GRF2543

Preliminary

High Gain, Ultra-LNA w/Bypass
802.11ac: 4.9—6.0 GHz

Features

Reference: 3.3V/15mA/5.5 GHz

- EVB NF: 1.0 dB
- Gain: 14.4 dB
- IP1dB: -1.0 dBm

- Flexible Bias Voltage and Current
- Internally Matched to 50 Ω
- Process: GaAs pHEMT

Applications

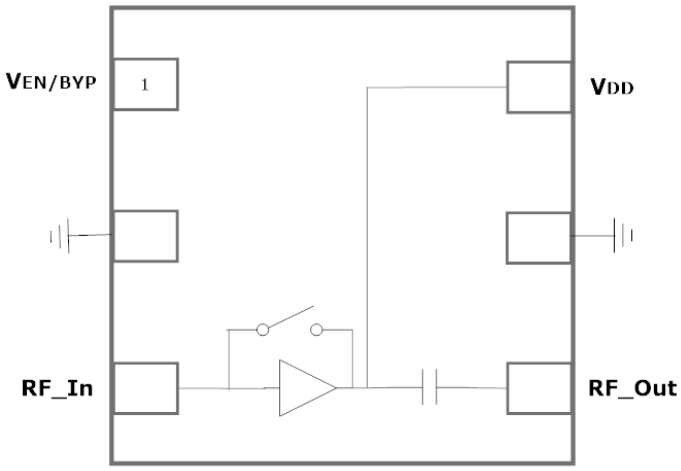
- WiFi Access Points
- Mobile WiFi Devices
- 802.11p Vehicle Communications
- Microwave Backhaul

Product Description

GRF2543 is an ultra-low noise amplifier (LNA) with by-pass designed for IEEE 802.11a/n/ac/p applications over 5.1 GHz to 5.925 GHz. The device exhibits out-standing noise figure, linearity and gain to 6 GHz. Note that the reported NF is for the entire evaluation board from SMA to SMA connector.

The LNA is operated from a single positive supply of 2.7 to 5.0 V with typical bias condition of 3.3 volts and 15 mA.

Consult with the GRF applications engineering team for custom tuning/evaluation board data.



1.5 x 1.5 mm DFN-6

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
Operating Temperature (Package Heat Sink)	T_{AMB}	-40	105	°C
Maximum Channel Temperature (MTTF > 10^6 Hours)	T_{MAX}		170	°C
Maximum Dissipated Power	$P_{DISS\ MAX}$		200	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	--

RoHS Compliant

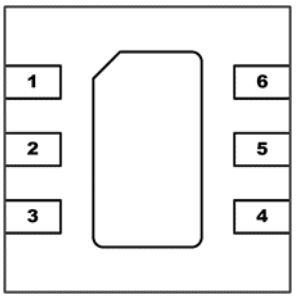
Caution! ESD Sensitive Device

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 GRF2543 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}	LNA enable	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 connections to die
3	RF_In	LNA RF input	Must provide external DC block to this pin
4	RF_Out	LNA RF output	Internally DC blocked but do not apply external DC > 0.2 volts to this pin. External capacitor to ground strongly affects the impedance matching of the device
5	NC	No Connect or Ground	No internal connections to die
6	VDD	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_{ENABLE} Truth Table:

Mode	Description	V_{ENABLE}
High Gain	High LNA Gain	1
Bypass	Linear Bypass	0
Logic Level "0"	Logic Low	0.0V to 0.2V
Logic Level "1"	Logic High	1.5V to Vdd

Nominal Operating Parameters:

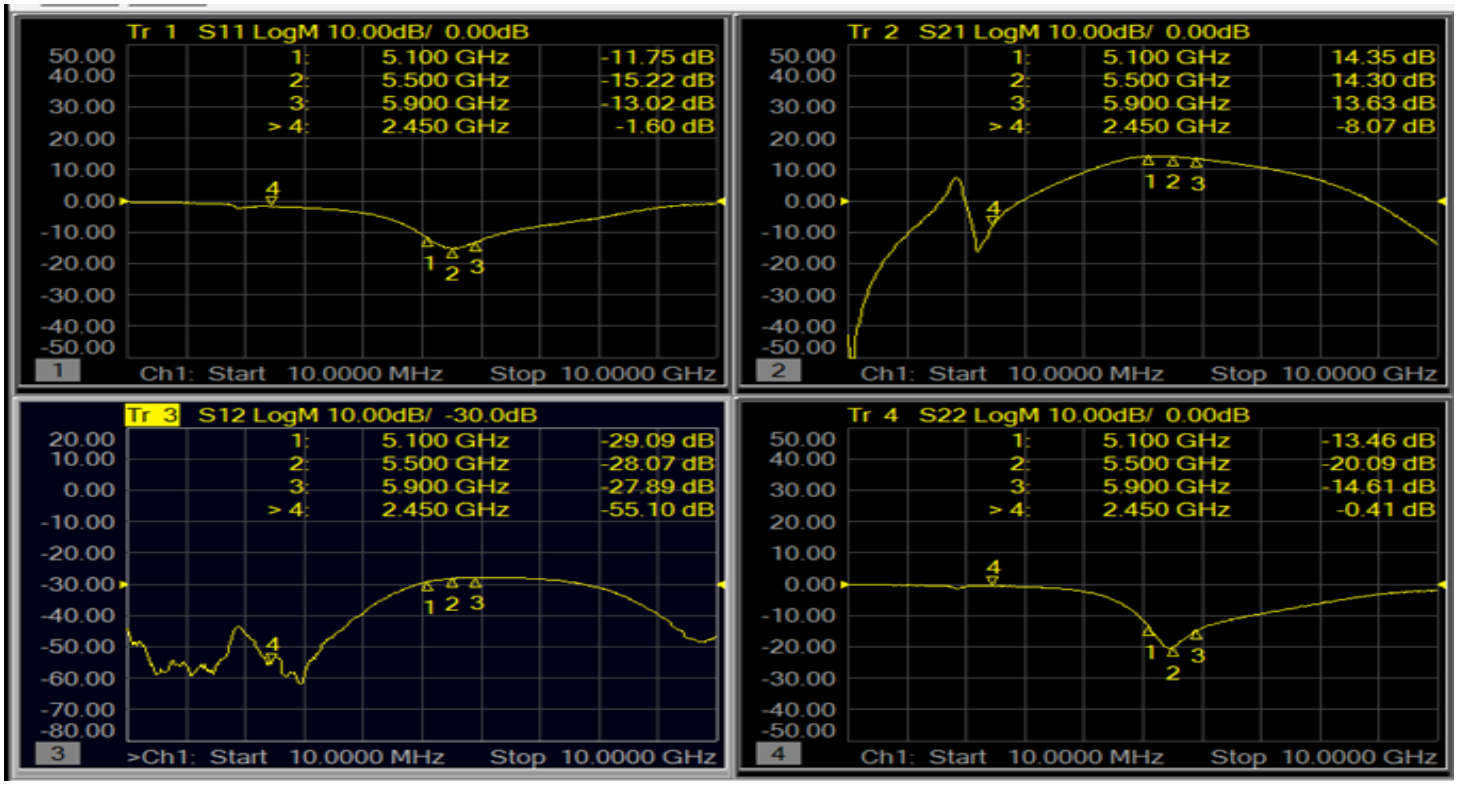
Parameter	Symbol	Specification			Unit	Condition
		Min.	Typ.	Max.		
High Gain Mode						V_{DD} = 3.3 V; V_{ENABLE}: High;
Test Frequency	F_{TEST}		5.5		GHz	
Gain	S21		14.4		dB	
Noise Figure (Evaluation Board)	NF		1.0		dB	
Input Power for 1.0% EVM (Gain Mode)	IP1%		TBD		dBm	Waveform: 802.11a/g; PAR: 11.6 dB
Input Power for 1.0% EVM (Bypass Mode)	IP1%		TBD		dBm	Waveform: 802.11a/g; PAR: 11.6 dB
Input 1dB Compression Point	IP1dB		-1.0		dBm	
Switching Rise Time	T_{RISE}		1400		ns	Bypass to Gain Mode
Switching Fall Time	T_{FALL}		200		ns	Gain to Bypass Mode
Supply Current	I_{DD}		15		mA	
Enable Current	I_{ENABLE}		0.7		mA	
Bypass Mode						V_{DD}: 3.3 V; Ven: 0.0 V
Gain	S(2,1)		-2.1		dB	
Input 1dB Compression Point	IP1dB		23.9		dBm	
Thermal Data						
Thermal Resistance (Infra-Red Scan)	Θjc		75		°C/W	
Channel Temperature @ +85 C reference (Package heat sink)	$T_{CHANNEL}$		89		°C	V_{DD}: 3.3 V; I_{DDQ}: 15 mA; No RF; Dissipated Power: 50 mW

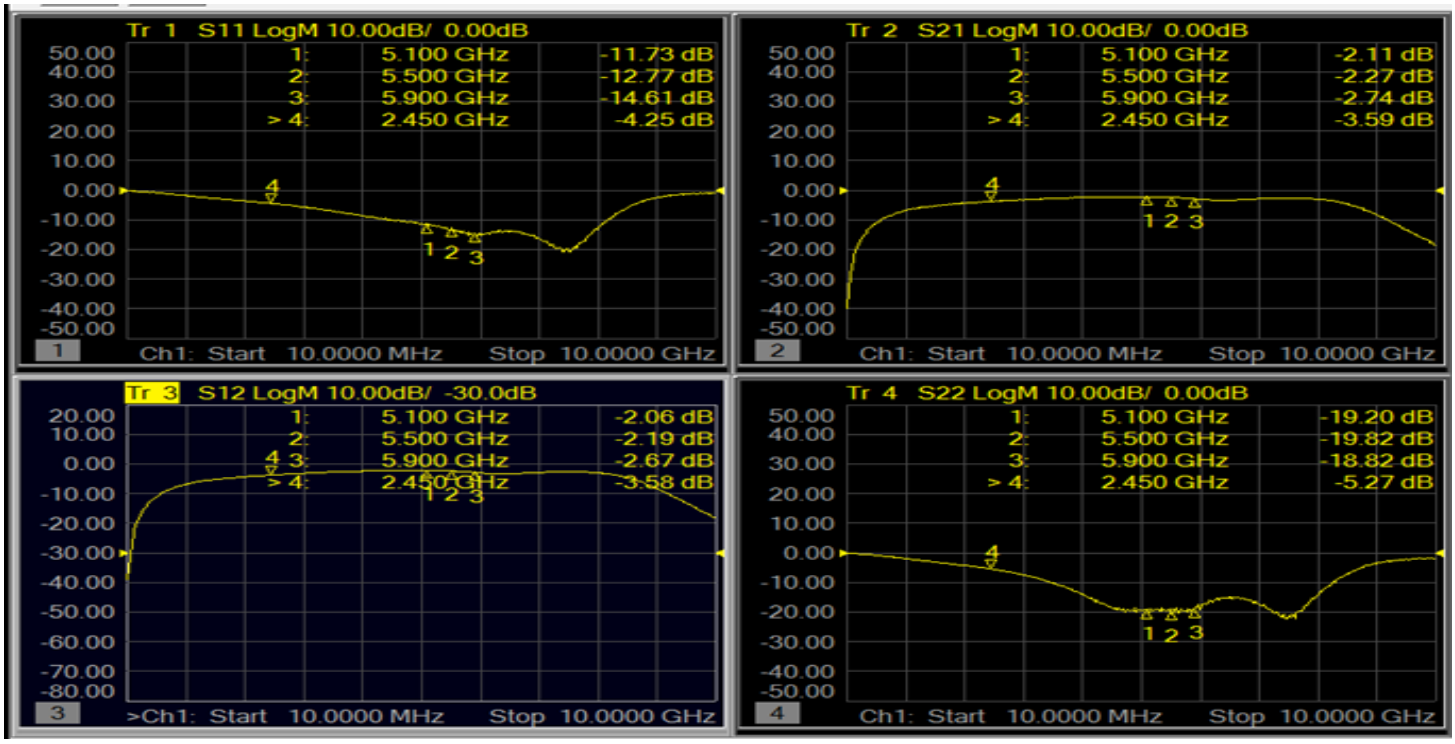
Note: MTTF >10^6 hours for $T_{CHANNEL}$ < =170 degrees C.

GRF2543 Evaluation Board Measured Data:

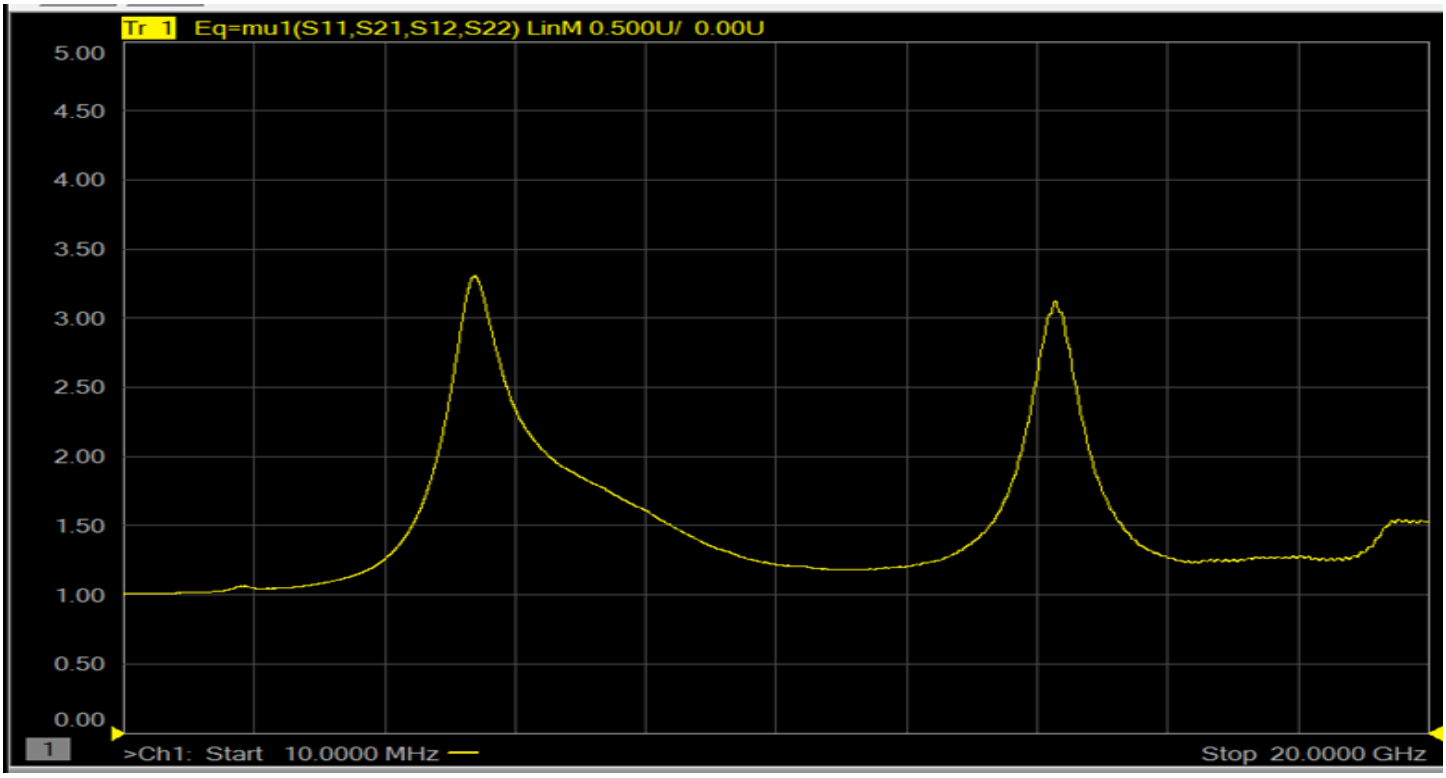
Descriptor	Freq MHz	Vdd	Iddq mA	Gain dB	IIP3 dBm	OIP3 dBm	IP1dB dBm	OP1dB dBm	EVB NF dB
GRF2543-4	5100	3.3	14.8	14.37	10.26	24.63	-1.2	12.05	1.00
GRF2543-4	5500	3.3	14.5	14.43	11.3	25.73	-0.7	12.7	0.97
GRF2543-4	5900	3.3	14.5	14.03	11.6	25.63	0.5	13.48	1.05
Descriptor	**Freq MHz**	**Vdd**	**Iddq mA**	**Gain dB**	**IIP3 dBm**	**OIP3 dBm**	**IP1dB dBm**	**OP1dB dBm**	**EVB NF dB**
GRF2543-4 Bypass	5100	3.3	0.5	-1.98	23.77	21.79	24.9	21.95	
GRF2543-4 Bypass	5500	3.3	0.5	-2.05	21.64	19.59	23.9	21.07	
GRF2543-4 Bypass	5900	3.3	0.5	-2.82	21.37	18.55	21.9	18.33	

GRF2543 Evaluation Board S-Pars (Gain and Bypass Modes):

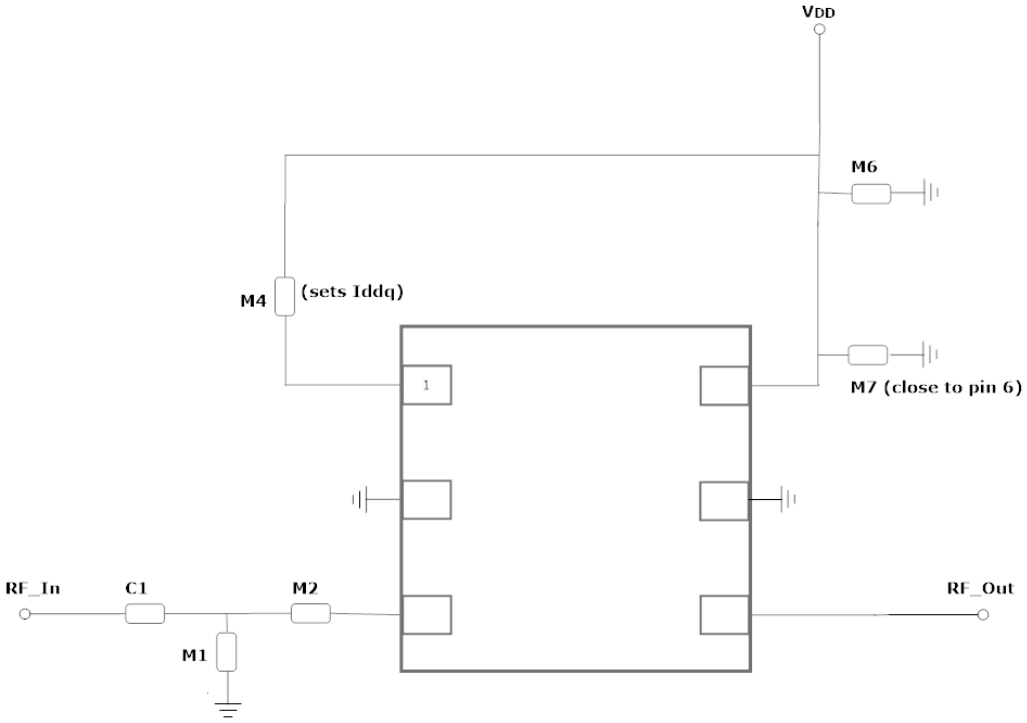




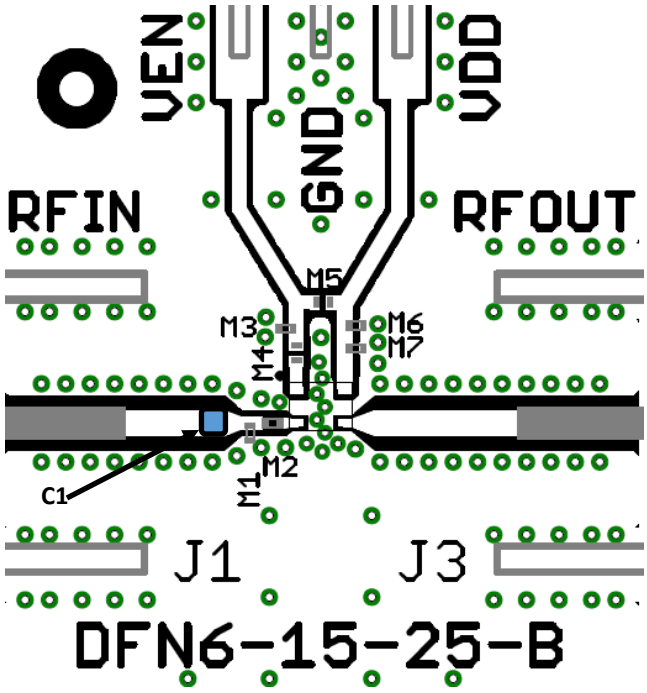
GRF2543 Evaluation Board Stability Mu Factor:



Note: Mu factor >= 1.0 implies unconditional stability.



GRF2543 Application Schematic

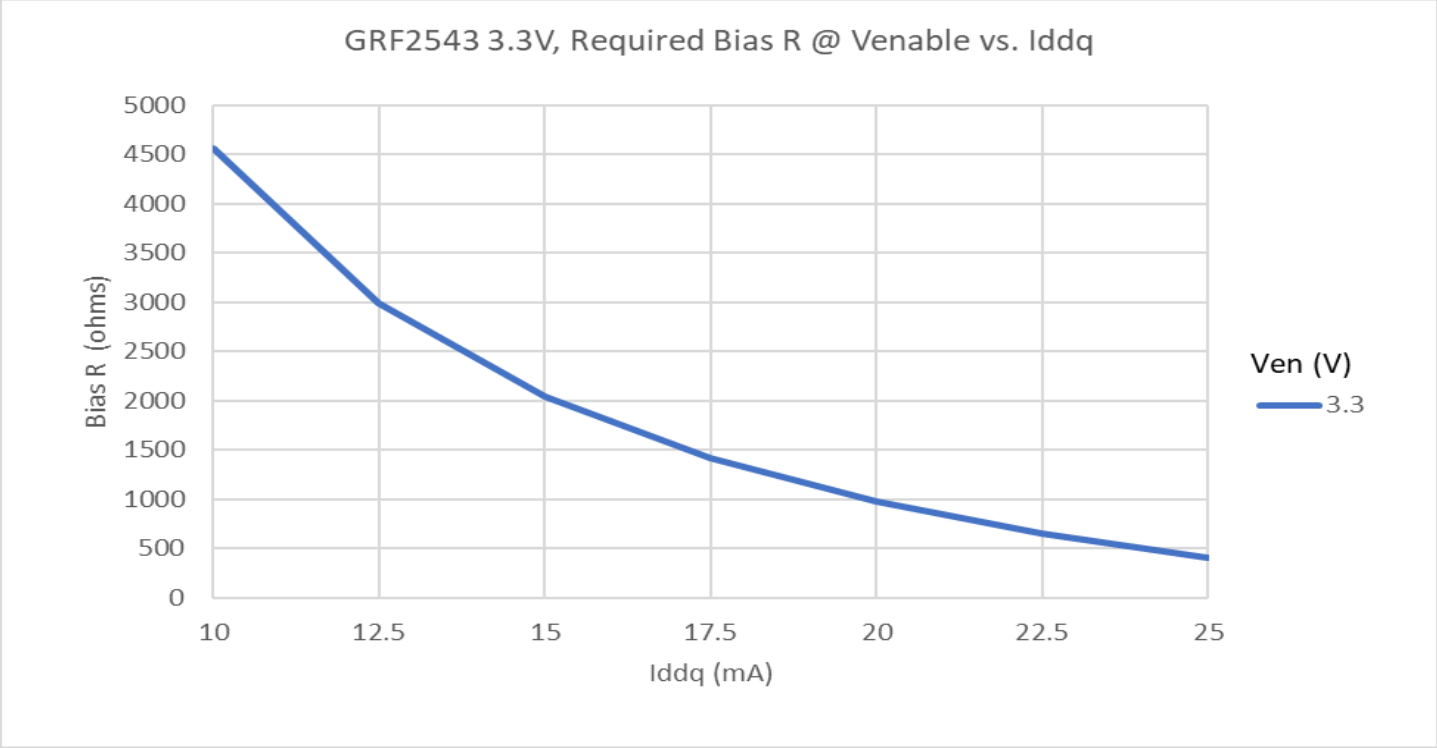


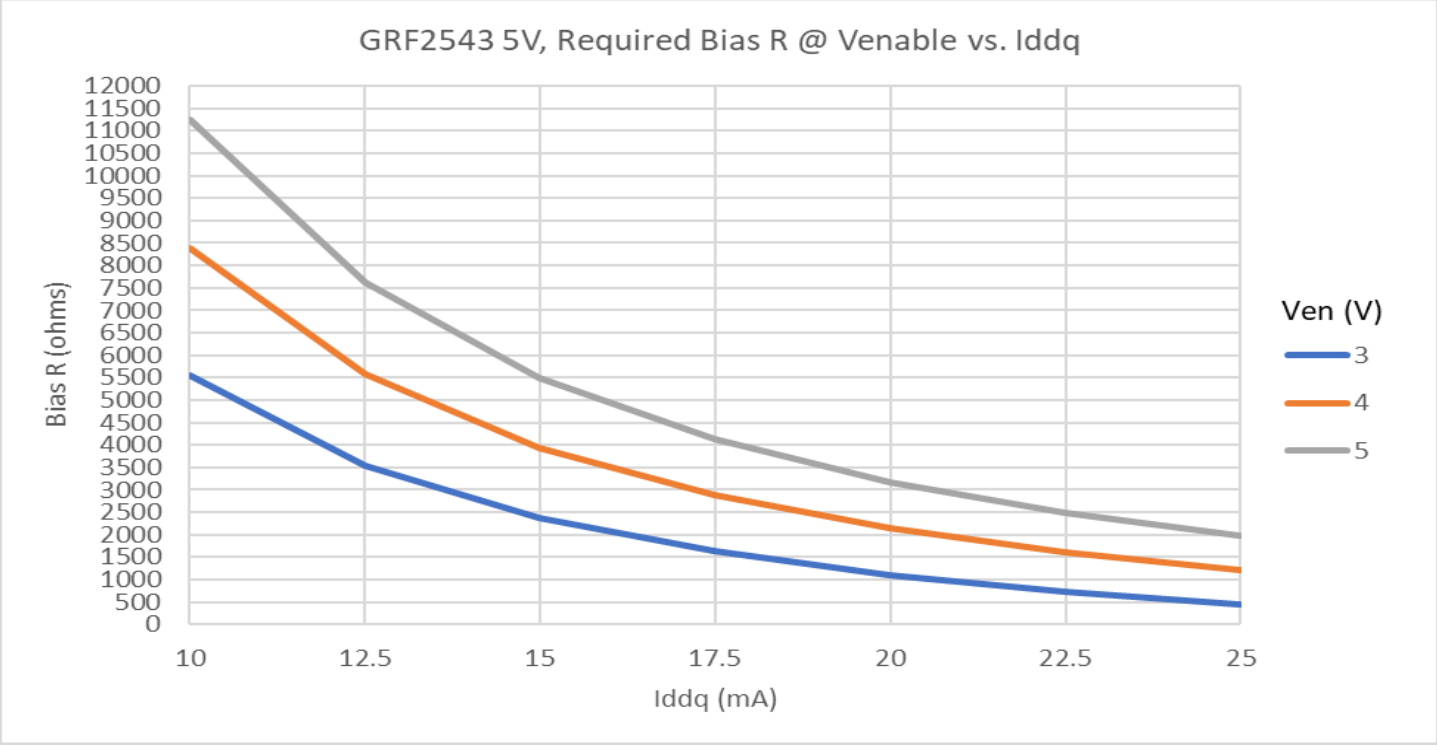
GRF2543 Evaluation Board Assembly Diagram

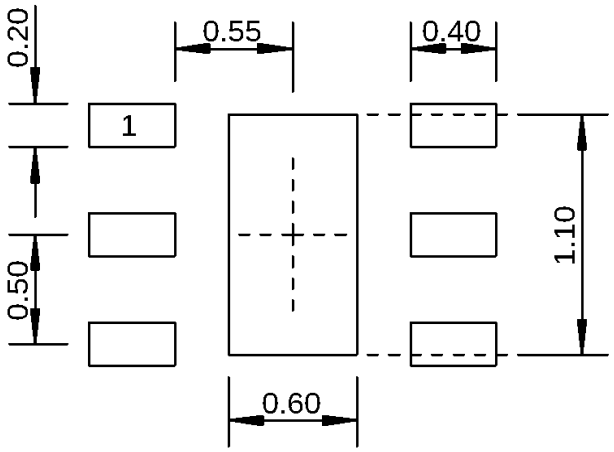
GRF2543 Standard Evaluation Board BOM: (5.0 to 6.0 GHz Tune)

Component	Type	Manufacturer	Family	Value	Package Size	Substitution
C1	Capacitor	Murata	GJM	5.1 pF	0201	ok
M1	Capacitor	Murata	GJM	0.6 pF	0201	ok
M2	Resistor: 5%	Various	—	0 Ohm	0201	ok
M4	Resistor: 5%	Various	—	—	0201	ok
M6	Capacitor	Murata	GRM	0.1 uF	0201	ok
M7	Capacitor	Murata	GJM	8.2 pF	0201	ok
Evaluation Board	DFN6-15-25-B					

GRF2543 Bias Resistor Selection Curves:

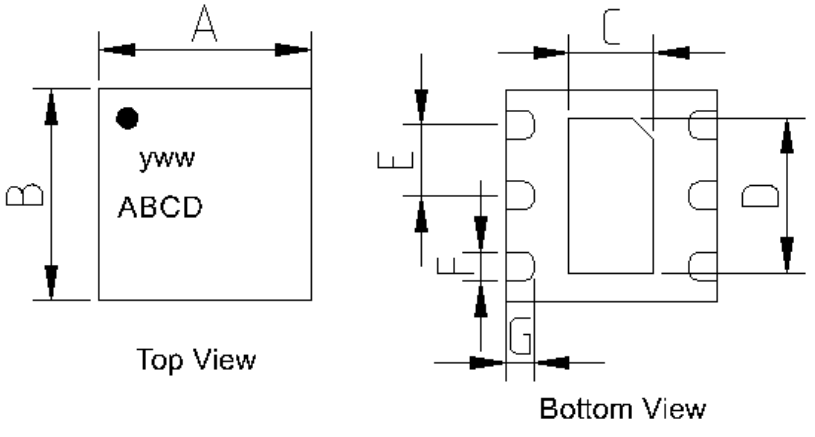






Dimensions in millimeters

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



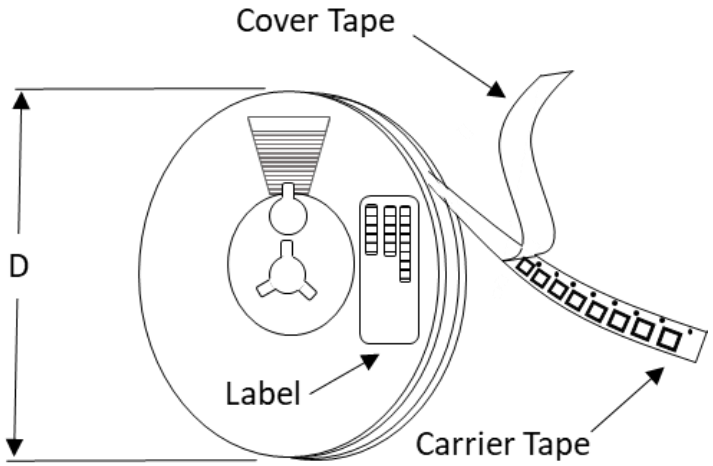
Dimensions (MM)	
A	1.5 +/- 0.050
B	1.5 +/- 0.050
C	.6 +/- 0.050
D	1.1 +/- 0.050
E	.5 Bsc
F	.2 +/- 0.050
G	.2 +/- 0.050
H	.45 +/- 0.050
J	.12 Ref.

1.5 mm DFN-6 Package Dimensions

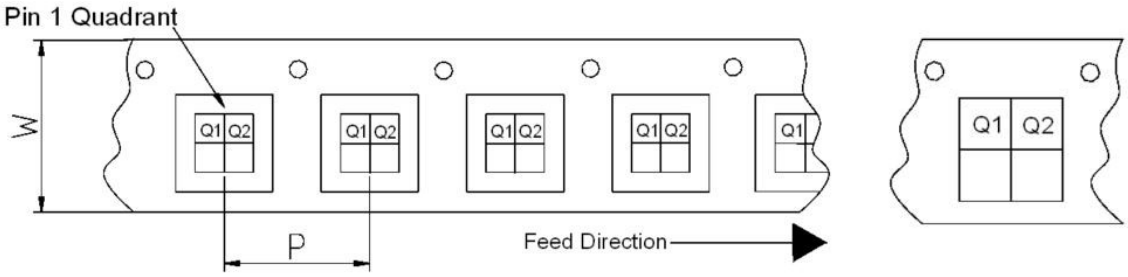
Tape and Reel Information:

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

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

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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