



GRF3044

Broadband Gain Block

0.01 to 12 GHz

RELEASE Ø DATA SHEET

FEATURES

Reference: 7 V / 100 mA / 4 GHz

- Gain: 16.7 dB
- OP1dB: 19.5 dBm
- OIP3: 28.3 dBm
- Evaluation Board Noise Figure: 2.4 dB
- Internally matched to 50 Ω
- Process: GaAs pHEMT

APPLICATIONS

- Microwave Backhaul
- C and X-Band Amplifiers
- General Purpose Amplifiers
- Instrumentation

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DESCRIPTION

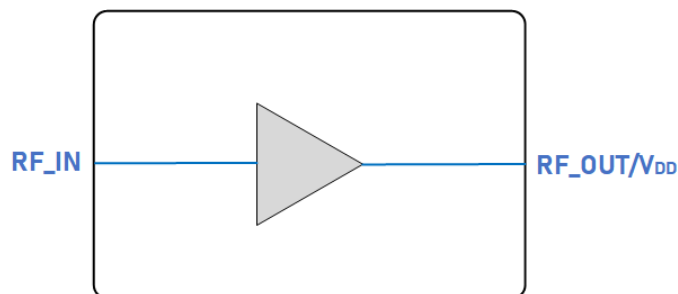
The GRF3044 is a broadband, low noise gain block designed for applications up to 12 GHz. The resistively-biased device employs an external resistor in series with V_{DD} to set a nominal I_{DDQ} of 100 mA. It is internally matched to 50 Ω at the input and output ports.

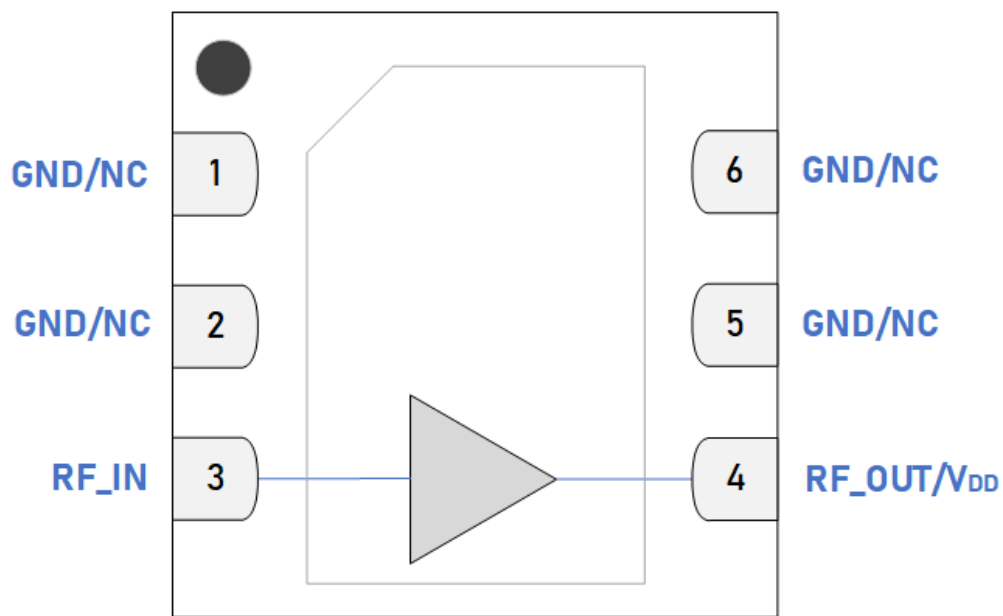
The device can be operated down to low frequency via the selection of suitably large input/output capacitors and bias inductor.

Please consult with the GRF applications engineering team for custom biasing options. Device de-embedded S-parameters are available on the website landing page.

Additional tunes can be found on the GRF3044 “Custom Tunes” product page: [GRF3044 Custom Tunes](#)

BLOCK DIAGRAM





Pin Out (Top View)

Pin Assignments

Pin	Name	Description	Note
1, 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	Internally matched to 50 Ω. An external DC blocking capacitor must be used.
4	RF_OUT/V _{DD}	RF Output	Internally matched to 50 Ω. 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	12	V
RF Input Power: CW, Load VSWR < 2:1, $I_{DDQ} = 100$ mA	$P_{IN\ MAX}$		21	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	$P_{DISS\ MAX}$		700	mW

Electrostatic Discharge

Human Body Model	HBM	1000		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}	6	7	12	V	
Operating Temperature Range	$T_{PKG\ BASE}$	-40		105	°C	
RF Frequency Range	FRF	0.01	4	12	GHz	Typical Application Schematic with external matching components (note 1 & 2) .
RF_IN Port Impedance	Z_{RFIN}		50		Ω	
RF_OUT Port Impedance	Z_{RFOUT}		50		Ω	

Note 1: Operation outside of this range is supported by using different custom tunes. Examples of other optimized tunes can be found here: [GRF3044 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}		100		mA	$V_{DD} = 7\text{ V}$. $R_{bias} = 13\ \Omega$.

Thermal Data

Thermal Resistance (Infrared Scan)	Θ_{JC}		102		$^{\circ}\text{C}/\text{W}$	On standard evaluation board (note 3) .
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Note 3: MTTF > 10^6 hours for $T_J \leq 170\ ^{\circ}\text{C}$

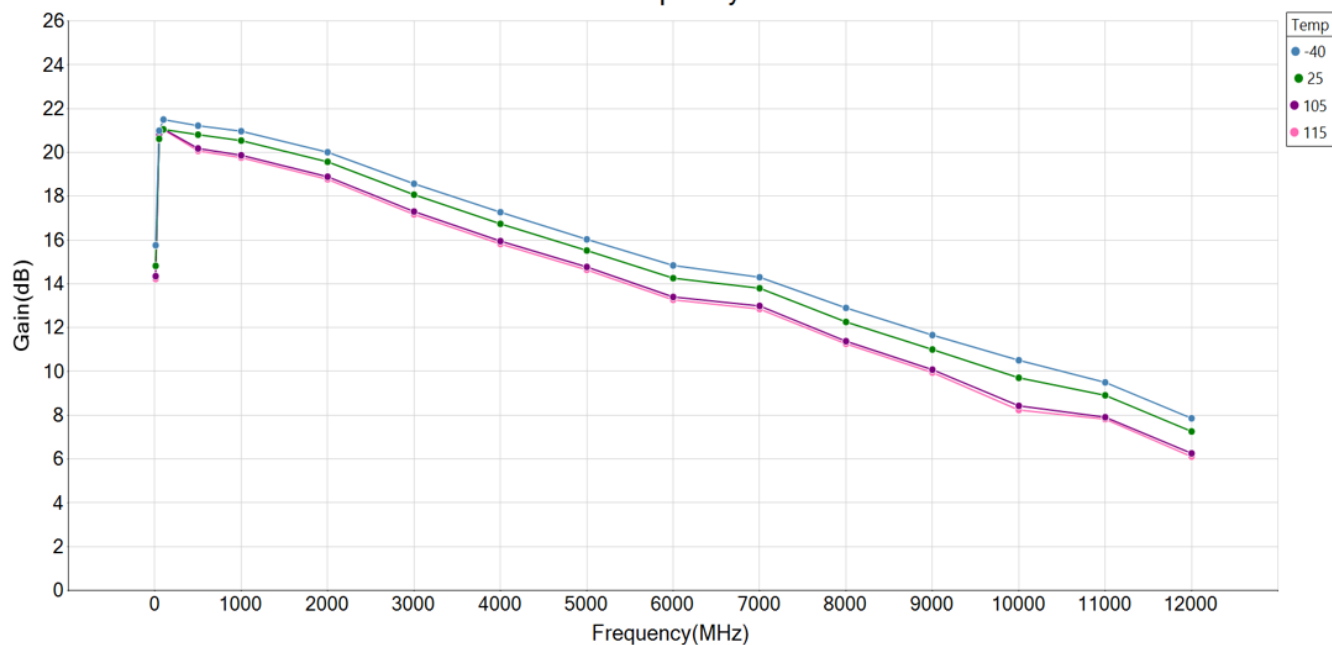
Nominal Operating Parameters - RF

The following conditions apply unless noted otherwise; Typical Application Schematic, $V_{DD} = 7\text{ V}$, $I_{DD} = 100\text{ mA}$, $M4 = 13\ \Omega$, $50\ \Omega$ system impedance, $F_{TEST} = 4\text{ GHz}$, $T_{PKG\ HEAT\ SINK} = 25\text{ }^{\circ}\text{C}$. Evaluation board losses are included within the specifications.

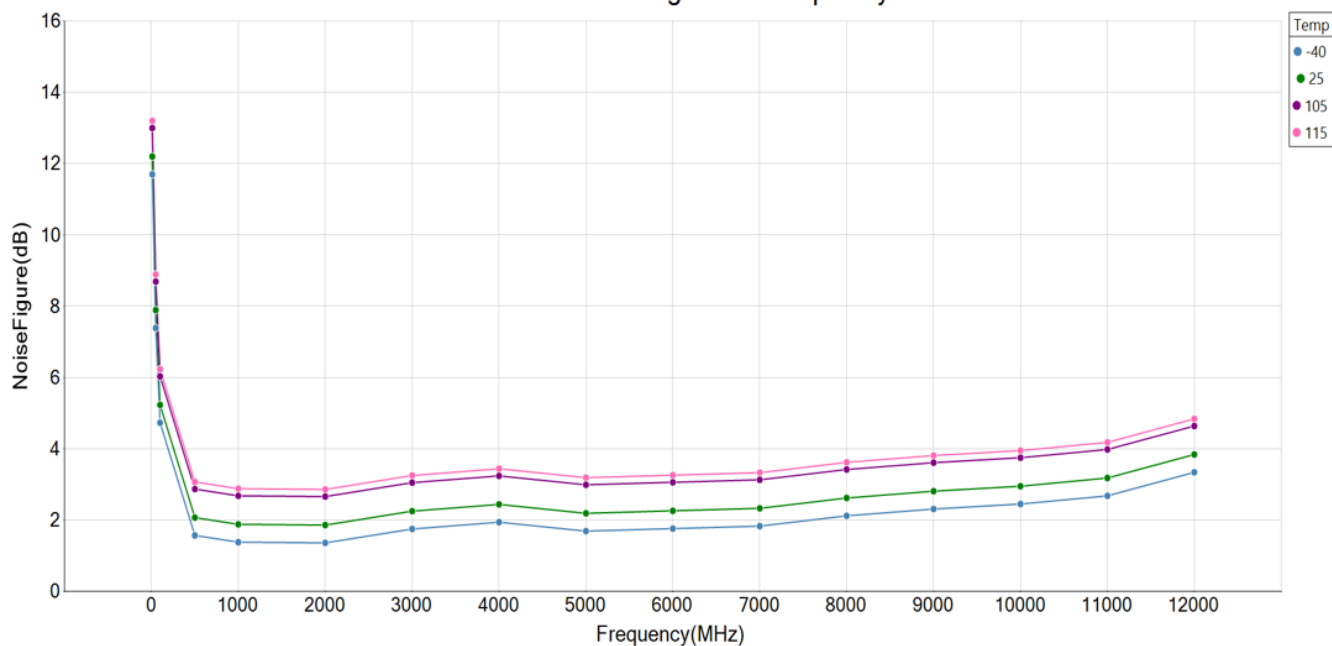
Parameter	Symbol	Specification			Unit	Condition
		Min.	Typ.	Max.		
Gain	S21	15.6	16.7		dB	
Output 3rd Order Intercept Point	OIP3		28.3		dBm	2 dBm P_{OUT} per tone at 2 MHz spacing (3999 and 4001).
Output 1 dB Compression Power	OP1dB	18.8	19.5		dBm	
Noise Figure	NF		2.4		dB	On standard evaluation board (does not include board trace losses).

GRF3044 Typical Operating Curves: 0.1 to 12 GHz

GRF3044 Gain vs Frequency at Pin = -20 dBm

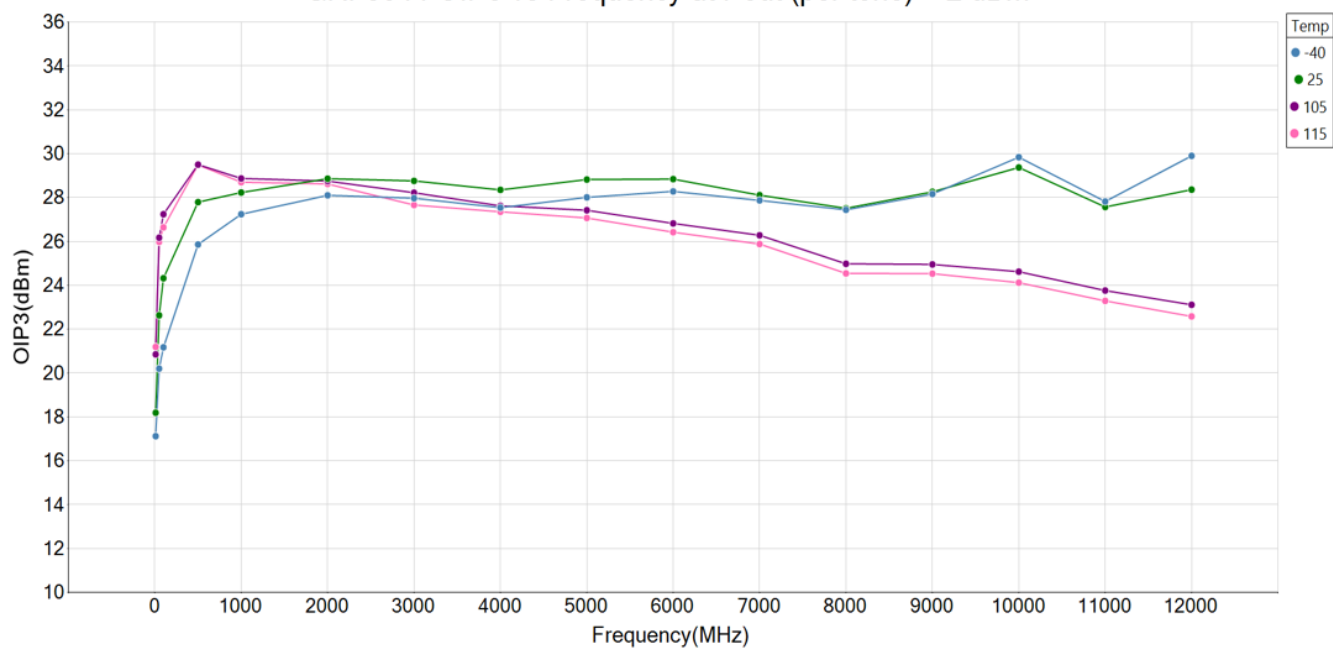


GRF3044 Noise Figure vs Frequency

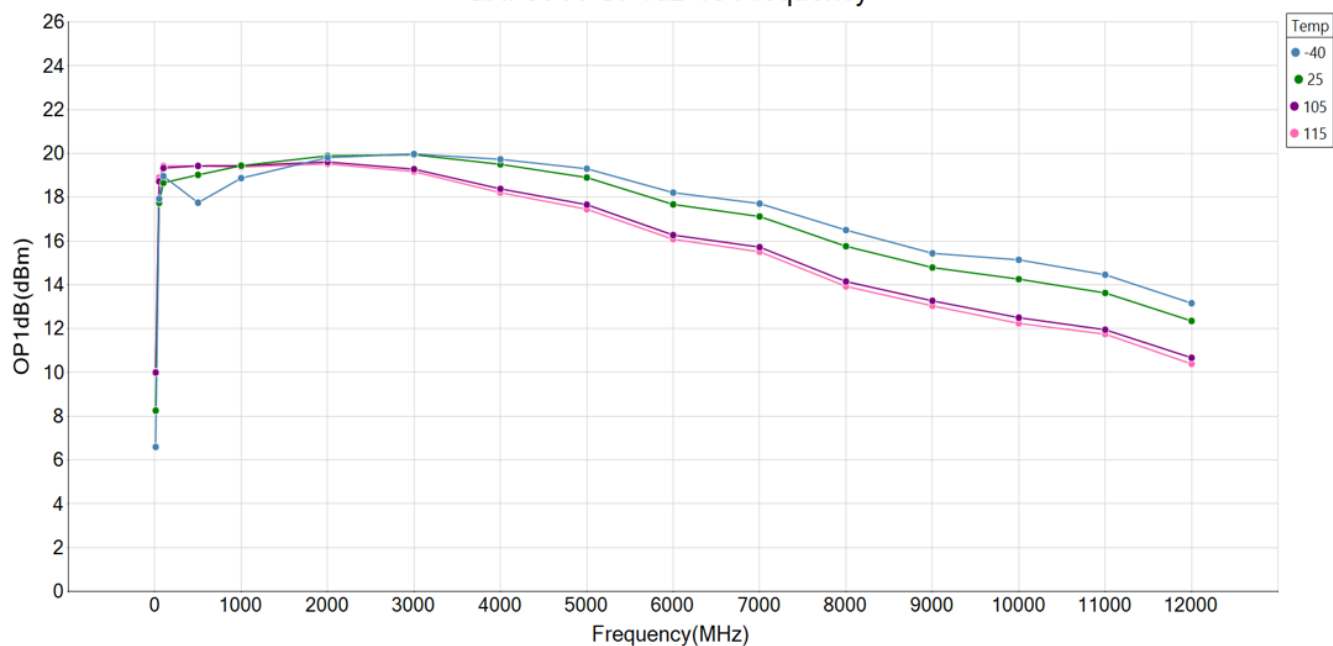


GRF3044 Typical Operating Curves: 0.1 to 12 GHz

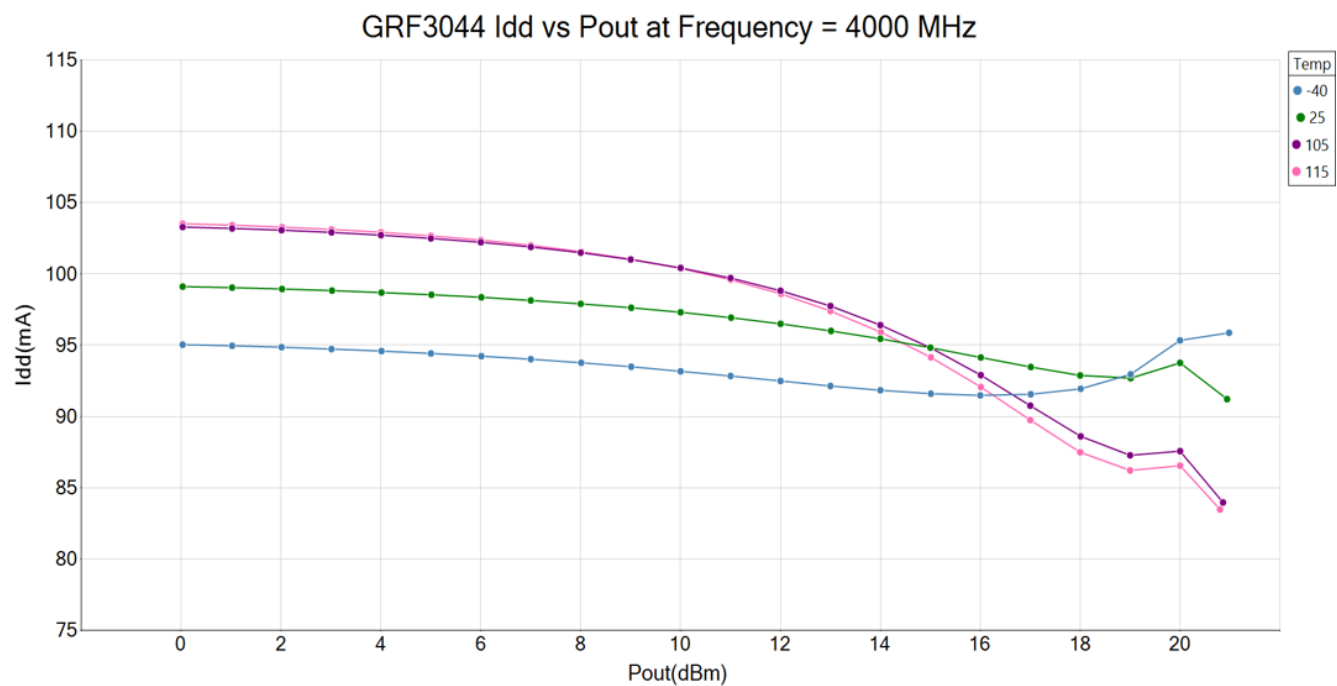
GRF3044 OIP3 vs Frequency at Pout (per tone) = 2 dBm



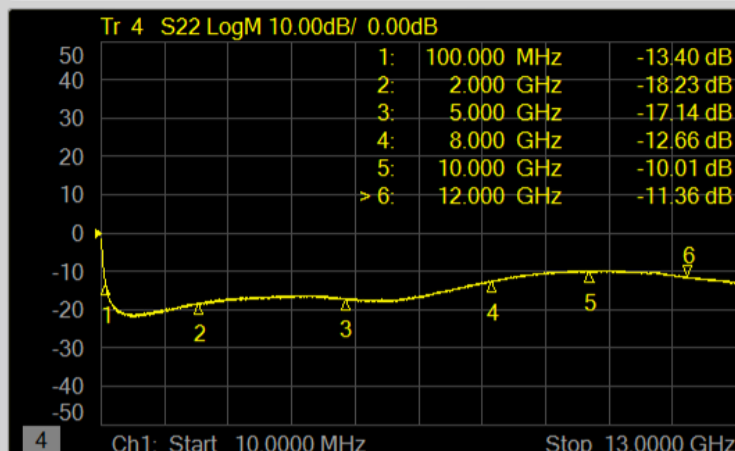
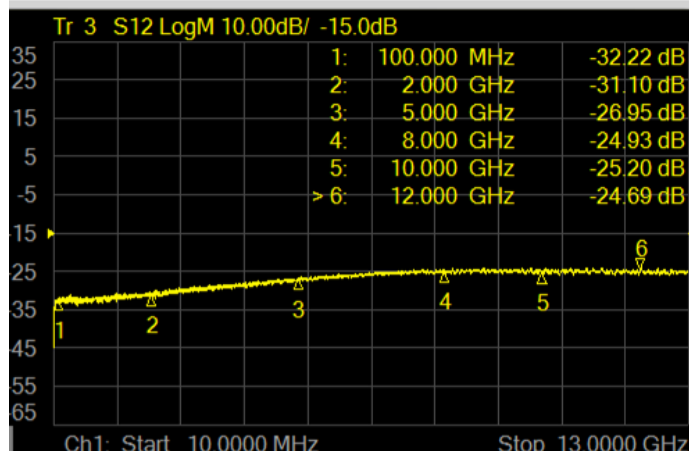
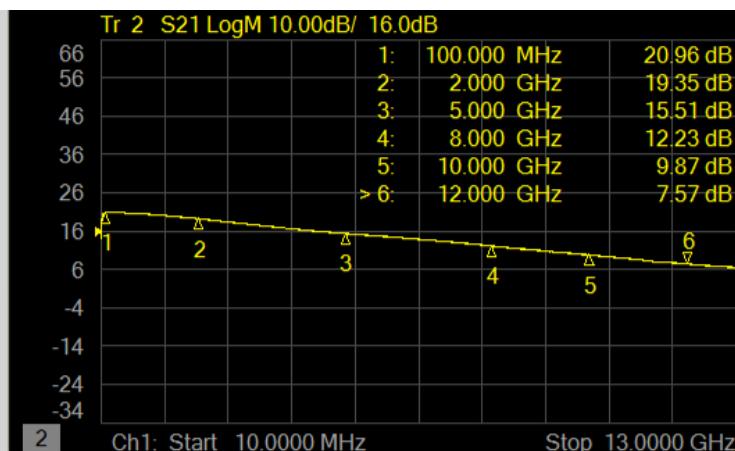
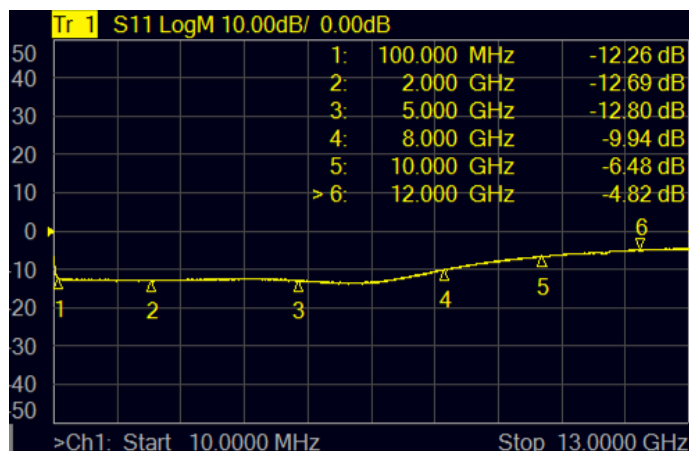
GRF3044 OP1dB vs Frequency



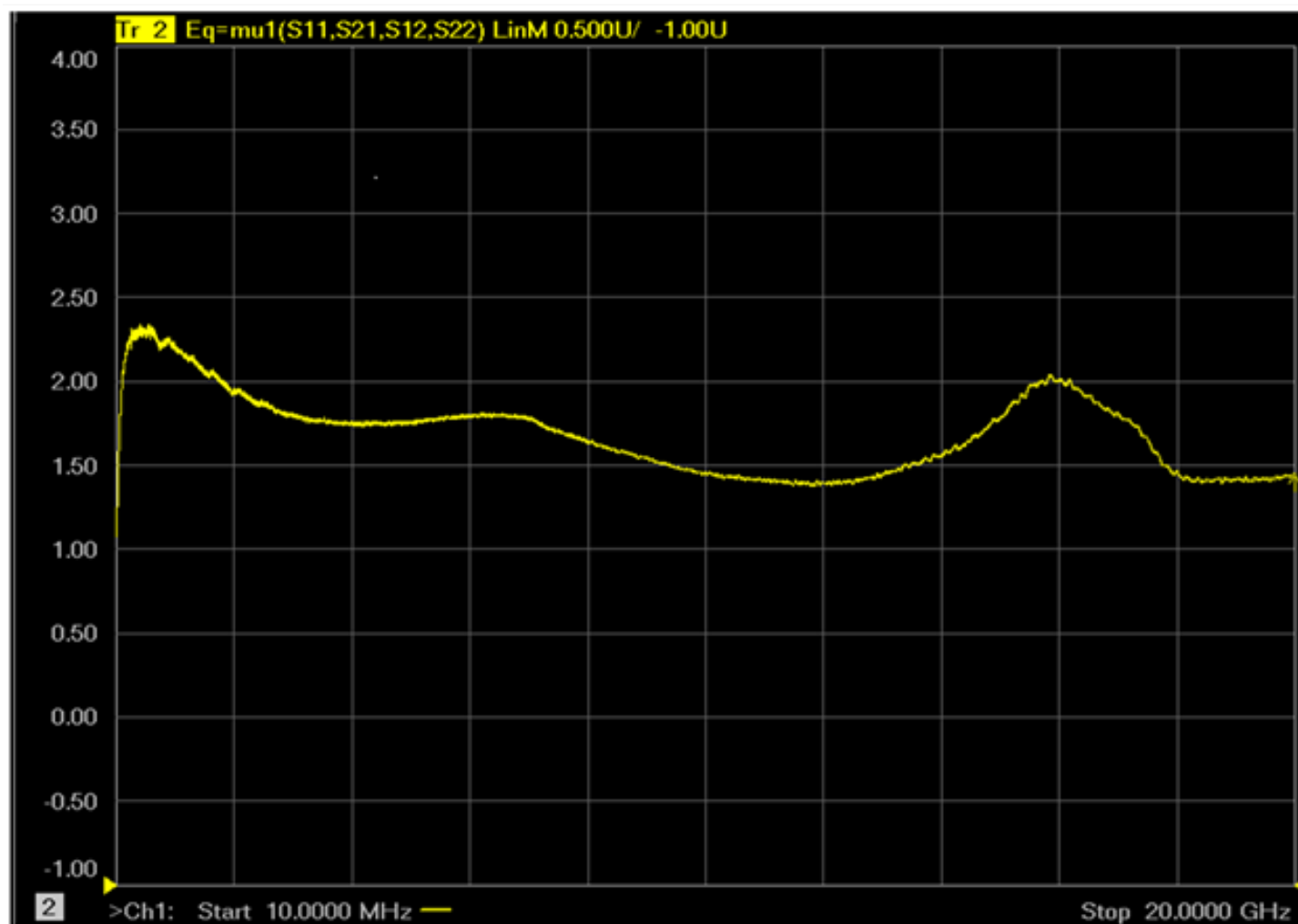
GRF3044 Typical Operating Curves: 0.1 to 12 GHz



GRF3044 Typical Operating Curves: S-Parameters (100 MHz to 12 GHz)



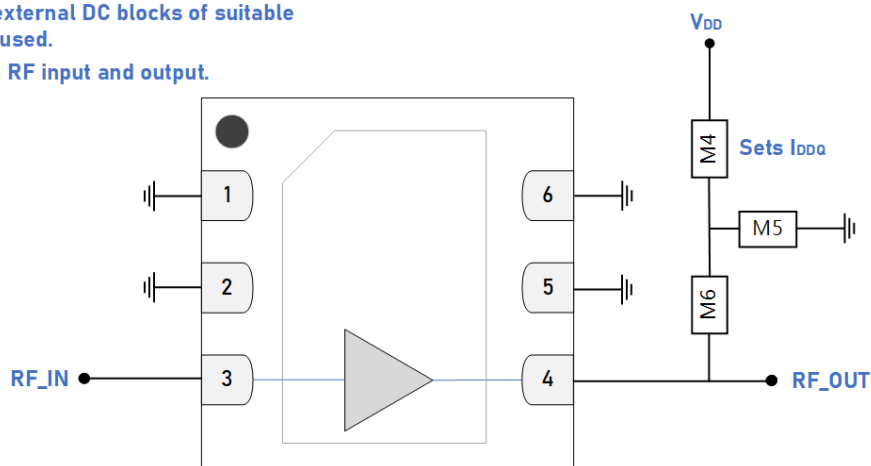
GRF3044 Typical Operating Curves: Stability Mu Factor (10 MHz to 20 GHz)



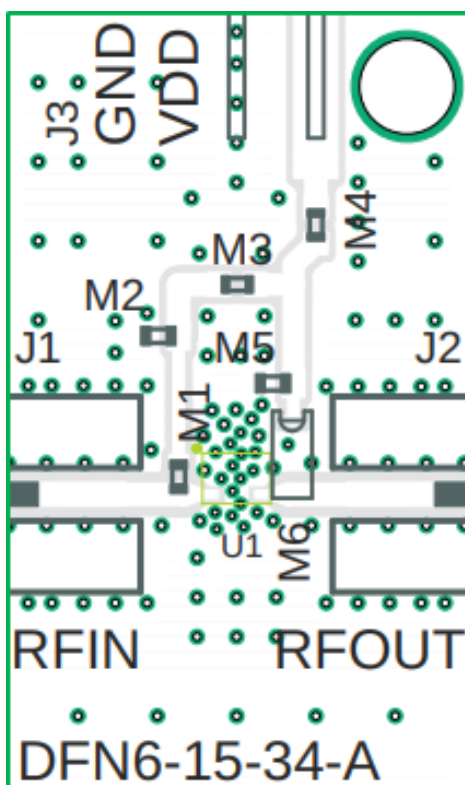
Note: Mu factor ≥ 1.0 implies unconditional stability.

Note: EVB supports device evaluation using:

1. VNA bias-T on the output with M6 not placed.
2. Alternatively a broadband conical inductor can be placed at M6 (supplied) to evaluate the device without using the VNA bias-T on the output.
3. With either method, external DC blocks of suitable bandwidths must be used.
4. DC block required on RF input and output.



GRF3044 Standard Evaluation Board Schematic



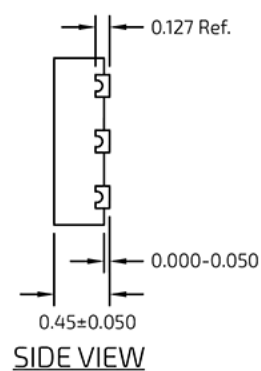
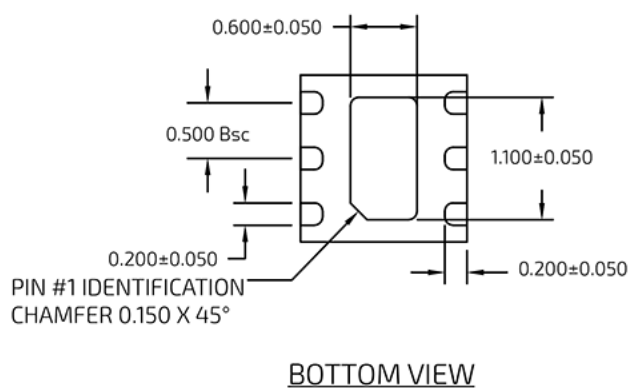
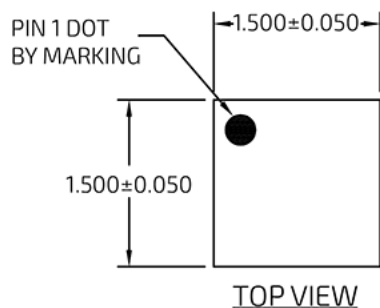
GRF3044 Evaluation Board Assembly Diagram

GRF3044 Evaluation Board Assembly Diagram Reference (0.1 to 12 GHz Tune)

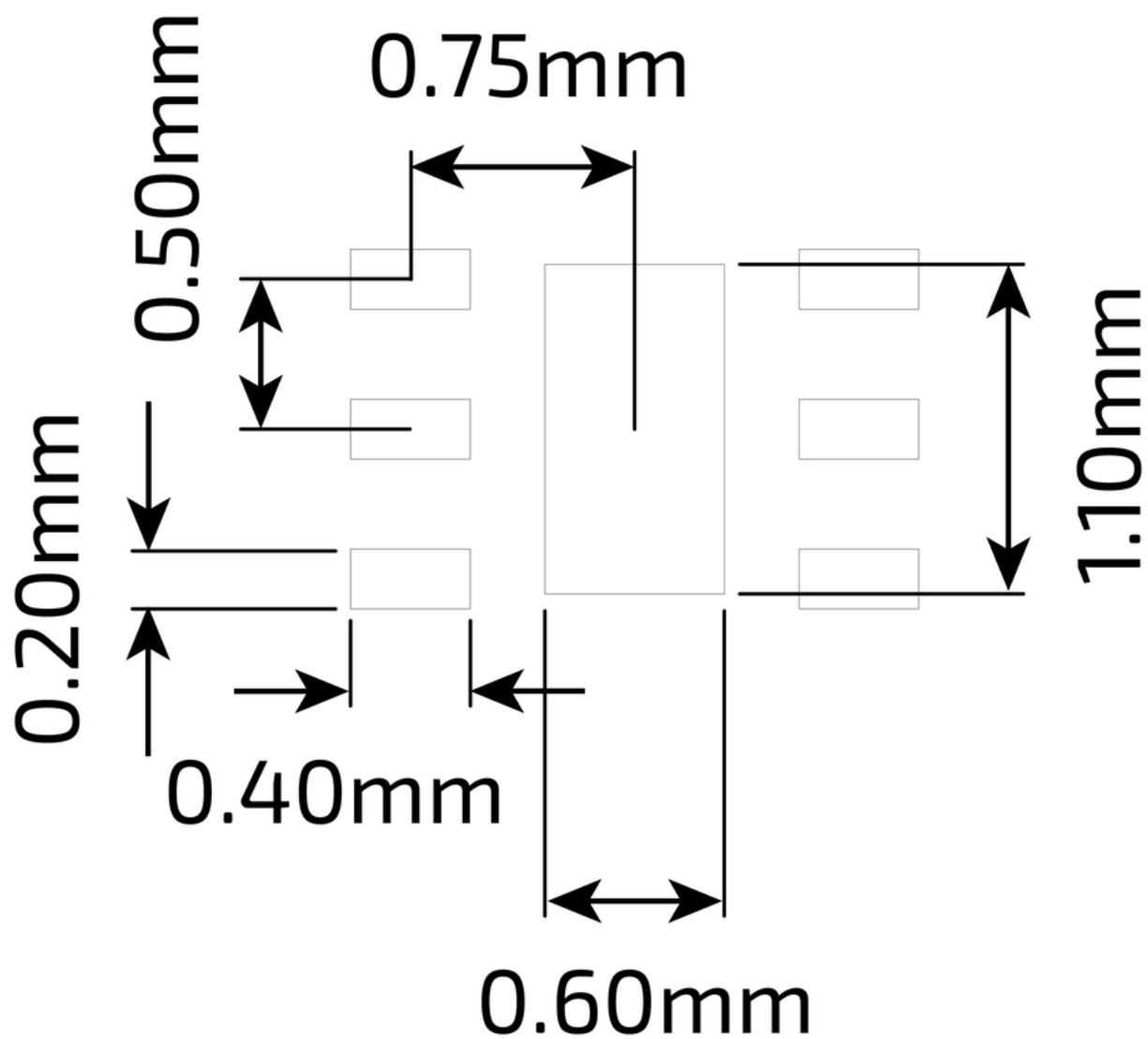
Component	Type	Manufacturer	Family	Value	Package Size	Substitution
M4 (sets I _{DDQ})	Resistor	Various	5%	see table	0402	ok
M5	Capacitor	Murata	GRM	0.1 µF	0402	ok
M6	Inductor	Piconics	CC19T40K240GS-C	220 nH	0402	ok
Evaluation Board	DFN6-15-34-A					

Bias Resistor (M4) Selection Table

V _{DD} (V)	M4 (ohms)
7	13
8	24
9	33
10	43
11	51
12	62



DFN 6 1.5x1.5mm Package Dimensions



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

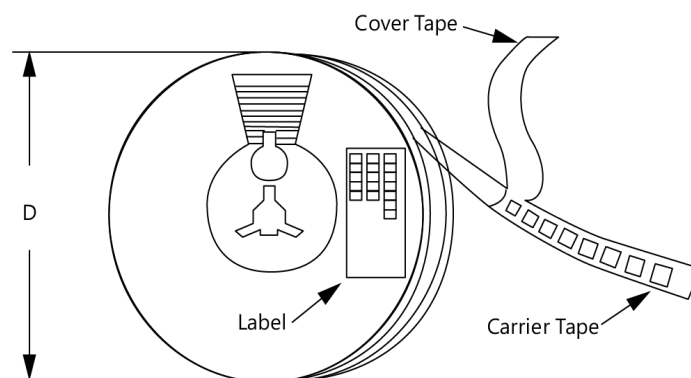
Package Marking Diagram



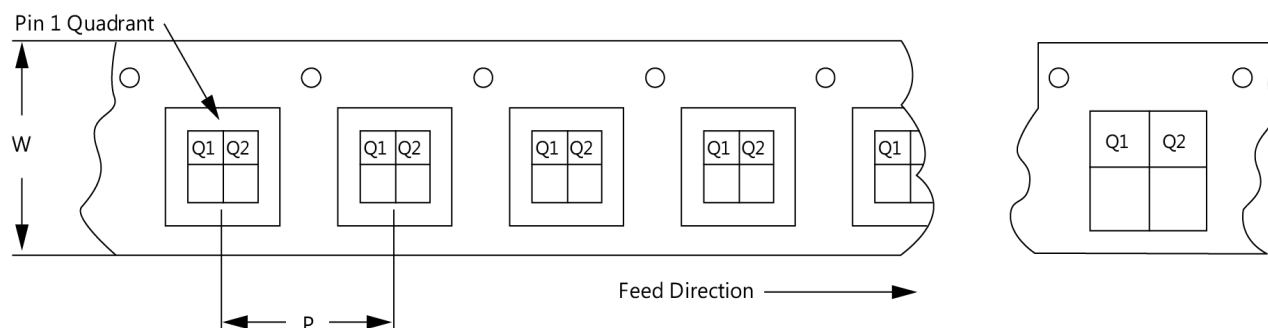
Line 1: "Y" = YEAR (single digit). "WW" = WORK WEEK the Device was assembled.
Line 2: "XXXX" = Device Part Number.

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
February 15, 2024	Preliminary Data Sheet.
November 22, 2024	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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