

Broadband CATV 3-Way Active Splitter with default loop-thru Switch 50 - 1100 MHz

Rev. V1

Features

- Always ON loop-thru path
- 3-Way Splitter
- 3.0 dB Gain
- +15 dBmV /Channel Input
- 3.8 dB Noise Figure
- Single 5 Volt Supply
- Lead-Free 3 mm 12-Lead PQFN Package
- RoHS* Compliant and 260°C Reflow Compatible

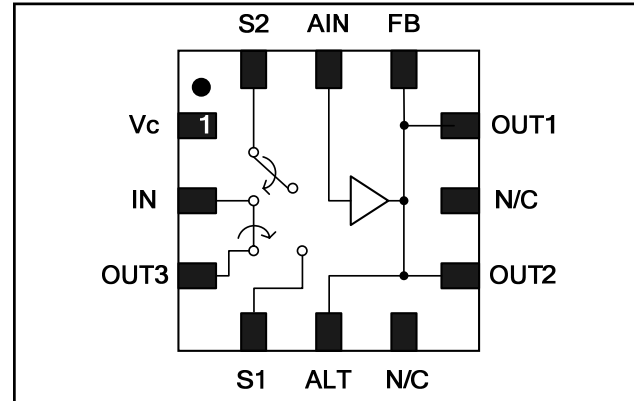
Description

The MAAM-009450 CATV 3-way active splitter with the default loop-thru path is a GaAs MMIC which exhibits low noise figure and distortion in a lead-free 3mm 12-lead PQFN plastic package. The design features 75 Ω inputs and outputs.

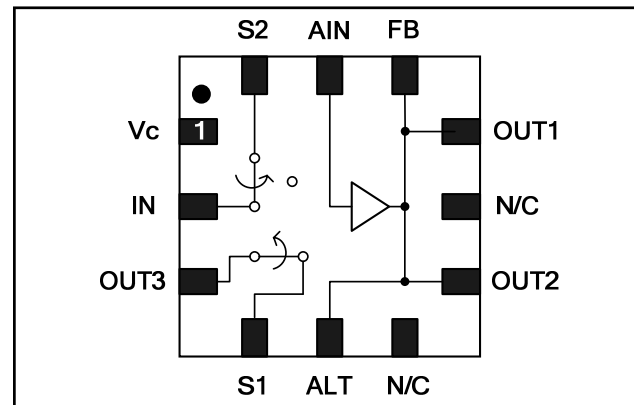
The MAAM-009450 is ideally suited for multi-tuner set top boxes, home gateways, and other broadband internet based applications.

The MAAM-009450 is fabricated using M/A-COM Technology's E/D pHEMT process to realize default loop-thru 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



Pin Configuration³

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

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

Ordering Information^{1,2}

| Part Number | Package |
|--------------------|-------------------|
| MAAM-009450-TR1000 | 1000 piece reel |
| MAAM-009450-TR3000 | 3000 piece reel |
| MAAM-009450-001SMB | Sample Test 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.

ADVANCED: Data Sheets contain information regarding a product M/A-COM Technology Solutions is considering for development. Performance is based on target specifications, simulated results, and/or prototype measurements. Commitment to develop is not guaranteed.

PRELIMINARY: Data Sheets contain information regarding a product M/A-COM Technology Solutions has under development. Performance is based on engineering tests. Specifications are typical. Mechanical outline has been fixed. Engineering samples and/or test data may be available. Commitment to produce in volume is not guaranteed.

• **North America** Tel: 800.366.2266 • **Europe** Tel: +353.21.244.6400
• **India** Tel: +91.80.43537383 • **China** Tel: +86.21.2407.1588
Visit www.macomtech.com for additional data sheets and product information.

M/A-COM Technology Solutions Inc. and its affiliates reserve the right to make changes to the product(s) or information contained herein without notice.

Broadband CATV 3-Way Active Splitter with default loop-thru Switch 50 - 1100 MHz

Rev. V1

Electrical Specifications: Freq. = 1000 MHz, T_A = 25°C, Z₀ = 75 Ω⁴

| Parameter | Test Conditions | V _{DD} | V _C | Units | Min. | Typ. | Max. |
|----------------------|---|-----------------|----------------|-------|------|------|------|
| Gain | IN to Out1, Out2 or Out3 | 5 | 3.3 | dB | 2.0 | 3.0 | 4.5 |
| Insertion Loss | IN to Out3 | 0 | 0 | dB | - | 0.75 | 1.0 |
| Noise Figure | IN to Out1, Out2 or Out3 | 5 | 3.3 | dB | - | 3.8 | - |
| Gain Flatness | IN to Out1, Out2 or Out3 | 5 | 3.3 | dB | - | 1.0 | - |
| Input Return Loss | Input | 5 | 3.3 | dB | - | 12.5 | - |
| Input Return Loss | Input | 0 | 0 | dB | - | 12.5 | - |
| Output Return Loss | Output | 5 | 3.3 | dB | - | 10 | - |
| Output Return Loss | Output | 0 | 0 | dB | - | 10 | - |
| Out to Out Isolation | Out1 to Out2 or Out3 | 5 | 3.3 | dB | - | 23 | - |
| Out to Out Isolation | Out1 to Out2 or Out3 | 0 | 0 | dB | - | 35 | - |
| CTB | 132 Ch, +15 dBmV/Ch at the Input | 5 | 3.3 | dBc | - | -65 | - |
| CSO | 132 Ch, +15 dBmV/Ch at the Input | 5 | 3.3 | dBc | - | -65 | - |
| Reverse Isolation | Out1 to In, Out2 to In | 5 | 3.3 | dB | - | 31 | - |
| Reverse Isolation | Out3 to In | 5 | 3.3 | dB | - | 23 | - |
| Reverse Isolation | Out1 to In, Out2 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 | - | 20 | - |
| P1dB | 500 MHz | 5 | 3.3 | dBm | - | 7 | - |
| P1dB | 500 MHz | 5 | 0 | dBm | - | 25 | - |
| I _{DD} | | 5 | 3.3 | mA | - | 100 | 120 |
| I _C | | 5 | 3.3 | μA | - | 205 | 250 |

4. The unpowered state is the same as V_{control} = 0V

Broadband CATV 3-Way Active Splitter with default loop-thru Switch 50 - 1100 MHz

Rev. V1

Absolute Maximum Ratings^{5,6,7}

| Parameter | Absolute Maximum |
|-----------------------------------|------------------|
| Max Input Power | +5 dBm |
| V _{DD} | +10.0 V |
| V _{CONTROL} | +8.5 V |
| Operating Temperature | -40°C to +85°C |
| Junction Temperature ⁸ | +150°C |
| Storage Temperature | -65°C to +150°C |

- Exceeding any one or combination of these limits may cause permanent damage to this device.
- M/A-COM Technology does not recommend sustained operation near these survivability limits.
- These operating conditions will ensure MTTF > 1 x 10⁶ hours.
- Junction Temperature (T_J) = T_A + Θ_{JC} * (V * I)
Typical thermal resistance (Θ_{JC}) = 73 °C/W.
 - For T_A = 25°C,
T_J = 76 °C @ 5.0 V, 140 mA
 - For T_A = 85°C,
T_J = 132 °C @ 5.0 V, 130 mA

Truth Table⁹

| V _{DD} | V _{CONTROL} | IN - OUT1 | IN - OUT2 | IN - OUT3 |
|-----------------|----------------------|-----------|-----------|-----------|
| 1 | 1 | On | On | On |
| 0 | 0 | Off | Off | On |

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

Handling Procedures

Please observe the following precautions to avoid damage:

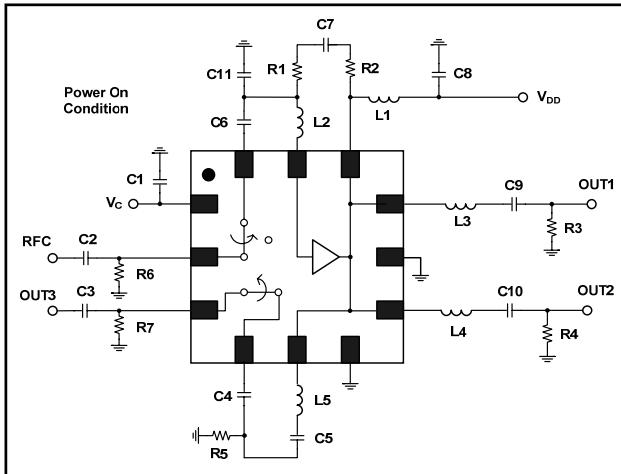
Static Sensitivity

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 inexpensive anti-parallel diode pair can be used to protect the IC.

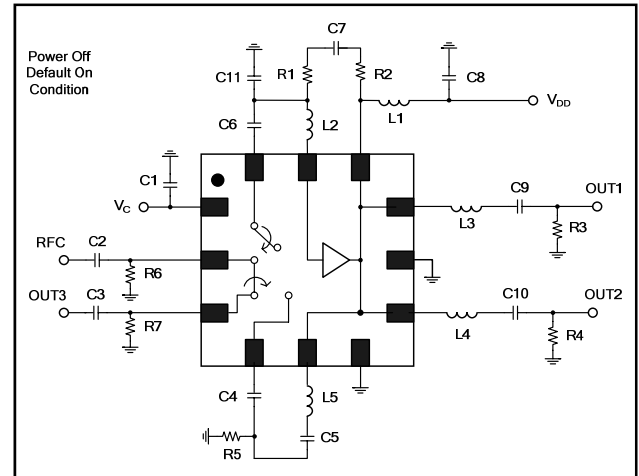
Please reference application note AN3028 on <http://www.macomtech.com> for further detail.

Schematics Including Off-Chip Components¹⁰

Power On Condition

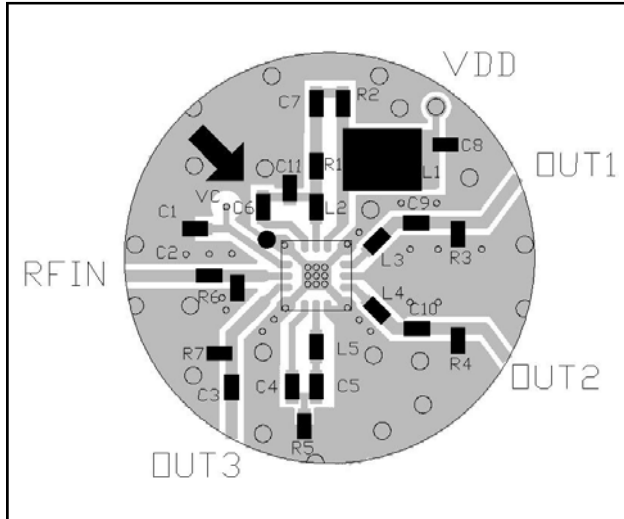


Power Off, Default on Condition

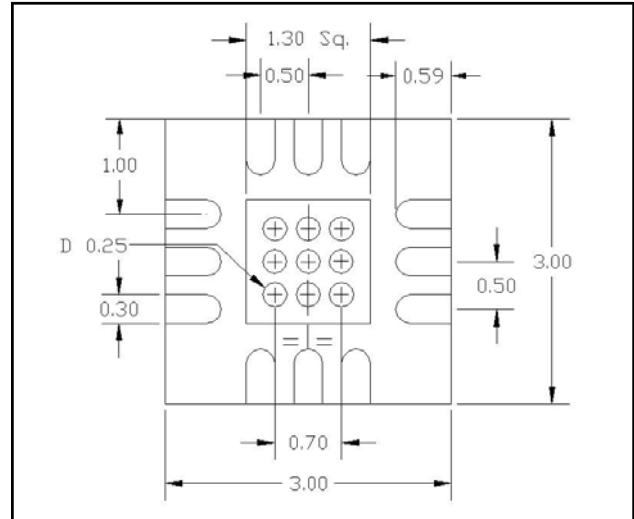


10. The exposed pad centered on the package bottom must be connected to ground for RF, DC and thermal considerations.

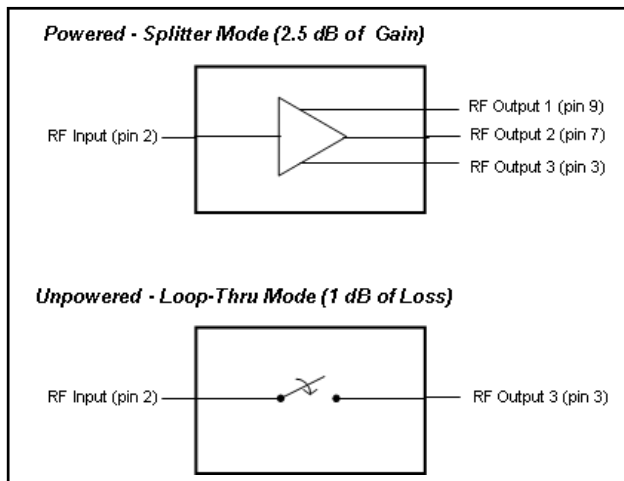
Recommended PCB



PCB Land Pattern



Block Diagram RF Signal Flow



Off-Chip Component Values

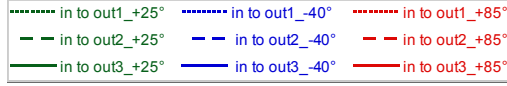
| Component | Value | Package |
|------------------|--------------|---------|
| C1 - C10 | 0.01 μ F | 0402 |
| C11 | 1.0 pF | 0402 |
| L1 ¹¹ | 1 μ H | 1210 |
| L2 - L5 | 7.5 nH | 0402 |
| R1, R2 | 300 Ω | 0402 |
| R3, R4 | 180 Ω | 0402 |
| R5 | 250 Ω | 0402 |
| R6, R7 | 22K Ω | 0402 |

11. L1 supplied from EPCOS, part number B82422A1102K100

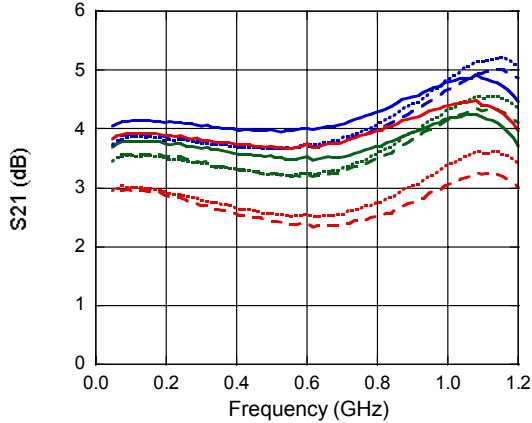
Broadband CATV 3-Way Active Splitter with default loop-thru Switch 50 - 1100 MHz

Rev. V1

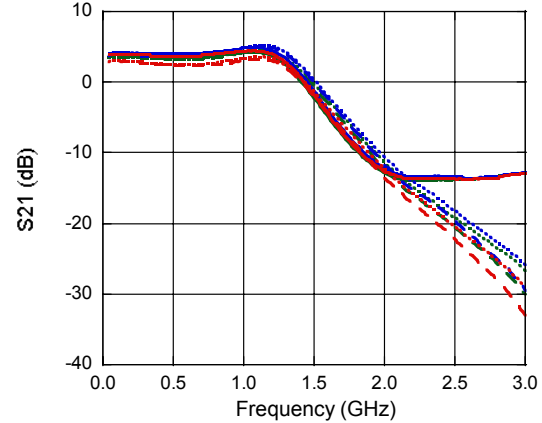
Typical Performance Curves



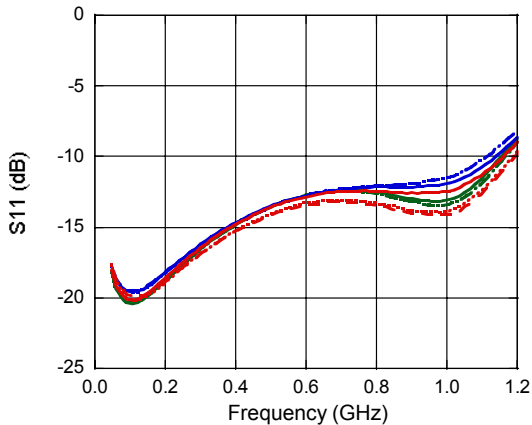
Gain



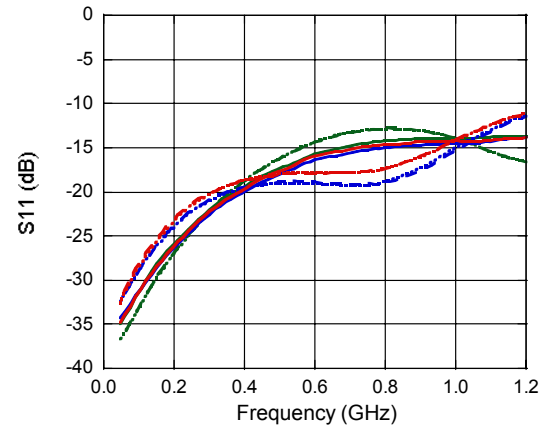
Gain



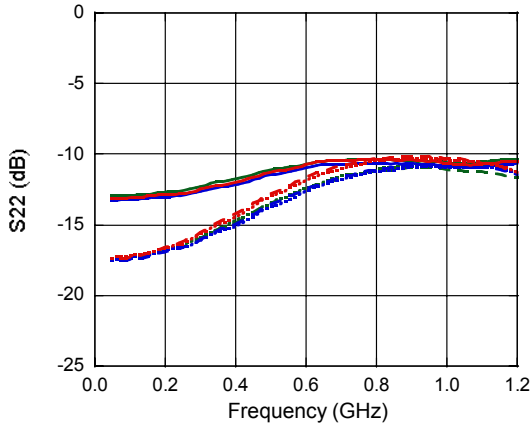
Input Return Loss (power on)



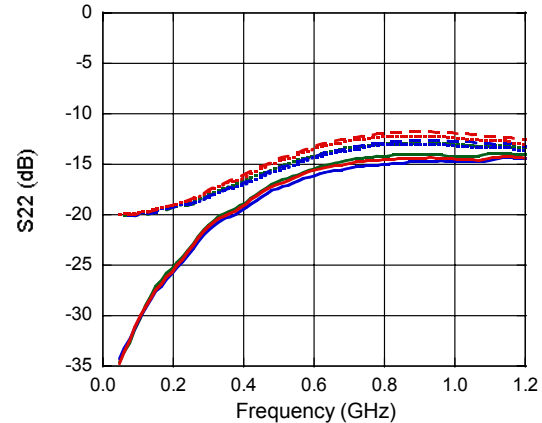
Input Return Loss (power off)



Output Return Loss (power on)



Output Return Loss (power off)



5

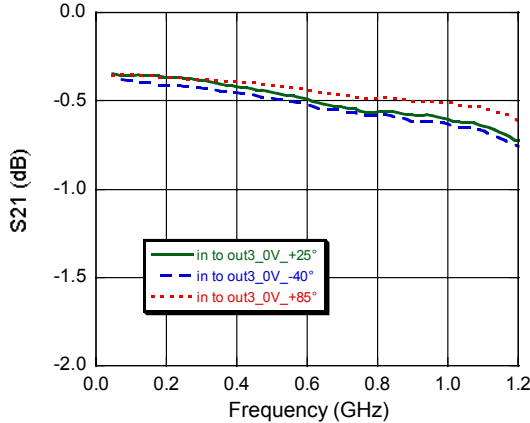
ADVANCED: Data Sheets contain information regarding a product M/A-COM Technology Solutions is considering for development. Performance is based on target specifications, simulated results, and/or prototype measurements. Commitment to develop is not guaranteed.
PRELIMINARY: Data Sheets contain information regarding a product M/A-COM Technology Solutions has under development. Performance is based on engineering tests. Specifications are typical. Mechanical outline has been fixed. Engineering samples and/or test data may be available. Commitment to produce in volume is not guaranteed.

• **North America** Tel: 800.366.2266 • **Europe** Tel: +353.21.244.6400
 • **India** Tel: +91.80.43537383 • **China** Tel: +86.21.2407.1588
 Visit www.macomtech.com for additional data sheets and product information.

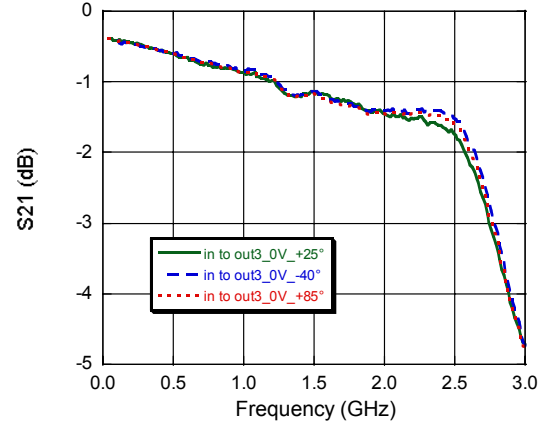
M/A-COM Technology Solutions Inc. and its affiliates reserve the right to make changes to the product(s) or information contained herein without notice.

Typical Performance Curves

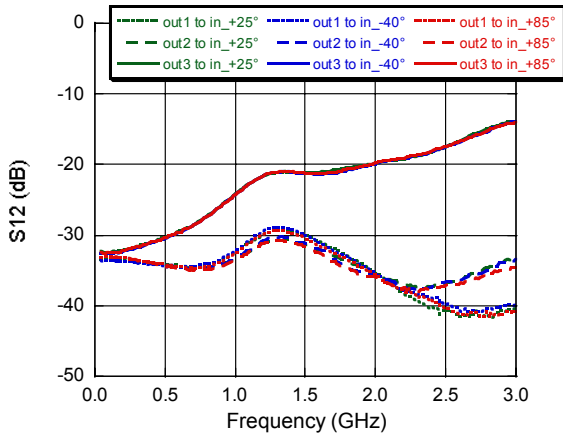
Insertion Loss to 1 GHz (power off)



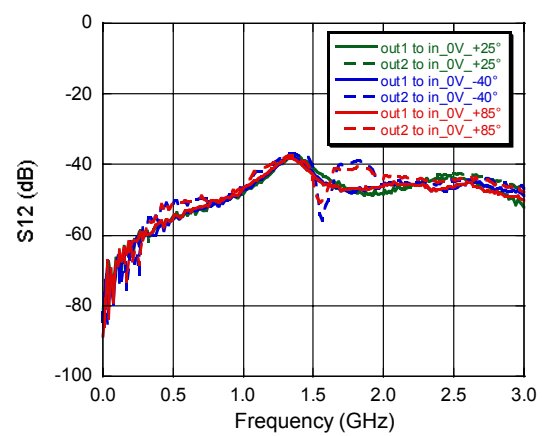
Insertion Loss to 3 GHz (power off)



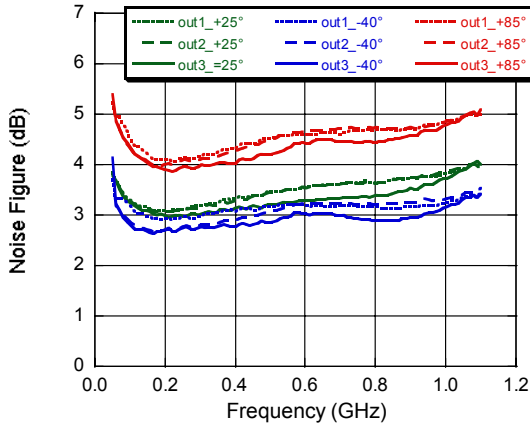
Reverse Isolation to 3 GHz (power on)



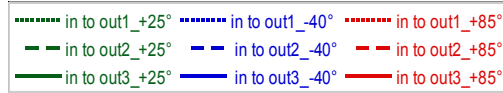
Reverse Isolation to 3 GHz (power off)



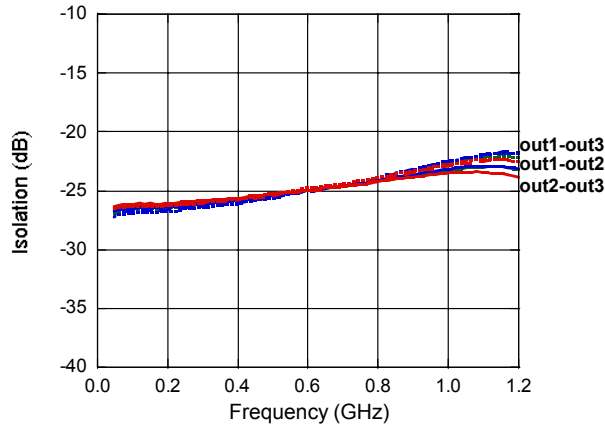
Noise Figure



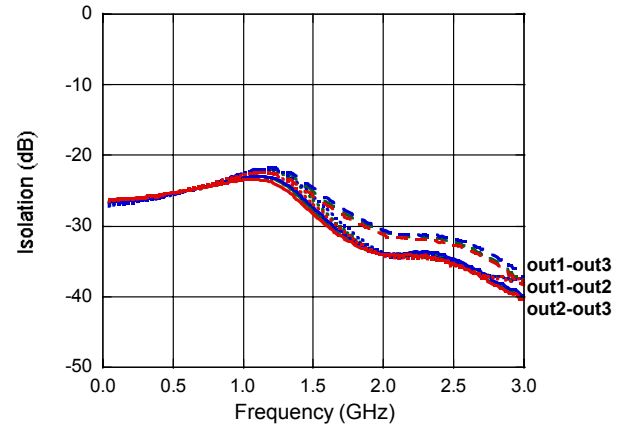
Typical Performance Curves



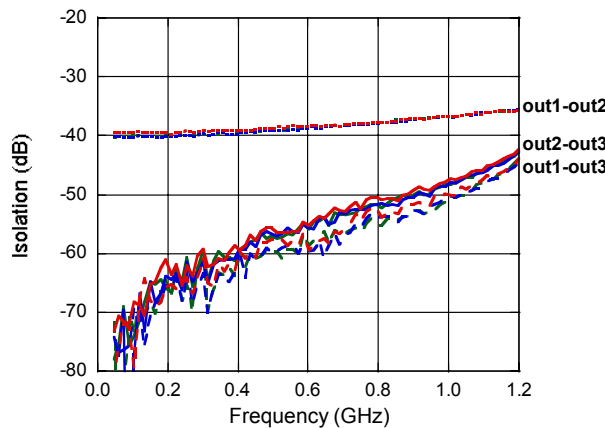
Out to Out Isolation to 1 GHz (power on)



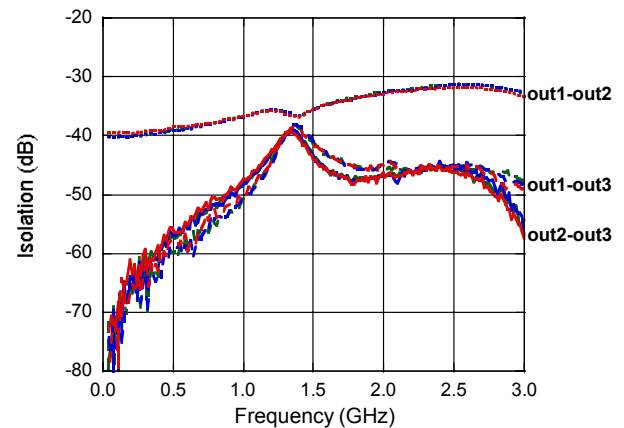
Out to Out Isolation to 3 GHz (power on)



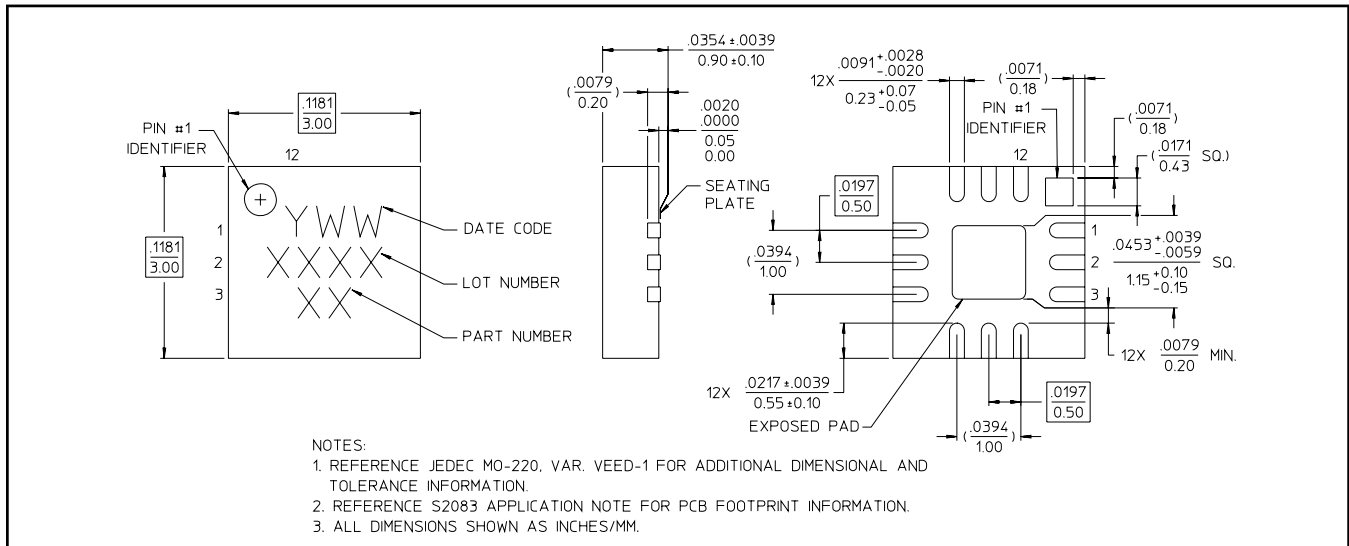
Out to Out Isolation to 1 GHz (power off)



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 plating over copper.