



GRF2111

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

References: 5 V / 65 mA / 10 GHz

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

APPLICATIONS

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

ORDERING INFORMATION

Buy it Now

DESCRIPTION

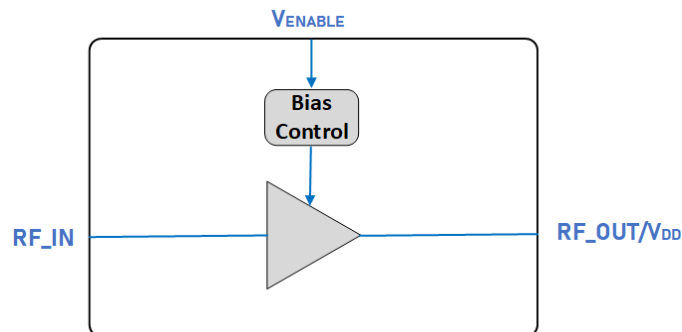
The GRF2111 is a broadband, ultra-low noise linear amplifier designed for X-Band and other high-performance RF applications up to 12 GHz. The standard tune exhibits outstanding noise figure (NF), linearity, return loss and gain flatness from 8 to 12 GHz. The device can be used outside of intended function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

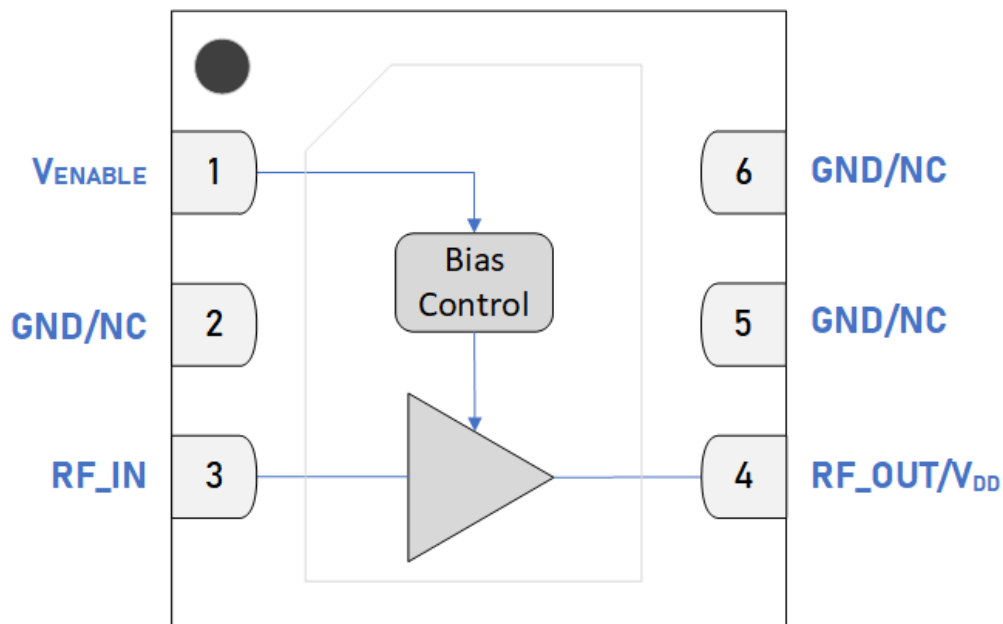
The device can be operated from a supply voltage (V_{DD}) of 2.7 to 6 volts with a typical bias condition of 5 volts and 80 mA for optimal efficiency and linearity.

Please consult 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





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. 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 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}	2.7	6	V
RF Input Power (transient): Load VSWR < 2:1, $V_{DD} = 5\text{ V}$	$P_{IN\text{ MAX}}$		20	dBm
RF Input Power (constant): Load VSWR < 2:1, $V_{DD} = 5\text{ V}$	$P_{IN\text{ MAX}}$		10	dBm
Operating Temperature (package base)	$T_{PKG\text{ BASE}}$	-40	105	°C
Maximum Channel Temperature (MTTF > 10^6 hours)	T_{MAX}		170	°C
Maximum Dissipated Power	$P_{DISS\text{ MAX}}$		500	mW

Electrostatic Discharge

Human Body Model	HBM	TBD		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}	2.7	5	6	V	
Operating Temperature Range	$T_{PKG\ BASE}$	-40		105	°C	
RF Frequency Range	F_{RF}	8		12	GHz	Typical application schematic with external matching components (notes 1 & 2).
RF1 Port Impedance	Z_{RFIN}		50		Ω	Single-ended.
RF2 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: [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

Parameter	Symbol	Specification			Unit	Condition
		Min.	Typ.	Max.		
Supply Current	I_{DD}		65		mA	$V_{DD} = 5\text{ V}$, $V_{ENABLE} = 5\text{ V}$.
Enable Current	I_{ENABLE}		1.1		mA	$V_{DD} = 5\text{ V}$, $V_{ENABLE} = 5\text{ V}$.
Switching Rise Time	T_{RISE}		40		ns	Disabled mode to Gain mode. $P_{OUT} = 0\text{ dBm}$ (note 3) .
Switching Fall Time	T_{FALL}		25		ns	Gain mode to Disabled mode. $P_{OUT} = 0\text{ dBm}$ (note 4) .

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}		83		$^{\circ}\text{C/W}$	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} .

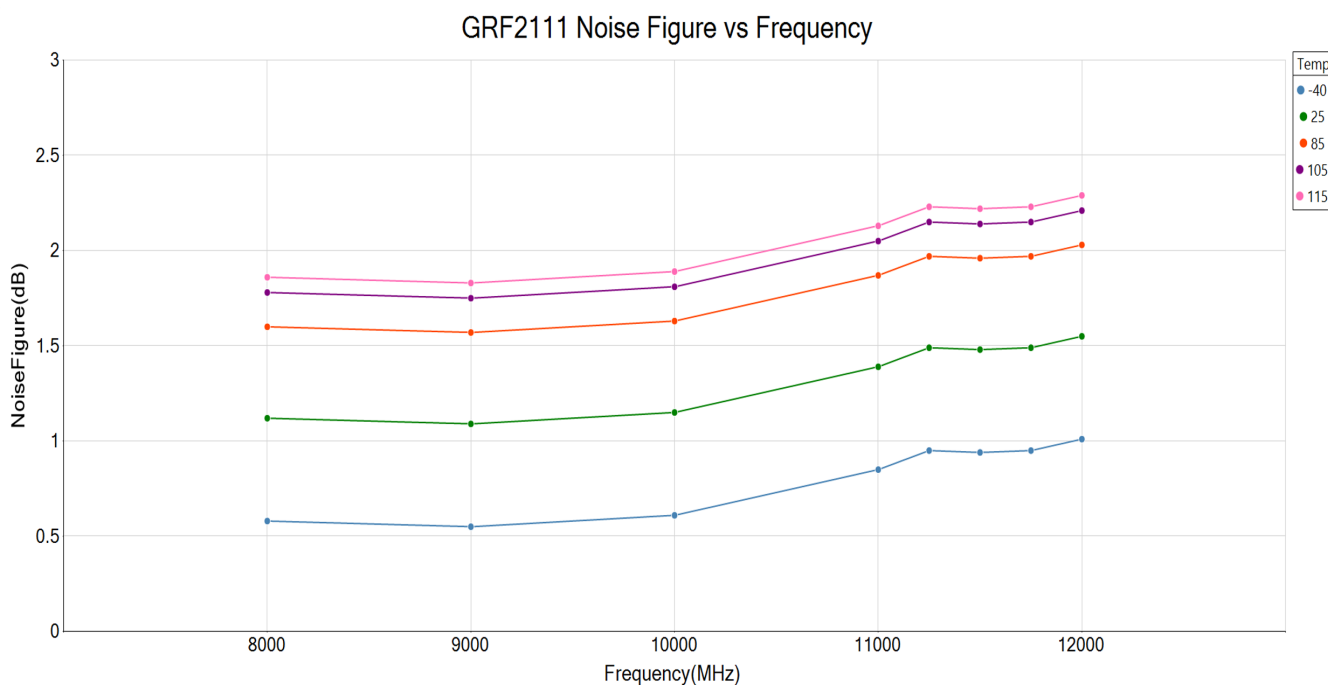
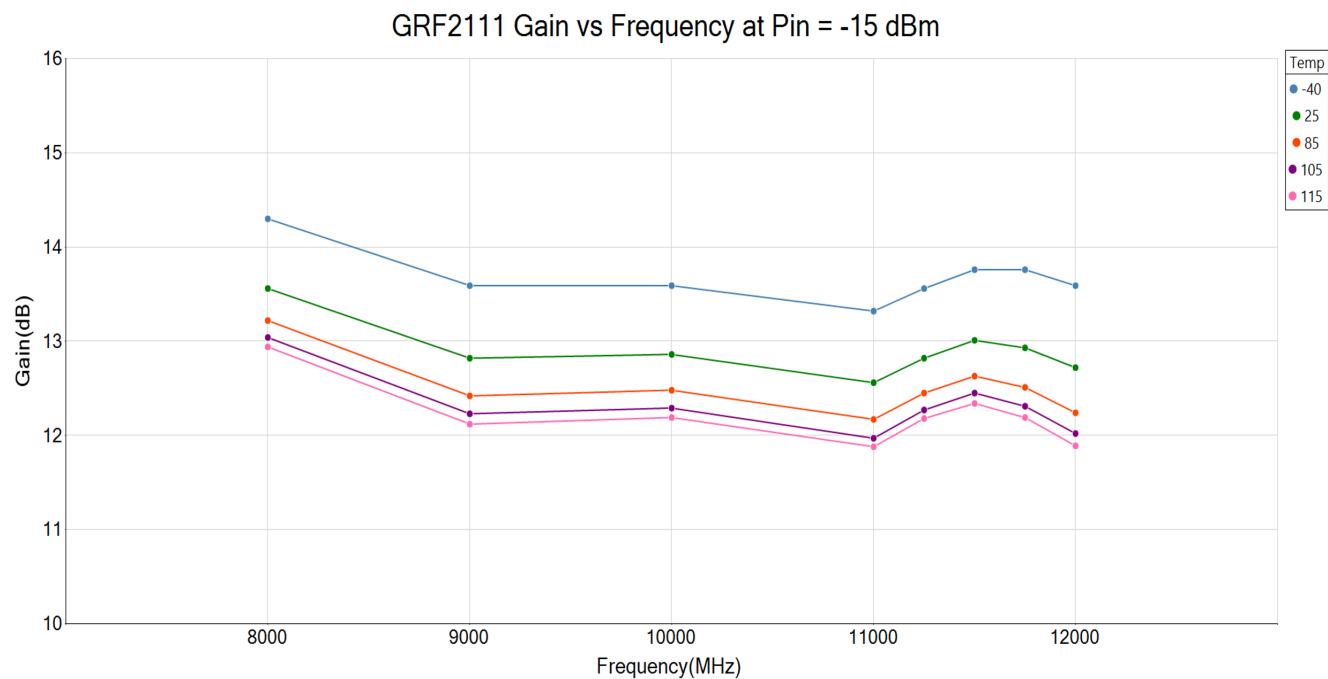
Note 5: MTTF > 10^6 hours for $T_j \leq 170\text{ }^{\circ}\text{C}$.

Nominal Operating Parameters - RF

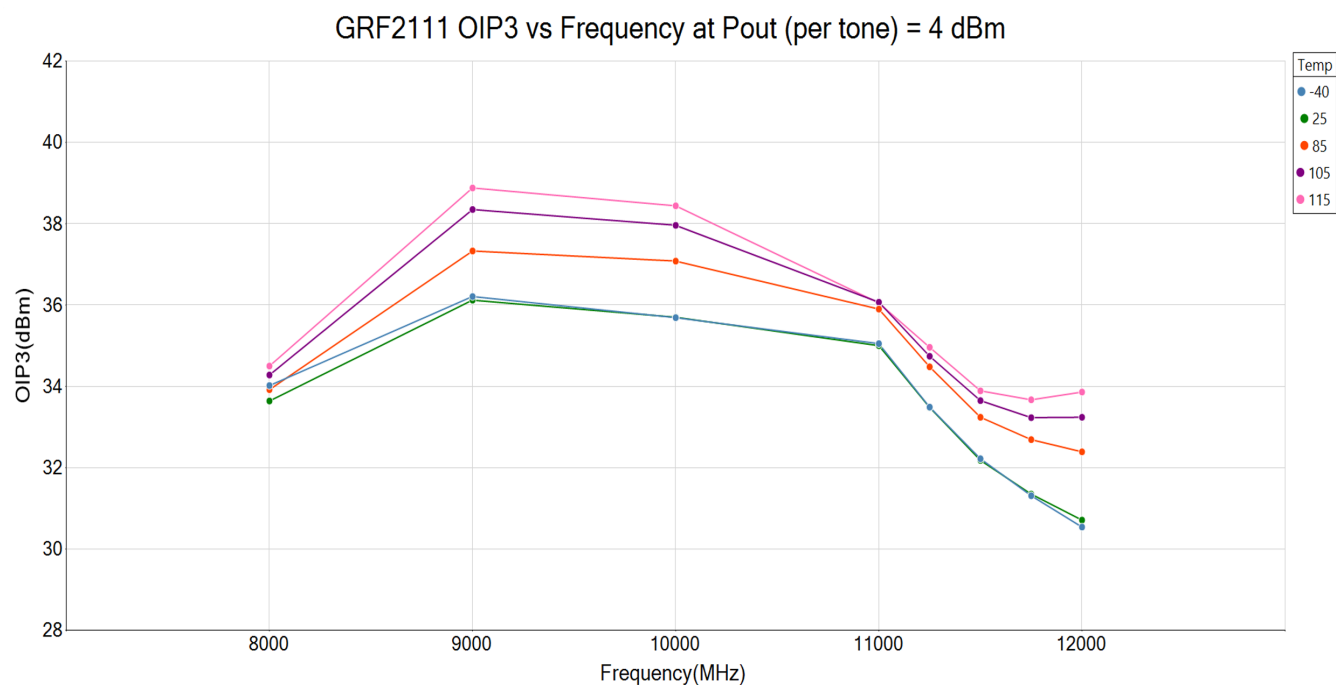
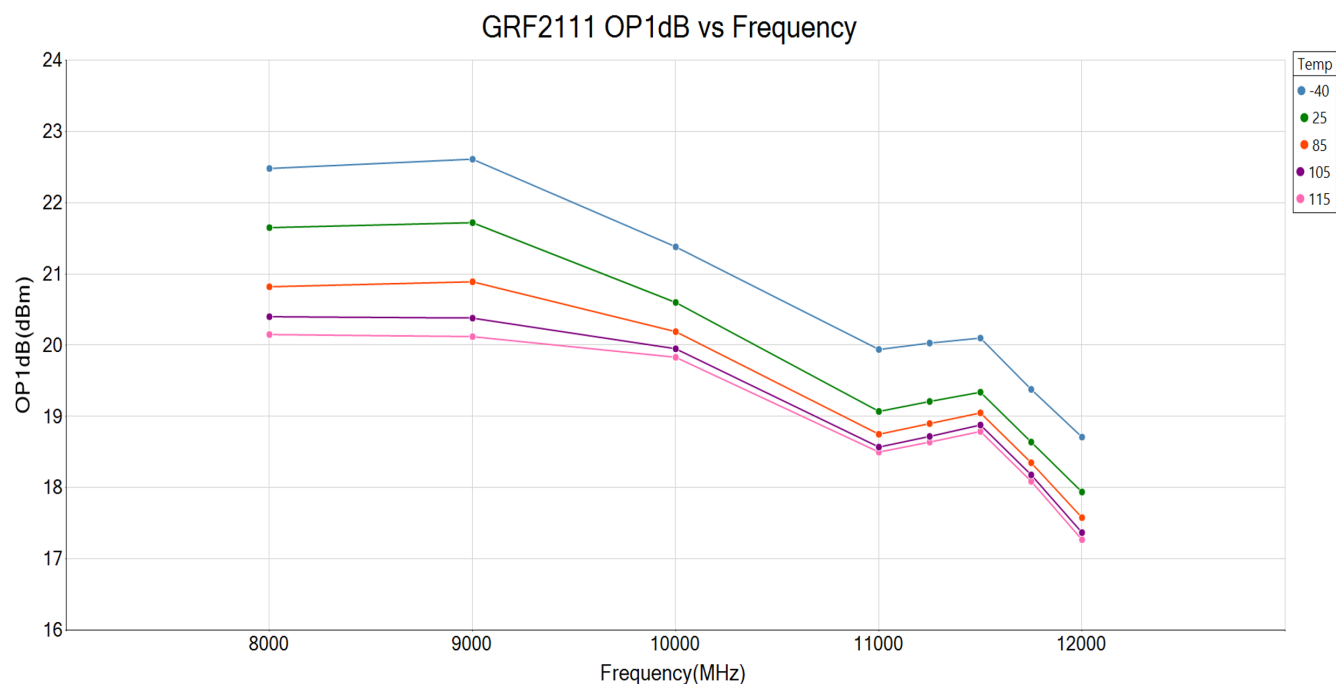
The following conditions apply unless noted otherwise: typical application schematic, $V_{DD} = 5\text{ V}$, $F_{TEST} = 10\text{ GHz}$, $50\ \Omega$ system impedance, $T_{PKG\ BASE} = 25\text{ }^{\circ}\text{C}$. Evaluation board losses are included within the specifications.

Parameter	Symbol	Specification			Unit	Condition
		Min.	Typ.	Max.		
Gain	S21		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	

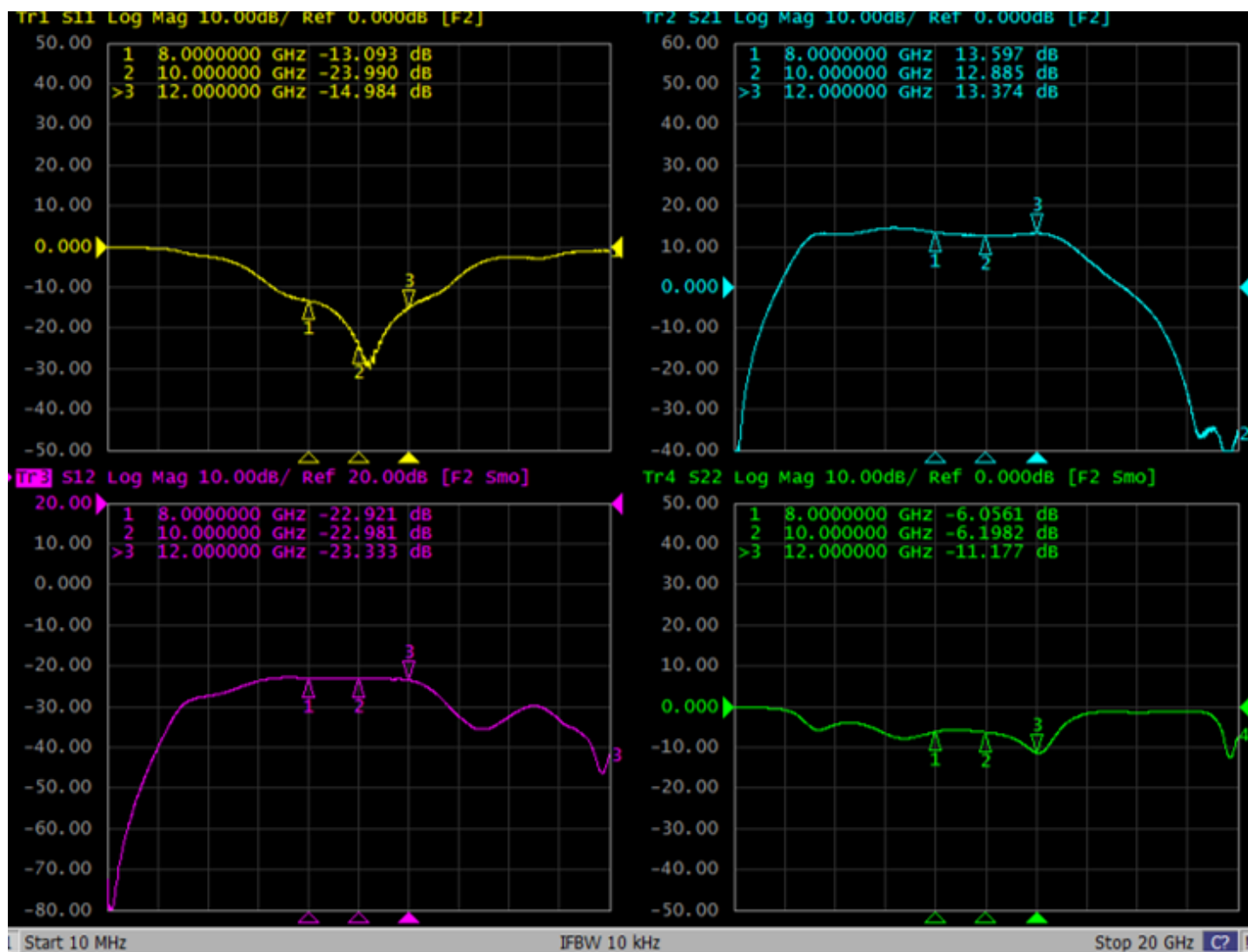
GRF2111 Typical Operating Curves: 8 to 12 GHz



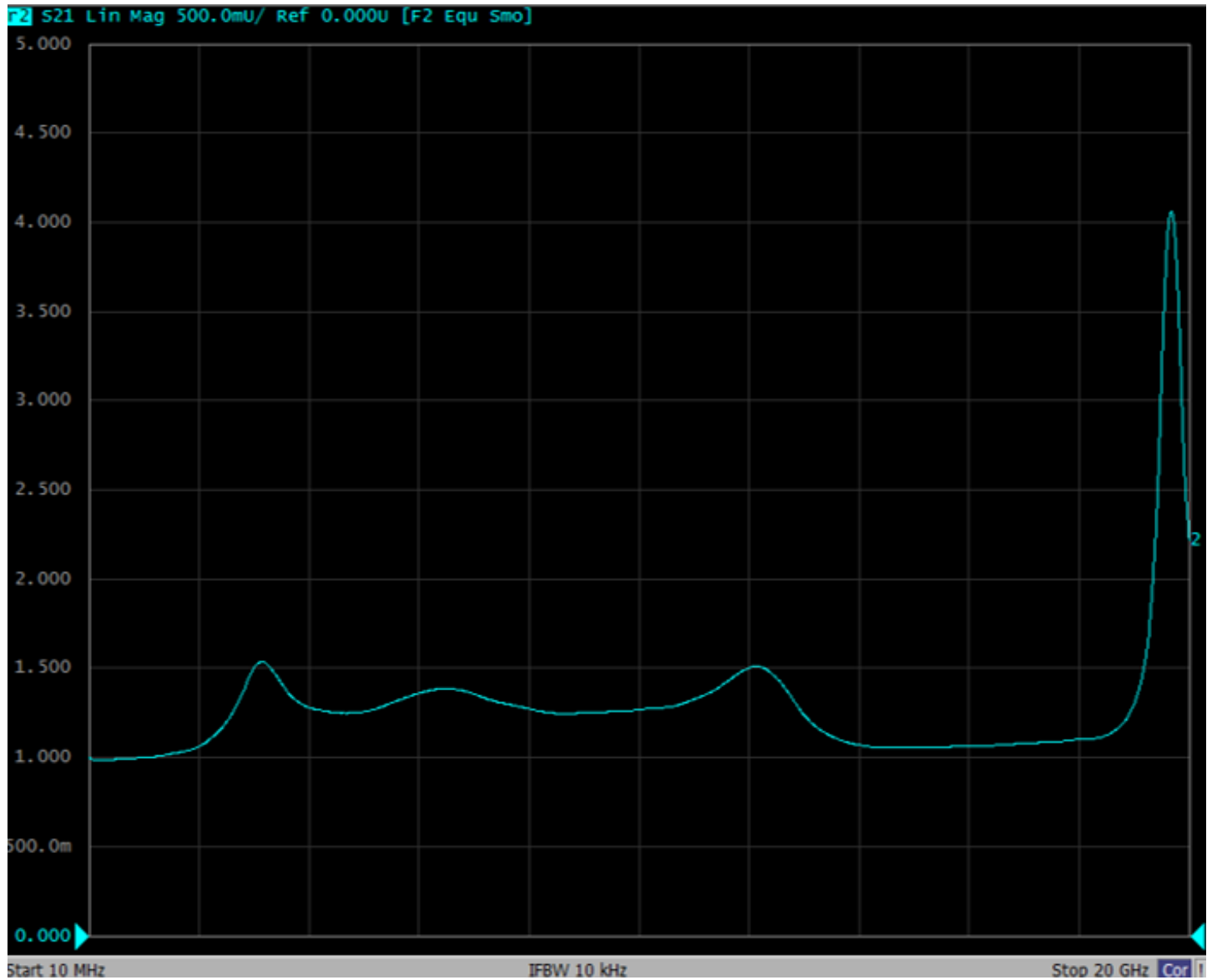
GRF2111 Typical Operating Curves: 8 to 12 GHz



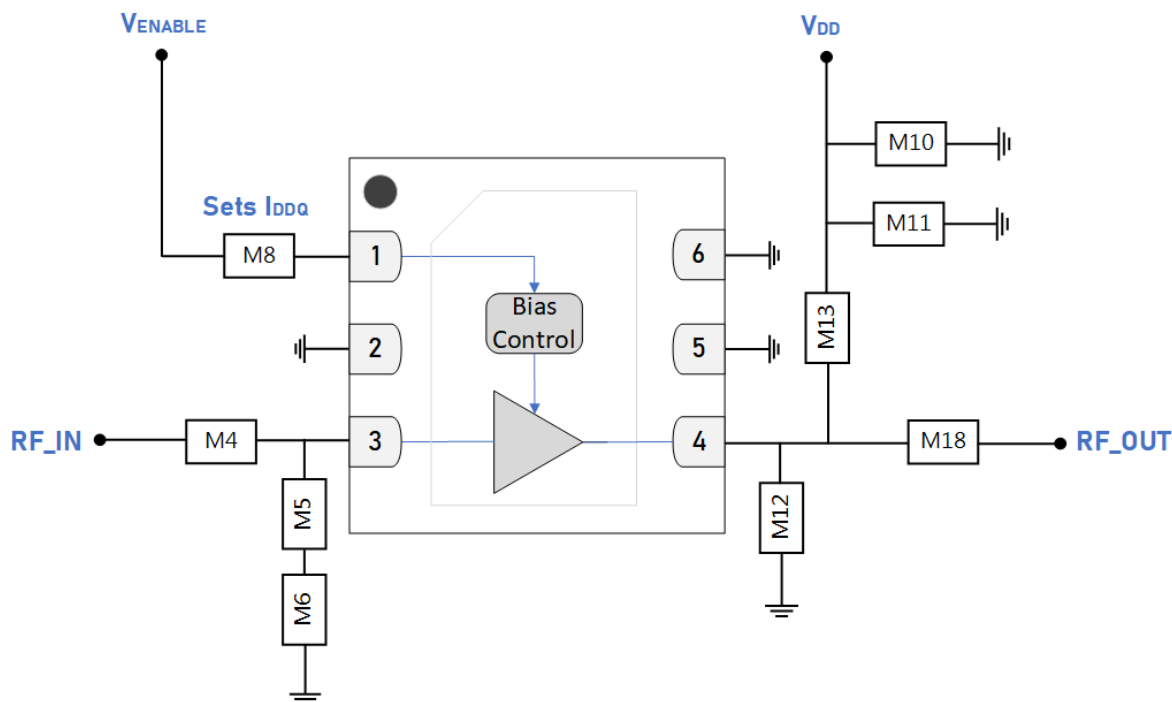
GRF2111 Typical Operating Curves: S-Parameters (8 to 12 GHz Tune)



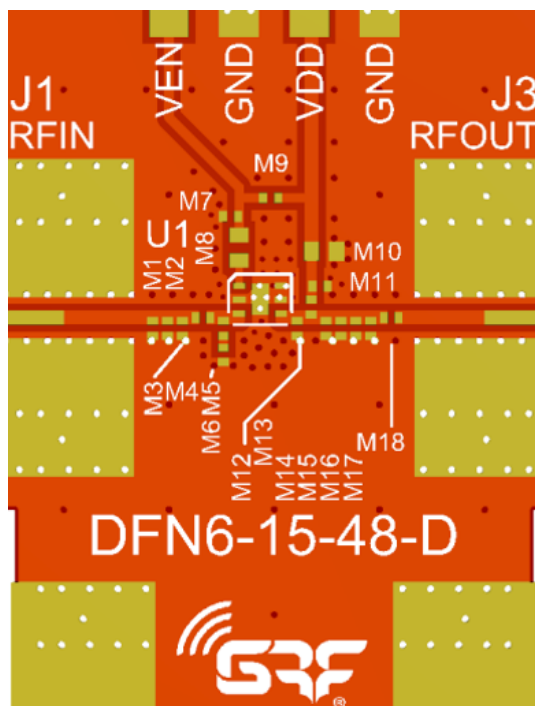
GRF2111 Typical Operating Curves: Stability Mu (10 MHz to 20 GHz)



Note: Mu Factor ≥ 1.0 implies unconditional stability.



GRF2111 Standard Evaluation Board Schematic



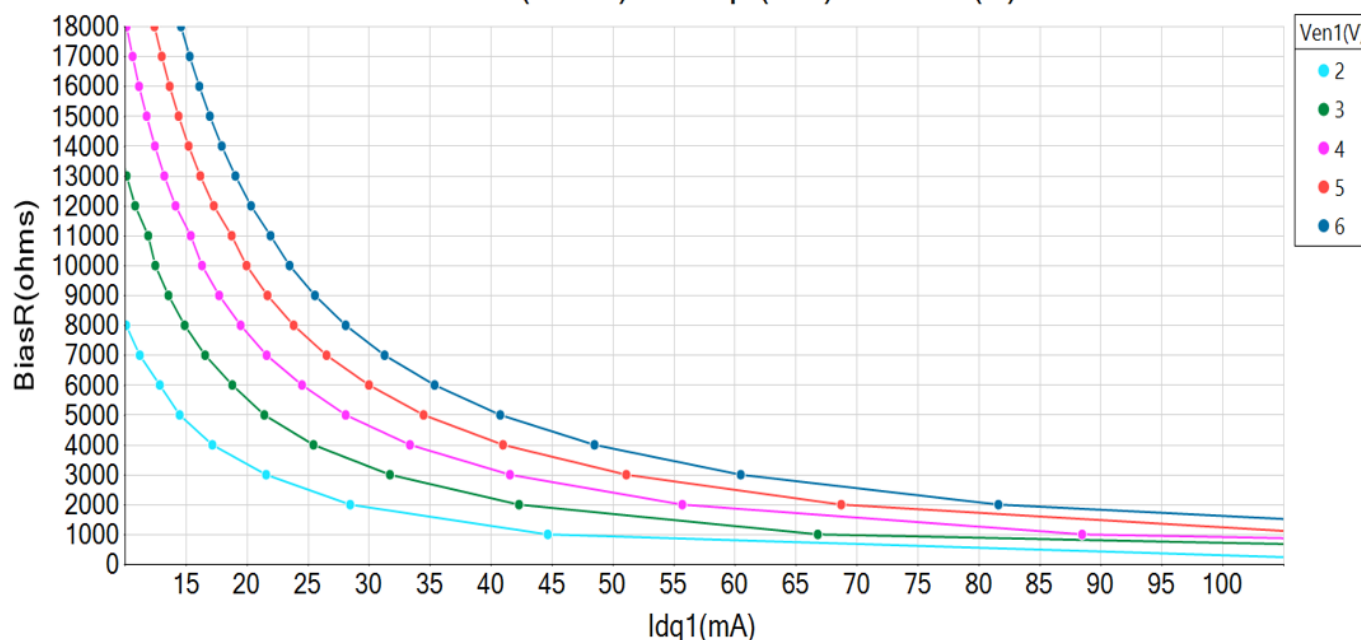
GRF2111 Evaluation Board Assembly Diagram

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 k Ω	0402	ok
M10	Capacitor	Murata	GRM	10 μ F	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					

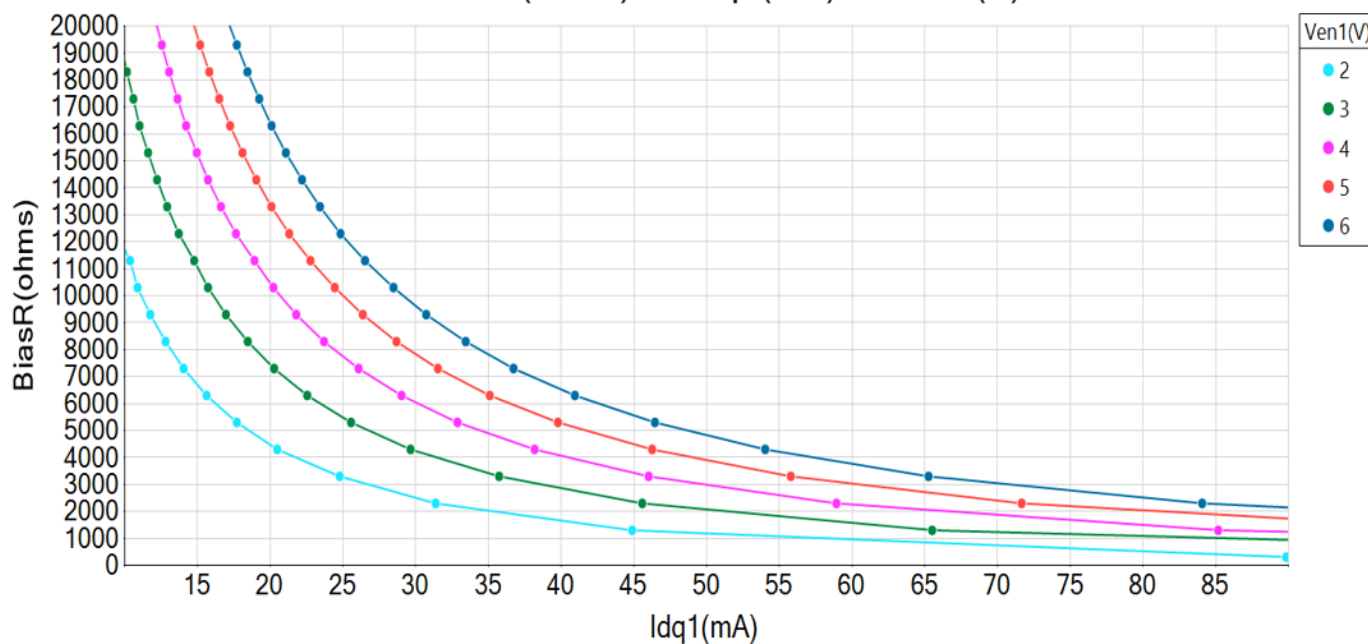
GRF2111 Bias Resistor Selection Curves:

GRF2111 BiasR(ohms) vs Idq1(mA) at Vdd1(V) = 2 V

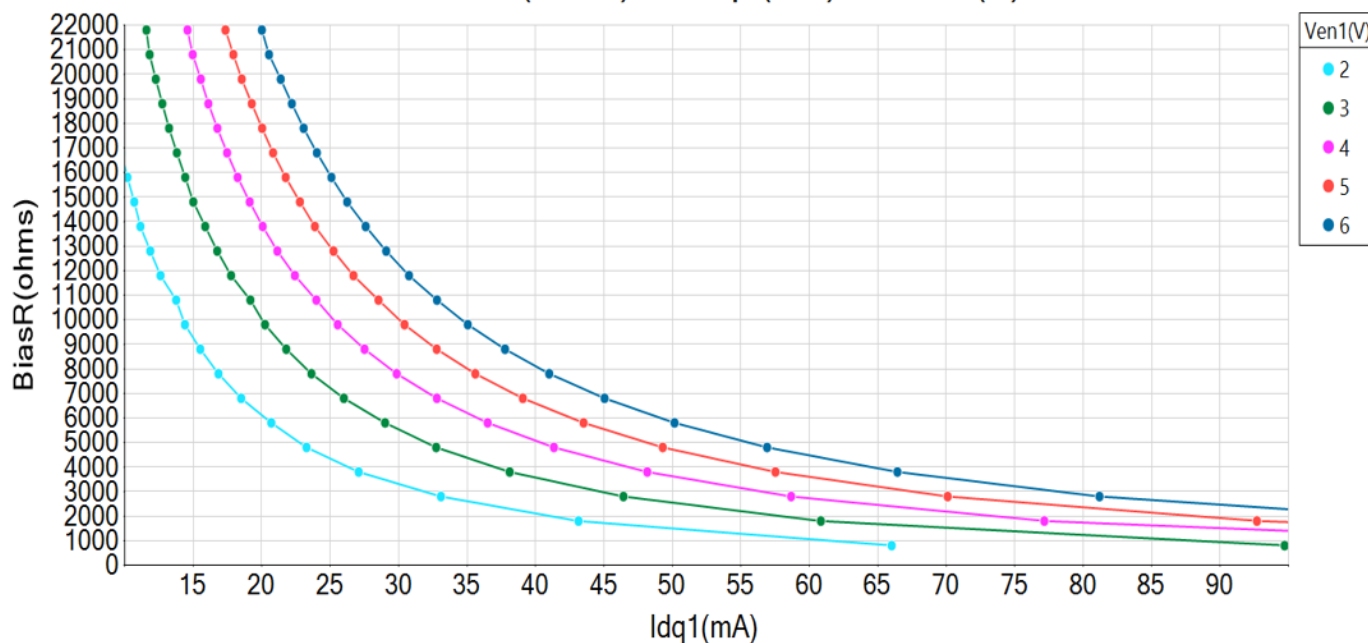


GRF2111 Bias Resistor Selection Curves:

GRF2111 BiasR(ohms) vs Idq1(mA) at Vdd1(V) = 3 V

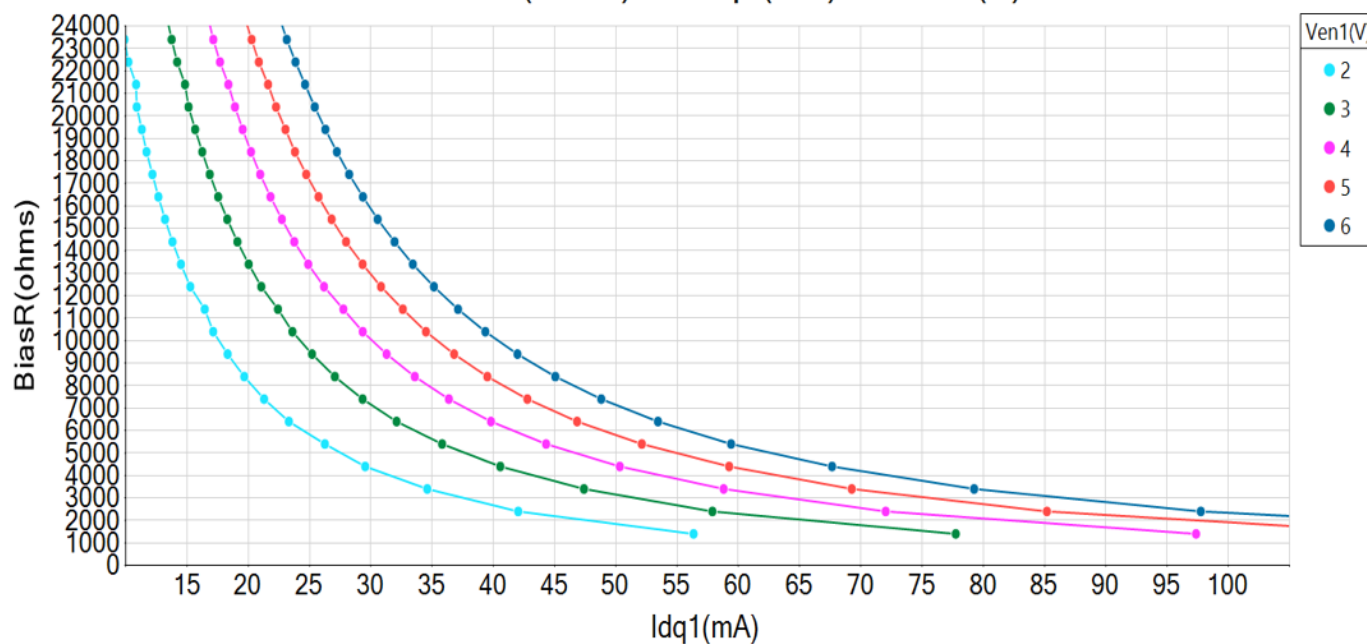


GRF2111 BiasR(ohms) vs Idq1(mA) at Vdd1(V) = 4 V

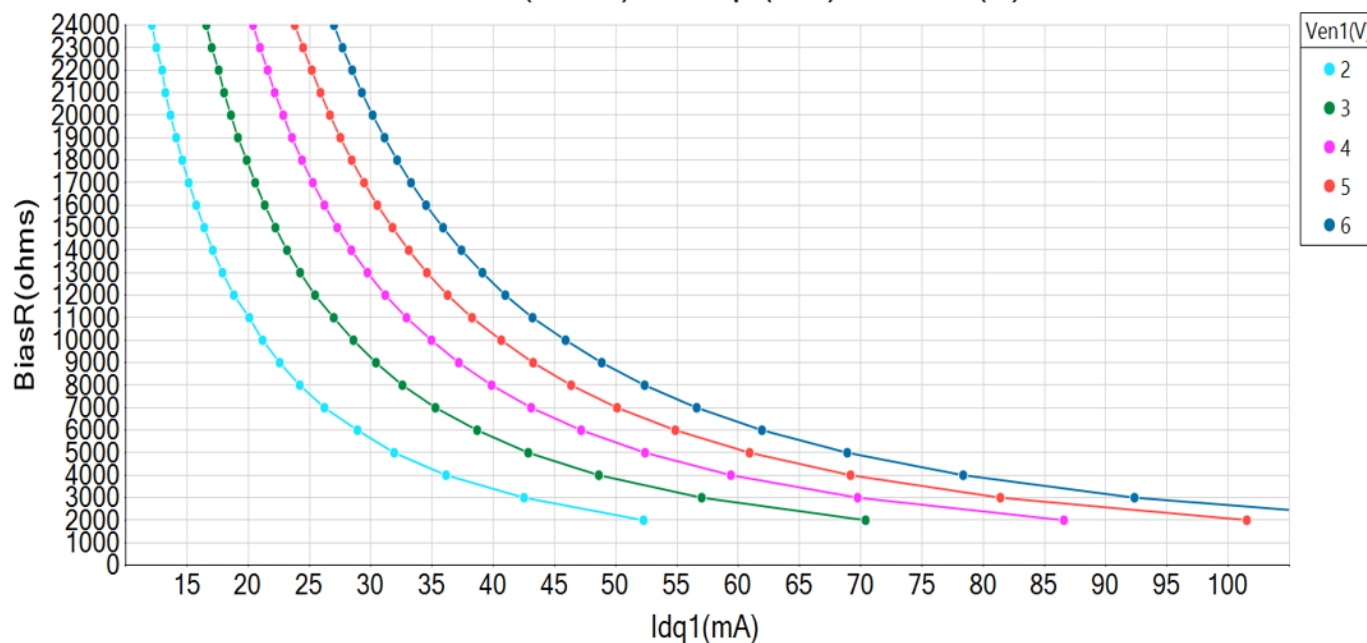


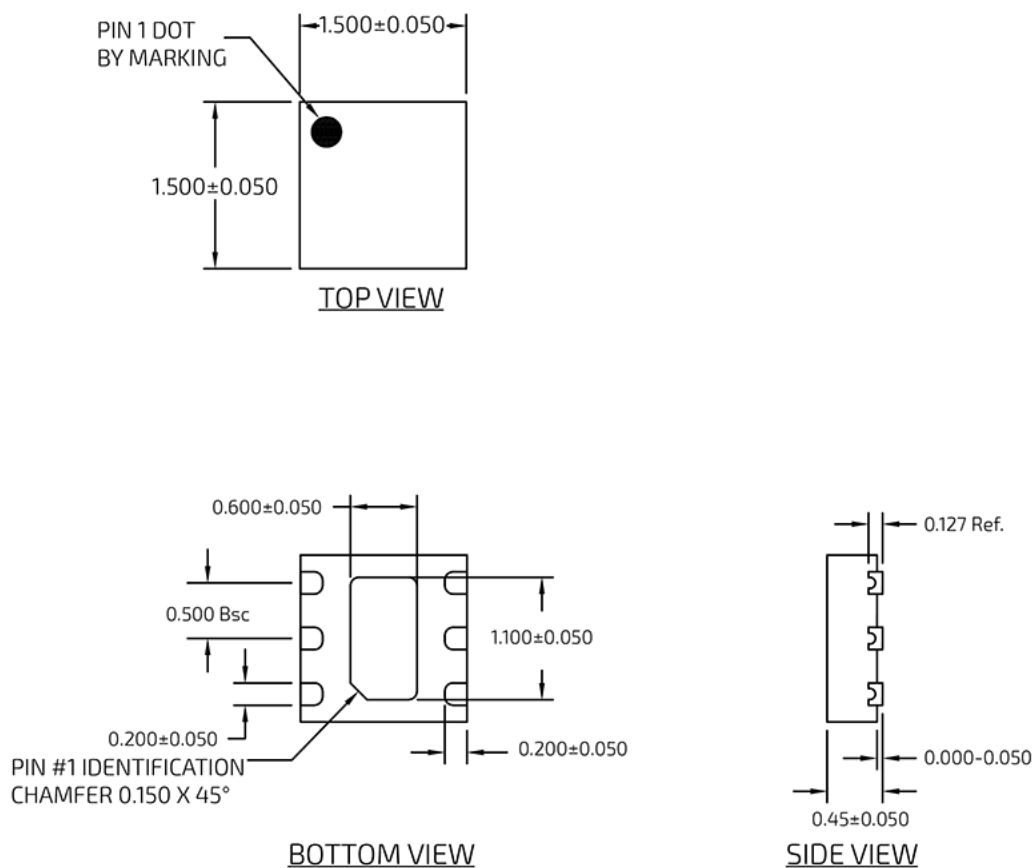
GRF2111 Bias Resistor Selection Curves:

GRF2111 BiasR(ohms) vs Idq1(mA) at Vdd1(V) = 5 V

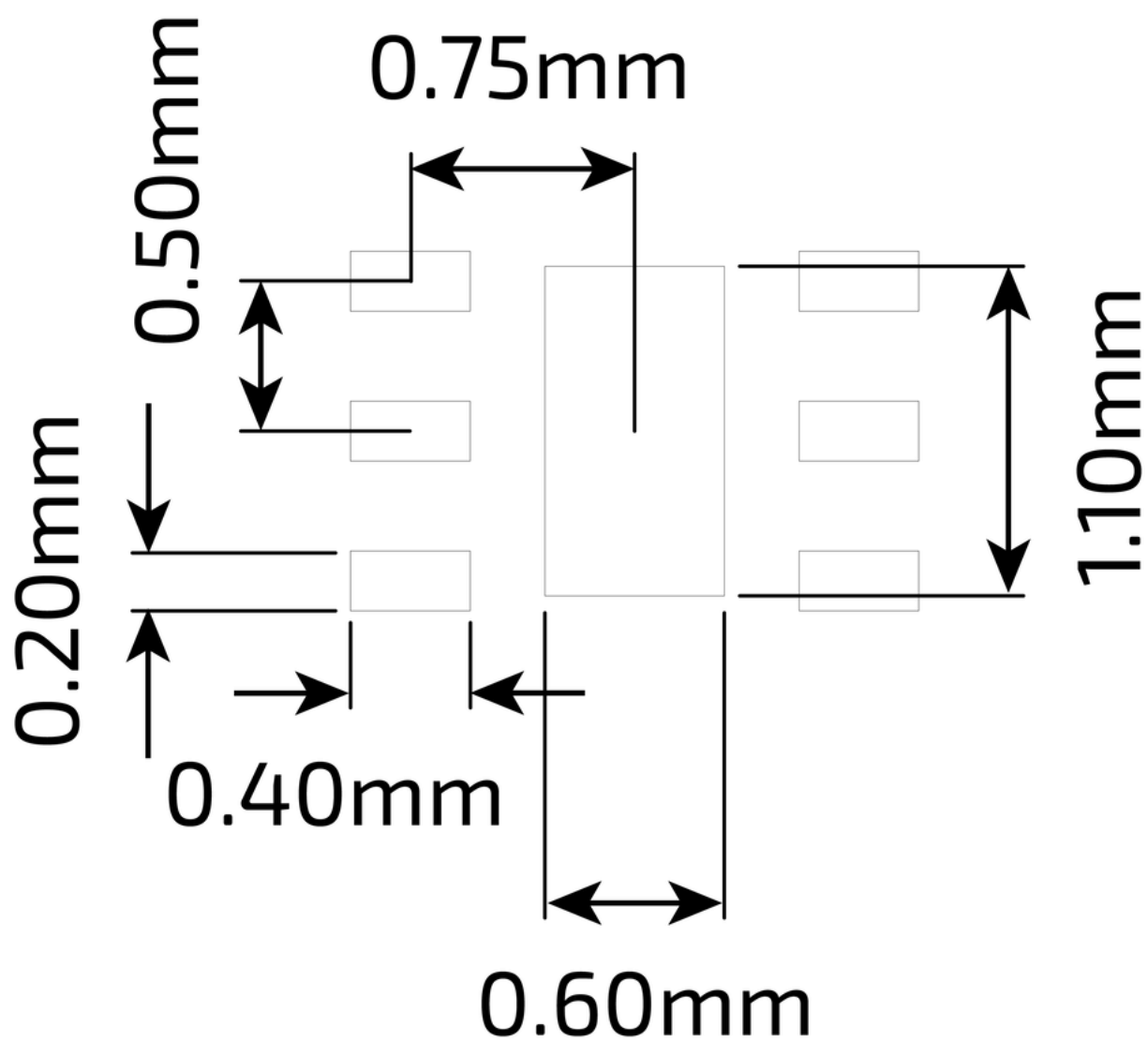


GRF2111 BiasR(ohms) vs Idq1(mA) at Vdd1(V) = 6 V





DFN 6 1.5x1.5mm Package Dimensions



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

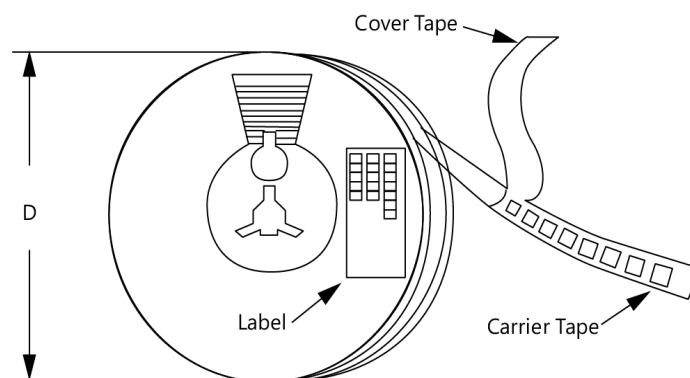
Package Marking Diagram



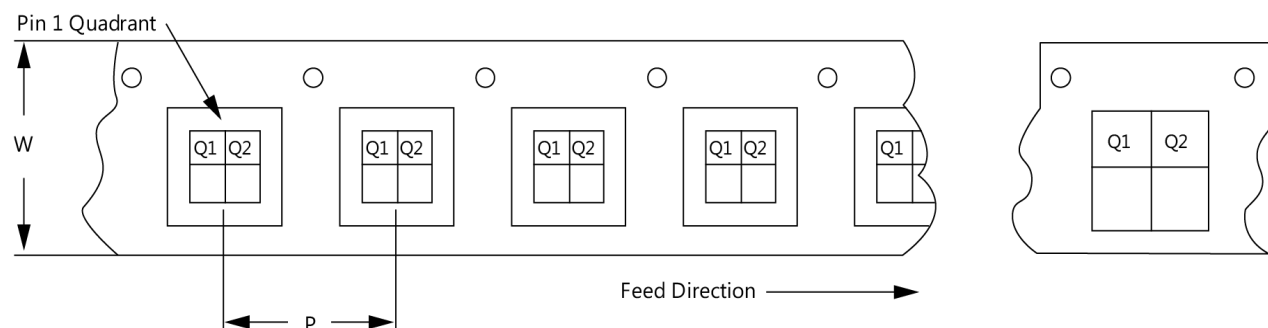
Line 1: "Y" = YEAR (single digit). "WW" = WORK WEEK the Device was assembled.
Line 2: "XXXX" = Device Part Number.

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



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RELEASE Ø DATA SHEET

Revision History

Revision Date	Description of Change
September 5, 2024	Preliminary Data Sheet.
March 26, 2025	Release Ø Data Sheet.



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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