



Product Description

GRF4003 is a broadband low noise gain block designed for small cell, wireless infrastructure and other high performance applications. It exhibits outstanding broadband NF, linearity and return losses over 100 to 3800 MHz with a single match.

Configured as a first stage LNA, linear driver or cascaded gain block, GRF4003 offers high levels of reuse both within a design and across platforms. The device is operated from a supply voltage (VDD) of 1.8 to 5.5 V with a selectable I_{DDQ} range of 30 to 120 mA for optimal efficiency and linearity.

GRF4003 is internally matched to 50 Ω at the input and output ports, needing only external DC blocks and a bias choke on the output.

Consult with the GRF applications engineering team for custom tuning/evaluation board data and device s-parameters.

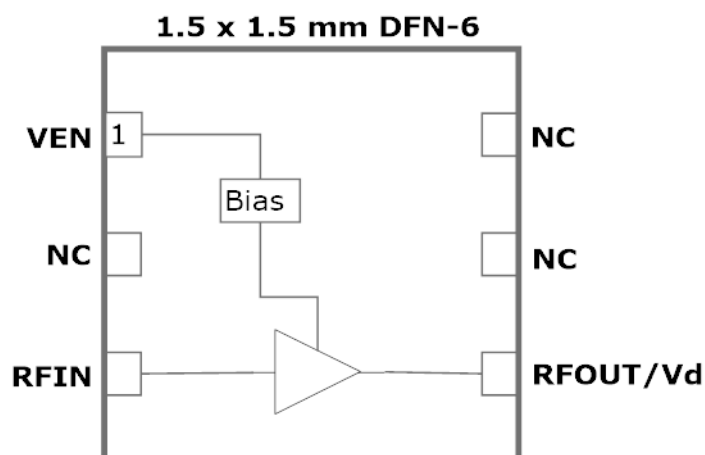
Features

Reference: 5V/95mA/2.5 GHz

- EVB NF: 0.85 dB
- Gain: 12.5 dB
- OP1dB: 25.0 dBm
- OIP3: 41.0 dBm
- Flexible Bias Voltage and Current
- Internally Matched to 50 Ω
- Process: GaAs pHEMT

Applications

- Linear Driver Amplifier
- Small Cells and Cellular Repeaters
- Distributed Antenna Systems
- First Stage LNA
- Microwave Backhaul



Absolute Ratings:

| Parameter | Symbol | Min. | Max. | Unit |
|---|-----------------------|------|------|------|
| Supply Voltage | V _{DD} | 0 | 6.0 | V |
| RF Input Power: (Load VSWR < 2:1; V _D : 5.0 volts) | P _{IN MAX} | | 22 | dBm |
| Operating Temperature (Package Heat Sink) | T _{AMB} | -40 | 105 | °C |
| Maximum Channel Temperature (MTF > 10 ⁶ Hours) | T _{MAX} | | 170 | °C |
| Maximum Dissipated Power | P _{DISS MAX} | | 700 | mW |
| Electrostatic Discharge: | | | | |
| Charged Device Model: | CDM | 1500 | | V |
| Human Body Model: | HBM | 250 | | V |
| Storage: | | | | |
| Storage Temperature | T _{STG} | -65 | 150 | °C |
| Moisture Sensitivity Level | MSL | | 1 | -- |



Caution! ESD Sensitive Device

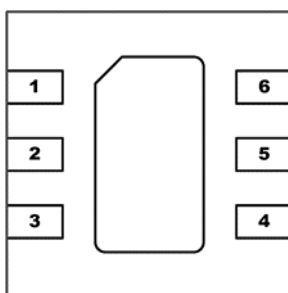


Exceeding Absolute Maximum Rating conditions may cause permanent damage to the device.

Note: For manufacturing information, see the Guerrilla-RF.com website for the following document located on the GRF4003 landing page: **Manufacturing Note—MN-001 Product Tape and Reel, Solderability and Package Outline Specification.**

[Link to manufacturing note](#)

Pin Out (Top View)



Pin Assignments:

| Pin | Name | Description | Note |
|-------------|---------------------|----------------------|---|
| 1 | V _{ENABLE} | Enable Voltage Input | V _{ENABLE} and series resistor set I _{DDQ} . V _{ENABLE} < 0.2 volts disables device. On-die pull-down resistor will turn the part off if this node is allowed to float. |
| 2 | NC | No Connect or Ground | No internal connection to die |
| 3 | RF _{In} | LNA RF input | Internally matched 50Ω. An external DC blocking cap must be used. |
| 4 | RF _{Out} | LNA RF output | Internally matched 50Ω. V _{DD} must be applied through a choke to this pin |
| 5 | NC | No Connect or Ground | No internal connection to die |
| 6 | NC | No Connect or Ground | No internal connection to die |
| PKG BASE | GND | Ground | Provides DC and RF ground for LNA, as well as thermal heat sink. Recommend multiple 8 mil vias beneath the package for optimal RF and thermal performance. Refer to evaluation board top layer graphic on schematic page. |



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GRF4003

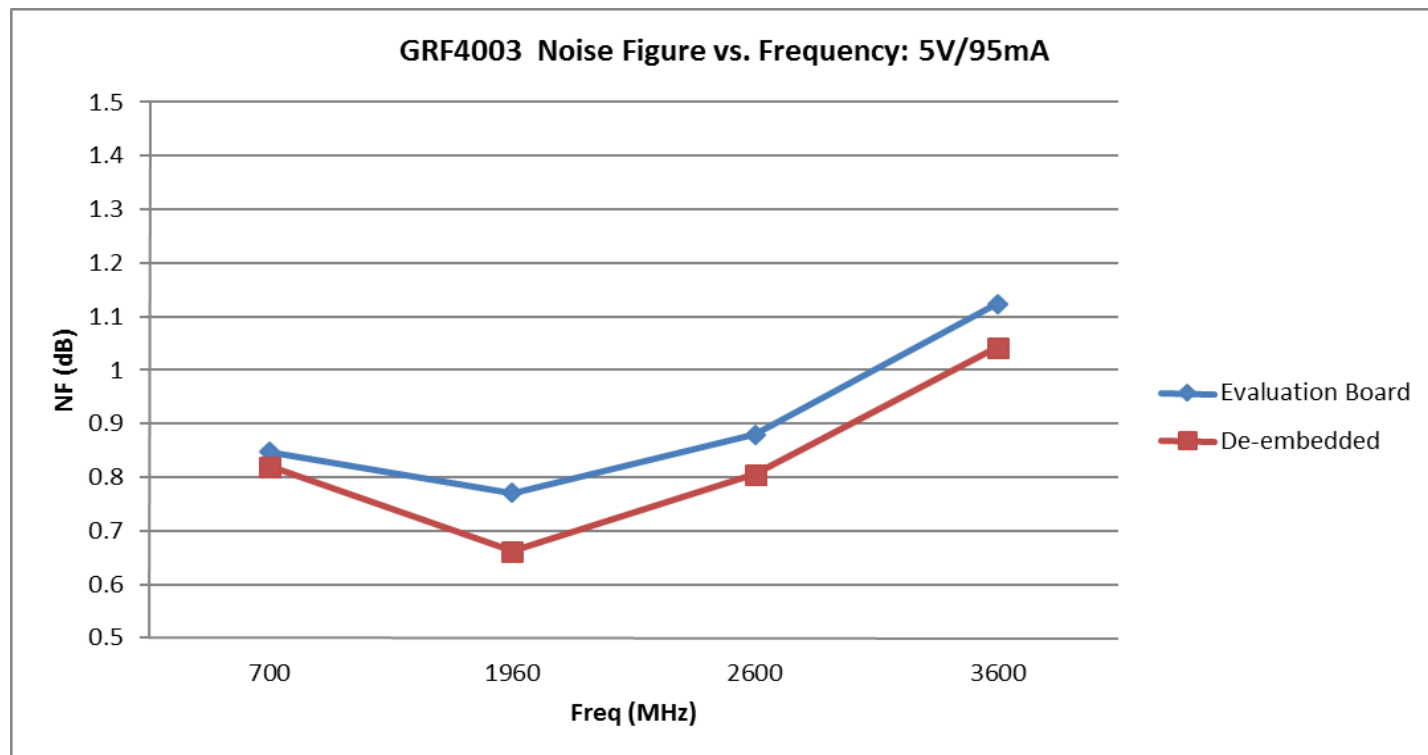
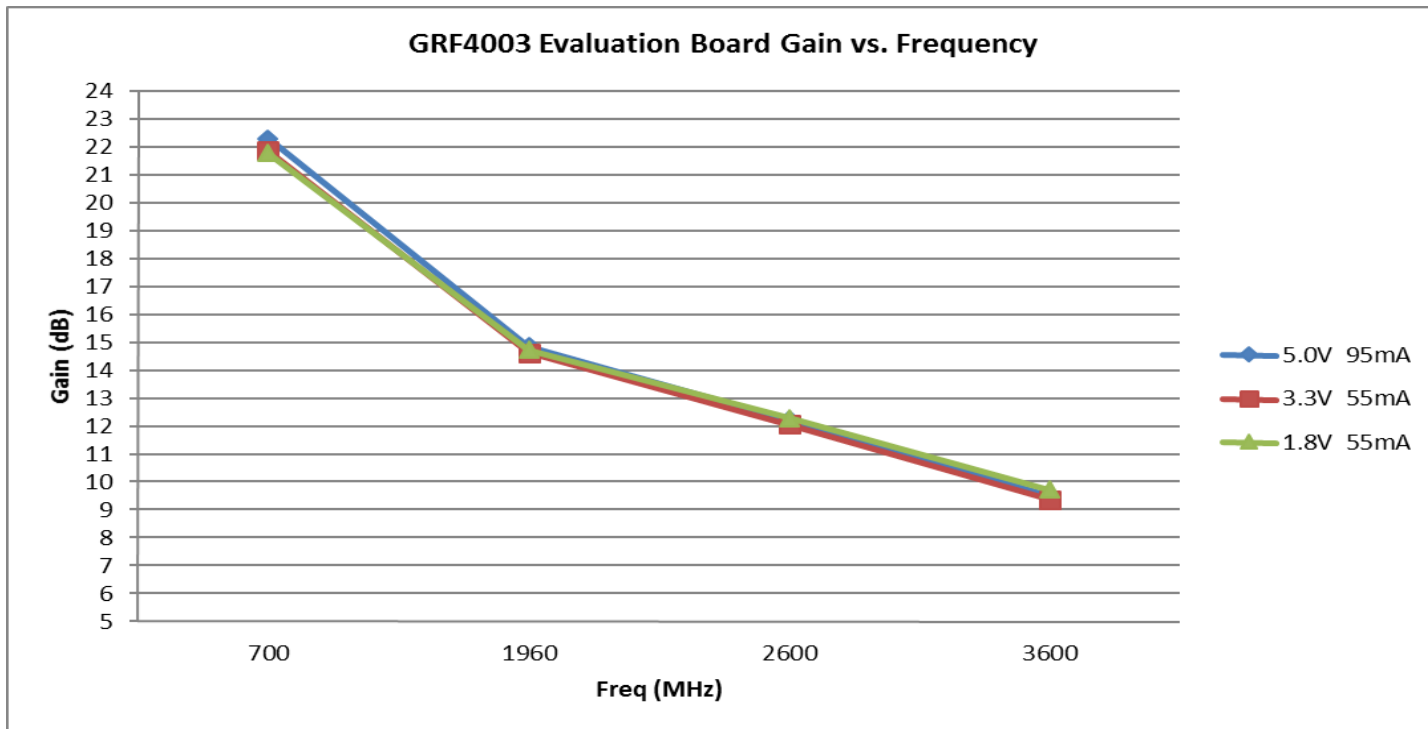
Broadband LNA/Linear Driver
0.1–3.8 GHz

Nominal Operating Parameters:

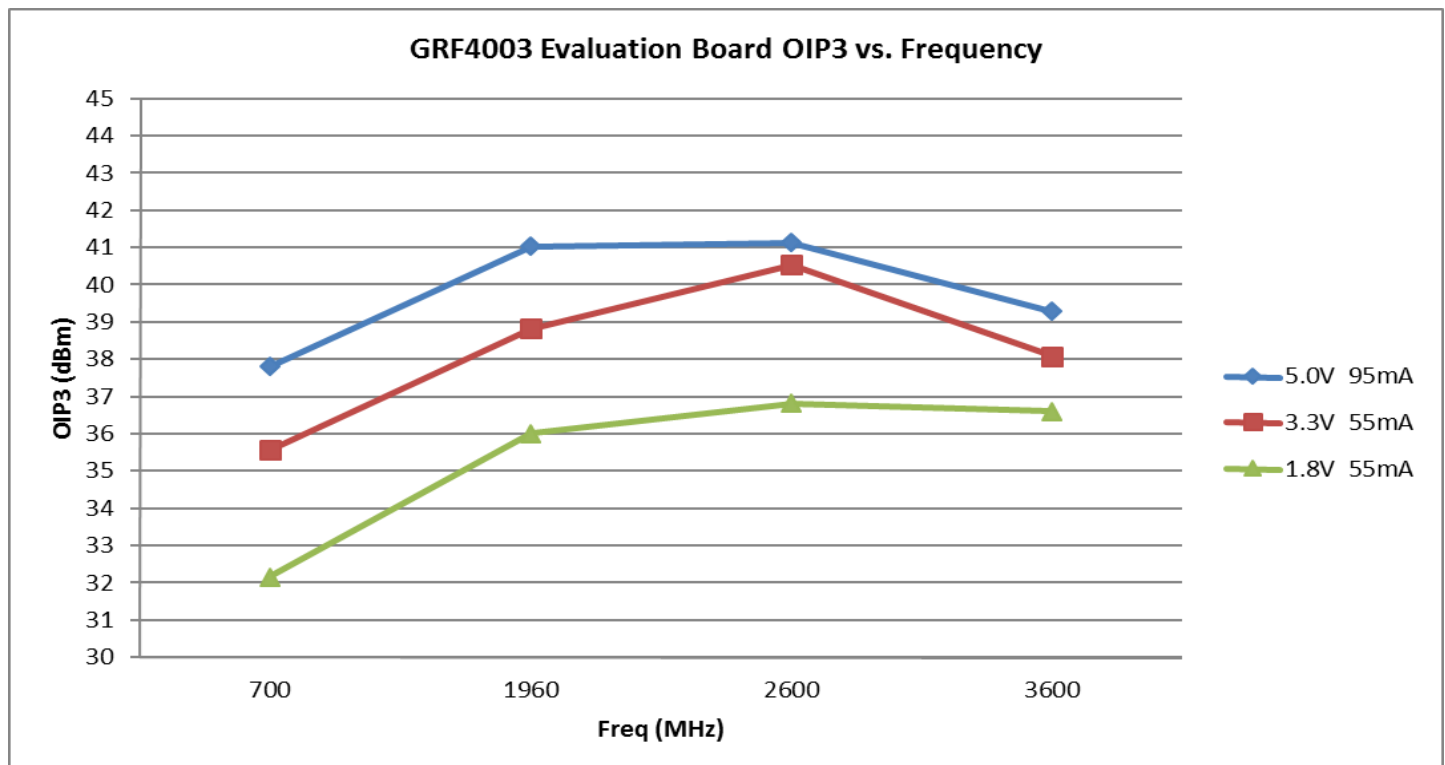
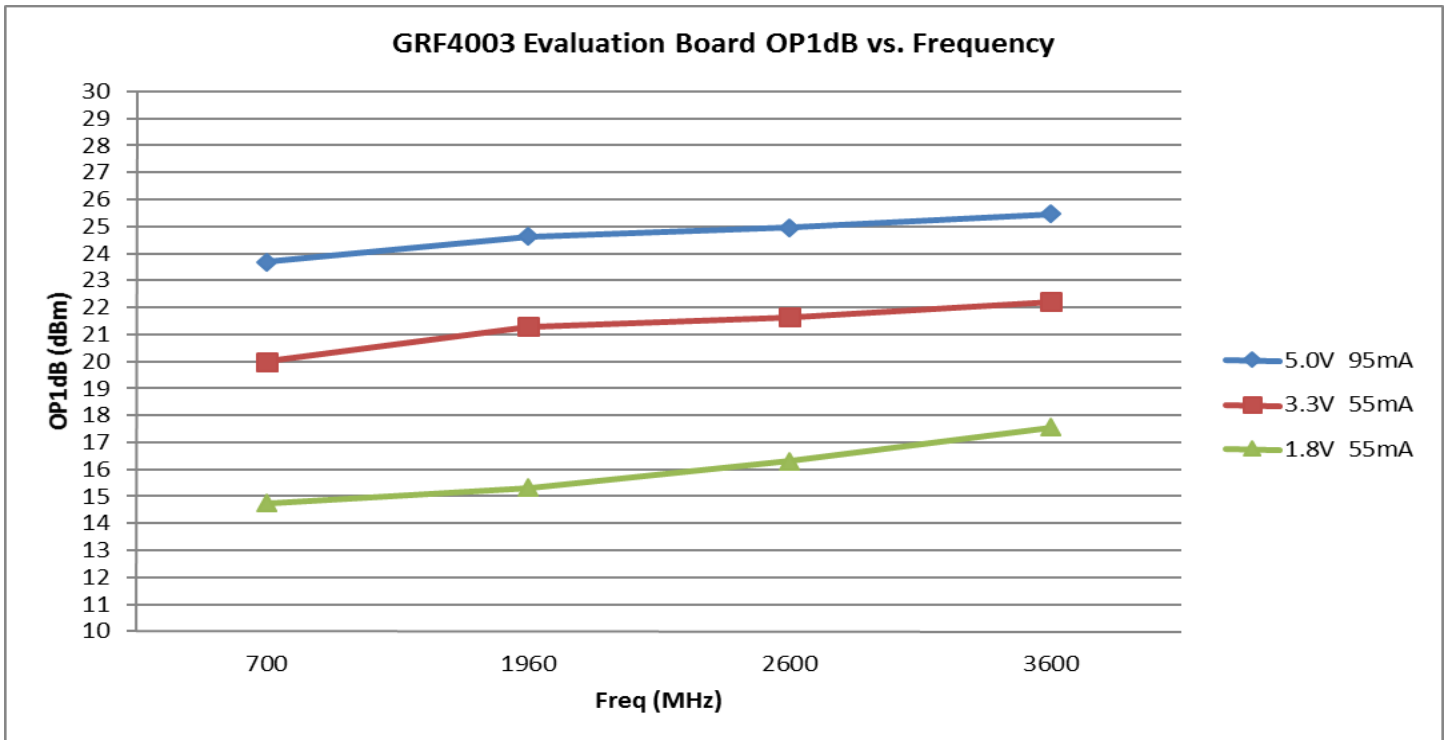
| Parameter | Symbol | Specification | | | Unit | Condition |
|---|----------------------|---------------|-------------------|-------|------|--|
| | | Min. | Typ. | Max. | | |
| Test Frequency | F _{TEST} | | 2500 | | MHz | V _{DD} = 5.0 V, T _A = 25 °C |
| Gain | S ₂₁ | 11.5 | 12.5 | | dB | |
| Evaluation Board Noise Figure | NF | | 0.85 | 1.05 | dB | |
| Output 3rd Order Intercept | OIP ₃ | | 41.0 | | dBm | +2.0 dBm P _{OUT} per tone at 2 MHz Spacing (2499 and 2501 MHz) |
| Output 1dB Compression Power | OP1dB | 23.5 | 25.0 | | dBm | |
| Switching Rise Time | T _{RISE} | | 500 | | ns | |
| Switching Fall Time | T _{FALL} | | 500 | | ns | |
| Supply Current | I _{DD} | 76.0 | 95.0 | 114.0 | mA | Target I _{DDQ} : 95 mA |
| Enable Current | I _{ENABLE} | | 3.0 | 6.0 | mA | |
| Disabled Mode | | | | | | |
| Leakage Current | I _{LEAKAGE} | | 3 | 30 | uA | V _{DD} : 5.0V; V _{ENABLE} : 0.0V |
| Thermal Data | | | | | | |
| Thermal Resistance: (Infra-Red Scan) | Θ _{jc} | | 117 | | °C/W | On standard Evaluation Board |
| Channel Temperature @ +85 C Reference (Package heat sink) | T _{CHANNEL} | | 141 (See note) | | °C | V _{DD} : 5.0 V; I _{DDQ} : 95 mA; No RF; P _{DISS} : 475 mW |

Note: MTTF >10⁶ hours for T_{CHANNEL} <=170 degrees C.

GRF4003 Evaluation Board Measured Data:



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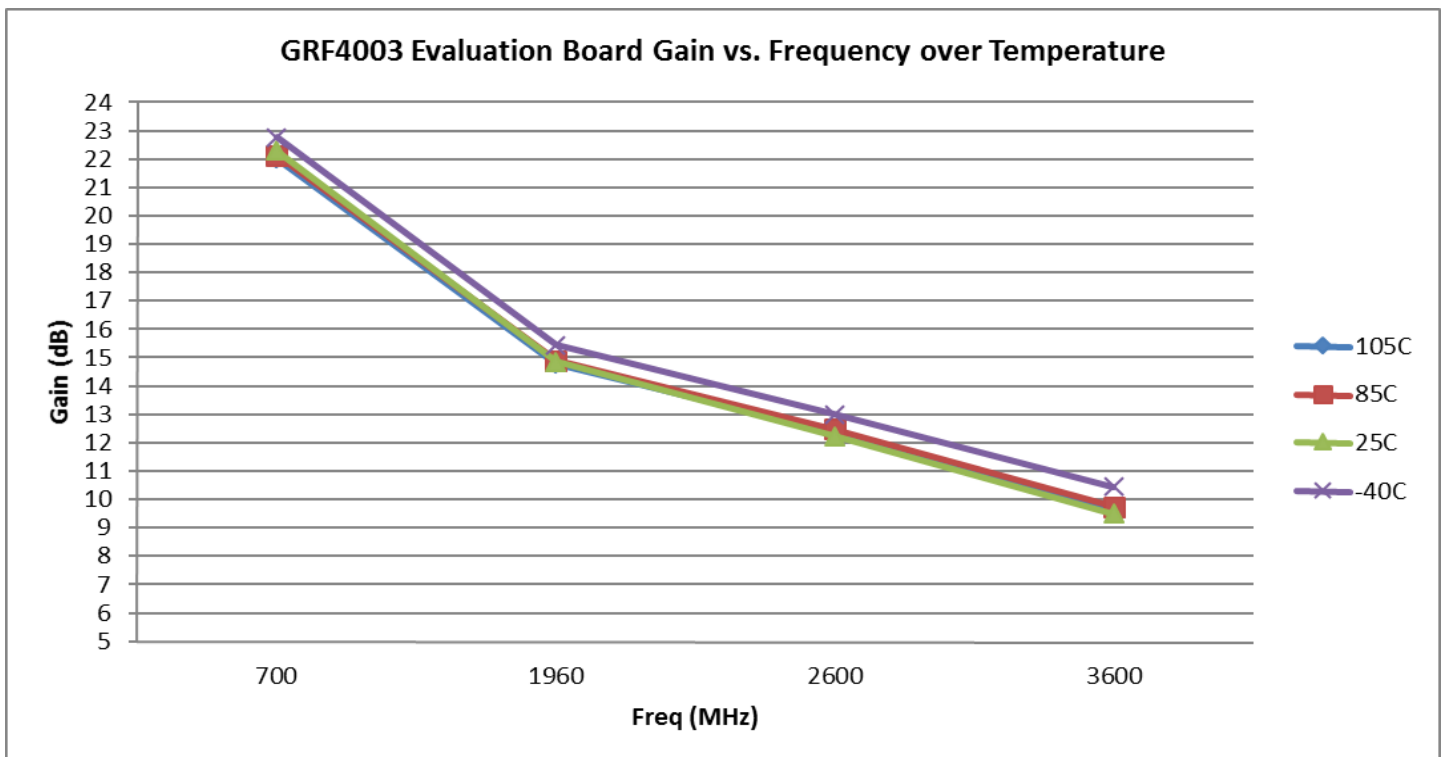
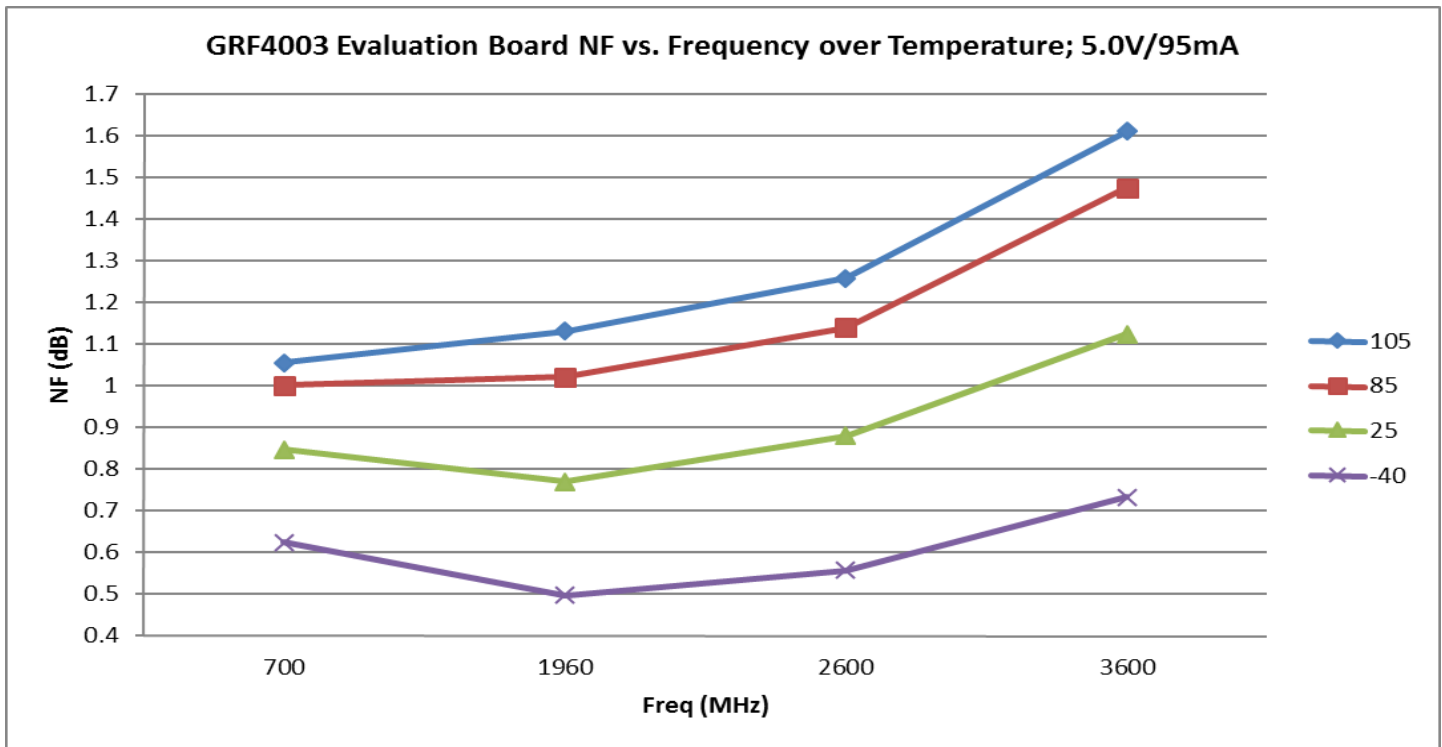


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GRF4003 Evaluation Board Performance over Temperature: (5V/95mA)



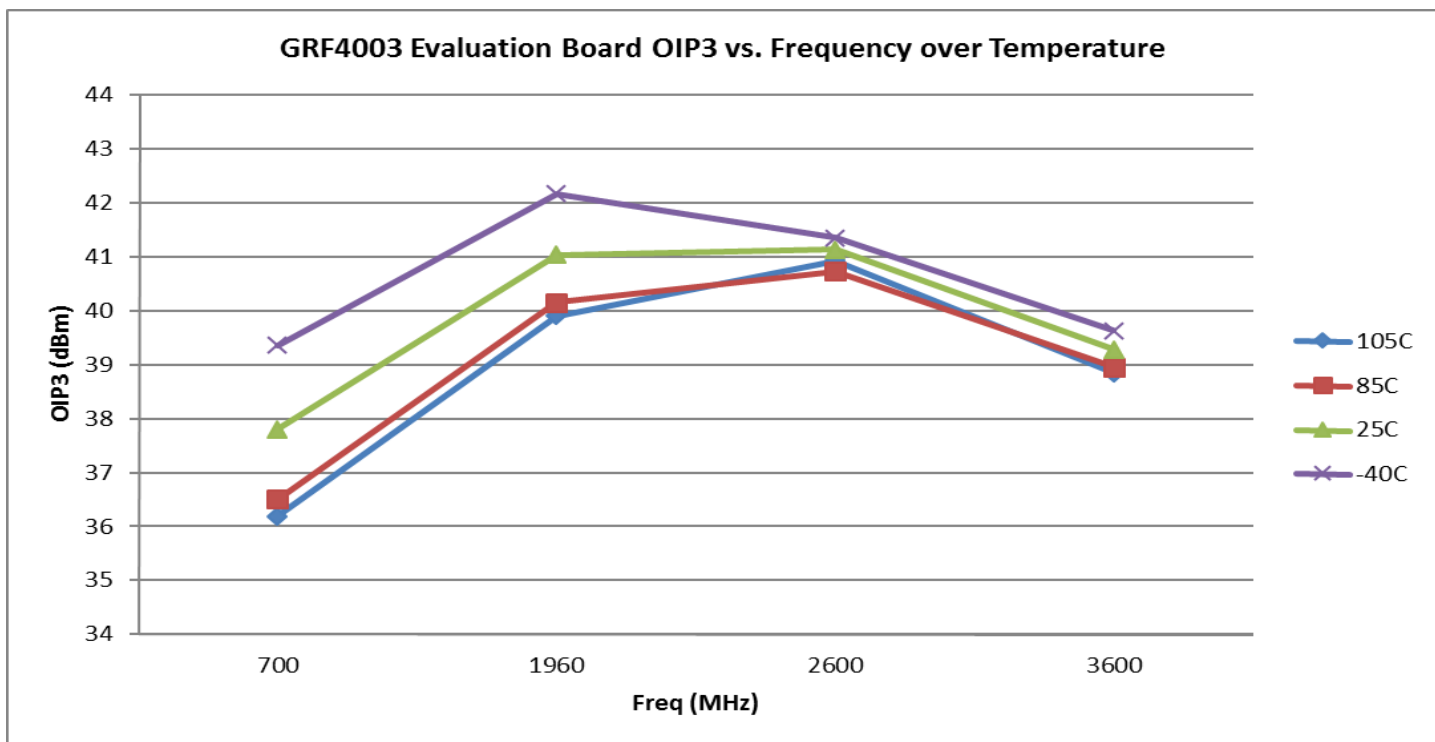
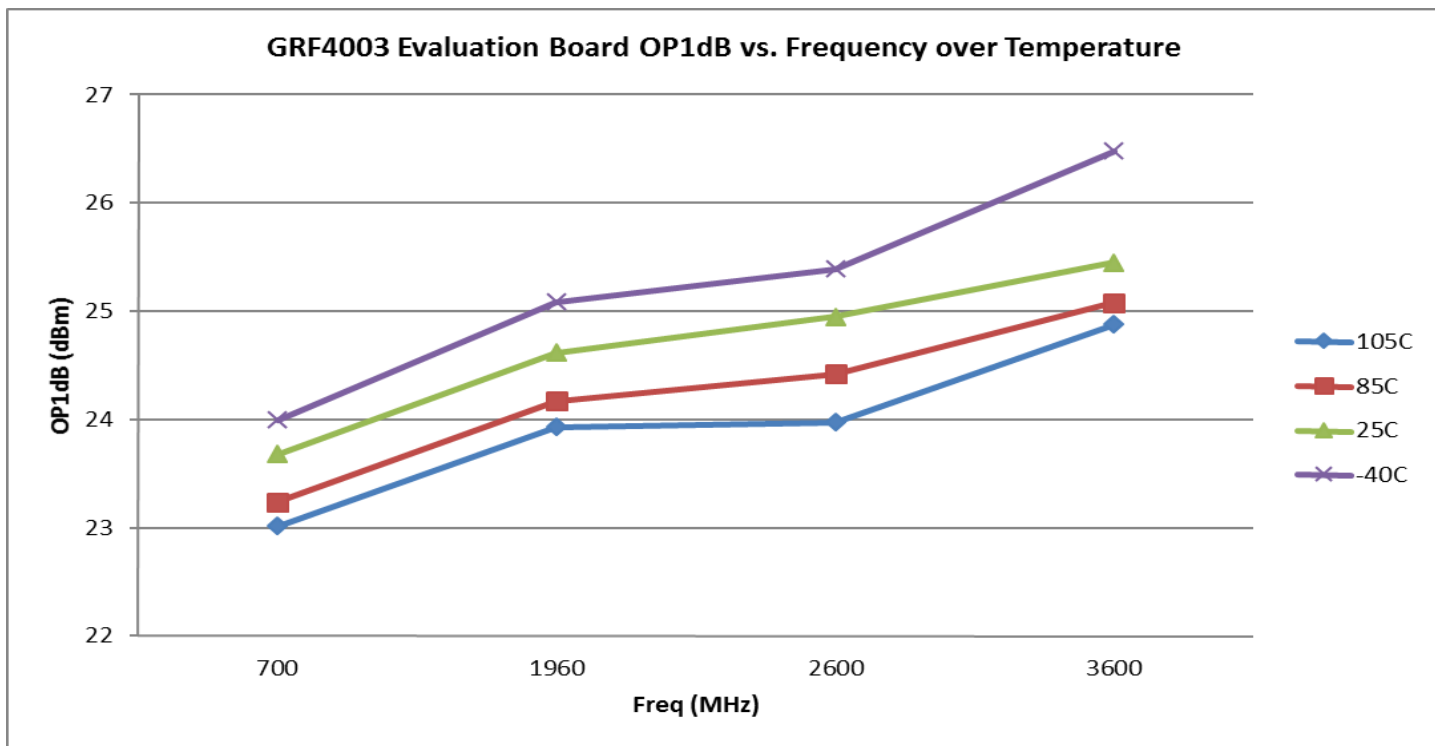


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GRF4003 Evaluation Board Performance over Temperature: (5V/95mA)



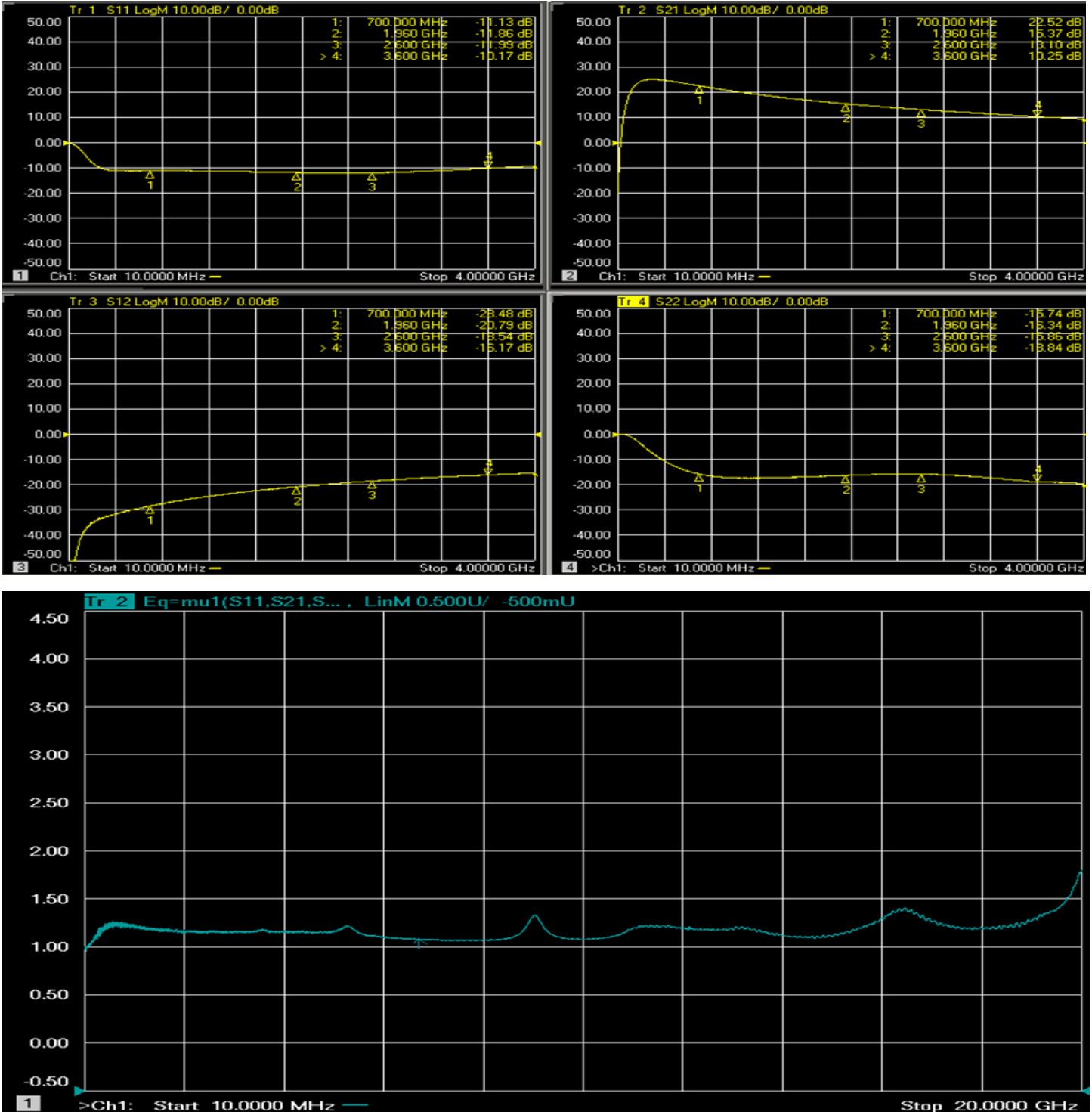


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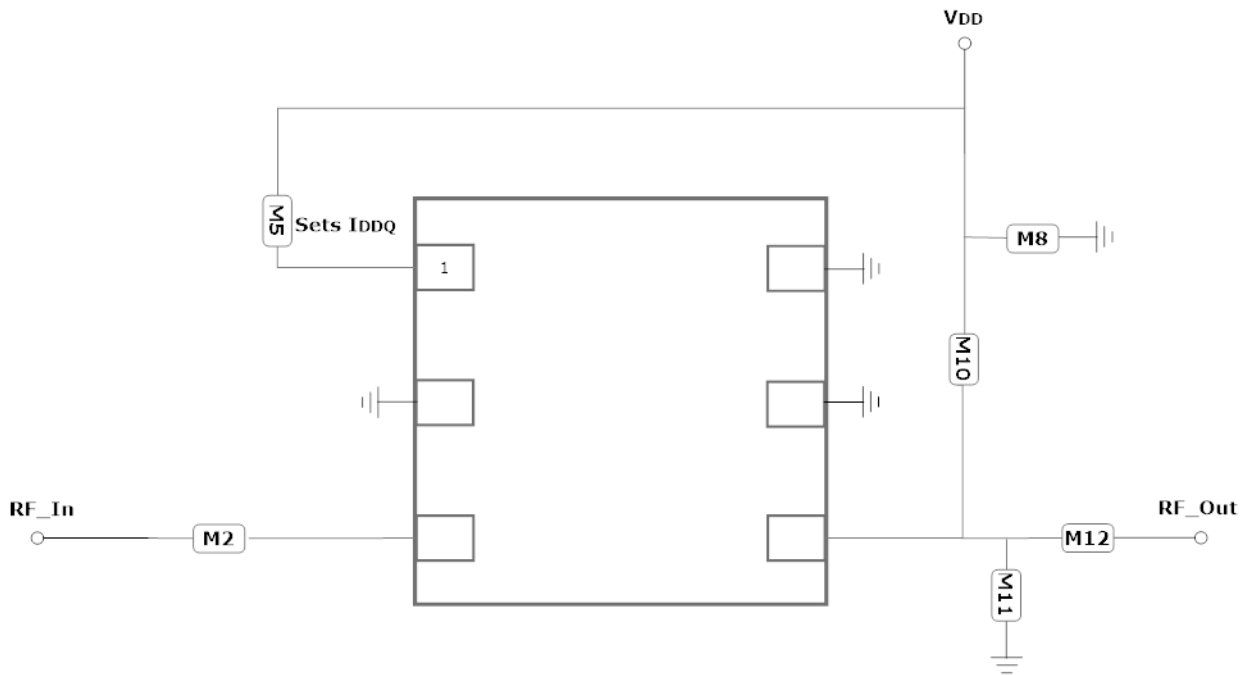
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0.1–3.8 GHz

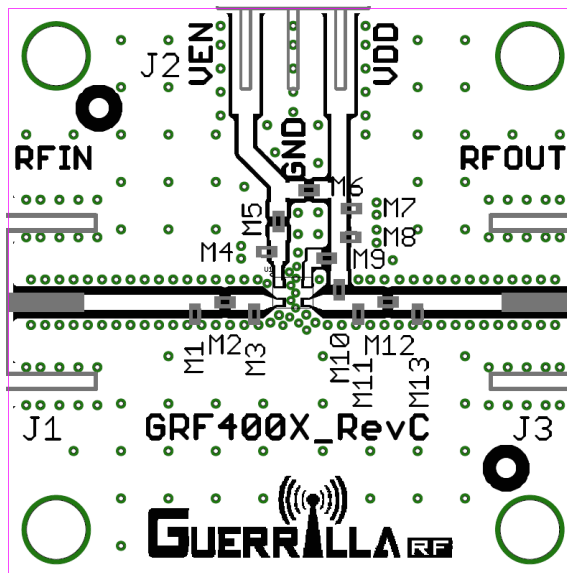
GRF4003 Evaluation Board S-Pars and Stability Mu Factor: (0.7 – 3.8 GHz Match)



Note: Mu factor ≥ 1.0 implies unconditional stability.



GRF4003 Application Schematic



GRF400X Evaluation Board Assembly Diagram



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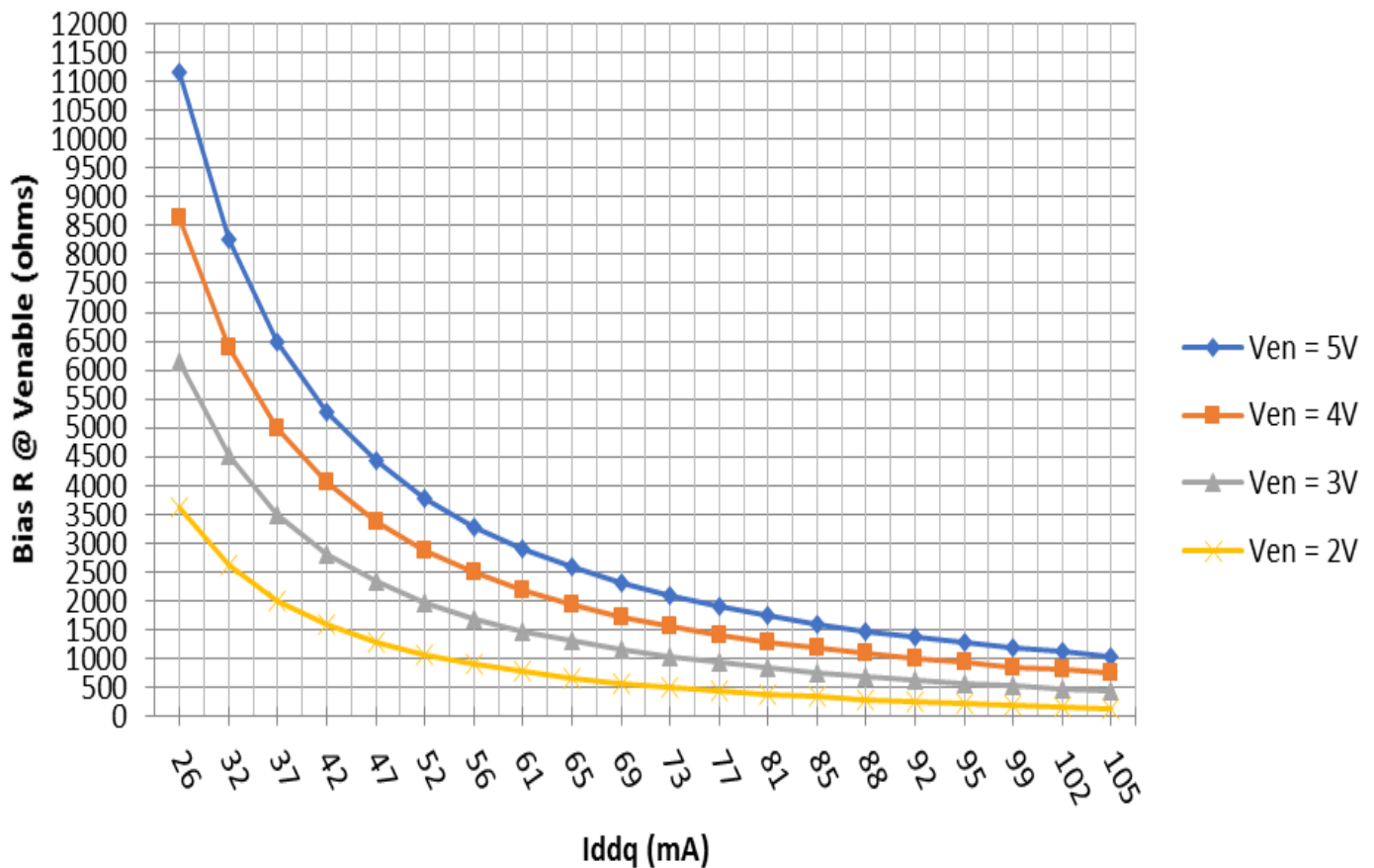
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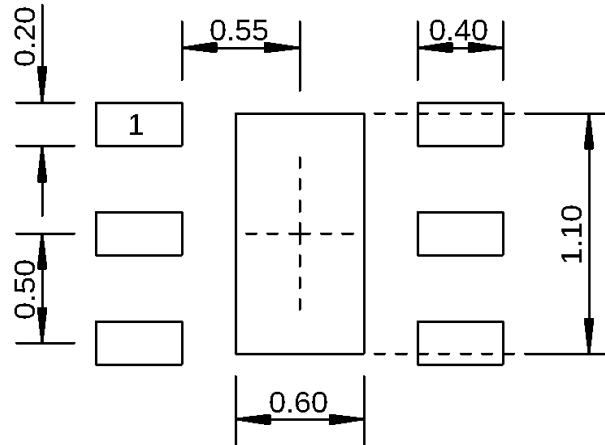
Broadband LNA/Linear Driver
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GRF4003 Standard Evaluation Board BOM: (0.7 to 3.8 GHz Tune)

| Component | Type | Manufacturer | Family | Value | Package Size | Substitution |
|-----------------|--------------|--------------|--------|--------|--------------|--------------|
| M2 | Capacitor | Murata | GJM | 30 pF | 0402 | ok |
| M5 (See curves) | Resistor: 5% | Various | — | — | 0402 | ok |
| M8 | Capacitor | Murata | GRM | 0.1 uF | 0402 | ok |
| M10 | Inductor | Murata | LQG | 68 nH | 0402 | ok |
| M11 | Capacitor | Murata | GJM | 0.5 pF | 0402 | ok |
| M12 | Capacitor | Murata | GJM | 10 pF | 0402 | ok |

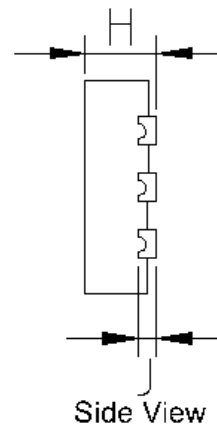
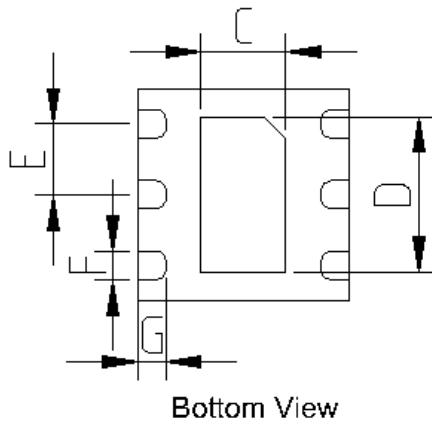
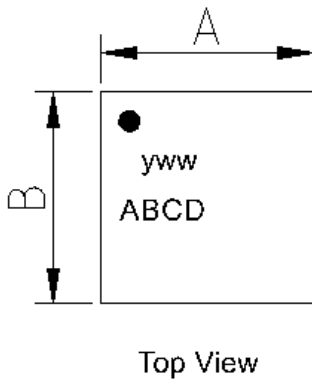
GRF4003 w/V_{dd} = 5.0V: Required Bias R @ Venable vs. I_{ddq}





Dimensions in millimeters

1.5 mm DFN-6 Suggested PCB Footprint (Top View)



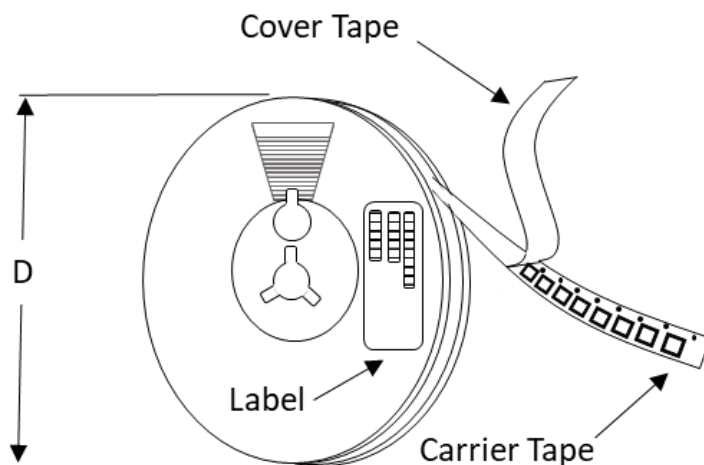
| Dimensions (MM) | |
|-----------------|---------------|
| A | 1.5 +/- 0.050 |
| B | 1.5 +/- 0.050 |
| C | .6 +/- 0.050 |
| D | 1.1 +/- 0.050 |
| E | .5 Bsc |
| F | .2 +/- 0.050 |
| G | .2 +/- 0.050 |
| H | .45 +/- 0.050 |
| J | .12 Ref. |

1.5 mm DFN-6 Package Dimensions

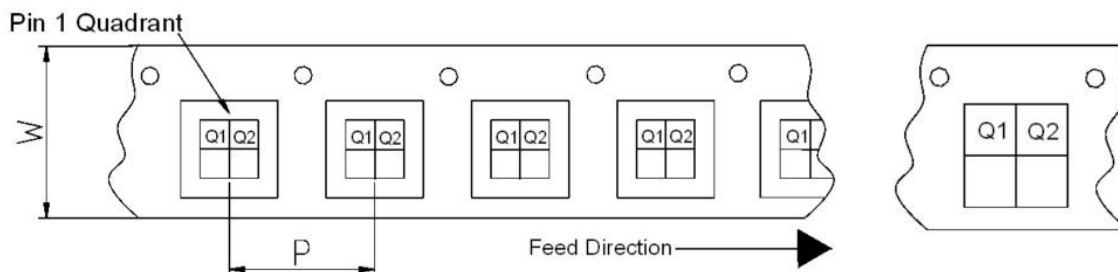
Tape and Reel Information:

Guerrilla RF’s Tape and Reel specification complies with the Electronics Industries Association (EIA) standards for ‘Embossed Carrier Tape of Surface Mount Components for Automatic Handling’. Reference EIA-481. See the table on the following page for Tape and Reel specifications along with units per reel.

Devices are loaded with pins down into the carrier pocket with protective cover tape, wound into a plastic reel. Each reel will be packaged in a cardboard box. There will be product labels on the reel, the protective ESD bag and the outside surface of the box.



Tape and Reel Packaging with Reel Diameter Noted (D)



Carrier Tape Width (W), Pitch (P), Feed Direction and Pin 1 Quadrant Information



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0.1–3.8 GHz

Tape and Reel Specification and Device Package Information Table

| Package | | | | Carrier Tape | | | Reel | |
|---------|------------------|----------|-------------|----------------|-----------------------|----------------|-----------------------|----------------|
| Type | Dimensions (mm) | Leads | Weight (mg) | Width (W) (mm) | Pocket Pitch (P) (mm) | Pin 1 Quadrant | Diameter (D) (inches) | Units per Reel |
| QFN | 2.0 x 2.0 x 0.50 | 12 | 7 | 8 | 4 | Q1 | 7 | 2500 |
| QFN | 3.0 x 3.0 x 0.85 | 16 | 24 | 12 | 8 | Q1 | 7 | 1500 |
| DFN | 1.5 x 1.5 x 0.45 | 6 | 4 | 8 | 4 | Q1 | 7 | 2500 |
| DFN | 2.0 x 2.0 x 0.75 | 8 | 12 | 8 | 4 | Q1 | 7 | 2500 |
| LFM | 3.5 x 3.5 x 0.75 | See note | TBD | 12 | 8 | Q2 | 7 | 1500 |
| LFM | 4.0 x 4.0 x 0.75 | See note | TBD | 12 | 8 | Q2 | 7 | 1500 |

Note: Lead count may vary. Reference applicable product data sheet



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Broadband LNA/Linear Driver
0.1–3.8 GHz

| Data Sheet Release Status: | Notes |
|----------------------------|---|
| Advance | S-parameter and NF data based on EM simulations for the fully packaged device using foundry supplied transistor s-parameters. Linearity estimates based on device size, bias condition and experience with related devices. |
| Preliminary | All data based on evaluation board measurements in the Guerrilla RF Applications Lab. |
| Released | All data based on device qualification data. Typically, this data is nearly identical to the data found in the preliminary version. Max and min values for key RF parameters are included. |

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