

TDLNA2069QFN

18 – 31 GHz Low Noise Amplifier

Product Overview

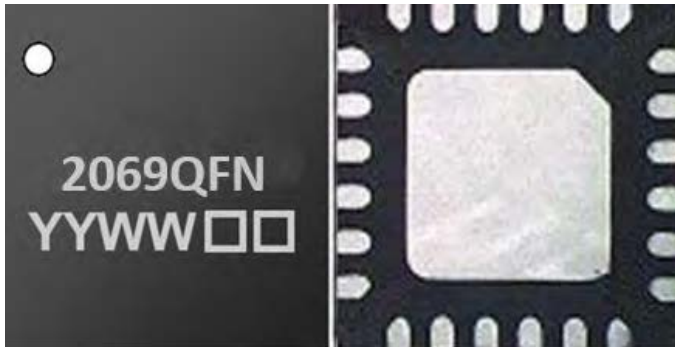
The TDLNA2069QFN is a three-stage, self-biased, wide band, monolithic, low noise amplifier.

The circuit is manufactured with a standard pHEMT process: 0.25 μm gate length, via holes through the substrate, air bridges and electron beam gate lithography.

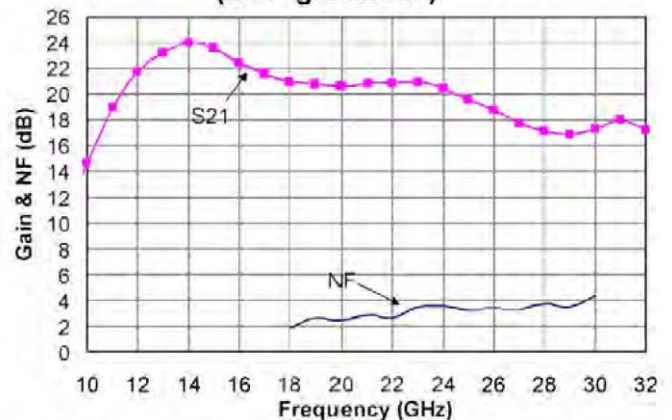
It is supplied in leadless surface mount 24-pin 4 x 4 mm² QFN package. The circuit is dedicated to space applications and also well suited for a wide range of microwave and millimeter wave applications and systems.

Features

- Broadband performance 18-31 GHz
- 3.0 dB typical Noise Figure
- 20 dBm 3rd order intercept point
- 20 dB gain
- 65 mA low dc power consumption
- 4 x 4 mm² 24-pin QFN package
- MSL Level: 1



Gain and NF @ high current configuration (BCF grounded)



Absolute Maximum Ratings¹

T_{amb.} = +25 °C

Symbol	Parameter	Values	Unit
V _d	Drain bias voltage	5	V
P _{in}	Maximum input power overdrive	+15	dBm
R _{th_BDE}	Thermal Resistance channel to ground paddle ²	130	°C/W
R _{th_BCF}	Thermal Resistance channel to ground paddle ²	120	°C/W
T _a	Operating temperature range	-40 to +85	°C
T _{stg}	Storage temperature range	-55 to +150	°C

- (1) Operation of this device above any one of these parameters may cause permanent damage.
- (2) Thermal Resistance for T_{amb.} = +85 °C and a T_{jmax} = +175 °C

Recommended Operating Conditions

T_{amb.} = +25 °C, V_d = +4,5 V Pads: B, C, F = GND (High current configuration)

Symbol	Parameter	Min	Typ	Max	Unit
G	Gain	17	20		dB
NF	Noise figure		3.0	4.5	dB
IP3	3rd order intercept point (P _{out} /tone=-5dBm) 18-26GHz	18	20		dB

ESD Protection: Electrostatic discharge sensitive device, please observe handling precautions!

Electrical Specifications

T_{amb.} = +25 °C, V_d = +4.5 V, pads: B, D, E = GND (Low Current Configuration)

Symbol	Parameter	Min	Typ	Max	Unit
F _{op}	Operating frequency range	18		31	GHz
G	Gain	16.5	19.5		dB
ΔG	Gain flatness		±2	±2.5	dB
NF	Noise figure		3	4.5	dB
IS11	Input return loss		-5	-2	dB
IS22I	Output return loss		-7	-2.5	dB
IP3	3rd order intercept point (P _{out} /tone=-5dBm) 18-26GHz	16.5	18.5		dBm
P1dB	Output power at 1dB gain compression	9.0	10.5		dBm
I _d	Drain bias current		65		mA

These values are representative of onboard measurements as defined on the drawing in paragraph "Evaluation mother board".



Electrical Specifications

Tamb = +25 °C, Vd = +4.5 V, pads: B, D, E = GND (High Current Configuration)

Symbol	Parameter	Min	Typ	Max	Unit
Fop	Operating frequency range	18		31	GHz
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NF	Noise figure		3	4.5	dB
IS11	Input return loss		-5	-2	dB
IS22I	Output return loss		-7	-2.5	dB
IP3	3rd order intercept point (Pout/tone=-5dBm) 18-26GHz	18	20		dBm
P1dB	Output power at 1dB gain compression	12	13.5		dBm
Id	Drain bias current		85		mA

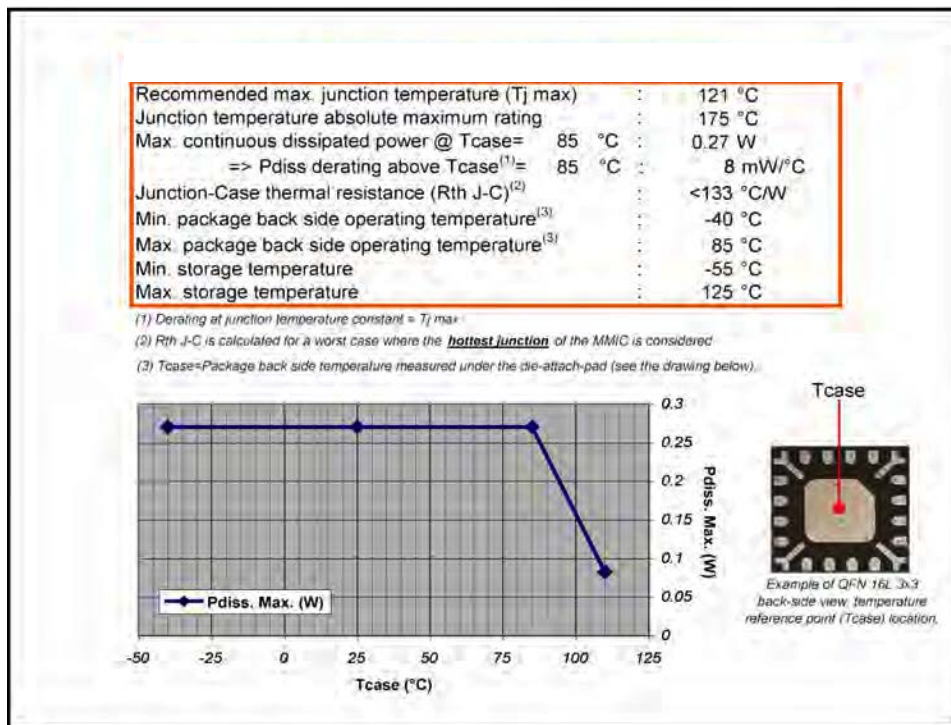
These values are representative of onboard measurements as defined on the drawing in paragraph "Evaluation mother board".

Device Thermal Performance

All the figures given in this section are obtained assuming that the QFN device is cooled down only by conduction through the package thermal pad (no convection mode considered).

The temperature is monitored at the package back-side interface (Tcase) as shown below. The system maximum temperature must be adjusted in order to guarantee that Tcase remains below the maximum value specified in the next table. So, the system PCB must be designed to comply with this requirement.

A derating must be applied on the dissipated power if the Tcase temperature can not be maintained below the maximum temperature specified (see the curve Pdiss. Max) in order to guarantee the nominal device life time (MTTF).



Typical Package Sij Parameters For Low Current Configuration

Tamb.= +25 °C, Vd = +4.5 V, Pads: B,D, E grounded

Freq (GHz)	S11 (dB)	S11 (°)	S12 (dB)	S12 (°)	S21 (dB)	S21 (°)	S22 (dB)	S22 (°)
2	-0.1	-58.7	-95.2	-85.6	-57.5	-2.4	-0.6	-148.4
3	-0.1	-89.3	-68.8	63.3	-77.6	-24.4	-0.9	157.1
4	-0.1	-123.5	-63.2	93.4	-52.9	62.8	-0.9	112.4
5	-0.2	-160.8	-62.9	47.1	-37.4	145.3	-1.3	72.0
6	-0.4	156.1	-58.1	11.4	-18.1	93.6	-1.7	39.9
7	-0.6	107.6	-67.5	-59.7	-4.4	28.0	-2.0	8.4
8	-1.2	58.9	-68.1	93.7	4.4	-52.1	-3.0	-20.2
9	-1.8	13.5	-61.6	-9.2	9.6	-122.4	-3.9	-38.6
10	-2.8	-26.1	-60.0	-42.6	14.7	176.1	-4.4	-69.5
11	-4.0	-58.0	-55.1	171.8	19.0	109.4	-8.3	-92.5
12	-5.7	-89.1	-53.4	87.2	21.7	41.3	-13.4	-92.8
13	-8.8	-122.0	-49.6	14.1	23.3	-24.1	-17.0	-67.1
14	-15.8	-173.9	-50.5	-42.8	24.0	-86.8	-12.6	-36.0
15	-17.4	24.9	-48.2	-120.3	23.5	-146.2	-8.3	-46.7
16	-10.9	-20.6	-48.3	171.6	22.4	162.0	-6.3	-65.3
17	-8.5	-47.1	-49.6	133.4	21.5	116.9	-5.9	-85.2
18	-7.0	-65.5	-47.3	121.9	20.9	75.8	-5.9	-99.8
19	-6.2	-82.8	-44.9	92.5	20.8	34.2	-6.1	-116.0
20	-5.8	-98.4	-42.5	57.3	20.7	-6.5	-7.2	-130.1
21	-4.9	-110.8	-43.2	20.1	20.9	-48.3	-7.9	-137.3
22	-4.7	-125.9	-45.3	14.9	20.9	-90.8	-9.2	-142.4
23	-4.3	-138.7	-43.3	-0.5	20.9	-135.3	-8.7	-139.3
24	-3.9	-152.2	-43.7	-14.8	20.4	178.7	-7.6	-141.9
25	-3.8	-163.2	-44.2	-36.7	19.6	135.8	-6.3	-148.5
26	-3.3	-173.7	-45.4	-48.5	18.8	92.8	-4.4	-156.9
27	-3.0	175.5	-46.5	-43.8	17.8	52.7	-3.7	-169.0
28	-2.5	166.4	-43.7	-45.2	17.1	13.2	-3.0	-179.9
29	-2.5	155.4	-43.2	-59.5	16.8	-26.3	-2.7	171.2
30	-2.8	146.3	-42.0	-81.7	17.3	-69.6	-2.7	161.4
31	-3.9	144.4	-46.4	-112.7	18.0	-123.9	-2.6	156.1
32	-2.8	154.3	-47.9	-148.6	17.2	168.4	-2.5	150.5

The Sij measurement calibration planes are defined in the paragraph "Definition of the Sij reference planes".

Typical Package Sij Parameters For High Current Configuration

Tamb.= +25 °C, Vd = +4.5 V, Pads: B,D, E grounded

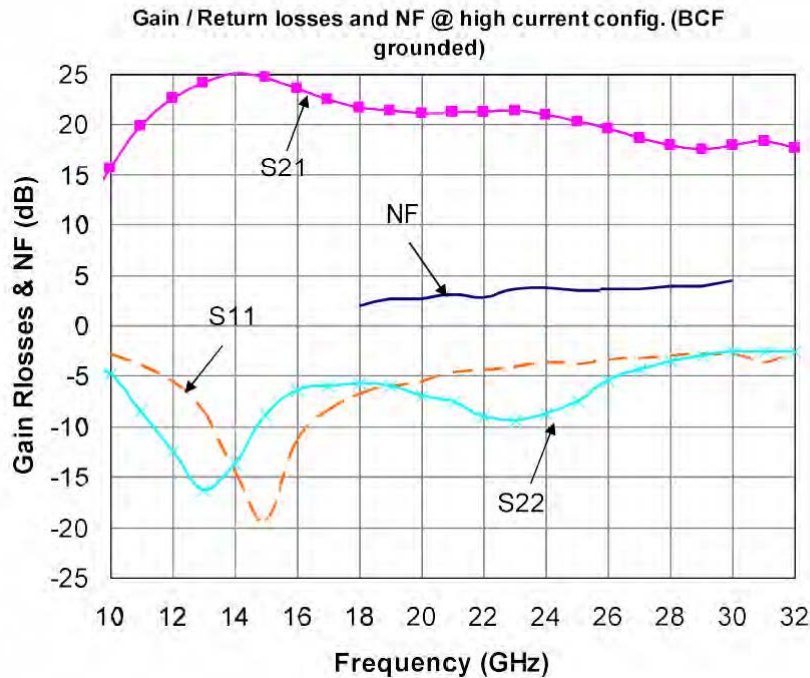
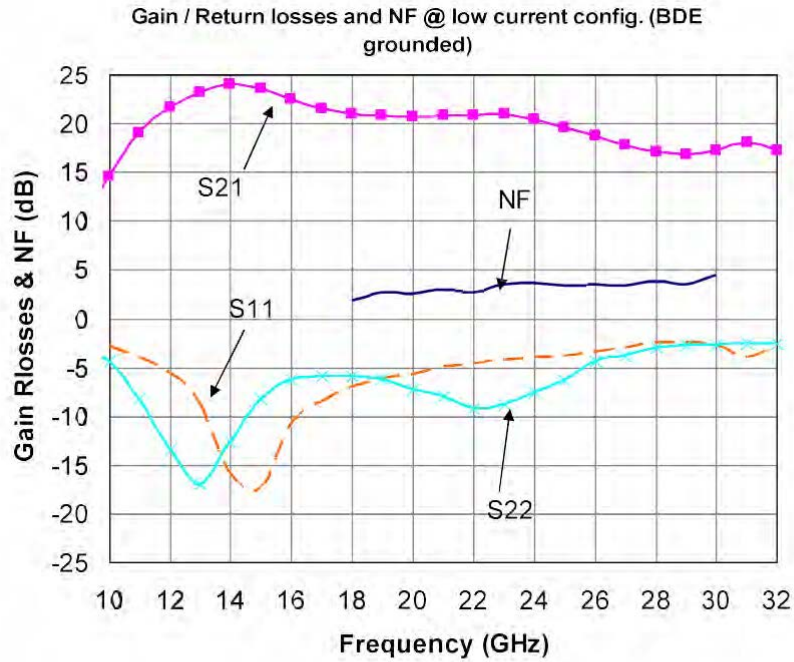
Freq (GHz)	S11 (dB)	S11 (°)	S12 (dB)	S12 (°)	S21 (dB)	S21 (°)	S22 (dB)	S22 (°)
2	-0.1	-58.5	-92.2	81.8	-57.9	0.4	-0.7	-146.6
3	-0.1	-88.9	-67.1	55.2	-69.1	-41.4	-1.1	159.3
4	-0.1	-122.6	-62.8	100.3	-51.5	77.3	-1.0	114.1
5	-0.2	-159.2	-63.0	51.4	-37.2	145.1	-1.5	73.0
6	-0.4	158.4	-56.6	15.4	-17.7	97.4	-1.9	40.1
7	-0.7	110.4	-64.5	-49.7	-3.8	31.4	-2.2	8.3
8	-1.3	60.8	-67.3	88.2	5.3	-49.4	-3.4	-21.8
9	-1.8	13.6	-61.5	-7.6	10.6	-120.9	-4.6	-40.0
10	-2.9	-27.8	-59.6	-45.7	15.6	177.2	-4.8	-68.3
11	-4.0	-60.9	-54.4	176.7	19.9	110.8	-8.5	-89.9
12	-5.6	-92.1	-53.9	99.3	22.7	43.0	-12.5	-90.4
13	-8.5	-123.1	-50.6	22.2	24.2	-22.2	-16.3	-76.8
14	-14.6	-169.0	-52.1	-32.8	25.1	-84.9	-13.8	-40.8
15	-19.5	26.2	-50.3	-120.6	24.8	-145.6	-8.9	-46.4
16	-11.3	-23.8	-49.4	165.3	23.6	161.3	-6.5	-65.0
17	-8.5	-49.1	-50.9	132.8	22.6	115.2	-6.0	-86.1
18	-6.9	-67.5	-46.9	122.6	21.8	73.8	-5.8	-101.6
19	-6.1	-83.9	-44.9	88.3	21.5	32.7	-6.1	-119.7
20	-5.6	-97.1	-43.0	53.7	21.2	-7.8	-7.0	-134.2
21	-4.6	-109.1	-44.1	21.4	21.3	-48.7	-7.6	-144.5
22	-4.4	-123.2	-45.4	19.8	21.3	-90.2	-9.0	-153.5
23	-4.1	-135.7	-43.9	7.2	21.4	-133.4	-9.4	-152.7
24	-3.7	-149.8	-43.4	-10.0	21.0	-178.9	-8.8	-151.9
25	-3.8	-162.0	-44.3	-34.6	20.3	138.4	-7.6	-155.6
26	-3.5	-173.4	-44.5	-42.2	19.7	94.7	-5.5	-161.7
27	-3.3	174.4	-47.4	-45.9	18.7	53.4	-4.5	-172.3
28	-3.0	164.8	-44.8	-39.0	18.0	12.8	-3.6	177.3
29	-2.9	153.8	-43.6	-43.1	17.6	-27.1	-3.0	168.4
30	-2.9	143.4	-41.7	-66.2	18.0	-70.8	-2.6	158.1
31	-3.8	138.2	-44.6	-91.4	18.4	-123.8	-2.6	150.7
32	-2.7	145.3	-49.9	-140.7	17.8	169.5	-2.6	144.6

The Sij measurement calibration planes are defined in the paragraph “Definition of the Sij reference planes”.

Typical On-Wafer Measurements

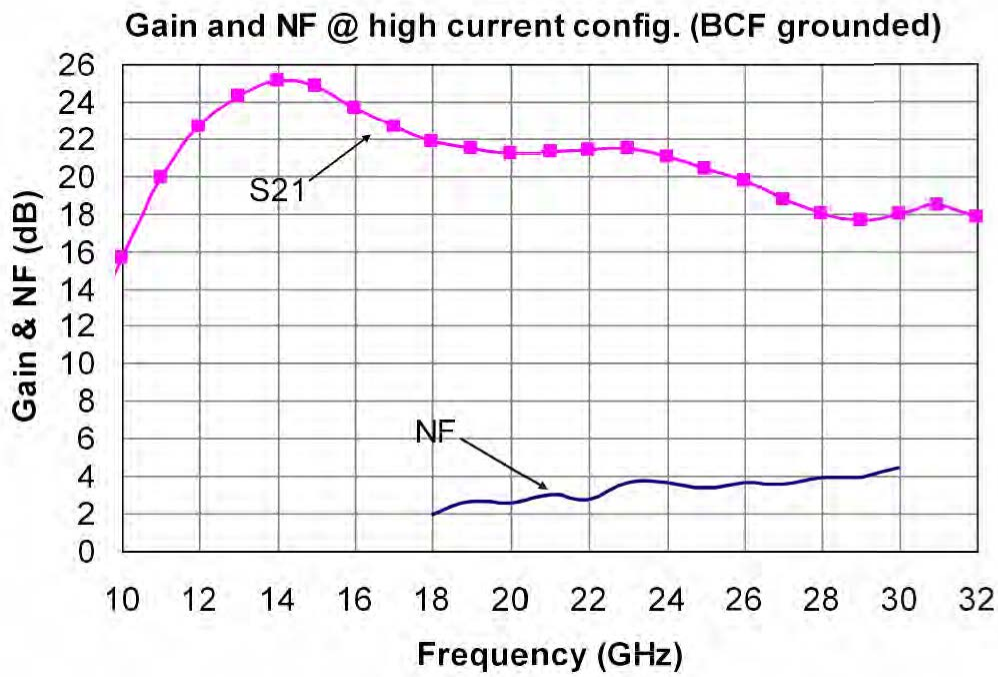
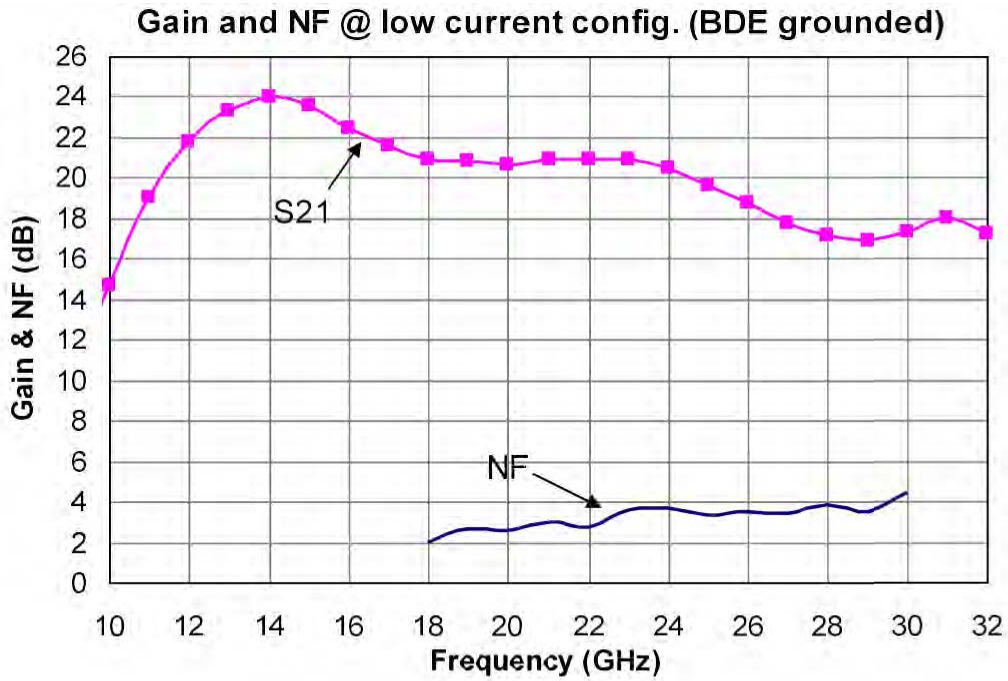
Tamb = +25 °C, Vd = +4.5 V

Measurements are given in the package access planes, using the proposed pattern and board given in the paragraph "Evaluation Mother Board".



Typical On-Wafer Measurements

Temp= +25 °C, Vd=4.5 V

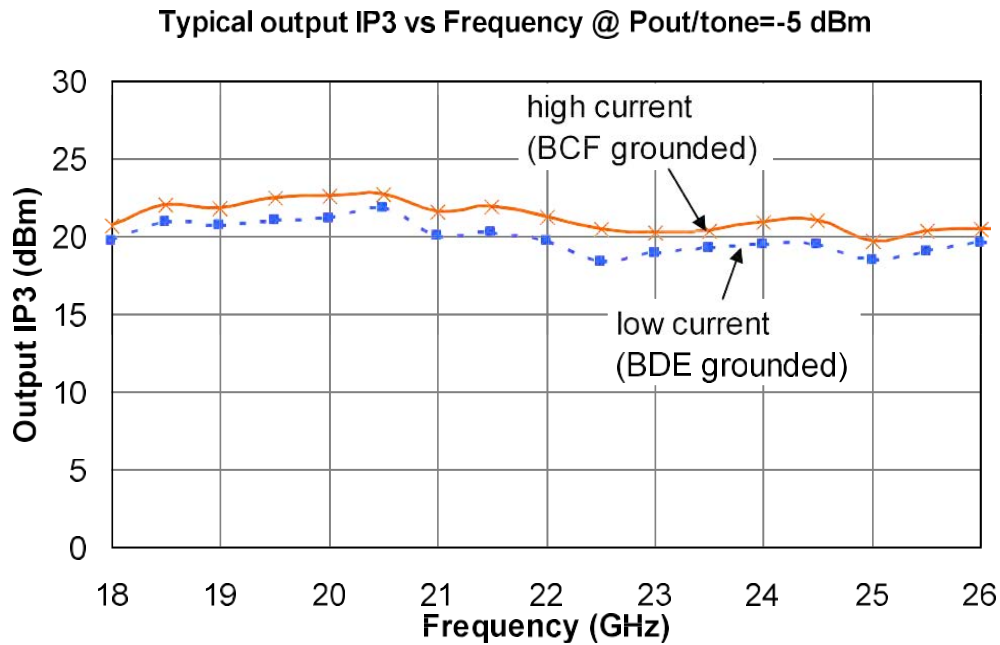
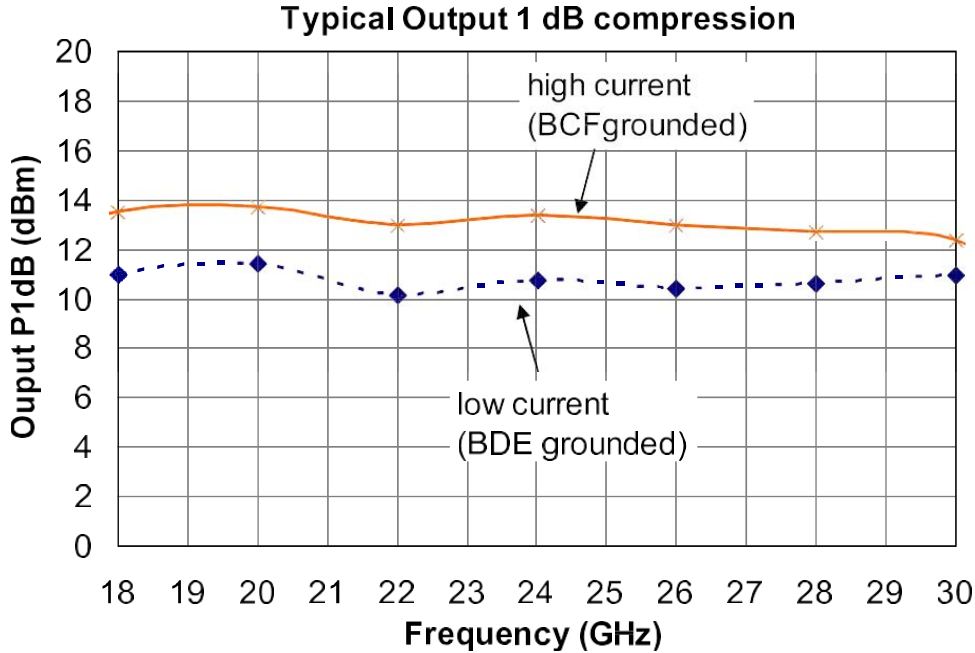


Typical On-Wafer Measurements

Tamb = +25 °C, Vd = +4.5 V

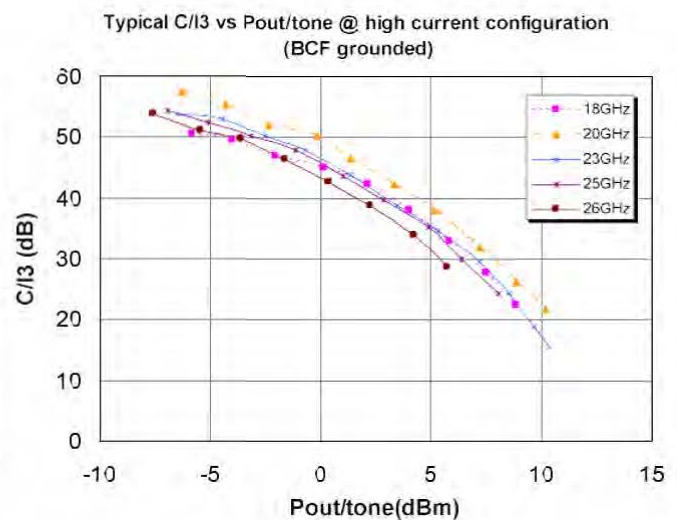
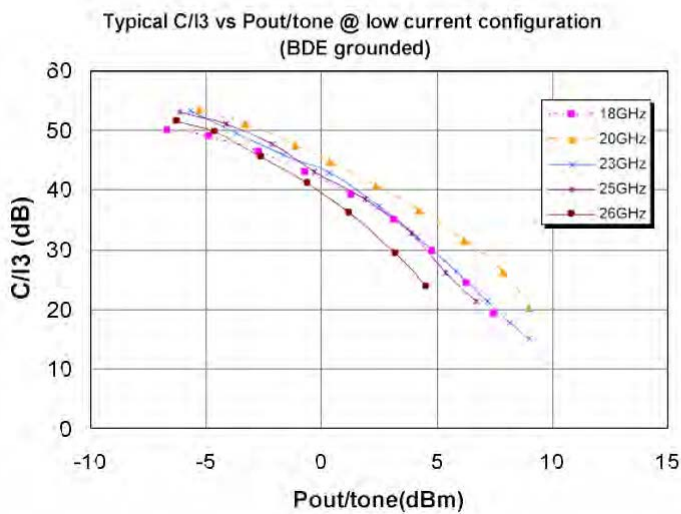
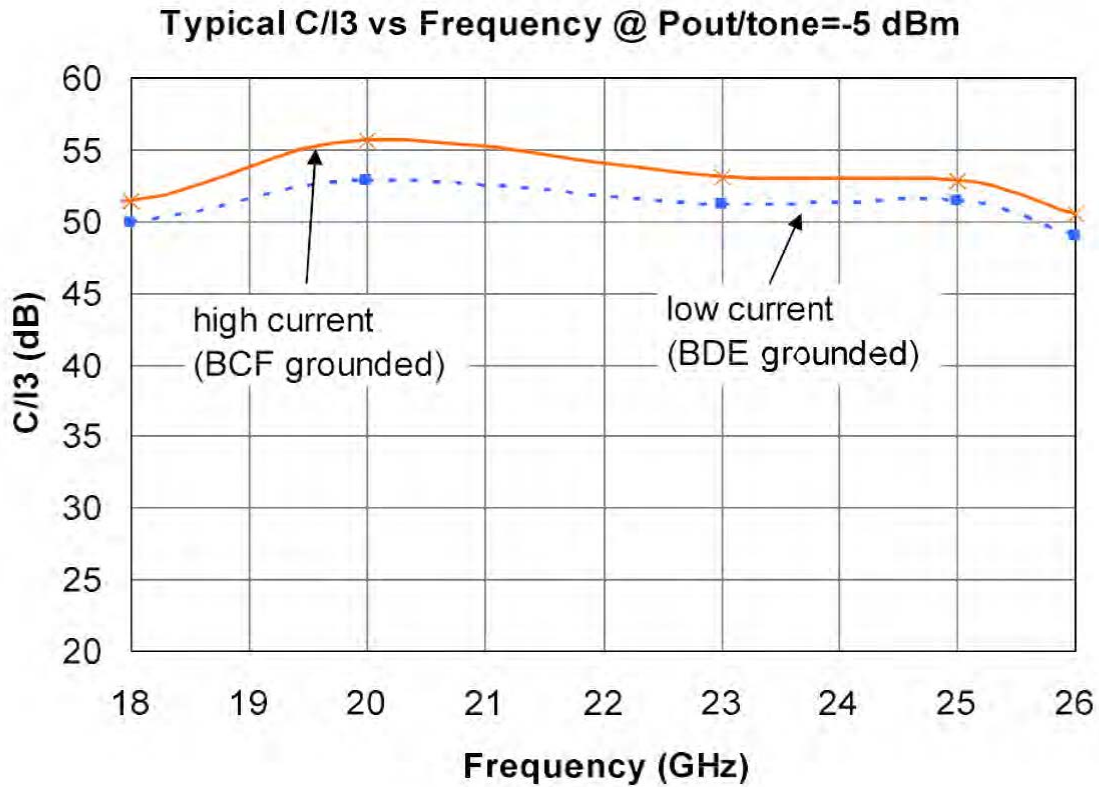
Measurements are given in the connectors' access plans, using the proposed land pattern and board given in the paragraph "Evaluation mother board".

For these measurements, losses due to board are not de-embedded.

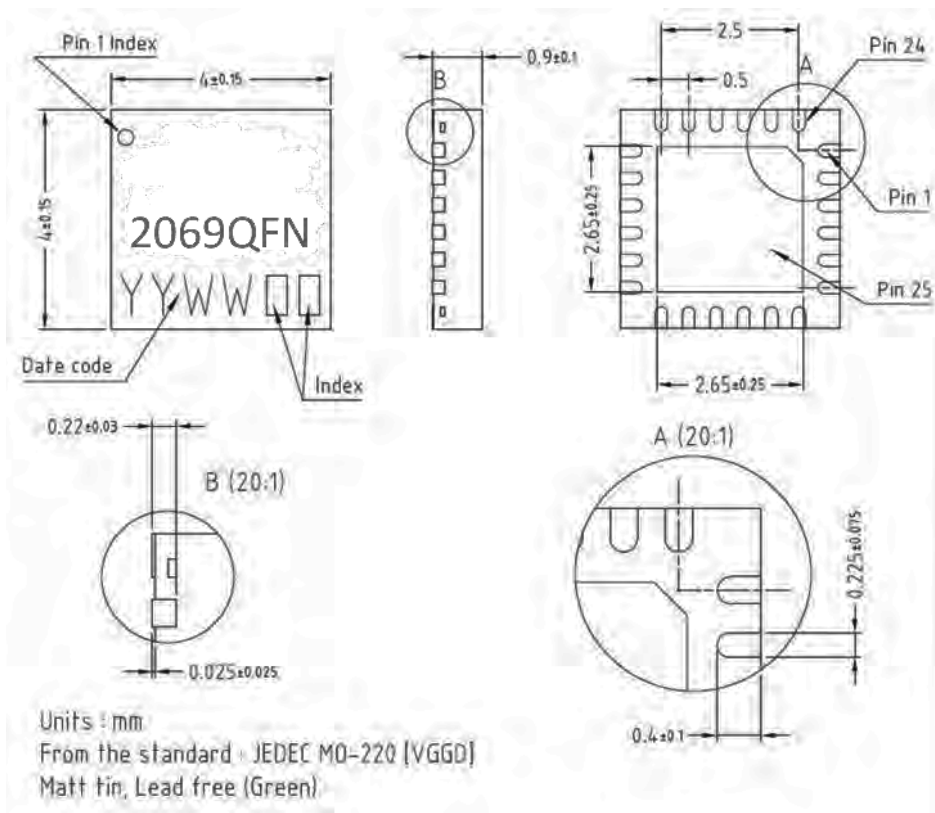


Typical On-Wafer Measurements

Tamb = +25 °C, Vd = +4.5 V



Package Outline 1



Matt tin, Lead Free	(Green)	1- Nc	13- Nc
Units	mm	2- Nc	14- Gnd
From the standard	JEDEC MO-220 (VGGD)	3- Gnd	15- RF OUT
		4- RF IN	16- Gnd
	25- GND	5- Gnd	17- Nc
		6- Nc	18- Nc
		7- B	19- Vd
		8- C	20- Vd
		9- D	21- Vg3
		10- Nc	22- Vg2
		11- E	23- Vg1
		12- F	24- Nc

All dimensions are in mm

¹ It is strongly recommended to ground all pins marked "Gnd" through the PCB board. Ensure that the PCB board is designed to provide the best possible ground to the package.

Ordering Information

Order Code	Description	Package	Shipping Method
TDLNA2069QFN	18 - 31 GHz Low Noise Amplifier	4 x 4 24-Pin QFN	Tape and Reel

Revision Information

Document	Description / Date	Change/Revision Details
TDLNA2069QFN-4-2024 Rev 0.3	TDLNA2069QFN / April 2024	Initial Release

Document Categories and Definitions:

Advance Information

The product is in a formative or design stage. The data sheet contains design target specifications for product development. Specifications and features may change in any manner without notice.

Preliminary Specification

The data sheet contains preliminary data. Additional data may be added at a later date. Teledyne e2v HiRel Electronics reserves the right to change specifications at any time without notice in order to supply the best possible product.

Product Specification

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Sales Contact

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