X-Band, High Input Power, GaN Low Noise Amplifier 8 - 12 GHz

MAAL-011250-DIE
Rev. V2

Features

- Noise Figure: 1.4 dB
- Gain: 20 dB
- High Input Power Handling
- Including DC Current Regulation
- DC Consumption: 150 mA
- Drain Voltage Bias: 8 V
- Input & Output Matched: 50 Ω
- Die Size: 3500 x 1560 x 100 µm
- RoHS* Compliant

Applications

- Radar
- SATCOM

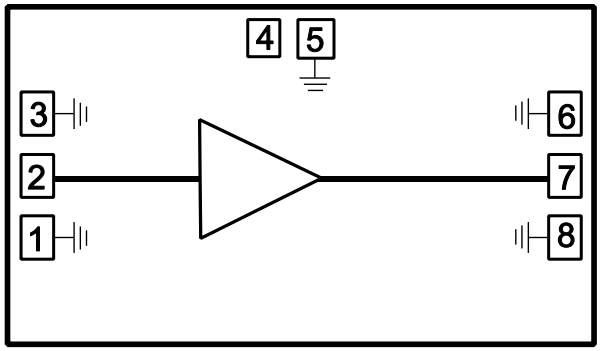
Description

The MAAL-011250-DIE is a very low noise 3 stage LNA designed to operate from 8 to 12 GHz with 1.4 dB of noise figure and 20 dB of gain and is offered in bare die form. It is fully matched across the frequency band.

The MAAL-011250-DIE has a single positive and single negative voltage bias which includes a DC current regulation. This LNA is matched to 50 Ω at both input and output ports. This device is ideally suited to satellite communication and radar applications.

The MAAL-011250-DIE is manufactured using a high performance 100 nm gate length GaN on Si HEMT power technology (D01GH). The MMIC uses gold bonding pads and backside metallization and is fully protected with silicon nitride passivation to obtain the highest level of reliability.

Block Diagram



Pad Configuration

Pad #	Function	Function
1,3,5,6,8	GND	Ground
2	RF_{IN}	RF Input
4	V_D	Voltage Drain
7	RF_{OUT}	RF Output

Ordering Information

Part Number	Package
MAAL-011250-DIE	DIE
MAAL-011250-SB2	Evaluation Board

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

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

Parameter	Test Conditions	Units	Min.	Typ.	Max.
Noise Figure	—	dB	—	1.4	1.9
Gain	—	dB	17	20	—
OP1dB	—	dBm	—	15	—
Input Return Loss	—	dB	—	11	—
Output Return Loss	—	dB	—	16	—
Current	Total DC current included DC current regulation	mA	—	150	300

Recommended Operating Conditions

Parameter	Unit
Input RF ports	-20 dBm
DC Supply V_D	8 V

Absolute Maximum Ratings[1,2,3,4]

Parameter	Absolute Maximum
Input RF ports	30 dBm
DC Voltage Drain Supply	12 V
Junction Temperature7,8	+200°C
Operating Temperature	-40°C to +85°C
Storage Temperature	-40°C to +150°C

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) = 32.5°C/W.
   a) For T_C = +85°C,
   T_J = 125°C @ 8 V, 150 mA

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.

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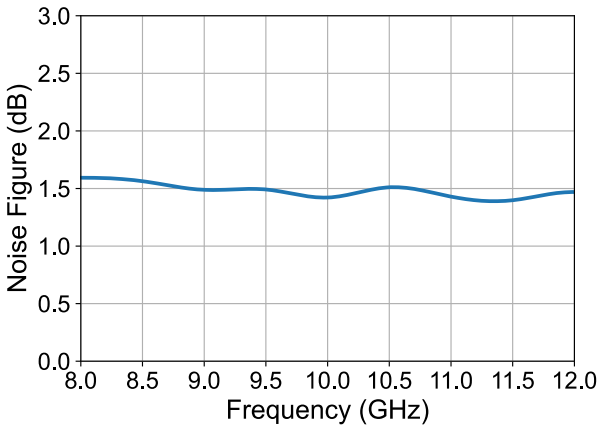
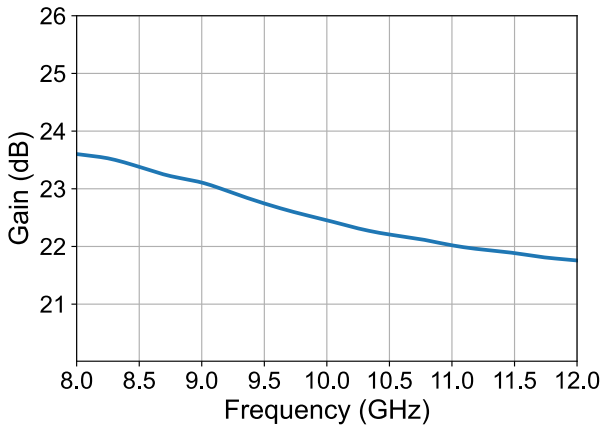
Typical Performance Curves @ T_C = 25°C in wafer:
S-Parameters with 0.1 nH assumed Wirebond

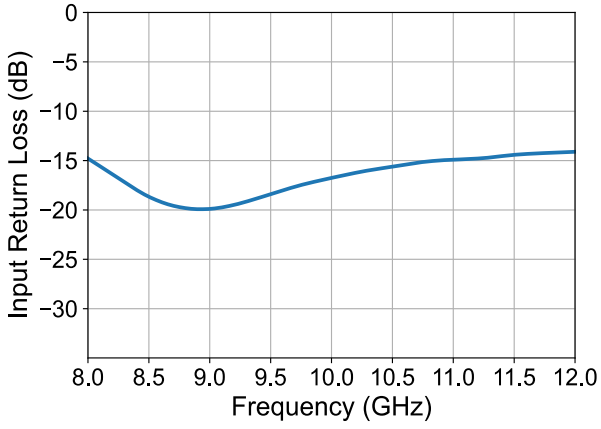
Noise Figure over Frequency



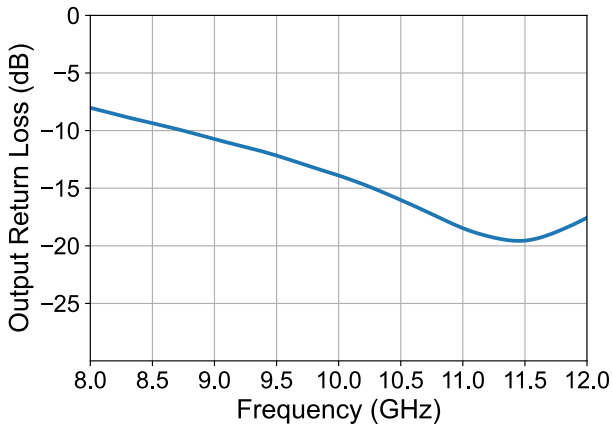
Gain over Frequency



Input Return Loss over Frequency



Output Return Loss over Frequency



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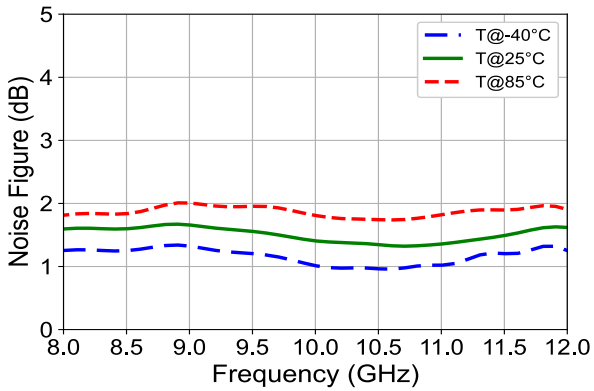
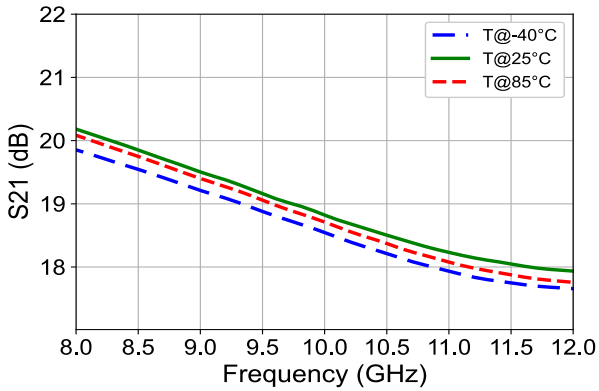
Typical Performance Curves In board @ T_C = 25°C with De-Embedding at different temperature: S-Parameters in CW @ PCB level with De-Embedding

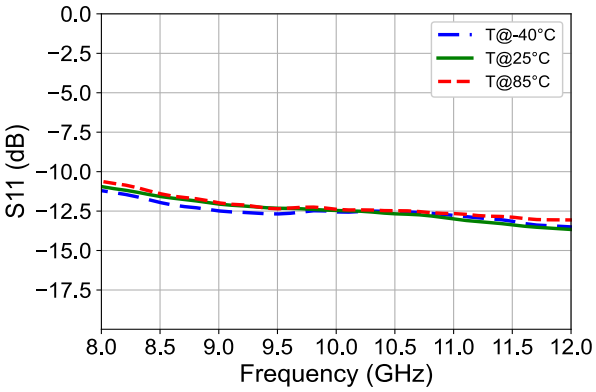
Noise Figure over Frequency



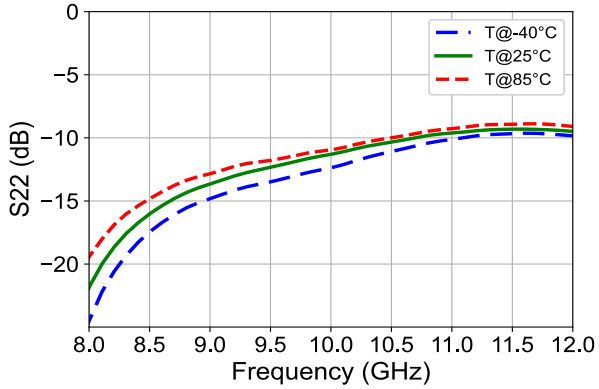
Gain over Frequency



Input Return Loss over Frequency



Output Return Loss over Frequency



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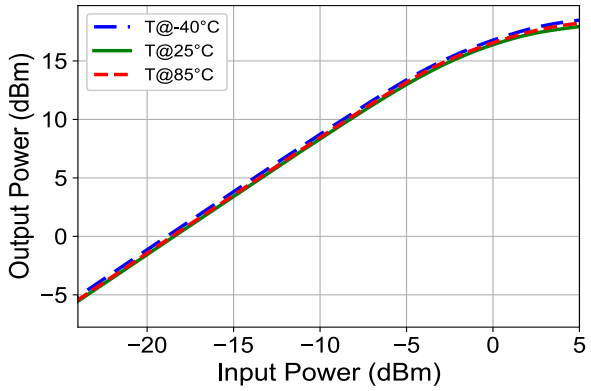
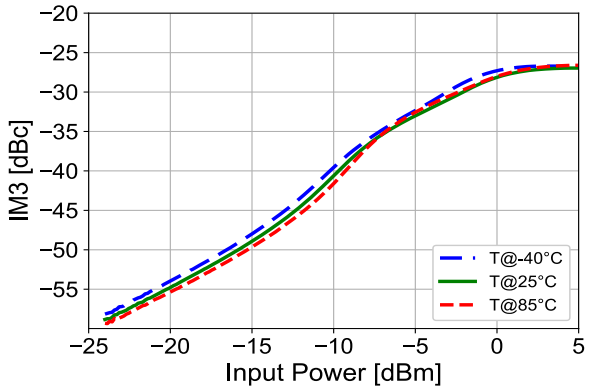
Typical Performance Curves In Board @ T_C = 25°C with De-Embedding at different temperature

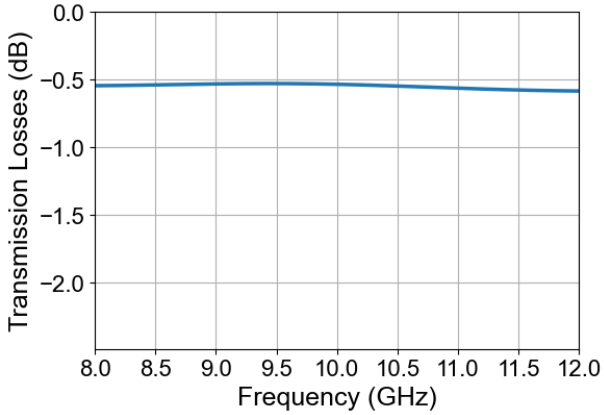
Output power over Input power



IM3 over Input power



RF access line & connector Losses over Frequency



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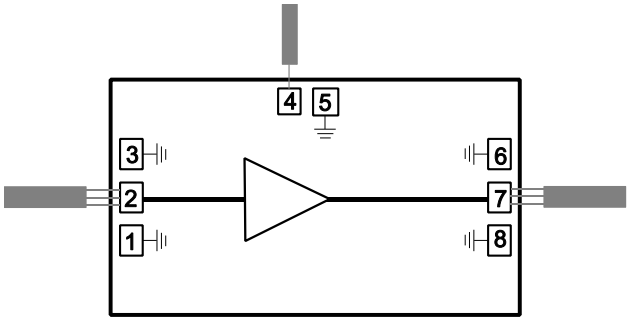
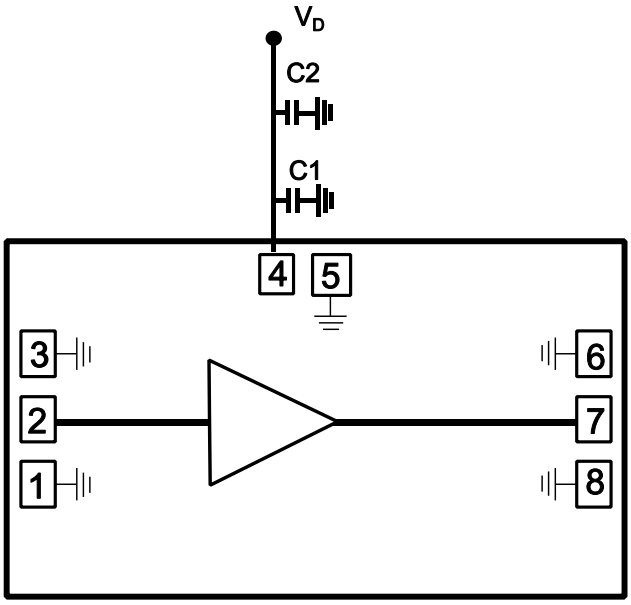
Recommended Bonding Diagram



Functional Schematic



Parts List

Part	Value	Case Style	Manufacturer	Type	Manufacturer's Part #
C1	47 pF	0.381 mm	KYOCERA AVX	single layer capacitor	116RG470M100TT
C2	10 nF	1005 mm	KYOCERA AVX	SMD multi layer capacitor	0402YC103KAT2A

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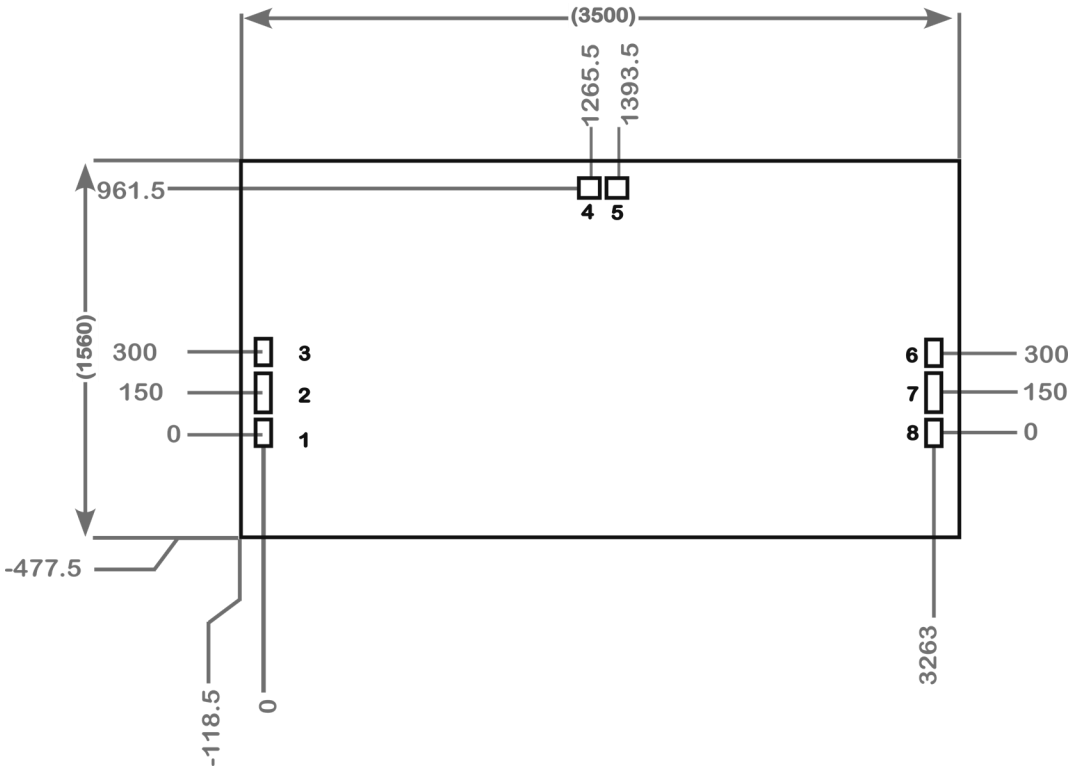
Die Outline



PADs Dimensions (µm)

Pad #	X	Y
1,3,6,8	72	97
2,7	72	147
4,5	97	77

Revision History

Rev	Date	Change description
V1	12/29/23	PTRR
V2	12/03/24	Production Release

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