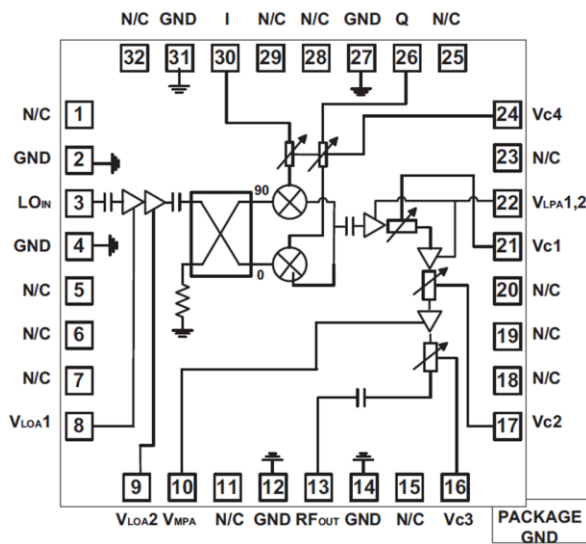


# RFUV1003

GaAs MMIC IQ UpConverter  
12GHz to 16GHz

RFMD's RFUV1003 is a 12GHz to 16GHz GaAs pHEMT upconverter, incorporating an integrated LO buffer amplifier, a balanced single-side band (image rejection) mixer followed by a variable gain amplifier and DC decoupling capacitors. The combination of high performance part and low cost packaging makes the RFUV1003 a cost effective solution, ideally suited to both current and next generation Point-to-Point and VSAT applications. RFUV1003 is packaged in a 5mm x 5mm QFN to simplify both system level board design and volume assembly.



Functional Block Diagram

## Ordering Information

|                 |  |
|-----------------|--|
| RFUV1003S2      | Sample bag with 2 pieces                 |
| RFUV1003SB      | Bag with 5 pieces                        |
| RFUV1003SQ      | Bag with 25 pieces                       |
| RFUV1003SR      | 7" Reel with 100 pieces                  |
| RFUV1003TR7     | 7" Reel with 750 pieces                  |
| RFUV1003TR13    | 13" Reel with 2500 pieces                |
| RFUV1003PCK-410 | Evaluation Board with 2-piece sample bag |



Package: QFN, 32-pin,  
5mm x 5mm x 0.95mm

## Features

- RF Frequency: 12GHz to 16GHz
- LO Frequency: 8GHz to 20GHz
- IF Frequency: DC to 4GHz
- Maximum Conversion Gain: 23dB
- Minimum Conversion Gain: -10dB
- Noise Figure (Maximum Gain): 11dB
- Noise Figure (Minimum Gain): 17dB
- OIP3 (Maximum Gain): +28dBm
- OIP3 (Minimum Gain): +12dBm
- Image Rejection: 20dBc

## Applications

- Point-to-Point
- VSAT

## Absolute Maximum Ratings

| Parameter               | Rating      | Unit |
|-------------------------|-------------|------|
| LPA Drain Voltage $V_d$ | 6           | V    |
| LOA Drain Voltage       | 6           | V    |
| RF Input Power          | 15          | dBm  |
| LO Input Power          | 15          | dBm  |
| $T_{OPER}$              | -40 to +85  | °C   |
| $T_{STOR}$              | -65 to +150 | °C   |
| ESD Human Body Model    | Class 1A    |      |



**Caution!** ESD sensitive device.



RFMD Green: RoHS compliant per EU Directive 2011/65/EU, halogen free per IEC 61249-2-21, <1000ppm each of antimony trioxide in polymeric materials and red phosphorus as a flame retardant, and <2% antimony solder.

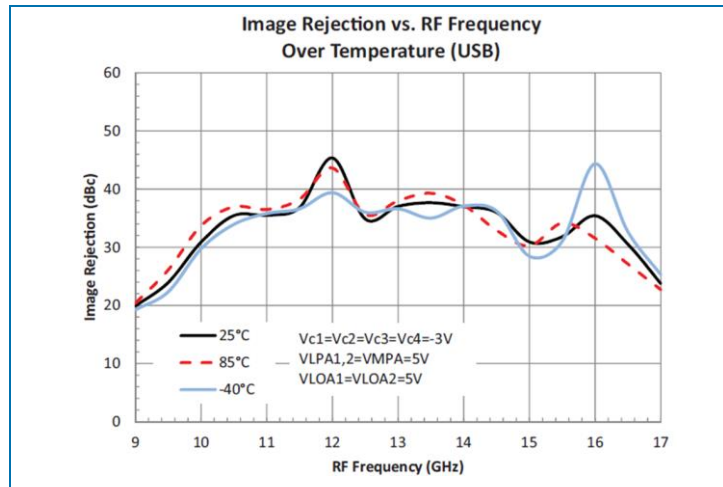
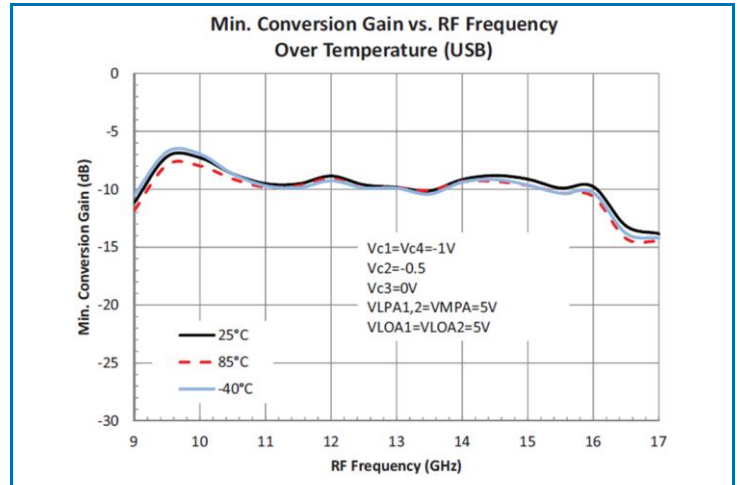
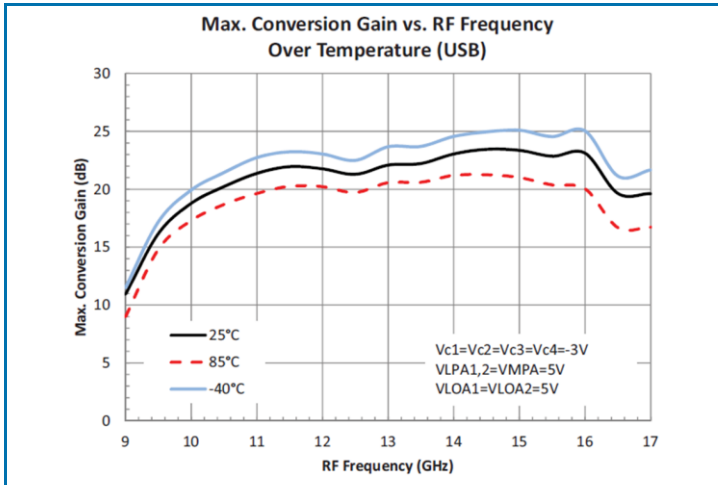
Exceeding any one or a combination of the Absolute Maximum Rating conditions may cause permanent damage to the device. Extended application of Absolute Maximum Rating conditions to the device may reduce device reliability. Specified typical performance or functional operation of the device under Absolute Maximum Rating conditions is not implied.

## Nominal Operating Parameters

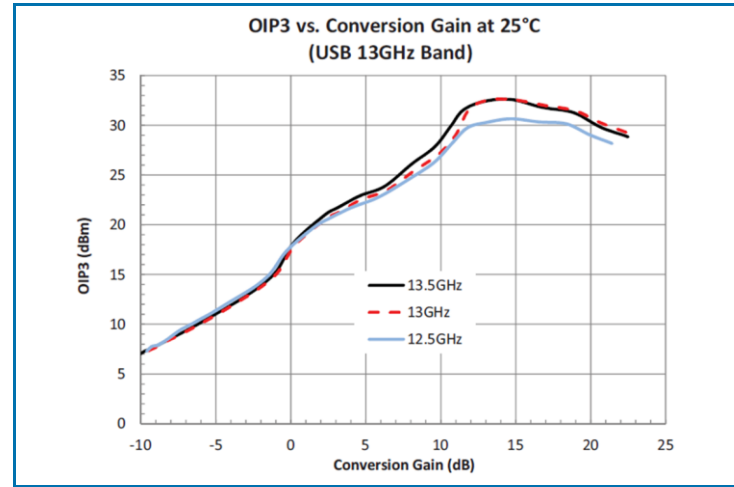
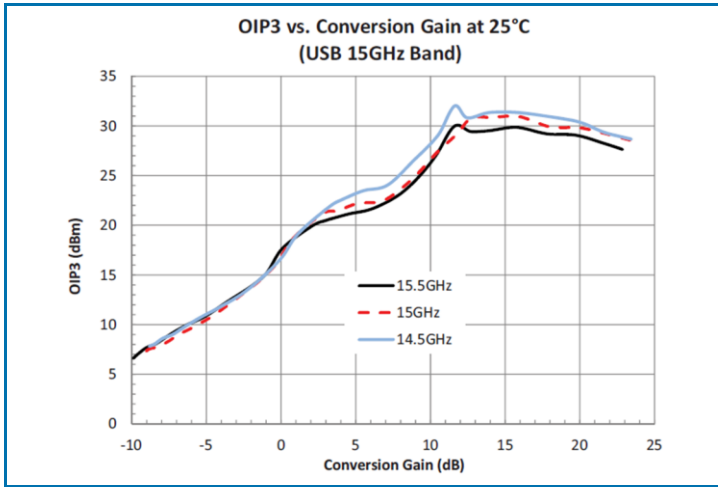
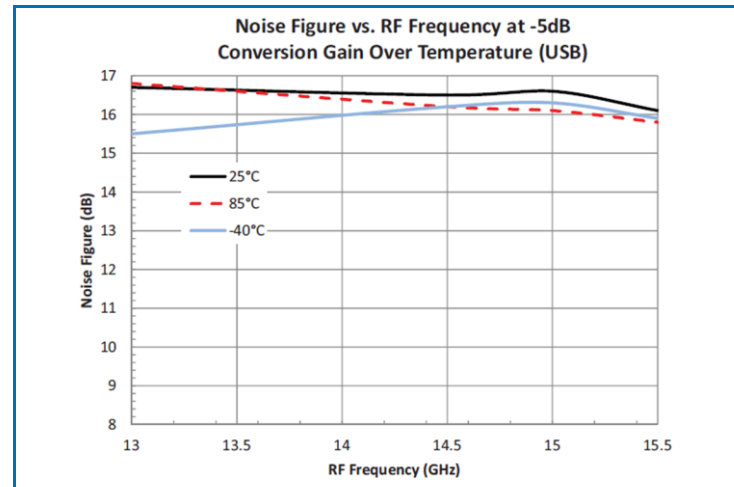
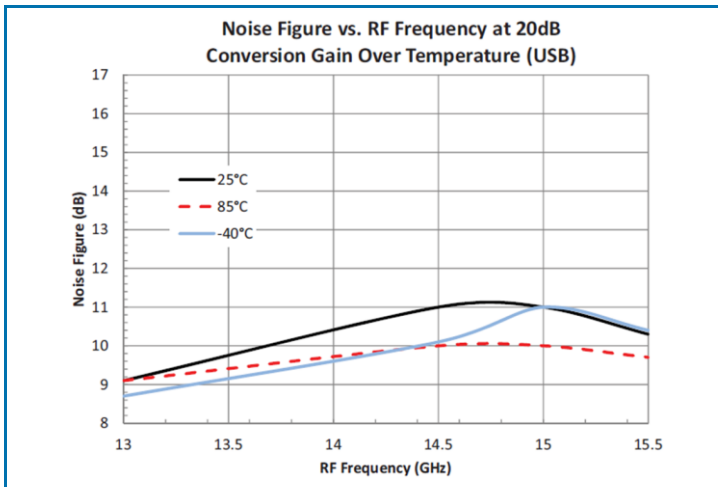
| Parameter                            | Specification |     |     | Unit | Condition    |
|--------------------------------------|---------------|-----|-----|------|--------------|
|                                      | Min           | Typ | Max |      |              |
| <b>General Performance</b>           |               |     |     |      |              |
| RF Frequency                         | 12            |     | 16  | GHZ  |              |
| LO Frequency                         | 8             |     | 20  | GHZ  |              |
| IF Frequency                         | DC            |     | 4   | GHZ  |              |
| LO input Drive                       | -1            | 0   | +5  | dBm  |              |
| Conversion Gain (Max.)               | 20            | 23  | 24  | dB   |              |
| Conversion Gain (Min.)               | -9            | -10 | -11 | dB   |              |
| NF (max. Gain)                       |               | 11  | 13  | dB   |              |
| NF (min. Gain)                       |               | 17  | 21  | dB   |              |
| OIP3 (max. Gain)                     | 25            | 28  |     | dBm  |              |
| OIP3 (min. Gain)                     | 9             | 12  |     | dBm  |              |
| Image Rejection                      | 15            | 20  |     | dBc  |              |
| LO Leakage at RF-Port (Maximum Gain) |               | -5  | 5   | dBm  | With IQ bias |
| LO Return Loss                       |               | 10  |     | dB   |              |
| RF Return Loss                       |               | 10  |     | dB   |              |
| $V_D$                                |               | 5   |     | V    |              |
| $I_D$                                |               | 380 | 500 | mA   |              |
| VVA                                  | -4            |     | 0   | V    |              |

### Typical Electrical Performance

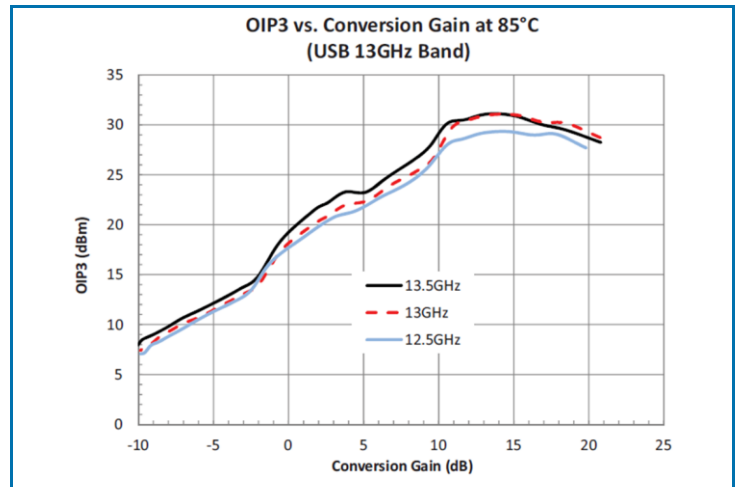
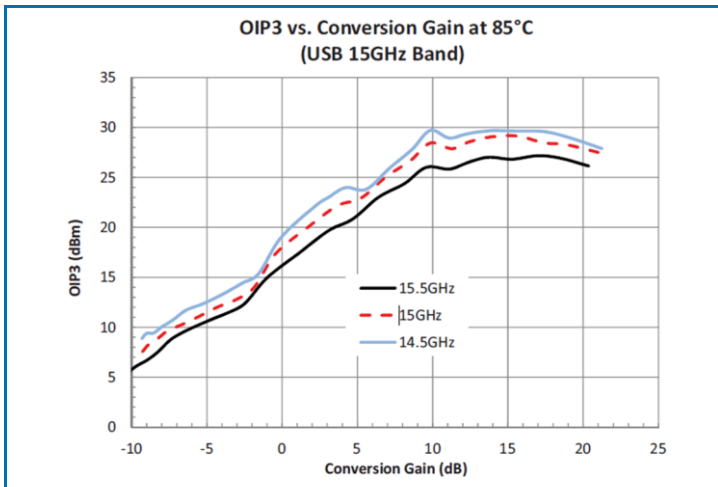
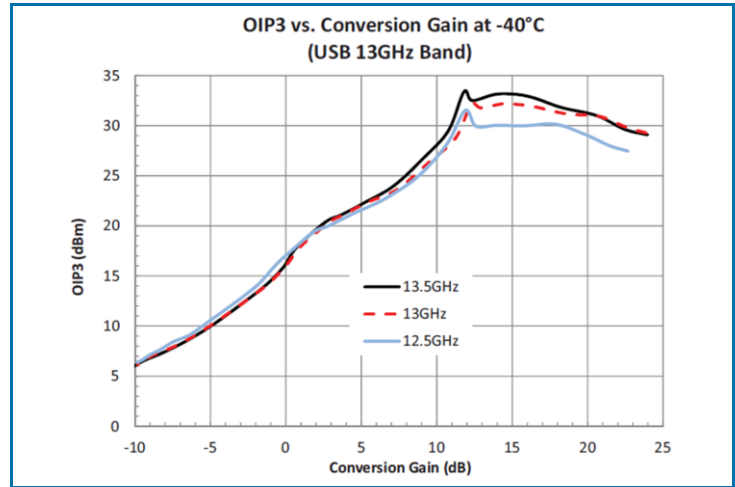
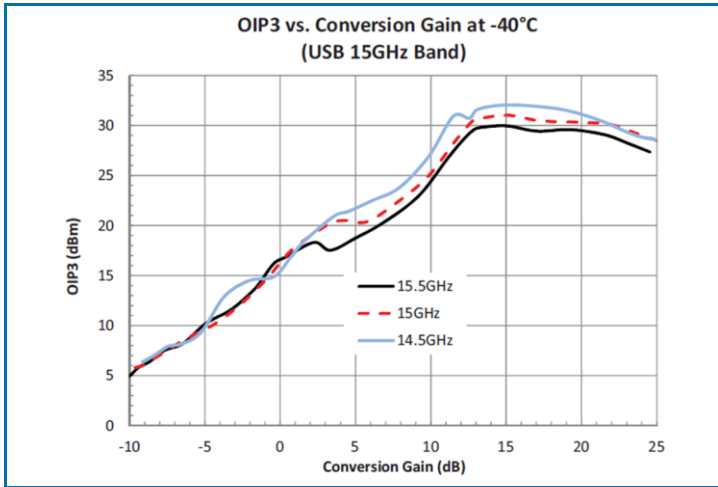
Measurements performed with I and Q (IF) ports connected to an external 90° Hybrid, LO Power = 0dBm and IF = 2.5GHz, -10dBm unless otherwise stated



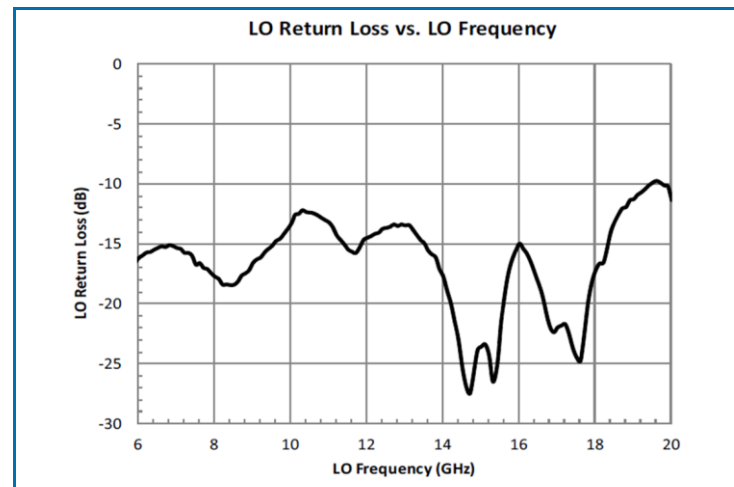
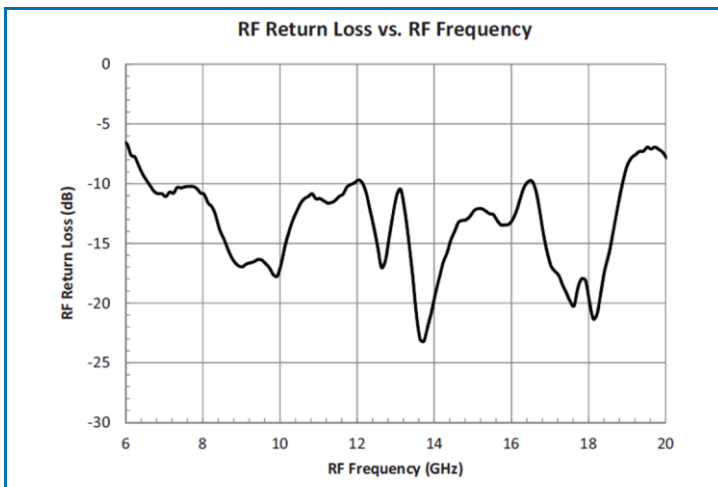
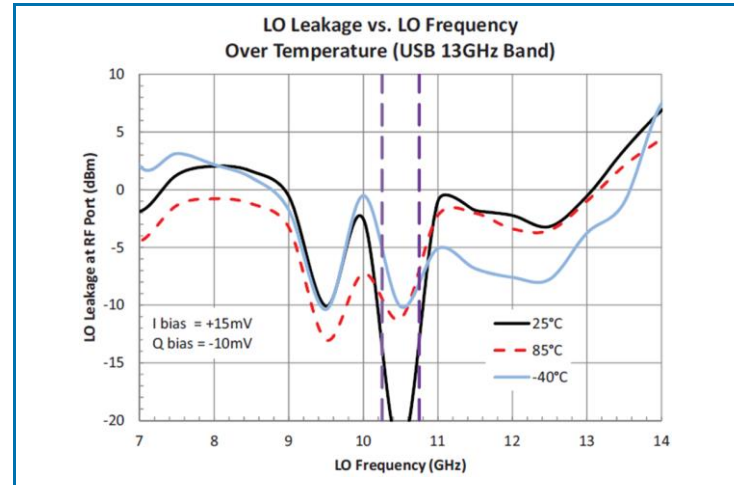
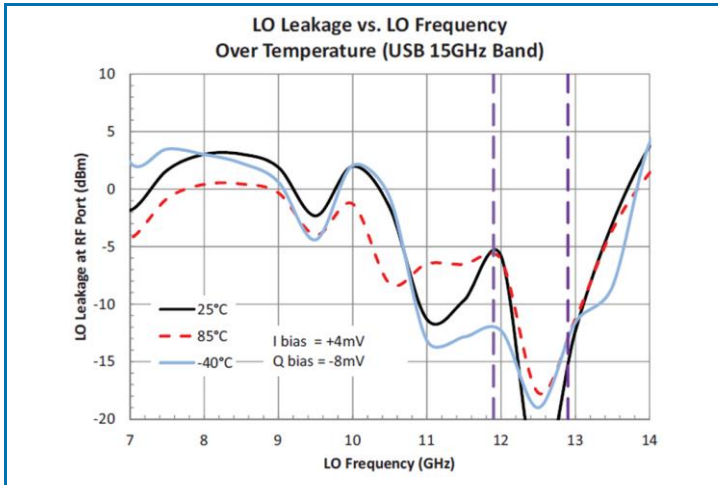
Typical Electrical Performance (continued)



Typical Electrical Performance (continued)



Typical Electrical Performance (continued)



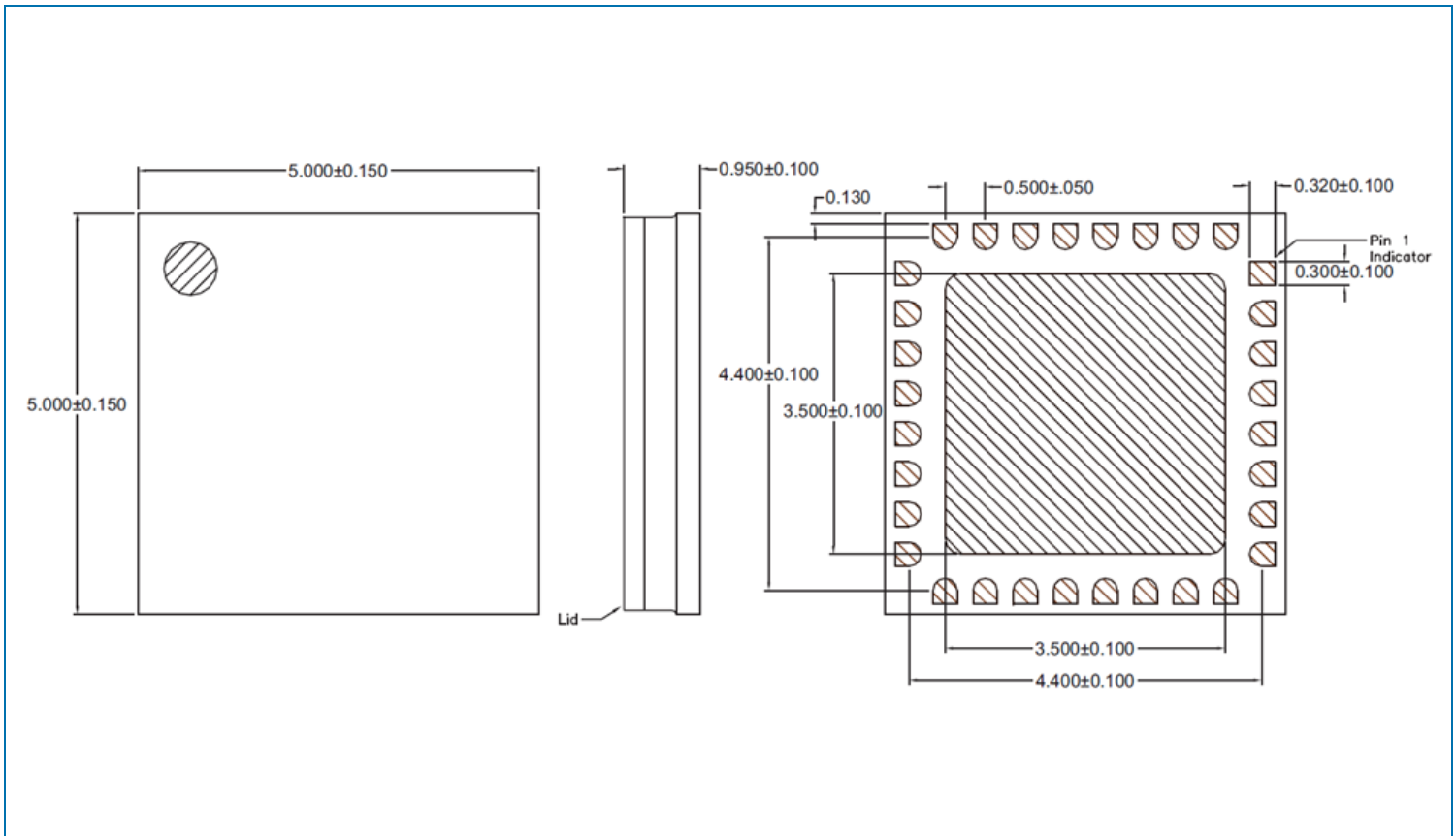
### Typical Bias Sequence and Gain Control

Optimum linearity versus gain is achieved using sequential bias. At maximum gain ( $V_{C1}$ ,  $V_{C4}$ ),  $V_{C2}$  and  $V_{C3}$  are set at -4V. ( $V_{C1}$ ,  $V_{C4}$ ),  $V_{C2}$  and  $V_{C3}$  are biased in sequence. The first dynamic range is achieved by setting  $V_{C2}$  and  $V_{C3}$  at -4V and varying ( $V_{C1}$ ,  $V_{C4}$ ) over the (-4V to -1.25V) range as shown in the table below. Similarly second dynamic range is achieved by setting ( $V_{C1}$ ,  $V_{C4}$ ) at -1V, setting  $V_{C3}$  to -4V and varying  $V_{C2}$  over the (-2.5V to -1.25V) range. Finally third dynamic range is achieved by setting ( $V_{C1}$ ,  $V_{C4}$ ) and  $V_{C2}$  at -1V, and varying  $V_{C3}$  over the (-2.5V to -1V) range.

### Bias Sequence 1 (Typical)

|          | Gmax |      |       |    |       |      |       |      |       |    |       |      |       |      |       |    |       |      | Gmin |
|----------|------|------|-------|----|-------|------|-------|------|-------|----|-------|------|-------|------|-------|----|-------|------|------|
| VC1, VC4 | -4   | -2.5 | -2.25 | -2 | -1.75 | -1.5 | -1.25 | -1   | -1    | -1 | -1    | -1   | -1    | -1   | -1    | -1 | -1    | -1   | -1   |
| VC2      | -4   | -4   | -4    | -4 | -4    | -4   | -4    | -2.5 | -2.25 | -2 | -1.75 | -1.5 | -1.25 | -1   | -1    | -1 | -1    | -1   | -1   |
| VC3      | -4   | -4   | -4    | -4 | -4    | -4   | -4    | -4   | -4    | -4 | -4    | -4   | -4    | -2.5 | -2.25 | -2 | -1.75 | -1.5 | -1   |

### Package Outline Drawing (Dimensions in millimeters)

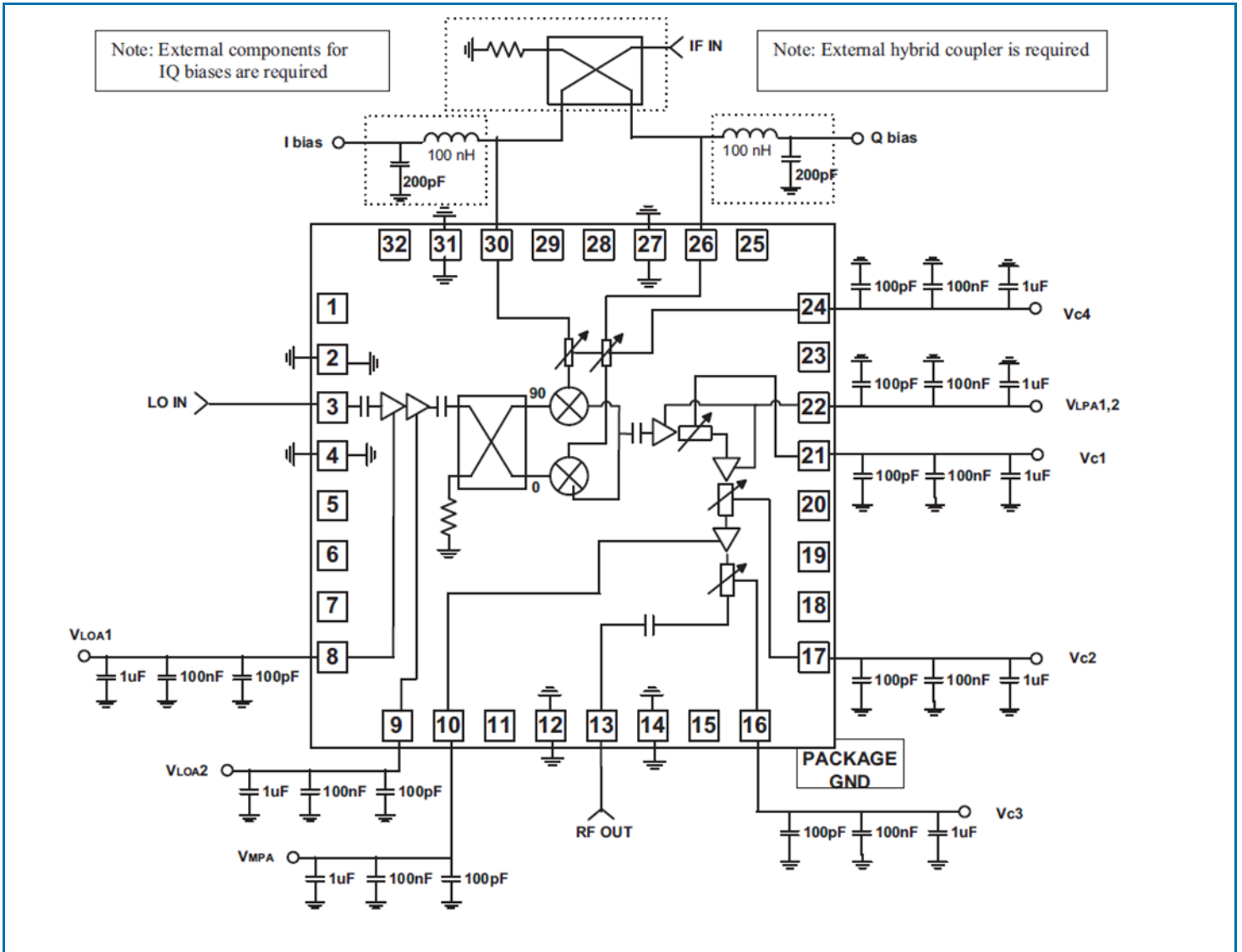


## Pin Names and Descriptions

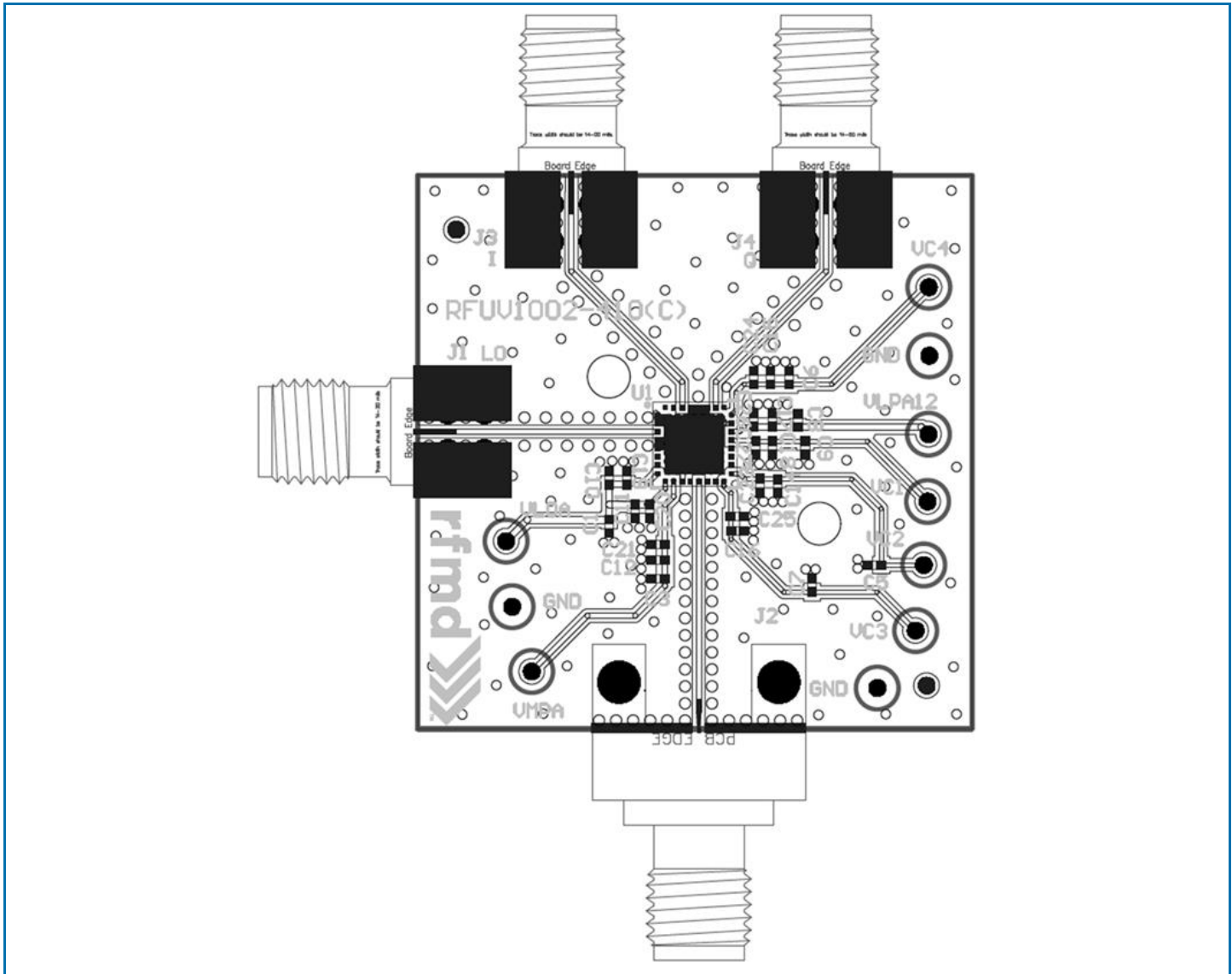
| Pin   | Name         | Description   |
|-------|--------------|---|
| 1     | N/C          |   |
| 2     | GND          | Ground  |
| 3     | LO           | Local oscillator input. AC coupled and matched to 50Ω |
| 4     | GND          | Ground  |
| 5-7   | N/C          |   |
| 8     | VLOA1        | LOA stage 1 drain bias                                |
| 9     | VLOA2        | LOA stage 2 drain bias                                |
| 10    | VMPA         | MPA drain bias  |
| 11    | N/C          |   |
| 12    | GND          | Ground  |
| 13    | RFOUT        | RF output. AC coupled and matched to 50W              |
| 14    | GND          | Ground  |
| 15    | N/C          |   |
| 16    | VC3          | Control line number 3 (See bias sequence description) |
| 17    | VC2          | Control line number 2 (See bias sequence description) |
| 18-20 | N/C          |   |
| 21    | VC1          | Control line number 1 (See bias sequence description) |
| 22    | VLPA1, VLPA2 | LPA stage 1,2 drain bias                              |
| 23    | N/C          |   |
| 24    | VC4          | Control line number 4 (See bias sequence description) |
| 25    | N/C          |   |
| 26    | Q            | IF Q input  |
| 27    | GND          | Ground  |
| 28-29 | N/C          |   |
| 30    | I            | If I input  |
| 31    | GND          | Ground  |
| 32    | N/C          |   |



### Application Circuit Block Diagram



Evaluation Board Layout



| Test Condition       |           |
|----------------------|-----------|
| LO Power             | 0dBm      |
| IF Power             | -10dBm    |
| VLOA1, VLOA2         | 5V        |
| VLPA1, VLPA2, VMPPA  | 5V        |
| (Vc1, Vc4), Vc2, Vc3 | -4V to 0V |

| Sub-Band Frequency Ranges |                      |
|---------------------------|----------------------|
| Band                      | Frequency Range      |
| 10GHz                     | 10GHz to 10.5GHz     |
| 11GHz                     | 10.7GHz to 11.7GHz   |
| 13GHz                     | 12.75GHz to 13.25GHz |
| 15GHz                     | 14.4GHz to 15.4GHz   |