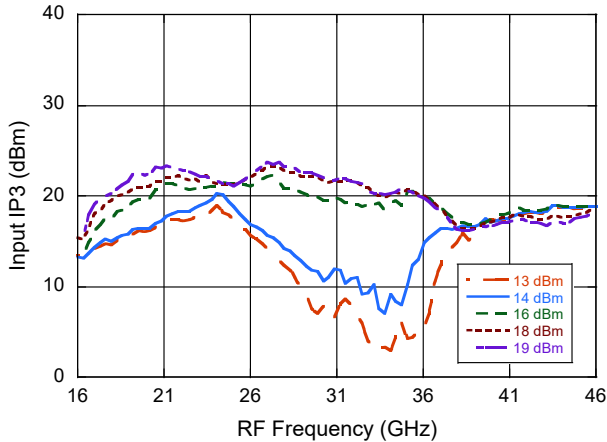


**IF Bandwidth**  
@ +25°C,  $F_{LO} = 24$  GHz,  $P_{LO} = 16$  dBm

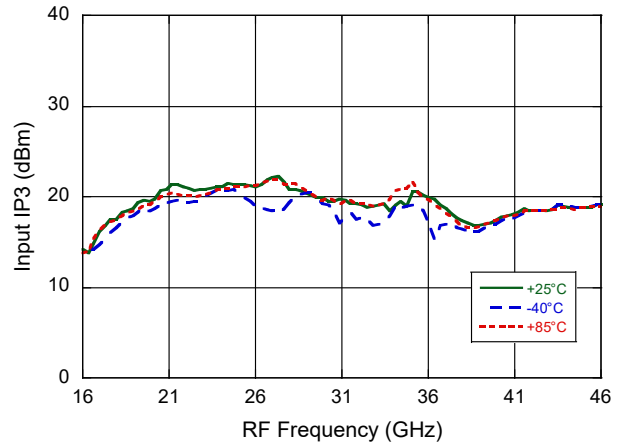


### Typical Performance Curves

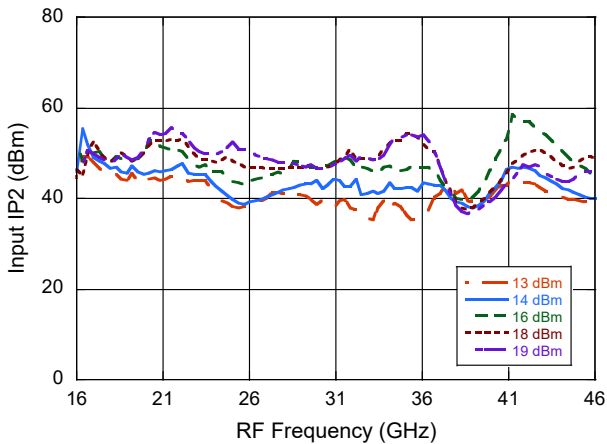
**IIP3 vs. LO Drive,  $I_F = 1$  GHz**



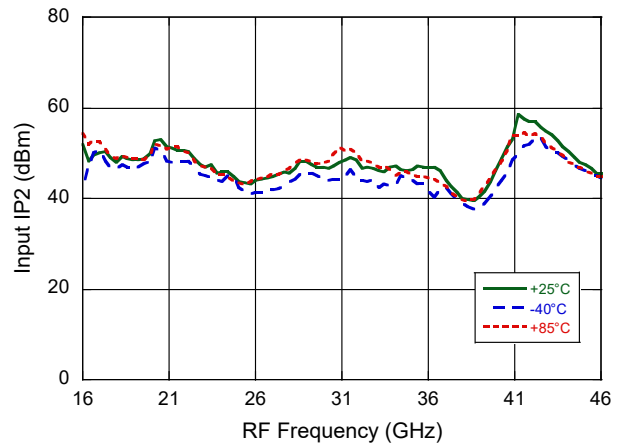
**IIP3 vs. Temperature @  $P_{LO} = 16$  dBm,  $I_F = 1$  GHz**



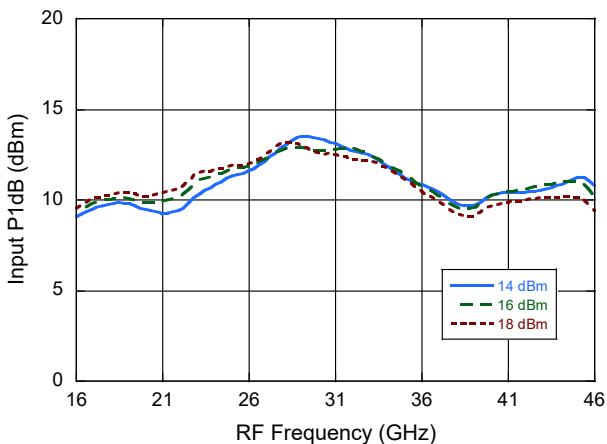
**IIP2 vs. LO Drive  $I_F = 1$  GHz**



**IIP2 vs. Temperature @  $P_{LO} = 16$  dBm,  $I_F = 1$  GHz**

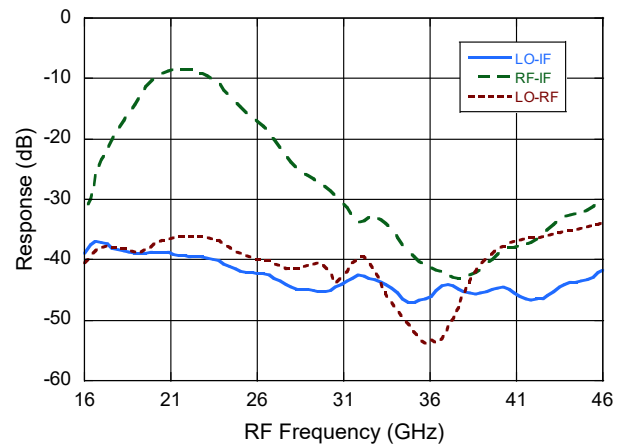


**P1dB vs. LO Drive,  $I_F = 1$  GHz**



**Isolation (Down Conversion)**

@  $I_F = 1$  GHz,  $P_{LO} = 16$  dBm;  $P_{RF} = -10$  dBm



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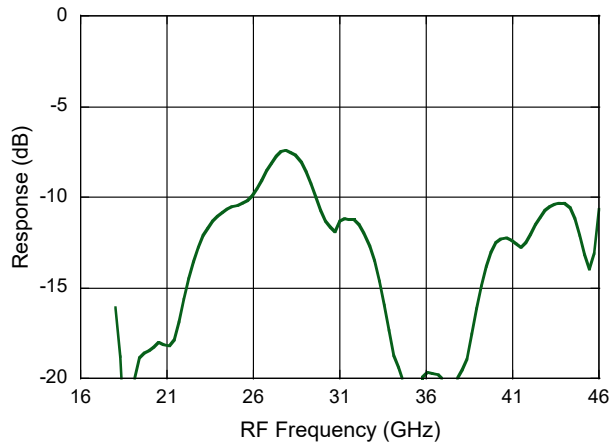
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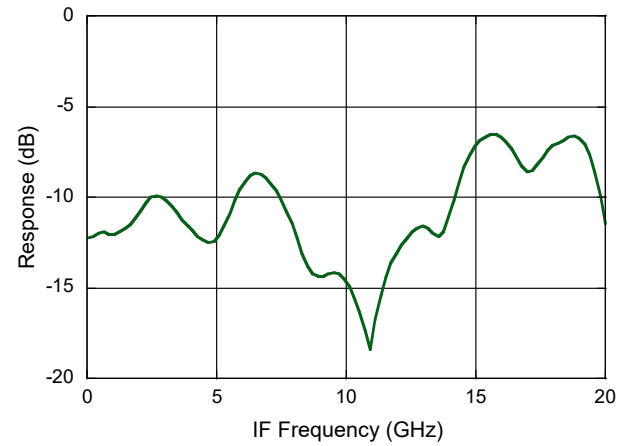
#### RF Return Loss

@ +25°C,  $F_{LO} = 28$  GHz,  $P_{LO} = 16$  dBm



#### IF Return Loss

@ +25°C,  $F_{LO} = 28$  GHz,  $P_{LO} = 16$  dBm



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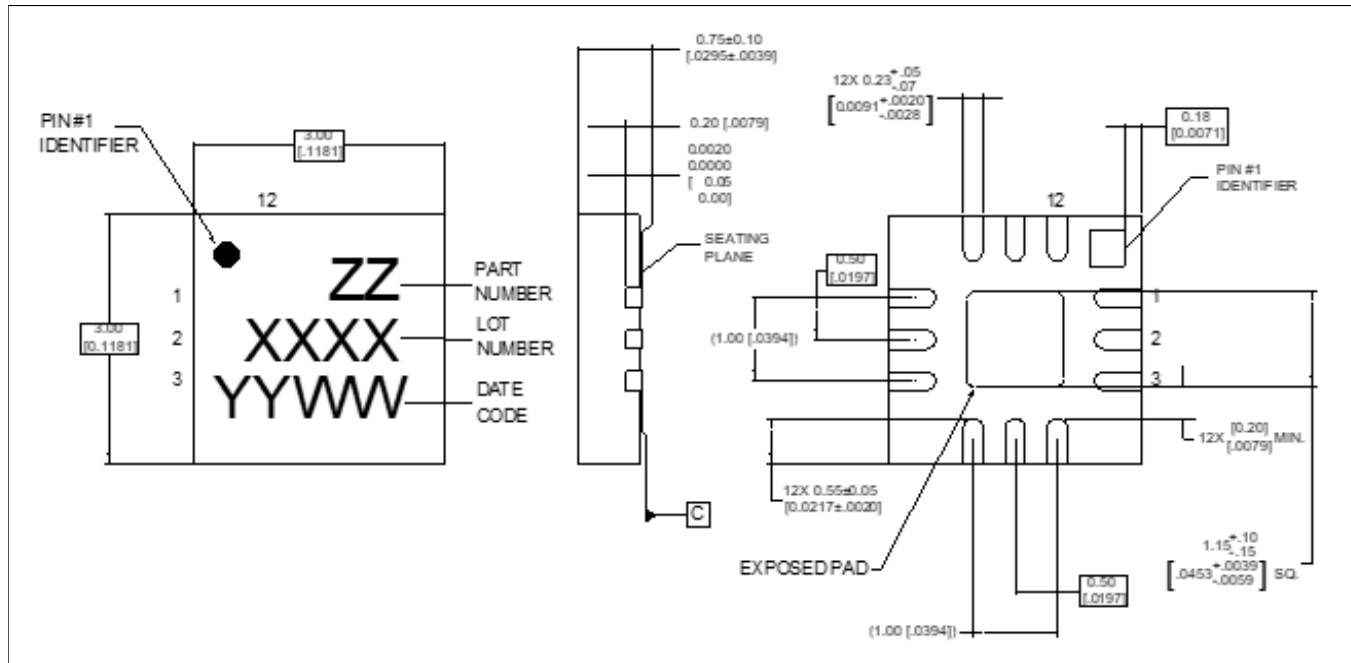
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### Lead-Free 3 mm 12-Lead QFN<sup>†</sup>



<sup>†</sup> Reference Application Note S2083 for lead-free solder reflow recommendations.  
 Meets JEDEC moisture sensitivity level 1 requirements.  
 Plating is 100% matte tin over copper.

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