

CATV Return Path Amplifier 5 - 300 MHz

Rev. V2

Features

- 21 dB Adjustable Gain
- 2.25 dB Noise Figure
- +5 V, 95 mA Adjustable Bias
- Low Distortion
- Wide Bandwidth for DOCSIS 3.1
- Lead-Free MSOP8-EP Package
- RoHS* Compliant and 260°C Reflow Compatible

Description

The MAAM-011184 is a 75 Ω single ended GaAs MMIC amplifier assembled in a lead-free MSOP8-EP package. This device provides high gain, low noise, and excellent linearity from 5 - 300 MHz.

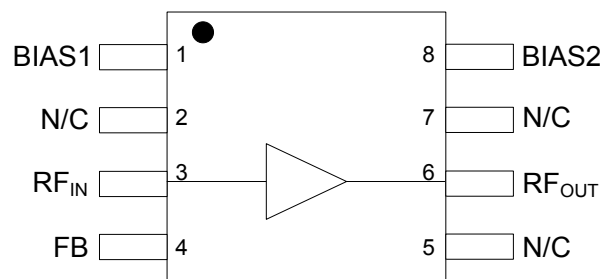
This amplifier is ideally suited for use in CATV return path applications, including DOCSIS 3.1 systems: it typically provides 2.25 dB noise figure, 64 dBm OIP2 and 43 dBm OIP3 while drawing 95 mA DC current at 5 V bias.

Ordering Information¹

Part Number	Package
MAAM-011184-TR1000	1000 piece reel
MAAM-011184-TR3000	3000 piece reel
MAAM-011184-001SMB	Sample Board

1. All sample boards include 5 loose parts.

Functional Schematic



Pin Configuration²

Pin No.	Pin Name	Description
1	BIAS1	V _{CC} Bias
2	N/C	No Connection
3	RF _{IN}	RF Input
4	FB	Feedback
5	N/C	No Connection
6	RF _{OUT}	RF Output (DC Bias)
7	N/C	No Connection
8	BIAS2	Active Bias
9	Pad ³	RF and DC Ground

2. All pins listed as 'No Connection' should be grounded.

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

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

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Electrical Specifications⁴: $T_A = 25^\circ\text{C}$, $V_{CC} = 5\text{ V}$, $Z_0 = 75\ \Omega$

Parameter	Test Conditions	Units	Min.	Typ.	Max.
Gain	$P_{IN} = -21\text{ dBm}$, 5 - 300 MHz $P_{IN} = -21\text{ dBm}$, 205 MHz	dB	— 20	21 21	—
Input Return Loss	$P_{IN} = -21\text{ dBm}$, 5 - 300 MHz	dB	—	26	—
Output Return Loss	$P_{IN} = -21\text{ dBm}$, 5 - 300 MHz	dB	—	23	—
Reverse Isolation	$P_{IN} = -21\text{ dBm}$, 5 - 300 MHz	dB	—	23	—
Noise Figure	5 - 205 MHz 205 - 300 MHz	dB	—	2.25 2.5	—
P1dB	5 - 300 MHz	dBm	—	21.7	—
OIP3 ⁵	$P_{IN} = -21\text{ dBm}$ per tone, 3 MHz spacing, $f_1 = 5 - 205\text{ MHz}$ $P_{IN} = -21\text{ dBm}$ per tone, 3 MHz spacing, $f_1 = 205\text{ MHz}$	dBm	— 38	43 41	—
OIP2 ⁵	$P_{IN} = -21\text{ dBm}$ per tone, 3 MHz spacing, $f_1 = 5 - 205\text{ MHz}$	dBm	—	64	—
Output Power at 30 dB MER ⁶	16 Channels, 5 - 205 MHz	dBmV/Channel	—	51	—
I_{CC} ⁷	$V_{CC} = 5\text{ V}$	mA	—	95	115

4. Data corresponds to the typical application circuit shown on page 3 of this datasheet. See pages 4 and 5 for typical performance using this application circuit.

5. f_1 is the frequency of the lower of the two input tones. Higher tone $f_2 = f_1 + 3\text{ MHz}$. OIP2 is measured at intermodulation frequency $f_1 + f_2$.

6. Modulation Error Ratio, 64 QAM 5.12 MS/s.

7. I_{CC} is the total DC current draw from the V_{CC} supply. As shown on page 3 of this datasheet, it is distributed to device pins 1, 6, and 8.

Absolute Maximum Ratings^{8,9}

Parameter	Absolute Maximum
Input Power	11 dBm
V_{CC}	6 V
Junction Temperature ^{10,11}	+150°C
Operating Temperature	-40°C to +85°C
Storage Temperature	-65°C to +125°C

8. Exceeding any one or a combination of these limits may cause permanent damage to this device.

9. MACOM does not recommend sustained operation near these survivability limits.

10. Operating at nominal conditions with $T_J \leq 150^\circ\text{C}$ will ensure $MTTF > 1 \times 10^6$ hours.

11. Junction Temperature (T_J) = $T_C + \Theta_{jc} * (V * I)$
Typical thermal resistance (Θ_{jc}) = 44° C/W.

a) For $T_C = +25^\circ\text{C}$,

$T_J = 46^\circ\text{C}$ @ 5 V, 95 mA

b) For $T_C = +85^\circ\text{C}$,

$T_J = 106^\circ\text{C}$ @ 5 V, 95 mA

Handling Procedures

Please observe the following precautions to avoid damage:

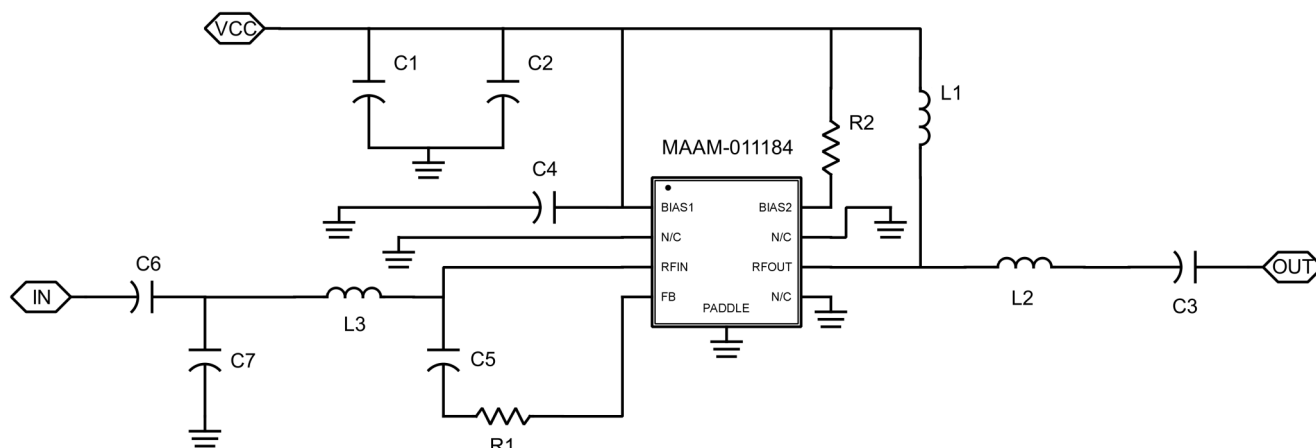
Static Sensitivity

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.

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Typical Application Circuit: Schematic



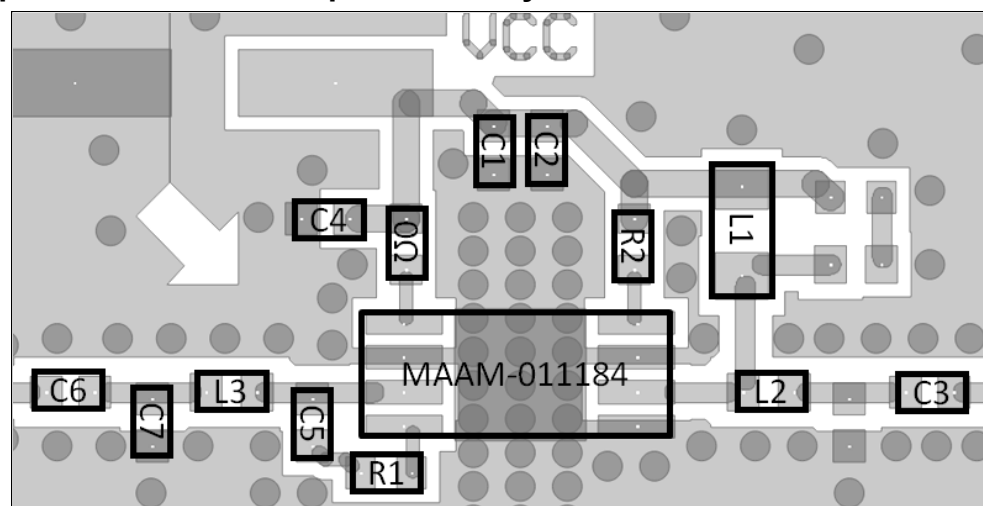
Typical Application Circuit: Component Values

Component	Value
C1 - C6	100 nF
C7	0.5 pF
R1 ¹²	330 Ω
R2 ¹²	SHORT - 0 Ω
L1 ¹³	22 μ H
L2	27 nH
L3	10 nH

12. Designers may decrease resistor R1 to reduce the gain of the amplifier by approximately 1 dB per 164 Ohms. Below 19.8 dB gain, typical input and output return losses fall below 20 dB. Resistor R2 may be increased in order to reduce bias current I_{CC} (at the cost of large-signal performance) by approximately 1 mA per 42 Ohms.

13. Low-ESR inductor LQH2MCN220K02 from Murata.

Typical Application Circuit: Sample Board Layout

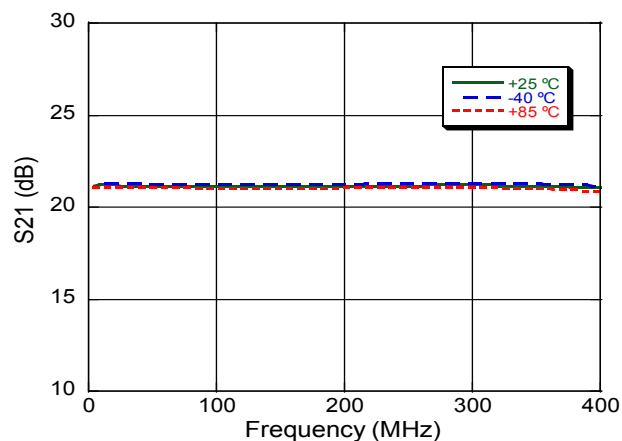


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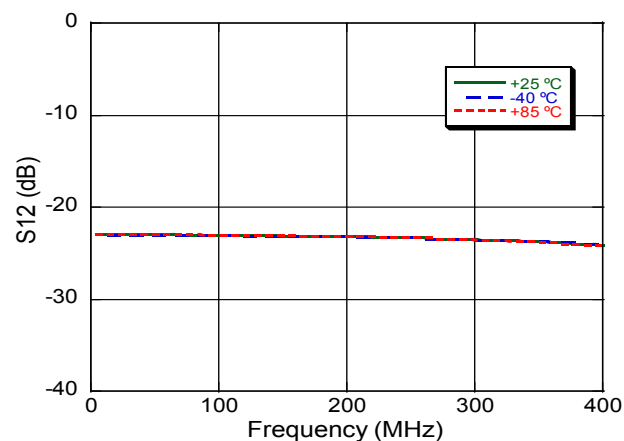
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Typical Performance Curves: Small-Signal

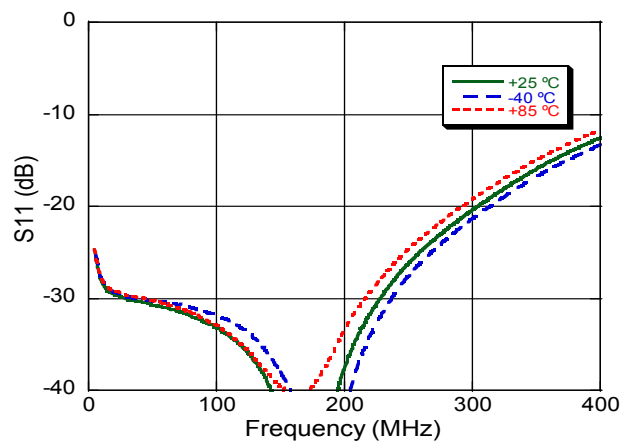
Gain



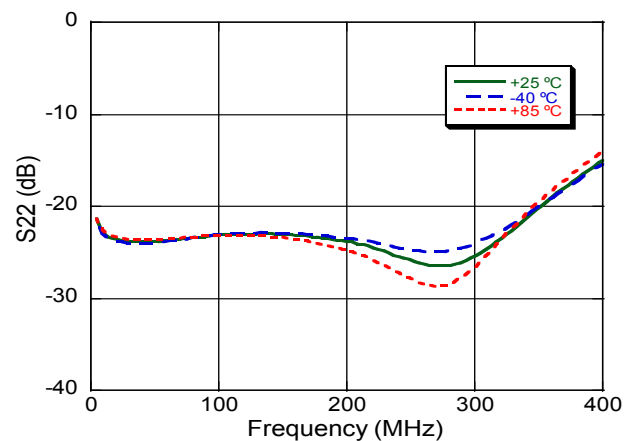
Reverse Isolation



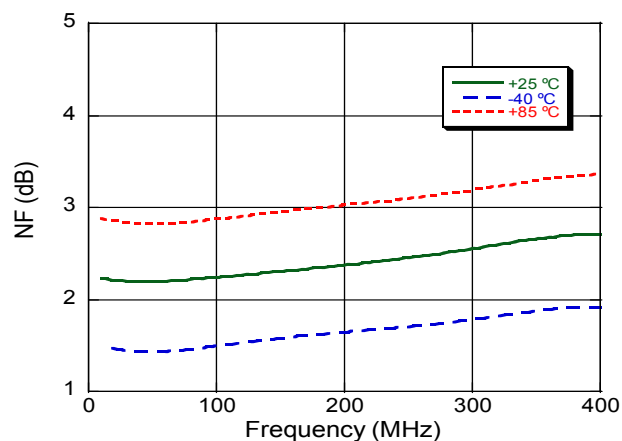
Input Return Loss



Output Return Loss



Noise Figure

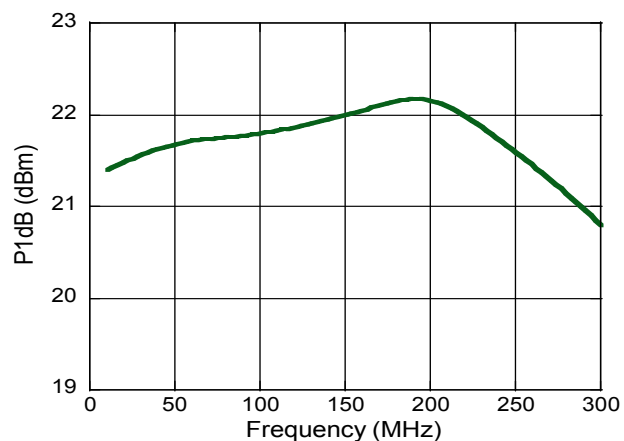


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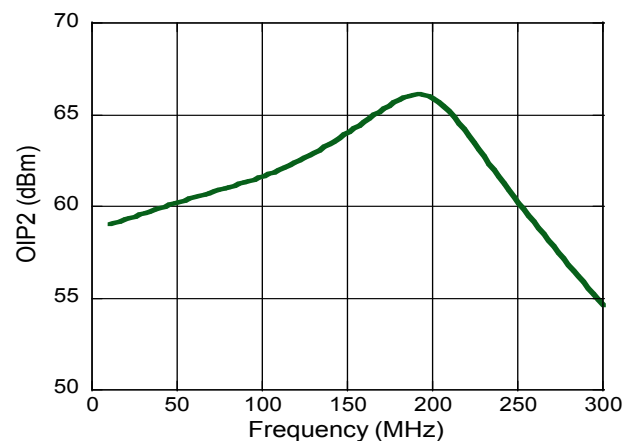
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Typical Performance Curves: Large-Signal

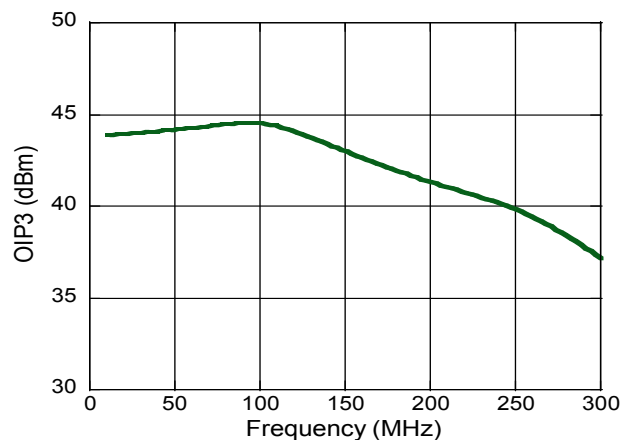
P1dB



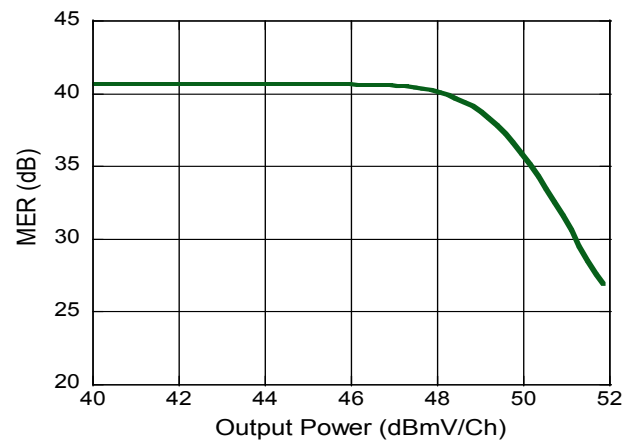
OIP2



OIP3



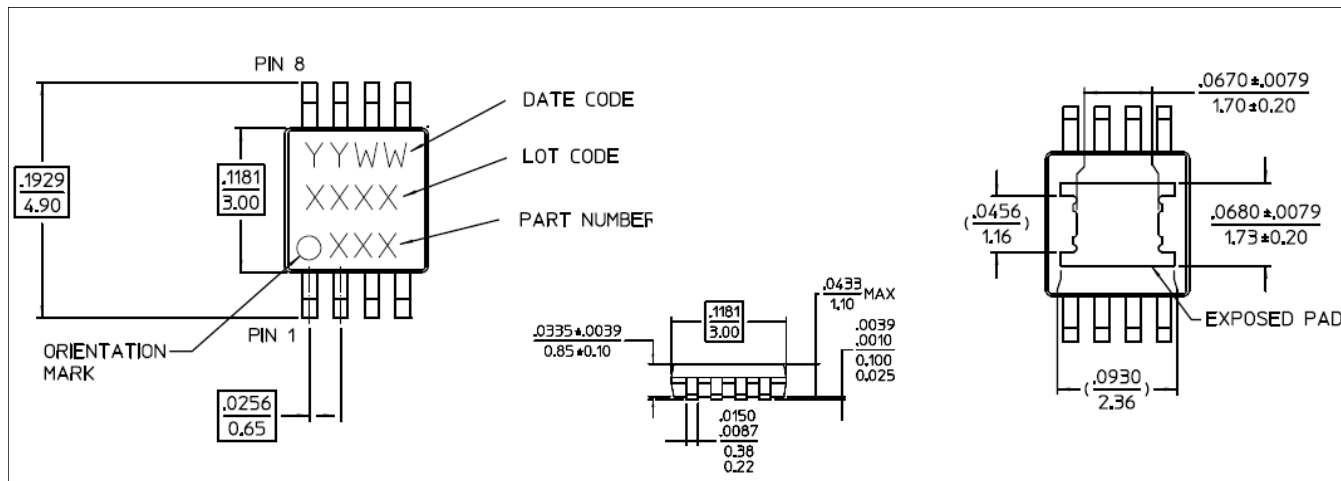
MER, 16 Channels 64-QAM



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Lead-Free MSOP8-EP Package[†]



[†] Dimensions shown as inches over millimeters [in/mm].
Meets JEDEC moisture sensitivity level 1 requirements.
Plating is 100% matte tin over copper.

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