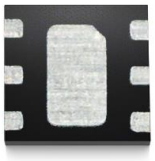
DATA SHEET

RELEASE Ø DATA SHEET



GRF3042

BROADBAND GAIN BLOCK
10 MHz to 15 GHz

FEATURES

- Internally Matched to 50 Ω
- Process: GaAs pHEMT
- Compact 1.5 x 1.5 mm DFN-6 Package

Reference: 5 V / 45 mA / 4 GHz

- Gain: 14 dB
- OIP3: 23 dBm
- OP1dB: 13 dBm
- Evaluation Board Noise Figure: 3.5 dB

APPLICATIONS

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

DESCRIPTION

The GRF3042 is a broadband gain block designed for applications in the 10 MHz to 15 GHz spectrum exhibiting a typical low noise figure (NF) of 3.5 dB along with good gain flatness.

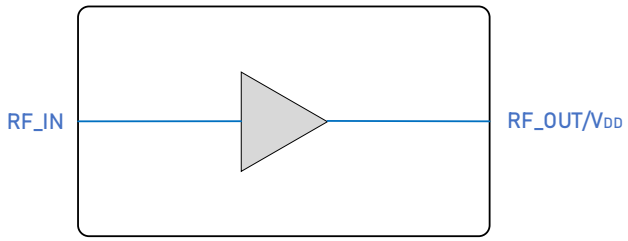
The device employs an external resistor to set a nominal I_{DDQ} of 45 mA. GRF3042 is internally matched to 50 Ω at the input and output ports.

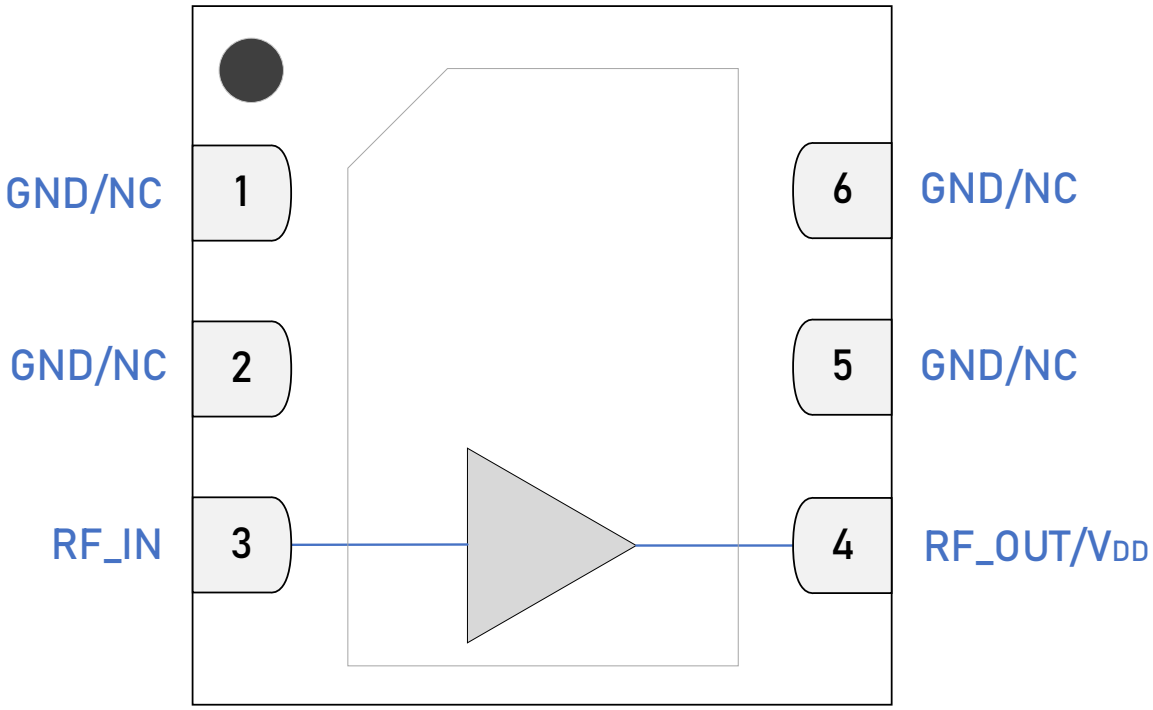
The device can be operated down to low frequency via the selection of suitably large input/output capacitors and bias inductor.

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

Additional tunes can be found on the GRF3042 "Custom Tunes" product page: GR3042 Custom Tunes

BLOCK DIAGRAM





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

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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 50 Ω. An external DC blocking capacitor must be used.
4	RF_OUT/V_{DD}	RF Output	Internally matched 50 Ω. V_{DD} must be applied through a choke to this pin.
PKG BASE	GND	Ground	Provides DC and RF ground for gain block 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
Drain Voltage	V_{DD}	0	6	V
RF Input Power: Load VSWR < 2:1, V_{DD} = 5 V	$P_{IN\ MAX}$		17	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	$P_{DISS\ MAX}$		350	mW

Electrostatic Discharge

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 to the device.

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*

Recommended Operating Conditions

Parameter	Symbol	Specification			Unit	Condition
		Min.	Typ.	Max.		
Drain Voltage	V_{DD}	0	5	6	V	
Operating Temperature (Package Base)	$T_{PKG\ BASE}$	-40		105	°C	
RF Frequency Range	F_{TEST}	0.01	4	15	GHz	Typical application schematic **(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: GRF3042 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 using the 10 MHz to 15 GHz tuning set. V_{DD} = 5 V, I_{DDQ} = 45 mA, M4 = 12 Ω, F_{TEST} = 4 GHz, $T_{PKG\ BASE}$ = 25 °C. Evaluation board losses are included within the specifications.

Parameter	Symbol	Specification			Unit	Condition
		Min.	Typ.	Max.		
Supply Current	I_{DDQ}		45		mA	V_{DD} = 5 V, R_{BIAS} = 12 Ω.

Thermal Data

Thermal Resistance (Infrared Scan)	Θ_{JC}		218		°C/W	On Standard Evaluation Board **(see note).**

Note: MTTF >10^6 hours for $T_{CHANNEL}$ ≤ 170 °C.

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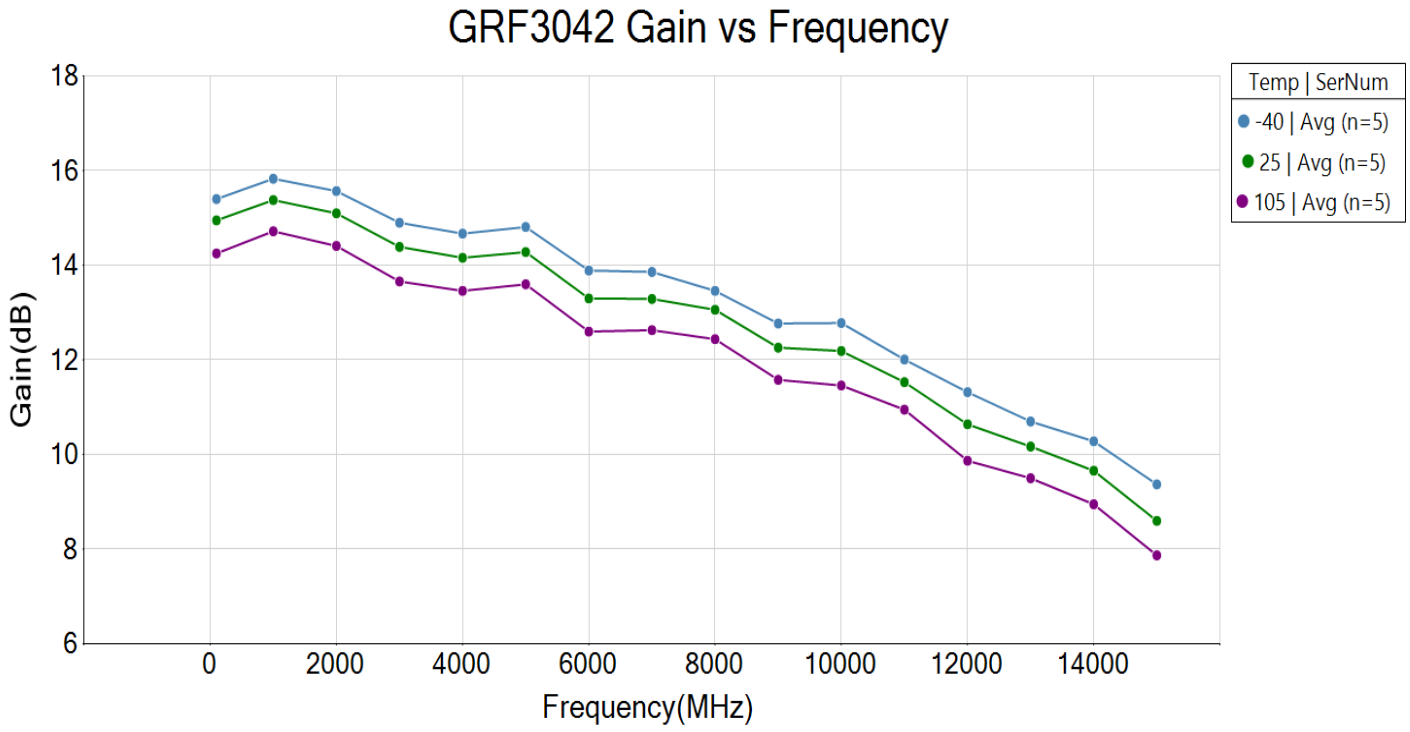
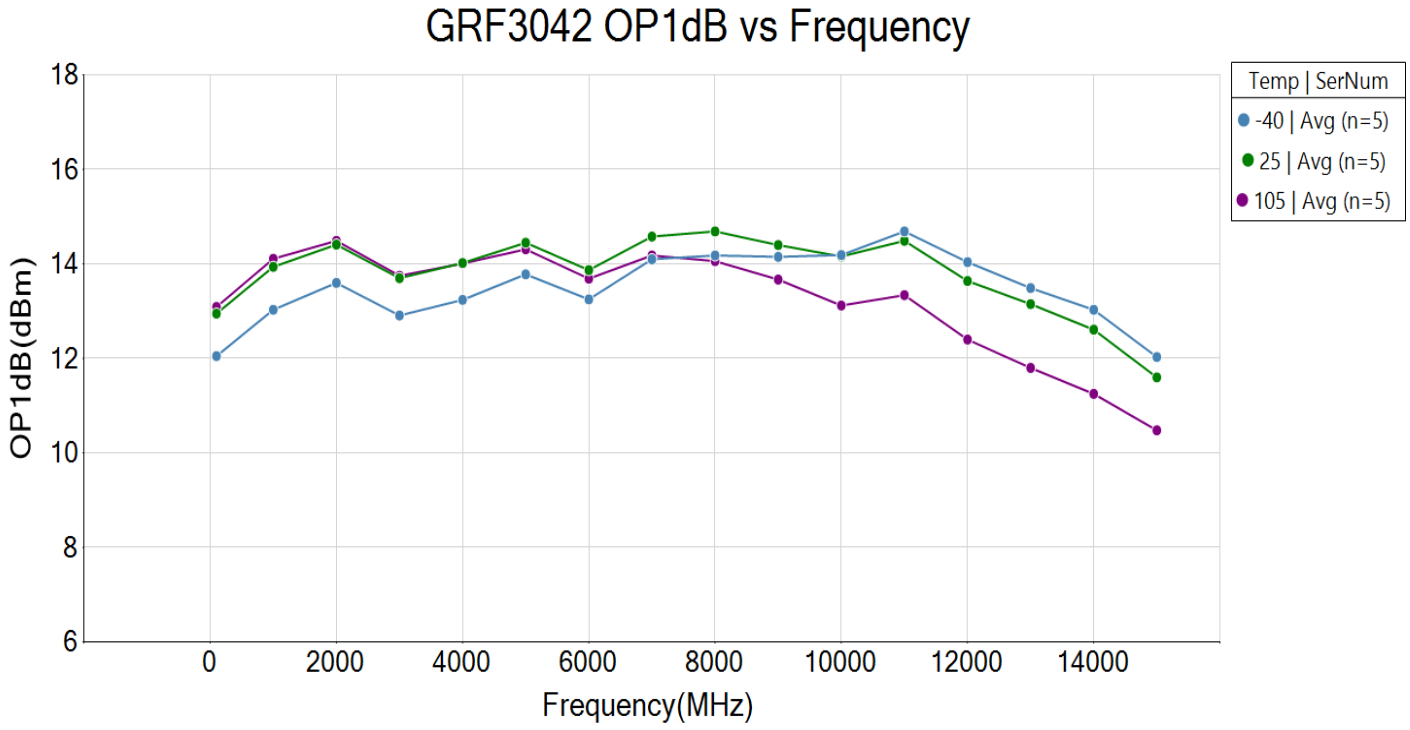
Nominal Operating Parameters – RF

The following conditions apply unless noted otherwise: typical application schematic using the 10 MHz to 15 GHz tuning set. V_{DD} = 5 V, I_{DDQ} = 45 mA, M4 = 12 Ω, F_{TEST} = 4 GHz, $T_{PKG\ BASE}$ = 25 °C. Evaluation board losses are included within the specifications.

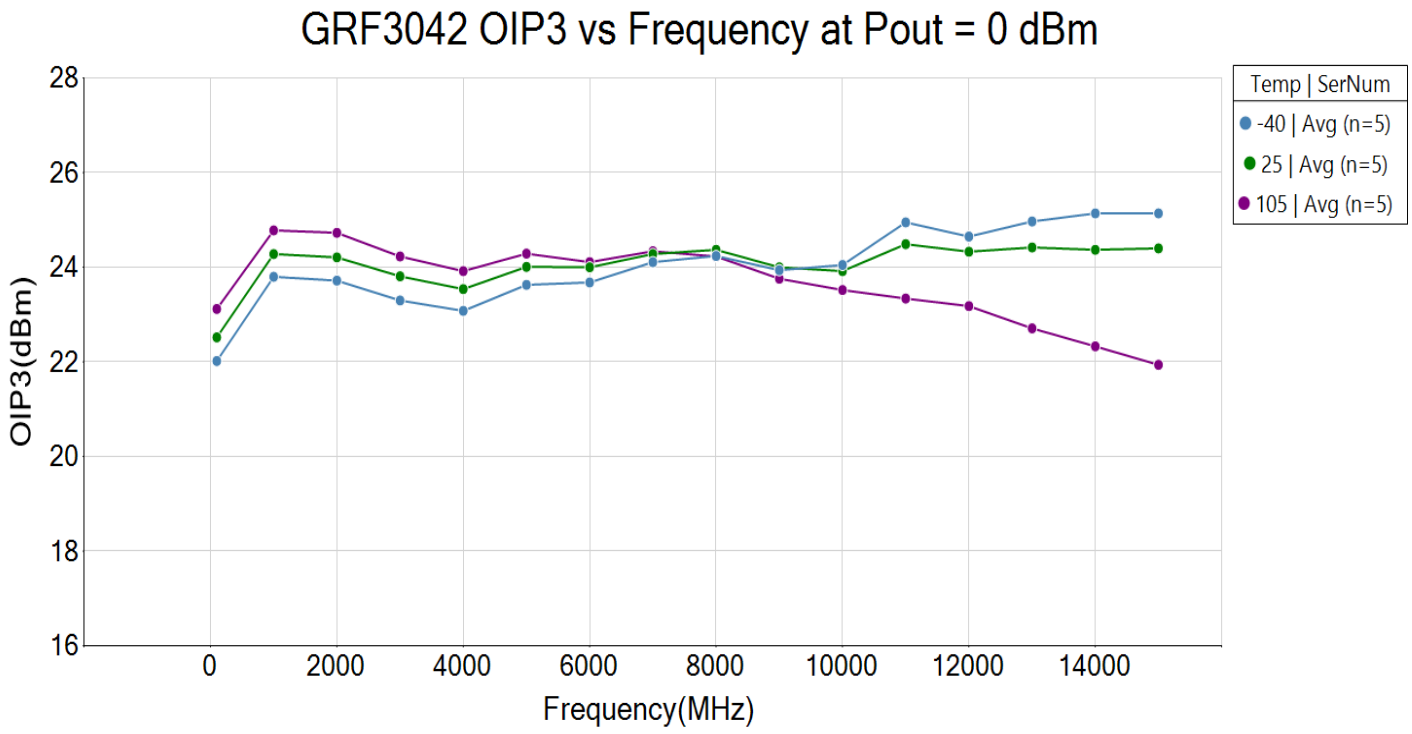
Parameter	Symbol	Specification			Unit	Condition
		Min.	Typ.	Max.		
Gain	S21		14		dB	V_{DD} = 5 V, R_{BIAS} = 12 Ω.
Noise Figure	NF		3.5		dB	On standard evaluation board.
Output 3rd Order Intercept Point	OIP3		23		dBm	0 dBm P_{OUT} per tone at 2 MHz spacing (3999 and 4001 MHz).
Output 1 dB Compression Power	OP1dB		13		dBm	

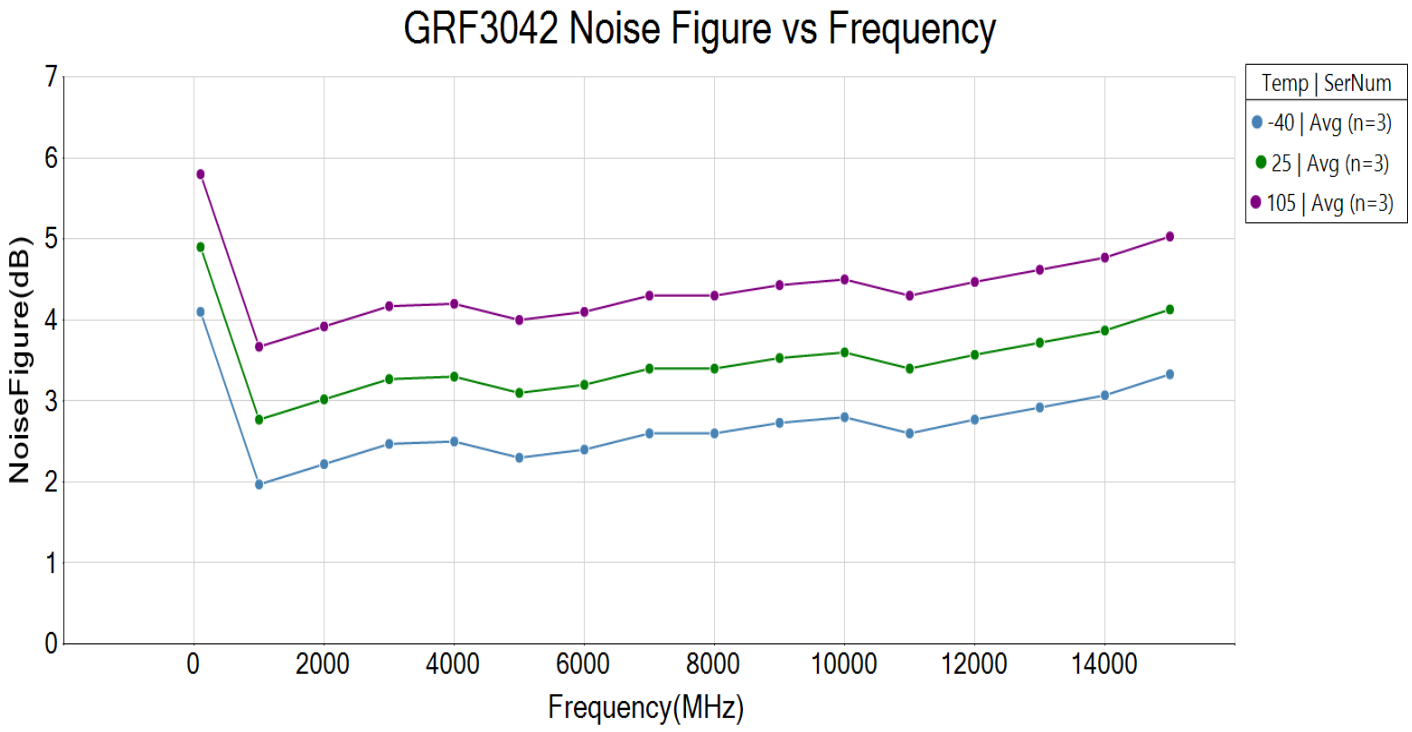
GRF3042 Typical Operating Curves: 10 MHz to 15 GHz, V_{DD} = 5 V, I_{DDQ} = 45 mA



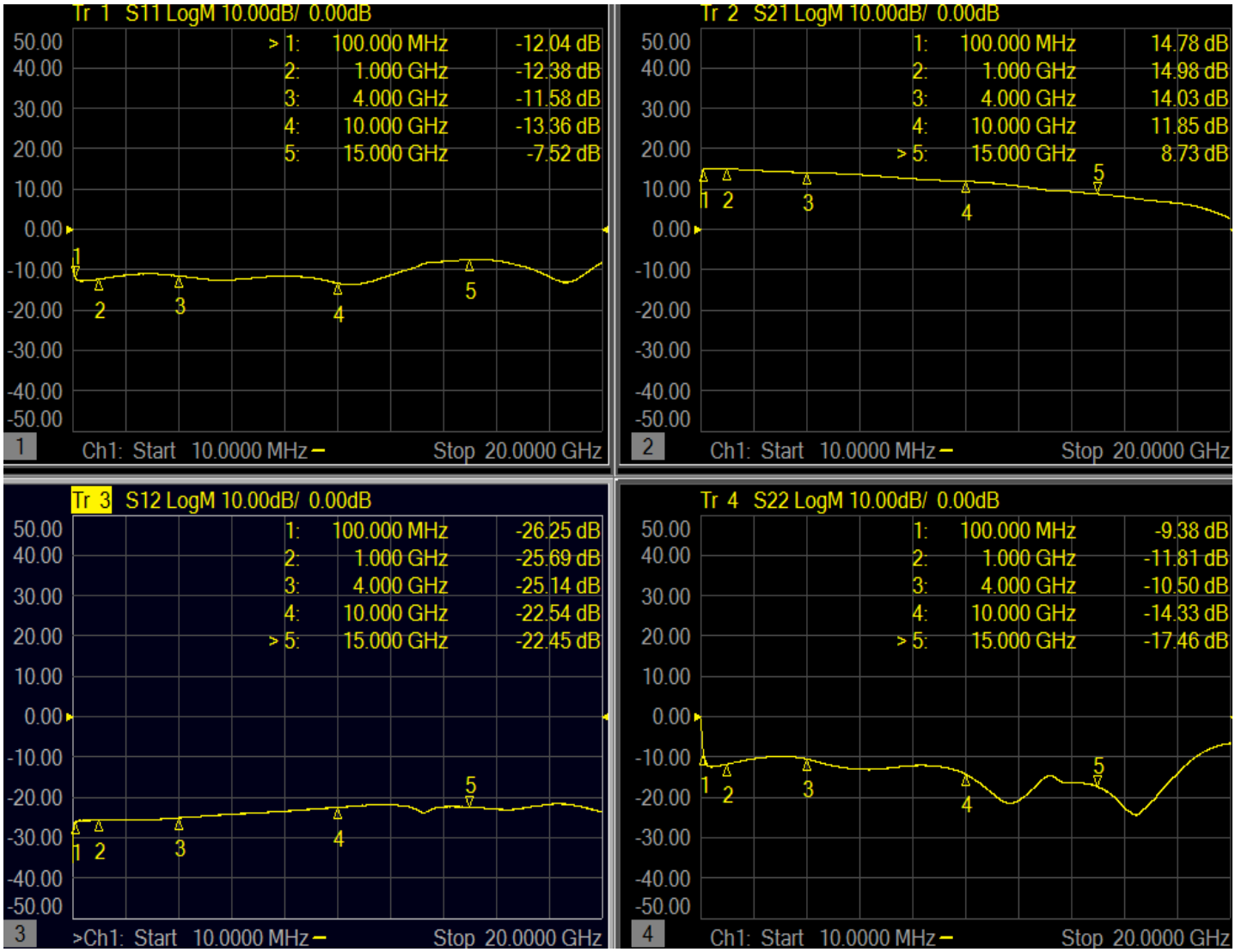


GRF3042 Typical Operating Curves: 10 MHz to 15 GHz, V_{DD} = 5 V, I_{DDQ} = 45 mA





GRF3042 Typical Operating Curves: S-Parameters (100 MHz to 15 GHz tune)



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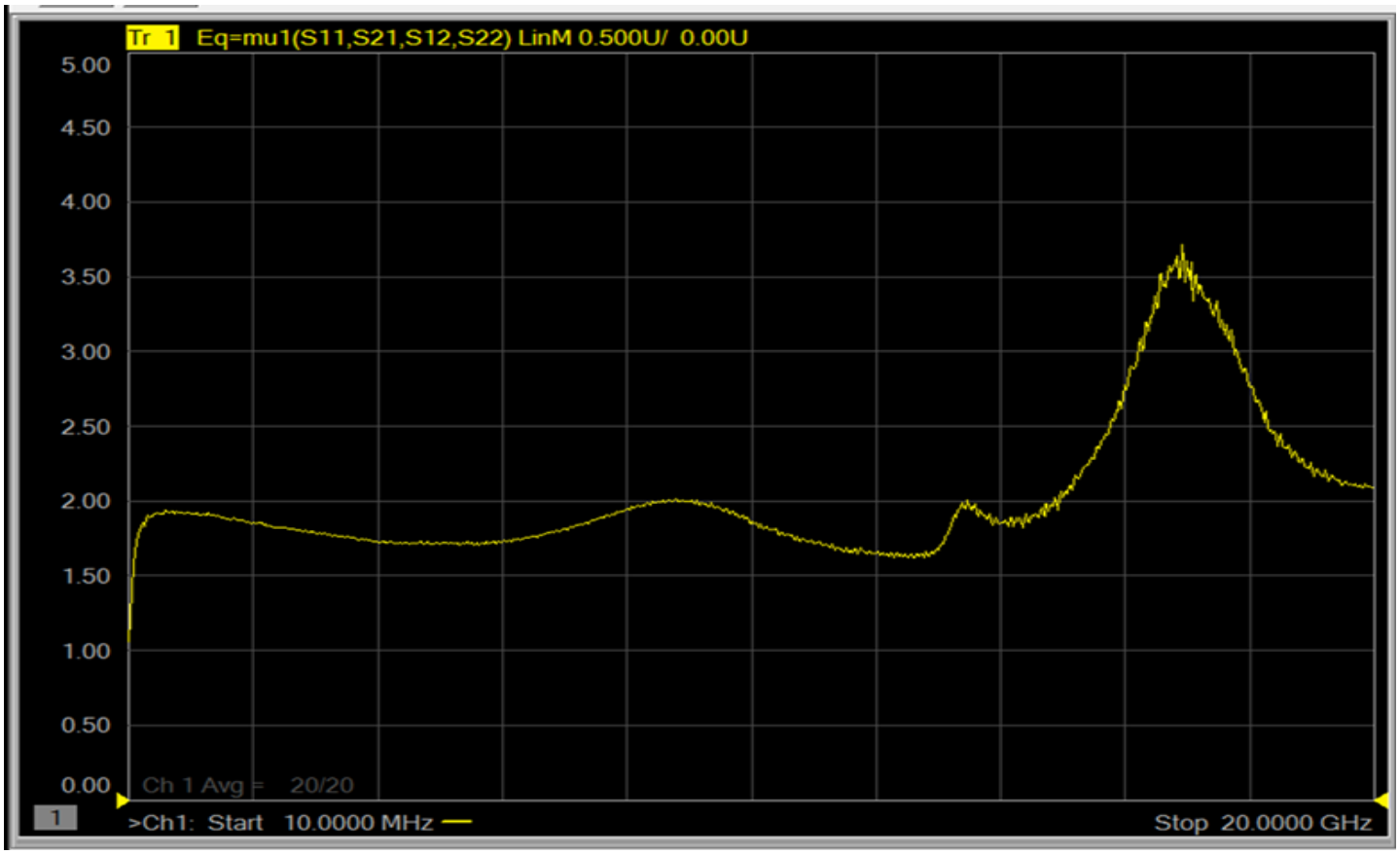
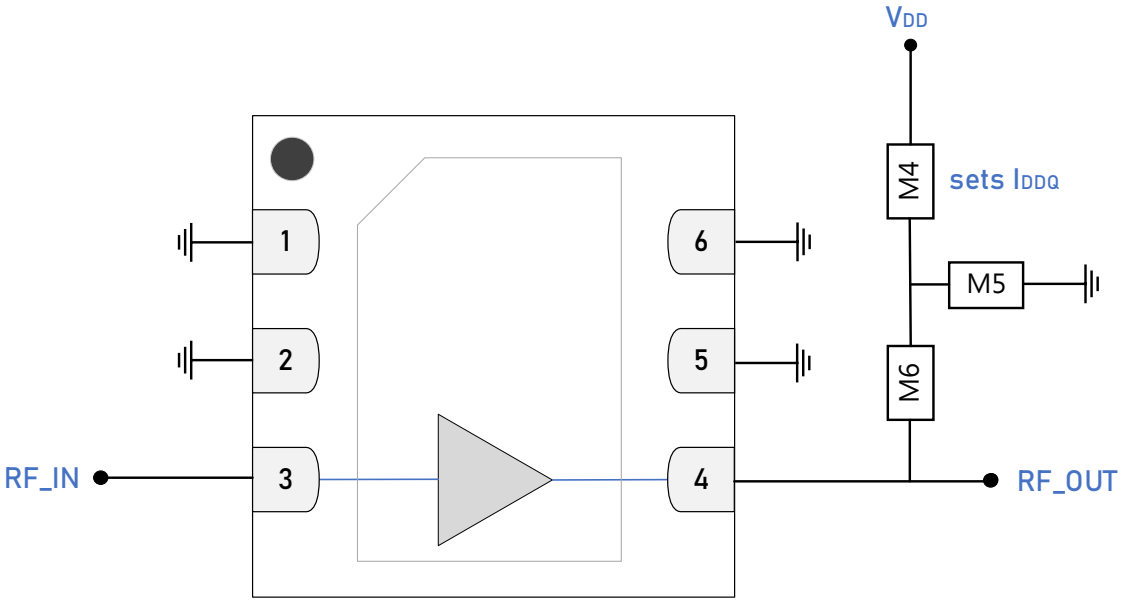
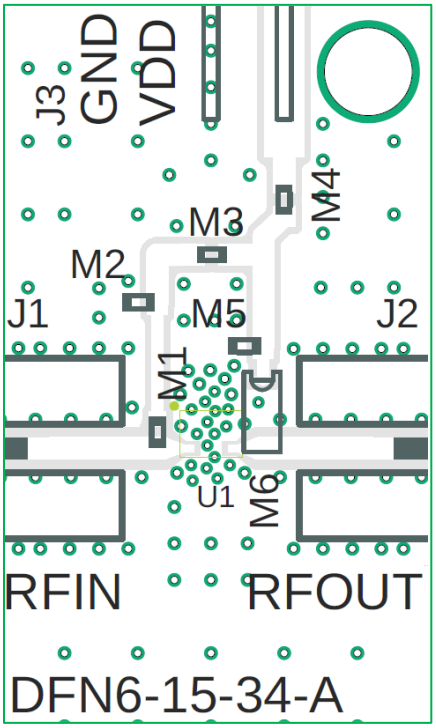
GRF3042 Typical Operating Curves: Stability Mu Factor (10 MHz to 20 GHz)



Note: Mu factor ≥ 1.0 implies unconditional stability



GRF3042 Standard Evaluation Board Schematic



GRF3042 Evaluation Board Assembly Diagram

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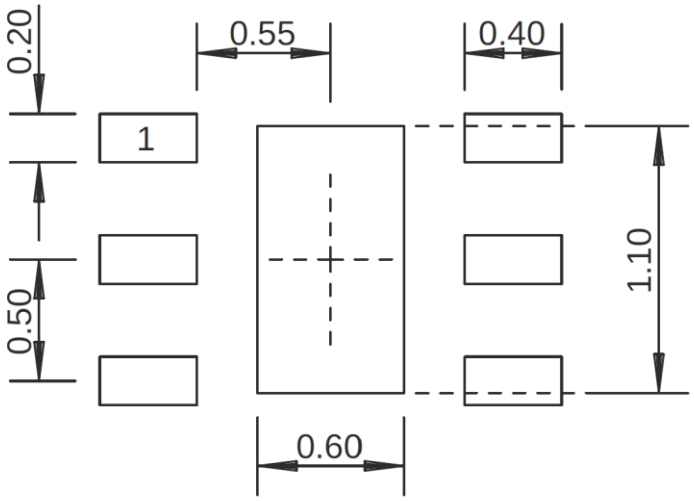
GRF3042 Evaluation Board Assembly Diagram Reference: 10 MHz to 15 GHz Tune

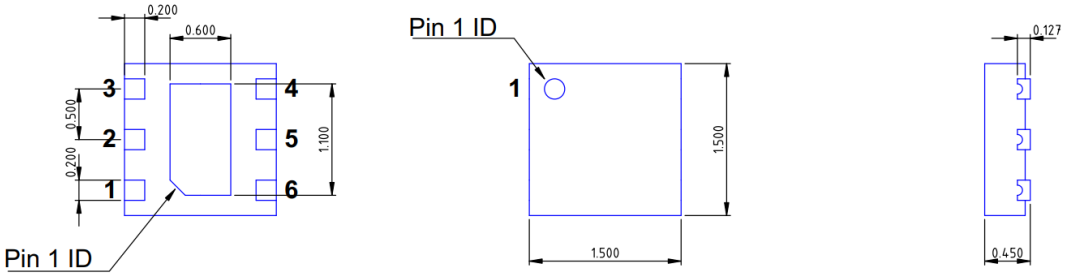
Component	Type	Manufacturer	Family	Value	Package Size	Substitution
M4	Resistor (sets I_{DDQ})	Various	5%	see table	0402	ok
M5	Capacitor	Murata	GRM	0.1 uF	0402	ok
M6	Inductor	Piconics	CC19T40K240G5-C	220 nH	0402	ok
Evaluation Board	DFN6-15-34-A					

Bias Resistor Selection Table: I_{DDQ} = 45 mA

V_{DD}	M4 (ohms)
5	12
7	22
8	43
9	68
10	91
11	110
12	130



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



Bottom View **Top View** **Side View**

DFN6 1.5x1.5mm
Dimensions in millimeters
Dimensional Tolerance: ±0.05

1.5 x 1.5 mm DFN-6 Package Dimensions

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Package Marking Diagram

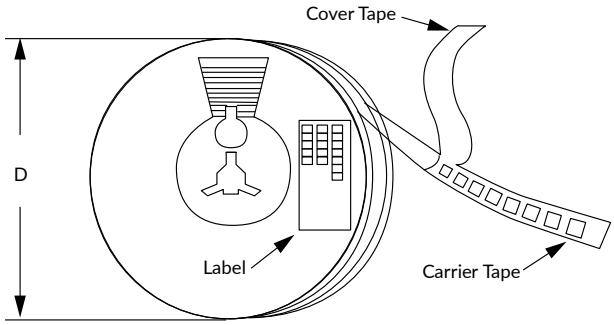
- Line 1: "Y" = YEAR (single digit). "WW" = WORK WEEK the Device was assembled.
- Line 2: "XXXX" = Device Part Number.

Tape and Reel Information

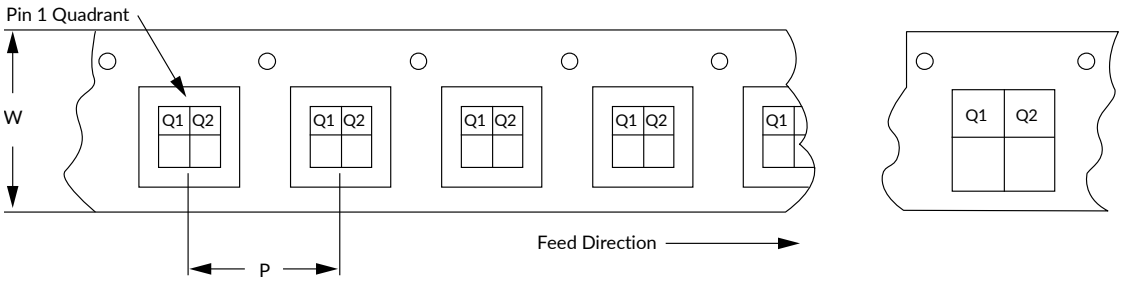
Guerrilla RF's tape and reel specification complies with Electronic Industries Alliance (EIA) standards for "Embossed Carrier Tape of Surface Mount Components for Automatic Handling" (reference EIA-481). See the following page for the Tape and Reel Specification and Device Package Information table, 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
January 16, 2017	Preliminary Data Sheet.
January 18, 2023	Release Ø Data Sheet. Upgraded Data Sheet to new format.

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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.