Differential RF Amplifier, 75 Ω
5 - 1800 MHz

MAAM-011299
Rev. V2

Features

- Single Stage, Differential Amplifier
- 5 V, 290 mA Operation
- 18.7 dB Flat Gain
- Low Noise
- Low Distortion Performance
- Configurable as a Single Stage TIA for Optical Applications
- Lead-Free SOIC-8EP Plastic Package
- RoHS* Compliant

Applications

- CATV Infrastructure

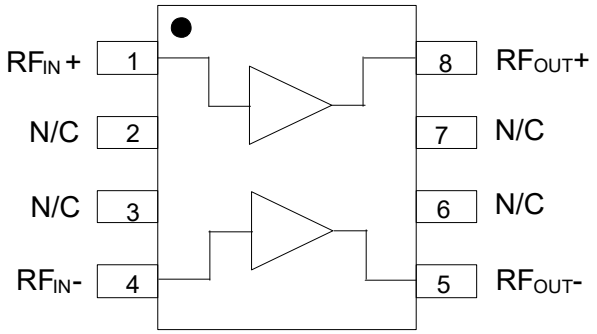
Description

The MAAM-011299 is high gain, high linearity and low noise differential RF amplifier assembled in a SOIC-8EP plastic package. This amplifier provides 18.7 dB of flat gain with very low noise figure. The differential push-pull topology provides superior 2nd order intermodulation performance.

The MAAM-011299 provides high gain, low noise and low distortion making it ideally suited for 75 Ω infrastructure applications.

The MAAM-011299 can be configured with input from a photo diode for optical receiver applications. Having a typical EIN of 3.5pA/√ Hz, high gain and excellent output return loss.

Functional Schematic



Pin Configuration[3,4]

Pin #	Pin Name	Function
1	RF_{IN}+	RF Input +
2, 3	N/C	No Connection
4	RF_{IN}-	RF Input -
5	RF_{OUT}-	RF Output - / V_{DD}
6, 7	N/C	No Connection
8	RF_{OUT}+	RF Output + / V_{DD}

3. The exposed pad centered on package bottom must be connected to RF and DC ground.
4. All pins listed as "No Connection" are not connected electrically inside the package.

Ordering Information[1,2]

Part Number	Package
MAAM-011299	bulk
MAAM-011299-TR1000	1000 piece reel
MAAM-011299-TR3000	3000 piece reel
MAAM-011299-001SMB	sample board

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

* Restrictions on Hazardous Substances, compliant to current RoHS EU directive.

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

Performance specified with input/output balun MABA-011112.

Parameter	Test Conditions	Units	Min.	Typ.	Max.
Gain	5 - 1800 MHz 50 MHz 1218 MHz 1800 MHz	dB	— 17.8 18.0 16.8	18.7 18.8 18.9 18.3	— 21.0 21.0 21.0
Tilt	5 - 1800 MHz	dB	—	0.7	—
Reverse Isolation	5 - 1800 MHz	dB	—	23	—
Input Return Loss	5 - 1800 MHz	dB	—	20	—
Output Return Loss	5 - 1800 MHz	dB	—	20	—
Noise Figure	45 MHz 1800 MHz	dB	—	1.8 3.8	—
Output IP2	5 - 1800 MHz, tone spacing 6 MHz P_{OUT} per tone = +13 dBm	dBm	—	59	—
Output IP3	5 - 1800 MHz, tone spacing 6 MHz P_{OUT} per tone = +13 dBm	dBm	—	42	—
P1dB	5 - 1800 MHz	dBm	—	24	—
Composite Triple Beat, CTB	79 channels, 0 dB Tilt, 39 dBmV per channel output, QAM to 1000 MHz	dBc	—	-74	—
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	350

Maximum Operating Ratings[5,6]

Parameter	Absolute Maximum
Input Power	10 dBm
V_{DD}	7 V
I_{DD}	400 mA
Operating Temperature	-40°C to +85°C
Junction Temperature[7,8]	150°C

Absolute Maximum Ratings[5,6]

Parameter	Absolute Maximum
RF Input Power CW	27 dBm
V_{DD}	10 V
Storage Temperature	-55ºC to +150ºC

5. Exceeding any one or combination of these limits may cause permanent damage to this device.
6. MACOM does not recommend sustained operation near these survivability limits.
7. Operating at nominal conditions with T_J <150°C will ensure MTTF > 1 x 10^6 hours.
8. 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 = 121°C @ 5 V, 245 mA

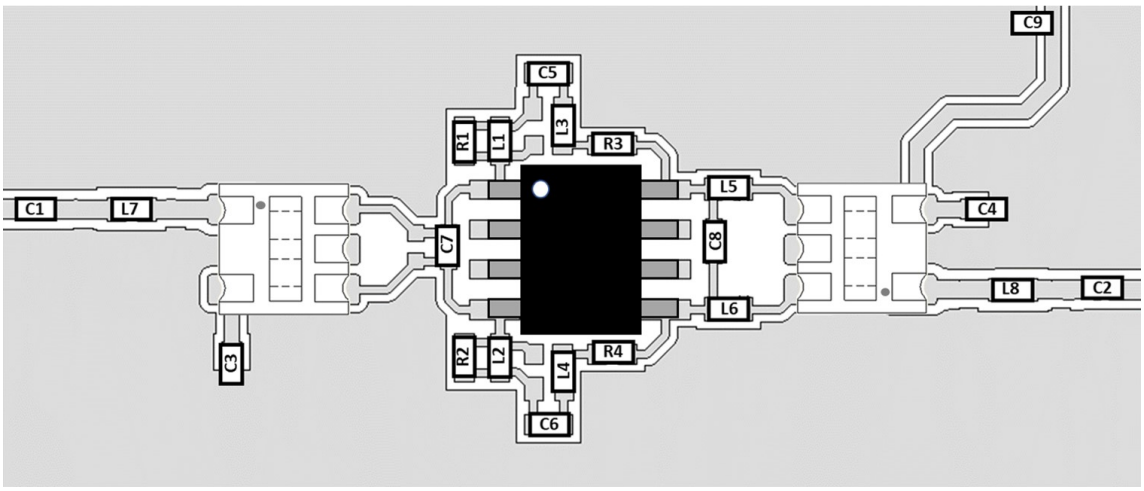
Handling Procedures

Please observe the following precautions to avoid damage:

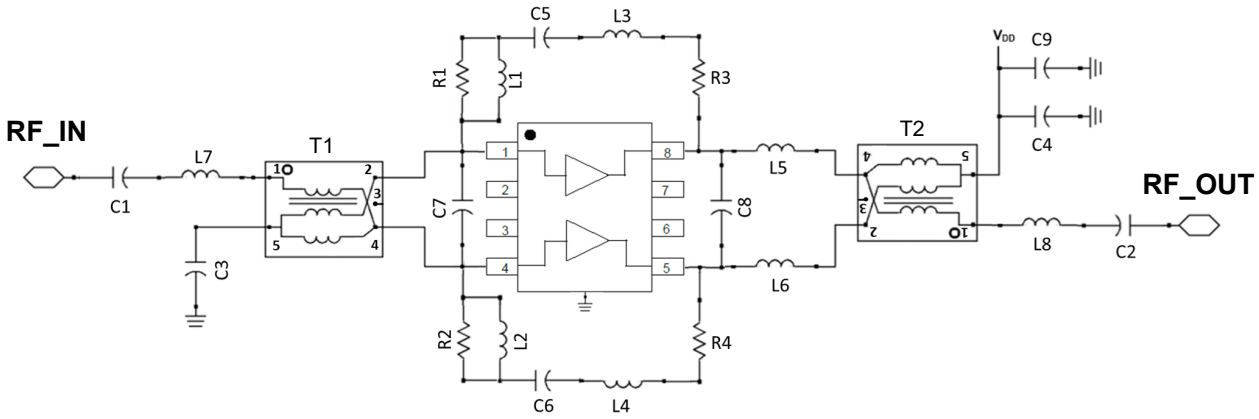
Static Sensitivity

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 1C devices.

Recommended PCB Layout



Schematic Including Off-Chip Components[9]



9. Pin 3 of MABA-011112 is an unconnected pin.

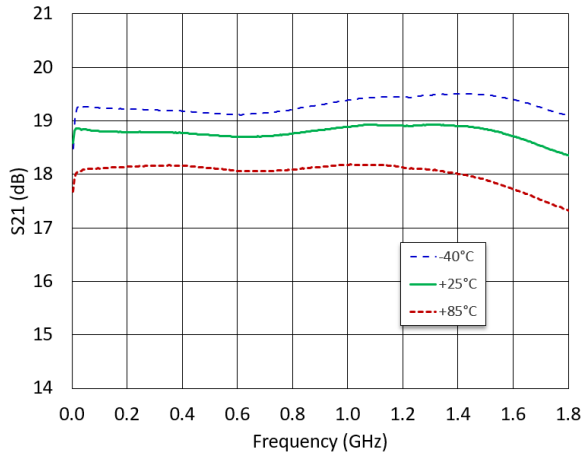
Parts List

Component	Value	Package	Component	Value	Package
C1 - C6, C9	10 nF	0402	L7	2.4 nH	0402
C7	0.3 pF	0402	L8	2.7 nH	0402
C8	0.7 pF	0402	R1, R2	86.7 Ω	0402
L1, L2	27 nH	0402	R3, R4	464 Ω	0402
L3, L4	3.9 nH	0402	T1, T2	1:1 Balun[10]	—
L5, L6	1.5 nH	0402			

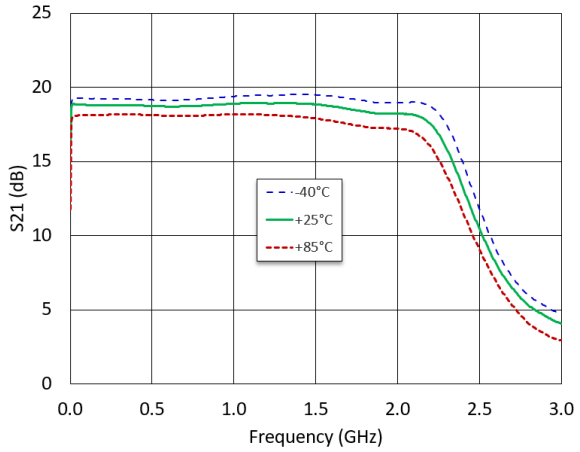
10. MABA-011112

Typical Performance Curves: V_{DD} = 5 V

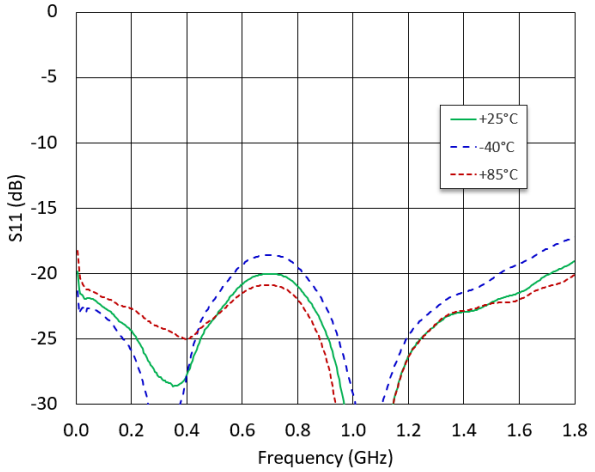
Gain



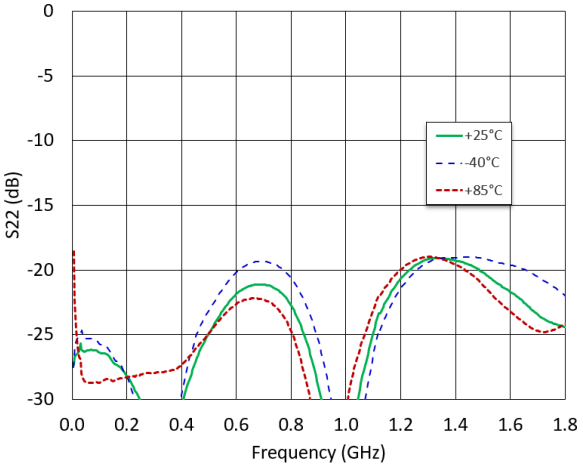
Gain to 3 GHz



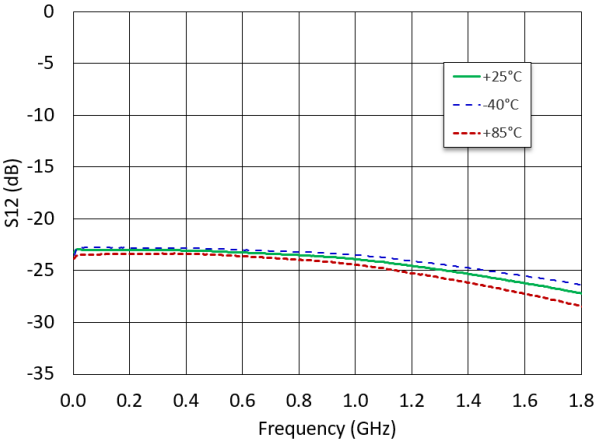
Input Return Loss



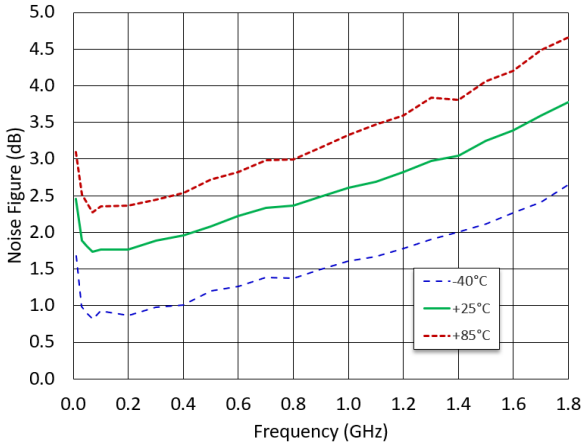
Output Return Loss



Reverse Isolation

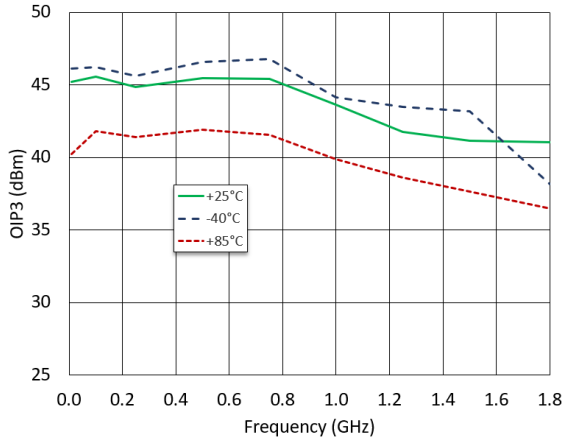


Noise Figure

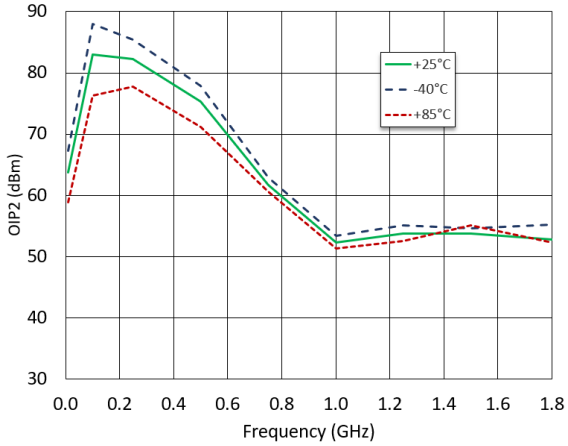


Typical Performance Curves: V_{DD} = 5 V

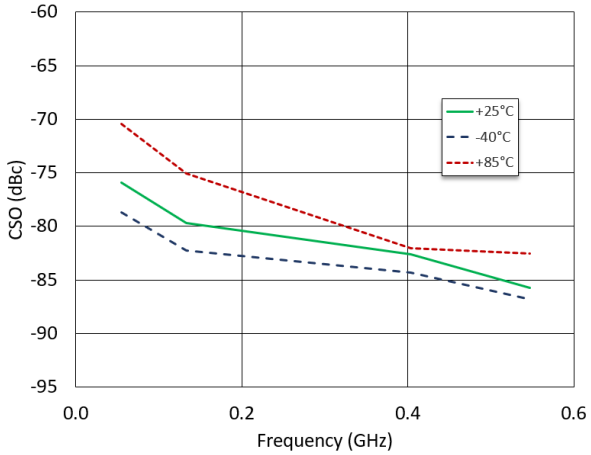
OIP3, P_{OUT} = +13 dBm/tone



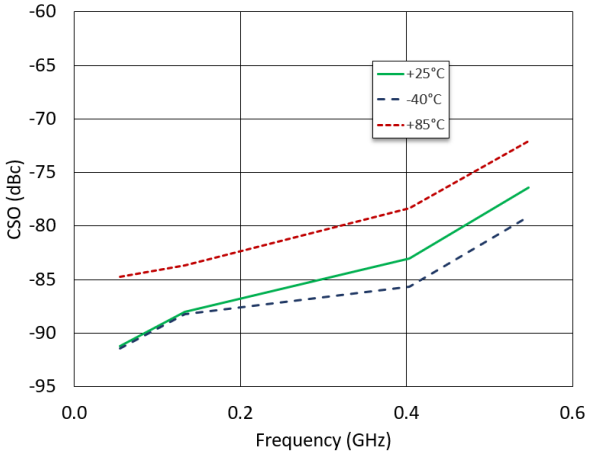
OIP2, P_{OUT} = +13 dBm/tone



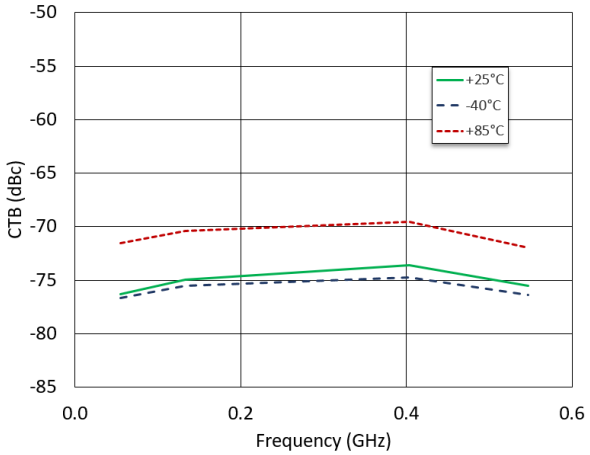
CSO Lower, 79 channels + QAM to 1 GHz, 0 dB tilt, 39 dBmV per channel



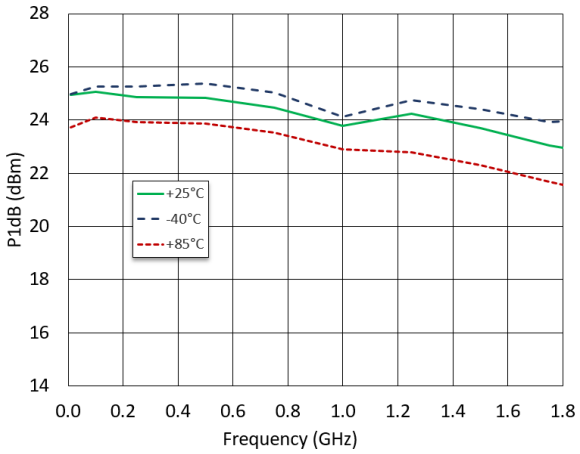
CSO Upper, 79 channels + QAM to 1 GHz, 0 dB tilt, 39 dBmV per channel



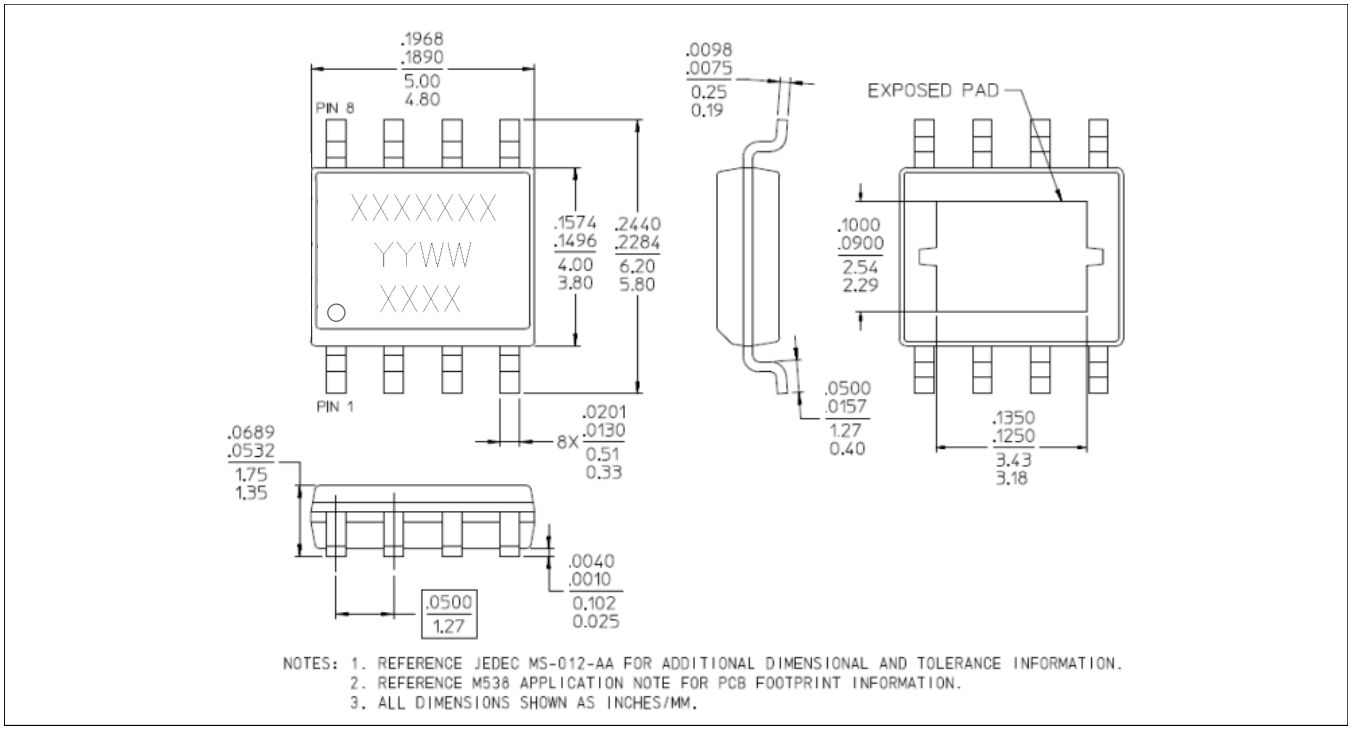
CTB, 79 channels + QAM to 1 GHz,



P1dB

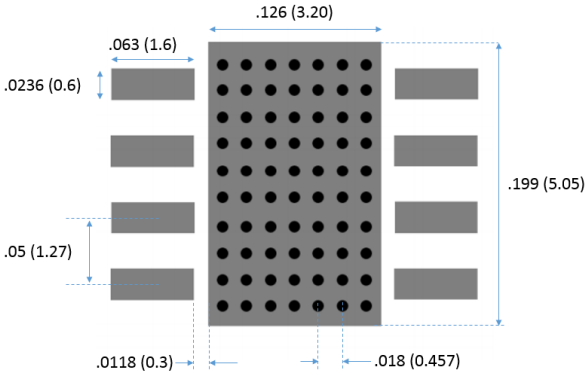


SOIC-8EP†



† 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
All dimensions shown as inches (mm)

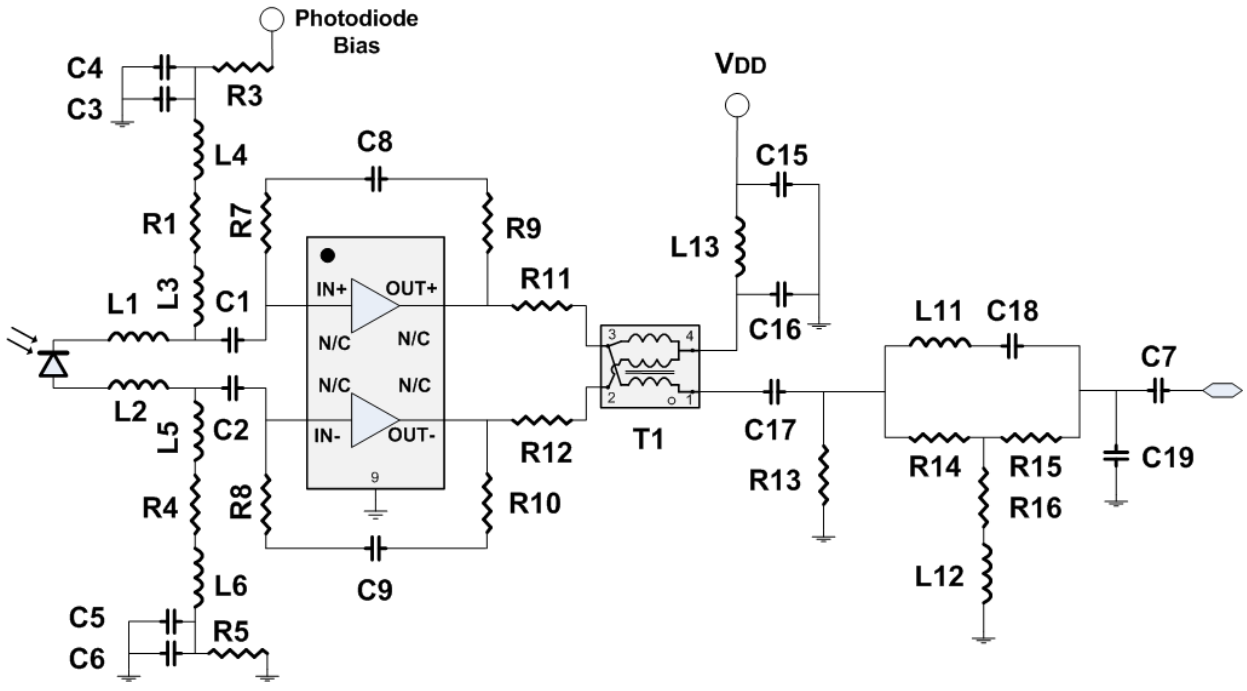
Applications Section: FTTx Application

The MAAM-011299 can be configured as a TIA for optical applications. Operating from 50 - 1200 MHz with a typical gain of 23dB and an output return loss better than 10 dB. The MAAM-011299 in this configuration has a typical EIN of 3.5 pA/√ Hz.

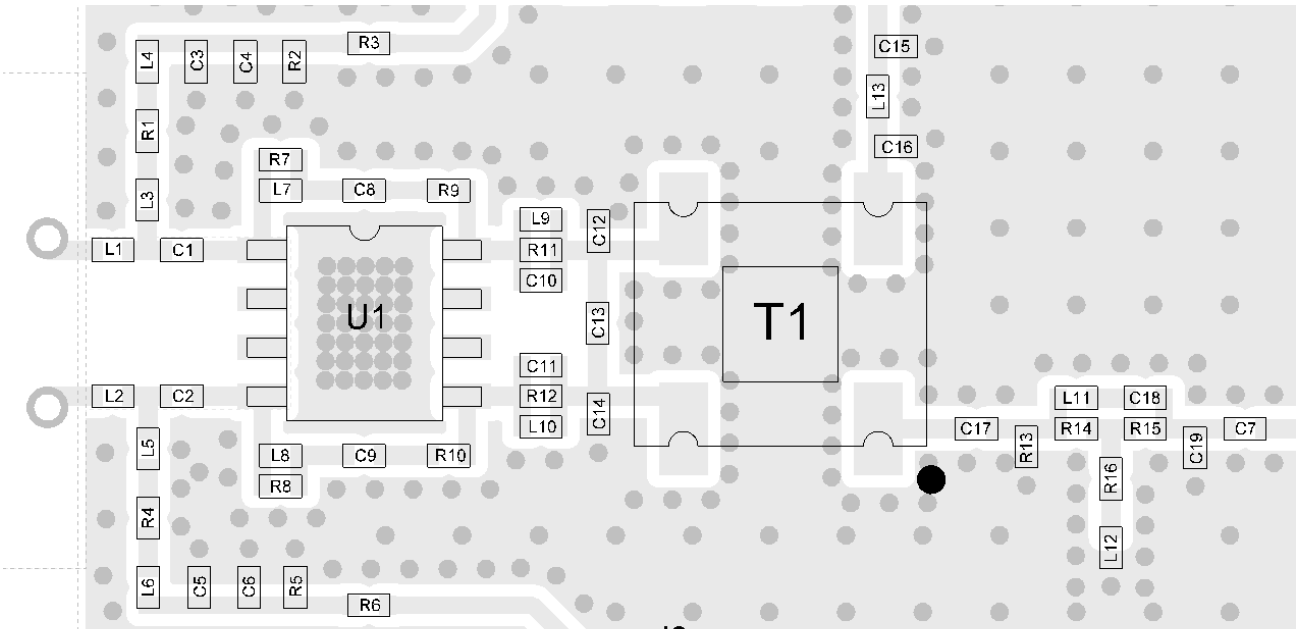
Electrical Specifications: 50 - 1200 MHz Tune, T_A = 25°C, V_{DD} = 5 V, Z_0 = 75 Ω

Parameter	Units	Min.	Typ.	Max.
Gain	dB	—	22.5	—
Output Return Loss	dB	—	12	—
Equivalent Input Noise	pA/√ Hz	—	3.5	—
I_{DD}	mA	—	265	—

Schematic Including Off-Chip Components



Recommended PCB Layout



Parts List

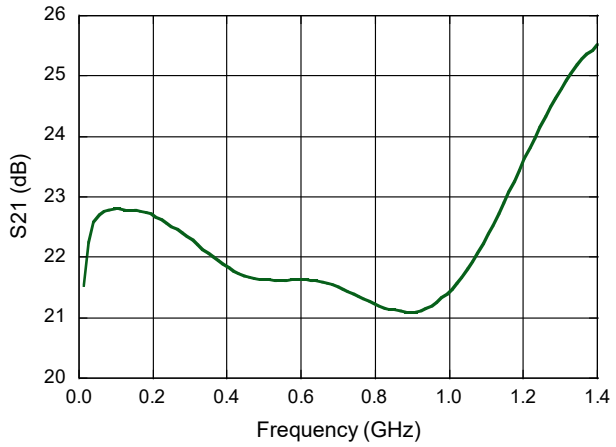
Component	Value	Package	Component	Value	Package
C1 - C3, C5, C7 - C9, C16, C17	10 nF	0402	R3	200 Ω	0402
C4, C6, C15	100 nF	0402	R7, R8	2 kΩ	0402
C18	5.6 pF	0402	R9, R10	470 Ω	0402
C19	0.5 pF	0402	R11, R12	0 Ω	0402
L1, L2	3.9 nH	0402	R13	430 Ω	0402
L11	12 nH	0402	R14, R15	39 Ω	0402
L12	68 nH	0402	R16	33 Ω	0402
L3 - L6, L13	BLM15HD182SN1	0402	T1	1:1 Balun[11]	
R1, R4, R5	1 kΩ	0402	J2	10 - Way Header	
L7 - L10, C10 - C14, R2, R6, J3	Do Not Fit				

11. MABA-009210-CT1760

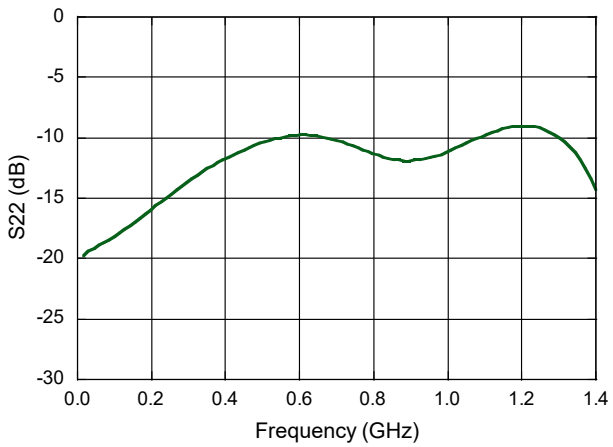
Applications Section: FTTx Application

Typical Performance Curves: V_{DD} = 5 V

Gain



Output Return Loss



Equivalent Input Noise