



## Product Description

GRF2501W is an ultra-low noise amplifier (LNA) designed for IEEE 802.11a/n/ac/p applications in the 5 GHz band and up to 9 GHz with appropriate matching.

The LNA is operated from a single positive supply of 2.7 to 5.0 V with a typical bias condition of 3.3 V and 18 mA and is internally matched to 50  $\Omega$  at the input and output ports.

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

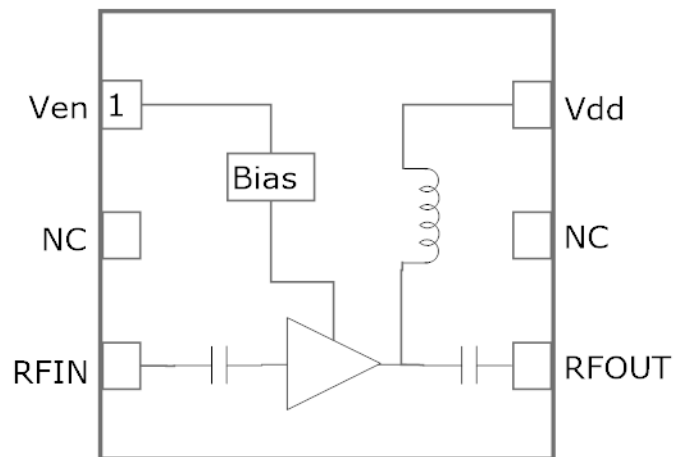
## Features

Reference: 3.3V/18mA/5.5 GHz

- Evaluation Board NF: 1.0 dB
- Gain: 17.0 dB
- OP1dB: 9.0 dBm
  
- Tested to AEC-Q100 Grade 2
- 100% Device Reflow at Assembly
- 100% Optical Die Inspection
  
- Flexible Bias Voltage and Current
- Process: GaAs pHEMT

## Applications

- WiFi Access Points
- Mobile WiFi Devices
- 802.11p Vehicle Communications
- Microwave Backhaul



1.5 x 1.5 mm DFN-6

## 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>		15	dBm
Operating Temperature (Package Heat Sink)	T <sub>AMB</sub>	-40	105	°C
Maximum Channel Temperature (MTTF > 10 <sup>6</sup> Hours)	T <sub>MAX</sub>		170	°C
Maximum Dissipated Power	P <sub>DISS MAX</sub>		200	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

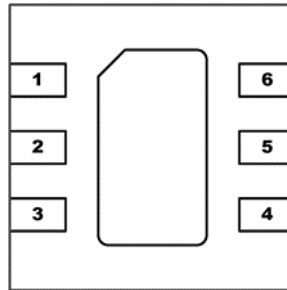


Exceeding Absolute Maximum Rating conditions may cause permanent damage to the device.

**Note:** For manufacturing information, see the [Guerrilla-RF.com](http://Guerrilla-RF.com) website for the following document located on the GRF2501W 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>	LNA Enable 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 to 50 Ω. These ports may be DC connected to ground externally but no DC > 0.2 volts should be applied to these ports.
4	RF_Out	LNA RF output	
5	NC	No Connect or Ground	No internal connection to die
6	V <sub>DD</sub>	Supply Voltage for the LNA	Requires bypass capacitance as close as possible to pin on PCB
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.

### V<sub>ENABLE</sub> Truth Table:

V <sub>DD</sub>	V <sub>ENABLE</sub>	Mode
High	>=1.8 V	LNA On
High	<0.1 V	LNA Off



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# GRF2501W

High Gain, Ultra-LNA  
802.11ac: 4.9–9.0 GHz

## Nominal Operating Parameters:

Parameter	Symbol	Specification			Unit	Condition
		Min.	Typ.	Max.		
<b>High Gain Mode</b>						$V_{DD} = 3.3\text{ V}, V_{ENABLE} = 3.3\text{ V}, T_A = 25\text{ }^\circ\text{C}$
Test Frequency	$F_{TEST}$		5500		MHz	
Gain	S21	15.0	17.0	19.0	dB	
Evaluation Board Noise Figure	NF		1.0	1.2	dB	
Input Power at 1% EVM	EVM		-19.0		dBm	802.11ac modulation
Output 1dB Compression	OP1dB	6.0	9.0		dBm	
Supply Current (Quiescent)	$I_{DD}$	12.0	18.0	28.0	mA	
Enable Current	$I_{ENABLE}$		1.5	3.0	mA	
<b>Disabled Mode</b>						$V_{DD} = 3.3\text{ V}, V_{ENABLE} = 0.0\text{ V}$
Supply Current (Leakage)	$I_{DD}$		200	500	$\mu\text{A}$	
Thermal Data						
Thermal Resistance (Infra-Red Scan)	$\Theta_{jc}$		150		$^\circ\text{C}/\text{W}$	
Channel Temperature @ +85 C reference (Package heat sink)	$T_{CHANNEL}$		99 (See note)		$^\circ\text{C}$	$V_{DD}: 3.3\text{ V}; I_{DDQ}: 28\text{ mA}; \text{No RF}$ $P_{DISS}: 92\text{ mW}$

Note: MTTF >10<sup>6</sup> hours for  $T_{CHANNEL} \leq 170$  degrees C.

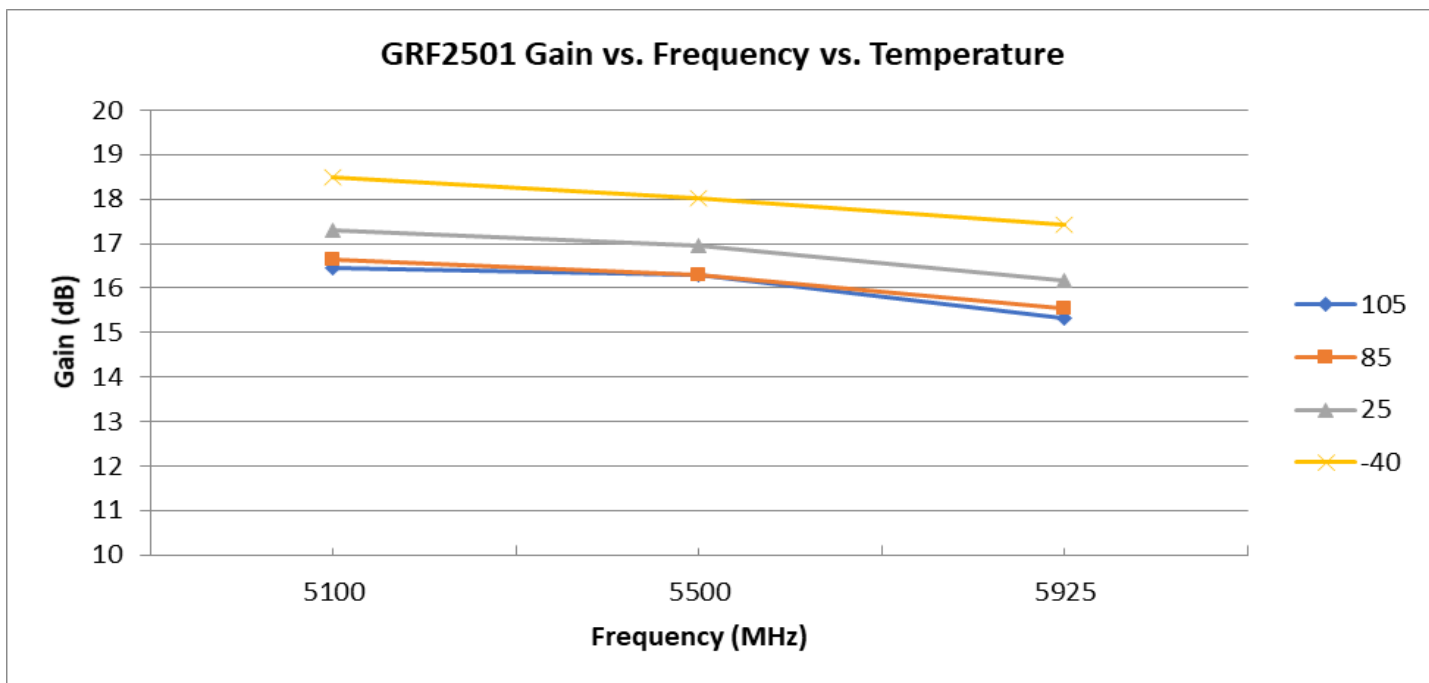
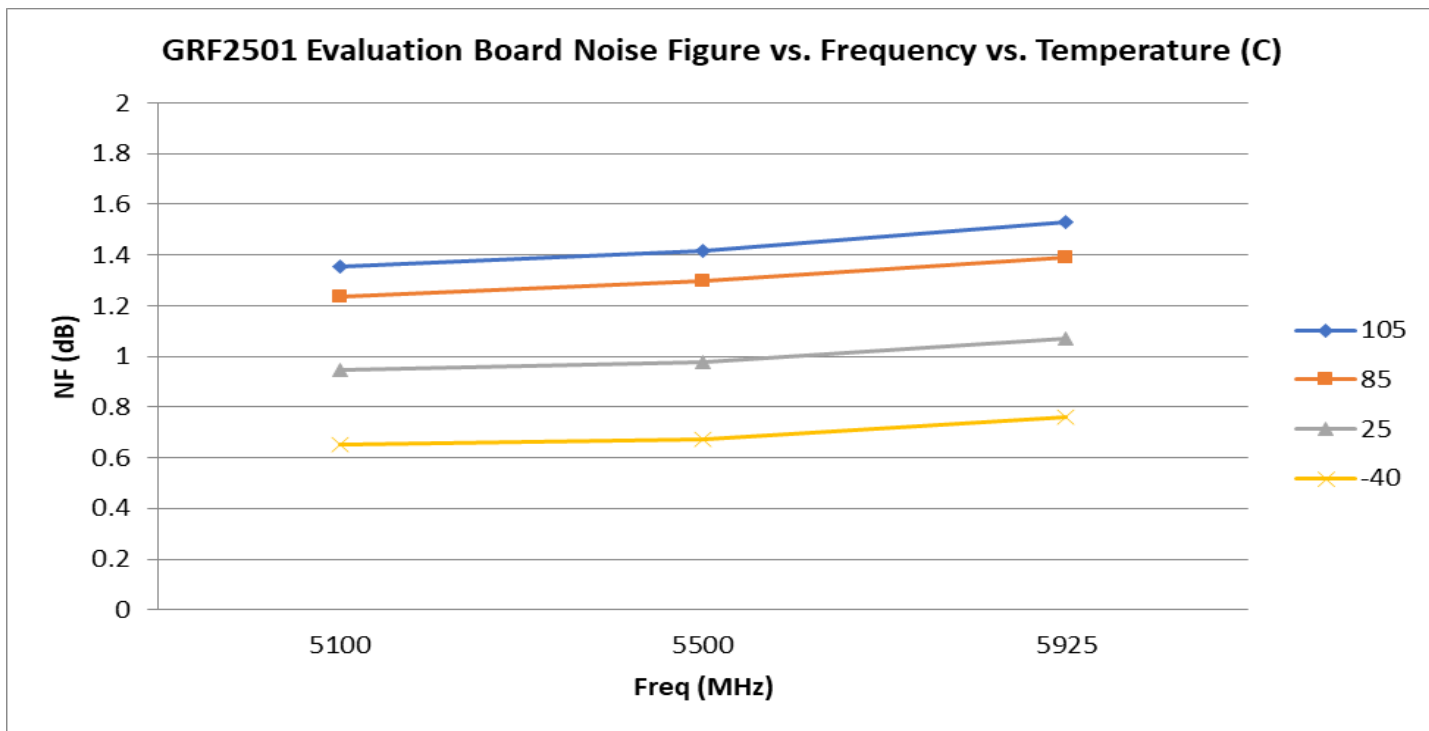


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# GRF2501W

High Gain, Ultra-LNA  
802.11ac: 4.9–9.0 GHz

## GRF2501W Evaluation Board Measured Data: 3.3V/18mA



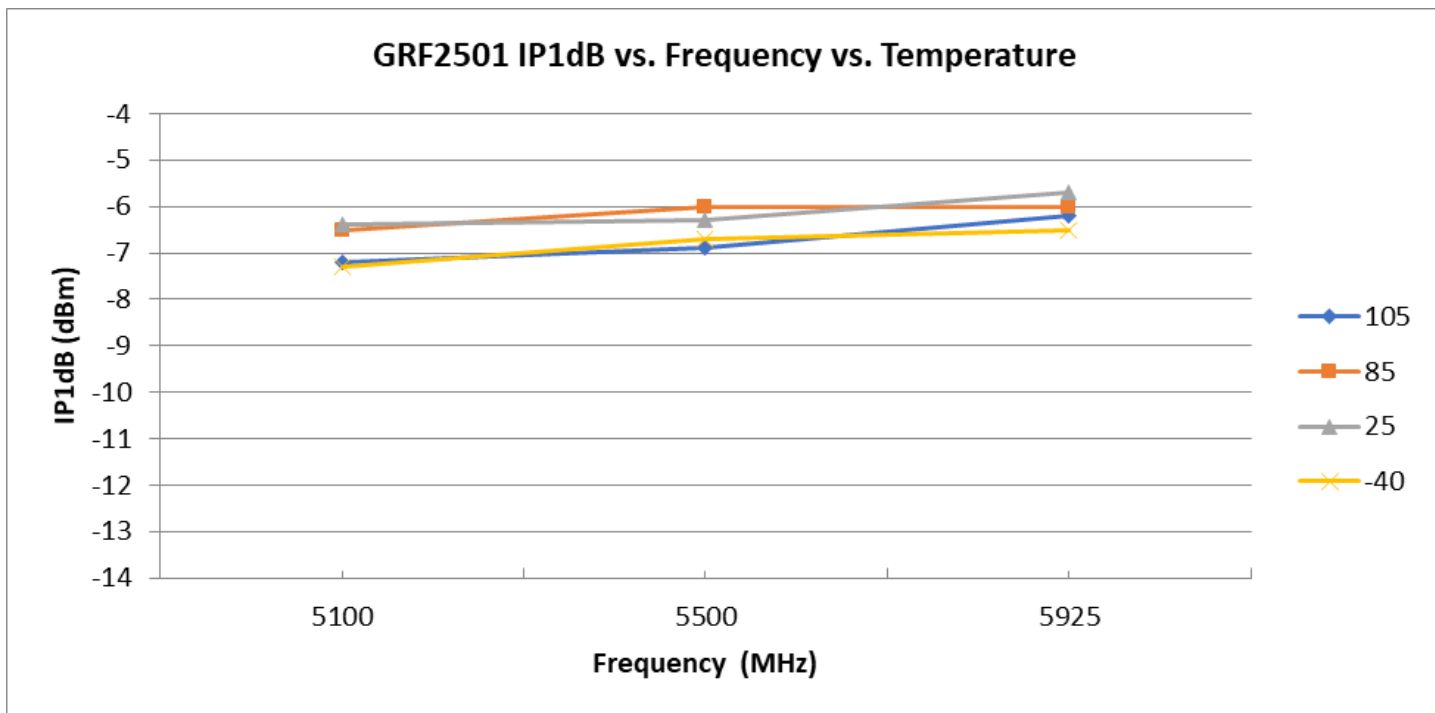
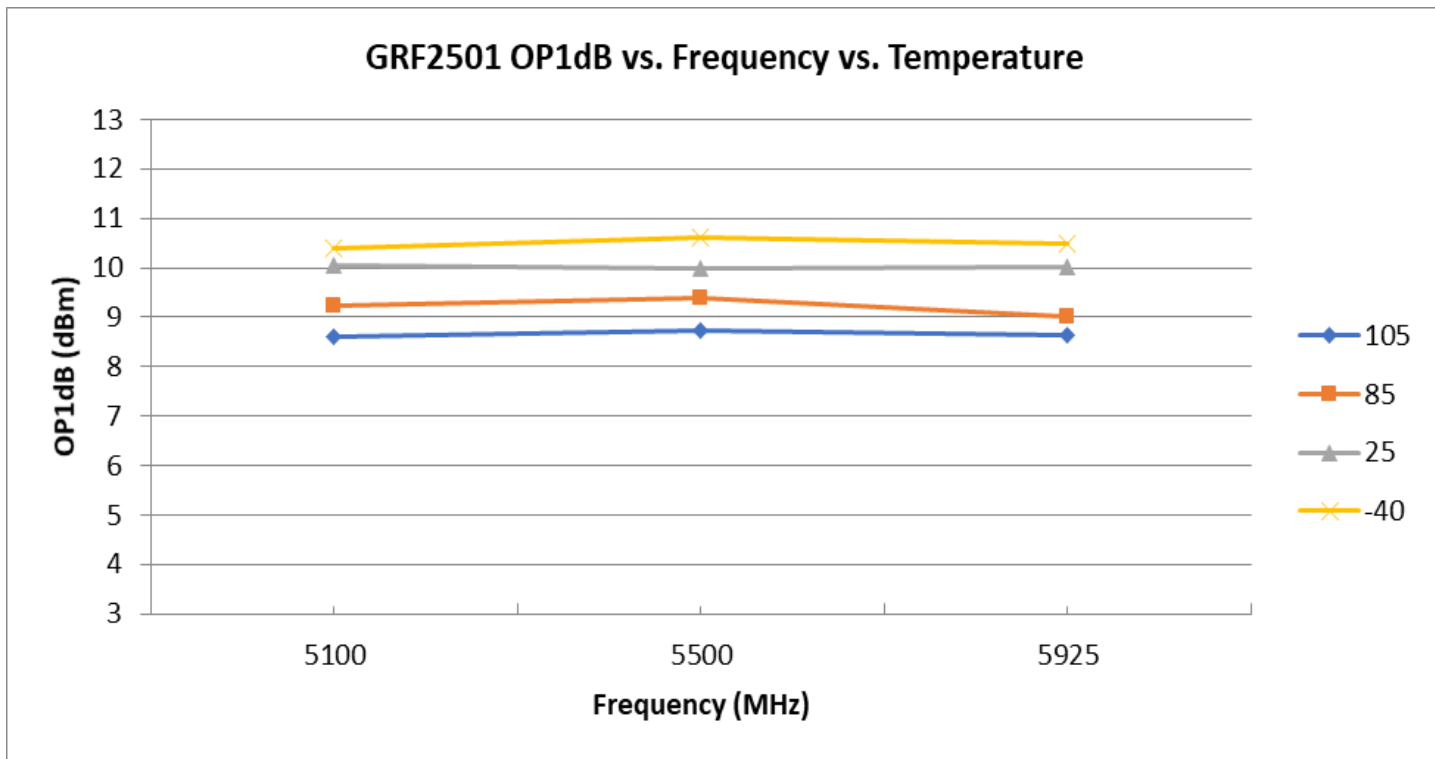


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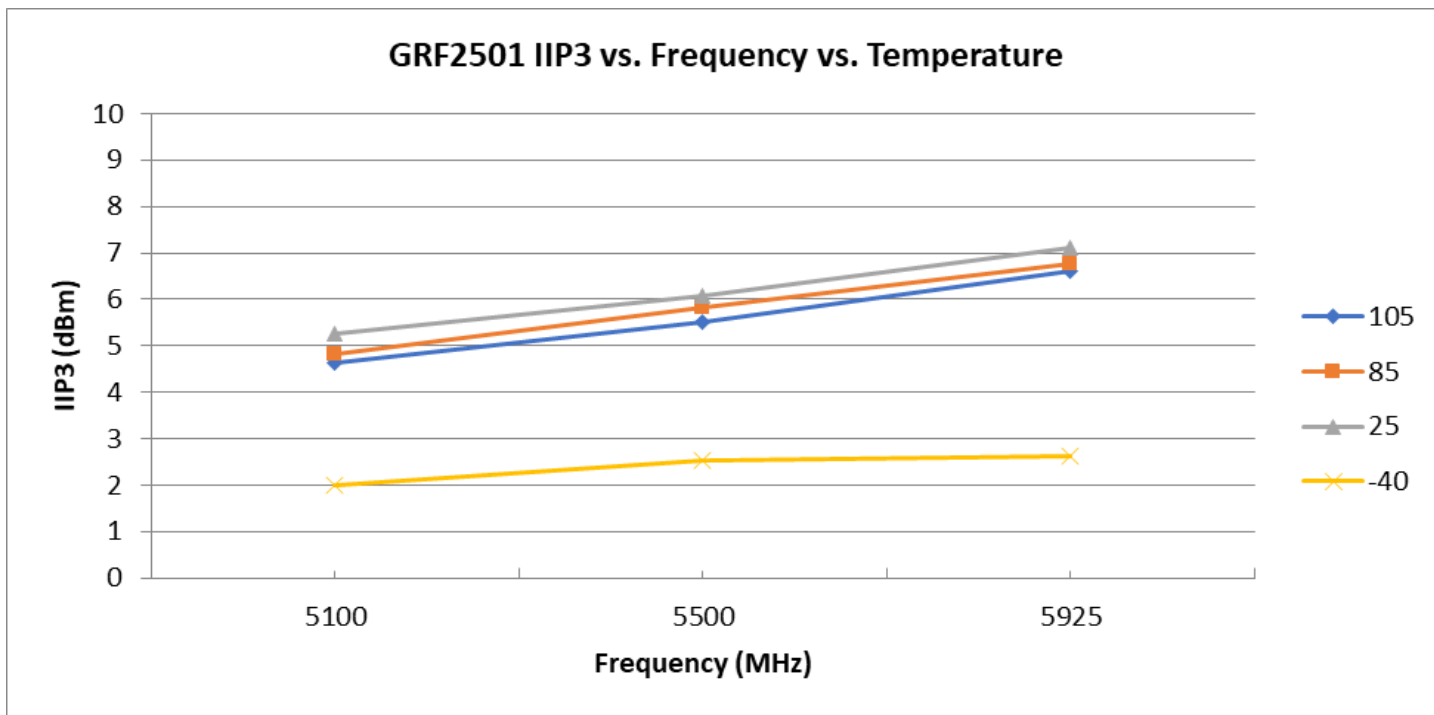
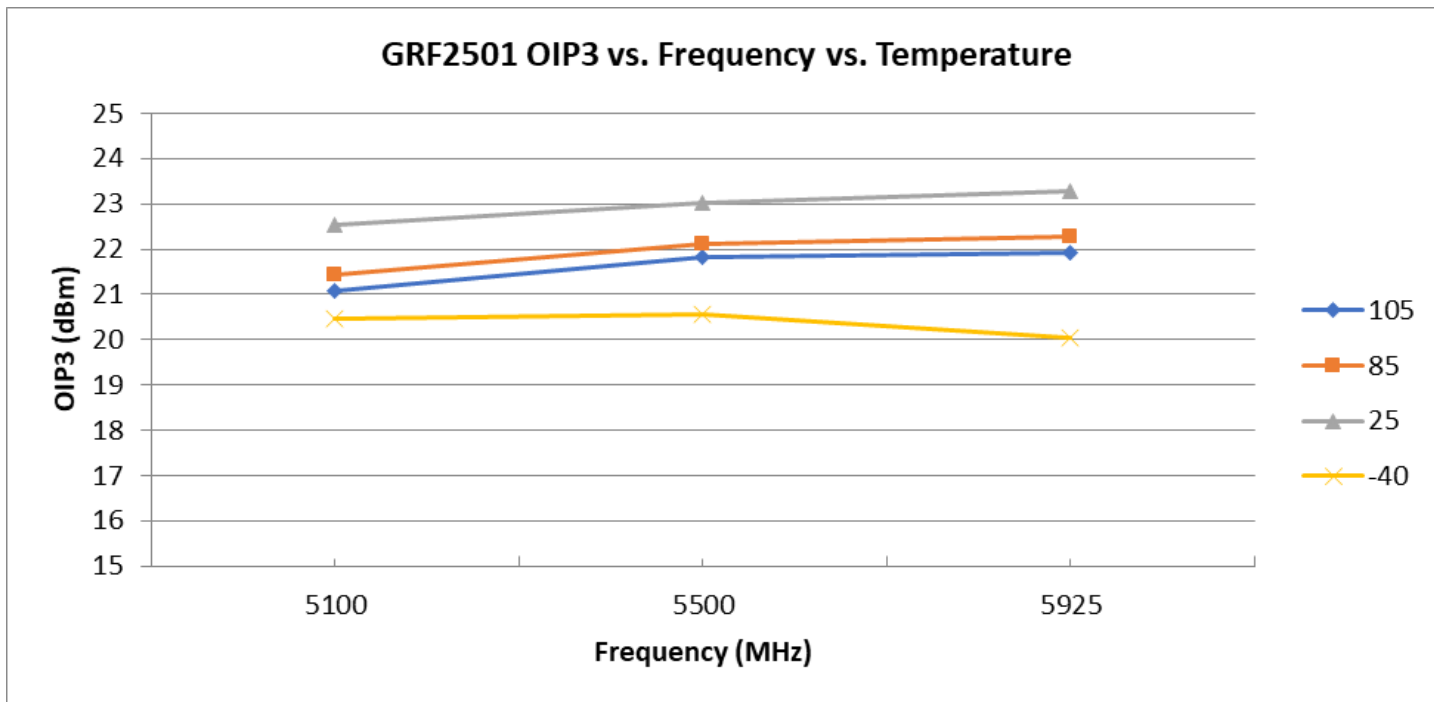


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High Gain, Ultra-LNA  
802.11ac: 4.9–9.0 GHz

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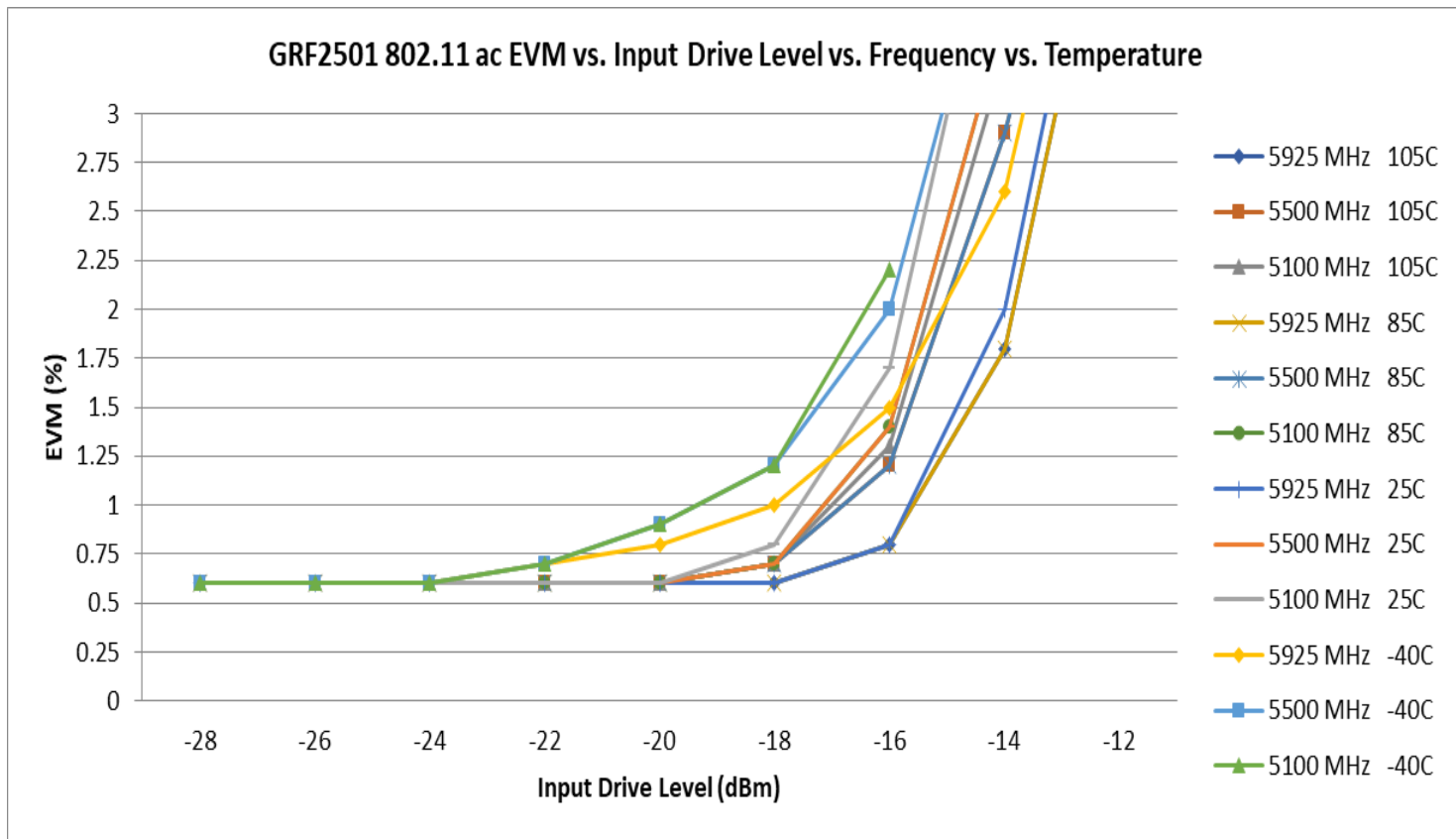


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802.11ac: 4.9–9.0 GHz

## GRF2501W Evaluation Board Measured Data: 3.3V/18mA





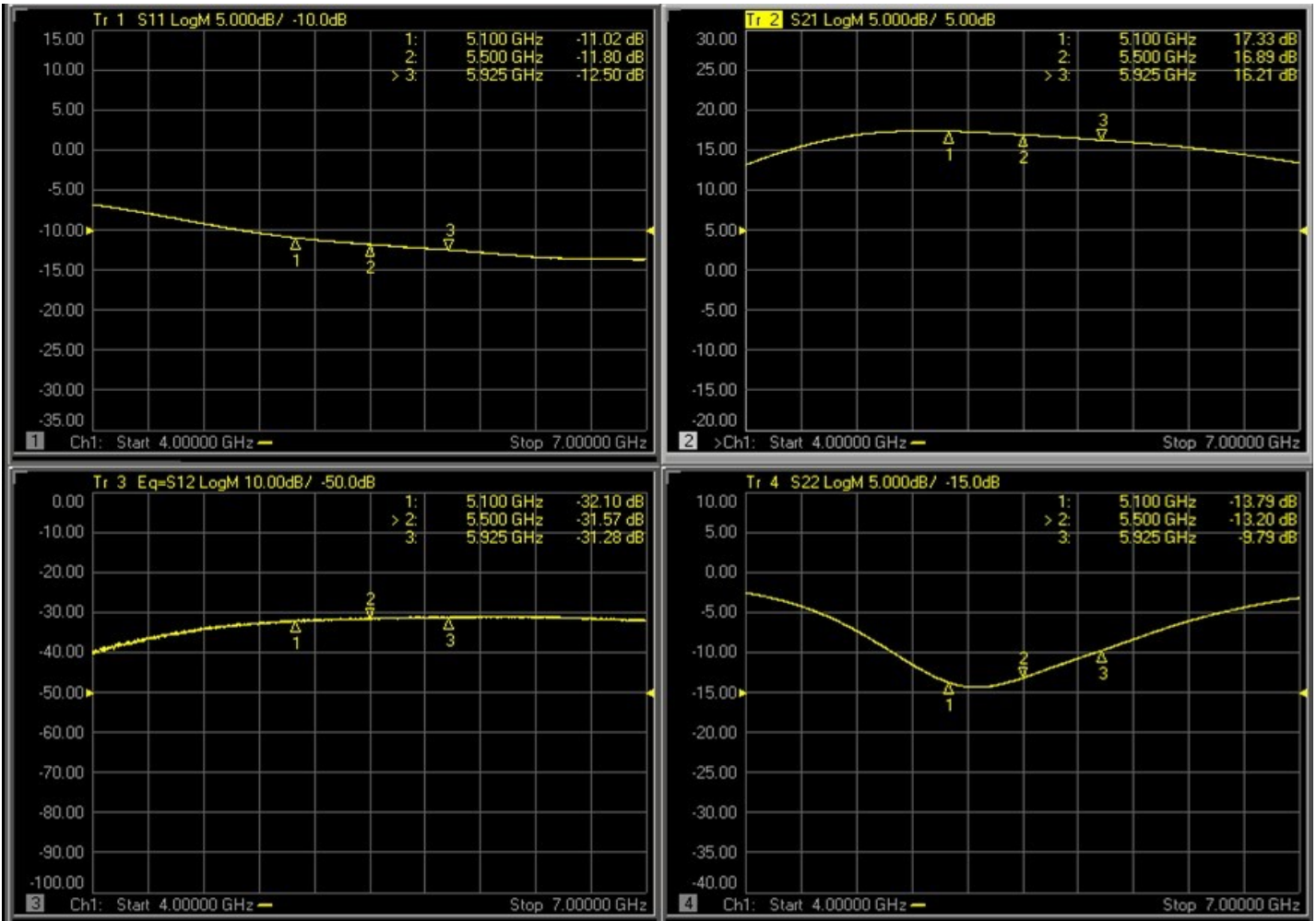


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High Gain, Ultra-LNA  
802.11ac: 4.9–9.0 GHz

## GRF2501W Evaluation Board S-Parms:



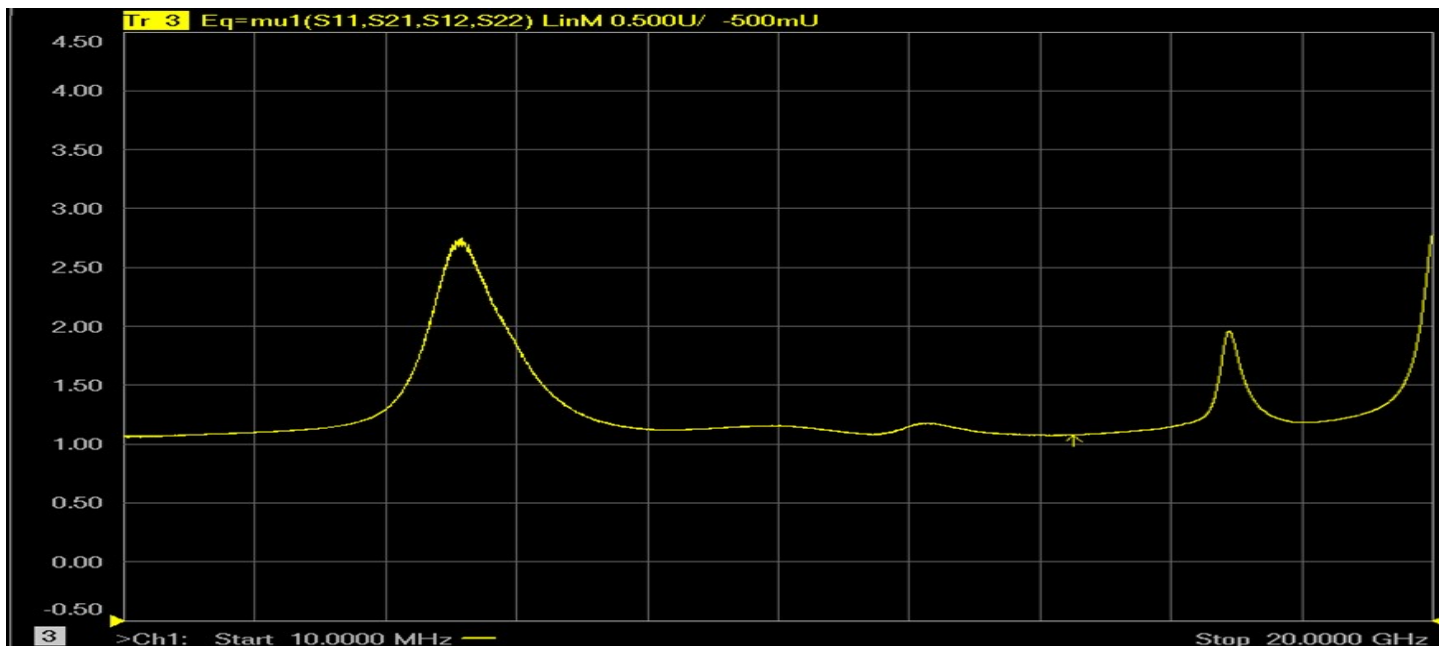


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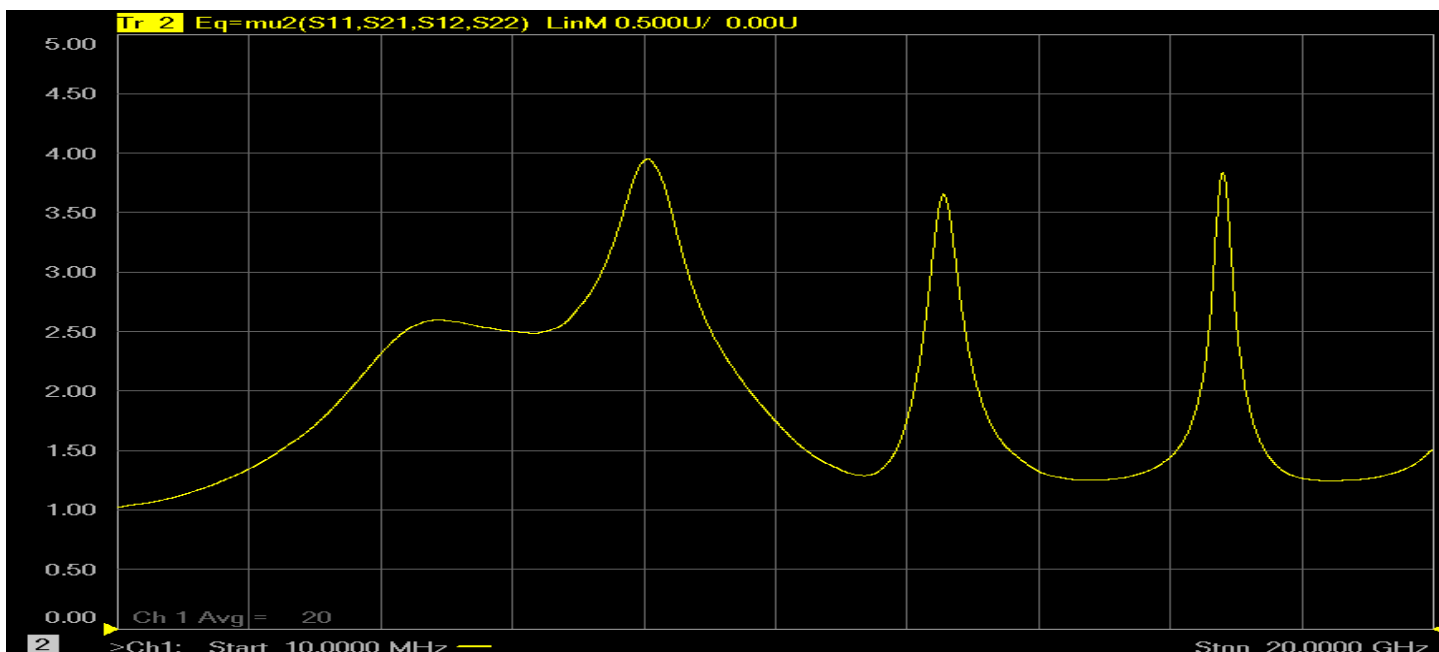
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802.11ac: 4.9–9.0 GHz

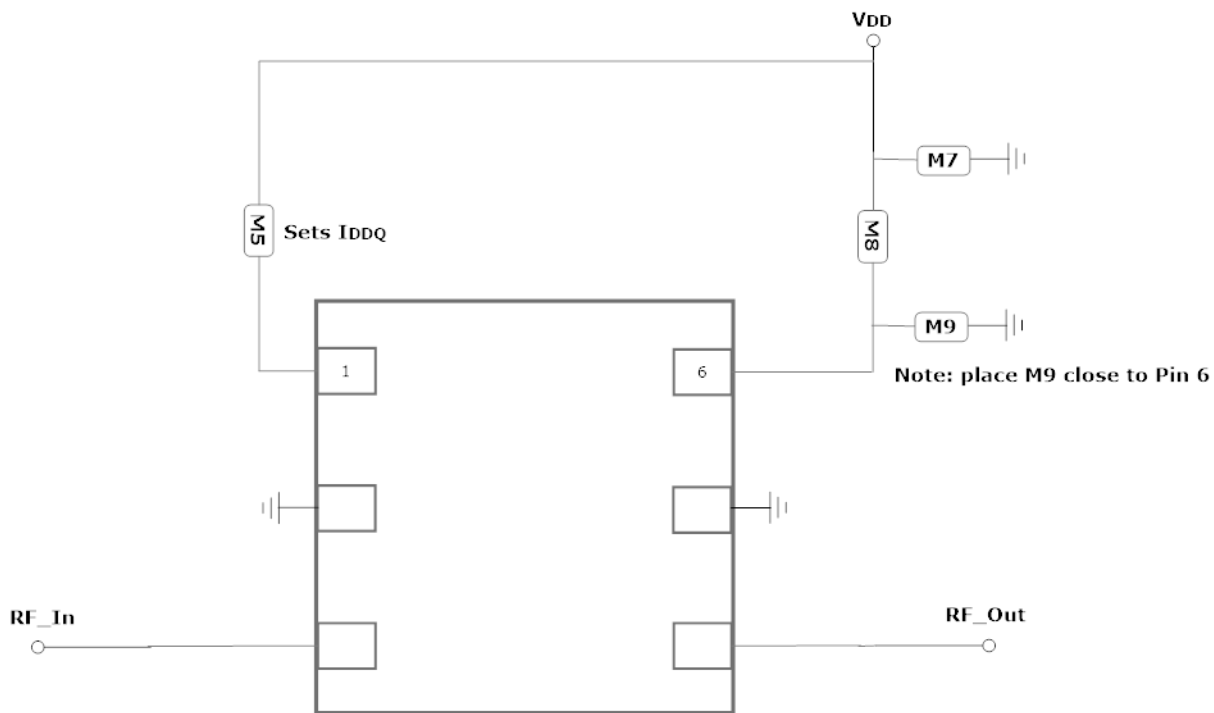
## GRF2501W Evaluation Board Mu/Mu Prime Stability Factors:



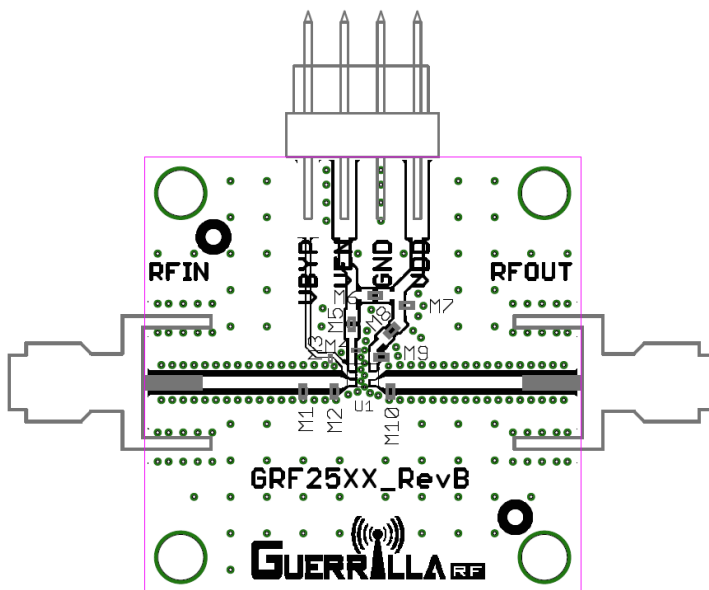
Note:  $\mu \geq 1.0$  implies unconditional stability



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



GRF2501W Application Schematic



GRF2501W Evaluation Board Assembly Diagram



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# GRF2501W

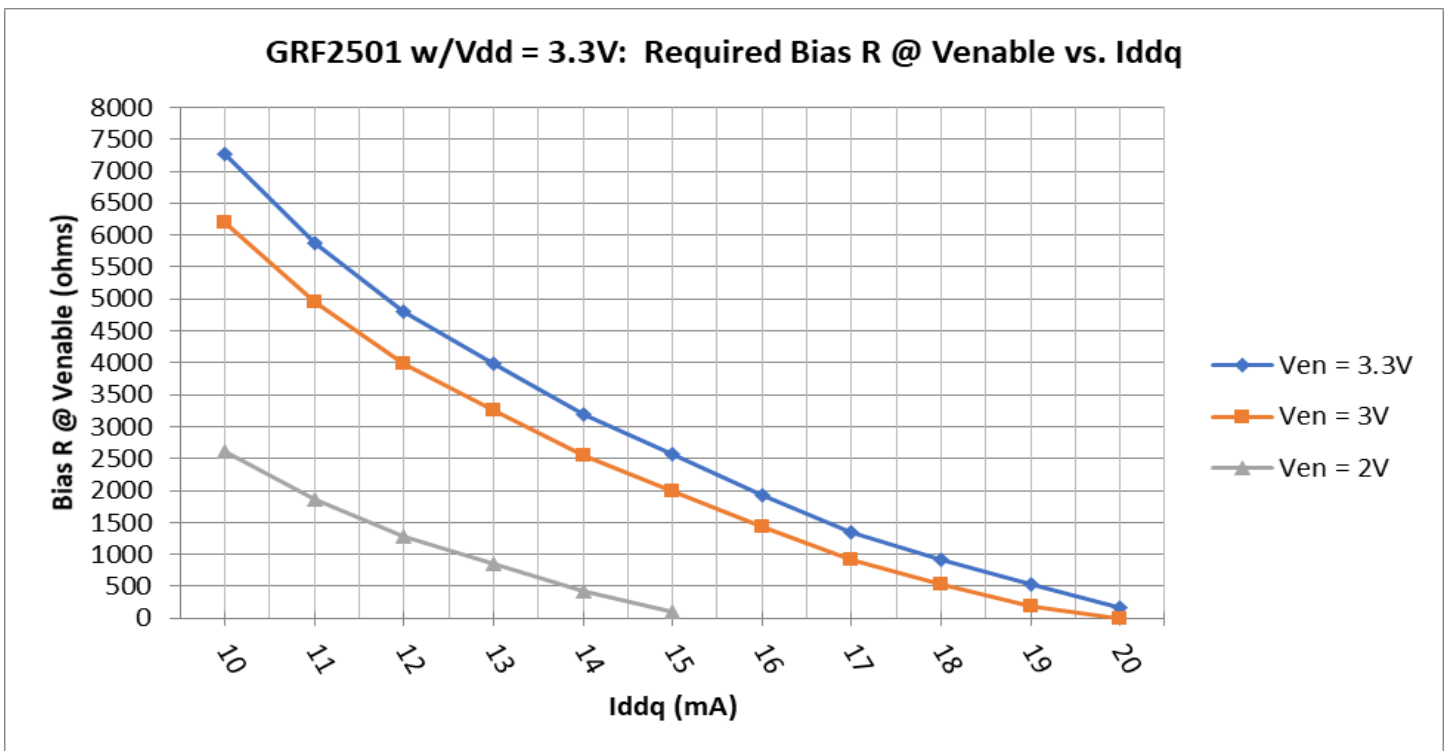
High Gain, Ultra-LNA  
802.11ac: 4.9–9.0 GHz

## GRF2501W Standard Evaluation Board BOM: (5.1 to 5.9 GHz Tune)

Component	Type	Manufacturer	Family	Value	Package Size	Substitution
M5	Resistor: 5%	Various	—	1k Ohm	0201	ok
M7	Capacitor	Murata	GRM	0.1 uF	0201	ok
M8	Ferrite Bead	Murata	BLM15AG121SN1D	120 Ohm	0201	ok
M9 (See note)	Capacitor	Murata	GJM	1.0 pF	0201	ok
Evaluation Board:	GRF25XX_RevB					

Note: Place M9 close to pin 6. The position of this component affects the device matching.

## GRF2501W Bias R Selection Table: Vdd: 3.3V



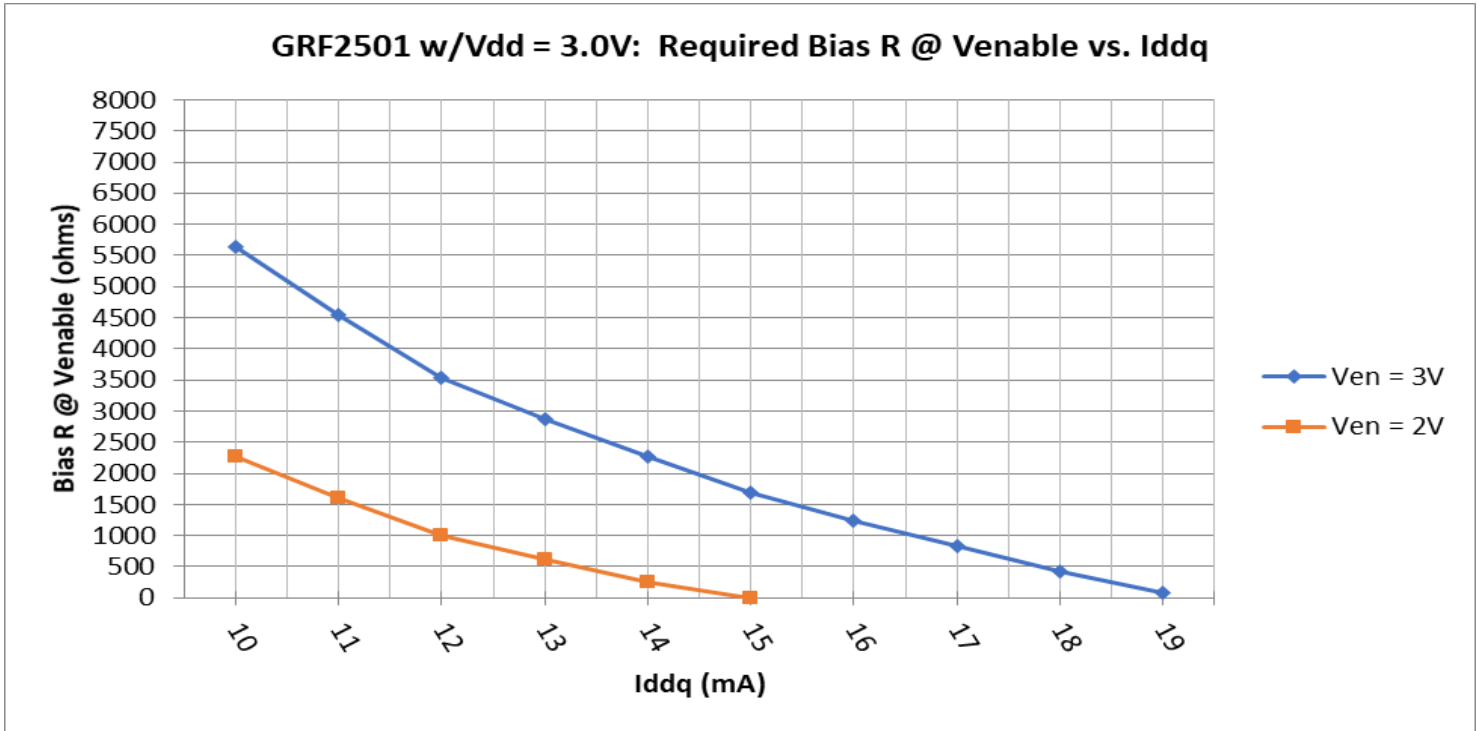


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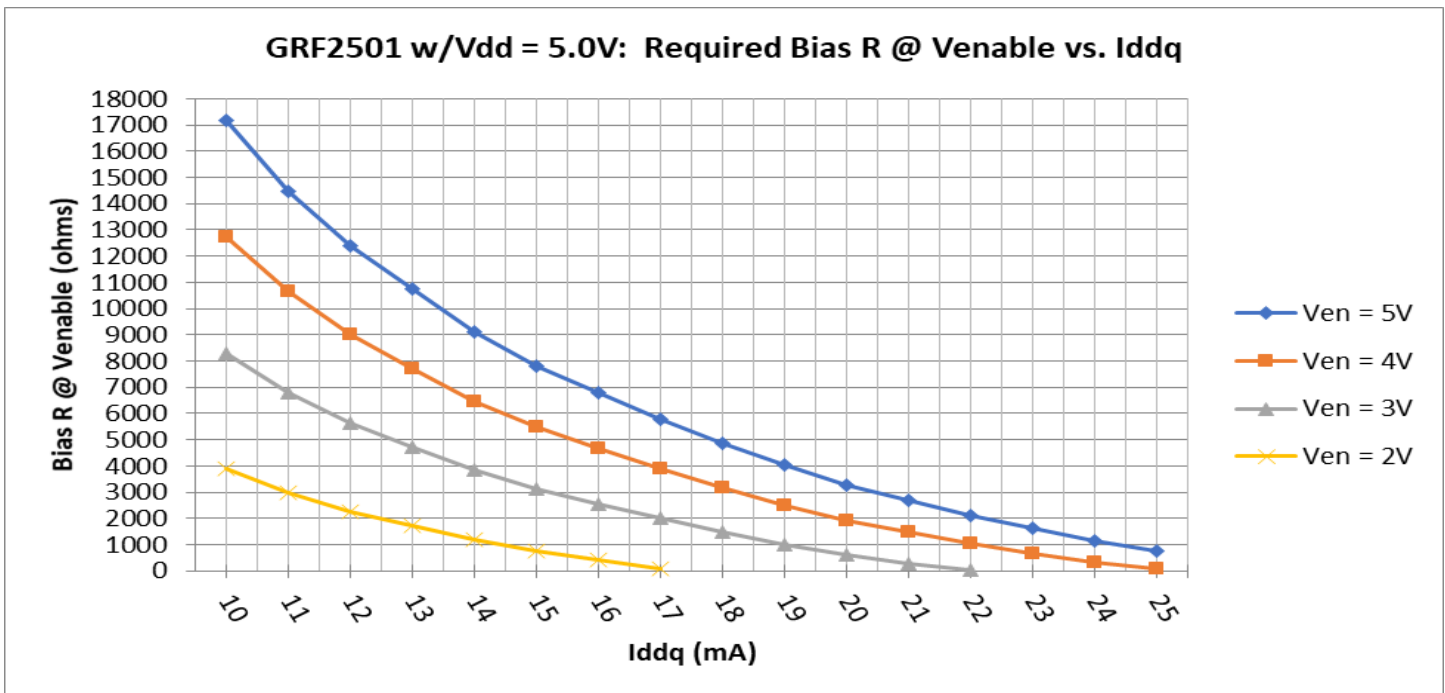
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802.11ac: 4.9–9.0 GHz

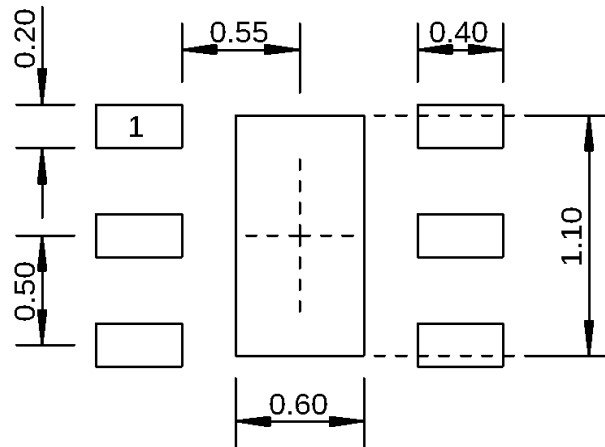
GRF2501W Bias R Selection Table: Vdd: 3.0 volts



GRF2501W Bias R Selection Table: Vdd: 5.0 volts

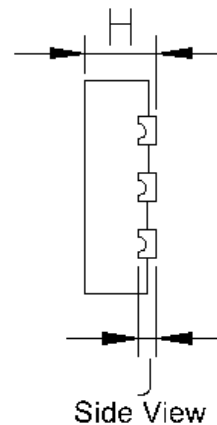
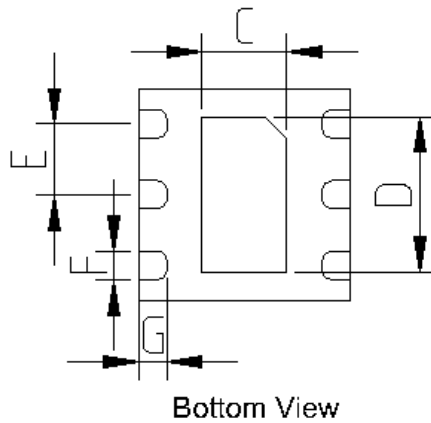
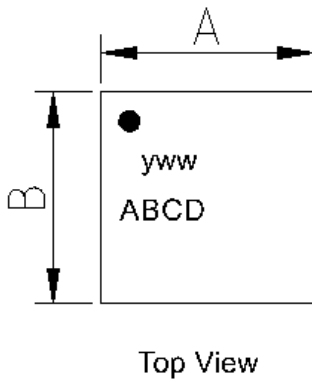


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Dimensions in millimeters

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



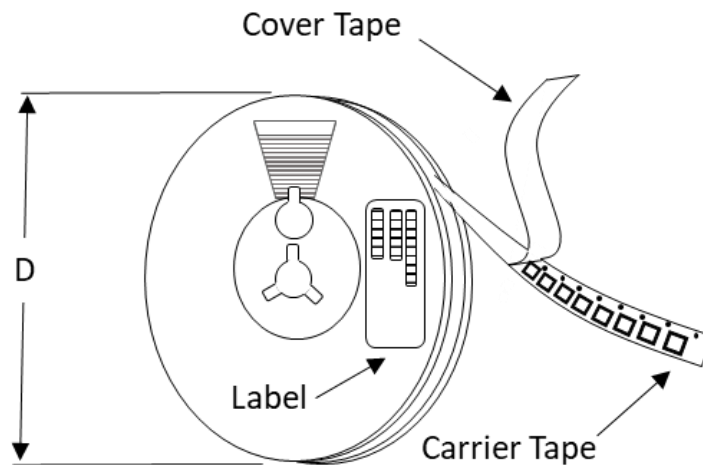
Dimensions (MM)	
A	1.5 +/- 0.050
B	1.5 +/- 0.050
C	.6 +/- 0.050
D	1.1 +/- 0.050
E	.5 Bsc
F	.2 +/- 0.050
G	.2 +/- 0.050
H	.45 +/- 0.050
J	.12 Ref.

### 1.5 mm DFN-6 Package Dimensions

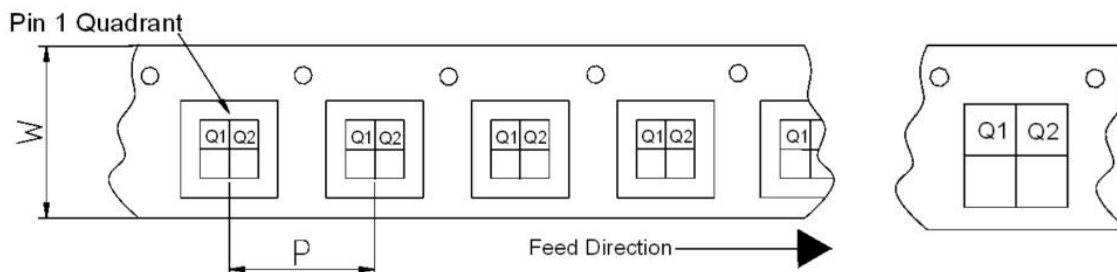
### Tape and Reel Information:

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 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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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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