37-40GHz Down converter

Preliminary

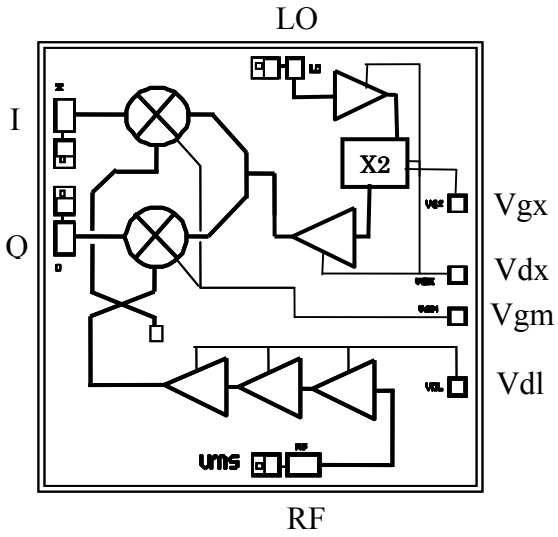
GaAs Monolithic Microwave IC in SMD package

Description

The MFC-PO13811-QDG is a multifunction part, which integrates a balanced cold FET mixer, a time two multiplier, and a RF LNA. It is designed for a wide range of applications, typically commercial communication systems.

The circuit is manufactured with a PM-HEMT process, 0.25µm gate length, via holes through the substrate and air bridges.

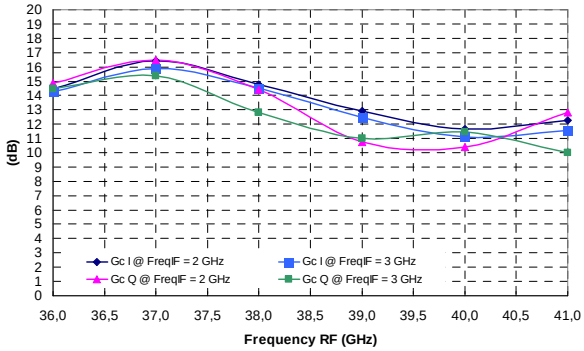
It is supplied in lead-free SMD package.



Main Features

- Broadband performance 37-40GHz
- 12dB gain
- -5dBm IIP3
- 12dBc Image Frequency Rejection
- ESD protected on LO, RF, Vgx, Vgm Accesses
- 24L-QFN4x4

Conversion gain (Inf. & Sup. Mode) @PLO=1dBm



Main Characteristics

Tamb. = 25℃, Vd = 4V

Symbol	Parameter	Min	Typ	Max	Unit
F_{RF}	RF frequency range	37		40	GHz
F_{LO}	LO frequency range	17.5		21	GHz
F_{IF}	IF frequency range	DC		3.5	GHz
G_c	Conversion gain		12		dB

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

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Electrical Characteristics

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Tamb=25℃, Vdx=Vdl = 4V, Typical Vgx = -0.9V & Vgm= -0.7V
These values are representative of onboard measurements (on connectors access planes) as defined on the drawing 96401

Symbol	Parameter	Min	Typ	Max	Unit
F_{RF}	RF frequency range	37		40	GHz
F_{LO}	LO frequency range	17.5		21	GHz
F_{IF}	IF frequency range	DC		3.5	GHz
G_c	Conversion gain		12		dB
P_{LO}	LO Input power		0		dBm
Img Sup	Image Suppression (1)		12		dBc
NF	Noise Figure		4.5		dB
IIP3	Input IP3		-5		dBm
LO VSWR	Input LO VSWR		2.0:1		
RF VSWR	Input RF VSWR		1.7:1		
Id	Bias current (2)		140		mA

(1) With external I/Q 90° hybrid coupler
(2) Typically, Idl= 60mA, Idx=80mA

Absolute Maximum Ratings (1)

Tamb = +25℃

Symbol	Parameter	Values	Unit
Vd	Maximum drain bias voltage	4.5	V
Id	Maximum drain bias current	200	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
Tch	Maximum channel temperature (2)	175	℃
Ta	Operating temperature range	-40 to +85	℃
Tstg	Storage temperature range	-55 to +125	℃

(1) Operation of this device above anyone of these paramaters may cause permanent damage.
(2) Thermal Resistance channel to ground paddle = 70.6℃/W for Tamb. = +85℃

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Typical Measured Performance

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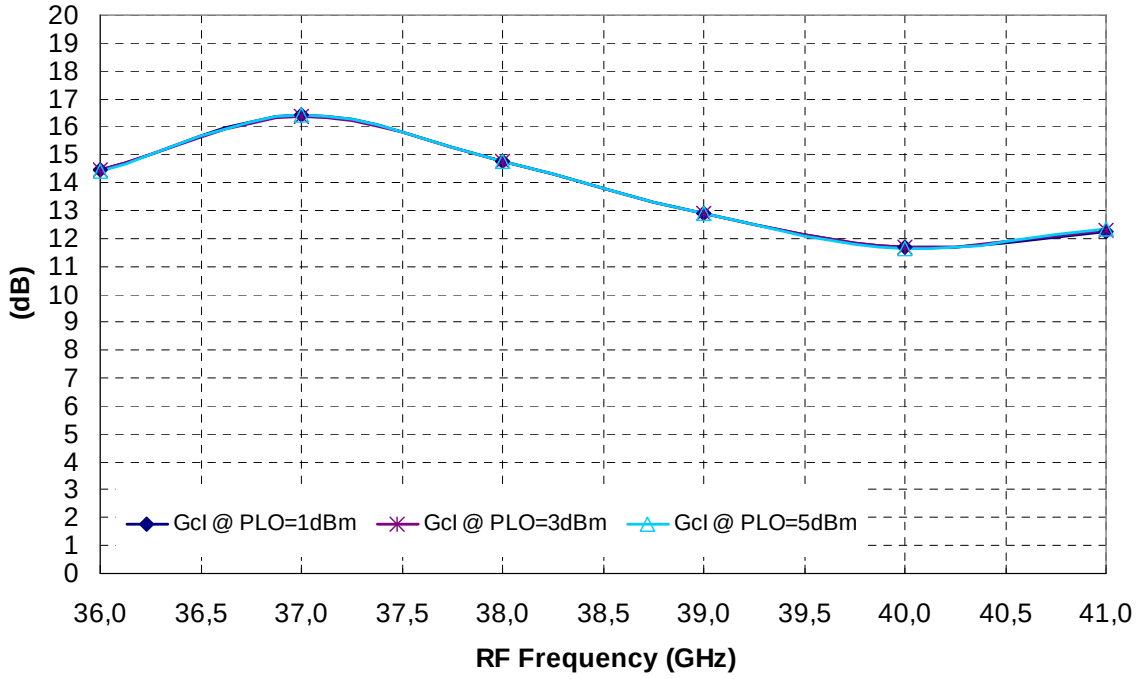
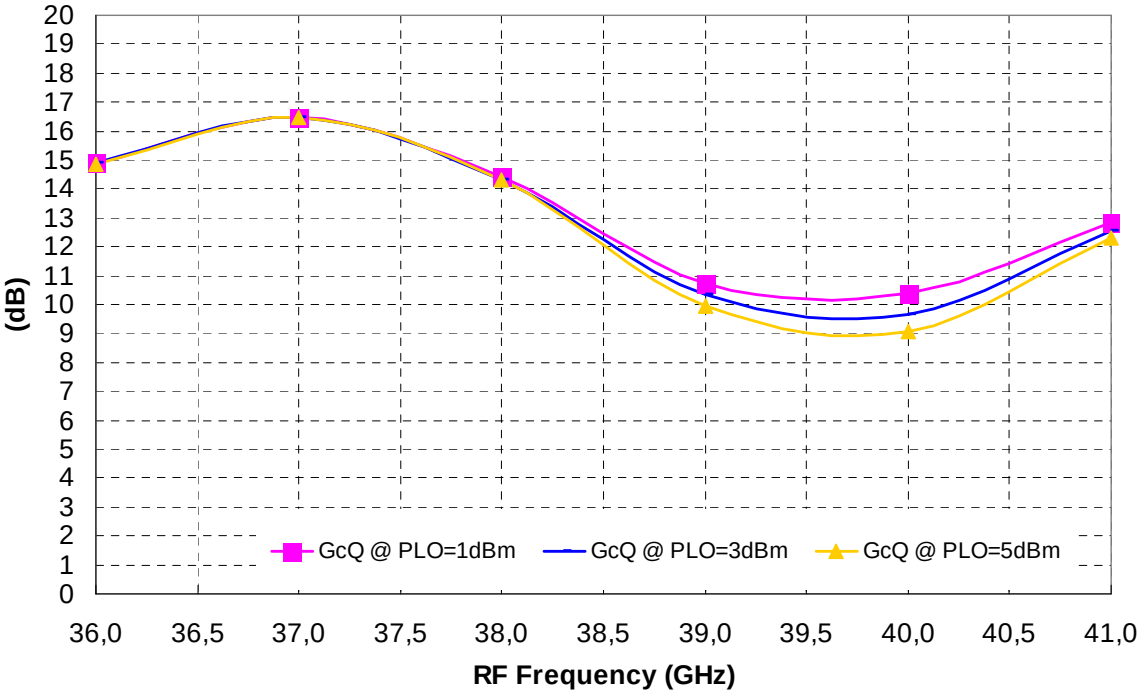
Tamb. = 25℃, Vdx=Vdl = 4V, Typical Vgx = -0.9V & V gm= -0.7V
These values are representative of onboard measurements (on connectors access planes) as defined on the drawing 96401

Conversion Gain (infradyne mode (1)) @ Freq_IF=2GHz



Conversion Gain (supradyne mode (2)) @ Freq_IF=2GHz



(1) Infradyne mode : FreqRF=2*FreqLO+FreqIF
(2) Supradyne mode : FreqRF=2*FreqLO-FreqIF

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Conversion Gain (Inf & sup mode) @ P_LO=1dBm

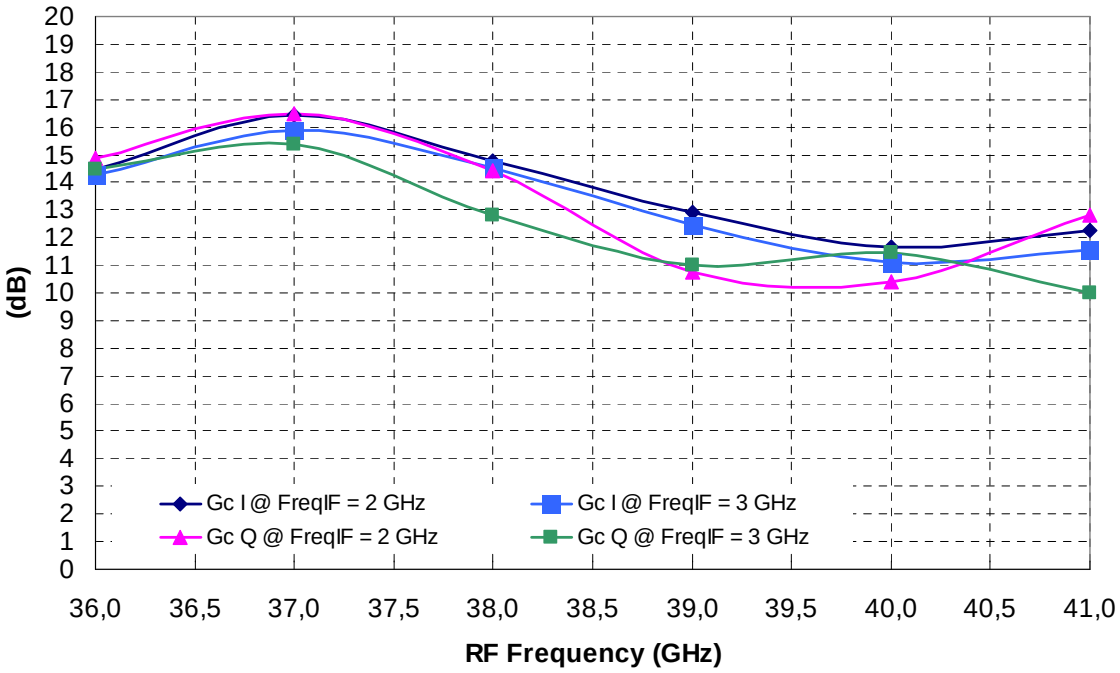
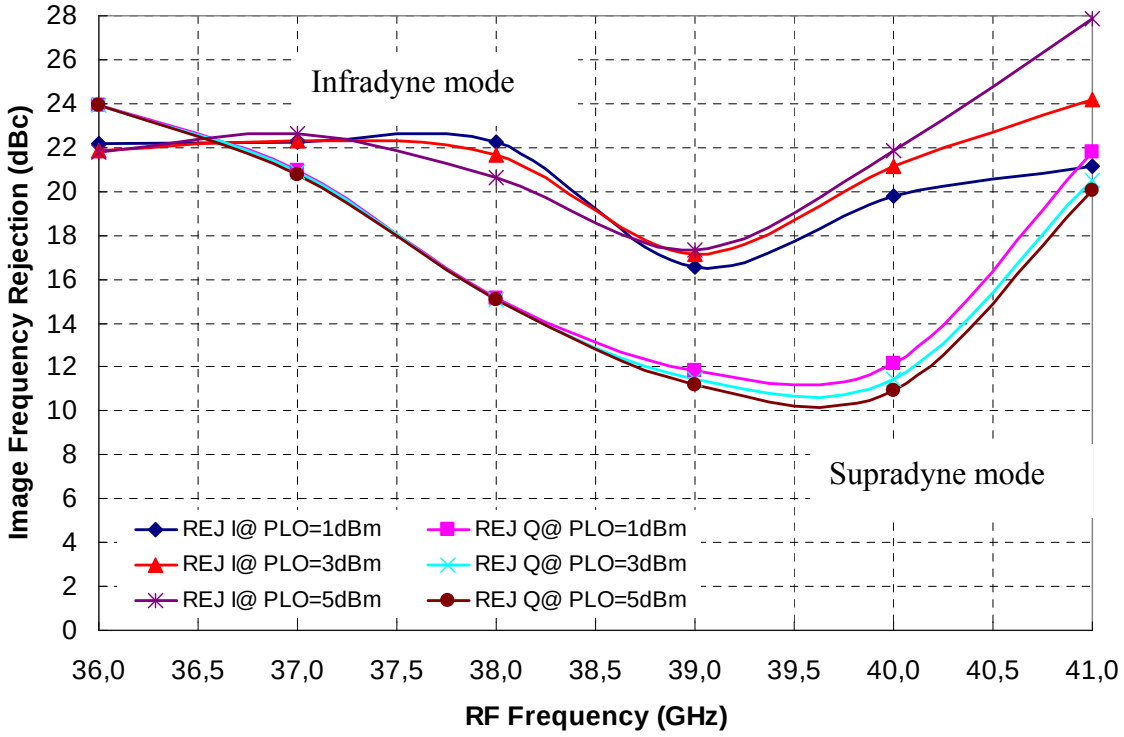


Image Frequency Rejection (inf. & sup. Mode) @ Freq FI=2GHz



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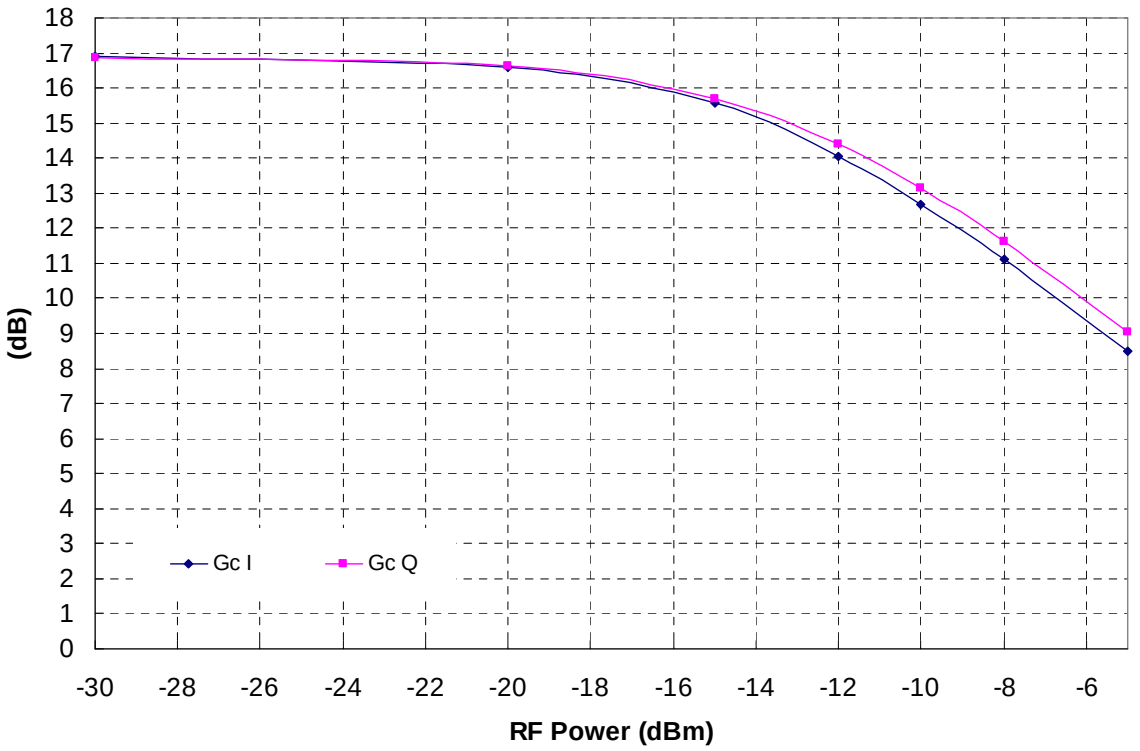
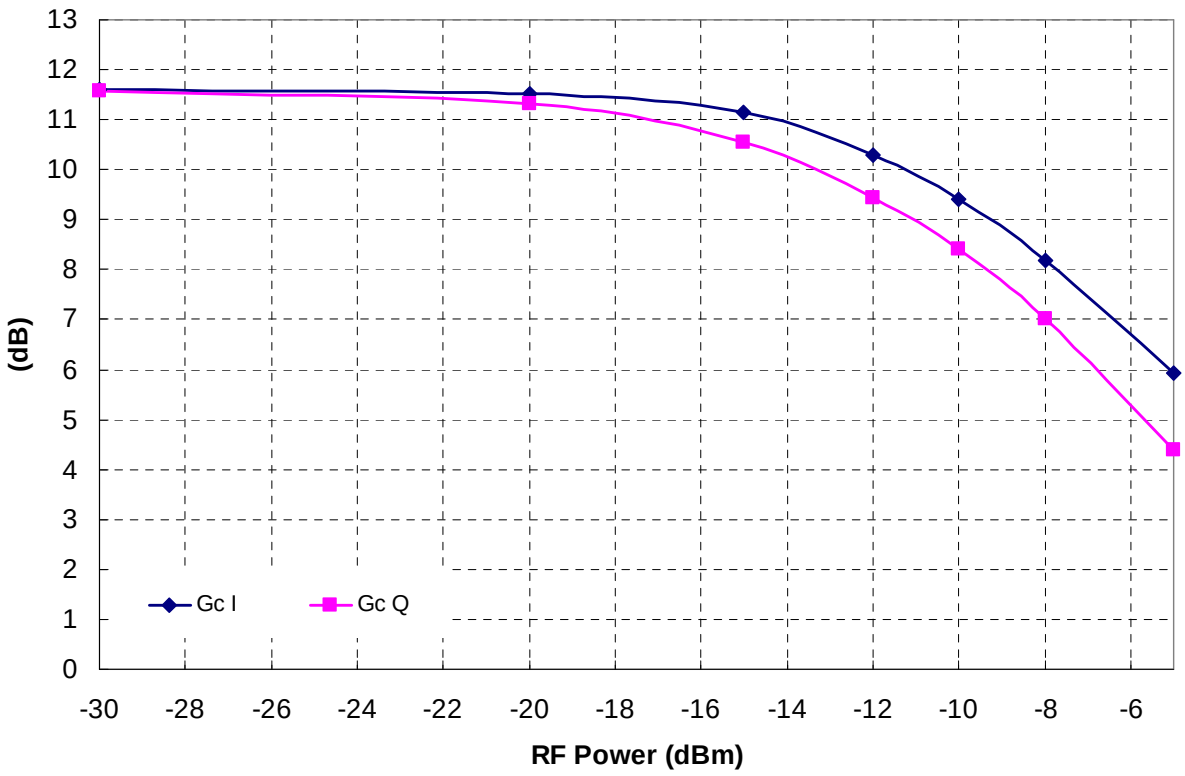
Compression vs P_RF (inf. & sup. Mode)
@ F_RF=37GHz & F_IF=2GHz & P_LO=0 dBm



Compression vs P_RF (inf. & sup. Mode)
@ F_RF=40GHz & F_IF=3GHz & P_LO=0 dBm



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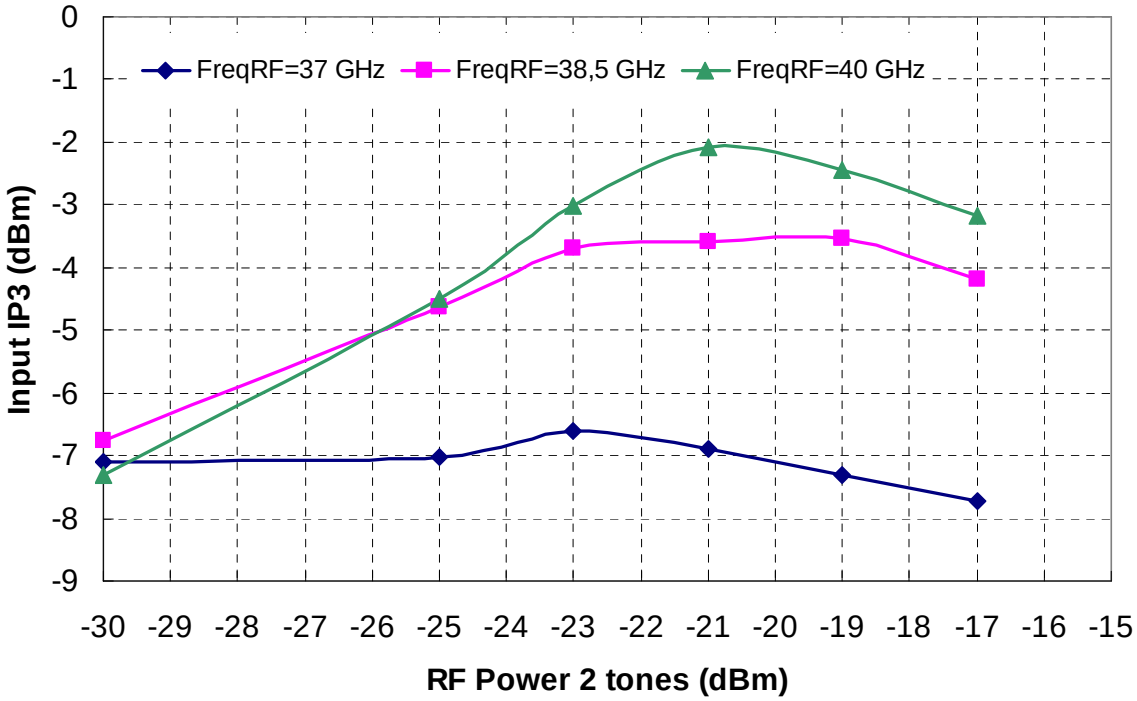
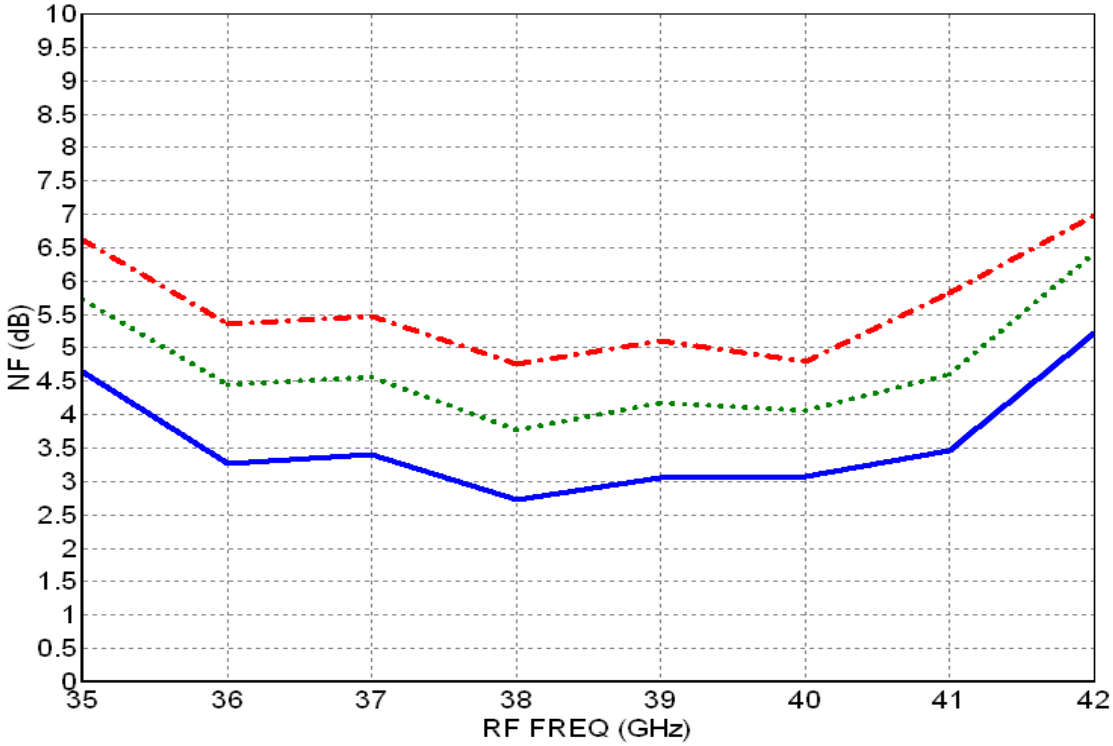
Input IP3 versus RF Power 2 tones
@ PLO=1dBm & FreqIF=2GHz



Noise figure versus RF Frequency



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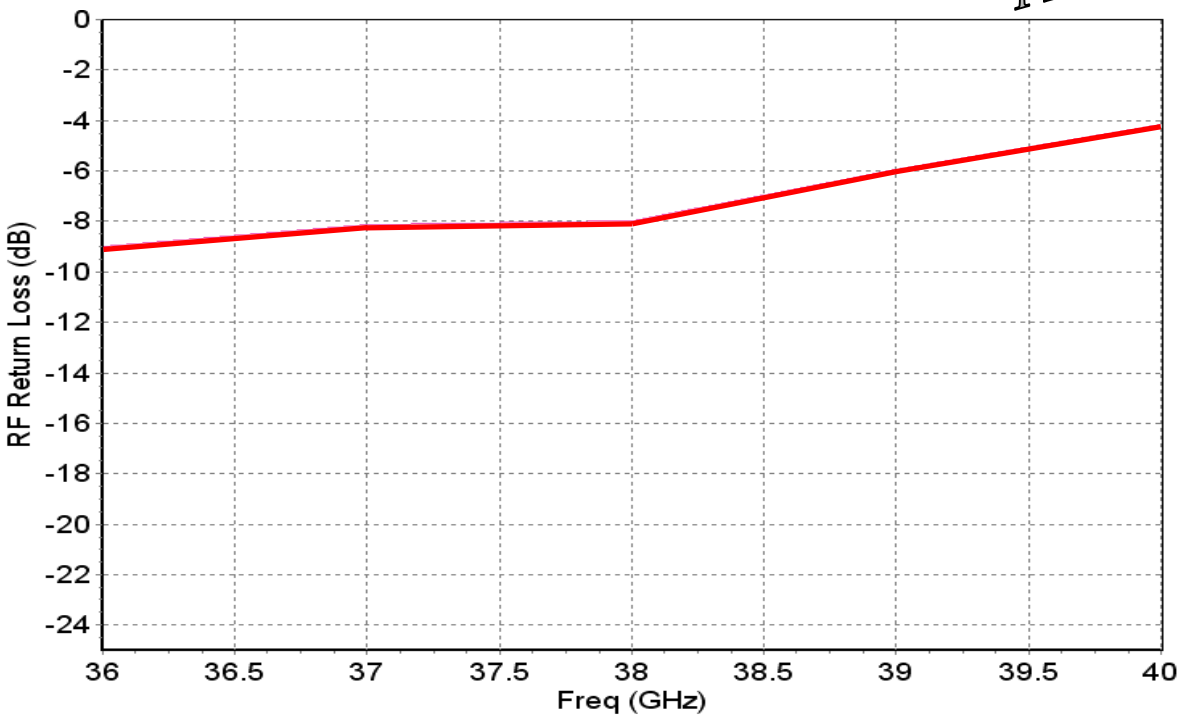
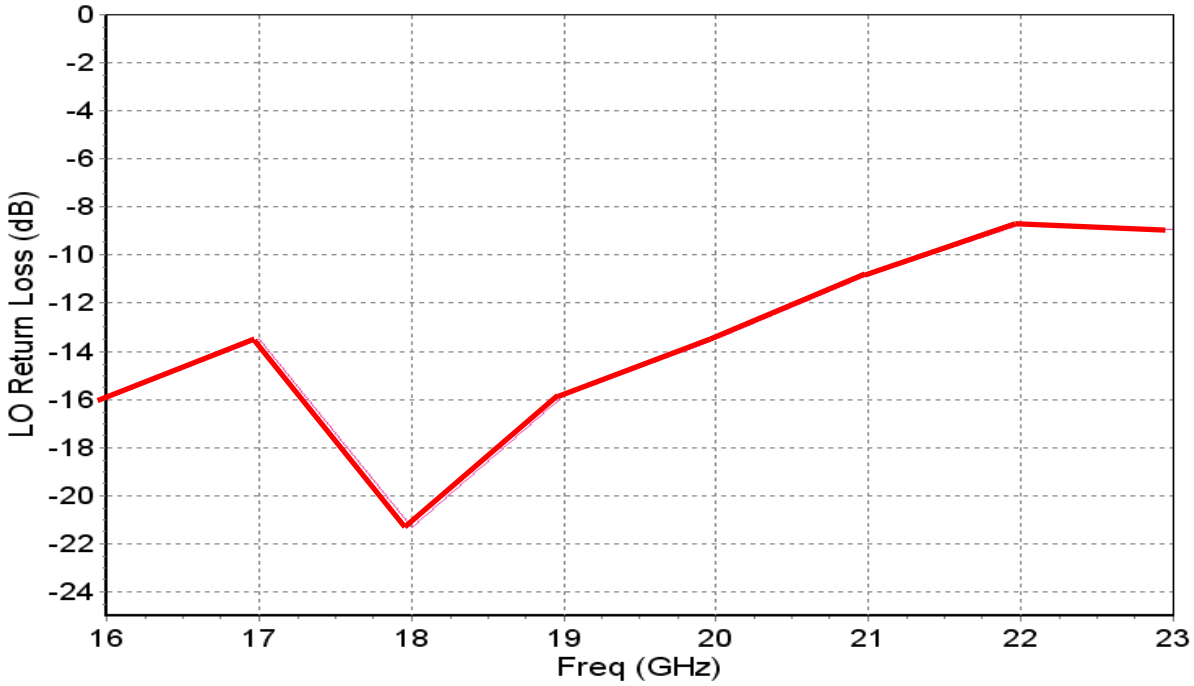
RF Return Loss versus Frequency



LO Return Loss versus Frequency



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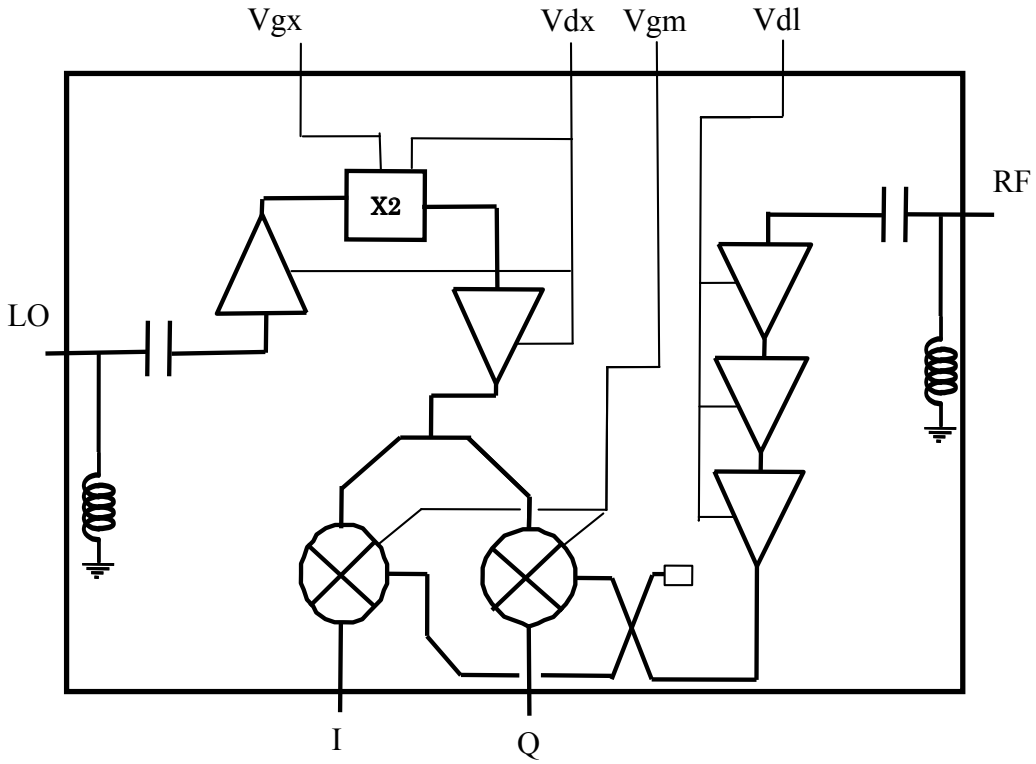
Note :

Due to ESD protection, LO and RF accesses are DC grounded, an external capacitance might be requested to isolate the product from external voltage that could be present on the RF accesses.



ESD protections are also implemented on gate accesses : Vgx and Vgm.

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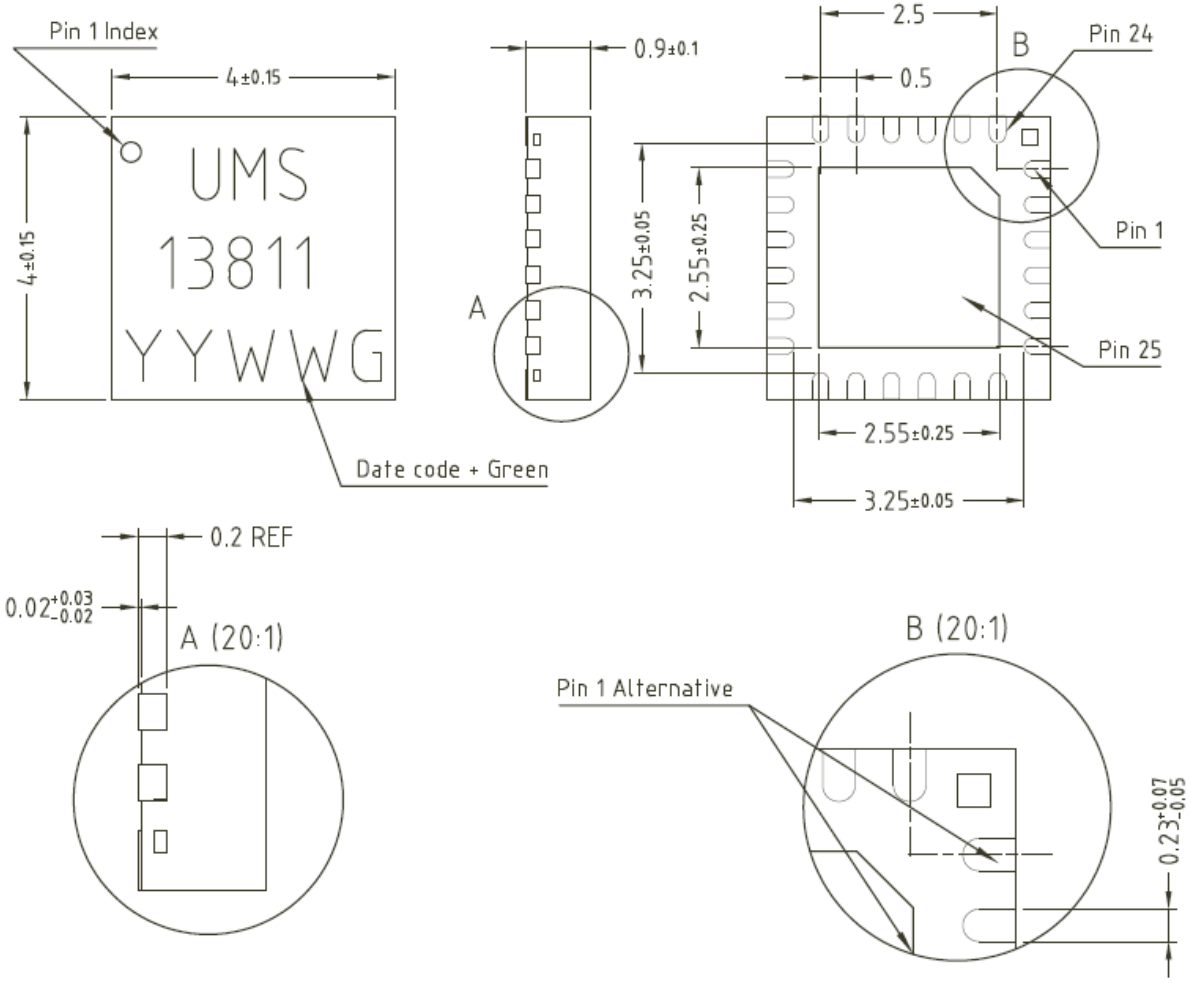
Package outline:



Matt tin, Lead Free	(Green)	1- NC	13- GND
Units	mm	2- GND	14- GND
From the standard	JEDEC MO-220	3- GND	15- LO IN
Pin 25 (paddle): GND		4- RF IN	16- GND
		5- GND	17- GND
		6- GND	18- NC
		7- Vdl	19- I-IF OUT
		8- Vgm	20- GND
		9- Vdx	21- GND
		10- NC	22- Q-IF OUT
		11- NC	23- NC
		12- Vgx	24- NC

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Proposed Assembly board "96401" for the 24L-QFN4x4 product characterization.

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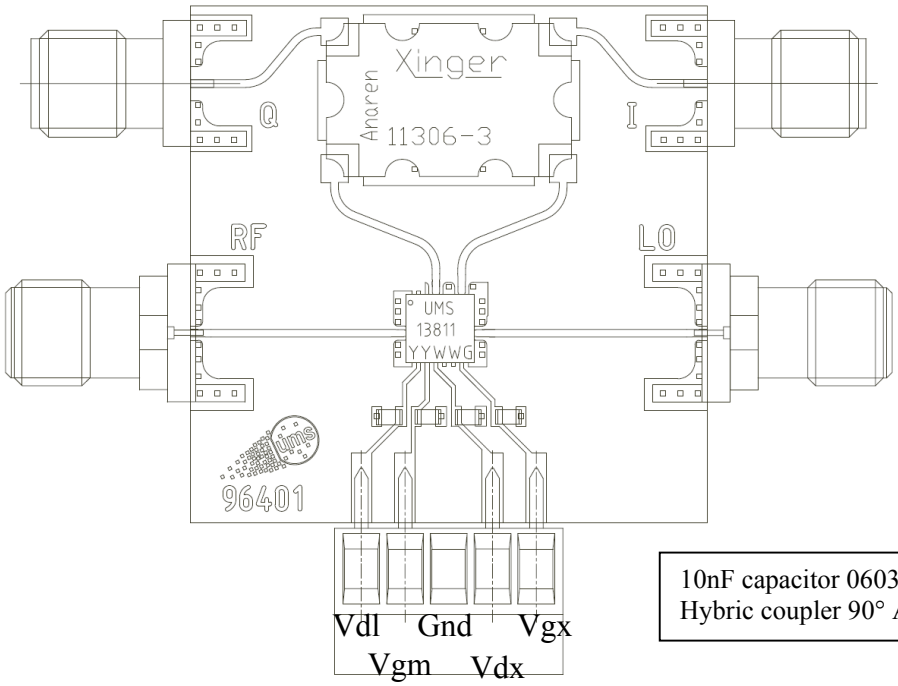
- Compatible with the proposed footprint.
- Based on typically Ro4003 / 8mils or equivalent.
- Using a microstrip to coplanar transition to access the package.
- Recommended for the implementation of this product on a module board.



10nF capacitor 0603
Hybric coupler 90° Anaren 11306-3

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

The SMD leadless package has been designed for high volume surface mount PCB assembly process. A typical footprint is proposed for the PCB (motherboard) in the previous drawing. For the mounting process standard techniques involving solder paste and a suitable reflow process can be used. For further details, see application note AN0017.

Ordering Information

QFN 4x4 RoHS compliant package: MFC-PO13811-QDG/XY
Stick: XY = 20 Tape & reel: XY = 21

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