Preliminary

GRF2051

Linear, Ultra-Low Noise Amplifier; 1.7 – 2.7 GHz

Package: 12-Pin QFN

Features

- 1700-2700 MHz with Single Tune
- Reference Frequency/Bias Condition: 1900 MHz; 5V/55 mA
- Evaluation Board Gain: 19.0 dB
- Evaluation Board NF: 0.35 dB
- De-embedded NF: 0.25 dB
- IIP3: +20.0 dBm
- IP1dB: +3.0 dBm
- Flexible Vdd: 3.0 – 6.0 volts
- Flexible Iddq: 20 - 80 mA

Applications

- First Stage LNA for Infrastructure
- Small Cells and Cellular Repeaters
- Fast Switching TDD Systems
- General Purpose Amplifier

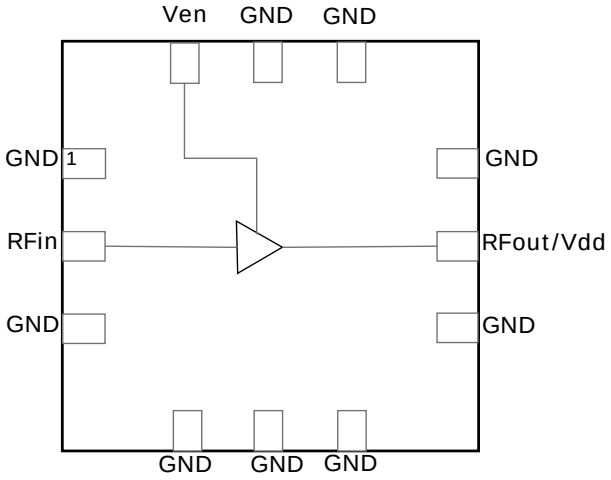
Product Description

The GRF2051 is a broadband, ultra-low noise linear amplifier designed for small cell, wireless infrastructure and other high performance RF applications requiring the absolute lowest possible NF, high gain and outstanding linearity. The device delivers industry leading NF and IP3 over 1700-2700 MHz using a single tune.

Configured as a first stage LNA, linear driver or cascaded gain block, GRF2051 offers high levels of reuse both within a design and across platforms. For higher gain applications from 2.3 GHz up to 3.8 GHz, the pin compatible GRF2052 should be used.

GRF2051 is housed in a 2.0 x 2.0 x 0.55 mm 12-pin plastic QFN.

Functional Block Diagram



2.0 mm x 2.0 mm QFN-12

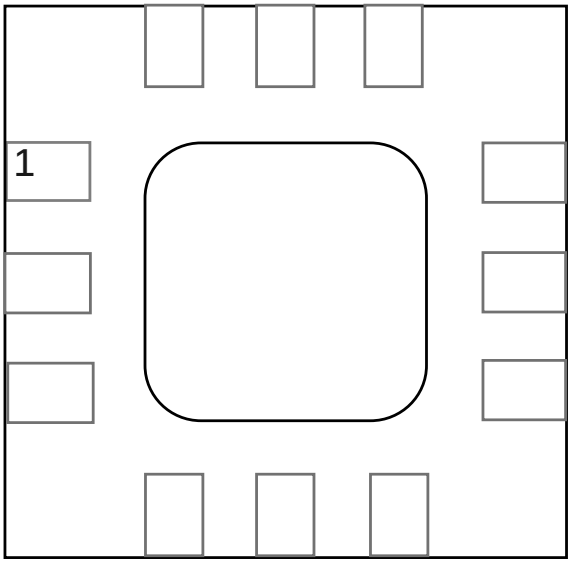
Absolute Ratings

Parameter	Symbol	Min.	Max.	Unit
Supply Voltage	Vdd	0	9.0	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)	Tmax		+160	°C
Maximum Disspated Power (Note: De-rate 8 mW/°C for T_{AMB} > +85C.	$P_{DISS\ MAX}$		500	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.

Pin Out (Top View)



Pin Assignments

Pin	Name	Description	Note
1	GND	Ground	
2	RFin	RF Input	External match must provide DC block
3	GND	Ground	
4	GND	Ground	
5	GND	Ground	
6	GND	Ground	
7	GND	Ground	
8	RFout/Vdd	RF Output	Provide device Vdd via external bias inductor
9	GND	Ground	
10	GND	Ground	
11	GND	Ground	
12	Ven	LNA Enable Control	Venable and series resistor set Iddq. Venable < 0.4 volts disables device.
PKG BASE	GND	Ground	Provides DC and RF ground for LNA, as well as thermal heat sink.

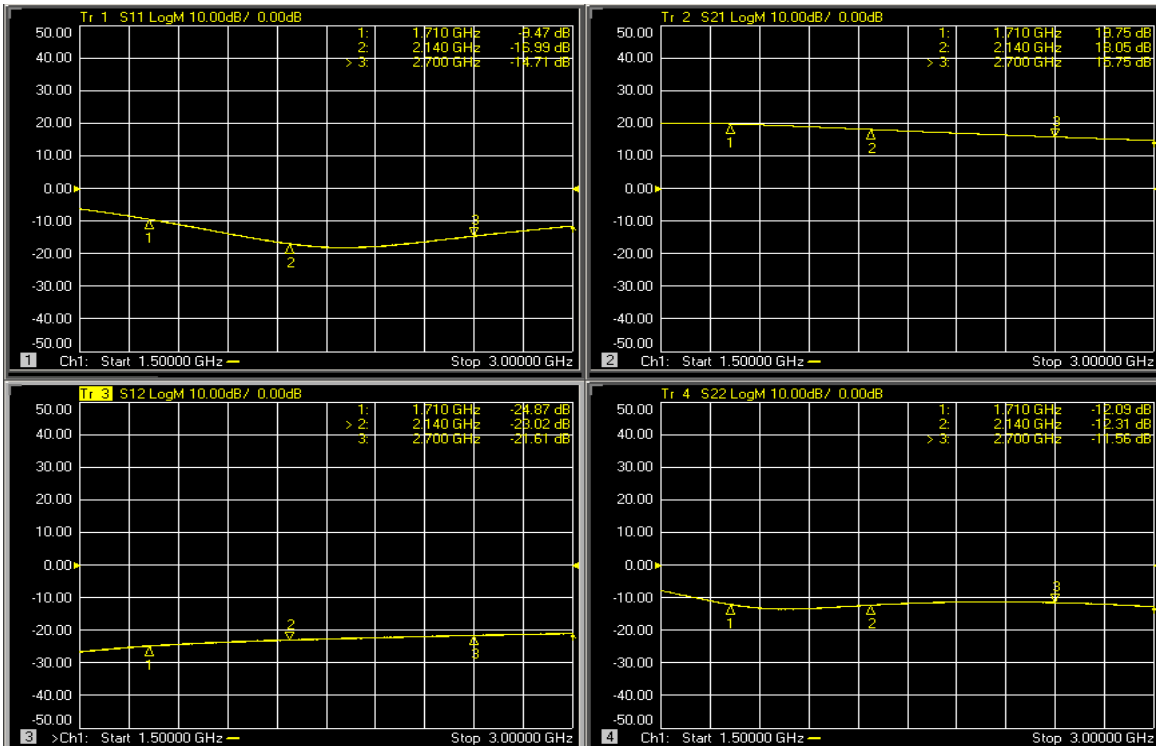
Nominal Operating Parameters

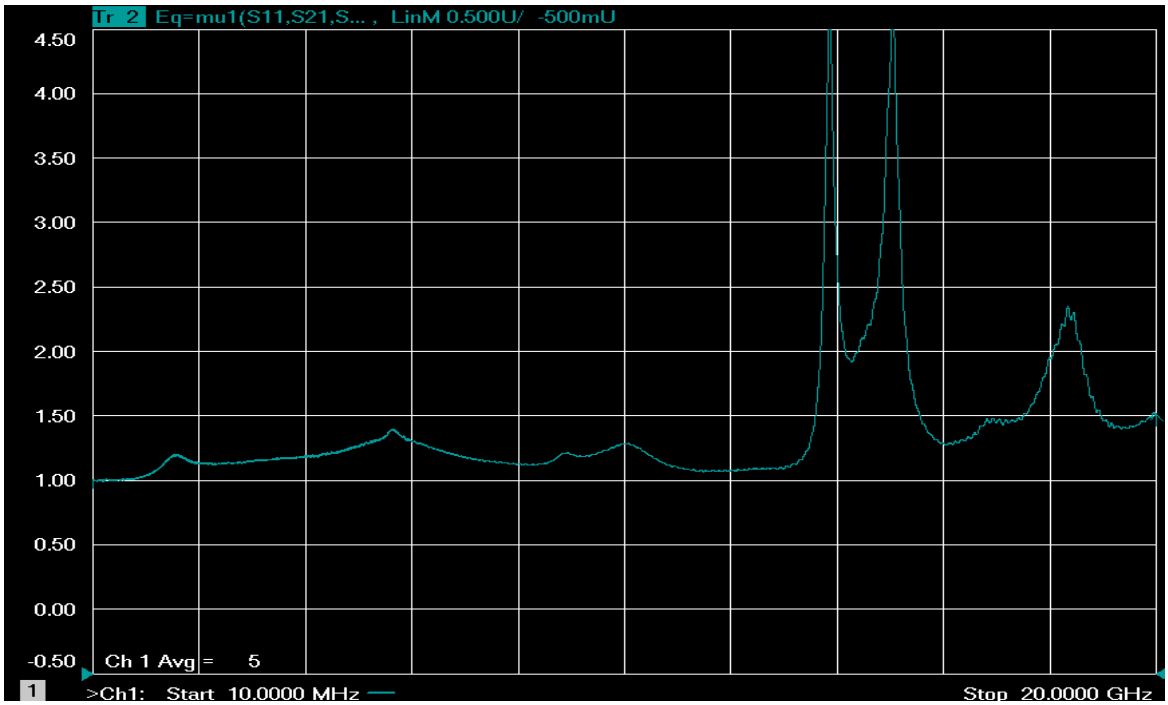
Parameter	Symbol	Specification			Unit	Condition
		Min.	Typ.	Max.		
Gain Mode (Venable high)						Vdd = 5.0 V, T_A = 25°C
Test Frequency	F_{test}		1900		MHz	1700 – 2700 MHz Tune
Evaluation Board Gain	S21		19.0		dB	
Input Return Loss	S11		-12		dB	
Output Return Loss	S22		-12		dB	
Evaluation Board Noise Figure	NF		0.35		dB	Evaluation Board SMA to SMA
De-embedded Noise Figure	NF		0.25		dB	Device Pin 2 to Pin 8
Input 3rd Order Intercept Point	IIP3		+20.0		dBm	+2 dBm P_{OUT} per tone at 2 MHz Spacing (2599 and 2601 MHz)
Input 1dB Compression Point	IP1dB		+3.0		dBm	
Switching Rise Time	T_{RISE}		300		ns	
Switching Fall Time	T_{FALL}		300		ns	
Supply Current	Idd		55		mA	Adjustable for optimal IP3
Enable Current	Ienable		2		mA	
Thermal Data						
Thermal Resistance (measured via IR scan)	Θjc		118		°C/W	On standard evaluation board
Channel Temperature @ +85 C Reference (Package Heat Sink)	Tchannel		+117		°C	Vdd: 5.0 V; Iddq: 55 mA; No RF; Pdiss: 275 mW

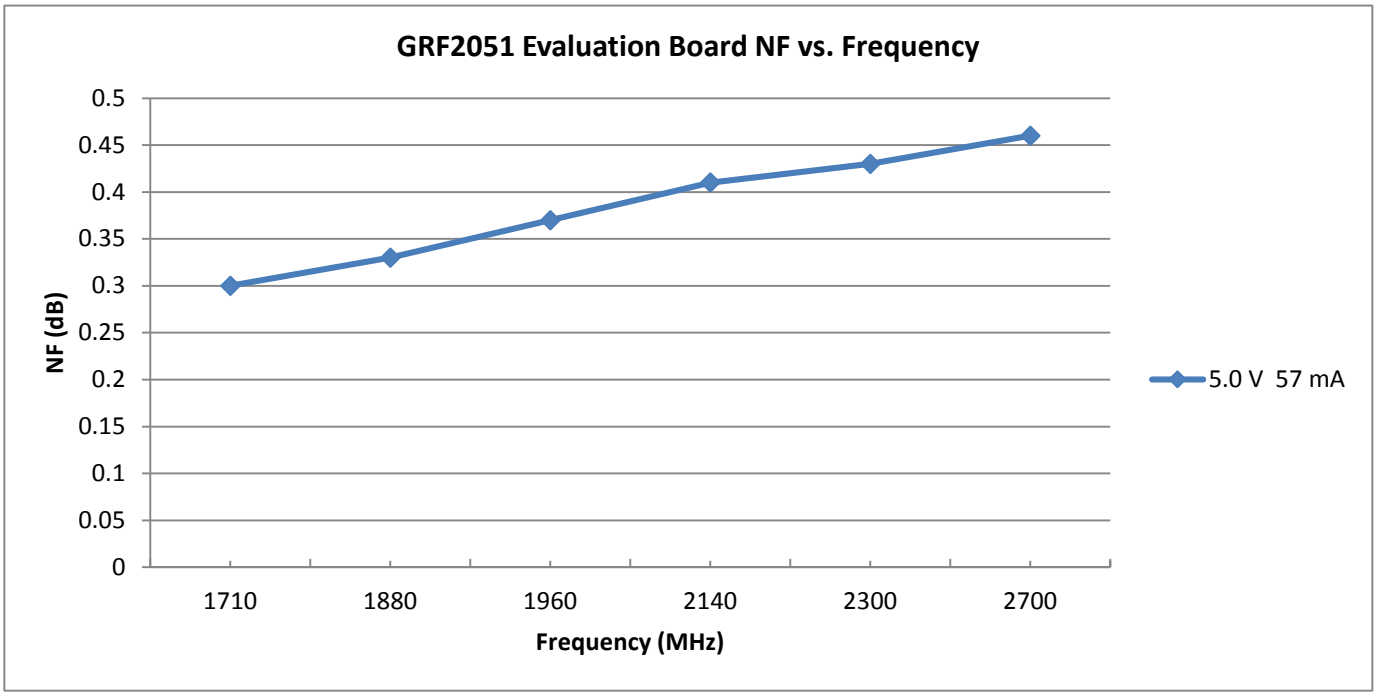
GRF2051 Multi-Band, Measured Performance Summary Table:

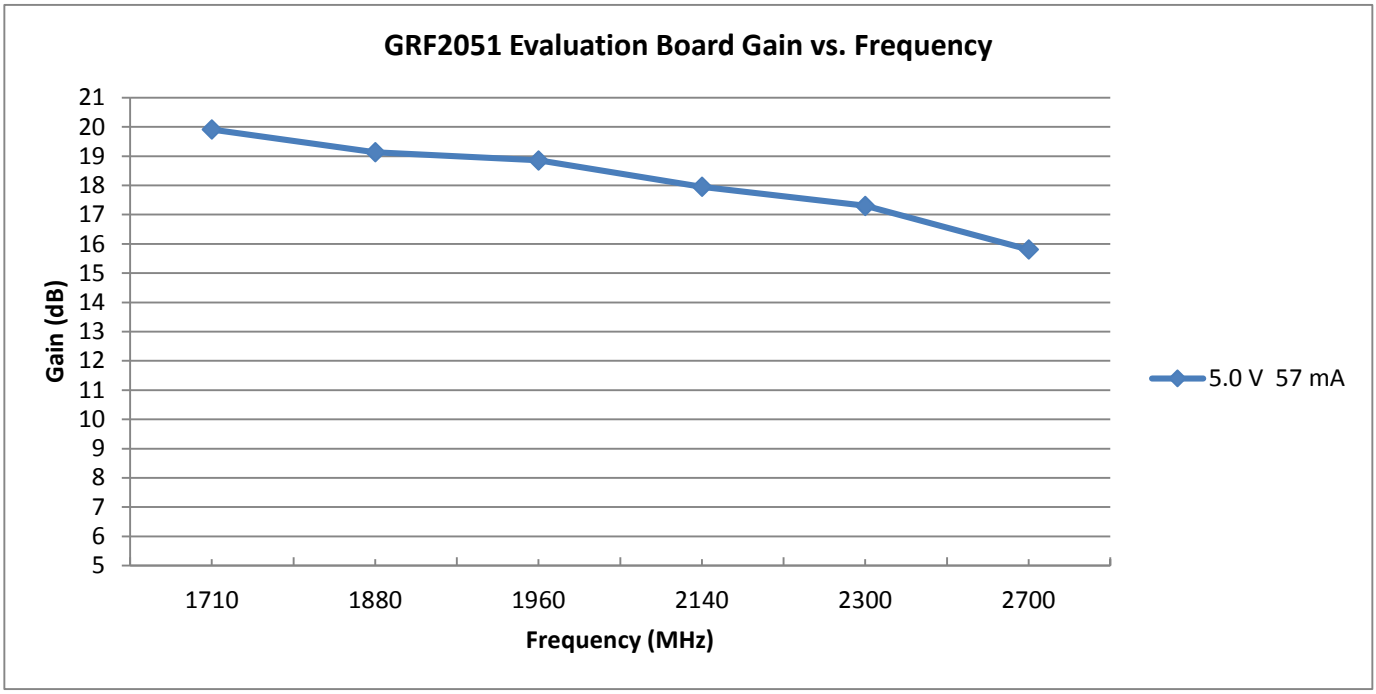
Tune (MHz)	Reference Freq. (MHz)	Gain (dB)	Eval Board NF (dB)	De-embedded NF (dB)	OP1dB (dBm)	OIP3 (dBm)	Bias Condition (V/mA)
1700 - 2700	1700	19.8	0.32	0.25	+20.5	+38.0	5.0/55
1700 - 2700	1900	19.0	0.35	0.25	+21.0	+39.0	5.0/55
1700 - 2700	2300	17.3	0.43	0.31	+21.5	+42.0	5.0/55
1700 - 2700	2500	16.5	0.44	0.35	+21.5	+43.0	5.0/55
1700 - 2700	2700	15.8	0.46	0.36	+21.5	+44.5	5.0/55

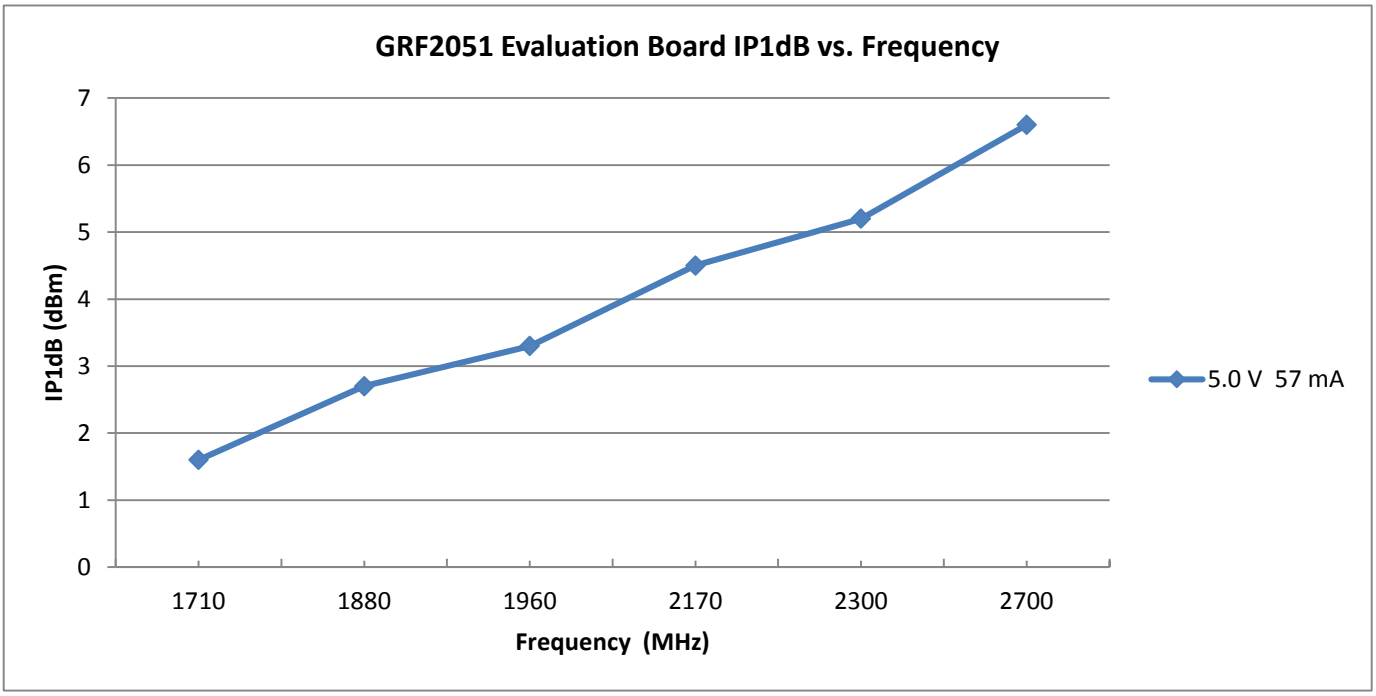
GRF2051 Evaluation Board S-Parameters and Stability Mu Factor: 1700 – 2700 MHz Tune

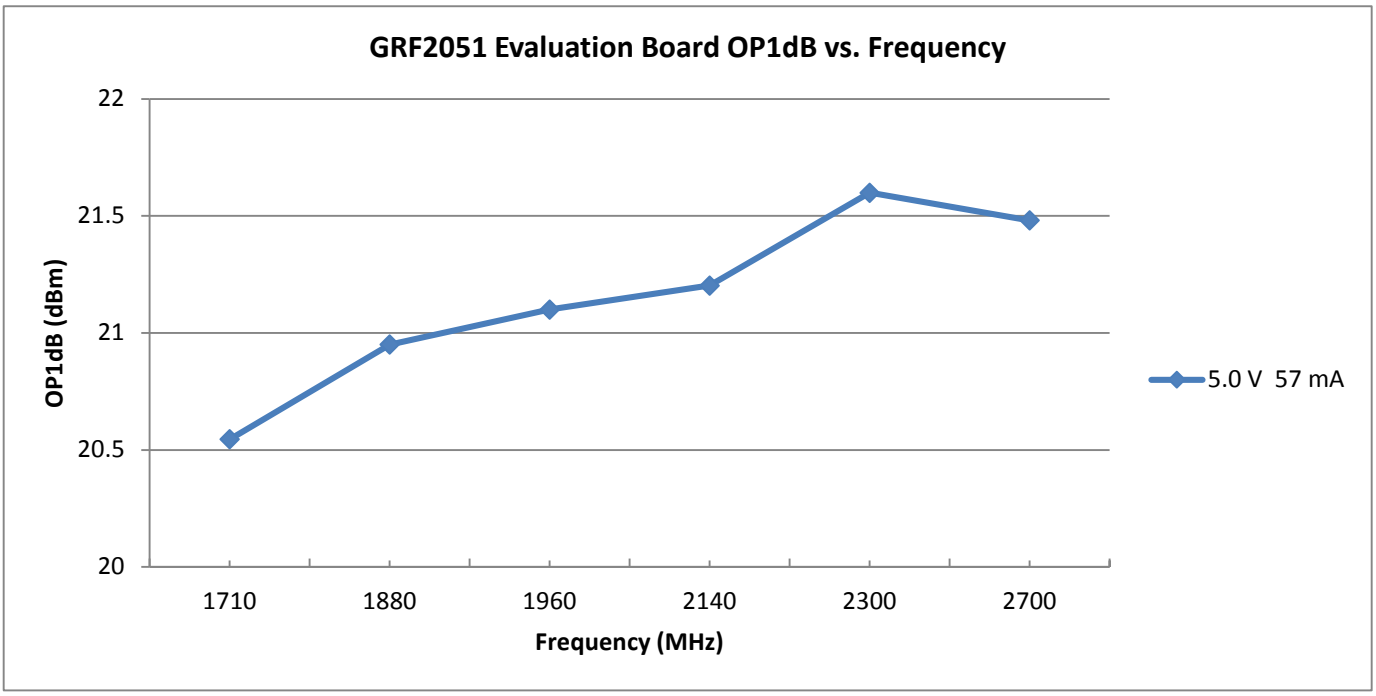


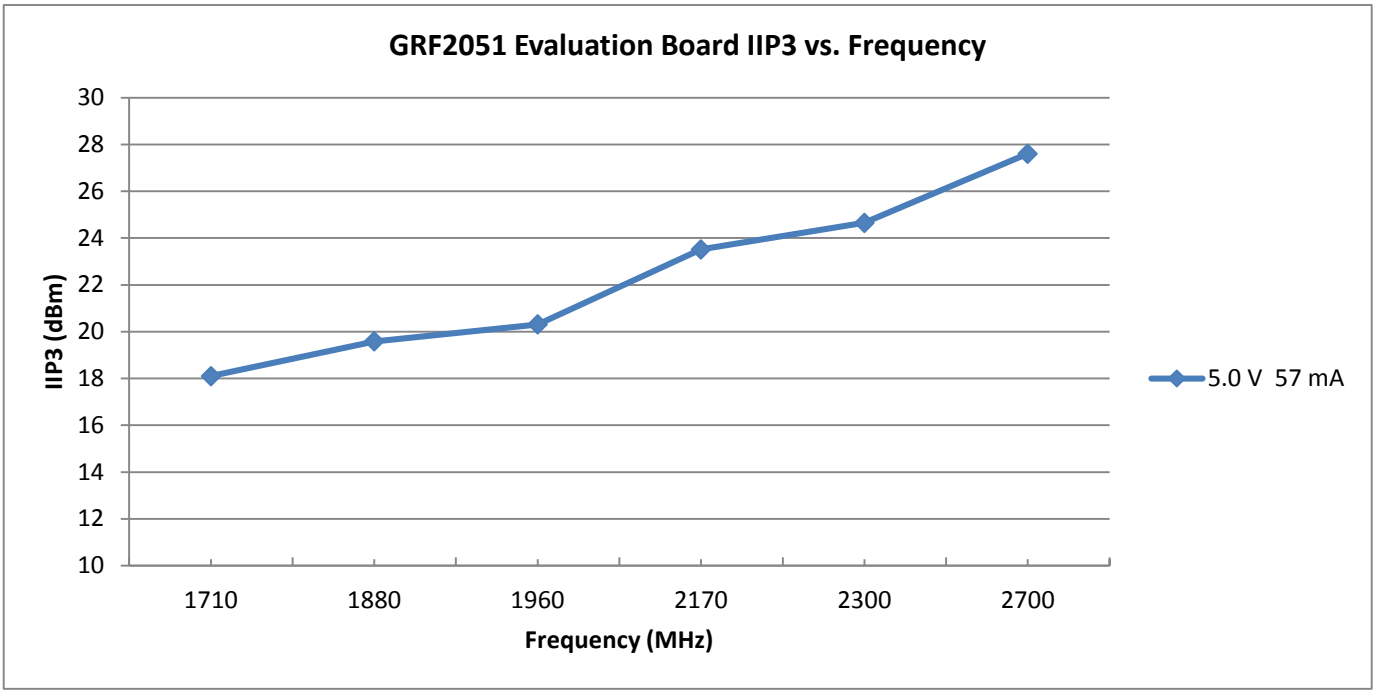


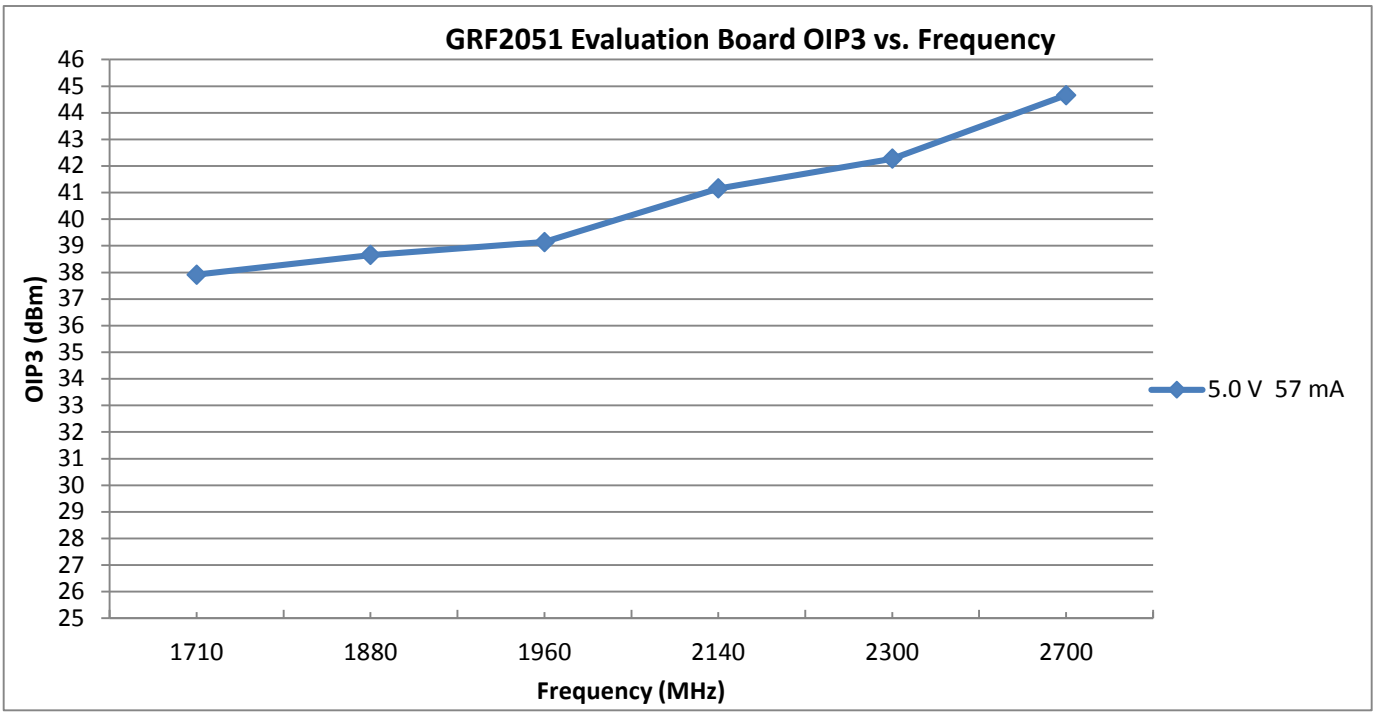

GRF2051 Evaluation Board NF vs. Frequency
NF (dB)
0.5
0.45
0.4
0.35
0.3
0.25
0.2
0.15
0.1
0.05
0
1710
1880
1960
2140
2300
2700
Frequency (MHz)
5.0 V 57 mA

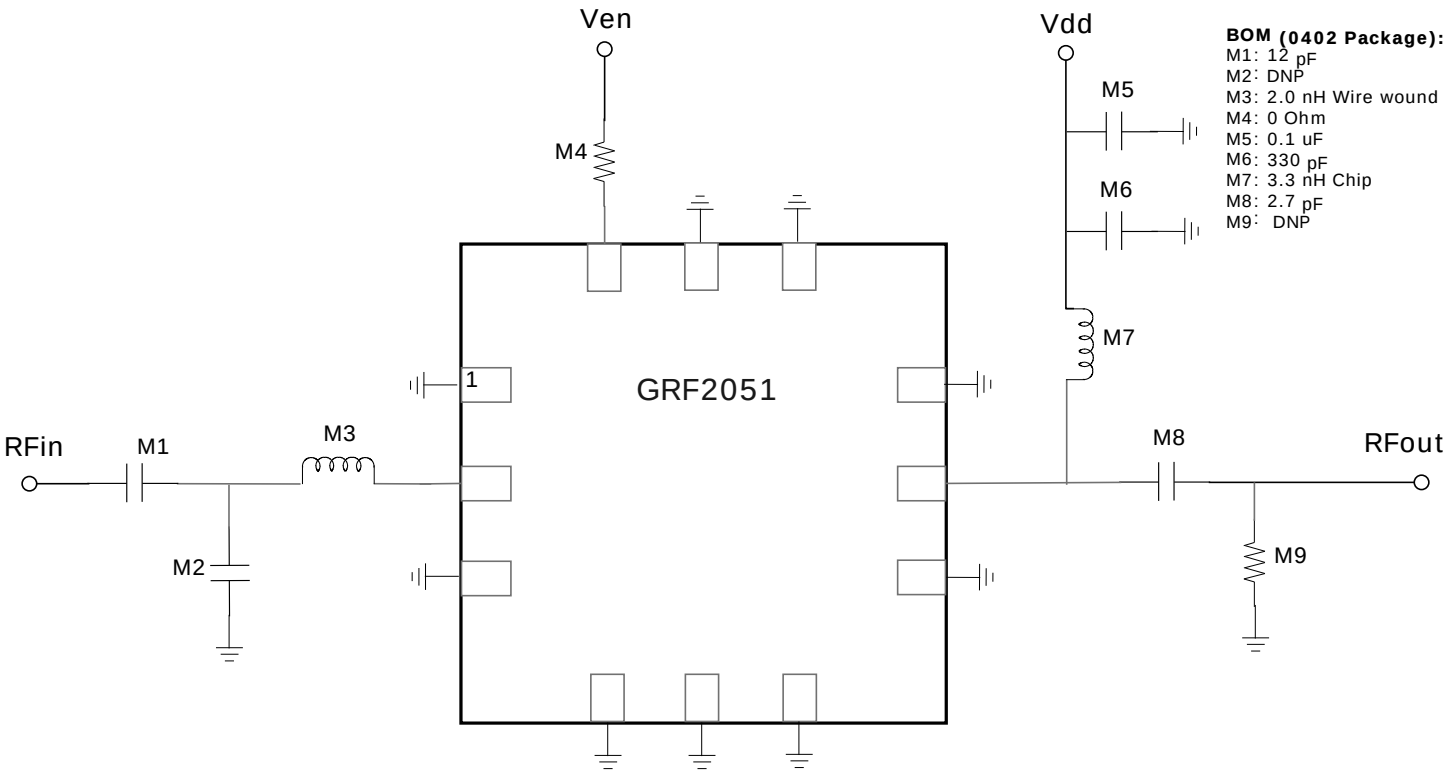

GRF2051 Evaluation Board Gain vs. Frequency
Gain (dB)
21
20
19
18
17
16
15
14
13
12
11
10
9
8
7
6
5
1710
1880
1960
2140
2300
2700
Frequency (MHz)
5.0 V 57 mA


GRF2051 Evaluation Board IP1dB vs. Frequency
IP1dB (dBm)
0
1
2
3
4
5
6
7
1710
1880
1960
2170
2300
2700
Frequency (MHz)
5.0 V 57 mA


GRF2051 Evaluation Board OP1dB vs. Frequency
OP1dB (dBm)
20
20.5
21
21.5
22
1710
1880
1960
2140
2300
2700
Frequency (MHz)
5.0 V 57 mA


GRF2051 Evaluation Board IIP3 vs. Frequency
IIP3 (dBm)
30
28
26
24
22
20
18
16
14
12
10
1710
1880
1960
2170
2300
2700
Frequency (MHz)
5.0 V 57 mA


GRF2051 Evaluation Board OIP3 vs. Frequency
OIP3 (dBm)
46
45
44
43
42
41
40
39
38
37
36
35
34
33
32
31
30
29
28
27
26
25
1710
1880
1960
2140
2300
2700
Frequency (MHz)
5.0 V 57 mA



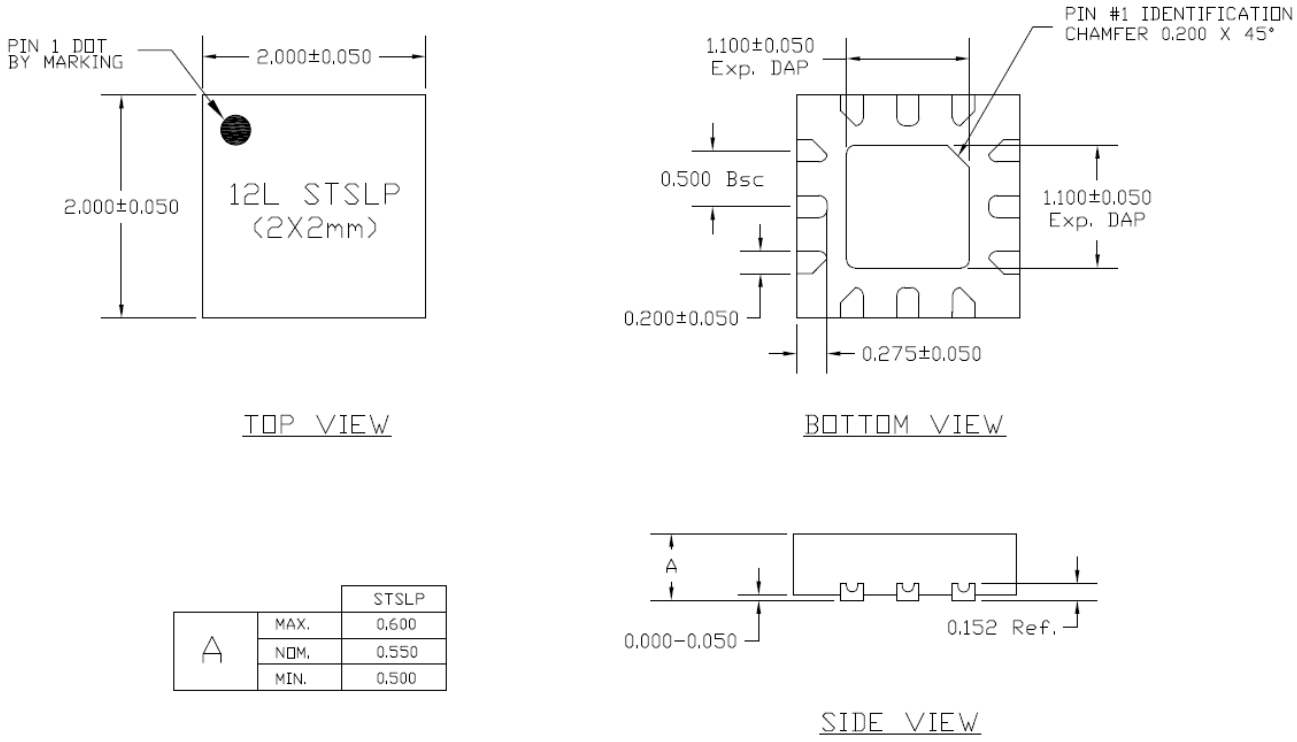
GRF2051 Application Schematic

GRF2051 Theory of Operation:

The GRF2051 is a single-stage, high-performance, ultra-low noise linear amplifier that is suitable for a wide range of high performance applications. With simple external matching on the output, the device can be tuned over 700-3800 MHz with fractional bandwidths up to 30%. This device is the intermediate gain member of the GRF205X family of LNA optimized as follows:

GRF2050: Optimized for 700 – 960 MHz (In Development)
GRF2051: Optimized for 1700 – 2700 MHz (Single Tune)
GRF2052: Optimized for 2300 – 2700 MHz and 3300 – 3800 MHz (Separate Tunes)

The device Iddq can be set independently from the supply voltage Vdd via the bias resistor in series with Venable. This allows the device Iddq to be optimized to meet a given linearity requirement with the highest possible efficiency. For a given Venable, increasing this resistor will result in lower Iddq.



		STSLP
A	MAX.	0.600
	NOM.	0.550
	MIN.	0.500

GRF2051 12-Pin QFN Package Dimensions

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.