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MAAM-011184

CATV Return Path Amplifier
5 - 300 MHz

Rev. V2

Features

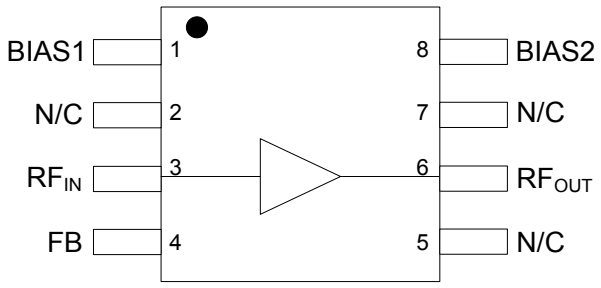
- 21 dB Adjustable Gain
- 2.25 dB Noise Figure
- +5 V, 95 mA Adjustable Bias
- Low Distortion
- Wide Bandwidth for DOCSIS 3.1
- Lead-Free MSOP8-EP Package
- RoHS* Compliant and 260°C Reflow Compatible

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.

Functional Schematic



Ordering Information[1]

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.

Pin Configuration[2]

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.

CATV Return Path Amplifier
5 - 300 MHz

Electrical Specifications[4]: T_A = 25°C, V_{CC} = 5 V, Z_0 = 75 Ω

Parameter	Test Conditions	Units	Min.	Typ.	Max.
Gain	P_{IN} = -21 dBm, 5 - 300 MHz P_{IN} = -21 dBm, 205 MHz	dB	— 20	21 21	—
Input Return Loss	P_{IN} = -21 dBm, 5 - 300 MHz	dB	—	26	—
Output Return Loss	P_{IN} = -21 dBm, 5 - 300 MHz	dB	—	23	—
Reverse Isolation	P_{IN} = -21 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 dBm per tone, 3 MHz spacing, f_1 = 5 - 205 MHz P_{IN} = -21 dBm per tone, 3 MHz spacing, f_1 = 205 MHz	dBm	— 38	43 41	—
OIP2[5]	P_{IN} = -21 dBm per tone, 3 MHz spacing, f_1 = 5 - 205 MHz	dBm	—	64	—
Output Power at 30 dB MER[6]	16 Channels, 5 - 205 MHz	dBmV/Channel	—	51	—
I_{CC}[7]	V_{CC} = 5 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 $f_2 = f_1 + 3$ 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 $T_J \leq 150°C$ will ensure MTTF > 1 x 10^6 hours.
11. Junction Temperature (T_J) = T_C + Θjc * (V * I)
    Typical thermal resistance (Θjc) = 44° C/W.
    a) For T_C = +25°C,
    T_J = 46°C @ 5 V, 95 mA
    b) For T_C = +85°C,
    T_J = 106°C @ 5 V, 95 mA

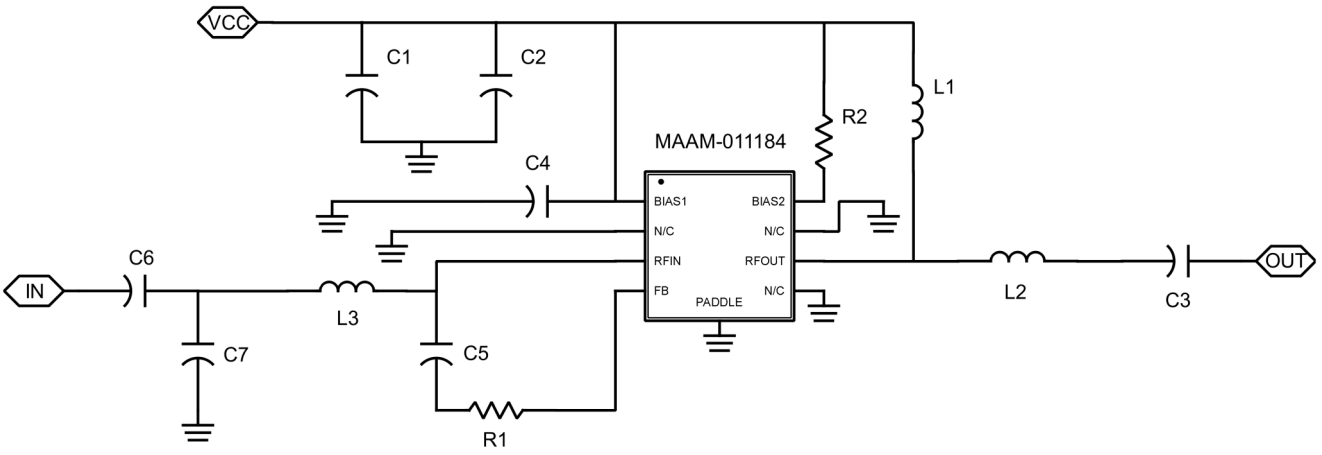
Handling Procedures

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.

Typical Application Circuit: Schematic

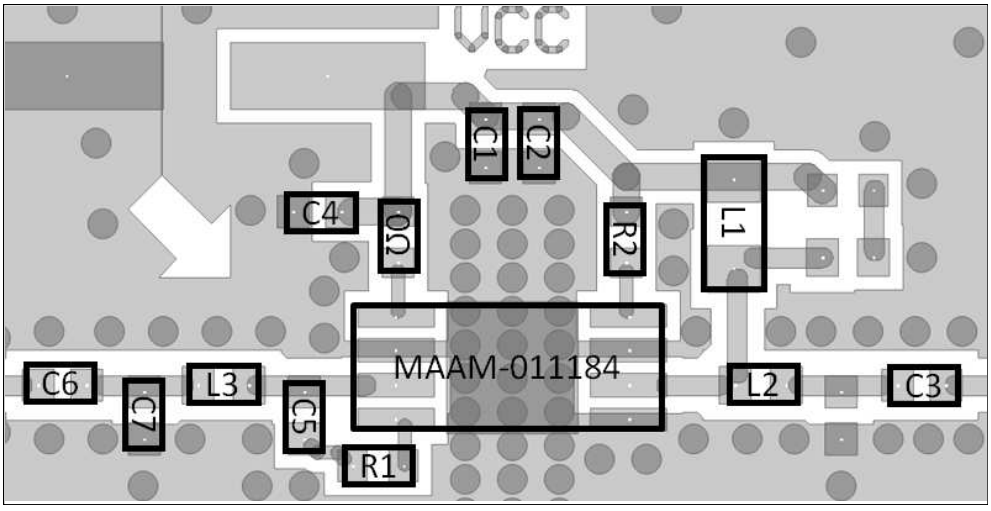


Typical Application Circuit: Component Values

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

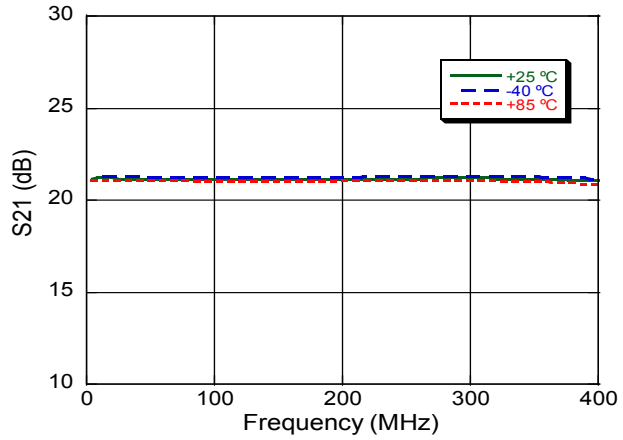
12. Designers may decrease resistor R1 to reduce the gain of the amplifier by approximately 1 dB per 164 Ohms. Below 19.8 dB gain, typical input and output return losses fall below 20 dB. Resistor R2 may be increased in order to reduce bias current I_{CC} (at the cost of large-signal performance) by approximately 1 mA per 42 Ohms.
13. Low-ESR inductor LQH2MCN220K02 from Murata.

Typical Application Circuit: Sample Board Layout

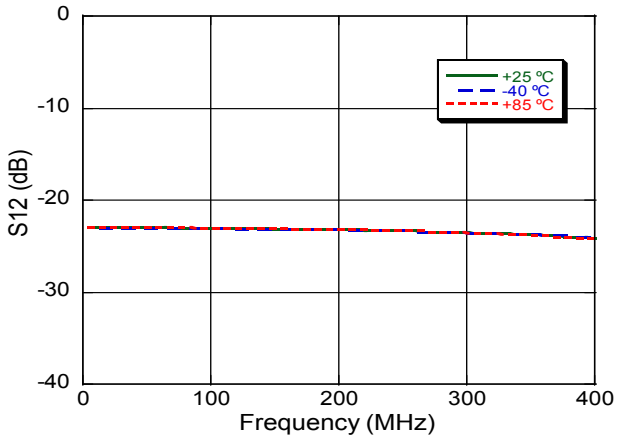


Typical Performance Curves: Small-Signal

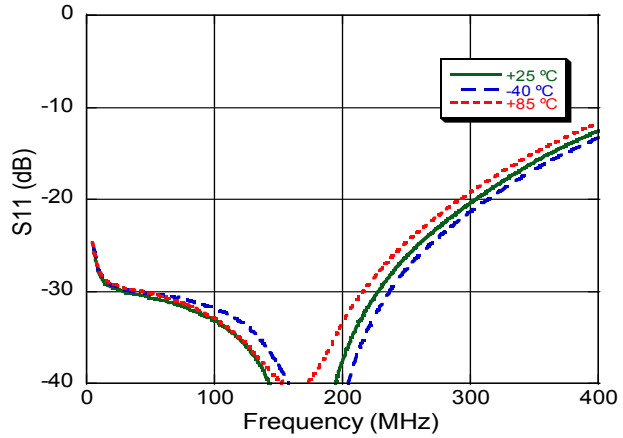
Gain



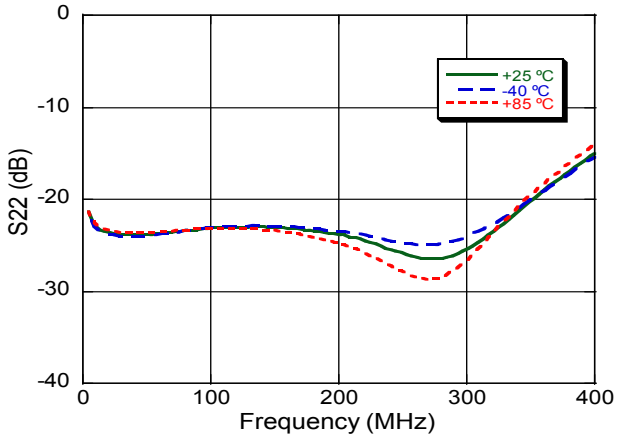
Reverse Isolation



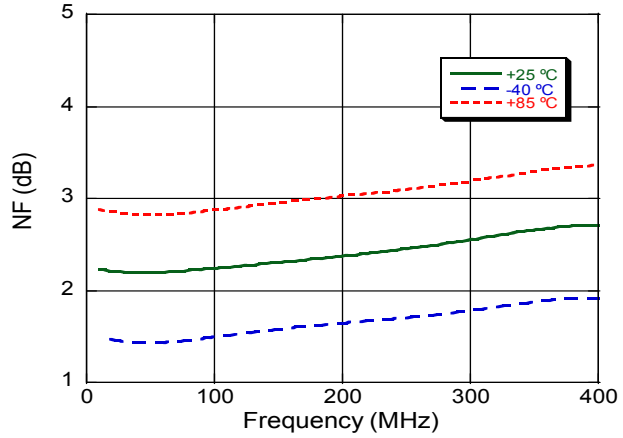
Input Return Loss



Output Return Loss

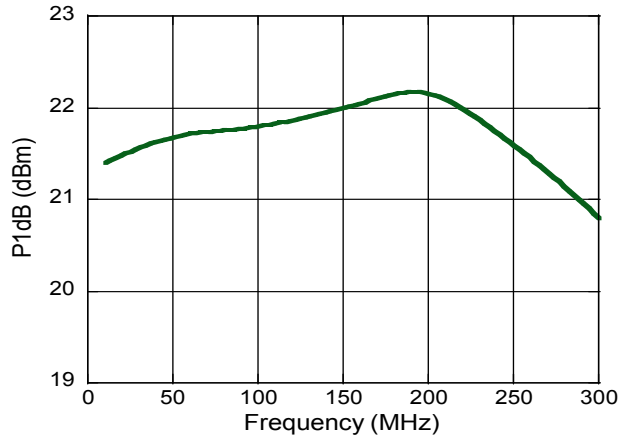


Noise Figure

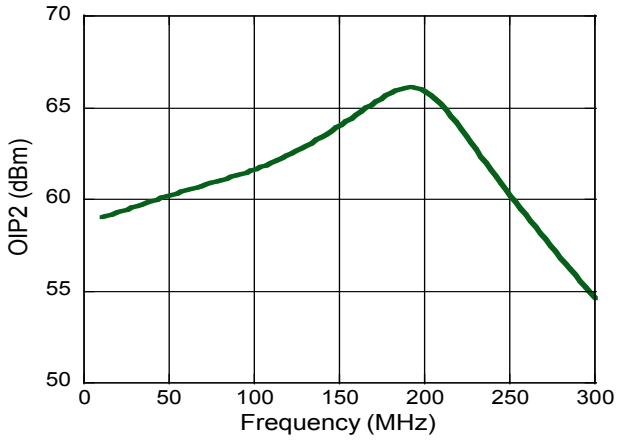


Typical Performance Curves: Large-Signal

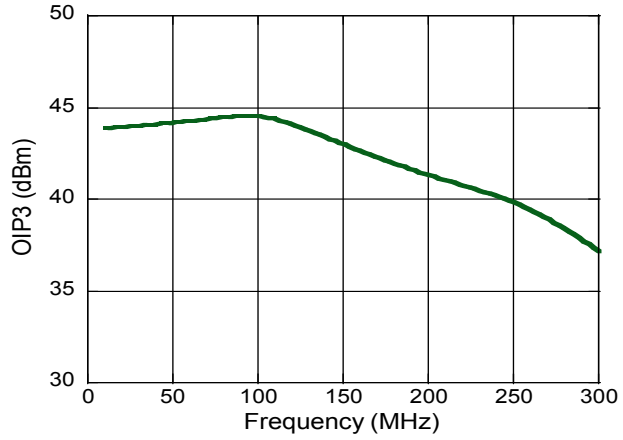
P1dB



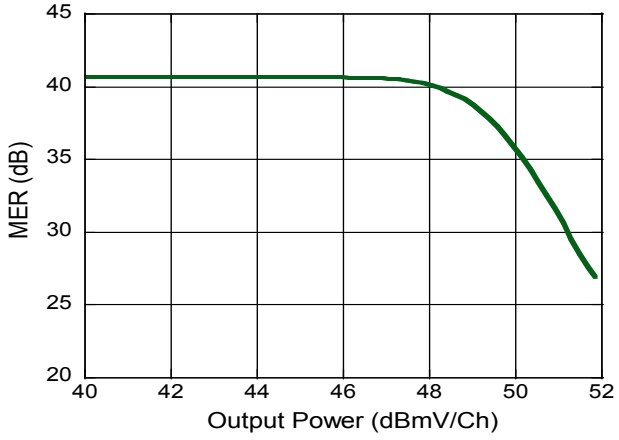
OIP2



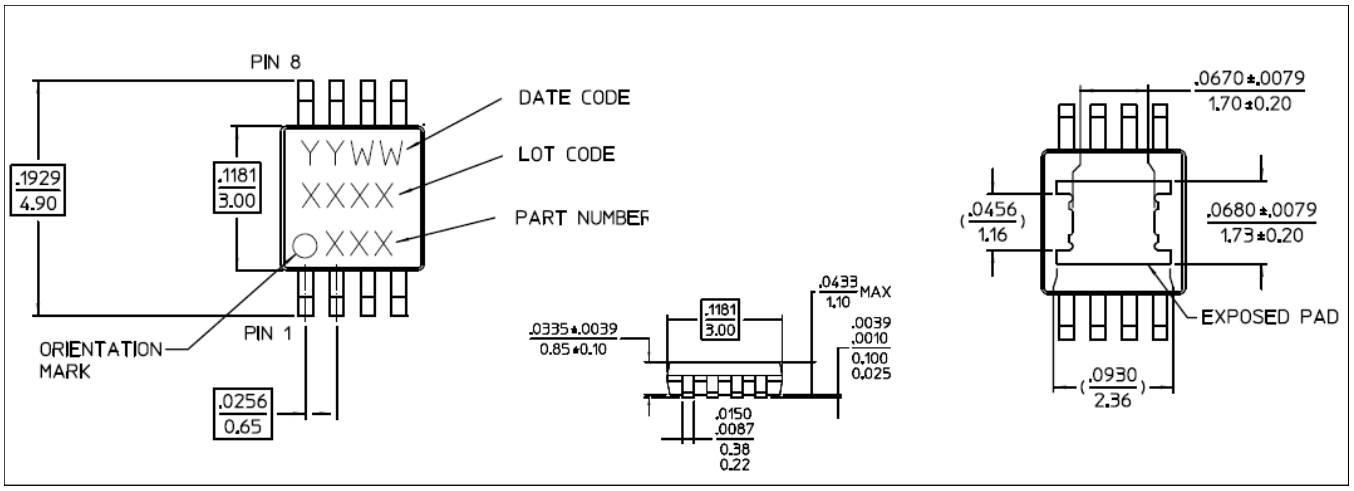
OIP3



MER, 16 Channels 64-QAM



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.