DATA SHEET

GRF5115

33.0 dBm Power-LNA
0.026 to 2.7 GHz

RELEASE Ø DATA SHEET

FEATURES

- Flexible Bias Voltage and Current
- Process: GaAs pHEMT

Reference: 5 V / 300 mA / 1.95 GHz

- Gain: 14.8 dB
- OP1dB: 33.2 dBm
- OIP3: 43 dBm
- Evaluation Board Noise Figure: 1.3 dB
- Drain Efficiency: 58%

APPLICATIONS

- High Efficiency Power Amplifier
- Multi-stage LNA
- Linear Driver

ORDERING INFORMATION

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DESCRIPTION

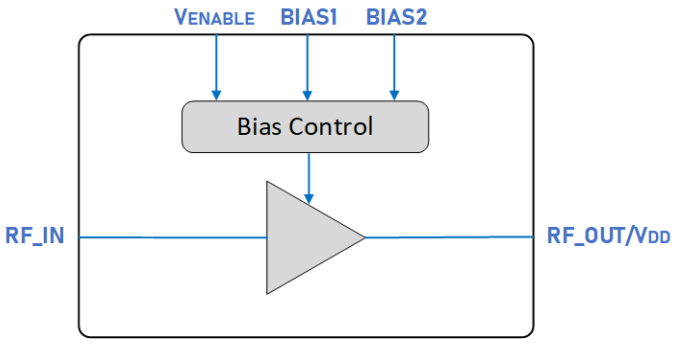
The GRF5115 is a high efficiency PA/Driver that delivers an OP1dB of 33 dBm with greater than 55% drain efficiency. It is tunable from 26 to 2700 MHz with typical fractional bandwidths of 5 to 10%.

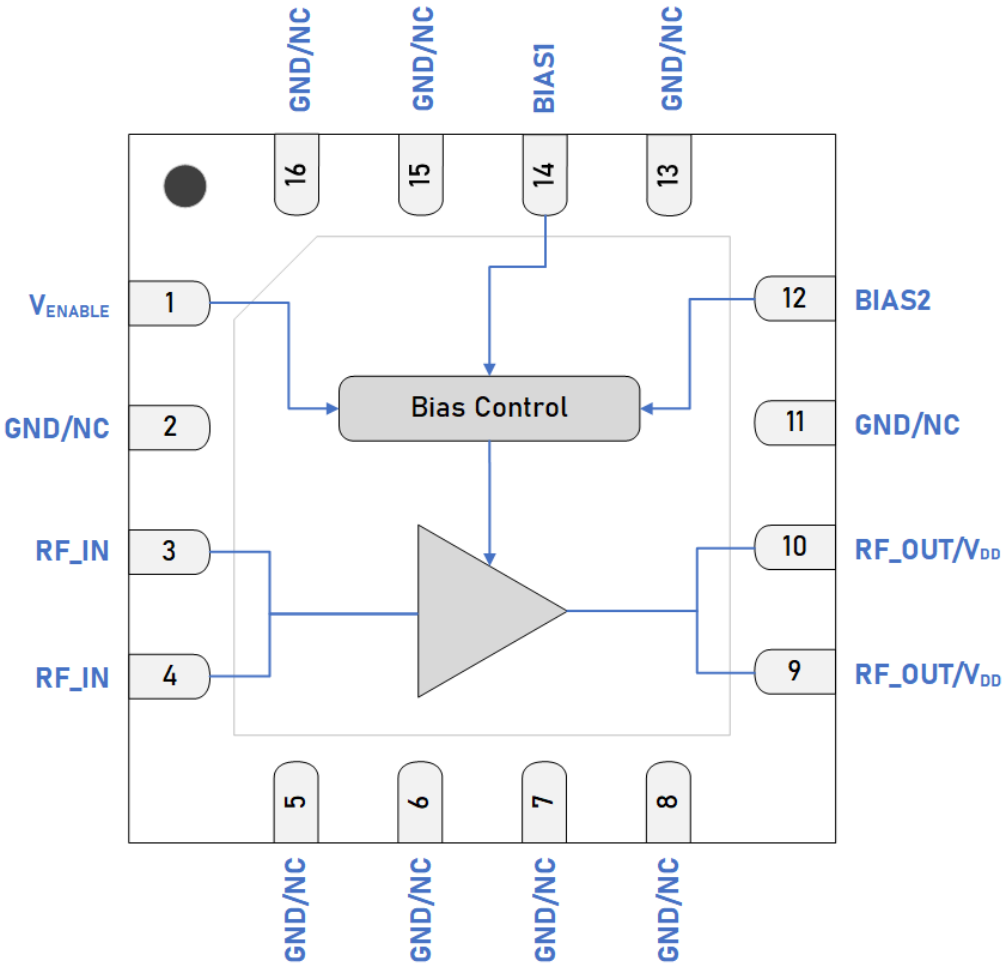
The device can be biased over a range of 2.7 to 5 volts (V_{DD}) and I_{DDQ} can be adjusted for optimal linearity and efficiency.

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 GRF5115 "Custom Tunes" product page: GRF5115 Custom Tunes

BLOCK DIAGRAM





Pin Out (Top View)

Pin Assignments

Pin	Name	Description	Note
1	V_{ENABLE}	Enable Voltage Input	V_{ENABLE} and series resistor set I_{DDQ}. $V_{ENABLE} \leq 0.2$ volts disables the device. On-die pull-down resistor turns the device off if this node is allowed to float.
2, 5, 6, 7, 8, 11, 13, 15, 16	GND/NC	Ground or No Connect	No internal connection to die.
3, 4	RF_IN	RF Input	Pins 3 & 4 tied together on system board. R1 to ground is placed to limit self-biasing. The value of R1 also contributes to the device I_{DDQ}.
9, 10	RF_OUT/V_{DD}	RF Output	Pins 9 & 10 tied together on system board. Supply V_{DD} here.
12	Bias2	Bias Circuit Supply	Connect to V_{DD} through external resistor.
14	Bias1	Bias Circuit Ground	Consult application schematic.
PKG BASE	GND	Ground	Provides DC and RF ground for amplifiers, as well as thermal heat sink. In order to match the device's rated performance, it is strongly recommended to use multiple 8mil 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
Drain Voltage	V_{DD}		5.5	V
Transient Average RF Input Power: Load VSWR < 2:1, Duration < 1 hour	$P_{IN\ MAX}$		23	dBm
Operating Temperature (package base)	$T_{PKG\ BASE}$	-40	85	°C
Maximum Junction Temperature	T_{MAX}		170	°C
Maximum Dissipated Power	$P_{DISS\ MAX}$		2	W
Electrostatic Discharge				
Charged Device Model	CDM	1500		V
Human Body Model	HBM	250		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 - 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}	3.3	5	5.5	V	
Operating Temperature	$T_{PKG\ BASE}$	-40	25	85	°C	
RF Frequency Range	F_{RF}	26		2700	MHz	**Note 1 & 2.**
RF_IN Port Impedance	Z_{RF_IN}		50		Ω	Single-ended.
RF_OUT Port Impedance	Z_{RF_OUT}		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: GRF5115 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.		
Test Frequency	F_{TEST}		1.95		GHz	
Switching Rise Time	T_{RISE}		100		ns	Disabled mode to Gain mode **(note 3)**.
Switching Fall Time	T_{FALL}		850		ns	Gain mode to Disabled mode **(note 4)**.
Quiescent Supply Current	I_{DDQ}	200	300	400	mA	V_{DD} = 5 V, V_{ENABLE} = 5 V, M1 = 22 kΩ, M9 = 100 kΩ, R1 = 15 kΩ.
Enable Current	I_{ENABLE}		0.5		mA	

Disabled Mode

Supply Current (Leakage)	$I_{LEAKAGE}$		2		µA	V_{DD} = 5 V, V_{ENABLE} = 0 V.

Thermal Data

Thermal Resistance (Infrared Scan)	Θ_{JC}		40		°C/W	On standard evaluation board **(note 5)**.
Channel Temperature at 85 °C Reference (Package Base)	$T_{CHANNEL}$		145		°C	V_{DD} = 5 V, I_{DDQ} = 300 mA, P_{DISS} = 1.5 W (no RF applied).

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}.

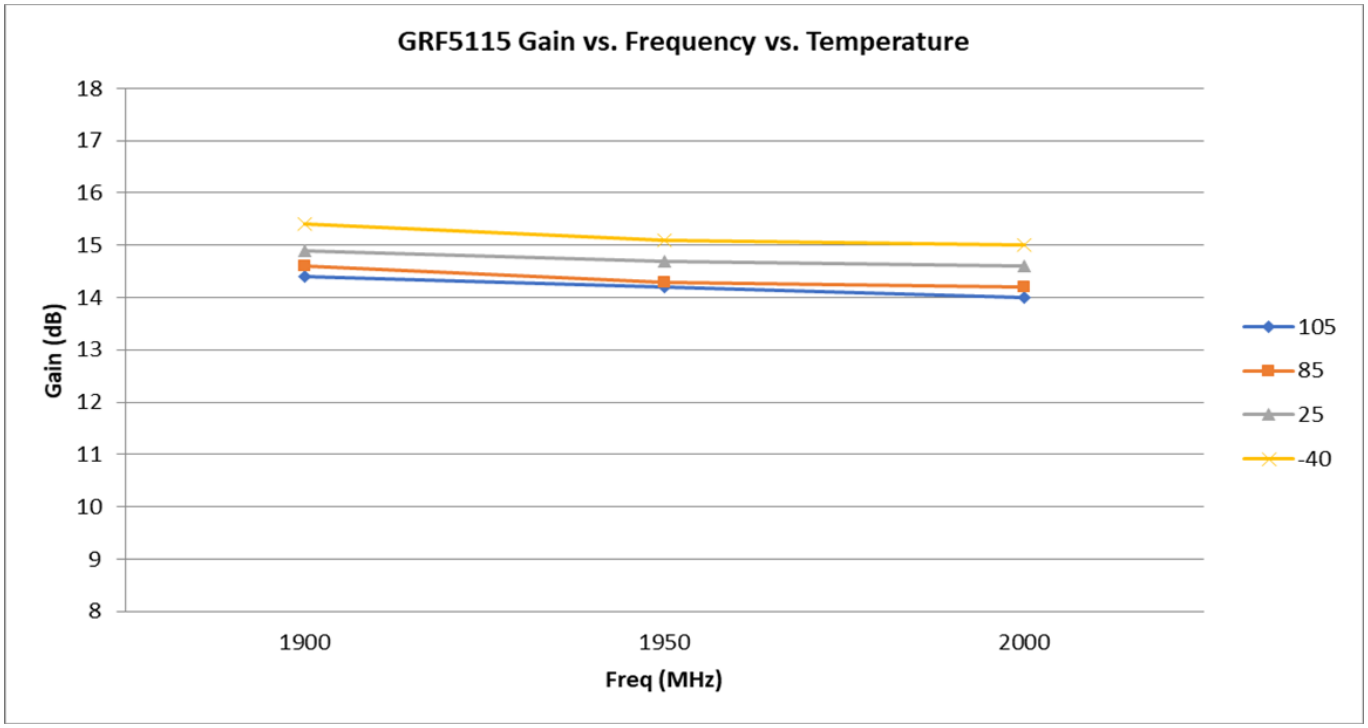
Note 5: MTTF > 10^6 hours for $T_j \leq 170$ °C.

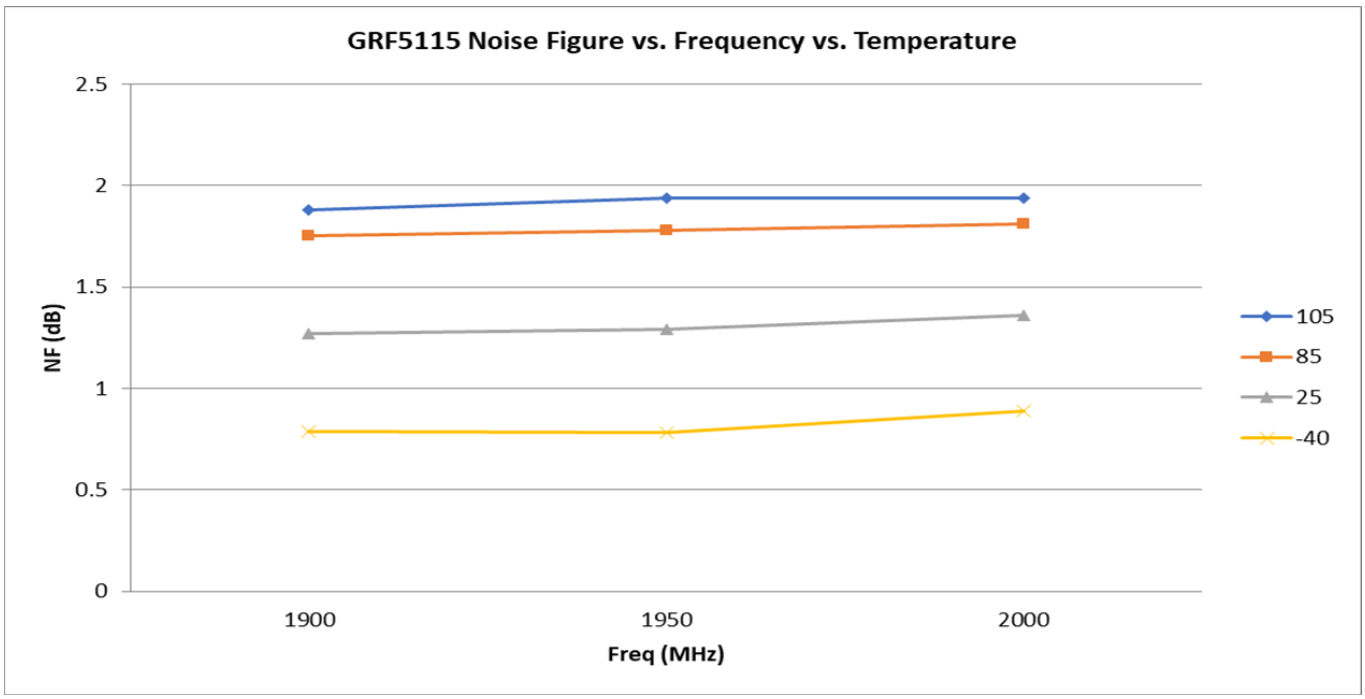
Nominal Operating Parameters - RF

The following conditions apply unless noted otherwise: typical application schematic, V_{DD} = 5 V, I_{DD} = 300 mA, F_{TEST} = 1.95 GHz, 50 Ω system impedance, $T_{PKG\ BASE}$ = 25 °C. Evaluation board losses are included within the specifications.

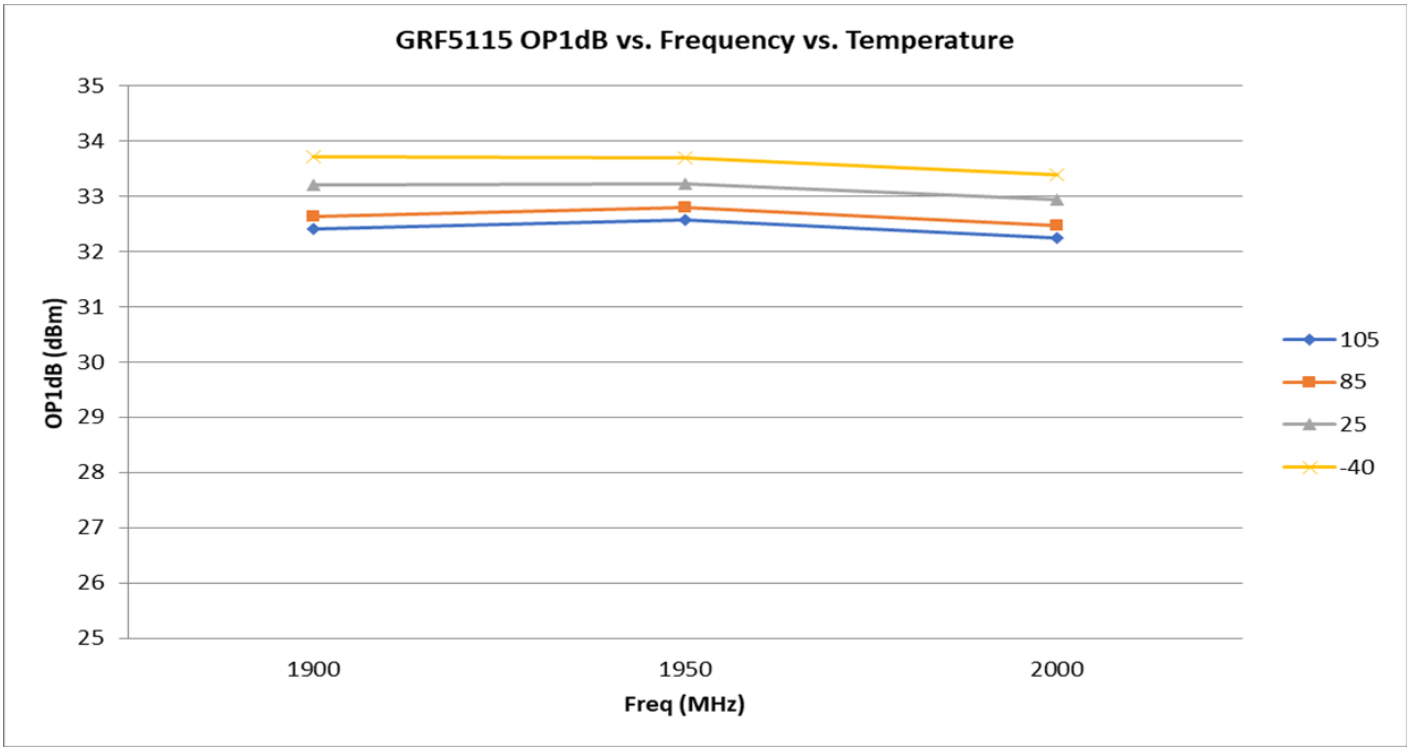
Parameter	Symbol	Specification			Unit	Condition
		Min.	Typ.	Max.		
Gain	S21	13.8	14.8	15.8	dB	V_{DD} = 5 V, I_{DD} = 300 mA.
Output 1 dB Compression Power	OP1dB	31.5	33		dBm	
Output 3rd Order Intercept Point	OIP3		43		dBm	12 dBm P_{OUT} per tone. 2 MHz spacing (1949 and 1951 MHz).
Noise Figure	NF		1.3		dB	On standard evaluation board.
Drain Efficiency at OP1dB	η		58		%	

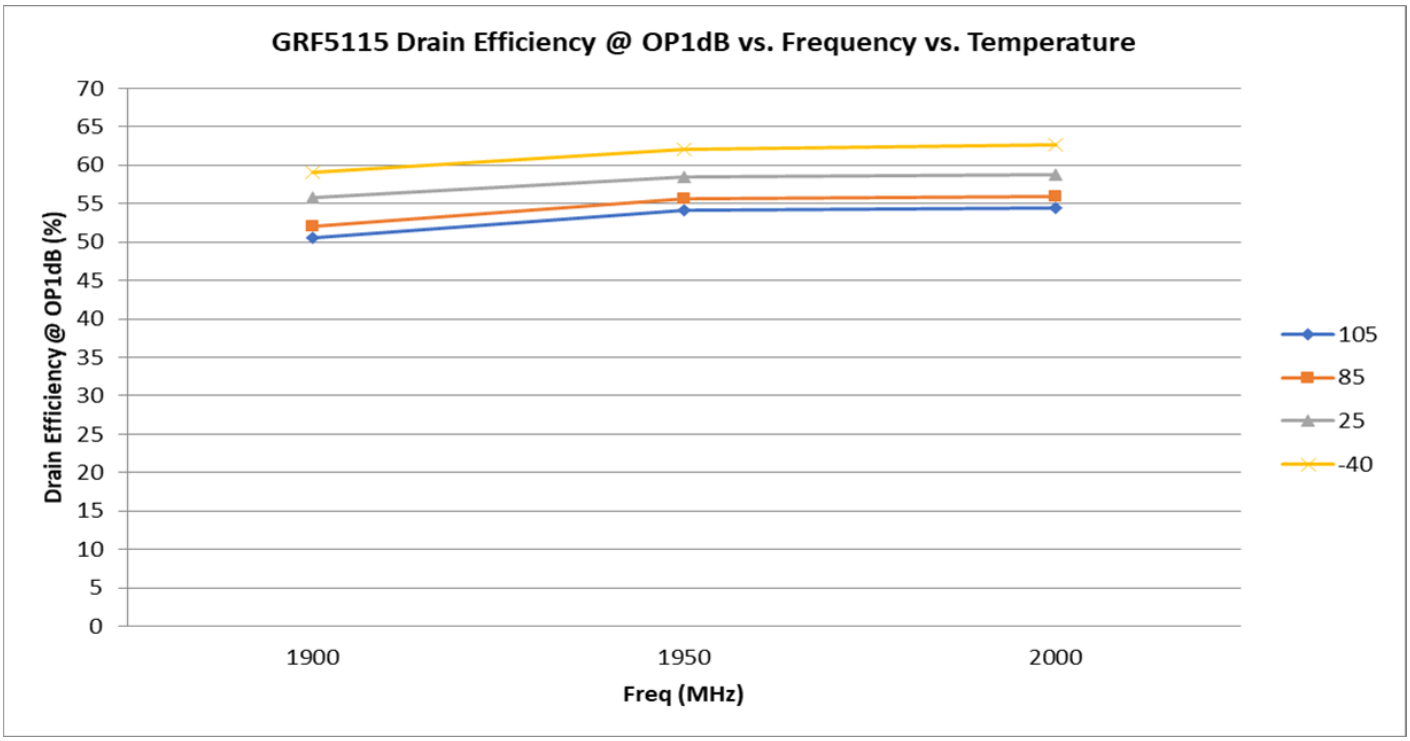
GRF5115 Typical Operating Curves: 1.9 to 2.0 GHz Tune





GRF5115 Typical Operating Curves: 1.9 to 2.0 GHz Tune





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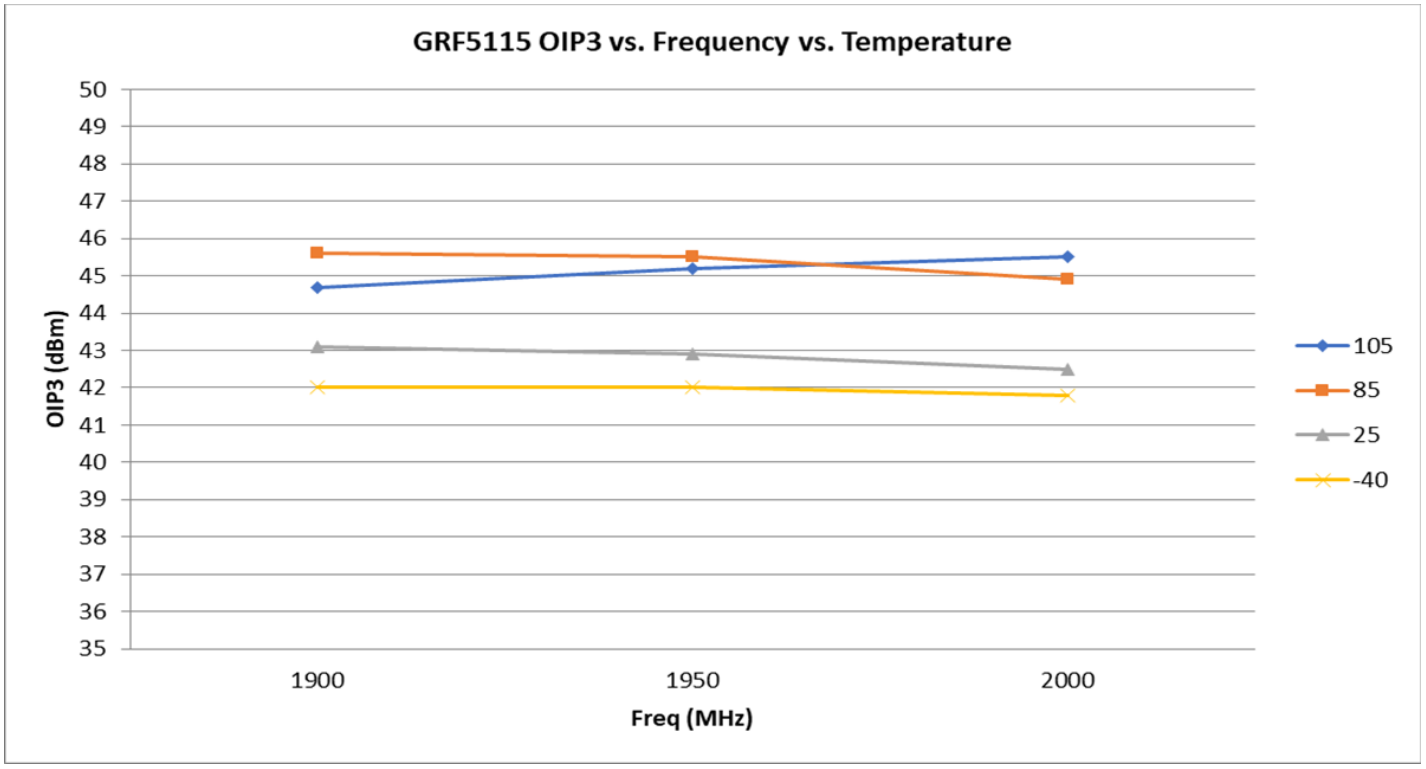
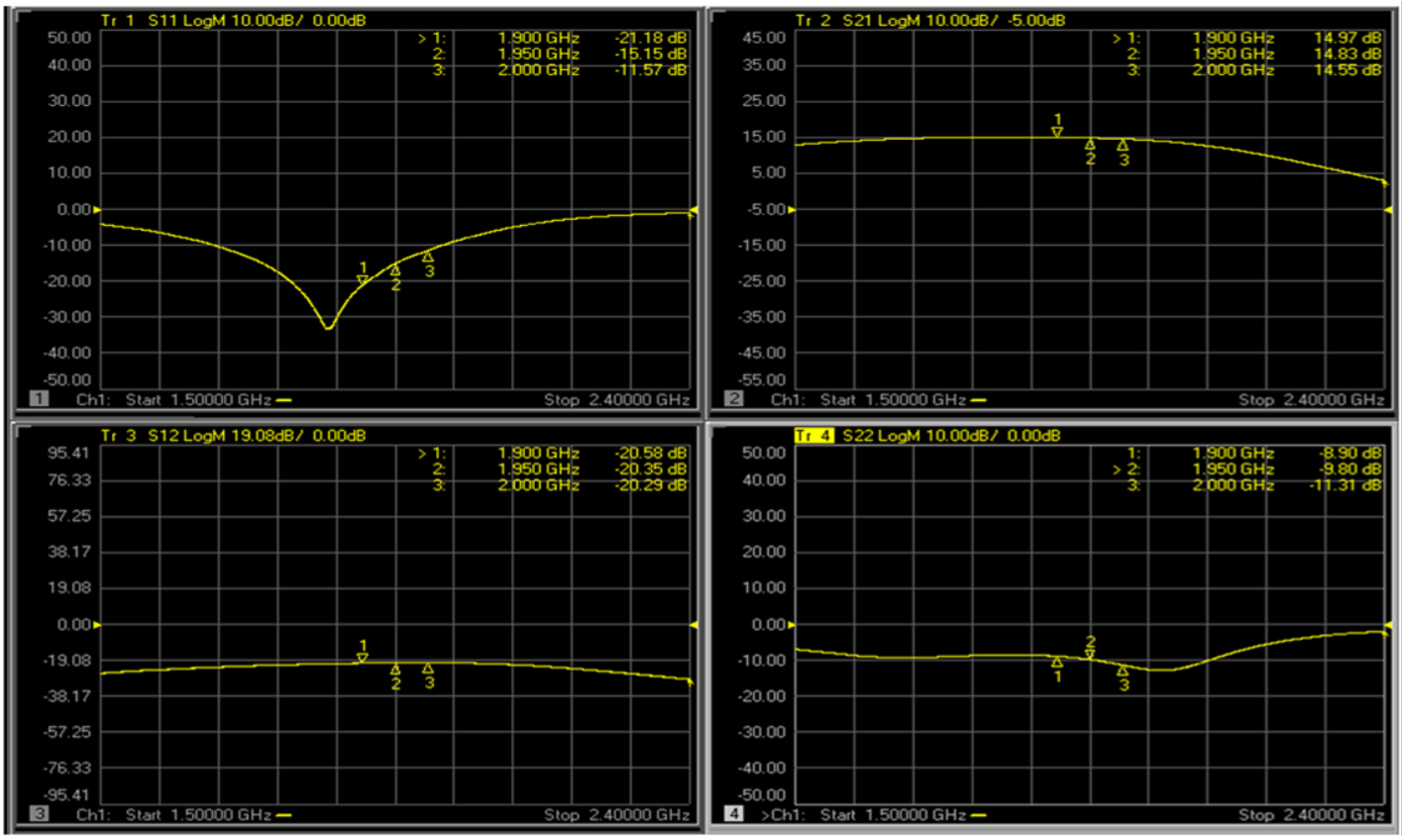
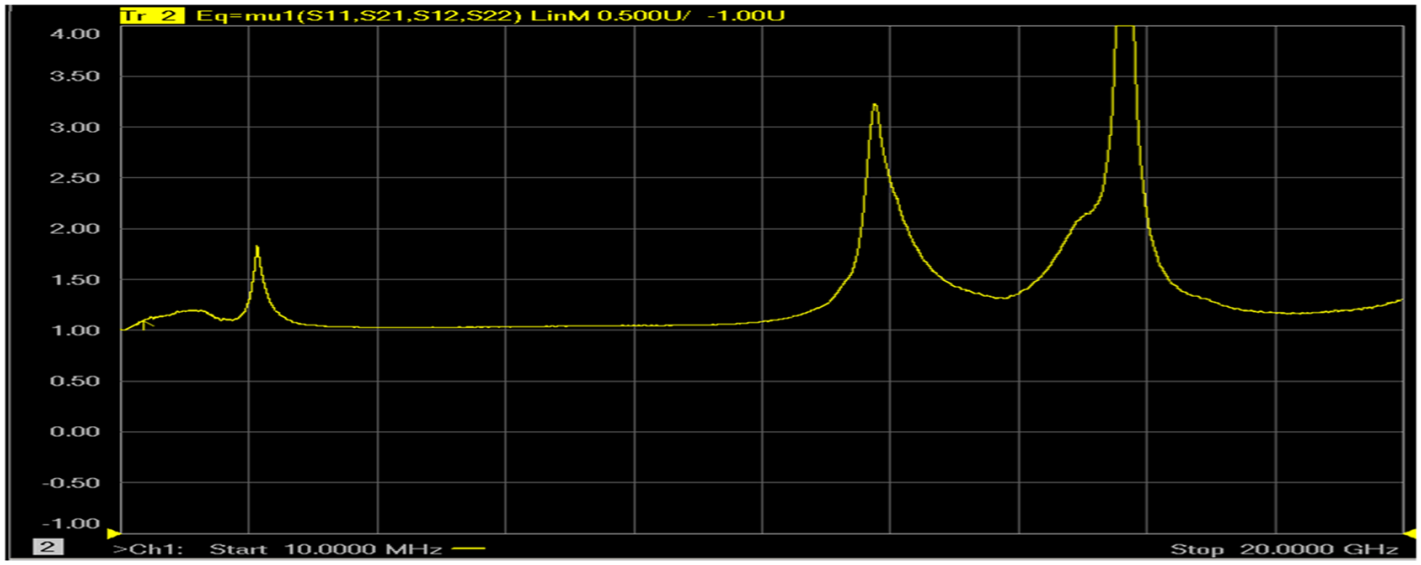


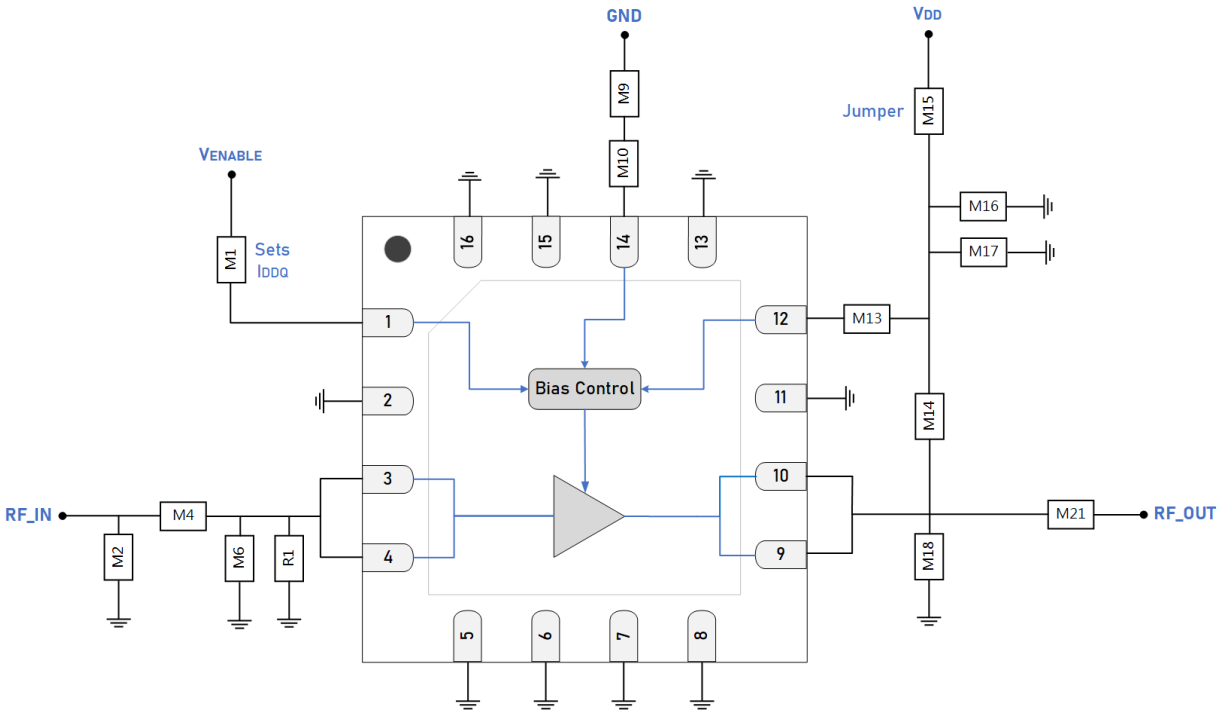
GRF5115 Typical Operating Curves: S-Parameters (1.9 to 2.0 GHz Tune)



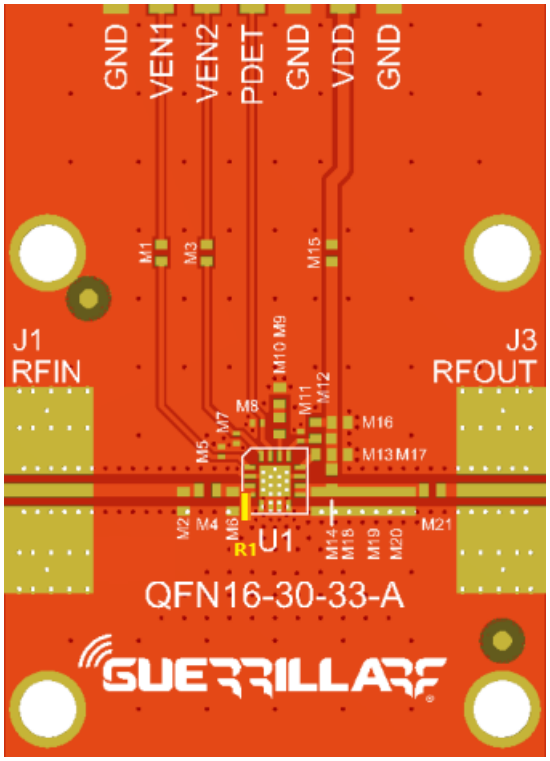
GRF5115 Typical Operating Curves: Stability Mu Factor (10 MHz to 20 GHz)



Note: Mu Factor ≥ 1.0 implies unconditional stability.



GRF5115 Standard Evaluation Board Schematic

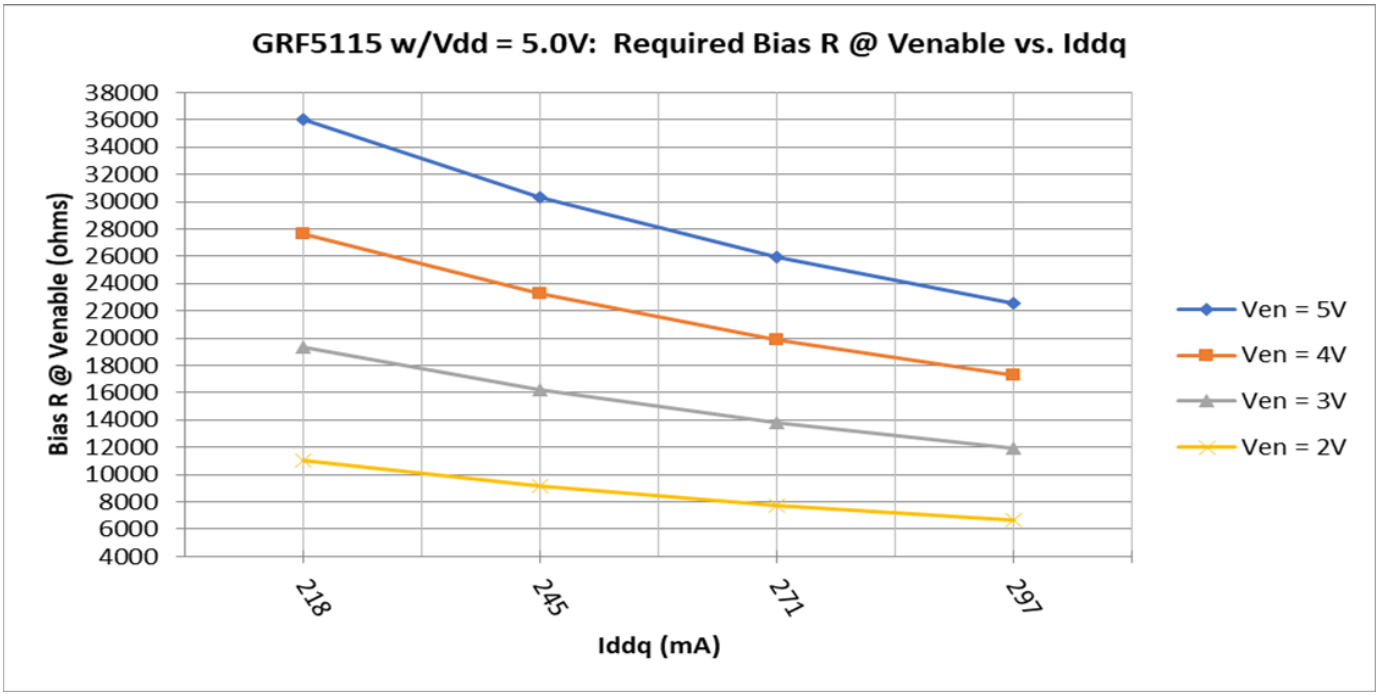


GRF5115 Evaluation Board Assembly Drawing

GRF5115 Evaluation Board Assembly Diagram Reference: 1.9 to 2.0 GHz Tune

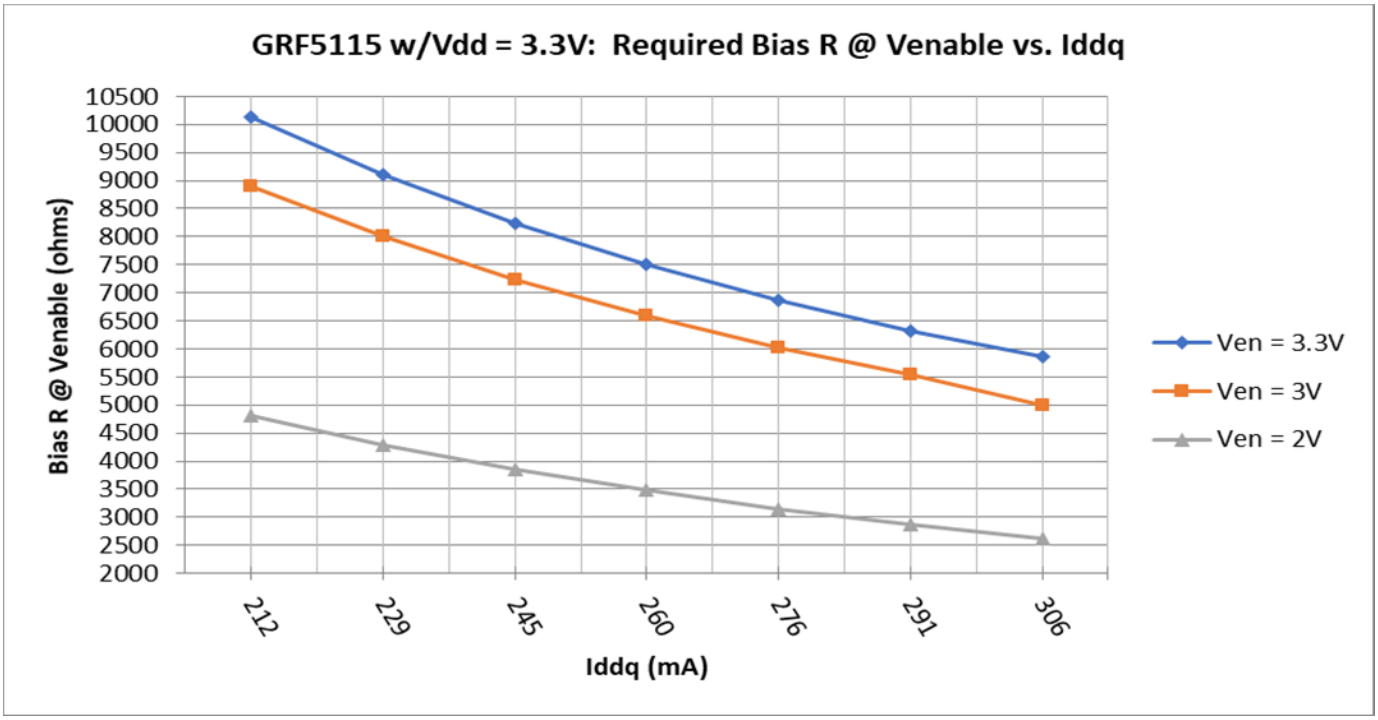
Component	Type	Manufacturer	Family	Value	Package Size	Substitution
M1 (sets I_{DDQ})	Resistor	Various	5%	see curves	0402	ok
M2	Inductor	Murata	LQP	6.2 nH	0402	ok
M4	Capacitor	Murata	GJM	1.5 pF	0402	ok
M6	Capacitor	Murata	GJM	3.9 pF	0402	ok
R1	Resistor	Various	5%	15 kΩ	0402	ok
M9	Resistor	Various	5%	100 kΩ	0402	ok
M10	Resistor	Various	5%	0 Ω	0402	ok
M13	Resistor	Various	5%	150 Ω	0402	ok
M14	Inductor	Coilcraft	HP	8.2 nH	0402	ok
M15	Resistor (jumper)	Various	5%	0 Ω	0402	ok
M16	Capacitor	Murata	GRM	0.1 µF	0402	ok
M17	Capacitor	Murata	GJM	100 pF	0402	ok
M18	Capacitor	Murata	GJM	3.9 pF	0402	ok
M21	Capacitor	Murata	GJM	15 pF	0402	ok
Evaluation Board	QFN-16-30-33-A					

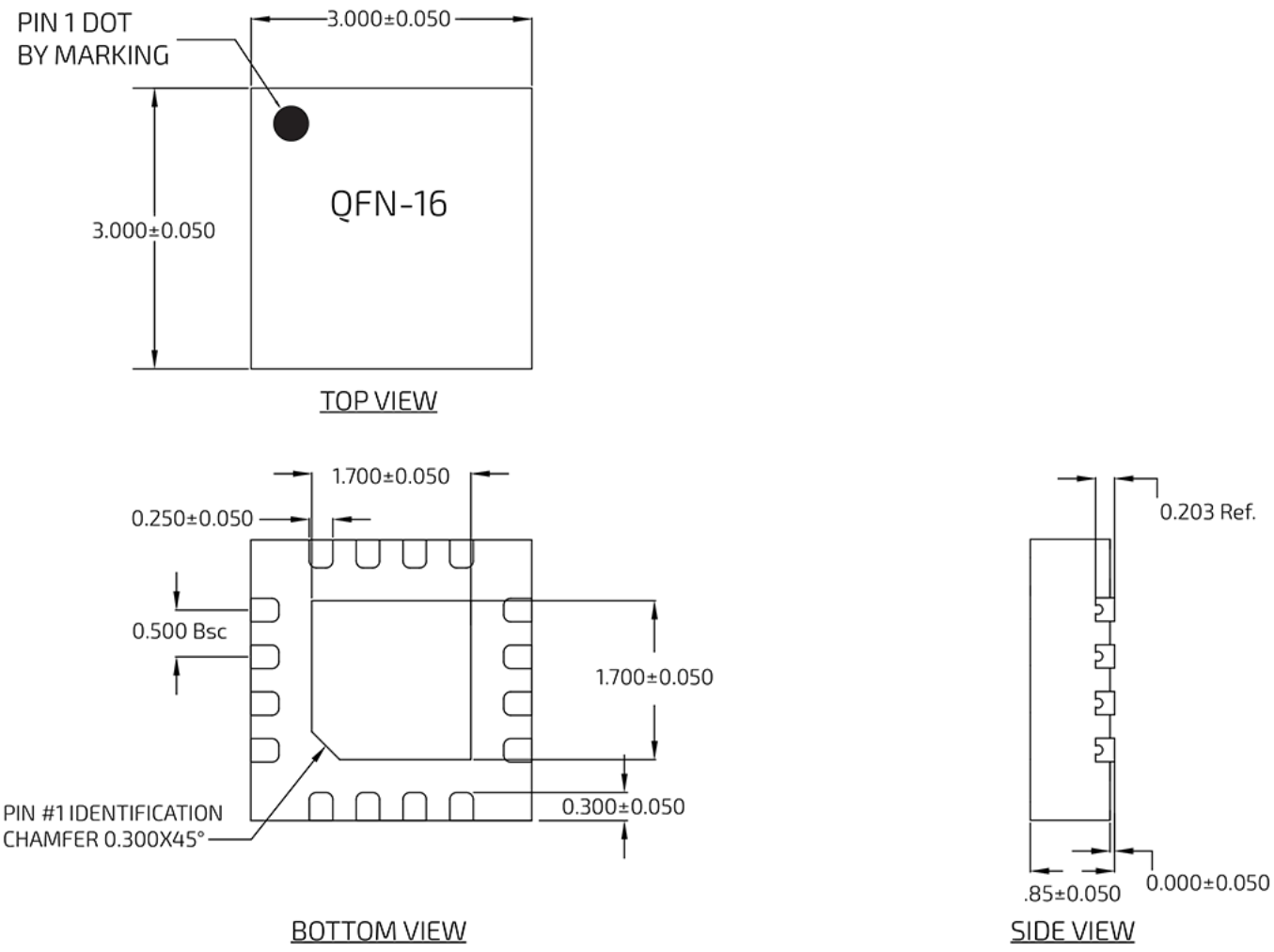
GRF5115 Bias Resistor Selection Curves:



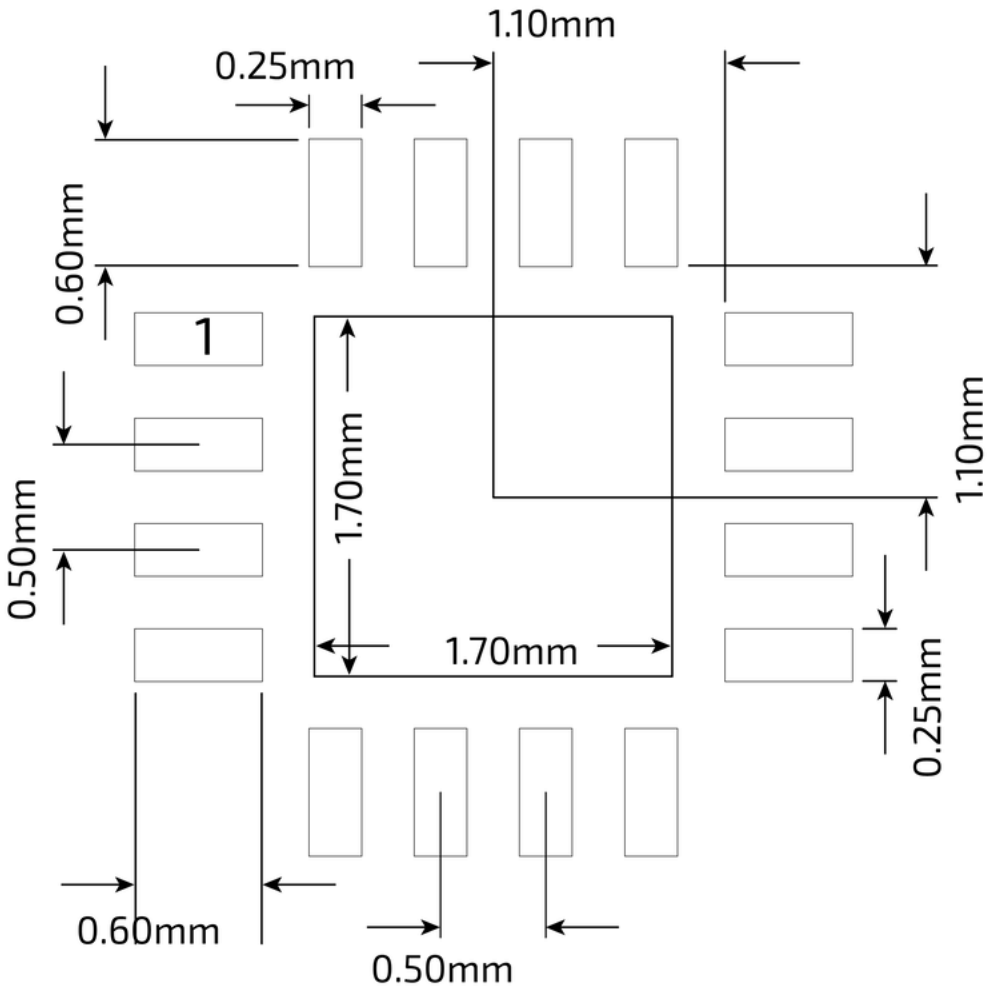
GRF5115 Evaluation Board Assembly Diagram Reference: 1.9 to 2.0 GHz Tune

GRF5115 Bias Resistor Selection Curves:





QFN 16 3x3mm Package Dimensions



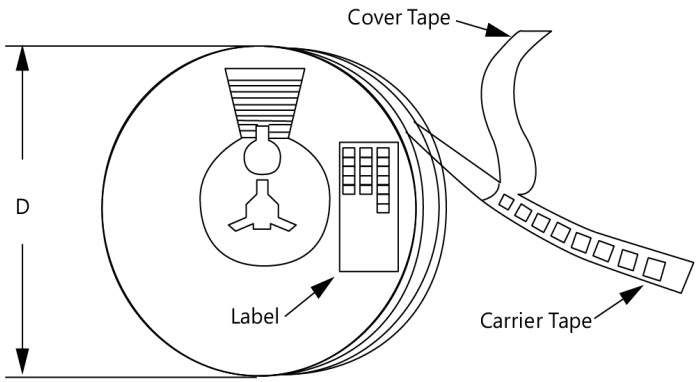
QFN 16 3x3mm Suggested PCB Footprint (Top View)

Package Marking Diagram

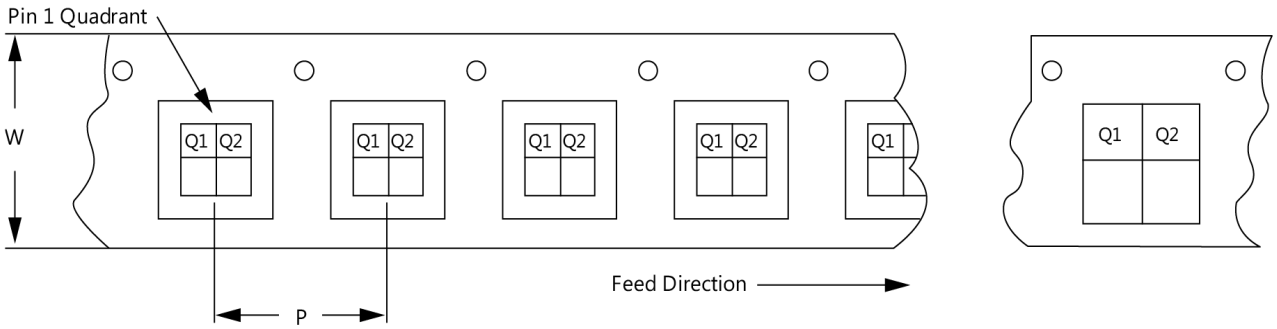
Line 1: “YY” = Year. “WW” = WORK WEEK the Device was assembled.
Line 2: “GRF” = Guerrilla RF
Line 3: “XXXX” = Device Part Number.

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
December 17, 2019	Release Ø Data Sheet.
July 17, 2024	Upgraded Data Sheet to new format. Added new Evaluation Board.
June 19, 2025	Extended lower frequency range from 100 MHz to 26 MHz.

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 *estimated* 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 *production-released* material. TYP values are based on a combination of ATE and bench-level measurements, with MIN/MAX limits defined using *modelled estimates* 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 *derived from multiple lots which have been fabricated over an extended period of time*. 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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