



## Product Description

The GRF4004 is a broadband low noise gain block designed for small cell, wireless infrastructure and other high performance applications. With simple external matching, it exhibits outstanding broadband NF, linearity and return losses over wide fractional bandwidths with a single match.

Configured as a first stage LNA, linear driver or cascaded gain block, GRF4004 offers high levels of reuse both within a design and across platforms. The device is operated from a supply voltage ( $V_{DD}$ ) of 1.8 to 5.0V.  $I_{DDQ}$  can be adjusted over a wide range for optimal efficiency and linearity.

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

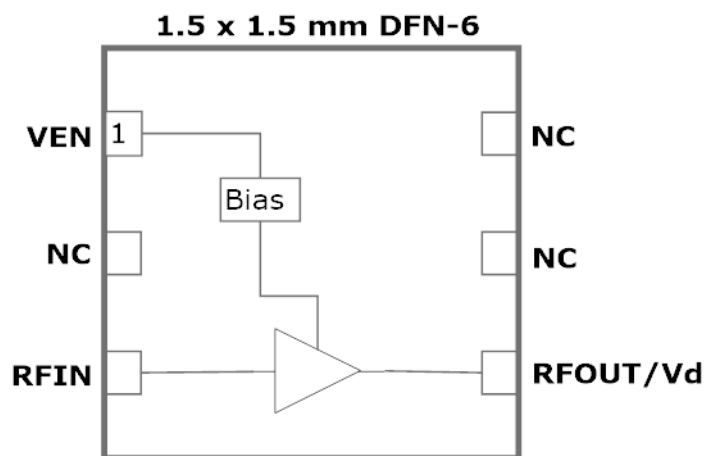
## Features

Reference: 5V/135mA /2.5 GHz

- EVB NF: 0.95 dB
- Gain: 12.5 dB
- OP1dB: 26.7 dBm
- OIP3: 42.3 dBm
- Flexible Bias Voltage and Current
- Process: GaAs pHEMT

## Applications

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





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# GRF4004

Broadband LNA/Linear Driver  
Tuning Range: 0.1–3.8 GHz

## Absolute Ratings:

| Parameter   | Symbol                | Min. | Max. | Unit |
|---|-----------------------|------|------|------|
| Supply Voltage  | V <sub>DD</sub>       | 0    | 6.0  | V    |
| RF Input Power: (Load VSWR < 2:1; V <sub>D</sub> : 5.0 volts) | P <sub>IN MAX</sub>   |      | 20   | dBm  |
| Operating Temperature (Package Heat Sink)                     | T <sub>AMB</sub>      | -40  | 105  | °C   |
| Maximum Channel Temperature (MTTF > 10 <sup>6</sup> Hours)    | T <sub>MAX</sub>      |      | 170  | °C   |
| Maximum Dissipated Power                                      | P <sub>DISS MAX</sub> |      | 800  | mW   |
| <b>Electrostatic Discharge:</b>                               |                       |      |      |      |
| Charged Device Model:   | CDM                   | 1500 |      | V    |
| Human Body Model:   | HBM                   | 250  |      | V    |
| <b>Storage:</b>   |                       |      |      |      |
| Storage Temperature   | T <sub>STG</sub>      | -65  | 150  | °C   |
| Moisture Sensitivity Level                                    | MSL                   |      | 1    | --   |



Caution! ESD Sensitive Device

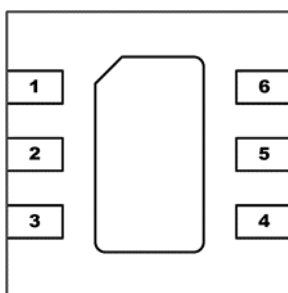


Exceeding Absolute Maximum Rating conditions may cause permanent damage to the device.

**Note:** For package dimensions and manufacturing information, see the [Guerrilla-RF.com](http://Guerrilla-RF.com) website for the following document located on the GRF4004 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 <sub>ENABLE</sub> | Enable Voltage Input | Venable < 0.1 volts turns the device off. Venable and series resistor control the device I <sub>DDQ</sub> .  |
| 2        | NC                  | No Connect or Ground | No internal connection to die  |
| 3        | RF_In               | LNA RF input         | An external DC blocking cap must be used.  |
| 4        | RF_Out              | LNA RF output        | V <sub>DD</sub> 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. Use multiple ground vias beneath the package for optimal RF and thermal performance |



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## Nominal Operating Parameters:

| Parameter   | Symbol        | Specification |      |      | Unit                      | Condition  |
|---|---------------|---------------|------|------|---------------------------|--|
|   |               | Min.          | Typ. | Max. |                           |  |
| Test Frequency  | $F_{TEST}$    |               | 2500 |      | MHz                       | $V_{DD} = 5.0\text{ V}$ , $T_A = 25\text{ }^\circ\text{C}$                           |
| Gain  | $S_{21}$      | 11.5          | 12.5 |      | dB                        |  |
| Evaluation Board Noise Figure                             | NF            |               | 0.95 | 1.15 | dB                        | Includes Board Losses  |
| Output 1dB Compression Power                              | OP1dB         | 25.2          | 26.7 |      | dBm                       |  |
| Output 3rd Order Intercept                                | OIP3          |               | 42.3 |      | dBm                       | +2.0 dBm $P_{OUT}$ per tone at 2 MHz Spacing (2499 and 2501 MHz)                     |
| Switching Rise Time                                       | $T_{RISE}$    |               | 300  |      | ns                        |  |
| Switching Fall Time                                       | $T_{FALL}$    |               | 300  |      | ns                        |  |
| Supply Current  | $I_{DD}$      | 108           | 135  | 162  | mA                        | Adjustable for optimal IP3   |
| Leakage Current   | $I_{LEAKAGE}$ |               | 1.0  | 10   | uA                        | $V_{DD}: 5.0\text{V}$ ; $V_{ENABLE}: 0.0\text{V}$                                    |
| Thermal Data  |               |               |      |      |                           |  |
| Thermal Resistance: (Infra-Red Scan)                      | $\Theta_{JC}$ |               | 100  |      | $^\circ\text{C}/\text{W}$ | On standard Evaluation Board   |
| Channel Temperature @ +85 C Reference (Package heat sink) | $T_{CHANNEL}$ |               | 153  |      | $^\circ\text{C}$          | $V_{DD}: 5.0\text{ V}$ ; $I_{DDQ}: 135\text{ mA}$ ; No RF; $P_{DISS}: 675\text{ mW}$ |

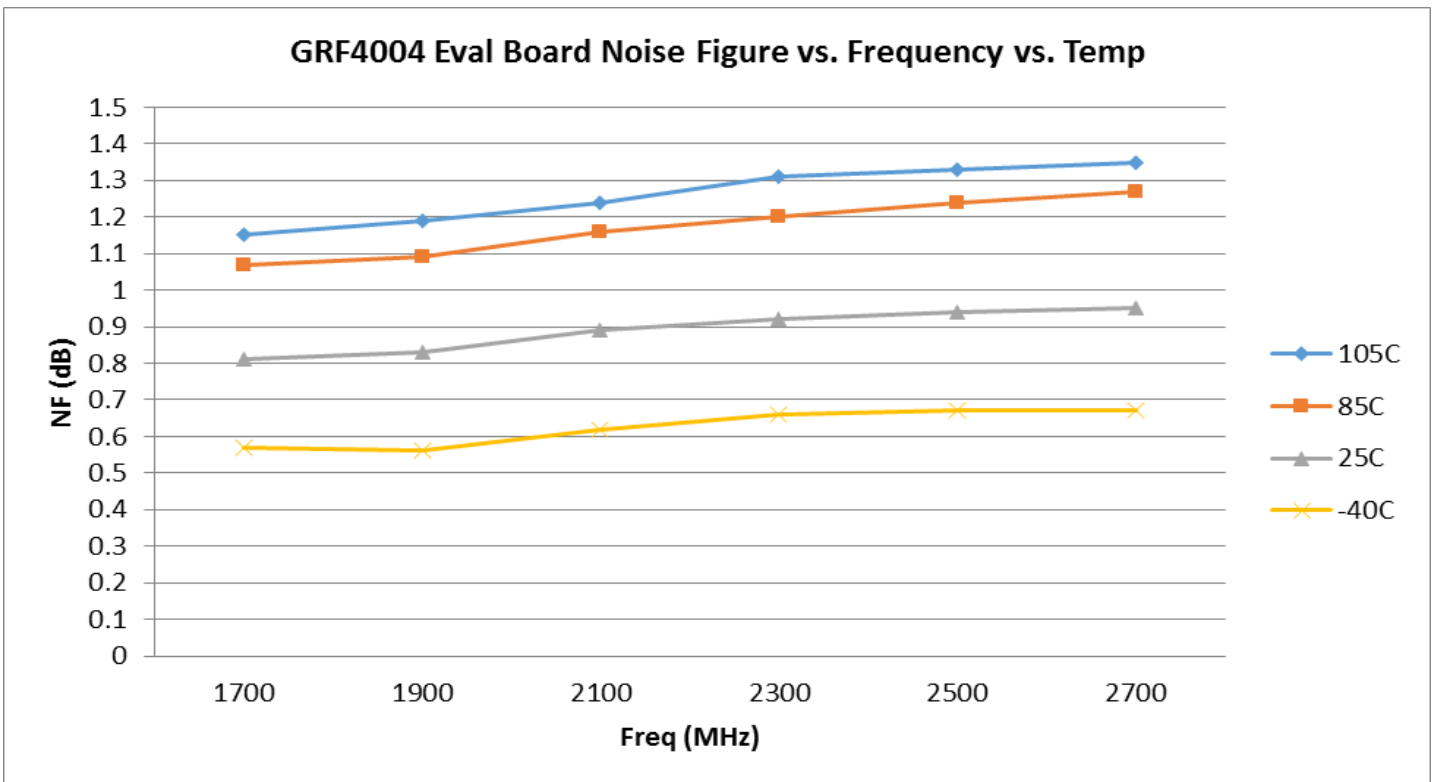
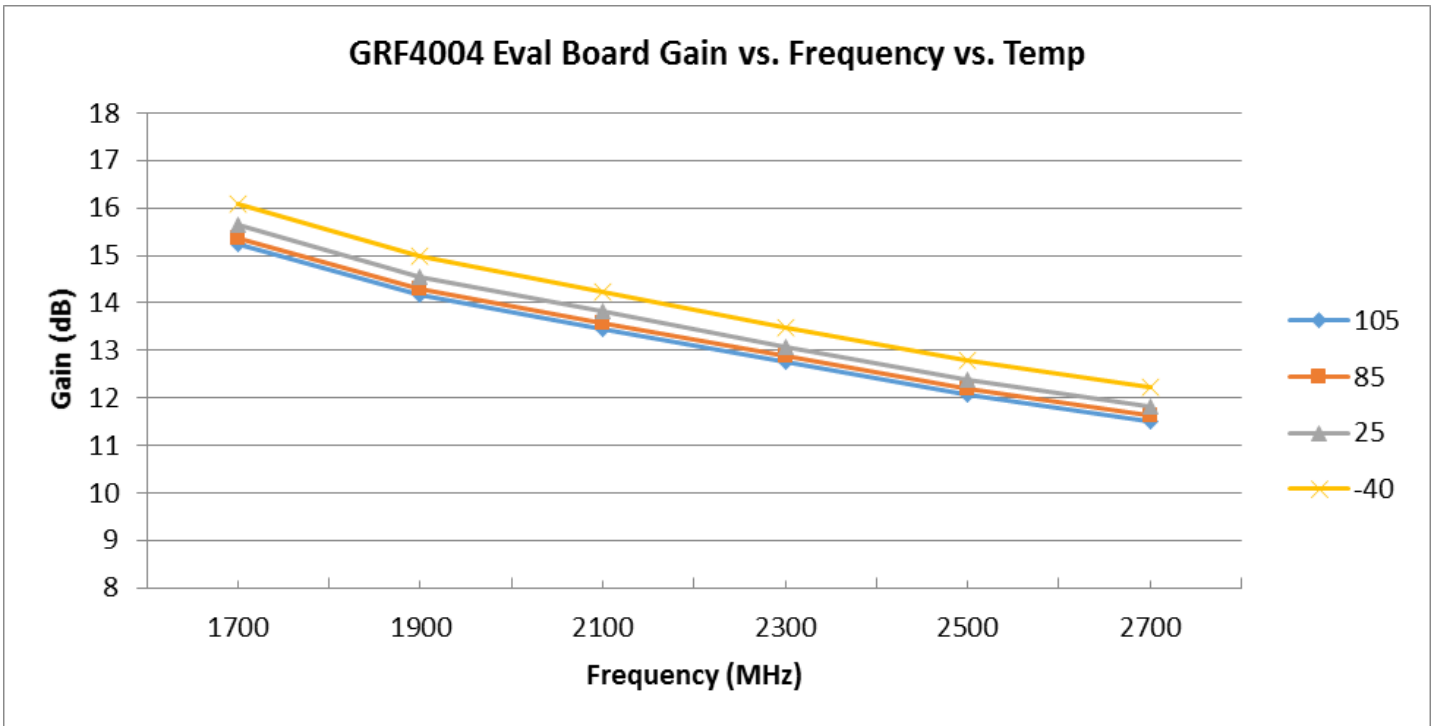


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## GRF4004 Evaluation Board Data:



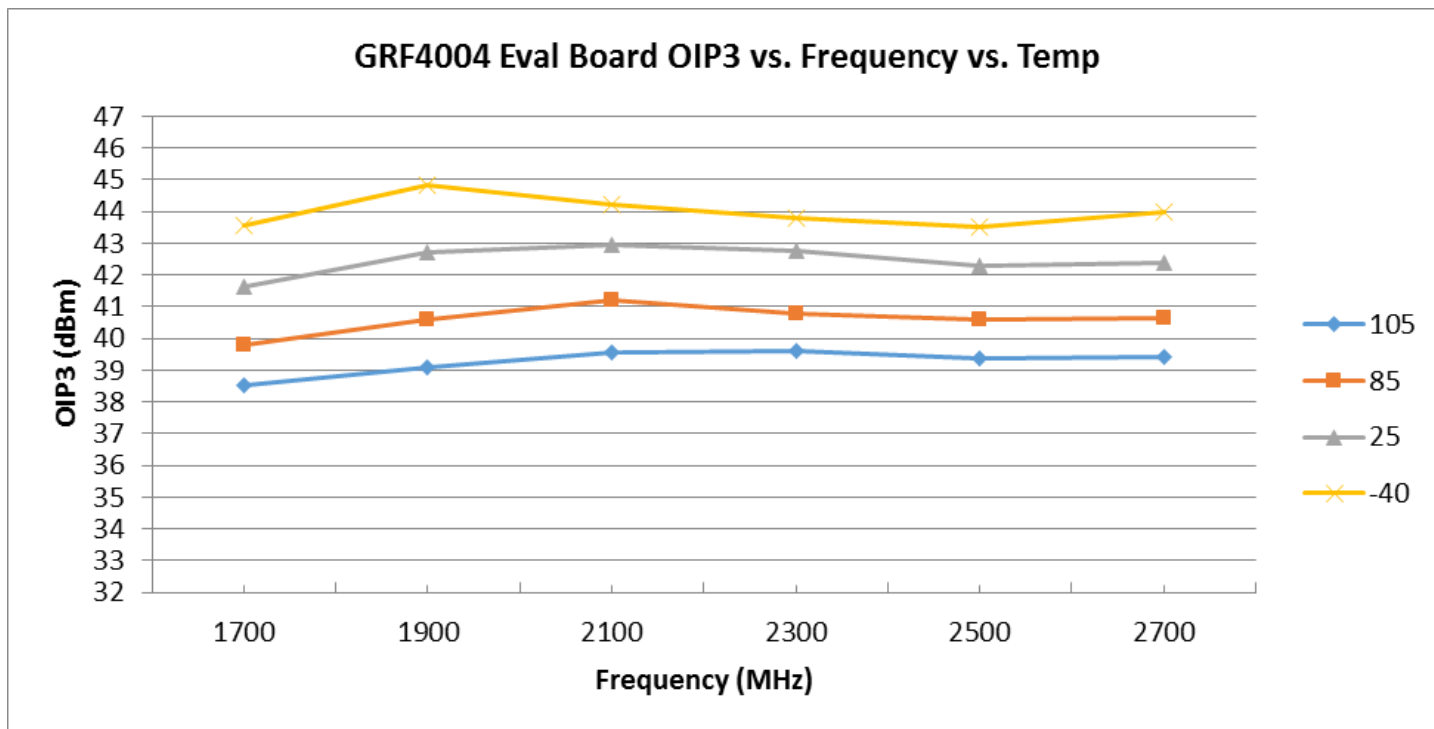
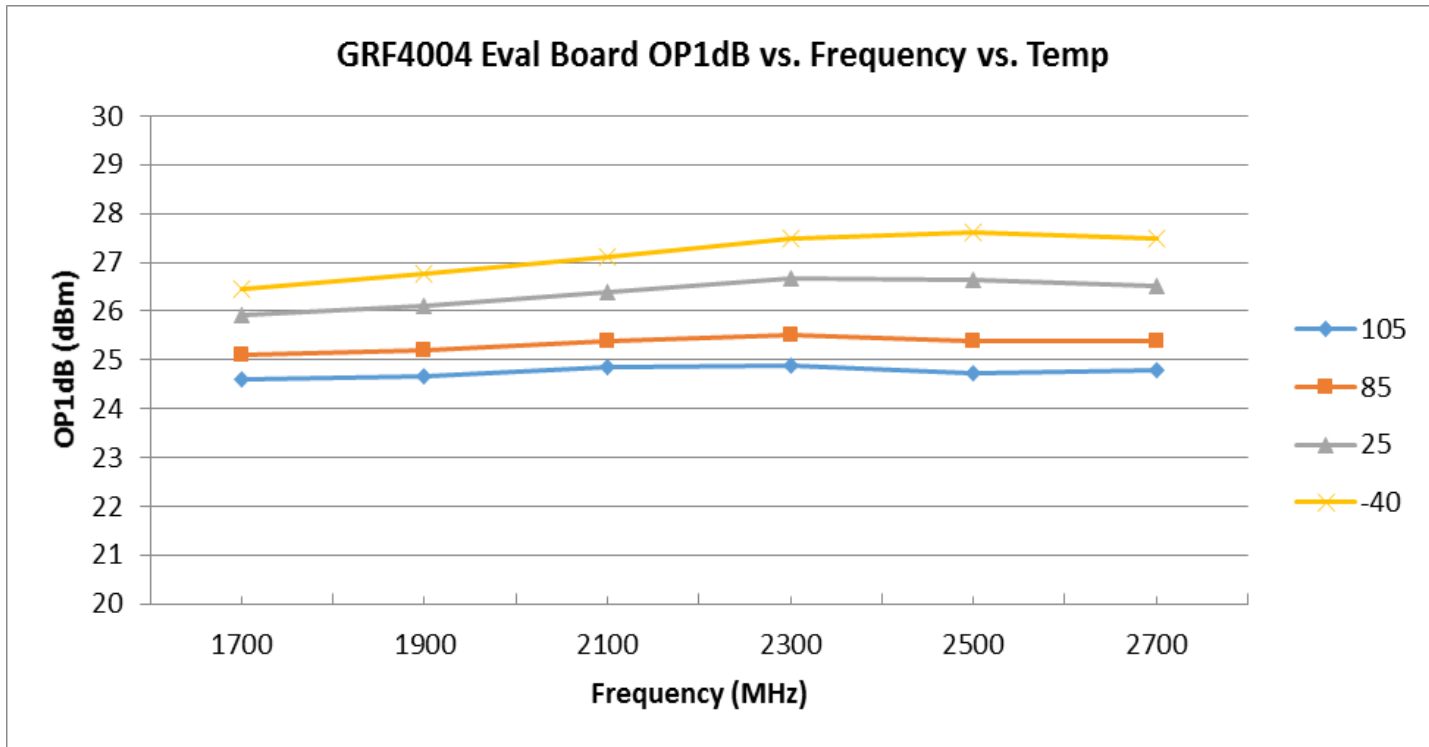


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Tuning Range: 0.1–3.8 GHz

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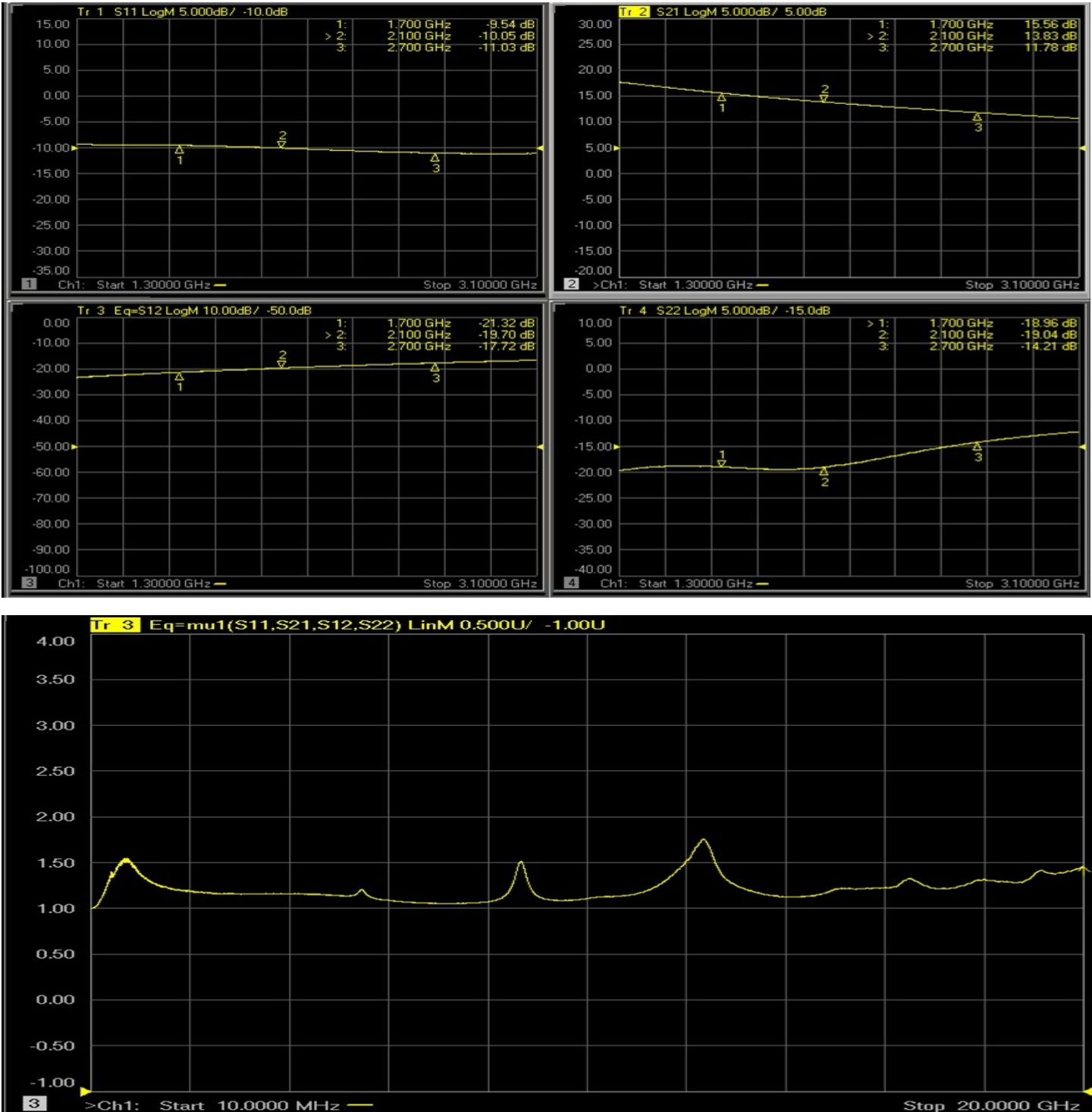


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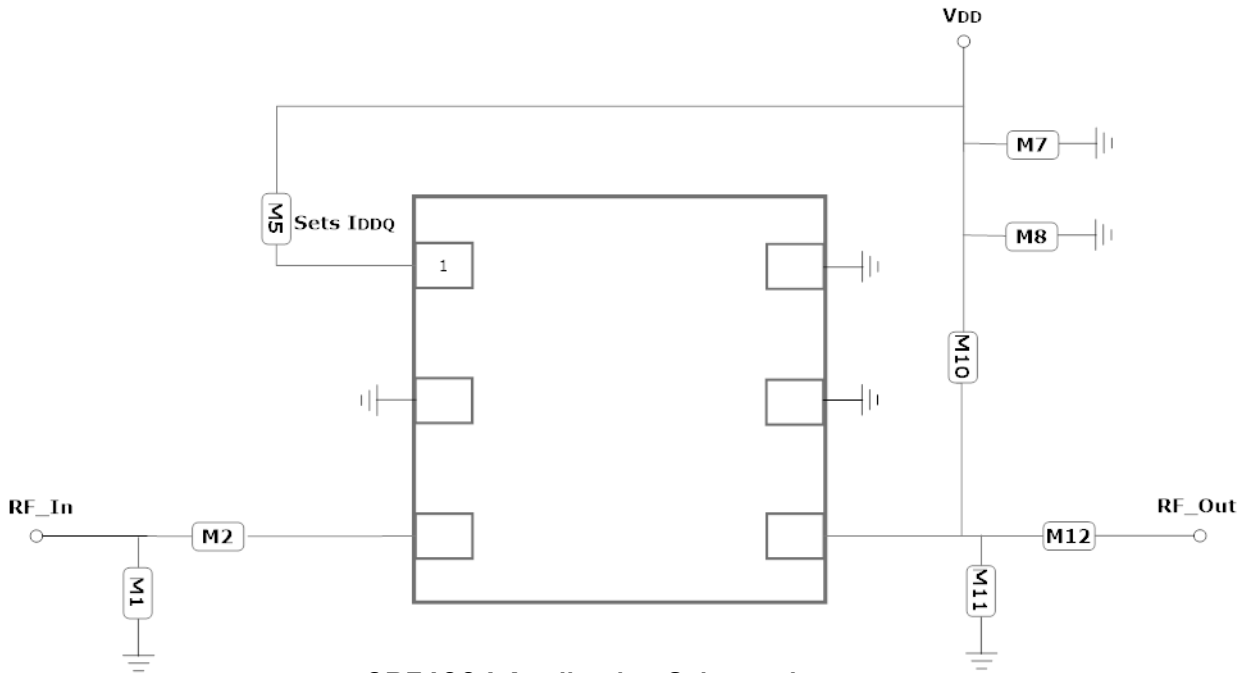
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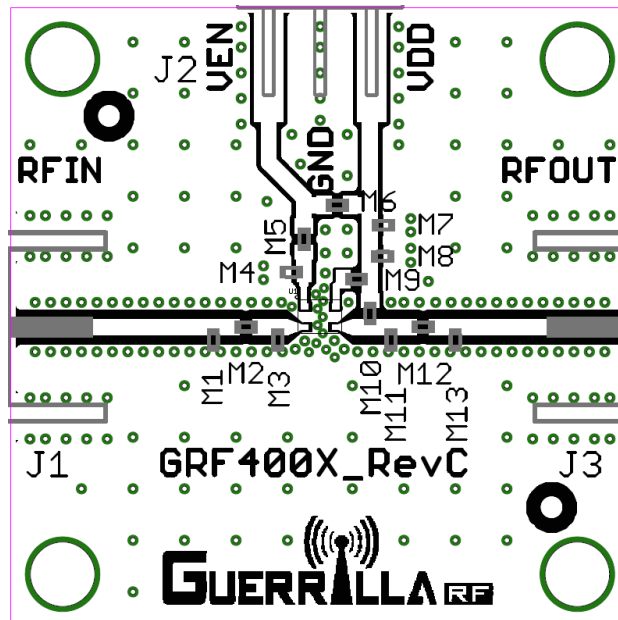
## GRF4004 Evaluation Board S-Pars and Stability Mu Factor: (1.7 – 2.7 GHz Match)



Note: Mu factor  $\geq 1.0$  implies unconditional stability.



GRF4004 Application Schematic



GRF400X Evaluation Board Assembly Diagram





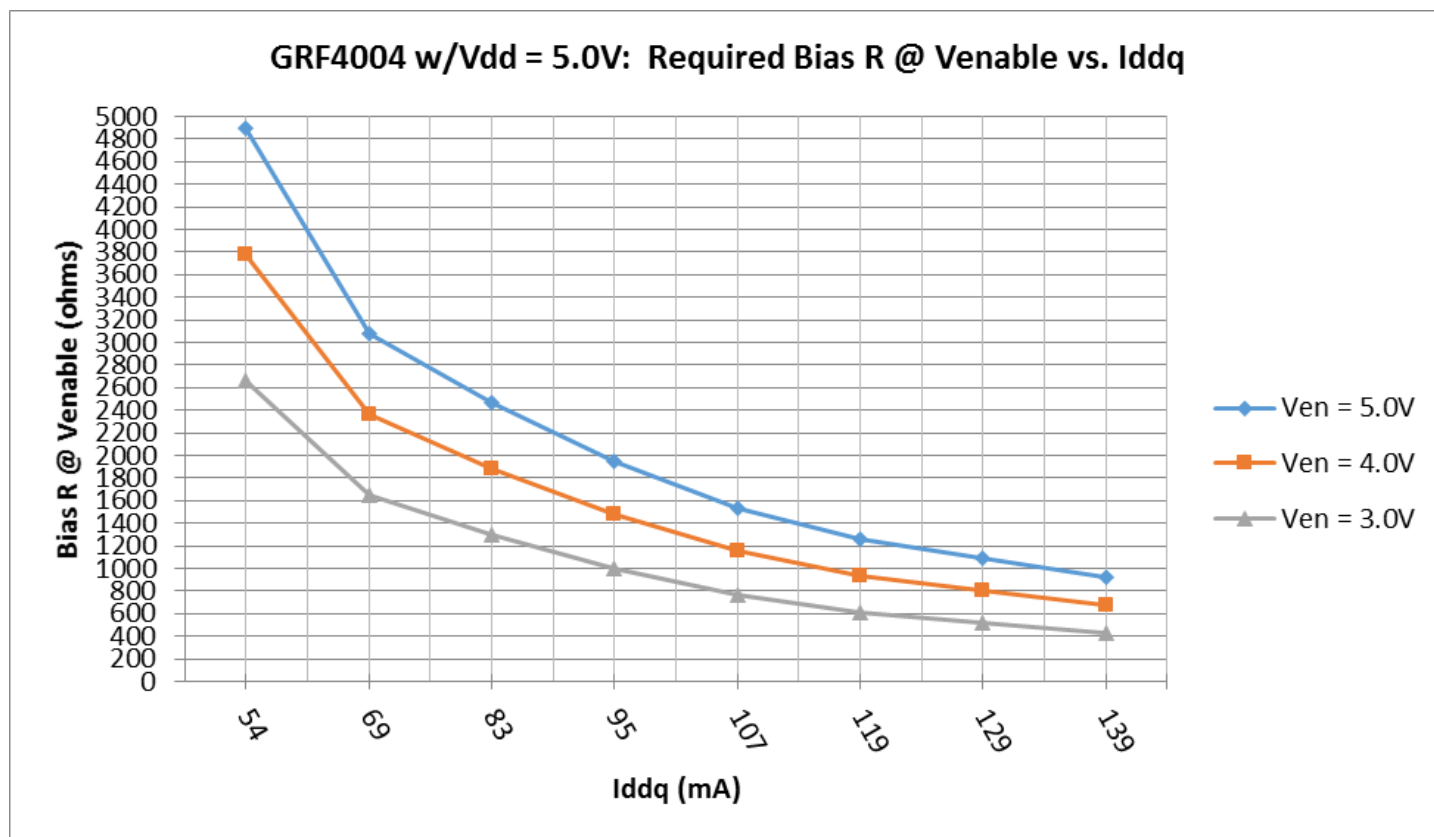
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## GRF4004 Standard Evaluation Board BOM: (1.7 to 2.7 GHz Tune)

| Component       | Type         | Manufacturer | Family | Value   | Package Size | Substitution |
|-----------------|--------------|--------------|--------|---------|--------------|--------------|
| M1              | Inductor     | Coilcraft    | HPA    | 8.2 nH  | 0402         | ok           |
| M2              | Capacitor    | Murata       | GJM    | 3.0 pF  | 0402         | ok           |
| M5 (See curves) | Resistor: 5% | Various      | —      | —       | 0402         | ok           |
| M7              | Capacitor    | Murata       | GRM    | 0.1 uF  | 0402         | ok           |
| M8              | Capacitor    | Murata       | GRM    | 27 pF   | 0402         | ok           |
| M10             | Inductor     | Coilcraft    | HPA    | 18.0 nH | 0402         | ok           |
| M11             | Capacitor    | Murata       | GJM    | 1.0 pF  | 0402         | ok           |
| M12             | Capacitor    | Murata       | GJM    | 15 pF   | 0402         | —            |





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| 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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