HIGH VOLTAGE CHIP CAPACITORS

V4N SERIES

1. PART NO. EXPRESSION :

V 4 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)

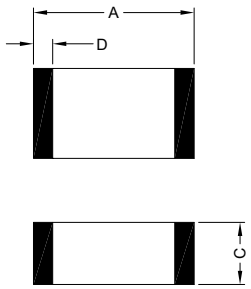
(c) Capacitance code : 2R0 = 2.0pF

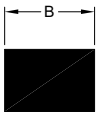
(d) Tolerance code

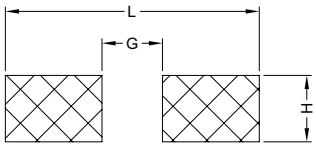
(e) Voltage code : B = 200Vdc

(f) 10 : Lead Free

2. CONFIGURATION & DIMENSIONS :





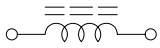


PCB Pattern

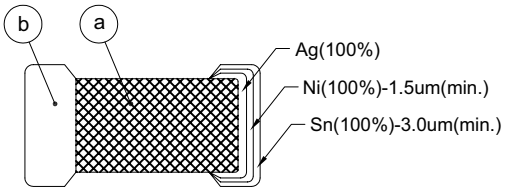
Unit:m/m

A	B	C	D	G	H	L
3.20±0.30	1.60±0.20	1.80 Max.	0.30 Min.	2.20 - 2.40	1.00 - 1.40	0.80 - 0.90

3. SCHEMATIC :



4. MATERIALS :



(a) Body : Ceramic

(b) Termination : Ag/Ni/Sn

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

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

15.01.2008

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

Part Number	Capacitance (pF)
V4N2R0 -B-10	2.0
V4N3R3 -B-10	3.3
V4N3R9 -B-10	3.9
V4N5R0 -B-10	5.0
V4N8R2 -B-10	8.2
V4N100 -B-10	10
V4N120 -B-10	12
V4N150 -B-10	15
V4N180 -B-10	18
V4N220 -B-10	22
V4N270 -B-10	27
V4N330 -B-10	33
V4N390 -B-10	39
V4N470 -B-10	47
V4N560 -B-10	56
V4N680 -B-10	68
V4N820 -B-10	82
V4N101 -B-10	100
V4N121 -B-10	120

Part Number	Capacitance (pF)
V4N151 -B-10	150
V4N181 -B-10	180
V4N221 -B-10	220
V4N271 -B-10	270
V4N331 -B-10	330
V4N391 -B-10	390
V4N471 -B-10	470
V4N561 -B-10	560
V4N681 -B-10	680
V4N821 -B-10	820
V4N102 -B-10	1000
V4N122 -B-10	1200
V4N152 -B-10	1500
V4N182 -B-10	1800
V4N222 -B-10	2200
V4N272 -B-10	2700
V4N332 -B-10	3300
V4N392 -B-10	3900
V4N472 -B-10	4700

Tolerance code :

: C : ±0.25pF

D : ±0.50pF

J : ±5%

K : ±10%

M : ±20%

RoHS Compliant

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

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

Part Number	Capacitance (pF)
V4N180 -C-10	18
V4N220 -C-10	22
V4N270 -C-10	27
V4N330 -C-10	33
V4N390 -C-10	39
V4N470 -C-10	47
V4N560 -C-10	56
V4N680 -C-10	68
V4N820 -C-10	82
V4N101 -C-10	100
V4N121 -C-10	120
V4N151 -C-10	150
V4N181 -C-10	180
V4N221 -C-10	220
V4N271 -C-10	270
V4N331 -C-10	330
V4N391 -C-10	390
V4N471 -C-10	470
V4N561 -C-10	560

Part Number	Capacitance (pF)
V4N681 -C-10	680
V4N821 -C-10	820
V4N102 -C-10	1000
V4N122 -C-10	1200
V4N152 -C-10	1500
V4N182 -C-10	1800
V4N222 -C-10	2200
V4N272 -C-10	2700
V4N332 -C-10	3300
V4N392 -C-10	3900
V4N472 -C-10	4700

Tolerance code :

: C : ±0.25pF

D : ±0.50pF

J : ±5%

K : ±10%

M : ±20%

RoHS Compliant

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

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

Part Number	Capacitance (pF)
V4N180 -E-10	18
V4N220 -E-10	22
V4N270 -E-10	27
V4N330 -E-10	33
V4N390 -E-10	39
V4N470 -E-10	47
V4N560 -E-10	56
V4N680 -E-10	68
V4N820 -E-10	82
V4N101 -E-10	100
V4N121 -E-10	120
V4N151 -E-10	150
V4N181 -E-10	180
V4N221 -E-10	220
V4N271 -E-10	270
V4N331 -E-10	330
V4N391 -E-10	390
V4N471 -E-10	470
V4N561 -E-10	560

Part Number	Capacitance (pF)
V4N681 -E-10	680
V4N821 -E-10	820
V4N102 -E-10	1000
V4N122 -E-10	1200
V4N152 -E-10	1500
V4N182 -E-10	1800

Tolerance code :

: C : ±0.25pF

D : ±0.50pF

J : ±5%

K : ±10%

M : ±20%

RoHS Compliant

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

6. ELECTRICAL CHARACTERISTICS : (Rated Voltage : 1KVdc)

Part Number	Capacitance (pF)
V4N100 -J-10	10
V4N120 -J-10	12
V4N150 -J-10	15
V4N180 -J-10	18
V4N220 -J-10	22
V4N270 -J-10	27
V4N330 -J-10	33
V4N390 -J-10	39
V4N470 -J-10	47
V4N560 -J-10	56
V4N680 -J-10	68
V4N820 -J-10	82
V4N101 -J-10	100
V4N121 -J-10	120
V4N151 -J-10	150
V4N181 -J-10	180
V4N221 -J-10	220
V4N271 -J-10	270
V4N331 -J-10	330

Part Number	Capacitance (pF)
V4N391 -J-10	390
V4N471 -J-10	470
V4N561 -J-10	560
V4N681 -J-10	680
V4N821 -J-10	820
V4N102 -J-10	1000

Tolerance code :

: C : ±0.25pF

D : ±0.50pF

J : ±5%

K : ±10%

M : ±20%

RoHS Compliant

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

6. ELECTRICAL CHARACTERISTICS : (Rated Voltage : 2KVdc)

Part Number	Capacitance (pF)
V4N100 -L-10	10
V4N120 -L-10	12
V4N150 -L-10	15
V4N180 -L-10	18
V4N220 -L-10	22
V4N270 -L-10	27
V4N330 -L-10	33
V4N390 -L-10	39
V4N470 -L-10	47
V4N560 -L-10	56
V4N680 -L-10	68
V4N820 -L-10	82
V4N101 -L-10	100
V4N121 -L-10	120
V4N151 -L-10	150
V4N181 -L-10	180
V4N221 -L-10	220
V4N271 -L-10	270
V4N331 -L-10	330
V4N391 -L-10	390

Tolerance code :

: C : ±0.25pF

D : ±0.50pF

J : ±5%

K : ±10%

M : ±20%

RoHS Compliant

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

6. ELECTRICAL CHARACTERISTICS : (Rated Voltage : 3KVdc)

Part Number	Capacitance (pF)
V4N2R0 -N-10	2.0
V4N3R3 -N-10	3.3
V4N3R9 -N-10	3.9
V4N5R0 -N-10	5.0
V4N8R0 -N-10	8.0
V4N8R2 -N-10	8.2
V4N100 -N-10	10
V4N120 -N-10	12
V4N150 -N-10	15
V4N180 -N-10	18
V4N220 -N-10	22
V4N270 -N-10	27
V4N330 -N-10	33
V4N390 -N-10	39

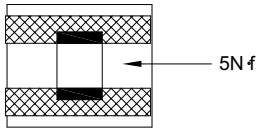
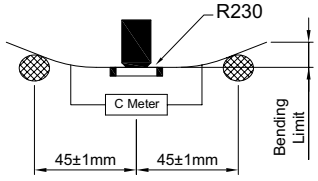
Tolerance code :

: C : ±0.25pF
D : ±0.50pF
J : ±5%
K : ±10%
M : ±20%

RoHS Compliant

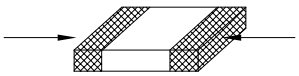
NOTE : Specifications subject to change without notice. Please check our website for latest information.

7. RELIABILITY & TEST CONDITION :

<table>
<tr><th>ITEM</th><th>PERFORMANCE</th><th>TEST CONDITION</th></tr>
<tr><td colspan="3">Electrical Characteristics Test</td></tr>
<tr><td>Visual</td><td>No abnormal exterior appearance</td><td>Visual inspection</td></tr>
<tr><td>Insulation
Resistance</td><td>10,000MΩ or 500/CΩ
product whichever is smaller</td><td>V ≦ 500V, Rated Voltage
V > 500V, Applied 500Vdc
Charge Time: 60sec
is applied less than 50mA current</td></tr>
<tr><td>Capacitance</td><td>Within the specified tolerance
[Class I (N) & Class II]</td><td rowspan="3">Class I :
C ≦ 100pF : Freq. = 1MHz±10%, Voltage = 1.0±0.2Vrms
C > 100pF : Freq. = 1KHz±10%
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</td></tr>
<tr><td>Q</td><td>Class I (N) :
More than 30pF : Q ≧ 1000
30pF & below : Q ≧ 400+20C
(C: Capacitance, pF)</td></tr>
<tr><td>Tan δ</td><td>Class II (X) : 2.5% maximum
Class II (Z/E) : 4.0% maximum</td></tr>
<tr><td>Withstanding Voltage</td><td>No dielectric breakdown or mechanical breakdown</td><td>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.
* Withstanding voltage testing requires immersion of the element in a isolation fluid prevent arching on the chip surface, at voltage over 1000Vdc.</td></tr>
<tr><td>Temperature Capacitance Coefficient</td><td>Class I :
<table><tr><th>Char.</th><th>Temp. Range</th><th>Cap. Change (%)</th></tr><tr><td>N</td><td>-55°C ~ +125°C</td><td>±30ppm/°C</td></tr></table>Class II :
<table><tr><th>Char.</th><th>Temp. Range</th><th>Cap. Change (%)</th></tr><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></table></td><td>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)</td></tr>
<tr><td>Adhesive Strength of Termination</td><td>No indication of peeling shall occur on the terminal electrode</td><td>A 5N f pull force shall be applied for 10±1second
  </td></tr>
<tr><td>Resistance to Flexure of Substrate</td><td>Appearance :
No mechanical damage shall be occur
C-Meter : Capacitance Change
N : ≦ ±5.0%
X : ≦ ±12.5%
E/Z : ≦ ±30.0%</td><td>Bending shall be applied to the 1.0mm with 1.0mm/sec
  </td></tr>
</table>

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

7. RELIABILITY & TEST CONDITION :

<table>
<tr><th>ITEM</th><th>PERFORMANCE</th><th>TEST CONDITION</th></tr>
<tr><td>Solderability</td><td>More than 90% of the terminal surface is to be soldered newly, so metal part does not come out or dissolve
  </td><td>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</td></tr>
<tr><td>Resistance to Soldering Heat</td><td>Appearance :
No mechanical damage shall be occur
Class I :<table><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>Class II :<table><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>Q(Class I), Tan δ(Class II),
Insulation Resistance & Withstand Voltage :
To satisfy the specified initial value</td><td>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
Measure at room temp. after cooling for
Class I : 24±2 hrs
Class II : 48±4 hrs</td></tr>
<tr><td>Temperature Cycle</td><td>Appearance :
No mechanical damage shall be occur
Class I :<table><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>Class II :<table><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>Q(Class I), Tan δ(Class II) &
Insulation Resistance :
To satisfy the specified initial value</td><td>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.<table><tr><th>Step</th><th>Temp. (°C)</th><th>Time (min)</th></tr><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></table>Measure at room temp. after cooling for
Class I : 24±2 hrs
Class II : 48±4 hrs
Solder the capacitor on P.C. board before testing</td></tr>
<tr><td>Humidity</td><td>Appearance :
No mechanical damage shall be occur
Class I :<table><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>Class II :<table><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></td><td>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
Measure at room temp. after cooling for
Class I : 24±2 hrs
Class II : 48±4 hrs
Solder the capacitor on P.C. board before testing</td></tr>
</table>

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

7. RELIABILITY & TEST CONDITION :

<table>
<tr><th>ITEM</th><th>PERFORMANCE</th><th>TEST CONDITION</th></tr>
<tr><td>Humidity</td><td>Q(Class I) :
More than 30pF : Q ≥ 350
30pF & below : Q ≥ 275 +2.5xC

Tan δ (Class II) :
<table><tr><th>Char.</th><th>Maximum</th></tr><tr><td>X</td><td>5.0%</td></tr><tr><td>Z/E</td><td>5.0%</td></tr></table>
Insulation Resistance :
1,000MΩ or 50/C Ω whichever is smaller.</td><td>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

Measure at room temp. after cooling for
Class I : 24±2 hrs
Class II : 48±4 hrs

Solder the capacitor on P.C. board before testing</td></tr>
<tr><td>High Temperature Load</td><td>Appearance :
No mechanical damage shall be occur

Class I :
<table><tr><th>Char.</th><th>Capacitance change</th></tr><tr><td>N</td><td>Within ±3.0% or ±0.3pF whichever is larger of initial value</td></tr></table>
Class II :
<table><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>
Q(Class I) :
More than 30pF : Q ≥ 350
30pF & below : Q ≥ 275 +2.5xC

Tan δ (Class II) :
<table><tr><th>Char.</th><th>Maximum</th></tr><tr><td>X</td><td>5.0%</td></tr><tr><td>Z/E</td><td>5.0%</td></tr></table>
Insulation Resistance :
1,000MΩ or 50/C Ω whichever is smaller.
(C in Farad)</td><td>Class II capacitors applied DC voltage (following table) is applied for 1 hr at max. operation temp. ±3°C then shall be set for 48±4 hrs at room temp. and the initial measurement shall be conducted.

Applied Voltage :
<table><tr><th>Rated Voltage</th><th>Applied Voltage</th></tr><tr><td>V ≤ 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></table>
Temp. : Max. operation temperature
Test Time : 1000 +12/-0 hr
Current Applied : 50mA max.

Measure at room temp. after cooling for
Class I : 24±2 hrs
Class II : 48±4 hrs</td></tr>
<tr><td>Vibration</td><td>Appearance :
No mechanical damage shall be occur

Class I :
<table><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>
Class II :
<table><tr><th>Char.</th><th>Capacitance change</th></tr><tr><td>X</td><td>Within ±7.5%</td></tr><tr><td>Z/E</td><td>Within ±20%</td></tr></table>
Q(Class I), Tan δ(Class II) &
Insulation Resistance :
To satisfy the specified initial value</td><td>Solder the capacitor on P.C. board before testing

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.

Repeat this for 2 hrs each in 3 perpendicular directions</td></tr>
</table>

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

8. SOLDERIND 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.

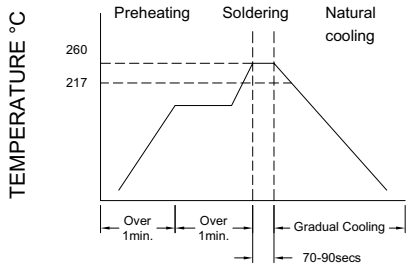


Figure 1. Re-flow Soldering

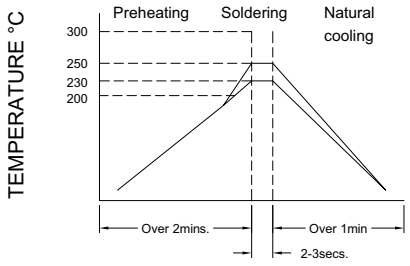


Figure 2. Wave Soldering

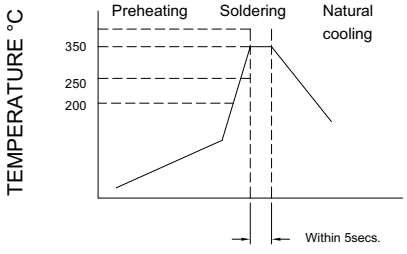


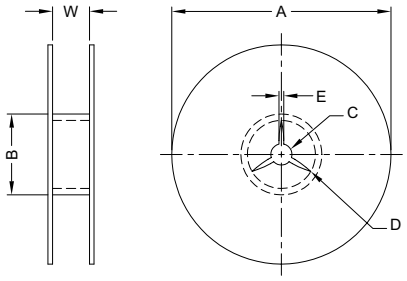
Figure 3. Hand Soldering

RoHS Compliant

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

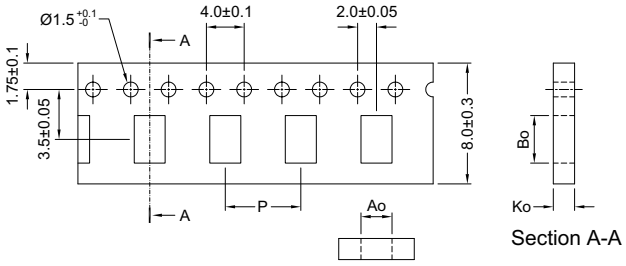
9. PACKAGING INFORMATION :

9-1. Reel Dimension

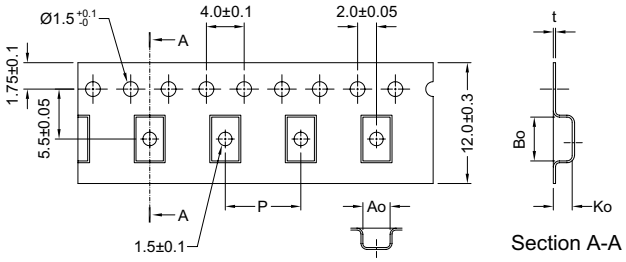


TYPE	A(mm)	B(mm)	C(mm)	D(mm)	E(mm)	W(mm)
V2	382 Max.	50 Min.	13±0.5	21±0.8	2.0±0.5	10±0.15
V3	382 Max.	50 Min.	13±0.5	21±0.8	2.0±0.5	10±0.15
V4	382 Max.	50 Min.	13±0.5	21±0.8	2.0±0.5	10±0.15
V5	382 Max.	50 Min.	13±0.5	21±0.8	2.0±0.5	10±0.15
V6	178±0.2	60±0.2	13±0.5	21±0.8	2.0±0.5	13±0.3
V7	178±0.2	60±0.2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

RoHS Compliant

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

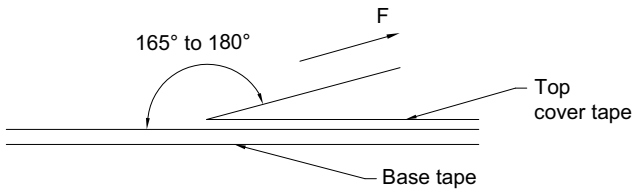
9-3. Packaging Quantity

Tape Mat'l	V2 / V3		V4		
	T≦0.90mm	T>0.90mm	T≦0.90mm	0.90mm<T≦1.25mm	T>1.25mm
Paper	4000pcs/reel	-	4000pcs/reel	-	-
Plastic	-	3000pcs/reel	-	3000pcs/reel	2000pcs/reel

Tape Mat'l	V5 / V6		V7 / V8	
	T≦1.25mm	T>1.25mm	T≦2.20mm	T>2.20mm
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.