



Product Description

GRF6011 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.

Features

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

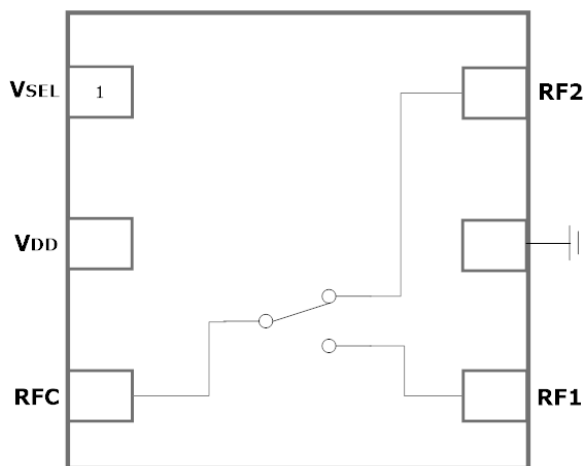
- Insertion Loss: 0.43 dB
- IP1dB: 32.0 dBm
- IIP3: 49.5 dBm
- Failsafe Mode: High loss

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

Applications

- Signal Boosters/Repeaters
- Tower Mounted Amplifiers
- ISM Radios
- Automotive Telematics
- RFID



1.5 x 1.5 mm DFN-6

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

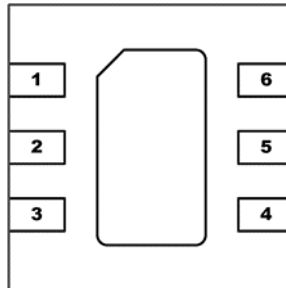


Exceeding Absolute Maximum Rating conditions may cause permanent damage to the device.

Note: For package dimensions and manufacturing information, see the Guerrilla-RF.com website for the following document located on the GRF6011 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	$3.0 \leq V_{SELECT} \leq V_{DD}$



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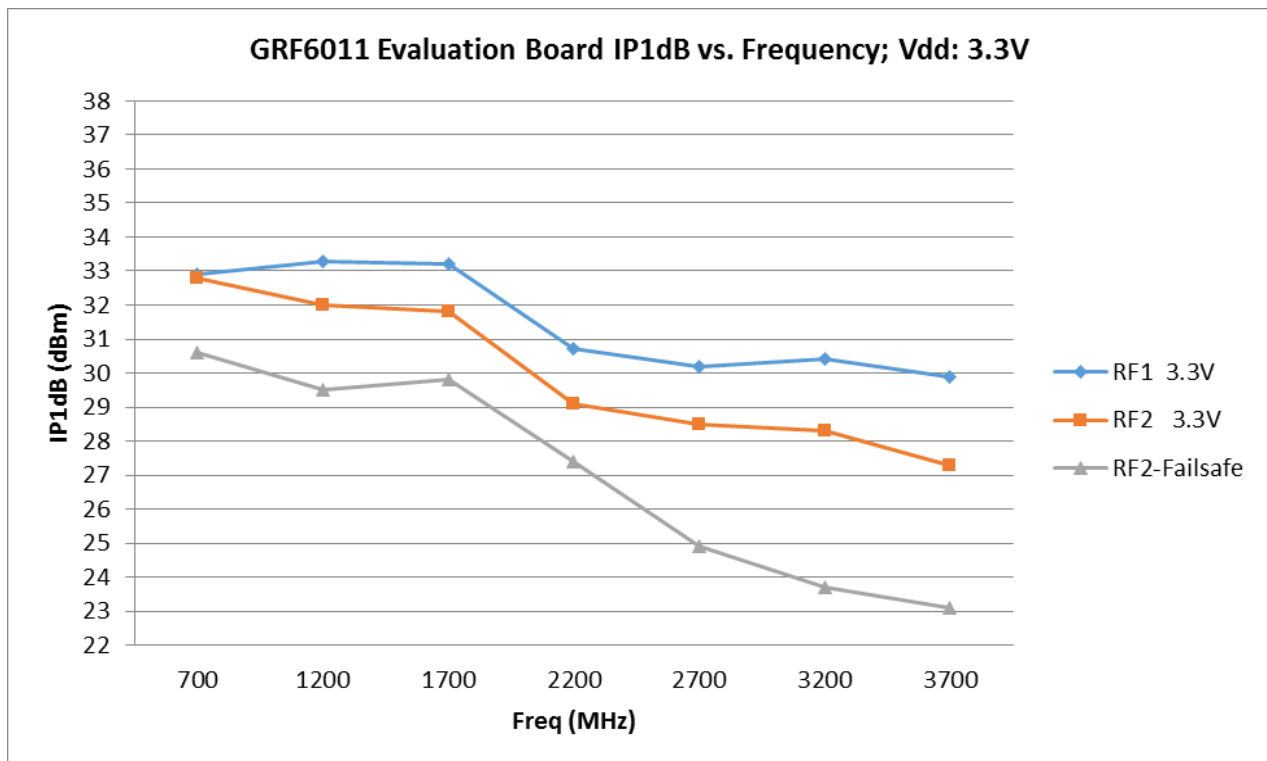
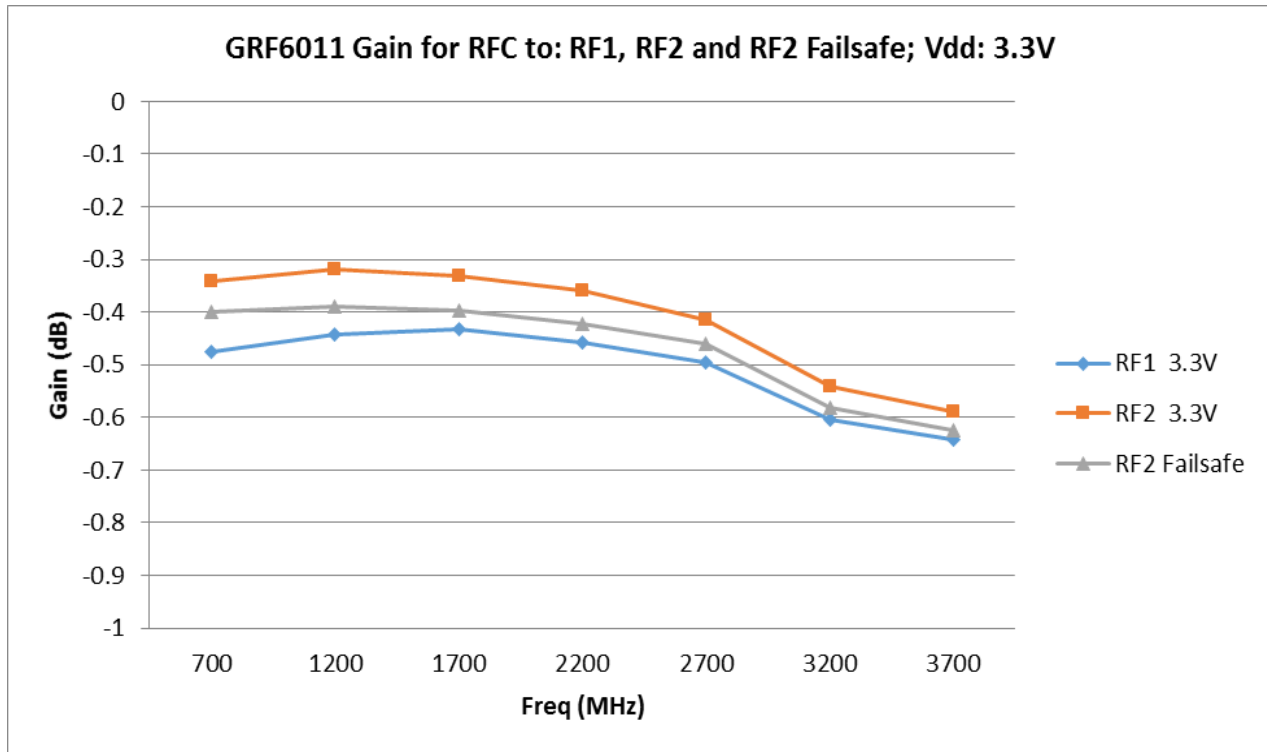
GRF6011

SPDT Failsafe Switch
0.1 – 6.0 GHz

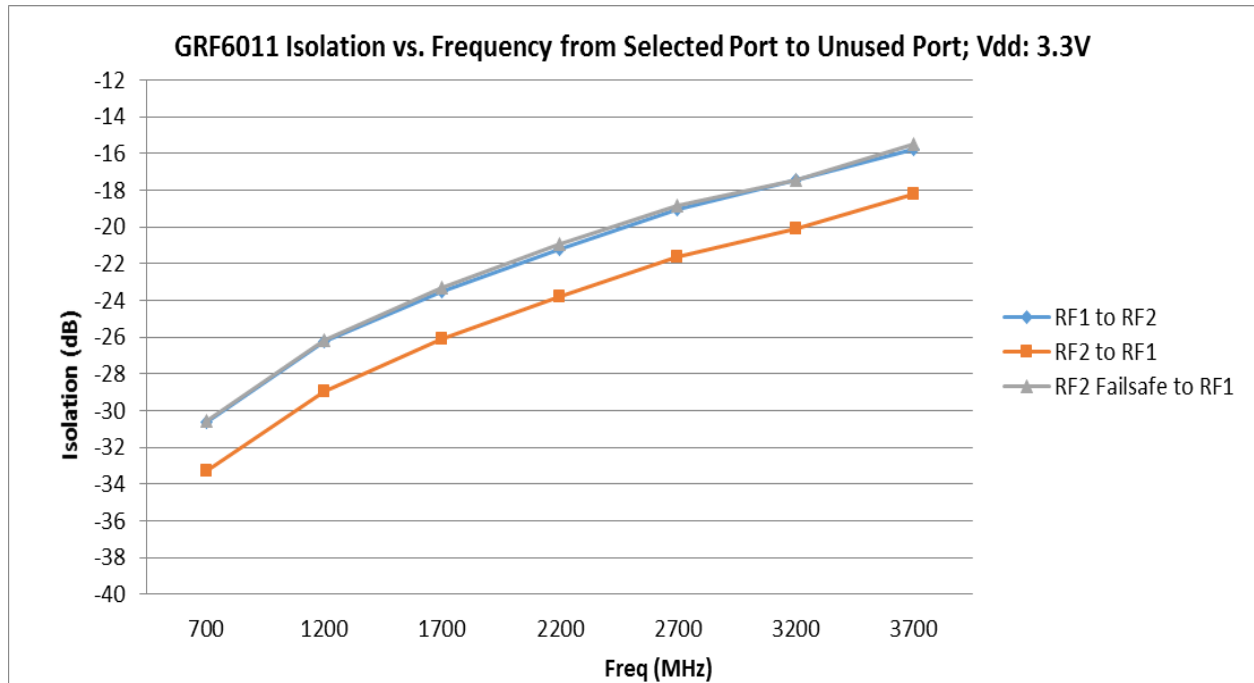
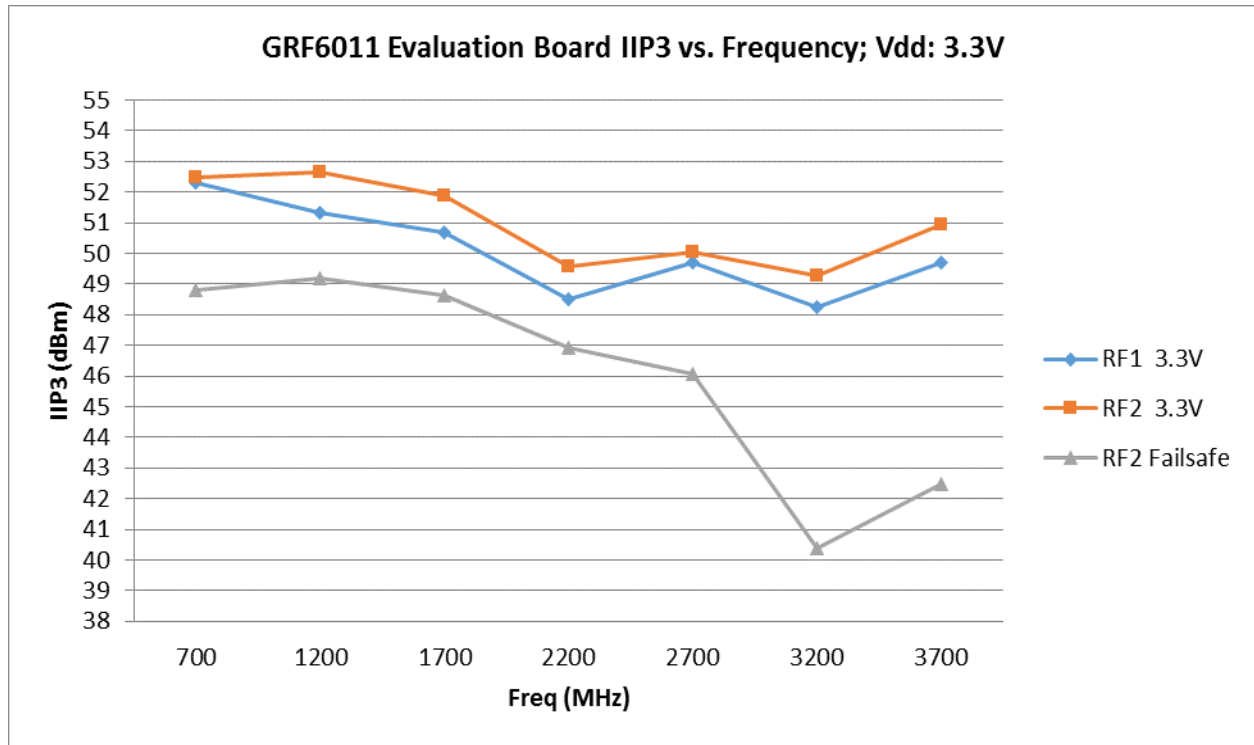
Nominal Operating Parameters:

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 °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		uA	
Select Current	I _{SELECT}		800		uA	
Switch Mode: RFC to RF2 Selected						V _{DD} : 3.3V; V _{SEL} : 0.0V, T _A = 25 °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		uA	
Select Current	I _{SELECT}		0		uA	
Failsafe Mode: RFC to RF2 (Default Short)						V _{DD} : 0.0V; V _{SEL} : 0.0 V, T _A = 25 °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 °C
Loss	Loss_1		23.0		dB	
Thermal Data						
Thermal Resistance: (Infra-Red Scan)	Θ _{jc}		TBD		°C/W	On standard Evaluation Board
Channel Temperature @ +85 C Reference (Package heat sink)	T _{CHANNEL}				°C	

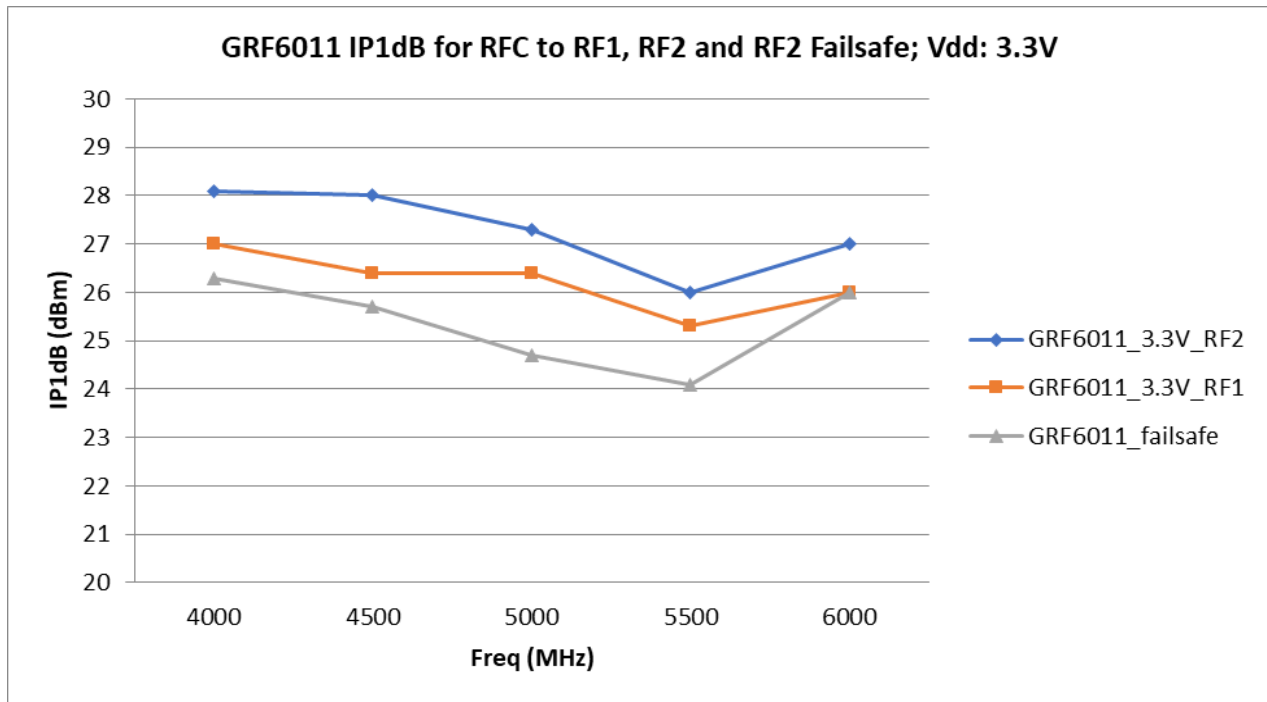
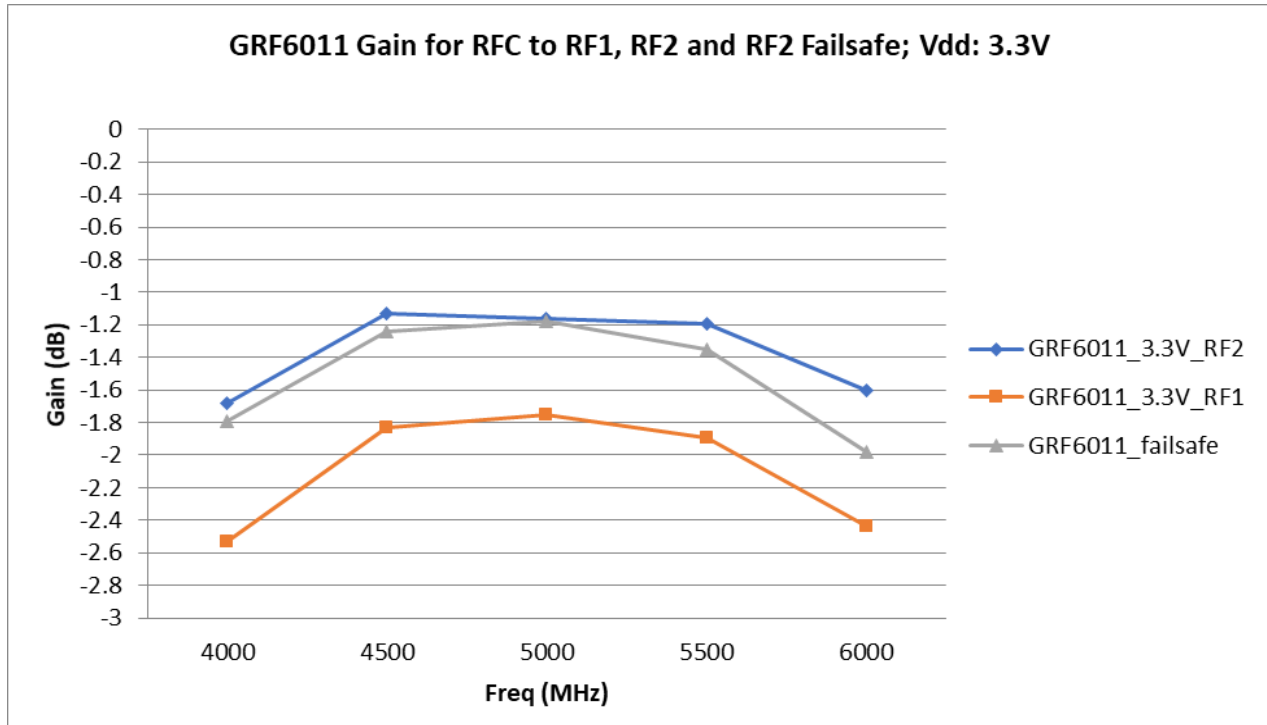
GRF6011 Measured Data (standard 700-4000 MHz tune)



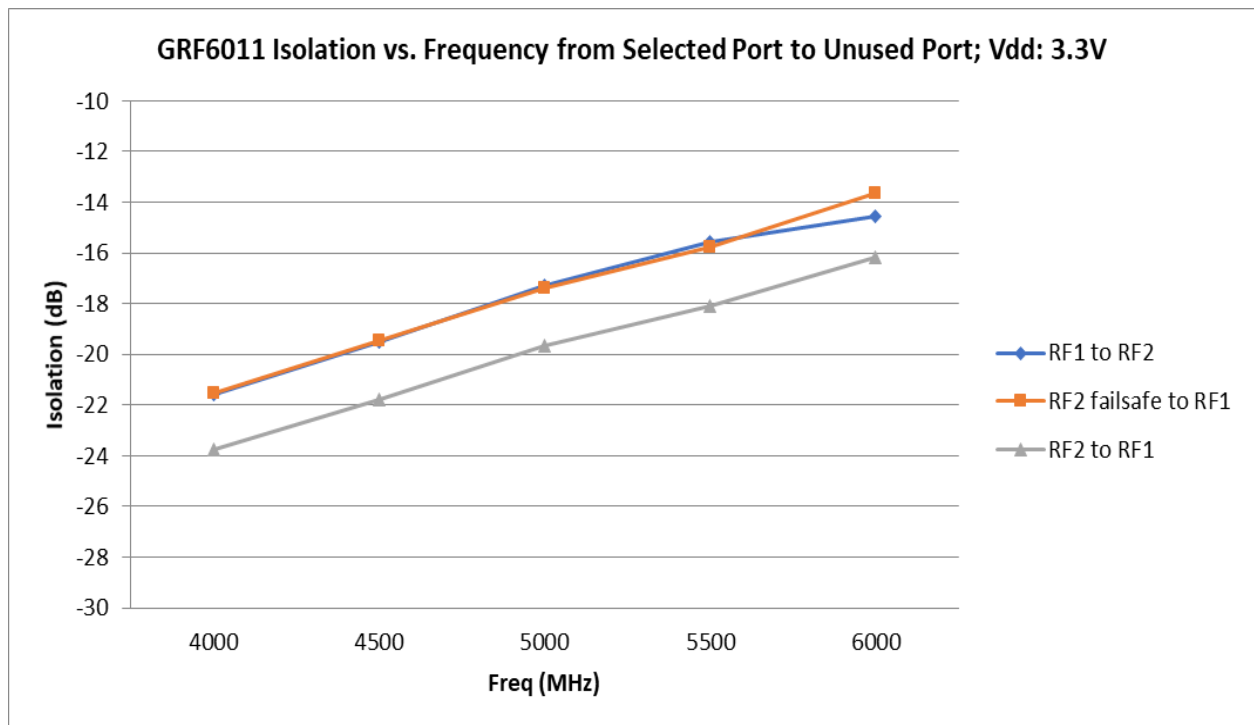
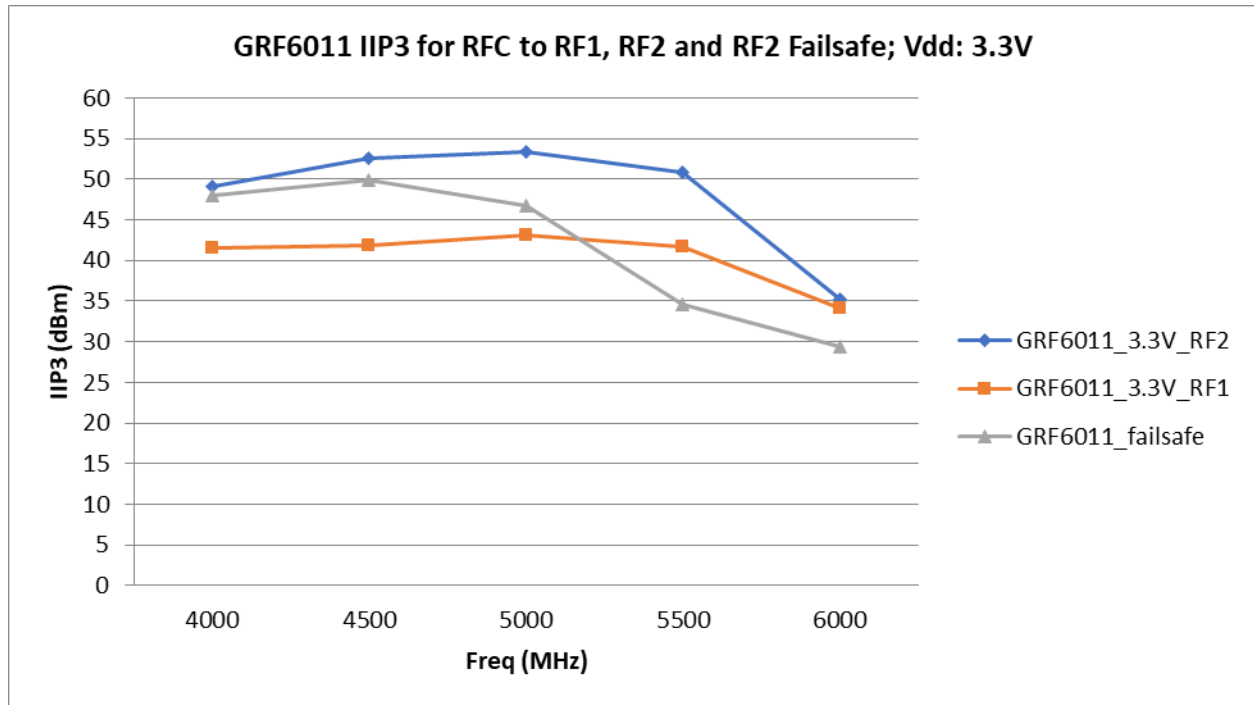
GRF6011 Measured Data (standard 700-4000 MHz tune)

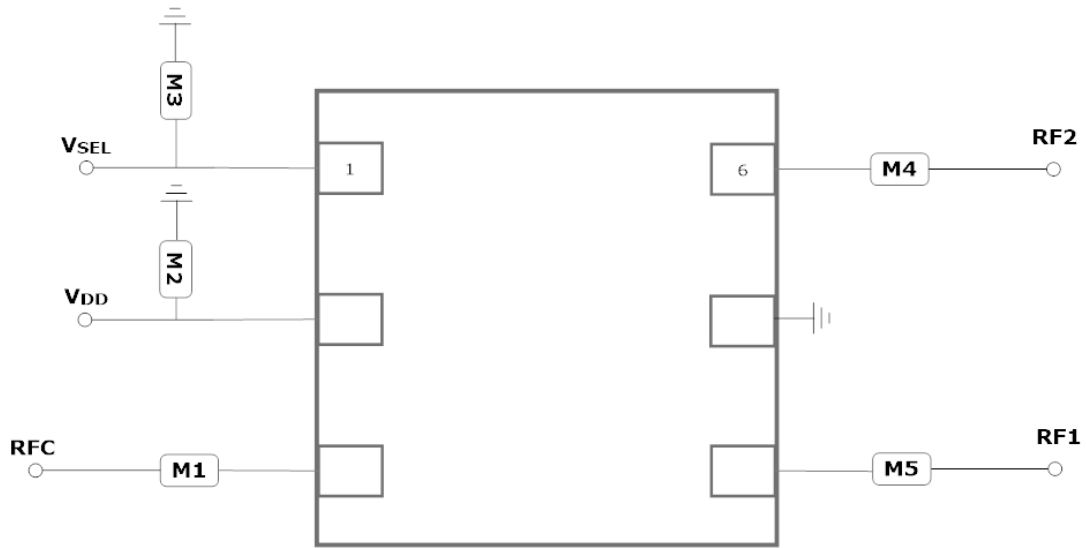


GRF6011 Measured Data (4000 to 6000 MHz tune)

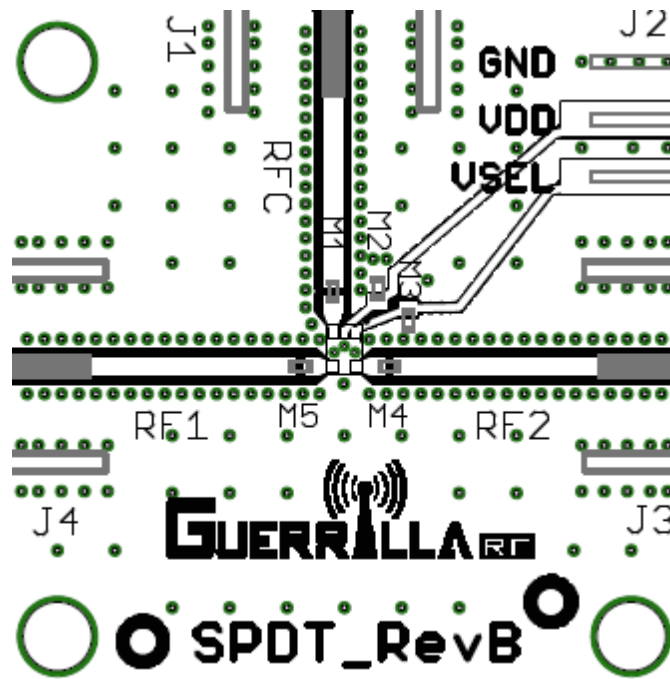


GRF6011 Measured Data (4000 to 6000 MHz tune)





GRF6011 Application Schematic



GRF6011 Evaluation Board Assembly Drawing



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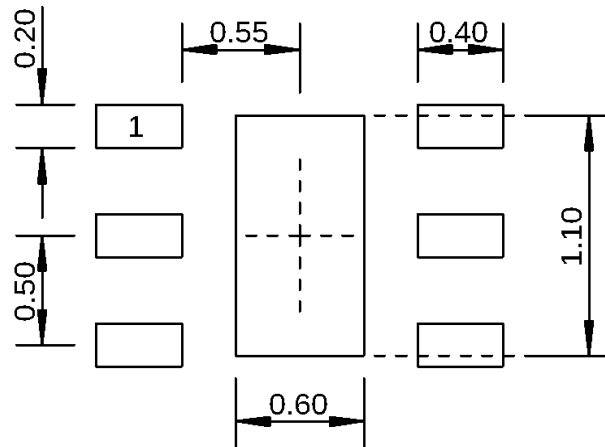
SPDT Failsafe Switch
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GRF6011 Standard Evaluation Board BOM: (0.4 to 4.0 GHz)

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

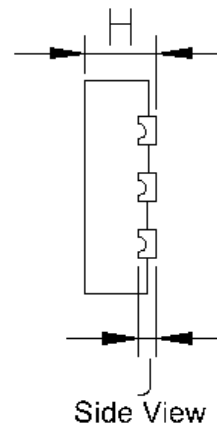
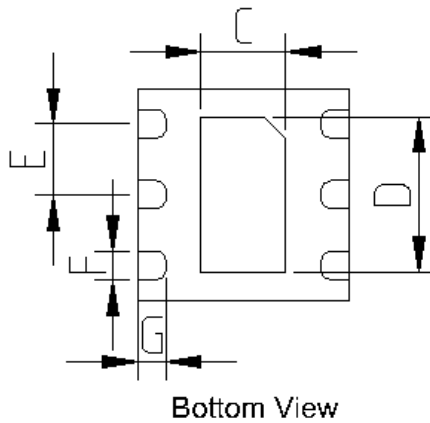
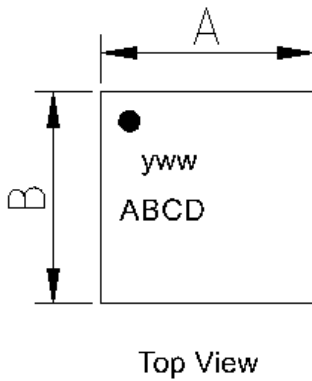
GRF6011 Evaluation Board BOM: (4.0 to 6.0 GHz)

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)



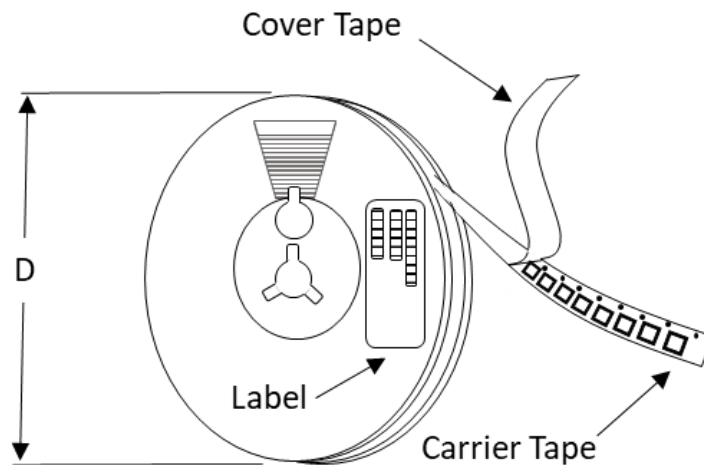
Dimensions (MM)	
A	1.5 +/- 0.050
B	1.5 +/- 0.050
C	.6 +/- 0.050
D	1.1 +/- 0.050
E	.5 Bsc
F	.2 +/- 0.050
G	.2 +/- 0.050
H	.45 +/- 0.050
J	.12 Ref.

1.5 mm DFN-6 Package Dimensions

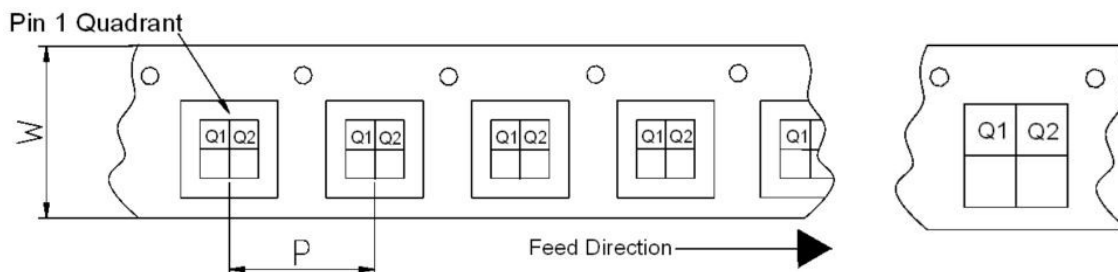
Tape and Reel Information:

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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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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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.

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

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