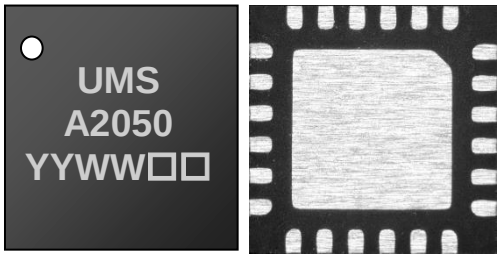
CHA2050-QDG

17-21.5GHz Low Noise Amplifier

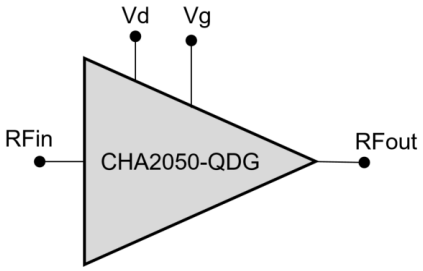
GaAs Monolithic Microwave IC in SMD leadless package

Description

The CHA2050-QDG is a three-stage GaAs Low Noise Amplifier operating in the frequency band 17-21.5GHz. This LNA typically presents 1.3dB Noise Figure associated to a typical small signal gain of 26dB. It provides 6dBm output power at 1dB gain compression. The overall power supply is 2V/30mA.



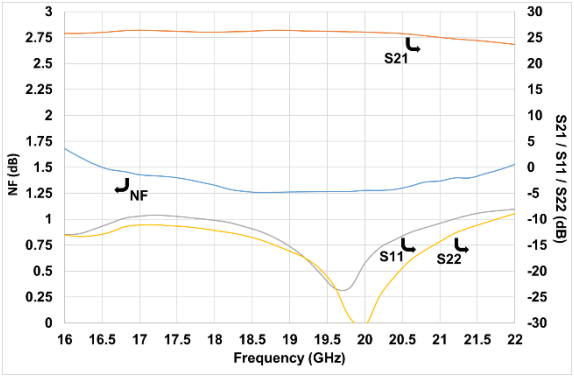
This LNA is dedicated to Satcom applications and well suited for a wide range of microwave applications and systems.



The product is developed with a pHEMT process, it is provided on low cost SMD RoHS compliant QFN 4x4 plastic package.

Main Features

- Broadband performances: 17-21.5GHz
- Gain: 26dB
- NF: 1.3dB
- OIP3: 17dBm
- DC bias: Vd=2Volt@Id=30mA
- MSL1



Main Electrical Characteristics

Tcase = +25°C

Symbol	Parameter	Min	Typ	Max	Unit
Freq	Frequency range	17		21.5	GHz
Gain	Linear Gain		26		dB
NF	Noise Figure		1.3		dB
P1dB	Output Power @1dB comp.		6		dBm

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Specifications

Tcase = +25°C, Vd = +2V / Idq=30mA

Symbol	Parameter	Min	Typ	Max	Unit
Freq	Frequency range	17		21.5	GHz
Gain	Linear Gain		26		dB
NF	Noise Figure		1.3		dB
S_{11}	Input return loss		-11		dB
S_{22}	Output return loss		-12		dB
P1dB	Output Power at 1dB gain compression		6		dBm
OIP3	3rd order Intercept point		17		dBm
Idq	Quiescent Current		30		mA

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

Absolute Maximum Ratings (1)

Tcase = +25°C

Symbol	Parameter	Values	Unit
Vd	Drain bias voltage	4	V
Id	Drain current	120	mA
Vg	Gate bias voltage	-2 to +0.4	V
Pin	Maximum input power	-10	dBm
Pdiss	Dissipated power	0.24	W

(1) Operation of this device above anyone of these parameters may cause permanent damage.

Recommended Operating Range (3), (4)

Symbol	Parameter	Values	Unit
Vd	Drain bias voltage	2 to 3	V
Idq	Drain bias current	30 to 40	mA
Vg	Gate bias voltage	-1.5 to +0.2	V
Tj	Maximum Junction temperature (2)	175	°C

(2) See Device thermal performances section
(3) Electrical performances are defined for specified test conditions
(4) Electrical performances are not guaranteed over all recommended operating conditions

Temperature Range

Tcase	Operating temperature range	-40 to +85	°C
Tstg	Storage temperature range	-55 to +150	°C

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Typical Bias Conditions

Tcase=+25°C

Symbol	Pad Nº	Parameter	Values	Unit
Vd	23	Drain Voltage	2	V
Vg	20	Gate Voltage	#-0.05	V
Idq		DC drain voltage	30	mA

“Power ON” sequence

1. Ground the device
2. Set the Gate voltage to -1.5V
3. Apply the Drain voltage Vd (Typically 2V)
4. Increase Vg up to quiescent bias drain current Idq
5. Apply RF signal

“Power OFF” sequence

1. Turn off RF signal
2. Decrease the Gate voltage to -1.5V
3. Decrease the Drain voltage to 0V
4. Turn off Vd supply
5. Turn off Vg supply

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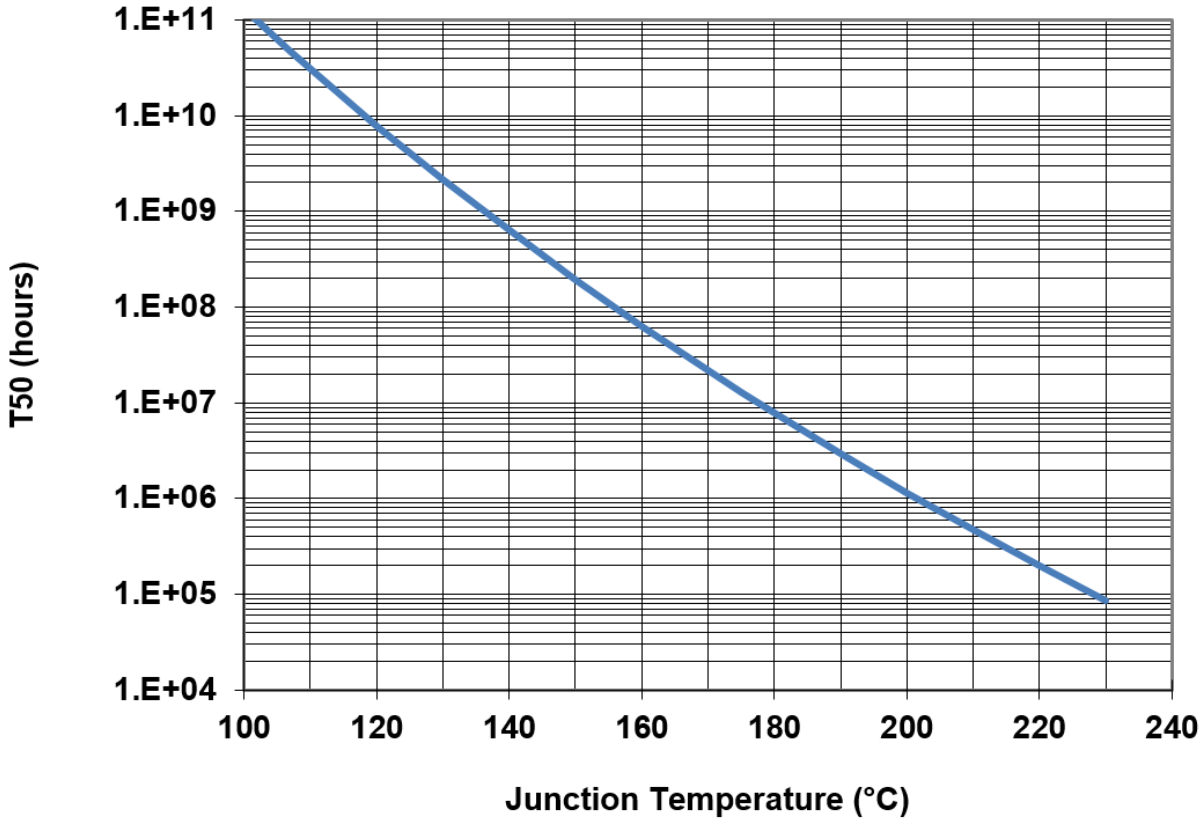
Device thermal performances

All the figures given in this section are obtained assuming that the QFN device is only cooled down by conduction through the package thermal pad (no convection mode considered).
The temperature is monitored at the package back-side interface (Tcase).
The system maximum temperature must be adjusted in order to guarantee that Tjunction remains below the maximum value specified in the Absolute Maximum Ratings table.
So, the system PCB must be designed to comply with this requirement.

Parameter	Biasing conditions	Tjunction (°C)	R_{TH} (°C/W)	T50 (hours)
R_{TH} (1) Thermal Resistance (Junction to Case)	Vd= 2V Id= 30mA Pdiss= 60mW	107	367	4.7E+10

[1] Assuming 85°C Tcase



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Typical Package Sij parameters

Tcase=+25°C, Vd = +2V, Id = 30mA

Freq (GHz)	S11 (dB)	PhS11 (°)	S12 (dB)	PhS12 (°)	S21 (dB)	PhS21 (°)	S22 (dB)	PhS22 (°)
16.0	-12.98	141.3	25.85	7.4	-52.19	115.5	-13.04	128.9
16.2	-12.80	137.3	25.82	-9.3	-49.56	104.5	-13.32	117.8
16.4	-11.87	130.8	25.94	-25.4	-50.08	84.3	-13.13	108.5
16.6	-10.84	120.6	26.13	-41.3	-49.31	67.3	-12.53	99.7
16.8	-9.82	106.0	26.37	-57.8	-51.91	62.0	-11.46	86.5
17.0	-9.42	90.7	26.43	-74.5	-52.03	66.0	-11.12	71.6
17.2	-9.22	75.4	26.37	-90.6	-49.15	58.1	-11.07	58.3
17.4	-9.36	61.8	26.29	-105.6	-50.83	82.1	-11.25	46.8
17.6	-9.61	49.5	26.19	-120.1	-48.36	63.7	-11.42	35.7
17.8	-9.90	38.4	26.09	-133.8	-47.62	41.2	-11.74	26.1
18.0	-10.23	27.9	26.07	-146.9	-47.06	41.4	-12.18	17.6
18.2	-10.68	17.2	26.14	-160.1	-47.00	32.2	-12.58	9.8
18.4	-11.46	7.0	26.20	-173.3	-46.21	19.2	-13.16	0.5
18.6	-12.33	-1.8	26.34	173.4	-46.06	16.2	-13.92	-8.6
18.8	-13.59	-10.7	26.43	159.4	-45.41	5.2	-14.97	-16.8
19.0	-15.26	-17.9	26.41	145.4	-45.02	-7.2	-16.16	-23.2
19.2	-17.44	-21.0	26.30	132.0	-46.13	-20.9	-17.44	-32.2
19.4	-20.39	-18.1	26.27	119.1	-45.51	-31.1	-19.55	-44.8
19.6	-23.35	1.1	26.21	105.9	-44.74	-46.5	-23.09	-61.5
19.8	-23.21	35.9	26.14	93.1	-44.63	-54.8	-28.98	-101.6
20.0	-18.45	52.8	26.09	80.0	-46.15	-67.5	-30.45	146.1
20.2	-15.48	46.7	25.98	67.2	-47.63	-89.6	-24.66	111.8
20.4	-13.96	41.0	25.88	53.9	-48.24	-93.4	-20.95	106.3
20.6	-12.58	35.1	25.68	40.7	-48.79	-108.8	-17.94	99.0
20.8	-11.66	28.7	25.37	28.0	-49.02	-132.4	-15.97	91.8
21.0	-10.80	23.3	25.06	15.9	-49.83	-136.1	-14.29	86.7
21.2	-9.92	16.7	24.76	4.4	-48.50	-144.3	-12.66	80.0
21.4	-9.16	10.0	24.56	-7.0	-48.98	-156.8	-11.60	73.3
21.6	-8.63	2.0	24.32	-18.8	-47.23	177.9	-10.69	67.8
21.8	-8.34	-4.9	24.01	-30.4	-47.45	161.2	-9.78	62.9
22.0	-8.06	-11.0	23.69	-41.7	-46.77	145.6	-8.92	56.9

Note: S parameters are given in the QFN reference planes (see page 14)

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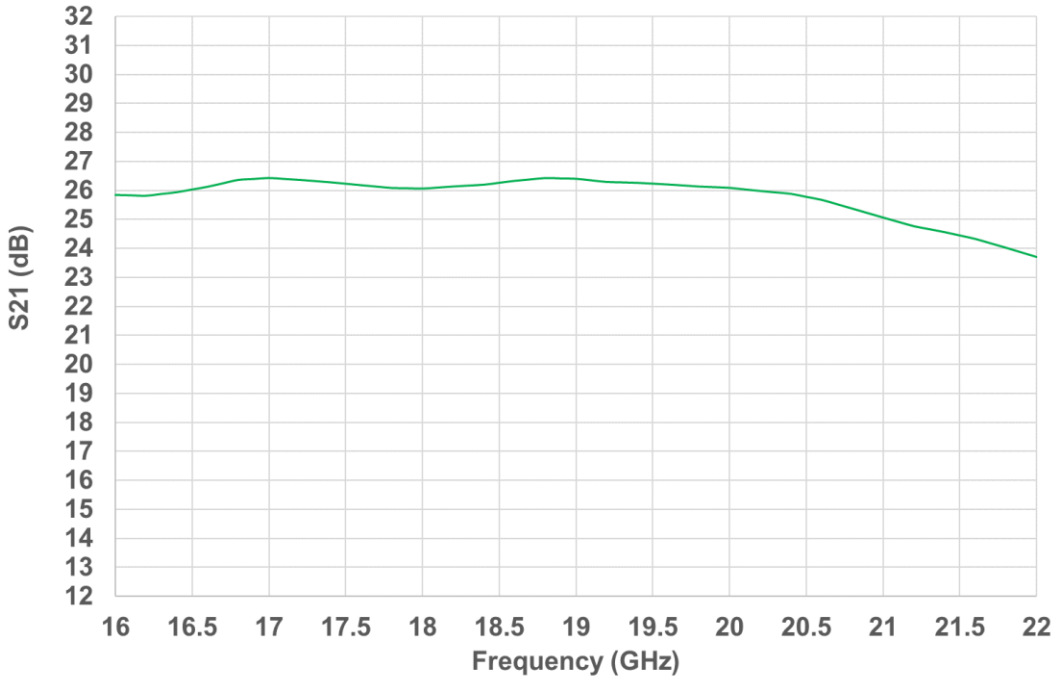
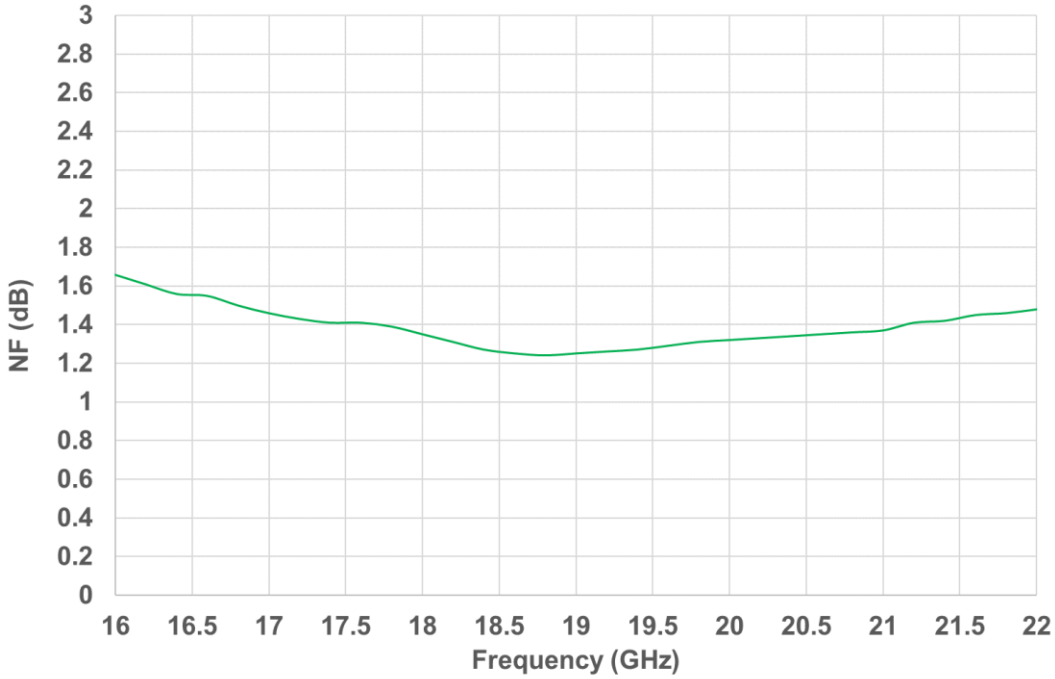
Typical Board Measurements:

Test conditions: CW, Vd = 2V, Idq = 30mA, Tcase = 25°C
S21 and NF in QFN reference planes

S21 in QFN reference planes



NF in QFN reference planes



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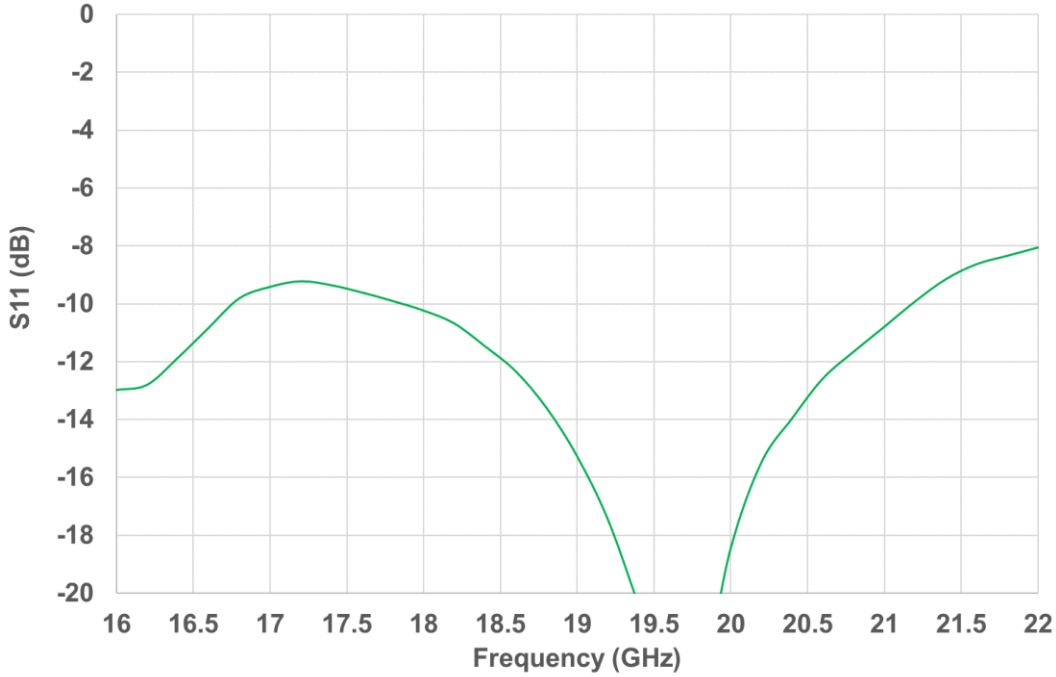
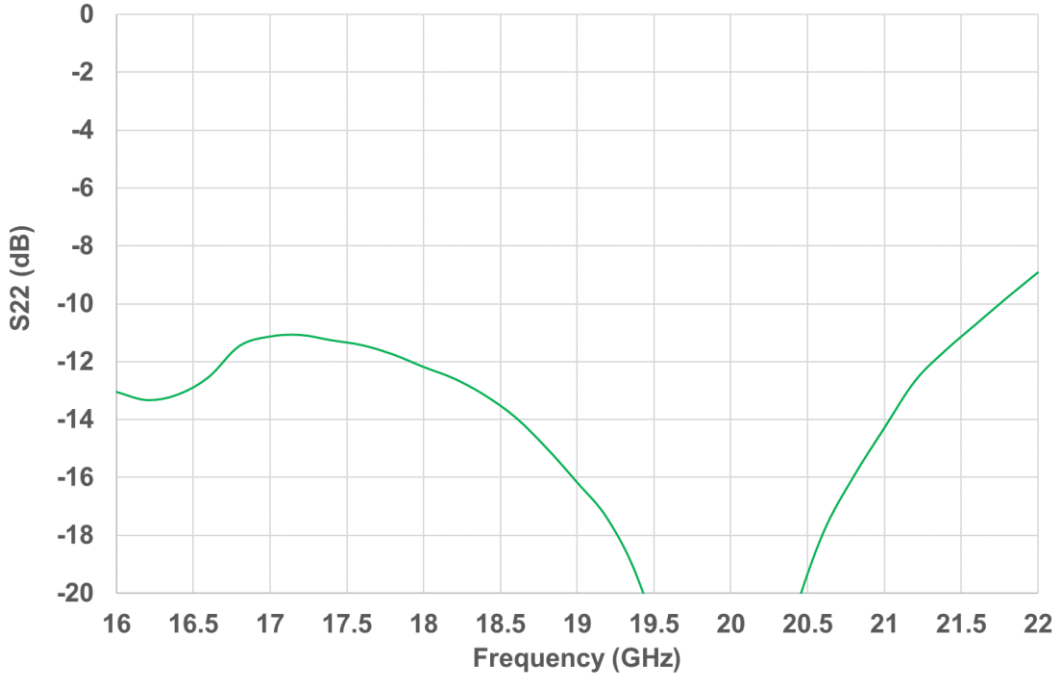
Typical Board Measurements:

Test conditions: CW, Vd = 2V, Idq = 30mA, Tcase = 25°C
S11 and S22 in QFN reference planes

S11 in QFN reference plane



S22 in QFN reference plane



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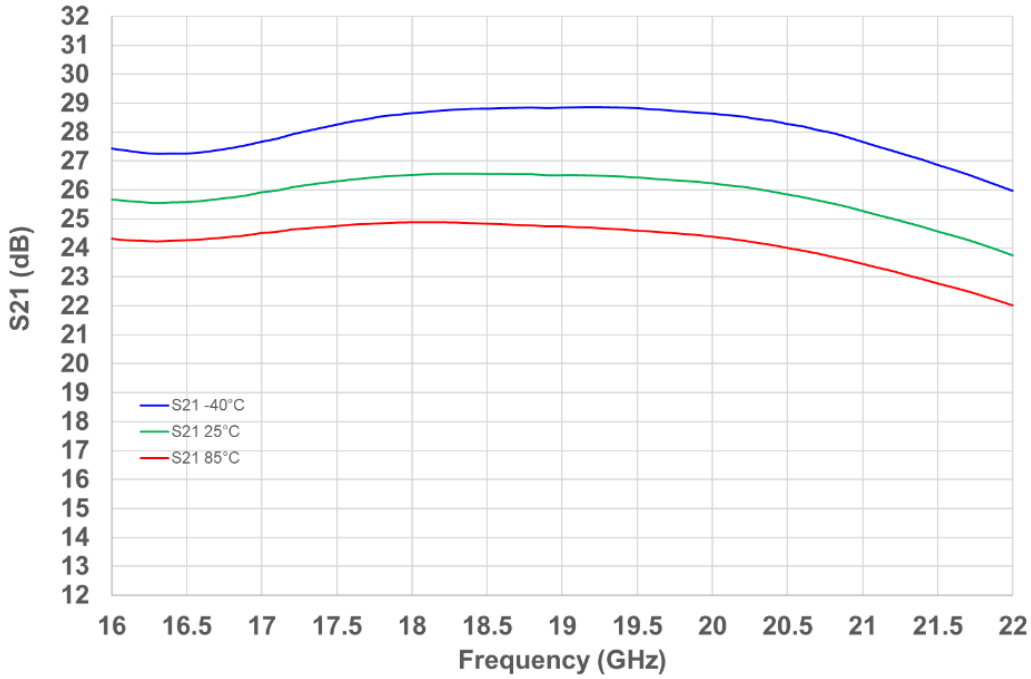
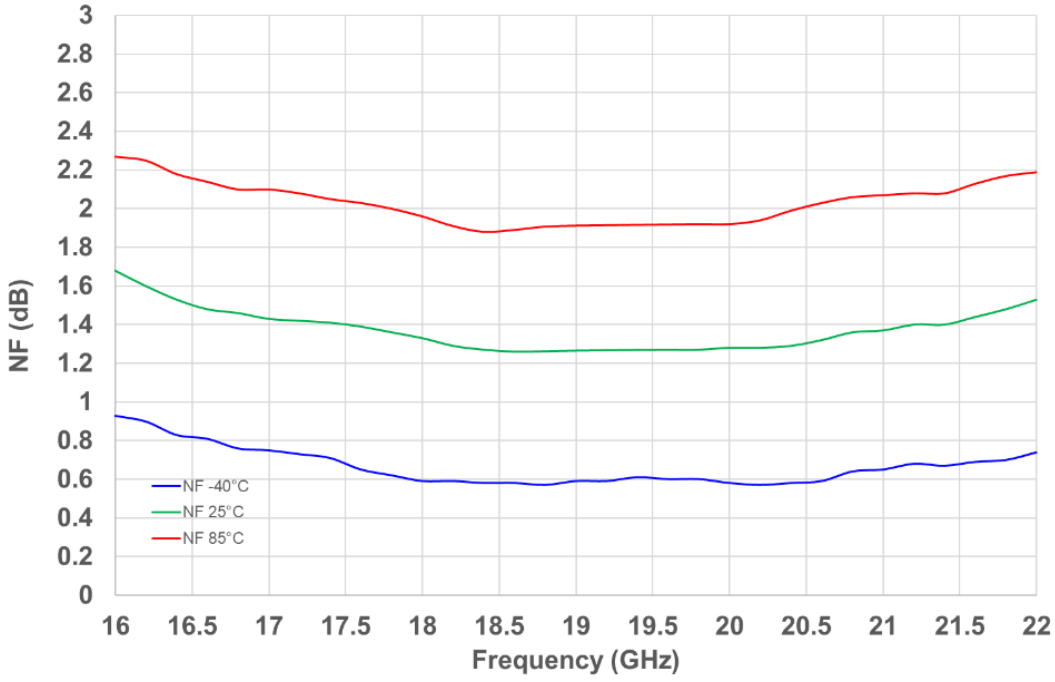
Typical Board Measurements for temperature variation evaluation

Test conditions: CW, Vd = 2V, Idq = 30mA, Tcase = -40°C / 25°C / 85 °C
S21 and NF measurements are de-embedded in QFN reference planes

S21 de-embedded in QFN reference planes



NF de-embedded in QFN reference planes



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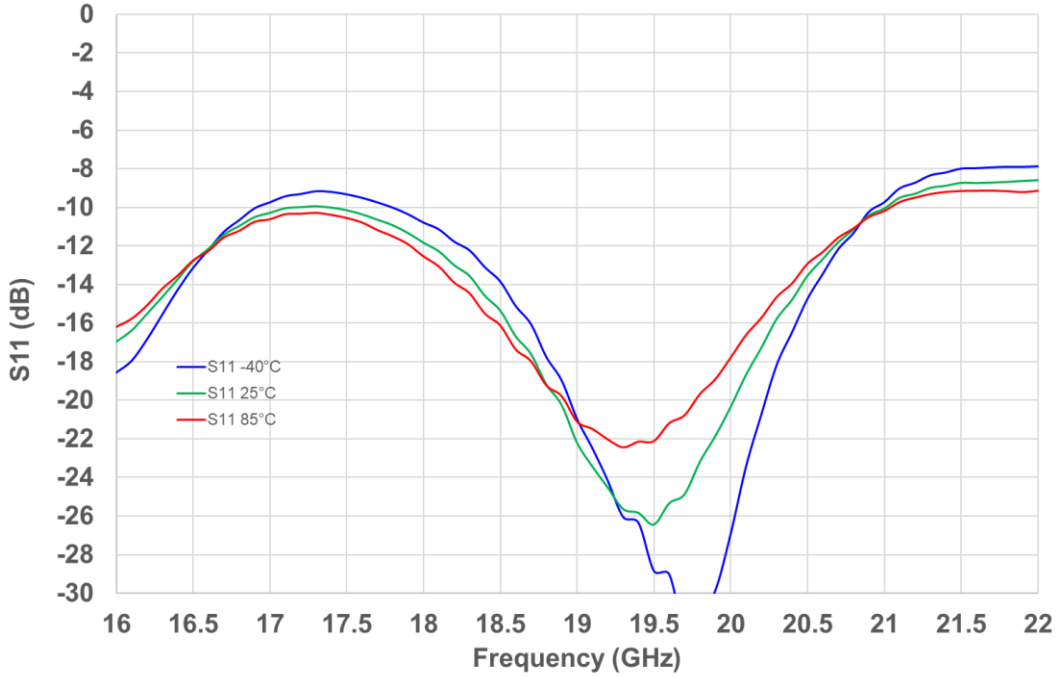
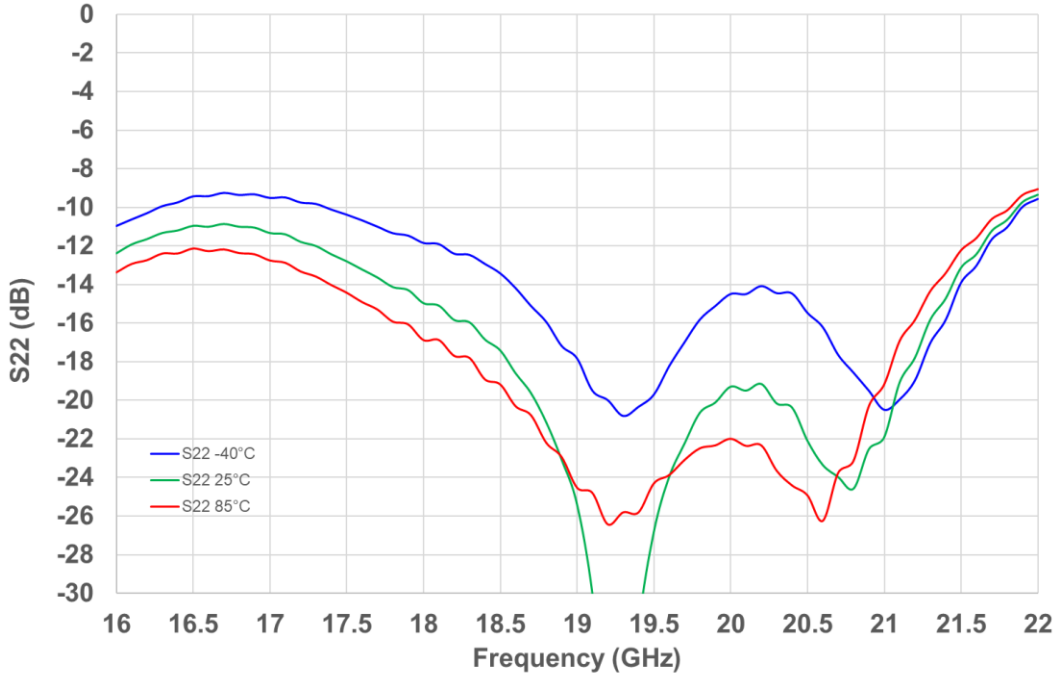
Typical Board Measurement for temperature variation evaluation

Test conditions: CW, Vd = 2V, Idq = 30mA, Tcase = -40°C / 25°C / 85 °C
S11 and S22 are given in the plane of the RF connectors of the board.
For intrinsec product performances see board measurement in QFN reference planes on page 7

S11 in input plane of the board



S22 in output plane of the board



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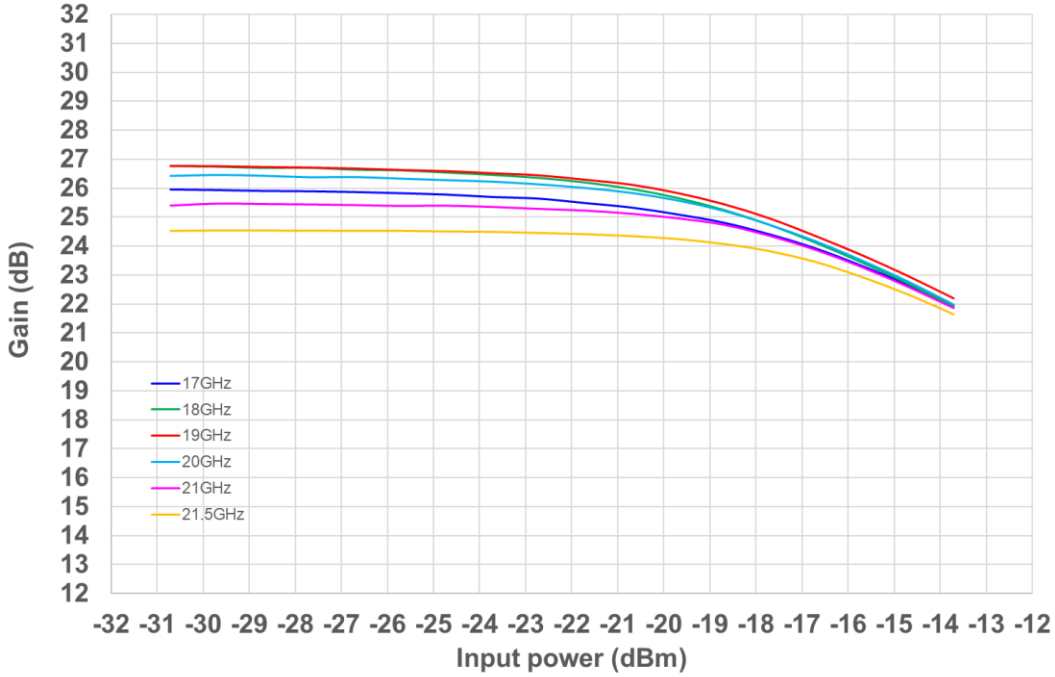
Typical Board Measurement for temperature variation evaluation

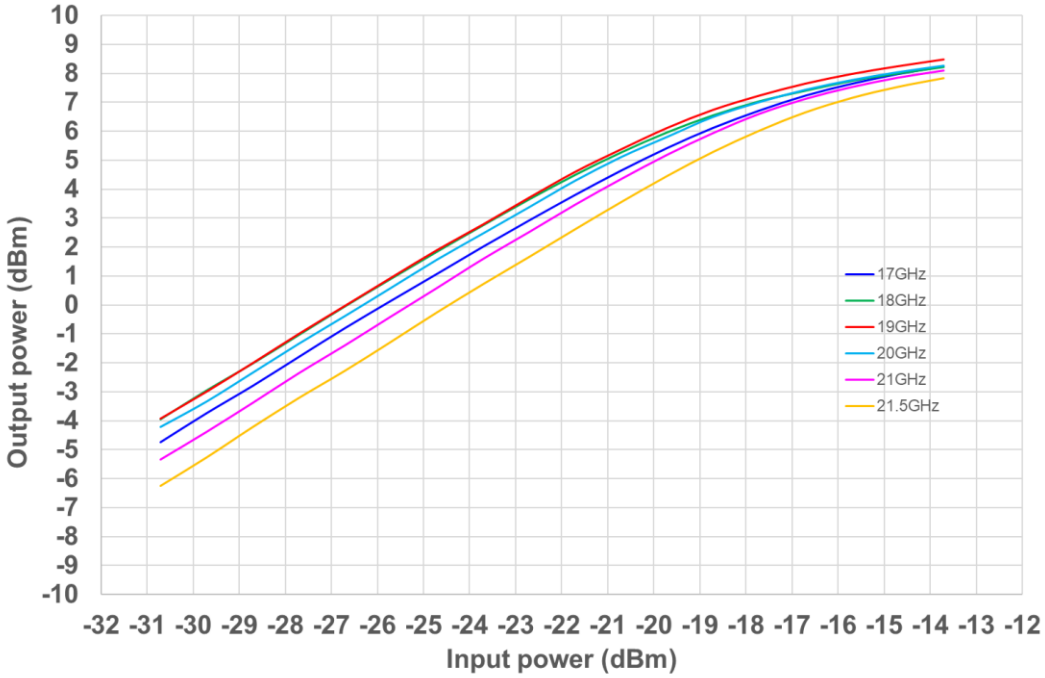
Gain and Output power

Test conditions: CW, Vd = 2V, Idq = 30mA, Tcase = 25°C
Gain and Output power are de-embedded in QFN reference planes

Gain versus input power



Output power versus input power



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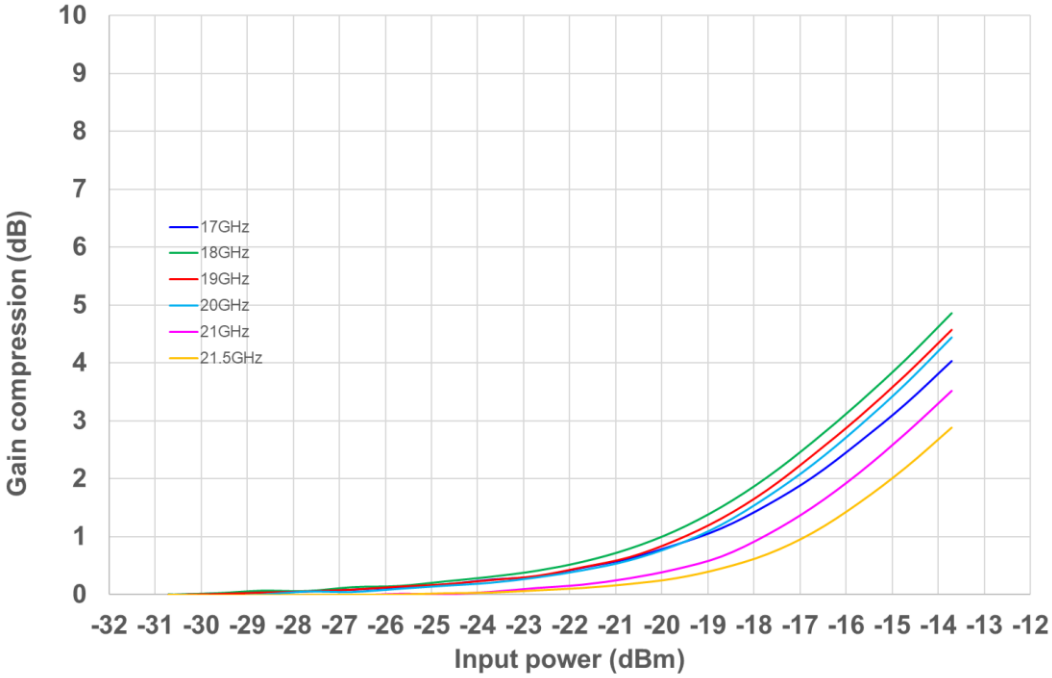
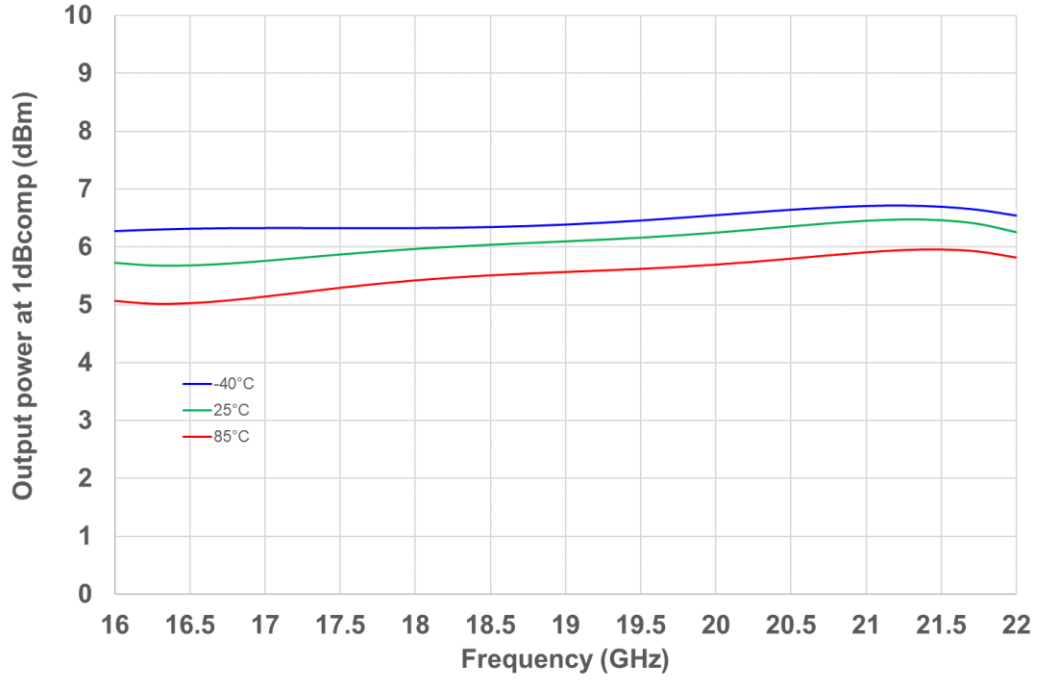
Typical Board Measurement for temperature variation evaluation

Test conditions: CW, Vd = 2V, Idq = 30mA, Tcase = 25°C
Gain compression and OP1dB are de-embedded in QFN reference planes

Gain compression versus input power



Output power at 1dB gain compression



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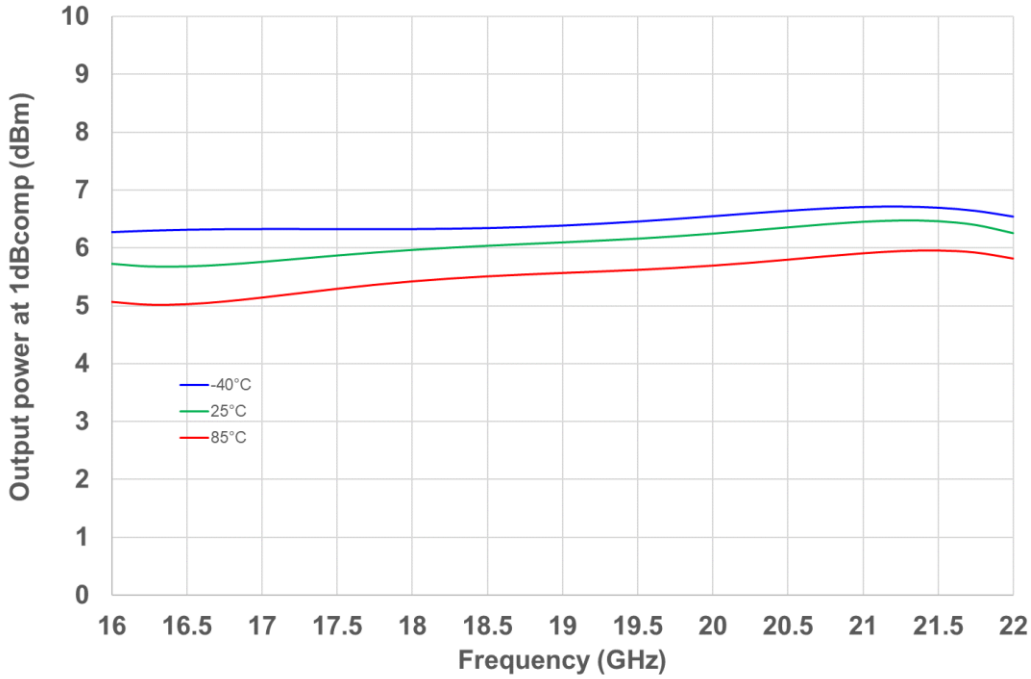
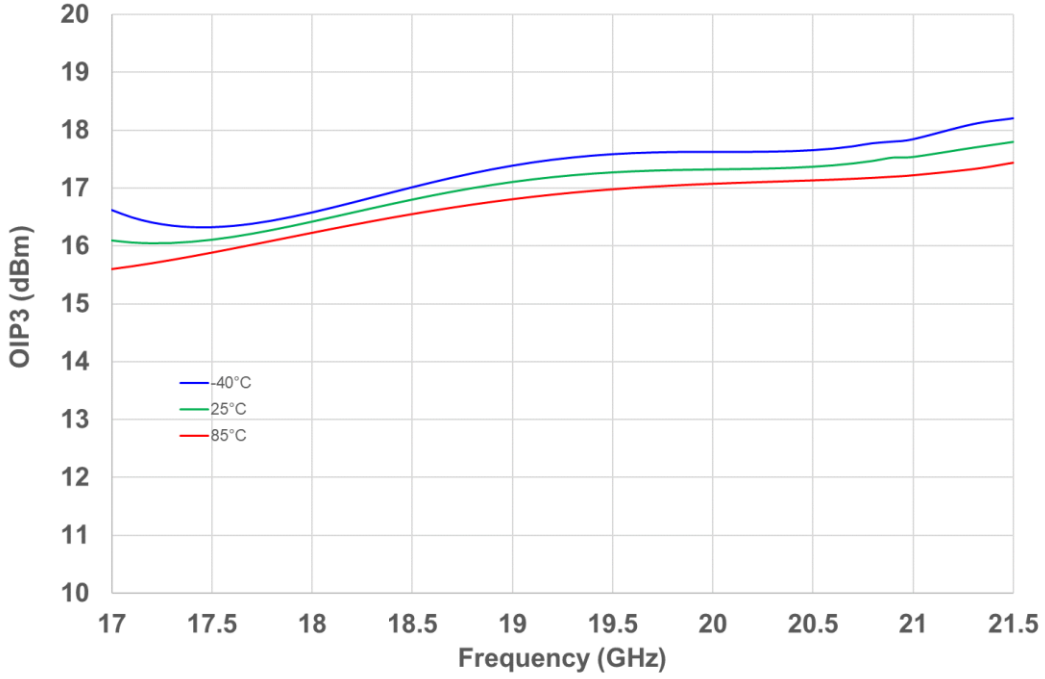
Typical Board Measurement for temperature variation evaluation

Test conditions: CW, Vd = 2V, Idq = 30mA, Tcase = -40°C / 25°C / 85 °C
P1dB and OIP3 are de-embedded in QFN reference planes

Output power at 1dB gain compression



Output third order intercept point



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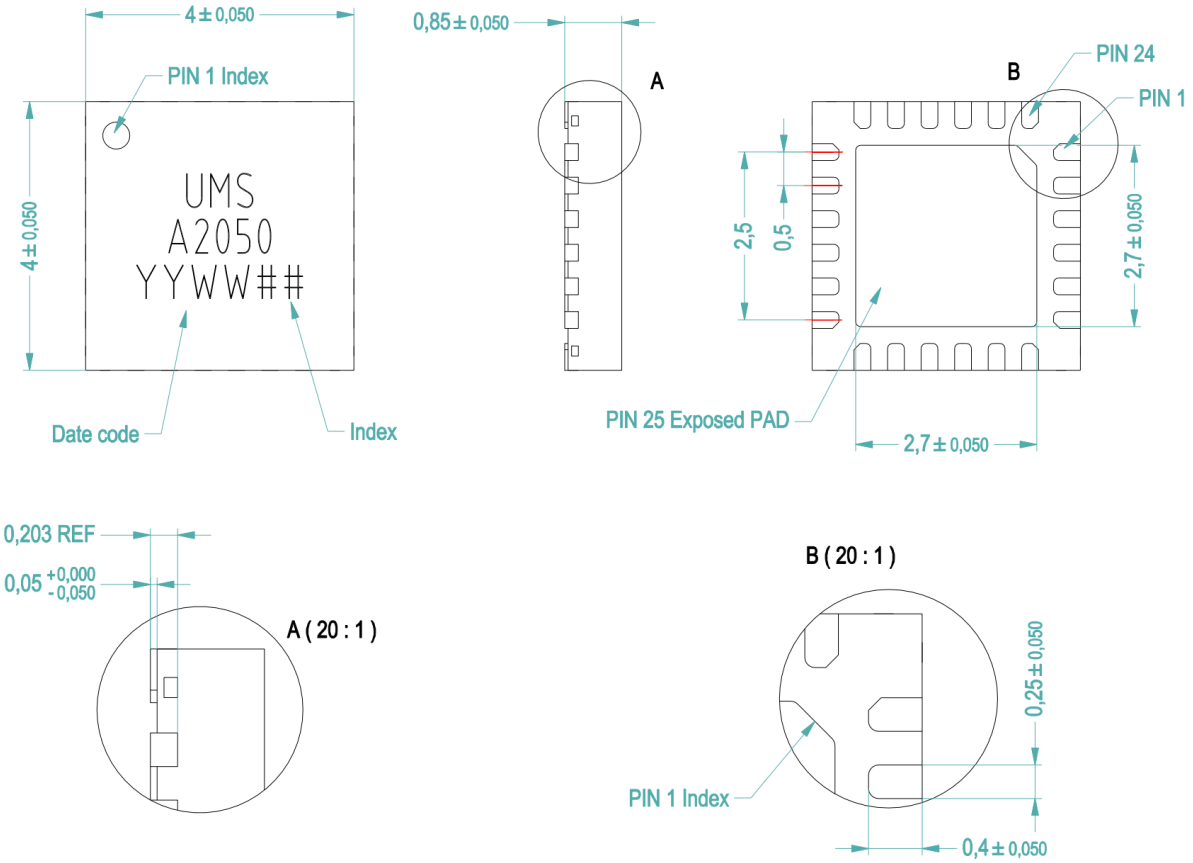
Package outline (1)



Finish:	Matt tin Lead Free (Green)	1- Nc	11- Nc	21- GND(2)
Units :	mm	2- Nc	12- Nc	22- GND(2)
From the standard :	JEDEC MO-220	3- GND(2)	13- Nc	23- VD
	(VGGD)	4- RF in	14- GND(2)	24- Nc
Nc:	Not Connected	5- GND(2)	15- RF out	25- GND(2)
		6- Nc	16- GND(2)	
		7- Nc	17- Nc	
		8- Nc	18- Nc	
		9- Nc	19- Nc	
		10- Nc	20- VG	

(1) Refer to the application note AN0017 (https://www.ums-rf.com) for general consideration and recommendations for Molded Plastic QFN/DFN packages.

(2) 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.

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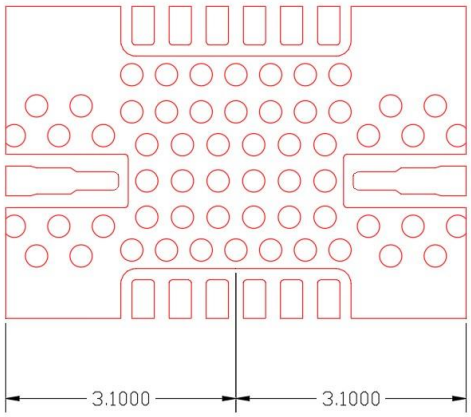
Definition of the Sij reference planes

The reference planes used measurements given above are symmetrical from the symmetrical axis of the package (see drawing beside). The input and output reference planes are located at 3.1mm offset (input wise and output wise respectively) from this axis.



Package Information

Parameter	Value
Package body material	RoHS-compliant
	Low stress Injection Molded Plastic
Lead finish	100% matte tin (Sn)
MSL Rating	MSL1

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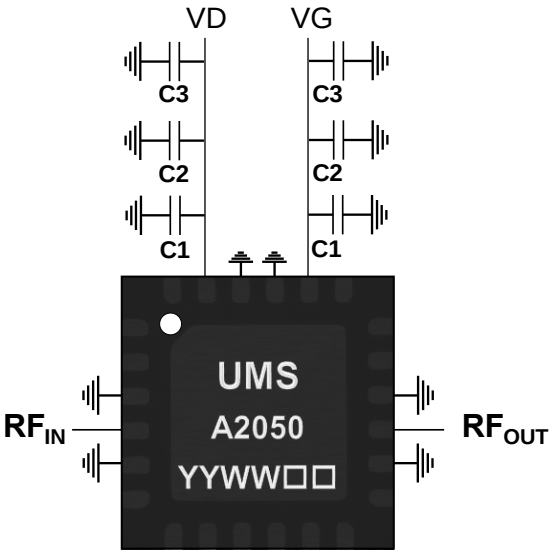
Recommended assembly plan



Bill of materials

Component	Value	Description
C1	68pF	Capacitor, 68pF ±5% 50V 0402
C2	1nF	Capacitor, 1nF ±5%, 50V, 0402
C3	1µF	Capacitor, 1µF ±10%, 50V, 0603

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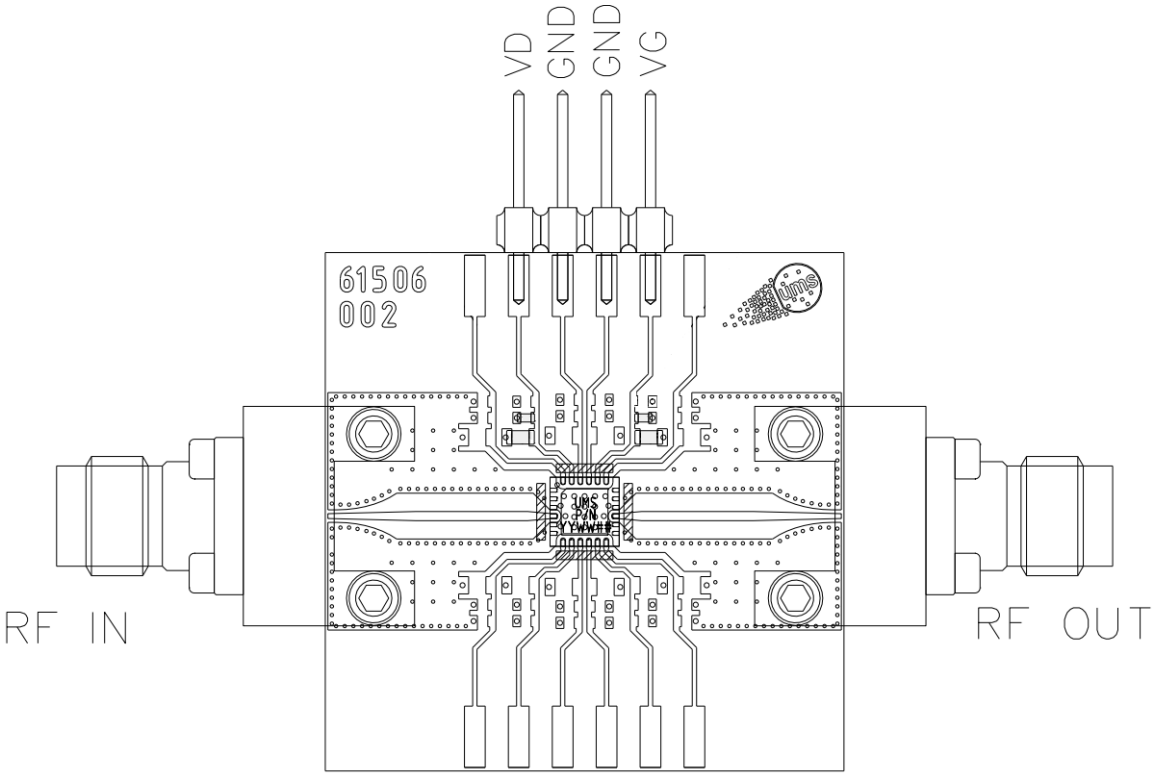
Evaluation mother board (thermal evaluation)

- Compatible with the proposed footprint.
- Based on typically Ro4003 / 8mils or equivalent.
- Using a micro-strip to coplanar transition to access the package.
- Recommended for the implementation of this product on a module board.
- See application note AN0017 for details.



Note: All board measurements are performed using shielded cables, even for DC bias, to ensure safe operation.

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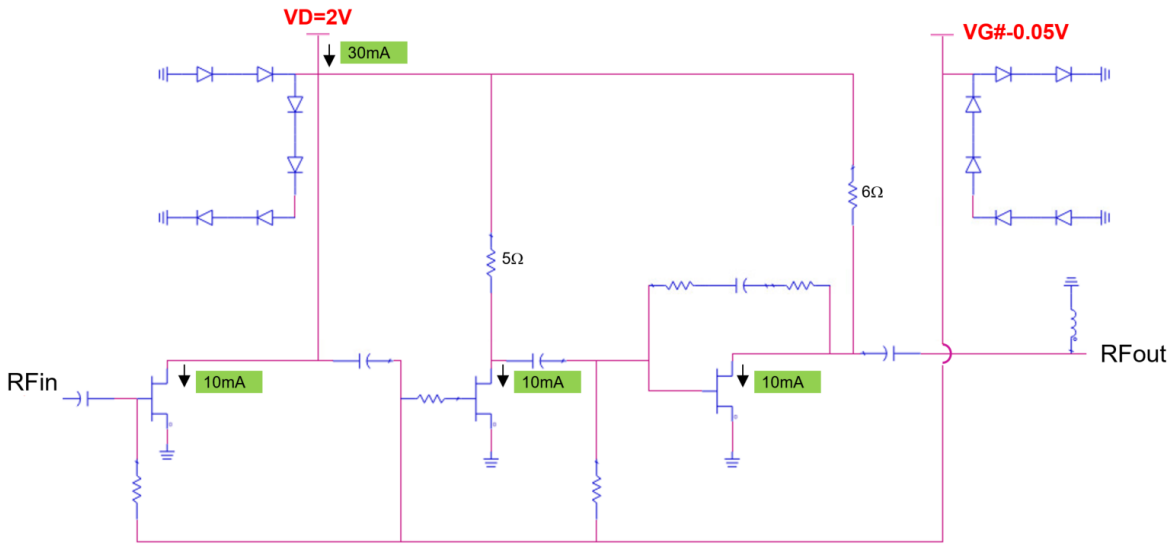
Notes

Due to ESD protection circuits on RF output (see DC Schematic below), an external capacitance might be requested to isolate the product from external voltage that could be present on the RF output access.

ESD protections are also implemented on gate and control accesses.
The DC connections do not include any decoupling capacitor in package, therefore it is mandatory to provide a good external DC decoupling on the PC board, as close as possible to the package.

DC Schematic

LNA: 2V, 30mA



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Recommended package footprint

Refer to the application note AN0017 available at https://www.ums-rf.com for package foot print recommendations.

SMD mounting procedure

For the mounting process standard techniques involving solder paste and a suitable reflow process can be used. For further details, see application note AN0017 at https://www.ums-rf.com.

Recommended environmental management

UMS products are compliant with the regulation in particular with the directives RoHS N°2011/65 and REACh N°1907/2006. More environmental data are available in the application note AN0019 also available at https://www.ums-rf.com.

Recommended ESD management

Refer to the application note AN0020 available at https://www.ums-rf.com for ESD sensitivity and handling recommendations for the UMS package products.

Ordering Information

QFN 4x4 package:	CHA2050-QDG/XY	
	Stick: XY = 20	Tape & reel: XY = 21

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