GRF4005

Released

Broadband LNA/Linear Driver
Tuning Range: 0.1—3.8 GHz

Features

Reference: 5V/170mA/2.5 GHz

- EVB NF: 0.88 dB
- Gain: 12.8 dB
- OP1dB: 27.5 dBm
- OIP3: 42.0 dBm

- Flexible Bias Voltage and Current
- Process: GaAs pHEMT

Applications

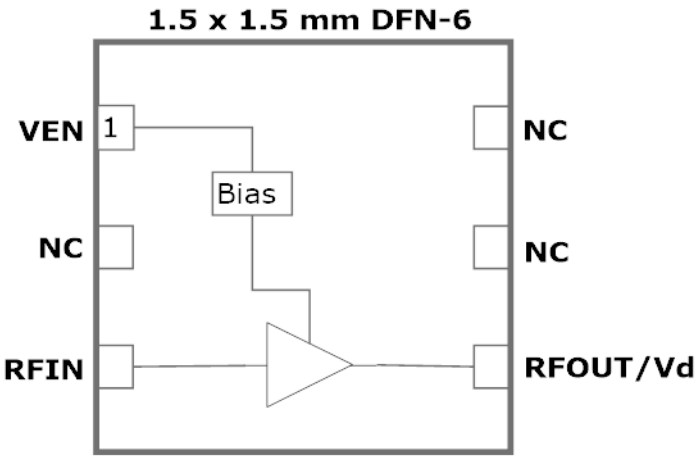
- Linear Driver Amplifier
- Small Cells and Cellular Repeaters
- Distributed Antenna Systems
- First/Second Stage LNA

Product Description

GRF4005 is a broadband low noise gain block designed for small cell, wireless infrastructure and other high performance applications. With simple external matching, it exhibits outstanding broadband NF, linearity and return losses over wide fractional bandwidths with a single match.

Configured as a first stage LNA, linear driver or cascaded gain block, GRF4005 offers high levels of reuse both within a design and across platforms. The device is operated from a supply voltage (V_{DD}) of 1.8 to 5.5 V. I_{DDQ} can be adjusted over a wide range for optimal efficiency and linearity.

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



Absolute Ratings:

Parameter	Symbol	Min.	Max.	Unit
Supply Voltage	V_{DD}	0	6.0	V
RF Input Power: (Load VSWR < 2:1; V_{DD}: 5.0 volts)	$P_{IN\ MAX}$		22	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	$P_{DISS\ MAX}$		0.85	W
Electrostatic Discharge:				
Charged Device Model:	CDM	1500		V
Human Body Model:	HBM	500		V
Storage:				
Storage Temperature	T_{STG}	-65	150	°C
Moisture Sensitivity Level	MSL		1	--

RoHS Compliant

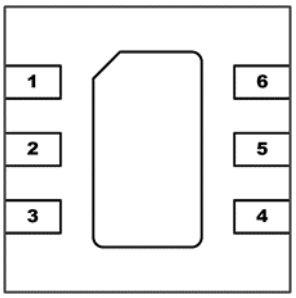
Caution! ESD Sensitive Device

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

Note: For package dimensions and manufacturing information, see the Guerrilla-RF.com website for the following document located on the GRF4005 landing page: Manufacturing Note—MN-001 Product Tape and Reel, Solderability and Package Outline Specification:

Link to manufacturing note

Pin Out (Top View)



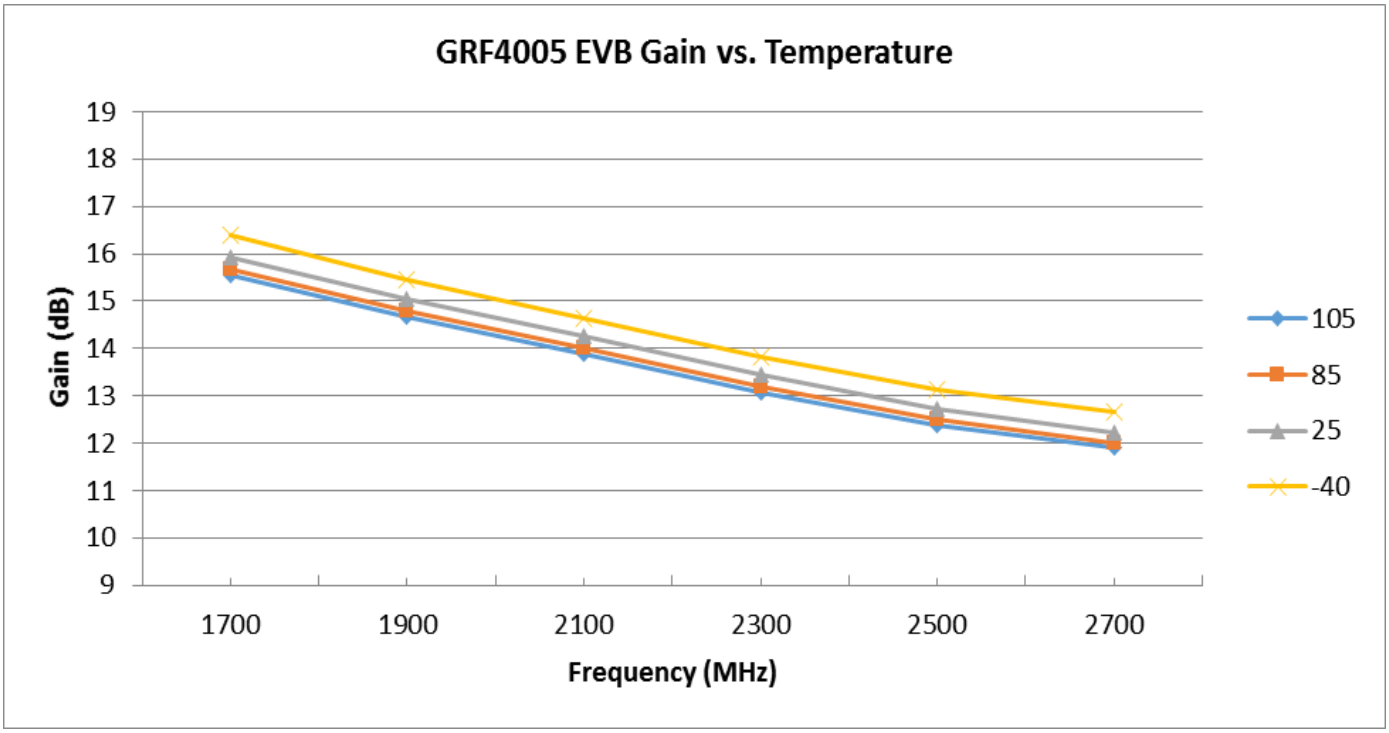
Pin Assignments:

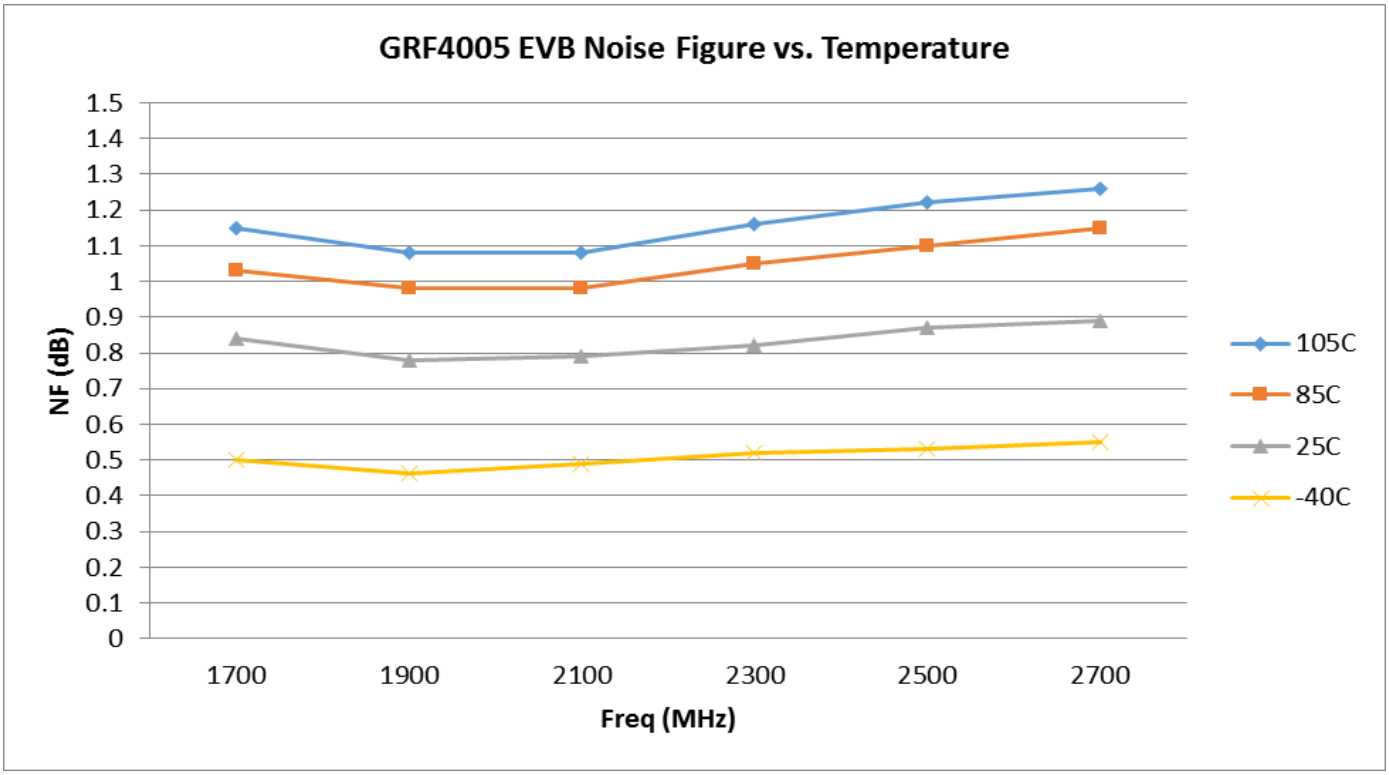
Pin	Name	Description	Note
1	V_{ENABLE}	Enable Voltage Input	V_{ENABLE} and series resistor set I_{DDQ}. V_{ENABLE} < =0.2 volts disables device. On -die pull-down resistor will turn the part off if this node is allowed to float.
2	NC	No Connect or Ground	No internal connection to die
3	RF_In	LNA RF input	An external DC blocking cap must be used.
4	RF_Out	LNA RF output	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:

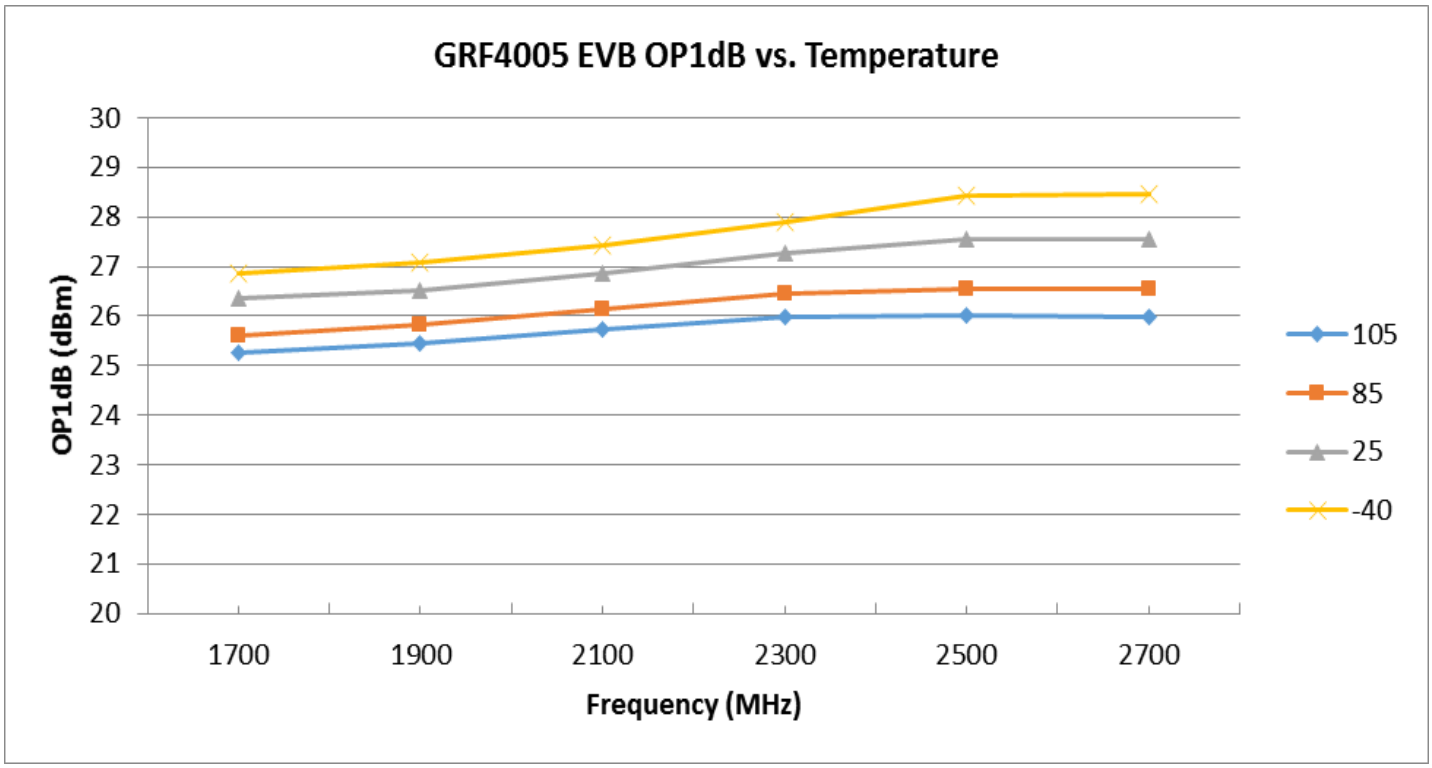
Parameter	Symbol	Specification			Unit	Condition
		Min.	Typ.	Max.		
Test Frequency	F_{TEST}		2500		MHz	V_{DD} = 5.0 V, T_A = 25°C
Gain	S21	11.8	12.8		dB	
Evaluation Board Noise Figure	NF		0.88	1.05	dB	Incudes Board Losses
Output 3rd Order Intercept	OIP3		42.0		dBm	+2.0 dBm P_{OUT} per tone at 2 MHz Spacing (2499 and 2501 MHz)
Output 1dB Compression Power	OP1dB	26.0	27.5		dBm	
Switching Rise Time	T_{RISE}		500		ns	
Switching Fall Time	T_{FALL}		500		ns	
Supply Current	I_{DD}	145	170	195	mA	Target I_{DDQ}: 170 mA
Leakage Current	$I_{LEAKAGE}$		4.5	20	uA	V_{DD}: 5.0V; V_{ENABLE}: 0.0V
Thermal Data						
Thermal Resistance: (Infra-Red Scan)	Θjc		87		°C/W	On standard Evaluation Board
Channel Temperature @ +85 C Reference (Package heat sink)	$T_{CHANNEL}$		160		°C	V_{DD}: 5.0 V; I_{DDQ}: 170 mA; No RF; P_{DISS}: 850 mW

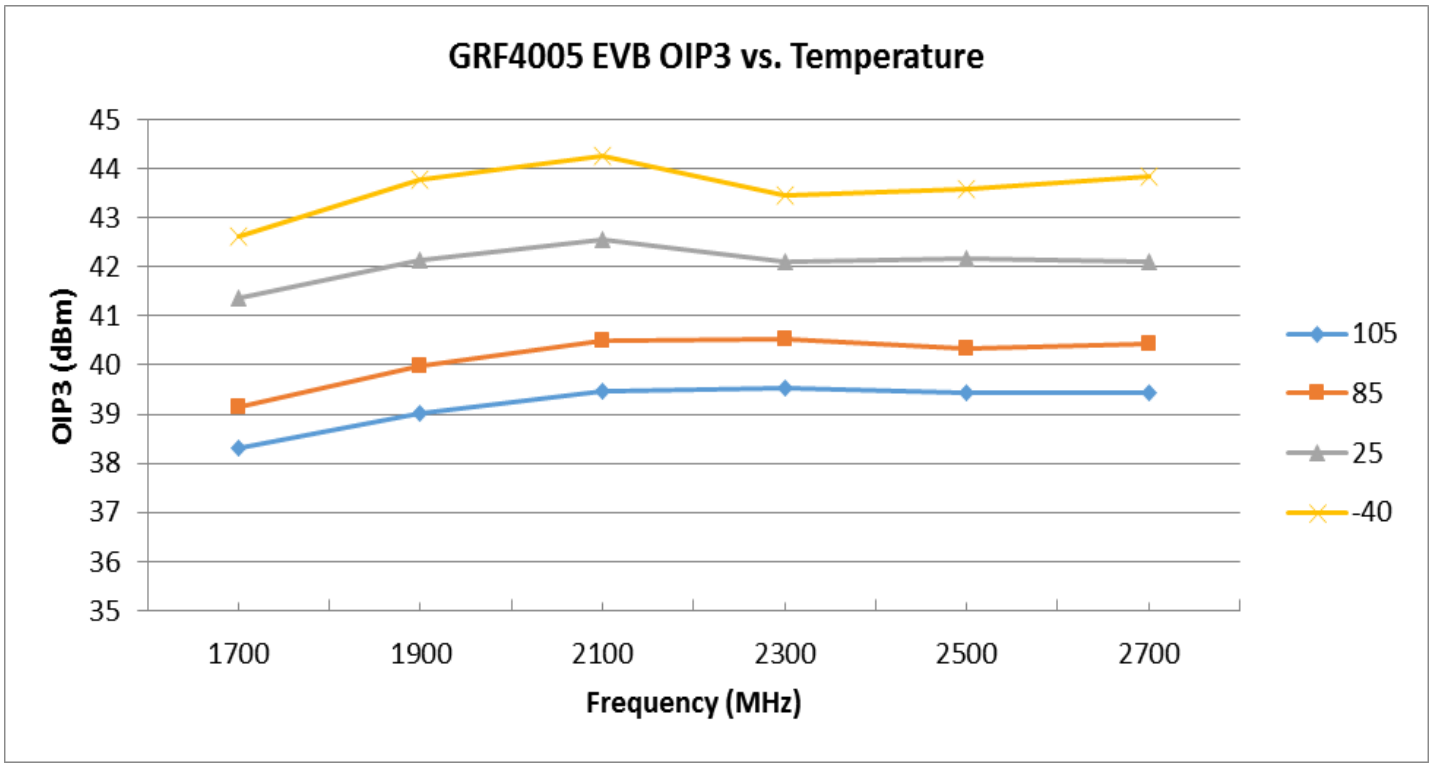
GRF4005 Evaluation Board Measured Data (1.7 to 2.7 GHz Tune):



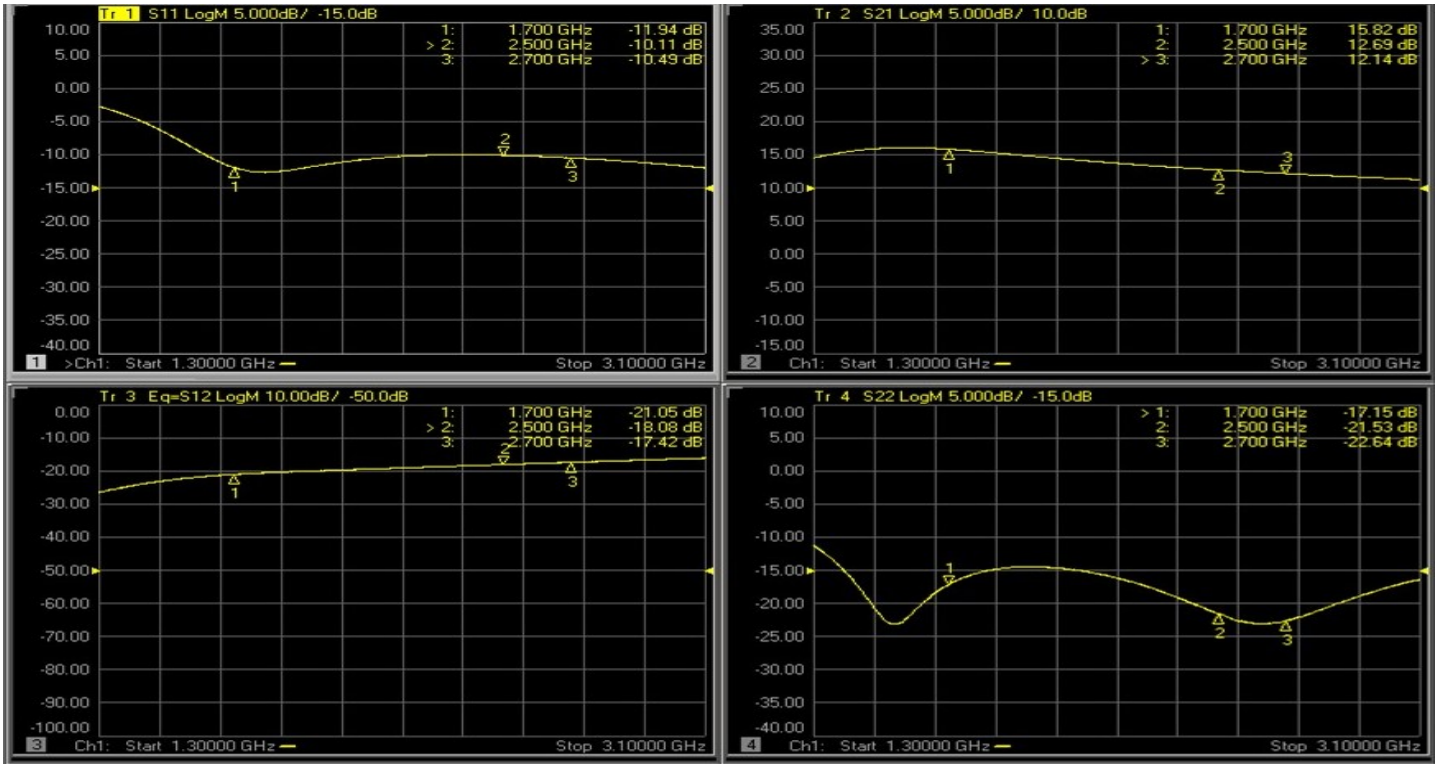


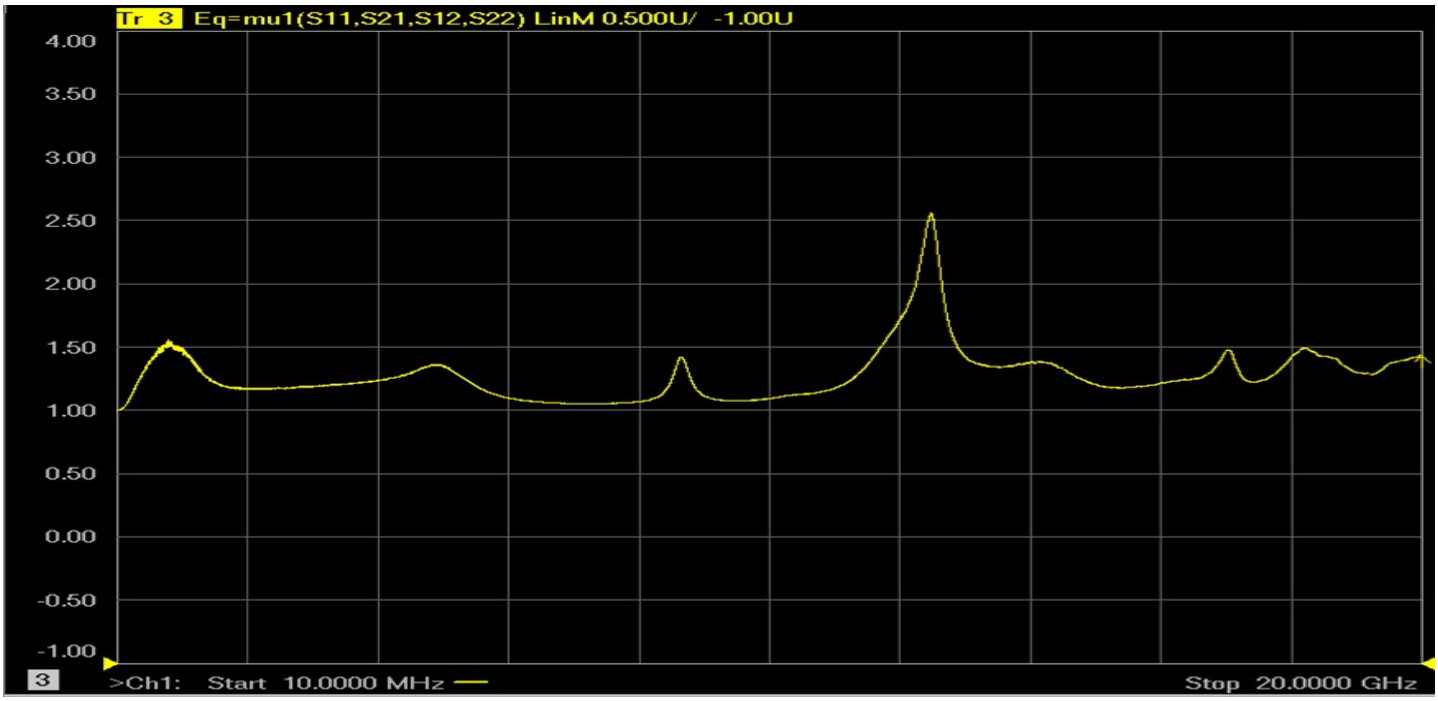
GRF4005 Evaluation Board Measured Data (1.7 to 2.7 GHz Tune):



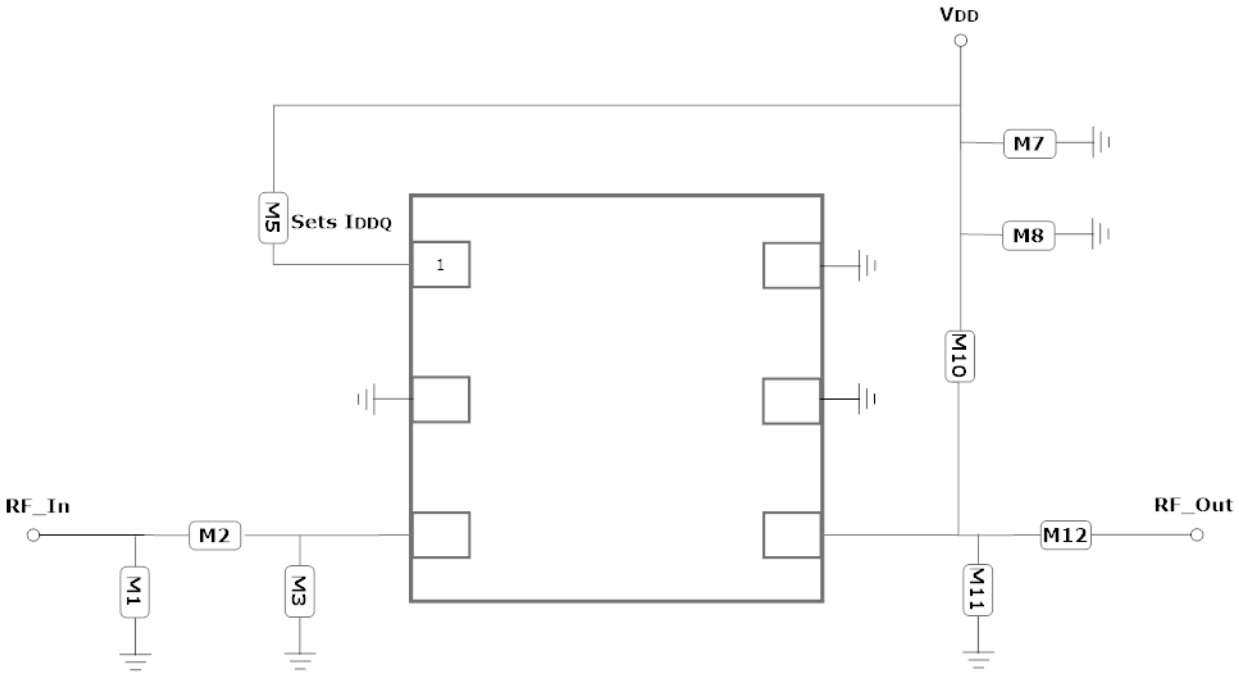


GRF4005 Evaluation Board S-Pars and Stability Mu Factor: (1.7 — 2.7 GHz Tune)

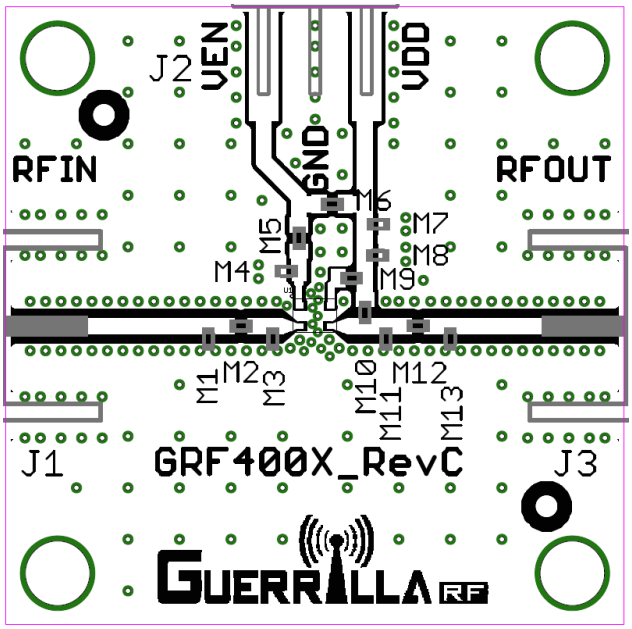




Note: Mu factor >= 1.0 implies unconditional stability.



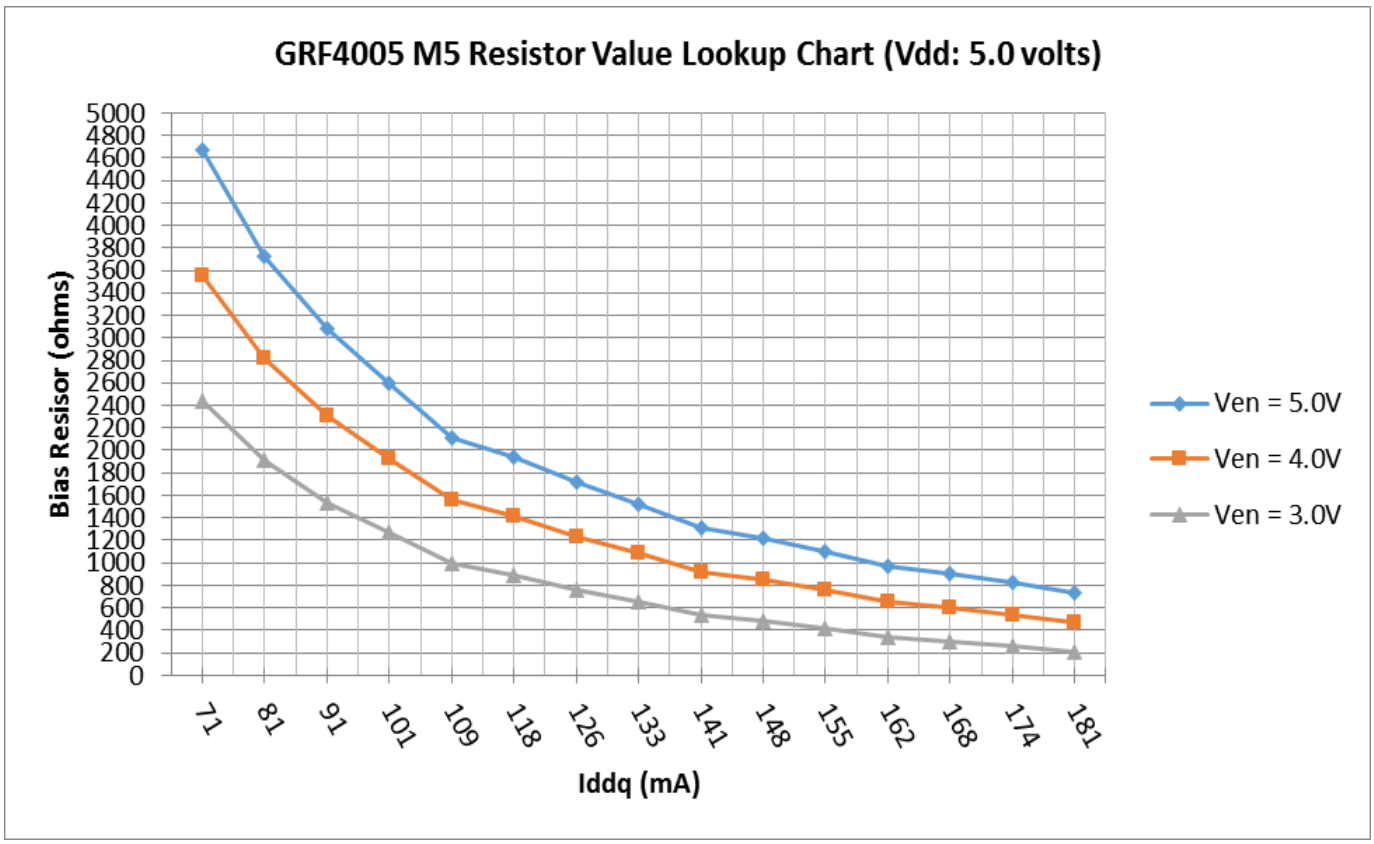
GRF4005 Application Schematic



GRF400X Evaluation Board Assembly Diagram

GRF4005 Standard Evaluation Board BOM: (1.7 to 2.7 GHz Tune)

Component	Type	Manufacturer	Family	Value	Package Size	Substitution
M1	Inductor	Coilcraft	HPA	3.3 nH	0402	ok
M2	Capacitor	Murata	GJM	2.0 pF	0402	ok
M3	Capacitor	Murata	GJM	1.5 pF	0402	ok
M5 (See curves)	Resistor: 5%	Various	—	—	0402	ok
M7	Capacitor	Murata	GRM	0.1 uF	0402	ok
M8	Capacitor	Murata	GRM	27 pF	0402	ok
M10	Inductor	Coilcraft	HPA	18.0 nH	0402	ok
M11	Capacitor	Murata	GJM	1.0 pF	0402	ok
M12	Capacitor	Murata	GJM	15 pF	0402	ok
Evaluation Board:	GRF400X_RevC					



Released

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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