

### Product Description

The BSW6622 is an absorptive SPDT 50Ω matched RF switch supporting bandwidth up to 9GHz. It's high linearity performance across the temperature range makes it ideally suitable for use in 3G/4G/5G/6G wireless infrastructure and 802.11 a/n/ac/ax applications where high isolation and excellent performance is required.

The BSW6622 is designed with robust ESD protection circuits at all pins and packaged in an industry standard, fully RoHS2-compliant, 20Lead, 4mm x 4mm x 0.9mm QFN package.

The BSW6622 does not require blocking capacitors. If DC is presented at the RF port, add a blocking capacitor.

A functional block diagram is shown in Figure 1.

### Block Diagram

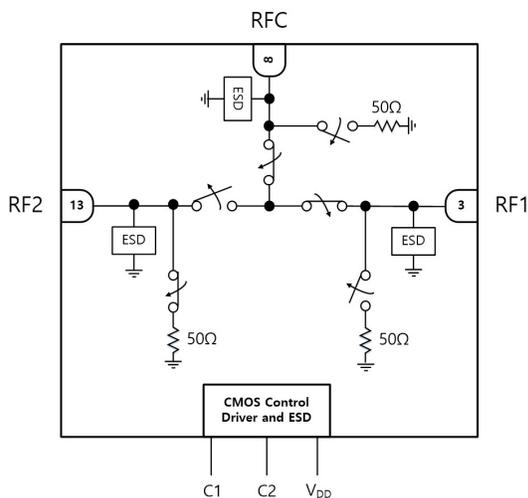


Figure 1. Functional Block Diagram

### Applications

- Wireless 3G/4G/5G/6G Infrastructure
- Base station & Repeater
- WLAN 802.11 a/b/ac/ax

### Package Type



4mm x 4mm x 0.9mm, 20-Lead QFN Package

Figure 2. Package type

### Device Features

- Output frequency range : 5MHz to 9.0GHz
- Supply Voltage : 2.7V to 5.5V
- Low Insertion Loss
  - : 0.66dB @ 2GHz
  - : 0.73dB @ 4GHz
  - : 1.13dB @ 6GHz
  - : 1.38dB @ 7.2GHz
- Ultra High Isolation
  - RFC to RFx
    - : 62dB @ 2GHz
    - : 58dB @ 4GHz
    - : 48dB @ 6GHz
    - : 46dB @ 7.2GHz
  - RFx to RFx
    - : 75dB @ 2GHz
    - : 58dB @ 4GHz
    - : 50dB @ 6GHz
    - : 45dB @ 7.2GHz
- Switching time : 120 to 220ns
- ESD, HBM : ±1.5kV @All pins
- Operating temperature range : -40°C to +125°C
- 20-Lead QFN package : 4.0mm x 4.0mm x 0.9mm
- Lead-free/RoHS2 compliant QFN package

**Electrical Specifications**

Typical conditions are at VDD = 5V, T<sub>A</sub> = +25°C, C1/C2 Low = 0V, C1/C2 High = 3.3V, Z<sub>L</sub> = 50Ω, excluding SMA Connector and PCB losses<sup>(1)</sup>, unless otherwise noted.

**Table 1. Electrical Specifications**

| Parameter                     | Path            | Condition   | Min | Typ          | Max  | Unit |
|-------------------------------|-----------------|-------------|-----|--------------|------|------|
| Operating Frequency           |                 |             | 5   |              | 9000 | MHz  |
| Insertion Loss                | RFC - RFx       | 1GHz        |     | 0.59         |      | dB   |
|                               |                 | 2GHz        |     | 0.66         |      |      |
|                               |                 | 3GHz        |     | 0.72         |      |      |
|                               |                 | 4GHz        |     | 0.73         |      |      |
|                               |                 | 5GHz        |     | 0.79         |      |      |
|                               |                 | 6GHz        |     | 1.13         |      |      |
|                               |                 | 7GHz        |     | 1.4          |      |      |
|                               |                 | 8GHz        |     | 1.21         |      |      |
|                               |                 | 9GHz        |     | 1.29         |      |      |
| Isolation (C to X)            | RFC - RFx       | 1GHz        |     | 68           |      | dB   |
|                               |                 | 2GHz        |     | 62           |      |      |
|                               |                 | 3GHz        |     | 60           |      |      |
|                               |                 | 4GHz        |     | 58           |      |      |
|                               |                 | 5GHz        |     | 53           |      |      |
|                               |                 | 6GHz        |     | 48           |      |      |
|                               |                 | 7GHz        |     | 47           |      |      |
|                               |                 | 8GHz        |     | 47           |      |      |
|                               |                 | 9GHz        |     | 50           |      |      |
| Isolation (X to X)            | RFx - RFx       | 1GHz        |     | 92           |      | dB   |
|                               |                 | 2GHz        |     | 75           |      |      |
|                               |                 | 3GHz        |     | 65           |      |      |
|                               |                 | 4GHz        |     | 58           |      |      |
|                               |                 | 5GHz        |     | 53           |      |      |
|                               |                 | 6GHz        |     | 50           |      |      |
|                               |                 | 7GHz        |     | 46           |      |      |
|                               |                 | 8GHz        |     | 42           |      |      |
|                               |                 | 9GHz        |     | 39           |      |      |
| Return Loss (Active Port)     | RFC / RF1 / RF2 | 5MHz — 4GHz |     | 20 / 25 / 25 |      | dB   |
|                               |                 | 4GHz — 8GHz |     | 10 / 15 / 15 |      |      |
|                               |                 | 8GHz — 9GHz |     | 15 / 20 / 15 |      |      |
| Return Loss (Terminated Port) | RF1 / RF2       | 5MHz — 4GHz |     | 25 / 22      |      | dB   |
|                               |                 | 4GHz — 8GHz |     | 20 / 17      |      |      |
|                               |                 | 8GHz — 9GHz |     | 25 / 20      |      |      |

(1) Excluding SMA Connector and PCB loss.

1GHz (0.1dB), 2GHz (0.19dB), 3GHz (0.23dB), 4GHz (0.29dB), 5GHz (0.36dB), 6GHz (0.4dB), 7GHz (0.42dB), 8GHz (0.55dB), 9GHz (0.62dB)

**Electrical Specifications**

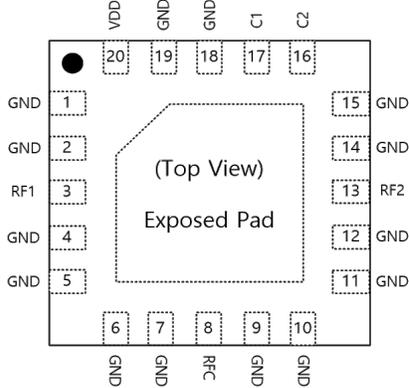
Typical conditions are at VDD = 5V, T<sub>A</sub> = +25°C, C1/C2 Low = 0V, C1/C2 High = 3.3V, Z<sub>L</sub> = 50Ω, excluding SMA Connector and PCB losses<sup>(1)</sup>, unless otherwise noted.

| Parameter                    |                | Path                           | Condition                | Min | Typ   | Max  | Unit     |
|------------------------------|----------------|--------------------------------|--------------------------|-----|-------|------|----------|
| Operating Frequency          |                |                                |                          | 5   |       | 9000 | MHz      |
| Input P1dB                   | RFC - RFx      | 2.35GHz                        |                          |     | 36    |      | dBm      |
|                              |                | 3.5GHz                         |                          |     | 36    |      |          |
|                              |                | 4.9GHz                         |                          |     | 34    |      |          |
| Input IP2 <sup>(2)</sup>     | RFC - RFx      | 2.35GHz                        |                          |     | 108   |      | dBm      |
|                              |                | 3.5GHz                         |                          |     | 105   |      |          |
|                              |                | 4.9GHz                         |                          |     | 100   |      |          |
| Input IP3 <sup>(2)</sup>     | RFC - RFx      | 2.35GHz                        |                          |     | 64    |      | dBm      |
|                              |                | 3.5GHz                         |                          |     | 64    |      |          |
|                              |                | 4.9GHz                         |                          |     | 65    |      |          |
| 2nd Harmonics <sup>(3)</sup> | RFC - RFx      | 2.35GHz                        |                          |     | 95    |      | dBc      |
|                              |                | 3.5GHz                         |                          |     | 90    |      |          |
|                              |                | 4.9GHz                         |                          |     | 80    |      |          |
| 3rd Harmonics <sup>(3)</sup> | RFC - RFx      | 2.35GHz                        |                          |     | 100   |      | dBc      |
|                              |                | 3.5GHz                         |                          |     | 101   |      |          |
|                              |                | 4.9GHz                         |                          |     | 95    |      |          |
| Switching Characteristics    | Rising Time    | RFC - RFx                      | 10% RF to 90% RF         |     | 50    |      | ns       |
|                              | Falling Time   |                                | 90% RF to 10% RF         |     | 50    |      |          |
|                              | Switching time | RFC - RFx                      | 50% CTRL to 90% RF       |     | 220   |      | ns       |
|                              |                |                                | 50% CTRL to 10% RF       |     | 120   |      |          |
| Settling time                | RFC - RFx      | 50% CTRL to 0.05dB final value |                          | 250 |       | ns   |          |
|                              |                | 50% CTRL to 0.05dB final value |                          | 130 |       |      |          |
| Maximum Spurious Level       |                | RFC - RFx                      | 5MHz–9GHz <sup>(4)</sup> |     | <-145 |      | dBm/10Hz |

(2) The each-tone Power is 20dBm and Tone spacing is 1MHz.

(3) Tone Power is 20dBm.

(4) No spurious signals were detected in all Frequency range.

**Product Description**

**Figure 3. Pin Description [Top View]**
**Table 2. Pin Descriptions**

| Pin No.   | Pin Name    | Description  |
|---|-------------|--|
| 1, 2, 4, 5, 6, 7, 9, 10, 11, 12, 14, 15, 18, 19 | GND         | Ground   |
| 3   | RF1         | RF1 Port   |
| 8   | RFC         | RFC Port   |
| 13  | RF2         | RF2 Port   |
| 16  | C2          | Switch Control Input<br>(Definition for the C2 pin, See Table 3) |
| 17  | C1          | Switch Control Input<br>(Definition for the C1 pin, See Table 3) |
| 20  | VDD         | Supply Voltage   |
| Pad   | Exposed Pad | Ground   |

**Table 3. Control Truth Table**

| C1 | C2 | RFC-RF1 | RFC-RF2 |
|----|----|---------|---------|
| 0  | 0  | OFF     | OFF     |
| 0  | 1  | OFF     | ON      |
| 1  | 0  | ON      | OFF     |
| 1  | 1  | N/A     | N/A     |

**Table 4. Recommended Operating Conditions**

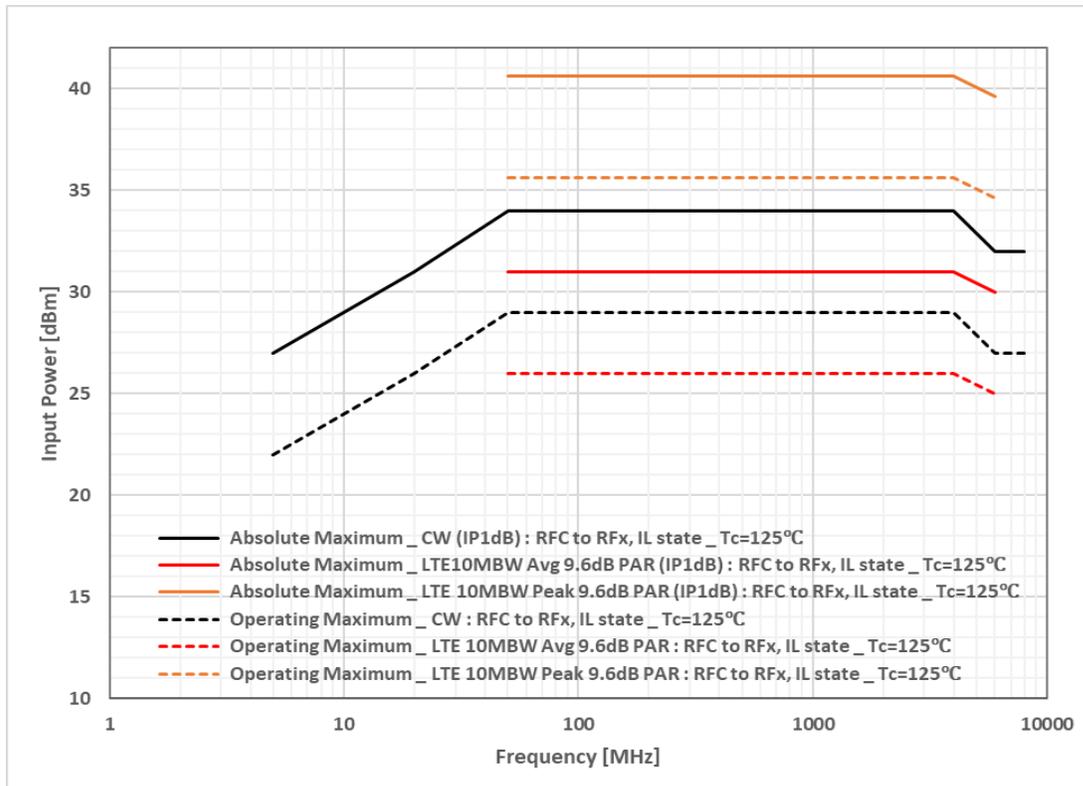
| Parameter                     | Symbol            | Min | Typical | Max          | Unit |
|-------------------------------|-------------------|-----|---------|--------------|------|
| Supply Voltage                | VDD               | 2.7 | 5       | 5.5          | V    |
| Supply Current                | IDD               | -   | 210     | -            | μA   |
| Digital Input Control (C1/C2) | C <sub>High</sub> | 1.0 | -       | 3.3          | V    |
|                               | C <sub>Low</sub>  | 0   | -       | 0.7          | V    |
| Operating Temperature Range   | T <sub>O</sub>    | -40 | +25     | +125         | °C   |
| RF Input Power                | P <sub>OP</sub>   | -   | -       | See Figure 4 | dBm  |

**Table 5. Absolute Maximum Ratings**

| Parameter                 |     | Symbol            | Min                 | Max          | Unit |   |
|---------------------------|-----|-------------------|---------------------|--------------|------|---|
| Supply Voltage            |     | VDD               | -0.3                | 5.5          | V    |   |
| Digital Input Voltage     |     | C1 / C2           | -0.3                | 3.6          | V    |   |
| Maximum Input Power       |     | RF <sub>MAX</sub> | -                   | See Figure 4 | dBm  |   |
| Storage Temperature Range |     | T <sub>ST</sub>   | -65                 | +150         | °C   |   |
| ESD                       | HBM | All pins          | V <sub>ESDHBM</sub> | -            | 1500 | V |
|                           | CDM | All pins          | V <sub>ESDCDM</sub> | -            | 1000 | V |

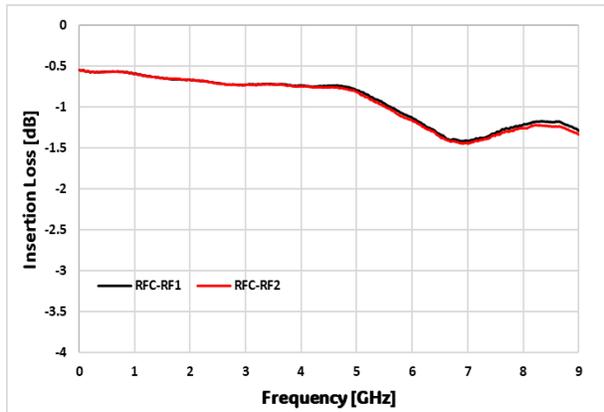
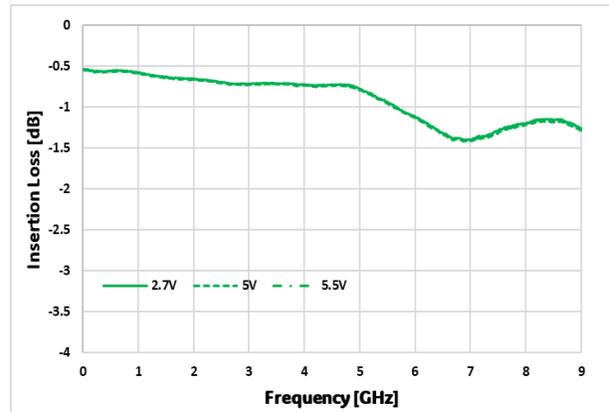
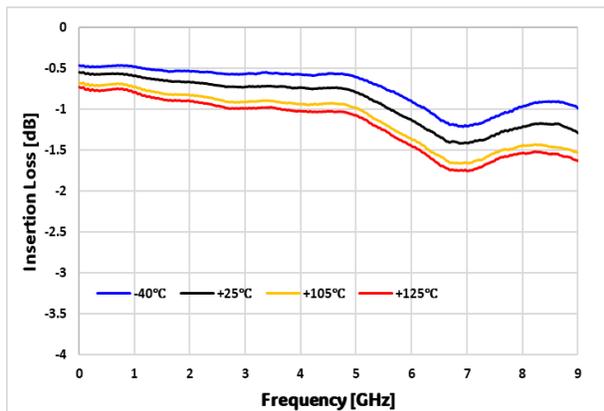
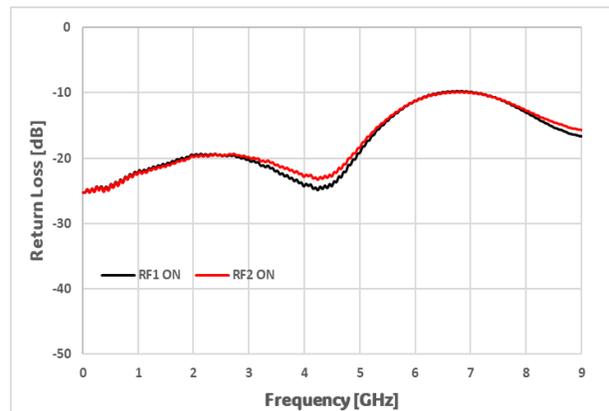
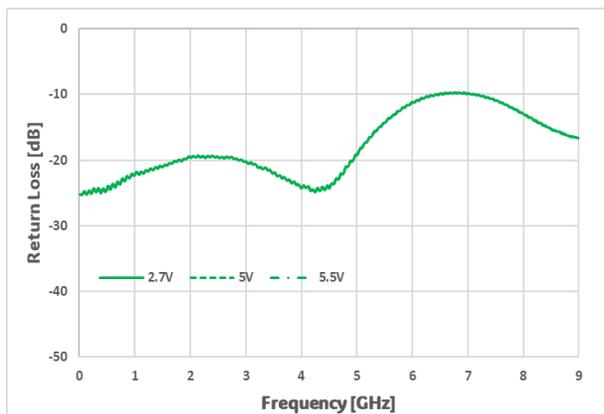
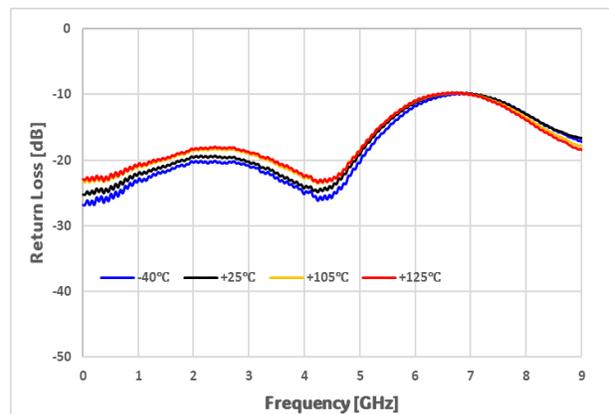
**Table 6. Package Thermal Characteristics**

| Parameter                              | Symbol        | Value | Unit |
|--|---------------|-------|------|
| Junction to Ambient Thermal Resistance | $\theta_{JA}$ | 43    | °C/W |

**Figure 4. Power De-rating Curve**


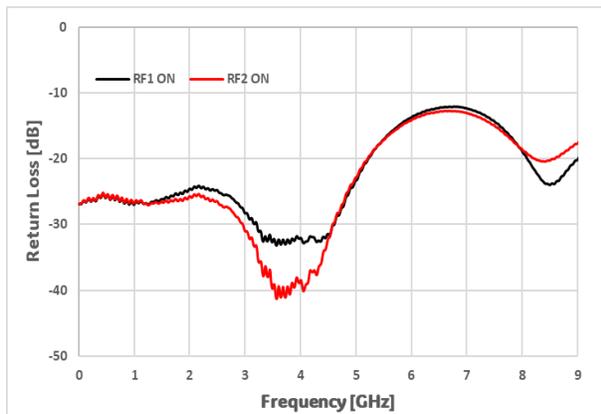
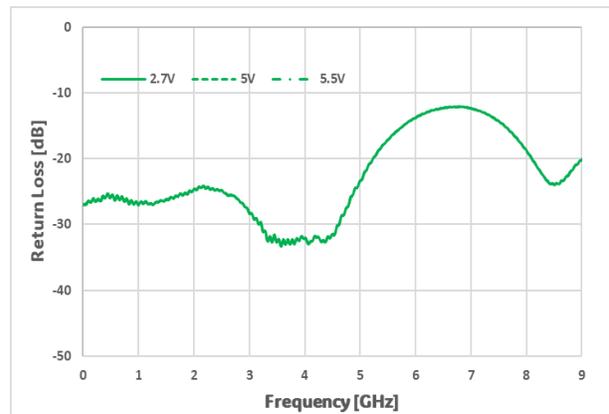
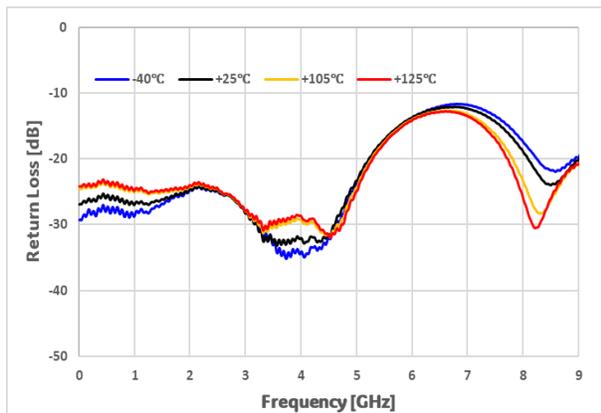
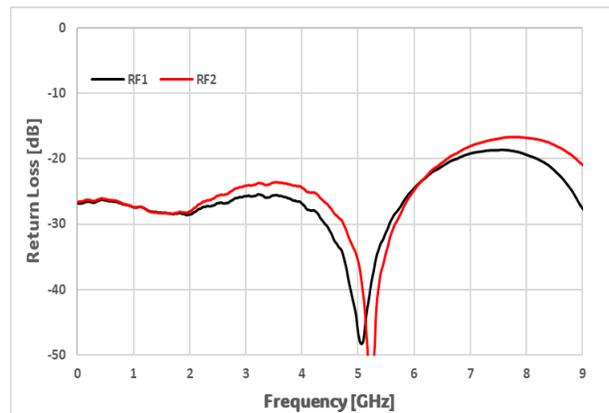
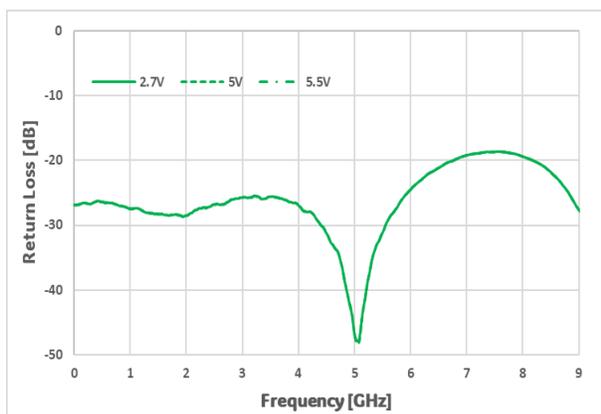
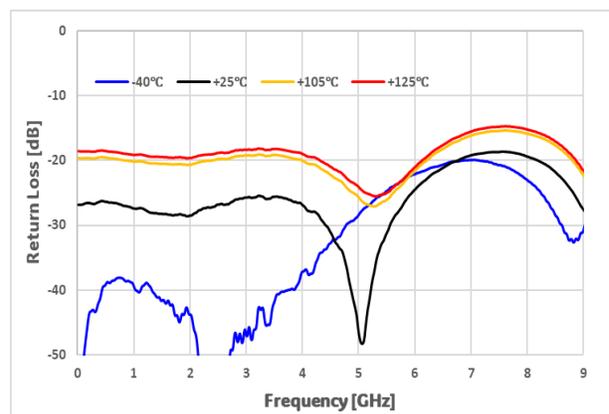
**Typical Performances**

Typical conditions are at VDD = 5V, T<sub>A</sub> = 25°C, C1/C2 Low = 0V, C1/C2 High = 3.3V, Z<sub>L</sub> = 50Ω, Excluding SMA Connector and PCB losses, unless otherwise noted.

**Figure 5. Insertion Loss vs Frequency**

**Figure 6. Insertion Loss vs VDD (RFC-RF1)**

**Figure 7. Insertion Loss vs Temp (RFC-RF1)**

**Figure 8. Return Loss vs Frequency (RFC Port)**

**Figure 9. Return Loss vs VDD (RFC Port)**

**Figure 10. Return Loss vs Temp (RFC Port)**


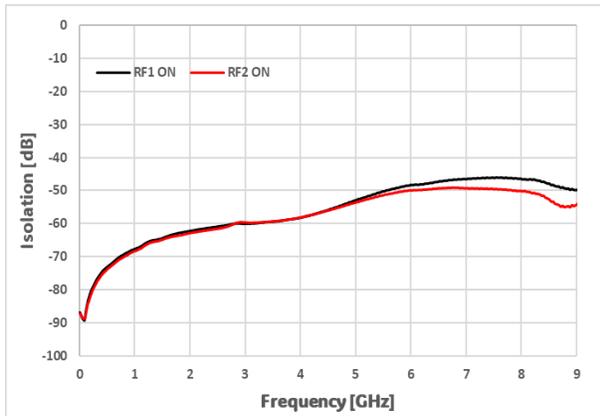
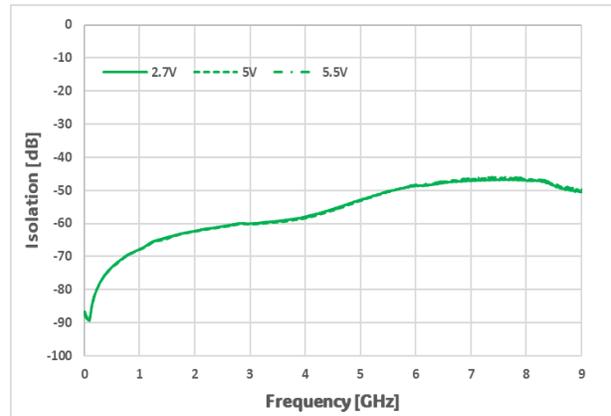
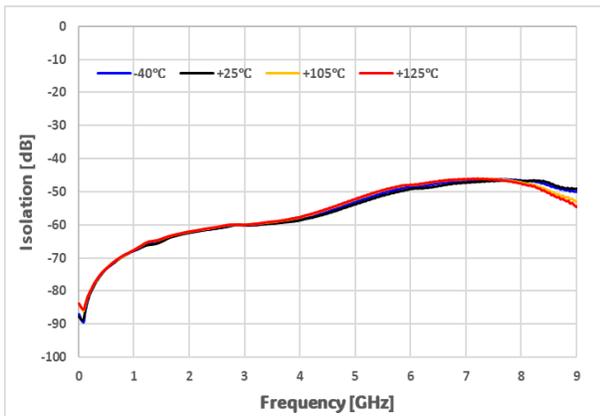
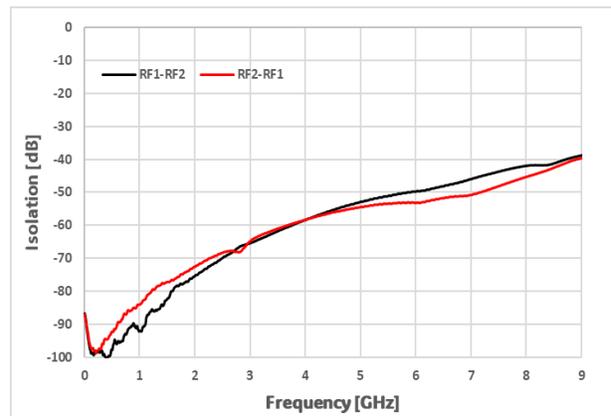
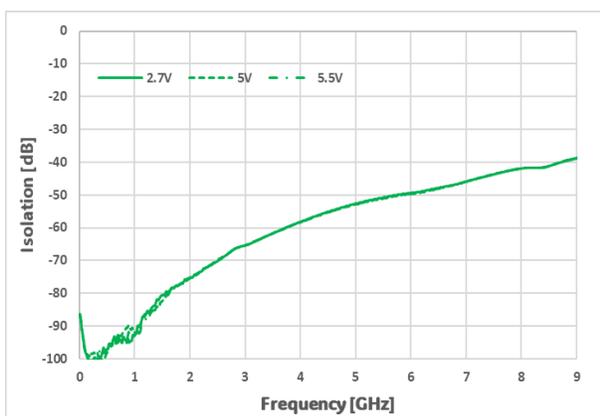
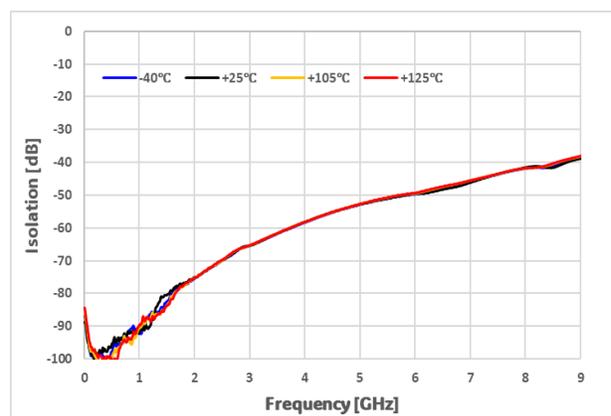
**Typical Performances**

Typical conditions are at  $V_{DD} = 5V$ ,  $T_A = 25^\circ C$ ,  $C1/C2$  Low =  $0V$ ,  $C1/C2$  High =  $3.3V$ ,  $Z_L = 50\Omega$ , Excluding SMA Connector and PCB losses, unless otherwise noted.

**Figure 11. Return Loss vs Frequency (Active Port)**

**Figure 12. Return Loss vs VDD (Active Port)**

**Figure 13. Return Loss vs Temp (Active Port)**

**Figure 14. Return Loss vs Frequency (Terminated Port)**

**Figure 15. Return Loss vs VDD (Terminated Port)**

**Figure 16. Return Loss vs Temp (Terminated Port)**


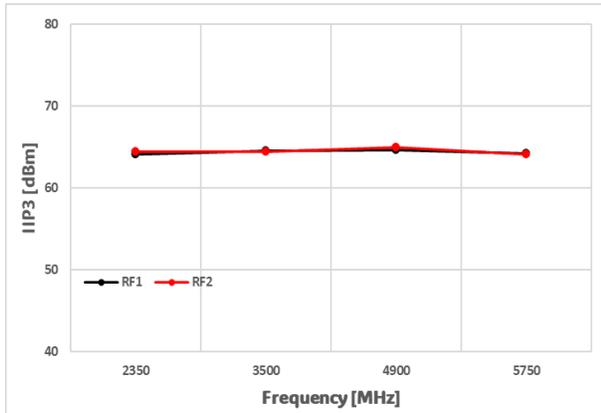
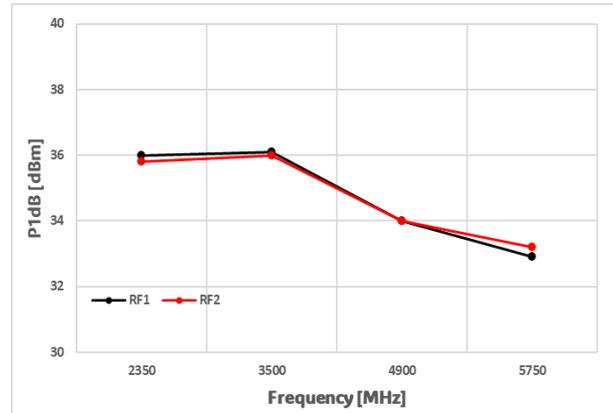
**Typical Performances**

Typical conditions are at VDD = 5V, T<sub>A</sub> = 25°C, C1/C2 Low = 0V, C1/C2 High = 3.3V, Z<sub>L</sub> = 50Ω, Excluding SMA Connector and PCB losses, unless otherwise noted.

**Figure 17. Isolation vs Frequency (RFC-RFx)**

**Figure 18. Isolation vs VDD (RFC-RF2, RF1 ON)**

**Figure 19. Isolation vs Temp (RFC-RF2, RF1 ON)**

**Figure 20. Isolation vs Frequency (RFx-RFx)**

**Figure 21. Isolation vs VDD (RF1-RF2, RF1 ON)**

**Figure 22. Isolation vs Temp (RF1-RF2, RF1 ON)**


**Typical Performances**

Typical conditions are at VDD = 5V, T<sub>A</sub> = 25°C, C1/C2 Low = 0V, C1/C2 High = 3.3V, Z<sub>L</sub> = 50Ω, Excluding SMA Connector and PCB losses, unless otherwise noted.

**Figure 23. IIP3 vs Frequency**

**Figure 24. P1dB vs Frequency**


### Evaluation Board

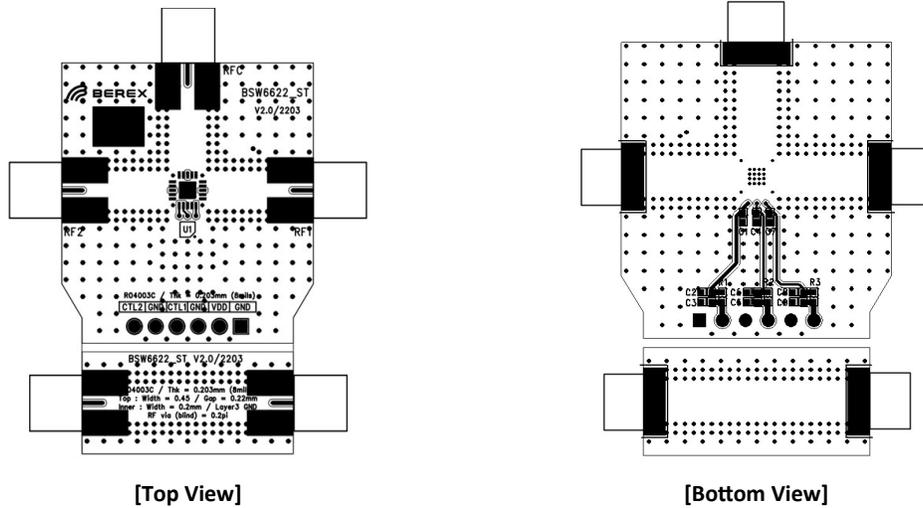
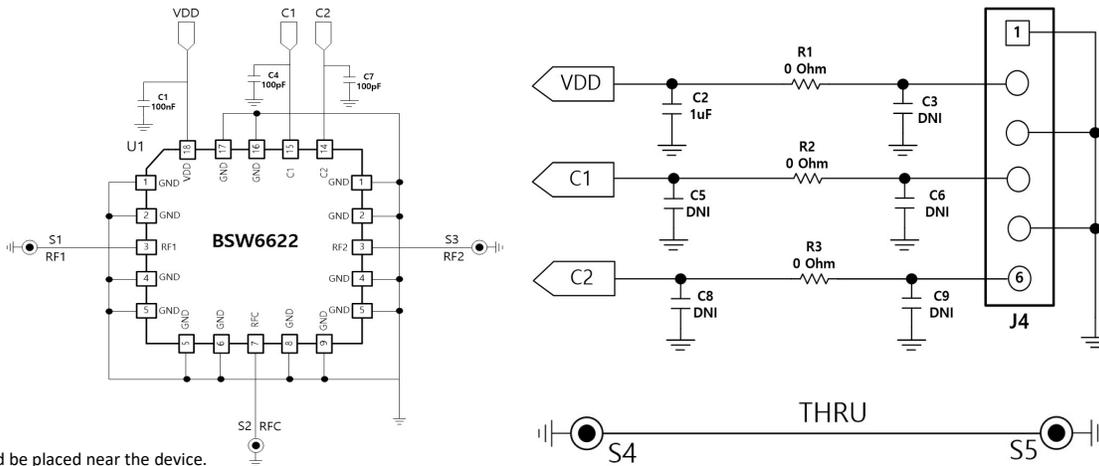


Figure 25. Evaluation Board Layout

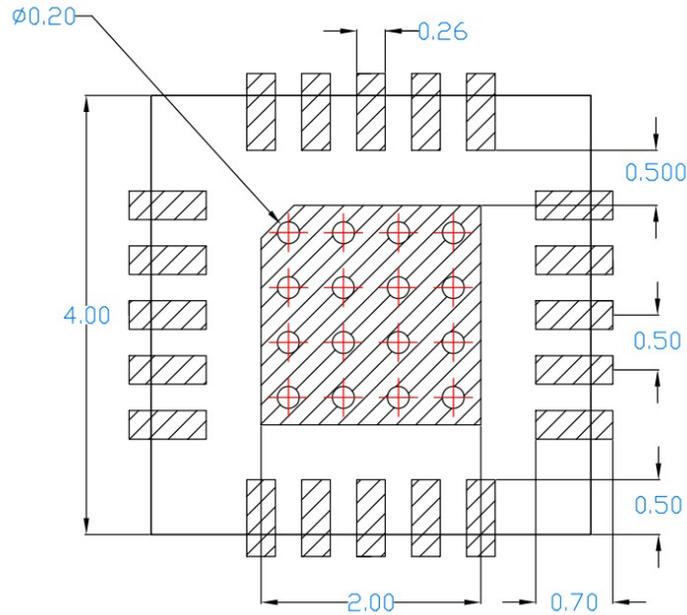
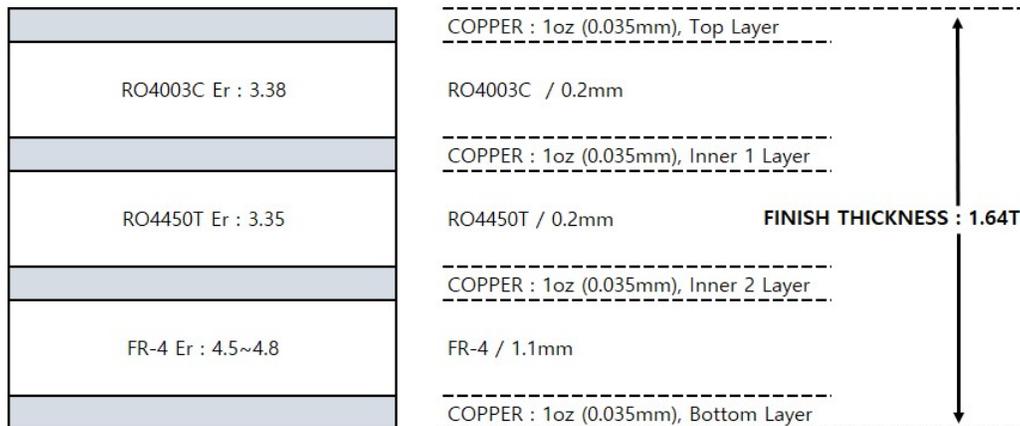


Note  
C1 should be placed near the device.

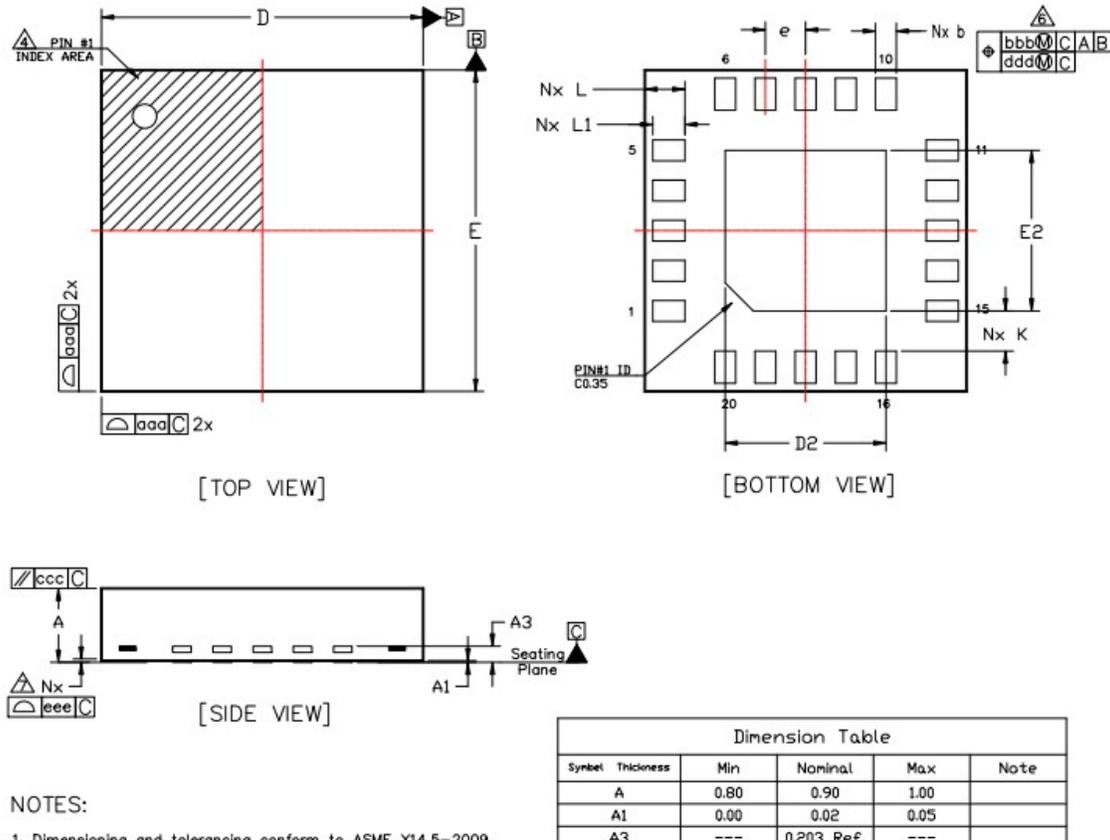
Figure 26. Evaluation Board Schematic

Table 7. Bill of Material - Evaluation Board

| No. | Ref Des        | Part Qty | Value  | Description    | Remark |
|-----|----------------|----------|--------|----------------|--------|
| 1   | C1             | 1        | 100nF  | CAP 1005 J 50V |        |
| 2   | C2             | 1        | 1uF    | CAP 1005 J 50V |        |
| 3   | C4,C7          | 2        | 100pF  | CAP 1005 J 50V |        |
| 4   | C3,C5,C6,C8,C9 | 5        | DNI    | CAP 1005       |        |
| 5   | R1,R2,R3       | 3        | 0 ohm  | RES 1005       |        |
| 6   | J4             | 1        | 2.54mm | 6 pin Header   |        |
| 7   | S1,S2,S3,S4,S5 | 5        | CON    | SMA_END_LAUNCH | Female |
| 8   | U1             | 1        | Chip   | BSW6622        |        |

**Evaluation Board**

**Figure 27. Suggested PCB Land Pattern**

**Figure 28. Evaluation Board PCB Layer Information**

### Package Outline Drawing



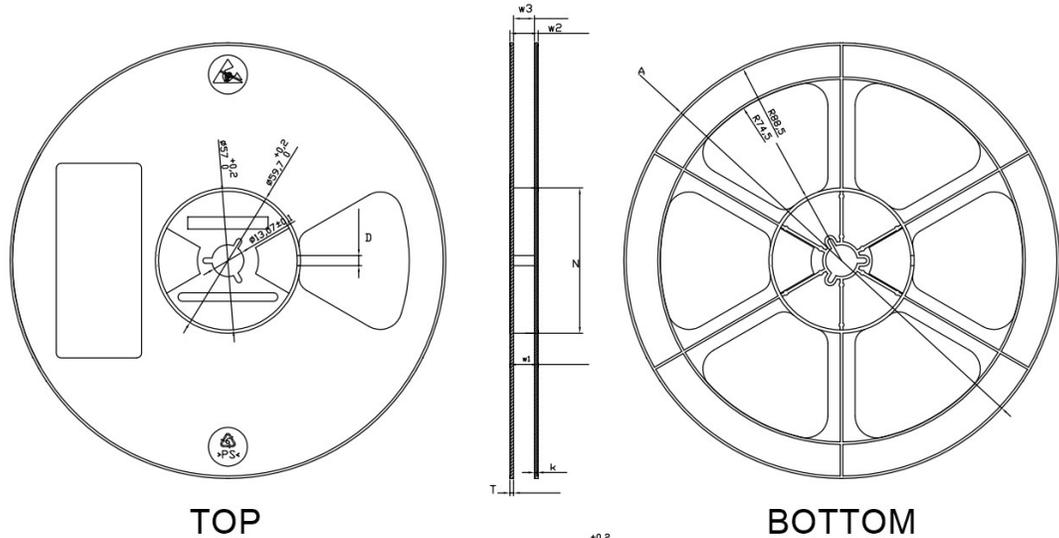
#### NOTES:

1. Dimensioning and tolerancing conform to ASME Y14.5–2009.
  2. All dimensions are in millimeters.
  3. N is the total number of terminals.
  4. The location of the marked terminal #1 identifier is within the hatched area.
  5. ND and NE refer to the number of terminals each D and E side respectively.
- ⚠ Dimension b applies to the metallized terminal and is measured between 0.15mm and 0.3mm from the terminal tip, if the terminal has a radius on the other end of it, dimension b should not be measured in that radius area.
- ⚠ Coplanarity applies to the terminals and all other bottom surface metallization.

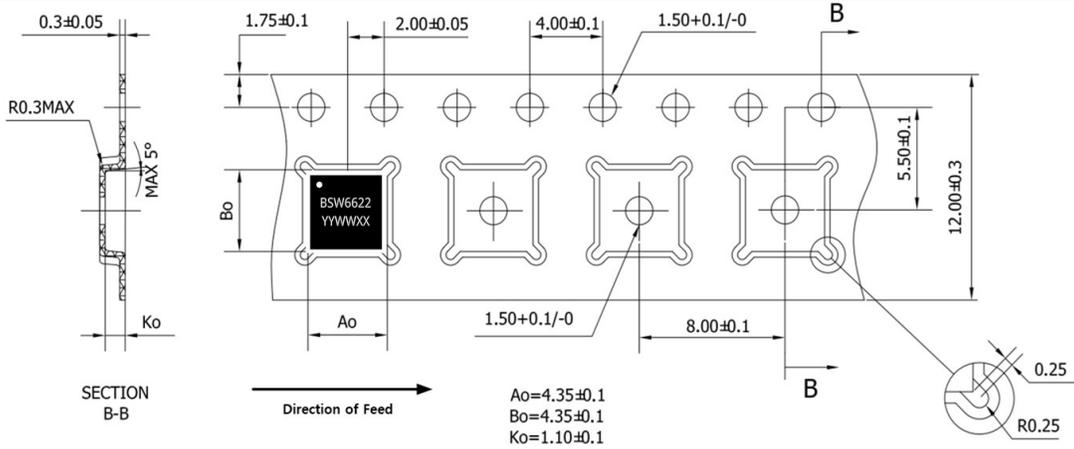
| Dimension Table |           |          |            |      |      |
|-----------------|-----------|----------|------------|------|------|
| Symbol          | Thickness | Min      | Nominal    | Max  | Note |
| A               |           | 0.80     | 0.90       | 1.00 |      |
| A1              |           | 0.00     | 0.02       | 0.05 |      |
| A3              |           | ---      | 0.203 ReF. | ---  |      |
| b               |           | 0.21     | 0.26       | 0.31 | 6    |
| D               |           | 4.00 BSC |            |      |      |
| E               |           | 4.00 BSC |            |      |      |
| e               |           | 0.50 BSC |            |      |      |
| D2              |           | 1.95     | 2.00       | 2.05 |      |
| E2              |           | 1.95     | 2.00       | 2.05 |      |
| K               |           | 0.20     | ---        | ---  |      |
| L1              |           | 0.35     | 0.40       | 0.45 |      |
| L               |           | 0.40     | 0.50       | 0.60 |      |
| aaa             |           | 0.05     |            |      |      |
| bbb             |           | 0.10     |            |      |      |
| ccc             |           | 0.10     |            |      |      |
| ddd             |           | 0.05     |            |      |      |
| eee             |           | 0.08     |            |      |      |
| N               |           | 20       |            | 3    |      |
| ND              |           | 5        |            | 5    |      |
| NE              |           | 5        |            | 5    |      |
| NOTES           |           | 1,2      |            |      |      |

Figure 29. Package Outline Dimension

### Tape & Reel



| TYPE | A                           | N                          | C                                | D             | w1               | w2               | w3               | T              | k             |
|------|-----------------------------|----------------------------|----------------------------------|---------------|------------------|------------------|------------------|----------------|---------------|
| 12MM | $\varnothing 180^{+2}_{-2}$ | $\varnothing 60^{+1}_{-1}$ | $\varnothing 13.1^{+0.2}_{-0.2}$ | $4.2 \pm 0.5$ | $12.5^{+1}_{-0}$ | $15.7^{+1}_{-1}$ | $12.7^{+1}_{-1}$ | $1.5 \pm 0.15$ | $1.2 \pm 0.1$ |



NOTES:  
 1 10 SPROCKET HOLE PITCH CUMULATIVE TOLERANCE #0.2  
 2 CAMBER IN COMPLIANCE WITH EIA 481  
 3 POCKET POSITION RELATIVE TO SPROCKET HOLE MEASURED AS TRUE POSITION OF POCKET, NOT POCKET HOLE

| Packaging information: |        |
|------------------------|--------|
| Tape Width             | 12mm   |
| Reel Size              | 7inch  |
| Device Cavity Pitch    | 8mm    |
| Device Per Reel        | 1000EA |

Figure 30. Tape & Reel Information

**Package Marking**


| Marking information: |                  |
|----------------------|------------------|
| BSW6622              | Device Name      |
| YY                   | Year             |
| WW                   | Work Week        |
| XX                   | Wafer Run Number |

**Figure 31. Package Marking**
**Lead plating finish**
**100% Tin Matte finish**

(All BeRex products undergo a 1 hour, 150 °C, anneal bake to eliminate tin whisker growth concerns.)

**ESD / MSL Rating**

| ESD information1 : |                            |
|--------------------|----------------------------|
| <b>Rating</b>      | Class 1C (±1500V)          |
| <b>Test</b>        | Human Body Model (HBM)     |
| <b>Standard</b>    | JEDEC Standard JS-001-2017 |

| ESD information2 : |                            |
|--------------------|----------------------------|
| <b>Rating</b>      | Class C3 (±1000V)          |
| <b>Test</b>        | Charged Device Model (CDM) |
| <b>Standard</b>    | JEDEC Standard JS-002-2018 |

| MSL information: |                                     |
|------------------|-------------------------------------|
| <b>Rating</b>    | Level 1 at +260°C convection reflow |
| <b>Standard</b>  | JEDEC Standard J-STD-020            |



Proper ESD procedures should be followed when handling the device.

**RoHS Compliance**

This part is compliant with Restrictions on the use of certain Hazardous Substances in Electrical and Electronic Equipment (RoHS) Directive 2011/65/EU as amended by Directive 2015/863/EU.

This product also is compliant with a concentration of the Substances of Very High Concern (SVHC) candidate list which are contained in a quantity of less than 0.1%(w/w) in each components of a product and/or its packaging placed on the European Community market by the BeRex and Suppliers.

**NATO CAGE code:**

|          |          |          |          |          |
|----------|----------|----------|----------|----------|
| <b>2</b> | <b>N</b> | <b>9</b> | <b>6</b> | <b>F</b> |
|----------|----------|----------|----------|----------|