



## GRF2083

### Ultra-LNA with Shutdown 2 to 6 GHz

#### FEATURES

- Excellent Noise Figure Performance
- High Isolation Shutdown State
- Flexible Bias Voltage
- Compact 2.0 x 2.0 mm DFN-8 Package
- Process: GaAs pHEMT

#### Reference: 5 V / 75 mA / 3.6 GHz

- Gain: 17.8 dB
- OIP3: 36.5 dBm
- OP1dB: 18.5 dBm
- Evaluation Board Noise Figure: 0.65 dB

#### APPLICATIONS

- Cellular Infrastructure
- Small Cells and Cellular Repeaters
- Distributed Antenna Systems
- TDD Systems
- 802.11ac

#### DESCRIPTION

The GRF2083 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.

The device features an integrated shutdown function which places the device into a high-isolation shutdown state.

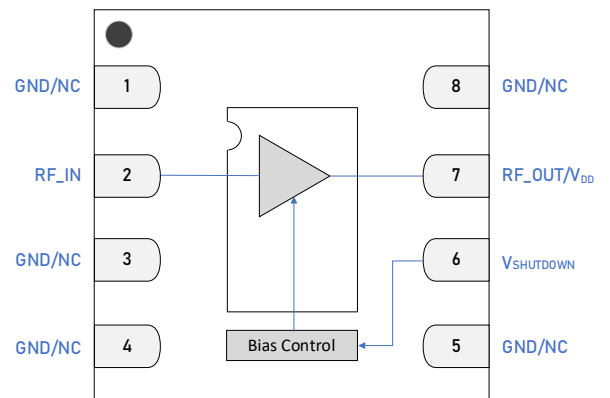
This device is a member of a family of pin-compatible, ultra-low noise devices which cover a wide range of frequency bands with industry leading NF and gain:

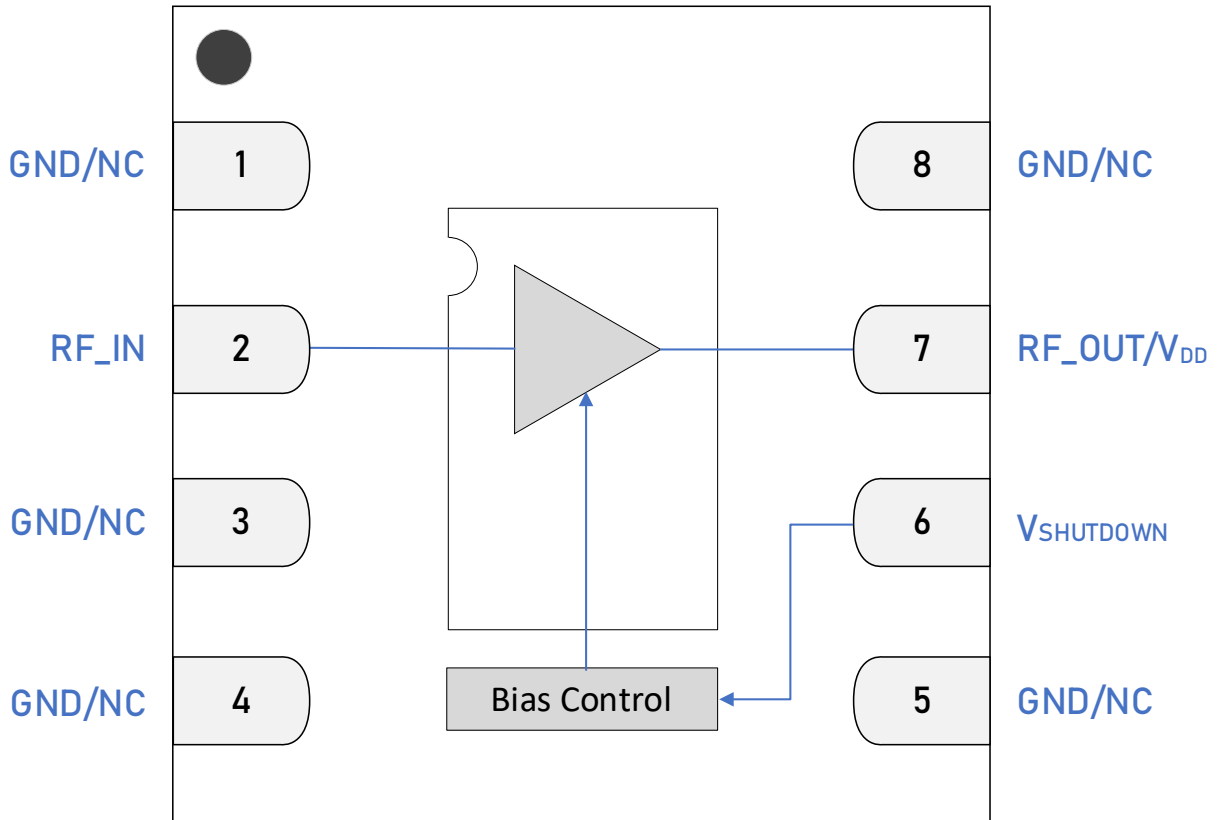
**GRF2080:** 0.1 to 1.5 GHz      **GRF2081:** 0.7 to 2.7 GHz

**GRF2082:** 1.5 to 3.8 GHz      **GRF2083:** 2.0 to 6.0 GHz

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

#### BLOCK DIAGRAM





2.0 x 2.0 mm DFN-8 Pin Out (Top View)

## Pin Assignments

Pin	Name	Description	Note
1, 3, 4, 5, 8	GND/NC	Ground or No Connect	No internal connection to die. We recommend connecting these pins to GND.
2	RF_IN	RF Input	External match must provide DC block.
6	V <sub>SHUTDOWN</sub>	Selects Shutdown Mode	See Control Logic Truth Table.
7	RF_Out/V <sub>DD</sub>	RF Output	Provide device V <sub>DD</sub> via external bias inductor.
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.

## Control Logic Truth Table

Mode	Description	V <sub>DD</sub>	V <sub>SHUTDOWN</sub>
High Gain	LNA Gain	High	Low
Shutdown	LNA Insertion Loss	High	High
Logic Level "0"	Logic Low	0 V	0 V to 0.2 V
Logic Level "1"	Logic High	≥ 2.7 V	1.5 V to V <sub>DD</sub>

## Absolute Ratings

Parameter	Symbol	Min.	Max.	Unit
Supply Voltage	$V_{DD}$	0	6	V
RF Input Power (CW, Load VSWR < 2:1, $V_{DD} = 5$ V)	$P_{IN\ MAX}$		23	dBm
Operating Temperature (Package Heat Sink)	$T_{PKG\ HEAT\ SINK}$	-40	105	°C
Maximum Channel Temperature (MTTF > 10 <sup>6</sup> Hours)	$T_{MAX}$		170	°C
Maximum Dissipated Power	$P_{DISS\ MAX}$		500	mW

## Electrostatic Discharge

Charged Device Model	CDM	1500		V
Human Body Model	HBM	500		V

## Storage

Storage Temperature	$T_{STG}$	-65	150	°C
Moisture Sensitivity Level	MSL		1	--



**Caution! ESD Sensitive Device.**

**Exceeding Absolute Maximum Rating conditions may cause permanent damage.**

Note: For additional information, please refer to *Manufacturing Note MN-001 — Package and Manufacturing Information*.



All Guerrilla RF products are provided in RoHS compliant lead (Pb)-free packaging requiring no exemptions. Additional information for this topic can be found at this link - [Environmental and Restricted Substance Statement Library](#)

## Recommended Operating Conditions

Parameter	Symbol	Specification			Unit	Condition
		Min.	Typ.	Max.		
Supply Voltage	V <sub>DD</sub>	0	5	6	V	
Operating Temperature (Package Heat Sink)	T <sub>PKG HEAT SINK</sub>	-40		105	°C	
RF Frequency Range	F <sub>RF</sub>	2	3.6	6	GHz	Typical Application Schematic with external matching components ( <b>note 1 &amp; 2</b> ).

**Note 1:** Operation outside this range is possible, but with degraded performance of some parameters.

**Note 2:** Contact the Guerrilla RF Applications team for guidance on optimizing the tuning of the device for alternative bands.

## Nominal Operating Parameters – General

The following conditions apply unless noted otherwise: Typical Application Schematic using the 3.4 to 3.8 GHz tuning set,  $V_{DD} = 5\text{ V}$ ,  $V_{SHUTDOWN} = < 0.2\text{ V}$ ,  $I_{DD} = 75\text{ mA}$ ,  $F_{TEST} = 3.6\text{ GHz}$ ,  $T_{PKG\ HEAT\ SINK} = 25\text{ }^{\circ}\text{C}$ . Evaluation board losses are included within the specifications.

Parameter	Symbol	Specification			Unit	Condition
		Min.	Typ.	Max.		
Supply Current	$I_{DD}$	50	75	95	mA	$V_{DD} = 5\text{ V}$ , $V_{SHUTDOWN} = 0\text{ V}$ .
Switching Rise Time	$T_{RISE}$		100		ns	
Switching Fall Time	$T_{FALL}$		100		ns	

### Thermal Data

Thermal Resistance: (Infrared Scan)	$\Theta_{JC}$		60		$^{\circ}\text{C}/\text{W}$	On standard evaluation board ( <b>note 3</b> ).
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**Note 3:** MTTF >  $10^6$  hours for  $T_{CHANNEL} \leq 170\text{ }^{\circ}\text{C}$ .

## Nominal Operating Parameters – RF

The following conditions apply unless noted otherwise: Typical Application Schematic using the 3.4 to 3.8 GHz tuning set,  $V_{DD} = 5\text{ V}$ ,  $V_{SHUTDOWN} = < 0.2\text{ V}$ ,  $I_{DD} = 75\text{ mA}$ ,  $F_{TEST} = 3.6\text{ GHz}$ ,  $T_{PKG\ HEAT\ SINK} = 25\text{ }^{\circ}\text{C}$ . Evaluation board losses are included within the specifications.

Parameter	Symbol	Specification			Unit	Condition
		Min.	Typ.	Max.		
Gain	S21	16.8	17.8		dB	
Evaluation Board Noise Figure	NF		0.65	0.85	dB	
Output 3 <sup>rd</sup> Order Intercept Point	OIP3		36.5		dBm	+4 dBm $P_{OUT}$ per tone at 2 MHz spacing (3599 and 3601 MHz).
Output 1 dB Compression Power	OP1dB	17.5	18.5		dBm	

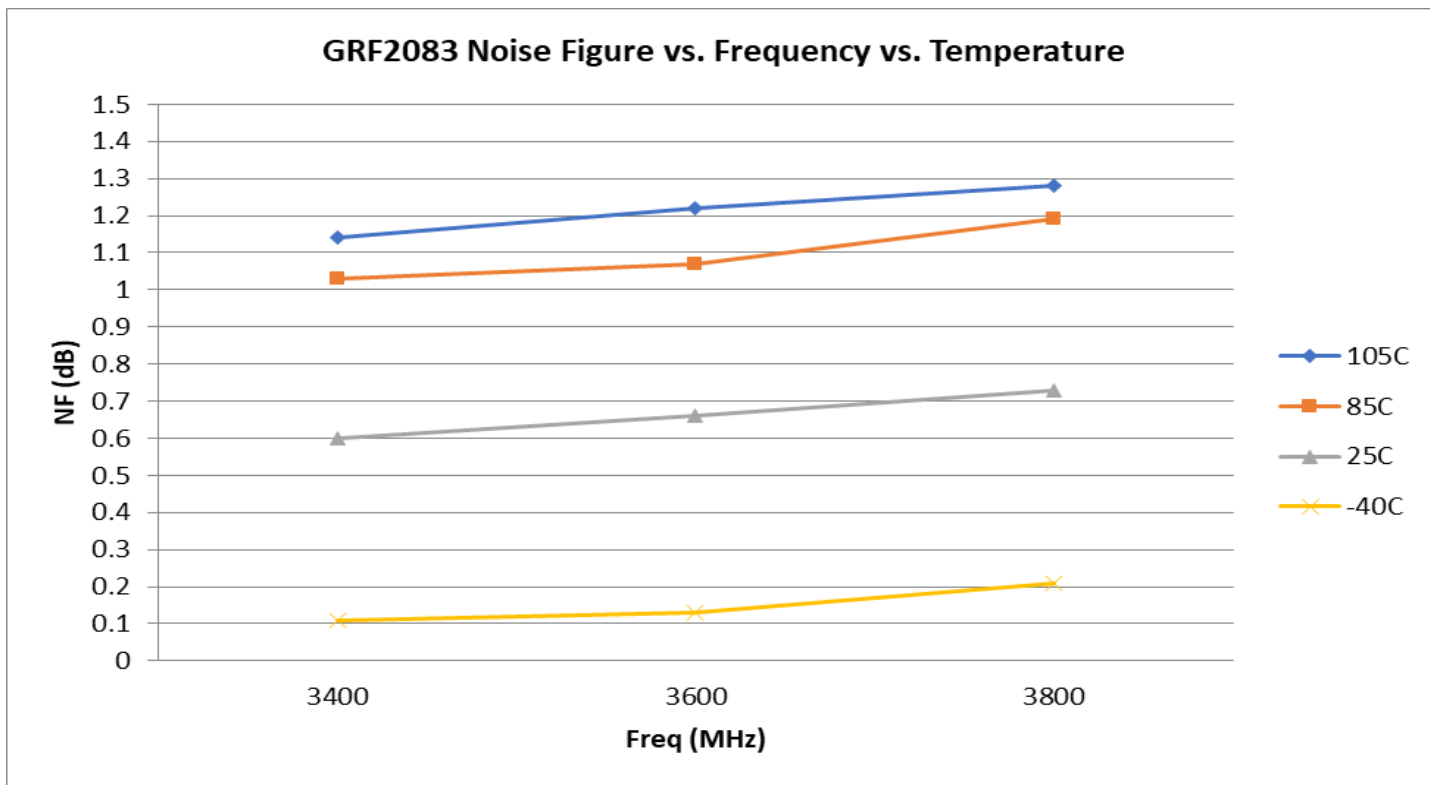
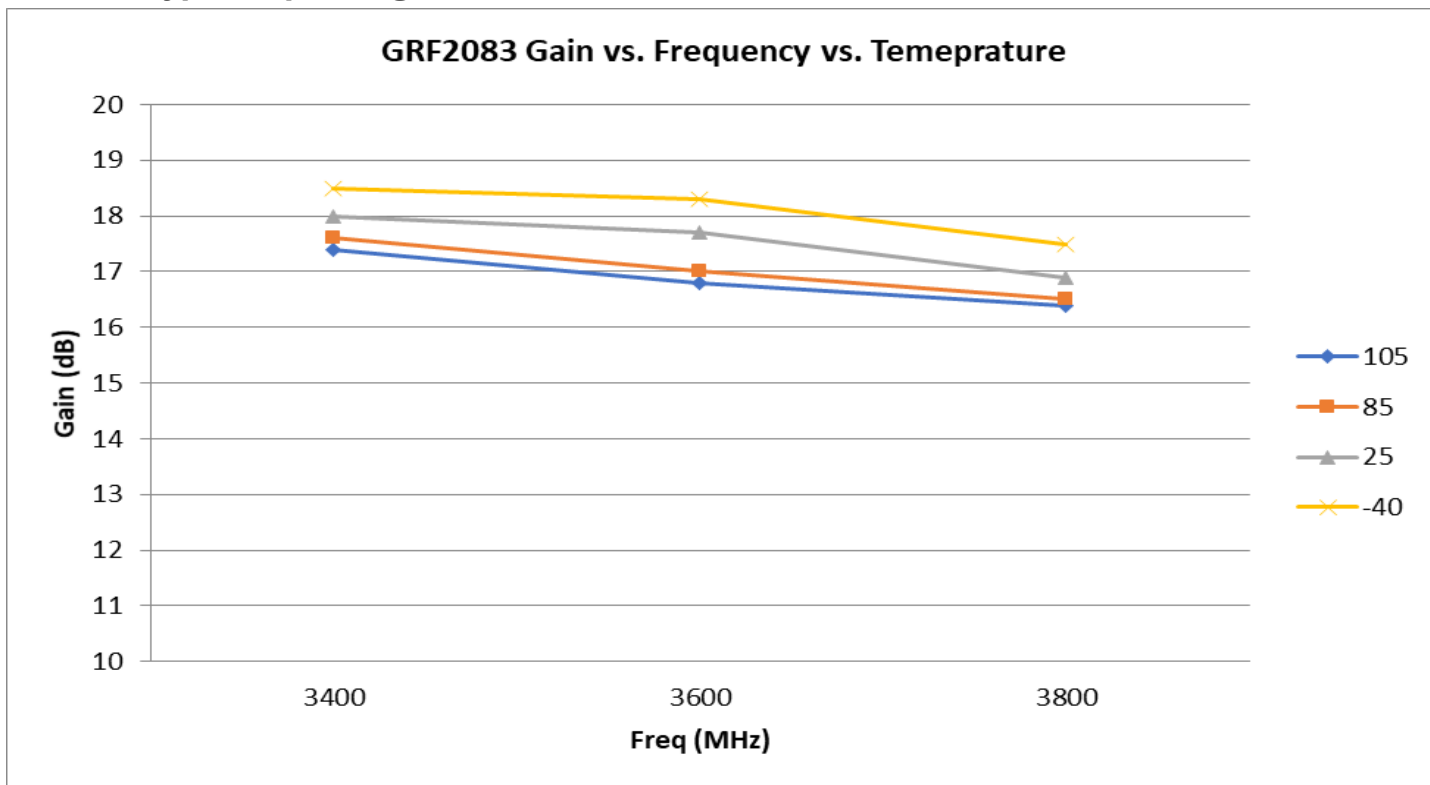
## Shutdown Mode

Gain (RF_IN = -10 dBm @ 3.6 GHz).	S21		-20		dB	$V_{DD} = 5\text{ V}$ , $V_{SHUTDOWN} = > 1.5\text{ V}$ .
Gain (RF_IN = 10 dBm @ 3.6 GHz).	S21		-16		dB	$V_{DD} = 5\text{ V}$ , $V_{SHUTDOWN} = > 1.5\text{ V}$ .
Shutdown Current (pin 6)	$I_{SHUTDOWN}$		40		$\mu\text{A}$	$V_{DD} = 5\text{ V}$ , $V_{SHUTDOWN} = 1.8\text{ V}$ .
Leakage Current (pin 7)	$I_{LEAKAGE}$		3.2		mA	$V_{DD} = 5\text{ V}$ , $V_{SHUTDOWN} = 1.8\text{ V}$ .

## Typical Operating Curve Conditions

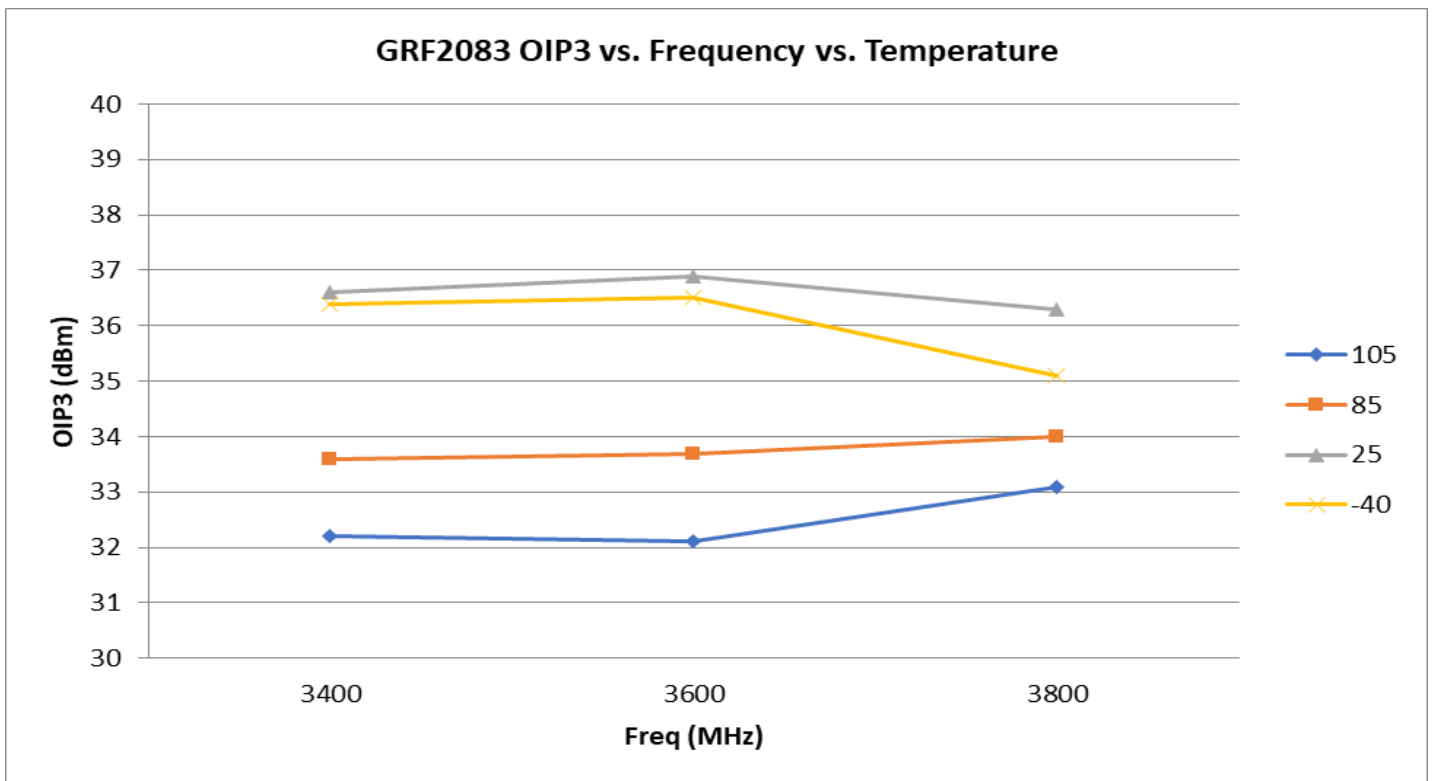
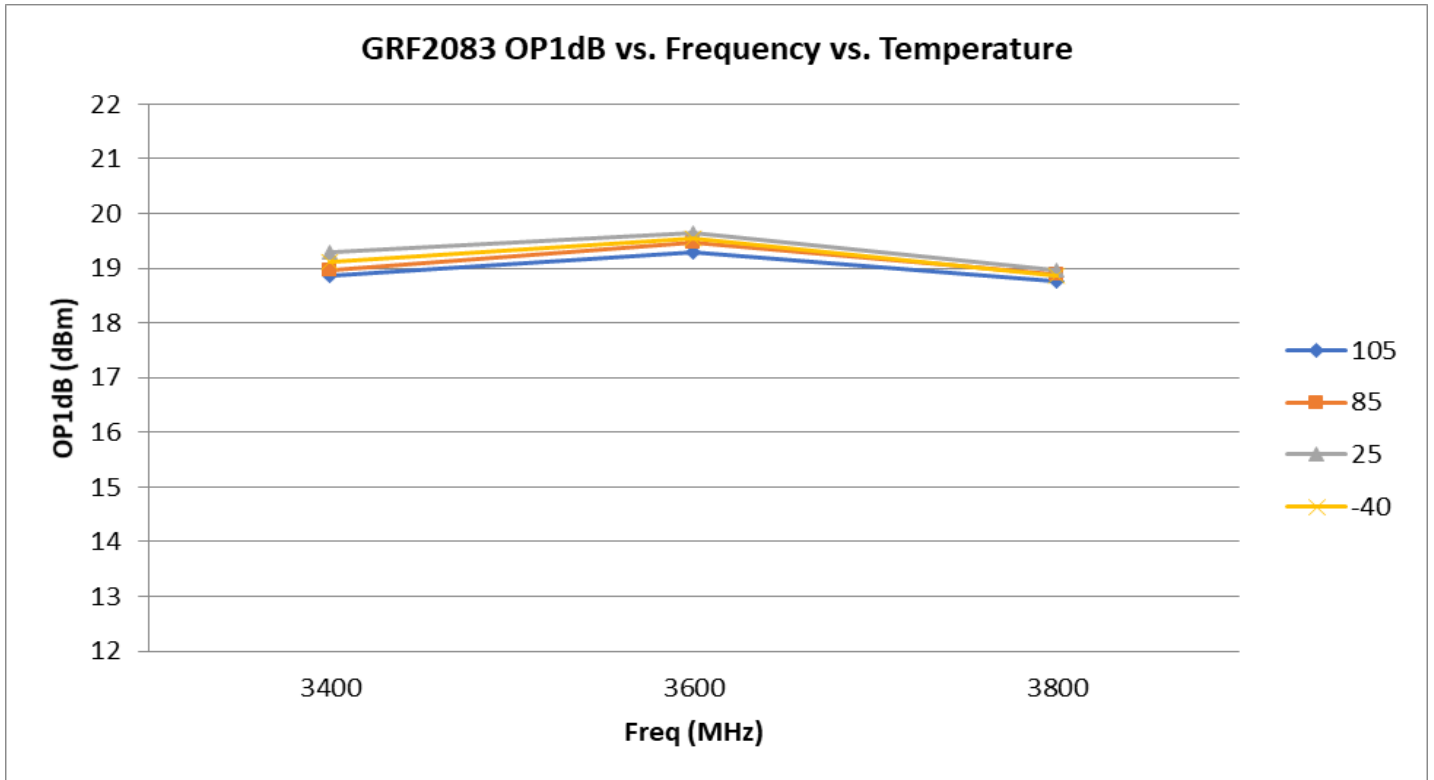
The following conditions apply unless noted otherwise: Typical Application Schematic using the 3.4 to 3.8 GHz tuning set,  $V_{DD} = 5\text{ V}$ ,  $V_{SHUTDOWN} = < 0.2\text{ V}$ ,  $I_{DD} = 75\text{ mA}$ ,  $F_{TEST} = 3.6\text{ GHz}$ ,  $T_{PKG\ HEAT\ SINK} = 25\text{ }^{\circ}\text{C}$ . Evaluation board losses are included within the plots.

GRF2083 Typical Operating Curves: 3.4 to 3.8 GHz Tune

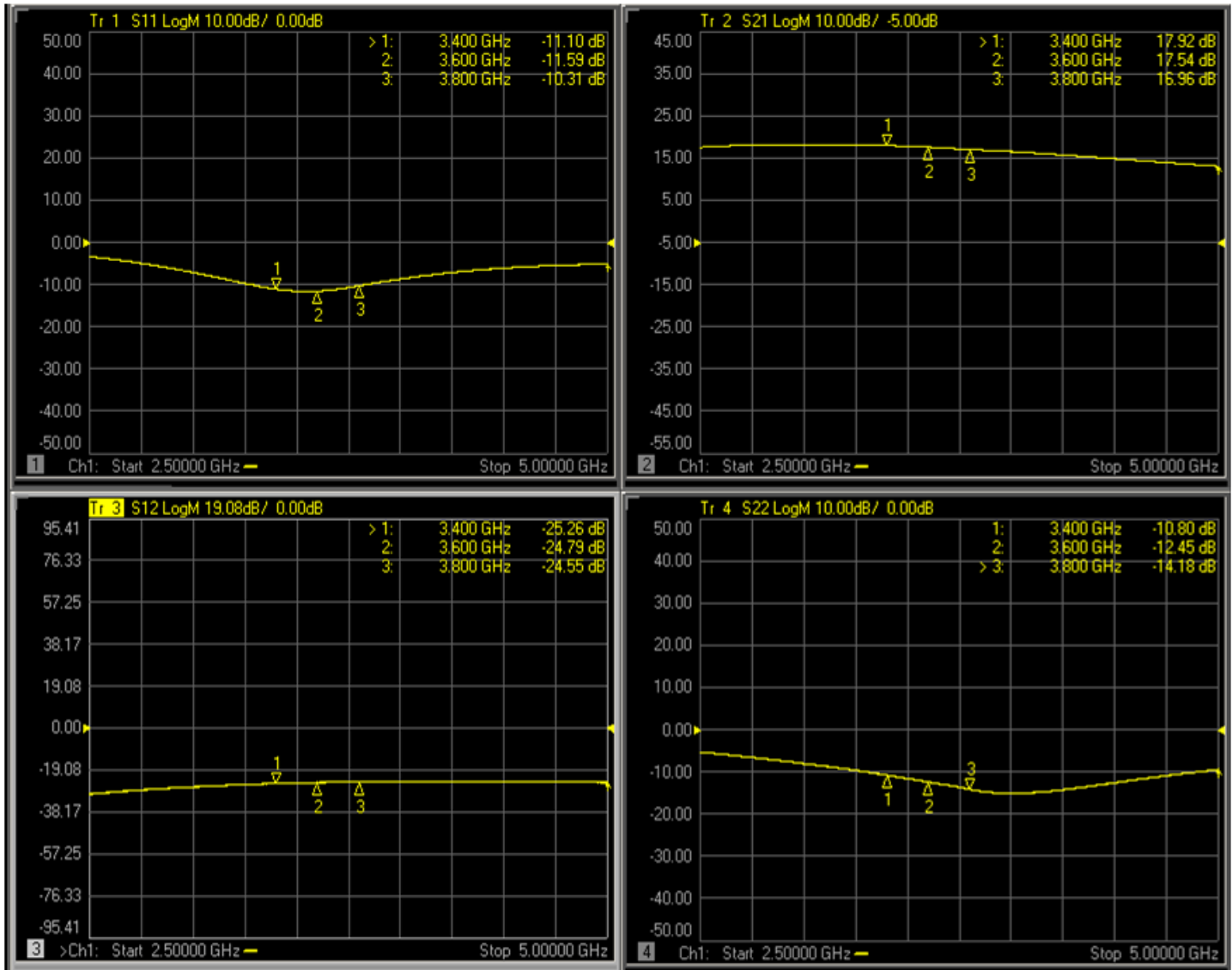




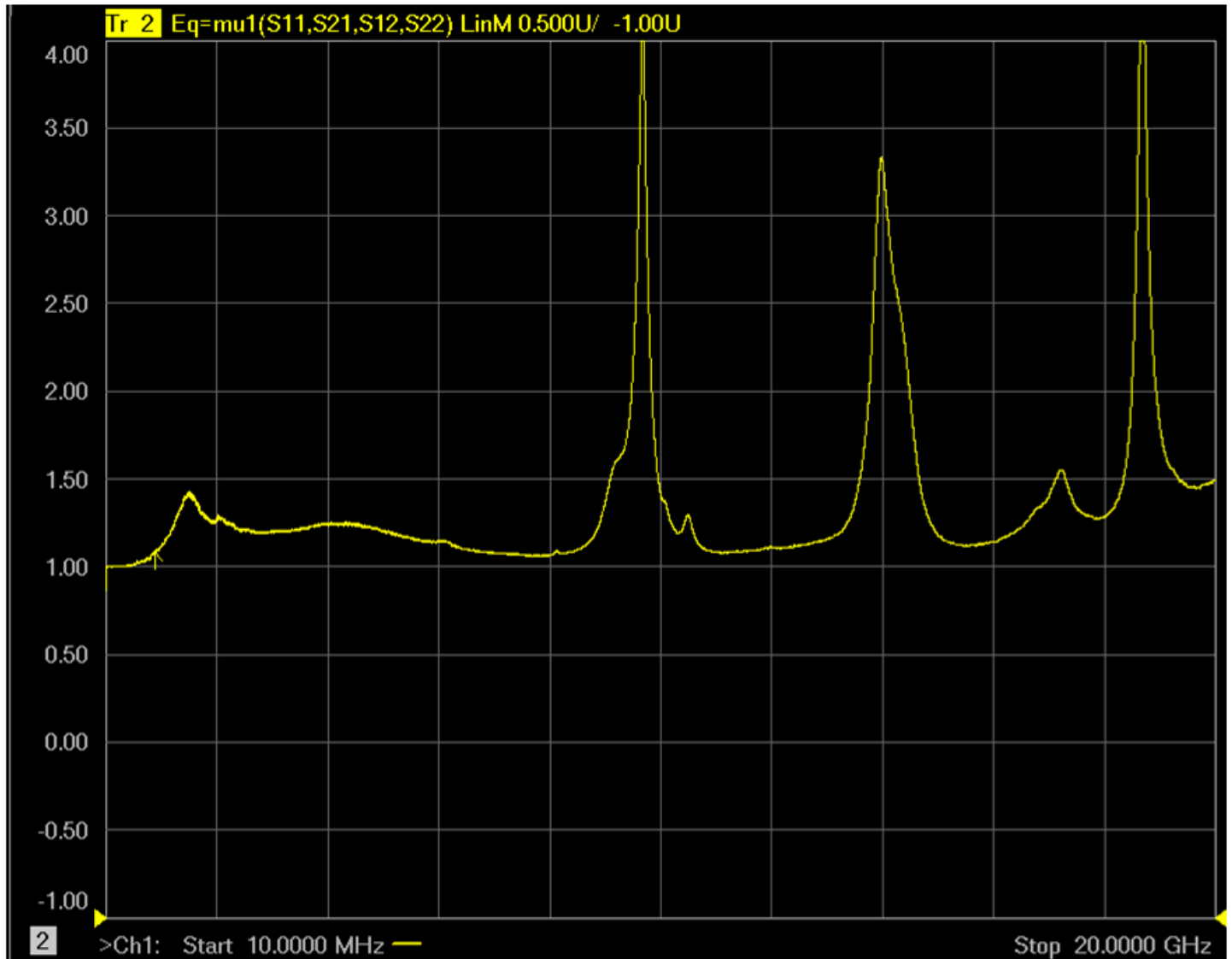
GRF2083 Typical Operating Curves: 3.4 to 3.8 GHz Tune



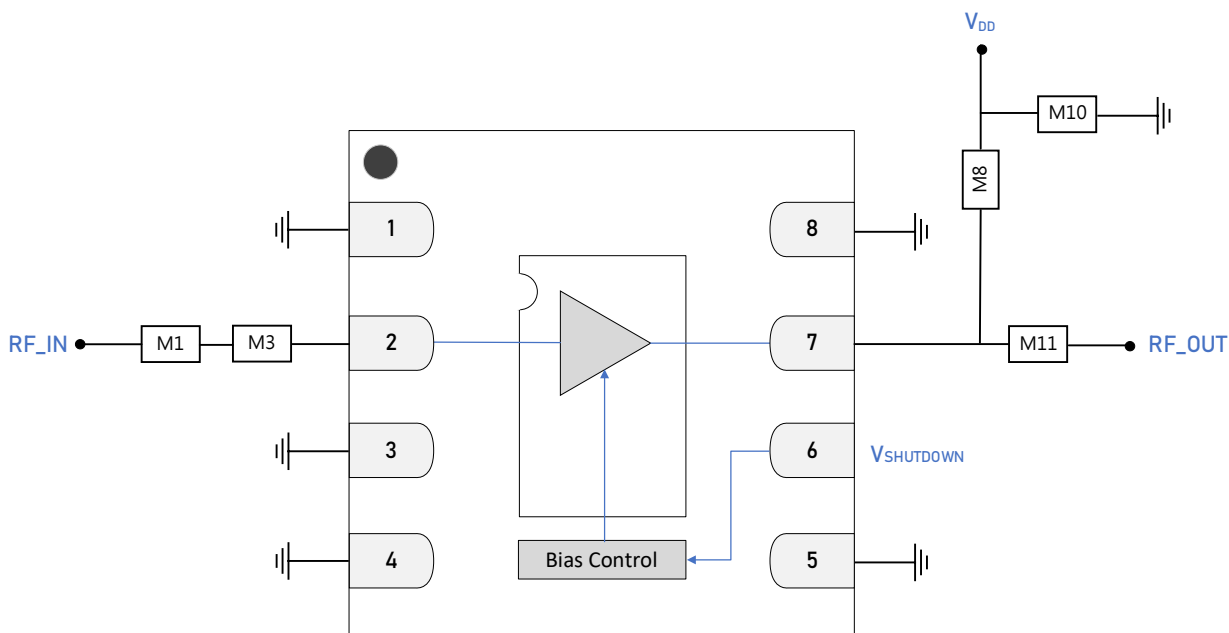
GRF2083 Typical Operating Curves: S-Parameters (3.4 to 3.8 GHz Tune)



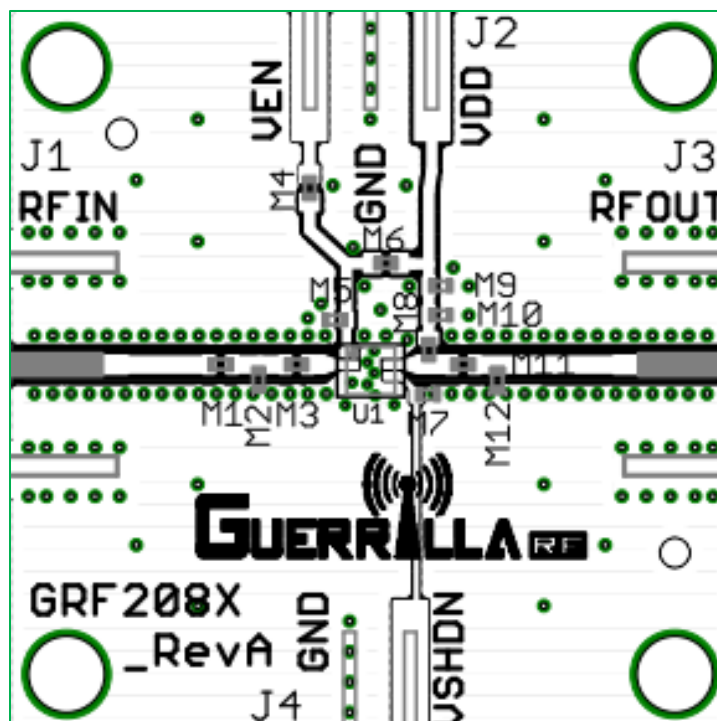
GRF2083 Typical Operating Curves: Stability Mu Factor (3.4 to 3.8 GHz Tune)



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



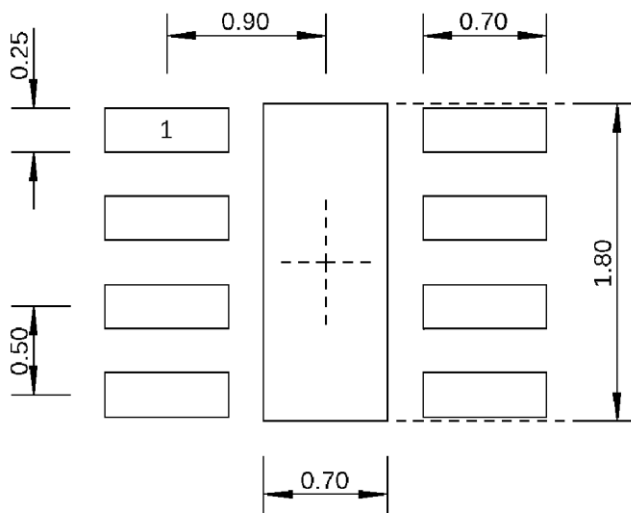
GRF2083 Standard Test Schematic



GRF2083 Evaluation Board Assembly Diagram

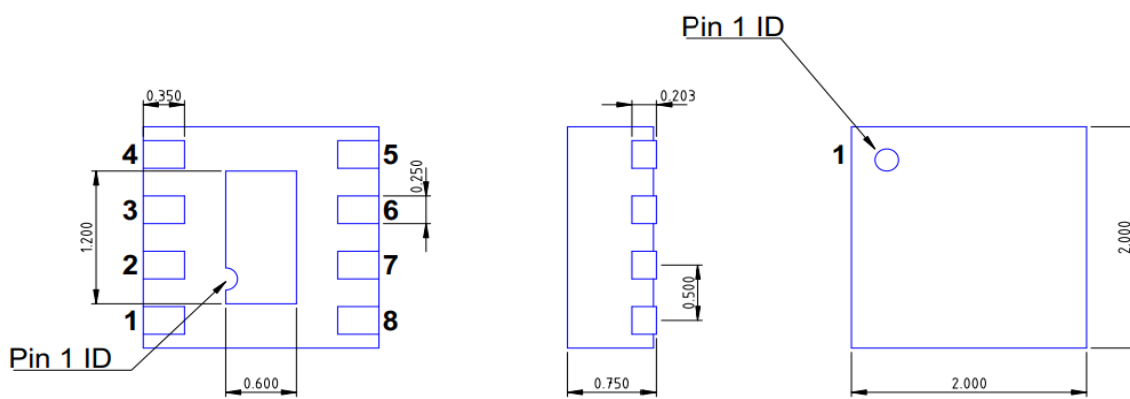
**GRF2083 Evaluation Board Assembly Diagram Reference: 3.4 to 3.8 GHz Tune**

Component	Type	Manufacturer	Family	Value	Package Size	Substitution
M1	Capacitor	Murata	GJM	1.2 pF	0402	ok
M3	Resistor (Jumper)	Various	5%	0 $\Omega$	0402	ok
M8	Inductor	Murata	LQG	1.8 nH	0402	ok
M10	Capacitor	Murata	GRM	0.1 $\mu$ F	0402	ok
M11	Capacitor	Murata	GJM	5.1 pF	0402	ok
Evaluation Board	GRF208X_RevA					



Dimensions in millimeters

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



Bottom View

Side View

Top View

**DFN8\_2X2MM**  
 Dimensions in millimeters  
 Dimensional Tolerance:  $\pm 0.05$

2.0 x 2.0 mm DFN-8 Package Dimensions

## Package Marking Diagram



Line 1: "Y" = YEAR (single digit). "WW" = WORK WEEK the device was assembled.

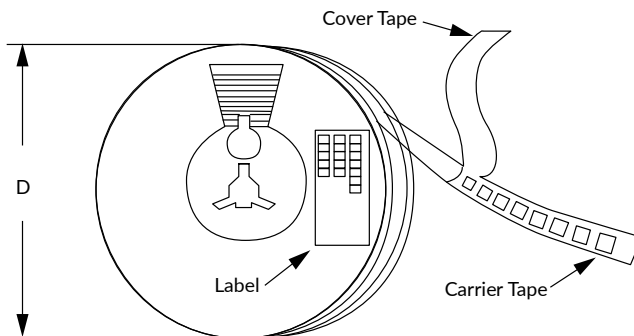
Line 2: "XXXX" = Device PART NUMBER.

## Tape and Reel Information

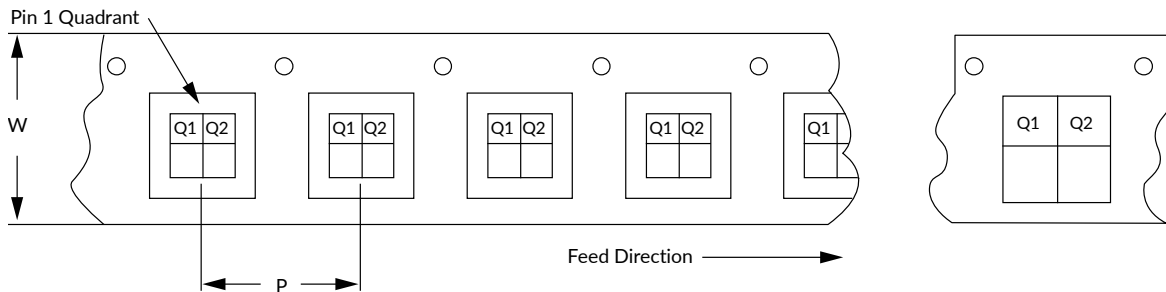
Guerrilla RF's tape and reel specification complies with Electronics Industries Association (EIA) standards for "Embossed Carrier Tape of Surface Mount Components for Automatic Handling" (reference EIA-481). See the following page for the Tape and Reel Specification and Device Package Information table, which includes units per reel.

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

For the Tape and Reel Reference Table, please refer to: [Package Manufacturing Information | Guerrilla RF \(guerrilla-rf.com\)](https://www.guerrilla-rf.com)



Tape and Reel Packaging with Reel Diameter Noted (D)



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



## Revision History

Revision Date	Description of Change
May 2, 2023	Upgraded to new format.





### Data Sheet Classifications

Data Sheet 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 limited evaluation board measurements taken within the Guerrilla RF Applications Lab. All parametric values are subject to change pending the collection of additional data.
Release Ø	All data based on measurements taken with <i>production-released</i> material. TYP values are based on a combination of ATE and bench-level measurements, with MIN/MAX limits defined using <i>modelled estimates</i> that account for part-to-part variations and expected process spreads. Although unlikely, future refinements to the TYP/MIN/MAX values may be in order as multiple lots are processed through the factory.
Release A-Z	All data based on measurements taken with production-released material <i>derived from multiple lots which have been fabricated over an extended period of time</i> . MIN/MAX limits may be refined over previous releases as more statistically significant data is collected to account for process spreads.

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