



## Product Description

The GRF4002 is a broadband low noise gain block designed for small cell, wireless infrastructure and other high performance applications. It exhibits outstanding broadband NF, linearity and return losses over 100 to 3800 MHz with a single match.

Configured as a first stage LNA, linear driver or cascaded gain block, GRF4002 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 5.5 V with a selectable  $I_{DDQ}$  range of 20 to 80 mA for optimal efficiency and linearity.

GRF4002 is internally matched to  $50 \Omega$  at the input and output ports, needing only external DC blocks and a bias choke on the output.

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

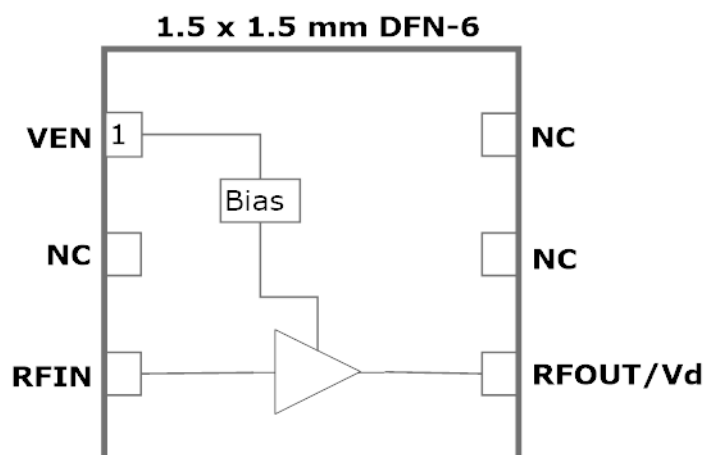
## Features

Reference: 5V/70mA/2.5 GHz

- EVB NF: 0.85 dB
- Gain: 15.0 dB
- OP1dB: 23.5 dBm
- OIP3: 36.5 dBm
- Flexible Bias Voltage and Current
- Internally Matched to  $50 \Omega$
- Process: GaAs pHEMT

## Applications

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





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# GRF4002

Broadband LNA/Linear Driver  
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>		17	dBm
Operating Temperature (Package Heat Sink)	T <sub>AMB</sub>	-40	105	°C
Maximum Channel Temperature (MTF > 10 <sup>6</sup> Hours)	T <sub>MAX</sub>		170	°C
Maximum Dissipated Power	P <sub>DISS MAX</sub>		500	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		2	--



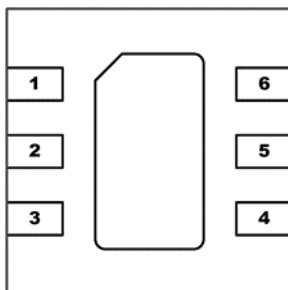
Caution! ESD Sensitive Device



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 GRF4002 landing page: **Manufacturing Note—MN-001 Product Tape and Reel, Solderability and Package Outline Specification.**

### Pin Out (Top View)



### Pin Assignments:

Pin	Name	Description	Note
1	V <sub>ENABLE</sub>	Enable Voltage Input	Venable < 0.2 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	Internally matched 50Ω. An external DC blocking cap must be used.
4	RF_Out	LNA RF output	Internally matched 50Ω. 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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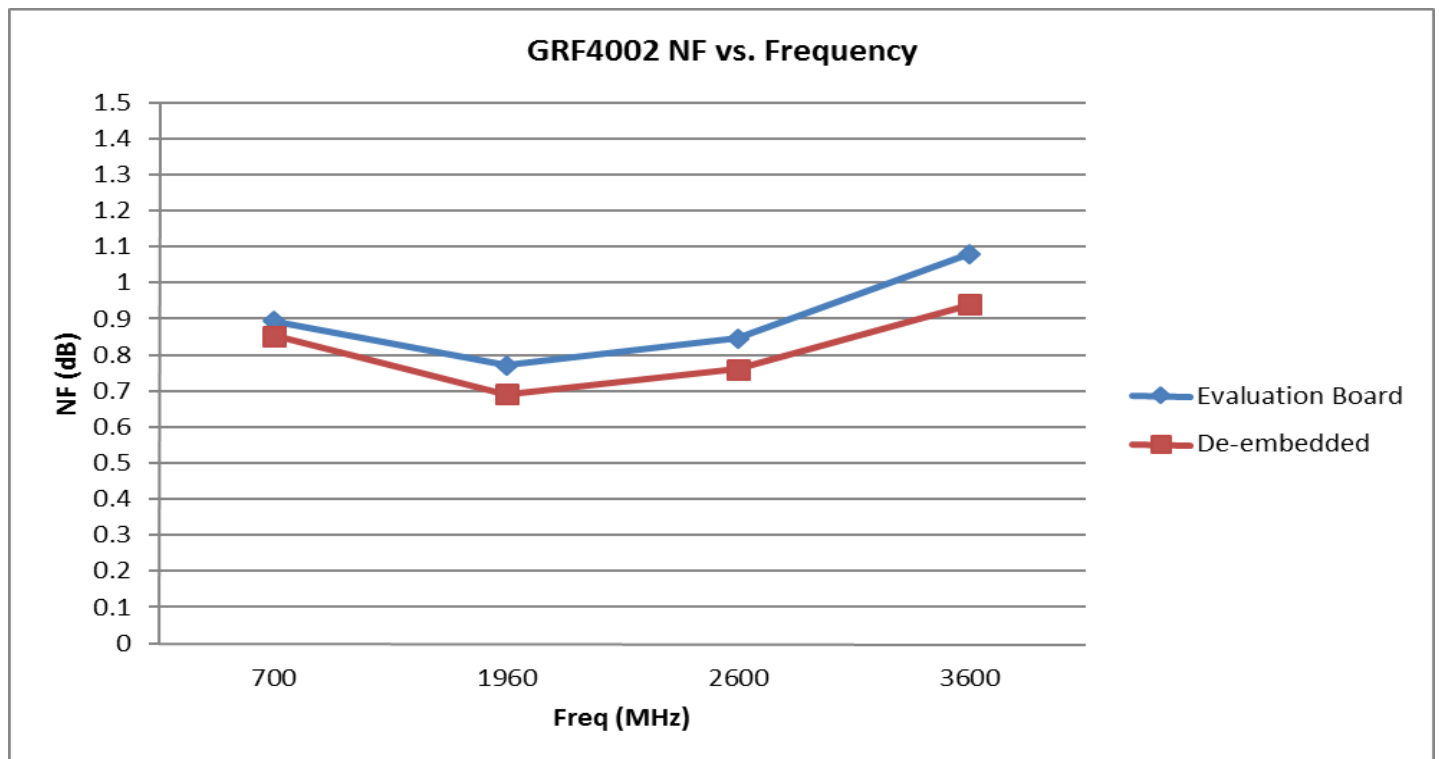
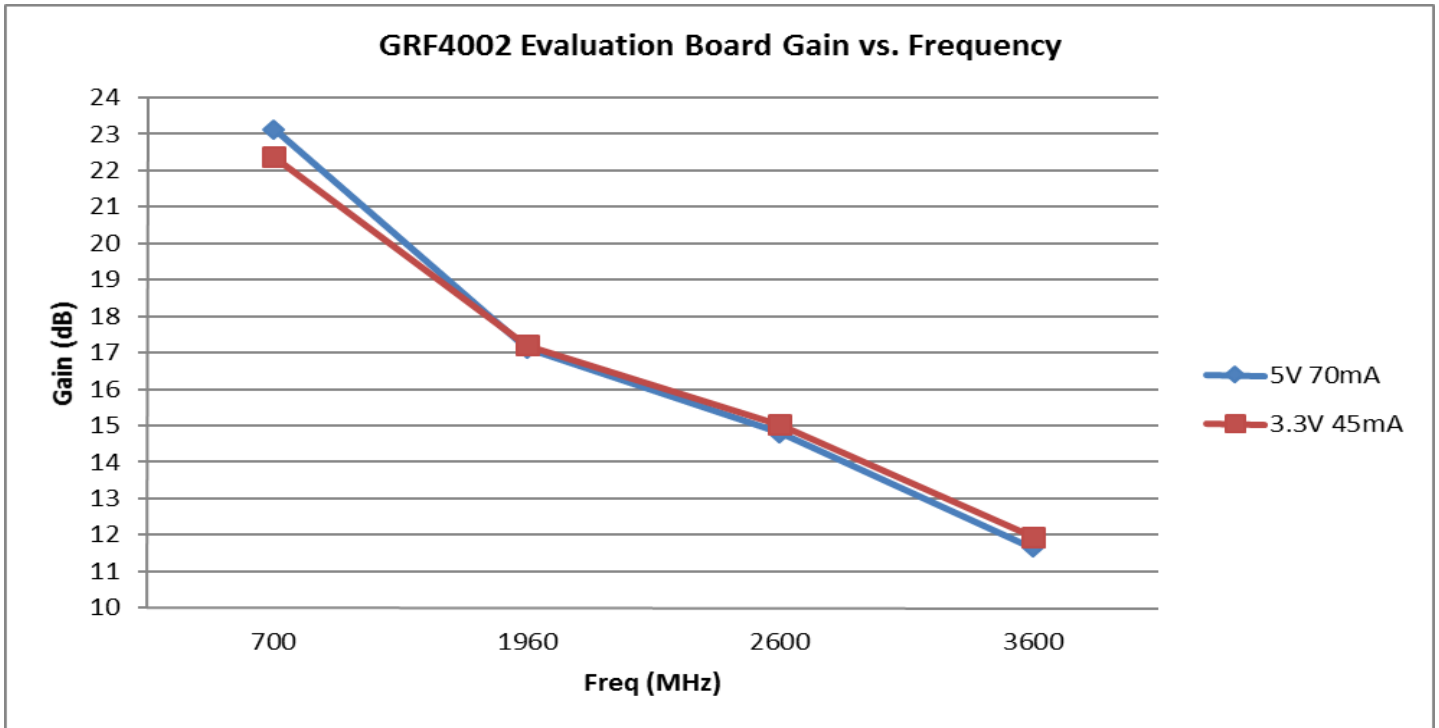
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0.1–3.8 GHz

## Nominal Operating Parameters:

Parameter	Symbol	Specification			Unit	Condition
		Min.	Typ.	Max.		
Test Frequency	F <sub>TEST</sub>		2500		MHz	V <sub>DD</sub> = 5.0 V, T <sub>A</sub> = 25 °C
Gain	S <sub>21</sub>	14.0	15.0		dB	
Evaluation Board Noise Figure	NF		0.85	1.0	dB	
Output 3rd Order Intercept	OIP <sub>3</sub>		36.5		dBm	+2.0 dBm P <sub>OUT</sub> per tone at 2 MHz Spacing (2499 and 2501 MHz)
Output 1dB Compression Point	OP <sub>1dB</sub>	22.5	23.5		dBm	
Switching Rise Time	T <sub>RISE</sub>		500		ns	
Switching Fall Time	T <sub>FALL</sub>		500		ns	
Supply Current	I <sub>DD</sub>	56.0	70.0	84.0	mA	Target I <sub>DDQ</sub> : 70 mA
Enable Current	I <sub>ENABLE</sub>		3.0	6.0	mA	
<b>Disabled Mode</b>						
Leakage Current	I <sub>LEAKAGE</sub>		40	100	uA	V <sub>DD</sub> : 5.0V; V <sub>ENABLE</sub> : 0.0V
<b>Thermal Data</b>						
Thermal Resistance: (Infra-Red Scan)	Θ <sub>jc</sub>		133		°C/W	On standard Evaluation Board
Channel Temperature @ +85 C Reference (Package heat sink)	T <sub>CHANNEL</sub>		132		°C	V <sub>DD</sub> : 5.0 V; I <sub>DDQ</sub> : 70 mA; No RF; P <sub>DISS</sub> : 350 mW

GRF4002 Evaluation Board Measured Data:



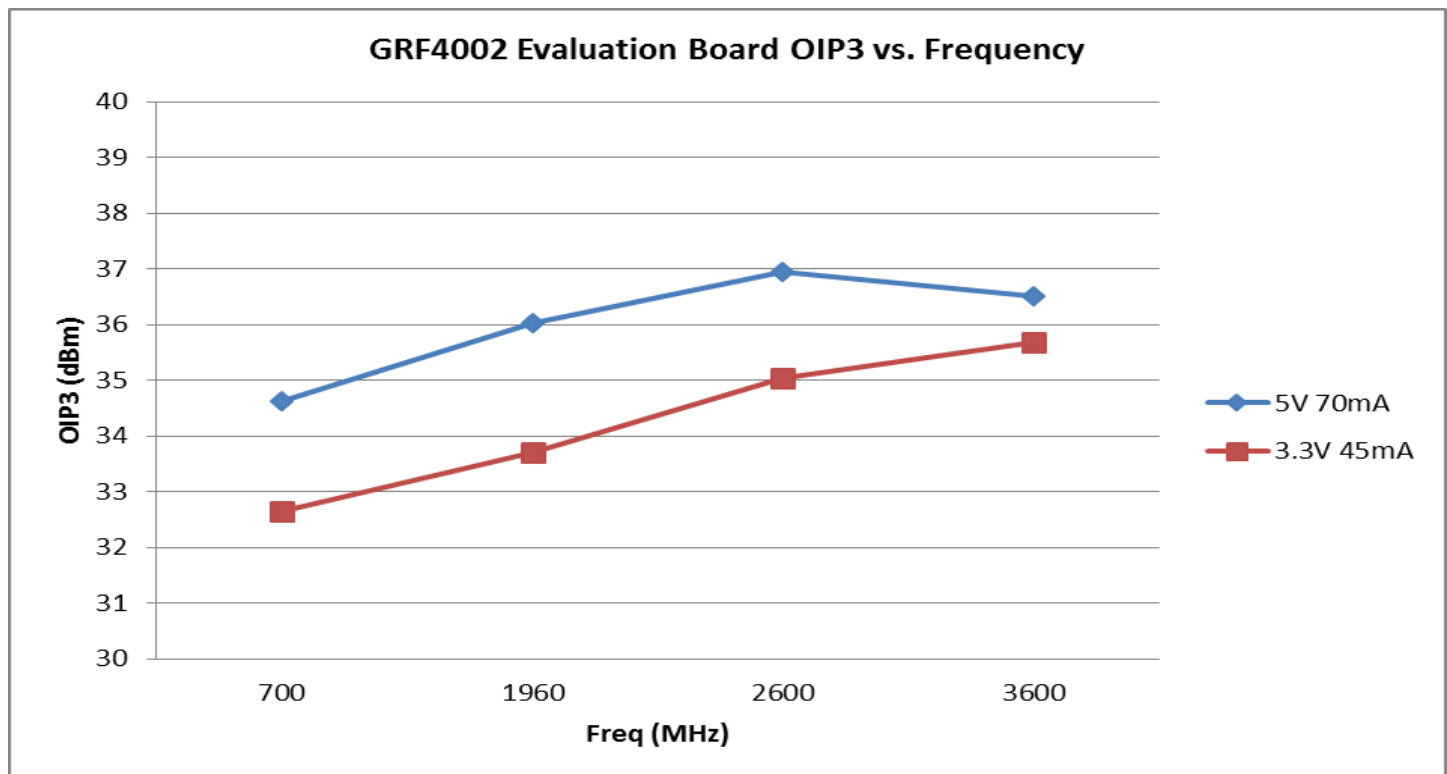
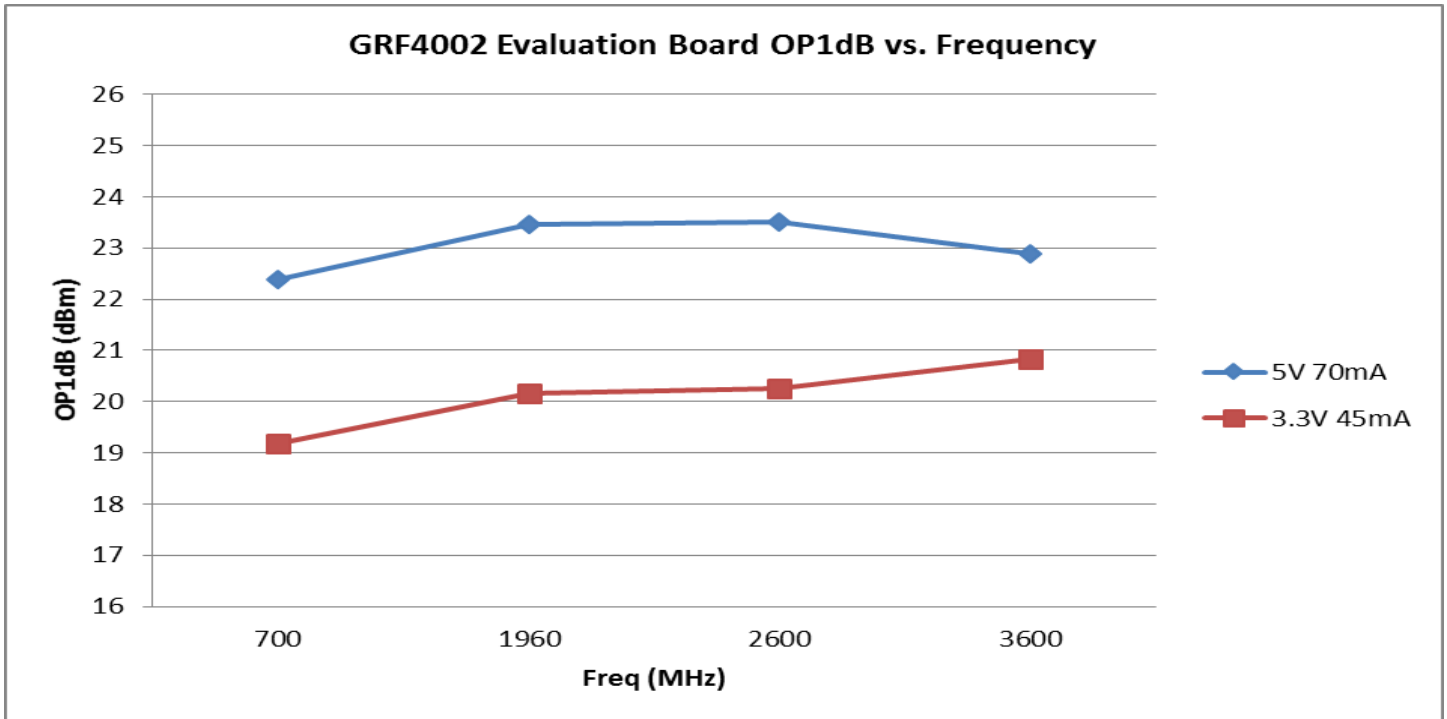


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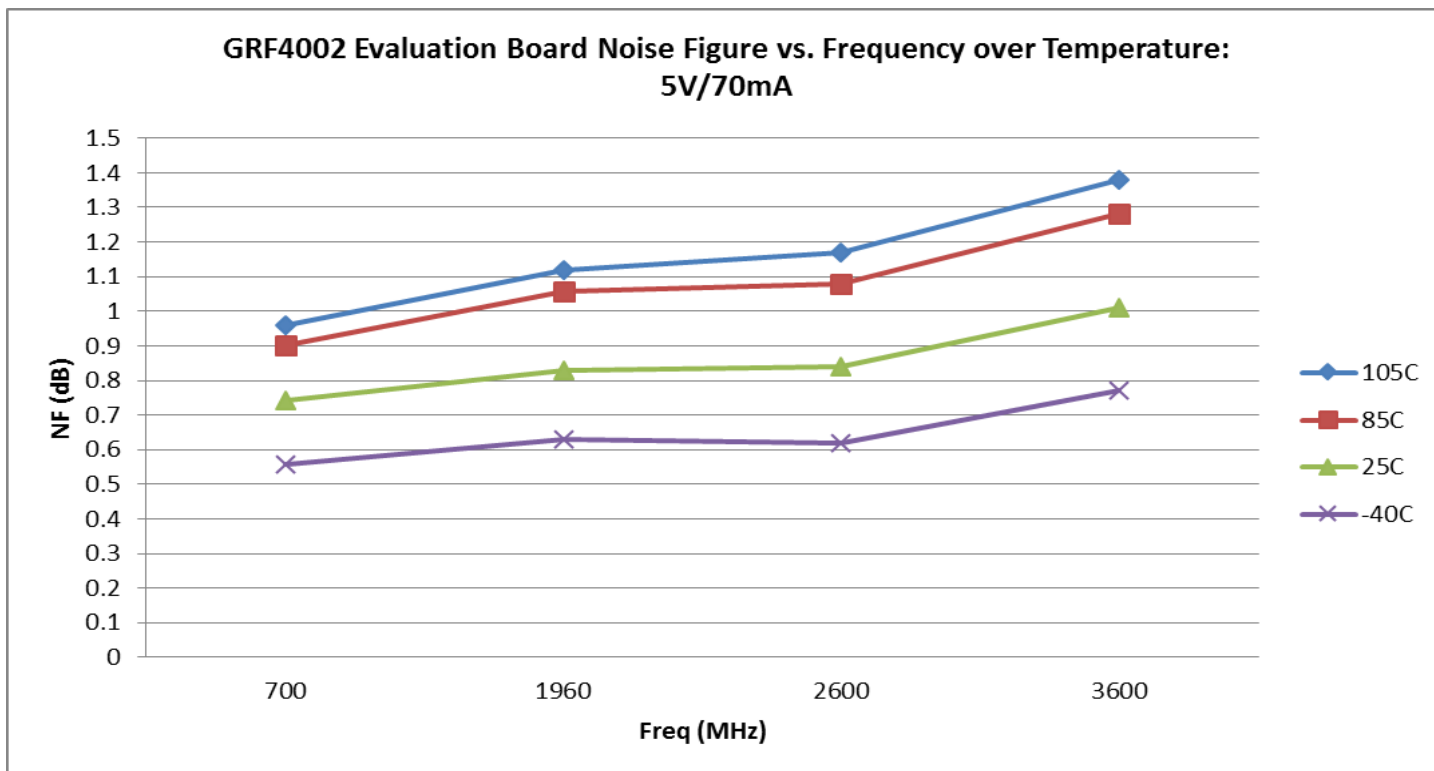
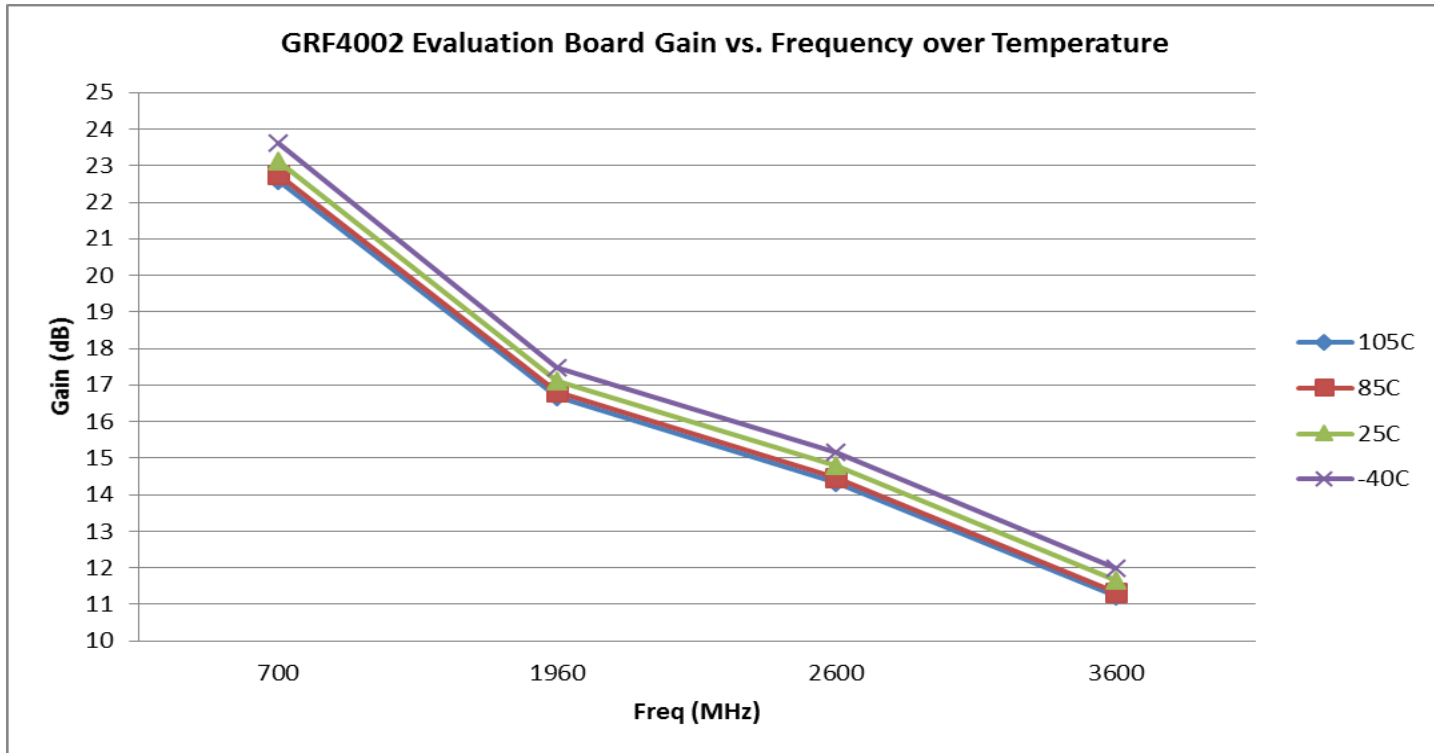
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Broadband LNA/Linear Driver  
0.1–3.8 GHz

## GRF4002 Evaluation Board Measured Data:



## GRF4002 Evaluation Board Performance over Temperature: (5V/70mA)



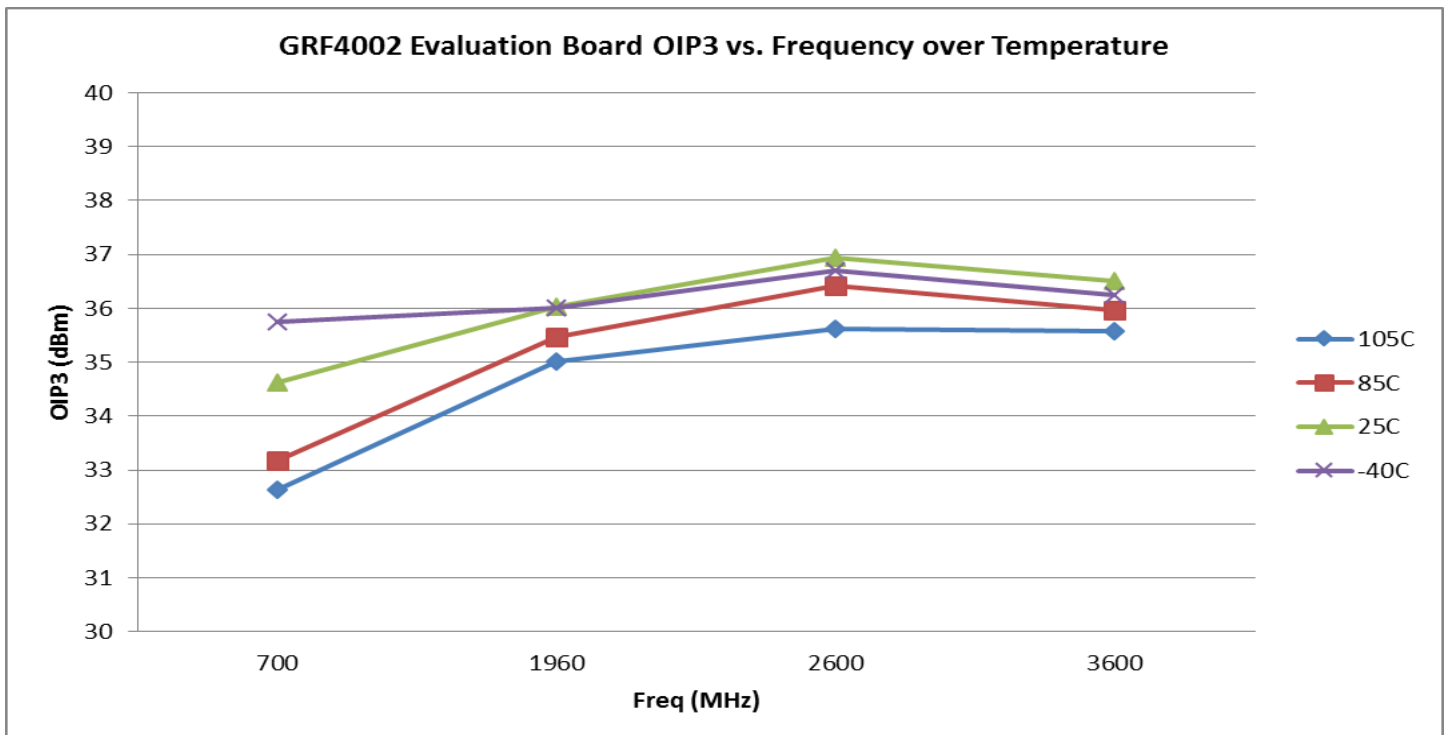
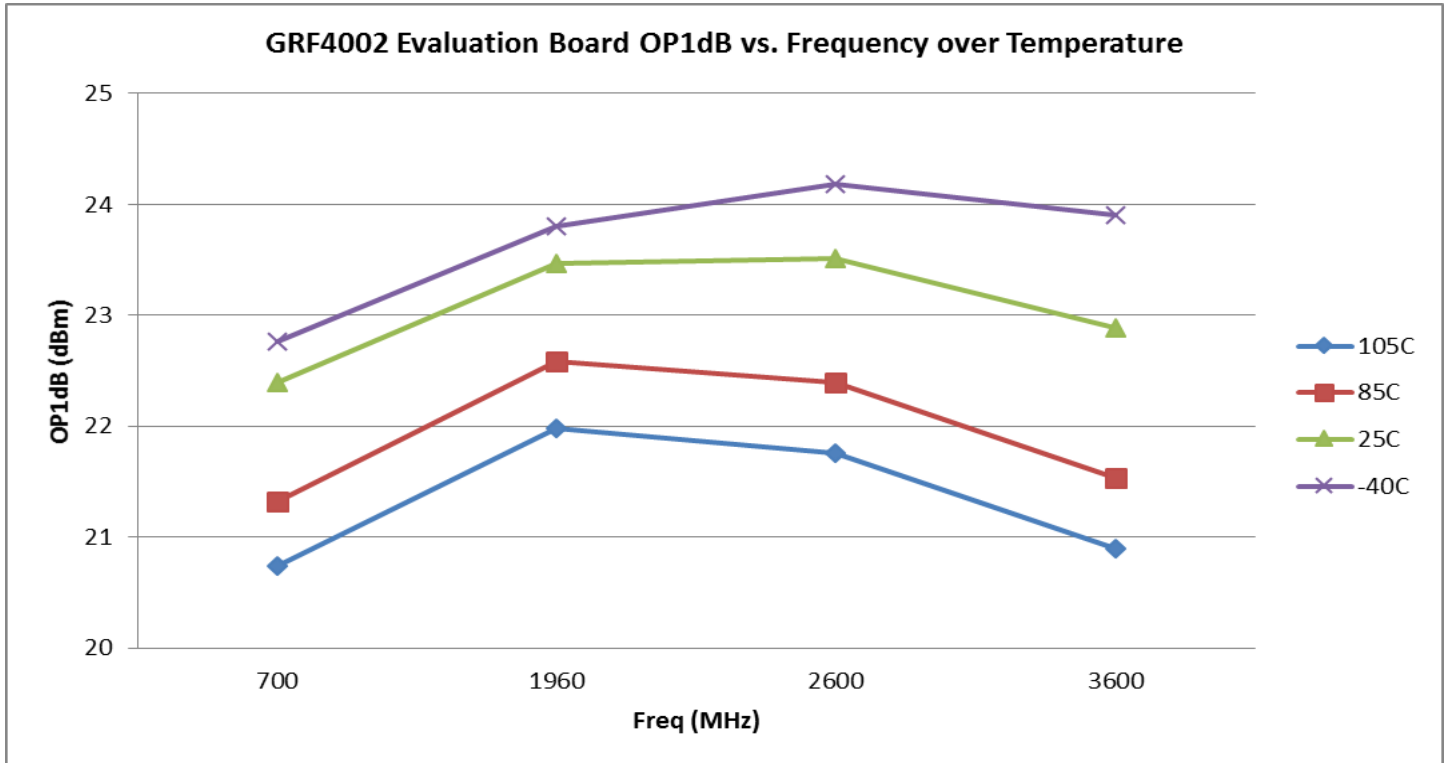


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## GRF4002 Evaluation Board Performance over Temperature: (5V/70mA)







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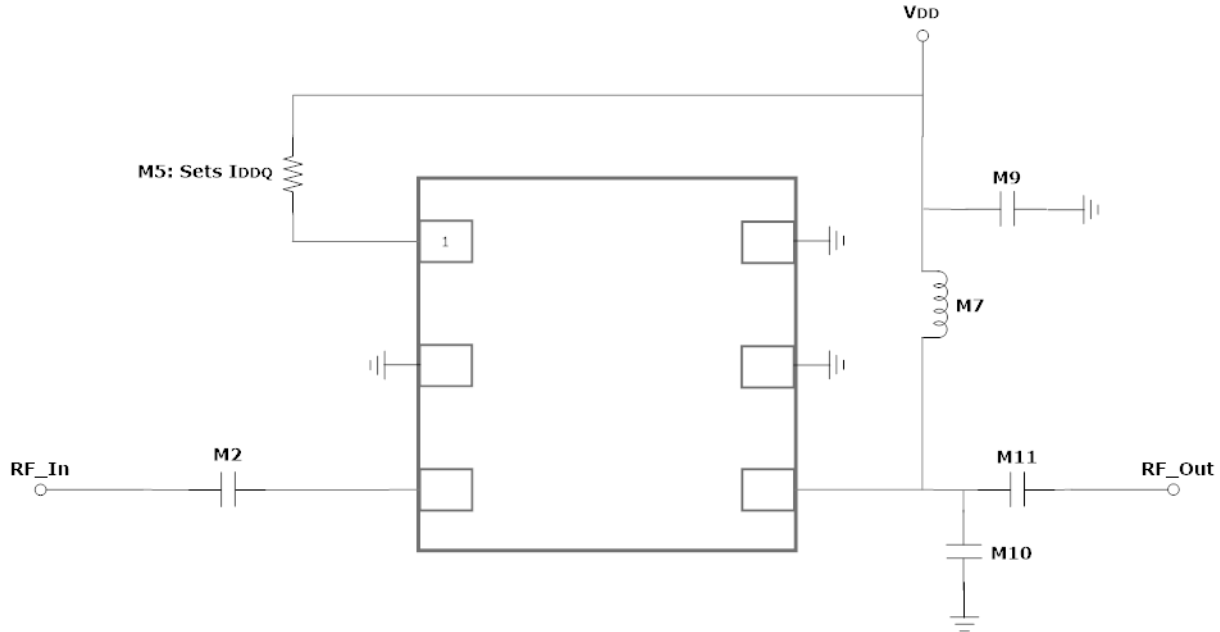
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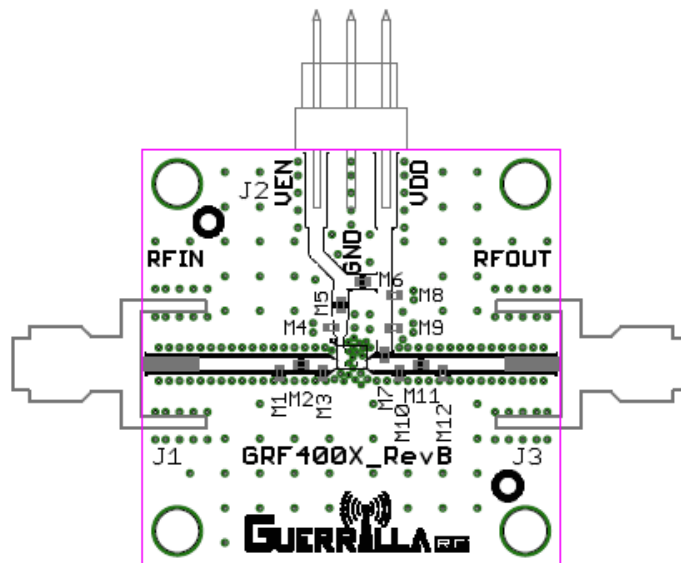
## GRF4002 Evaluation Board S-Pars and Stability Mu Factor: (0.7 – 3.8 GHz Match)



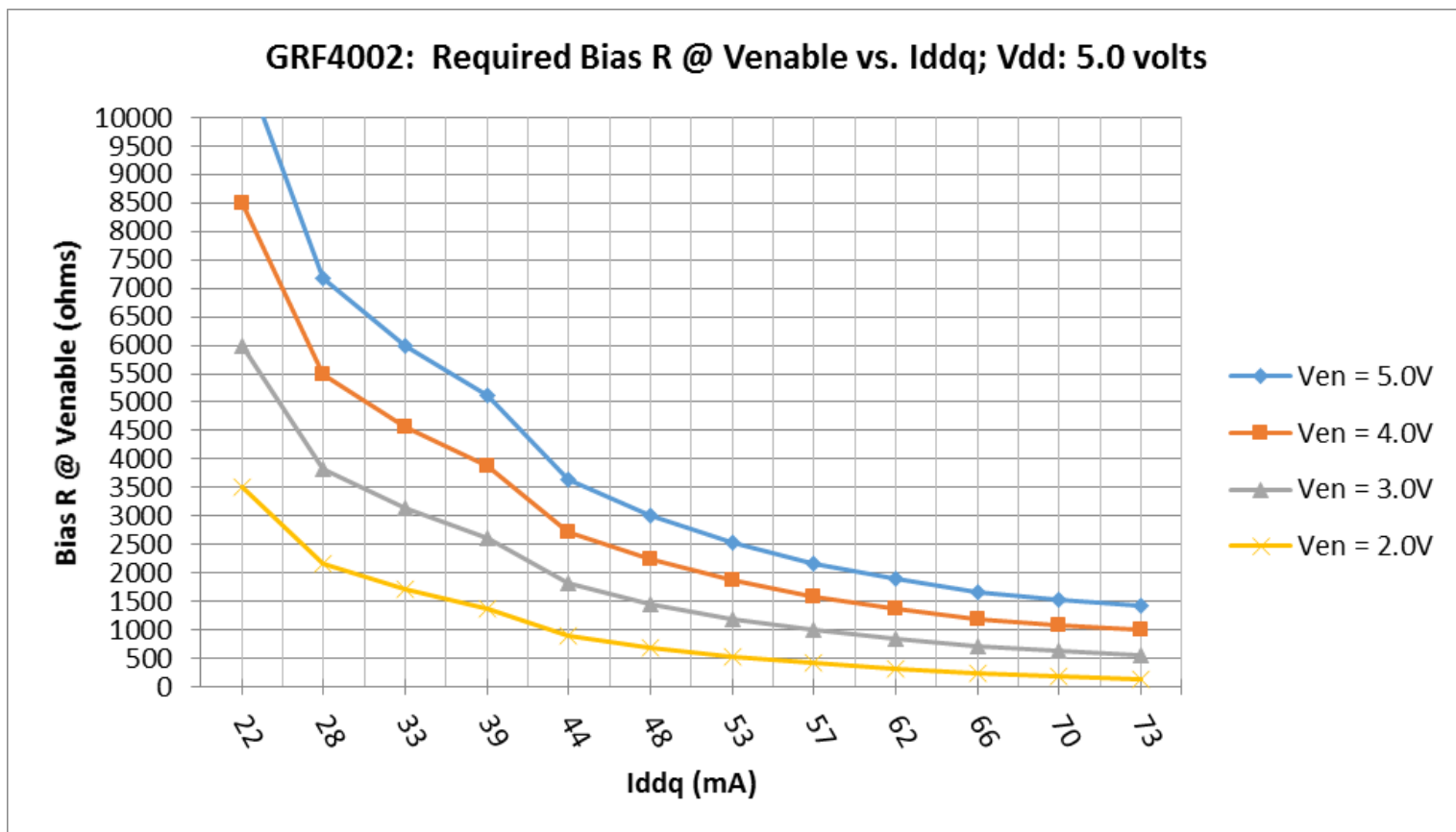
Note: Mu factor  $\geq 1.0$  implies unconditional stability.



GRF4002 Application Schematic



GRF400X Evaluation Board Assembly Diagram



**GRF4002 Bias Resistor Selection Chart**

Component	Type	Manufacturer	Family	Value	Package Size	Substitution
M2	Capacitor	Murata	GRM	100 pF	0402	ok
M5	Resistor	Various	5%	Sets Iddq	0402	ok
M7	Inductor	Various	MLC	220 nH	0402	ok
M9	Capacitor	Murata	GRM	0.1 uF	0402	ok
M10	Capacitor	Murata	GRM	0.5 pF	0402	ok
M11	Capacitor	Murata	GRM	100 pF	0402	ok

**GRF4002 Standard Evaluation Board BOM: (0.1 to 3.8 GHz Tune)**



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# GRF4002

## Broadband LNA/Linear Driver 0.1–3.8 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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