22-24.5GHz RX Multifunction

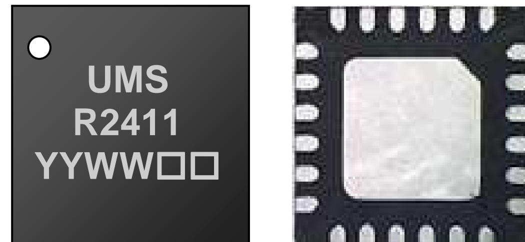
GaAs Monolithic Microwave IC in SMD package

Description

The CHR2411 is a monolithic multifunction in K-Band which integrates a low noise amplifier and a mixer providing an IF signal from DC to 1 MHz. All the active devices are self biased on chip.

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

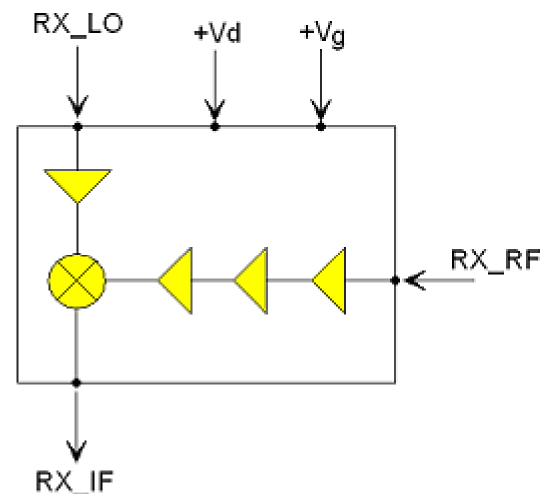
Available in a 24 leads RoHS compliant QFN4x4 package.



Plastic package

Main Features

- 22-24.5 GHz Bandwidth
- 7 dB Typical Noise figure
- 23 dB ± 2.5 dB Stable gain @ temperature
- +5V single supply Voltage
- 24L-QFN 4x4 SMD leadless package



Multifunction block diagram

Main Characteristics

Symbol	Parameters	Min	Typ	Max	Unit
RX_RF	Frequency range	22		24.5	GHz
Gc	Conversion Gain	19	23	27	dB
NF	SSB Noise figure (IF=1MHz)		7		dB
RX_LO / RX_RF	Input / Output Return Loss		-15	-8	dB

ESD Protection : Electrostatic discharge sensitive device. Observe handling precautions !

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Electrical Characteristics

Full temperature range

Symbol Pins	Parameters	Min	Typ	Max	Unit
RX_RF	Frequency range	22		24.5	GHz
RX_LO	Frequency range	22		24.5	GHz
RX_IF	Frequency range	DC		1	MHz
RX_RF	Return Loss		-15	-8	dB
RX_LO	Return Loss		-15	-8	dB
RX_IF	IF Load impedance		50		Ohms
PLO	LO Drive Power	0	5		dBm
Gc	Conversion Gain	19	23	27	dB
ΔG(T)	Gain variation over Temperature		± 2.5		dB
NF	SSB Noise figure (IF=1MHz)		7		dB
P.1dB_IN	Input Power at 1 dB Gain Compression @24GHz		-21		dBm
IP3_IN	Input IP3 @24GHz		-12		dBm
I_LO/RF	LO to RF Isolation		-45	-30	dB
+Vg, +Vd	Supply Voltage		5		V
+I	Supply Current		60	80	mA
Top	Operating temperature range	-40	25	100	°C

Remark
These performance has been obtained with the chip in QFN package mounted on the recommended boards (ref. 95541 & 95581) described in this document. These performance are highly dependent on this environment.

Absolute Maximum Ratings (1)

Symbol	Parameters	Values	Unit
+Vg, +Vd	Maximum positive supply voltage	6	V
+I	Maximum positive supply voltage	90	mA
PLO	Maximum peak input power overdrive	8	dBm
PRF	Maximum peak input power overdrive	-12	dBm
Top	Operating temperature range	-40 to +100	°C
Tstg	Storage temperature range	-55 to +125	°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 than the maximum value specified in the next table. So, the system PCB must be designed to comply with this requirement.

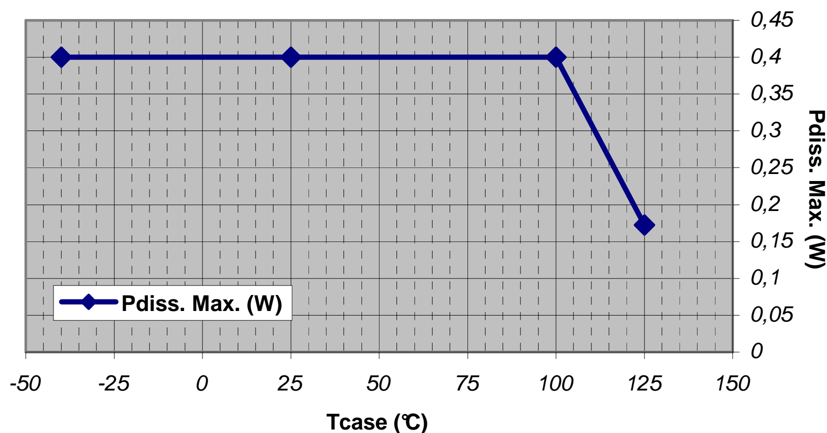
A derating must be applied on the dissipated power if the Tcase temperature can not be maintained below than the maximum temperature specified (see the curve Pdiss. Max) in order to guarantee the nominal device life time (MTTF).

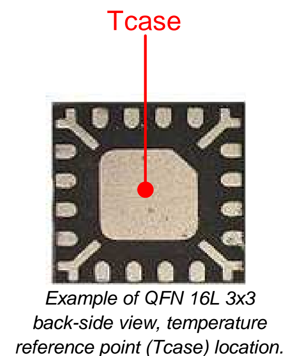
DEVICE THERMAL SPECIFICATION : Product name			
Max. junction temperature (Tj max)		:	144 °C
Max. continuous dissipated power @ Tcase=	100 °C	:	0,4 W
=> Pdiss derating above Tcase(1)=	100 °C	:	9 mW/°C
Junction-Case thermal resistance (Rth J-C)(2)		:	<109 °C/W
Min. package back side operating temperature(3)		:	-40 °C
Max. package back side operating temperature(3)		:	100 °C
Min. storage temperature		:	-55 °C
Max. storage temperature		:	125 °C

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

*(2) Rth J-C is calculated for a worst case where the **hotter junction** of the MMIC is considered.*

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





Example of QFN 16L 3x3 back-side view, temperature reference point (Tcase) location.

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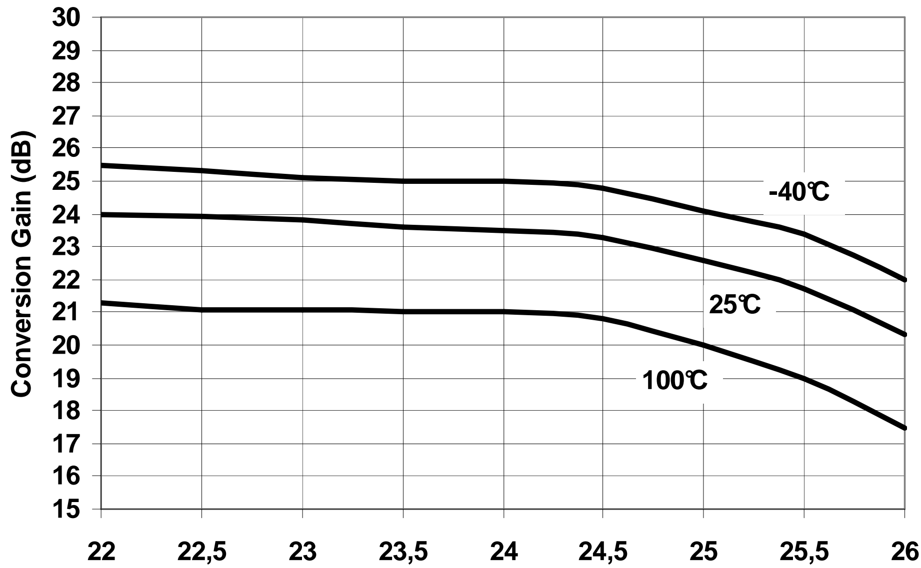
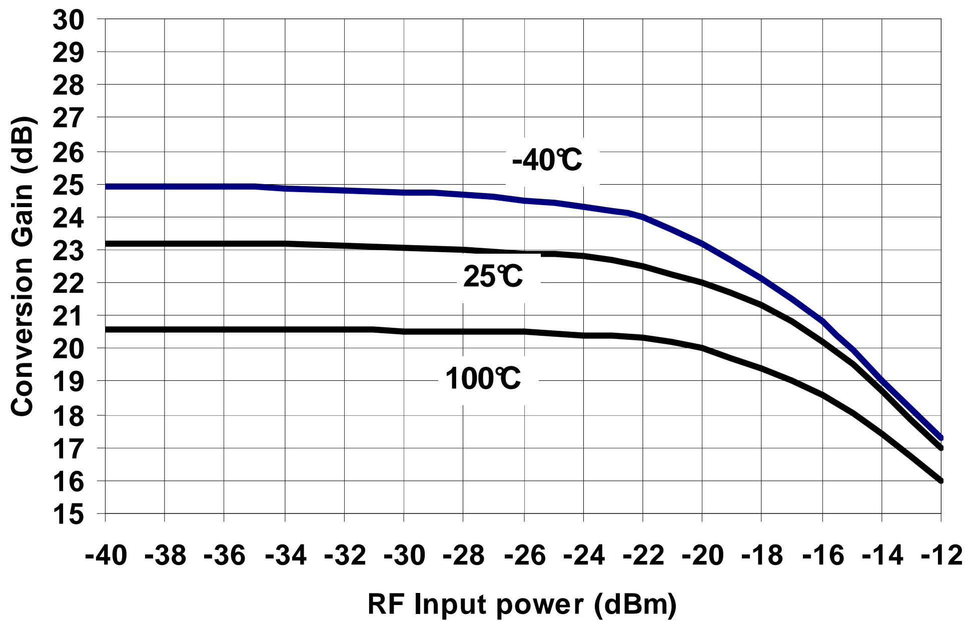
Typical QFN measurements on board 95541 (QFN plan)

Conversion Gain versus Frequency PLO=0dBm



Conversion Gain versus RF Input Power LO=0dBm FLO=24.25GHz



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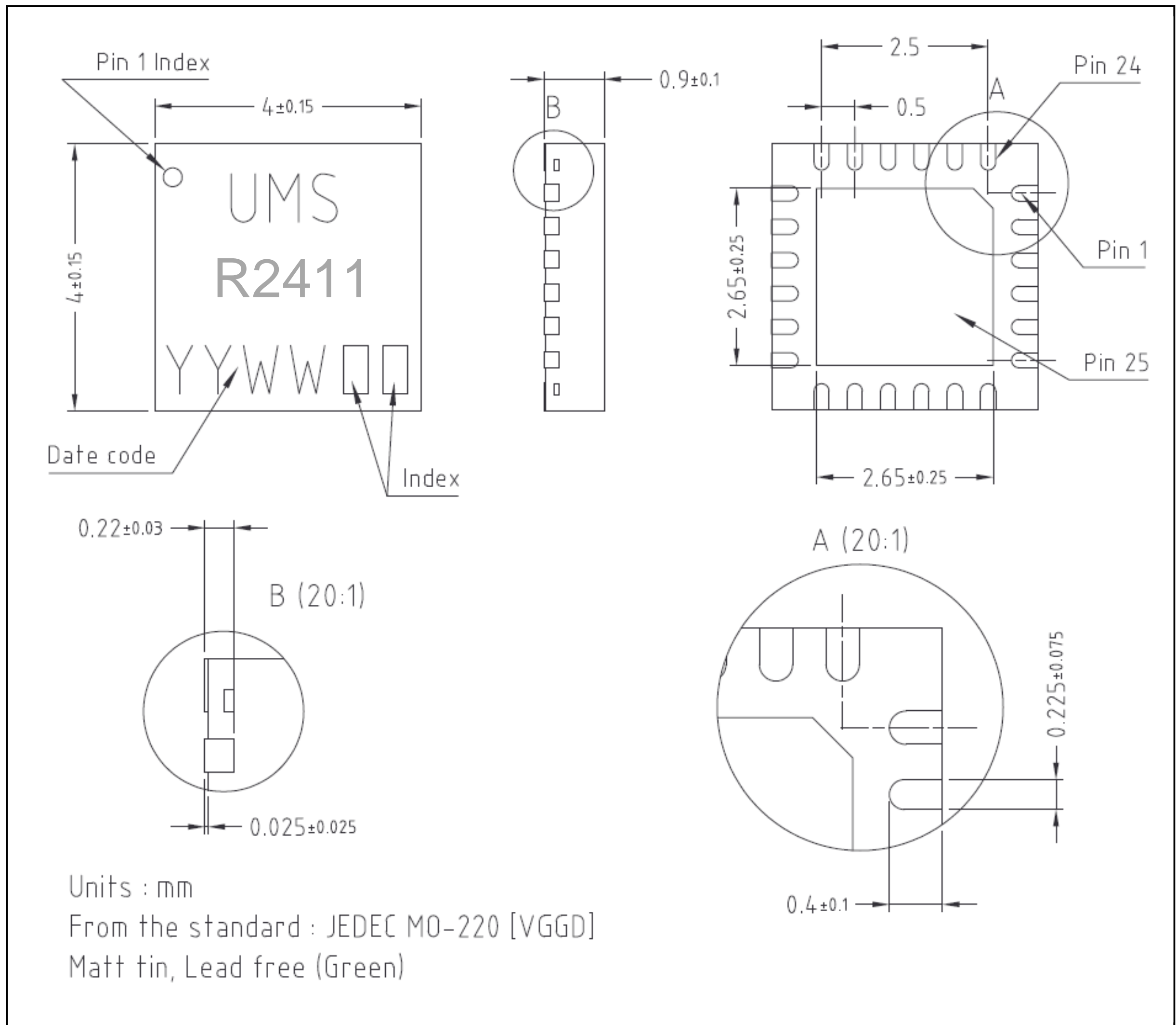
QFN Outline (1)



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

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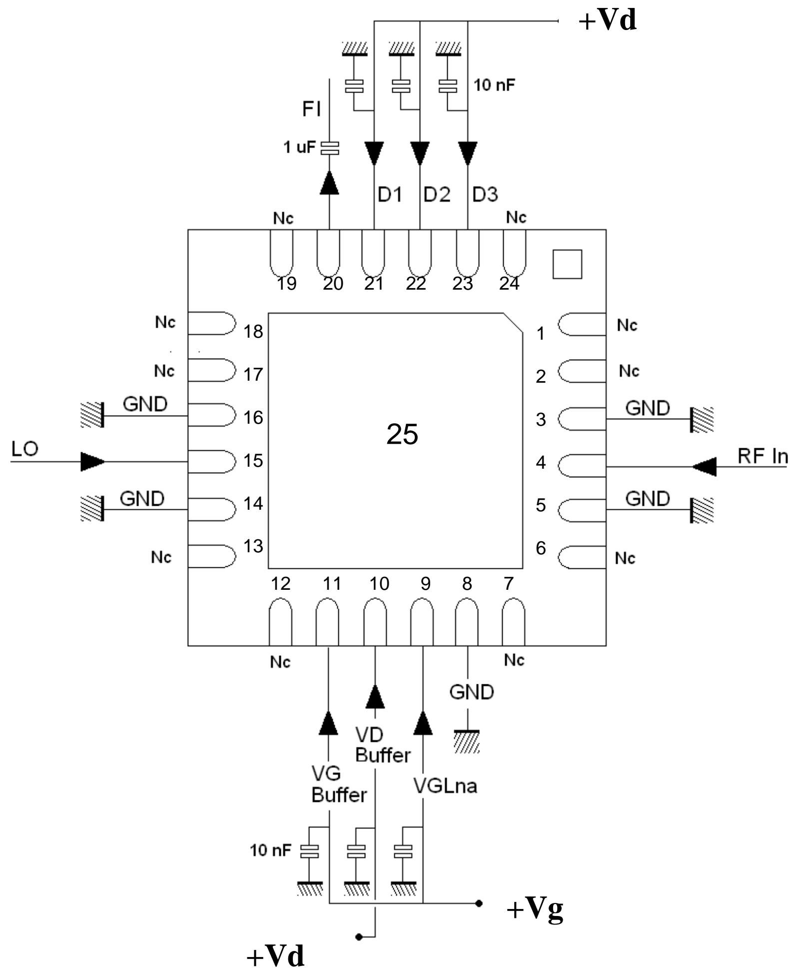
QFN Pin-out description

Pin number	Pin name	Symbol Name	Description
4	RFIn	RX_RF	RF Input port
15	LO	RX_LO	LO Input port
20	FI	RX_IF	IF Output port
10, 21, 22, 23	D1, D2, D3, VD Buffer	+Vd	Positive Drain supply voltage
9, 11	VGLna, VG Buffer	+Vg	Positive Gate supply voltage
3, 5, 8, 14, 16, 25	GND	GND	Ground
1, 2, 6, 7, 12, 13, 17, 18, 19, 24	Nc	Nc	Not connected

External Components and bias configuration (recommended)



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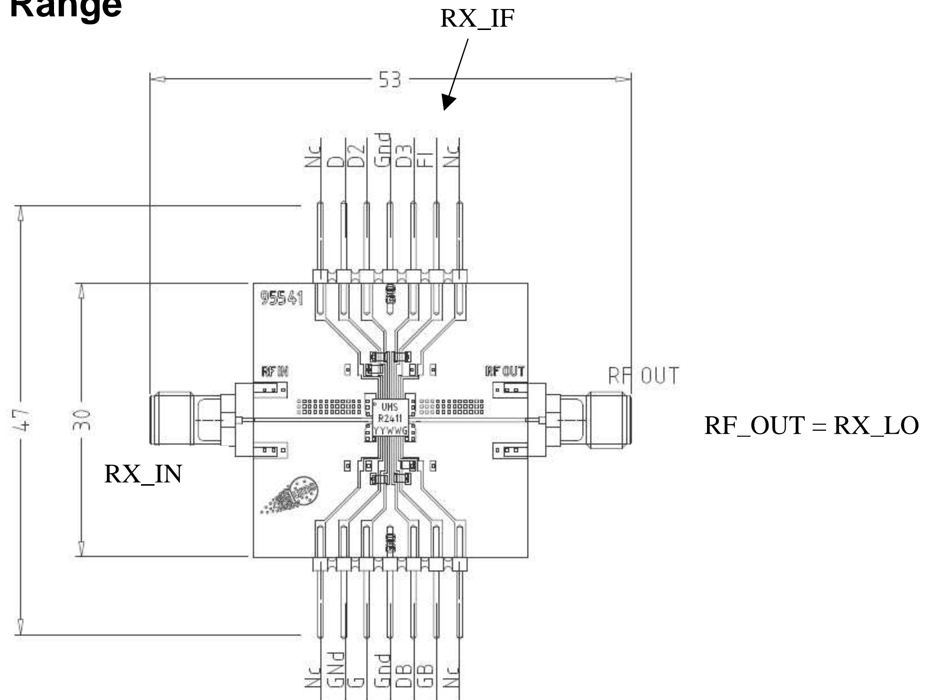
Recommended Test Fixture (Ref. 95541) for measurements over Temperature Range



Rep	P/N	Qt	DESIGNATION	REF FABRICANT	FABRICANT
	61495564	1	Monture 30X30 EDG	SEMELLE	(Sous traitance mecanique)
	61495541	1	Demonstrateur Board 24L QFN4X4	CIRCUIT 95541	(Sous traitance Circuit Imprimé)
	47000774	2	Connecteur SMA (DC-28GHz)	PSF-S03-000-01	GIGALANE
	61495570	2	Adaptateur connecteur PSF-S03-000-01	FOURCHE	
		4	Vis CL M2.5X3		
		6	Condo 0603 X7R 10nF ±10% 50V	GRM1888R71H103K	MURATA
		2	Barette Male 7x2 Contacts pl. 61497366	4730334180400	Kontek COMATEL
		1	CHR2411QDG		

Remark
- Unit = mm
-1uF serial capacitor is used on RX_FI port.

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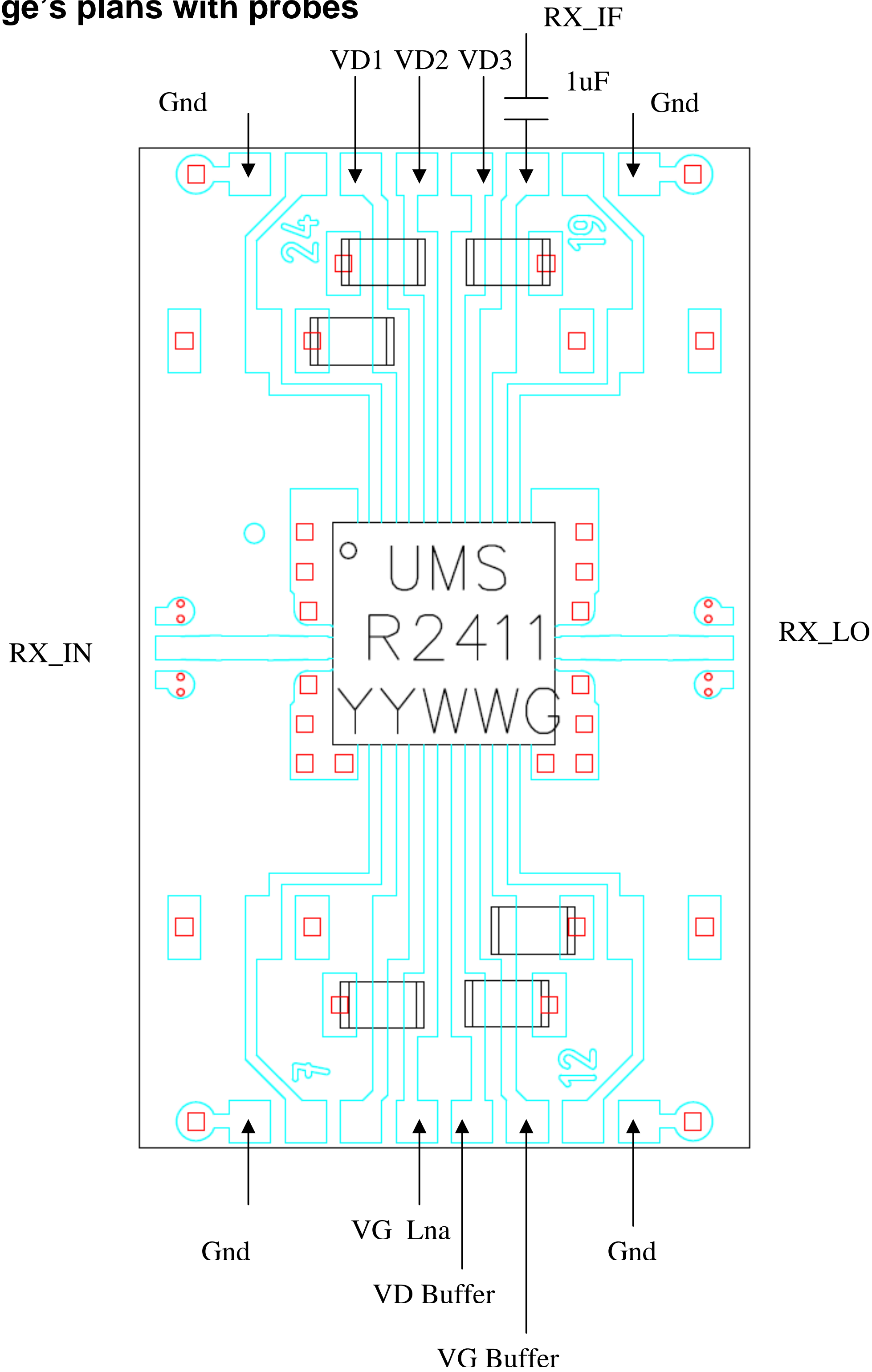
Recommended Test Fixture (Ref. 95581) for measurements in the package's plans with probes



6 capacitors 0603 10nF

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ESD sensitivity

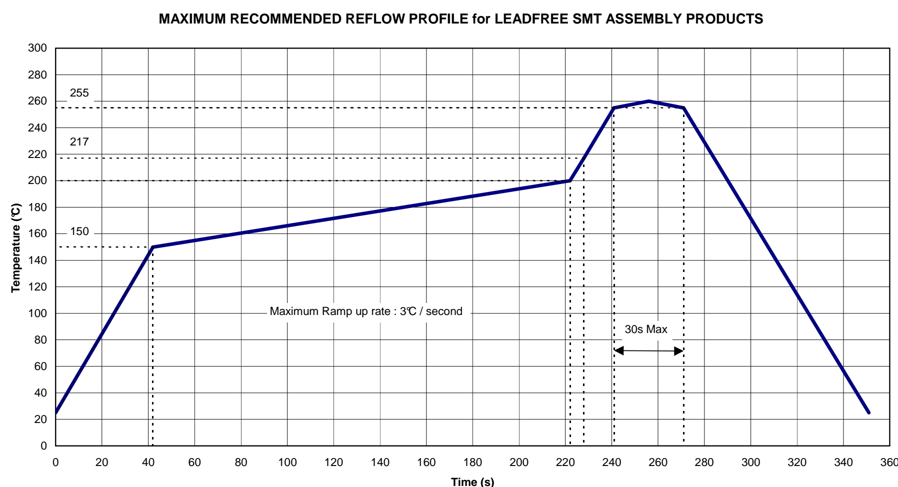
Standard	Value
MIL-STD-1686C	HBM Class 1 >0V – 1999V)
ESD STM5.1-2001	HBM Class 0 (<250V)

Package Information

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

Recommended surface mount package assembly (see UMS AN0017)

For volume production the SMD type package can be treated as a standard surface mount component (please refer to the IPC/JEDEC J-STD-020C standard or equivalent). The assembly on the motherboard can be performed using a standard assembly process (e.g. stencil solder printing, standard pick-and-place machinery, and solder reflow oven). However, caution should be taken to perform a good and reliable contact over the whole pad area.



Caution

The solder thickness after reflow should be typical 50µm [2 mils] and the lateral alignment between the package and the motherboard should be within 50µm [2 mils].
It is important for the performance of the product that the whole overlapping area between the motherboard and package pads is connected. Voids or other improper connections, in particular, between the ground pads on motherboard and package will lead to a deterioration of the RF performance and the heat dissipation. The latter effect can reduce drastically reliability and lifetime of the product.

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Ordering Information

24L-QFN4x4 Lead Free Package : CHR2411-QDG/XY

Stick: XY=20 Tape and reel: XY=21

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