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## 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.

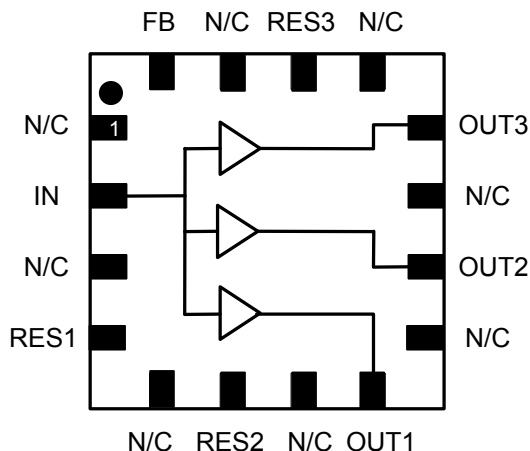
The MAAM-007239 is fabricated using a pHEMT process to realize low noise and low distortion. The process features full passivation for robust performance and reliability.

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

| 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 <sup>3</sup> | RF and DC Ground |

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

<sup>1</sup> \* Restrictions on Hazardous Substances, European Union Directive 2011/65/EU.

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

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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<br>Two Tones at 6 MHz Spacing, $P_{IN} = -10 \text{ dBm}$ per Tone | dBm   | -    | 23   | -    |
| OIP2                        | 50 MHz / 1 GHz<br>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

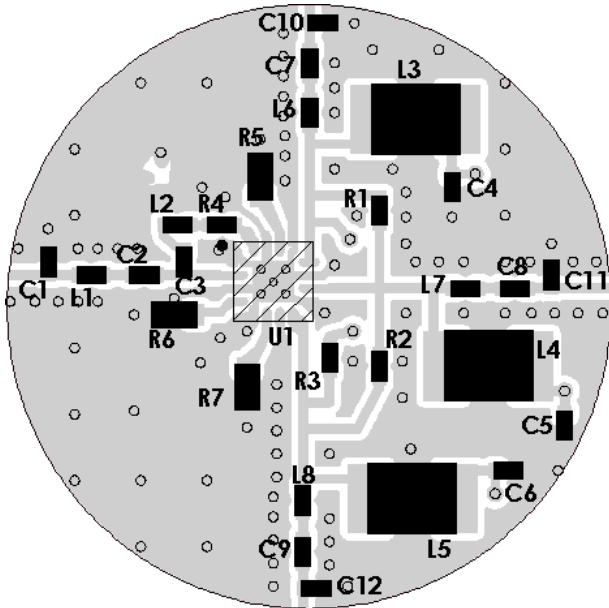
Typical Performance:  $F = 50 - 1000 \text{ MHz}$ ,  $T_A = 25^\circ \text{ C}$ ,  $V_{DD} = 5 \text{ Volts}$ ,  $Z_0 = 75 \Omega$

| 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<br>Two Tones at 6 MHz Spacing, $P_{IN} = -10 \text{ dBm}$ per Tone | dBm   | -    | 27   | -    |
| OIP2                        | 50 MHz / 1 GHz<br>Two Tones at 6 MHz Spacing, $P_{IN} = -10 \text{ dBm}$ per Tone | dBm   | -    | 52   | -    |
| $I_{DD}$                    | $V_{DD} = 5 \text{ Volts}$  | mA    | -    | 210  | -    |

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

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### Recommended PCB configuration Low Current Configuration

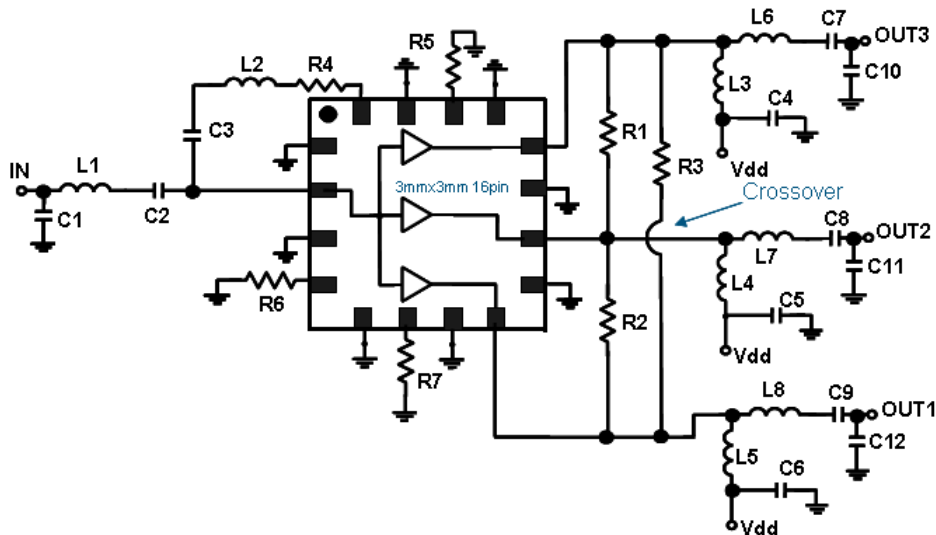


### Off-Chip Component Values<sup>4</sup> Low Current Configuration

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

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

### Schematic Including Off-Chip Components Low Current Configuration



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

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### Absolute Maximum Ratings<sup>5,6,7</sup>

| Parameter                         | Absolute Maximum |
|-----------------------------------|------------------|
| Input Power                       | 12 dBm           |
| V <sub>BIAS</sub>                 | 10 V             |
| Operating Temperature             | -40°C to +85°C   |
| Junction Temperature <sup>8</sup> | 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 10<sup>6</sup> hours.
- Junction Temperature (T<sub>J</sub>) = T<sub>C</sub> + (Θ<sub>Jc</sub>) \* (V\*I)  
Typical thermal resistance (Θ<sub>Jc</sub>) = 42°C/W.
  - For T<sub>C</sub> = 25°C,  
(Low Current Configuration) T<sub>J</sub> = 51°C @ 5 V, 125 mA  
(High Current Configuration) T<sub>J</sub> = 69°C @ 5 V, 210 mA
  - For T<sub>C</sub> = 85°C,  
(Low Current Configuration) T<sub>J</sub> = 111°C @ 5 V, 125 mA  
(High Current Configuration) T<sub>J</sub> = 129°C @ 5 V, 210 mA

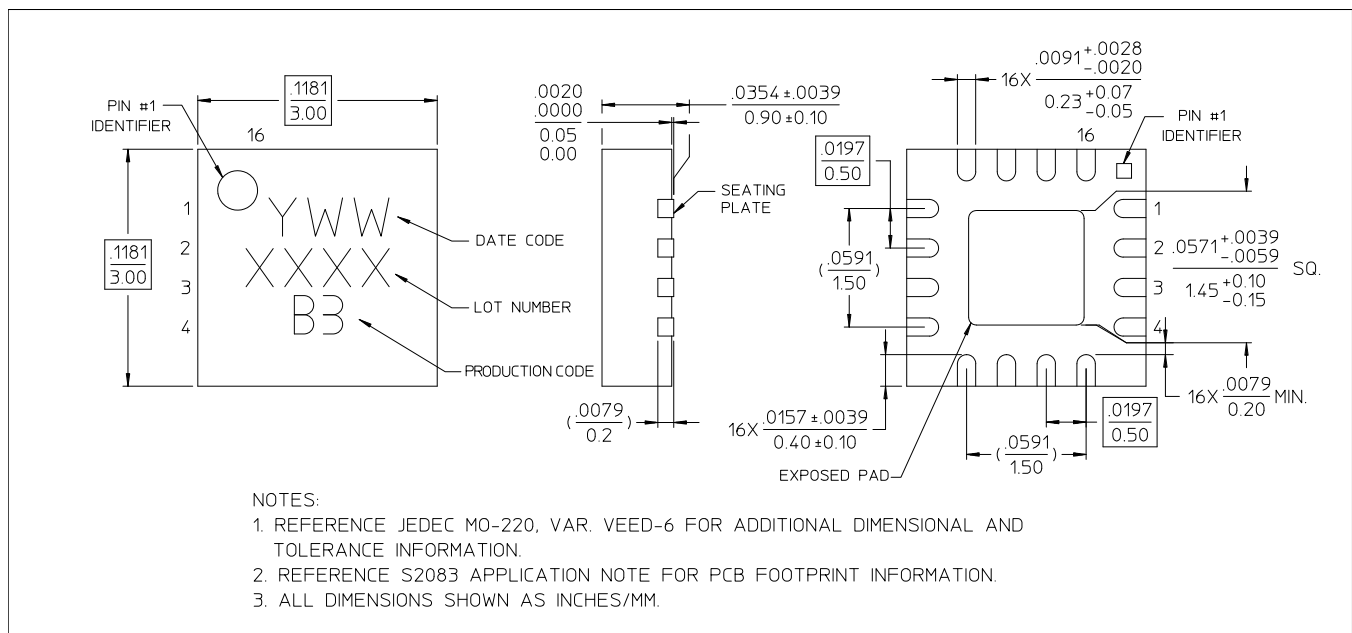
### Handling Procedures

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<sup>†</sup>



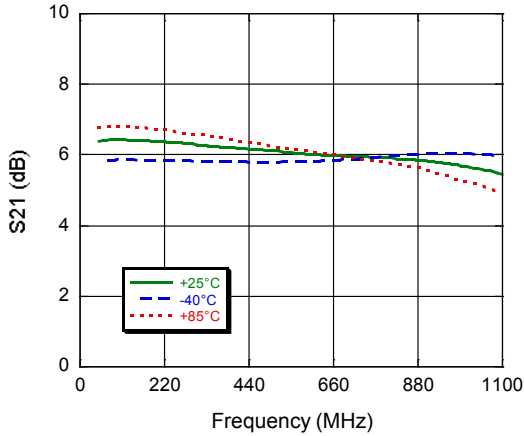
<sup>†</sup> Reference Application Note S2083 for lead-free solder reflow recommendations.  
 Meets JEDEC moisture sensitivity level 1 requirements.  
 Plating is 100% matte tin over copper.

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

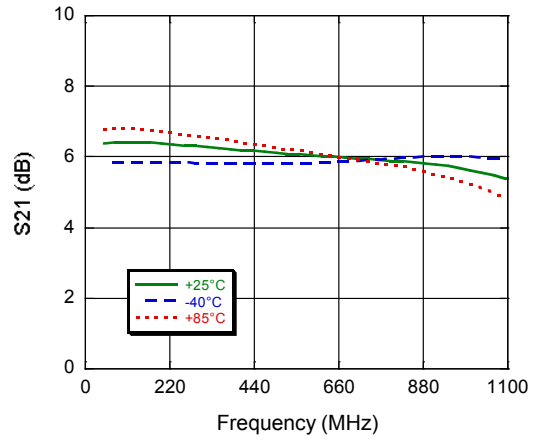
Rev. V2

### Typical Performance Curves: Low Current Configuration

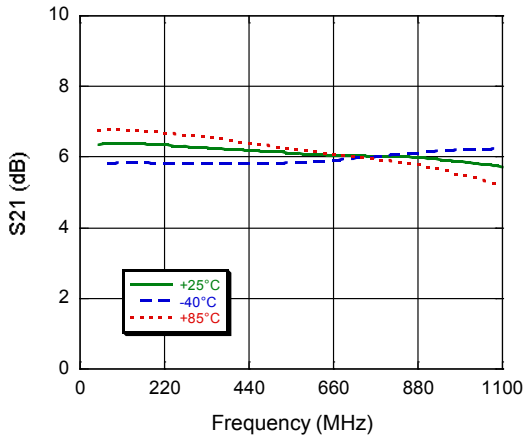
Gain - OUT1



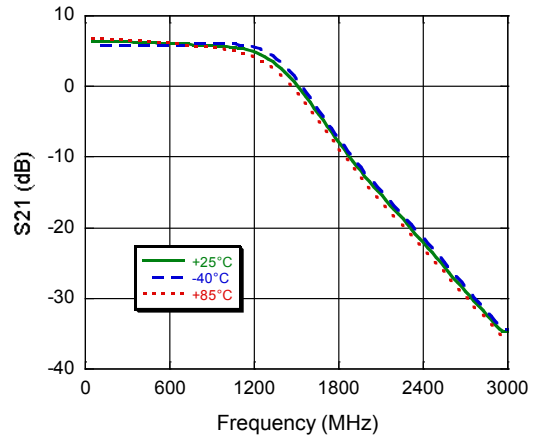
Gain - OUT2



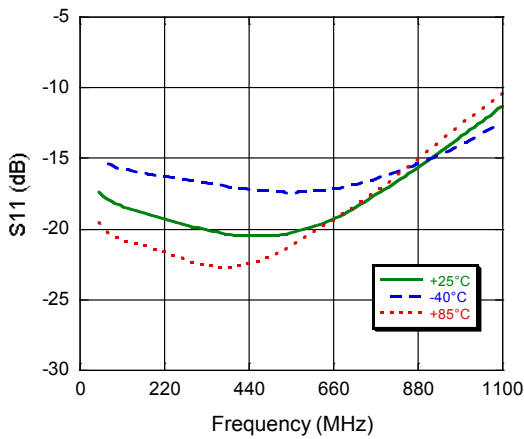
Gain - OUT3



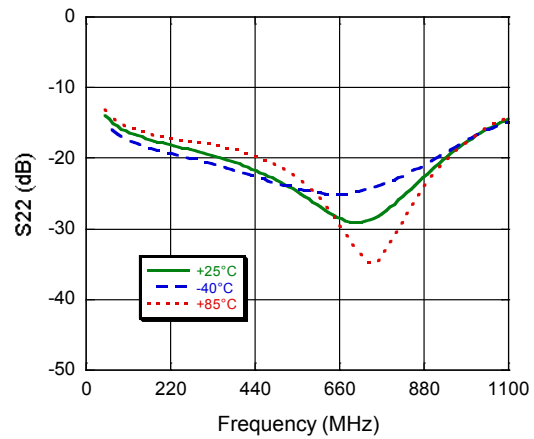
Gain - typical all ports - to 3 GHz



Input Return Loss



Out1 - Return Loss

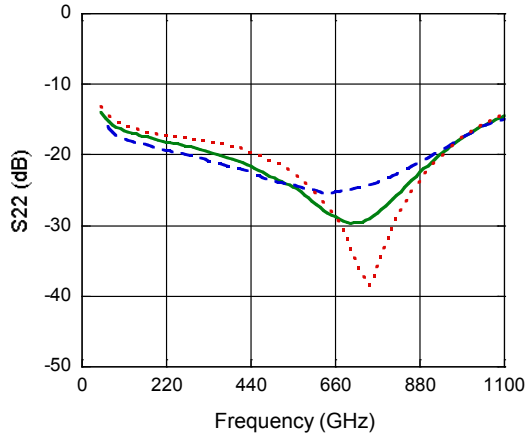


## Broadband CATV Single Ended 3-Way Active Splitter 50 - 1100 MHz

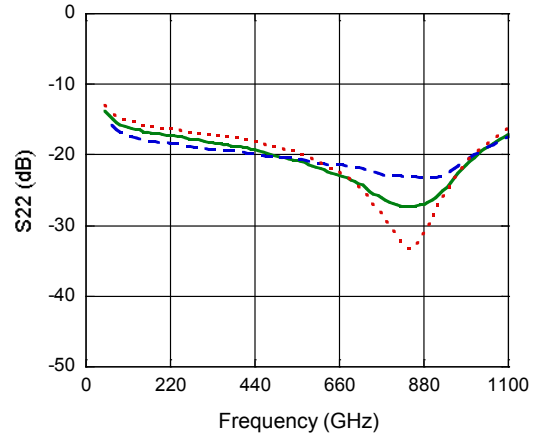
Rev. V2

### Typical Performance Curves: Low Current Configuration

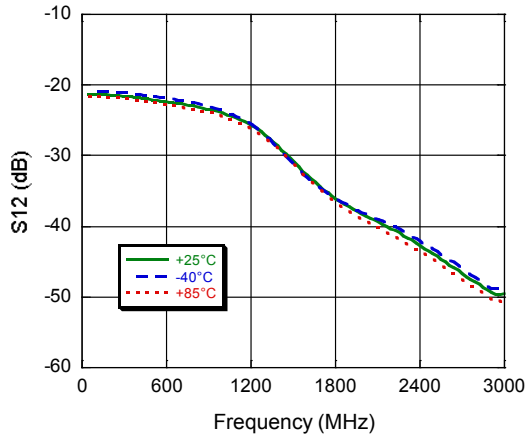
**Out2 - Return Loss**



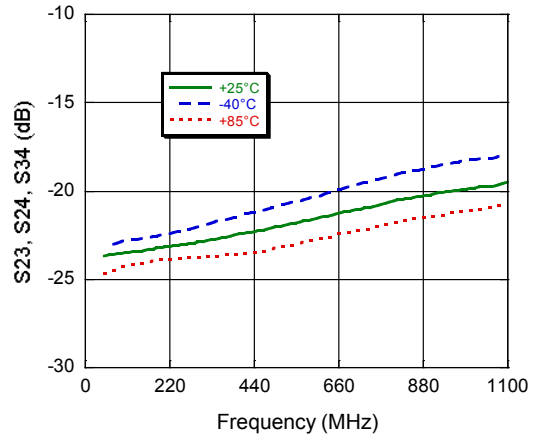
**Out3 - Return Loss**



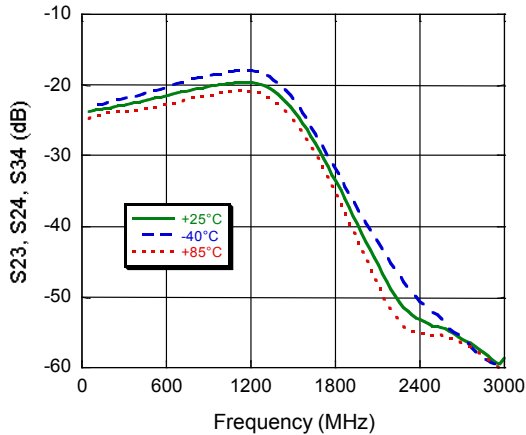
**Reverse Isolation**



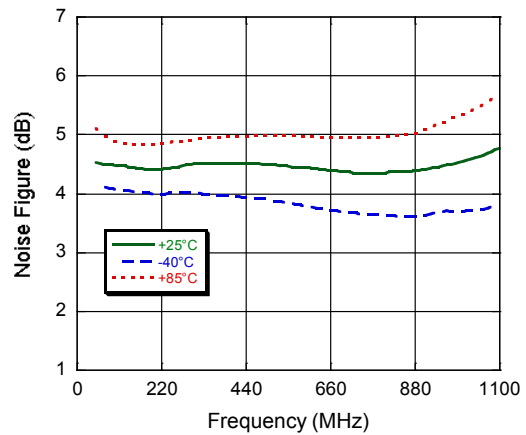
**OUT - OUT Isolation - to 1 GHz**



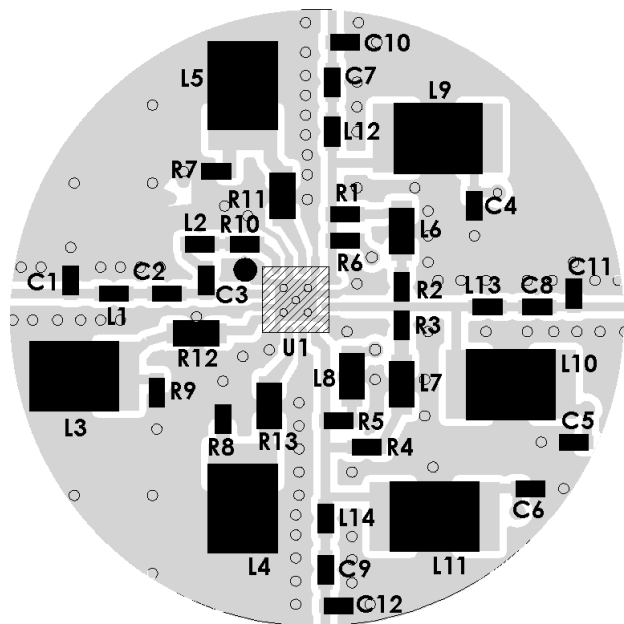
**OUT - OUT Isolation - to 3 GHz**



**Noise Figure - Typical for all ports**



**Recommended PCB configuration**  
**High Isolation Configuration**

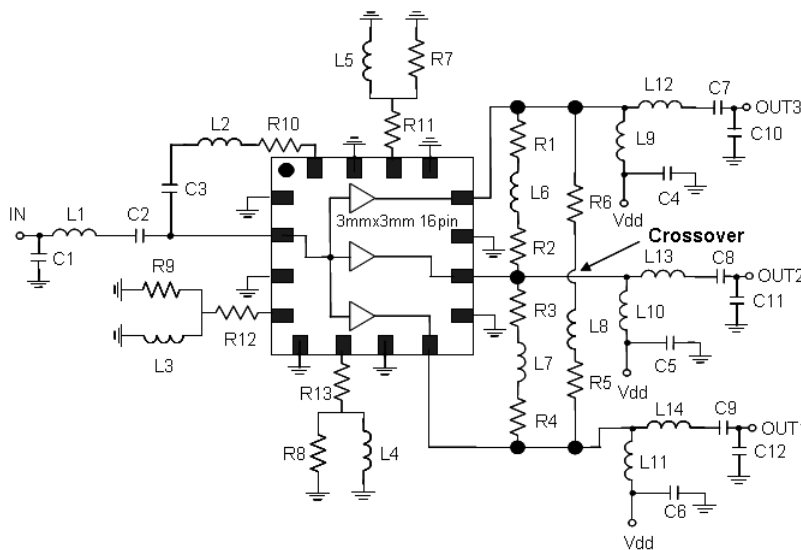


**Off-Chip Component Values<sup>9</sup>**  
**High Isolation Configuration**

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

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

**Schematic Including Off-Chip Components**  
**High Isolation Configuration**



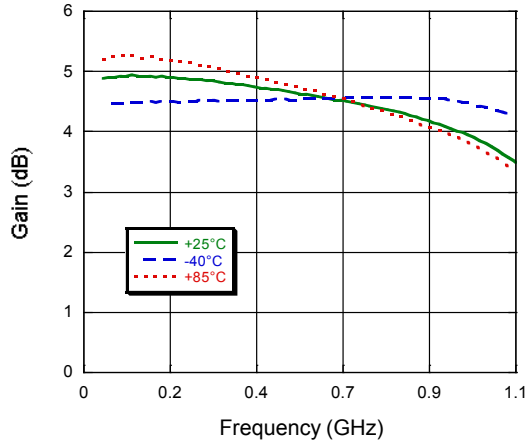


## Broadband CATV Single Ended 3-Way Active Splitter 50 - 1100 MHz

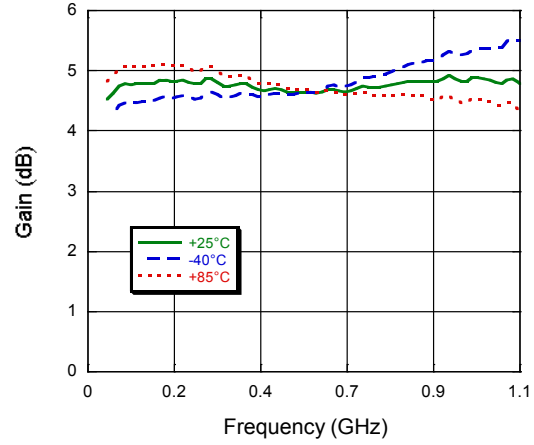
Rev. V2

### Typical Performance Curves: High Isolation Configuration

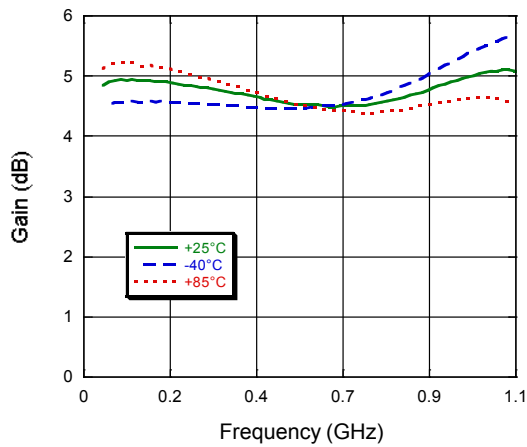
**Gain - OUT1**



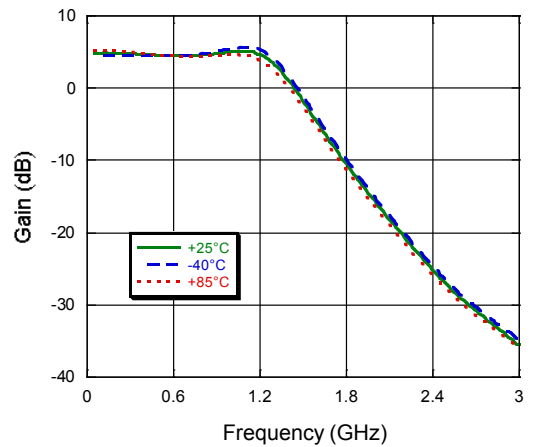
**Gain - OUT2**



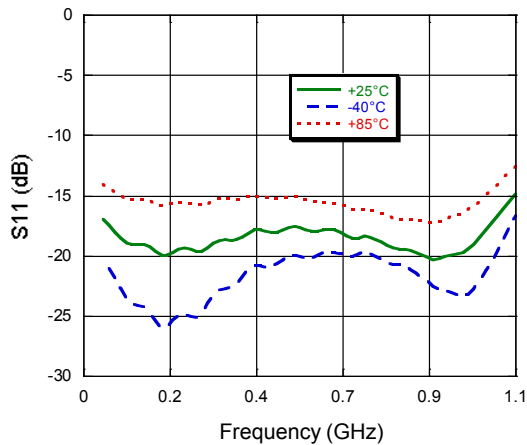
**Gain - OUT3**



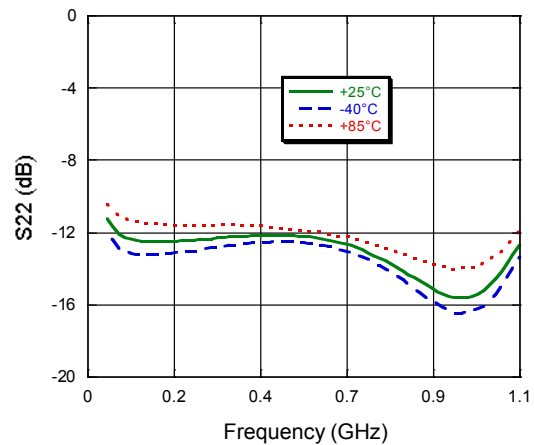
**Gain - typical all ports - to 3 GHz**



**Input Return Loss**



**Out1 - Return Loss**

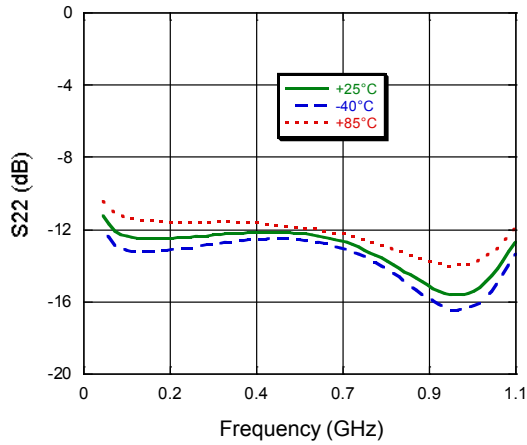


## Broadband CATV Single Ended 3-Way Active Splitter 50 - 1100 MHz

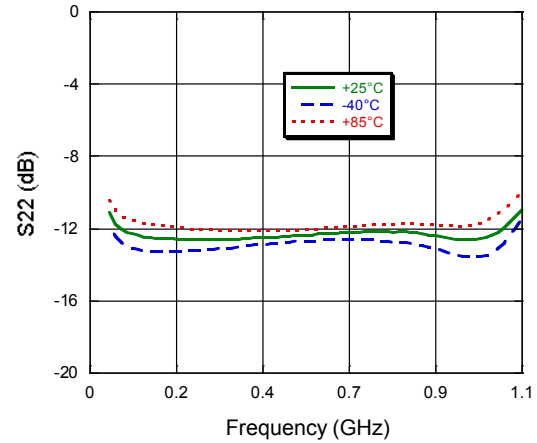
Rev. V2

### Typical Performance Curves: High Isolation Configuration

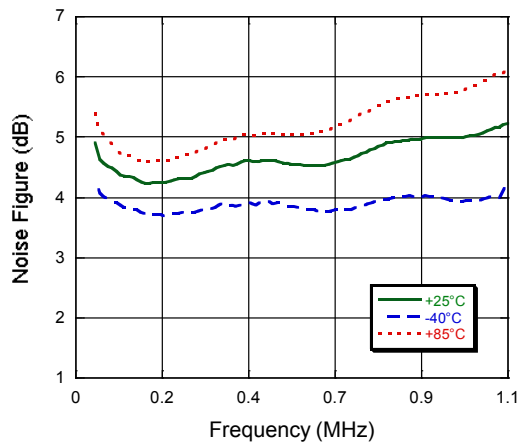
**OUT2 - Return Loss**



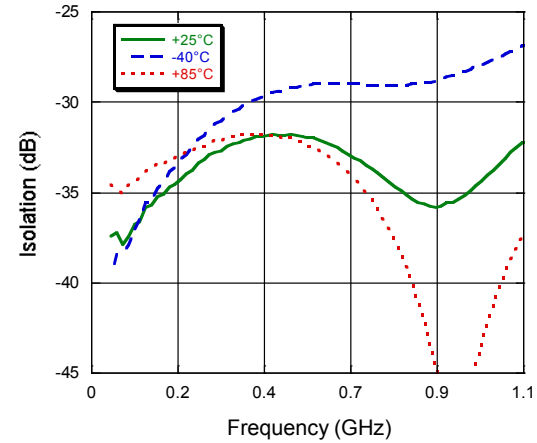
**OUT3 - Return Loss**



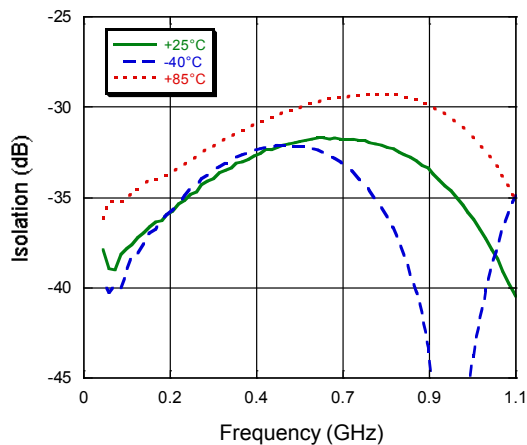
**Noise Figure - Typical for all ports**



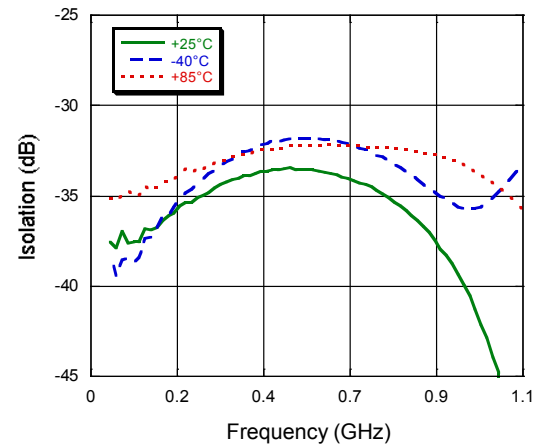
**OUT1 - OUT2 Isolation**



**OUT1 - OUT3 Isolation**



**OUT2 - OUT3 Isolation**



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