



Product Description

GRF2003 is a broadband, low noise linear gain block designed for small cell, wireless infrastructure and other high performance RF applications. A single match will offer strong RF performance over 0.5 to 10.0 GHz. With optimized external components, the device can be operated down to 100 MHz.

The device can be operated over a range of supply voltages from 2.7 to 5.0 V with a typical I_{ddq} range of 40 to 80 mA for optimal efficiency and linearity.

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

Features

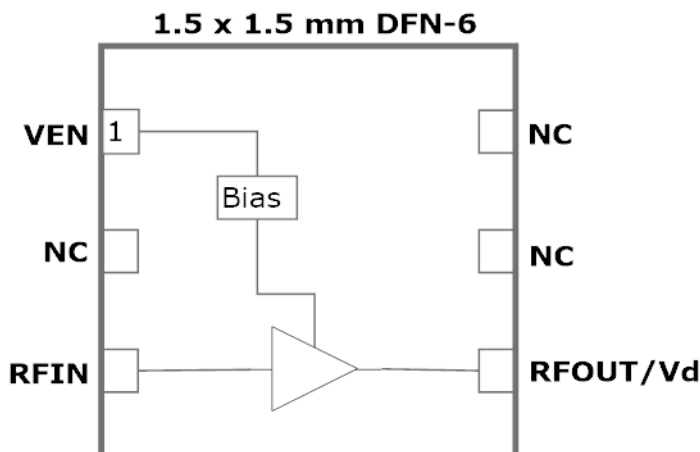
Reference: 5V/55 mA/5.5 GHz

- Gain: 12.0 dB
- OP1dB: 15.0 dBm
- OIP3: 29.0 dBm
- Eval Board NF: 3.5 dB

- Flexible Bias Voltage and Current
- Internally Matched to 50Ω
- Process: GaAs pHEMT

Applications

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



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 |
| 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} | | 400 | 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

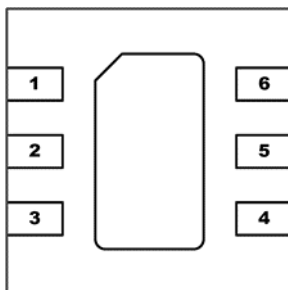


Exceeding Absolute Maximum Rating conditions may cause permanent damage to the device.

Note: For manufacturing information, see the Guerrilla-RF.com website for the following document located on the GRF2003 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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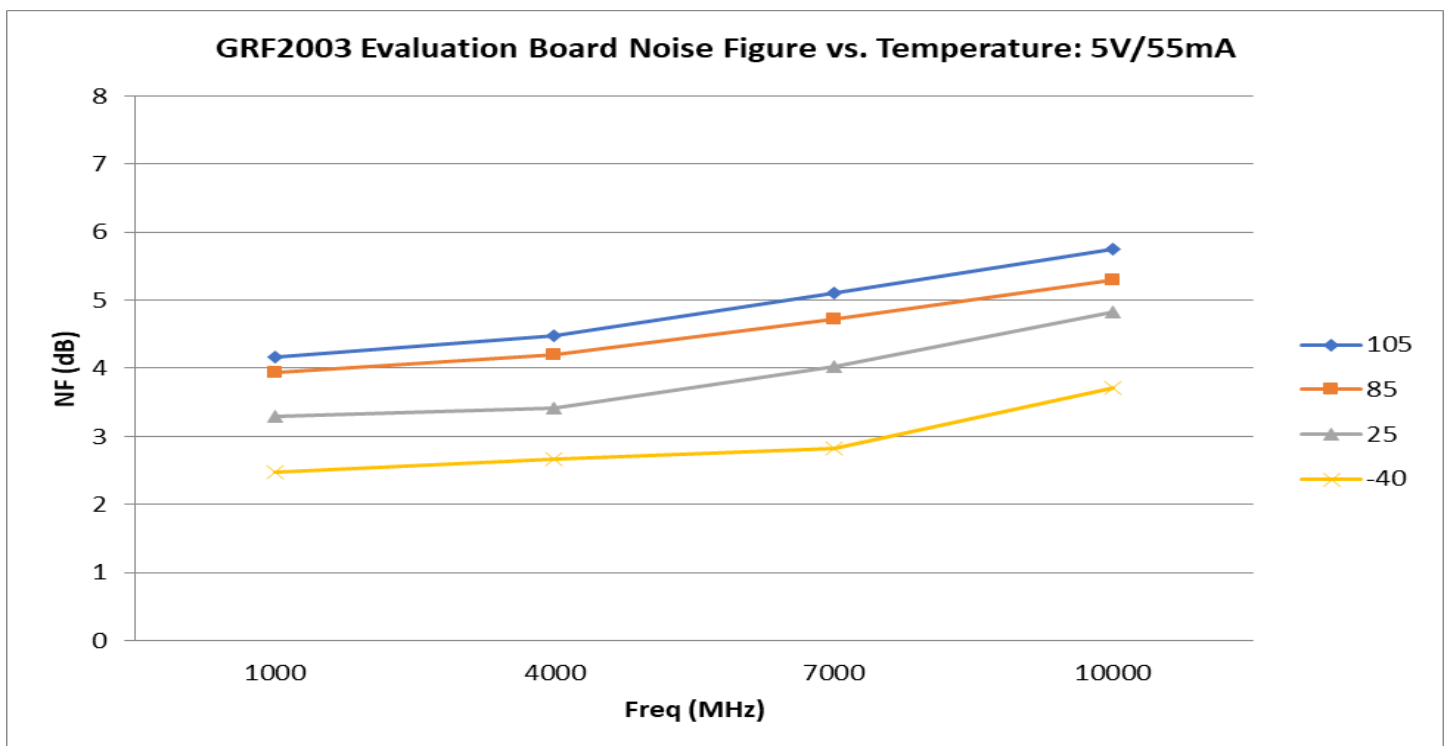
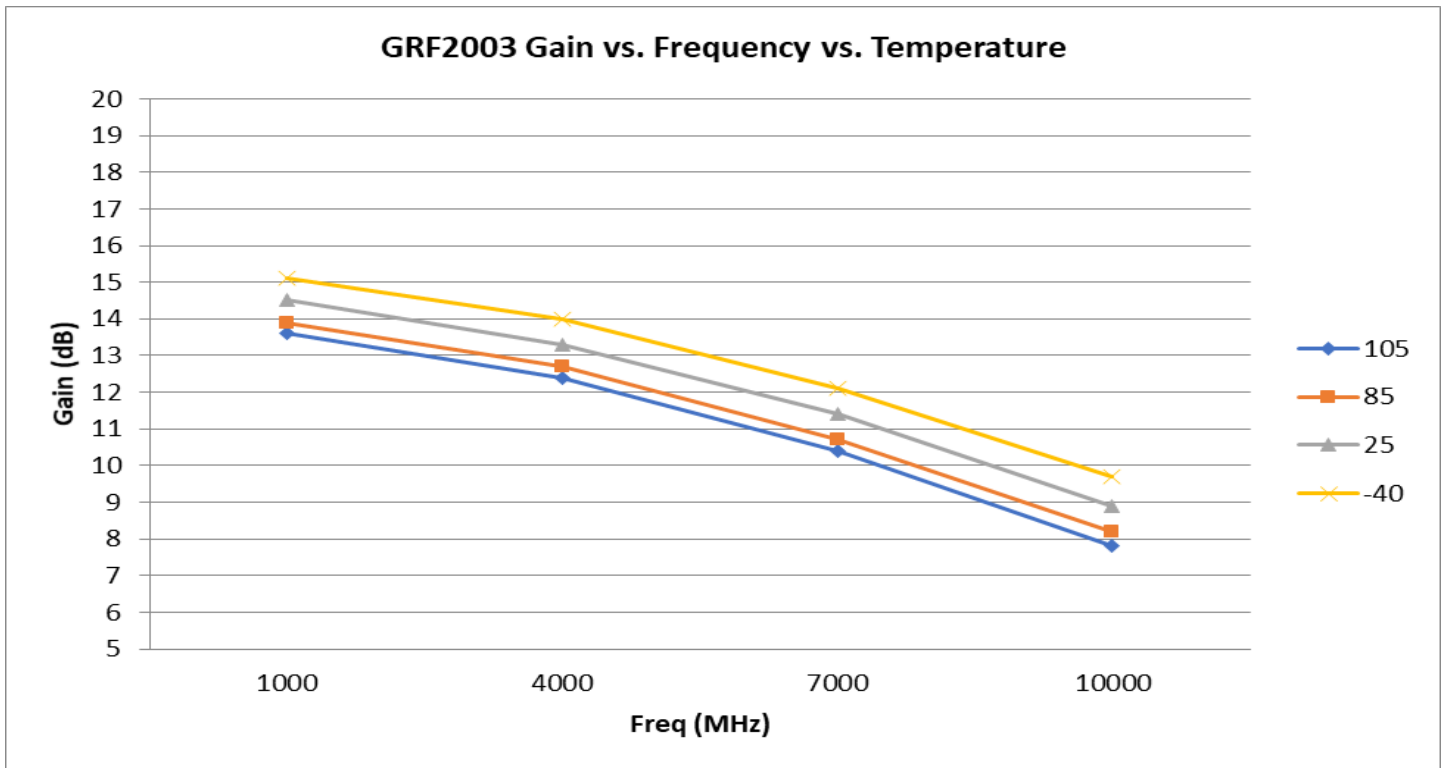
Broadband Gain Block
0.1–10.0 GHz

Nominal Operating Parameters:

| Parameter | Symbol | Specification | | | Unit | Condition |
|--|----------------------|---------------|-------------------|------|------|---|
| | | Min. | Typ. | Max. | | |
| Test Frequency | F _{TEST} | | 5.5 | | GHz | V _{DD} = 5.0 V, T _A = 25 °C |
| Gain | S ₂₁ | 11.0 | 12.0 | | dB | |
| Eval Board Noise Figure | NF | | 3.5 | | dB | |
| Output 3rd Order Intercept | OIP ₃ | | 29.0 | | dBm | 0 dBm P _{OUT} per tone at 2 MHz Spacing (5499 and 5501 MHz) |
| Output 1dB Compression Point | OP _{1dB} | 12.5 | 15.0 | | dBm | |
| Switching Rise Time | T _{RISE} | | 1600 | | ns | |
| Switching Fall Time | T _{FALL} | | 1000 | | ns | |
| Supply Current | I _{DD} | | 55 | | mA | |
| Enable Current | I _{ENABLE} | | 1.5 | | mA | |
| Leakage Current | I _{LEAKAGE} | | 1 | | uA | V _{DD} : 5.0V; V _{ENABLE} : 0.0V |
| Thermal Data | | | | | | |
| Thermal Resistance: (Infra-Red Scan) | Θ _{JC} | | 198 | | °C/W | On standard Evaluation Board |
| Channel Temperature @ +85 C Reference (Package heat sink) | T _{CHANNEL} | | 140 (See note) | | °C | V _{DD} : 5.0 V; I _{DDQ} : 55 mA; No RF; P _{DISS} : 275 mW |

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

GRF2003 Measured Data: (5.0 volts; 55 mA)



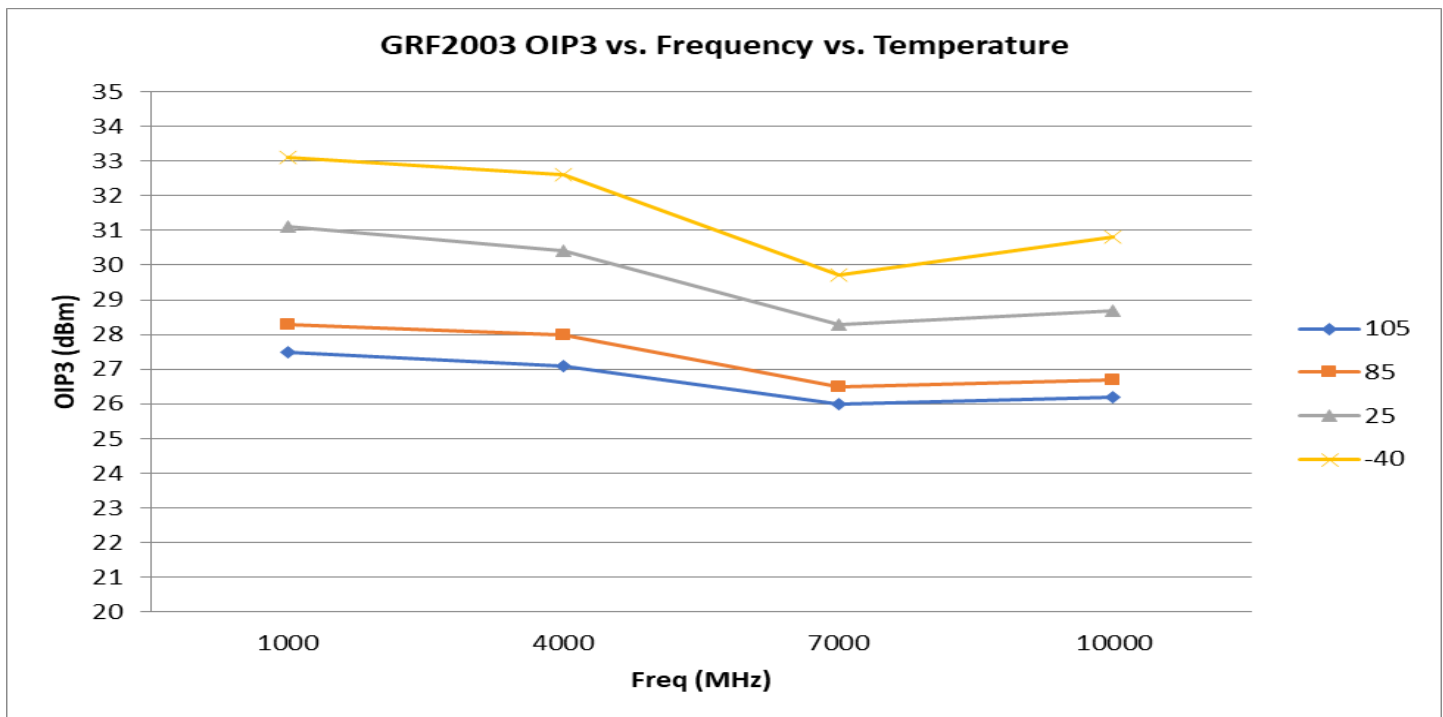
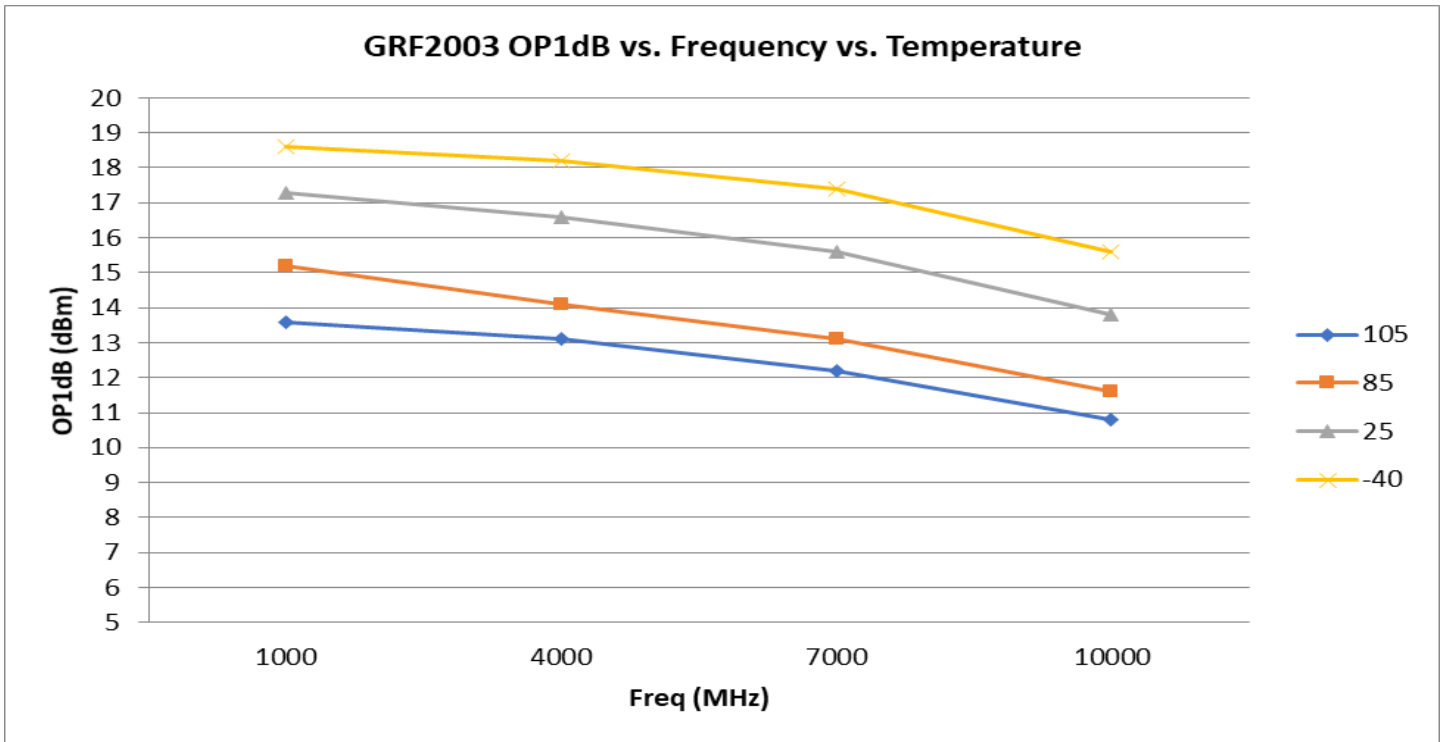


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GRF2003 Measured Data: (5.0 volts; 55 mA)



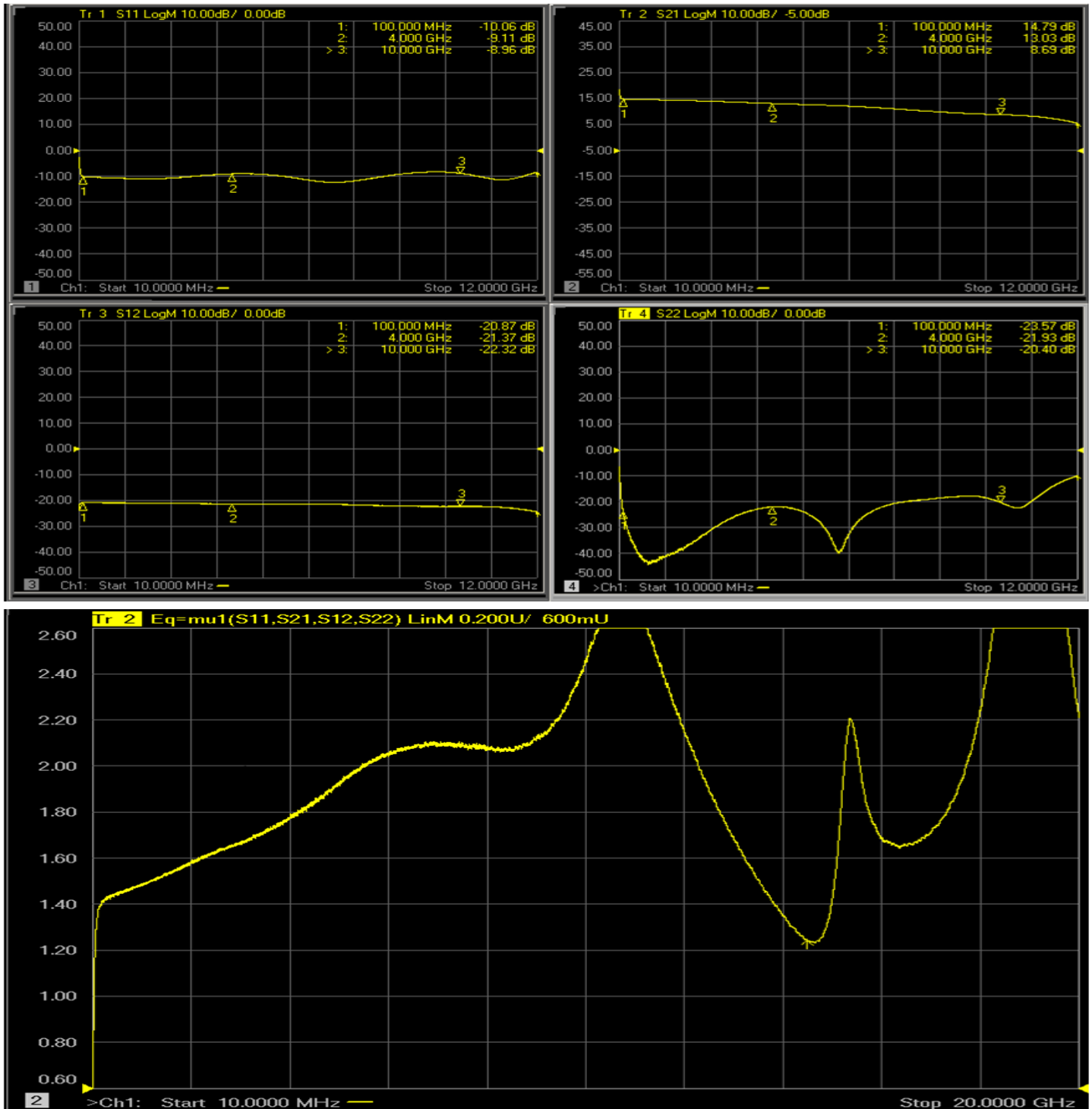


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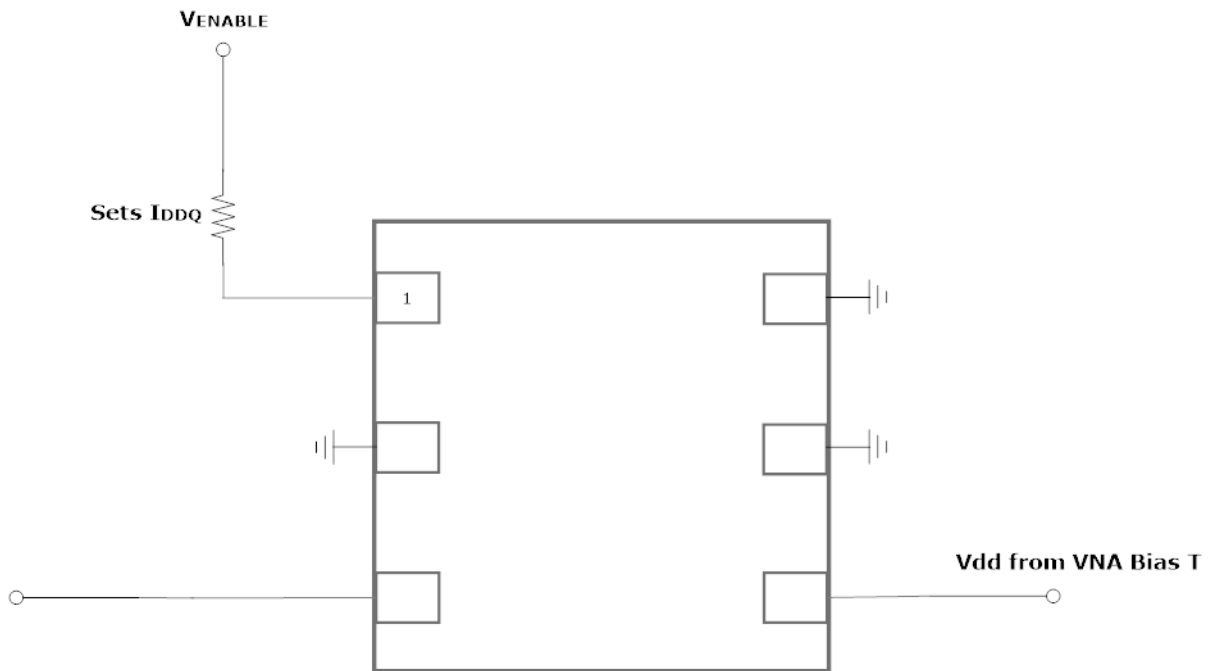
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Broadband Gain Block
0.1–10.0 GHz

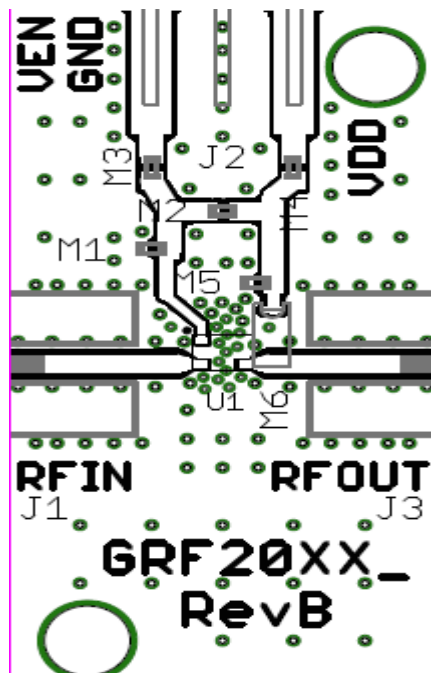
GRF2003 Evaluation Board S-Pars and Stability Mu Factor: (0.5 to 10.0 GHz Tune)



Note: Mu factor ≥ 1.0 implies unconditional stability.



GRF2003 Broadband Measurement Schematic



GRF2003 Evaluation Board Assembly Drawing



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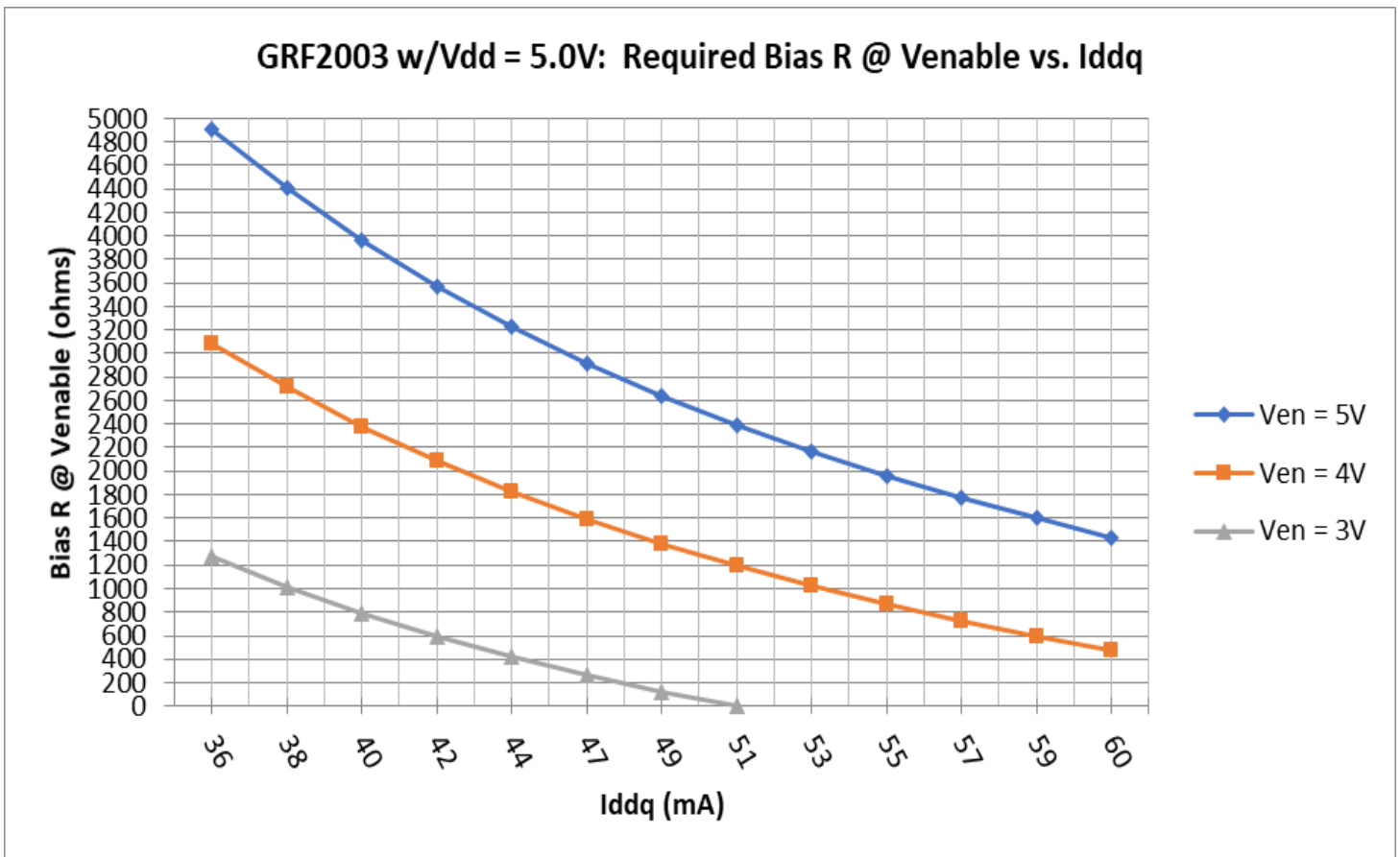
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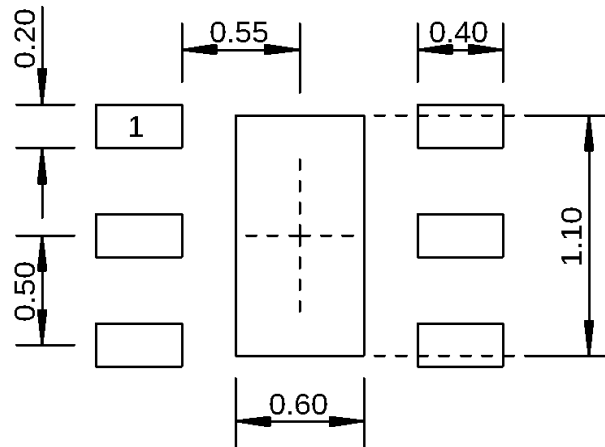
Broadband Gain Block
0.1–10.0 GHz

GRF2003 Standard Evaluation Board BOM: (VNA bias T evaluation configuration)

| Component | Type | Manufacturer | Family | Value | Package Size | Substitution |
|------------------|--------------|--------------|--------|-----------|--------------|--------------|
| M5 (See curves) | Resistor | Various | 5% | Sets Iddq | 0402 | ok |
| Evaluation Board | GRF20XX_RevB | | | | | |

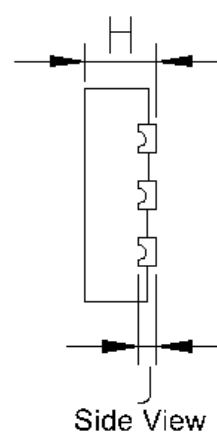
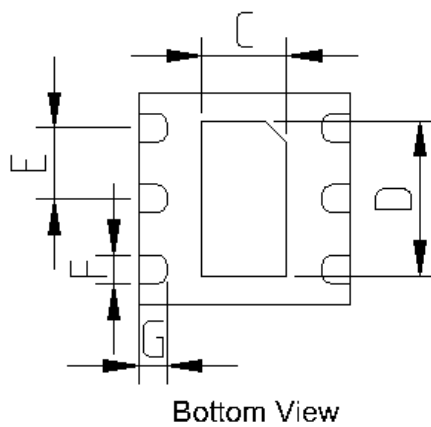
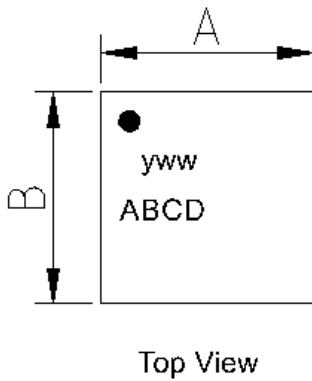
GRF2003 Bias Resistor Selection Curves





Dimensions in millimeters

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



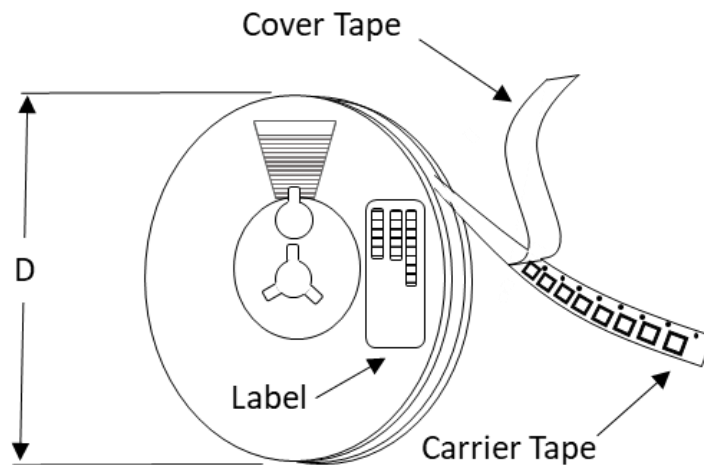
| Dimensions (MM) | |
|-----------------|---------------|
| A | 1.5 +/- 0.050 |
| B | 1.5 +/- 0.050 |
| C | .6 +/- 0.050 |
| D | 1.1 +/- 0.050 |
| E | .5 Bsc |
| F | .2 +/- 0.050 |
| G | .2 +/- 0.050 |
| H | .45 +/- 0.050 |
| J | .12 Ref. |

1.5 mm DFN-6 Package Dimensions

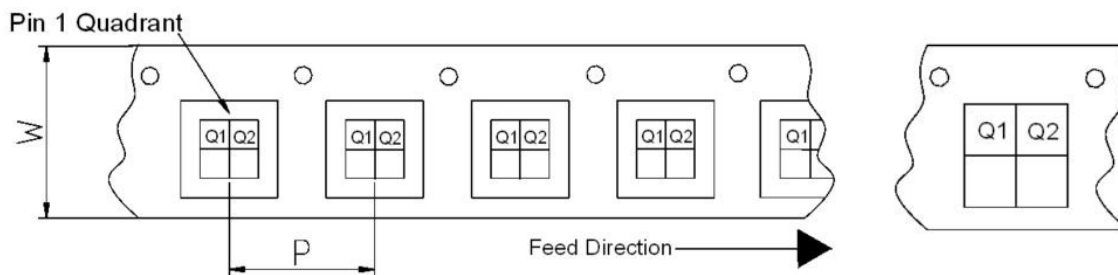
Tape and Reel Information:

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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Broadband Gain Block
0.1–10.0 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 | 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 Gain Block 0.1–10.0 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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