



GRF2108

Low-Current LNA

0.1 to 3.8 GHz

RELEASE Ø DATA SHEET

FEATURES

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

Reference: 3.3 V / 12 mA / 900 MHz

- Gain: 17 dB
- OP1dB: 17.5 dBm
- OIP3: 21 dBm
- Evaluation Board NF: 0.9 dB

APPLICATIONS

- ISM LNA
- Wireless Microphones
- Small Cell and Cellular Repeaters
- Distributed Antenna Systems



ORDERING INFORMATION

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DESCRIPTION

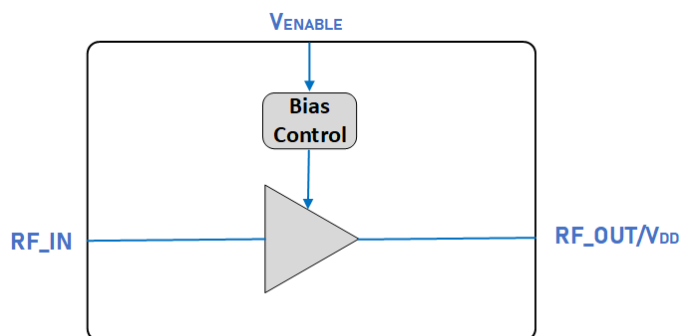
The GRF2108 is a high-gain, low-current LNA tunable over 100 to 3800 MHz. It exhibits outstanding gain and noise figure (NF) with I_{DDQ} levels as low as 4 mA.

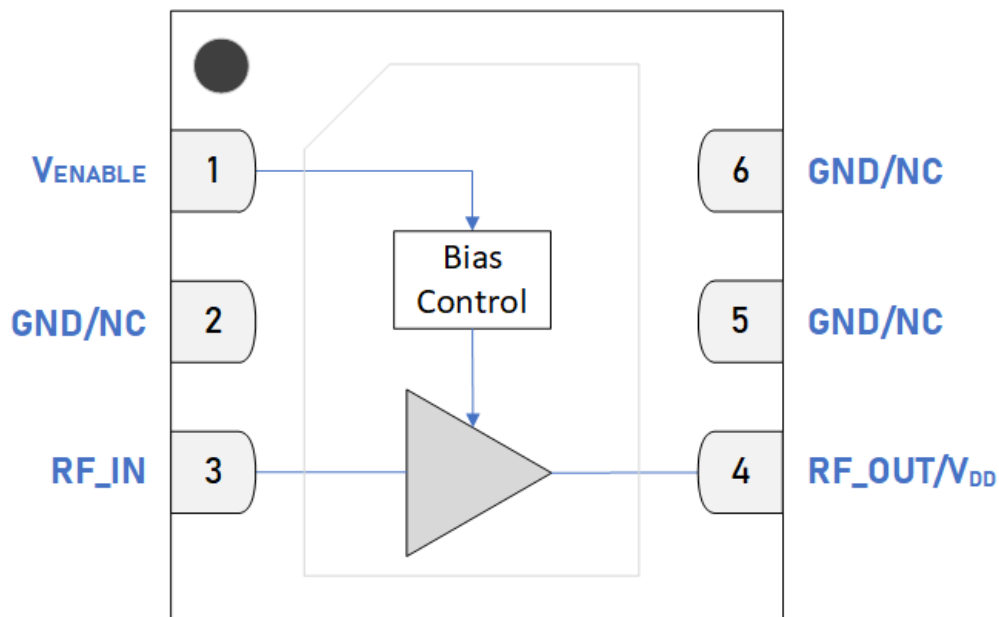
The device can be operated from a supply voltage (V_{DD}) of 1.8 to 5 volts with a selectable I_{DDQ} range of 4 to 20 mA for optimal efficiency and linearity.

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

Additional tunes can be found on the GRF2108 “Custom Tunes” product page: [GRF2108 Custom Tunes](#)

BLOCK DIAGRAM





Pin Out (Top View)

Pin Assignments

Pin	Name	Description	Note
1	V _{ENABLE}	Enable Input Voltage	V _{ENABLE} and series resistor sets 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	RF Input	An external DC blocking capacitor must be used.
4	RF_OUT/V _{DD}	RF Output	V _{DD} must be applied through a RF 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}	0	5.5	V
RF Input Power (Load VSWR < 2:1, V_{DD} = 5 V)	$P_{IN\ MAX}$		22	dBm
Operating Temperature (Package Base)	$T_{PKG\ BASE}$	-40	105	°C
Maximum Channel Temperature (MTTF > 10 ⁶ Hours)	T_{MAX}		170	°C
Maximum Dissipated Power	$P_{DISS\ MAX}$		TBD	W

Electrostatic Discharge

Human Body Model	HBM	250		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 [Manufacturing Note MN-001 - Packaging and Manufacturing Information](#).



All Guerrilla RF products are provided in RoHS compliant lead (Pb)-free packaging. For additional information, please refer to the [Certificate of RoHS Compliance](#).

Recommended Operating Conditions

Parameter	Symbol	Specification			Unit	Condition
		Min.	Typ.	Max.		
Supply Voltage	V_{DD}	1.8	3.3	5.5	V	
Operating Temperature Range	$T_{PKG\ BASE}$	-40		105	°C	
RF Frequency Range	FRF	0.1	0.9	3.8	GHz	Typical Application Schematic with external matching components (notes 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 of this range is supported by using different custom tunes. Examples of other optimized tunes can be found here: [GRF2108 Custom Tunes](#)

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

Nominal Operating Parameters - General

Parameter	Symbol	Specification			Unit	Condition
		Min.	Typ.	Max.		
Supply Current	I_{DDQ}		12		mA	$V_{DD} = 3.3 \text{ V}$, $V_{ENABLE} = 3.3 \text{ V}$.
Enable Current	I_{ENABLE}		0.5		mA	$V_{DD} = 3.3 \text{ V}$, $V_{ENABLE} = 3.3 \text{ V}$.
Switching Rise Time	T_{RISE}		TBD		ns	Disabled Mode to Gain Mode (note 3) .
Switching Fall Time	T_{FALL}		TBD		ns	Gain Mode to Disabled Mode (note 4) .

Disabled Mode

Leakage Current	$I_{LEAKAGE}$		TBD		μA	$V_{DD} = 3.3 \text{ V}$, $V_{ENABLE} = 0 \text{ V}$.
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Thermal Data

Thermal Resistance (Infrared Scan)	Θ_{JC}				$^{\circ}\text{C}/\text{W}$	On standard evaluation board (note 5) .
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Note 3: Switching Time: 50% of V_{ENABLE} to 90% of P_{OUT} .

Note 4: Switching Time: 50% of V_{ENABLE} to 10% of P_{OUT} .

Note 5: MTTF > 10^6 hours for $T_j \leq 170^{\circ}\text{C}$

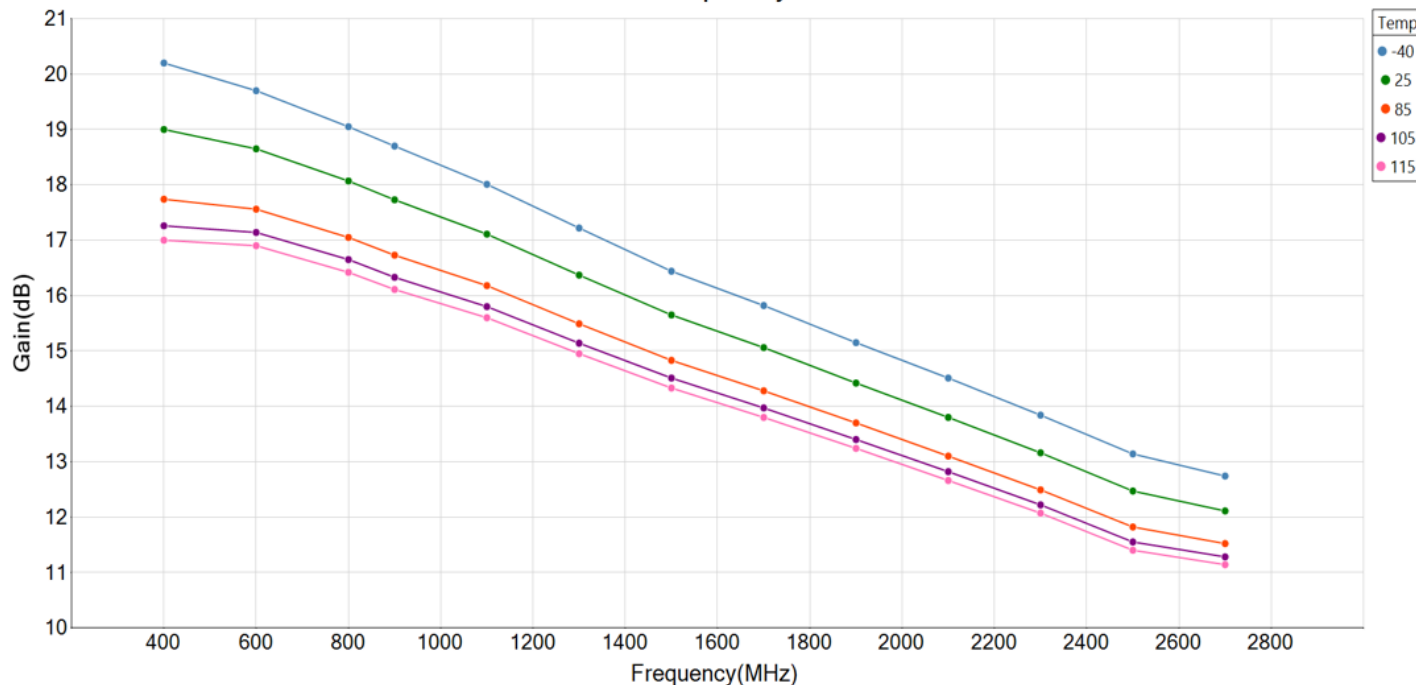
Nominal Operating Parameters - RF

The following conditions apply unless noted otherwise; Typical Application Schematic, $V_{DD} = 3.3\text{ V}$, $V_{ENABLE} = 3.3\text{ V}$, $50\ \Omega$ system impedance, $F_{TEST} = 0.9\text{ GHz}$, $T_{PKG\ BASE} = 25\text{ }^{\circ}\text{C}$. Evaluation board losses are included within the specifications.

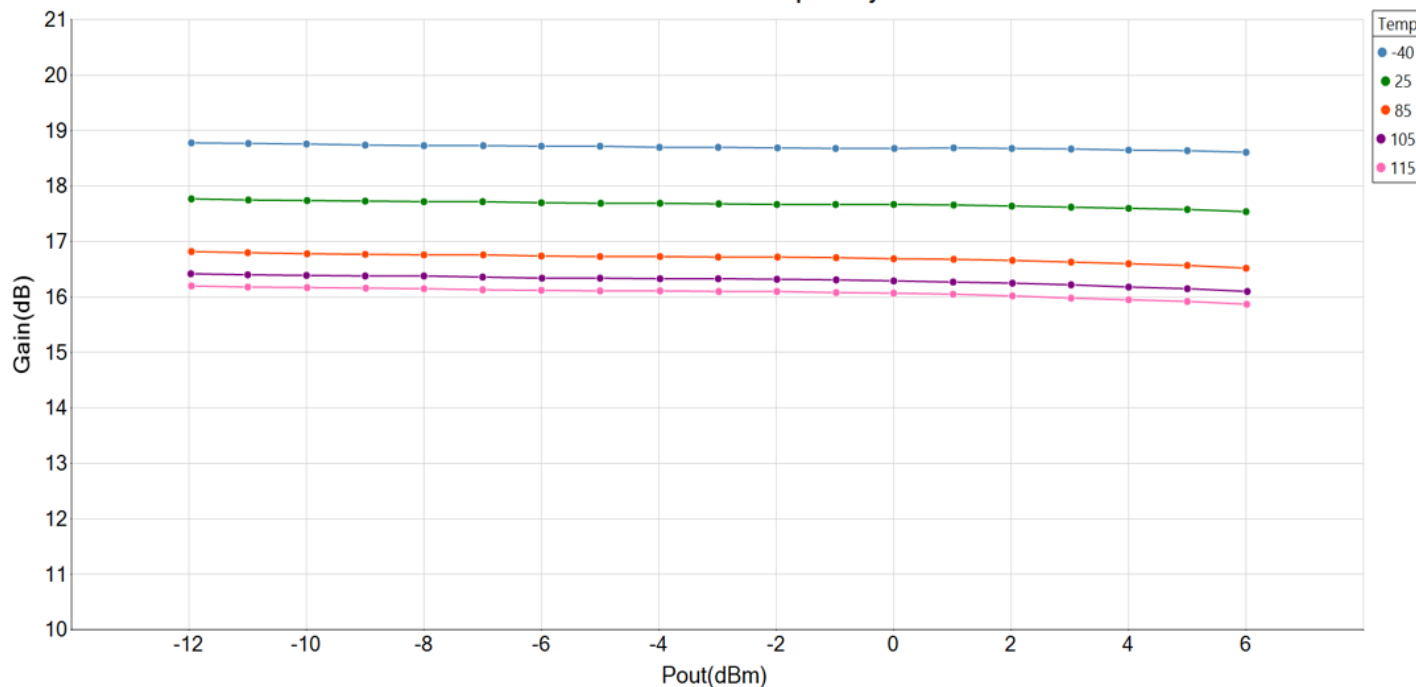
Parameter	Symbol	Specification			Unit	Condition
		Min.	Typ.	Max.		
Gain	S21		17		dB	$V_{DD} = 3.3\text{ V}$, $V_{ENABLE} = 3.3\text{ V}$.
Evaluation Board Noise Figure	NF		0.9		dB	
Output 3rd Order Intercept Point	OIP3		21		dBm	2 MHz spacing (899 and 901 MHz).
Output 1 dB Compression Power	OP1dB		17.5		dBm	

GRF2108 Typical Operating Curves: 3.3 V, 12 mA (0.4 to 2.7 GHz Tune)

GRF2108 Gain vs Frequency at Pin = -20 dBm

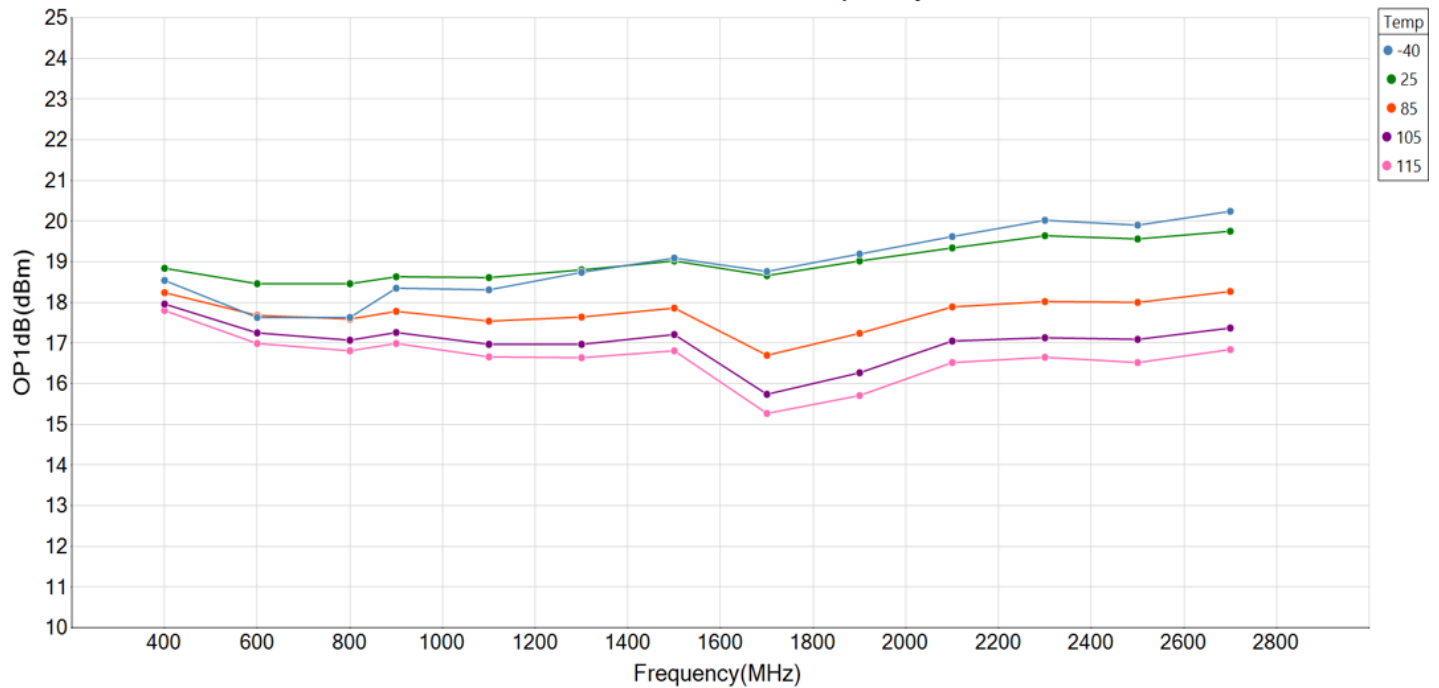


GRF2108 Gain vs Pout at Frequency = 900 MHz

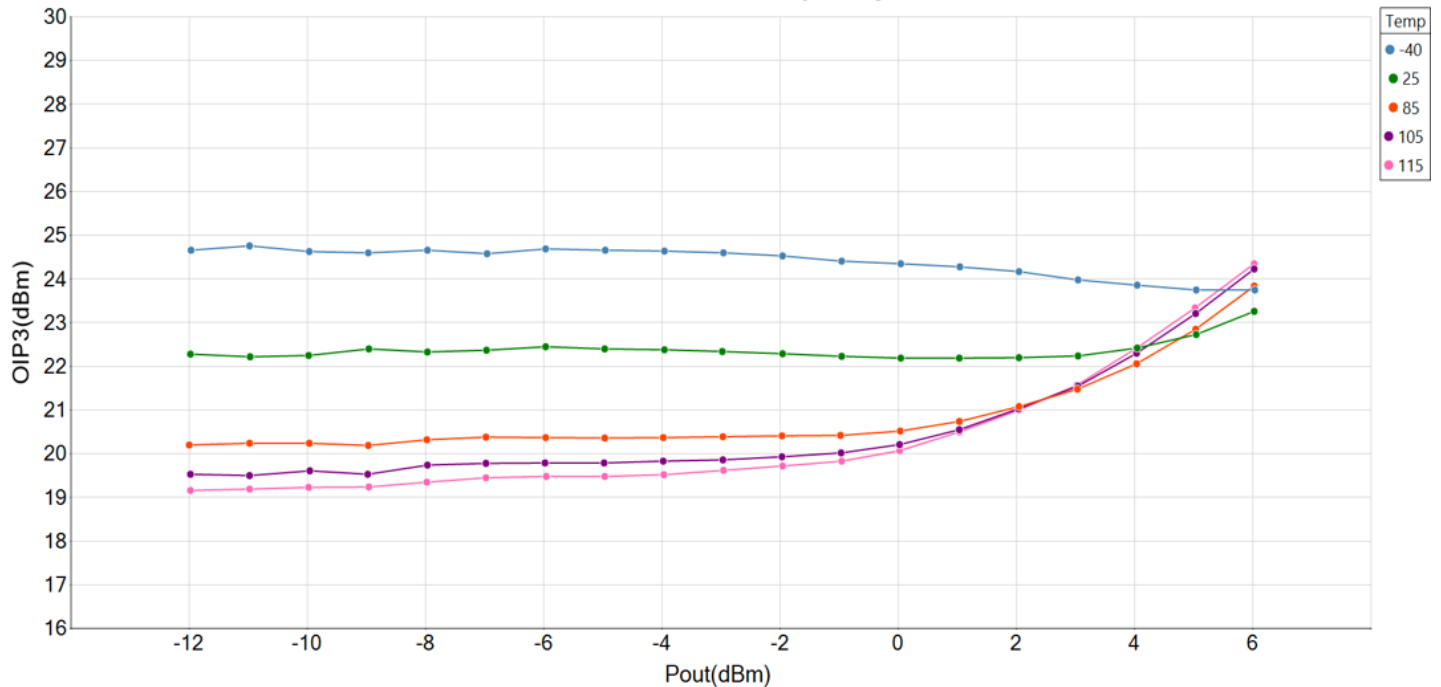


GRF2108 Typical Operating Curves: 3.3 V, 12 mA (0.4 to 2.7 GHz Tune)

GRF2108 OP1dB vs Frequency

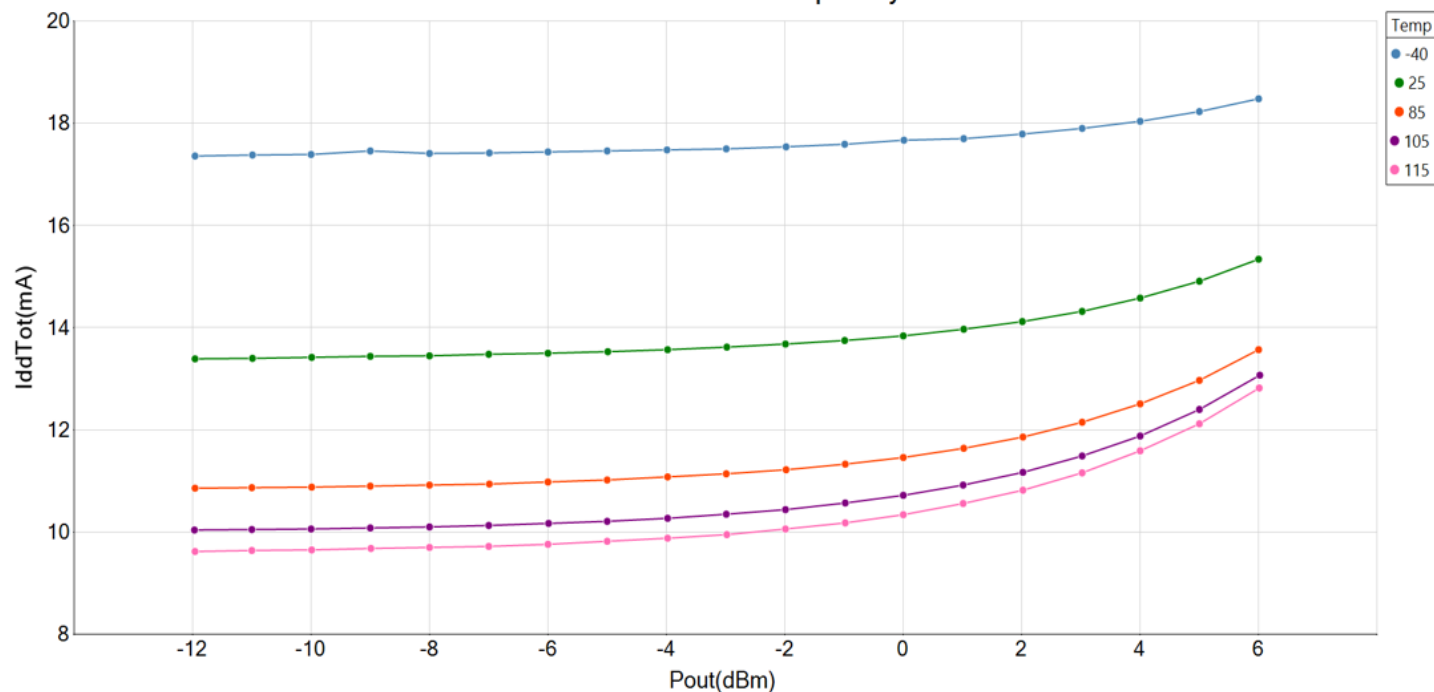


GRF2108 OIP3 vs Pout at Frequency = 900 MHz

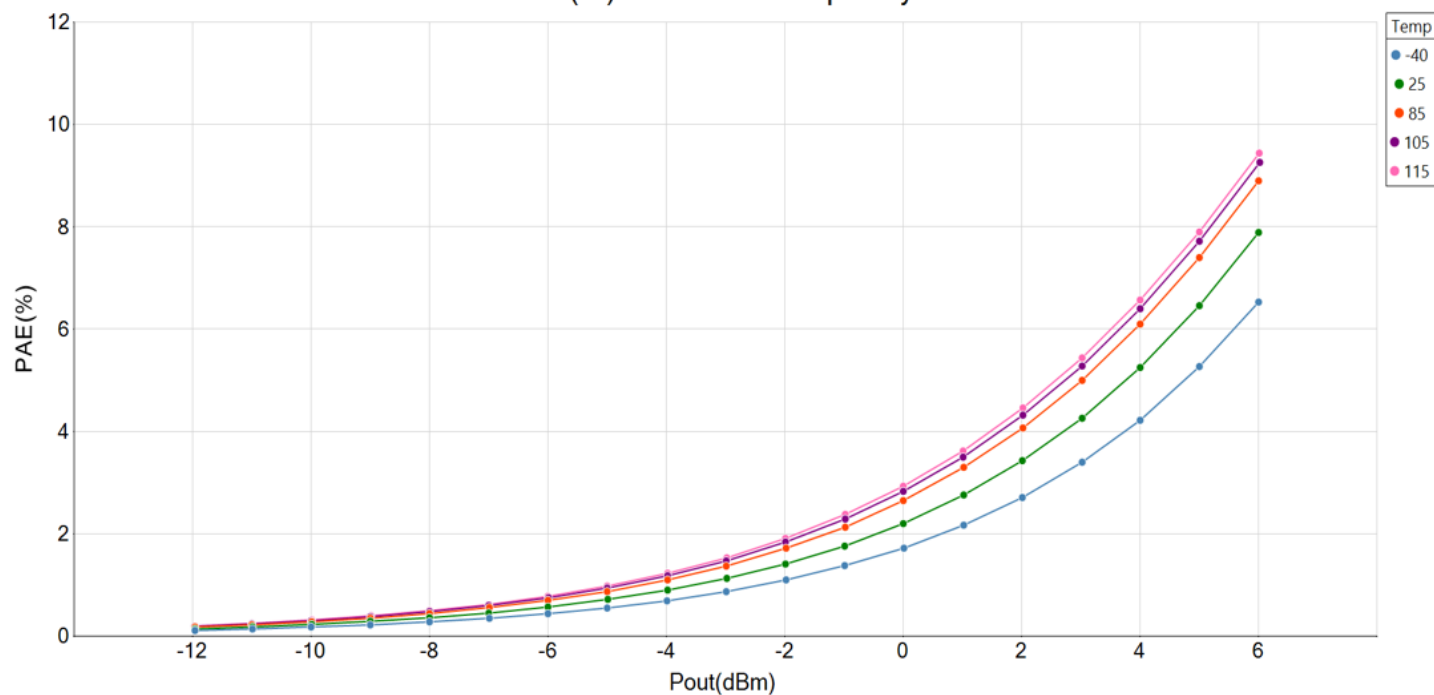


GRF2108 Typical Operating Curves: 3.3 V, 12 mA (0.4 to 2.7 GHz Tune)

GRF2108 IddTot vs Pout at Frequency = 900 MHz

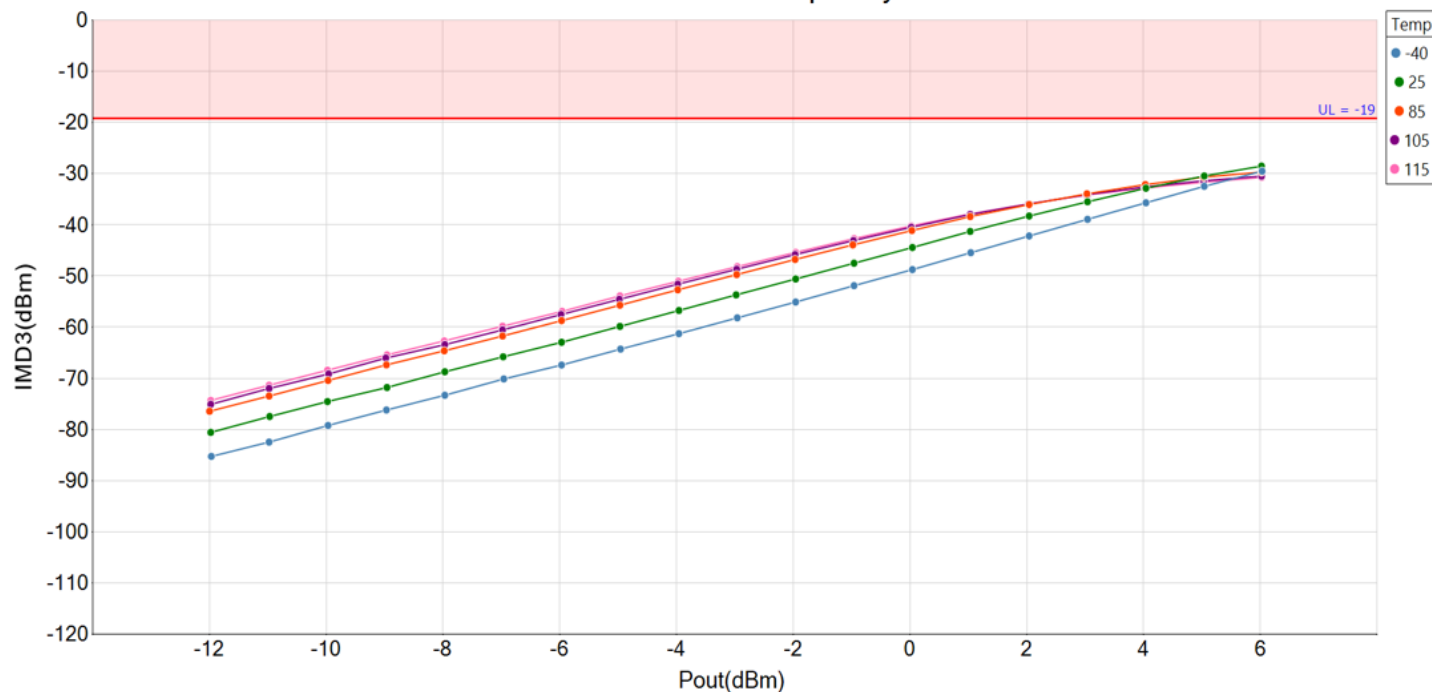


GRF2108 PAE(%) vs Pout at Frequency = 900 MHz

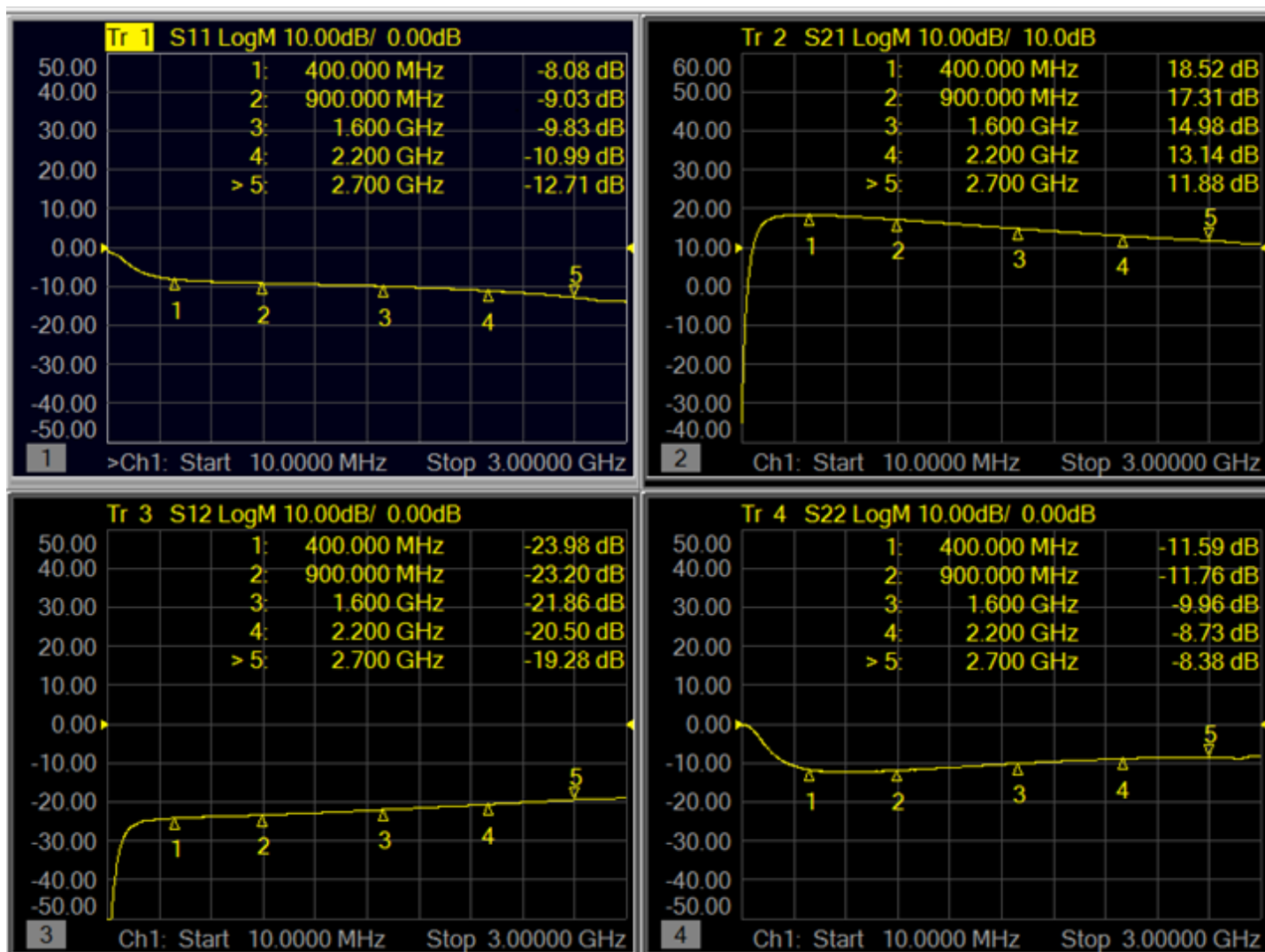


GRF2108 Typical Operating Curves: 3.3 V, 12 mA (0.4 to 2.7 GHz Tune)

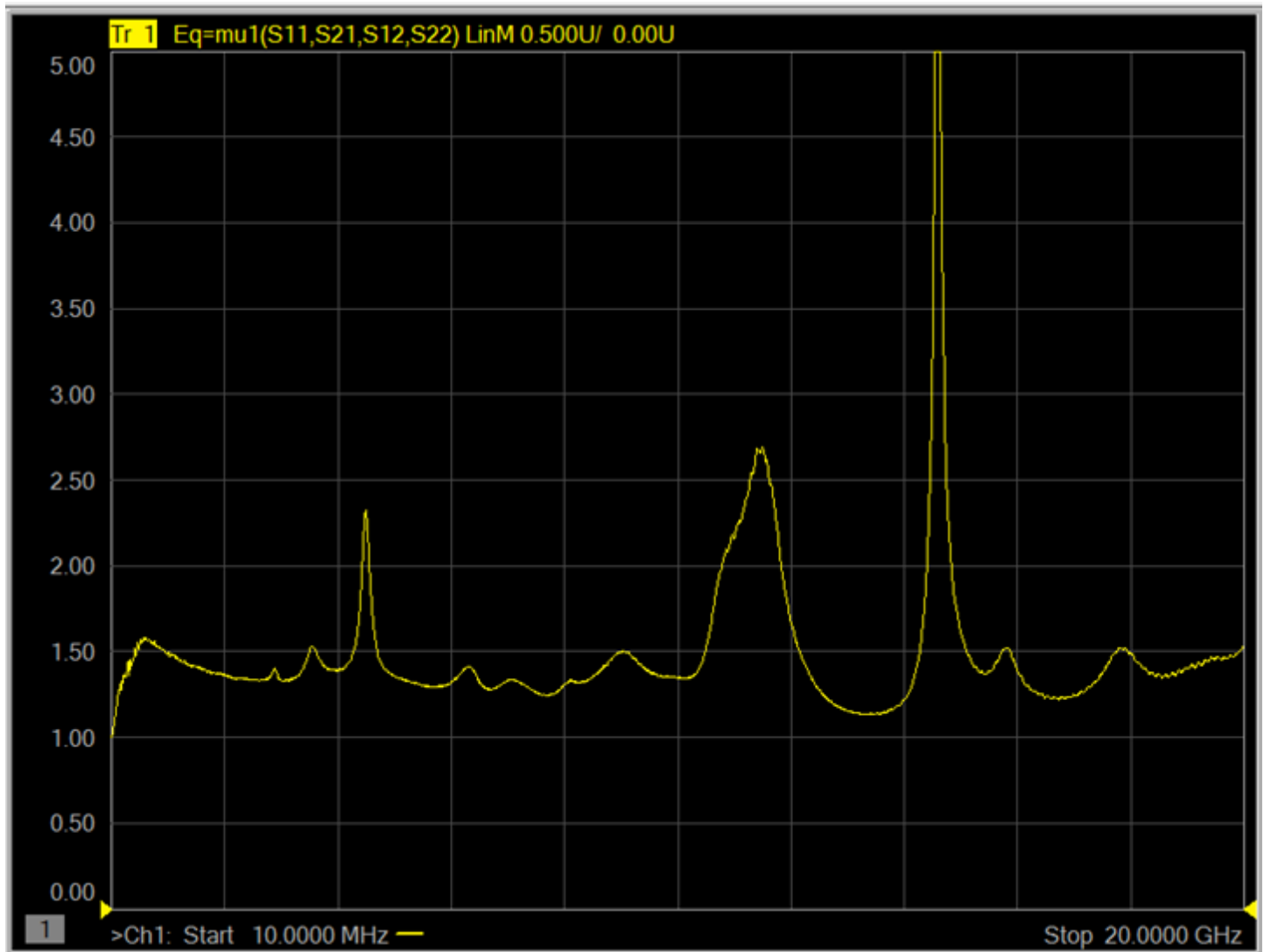
GRF2108 IMD3 vs Pout at Frequency = 900 MHz



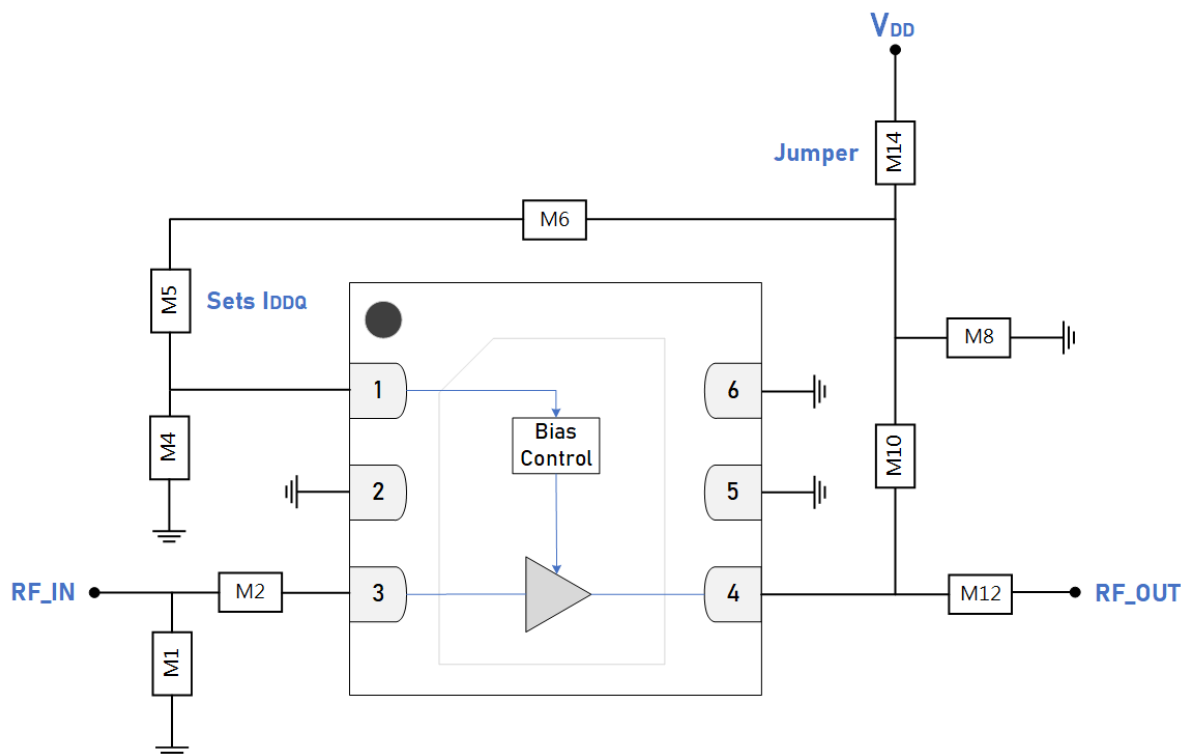
GRF2108 Typical Operating Curves: S-Parameters (0.4 to 2.7 GHz Tune)



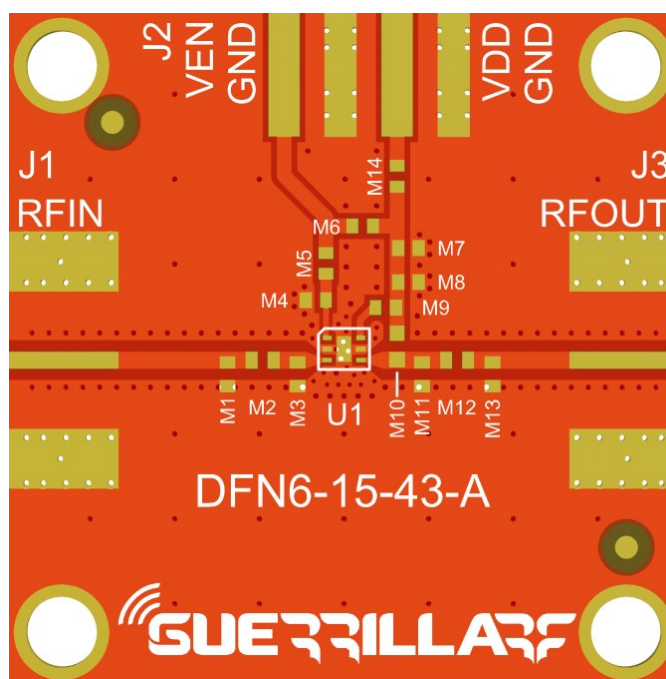
GRF2108 Typical Operating Curves: Stability Mu Factor (10 MHz to 20 GHz Tune)



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



GRF2108 Standard Evaluation Board Schematic

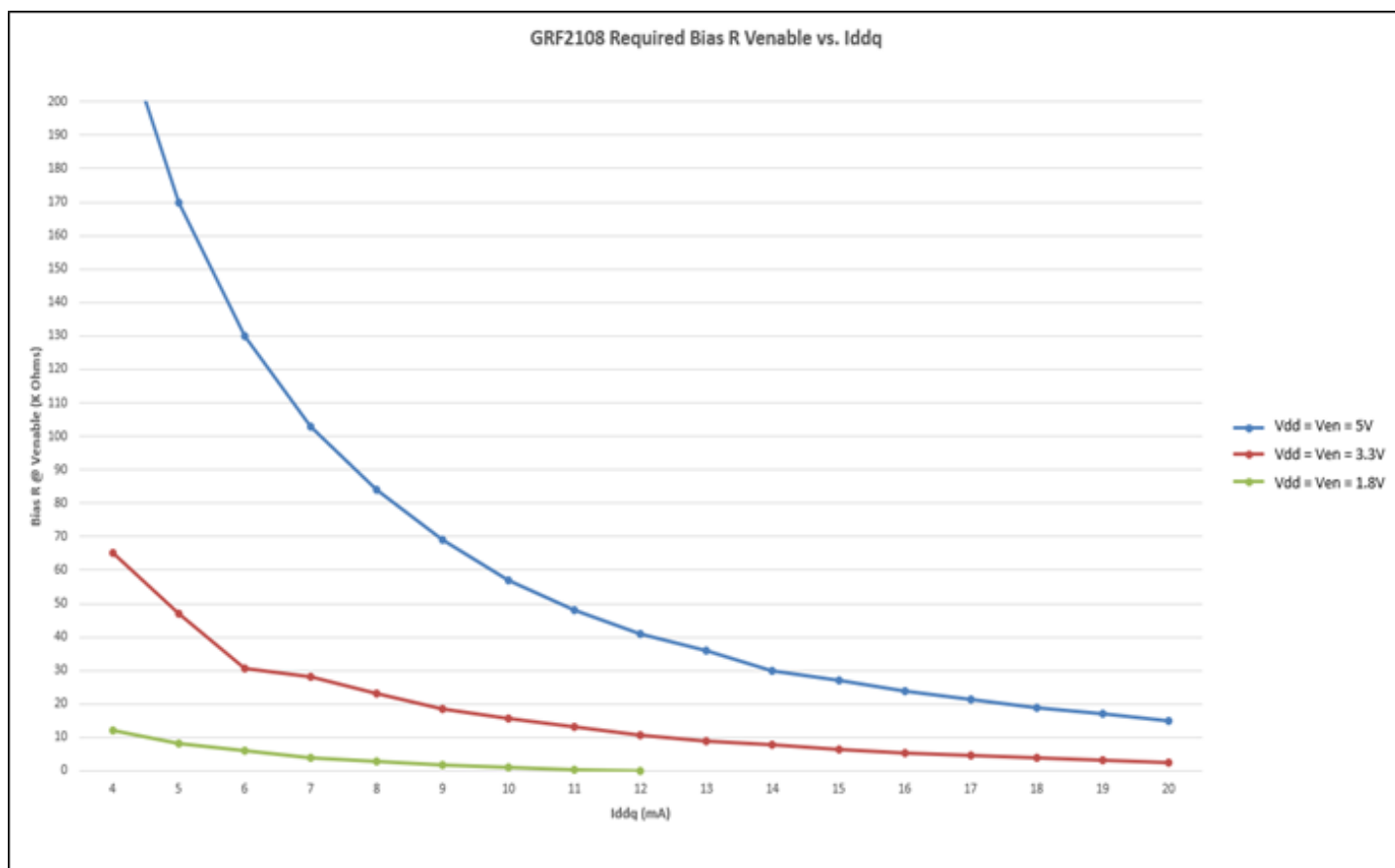


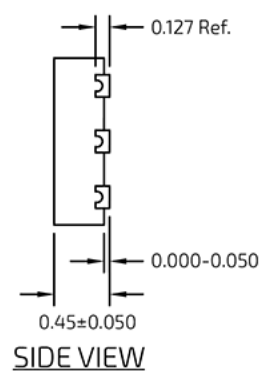
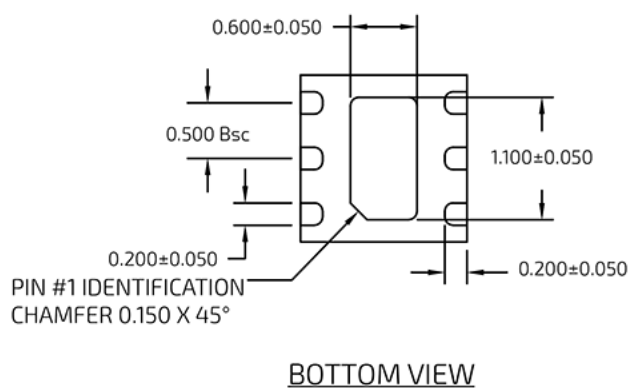
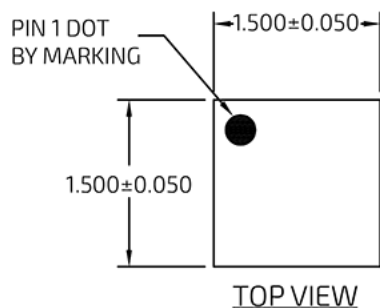
GRF2108 Evaluation Board Assembly Diagram

GRF2108 Evaluation Board Assembly Diagram Reference: 0.4 to 2.7 GHz Tune

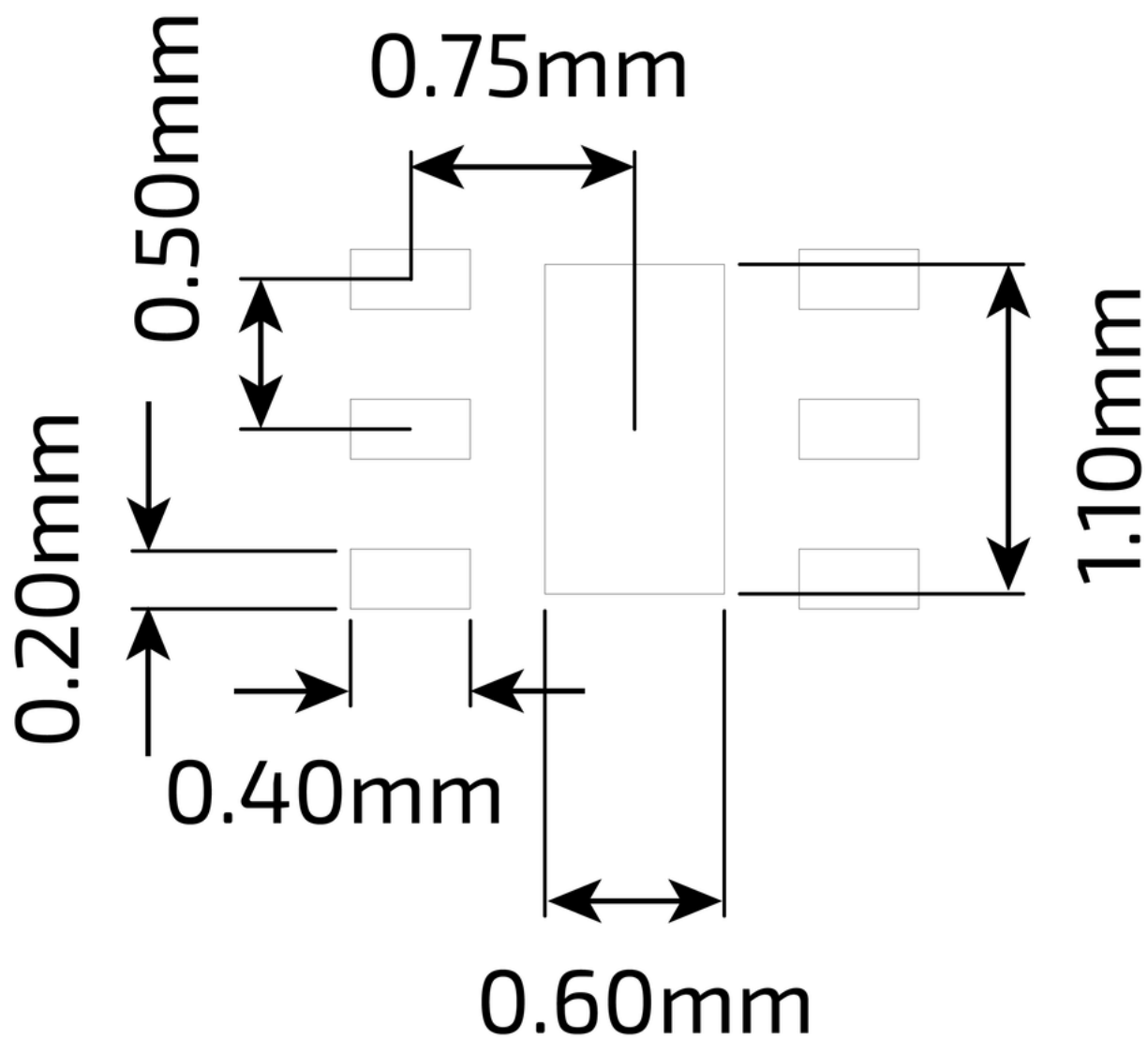
Component	Type	Manufacturer	Family	Value	Package Size	Substitution
M1	Inductor	Murata	LQG	150 nH	0402	ok
M2	Capacitor	Murata	GJM	47 pF	0402	ok
M4	Capacitor	Murata	GRM	100 pF	0402	ok
M5 (sets I _{DDQ})	Resistor	Murata	5%	see curves	0402	ok
M6	Resistor (jumper)	Murata	5%	0 Ω	0402	ok
M8	Capacitor	Murata	GRM	0.1 μF	0402	ok
M10	Inductor	Murata	LQG	39 nH	0402	ok
M12	Capacitor	Murata	GJM/GRM	47 pF	0402	ok
M14	Resistor (jumper)	Various	5%	0 Ω	0402	ok
Evaluation Board	DFN6-15-43-A					

GRF2108 Bias Resistor Selection Curves:





DFN 6 1.5x1.5mm Package Dimensions



DFN 6 1.5x1.5mm Suggested PCB Footprint (Top View)

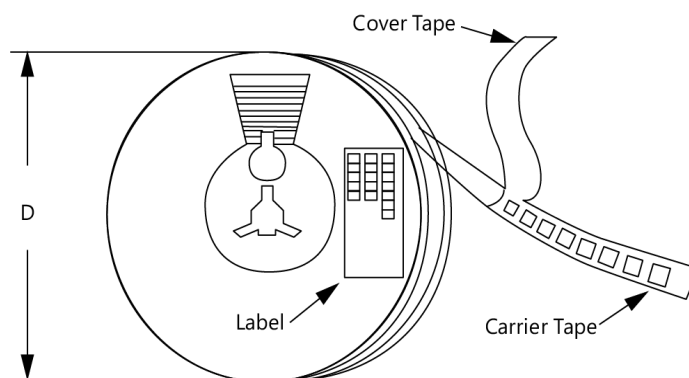
Package Marking Diagram



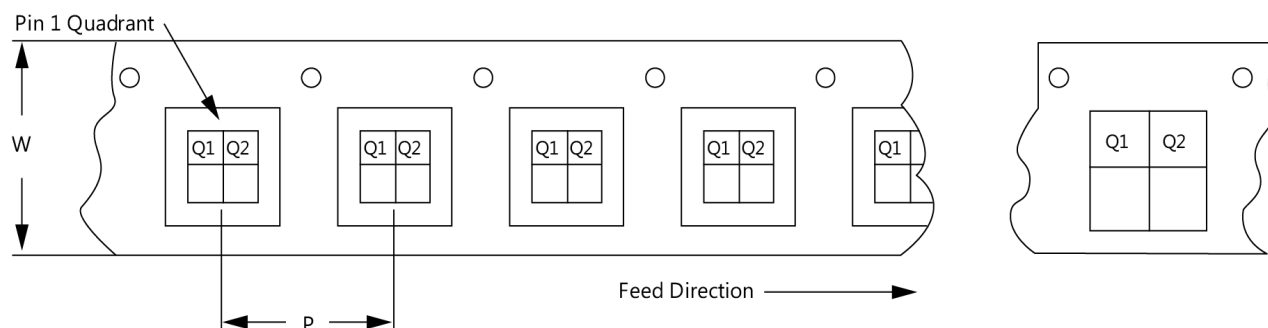
Line 1: "Y" = YEAR (single digit). "WW" = WORK WEEK the Device was assembled.
Line 2: "XXXX" = Device Part Number.

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). 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 latest reel specifications and package information (including units/reel), please visit [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
August 13, 2021	Preliminary Data Sheet.
May 22, 2023	Upgraded Data Sheet to new format. Changed R_{ENABLE} (M5) from 15 k Ω to 9.1 k Ω to match PTP. Changed I_{DDQ} typical value from 10 to 12 mA to match PTP.
December 1, 2023	Release Ø Data Sheet. Upgraded Data Sheet to newest 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 evaluation board measurements taken within the Guerrilla RF Applications Lab. Any MIN/MAX limits represented within the data sheet are based solely on <i>estimated</i> part-to-part variations and process spreads. 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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