

Broadband CATV 4-Way Active Splitter with Default Loop-Through Switch 50 - 1100 MHz

Rev. V1

Features

- Always ON loop-through path
- 4-Way Splitter
- 2.5 dB Gain
- +15 dBmV/Channel Input
- 4.5 dB Noise Figure
- Lead-Free 3 mm 12-Lead PQFN Package
- RoHS* Compliant and 260°C Reflow Compatible

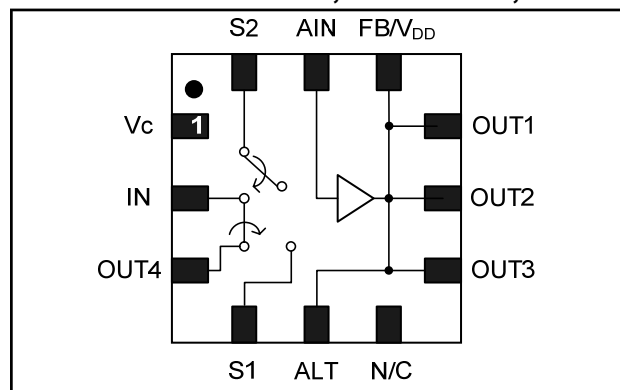
Description

The MAAM-009778 CATV 4-way active splitter with the default loop-through path is a GaAs MMIC which exhibits low noise figure and distortion in a lead-free 3 mm 12-lead PQFN plastic package. The design features 75 Ω inputs and outputs.

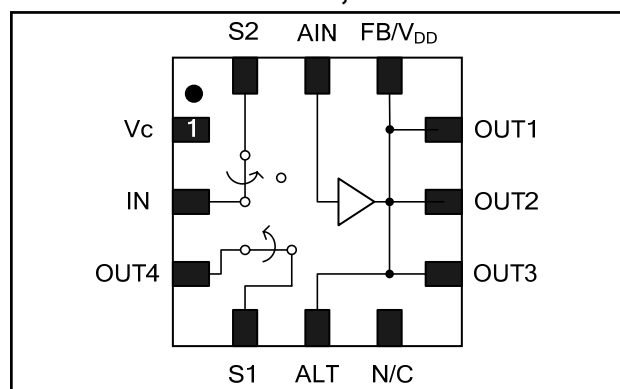
The MAAM-009778 is ideally suited for multi-tuner set top boxes, home gateways, and other broadband internet based applications.

The MAAM-009778 is fabricated using M/A-COM Technology Solutions' E/D pHEMT process to realize default loop-through operation, low noise and low distortion. The process features full passivation for robust performance and reliability.

Functional Schematic, Default On, Power Off



Functional Schematic, Power On



Ordering Information ^{1,2}

| Part Number | Package |
|--------------------|-------------------|
| MAAM-009778-TR1000 | 1000 piece reel |
| MAAM-009778-TR3000 | 3000 piece reel |
| MAAM-009778-001SMB | Sample Test Board |

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

Pin Configuration

| Pin No. | Pin Name | Description |
|---------|---------------------|------------------------------------|
| 1 | V _c | Voltage Control |
| 2 | IN | RF Input |
| 3 | OUT4 | RF Output 4 |
| 4 | S1 | Switch Input |
| 5 | ALT | Alternate Output |
| 6 | N/C | No Connection |
| 7 | OUT3 | RF Output 3 |
| 8 | OUT2 | RF Output 2 |
| 9 | OUT1 | RF Output 1 |
| 10 | FB/V _{DD} | Amplifier Feedback / Drain Voltage |
| 11 | AIN | Amplifier Input |
| 12 | S2 | Switch Output |
| 13 | Paddle ³ | RF and DC Ground |

3. The exposed pad centered on the package bottom must be connected to RF and DC ground.

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

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Electrical Specifications⁴: Freq. = 1000 MHz, T_A = 25°C, Z₀ = 75 Ω

| Parameter | Test Conditions | V _{DD} (V) | V _C (V) | Units | Min. | Typ. | Max. |
|----------------------|-------------------------------------------------|---------------------|--------------------|-------|----------|------------|------------|
| Gain | In to Out1, 2, or 3 In to Out4 | 5 | 3.3 | dB | 2 1.8 | 2.5 2.5 | 4.5 4.5 |
| Insertion Loss | In to Out4 | 0 | 0 | dB | - | 0.75 | 1.0 |
| Noise Figure | In to Out1, 2, 3, or 4 | 5 | 3.3 | dB | - | 4.5 | - |
| Gain Flatness | In to Out1, 2, 3, or 4 | 5 | 3.3 | dB | - | 0.8 | - |
| Input Return Loss | Input | 5 | 3.3 | dB | - | 12 | - |
| Input Return Loss | Input | 0 | 0 | dB | - | 12 | - |
| Output Return Loss | Output | 5 | 3.3 | dB | - | 10 | - |
| Output Return Loss | Output | 0 | 0 | dB | - | 10 | - |
| Out to Out Isolation | Out1 to Out2, 3 or 4 | 5 | 3.3 | dB | - | 22 | - |
| Out to Out Isolation | Out1 to Out2 or 3 | 0 | 0 | dB | - | 35 | - |
| CTB | 132 Channels, +15 dBmV/Channel at the input | 5 | 3.3 | dBc | - | -65 | - |
| CSO | 132 Channels, +15 dBmV/Channel at the input | 5 | 3.3 | dBc | - | -60 | - |
| Reverse Isolation | Out1, 2, 3 to In | 5 | 3.3 | dB | - | 31 | - |
| Reverse Isolation | Out4 to In | 5 | 3.3 | dB | - | 23 | - |
| Reverse Isolation | Out1, 2, 3 to In | 0 | 0 | dB | - | 45 | - |
| OIP2 | 500 MHz, 2-tone, 6 MHz spacing, -10 dBm Pout | 5 | 3.3/0 | dBm | - | 42 | - |
| OIP3 | 500 MHz, 2-tone, 6 MHz spacing, -10 dBm Pout | 5 | 3.3/0 | dBm | - | 22 | - |
| P1dB | 500 MHz | 5 | 3.3 | dBm | - | 6 | - |
| P1dB | 500 MHz | 5 | 0 | dBm | - | 25 | - |
| I _{DD} | | 5 | 3.3 | mA | - | 100 | 130 |
| I _C | | 5 | 3.3 | μA | - | 230 | 250 |

4. The unpowered state is the same as V_C = 0V

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Absolute Maximum Ratings^{5,6,7}

| Parameter | Absolute Maximum |
|-----------------------------------|------------------|
| Max Input Power | +5 dBm |
| V _{DD} | +10.0 V |
| V _C | +8.5 V |
| Operating Temperature | -40°C to +85°C |
| Junction Temperature ⁸ | +150°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.
7. These operating conditions will ensure MTTF > 1 x 10⁶ hours.
8. Junction Temperature (T_J) = T_A + Θ_{Jc} * (V * I)
Typical thermal resistance (Θ_{Jc}) = 73 °C/W.
 - a) For T_A = 25°C,
T_J = 72 °C @ 5.0 V, 130 mA
 - b) For T_A = 85°C,
T_J = 129 °C @ 5.0 V, 120 mA

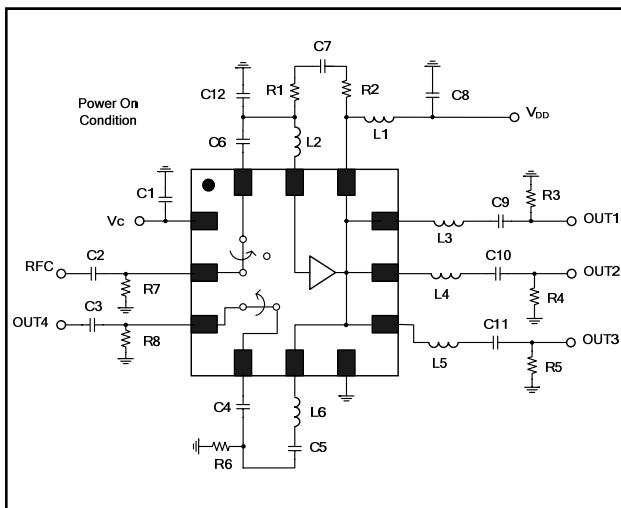
Truth Table⁹

| V _{DD} | V _C | IN - OUT1, 2 or 3 | IN - OUT4 |
|-----------------|----------------|-------------------|-----------|
| 1 | 1 | On | On |
| 0 | 0 | Off | On |

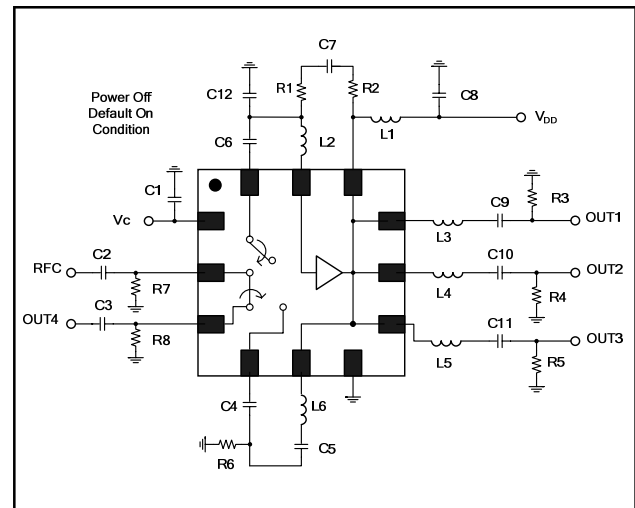
9. Logic "1" for V_{DD} = +5 volts and V_C = +3.3 volts typical.

Schematics Including Off-Chip Components¹⁰

Power On Condition

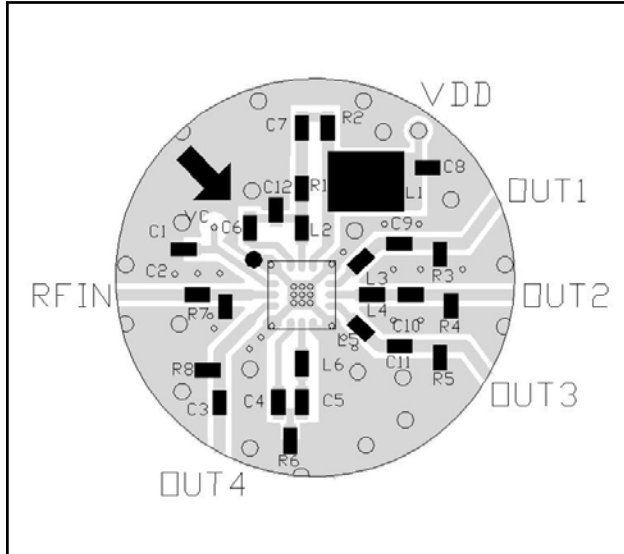


Power Off, Default on Condition

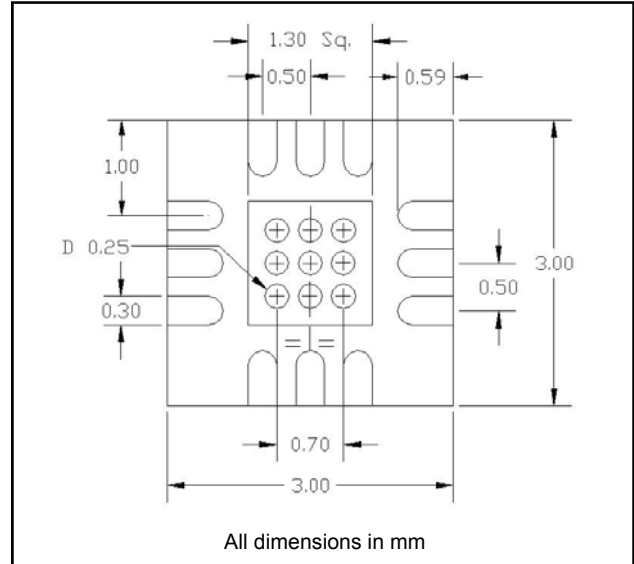


10. The exposed pad centered on the package bottom must be connected to ground for RF, DC and thermal considerations.

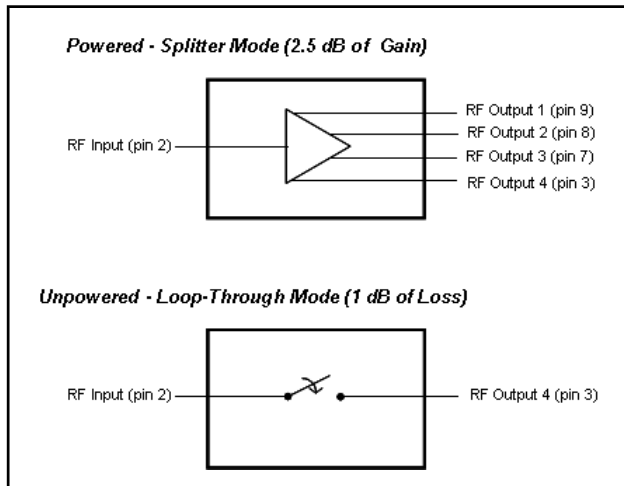
Recommended PCB



PCB Land Pattern



Block Diagram RF Signal Flow



Off-Chip Component Values

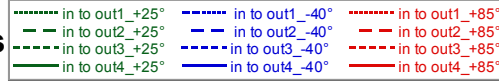
| Component | Value | Package |
|------------------|---------------|---------|
| C1 - C11 | 0.01 μ F | 0402 |
| C12 | 1.0 pF | 0402 |
| L1 ¹¹ | 1 μ H | 1210 |
| L2 - L6 | 7.5 nH | 0402 |
| R1, R2 | 300 Ω | 0402 |
| R3 - R5 | 180 Ω | 0402 |
| R6 | 250 Ω | 0402 |
| R7, R8 | 22 K Ω | 0402 |

11. L1 supplied from EPCOS, part number B82422A1102K100

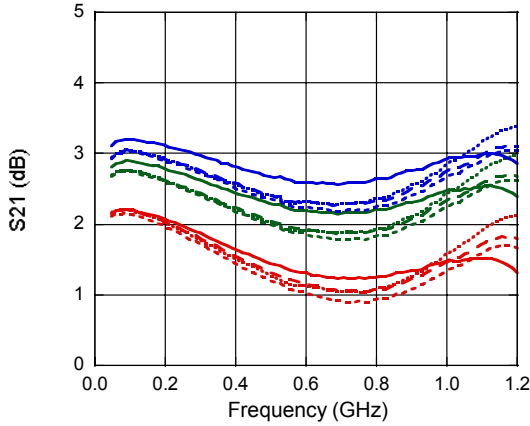
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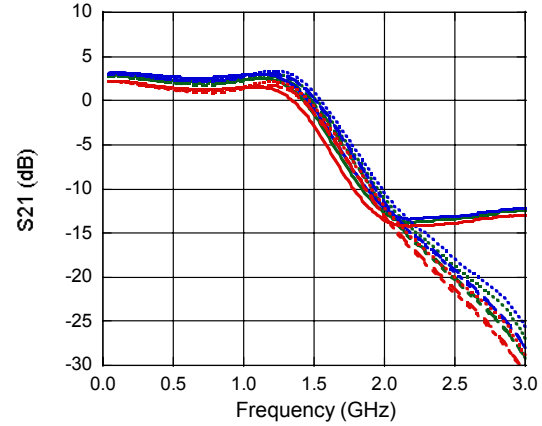
Typical Performance Curves



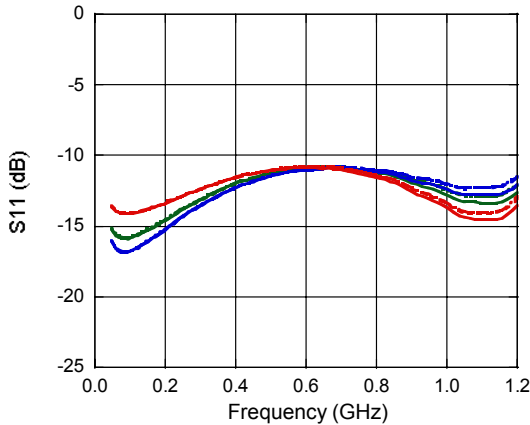
Gain



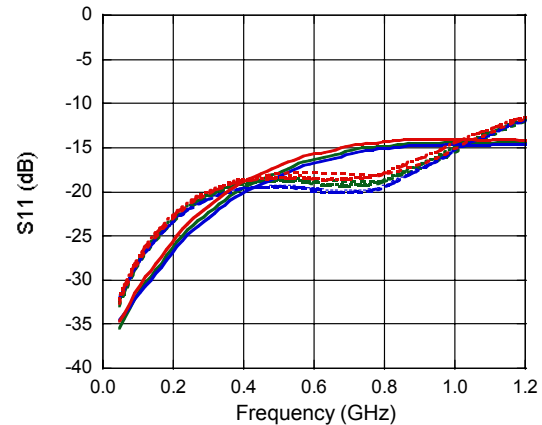
Gain



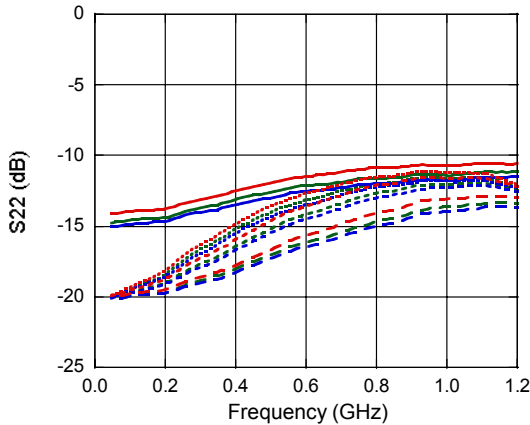
Input Return Loss (power on)



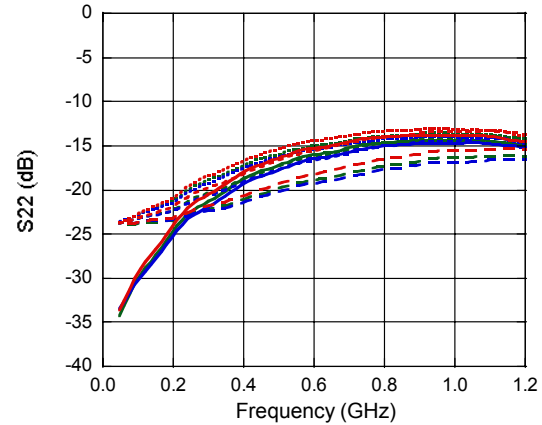
Input Return Loss (power off)



Output Return Loss (power on)



Output Return Loss (power off)



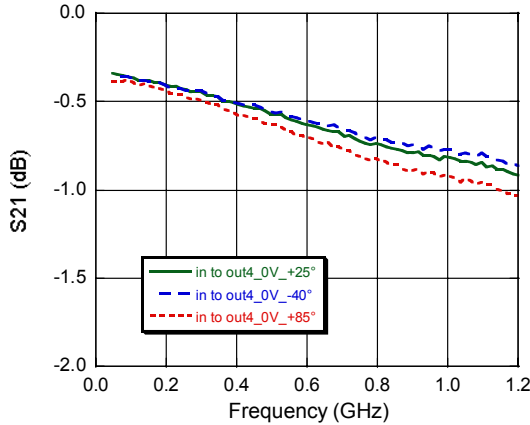
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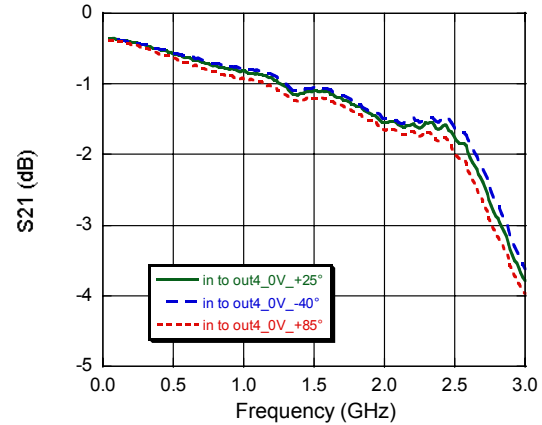
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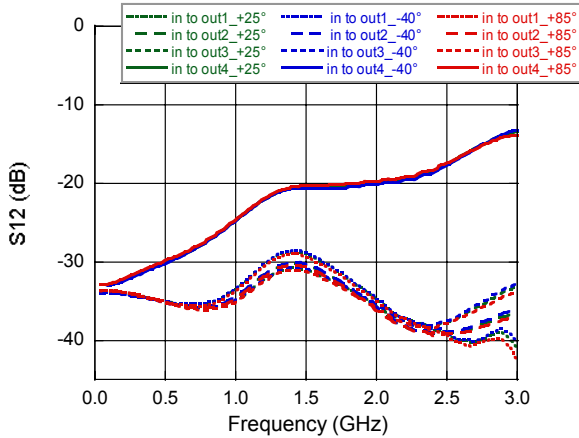
Insertion Loss to 1 GHz (power off)



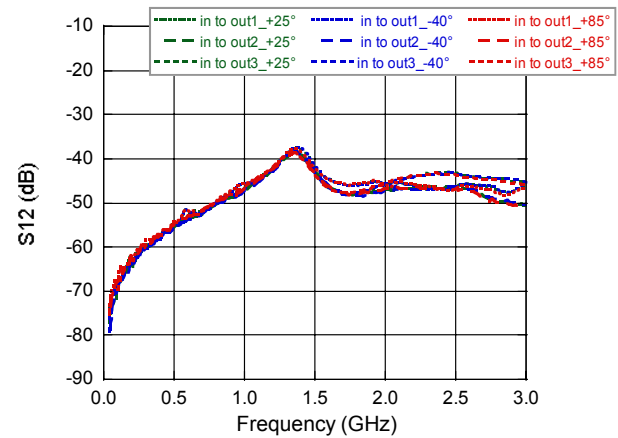
Insertion Loss to 3 GHz (power off)



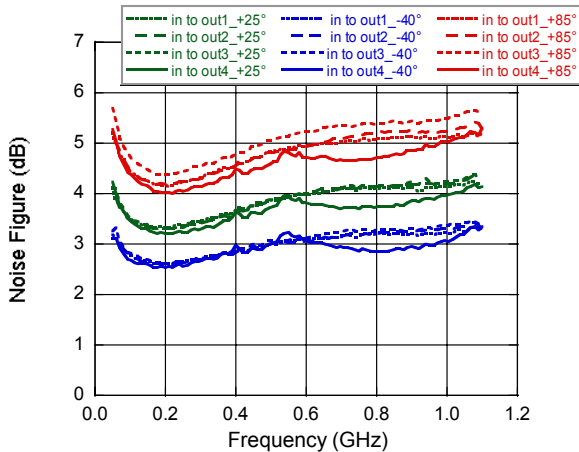
Reverse Isolation to 3 GHz (power on)



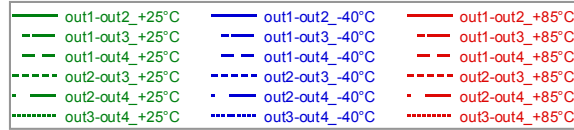
Reverse Isolation to 3 GHz (power off)



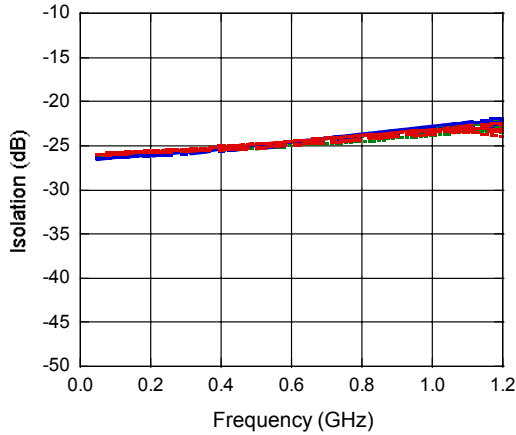
Noise Figure



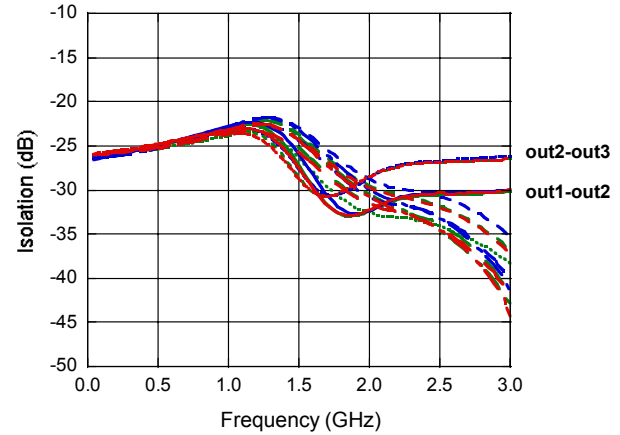
Typical Performance Curves



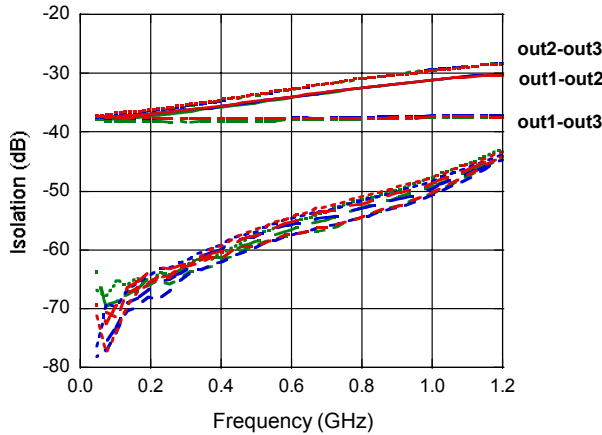
Out to Out Isolation to 1 GHz (power on)



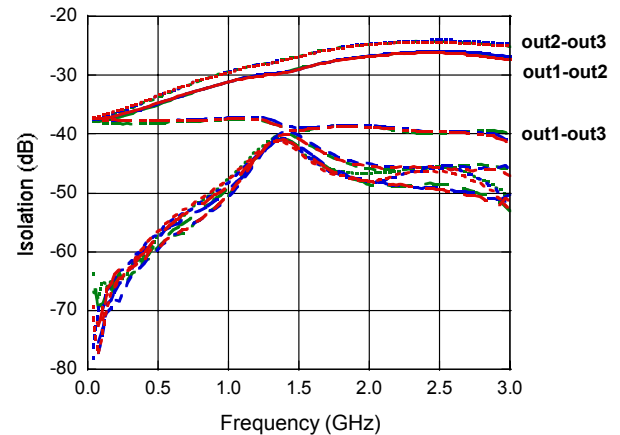
Out to Out Isolation to 3 GHz (power on)



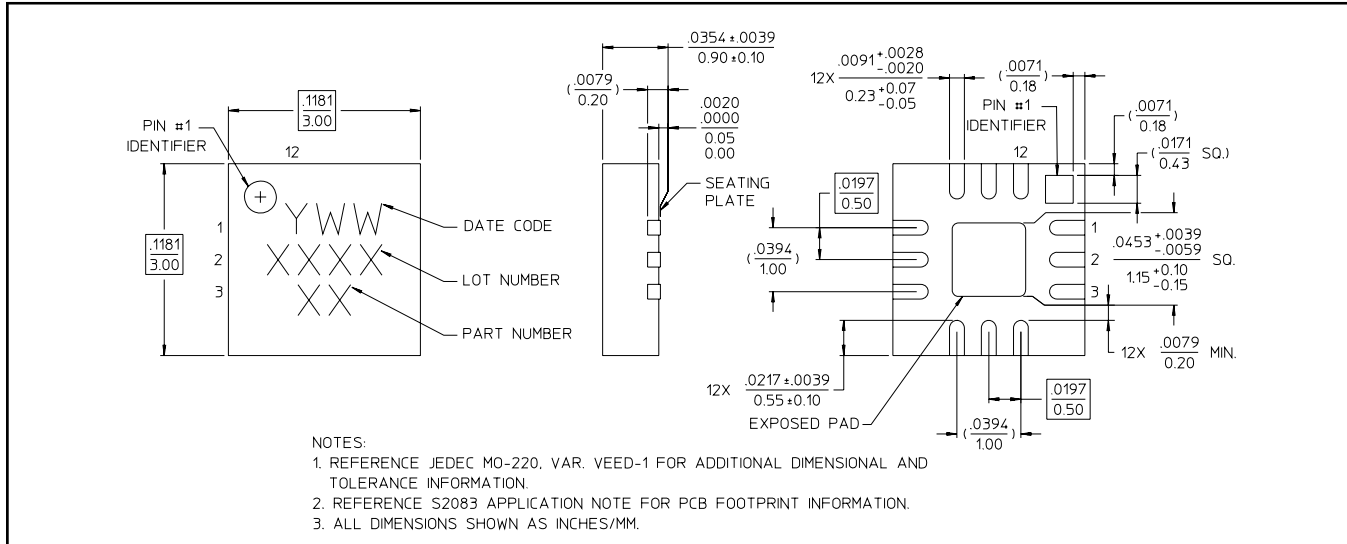
Out to Out Isolation to 1 GHz (power off)



Out to Out Isolation to 3 GHz (power off)



Lead-Free 3 mm 12-Lead PQFN[†]



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

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. An external protection circuit using an anti-parallel diode pair can be used to protect the IC.

Please reference application note AN3028 on <http://www.macomtech.com> for further detail.