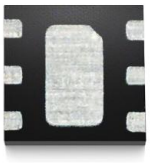
DATA SHEET

RELEASE Ø DATA SHEET



GRF2111

Low Noise Amplifier / Linear Driver
8 to 12 GHz: Useable Range 3 to 12.6 GHz

FEATURES

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

Reference: 5 V / 65 mA / 10 GHz

- Gain: 12.9 dB
- OIP3: 36 dBm
- OP1dB: 20.6 dBm
- Evaluation Board NF: 1.2 dB

APPLICATIONS

- Radar
- X-Band
- Sat Com
- Linear Driver Amplifier
- Weather Monitoring Solutions

DESCRIPTION

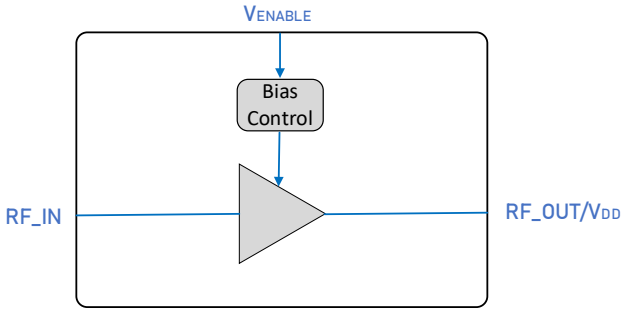
The GRF2111 is a broadband, ultra-low noise linear amplifier designed for X-Band and other high-performance RF applications up to 12 GHz. The standard tune exhibits outstanding noise figure (NF), linearity, return loss and gain flatness from 8 to 12 GHz. The device can be used outside of the intended function from 3 to 12.6 GHz.

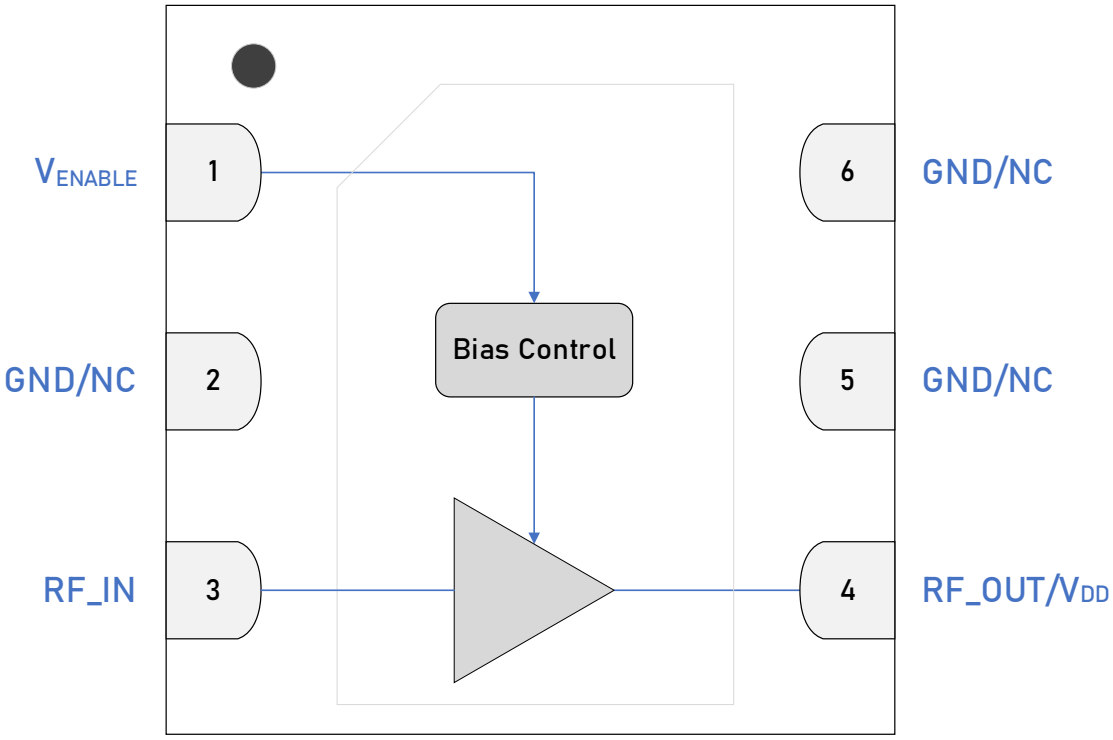
The device can be operated from a supply voltage (V_{DD}) of 2.7 to 6 volts with a typical bias condition of 5 volts and 80 mA for optimal efficiency and linearity.

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

Additional tunes can be found on the GRF2111 "Custom Tunes" product page: [GRF2111 Custom Tunes]

BLOCK DIAGRAM





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

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Pin Assignments

Pin	Name	Description	Note
1	V_{ENABLE}	Enable Voltage Input	V_{ENABLE} and series resistor sets I_{DDQ}. $V_{ENABLE} \leq 0.2$ volts disables the 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. We recommend connecting these pins to ground.
3	RF_IN	RF Input	Some external matching required. An external DC blocking capacitor must be used.
4	RF_OUT/V_{DD}	RF Output	Some external matching required. V_{DD} must be applied through an RF choke to this pin.
PKG BASE	GND	Ground	Provides DC and RF ground 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}	2.7	6	V
RF Input Power (transient): Load VSWR < 2:1, V_{DD} = 5 V.	$P_{IN\ MAX}$		20	dBm
RF Input Power (constant): Load VSWR < 2:1, V_{DD} = 5 V.	$P_{IN\ MAX}$		10	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	$P_{DISS\ MAX}$		500	mW

Electrostatic Discharge

Human Body Model	HBM	TBD		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 *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*

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Recommended Operating Conditions

Parameter	Symbol	Specification			Unit	Condition
		Min.	Typ.	Max.		
Supply Voltage	V_{DD}	2.7	5	6	V	
RF Frequency Range	F_{RF}	8		12	GHz	Typical application schematic with external matching components **(notes 1 & 2)**.
Operating Temperature (package base)	$T_{PKG\ BASE}$	-40		105	°C	
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: GRF2111 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

The following conditions apply unless noted otherwise: typical application schematic, V_{DD} = 5 V, V_{ENABLE} = 5 V, F_{TEST} = 10 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.		
Supply Current	I_{DD}		65		mA	V_{DD} = 5 V, V_{ENABLE} = 5 V.
Enable Current	I_{ENABLE}		1.1		mA	V_{DD} = 5 V, V_{ENABLE} = 5 V.
Switching Rise Time	T_{RISE}		40		ns	Disabled mode to Gain mode. P_{OUT} = 0 dBm **(note 3)**.
Switching Fall Time	T_{FALL}		25		ns	Gain mode to Disabled mode. P_{OUT} = 0 dBm **(note 4)**.
Disabled Mode						
Leakage Current	$I_{LEAKAGE}$		250		µA	V_{DD} = 5 V, V_{ENABLE} = 0 V.
Thermal Data						
Thermal Resistance (Infrared Scan)	Θ_{JC}		83		°C/W	On standard evaluation board **(note 5)**.

Note 3: Switching Time: 50% of V_{ENABLE} to 90% of Pout.

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

Note 5: MTTF > 10^6 hours for T_j < 170 °C.

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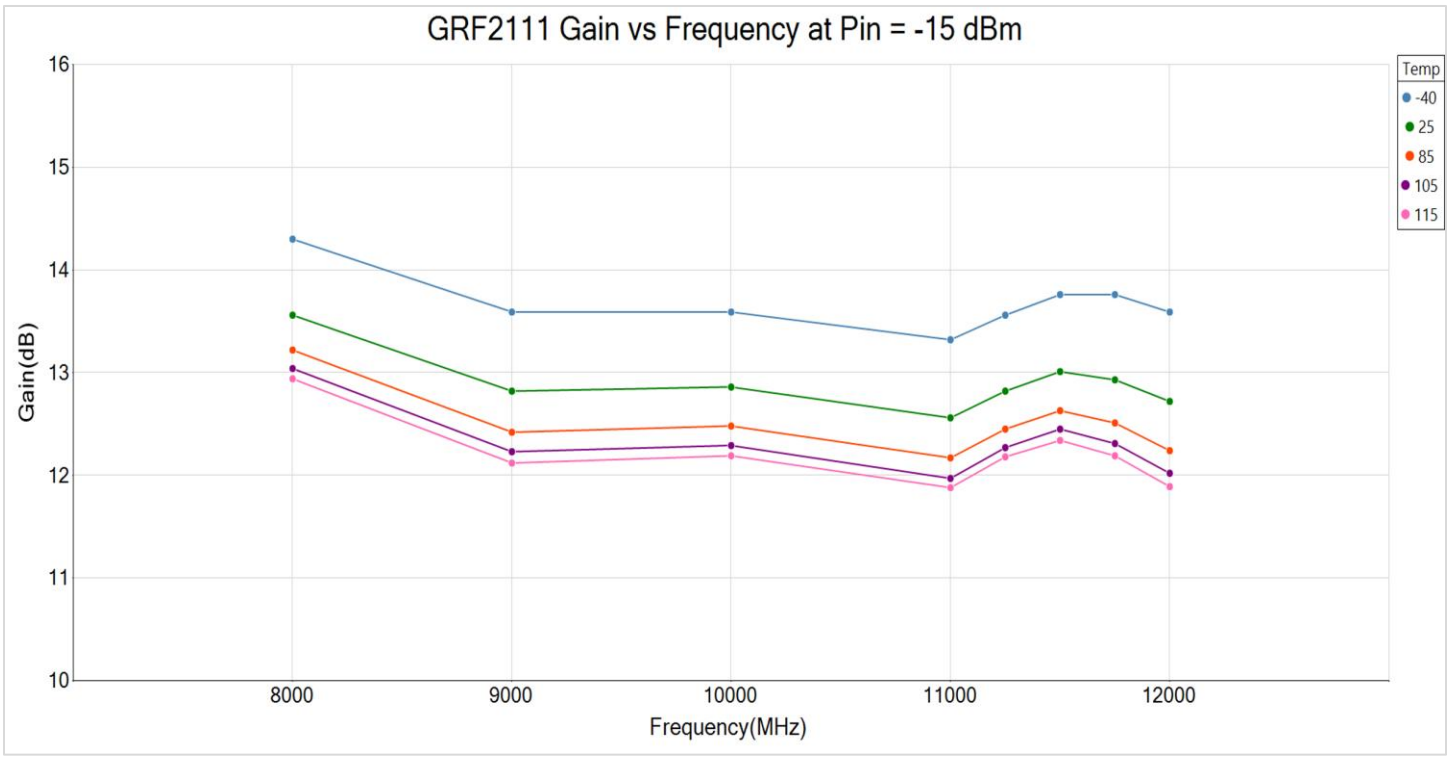
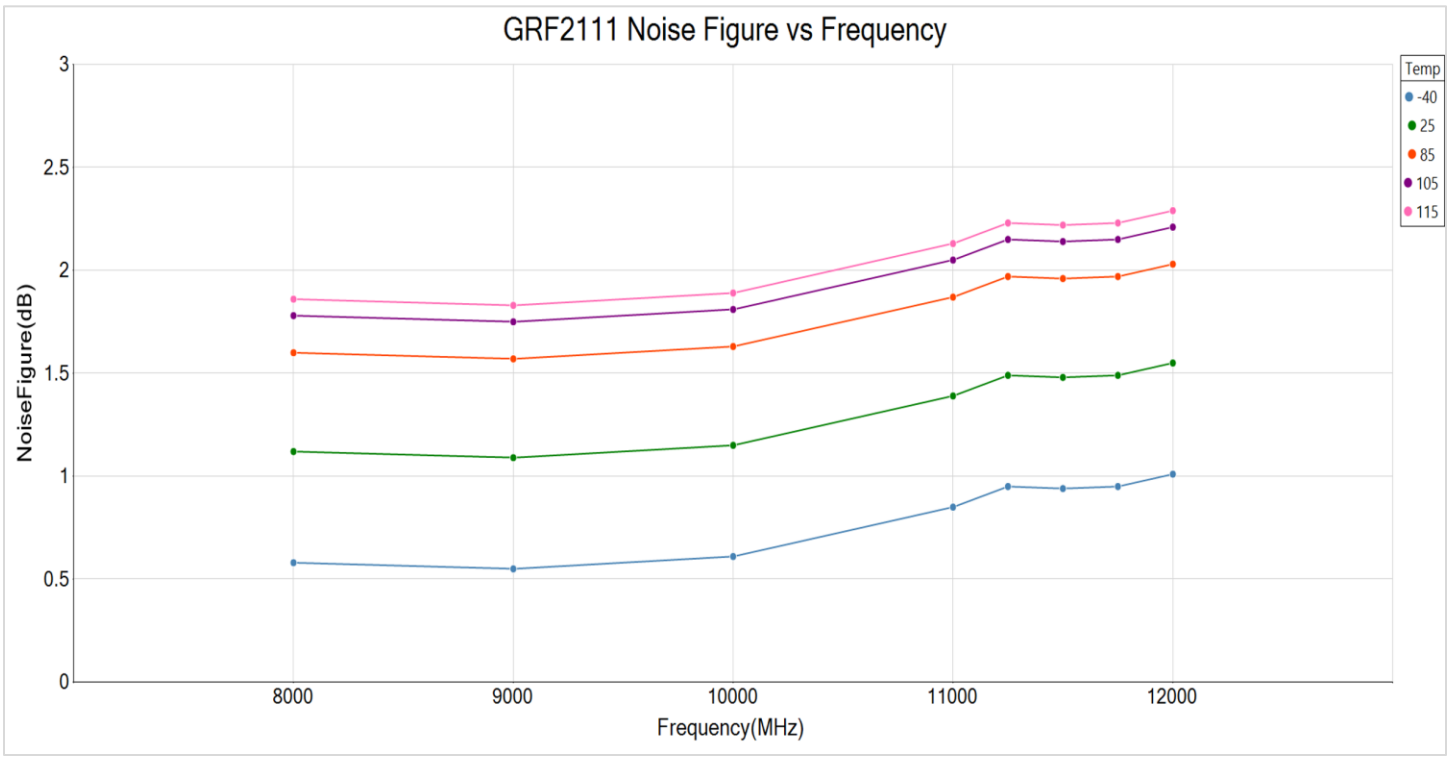
Nominal Operating Parameters – RF

The following conditions apply unless noted otherwise: typical application schematic, V_{DD} = 5 V, V_{ENABLE} = 5 V, F_{TEST} = 10 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		12.9		dB	
Evaluation Board Noise Figure	NF		1.2		dB	Input SMA and trace contributes roughly 0.2 dB at 10 GHz.
Output 3rd Order Intercept Point	OIP3		36		dBm	+4 dBm P_{OUT} per tone.
Output 1 dB Compression Power	OP1dB		20.6		dBm	

GRF2111 Typical Operating Curves: 8 to 12 GHz Tune





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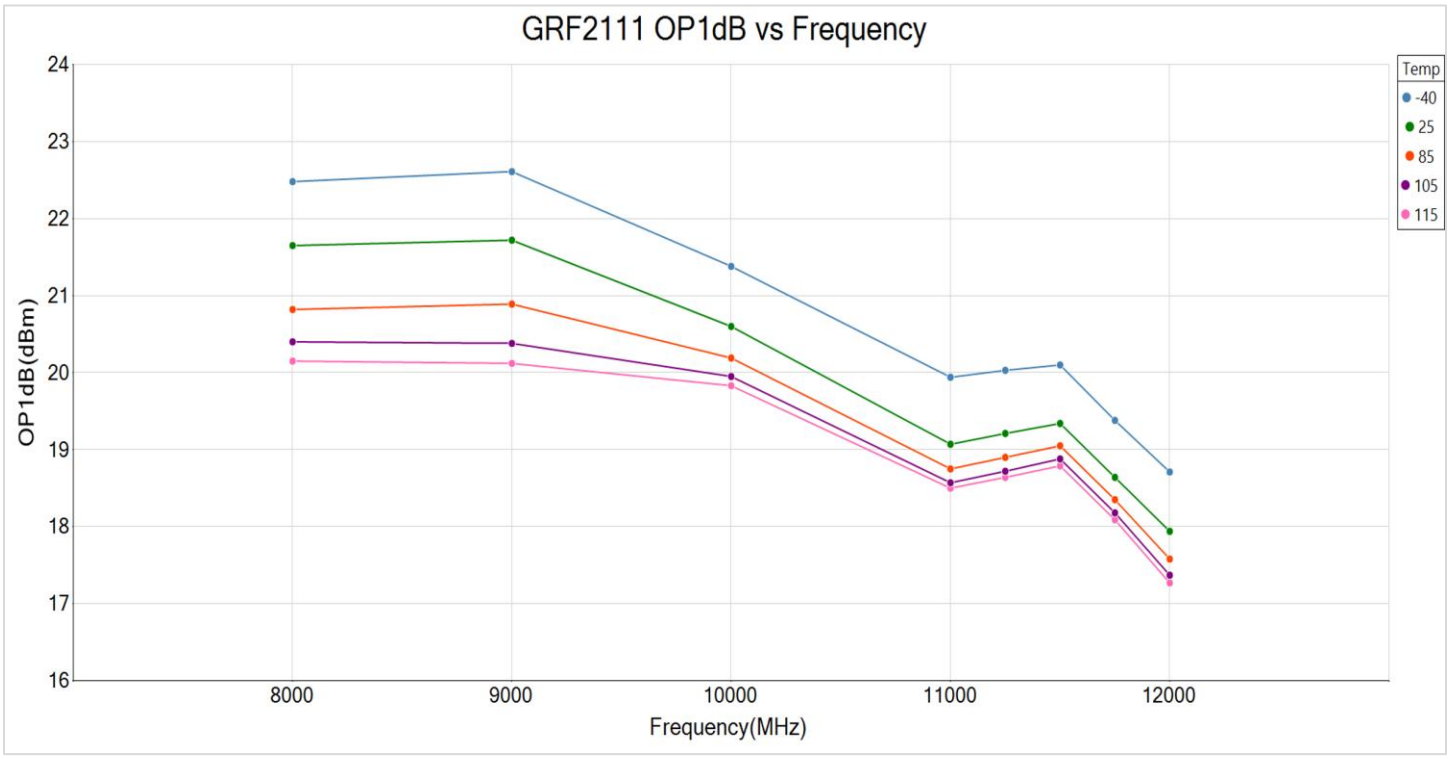
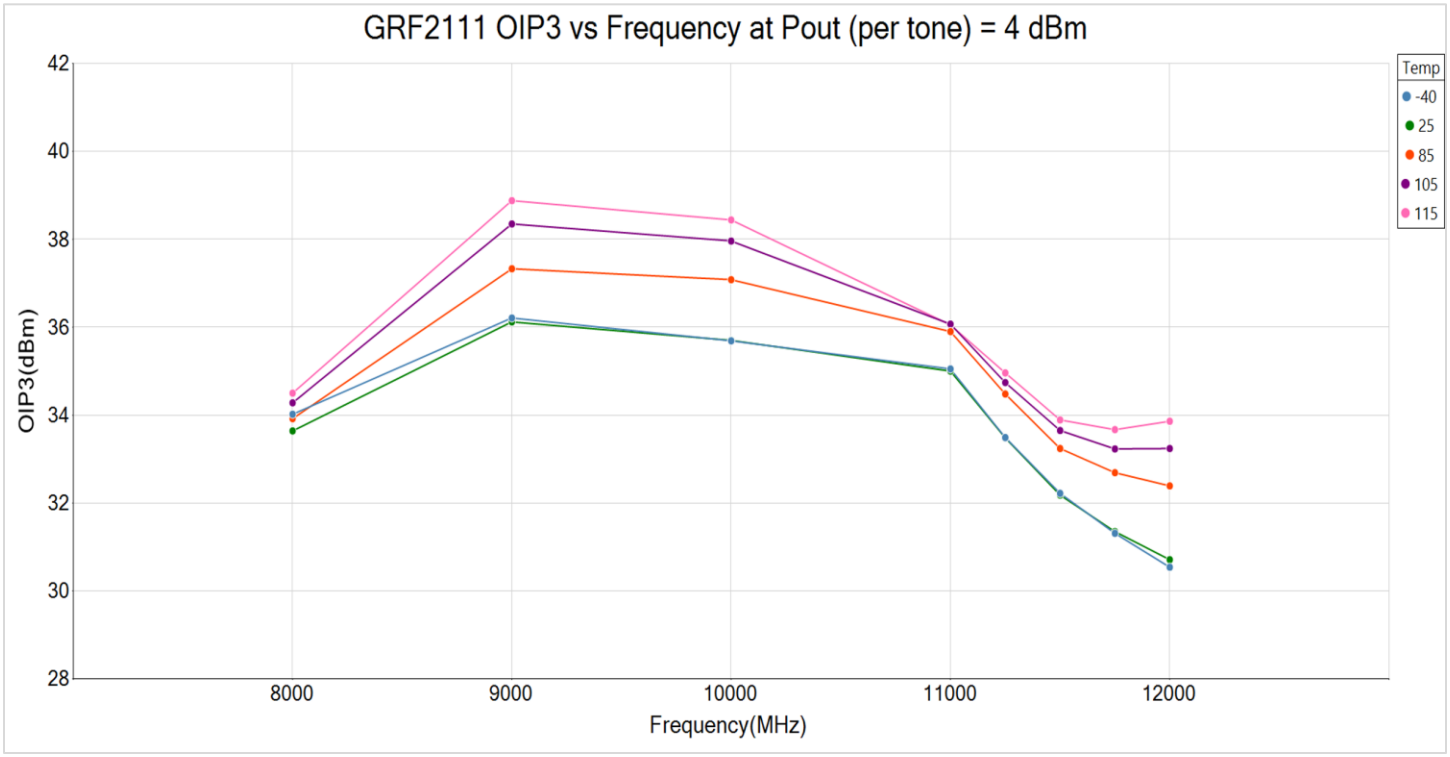
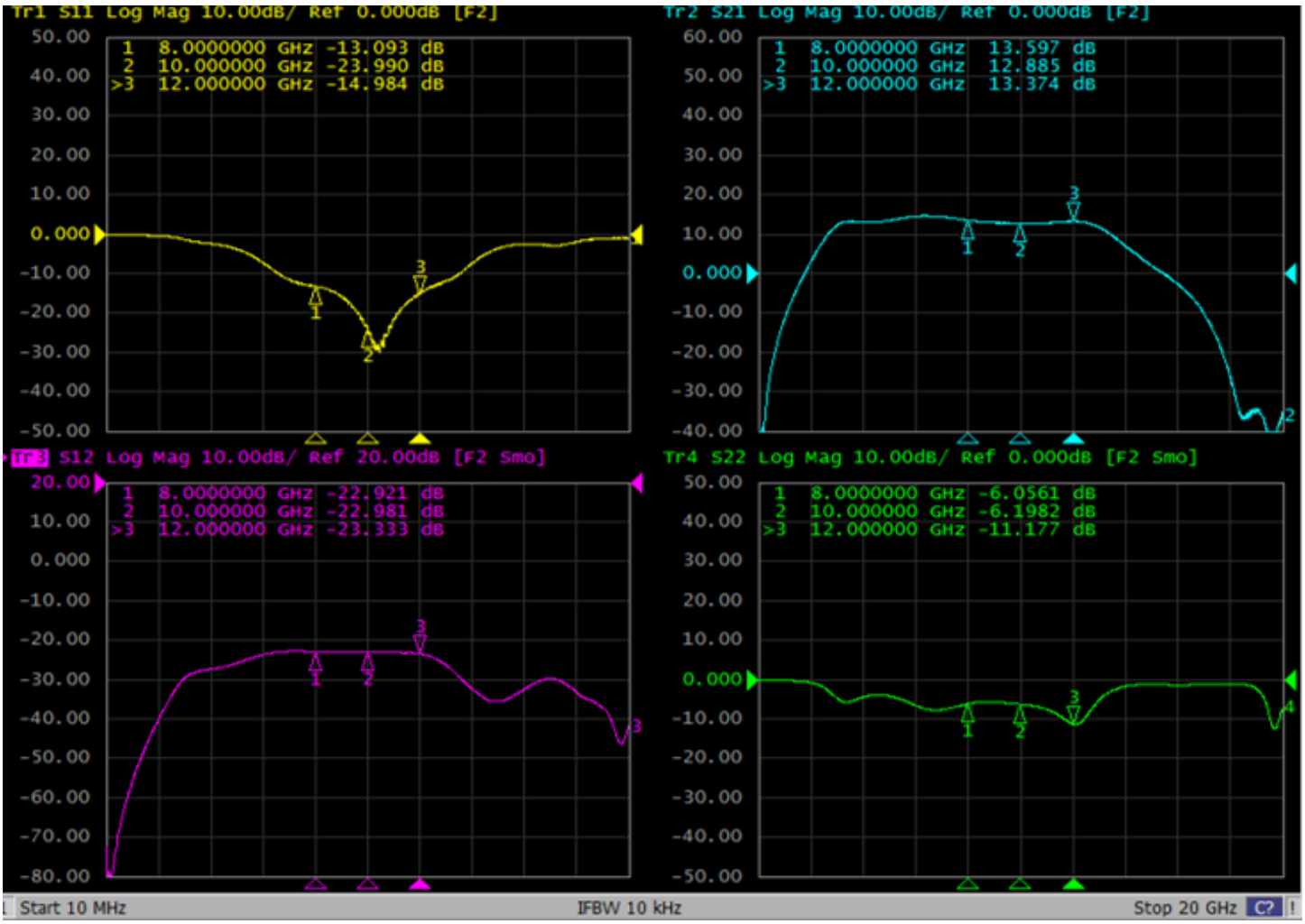
GRF2111 Typical Operating Curves: 8 to 12 GHz Tune





GRF2111 Typical Operating Curves: S-Parameters (8 to 12 GHz Tune)



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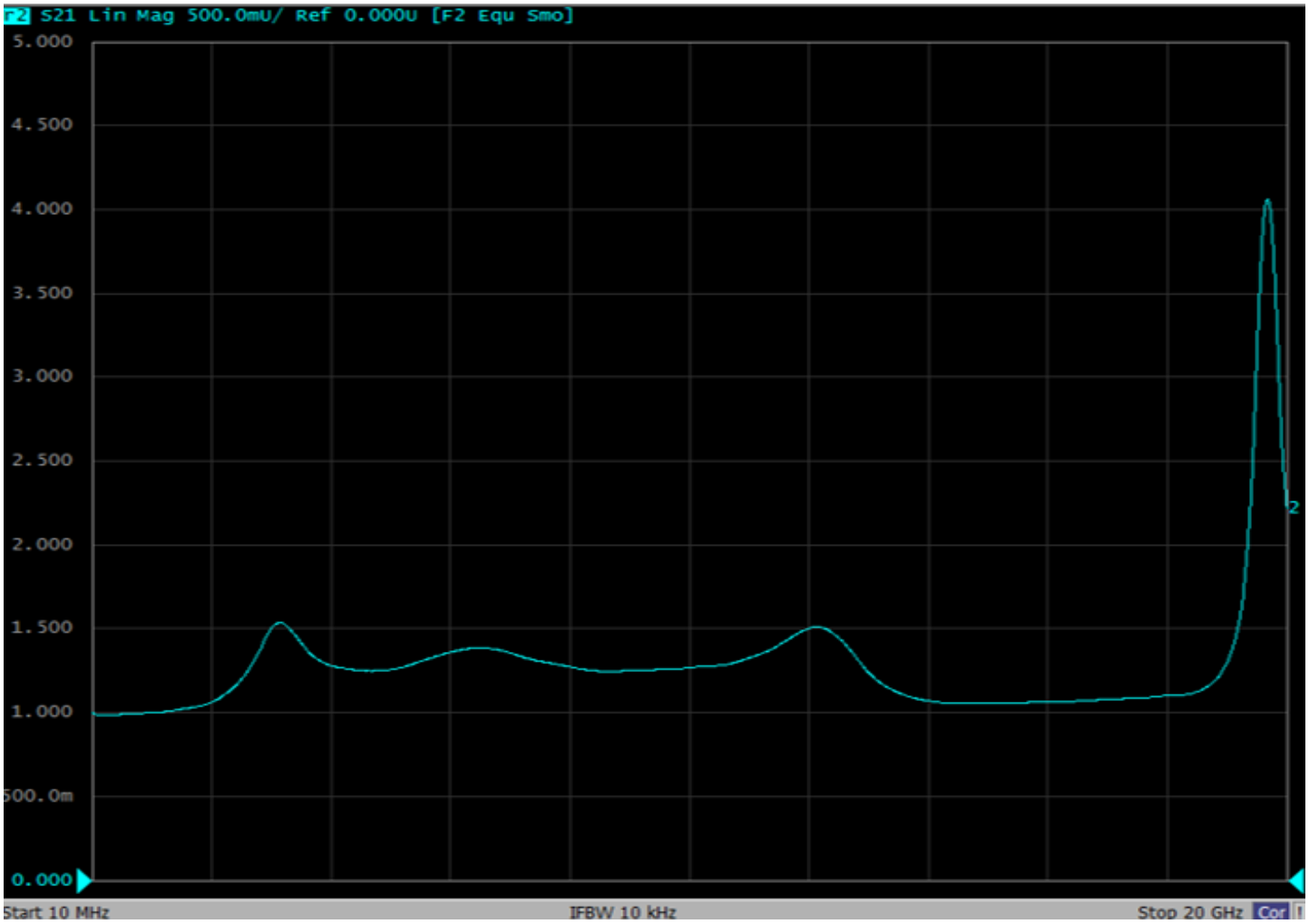
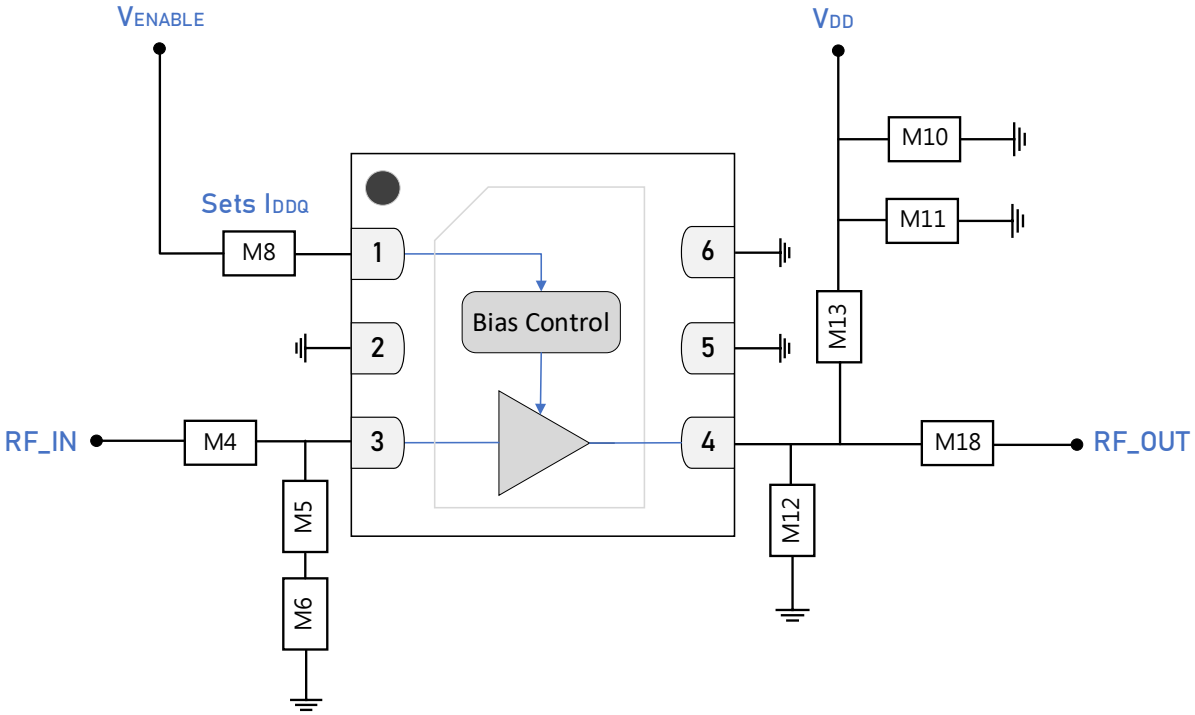
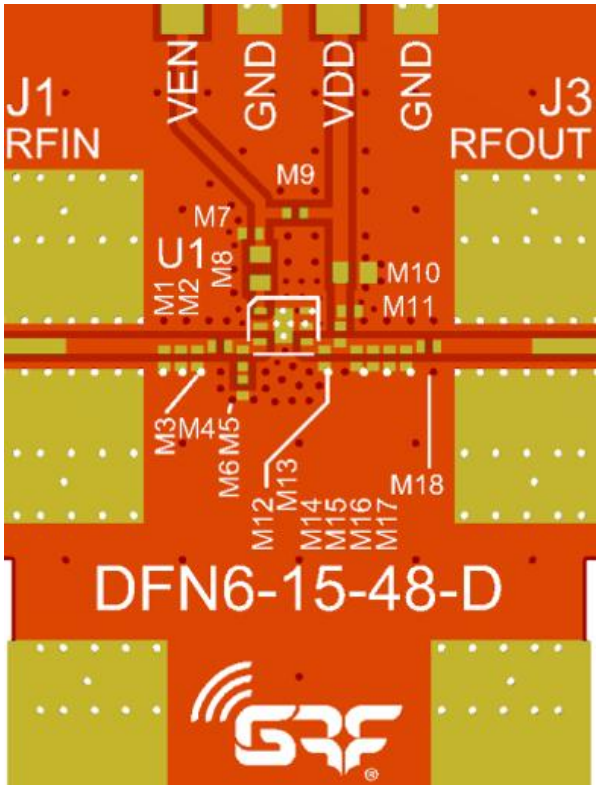
GRF2111 Typical Operating Curves: Stability Mu (10 MHz to 20 GHz)



Note: Mu Factor ≥ 1.0 implies unconditional stability.



GRF2111 Standard Evaluation Board Schematic



GRF2111 Evaluation Board Assembly Diagram

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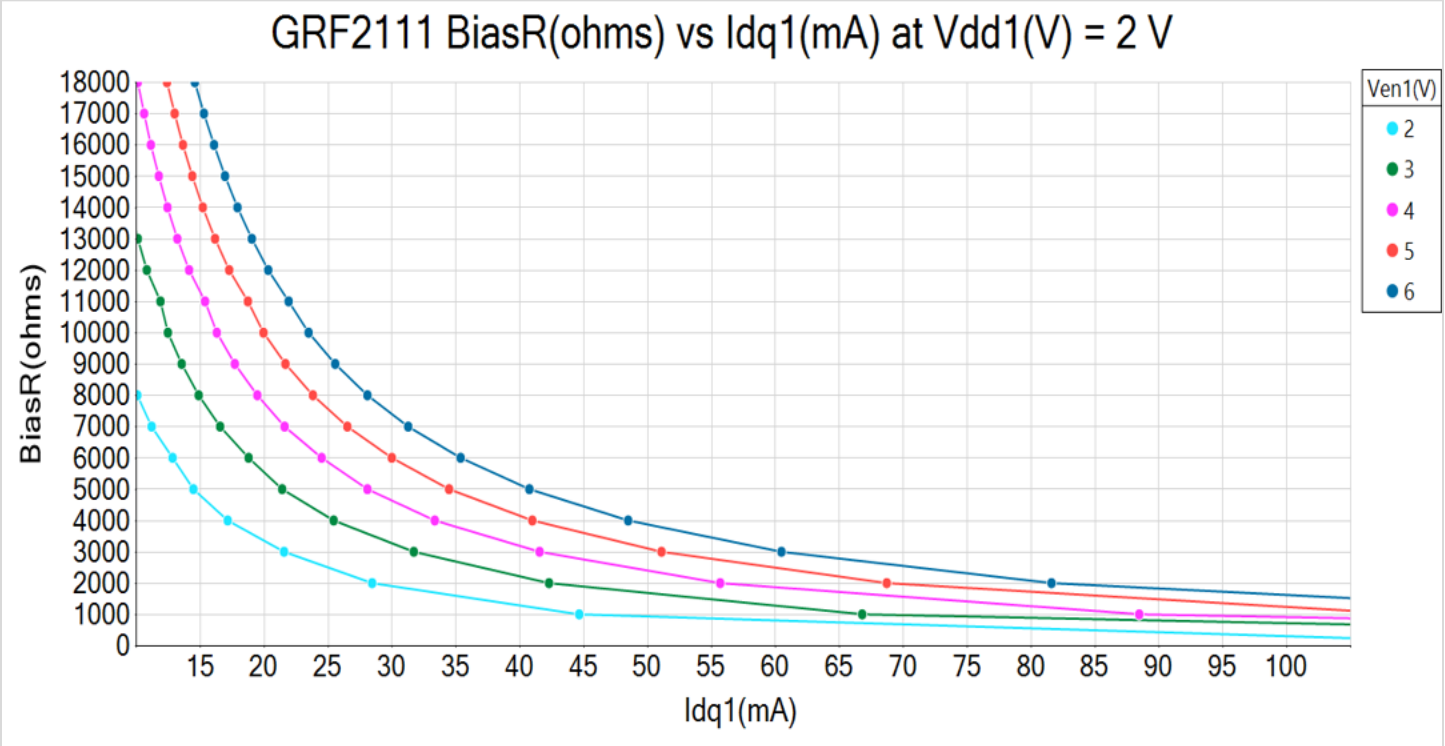
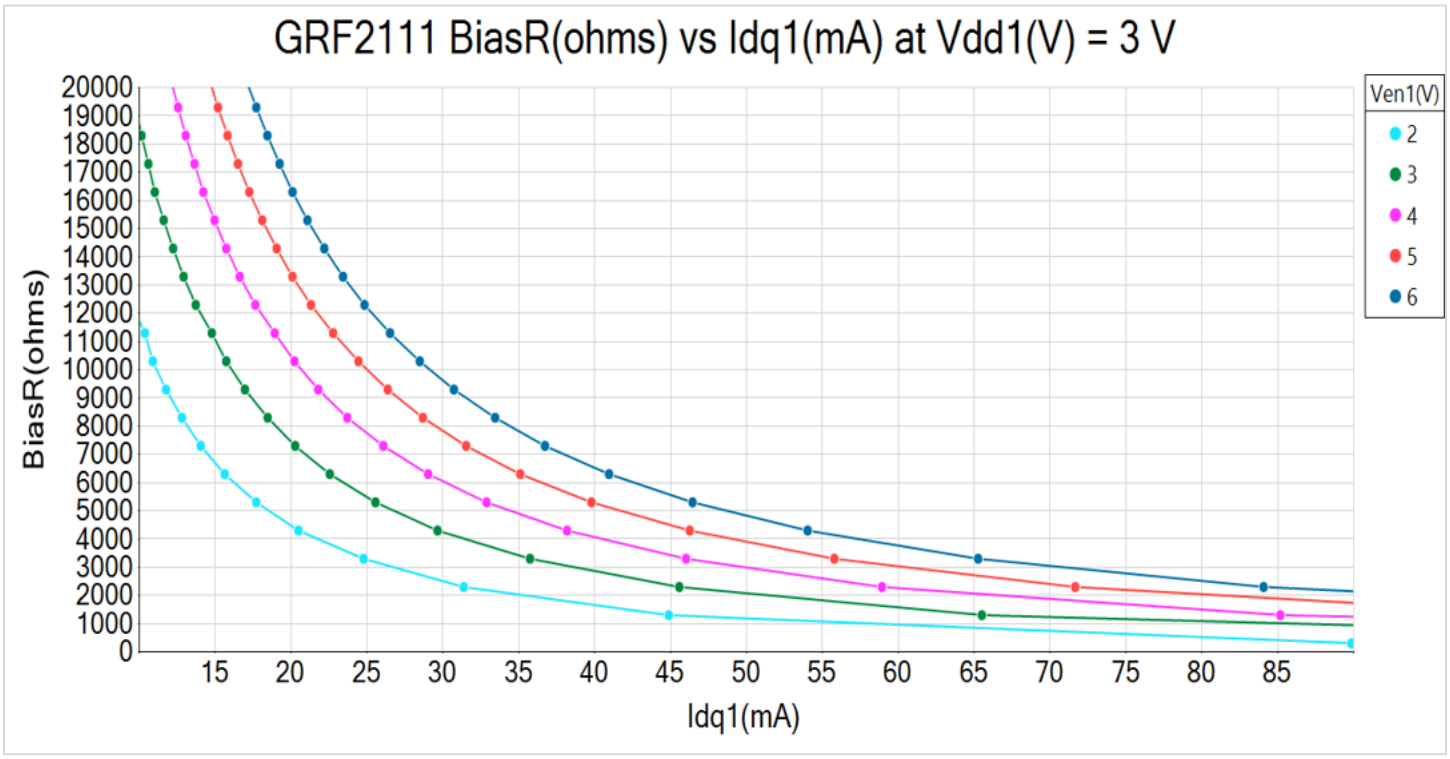
GRF2111 Evaluation Board Assembly Diagram Reference: 8 to 12 GHz Tune

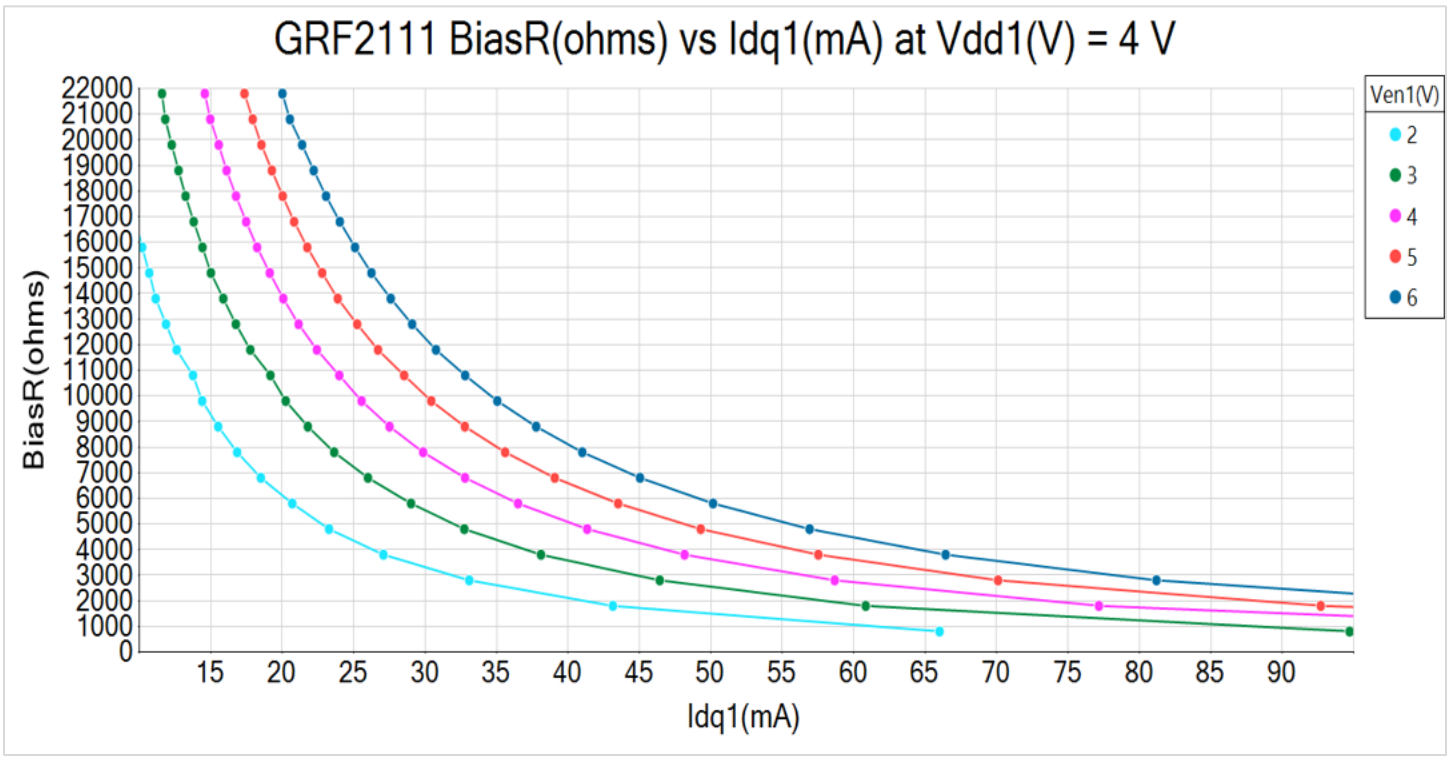
Component	Type	Manufacturer	Family	Value	Package Size	Substitution
M4	Capacitor	Murata	GJM	0.4 pF	0201	ok
M5	Capacitor	Murata	GJM	0.2 pF	0201	ok
M6	Capacitor	Murata	GJM	0.2 pF	0201	ok
M8 (sets I_{DDQ})	Resistor	Various	5%	3.9 kΩ	0402	ok
M10	Capacitor	Murata	GRM	10 µF	0402	ok
M11	Capacitor	Murata	GRM	1000 pF	0201	ok
M12	Capacitor	Murata	GJM	0.2 pF	0201	ok
M13	Inductor (HI-Q)	Murata	LQP-TN	2.7 nH	0201	ok
M18	Capacitor	Murata	GJM	1.0 pF	0201	ok
Evaluation Board	DFN6-15-48-D					

GRF2111 Bias Resistor Selection Curves:



GRF2111 Bias Resistor Selection Curves:





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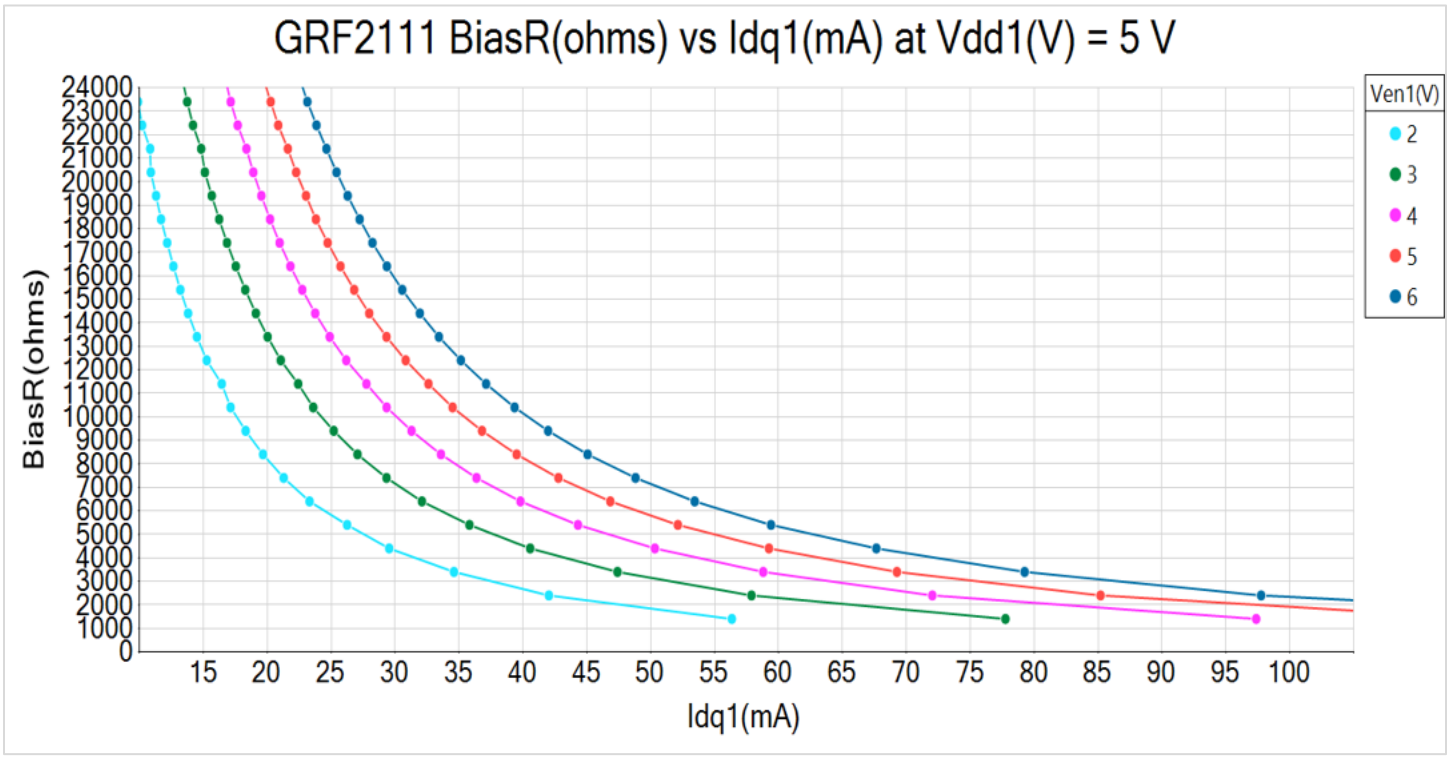
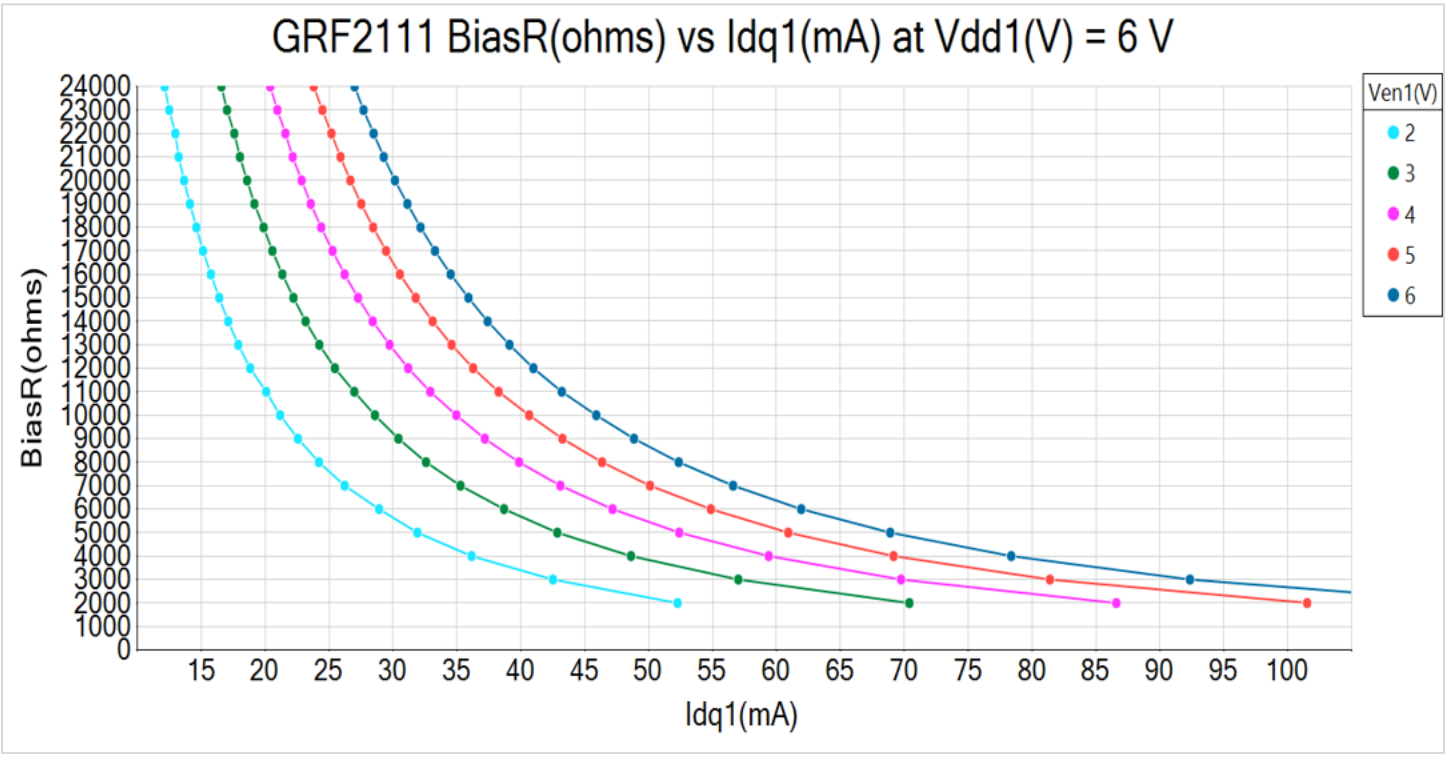
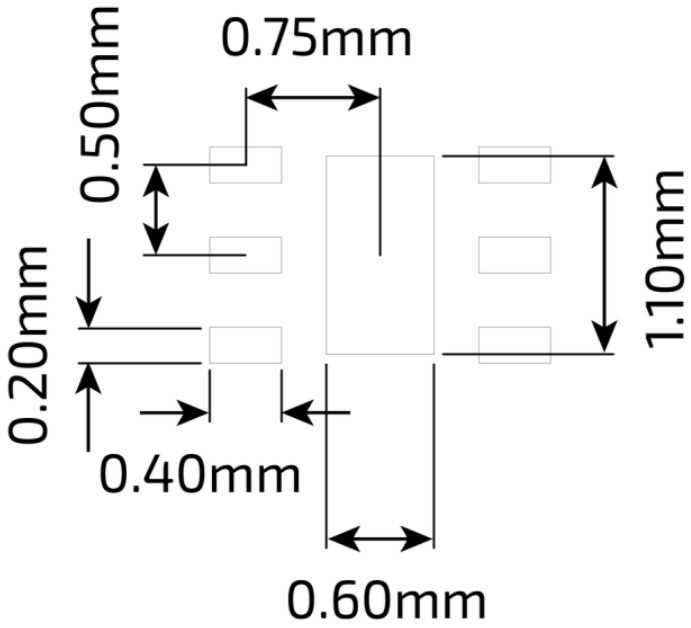
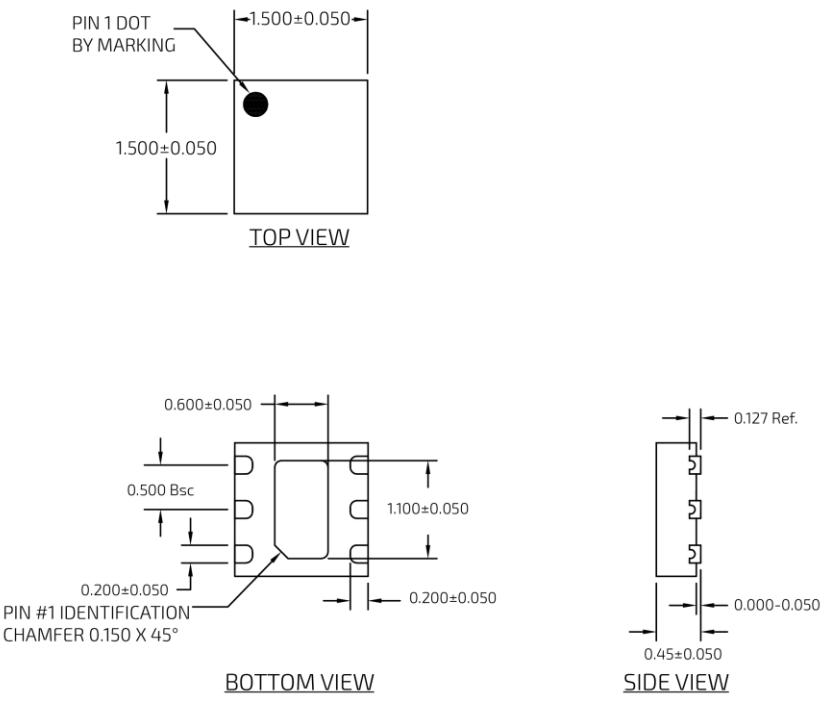
GRF2111 Bias Resistor Selection Curves:







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



DFN-6 1.5 x 1.5 mm Package Dimensions

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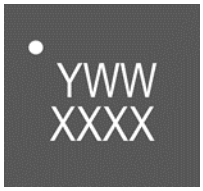
Package Marking Diagram



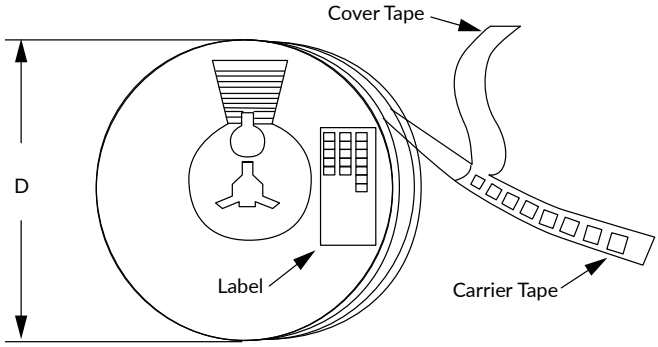
- Line 1: "Y" = YEAR (single digit). "WW" = WORK WEEK the device was assembled.
- Line 2: "XXXX" = Device PART NUMBER.

Tape and Reel Information

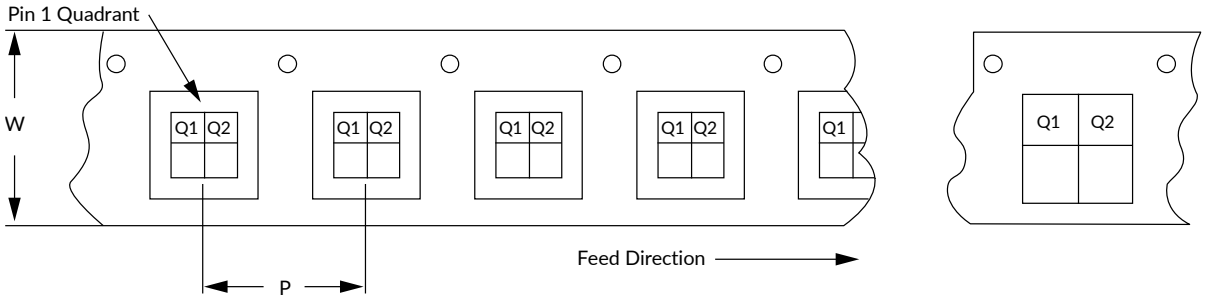
Guerrilla RF's tape and reel specification complies with Electronic Industries Alliance (EIA) standards for "Embossed Carrier Tape of Surface Mount Components for Automatic Handling" (reference EIA-481). See the following page for the Tape and Reel Specification and Device Package Information table, 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
September 5, 2024	Preliminary Data Sheet.
March 26, 2025	Release Ø Data Sheet.
October 8, 2025	Upgraded Data Sheet to new format. No change to device or device specifications.

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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 *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.