

# 37-40GHz Down converter *Preliminary*

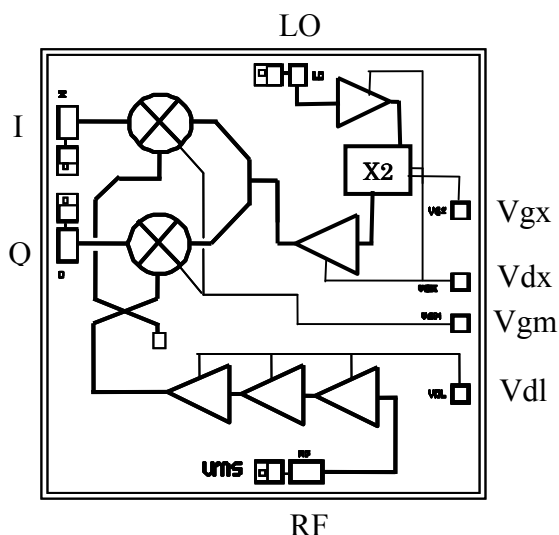
## GaAs Monolithic Microwave IC in SMD package

### 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.



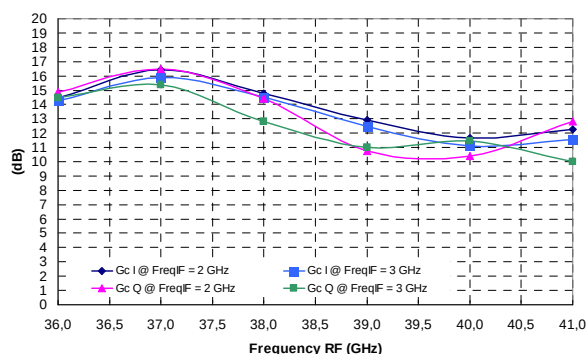
### Main Features

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

### Main Characteristics

Tamb. = 25°C, Vd = 4V

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



| 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!

**Electrical Characteristics**

Tamb=25°C, 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

*Preliminary*

| Symbol          | Parameter             | Min  | Typ   | Max | Unit |
|-----------------|-----------------------|------|-------|-----|------|
| F <sub>RF</sub> | RF frequency range    | 37   |       | 40  | GHz  |
| F <sub>LO</sub> | LO frequency range    | 17.5 |       | 21  | GHz  |
| F <sub>IF</sub> | IF frequency range    | DC   |       | 3.5 | GHz  |
| G <sub>c</sub>  | Conversion gain       |      | 12    |     | dB   |
| P <sub>LO</sub> | 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 |     |      |
| I <sub>d</sub>  | Bias current (2)      |      | 140   |     | mA   |

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

(2) Typically, I<sub>dI</sub>= 60mA, I<sub>dx</sub>=80mA

**Absolute Maximum Ratings (1)**

Tamb = +25°C

| Symbol           | Parameter                       | Values       | Unit |
|------------------|---------------------------------|--------------|------|
| V <sub>d</sub>   | Maximum drain bias voltage      | 4.5          | V    |
| I <sub>d</sub>   | Maximum drain bias current      | 200          | mA   |
| V <sub>g</sub>   | Gate bias voltage               | -2.0 to +0.4 | V    |
| P <sub>RF</sub>  | Maximum RF input power          | 10           | dBm  |
| P <sub>LO</sub>  | Maximum LO input power          | 10           | dBm  |
| T <sub>ch</sub>  | Maximum channel temperature (2) | 175          | °C   |
| T <sub>a</sub>   | Operating temperature range     | -40 to +85   | °C   |
| T <sub>stg</sub> | Storage temperature range       | -55 to +125  | °C   |

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

(2) Thermal Resistance channel to ground paddle = 70.6°C/W for Tamb. = +85°C

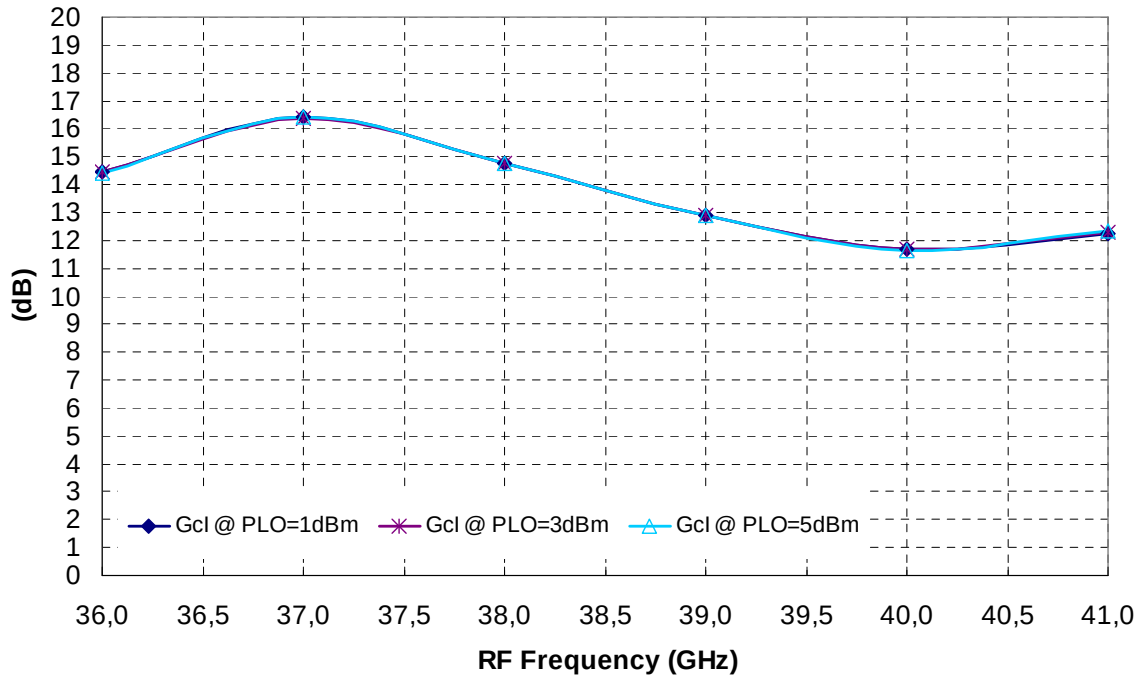
## Typical Measured Performance

T<sub>amb</sub> = 25°C, V<sub>dx</sub>=V<sub>dl</sub> = 4V, Typical V<sub>gx</sub> = -0.9V & V<sub>gm</sub> = -0.7V

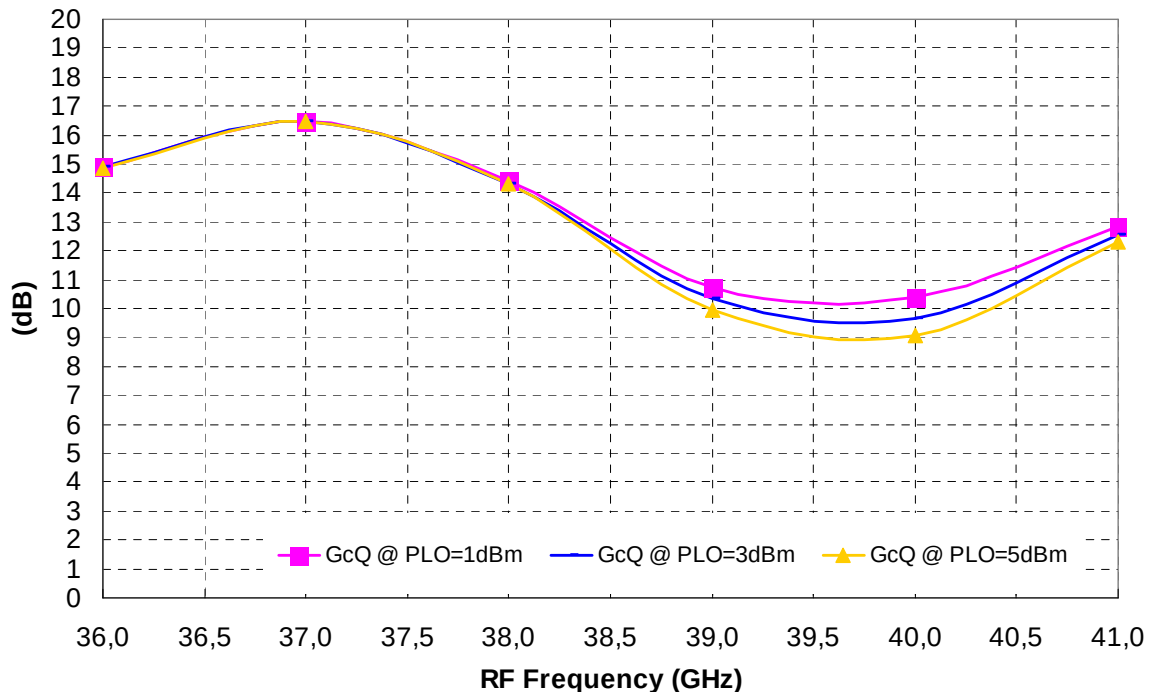
These values are representative of onboard measurements (on connectors access planes) as defined on the drawing 96401

*Preliminary*

Conversion Gain (infradyne mode (1)) @ Freq\_IF=2GHz



Conversion Gain (supradyne mode (2)) @ Freq\_IF=2GHz



- (1) Infradyne mode :  $\text{FreqRF} = 2 \cdot \text{FreqLO} + \text{FreqIF}$
- (2) Supradyne mode :  $\text{FreqRF} = 2 \cdot \text{FreqLO} - \text{FreqIF}$

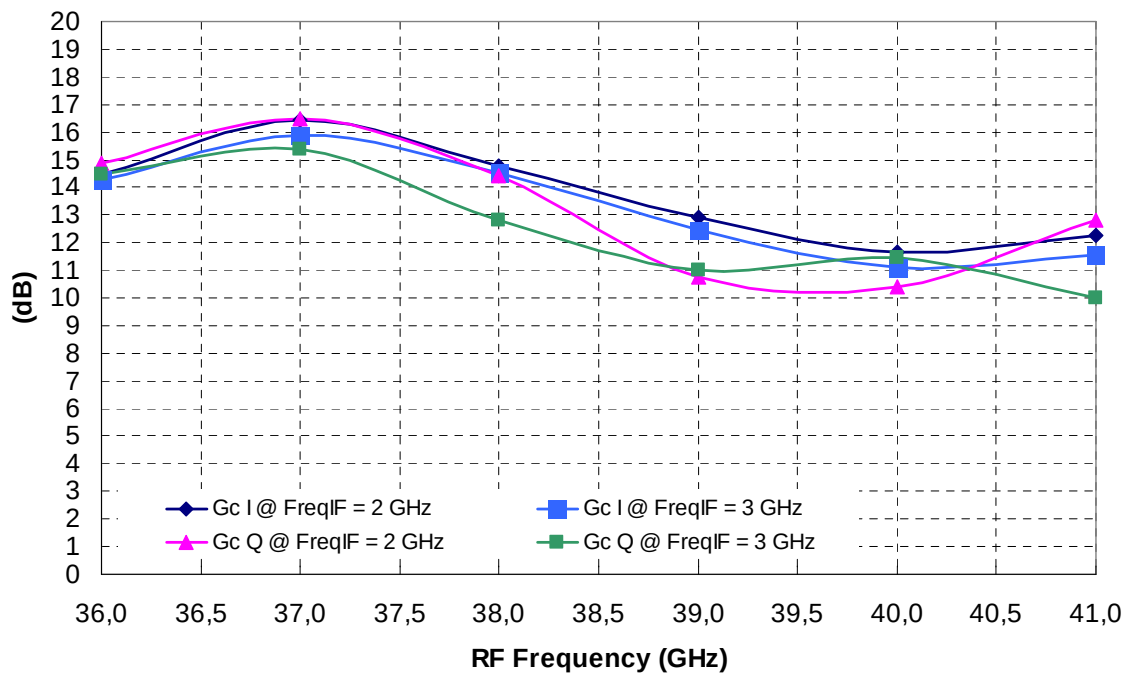
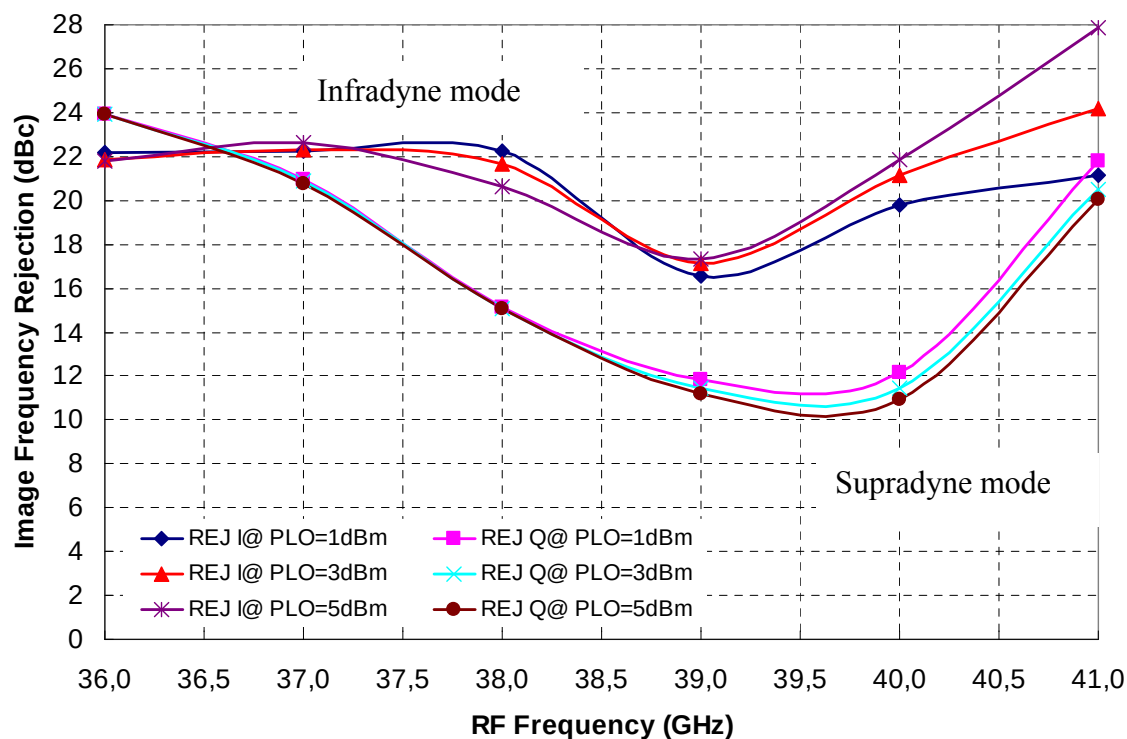
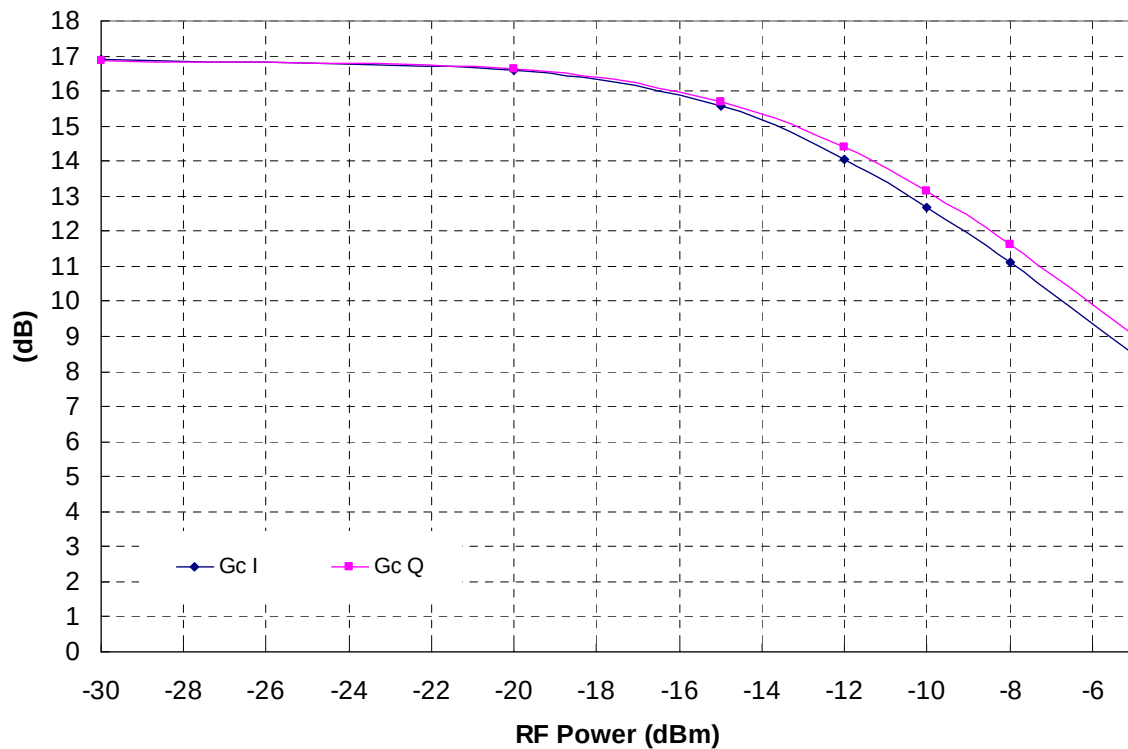
*Preliminary*Conversion Gain (Inf & sup mode) @ P<sub>LO</sub>=1dBm

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

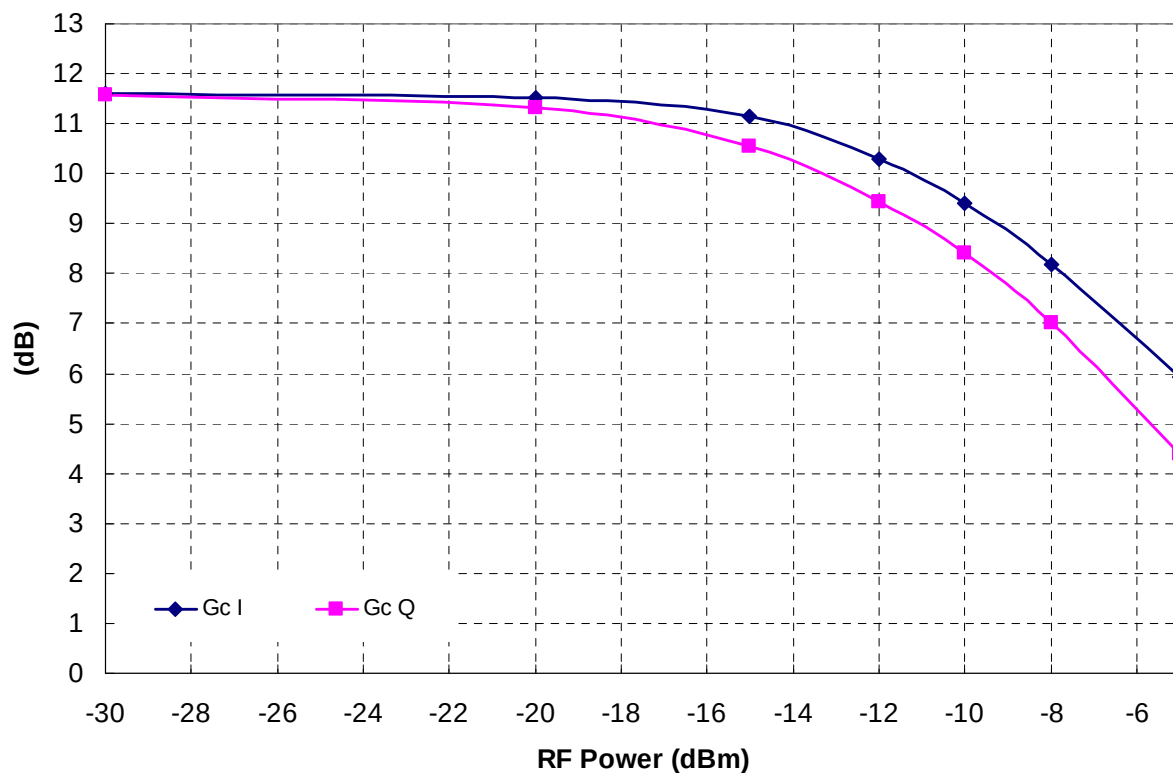


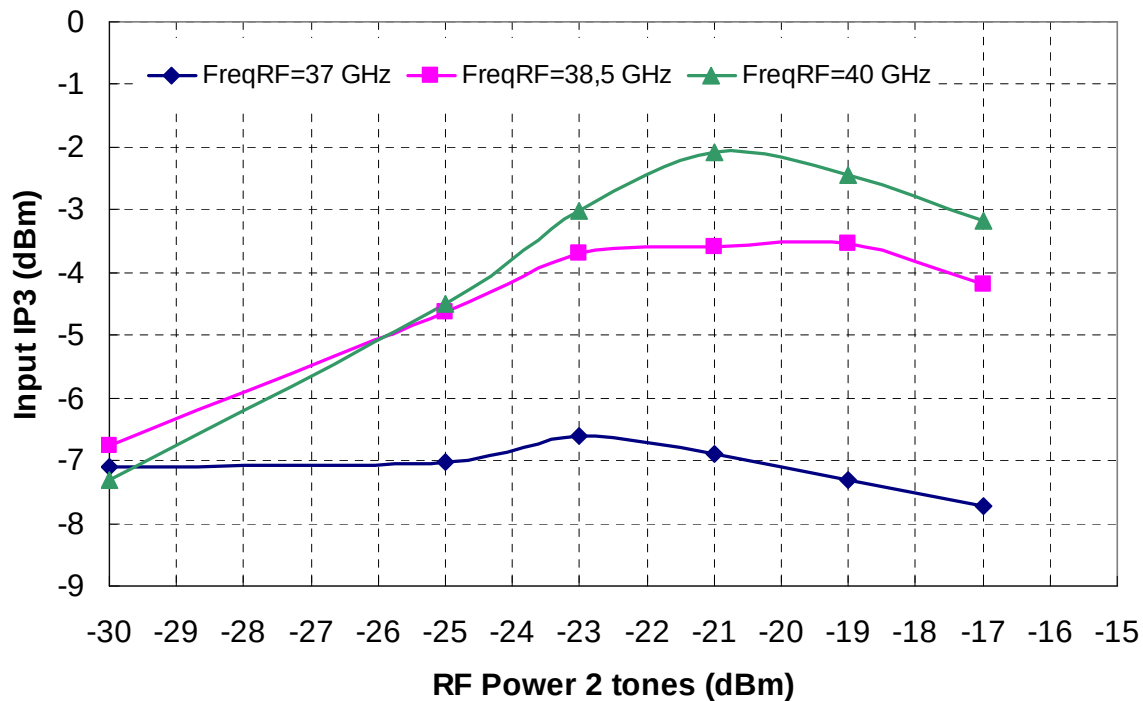
*Preliminary*

Compression vs P<sub>RF</sub> (inf. & sup. Mode)  
@ F<sub>RF</sub>=37GHz & F<sub>IF</sub>=2GHz & P<sub>LO</sub>=0 dBm

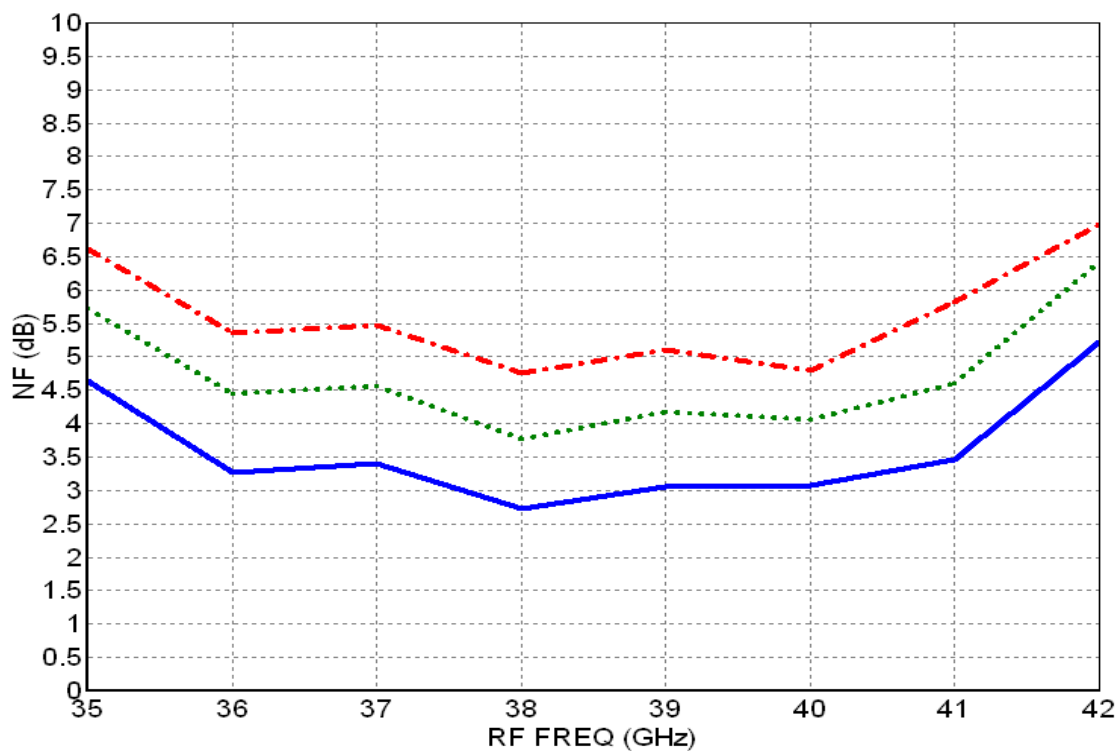


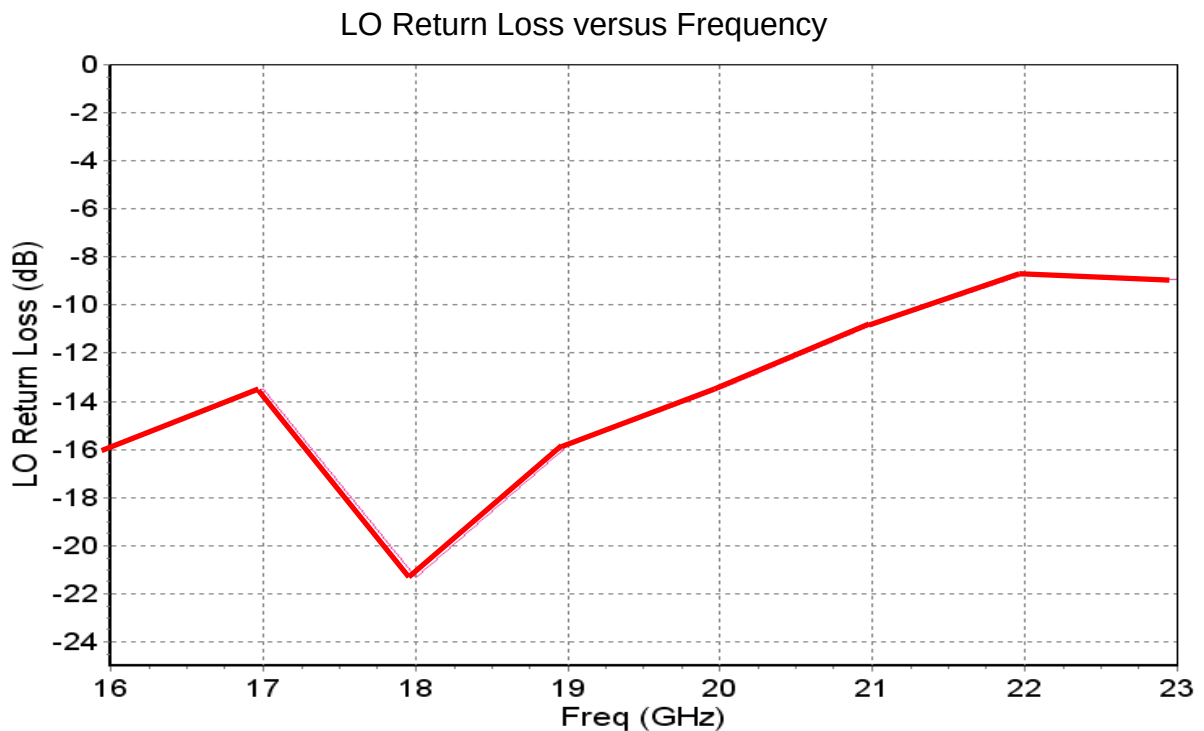
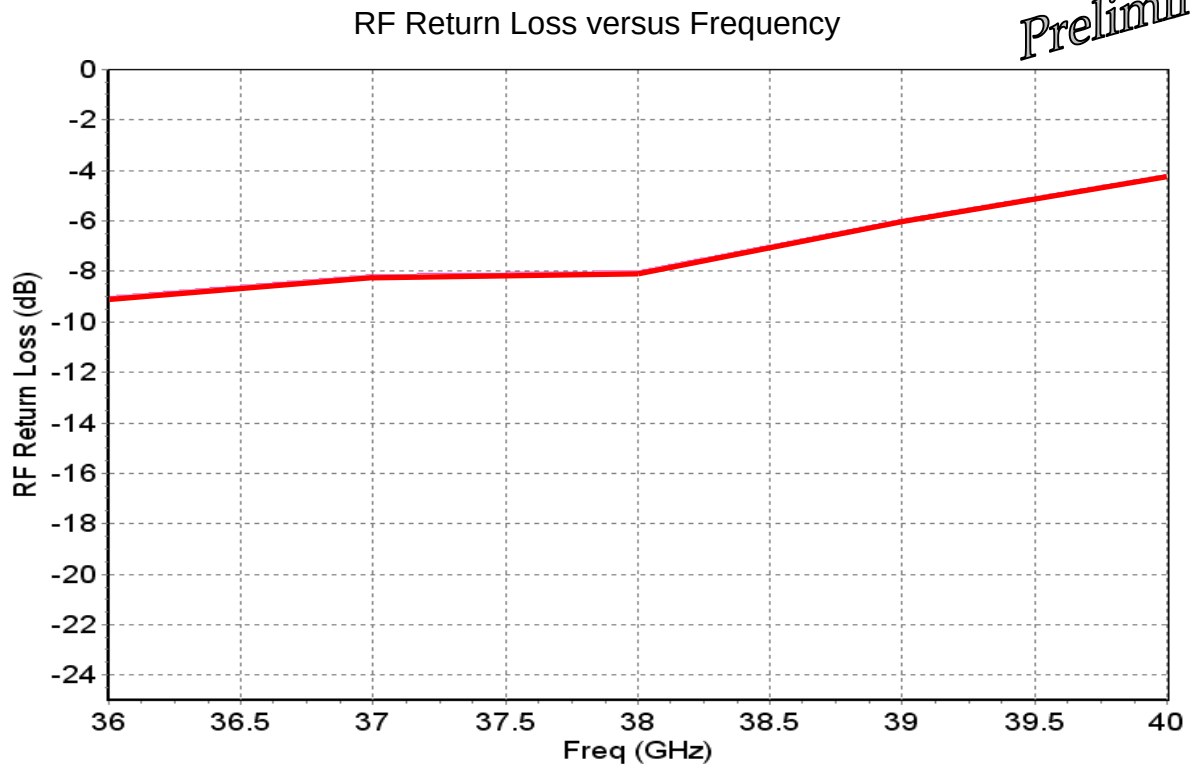
Compression vs P<sub>RF</sub> (inf. & sup. Mode)  
@ F<sub>RF</sub>=40GHz & F<sub>IF</sub>=3GHz & P<sub>LO</sub>=0 dBm



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

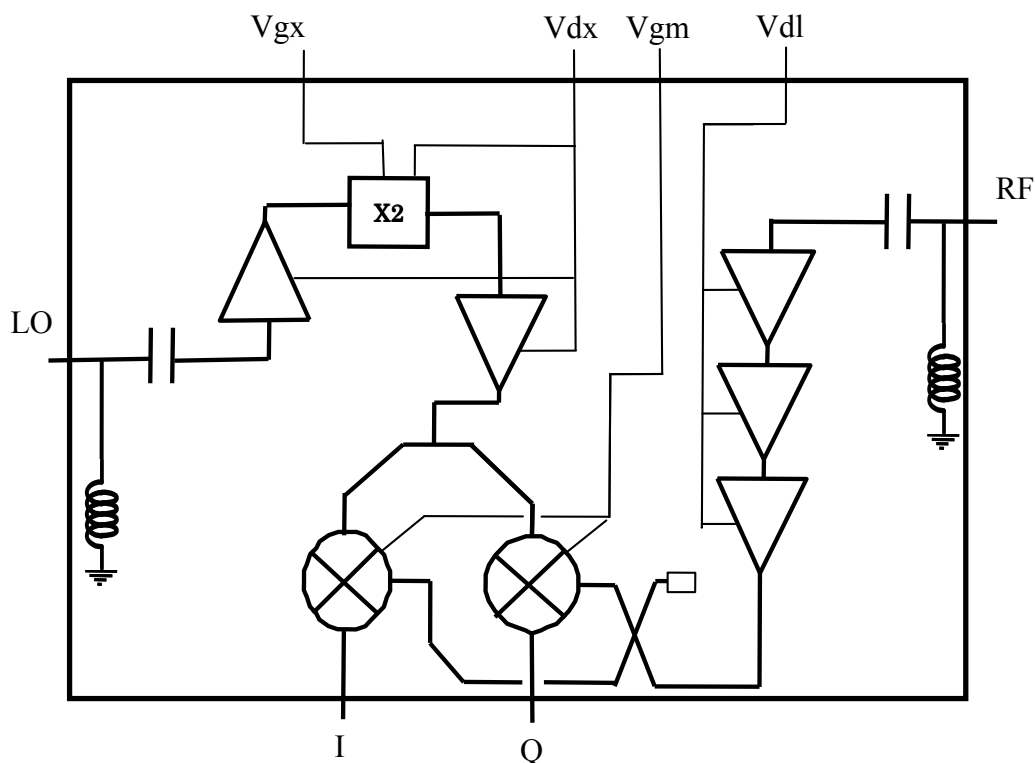
Noise figure versus RF Frequency





*Preliminary***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.

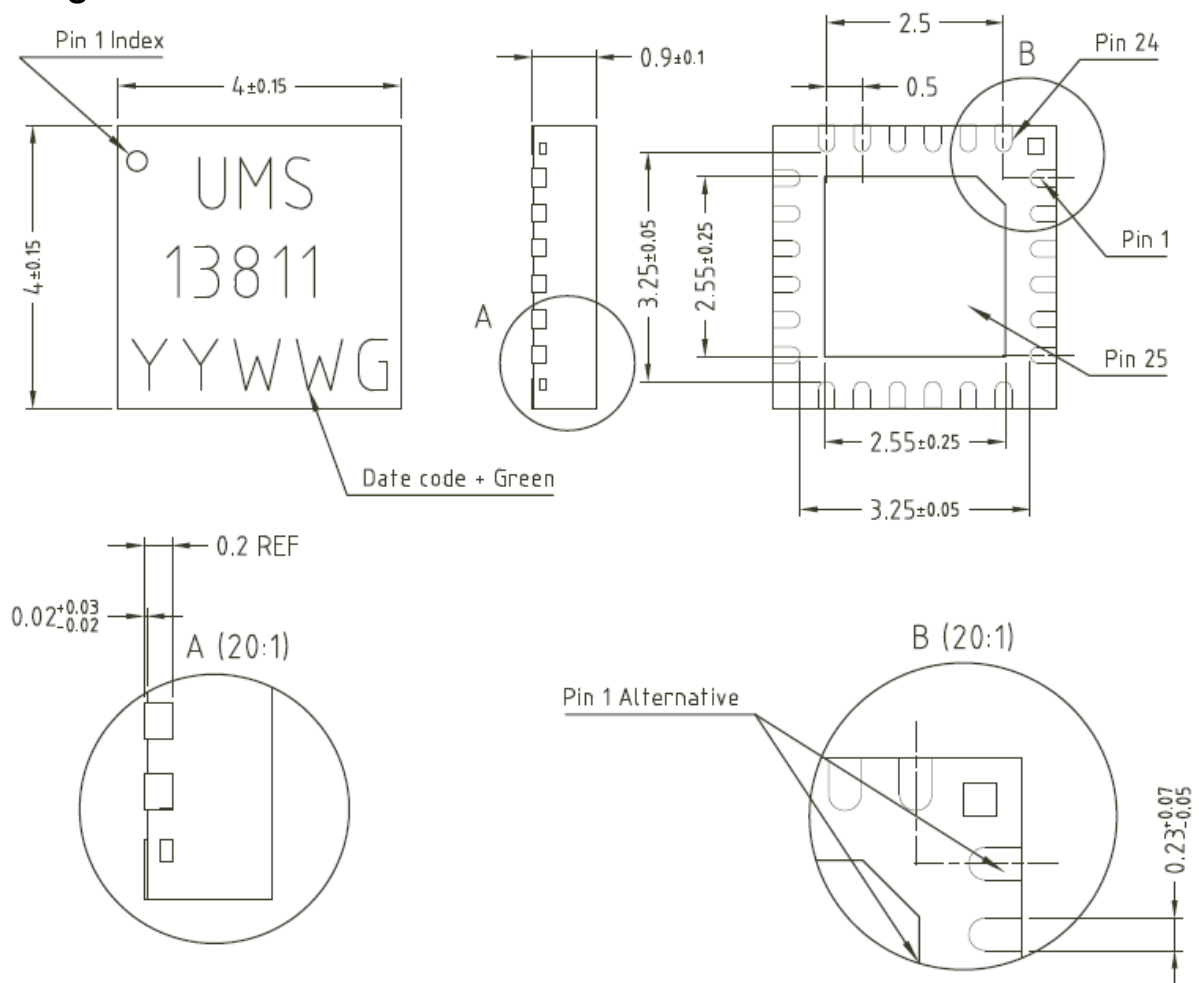


ESD protections are also implemented on gate accesses : Vgx and Vgm.



Preliminary

### Package outline:



Matt tin, Lead Free  
Units  
From the standard  
Pin 25 (paddle): GND

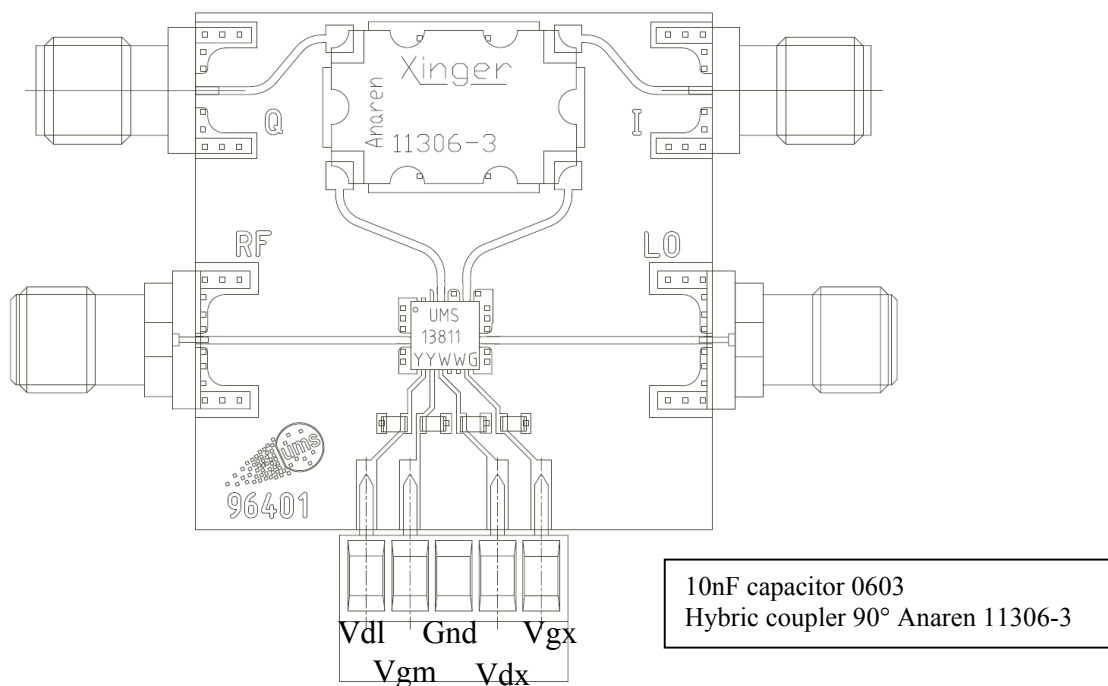
(Green)  
mm  
JEDEC MO-220

|          |              |
|----------|--------------|
| 1- NC    | 13- GND      |
| 2- GND   | 14- GND      |
| 3- GND   | 15- LO IN    |
| 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       |

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

*Preliminary*

- 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.



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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