

GRF2110 LNA / Linear Driver 5 to 8 GHz

FEATURES

- Flexible Bias Voltage and Current
- Process: GaAs pHEMT
- Compact 1.5 x 1.5 mm DFN-6 Package

Reference: 5 V / 7 GHz / 70 mA

- Gain: 17 dB
- OIP3: 38 dBm
- OP1dB: 22 dBm
- Evaluation Board Noise Figure: 1.1 dB

APPLICATIONS

- WiFi 6/6E LNA
- Linear Driver Amplifier
- Small Cells and Cellular Repeaters
- Wireless Backhaul
- C-Band Amplifier
- UWB Amplifier

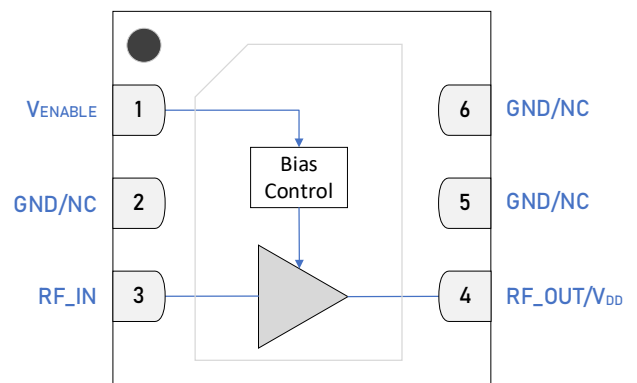
DESCRIPTION

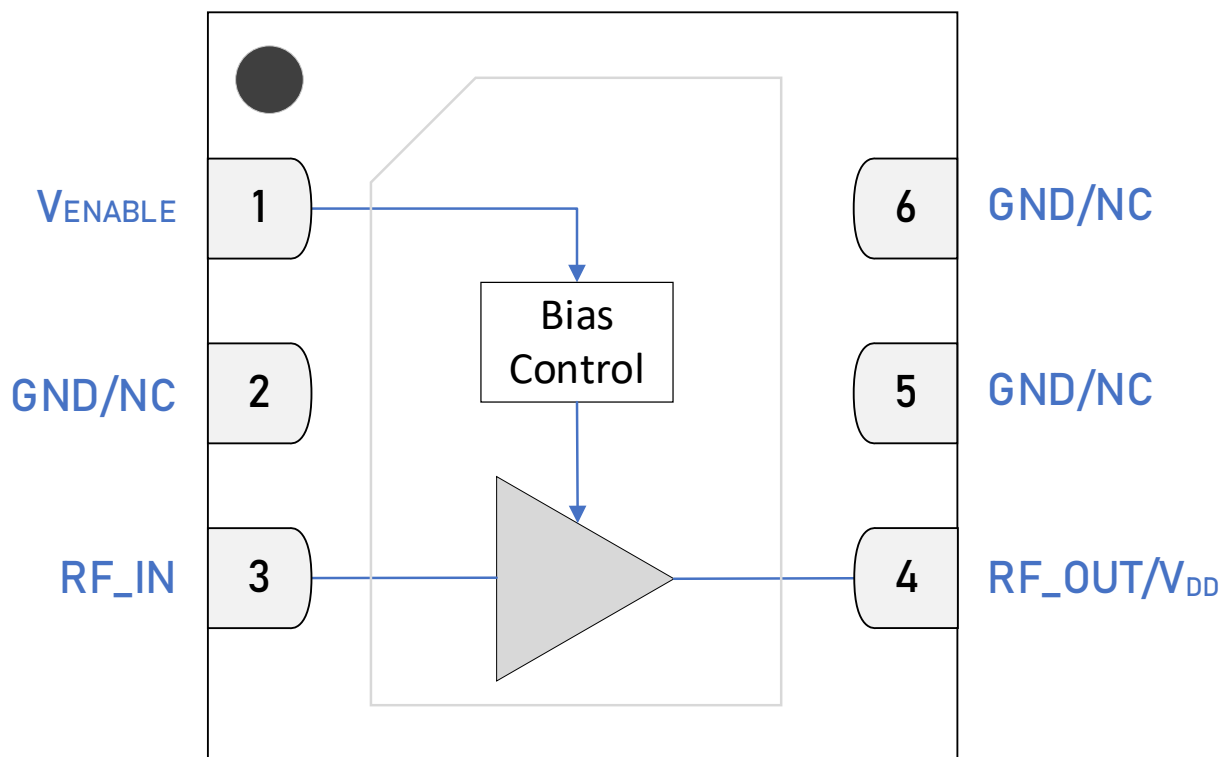
The GRF2110 is a broadband, ultra-low noise linear amplifier designed for WiFi 6/6E, small cell, wireless infrastructure, and other high performance RF applications up to 8 GHz. The standard tune exhibits outstanding NF, linearity, return loss and gain flatness from 5 to 8 GHz.

The device can be operated from a supply voltage (V_{DD}) of 2.7 to 5 V with a typical bias condition of 5 volts and 70 mA for optimal efficiency and linearity.

Consult with the GRF applications engineering team for custom tuning/evaluation board data.

BLOCK DIAGRAM





1.5 x 1.5 mm DFN-6 Pin Out (Top View)

Pin Assignments

Pin	Name	Description	Note
1	V _{ENABLE}	Enable Voltage Input	V _{ENABLE} and series resistor set I _{DDQ} . V _{ENABLE} ≤ 0.2 volts disables device. On-die pull-down resistor will turn the device off if this node is allowed to float.
2, 5, 6	GND/NC	Ground or No Connect	No internal connection to die.
3	RF_IN	LNA RF Input	Some external matching required. An external DC blocking capacitor must be used.
4	RF_OUT/V _{DD}	LNA RF Output	Some external matching required. V _{DD} must be applied through a choke to this pin.
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.

Absolute Ratings

Parameter	Symbol	Min.	Max.	Unit
Supply Voltage	V_{DD}		6	V
RF Input Power (Load VSWR < 2:1, $V_{DD} = 5$ V)	$P_{IN\ MAX}$		20	dBm
Operating Temperature (Package Heat Sink)	$T_{PKG\ HEAT\ SINK}$	-40	105	°C
Maximum Channel Temperature (MTTF > 10 ⁶ Hours)	T_{MAX}		170	°C
Maximum Dissipated Power	$P_{DISS\ MAX}$		0.6	W

Electrostatic Discharge

Human Body Model	HBM	500		V
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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 *Package Manufacturing Information* | *Guerrilla RF* (guerrilla-rf.com)



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_{DD}	2.7	5	6	V	
Operating Temperature (Package Heat Sink)	$T_{PKG\ HEAT\ SINK}$	-40		105	°C	
RF Frequency Range	F_{RF}	5		8	GHz	Typical Application Schematic with external matching components (note 1 & 2).
RF_IN Port Impedance	Z_{RFIN}		50		Ω	Single Ended.
RF_OUT Port Impedance	Z_{RFOUT}		50		Ω	Single Ended.

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 5 to 8 GHz tuning set. $M6 = 3.32 \text{ k}\Omega$, $V_{DD} = 5 \text{ V}$, $V_{ENABLE} = 5 \text{ V}$, $I_{DD} = 70 \text{ mA}$. $F_{TEST} = 7 \text{ GHz}$. $T_{PKG \text{ HEAT SINK}} = 25 \text{ }^\circ\text{C}$. Evaluation board losses are included within the specifications.

Parameter	Symbol	Specification			Unit	Condition
		Min.	Typ.	Max.		
Supply Current	I_{DD}		70		mA	$V_{DD} = V_{ENABLE} = 5 \text{ V}$
Enable Current	I_{ENABLE}		1.2		mA	$V_{DD} = V_{ENABLE} = 5 \text{ V}$
Switching Rise Time	T_{RISE}		100		ns	
Switching Fall Time	T_{FALL}		150		ns	

Disabled Mode

Leakage Current	$I_{LEAKAGE}$		250		μA	$V_{DD} = 5 \text{ V}$, $V_{ENABLE} = 0 \text{ V}$
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Thermal Data

Thermal Resistance: (Infrared Scan)	Θ_{JC}		TBD		$^\circ\text{C}/\text{W}$	On Standard Evaluation Board (note 3).
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Note 3: $\text{MTTF} > 10^6$ 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 5 to 8 GHz tuning set. $M6 = 3.32 \text{ k}\Omega$, $V_{DD} = 5 \text{ V}$, $V_{ENABLE} = 5 \text{ V}$, $I_{DD} = 70 \text{ mA}$. $F_{TEST} = 7 \text{ GHz}$. $T_{PKG \text{ HEAT SINK}} = 25 \text{ }^\circ\text{C}$. Evaluation board losses are included within the specifications.

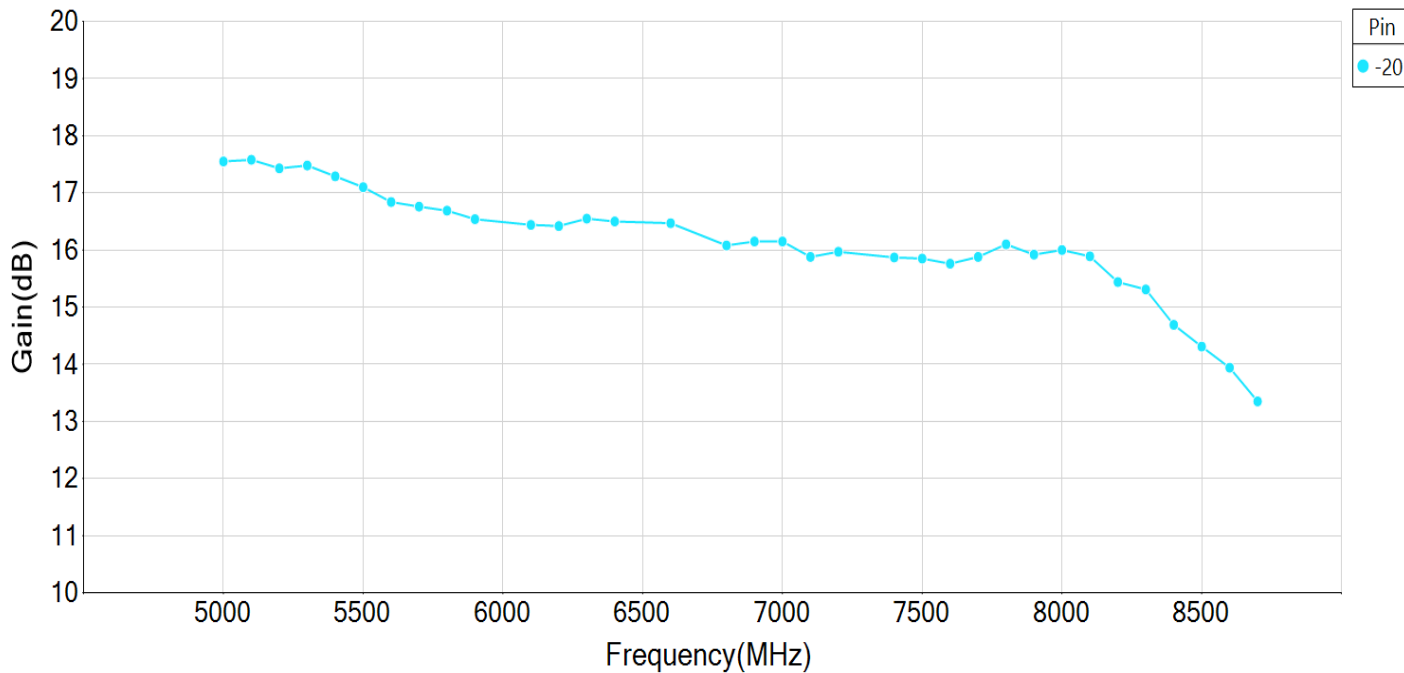
Parameter	Symbol	Specification			Unit	Condition
		Min.	Typ.	Max.		
Gain	S21		17		dB	
Evaluation Board Noise Figure	NF		1.1		dB	
Output 3 rd Order Intercept	OIP3		38		dBm	+2 dBm P_{OUT} per tone at 2 MHz spacing (6999 and 7001 MHz).
Output 1 dB Compression Power	OP1dB		22		dBm	

Typical Operating Curve Conditions

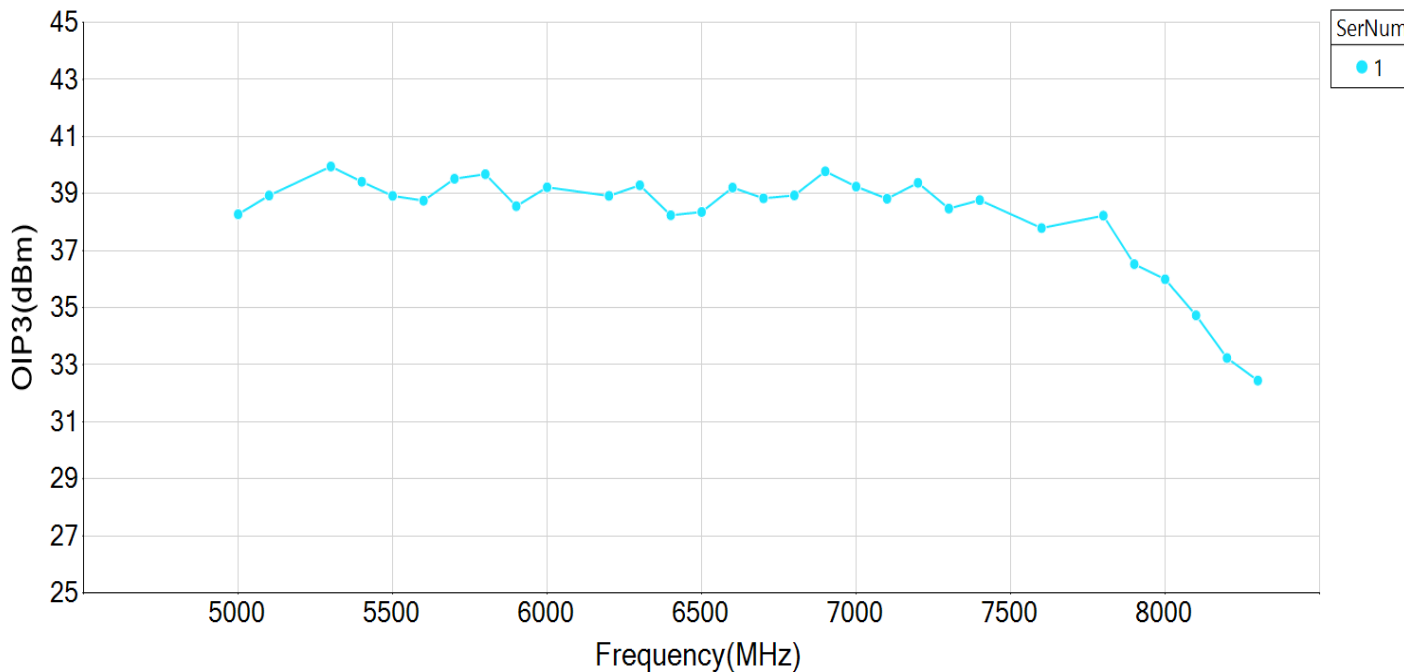
The following conditions apply unless noted otherwise: Typical Application Schematic using the 5 to 8 GHz tuning set. $M6 = 3.32 \text{ k}\Omega$, $V_{DD} = 5 \text{ V}$, $V_{ENABLE} = 5 \text{ V}$, $I_{DD} = 70 \text{ mA}$. $F_{TEST} = 7 \text{ GHz}$. $T_{PKG \text{ HEAT SINK}} = 25 \text{ }^\circ\text{C}$. Evaluation board losses are included within the plots.

GRF2110 Typical Operating Curves: 5 to 8.5 GHz Tune

GRF2110 Gain vs Frequency

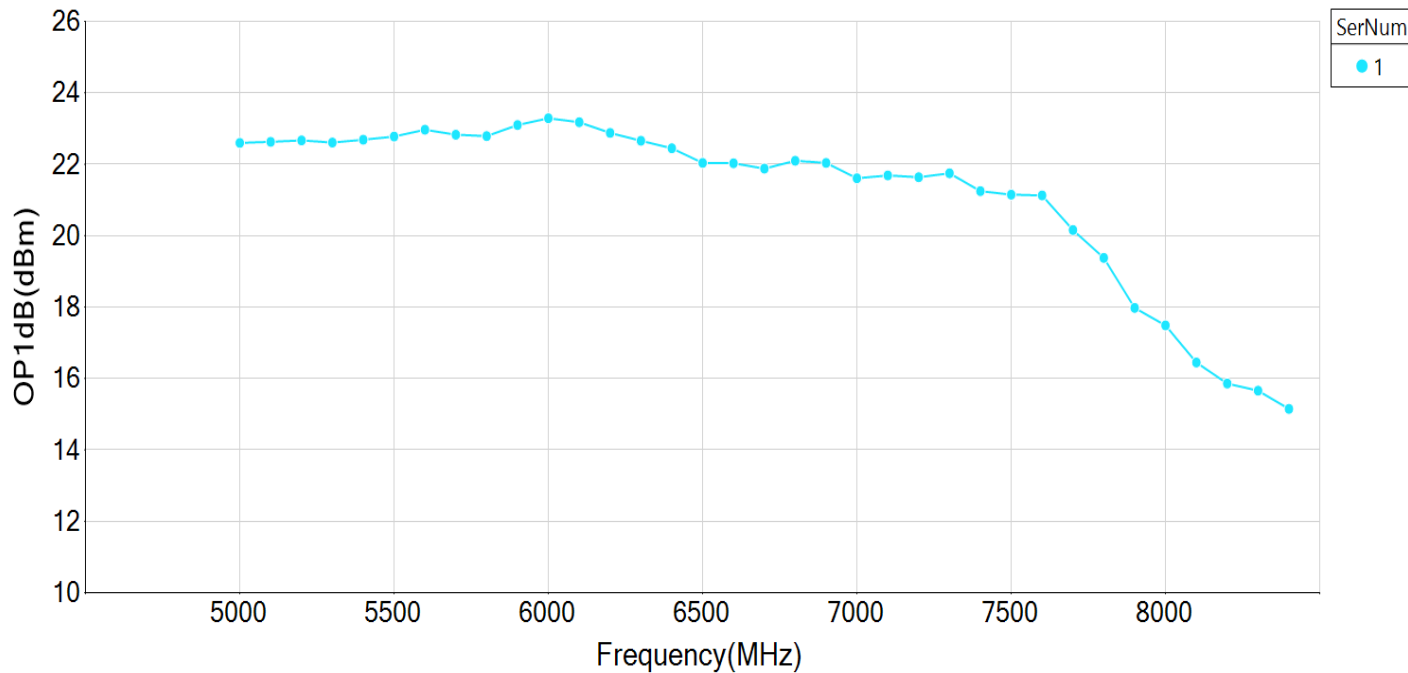


GRF2110 OIP3 vs Frequency

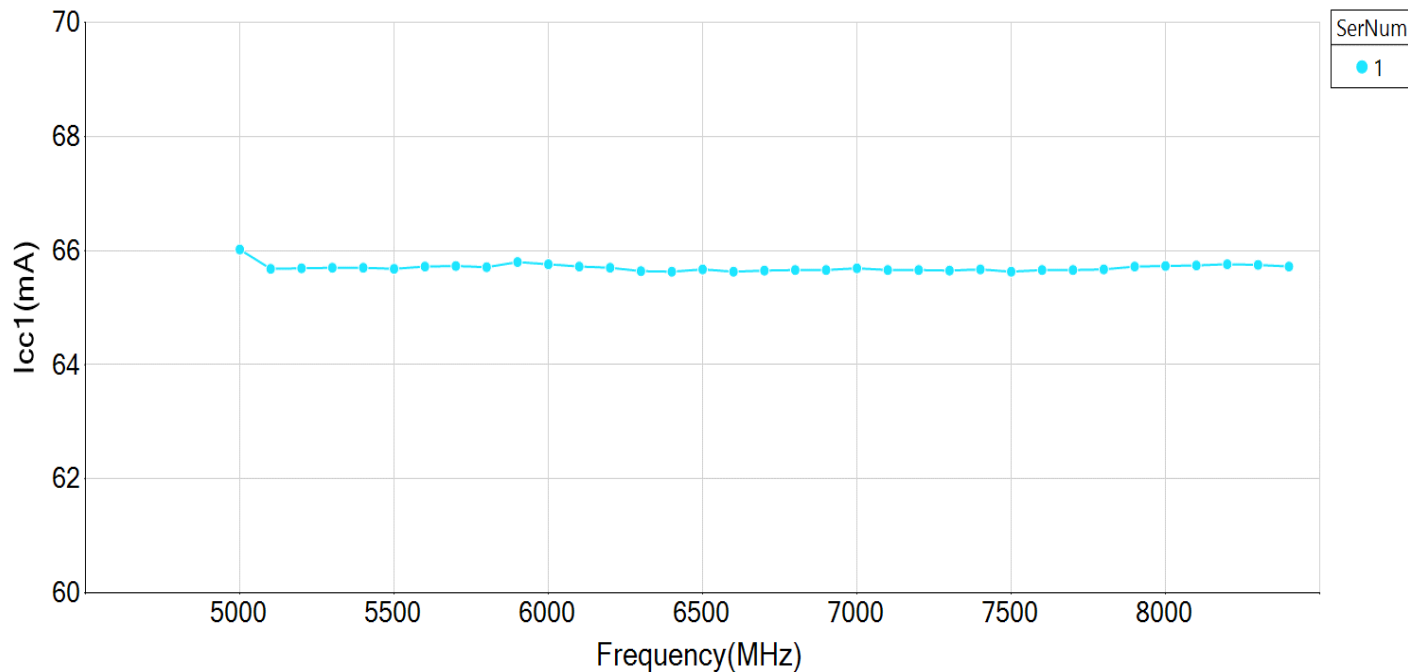


GRF2110 Typical Operating Curves: 5 to 8.5 GHz Tune

GRF2110 OP1dB vs Frequency

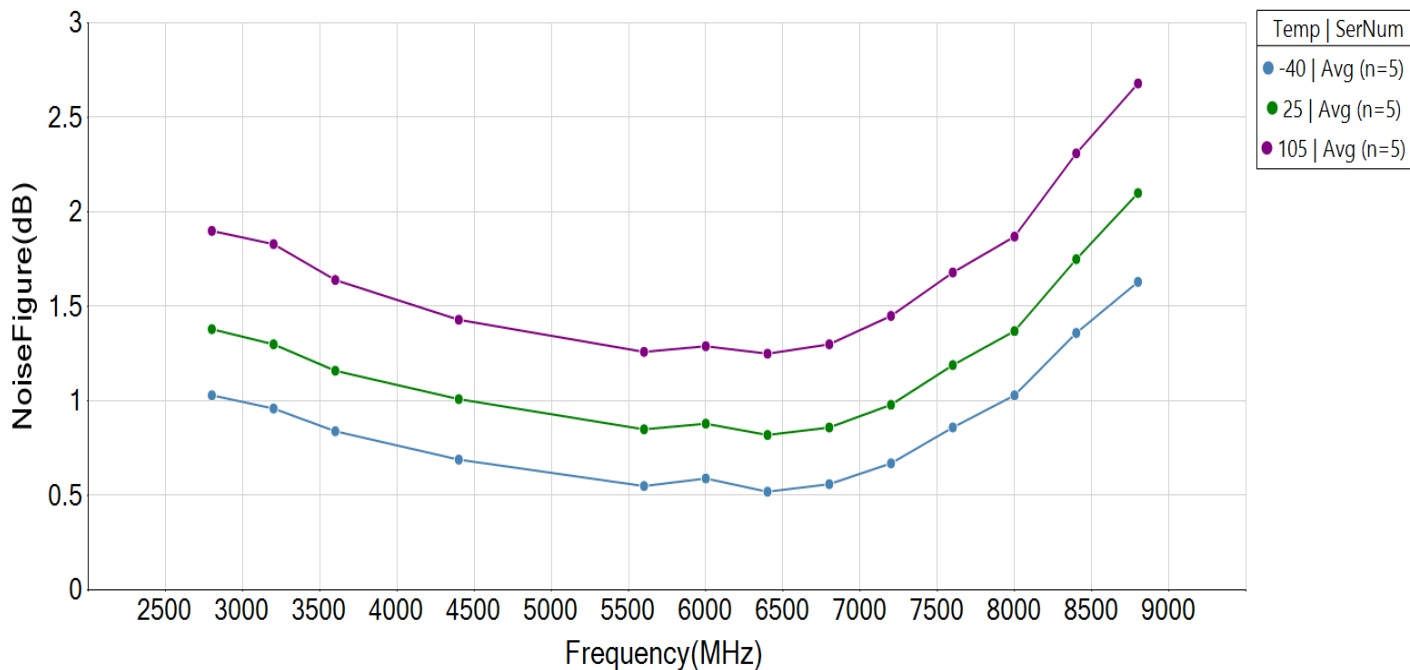


GRF2110 Icc1 vs Frequency

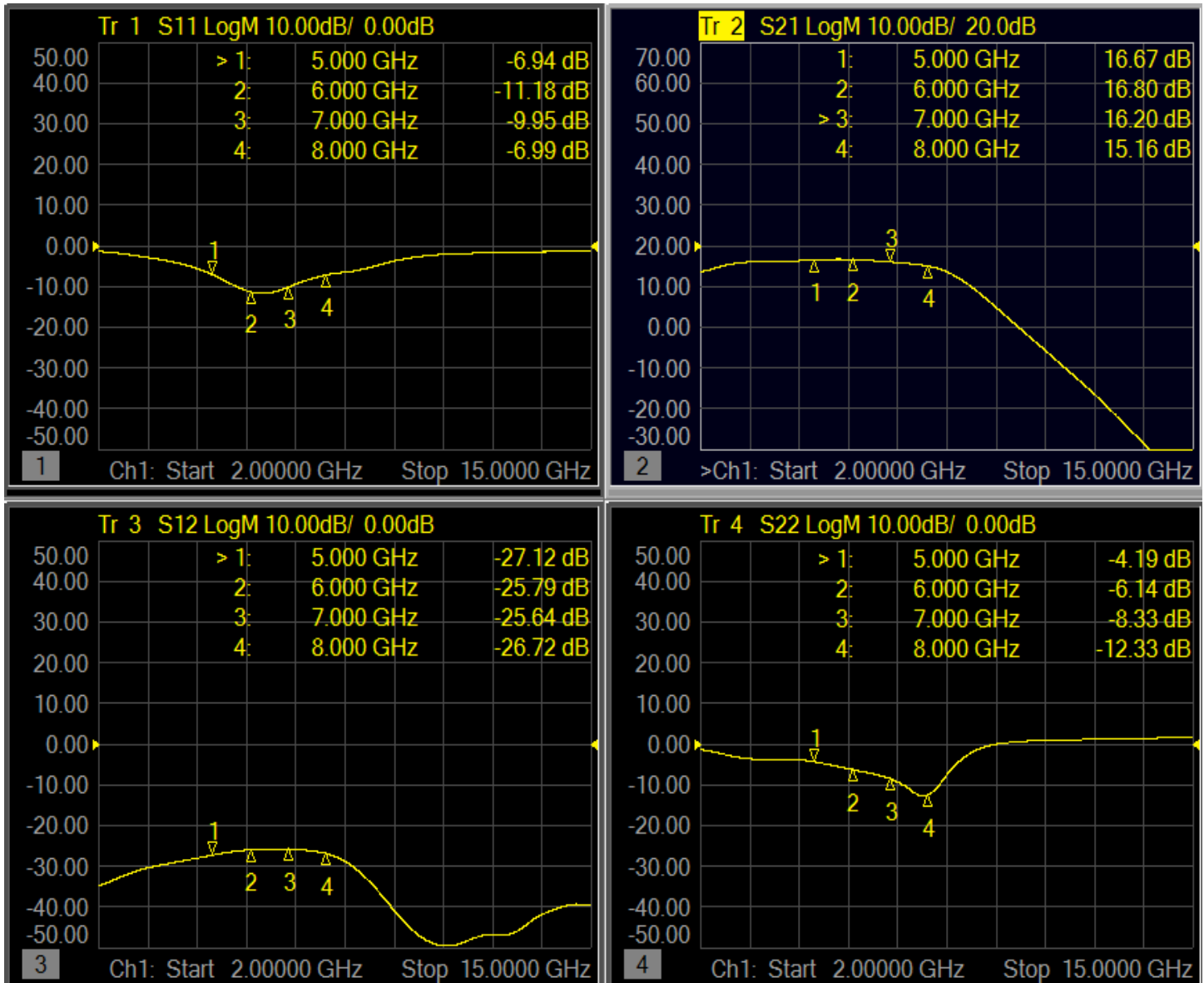


GRF2110 Typical Operating Curves: 5 to 8.5 GHz Tune

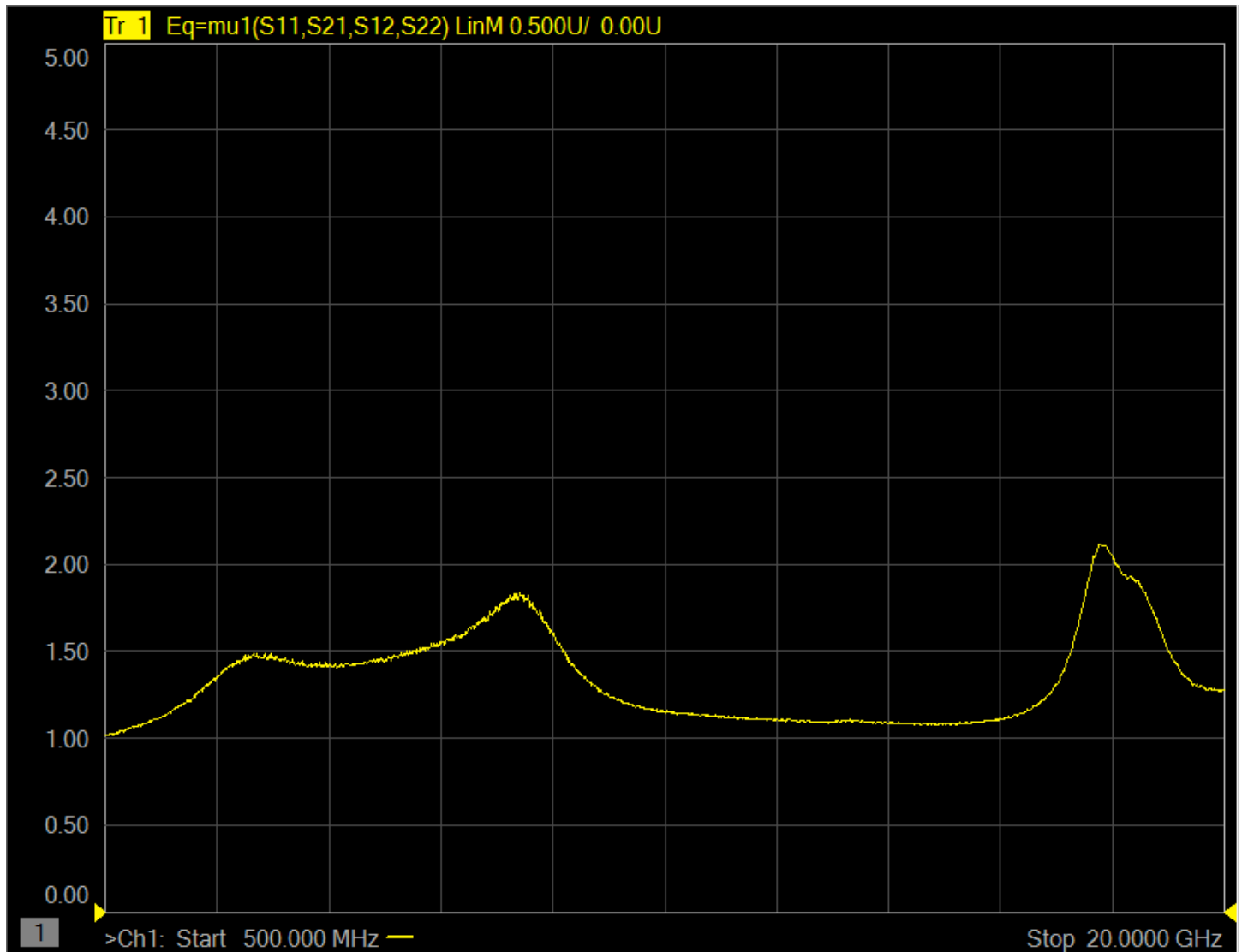
GRF2110 Noise Figure vs Frequency



GRF2110 Typical Operating Curves: S-Parameters (5 to 8 GHz)



GRF2110 Typical Operating Curves: S-Parameters (3.3 to 8.5 GHz)



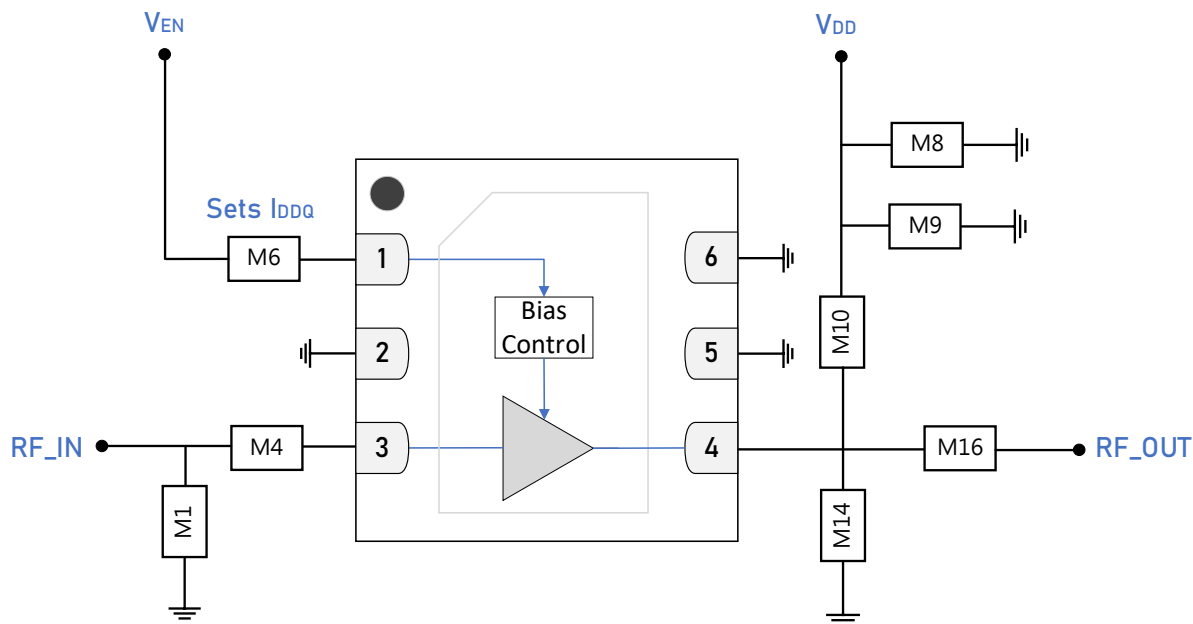
Note: Mu Factor ≥ 1.0 implies unconditional stability.



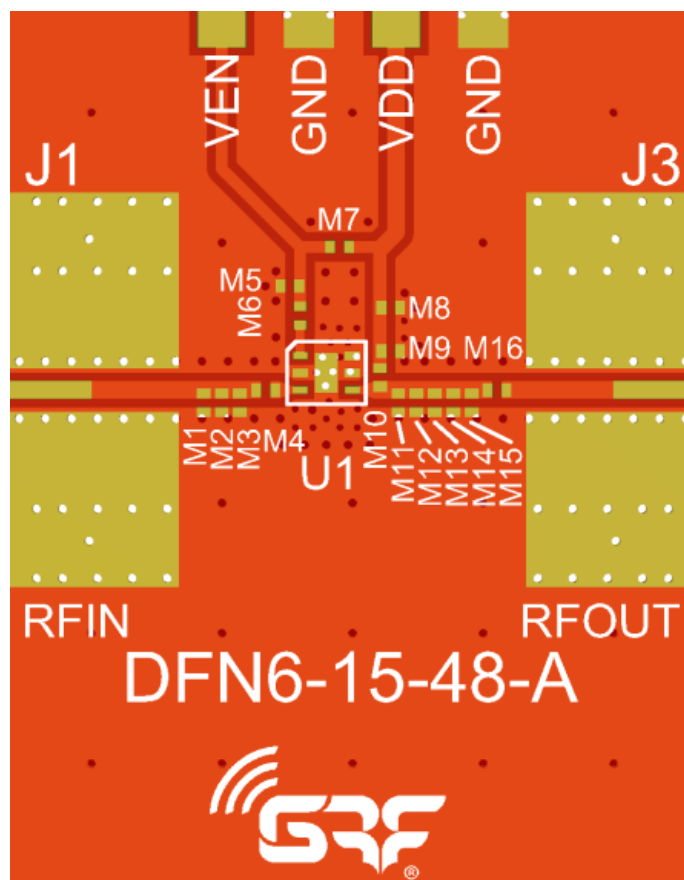
GRF2110 Measured Evaluation Board Data; Reference Bias: 5 V / 70 mA

Freq (MHz)	Gain (dB)	IP1dB (dBm)	OP1dB (dBm)	IIP3 (dBm)	OIP3 (dBm)	EVB NF (dB)*
5000	17.2	7.3	23.2	21.3	38.0	1.0
5500	17.4	6.7	23.1	20.5	38.2	0.75
6000	17.3	6.4	22.7	20.0	38.0	0.75
6500	17.2	5.9	19.2	19.2	38.0	0.85
7000	16.8	5.7	19.1	19.1	38.5	0.75
7500	16.5	4.4	19.1	19.1	37.0	0.95
8000	16.3	2.9	17.9	17.9	35.0	1.25

Note*: NF number includes input SMA/trace loss of roughly 0.15 over the band.



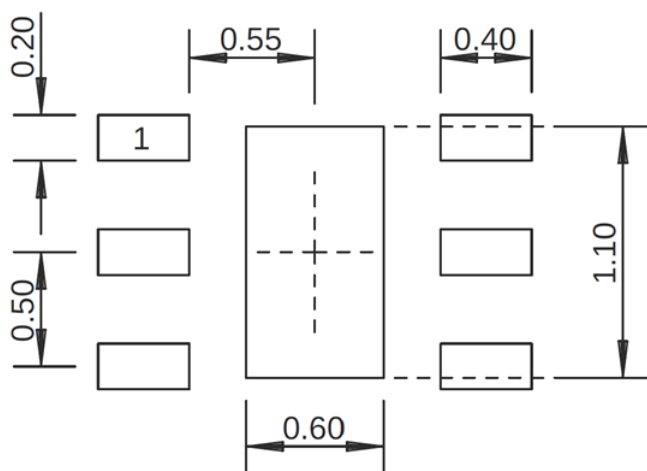
GRF2110 Standard Test Schematic



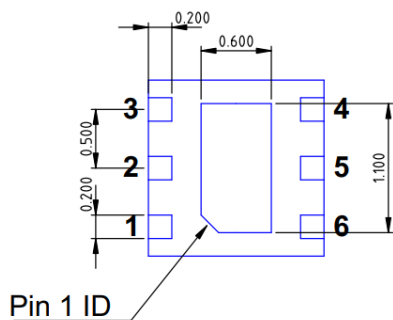
GRF2110 Evaluation Board Assembly Diagram

GRF2110 Evaluation Board Assembly Diagram Reference: 5 to 8.5 GHz Tune

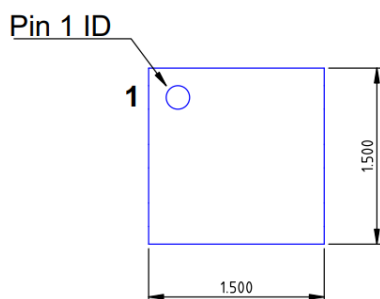
Component	Type	Manufacturer	Family	Value	Package Size	Substitution
M1	Capacitor	Murata	GJM	0.3 pF	0201	ok
M4	Capacitor	Murata	GJM	1.2 pF	0201	ok
M6 (sets I _{DDQ})	Resistor	Various	5%	3.32 kΩ	0201	ok
M8	Capacitor	Murata	GRM	4.7 μF	0201	ok
M9	Capacitor	Murata	GRM	1000 pF	0201	ok
M10	Inductor	Murata	LQP HQ	2 nH	0201	ok: HQ for best performance
M14	Capacitor	Murata	GJM	0.4 pF	0201	ok
M16	Capacitor	Murata	GJM	5.1 pF	0201	ok
M2, M3, M5, M7, M11, M12, M13, M15	DNP	--	--	--	--	--
Evaluation Board	DFN6-15-48_A					



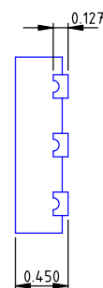
1.5 x 1.5 mm DFN-6 Suggested PCB Footprint (Top View)



Bottom View



Top View



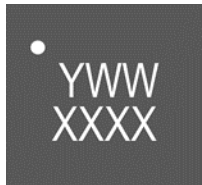
Side View

DFN6 1.5x1.5mm

Dimensions in millimeters
Dimensional Tolerance: ± 0.05

1.5 x 1.5 mm DFN-6 Package Dimensions

Package Marking Diagram



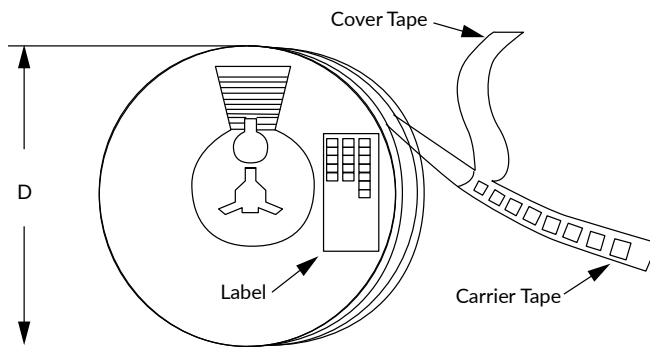
- Line 1: "Y" = YEAR (single digit). "WW" = WORK WEEK the Device was assembled.
- Line 2: "XXXX" = Device PART NUMBER.

Tape and Reel Information

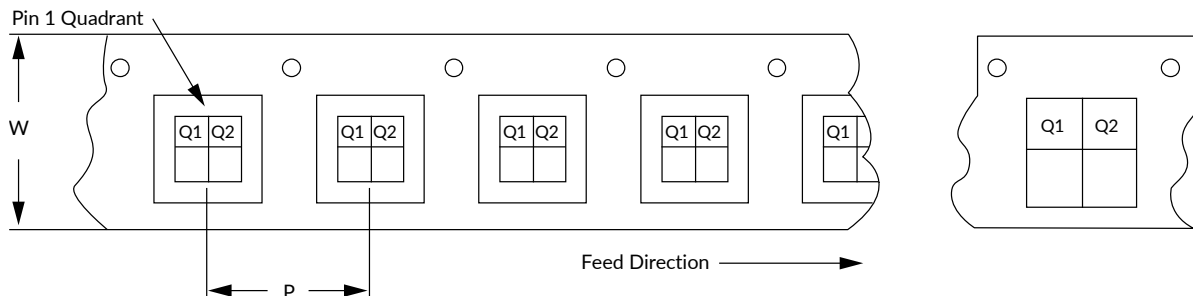
Guerrilla RF's tape and reel specification complies with Electronics Industries Association (EIA) standards for "Embossed Carrier Tape of Surface Mount Components for Automatic Handling" (reference EIA-481). See the following page for the Tape and Reel Specification and Device Package Information table,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



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
June 3, 2022	Advance Data Sheet Release.
January 25, 2023	Preliminary Data Sheet.