MAAM-011163

75 Ω, Differential RF Amplifier
5 - 1218 MHz

Rev. V1

Features

- Single Stage, Differential Amplifier
- 5 V, 290 mA Operation
- 19 dB Flat Gain
- Low Noise
- Low Distortion Performance
- ESD Class 1B for HBM
- Lead-Free SOIC-8EP Plastic Package
- Halogen-Free "Green" Mold Compound
- RoHS* Compliant

Description

The MAAM-011163 is high gain, high linearity and low noise differential RF amplifier assembled in a SOIC-8EP plastic package. This amplifier provides 19 dB of flat gain with very low noise figure. The differential push-pull topology provides superior 2nd order intermodulation performance.

The MAAM-011163 provides high gain, low noise and low distortion making it ideally suited for 75 Ω infrastructure applications.

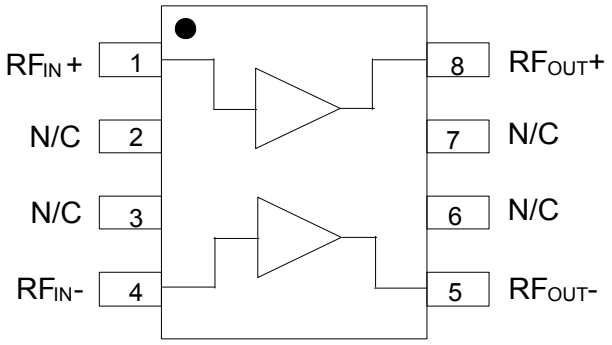
The MAAM-011163 is fabricated using GaAs pHEMT technology.

Ordering Information[1,2]

Part Number	Package
MAAM-011163	Bulk Packaging
MAAM-011163-TR1000	1000 Part Reel
MAAM-011163-TR3000	3000 Part Reel
MAAM-01163-001SMB	Sample Board, 45 - 1218 MHz
MAAM-01163-002SMB	Sample Board, 5 - 300 MHz

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	Function
1	RF_{IN}+	RF Input +
2	N/C	No Connection
3	N/C	No Connection
4	RF_{IN}-	RF Input -
5	RF_{OUT}-	RF Output - / V_{DD}
6	N/C	No Connection
7	N/C	No Connection
8	RF_{OUT}+	RF Output + / V_{DD}
9	Pad[3]	RF and DC Ground

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

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

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75 Ω, Differential RF Amplifier
5 - 1218 MHz

Electrical Specifications: T_A = 25°C, V_{DD} = 5 V, Z_0 = 75 Ω

Performance specified with input/output balun MABA-009210-CT1760.

Parameter	Test Conditions	Units	Min.	Typ.	Max.
Gain	1218 MHz	dB	18.0	19.0	21.5
Tilt	45 - 1218 MHz	dB	—	0	—
Reverse Isolation	45 - 1218 MHz	dB	—	22	—
Input Return Loss	45 - 1218 MHz	dB	—	20	—
Output Return Loss	45 - 1218 MHz	dB	—	20	—
Noise Figure	45 MHz 1218 MHz	dB	—	1.4 2.4	—
Output IP2	45 - 1218 MHz, tone spacing 6 MHz P_{OUT} per tone = +13 dBm	dBm	—	62	—
Output IP3	45 - 1218 MHz, tone spacing 6 MHz P_{OUT} per tone = +13 dBm	dBm	—	42	—
P1dB	45 - 1218 MHz	dBm	—	25	—
Composite Triple Beat, CTB	79 channels, 0 dB Tilt, 39 dBmV per channel output, QAM to 1000 MHz	dBc	—	-72	—
Composite Second Order, CSO	79 channels, 0 dB Tilt, 39 dBmV per channel output, QAM to 1000 MHz	dBc	—	-75	—
I_{DD}	V_{DD} = 5 V	mA	—	290	345

Absolute Maximum Ratings[4,5,6]

Parameter	Absolute Maximum
Max Input Power	10 dBm
Operating Voltage	8 V
Operating Temperature	-40°C to +85°C
Storage Temperature	-65°C to +150°C
Junction Temperature[7]	150°C

4. Exceeding any one or combination of these limits may cause permanent damage to this device.
5. MACOM does not recommend sustained operation near these survivability limits.
6. Operating at nominal conditions with T_J < 150°C will ensure MTTF > 1 x 10^6 hours.
7. Junction Temperature (T_J) = Case Temperature (T_C) + Θ_{JC}*(V*I)
   Typical thermal resistance (Θ_{JC}) = 29°C/W.
   a) For T_C = 25°C,
   T_J = 67°C @ 5V, 290 mA
   b) For T_C = 85°C,
   T_J = 127°C @ 5 V, 290 mA

Handling Procedures

Please observe the following precautions to avoid damage:

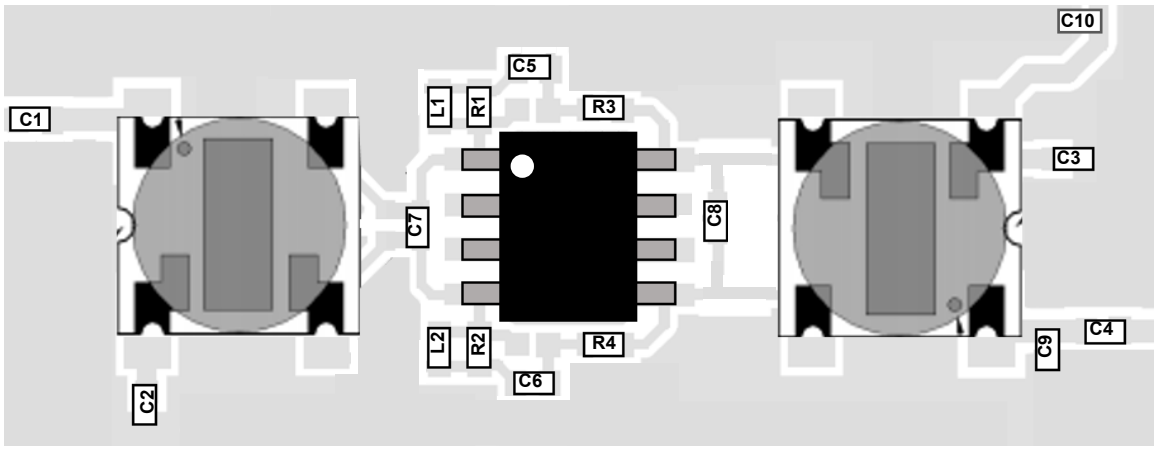
Static Sensitivity

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 (HBM) Class 1B devices.

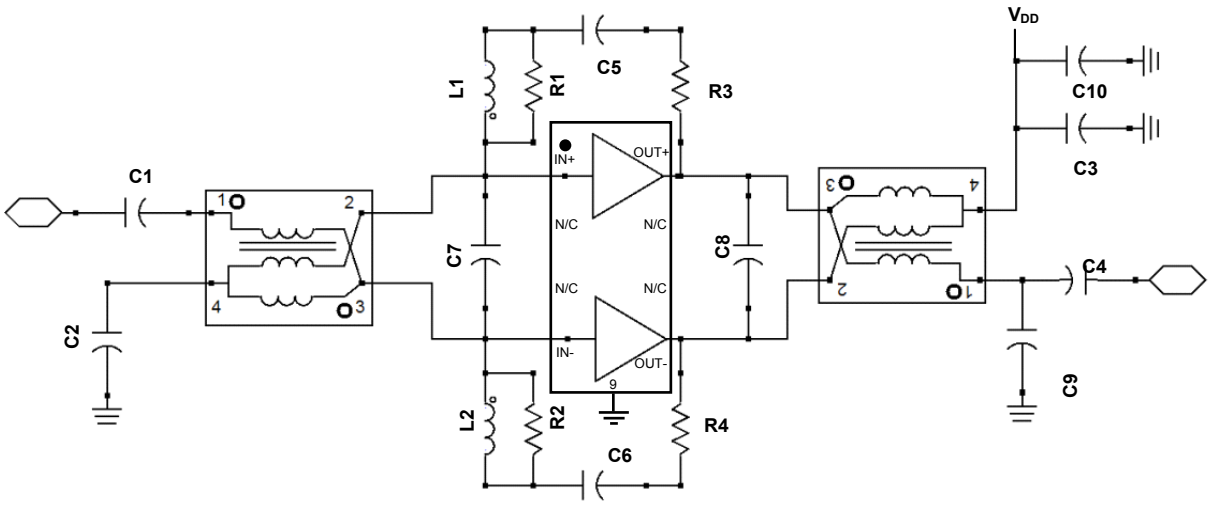
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Recommended PCB Layout



Schematic Including Off-Chip Components



Parts List

Component	Value	Package	Component	Value	Package
C1, C4	270 pF	0402	L1, L2	33 nH	0402
C2,C3,C5,C6,C10	10 nF	0402	R1, R2	82 Ω	0402
C7	0.5 pF	0402	R3, R4	374 Ω	0402
C8	1.2 pF	0402	T1, T2	1:1 Balun[8]	—
C9	Do Not Install	0402			

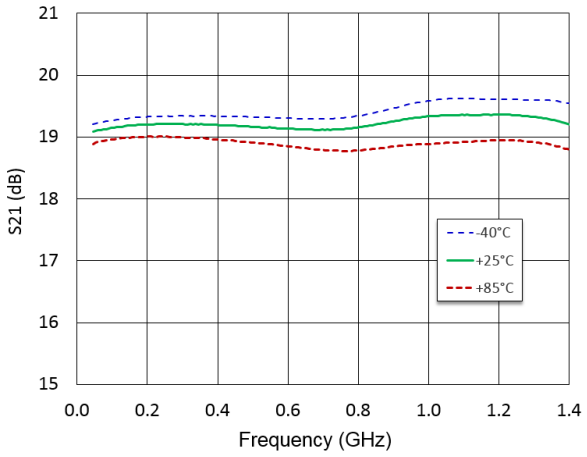
8. MABA-009210-CT1760

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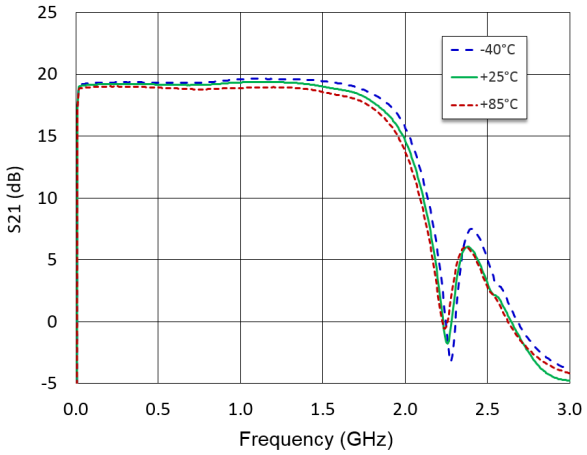
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Typical Performance Curves: V_{DD} = 5 V

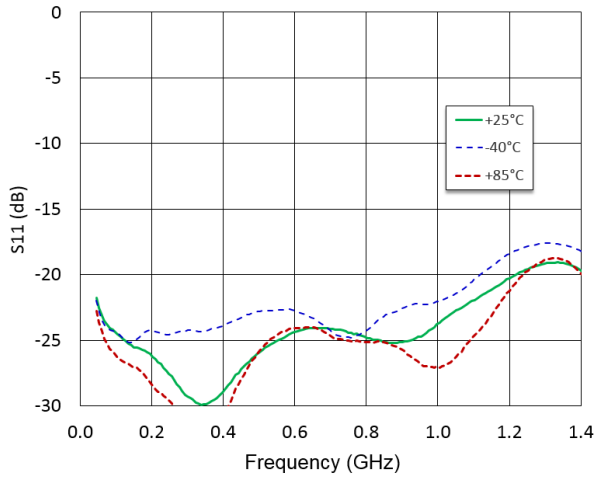
Gain



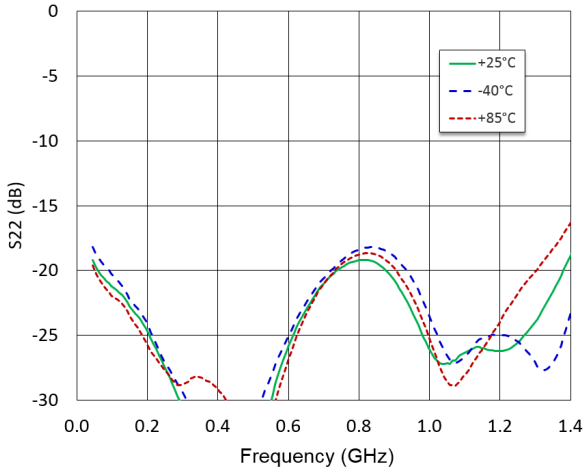
Gain to 3 GHz



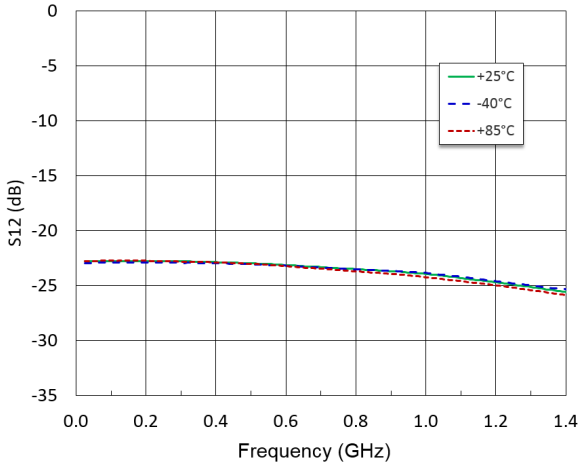
Input Return Loss



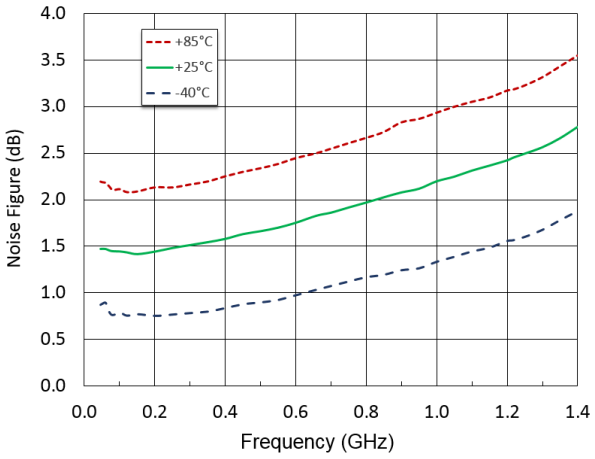
Output Return Loss



Reverse Isolation



Noise Figure

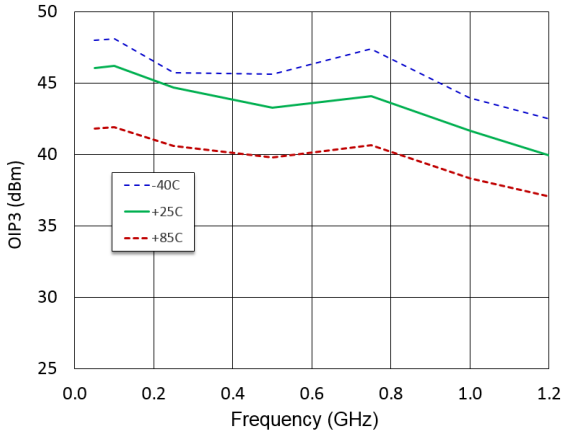


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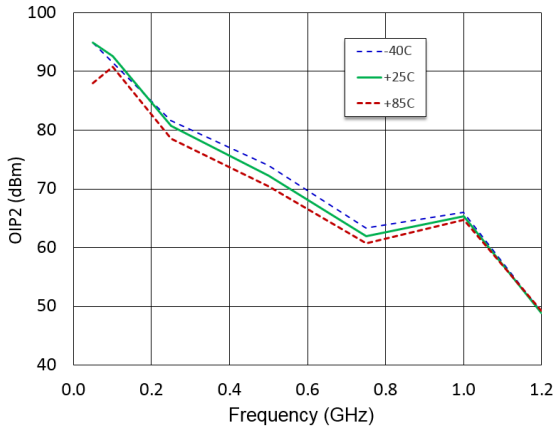
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Typical Performance Curves: V_{DD} = 5 V

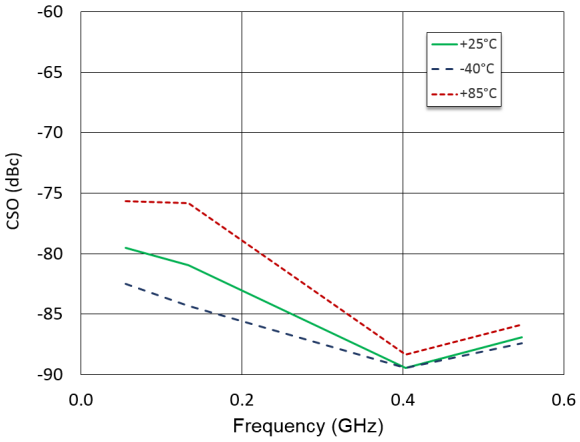
OIP3, P_{OUT} = +13 dBm/tone



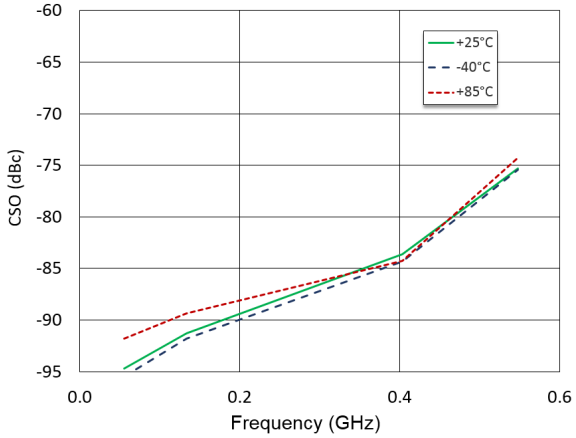
OIP2, P_{OUT} = +13 dBm/tone



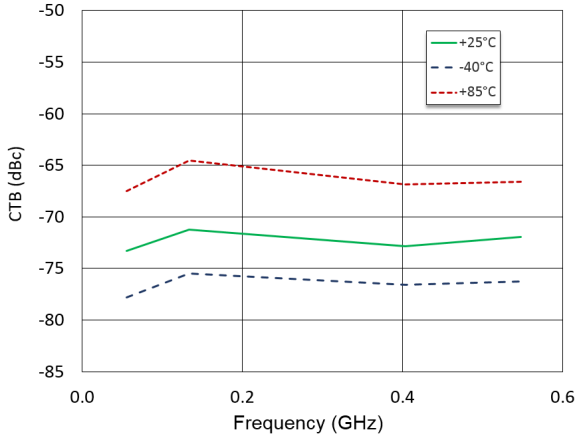
CSO Lower, 79 channels + QAM to 1 GHz, 0 dB tilt, 39 dBmV per channel



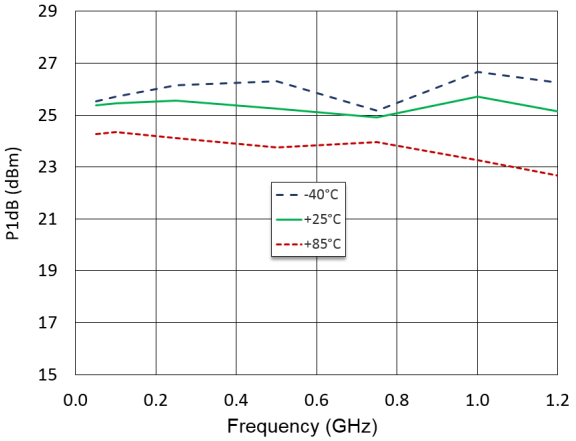
CSO Upper, 79 channels + QAM to 1 GHz, 0 dB tilt, 39 dBmV per channel



CTB, 79 channels + QAM to 1 GHz, 0 dB tilt, 39 dBmV per channel



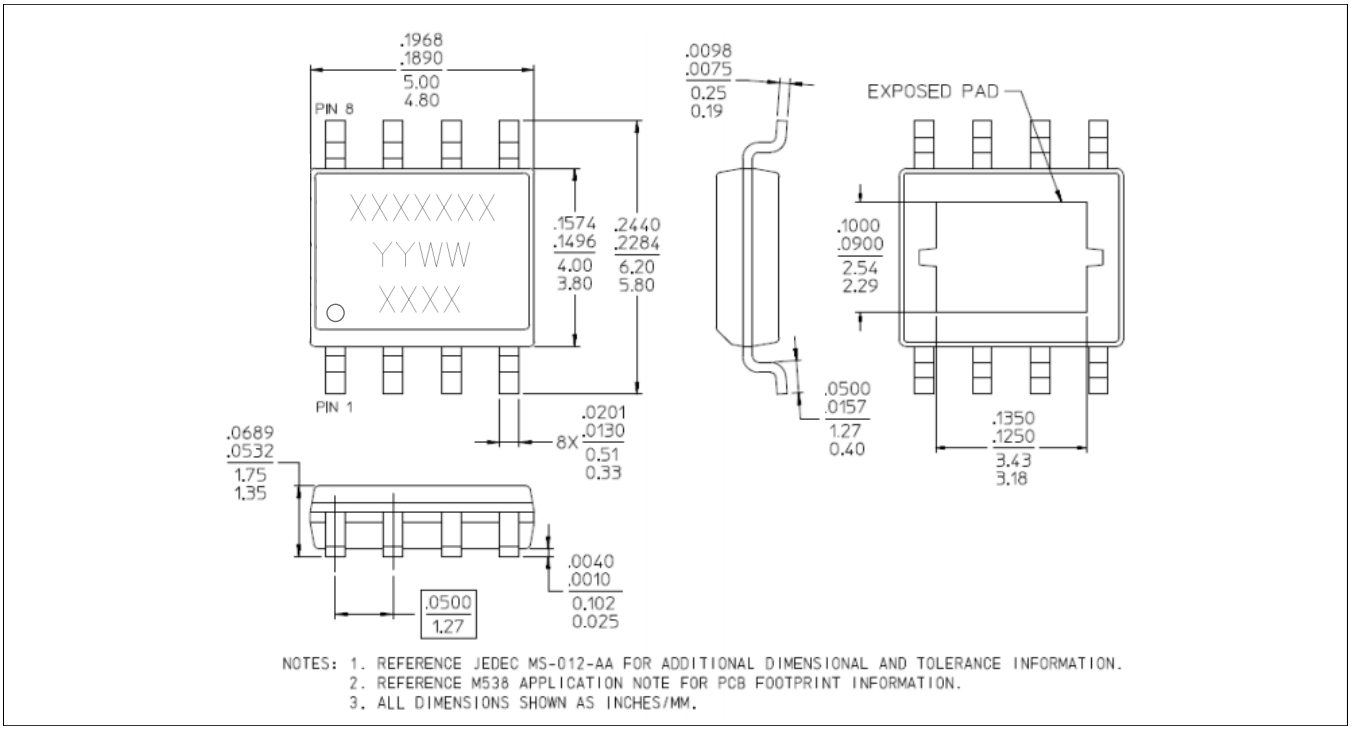
P1dB



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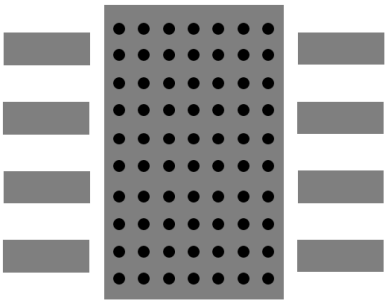
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SOIC-8EP†



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

Recommended PCB Land Pattern



70 ground vias
0.008 inch finished hole diameter

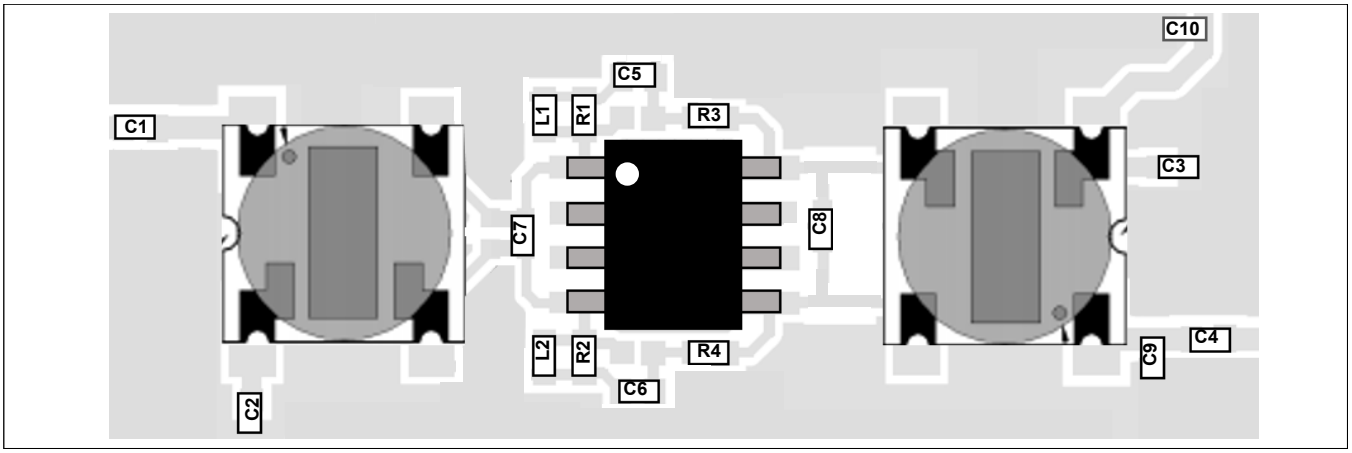
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Applications Section: 5 - 300 MHz Application

The MAAM-011163 may be tuned for operation in the 5 - 300 MHz band for CATV reverse path (upstream) applications using an alternate balun and other external tuning components as identified in the table below. The recommended PCB layout and schematic are the same as identified on page 3.

Recommended PCB Layout for Upstream



Parts List : 5 - 300 MHz Tune

Component	Value	Package	Component	Value	Package
C1 - C6, C10	10 nF	0402	L1, L2	33 nH	0402
C7	0.5 pF	0402	R1, R2	82 Ω	0402
C8	1.2 pF	0402	R3, R4	374 Ω	0402
C9	Do Not Install	0402	T1, T2	1:1 Balun[8]	—

9. MABA-0011085

Electrical Specifications: 5 - 300 MHz Tune, T_A = 25°C, V_{DD} = 5 V, Z_0 = 75 Ω

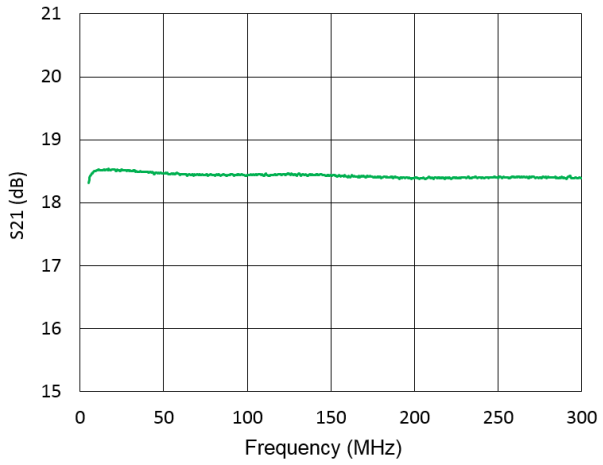
Parameter	Test Conditions	Units	Min.	Typ.	Max.
Gain	5 - 300 MHz	dB	—	18.5	—
Reverse Isolation	5 - 300 MHz	dB	—	22	—
Input Return Loss	5 - 300 MHz	dB	—	25	—
Output Return Loss	5 - 300 MHz	dB	—	18	—
Noise Figure	5 - 10 MHz 20 - 300 MHz	dB	—	2.5 1.5	—
Output IP2	5 - 300 MHz, tone spacing 6 MHz P_{OUT} per tone = +13 dBm	dBm	—	75	—
Output IP3	5 - 300 MHz, tone spacing 6 MHz P_{OUT} per tone = +13 dBm	dBm	—	45	—
P1dB	45 - 1218 MHz	dBm	—	25	—
I_{DD}	V_{DD} = 5 V	mA	—	290	—

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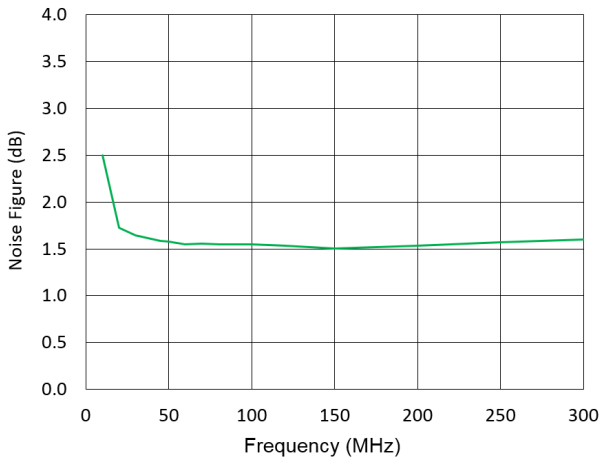
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Typical Performance Curves: 5 - 300 MHz Tune, V_{DD} = 5 V, +25°C

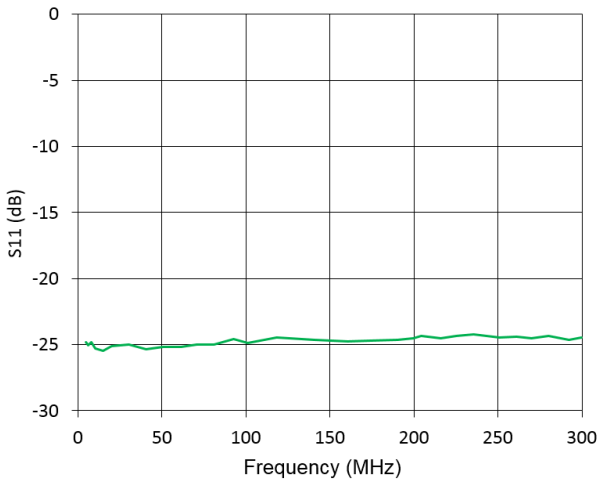
Gain



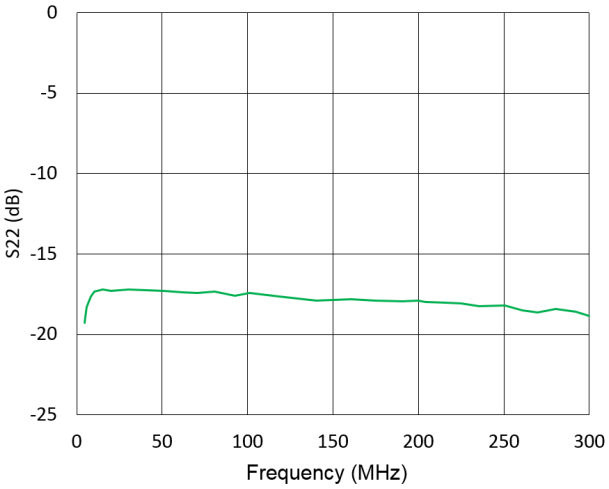
Noise Figure, 10 - 300 MHz



Input Return Loss



Output Return Loss



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