gANZ0031
V-band LNA MMIC
57-66 (52 - 72) GHz

Features

- 3.5 dB NF
- V-band coverage
- 24 dBm OIP3
- 21 dB gain

Typical Applications

- WiGig
- Point-to-point communication
- Instrumentation
- Fiber over radio

Description

gANZ0031 is a Low Noise Amplifier (LNA) in the 60 GHz ISM frequency band suitable for WiGig, including the newly extended bands, and V-band point-to-point communication. The LNA features 3.5 dB Noise Figure and very flat frequency response. Furthermore, the LNA has high gain, high linearity and low input/output return loss.

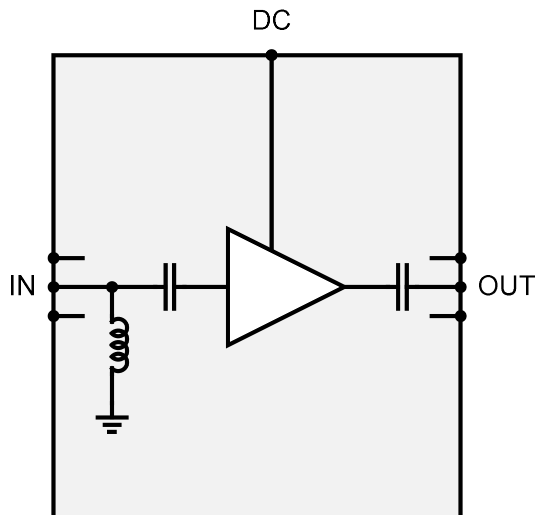

Figure 1. Block diagram of the LNA.

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Electrical Performance

Table 1. Electrical performance T_A=25°C

Parameter	Min	Typ	Max	Unit
Frequency	57 (52)		66 (72)	GHz
Gain	19	21	23	dB
NF		3.5	4	dB
P1dB	9	10	11	dBm
PSAT				dBm
OIP3	19	20	21	dBm
PAE				%
Input return loss	10			dB
Output return loss	15 (10)			dB
Power consumption		112		mW

Measured Performance

The chip has been measured on-wafer using CW and 2-tone input test signals. The LNA uses typical bias settings if not specified differently.

Table 2. Test conditions

Parameter	Setting
RF input power	-25 dBm/tone
RF input frequency	61 GHz
Frequency separation	10 MHz
Temperature	25°C

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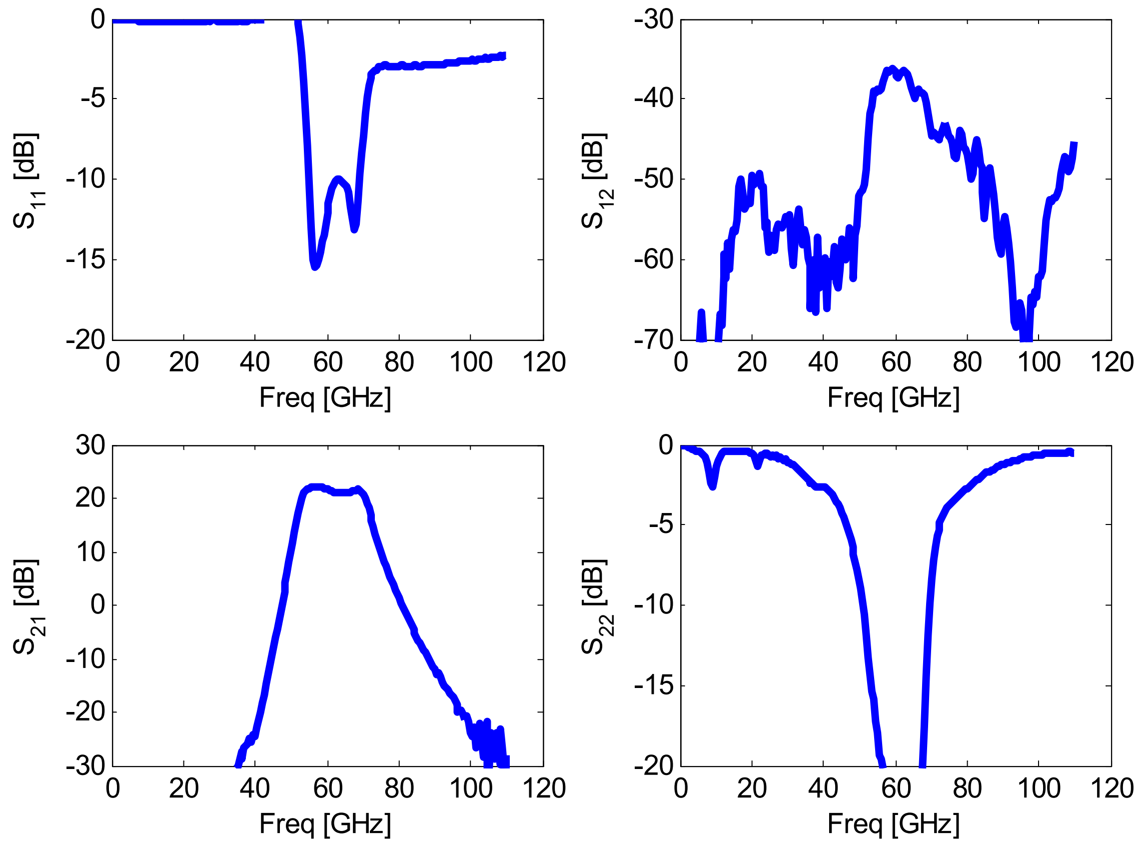
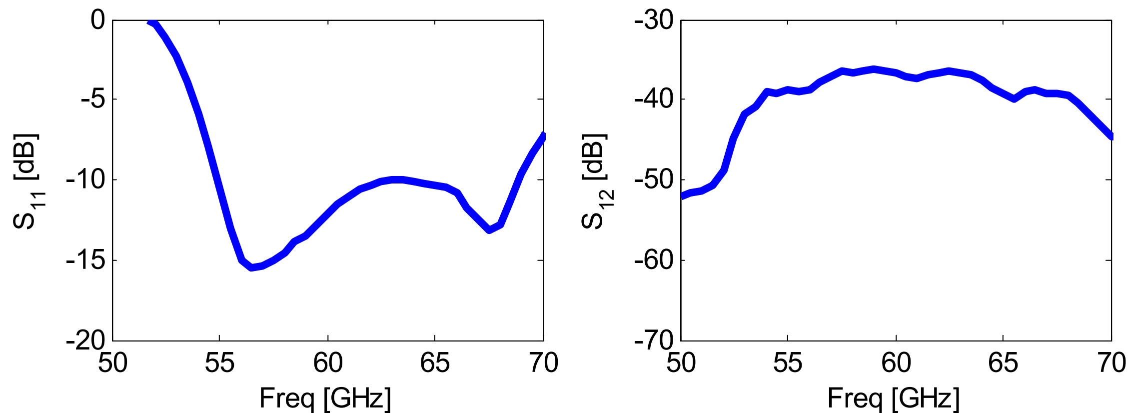


Figure 2. Small signal response from 0-120 GHz at nominal bias. (Upper left): Input matching. (Upper right): Reverse isolation. (Lower left): Small-signal gain. (Lower right): Output matching.



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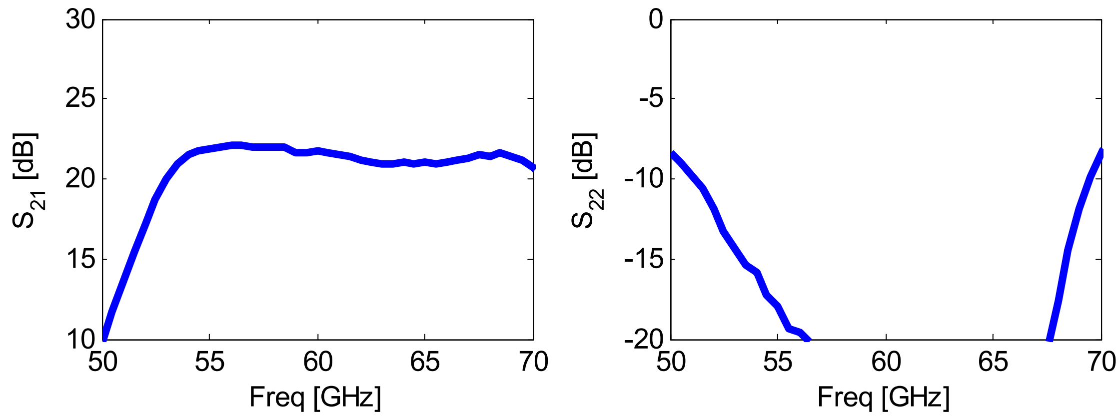

Figure 3. Small signal response within the 60 GHz ISM-band at nominal bias. (Upper left): Input matching. (Upper right): Reverse isolation. (Lower left): Small-signal gain. (Lower right): Output matching.

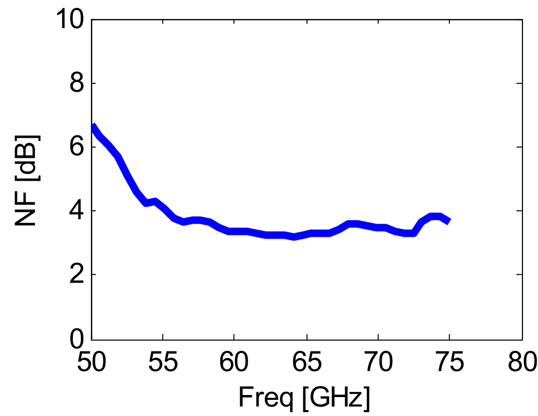

Figure 4. : NF vs freq.

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RECOMMENDED OPERATING CONDITIONS

Bias should first be applied to the gates (VG…) followed by the drains (VD…). The gate voltages must be adjusted within the min/max range indicated in Table 3-5 to obtain the specified drain currents. The drain currents are stated with no input signal.

Table 3. Electrical settings on connector P1

Connector P1	Pad No.	Bias settings (V/mA)			I/O
		Min	Typ	Max	
NC	1				NC
VD2	2	1.9	2.0 / 50	2.1	Input
VG2	3	-0.7	-0.5	-0.3	Input
GND	4				Ground
VD1	5	1.1	1.2 / 10	1.3	Input
VG1	6	-0.7	-0.5	-0.3	Input
NC	7				NC

Table 4. Electrical settings on connector P2

Connector P2	Pad No.	Interface	I/O
GND	1		Ground
RF_OUT	2	Z_0 = 50 Ohm, AC coupled	Input
GND	3		Ground

Table 5. Electrical settings on connector P3

Connector P3	Pad No.	Interface	I/O
GND	1		Ground
RF_IN	2	Z_0 = 50 Ohm, AC coupled	Input
GND	3		Ground

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ABSOLUTE MAXIMUM RATINGS

Table 6. Absolute maximum ratings

Gate-source voltage	-2 to +0.7 V
Drain-source voltage	4.5 V
Gate-drain breakdown voltage	8 V
ID2	120 mA
ID1	50 mA
RF input power	+15 dBm
Operating temperature	-40 to + 85°C
Storage temperature	-65 to +150°C

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OUTLINE DRAWING

Mechanical drawing with pad locations is also available in dxf-file format on the web. The substrate thickness is 50 µm (GaAs).

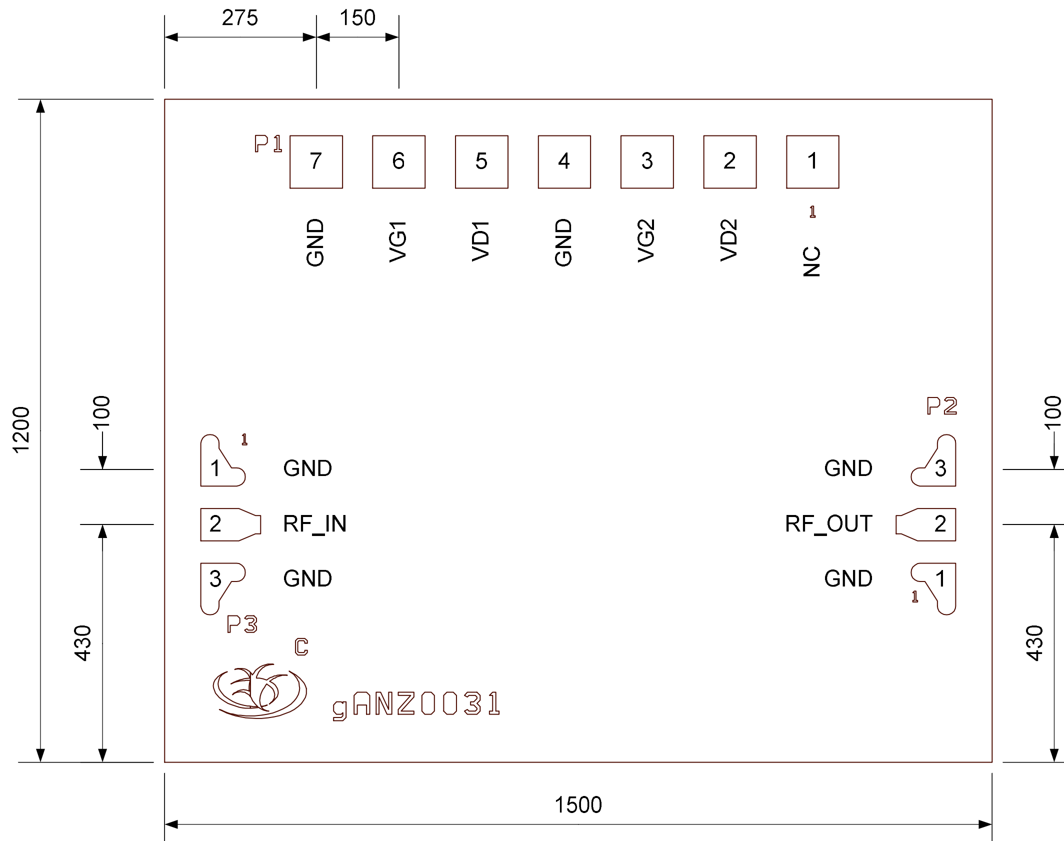

Figure 5. Outline drawing of the MMIC. Dimensions are in um.

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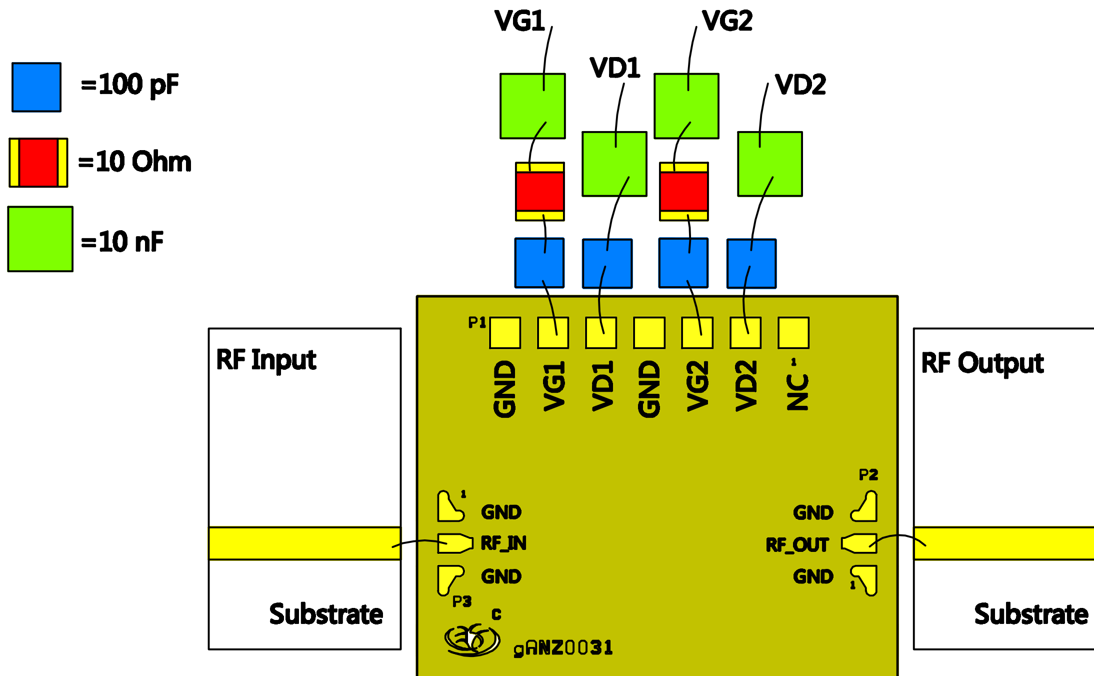
Recommended Assembly Diagram



Biasing Procedure

Turn on

1) Vg = - 2 V
2) Vd1 = +1.2 V, Vd2= +2V
3) Adjust Vg to obtain Id1 = 10 mA, Id2=50mA

Turn off

1) Vd = 0V
2) Vg = 0V

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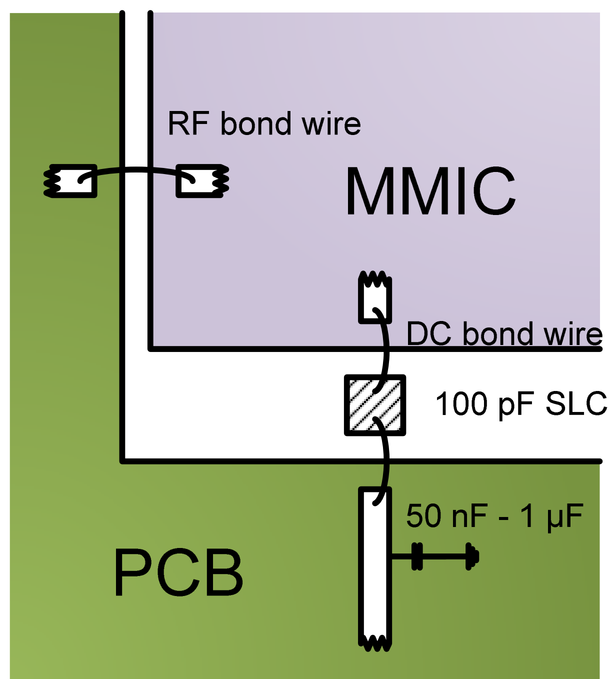
DIE ATTACH

The die mounting surface must be clean and flat. Our MMICs are all back metalized which also serves as ground. The back side must be both electrically and thermally connected using soldering or epoxy with high thermal and electrical conductivity. Using conductive silver filled epoxy, recommended epoxies are DieMat DM6030HK-PT/H579. Apply sufficient epoxy to meet required epoxy bond line thickness, epoxy fillet height and epoxy coverage around total die periphery. The thickness of our MMICs is 50 µm (2 mil). For the best RF performance, the circuit board line should be at the same height. It is recommended to use antistatic die pick up tools only.

WIRE BONDING

Bond pad openings in the surface passivation above the bond pads are provided to allow wire bonding to the square gold bond pads. Bond force, time, ultrasonic power and temperature are all critical parameters for good attachment.



We recommend using 25 µm (1 mil) diameter bond wires or 75 µm × 12.5 µm (3 × 0.5 mil) ribbons. The width of the RF pads on the MMIC is 72 µm and DC is 90 µm. All RF bondwires should be kept as short as possible and not exceeding 300 µm. Long bond wires will result in an undesirable series inductance that is difficult to compensate for over large bandwidths. Bondwires to DC pads should preferably also be kept as short as possible.

Figure 1. Assembly diagram

To the DC pads, we recommended first bonding to a 100 pF SLC capacitor and then to a 50 nF-1 µF capacitor onto the circuit board.

Table 1. Typical wire dimensions for wedge bonding

Parameter	Min	Typ	Max	Unit
RF bond wire diameter	17	25	25	um
RF bond wire length	0	150	300	um
DC bond wire diameter	17	25	75	um
DC bond wire length	0	300	2000	um