United Monolithic Semiconductors

CHA4253aQQG

17- 24GHz Medium Power Amplifier

GaAs Monolithic Microwave IC

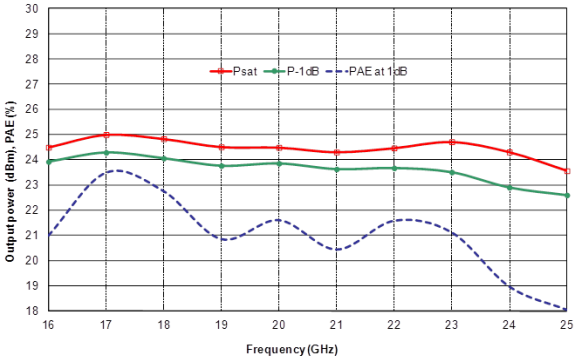
Description

The CHA4253aQQG is a four stage monolithic medium power amplifier.
It is designed for a wide range of applications, from military to commercial communication systems.
The circuit is manufactured with a pHEMT process, 0.15µm gate length.
It is supplied in RoHS compliant SMD package.

Main Features

- Broadband performances: 17- 24GHz
- 24dBm Pout for 1dB gain compression
- 23dB gain
- 33dBm OTOI
- DC bias: Vd= 4.0V, Id= 230mA
- 16L-QFN4x4 (QQG)
- MSL1

Output power & PAE versus Frequency



Main Electrical Characteristics

Tamb.= +25°C

Symbol	Parameter	Min	Typ	Max	Unit
Freq	Frequency range	17.0		24.0	GHz
Gain	Linear Gain		23		dB
P-1dB	Output Power @1dB comp.		24		dBm
OTOI	3rd order Intercept point		33		dBm

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Electrical Characteristics

Tamb.= +25°C, Vd = +4.0V

Symbol	Parameter	Min	Typ	Max	Unit
Freq	Frequency range	17.0		24.0	GHz
Gain	Linear Gain		23		dB
ΔG	Gain variation in temperature		0.04		dB/°C
OTOI	3rd order Intercept point		33		dBm
P_{-1dB}	Output power @ 1dB compression		24		dBm
Psat	Saturated Output Power		24.5		dBm
RLin	Input Return Loss		12		dB
RLout	Output Return Loss		15		dB
NF	Noise figure		7.5		dB
Id	Quiescent Drain current		230		mA
Vg	Gate voltage		-0.7		V

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

Absolute Maximum Ratings (1)

Tamb.= +25°C

Symbol	Parameter	Values	Unit
Vd	Drain bias voltage	6V	V
Id	Drain bias quiescent current	300	mA
Vg	Gate bias voltage	-2 to +0.4	V
Pin	Maximum input power	10	dBm
Tj	Junction temperature (2)	175	°C
Ta	Operating temperature range	-40 to +85	°C
Tstg	Storage temperature range	-55 to +150	°C

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

Typical Bias Conditions

Tamb.= +25°C

Symbol	Pad N°	Parameter	Values	Unit
Vd12	6	DC Drain voltage 1st, 2nd stage	4	V
Vd34	7	DC Drain voltage 3rd, 4th stage	4	V
Vg12	16	DC Gate voltage 1st & 2nd stage	-0.7	V
Vg34	14	DC Gate voltage 3rd & 4th stage	-0.7	V

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Device thermal performances

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.

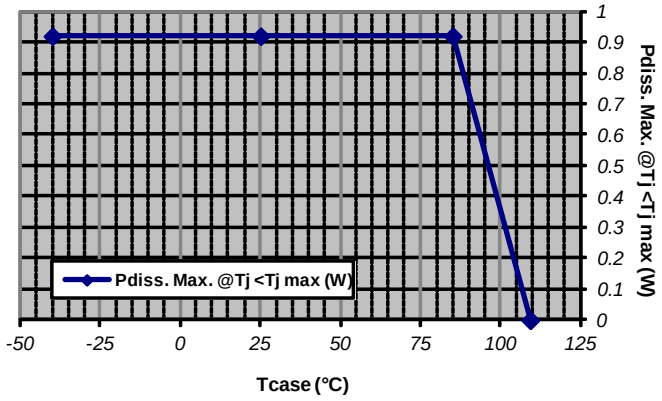
A derating must be applied on the dissipated power if the Tcase temperature can not be maintained below the maximum specified temperature (see the curve Pdiss. Max) in order to guarantee the nominal device life time (MTTF).

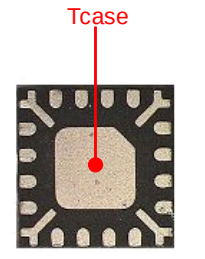
DEVICE THERMAL SPECIFICATION : CHA4253aQQG			
Recommended max. junction temperature (Tj max)	:	109	°C
Junction temperature absolute maximum rating	:	175	°C
Max. continuous dissipated power (Pdiss. Max.)	:	0.9	W
=> Pdiss. Max. derating above Tcase(1)= 85 °C	:	38	mW/°C
Junction-Case thermal resistance (Rth J-C)(2)	:	<26	°C/W
Minimum Tcase operating temperature(3)	:	-40	°C
Maximum Tcase operating temperature(3)	:	85	°C
Minimum storage temperature	:	-55	°C
Maximum storage temperature	:	150	°C

(1) Derating at junction temperature constant = Tj max.

(2) Rth J-C is calculated for a worst case considering the ***hottest junction*** *of the MMIC and all the devices biased.*

(3) Tcase=Package back side temperature measured under the die-attach-pad (see the drawing below).





Example: QFN 16L 3x3
Location of temperature reference point (Tcase) on package's bottom side

6.4

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Typical Package Sij parameters

Tamb.= +25°C, Vd = +4.0V, Id = 230mA

Freq (GHz)	S11 (dB)	PhS11 (°)	S12 (dB)	PhS12 (°)	S21 (dB)	PhS21 (°)	S22 (dB)	PhS22 (°)
2	-0.730	123.2	-63.711	-6.2	-69.063	-19.0	-0.761	122.7
2.5	-0.818	108.9	-60.605	32.4	-62.846	45.7	-0.824	107.8
3	-0.889	93.9	-80.897	-91.2	-63.457	-101.8	-0.871	92.9
3.5	-0.991	78.5	-60.653	0.0	-63.035	0.0	-0.926	76.8
4	-1.122	62.7	-82.251	151.3	-71.708	12.1	-1.013	60.6
4.5	-1.313	46.1	-71.038	17.2	-64.931	159.5	-1.105	43.5
5	-1.612	29.2	-67.796	-42.8	-55.944	-159.0	-1.178	25.6
5.5	-2.064	13.5	-84.782	-143.9	-37.521	105.8	-1.258	7.0
6	-2.252	-2.3	-71.634	179.9	-29.698	13.5	-1.365	-13.0
6.5	-2.374	-18.8	-86.383	9.9	-25.728	-54.4	-1.466	-34.4
7	-2.411	-35.5	-76.642	85.1	-22.287	-108.9	-1.587	-56.4
7.5	-2.553	-53.4	-65.973	16.6	-19.062	-156.7	-1.689	-79.6
8	-2.807	-73.4	-57.797	-35.6	-15.918	156.3	-1.895	-105.8
8.5	-3.106	-92.5	-61.487	-72.0	-13.083	112.8	-2.119	-131.9
9	-3.437	-111.1	-58.268	-112.3	-10.411	70.6	-2.569	-158.7
9.5	-3.744	-129.8	-53.604	-159.7	-7.919	30.1	-3.050	175.5
10	-4.119	-148.9	-52.704	154.8	-5.729	-9.6	-3.768	150.1
10.5	-4.624	-167.6	-51.720	128.3	-3.607	-47.9	-4.610	124.2
11	-5.000	174.6	-51.281	98.9	-1.635	-84.6	-5.691	99.1
11.5	-5.412	155.5	-51.977	85.1	0.380	-120.5	-6.935	75.3
12	-6.006	137.4	-52.427	71.2	2.321	-155.2	-8.434	51.2
12.5	-6.561	119.3	-54.460	58.2	4.409	170.5	-10.254	27.7
13	-7.192	101.3	-52.056	58.2	6.459	136.3	-12.708	5.0
13.5	-7.821	83.3	-51.474	52.7	8.618	102.4	-15.917	-17.6
14	-8.574	66.0	-49.641	30.7	10.961	68.3	-21.061	-41.1
14.5	-9.476	50.2	-52.379	26.7	13.479	33.2	-36.427	-69.4
15	-10.598	37.2	-49.987	19.8	16.282	-3.3	-25.516	100.2
15.5	-11.463	26.8	-50.339	10.8	19.272	-44.5	-17.628	73.8
16	-12.173	20.0	-49.840	-4.0	21.933	-90.8	-14.862	46.8
16.5	-12.377	17.9	-49.950	-14.7	23.964	-142.6	-13.179	28.7
17	-11.523	13.9	-50.695	-42.6	24.674	164.5	-11.997	5.4
17.5	-10.464	2.8	-52.234	-56.5	24.263	116.0	-12.390	-17.8
18	-10.569	-11.6	-72.354	-15.8	24.017	74.4	-14.325	-24.0
18.5	-11.713	-19.2	-57.420	33.1	23.906	32.9	-13.449	-27.4
19	-11.467	-22.2	-56.914	13.9	23.424	-6.2	-13.393	-37.2
19.5	-11.136	-28.8	-54.933	-2.0	23.237	-43.4	-14.040	-43.4
20	-10.861	-39.1	-53.015	1.5	23.489	-79.4	-13.984	-48.0
20.5	-10.972	-49.8	-52.555	7.8	23.585	-117.4	-14.192	-52.3
21	-11.122	-63.0	-52.100	-17.7	23.717	-155.5	-13.594	-56.0
21.5	-12.282	-73.8	-49.378	-12.2	23.677	166.7	-13.879	-66.0
22	-13.692	-84.9	-47.135	-18.4	23.695	129.6	-14.959	-70.5
22.5	-15.153	-87.1	-49.422	11.2	24.074	93.9	-15.768	-52.8
23	-17.851	-88.8	-44.268	-34.4	24.814	53.8	-13.893	-55.7
23.5	-19.454	-73.3	-43.006	-46.5	25.271	12.9	-12.633	-56.1
24	-18.605	-51.9	-47.877	-47.5	26.081	-32.6	-13.531	-67.6
24.5	-15.959	-40.6	-46.682	-66.3	26.115	-82.2	-12.795	-49.3
25	-11.350	-46.7	-47.170	-53.9	25.590	-134.0	-8.978	-47.8
25.5	-8.897	-63.9	-49.365	-43.8	23.981	172.9	-5.884	-61.9

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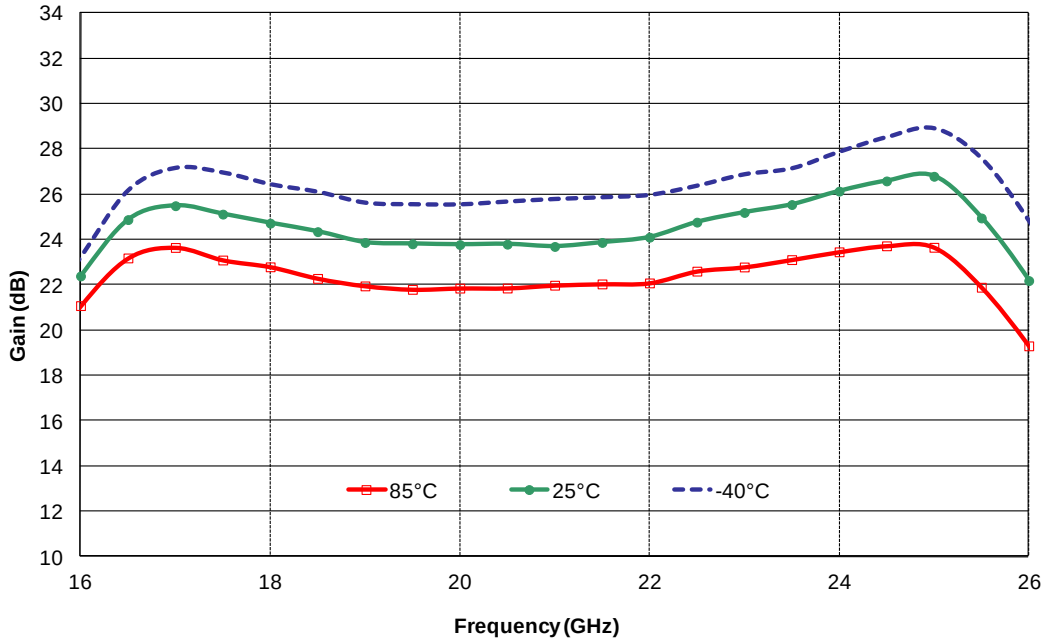
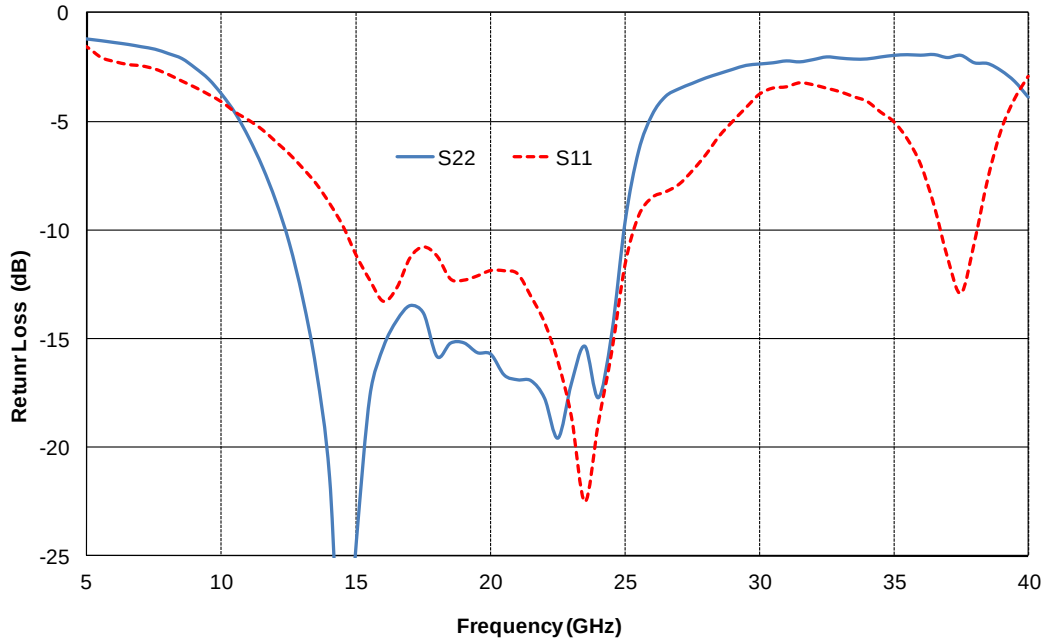
Typical Board Measurements

Tamb.= +25°C, Vd = +4.0V, Id = 230mA
These values are representative of onboard measurements as defined on the drawing in paragraph "Evaluation mother board".

Linear Gain versus Frequency in Temperature



Return losses versus Frequency



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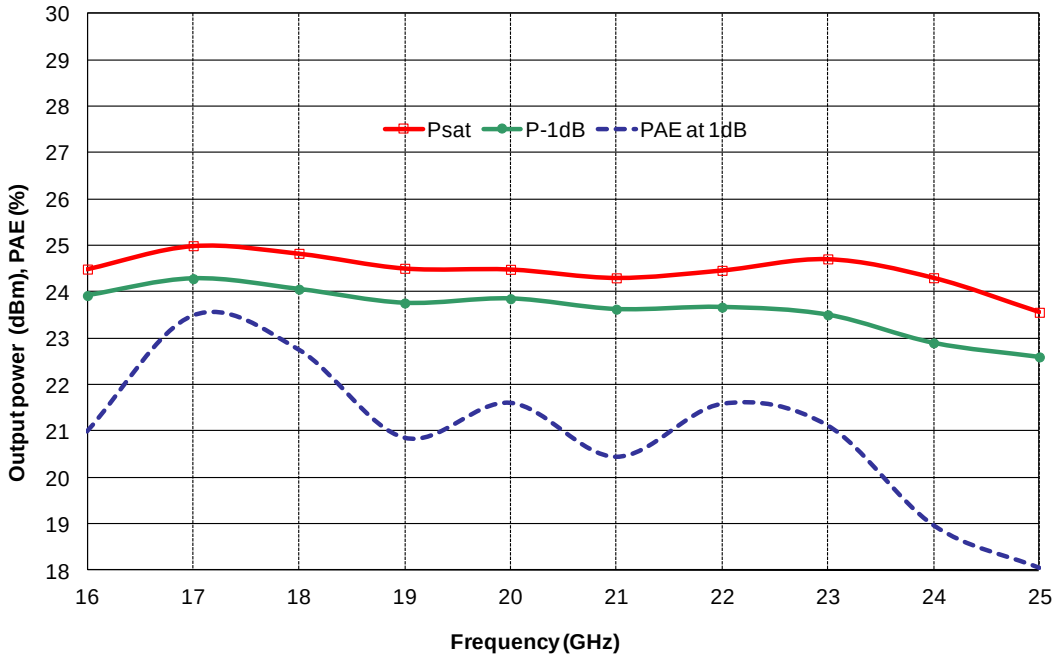
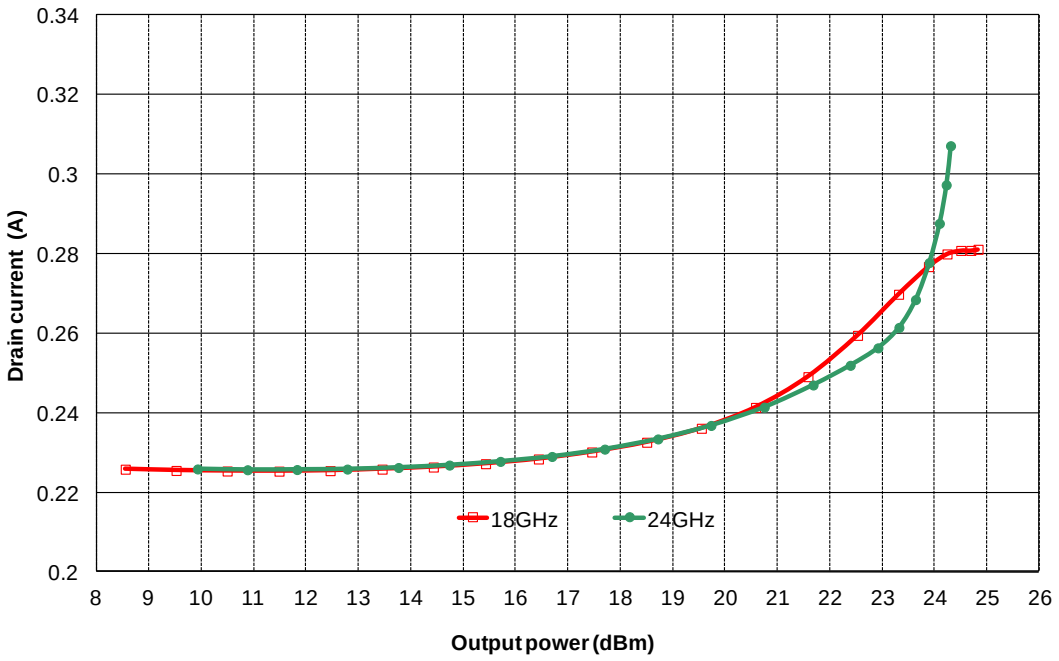
Typical Board Measurements

Tamb.= +25°C, Vd = +4.0V, Id = 230mA

Output power & PAE versus Frequency



Current versus Output Power



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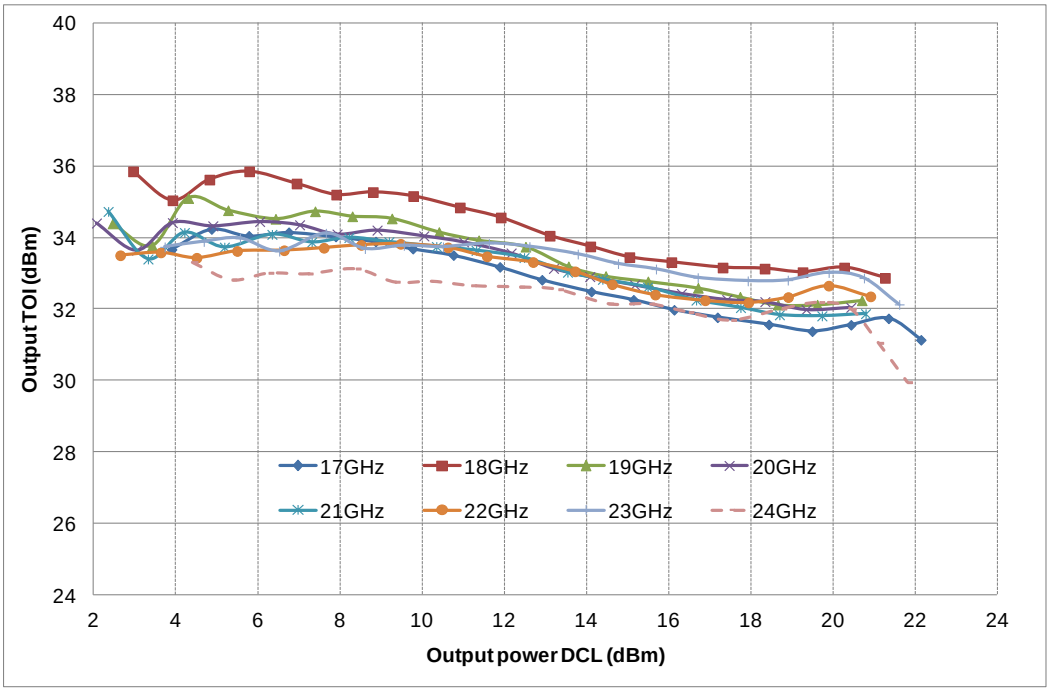
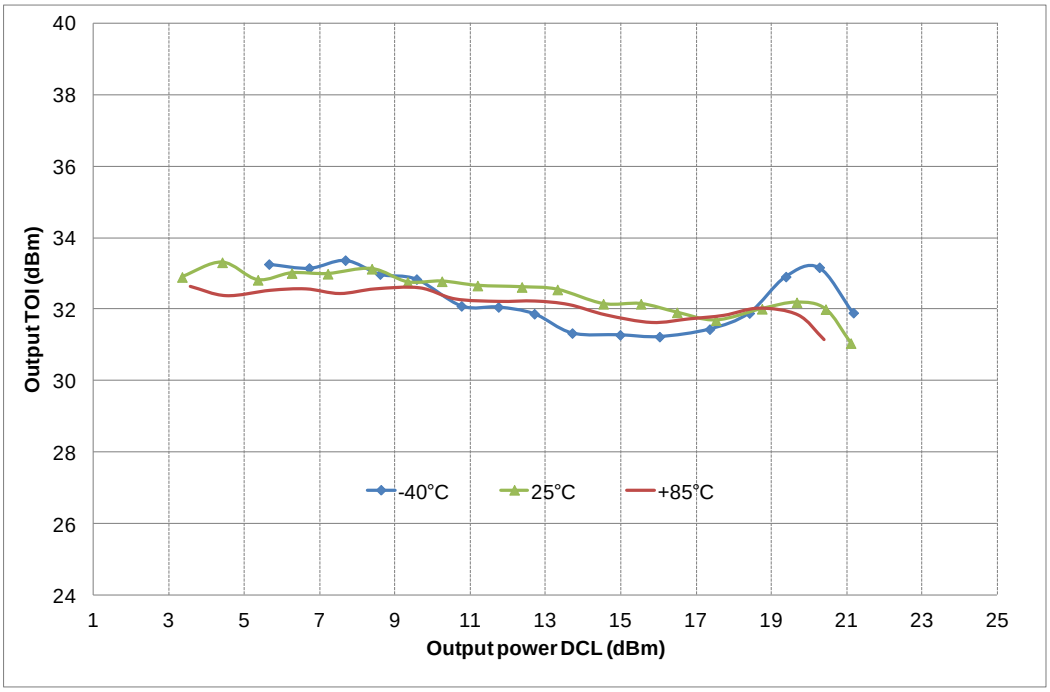
Typical Board Measurements

Tamb.= +25°C, Vd = +4.0V, Id = 230mA

Output TOI versus Output Power DCL & Frequency



Output TOI versus Output Power DCL in Temperature at 24GHz



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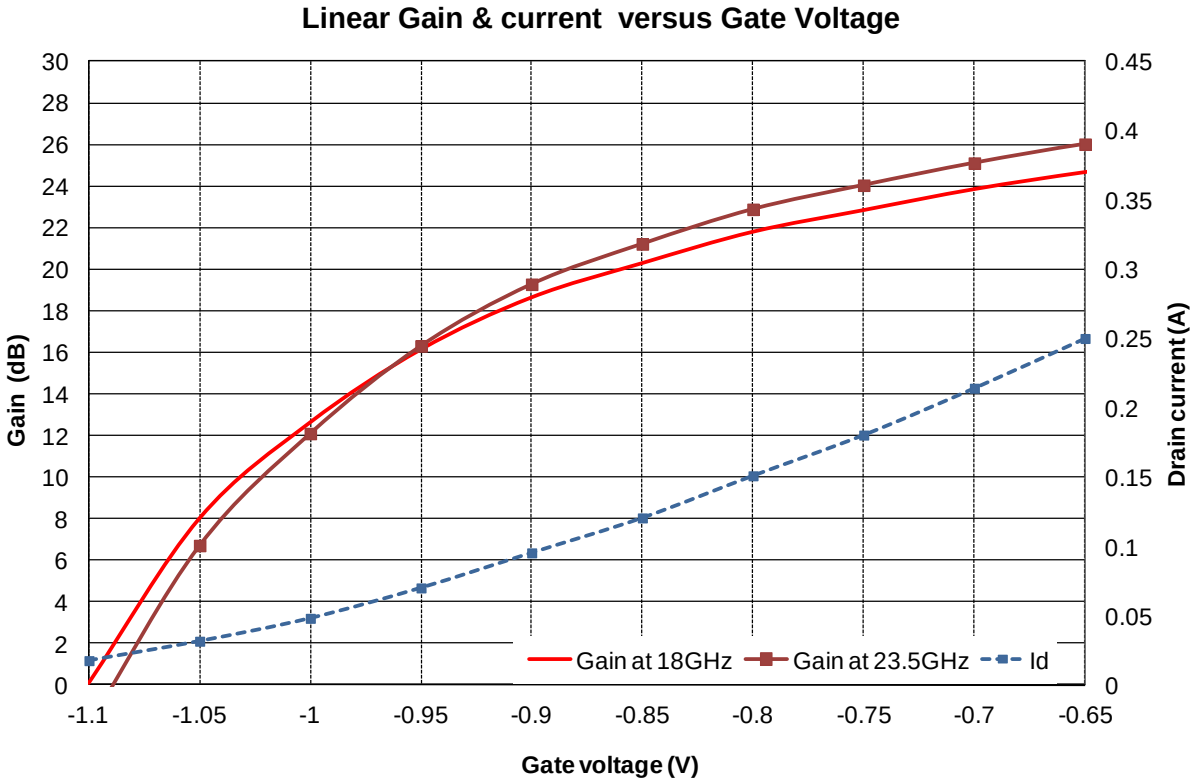

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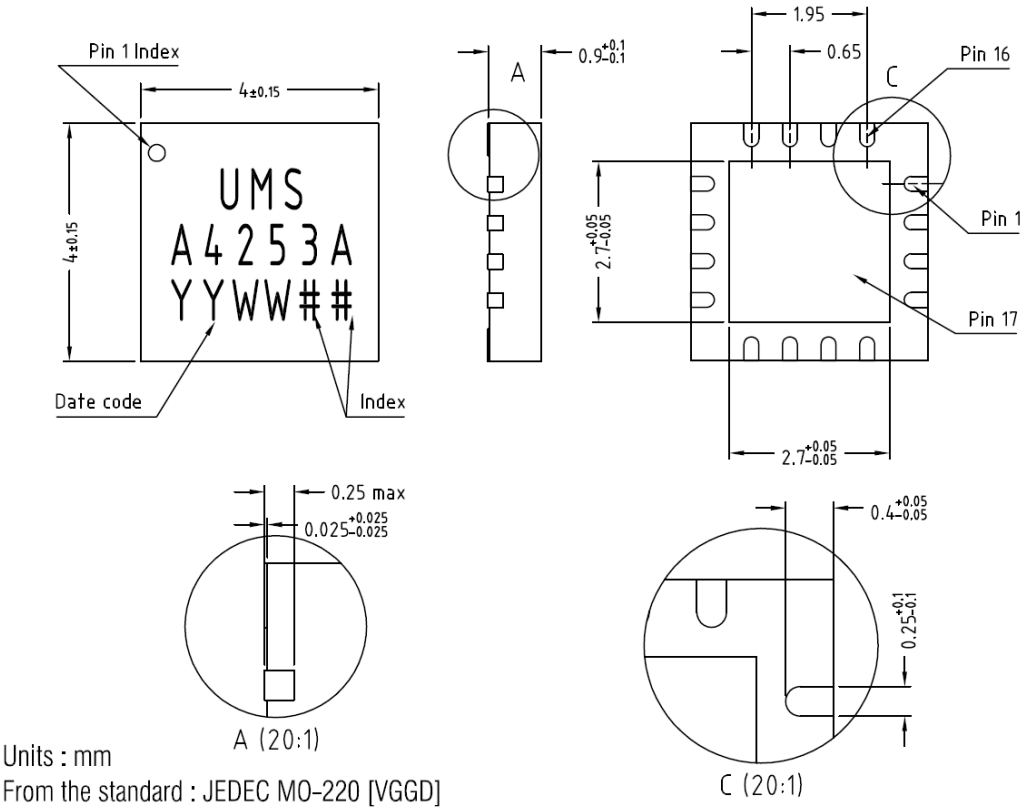
Package outline (1)



Units : mm
From the standard : JEDEC MO-220 [VGGD]
Matt tin, Lead free (Green)

Matt tin, Lead Free	(Green)	1- NC	7- Vd34	13- NC
Units :	mm	2- Gnd(2)	8- NC	14- Vg34
From the standard :	JEDEC MO-220	3- RF IN	9- NC	15- Nc
	(VGGD)	4- NC	10- Gnd(2)	16- Vg12
17- GND		5- Gnd(2)	11- RF OUT	
		6- Vd12	12- NC	

(1) The package outline drawing included in this data-sheet is given for indication. Refer to the application note AN0017 (http://www.ums-gaas.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.

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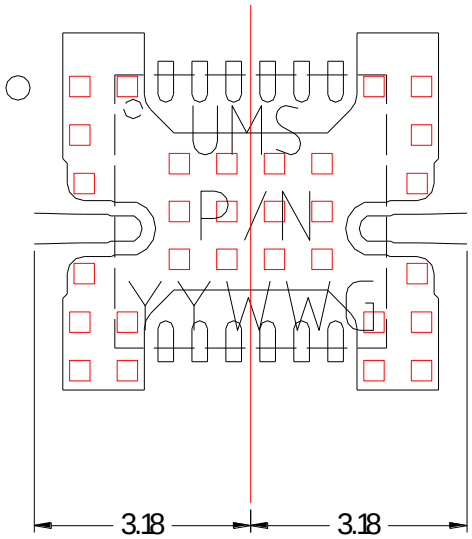
Definition of the Sij reference planes

The reference planes used for Sij measurements given above are symmetrical from the symmetrical axis of the package (see drawing beside). The input and output reference planes are located at 3.18mm offset (input wise and output wise respectively) from this axis. Then, the given Sij parameters incorporate the land pattern of the evaluation motherboard recommended in paragraph "Evaluation mother board".



ESD sensitivity

Standard	Value
JESD22-A114C	HBM Class 1A
	MM Class A
	CDM Class IV
ESD STM5.1-1998	HBM Class 1B
	MM Class M1
	CDM Class C7

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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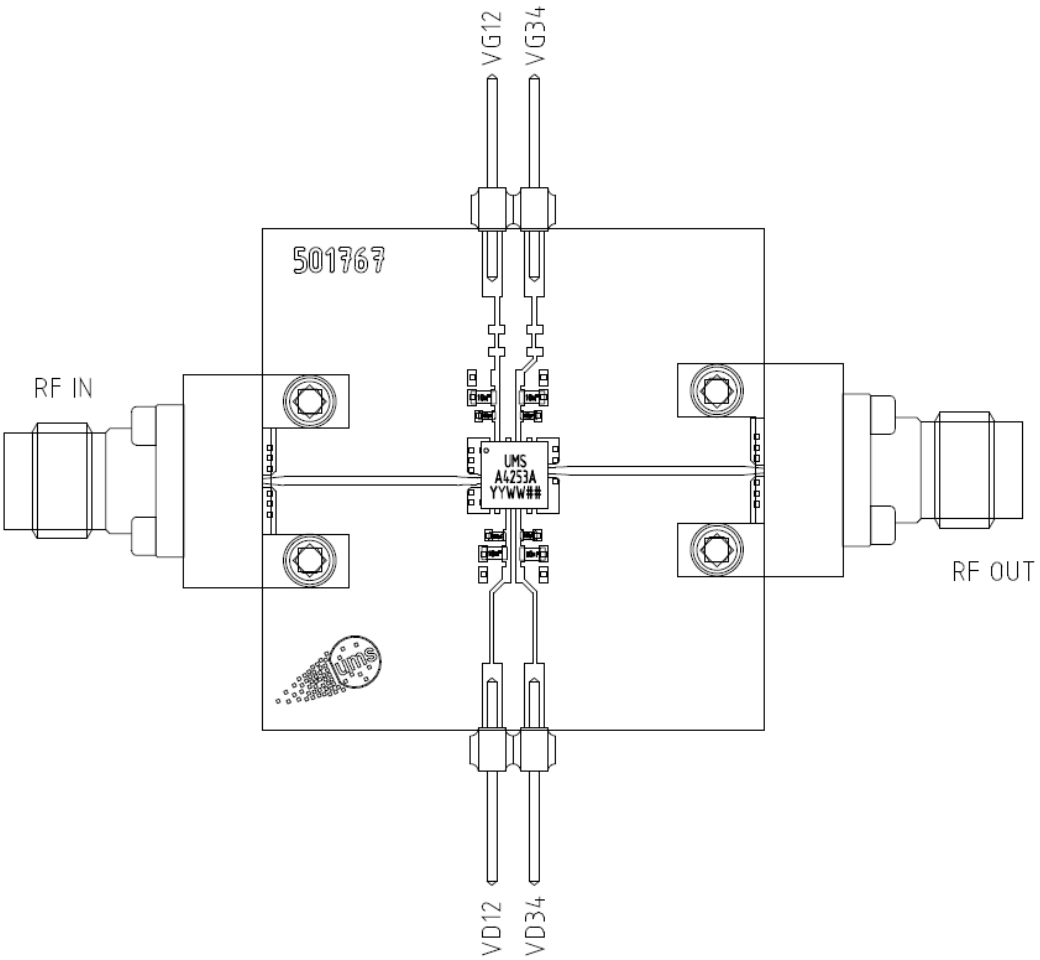
Evaluation mother board

- Compatible with the proposed footprint.
- Based on typically Ro4350 / 10mils 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 100pF ±5% and 10nF ±10% are recommended for all DC accesses.
- See application note AN0017 for details.



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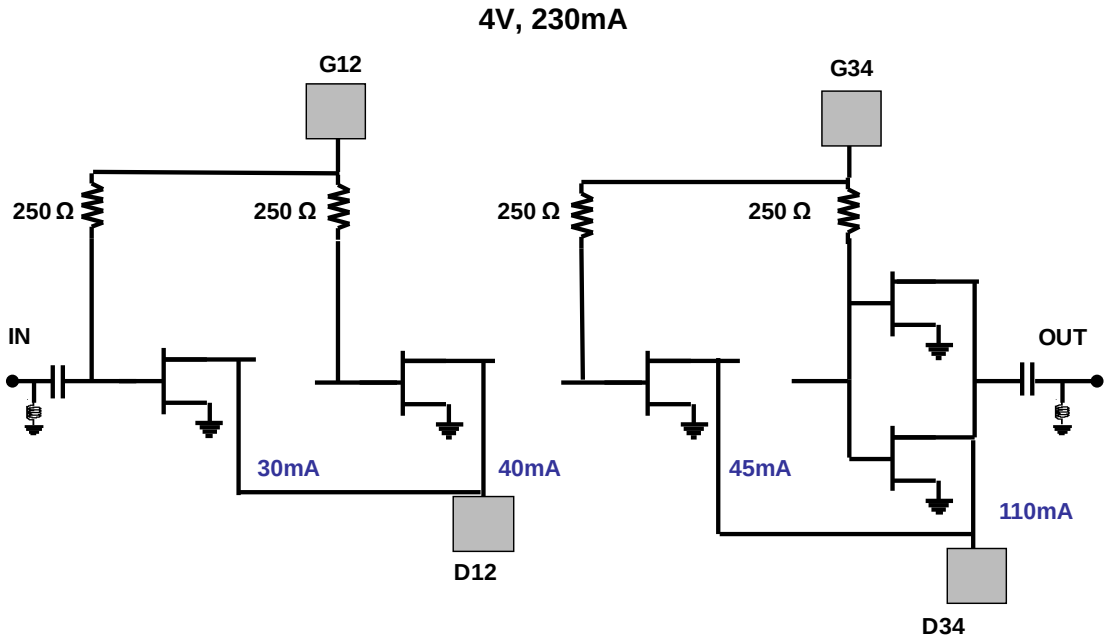
DC Schematic



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Notes

Due to ESD protection circuits on RF input and output, an external capacitance might be requested to isolate the product from external voltage that could be present on the RF accesses.

The DC connections do not include any decoupling capacitor in package, therefore it is mandatory to provide a good external DC decoupling (100pF, 10nF) on the PC board, as close as possible to the package.

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Recommended package footprint

Refer to the application note AN0017 available at http://www.ums-gaas.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.

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 http://www.ums-gaas.com.

Recommended ESD management

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

Ordering Information

QFN 4x4 package:	CHA4253aQQG/XY	
	Stick: XY = 20	Tape & reel: XY = 21

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