



Product Description

GRF2004 is a broadband, low noise linear gain block designed for small cell, wireless infrastructure and other high performance RF applications. Due to the extreme broadband nature of the device, data is presented for wideband RF measurements using network analyzer bias tees. Under these conditions, the device exhibits good performance over 100 MHz to 10 GHz with minimal external components.

The device can be operated over a range of supply voltages from 1.8 to 5.0 V selectable Iddq for optimal efficiency and linearity.

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

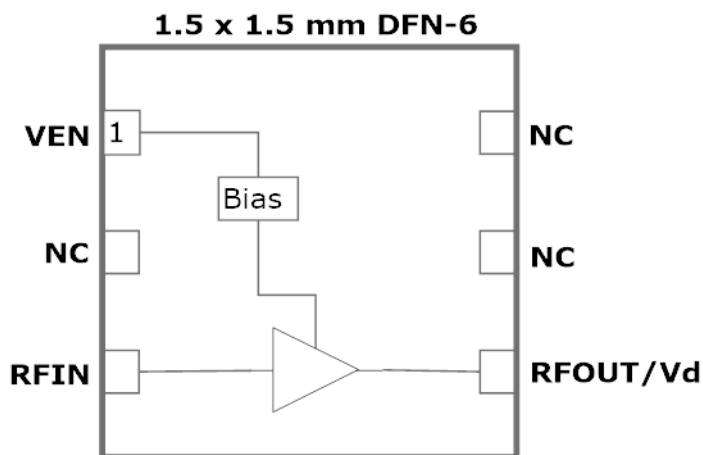
Features

Reference: 5V/100mA/4.0 GHz

- Gain: 16.5 dB
- OP1dB: 18.0 dBm
- OIP3: 31.0 dBm
- Eval Board NF: 1.9 dB
- Flexible Bias Voltage and Current
- Internally Matched to 50 Ω
- Process: GaAs pHEMT

Applications

- Microwave Backhaul
- C/X-Band Amplifiers
- General Purpose Amplifiers
- Instrumentation





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GRF2004

Broadband Gain Block
0.1 to 10.0 GHz

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} | | 15 | dBm |
| RF Input Power: (Load VSWR < 2:1; V _D : <4.0 volts) | P _{IN MAX} | | 20 | dBm |
| Operating Temperature (Package Heat Sink) | T _{AMB} | -40 | 105 | °C |
| Maximum Channel Temperature (MTTF > 10 ⁶ Hours) | T _{MAX} | | 170 | °C |
| Maximum Dissipated Power | P _{DISS MAX} | | 600 | 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

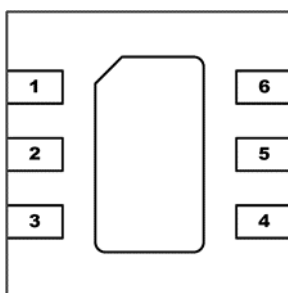


Exceeding Absolute Maximum Rating conditions may cause permanent damage to the device.

Note: For manufacturing information, see the Guerrilla-RF.com website for the following document located on the GRF2004 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} /V _{DD} | 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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Nominal Operating Parameters:

| Parameter | Symbol | Specification | | | Unit | Condition |
|--|----------------------|---------------|-------------------|------|------|--|
| | | Min. | Typ. | Max. | | |
| Test Frequency | F _{TEST} | | 4.0 | | GHz | V _{DD} = 5.0 V, T _A = 25 °C |
| Gain | S ₂₁ | 15.0 | 16.5 | | dB | |
| Evaluation Board Noise Figure | NF | | 1.9 | | dB | |
| Output 3rd Order Intercept | OIP3 | | 31.0 | | dBm | 0.0 dBm P _{OUT} per tone at 2 MHz Spacing (3999 and 4001 MHz) |
| Output 1dB Compression Point | OP1dB | 16.0 | 18.0 | | dBm | |
| Switching Rise Time | T _{RISE} | | 800 | | ns | |
| Switching Fall Time | T _{FALL} | | 600 | | ns | |
| Supply Current | I _{DD} | | 100 | | mA | |
| Enable Current | I _{ENABLE} | | 1.8 | | mA | |
| Leakage Current | I _{LEAKAGE} | | 1 | | uA | V _{DD} : 5.0V; V _{ENABLE} : 0.0V |
| Thermal Data | | | | | | |
| Thermal Resistance: (Infra-Red Scan) | Θ _{jc} | | 104 | | °C/W | On standard Evaluation Board |
| Channel Temperature @ +85 C Reference (Package heat sink) | T _{CHANNEL} | | 137 (See note) | | °C | V _{DD} : 5.0 V; I _{DDQ} : 100 mA; No RF; P _{DISS} : 500 mW |

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

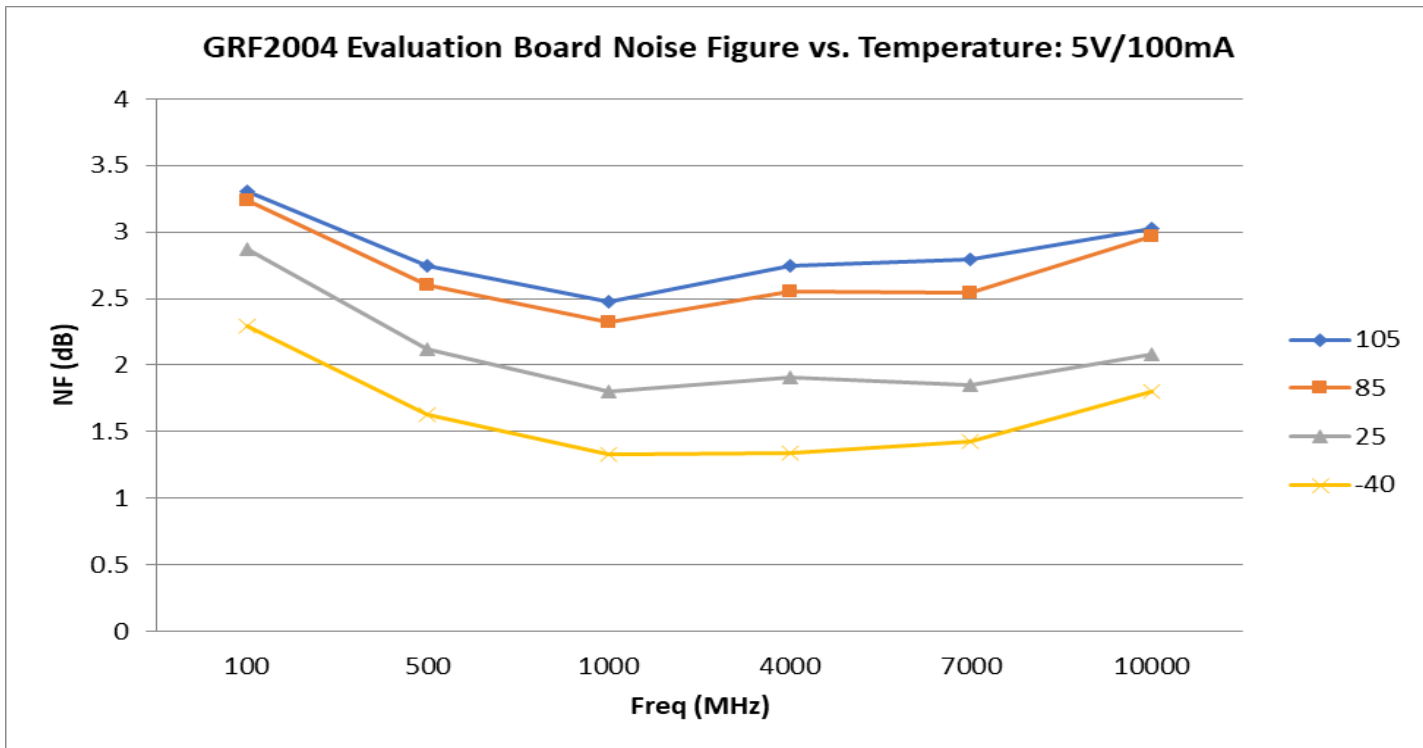
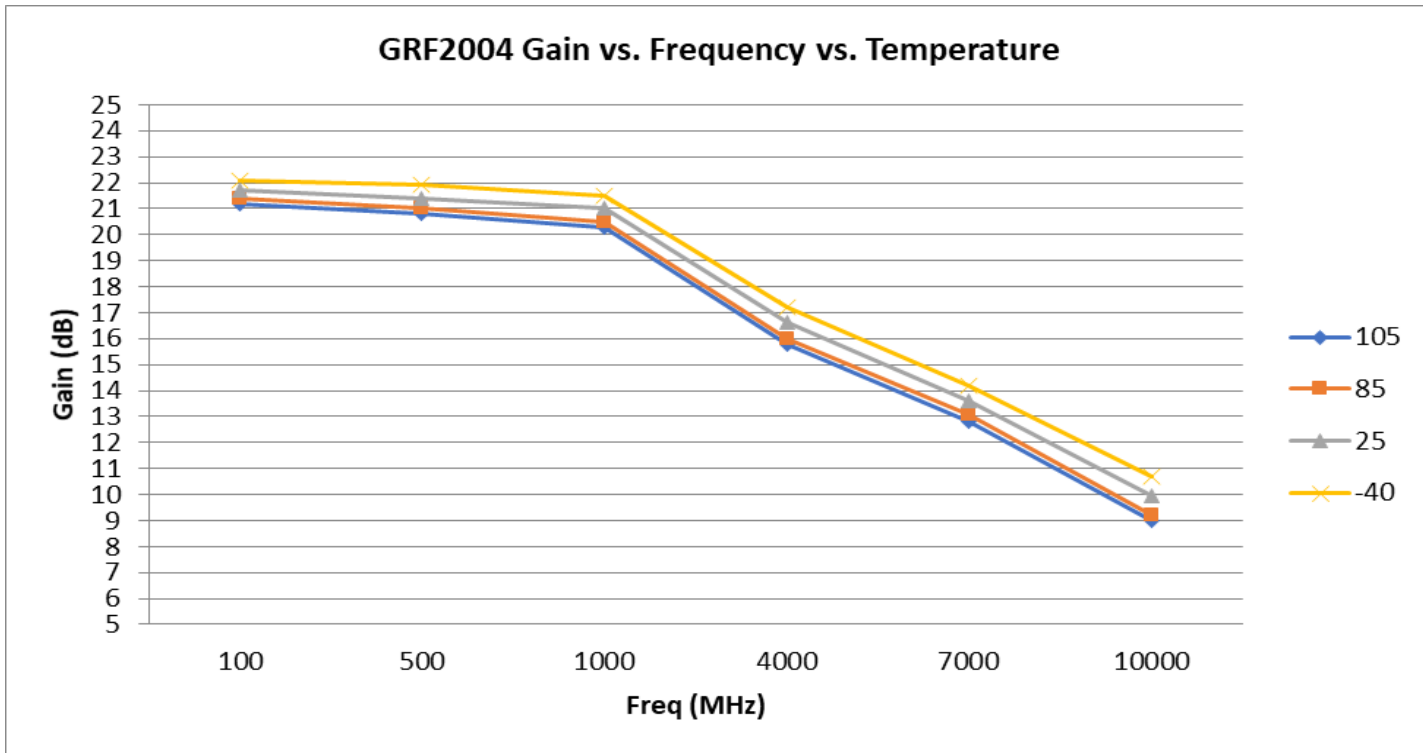


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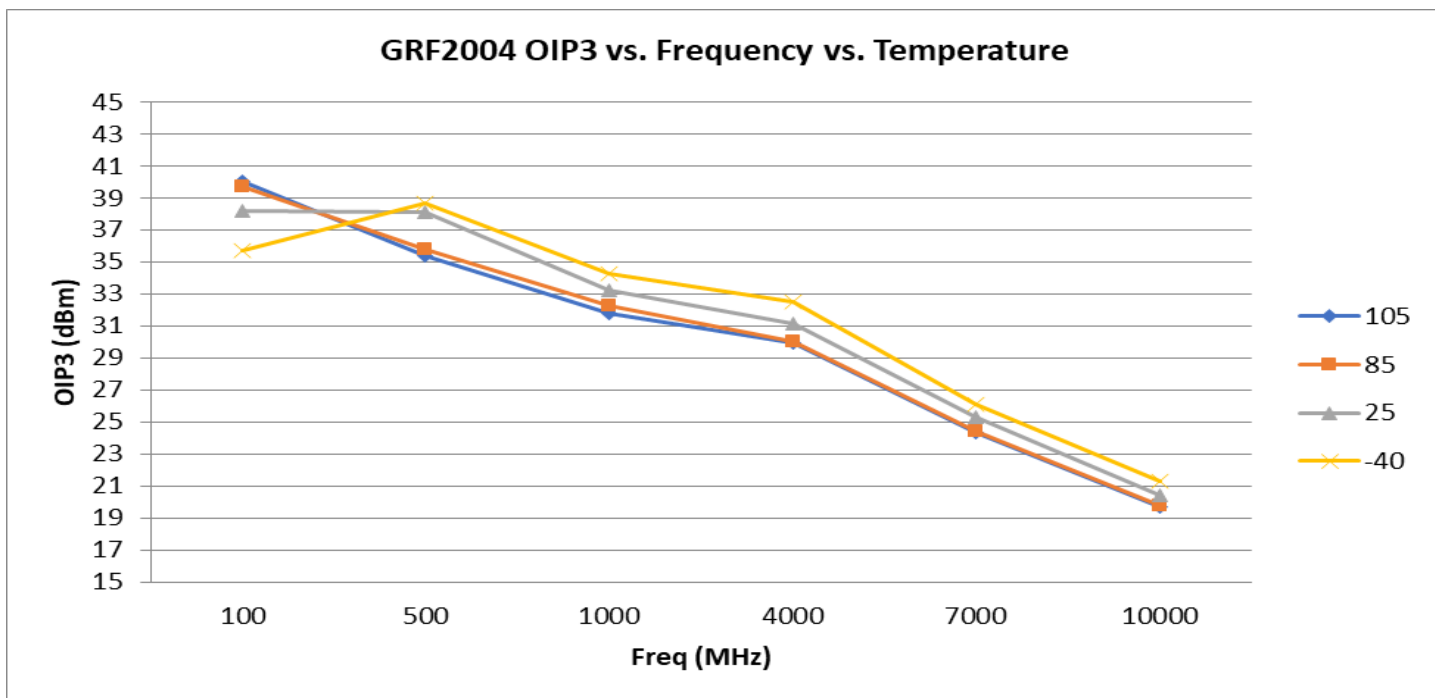
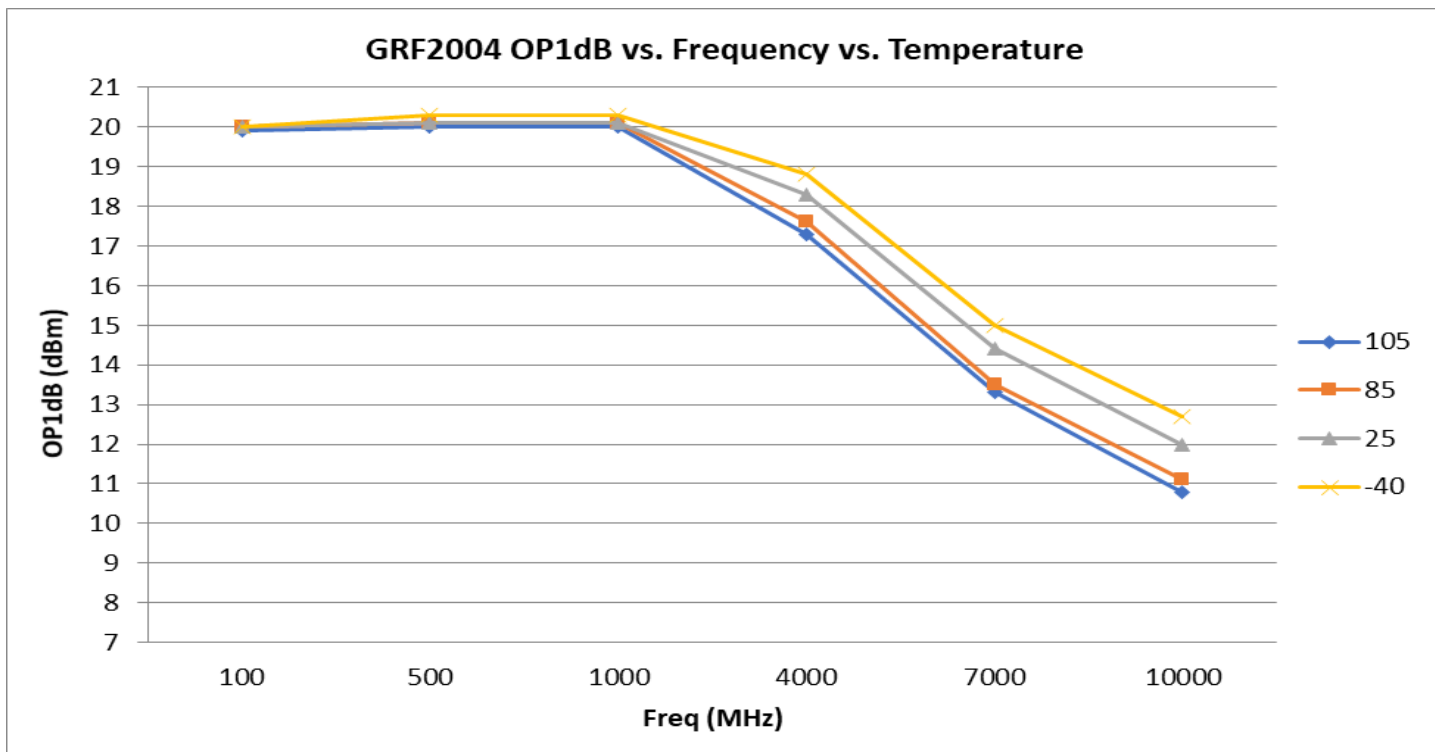
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GRF2004 Evaluation Board Measured Data: (0.1 to 10.0 GHz Bias T Measurements)



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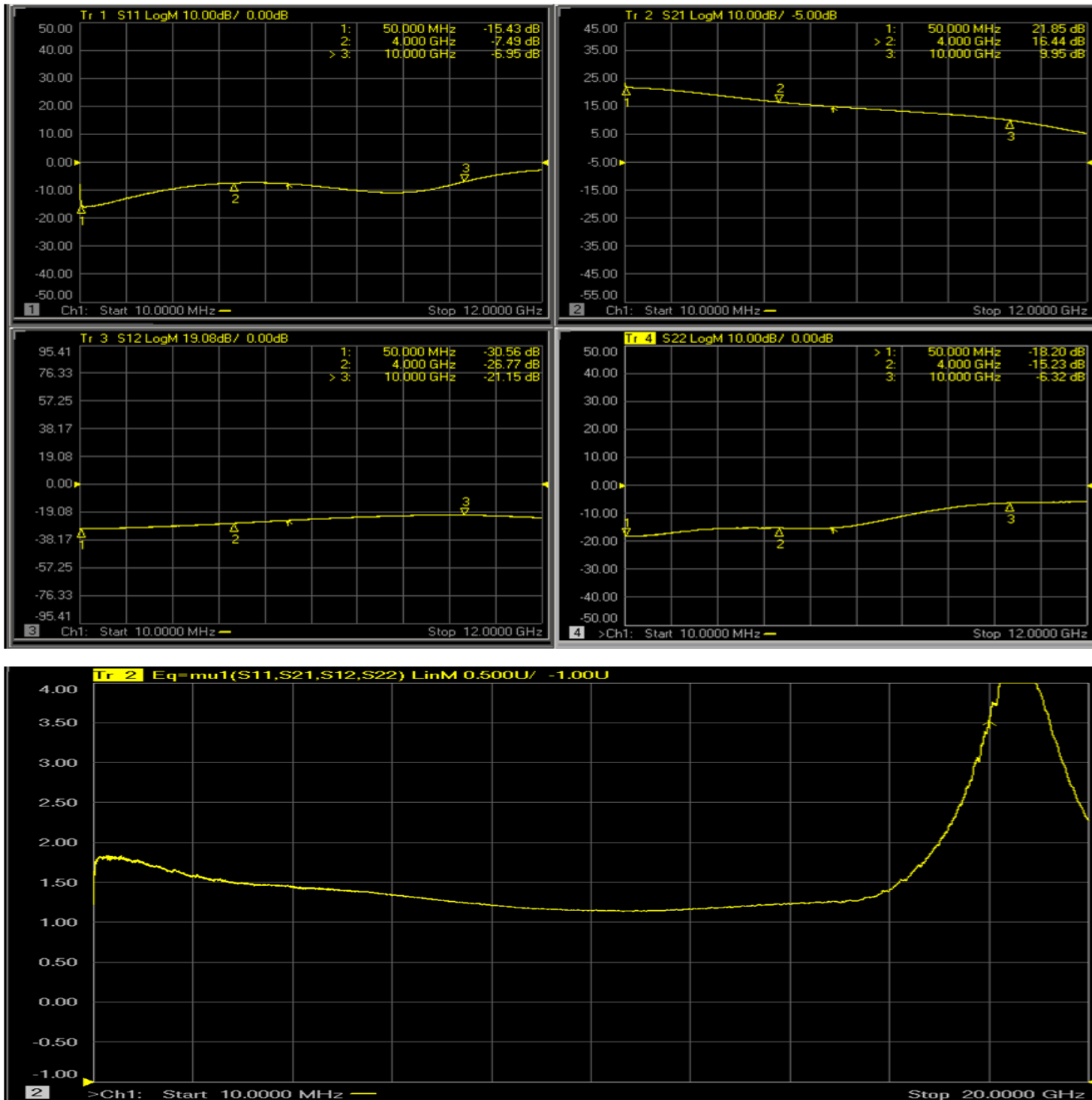


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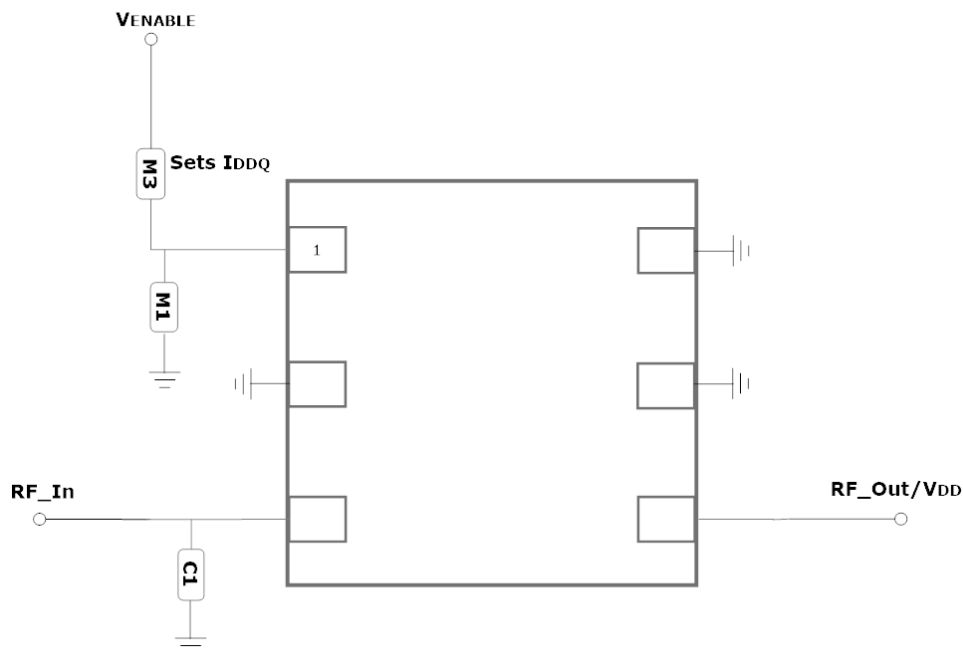
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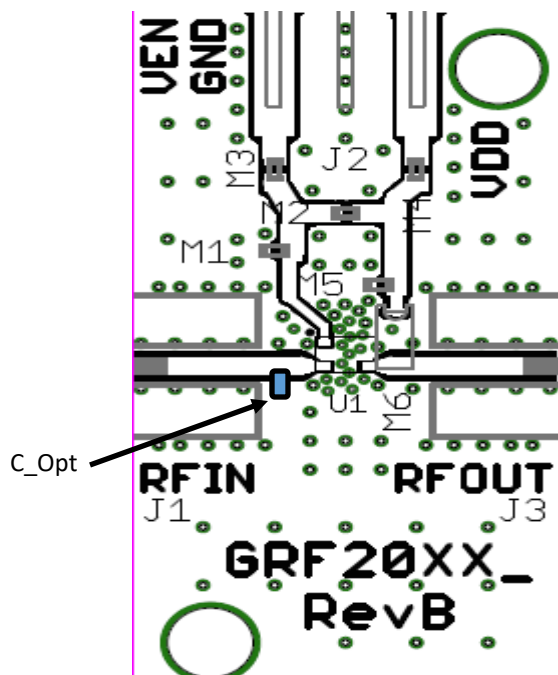
GRF2004 Evaluation Board S-Pars and Stability Mu Factor: (0.1 to 10.0 GHz VNA Bias Ts)



Note: Mu factor ≥ 1.0 implies unconditional stability.



GRF2004 Application Schematic (0.1 to 10.0 GHz Eval Board)



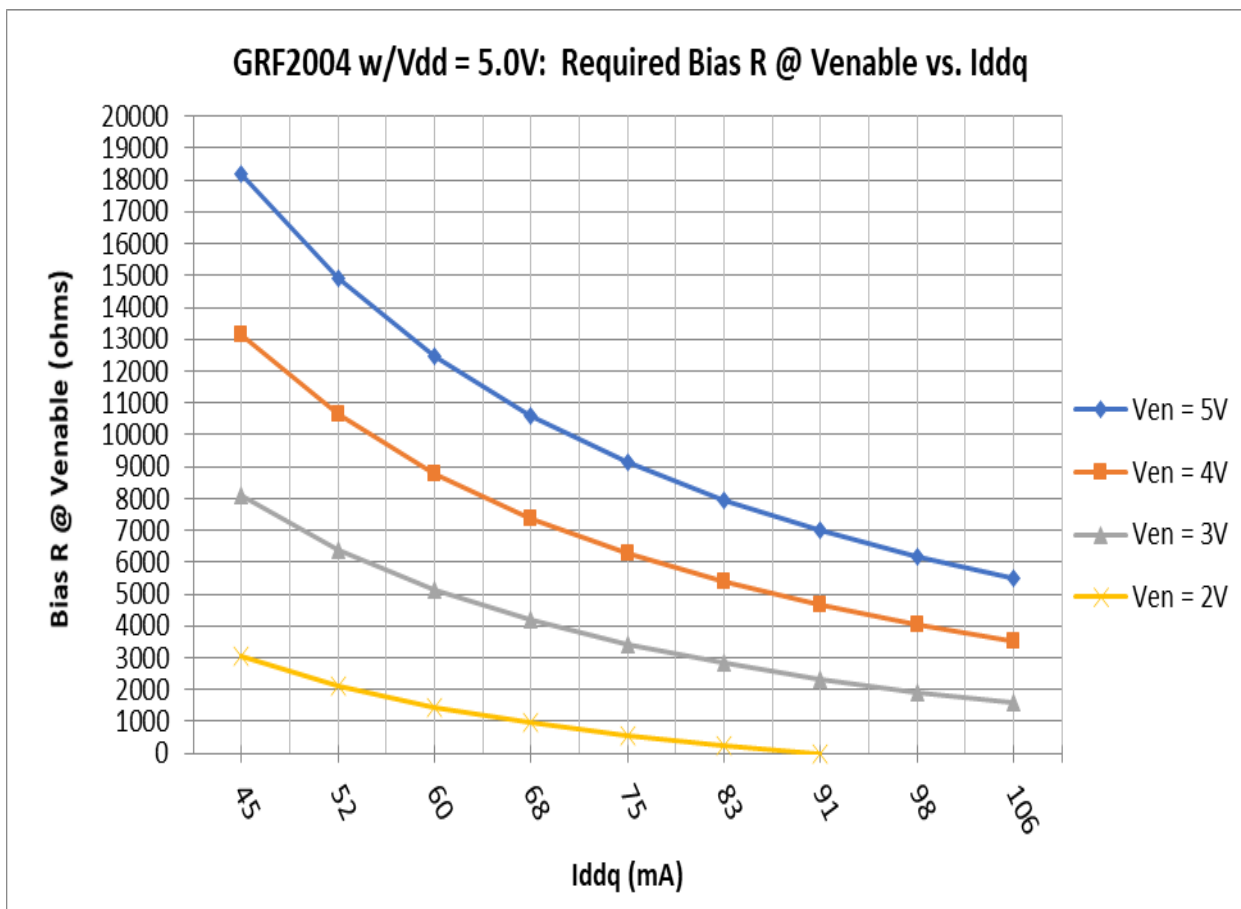
GRF2004 Evaluation Board Assembly Drawing

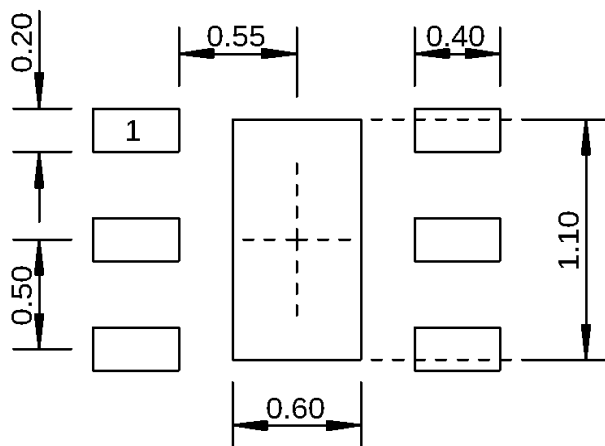
GRF2004 Evaluation Board BOM for VNA S-parameter measurement

| Component | Type | Manufacturer | Family | Value | Package Size | Substitution |
|------------------|--------------|--------------|--------|-----------|--------------|--------------|
| M1 | Capacitor | Murata | GRM | 1000 pF | 0402 | ok |
| M3 (See curves) | Resistor | Various | 5% | Sets Iddq | 0402 | ok |
| C1 | Capacitor | Murata | GJM | 0.2 pF | 0402 | ok |
| Evaluation Board | GRF20XX_RevB | — | — | — | — | — |

Note: C1 is added to test board input to enhance high frequency gain of the device.

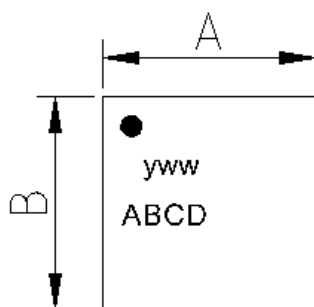
Bias Resistor Selection Curves



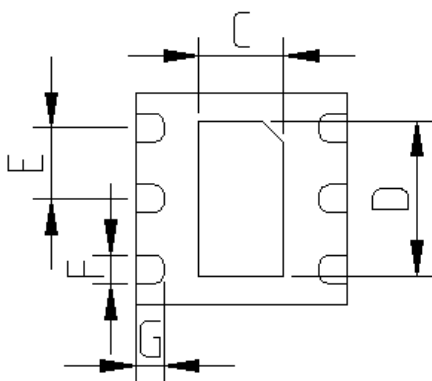


Dimensions in millimeters

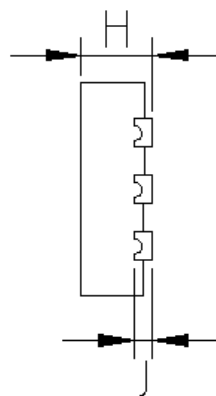
1.5 mm DFN-6 Suggested PCB Footprint (Top View)



Top View



Bottom View



Side 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



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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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