



GRF2081

Ultra-LNA with Shutdown 0.7 to 2.7 GHz

FEATURES

- Excellent Noise Figure Performance
- High Isolation Shutdown State
- Flexible Bias Voltage
- Compact 2.0 x 2.0 mm DFN-8 Package
- Process: GaAs pHEMT

Reference: 5 V / 75 mA / 1.9 GHz

- Gain: 18.5 dB
- OIP3: 37.5 dBm
- OP1dB: 19.5 dBm
- Evaluation Board Noise Figure: 0.4 dB

APPLICATIONS

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

DESCRIPTION

The GRF2081 is a broadband, linear, ultra-low noise amplifier designed for small cell, wireless infrastructure, and other high performance RF applications requiring ultra-low NF, high gain and linearity.

The device features an integrated shutdown function which places the device into a high-isolation shutdown state.

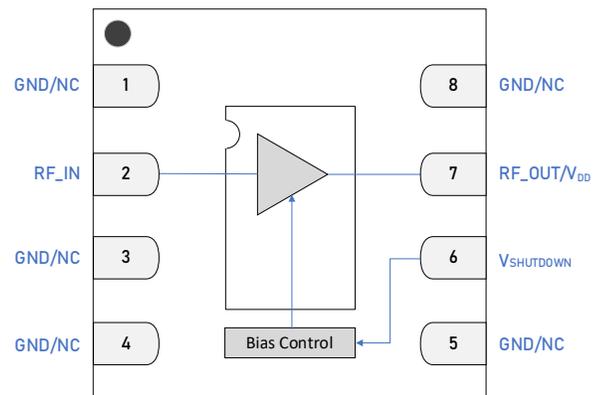
This device is a member of a family of pin-compatible, ultra-low noise devices which cover a wide range of frequency bands with industry leading NF and gain:

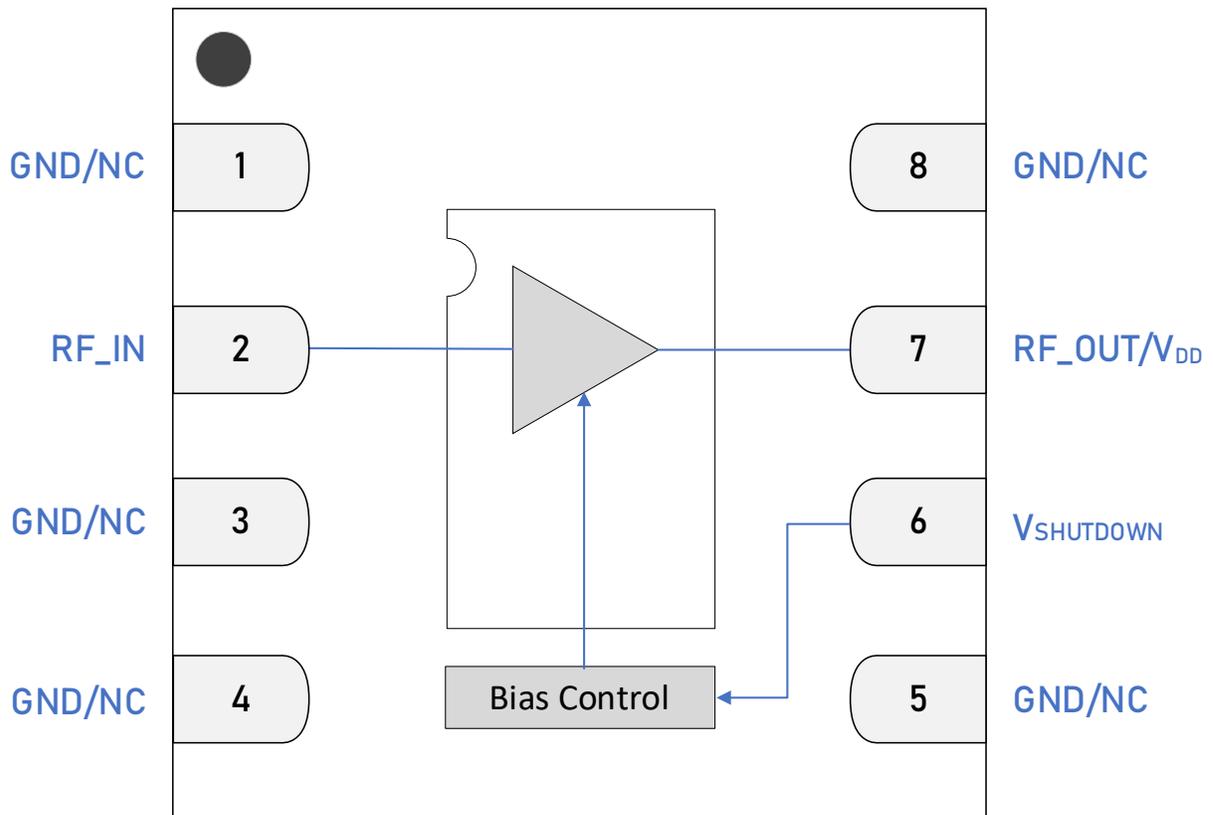
GRF2080: 0.1 to 1.5 GHz **GRF2081:** 0.7 to 2.7 GHz

GRF2082: 1.5 to 3.8 GHz **GRF2083:** 2.0 to 6.0 GHz

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

BLOCK DIAGRAM





2.0 x 2.0 mm DFN-8 Pin Out (Top View)

Pin Assignments

| Pin | Name | Description | Note |
|---------------|------------------------|-----------------------|---|
| 1, 3, 4, 5, 8 | GND/NC | Ground or No Connect | No internal connection to die. We recommend connecting these pins to GND. |
| 2 | RF_IN | RF Input | External match must provide DC block. |
| 6 | V _{SHUTDOWN} | Selects Shutdown Mode | See Control Logic Truth Table. |
| 7 | RF_Out/V _{DD} | RF Output | Provide device V _{DD} via external bias inductor. |
| 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. |

Control Logic Truth Table

| Mode | Description | V _{DD} | V _{SHUTDOWN} |
|-----------------|--------------------|-----------------|--------------------------|
| High Gain | LNA Gain | High | Low |
| Shutdown | LNA Insertion Loss | High | High |
| Logic Level "0" | Logic Low | 0 V | 0 V to 0.2 V |
| Logic Level "1" | Logic High | ≥ 2.7 V | 1.5 V to V _{DD} |

Absolute Ratings

| Parameter | Symbol | Min. | Max. | Unit |
|--|-----------------------|------|------|------|
| Supply Voltage | V_{DD} | 0 | 6 | V |
| RF Input Power (CW, Load VSWR < 2:1, $V_{DD} = 5$ V) | $P_{IN\ MAX}$ | | 23 | dBm |
| Operating Temperature (Package Heat Sink) | $T_{PKG\ HEAT\ SINK}$ | -40 | 105 | °C |
| Maximum Channel Temperature (MTTF > 10 ⁶ Hours) | T_{MAX} | | 170 | °C |
| Maximum Dissipated Power | $P_{DISS\ MAX}$ | | 600 | mW |

Electrostatic Discharge

| | | | | |
|----------------------|-----|------|--|---|
| Charged Device Model | CDM | 1500 | | V |
| 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 *Manufacturing Note MN-001 — Package and Manufacturing Information*.



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. | | |
| Supply Voltage | V _{DD} | 0 | 5 | 6 | V | |
| Operating Temperature (Package Heat Sink) | T _{PKG HEAT SINK} | -40 | | 105 | °C | |
| RF Frequency Range | F _{RF} | 0.7 | 1.9 | 2.7 | GHz | Typical Application Schematic with external matching components (note 1 & 2). |

Note 1: Operation outside this range is possible, but with degraded performance of some parameters.

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 1.7 to 2.7 GHz tuning set, $V_{DD} = 5\text{ V}$, $V_{SHUTDOWN} = < 0.2\text{ V}$, $I_{DD} = 75\text{ mA}$, $F_{TEST} = 1.9\text{ GHz}$, $T_{PKG\ HEAT\ SINK} = 25\text{ }^{\circ}\text{C}$. Evaluation board losses are included within the specifications.

| Parameter | Symbol | Specification | | | Unit | Condition |
|---------------------|------------|---------------|------|------|------|---|
| | | Min. | Typ. | Max. | | |
| Supply Current | I_{DD} | 50 | 75 | 95 | mA | $V_{DD} = 5\text{ V}$, $V_{SHUTDOWN} = 0\text{ V}$. |
| Switching Rise Time | T_{RISE} | | 100 | | ns | |
| Switching Fall Time | T_{FALL} | | 100 | | ns | |

Thermal Data

| | | | | | | |
|-------------------------------------|---------------|--|----|--|-----------------------------|---|
| Thermal Resistance: (Infrared Scan) | Θ_{JC} | | 60 | | $^{\circ}\text{C}/\text{W}$ | On standard evaluation board (note 3). |
|-------------------------------------|---------------|--|----|--|-----------------------------|---|

Note 3: MTTF > 10^6 hours for $T_{CHANNEL} \leq 170\text{ }^{\circ}\text{C}$.

Nominal Operating Parameters – RF

The following conditions apply unless noted otherwise: Typical Application Schematic using the 1.7 to 2.7 GHz tuning set, $V_{DD} = 5\text{ V}$, $V_{SHUTDOWN} = < 0.2\text{ V}$, $I_{DD} = 75\text{ mA}$, $F_{TEST} = 1.9\text{ GHz}$, $T_{PKG\ HEAT\ SINK} = 25\text{ }^{\circ}\text{C}$. Evaluation board losses are included within the specifications.

| Parameter | Symbol | Specification | | | Unit | Condition |
|--|--------|---------------|------|------|------|---|
| | | Min. | Typ. | Max. | | |
| Gain | S21 | 17.5 | 18.5 | | dB | |
| Evaluation Board Noise Figure | NF | | 0.4 | 0.6 | dB | |
| Output 3 rd Order Intercept Point | OIP3 | | 37.5 | | dBm | +4 dBm P_{OUT} per tone at 2 MHz spacing (1899 and 1901 MHz). |
| Output 1 dB Compression Power | OP1dB | 18 | 19.5 | | dBm | |

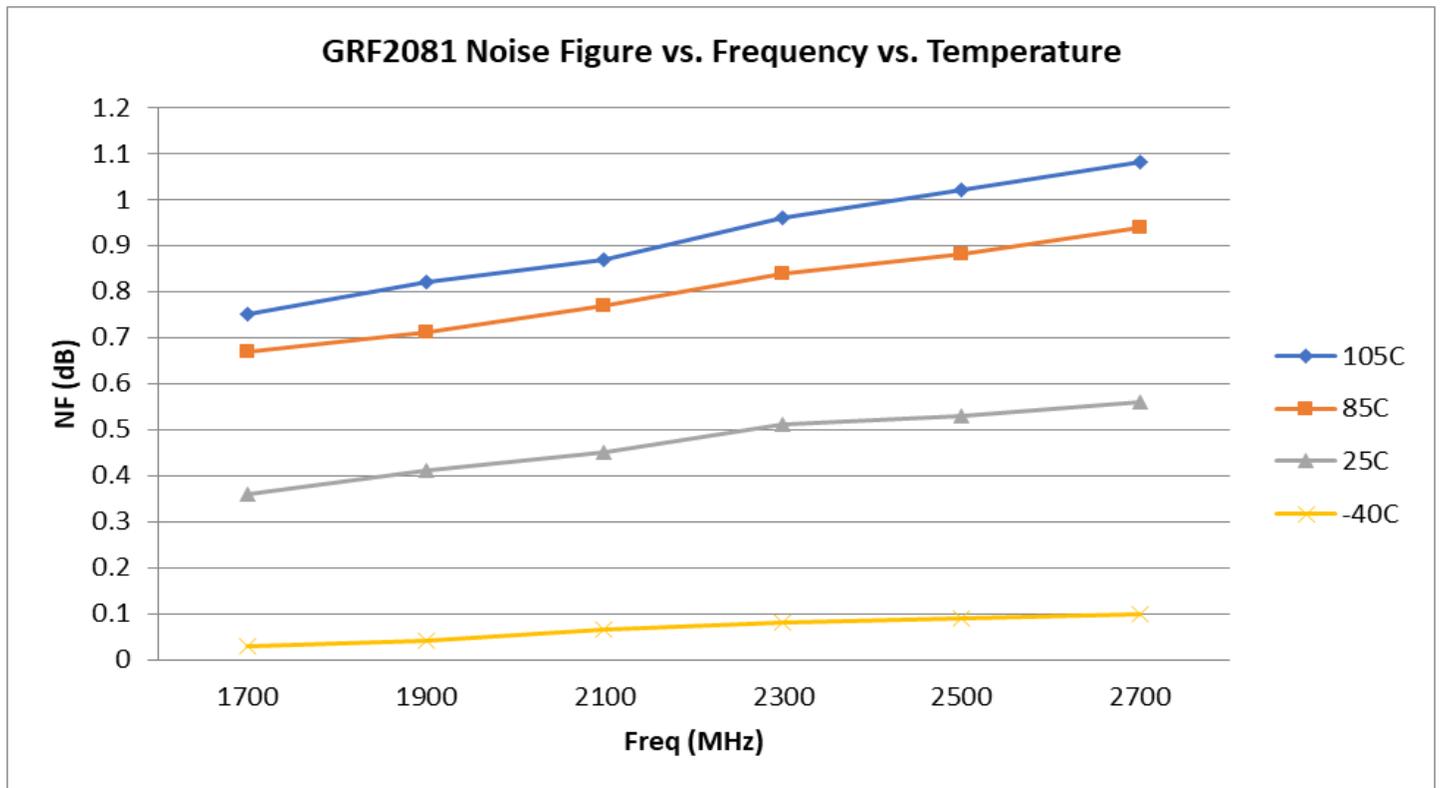
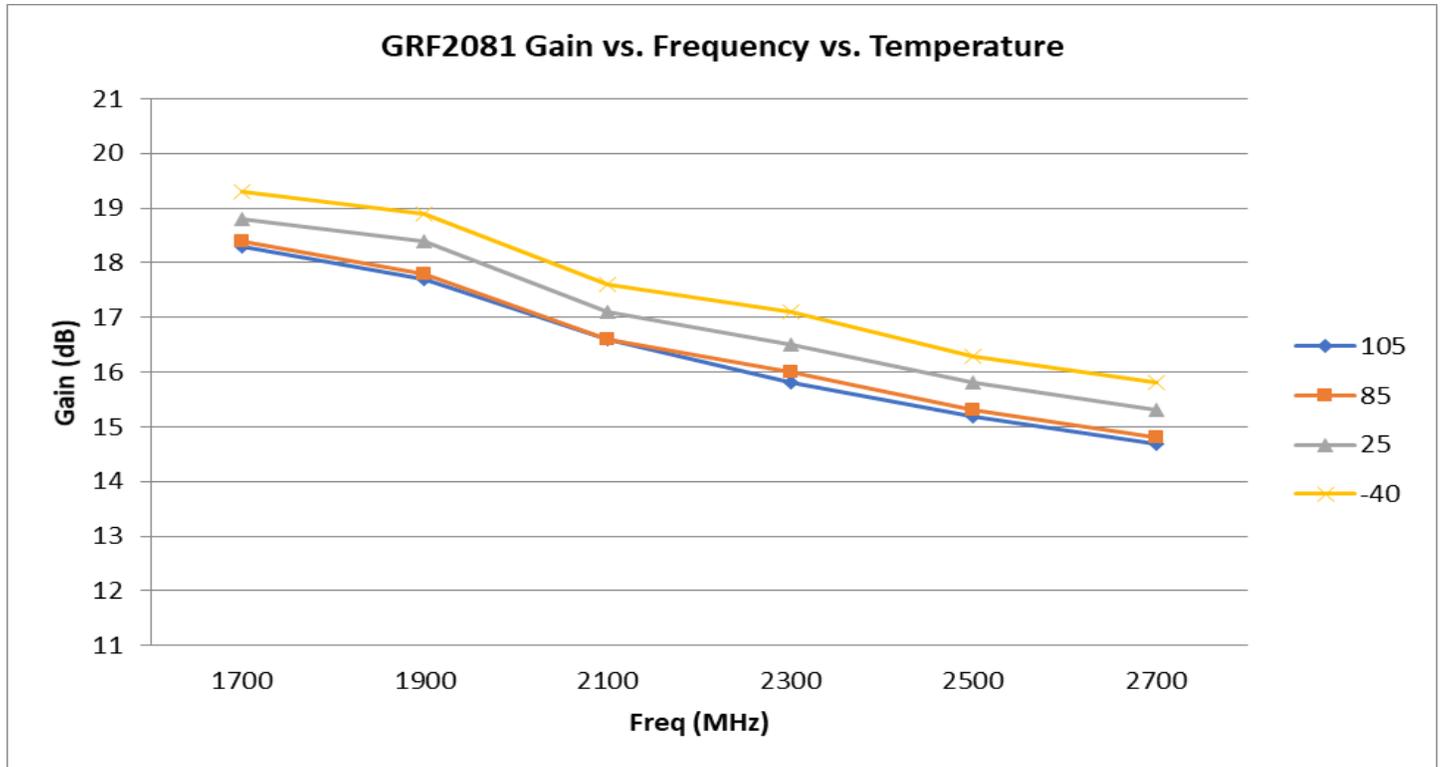
Shutdown Mode

| | | | | | | |
|-----------------------------------|----------------|--|-----|--|---------------|---|
| Gain (RF_IN = -10 dBm @ 1.9 GHz). | S21 | | -25 | | dB | $V_{DD} = 5\text{ V}$, $V_{SHUTDOWN} = > 1.5\text{ V}$. |
| Gain (RF_IN = 10 dBm @ 1.9 GHz). | S21 | | -15 | | dB | $V_{DD} = 5\text{ V}$, $V_{SHUTDOWN} = > 1.5\text{ V}$. |
| Shutdown Current (pin 6) | $I_{SHUTDOWN}$ | | 40 | | μA | $V_{DD} = 5\text{ V}$, $V_{SHUTDOWN} = 1.8\text{ V}$. |
| Leakage Current (pin 7) | $I_{LEAKAGE}$ | | 3.2 | | mA | $V_{DD} = 5\text{ V}$, $V_{SHUTDOWN} = 1.8\text{ V}$. |

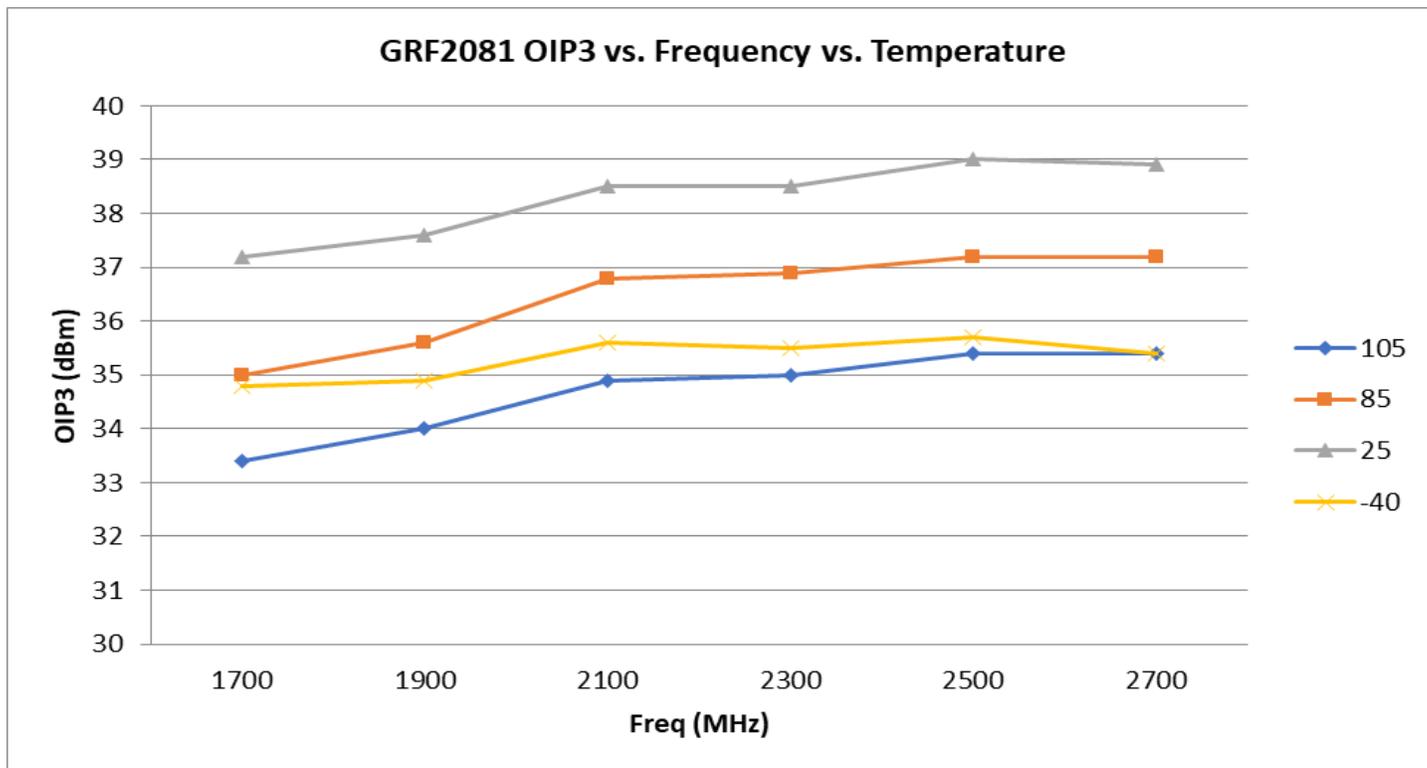
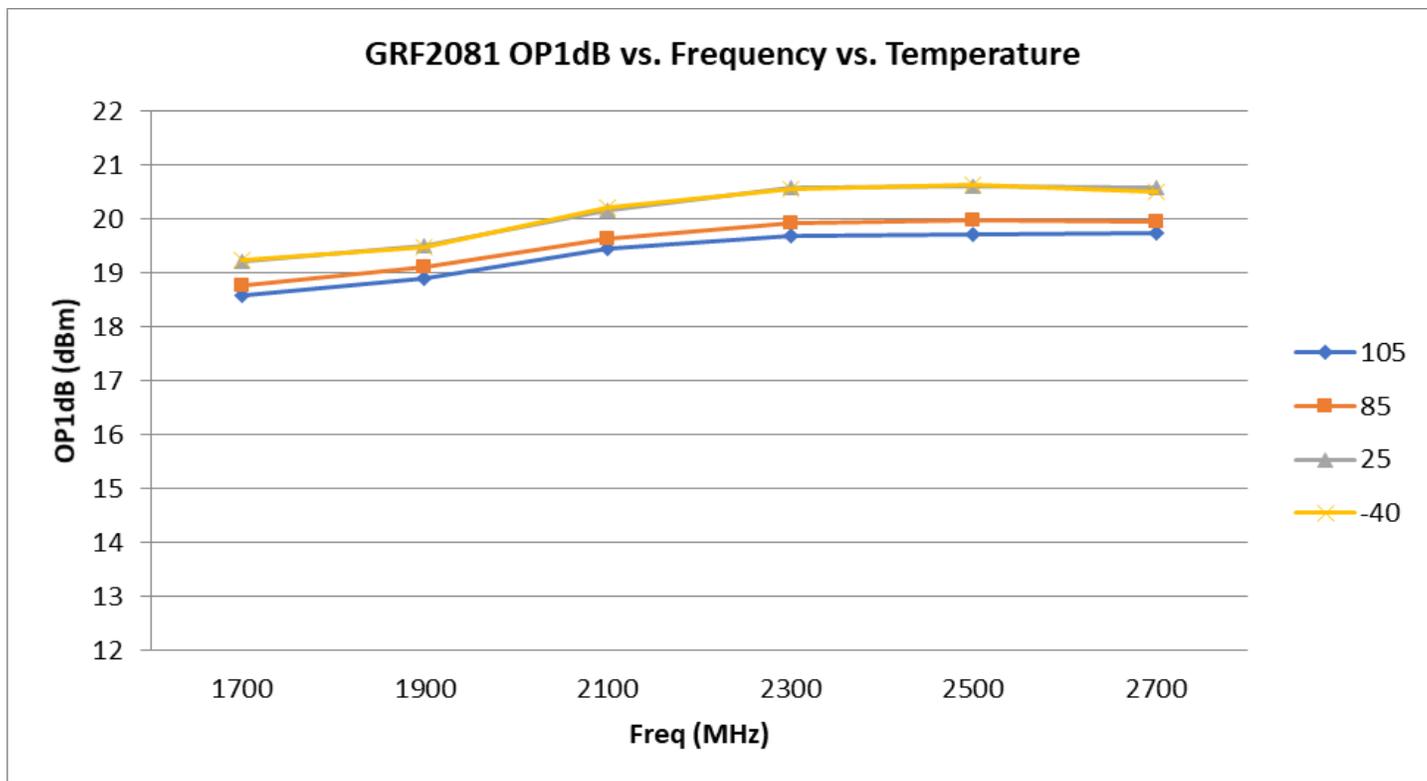
Typical Operating Curve Conditions

The following conditions apply unless noted otherwise: Typical Application Schematic using the 1.7 to 2.7 GHz tuning set, $V_{DD} = 5\text{ V}$, $V_{SHUTDOWN} = < 0.2\text{ V}$, $I_{DD} = 75\text{ mA}$, $F_{TEST} = 1.9\text{ GHz}$, $T_{PKG\ HEAT\ SINK} = 25\text{ }^{\circ}\text{C}$. Evaluation board losses are included within the plots.

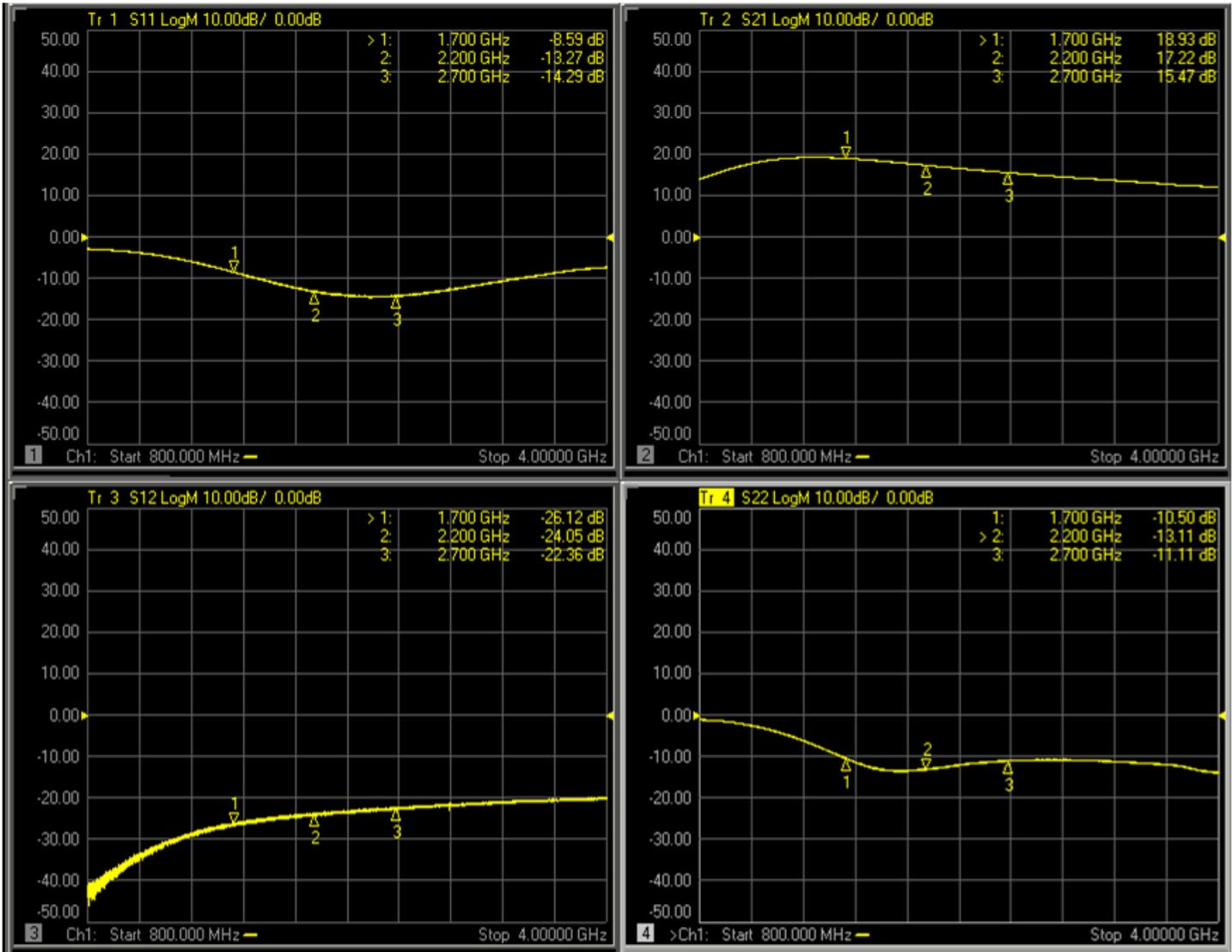
GRF2081 Typical Operating Curves: 1.7 to 2.7 GHz Tune



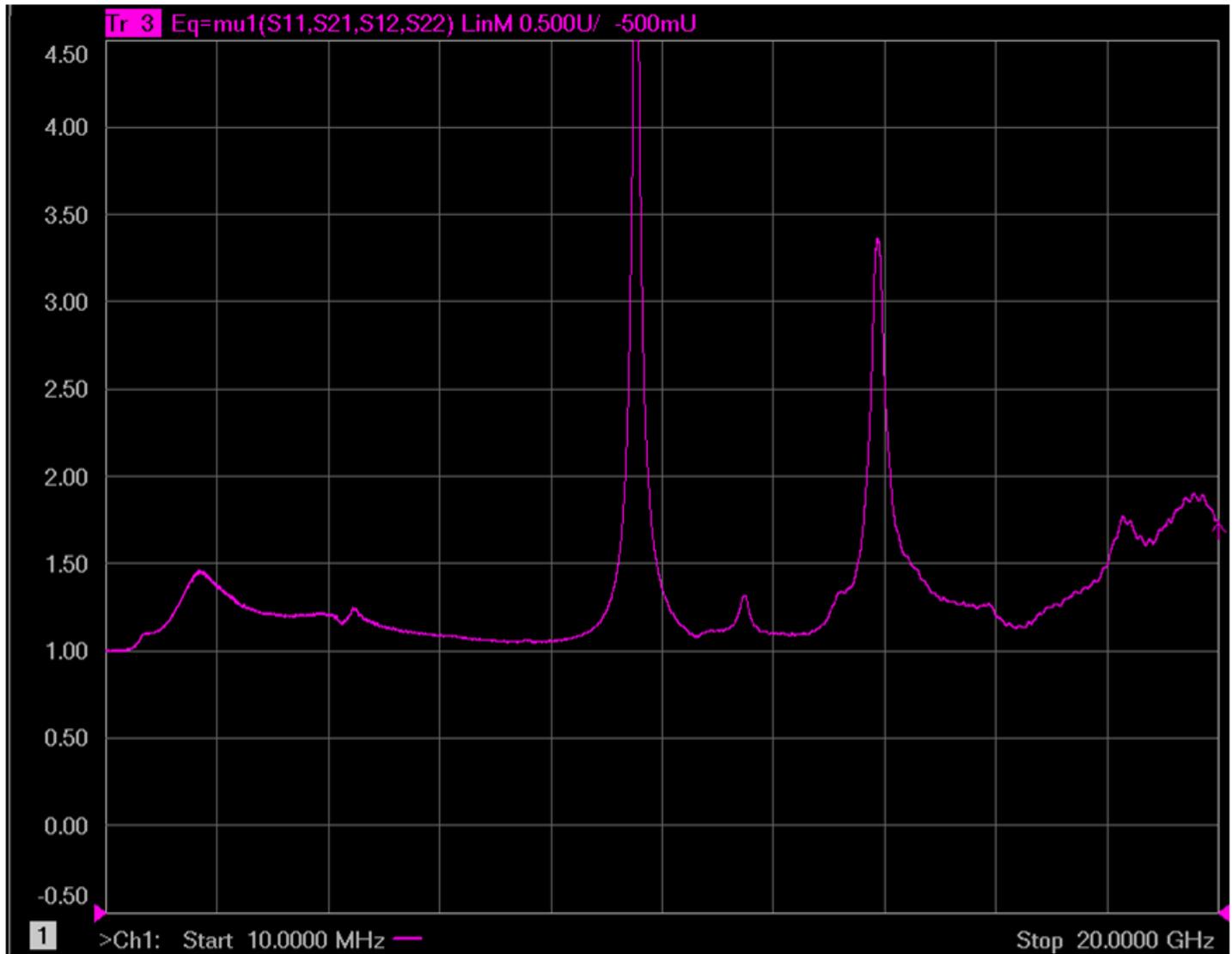
GRF2081 Typical Operating Curves: 1.7 to 2.7 GHz Tune



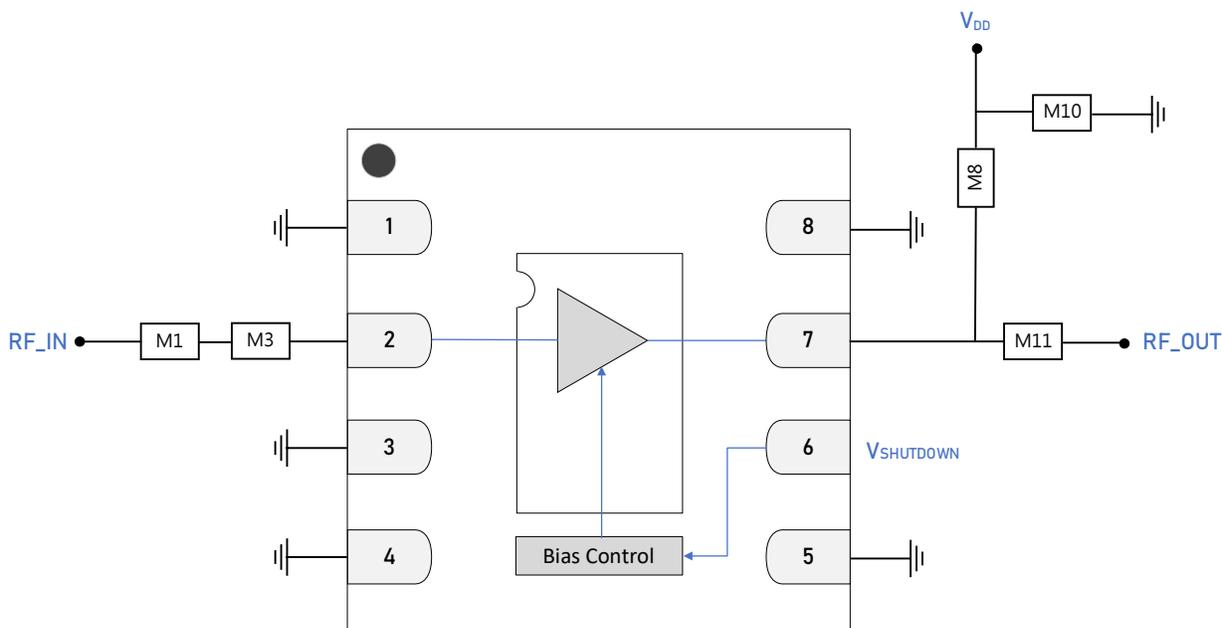
GRF2081 Typical Operating Curves: S-Parameters (1.7 to 2.7 GHz Tune)



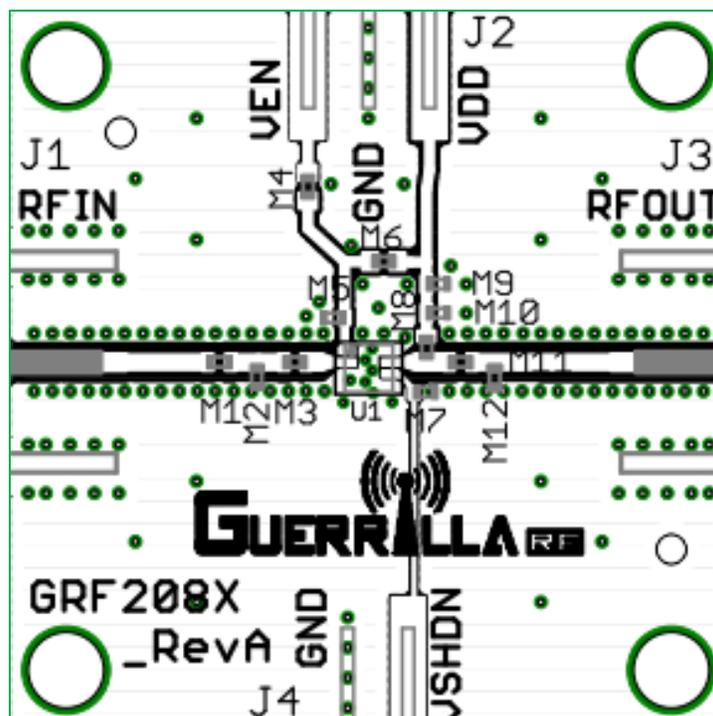
GRF2081 Typical Operating Curves: Stability Mu Factor (1.7 to 2.7 GHz Tune)



Note: Mu Factor ≥ 1.0 implies unconditional stability.



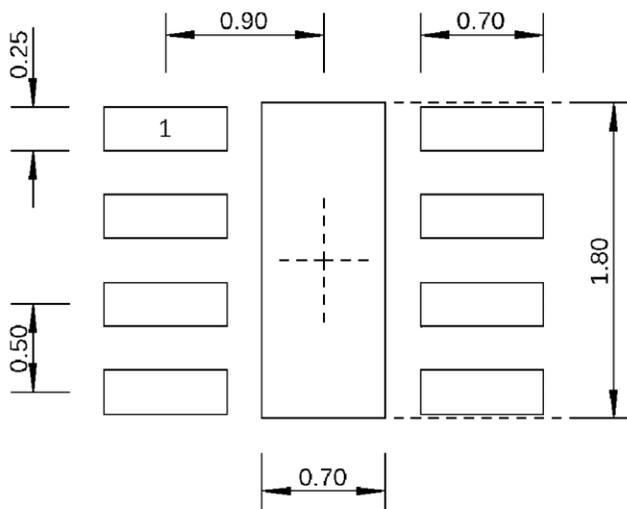
GRF2081 Standard Test Schematic



GRF2081 Evaluation Board Assembly Diagram

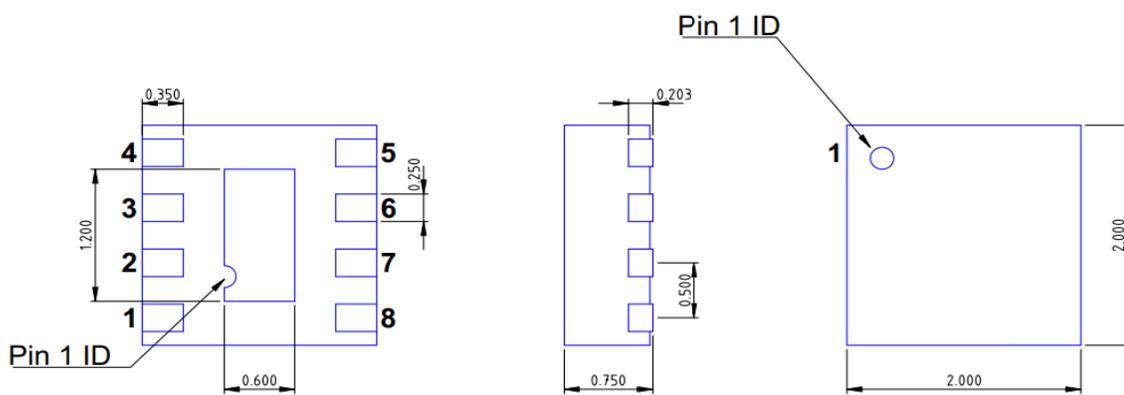
GRF2081 Evaluation Board Assembly Diagram Reference: 1.7 to 2.7 GHz Tune

| Component | Type | Manufacturer | Family | Value | Package Size | Substitution |
|------------------|--------------|--------------|--------|-------------|--------------|--------------|
| M1 | Capacitor | Murata | GJM | 12 pF | 0402 | ok |
| M3 | Inductor | Murata | LQG | 1.5 nH | 0402 | ok |
| M8 | Inductor | Murata | LQG | 3.6 nH | 0402 | ok |
| M10 | Capacitor | Murata | GRM | 0.1 μ F | 0402 | ok |
| M11 | Capacitor | Murata | GRM | 2.7 pF | 0402 | ok |
| Evaluation Board | GRF208X_RevA | | | | | |



Dimensions in millimeters

2.0 x 2.0 mm DFN-8 Suggested PCB Footprint (Top View)



Bottom View

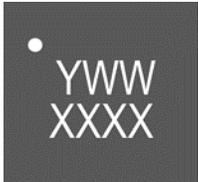
Side View

Top View

DFN8_2X2MM
 Dimensions in millimeters
 Dimensional Tolerance: ± 0.05

2.0 x 2.0 mm DFN-8 Package Dimensions

Package Marking Diagram



Line 1: "Y" = YEAR (single digit). "WW" = WORK WEEK the device was assembled.

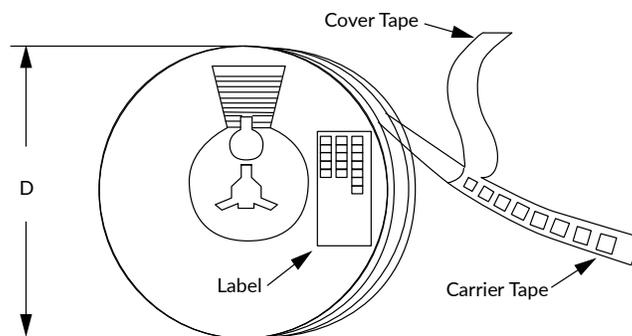
Line 2: "XXXX" = Device PART NUMBER.

Tape and Reel Information

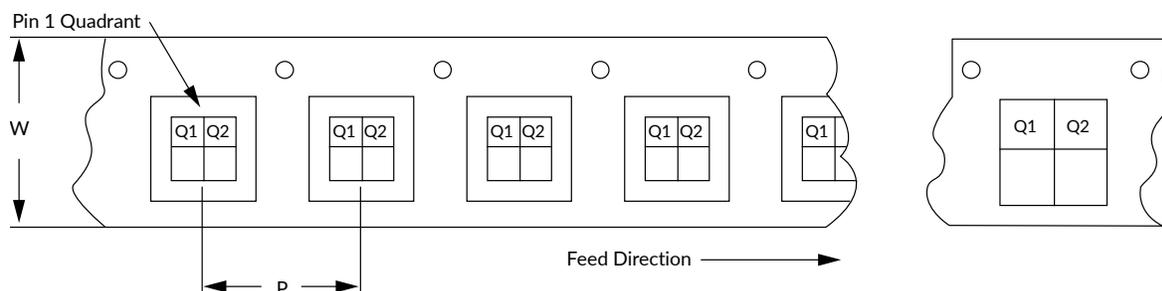
Guerrilla RF's tape and reel specification complies with Electronics Industries Association (EIA) standards for "Embossed Carrier Tape of Surface Mount Components for Automatic Handling" (reference EIA-481). See the following page for the Tape and Reel Specification and Device Package Information table, 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 \(guerrilla-rf.com\)](https://www.guerrilla-rf.com/package-manufacturing-information)



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 |
|---------------|-------------------------|
| May 3, 2023 | Upgraded to new format. |



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 <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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