



# SPECIFICATION

SPEC. No. \_\_\_\_\_

DATE : \_\_\_\_\_

Customer  
  
\_\_\_\_\_

CUSTOMER'S PRODUCT NAME

TDK PRODUCT NAME

MULTILAYER CERAMIC CHIP CAPACITORS

C1005, C1608, C2012, C3216, C3225 Type

X8R Characteristics

Please sign and return this specification to your local TDK representative.  
If orders are placed without this returned documentation, we must consider you found the specification acceptable.

## THIS SPECIFICATION IS RECEIVED

DATE: \_\_\_\_\_ YEAR \_\_\_\_\_ MONTH \_\_\_\_\_ DAY \_\_\_\_\_

TDK-EPC Corporation  
1-13-1, Nihonbashi, Chuo-ku, Tokyo  
103-0027, Japan

### ENGINEERING

ISSUED	CHECKED	APPROVED
DATE	DATE	DATE

Sales Office \_\_\_\_\_

Sales Tel. \_\_\_\_\_ ( ) \_\_\_\_\_

PRODUCT CLASSIFICATION  
CODE

040320

## 1. SCOPE

This specification is applicable to chip type multilayer ceramic capacitors with a priority over other relevant specifications. Production places defined in this specification shall be TDK-EPC Corporation Japan, TDK (Suzhou) Co.,Ltd, TDK-EPC HONG KONG LIMITED, TDK (Malaysia) Sdn.Bhd, and TDK Components U.S.A. Inc.

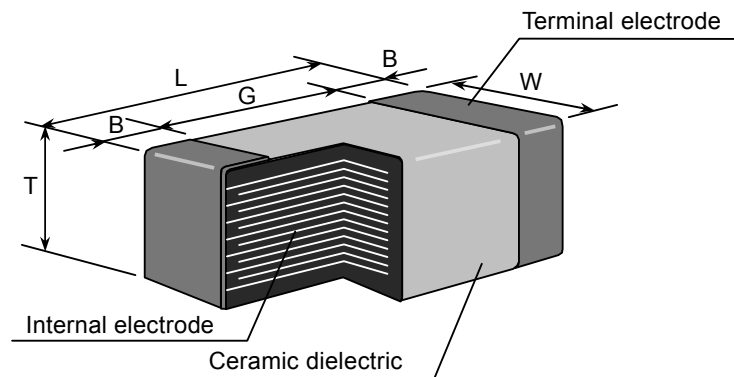
### EXPLANATORY NOTE:

This specification warrants the quality of the TDK ceramic chip capacitor. The product should be evaluated and confirmed in your product before use. If the use of the product exceeds the bounds of this specification, we can not guarantee its quality and/or reliability.

## 2. CODE CONSTRUCTION

(Example)      C1608              X8R              1E              104              K              T  
                                   (1)                            (2)                            (3)                            (4)                            (5)                            (6)

### 1. Type



Please refer to product list for the dimension of each product. See Section 9 for inside structure and material.

### 2. Temperature Characteristics (Details are shown in Section 8, No.6)

### 3. Rated Voltage

Symbol	Rated Voltage
2 A	100 V DC
1 H	50 V DC
1 E	25 V DC
1 C	16 V DC

### 4. Rated Capacitance

Stated in three digits and in units of pico farads (pF). The first and second digits identify the first and second significant figures of the capacitance; the third digit identifies the multiplier.

Example      222 → 2,200pF  
                   104 → 100,000pF

### 5. Capacitance tolerance

Symbol	Tolerance
K	±10 %
M	±20 %

### 6. Packaging

Symbol	Packaging
B	Bulk (C1005 type is not applicable.)
T	Taping

### 3. RATED CAPACITANCE AND TOLERANCE

#### 3.1 Standard combination of rated capacitance and tolerances

Temperature Characteristics	Capacitance tolerance	Rated capacitance
X8R	K ( $\pm 10\%$ )	E- 6 series
	M ( $\pm 20\%$ )	

#### 3.2 Capacitance Step in E series

E series	Capacitance Step					
E- 6	1.0	1.5	2.2	3.3	4.7	6.8

### 4. OPERATING TEMPERATURE RANGE

T.C.	Min. operating Temperature	Max. operating Temperature	Reference Temperature
X8R	-55°C	150°C	25°C

### 5. STORING CONDITION AND TERM

5 to 40°C at 20 to 70%RH  
6 months Max.

### 6. P.C. BOARD

When mounting on an aluminum substrate, large case sizes such as C3225, C4532 and C5750 types are more likely to be affected by heat stress from the substrate. Please inquire separate specification for the large case sizes when mounted on the substrate.

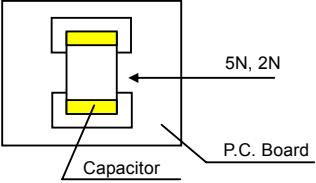
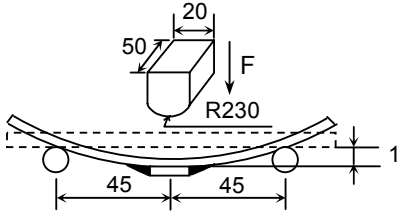
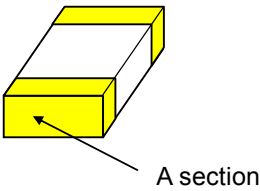
### 7. INDUSTRIAL WASTE DISPOSAL

Dispose this product as industrial waste in accordance with local Industrial Waste Laws.

## 8. PERFORMANCE

No.	Item	Performance	Test or inspection method												
1	External Appearance	No defects which may affect performance.	Inspect with magnifying glass(3×)												
2	Insulation Resistance	10,000MΩ or 500 MΩ · μF min.	Apply rated voltage for 60s.												
3	Voltage Proof	Withstand test voltage without insulation breakdown or other damage.	2.5 times of rated voltage Above DC voltage shall be applied for 1~5s. Charge / discharge current shall not exceed 50mA.												
4	Capacitance	Within the specified capacitance tolerance.	<table border="1"> <thead> <tr> <th>Measuring frequency</th> <th>Measuring voltage</th> </tr> </thead> <tbody> <tr> <td>1kHz±10%</td> <td>1.0±0.2 Vrms.</td> </tr> </tbody> </table>	Measuring frequency	Measuring voltage	1kHz±10%	1.0±0.2 Vrms.								
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5	Dissipation Factor	Characteristics <table border="1"> <thead> <tr> <th>T.C.</th> <th>D.F.</th> </tr> </thead> <tbody> <tr> <td>X8R</td> <td>0.03max.</td> </tr> </tbody> </table>	T.C.	D.F.	X8R	0.03max.	<table border="1"> <thead> <tr> <th>Measuring frequency</th> <th>Measuring voltage</th> </tr> </thead> <tbody> <tr> <td>1kHz±10%</td> <td>1.0±0.2 Vrms.</td> </tr> </tbody> </table>	Measuring frequency	Measuring voltage	1kHz±10%	1.0±0.2 Vrms.				
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6	Temperature Characteristics of Capacitance	Capacitance Change (%) <table border="1"> <thead> <tr> <th>No voltage applied</th> </tr> </thead> <tbody> <tr> <td>X8R : ±15</td> </tr> </tbody> </table>	No voltage applied	X8R : ±15	Capacitance shall be measured by the steps shown in the following table, after thermal equilibrium is obtained for each step. ΔC be calculated ref. STEP3 reading. <table border="1"> <thead> <tr> <th>Step</th> <th>Temperature(°C)</th> </tr> </thead> <tbody> <tr> <td>1</td> <td>Reference temp. ±2</td> </tr> <tr> <td>2</td> <td>Min. operating temp. ±2</td> </tr> <tr> <td>3</td> <td>Reference temp. ±2</td> </tr> <tr> <td>4</td> <td>Max. operating temp.±2</td> </tr> </tbody> </table>	Step	Temperature(°C)	1	Reference temp. ±2	2	Min. operating temp. ±2	3	Reference temp. ±2	4	Max. operating temp.±2
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(8. Performance, continued)

No.	Item	Performance	Test or inspection method
7	Robustness of Terminations	No sign of termination coming off, breakage of ceramic, or other abnormal signs.	<p>Reflow solder the capacitor on a P.C. board (shown in Appendix 1) and apply a pushing force of 5N (C1608, C2012, C3216, C3225 type) and 2N (C1005 type) for 10±1s.</p>  <p>The diagram shows a yellow capacitor mounted on a P.C. board. A horizontal arrow labeled '5N, 2N' points to the capacitor, indicating the direction and magnitude of the applied force.</p>
8	Bending	No mechanical damage.	<p>Reflow solder the capacitor on a P.C. board (shown in Appendix 2) and bend 1mm as illustrated:</p>  <p>The diagram illustrates a capacitor being bent. A force 'F' is applied downwards to the center of the capacitor. The bending radius is labeled 'R230'. The distance from the center of the capacitor to the points of contact on the board is 45 mm on both sides. The height of the capacitor is 50 mm, and its width is 20 mm. The board is bent to a height of 1 mm at the center.</p> <p>(Unit : mm)</p>
9	Solderability	<p>New solder to cover over 75% of termination. 25% may have pinholes or rough spots but not concentrated in one spot. Ceramic surface of "A sections" shall not be exposed due to melting or shifting of termination material.</p>  <p>The diagram shows a yellow rectangular capacitor with a cross-section labeled 'A section' indicated by an arrow pointing to the top surface.</p>	<p>Completely soak both terminations in solder at 235±5°C for 2±0.5s.</p> <p>Solder : H63A(JIS Z 3282)</p> <p>Flux : Isopropyl alcohol (JIS K 8839) Rosin (JIS K 5902) 25% solid solution.</p>

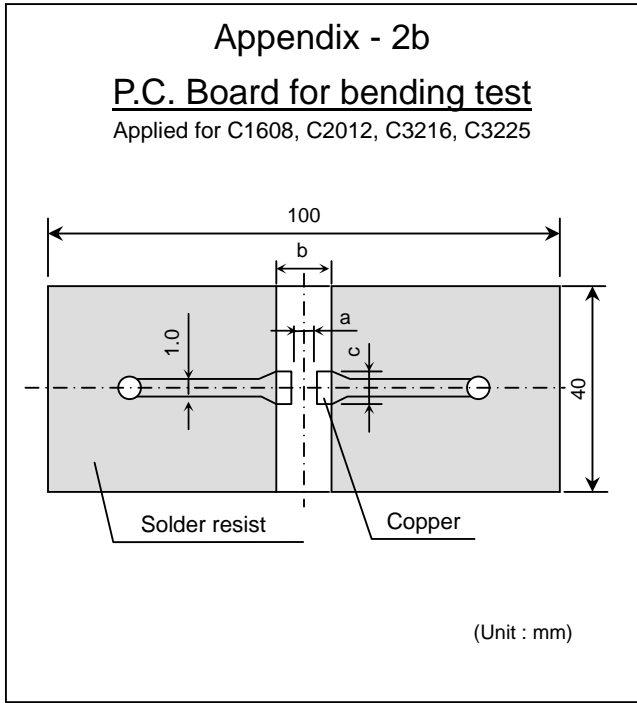
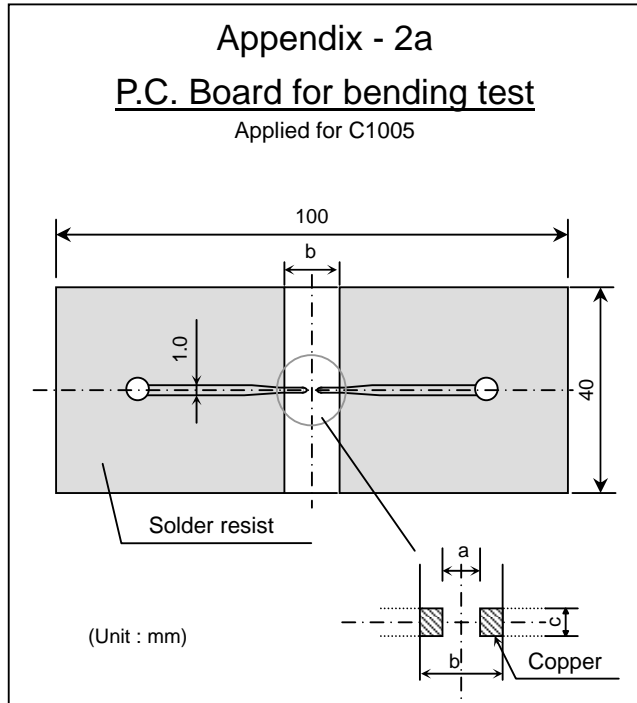
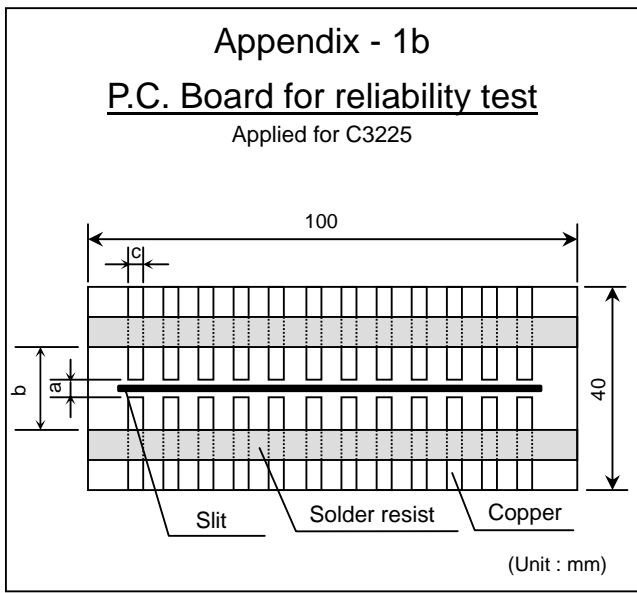
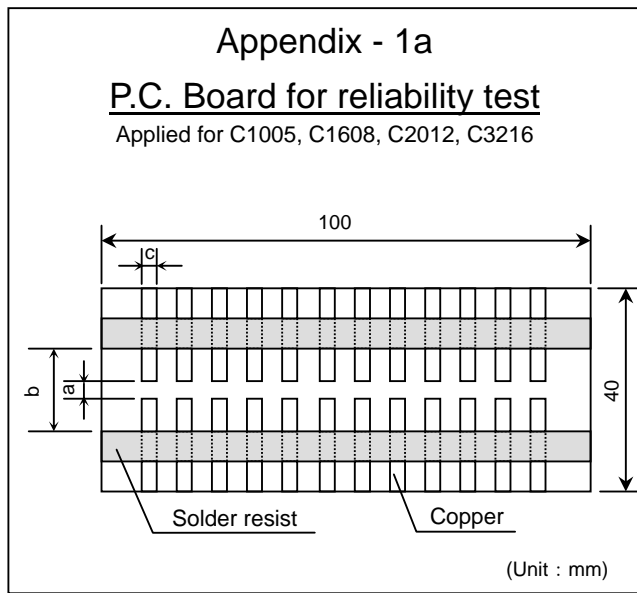
## (8. Performance, continued)

No.	Item		Performance	Test or inspection method															
10	Resistance to solder heat	External appearance	No cracks are allowed and terminations shall be covered at least 60% with new solder.	<p>Completely soak both terminations in solder at 260±5°C for 5±1s.</p> <p>Preheating condition Temp. : 150±10°C Time : 1~2min.</p> <p>Flux : Isopropyl alcohol(JIS K 8839) Rosin(JIS K 5902) 25% solid solution.</p> <p>Solder : H63A(JIS Z 3282)</p> <p>Leave the capacitor in ambient conditions for 48±4h before measurement.</p>															
		Capacitance	Characteristics		Change from the value before test														
			X8R		±7.5 %														
		D.F.	Meet the initial spec.																
		Insulation Resistance	Meet the initial spec.																
		Voltage proof	No insulation breakdown or other damage.																
11	Vibration	External appearance	No mechanical damage.	<p>Reflow solder the capacitor on a P.C. board (shown in Appendix 1) before testing.</p> <p>Vibrate the capacitor with amplitude of 1.5mm P-P changing the frequencies from 10Hz to 55Hz and back to 10Hz in after 1min.</p> <p>Repeat this for 2h each in 3 perpendicular directions.</p>															
		Capacitance	Characteristics		Change from the value before test														
			X8R		±7.5 %														
		D.F.	Meet the initial spec.																
12	Temperature cycle	External appearance	No mechanical damage.	<p>Reflow solder the capacitors on P.C. board (shown in Appendix 1) before testing.</p> <p>Expose the capacitor in the condition step 1 through 4, and repeat 5 times consecutively.</p> <p>Leave the capacitors in ambient conditions for 48±4h before measurement.</p> <table border="1" data-bbox="987 1440 1390 1722"> <thead> <tr> <th>Step</th> <th>Temperature (°C)</th> <th>Time (min.)</th> </tr> </thead> <tbody> <tr> <td>1</td> <td>Min. operating temp. ±3</td> <td>30±3</td> </tr> <tr> <td>2</td> <td>Reference temp. per para. 4.</td> <td>2~5</td> </tr> <tr> <td>3</td> <td>Max. operating temp. ±2</td> <td>30±2</td> </tr> <tr> <td>4</td> <td>Reference temp. per para. 4.</td> <td>2~5</td> </tr> </tbody> </table>	Step	Temperature (°C)	Time (min.)	1	Min. operating temp. ±3	30±3	2	Reference temp. per para. 4.	2~5	3	Max. operating temp. ±2	30±2	4	Reference temp. per para. 4.	2~5
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Capacitance	Characteristics	Change from the value before test																	
	X8R	±7.5 %																	
D.F.	Meet the initial spec.																		
Insulation Resistance	Meet the initial spec.																		
Voltage proof	No insulation breakdown or other damage.																		

## (8. Performance, continued)

No.	Item		Performance	Test or inspection method	
13	Moisture Resistance (Steady State)	External appearance	No mechanical damage.	<p>Reflow solder the capacitor on P.C. board (shown in Appendix 1) before testing.</p> <p>Leave at temperature <math>40\pm 2^{\circ}\text{C}</math>, 90 to 95%RH for 500 +24,0h.</p> <p>Leave the capacitor in ambient conditions for <math>48\pm 4\text{h}</math> before measurement.</p>	
		Capacitance	Characteristics		Change from the value before test
			X8R		$\pm 12.5\%$
		D.F.	200% of initial spec max.		
		Insulation Resistance	1,000M $\Omega$ or 50 M $\Omega$ · $\mu\text{F}$ min.		
14	Moisture Resistance	External appearance	No mechanical damage.	<p>Reflow solder the capacitor on P.C. board (shown in Appendix 1) before testing.</p> <p>Apply the rated voltage at temperature <math>40\pm 2^{\circ}\text{C}</math> and 90 to 95%RH for 500 +24,0h.</p> <p>Charge/discharge current shall not exceed 50mA.</p> <p>Leave the capacitor in ambient conditions for <math>48\pm 4\text{h}</math> before measurement.</p> <p>Voltage conditioning: Voltage treats the capacitor under testing temperature and voltage for 1 hour.</p> <p>Leave the capacitor in ambient condition for <math>48\pm 4\text{h}</math> before measurement.</p> <p>Use this measurement for initial value.</p>	
		Capacitance	Characteristics		Change from the value before test
			X8R		$\pm 12.5\%$
		D.F.	200% of initial spec max.		
		Insulation Resistance	500M $\Omega$ or 25 M $\Omega$ · $\mu\text{F}$ min.		
15	Life	External appearance	No mechanical damage.	<p>Reflow solder the capacitor on P.C. board (shown in Appendix 1) before testing.</p> <p>Apply 2× rated voltage at maximum operating temperature <math>\pm 3^{\circ}\text{C}</math> for 1,000 +48,0h.</p> <p>Charge/discharge current shall not exceed 50mA.</p> <p>Leave the capacitor in ambient conditions for <math>48\pm 4\text{h}</math> before measurement.</p> <p>Voltage conditioning : Voltage treats the capacitor under testing temperature and voltage for 1 hour.</p> <p>Leave the capacitor in ambient conditions for <math>48\pm 4\text{h}</math> before measurement.</p> <p>Use this measurement for initial value.</p>	
		Capacitance	Characteristics		Change from the value before test
			X8R		$\pm 15\%$
		D.F.	200% of initial spec max.		
		Insulation Resistance	1,000M $\Omega$ or 50 M $\Omega$ · $\mu\text{F}$ min.		

\*As for the initial measurement of capacitors on number 6,10,11,12 and 13, leave capacitor at  $150 - 10, 0^{\circ}\text{C}$  for 1h and measure the value after leaving the capacitor for  $48\pm 4\text{h}$  in ambient conditions.



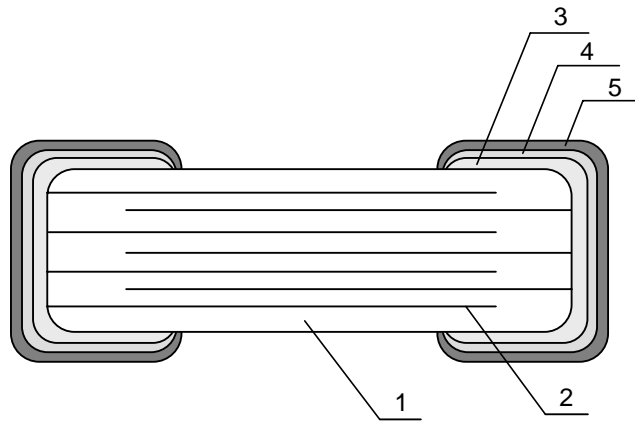
Material: Glass Epoxy (As per JIS C6484 GE4)

P.C. Board thickness : Appendix-2a                      0.8mm  
    Appendix-1a, 1b, 2b            1.6mm

- Copper (thickness 0.035mm)
- Solder resist

TDK (EIA style)	Dimensions (mm)		
	a	b	c
C1005 (CC0402)	0.4	1.5	0.5
C1608 (CC0603)	1.0	3.0	1.2
C2012 (CC0805)	1.2	4.0	1.65
C3216 (CC1206)	2.2	5.0	2.0
C3225 (CC1210)	2.2	5.0	2.9

## 9. INSIDE STRUCTURE AND MATERIAL



No.	NAME	MATERIAL
		Class 2
1	Dielectric	BaTiO <sub>3</sub>
2	Electrode	Nickel (Ni)
3	Termination	Copper (Cu)
4		Nickel (Ni)
5		Tin (Sn)

## 10. RECOMMENDATION

As for C3225 type, it is recommended to provide a slit (about 1mm wide) in the board under the components to improve washing flux. Please make sure to completely remove all cleaning solvents.

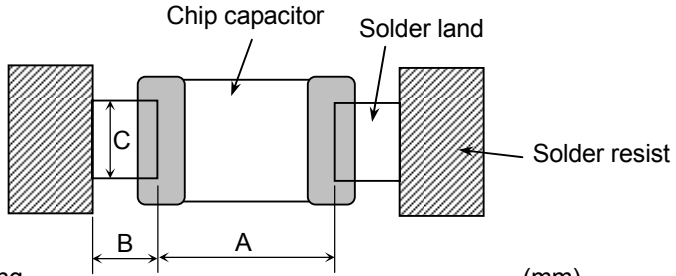
## 11. SOLDERING CONDITION

For C1608 (CC0603) ~ C3216 (CC1206) case size, TDK recommends reflow or wave soldering. Smaller case sizes, C0603 (CC0201) ~ C1005 (CC0402), and larger case sizes, C3225 (CC1210) ~ C5750 (CC2220), should use reflow solder only. See "Caution" Section No.3 for details.

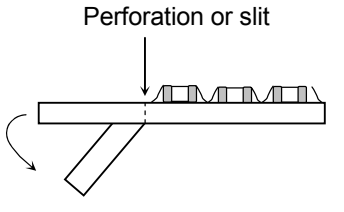
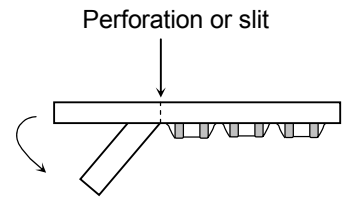
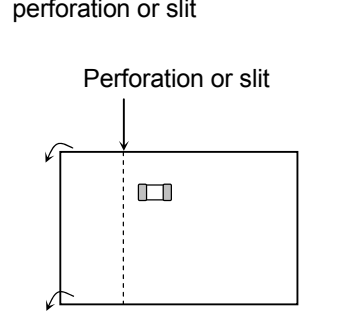
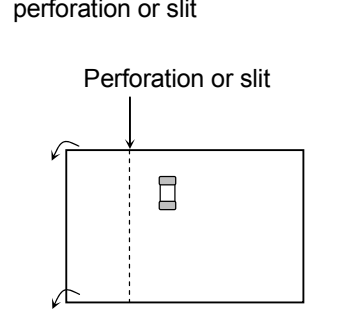
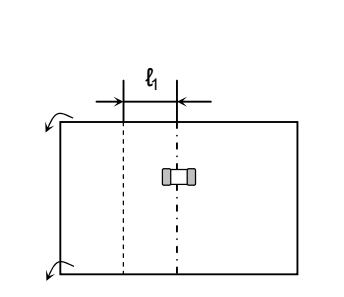
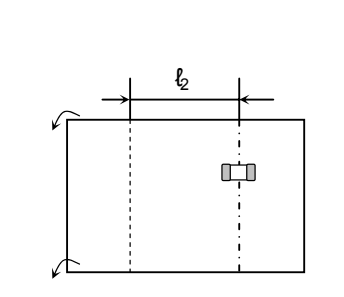
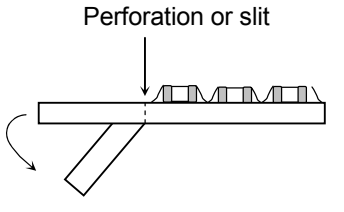
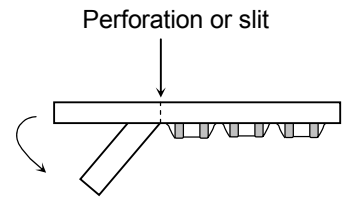
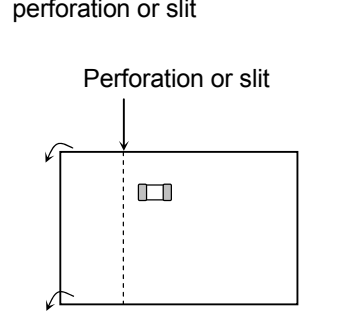
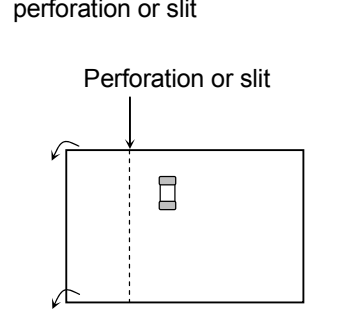
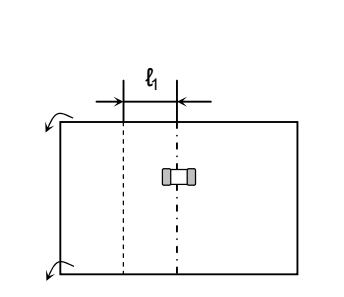
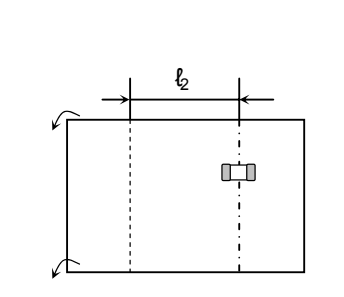
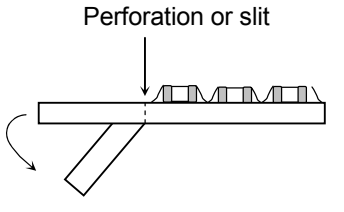
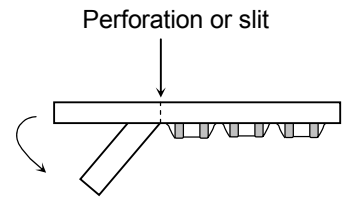
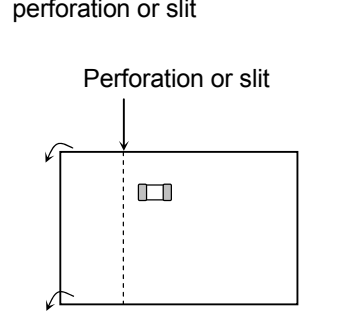
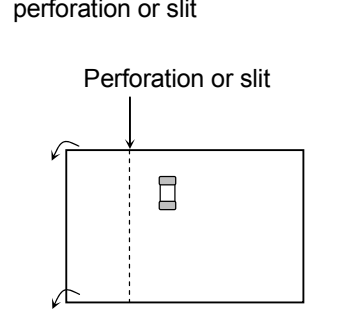
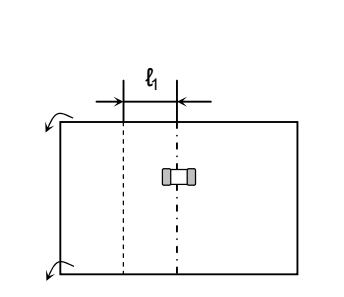
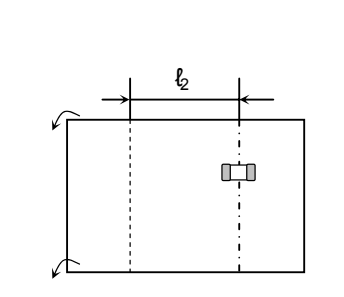
## 12. CAUTION

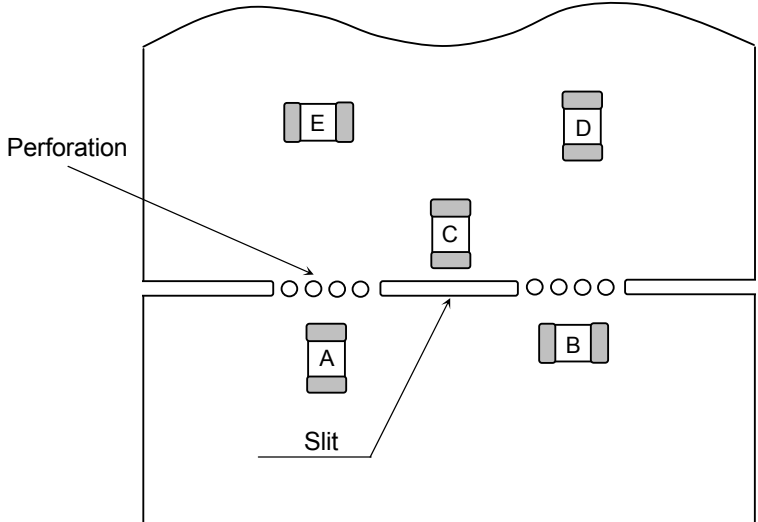
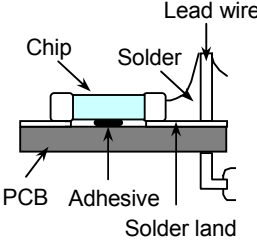
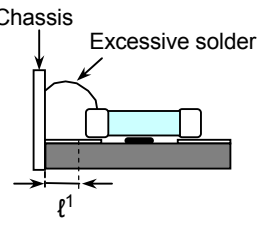
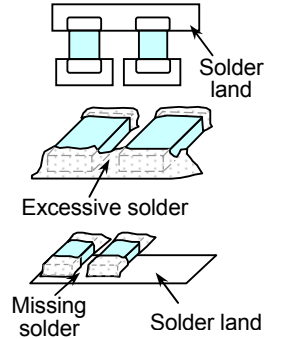
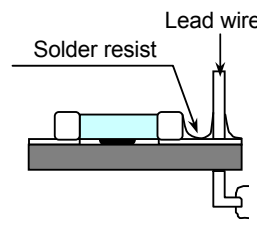
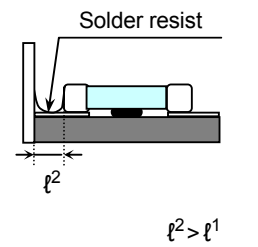
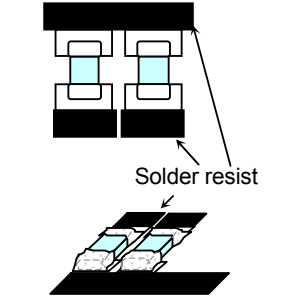
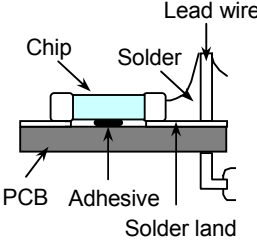
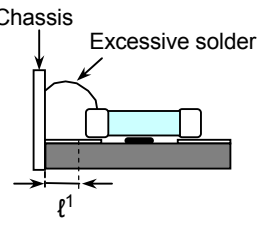
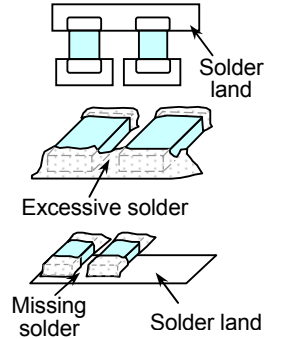
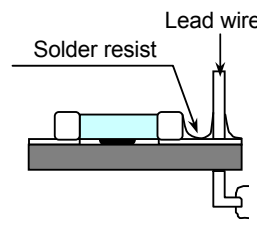
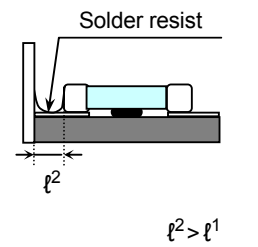
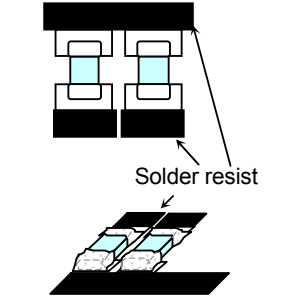
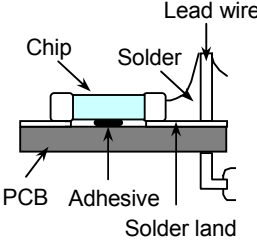
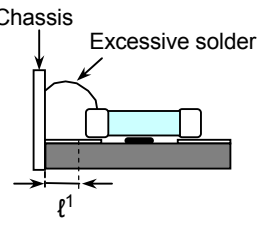
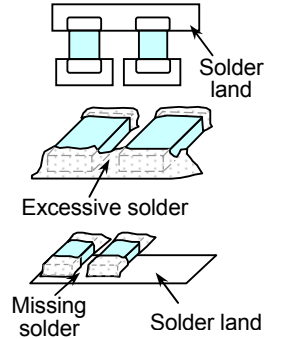
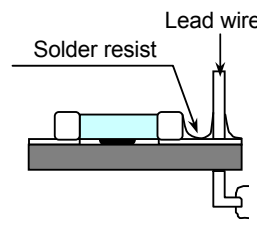
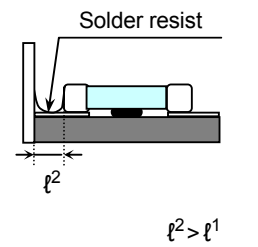
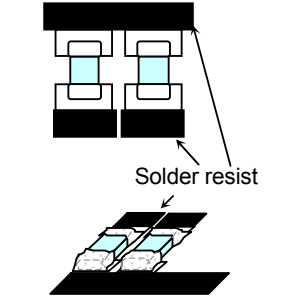
No.	Process	Condition														
1	Operating Condition (Storage, Transportation)	<p>1.1 Storage</p> <ol style="list-style-type: none"> <li>The capacitor must be stored in an ambient temperature of 5 to 40°C with a relative humidity of 20 to 70%RH. The product should be used within 6 months upon receipt.</li> <li>The capacitor must be operated and stored in an environment free of condensation and corrosive gases such as hydrogen sulphide, hydrogen sulphate, chlorine, ammonia and sulfur.</li> <li>Avoid storing in sun light and falling of dew.</li> <li>Do not use capacitor under high humidity and high/low atmospheric pressure which may compromise product reliability.</li> <li>Capacitor should be tested for solderability when stored for long periods of time.</li> </ol> <p>1.2 Handling in transportation</p> <p>In case of the transportation, the performance of the capacitor may be deteriorated depending on the transportation condition. (Refer to JEITA RCR-2335B 9.2 "Handling in transportation")</p>														
2	Circuit design	<p>2.1 Operating temperature</p> <p>Operating temperature should be followed strictly within this specification.</p> <ol style="list-style-type: none"> <li>Do not use capacitors above the maximum allowable operating temperature.</li> <li>Surface temperature including self heating should be below maximum operating temperature. (Due to dielectric loss, capacitors will heat itself when AC is applied. Especially at high frequencies around its SRF, the heat might be so extreme that it may damage itself or the product it's mounted on. Please design the circuit so that the maximum temperature of the capacitors (including the self heating) will be below the maximum allowable operating temperature. Temperature rise at capacitor surface shall be below 20°C)</li> <li>The electrical characteristics of the capacitor will vary depending on the temperature. The capacitor should be selected and designed after taking temperature into consideration.</li> </ol> <p>2.2 Operating voltage</p> <ol style="list-style-type: none"> <li>Operating voltage across the terminals should be below the rated voltage. When AC and DC are super imposed, <math>V_{0-P}</math> must be below the rated voltage. Reference figures 1 and 2 below. AC or pulse with overshooting, <math>V_{P-P}</math> must be below the rated voltage. Reference: figures 3, 4 and 5 below. When the voltage is started/ stopped to the circuit an irregular voltage may be generated for a transit period because of resonance or switching. Be sure to use the capacitor within its rated voltage during these Irregular voltage periods.</li> </ol> <table border="1" style="width: 100%; text-align: center;"> <thead> <tr> <th>Voltage</th> <th>(1) DC voltage</th> <th>(2) DC+AC voltage</th> <th>(3) AC voltage</th> </tr> </thead> <tbody> <tr> <td>Positional Measurement (Rated voltage)</td> <td></td> <td></td> <td></td> </tr> </tbody> </table> <table border="1" style="width: 100%; text-align: center;"> <thead> <tr> <th>Voltage</th> <th>(4) Pulse voltage (A)</th> <th>(5) Pulse voltage (B)</th> </tr> </thead> <tbody> <tr> <td>Positional Measurement (Rated voltage)</td> <td></td> <td></td> </tr> </tbody> </table>	Voltage	(1) DC voltage	(2) DC+AC voltage	(3) AC voltage	Positional Measurement (Rated voltage)				Voltage	(4) Pulse voltage (A)	(5) Pulse voltage (B)	Positional Measurement (Rated voltage)		
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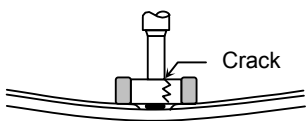
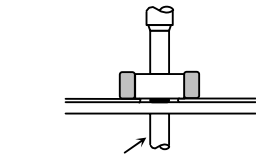
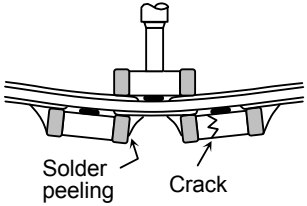
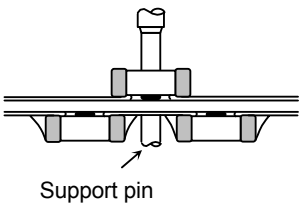
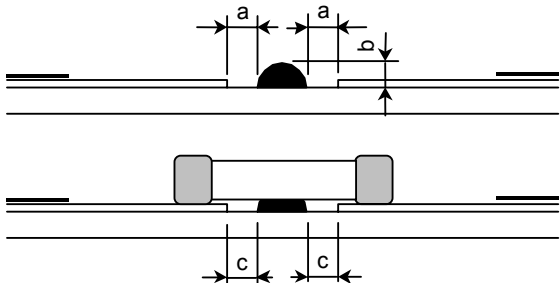
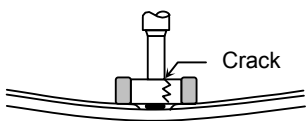
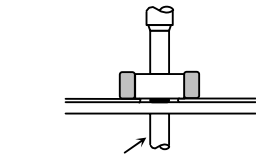
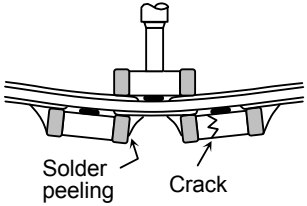
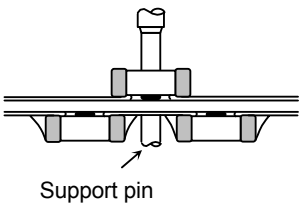
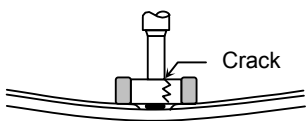
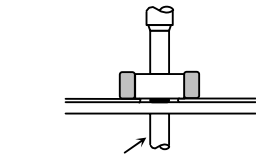
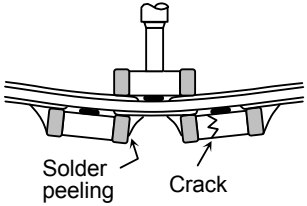
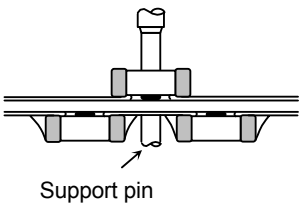
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2	Circuit design	<p>2.2 Operating Voltage (continued)</p> <ol style="list-style-type: none"> <li>Even below the rated voltage, if repetitive high AC frequency or pulsed voltage is applied, the reliability of the capacitors may be reduced.</li> <li>The effective capacitance will vary depending on applied DC and AC voltages. The capacitor should be selected after considering the voltage affect.</li> </ol> <p>2.3 Frequency</p> <p>When Class 2 capacitors are used in AC and/or pulsed voltages, the capacitors may self vibrate and generate audible sound (piezoelectric affect).</p>																																												
3	Designing P.C. Board	<p>The amount of solder at the terminations has a direct effect on the reliability of the capacitor.</p> <ol style="list-style-type: none"> <li>The greater the amount of solder, the higher the stress on the chip capacitor, and the more likely that it will break. When designing a P.C. board, determine the shape and size of the solder lands to have proper amount of solder on the terminations.</li> <li>Avoid using common solder land for multiple terminations and provide individual solder land for each termination instead.</li> <li>Size and recommended land dimensions provided below:</li> </ol> <div style="text-align: center;">  </div> <p style="text-align: center;">Flow soldering (mm)</p> <table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th>Type</th> <th>C1608 [CC0603]</th> <th>C2012 [CC0805]</th> <th>C3216 [CC1206]</th> </tr> </thead> <tbody> <tr> <td>A</td> <td>0.7 - 1.0</td> <td>1.0 - 1.3</td> <td>2.1 - 2.5</td> </tr> <tr> <td>B</td> <td>0.8 - 1.0</td> <td>1.0 - 1.2</td> <td>1.1 - 1.3</td> </tr> <tr> <td>C</td> <td>0.6 - 0.8</td> <td>0.8 - 1.1</td> <td>1.0 - 1.3</td> </tr> </tbody> </table> <p style="text-align: center;">Reflow soldering (mm)</p> <table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th>Type</th> <th>C1005 [CC0402]</th> <th>C1608 [CC0603]</th> <th>C2012 [CC0805]</th> <th>C3216 [CC1206]</th> </tr> </thead> <tbody> <tr> <td>A</td> <td>0.3 - 0.5</td> <td>0.6 - 0.8</td> <td>0.9 - 1.2</td> <td>2.0 - 2.4</td> </tr> <tr> <td>B</td> <td>0.35 - 0.45</td> <td>0.6 - 0.8</td> <td>0.7 - 0.9</td> <td>1.0 - 1.2</td> </tr> <tr> <td>C</td> <td>0.4 - 0.6</td> <td>0.6 - 0.8</td> <td>0.9 - 1.2</td> <td>1.1 - 1.6</td> </tr> </tbody> </table> <table border="1" style="width: 100%; border-collapse: collapse; margin-top: 10px;"> <thead> <tr> <th>Type</th> <th>C3225 [CC1210]</th> </tr> </thead> <tbody> <tr> <td>A</td> <td>2.0 - 2.4</td> </tr> <tr> <td>B</td> <td>1.0 - 1.2</td> </tr> <tr> <td>C</td> <td>1.9 - 2.5</td> </tr> </tbody> </table>	Type	C1608 [CC0603]	C2012 [CC0805]	C3216 [CC1206]	A	0.7 - 1.0	1.0 - 1.3	2.1 - 2.5	B	0.8 - 1.0	1.0 - 1.2	1.1 - 1.3	C	0.6 - 0.8	0.8 - 1.1	1.0 - 1.3	Type	C1005 [CC0402]	C1608 [CC0603]	C2012 [CC0805]	C3216 [CC1206]	A	0.3 - 0.5	0.6 - 0.8	0.9 - 1.2	2.0 - 2.4	B	0.35 - 0.45	0.6 - 0.8	0.7 - 0.9	1.0 - 1.2	C	0.4 - 0.6	0.6 - 0.8	0.9 - 1.2	1.1 - 1.6	Type	C3225 [CC1210]	A	2.0 - 2.4	B	1.0 - 1.2	C	1.9 - 2.5
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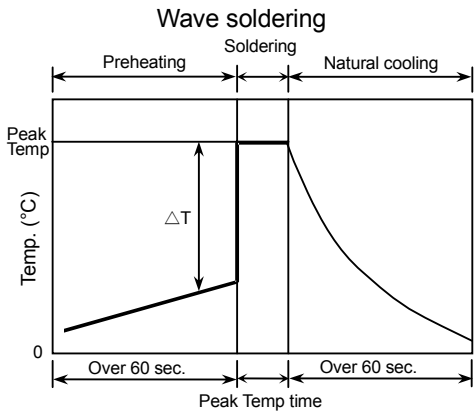
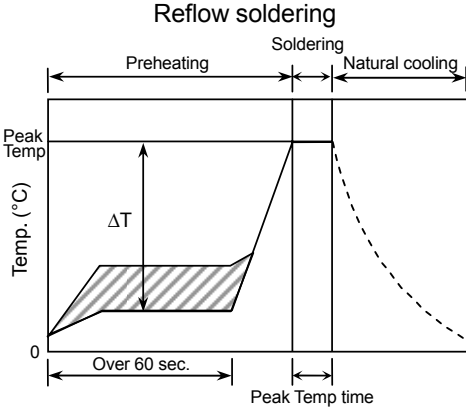
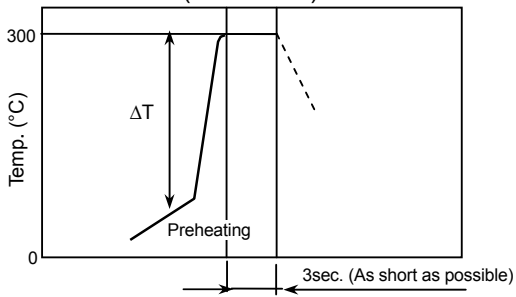
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3	Designing P.C. Board (continued)	<p>5. Mechanical stress varies according to location of chip capacitor on the P.C. board.</p>  <p>The relative stress applied to these capacitors during depaneling is in the following order:  <math>A &gt; B = C &gt; D &gt; E</math></p> <p>6. Layout recommendation</p> <table border="1" data-bbox="418 947 1448 1801"> <thead> <tr> <th data-bbox="423 953 578 1052">Example</th> <th data-bbox="583 953 857 1052">Use of common solder land</th> <th data-bbox="862 953 1136 1052">Soldering with chassis</th> <th data-bbox="1141 953 1442 1052">Use of common solder land with other SMD</th> </tr> </thead> <tbody> <tr> <td data-bbox="423 1058 578 1409">Need to avoid</td> <td data-bbox="583 1058 857 1409">  </td> <td data-bbox="862 1058 1136 1409">  </td> <td data-bbox="1141 1058 1442 1409">  </td> </tr> <tr> <td data-bbox="423 1415 578 1795">Recommendation</td> <td data-bbox="583 1415 857 1795">  </td> <td data-bbox="862 1415 1136 1795">  </td> <td data-bbox="1141 1415 1442 1795">  </td> </tr> </tbody> </table>	Example	Use of common solder land	Soldering with chassis	Use of common solder land with other SMD	Need to avoid				Recommendation			
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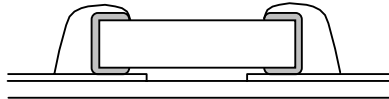
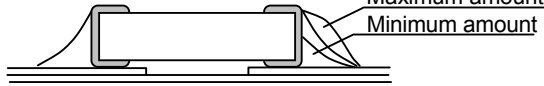
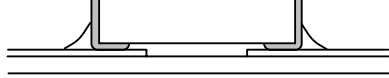
(12. Caution, continued)

No.	Process	Condition																	
4	Mounting	<p>4.1 Stress from mounting head</p> <p>If the mounting head is adjusted too low, it may induce excessive stress on the chip capacitor and result in cracking. Please take following precautions.</p> <ol style="list-style-type: none"> <li>1. Adjust the bottom dead center of the mounting head to reach the P.C. board surface but do not contact it.</li> <li>2. Adjust the mounting head pressure to be 1 to 3N of static weight.</li> <li>3. To minimize the impact energy from mounting head, it is important to provide support from the bottom side of the P.C. board. See following examples.</li> </ol> <table border="1" data-bbox="516 558 1403 1087"> <thead> <tr> <th></th> <th data-bbox="688 558 1057 606">Not recommended</th> <th data-bbox="1057 558 1403 606">Recommended</th> </tr> </thead> <tbody> <tr> <td data-bbox="516 606 688 842">Single sided mounting</td> <td data-bbox="688 606 1057 842">  </td> <td data-bbox="1057 606 1403 842">  </td> </tr> <tr> <td data-bbox="516 842 688 1087">Double-sided mounting</td> <td data-bbox="688 842 1057 1087">  </td> <td data-bbox="1057 842 1403 1087">  </td> </tr> </tbody> </table> <p>When the centering jaw is worn, mechanical impact on the capacitor may occur and damage the product. Please control the closing dimension of the centering jaw and provide sufficient preventive maintenance and/or replacement if necessary.</p> <p>4.2 Amount of adhesive</p>  <table border="1" data-bbox="683 1629 1203 1822"> <thead> <tr> <th colspan="2" data-bbox="683 1629 1203 1667">Example : C2012 (CC0805), C3216 (CC1206)</th> </tr> </thead> <tbody> <tr> <td data-bbox="683 1667 821 1724">a</td> <td data-bbox="821 1667 1203 1724">0.2mm min.</td> </tr> <tr> <td data-bbox="683 1724 821 1780">b</td> <td data-bbox="821 1724 1203 1780">70 - 100μm</td> </tr> <tr> <td data-bbox="683 1780 821 1822">c</td> <td data-bbox="821 1780 1203 1822">Do not touch the solder land</td> </tr> </tbody> </table>		Not recommended	Recommended	Single sided mounting			Double-sided mounting			Example : C2012 (CC0805), C3216 (CC1206)		a	0.2mm min.	b	70 - 100μm	c	Do not touch the solder land
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(12. Caution, continued)

No.	Process	Condition																			
5	Soldering	<p>5.1 Flux selection</p> <p>Although highly-activated flux gives better solderability, substances which increase activity may also degrade the insulation of the chip capacitor. To avoid such degradation, the following is recommended.</p> <ol style="list-style-type: none"> <li>1. Use a mildly activated rosin flux (less than 0.1wt% chlorine).</li> <li>2. Excessive flux must be avoided. Please provide proper amount of flux.</li> <li>3. When water-soluble flux is used, sufficient washing is necessary.</li> </ol> <p>5.2 Recommended soldering profile by various methods</p> <div style="display: flex; justify-content: space-around;"> <div style="text-align: center;"> <p><b>Wave soldering</b></p>  </div> <div style="text-align: center;"> <p><b>Reflow soldering</b></p>  </div> </div> <div style="text-align: center; margin-top: 20px;"> <p><b>Manual soldering (Solder iron)</b></p>  </div> <div style="margin-top: 20px;"> <p><b>APPLICATION</b></p> <p>As for C1608 (CC0603), C2012 (CC0805) and C3216 (CC1206), applied to wave soldering and reflow soldering.</p> <p>As for C1005 (CC0402), C3225 (CC1210), applied only to reflow soldering.</p> </div> <p>5.3 Recommended soldering peak temp and duration</p> <table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th rowspan="2" style="text-align: center;">Temp./Duration</th> <th colspan="2" style="text-align: center;">Wave soldering</th> <th colspan="2" style="text-align: center;">Reflow soldering</th> </tr> <tr> <th style="text-align: center;">Peak temp(°C)</th> <th style="text-align: center;">Duration(sec.)</th> <th style="text-align: center;">Peak temp(°C)</th> <th style="text-align: center;">Duration(sec.)</th> </tr> </thead> <tbody> <tr> <td style="text-align: center;">Pb-Sn Solder</td> <td style="text-align: center;">250 max.</td> <td style="text-align: center;">3 max.</td> <td style="text-align: center;">230 max.</td> <td style="text-align: center;">20 max.</td> </tr> <tr> <td style="text-align: center;">Lead Free Solder</td> <td style="text-align: center;">260 max.</td> <td style="text-align: center;">5 max.</td> <td style="text-align: center;">260 max.</td> <td style="text-align: center;">10 max.</td> </tr> </tbody> </table> <p>Recommended solder compositions</p> <p>Sn-37Pb (Pb-Sn solder)</p> <p>Sn-3.0Ag-0.5Cu (Lead Free Solder)</p>	Temp./Duration	Wave soldering		Reflow soldering		Peak temp(°C)	Duration(sec.)	Peak temp(°C)	Duration(sec.)	Pb-Sn Solder	250 max.	3 max.	230 max.	20 max.	Lead Free Solder	260 max.	5 max.	260 max.	10 max.
Temp./Duration	Wave soldering			Reflow soldering																	
	Peak temp(°C)	Duration(sec.)	Peak temp(°C)	Duration(sec.)																	
Pb-Sn Solder	250 max.	3 max.	230 max.	20 max.																	
Lead Free Solder	260 max.	5 max.	260 max.	10 max.																	

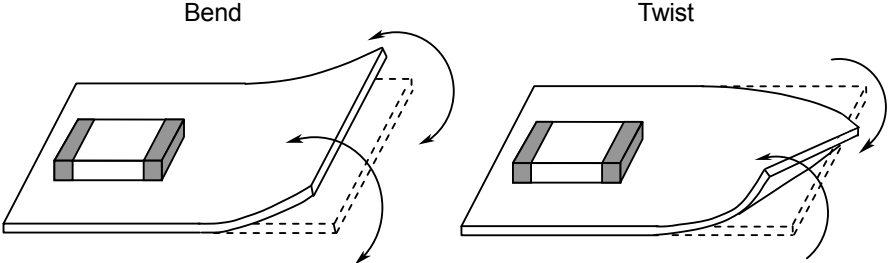
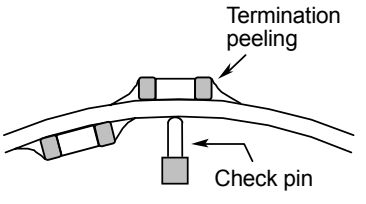
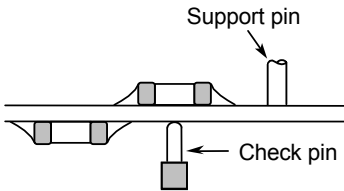
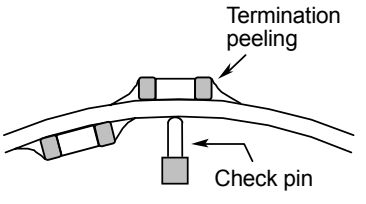
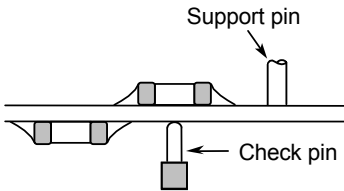
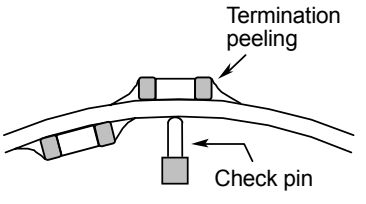
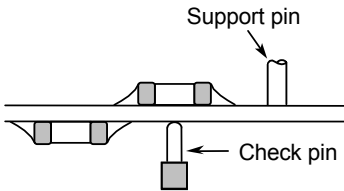
(12. Caution, continued)

No.	Process	Condition																
5	Soldering (continued)	<p>5.4 Avoiding thermal shock</p> <p>1. Preheating condition</p> <table border="1" data-bbox="581 247 1398 533"> <thead> <tr> <th data-bbox="581 247 794 285">Soldering</th> <th data-bbox="794 247 1203 285">Type</th> <th data-bbox="1203 247 1398 285">Temp. (°C)</th> </tr> </thead> <tbody> <tr> <td data-bbox="581 285 794 348">Wave soldering</td> <td data-bbox="794 285 1203 348">C1608(CC0603), C2012(CC0805), C3216(CC1206)</td> <td data-bbox="1203 285 1398 348"><math>\Delta T \leq 150</math></td> </tr> <tr> <td data-bbox="581 348 794 443" rowspan="2">Reflow soldering</td> <td data-bbox="794 348 1203 411">C1005(CC0402), C1608(CC0603), C2012(CC0805), C3216(CC1206)</td> <td data-bbox="1203 348 1398 411"><math>\Delta T \leq 150</math></td> </tr> <tr> <td data-bbox="794 411 1203 443">C3225(CC1210)</td> <td data-bbox="1203 411 1398 443"><math>\Delta T \leq 130</math></td> </tr> <tr> <td data-bbox="581 443 794 533" rowspan="2">Manual soldering</td> <td data-bbox="794 443 1203 506">C1005(CC0402), C1608(CC0603), C2012(CC0805), C3216(CC1206)</td> <td data-bbox="1203 443 1398 506"><math>\Delta T \leq 150</math></td> </tr> <tr> <td data-bbox="794 506 1203 533">C3225(CC1210)</td> <td data-bbox="1203 506 1398 533"><math>\Delta T \leq 130</math></td> </tr> </tbody> </table> <p>2. Cooling condition</p> <p>Natural cooling using air is recommended. If the chips are dipped into a solvent for cleaning, the temperature difference (<math>\Delta T</math>) must be less than 100°C.</p> <p>5.5 Amount of solder</p> <p>Excessive solder will induce higher tensile force on the chip capacitor during temperature changes and may result in chip cracking. Insufficient solder may detach the capacitor from the P.C. board.</p> <div style="display: flex; justify-content: space-between; align-items: flex-start;"> <div data-bbox="542 919 656 982" style="width: 30%;">Excessive solder</div> <div data-bbox="716 919 1101 1016" style="width: 35%; text-align: center;">  </div> <div data-bbox="1127 919 1386 1003" style="width: 30%;">Higher tensile force on the chip capacitors may cause cracking.</div> </div> <hr/> <div style="display: flex; justify-content: space-between; align-items: center;"> <div data-bbox="542 1087 656 1150" style="width: 30%;">Adequate solder</div> <div data-bbox="716 1087 1256 1171" style="width: 35%; text-align: center;">  </div> </div> <hr/> <div style="display: flex; justify-content: space-between; align-items: flex-start;"> <div data-bbox="542 1247 656 1310" style="width: 30%;">Insufficient solder</div> <div data-bbox="716 1247 1101 1323" style="width: 35%; text-align: center;">  </div> <div data-bbox="1127 1205 1419 1352" style="width: 30%;">Small solder fillet may cause inadequate electrical contact or failure to hold the chip capacitor to the P.C. board.</div> </div> <hr/> <p>5.6 Solder repair by solder iron</p> <p>1. Selection of the soldering iron tip</p> <p>Tip temperature of the solder iron varies by its type, P.C. board material and solder land sizes. Higher temperatures may provide quicker operation; however, heat shock may cause a crack in the capacitor. Please confirm the tip temperature before soldering and keep the peak temperature and time in accordance with following recommended condition. (Please preheat the chip capacitors with the condition in 5.4 to avoid the thermal shock.)</p>	Soldering	Type	Temp. (°C)	Wave soldering	C1608(CC0603), C2012(CC0805), C3216(CC1206)	$\Delta T \leq 150$	Reflow soldering	C1005(CC0402), C1608(CC0603), C2012(CC0805), C3216(CC1206)	$\Delta T \leq 150$	C3225(CC1210)	$\Delta T \leq 130$	Manual soldering	C1005(CC0402), C1608(CC0603), C2012(CC0805), C3216(CC1206)	$\Delta T \leq 150$	C3225(CC1210)	$\Delta T \leq 130$
Soldering	Type	Temp. (°C)																
Wave soldering	C1608(CC0603), C2012(CC0805), C3216(CC1206)	$\Delta T \leq 150$																
Reflow soldering	C1005(CC0402), C1608(CC0603), C2012(CC0805), C3216(CC1206)	$\Delta T \leq 150$																
	C3225(CC1210)	$\Delta T \leq 130$																
Manual soldering	C1005(CC0402), C1608(CC0603), C2012(CC0805), C3216(CC1206)	$\Delta T \leq 150$																
	C3225(CC1210)	$\Delta T \leq 130$																

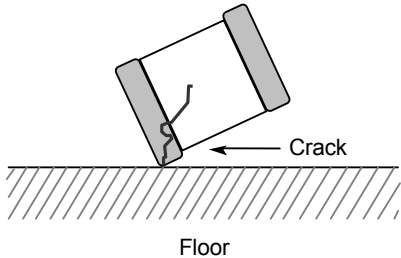
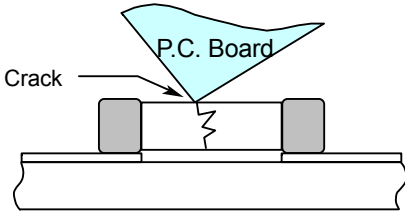
(12. Caution, continued)

No.	Process	Condition								
5	Soldering (continued)	<p data-bbox="553 197 1365 226">Recommended solder iron condition (Pb-Sn Solder and Lead Free Solder)</p> <table border="1" data-bbox="583 226 1362 342"><thead><tr><th data-bbox="583 226 777 279">Temp. (°C)</th><th data-bbox="777 226 972 279">Duration (sec.)</th><th data-bbox="972 226 1167 279">Wattage (W)</th><th data-bbox="1167 226 1362 279">Shape (mm)</th></tr></thead><tbody><tr><td data-bbox="583 279 777 342">300 max.</td><td data-bbox="777 279 972 342">3 max.</td><td data-bbox="972 279 1167 342">20 max.</td><td data-bbox="1167 279 1362 342">Ø 3.0 max.</td></tr></tbody></table> <p data-bbox="500 390 1386 489">2. Direct contact of the soldering iron with ceramic dielectric of the chip capacitor may cause cracking. Do not touch the ceramic dielectric and the terminations by solder iron.</p> <p data-bbox="488 554 1170 642">5.7 Sn-Zn solder Sn-Zn solder affects product reliability. Please contact TDK in advance when utilize Sn-Zn solder.</p> <p data-bbox="488 674 1425 888">5.8 Countermeasure for tombstone The misalignment between the mounted positions of the capacitors and the land patterns should be minimized. The tombstone phenomenon may occur especially when the capacitors are mounted (in longitudinal direction) in the same direction of the reflow soldering. (Refer to JEITA RCR-2335B Annex A “Recommendations to prevent the tombstone phenomenon”)</p>	Temp. (°C)	Duration (sec.)	Wattage (W)	Shape (mm)	300 max.	3 max.	20 max.	Ø 3.0 max.
Temp. (°C)	Duration (sec.)	Wattage (W)	Shape (mm)							
300 max.	3 max.	20 max.	Ø 3.0 max.							
6	Cleaning	<p data-bbox="500 926 1435 1062">1. If an unsuitable cleaning fluid is used, flux residue or some foreign articles may stick to the chip capacitor surface and deteriorate the insulation resistance. 2. If cleaning condition is not suitable, it may deteriorate the chip capacitor's insulation resistance.</p> <p data-bbox="488 1073 748 1102">2.1 Insufficient washing</p> <ol data-bbox="548 1119 1382 1297" style="list-style-type: none"><li>1. Terminal electrodes may be corroded by Halogen in the flux.</li><li>2. Halogen in the flux may adhere on the surface of capacitor, and lower the insulation resistance.</li><li>3. Water soluble flux has higher tendency to have above mentioned problems (1) and (2).</li></ol> <p data-bbox="488 1325 740 1354">2.2 Excessive washing</p> <p data-bbox="581 1367 1435 1472">When ultrasonic cleaning is used, excessively high energy output can affect the connection between the ceramic chip capacitor's body and the terminal electrode. To avoid this, the following is recommended.</p> <p data-bbox="792 1499 997 1528">Power: 20 W/ℓmax</p> <p data-bbox="792 1539 1057 1568">Frequency: 40 kHz max.</p> <p data-bbox="792 1579 1117 1608">Washing time: 5 minutes max.</p> <p data-bbox="488 1635 1362 1696">2.3 If the cleaning fluid is contaminated, the Halogen concentration can increase and bring the same result as insufficient cleaning.</p>								

(12. Caution, continued)

No.	Process	Condition						
7	Coating and molding of the P.C. Board	<ol style="list-style-type: none"> <li>When the P.C. board is coated, please verify the impact on the capacitor.</li> <li>Please carefully verify that there is no harmful decomposing or reaction gas emission during curing which may damage the chip capacitor.</li> <li>Please verify the curing temperature.</li> </ol>						
8	Handling after chip mounted	<ol style="list-style-type: none"> <li>Please pay attention not to bend or distort the P.C. board after soldering otherwise the chip capacitor may crack.                     <div style="text-align: center; margin: 10px 0;">  </div> </li> <li>When functional check of the P.C. board is performed, higher pin pressures tend to be used to avoid poor contact. But if the pressure is excessive and bends the P.C. board, it may crack the capacitor or peel the termination. Please adjust the pins accordingly to ensure the P.C. board is not flexed.                     <table border="1" style="width: 100%; border-collapse: collapse; margin-top: 10px;"> <thead> <tr> <th data-bbox="526 1058 656 1115">Item</th> <th data-bbox="656 1058 1045 1115">Not recommended</th> <th data-bbox="1045 1058 1419 1115">Recommended</th> </tr> </thead> <tbody> <tr> <td data-bbox="526 1115 656 1394" style="vertical-align: middle;">Board bending</td> <td data-bbox="656 1115 1045 1394" style="text-align: center;">  </td> <td data-bbox="1045 1115 1419 1394" style="text-align: center;">  </td> </tr> </tbody> </table> </li> </ol>	Item	Not recommended	Recommended	Board bending		
Item	Not recommended	Recommended						
Board bending								

(12. Caution, continued)

No.	Process	Condition
9	Handling of loose chip capacitors	<p>1. The chip capacitor may crack if dropped, especially large case sizes. Please handle with care and do not use if dropped.</p>  <p>2. When stacking the P.C. board for storage or handling after soldering, the corner of the P.C. board may hit the chip capacitor of a neighboring board and cause a crack.</p> 
10	Capacitance aging	<p>Class 2 capacitors have an aging characteristic, which is a decrease in capacitance over time due to crystalline changes that occur in ferroelectric ceramics. Careful consideration should be done in case of a time constant circuit.</p>
11	Estimated life and estimated failure rate of capacitors	<p>The estimated life and (failure rate) depend on the temperature and voltage applied. This can be calculated by the equation described in JEITA RCR-2335B Annex 6 "Calculation of the estimated lifetime and the failure rate." The risk can be decreased by reducing the temperature and voltage but the failure rate can not be guaranteed.</p>
12	Others	<p>The products listed on this specification sheet are intended for use in general electronic equipment (AV equipment, telecommunications equipment, home appliances, amusement equipment, computer equipment, personal equipment, office equipment, measurement equipment, industrial robots) under a normal operation and use condition.</p> <p>The products are not designed or warranted to meet the requirements of the applications listed below, whose performance and/or quality require a more stringent level of safety or reliability, or whose failure, malfunction or trouble could cause serious damage to society, person or property. Please understand that TDK is not responsible for any damage or liability caused by use of this product in any of the applications below or for any other use exceeding the range or conditions set forth in this specification sheet:</p> <p>Aerospace/Aviation equipment. Transportation equipment (cars, electric trains, ships, etc.) Medical equipment. Power-generation control equipment. Atomic energy-related equipment. Seabed equipment. Transportation control equipment. Public information-processing equipment. Military equipment. Electric heating apparatus, burning equipment. Disaster prevention/crime prevention equipment. Safety equipment. Other applications that are not considered general-purpose applications.</p> <p>When using this product in general-purpose applications, you are kindly requested to take into consideration securing protection circuit/equipment or providing backup circuits, etc., to ensure higher safety.</p>

### 13. Packaging label

Packaging shall be done to protect the components from the damage during transportation and storing, and a label which has the following information shall be attached.

- 1) Inspection No.
- 2) TDK P/N
- 3) Customer's P/N
- 4) Quantity

\*Composition of Inspection No.

Example     M 0 A - 00 - 000  
                  (a) (b) (c)        (d)        (e)

- a) Line code
- b) Last digit of the year
- c) Month and A for January and B for February and so on. (Skip I)
- d) Inspection Date of the month.
- e) Serial No. of the day

### 14. Bulk packaging quantity

Total number of components in a plastic bag for bulk packaging: 1,000pcs.  
As for C1005 type, not available for bulk packaging.

# 15. TAPE PACKAGING SPECIFICATION

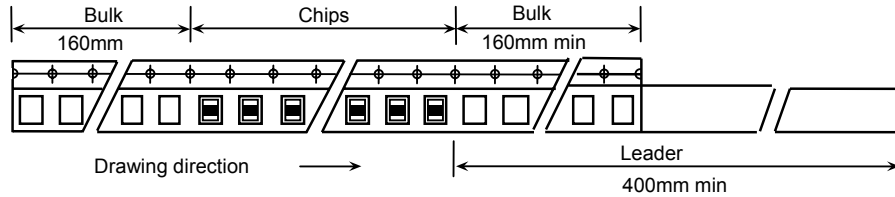
## 1. CONSTRUCTION AND DIMENSION OF TAPING

### 1.1 Dimensions of carrier tape

Dimensions of paper tape shall be according to Appendix 3, 4.

Dimensions of plastic tape shall be according to Appendix 5.

### 1.2 Bulk part and leader of taping

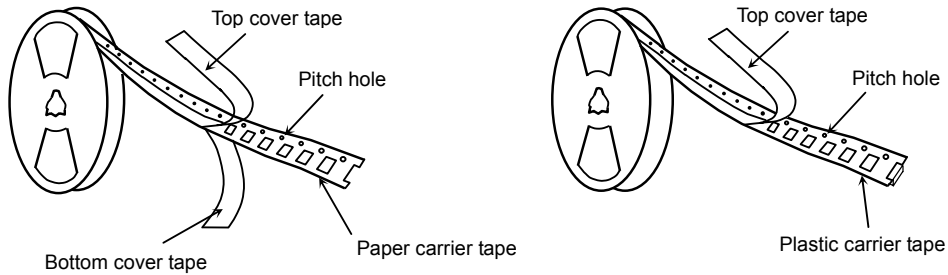


### 1.3 Dimensions of reel

Dimensions of  $\phi 178$  reel shall be according to Appendix 6, 7.

Dimensions of  $\phi 330$  reel shall be according to Appendix 8, 9.

### 1.4 Structure of taping



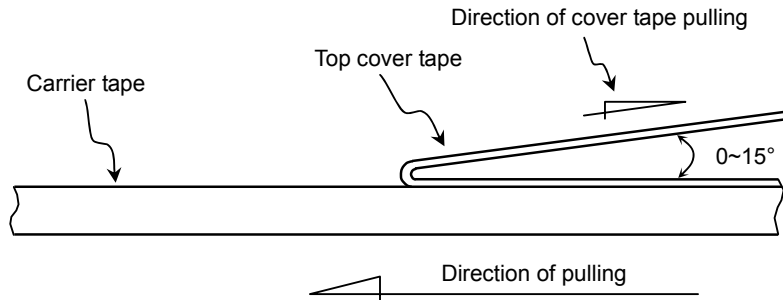
## 2. CHIP QUANTITY

Type	Thickness of chip	Taping Material	Chip quantity (pcs.)	
			$\phi 178$ mm reel	$\phi 330$ mm reel
C1005 (CC0402)	0.50 mm	Paper	10,000	50,000
C1608 (CC0603)	0.80 mm	Paper	4,000	10,000
C2012 (CC0805)	0.85 mm	Paper	4,000	10,000
	1.25 mm	Plastic	2,000	
C3216 (CC1206)	0.85 mm	Paper	4,000	10,000
	1.15 mm	Plastic	2,000	
	1.60 mm			8,000
C3225 (CC1210)	1.60 mm	Plastic	2,000	8,000
	2.00 mm		1,000	5,000
	2.50 mm			

### 3. PERFORMANCE SPECIFICATIONS

#### 3.1 Peel back Cover (top tape)

0.05-0.7N. (See the following figure.)



3.2 Carrier tape shall be flexible enough to be wound around a minimum radius of 30mm with components in tape.

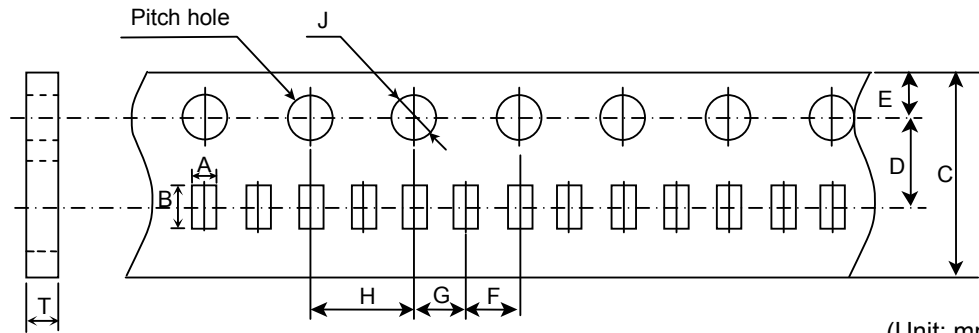
3.3 The missing of components shall be less than 0.1%

3.4 Components shall not stick to the cover tape.

3.5 The cover tapes shall not protrude beyond the edges of the carrier tape not shall cover the sprocket holes.

## Appendix 3

### Paper Tape



(Unit: mm)

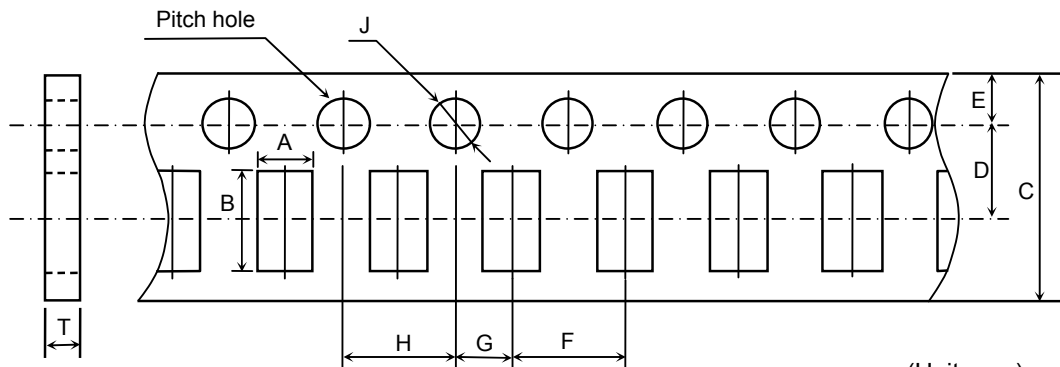
Symbol	A	B	C	D	E	F
Type						
C1005 (CC0402)	( 0.65 )	( 1.15 )	8.00 ± 0.30	3.50 ± 0.05	1.75 ± 0.10	2.00 ± 0.05

Symbol	G	H	J	T
Type				
C1005 (CC0402)	2.00 ± 0.05	4.00 ± 0.10	∅ 1.5 $\begin{smallmatrix} +0.10 \\ 0 \end{smallmatrix}$	0.60 ± 0.05

\* The values in the parentheses ( ) are for reference

## Appendix 4

### Paper Tape



(Unit: mm)

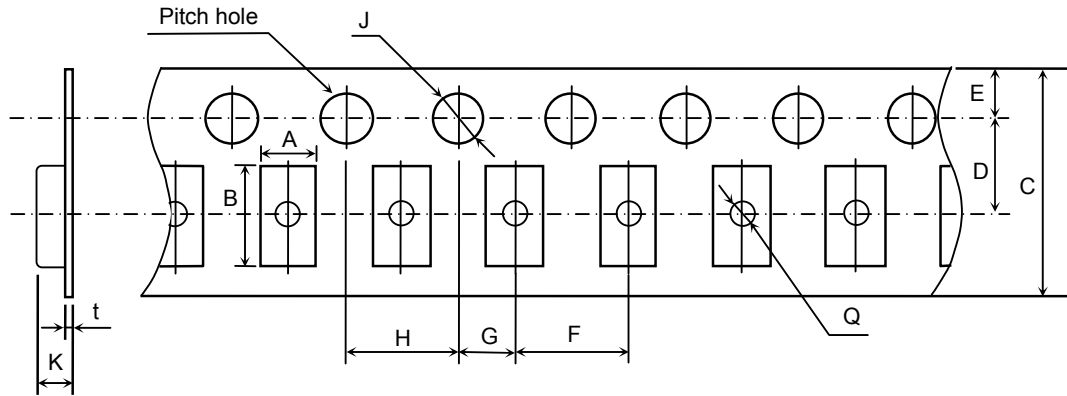
Symbol	A	B	C	D	E	F
Type						
C1608 (CC0603)	( 1.10 )	( 1.90 )	8.00 ± 0.30	3.50 ± 0.05	1.75 ± 0.10	4.00 ± 0.10
C2012 (CC0805)	( 1.50 )	( 2.30 )				
C3216 (CC1206)	( 1.90 )	( 3.50 )				

Symbol	G	H	J	T
Type				
C1608 (CC0603)	2.00 ± 0.05	4.00 ± 0.10	∅ 1.5 $\begin{smallmatrix} +0.10 \\ 0 \end{smallmatrix}$	1.10 max.
C2012 (CC0805)				
C3216 (CC1206)				

\* The values in the parentheses ( ) are for reference.

# Appendix 5

## Plastic Tape



(Unit: mm)

Symbol Type	A	B	C	D	E	F
C2012 (CC0805)	( 1.50 )	( 2.30 )	8.00 ± 0.30 [12.0 ± 0.30]	3.50 ± 0.05 [5.50 ± 0.05]	1.75 ± 0.10	4.00 ± 0.10
C3216 (CC1206)	( 1.90 )	( 3.50 )				
C3225 (CC1210)	( 2.90 )	( 3.60 )				

Symbol Type	G	H	J	K	t	Q
C2012 (CC0805)	2.00 ± 0.05	4.00 ± 0.10	∅ 1.5 <sup>+0.10</sup> <sub>0</sub>	2.50 max.	0.30 max.	∅ 0.50 min.
C3216 (CC1206)				3.20 max.	0.60 max.	
C3225 (CC1210)						

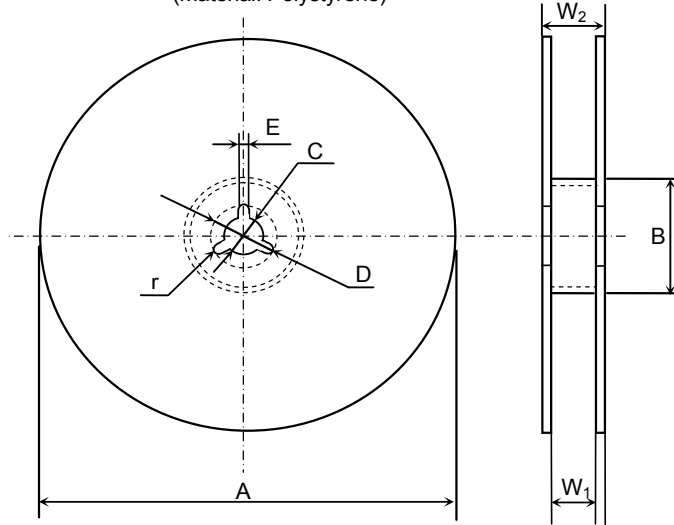
\* The values in the parentheses ( ) are for reference.

\* As for 2.5mm thickness products, apply values in the brackets [ ].

## Appendix 6

C1005, C1608, C2012, C3216, C3225 (As for C3225 type, any thickness of the item except 2.5mm)

(Material: Polystyrene)



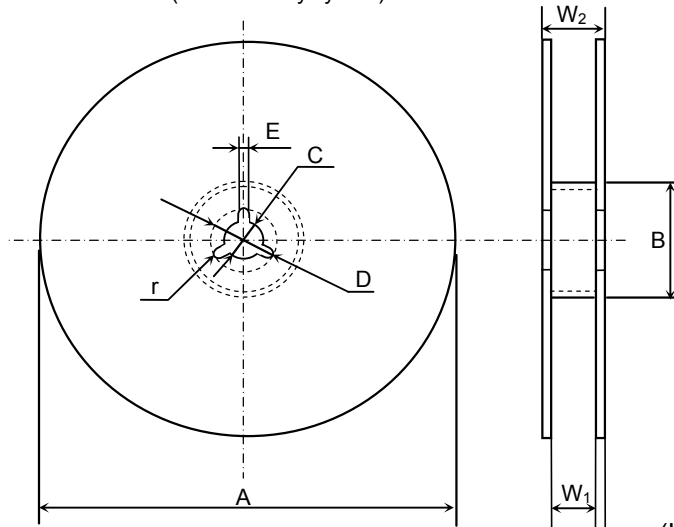
(Unit: mm)

Symbol	A	B	C	D	E	W <sub>1</sub>
Dimension	Ø178 ± 2.0	Ø60 ± 2.0	Ø13 ± 0.5	Ø21 ± 0.8	2.0 ± 0.5	9.0 ± 0.3
Symbol	W <sub>2</sub>	r				
Dimension	13.0 ± 1.4	1.0				

## Appendix 7

C3225 (As for C3225 type, applied to 2.5mm thickness products)

(Material: Polystyrene)



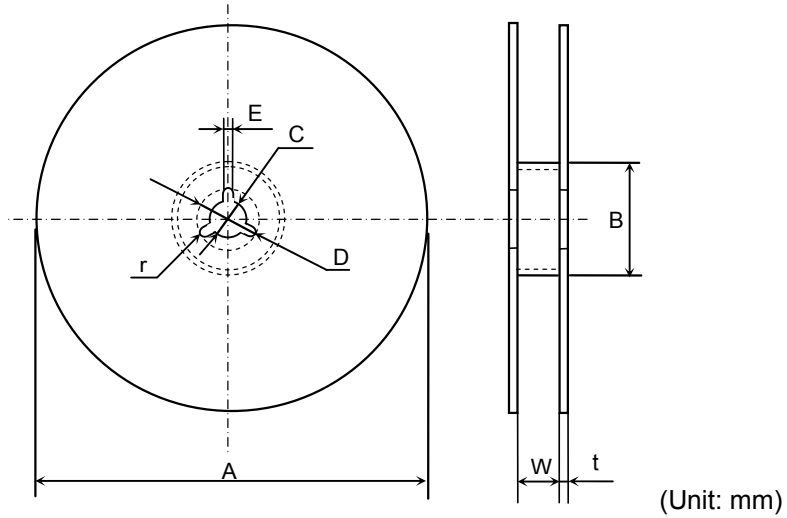
(Unit: mm)

Symbol	A	B	C	D	E	W <sub>1</sub>
Dimension	Ø178 ± 2.0	Ø60 ± 2.0	Ø13 ± 0.5	Ø21 ± 0.8	2.0 ± 0.5	13.0 ± 0.3
Symbol	W <sub>2</sub>	r				
Dimension	17.0 ± 1.4	1.0				

## Appendix 8

C1005, C1608, C2012, C3216, C3225 (As for C3225 type, any thickness of the item except 2.5mm)

(Material: Polystyrene)

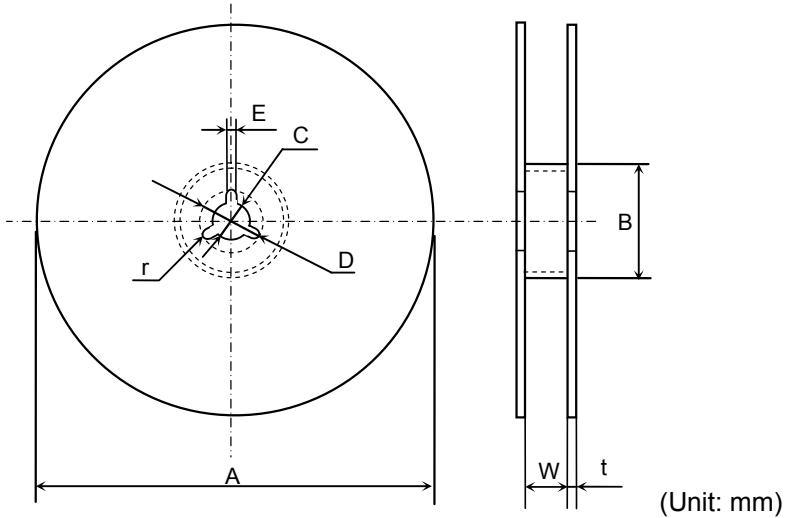


Symbol	A	B	C	D	E	W
Dimension	Ø382 max. (Nominal Ø330)	Ø50 min.	Ø13 ± 0.5	Ø21 ± 0.8	2.0 ± 0.5	10.0 ± 1.5
Symbol	t	r				
Dimension	2.0 ± 0.5	1.0				

## Appendix 9

C3225 (As for C3225 type, applied to 2.5mm thickness products)

(Material: Polystyrene)



Symbol	A	B	C	D	E	W
Dimension	Ø382 max. (Nominal Ø330)	Ø50 min.	Ø13 ± 0.5	Ø21 ± 0.8	2.0 ± 0.5	14.0 ± 1.5
Symbol	t	r				
Dimension	2.0 ± 0.5	1.0				

END PAGE