# GRF4142

*Released*

**LNA/Driver w/Bypass**
**Tuning Range: 0.1 to 6.0 GHz**


## Features

Reference: 3.3V/50mA/1.9 GHz

- Gain: 15.3 dB
- EVB NF: 0.90 dB
- OP1dB: 19.3 dBm
- OIP3: 33.0 dBm
- Bypass Mode Gain: -1.9 dB
- Bypass OP1dB: 25.4
- Bypass OIP3: 43.7

- Flexible Bias Voltage and Current
- Single Control Logic Input
- Pre-matched to 50 Ω
- Process: GaAs pHEMT

## Applications

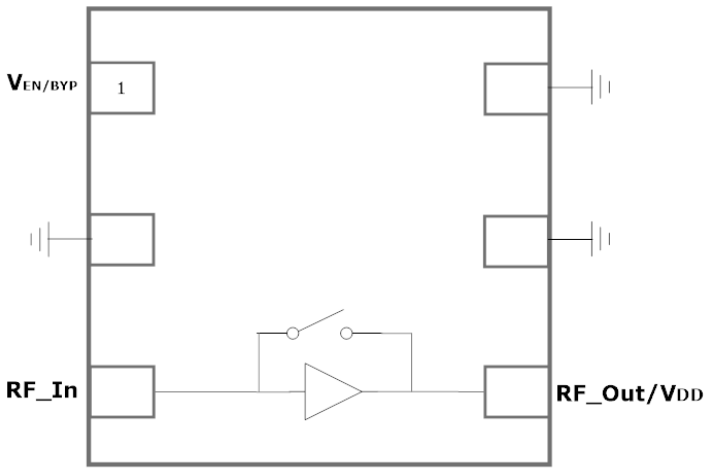
- Cellular Repeaters and Signal Boosters
- Cellular Infrastructure
- VHF/UHF and ISM Radios

## Product Description

GRF4142 is a low noise amplifier (LNA) with low loss bypass which requires only a single control input. It is designed for high performance applications up to 6 GHz.

With minimal external matching, the device achieves outstanding noise figure (NF), high gain and high linearity. The LNA is operated from a single positive supply of 1.8 to 5.0 V with a selectable Iddq range of 15 to 80 mA.

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




1.5 x 1.5 mm DFN-6

## 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) | $P_{IN\ MAX}$ | | 20 | 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 | $P_{DISS\ MAX}$ | | 500 | 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 | | 2 | -- |

RoHS Compliant

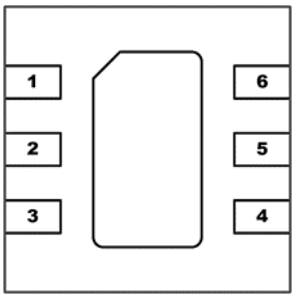
**Caution!** ESD Sensitive Device

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 GRF4142 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 | $V_{ENABLE/BYPASS}$ | Enable Voltage Input | Venable < =0.2 volts sets bypass Mode. Venable and external series resistor control the device Iddq when Venable is high. |
| 2 | NC | No Connect or Ground | No internal connection to die |
| 3 | RF_In | LNA RF input | Partially-matched 50Ω. An external DC blocking cap must be used. |
| 4 | RF_Out | LNA RF output | Internally matched 50Ω. $V_{DD}$ must be applied through a choke to this pin |
| 5 | NC | No Connect or Ground | No internal connection to die |
| 6 | NC | No Connect or Ground | No internal connection to die |
| 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:

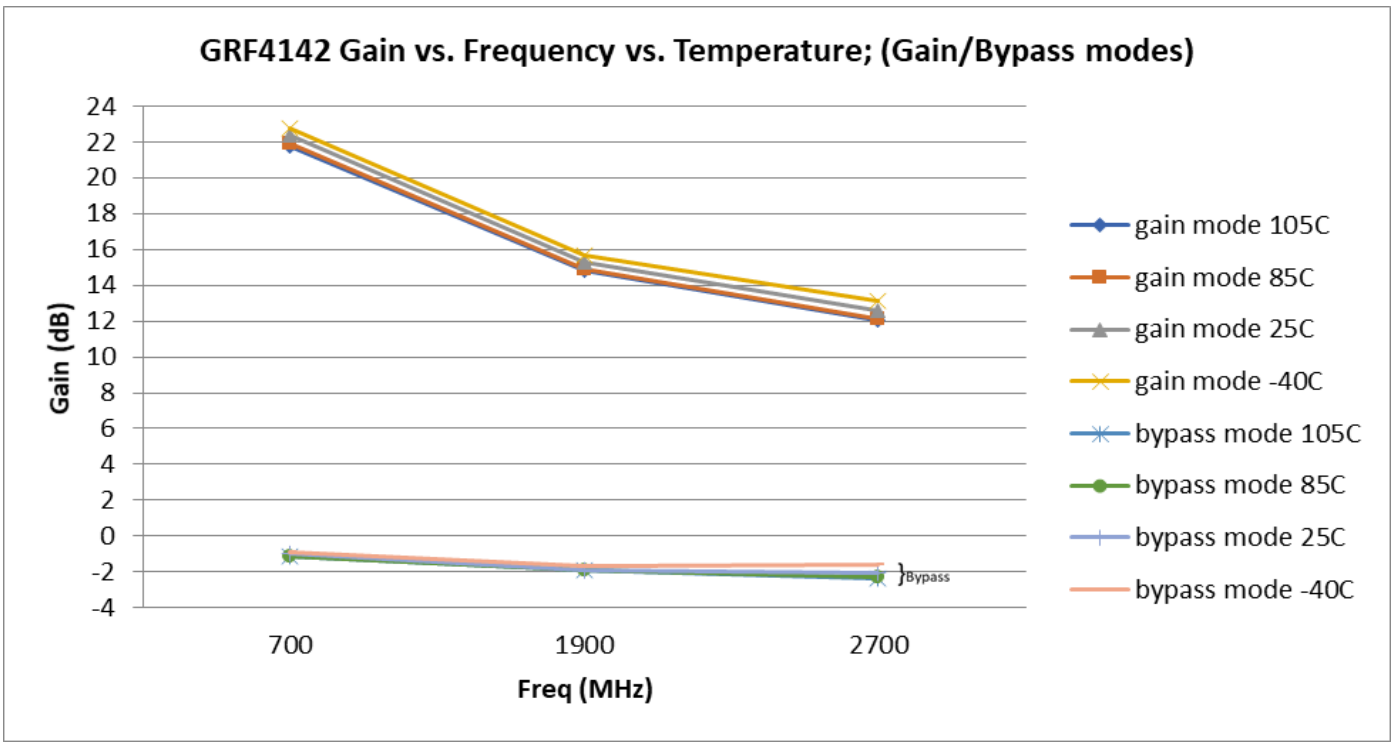
| Mode | Description | $V_{DD}$ | $V_{ENABLE/BYPASS}$ |
|---|---|---|---|
| High Gain | High LNA Gain | 1 | 1 |
| Bypass | Linear Bypass Mode | 1 | 0 |
| Logic Level “0” | Logic Low | 0.0V to 0.2V | 0.0V to 0.2V |
| Logic Level “1” | Logic High | 1.8V to 5.0V | 1.5V to Vdd |

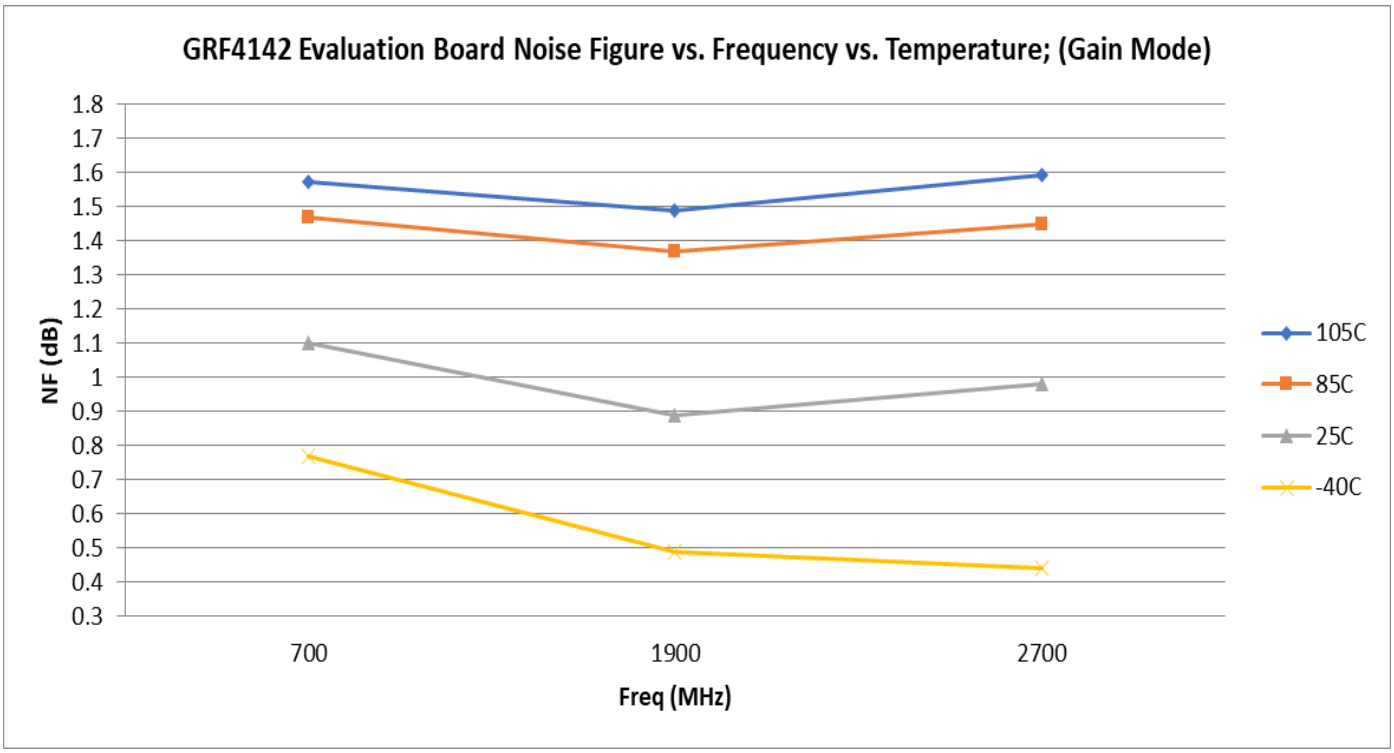
## Nominal Operating Parameters: (Standard Match)

| Parameter | Symbol | Specification | | | Unit | Condition |
|---|---|---|---|---|---|---|
| | | Min. | Typ. | Max. | | |
| **High Gain Mode** | | | | | | $V_{DD}$ = 3.3 V; $V_{ENABLE}$: High |
| Test Frequency | $F_{TEST}$ | | 1.9 | | GHz | |
| Gain | S21 | 14.3 | 15.3 | | dB | |
| Noise Figure (Evaluation Board) | NF | | 0.90 | 1.1 | dB | |
| Output 1dB Compression Point | OP1dB | 17.7 | 19.2 | | dBm | |
| Output Third Order Intercept Point | OIP3 | | 33.0 | | dBm | |
| Switching Rise Time | $T_{RISE}$ | | 800 | | ns | Bypass to gain mode |
| Switching Fall Time | $T_{FALL}$ | | 200 | | ns | Gain to bypass mode |
| Supply Current | $I_{DD}$ | | 55 | | mA | |
| Enable Current | $I_{ENABLE}$ | | 2.0 | | mA | |
| **Bypass Mode** | | | | | | $V_{DD}$: 3.3 V; Ven: 0.0 V; |
| **Gain** | S(2,1) | -3.0 | -2.0 | | dB | |
| Output 1dB Compression Point | OP1dB | | 25.4 | | dBm | |
| Output Third Order Intercept Point | OIP3 | | 43.7 | | dBm | |
| Leakage Current | $I_{LEAKAGE}$ | | 475 | | uA | $V_{DD}$: 3.3V; $V_{ENABLE}$: 0.0V |
| Thermal Data | | | | | | |
| Thermal Resistance (Infra-Red Scan) | $\Theta jc$ | | 132 | | °C/W | |
| Channel Temperature @ +85 C reference (Package heat sink) | $T_{CHANNEL}$ | | 109 | | °C | $V_{DD}$: 3.3 V; $I_{DDQ}$: 55 mA; No RF; Dissipated Power:182 mW |

Note: MTTF >10^6 hours for $T_{CHANNEL}$ < =170 degrees C.

## GRF4142 Evaluation Board Data: (3.3V/55mA)



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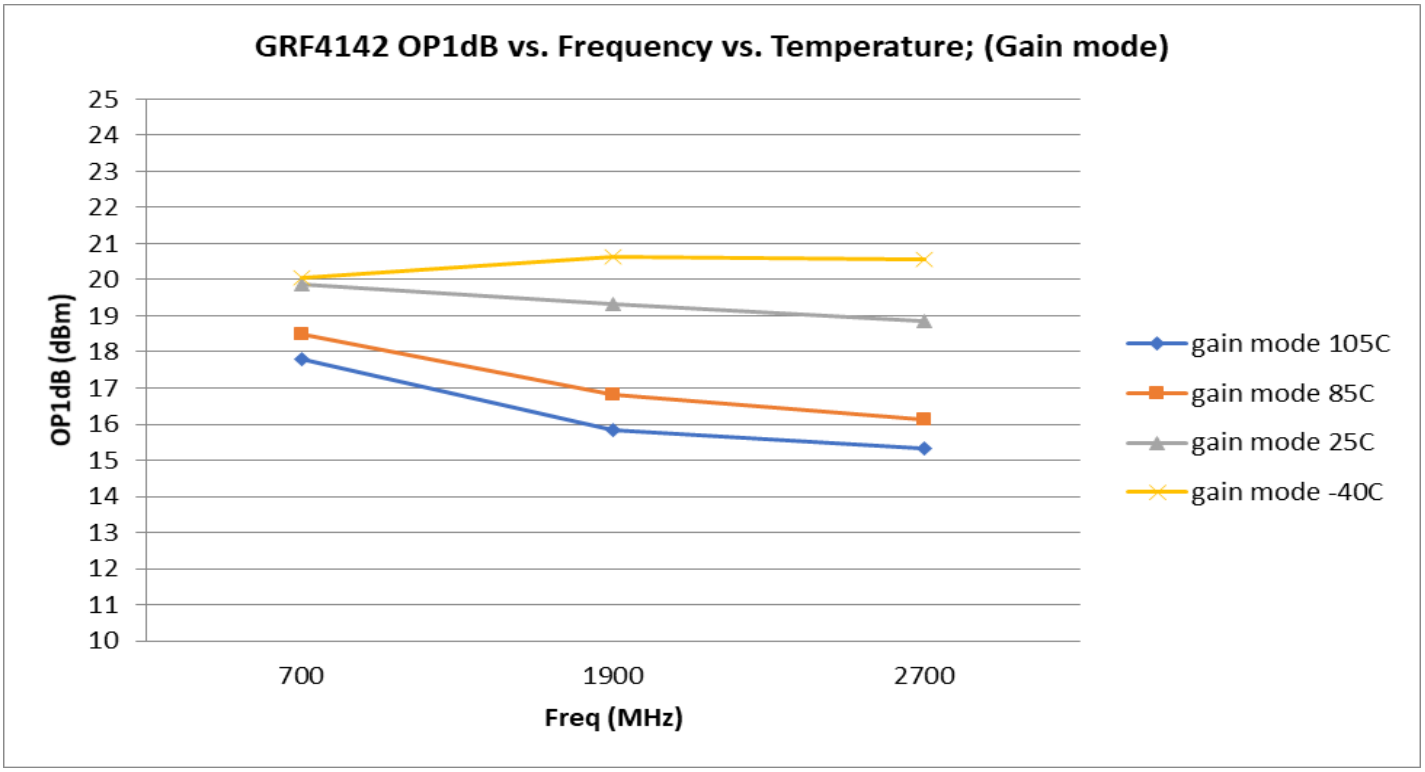


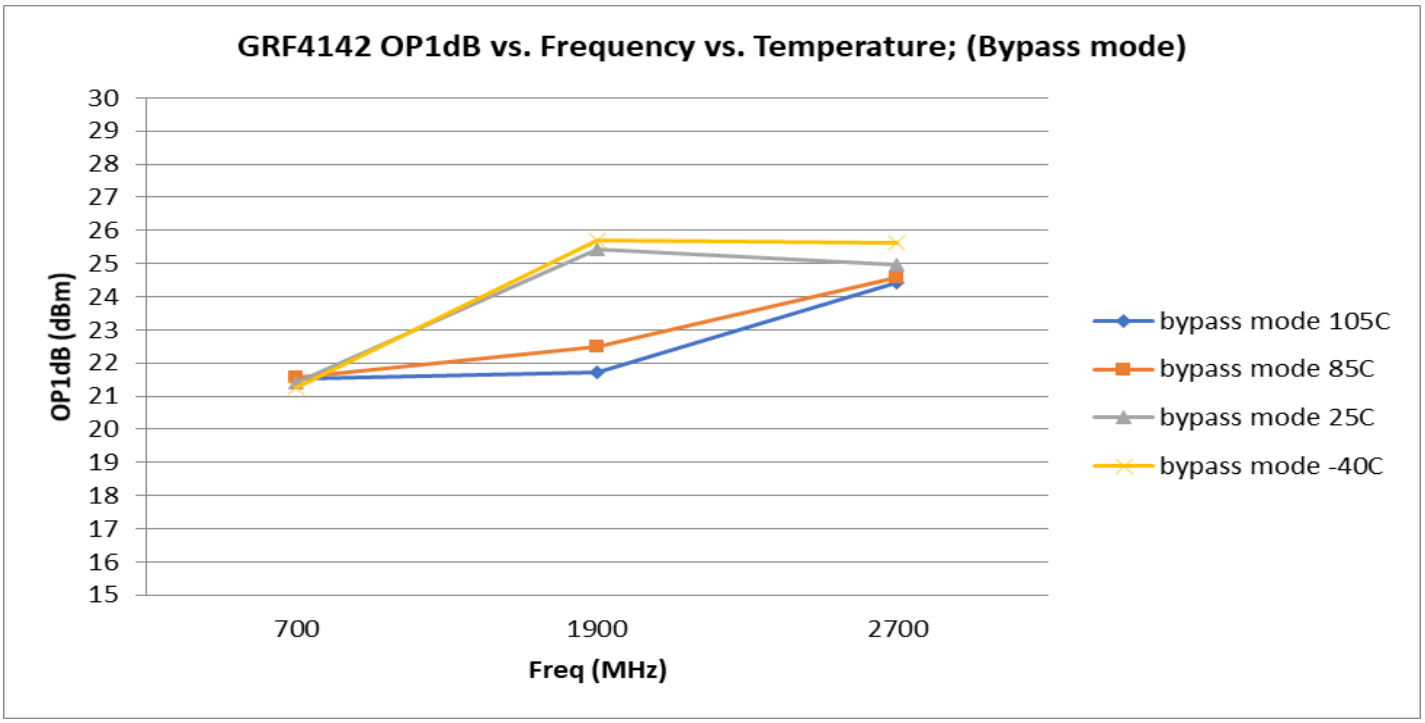

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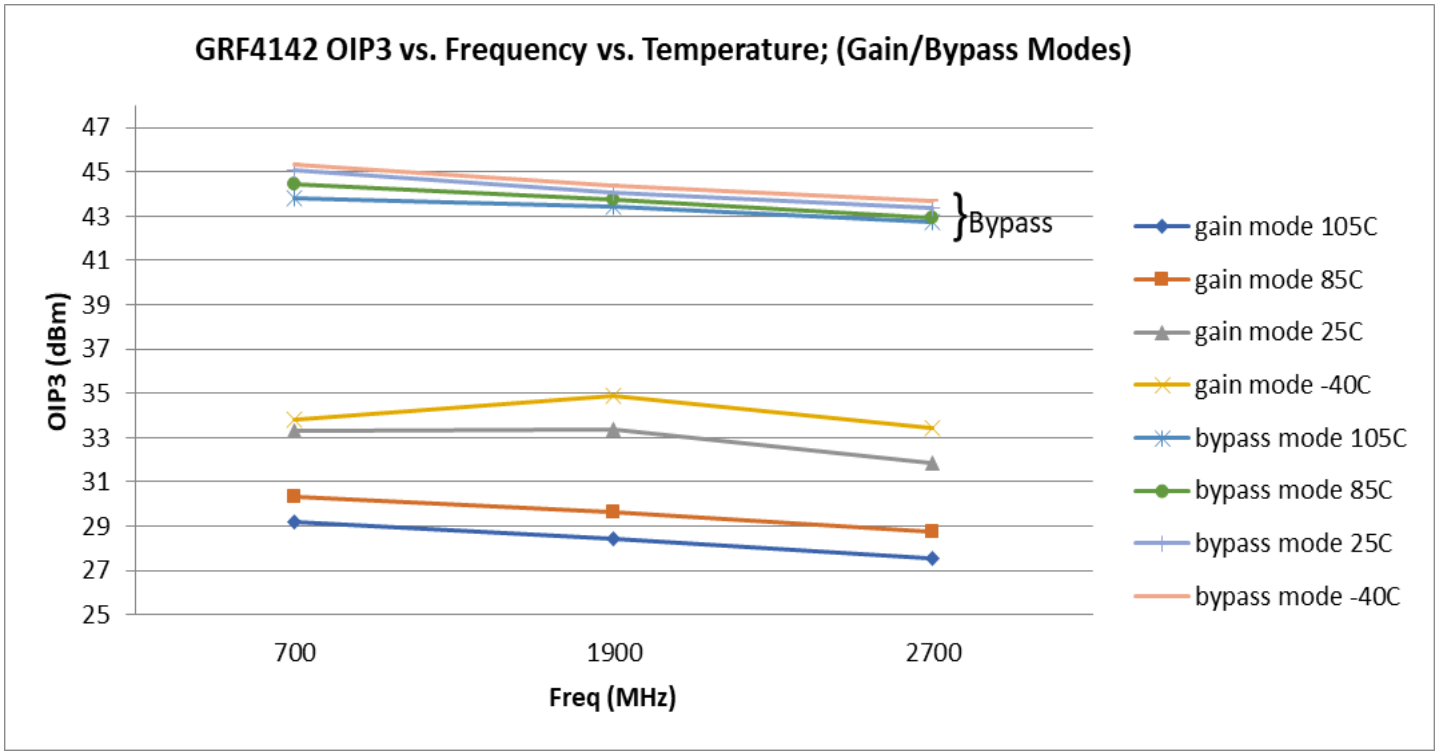
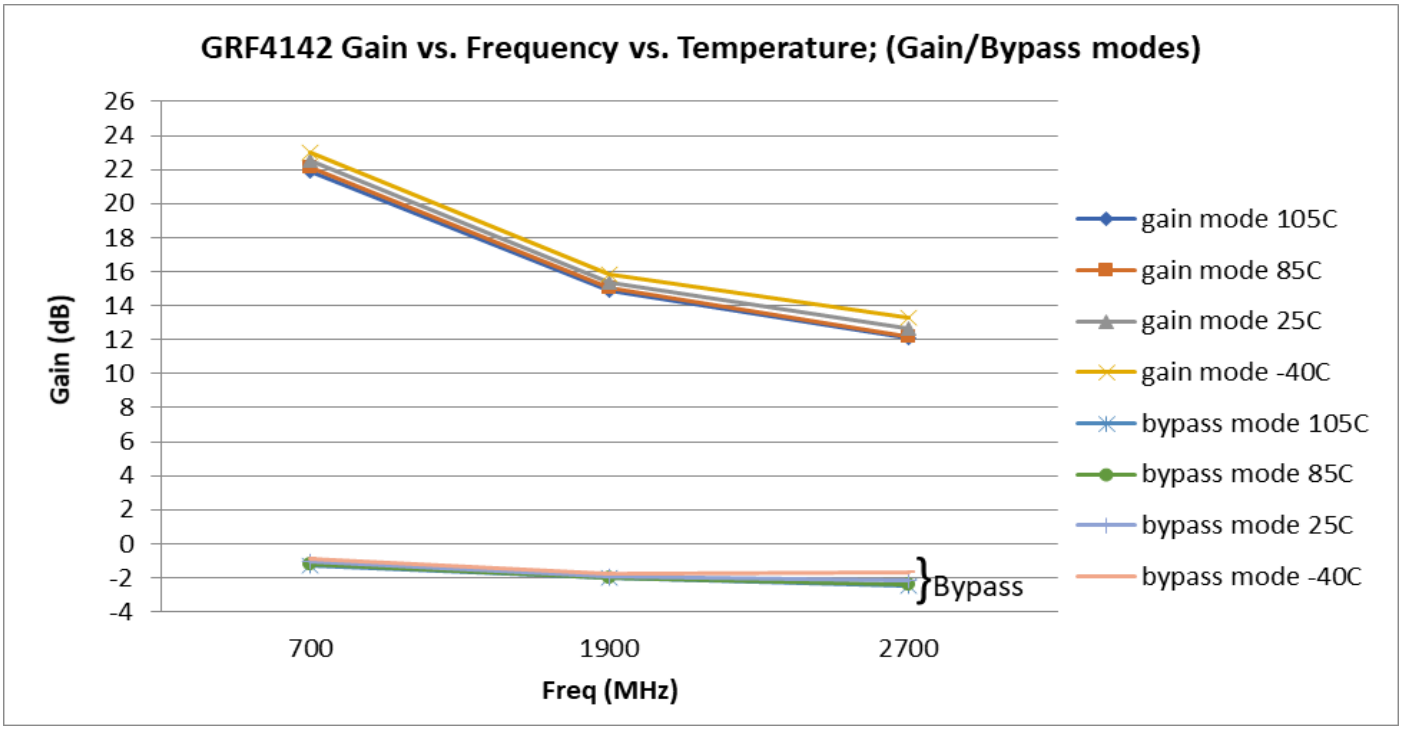
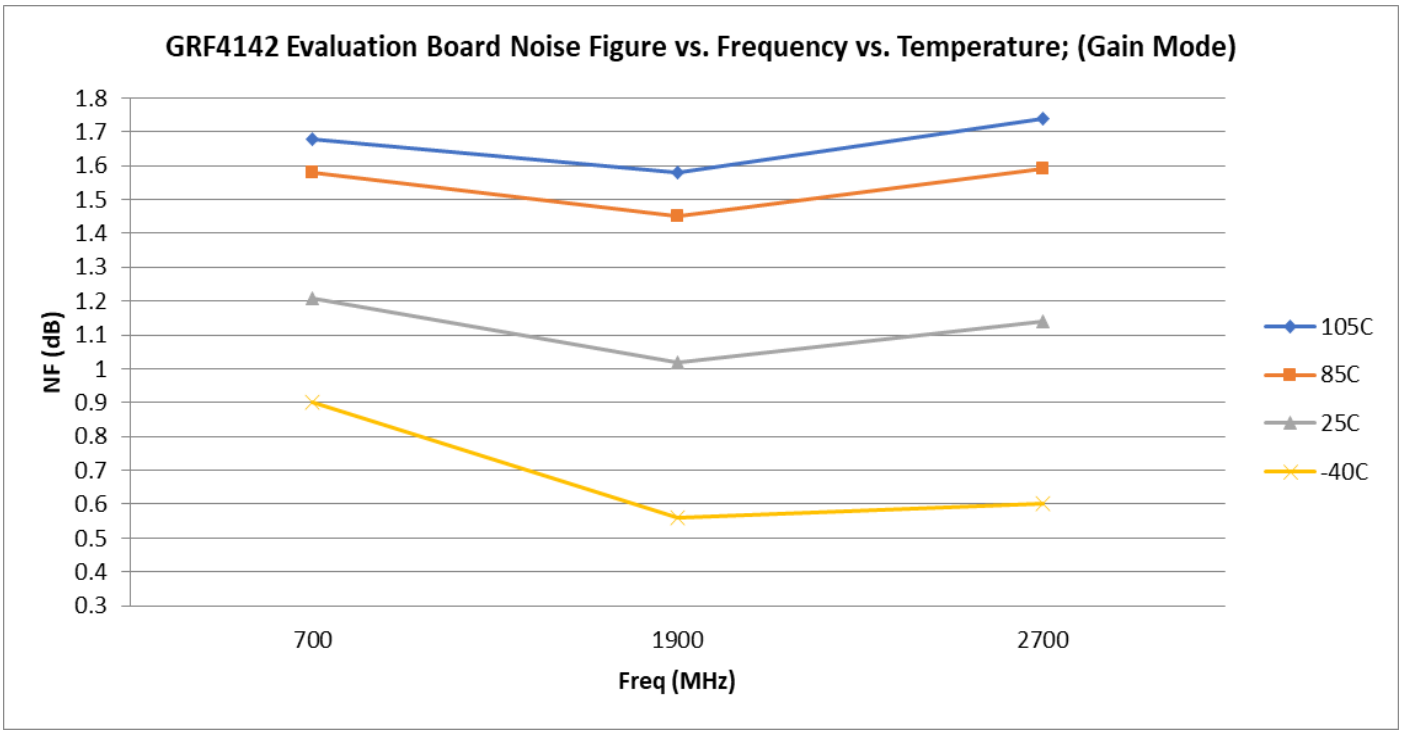


## GRF4142 Evaluation Board Data: (5.0V/70mA)



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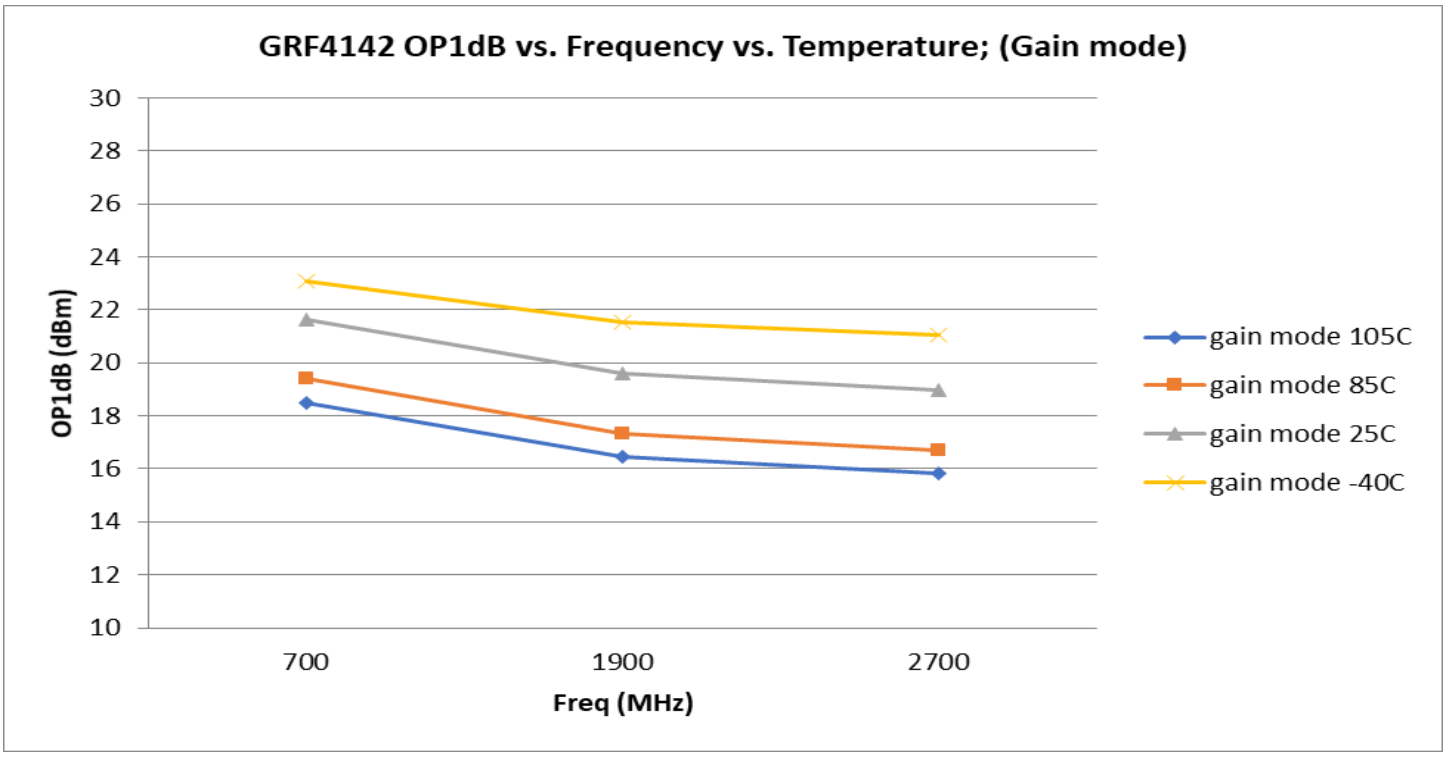


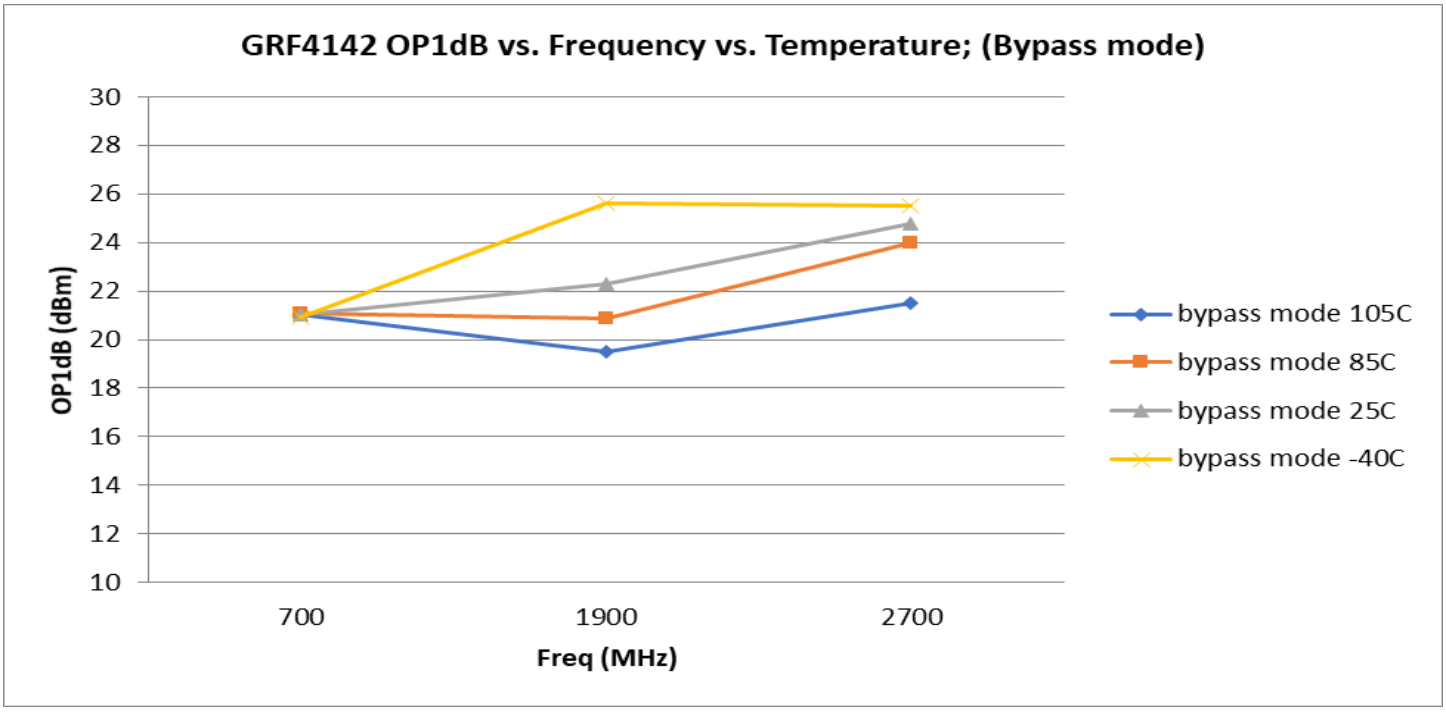

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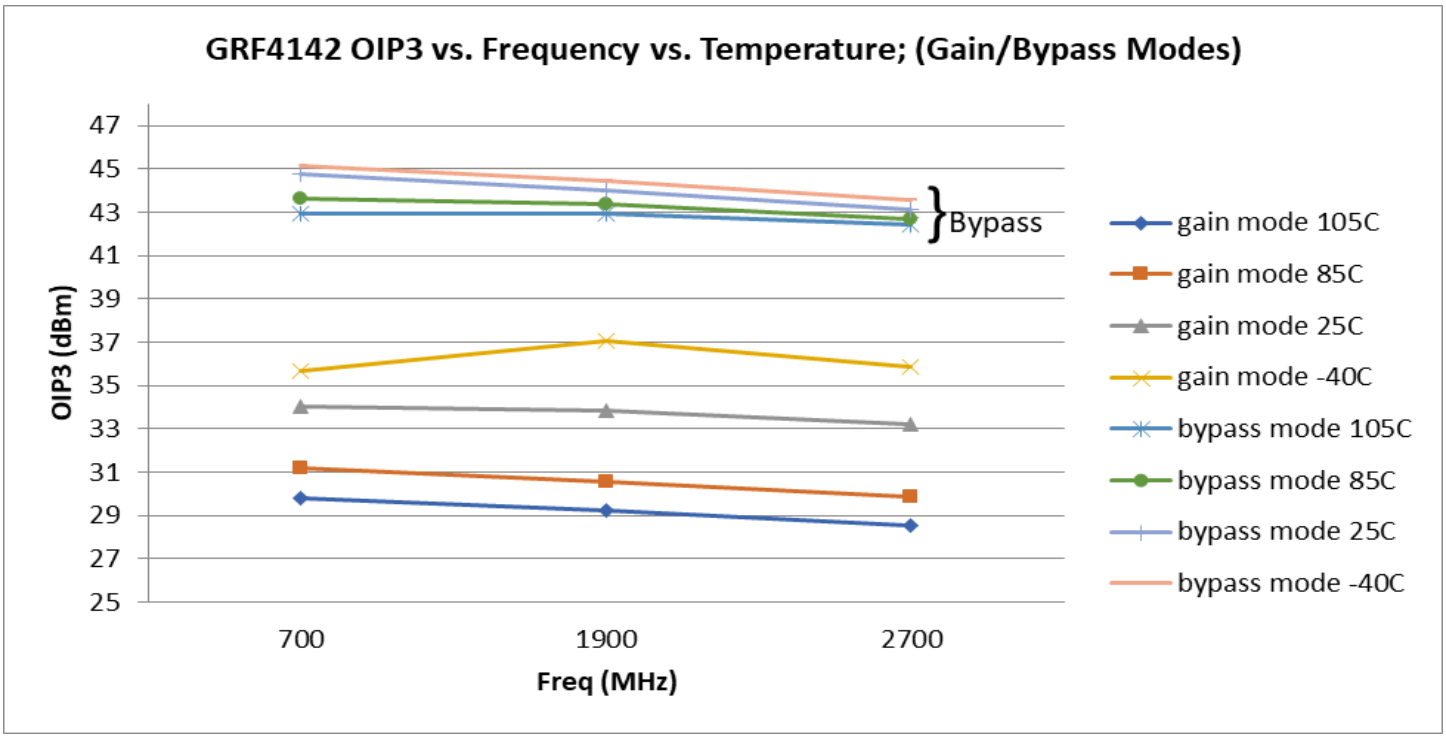
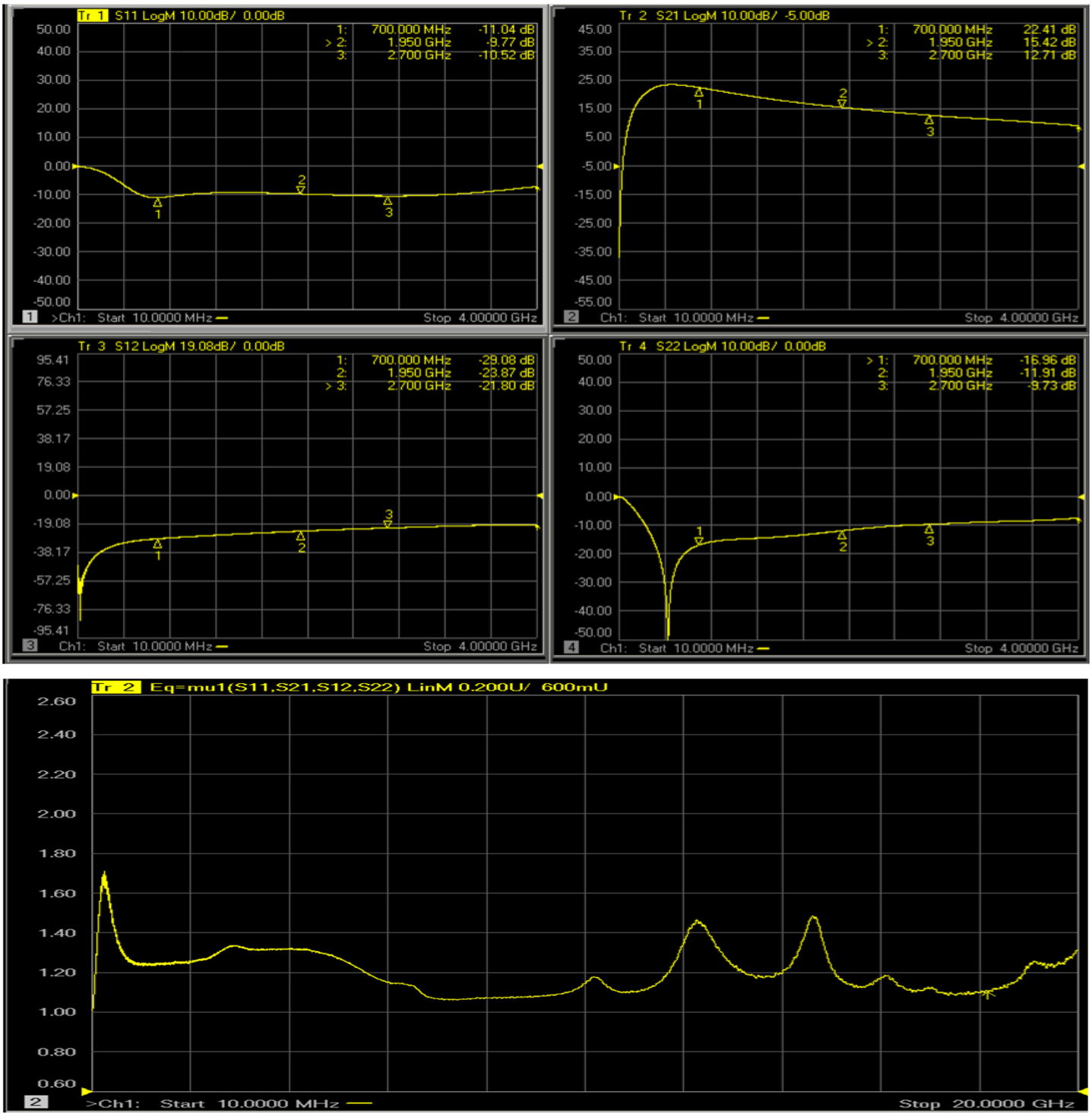
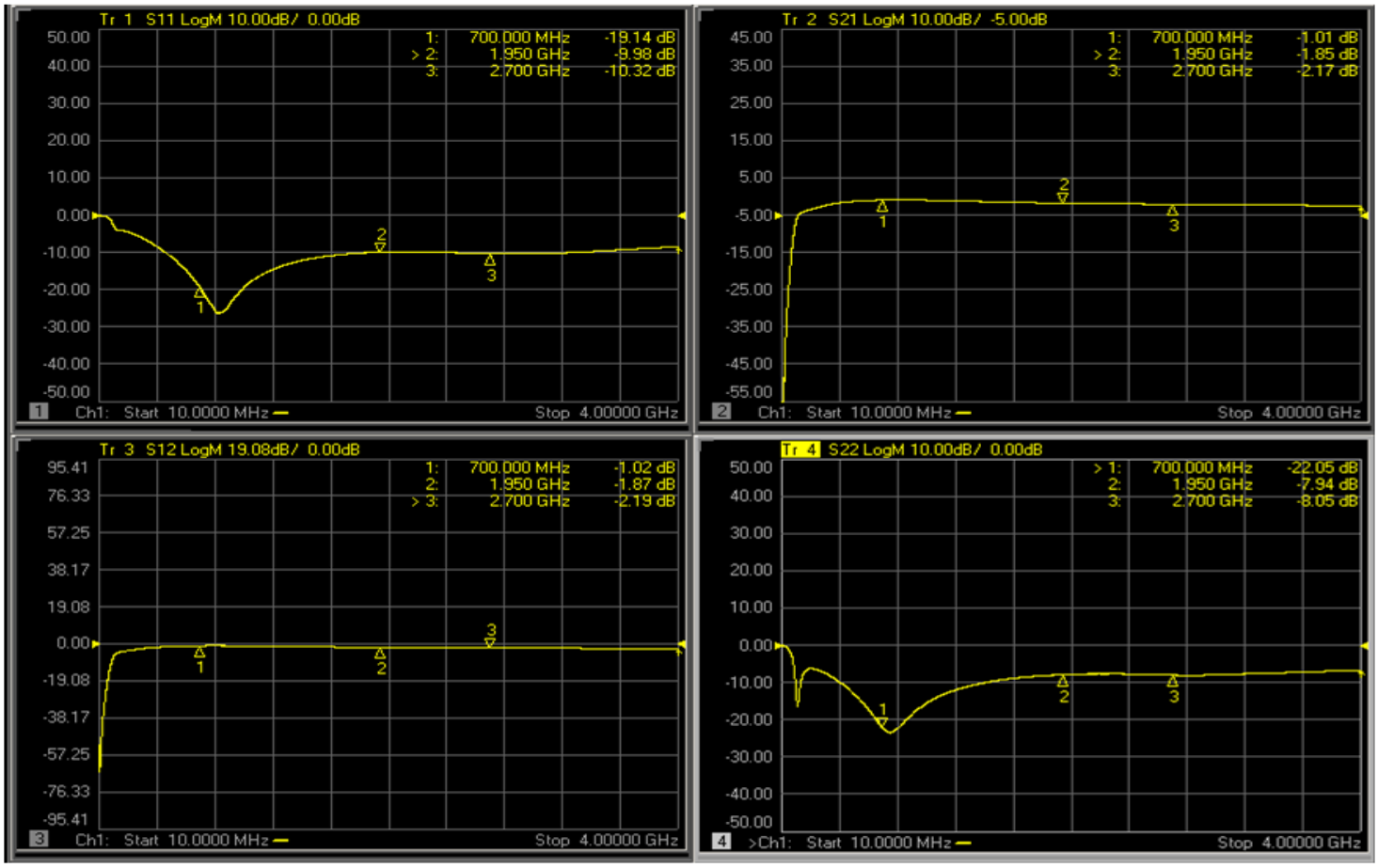


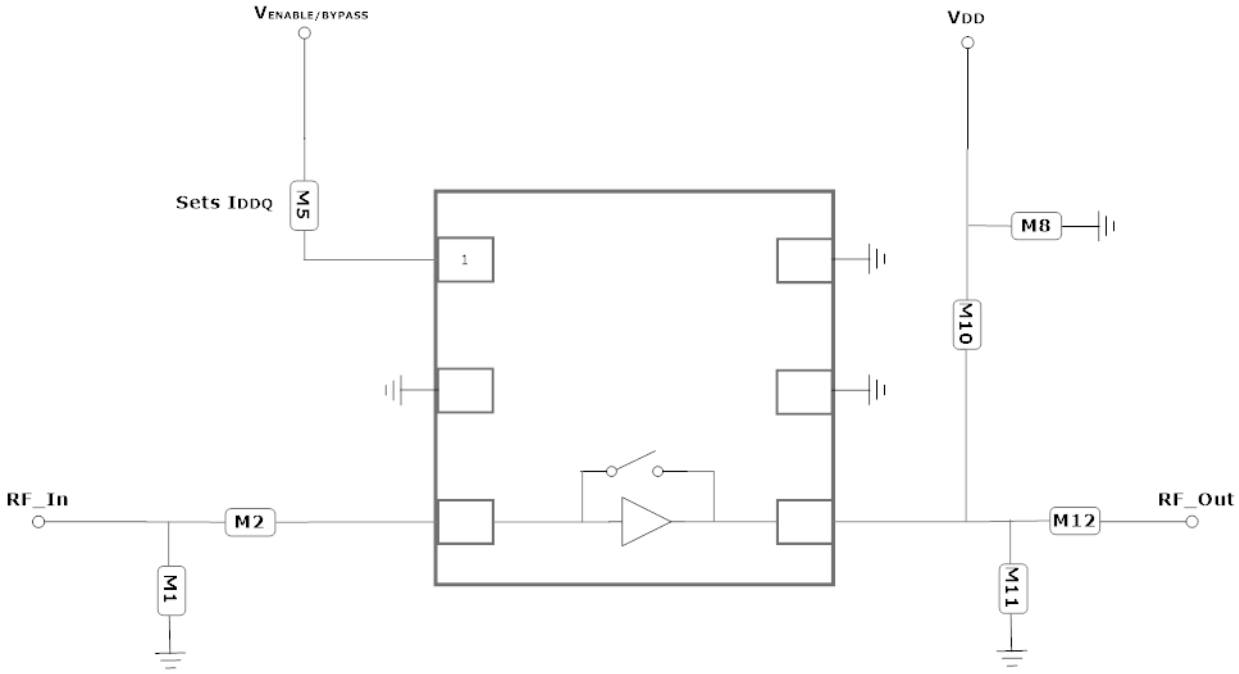
## GRF4142 Evaluation Board S-Pars and Stability Mu Factor: (0.7 to 2.7 GHz Match)



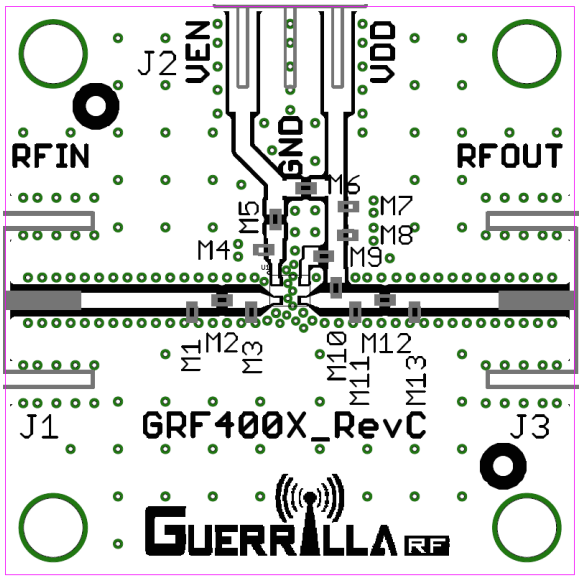

**Note: Mu factor >= 1.0 implies unconditional stability.**

## GRF4142 Evaluation Board S-Pars and Stability Mu Factor: (Bypass Mode; 0.7 to 2.7 GHz)






GRF4142 Application Schematic

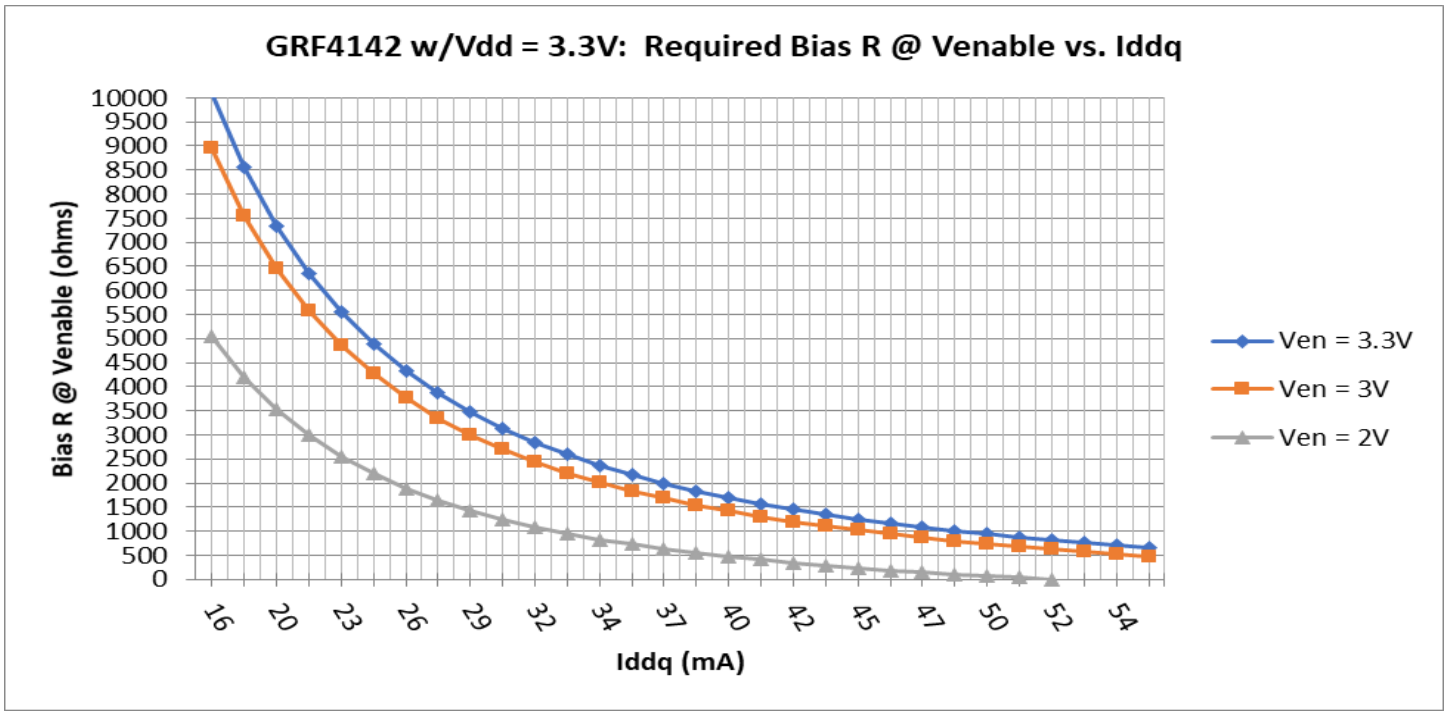


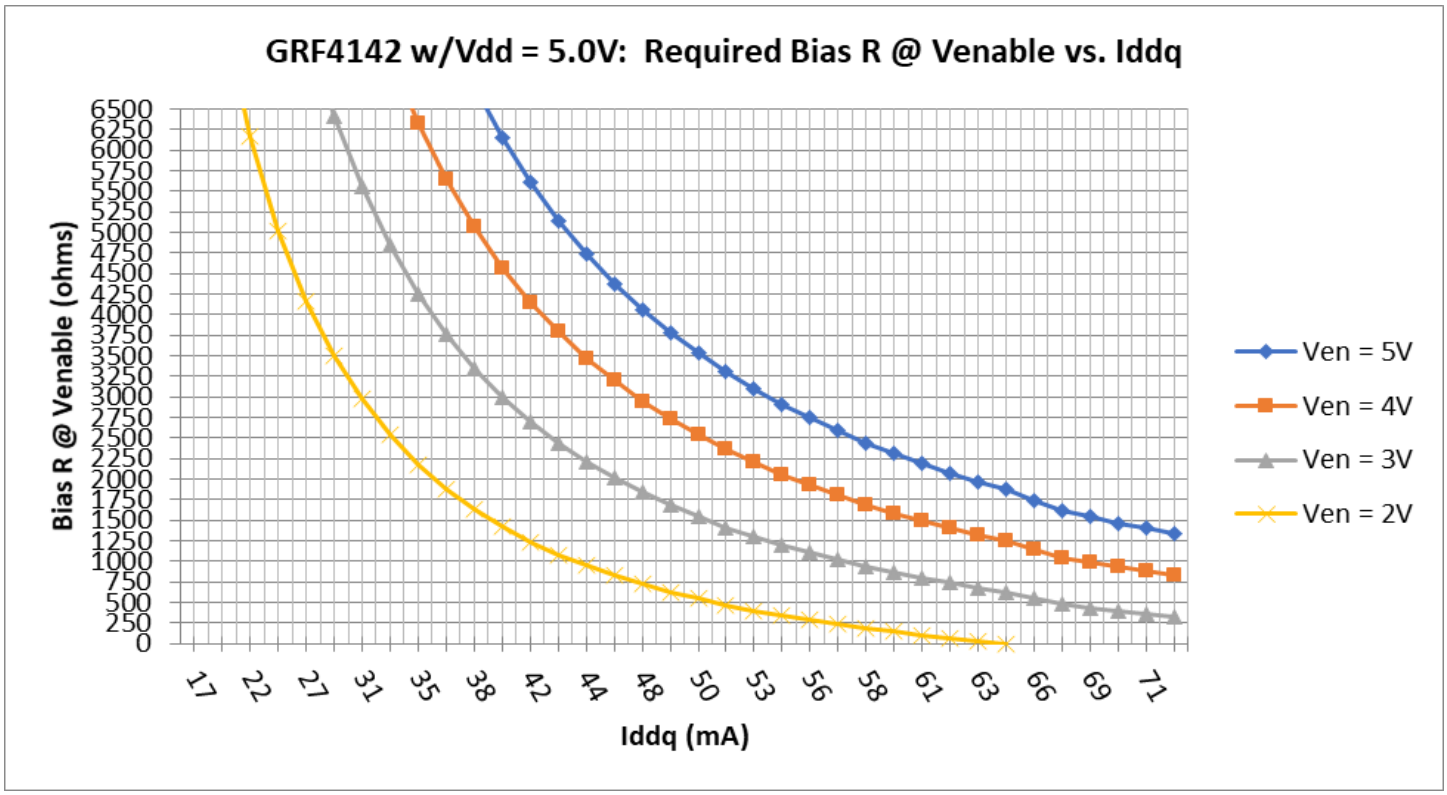

GRF4142 Evaluation Board Assembly Diagram

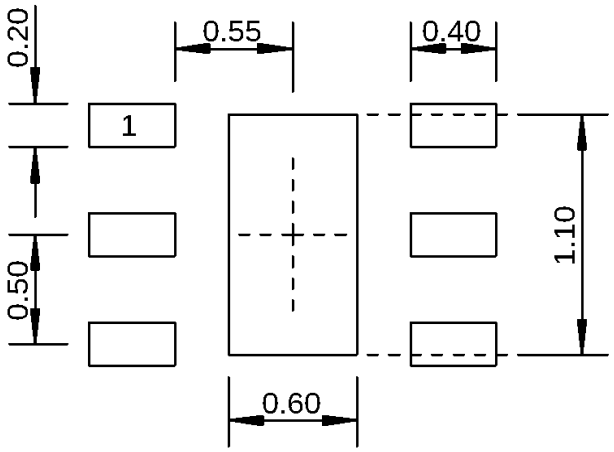
## GRF4142 Standard Evaluation Board BOM: (Standard 0.7 to 2.7 GHz Tune)

| Component | Type | Manufacturer | Family | Value | Package Size | Substitution |
|---|---|---|---|---|---|---|
| M1 | Inductor | Murata | LQG | 22 nH | 0402 | ok |
| M2 | Capacitor | Murata | GJM | 30 pF | 0402 | ok |
| M5 (See Curves) | Resistor | Various | 5% | Sets Iddq | 0402 | ok |
| M8 | Capacitor | Murata | GRM | 0.1 uF | 0402 | ok |
| M10 | Inductor | Murata | LQG | 39 nH | 0402 | ok |
| M11 | Capacitor | Murata | GJM | 0.5 pF | 0402 | ok |
| M12 | Capacitor | Murata | GRM | 100 pF | 0402 | ok |
| Evaluation Board | GRF400X_RevC | | | | | |

## GRF4142 Bias Resistor Selection Charts

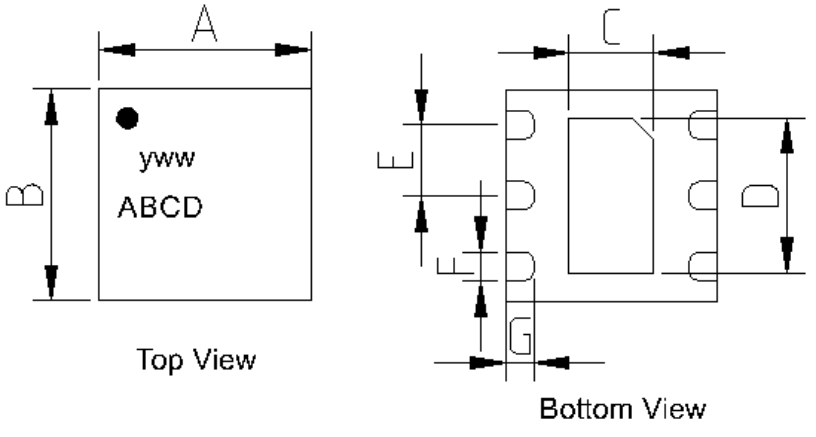





Dimensions in millimeters

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



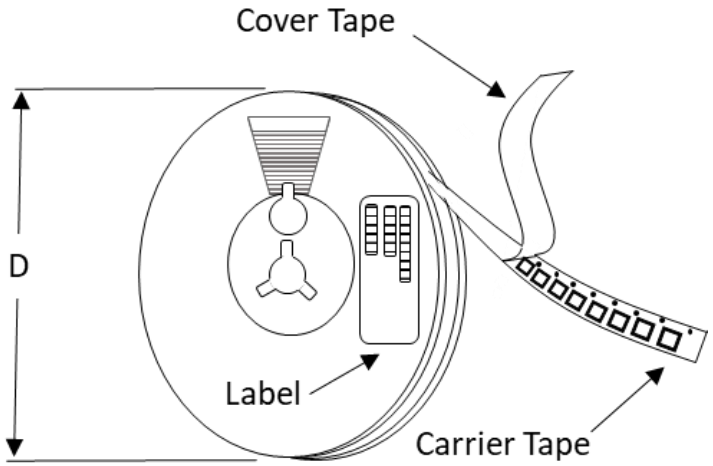

| Dimensions (MM) | |
|---|---|
| A | 1.5 +/- 0.050 |
| B | 1.5 +/- 0.050 |
| C | .6 +/- 0.050 |
| D | 1.1 +/- 0.050 |
| E | .5 Bsc |
| F | .2 +/- 0.050 |
| G | .2 +/- 0.050 |
| H | .45 +/- 0.050 |
| J | .12 Ref. |

**1.5 mm DFN-6 Package Dimensions**

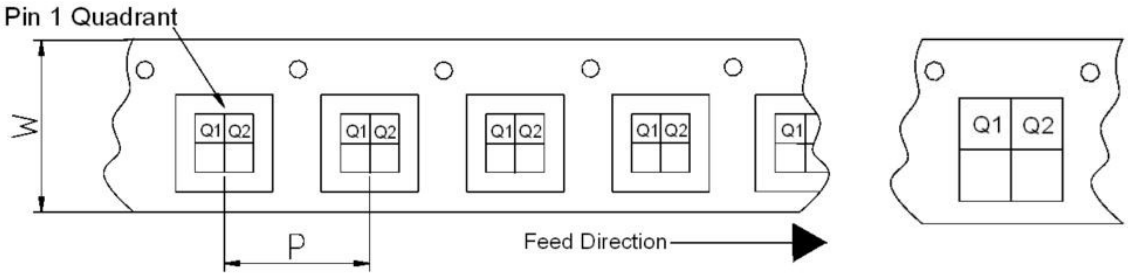
## Tape and Reel Information:

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**

## 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 Quad-rant | 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

| 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. |