GRF3042

Preliminary

Broadband Gain Block
10 MHz to 13.0 GHz

Features

- Reference: 4.0 GHz; Iddq: 45 mA
- Gain: 14.3 dB
- OP1dB: 14.0 dBm
- OIP3: 26.0 dBm
- NF: 3.0 dB

- Internally Matched to 50 Ω
- Process: GaAs pHEMT

Applications

- Microwave Backhaul
- C and X-Band Amplifiers
- General Purpose Amplifiers
- Instrumentation

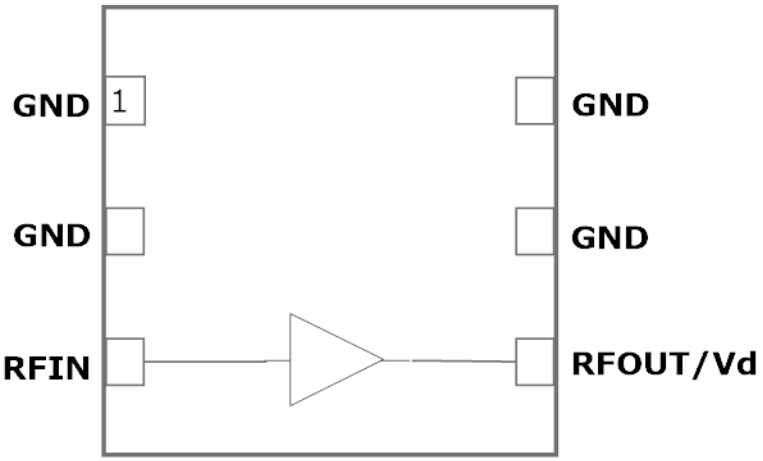
Product Description

GRF3042 is a broadband low noise gain block designed for applications in the 0.05 to 13.0 GHz spectrum, exhibiting a typical low noise figure (NF) of 3.5 dB along with high gain.

This resistively biased device employs an external resistor in series with VDD to set a nominal IDDQ of 45 mA. GRF3042 is internally matched to 50Ω at the input and output ports.

The device can be operated down to low frequency via the selection of suitably large input/output caps and bias inductor.

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



1.5 x 1.5 mm DFN-6

Absolute Ratings:

Parameter	Symbol	Min.	Max.	Unit
Drain Voltage	V_D	0	6.0	V
RF Input Power: (Load VSWR < 2:1; V_D: 5.0 volts)	$P_{IN\ MAX}$		17	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	$P_{DISS\ MAX}$		350	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	--

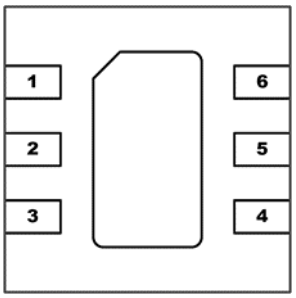
Caution! ESD Sensitive Device

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

Note: For package dimensions and manufacturing information, see the Guerrilla-RF.com website for the following document located on the GRF3042 landing page: Manufacturing Note—MN-001 Product Tape and Reel, Solderability and Package Outline Specification.

Link to manufacturing note

Pin Out (Top View)



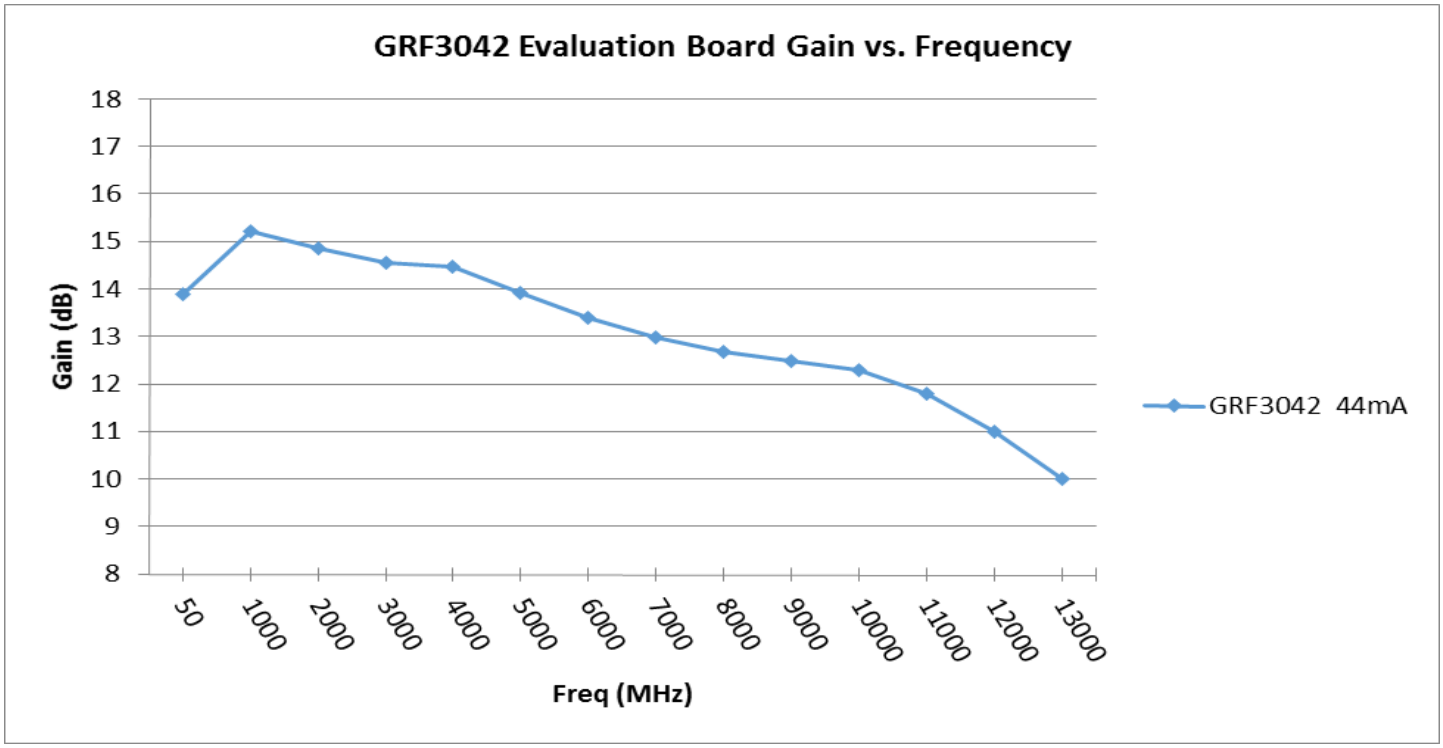
Pin Assignments:

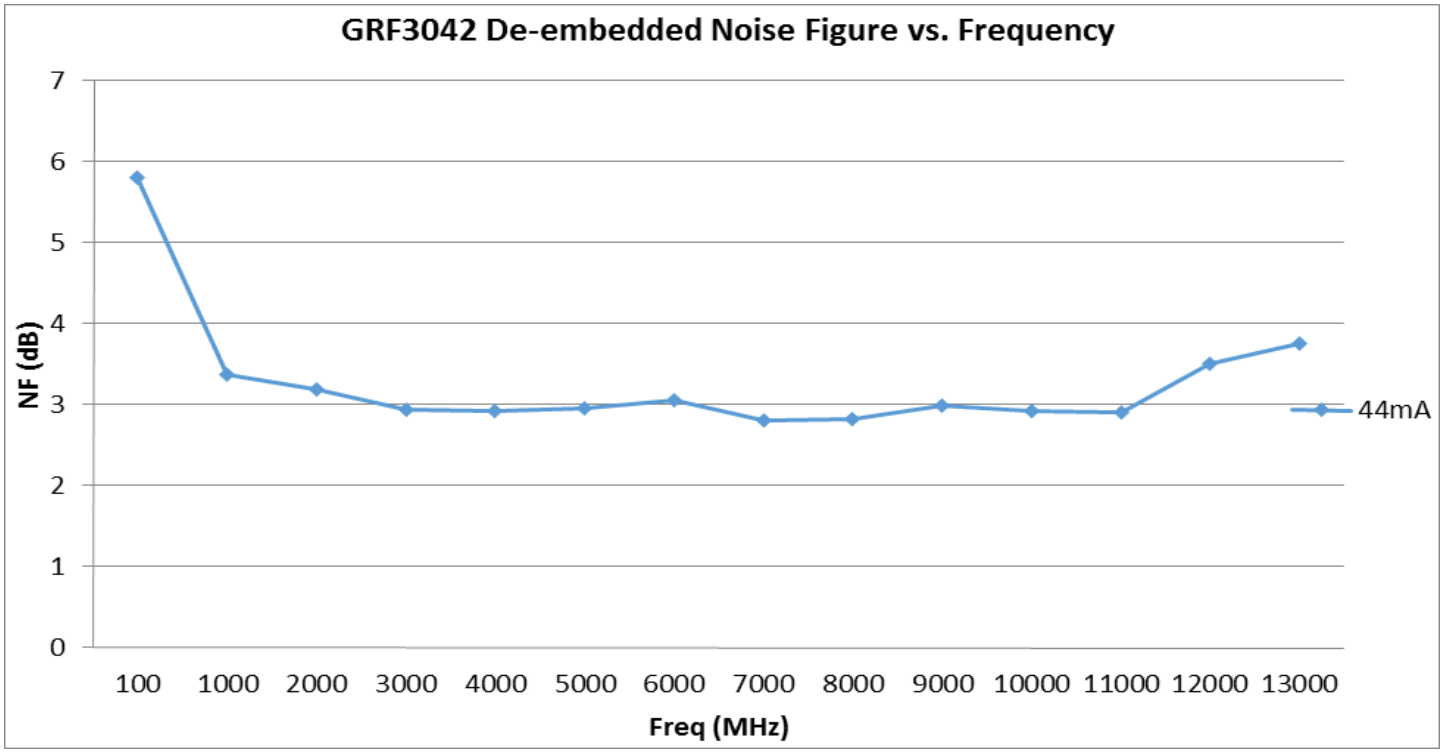
Pin	Name	Description	Note
1	NC	No Connect or Ground	No internal connection to die
2	NC	No Connect or Ground	No internal connection to die
3	RF_In	LNA RF input	Internally matched 50Ω. An external DC blocking cap must be used.
4	RF_Out/V_{DD}	LNA RF output	Internally matched 50Ω. V_{DD} must be applied through a choke to this pin
5	NC	No Connect or Ground	No internal connection to die
6	NC	No Connect or Ground	No internal connection to die
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.

Nominal Operating Parameters:

Parameter	Symbol	Specification			Unit	Condition
		Min.	Typ.	Max.		
Gain Mode (Venable high)						I_{DDQ} = 45 mA, T_A = 25°C
Test Frequency	F_{TEST}		4.0		GHz	
Gain	S21	13.3	14.3		dB	
Noise Figure	NF		3.0		dB	Input trace losses de-embedded
Output 3rd Order Intercept	OIP3		26.0		dBm	0 dBm P_{OUT} per tone at 2 MHz Spacing (3999 and 4001 MHz)
Output 1dB Compression Power	OP1dB	13.0	14.0		dBm	
Switching Rise Time	T_{RISE}		500		ns	
Switching Fall Time	T_{FALL}		500		ns	
Supply Current	I_{DDQ}	40	45	50	mA	Ref: V_{DD}: 7.0 V; R_{BIAS}: 22 Ohm
Thermal Data						
Thermal Resistance (measured via IR scan)	Θ_{jc}		218		°C/W	On standard evaluation board
Channel Temperature @ +85 C Reference (Package Heat Sink)	$T_{CHANNEL}$		149		°C	V_D: 5.9 V; I_{DDQ}: 50 mA; No RF; P_{DISS}: 295 mW

GRF3042 Evaluation Board Measured Data:





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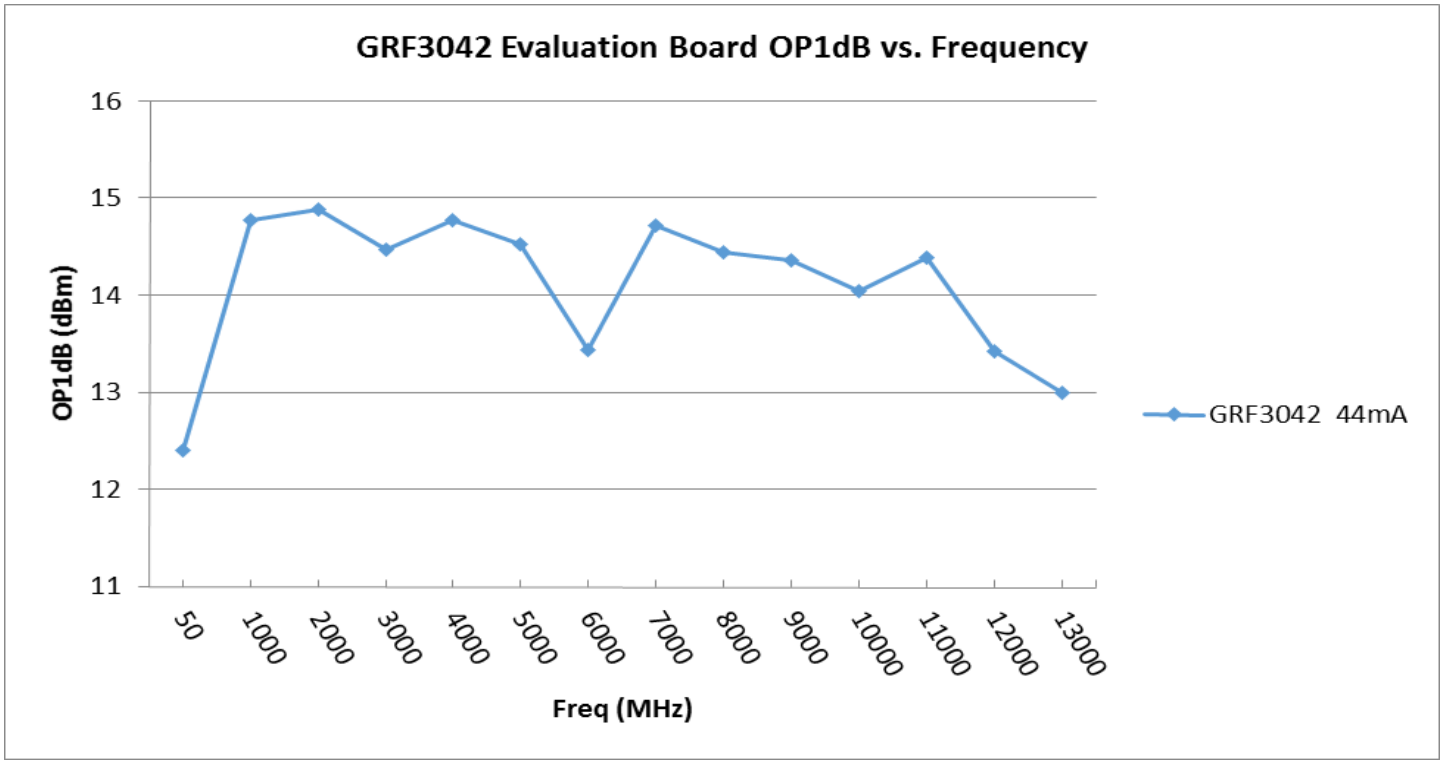
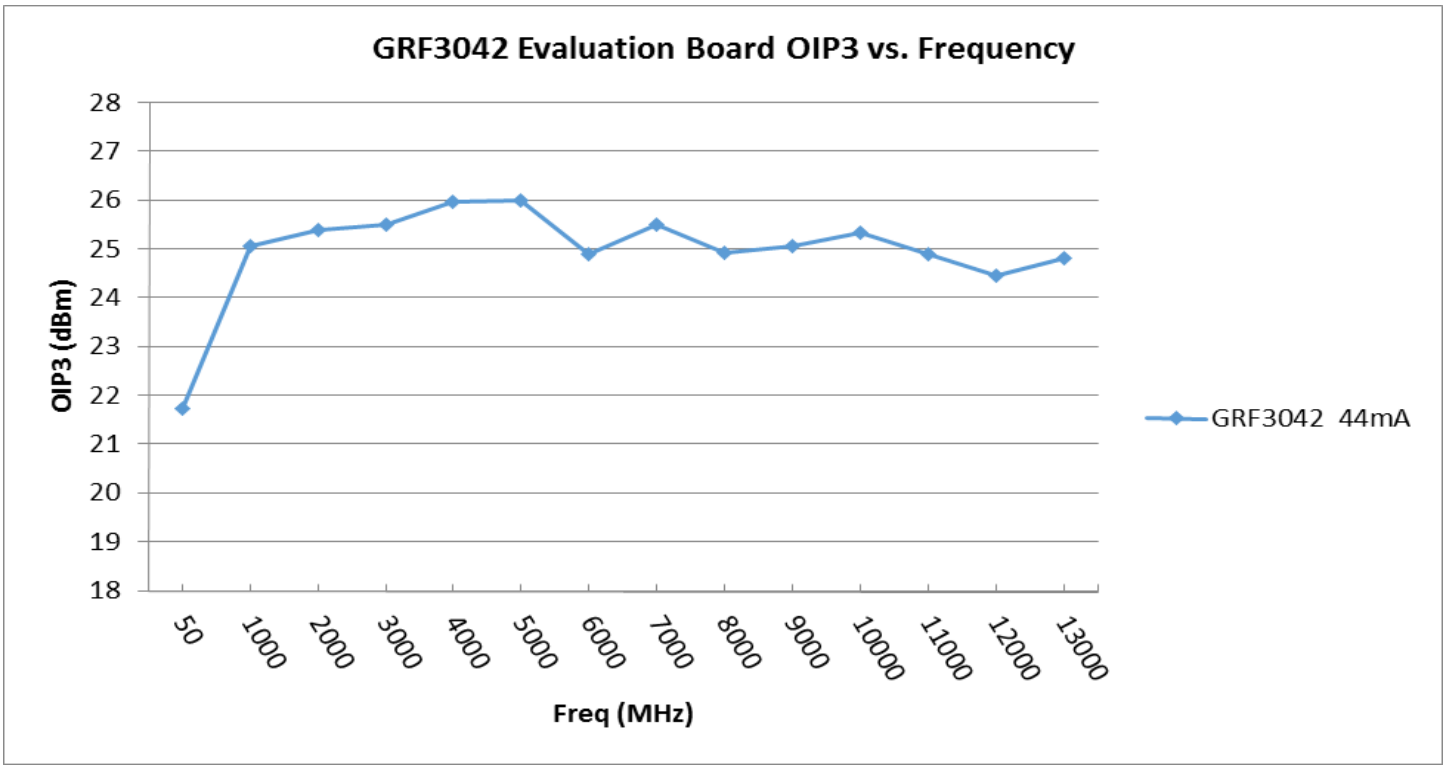
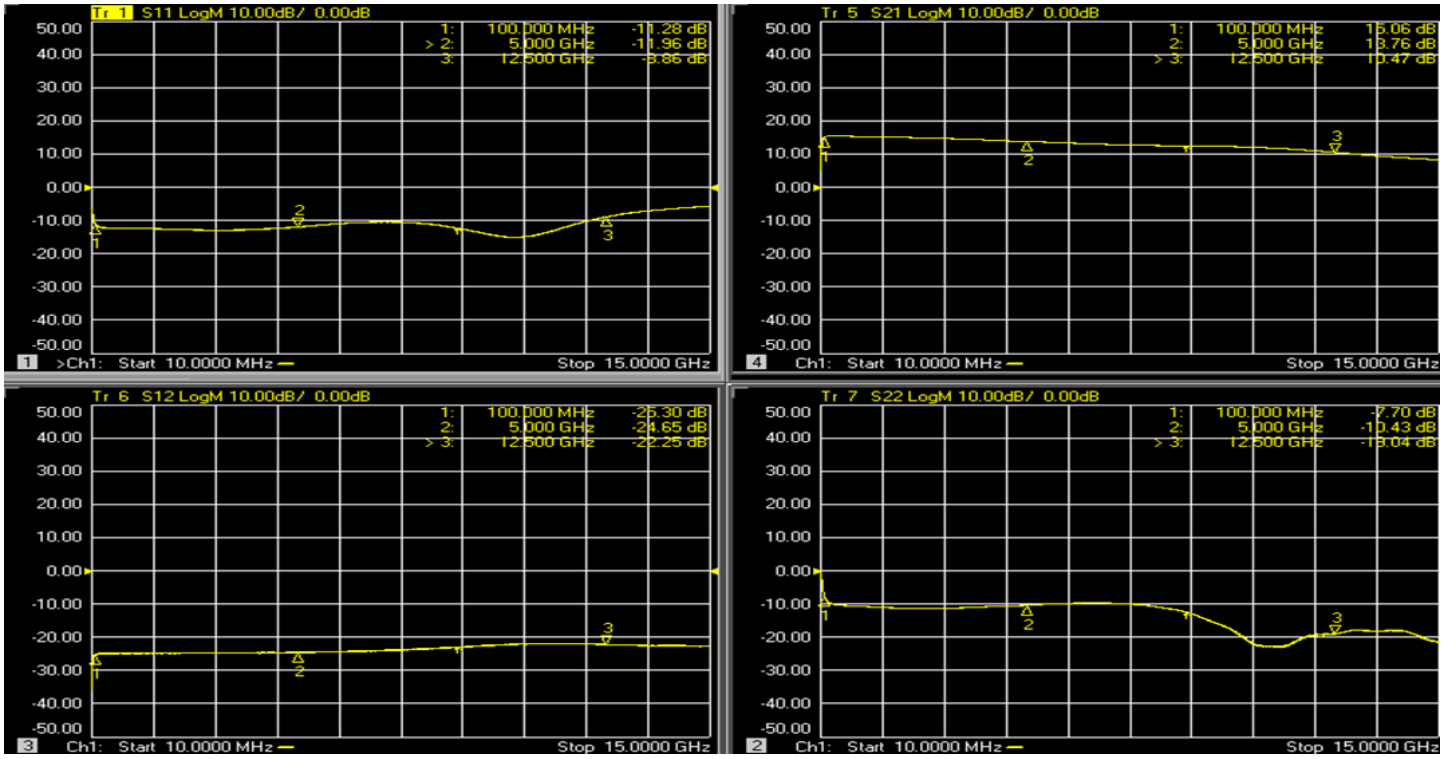
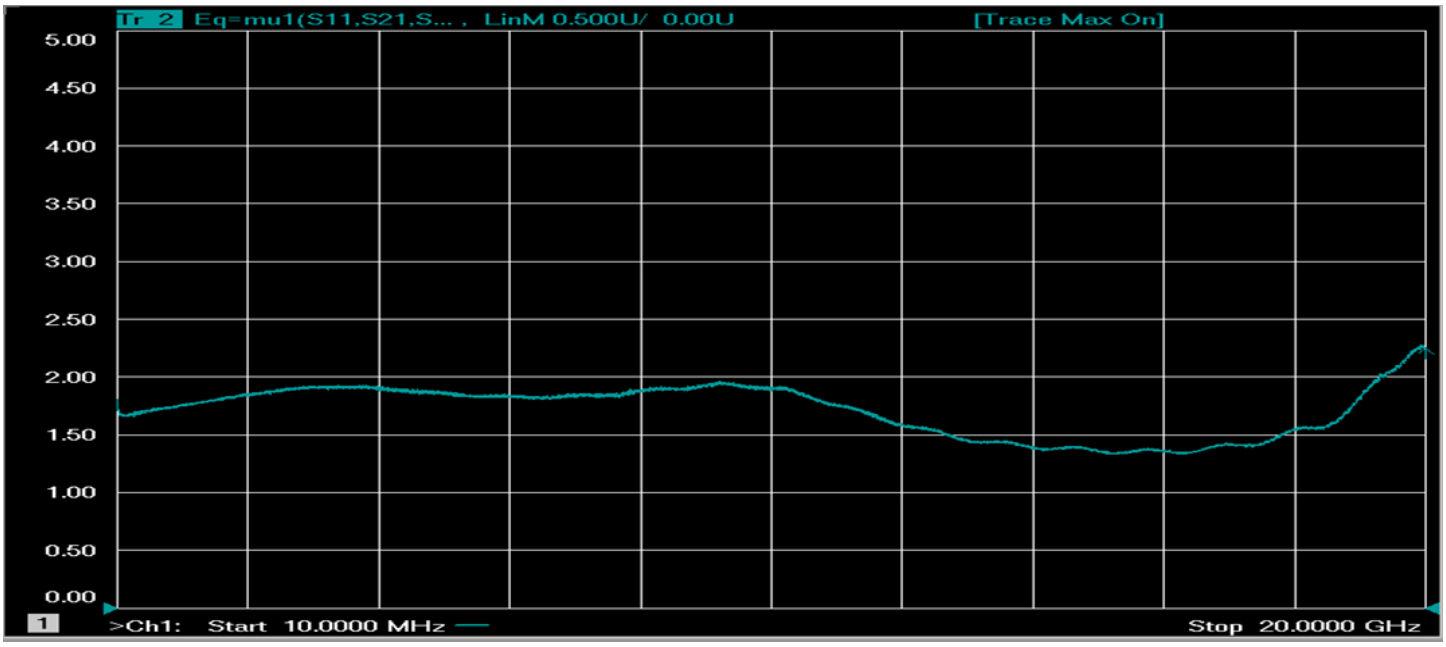


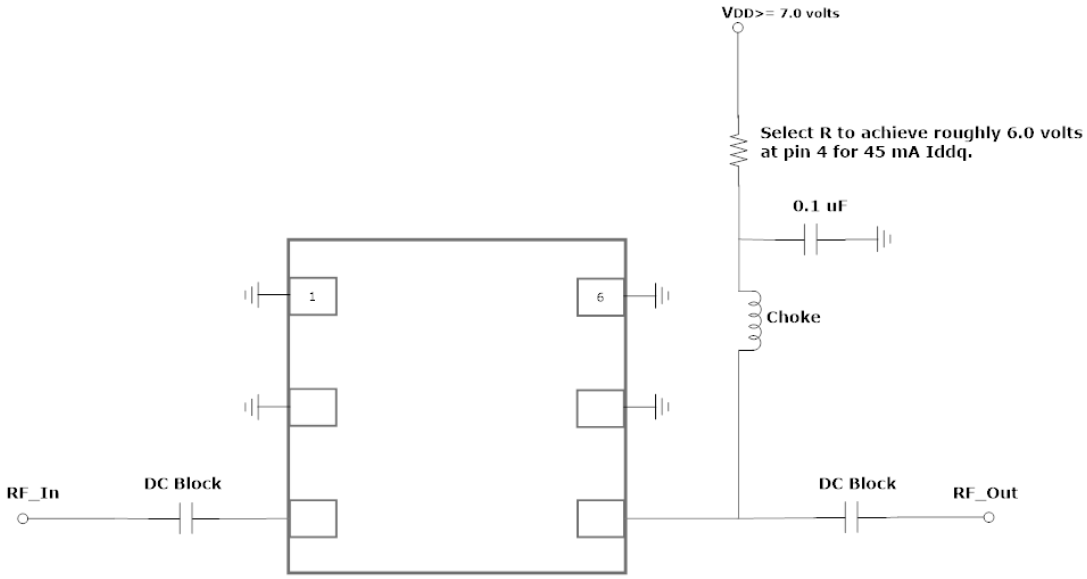


GRF3042 Evaluation Board S-Pars and Stability Mu Factor:

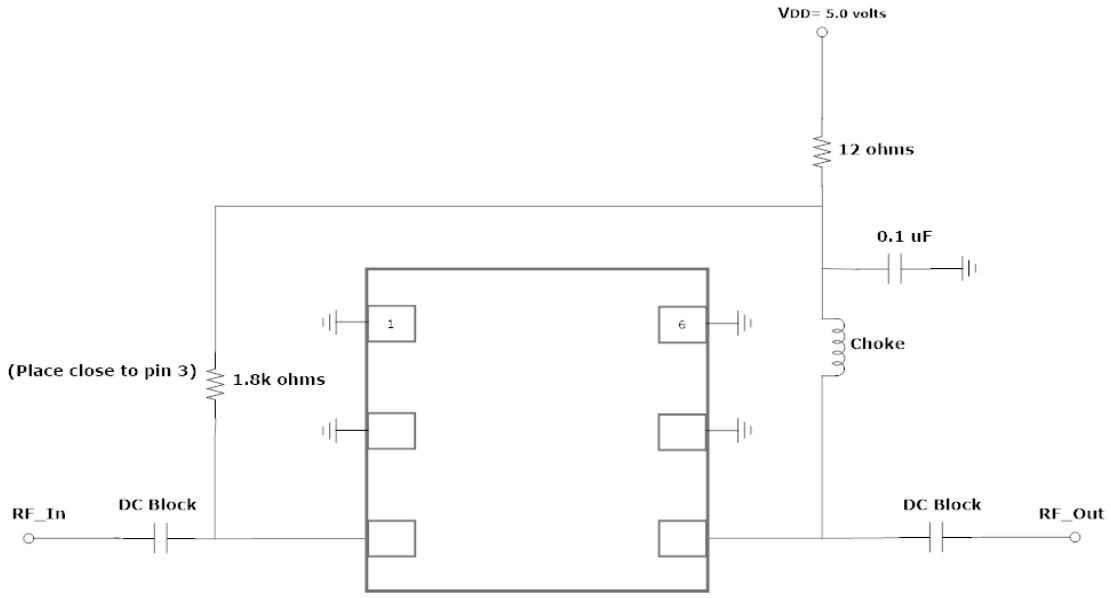




Note: Mu factor >= 1.0 implies unconditional stability.



GRF3042 Standard Application Schematic



GRF3042 5-Volt Application Schematic

GRF3042 Theory of Operation:

The GRF3042 is a broadband gain block amplifier that is suitable for a wide range of applications. The device is internally matched to 50 ohms and covers 0.05 to 13.0 GHz requiring only a broadband choke to supply the device drain voltage (V_D) and current (I_{DD}) at pin 4.

This amplifier uses a resistive bias scheme requiring an external resistor in series with the supply voltage (V_{DD}). The device quiescent bias current (I_{DDQ}) is proportional to the V_D. The target Iddq is 45 mA and this requires a V_D of 6.0 volts. In order to have sufficient resistive feedback in the bias circuit, the minimum recommended V_{DD} is 7.0 volts. A 22 Ohm net resistance (Resistor plus bias choke DC resistance) in series with 7.0 volts V_{DD} will deliver the required 6.0 Volt drain voltage to the output pin of the device. Larger values of V_{DD} would simply require a larger bias resistor to achieve the desired 45 mA and 6.0 volts on pin 4.

Operating the device with a 6.0 Volt supply and no series resistor is not recommended as this condition would provide no bias current stability over normal process and temperature variations.

5-Volt Operation: The device can be operated with Vdd as low as 5 volts and the required 5-Volt application schematic is shown immediately below the standard schematic.

BOM: DC blocking caps must be used on both RF_In and RF_Out. These caps also need to be essentially an RF short over the band of interest. The bias inductor should be an RF choke over the target frequency range. For general purpose, extreme broadband performance, a large value conical inductor such as the Piconics: 220 nH (CC19T40K240G5-C) makes a good choice for the bias inductor.

Note: The performance plots shown in this document were taken on the VNA using the instrument bias T to provide the bias voltage/current to pin 6.

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.