Low Noise Amplifier
18 - 26 GHz

MAAL-FR1270
Rev. V1

Features

- Single Supply Architecture
- Noise Figure: 1.7 dB
- Gain: 18 dB
- P1dB: 5 dBm
- Return Loss: 15/8 dB
- Power Supply: 60 mA @ 1.5 V
- Lead-Free 3 x 4 QFN, 22 lead SMT
- Demonstration Boards Available
- RoHS* Compliant

Applications

- RADAR
- SATCOM

Description

The MAAL-FR1270 is a two stage low noise amplifier (LNA) designed to operate from 18 - 26 GHz with 1.7 dB of noise figure and 18 dB of gain. This amplifier is a single positive and single negative voltage bias which include a DC current regulation.

This LNA is matched to 50 Ω at both input and output ports.

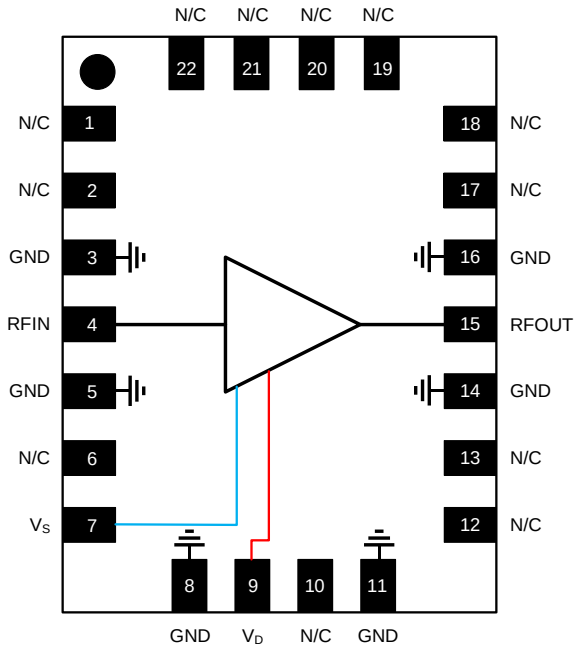
The die is manufactured using a 0.07 µm gate length pHEMT technology. The MMIC uses gold bond pads and backside metallization and is fully protected with Silicon Nitride passivation to obtain the highest level of reliability.

Also available in DIE form part# CGY2121XUH/C1.

Ordering Information

Part Number	Package
MAAL-FR1270-TR1000	1000 part reel
MAAL-FR1270-001SMB	Evaluation Board

Block Diagram



Pad Configuration

Pad #	Pad Name	Function
1,2,6,10,12,13,17, 18,19,20,21,22	N/C	Not Connected
3,5,8,11,14,16	GND	Ground
4	RF_{IN}	RF Input
15	RF_{OUT}	RF Output
9	V_D	Voltage Drain
7	V_S	Voltage Source

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

Electrical Specifications: Freq. = 18 - 26 GHz, T_A = +25°C, V_D = +1.5 V, V_G = -1.5 V

Parameter	Test Conditions	Units	Min.	Typ.	Max.
Gain	18 - 24 GHz 24 - 26 GHz	dB	16 14	18 16	—
Noise Figure	—	dB	—	1.7	2.5
Drain Supply Voltage	—	V	—	1.5	—
Drain Supply Current	—	mA	—	60	—
Reverse Isolation	RF_{OUT} / RF_{IN}	dB	—	-40	—
P1dB	—	dBm	—	5	—
Output IP3	—	dBm	—	12	—
Output IM3	Tone Spacing = 100 MHz	dBc	—	30	—
Input Return Loss	50 Ω	dB	—	-10	—
Output Return Loss	50 Ω	dB	—	-8	—

Recommended Operating Conditions

Parameter	Typical Rating
Input RF Ports	-25 dBm
DC Voltage Drain Supply	+1.5 V
DC Voltage Source Supply	-1.5 V

Absolute Maximum Ratings[1,2]

Parameter	Absolute Maximum
Input RF Ports	+10 dBm
DC Voltage Drain Supply	+2.0 V
Junction Temperature[3,4]	+150°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 ≤ +150°C will ensure MTTF > 1 x 10^{11} hours.
4. Junction Temperature (T_J) = T_C + Θjc * (V * I)
   Typical thermal resistance (Θjc) = 468°C/W.
   a) For T_C = +25°C,
   T_J = 60.1°C @ 1.5 V, 60 mA
   b) For T_C = +85°C
   T_J = 127°C @ 1.5 V, 65 mA

Handling Procedures

Please observe the following precautions to avoid damage:

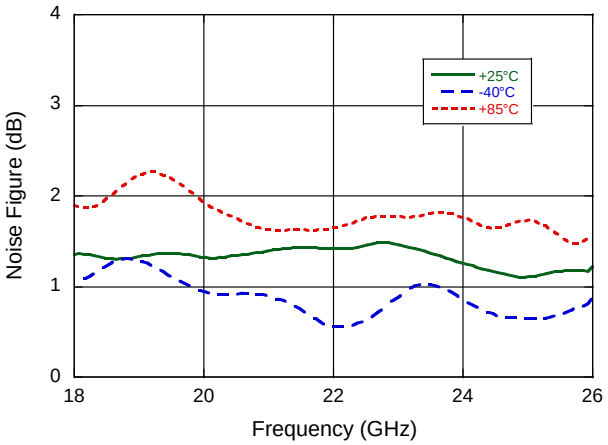
Static Sensitivity

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.

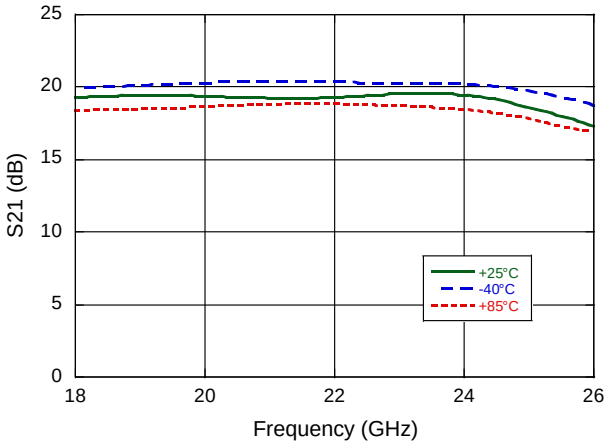
Typical Performance Curves: V_D = +1.5 V, V_S = -1.5 V, I_D = 60 mA

S-Parameters & Noise @ PCB level with De-Embedding at different temperatures

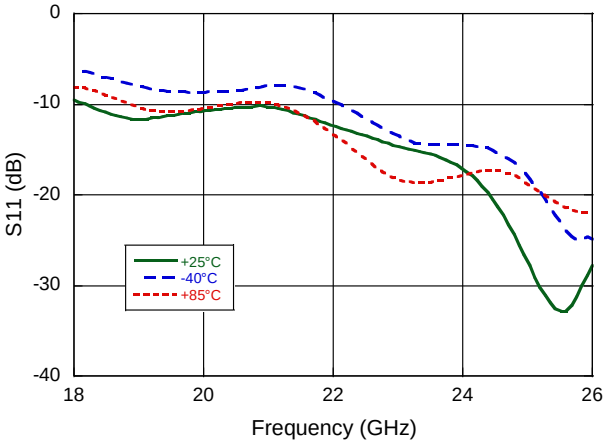
Noise Figure vs. Frequency



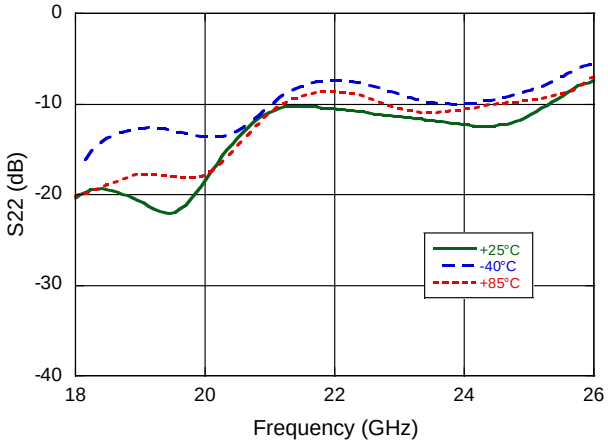
Gain vs. Frequency



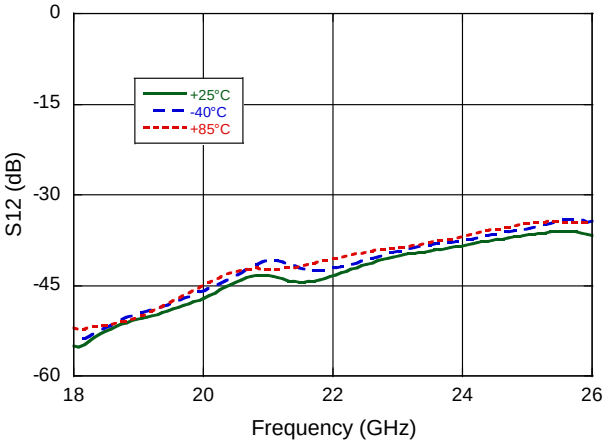
Input Return Loss vs. Frequency



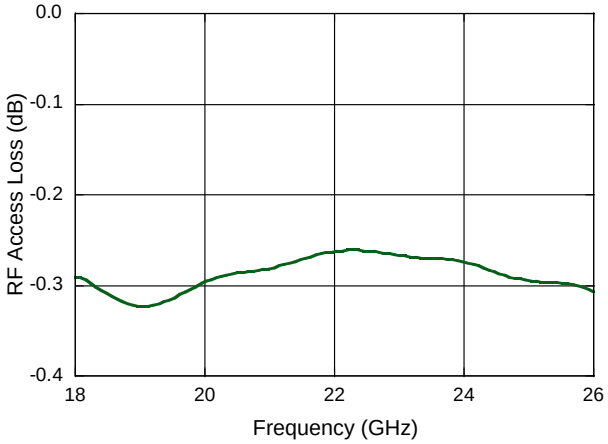
Output Return Loss vs. Frequency



Reverse Isolation vs. Frequency

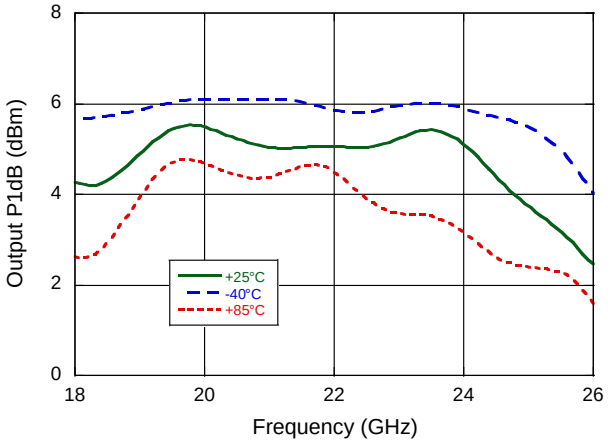


RF Access Line & Connector Losses vs. Frequency

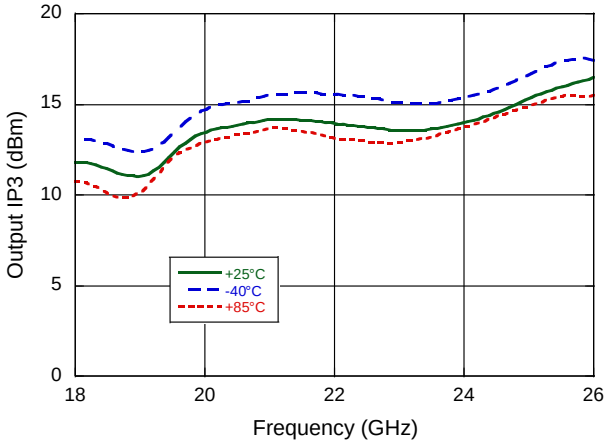


Typical Performance Curves:
In board with De-Embedding at different temperatures

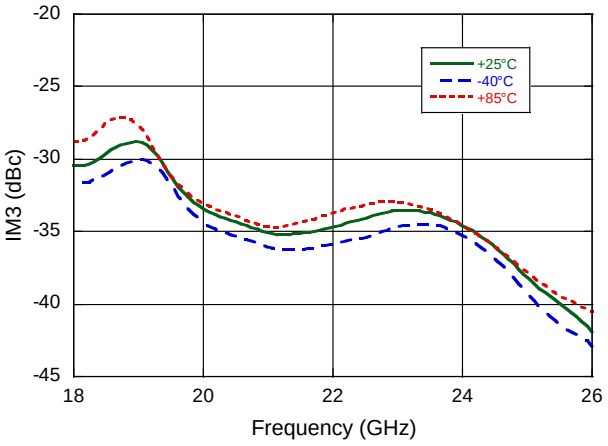
P1dB vs. Frequency



OIP3 vs. Frequency



IM3 vs. Frequency

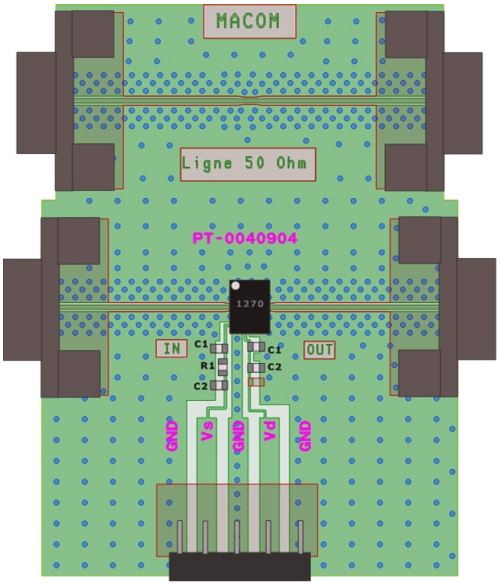


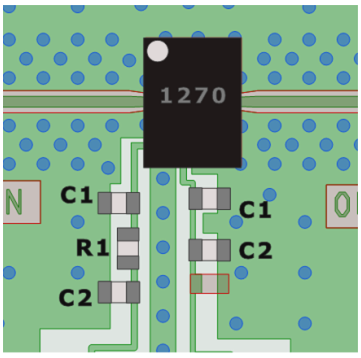
Biasing Procedure

Biasing UP
Set I_D limit to 80 mA.
Ensure voltages are at 0 before to turn on DC supply.
Set V_S to -1.5 V.
Set V_D to +1.5 V.

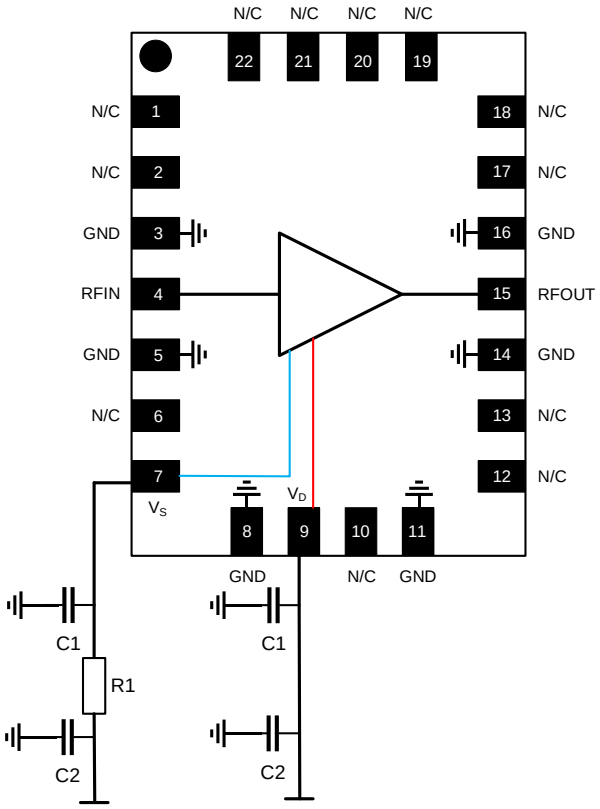
Biasing DOWN
Set V_D to 0 V.
Set V_S to 0 V.
Turn off DC supply.

PCB Layout





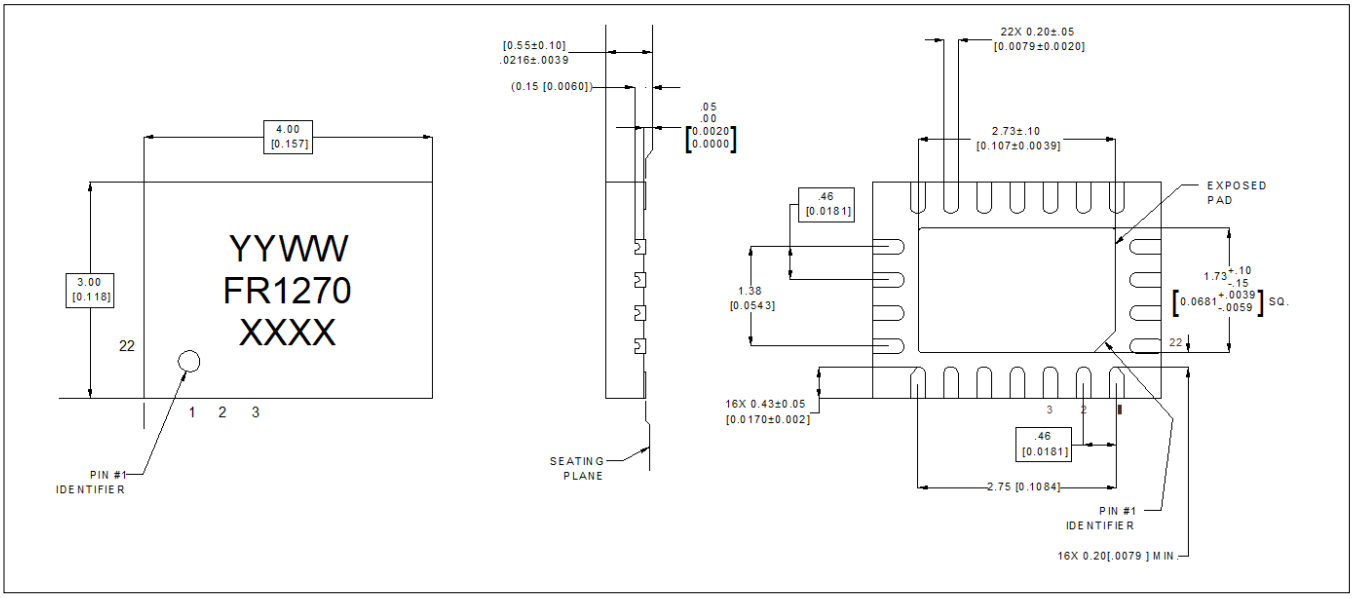
Functional Schematic



Parts List

Part	Value	Case Style	Manufacturer	Manufacturer's Part number
C1	47 pF	0402	Murata	GRT1555C1H470JA02D
C2	10 nF	0402	Murata	GRT188R71E474KE13D
R1	100 Ω	0402	Vishay	CRCW0402100RFKEDC

Lead-Free 3 x 4, 22-Lead SMT †



† Reference Application Note S2083 for lead-free solder reflow recommendations.
Meets JEDEC moisture sensitivity level (MSL) 1 requirements.
Plating is NiPdAu over Copper.

Revision History

Rev	Date	Change description
V1	Jan. 2025	Initial Release