

Broadband CATV Single Ended 3-Way Active Splitter 50 - 1100 MHz

Rev. V2

Features

- 3-Way Splitter
- Single Ended Input and Outputs
- 4.5 dB and 6 dB Gain Configurations
- Single 5 Volt Supply
- Lead-Free 3 mm 16-Lead PQFN Package
- Halogen-Free “Green” Mold Compound
- RoHS* Compliant and 260°C Reflow Compatible

Description

The MAAM-007239 CATV 3-way active splitter is a GaAs MMIC which exhibits low noise figure and distortion in a lead-free 3 mm 16-lead PQFN plastic package. The design employs a low noise, high linearity amplifier and power splitter functionality. The design features 75 Ω inputs and outputs.

The MAAM-007239 is ideally suited for multi-tuner set top boxes, home gateways, and other broadband internet based appliances.

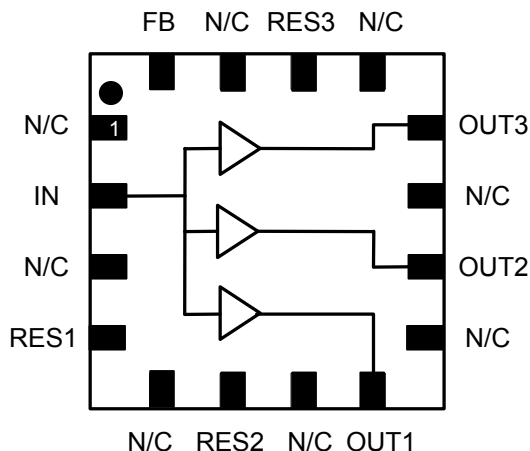
The MAAM-007239 is fabricated using a pHEMT process to realize low noise and low distortion. The process features full passivation for robust performance and reliability.

Ordering Information ^{1,2}

| Part Number | Package |
|--------------------|------------------------------|
| MAAM-007239-TR1000 | 1000 piece reel |
| MAAM-007239-TR3000 | 3000 piece reel |
| MAAM-007239-001SMB | High Isolation Configuration |
| MAAM-007239-002SMB | Low Current Configuration |

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

Functional Schematic



Pin Configuration

| Pin No. | Pin Name | Description |
|---------|---------------------|------------------|
| 1 | N/C | No Connection |
| 2 | IN | RF Input |
| 3 | N/C | No Connection |
| 4 | RES1 | Resistor 1 |
| 5 | N/C | No Connection |
| 6 | RES2 | Resistor 2 |
| 7 | N/C | No Connection |
| 8 | OUT1 | RF Output 1 |
| 9 | N/C | No Connection |
| 10 | OUT2 | RF Output 2 |
| 11 | N/C | No Connection |
| 12 | OUT3 | RF Output 3 |
| 13 | N/C | No Connection |
| 14 | RES3 | Resistor 3 |
| 15 | N/C | No Connection |
| 16 | FB | Feedback |
| 17 | Paddle ³ | RF and DC Ground |

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

¹ * Restrictions on Hazardous Substances, European Union Directive 2011/65/EU.

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Low Current Configuration

Electrical Specifications: $F = 50 - 1000 \text{ MHz}$, $T_A = 25^\circ \text{ C}$, $V_{DD} = 5 \text{ Volts}$, $Z_0 = 75 \Omega$

| Parameter | Test Conditions | Units | Min. | Typ. | Max. |
|-----------------------------|---|-------|------|------|------|
| Gain | IN to OUT1, IN to OUT2, IN to OUT3 | dB | 5.0 | 6.0 | 7.0 |
| Gain Flatness | IN to OUT1, IN to OUT2, IN to OUT3 | dB | - | 1.0 | 1.8 |
| Noise Figure | IN to OUT1, IN to OUT2, IN to OUT3 | dB | - | 4.5 | 5.0 |
| Input Return Loss | IN | dB | - | 15 | - |
| Output Return Loss | OUT1, OUT2, OUT3 | dB | - | 20 | - |
| Composite Triple Beat, CTB | 132 channels, +15 dBmV/channel at the input | dBc | - | -77 | -70 |
| Composite Second Order, CSO | 132 channels, +15 dBmV/channel at the input | dBc | - | -65 | -56 |
| Crossmodulation, XMOD | 132 channels, +15 dBmV/channel at the input | dBc | - | -65 | - |
| Reverse Isolation | OUT1 to IN, OUT2 to IN, OUT3 to IN | dB | - | 23 | - |
| Output to Output Isolation | OUT1 to OUT2 or OUT3 | dB | - | 22 | - |
| P1dB | 400 MHz | dBm | - | 17 | - |
| OIP3 | 50 MHz / 1 GHz Two Tones at 6 MHz Spacing, $P_{IN} = -10 \text{ dBm}$ per Tone | dBm | - | 23 | - |
| OIP2 | 50 MHz / 1 GHz Two Tones at 6 MHz Spacing, $P_{IN} = -10 \text{ dBm}$ per Tone | dBm | - | 48 | - |
| I_{DD} | $V_{DD} = 5 \text{ Volts}$ | mA | - | 125 | 150 |

High Isolation Configuration

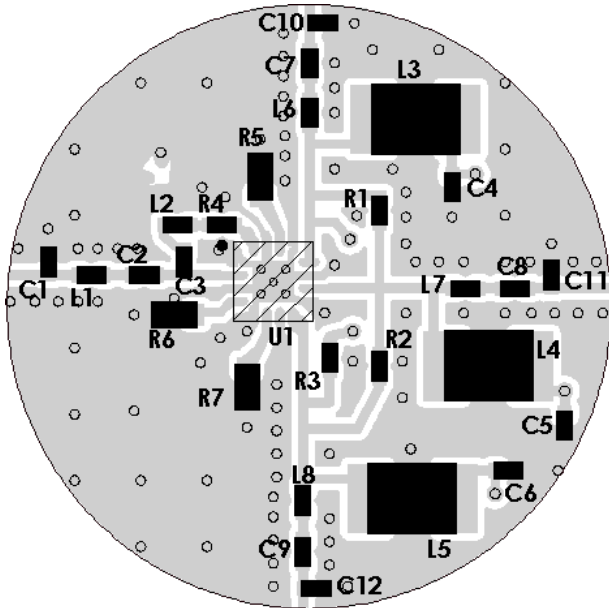
Typical Performance: $F = 50 - 1000 \text{ MHz}$, $T_A = 25^\circ \text{ C}$, $V_{DD} = 5 \text{ Volts}$, $Z_0 = 75 \Omega$

| Parameter | Test Conditions | Units | Min. | Typ. | Max. |
|-----------------------------|---|-------|------|------|------|
| Gain | IN to OUT1, IN to OUT2, IN to OUT3 | dB | - | 4.6 | - |
| Gain Flatness | IN to OUT1, IN to OUT2, IN to OUT3 | dB | - | 0.8 | - |
| Noise Figure | IN to OUT1, IN to OUT2, IN to OUT3 | dB | - | 4.5 | - |
| Input Return Loss | IN | dB | - | 17 | - |
| Output Return Loss | OUT1, OUT2, OUT3 | dB | - | 12 | - |
| Composite Triple Beat, CTB | 132 channels, +15 dBmV/channel at the input | dBc | - | -83 | - |
| Composite Second Order, CSO | 132 channels, +15 dBmV/channel at the input | dBc | - | -70 | - |
| Crossmodulation, XMOD | 132 channels, +15 dBmV/channel at the input | dBc | - | -65 | - |
| Reverse Isolation | OUT1 to IN, OUT2 to IN, OUT3 to IN | dB | - | 25 | - |
| Output to Output Isolation | OUT1 to OUT2 or OUT3 | dB | - | 32 | - |
| P1dB | 400 MHz | dBm | - | 19 | - |
| OIP3 | 50 MHz / 1 GHz Two Tones at 6 MHz Spacing, $P_{IN} = -10 \text{ dBm}$ per Tone | dBm | - | 27 | - |
| OIP2 | 50 MHz / 1 GHz Two Tones at 6 MHz Spacing, $P_{IN} = -10 \text{ dBm}$ per Tone | dBm | - | 52 | - |
| I_{DD} | $V_{DD} = 5 \text{ Volts}$ | mA | - | 210 | - |

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Recommended PCB configuration Low Current Configuration

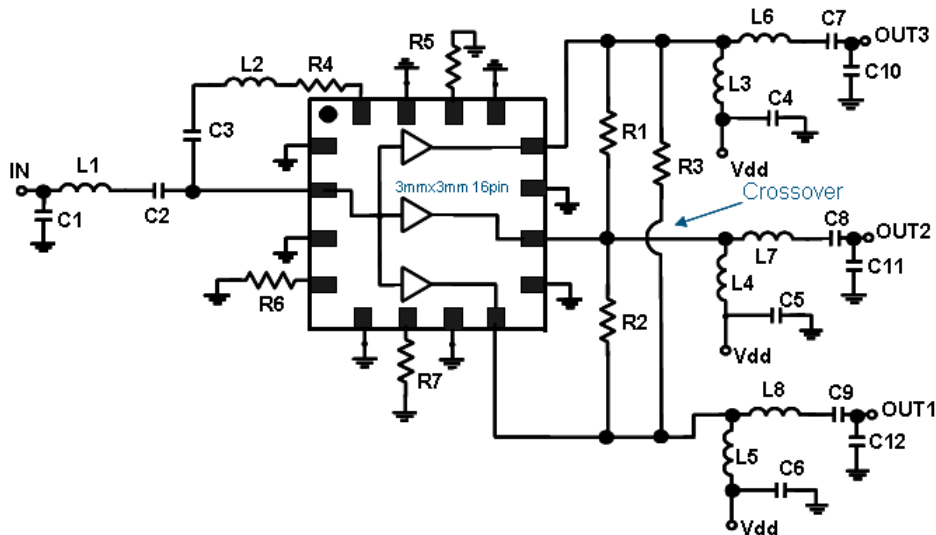


Off-Chip Component Values⁴ Low Current Configuration

| Component | Value | Package |
|-----------|--------------|---------|
| C1 | 1 pF | 0402 |
| C2 - C9 | 0.01 μ F | 0402 |
| C10 - C12 | 0.5 pF | 0402 |
| L1, L2 | 11 nH | 0402 |
| L3 - L5 | 1 μ H | 1210 |
| L6 - L8 | 12 nH | 0402 |
| R1 - R3 | 620 Ω | 0402 |
| R4 | 68 Ω | 0402 |
| R5 - R7 | 18 Ω | 0603 |

4. L3 - L5 supplied from EPCOS, part number B82422A1102K100

Schematic Including Off-Chip Components Low Current Configuration



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Absolute Maximum Ratings^{5,6,7}

| Parameter | Absolute Maximum |
|-----------------------------------|------------------|
| Input Power | 12 dBm |
| V _{BIAS} | 10 V |
| Operating Temperature | -40°C to +85°C |
| Junction Temperature ⁸ | 150°C |
| Storage Temperature | -65°C to +125°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.
- These operating conditions will ensure MTTF > 1 x 10⁶ hours.
- Junction Temperature (T_J) = T_C + (Θ_{Jc}) * (V*I)
Typical thermal resistance (Θ_{Jc}) = 42°C/W.
 - For T_C = 25°C,
(Low Current Configuration) T_J = 51°C @ 5 V, 125 mA
(High Current Configuration) T_J = 69°C @ 5 V, 210 mA
 - For T_C = 85°C,
(Low Current Configuration) T_J = 111°C @ 5 V, 125 mA
(High Current Configuration) T_J = 129°C @ 5 V, 210 mA

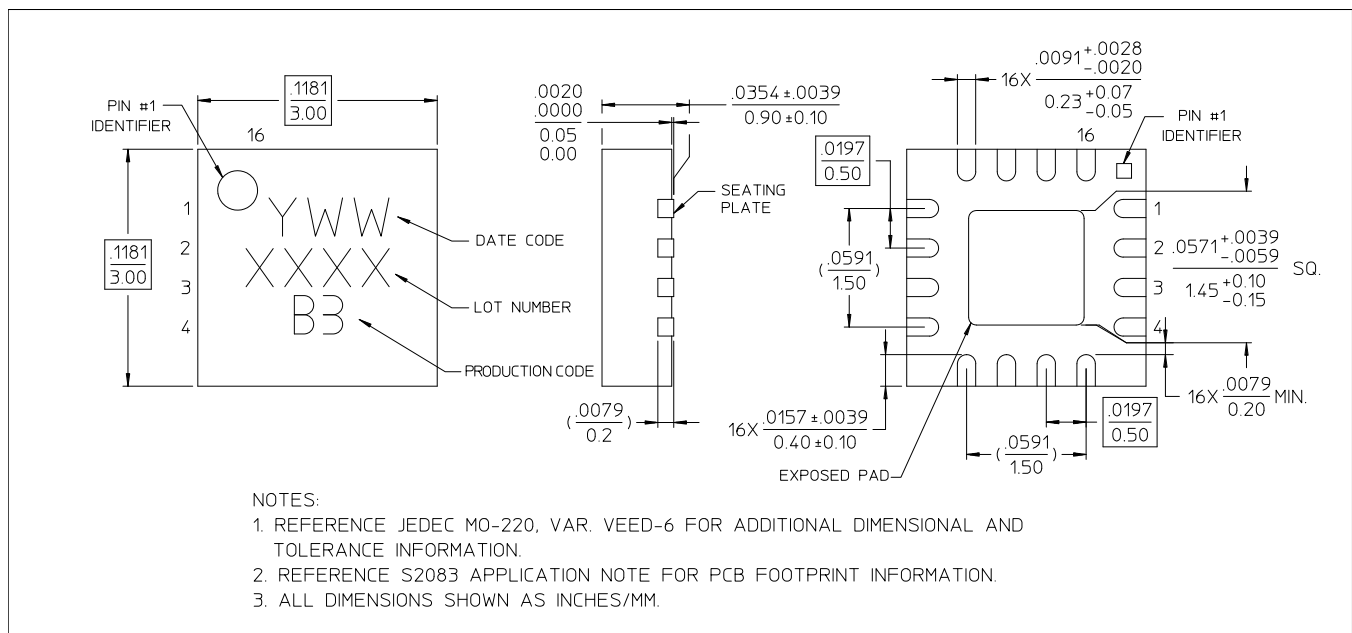
Handling Procedures

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.

Lead-Free 3 mm 16-Lead PQFN[†]



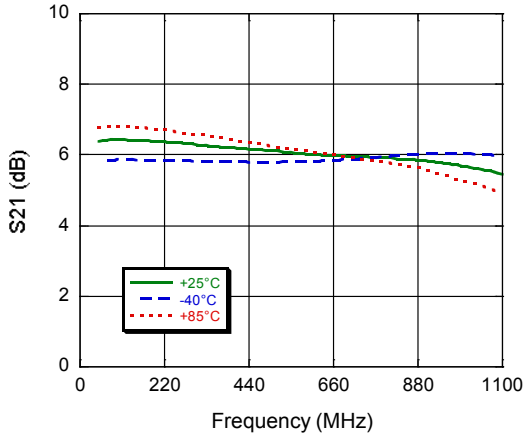
[†] Reference Application Note S2083 for lead-free solder reflow recommendations.
Meets JEDEC moisture sensitivity level 1 requirements.
Plating is 100% matte tin over copper.

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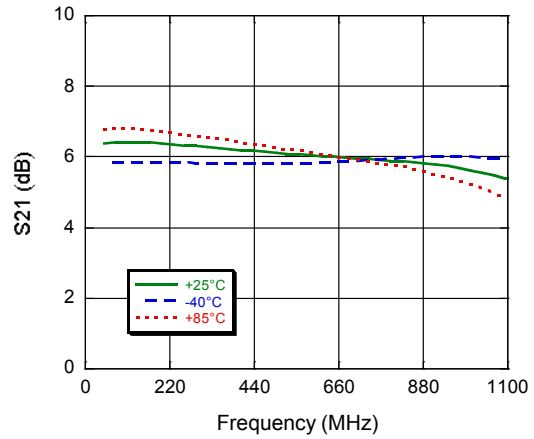
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Typical Performance Curves: Low Current Configuration

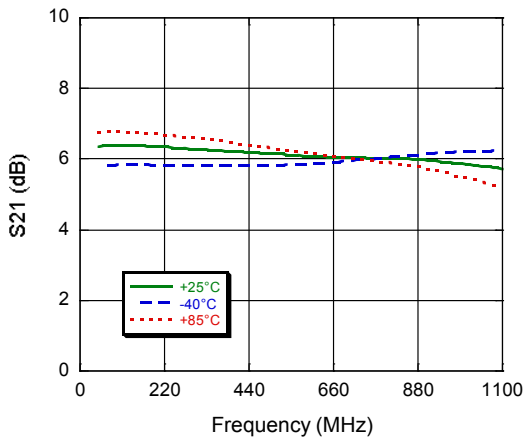
Gain - OUT1



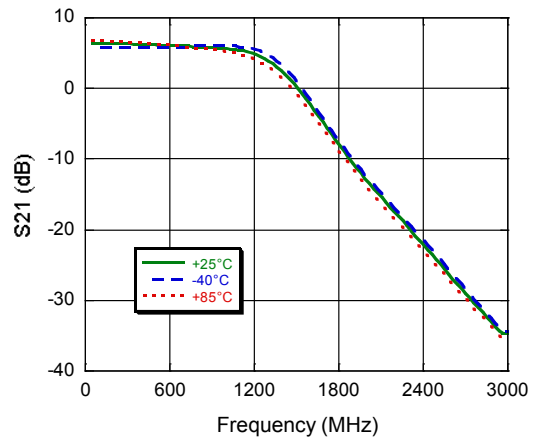
Gain - OUT2



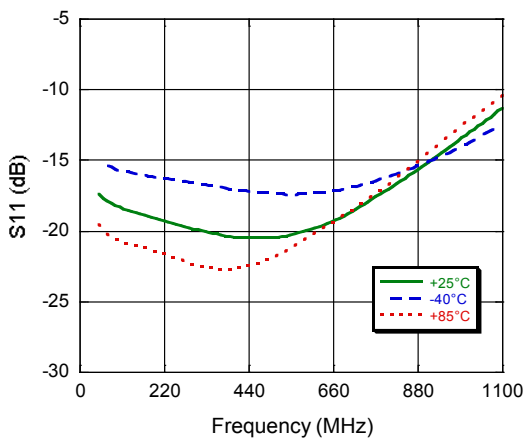
Gain - OUT3



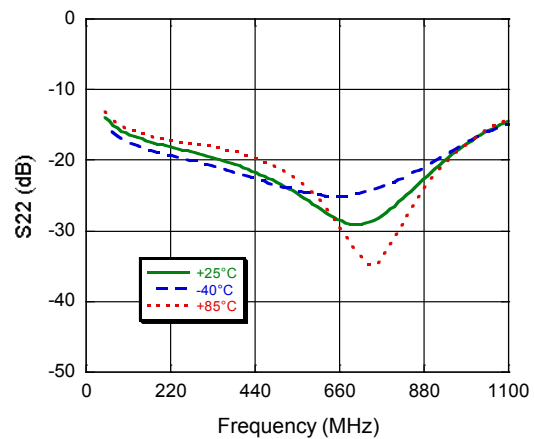
Gain - typical all ports - to 3 GHz



Input Return Loss



Out1 - Return Loss

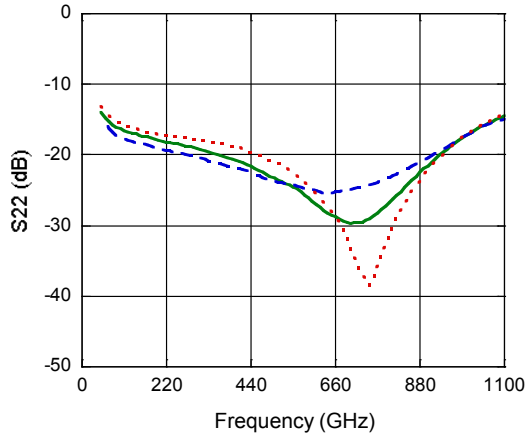


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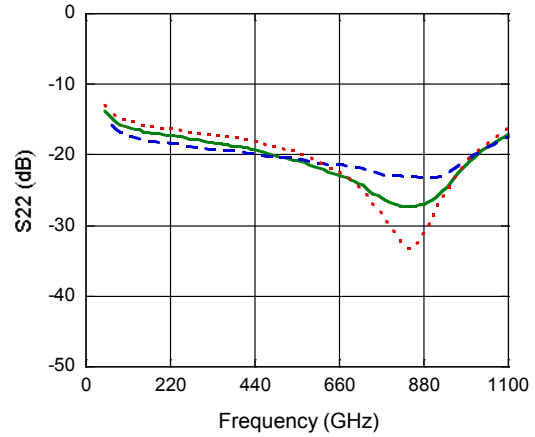
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Typical Performance Curves: Low Current Configuration

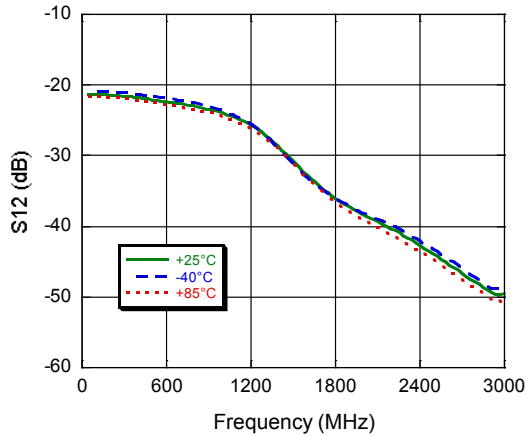
Out2 - Return Loss



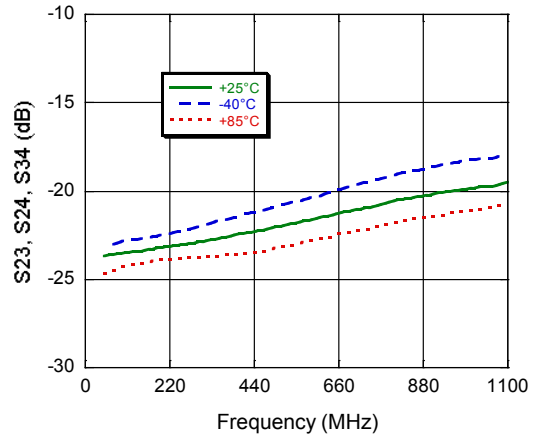
Out3 - Return Loss



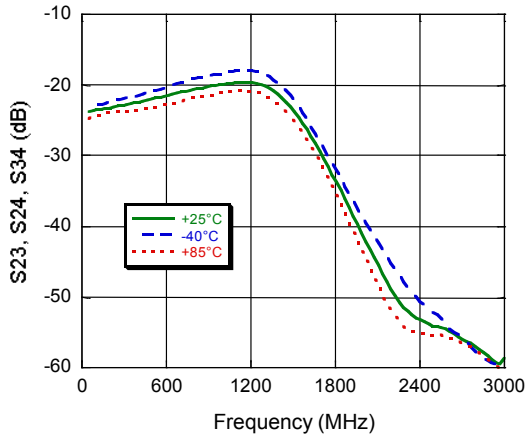
Reverse Isolation



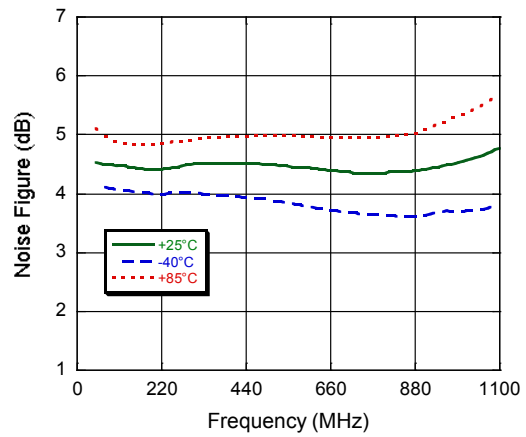
OUT - OUT Isolation - to 1 GHz



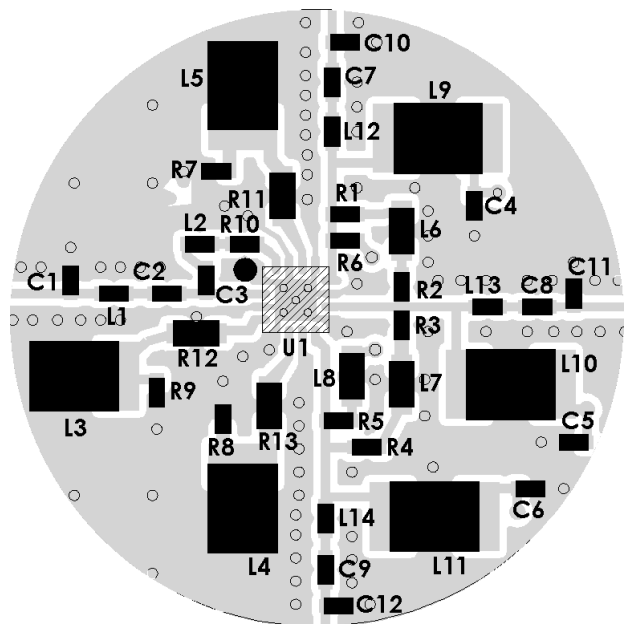
OUT - OUT Isolation - to 3 GHz



Noise Figure - Typical for all ports



Recommended PCB configuration
High Isolation Configuration

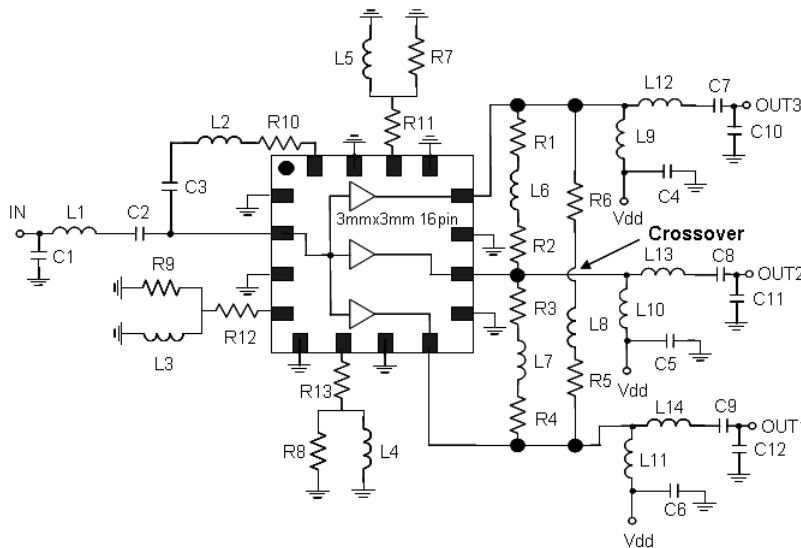


Off-Chip Component Values⁹
High Isolation Configuration

| Component | Value | Package |
|-------------------|--------------|---------|
| C1 | 1 pF | 0402 |
| C2 - C9 | 0.01 μ F | 0402 |
| C10 - C12 | 0.5 pF | 0402 |
| L1 | 11 nH | 0402 |
| L2 | 19 nH | 0402 |
| L3 - L5, L9 - L11 | 1 μ H | 1210 |
| L6 | 100 nH | 0603 |
| L7 | 110 nH | 0603 |
| L8 | 82 nH | 0603 |
| L12 - L14 | 12 nH | 0402 |
| R1 - R6 | 270 Ω | 0402 |
| R7 - R9 | 22 Ω | 0402 |
| R10 | 100 Ω | 0402 |
| R11 - R13 | 8.2 Ω | 0603 |

9. L3 - L5 and L9 - L11 supplied from EPCOS, part number B82422A1102K100.

Schematic Including Off-Chip Components
High Isolation Configuration

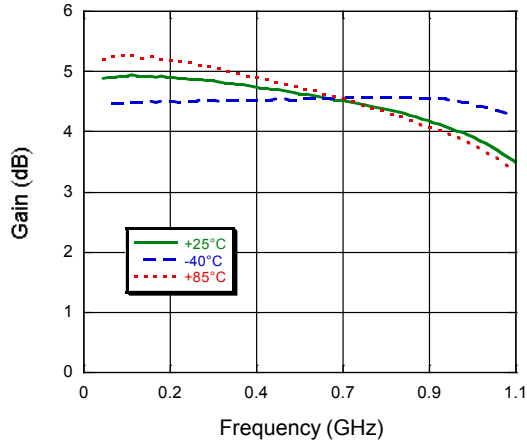


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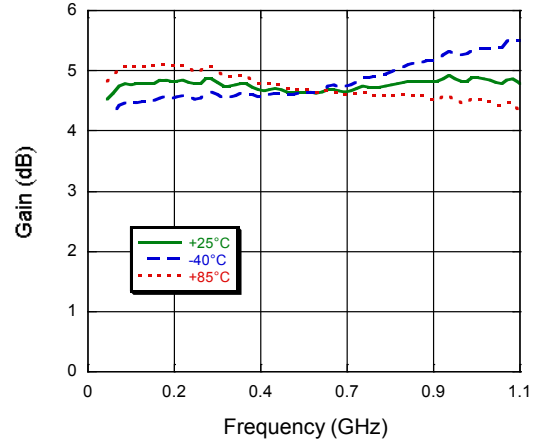
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Typical Performance Curves: High Isolation Configuration

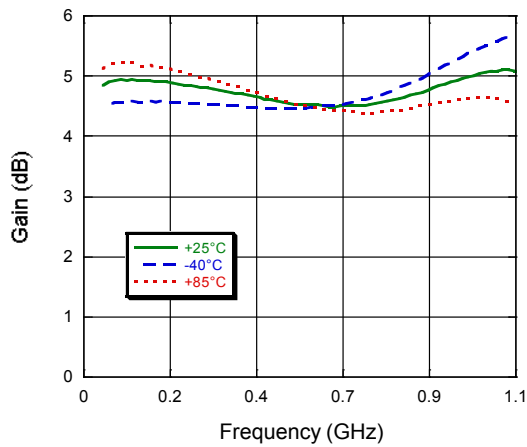
Gain - OUT1



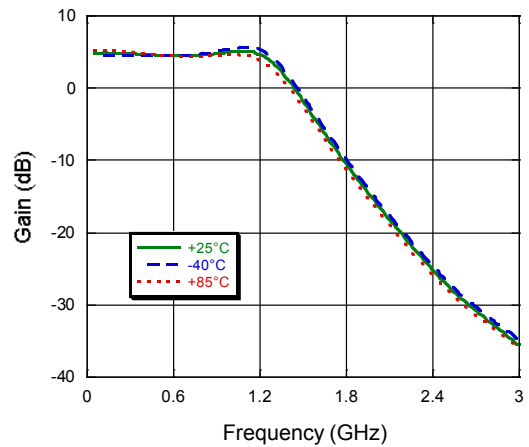
Gain - OUT2



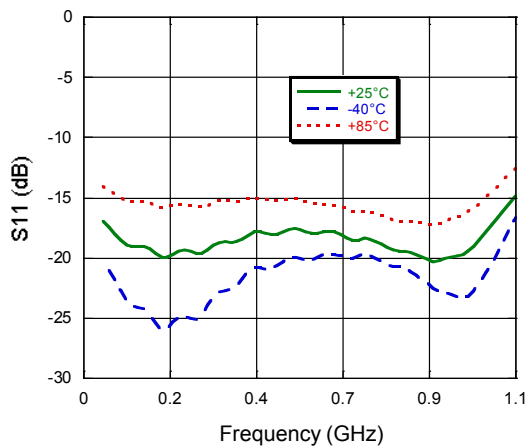
Gain - OUT3



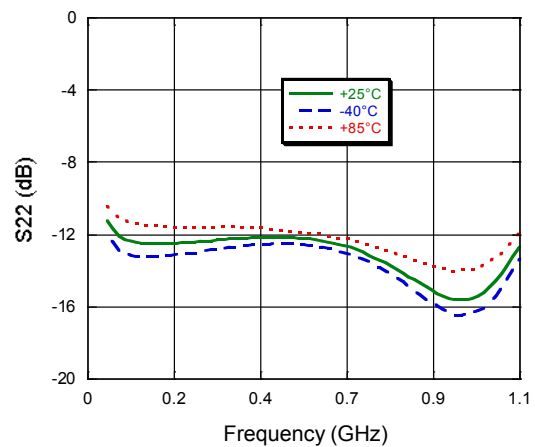
Gain - typical all ports - to 3 GHz



Input Return Loss



Out1 - Return Loss

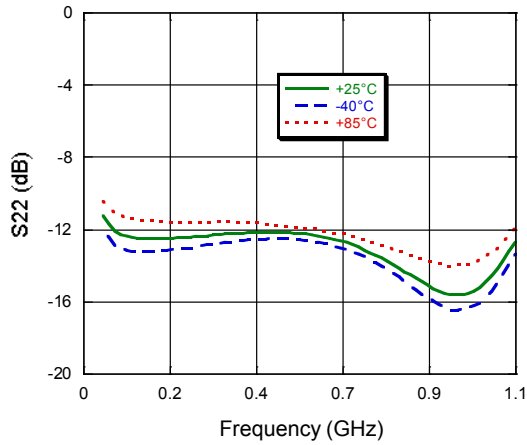


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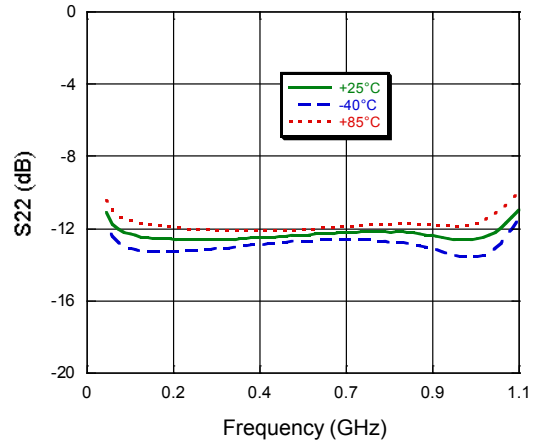
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Typical Performance Curves: High Isolation Configuration

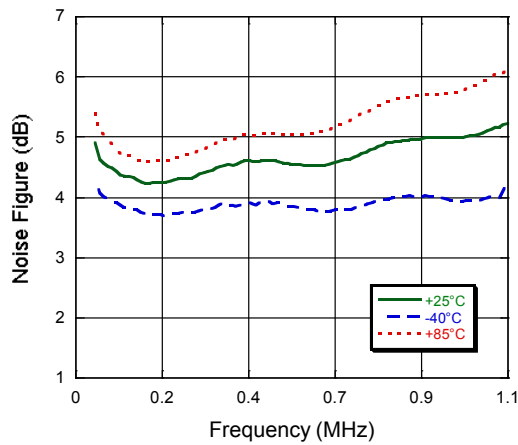
OUT2 - Return Loss



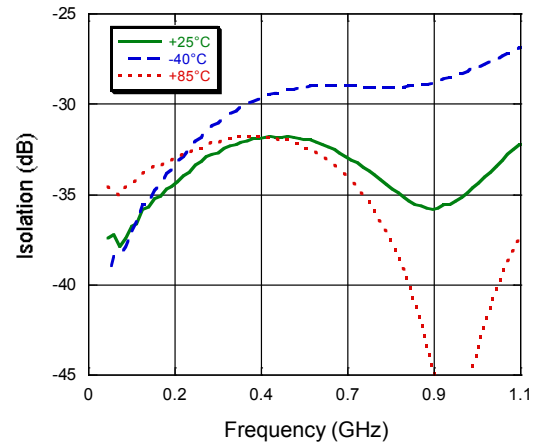
OUT3 - Return Loss



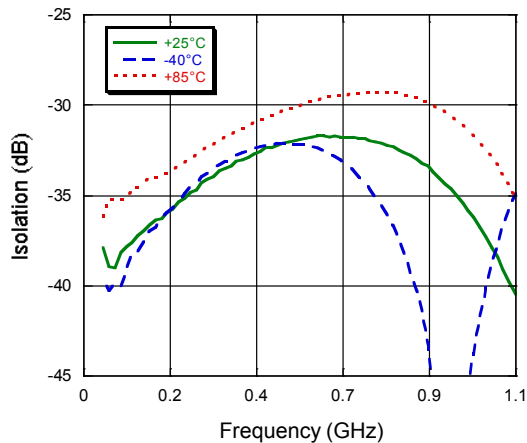
Noise Figure - Typical for all ports



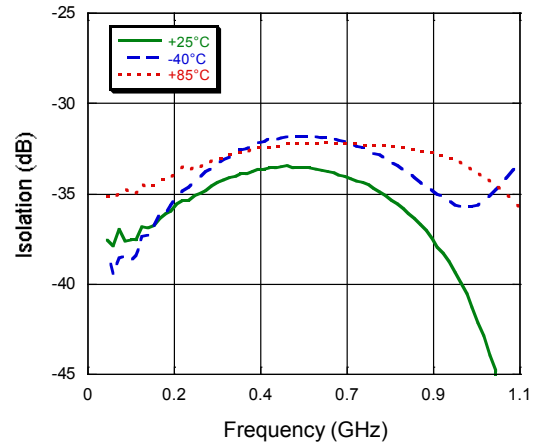
OUT1 - OUT2 Isolation



OUT1 - OUT3 Isolation



OUT2 - OUT3 Isolation



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