



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 de-embedded noise figure (NF) of 1.0 dB along with a high, flat gain of approximately 17.0 to 17.5 dB over the band. Guerrilla Armor™ technology provides exceptional off-state isolation in the presence of high RF input signal levels in LNA disabled mode. The LNA is operated from a single positive supply of 2.7 to 5.0 V with a selectable I_{ddq} range of 8 to 30 mA. The typical bias condition is 3.3 volts and 15 mA.

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

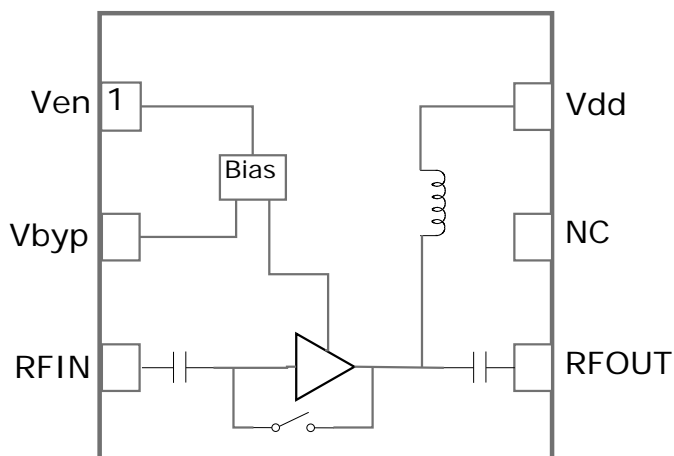
Features

- Bypass + Guerrilla Armor™
- 1.0 dB De-embedded NF
- 1.2 dB Evaluation Board NF
- 17.5 dB Flat Gain
- 2.7 V to 5.0 V Single Supply
- Internally Matched to 50 Ω
- Process: GaAs pHEMT
- U.S. Patents: 8,970,296 and 9,160,279

Applications

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

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
Maximum Channel Temperature	T _{MAX}		+170	°C
Maximum Dissipated Power	P _{DISS MAX}		200	mW
Electro Static Discharge:				
Charged Device Model: (TBD)	CDM	500		Volts
Human Body Model: (TBD)	HBM	250		Volts
Storage:				
Storage Temperature	T _{STG}	-40	+150	°C
Moisture Sensitivity Level	MSL		2	--

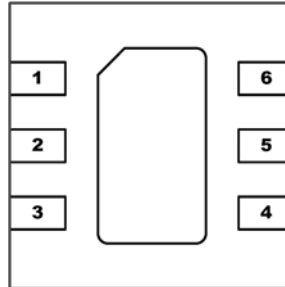


Caution! ESD Sensitive Device



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

Pin Out (Top View)



Pin Assignments:

Pin	Name	Description	Note
1	V_{ENABLE}	LNA enable	Increase voltage to draw more current and increase IP3. Unlike V _{byp} , this is an analog input.
2	V_{BYP}	Bypass function enable	Logic high invokes the LNA bypass mode.
3	RF_In	LNA RF input	Internally matched to 50 Ω. These ports may be DC connected to ground internally 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 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. Please see evaluation board assembly diagram for reference.

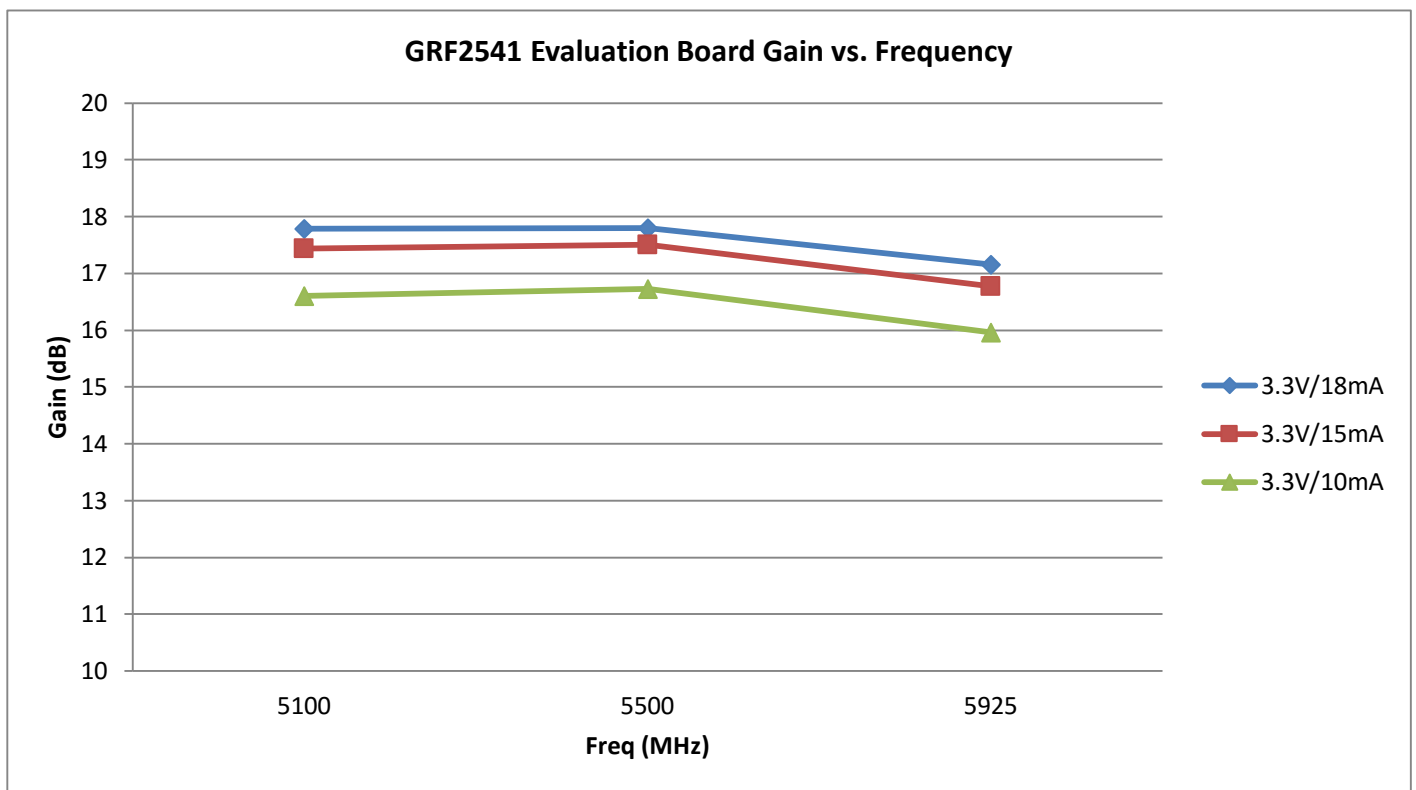
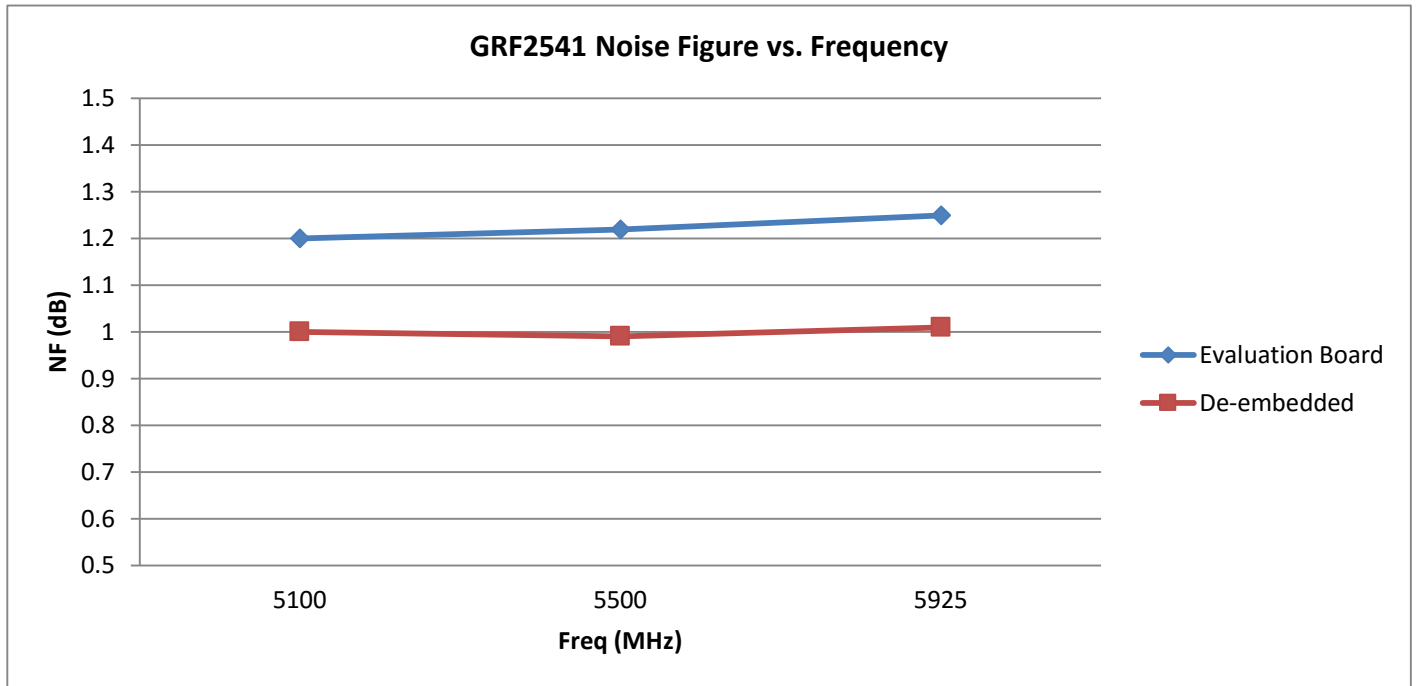
Control Logic Truth Table

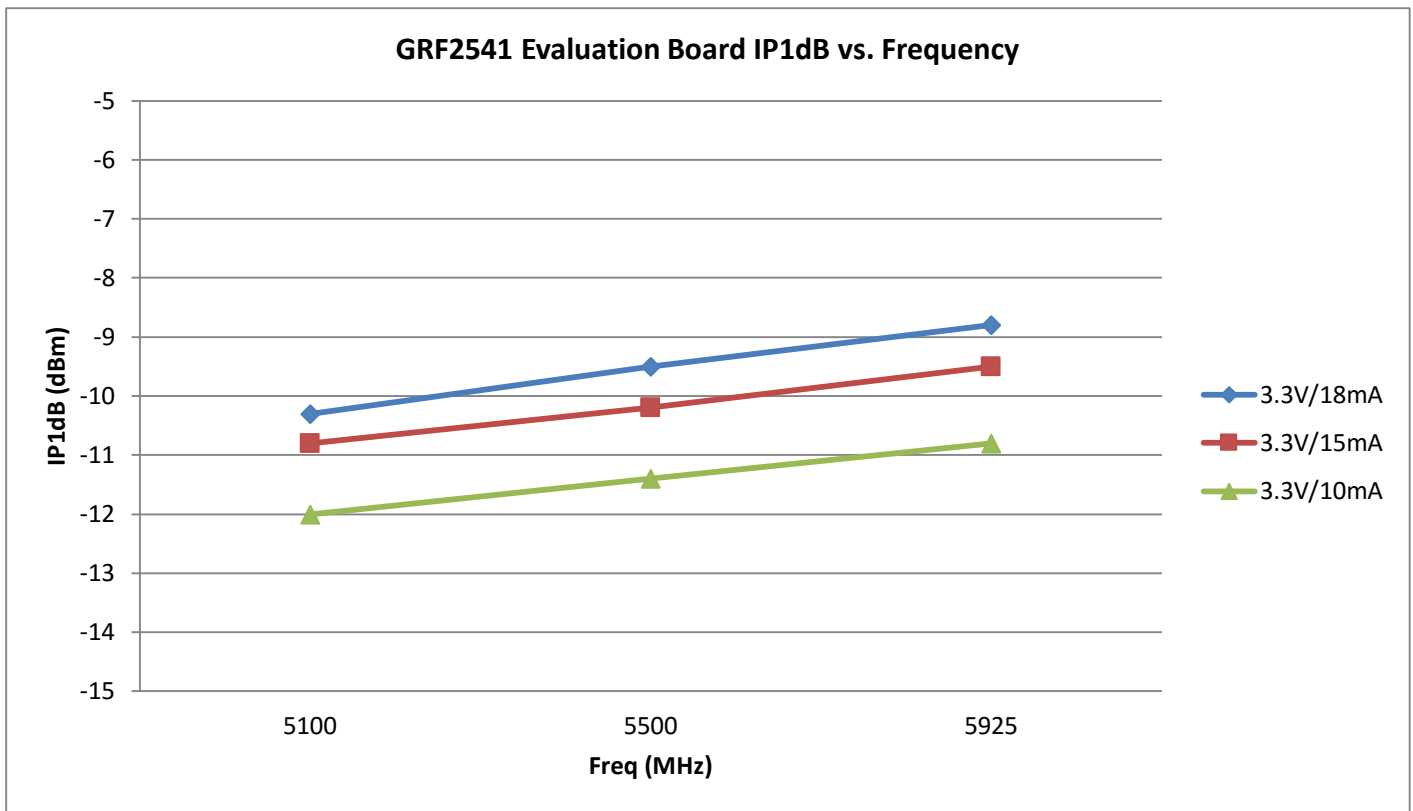
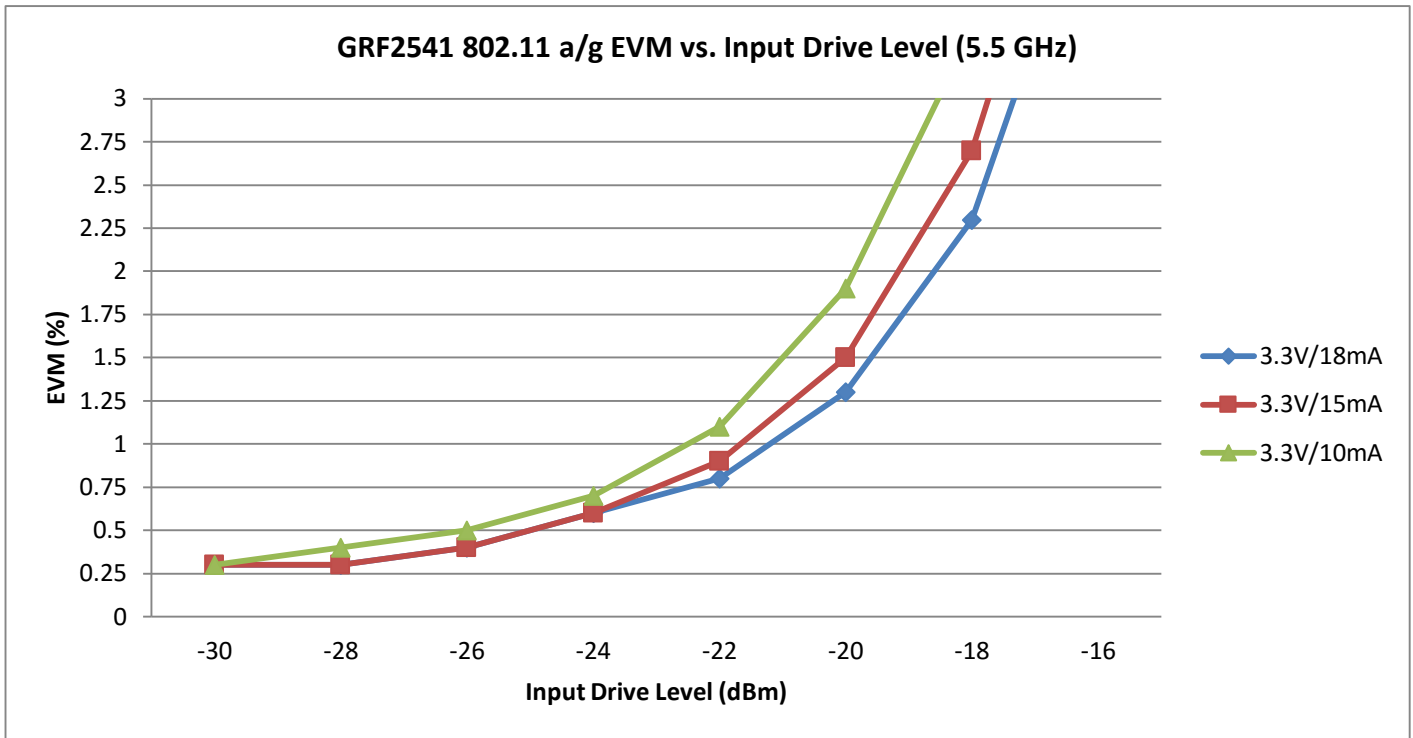
Mode	Description	V _{ENABLE}	V _{BYP}
High Gain	High LNA Gain	1	0
Bypass	High Linearity Bypass	0	1
Disabled	LNA Powered Down	0	0
Logic Level "0"	Logic Low	0.0V to 0.2V	0.0V to 0.2V
Logic Level "1"	Logic High	1.5V to V _{dd}	1.5V to V _{dd}

Nominal Operating Parameters:

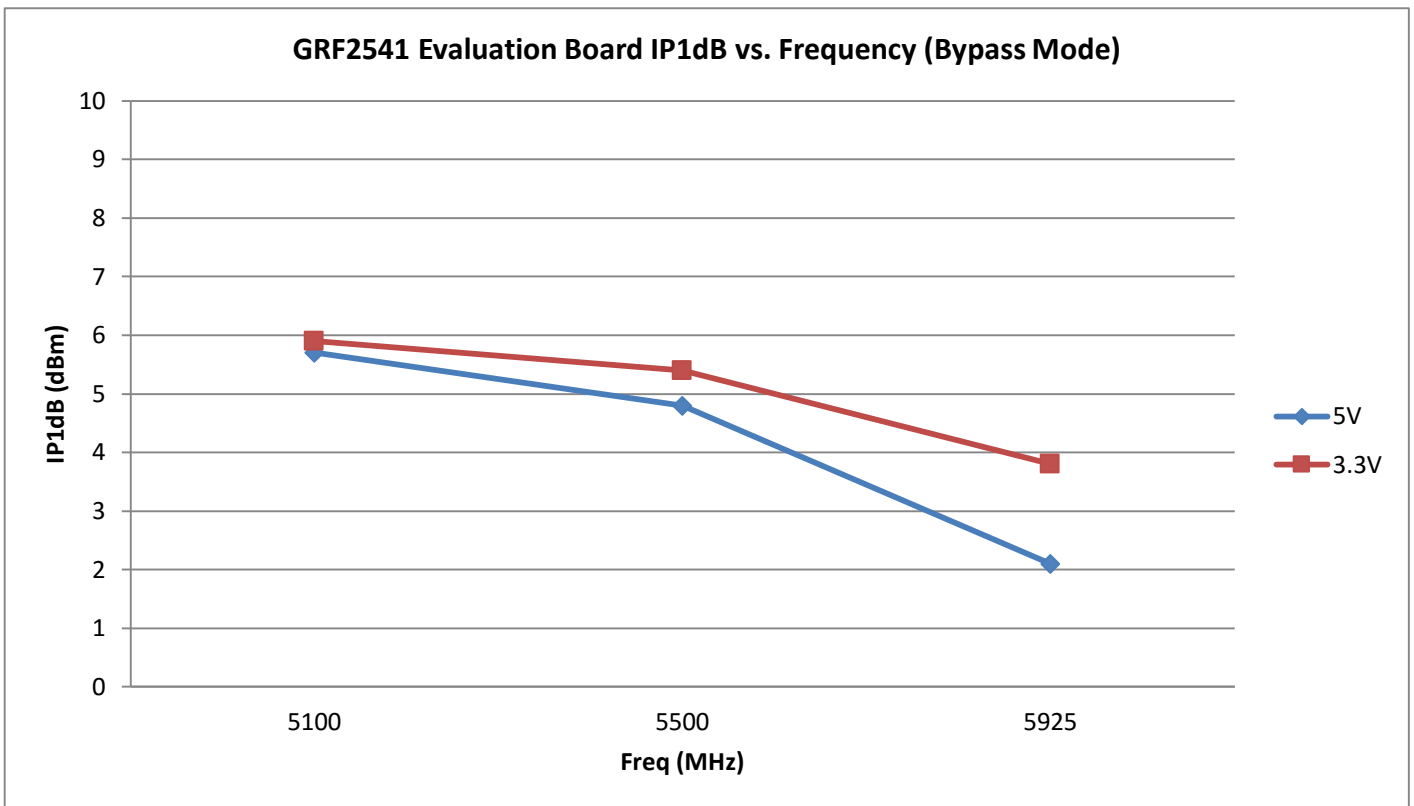
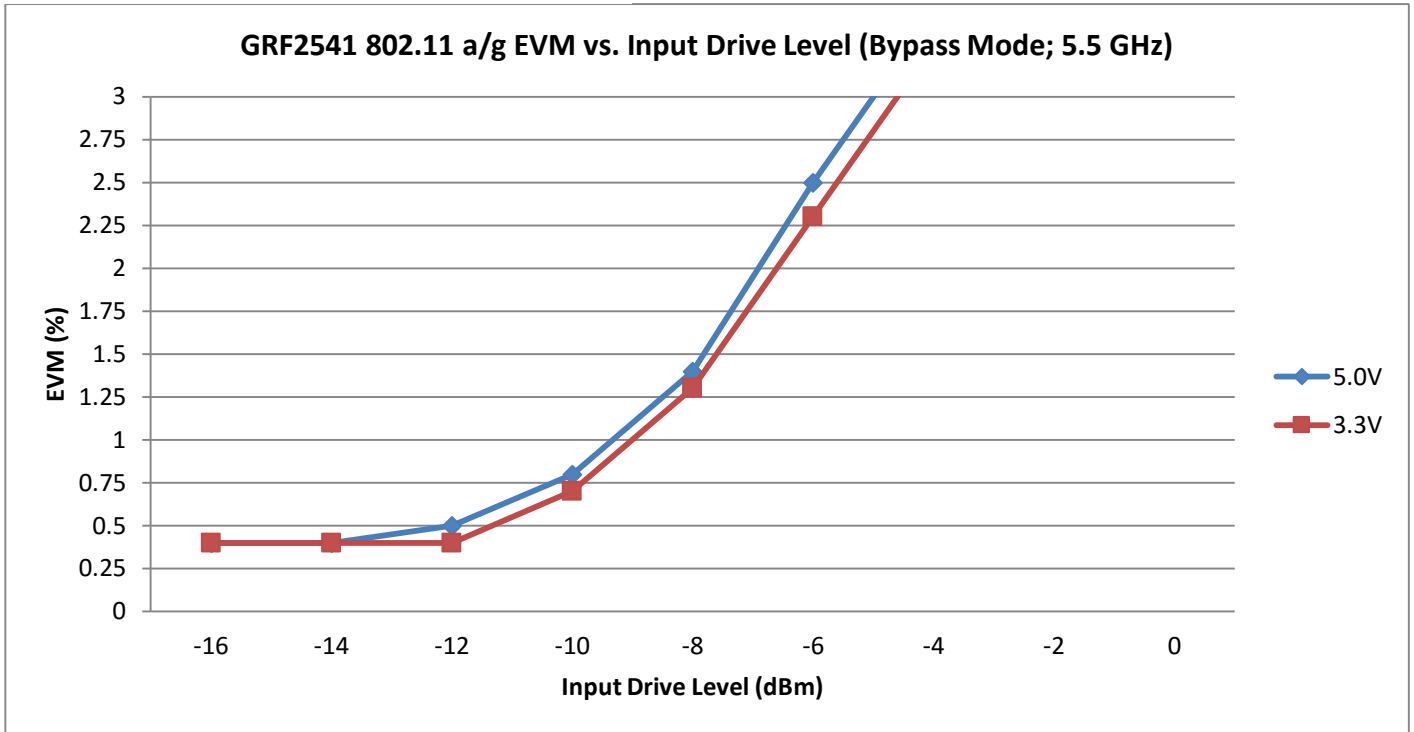
Parameter	Symbol	Specification			Unit	Condition
		Min.	Typ.	Max.		
High Gain Mode						V _{DD} = 3.3 V; Ven: High; Vbyp: 0.0 V
Test Frequency	F _{TEST}		5.5		GHz	
Gain	S ₂₁		17.5		dB	
Gain Flatness	ΔS ₂₁		+/- 0.5		dB	Across 5.1 to 5.925 GHz
Input Return Loss	S ₁₁		-10		dB	
Output Return Loss	S ₂₂		-13		dB	
Noise Figure (De-embedded)	NF		1.0		dB	
Noise Figure (Evaluation Board)	NF		1.2		dB	
Input Power for 1.0% EVM (Gain Mode)	IP1%		-22.0		dBm	Waveform: 802.11a/g; PAR: 11.6 dB
Input Power for 1.0% EVM (Bypass Mode)	IP1%		-9.0		dBm	Waveform: 802.11a/g; PAR: 11.6 dB
Input 1dB Compression Point	IP1dB		-10		dBm	
Supply Current	I _{DD}		15		mA	
Enable Current	I _{ENABLE}		1.0		mA	
Bypass Mode						V _{DD} : 3.3 V; Ven: 0.0 V; Vbyp: High
Gain	S(2,1)		-5.5		dB	
Input 1dB Compression Point	IP1dB		+5.0		dBm	
Disabled Mode (Guerrilla Armor)						V _{DD} = 3.3V, Venable=Vbypass= 0.0 V
Gain	S(2,1)		-32		dB	RF Input Power: +20 dBm
Supply Current (Leakage)	I _{DD}		500		μA	
Enable Current	I _{ENABLE}		0.01		μA	
Thermal Data						
Thermal Resistance (Infra-Red Scan)	Θ _{Jc}		141		°C/W	
Channel Temperature @ +85 C reference package heat sink)	T _{CHANNEL}		91		°C	V _{DD} : 3.3 V; I _{DDQ} : 15 mA; No RF; Dissipated Power: 45 mW

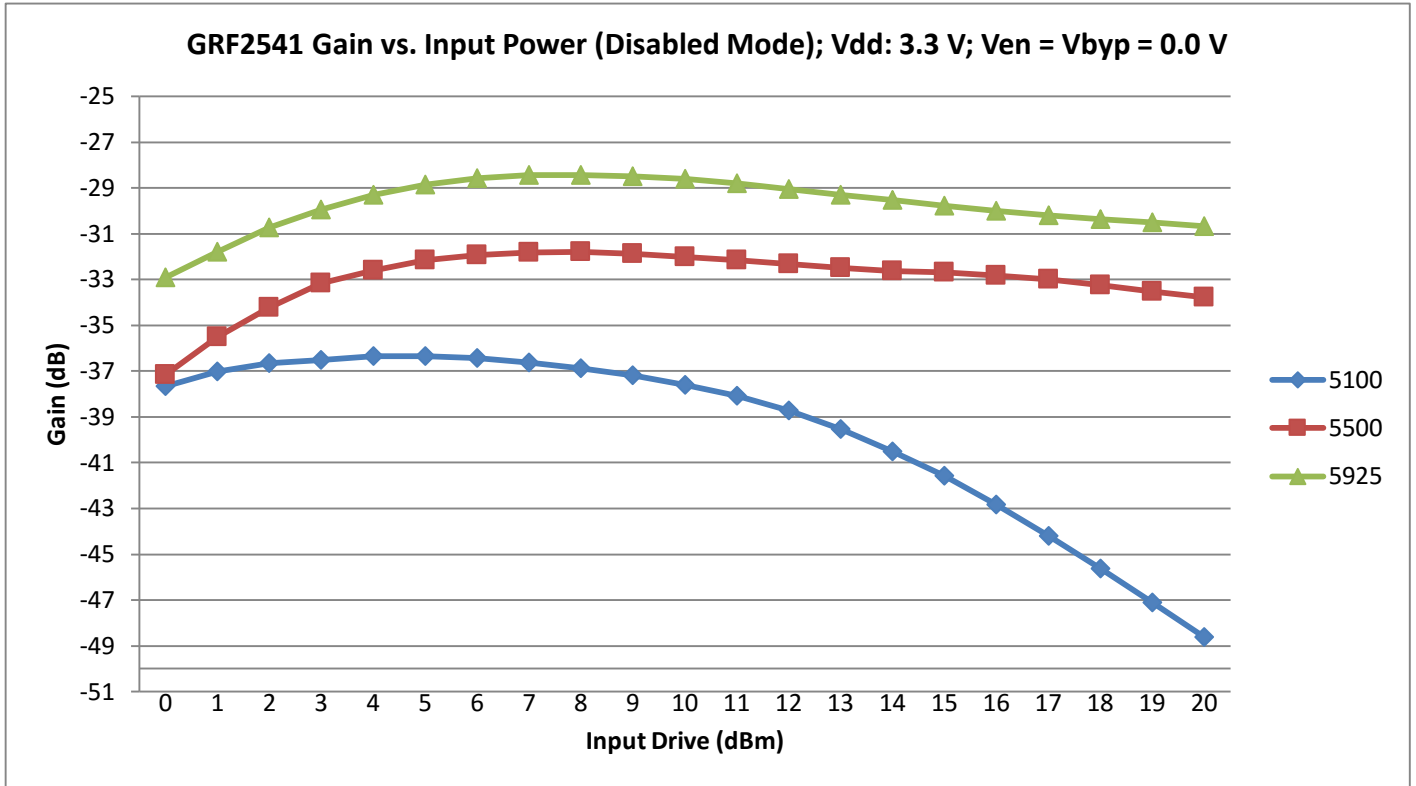
Gain Mode Data:



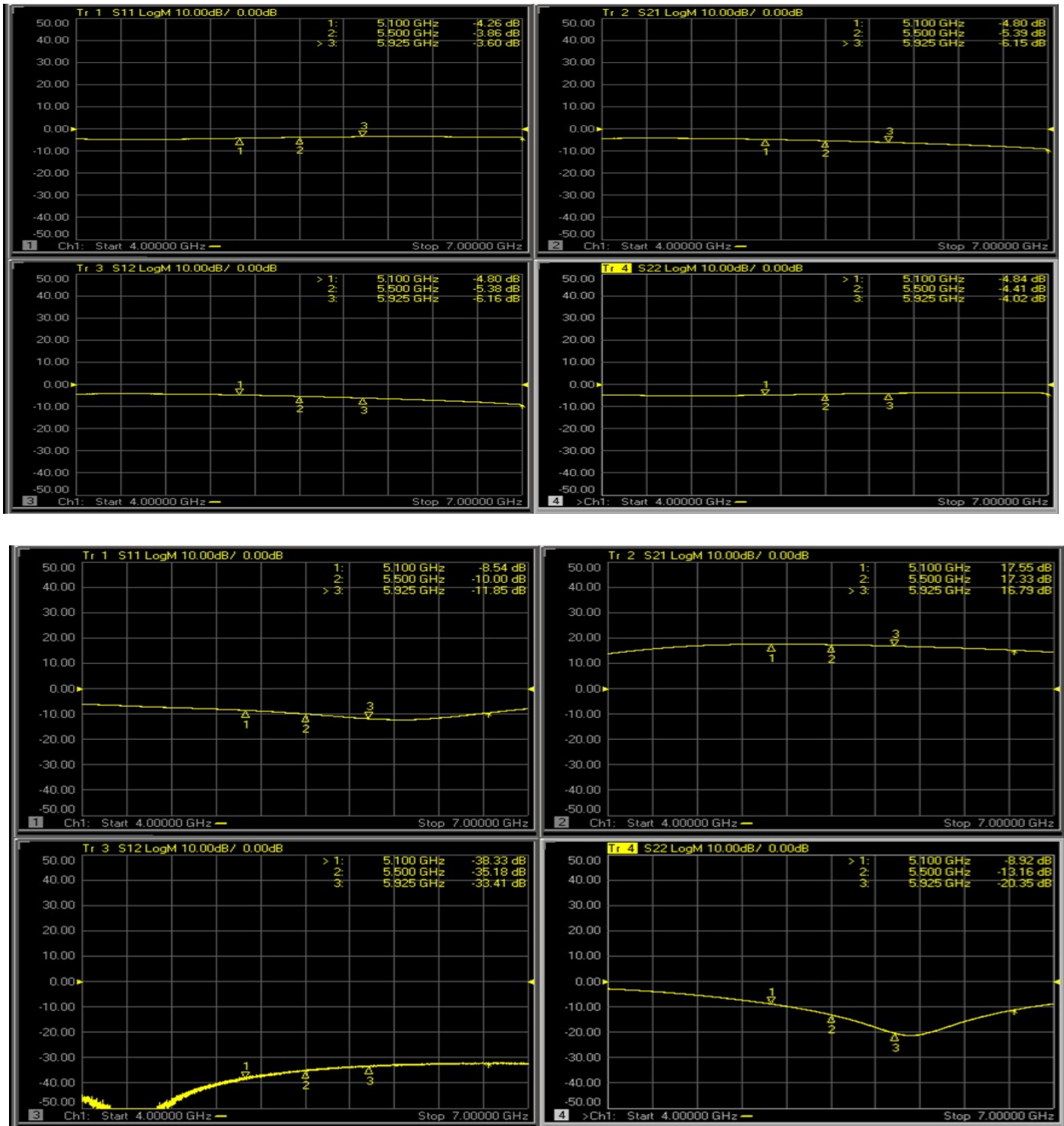


Bypass and Disabled Mode Data:

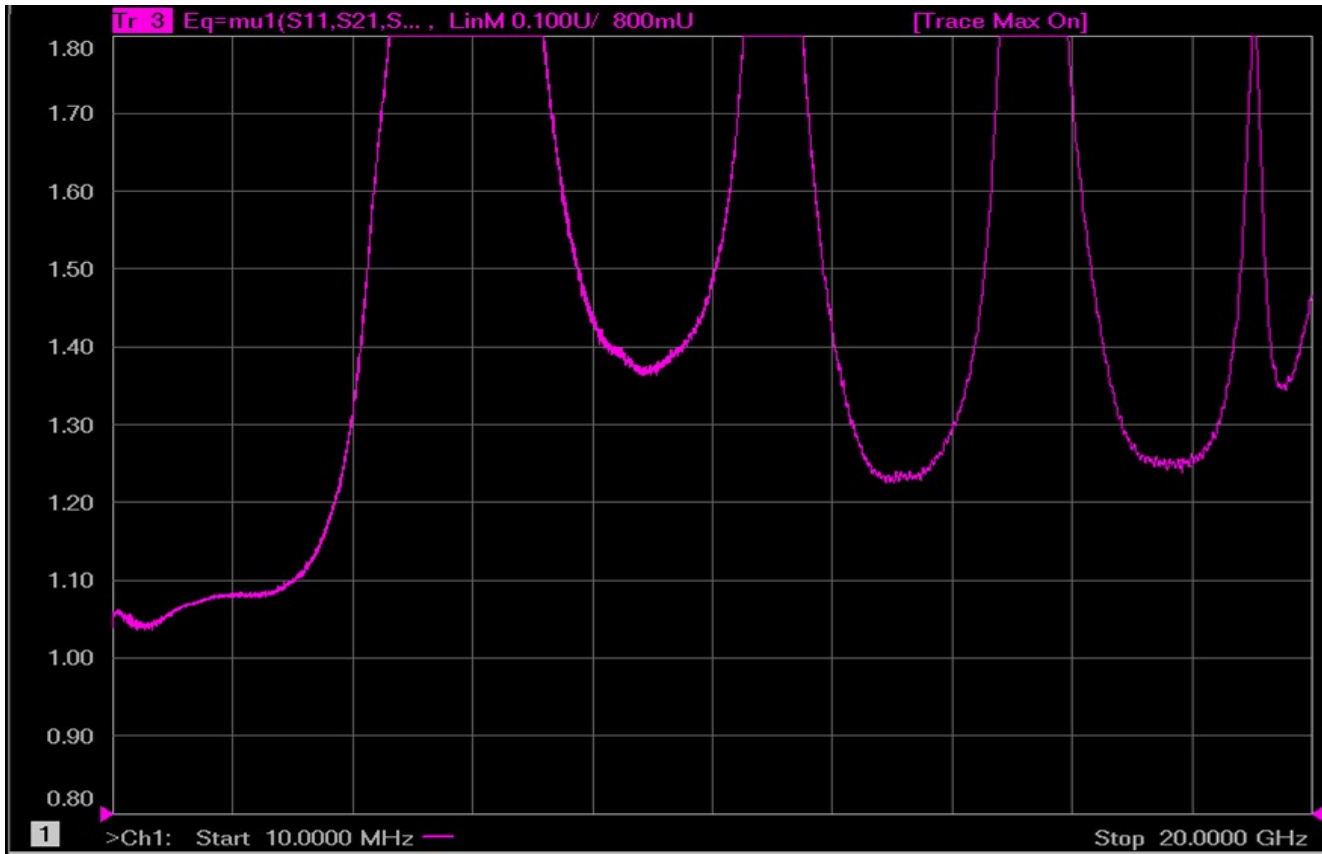




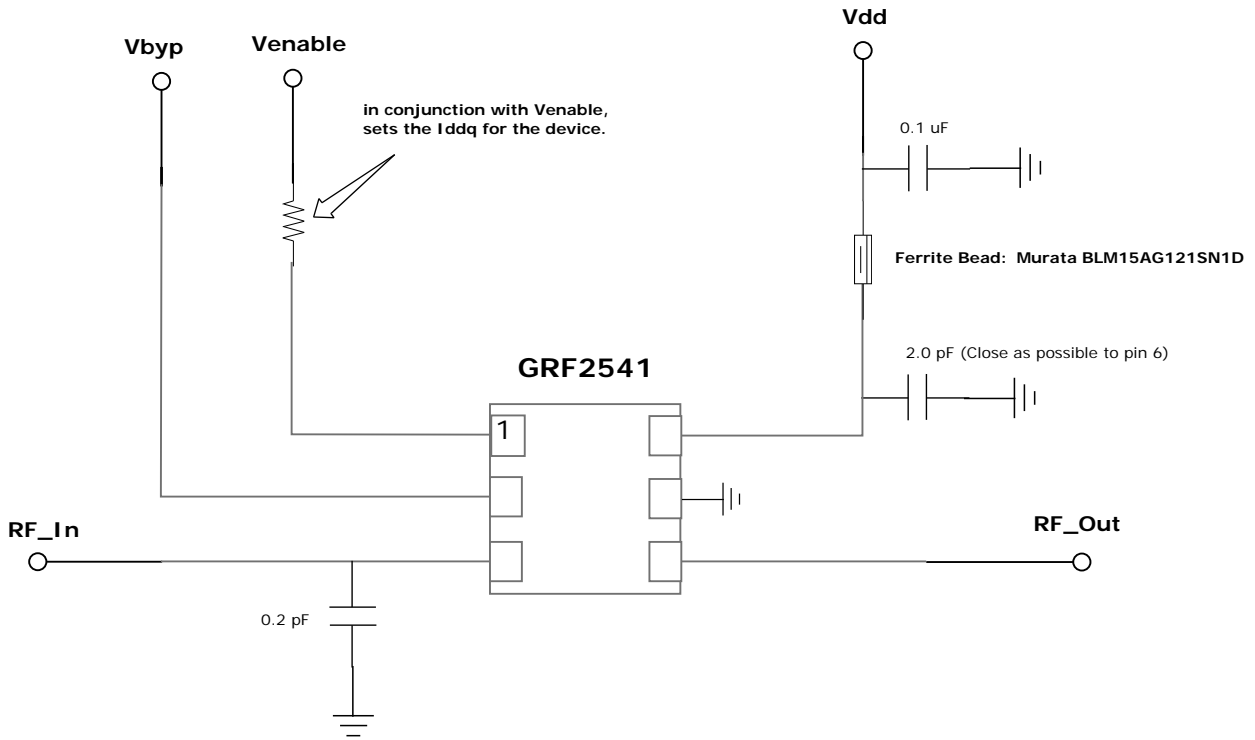
GRF2541 Evaluation Board S-Parms: Gain and Bypass Modes



GRF2541 Evaluation Board Stability Mu Factor:

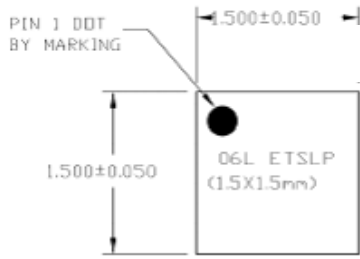


Note: $\mu \geq 1.0$ implies unconditional stability

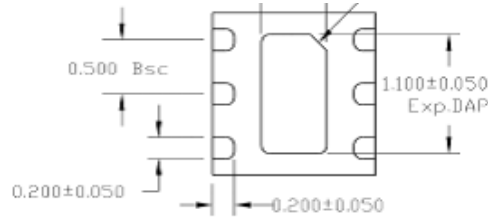


GRF2541 Evaluation Board Application Schematic

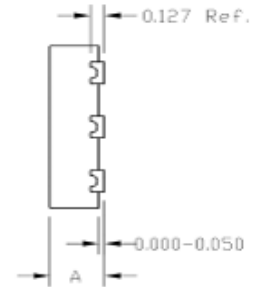
GRF2541 DFN-6 Package Dimensions



TOP VIEW




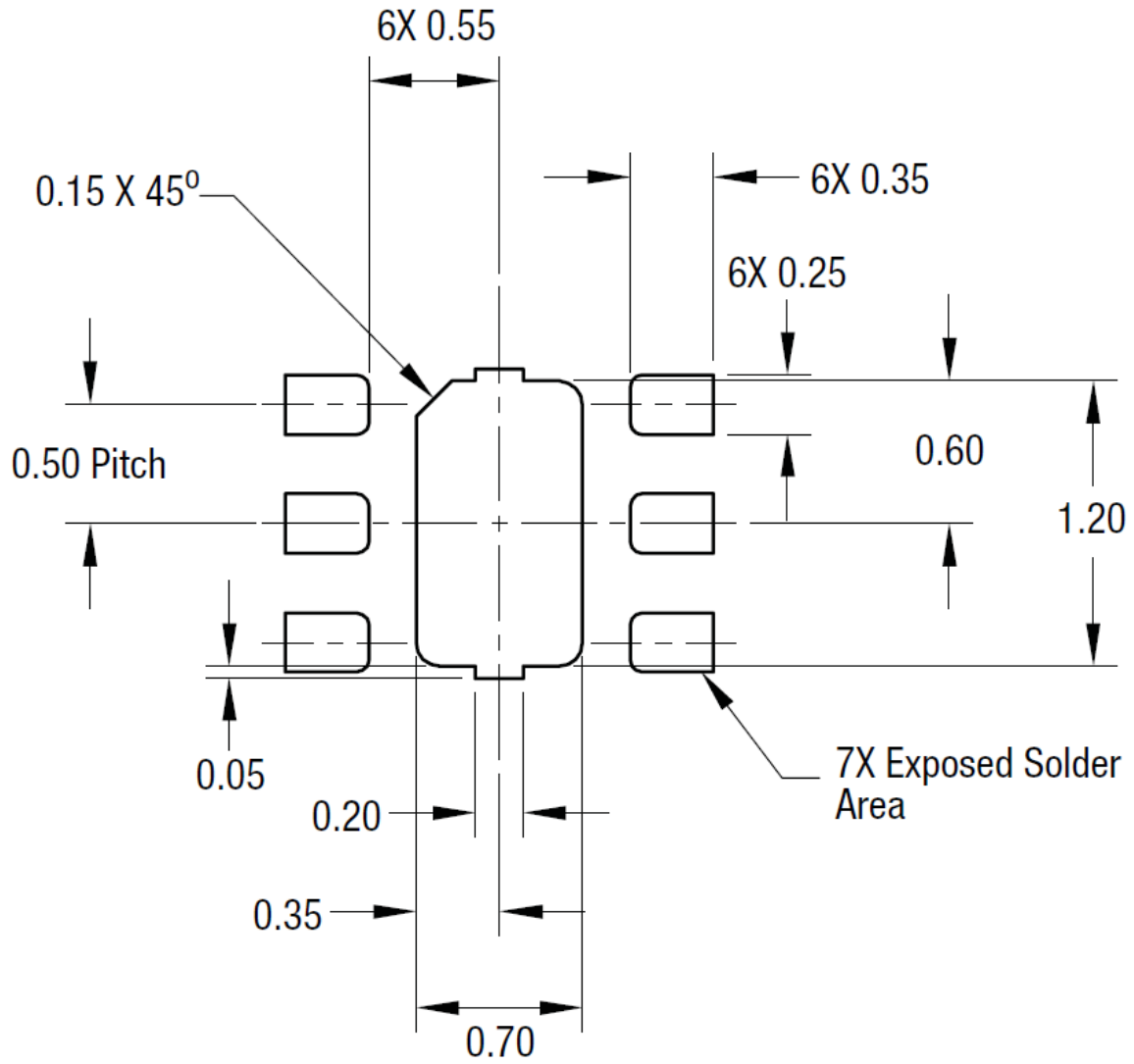
BOTTOM VIEW



SIDE VIEW

A		ETSLP
	MAX.	0.500
	NOM.	0.450
	MIN.	0.400

				TOLERANCES REFER TO SPECIFICATION ABOVE	UNIT: MM	SCALE: NTS	SYMBOL 	DATE:	
								DATE:	
DESCRIPTION	DATE	BY	APPD					REV: 00	SHEET NO. 1 OF 1



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

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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