GRF4002

Released

Broadband LNA/Linear Driver
0.1—3.8 GHz



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 50Ω
- Process: GaAs pHEMT

Applications

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

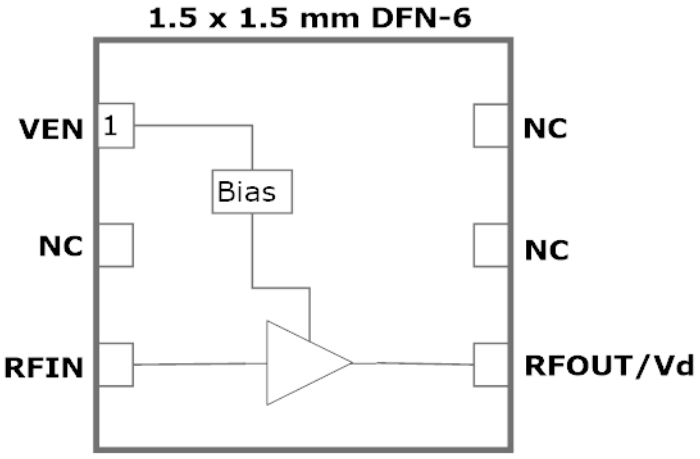
Product Description

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 700 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 5.0 V with a selectable I_{DDQ} range of 20 to 80 mA for optimal efficiency and linearity.

GRF4002 is internally matched to 50Ω 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. Packaged device s-parameters are available on the website landing page.



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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)	$P_{IN\ MAX}$		22	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	$P_{DISS\ MAX}$		500	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

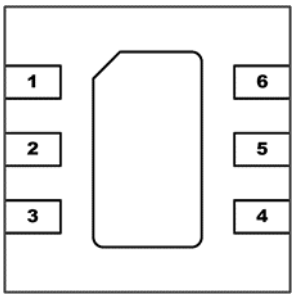
Exceeding Absolute Maximum Rating conditions may cause permanent damage to the device.

Note: For manufacturing information, see the Guerrilla-RF.com website for the following document located on the GRF4002 landing page: Manufacturing Note—MN-001 Product Tape and Reel, Solderability and Package Outline Specification.

Link to manufacturing note

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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	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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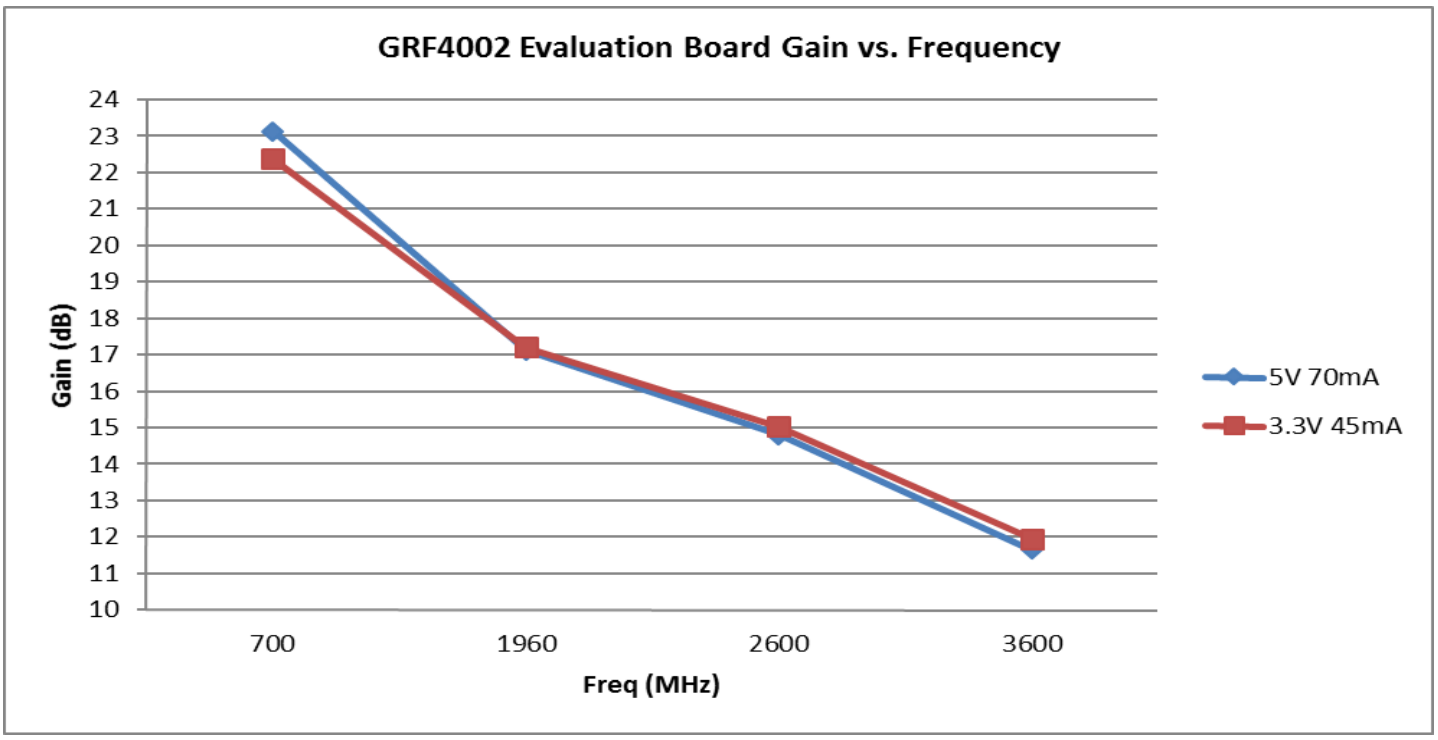
Nominal Operating Parameters:

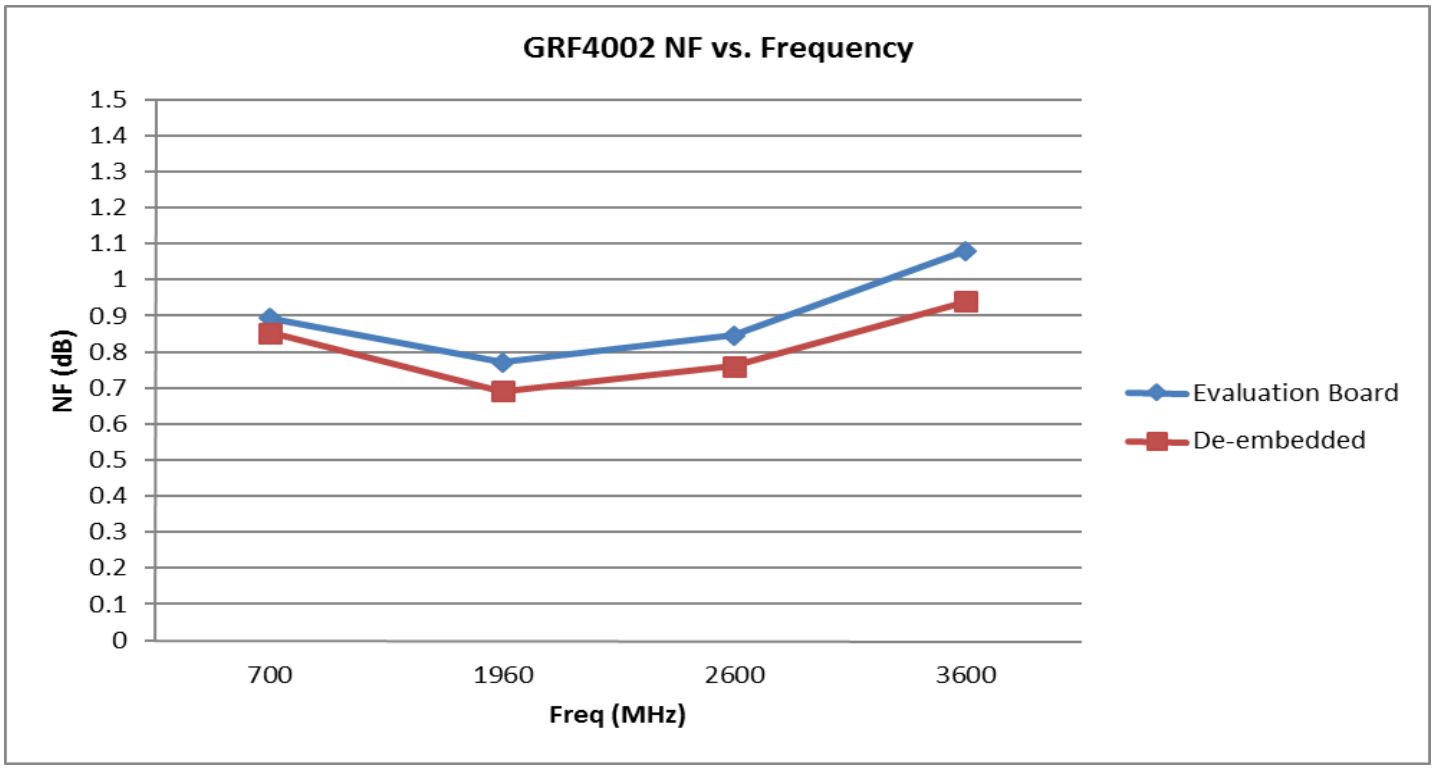
Parameter	Symbol	Specification			Unit	Condition
		Min.	Typ.	Max.		
Test Frequency	F_{TEST}		2500		MHz	V_{DD} = 5.0 V, T_A = 25°C
Gain	S21	14.0	15.0		dB	
Evaluation Board Noise Figure	NF		0.85	1.0	dB	
Output 3rd Order Intercept	OIP3		36.5		dBm	2.0 dBm P_{OUT} per tone at 2 MHz Spacing (2499 and 2501 MHz)
Output 1dB Compression Point	OP1dB	22.0	23.5		dBm	
Switching Rise Time	T_{RISE}		500		ns	
Switching Fall Time	T_{FALL}		500		ns	
Supply Current	I_{DD}		70.0		mA	V_{DD}=V_{ENABLE}= 5.0V; M5: 1500 ohms
Enable Current	I_{ENABLE}		3.0	6.0	mA	
Disabled Mode						
Leakage Current	$I_{LEAKAGE}$		40	100	uA	V_{DD}: 5.0V; V_{ENABLE}: 0.0V
Thermal Data						
Thermal Resistance: (Infra-Red Scan)	Θjc		131		°C/W	On standard Evaluation Board
Channel Temperature @ +85 C Reference (Package heat sink)	$T_{CHANNEL}$		131 (See note)		°C	V_{DD}: 5.0 V; I_{DDQ}: 70 mA; No RF; P_{DISS}: 350 mW

Note: MTTF >10^6 hours for $T_{CHANNEL}$ < =170 degrees C.

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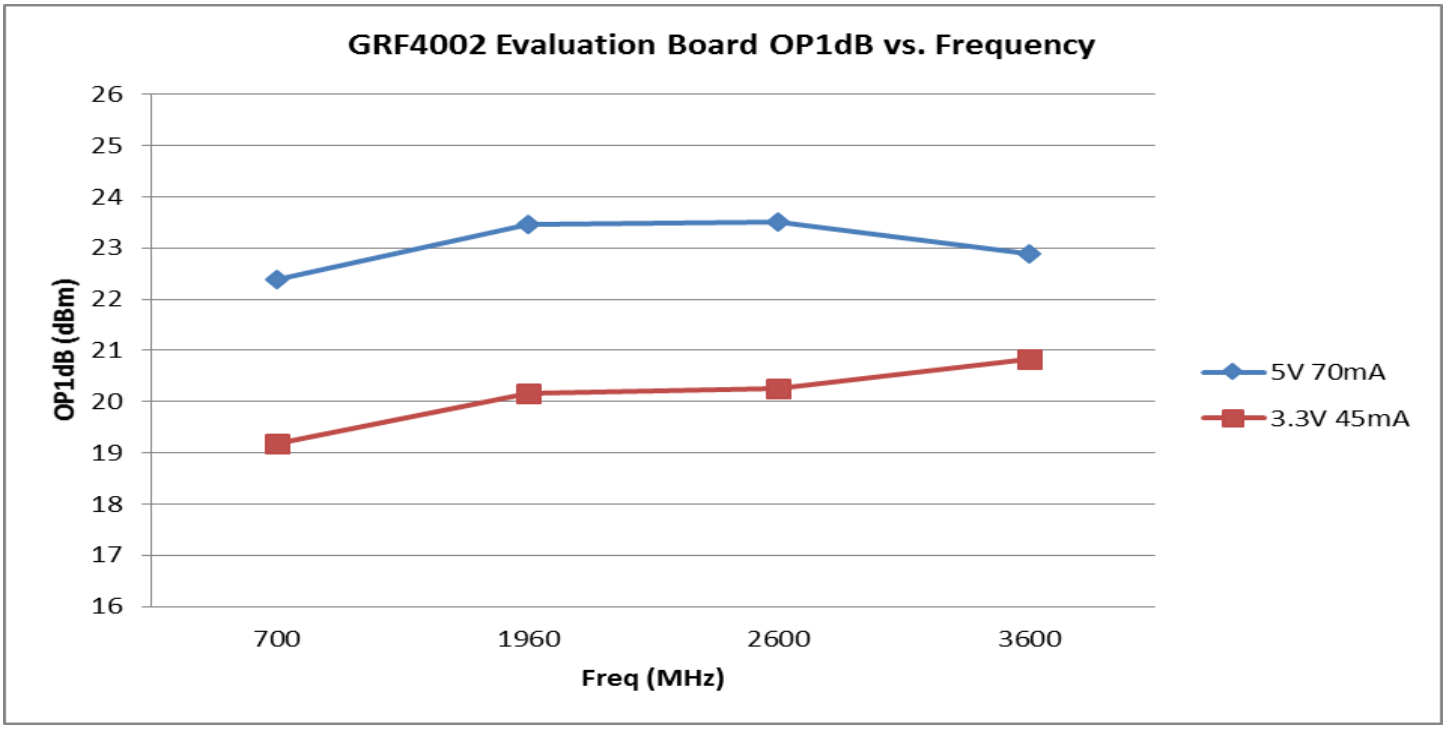
GRF4002 Evaluation Board Measured Data:

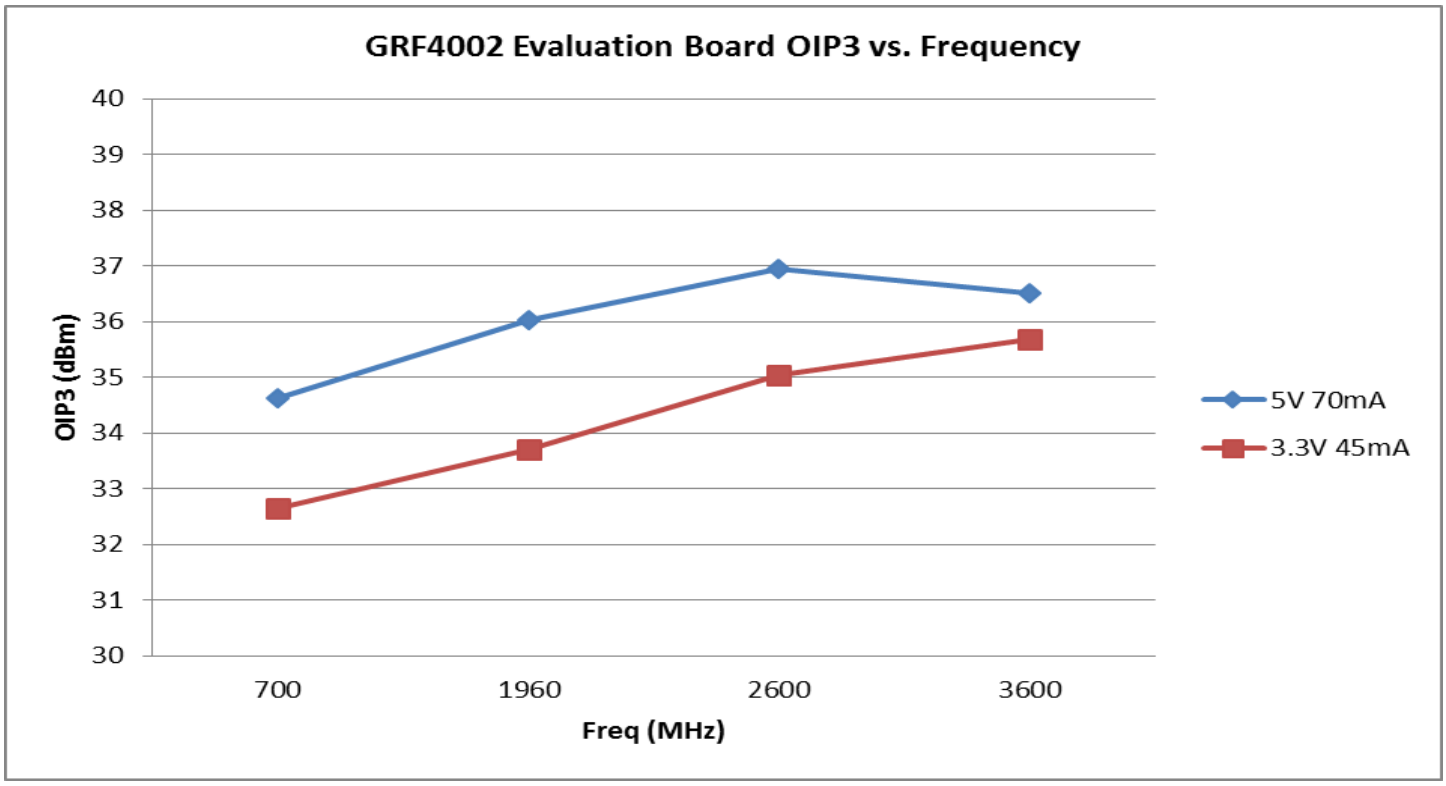




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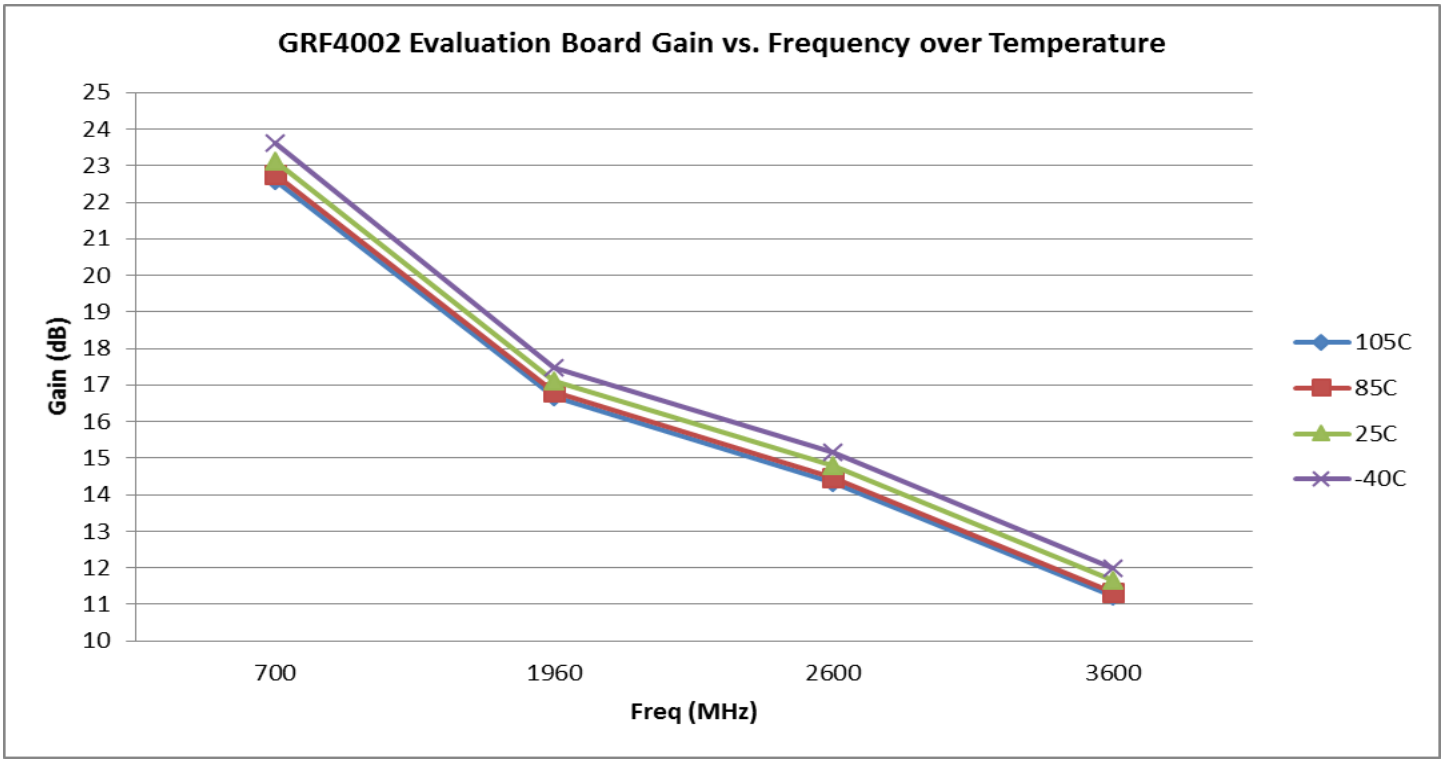
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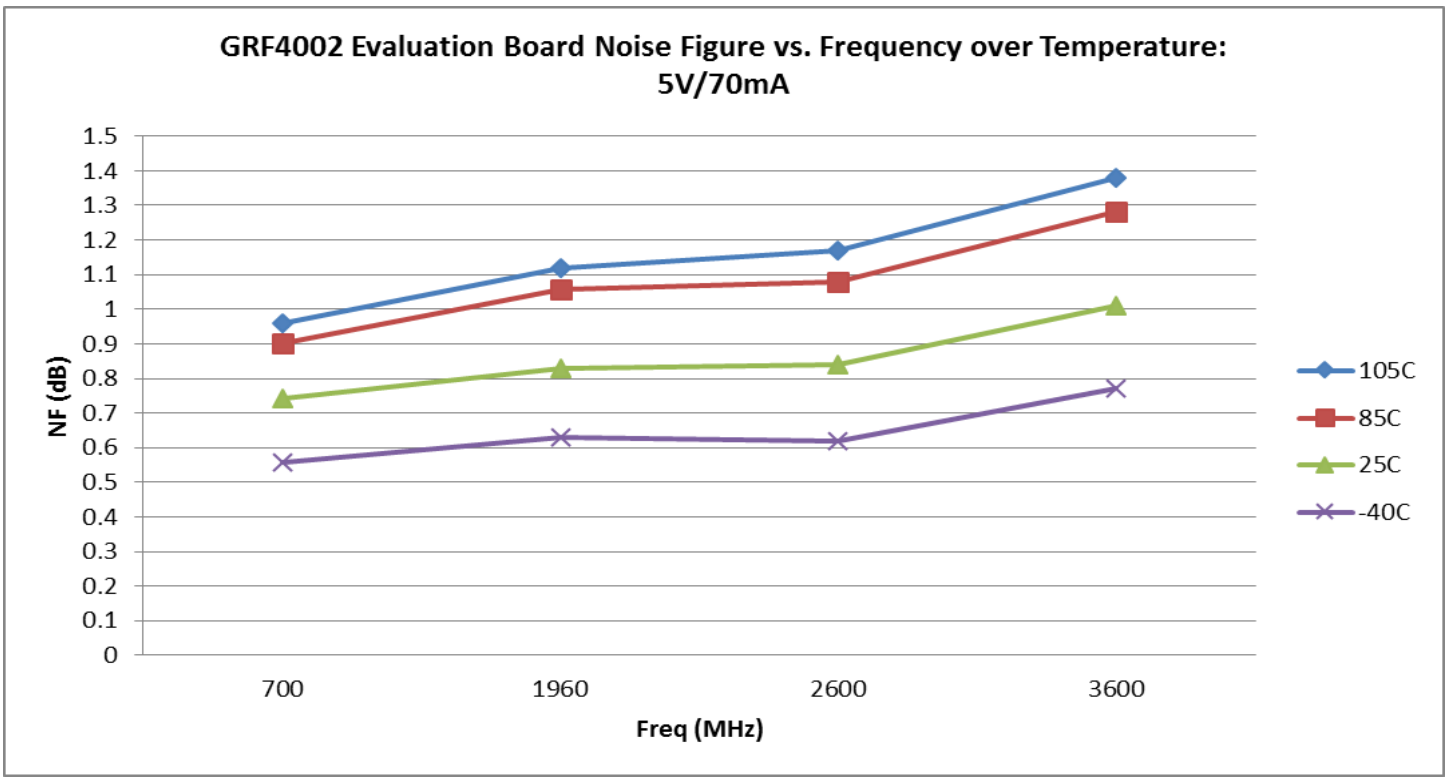




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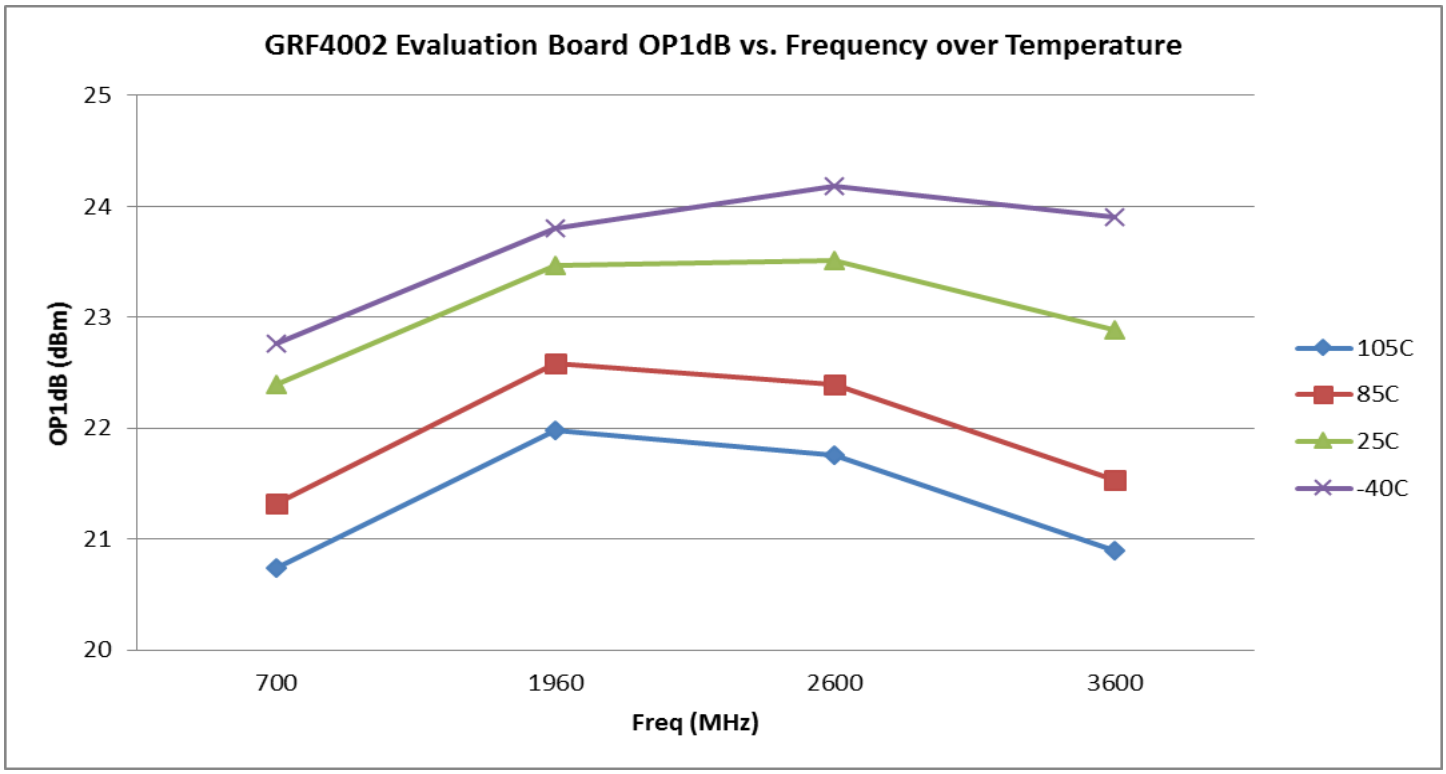
GRF4002 Evaluation Board Performance over Temperature: (5V/70mA)

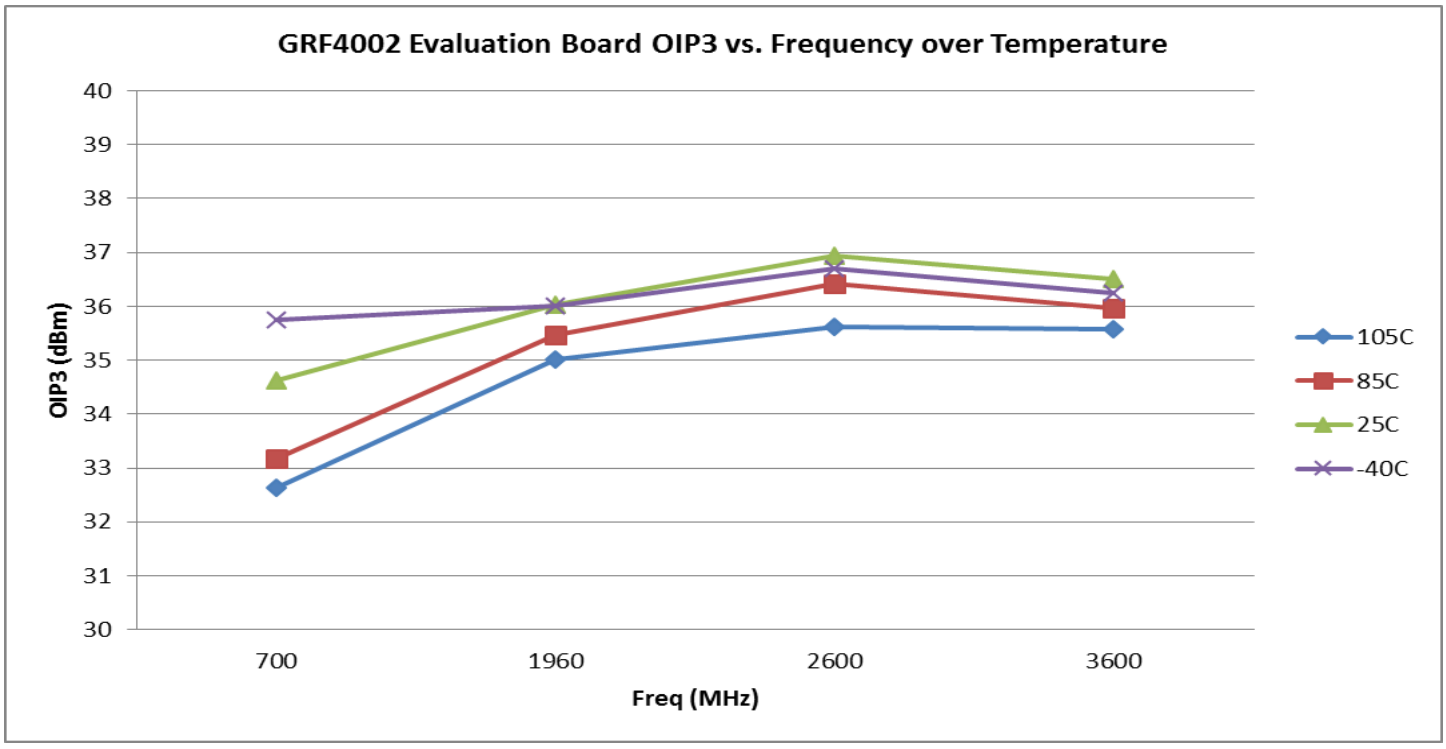




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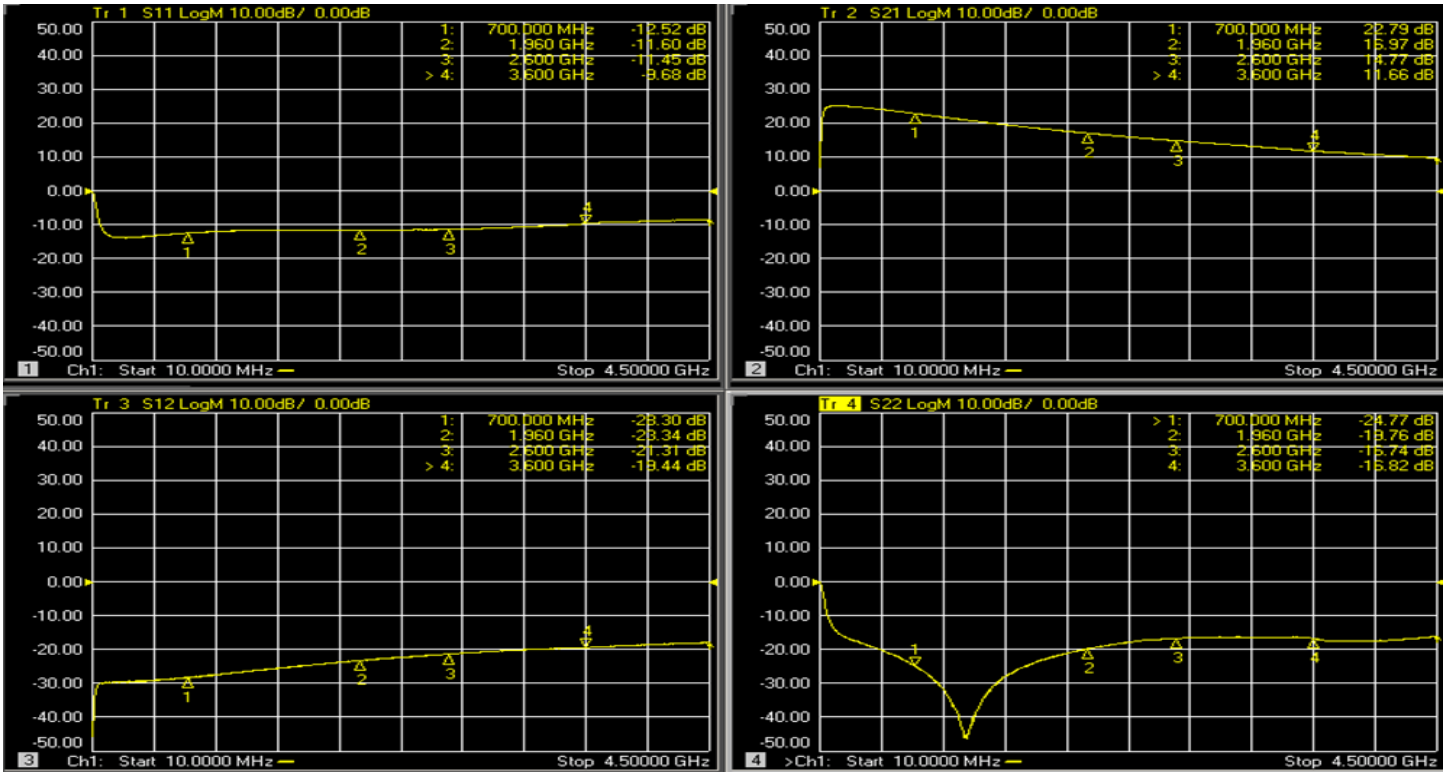
GRF4002 Evaluation Board Performance over Temperature: (5V/70mA)

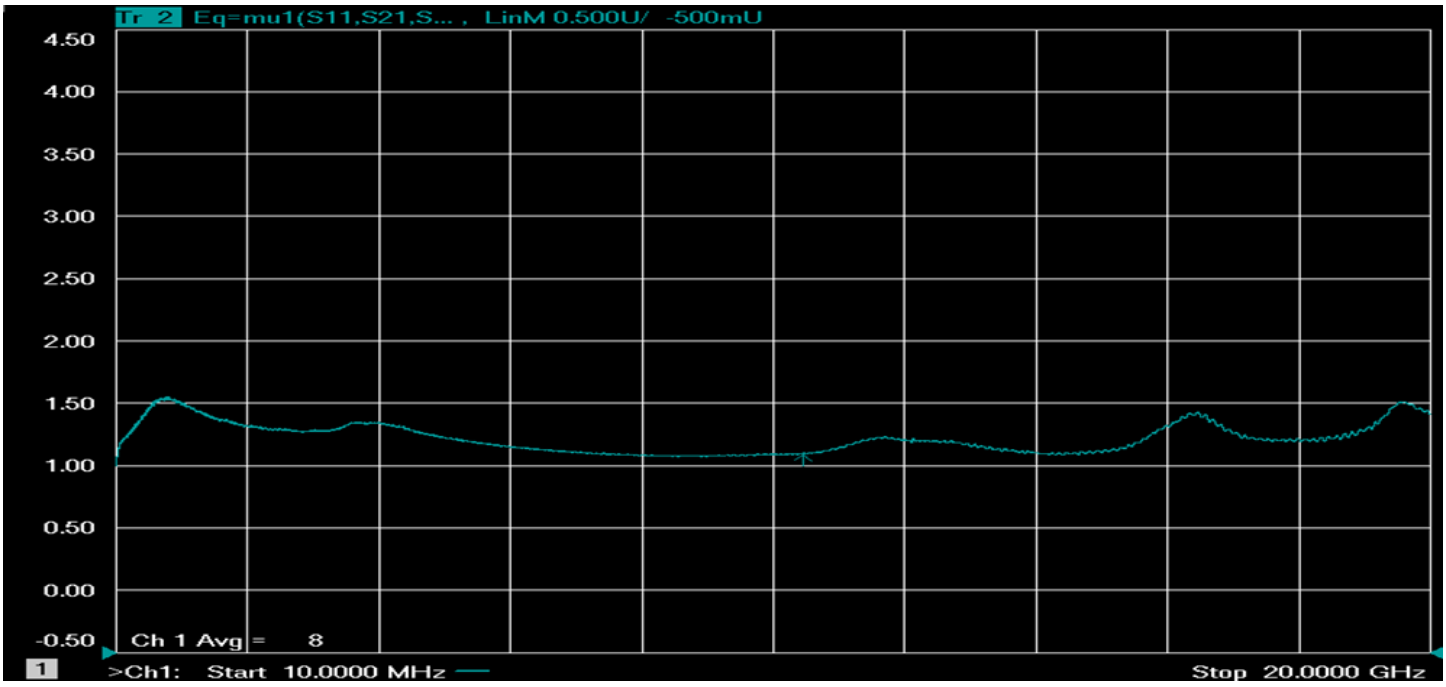




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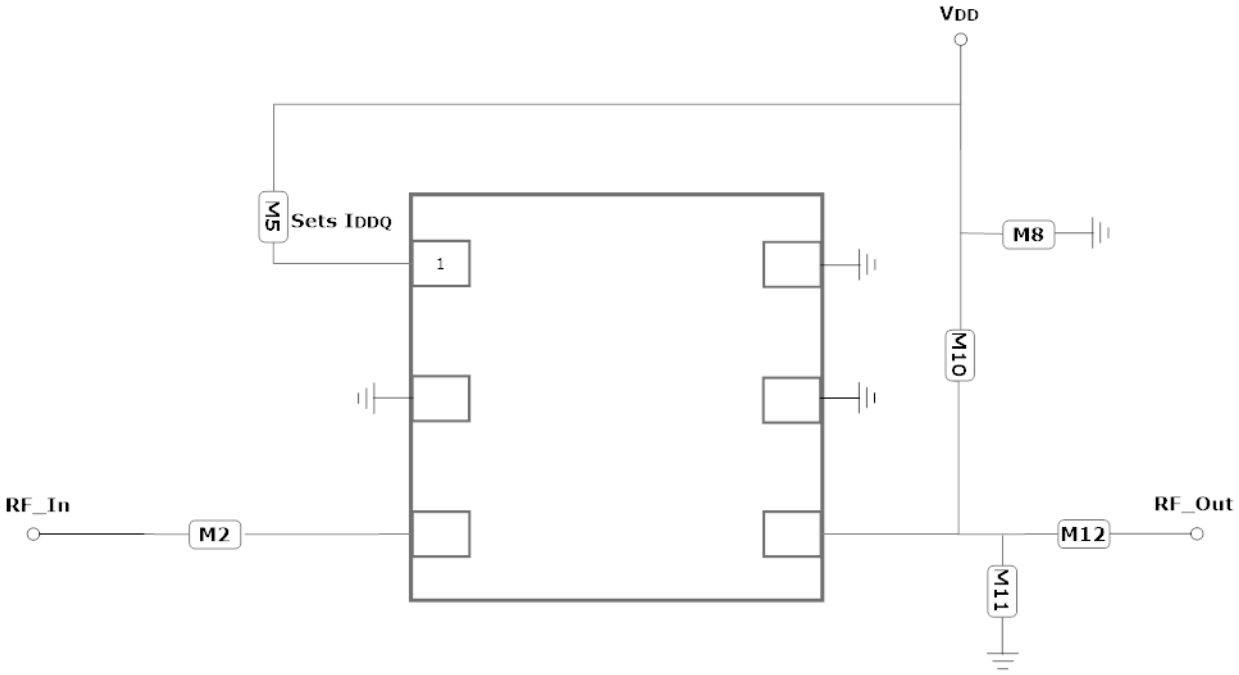
GRF4002 Evaluation Board S-Pars and Stability Mu Factor: (0.7 — 3.8 GHz Match)



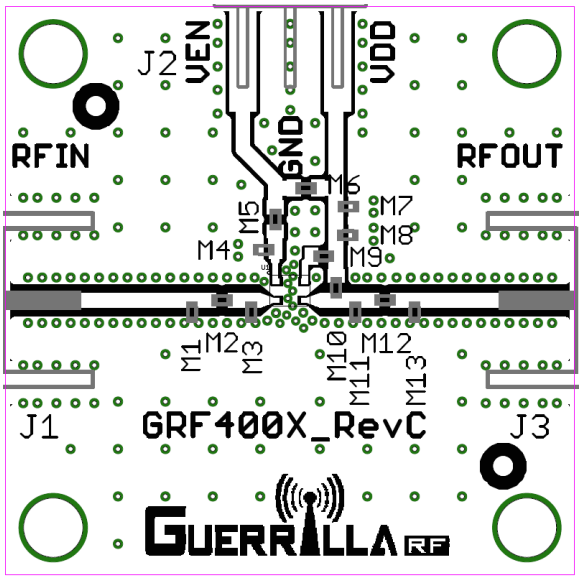


Note: Mu factor >= 1.0 implies unconditional stability.

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GRF4002 Application Schematic



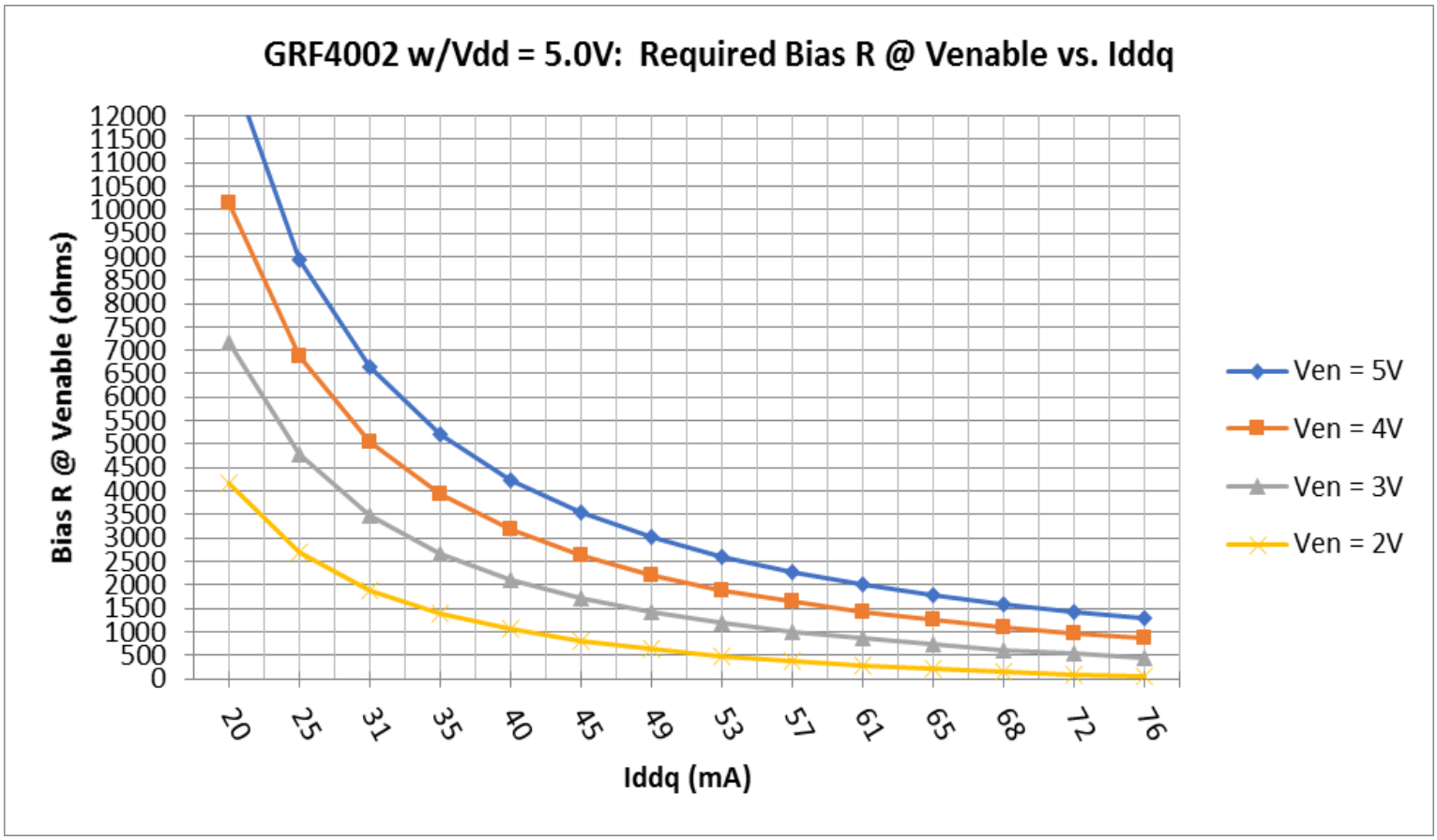
GRF400X Evaluation Board Assembly Diagram

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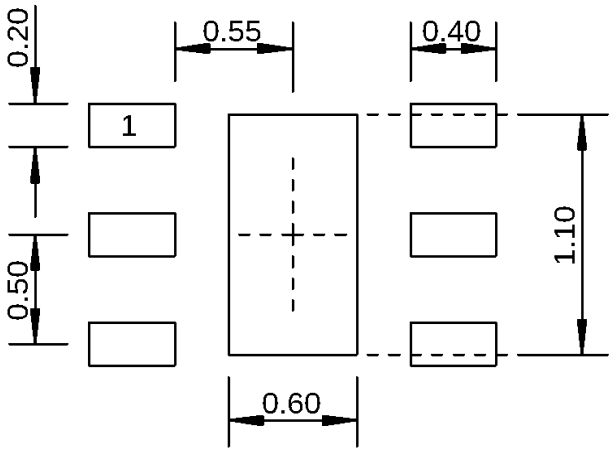
GRF4002 Standard Evaluation Board BOM: (0.1 to 3.8 GHz Tune)

Component	Type	Manufacturer	Family	Value	Package Size	Substitution
M2	Capacitor	Murata	GRM	100 pF	0402	ok
M5 (See curves)	Resistor	Various	5%	Sets Iddq	0402	ok
M8	Capacitor	Murata	GRM	0.1 uF	0402	ok
M10	Inductor	Coilcraft	HP	100 nH	0402	ok
M11	Capacitor	Murata	GRM/GJM	0.5 pF	0402	ok
M12	Capacitor	Murata	GRM	100 pF	0402	ok

GRF4002 Bias Resistor Selection Chart

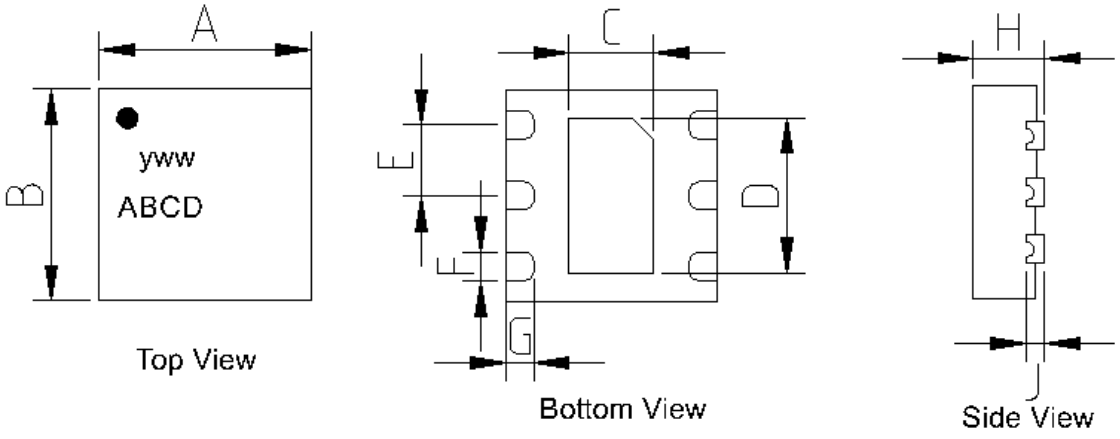


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Dimensions in millimeters

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.

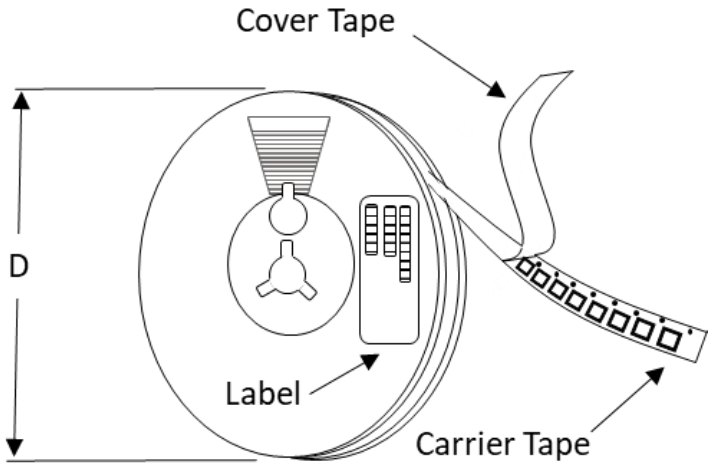
1.5 mm DFN-6 Package Dimensions

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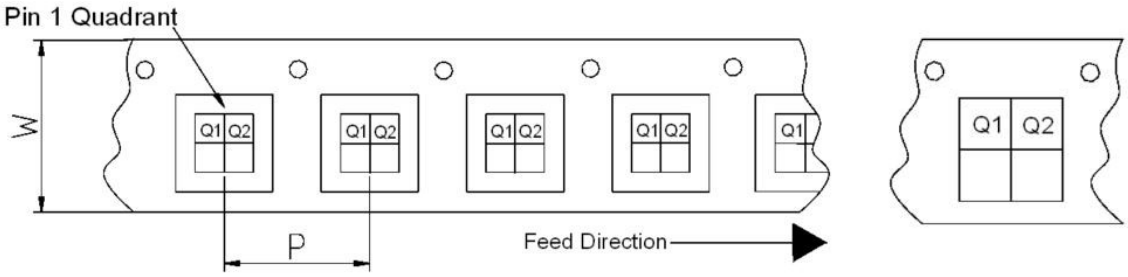
Tape and Reel Information:

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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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 Quad-rant	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 note	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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Released

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.

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