Preliminary

GRF5020

+28.5 dBm Power-LNA™
0.1 – 3.8 GHz

Package: 3.0 x 3.0 mm QFN-16

Features

- 1.7 – 2.7 GHz with single match
- 17.5 dB Gain at 2500 GHz
- Evaluation Board NF: 0.77 dB at 2.5 GHz
- OP1dB: +28.5 dBm at Vdd: 8.0 volts
- OIP3: +50.0 dBm at Vdd: 8.0 volts
- Flexible Bias Voltage: 3.3 - 8.0 volts
- Adjustable Bias Current and Low Current Power Down function
- Unconditionally Stable

Applications

- Second or Third Stage LNA Requiring Ultra-High Linearity and Low Noise
- Linear Driver Amp for High PAR waveforms: such as LTE and WCDMA
- Small Cells
- Cellular Repeaters and Signal Boosters
- Microwave Backhaul
- Fast Switching TDD Systems

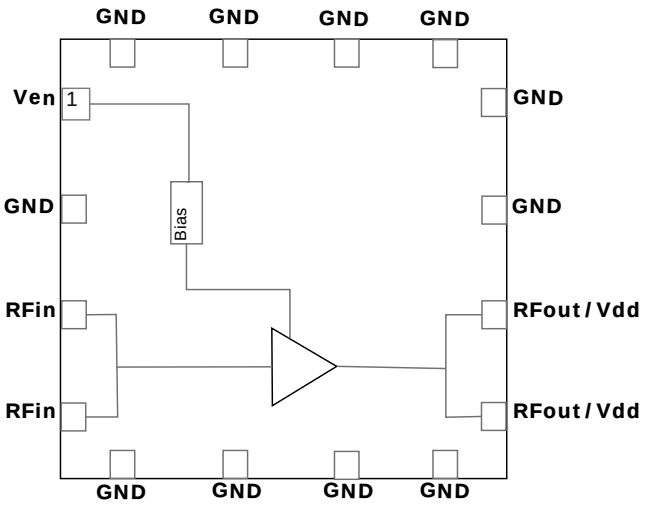
Product Description

The GRF5020 is a high linearity PA with ultra-low noise figure (NF). The primary tune for this device covers 1.7 to 2.7 GHz and it achieves outstanding P1dB, IP3 and NF over the band. The device can be tuned to deliver outstanding performance over 0.1 GHz. to 3.8 GHz with fractional bandwidths >20%.

In addition to use as a PA or linear driver, GRF5020 is well suited to demanding first, second or third stage LNA applications requiring high linearity, ruggedness and low NF.

GRF5020 is housed in a 3.0 x 3.0 x 0.55 mm 16-pin plastic QFN package.

Functional Block Diagram



Absolute Ratings

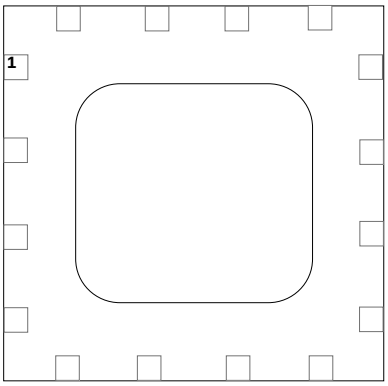
Parameter	Symbol	Min.	Max.	Unit
Drain Voltage	Vd	0	10	V
Avg. RF Input Power: (Load VSWR < 2:1; V_D: 8.0 volts)	$P_{IN\ MAX}$		+24	dBm
Avg. RF Input Power: (Load VSWR < 2:1; V_D: 5.0 volts)	$P_{IN\ MAX}$		+28	dBm
Operating Temperature (Package Heat Sink)	T_{AMB}	-40	+105	°C
Storage Temperature	T_{STG}	-40	+150	°C
Maximum Channel Temperature (MTTF > 10^6 Hours)	Tmax		+160	°C
Maximum Disspated Power (Note: De-rate 10 mW/°C for T_{AMB} > +85C.	$P_{DISS\ MAX}$		1600	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.

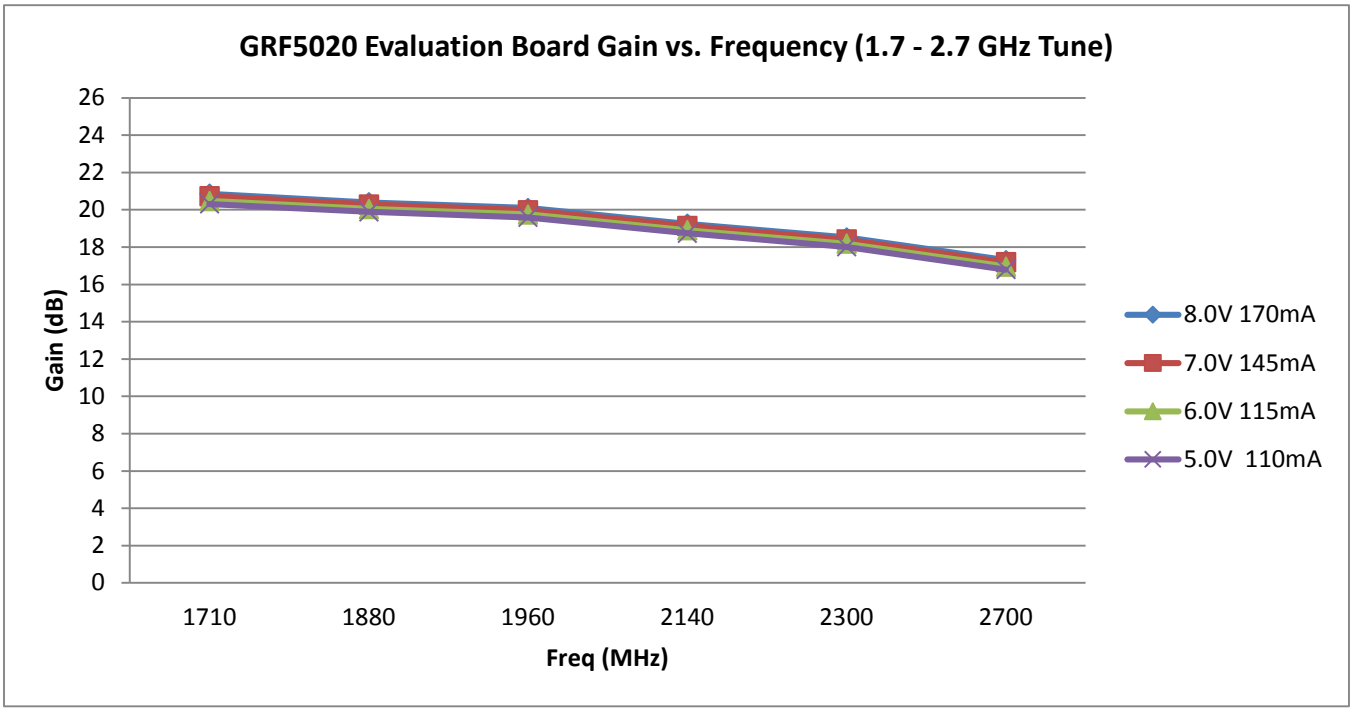
Parameter	Symbol	Specification			Unit	Condition
		Min.	Typ.	Max.		
Target Performance (1700-2700 MHz Tune)						**Bias: 5.0 V and 110 mA unless otherwise noted. (+25C)**
Test Frequency	Ftest		2.5		GHz	
Gain	S(2,1)		17.5		dB	
Noise Figure (De-embedded)	NF		0.65		dB	
Noise Figure (Evaluation Board)	NF		0.77		dB	
Output 1dB Compression Point	OP1dB		+24.3		dBm	Vdd: 5.0 volts; Iddq: 110 mA
Output 1dB Compression Point	OP1dB		+26.0		dBm	Vdd: 6.0 volts; Iddq: 115 mA
Output 1dB Compression Point	OP1dB		+27.5		dBm	Vdd: 7.0 volts; Iddq: 145 mA
Output 1dB Compression Point	OP1dB		+28.5		dBm	Vdd: 8.0 volts; Iddq: 170 mA
Output Third Order Intercept Point	OIP3		+43.5		dBm	Vdd: 5.0 volts; Iddq: 110 mA
Output Third Order Intercept Point	OIP3		+45.5		dBm	Vdd: 6.0 volts; Iddq: 115 mA
Output Third Order Intercept Point	OIP3		+49.5		dBm	Vdd: 7.0 volts; Iddq: 145 mA
Output Third Order Intercept Point	OIP3		+50.0		dBm	Vdd: 8.0 volts; Iddq: 170 mA
Drain Efficiency @ OP1dB	η		42.0		%	Vdd: 5.0 volts; Iddq: 110 mA
Drain Efficiency @ OP1dB	η		45.0		%	Vdd: 6.0 volts; Iddq: 115 mA
Drain Efficiency @ OP1dB	η		45.5		%	Vdd: 7.0 volts; Iddq: 145 mA
Drain Efficiency @ OP1dB	η		46.0		%	Vdd: 8.0 volts; Iddq: 170 mA
Input Return Loss	S(1,1)		-11.0		dB	
Output Return Loss	S(2,2)		-13.0		dB	
Switching Rise Time	T_rise		400		ns	
Switching Fall Time	T_fall		400		ns	
Quiescent Supply Current	Iddq		110		mA	No RF Applied
Disabled Mode						
Supply Current (Leakage)	I_{DD}		TBD		uA	
Enable Current	I_enable		TBD		uA	
Thermal Data						
Thermal Resistance: (TBD)	Θjc		40		°C/W	Estimated Pending IR Scan
Channel Temperature @ +85C Reference (package heat sink)	T_ch		139		°C	Vdd: 8.0 volts; Iddq: 170 mA Pdiss: 1.36 W; No RF

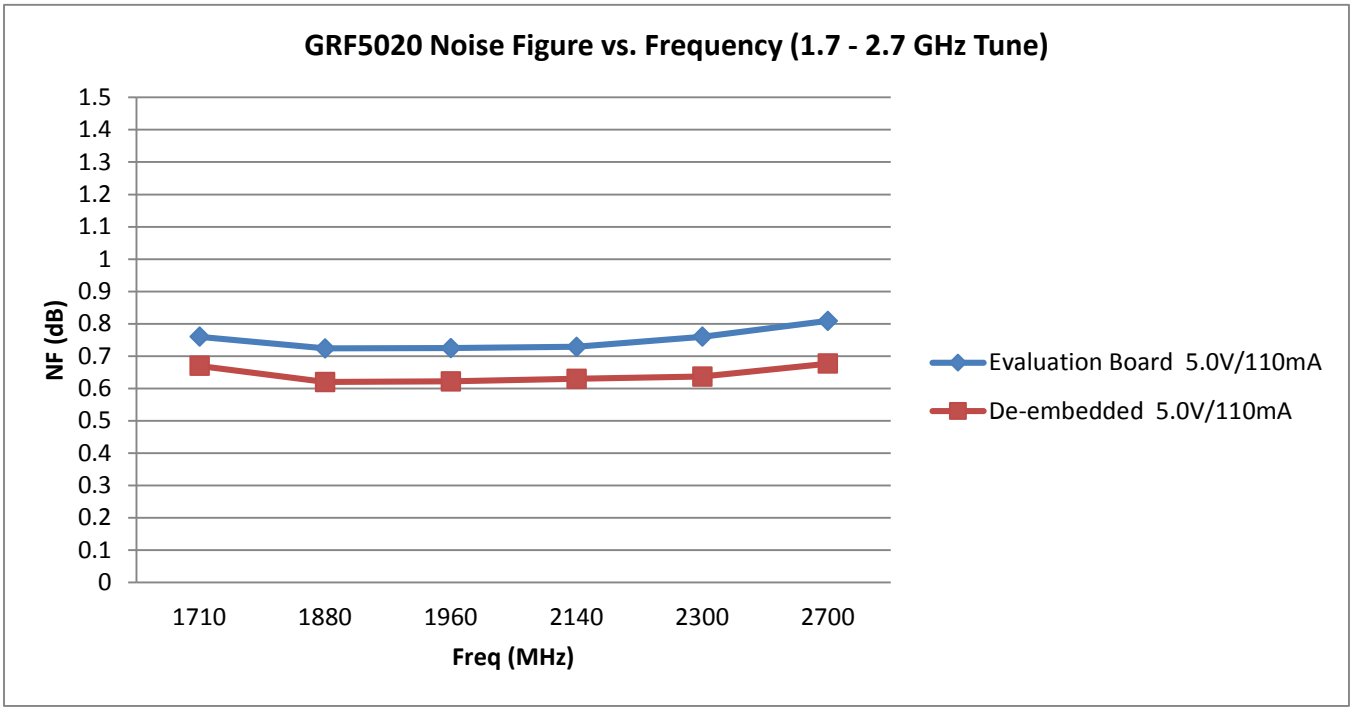
Pin Out (Top View)

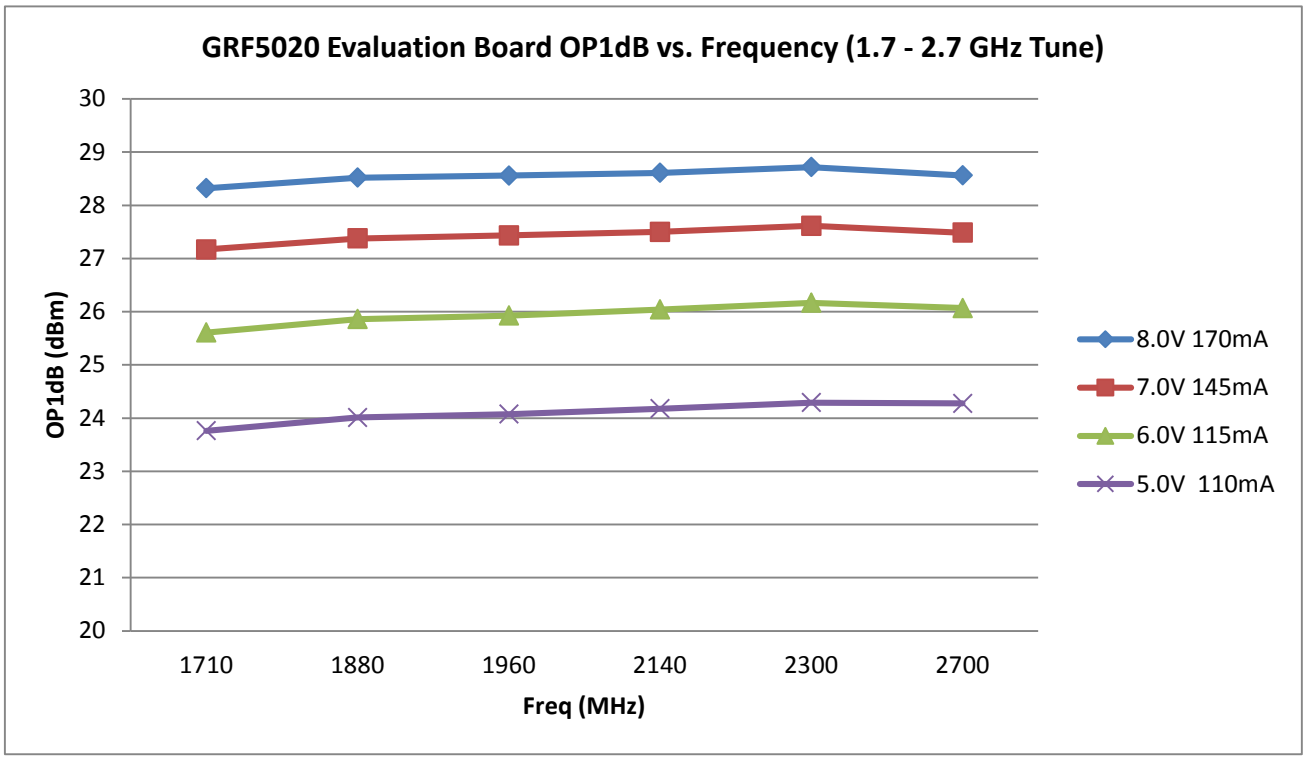


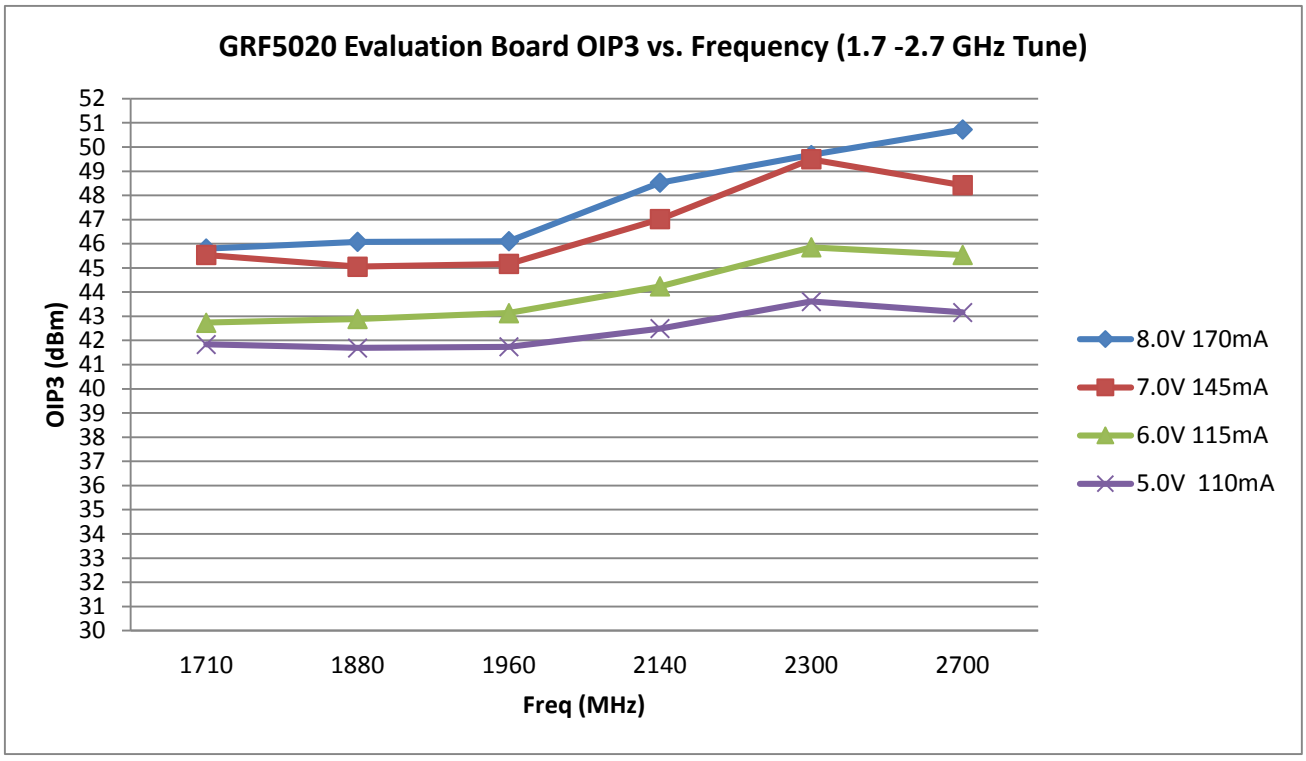
Pin Assignments

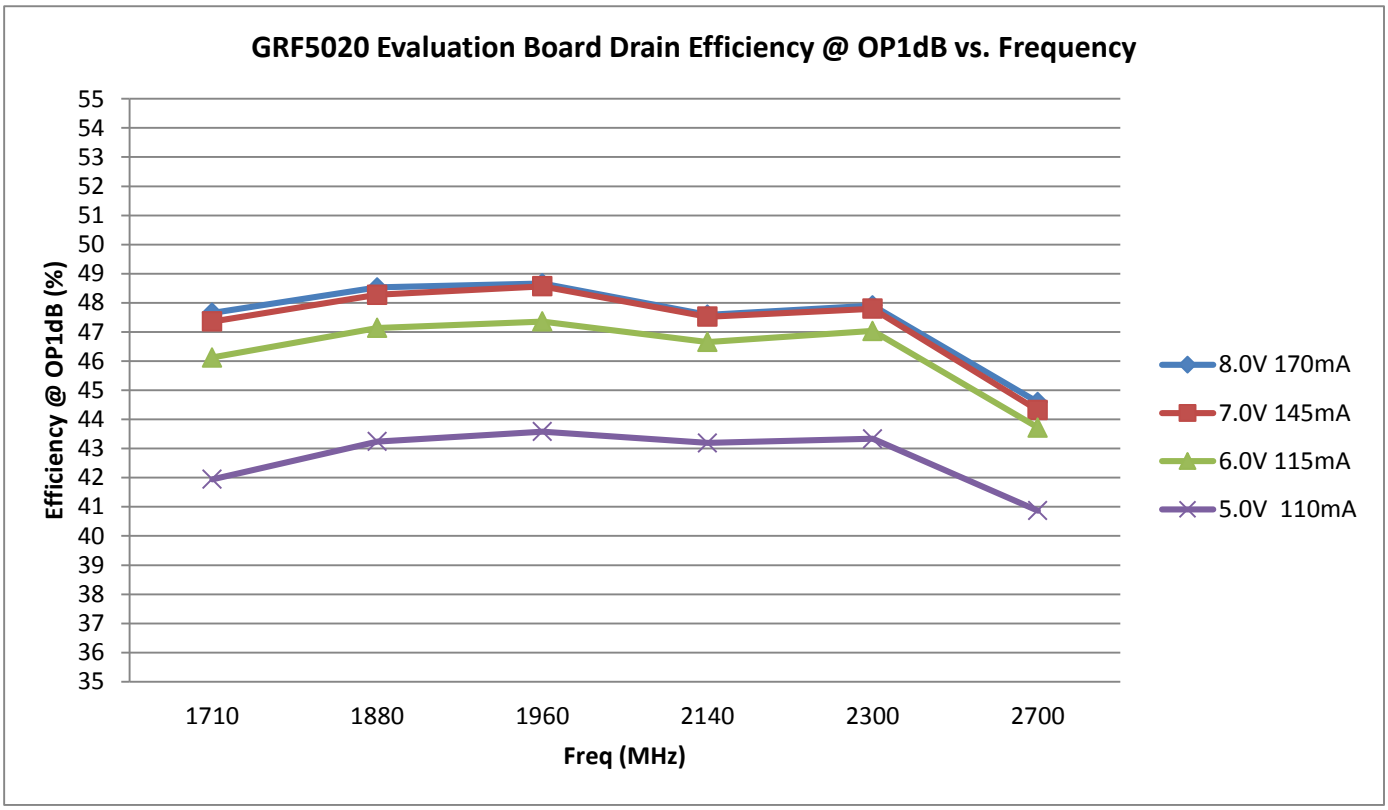
Pin	Name	Description	Note
1	Ven	Enable Voltage	Venable and series resistor M4 set the device Iddq.
2	GND	Ground	
3	RFin	RF Input	Pins 3-4 tied together on system board
4	RFin	RF Input	Pins 3-4 tied together on system board
5	GND	Ground	
6	GND	Ground	
7	GND	Ground	
8	GND	Ground	
9	RFout/Vdd	PA Output/Bias	Pins 9-10 tied together on system board. Supply Vdd here.
10	RFout/Vdd	PA Output/Bias	Pins 9-10 tied together on system board. Supply Vdd here.
11	GND	Ground	
12	GND	Ground	
13	GND	Ground	
14	GND	Ground	
15	GND	Ground	
16	GND	Ground	
PKG BASE	GND	Ground	Connect to system board ground


GRF5020 Evaluation Board Gain vs. Frequency (1.7 - 2.7 GHz Tune)
Gain (dB)
26
24
22
20
18
16
14
12
10
8
6
4
2
0
1710
1880
1960
2140
2300
2700
Freq (MHz)
8.0V 170mA
7.0V 145mA
6.0V 115mA
5.0V 110mA

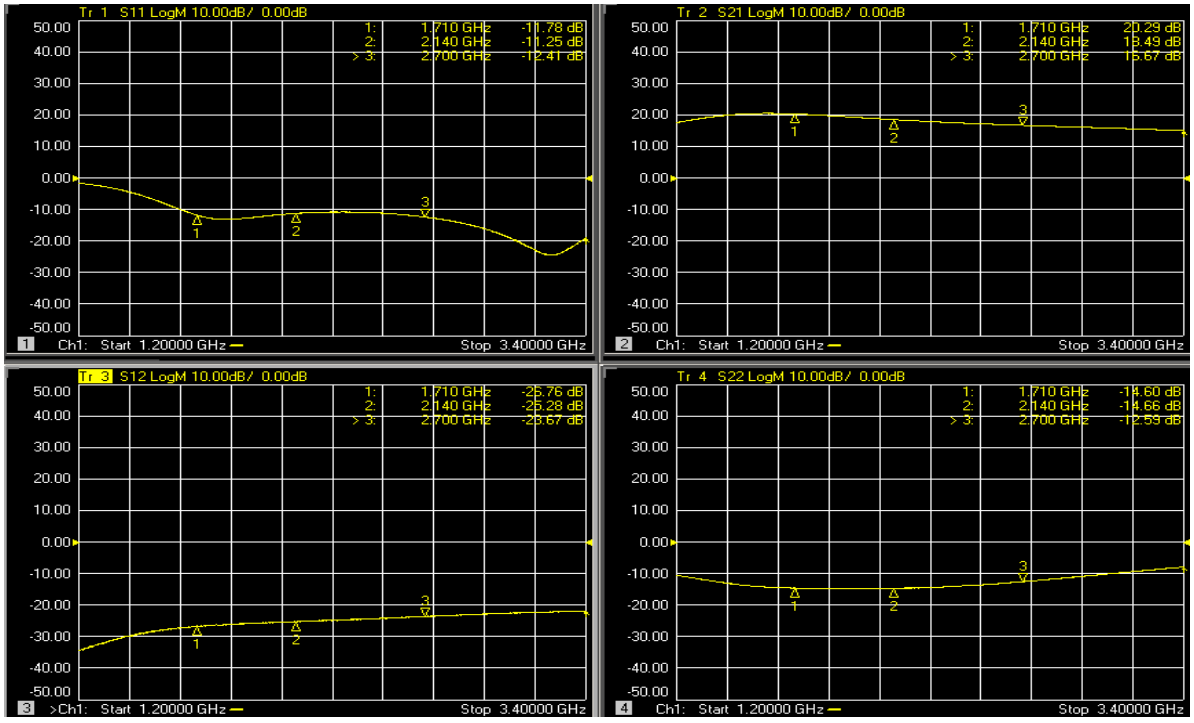

GRF5020 Noise Figure vs. Frequency (1.7 - 2.7 GHz Tune)
NF (dB)
1.5
1.4
1.3
1.2
1.1
1
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
1710
1880
1960
2140
2300
2700
Freq (MHz)
Evaluation Board 5.0V/110mA
De-embedded 5.0V/110mA

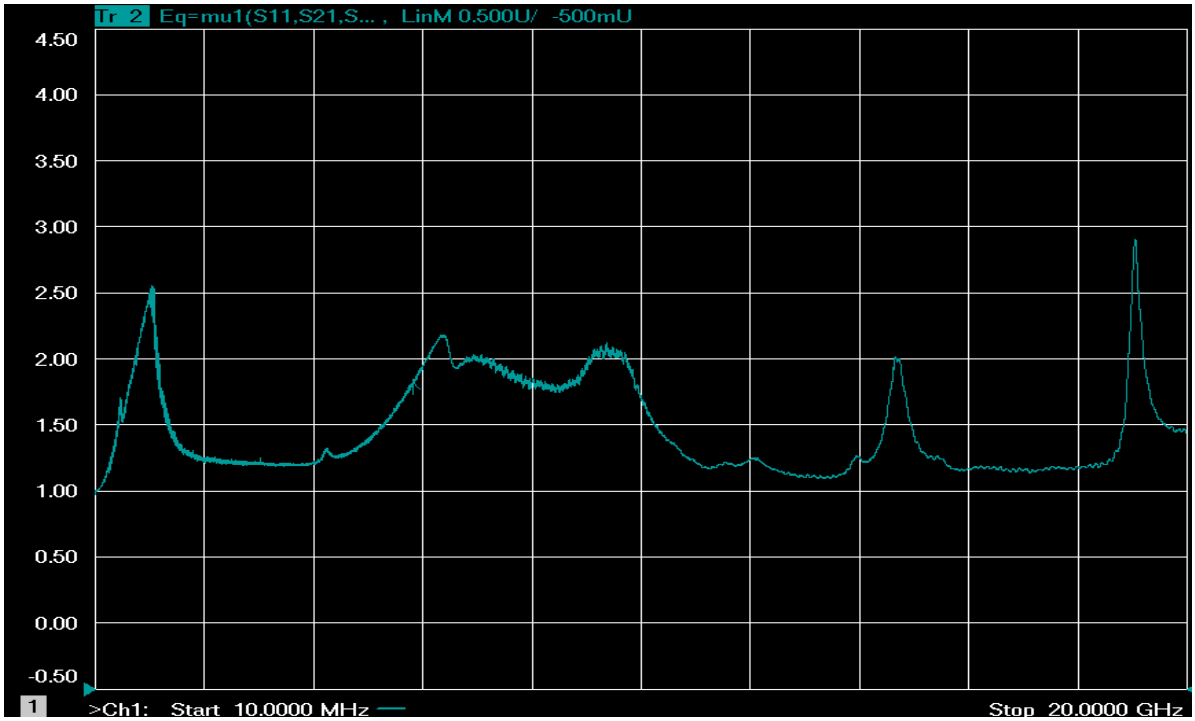

GRF5020 Evaluation Board OP1dB vs. Frequency (1.7 - 2.7 GHz Tune)
OP1dB (dBm)
30
29
28
27
26
25
24
23
22
21
20
1710
1880
1960
2140
2300
2700
Freq (MHz)
8.0V 170mA
7.0V 145mA
6.0V 115mA
5.0V 110mA

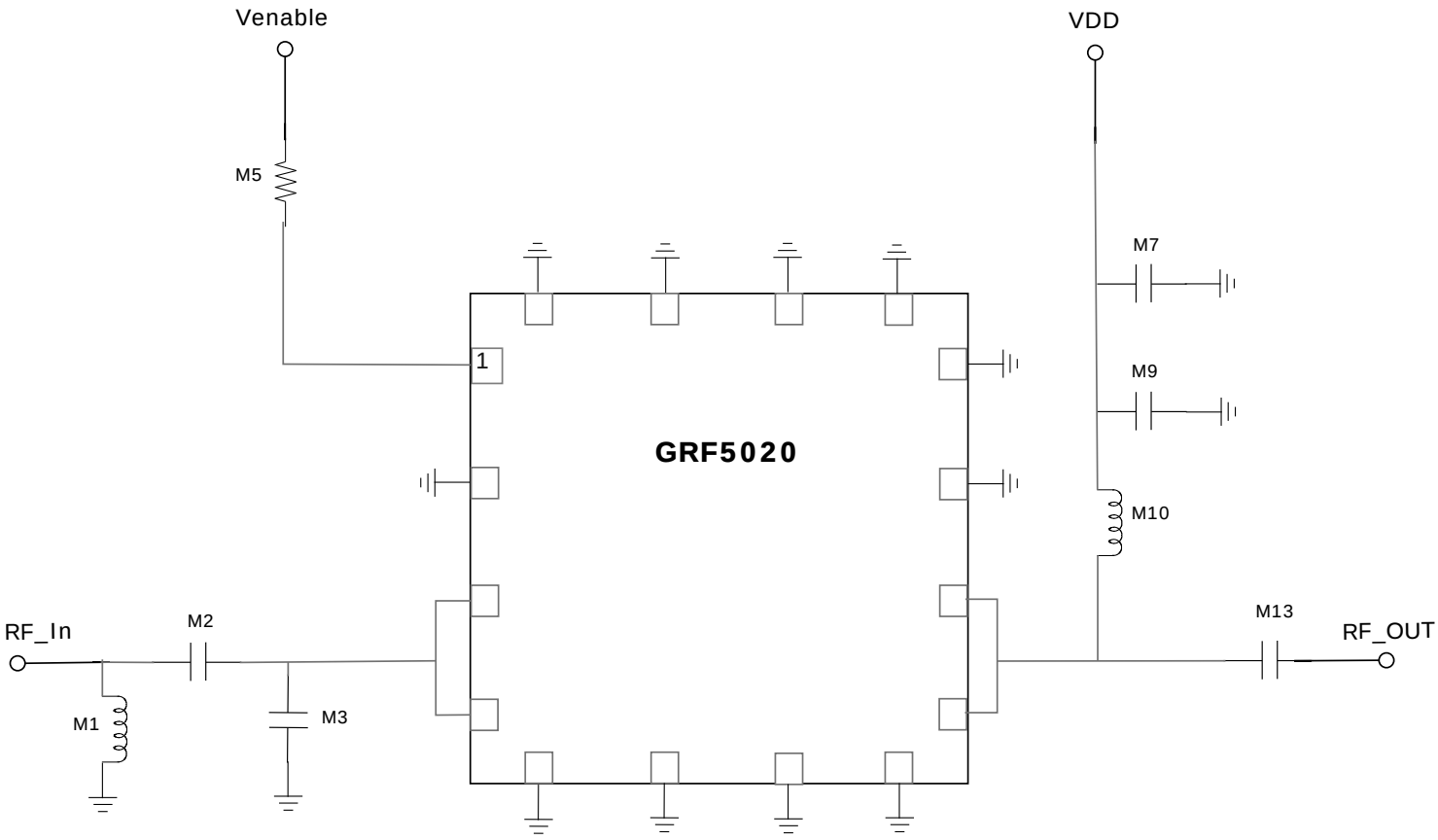

GRF5020 Evaluation Board OIP3 vs. Frequency (1.7 -2.7 GHz Tune)
OIP3 (dBm)
52
51
50
49
48
47
46
45
44
43
42
41
40
39
38
37
36
35
34
33
32
31
30
1710
1880
1960
2140
2300
2700
Freq (MHz)
8.0V 170mA
7.0V 145mA
6.0V 115mA
5.0V 110mA


GRF5020 Evaluation Board Drain Efficiency @ OP1dB vs. Frequency
Efficiency @ OP1dB (%)
55
54
53
52
51
50
49
48
47
46
45
44
43
42
41
40
39
38
37
36
35
1710
1880
1960
2140
2300
2700
Freq (MHz)
8.0V 170mA
7.0V 145mA
6.0V 115mA
5.0V 110mA

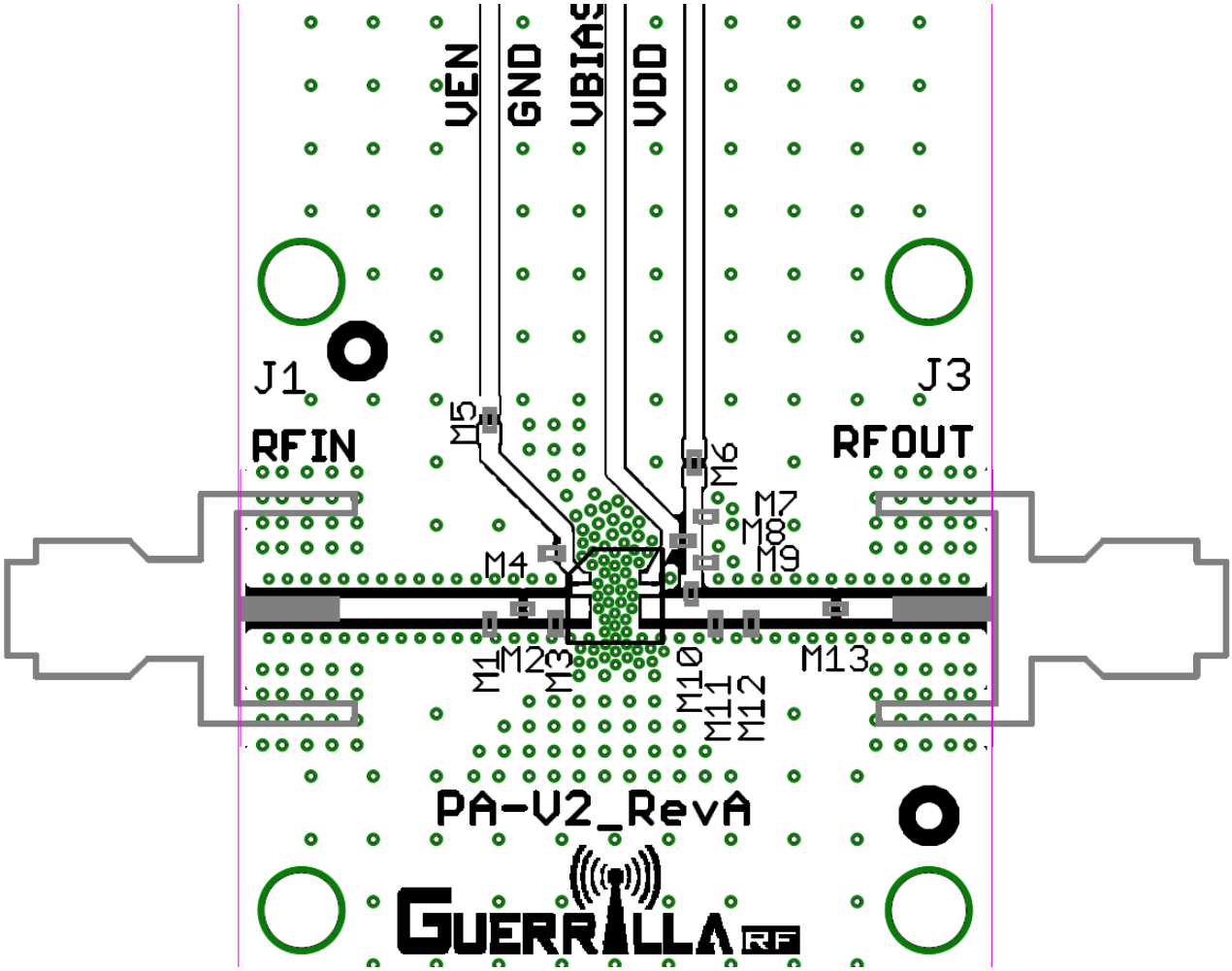
GRF5020 Evaluation Board S-Parameters and Stability Mu Factor Plots (1.7 – 2.7 GHz Tune:



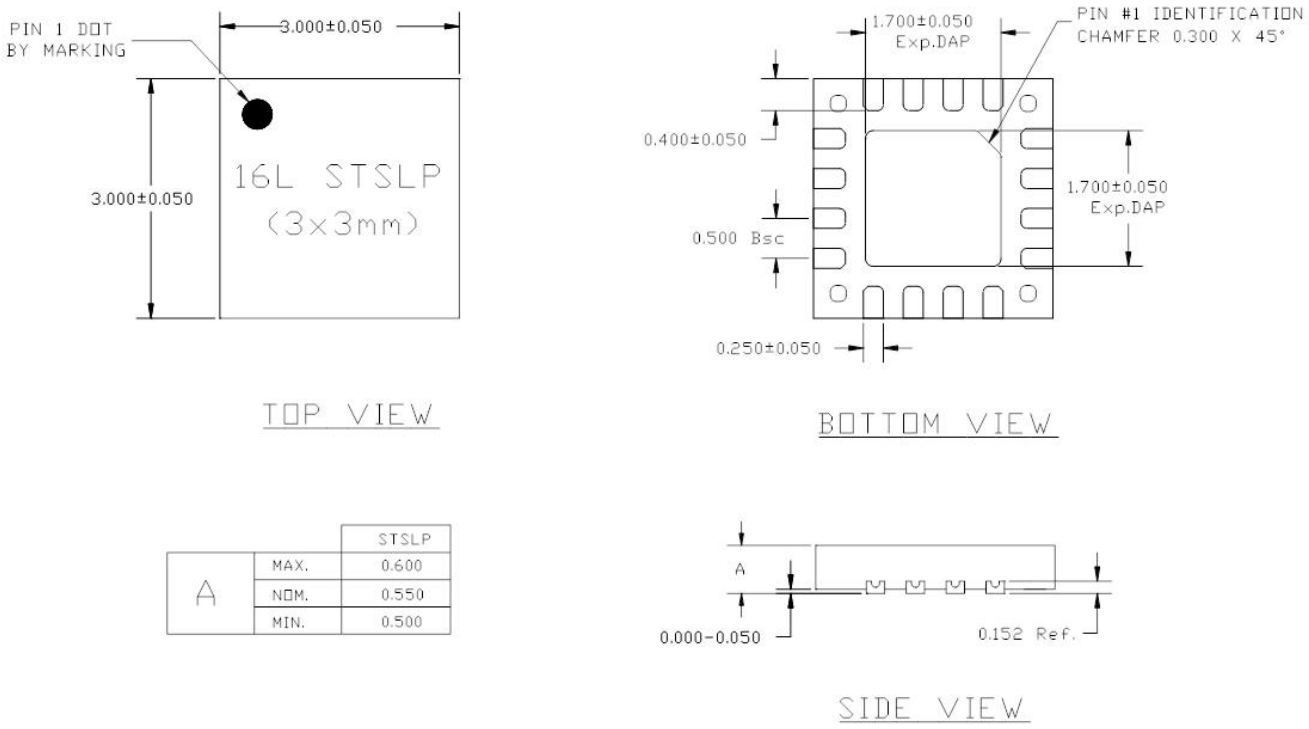




GRF5020 Evaluation Board Application Schematic



GRF5020 Evaluation Board Assembly Diagram



GRF5020 16-Pin QFN Package Dimensions (mm)

TBD

GRF5020 3.0 x 3.0 mm 16-Pin QFN PCB Layout Footprint (mm)

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.