GRF2541

Preliminary

Low Noise Amplifier with Bypass 802.11a/n/ac; 4.9 - 6.0 GHz

Package: 6-Pin DFN

Features

- 4.9 GHz to 6 GHz Operation
- Bypass + Guerrilla Armor™
- 1.0 dB Noise Figure
- 15.0 dB Flat Gain (5.1 to 5.925 GHz)
- 2.7 V to 5.0 V Single Supply
- Internally Matched to 50 Ω
- Unconditionally Stable

Applications

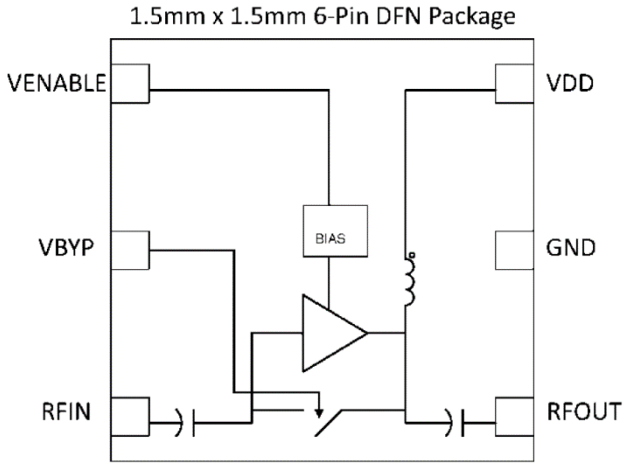
- WiFi Access Points
- Mobile WiFi Devices
- Microwave Backhaul
- 802.11p Vehicle Communications

Product Description

The GRF2541 is an ultra-low noise amplifier (LNA) with bypass designed for IEEE 802.11a/n/ac/p applications in the 5GHz band (5.1 GHz to 5.925 GHz). The device exhibits outstanding noise figure (NF) of 1.0 dB along with a flat gain of approximately 15 dB over the band. Guerrilla Armor™ technology provides exceptional off-state isolation in the presence of high RF input signal levels in LNA power-down mode.

Housed in a 1.5 x 1.5 x 0.5 mm 6-pin plastic DFN package, the LNA is operated from a single positive supply of 2.7 to 5.0 V with a selectable Iddq range of 10 to 40 mA.

Functional Block Diagram



Absolute Ratings

Parameter	Symbol	Min.	Max.	Unit
Supply Voltage	V_{DD}	0	6.0	V
DC Voltage at Control Port (Pin 1)	V_{ENABLE}	0	V_{DD}	V
DC Voltage at Control Port (Pin 2)	V_{BYP}	0	V_{DD}	V
RF CW Input Power (LNA Gain Mode)	$P_{IN\ MAX}$		+15	dBm
RF CW Input Power (LNA Bypass Mode)	$P_{IN\ MAX}$		+20	dBm
RF CW Input Power (LNA Disabled Mode)	$P_{IN\ MAX}$		+20	dBm
Operating Temperature (Package heat sink)	T_{AMB}	-40	+105	°C
Storage Temperature	T_{STG}	-40	+150	°C
Maximum Channel Temperature	T_{MAX}		+160	°C
Maximum Disspated Power	$P_{DISS\ MAX}$		200	mW
Electro Static Discharge:				
Charged Device Model: (TBD)	CDM	Class 4: 1000		Volts
Human Body Model: (TBD)	HBM	Class 1B: 500		Volts
Machine Model: (TBD)	MM	Class A: 50		Volts

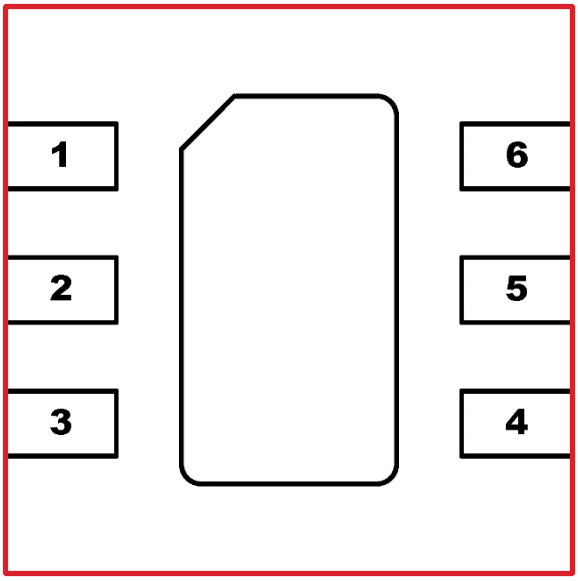
Caution! ESD Sensitive Device: Exceeding Absolute Maximum Rating conditions may cause permanent damage to the device.

Nominal Operating Parameters

Parameter	Symbol	Specification			Unit	Condition
		Min.	Typ.	Max.		
High Gain Mode						V_{DD} = 3.3 V; Temp: +25C
Test Frequency	F_{TEST}		5500		MHz	
Gain	S21		15.0		dB	
Gain Flatness	ΔS21		+/- 0.5		dB	Across 5.1 to 5.825 GHz
Input Return Loss	S11		-10		dB	
Output Return Loss	S22		-13		dB	
Noise Figure	NF		1.0		dB	(Board Losses De-embedded)
Input Third Order Intercept Point	IIP3		+7.0		dBm	
Input 1dB Compression Point	IP1dB		-4		dBm	In band
Input 1 dB Compression (2450 MHz)	IP1dB		TBD		dBm	Out of band
Supply Current	I_{DD}		15		mA	
Enable Current	I_{enable}		400		uA	
Bypass Mode						Vdd: 3.3 V; Temp: +25C
Gain	S(2,1)		-8		dB	
Input 1dB Compression Point	IP1dB		+8		dBm	
Disabled Mode						V_{DD} = 3.3V, Temp: +25C
Supply Current (Leakage)	I_{DD}		500		µA	
Enable Current	I_{enable}		0.01		µA	
Thermal Data						
Thermal Resistance (Infra-Red Scan)	Θjc		141		°C/W	
Channel Temperature @ +85 C reference (Package heat sink)	$T_{CHANNEL}$		+92.0		°C	Vdd: 3.3 V; Iddq: 15 mA; No RF; Dissipated Power: 50 mW

GUERRILLA ARMOR

Pin Out (Top View)

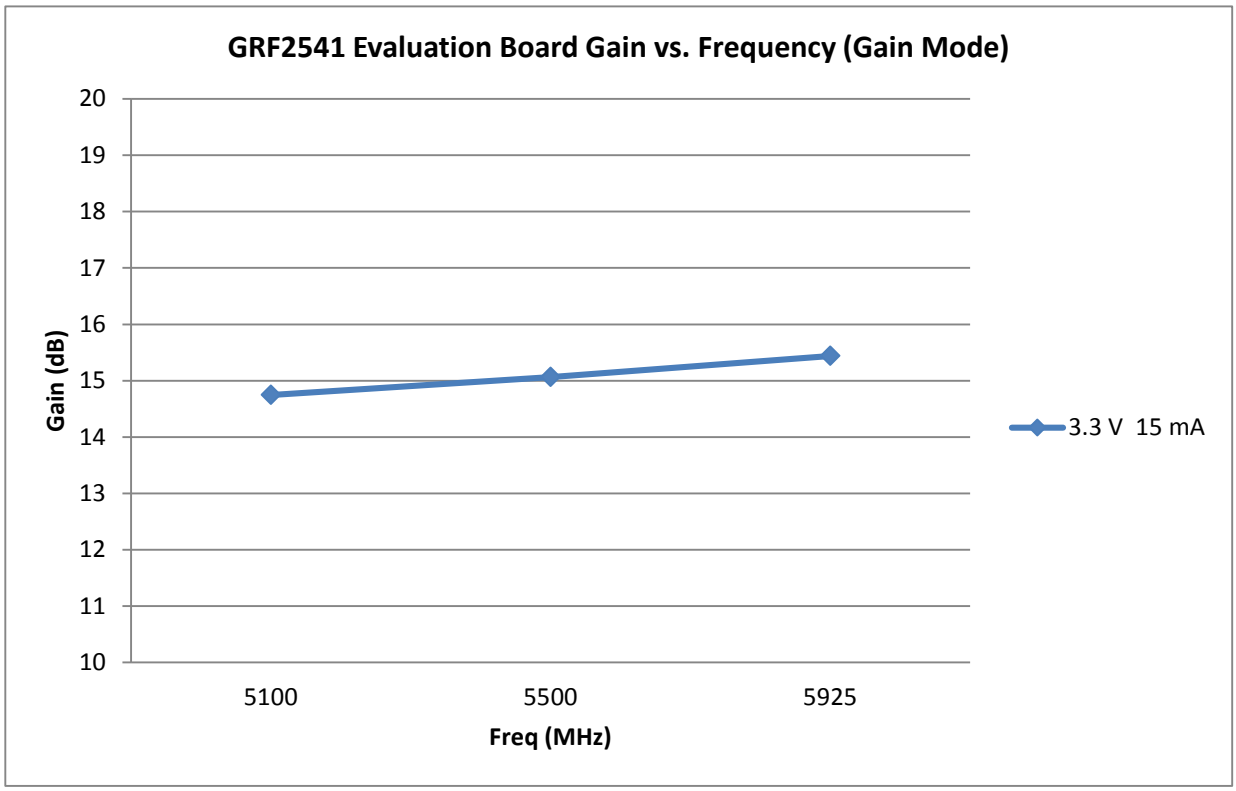


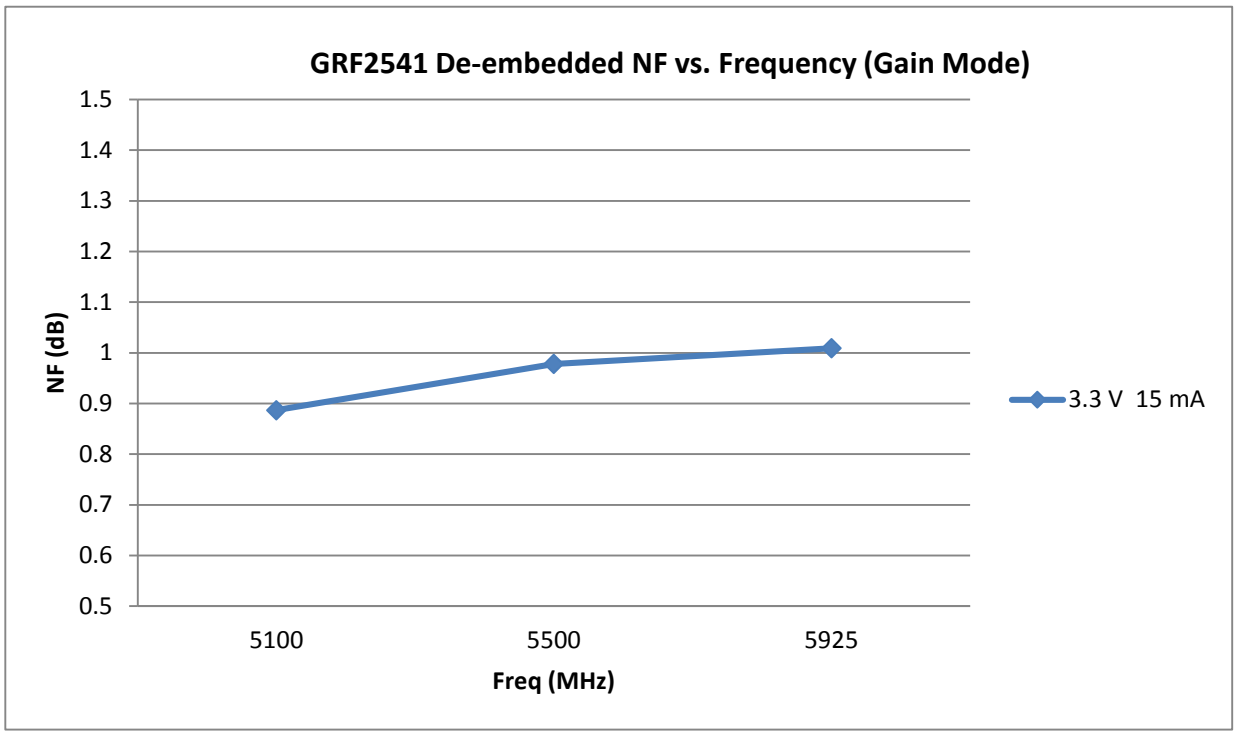
Pin Assignments

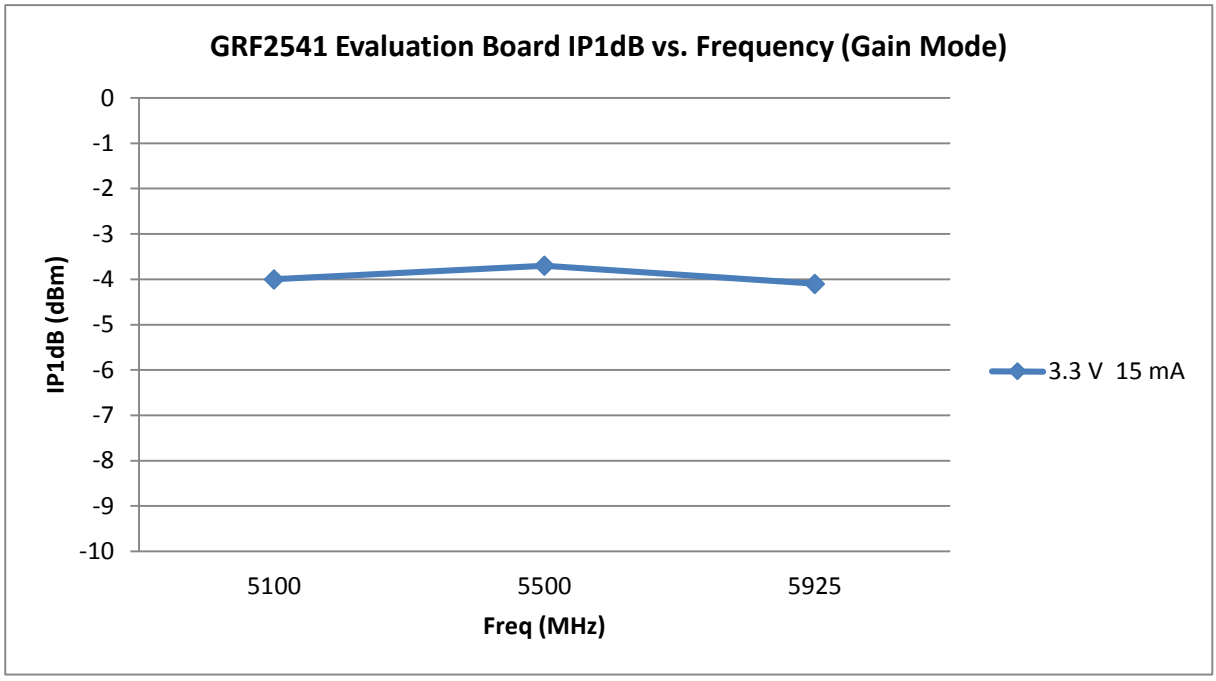
Pin	Name	Description	Note
1	VENABLE	LNA enable	Increase voltage to draw more current and increase IP3.
2	VBYP	Bypass function enable	Logic high invokes the LNA bypass mode.
3	RFIN	LNA RF input	Internally matched to 50 Ω. These ports may be DC connected to ground externally but no DC > 0.2 volts should be applied to these ports.
4	RFOUT	LNA RF output	
5	GND	Ground	Connect to ground for maximum RF performance
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. Please see evaluation board assembly diagram for reference.

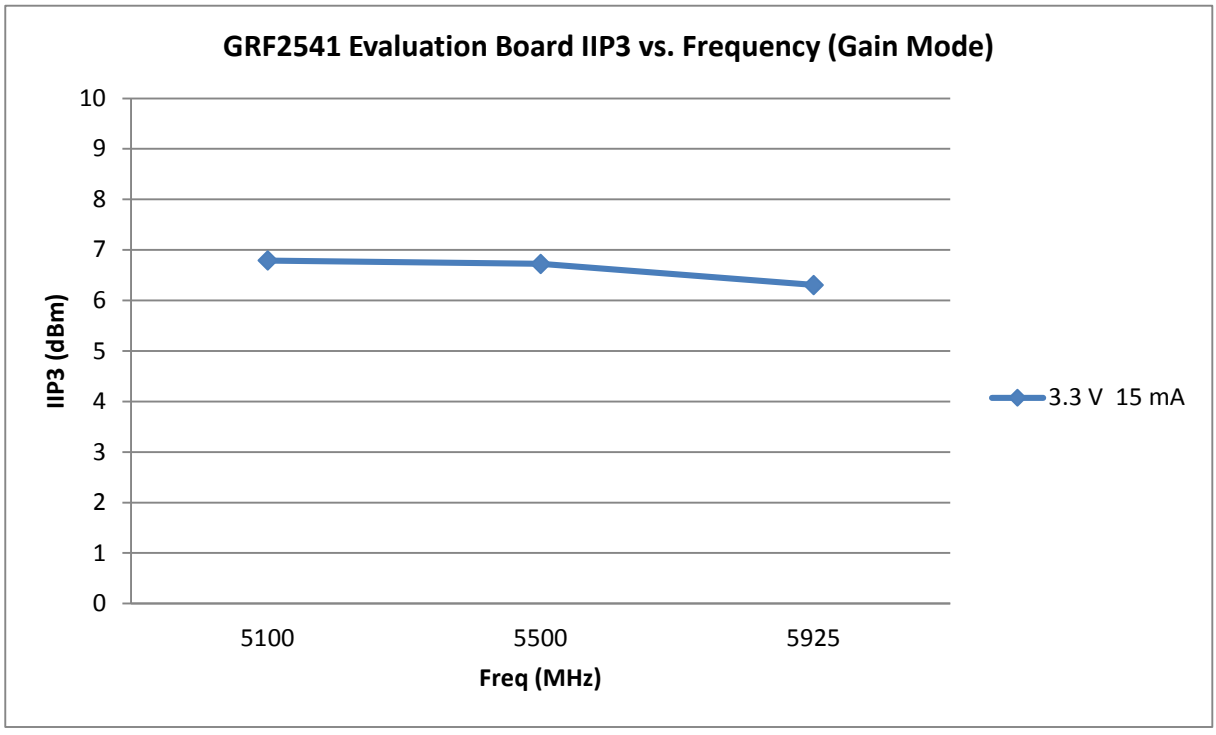
Control Logic Truth Table

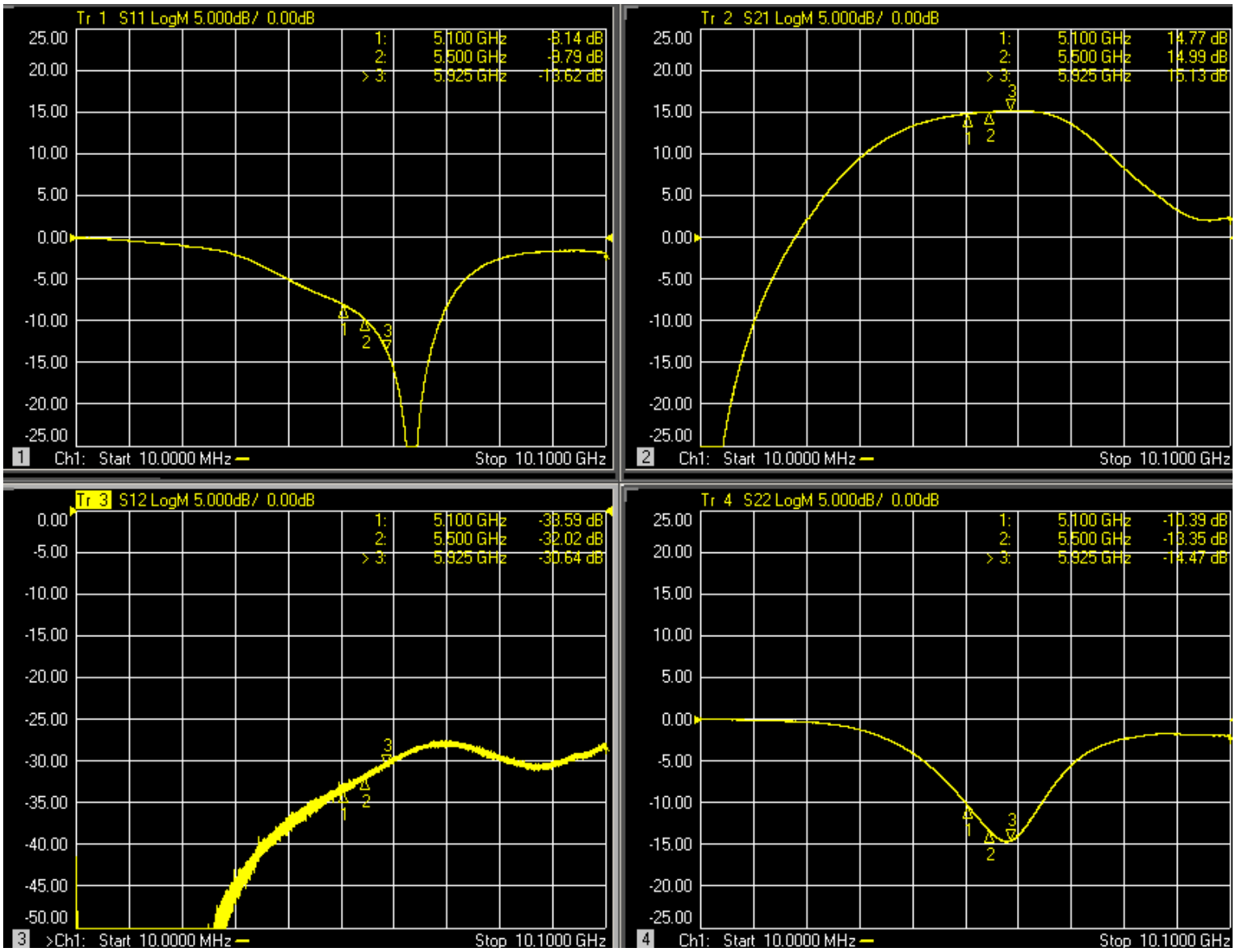
Mode	Description	VENABLE	VBYP
High Gain	High LNA Gain	1	0
Bypass	High Linearity Bypass	0	1
Disabled	LNA Powered Down	0	0
Logic Level “0”	Logic Low	0.0V to 0.2V	0.0V to 0.2V
Logic Level “1”	Logic High	1.5V to Vdd	1.5V to Vdd


GRF2541 Evaluation Board Gain vs. Frequency (Gain Mode)
Gain (dB)
20
19
18
17
16
15
14
13
12
11
10
5100
5500
5925
Freq (MHz)
3.3 V 15 mA


GRF2541 De-embedded NF vs. Frequency (Gain Mode)
NF (dB)
1.5
1.4
1.3
1.2
1.1
1
0.9
0.8
0.7
0.6
0.5
5100
5500
5925
Freq (MHz)
3.3 V 15 mA

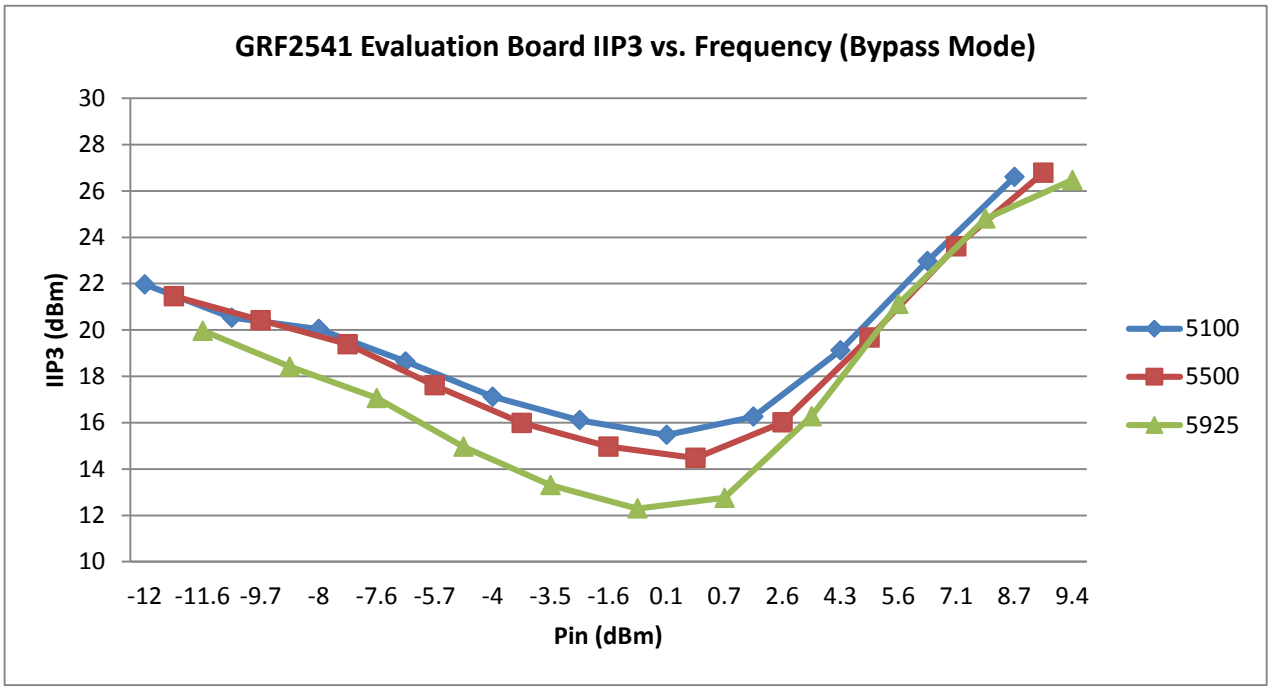

GRF2541 Evaluation Board IP1dB vs. Frequency (Gain Mode)
IP1dB (dBm)
0
-1
-2
-3
-4
-5
-6
-7
-8
-9
-10
5100
5500
5925
Freq (MHz)
3.3 V 15 mA

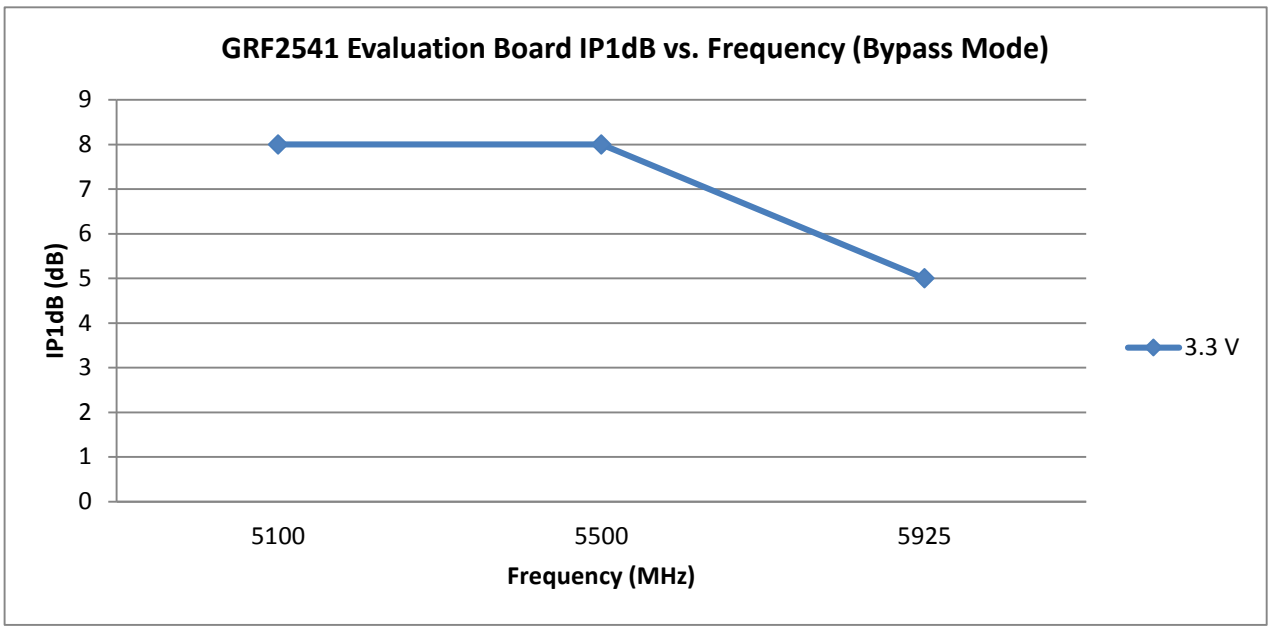

GRF2541 Evaluation Board IIP3 vs. Frequency (Gain Mode)
IIP3 (dBm)
10
9
8
7
6
5
4
3
2
1
0
5100
5500
5925
Freq (MHz)
3.3 V 15 mA

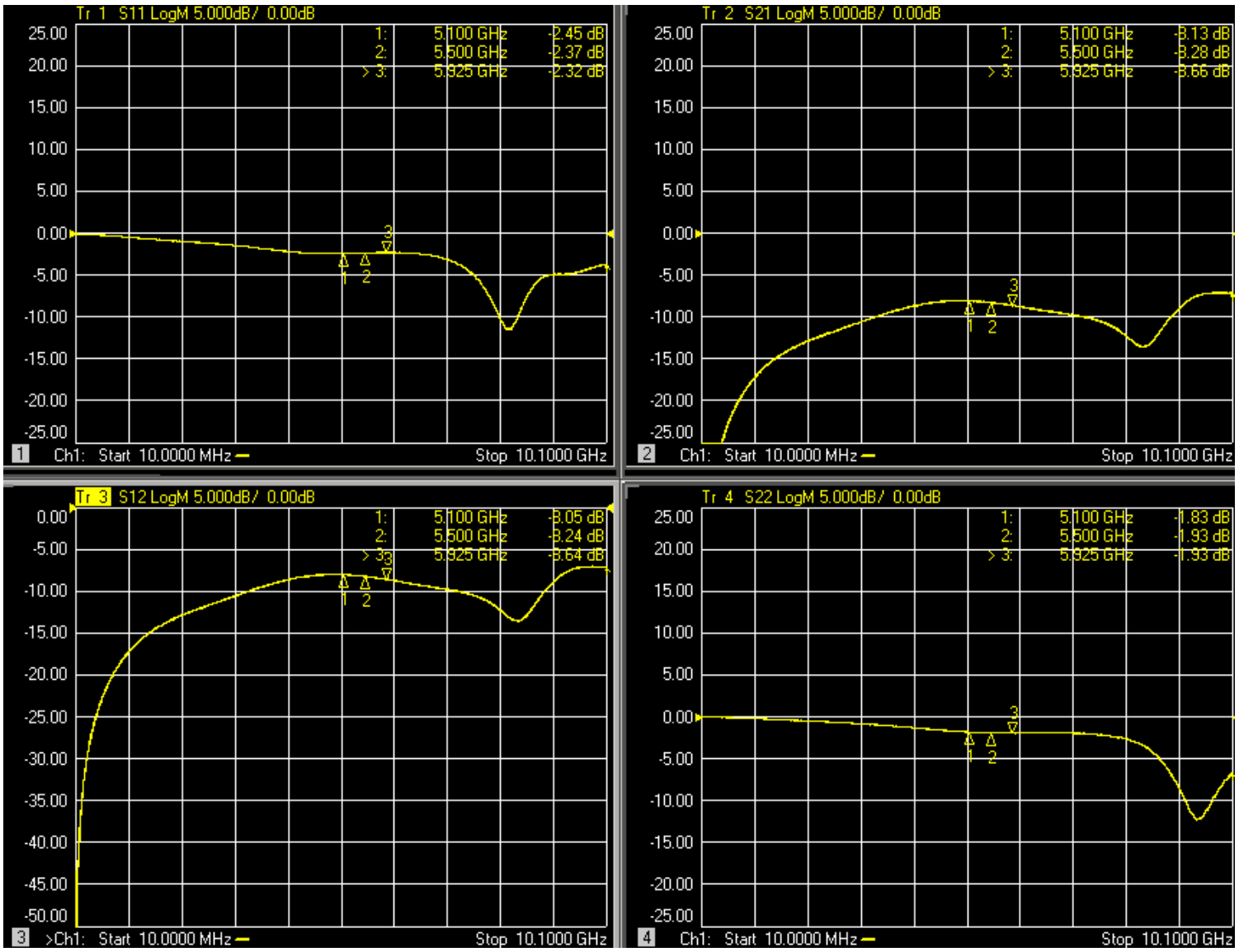


GRF2541 Evaluation Board S-Parameters (Gain Mode); Vdd: 3.3 volts and 15 mA

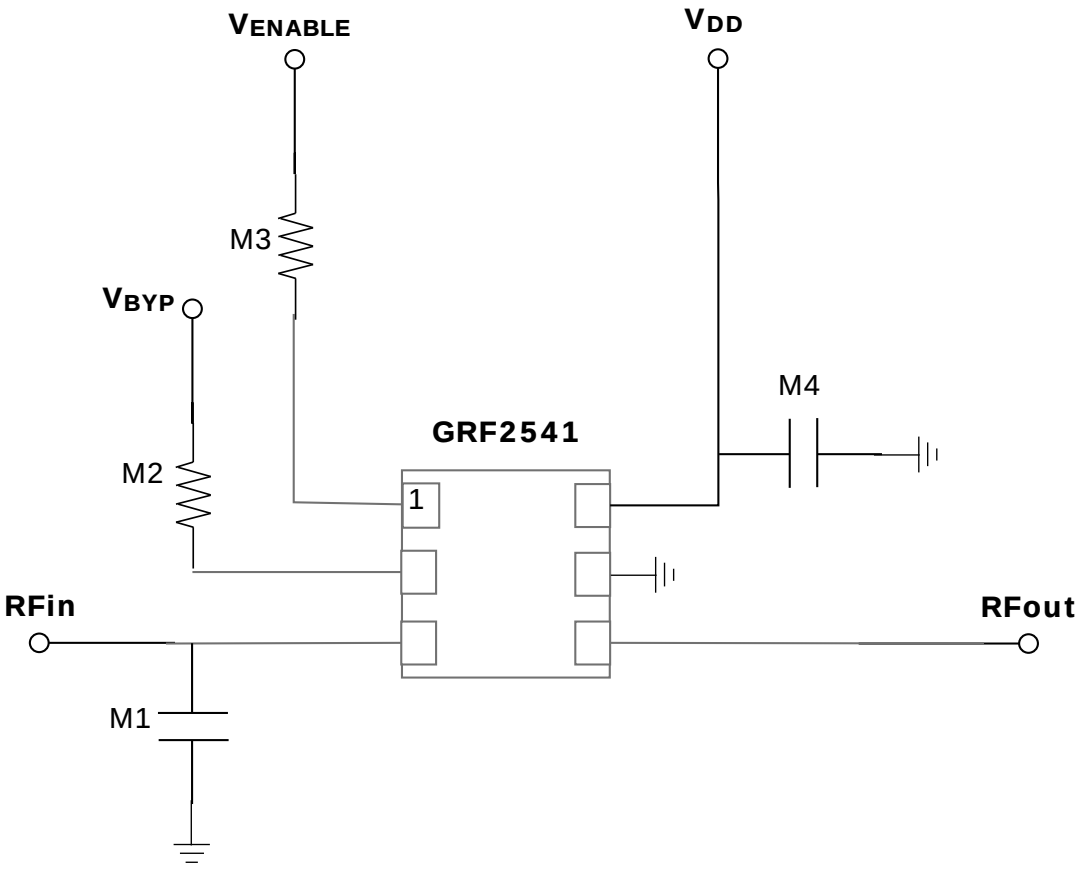
Bypass Mode Data (3.3V):



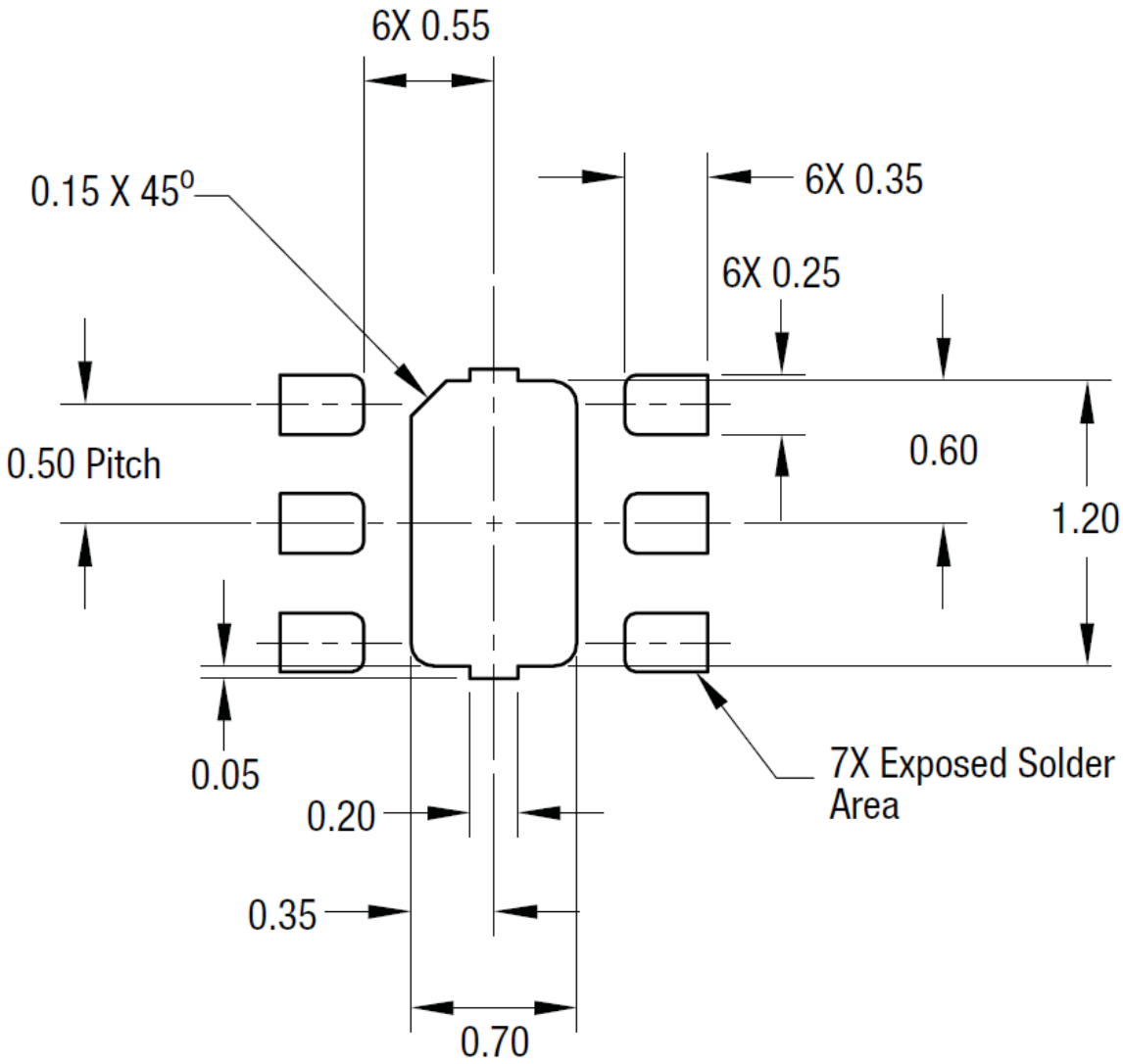




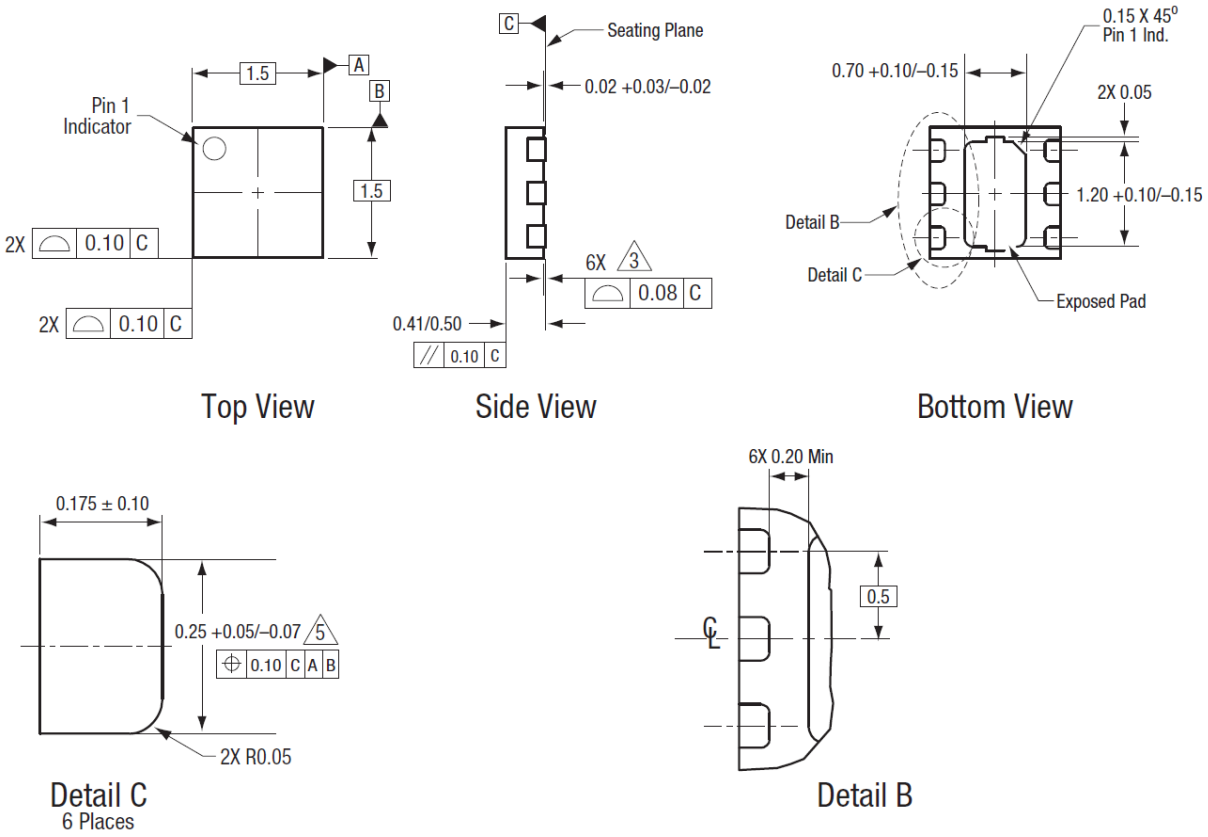
GRF2541 Evaluation Board S-Parameters (Bypass Mode); Vdd: 3.3 volts



GRF2541 Evaluation Board Application Schematic



GRF2541 1.5 x 1.5mm 6-Pin DFN PCB Layout Footprint



All measurements are in millimeters.
Dimensioning and tolerancing according to ASME Y14.5M-1994.
Coplanarity applies to the exposed heat sink slug as well as the terminals..
Plating requirement per source control drawing (SCD) 2504.
Dimension applies to metalized terminal and is measured between 0.15 mm and 0.30 mm from terminal tip.

GRF2541 6-Pin DFN Package Dimensions

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.