

## Features

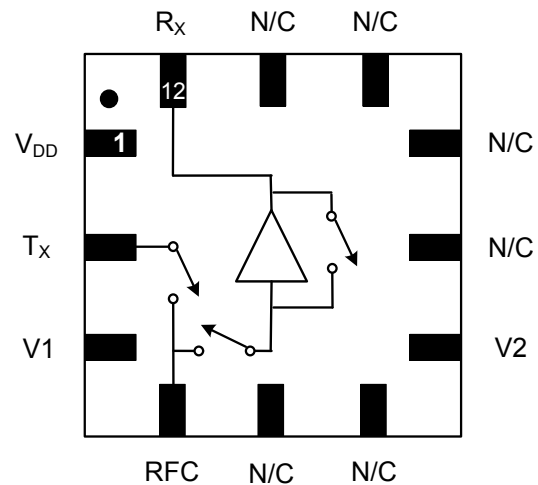
- 802.11a,n,ac Applications
- 0.9 dB  $T_X$  Insertion Loss
- 19 dB  $R_X$  Isolation
- 12 dB  $R_X$  Gain
- 2.2 dB Noise Figure
- 10 mA Current
- -40 dB EVM @ 23 dBm Input (802.11ac 80 MHz / 256 QAM)
- Lead Free 2 mm 12-lead STQFN package
- RoHS\* Compliant and 260°C Reflow Compatible

## Description

The MAMF-010614 is a multi-function MMIC which includes a SPDT switch and LNA with bypass mode for the  $R_X$  path. This part would typically be used on the front end of WLAN 802.11a,n,ac modules where small size is critical.

The MAMF-010614 delivers high isolation between  $T_X$  and  $R_X$  paths, low  $T_X$  insertion loss and a high gain, low noise  $R_X$  path.

## Functional Schematic



## Pin Configuration<sup>3</sup>

| Pin No. | Function            | Description          |
|---------|---------------------|----------------------|
| 1       | $V_{DD}$            | Drain Voltage Supply |
| 2       | $T_X$               | $T_X$ Port           |
| 3       | V1                  | Control 1            |
| 4       | RFC                 | RF Common            |
| 5       | N/C                 | No Connection        |
| 6       | N/C                 | No Connection        |
| 7       | V2                  | Control 2            |
| 8       | N/C                 | No Connection        |
| 9       | N/C                 | No Connection        |
| 10      | N/C                 | No Connection        |
| 11      | N/C                 | No Connection        |
| 12      | $R_X$               | $R_X$ Port           |
| 13      | Paddle <sup>4</sup> | Ground               |

3. M/A-COM Technology Solutions recommends connecting unused package pins to ground.
4. The exposed pad centered on the package bottom must be connected to RF and DC ground.

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

| Part Number        | Package         |
|--------------------|-----------------|
| MAMF-010614-TR3000 | 3000 piece reel |
| MAMF-010614-001SMB | Sample Board    |

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

\* Restrictions on Hazardous Substances, European Union Directive 2002/95/EC.

## Integrated SPDT Switch and LNA with Bypass Mode 5.0 - 6.0 GHz

Rev. V4

**Electrical Specifications: Freq. = 5.25 - 5.825 GHz,  $V_{DD} = 3\text{ V}$ ,  $V_C = 0/2.8\text{ V}$ ,  $T_A = 25^\circ\text{C}$**

| Parameter                        | Test Conditions  | Units         | Min. | Typ.     | Max.   |
|----------------------------------|--|---------------|------|----------|--------|
| Isolation                        | RFC to $T_X$<br>RFC to $R_X$                             | dB            | —    | 19<br>19 | —<br>— |
| $T_X$ Insertion Loss             | RFC to $T_X$   | dB            | —    | 0.9      | 1.2    |
| $T_X$ Input / Output Return Loss | RFC to $T_X$   | dB            | —    | 12       | —      |
| $T_X$ Input P0.1dB               | $T_X$ Path On  | dBm           | —    | 31       | —      |
| $T_X$ EVM                        | $P_{IN} = +23\text{ dBm}$ ,<br>802.11AC 80 MHz / 256 QAM | dB            | —    | -42      | —      |
| $R_X$ Gain                       | RFC to $R_X$ , Gain Mode                                 | dB            | 10   | 12       | —      |
| $R_X$ Insertion Loss             | RFC to $R_X$ , Bypass Mode                               | dB            | —    | 6        | 7.5    |
| $R_X$ Input / Output Return Loss | RFC to $R_X$ , Gain Mode                                 | dB            | —    | 10       | —      |
| $R_X$ Noise Figure               | Gain Mode  | dB            | —    | 2.2      | —      |
| $R_X$ Input IP3                  | Gain Mode  | dBm           | —    | 10       | —      |
| $R_X$ Input P0.1dB               | Bypass Mode  | dBm           | —    | 10       | —      |
| $R_X$ Input P1dB                 | Gain Mode  | dBm           | -5   | -3       | —      |
| $R_X$ EVM                        | $P_{IN} = -15\text{ dBm}$ , Gain Mode                    | dB            | —    | -46      | —      |
| Quiescent Current                | No RF, Gain Mode, $V_{DD} = 3\text{ V}$                  | mA            | —    | 10       | 12     |
| Leakage Current                  | All States except High Gain                              | $\mu\text{A}$ | —    | 10       | —      |

### Absolute Maximum Ratings<sup>5,6</sup>

| Parameter   | Absolute Maximum                          |
|---|---|
| Input Power<br>$R_X$ Gain Mode<br>$R_X$ Bypass Mode<br>$T_X$ , 5 $V_C$ , RFC - $T_X$<br>$T_X$ , 3.3 $V_C$ , RFC - $T_X$ | 0 dBm<br>20 dBm<br>35 dBm CW<br>33 dBm CW |
| $V_{DD}$  | +5 volts                                  |
| Operating Temperature   | -40°C to +85°C                            |
| Storage Temperature   | -65°C to +150°C                           |

5. Exceeding any one or combination of these limits may cause permanent damage to this device.  
6. M/A-COM Technology Solutions does not recommend sustained operation near these survivability limits.

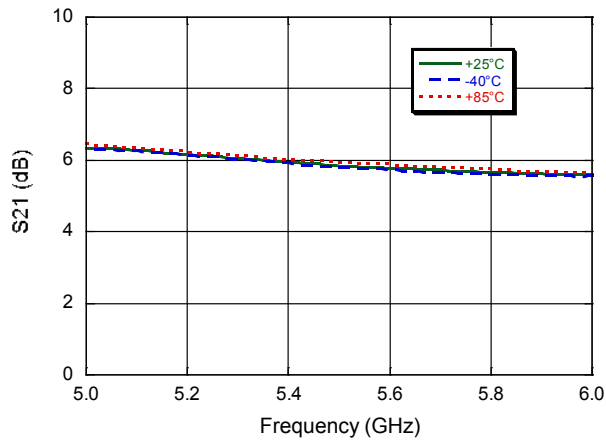
### Truth Table<sup>7,8</sup>

| Control V1 | Control V2 | RFC- $R_X$  | RFC- $T_X$ |
|------------|------------|-------------|------------|
| Low        | Low        | Bypass Mode | Off        |
| Hi         | Low        | Gain Mode   | Off        |
| Low        | Hi         | Off         | On         |

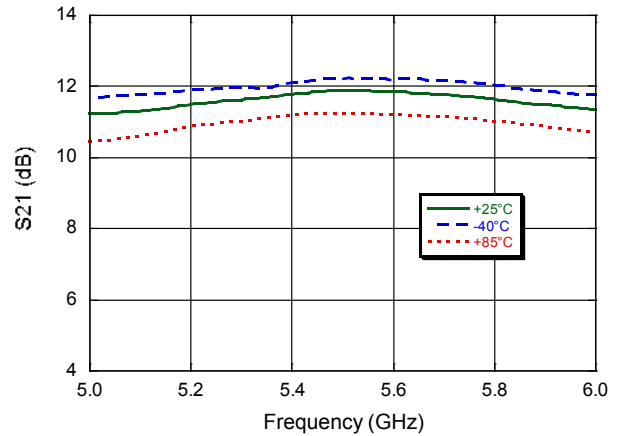
7. Differential voltage, V (state Low) - V (state Hi), must be +2.7 V minimum and must not exceed +5 V.  
8. Low =  $0 \pm 0.3\text{ V}$ , Hi = +2.7 V to +5 V.

## Typical Performance Curves:

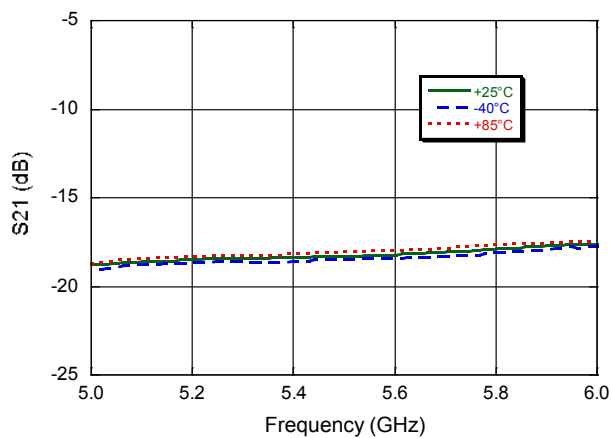
**R<sub>x</sub> Insertion Loss, Bypass Mode**



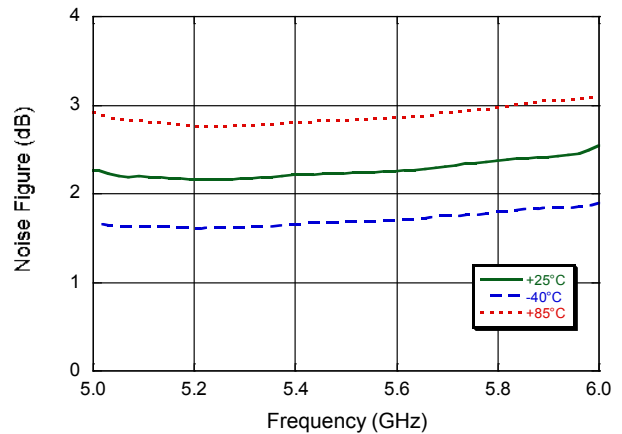
**R<sub>x</sub> Gain, Gain Mode**



**RFC - R<sub>x</sub> Isolation (T<sub>x</sub> On)**

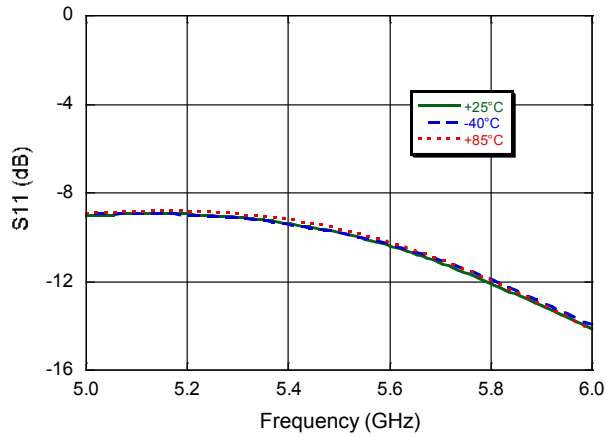


**R<sub>x</sub> Noise Figure, Gain Mode**

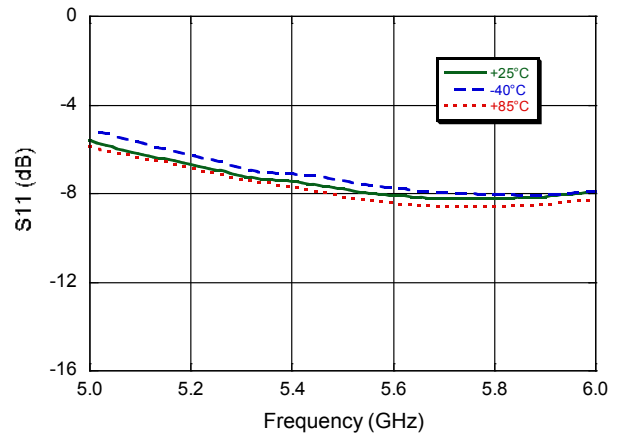


## Typical Performance Curves:

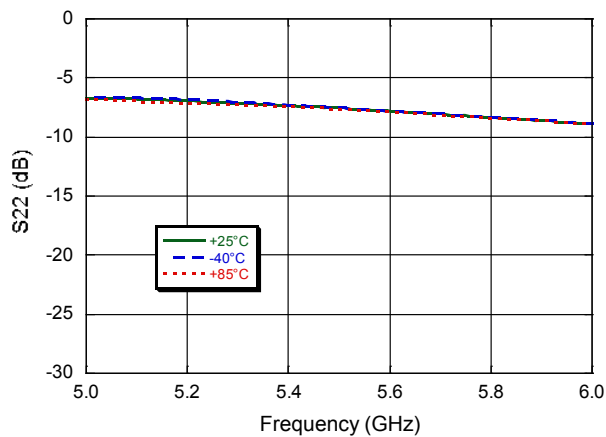
**R<sub>x</sub> Input Return Loss, Bypass Mode**



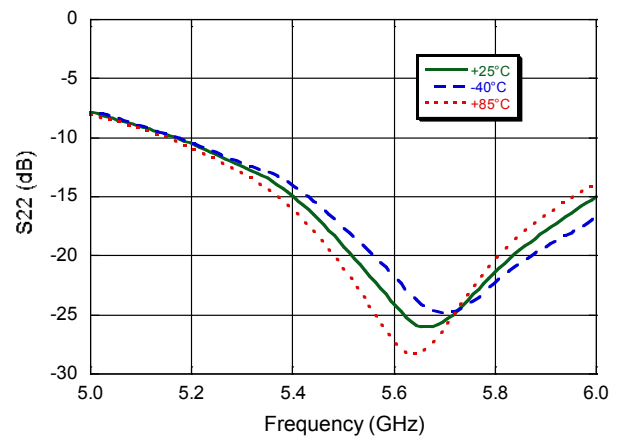
**R<sub>x</sub> Input Return Loss, Gain Mode**



**R<sub>x</sub> Output Return Loss, Bypass Mode**



**R<sub>x</sub> Output Return Loss, Gain Mode**

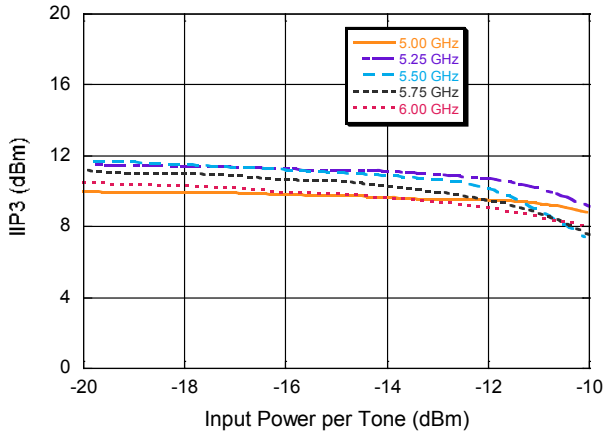


## Integrated SPDT Switch and LNA with Bypass Mode 5.0 - 6.0 GHz

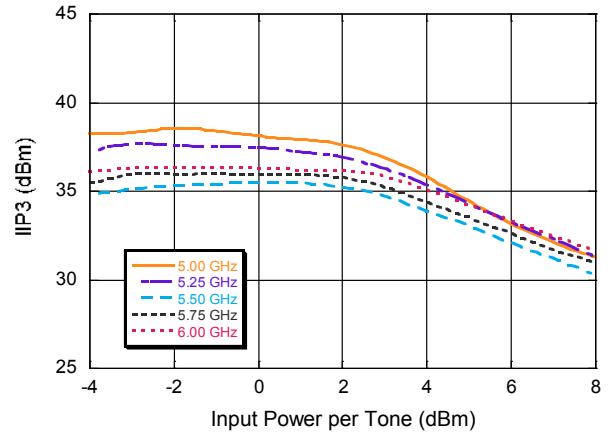
Rev. V4

### Typical Performance Curves:

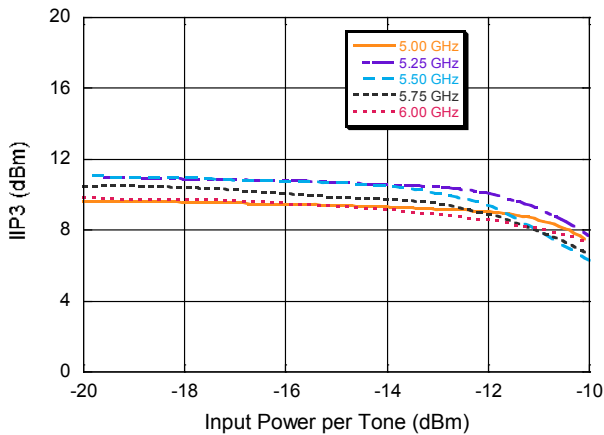
**R<sub>x</sub> Input IP<sub>3</sub>, Gain Mode @ +25°C**



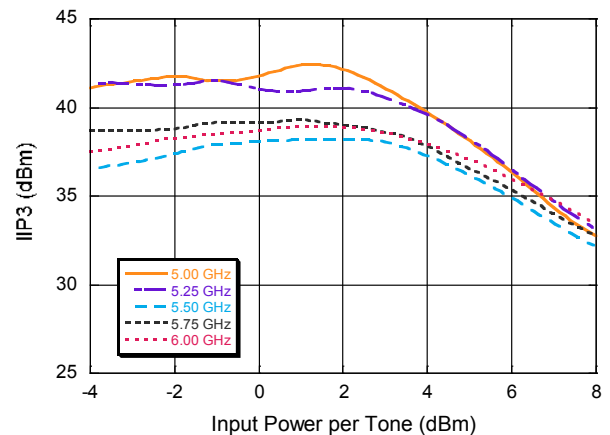
**R<sub>x</sub> Input IP<sub>3</sub>, Bypass Mode @ +25°C**



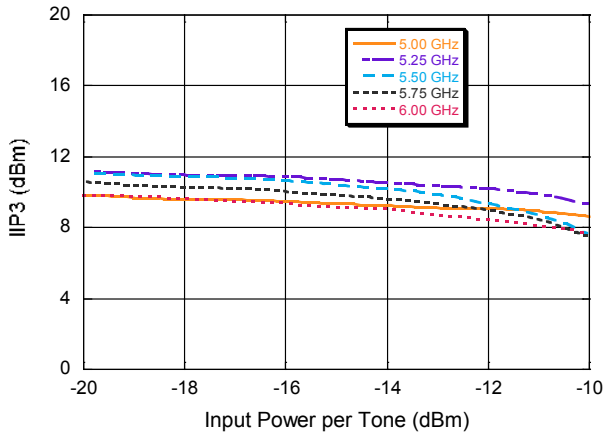
**R<sub>x</sub> Input IP<sub>3</sub>, Gain Mode @ -40°C**



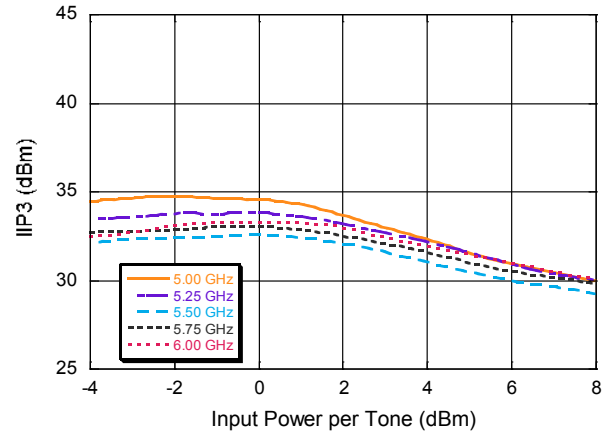
**R<sub>x</sub> Input IP<sub>3</sub>, Bypass Mode @ -40°C**



**R<sub>x</sub> Input IP<sub>3</sub>, Gain Mode @ +85°C**

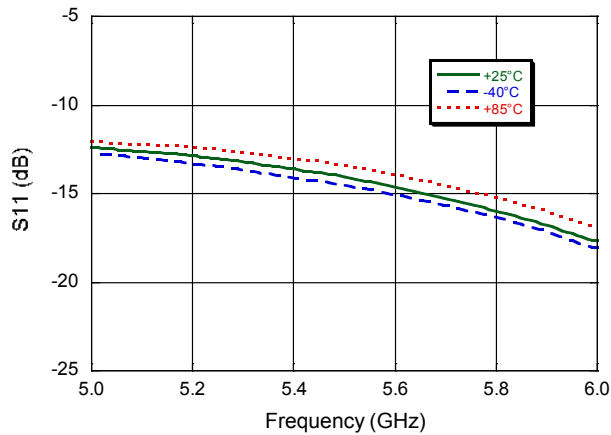


**R<sub>x</sub> Input IP<sub>3</sub>, Bypass Mode @ +85°C**

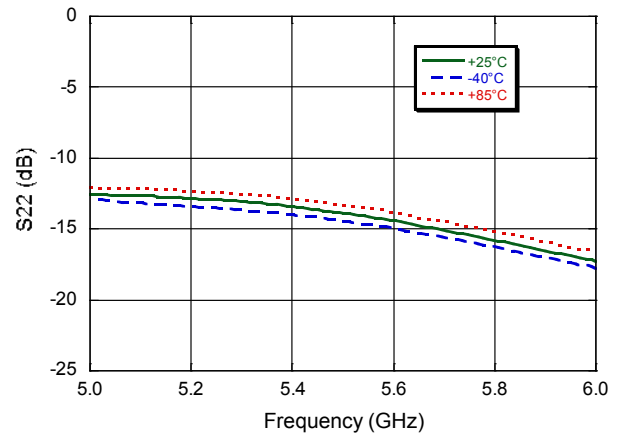


## Typical Performance Curves:

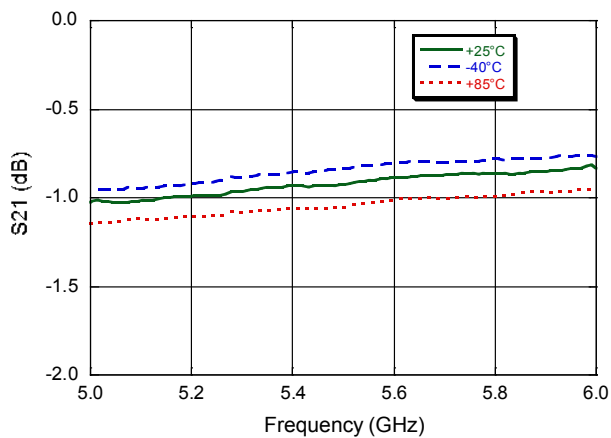
**$T_x$  Input Return Loss**



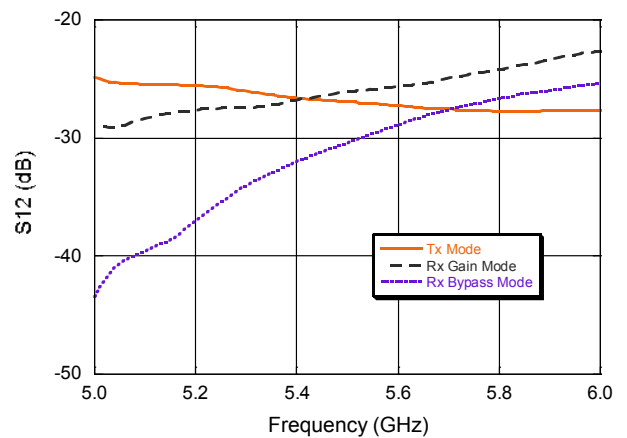
**$T_x$  Output Return Loss**



**$T_x$  Insertion Loss**

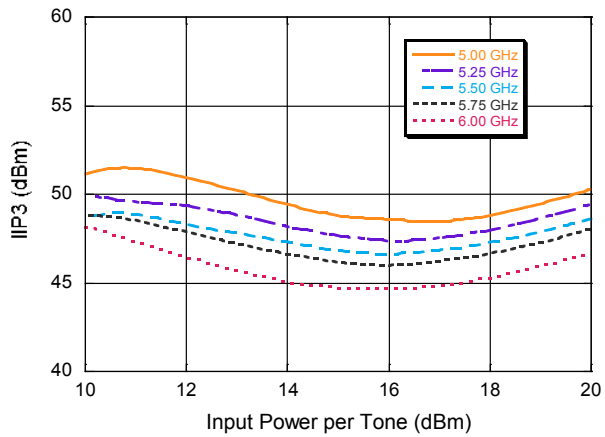


**$T_x - R_x$  Isolation**

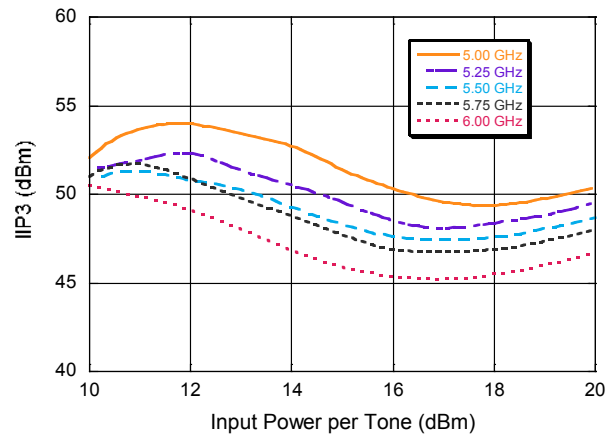


## Typical Performance Curves:

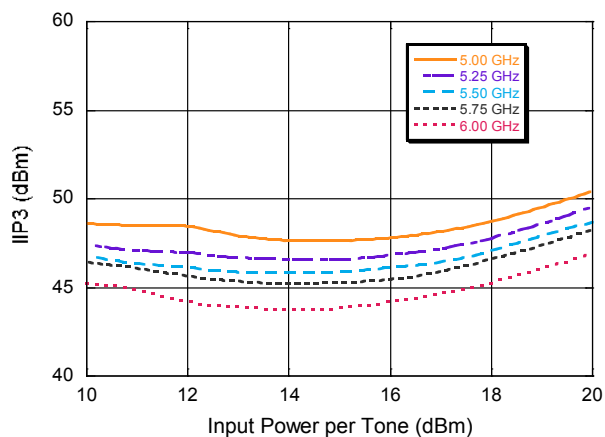
**$T_x$  Input IP3 @ +25°C**



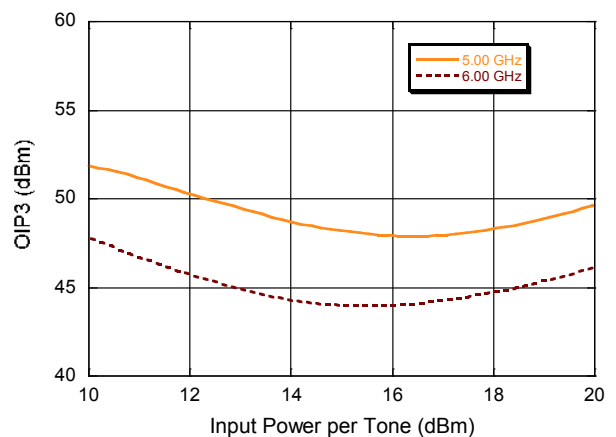
**$T_x$  Input IP3 @ -40°C**



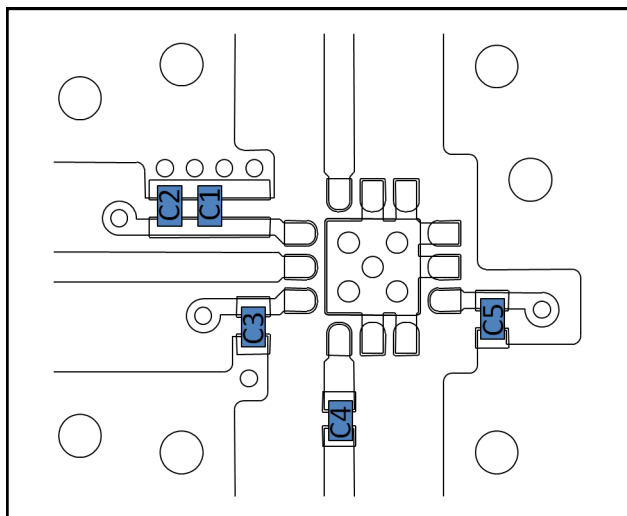
**$T_x$  Input IP3 @ +85°C**



**$T_x$  Output IP3 @ +25°C**

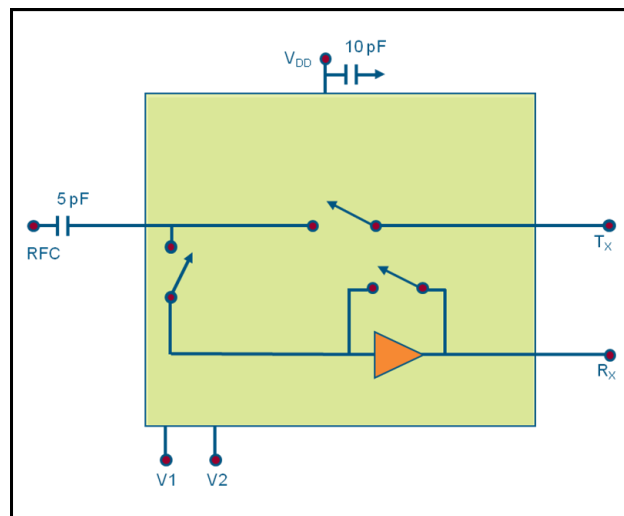


## Recommended Sample Board<sup>9</sup>



9. Place C1 and C2 as shown.

## Functional Schematic



## Parts List

| Component  | Value       | Case Size |
|------------|-------------|-----------|
| C1         | 10 pF       | 0201      |
| C2, C3, C5 | 0.1 $\mu$ F | 0201      |
| C4         | 5 pF        | 0201      |

## Handling Procedures

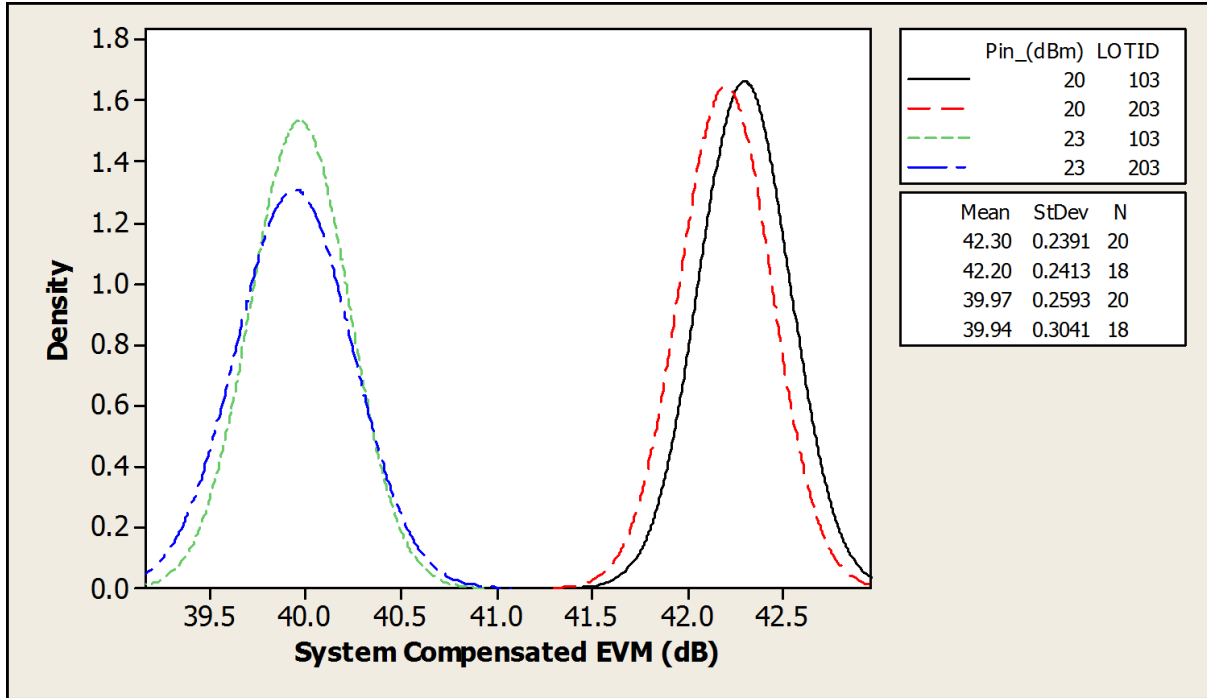
Please observe the following precautions to avoid damage:

## Static Sensitivity

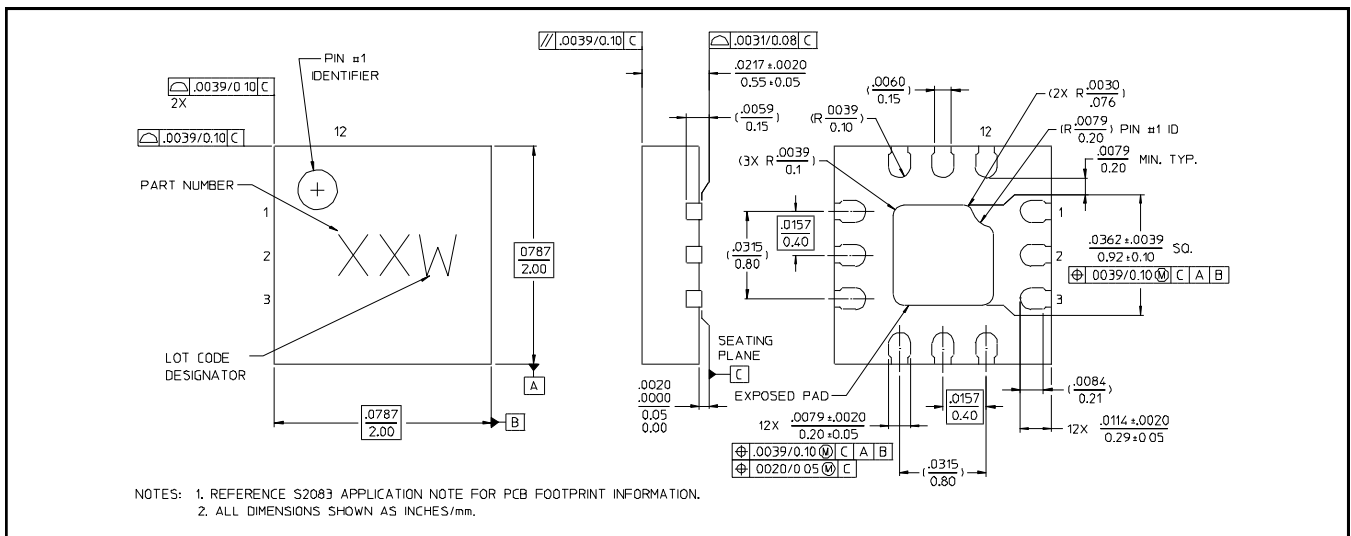
Gallium Arsenide Integrated Circuits are sensitive to electrostatic discharge (ESD) and can be damaged by static electricity. Proper ESD control techniques should be used when handling these devices.



## System Compensated EVM, 802.11AC 80 MHz / 256 QAM



## Lead-Free 2 mm STQFN-12LD-0.4mm Pitch†



† Reference Application Note S2083 for lead-free solder reflow recommendations.  
 Meets JEDEC moisture sensitivity level 1 requirements.  
 Plating is Ni/Pd/Au over Copper.

M/A-COM Technology Solutions Inc. All rights reserved.

Information in this document is provided in connection with M/A-COM Technology Solutions Inc ("MACOM") products. These materials are provided by MACOM as a service to its customers and may be used for informational purposes only. Except as provided in MACOM's Terms and Conditions of Sale for such products or in any separate agreement related to this document, MACOM assumes no liability whatsoever. MACOM assumes no responsibility for errors or omissions in these materials. MACOM may make changes to specifications and product descriptions at any time, without notice. MACOM makes no commitment to update the information and shall have no responsibility whatsoever for conflicts or incompatibilities arising from future changes to its specifications and product descriptions. No license, express or implied, by estoppel or otherwise, to any intellectual property rights is granted by this document.

THESE MATERIALS ARE PROVIDED "AS IS" WITHOUT WARRANTY OF ANY KIND, EITHER EXPRESS OR IMPLIED, RELATING TO SALE AND/OR USE OF MACOM PRODUCTS INCLUDING LIABILITY OR WARRANTIES RELATING TO FITNESS FOR A PARTICULAR PURPOSE, CONSEQUENTIAL OR INCIDENTAL DAMAGES, MERCHANTABILITY, OR INFRINGEMENT OF ANY PATENT, COPYRIGHT OR OTHER INTELLECTUAL PROPERTY RIGHT. MACOM FURTHER DOES NOT WARRANT THE ACCURACY OR COMPLETENESS OF THE INFORMATION, TEXT, GRAPHICS OR OTHER ITEMS CONTAINED WITHIN THESE MATERIALS. MACOM SHALL NOT BE LIABLE FOR ANY SPECIAL, INDIRECT, INCIDENTAL, OR CONSEQUENTIAL DAMAGES, INCLUDING WITHOUT LIMITATION, LOST REVENUES OR LOST PROFITS, WHICH MAY RESULT FROM THE USE OF THESE MATERIALS.

MACOM products are not intended for use in medical, lifesaving or life sustaining applications. MACOM customers using or selling MACOM products for use in such applications do so at their own risk and agree to fully indemnify MACOM for any damages resulting from such improper use or sale.