

5.8-17GHz Low Noise Amplifier

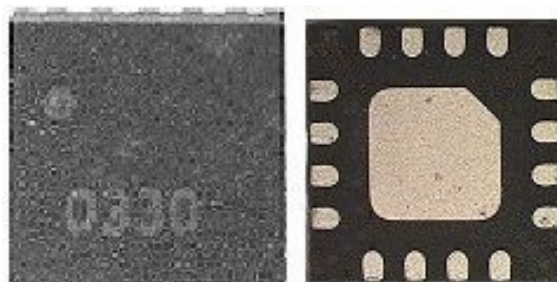
GaAs Monolithic Microwave IC in SMD leadless package

Description

The CHA3666-QAG is a two-stage self-biased wide band monolithic low noise amplifier.

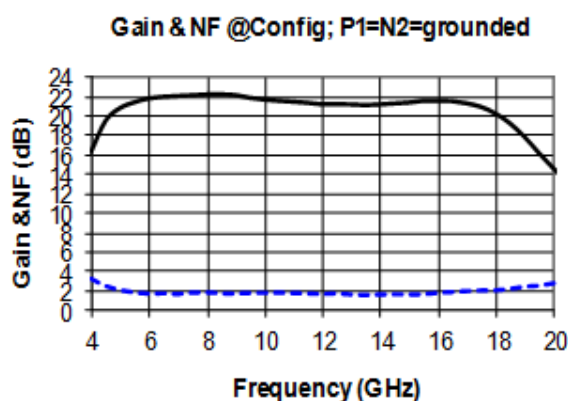
The circuit is manufactured with a standard pHEMT process: 0.25 μ m gate length, via holes through the substrate, air bridges and electron beam gate lithography.

It is supplied in RoHS compliant SMD package.



Main Features

- Broadband performance 6-17GHz
- 1.8dB noise figure
- 26dBm 3rd order intercept point
- 16dBm power at 1dB compression
- 21dB gain
- Low DC power consumption
- 16L-QFN3X3 SMD package
- MSL1



Main Electrical Characteristics

Tamb.= +25°C, Vd1=Vd2= +4V, P1& N2=GND

Symbol	Parameter	Min	Typ	Max	Unit
Freq	Frequency range	5.8		17	GHz
NF	Noise Figure		1.8	2	dB
G	Gain	19	21		dB
IP3	3 rd order intercept point		26		dBm

Specifications

Tamb.= +25°C, Vd = +4.0V

Symbol	Parameter	Min	Typ	Max	Unit
Freq	Frequency range	5.8		17	GHz
Gain	Linear Gain (2)	19	21		dB
ΔG	Gain flatness		± 0.5		dB
NF	Noise Figure (2)		1.8	2	dB
S11	Input return loss (2)		2.5:1	2.7:1	
S22	Output return loss (2)		2.0:1	2.2:1	
IP3	3 rd order intercept point		26		dBm
P1dB	Output power at 1 dB gain comp (2) (3)	15	16		dBm
Vd1, 2	Drain bias voltage		4		V
Id	Drain bias current	60	80	100	mA

(1) The other leads are not connected.

(2) These values are representative of on board measurements as defined on the drawing (see below).

(3) P1dB can be increased (+0.5dBm) when P1& P2 are connected to ground and the other leads non-connected. In this case Id is typically of 85mA.

“Power ON” sequence

1. Ground the device
2. Apply Vds bias voltage (Typically: Vd = 4V)
3. Apply RF signal

“Power OFF” sequence

1. Turn off RF signal
2. Turn Vds bias voltage to 0V

Absolute Maximum Ratings ⁽¹⁾T_{amb.} = +25°C

Symbol	Parameter	Values	Unit
V _d	Drain bias voltage	4.5V	V
P _{in}	RF input power	10	dBm
T _{op}	Operating temperature range	-40 to +85	°C
T _j	Maximum Junction temperature ⁽²⁾	175	°C

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

⁽²⁾ Thermal Resistance channel to ground paddle

Recommended Operating Range ^{3, 4}

Symbol	Parameter	Values	Unit
V _d	Drain bias voltage	3 to 4	V
P _{in}	Maximum peak input power overdrive	5	dBm

Temperature Range

T _a	Operating temperature range	-40 to +95	°C
T _{stg}	Storage temperature range	-55 to +150	°C

Typical Bias ConditionsT_{amb.} = +25°C

Symbol	Pad N°	Parameter	Values	Unit
D1	16	V1	4	V
D2	14	V2	4	V

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).

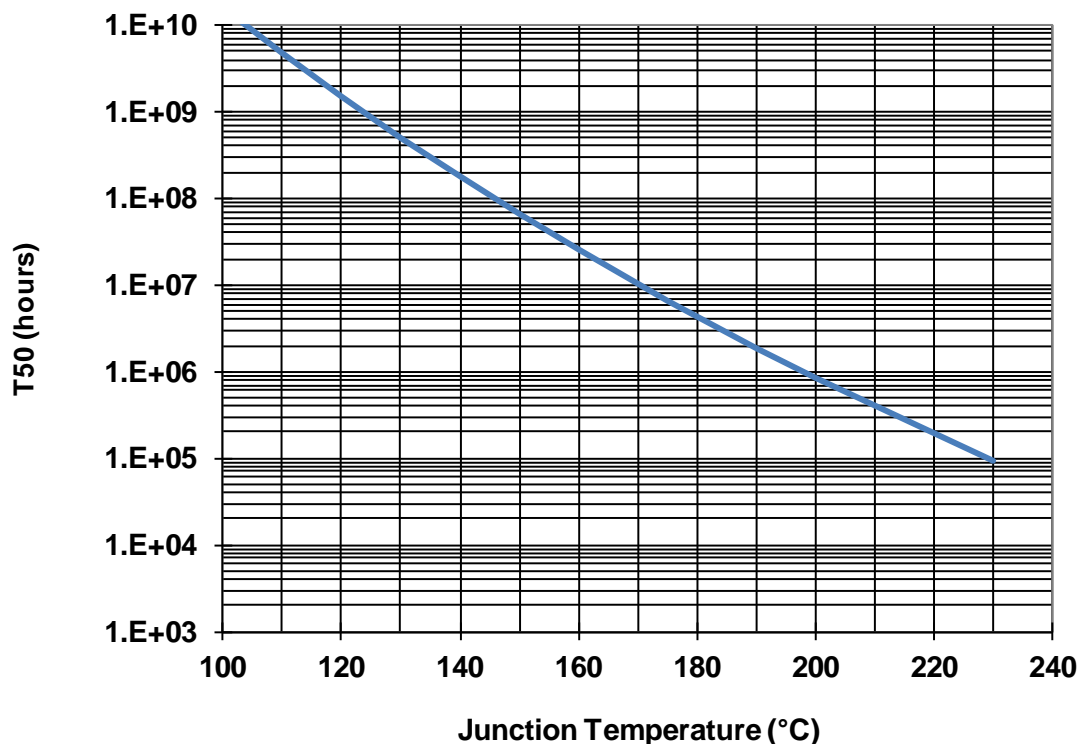
The temperature is monitored at the package back-side interface (Tcase).

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)	V _d = 4V I _d = 80mA P _{diss} = 0.32W	147	162.5	8.83E+07

¹ Assuming 95°C Tcase



Typical Package Sij parameters for low current configuration

Temp = +25°C, Vd1=Vd2= +4V, typical Id=80mA P1, N2 = GND

F(GHz)	dBS11	PhS11(°)	dBS21	PhS21(°)	dBS12	PhS12(°)	dBS22	PhS22(°)	NF(dB)
1,00	-0,09	-37,85	-52,18	137,30	-66,34	-86,13	-0,24	-36,27	
1,50	-0,17	-57,58	-60,02	-45,40	-68,26	-149,70	-0,21	-55,53	
2,00	-0,27	-78,58	-29,12	-11,07	-62,73	-158,40	-0,40	-76,22	
2,50	-0,47	-102,50	-11,73	-37,70	-60,61	141,90	-1,09	-99,08	
3,00	-0,91	-131,30	1,07	-86,70	-67,97	148,20	-2,87	-120,80	
3,50	-1,99	-170,20	10,07	-144,40	-64,90	-21,46	-5,19	-134,50	
4,00	-4,95	131,20	16,26	154,50	-58,71	-137,00	-7,01	-141,30	2,91
4,50	-9,47	46,82	19,44	94,84	-47,18	168,40	-8,02	-147,50	2,45
5,00	-9,90	-29,48	20,76	45,24	-45,08	132,60	-8,95	-155,40	1,97
5,50	-9,48	-70,17	21,36	3,43	-42,32	101,00	-9,67	-161,70	1,67
6,00	-9,12	-92,50	21,76	-32,80	-41,24	78,57	-10,26	-168,50	1,54
6,50	-8,87	-107,10	21,92	-65,87	-39,31	54,54	-10,75	-178,10	1,59
7,00	-8,39	-120,20	22,00	-95,39	-39,37	32,14	-11,22	170,60	1,52
7,50	-8,08	-134,00	22,08	-123,10	-38,59	10,27	-11,97	155,50	1,68
8,00	-8,05	-146,70	22,17	-149,60	-38,58	-11,10	-13,37	136,20	1,72
8,50	-7,93	-159,40	22,18	-175,50	-37,62	-30,90	-15,43	115,40	1,63
9,00	-7,94	-173,80	22,10	159,30	-37,78	-39,64	-18,09	89,58	1,62
9,50	-8,32	172,20	21,82	135,70	-36,70	-65,10	-20,88	56,05	1,67
10,00	-9,01	157,70	21,64	113,60	-36,83	-81,53	-22,71	16,48	1,71
10,50	-9,80	142,20	21,52	91,87	-36,41	-101,90	-22,45	-26,02	1,71
11,00	-10,55	125,50	21,42	70,57	-35,93	-117,80	-21,60	-59,75	1,66
11,50	-11,13	109,40	21,31	49,41	-35,96	-137,50	-20,83	-82,56	1,62
12,00	-11,82	91,93	21,16	29,06	-35,66	-154,20	-20,36	-98,06	1,58
12,50	-12,41	76,20	21,17	8,99	-35,34	-173,60	-20,00	-113,80	1,63
13,00	-12,37	59,41	21,15	-11,91	-35,74	168,30	-20,92	-130,10	1,55
13,50	-12,07	40,87	21,08	-32,15	-35,37	154,30	-23,41	-136,20	1,50
14,00	-12,07	22,74	21,14	-52,19	-33,72	140,00	-22,32	-137,50	1,54
14,50	-11,24	7,92	21,24	-72,86	-35,92	118,20	-22,12	-146,20	1,57
15,00	-10,18	-9,73	21,33	-93,85	-36,96	85,55	-22,14	-153,80	1,54
15,50	-9,31	-27,72	21,51	-116,50	-37,19	67,53	-20,95	-174,90	1,58
16,00	-8,48	-46,24	21,53	-139,20	-37,70	45,96	-19,59	159,80	1,70
16,50	-7,67	-66,34	21,48	-163,20	-38,82	25,63	-17,54	124,50	1,80
17,00	-7,21	-88,27	21,27	171,60	-39,99	-5,00	-15,22	88,77	1,95
17,50	-6,95	-111,10	20,89	146,10	-47,86	-18,70	-13,42	58,24	1,98
18,00	-6,97	-137,00	20,22	120,00	-71,77	-44,50	-10,69	30,88	1,97
18,50	-7,48	-167,10	19,22	93,46	-49,03	133,30	-8,82	2,77	2,16
19,00	-8,44	162,80	17,86	68,78	-43,68	87,71	-7,83	-22,41	2,35
19,50	-9,50	129,30	16,20	45,38	-40,71	67,86	-6,87	-43,91	2,48
20,00	-10,39	95,35	14,62	25,08	-40,21	48,11	-6,46	-61,92	2,67

Refer to the “definition of the Sij reference planes” section below.

Typical Package Sij parameters for high current configuration

Temp = +25°C, Vd1=Vd2= +4V, typical Id= 86mA P1, P2 = GND

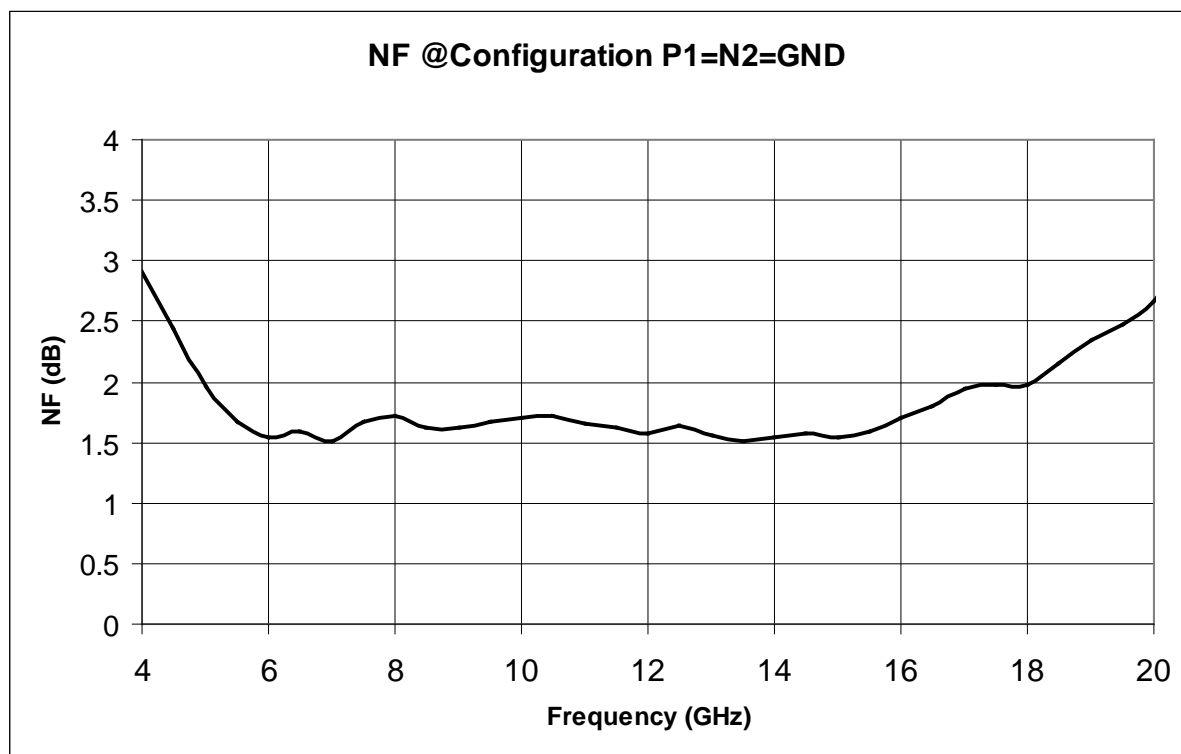
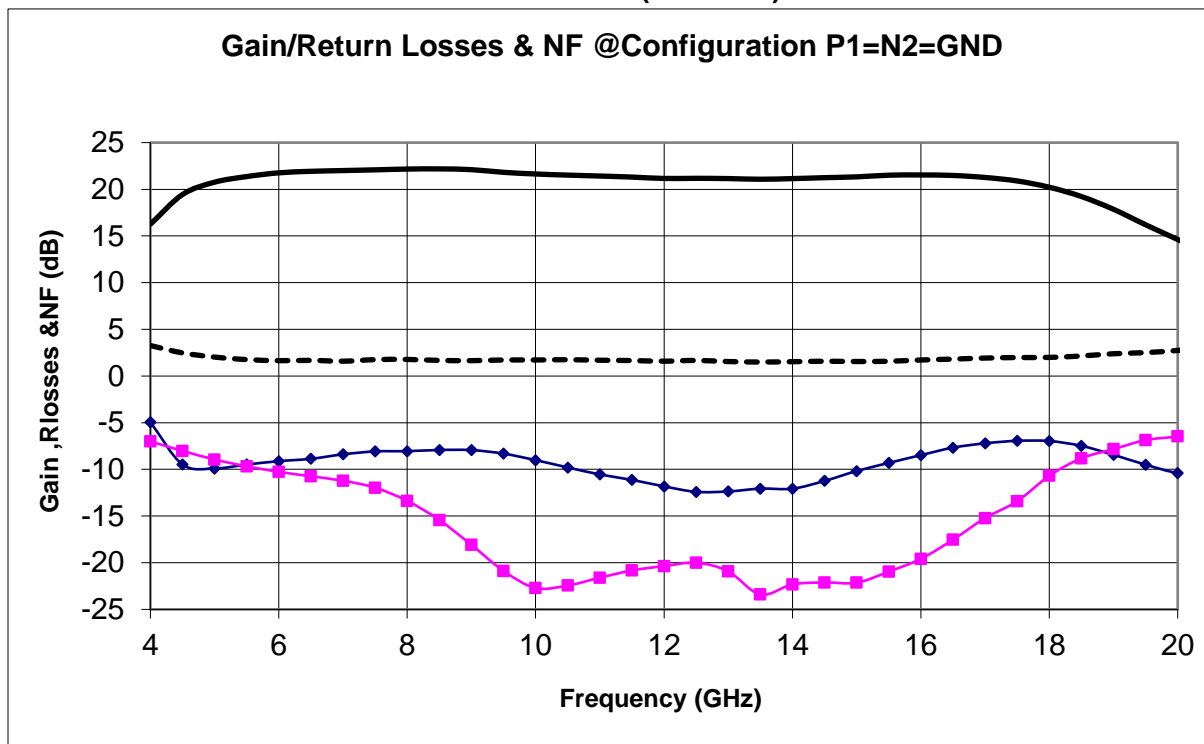
F(GHz)	dBS11	PhS11(°)	dBS21	PhS21(°)	dBS12	PhS12(°)	dBS22	PhS22(°)	NF(dB)
1,00	-0,10	-38,12	-51,07	154,70	-58,77	-115,10	-0,23	-36,50	
1,50	-0,17	-57,85	-59,34	-26,09	-66,35	-81,29	-0,20	-55,71	
2,00	-0,29	-78,80	-28,95	-9,44	-66,30	149,00	-0,40	-76,31	
2,50	-0,50	-102,50	-11,71	-38,04	-61,37	124,50	-1,09	-98,95	
3,00	-0,94	-131,20	1,13	-86,50	-65,28	116,80	-2,81	-120,40	
3,50	-2,07	-170,20	10,20	-144,40	-74,13	37,65	-5,08	-133,70	
4,00	-5,28	129,80	16,42	153,80	-56,80	-156,90	-6,82	-140,20	2,93
4,50	-10,01	40,92	19,50	93,70	-48,32	168,00	-7,74	-146,10	2,43
5,00	-9,91	-35,58	20,73	44,18	-43,98	131,00	-8,53	-153,80	2,00
5,50	-9,34	-74,07	21,28	2,92	-42,51	102,20	-9,24	-160,00	1,74
6,00	-8,94	-94,94	21,67	-32,98	-41,13	73,15	-9,76	-166,30	1,59
6,50	-8,62	-108,60	21,83	-65,73	-39,94	52,60	-10,20	-175,20	1,63
7,00	-8,15	-121,40	21,91	-95,13	-39,14	32,34	-10,61	173,80	1,53
7,50	-7,87	-135,10	22,00	-122,50	-38,78	7,76	-11,36	159,80	1,69
8,00	-7,84	-147,90	22,11	-148,90	-38,43	-11,09	-12,74	142,20	1,71
8,50	-7,82	-160,50	22,15	-174,70	-36,93	-29,03	-14,93	124,00	1,64
9,00	-7,84	-174,60	22,08	160,00	-37,08	-43,41	-18,00	100,70	1,61
9,50	-8,29	170,70	21,79	136,40	-37,31	-63,49	-21,92	69,39	1,68
10,00	-9,07	157,10	21,62	114,40	-36,75	-79,53	-25,37	20,68	1,70
10,50	-10,00	141,60	21,50	92,72	-36,09	-101,30	-24,20	-37,52	1,73
11,00	-10,82	126,20	21,40	71,49	-36,10	-118,70	-21,65	-72,89	1,66
11,50	-11,56	110,10	21,30	50,42	-35,94	-136,90	-20,10	-94,73	1,64
12,00	-12,24	93,43	21,15	29,96	-35,35	-155,90	-19,20	-108,10	1,58
12,50	-12,94	77,04	21,12	10,07	-35,62	-176,50	-18,36	-121,60	1,67
13,00	-13,14	61,01	21,16	-10,38	-35,79	167,70	-18,41	-136,50	1,57
13,50	-12,77	40,95	21,10	-30,88	-35,38	152,40	-20,21	-144,30	1,51
14,00	-12,62	22,25	21,14	-50,80	-34,81	131,40	-20,02	-143,90	1,56
14,50	-11,89	5,31	21,24	-71,12	-35,50	110,30	-19,31	-145,20	1,59
15,00	-10,98	-11,61	21,36	-91,89	-35,37	88,68	-18,30	-151,20	1,59
15,50	-9,93	-30,60	21,60	-114,20	-36,49	70,74	-17,36	-170,10	1,62
16,00	-8,94	-49,93	21,70	-137,00	-36,11	42,49	-16,39	174,50	1,75
16,50	-8,02	-70,22	21,75	-161,30	-38,73	31,56	-14,82	145,80	1,87
17,00	-7,47	-90,97	21,54	172,90	-40,94	-11,86	-13,42	110,00	2,00
17,50	-6,89	-114,60	21,12	147,30	-44,21	-54,62	-12,54	75,31	2,03
18,00	-6,84	-139,40	20,45	121,30	-52,00	-103,90	-10,83	42,27	2,06
18,50	-7,02	-167,10	19,55	94,64	-49,81	161,20	-9,00	12,10	2,24
19,00	-7,77	163,80	18,18	68,72	-43,10	105,40	-7,54	-17,98	2,47
19,50	-8,85	132,90	16,46	45,53	-40,09	74,77	-6,94	-42,60	2,64
20,00	-9,90	100,10	14,78	24,54	-39,56	45,06	-6,12	-62,32	2,84

Typical Measured Performance

Temp = +25°C, Vd1=Vd2=4V

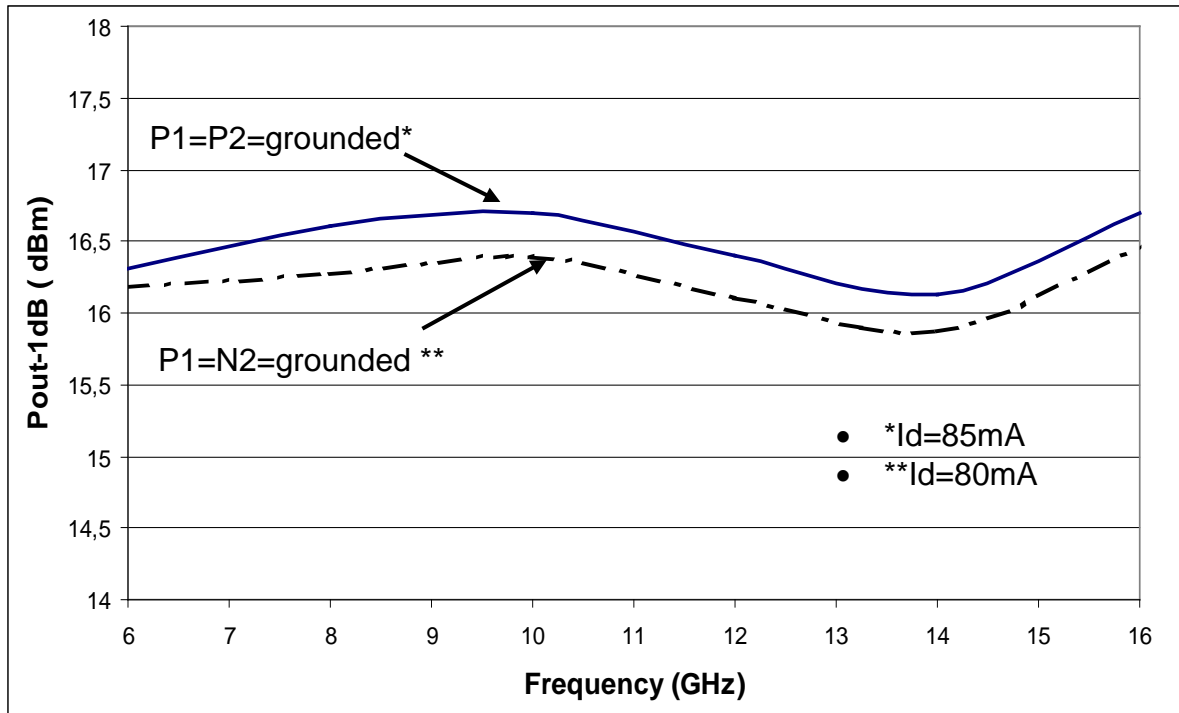
Measurements in the package access planes, using the proposed land pattern & board

P1=N2 = GND (Id=80mA)

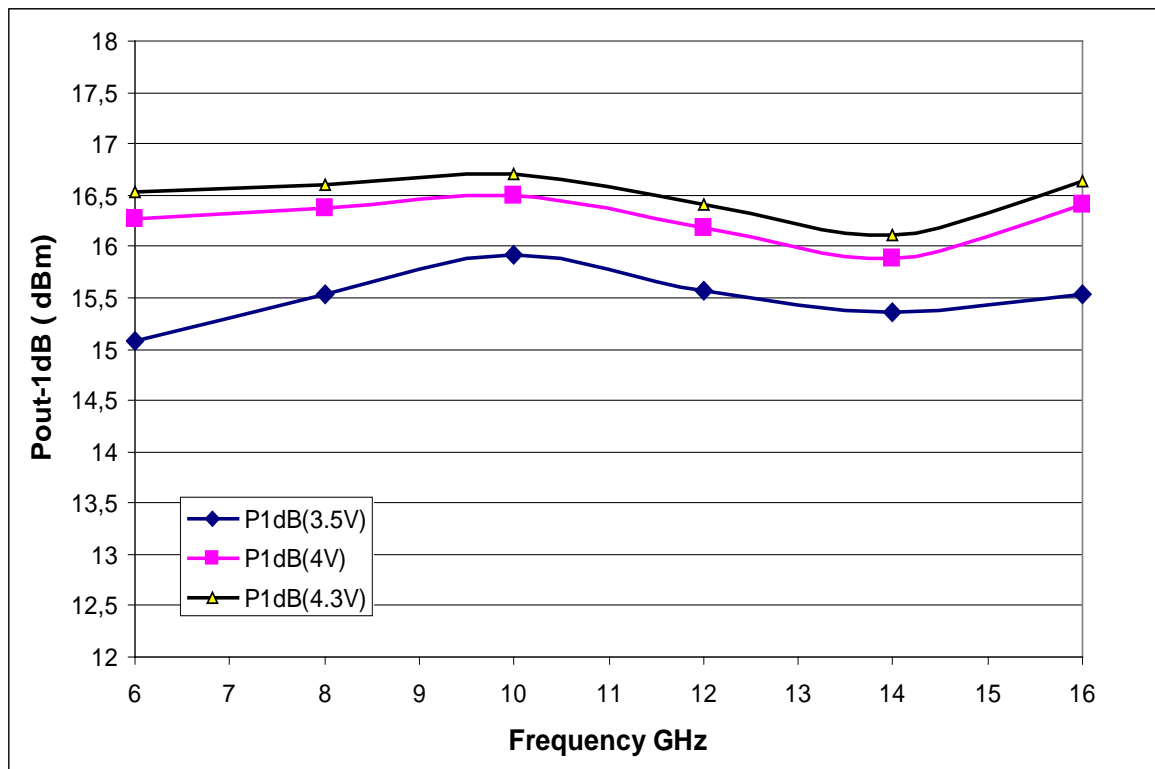


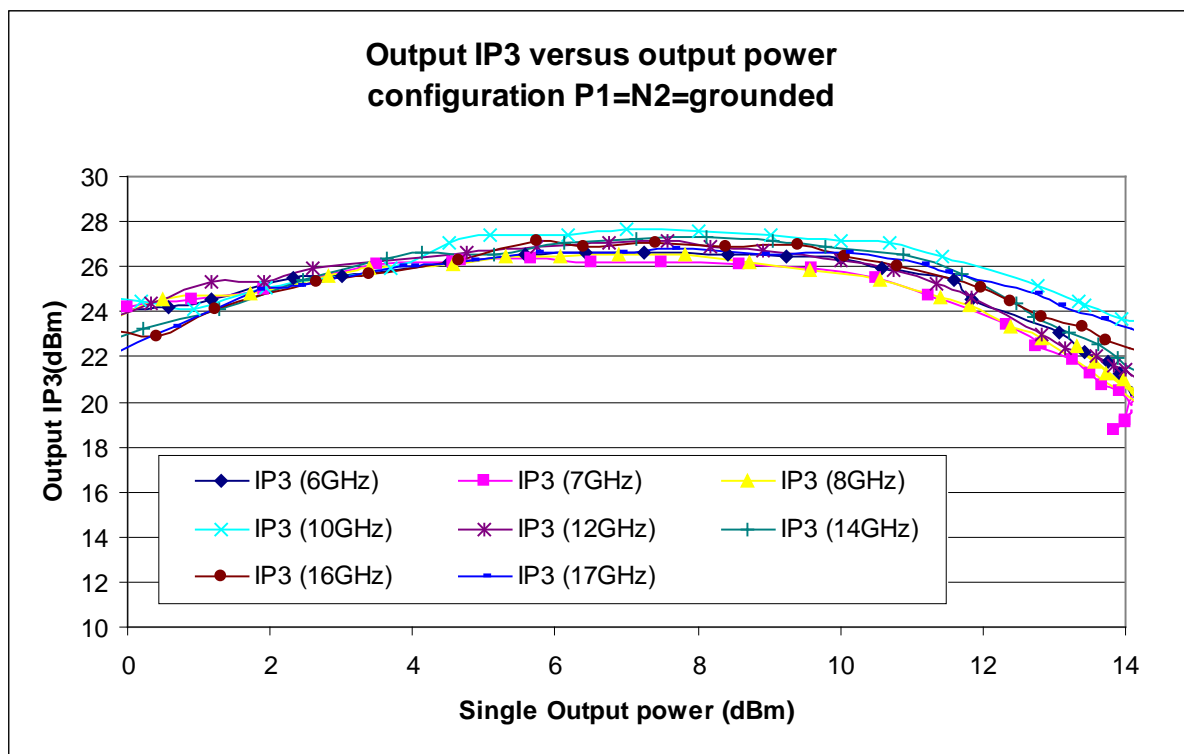
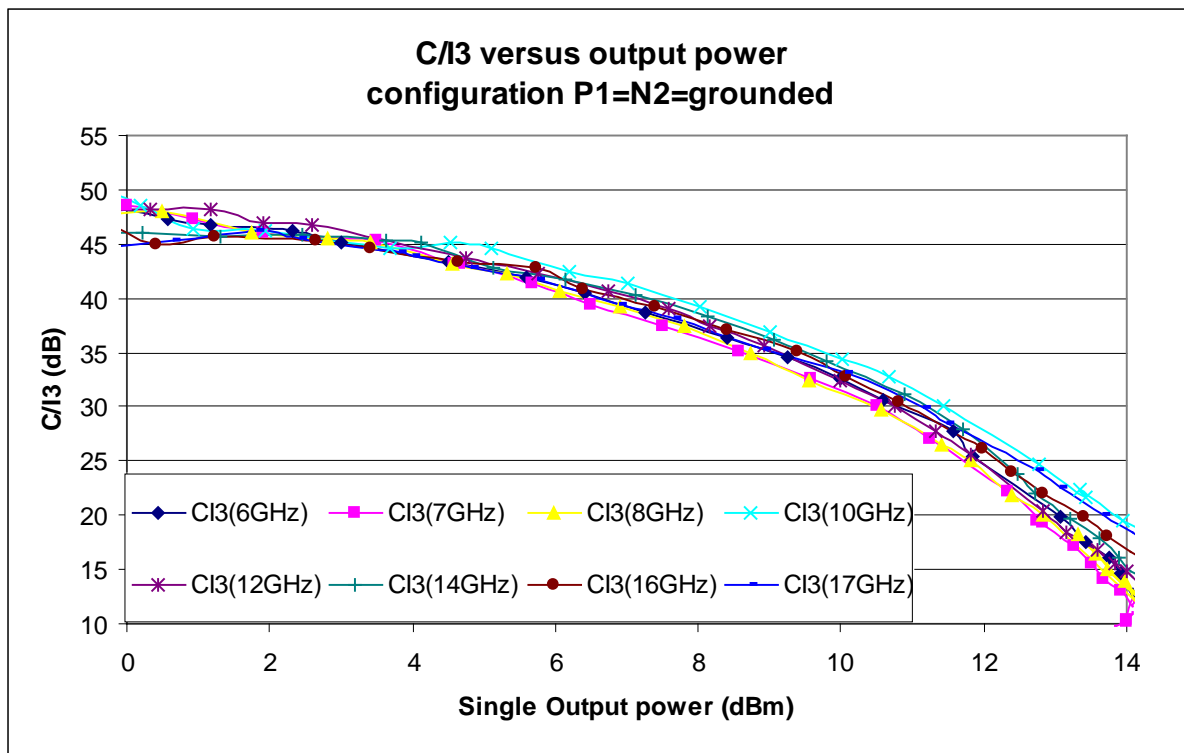
Output power at 1dB compression versus frequency

Tamb.= +25°C, Vd = 4 V

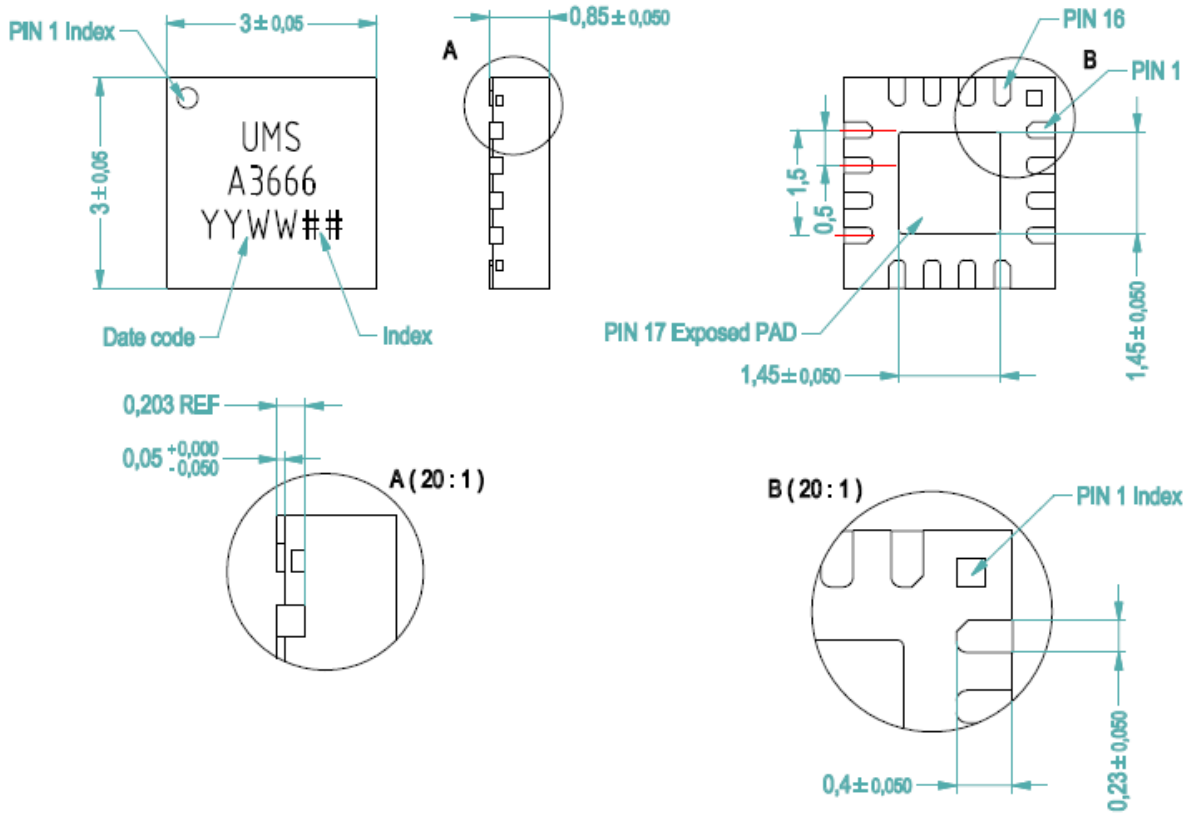


Output power at 1dB compression versus frequency configuration P1=N2=GND (Variation of Vd)

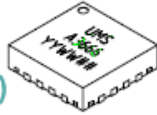




Package outline ⁽¹⁾



Units : mm
 Finish : Matt tin
 Lead free (Green)



1- Nc	7- P2	13- Nc
2- GND	8- N2	14- D2
3- RF IN	9- GND	15- GND
4- GND	10- RF OUT	16- D1
5- P1	11- GND	17- GND
6- F1	12- Nc	

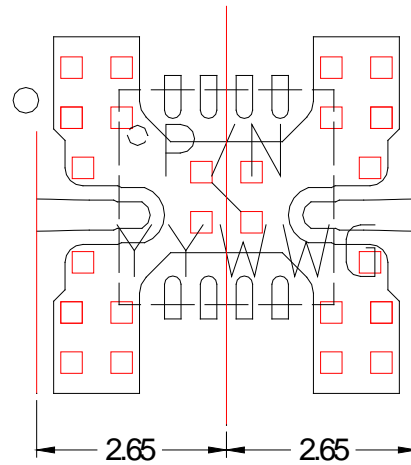
⁽¹⁾ The package outline drawing included to this data-sheet is given for indication. Refer to the application note AN0017 (<https://www.ums-rf.com>) for exact package dimensions.

⁽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.

Definition of the Sij reference planes

The reference planes are defined from the footprint of the recommended characterization board shown below.

The reference is the symmetrical axis of the package. The input and output reference planes are located at 2.65mm offset (input wise and output wise respectively) from this axis. Then, the given Sij incorporates this land pattern.



ESD sensitivity

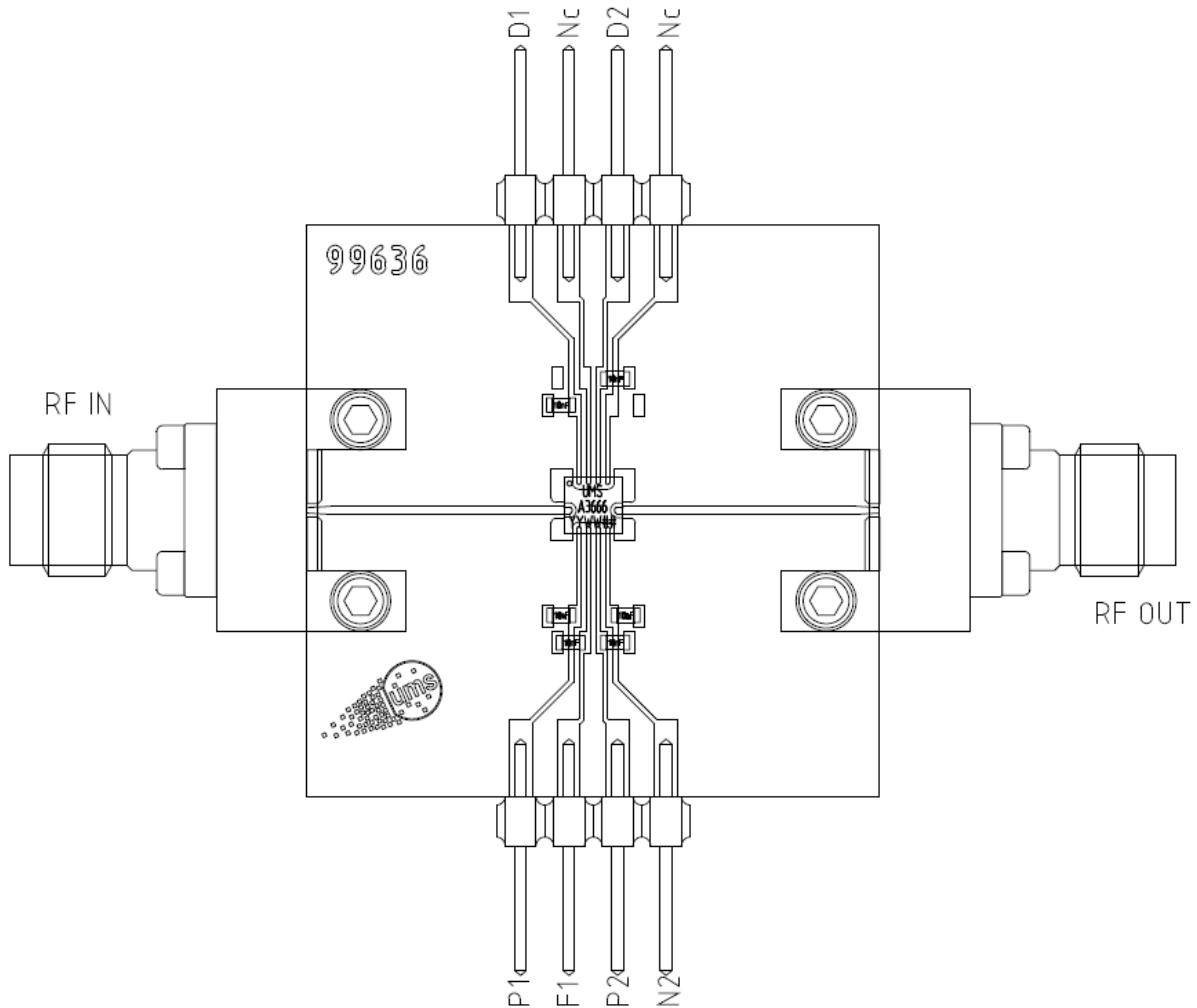
Standard	Value
Jedec JESD22 A114D	HBM Class 1A (>300V)

Package Information

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

Evaluation mother board

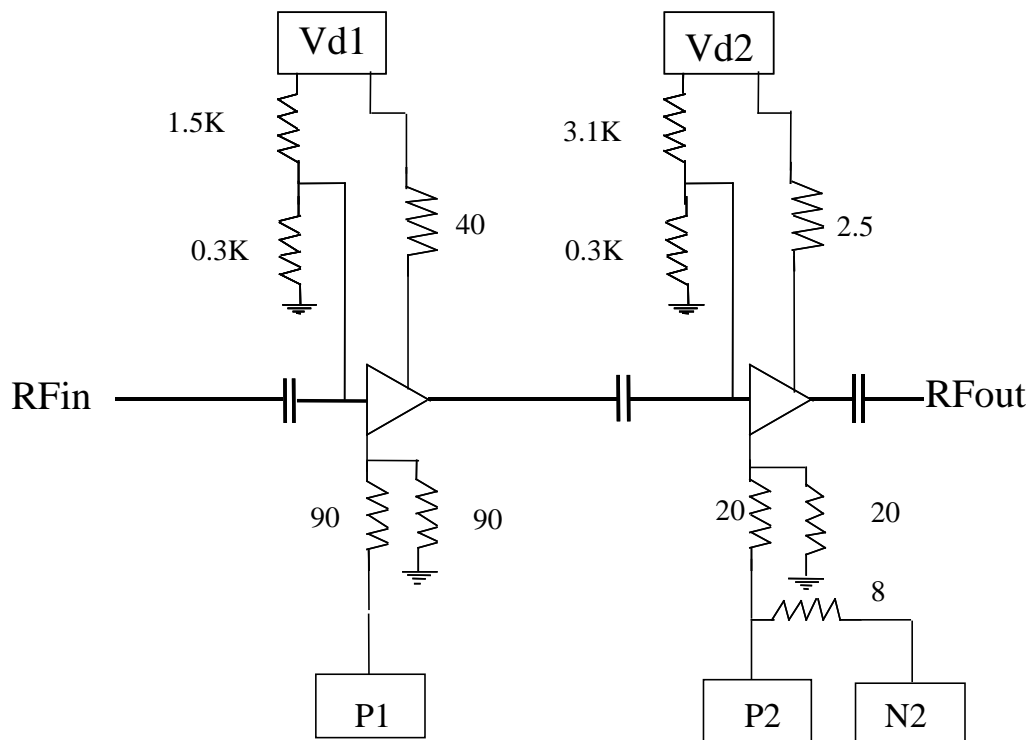
- Compatible with the proposed footprint.
- Based on typically Ro4003 / 8mils or equivalent.
- Using a micro-strip to coplanar transition to access the package.
- Recommended for the implementation of this product on a module board.
- Decoupling capacitors of 10nF \pm 10% are recommended for all DC accesses.
- See application note AN0017 for details.



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

Package Biasing options

This chip is self-biased, and flexibility is provided by the access to number of leads. The internal DC electrical schematic is given in order to use these leads in a safe way. All values are given in Ohms.



Recommended package footprint

Refer to the application note AN0017 available at <https://www.ums-rf.com> for package footprint 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:

CHA3666-QAG/XY

Stick: XY = 20

Tape & reel: XY = 21

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