



Product Description

GRF2201 is a low-cost, linear LNA designed for demanding 2.4 GHz WLAN and ISM band applications.

The device is operated from a supply voltage (V_{DD}) range of 2.7 to 5.0 V with a typical bias condition of 3.3 volts and 15 mA for optimal efficiency and linearity.

The device is housed in a 1.5 x 1.5 x 0.5 mm 6-pin plastic DFN package. Consult with the GRF applications engineering team for custom tuning/evaluation board data and device s-parameters.

Features

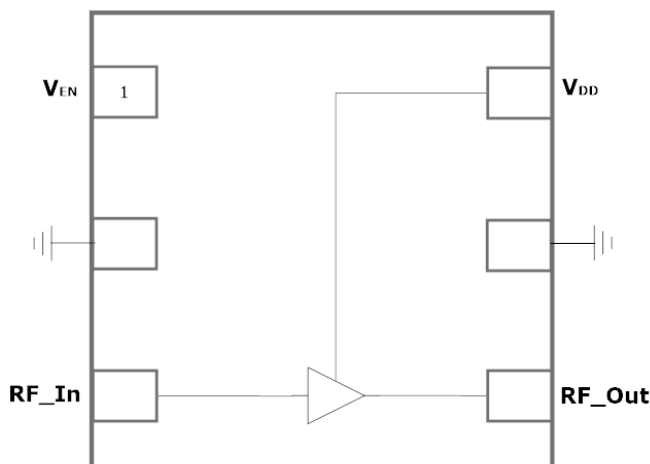
Reference: 3.3V/15mA/2.45 GHz

- Gain: 20.0 dB
- Evaluation Board NF: 0.72 dB
- OP1dB: 12.0 dBm
- OIP3: 25.5 dBm

- Flexible bias voltage and Current
- Minimal External Components
- Process: GaAs pHEMT

Applications

- 2.4 GHz 802.11 b, g, n
- Bluetooth
- ZigBee
- ISM



1.5 x 1.5 mm DFN-6



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High Gain LNA
2.4 GHz ISM; 802.11 b, g, n

Absolute Ratings:

| Parameter | Symbol | Min. | Max. | Unit |
|--|-----------------------|------|------|------|
| Supply Voltage | V _{DD} | 0 | 6.0 | V |
| RF Input Power CW: (Load VSWR < 2:1; V _D : 5.0 volts) | P _{IN MAX} | | 17.0 | dBm |
| Operating Temperature (Package Heat Sink) | T _{AMB} | -40 | 105 | °C |
| Maximum Channel Temperature (MTTF > 10 ⁶ Hours) | T _{MAX} | | 170 | °C |
| Maximum Dissipated Power | P _{DISS MAX} | | 150 | mW |
| Electrostatic Discharge: | | | | |
| Charged Device Model: | CDM | 1500 | | V |
| Human Body Model: | HBM | 250 | | V |
| Storage: | | | | |
| Storage Temperature | T _{STG} | -65 | 150 | °C |
| Moisture Sensitivity Level | MSL | | 1 | -- |



Caution! ESD Sensitive Device

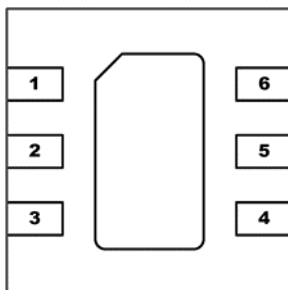


Exceeding Absolute Maximum Rating conditions may cause permanent damage to the device.

Note: For manufacturing information, see the Guerrilla-RF.com website for the following document located on the GRF2201 landing page: Manufacturing Note—MN-001 Product Tape and Reel, Solderability and Package Outline Specification.

[Link to manufacturing note](#)

Pin Out (Top View)



Pin Assignments:

| Pin | Name | Description | Note |
|-------------|---------------------|----------------------|---|
| 1 | V _{ENABLE} | Enable Voltage Input | V _{ENABLE} and series resistor set I _{DDQ} . V _{ENABLE} < =0.2 volts disables device. On-die pull-down resistor will turn the part off if this node is allowed to float. |
| 2 | NC | No Connect or Ground | No internal connection to die |
| 3 | RF_In | LNA RF input | Internally matched 50Ω. An external DC blocking cap must be used. |
| 4 | RF_Out | LNA RF output | Internally matched 50Ω. An external DC blocking cap must be used. |
| 5 | NC | No Connect or Ground | No internal connection to die |
| 6 | V _{DD} | Supply Voltage Input | 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. |



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Nominal Operating Parameters:

| Parameter | Symbol | Specification | | | Unit | Condition |
|---|----------------------|---------------|------|------|------|--|
| | | Min. | Typ. | Max. | | |
| Test Frequency | F _{TEST} | | 2.45 | | GHz | V _{DD} =V _{ENABLE} = 3.3 V, T _A = 25 °C |
| Gain | S ₂₁ | | 20.0 | | dB | |
| Noise Figure (Evaluation Board) | NF | | 0.72 | | dB | |
| Output 1dB Compression Power | OP1dB | | 12.0 | | dBm | |
| Output 3rd Order Intercept | OIP3 | | 25.5 | | dBm | 2.0 dBm P _{OUT} per tone (2399 and 2401 MHz) |
| Switching Rise Time | T _{RISE} | | 1400 | | ns | Fast switching requires V _{ENABLE} controlled separately from V _{DD} |
| Switching Fall Time | T _{FALL} | | 100 | | ns | |
| Supply Current | I _{DD} | | 15 | | mA | |
| Enable Current | I _{ENABLE} | | 1.0 | | mA | |
| Disabled Mode | | | | | | |
| Leakage Current | I _{LEAKAGE} | | 200 | | uA | V _{DD} : 3.0V; V _{ENABLE} : 0.0V |
| Thermal Data | | | | | | |
| Thermal Resistance: (Infra-Red Scan) | Q _{JC} | | 100 | | °C/W | On standard Evaluation Board |
| Channel Temperature @ +85 C Reference (Package heat sink) | T _{CHANNEL} | | 90 | | °C | V _{DD} : 3.3 V; I _{DDQ} : 15 mA; No RF; P _{DISS} : 50 mW |

Note: MTTF >10⁶ hours for T_{CHANNEL} < =170 degrees C.

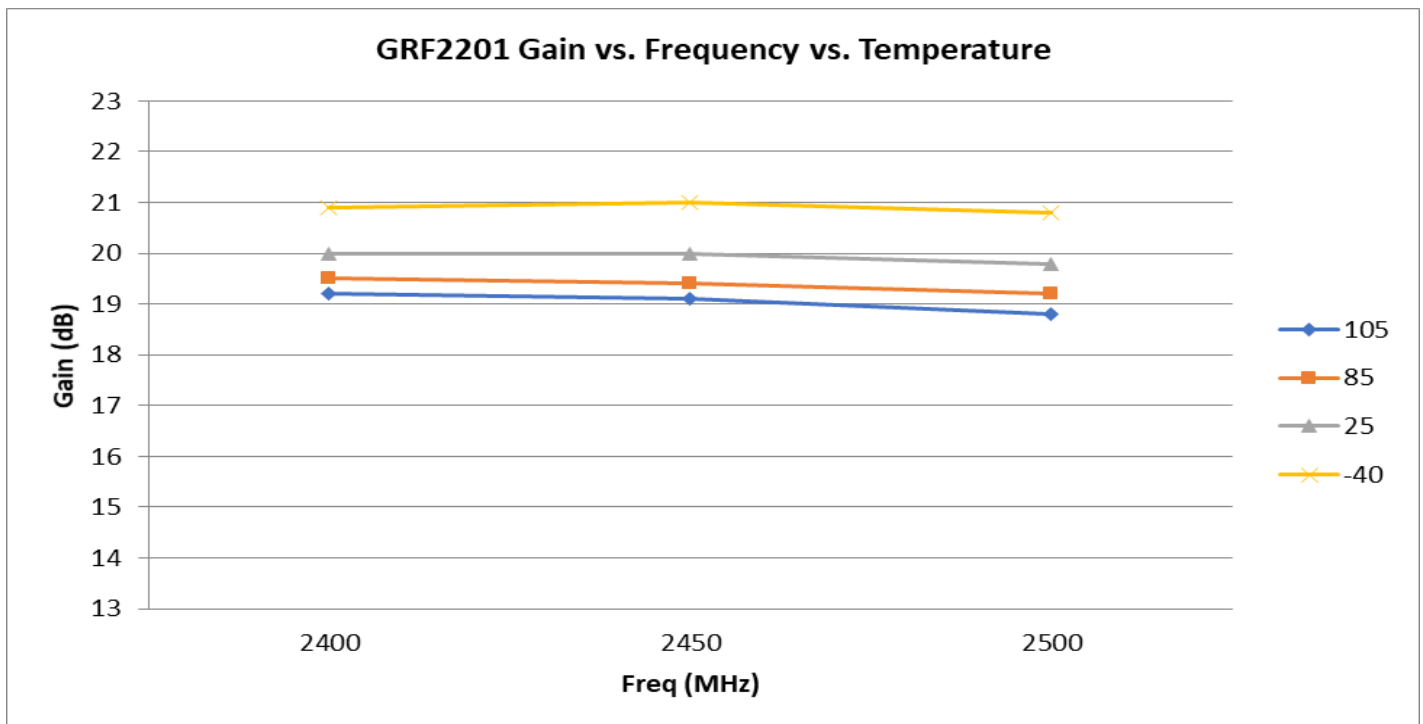
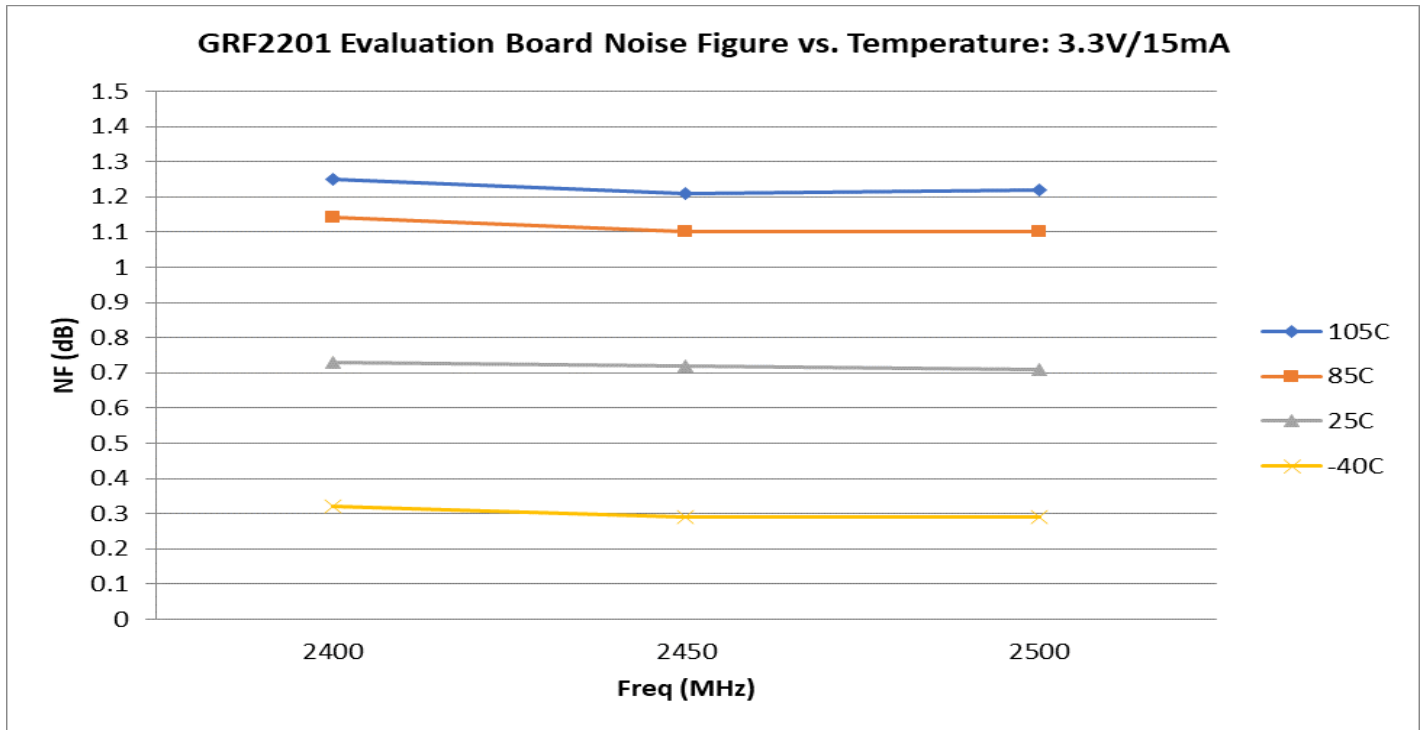


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GRF2201 Evaluation Board Data:



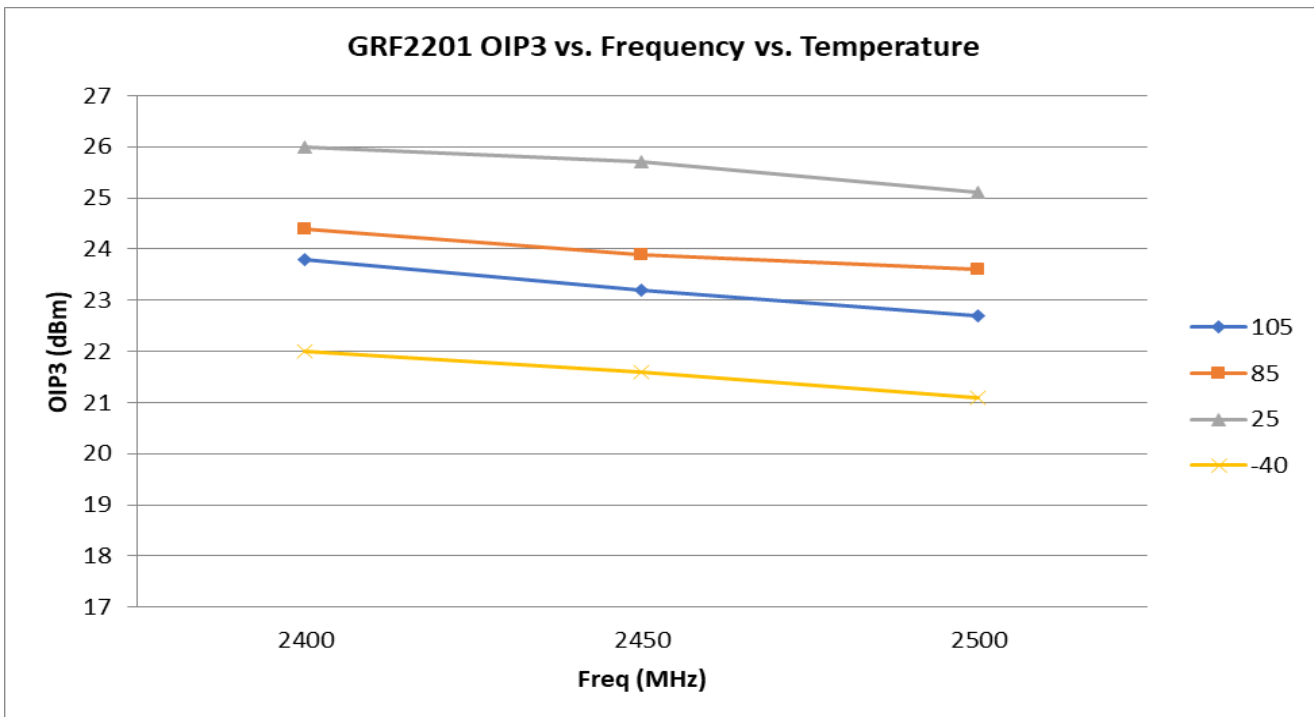
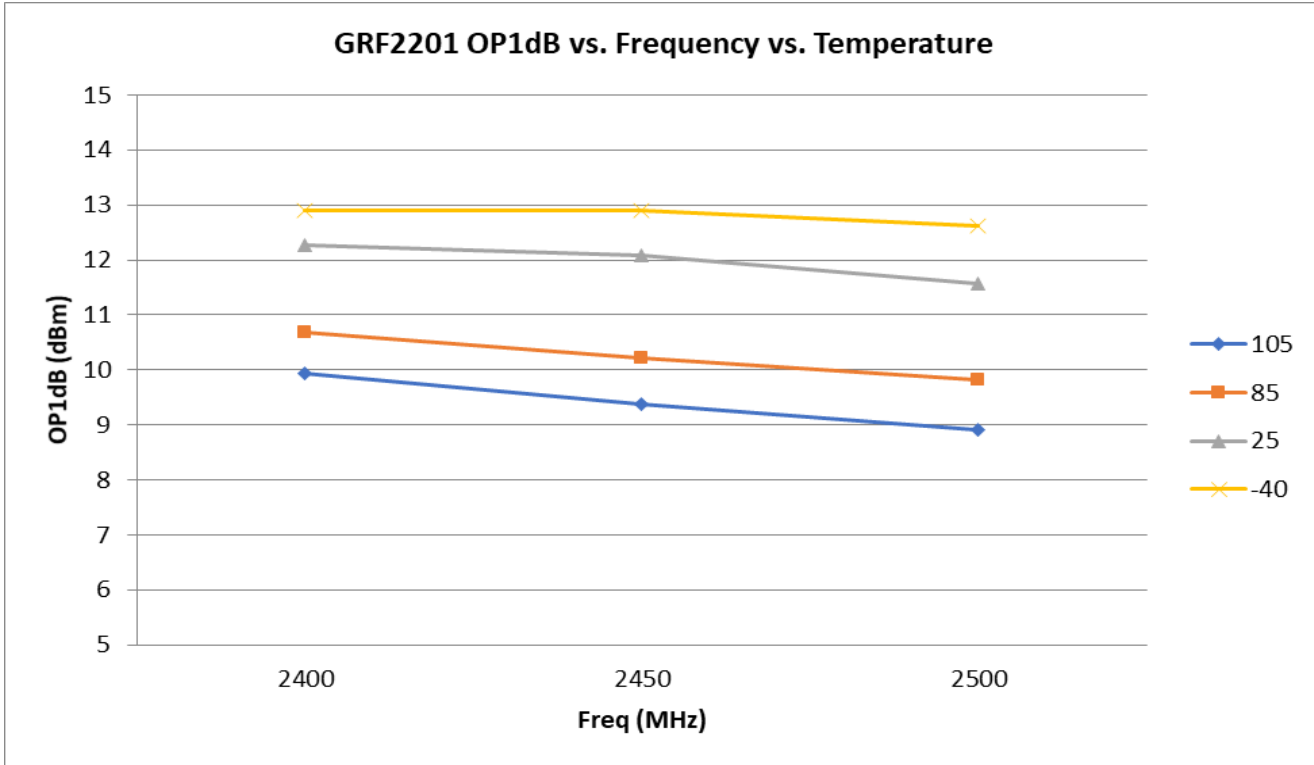


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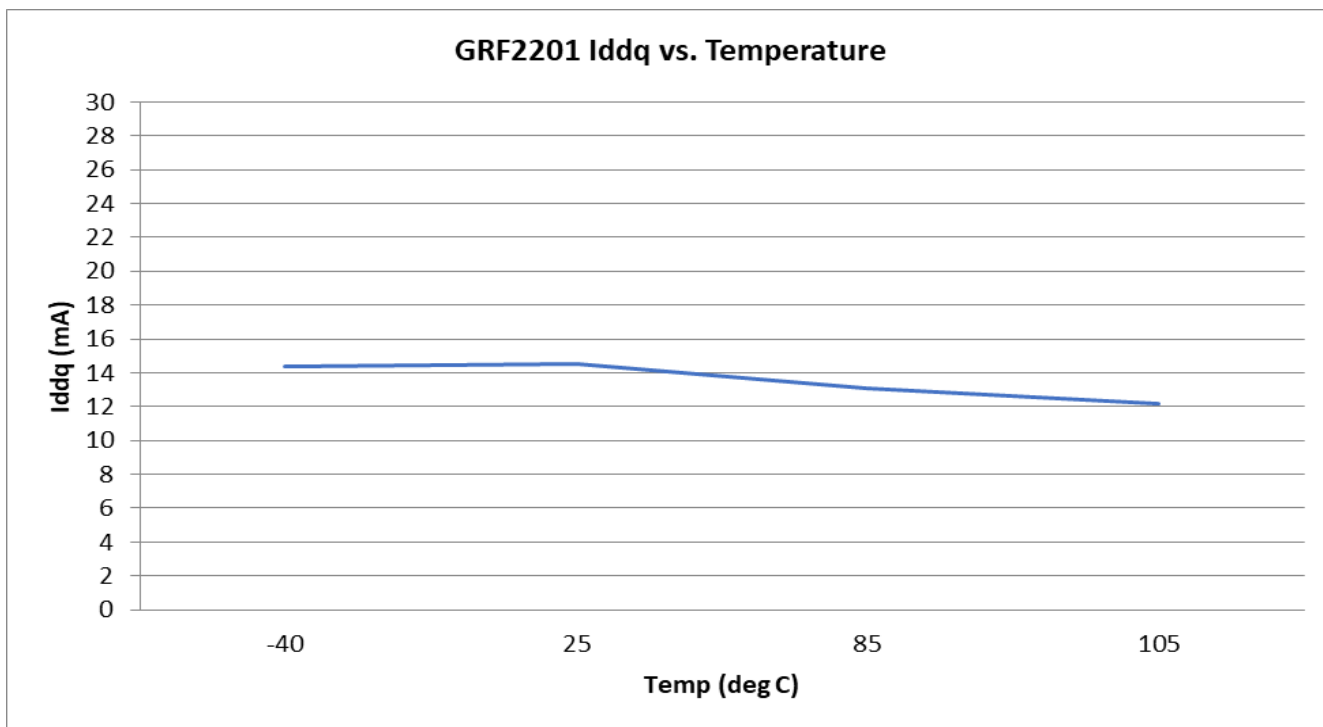
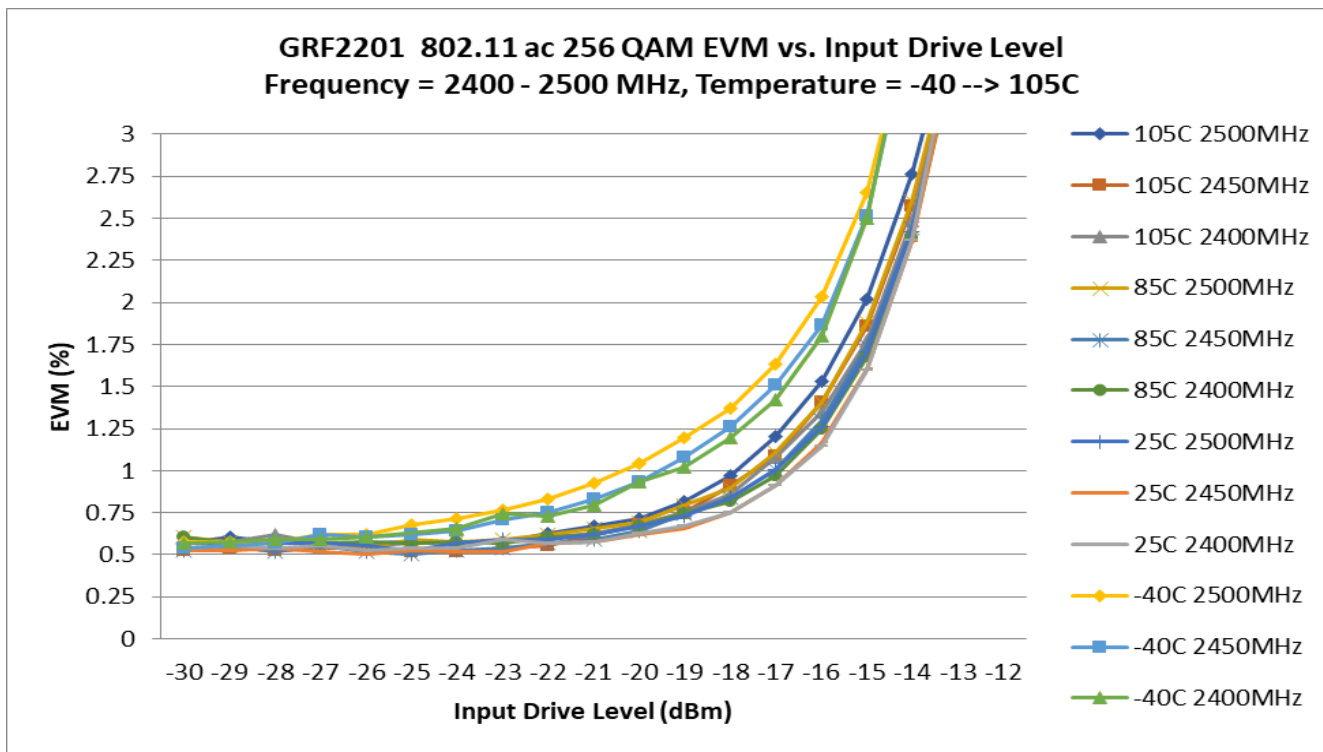


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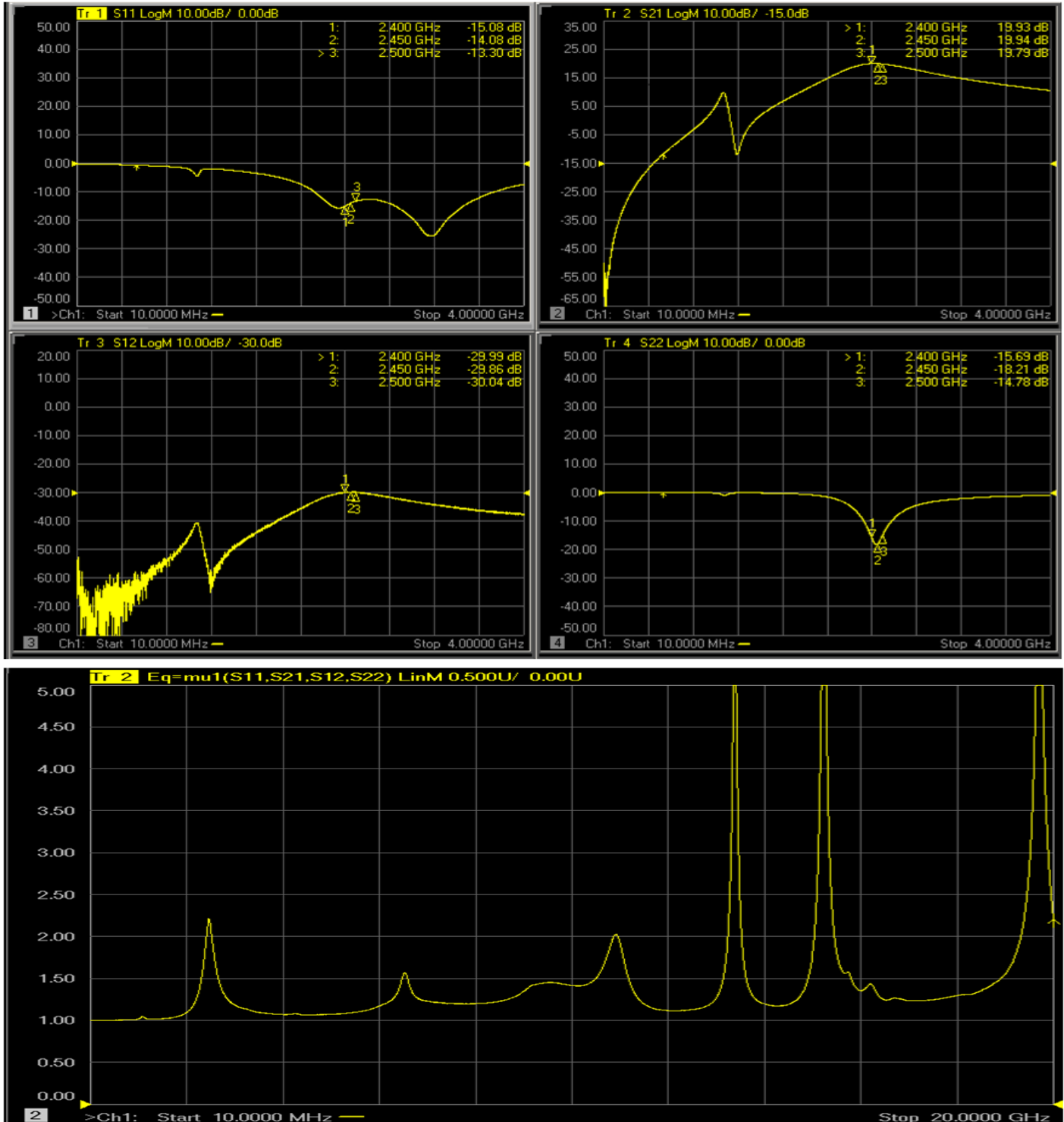


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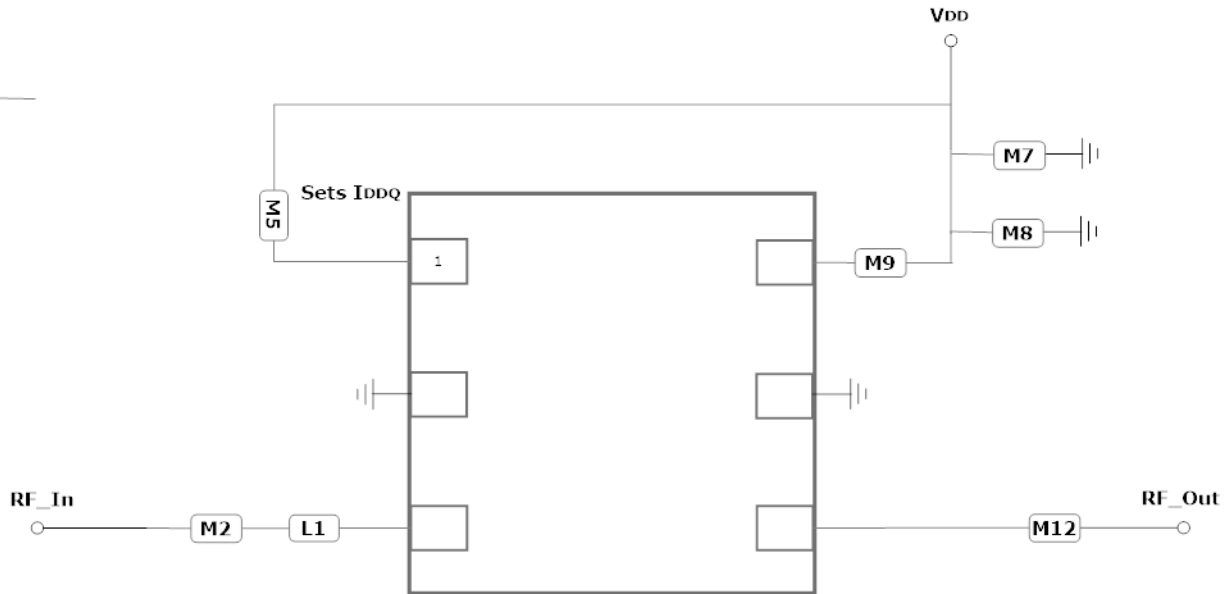
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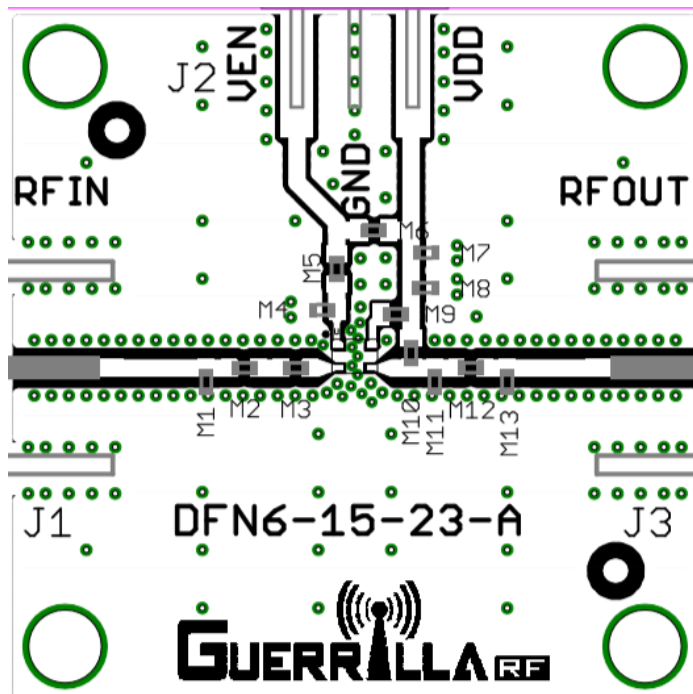
GRF2201 Evaluation Board S-params:



Note: $\mu \geq 1.0$ implies unconditional stability



GRF2201 Application Schematic (2.4 GHz Tune)



GRF2201 Evaluation Board Assembly Drawing



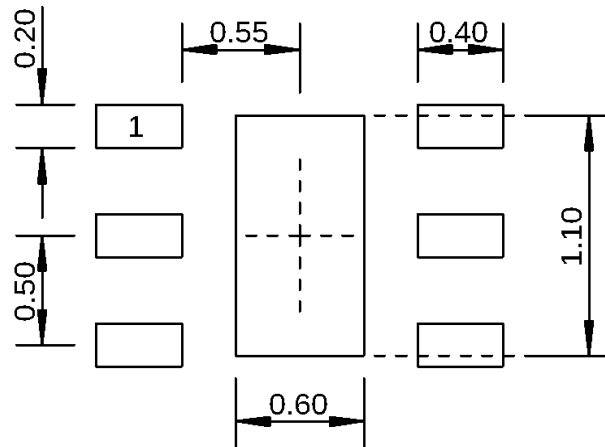
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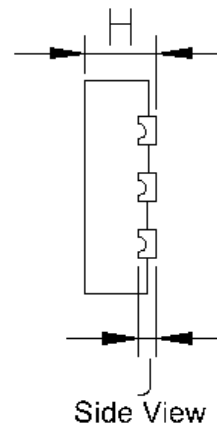
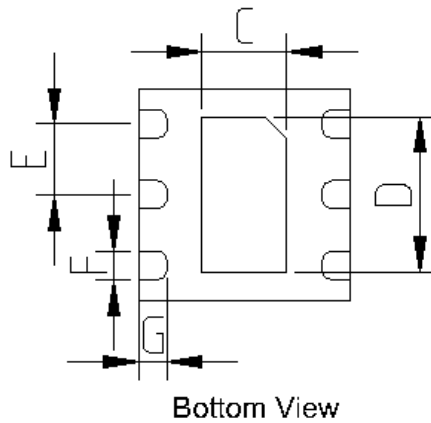
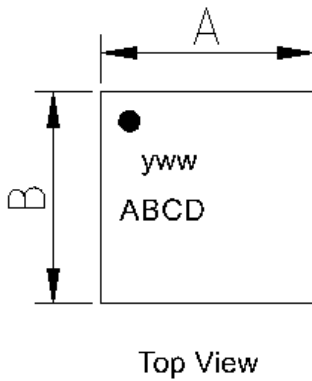
GRF2201 Standard Evaluation Board BOM: (2.4 GHz Tune)

| Component | Type | Manufacturer | Family | Value | Package Size | Substitution |
|------------------|--------------|--------------|--------|--------|--------------|--------------|
| M2 | Capacitor | Murata | GJM | 22 pF | 0402 | ok |
| M3 | Inductor | Coilcraft | HP | 2.7 nH | 0402 | ok |
| M5 | Resistor | Various | 5% | — | 0402 | ok |
| M7 | Capacitor | Murata | GRM | 0.1 uF | 0402 | ok |
| M8 | Capacitor | Murata | GRM | 22 pF | 0402 | ok |
| M9 | Inductor | Murata | 1.3 nH | LQP | 0402 | ok |
| M12 | Capacitor | Murata | GJM | 0.6 pF | 0402 | ok |
| Evaluation Board | DFN6-15-23-A | | | | | |



Dimensions in millimeters

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



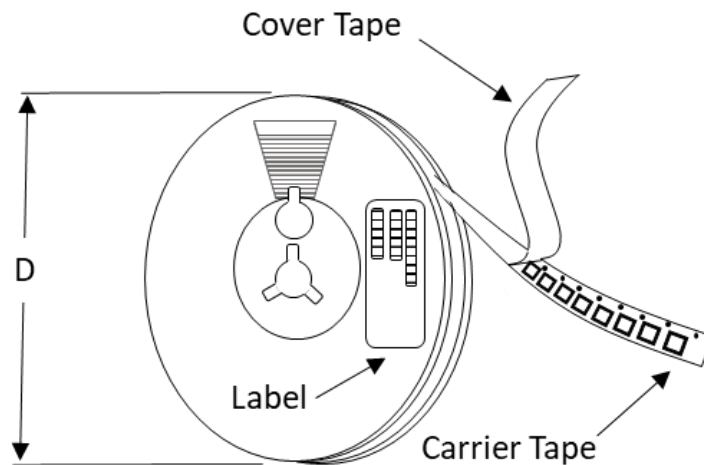
| Dimensions (MM) | |
|-----------------|---------------|
| A | 1.5 +/- 0.050 |
| B | 1.5 +/- 0.050 |
| C | .6 +/- 0.050 |
| D | 1.1 +/- 0.050 |
| E | .5 Bsc |
| F | .2 +/- 0.050 |
| G | .2 +/- 0.050 |
| H | .45 +/- 0.050 |
| J | .12 Ref. |

1.5 mm DFN-6 Package Dimensions

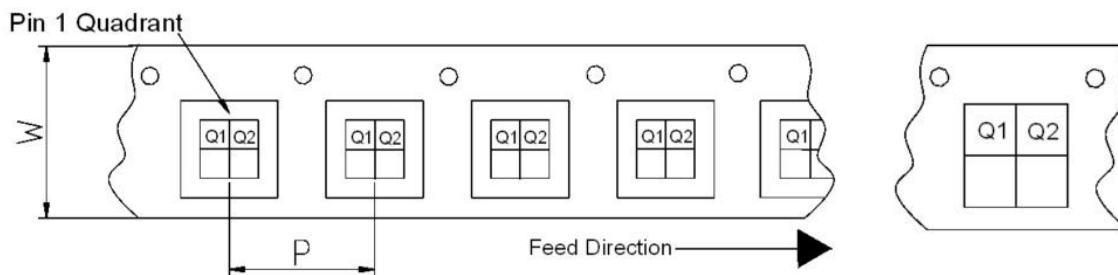
Tape and Reel Information:

Guerrilla RF's Tape and Reel specification complies with the Electronics Industries Association (EIA) standards for 'Embossed Carrier Tape of Surface Mount Components for Automatic Handling'. Reference EIA-481. See the table on the following page for Tape and Reel specifications along with units per reel.

Devices are loaded with pins down into the carrier pocket with protective cover tape, wound into a plastic reel. Each reel will be packaged in a cardboard box. There will be product labels on the reel, the protective ESD bag and the outside surface of the box.



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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Tape and Reel Specification and Device Package Information Table

| Package | | | | Carrier Tape | | | Reel | |
|---------|------------------|----------|-------------|----------------|-----------------------|----------------|-----------------------|----------------|
| Type | Dimensions (mm) | Leads | Weight (mg) | Width (W) (mm) | Pocket Pitch (P) (mm) | Pin 1 Quadrant | Diameter (D) (inches) | Units per Reel |
| QFN | 2.0 x 2.0 x 0.50 | 12 | 7 | 8 | 4 | Q1 | 7 | 2500 |
| QFN | 3.0 x 3.0 x 0.85 | 16 | 24 | 12 | 8 | Q1 | 7 | 1500 |
| DFN | 1.5 x 1.5 x 0.45 | 6 | 4 | 8 | 4 | Q1 | 7 | 2500 |
| DFN | 2.0 x 2.0 x 0.75 | 8 | 12 | 8 | 4 | Q1 | 7 | 2500 |
| LFM | 3.5 x 3.5 x 0.75 | See | TBD | 12 | 8 | Q2 | 7 | 1500 |
| LFM | 4.0 x 4.0 x 0.75 | See note | TBD | 12 | 8 | Q2 | 7 | 1500 |

Note: Lead count may vary. Reference applicable product data sheet



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| Data Sheet Release 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 in the Guerrilla RF Applications Lab. |
| Released | All data based on device qualification data. Typically, this data is nearly identical to the data found in the preliminary version. Max and min values for key RF parameters are included. |

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