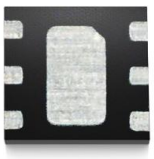
DATA SHEET

RELEASE B DATA SHEET





GRF2105

Enhanced Gain Flatness Low Noise Amplifier 0.15 to 5.36 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 / 2.5 GHz

- Gain: 20.5 dB
- OIP3: 37 dBm
- OP1dB: 21 dBm
- Evaluation Board Noise Figure: 0.7 dB

APPLICATIONS

- Broadband LNA
- TDD-LTE
- 3.5 GHz CBRS
- C-Band Amplifier
- Wireless Backhaul
- Linear Driver Amplifier
- Small Cells and Cellular Repeaters

DESCRIPTION

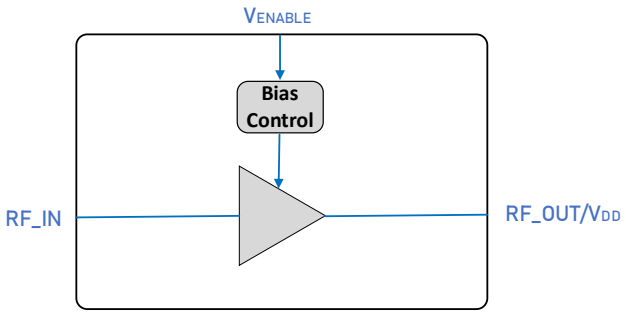
The GRF2105 is a broadband, ultra-low noise linear amplifier designed for small cell, wireless infrastructure and other high-performance RF applications. The standard tune exhibits outstanding noise figure (NF), linearity, return losses and enhanced gain flatness from 0.4 to 3.8 GHz.

The device is operated from a supply voltage (V_{DD}) range of 2.7 to 6 volts with a typical bias condition of 5 volts and 65 mA for optimal efficiency and linearity.

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

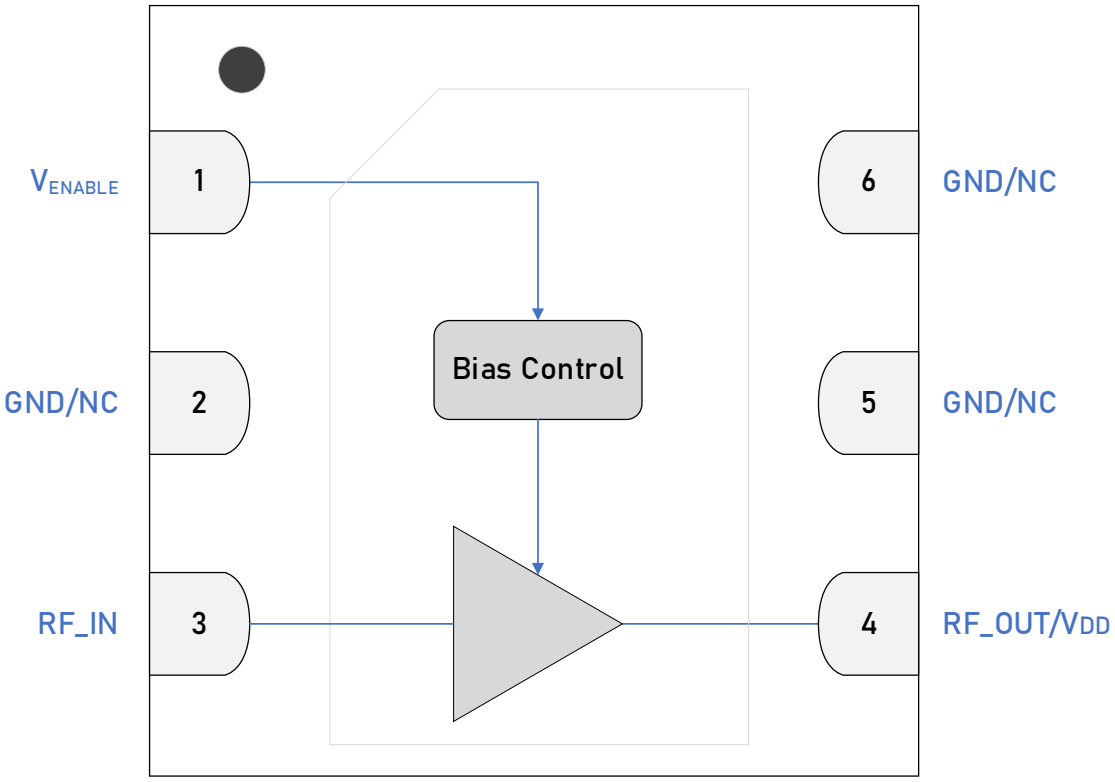
Additional tunes can be found on the GRF2105 "Custom Tunes" product page: GRF2105 Custom Tunes

BLOCK DIAGRAM



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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 device. On-die pull-down resistor will turn the part 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	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 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.

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Absolute Ratings

Parameter	Symbol	Min.	Max.	Unit
Supply Voltage	V_{DD}	0	6	V
RF Input Power: Load VSWR < 2:1, V_{DD} = 5 V, V_{ENABLE} = 5 V.	$P_{IN\ MAX\ ON}$		20	dBm
RF Input Power: Load VSWR < 2:1, V_{DD} = 5 V, V_{ENABLE} = 0 V.	$P_{IN\ MAX\ OFF}$		20	dBm
Operating Temperature (package base).	$T_{PKG\ BASE}$	-40	115	°C
Maximum Channel Temperature (MTTF > 10^6 hours).	T_{MAX}		170	°C
Maximum Dissipated Power	$P_{DISS\ MAX}$		600	mW

Electrostatic Discharge

Human Body Model	HBM	500		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)*

RoHS compliant

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}	0.15	2.5	5.36	GHz	Typical application schematic with external matching components **(notes 1 & 2)**.
Operating Temperature (package base)	$T_{PKG\ BASE}$	-40		115	°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: GRF2105 Custom Tunes

Note 2: Contact the Guerrilla RF applications team for guidance on optimizing the tuning of the device for alternative bands.

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Nominal Operating Parameters – General

The following conditions apply unless noted otherwise: typical application schematic. V_{DD} = 5 V, V_{ENABLE} = 5 V, F_{TEST} = 2.5 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}	50	65	85	mA	V_{DD} = 5 V, V_{ENABLE} = 5 V.
Enable Current	I_{ENABLE}		1.4	2	mA	V_{DD} = 5 V, V_{ENABLE} = 5 V.
Switching Rise Time	T_{RISE}		1200		ns	Disabled mode to Gain mode **(note 3)**.
Switching Fall Time	T_{FALL}		400		ns	Gain mode to Disabled mode **(note 4)**.
Disabled Mode						
Leakage Current	$I_{LEAKAGE}$		270	500	µA	V_{DD} = 5 V, V_{ENABLE} = 0 V.
Thermal Data						
Thermal Resistance: (Infrared Scan)	Θ_{JC}		65		°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 $T_{CHANNEL}$ ≤ 170 °C.

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Nominal Operating Parameters – RF

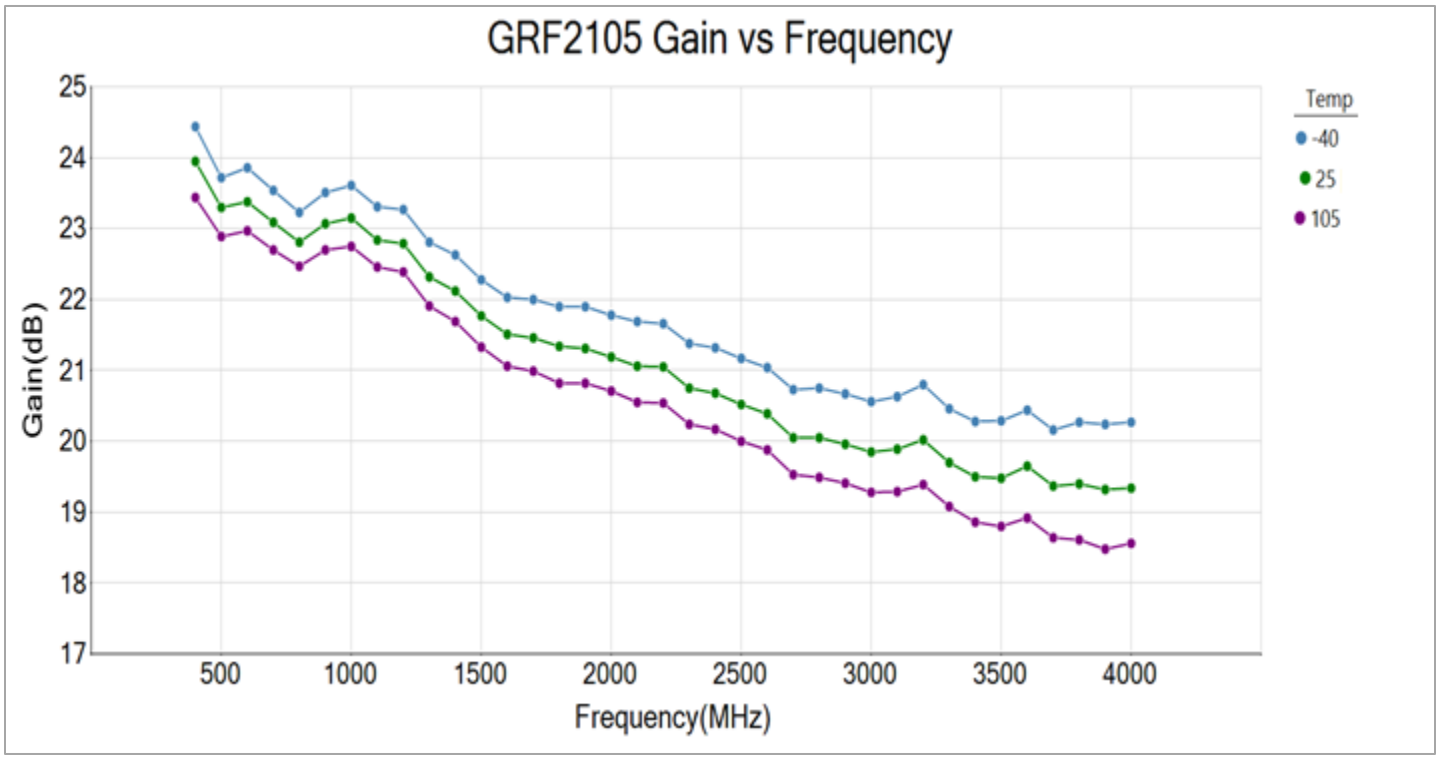
The following conditions apply unless noted otherwise: typical application schematic. V_{DD} = 5 V, V_{ENABLE} = 5 V, F_{TEST} = 2.5 GHz. 50 Ω system impedance, $T_{PKG\ BASE}$ = 25 °C. Evaluation board losses are included within the specifications.

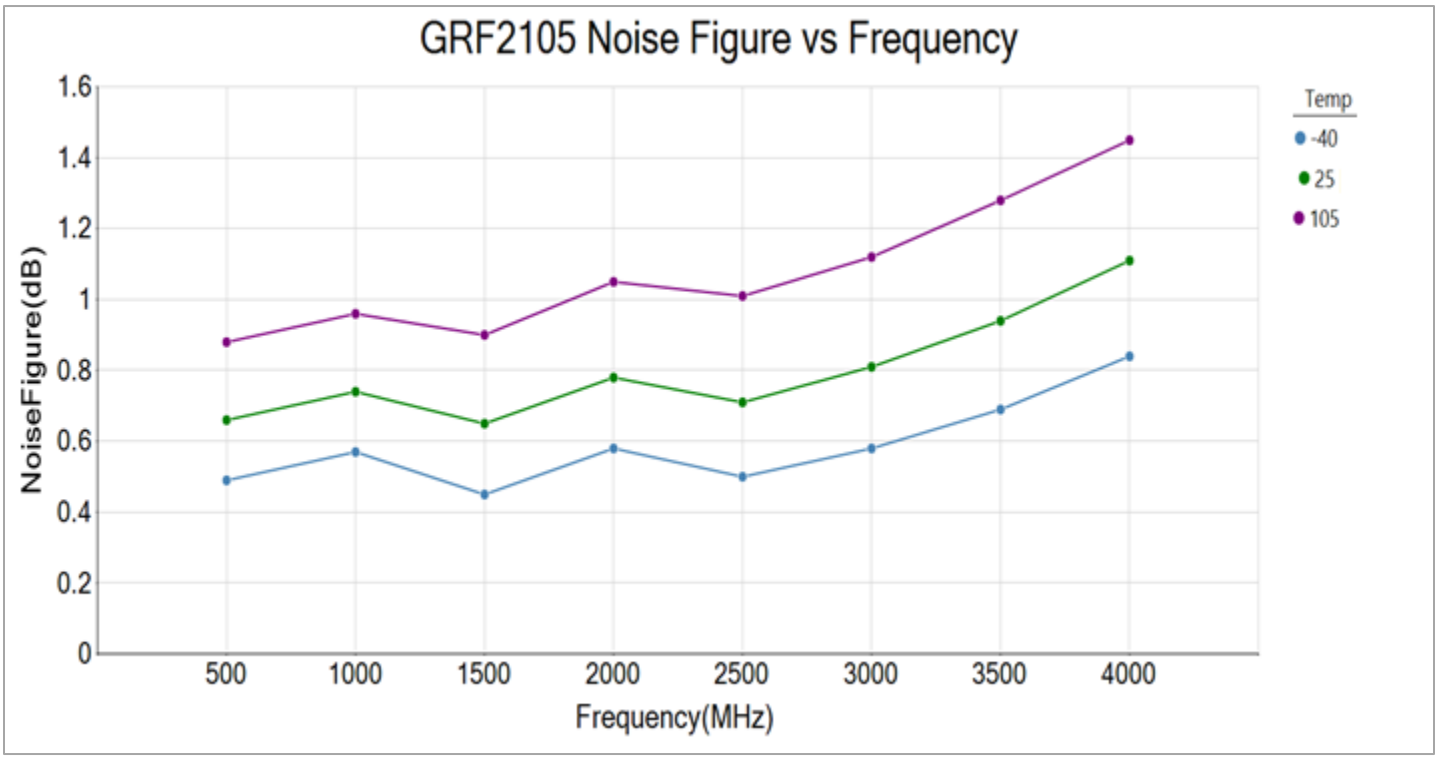
Parameter	Symbol	Specification			Unit	Condition
		Min.	Typ.	Max.		
Gain	S21	19	20.5	22.5	dB	
Reverse Isolation	S12		< -27		dB	
Noise Figure	NF		0.7		dB	On standard evaluation board.
Output 3rd Order Intercept Point	OIP3		37		dBm	2 dBm P_{OUT} per tone at 2 MHz spacing (2499 and 2501 MHz).
Output 1 dB Compression Power	OP1dB	19	21	23	dBm	

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GRF2105 Typical Operating Curves: 0.4 to 3.8 GHz Tune

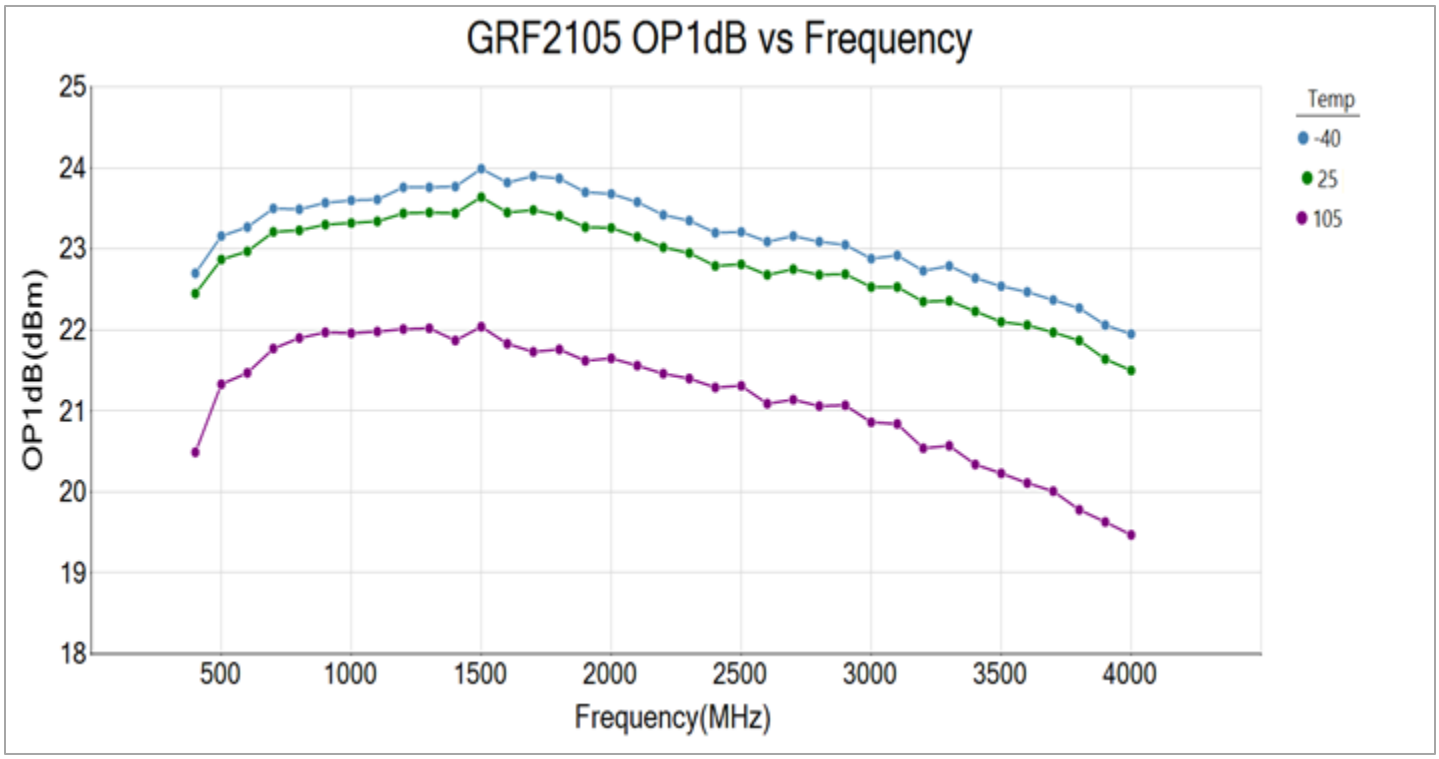


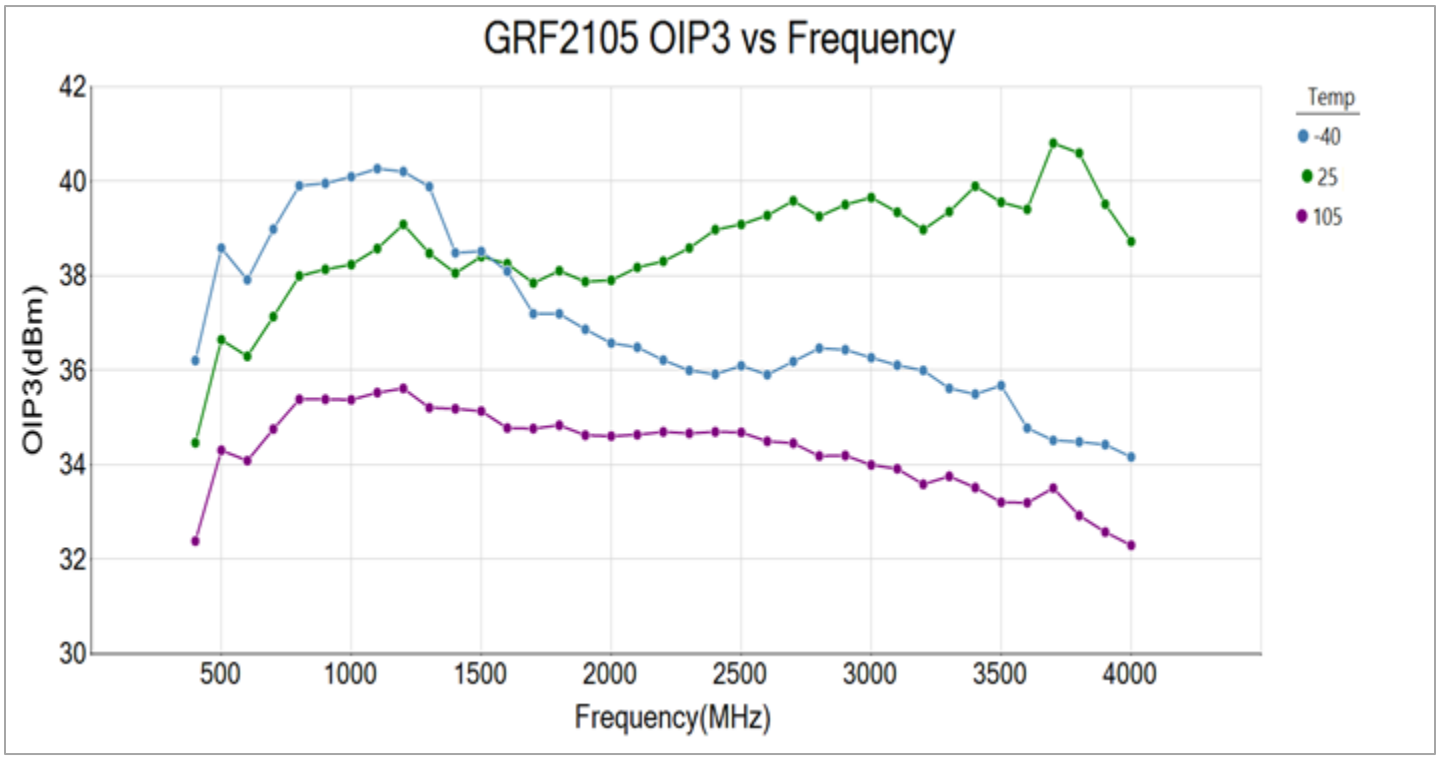


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GRF2105 Typical Operating Curves: 0.4 to 3.8 GHz Tune

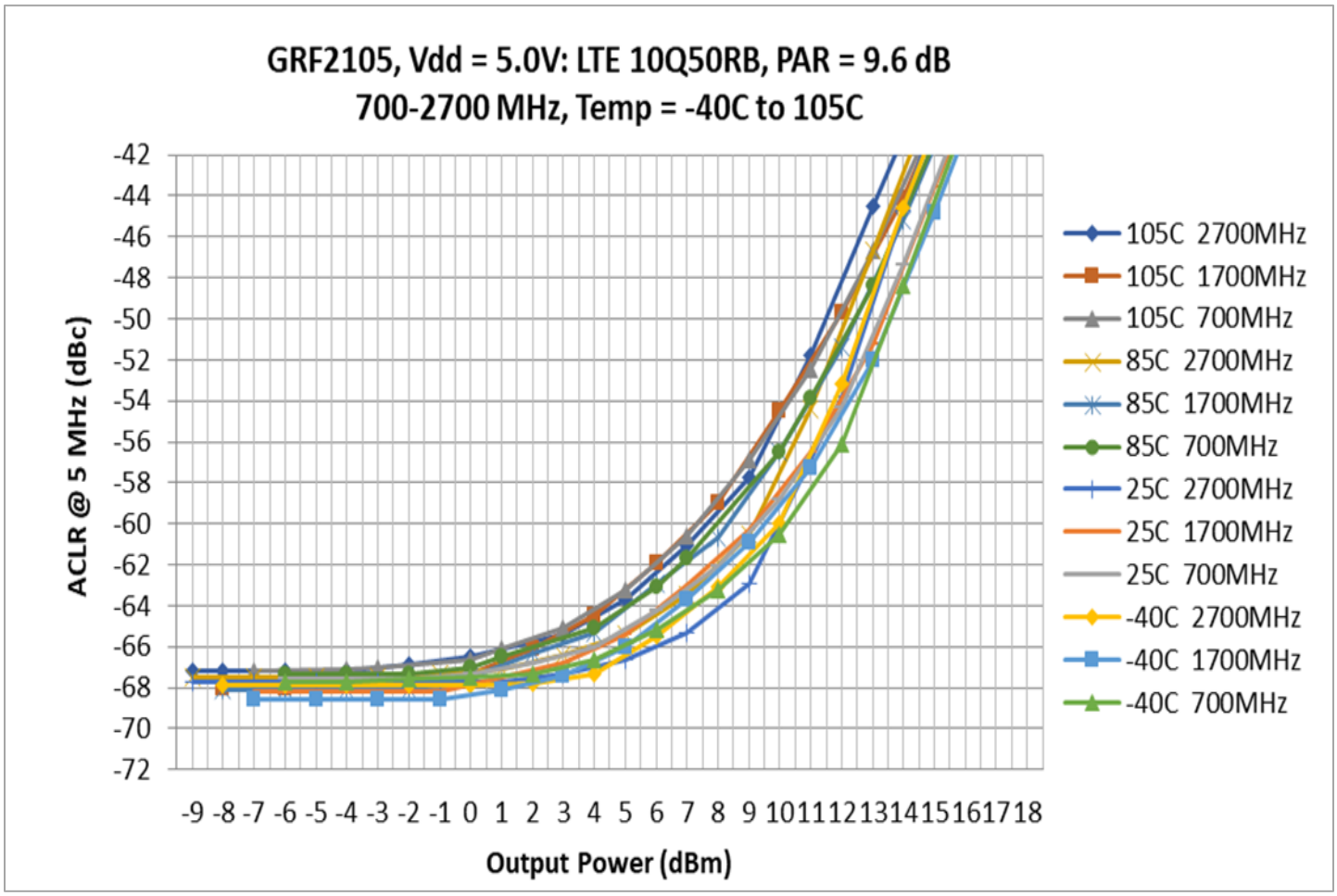




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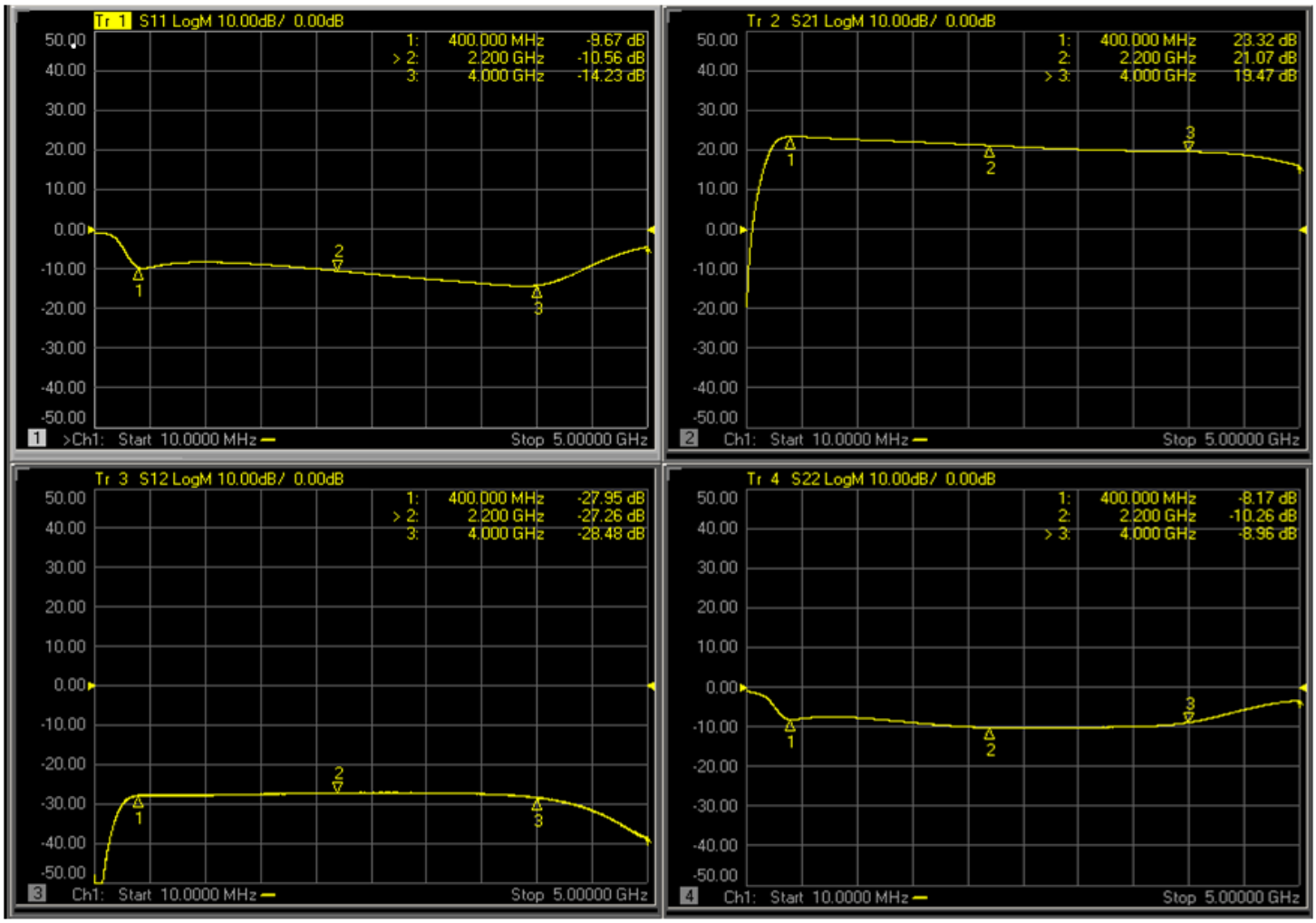
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GRF2105 Typical Operating Curves: 0.4 to 3.8 GHz Tune



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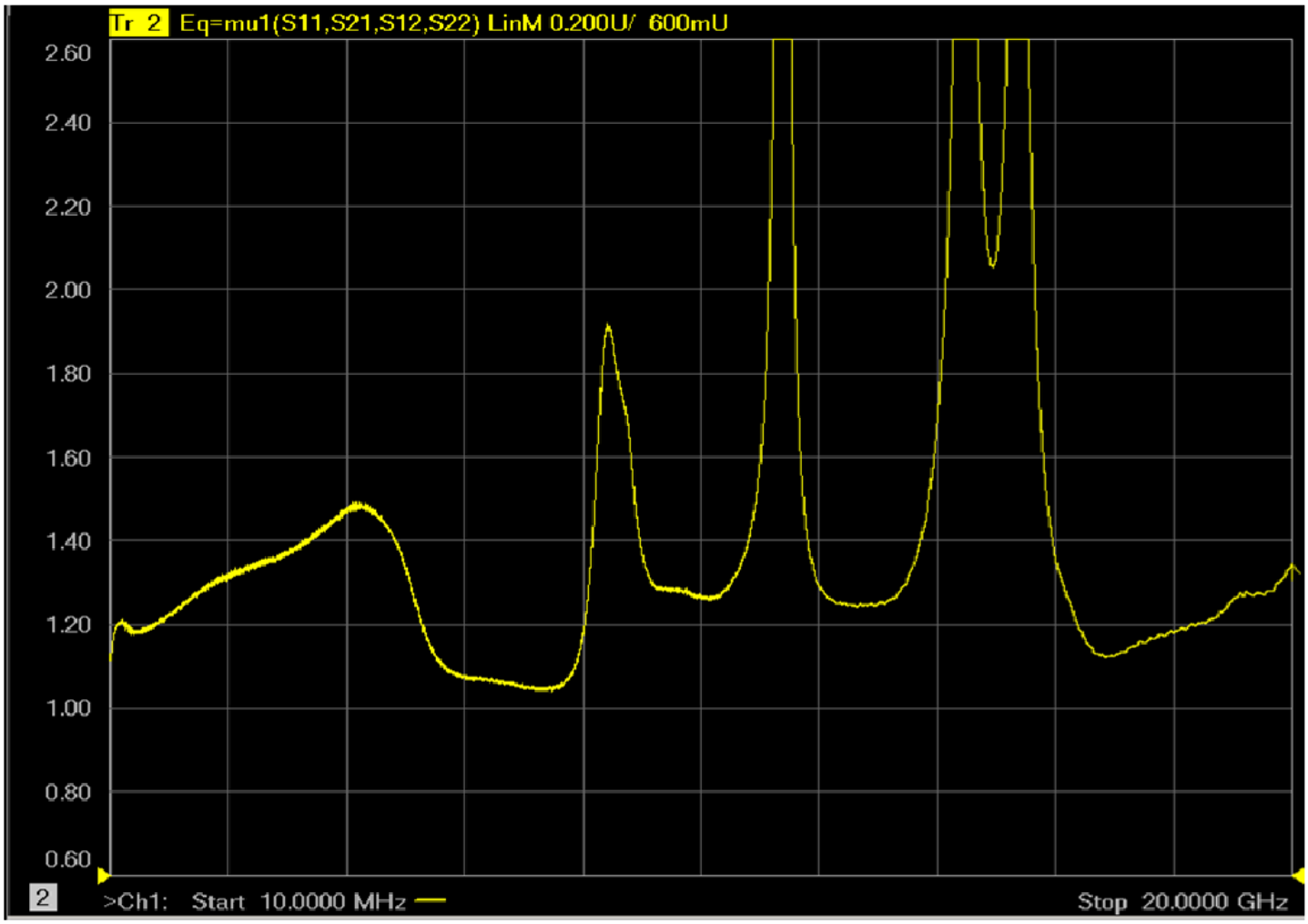
GRF2105 Typical Operating Curves: S-Parameters (0.4 to 3.8 GHz Tune)



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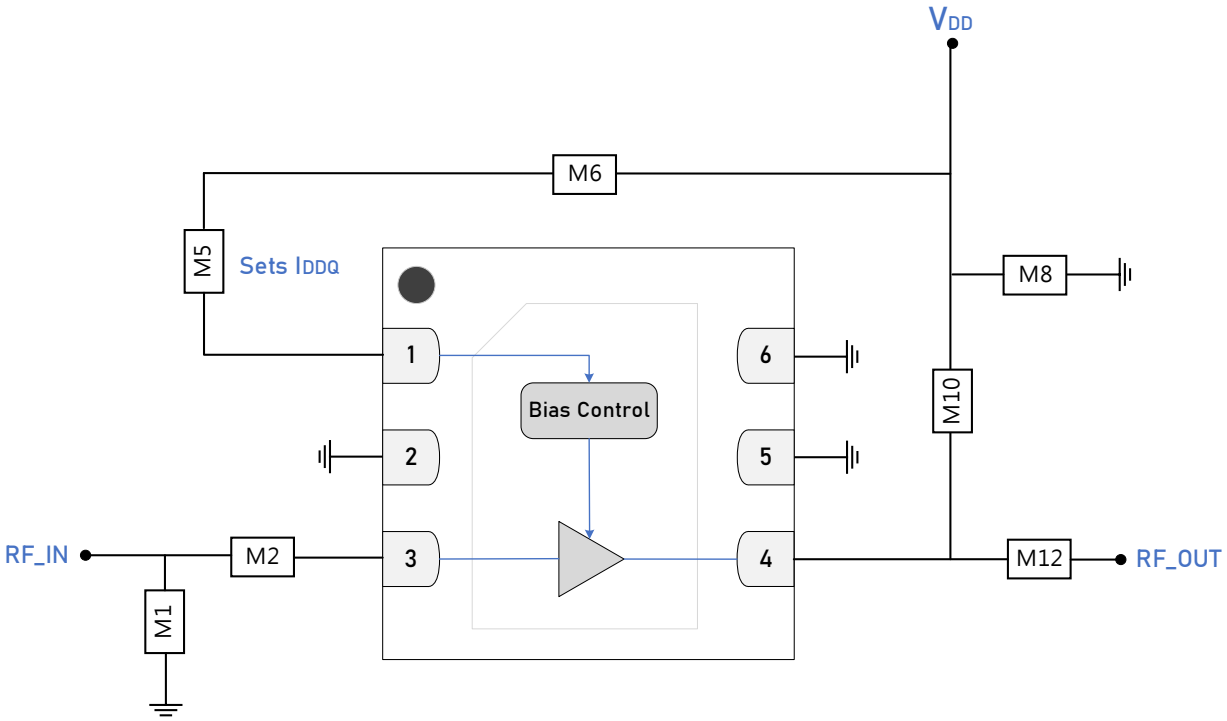
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GRF2105 Typical Operating Curves: Stability Mu Factor (10 MHz to 20 GHz)

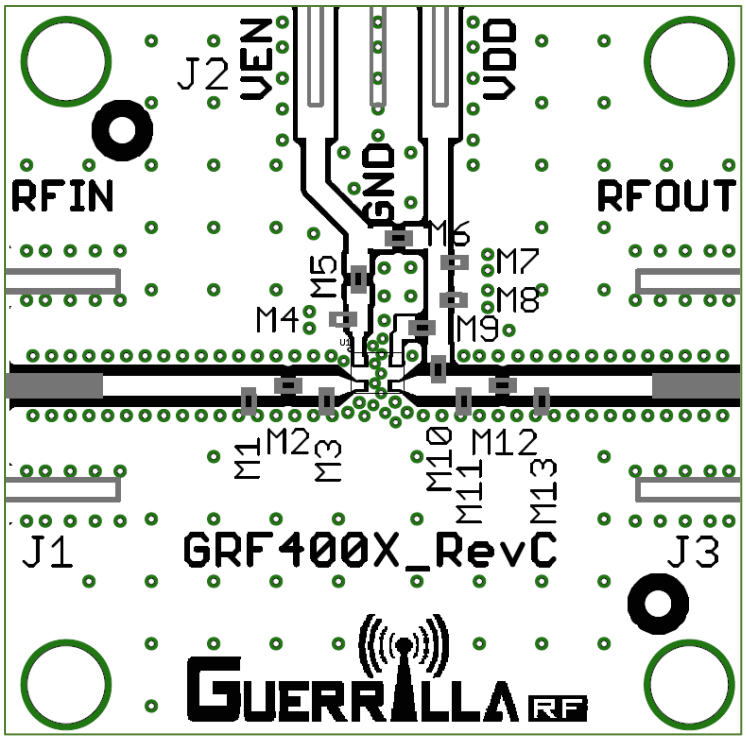


Note: Mu ≥ 1.0 implies unconditional stability

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GRF2105 Standard Evaluation Board Schematic



GRF2105 Evaluation Board Assembly Diagram

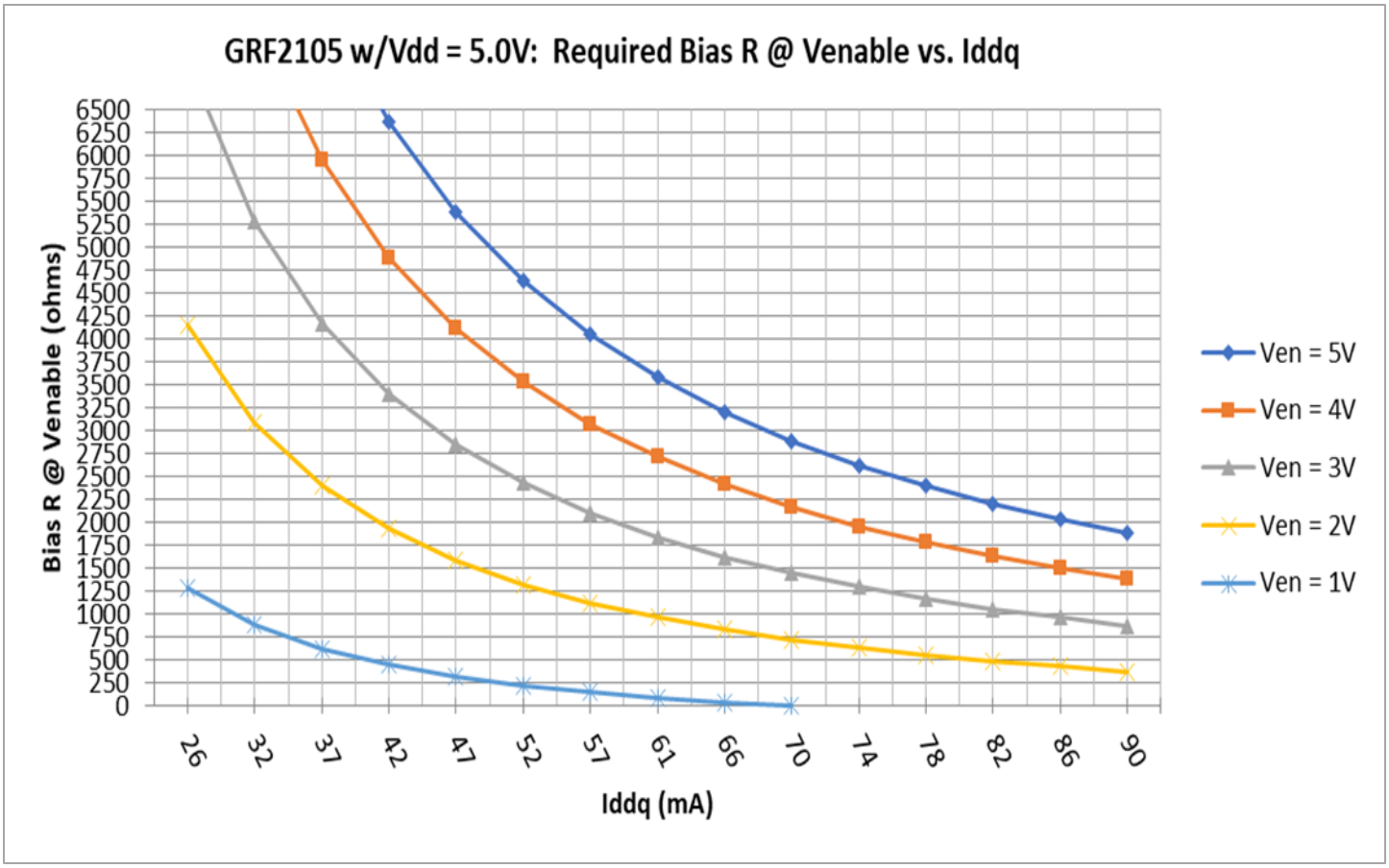
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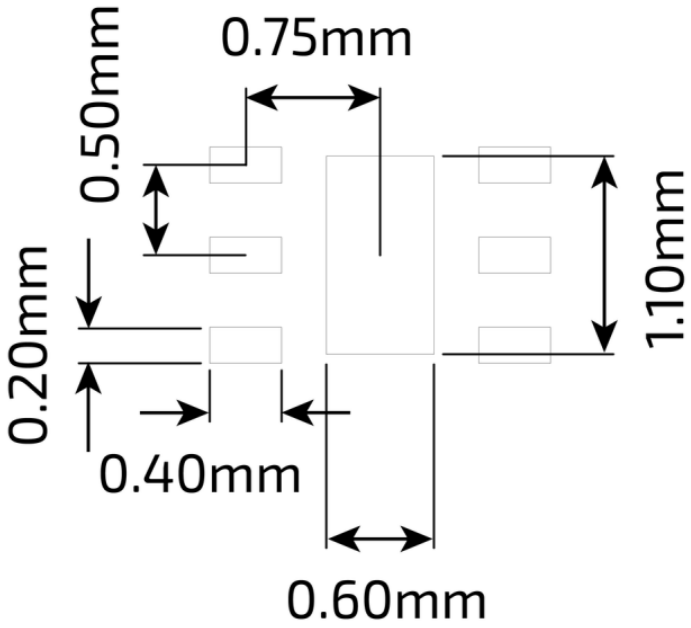
GRF2105 Evaluation Board Assembly Diagram Reference: 0.4 to 3.8 GHz Tune

Component	Type	Manufacturer	Family	Value	Package Size	Substitution
M1	Inductor	Murata	LQG	27.0 nH	0402	ok
M2	Capacitor	Murata	GJM	15.0 pF	0402	ok
M5 (sets I_{DDQ})	Resistor	Various	5%	See Curves	0402	ok
M6	Resistor (jumper)	Various	5%	0 Ω	0402	ok
M8	Capacitor	Murata	GRM	0.1 µF	0402	ok
M10	Inductor	Murata	LQG	27.0 nH	0402	ok
M12	Capacitor	Murata	GRM	1000 pF	0402	ok
Evaluation Board	GRF400X_RevC					

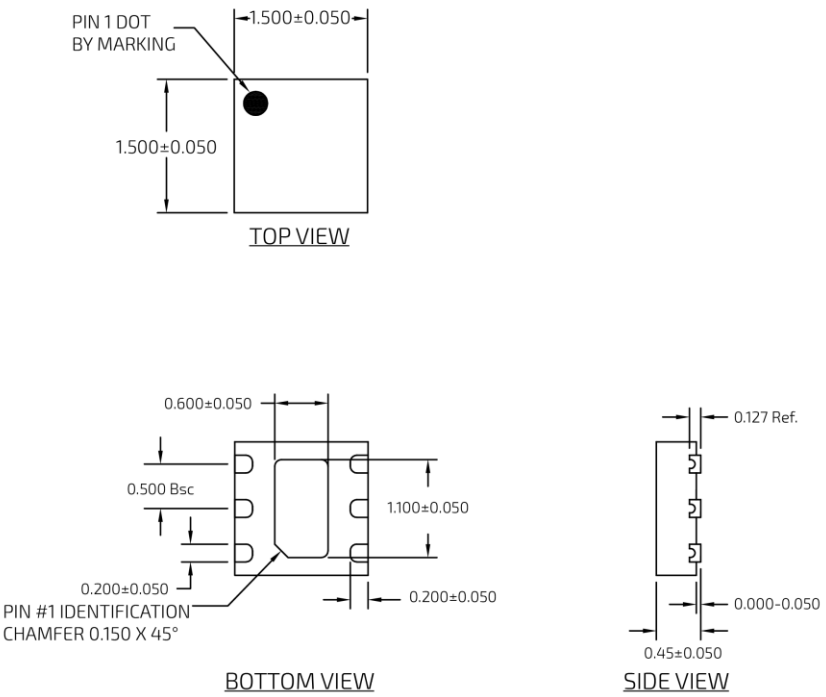
GRF2105 Bias Resistor Selection Curves



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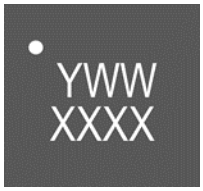
DFN-6 1.5 x 1.5 mm Suggested PCB Footprint (Top View)



DFN-6 1.5 x 1.5 mm Package Dimensions

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Package Marking Diagram



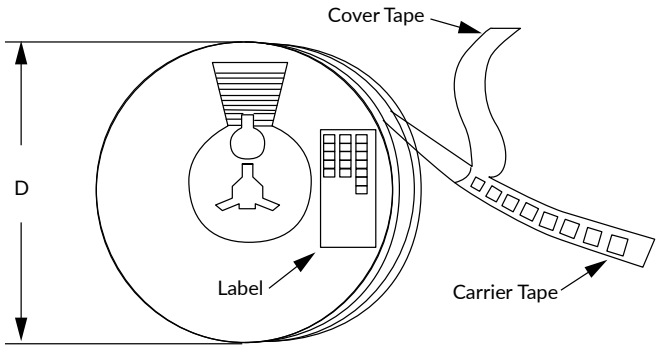
- Line 1: "Y" = YEAR (single digit). "WW" = WORK WEEK the device was assembled.
- Line 2: "XXXX" = Device PART NUMBER.

Tape and Reel Information

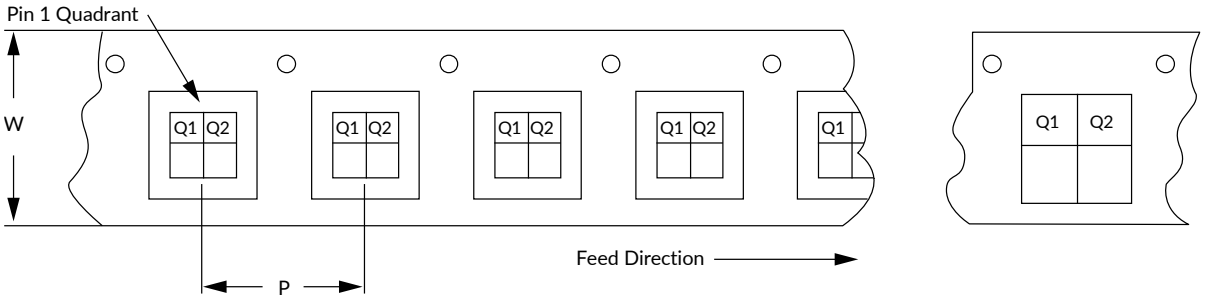
Guerrilla RF's tape and reel specification complies with Electronic Industries Alliance (EIA) standards for "Embossed Carrier Tape of Surface Mount Components for Automatic Handling" (reference EIA-481). See the following page for the Tape and Reel Specification and Device Package Information table, 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

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Revision History

Revision Date	Description of Change
April 9, 2018	Release Ø Data Sheet.
June 27, 2022	Upgraded Data Sheet to new format. Added new characterization plots for Gain, NF, OP1dB & OIP3. Lowered IDD typical value from 70 to 65 mA to match PTP. Lowered NF from 0.77 to 0.7 dB to match new plot. Changed M1 and M10 Inductors on evaluation board BOM from LQW/LQP to LQG series.
February 21, 2023	Release A Data Sheet.
July 31, 2023	Upgraded Data Sheet to newest format only. No change to device or device specifications.
December 1, 2023	Release B Data Sheet. Added $P_{IN\ MAX\ OFF}$ parameter to Absolute Ratings Table.
April 29, 2025	Raised Maximum Operating Temperature from 105 to 115 °C.
May 6, 2025	Changed Frequency Range from 0.4 - 5 GHz to 0.15 - 5.36 GHz.
October 1, 2025	Upgraded Data Sheet to new format only. 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.

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