

Features

- 20.5 dB Gain
- +8 V DC Bias
- Differential Inputs and Outputs
- Low Distortion
- Lead-Free TSSOP-16LD exposed paddle
- Halogen-Free “Green” Mold Compound
- RoHS* Compliant and 260°C Reflow Compatible

Description

The MAAM-010144 is a GaAs MESFET MMIC amplifier in a lead-free TSSOP-16LD exposed paddle package. The MMIC design is configured as a pair of cascode MESFET amplifiers for broadband performance. It is designed for integration in a 75 Ω push-pull, low distortion, amplifier circuit.

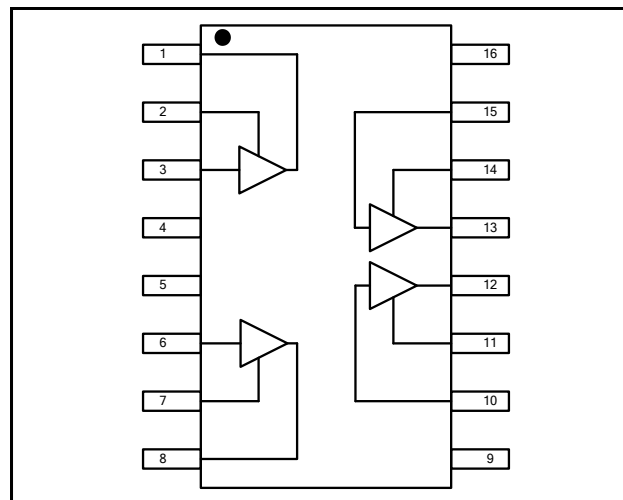
The device is ideally suited for use in CATV, FTTX, DBS, and HDTV applications where low noise figure and low distortion are required.

Ordering Information ^{1,2}

| Part Number | Package |
|--------------------|-------------------|
| MAAM-010144-000000 | Bulk Packaging |
| MAAM-010144-TR1000 | 1000 Piece Reel |
| MAAM-010144-TR3000 | 3000 Piece Reel |
| MAAM-010144-001SMB | Sample Test Board |

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

Functional Schematic



Pin Configuration ³

| Pin No. | Pin Name | Description |
|---------------------|----------|------------------|
| 1 | OUT1+ | Output 1+ |
| 2 | FB1+ | Feedback 1+ |
| 3 | IN1+ | Input 1+ |
| 4 | N/C | No Connection |
| 5 | N/C | No Connection |
| 6 | IN1- | Input 1- |
| 7 | FB1- | Feedback 1- |
| 8 | OUT1- | Output 1- |
| 9 | BIAS- | DC Bias |
| 10 | IN2- | Input 2- |
| 11 | FB2- | Feedback 2- |
| 12 | OUT2- | Output 2- |
| 13 | OUT2+ | Output 2+ |
| 14 | FB2+ | Feedback 2+ |
| 15 | IN2+ | Input 2+ |
| 16 | BIAS+ | DC Bias |
| Paddle ⁴ | | RF and DC Ground |

3. It is recommended, but not absolutely compulsory, that all No Connections (N/C) within the IC are connected to ground on the printed circuit board.
4. 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.

Push Pull CATV Amplifier 50 - 1000 MHz

Rev. V1

**Electrical Specifications: $T_A = 25^\circ\text{C}$, Freq: 50 - 1000 MHz, $V_{DD} = +8$ Volts, $Z_0 = 75 \Omega$,
Test Circuit with M/A-COM Technology Balun MABA-009210-CT1760**

| Parameter | Test Conditions | Units | Min. | Typ. | Max. |
|-----------------------------|--|-------|------|------|------|
| Gain | — | dB | 19 | 20.5 | 23 |
| Gain Flatness | — | dB | — | 0.6 | — |
| Noise Figure | — | dB | — | 5.5 | — |
| Input Return Loss | — | dB | — | 18 | — |
| Output Return Loss | — | dB | — | 15 | — |
| Reverse Isolation | — | dB | — | 36 | — |
| Output IP2 | 500 MHz, +8 dBm output | dBm | — | 80 | — |
| Output IP3 | Two tones at 500 & 506 MHz, +8 dBm output/tone | dBm | 41 | 43 | — |
| Composite Triple Beat, CTB | 77 Channels, +39 dBm V / Channel at the output | dBc | — | -70 | — |
| Composite Second Order, CSO | 77 Channels, +39 dBm V / Channel at the output | dBc | — | -70 | — |
| Cross modulation | 77 Channels, +39 dBm V / Channel at the output | dBc | — | -70 | — |
| P1dB | 500 MHz | dBm | — | 26 | — |
| I_{DD} | +8 Volts | mA | — | 325 | 385 |

Electrical Specifications: Frequency = 500 MHz, 256 QAM

| Parameter | Test Conditions | Units | Ref Spec ⁵ | Typical data |
|--|---|-------|-----------------------|-------------------|
| Adjacent channel up to 750 KHz from channel block edge | $P_{OUT} = +60$ dBmV, N=1 $P_{OUT} = +56$ dBmV, N=2 $P_{OUT} = +52$ dBmV, N=4 | dBc | <-58 <-58 <-58 | -65 -65 -66 |
| Adjacent channel (750 kHz from channel block edge to 6 MHz from channel block edge) | $P_{OUT} = +60$ dBmV, N=1 $P_{OUT} = +56$ dBmV, N=2 $P_{OUT} = +52$ dBmV, N=4 | dBc | <-62 <-60 <-60 | -67 -64 -63 |
| Next-adjacent channel (6 MHz from channel block edge to 18 MHz from channel block edge) | $P_{OUT} = +60$ dBmV, N=1 $P_{OUT} = +56$ dBmV, N=2 $P_{OUT} = +52$ dBmV, N=4 | dBc | <-65 <-64 <-63 | -75 -70 -65 |
| Third-adjacent channel (12 MHz from channel block edge to 18 MHz from channel block edge) | $P_{OUT} = +60$ dBmV, N=1 $P_{OUT} = +56$ dBmV, N=2 $P_{OUT} = +52$ dBmV, N=4 | dBc | <-73 <-70 <-65 | -76 -73 -68 |
| In each of 2N contiguous 6 MHz channels or in each of 3N contiguous 6 MHz channels coinciding with 2nd harmonic and with 3rd harmonic components respectively (up to 1000 MHz) | $P_{OUT} = +60$ dBmV, N=1, 2nd Harmonic $P_{OUT} = +60$ dBmV, N=1, 3rd Harmonic | dBc | -63 -63 | -70 -65 |

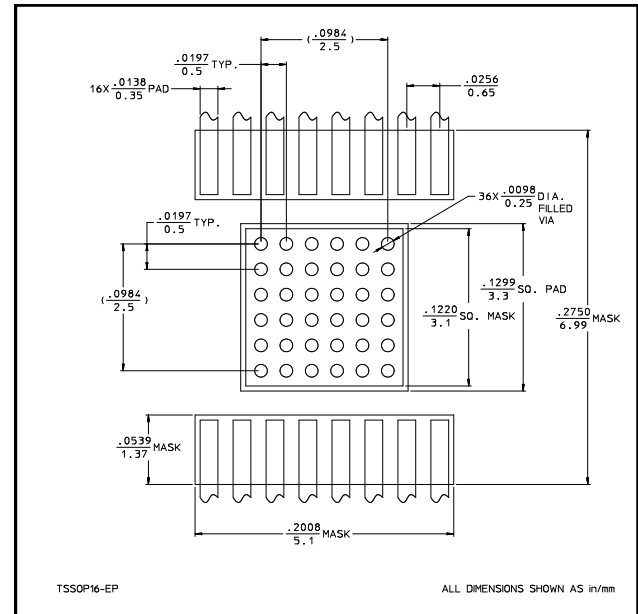
5. Reference Specification Data-Over-Cable Service Interface Specifications, DOCSIS. Downstream RF Interface Specification, DRF1.

Absolute Maximum Ratings ^{6,7,8}

| Parameter | Absolute Maximum |
|-----------------------------------|------------------|
| RF Input Power | 6 dBm |
| Voltage | 15.0 volts |
| Operating Temperature | -40°C to +85°C |
| Junction Temperature ⁹ | +150°C |
| Storage Temperature | -65°C to +150°C |

6. Exceeding any one or combination of these limits may cause permanent damage to this device.
7. M/A-COM Technology Solutions does not recommend sustained operation near these survivability limits.
8. Operating at nominal conditions with $T_J \leq +150^\circ\text{C}$ will ensure $\text{MTTF} > 1 \times 10^6$ hours.
9. Junction Temperature (T_J) = $T_C + \Theta_{jc} * (V * I)$
Typical thermal resistance (Θ_{jc}) = 13 °C/W.
 - a) For $T_C = 25^\circ\text{C}$,
 $T_J = 65^\circ\text{C} @ 8 \text{ V}, 385 \text{ mA}$
 - b) For $T_C = 85^\circ\text{C}$,
 $T_J = 124^\circ\text{C} @ 8 \text{ V}, 375 \text{ mA}$

Land Pattern ¹⁰



10. Vias to be plated solid copper.

Handling Procedures

Please observe the following precautions to avoid damage:

Static Sensitivity

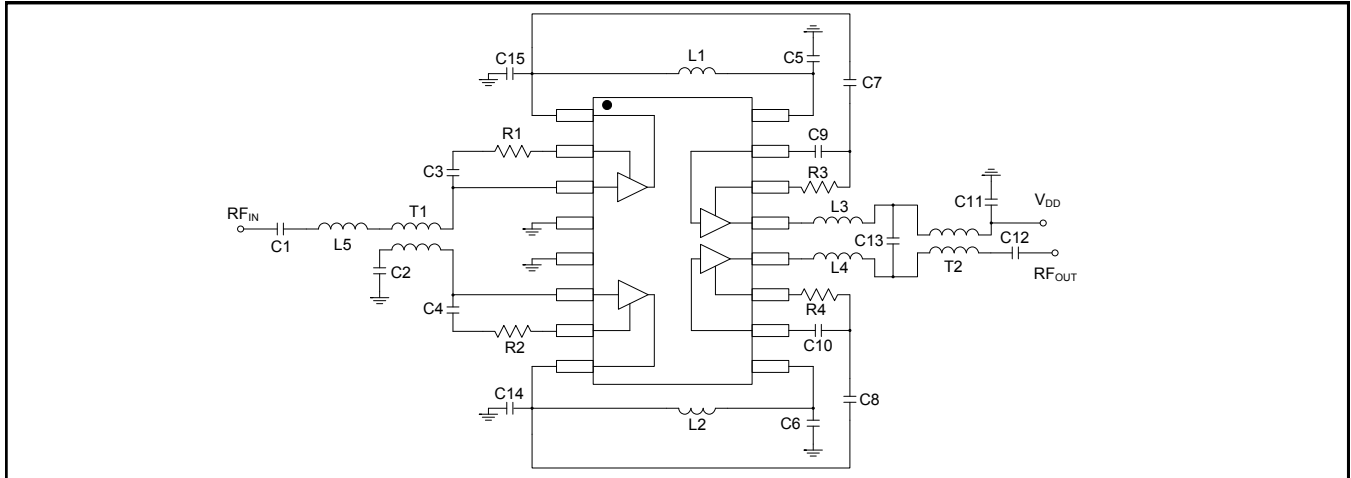
Gallium Arsenide Integrated Circuits are sensitive to electrostatic discharge (ESD) and can be damaged by static electricity. Proper ESD control techniques should be used when handling these devices.

An external protection circuit using an 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.

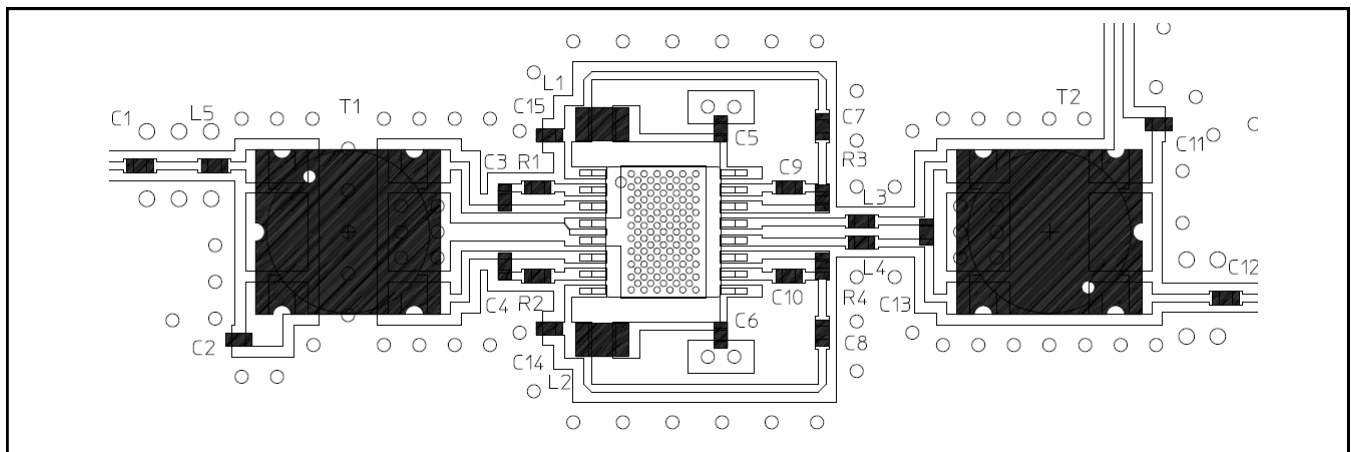
Push Pull CATV Amplifier 50 - 1000 MHz

Rev. V1

Application Schematic



Recommended PCB



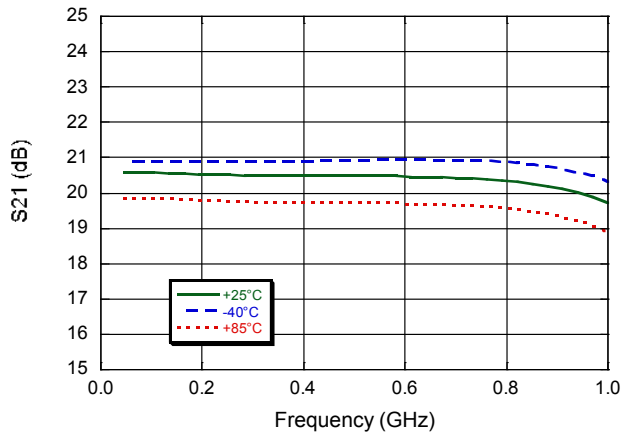
Parts List¹¹

| Component | Value | Package |
|-----------|--------------|---------|
| C1 - C12 | 0.01 μ F | 0402 |
| C13 | 2.7 pF | 0402 |
| C14, C15 | 2.0 pF | 0402 |
| R1 - R4 | 0 Ω | 0402 |
| L1, L2 | 390 nH | 0805 |
| L3, L4 | 2.0 nH | 0402 |
| L5 | 5.6 nH | 0402 |
| T1, T2 | 1:1 Baluns | |

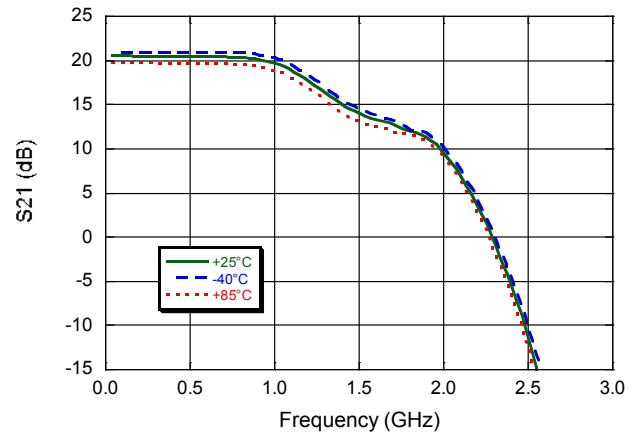
11. The 1:1 baluns, T1 & T2 are M/A-COM Technology Solutions part number MABA-009210-CT1760

Typical Performance Curves Over Temperature

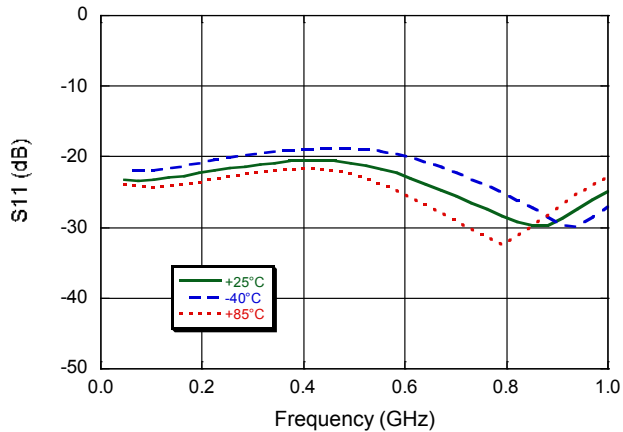
Gain to 1 GHz



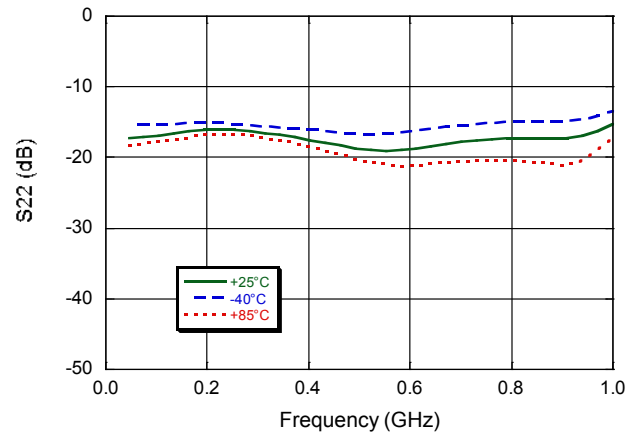
Gain to 3 GHz



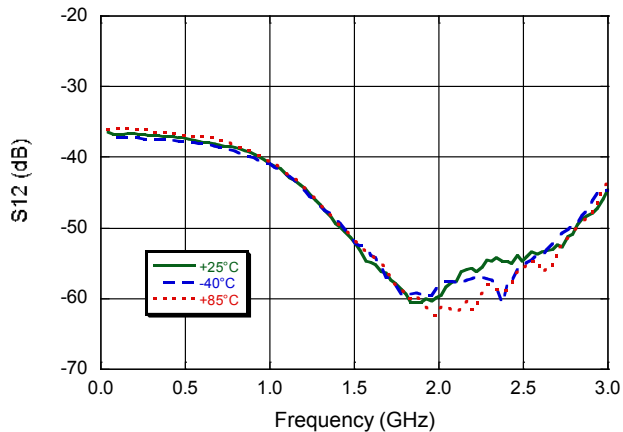
Input Return Loss



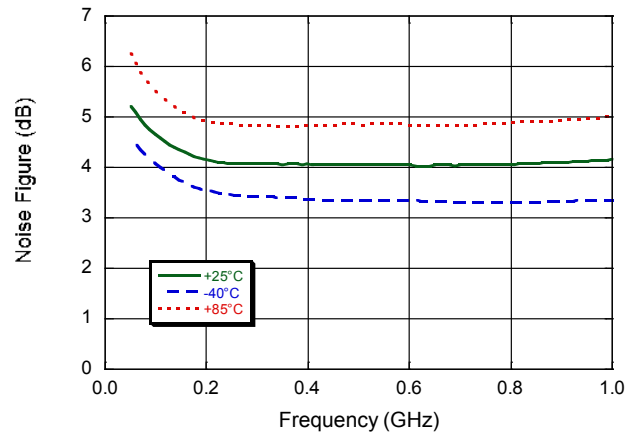
Output Return Loss



Reverse Isolation to 3 GHz



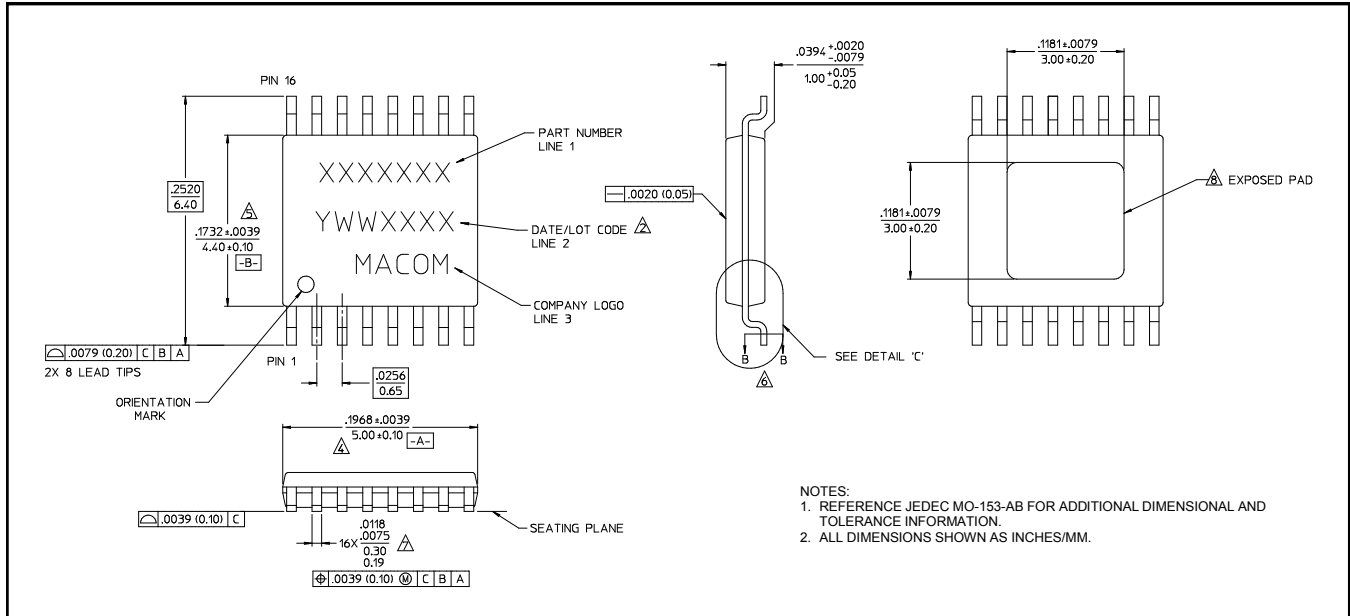
Noise Figure



Push Pull CATV Amplifier 50 - 1000 MHz

Rev. V1

Lead Free TSSOP 16-lead exposed paddle[†]



[†] Reference Application Note M538 for lead-free solder reflow recommendations and PCB footprint information.
Meets JEDEC moisture sensitivity level 1 requirements.
Plating is 100% matte tin over copper.

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