

# RFSW6042

Low Insertion High Isolation SP4T Switch  
5MHz to 6000MHz

The RFSW6042 is a low loss, high isolation SP4T switch with performance optimized for use in Cellular BTS applications. Plus it is also ideally suited for use in CATV and SATV applications. This part is packaged in a compact 1.8mm x 1.8mm, 12-pin, QFN package which allows for a small solution size with no need for external DC blocking capacitors (when no external DC is applied to the device ports).



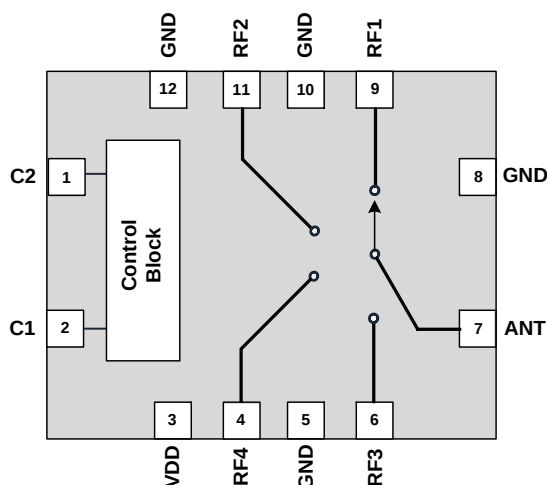
Package: QFN, 12-pin,  
1.8mm x 1.8mm

## Features

- 5MHz to 6000MHz Operation
- Low Insertion Loss: 0.45dB at 2GHz
- High Isolation: 34dB at 2GHz
- High IP3: >70dBm at 2GHz
- Compatible with Low Voltage Logic ( $V_{HIGH}$  Minimum = 1.3V)
- No External DC Blocking
  - Capacitors Required on RF Paths if DC is Applied Externally
- 2000V HBM ESD Rating on All Ports
- 3V to 5V Operation

## Applications

- Cellular BTS
- CATV, SATV Applications
- Test Equipment
- General Purpose Switch



Functional Block Diagram

## Ordering Information

|                 |                                           |
|-----------------|-------------------------------------------|
| RFSW6042SQ      | Sample bag with 25 pieces                 |
| RFSW6042SR      | 7" Reel with 100 pieces                   |
| RFSW6042TR7     | 7" Reel with 2500 pieces                  |
| RFSW6042PCK-410 | 5MHz to 3GHz PCBA with 5-piece sample bag |
| RFSW6042PCK-411 | 3GHz to 6GHz PCB with 5-piece sample bag  |

## Absolute Maximum Ratings

| Parameter                                | Rating      | Unit |
|------------------------------------------|-------------|------|
| Control Voltage ( $V_{CTL}$ )            | 3.0         | V    |
| Supply Voltage ( $V_{DD}$ )              | 6.0         | V    |
| Maximum CW Input Power for $V_{DD} = 3V$ | 35          | dBm  |
| Storage Temperature Range                | -40 to +150 | °C   |
| ESD Rating - Human Body Model (HBM)      | 2000        | V    |
| Moisture Sensitivity Level               | MSL2        |      |



**Caution!** ESD sensitive device.



RFMD Green: RoHS status based on EU Directive 2011/65/EU (at time of this document revision), halogen free per IEC 61249-2-21, < 1000ppm each of antimony trioxide in polymeric materials and red phosphorus as a flame retardant, and <2% antimony in solder.

Exceeding any one or a combination of the Absolute Maximum Rating conditions may cause permanent damage to the device. Extended application of Absolute Maximum Rating conditions to the device may reduce device reliability. Specified typical performance or functional operation of the device under Absolute Maximum Rating conditions is not implied.

## Recommended Operating Condition

| Parameter                        | Specification |     |     | Unit |
|----------------------------------|---------------|-----|-----|------|
|                                  | Min           | Typ | Max |      |
| Operating Temperature Range      | -40           |     | +85 | °C   |
| $V_{DD}$ – Switch Supply Voltage | 3             | 5   | 5.5 | V    |

## Nominal Operating Parameters

| Parameter                                | Specification |      |      | Unit | Condition                                  |
|------------------------------------------|---------------|------|------|------|--------------------------------------------|
|                                          | Min           | Typ  | Max  |      |                                            |
| General Performance                      |               |      |      |      | Electrical Specifications, TA=25°C, VDD=5V |
| Operating Frequency Range                | 5             |      | 6000 | MHz  |                                            |
| Insertion Loss (RFC to RF1/RF2/ RF3/RF4) |               | 0.32 | 0.5  | dB   | 925MHz                                     |
|                                          |               | 0.45 | 0.6  | dB   | 1990MHz                                    |
|                                          |               | 0.45 |      | dB   | 2650MHz                                    |
|                                          |               | 1.25 |      | dB   | 5850MHz                                    |
| Isolation (RFC to RF1/RF2/RF3 / RF4)     |               | 36   |      | dB   | 925MHz                                     |
|                                          |               | 28   |      | dB   | 1990MHz                                    |
|                                          |               | 25   |      | dB   | 2650MHz                                    |
|                                          |               | 17   |      | dB   | 5850MHz                                    |
| Isolation (RF1 to RF2/RF3/RF4)           | 35            | 43   |      | dB   | 925MHz                                     |
|                                          | 27            | 34   |      | dB   | 1990MHz                                    |
|                                          |               | 30   |      | dB   | 2650MHz                                    |
|                                          |               | 15   |      | dB   | 5850MHz                                    |
| Return Loss (On State)                   |               | -15  |      | dB   | 5MHz ~ 3GHz                                |
| Return Loss (On State)                   |               | -12  |      | dB   | 3GHz ~ 6GHz                                |
| 900MHz Second Harmonic                   |               | -108 | -95  | dBc  | Pin = 28dBm                                |

| Parameter                               | Specification |      |      | Unit | Condition                                             |
|-----------------------------------------|---------------|------|------|------|-------------------------------------------------------|
|                                         | Min           | Typ  | Max  |      |                                                       |
| 900MHz Third Harmonic                   |               | -103 | -90  | dBc  | Pin = 33dBm                                           |
| 2000MHz Second Harmonic                 |               | -100 | -80  | dBc  |                                                       |
| 2000MHz Third Harmonic                  |               | -89  | -77  | dBc  |                                                       |
| Input IP3                               |               | 71   |      | dBm  | 2Ghz, 21dBm per tone, 1MHz spacing                    |
| Max Operational Input Power             |               | 35   |      | dBm  |                                                       |
| <b>Power Supply</b>                     |               |      |      |      |                                                       |
| V <sub>DD</sub> Supply Current          |               | 65   | 130  | μA   |                                                       |
| CTL1, CTL2 – Control Voltage High       | 1.3           |      | 2.7  | V    |                                                       |
| CTL1, CTL2 – Control Voltage Low        | 0             |      | 0.45 | V    |                                                       |
| Control Current                         |               |      | 5    | μA   |                                                       |
| Switching Speed, One RF Port to Another |               | 2    | 5    | us   | 10% to 90% RF                                         |
| Turn On Time                            |               |      | 20   | us   | Time for V <sub>DD</sub> = 0V to part ON and RF = 90% |

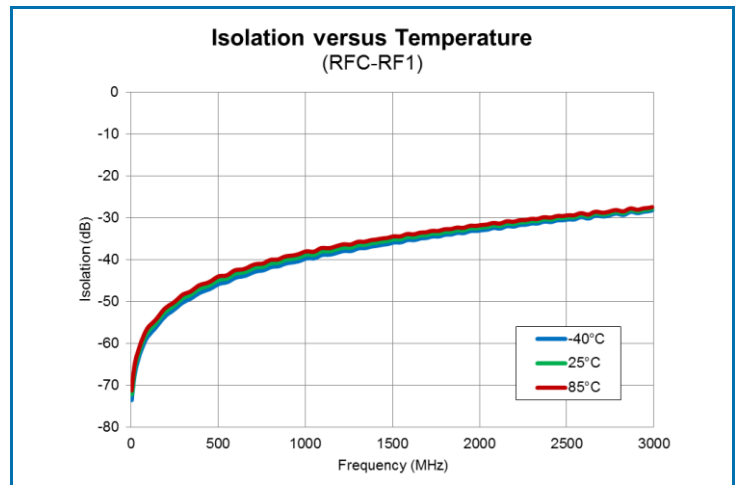
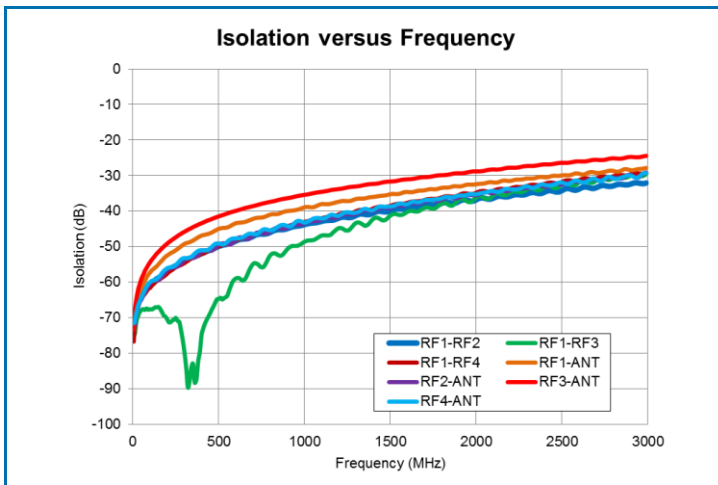
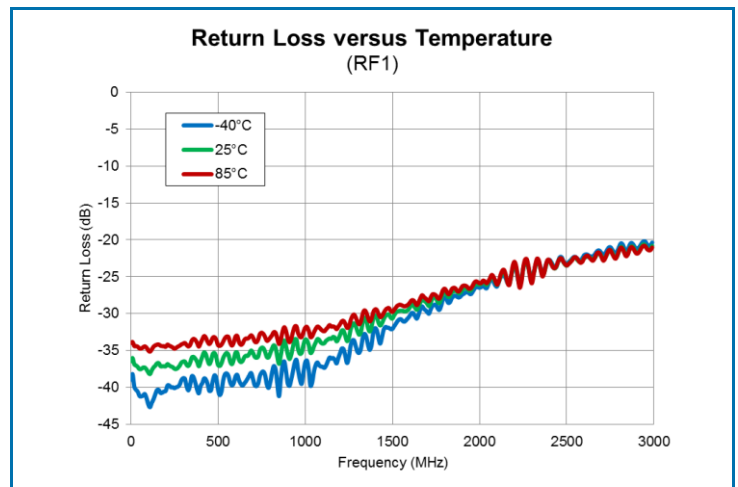
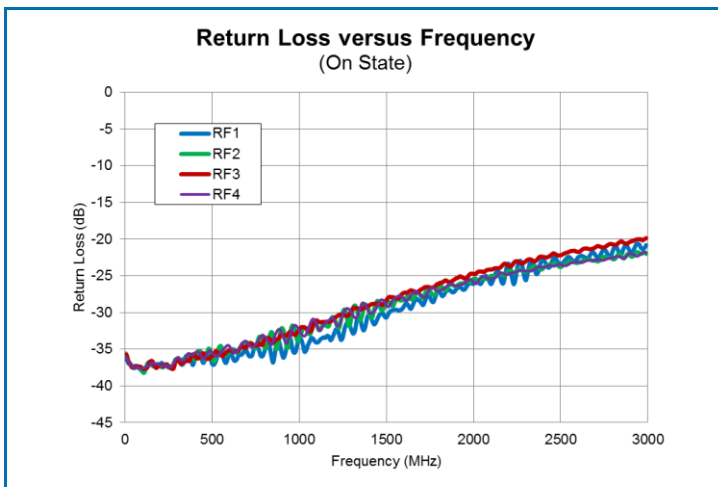
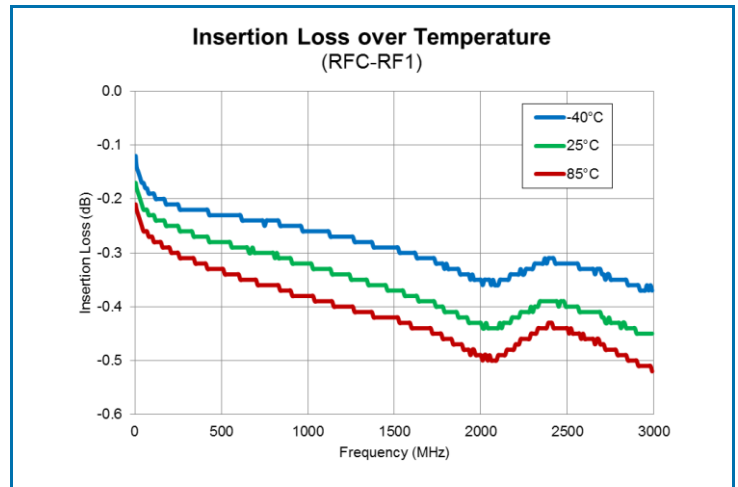
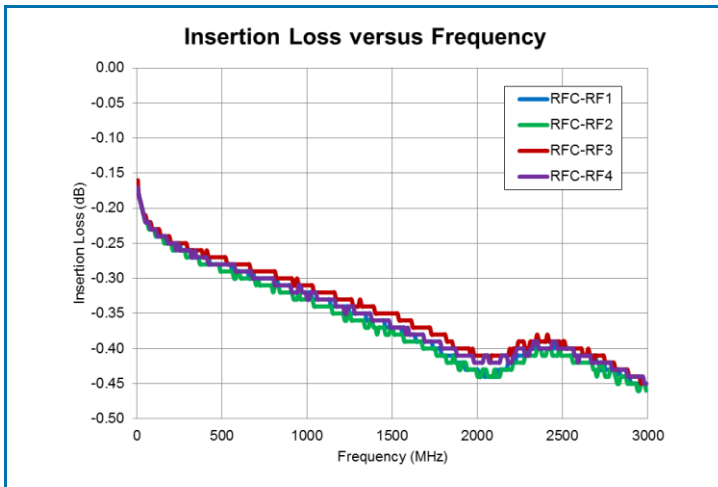
## Power-up / Power-down Sequence and Operation Controls

| Power-up / Power-down | Sequence for Power-up and Power-down from Supply that is Connected to V <sub>DD</sub> Pin |
|-----------------------|-------------------------------------------------------------------------------------------|
| Power-up              | Turn on VDD, then C1 and C2, then (20μs or greater), apply RF signal                      |
| Power-down            | Turn off RF signal, then C1 and C2, turn off V <sub>DD</sub>                              |
| Switching Ports       | Turn off RF signal, then change C1 and C2 state, then (5μs or greater). Turn on RF signal |

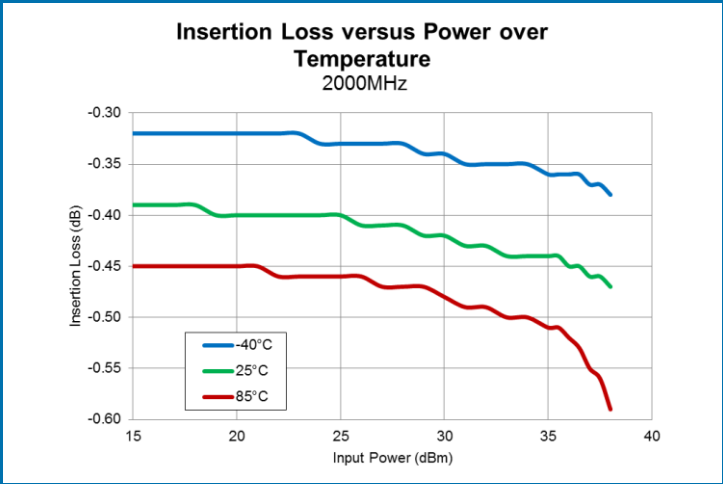
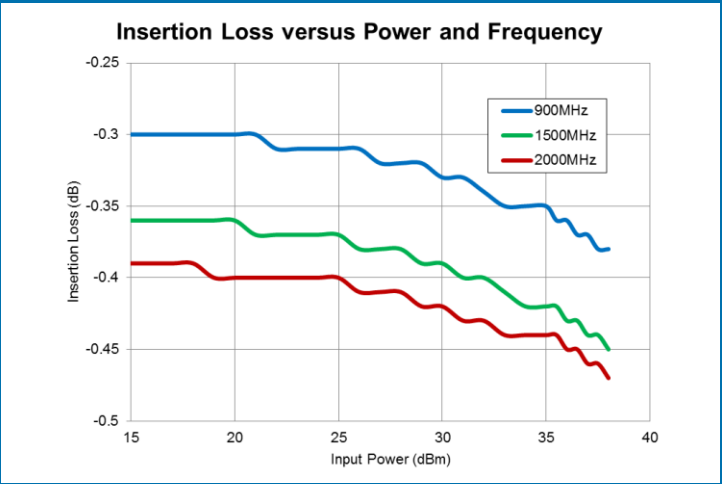
## Switch is controlled by C1 and C2

| Mode    | C1   | C2   |
|---------|------|------|
| RF1-ANT | High | Low  |
| RF2-ANT | Low  | High |
| RF3-ANT | High | High |
| RF4-ANT | Low  | Low  |

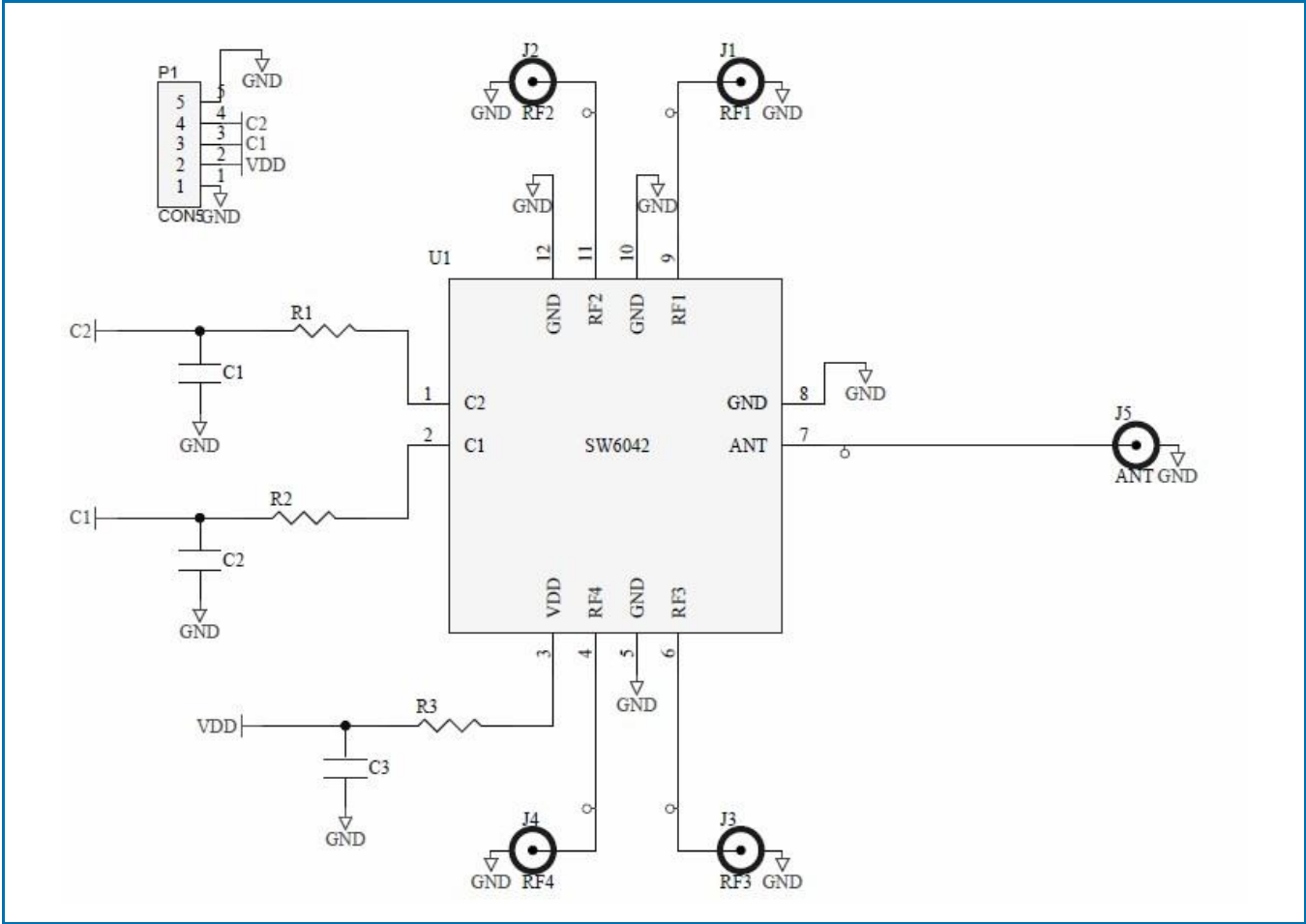
Typical Performance: 5MHz ~ 3000MHz,  $V_{DD} = 5V$  unless otherwise noted



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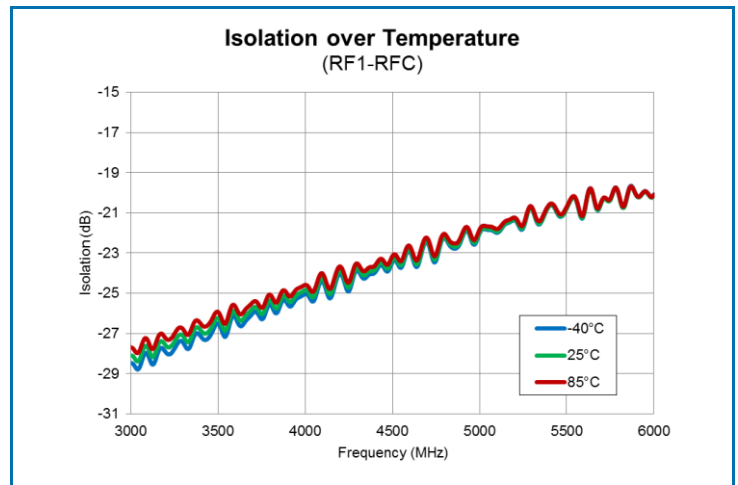
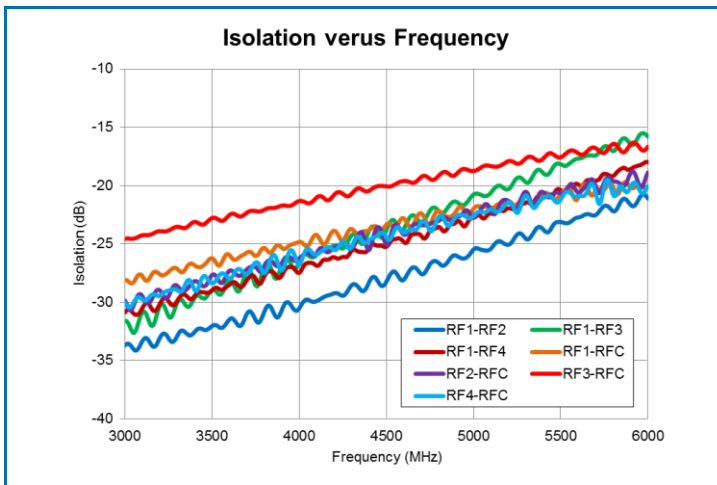
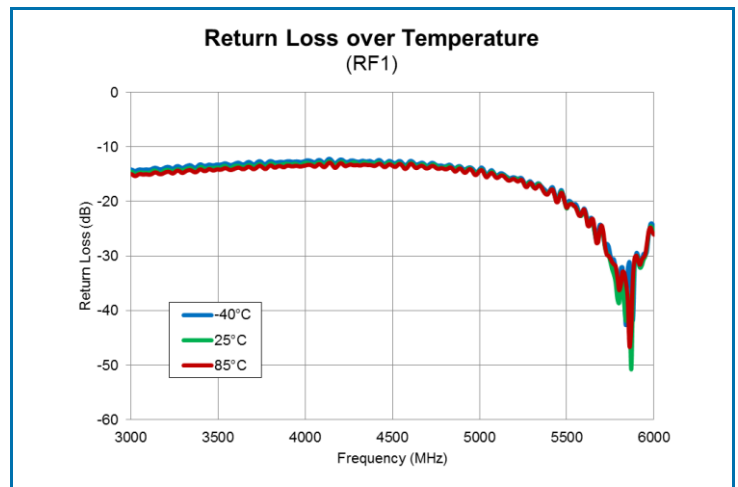
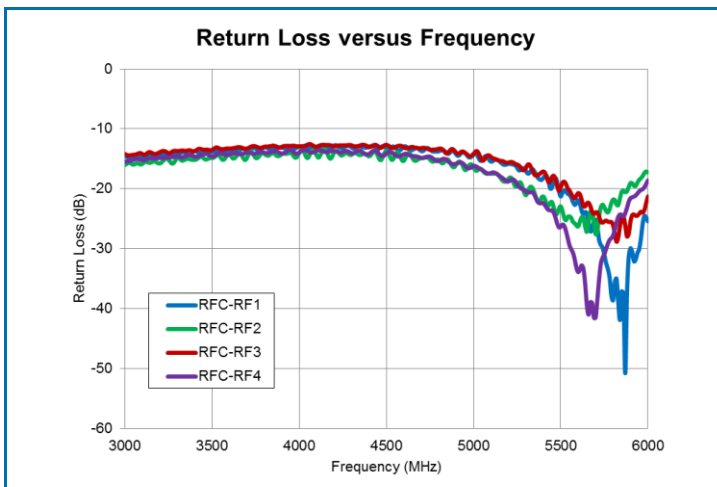
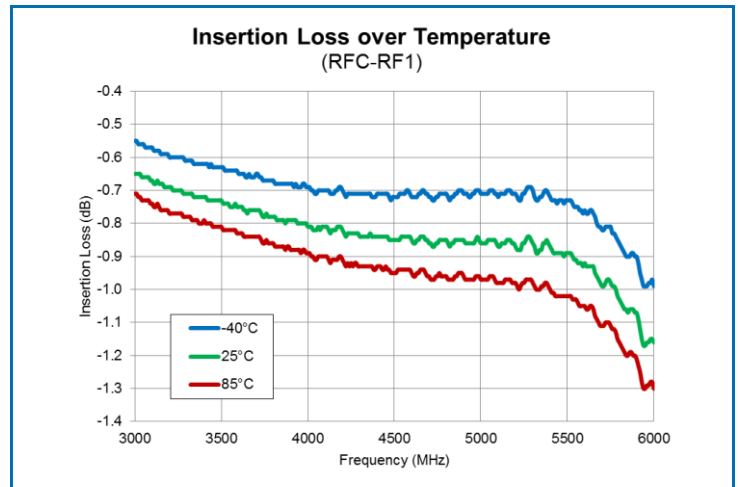
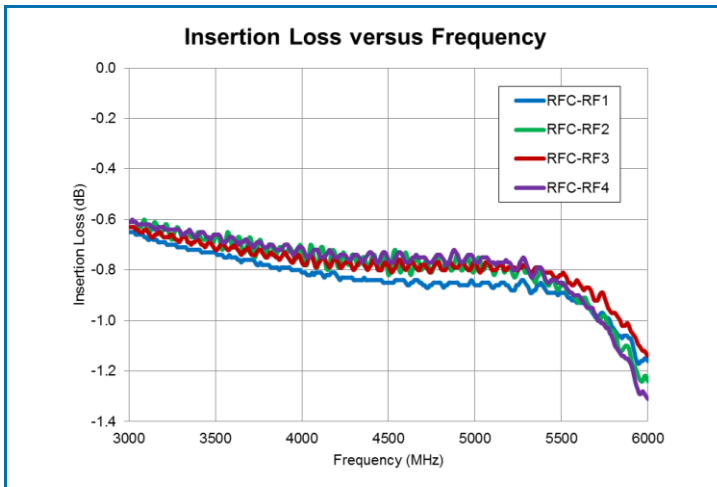
Evaluation Board Schematic 5MHz to 3000MHz Application Circuit



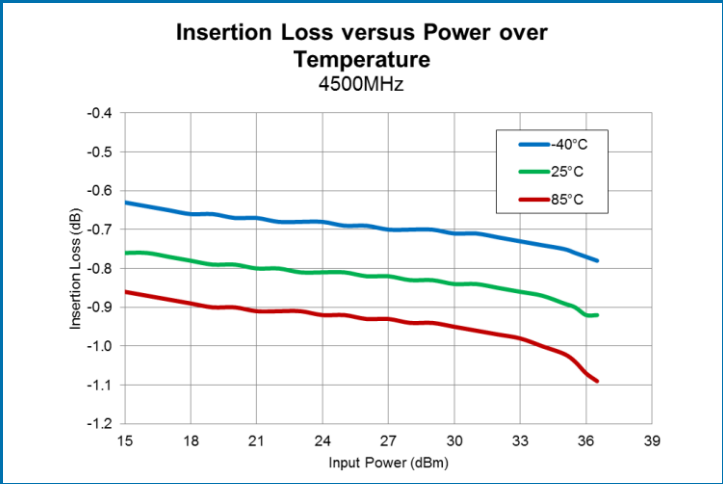
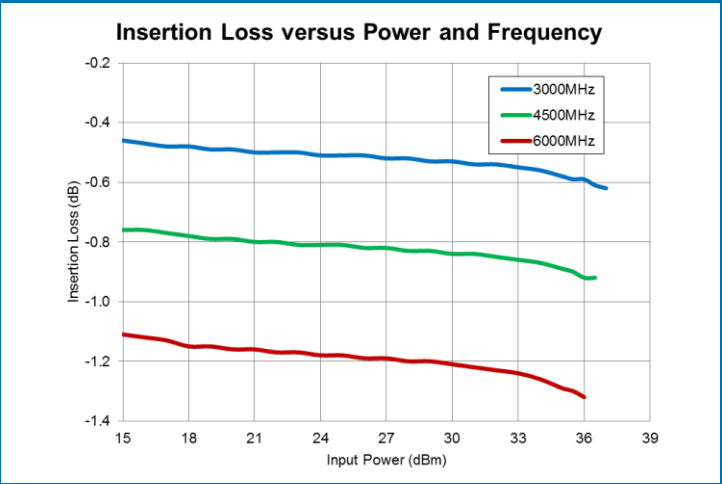
Evaluation Board Bill of Materials (BOM) 5MHz to 3000MHz Application Circuit

| Description                            | Reference Designator | Manufacturer          | Manufacturer's P/N |
|----------------------------------------|----------------------|-----------------------|--------------------|
| RFSW6032 Evaluation Board              |                      |                       | RFSW6032-410       |
| CAP, 100pF, 5%, 50V, C0G, 0402         | C1-C2                | Murata Electronics    | GRM1555C1H101JA01D |
| CAP, 10000pF, 10%, 25V, X7R, 0402      | C3                   | Murata Electronics    | GRM155R71E103KA01D |
| RES, 0Ω, 0402                          | R1-R3                | Kamaya, Inc.          | RMC1-16SJPTH       |
| CONN, SMA, END LNCH, MINI, FLT, 0.068" | J1-J5                | Emerson Network Power | 142-0741-851       |
| CONN, HDR, ST, PLRZD, 5-PIN, 0.100"    | P1                   | ITW Pancon            | MPSS100-5-C        |
| High Power SP4T                        | U1                   | RFMD                  | RFSW6042           |

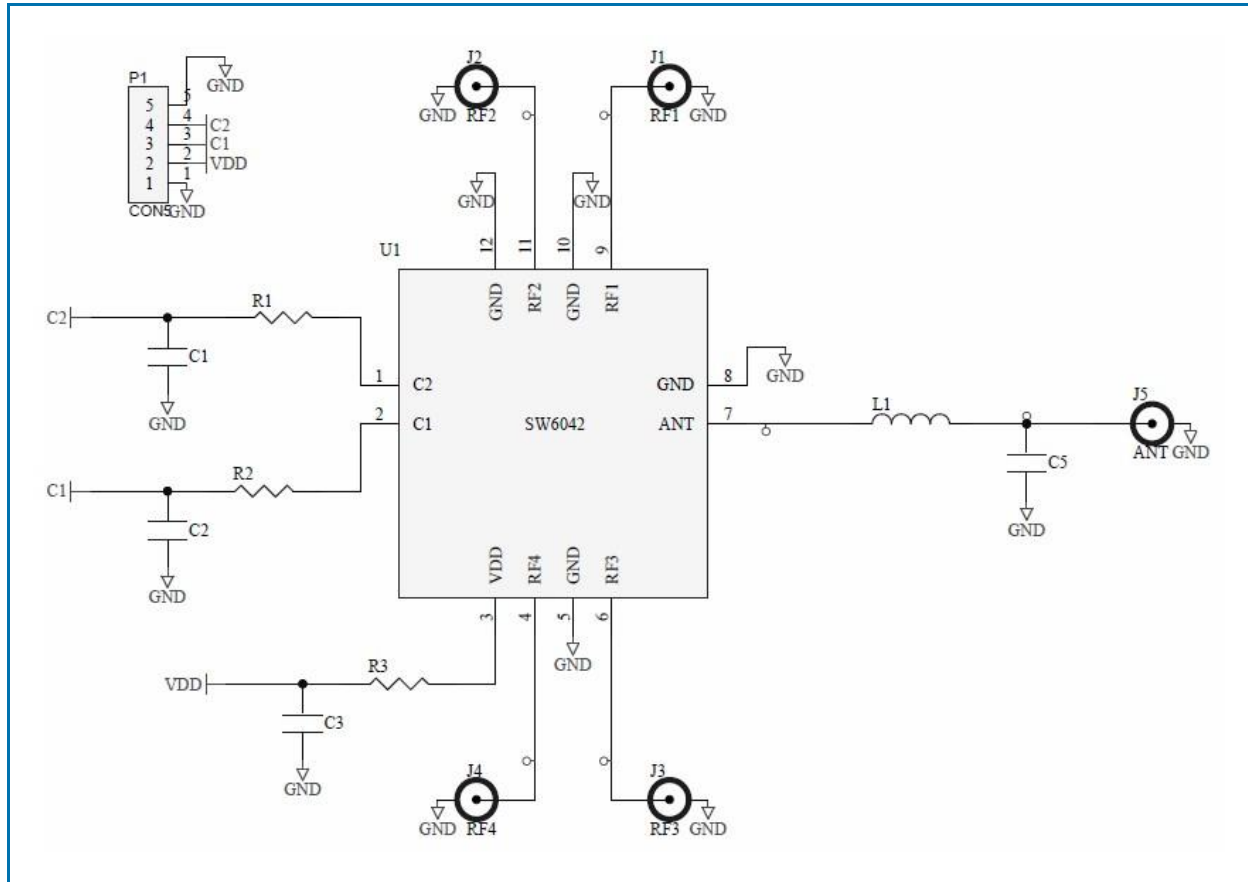
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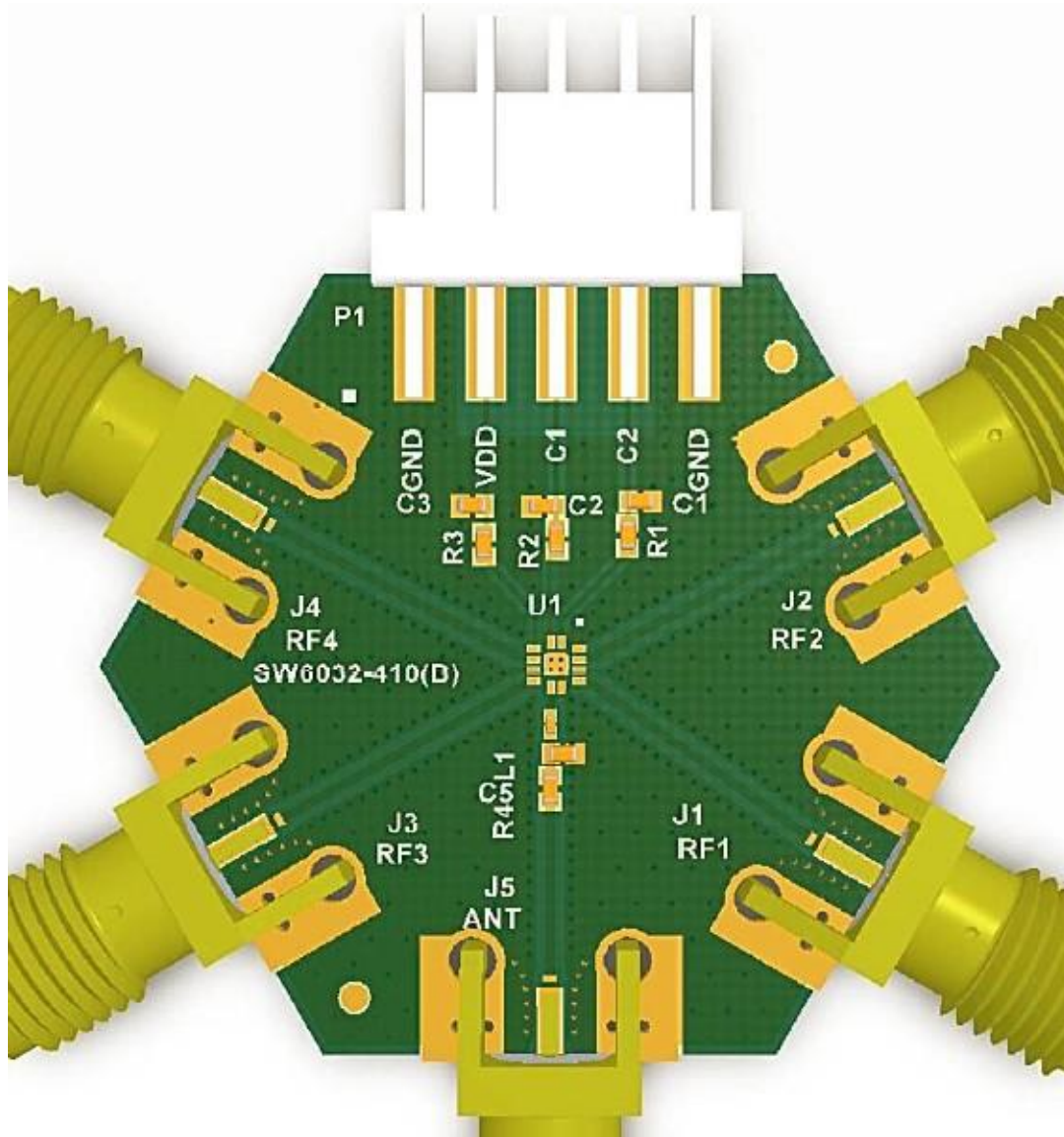
## Evaluation Board Schematic 3000MHz to 6000MHz Application Circuit



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| CAP, 10000pF, 10%, 25V, X7R, 0402      | C3                   | Murata Electronics    | GRM155R71E103KA01D |
| CAP, 0.5pF, +/-0.25pF, 50V, C0G, 0402  | C5                   | Murata Electronics    | GRM1555C1HR50CA01D |
| RES, 0Ω, 0402                          | R1-R3                | Kamaya, Inc.          | RMC1-16SJPTH       |
| IND, 1nH, +/-0.1nH, T/F, 0201          | L1                   | Murata Electronics    | LQP03TG1N0B02D     |
| CONN, SMA, END LNCH, MINI, FLT, 0.068" | J1-J5                | Emerson Network Power | 142-0741-851       |
| CONN, HDR, ST, PLRZD, 5-PIN, 0.100"    | P1                   | ITW Pancon            | MPSS100-5-C        |
| High Power SP4T                        | U1                   | RFMD                  | RFSW6042           |

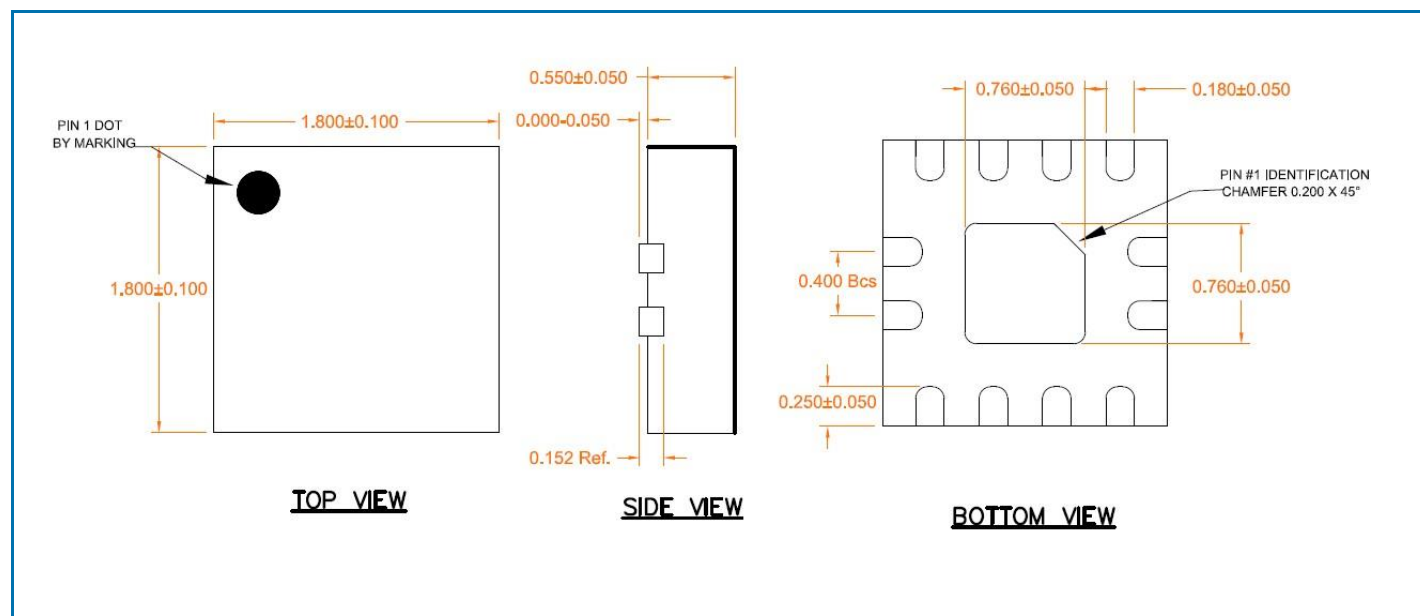
## Evaluation Board Assembly Drawing



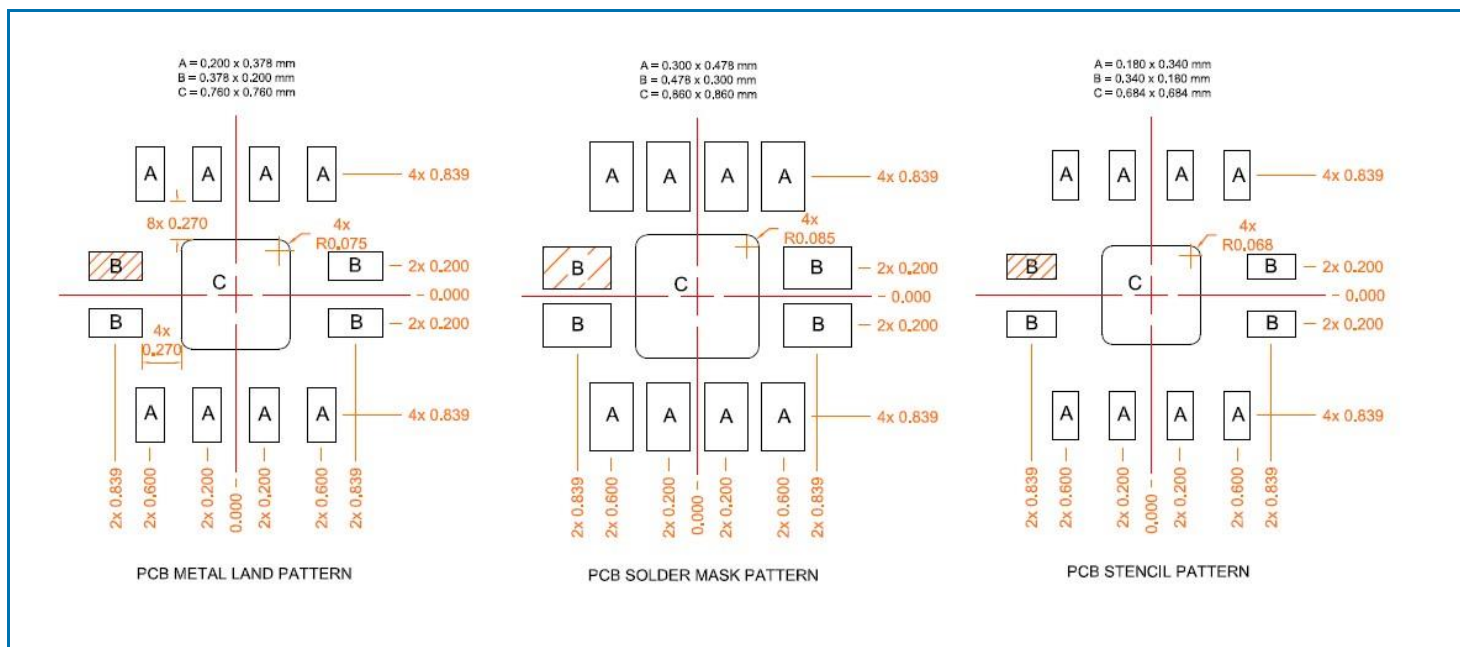
## Pin Names and Descriptions

| Pin | Name | Description                   |
|-----|------|-------------------------------|
| 1   | C2   | Switch Logic Control 2        |
| 2   | C1   | Switch Logic Control 1        |
| 3   | VDD  | Supply Voltage                |
| 4   | RF4  | Single-ended RF Port          |
| 5   | GND  | Low Inductance Path to Ground |
| 6   | RF3  | Single-ended RF Port          |
| 7   | ANT  | Single-ended RF Port          |
| 8   | GND  | Low Inductance Path to Ground |
| 9   | RF1  | Single-ended RF Port          |
| 10  | GND  | Low Inductance Path to Ground |
| 11  | RF2  | Single-ended RF Port          |
| 12  | GND  | Low Inductance Path to Ground |

## Package Outline Drawing (Dimensions in millimeters)



## Stencil, PCB Pattern (Dimensions in millimeters)



## Branding Diagram

