## Product Features

Frequency: 10MHz ~ 6GHz

Low Insertion Loss: 0.6dB@2.0GHz

Isolation: 52dB@2.0GHz

Input Power for 1dB Compression:

34dBm@2.0GHz

Input Third-Order Interception:

48dBm@2.0GHz

Switching Time: 130ns (ON)

32ns (OFF)

Supply Voltage:+3.3V/+5V

Positive Control Voltage: 0/+3V ~ +5V

Operating Current: 1mA

Package: QFN16

## Application

Cellular/4G Infrastructure

WiMAX, WiBro & Fixed Wireless

Automotive Telematics

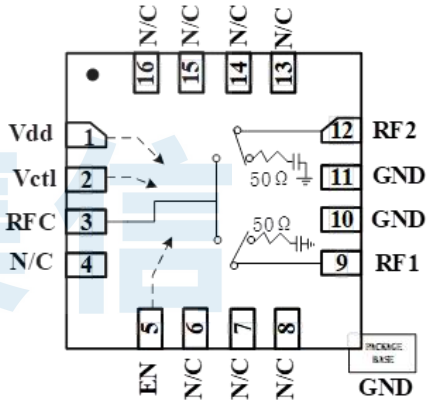
Mobile Radio

Test Equipment

## General Description

The BR9147FD is a high-isolation non-reflective DC to 6 GHz GaAs pHEMT SPDT switch in a low-cost leadless surface-mount package. The BR9147FD is well-suited for cellular infrastructure applications by yielding high isolation of 52 dB, low insertion loss of 0.6 dB, high input IP3 of 48 dBm, and high input P1dB of 34 dBm. The BR9147FD operates with a single positive supply voltage from 3 V to 5 V and provides a CMOS-/TTL-compatible control interface.

## Functional Block Diagram




## Ordering Information

| Part Number | Package | Description |
|---|---|---|
| BR9147FD | QFN16 | 10MHz~6GHz Nonreflective SPDT Switch |

## Electrical Specifications

| Parameters | Test Conditions | Min. | Typ. | Max. | Units |
|---|---|---|---|---|---|
| Insertion Loss | 0.01GHz to 3GHz | - | -0.6 | - | dB |
| | 3GHz to 4GHz | - | -0.7 | - | dB |
| | 4GHz to 6GHz | - | -0.8 | - | dB |
| Isolation | 0.01GHz to 2GHz | - | -54 | - | dB |
| | 2GHz to 6GHz | - | -40 | - | dB |
| Return Loss (ON) | 0.01GHz to 3GHz | - | -18 | - | dB |
| | 3GHz to 6GHz | - | -12 | - | dB |
| Return Loss (OFF) | 0.01GHz to 6GHz | - | -15 | - | dB |
| Input Power for 1dB Compression | 0.01GHz to 2.5GHz | 19 | 33 | 35 | dBm |
| Input Third-Order Interception | 0.03GHz to 4.2GHz | 43 | 44 | - | dBm |
| Switching Time Characteristics | | | | | |
| $t_{on}$, (50% CTL-90% RF) | 200MHz | - | 130 | - | ns |
| $t_{off}$ (50% CTL-10% RF) | Pin=0dBm | - | 32 | - | ns |
| Test Conditions: $V_{dd}$=+5V, $I_{dd}$=1mA, $V_{ctl}$=0/+5V, IIP3 spacing=1MHz, $P_{in}$=10dBm/tone, Temp=+25℃ | | | | | |

**Absolute Maximum Ratings**

Maximum Operating Voltage (Vdd): +7V

Max RF Pass Power: 36dBm@5V@2GHz

34dBm@3V@2GHz

Maximum RF Absorbed Power:

36dBm@5V@2GHz

34dBm@3V@2GHz

Control Voltage Range: 0V ~ Vdd

Maximum Heat Transfer Power:

30dBm@2GHz

**Recommended Operating Conditions**

Supply Voltage: 5V/3.3V

Control Voltages: 0V ~ 0.8V (low level)

2.7V ~ Vdd (high level)

Supply Current: <1mA

Working Temperature: -55℃ ~ +125℃

Storage Temperature: -65℃ ~ +150℃

Note: Operation of the device outside the parameter ranges given absolute-maximum-ratings conditions may cause permanent damage, and. exposure to absolute-maximum-ratings conditions for extended periods will affect the reliability.

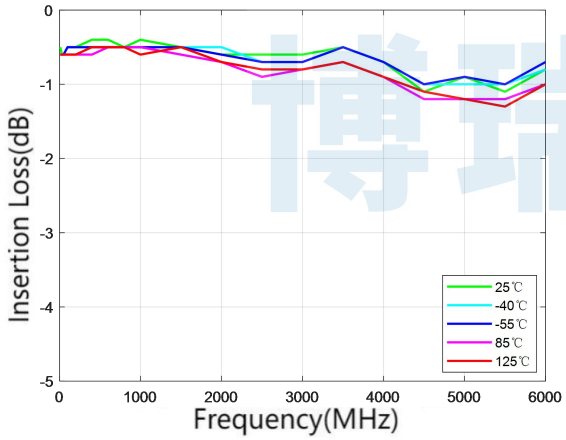
**ESD WARNING**

**ELECTROSTATIC SENSITIVE DEVICE**

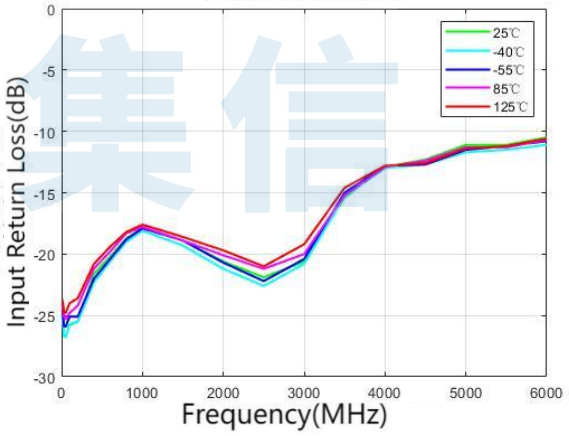
**OBSERVE HANDLING PRECAUTIONS**

## Typical Performance (EVB test results)

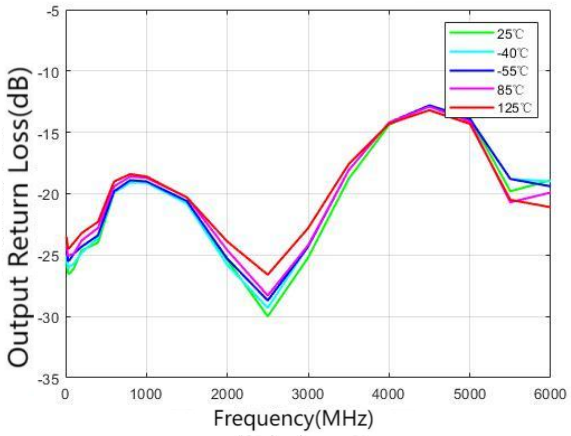
| Parameters | Typ. | | | | | | | | Units |
|---|---|---|---|---|---|---|---|---|---|
| Frequency | 10 | 200 | 1000 | 2000 | 3000 | 4000 | 5000 | 6000 | MHz |
| Return Loss (RFC) | -25 | -25 | -17 | -20 | -20 | -13 | -11 | -10 | dB |
| Return Loss (RF1/RF2) | -24 | -24 | -19 | -24 | -25 | -14 | -20 | -19 | dB |
| Return Loss (RF1/RF2 OFF) | -1 | -15 | -22 | -43 | -17 | -17 | -21 | -26 | dB |
| Insertion Loss | -0.7 | -0.5 | -0.4 | -0.6 | -0.6 | -0.7 | -0.9 | -0.8 | dB |
| Path Isolation | -66 | -67 | -60 | -52 | -45 | -44 | -42 | -40 | dB |
| Port Isolation | -71 | -68 | -51 | -44 | -40 | -38 | -35 | -34 | dB |
| Frequency | 10 | 50 | 100 | 500 | 1000 | 1600 | 2000 | 2500 | MHz |
| Input Power for 1dB Compression | 19 | 24 | 27 | 32 | 33 | 34 | 34 | 33 | dBm |
| Frequency | 30 | 50 | 100 | 1000 | 2000 | 3000 | 4000 | 4200 | MHz |
| Input Third-Order Interception | 45 | 45 | 44 | 47 | 48 | 48 | 44 | 46 | dBm |
| Switching Time | 130ns rise switch | | | | | 32ns down switch | | | |
| Test Conditions: Vdd=+5V, Idd=1mA, Vctl=0/+5V, IIP3 spacing=1MHz, Pin=10dBm/tone, Temp=+25°C | | | | | | | | | |



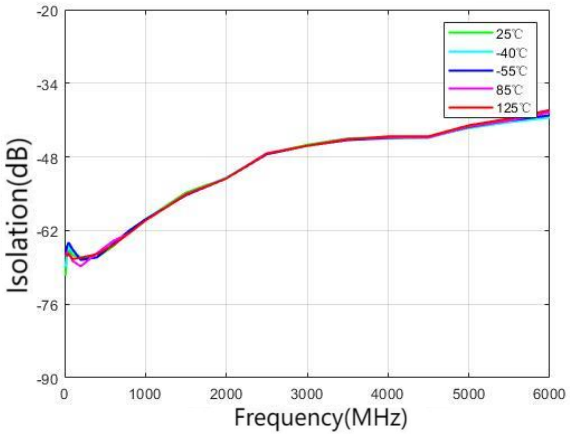

Insertion Loss RFC vs. RF1/RF2



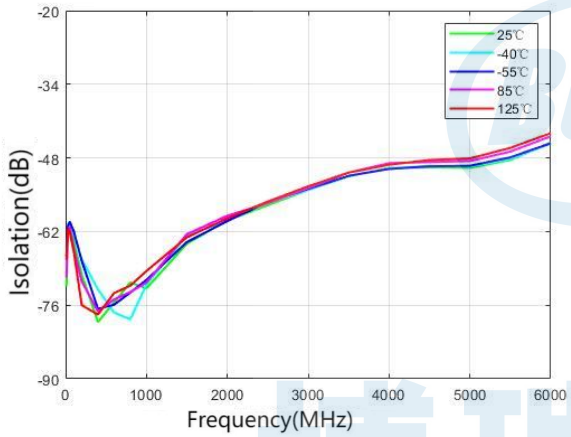

RFC Return Loss



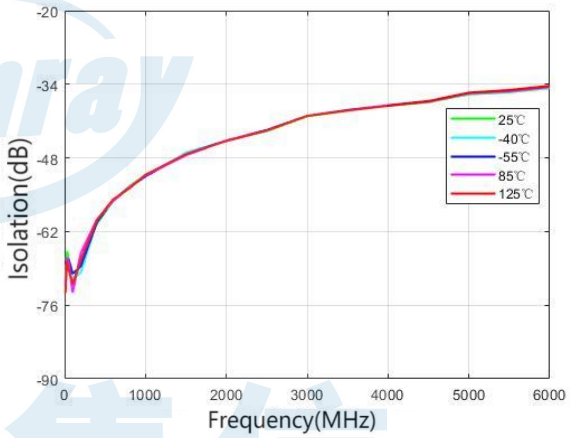

RF1/RF2 on Output Return Loss



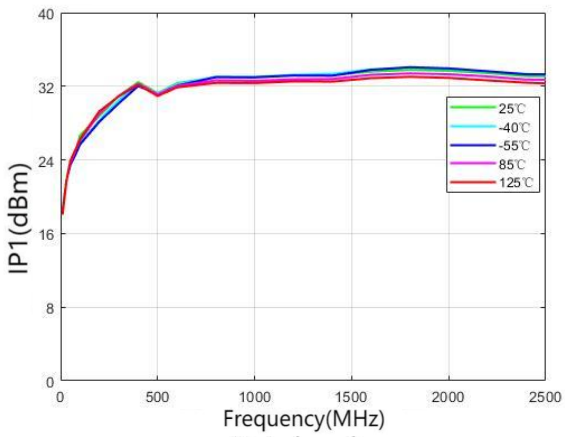

RFC and RF1/RF2 Isolation



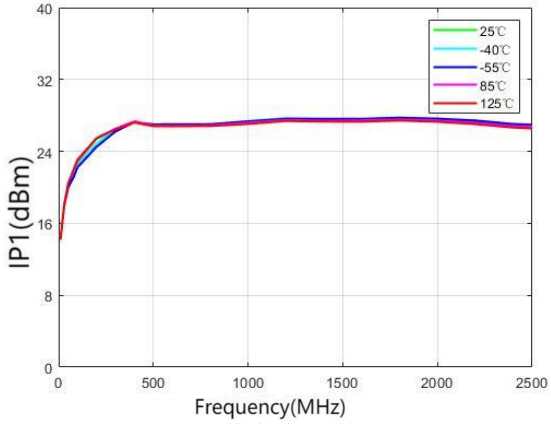

EN=1 Isolation between RFC and RF




Isolation between RF1 and RF2

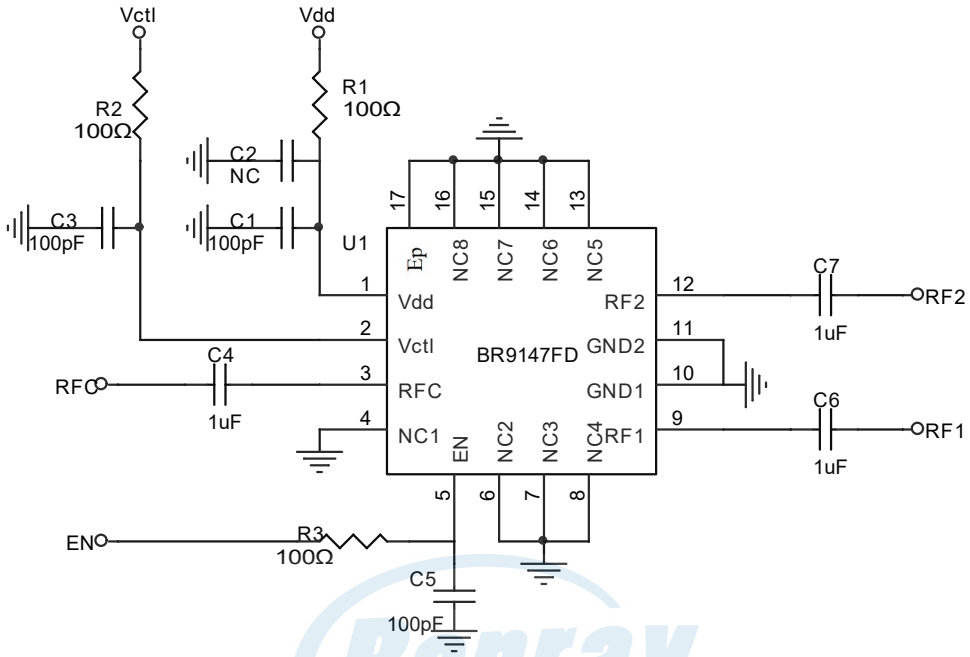



Input Power for 1dB Compression (+5V Vdd)




Input Power for 1dB Compression (+3V Vdd)

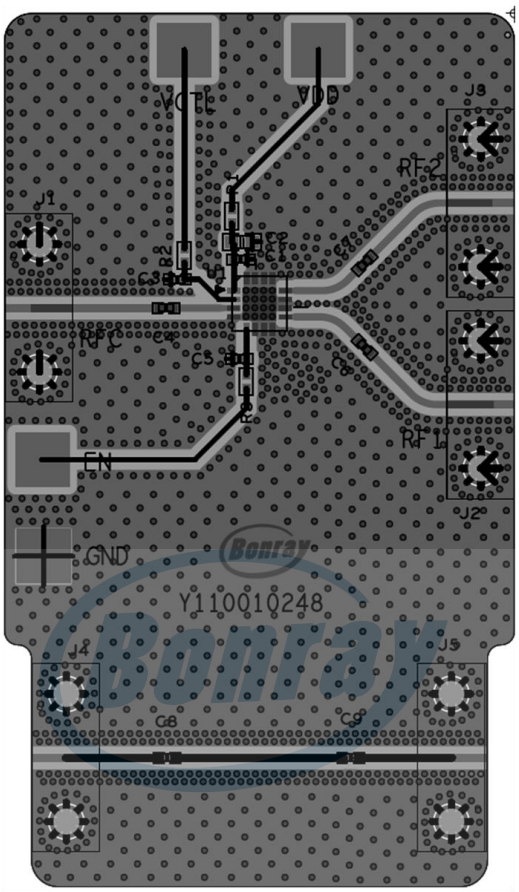
## Typical Application Schematic

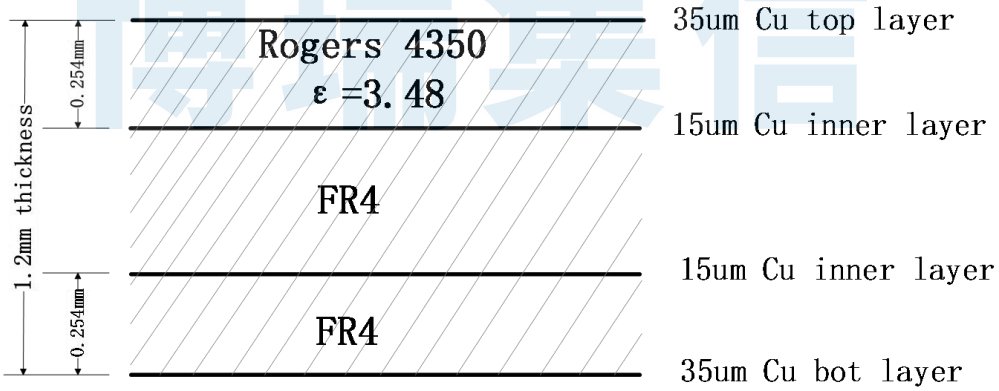



## Bill of Material

| Designator | Package | Description | Part Number |
|---|---|---|---|
| C4, C6, C7 | 0402 | 1uF | GRM1555C1H105JA01 |
| C1, C3, C5 | 0402 | 100pF | GRM1555C1H101JA01D |
| R1, R2, R3 | 0402 | 100Ω | RC0402JR-07100RL |
| C2 | 0402 | NC | / |

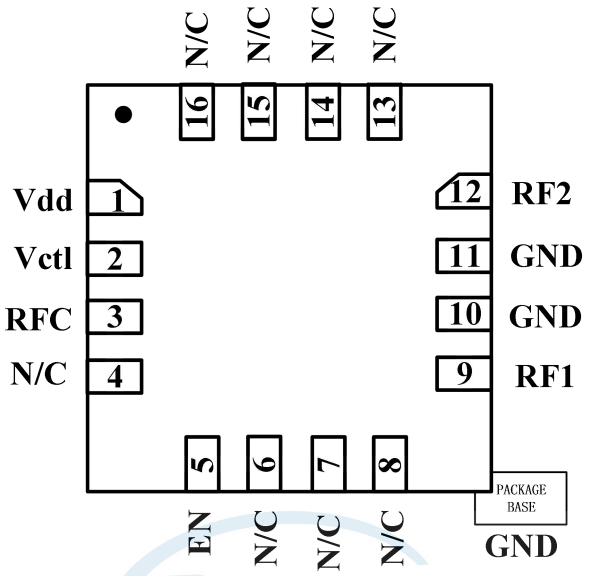
**PCB Evaluation Board**




50 ohms Impedance Signal Lines: width=0.53mm, spacing=0.52mm

## Pin Configuration and Description

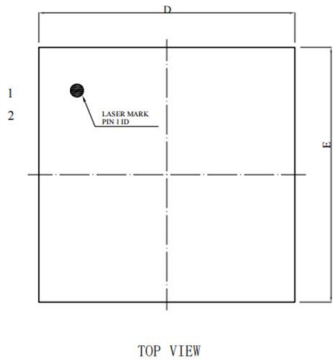



| Pin Number | Pin Name | Description |
|---|---|---|
| 4,6,7,8,13,14,15,16 | NC | No electrical connection. Provide grounded land pads for PCB mounting integrity. |
| 1 | VDD | RF pins. DC Block is required. |
| 2 | Vctl | Control input. See truth table. |
| 5 | EN | Enable. See truth table. |
| 10, 11 | GND | RF/DC ground pins. Connect to RF/DC ground |
| 3,9,12 | RFC, RF1, RF2 | RF pins. DC Block is required. |
| - | EP | RF/DC ground. Use recommended via pattern for suggested footprint. to minimize inductance and thermal resistance; See PCB Mounting Pattern for suggested footprint. |

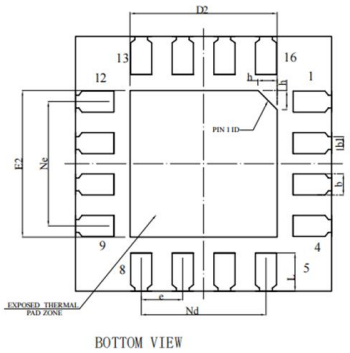
### Truth Table

| Control Input | | Signal Path State | |
|---|---|---|---|
| EN | Vctrl | RFC/RF1 | RFC/RF2 |
| Low | Low | OFF | ON |
| Low | High | ON | OFF |
| High | Low | OFF | ON |
| High | High | OFF | OFF |

**Package Dimensions (mm)**








| SYMBOL | MILLIMETER | | |
|---|---|---|---|
| | MIN | NOM | MAX |
| A | 0.70 | 0.75 | 0.80 |
| A1 | -- | 0.02 | 0.05 |
| b | 0.27 | 0.33 | 0.39 |
| b1 | 0.20REF | | |
| c | 0.203REF | | |
| D | 3.90 | 4.00 | 4.10 |
| D2 | 2.15 | 2.30 | -- |
| e | 0.65BSC | | |
| Ne | 1.95BSC | | |
| Nd | 1.95BSC | | |
| E | 3.90 | 4.00 | 4.10 |
| E2 | 2.15 | 2.30 | -- |
| L | 0.50 | 0.60 | 0.70 |
| h | 0.20 | 0.30 | 0.40 |