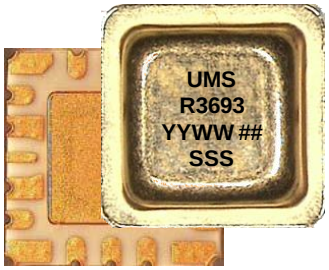
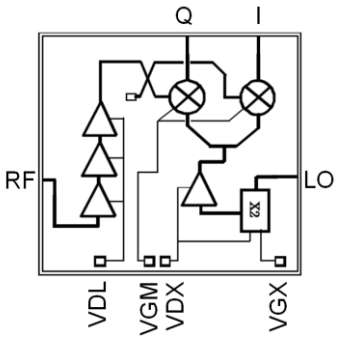
21-26.5GHz Integrated Down converter

GaAs Monolithic Microwave IC in SMD leadless package

Description

The CHR3693-FAB is a down-convertor in leadless surface mount hermetic metal ceramic 6x6mm² package.
It integrates a balanced cold FET mixer, a time two multiplier, and a RF LNA. The RF range is 21-26.5GHz and the IF range is DC-3.5GHz.
It is designed for a wide range of applications, from military to commercial and space communication systems.
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.

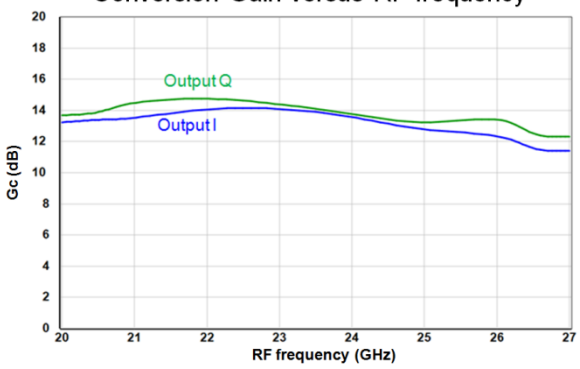




Main Features

- Broadband performance 21-26.5GHz
- Conversion gain (no external I/Q 90° coupling): 13dB
- NF: 2.5dB
- Input IP3: -5dBm
- DC bias: Vd=4Volt@Id=160mA
- 6x6mm² hermetic metal ceramic package
- Semiconductor Technology in EPPL
- Suitable for Space with proper screening

Conversion Gain versus RF frequency



Main Electrical Characteristics

Tamb.= +25°C, Vdx = Vdl = +4.0V, Vgx = -0.9V, Vgm = -0.7V

Symbol	Parameter	Min	Typ	Max	Unit
F_RF	RF frequency range	21		26.5	GHz
F_LO	LO frequency range	9		14	GHz
F_IF	IF frequency range	DC		3.5	GHz
Gc	Conversion gain		13		dB

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Electrical Characteristics

Tamb.= +25°C, Vdx = Vdl = +4.0V, Vgx = -0.9V, Vgm = -0.7V

Symbol	Parameter	Min	Typ	Max	Unit
F_RF	RF frequency range	21		26.5	GHz
F_LO	LO frequency range	9		14	GHz
F_IF	IF frequency range	DC		3.5	GHz
Gc	Conversion gain on output I / output Q		13		dB
Img Sup	Image Suppression(1)		20		dBc
NF	Noise Figure for IF>0.1GHz		2.5		dB
P_LO	LO Input power		2	5	dBm
IIP3	Input IP3		-5		dBm
LO_RL	LO return loss		-8		dB
RF_RL	RF return loss (21 to 24GHz) RF return loss (24 to 26.5GHz)		-8 -6.5		dB dB
LO/RF	Isolation LO → RF		45		dBc
2LO/RF	Isolation 2LO → RF		50		dBc
Id	Bias current(2) (Idl + Idx)		160		mA
Vd	Drain Voltage		4		V

(1) With external I/Q 90° hybrid coupler

(2) Typically, Idl= 90mA, Idx=70mA

These values are representative of “on board” measurements. Performances are provided in the package reference planes except for:

- LO_RL and RF_RL that are given in the planes of the connectors of the evaluation board.
- Image suppression that is given in the planes of the connectors of an external I/Q 90° hybrid coupler associated to the evaluation board

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Absolute Maximum Ratings (1)

Tamb.= +25°C

Symbol	Parameter	Values	Unit
Vd	Maximum drain bias voltage	4.5	V
Id	Maximum drain bias current	230	mA
Vg	Gate bias voltage	-2.0 to +0.4	V
P_RF	Maximum RF input power	10	dBm
P_LO	Maximum LO input power	10	dBm
Tj	Maximum channel temperature	175	°C

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

Temperature Range

Ta	Operating temperature range	-55 to +85	°C
Tstg	Storage temperature range	-55 to +150	°C

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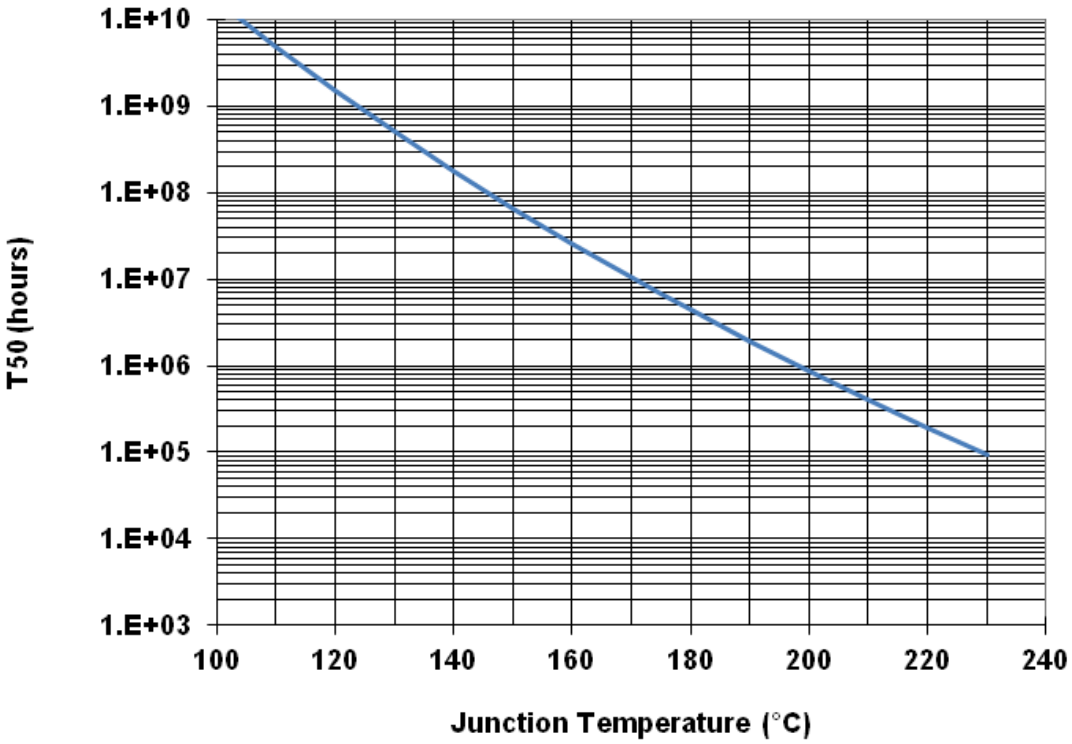
Device thermal performances

All the figures given in this section are obtained assuming that the FAB 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)	Vdx=Vdl = +4.0V, Vgx=-0.9V, Vgm=-0.7V Id=160mA	125	67.5	1.0E09

(1) Assuming 85°C Tcase



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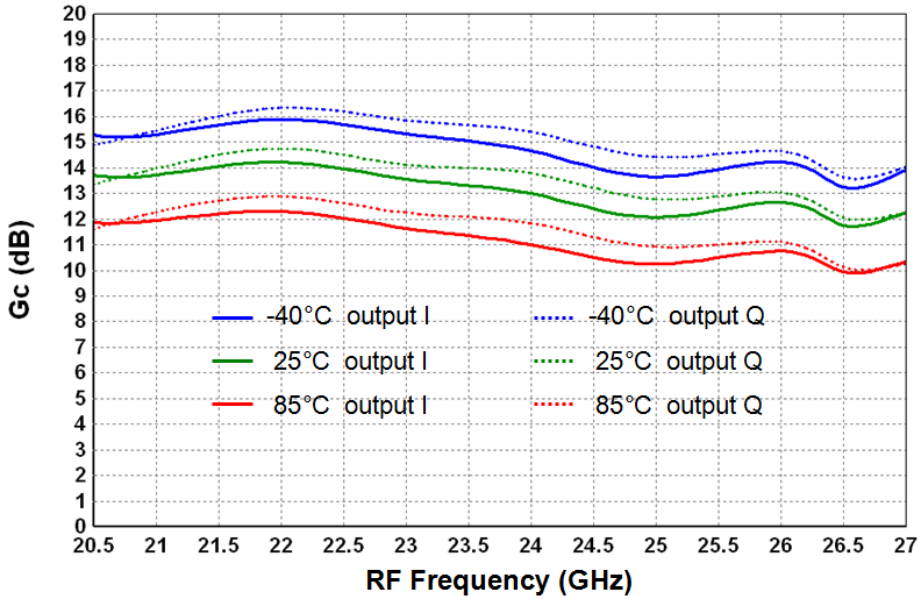
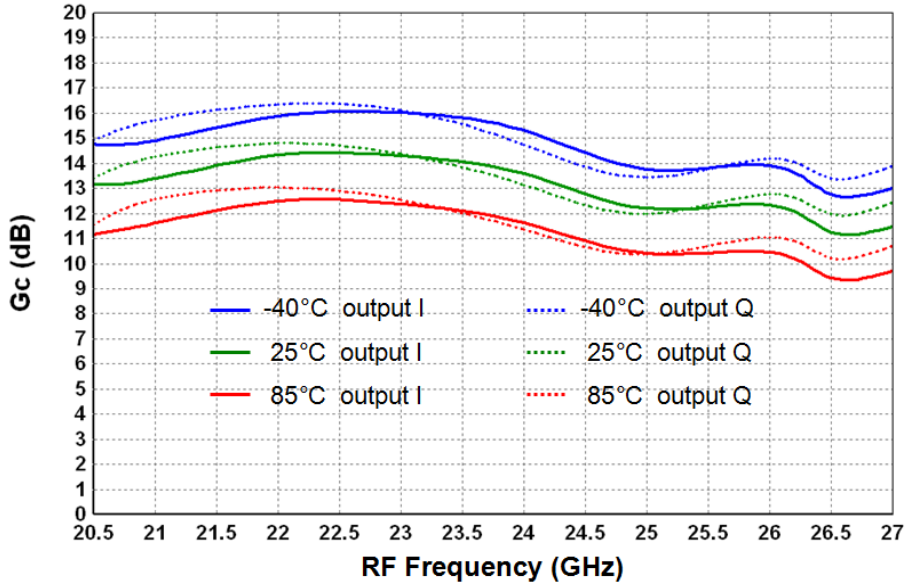
Typical Board Measurements

Vdx = Vdl = 4V, Typical Vgx = -0.9V & Vgm = -0.7V
P_LO = 2dBm, F_IF = 2GHz
Board losses have been de-embedded (results in package access planes)

Infradyne mode Conversion Gain versus frequency on output I and Q
F_RF = 2xF_LO-F_IF



Supradyne mode Conversion Gain versus frequency on output I and Q
F_RF = 2xF_LO+F_IF



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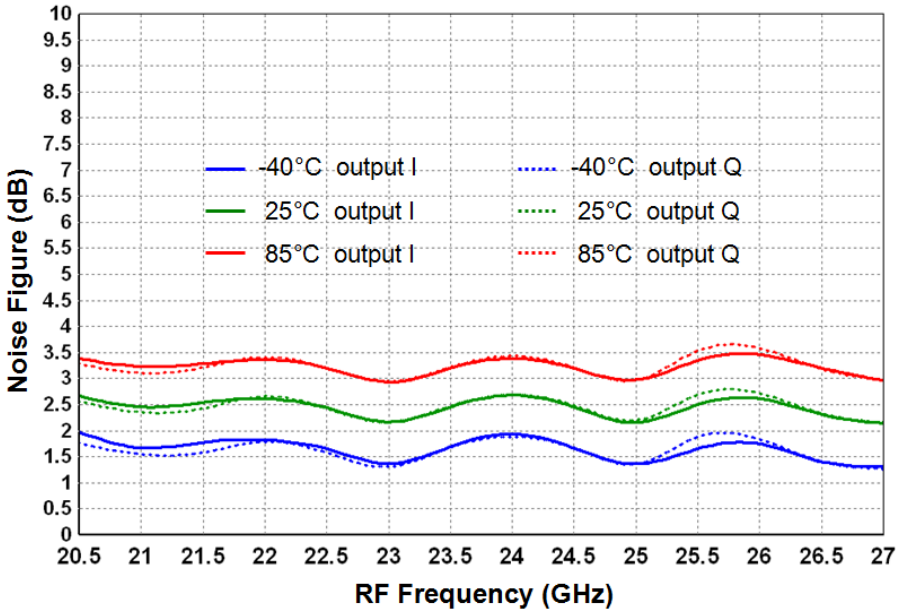
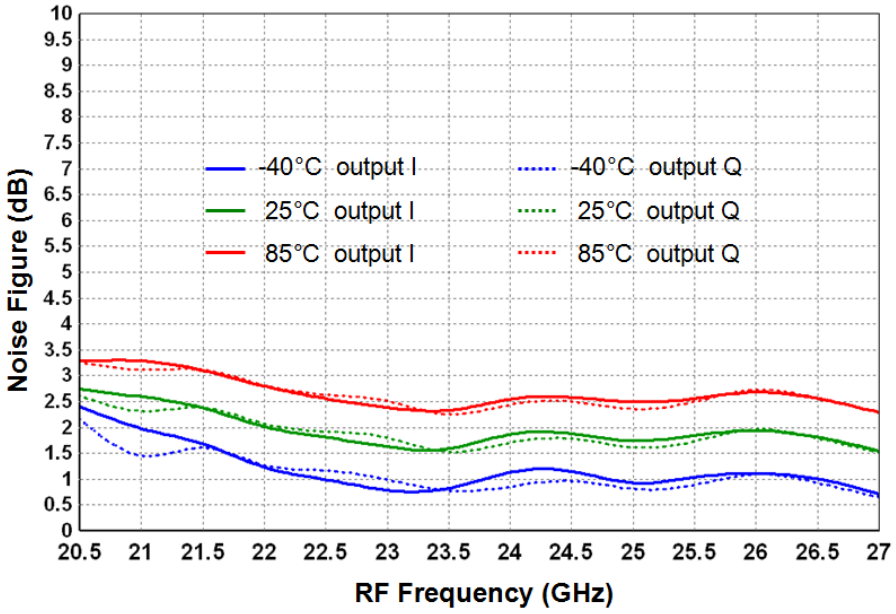
Typical Board Measurements

Vdx = Vdl = 4V, Typical Vgx = -0.9V & Vgm = -0.7V
P_LO = 2dBm, F_IF = 2GHz
Board losses have been de-embedded (results in package access planes)

Infradyne mode Noise Figure versus frequency on output I and output Q
F_RF = 2xF_LO-F_IF



Supradyne mode Noise Figure versus frequency on output I and output Q
F_RF = 2xF_LO+F_IF



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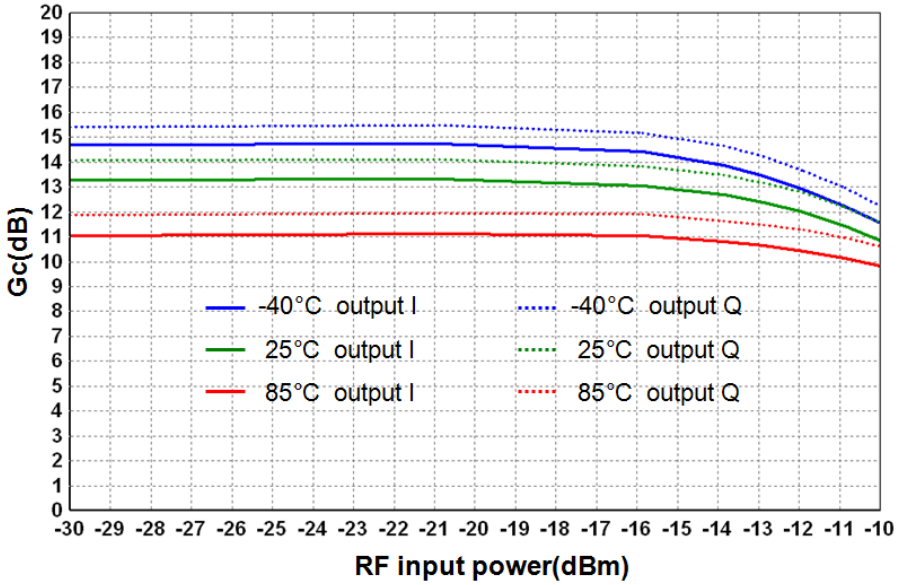
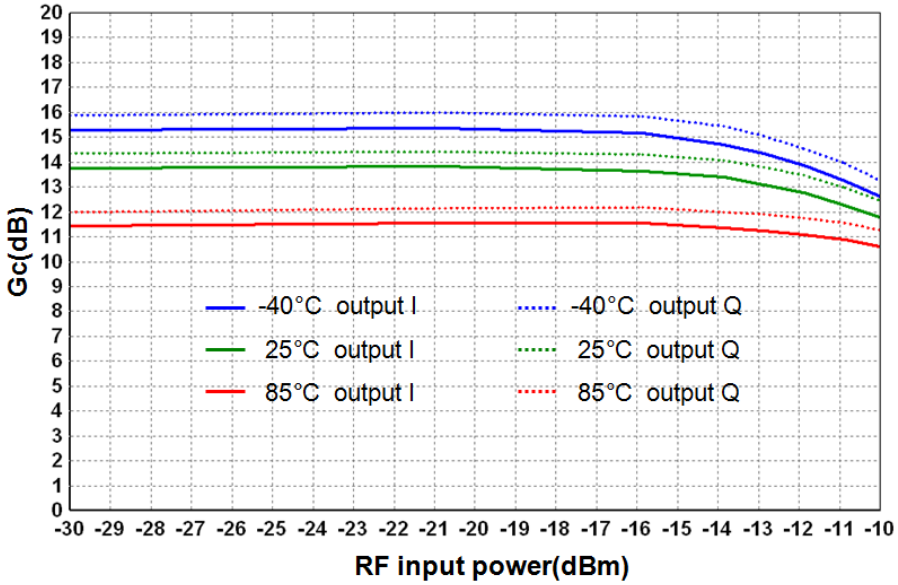
Typical Board Measurements

Vdx = Vdl = 4V, Typical Vgx = -0.9V & Vgm = -0.7V
P_LO = 2dBm
Board losses have been de-embedded (results in package access planes)

Gain compression versus P_RF in infradyne mode
F_RF = 24GHz & F_IF = 3GHz



Compression versus PRF in supradyne mode
F_RF = 24GHz & F_IF = 3GHz



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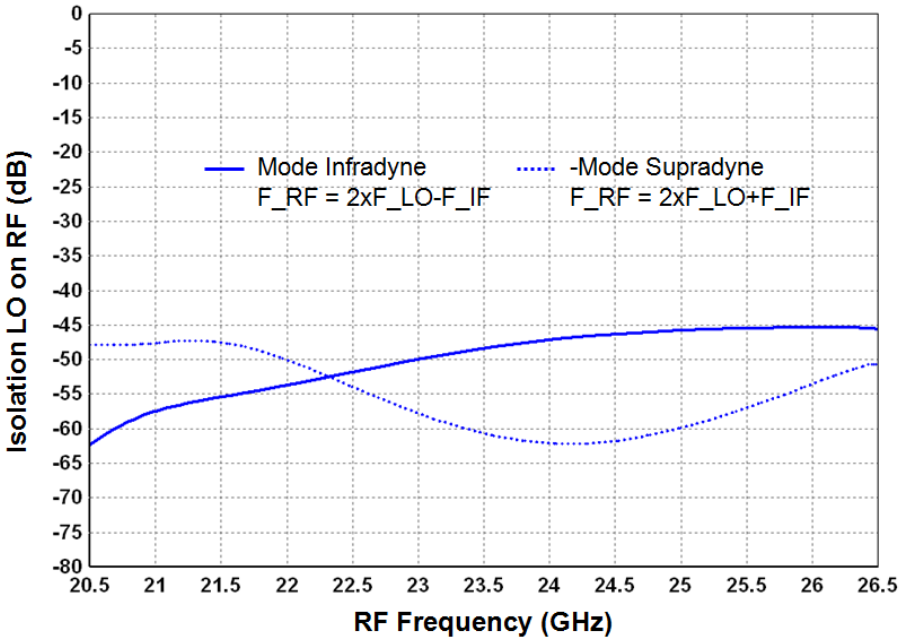
Typical Board Measurements

Tamb = 25°C, Vdx = Vdl = 4V, Typical Vgx = -0.9V & Vgm = -0.7V
Board losses have been de-embedded (results in package access planes)

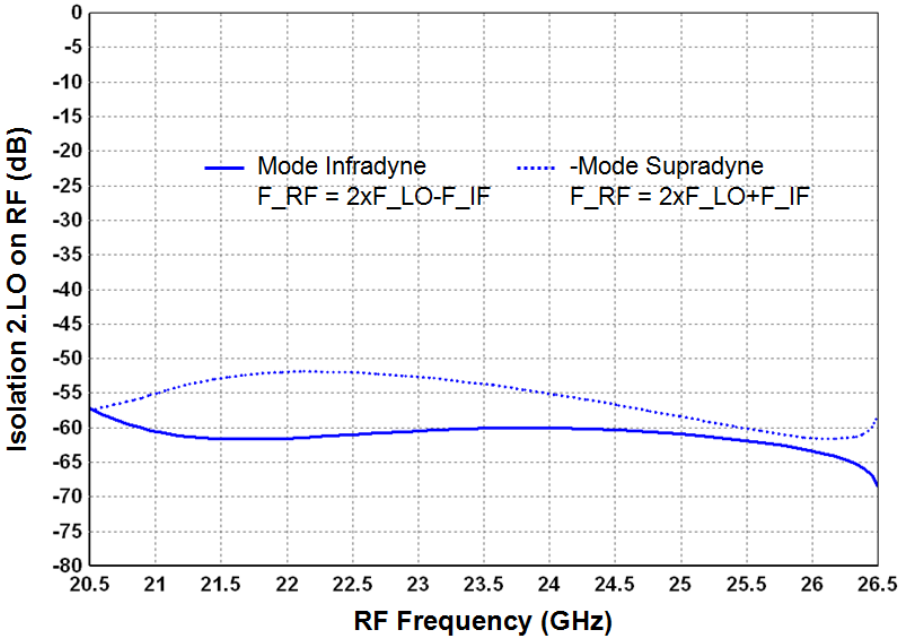
Isolation LO/RF

P_LO = 5dBm



Isolation 2.LO/RF

P_LO = 5dBm



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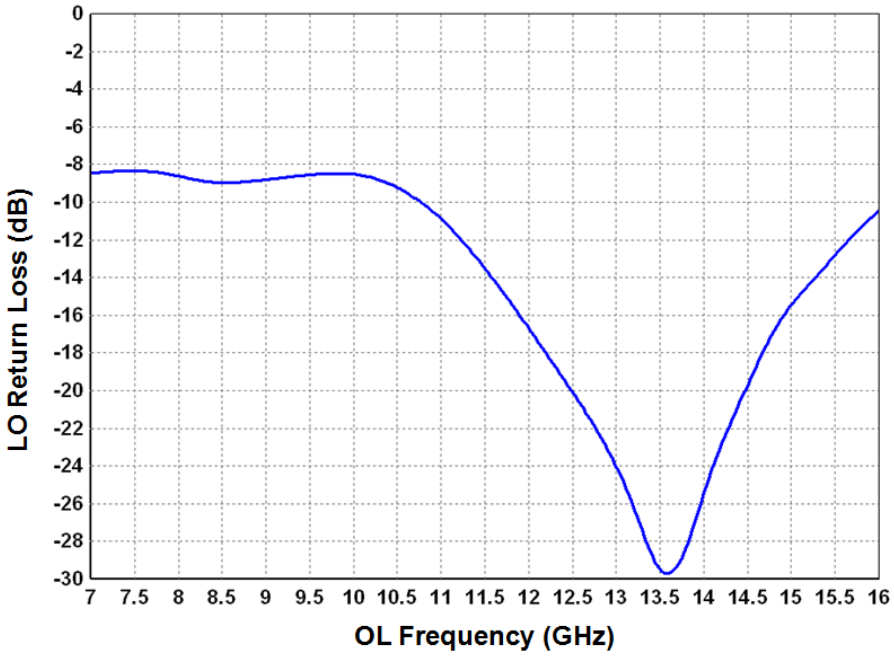
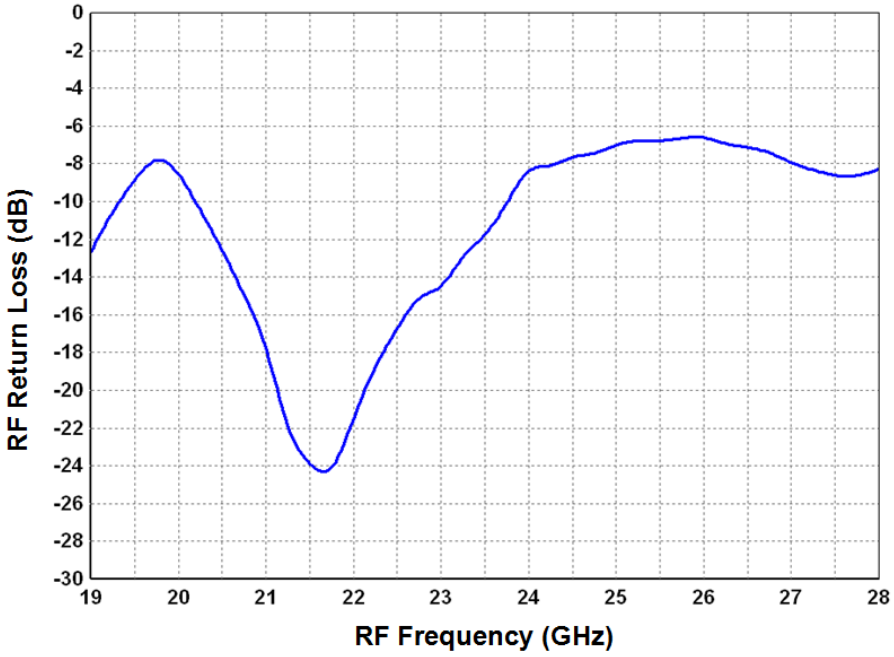
Typical Board Measurements

Tamb = 25°C, Vdx = Vdl = 4V, Typical Vgx = -0.9V & Vgm = -0.7V
Measurements in the planes of the connectors of the evaluation board.

LO Return Loss @ P_LO = 0dBm



RF Return Loss @ P_RF = -30dBm



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Typical Board Measurements

Tamb = 25°C, Vdx = Vdl = 4V, Typical Vgx = -0.9V & Vgm = -0.7V
Measurements in the planes of the connectors of the external hybrid I/Q 90° coupler.

Image rejection @ P_LO = 2dBm FI = 1GHz

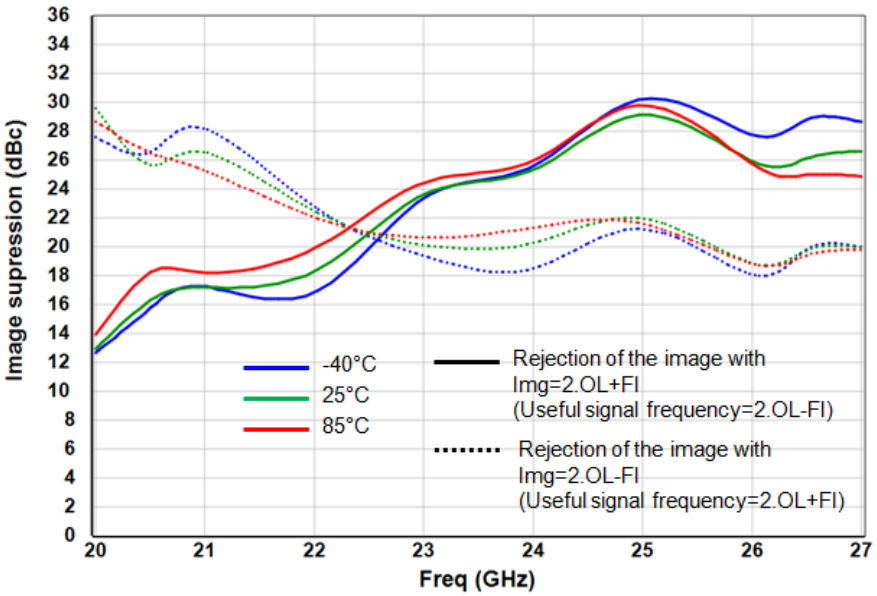
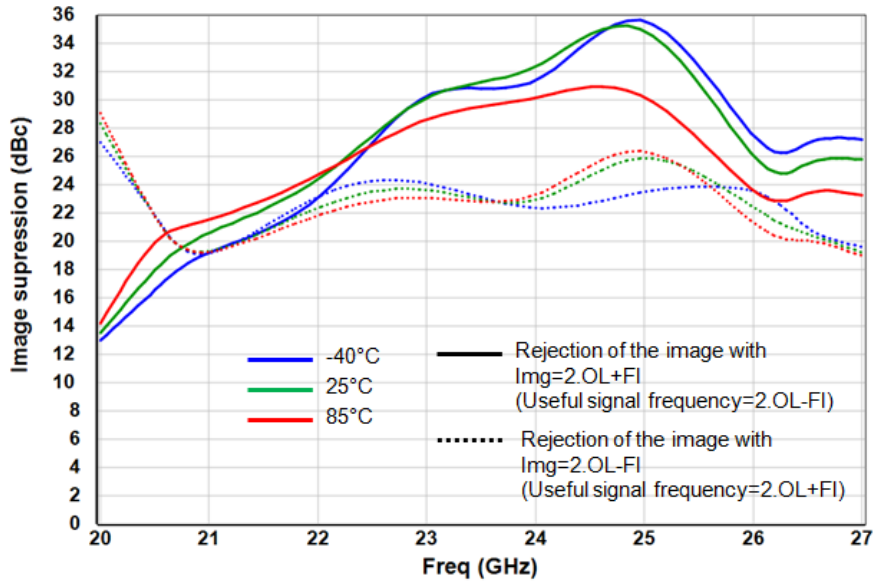


Image rejection @ P_LO = 2dBm FI = 2GHz



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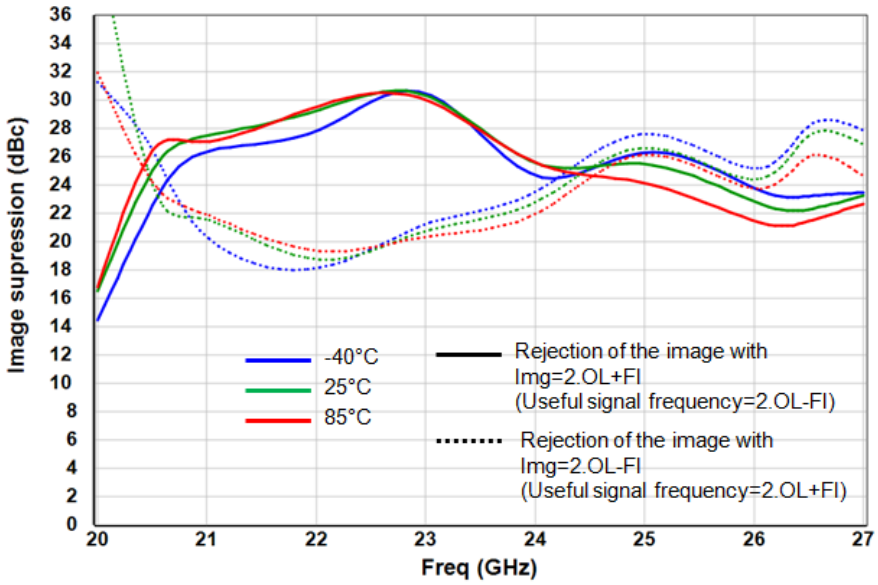
Typical Board Measurements

Tamb = 25°C, Vdx = Vdl = 4V, Typical Vgx = -0.9V & Vgm = -0.7V
Measurements in the planes of the connectors of the external hybrid I/Q 90° coupler.

Image rejection @ P_LO = 2dBm FI = 3.5GHz



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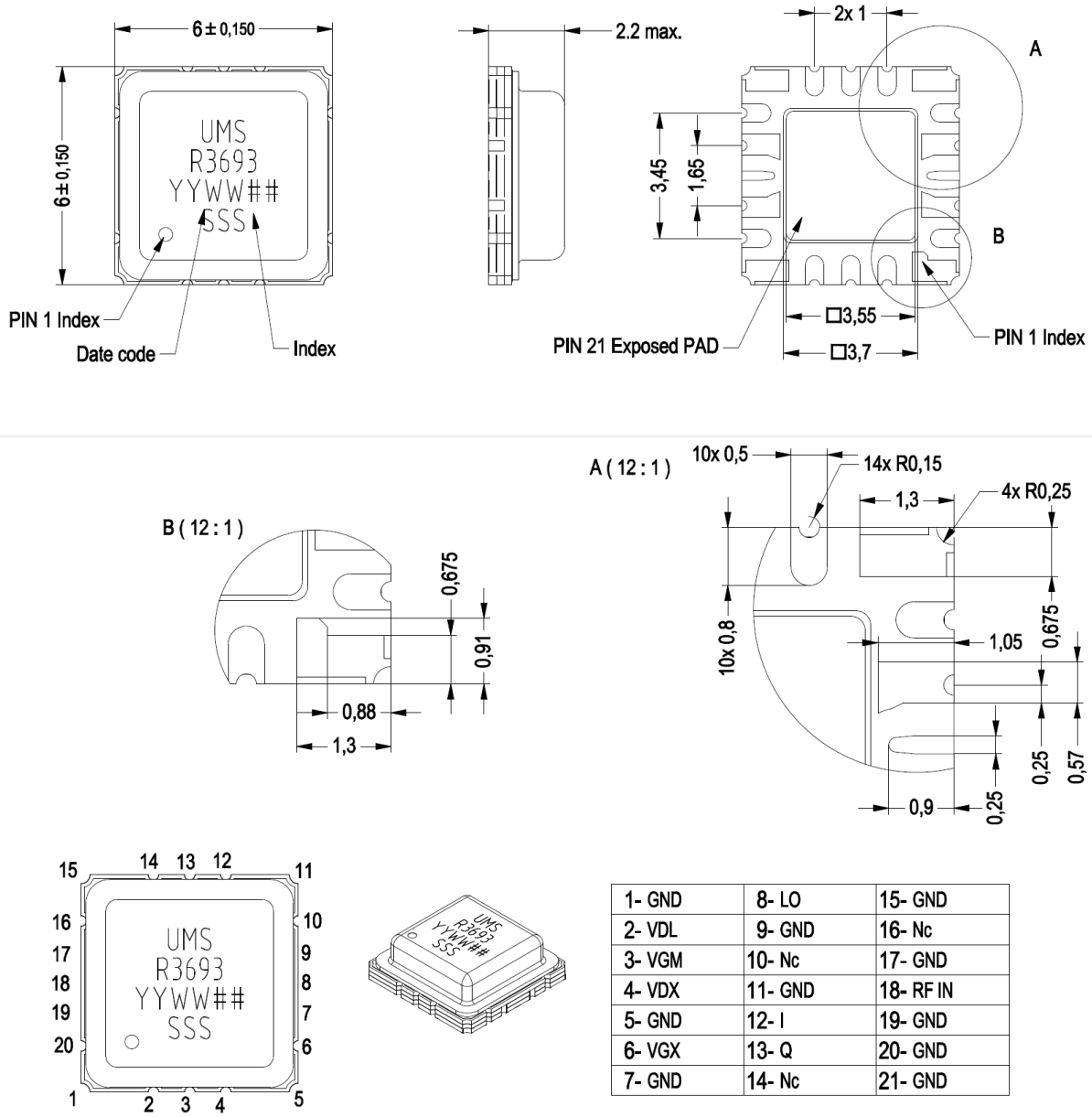
Package outline (1)



1- GND	8- LO	15- GND
2- VDL	9- GND	16- Nc
3- VGM	10- Nc	17- GND
4- VDX	11- GND	18- RF IN
5- GND	12- I	19- GND
6- VGX	13- Q	20- GND
7- GND	14- Nc	21- GND

All dimensions are in mm

(1) The package outline drawing included to this data-sheet is given for indication. Refer to the application note AN0024 (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.

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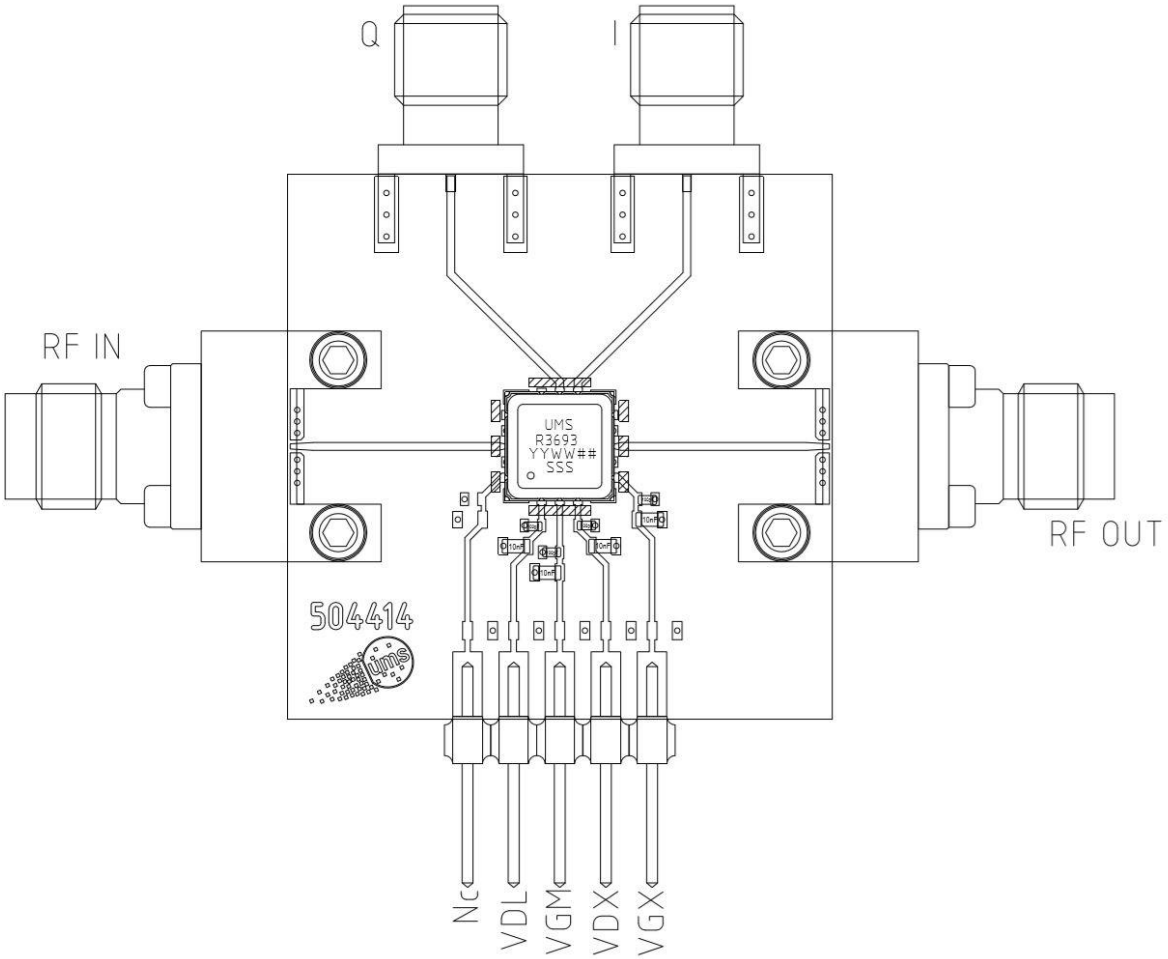
Evaluation board description

■ 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 100pF and 10nF are recommended on each DC access (VDL / VGM / VDX / VGX)



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Recommended package footprint for FAB Package

Refer to the application note AN0024 available at https://www.ums-rf.com for package foot print recommendations and exact package dimensions.

SMD mounting procedure for FAB Package

For the mounting process standard techniques involving solder paste and a suitable reflow process can be used. For further details, see application note AN0024 available 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

FAB package:	CHR3693-FAB/XY Waffle pack: XY = 24

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