



## Product Description

GRF2201 is a low-cost, linear LNA designed for demanding 2.4 GHz WLAN and ISM band applications.

The device is operated from a supply voltage ( $V_{DD}$ ) range of 2.7 to 5.0 V with a typical bias condition of 3.3 volts and 15 mA for optimal efficiency and linearity.

The device is housed in a 1.5 x 1.5 x 0.5 mm 6-pin plastic DFN package. Consult with the GRF applications engineering team for custom tuning/evaluation board data and device s-parameters.

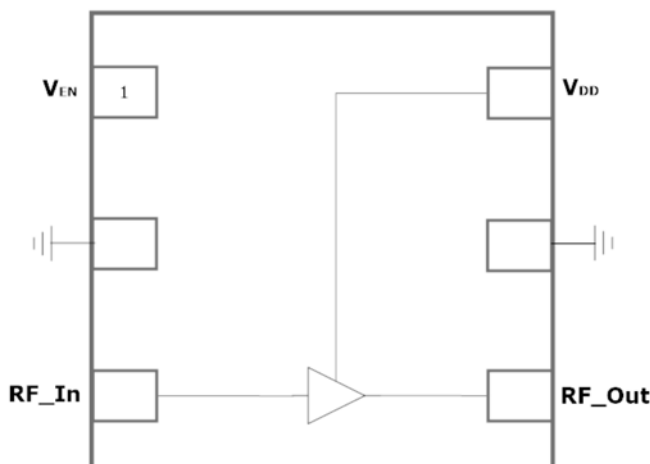
## Features

Reference: 3.3V/15mA/2.45 GHz

- Gain: 20.7 dB
- Evaluation Board NF: 0.73 dB
- OP1dB: 12.8 dBm
- OIP3: 26.0 dBm
  
- Flexible bias voltage and Current
- Minimal External Components
- Process: GaAs pHEMT

## Applications

- 2.4 GHz 802.11 b, g, n
- Bluetooth
- ZigBee
- ISM



**1.5 x 1.5 mm DFN-6**



Preliminary

# GRF2201

High Gain LNA  
2.4 GHz ISM; 802.11 b, g, n

## Absolute Ratings:

Parameter	Symbol	Min.	Max.	Unit
Supply Voltage	V <sub>DD</sub>	0	6.0	V
RF Input Power CW: (Load VSWR < 2:1; V <sub>D</sub> : 5.0	P <sub>IN MAX</sub>		17.0	dBm
Operating Temperature (Package Heat Sink)	T <sub>AMB</sub>	-40	105	°C
Maximum Channel Temperature	T <sub>MAX</sub>		170	°C
Maximum Dissipated Power	P <sub>DISS MAX</sub>		150	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

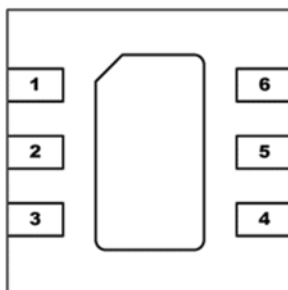


Exceeding Absolute Maximum Rating conditions may cause permanent damage to the device.

**Note:** For package dimensions and manufacturing information, see the [Guerrilla-RF.com](http://Guerrilla-RF.com) website for the following document located on the GRF2201 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	V <sub>ENABLE</sub> and series resistor set I <sub>DDQ</sub> . V <sub>ENABLE</sub> <= 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. An external DC blocking cap must be used.
5	NC	No Connect or Ground	No internal connection to die
6	V <sub>DD</sub>	Supply Voltage Input	V <sub>DD</sub> must be applied through a choke to this pin
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.



Preliminary

# GRF2201

High Gain LNA  
2.4 GHz ISM; 802.11 b, g, n

## Nominal Operating Parameters:

Parameter	Symbol	Specification			Unit	Condition
		Min.	Typ.	Max.		
Test Frequency	$F_{TEST}$		2.45		GHz	$V_{DD}=V_{ENABLE}= 3.3 V, T_A = 25^\circ C$
Gain	S21		20.7		dB	
Noise Figure (Evaluation Board)	NF		0.73		dB	
Output 1dB Compression Power	OP1dB		12.8		dBm	
Output 3rd Order Intercept	OIP3		26.0		dBm	2.0 dBm $P_{OUT}$ per tone (2399 and 2401 MHz)
Switching Rise Time	$T_{RISE}$		500		ns	Fast switching requires $V_{ENABLE}$ controlled separately from $V_{DD}$
Switching Fall Time	$T_{FALL}$		500		ns	
Supply Current	$I_{DD}$		15		mA	
Enable Current	$I_{ENABLE}$		1.0		mA	
<b>Disabled Mode</b>						
Leakage Current	$I_{LEAKAGE}$		100		uA	$V_{DD}: 3.0V; V_{ENABLE}: 0.0V$
<b>Thermal Data</b>						
Thermal Resistance: (Infra-Red Scan)	$\theta_{JC}$		TBD		°C/W	On standard Evaluation Board
Channel Temperature @ +85 C Reference (Package heat sink)	$T_{CHANNEL}$		TBD		°C	$V_{DD}: 3.0 V; I_{DDQ}: 15 mA; No RF; P_{DISS}: 45 mW$

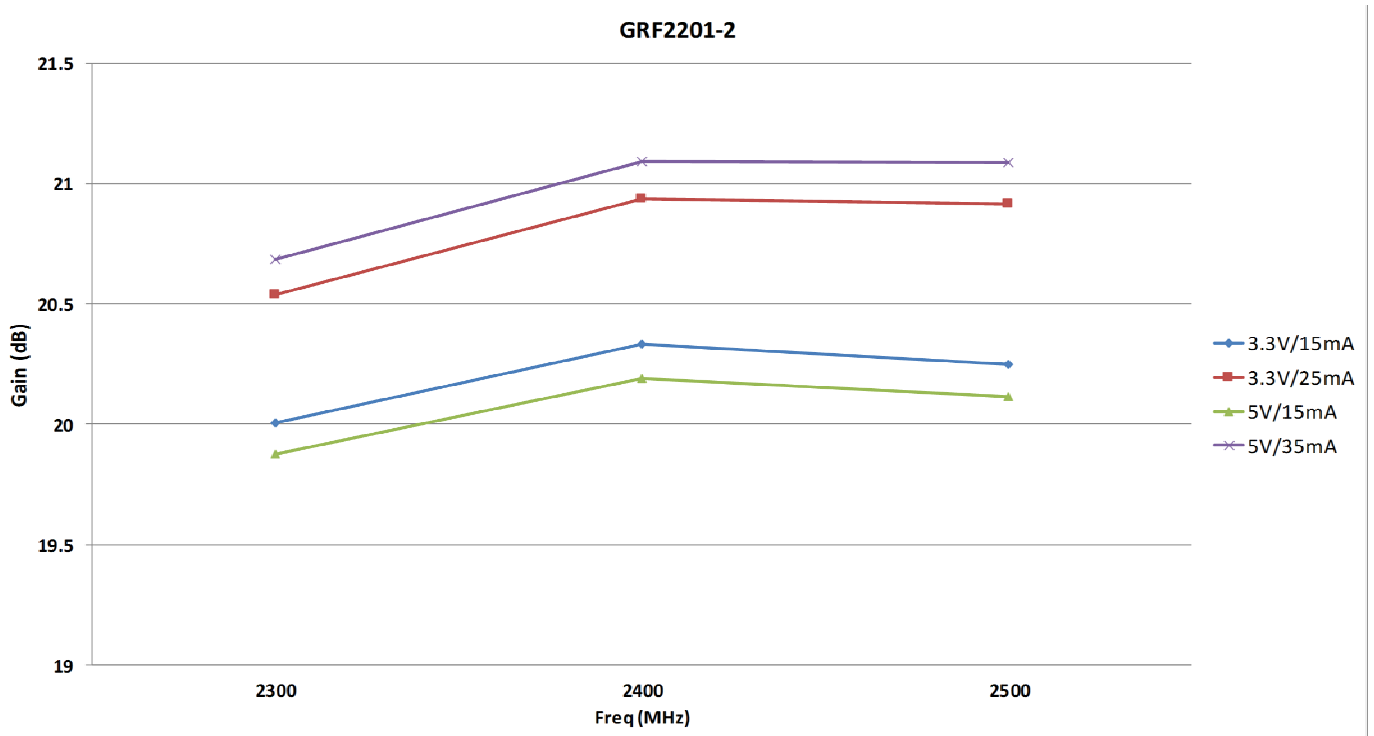
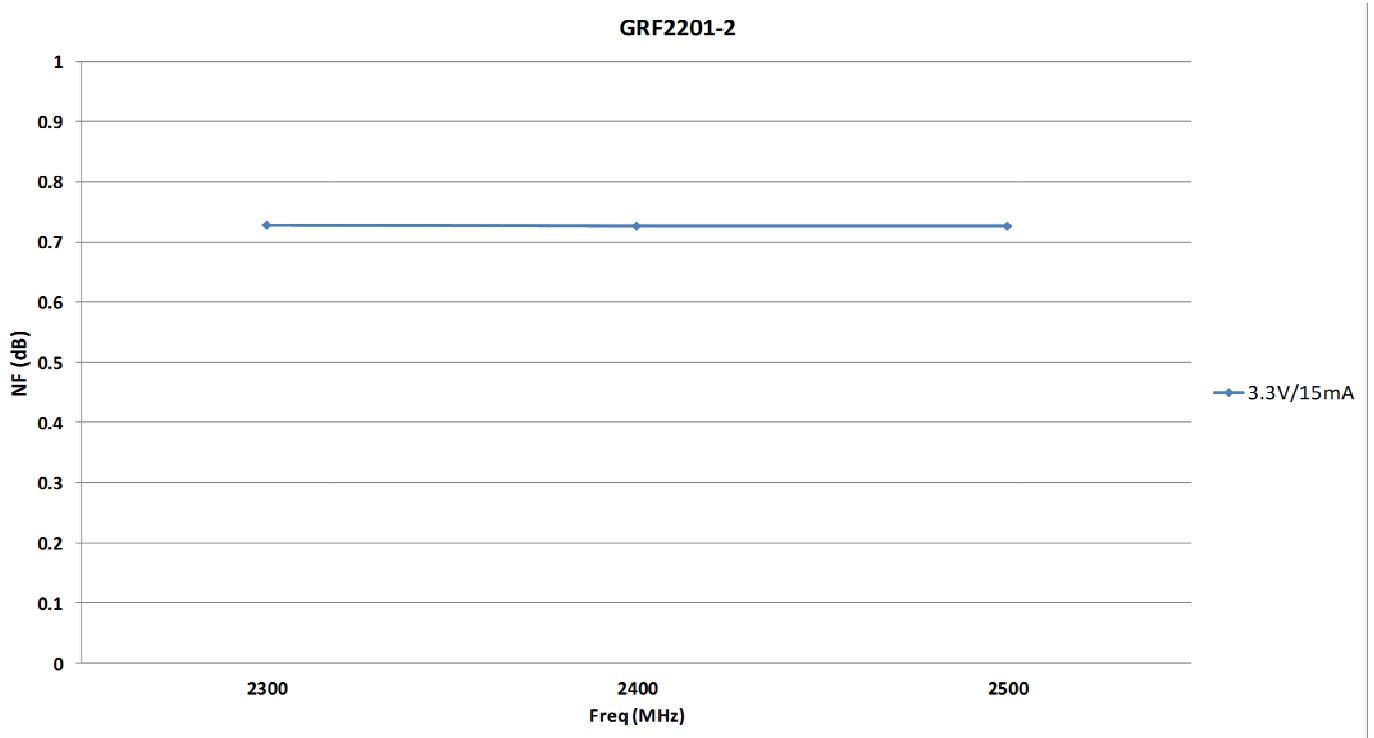


Preliminary

# GRF2201

High Gain LNA  
2.4 GHz ISM; 802.11 b, g, n

## GRF2201 Evaluation Board Noise Figure and Gain Data



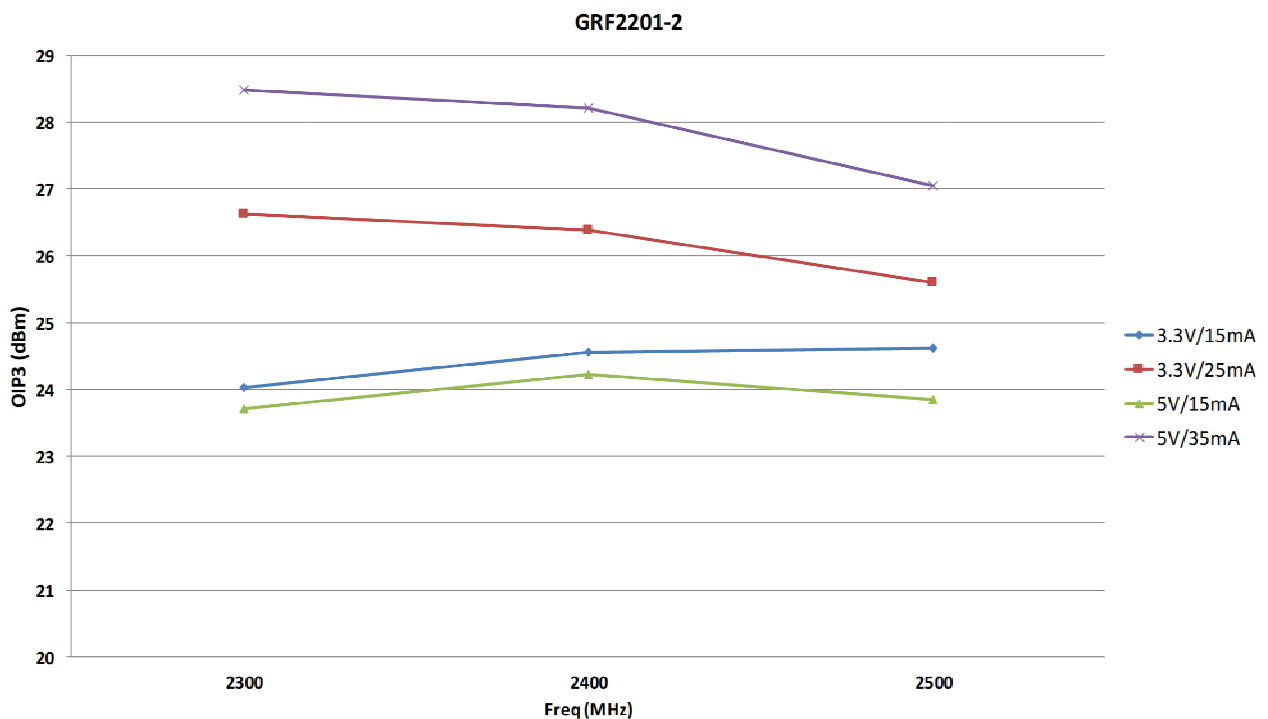
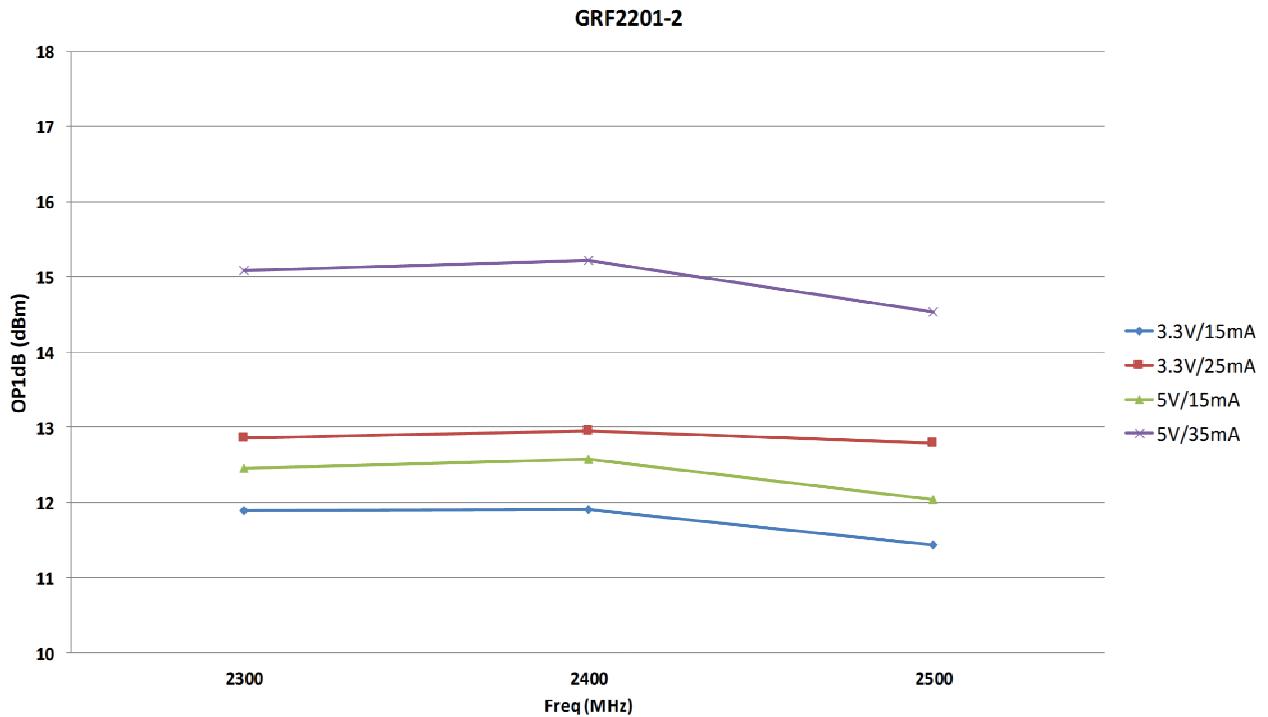


Preliminary

# GRF2201

High Gain LNA  
2.4 GHz ISM; 802.11 b, g, n

## GRF2201 Evaluation Board OP1dB and OIP3 Data



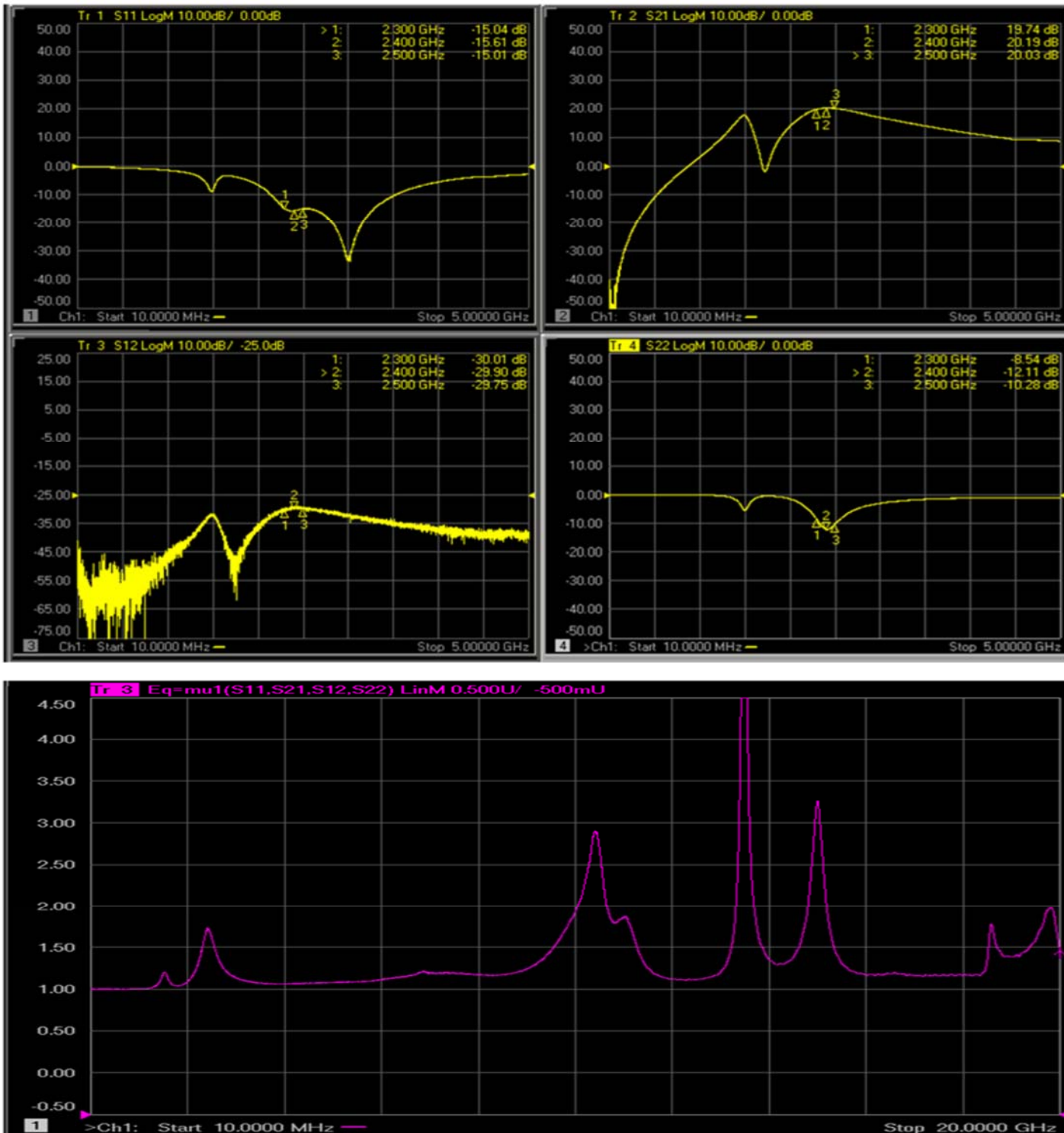


Preliminary

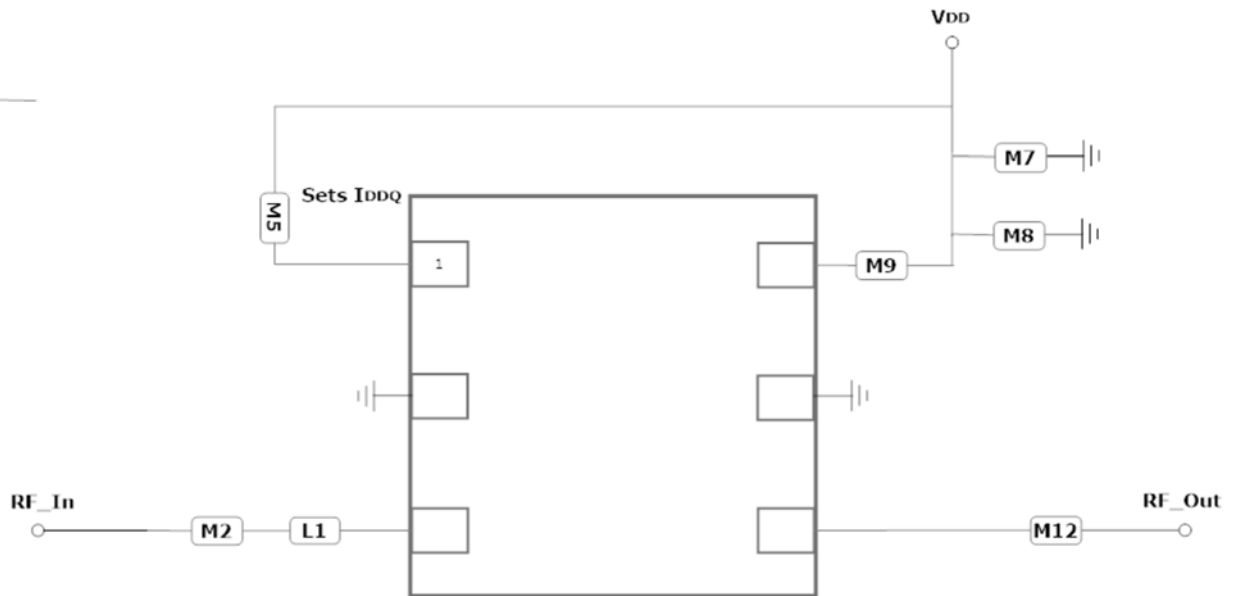
# GRF2201

High Gain LNA  
2.4 GHz ISM; 802.11 b, g, n

## GRF2201 Evaluation Board S-pars (Gain Mode):



Note:  $\mu \geq 1.0$  implies unconditional stability



GRF2201 Application Schematic (2.4 GHz Tune)





Preliminary

# GRF2201

High Gain LNA  
2.4 GHz ISM; 802.11 b, g, n

## GRF2201 Standard Evaluation Board BOM: (2.4 GHz Tune)

Component	Type	Manufacturer	Family	Value	Package Size	Substitution
M2	Capacitor	Murata	GJM	47 pF	0402	ok
L1	Inductor	Murata	3.3 nH	LQG	0402	ok
M5	Resistor	Various	5%	—	0402	ok
M7	Capacitor	Murata	GRM	0.1 uF	0402	ok
M8	Capacitor	Murata	GRM	10 pF	0402	ok
M9	Inductor	Murata	1.6 nH	LQG	0402	ok
M12	Capacitor	Murata	GJM	0.7 pF	0402	ok



Preliminary

# GRF2201

High Gain LNA  
2.4 GHz ISM; 802.11 b, g, n

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:](#)

[GRF2201](#) [GRF2201-EVB](#)