



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.

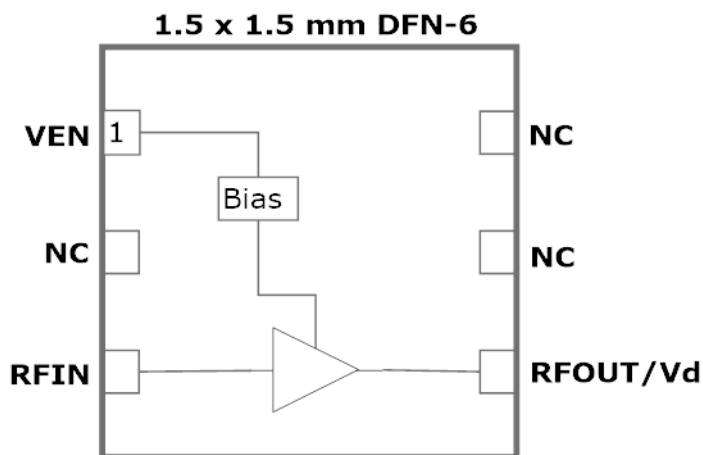
Features

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



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

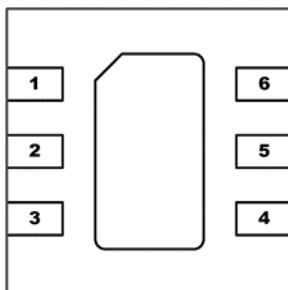


Exceeding Absolute Maximum Rating conditions may cause permanent damage to the device.

Note: For package dimensions and 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.



Released

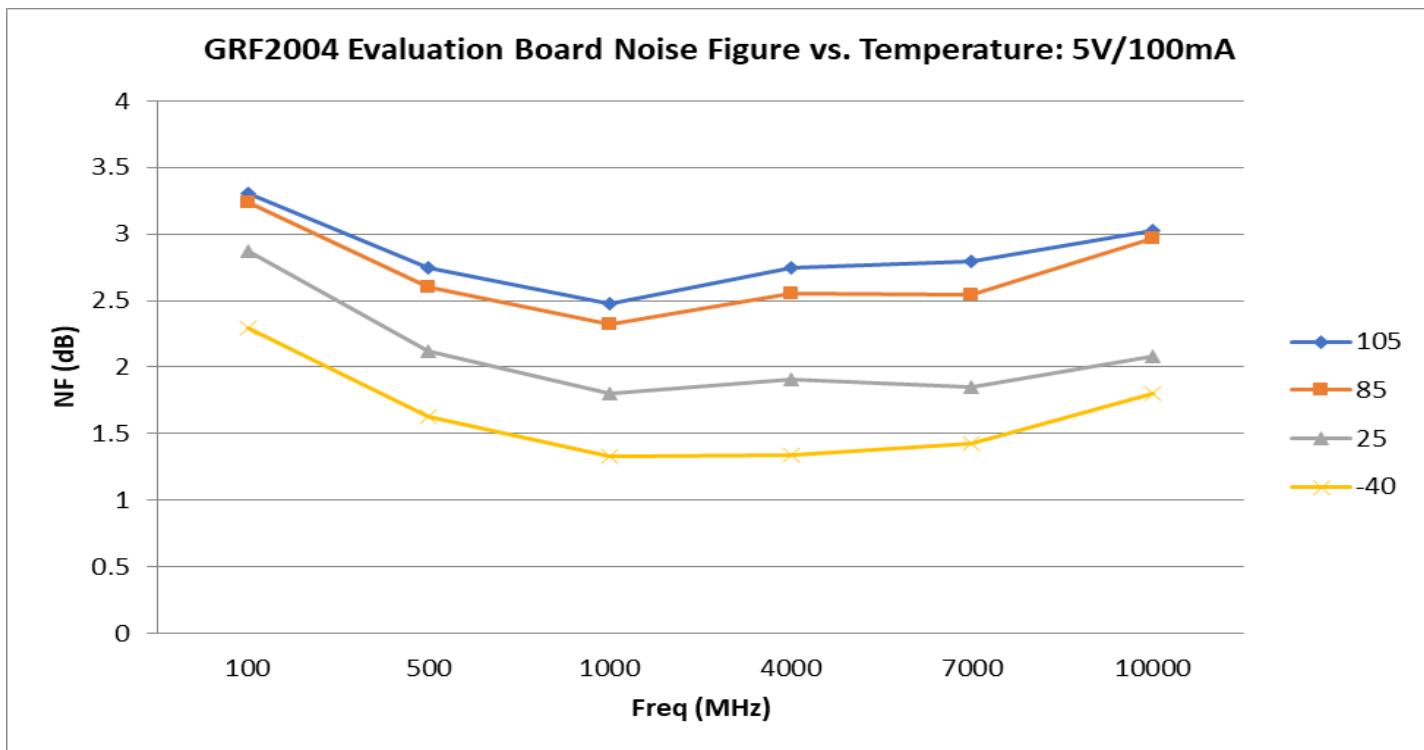
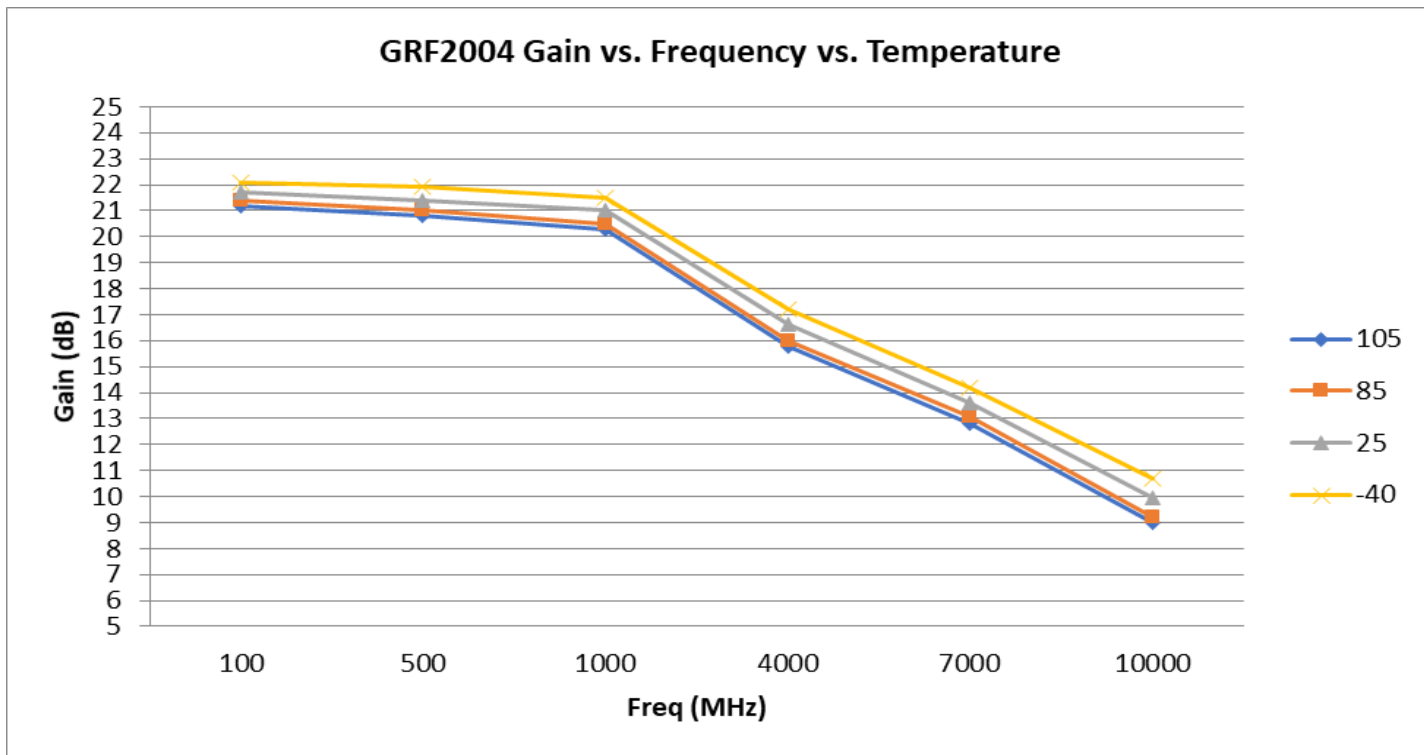
GRF2004

Broadband Gain Block
0.1 to 10.0 GHz

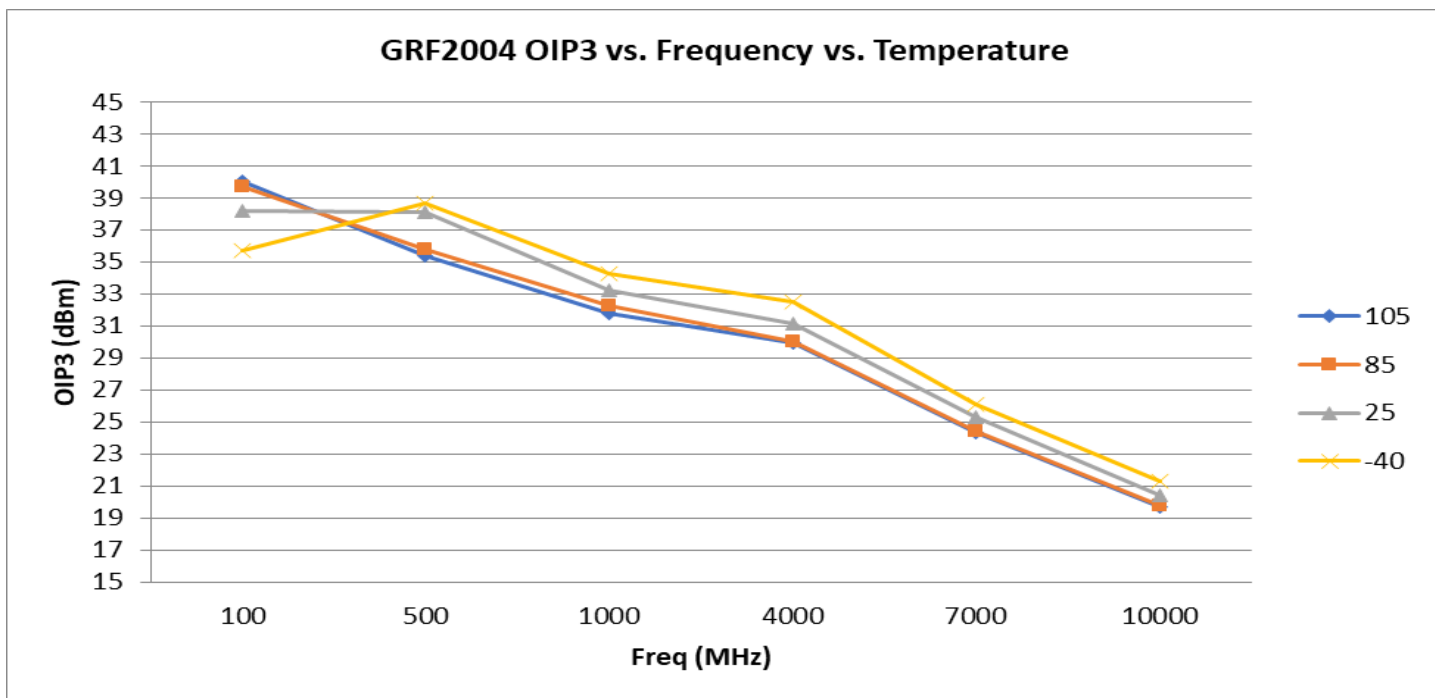
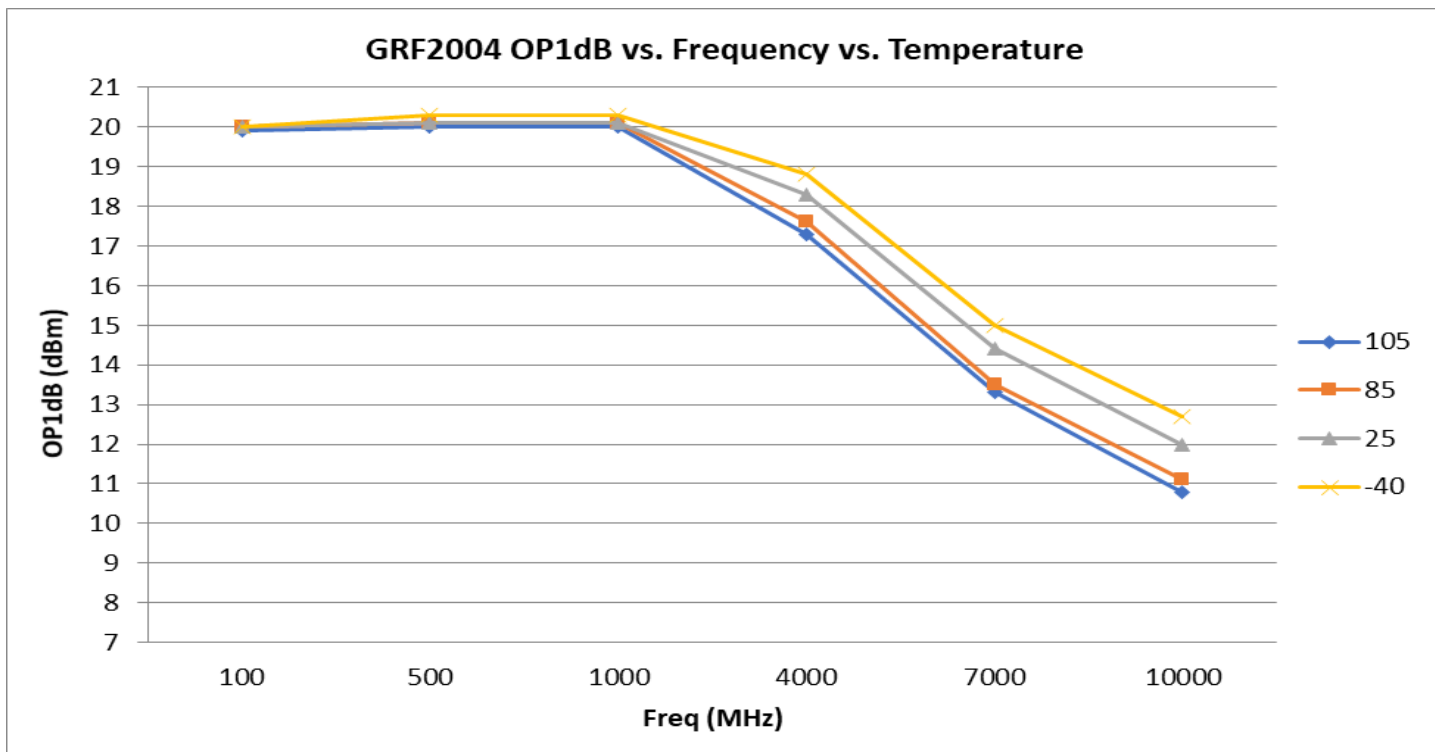
Nominal Operating Parameters:

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		°C	V _{DD} : 5.0 V; I _{DDQ} : 100 mA; No RF; P _{DISS} : 500 mW

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



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



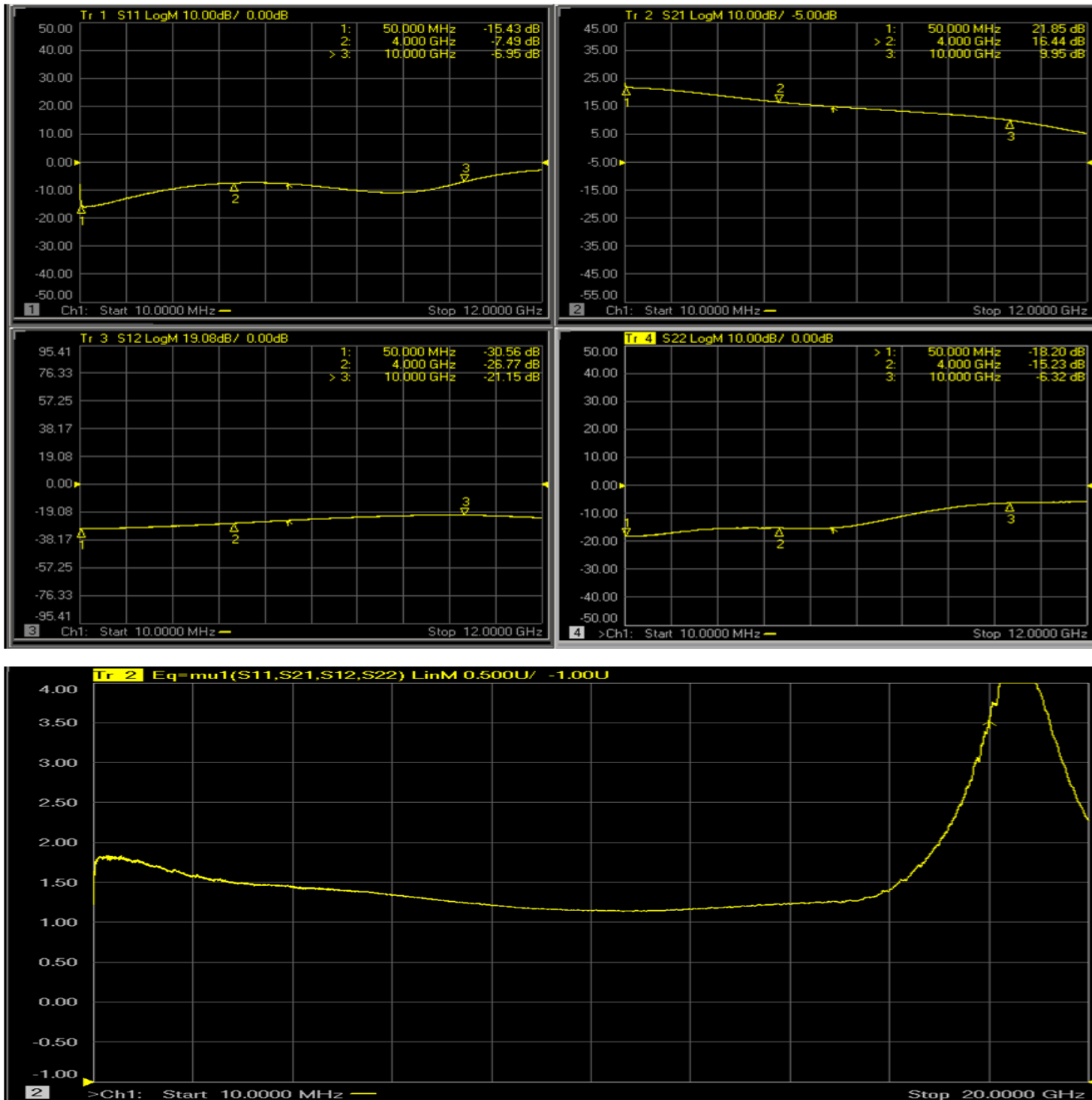


Released

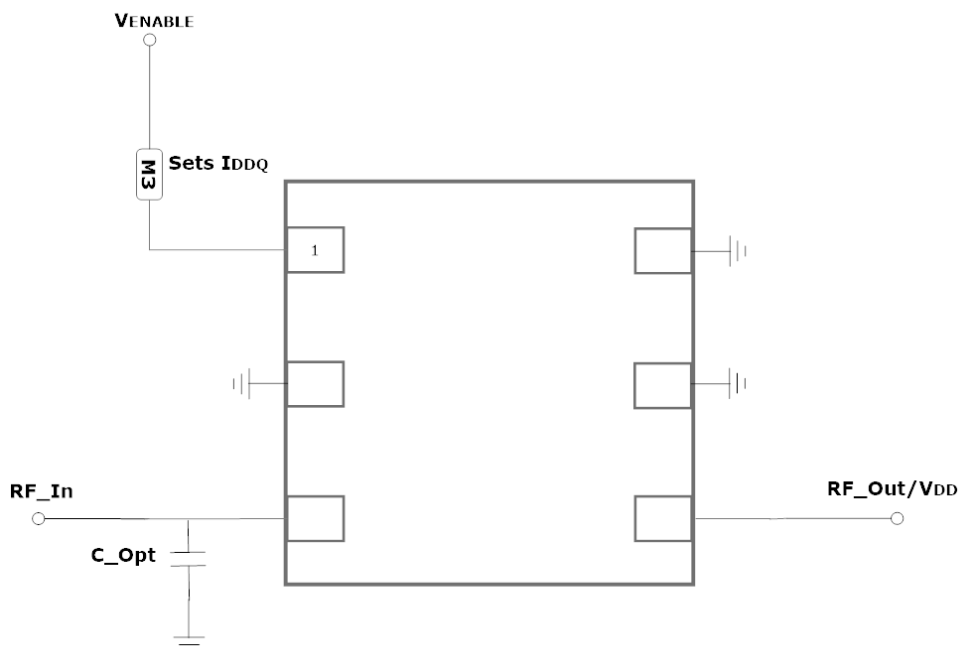
GRF2004

Broadband Gain Block
0.1 to 10.0 GHz

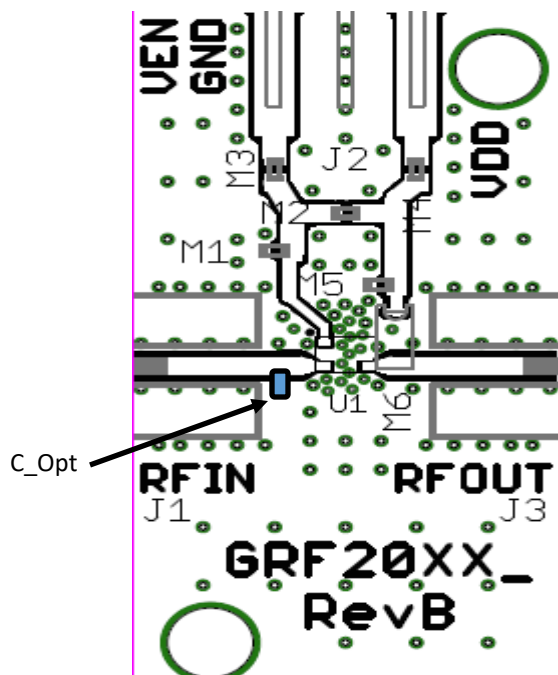
GRF2004 Evaluation Board S-Pars and Stability Mu Factor: (0.1 to 10.0 GHz VNA Bias Ts)



Note: Mu factor ≥ 1.0 implies unconditional stability.



GRF2004 Application Schematic (0.1 to 10.0 GHz Eval Board)



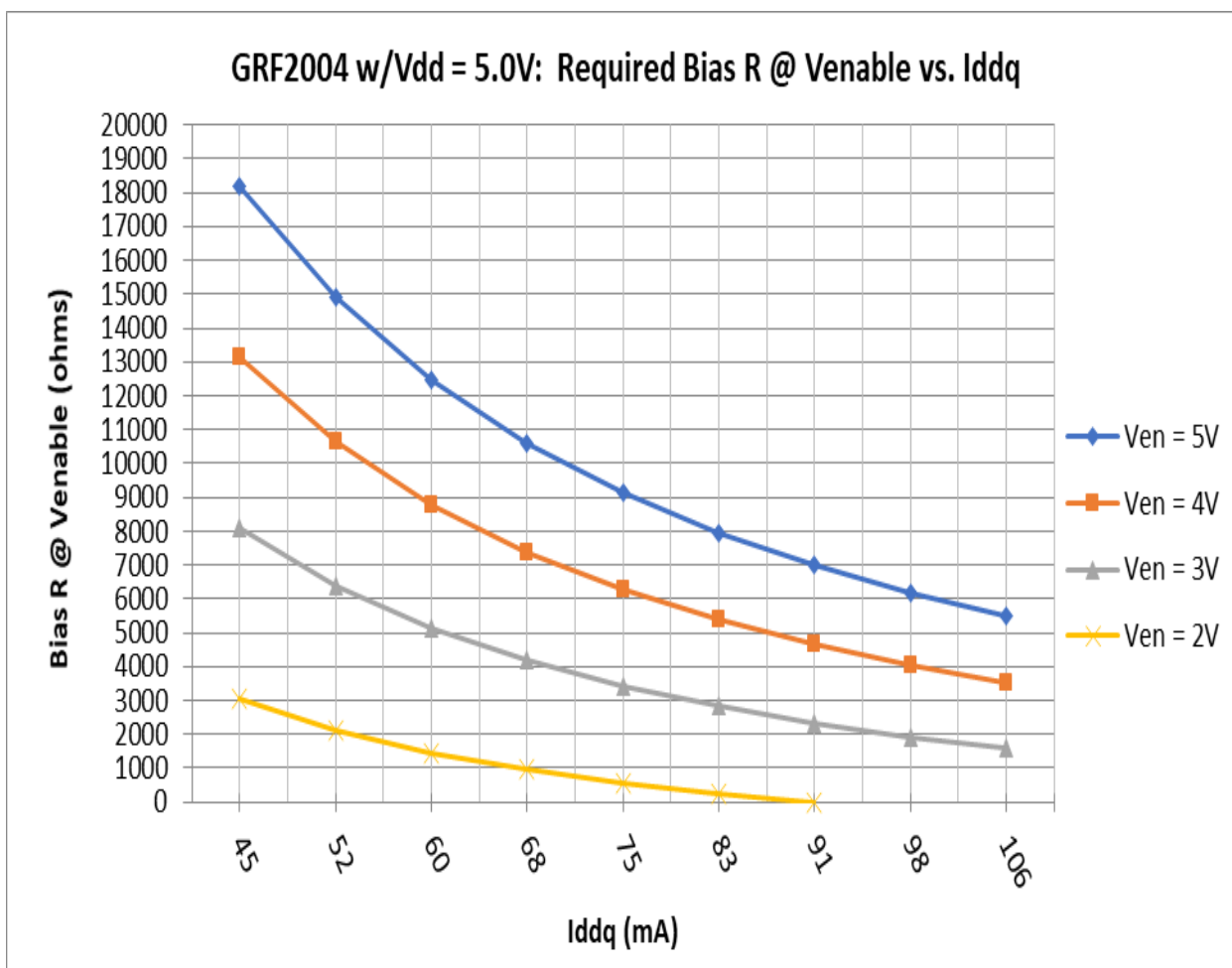
GRF2004 Evaluation Board Assembly Drawing

GRF2004 Evaluation Board BOM for VNA S-parameter measurement

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

Note: 0.2 pF cap is added to test board input to enhance high frequency gain of the device.

Bias Resistor Selection Curves





Released

GRF2004

**Broadband Gain Block
0.1 to 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.

Information in this datasheet is specific to the Guerrilla RF, Inc. ("Guerrilla RF") product identified.

This datasheet, including the information contained in it, is provided by Guerrilla RF as a service to its customers and may be used for informational purposes only by the customer. Guerrilla RF assumes no responsibility for errors or omissions on this datasheet or the information contained herein. Information provided is believed to be accurate and reliable, however, no responsibility is assumed by Guerrilla RF for its use, nor for any infringement of patents, or other rights of third parties, resulting from its use. Guerrilla RF assumes no liability for any datasheet, datasheet information, materials, products, product information, or other information provided hereunder, including the sale, distribution, reproduction or use of Guerrilla RF products, information or materials.

No license, whether express, implied, by estoppel, by implication or otherwise is granted by this datasheet for any intellectual property of Guerrilla RF, or any third party, including without limitation, patents, patent rights, copyrights, trademarks and trade secrets. All rights are reserved by Guerrilla RF.

All information herein, products, product information, datasheets, and datasheet information are subject to change and availability without notice. Guerrilla RF reserves the right to change component circuitry, recommended application circuitry and specifications at any time without prior notice. Guerrilla RF may further change its datasheet, product information, documentation, products, services, specifications or product descriptions at any time, without notice. Guerrilla RF makes no commitment to update any materials or information and shall have no responsibility whatsoever for conflicts, incompatibilities, or other difficulties arising from any future changes.

GUERRILLA RF INFORMATION, PRODUCTS, PRODUCT INFORMATION, DATASHEETS AND DATASHEET INFORMATION ARE PROVIDED "AS IS" AND WITHOUT WARRANTY OF ANY KIND, WHETHER EXPRESS, IMPLIED, STATUTORY, OR OTHERWISE, INCLUDING FITNESS FOR A PARTICULAR PURPOSE OR USE, MERCHANTABILITY, PERFORMANCE, QUALITY OR NON-INFRINGEMENT OF ANY INTELLECTUAL PROPERTY RIGHT; ALL SUCH WARRANTIES ARE HEREBY EXPRESSLY DISCLAIMED. GUERRILLA RF DOES NOT WARRANT THE ACCURACY OR COMPLETENESS OF THE INFORMATION, TEXT, GRAPHICS OR OTHER ITEMS CONTAINED WITHIN THESE MATERIALS. GUERRILLA RF SHALL NOT BE LIABLE FOR ANY DAMAGES, INCLUDING BUT NOT LIMITED TO ANY SPECIAL, INDIRECT, INCIDENTAL, STATUTORY, OR CONSEQUENTIAL DAMAGES, INCLUDING WITHOUT LIMITATION, LOST REVENUES OR LOST PROFITS THAT MAY RESULT FROM THE USE OF THE MATERIALS OR INFORMATION, WHETHER OR NOT THE RECIPIENT OF MATERIALS HAS BEEN ADVISED OF THE POSSIBILITY OF SUCH DAMAGE.

Customers are solely responsible for their use of Guerrilla RF products in the Customer's products and applications or in ways which deviate from Guerrilla RF's published specifications, either intentionally or as a result of design defects, errors, or operation of products outside of published parameters or design specifications. Customers should include design and operating safeguards to minimize these and other risks. Guerrilla RF assumes no liability or responsibility for applications assistance, customer product design, or damage to any equipment resulting from the use of Guerrilla RF products outside of stated published specifications or parameters.

Mouser Electronics

Authorized Distributor

Click to View Pricing, Inventory, Delivery & Lifecycle Information:

Guerrilla RF:

[GRF2004](#) [GRF2004-EVB](#)