



## Product Description

GRF2014 is a broadband, linear gain block designed for small cell, wireless infrastructure and other high performance applications. It exhibits outstanding broadband linearity and return losses over 500 to 2700 MHz with a single match.

The device is operated from a supply voltage ( $V_{DD}$ ) of 2.7 to 8.0V with adjustable  $I_{DDQ}$  for optimal efficiency and linearity.

The device is internally matched to  $50\ \Omega$  at the input and output ports, needing only external DC blocks and a bias choke on the output.

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

## Features

Reference: 5.0V/150mA/900 MHz

- Gain: 15.9 dB
- OIP3: 43.5 dBm;
- OP1dB: 24.0 dBm

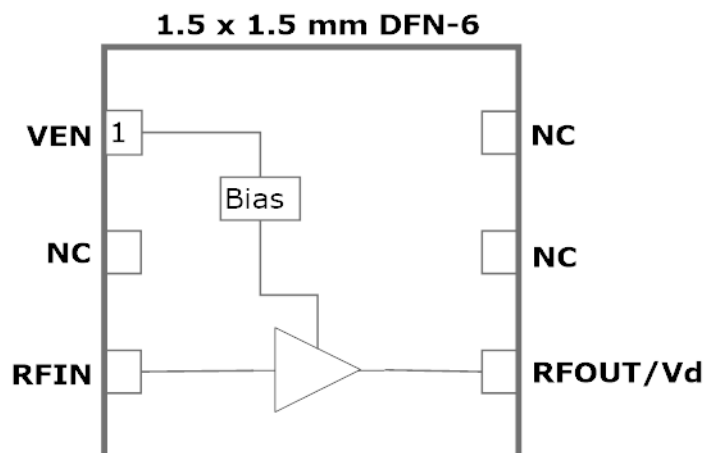
Reference: 8.0V/150mA/900 MHz

- Gain: 15.9 dB
- OIP3: 41.0 dBm;
- OP1dB: 27.5 dBm

- Flexible Bias Voltage and Current
- Internally Matched to  $50\ \Omega$
- Process: GaAs pHEMT

## Applications

- Linear Driver Amplifier
- Small Cells and Cellular Repeaters
- Distributed Antenna Systems
- IF Amplifier
- General Purpose Linear Gain Block





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# GRF2014

Broadband Linear Gain Block  
0.05 to 3.8 GHz

## Absolute Ratings:

Parameter	Symbol	Min.	Max.	Unit
Supply Voltage	V <sub>DD</sub>	0	9.0	V
RF Input Power: (Load VSWR < 2:1; V <sub>D</sub> : <= 8.0 volts)	P <sub>IN MAX</sub>		21	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>		1.5	W
<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

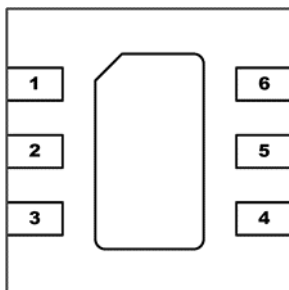


Exceeding Absolute Maximum Rating conditions may cause permanent damage to the device.

**Note:** For manufacturing information, see the [Guerrilla-RF.com](http://Guerrilla-RF.com) website for the following document located on the GRF2014 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 <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.
2	NC	No Connect or Ground	No internal connection to die
3	RF_In	LNA RF input	Internally matched 50Ω. An external DC blocking cap must be used.
4	RF_Out	LNA RF output	Internally matched 50Ω. V <sub>DD</sub> 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.



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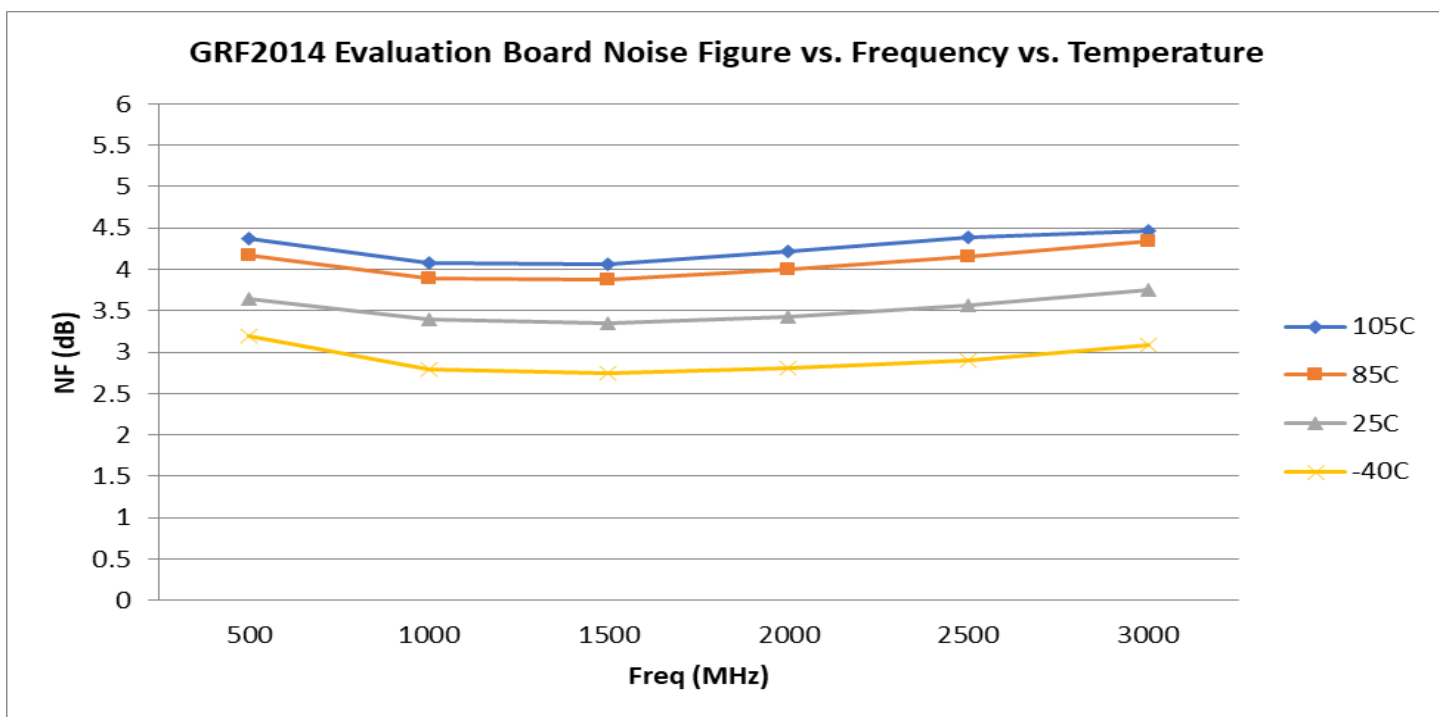
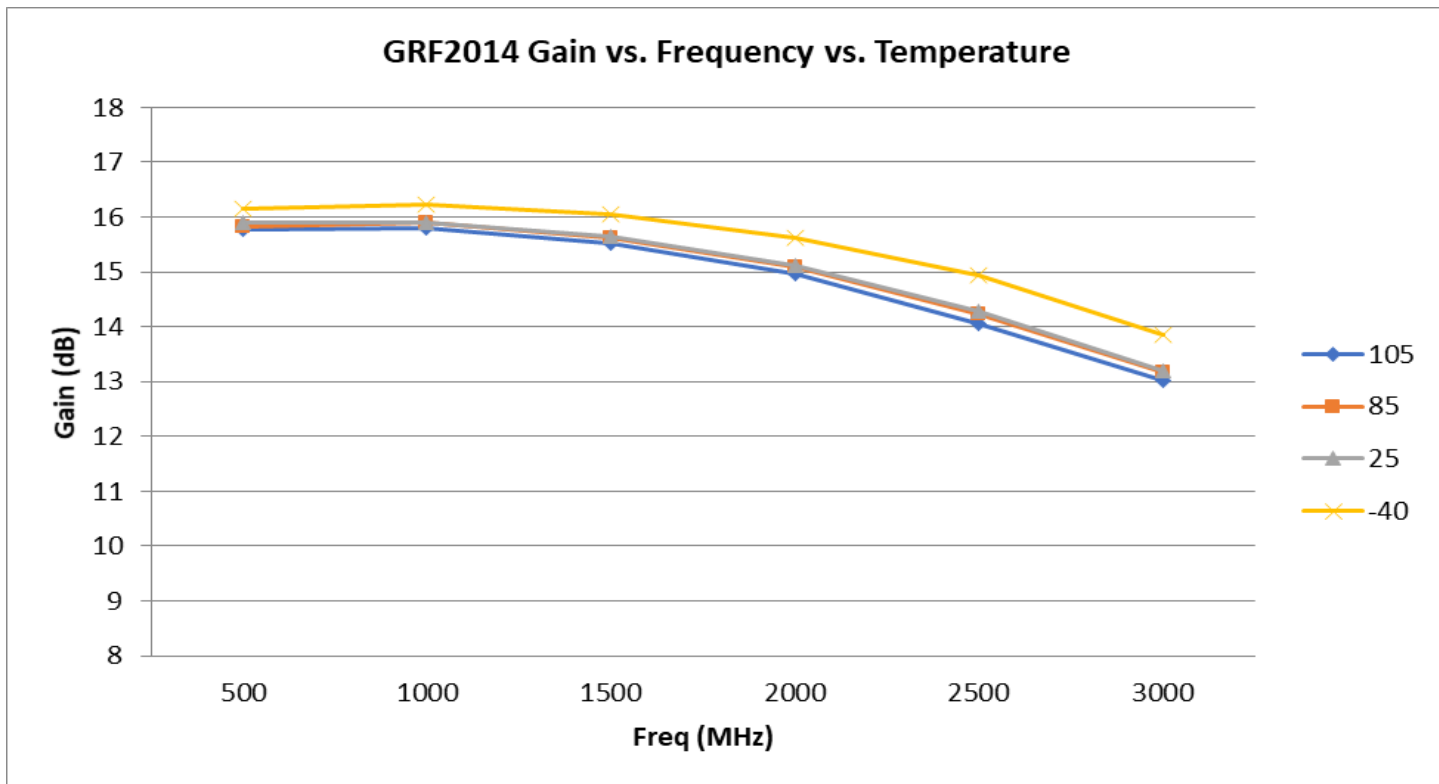
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## Nominal Operating Parameters:

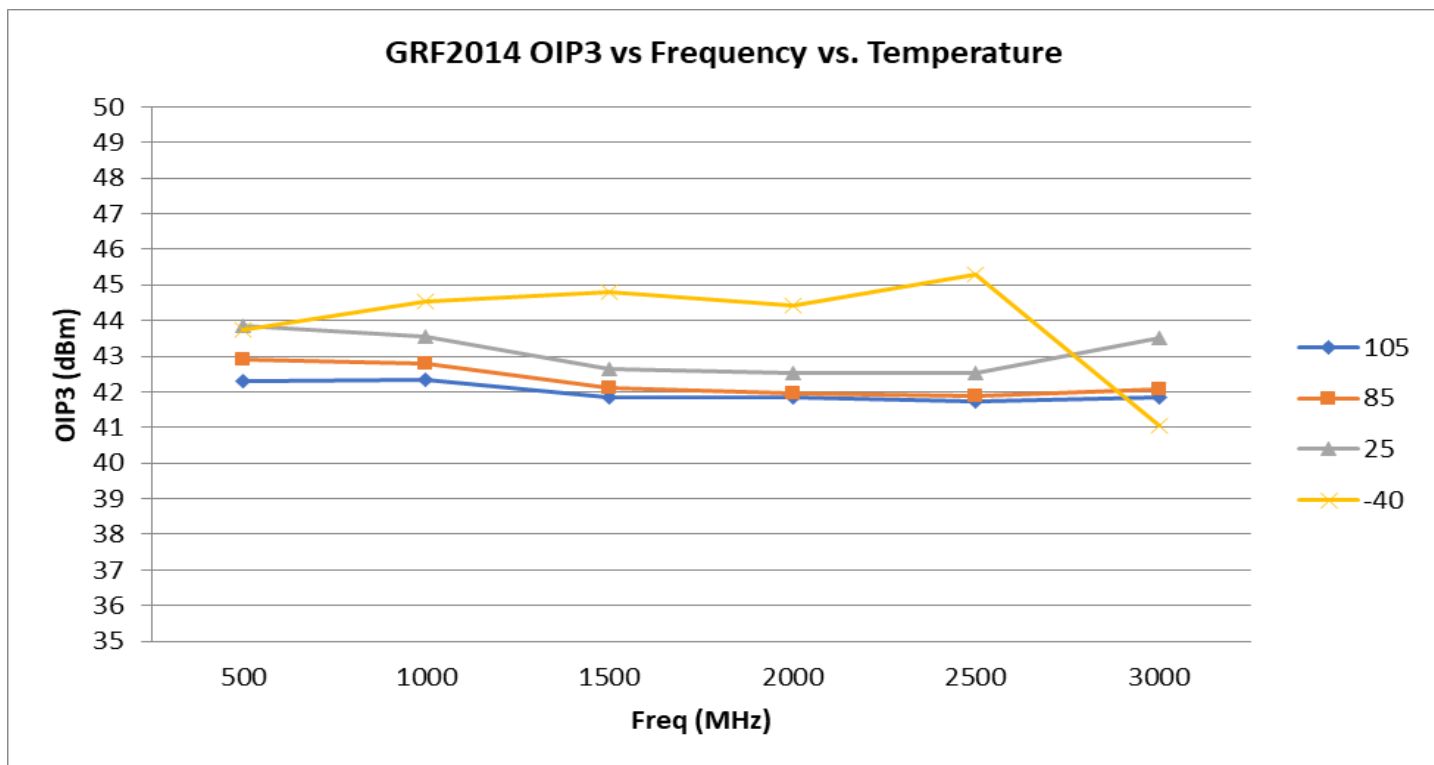
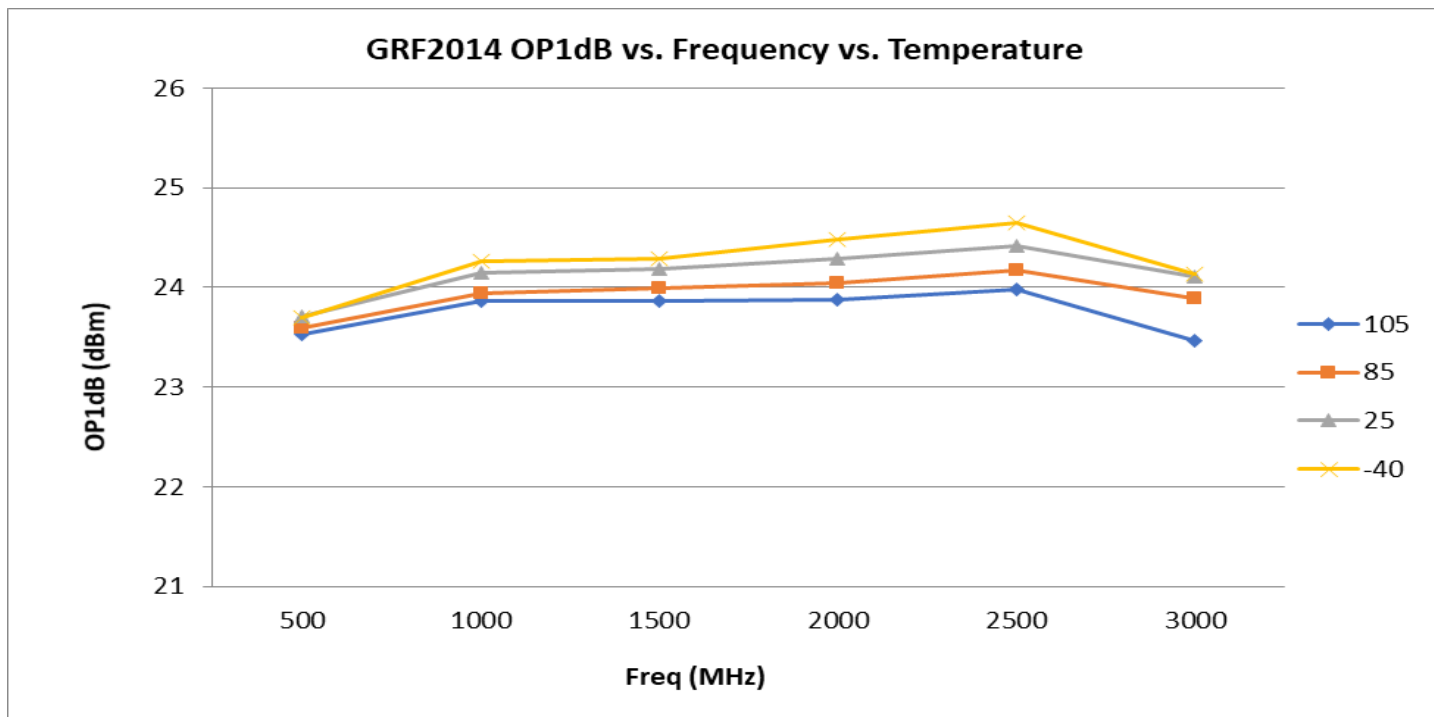
Parameter	Symbol	Specification			Unit	Condition
		Min.	Typ.	Max.		
Test Frequency	F <sub>TEST</sub>		900		MHz	V <sub>DD</sub> = 5.0 V, T <sub>A</sub> = 25 °C
Gain	S <sub>21</sub>	14.9	15.9		dB	
Evaluation Board Noise Figure	NF		3.4		dB	
Output 3rd Order Intercept	OIP3		43.5		dBm	+2.0 dBm P <sub>OUT</sub> per tone at 2 MHz Spacing (899 and 901 MHz)
Output 1dB Compression Power	OP1dB	22.5	24.0		dBm	
Switching Rise Time	T <sub>RISE</sub>		200		ns	
Switching Fall Time	T <sub>FALL</sub>		200		ns	
Supply Current	I <sub>DD</sub>		150		mA	
Enable Current	I <sub>ENABLE</sub>		5.5		mA	
Disabled Mode						
Leakage Current	I <sub>LEAKAGE</sub>		800		uA	V <sub>DD</sub> : 5.0V; V <sub>ENABLE</sub> : 0.0V
Thermal Data						
Thermal Resistance: (Infra-Red Scan)	Θ <sub>jc</sub>		38		°C/W	On standard Evaluation Board
Channel Temperature @ +85 C Reference (Package heat sink)	T <sub>CHANNEL</sub>		114 (See note)		°C	V <sub>DD</sub> : 5.0 V; I <sub>DDQ</sub> : 150 mA; No RF; P <sub>DISS</sub> : 750 mW

Note: MTTF >10<sup>6</sup> hours for T<sub>CHANNEL</sub> < =170 degrees C.

## GRF2014 Performance over Temperature (5V/150 mA)



## GRF2014 Performance over Temperature (5V/150 mA)

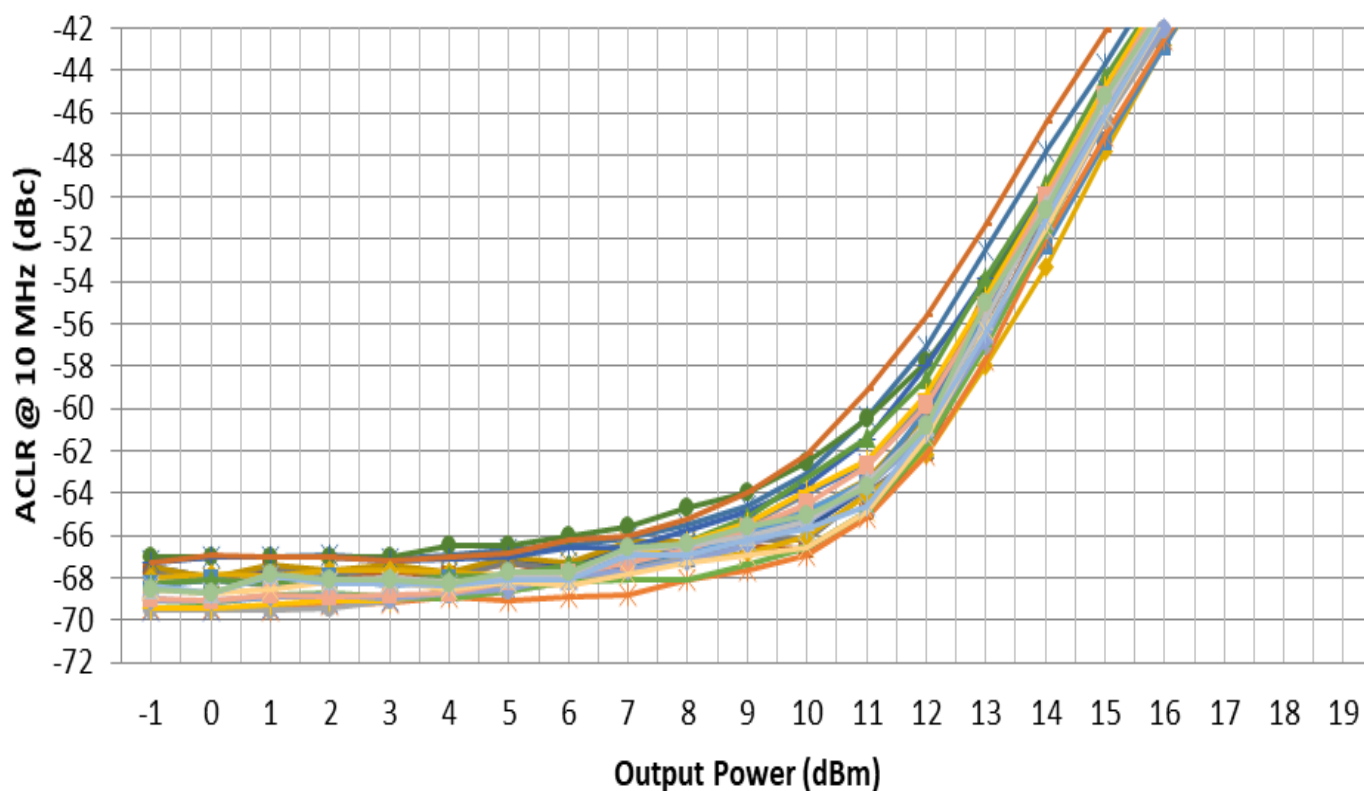


## GRF2014 Performance over Temperature (5V/150 mA)

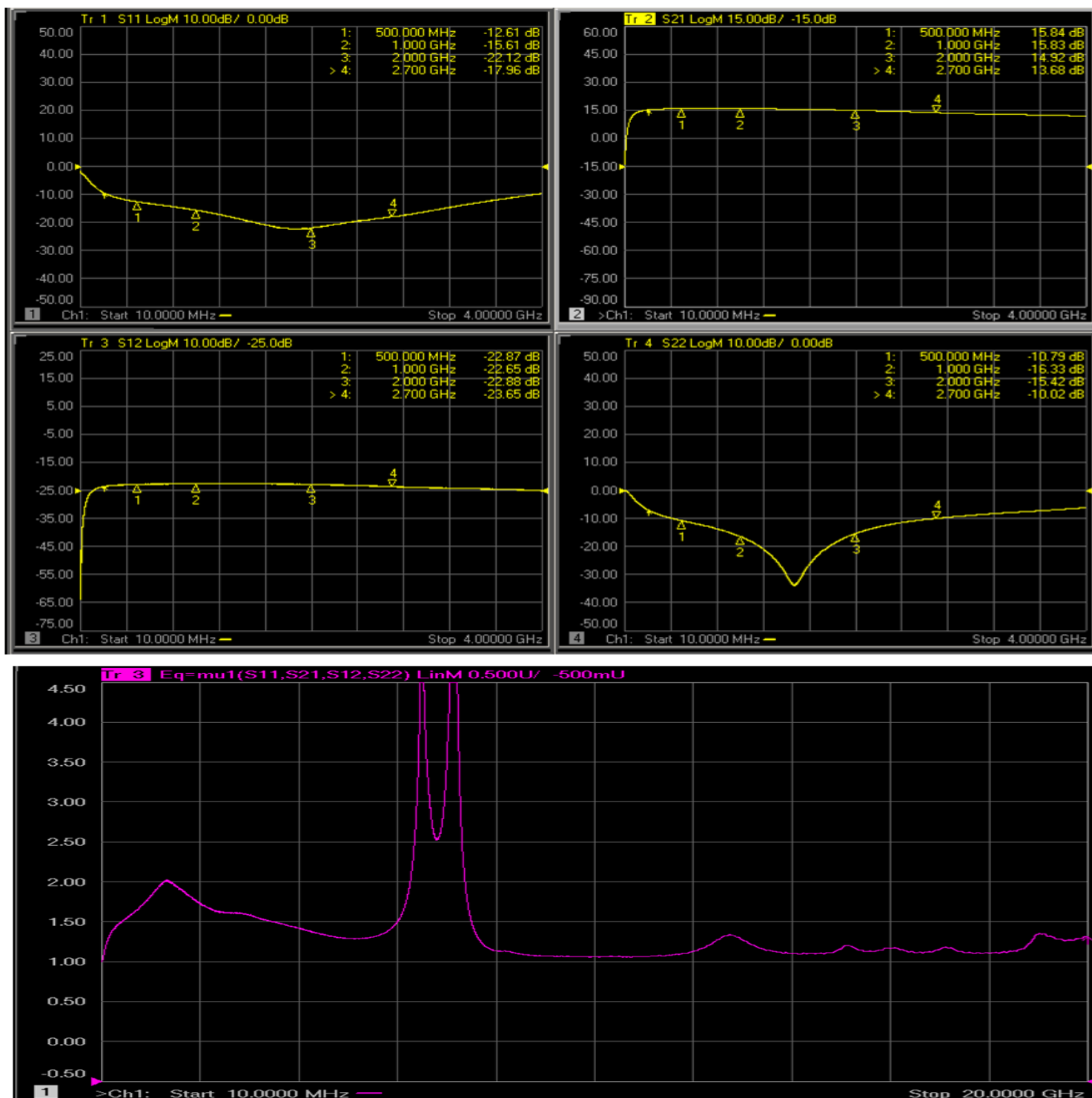
### GRF2014 ACLR vs. Pout vs. Frequency vs. Temperature

Vdd = 5.0V: LTE 10Q50RB, PAR = 9.6 dB

500-3000 MHz, Temp = -40C -> 105C

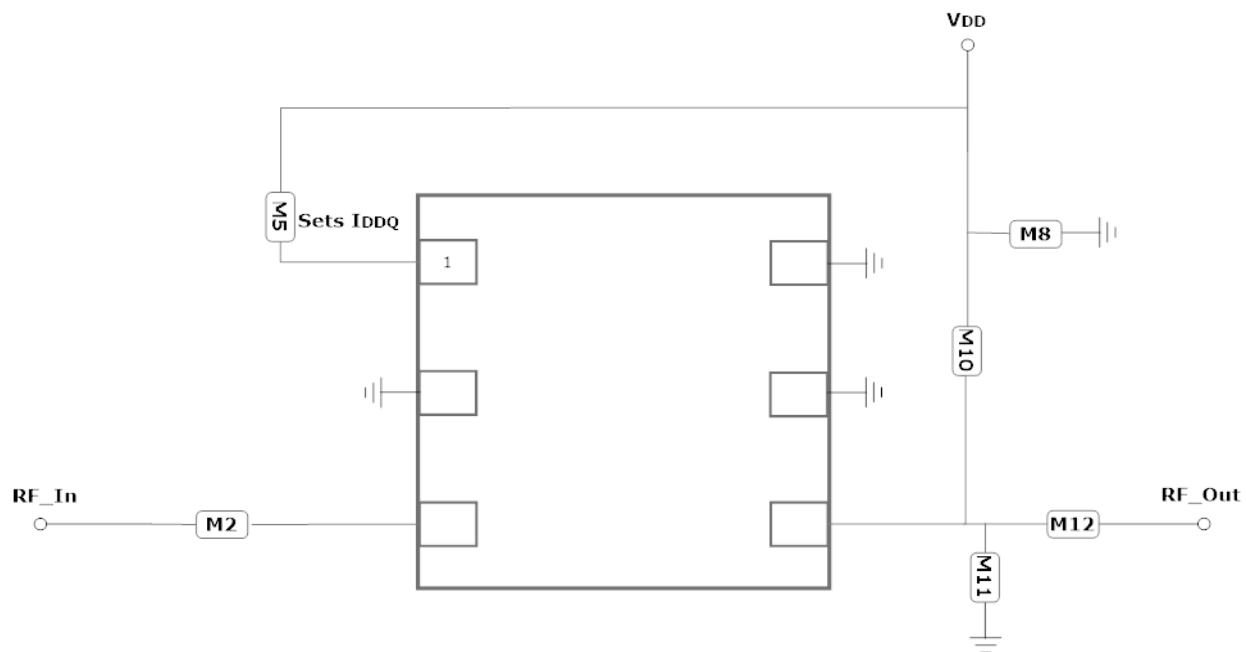


## GRF2014 Evaluation Board S-Pars and Stability Mu Factor: (0.5 — 2.7 GHz Match)

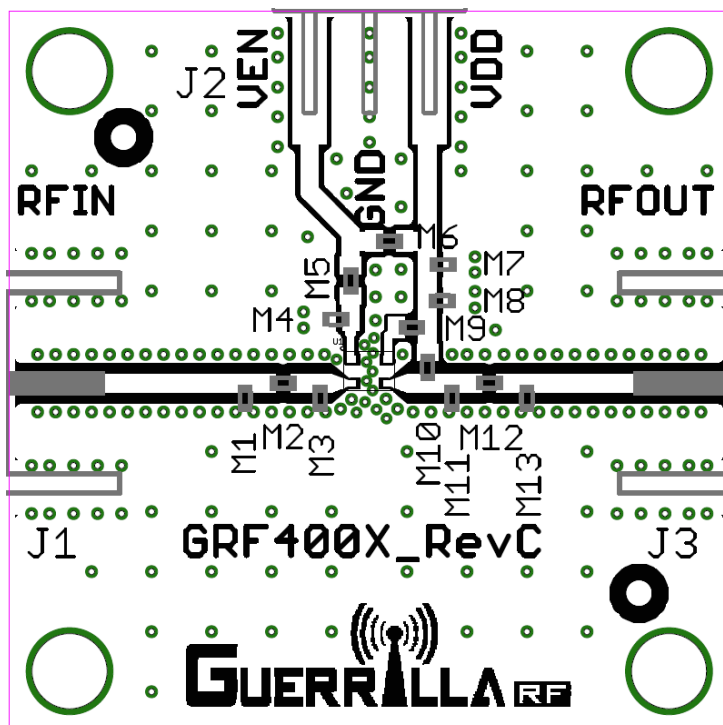


Note: Mu factor  $\geq 1.0$  implies unconditional stability.





GRF2014 Application Schematic



GRF2014 Evaluation Board Assembly Diagram



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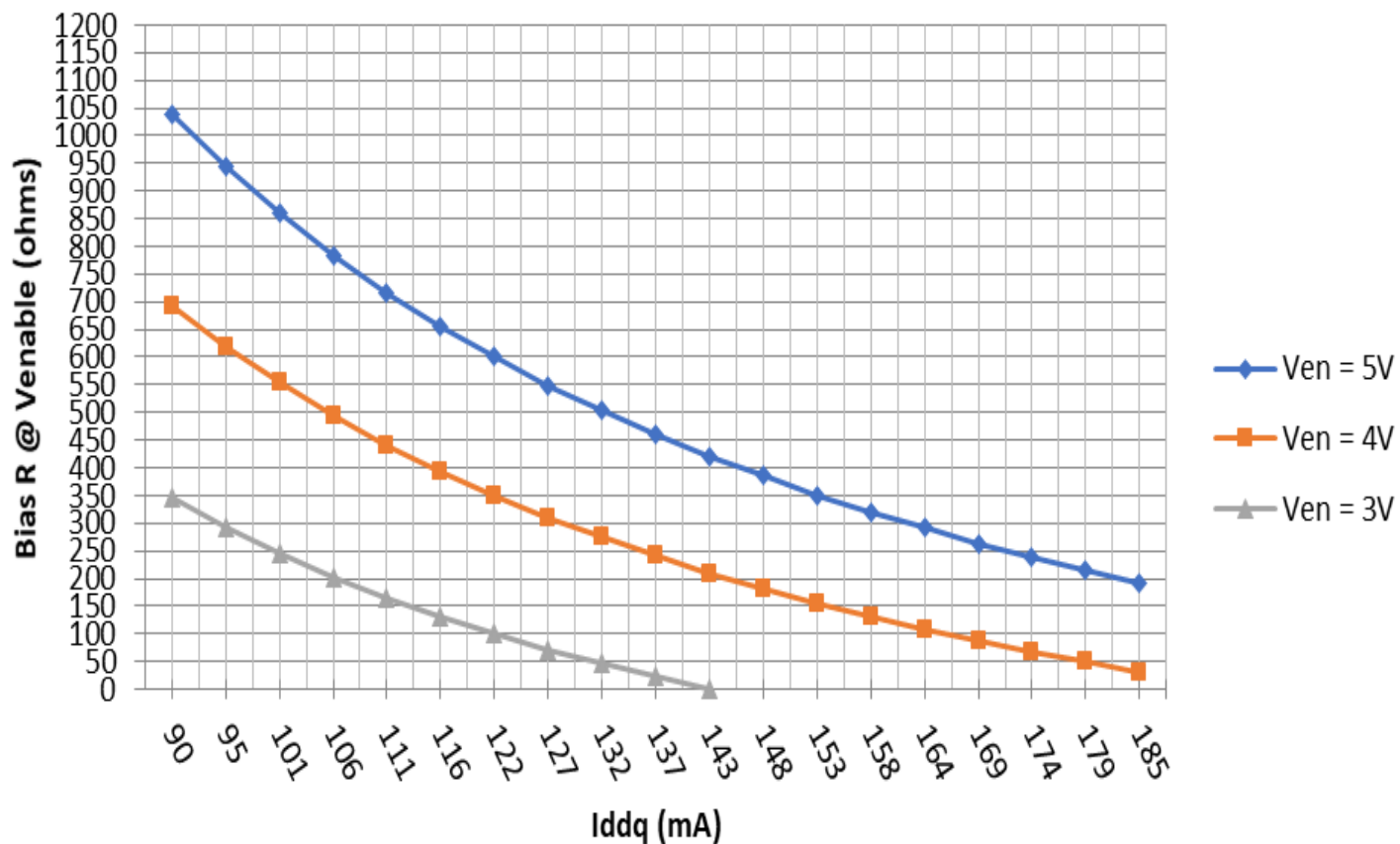
# GRF2014

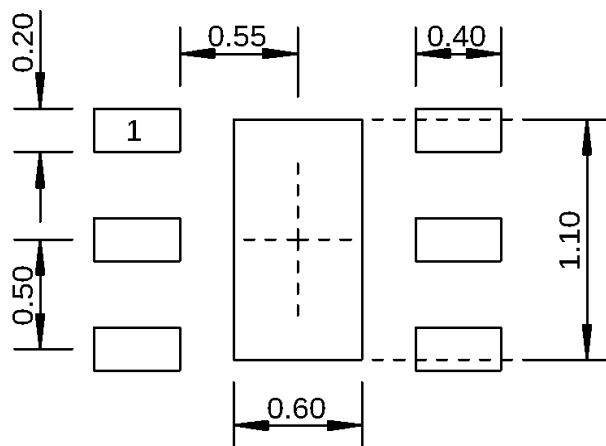
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## GRF2014 Standard Evaluation Board BOM: (0.5 to 2.7 GHz Tune)

Component	Type	Manufacturer	Family	Value	Package Size	Substitution
M2	Capacitor	Murata	GRM	100 pF	0402	ok
M5 (See curves )	Resistor	Various	5%	Sets Iddq	0402	ok
M8	Capacitor	Murata	GRM	0.1 uF	0402	ok
M10	Inductor	Various	MLC	33 nH	0402	ok
M11	Capacitor	Murata	GRM	0.5 pF	0402	ok
M12	Capacitor	Murata	GRM	100 pF	0402	ok
Evaluation Board	GRF400X_RevC					

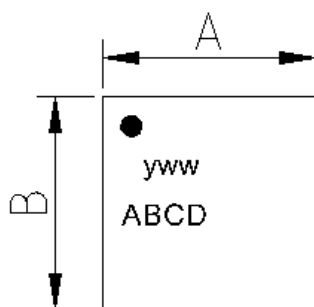
## GRF2014 w/Vdd = 5.0V: Required Bias R @ Venable vs. Iddq



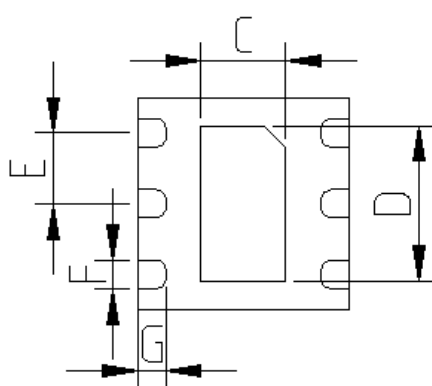


Dimensions in millimeters

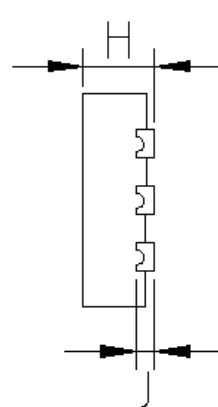
## 1.5 mm DFN-6 Suggested PCB Footprint (Top View)



Top View



Bottom View



Side View

Dimensions (MM)	
A	1.5 +/- 0.050
B	1.5 +/- 0.050
C	.6 +/- 0.050
D	1.1 +/- 0.050
E	.5 Bsc
F	.2 +/- 0.050
G	.2 +/- 0.050
H	.45 +/- 0.050
J	.12 Ref.

## 1.5 mm DFN-6 Package Dimensions



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## Broadband Linear Gain Block 0.05 to 3.8 GHz

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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