



## 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.

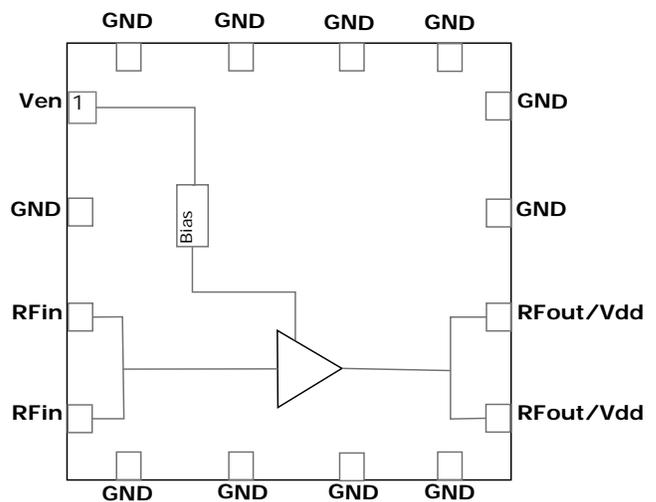
## Features

- 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

## Functional Block Diagram



## Absolute Ratings

Parameter	Symbol	Min.	Max.	Unit
Drain Voltage	V <sub>d</sub>	0	10	V
Avg. RF Input Power: (Load VSWR < 2:1; V <sub>d</sub> : 8.0 volts)	P <sub>IN MAX</sub>		+24	dBm
Avg. RF Input Power: (Load VSWR < 2:1; V <sub>d</sub> : 5.0 volts)	P <sub>IN MAX</sub>		+28	dBm
Operating Temperature (Package Heat Sink)	T <sub>AMB</sub>	-40	+105	°C
Storage Temperature	T <sub>STG</sub>	-40	+150	°C
Maximum Channel Temperature (MTTF > 10 <sup>6</sup> Hours)	T <sub>max</sub>		+160	°C
Maximum Dissipated Power (Note: De-rate 10 mW/°C for T <sub>AMB</sub> > +85C.)	P <sub>DISS MAX</sub>		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

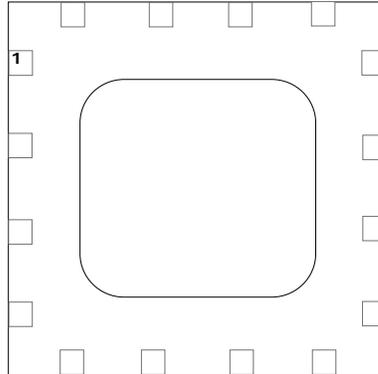


**Caution!** ESD Sensitive Device

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

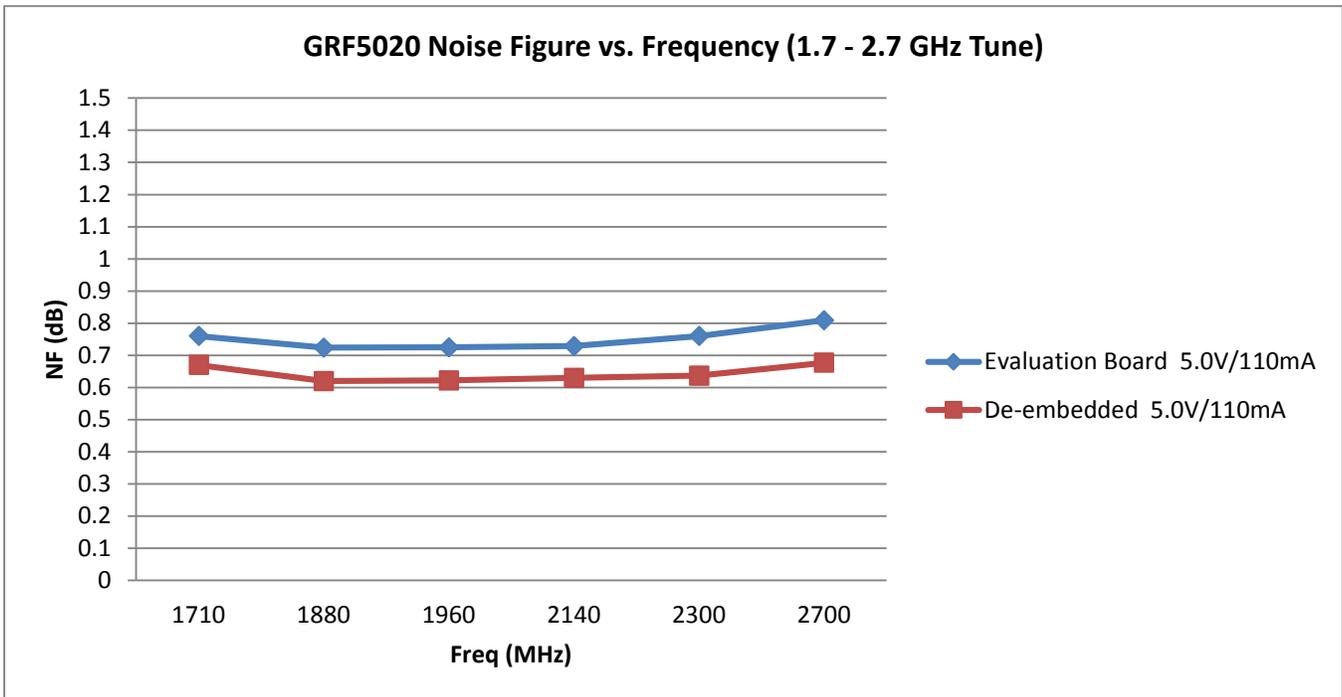
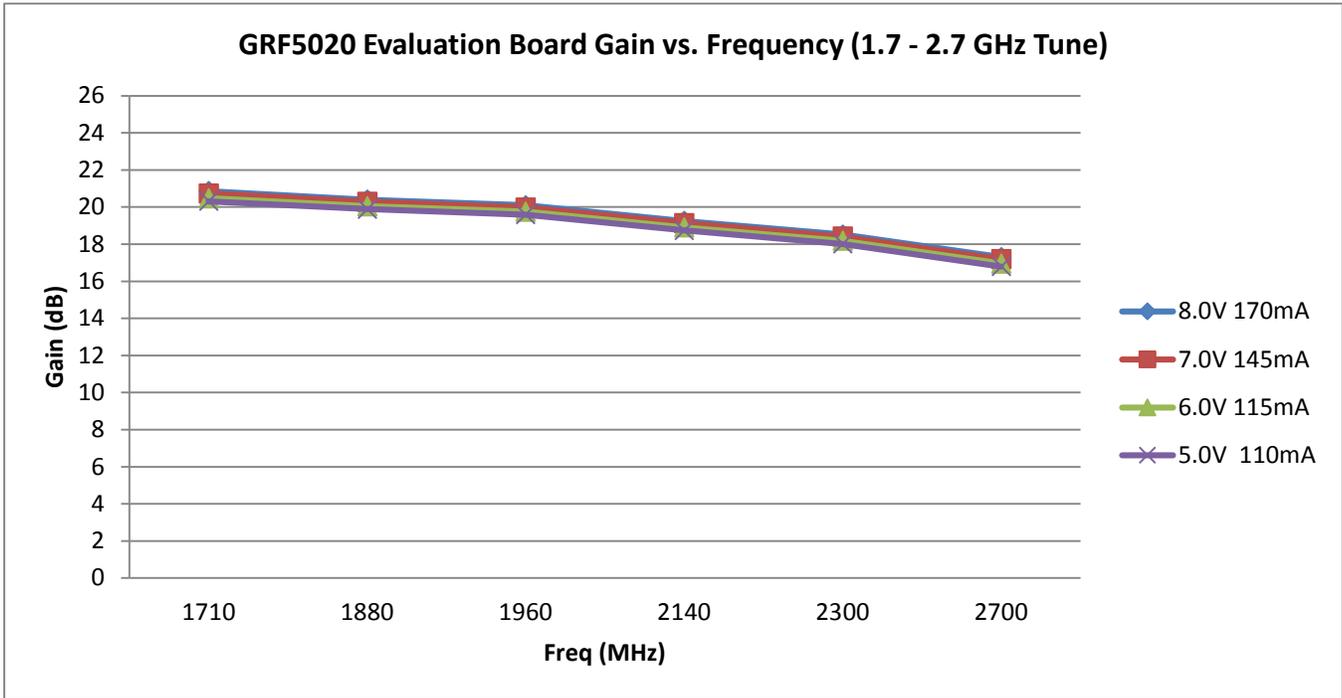
Parameter	Symbol	Specification			Unit	Condition
		Min.	Typ.	Max.		
<b>Target Performance (1700-2700 MHz Tune)</b>						<b>Bias: 5.0 V and 110 mA unless otherwise noted. (+25C)</b>
Test Frequency	F <sub>test</sub>		2.5		GHz	
Gain	S(2,1)		17.5		dB	
Noise Figure (De-embedded)	NF		0.65		dB	
Noise Figure (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 <sub>rise</sub>		400		ns	
Switching Fall Time	T <sub>fall</sub>		400		ns	
Quiescent Supply Current	I <sub>ddq</sub>		110		mA	No RF Applied
<b>Disabled Mode</b>						
Supply Current (Leakage)	I <sub>DD</sub>		TBD		uA	
Enable Current	I <sub>enable</sub>		TBD		uA	
<b>Thermal Data</b>						
Thermal Resistance: (TBD)	Θ <sub>jc</sub>		40		°C/W	Estimated Pending IR Scan
Channel Temperature @ +85C Reference (package heat sink)	T <sub>ch</sub>		139		°C	Vdd: 8.0 volts; Iddq: 170 mA Pdiss: 1.36 W; No RF

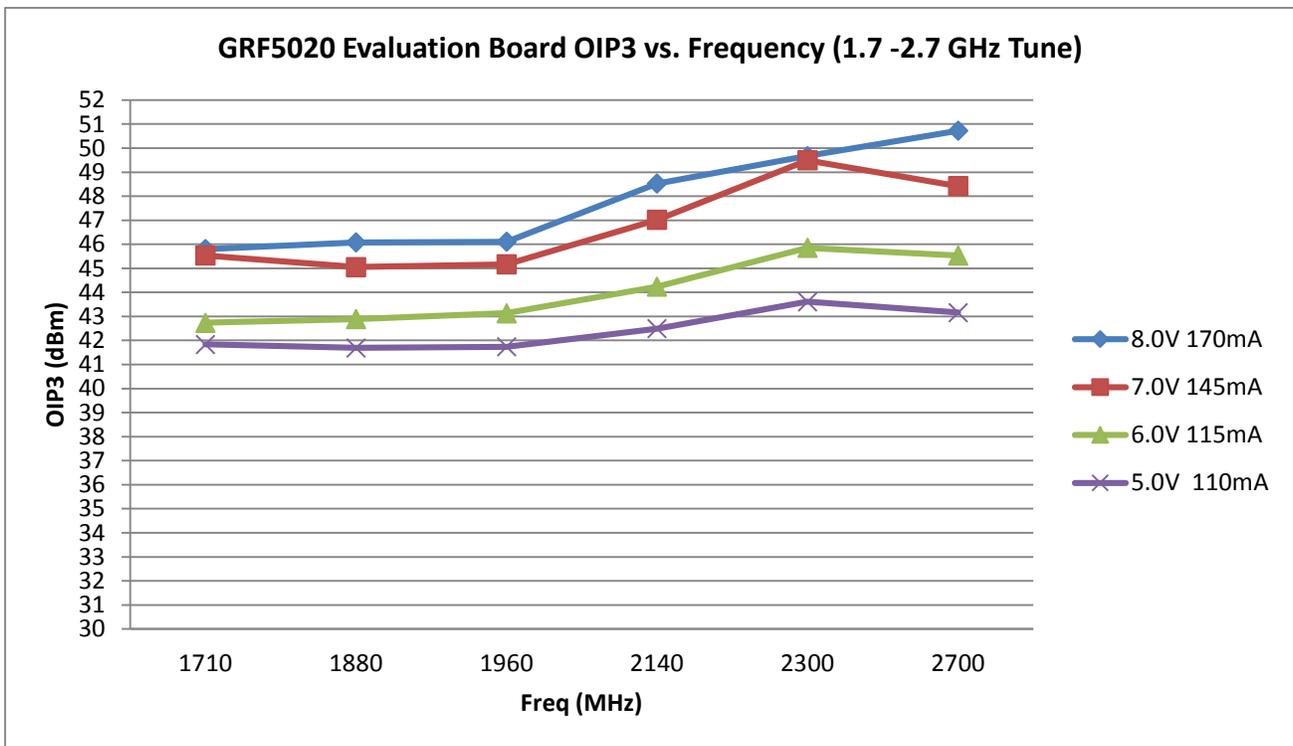
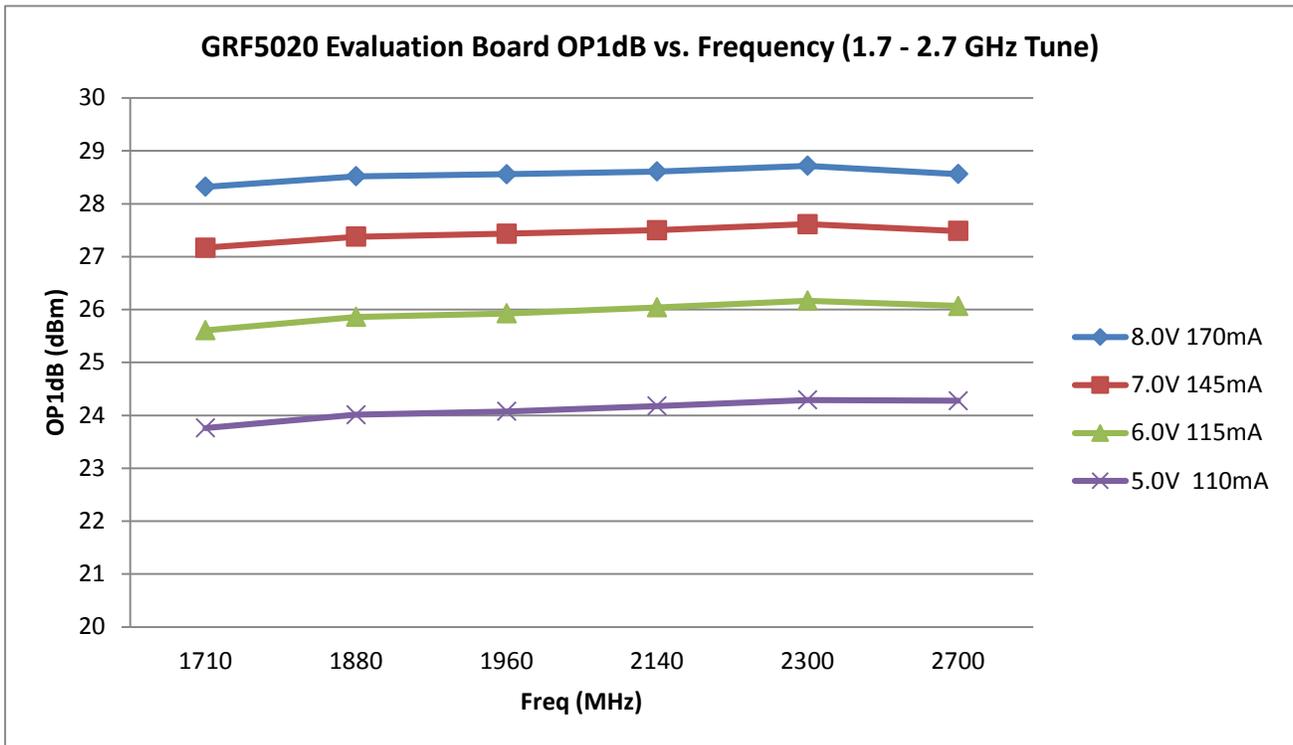
## Pin Out (Top View)

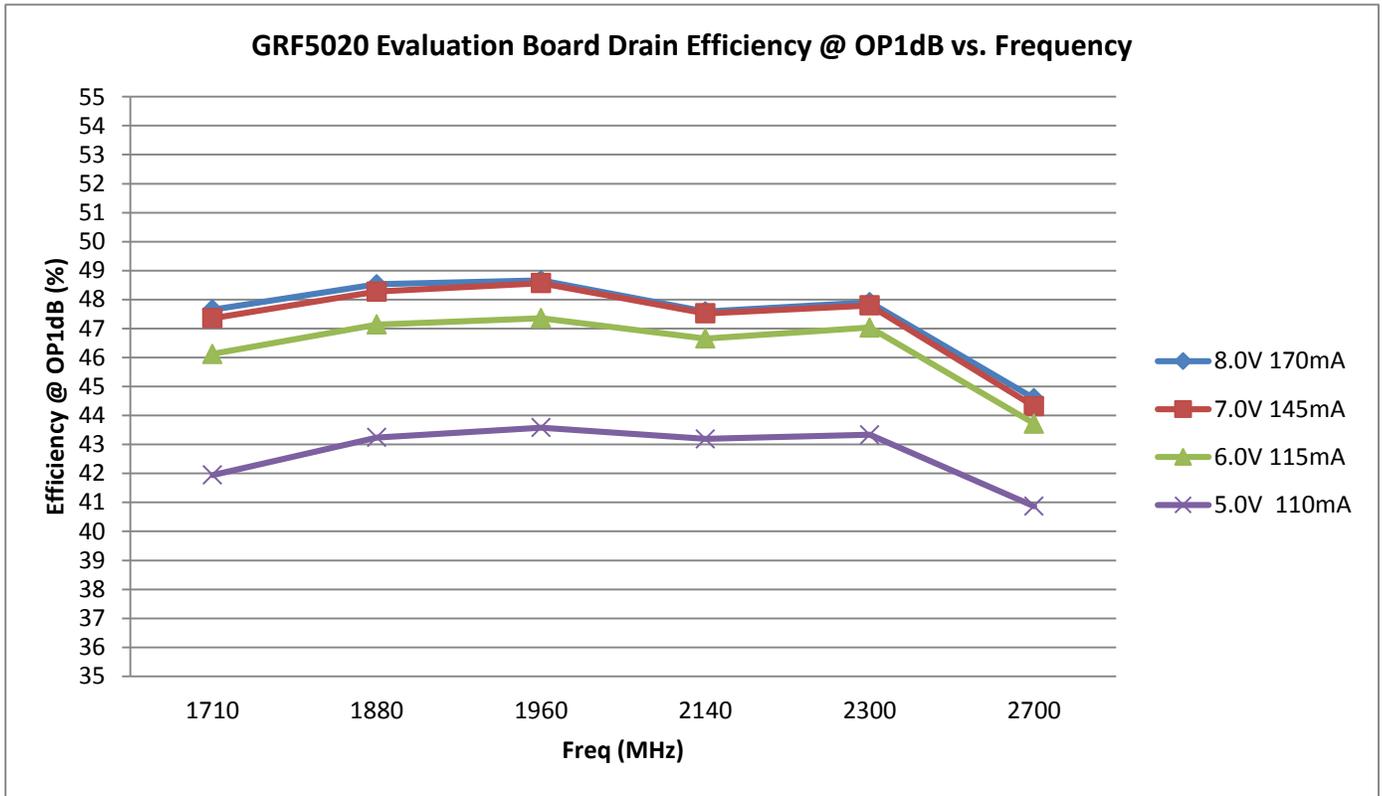


## Pin Assignments

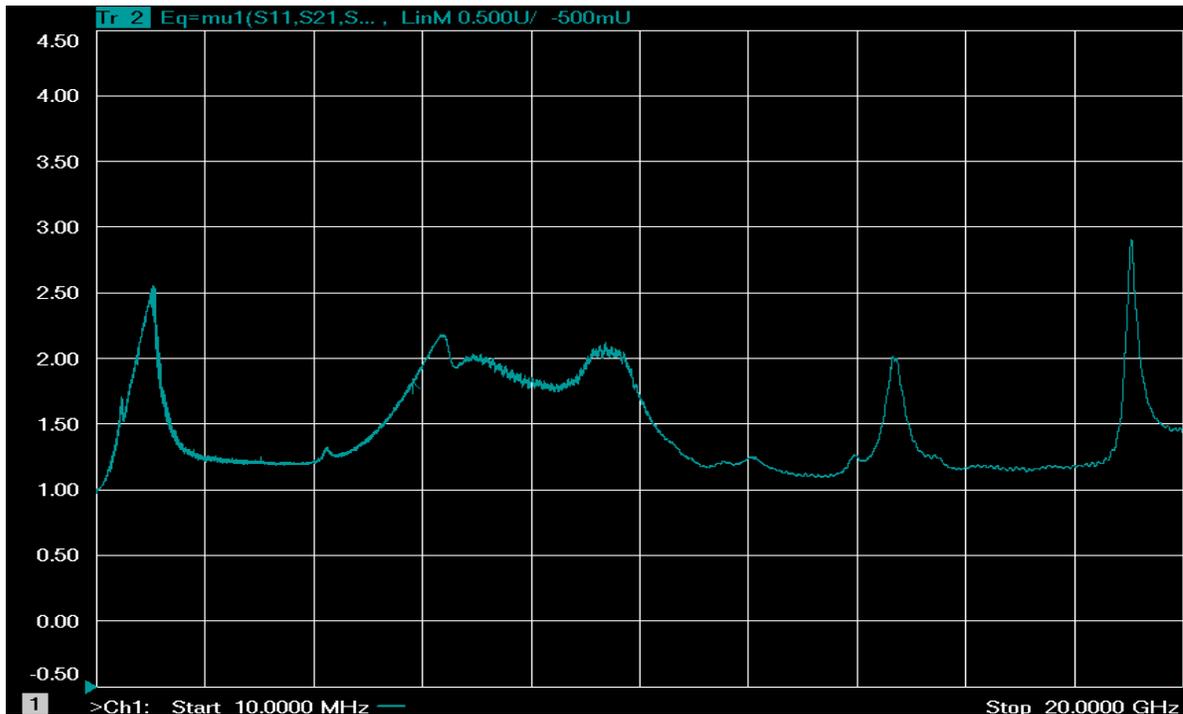
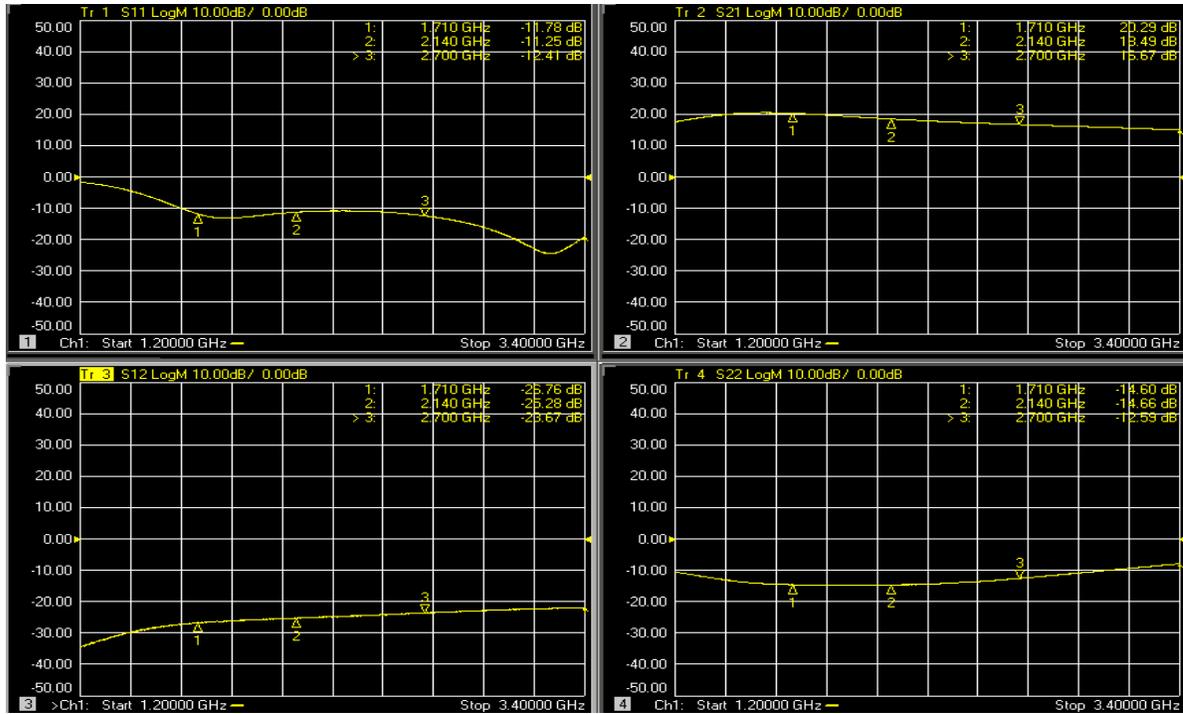
Pin	Name	Description	Note
<b>1</b>	<b>Ven</b>	Enable Voltage	Venable and series resistor M4 set the device Iddq.
<b>2</b>	<b>GND</b>	Ground	
<b>3</b>	<b>RFin</b>	RF Input	Pins 3-4 tied together on system board
<b>4</b>	<b>RFin</b>	RF Input	Pins 3-4 tied together on system board
<b>5</b>	<b>GND</b>	Ground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

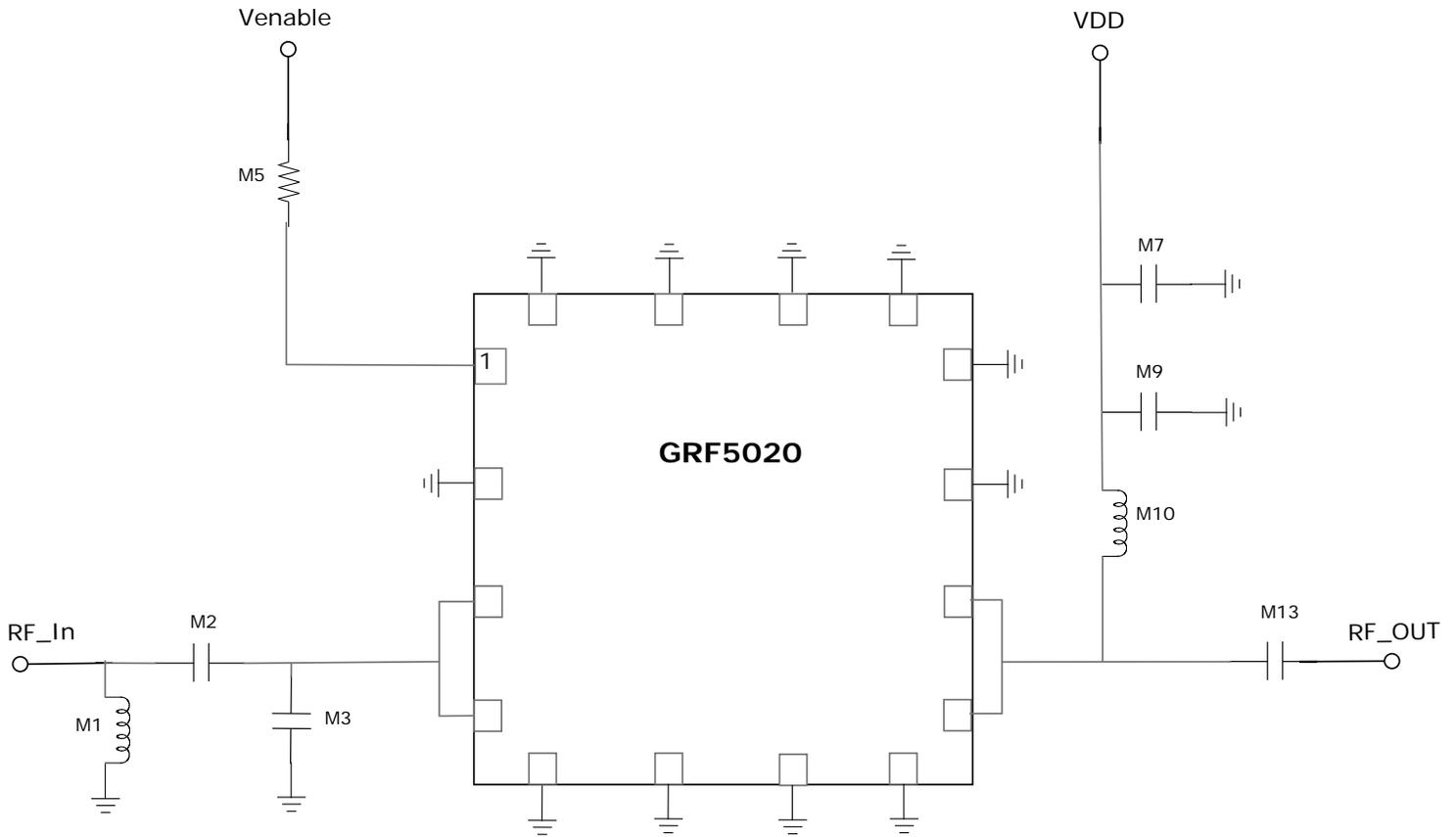




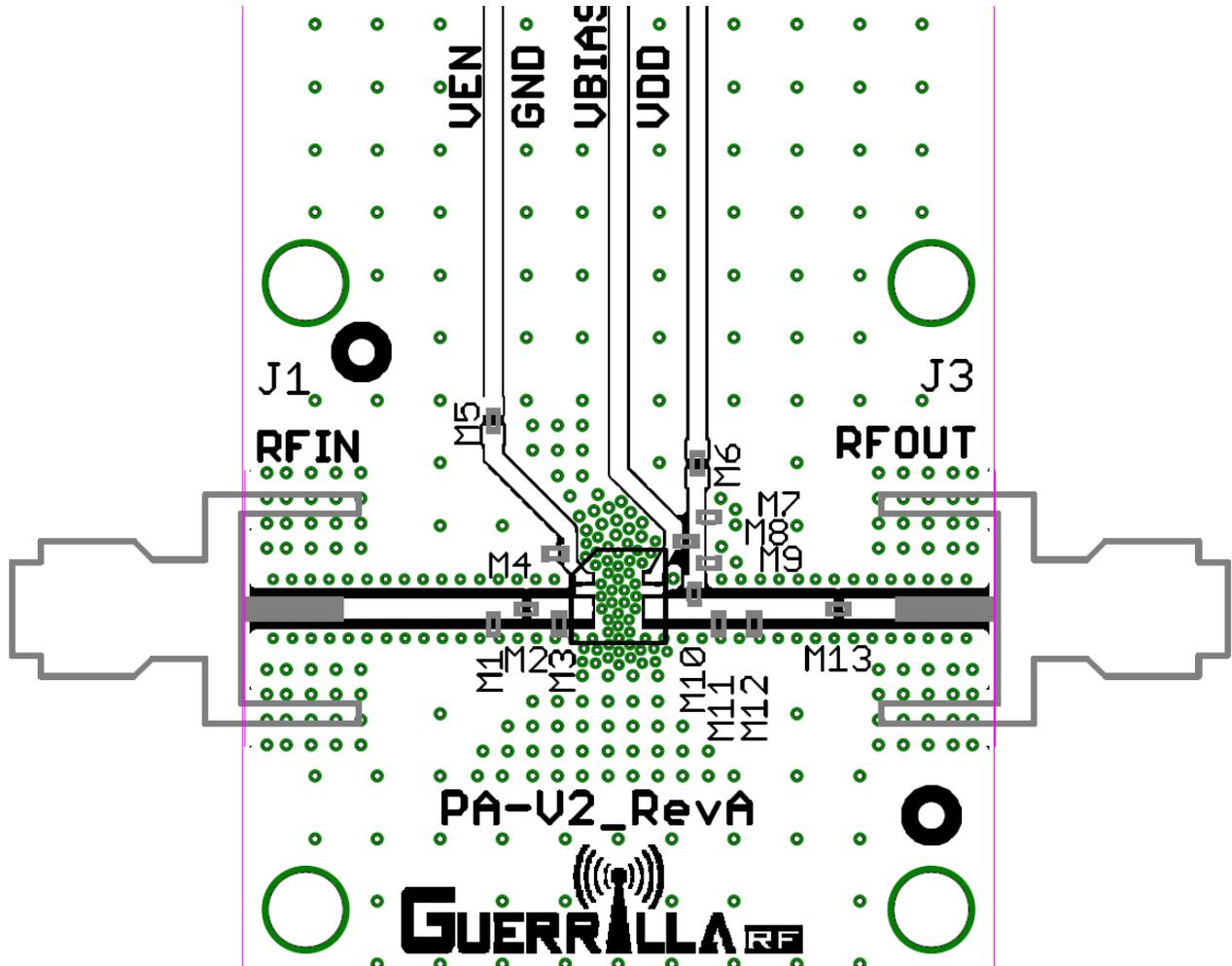


GRF5020 Evaluation Board S-Parameters and Stability Mu Factor Plots (1.7 - 2.7 GHz Tune:

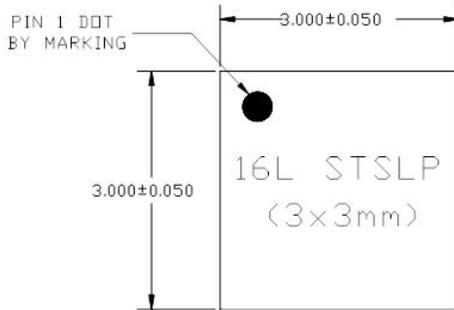




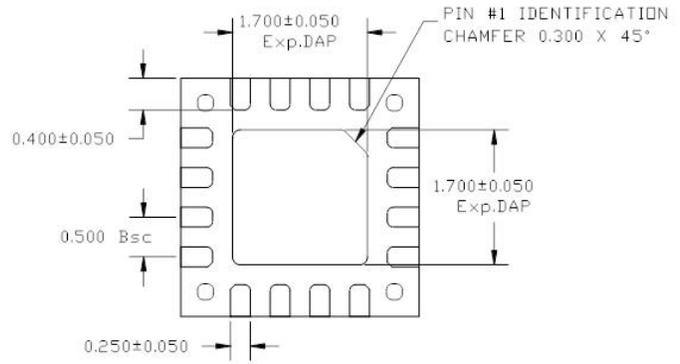
GRF5020 Evaluation Board Application Schematic



GRF5020 Evaluation Board Assembly Diagram

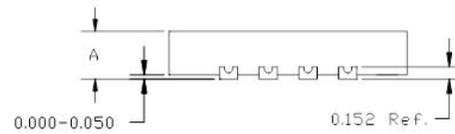


TOP VIEW



BOTTOM VIEW

		STSLP
A	MAX.	0.600
	NOM.	0.550
	MIN.	0.500



SIDE VIEW

## 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.

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