



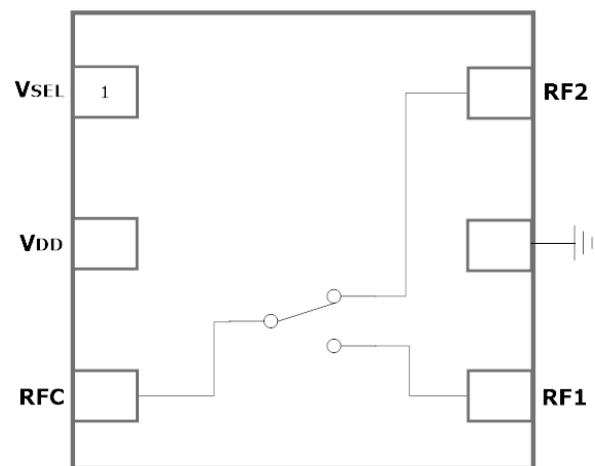
Product Description

GRF6011W is a linear, ultra-low loss SPDT switch that has been designed with failsafe characteristics when all voltage inputs are removed. In switching mode, the device delivers IP1dB levels greater than 1 Watt along with >49 dBm IIP3 levels for both RF paths.

When powered down (Failsafe Mode), RFC to RF1 defaults to a high insertion loss while RFC to RF2 defaults to a low insertion loss state that retains high linearity.

With optimization of external components, the upper frequency range of the device can be extended to 6.0 GHz. Data plots using this high frequency tune are also included on the following pages. Optimization for a particular band essentially involves selecting the optimal series capacitor values (M1, M4, M5) for the three RF ports.

The device is operated from a supply voltage of 3.0 volts to 5.0 volts with the single control input (VSEL) from 3.0 volts up to VDD.



1.5 x 1.5 mm DFN-6

Features

Path: RFC to RF1: (1.9 GHz); Vdd: 3.3V

- Insertion Loss: 0.43 dB
- IP1dB: 32.0 dBm
- IIP3: 49.5 dBm
- Failsafe Mode: High loss

Path: RFC to RF2: (1.9 GHz); Vdd: 3.3V

- Insertion Loss: 0.33 dB
- IP1dB: 30.5 dBm
- IIP3: 51.0 dBm
- Failsafe Mode: 0.4 dB loss

- AEC-Q100 Grade 2 Qual Pending

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

Applications

- Signal Boosters/Repeaters
- Automotive Telematics

Absolute Ratings:

| Parameter | Symbol | Min. | Max. | Unit |
|-----------------------------|---------------|------|------|------|
| Drain Voltage | V_D | 0 | 6.0 | V |
| RF Input Power (average) | $P_{IN\ MAX}$ | | 36 | dBm |
| Operating Temperature | T_{AMB} | -40 | 105 | °C |
| Maximum Channel Temperature | T_{MAX} | | 170 | °C |
| Electrostatic Discharge: | | | | |
| Charged Device Model: (TBD) | CDM | | | V |
| Human Body Model: | HBM | 125 | | V |
| Storage: | | | | |
| Storage Temperature | T_{STG} | -40 | 150 | °C |
| Moisture Sensitivity Level | MSL | | 1 | -- |



Caution! ESD Sensitive Device

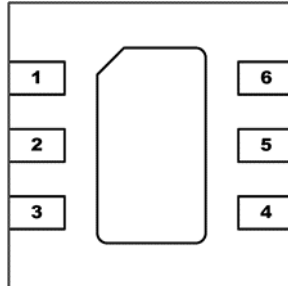


Exceeding Absolute Maximum Rating conditions may cause permanent damage to the device.

Note: For manufacturing information, see the Guerrilla-RF.com website for the following document located on the GRF6011W 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 _{SEL} | Switching control Input | Selects RF path |
| 2 | V _{DD} | Supply voltage input | |
| 3 | RFC | Common RF Path | DC blocking cap must be used |
| 4 | RF1 | RFC to RF1 | This path defaults to high insertion loss when all power is removed. DC blocking cap must be used |
| 5 | GND | Ground | |
| 6 | RF2 | RFC to RF2 | This path defaults to low insertion loss when all power is removed. DC blocking cap must be used |
| 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 _{SELECT} |
|-------------------------------------|------------------|-----------------|-----------------------------------|
| RFC to RF1 | Select RF1 | ≥ 3.0 | 1 |
| RFC to RF2 | Select RF2 | ≥ 3.0 | 0 |
| Failsafe | No voltage input | 0.0 or float | 0.0 or float |
| V _{SELECT} Logic Level "0" | Logic Low | ≥ 3.0 | $< 0.1V$ |
| V _{SELECT} Logic Level "1" | Logic High | ≥ 3.0 | $3.0 \leq V_{SELECT} \leq V_{DD}$ |



Preliminary

GRF6011W

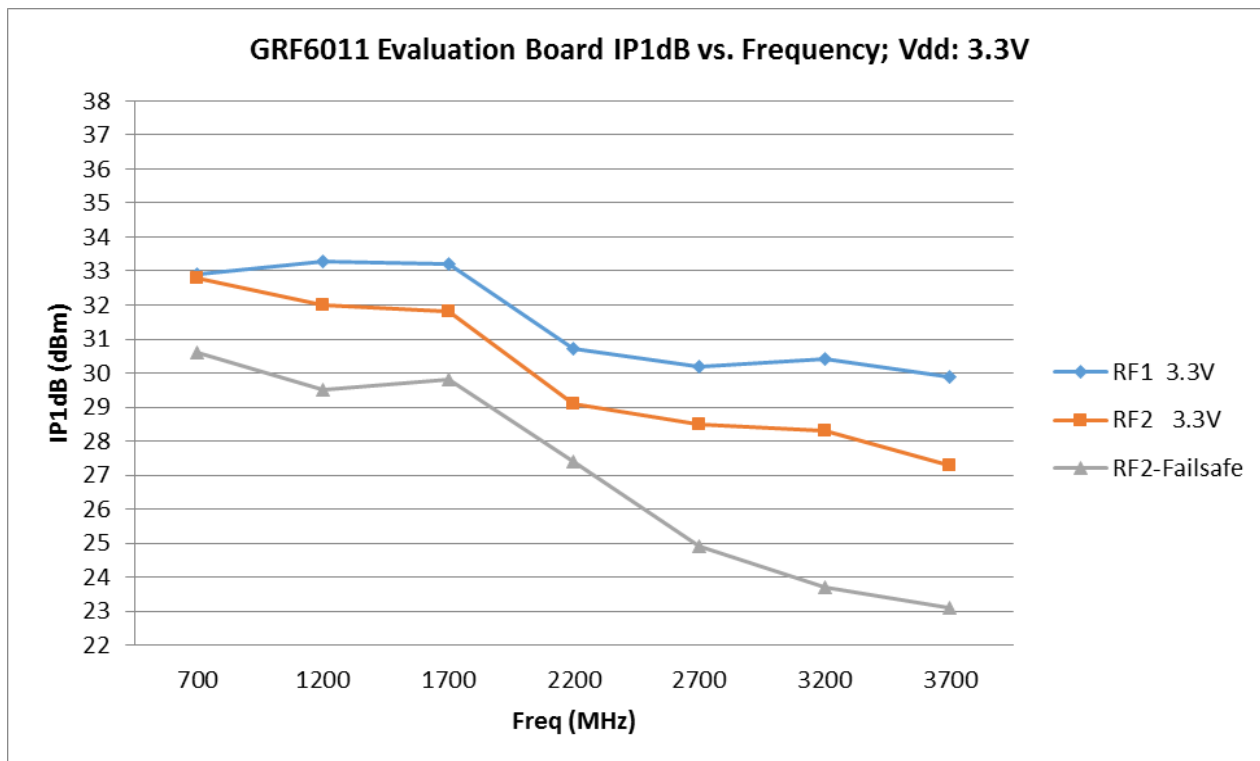
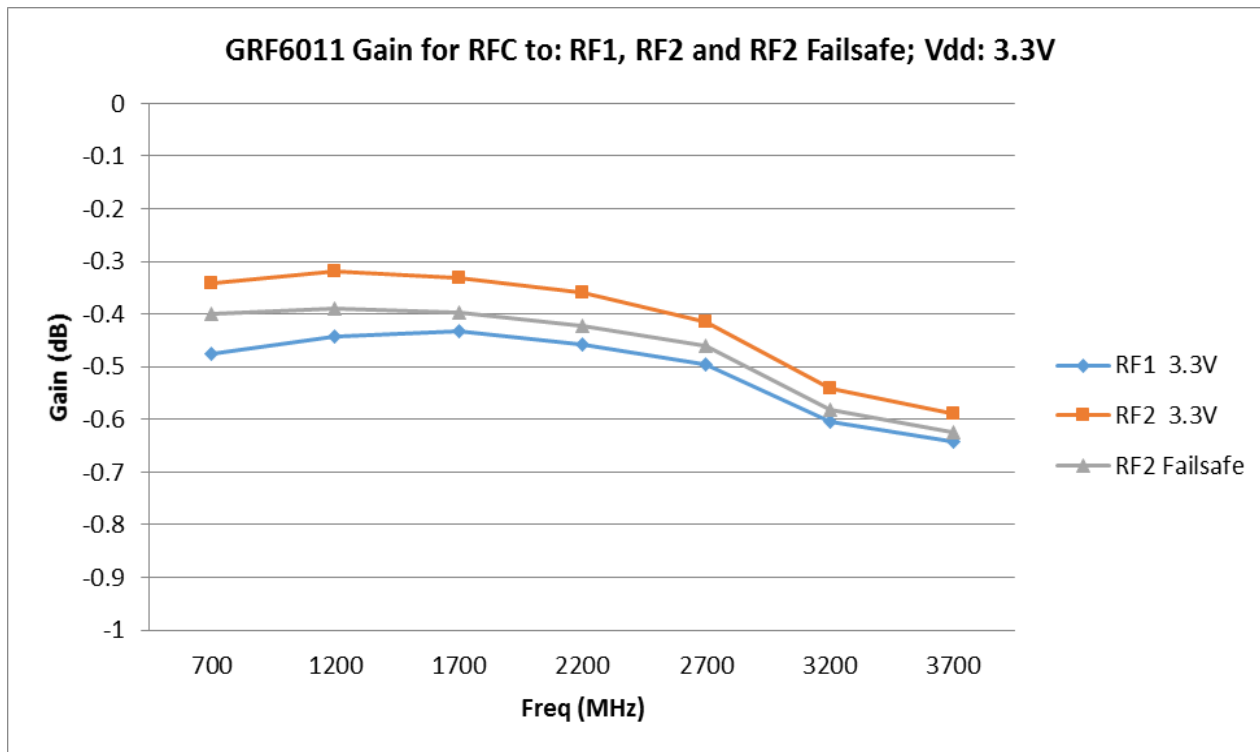
SPDT Failsafe Switch
0.1 – 6.0 GHz

Nominal Operating Parameters:

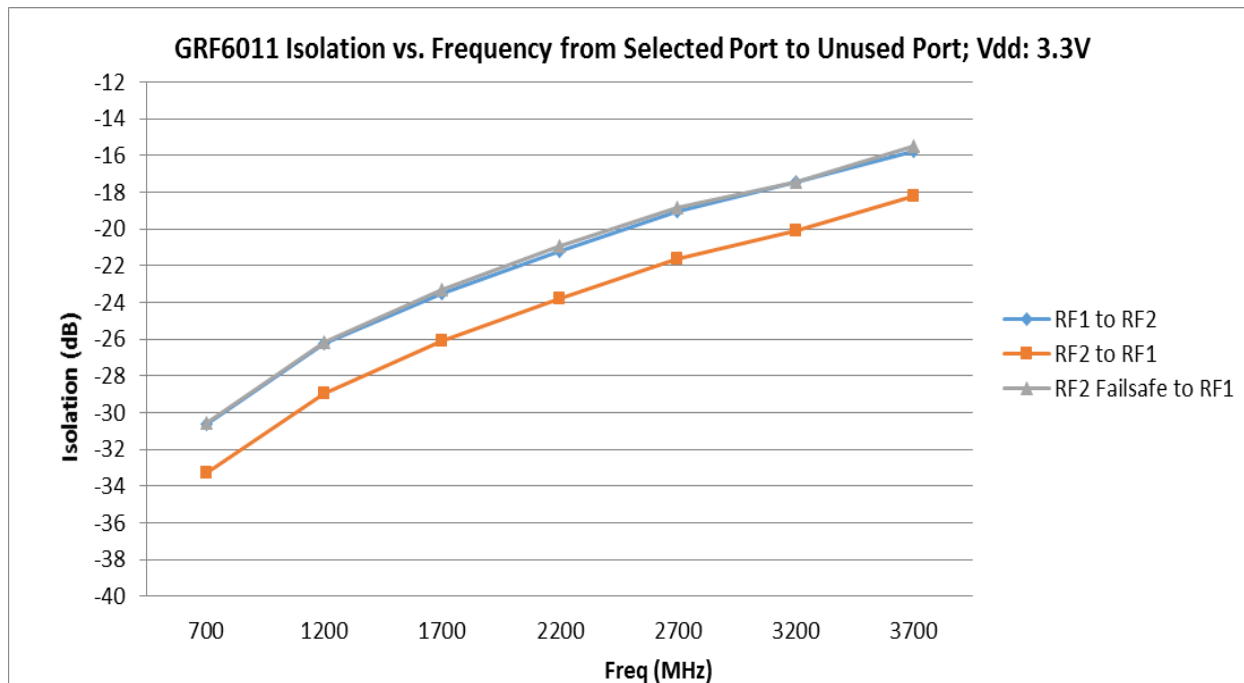
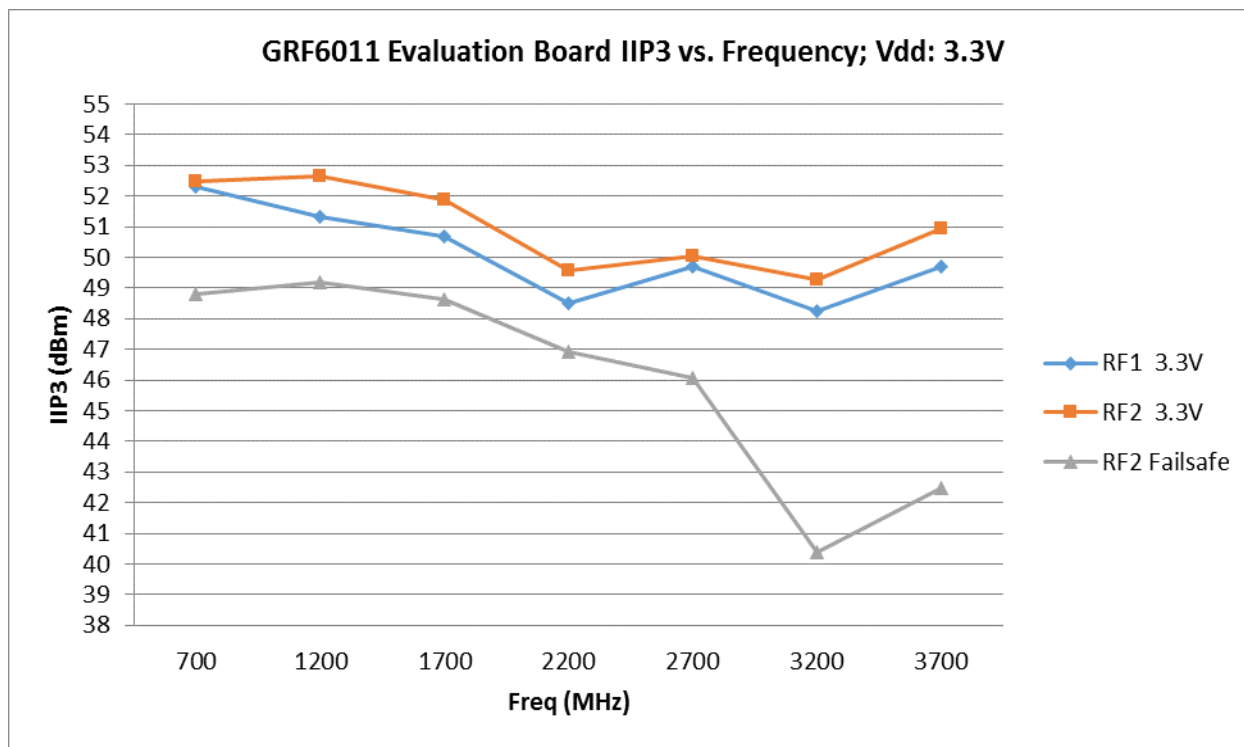
| Parameter | Symbol | Specification | | | Unit | Condition |
|--|---------------|---------------|------|------|--------------|--|
| | | Min. | Typ. | Max. | | |
| Test Frequency | F_{TEST} | | 1.9 | | GHz | |
| Switch Mode: RFC to RF1 Selected | | | | | | $V_{DD}: 3.3V; V_{SEL}: 3.3V; T_A = 25^\circ C$ |
| Loss (Packaged Device) | Loss_1 | | 0.43 | | dB | |
| Isolation: RF1 to RF2 | Isol_1_2 | | 22.0 | | dB | |
| Input Power for 1 dB Compression | IP1dB_1 | | 32.0 | | dBm | |
| Input 3rd Order Intercept | IIP3_1 | | 49.5 | | dBm | |
| Supply Current | I_{DD} | | 1000 | | μA | |
| Select Current | I_{SELECT} | | 800 | | μA | |
| Switch Mode: RFC to RF2 Selected | | | | | | $V_{DD}: 3.3V; V_{SEL}: 0.0V, T_A = 25^\circ C$ |
| Loss (Packaged Device) | Loss_2 | | 0.33 | | dB | |
| Isolation: RF1 to RF2 | Isol_1_2 | | 25.0 | | dB | |
| Input Power for 1 dB Compression | IP1dB_2 | | 30.5 | | dBm | |
| Input 3rd Order Intercept | IIP3_2 | | 51.0 | | dBm | |
| Supply Current | I_{DD} | | 300 | | μA | |
| Select Current | I_{SELECT} | | 0 | | μA | |
| Failsafe Mode: RFC to RF2 (Default Short) | | | | | | $V_{DD}: 0.0V; V_{SEL}: 0.0 V, T_A = 25^\circ C$ |
| Loss | Loss_2 | | 0.40 | | dB | |
| Isolation: RF1 to RF2 | Isol_1_2 | | 22.0 | | dB | |
| Input Power for 1 dB Compression | IP1dB_2 | | 29.0 | | dBm | |
| Input 3rd Order Intercept | IIP3_2 | | 48.0 | | dBm | |
| Failsafe Mode: RFC to RF1 (Default Open) | | | | | | $V_{DD}: 0.0V; V_{SEL}: 0.0 V, T_A = 25^\circ C$ |
| Loss | Loss_1 | | 23.0 | | dB | |
| Thermal Data | | | | | | |
| Thermal Resistance: (Infra-Red Scan) | Θ_{jc} | | TBD | | $^\circ C/W$ | On standard Evaluation Board |
| Channel Temperature @ +85 C Reference (Package heat sink) | $T_{CHANNEL}$ | | | | $^\circ C$ | |

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

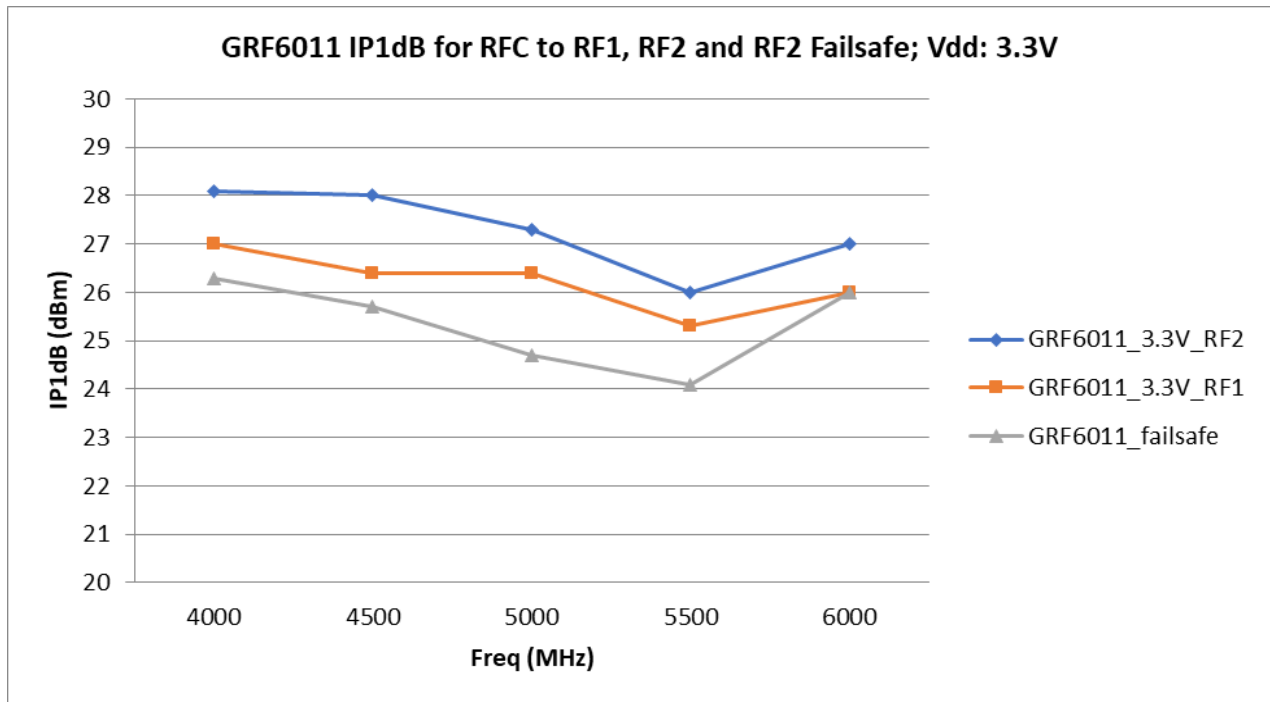
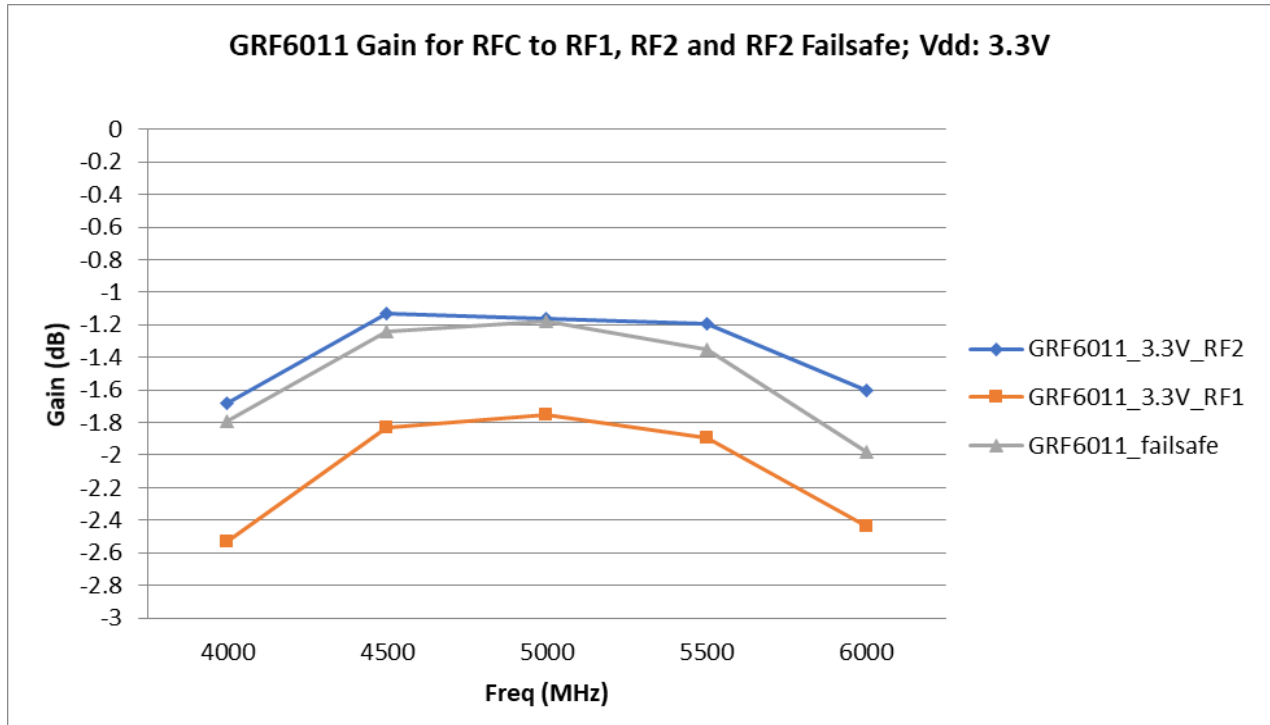
GRF6011W Measured Data (standard 700-4000 MHz tune)



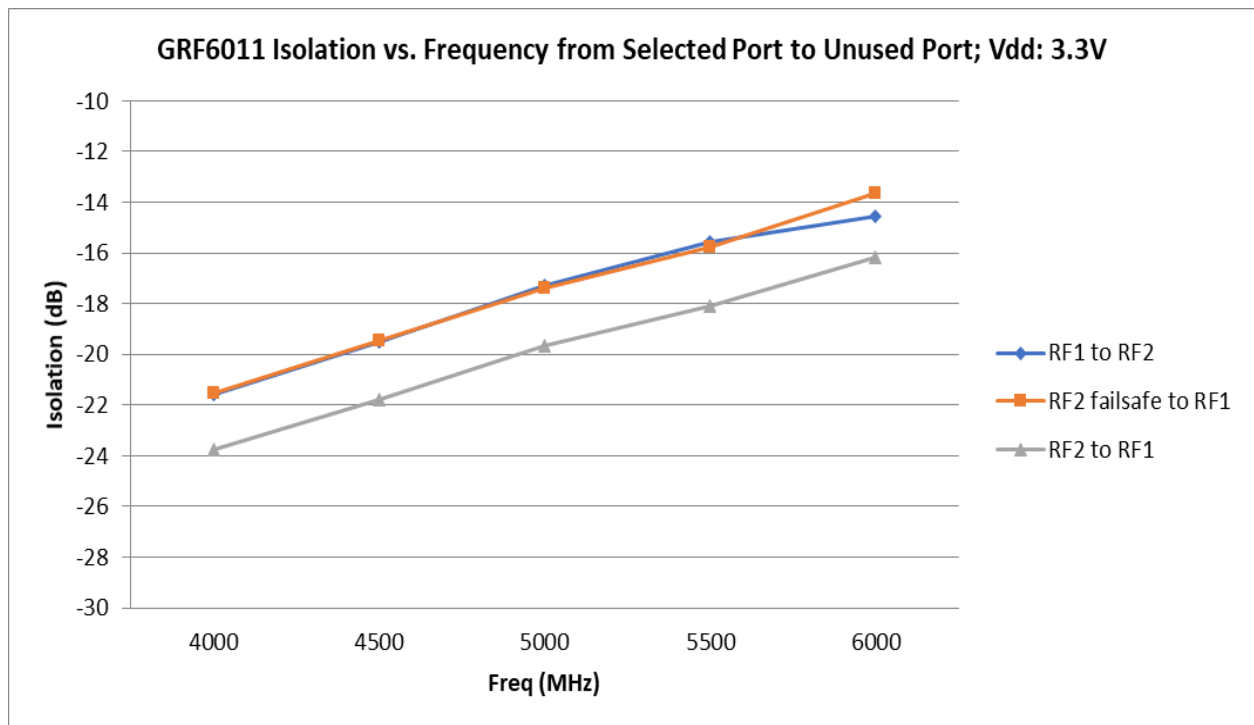
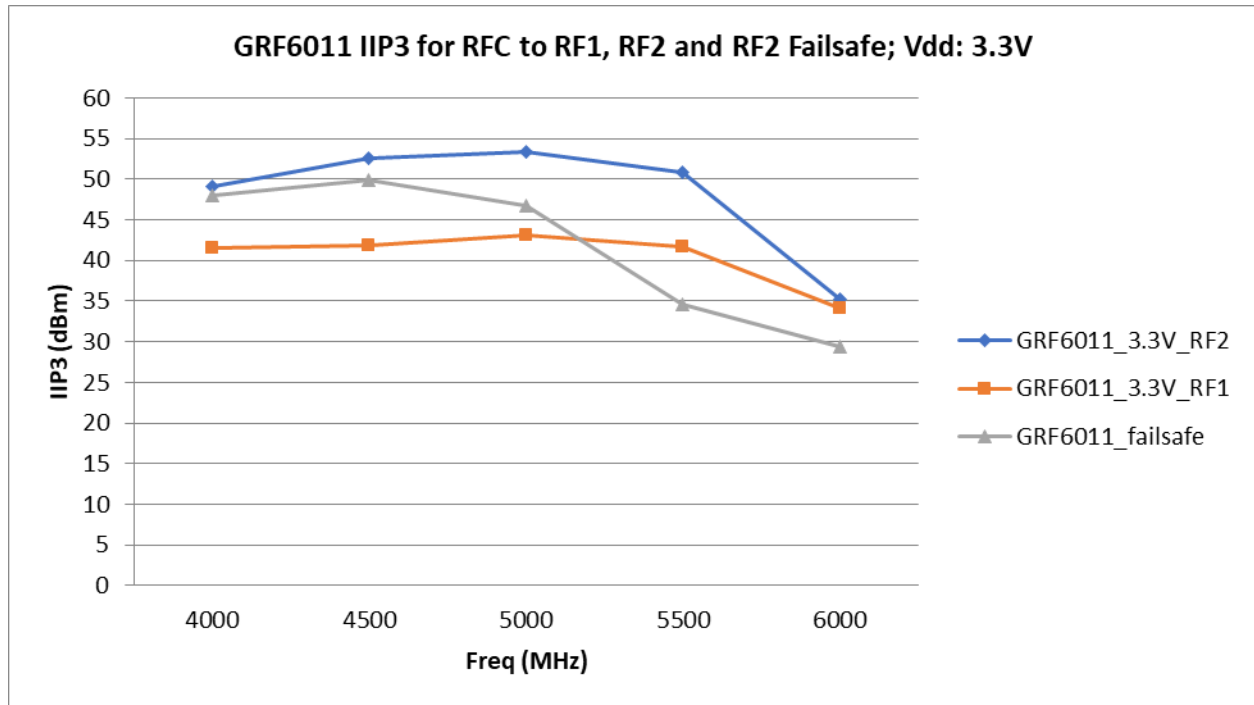
GRF6011W Measured Data (standard 700-4000 MHz tune)

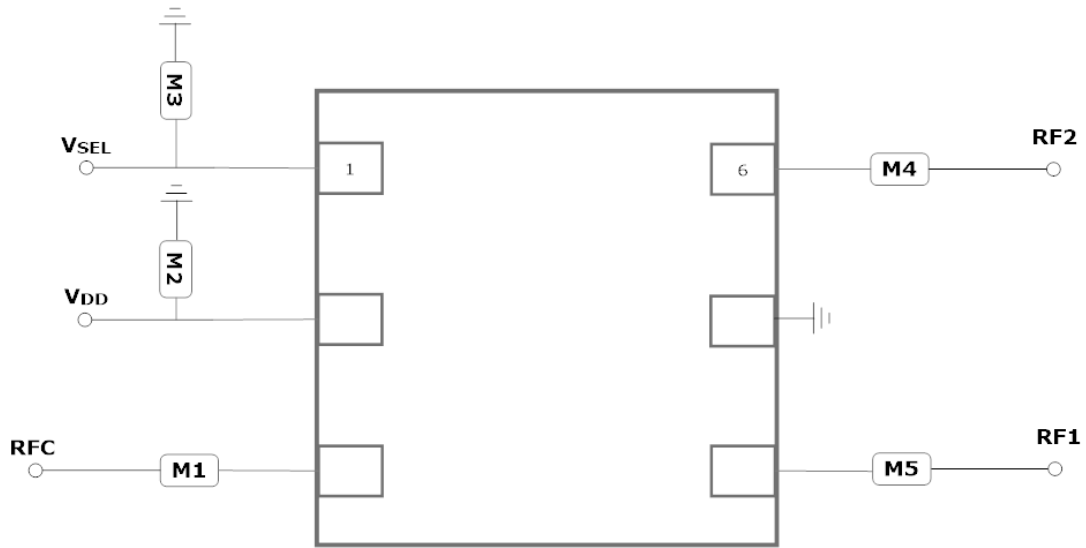


GRF6011W Measured Data (4000 to 6000 MHz tune)

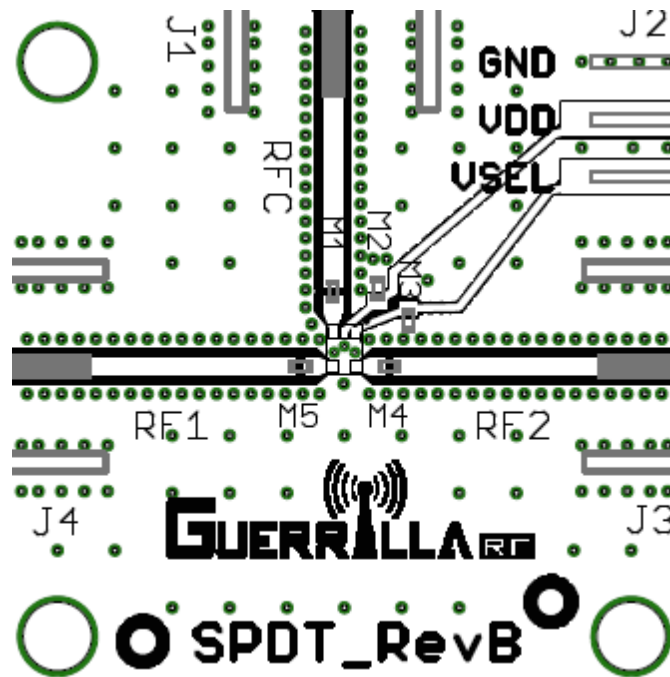


GRF6011W Measured Data (4000 to 6000 MHz tune)





GRF6011W Application Schematic



GRF6011W Evaluation Board Assembly Drawing



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GRF6011W

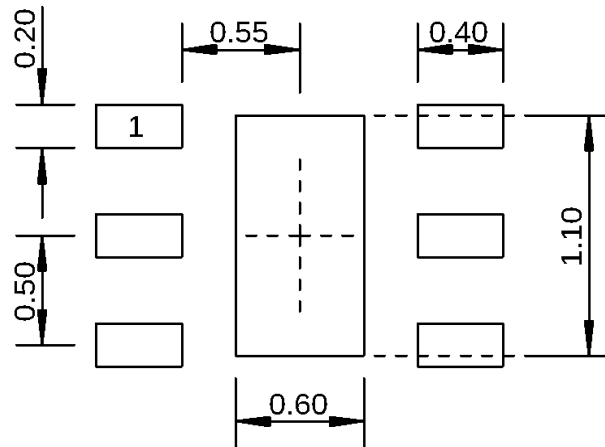
SPDT Failsafe Switch
0.1 – 6.0 GHz

GRF6011W Standard Evaluation Board BOM: (0.4 to 4.0 GHz)

| Component | Type | Manufacturer | Family | Value | Package Size | Substitution |
|-----------|-----------|--------------|--------|--------|--------------|--------------|
| M1 | Capacitor | Murata | GJM | 47 pF | 0402 | ok |
| M2 | Capacitor | Murata | GRM | 100 pF | 0402 | ok |
| M3 | Capacitor | Murata | GRM | 100 pF | 0402 | ok |
| M4 | Capacitor | Murata | GJM | 47 pF | 0402 | ok |
| M5 | Capacitor | Murata | GJM | 47 pF | 0402 | ok |

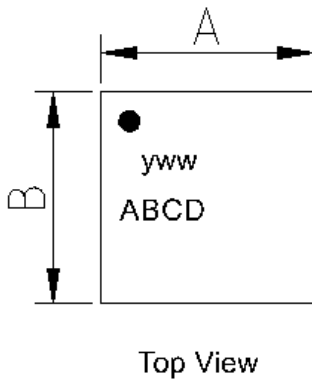
GRF6011W Evaluation Board BOM: (4.0 to 6.0 GHz)

| Component | Type | Manufacturer | Family | Value | Package Size | Substitution |
|-----------|-----------|--------------|--------|--------|--------------|--------------|
| M1 | Capacitor | Murata | GJM | 1.0 pF | 0402 | ok |
| M2 | Capacitor | Murata | GRM | 100 pF | 0402 | ok |
| M3 | Capacitor | Murata | GRM | 100 pF | 0402 | ok |
| M4 | Capacitor | Murata | GJM | 1.0 pF | 0402 | ok |
| M5 | Capacitor | Murata | GJM | 1.0 pF | 0402 | ok |

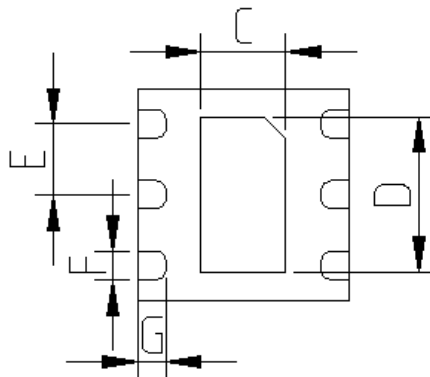


Dimensions in millimeters

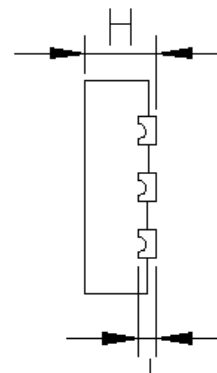
1.5 mm DFN-6 Suggested PCB Footprint (Top View)



Top View



Bottom View



Side View

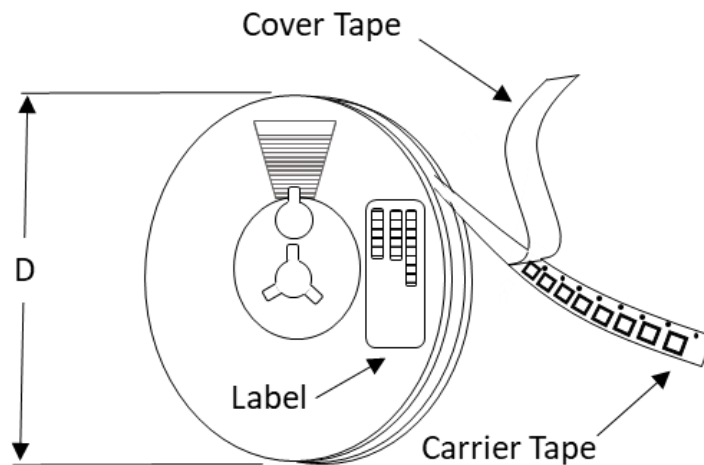
| Dimensions (MM) | |
|-----------------|---------------|
| A | 1.5 +/- 0.050 |
| B | 1.5 +/- 0.050 |
| C | .6 +/- 0.050 |
| D | 1.1 +/- 0.050 |
| E | .5 Bsc |
| F | .2 +/- 0.050 |
| G | .2 +/- 0.050 |
| H | .45 +/- 0.050 |
| J | .12 Ref. |

1.5 mm DFN-6 Package Dimensions

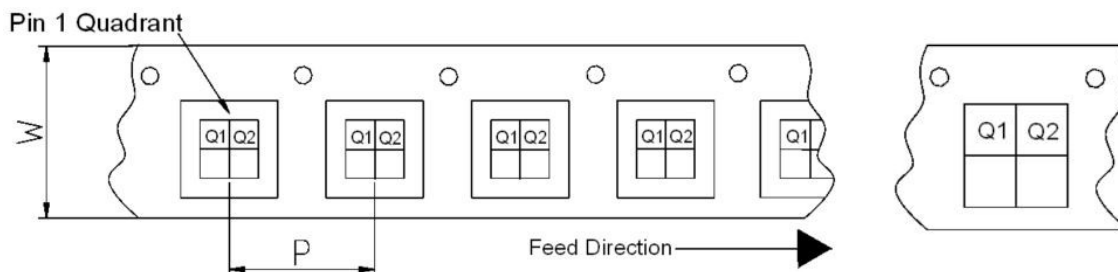
Tape and Reel Information:

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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GRF6011W

SPDT Failsafe Switch
0.1 – 6.0 GHz

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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GRF6011W

SPDT Failsafe Switch

0.1 – 6.0 GHz

| 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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