

Low Noise Amplifier

13 - 15 GHz



MAAL-011258

Rev. V1

Features

- Noise Figure: 1.7 dB
- Gain: 27 dB
- I_{DD} : 29 mA DC Consumption
- VDD: 3 V
- Lead-Free 4 mm 20-Lead QFN
- RoHS* Compliant

Applications

- Radar
- SATCOM

Description

The MAAL-011258 is a high performance GaAs low noise amplifier MMIC designed to operate in the Ku band.

This device has a low noise figure of 1.7 dB with 27 dB of gain for a power consumption of only 80 mW. On chip matching provides 20 dB of input and output return loss at 14 GHz. It can be used in Radar, and SatCom applications.

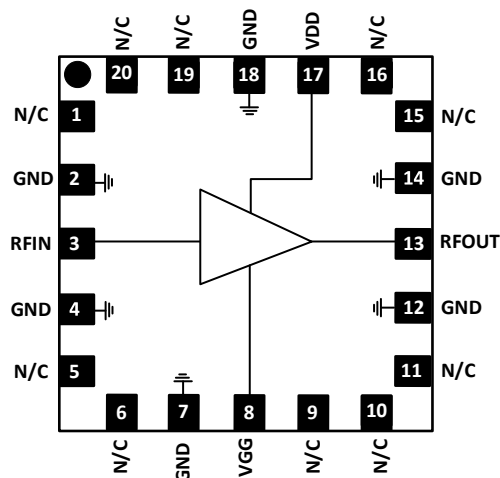
The die is manufactured using a 0.13 μm gate length pHEMT technology. The MMIC uses gold bond pads and backside metallization and is fully protected with Silicon Nitrite passivation to obtain the highest level of reliability.

Ordering Information¹

Part Number	Package
MAAL-011258-TR1000	1000 part reel
MAAL-011258-001SMB	Evaluation Board

1. Reference Application Note M513 for reel size information.

Block Diagram



Pin Function

Pad #	Pad Name	Function
1,5,6,9,10,11,15,16,19,20	N/C	Not connected
2,4,7,12,14,18	GND	Ground
3	RF _{IN}	RF Input
8	V _{GG}	Standby Voltage ²
13	RF _{OUT}	RF Output
17	V _{DD}	Voltage Drain

2. V_{GG} is a standby negative voltage. When applying V_{GG} = -1 V drain current drops to 1.5 mA. V_{GG} = 0 V is for standard use.

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

Electrical Specifications: Freq = 14 GHz, V_{DD} = 3 V, V_{GG} = 0 V, T_A = +25°C

Parameter	Test Conditions	Units	Min.	Typ.	Max.
Noise Figure	13 GHz	dB	—	1.5	—
	14 GHz			1.7	2.4
	15 GHz			1.9	—
Gain	13 GHz	dB	—	28.5	—
	14 GHz		24	27.0	
	15 GHz		—	25.0	
Output P1dB	14 GHz	dBm	—	4	—
Input Return Loss	13 - 15 GHz	dB	—	-7	—
Output Return Loss	13 - 15 GHz	dB	—	-10	—
Current	Total DC current included DC current regulation	mA	—	29	—

Recommended Operating Conditions

Parameter	Unit
Input RF Ports	-35 dBm
DC Supply V _{DD}	3 V
DC Supply V _{GG} (Standby OFF)	0 V

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 devices.

Absolute Maximum Ratings^{3,4}

Parameter	Unit
Input RF ports	10 dBm
DC Voltage Drain Supply	+4 V
DC Voltage Gate Supply	-4 V
Junction Temperature ^{5,6}	+150°C
Operating Temperature ⁵	-40°C to +85°C
Storage Temperature	-40°C to +150°C

3. Exceeding any one or combination of these limits may cause permanent damage to this device.
4. MACOM does not recommend sustained operation near these survivability limits.
5. Operating at nominal conditions with T_J ≤ +150°C will ensure MTTF > 1 x 10¹¹ hours.
6. Junction Temperature (T_J) = T_C + Θ_{Jc} * (V * I)
 Typical thermal resistance (Θ_{Jc}) = 283 °C/W.
 - a) For T_C = +25°C,
T_J = 29°C @ 3 V, 29 mA
 - b) For T_C = +85°C
T_J = 90°C @ 3 V, 27 mA

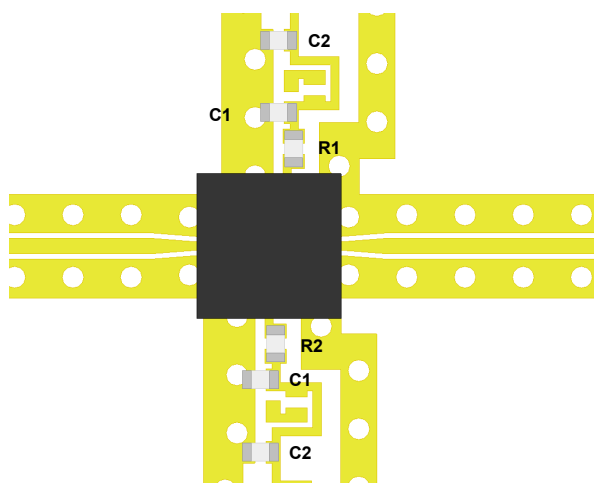
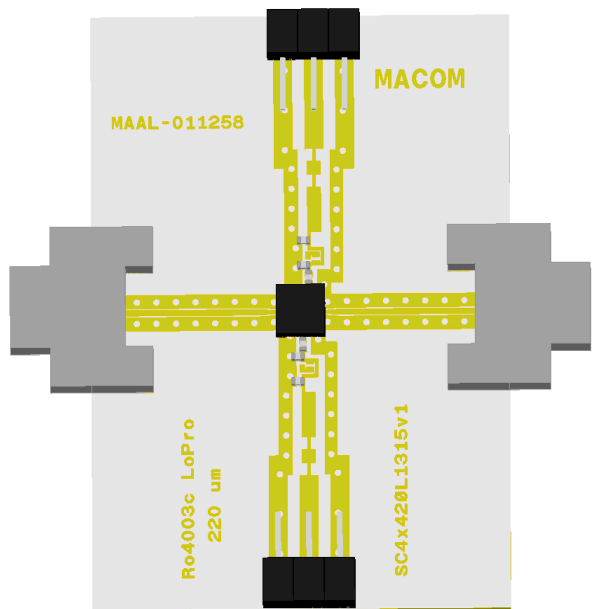
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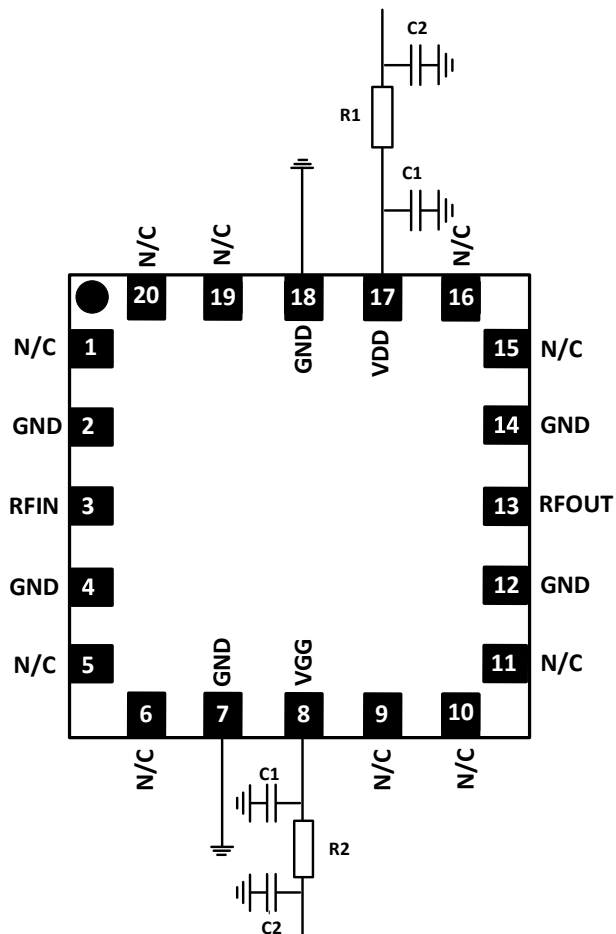
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PCB Layout



Functional Schematic



Parts List

Part	Value	Case Style	Manufacturer	Manufacturer's Part number
C1	47 pF	0402	Murata	GRT1555C1H470JA02D
C2	10 nF	0402	Murata	GRT188R71E474KE13D
R1	0 Ω	0402	Panasonic	ERJ2GE0R00X
R2	500 Ω	0402	Vishay	FC0402E5000FTBST0

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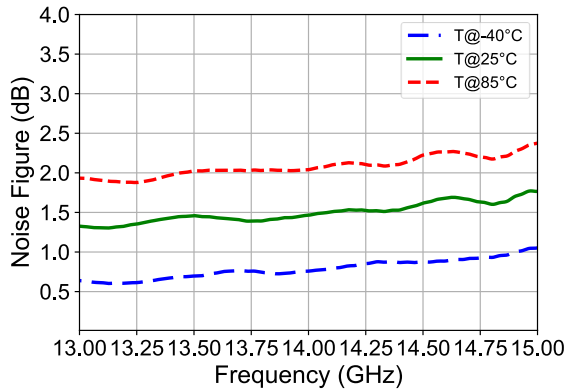


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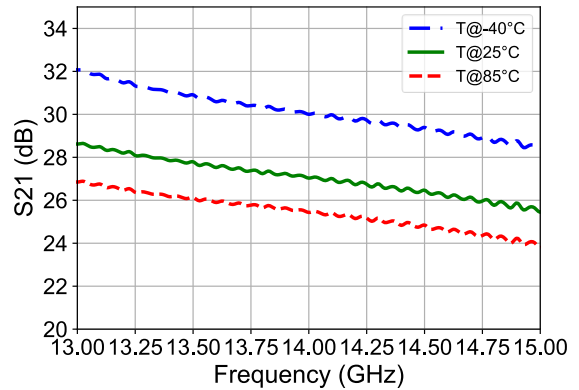
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Typical performance curves In board with De-Embedding at different temperature: S-parameters at PCB level with De-Embedding

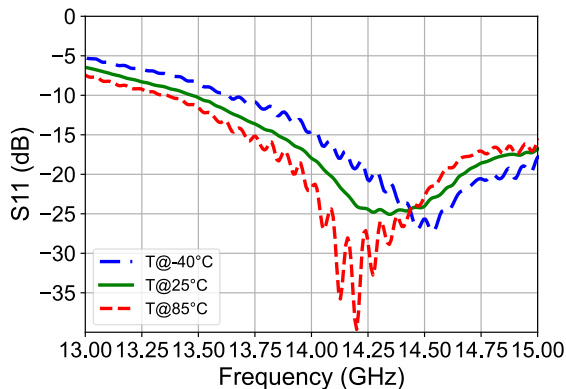
Noise Figure over Frequency



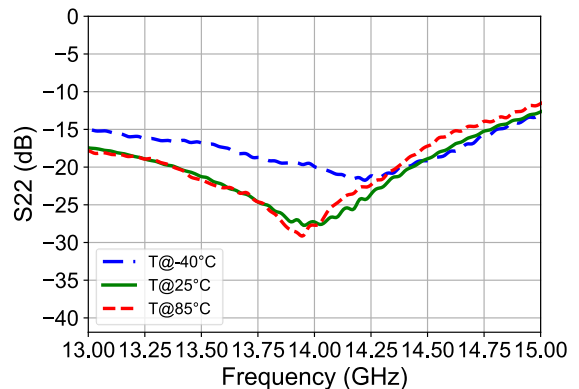
Gain over Frequency



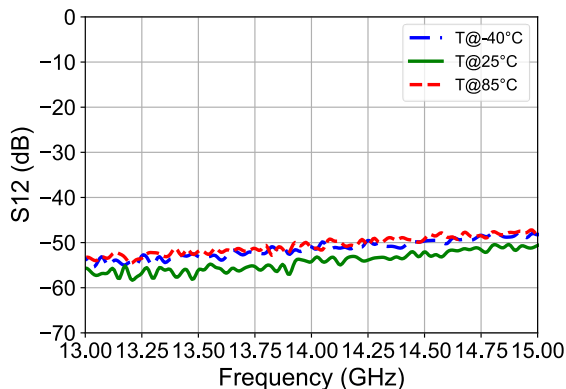
Input Return Loss over Frequency



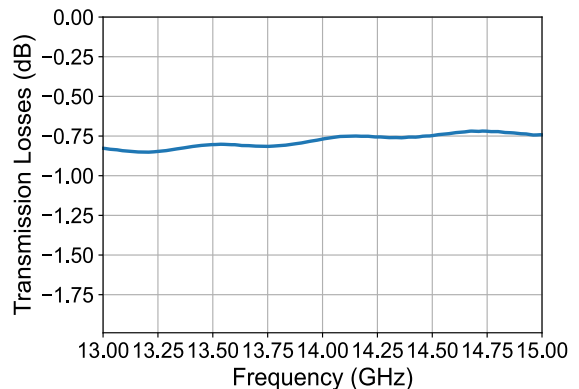
Output Return Loss over Frequency



Reverse Isolation over Frequency

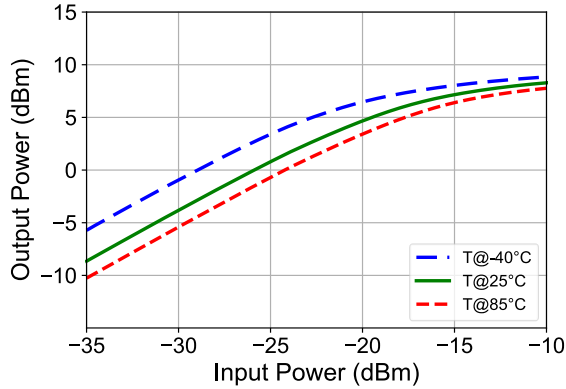


RF access line & connector Losses over Frequency

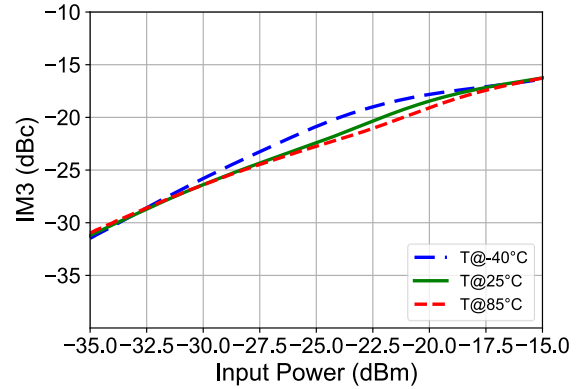


Typical performance curves In board with De-Embedding at different temperature

Output power over Input power

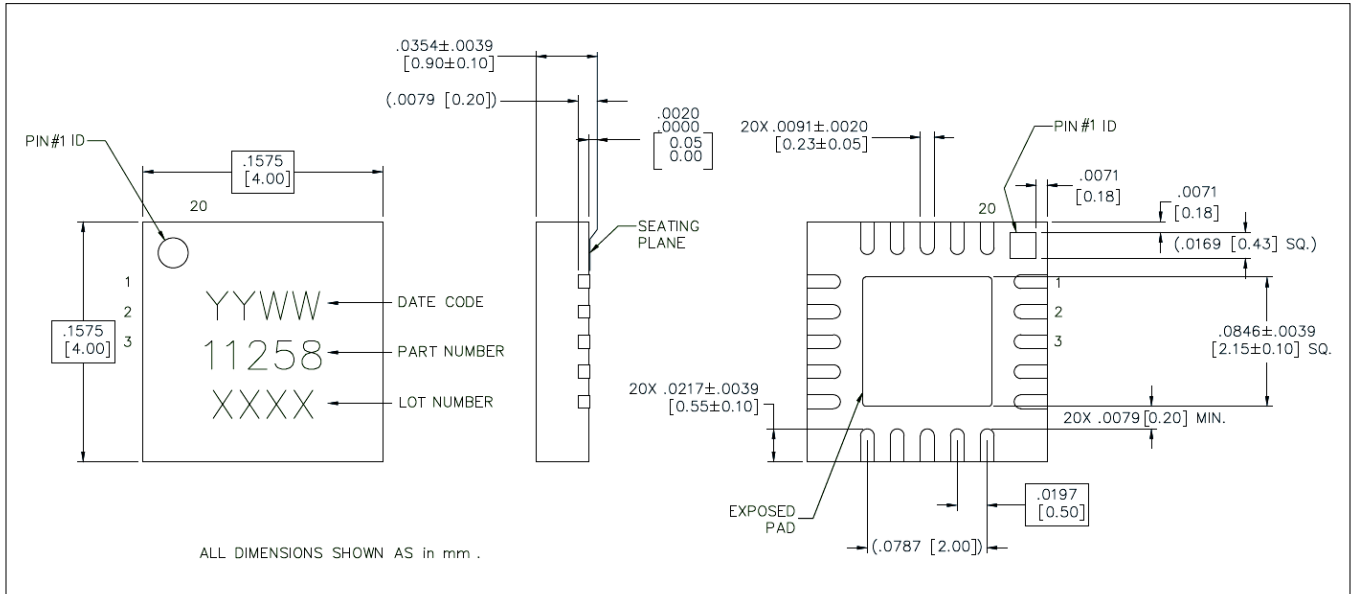


IM3 over Input power



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Lead-Free 4 mm 20-Lead QFN



† 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	June 2024	Initial Release

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