

5MHz-6000MHz High Linearity Reflective SPDT RF switch

Product Description

The BSW6321 is a reflective SPDT RF switch that can be used in high power and good performance WiMAX 802.16, WLAN 802.11 a/b/g/n/ac/ax and DOCSIS 3.0/3.1 applications.

This device is packaged in RoHS-compliant with 1.5x1.5mm, 6-lead UDFN package. It must be used with back side ground soldering.

The BSW6321 has robust ESD protection circuits at all pins and temperature performance (operating temperature range : -40 ~ +105°C), furthermore this switch does not require blocking capacitors.

This device also has a high linearity performance over all temperature range such as IIP3, IIP2.

A functional block diagram is shown in Figure 1.

Block Diagram

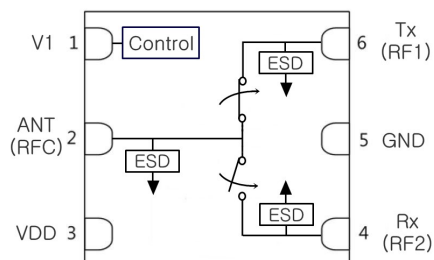


Figure 1 Functional Block Diagram

Applications

- WiMAX 802.16
- WLAN 802.11 a/b/g/n/ac/ax
- DOCSIS 3.0/3.1
- Drone
- NFC
- Bluetooth
- Smart Card
- Wireless Infrastructure
- Remote keyless entry
- Telematics / Infotainment
- Two-way radios
- Wireless control systems
- GPS/Navigation

Package Type



6-Lead 1.5x1.5mm, UDFN Package

Figure 2 Package Type

Device Features - Common

- Output frequency range : 5 MHz to 6.0 GHz
- Supply Voltage : 2.7V to 5.5V
- ESD protection : 2.5kV @ all pins
- 6-lead DFN package : 1.5mm x 1.5mm x 0.5mm
- Operating temperature range : -40°C - +105°C

Device Features - 50Ω

- Low insertion loss
 - : 0.50dB @ 2.45GHz
 - : 0.75dB @ 5.75GHz
- High isolation
 - : 40dB @ 2.45GHz
 - : 30dB @ 5.75GHz
- Input 1 dB output compression (ANT– Tx)
 - : 39dBm @ 2.45GHz
 - : 36dBm @ 5.75GHz
- High IIP3 (ANT– Tx)
 - : 63dBm @ 2.45GHz
 - : 67dBm @ 5.75GHz

Device Features - 75Ω

- Low insertion loss
 - : 0.29dB @ 204MHz
- High isolation
 - : 50dB @ 204MHz
- High IIP3
 - : 72dBm @ 633MHz
- 2nd / 3rd Harmonic
 - : 111dBc / 120dBc @ 633MHz

5MHz-6000MHz High Linearity Reflective SPDT RF switch

Electrical Specifications - 50Ω

Typical conditions are at VDD = 3.3V, T_A = 25°C, V1 Low = 0V, V1 High = 3.3V, Z_L = 50Ω, Excluding SMA Connector and PCB loss, unless otherwise noted.

Table 1 Electrical Specifications - 50Ω

| Parameter | Path | Condition | Min | Typ | Max | Unit |
|---------------------|-------------|---------------------------|-----|------|------|------|
| Operating Frequency | | | 5 | | 6000 | MHz |
| Insertion Loss | ANT - Tx | 13.56MHz | | 0.34 | | dB |
| | | 1GHz | | 0.42 | | |
| | | 2GHz | | 0.48 | | |
| | | 2.45GHz | | 0.50 | | |
| | ANT - Rx | 3GHz | | 0.58 | | |
| | | 4GHz | | 0.60 | | |
| | | 5GHz | | 0.73 | | |
| | | 5.75GHz | | 0.75 | | |
| Isolation | ANT - Tx | 6GHz | | 0.80 | | dB |
| | | 13.56MHz | | 82 | | |
| | | 1GHz | | 52 | | |
| | | 2GHz | | 43 | | |
| | ANT - Rx | 2.45GHz | | 40 | | |
| | | 3GHz | | 38 | | |
| | | 4GHz | | 33 | | |
| | | 5GHz | | 32 | | |
| Isolation | Tx - Rx | 5.75GHz | | 30 | | dB |
| | | 6GHz | | 28 | | |
| | | 13.56MHz | | 82 | | |
| | | 1GHz | | 43 | | |
| | Rx - Tx | 2GHz | | 36 | | |
| | | 2.45GHz | | 35 | | |
| | | 3GHz | | 32 | | |
| | | 4GHz | | 29 | | |
| Return Loss | ANT, Tx, Rx | 5MHz – 6GHz (Active port) | | 20 | | dB |
| | | | | | | |
| Input P1dB | ANT - Tx | 2.45GHz | | 39 | | dBm |
| | | 5.75GHz | | 36 | | |
| | ANT - Rx | 2.45GHz | | 38 | | |
| | | 5.75GHz | | 34 | | |

* Tone Power is 18dBm and Tone spacing is 20KHz.

** DC transient test at RF all ports (ANT,Tx,Rx) when V1 is switched from High to Low or from Low to High in a 50Ω setup.
Excluding SMA Connector and PCB loss. 1GHz (0.12dB), 2GHz (0.20dB), 3GHz (0.27dB), 4GHz (0.35dB), 5GHz (0.51dB), 6GHz (0.52dB)

5MHz-6000MHz High Linearity Reflective SPDT RF switch

Electrical Specifications - 50Ω

Typical conditions are at VDD = 3.3V, T_A = 25°C, V1 Low = 0V, V1 High = 3.3V, Z_L = 50Ω, Excluding SMA Connector and PCB loss, unless otherwise noted.

Table 2 Electrical Specifications - 50Ω

| Parameter | Path | Condition | Min | Typ | Max | Unit |
|--------------------------|----------|-----------------------|-----|-----|-----|------|
| Input IP3* | ANT - Tx | 2.45GHz | | 63 | | dBm |
| | | 5.75GHz | | 67 | | |
| | ANT - Rx | 2.45GHz | | 56 | | |
| | | 5.75GHz | | 67 | | |
| Input IP2* | ANT - Tx | 2.45GHz | | 98 | | dBm |
| | | 5.75GHz | | 105 | | |
| | ANT - Rx | 2.45GHz | | 90 | | |
| | | 5.75GHz | | 115 | | |
| 2 nd Harmonic | ANT - Tx | 2.45GHz | | 85 | | dBc |
| | | 5.75GHz | | 95 | | |
| | ANT - Rx | 2.45GHz | | 80 | | |
| | | 5.75GHz | | 105 | | |
| 3 rd Harmonic | ANT - Tx | 2.45GHz | | 100 | | dBc |
| | | 5.75GHz | | 108 | | |
| | ANT - Rx | 2.45GHz | | 85 | | |
| | | 5.75GHz | | 108 | | |
| Video Feedthrough** | | 5ns rise-time pulse | | 15 | | mVpp |
| Switching Time | ANT - Tx | 50% control to 90% RF | | 500 | | ns |
| | ANT - Rx | 50% control to 10% RF | | 400 | | |

* Tone Power is 18dBm and Tone spacing is 20KHz.

** DC transient test at RF all ports (ANT,Tx,Rx) when V1 is switched from High to Low or from Low to High in a 50Ω setup.

Excluding SMA Connector and PCB loss. 1GHz (0.12dB), 2GHz (0.20dB), 3GHz (0.27dB), 4GHz (0.35dB), 5GHz (0.51dB), 6GHz (0.52dB)

5MHz-6000MHz High Linearity Reflective SPDT RF switch

Electrical Specifications - 75Ω

Typical conditions are at VDD = 3.3V, T_A = 25°C, V1 Low = 0V, V1 High = 3.3V, Z_L = 75Ω, Excluding SMA Connector and PCB loss, unless otherwise noted.

Table 3 Electrical Specifications - 75Ω

| Parameter | Path | Condition | Min | Typ | Max | Unit |
|--------------------------|------------|---|-----|--------------------------------------|------|------|
| Operating Frequency | | | 1 | | 6000 | MHz |
| Insertion Loss | RFC - RFx | 5MHz 204MHz 1218MHz 1700MHz 1794MHz | | 0.25 0.29 0.45 0.39 0.36 | | dB |
| Isolation | RFC to RFx | 5MHz 204MHz 612MHz 1218MHz 1794MHz | | 85 50 40 34 27 | | dB |
| Isolation | RFx to RFx | 5MHz 204MHz 612MHz 1218MHz 1794MHz | | 85 60 48 38 35 | | dB |
| Return Loss | RFC, RFx | 5MHz – 3GHz (Active port) | 15 | 20 | | dB |
| Input P1dB | RFC - RFx | 50Ω Impedance @2140MHz | | 33 | | dBm |
| Input IP3* (note) | RFC - RFx | 633MHz (Pin=18dBm/tone) | | 72 | | dBm |
| Input IP2* (note) | RFC – RFx | 633MHz (Pin=18dBm/tone) | | 110 | | dBm |
| 2 nd Harmonic | RFC – RFx | 633MHz (Pin=25dBm) | | 111 | | dBc |
| 3 rd Harmonic | RFC – RFx | 633MHz (Pin=25dBm) | | 120 | | dBc |
| Video Feedthrough** | | 5ns rise-time pulse | | 15 | | mVpp |
| Switching Time | RFC – RFx | 50% control to 90% RF 50% control to 10% RF | | 500 400 | | ns |

* Tone spacing is 20KHz.

** DC transient test at RF all ports (RFC, RF1, RF2) when V1 is switched from High to Low or from Low to High in a 75Ω setup.
Excluding SMA Connector and PCB loss. 5MHz(0.02dB), 204MHz(0.05dB), 1218MHz(0.13dB), 1700MHz(0.17dB), 1794MHz(0.19dB)

5MHz-6000MHz High Linearity Reflective SPDT RF switch

Product Description

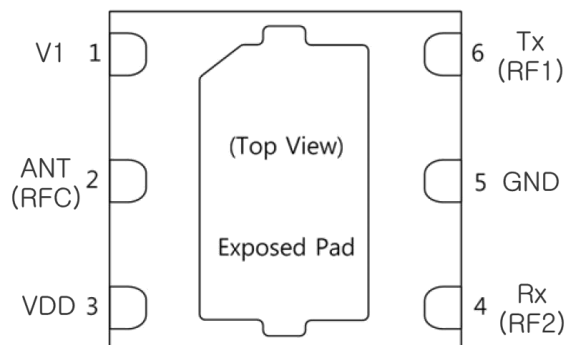


Figure 3 Functional Block Diagram

Table 4 Pin Descriptions

| No. | Pin Name | Descriptions |
|-----|-------------|------------------------------|
| 1 | V1 | Digital Control Logic Input. |
| 2 | ANT (RFC) | ANT RF port (RFC). |
| 3 | VDD | Supply Voltage. |
| 4 | Rx (RF2) | Rx RF port (RF2). |
| 5 | GND | Ground |
| 6 | Tx (RF1) | Tx RF port (RF1). |
| Pad | Exposed Pad | Ground |

Table 5 V1 Control Truth Table

| V1 | ANT-Tx | ANT-Rx |
|----|--------|--------|
| 0 | OFF | ON |
| 1 | ON | OFF |

Table 6 Operating Ranges

| Parameter | Symbol | Min | Typ | Max | Unit |
|-----------------------------|---------|-----|-----|------|------|
| Supply Voltage | VDD | 2.7 | 3.3 | 5.5 | V |
| Supply Current | IDD | - | 140 | - | μA |
| Digital Input Control (V1) | V1 High | 1.0 | - | 3.3 | V |
| | V1 Low | 0 | - | 0.7 | V |
| Operating Temperature Range | To | -40 | +25 | +105 | °C |

Table 7 Absolute Maximum Ratings

| Parameter | | | Symbol | Min | Max | Unit |
|----------------------------|-----|----------|--------|------|------|------|
| Supply Voltage | | | VDD | -0.3 | 5.5 | V |
| Digital Input Voltage (V1) | | | V1 | -0.3 | 3.6 | V |
| Maximum Input Power | | | - | - | 41 | dBm |
| Storage Temperature range | | | - | -65 | +150 | °C |
| ESD | HBM | All pins | - | - | 2500 | V |
| | CDM | All pins | - | - | 1000 | V |

5MHz-6000MHz High Linearity Reflective SPDT RF switch

Typical Performances - 50Ω

Typical conditions are at VDD = 3.3V, T_A = 25°C, V1 Low = 0V, V1 High = 3.3V, Z_L = 50Ω, Excluding SMA Connector and PCB loss, unless otherwise noted.

Figure 4 Insertion Loss vs. Vdd (RFC - RFx)

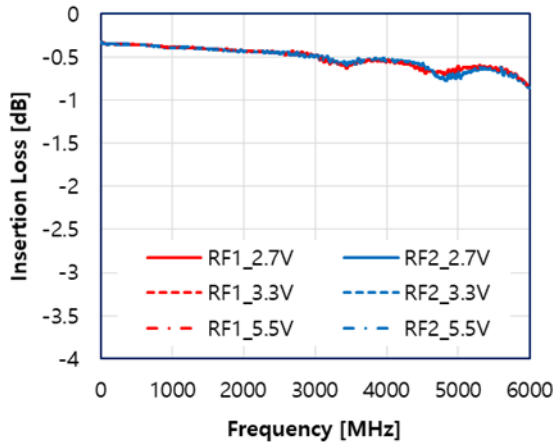


Figure 5 Insertion Loss vs. Temp (RFC - RFx)

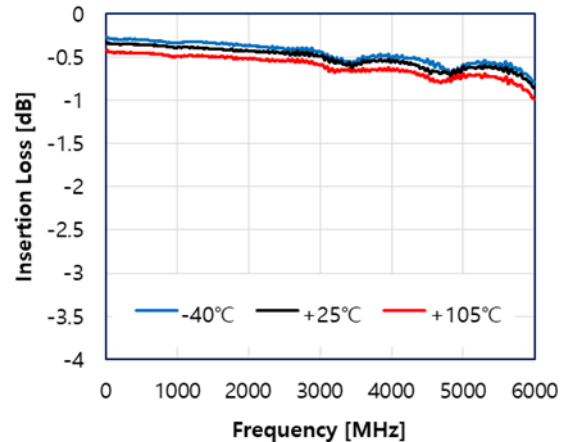


Figure 6 Return Loss (RFC, RFx)

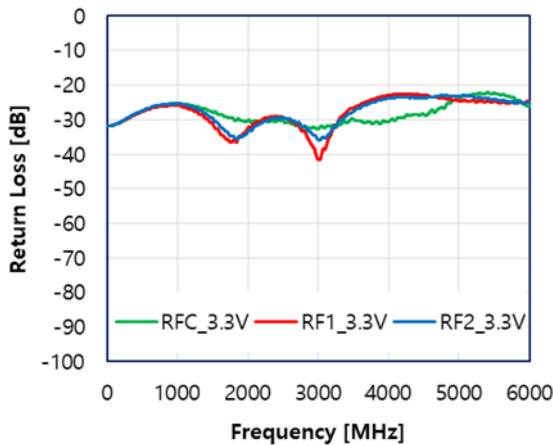
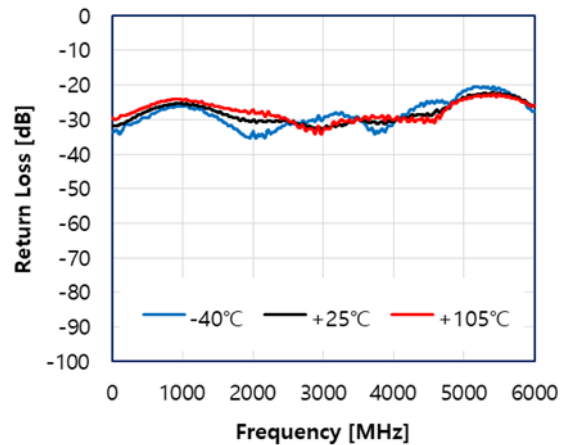


Figure 7 Return Loss vs. Temp (RFC)



5MHz-6000MHz High Linearity Reflective SPDT RF switch

Typical Performances - 50Ω

Typical conditions are at VDD = 3.3V, T_A = 25°C, V1 Low = 0V, V1 High = 3.3V, Z_L = 50Ω, Excluding SMA Connector and PCB loss, unless otherwise noted.

Figure 8 Isolation vs. Vdd (RFC - RFx)

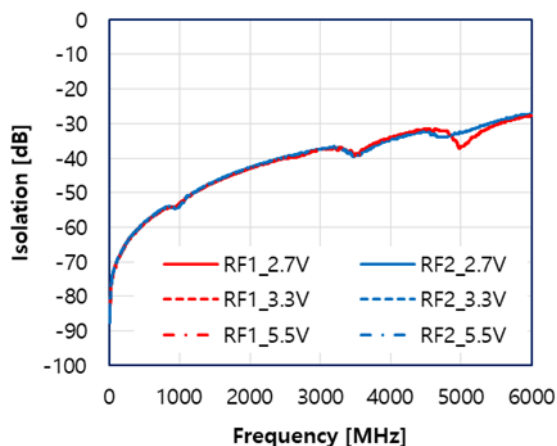


Figure 9 Isolation vs. Temp (RFC-RFx)

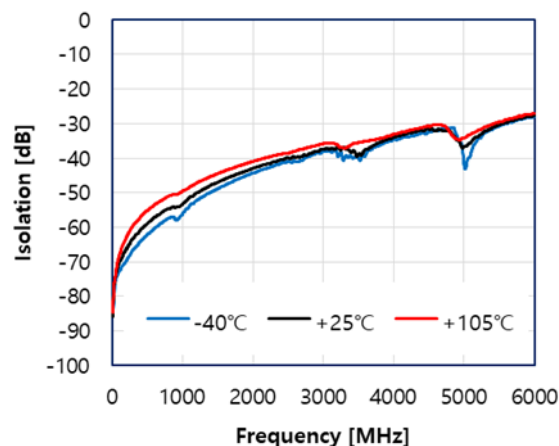


Figure 10 Isolation vs. Vdd (RFx - RFx)

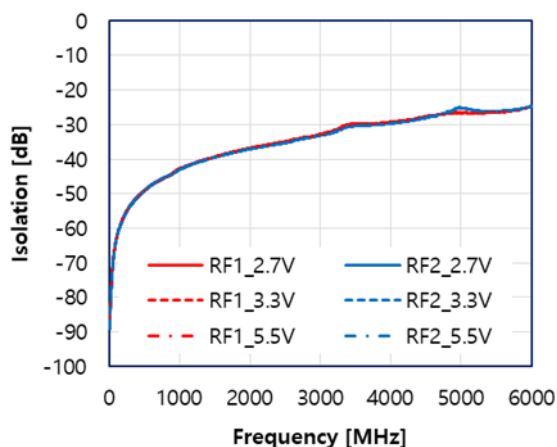
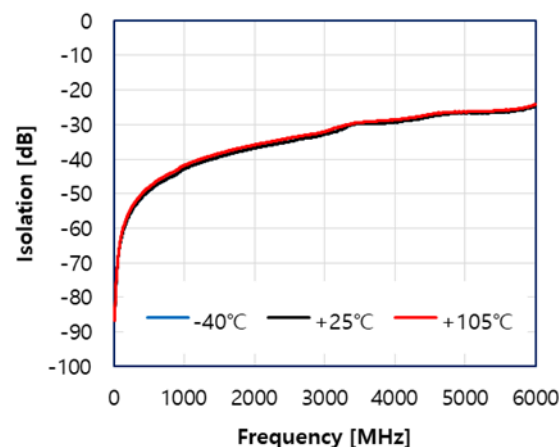


Figure 11 Isolation vs. Temp (RFx - RFx)



5MHz-6000MHz High Linearity Reflective SPDT RF switch

Typical Performances - 75Ω

Typical conditions are at VDD = 3.3V, T_A = 25°C, V1 Low = 0V, V1 High = 3.3V, Z_L = 75Ω, Excluding SMA Connector and PCB loss, unless otherwise noted.

Figure 12 Insertion Loss (RFC - RFx)

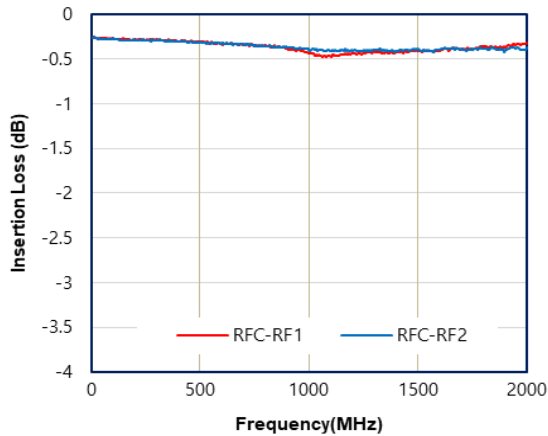


Figure 13 Insertion Loss vs. Temp (RFC - RFx)

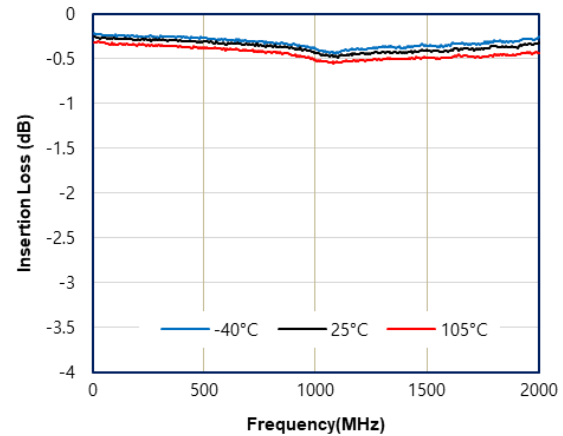


Figure 14 Return Loss (RFC, RFx)

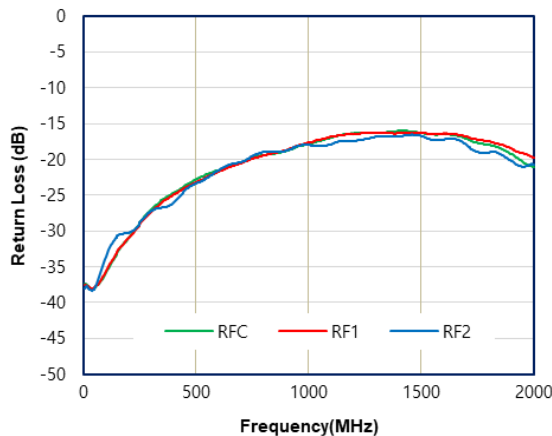
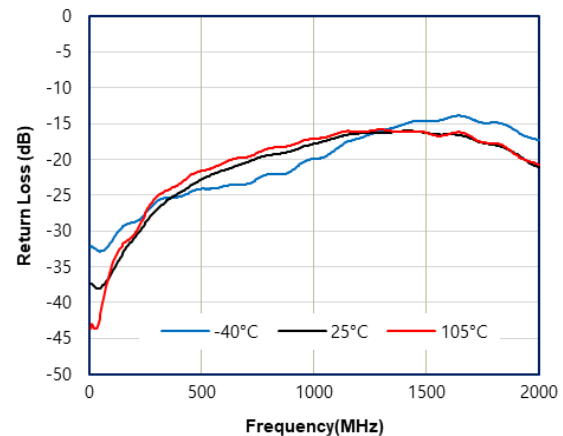


Figure 15 Return Loss vs. Temp (RFC)



5MHz-6000MHz High Linearity Reflective SPDT RF switch

Typical Performances - 75Ω

Typical conditions are at VDD = 3.3V, T_A = 25°C, V1 Low = 0V, V1 High = 3.3V, Z_L = 75Ω, Excluding SMA Connector and PCB loss, unless otherwise noted.

Figure 16 Isolation (RFC - RFx)

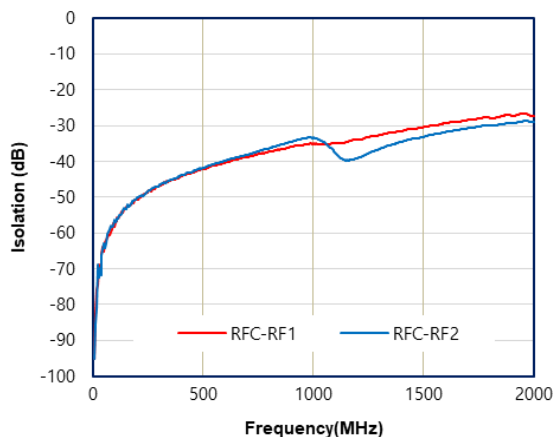


Figure 17 Isolation vs. Temp (RFC - RFx)

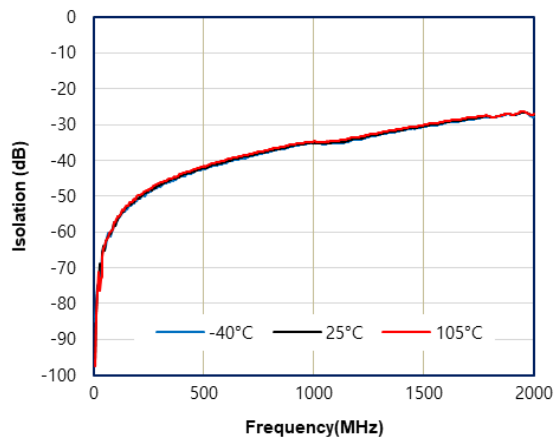


Figure 18 Isolation (RFx - RFx)

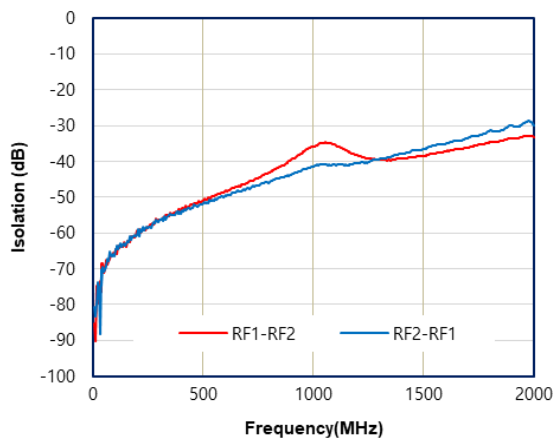
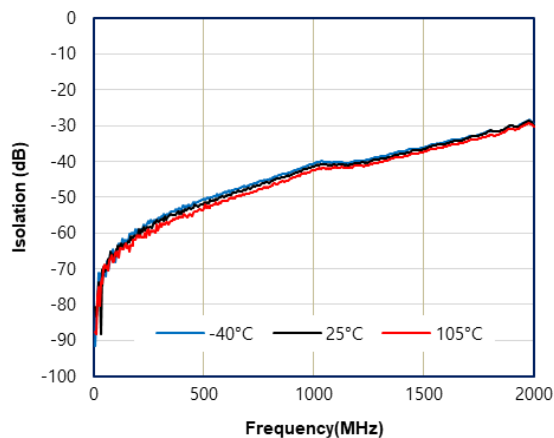


Figure 19 Isolation vs. Temp (RFx - RFx)



5MHz-6000MHz High Linearity Reflective SPDT RF switch

Evaluation Board - 50Ω

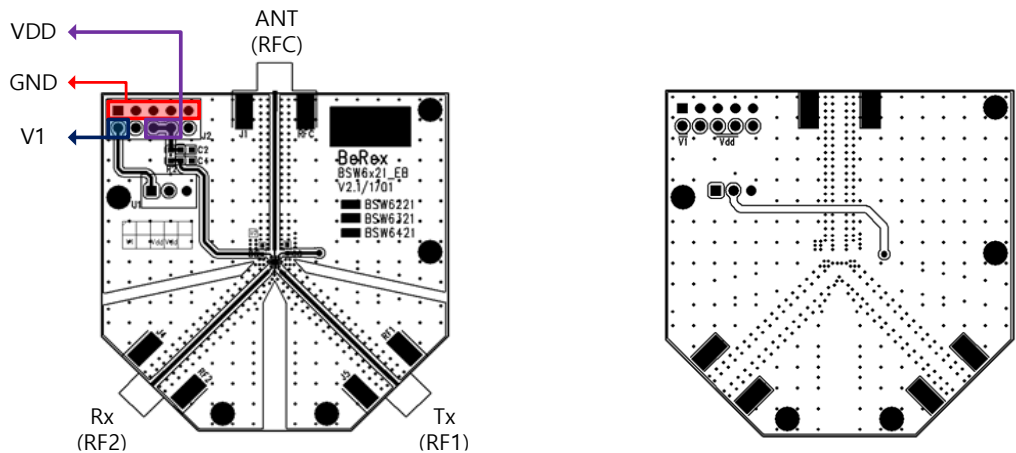


Figure 20 Evaluation Board Layout - 50Ω

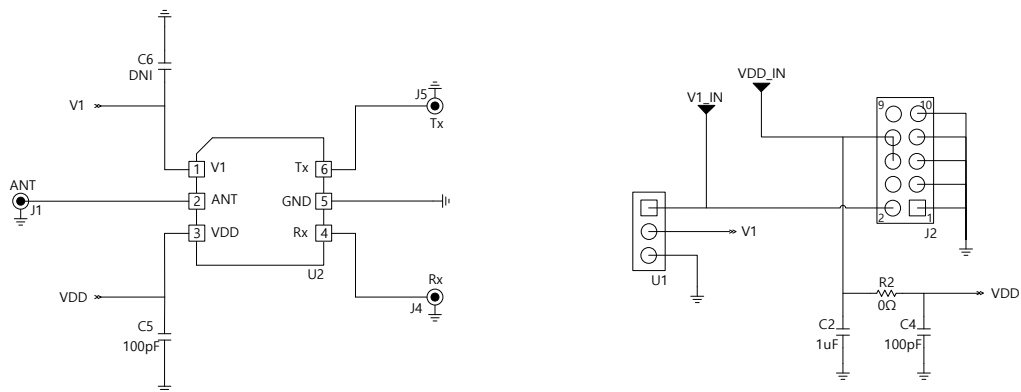


Figure 21 Evaluation Board Schematic - 50Ω

Table 8 Bill of Material - Evaluation Board 50Ω

| No. | Ref Des | Part Qty | Part Number | Remark |
|-----|-------------|----------|----------------------|--------|
| 1 | C2 | 1 | CAP 1608 1uF J 50V | |
| 2 | C4 | 1 | CAP 1608 100pF J 50V | |
| 3 | C5* | 1 | CAP 1005 100pF J 50V | |
| 4 | C6 | 1 | CAP 1005 DNI | |
| 5 | R2 | 1 | RES 1608 J 0ohm | |
| 6 | U1 | 1 | 3 Pin Header | |
| 7 | J2 | 1 | 10 Pin Header | |
| 8 | ANT, Tx, Rx | 3 | SMA_END_LAUNCH | |
| 9 | U2 | 1 | 1.5X1.5_6L_ BSW6321 | |

* C5 should be placed near the device.

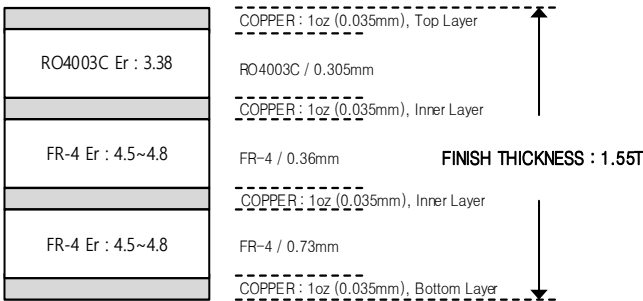


Figure 22 Evaluation Board PCB Layer Information 50Ω

5MHz-6000MHz High Linearity Reflective SPDT RF switch

Evaluation Board - 75Ω

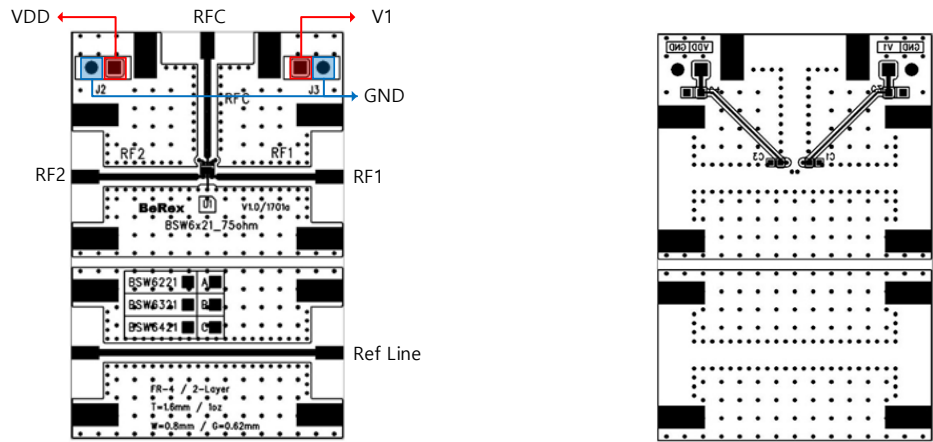


Figure 23 Evaluation Board Layout - 75Ω

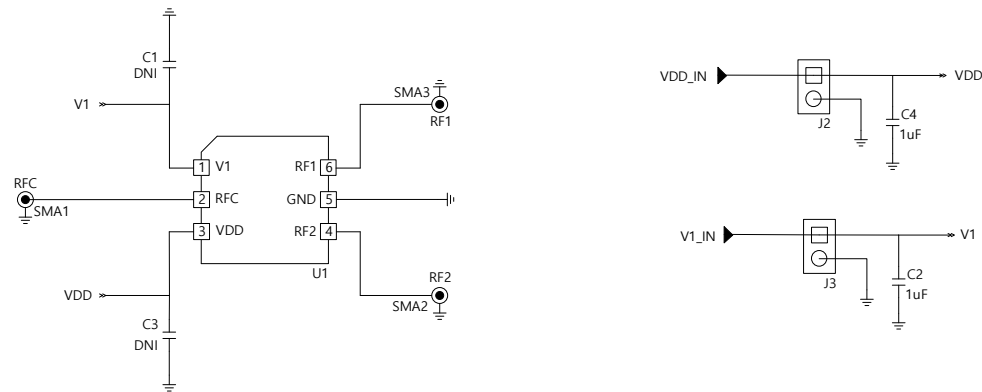


Figure 24 Evaluation Board Schematic - 75Ω

| | |
|-------------------|-------------------------------------|
| | COPPER: 1oz (0.035mm), Top Layer |
| FR-4 Er : 4.5~4.8 | FR-4 / 0.58mm |
| | COPPER: 1oz (0.035mm), Inner Layer |
| FR-4 Er : 4.5~4.8 | FR-4 / 0.3mm |
| | COPPER: 1oz (0.035mm), Inner Layer |
| FR-4 Er : 4.5~4.8 | FR-4 / 0.58mm |
| | COPPER: 1oz (0.035mm), Bottom Layer |

FINISH THICKNESS :1.6T

Figure 25 Evaluation Board PCB Layer Information 75Ω

Table 9 Bill of Material - Evaluation Board 75Ω

| No. | Ref Des | Part Qty | Part Number | Remark |
|-----|-------------|----------|----------------------------|--------|
| 1 | C2,C4 | 2 | CAP 0603 1uF 50V | |
| 2 | C1,C3 | 2 | CAP 0402 DNI | |
| 3 | RFC,RF1,RF2 | 3 | F Type_END_LAUNCH | |
| 4 | J2,J3 | 2 | 2 Pin Header | |
| 5 | U2 | 1 | DFN 1.5X1.5_6L_ BSW6321 | |

5MHz-6000MHz High Linearity Reflective SPDT RF switch

Package Outline Drawing

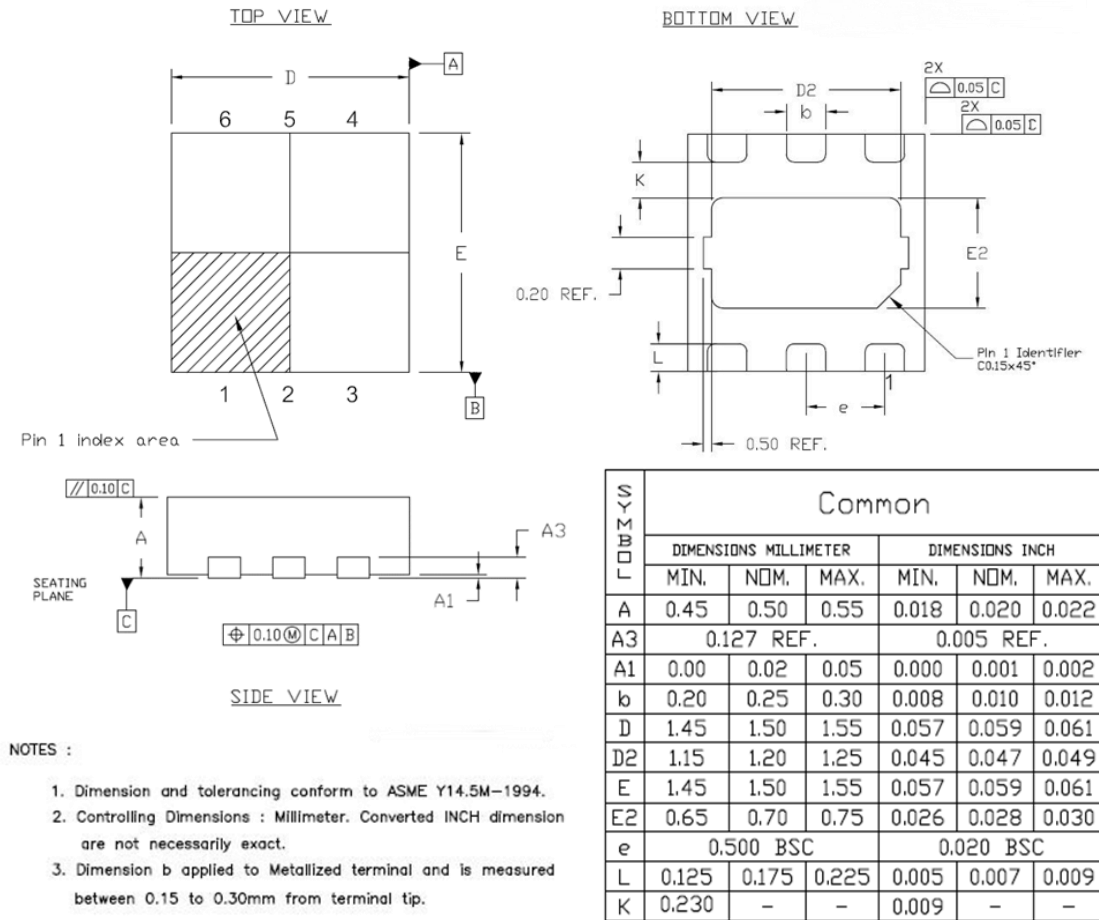


Figure 26 Package Outline Drawing

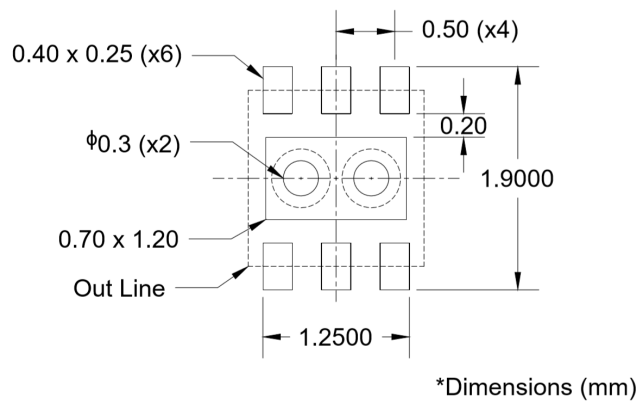
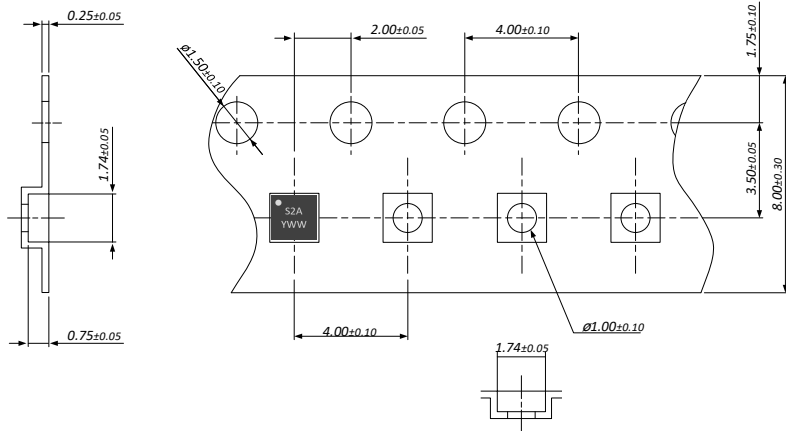


Figure 27 Recommended Land Pattern

5MHz-6000MHz High Linearity Reflective SPDT RF switch

Tape & Reel



Packaging information :

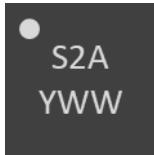
Tape Width (mm) : 8

Reel Size (inches) : 7

Device Cavity Pitch (mm) : 4

Device Per Reel : 3000EA

Package Marking



S : Switch

2 : The number of switch throw

B : Sequential Number

Y : Year

WW : Work Week

Figure 28 Package Marking

Lead plating finish

100% Tin Matte finish

(All BeRex products undergoes a 1 hour, 150 degree C, Anneal bake to eliminate thin whisker growth concerns.)

MSL / ESD Rating

ESD Rating: Class 2

Value: Passes < 2500V

Test: Human Body Model (HBM)

Standard: JEDEC Standard JESD22-A114B

MSL Rating: Level 1 at +265°C convection reflow

Standard: JEDEC Standard J-STD-020



Proper ESD procedures should be followed when handling this device.

NATO CAGE code:

| | | | | |
|---|---|---|---|---|
| 2 | N | 9 | 6 | F |
|---|---|---|---|---|