23.75-24.5GHz Dual Rx Channel

GaAs Monolithic Microwave IC in SMD leadless package

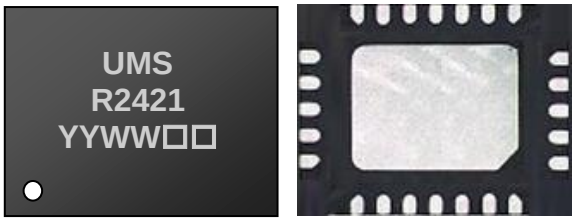
Description

The CHR2421-CHR2421-QEGQEG is a monolithic multifunction dual channel receiver in K-Band which integrates low noise amplifiers and mixers providing an IF signal from DC to 1 MHz. All the active devices are self biased on chip.

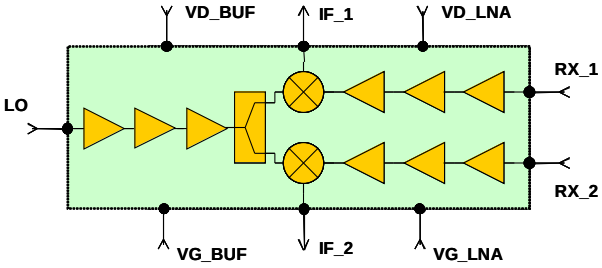
The circuit is dedicated to sensors and also well suited for a wide range of microwave and millimetre wave applications and systems.

The circuit is manufactured with a pHEMT process, 0.25µm gate length.

It is supplied in a 24 leads RoHS compliant QFN4x5 package.



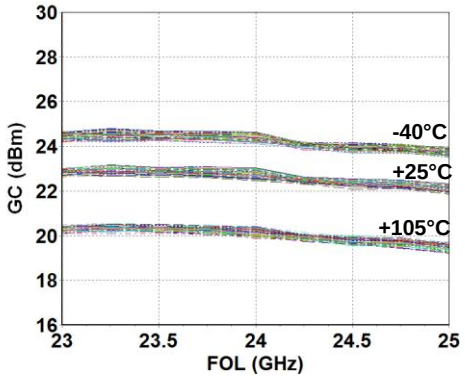
Plastic package



Block Diagram

Main Features

- 23.75-24.5 GHz Bandwidth
- 7 dB Typical Noise figure @1MHz
- 22 dB ± 2 dB gain vs temperature
- +5V single supply Voltage
- 24L-QFN 4x5 SMD leadless package
- MSL1



Conversion gain versus Fol and temperature

Main Electrical Characteristics

Tamb.= +25°C

Symbol	Parameter	Min	Typ	Max	Unit
Freq	Frequency range	23.75		24.5	GHz
Gain	Linear Gain		22		dB
NF	Noise Figure @1MHz		7		dB
P-1dB_RX	RX Input Power at 1 dB Gain compression	-25	-20		dBm

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Electrical Characteristics

Temp.= -40°C to +105°C

Symbol	Parameter	Min	Typ	Max	Unit	Conditions
F_RX	RX Frequency Range	23.75		24.5	GHz	
F_LO	LO Frequency Range	23.75		24.5	GHz	
F_IF	IF Frequency Range	DC		1	MHz	
RL_RX	RX Return Loss	10	15		dB	
RL_LO	LO Return Loss	10	15		dB	
L_IF	IF Load impedance		50		Ohms	
P_LO	LO Drive Power	0	2	8	dBm	
P_RF	RF Drive Power range			-15	dBm	
Gc (1)	Conversion Gain within F_RX	17.5	22	26	dB	VG_LNA≥4.7V
ΔG(F)	Gain variation over Frequency		± 0.5	± 1	dB	F_RX, F_LO
ΔG(T)	Gain variation over Temperature		± 2	± 3.5	dB	
ΔG(VG_LNA)	Uncompressed Gain versus VG control range	4			dB	
NF	SSB Noise figure (IF=1MHz)		7	12	dB	VG_LNA≥4.7V
			7	13		Gc≥18dB
NF	SSB Noise figure (IF=100kHz)		13	18	dB	VG_LNA≥4.7V
			14	19		Gc≥18dB
NF	SSB Noise figure (IF=10kHz)		18	25	dB	VG_LNA≥4.7V
			19	29		Gc≥18dB
P.1dB_RX	RX Input Power at 1 dB Gain compression	-25	-20		dBm	VG_LNA≥4.7V P_LO≥0dBm
IP3_RX	RX Input IP3		-12		dBm	
I_LO/RX	LO to RX Isolation		-50		dB	
I_LO/IF	LO to IF Isolation		-20		dB	P_LO=8dBm
I_RXi/IFj (2)	RXi to IFj Isolation (P_IFj-P_IFi) within F_RX_R2		-25	-22	dB	
DG_RX	Calibrated differential Gain RX_1 vs RX_2 over operating conditions		+/- 0.25	+/-1	dB	Gc≥18dB
DP_RX	Calibrated differential Phase RX_1 vs RX_2 over operating conditions		+/- 1.5	+/-4	°	Gc≥18dB
VD_LNA; VG_LNA; VG_BUF, VD_BUF	Supply Voltage	+4.7	+5	+5.3	V	
VG_LNA	Supply Voltage for gain tune	0		5.3	V	
I_VG_LNA	LNA Total VG Supply Current		10	15	mA	
I_VD_LNA	LNA Total VD Supply Current		90	125	mA	
I_BUF	Buffer Total VG & VD Supply Current		55	75	mA	
I_VG_BUF	Buffer VG current alone		9	14	mA	
Top	Operating temperature range	-40		+105	°C	Top=Tcase

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(1) Conversion gain is typically improved of +0.8dB with 220Ω IF optimum load.
(2) RXi to IFj Isolation (P_IFj-P_IFi) is typically improved of 2dB with 220_ IF optimum load.

These values are representative of on-board measurements.

Packaged RX is conditionally Stable (Stability guaranteed on UMS demo-board and for RF loads VSWR <3:1).
Full temperature and supply voltage range.

Absolute Maximum Ratings

Tamb.= +25°C

Symbol	Parameter	Values	Unit
+VGi, +VDi	Maximum positive supply voltage (1) Minimum positive supply voltage (1)	6 -0.5	V
+I_VG_BUF	Maximum Buffer VG positive supply current (1)	16	mA
+I_VG_LNA	Maximum LNA VG positive supply current (1)	20	mA
+I_VD_LNA	Maximum LNA VD positive supply current (1)	135	mA
+I_BUF	Maximum Buffer VG & VD positive supply current (1)	85	mA
P_LO	LO port maximum peak input power overdrive (1)	12	dBm
P_RF	RF port maximum peak input power overdrive (1)	-12	dBm
Tj	Junction temperature (2)	175	°C
Top	Operating temperature range	-40 to +125	°C
Tstg	Storage temperature range	-55 to +150	°C

(1) Operation of this device above anyone of these parameters may cause permanent damage.
(2) Top=Tcase. Operation of this device above these parameters may cause permanent damage or reduce MTTF.

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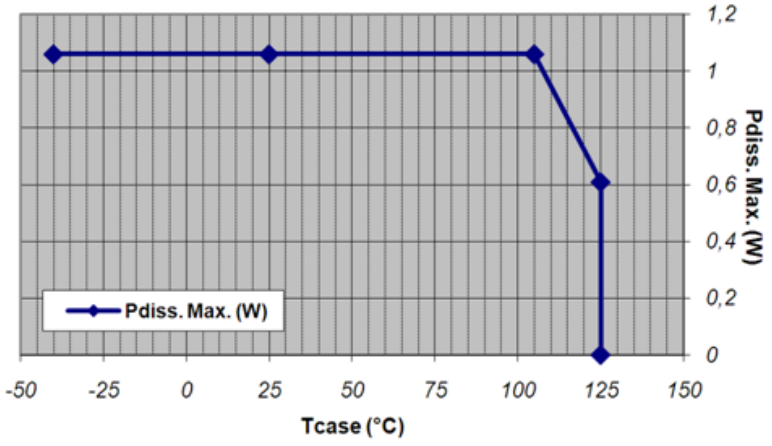
Device thermal performances

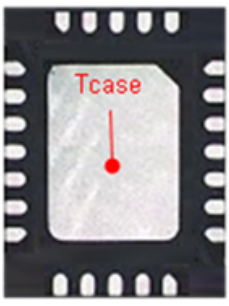
All the figures given in this section are obtained assuming that the QFN device is cooled down only by conduction through the package thermal pad (no convection mode considered). The temperature is monitored at the package back-side interface (Tcase) as shown below.
The system maximum temperature must 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 :			
Recommended max. junction temperature (Tj max) (1)	: 150	°C
Junction temperature absolute maximum rating	: 175	°C
Max. continuous dissipated power @ Tcase= 105 °C	: 1,25	W
=> Pdiss derating above Tcase(2)= 105 °C	: 23	mW/°C
Junction-Case thermal resistance (Rth J-C)(3)	: <44	°C/W
Minimum Tcase operating temperature(4)	: -40	°C
Maximum Tcase operating temperature(4)	: 105	°C
Absolute maximum rating Tcase temperature(4)	: 125	°C
Minimum storage temperature	: -55	°C
Maximum storage temperature	: 150	°C

(1) Typical voltage supply considered.
(2) Derating at junction temperature constant = Tj max
*(3) Rth J-C is calculated for a worst case where the **hottest junction** of the MMIC is considered, and all component biasing are supplied.*
(4) Tcase=Package back side temperature measured under the die-attach-pad (see the drawing below).





Example: QFN 35L 4x5
Location of temeprature reference point (Tcase) on package's bottom side

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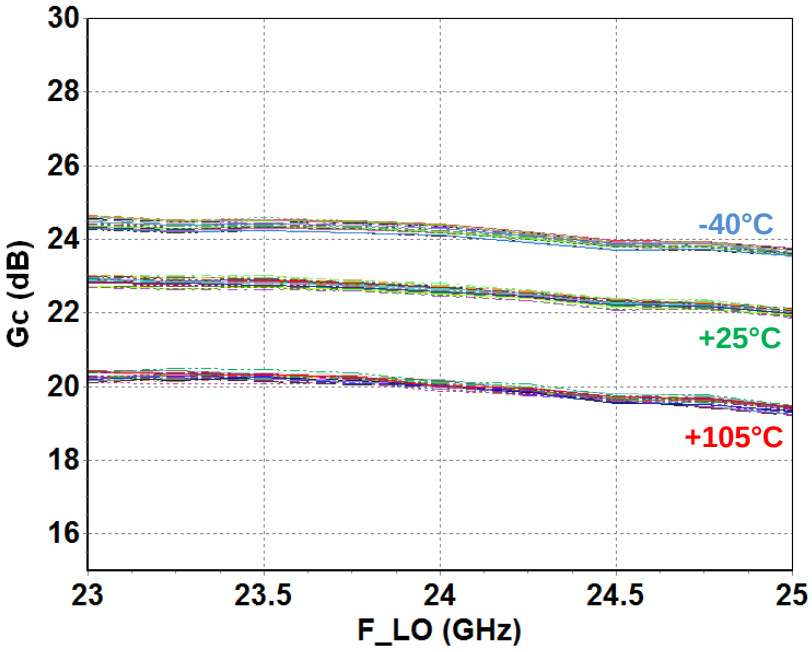
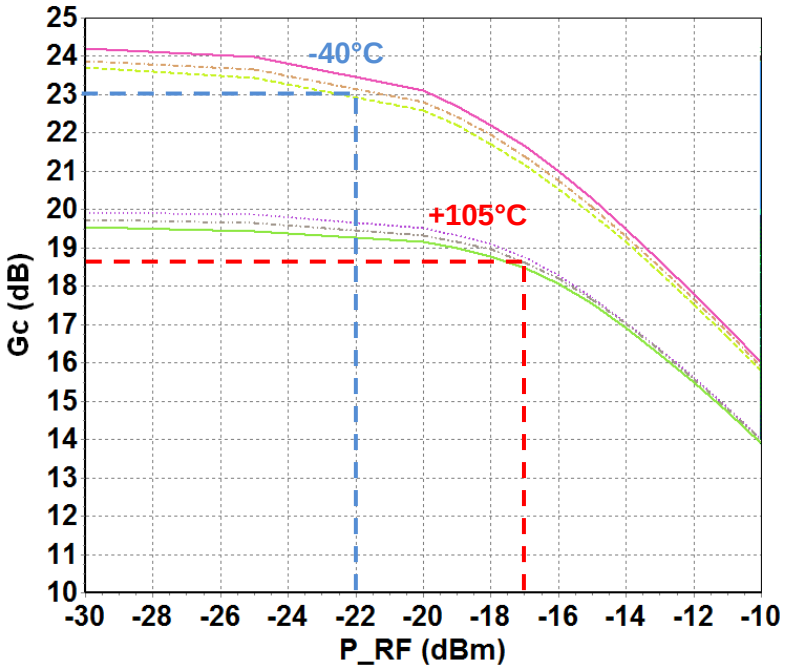
Typical Board Measurements (QFN plan)

Vd=Vg= +4.7V; +5V; +5.3V

Conversion Gain versus F_LO and temperature on channel 1
P_LO=0 / 4 / 8dBm



Conversion Gain versus P_RF and temperature on channel 1
P_LO=0dBm; F_LO=23.75 / 24.25 / 24.5GHz



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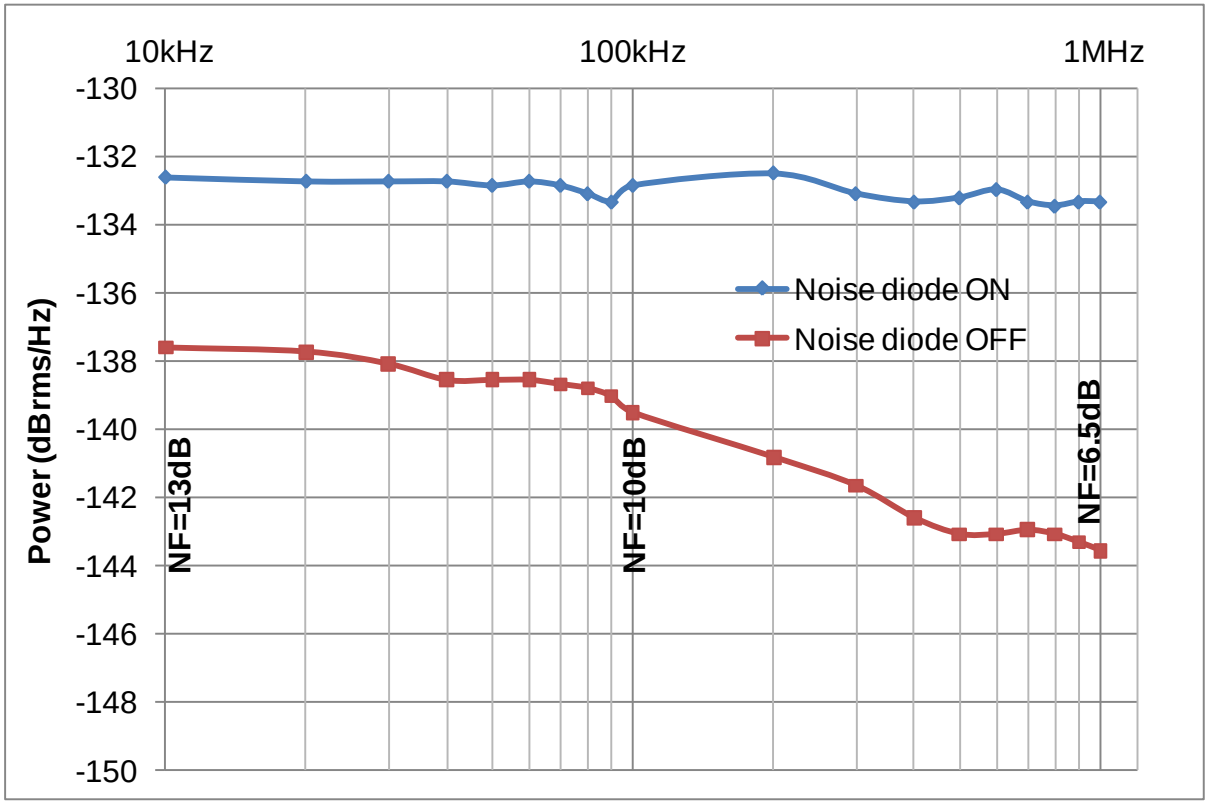
Typical Board Measurements (QFN plan)

Tamb.= +25°C, Vd=Vg= +5V

Typical SSB NF over IF Frequency



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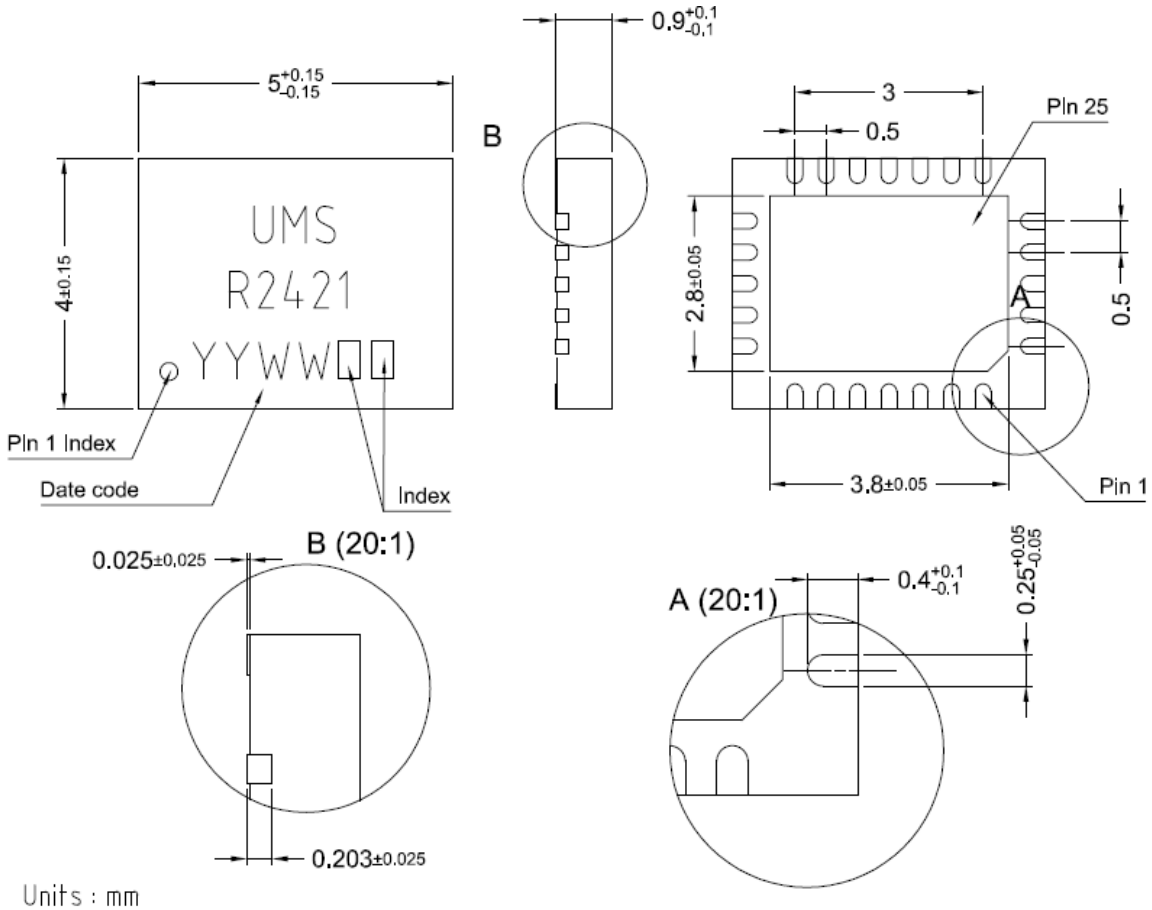
Package outline (1)



Matt tin, Lead Free (Green)	1- Gnd(2)	9- Gnd(2)	17- Gnd(2)
Units : mm	2- RX_2	10- LO	18- RX_1
From the standard : JEDEC MO-220 (VGGD)	3- Gnd(2)	11- Nc	19- Gnd(2)
	4- VD_LNA22	12- VG_BUF1	20- Nc
	5- VG_LNA2	13- VD_BUF1	21- VD_LNA11
25- GND	6- IF_2	14- IF_1	22- Nc
	7- VD_BUF2	15- VG_LNA1	23- VD_LNA12
	8- VG_BUF2	16- VD_LNA21	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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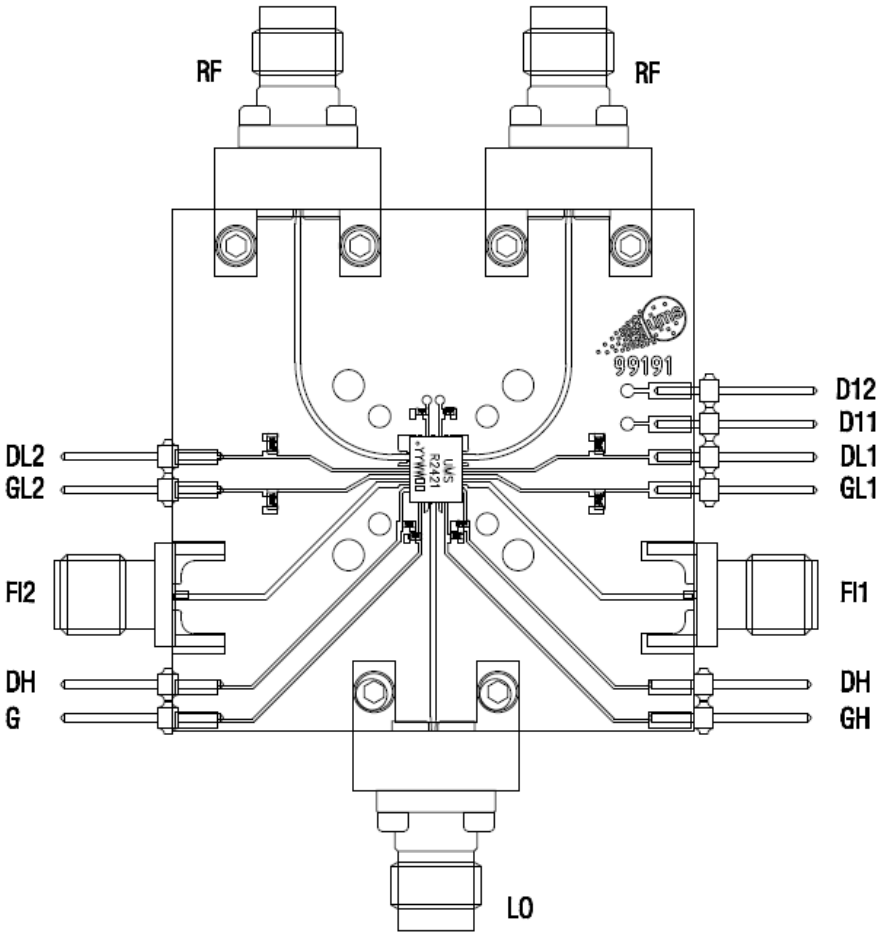
Evaluation mother board

- 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.



Notes

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

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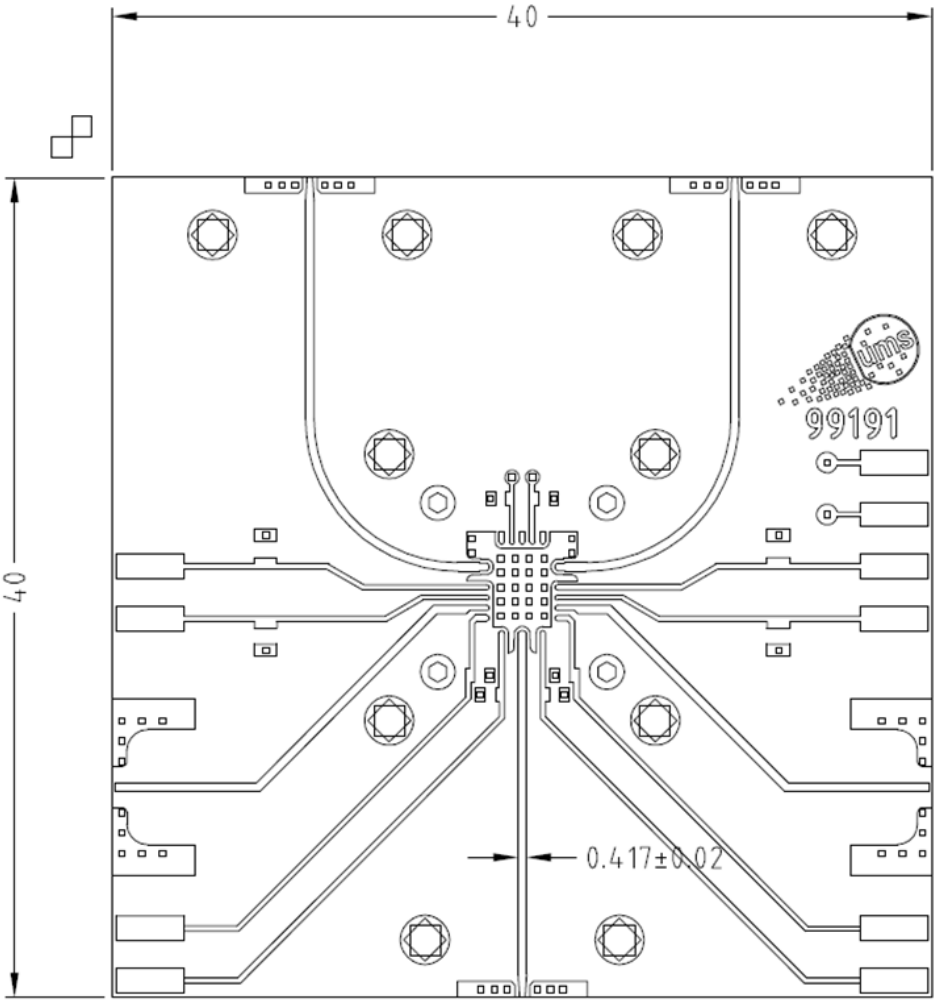
Recommended Test Fixture PCB layout (Ref. 99191)



MATERIAL
Ro4003 ROGERS
Multilayer

FINISH
Front side: electroless Au 0.08 – 0.1µm over electroless Ni 5µm
Back side: electroless Au 0.08 – 0.1µm over electroless Ni 5µm

Via holes

□	76	Ø0.2 Finish
⬡	4	Ø1 Finish
⯃	10	Ø2 Finish

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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 4x5 RoHS compliant package:	CHR2421-QEG/XY	
	Stick: XY = 20	Tape & reel: XY = 21

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