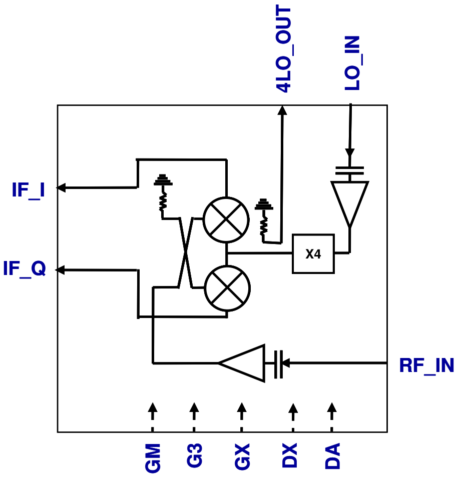
40-44GHz Down converter

GaAs Monolithic Microwave IC

Description

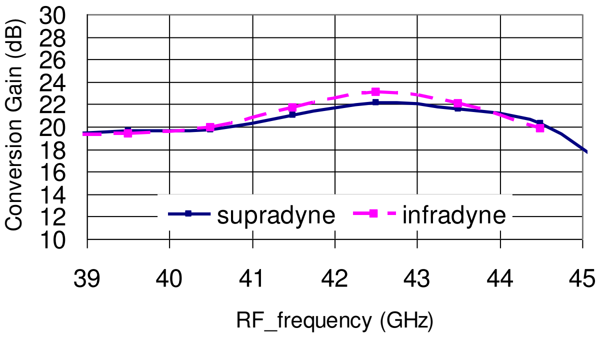
The CHR2299-99F is a down converter multifunction chip, which integrates LO X4 multiplier, a balanced cold FET mixer and a RF LNA.
It is designed for a wide range of applications, from military to commercial communication systems.
The circuit is manufactured with a power pHEMT process, 0.15µm gate length, via holes through the substrate, air bridges and electron beam gate lithography.

It is available in chip form.



Main Features

- ■ 40-44GHz RF bandwidth
- ■ 21dB conversion gain
- ■ x4 LO frequency multiplier
- ■ x4 LO output port
- ■ > 12dB image rejection
- ■ DC bias: Vd = 4V @ Id = 240mA
- ■ Chip size 3.97x2.25x0.1mm



Main Characteristics

Tamb.= +25℃

Symbol	Parameter	Min	Typ	Max	Unit
F_RF	RF frequency range	40		44	GHz
F_LO	LO frequency range	9.5		11.5	GHz
F_IF	IF frequency range	DC		2.0	GHz
Gc	Conversion gain		21		dB

Electrical Characteristics

Tamb. = +25°C

Symbol	Parameter	Min	Typ	Max	Unit
F_RF	RF frequency range	40		44	GHz
F_LO	LO frequency range	9.5		11.5	GHz
F_IF	IF frequency range	DC		2.0	GHz
Gc	Conversion gain		21		dB
Im rej	Image rejection		12		dB
P_LO	LO Input power		0		dBm
NF	Noise figure for IF>0.1GHz		4.5		dB
IMD3	Intermodulation level at Pin_{2tones} = -30dBm		45		dBc
RL_RF	RF Return Loss		6		dB
RL_LO	LO Return Loss		12		dB
P_4FLO	Output power at 4LO_OUT port		-1		dBm
4xFLO_Lk	4xFLO leakage on RF port		-38		dBm
DX, DA	LO multiplier, buffer and LNA biasing		4		V
GM	Mixer gate biasing		-0.6		V
G3	LO buffer gate biasing		-0.3		V
GX	Multiplier gate biasing		-1.2		V
IdT	Total biasing current		240		mA

Electrostatic discharge sensitive device observe handling precautions!
These values are representative of chip on board measurements with a 90° hybrid coupler.

Absolute Maximum Ratings (1)

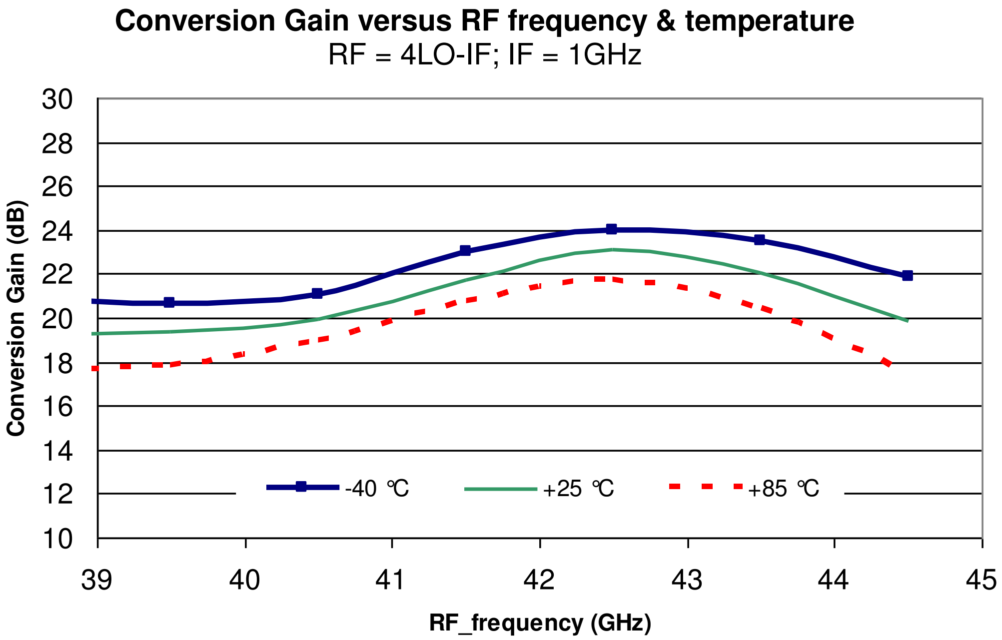
Tamb.= +25°C

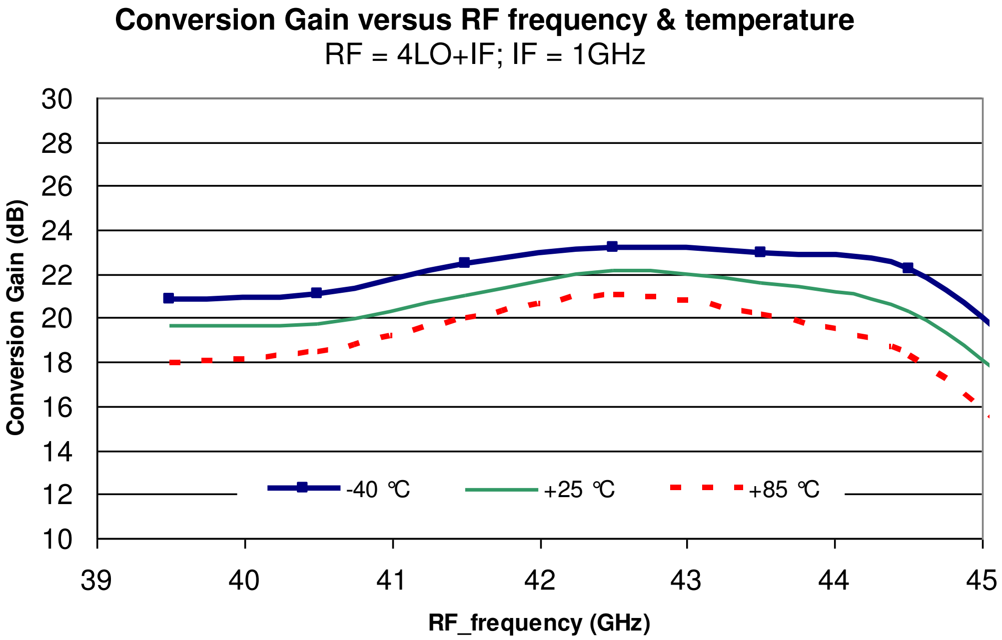
Symbol	Parameter	Values	Unit
DX, DA	LO multiplier, buffer and LNA biasing	4.5	V
IdT	Total biasing current	300	mA
GM, G3, GX	Gate bias voltage	-2; +0.6	V
P_LO	Maximum peak input LO power overdrive (2)	10	dBm
Pin_RF	Maximum peak input RF power overdrive (2)	-5	dBm
Tj	Junction temperature	175	°C
Ta	Operating temperature range	-40 to +85	°C
Tstg	Storage temperature range	-55 to +155	°C
RTh	Thermal resistance, Tback side = +85 °C, Ptotal = 0.96 W	80	°C/W

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

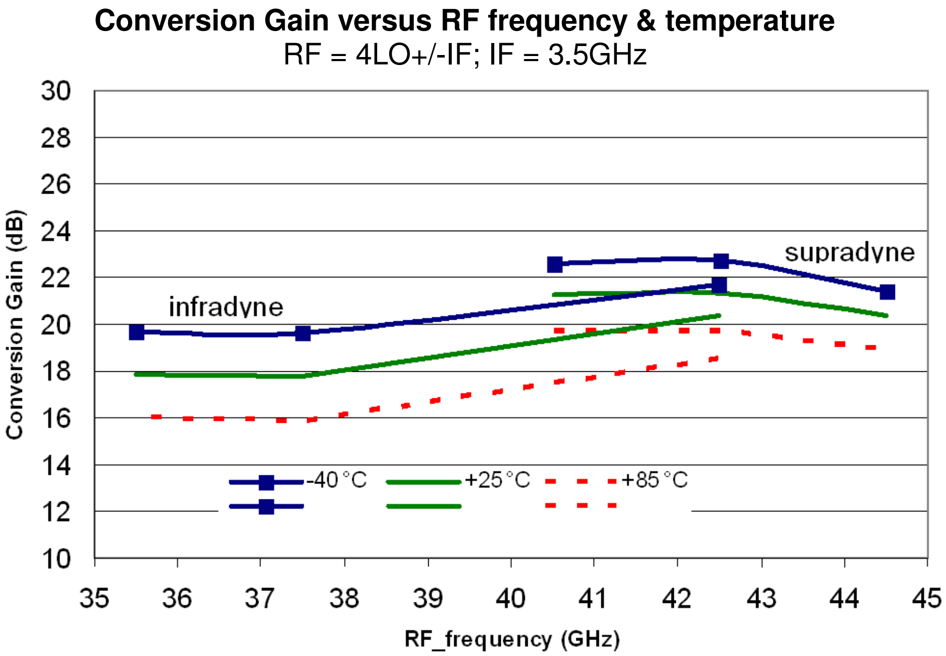
Typical chip on board Measurements in Temperature

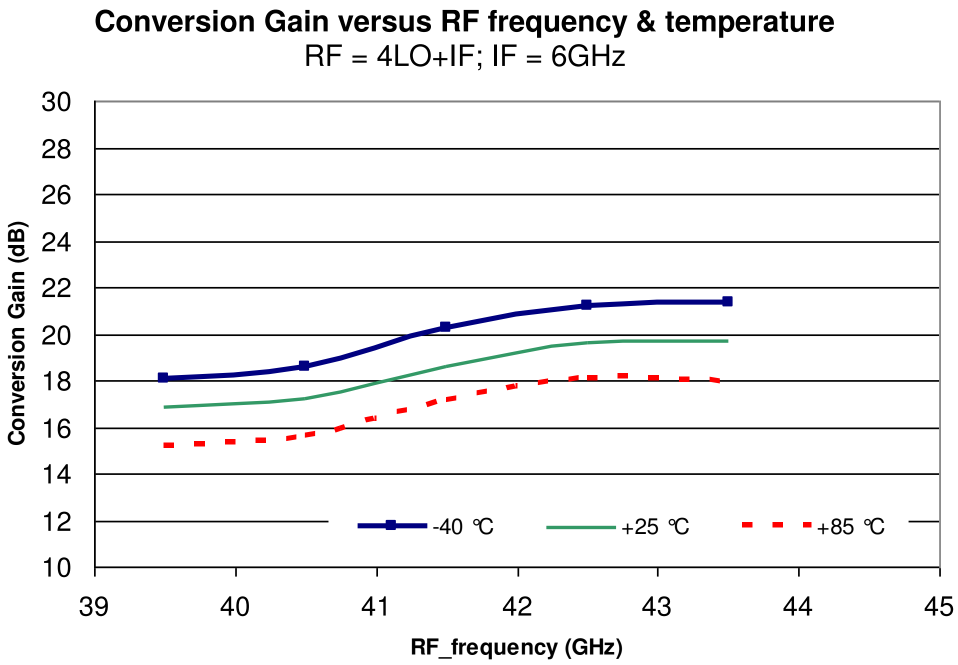
DX= DA = 4V, GM = -0.6V, G3 = -0.3V, GX = -1.2V, P_LO = 0dBm
These values are representative of onboard measurements as defined on the section ”Evaluation mother board”. The losses are de-embedded.



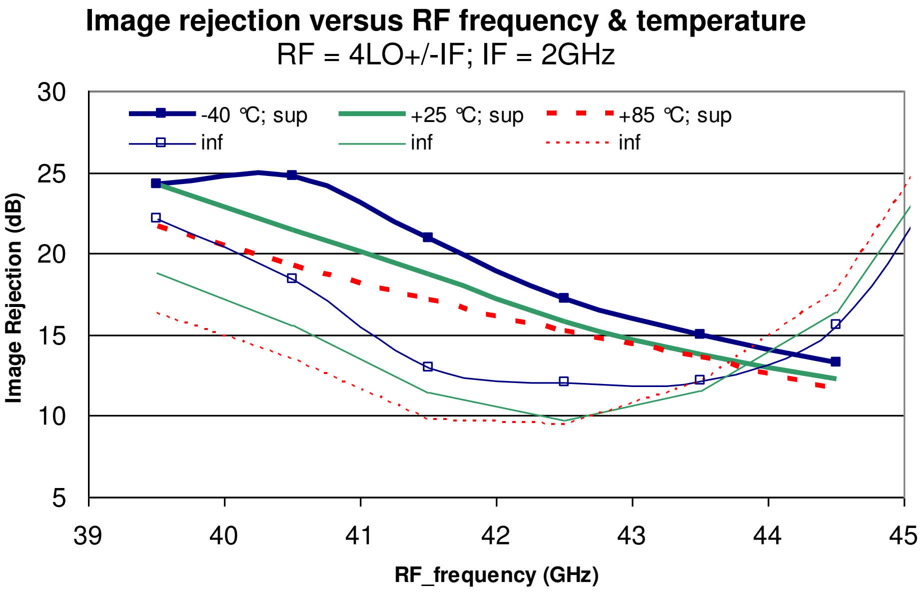


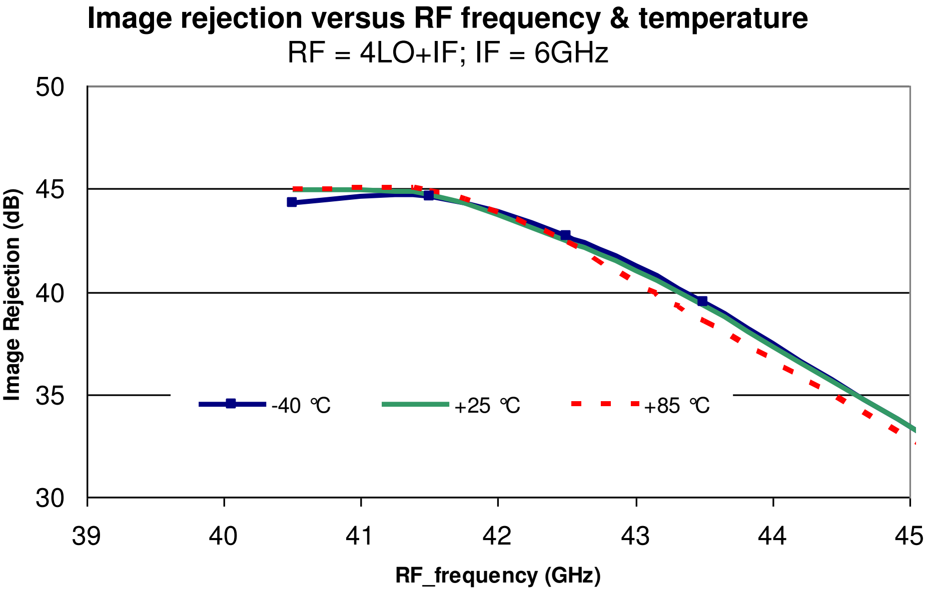
Typical chip on board Measurements in Temperature





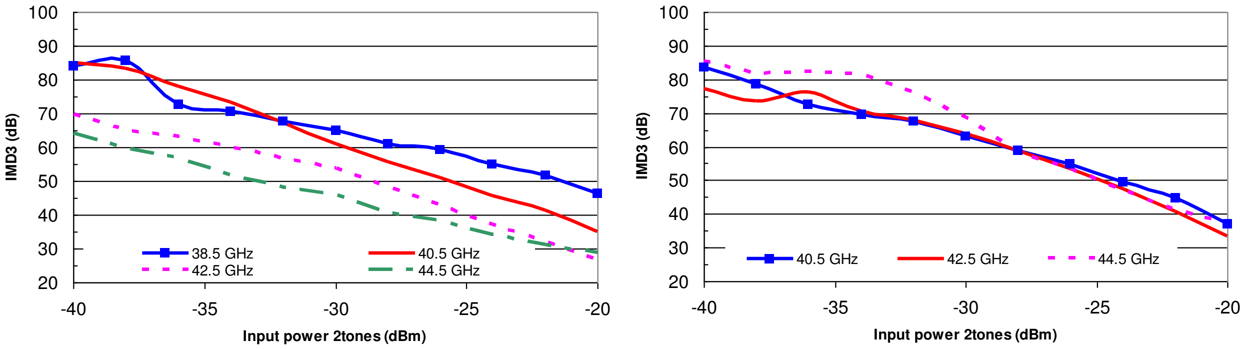
Typical chip on board Measurements in Temperature





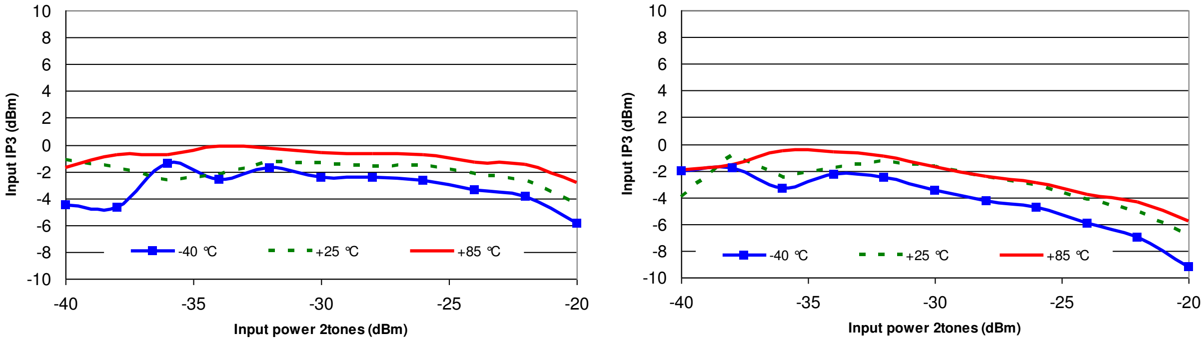
Typical chip on board Measurements

IMD3 versus RF frequency & Input power


Infradyne: IF = 2GHz

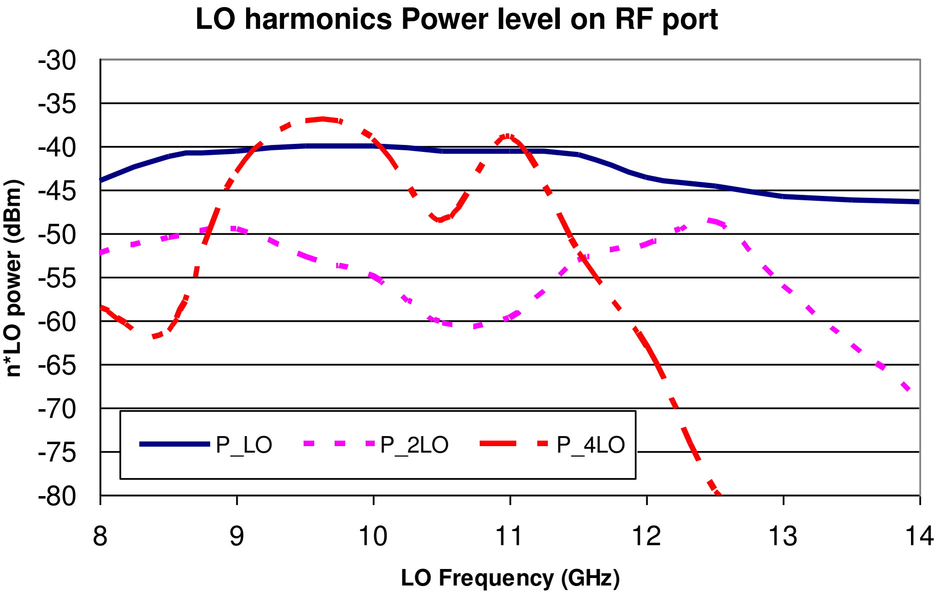
Supradyne: IF = 2GHz

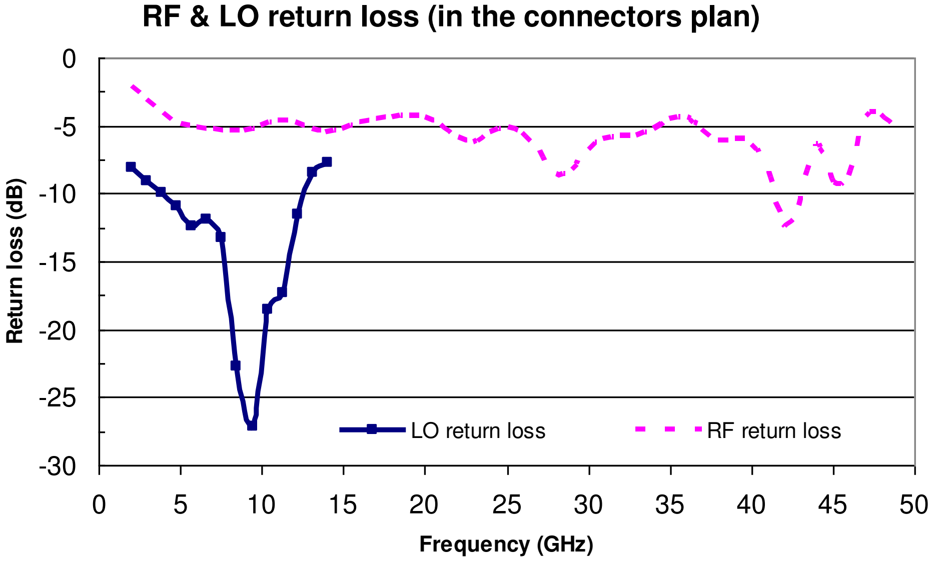
Input IP3 versus Temperature & Input power


Supradyne: RF = 40.5GHz; IF = 2GHz

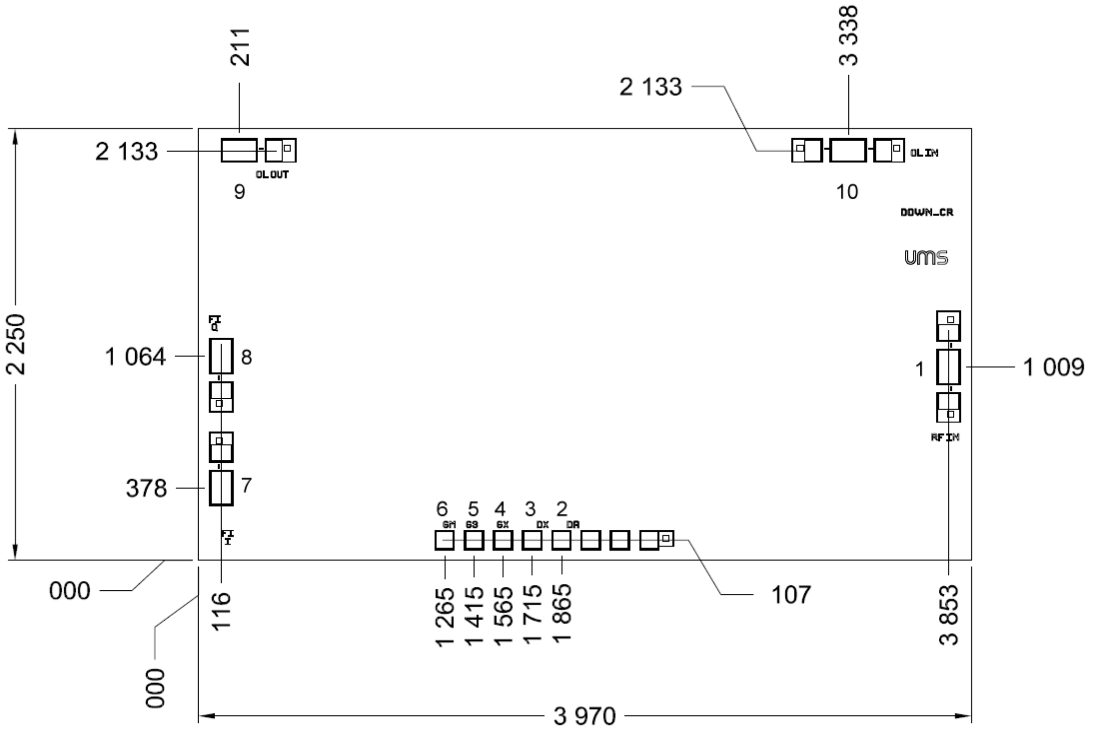
Supradyne: RF = 40.5GHz; IF = 3.5GHz

Typical chip on board Measurements





Mechanical data



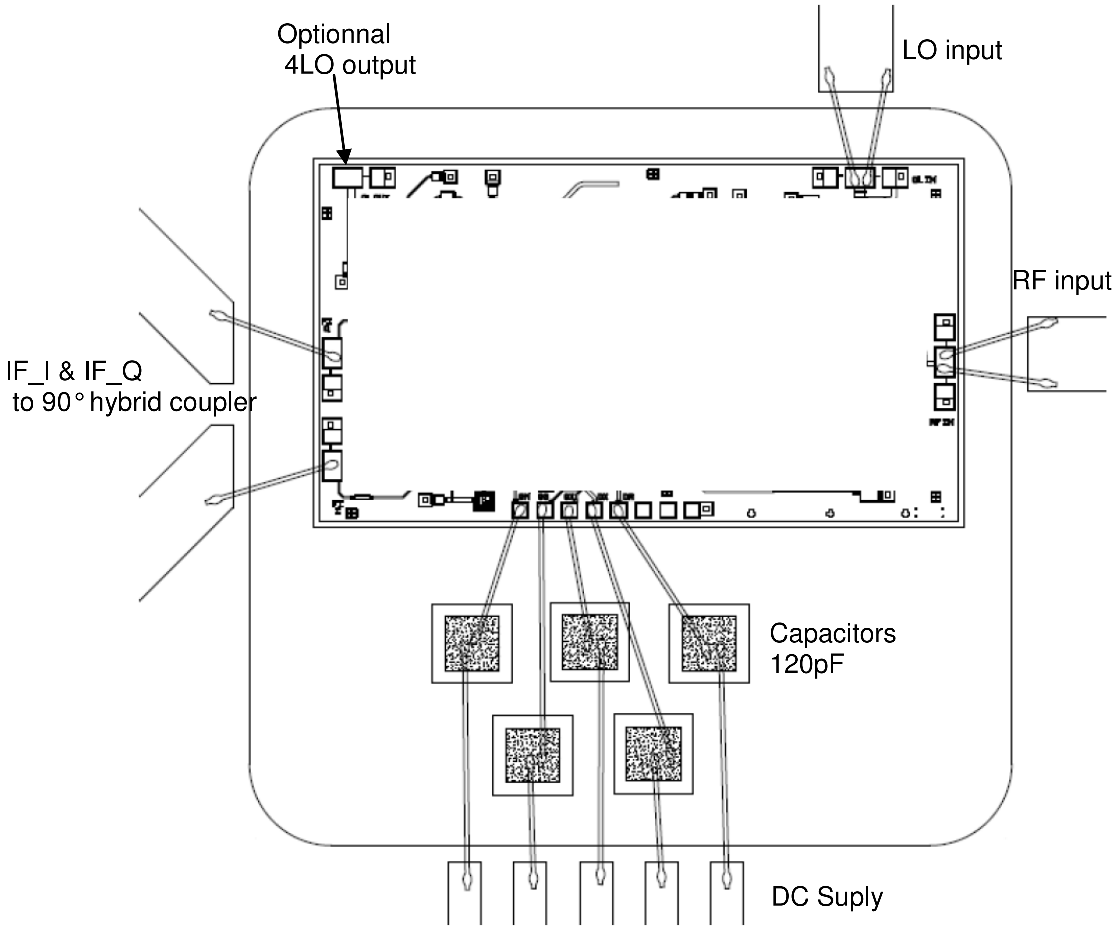
Chip thickness: 100 µm, units: µm, tol:+/- 35 µm
DC pads = 92x92 µm, RF pads = 178x114 µm

Pin number	Pin name	Description
1	RF_IN	RF input
2	DA	LNA drain voltage
3	DX	Multiplier & Buffer drain voltage
4	GX	Multiplier gate voltage
5	G3	LO buffer gate voltage
6	GM	Mixer gate voltage
7, 8	IF_I & IF_Q	IF outputs
9	4LO_OUT	Output 4xLO frequency
10	LO_IN	LO input

Recommended biasing

Pin Name	Pin Number	Parameter	Nominal value
GM	6	Mixer gate voltage	-0.6 V
G3	5	LO buffer gate voltage	-0.3 V
GX	4	X4 gate voltage	-1.2 V
DX	3	X4 and buffer drain voltage	4 V
DA	2	LNA Drain voltage	4 V

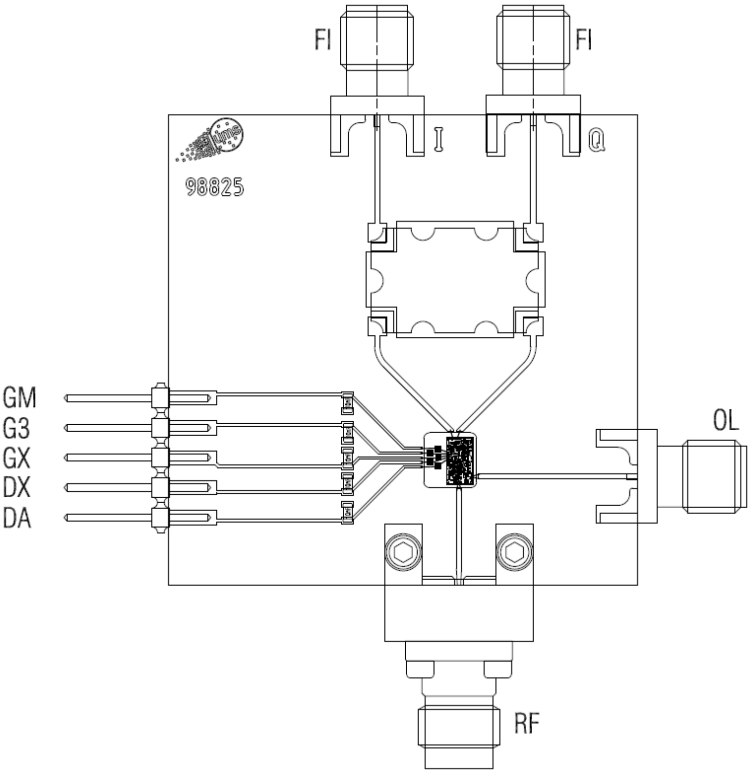
Chip assembly



Note: Supply feed should be capacitively bypassed. 25µm diameter gold wire is recommended

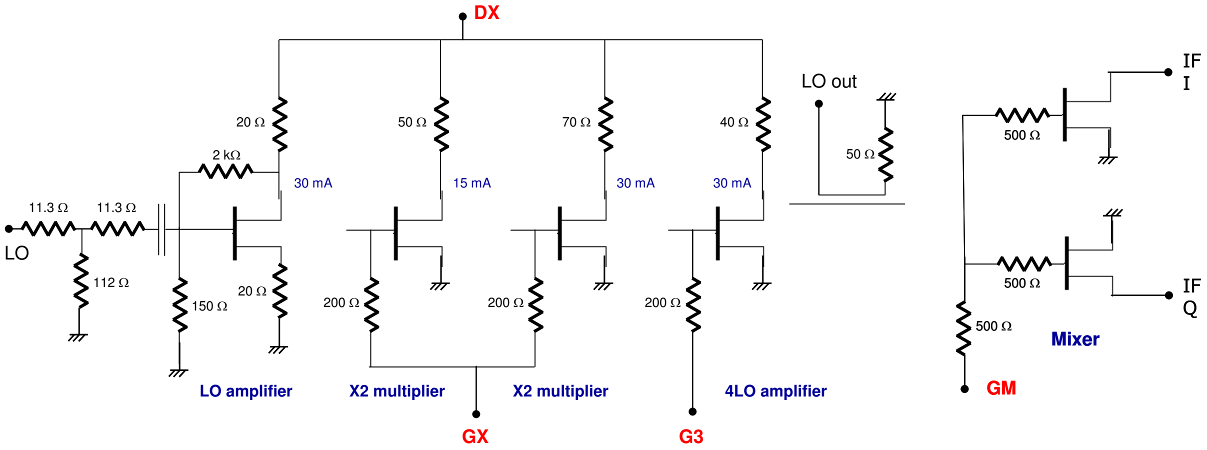
Evaluation mother board

Based on typically Ro4003 / 8 mils or equivalent.
Decoupling capacitors of 10nF ±10% and chip 120pF ±10%
90° hybrid coupler: 1-2GHz or 2-4GHz

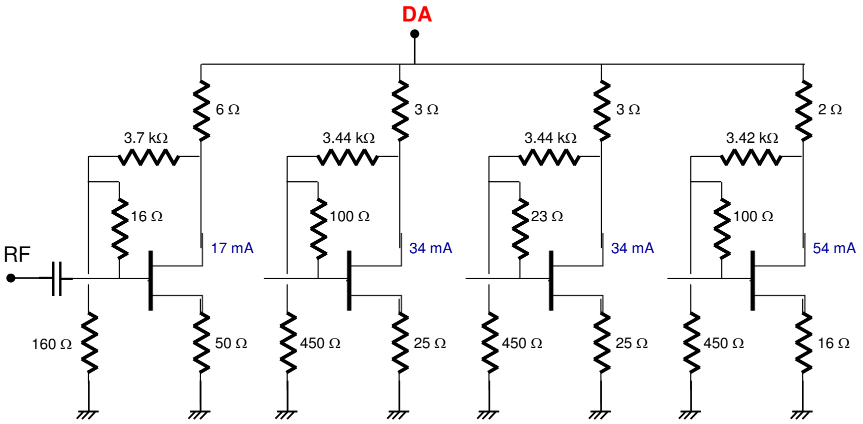


DC Schematic

LO multiplier and buffers: 4V, 105mA



LNA: 4V, 140mA



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 products.

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.

Ordering Information

Chip form:	CHR2299-99F/00