



## Product Description

GRF2051 is an ultra-low noise amplifier designed for wireless infrastructure and other high performance RF applications requiring the absolute lowest possible NF, high gain and outstanding linearity. Broadband external matches deliver outstanding RF performance over 0.7 to 3.8 GHz.

Configured as a first stage LNA, linear driver or cascaded gain block, the GRF2051 flexible biasing capability offers high levels of reuse both within a design and across platforms. For higher gain applications from 1.7 GHz up to 4.5 GHz, the pin compatible GRF2052 should be used.

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

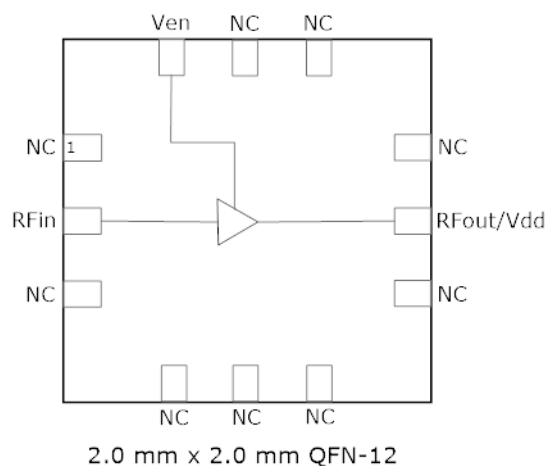
## Features

Reference: 5V/70mA/1.9 GHz

- Gain: 19.0 dB
- Eval Board NF: 0.37 dB
- OP1dB: 21.0 dBm
- OIP3: 36.0 dBm
  
- Flexible Bias Voltage and Current
- Process: GaAs pHEMT

## Applications

- Cellular Infrastructure
- Small Cells and Cellular Repeaters
- Distributed Antenna Systems
- High Performance GPS



## Absolute Ratings:

Parameter	Symbol	Min.	Max.	Unit
Supply Voltage	V <sub>DD</sub>	0	6.0	V
RF Input Power: (Load VSWR < 2:1; V <sub>D</sub> : 5.0 volts)	P <sub>IN MAX</sub>		20	dBm
Operating Temperature (Package Heat Sink)	T <sub>AMB</sub>	-40	105	°C
Maximum Channel Temperature (MTTF > 10 <sup>6</sup> Hours)	T <sub>MAX</sub>		170	°C
Maximum Dissipated Power	P <sub>DISS MAX</sub>		500	mW
<b>Electrostatic Discharge:</b>				
Charged Device Model:	CDM	1500		V
Human Body Model:	HBM	250		V
<b>Storage:</b>				
Storage Temperature	T <sub>STG</sub>	-65	150	°C
Moisture Sensitivity Level	MSL		1	--



**Caution!** ESD Sensitive Device

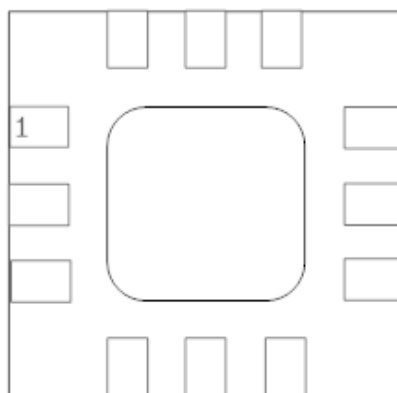


Exceeding Absolute Maximum Rating conditions may cause permanent damage to the device.

**Note:** For manufacturing information, see the [Guerrilla-RF.com](http://Guerrilla-RF.com) website for the following document located on the GRF2051 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	RF_In	RF Input	External match must provide DC block
3	NC	No Connect or Ground	No internal connection to die
4	NC	No Connect or Ground	No internal connection to die
5	NC	No Connect or Ground	No internal connection to die
6	NC	No Connect or Ground	No internal connection to die
7	NC	No Connect or Ground	No internal connection to die
8	RF_Out/V <sub>DD</sub>	RF Output	Provide device V <sub>DD</sub> via external bias inductor
9	NC	No Connect or Ground	No internal connection to die
10	NC	No Connect or Ground	No internal connection to die
11	NC	No Connect or Ground	No internal connection to die
12	V <sub>ENABLE</sub>	Enable Voltage Input	V <sub>ENABLE</sub> and series resistor set I <sub>DDQ</sub> . V <sub>ENABLE</sub> < =0.2 volts disables device. On -die pull-down resistor will turn the part off if this node is allowed to float.
<b>PKG BASE</b>	<b>GND</b>	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.



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# GRF2051

Ultra-Low Noise Amplifier  
Tuning Range: 0.7 – 3.8 GHz

## Nominal Operating Parameters:

Parameter	Symbol	Specification			Unit	Condition
		Min.	Typ.	Max.		
<b>Gain Mode (Venable high)</b>						$V_{DD} = 5.0\text{ V}$ , $T_A = 25^\circ\text{C}$
Test Frequency	$F_{TEST}$		1900		MHz	1700 – 2700 MHz Tune
Gain	$S_{21}$	18.0	19.0		dB	
Noise Figure	NF		0.37	0.57	dB	Evaluation Board SMA to SMA
Output 3rd Order Intercept Point	OIP3		36.0		dBm	+3 dBm $P_{OUT}$ per tone at 2 MHz Spacing (1899 and 1901 MHz)
Output 1dB Compression Point	OP1dB	19.5	21.0		dBm	
Switching Rise Time	$T_{RISE}$		500		ns	
Switching Fall Time	$T_{FALL}$		500		ns	
Supply Current	$I_{DD}$		70		mA	
Enable Current	$I_{ENABLE}$		4.0	8.0	mA	
<b>Disabled Mode</b>						
	$I_{LEAKAGE}$		10	150	uA	$V_{DD}: 5.0\text{V}$ ; $V_{ENABLE}: 0.0\text{V}$
<b>Thermal Data</b>						
Thermal Resistance (measured via IR scan)	$\Theta_{jc}$		56		$^\circ\text{C}/\text{W}$	On standard evaluation board
Channel Temperature @ +85 C Reference (Package Heat Sink)	$T_{CHANNEL}$		105 (See note)		$^\circ\text{C}$	$V_{DD}: 5.0\text{ V}$ ; $I_{DDQ}: 70\text{ mA}$ ; No RF; $P_{DISS}: 350\text{ mW}$

Note: MTTF >10<sup>6</sup> hours for  $T_{CHANNEL} < =170$  degrees C.

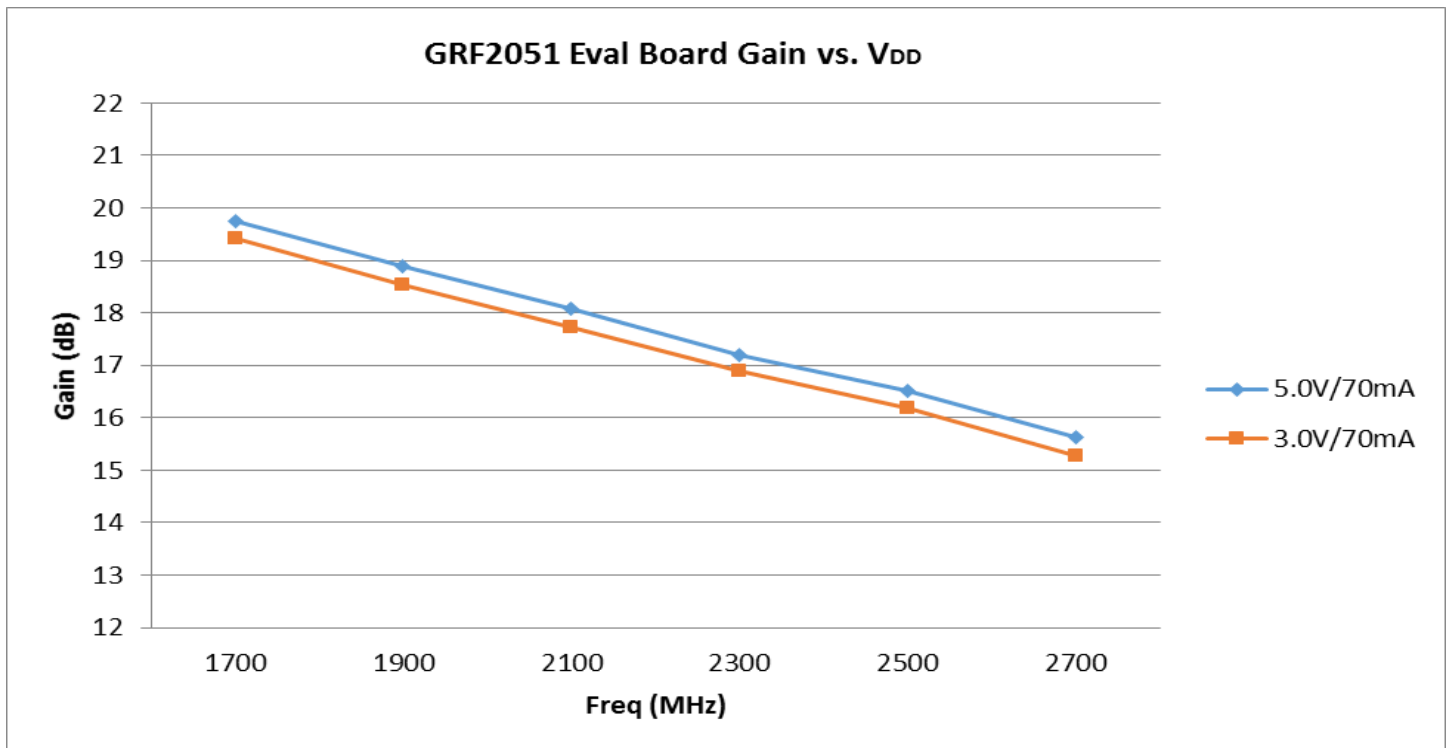
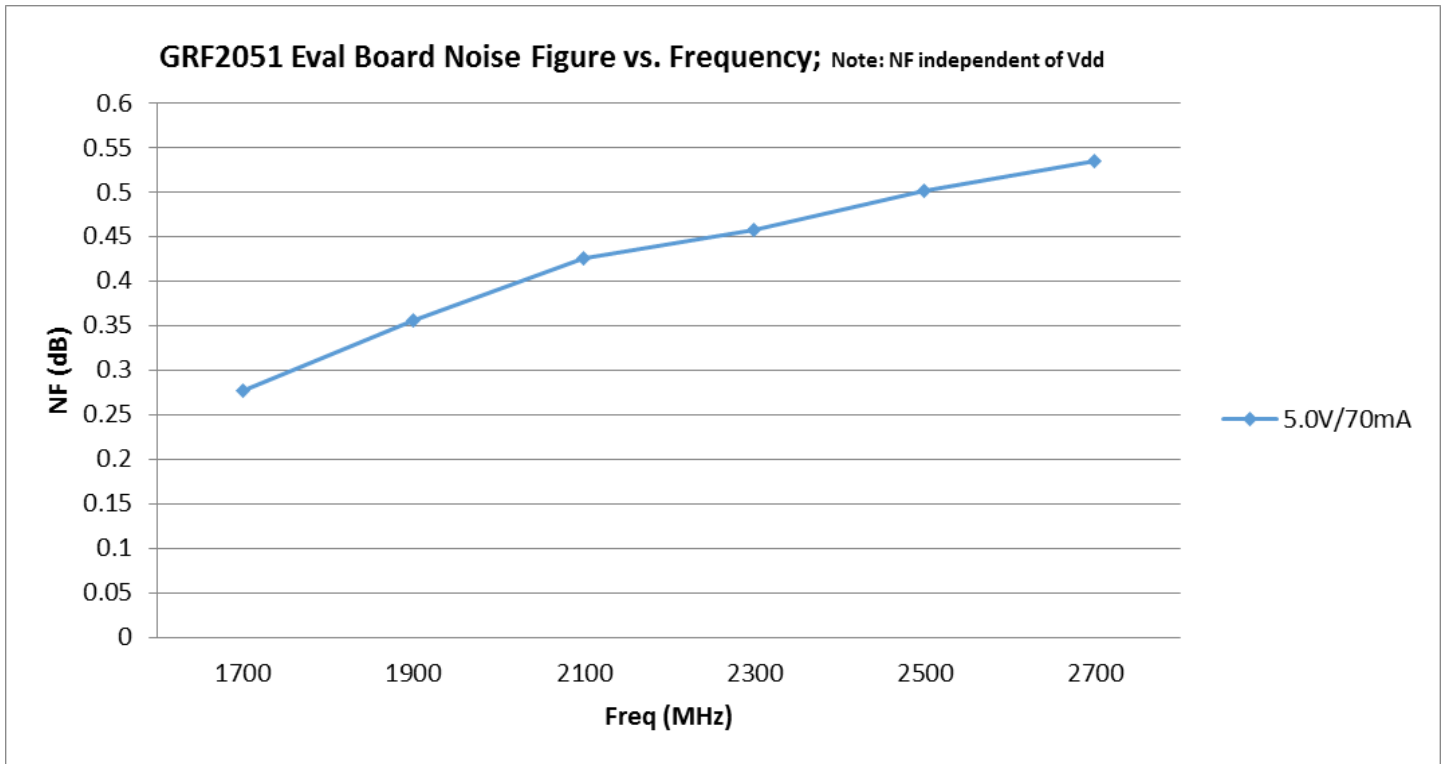


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Tuning Range: 0.7 – 3.8 GHz

## GRF2051 Performance: (25C)



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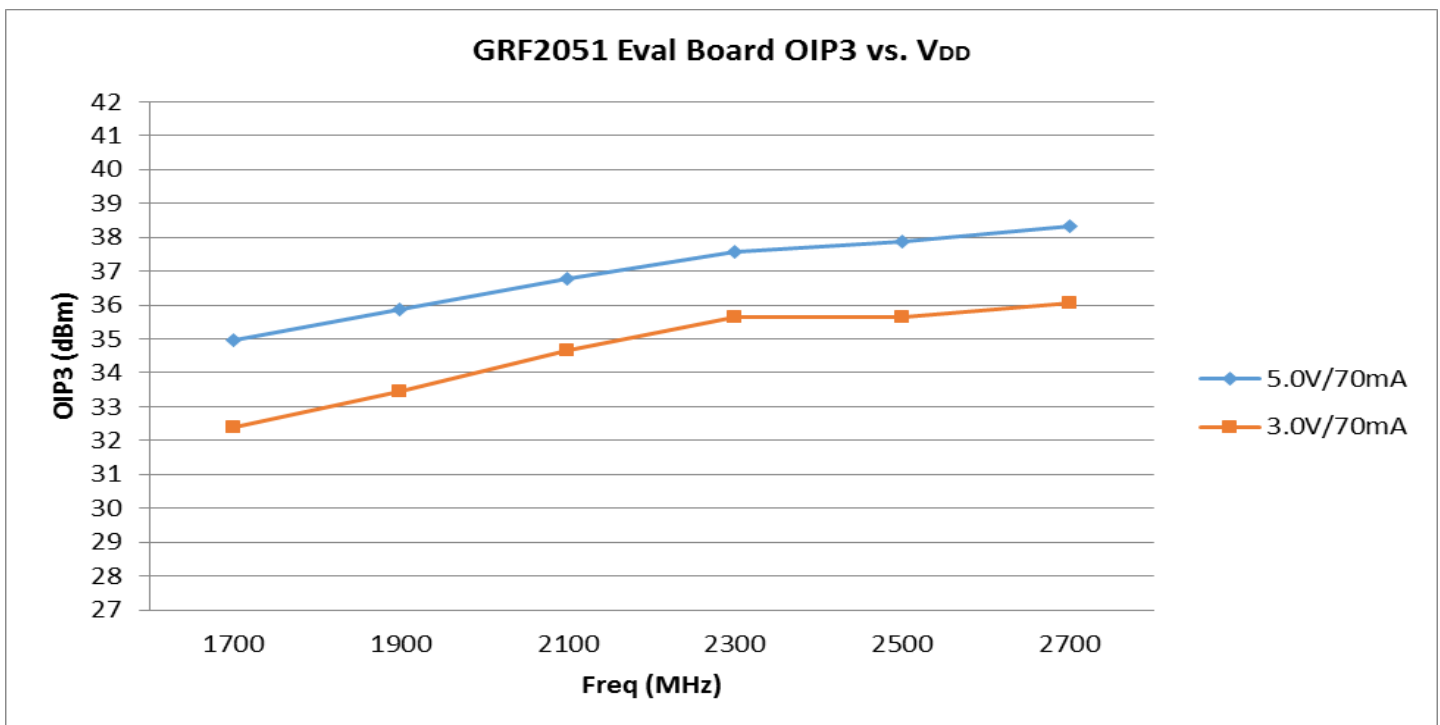
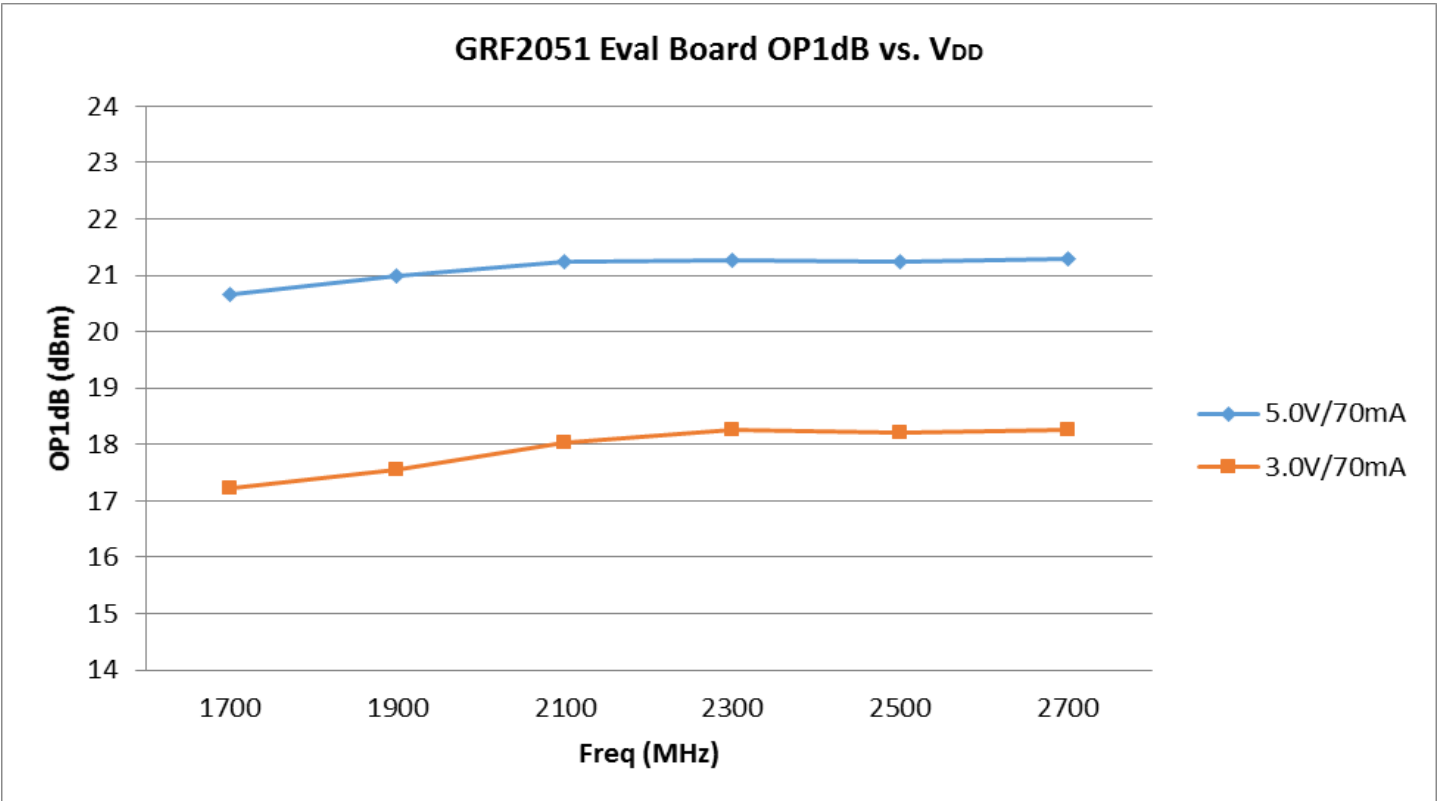


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## GRF2051 Performance: (25C)



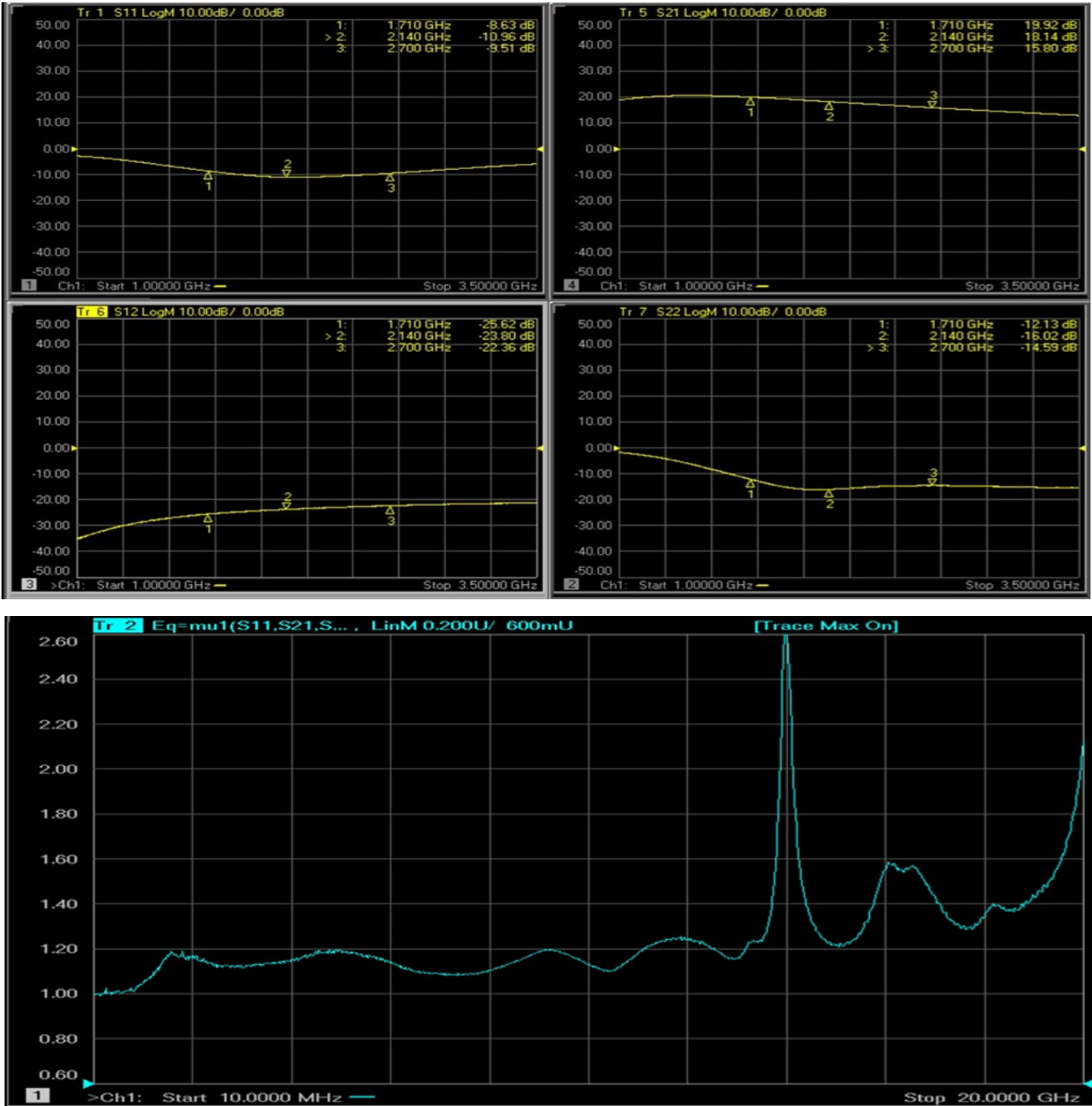


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# GRF2051

Ultra-Low Noise Amplifier  
Tuning Range: 0.7 – 3.8 GHz

## GRF2051 Evaluation Board S-Pars: (1.7 to 2.7 GHz Tune)



Note: Mu factor  $\geq 1.0$  implies unconditional stability.

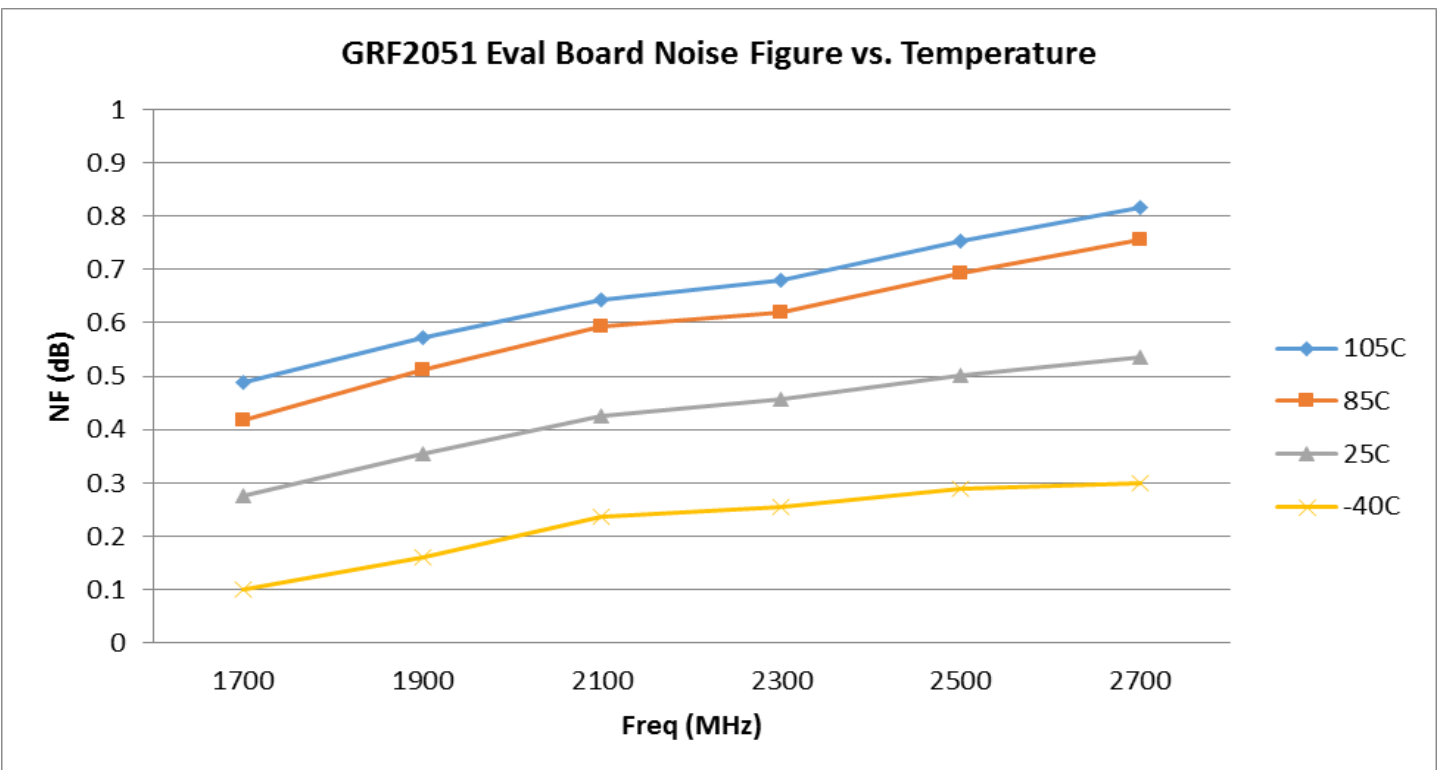
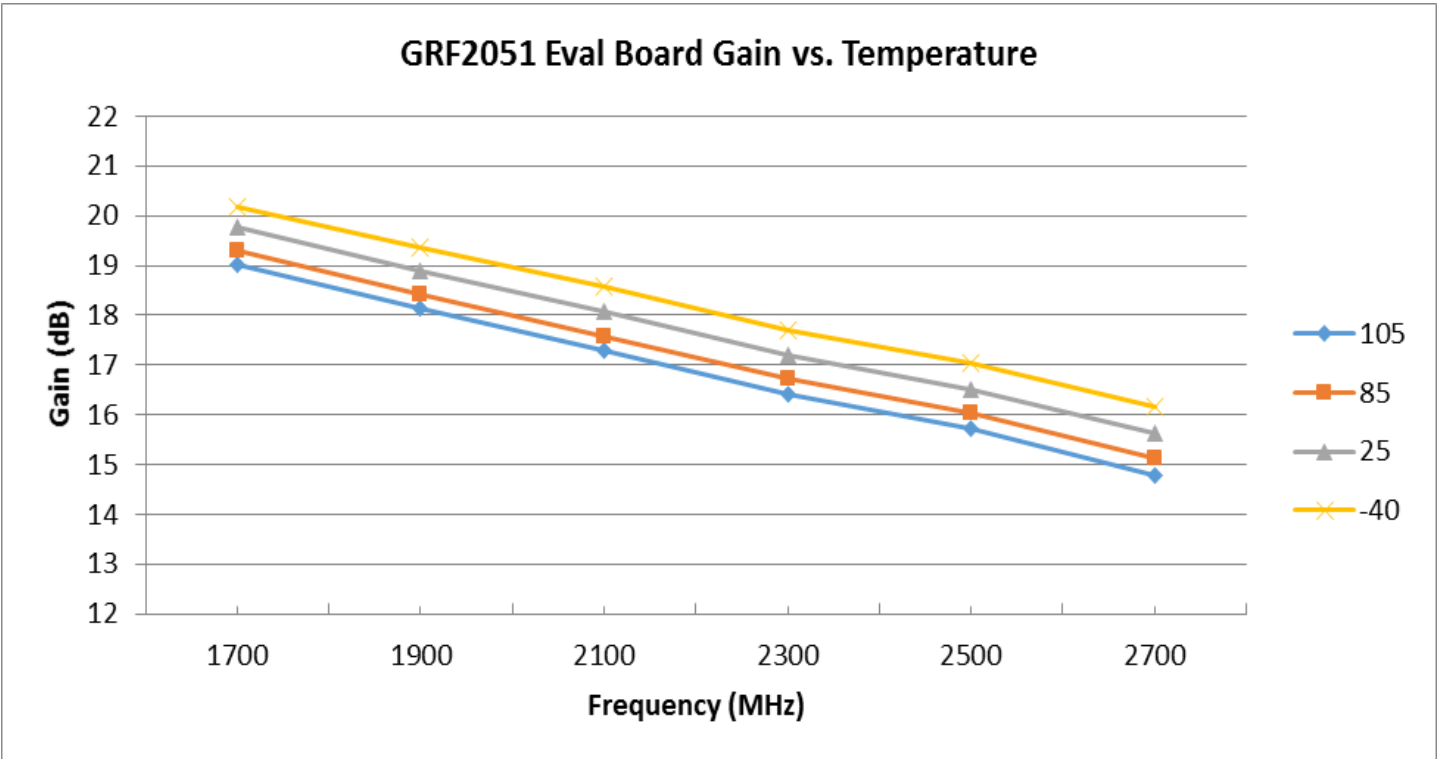


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# GRF2051

Ultra-Low Noise Amplifier  
Tuning Range: 0.7 – 3.8 GHz

## GRF2051 Performance vs. Temperature:





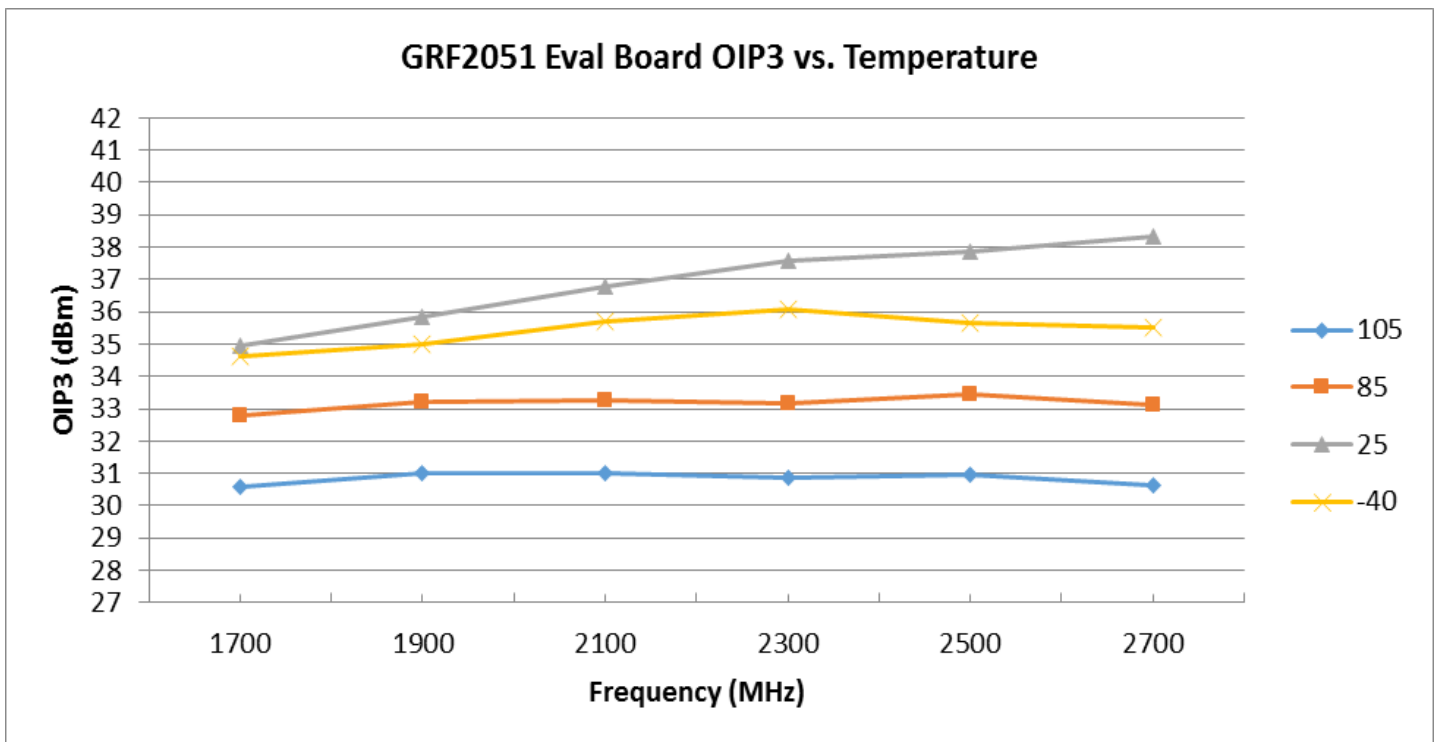
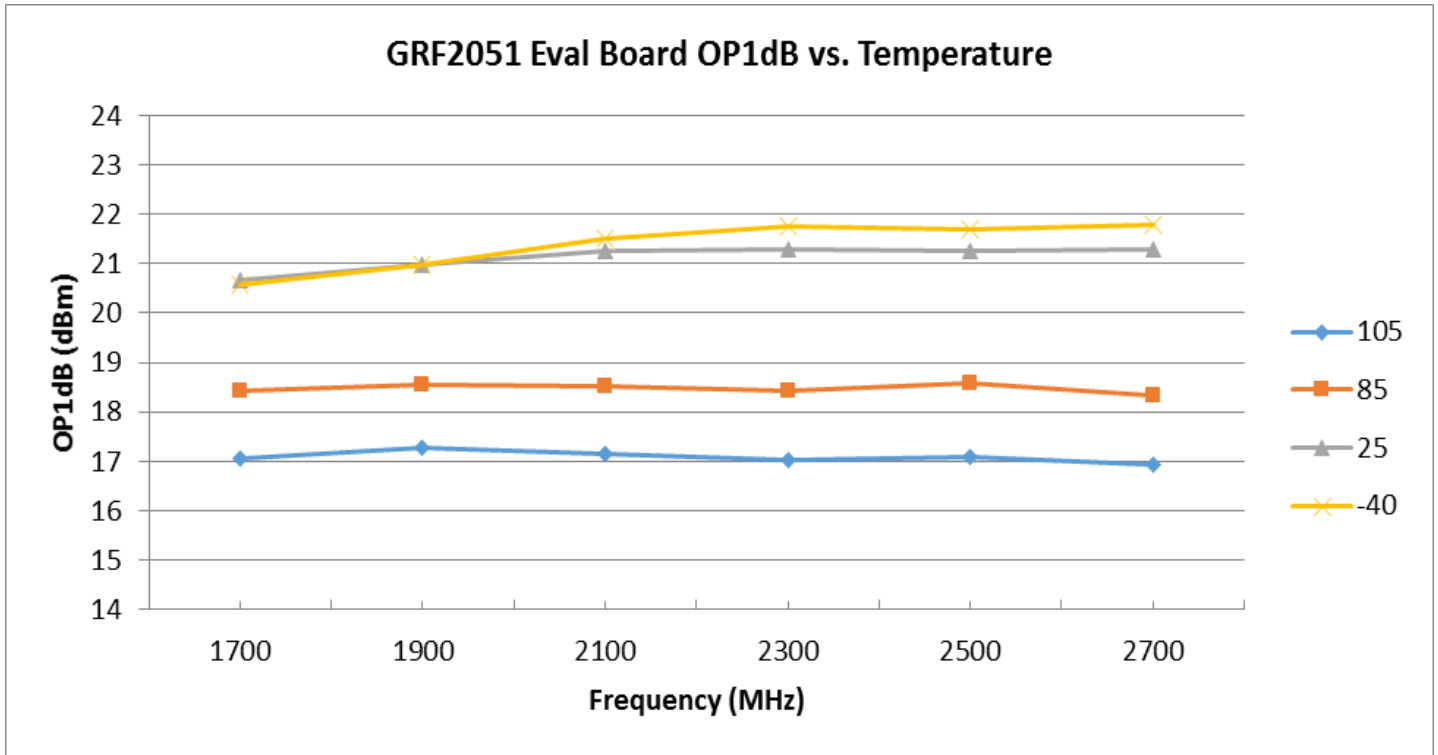


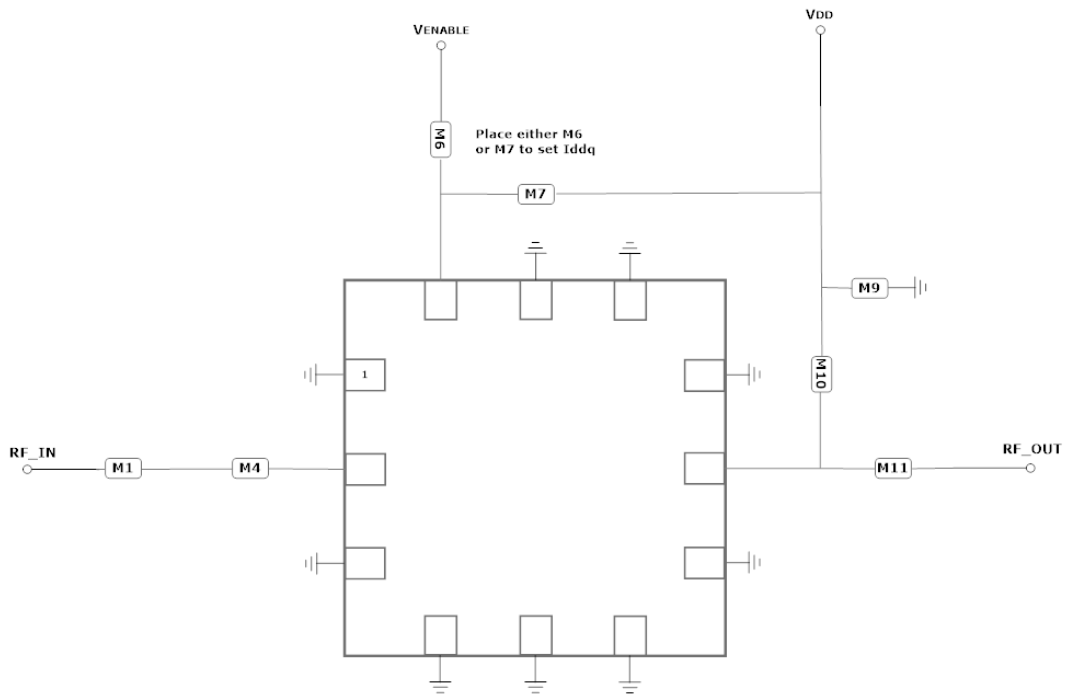
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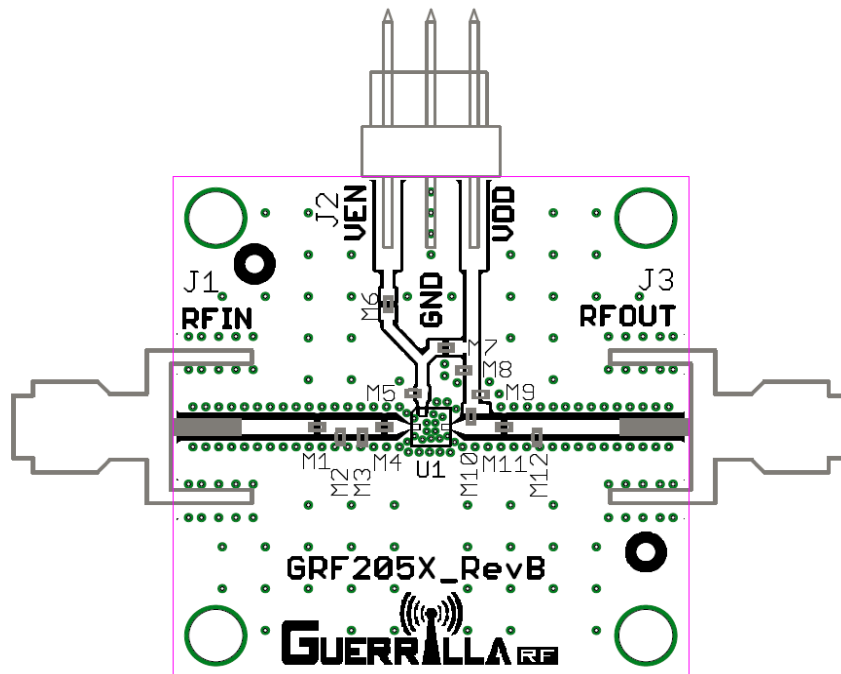
Ultra-Low Noise Amplifier  
Tuning Range: 0.7 – 3.8 GHz

## GRF2051 Performance vs. Temperature:





GRF2051 Application Schematic



GRF2051 Eval Board Assembly Drawing



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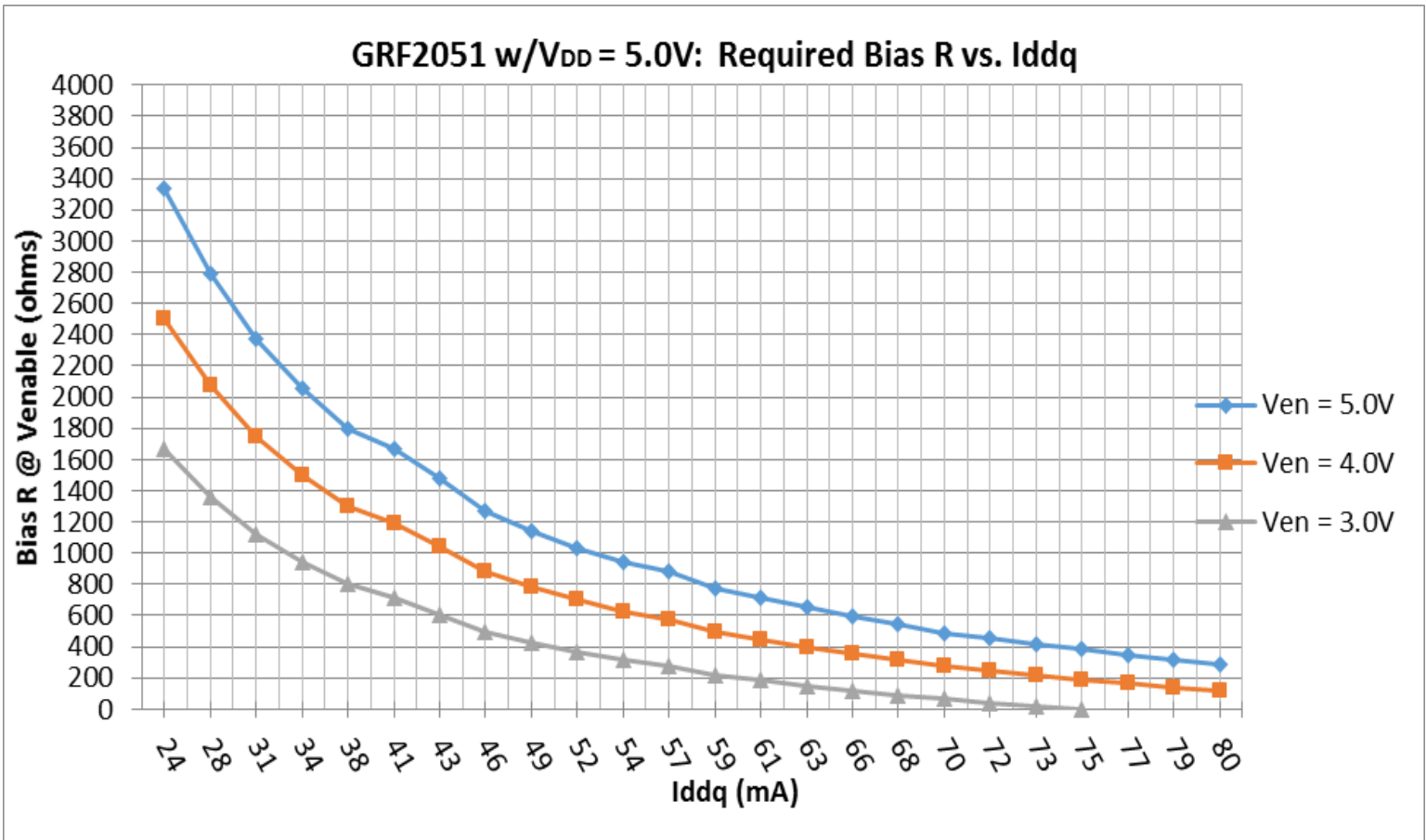
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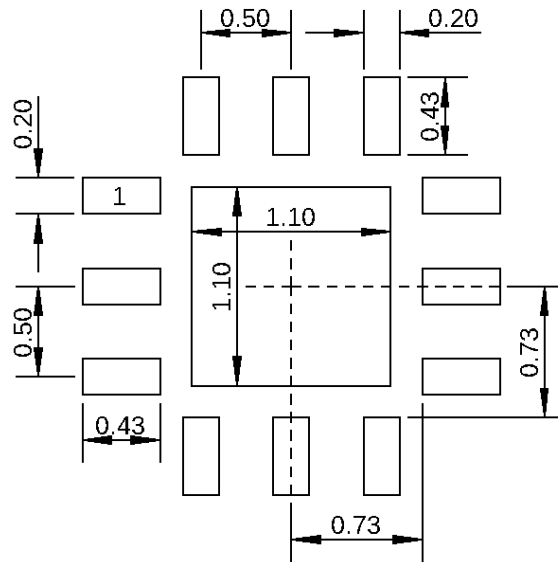
Ultra-Low Noise Amplifier  
Tuning Range: 0.7 – 3.8 GHz

## GRF2051 Evaluation Board BOM: (1.7 to 2.7 GHz Tune)

Component	Type	Manufacturer	Family	Value	Package Size	Substitution	Comment
M1	Capacitor	Murata	GJM	12 pF	0402	ok	
M4	Inductor	Coilcraft	HPA	2.0 nH	0402	ok	
M6/7	Resistor: 5%	Various	—	—	0402	ok	Place M6 or M7
M9	Capacitor	Murata	GRM	0.1 uF	0402	ok	
M10	Inductor	Various	MLC	3.3 nH	0402	ok	
M11	Capacitor	Murata	GJM	2.7 pF	0402	ok	
Evaluation Board	GRF205X_RevB						

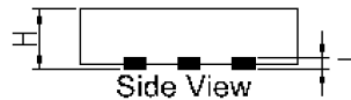
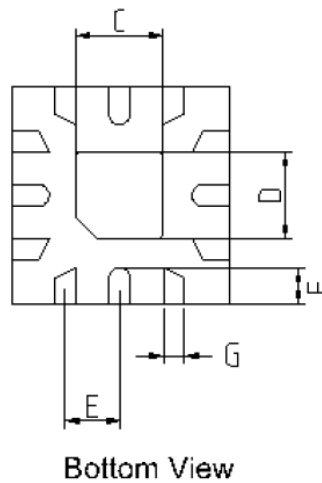
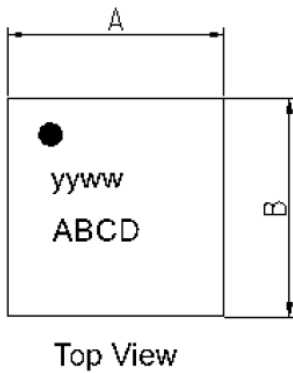
Note: Standard evaluation board bias: Vdd: 5.0V; Venable: 5.0V; M6/M7:





Dimensions in millimeters

### 2.0 mm QFN-12 Suggested PCB Footprint (Top View)



Dimensions (MM)	
A	2.00 Bsc
B	2.00 Bsc
C	.80 +/- .10
D	.80 +/- .10
E	.50 Bsc
F	.30 +/- .05
G	.20 +/- .05
H	.50 +/- .05
J	.12 Ref

### 2.0 mm QFN-12 Package Dimensions



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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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