



Product Description

The GRF3013 is broadband SOT-89 gain block with low noise figure and industry leading linearity designed for small cell, wireless infrastructure and other high performance applications. It exhibits outstanding broadband NF, linearity and return losses over 500 to 2700 MHz with a single match.

Configured as a linear driver or cascaded gain block, GRF3013 offers high levels of reuse both within a design and across platforms. Typically operated from a supply voltage of 5.0 volts, the device delivers outstanding performance with supply voltages from 3.0 to 6.0 volts. This device is a superior, cost effective drop-in replacement for industry standard SOT-89 gain blocks.

GRF3013 is internally matched to 50 Ω 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 and device s-parameters

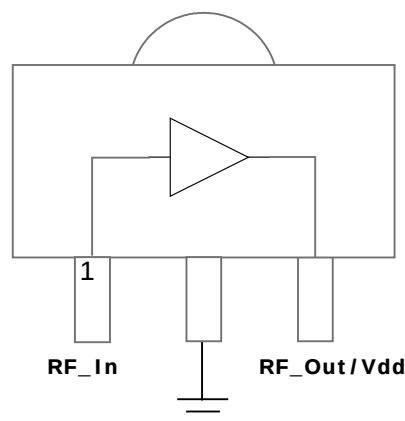
Features

- 0.5 GHz to 2.7 GHz (Single Match)
- Gain: 16.5 dB @ 2.5 GHz
- OIP3: +36.2 dBm @ 2.5 GHz
- OP1dB: +21.2 dBm @ 2.5 GHz
- NF: 2.4 dB @ 2.5 GHz
- Typical Bias: 5.0 V and 85 mA
- Operation to +105C Ambient
- Internally Matched to 50 Ω

Applications

- Linear Driver Amp for High PAR waveforms such as LTE and WCDMA
- Small Cells and Cellular Repeaters
- General Purpose Linear Amplifier
- Drop-in Replacement for Industry Standard High Performance Gain Blocks.

Functional Block Diagram



Absolute Ratings

Parameter	Symbol	Min.	Max.	Unit
Drain Voltage	V _d	0	7.0	V
RF Input Power: (Load VSWR < 2:1; V _D : 5.0 volts)	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 (MTTF > 10 ⁶ Hours)	T _{max}		+160	°C
Maximum Dissipated Power	P _{DISS MAX}		600	mW
Electrostatic Discharge:				
Charged Device Model: (TBD)	CDM	Class 4: 1000		V
Human Body Model: (TBD)	HBM	Class 1B: 500		V
Machine Model: (TBD)	MM	Class A: 50		V



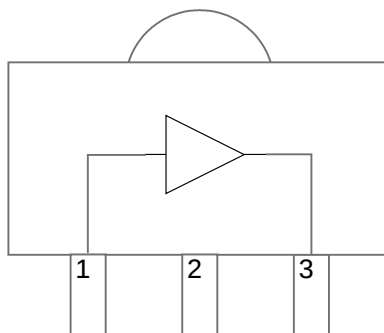
Caution! ESD Sensitive Device

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

Nominal Operating Parameters

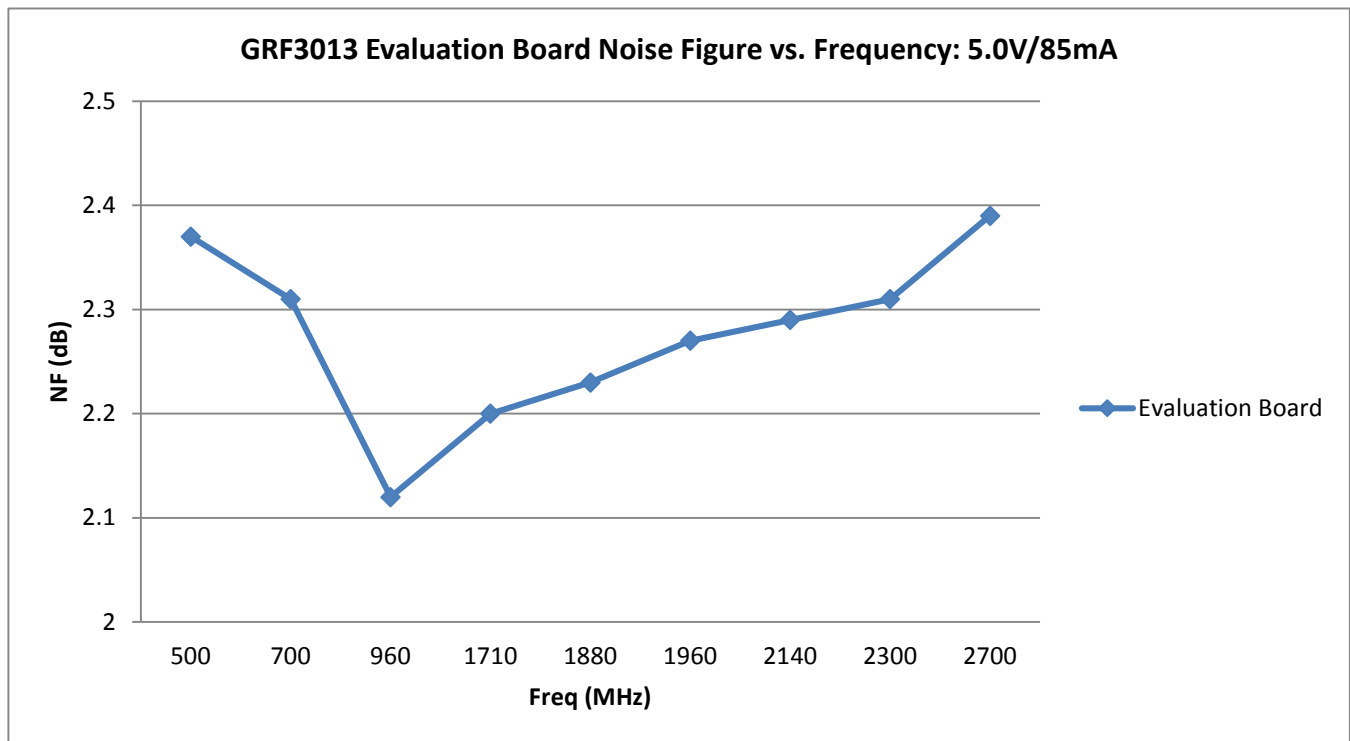
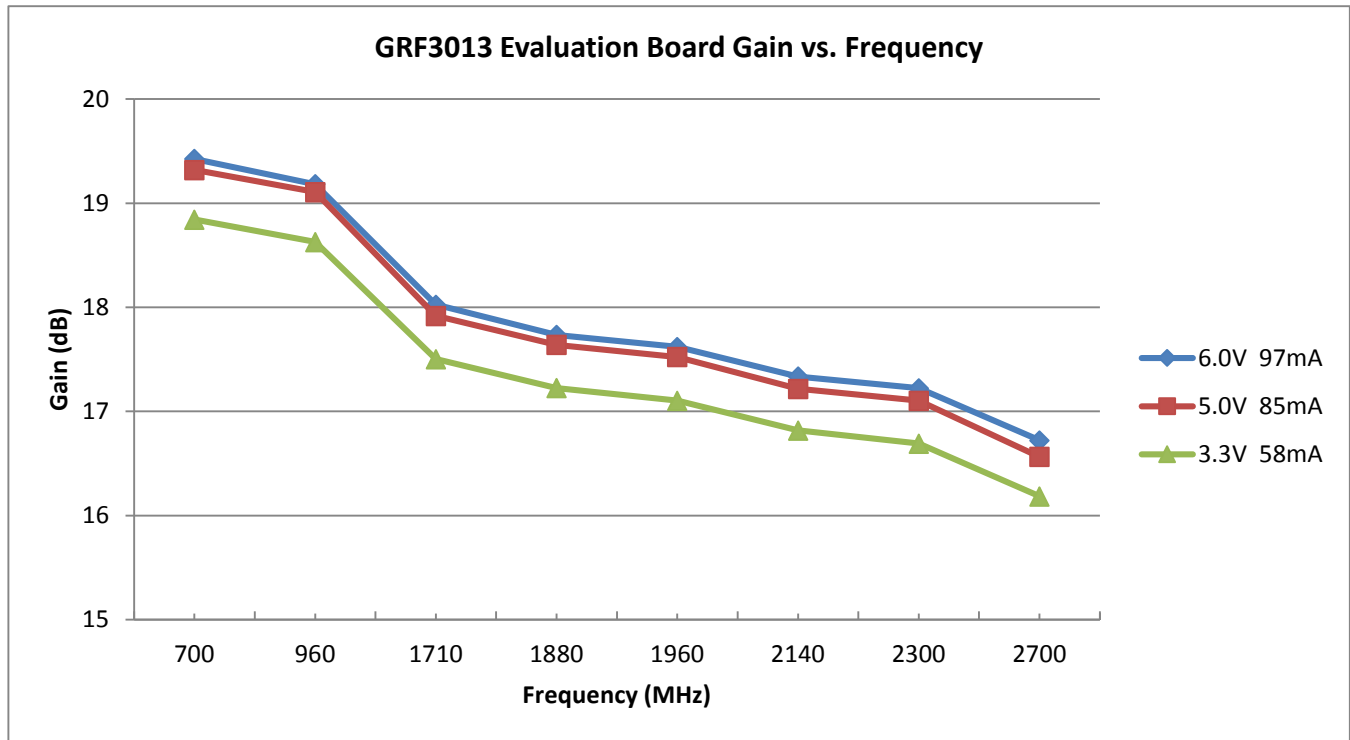
Parameter	Symbol	Specification			Unit	Condition
		Min	Typ.	Max.		
Gain Mode (Venable high)						V _{dd} : 5.0 V, T _A = 25 °C
Test Frequency	F _{TEST}		2500		MHz	
Gain	S ₂₁		16.5		dB	
Input Return Loss	S ₁₁		-15		dB	
Output Return Loss	S ₂₂		-12		dB	
Noise Figure	NF		2.4		dB	Input trace losses de-embedded
Output 3rd Order Intercept	OIP3		+36.2		dBm	+7.0 dBm P _{OUT} per tone at 2 MHz Spacing (2499 and 2501 MHz)
Output 1dB Compression Power	OP1dB		+21.2		dBm	
Switching Rise Time	T _{RISE}		300		ns	
Switching Fall Time	T _{FALL}		300		ns	
Supply Current	I _{dd}		85		mA	
Enable Current	I _{enable}		2		mA	
Thermal Data						
Thermal Resistance (measured via IR scan)	Θ _{jc}		55		°C/W	On standard evaluation board
Channel Temperature @ +85 C Reference (Package Heat Sink)	T _{channel}		+108		°C	V _d : 5.0 V; I _{ddq} : 85 mA; No RF; P _{diss} : 425 mW

Pin Out (Top View)

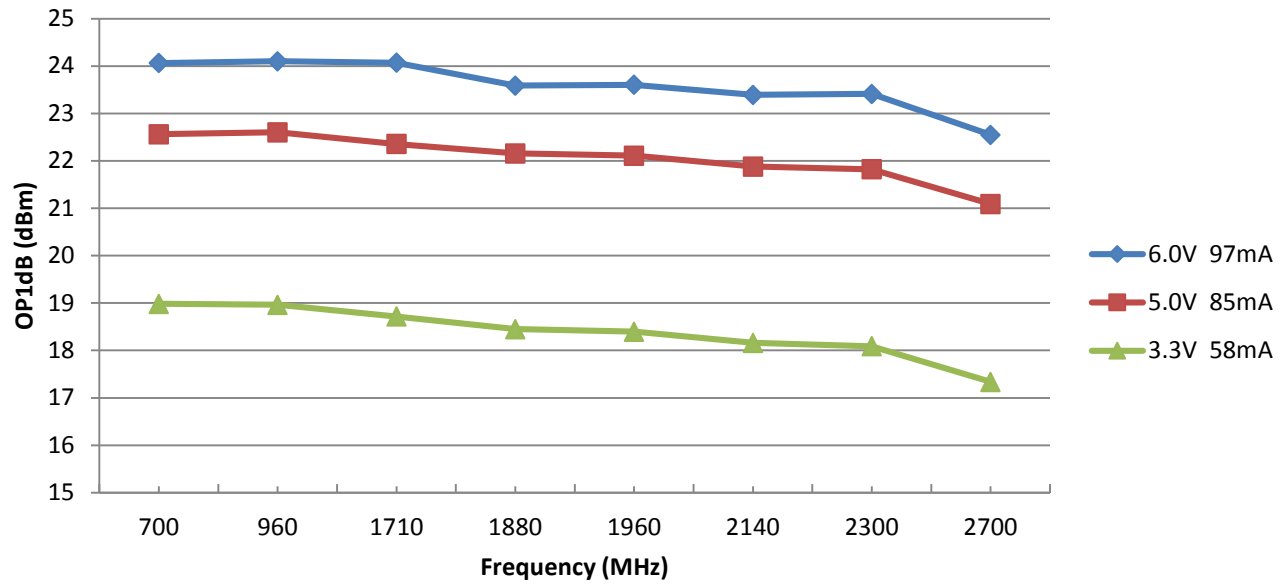


Pin Assignments

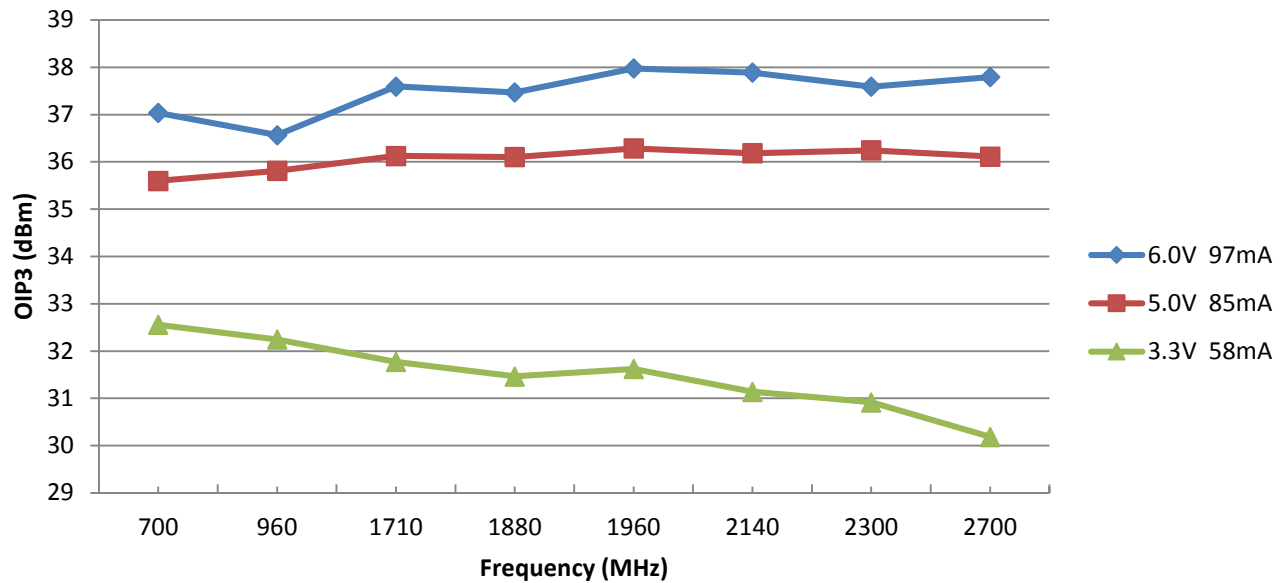
Pin	Name	Description	Note
1	RF_IN	RF Input	Venable < 0.2 volts turns the device off. Venable and series resistor M3 control the device Iddq.
2	GND	Ground	Connect to ground for maximum RF performance.
3	RF_OUT	RF Output	Internally matched 50 Ω . Requires external DC block.
PKG BASE	GND	Ground	Provides DC and RF ground for LNA, as well as thermal heat sink. Use multiple ground vias beneath the package for optimal RF and thermal performance.



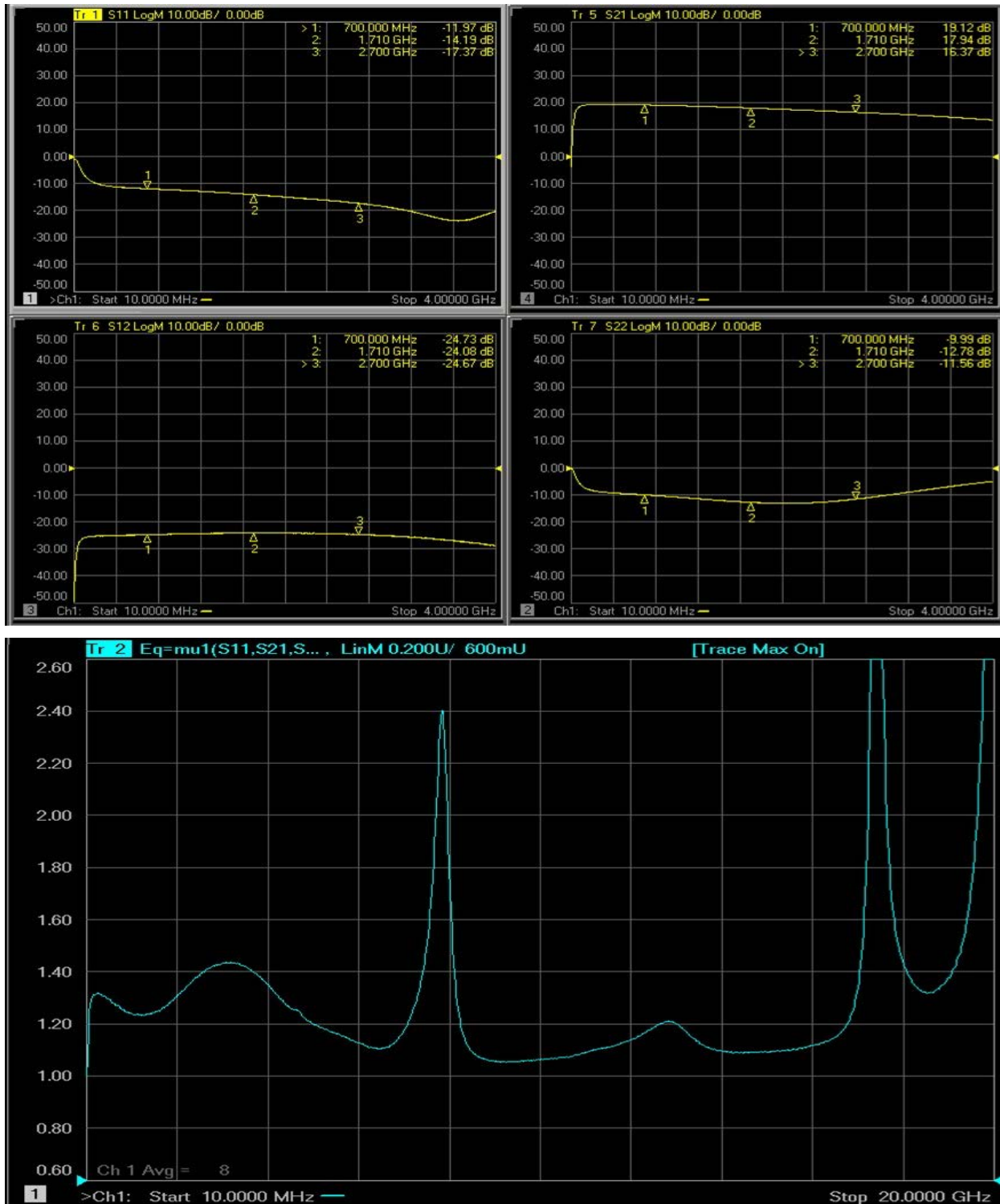
GRF3013 Evaluation Board OP1dB vs. Frequency



GRF3013 Evaluation Board OIP3 vs. Frequency



GRF3013 Evaluation Board S-Parameters and Stability Mu Factor (500 - 2700 MHz Match)

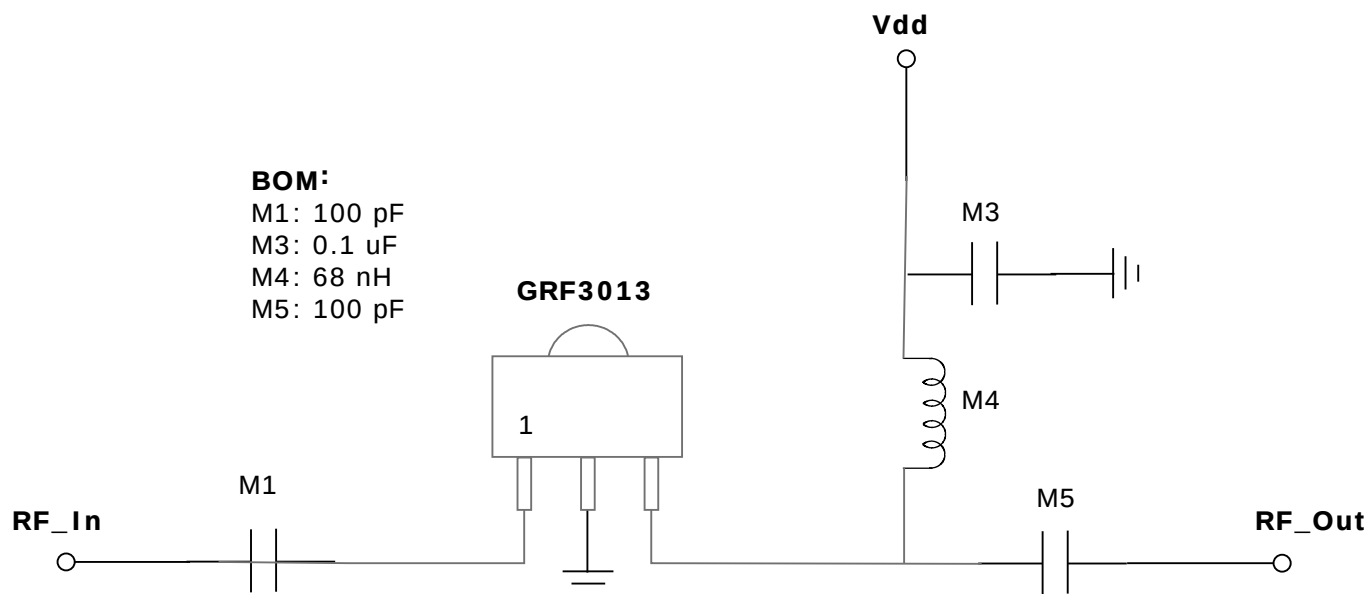


Note: $\mu \geq 1.0$ implies unconditional stability

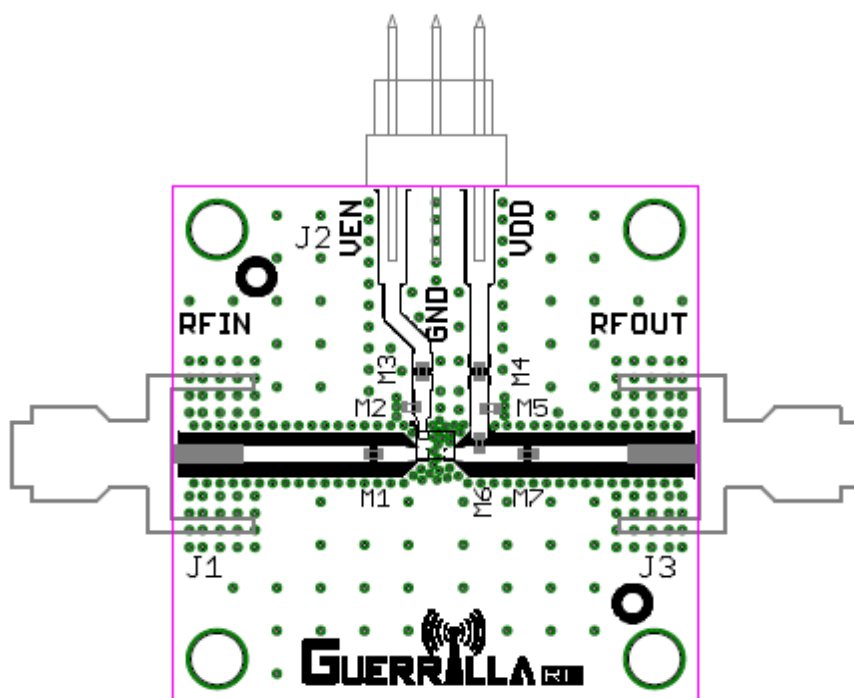
GRF3013 Theory of Operation:

The GRF3013 is a high gain, ultra linear gain block that is suitable for a wide range of applications. In an industry standard SOT-89 package, it can be a superior drop-in replacement for today's industry leading gain blocks. The device is internally matched to 50 ohms and covers 500 - 2700 MHz with a single set of DC blocking caps (M1) and (M5) and bias inductor (M4). With changes to the simple external matching, the device offers outstanding performance from 50 MHz to 3800 MHz.

For this SOT-89 device, the I_{ddq} is directly proportional to V_{dd} . The device delivers outstanding gain and linearity with V_{dd} over a range of 3.0 to 6.0 volts.

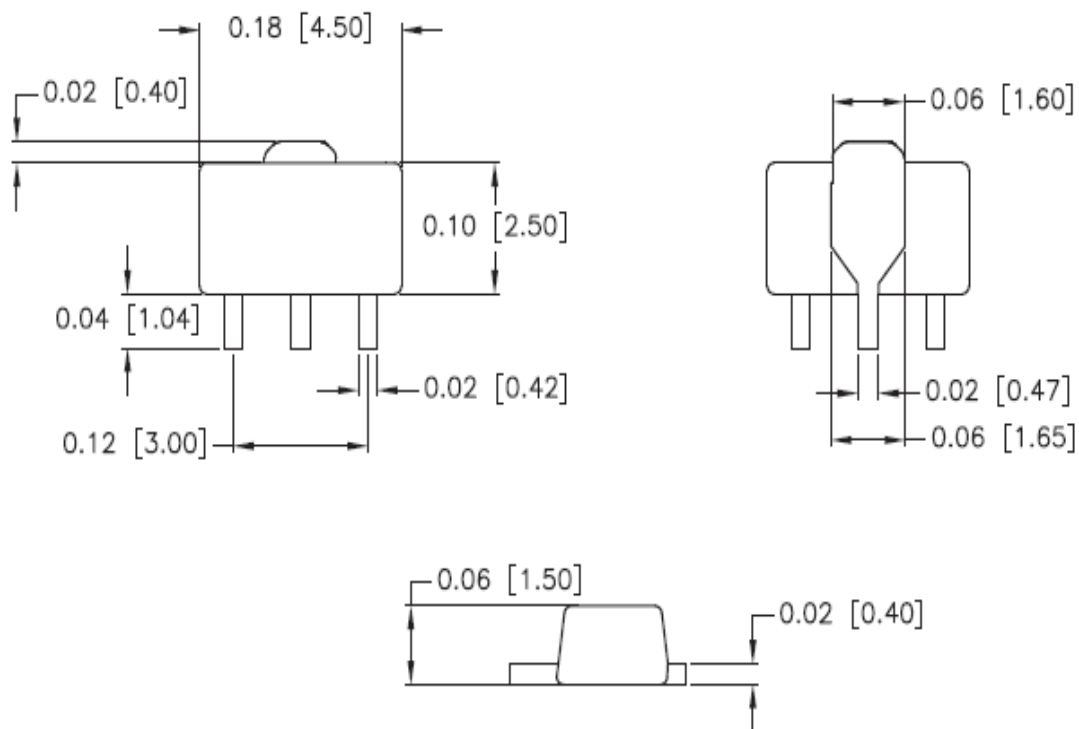


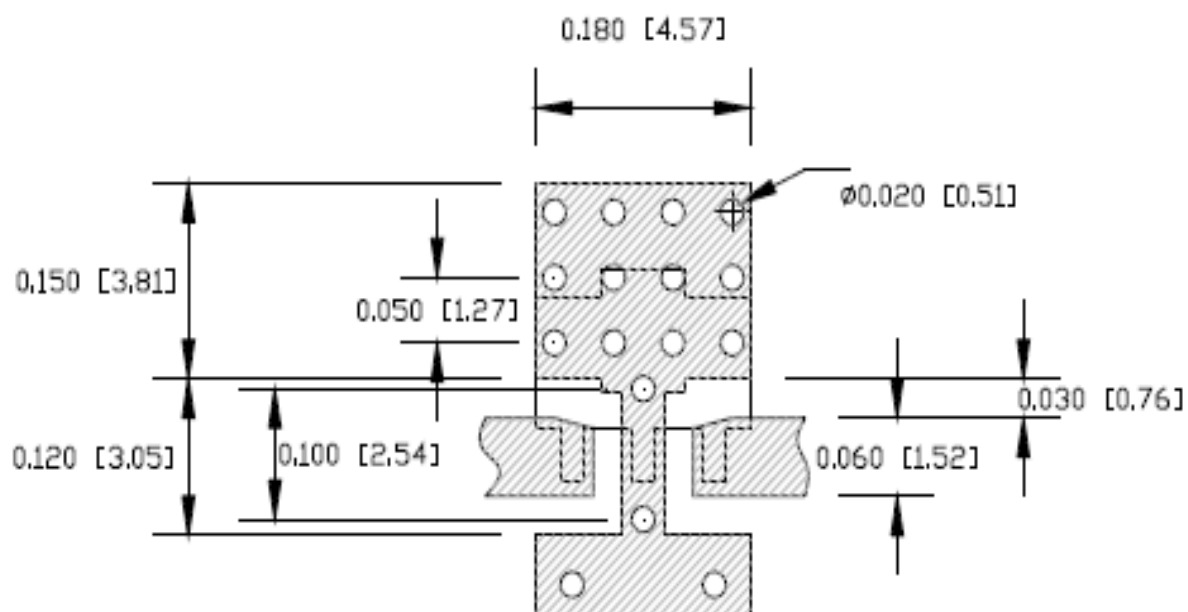
GRF3013 Evaluation Board Application Schematic



GRF2013 Evaluation Board Assembly Diagram

Dimensions in inches (millimeters)

**GRF3013 SOT-89 Package Dimensions**

**GRF3013 SOT-89 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.

Information in this datasheet is specific to the Guerrilla RF, LLC ("Guerrilla RF") product identified.

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