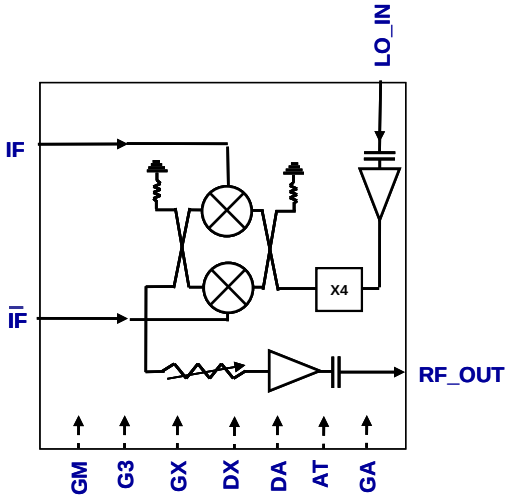
40-44GHz Up converter

GaAs Monolithic Microwave IC

Description

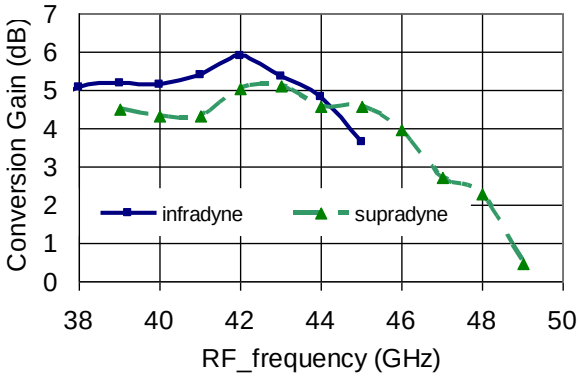
The CHU2299-99F is an up converter multifunction chip, which integrates LO X4 multiplier, a balanced cold FET mixer and a RF amplifier with gain control.
It is designed for a wide range of applications, from military to commercial communication systems.
The circuit is manufactured with a power pHEMT 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
- 5dB conversion gain
- 20dB of gain control
- x4 LO frequency multiplier
- 16dBm output IP3
- DC bias: Vd = 4V @ Id = 250mA
- Chip size 3.97x2.25x0.1mm



Main 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
G_c	Conversion gain		5		dB

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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
G_c	Conversion gain @min. attenuation		5		dB
ΔG	Gain control range		20		dB
P_{LO}	LO Input power		1		dBm
NF	Noise figure at gain max Noise figure all case		13 27		dB
OIP3	Output IP3@ min. attenuation Output IP3@ max. attenuation		16 4		dBm
RL	RF & LO Return Loss		12		dB
$4xF_{LO}$_lk	4xLO leakage on RF port @min. Att.		-5		dBm
DX, DA	LO multiplier, buffer and RF amplifier biasing		4		V
GM	Mixer DC gate biasing		-0.6		V
G3	LO buffer gate biasing		-0.3		V
GX	Multiplier gate biasing		-1.2		V
GA	RF amplifier gate biasing		-0.5		V
AT	Attenuation voltage control	-1.5		0.5	V
Id	Drain current		250		mA

Electrostatic discharge sensitive device observe handling precautions!
These values are representative of chip on board measurements with an external 180° hybrid balun between IF & IFb.

Absolute Maximum Ratings (1)

Tamb.= +25°C

Symbol	Parameter	Values	Unit
DX, DA	LO multiplier, buffer and RF amplifier biasing	4.5	V
Id	Drain bias current	310	mA
G3, GA	Amplifier gate biasing	-2; +0.6	V
GX, GM	Multiplier and mixer gate biasing	-2; +0.6	V
AT	Attenuation voltage control	-2	V
P_LO	Maximum peak LO input power overdrive (2)	10	dBm
Pin_RF	Maximum peak RF input power overdrive (2)	17	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 = 1 W	73	°C/W

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

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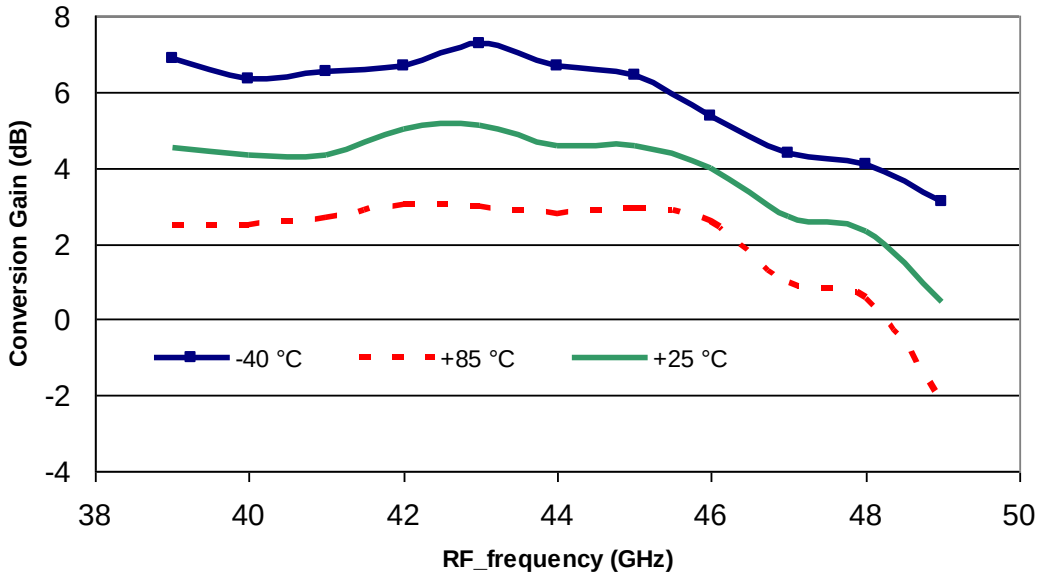
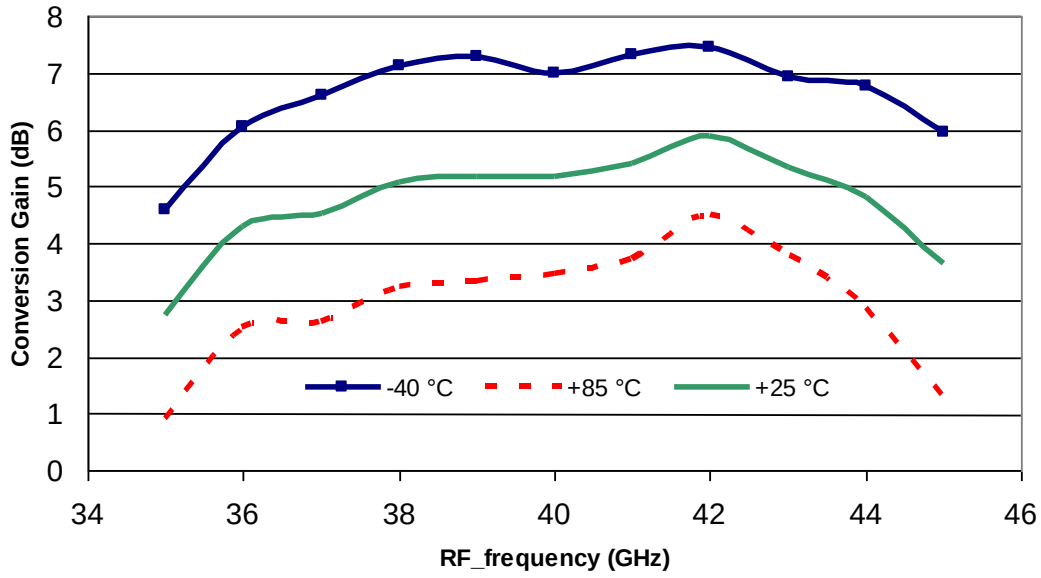
Typical chip on board Measurements in Temperature

DX = DA = 4V, GA = -0.5V, GM = -0.6V, G3 = -0.3V, GX = -1.2V, P_LO = 1dBm.
These values are representative of onboard measurements as defined on the paragraph ”Evaluation mother board”. The losses are de-embedded.

Conversion Gain versus RF frequency & temperature
RF= 4LO+IF; IF = 2GHz; AT = -1.5V



Conversion Gain versus RF frequency & temperature
RF= 4LO-IF; IF = 2GHz; AT = -1.5V



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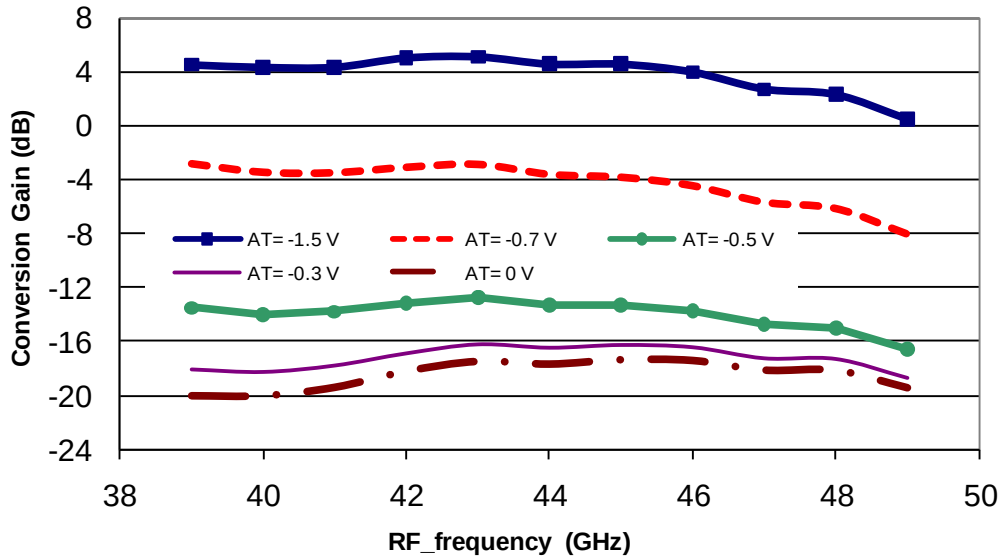
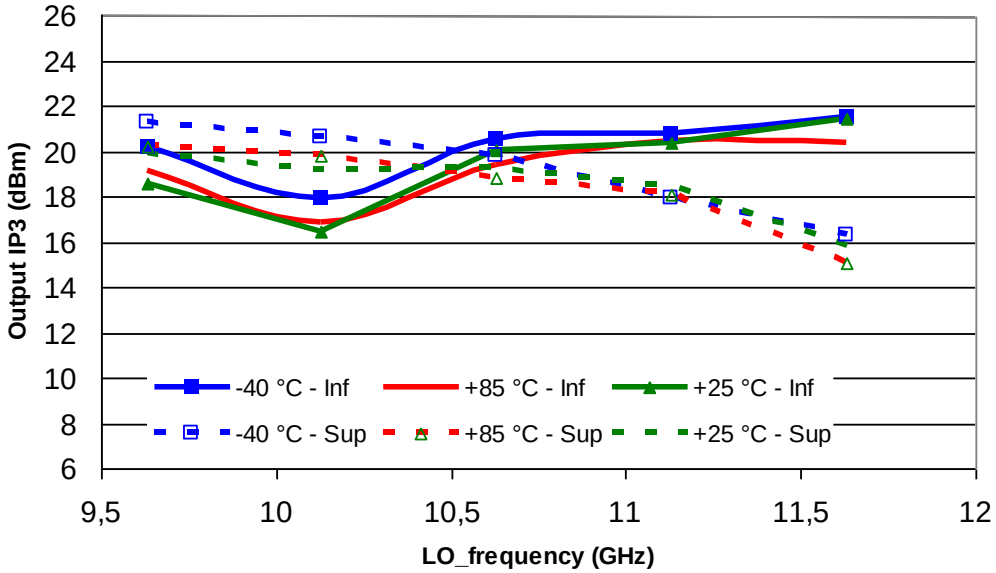
Typical chip on board Measurements in Temperature

DX = DA = 4V, GA = -0.5V, GM = -0.6V, G3 = -0.3V, GX = -1.2V, P_LO = 1dBm.

Conversion Gain versus RF frequency & attenuation
RF = 4LO+IF; IF = 2GHz



Output IP3 versus LO frequency at max. gain
RF = 4LO+/-IF; IF = 2GHz; Pin = -16dBm



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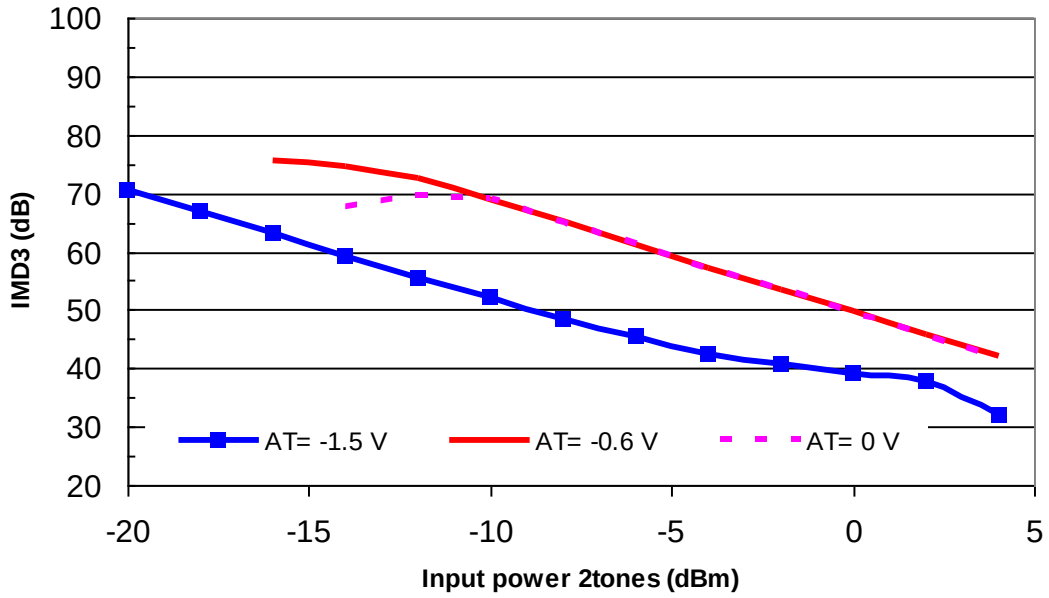
Typical chip on board Measurements in Temperature

DX = DA = 4V, GA = -0.5V, GM = -0.6V, G3 = -0.3V, GX = -1.2V, P_LO = 1dBm.

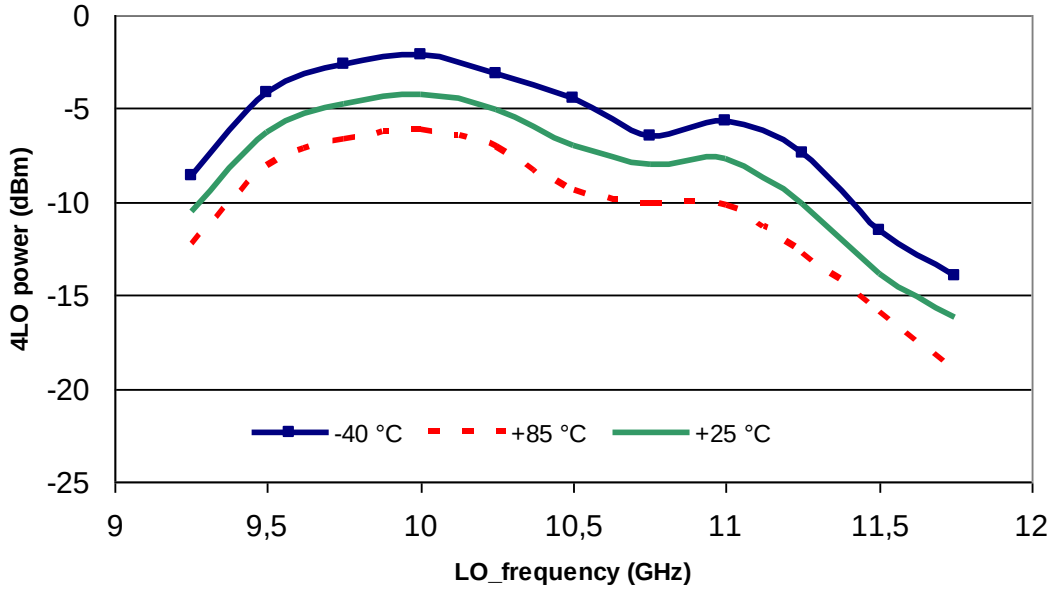
IMD3 versus input power & attenuation

RF = 4LO-IF; IF = 2GHz, LO = 10.6GHz, Tamb = +25°C



4LO power leakage on RF port

RF = 4LO+IF; IF = 2GHz



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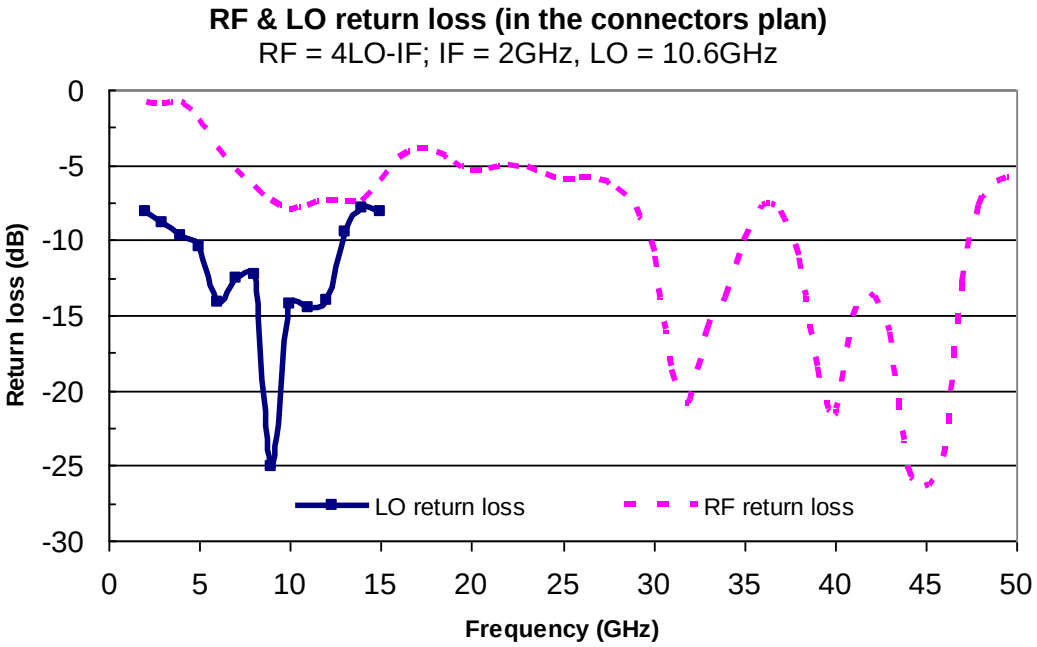
Typical chip on board Measurements

Tamb = +25°C, DX = DA = 4V, GA = -0.5V, GM = -0.6V, G3 = -0.3V, GX = -1.2V,
P_LO = 1dBm.



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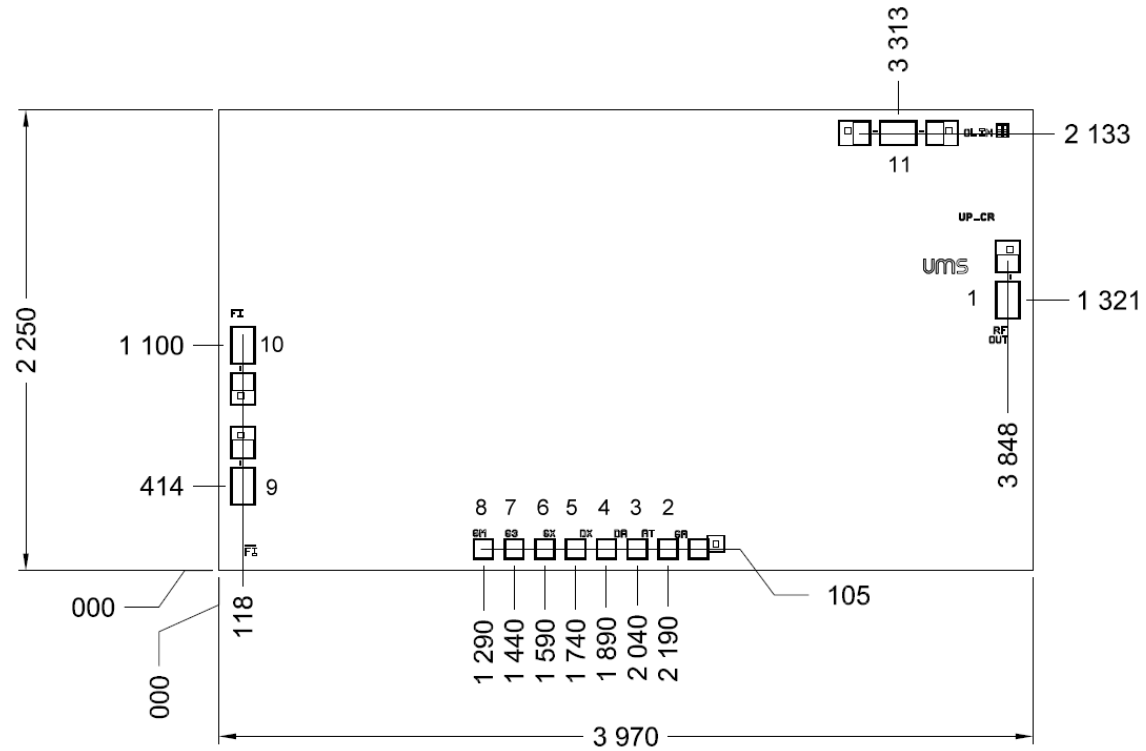
Mechanical data



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

Pin number	Pin name	Description
1	RF_OUT	RF output
2	GA	RF buffer gate voltage
3	AT	Attenuation control voltage
4	DA	RF buffer drain voltage
5	DX	Multiplier & LO Buffer drain voltage
6	GX	Multiplier gate voltage
7	G3	Buffer gate voltage
8	GM	Mixer gate voltage
9, 10	IF & IFb	IF inputs
11	LO_IN	LO input

Recommended biasing

Pin Name	Pin Number	Parameter	Nominal value
GM	8	Mixer Gate voltage	-0.6V
G3	7	Buffer Gate voltage	-0.3V
GX	6	X4 Gate voltage	-1.2V
GA	2	RF amplifier Gate voltage	-0.5V
DX	5	X4 Drain voltage	4V
DA	4	RF amplifier Drain voltage	4V
AT	3	Attenuation control voltage	-1.5V to +0.5V

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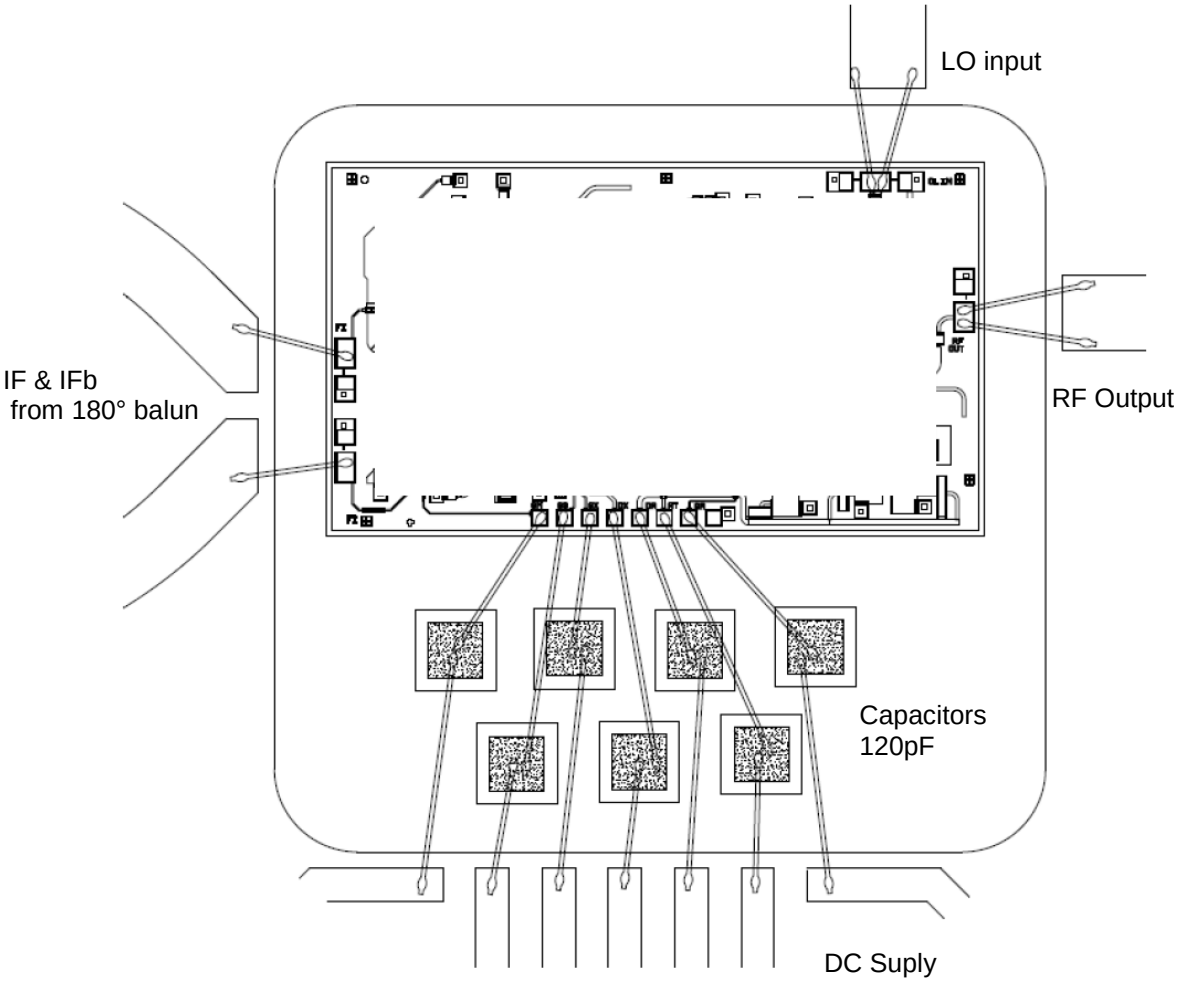
Chip assembly



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

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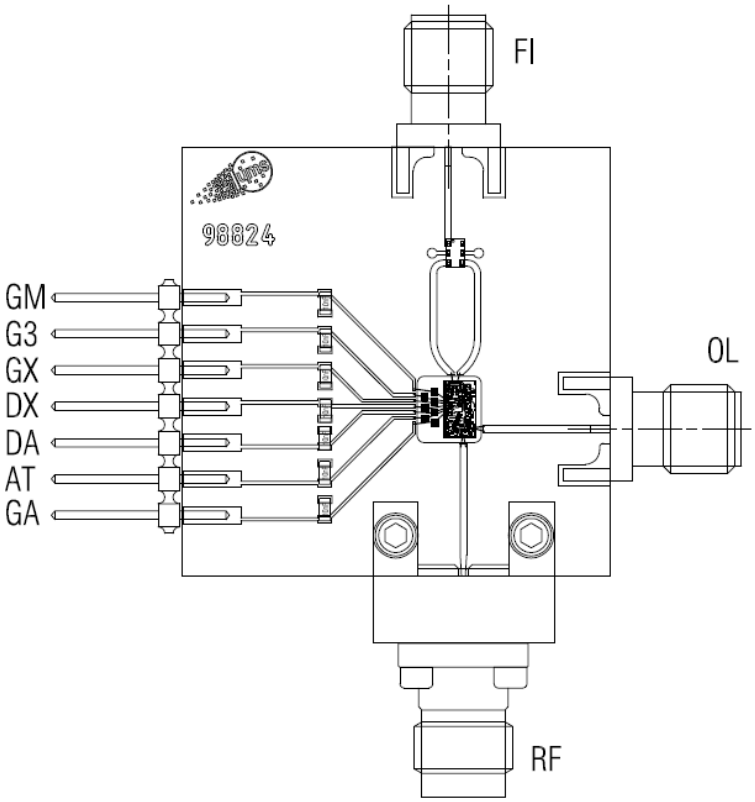
Evaluation mother board

Based on typically Ro4003 / 8 mils or equivalent.
Decoupling capacitors of 10nF ±10% and chip 120pF ±10%
180° hybrid balun: 2-2.5GHz



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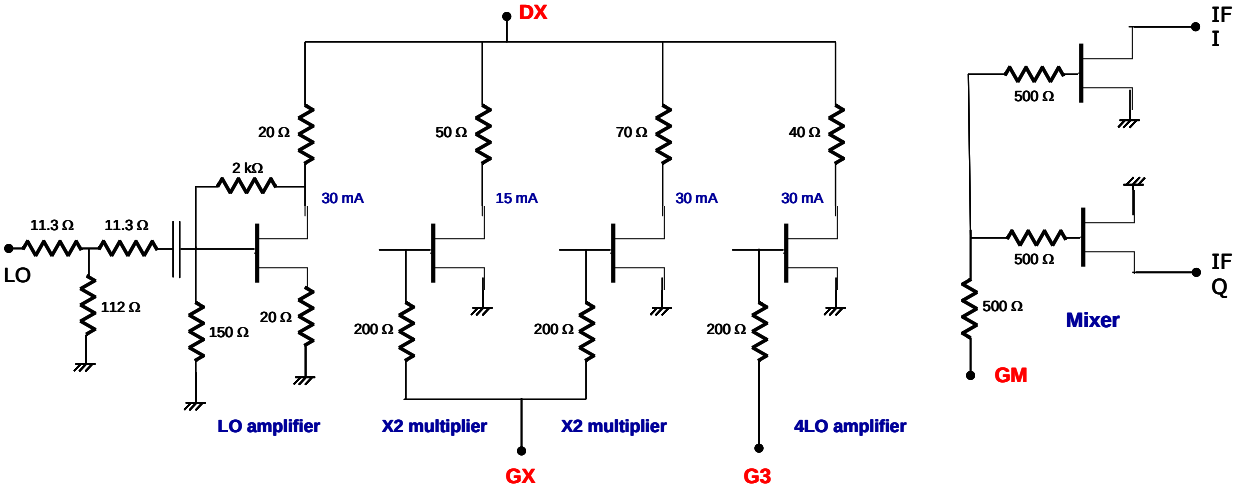
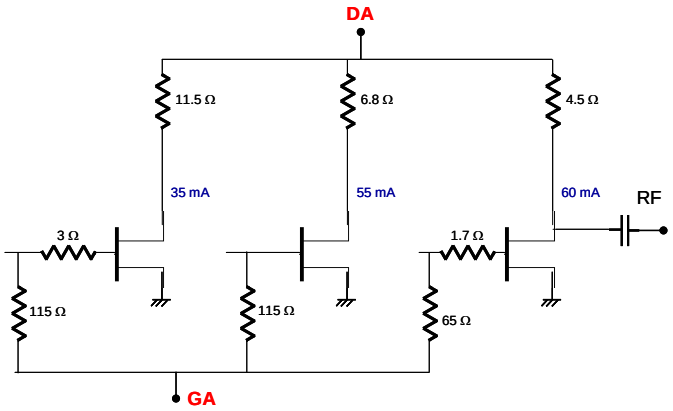
DC Schematic

LO multiplier and buffers: 4V, 105mA



RF amplifier: 4V, 150mA



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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:	CHU2299-99F/00

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