

Push Pull CATV Amplifier 50 - 1000 MHz

Rev. V1

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.

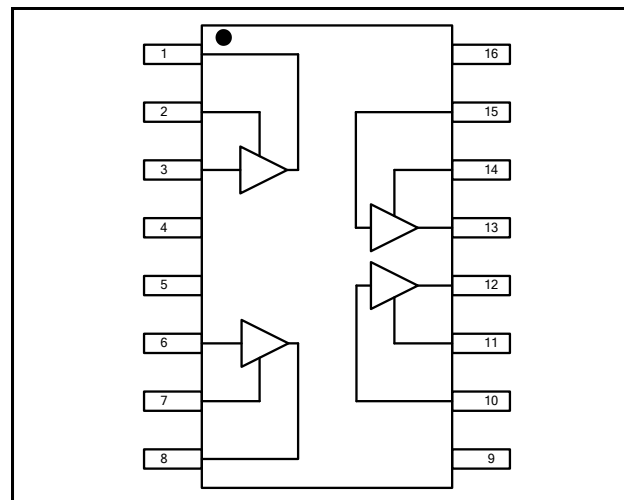
Ordering Information ^{1,2}

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, DRFI.

Push Pull CATV Amplifier 50 - 1000 MHz

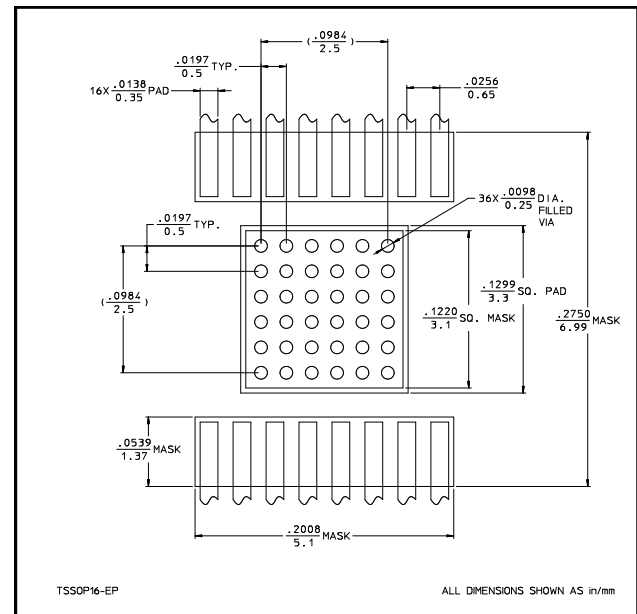
Rev. V1

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 V, 385 mA
 - b) For $T_C = 85^\circ\text{C}$,
 $T_J = 124^\circ\text{C}$ @ 8 V, 375 mA

Land Pattern¹⁰



10. Vias to be plated solid copper.

Handling Procedures

Please observe the following precautions to avoid damage:

Static Sensitivity

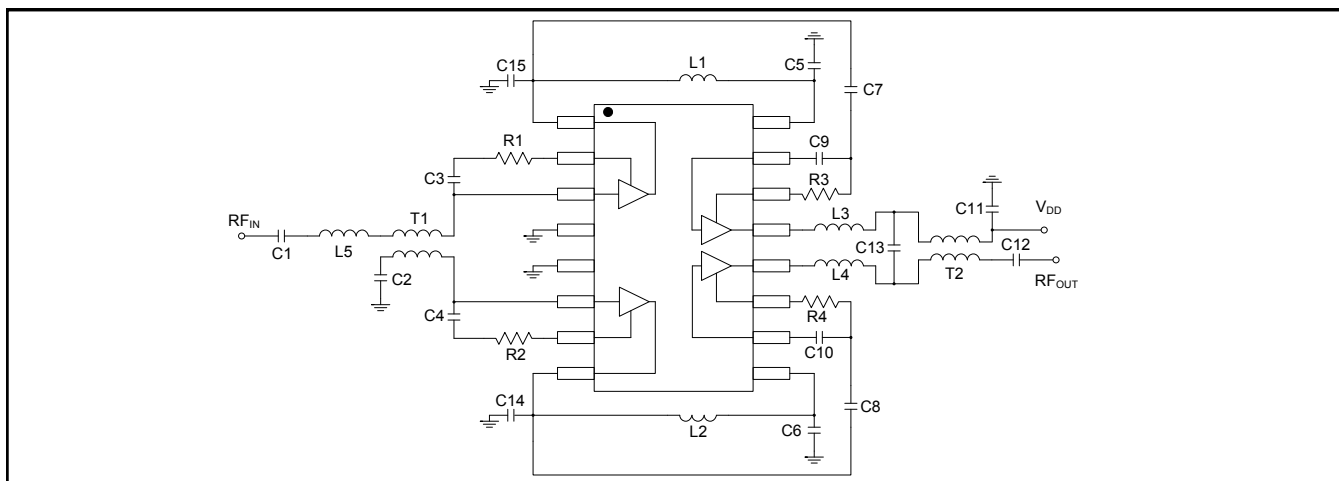
Gallium Arsenide Integrated Circuits are sensitive to electrostatic discharge (ESD) and can be damaged by static electricity. Proper ESD control techniques should be used when handling these devices.

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.

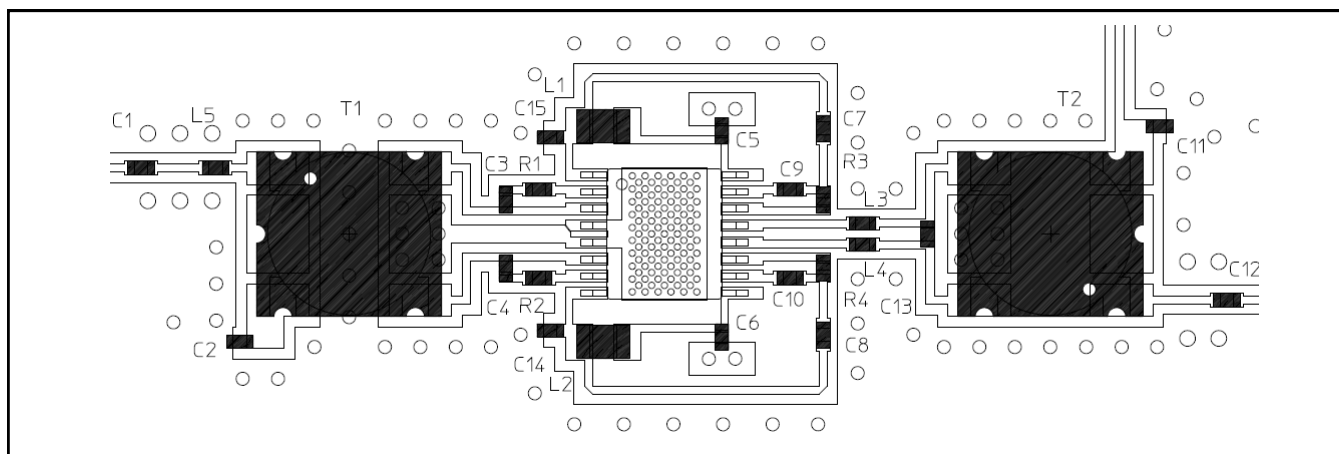
Push Pull CATV Amplifier 50 - 1000 MHz

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	

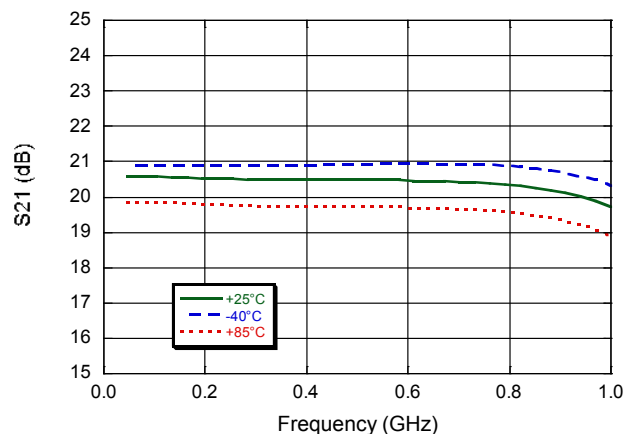
11. The 1:1 baluns, T1 & T2 are M/A-COM Technology Solutions part number MABA-009210-CT1760

Push Pull CATV Amplifier 50 - 1000 MHz

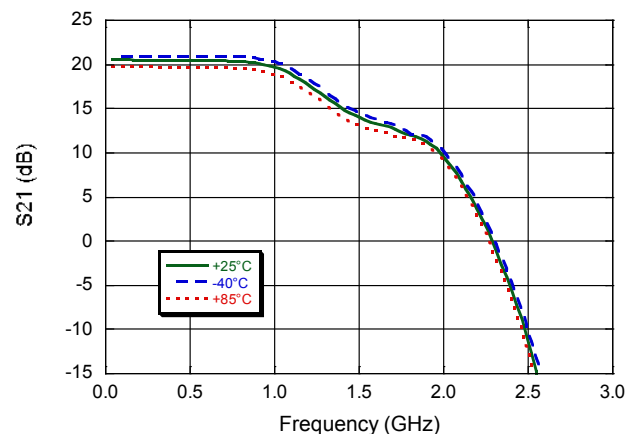
Rev. V1

Typical Performance Curves Over Temperature

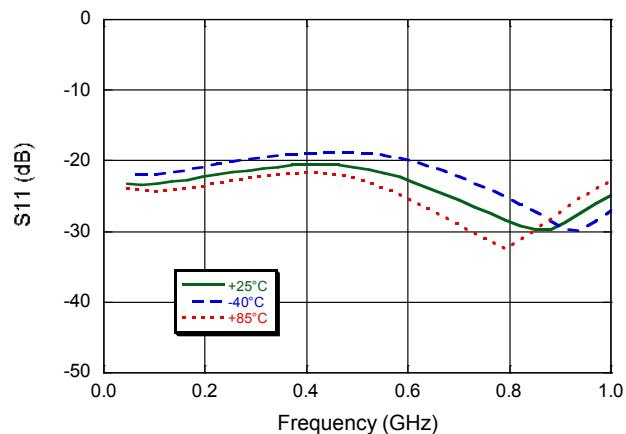
Gain to 1 GHz



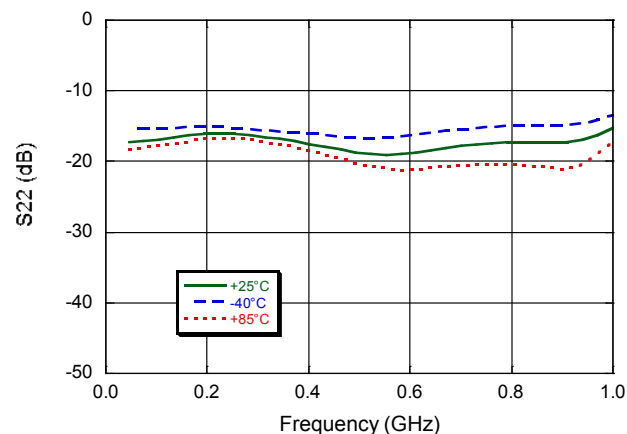
Gain to 3 GHz



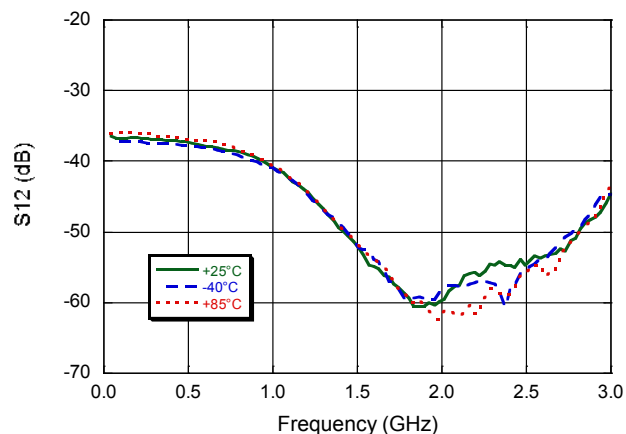
Input Return Loss



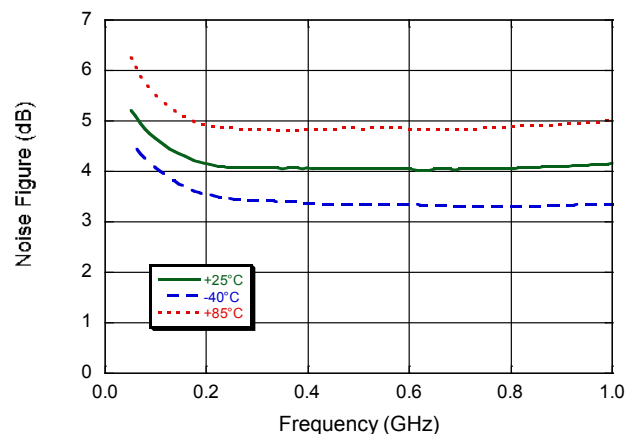
Output Return Loss



Reverse Isolation to 3 GHz



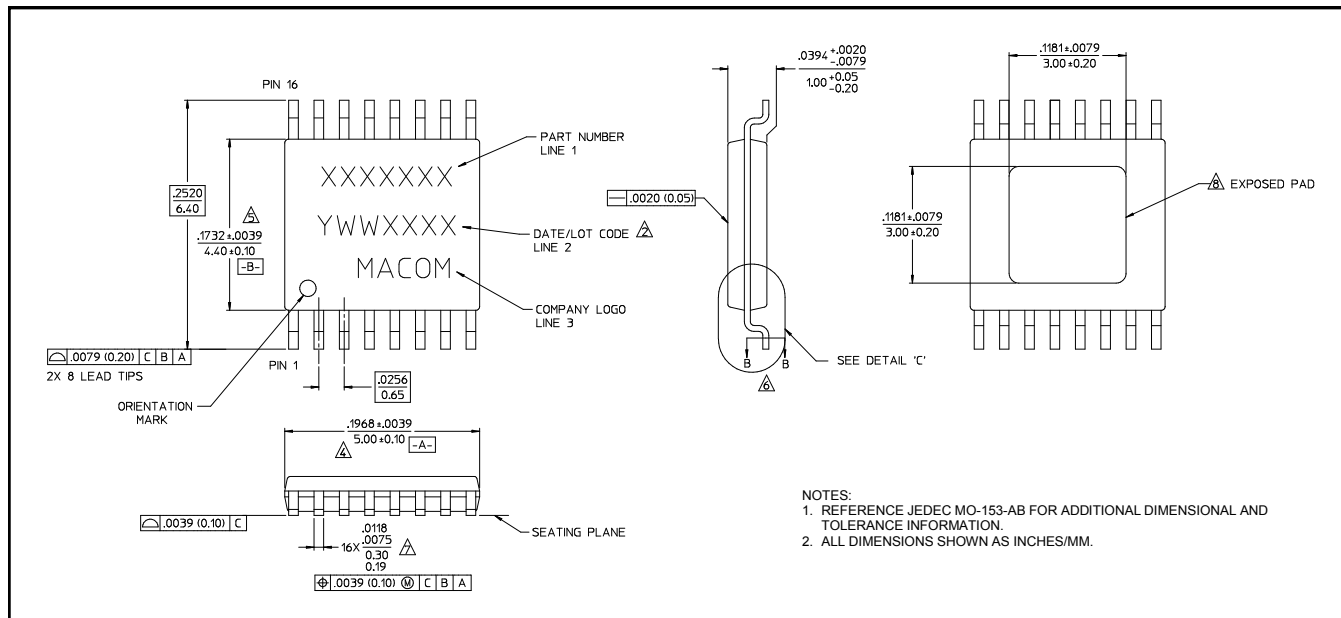
Noise Figure



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.

M/A-COM Technology Solutions Inc. All rights reserved.

Information in this document is provided in connection with M/A-COM Technology Solutions Inc ("MACOM") products. These materials are provided by MACOM as a service to its customers and may be used for informational purposes only. Except as provided in MACOM's Terms and Conditions of Sale for such products or in any separate agreement related to this document, MACOM assumes no liability whatsoever. MACOM assumes no responsibility for errors or omissions in these materials. MACOM may make changes to specifications and product descriptions at any time, without notice. MACOM makes no commitment to update the information and shall have no responsibility whatsoever for conflicts or incompatibilities arising from future changes to its specifications and product descriptions. No license, express or implied, by estoppel or otherwise, to any intellectual property rights is granted by this document.

THESE MATERIALS ARE PROVIDED "AS IS" WITHOUT WARRANTY OF ANY KIND, EITHER EXPRESS OR IMPLIED, RELATING TO SALE AND/OR USE OF MACOM PRODUCTS INCLUDING LIABILITY OR WARRANTIES RELATING TO FITNESS FOR A PARTICULAR PURPOSE, CONSEQUENTIAL OR INCIDENTAL DAMAGES, MERCHANTABILITY, OR INFRINGEMENT OF ANY PATENT, COPYRIGHT OR OTHER INTELLECTUAL PROPERTY RIGHT. MACOM FURTHER DOES NOT WARRANT THE ACCURACY OR COMPLETENESS OF THE INFORMATION, TEXT, GRAPHICS OR OTHER ITEMS CONTAINED WITHIN THESE MATERIALS. MACOM SHALL NOT BE LIABLE FOR ANY SPECIAL, INDIRECT, INCIDENTAL, OR CONSEQUENTIAL DAMAGES, INCLUDING WITHOUT LIMITATION, LOST REVENUES OR LOST PROFITS, WHICH MAY RESULT FROM THE USE OF THESE MATERIALS.

MACOM products are not intended for use in medical, lifesaving or life sustaining applications. MACOM customers using or selling MACOM products for use in such applications do so at their own risk and agree to fully indemnify MACOM for any damages resulting from such improper use or sale.