



## GRF2100W

### Low-Current Low Noise Amplifier 0.08 to 5.3 GHz

RELEASE B DATA SHEET

#### FEATURES

- Flexible Bias Voltage and Current
- Internally Matched to 50  $\Omega$
- Process: GaAs pHEMT
- Compact 1.5 x 1.5 mm DFN-6 Package

#### AEC-Q100 Grade 2 Qualified

- 100% Device Reflow at Assembly
- 100% Optical Die Inspection

#### Reference: 3.3 V / 15 mA / 2.5 GHz

- Gain: 16.5 dB
- OIP3: 19 dBm
- OP1dB: 10 dBm
- Evaluation Board Noise Figure: 0.8 dB

#### APPLICATIONS

- GPS
- Compensator
- Small Cells and Cellular Repeaters
- Distributed Antenna Systems

#### ORDERING INFORMATION

Buy it Now

#### DESCRIPTION

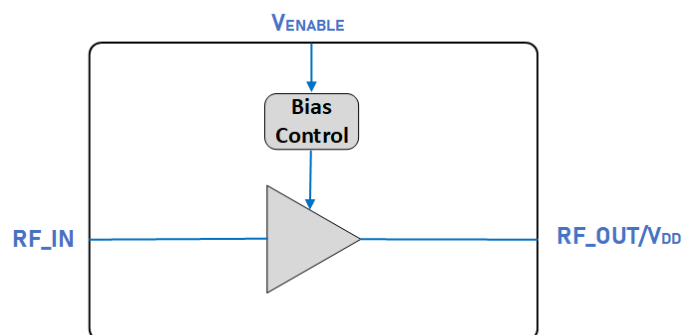
The GRF2100W is a high-gain, low-current LNA tunable over 0.08 to 5.3 GHz. It exhibits outstanding gain and noise figure (NF) with  $I_{DDQ}$  levels as low as 8 mA.

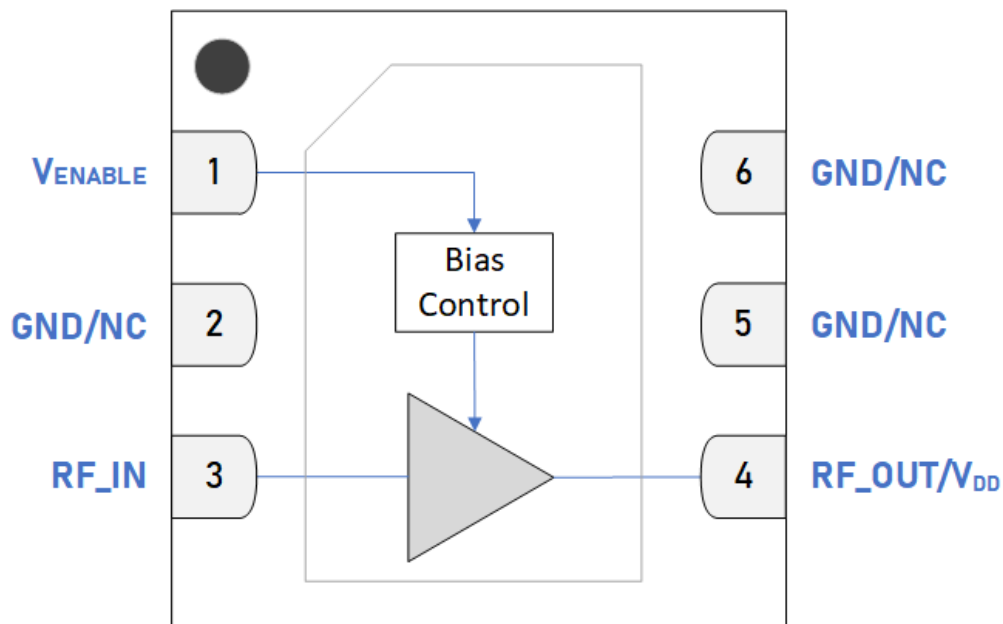
The device is operated from a Supply Voltage ( $V_{DD}$ ) of 1.8 to 5 V with a selectable  $I_{DDQ}$  range from 8 to 30 mA for optimal efficiency and linearity.

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 GRF2100W "Custom Tunes" product page: [GRF2100W Custom Tunes](#)

#### BLOCK DIAGRAM





Pin Out (Top View)



## Pin Assignments

| Pin      | Name                   | Description          | Note                                                                                                                                                                                                                                |
|----------|------------------------|----------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1        | V <sub>ENABLE</sub>    | Enable Voltage Input | V <sub>ENABLE</sub> and series resistor set I <sub>DDQ</sub> . V <sub>ENABLE</sub> ≤ 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                  | LNA RF Input         | An external DC blocking capacitor must be used.                                                                                                                                                                                     |
| 4        | RF_OUT/V <sub>DD</sub> | LNA RF Output        | V <sub>DD</sub> must be applied to this pin through an RF choke.                                                                                                                                                                    |
| PKG BASE | GND                    | Ground               | Provides DC and RF ground for LNA, as well as a thermal heat sink. Recommend multiple 8 mil vias beneath the package for optimal RF and thermal performance. Refer to the evaluation board top layer graphic on the schematic page. |

## Absolute Ratings

| Parameter                                                          | Symbol             | Min. | Max. | Unit |
|--------------------------------------------------------------------|--------------------|------|------|------|
| Supply Voltage                                                     | $V_{DD}$           | 0    | 5.5  | V    |
| RF Input Power: Load VSWR < 2:1, $V_{DD} \leq 5$ V, $V_{EN} = 5$ V | $P_{IN\ MAX\ ON}$  |      | 15   | dBm  |
| RF Input Power: Load VSWR < 2:1, $V_{DD} \leq 5$ V, $V_{EN} = 0$ V | $P_{IN\ MAX\ OFF}$ |      | 15   | dBm  |
| Operating Temperature (Package Base)                               | $T_{PKG\ BASE}$    | -40  | 105  | °C   |
| Maximum Channel Temperature (MTTF > 10 <sup>6</sup> hours)         | $T_{MAX}$          |      | 170  | °C   |
| Maximum Dissipated Power                                           | $P_{DISS\ MAX}$    |      | 150  | 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.**

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                          | $V_{DD}$        | 0             | 3.3  | 5.5  | V        |                                                                                            |
| Operating Temperature<br>(Package Base) | $T_{PKG\ BASE}$ | -40           |      | 105  | °C       |                                                                                            |
| RF Frequency Range                      | $F_{TEST}$      | 0.08          | 2.5  | 5.3  | GHz      | Typical application schematic with external matching components ( <b>note 1 &amp; 2</b> ). |
| RF_IN Port Impedance                    | $Z_{RFIN}$      |               | 50   |      | $\Omega$ | Single ended.                                                                              |
| RF_OUT Port Impedance                   | $Z_{RFOUT}$     |               | 50   |      | $\Omega$ | 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: [GRF2100W 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 Measurement Schematic using the 0.1 to 3.8 GHz tuning set, 50  $\Omega$  system impedance,  $M5 = 6 \text{ k}\Omega$ ,  $V_{DD} = 3.3 \text{ V}$ ,  $V_{ENABLE} = 3.3 \text{ V}$ ,  $I_{DD} = 15 \text{ mA}$ ,  $F_{TEST} = 2.5 \text{ GHz}$ ,  $T_{PKG \text{ BASE}} = 25 \text{ }^{\circ}\text{C}$ . Evaluation Board losses are included within the specifications.

| Parameter           | Symbol       | Specification |      |      | Unit | Condition                                                              |
|---------------------|--------------|---------------|------|------|------|------------------------------------------------------------------------|
|                     |              | Min.          | Typ. | Max. |      |                                                                        |
| Switching Rise Time | $T_{RISE}$   |               | 800  |      | ns   | Disabled Mode to Gain Mode <b>(note 3)</b> .                           |
| Switching Fall Time | $T_{FALL}$   |               | 200  |      | ns   | Gain Mode to Disabled Mode <b>(note 4)</b> .                           |
| Supply Current      | $I_{DD}$     | 10            | 15   | 21   | mA   | $V_{DD} = V_{ENABLE} = 3.3 \text{ V}$ , $R_{BIAS} = 6 \text{ k}\Omega$ |
| Enable Current      | $I_{ENABLE}$ |               | 0.2  |      | mA   |                                                                        |

### Disabled Mode

|                 |               |  |   |  |               |                                                         |
|-----------------|---------------|--|---|--|---------------|---------------------------------------------------------|
| Leakage Current | $I_{LEAKAGE}$ |  | 1 |  | $\mu\text{A}$ | $V_{DD} = 3.3 \text{ V}$ , $V_{ENABLE} = 0 \text{ V}$ . |
|-----------------|---------------|--|---|--|---------------|---------------------------------------------------------|

### Thermal Data

|                                    |               |  |     |  |                      |                                                |
|------------------------------------|---------------|--|-----|--|----------------------|------------------------------------------------|
| Thermal Resistance (Infrared Scan) | $\Theta_{JC}$ |  | 300 |  | $^{\circ}\text{C/W}$ | On standard evaluation board <b>(note 5)</b> . |
|------------------------------------|---------------|--|-----|--|----------------------|------------------------------------------------|

**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  $T_{CHANNEL} < 170 \text{ }^{\circ}\text{C}$ .

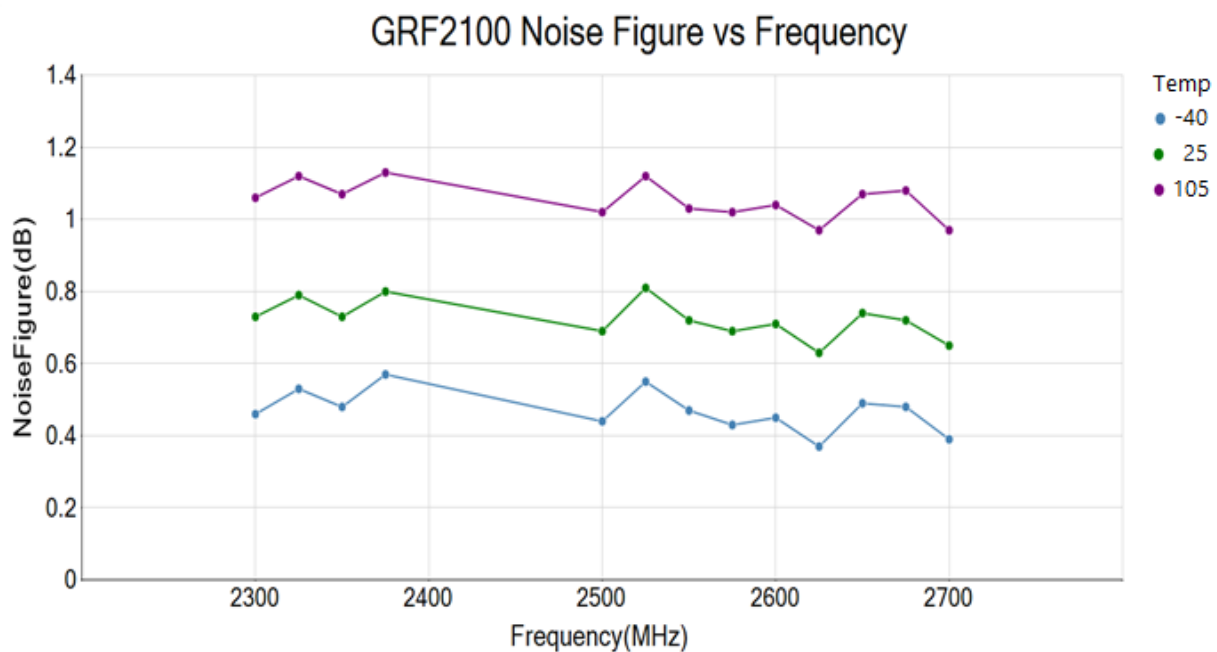
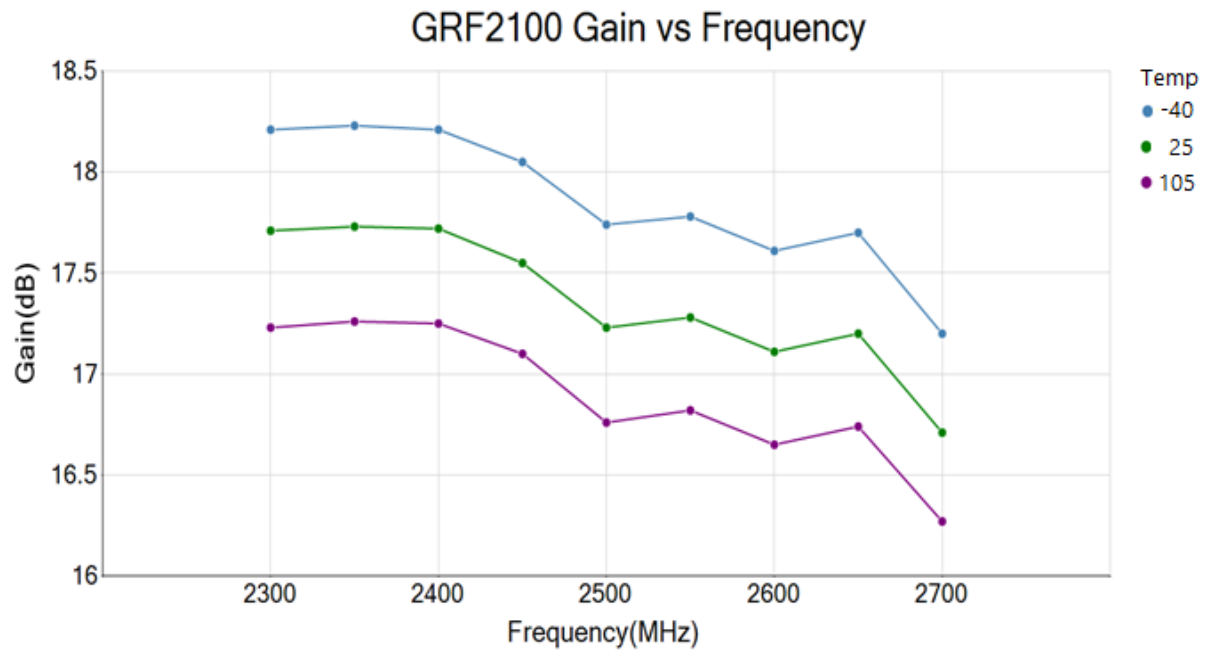


## Nominal Operating Parameters - RF

The following conditions apply unless noted otherwise: Typical Measurement Schematic using the 0.1 to 3.8 GHz tuning set. 50  $\Omega$  system impedance.  $M5 = 6\text{ k}\Omega$ .  $V_{DD} = 3.3\text{ V}$ ,  $V_{ENABLE} = 3.3\text{ V}$ ,  $I_{DD} = 15\text{ mA}$ .  $F_{TEST} = 2.5\text{ GHz}$ .  $T_{PKG\text{ BASE}} = 25\text{ }^{\circ}\text{C}$ . Evaluation Board losses are included within the specifications.

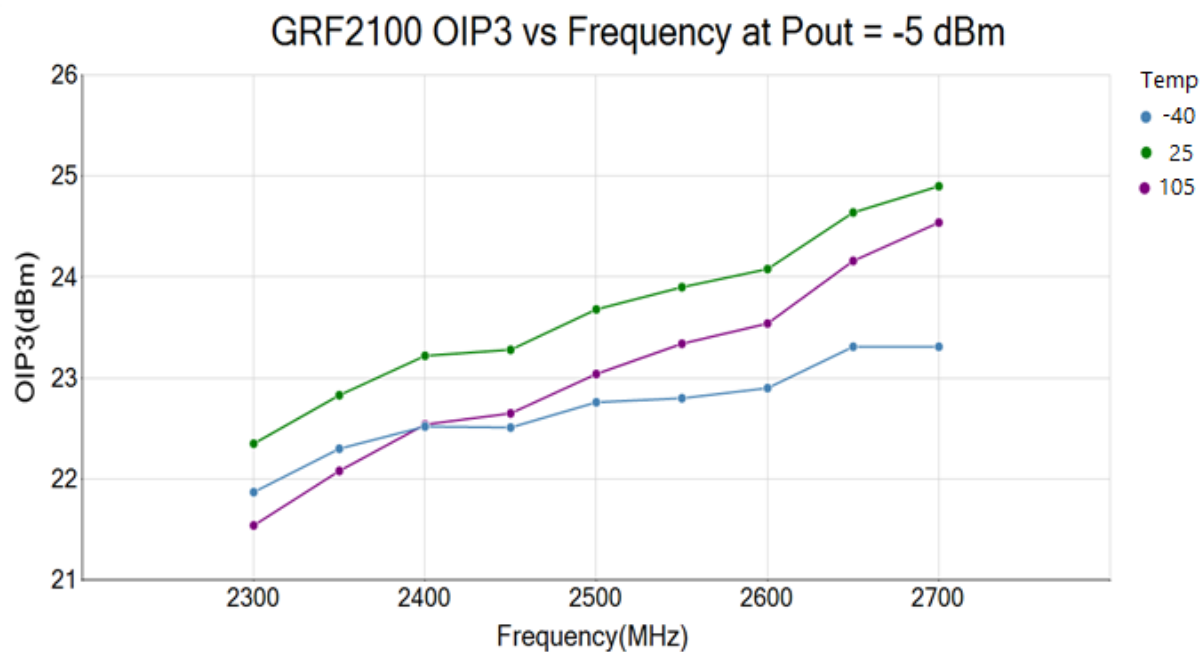
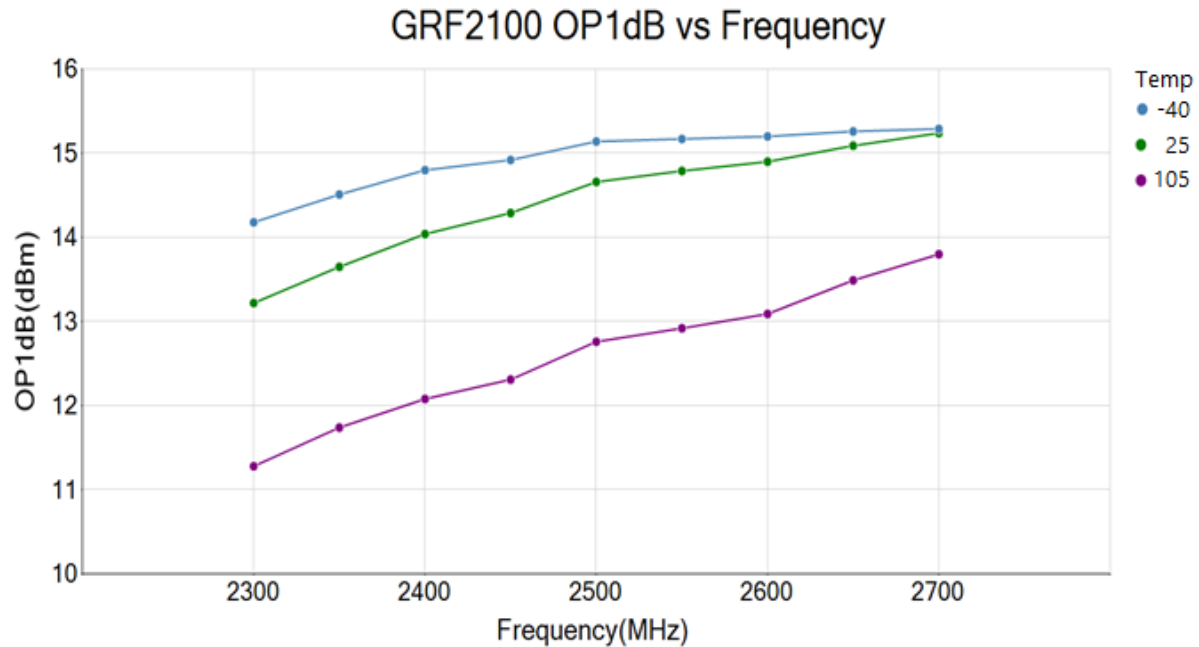
| Parameter                        | Symbol | Specification |       |      | Unit | Condition                                                       |
|----------------------------------|--------|---------------|-------|------|------|-----------------------------------------------------------------|
|                                  |        | Min.          | Typ.  | Max. |      |                                                                 |
| Gain                             | S21    | 15            | 16.5  |      | dB   |                                                                 |
| Reverse Isolation                | S12    |               | < -20 |      | dB   | $F_{RF} = 0.4\text{ to }3.8\text{ GHz}$ .                       |
| Evaluation Board Noise Figure    | NF     |               | 0.8   | 1    | dB   |                                                                 |
| Output 3rd Order Intercept Point | OIP3   |               | 19    |      | dBm  | -5 dBm $P_{OUT}$ per tone at 2 MHz spacing (2499 and 2501 MHz). |
| Output 1 dB Compression Power    | OP1dB  | 8             | 10    |      | dBm  |                                                                 |

## GRF2100W Typical Operating Curves: 3.3 V, 15 mA, 2.3 to 2.7 GHz Tune

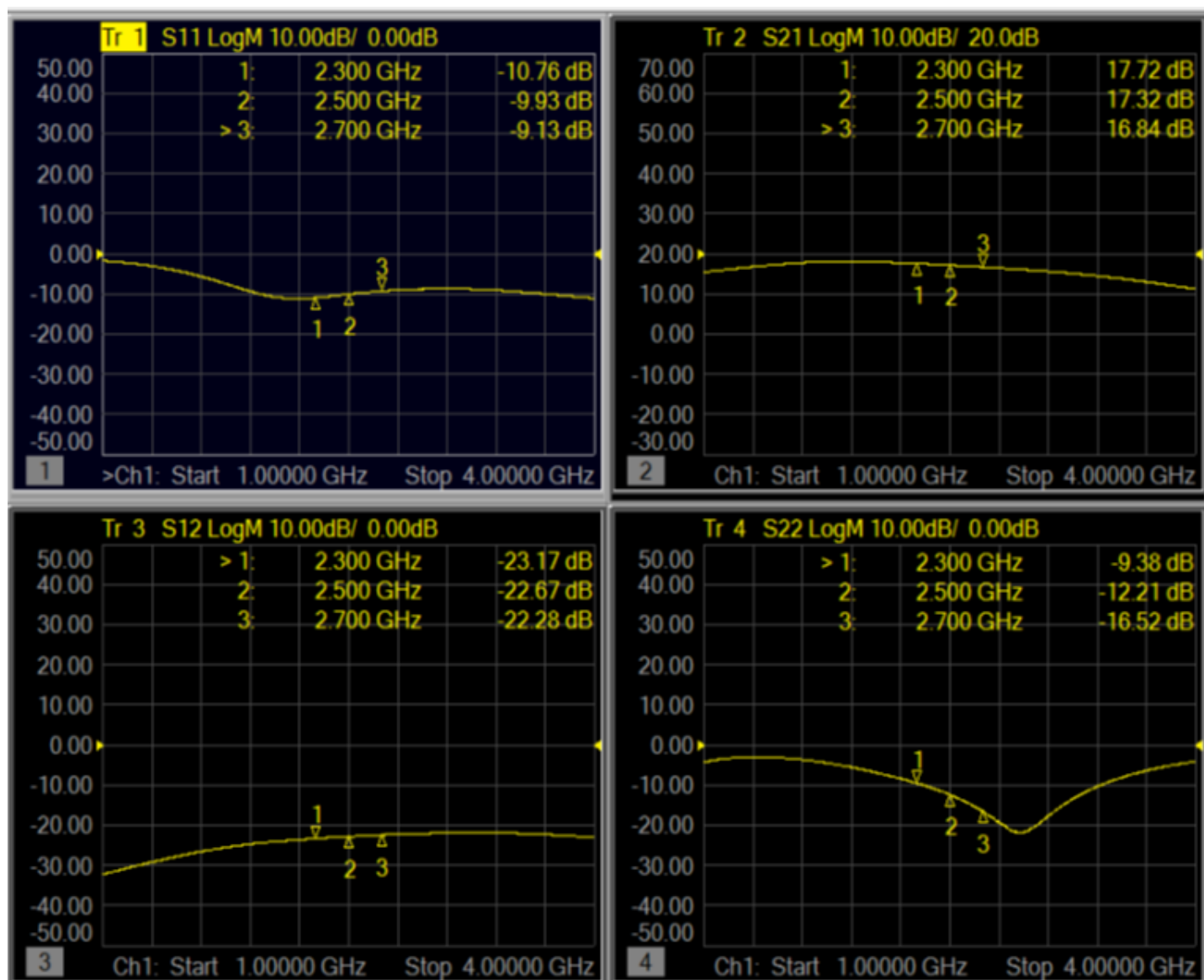




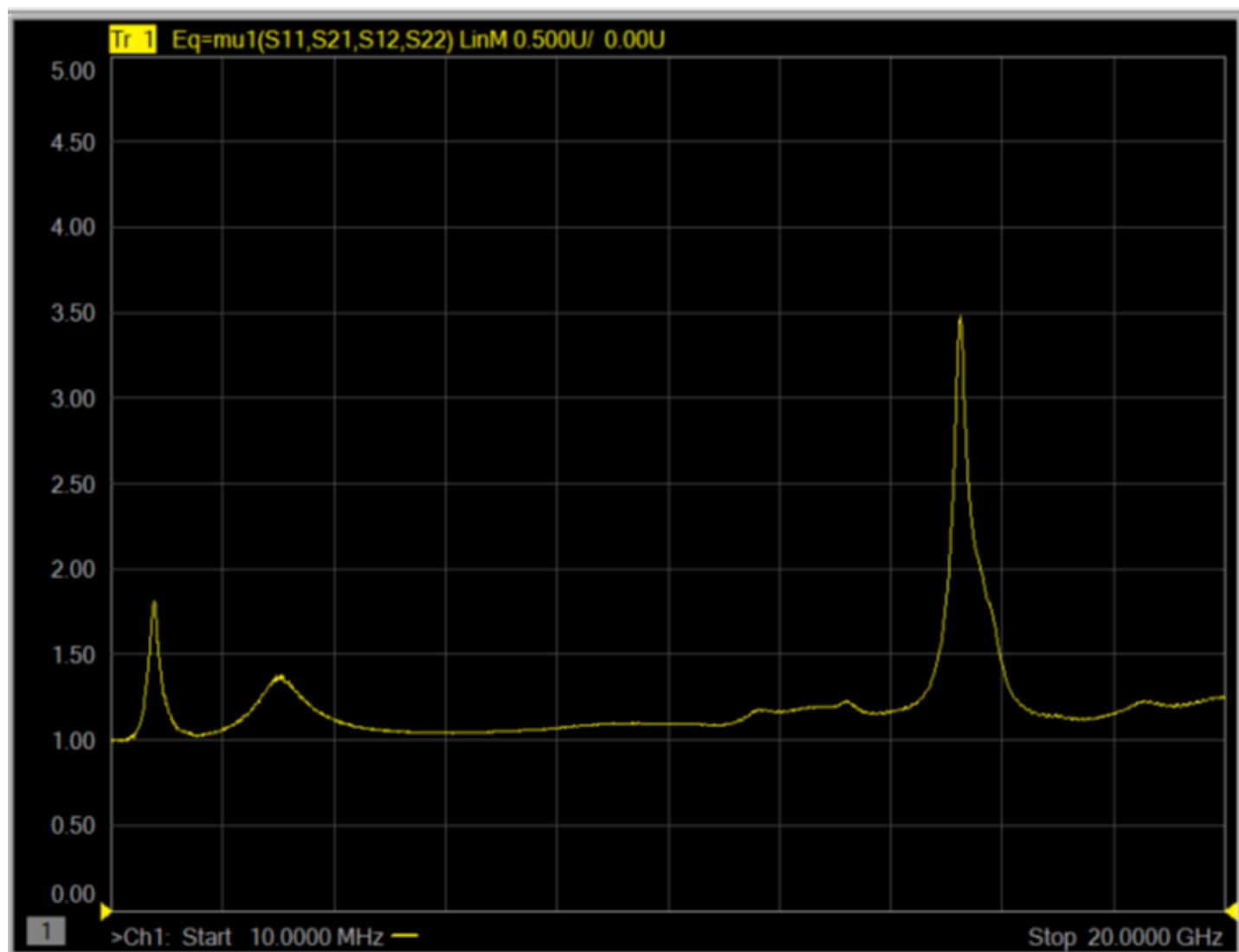
## GRF2100W Typical Operating Curves: 3.3 V, 15 mA, 2.3 to 2.7 GHz Tune



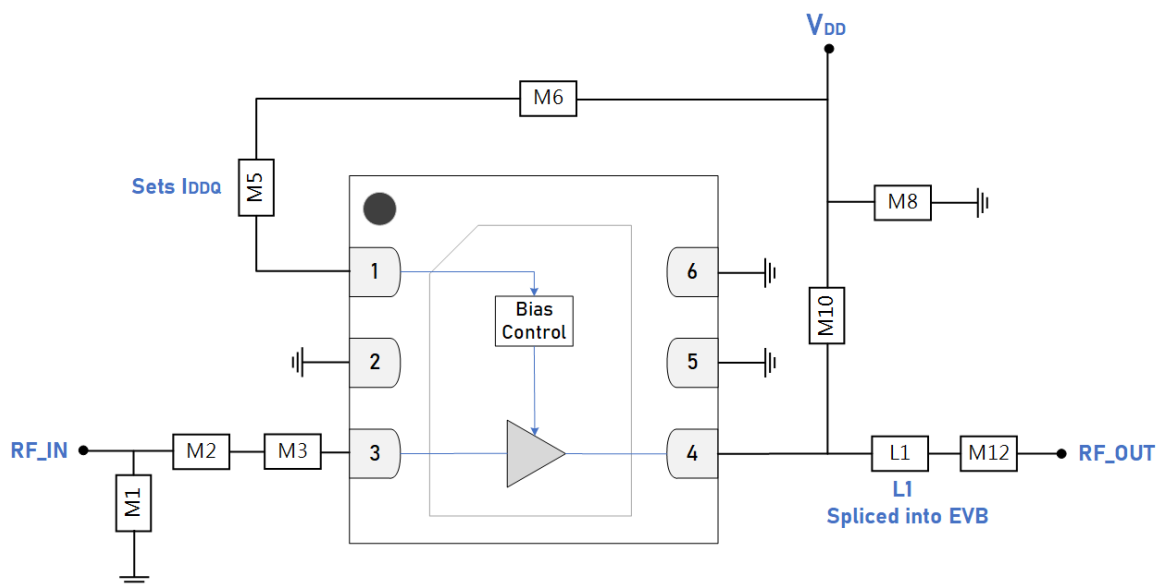
## GRF2100W Typical Operating Curves: S-Parameters (2.3 to 2.7 GHz Tune)



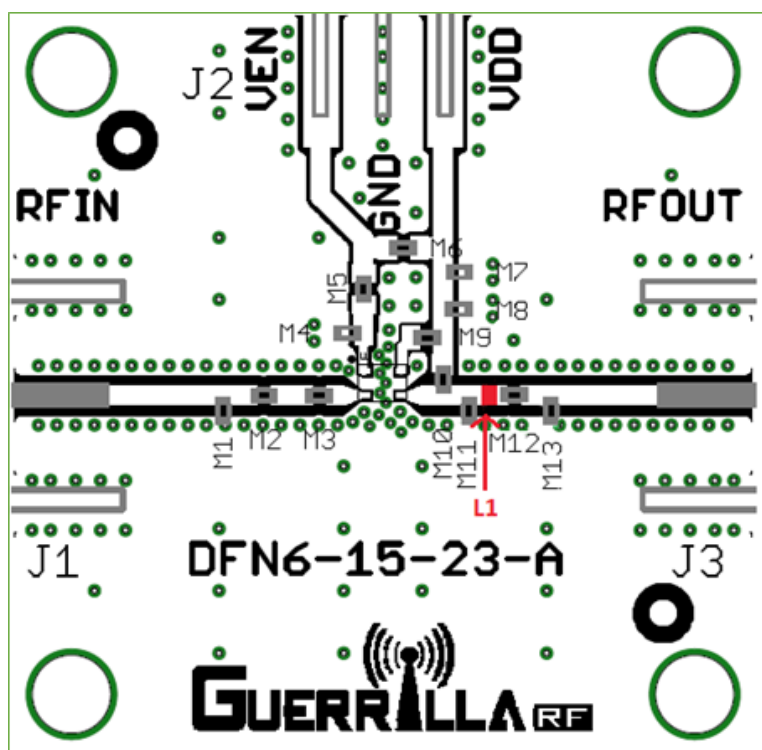
## GRF2100W Typical Operating Curves: Stability Mu Factor (10 MHz to 20 GHz)



Note: Mu factor  $\geq 1.0$  implies unconditional stability.



**GRF2100W Standard Evaluation Board Schematic**



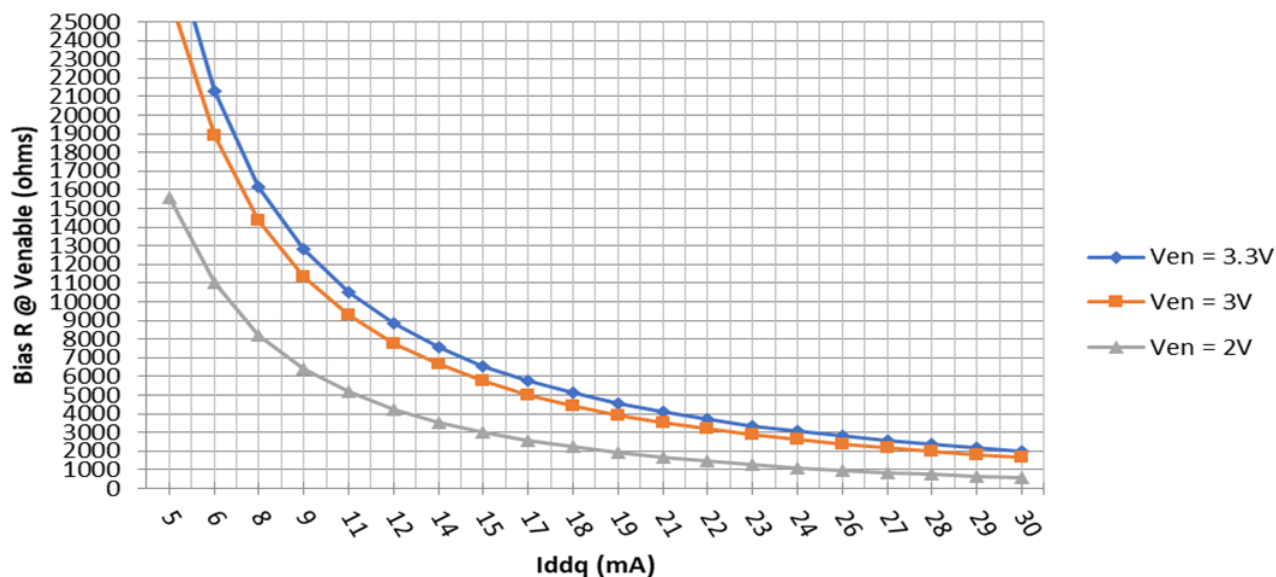
**GRF2100W Evaluation Board Assembly Diagram**

## GRF2100W Evaluation Board Assembly Diagram Reference: 2.3 to 2.7 GHz

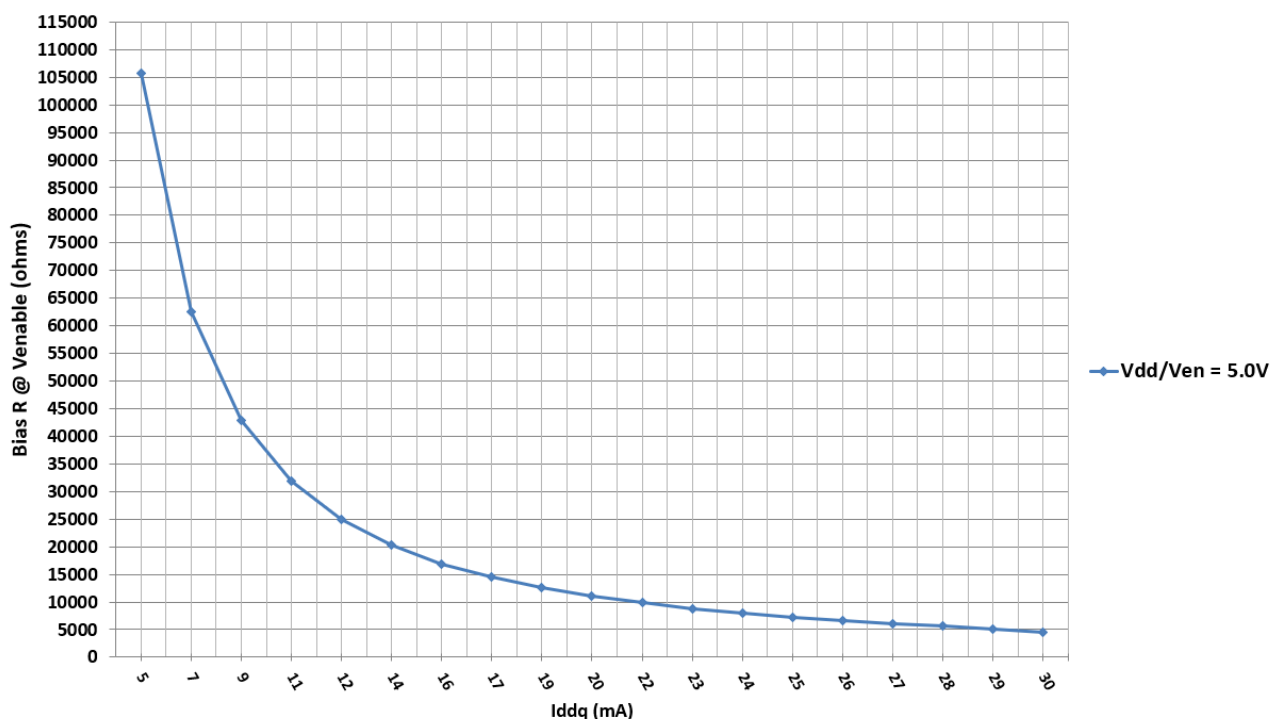
| Component            | Type                  | Manufacturer | Family  | Value        | Package Size | Substitution |
|----------------------|-----------------------|--------------|---------|--------------|--------------|--------------|
| M1                   | Inductor              | Murata       | LQG     | 3.9 nH       | 0402         | ok           |
| M2                   | Capacitor             | Murata       | GJM     | 8.2 pF       | 0402         | ok           |
| M3                   | Resistor (jumper)     | Various      | 5%      | 0 $\Omega$   | 0402         | ok           |
| M5 (sets $I_{DDQ}$ ) | Resistor              | Various      | 5%      | 6 k $\Omega$ | 0402         | ok           |
| M6                   | Resistor (jumper)     | Various      | 5%      | 0 $\Omega$   | 0402         | ok           |
| M8                   | Capacitor             | Murata       | GRM     | 0.1 $\mu$ F  | 0402         | ok           |
| M10                  | Inductor              | Murata       | LQG     | 10 nH        | 0402         | ok           |
| M12                  | Capacitor             | Murata       | GJM/GRM | 2.7 pF       | 0402         | ok           |
| L1                   | Inductor (spliced in) | Murata       | LQG     | 3 nH         | 0402         | ok           |
| Evaluation Board     | DFN6-15-23-A          |              |         |              |              |              |

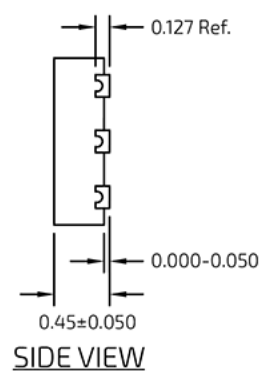
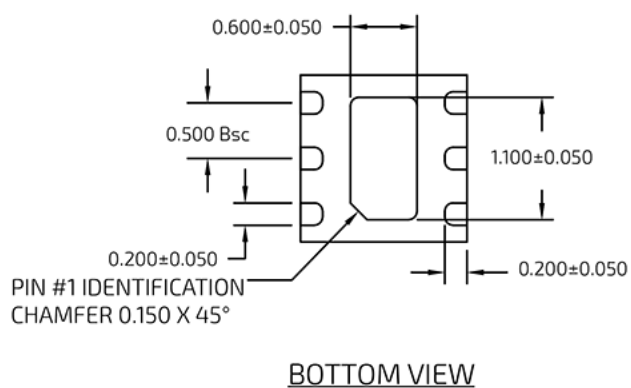
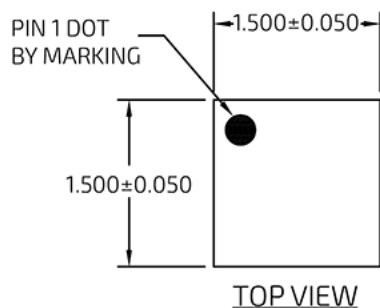
## GRF2100W Bias Resistor Selection Curves:

**GRF2100: Vdd = 3.3V: Required Bias R @ Venable vs. Iddq**

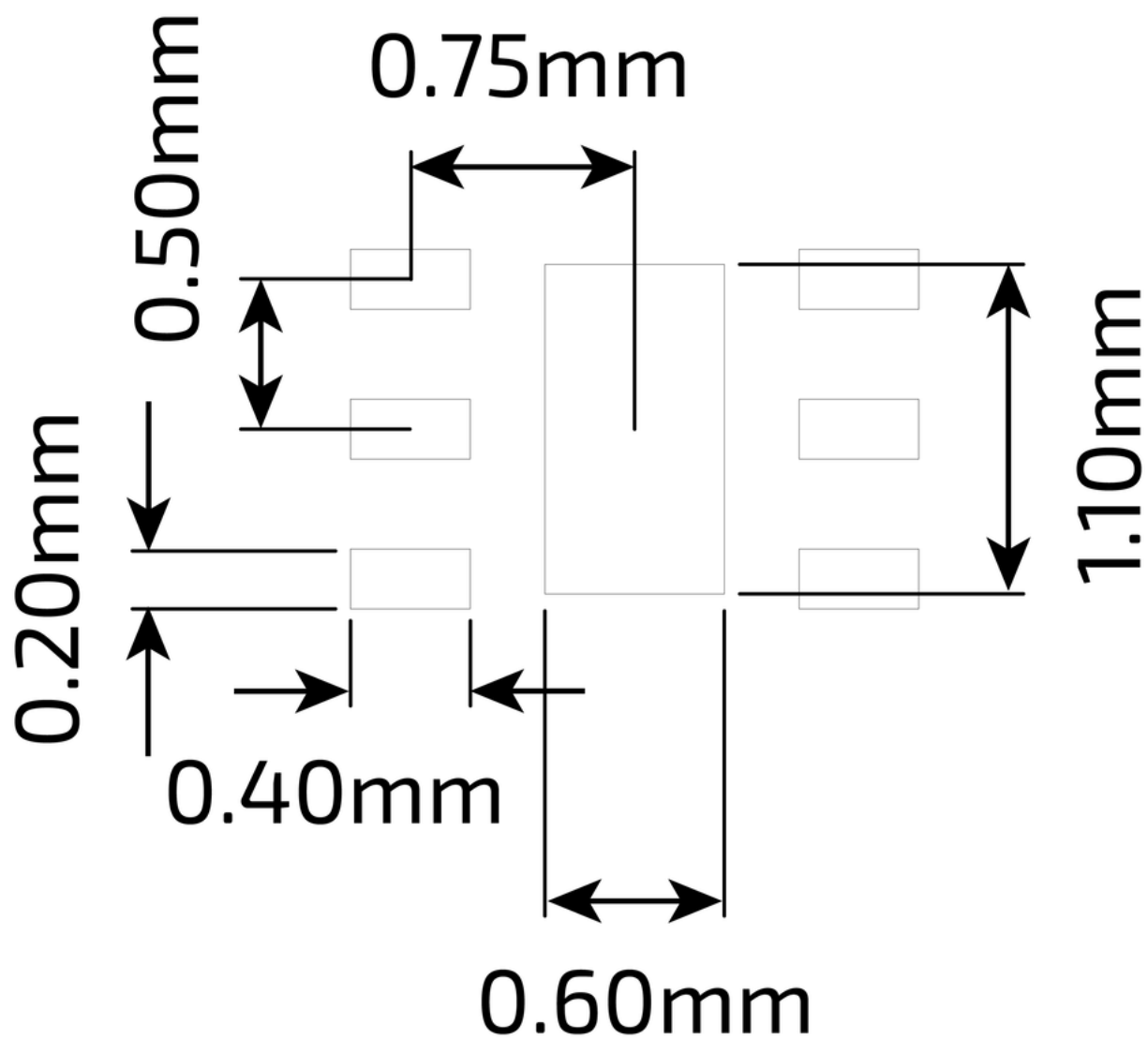


**GRF2100: Vdd/Ven = 5.0V: Required Bias R @ Venable vs. Iddq**





### DFN 6 1.5x1.5mm Package Dimensions



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



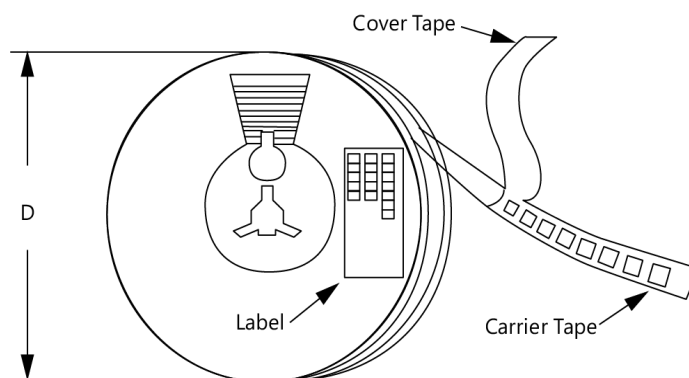
## Package Marking Diagram



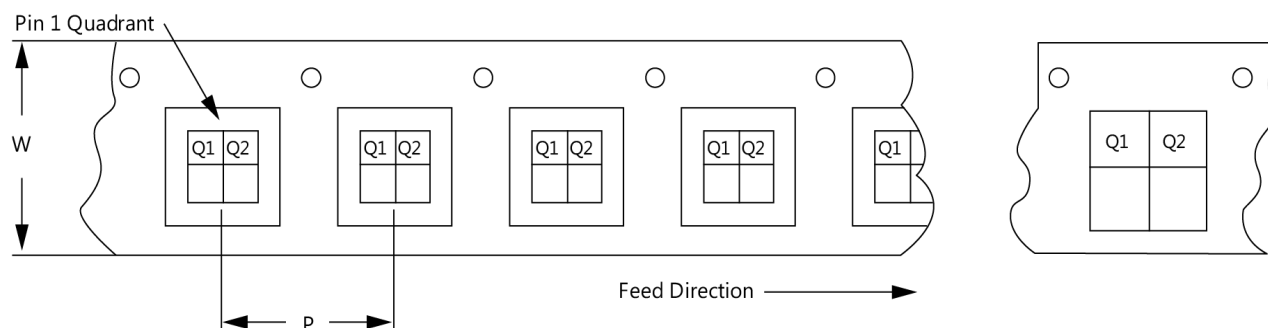
Line 1: "Y" = YEAR (single digit). "WW" = WORK WEEK and "w" = W for automotive.  
Line 2: "XXXX" = Device Part Number.

## 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](http://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                                                                          |
|-------------------|------------------------------------------------------------------------------------------------|
| June 2, 2021      | Release Ø Data Sheet.                                                                          |
| October 5, 2021   | Release A Data Sheet.                                                                          |
| September 6, 2022 | Updated evaluation board BOM and schematic for new tune. Added updated characterization plots. |
| November 27, 2023 | Release B Data Sheet. Added "Pin Max Off" parameter to Absolute Ratings Table.                 |
| March 13, 2024    | Upgraded Data Sheet to newest format only.                                                     |
| May 12, 2025      | Extended frequency range from 100 - 3800 MHz to 80 - 5300 MHz.                                 |



## 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.                                                                                                                   |

Information in this data sheet is specific to the Guerrilla RF, Inc. ("Guerrilla RF") product identified.

This data sheet, including the information contained in it, is provided by Guerrilla RF as a service to its customers and may be used for informational purposes only by the customer. Guerrilla RF assumes no responsibility for errors or omissions on this data sheet or the information contained herein. Information provided is believed to be accurate and reliable, however, no responsibility is assumed by Guerrilla RF for its use, nor for any infringement of patents, or other rights of third parties, resulting from its use. Guerrilla RF assumes no liability for any data sheet, data sheet information, materials, products, product information, or other information provided hereunder, including the sale, distribution, reproduction or use of Guerrilla RF products, information or materials.

No license, whether express, implied, by estoppel, by implication or otherwise granted by this data sheet for any intellectual property of Guerrilla RF, or any third party, including without limitation, patents, patent rights, copyrights, trademarks, and trade secrets. All rights are reserved by Guerrilla RF.

All information herein, products, product information, data sheets, and data sheet information are subject to change and availability without notice. Guerrilla RF reserves the right to change component circuitry, recommended application circuitry and specifications at any time without prior notice. Guerrilla RF may further change its data sheet, product information, documentation, products, services, specifications or product descriptions at any time, without notice. Guerrilla RF makes no commitment to update any materials or information and shall have no responsibility whatsoever for conflicts, incompatibilities, or other difficulties arising from any future changes.

GUERRILLA RF INFORMATION, PRODUCTS, PRODUCT INFORMATION, DATA SHEETS AND DATA SHEET INFORMATION ARE PROVIDED "AS IS" AND WITHOUT WARRANTY OF ANY KIND, WHETHER EXPRESS, IMPLIED, STATUTORY, OR OTHERWISE, INCLUDING FITNESS FOR A PARTICULAR PURPOSE OR USE, MERCHANTABILITY, PERFORMANCE, QUALITY OR NON-INFRINGEMENT OF ANY INTELLECTUAL PROPERTY RIGHT; ALL SUCH WARRANTIES ARE HEREBY EXPRESSLY DISCLAIMED. GUERRILLA RF DOES NOT WARRANT THE ACCURACY OR COMPLETENESS OF THE INFORMATION, TEXT, GRAPHICS OR OTHER ITEMS CONTAINED WITHIN THESE MATERIALS. GUERRILLA RF SHALL NOT BE LIABLE FOR ANY DAMAGES, INCLUDING BUT NOT LIMITED TO ANY SPECIAL, INDIRECT, INCIDENTAL, STATUTORY, OR CONSEQUENTIAL DAMAGES, INCLUDING WITHOUT LIMITATION, LOST REVENUES OR LOST PROFITS THAT MAY RESULT FROM THE USE OF THE MATERIALS OR INFORMATION, WHETHER OR NOT THE RECIPIENT OF MATERIALS HAS BEEN ADVISED OF THE POSSIBILITY OF SUCH DAMAGE.

Customers are solely responsible for their use of Guerrilla RF products in the Customer's products and applications or in ways which deviate from Guerrilla RF's published specifications, either intentionally or as a result of design defects, errors, or operation of products outside of published parameters or design specifications. Customers should include design and operating safeguards to minimize these and other risks. Guerrilla RF assumes no liability or responsibility for applications assistance, customer product design, or damage to any equipment resulting from the use of Guerrilla RF products outside of stated published specifications or parameters.