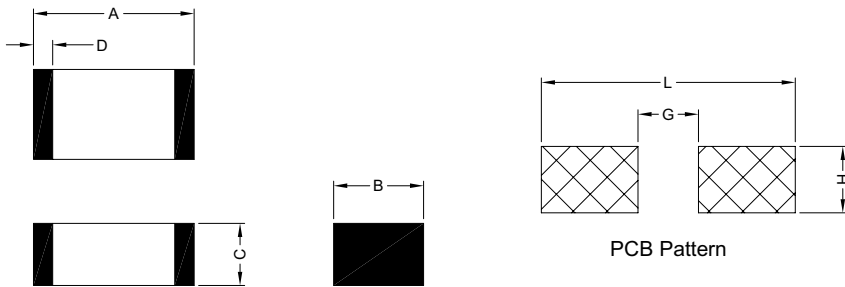


### 1. PART NO. EXPRESSION :

V 3 N 2 R 0 J - B - 1 0  
 (a) (b) (c) (d) (e) (f)

- (a) Chip Size
- (b) Temp. Coefficient : N ( 30ppm/°C )  
 ( Temp. range : -55°C to +125°C )
- (c) Capacitance code : 2R0 = 2.0pF
- (d) Tolerance code
- (e) Voltage code : B = 200Vdc
- (f) 10 : Lead Free

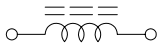
### 2. CONFIGURATION & DIMENSIONS :



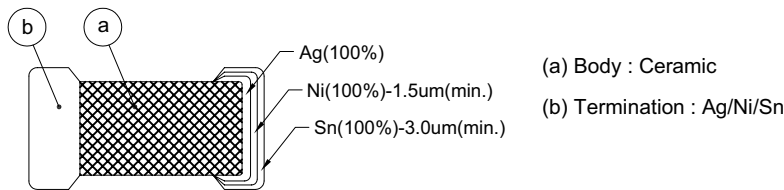
Unit:m/m

| A         | B         | C         | D         | G           | H           | L           |
|-----------|-----------|-----------|-----------|-------------|-------------|-------------|
| 2.00±0.20 | 1.25±0.20 | 1.45 Max. | 0.20 Min. | 0.70 - 0.90 | 0.80 - 1.10 | 0.60 - 0.80 |

### 3. SCHEMATIC :



### 4. MATERIALS :



### 5. GENERAL SPECIFICATION :

- a) Storage temp. : +5°C to +40°C
- b) Operating temp. : -55°C to +125°C
- c) Resistance to solder heat : 260°C.10secs



**RoHS Compliant**

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### 6. ELECTRICAL CHARACTERISTICS : ( Rated Voltage : 200Vdc )

| Part Number  | Capacitance<br>( pF ) |
|--------------|-----------------------|
| V3N2R0 -B-10 | 2.0                   |
| V3N3R3 -B-10 | 3.3                   |
| V3N3R9 -B-10 | 3.9                   |
| V3N5R0 -B-10 | 5.0                   |
| V3N8R2 -B-10 | 8.2                   |
| V3N100 -B-10 | 10                    |
| V3N120 -B-10 | 12                    |
| V3N150 -B-10 | 15                    |
| V3N180 -B-10 | 18                    |
| V3N220 -B-10 | 22                    |
| V3N270 -B-10 | 27                    |
| V3N330 -B-10 | 33                    |
| V3N390 -B-10 | 39                    |
| V3N470 -B-10 | 47                    |
| V3N560 -B-10 | 56                    |
| V3N680 -B-10 | 68                    |
| V3N820 -B-10 | 82                    |
| V3N101 -B-10 | 100                   |
| V3N121 -B-10 | 120                   |

| Part Number  | Capacitance<br>( pF ) |
|--------------|-----------------------|
| V3N151 -B-10 | 150                   |
| V3N181 -B-10 | 180                   |
| V3N221 -B-10 | 220                   |
| V3N271 -B-10 | 270                   |
| V3N331 -B-10 | 330                   |
| V3N391 -B-10 | 390                   |
| V3N471 -B-10 | 470                   |
| V3N561 -B-10 | 560                   |
| V3N681 -B-10 | 680                   |

Tolerance code :

- C :  $\pm 0.25\text{pF}$
- D :  $\pm 0.50\text{pF}$
- J :  $\pm 5\%$
- K :  $\pm 10\%$
- M :  $\pm 20\%$



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### 6. ELECTRICAL CHARACTERISTICS : ( Rated Voltage : 250Vdc )

| Part Number  | Capacitance<br>( pF ) |
|--------------|-----------------------|
| V3N2R0 -C-10 | 2.0                   |
| V3N3R3 -C-10 | 3.3                   |
| V3N3R9 -C-10 | 3.9                   |
| V3N5R0 -C-10 | 5.0                   |
| V3N8R2 -C-10 | 8.2                   |
| V3N100 -C-10 | 10                    |
| V3N120 -C-10 | 12                    |
| V3N150 -C-10 | 15                    |
| V3N180 -C-10 | 18                    |
| V3N220 -C-10 | 22                    |
| V3N270 -C-10 | 27                    |
| V3N330 -C-10 | 33                    |
| V3N390 -C-10 | 39                    |
| V3N470 -C-10 | 47                    |
| V3N560 -C-10 | 56                    |
| V3N680 -C-10 | 68                    |
| V3N820 -C-10 | 82                    |
| V3N101 -C-10 | 100                   |
| V3N121 -C-10 | 120                   |

| Part Number  | Capacitance<br>( pF ) |
|--------------|-----------------------|
| V3N151 -C-10 | 150                   |
| V3N181 -C-10 | 180                   |
| V3N221 -C-10 | 220                   |
| V3N271 -C-10 | 270                   |
| V3N331 -C-10 | 330                   |
| V3N391 -C-10 | 390                   |
| V3N471 -C-10 | 470                   |
| V3N561 -C-10 | 560                   |
| V3N681 -C-10 | 680                   |

Tolerance code :

- : C :  $\pm 0.25\text{pF}$
- D :  $\pm 0.50\text{pF}$
- J :  $\pm 5\%$
- K :  $\pm 10\%$
- M :  $\pm 20\%$



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### 6. ELECTRICAL CHARACTERISTICS : ( Rated Voltage : 500Vdc )

| Part Number  | Capacitance<br>( pF ) |
|--------------|-----------------------|
| V3N2R0 -E-10 | 2.0                   |
| V3N3R3 -E-10 | 3.3                   |
| V3N3R9 -E-10 | 3.9                   |
| V3N5R0 -E-10 | 5.0                   |
| V3N8R2 -E-10 | 8.2                   |
| V3N100 -E-10 | 10                    |
| V3N120 -E-10 | 12                    |
| V3N150 -E-10 | 15                    |
| V3N180 -E-10 | 18                    |
| V3N220 -E-10 | 22                    |
| V3N270 -E-10 | 27                    |
| V3N330 -E-10 | 33                    |
| V3N390 -E-10 | 39                    |
| V3N470 -E-10 | 47                    |
| V3N560 -E-10 | 56                    |
| V3N680 -E-10 | 68                    |
| V3N820 -E-10 | 82                    |
| V3N101 -E-10 | 100                   |
| V3N121 -E-10 | 120                   |

| Part Number  | Capacitance<br>( pF ) |
|--------------|-----------------------|
| V3N151 -E-10 | 150                   |
| V3N181 -E-10 | 180                   |
| V3N221 -E-10 | 220                   |
| V3N271 -E-10 | 270                   |
| V3N331 -E-10 | 330                   |
| V3N391 -E-10 | 390                   |
| V3N471 -E-10 | 470                   |
| V3N561 -E-10 | 560                   |
| V3N681 -E-10 | 680                   |

Tolerance code :

- : C :  $\pm 0.25\text{pF}$
- D :  $\pm 0.50\text{pF}$
- J :  $\pm 5\%$
- K :  $\pm 10\%$
- M :  $\pm 20\%$



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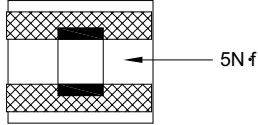
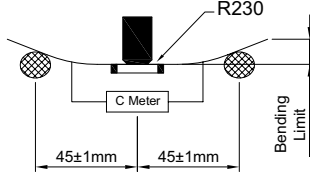
NOTE : Specifications subject to change without notice. Please check our website for latest information.

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### 7. RELIABILITY & TEST CONDITION :

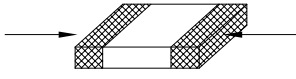
| ITEM                                | PERFORMANCE  | TEST CONDITION   |             |                 |   |                |           |       |             |                 |   |                |      |   |               |             |   |               |             |   |
|-------------------------------------|--|--|-------------|-----------------|---|----------------|-----------|-------|-------------|-----------------|---|----------------|------|---|---------------|-------------|---|---------------|-------------|---|
| Electrical Characteristics Test     |  |  |             |                 |   |                |           |       |             |                 |   |                |      |   |               |             |   |               |             |   |
| Visual                              | No abnormal exterior appearance  | Visual inspection  |             |                 |   |                |           |       |             |                 |   |                |      |   |               |             |   |               |             |   |
| Insulation Resistance               | 10,000MΩ or 500/CΩ<br>product whichever is smaller   | V ≤ 500V, Rated Voltage<br>V > 500V, Applied 500Vdc<br>Charge Time: 60sec<br>is applied less than 50mA current   |             |                 |   |                |           |       |             |                 |   |                |      |   |               |             |   |               |             |   |
| Capacitance                         | Within the specified tolerance<br>[Class I (N) & Class II]   | Class I :<br>C ≤ 100pF : Freq. = 1MHz±10%, Voltage = 1.0±0.2Vrms<br>C > 100pF : Freq. = 1KHz±10%   |             |                 |   |                |           |       |             |                 |   |                |      |   |               |             |   |               |             |   |
| Q                                   | Class I (N) :<br>More than 30pF : Q ≥ 1000<br>30pF & below : Q ≥ 400+20C<br>(C: Capacitance, pF)   | Class II :<br>X : Freq. = 1KHz±10%, Voltage = 1.0±0.2Vrms<br>Z/E : Freq. = 1KHz±10%, Voltage = 1.0±0.2Vrms<br>Perform a heat temp. at 150±5°C for 30min. then place room temp. for 24±2hr  |             |                 |   |                |           |       |             |                 |   |                |      |   |               |             |   |               |             |   |
| Tan δ                               | Class II (X) : 2.5% maximum<br>Class II (Z/E) : 4.0% maximum   |  |             |                 |   |                |           |       |             |                 |   |                |      |   |               |             |   |               |             |   |
| Withstanding Voltage                | No dielectric breakdown or mechanical breakdown  | 200V ≤ V < 500V : 200% rated voltage<br>500V ≤ V < 1000V : 150% rated voltage<br>1000 ≤ V : 120% rated voltage<br>for 1-5sec. Current is limited to less than 50mA.<br><br>* Withstanding voltage testing requires immersion of the element in a isolation fluid prevent arching on the chip surface, at voltage over 1000Vdc. |             |                 |   |                |           |       |             |                 |   |                |      |   |               |             |   |               |             |   |
| Temperature Capacitance Coefficient | Class I :<br><table border="1"> <thead> <tr> <th>Char.</th> <th>Temp. Range</th> <th>Cap. Change (%)</th> </tr> </thead> <tbody> <tr> <td>N</td> <td>-55°C ~ +125°C</td> <td>±30ppm/°C</td> </tr> </tbody> </table><br>Class II :<br><table border="1"> <thead> <tr> <th>Char.</th> <th>Temp. Range</th> <th>Cap. Change (%)</th> </tr> </thead> <tbody> <tr> <td>X</td> <td>-55°C ~ +125°C</td> <td>±15%</td> </tr> <tr> <td>E</td> <td>-30°C ~ +85°C</td> <td>+22% ~ -56%</td> </tr> <tr> <td>Z</td> <td>+10°C ~ +85°C</td> <td>+22% ~ -56%</td> </tr> </tbody> </table> | Char.  | Temp. Range | Cap. Change (%) | N | -55°C ~ +125°C | ±30ppm/°C | Char. | Temp. Range | Cap. Change (%) | X | -55°C ~ +125°C | ±15% | E | -30°C ~ +85°C | +22% ~ -56% | Z | +10°C ~ +85°C | +22% ~ -56% | Class I :<br>[C2-C1/C1(T2-T1)] x 100%<br><br>Class II :<br>(C2-C1)/C1 x 100%<br><br>T1 : Standard temperature (25°C)<br>T2 : Test temperature<br>C1 : Capacitance at standard temperature (25°C)<br>C2 : Capacitance at test temperature (T2) |
| Char.                               | Temp. Range  | Cap. Change (%)  |             |                 |   |                |           |       |             |                 |   |                |      |   |               |             |   |               |             |   |
| N                                   | -55°C ~ +125°C   | ±30ppm/°C  |             |                 |   |                |           |       |             |                 |   |                |      |   |               |             |   |               |             |   |
| Char.                               | Temp. Range  | Cap. Change (%)  |             |                 |   |                |           |       |             |                 |   |                |      |   |               |             |   |               |             |   |
| X                                   | -55°C ~ +125°C   | ±15%   |             |                 |   |                |           |       |             |                 |   |                |      |   |               |             |   |               |             |   |
| E                                   | -30°C ~ +85°C  | +22% ~ -56%  |             |                 |   |                |           |       |             |                 |   |                |      |   |               |             |   |               |             |   |
| Z                                   | +10°C ~ +85°C  | +22% ~ -56%  |             |                 |   |                |           |       |             |                 |   |                |      |   |               |             |   |               |             |   |
| Adhesive Strength of Termination    | No indication of peeling shall occur on the terminal electrode   | A 5N f pull force shall be applied for 10±1second<br><br>  |             |                 |   |                |           |       |             |                 |   |                |      |   |               |             |   |               |             |   |
| Resistance to Flexure of Substrate  | Appearance :<br>No mechanical damage shall be occur<br><br>C-Meter : Capacitance Change<br>N : ≤ ±5.0%<br>X : ≤ ±12.5%<br>E/Z : ≤ ±30.0%   | Bending shall be applied to the 1.0mm with 1.0mm/sec<br><br>   |             |                 |   |                |           |       |             |                 |   |                |      |   |               |             |   |               |             |   |

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### 7. RELIABILITY & TEST CONDITION :

| ITEM                         | PERFORMANCE  | TEST CONDITION   |                    |   |  |       |                    |     |              |       |             |  |      |            |            |   |                        |    |   |    |   |   |                        |    |   |    |   |
|------------------------------|--|--|--------------------|---|--|-------|--------------------|-----|--------------|-------|-------------|--|------|------------|------------|---|------------------------|----|---|----|---|---|------------------------|----|---|----|---|
| Solderability                | <p>More than 90% of the terminal surface is to be soldered newly, so metal part does not come out or dissolve</p>   | <p>Solder Temp. : 245±5°C<br/>                     Dip Time : 5±0.5sec<br/>                     Immersing Speed : 25±10% mm/s<br/>                     Solder : H63A<br/>                     Flux : Rosin<br/>                     Preheat : At 80~120°C for 10~30sec</p> |                    |   |  |       |                    |     |              |       |             |  |      |            |            |   |                        |    |   |    |   |   |                        |    |   |    |   |
| Resistance to Soldering Heat | <p>Appearance :<br/>                     No mechanical damage shall be occur</p> <p>Class I :</p> <table border="1"> <tr> <th>Char.</th> <th>Capacitance change</th> </tr> <tr> <td>N</td> <td>Within ±2.5% or ±0.25pF whichever is larger of initial value</td> </tr> </table> <p>Class II :</p> <table border="1"> <tr> <th>Char.</th> <th>Capacitance change</th> </tr> <tr> <td>X</td> <td>Within ±10%</td> </tr> <tr> <td>Z/E</td> <td>Within ±20%</td> </tr> </table> <p>Q(Class I), Tan δ(Class II),<br/>                     Insulation Resistance &amp; Withstand Voltage :<br/>                     To satisfy the specified initial value</p> | Char.  | Capacitance change | N | Within ±2.5% or ±0.25pF whichever is larger of initial value | Char. | Capacitance change | X   | Within ±10%  | Z/E   | Within ±20% | <p>Class II capacitor shall be set for 48±4 hrs at room temp. after 1 hr heat treatment at 150+0/-10°C before initial measure.<br/>                     Preheat : At 150±10°C for 60~120sec<br/>                     Dip : Solder Temp. of 260±5°C<br/>                     Dip Time : 10±1sec<br/>                     Immersing speed : 25±10% mm/s<br/>                     Solder : H63A<br/>                     Flux : Rosin</p> <p>Measure at room temp. after cooling for<br/>                     Class I : 24±2 hrs<br/>                     Class II : 48±4 hrs</p>   |      |            |            |   |                        |    |   |    |   |   |                        |    |   |    |   |
| Char.                        | Capacitance change   |  |                    |   |  |       |                    |     |              |       |             |  |      |            |            |   |                        |    |   |    |   |   |                        |    |   |    |   |
| N                            | Within ±2.5% or ±0.25pF whichever is larger of initial value   |  |                    |   |  |       |                    |     |              |       |             |  |      |            |            |   |                        |    |   |    |   |   |                        |    |   |    |   |
| Char.                        | Capacitance change   |  |                    |   |  |       |                    |     |              |       |             |  |      |            |            |   |                        |    |   |    |   |   |                        |    |   |    |   |
| X                            | Within ±10%  |  |                    |   |  |       |                    |     |              |       |             |  |      |            |            |   |                        |    |   |    |   |   |                        |    |   |    |   |
| Z/E                          | Within ±20%  |  |                    |   |  |       |                    |     |              |       |             |  |      |            |            |   |                        |    |   |    |   |   |                        |    |   |    |   |
| Temperature Cycle            | <p>Appearance :<br/>                     No mechanical damage shall be occur</p> <p>Class I :</p> <table border="1"> <tr> <th>Char.</th> <th>Capacitance change</th> </tr> <tr> <td>N</td> <td>Within ±2.5% or ±0.25pF whichever is larger of initial value</td> </tr> </table> <p>Class II :</p> <table border="1"> <tr> <th>Char.</th> <th>Capacitance change</th> </tr> <tr> <td>X/B</td> <td>Within ±7.5%</td> </tr> <tr> <td>Y/Z/E</td> <td>Within ±20%</td> </tr> </table> <p>Q(Class I), Tan δ(Class II) &amp;<br/>                     Insulation Resistance :<br/>                     To satisfy the specified initial value</p>               | Char.  | Capacitance change | N | Within ±2.5% or ±0.25pF whichever is larger of initial value | Char. | Capacitance change | X/B | Within ±7.5% | Y/Z/E | Within ±20% | <p>Class II capacitor shall be set for 48±4 hrs at room temp. after 1 hr heat treatment at 150+0/-10°C before initial measure.</p> <table border="1"> <thead> <tr> <th>Step</th> <th>Temp. (°C)</th> <th>Time (min)</th> </tr> </thead> <tbody> <tr> <td>1</td> <td>Min. rated temp. +0/-3</td> <td>30</td> </tr> <tr> <td>2</td> <td>25</td> <td>3</td> </tr> <tr> <td>3</td> <td>Min. rated temp. +3/-0</td> <td>30</td> </tr> <tr> <td>4</td> <td>25</td> <td>3</td> </tr> </tbody> </table> <p>Measure at room temp. after cooling for<br/>                     Class I : 24±2 hrs<br/>                     Class II : 48±4 hrs</p> <p>Solder the capacitor on P.C. board before testing</p> | Step | Temp. (°C) | Time (min) | 1 | Min. rated temp. +0/-3 | 30 | 2 | 25 | 3 | 3 | Min. rated temp. +3/-0 | 30 | 4 | 25 | 3 |
| Char.                        | Capacitance change   |  |                    |   |  |       |                    |     |              |       |             |  |      |            |            |   |                        |    |   |    |   |   |                        |    |   |    |   |
| N                            | Within ±2.5% or ±0.25pF whichever is larger of initial value   |  |                    |   |  |       |                    |     |              |       |             |  |      |            |            |   |                        |    |   |    |   |   |                        |    |   |    |   |
| Char.                        | Capacitance change   |  |                    |   |  |       |                    |     |              |       |             |  |      |            |            |   |                        |    |   |    |   |   |                        |    |   |    |   |
| X/B                          | Within ±7.5%   |  |                    |   |  |       |                    |     |              |       |             |  |      |            |            |   |                        |    |   |    |   |   |                        |    |   |    |   |
| Y/Z/E                        | Within ±20%  |  |                    |   |  |       |                    |     |              |       |             |  |      |            |            |   |                        |    |   |    |   |   |                        |    |   |    |   |
| Step                         | Temp. (°C)   | Time (min)   |                    |   |  |       |                    |     |              |       |             |  |      |            |            |   |                        |    |   |    |   |   |                        |    |   |    |   |
| 1                            | Min. rated temp. +0/-3   | 30   |                    |   |  |       |                    |     |              |       |             |  |      |            |            |   |                        |    |   |    |   |   |                        |    |   |    |   |
| 2                            | 25   | 3  |                    |   |  |       |                    |     |              |       |             |  |      |            |            |   |                        |    |   |    |   |   |                        |    |   |    |   |
| 3                            | Min. rated temp. +3/-0   | 30   |                    |   |  |       |                    |     |              |       |             |  |      |            |            |   |                        |    |   |    |   |   |                        |    |   |    |   |
| 4                            | 25   | 3  |                    |   |  |       |                    |     |              |       |             |  |      |            |            |   |                        |    |   |    |   |   |                        |    |   |    |   |
| Humidity                     | <p>Appearance :<br/>                     No mechanical damage shall be occur</p> <p>Class I :</p> <table border="1"> <tr> <th>Char.</th> <th>Capacitance change</th> </tr> <tr> <td>N</td> <td>Within ±5.0% or ±0.5pF whichever is larger of initial value</td> </tr> </table> <p>Class II :</p> <table border="1"> <tr> <th>Char.</th> <th>Capacitance change</th> </tr> <tr> <td>X</td> <td>Within ±15%</td> </tr> <tr> <td>Z/E</td> <td>Within ±30%</td> </tr> </table>   | Char.  | Capacitance change | N | Within ±5.0% or ±0.5pF whichever is larger of initial value  | Char. | Capacitance change | X   | Within ±15%  | Z/E   | Within ±30% | <p>Class II capacitor shall be set for 48±4 hrs at room temp. after 1 hr heat treatment at 150+0/-10°C before initial measure.<br/>                     Temperature : 40±2°C<br/>                     Relative Humidity : 90~95% RH<br/>                     Test Time : 500 +12/-0 hr</p> <p>Measure at room temp. after cooling for<br/>                     Class I : 24±2 hrs<br/>                     Class II : 48±4 hrs</p> <p>Solder the capacitor on P.C. board before testing</p>  |      |            |            |   |                        |    |   |    |   |   |                        |    |   |    |   |
| Char.                        | Capacitance change   |  |                    |   |  |       |                    |     |              |       |             |  |      |            |            |   |                        |    |   |    |   |   |                        |    |   |    |   |
| N                            | Within ±5.0% or ±0.5pF whichever is larger of initial value  |  |                    |   |  |       |                    |     |              |       |             |  |      |            |            |   |                        |    |   |    |   |   |                        |    |   |    |   |
| Char.                        | Capacitance change   |  |                    |   |  |       |                    |     |              |       |             |  |      |            |            |   |                        |    |   |    |   |   |                        |    |   |    |   |
| X                            | Within ±15%  |  |                    |   |  |       |                    |     |              |       |             |  |      |            |            |   |                        |    |   |    |   |   |                        |    |   |    |   |
| Z/E                          | Within ±30%  |  |                    |   |  |       |                    |     |              |       |             |  |      |            |            |   |                        |    |   |    |   |   |                        |    |   |    |   |

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### 7. RELIABILITY & TEST CONDITION :

| ITEM                          | PERFORMANCE   | TEST CONDITION |                    |   |  |       |                    |   |                    |     |                   |   |         |   |      |     |      |  |               |                 |                 |                    |                 |                    |                               |                    |
|-------------------------------|---|----------------|--------------------|---|--|-------|--------------------|---|--------------------|-----|-------------------|---|---------|---|------|-----|------|--|---------------|-----------------|-----------------|--------------------|-----------------|--------------------|-------------------------------|--------------------|
| Humidity                      | <p>Q(Class I) :<br/>More than 30pF : <math>Q \geq 350</math><br/>30pF &amp; below : <math>Q \geq 275 + 2.5 \times C</math></p> <p>Tan <math>\delta</math> (Class II) :</p> <table border="1"> <thead> <tr> <th>Char.</th> <th>Maximum</th> </tr> </thead> <tbody> <tr> <td>X</td> <td>5.0%</td> </tr> <tr> <td>Z/E</td> <td>5.0%</td> </tr> </tbody> </table> <p>Insulation Resistance :<br/>1,000M<math>\Omega</math> or 50/C <math>\Omega</math> whichever is smaller.</p>  | Char.          | Maximum            | X | 5.0%   | Z/E   | 5.0%               | <p>Class II capacitor shall be set for 48<math>\pm</math>4 hrs at room temp. after 1 hr heat treatment at 150+0/-10°C before initial measure.</p> <p>Temperature : 40<math>\pm</math>2°C<br/>Relative Humidity : 90~95% RH<br/>Test Time : 500 +12/-0 hr</p> <p>Measure at room temp. after cooling for<br/>Class I : 24<math>\pm</math>2 hrs<br/>Class II : 48<math>\pm</math>4 hrs</p> <p>Solder the capacitor on P.C. board before testing</p> |                    |     |                   |   |         |   |      |     |      |  |               |                 |                 |                    |                 |                    |                               |                    |
| Char.                         | Maximum   |                |                    |   |  |       |                    |   |                    |     |                   |   |         |   |      |     |      |  |               |                 |                 |                    |                 |                    |                               |                    |
| X                             | 5.0%  |                |                    |   |  |       |                    |   |                    |     |                   |   |         |   |      |     |      |  |               |                 |                 |                    |                 |                    |                               |                    |
| Z/E                           | 5.0%  |                |                    |   |  |       |                    |   |                    |     |                   |   |         |   |      |     |      |  |               |                 |                 |                    |                 |                    |                               |                    |
| High Temperature Load         | <p>Appearance :<br/>No mechanical damage shall be occur</p> <p>Class I :</p> <table border="1"> <thead> <tr> <th>Char.</th> <th>Capacitance change</th> </tr> </thead> <tbody> <tr> <td>N</td> <td>Within <math>\pm 3.0\%</math> or <math>\pm 0.3\text{pF}</math> whichever is larger of initial value</td> </tr> </tbody> </table> <p>Class II :</p> <table border="1"> <thead> <tr> <th>Char.</th> <th>Capacitance change</th> </tr> </thead> <tbody> <tr> <td>X</td> <td>Within <math>\pm 15\%</math></td> </tr> <tr> <td>Z/E</td> <td>Within <math>\pm 30\%</math></td> </tr> </tbody> </table> <p>Q(Class I) :<br/>More than 30pF : <math>Q \geq 350</math><br/>30pF &amp; below : <math>Q \geq 275 + 2.5 \times C</math></p> <p>Tan <math>\delta</math> (Class II) :</p> <table border="1"> <thead> <tr> <th>Char.</th> <th>Maximum</th> </tr> </thead> <tbody> <tr> <td>X</td> <td>5.0%</td> </tr> <tr> <td>Z/E</td> <td>5.0%</td> </tr> </tbody> </table> <p>Insulation Resistance :<br/>1,000M<math>\Omega</math> or 50/C <math>\Omega</math> whichever is smaller.<br/>(C in Farad)</p> | Char.          | Capacitance change | N | Within $\pm 3.0\%$ or $\pm 0.3\text{pF}$ whichever is larger of initial value  | Char. | Capacitance change | X   | Within $\pm 15\%$  | Z/E | Within $\pm 30\%$ | Char.   | Maximum | X | 5.0% | Z/E | 5.0% | <p>Class II capacitors applied DC voltage (following table) is applied for 1 hr at max. operation temp. <math>\pm 3^\circ\text{C}</math> then shall be set for 48<math>\pm</math>4 hrs at room temp. and the initial measurement shall be conducted.</p> <p>Applied Voltage :</p> <table border="1"> <thead> <tr> <th>Rated Voltage</th> <th>Applied Voltage</th> </tr> </thead> <tbody> <tr> <td>V <math>\leq</math> 250Vdc</td> <td>150% rated voltage</td> </tr> <tr> <td>Less than 1KVdc</td> <td>120% rated voltage</td> </tr> <tr> <td>More than 1KVdc (include 1KV)</td> <td>100% rated voltage</td> </tr> </tbody> </table> <p>Temp. : Max. operation temperature<br/>Test Time : 1000 +12/-0 hr<br/>Current Applied : 50mA max.</p> <p>Measure at room temp. after cooling for<br/>Class I : 24<math>\pm</math>2 hrs<br/>Class II : 48<math>\pm</math>4 hrs</p> | Rated Voltage | Applied Voltage | V $\leq$ 250Vdc | 150% rated voltage | Less than 1KVdc | 120% rated voltage | More than 1KVdc (include 1KV) | 100% rated voltage |
| Char.                         | Capacitance change  |                |                    |   |  |       |                    |   |                    |     |                   |   |         |   |      |     |      |  |               |                 |                 |                    |                 |                    |                               |                    |
| N                             | Within $\pm 3.0\%$ or $\pm 0.3\text{pF}$ whichever is larger of initial value   |                |                    |   |  |       |                    |   |                    |     |                   |   |         |   |      |     |      |  |               |                 |                 |                    |                 |                    |                               |                    |
| Char.                         | Capacitance change  |                |                    |   |  |       |                    |   |                    |     |                   |   |         |   |      |     |      |  |               |                 |                 |                    |                 |                    |                               |                    |
| X                             | Within $\pm 15\%$   |                |                    |   |  |       |                    |   |                    |     |                   |   |         |   |      |     |      |  |               |                 |                 |                    |                 |                    |                               |                    |
| Z/E                           | Within $\pm 30\%$   |                |                    |   |  |       |                    |   |                    |     |                   |   |         |   |      |     |      |  |               |                 |                 |                    |                 |                    |                               |                    |
| Char.                         | Maximum   |                |                    |   |  |       |                    |   |                    |     |                   |   |         |   |      |     |      |  |               |                 |                 |                    |                 |                    |                               |                    |
| X                             | 5.0%  |                |                    |   |  |       |                    |   |                    |     |                   |   |         |   |      |     |      |  |               |                 |                 |                    |                 |                    |                               |                    |
| Z/E                           | 5.0%  |                |                    |   |  |       |                    |   |                    |     |                   |   |         |   |      |     |      |  |               |                 |                 |                    |                 |                    |                               |                    |
| Rated Voltage                 | Applied Voltage   |                |                    |   |  |       |                    |   |                    |     |                   |   |         |   |      |     |      |  |               |                 |                 |                    |                 |                    |                               |                    |
| V $\leq$ 250Vdc               | 150% rated voltage  |                |                    |   |  |       |                    |   |                    |     |                   |   |         |   |      |     |      |  |               |                 |                 |                    |                 |                    |                               |                    |
| Less than 1KVdc               | 120% rated voltage  |                |                    |   |  |       |                    |   |                    |     |                   |   |         |   |      |     |      |  |               |                 |                 |                    |                 |                    |                               |                    |
| More than 1KVdc (include 1KV) | 100% rated voltage  |                |                    |   |  |       |                    |   |                    |     |                   |   |         |   |      |     |      |  |               |                 |                 |                    |                 |                    |                               |                    |
| Vibration                     | <p>Appearance :<br/>No mechanical damage shall be occur</p> <p>Class I :</p> <table border="1"> <thead> <tr> <th>Char.</th> <th>Capacitance change</th> </tr> </thead> <tbody> <tr> <td>N</td> <td>Within <math>\pm 2.5\%</math> or <math>\pm 0.25\text{pF}</math> whichever is larger of initial value</td> </tr> </tbody> </table> <p>Class II :</p> <table border="1"> <thead> <tr> <th>Char.</th> <th>Capacitance change</th> </tr> </thead> <tbody> <tr> <td>X</td> <td>Within <math>\pm 7.5\%</math></td> </tr> <tr> <td>Z/E</td> <td>Within <math>\pm 20\%</math></td> </tr> </tbody> </table> <p>Q(Class I), Tan <math>\delta</math>(Class II) &amp;<br/>Insulation Resistance :<br/>To satisfy the specified initial value</p>   | Char.          | Capacitance change | N | Within $\pm 2.5\%$ or $\pm 0.25\text{pF}$ whichever is larger of initial value | Char. | Capacitance change | X   | Within $\pm 7.5\%$ | Z/E | Within $\pm 20\%$ | <p>Solder the capacitor on P.C. board before testing</p> <p>Vibrate the capacitor with amplitude of 1.5mm P-P changing the frequencies from 10Hz to 55 Hz and back to 10Hz in about 1min.</p> <p>Repeat this for 2 hrs each in 3 perpendicular directions</p> |         |   |      |     |      |  |               |                 |                 |                    |                 |                    |                               |                    |
| Char.                         | Capacitance change  |                |                    |   |  |       |                    |   |                    |     |                   |   |         |   |      |     |      |  |               |                 |                 |                    |                 |                    |                               |                    |
| N                             | Within $\pm 2.5\%$ or $\pm 0.25\text{pF}$ whichever is larger of initial value  |                |                    |   |  |       |                    |   |                    |     |                   |   |         |   |      |     |      |  |               |                 |                 |                    |                 |                    |                               |                    |
| Char.                         | Capacitance change  |                |                    |   |  |       |                    |   |                    |     |                   |   |         |   |      |     |      |  |               |                 |                 |                    |                 |                    |                               |                    |
| X                             | Within $\pm 7.5\%$  |                |                    |   |  |       |                    |   |                    |     |                   |   |         |   |      |     |      |  |               |                 |                 |                    |                 |                    |                               |                    |
| Z/E                           | Within $\pm 20\%$   |                |                    |   |  |       |                    |   |                    |     |                   |   |         |   |      |     |      |  |               |                 |                 |                    |                 |                    |                               |                    |

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### 8. SOLDERING AND MOUNTING :

#### 8-1 Re-flow Soldering :

Preheat and gradual increase in temp. to the reflow temp. is recommended to decrease the potential of the thermal crack on the components. The recommended heating rate depends on the size of the component, however it should not exceed 3°C/sec.

#### 8-2 Wave Soldering :

Most of the components are wave soldered with solder at 230~250°C. Adequate care must be taken to prevent the potential of thermal cracks on the ceramic capacitors. Refer to Figure 2 for optimum soldering benefits.

#### 8-3 Hand Soldering :

Sudden temp. change in components, results in a temp. gradient, and therefore may cause internal thermal cracks in the components. In general a hand soldering method is not recommend unless proper preheating and handling practices have been taken. Care must also be taken not to touch the ceramic body of the capacitor with the tip of solder iron.

How to solder repair by solder iron :

1) Selection of soldering iron tip

The required temp. of solder iron for any type of repair depends on the type of the tip, the substrate material, and the solder land size

2) recommended solder iron condition

- a) Preheat substrate to (60°C~120°C).
- b) 350°C tip temperature (max)
- c) Never contact the ceramic with the iron tip
- d) 3.0mm tip diameter (max)
- e) Use a 30 watt (max.) soldering iron with tip diameter of 3.0mm
- f) Limit soldering time to 5 secs.

Cooling condition :

Natural cooling using air is recommended. If the chips are dipped into a solvent for cleaning, the temp. difference between the solvent and the chips must be less than 100°C.

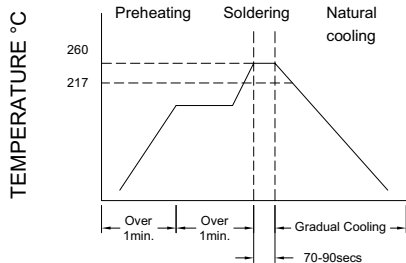


Figure 1. Re-flow Soldering

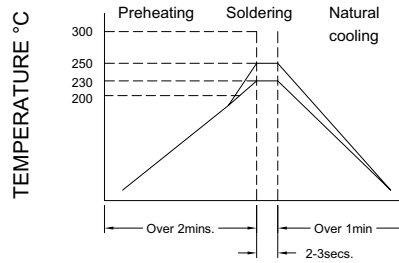


Figure 2. Wave Soldering

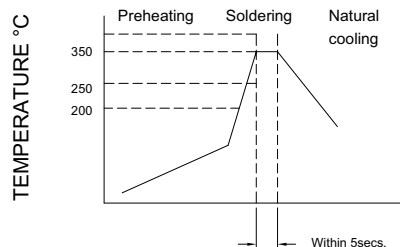


Figure 3. Hand Soldering



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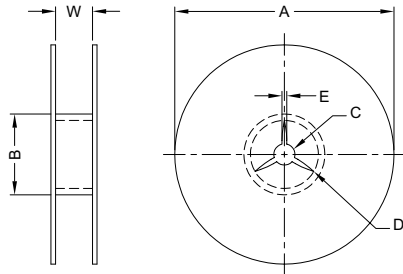
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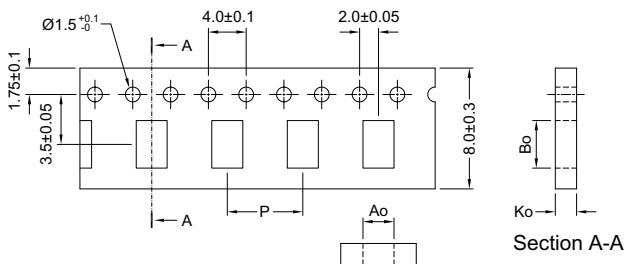
### 9. PACKAGING INFORMATION :

#### 9-1. Reel Dimension

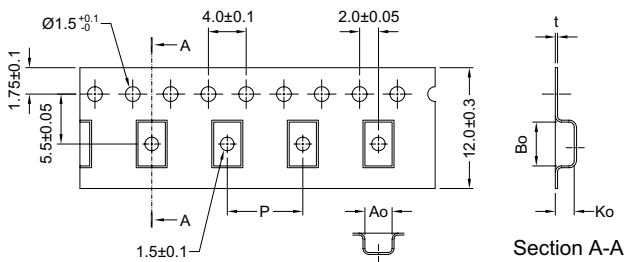


| TYPE | A(mm)    | B(mm)   | C(mm)  | D(mm)  | E(mm)   | W(mm)   |
|------|----------|---------|--------|--------|---------|---------|
| V2   | 382 Max. | 50 Min. | 13±0.5 | 21±0.8 | 2.0±0.5 | 10±0.15 |
| V3   | 382 Max. | 50 Min. | 13±0.5 | 21±0.8 | 2.0±0.5 | 10±0.15 |
| V4   | 382 Max. | 50 Min. | 13±0.5 | 21±0.8 | 2.0±0.5 | 10±0.15 |
| V5   | 382 Max. | 50 Min. | 13±0.5 | 21±0.8 | 2.0±0.5 | 10±0.15 |
| V6   | 178±0.2  | 60±0.2  | 13±0.5 | 21±0.8 | 2.0±0.5 | 13±0.3  |
| V7   | 178±0.2  | 60±0.2  | 13±0.5 | 21±0.8 | 2.0±0.5 | 13±0.3  |
| V8   | 178±0.2  | 60±0.2  | 13±0.5 | 21±0.8 | 2.0±0.5 | 13±0.3  |

#### 9-2. Tape Dimension



| TYPE | Ao(mm)  | Bo(mm)  | Ko(mm)   | P(mm)   |
|------|---------|---------|----------|---------|
| V2   | 1.1±0.2 | 1.9±0.2 | 1.1 MAX. | 4.0±0.1 |
| V3   | 1.5±0.2 | 2.3±0.2 | 1.1 MAX. | 4.0±0.1 |
| V4   | 1.9±0.2 | 3.5±0.2 | 1.1 MAX. | 4.0±0.1 |
| V5   | 2.9±0.2 | 3.6±0.2 | 1.1 MAX. | 4.0±0.1 |



| TYPE | Ao(mm)  | Bo(mm)  | Ko(mm)   | P(mm)   | t(mm)    |
|------|---------|---------|----------|---------|----------|
| V6   | 2.5±0.2 | 4.9±0.2 | 4.0 MAX. | 4.0±0.1 | 0.3 MAX. |
| V7   | 3.6±0.2 | 4.9±0.2 | 4.0 MAX. | 4.0±0.1 | 0.3 MAX. |
| V8   | 5.4±0.2 | 6.1±0.2 | 4.0 MAX. | 4.0±0.1 | 0.3 MAX. |



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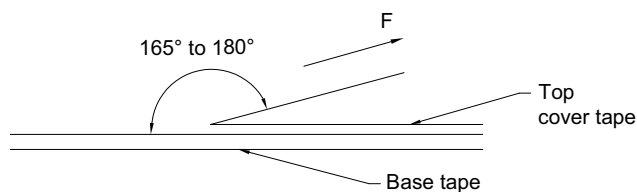
### 9-3. Packaging Quantity

| Tape Mat'l | V2 / V3                |                     | V4                     |  |                     |
|------------|------------------------|---------------------|------------------------|--|---------------------|
|            | $T \leq 0.90\text{mm}$ | $T > 0.90\text{mm}$ | $T \leq 0.90\text{mm}$ | $0.90\text{mm} < T \leq 1.25\text{mm}$ | $T > 1.25\text{mm}$ |
| Paper      | 4000pcs/reel           | -                   | 4000pcs/reel           | -                                      | -                   |
| Plastic    | -                      | 3000pcs/reel        | -                      | 3000pcs/reel                           | 2000pcs/reel        |

| Tape Mat'l | V5 / V6                |                     | V7 / V8                |                     |
|------------|------------------------|---------------------|------------------------|---------------------|
|            | $T \leq 1.25\text{mm}$ | $T > 1.25\text{mm}$ | $T \leq 2.20\text{mm}$ | $T > 2.20\text{mm}$ |
| Paper      | -                      | -                   | -                      | -                   |
| Plastic    | 3000pcs/reel           | 2000pcs/reel        | 1000pcs/reel           | 700pcs/reel         |

T : Chip Thickness

### 9-4. Tearing Off Force



The force for tearing off cover tape is 5 to 70 grams in the arrow direction under the following conditions.

### Storage

Store the capacitors where the temp. and relative humidity do not exceed  $40^\circ\text{C}$  and 70%RH. Capacitors are recommended to be used within 6 months from the date of manufacturing. Store the products in the original package and do not open the outer wrapped, polyethylene bag, till just before usage. If is open, seal it as soon as possible or keep it in a desiccant with a desiccation agent.



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