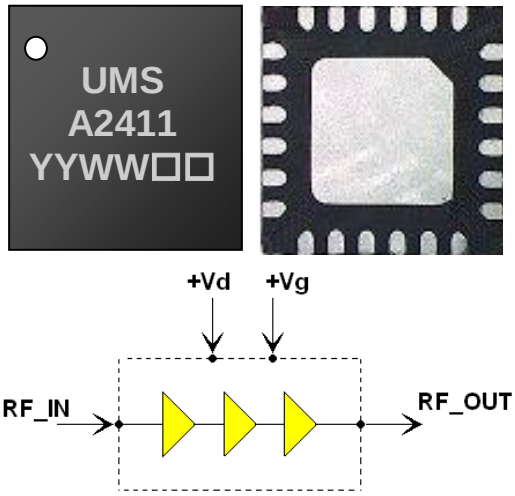
20-25GHz Low Noise Amplifier

GaAs Monolithic Microwave IC in SMD leadless package

Description

The CHA2411-QDG is a K-band low noise amplifier providing 26dB gain with a noise figure of 2.5dB from a single bias supply +5V.

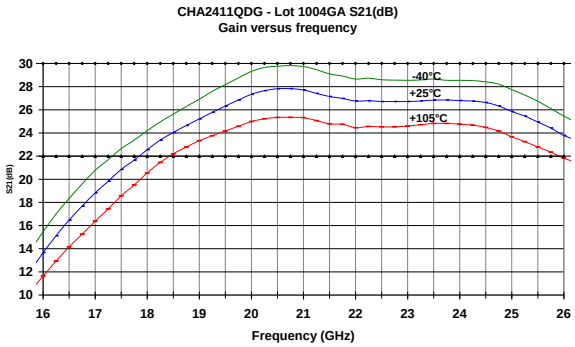
The circuit is manufactured with a pHEMT process, 0.25µm gate length, via holes through the substrate, air bridges and electron beam gate lithography.
It is supplied in RoHS compliant SMD package.



Functional diagram

Main Features

- Broadband performances: 20-25GHz
- Excellent 2.5dB Noise figure
- 26dB ± 2dB stable Gain vs Temperature
- DC bias: Vd=5.0 Volt @ +I=43mA
- 24L-QFN4x4 SMD leadless package
- MSL1



Main Characteristics

Tamb.= +25°C

Symbol	Parameter	Min	Typ	Max	Unit
Fop	Frequency range	20		25	GHz
G	Linear Gain	22	26	30	dB
NF	Noise Figure		2.5		dB
RLoss	Input / Output Return Losses.		15		dB

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Main Characteristics

Symbol	Parameter	Min	Typ	Max	Unit
Fop	Frequency range	20		25	GHz
G	Linear Gain	22	26	30	dB
ΔG(Fop)	Gain variation in frequency range		± 0.5		dB
ΔG(T)	Gain variation in temperature range		± 2		dB
NF	Noise figure		2.5		dB
RLoss	Input / Output Return RLosses.		-10		dB
P_{-1dB} in	Input Power at 1dB Gain Comp @24GHz		-14		dBm
IP3 in	Input IP3 @24GHz		-7.5		dBm
Pout_sat	Saturated Output Power @24GHz		13.5	15	dBm
+Vd, +Vg	Supply Voltage		5		V
+I	Supply Current		43	55	mA
Top	Operating temperature range	-40	25	105	°C

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

These performances have been obtained with the chip in QFN package mounted on the recommended boards (reference 95541) described in this document. These performances are highly dependent on this environment.

Absolute Maximum Ratings

Tamb.= +25°C(1)

Symbol	Parameter	Values	Unit
+Vg, +Vd	Maximum positive supply voltage	6V	V
+I	Maximum positive supply current	65	mA
Pin	Maximum peak input power overdrive	-5	dBm
Top	Operating temperature range	-40 to +105	°C
Tstg	Storage temperature range	-55 to +150	°C

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

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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 PCB system must be designed to comply with this requirement.

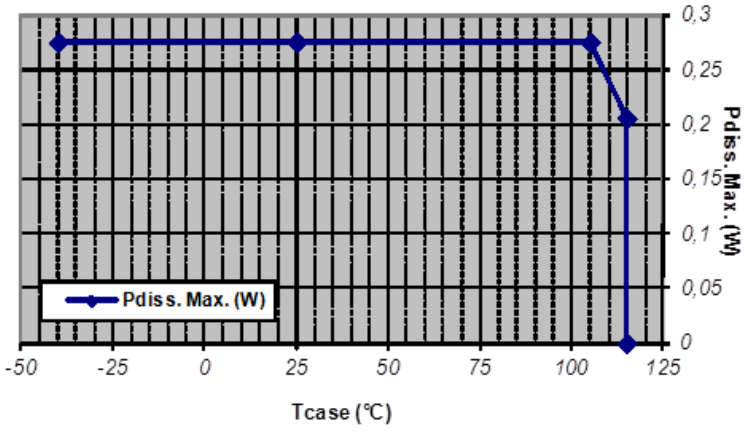
A derating must be applied on the dissipated power if the Tcase temperature cannot be maintained below the maximum temperature specified (see the curve Pdiss. Max) in order to guarantee the nominal device life time (MTTF).

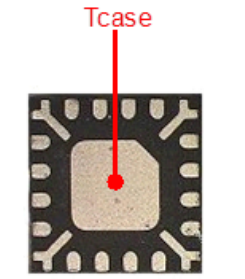
DEVICE THERMAL SPECIFICATION : CHA2411-QDG		
Recommended max. junction temperature (Tj max)	:	145 °C
Junction temperature absolute maximum rating	:	175 °C
Max. continuous dissipated power @ Tcase= 105 °C	:	0,3 W
=> Pdiss derating above Tcase(1)= 105 °C	:	7 mW/°C
Junction-Case thermal resistance (Rth J-C)(2)	:	<143 °C/W
Minimum Tcase operating temperature(3)	:	-40 °C
Maximum Tcase operating temperature(3)	:	105 °C
Absolute maximum rating Tcase temperature(3)	:	115 °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 where the **hottest junction** of the MMIC is considered.*

(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

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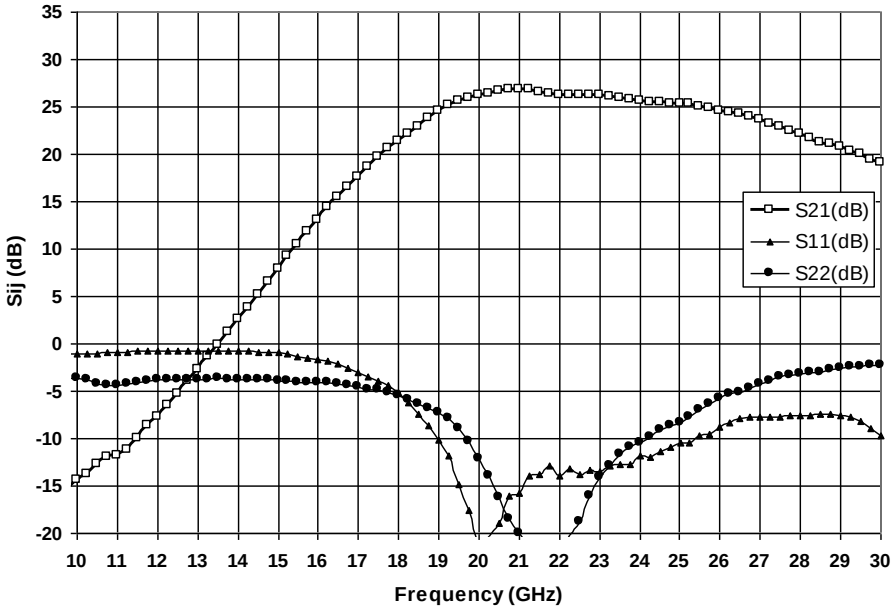
Typical Package Sij parameters

Tamb.= +25°C, Vd = +4.5V, Id = 43mA

Freq (GHz)	S11 (dB)	PhS11 (°)	S12 (dB)	PhS12 (°)	S21 (dB)	PhS21 (°)	S22 (dB)	PhS22 (°)
10.0	-1.07	-49.55	-14.38	-58.07	-59.27	-175.76	-3.68	-21.83
11.0	-0.91-	-68.36	-55.9	-102.44	-11.75	148.54	-4.36	-36.48
12.0	-0.78	-87.98	-54.01	-148.74	-7.68	126.87	-3.85	-53.87
13.0	-0.73	-107.81	-49.64	178.55	-2.72	98.18	-3.72	-73.42
14.0	-0.74	-128.9	-46.02	139.21	2.54	64.31	-3.71	-93.32
15.0	-0.98	-151.4	-46.54	107.66	7.85	24.67	-3.92	-113.67
16.0	-1.61	-176.03	-42.24	89.48	13.10	-21.61	-4.10	-133.26
17.0	-3.00	156.34	-42.85	34.58	17.64	-74.45	-4.56	-154.71
18.0	-5.18	123.53	-45.15	17.88	21.34	-132.27	-5.50	-179.79
19.0	-10.11	84.87	-50.38	-17.51	24.50	168.46	-7.22	152.98
20.0	-21.11	-6.32	-52.53	-49.82	26.22	104.07	-12.06	111.32
21.0	-15.70	-136.32	-55.01	127.63	26.76	42.30	-19.95	67.22
22.0	-13.98	-172.06	-47.39	77.30	26.20	-13.39	-21.91	-57.46
23.0	-13.50	-179.07	-64.30	-43.79	26.17	-64.30	-14.09	-87.97
24.0	-11.79	175.47	-41.92	19.85	25.62	-115.15	-10.50	-118.95
25.0	-10.43	165.19	-42.35	4.31	25.27	-163.45	-8.33	-136.39
26.0	-8.74	154.28	-41.19	-6.44	24.56	146.28	-5.78	-152.57
27.0	-7.78	131.33	-41.32	-17.81	23.64	96.46	-4.30	-170.04
28.0	-7.62	113.23	-39.65	-29.56	22.06	49.94	-3.15	170.66
29.0	-7.60	91.53	-38.35	-57.29	20.70	7.00	-2.55	155.07
30.0	-9.76	62.59	-39.18	-83.28	19.04	-39.18	-2.26	137.12

Typical Sij Parameters versus Frequency in the QFN package plans



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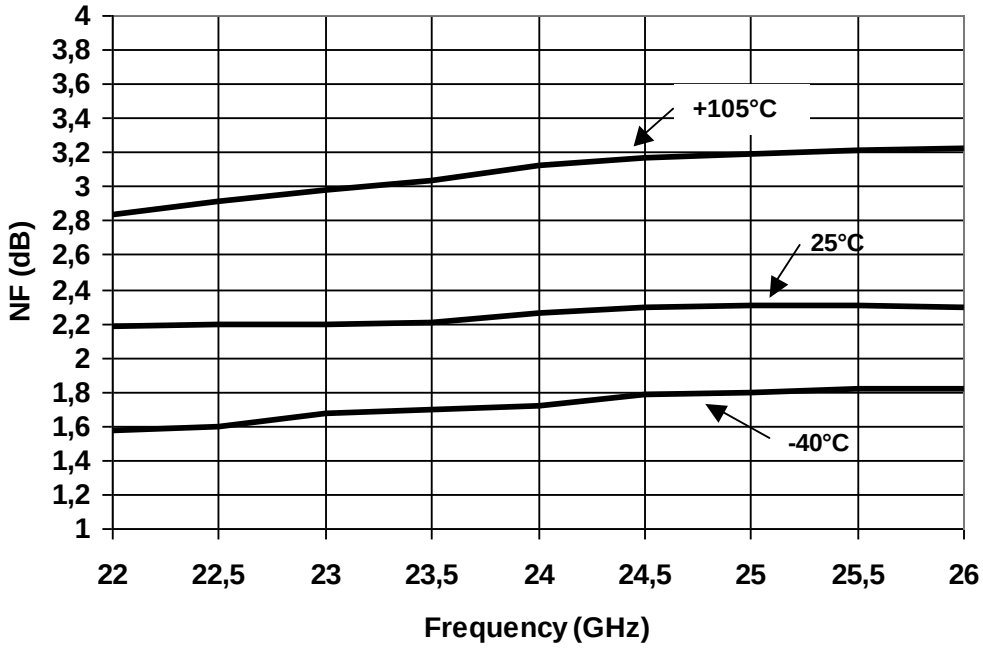
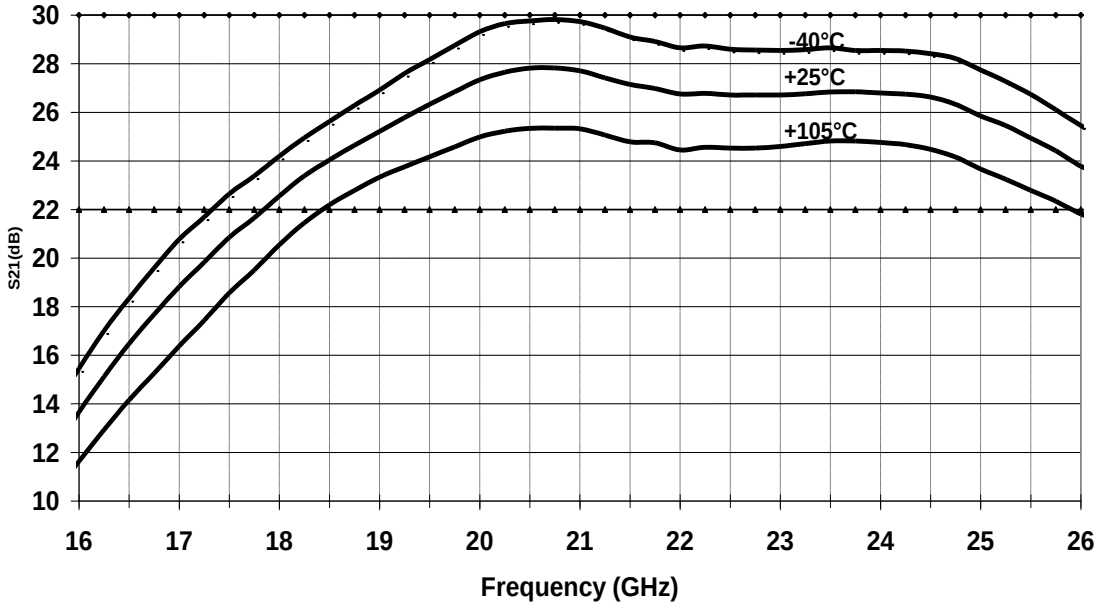
Typical Measurements on board 95541 (QFN plan)

Tamb.= -40°; +25°C; +105°C ,Vd = +4.5V / 55mA max

Noise Figure versus Frequency



Linear Gain versus Frequency



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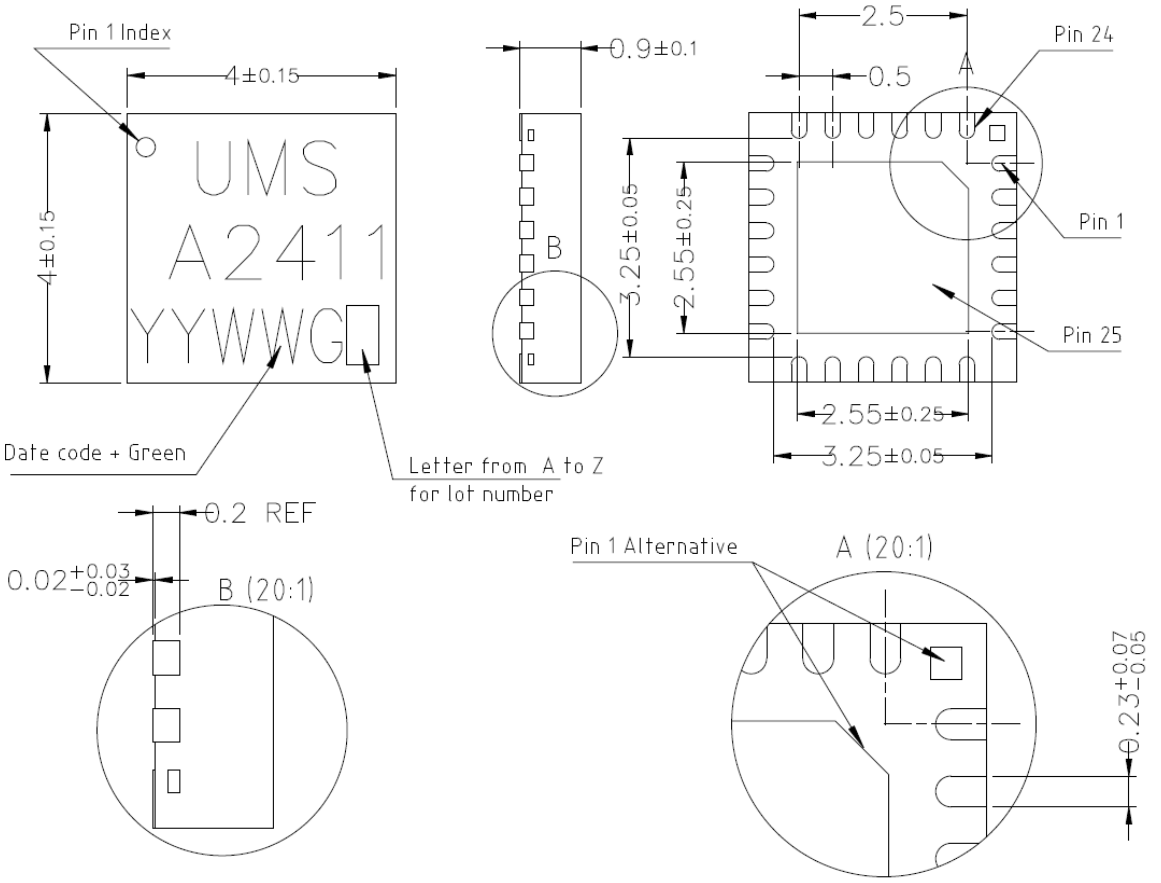
Package outline



Matt tin, Lead Free (Green)		1- Nc	13- Nc
Units : mm		2- Nc	14- Gnd(2)
From the standard : JEDEC MO-220 (VGGD)		3- Gnd(2)	15- RF_OUT
		4- RF_IN	16- Gnd(2)
25- GND		5- Gnd(2)	17- Nc
		6- Nc	18- Nc
		7- Nc	19- Nc
		8- Nc	20- Nc
		9- VG	21- Nc
		10- Nc	22- VD
		11- Nc	23- Nc
		12- Nc	24- Nc

(1) The package outline drawing included to 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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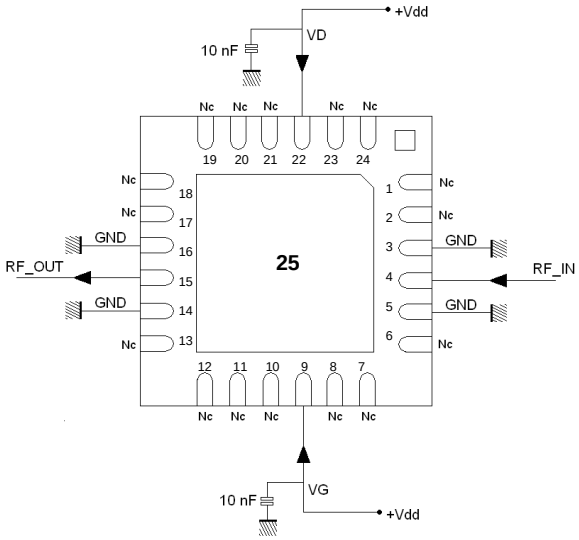
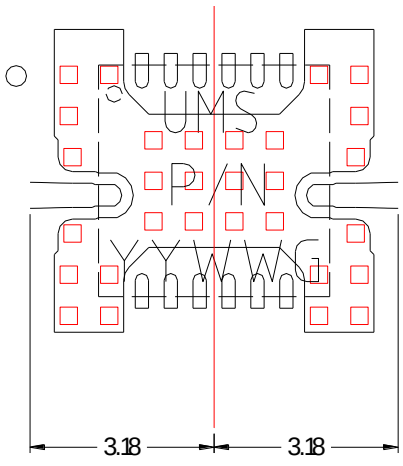
External Components and bias configuration (recommended)



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".



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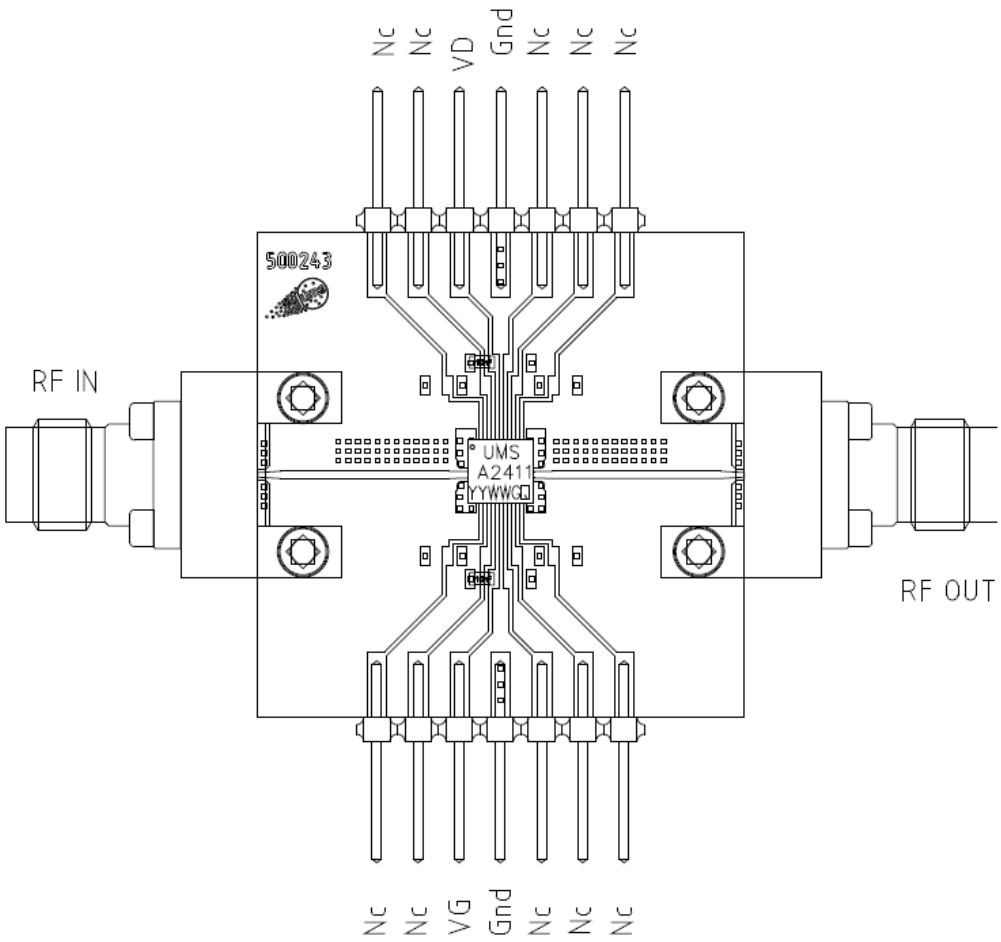
Evaluation mother board

- 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 ±10% are recommended for all DC accesses.
- See application note AN0017 for details.

Recommended Test fixture (Ref. 500243) for measurements over temperature range



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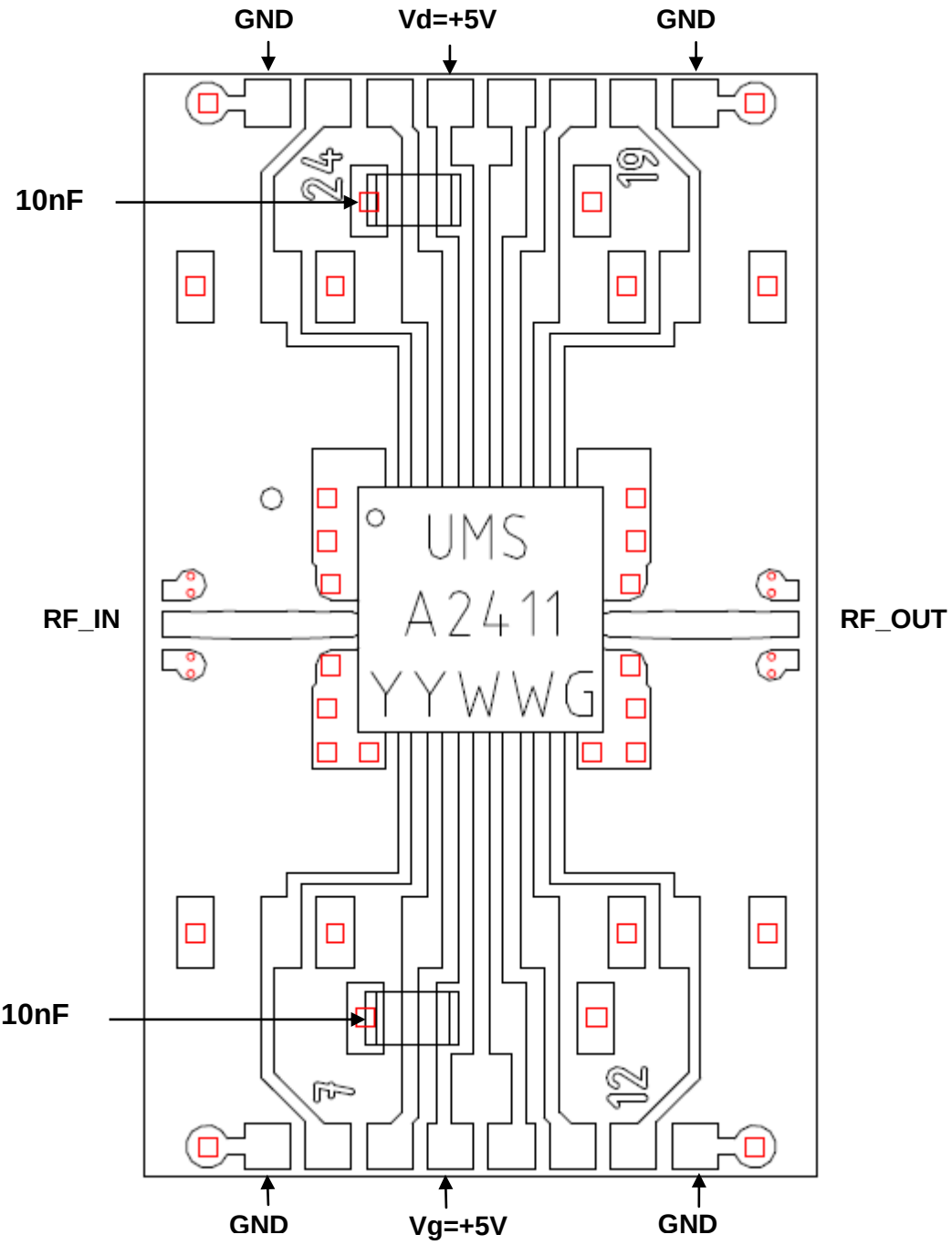
Evaluation mother board

Recommended Test fixture (Ref. 95541) for measurements over temperature range (unit=mm)



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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

QFN4x4 RoHS compliant package:	CHA2411-QDG/XY	
	Stick: XY = 20	Tape & reel: XY = 21

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