



## Product Description

GRF2073W is a linear, ultra-low noise amplifier designed for automotive satellite radio multi-stage LNAs, signal booster and 5G applications.

With its ultra-low noise and high gain characteristics, this amplifier is an ideal first-stage LNA solution for high-performance, multi-stage SDARS LNA designs. With superior performance, it offers a drop-in alternative to legacy SDARS LNA solutions.

This device is part of a growing family of automotive-qualified ultra-low noise amplifiers targeted for stage 1 SDARS LNA and compensator applications to include:

**GRF2071W:** 0.7 to 2.7 GHz

**GRF2072W:** 1.5 to 3.8 GHz

**GRF2073W:** 2.0 to 6.0 GHz

Each of the above devices offers ultra-low NF with different gain levels for optimal performance within a variety of radio architectures.

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

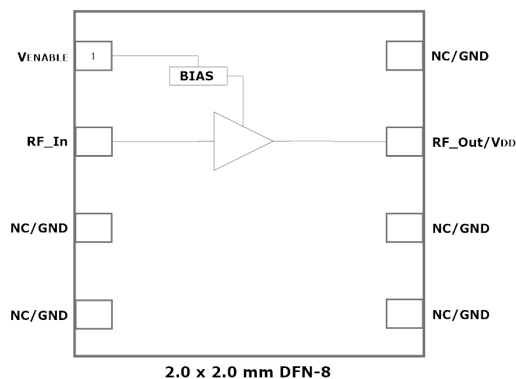
## Features

Reference: 5V/70 mA/2332.5 MHz

- Gain: 20.5 dB
- NF: 0.40 dB
- OP1dB: 19.8 dBm
- OIP3: 35.0 dBm
- Tested to AEC-Q100 Grade 2
- Flexible Bias Voltage and Current
- Process: GaAs pHEMT

## Applications

- SDARS LNA
- Cellular Boosters (Compensator)
- 5G LNA





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# GRF2073W

Ultra-Low Noise Amplifier  
Tuning Range: 2.0 to 6.0 GHz

## Absolute Ratings:

Parameter	Symbol	Min.	Max.	Unit
Supply Voltage	V <sub>DD</sub>	0	7.0	V
RF Input Power CW: (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>		600	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

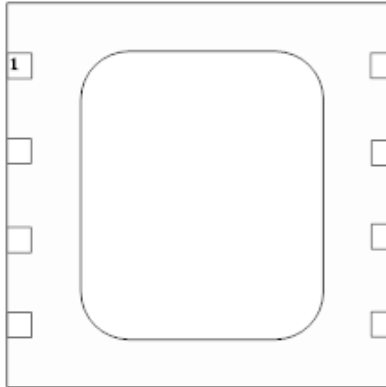


Exceeding Absolute Maximum Rating conditions may cause permanent damage to the device.

**Note:** For manufacturing information, see the [Guerrilla-RF.com](http://Guerrilla-RF.com) website for the following document located on the GRF2073W 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
<b>PKG BASE</b>	<b>GND</b>	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	$F_{TEST}$		3.6		GHz	3.4 to 3.8 GHz Tune
Gain	$S_{21}$	17.5	18.5		dB	
Evaluation Board Noise Figure	NF		0.65	0.85	dB	Evaluation Board SMA to SMA
Output 3rd Order Intercept Point	OIP3		35.0		dBm	+3 dBm $P_{OUT}$ per tone at 2 MHz Spacing (3599 and 3601 MHz)
Output 1dB Compression Point	OP1dB	16.5	18.0		dBm	
Switching Rise Time	$T_{RISE}$		300		ns	
Switching Fall Time	$T_{FALL}$		300		ns	
Supply Current	$I_{DD}$		70		mA	
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.

Parameter	Symbol	Specification			Unit	Condition
		Min.	Typ.	Max.		
<b>Gain Mode</b>						$V_{DD} = 5.0\text{ V}$ , $T_A = 25^\circ\text{C}$ ; $V_{ENABLE}: \text{High}$
Test Frequency	$F_{TEST}$		2332.5		MHz	2320 to 2345 MHz SDARS Tune
Evaluation Board Gain	$S_{21}$	19.5	20.5		dB	
Noise Figure (de-embedded)	NF		0.40	0.60	dB	
Output 3rd Order Intercept Point	OIP3		35.0		dBm	4.0 dBm $P_{OUT}$ per tone at 2 MHz Spacing (2331.5 and 2333.5 MHz)
Output 1dB Compression Point	OP1dB	18.3	19.8		dBm	
Switching Rise Time	$T_{RISE}$		300		ns	
Switching Fall Time	$T_{FALL}$		300		ns	
Supply Current	$I_{DD}$		70		mA	
Enable Current	$I_{ENABLE}$		3.5		mA	

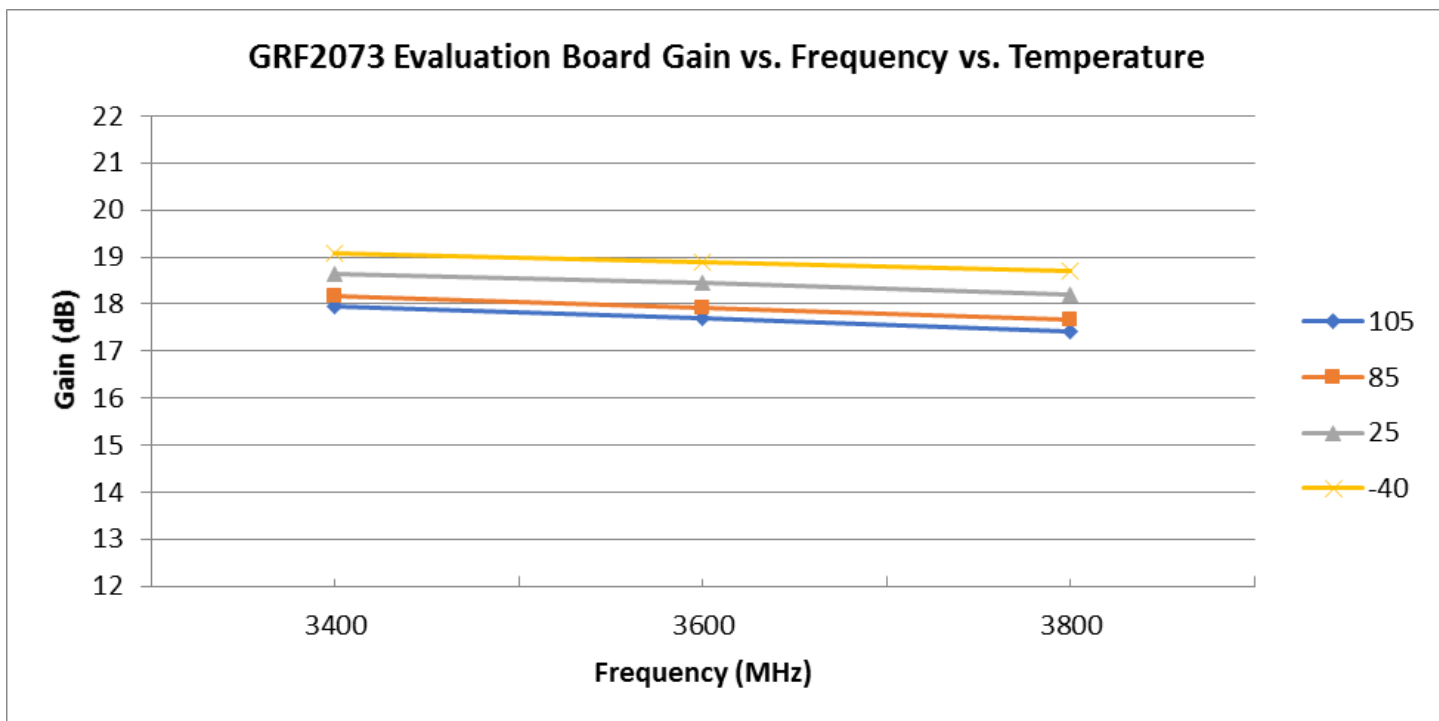
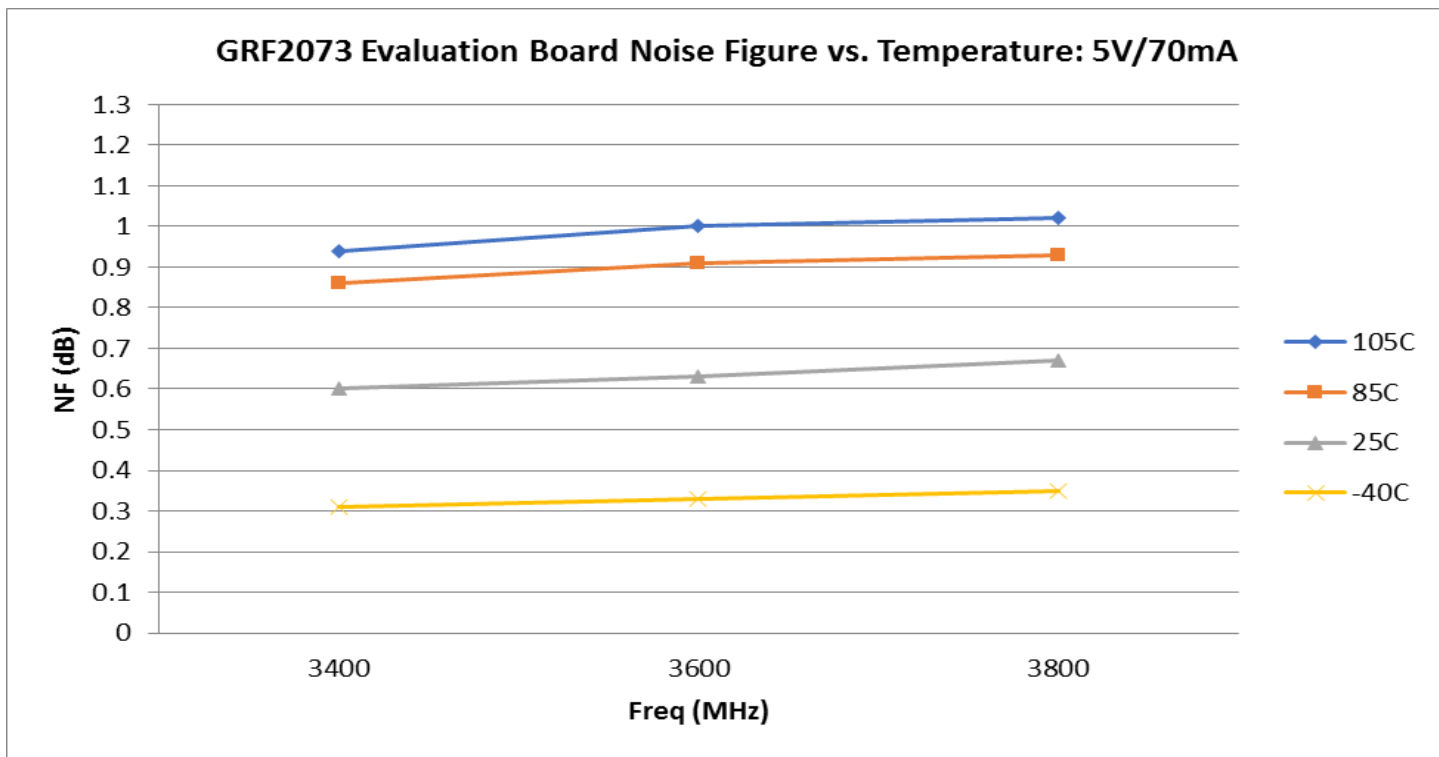


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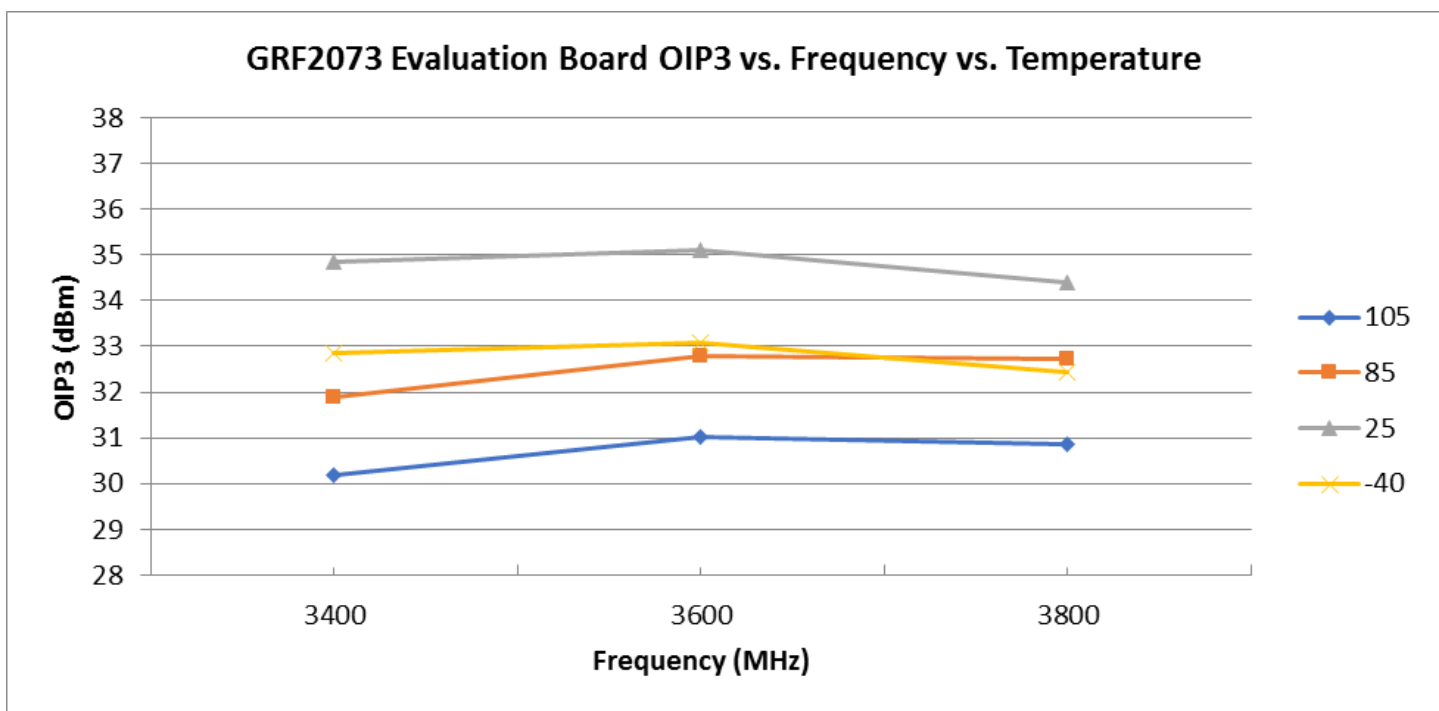
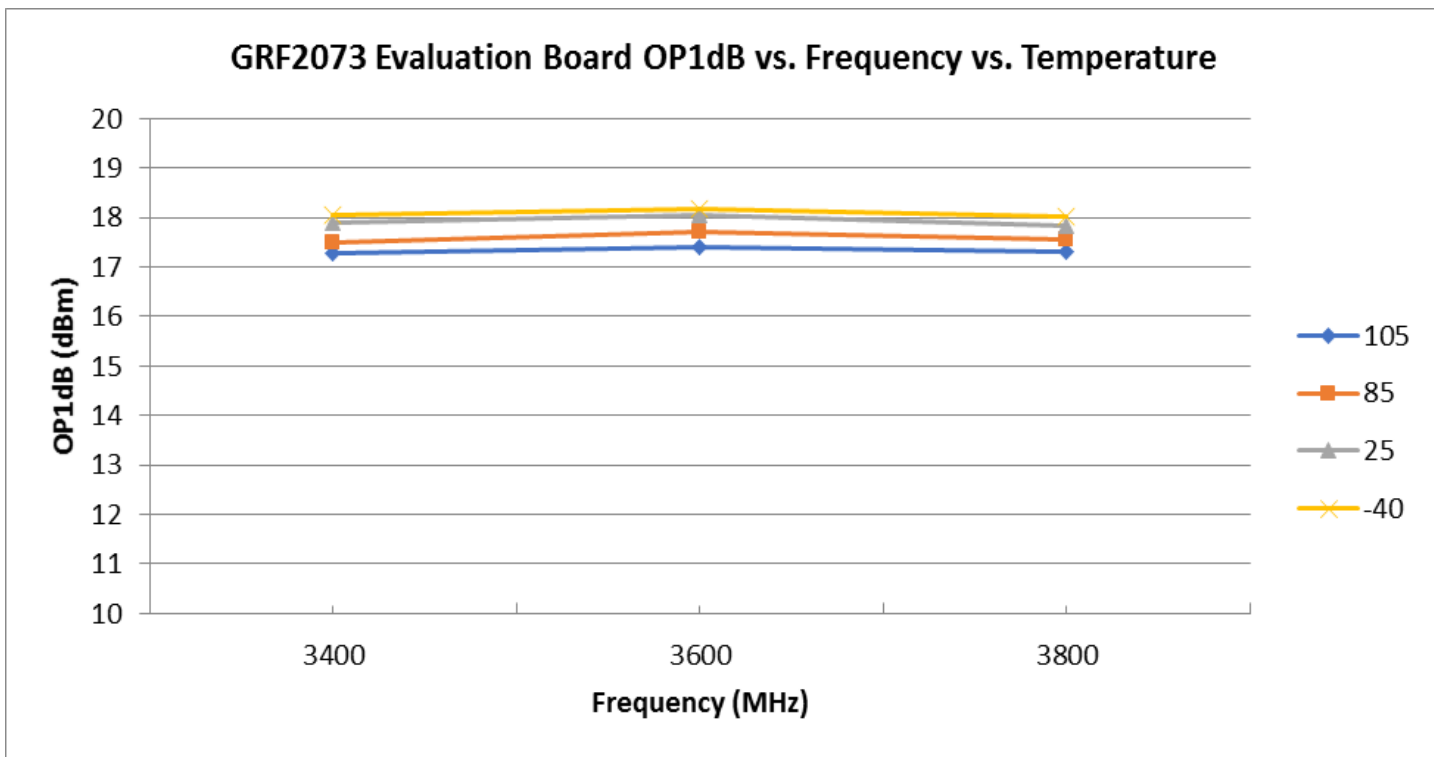
# GRF2073W

Ultra-Low Noise Amplifier  
Tuning Range: 2.0 to 6.0 GHz

## GRF2073W Evaluation Board Data over Temperature: (3.4 to 3.8 GHz match)



GRF2073W Evaluation Board Data over Temperature: (3.4 to 3.8 GHz Match)



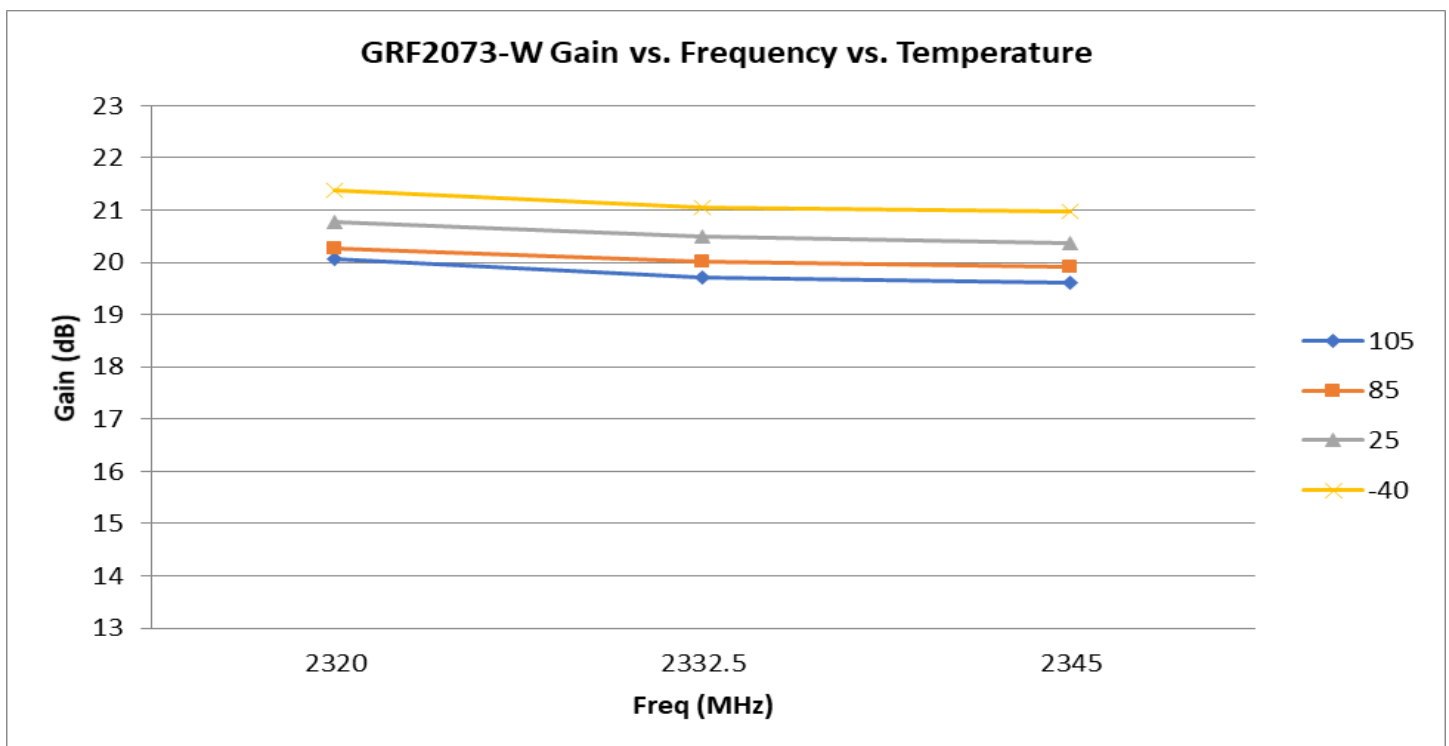
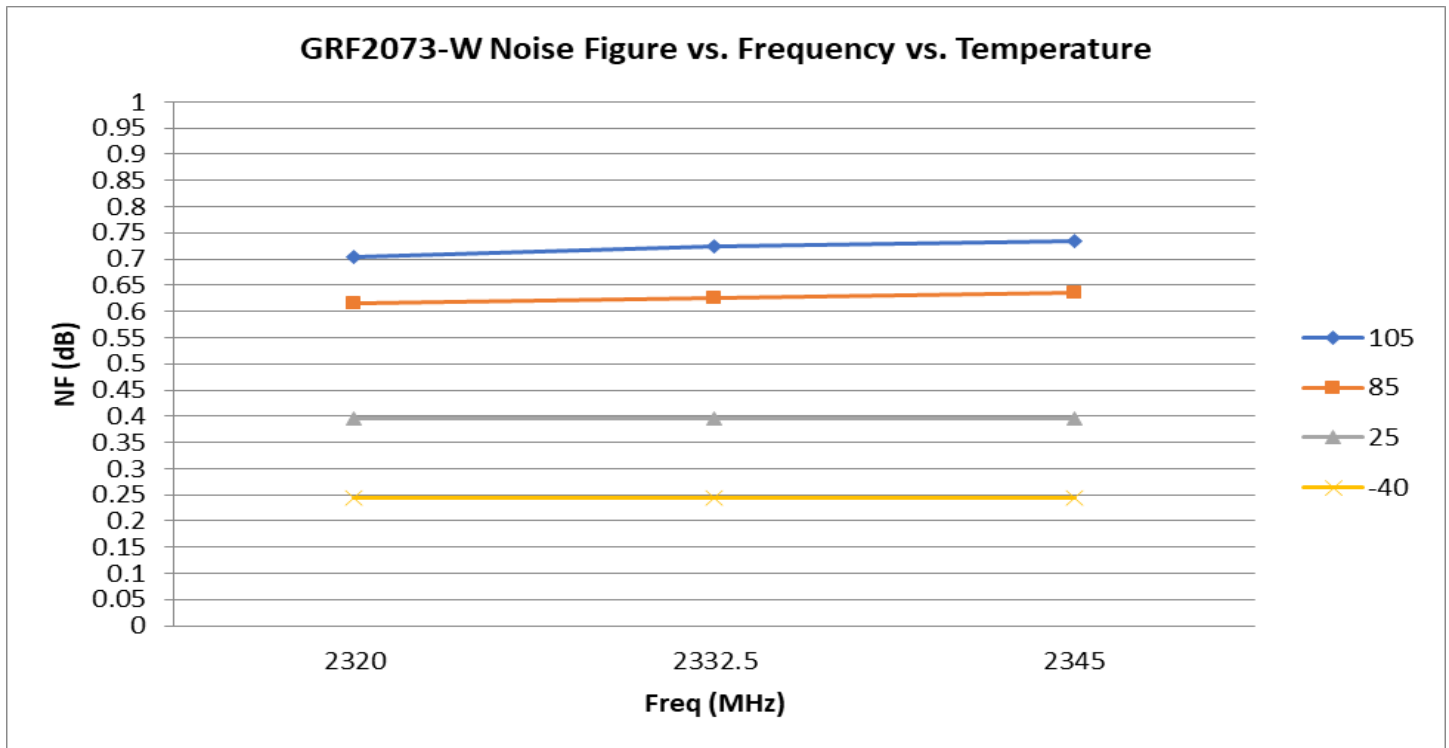


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# GRF2073W

Ultra-Low Noise Amplifier  
Tuning Range: 2.0 to 6.0 GHz

## GRF2073W Evaluation Board Data over Temperature: (SDARS Match; NF De-embedded)



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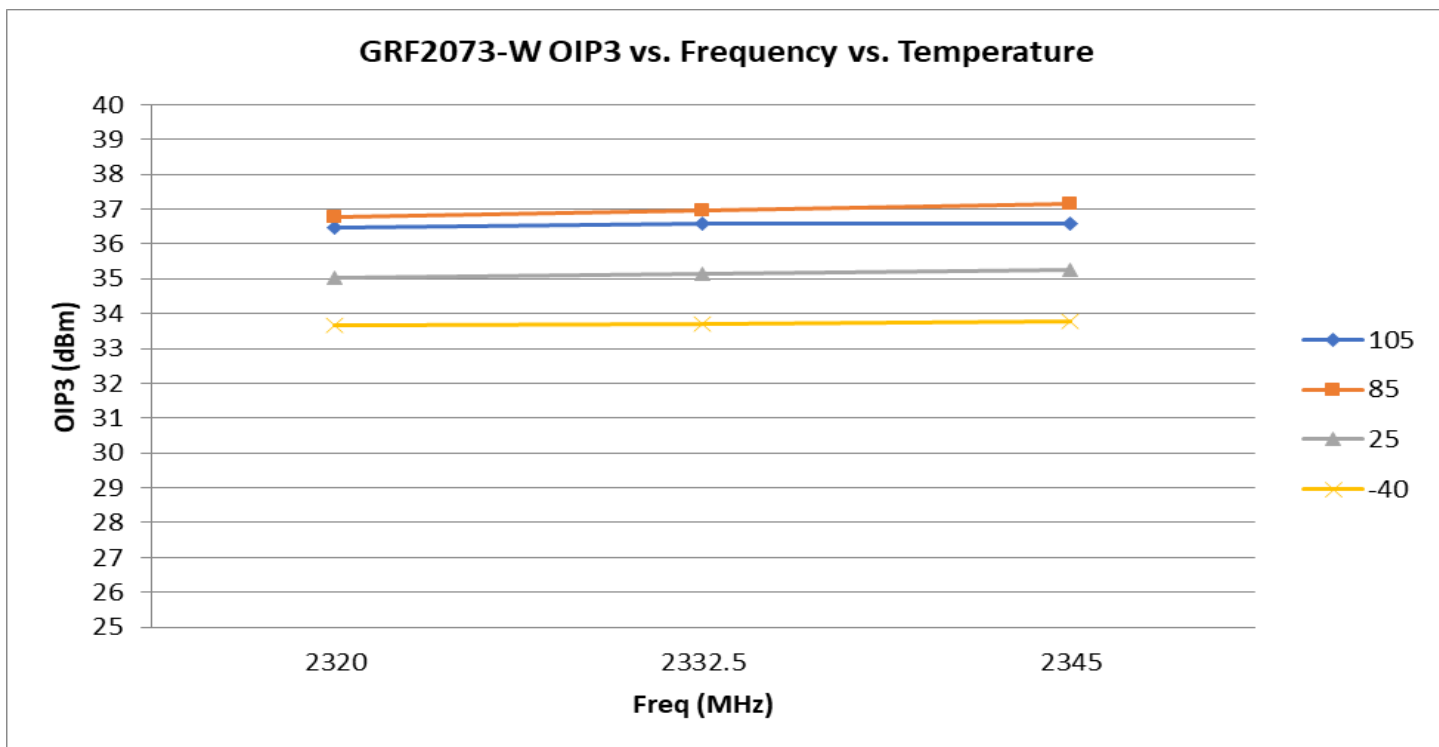
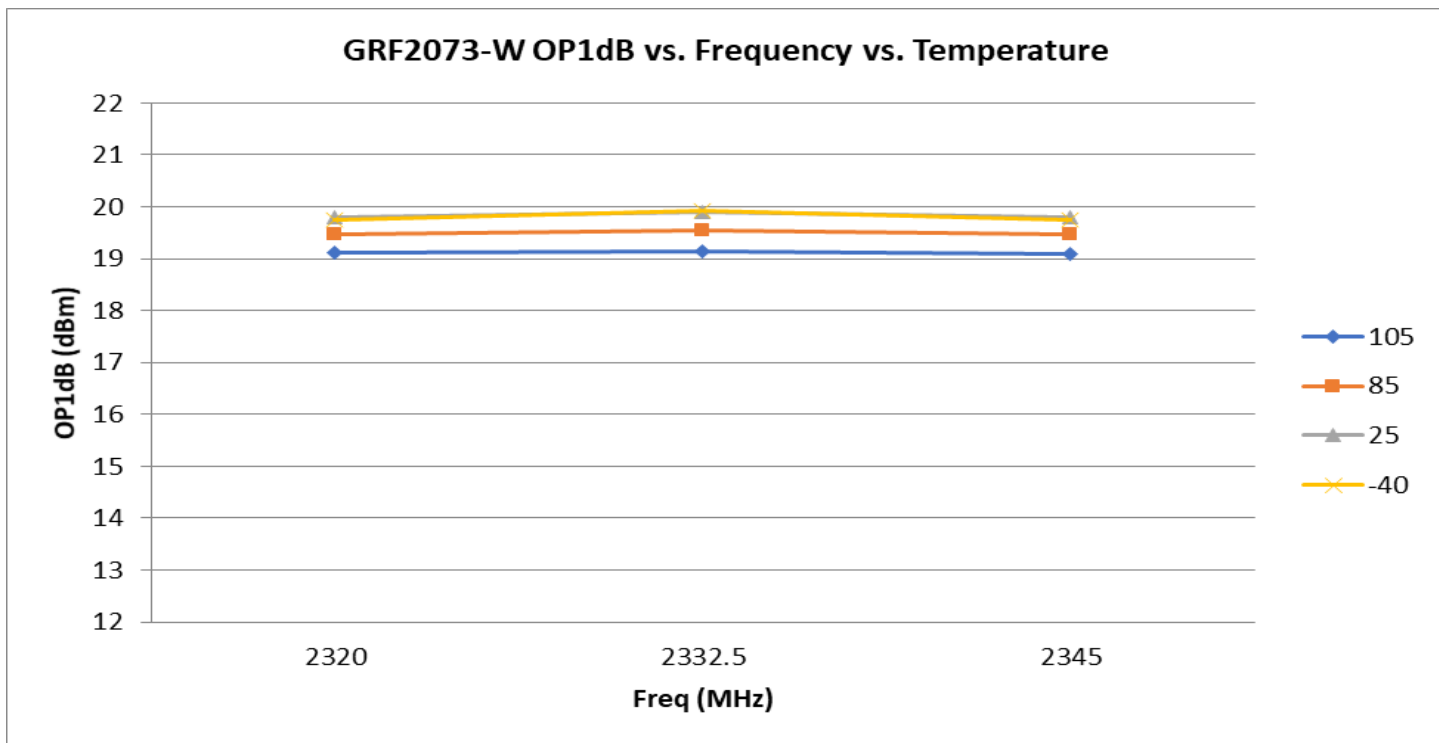


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# GRF2073W

Ultra-Low Noise Amplifier  
Tuning Range: 2.0 to 6.0 GHz

## GRF2073W Evaluation Board Data over Temperature: (SDARS Match)



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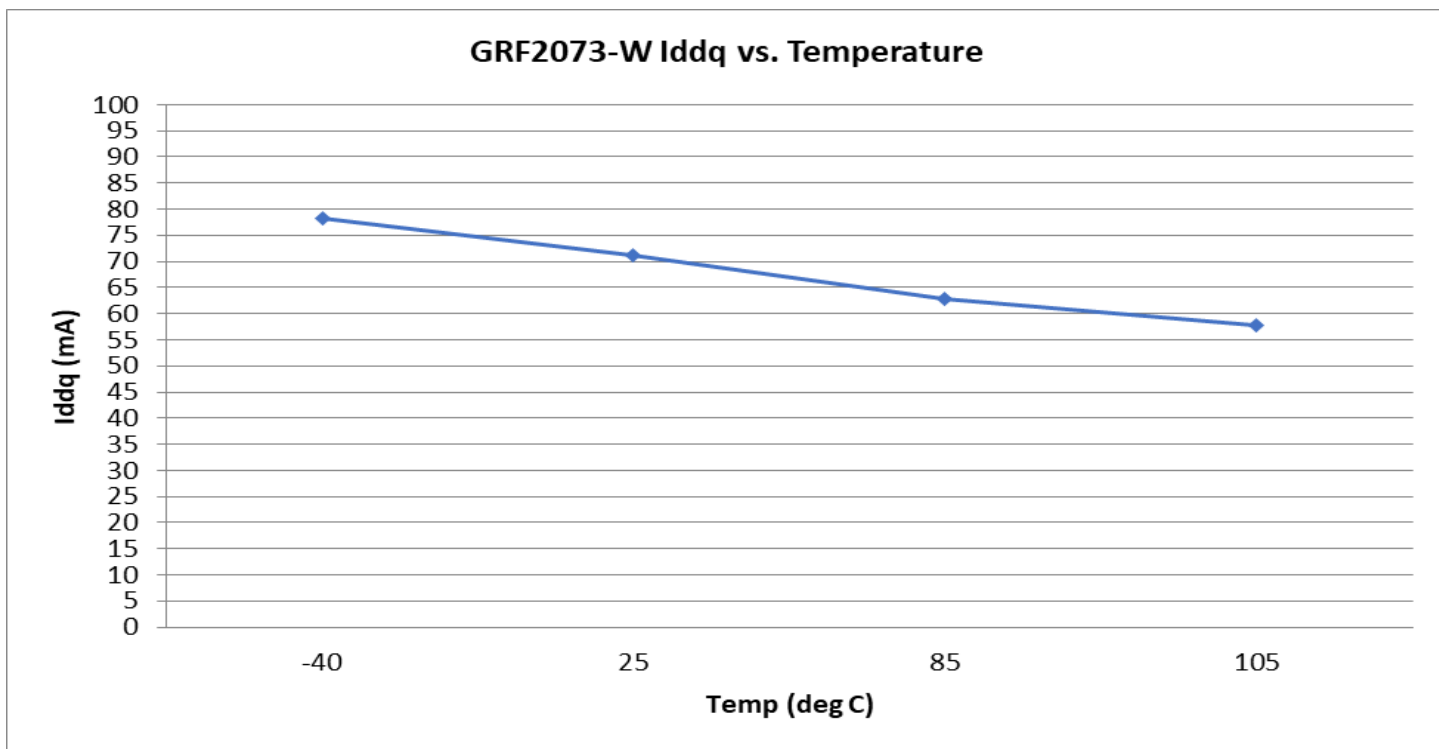


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# GRF2073W

Ultra-Low Noise Amplifier  
Tuning Range: 2.0 to 6.0 GHz

## GRF2073W Evaluation Board Data over Temperature:



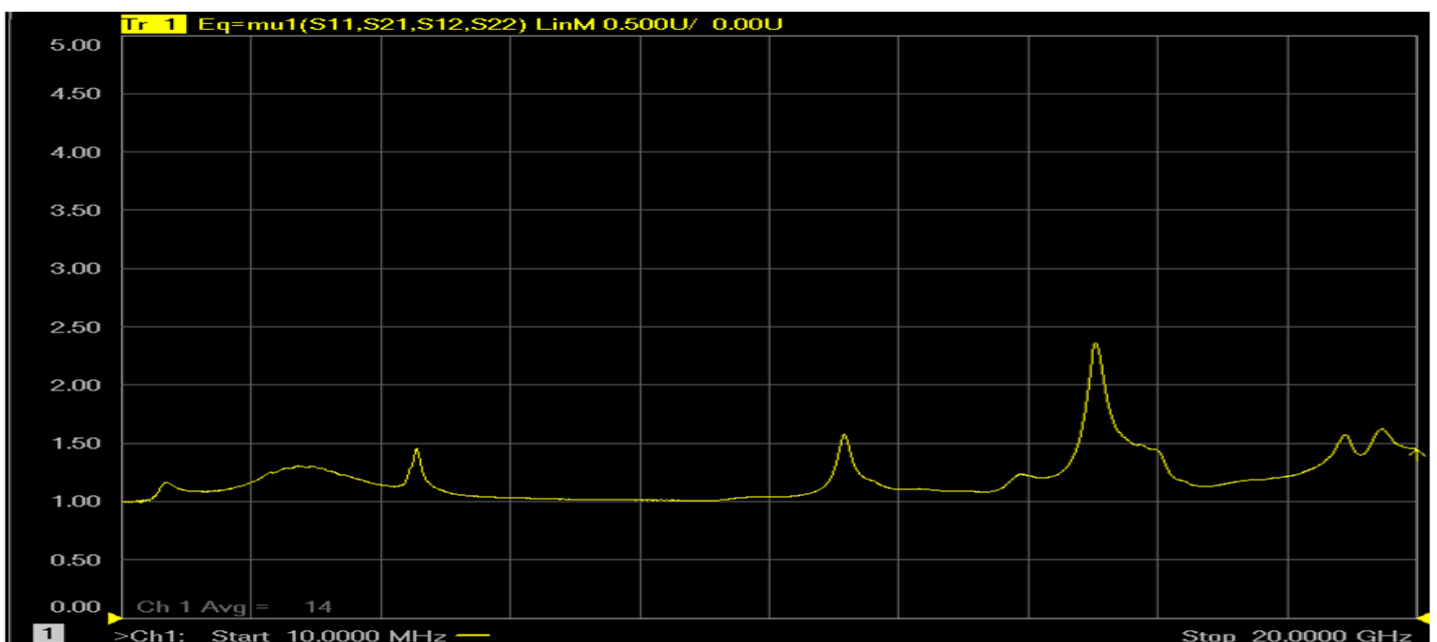
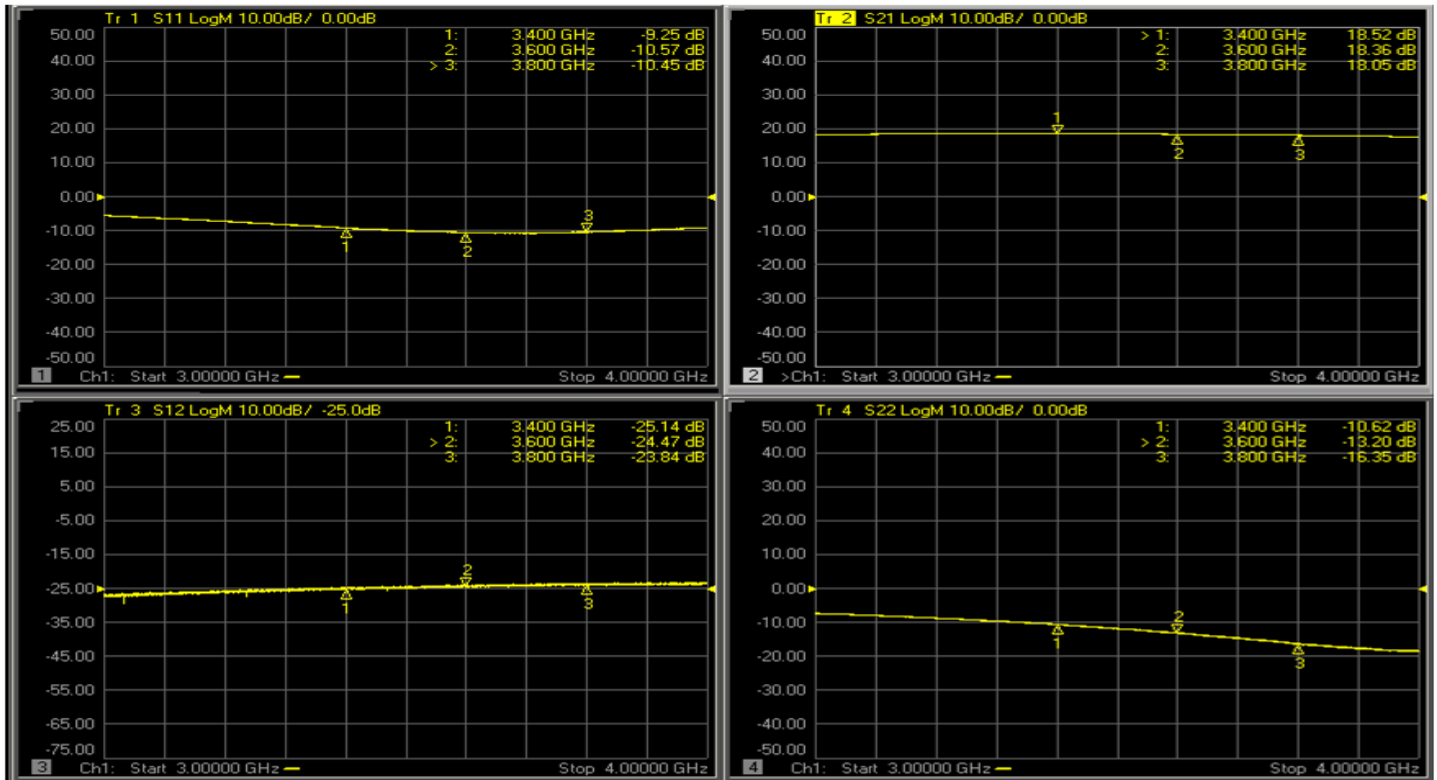


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# GRF2073W

Ultra-Low Noise Amplifier  
Tuning Range: 2.0 to 6.0 GHz

## GRF2073W Gain Mode S-Params: (3.4 to 3.8 GHz Match)



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

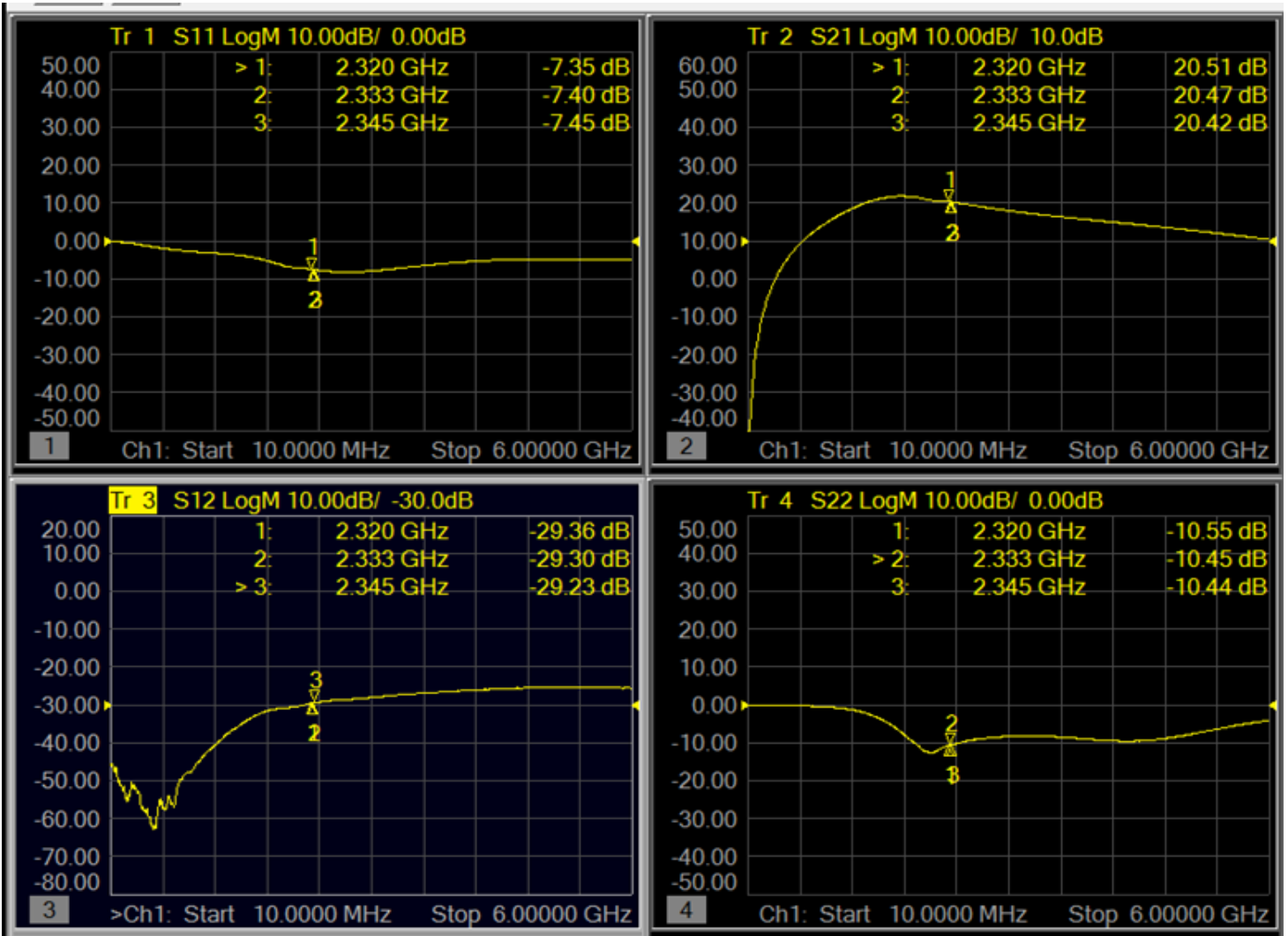


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# GRF2073W

Ultra-Low Noise Amplifier  
Tuning Range: 2.0 to 6.0 GHz

## GRF2073W Gain Mode S-Pars: (SDARS Match)



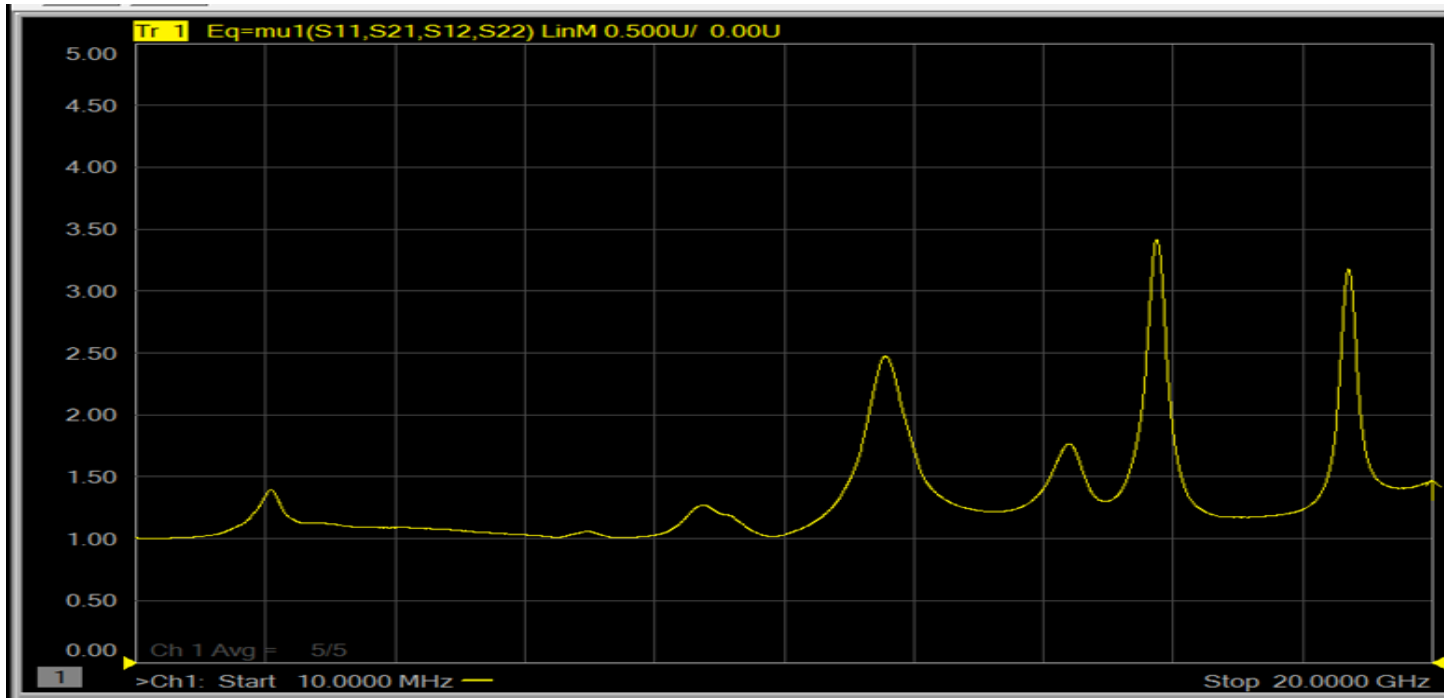


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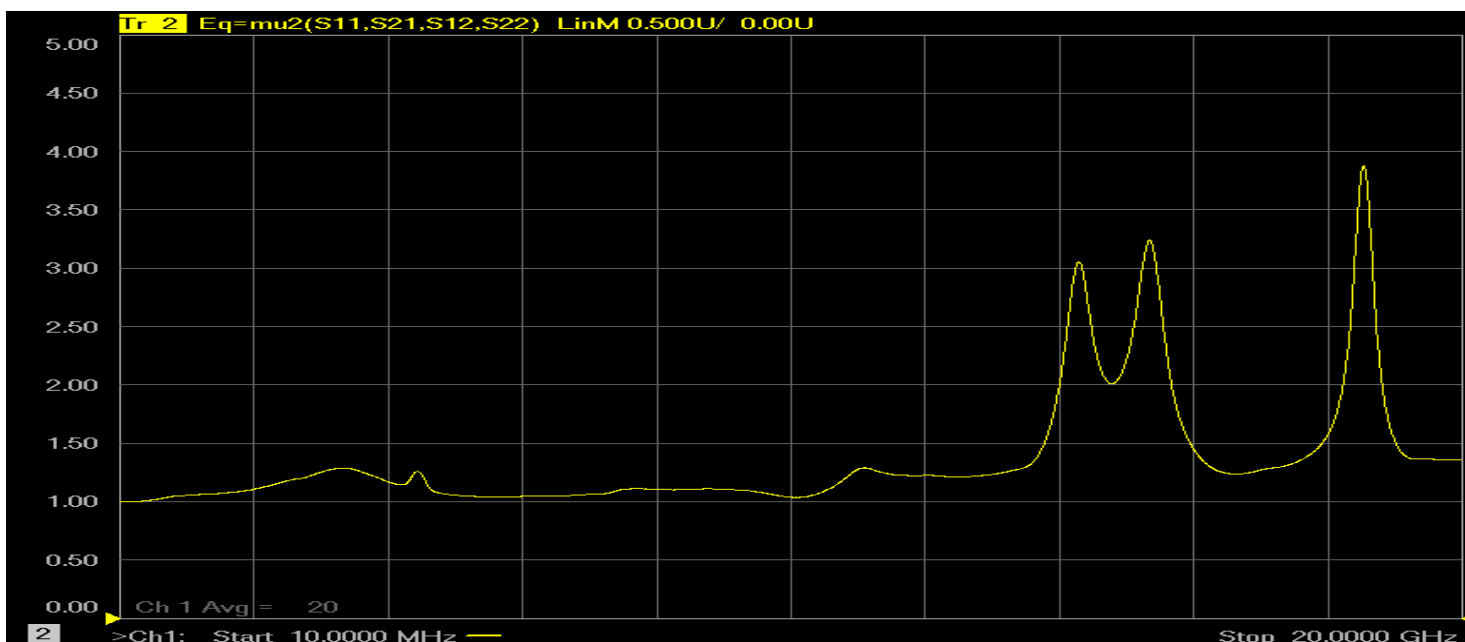
# GRF2073W

Ultra-Low Noise Amplifier  
Tuning Range: 2.0 to 6.0 GHz

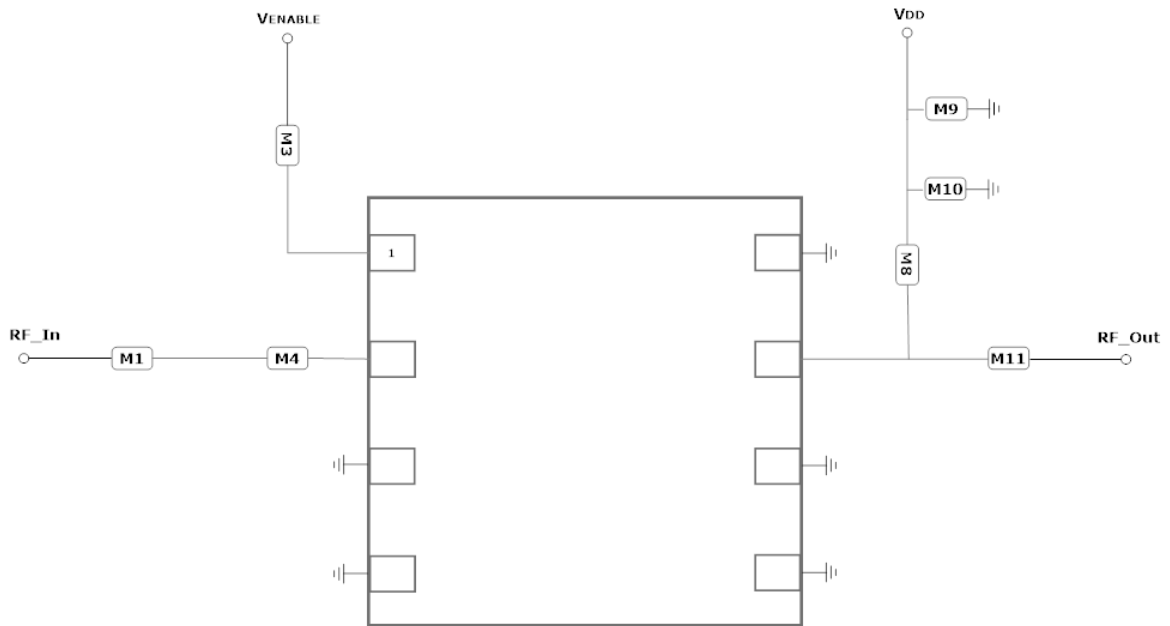
## GRF2073W Evaluation Board Mu/Mu Prime Stability Factors: (SDARS Match)



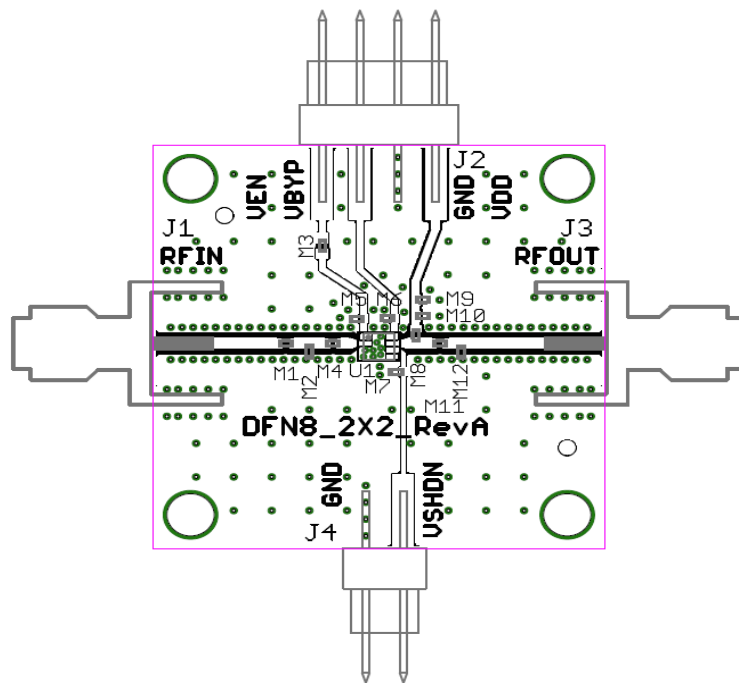
Note:  $\mu \geq 1.0$  implies unconditional stability.



Note:  $\mu \text{ Prime} \geq 1.0$  implies unconditional stability.



GRF2073W Application Schematic



GRF2073W EVB Assembly Drawing



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# GRF2073W

Ultra-Low Noise Amplifier  
Tuning Range: 2.0 to 6.0 GHz

## GRF2073W Evaluation Board BOM: (3.4 to 3.8 GHz Tune)

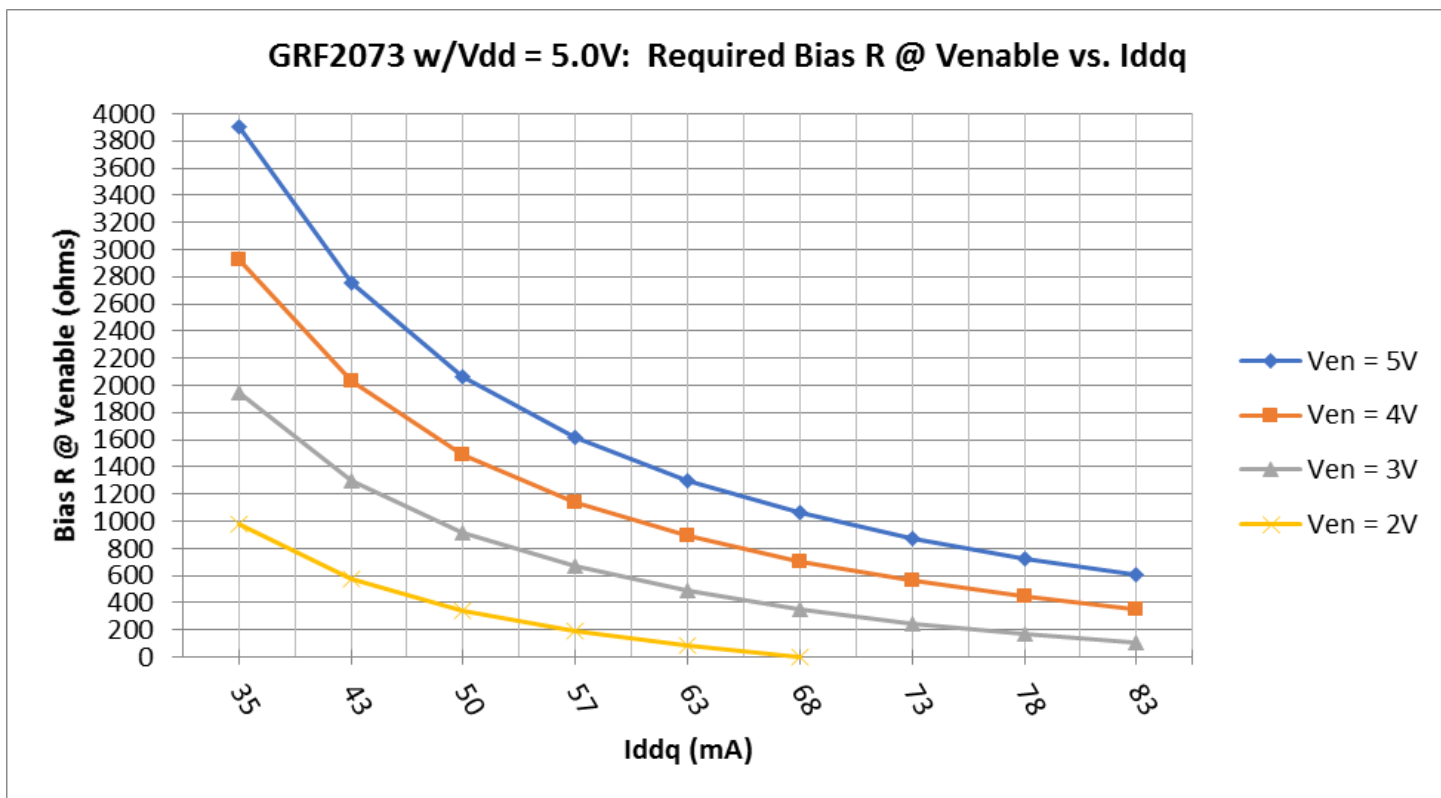
Component	Type	Manufacturer	Family	Value	Package Size	Substitution
M1	Capacitor	Murata	GJM	1.2 pF	0402	Ok (high Q)
M3	Resistor	Various	5%	Sets Iddq	0402	ok
M4	Resistor	Various	—	0 Ohm	0402	ok
M8	Inductor	Murata	LQP/LQG	1.8 nH	0402	ok
M9	Capacitor	Murata	GRM	0.1 uF	0402	ok
M10	Capacitor	Murata	GRM	100 pF	0402	ok
M11	Capacitor	Murata	GJM	5.1 pF	0402	ok
Evaluation Board	DFN8_2x2_RevA	—	—	—	—	—

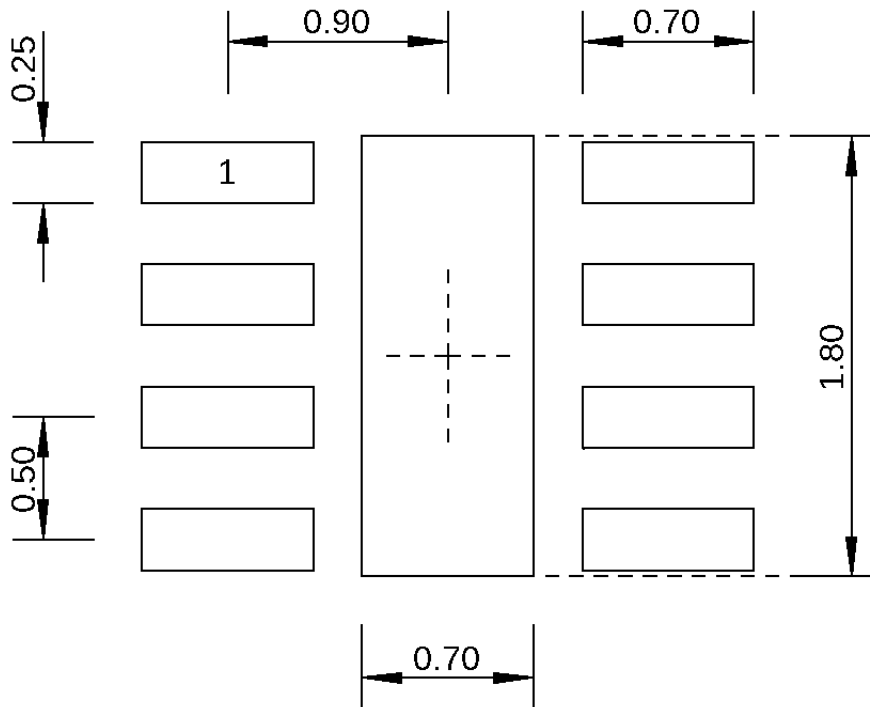
## GRF2073W Standard Evaluation Board BOM: (SDARS Tune)

Component	Type	Manufacturer	Family	Value	Package Size	Substitution
M1	Jumper (Not Required)	—	—	0 ohms	0402	ok
M3	Resistor	Various	5%	Sets Iddq	0402	ok
M4	Capacitor	Murata	GJM	20 pF	0402	ok (high Q)
M8	Inductor	Murata	LQG	2.0 nH	0402	ok
M9	Capacitor	Murata	GRM	0.1 uF	0402	ok
M10	Capacitor	Murata	GRM	100 pF	0402	ok
M11	Capacitor	Murata	GRM	2.0 pF	0402	ok
Evaluation Board	DFN8_2x2_RevA	—	—	—	—	—

**Note:** The match represented by the above SDARS BOM is designed to achieve optimal noise figure over 2320 to 2345 MHz. The high gain of GRF2073 allows for NF to be emphasized over input return loss for what is intended as a first-stage LNA SDARS application. This matching approach has been found to yield the best overall compliance to the SDARS specification which typically requires two SAW filters along with two high-gain amplifier stages.

GRF2073W Bias Resistor Selection Curves:

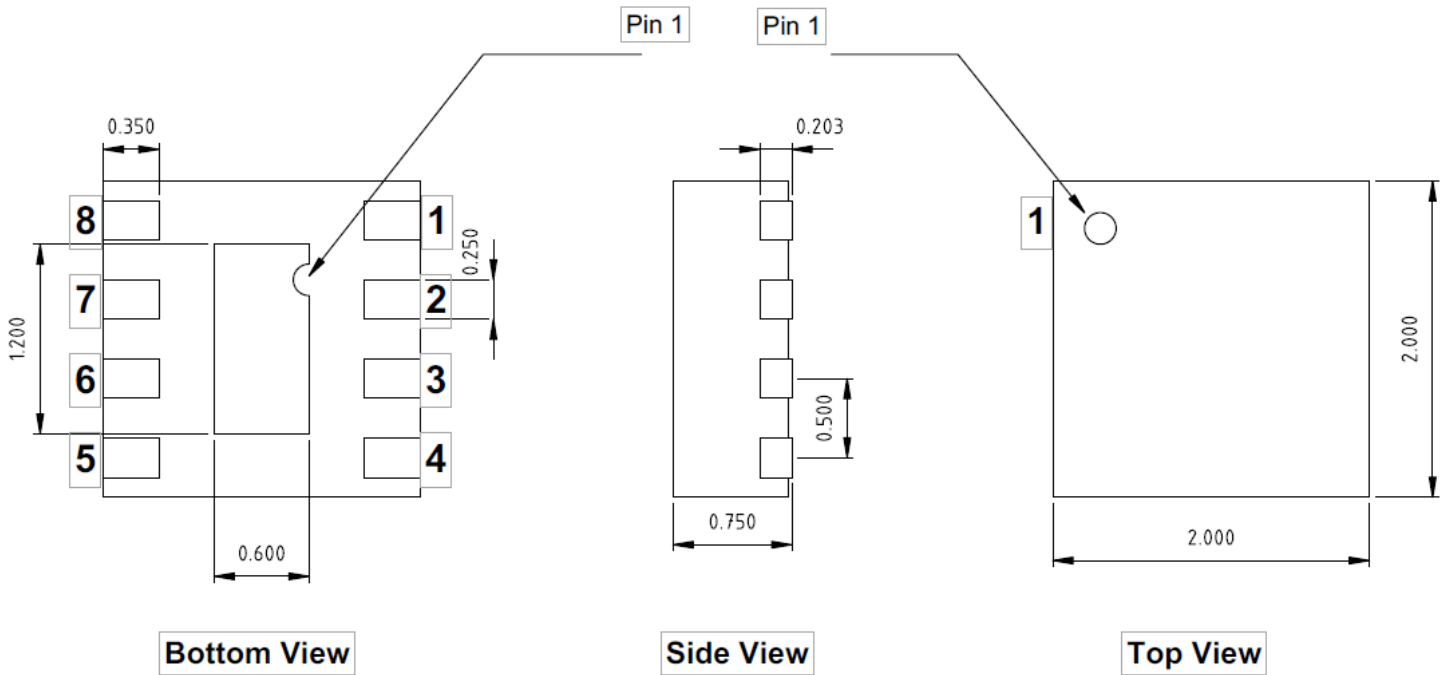




Dimensions in millimeters

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



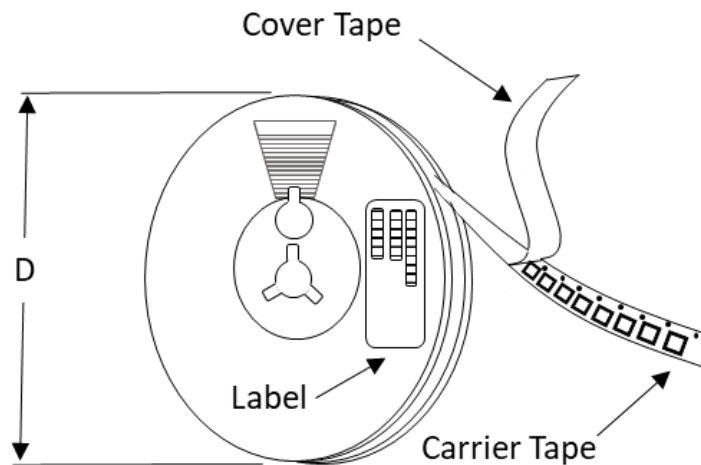


2.0 x 2.0 DFN-8 Package Dimensions (mm)

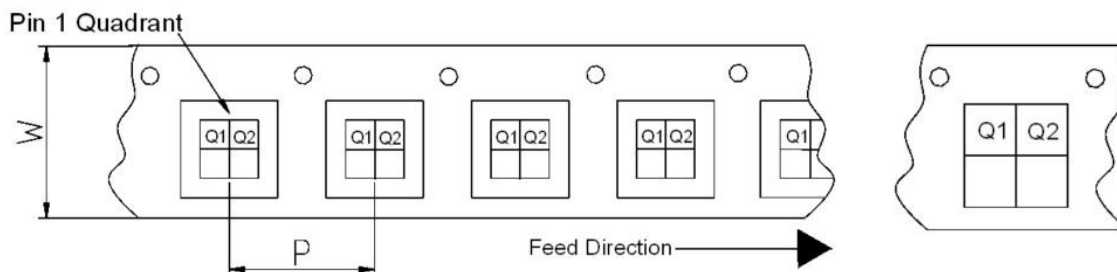
### Tape and Reel Information:

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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# GRF2073W

Ultra-Low Noise Amplifier  
Tuning Range: 2.0 to 6.0 GHz

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	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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# GRF2073W

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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.

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