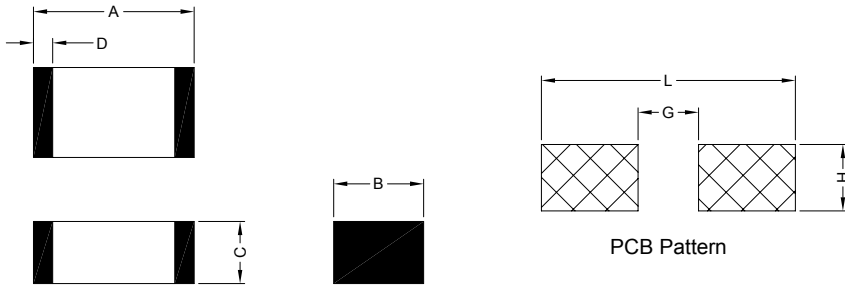


### 1. PART NO. EXPRESSION :

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

- (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

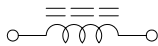
### 2. CONFIGURATION & DIMENSIONS :



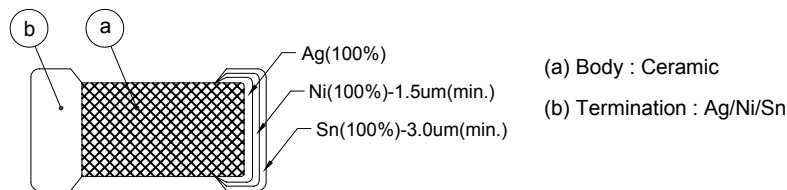
Unit:m/m

A	B	C	D	G	H	L
1.60±0.10	0.80±0.10	0.90 Max.	0.15 Min.	0.40 - 0.60	0.60 - 0.80	0.60 - 0.70

### 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



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

Part Number	Capacitance ( pF )
V2N2R0□-B-10	2.0
V2N3R3□-B-10	3.3
V2N3R9□-B-10	3.9
V2N5R0□-B-10	5.0
V2N8R2□-B-10	8.2
V2N100□-B-10	10
V2N120□-B-10	12
V2N150□-B-10	15
V2N180□-B-10	18
V2N220□-B-10	22
V2N270□-B-10	27
V2N330□-B-10	33
V2N390□-B-10	39
V2N470□-B-10	47
V2N560□-B-10	56
V2N680□-B-10	68
V2N820□-B-10	82
V2N101□-B-10	100
V2N121□-B-10	120
V2N151□-B-10	150

Tolerance code :

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



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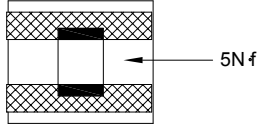
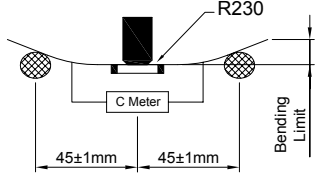
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### 7. RELIABILITY & TEST CONDITION :

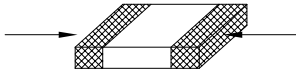
ITEM	PERFORMANCE	TEST CONDITION																		
Electrical Characteristics Test																				
Visual	No abnormal exterior appearance	Visual inspection																		
Insulation Resistance	10,000MΩ or 500/CΩ product whichever is smaller	V ≤ 500V, Rated Voltage V > 500V, Applied 500Vdc Charge Time: 60sec is applied less than 50mA current																		
Capacitance	Within the specified tolerance [Class I (N) & Class II]	Class I : C ≤ 100pF : Freq. = 1MHz±10%, Voltage = 1.0±0.2Vrms C > 100pF : Freq. = 1KHz±10%																		
Q	Class I (N) : More than 30pF : Q ≥ 1000 30pF & below : Q ≥ 400+20C (C: Capacitance, pF)	Class II : X : Freq. = 1KHz±10%, Voltage = 1.0±0.2Vrms Z/E : Freq. = 1KHz±10%, Voltage = 1.0±0.2Vrms 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 Class II (Z/E) : 4.0% maximum																			
Withstanding Voltage	No dielectric breakdown or mechanical breakdown	200V ≤ V < 500V : 200% rated voltage 500V ≤ V < 1000V : 150% rated voltage 1000 ≤ V : 120% rated voltage for 1-5sec. Current is limited to less than 50mA. <small>* Withstanding voltage testing requires immersion of the element in a isolation fluid prevent arching on the chip surface, at voltage over 1000Vdc.</small>																		
Temperature Capacitance Coefficient	Class I : <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> Class II : <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 : [C2-C1/C1(T2-T1)] x 100%  Class II : (C2-C1)/C1 x 100%  T1 : Standard temperature (25°C) T2 : Test temperature C1 : Capacitance at standard temperature (25°C) 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 																		
Resistance to Flexure of Substrate	Appearance : No mechanical damage shall be occur  C-Meter : Capacitance Change N : ≤ ±5.0% X : ≤ ±12.5% E/Z : ≤ ±30.0%	Bending shall be applied to the 1.0mm with 1.0mm/sec 																		

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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                      Dip Time : 5±0.5sec                      Immersing Speed : 25±10% mm/s                      Solder : H63A                      Flux : Rosin                      Preheat : At 80~120°C for 10~30sec</p>																									
Resistance to Soldering Heat	<p>Appearance :                      No mechanical damage shall be occur</p> <p>Class I :</p> <table border="1"> <tr> <td>Char.</td> <td>Capacitance change</td> </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> <td>Char.</td> <td>Capacitance change</td> </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),                      Insulation Resistance &amp; Withstand Voltage :                      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.                      Preheat : At 150±10°C for 60~120sec                      Dip : Solder Temp. of 260±5°C                      Dip Time : 10±1sec                      Immersing speed : 25±10% mm/s                      Solder : H63A                      Flux : Rosin</p> <p>Measure at room temp. after cooling for                      Class I : 24±2 hrs                      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 :                      No mechanical damage shall be occur</p> <p>Class I :</p> <table border="1"> <tr> <td>Char.</td> <td>Capacitance change</td> </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> <td>Char.</td> <td>Capacitance change</td> </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;                      Insulation Resistance :                      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                      Class I : 24±2 hrs                      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 :                      No mechanical damage shall be occur</p> <p>Class I :</p> <table border="1"> <tr> <td>Char.</td> <td>Capacitance change</td> </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> <td>Char.</td> <td>Capacitance change</td> </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.                      Temperature : 40±2°C                      Relative Humidity : 90~95% RH                      Test Time : 500 +12/-0 hr</p> <p>Measure at room temp. after cooling for                      Class I : 24±2 hrs                      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%																										

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																								
Humidity	<p>Q(Class I) :</p> <p>More than 30pF : <math>Q \geq 350</math>                      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 :                      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                      Relative Humidity : 90~95% RH                      Test Time : 500 +12/-0 hr</p> <p>Measure at room temp. after cooling for                      Class I : 24<math>\pm</math>2 hrs                      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 :                      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) :</p> <p>More than 30pF : <math>Q \geq 350</math>                      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 :                      1,000M<math>\Omega</math> or 50/C <math>\Omega</math> whichever is smaller.                      (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><math>V \leq 250\text{Vdc}</math></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                      Test Time : 1000 +12/-0 hr                      Current Applied : 50mA max.</p> <p>Measure at room temp. after cooling for                      Class I : 24<math>\pm</math>2 hrs                      Class II : 48<math>\pm</math>4 hrs</p>	Rated Voltage	Applied Voltage	$V \leq 250\text{Vdc}$	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																									
$V \leq 250\text{Vdc}$	150% rated voltage																									
Less than 1KVdc	120% rated voltage																									
More than 1KVdc (include 1KV)	100% rated voltage																									
Vibration	<p>Appearance :                      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;                      Insulation Resistance :                      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.

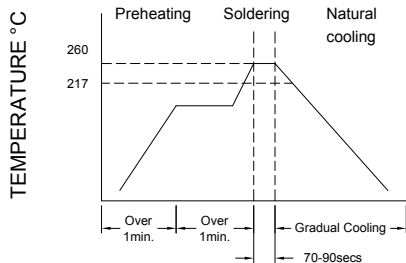


Figure 1. Re-flow Soldering

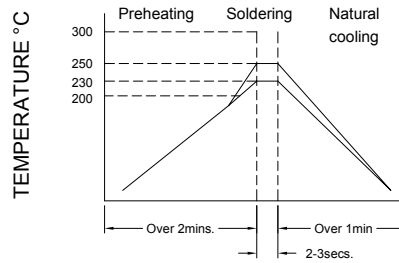


Figure 2. Wave Soldering

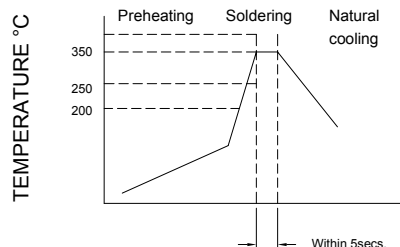


Figure 3. Hand Soldering



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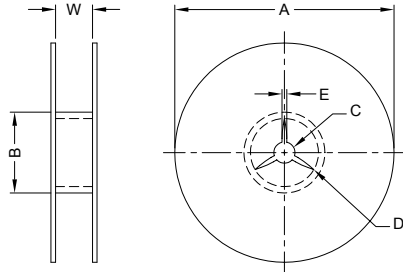
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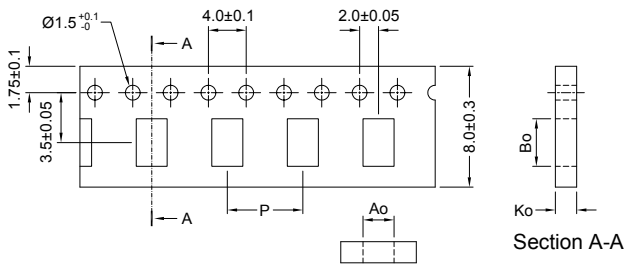
### 9. PACKAGING INFORMATION :

#### 9-1. Reel Dimension

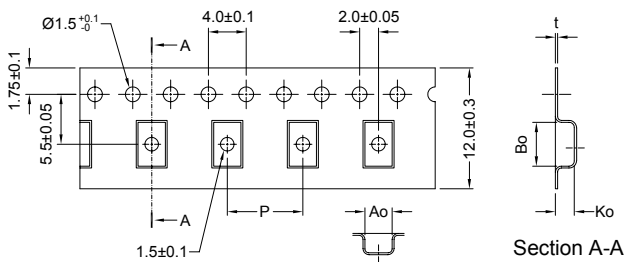


TYPE	A(mm)	B(mm)	C(mm)	D(mm)	E(mm)	W(mm)
V2	382 Max.	50 Min.	13±0.5	21±0.8	2.0±0.5	10±0.15
V3	382 Max.	50 Min.	13±0.5	21±0.8	2.0±0.5	10±0.15
V4	382 Max.	50 Min.	13±0.5	21±0.8	2.0±0.5	10±0.15
V5	382 Max.	50 Min.	13±0.5	21±0.8	2.0±0.5	10±0.15
V6	178±0.2	60±0.2	13±0.5	21±0.8	2.0±0.5	13±0.3
V7	178±0.2	60±0.2	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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15.01.2008



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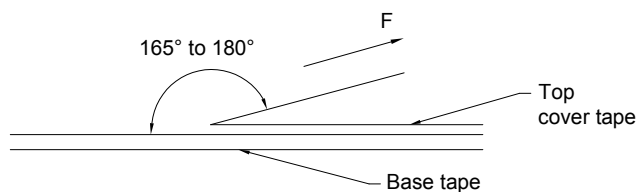
### 9-3. Packaging Quantity

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°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.



**RoHS Compliant**

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

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