X-Band Low Noise Amplifier
8 - 12 GHz

MAAL-011272
Rev. V1

Features

- Noise Figure: 1.5 dB
- Gain: 33 dB
- Drain Current: 50 mA DC Consumption
- Drain Voltage: 5 V
- Lead-Free 4 mm, 24-Lead QFN
- RoHS* Compliant

Applications

- Radar
- Military

Description

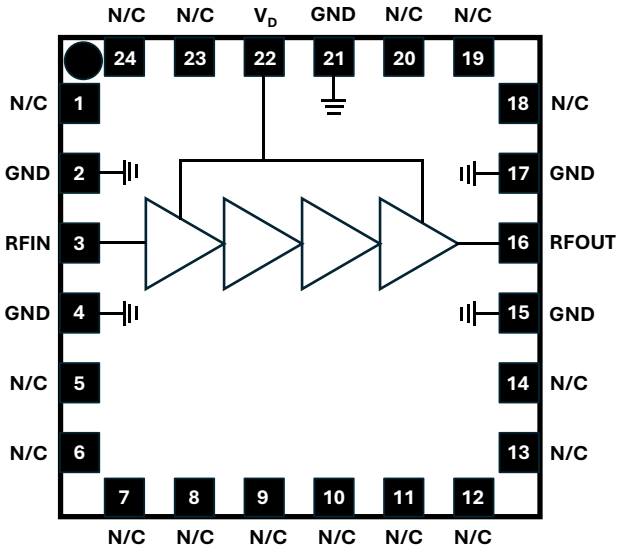
The MAAL-011272 is a high performance GaAs low noise amplifier MMIC designed to operate in X band.

This device has a low noise figure of 1.5 dB with 33 dB of gain for a power consumption of only 250 mW. Ideally suited for use in military and radar.

The die is manufactured using 0.13 µm gate length pHEMT technology. The MMIC uses gold bond pads and backside metallization and is fully protected with silicon nitrite passivation to obtain the highest level of reliability.

This technology has been evaluated for space applications and is on the European Preferred Parts List of the European Space Agency.

Block Diagram



Pad Configuration

Pad #	Pad Name	Function
1,5,6,7-14, 18-20,23,24	N/C	Not Connected
2,4,15,17,21	GND	Ground
3	RF_{IN}	RF Input
16	RF_{OUT}	RF Output
22	V_D	Voltage Drain

Ordering Information

Part Number	Package
MAAL-011272-TR1000	1000 part reel
MAAL-011272-001SMB	Evaluation Board

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

Electrical Specifications: Freq. = 8 - 12 GHz, V_D = 5 V, T_A = +25°C

Parameter	Test Conditions	Units	Min.	Typ.	Max.
Gain	8 GHz 10 GHz 12 GHz	dB	— 30 —	— 33 —	—
Noise Figure	8 GHz 10 GHz 12 GHz	dB	—	— 1.5 —	— 2 —
Output P1dB	10 GHz	dBm	—	10	—
Input Return Loss	8 - 12 GHz	dB	—	-7	—
Output Return Loss	8 - 12 GHz	dB	—	-10	—
Current	Total DC current included DC current regulation	mA	—	50	—

Recommended Operating Conditions

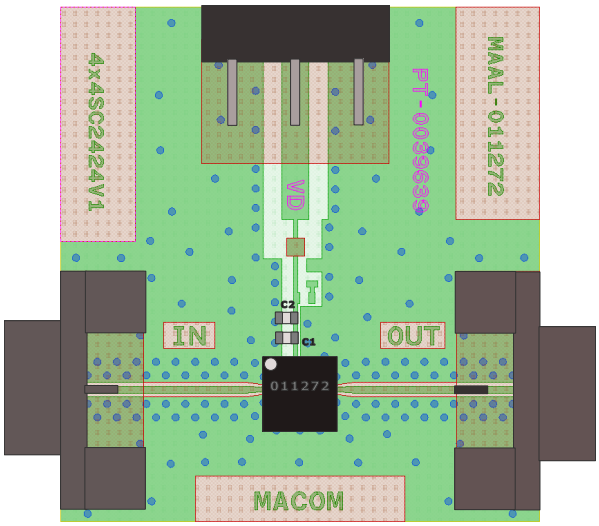
Parameter	Symbol	Unit	Min.	Typ.	Max.
Input RF Ports	RF_{IN}	dBm	—	-15	—
DC Voltage Drain Supply	V_D	V	—	+5	—

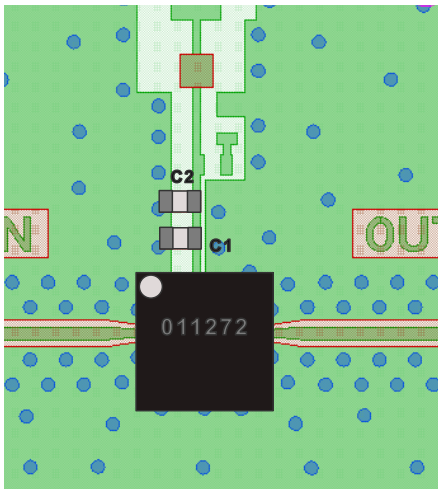
Absolute Maximum Ratings[1,2]

Parameter	Symbol	Unit	Min.	Max.
Input RF Ports	$RF_{IN,}$	dBm	—	+10
DC Voltage Drain Supply	V_D	V	—	—
Junction Temperature[3,4]	T_J	°C	—	+150
Operating Temperature[5]	T_C	°C	-40	+85
Storage Temperature	T_{STG}	°C	-40	+150

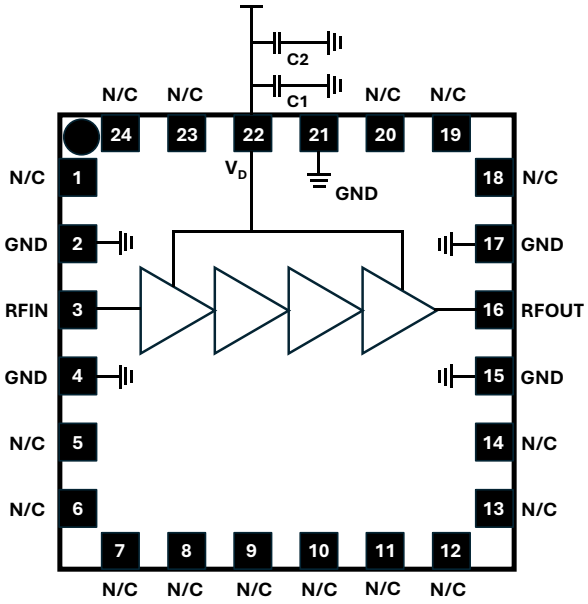
1. Exceeding any one or combination of these limits may cause permanent damage to this device.
2. MACOM does not recommend sustained operation near these survivability limits.
3. Operating at nominal conditions with $T_J \leq +150°C$ will ensure MTTF > 1 x 10^{11} hours.
4. Junction Temperature (T_J) = T_C + Θjc * (V * I)
   Typical thermal resistance (Θjc) = 283 °C/W.
   a) For T_C = +25°C,
   T_J = 32,3°C @5V, 50 mA
   b) For T_C = +85°C
   T_J = 98,9°C @5V, 48 mA

PCB Layout





Functional Schematic



Handling Procedures

Please observe the following precautions to avoid damage:

Static Sensitivity

These electronic devices 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 0 devices.

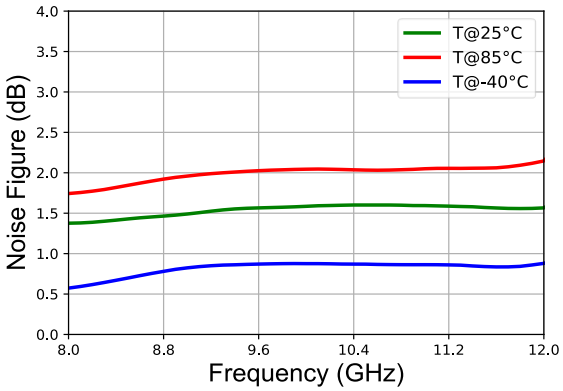
Parts List

Part	Value	Case Style	Manufacturer	Manufacturer's Part number
C1	47 pF	0402	Murata	GRT1555C1H470JA02D
C2	10 nF	0402	Murata	GRT188R71E474KE13D

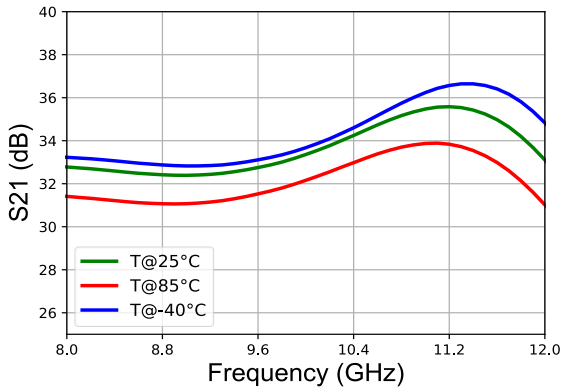
Typical Performance Curves: In board without De-Embedding at different temperature

S-parameters at PCB level without De-Embedding

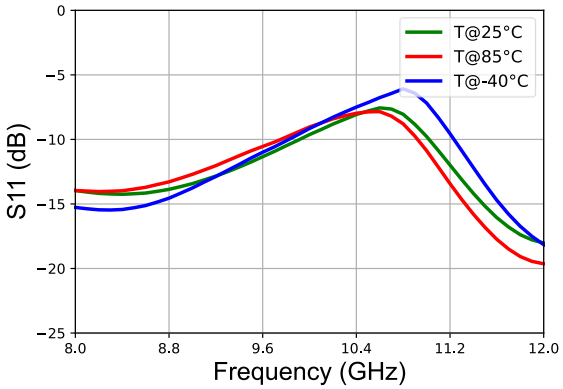
Noise Figure over Frequency



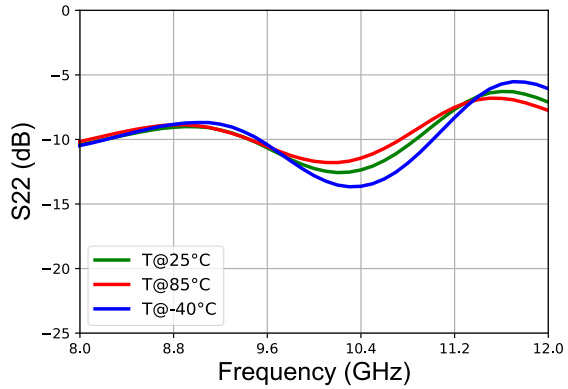
Gain over Frequency



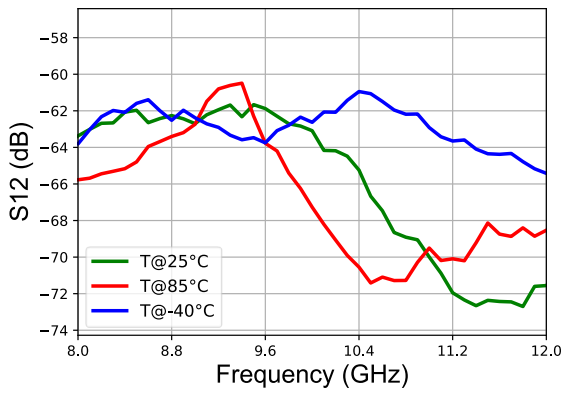
Input Return Loss over Frequency



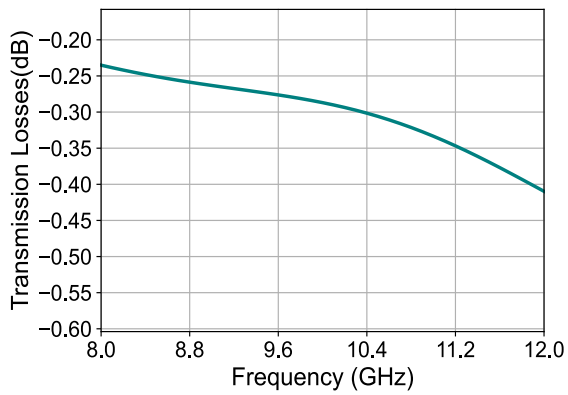
Output Return Loss over Frequency



Reverse Isolation over Frequency

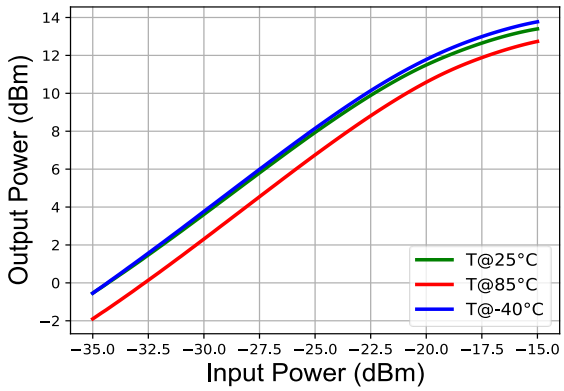


RF access line & connector Losses over Frequency

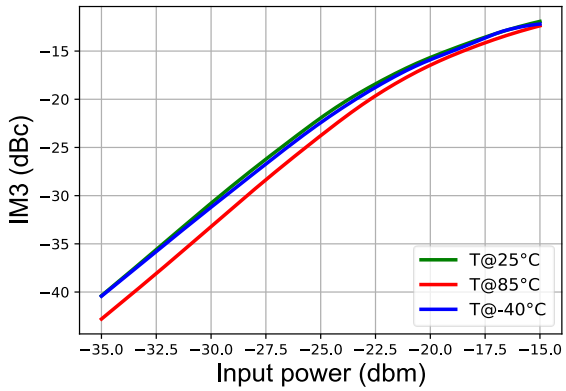


Typical Performance Curves: In board without De-Embedding at different temperature

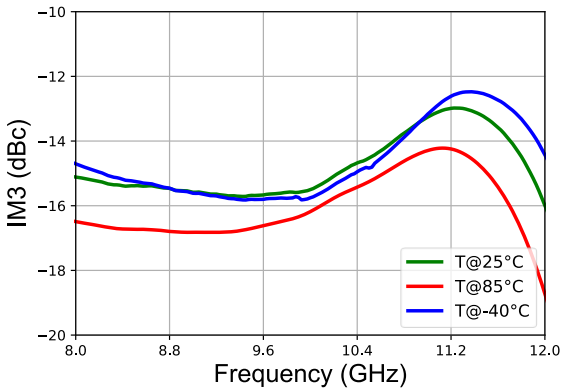
Output power over Input power



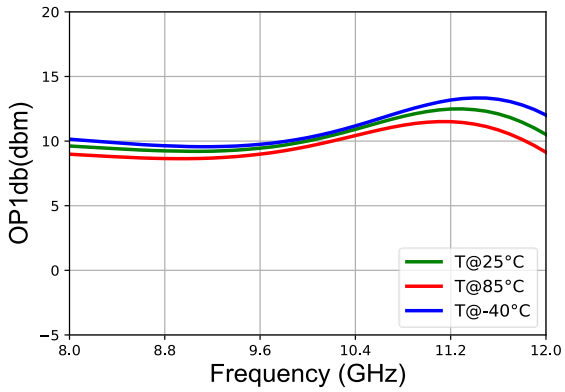
IM3 over Input power



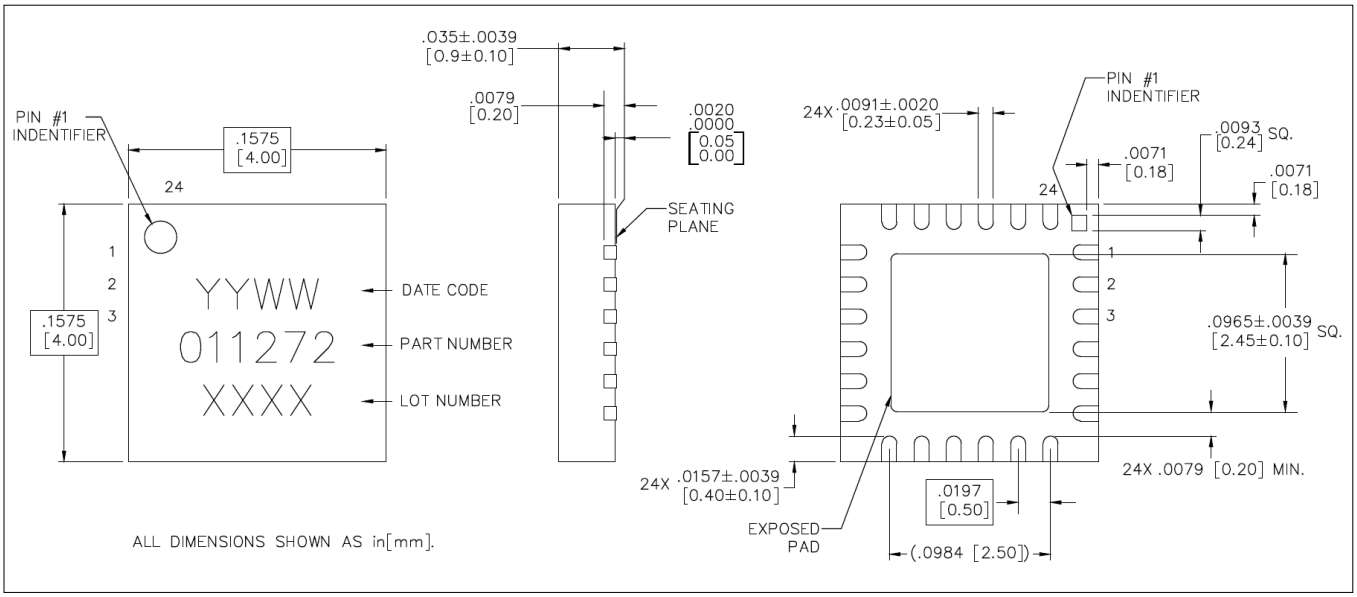
IM3 over Frequency



P1dB over Frequency



Lead-Free 4mm 24-Lead PQFN†



† Reference Application Note S2083 for lead-free solder reflow recommendations.
Meets JEDEC moisture sensitivity level 1 requirements in accordance to JEDEC J-STD-020D.
Plating is NiPdAu over Copper

Revision History

Rev	Date	Change Description
V1	09/23/24	Initial Release