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# GRF2070

Ultra-Low Noise Amplifier  
Tuning Range: 0.1 to 1.5 GHz



## Product Description

GRF2070 is a broadband, linear, ultra-low noise amplifier designed for small cell, wireless infrastructure and other high performance RF applications requiring ultra-low NF, high gain and linearity.

This device is a member of a family of pin compatible, ultra low noise devices which cover a wide range of frequency bands with industry leading NF and gain:

**GRF2070:** 0.1 to 1.5 GHz

**GRF2071:** 0.7 to 2.7 GHz

**GRF2072:** 1.5 to 3.8 GHz

**GRF2073:** 2.0 to 6.0 GHz

**GRF2074:** 1.0 to 6.0 GHz (next-gen process)

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

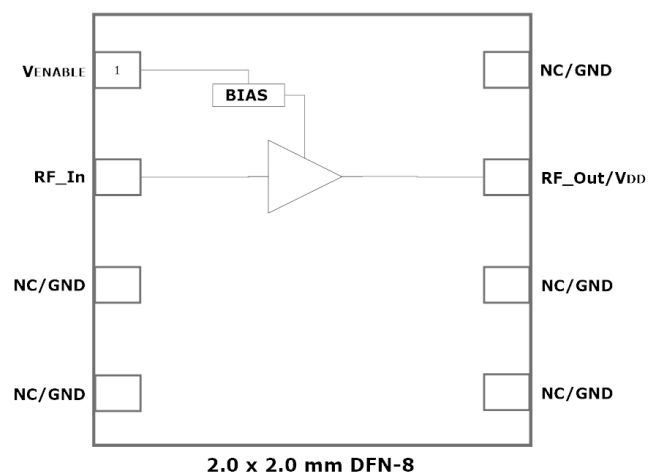
## Features

Reference: 5V/70mA/0.9 GHz

- Gain: 20.8 dB
- Eval Board NF: 0.38 dB
- OP1dB: 20.1 dBm
- OIP3: 38.8 dBm
- Flexible Bias Voltage and Current
- Process: GaAs pHEMT

## Applications

- Cellular Infrastructure
- Small Cells and Cellular Repeaters
- Distributed Antenna Systems



## 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>		23	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	500		V
<b>Storage:</b>				
Storage Temperature	T <sub>STG</sub>	-65	150	°C
Moisture Sensitivity Level	MSL		1	--



**Caution!** ESD Sensitive Device

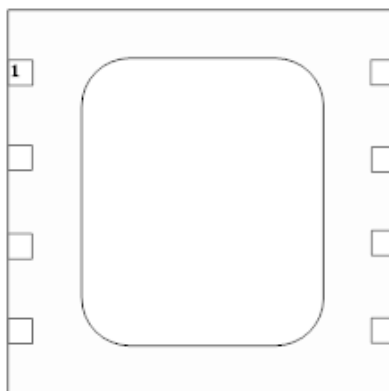


Exceeding Absolute Maximum Rating conditions may cause permanent damage to the device.

**Note:** For manufacturing information, see the [Guerrilla-RF.com](http://Guerrilla-RF.com) website for the following document located on the GRF2070 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	VENABLE	Enable Voltage Input	VENABLE and series resistor set I <sub>DDQ</sub> . VENABLE < =0.2 volts disables device. On -die pull-down resistor will turn the part off if this node is allowed to float.
2	RF_In	RF Input	External match must provide DC block
3	NC/GND	No Connect or Ground	No internal connection to die
4	NC/GND	No Connect or Ground	No internal connection to die
5	NC/GND	No Connect or Ground	No internal connection to die
6	NC/GND	No Connect or Ground	No internal connection to die
7	RF_Out/VDD	RF Output	Provide device V <sub>DD</sub> via external bias inductor
8	NC/GND	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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## 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	$F_{TEST}$		900		MHz	700 to 960 MHz Tune
Evaluation Board Gain	S21	19.8	20.8		dB	
Evaluation Board Noise Figure	NF		0.38	0.58	dB	Evaluation Board SMA to SMA
Output 3rd Order Intercept Point	OIP3		38.8		dBm	+4.0 dBm $P_{OUT}$ per tone at 2 MHz Spacing (899 and 901 MHz)
Output 1dB Compression Point	OP1dB	18.6	20.1		dBm	
Switching Rise Time	$T_{RISE}$		1800		ns	
Switching Fall Time	$T_{FALL}$		900		ns	
Supply Current	$I_{DD}$		70		mA	Adjustable for optimal IP3
Enable Current	$I_{ENABLE}$		3.5		mA	
<b>Thermal Data</b>						
Thermal Resistance (measured via IR scan)	$\Theta_{jc}$		60		$^\circ\text{C}/\text{W}$	On standard evaluation board
Channel Temperature @ +85 C Reference (Package Heat Sink)	$T_{CHANNEL}$		106 (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  $T_{CHANNEL} \leq 170$  degrees C.

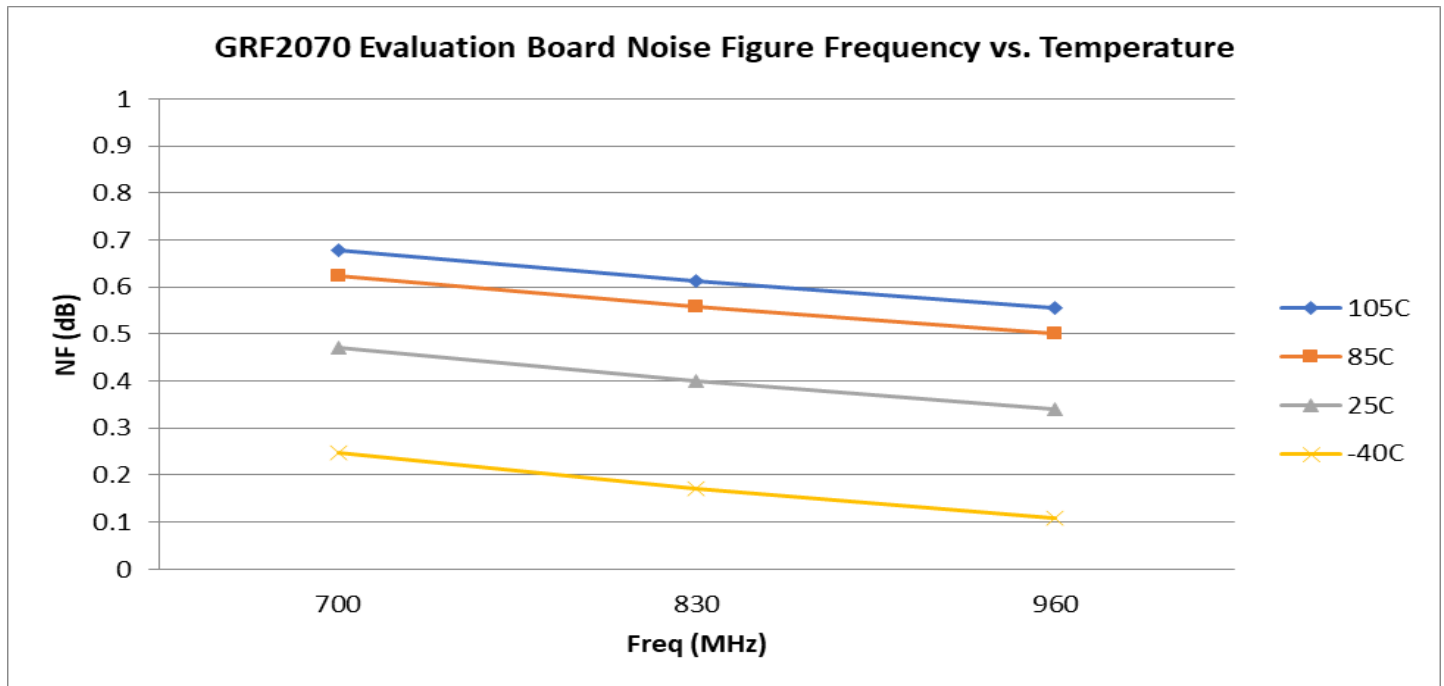
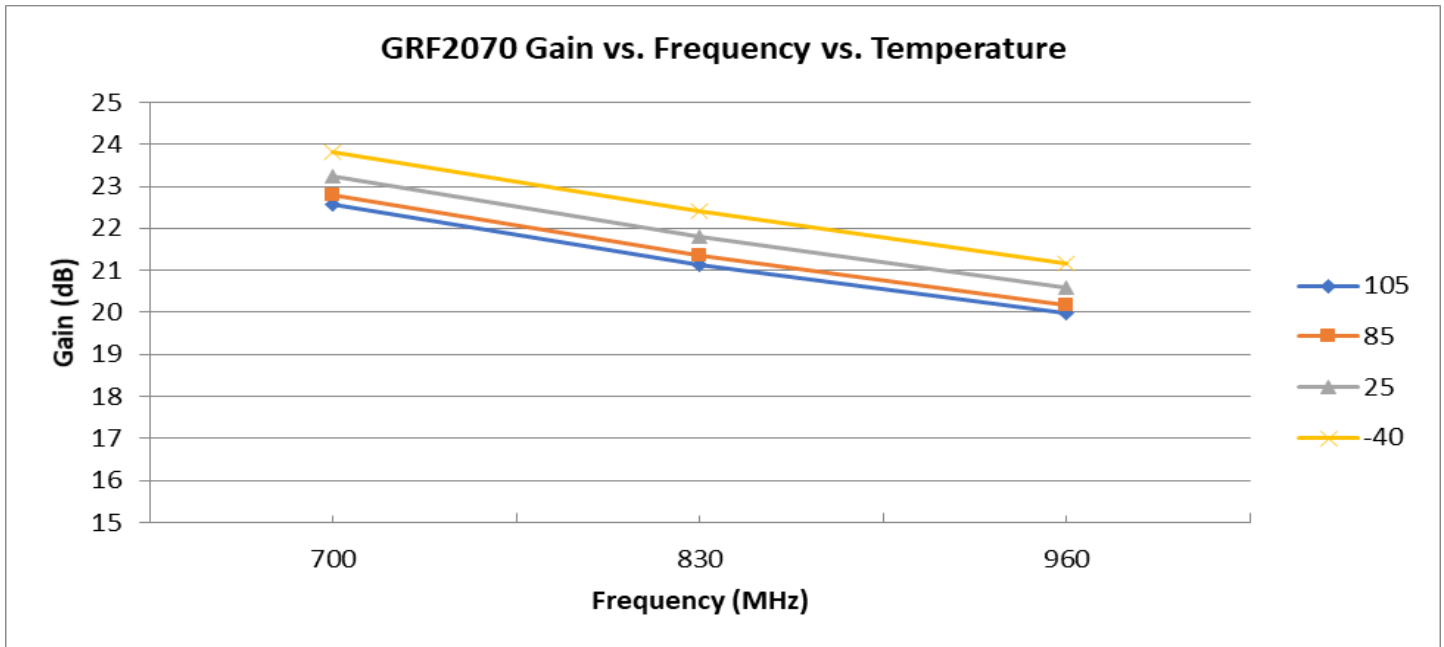


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## GRF2070 Evaluation Board Measured Data:



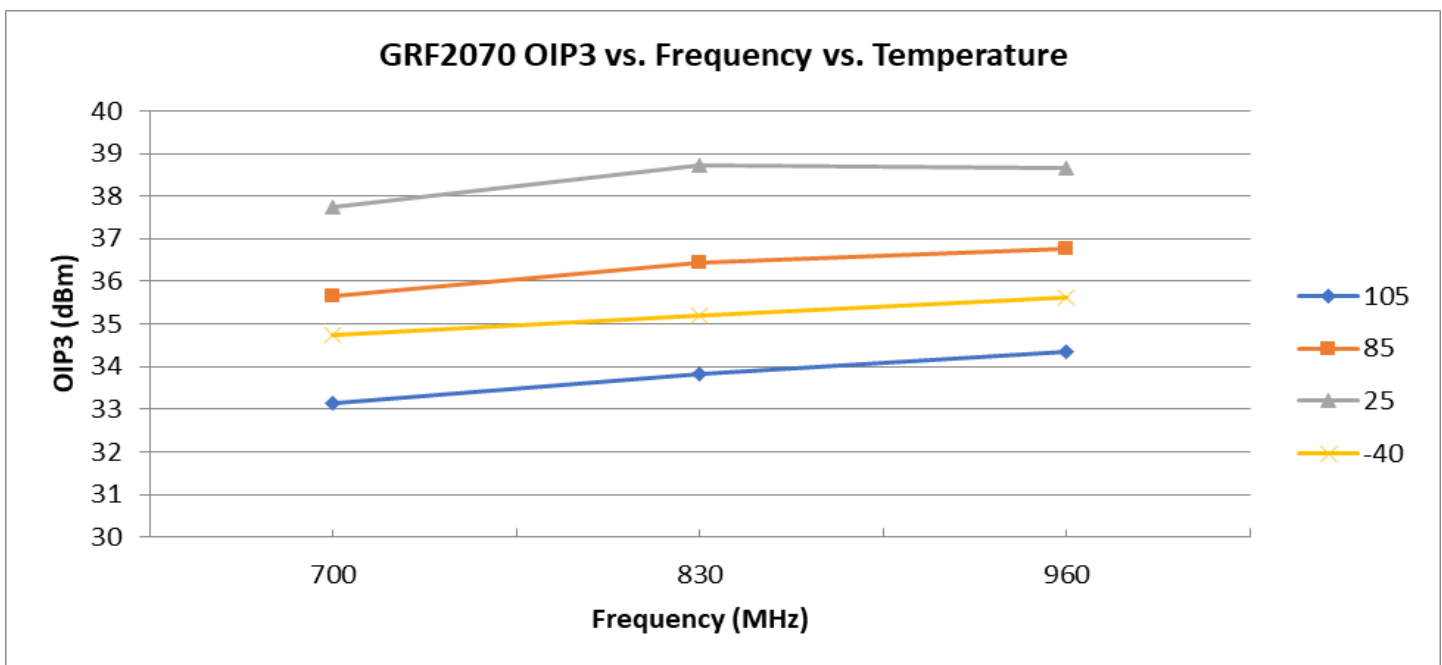
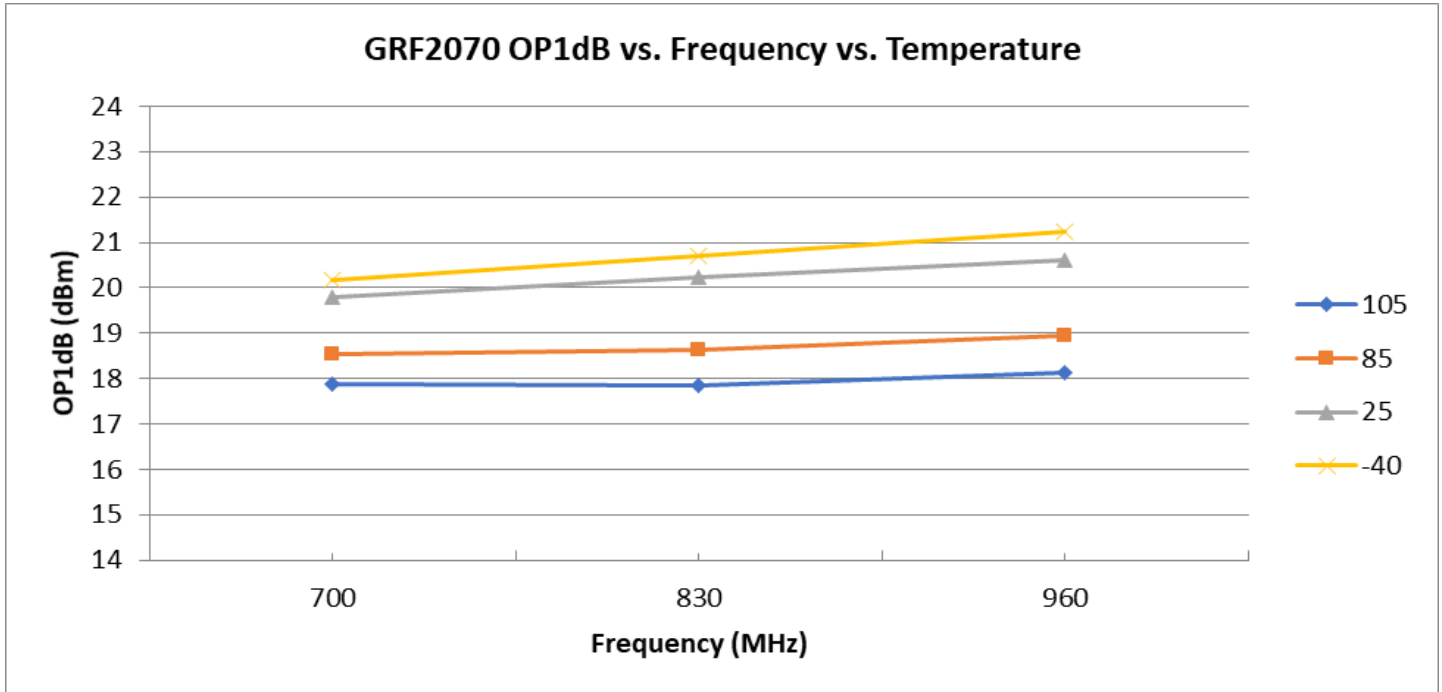


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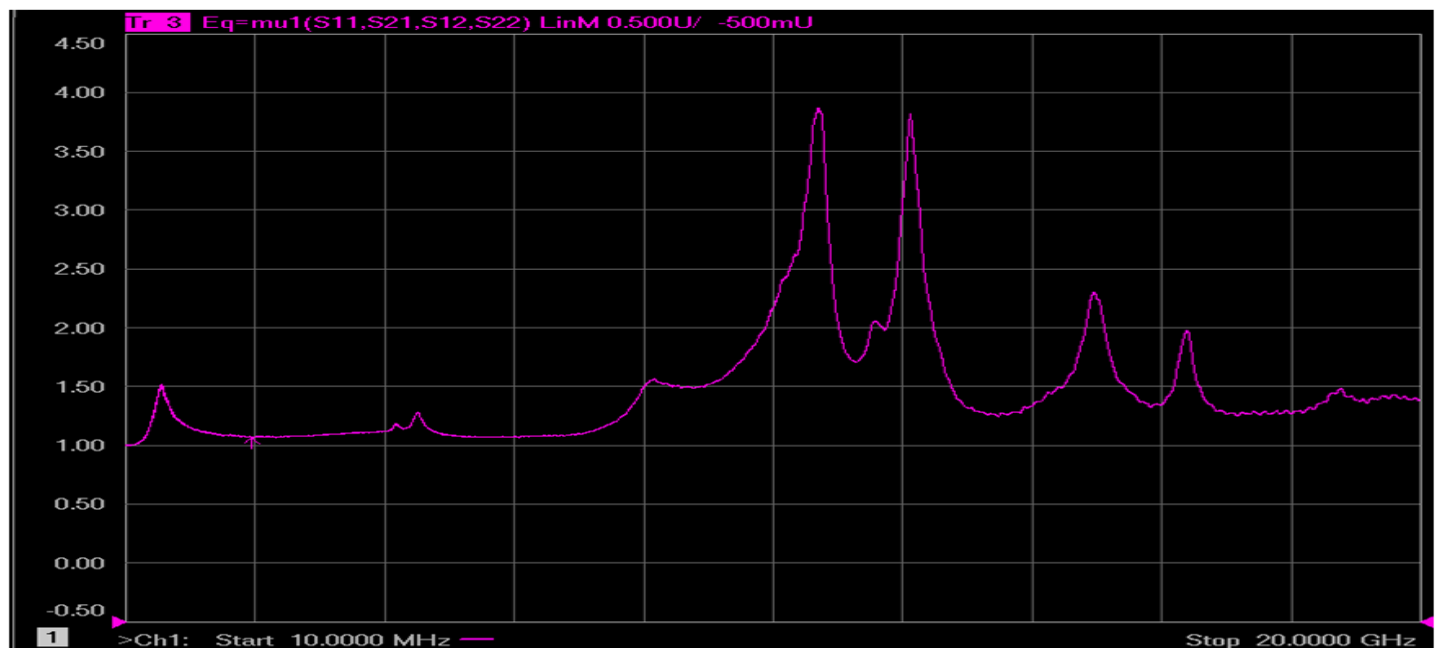
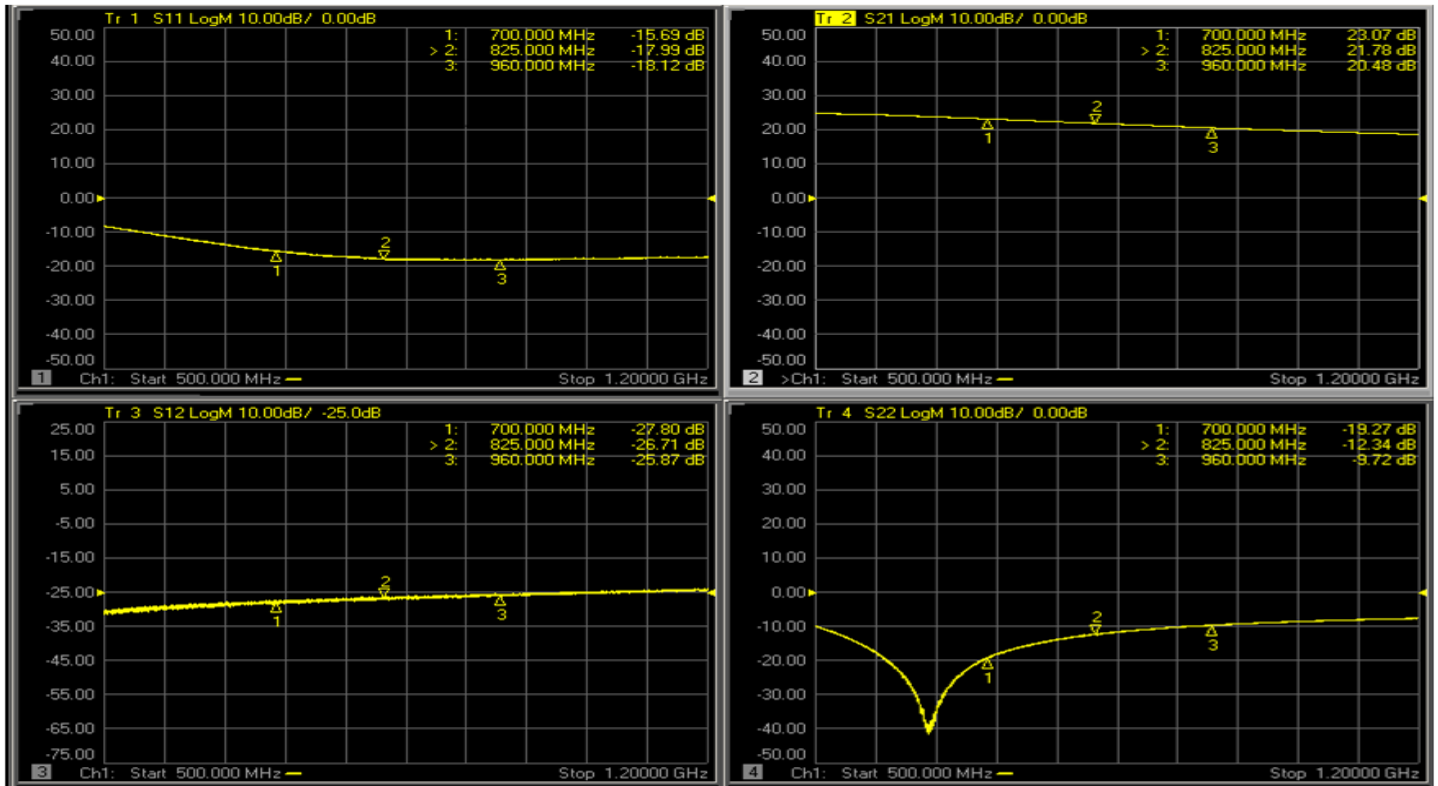


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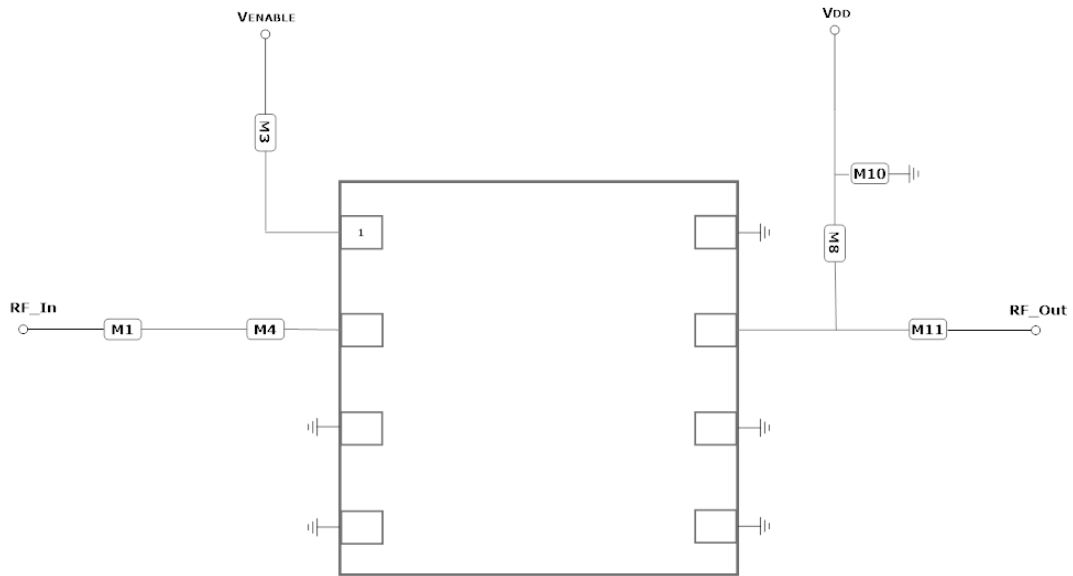
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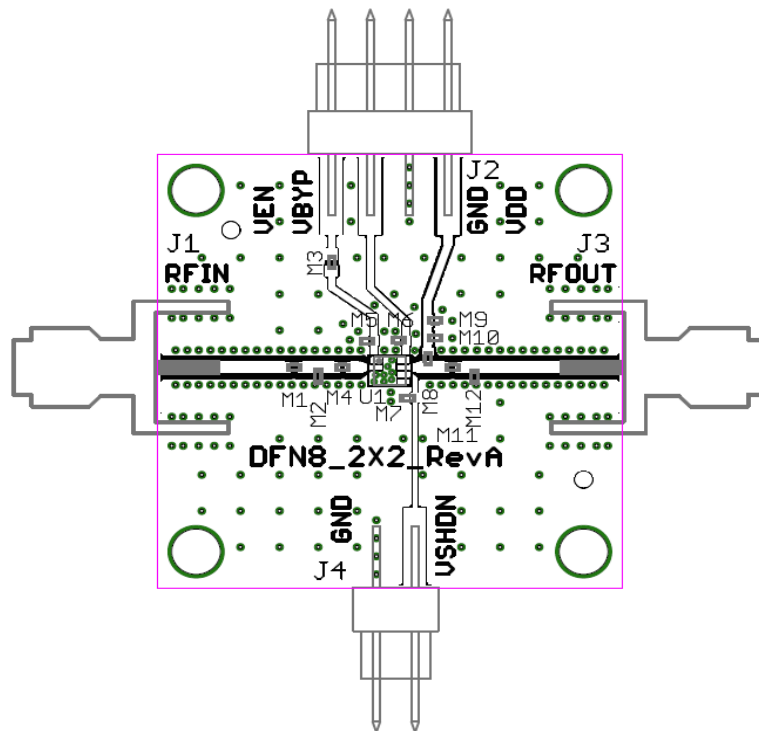
## GRF2070 Evaluation Board S-Pars: (0.7 to 0.96 GHz Match)



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



GRF2070 Application Schematic



GRF2070 EVB Assembly Drawing





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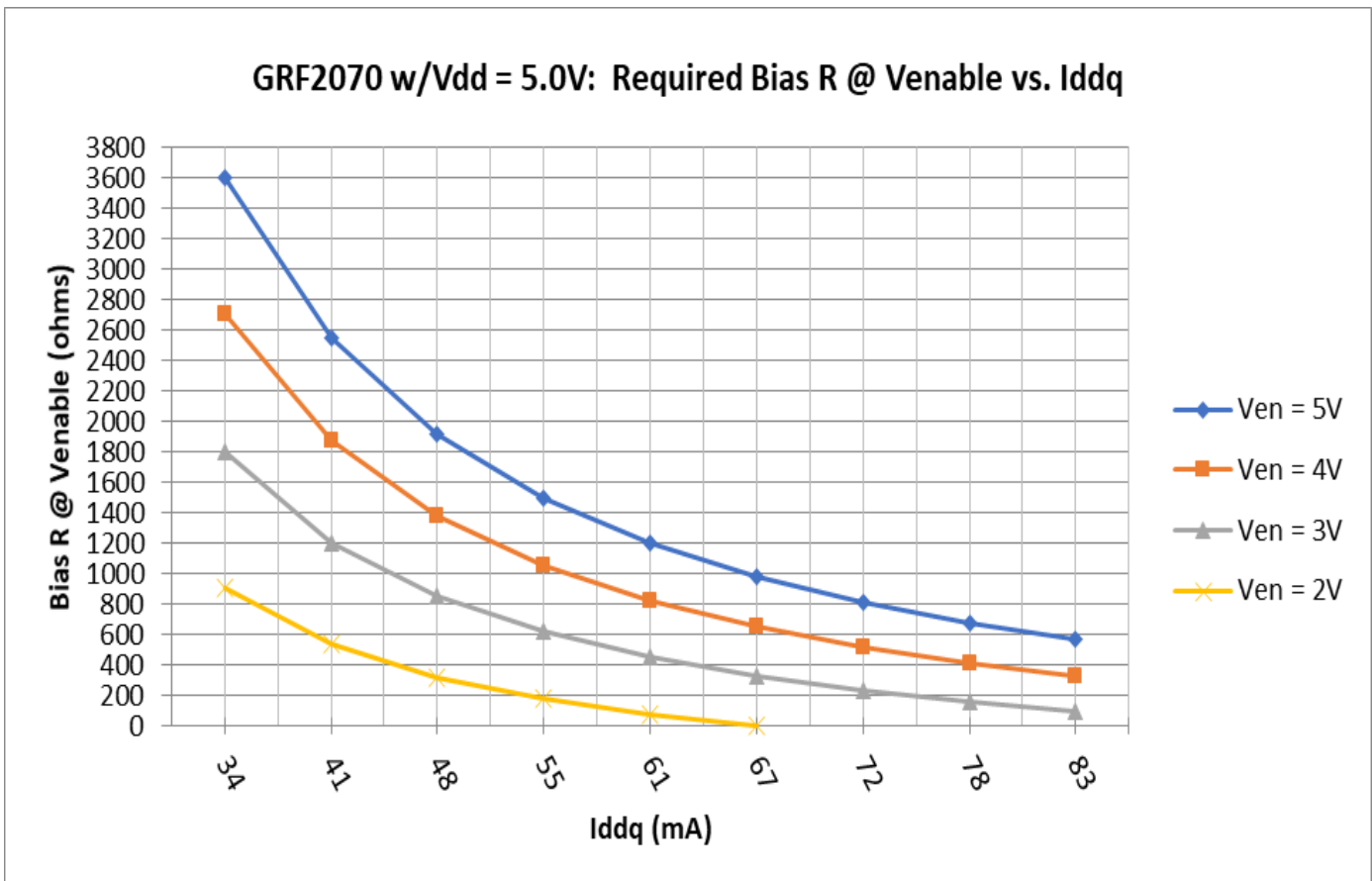
# GRF2070

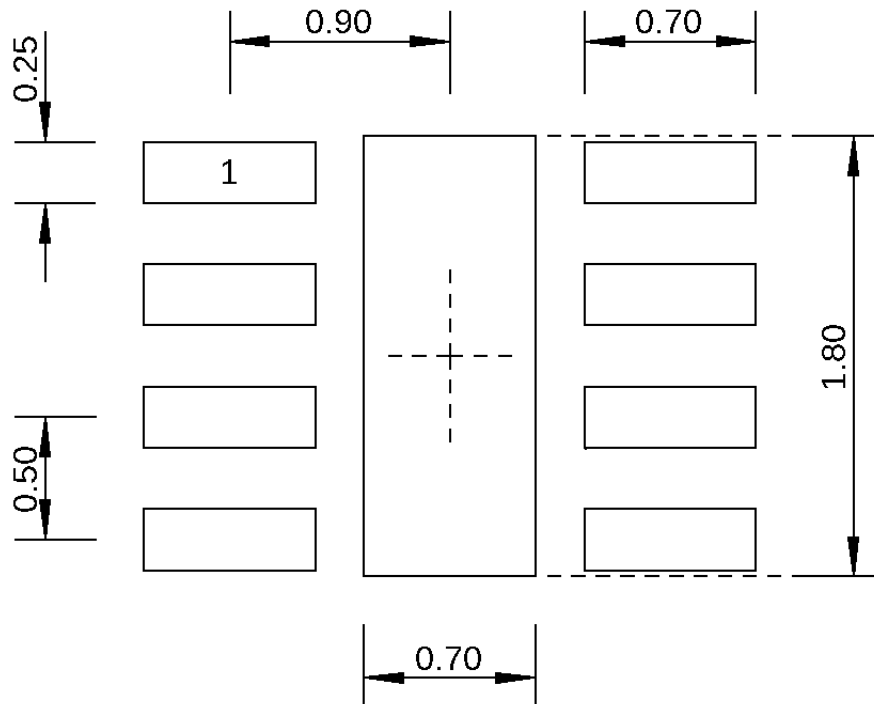
Ultra-Low Noise Amplifier  
Tuning Range: 0.1 to 1.5 GHz

## GRF2070 Standard Evaluation Board BOM: (0.7 to 0.96 GHz Tune)

Component	Type	Manufacturer	Family	Value	Package Size	Substitution
M1	Resistor (jumper)	Various	—	0 Ohm	0402	ok
M3	Resistor	Various	5%	Sets Iddq	0402	ok
M4	Capacitor	Murata	GJM	47 pF	0402	ok
M8	Inductor	Murata	LQW	22 nH	0402	ok
M10	Capacitor	Murata	GRM	0.1 uF	0402	ok
M11	Capacitor	Murata	GRM	4.7 pF	0402	ok
Evaluation Board	DFN8_2x2_RevA	—	—	—	—	—

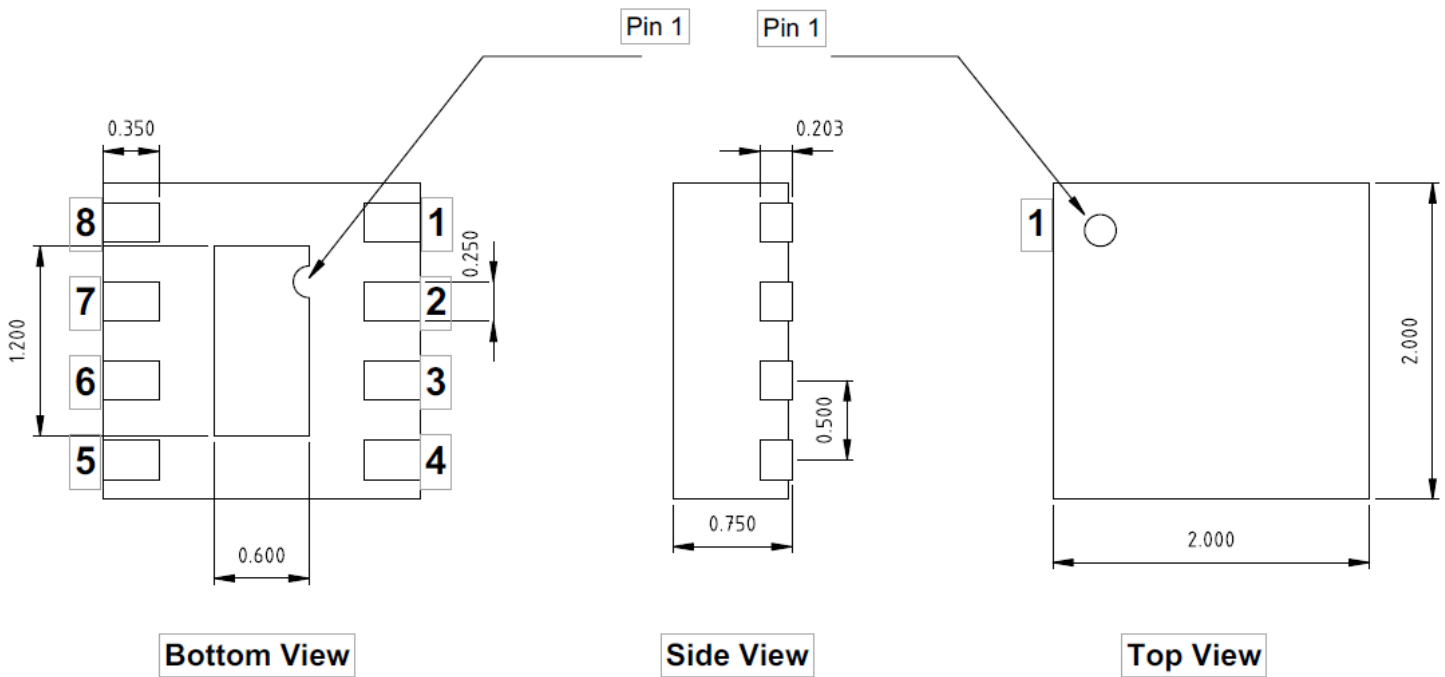
## GRF2070 Bias Resistor Selection Curves:





Dimensions in millimeters

## 2.0 mm DFN-8 Suggested PCB Footprint (Top View)

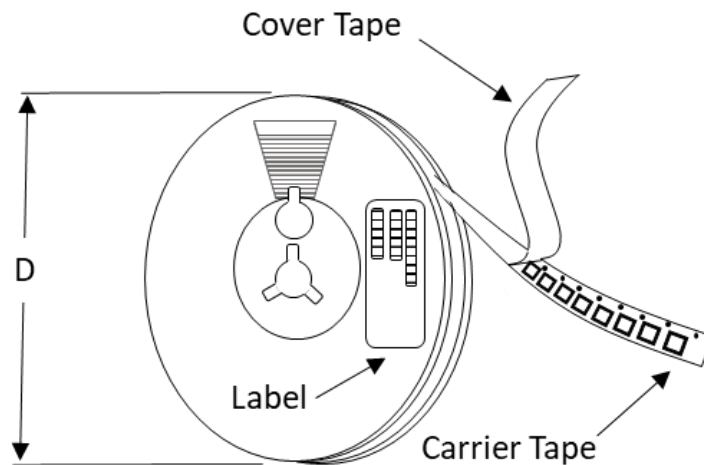


2.0 x 2.0 DFN-8 Package Dimensions (mm)

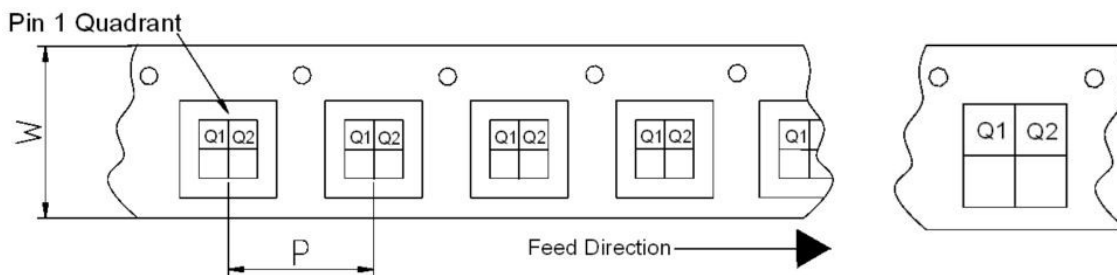
### Tape and Reel Information:

Guerrilla RF's Tape and Reel specification complies with the Electronics Industries Association (EIA) standards for 'Embossed Carrier Tape of Surface Mount Components for Automatic Handling'. Reference EIA-481. See the table on the following page for Tape and Reel specifications along with units per reel.

Devices are loaded with pins down into the carrier pocket with protective cover tape, wound into a plastic reel. Each reel will be packaged in a cardboard box. There will be product labels on the reel, the protective ESD bag and the outside surface of the box.



Tape and Reel Packaging with Reel Diameter Noted (D)



Carrier Tape Width (W), Pitch (P), Feed Direction and Pin 1 Quadrant Information



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Tape and Reel Specification and Device Package Information Table

Package				Carrier Tape			Reel	
Type	Dimensions (mm)	Leads	Weight (mg)	Width (W) (mm)	Pocket Pitch (P) (mm)	Pin 1 Quadrant	Diameter (D) (inches)	Units per Reel
QFN	2.0 x 2.0 x 0.50	12	7	8	4	Q1	7	2500
QFN	3.0 x 3.0 x 0.85	16	24	12	8	Q1	7	1500
DFN	1.5 x 1.5 x 0.45	6	4	8	4	Q1	7	2500
DFN	2.0 x 2.0 x 0.75	8	12	8	4	Q1	7	2500
LFM	3.5 x 3.5 x 0.75	See note	TBD	12	8	Q2	7	1500
LFM	4.0 x 4.0 x 0.75	See note	TBD	12	8	Q2	7	1500

Note: Lead count may vary. Reference applicable product data sheet



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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.

Information in this datasheet is specific to the Guerrilla RF, Inc. ("Guerrilla RF") product identified.

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