

# SPECIFICATION

SPEC. No. A-High-c

D A T E : 2015 Jan.

To

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**Non-Controlled Copy**

CUSTOMER'S PRODUCT NAME

TDK PRODUCT NAME

MULTILAYER CERAMIC CHIP CAPACITORS

CGA Series / Automotive Grade

High Voltage

Please return this specification to TDK representatives.

If orders are placed without returned specification, please allow us to judge that specification is accepted by your side.

## RECEIPT CONFIRMATION

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

TDK Corporation  
Sales  
Electronic Components  
Sales & Marketing Group

TDK-EPC Corporation  
Engineering  
Ceramic Capacitors Business Group

APPROVED	Person in charge

APPROVED	CHECKED	Person in charge

1. SCOPE

This specification is applicable to chip type multilayer ceramic capacitors with a priority over the other relevant specifications.

Production places defined in this specification shall be TDK-EPC Corporation Japan, TDK (Suzhou) Co., Ltd and TDK Components U.S.A. Inc.

EXPLANATORY NOTE:

This specification warrants the quality of the ceramic chip capacitors. The chips should be evaluated or confirmed a state of mounted on your product.

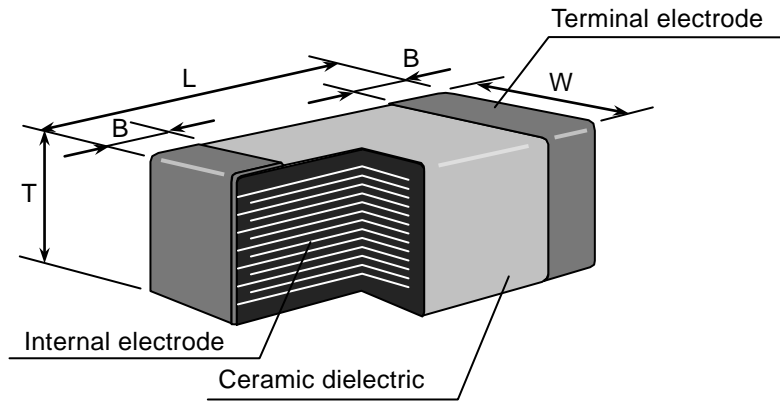
If the use of the chips goes beyond the bounds of the specification, we can not afford to guarantee.

2. CODE CONSTRUCTION

(Example)

Catalog Number :	<u>CGA8</u>	<u>K</u>	<u>1</u>	<u>X7R</u>	<u>3 D</u>	<u>222</u>	<u>M</u>	<u>130</u>	<u>K</u>	<u>A</u>
(Web)	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Item Description :	<u>CGA8</u>	<u>K</u>	<u>1</u>	<u>X7R</u>	<u>3 D</u>	<u>222</u>	<u>M</u>	<u>I</u>	<u>xxxx</u>	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(11)	(12)	

(1) Type



Please refer to product list for the dimension of each product.

(2) Thickness

\* As for dimension tolerance, please contact with our sales representative.

Thickness	Dimension(mm)
F	0.85
G	1.10
K	1.30
L	1.60
M	2.00
N	2.30
P	2.50

(3) Voltage condition in the life test

(Max. operating Temp./1000h)

Sign	Condition
1	Rated Voltage x 1

(4) Temperature Characteristics (Details are shown in table 1 No.7 and No.8 at page 5.)

(5) Rated Voltage

Symbol	Rated Voltage
3 A	DC 1 kV
3 D	DC 2 kV
3 F	DC 3 kV

(6) 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.

R is designated for a decimal point.

Example 222 → 2,200pF

(7) Capacitance tolerance

Symbol	Tolerance	Capacitance
F	± 1 pF	10pF
K	± 10 %	Over 10pF
M	± 20 %	

(8) Thickness code (Only Catalog Number)

(9) Package code (Only Catalog Number)

(10) Special code (Only Catalog Number)

(11) Packaging

Symbol	Packaging
B	Bulk
T	Taping

(12) Internal code (Only Item Description)

### 3. RATED CAPACITANCE AND CAPACITANCE TOLERANCE

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

Class	Temperature Characteristics	Capacitance tolerance		Rated capacitance
		1	C0G	
Over 10pF	K ( $\pm 10\%$ )			E – 12 series
2	X7R X7S	K ( $\pm 10\%$ ) M ( $\pm 20\%$ )		E – 3 series

#### 3.2 Capacitance Step in E series

E series	Capacitance Step											
E- 3	1.0			2.2				4.7				
E- 12	1.0	1.2	1.5	1.8	2.2	2.7	3.3	3.9	4.7	5.6	6.8	8.2

### 4. OPERATING TEMPERATURE RANGE

T.C.	Min. operating Temperature	Max. operating Temperature	Reference Temperature
C0G X7R X7S	-55°C	125°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 CGA6, CGA7, CGA8 and CGA9 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

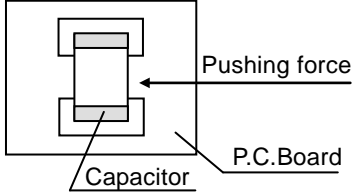
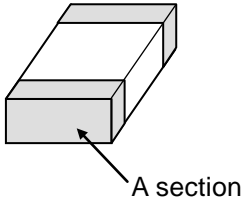
Dispose this product as industrial waste in accordance with the Industrial Waste Law.

8. PERFORMANCE

table 1

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 min.	Apply 500V DC for 60s.									
3	Voltage Proof	Withstand test voltage without insulation breakdown or other damage.	1.2 times of rated voltage, above DC voltage shall be applied for 1s. Charge / discharge current shall not exceed 50mA.									
4	Capacitance	Within the specified tolerance.	<table border="1"> <thead> <tr> <th>Class</th> <th>Measuring frequency</th> <th>Measuring voltage</th> </tr> </thead> <tbody> <tr> <td>Class1</td> <td>1MHz±10%</td> <td>0.5 - 5 Vrms.</td> </tr> <tr> <td>Class2</td> <td>1kHz±10%</td> <td>1.0±0.2 Vrms.</td> </tr> </tbody> </table>	Class	Measuring frequency	Measuring voltage	Class1	1MHz±10%	0.5 - 5 Vrms.	Class2	1kHz±10%	1.0±0.2 Vrms.
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5	Q (Class1)	<table border="1"> <thead> <tr> <th>Rated Capacitance</th> <th>Q</th> </tr> </thead> <tbody> <tr> <td>30pF and over</td> <td>1,000 min.</td> </tr> <tr> <td>Under 30pF</td> <td>400+20×C min.</td> </tr> </tbody> </table> <p>C : Rated capacitance (pF)</p>	Rated Capacitance	Q	30pF and over	1,000 min.	Under 30pF	400+20×C min.	See No.4 in this table for measuring condition.			
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6	Dissipation Factor (Class2)	<table border="1"> <thead> <tr> <th>T.C.</th> <th>D.F.</th> </tr> </thead> <tbody> <tr> <td>X7R X7S</td> <td>0.03 max.</td> </tr> </tbody> </table>	T.C.	D.F.	X7R X7S	0.03 max.	See No.4 in this table for measuring condition.					
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(continued)

No.	Item	Performance	Test or inspection method										
7	Temperature Characteristics of Capacitance (Class1)	<table border="1" data-bbox="517 259 909 383"> <tr> <td data-bbox="517 259 603 309">T.C.</td> <td data-bbox="603 259 909 309">Temperature Coefficient</td> </tr> <tr> <td data-bbox="517 309 603 383">COG</td> <td data-bbox="603 309 909 383">0 ± 30 (ppm/°C)</td> </tr> </table> <p data-bbox="499 423 909 488">Capacitance drift within ± 0.2% or ± 0.05pF, whichever larger.</p>	T.C.	Temperature Coefficient	COG	0 ± 30 (ppm/°C)	<p data-bbox="948 237 1437 336">Temperature coefficient shall be calculated based on values at 25°C and 85°C temperature.</p> <p data-bbox="948 374 1445 439">Measuring temperature below 20°C shall be -10°C and -25°C.</p>						
T.C.	Temperature Coefficient												
COG	0 ± 30 (ppm/°C)												
8	Temperature Characteristics of Capacitance (Class2)	<p data-bbox="557 544 863 577">Capacitance Change (%)</p> <hr/> <p data-bbox="596 607 823 640">No voltage applied</p> <hr/> <p data-bbox="644 669 775 703">X7R : ± 15</p> <p data-bbox="644 703 775 736">X7S : ± 22</p> <hr/>	<p data-bbox="948 533 1430 663">Capacitance shall be measured by the steps shown in the following table after thermal equilibrium is obtained for each step.</p> <p data-bbox="948 669 1398 703"><u>ΔC be calculated ref. STEP3 reading</u></p> <table border="1" data-bbox="1002 703 1401 992"> <thead> <tr> <th data-bbox="1002 703 1118 741">Step</th> <th data-bbox="1118 703 1401 741">Temperature(°C)</th> </tr> </thead> <tbody> <tr> <td data-bbox="1002 741 1118 801">1</td> <td data-bbox="1118 741 1401 801">25 ± 2</td> </tr> <tr> <td data-bbox="1002 801 1118 862">2</td> <td data-bbox="1118 801 1401 862">-55 ± 3</td> </tr> <tr> <td data-bbox="1002 862 1118 922">3</td> <td data-bbox="1118 862 1401 922">25 ± 2</td> </tr> <tr> <td data-bbox="1002 922 1118 992">4</td> <td data-bbox="1118 922 1401 992">125 ± 2</td> </tr> </tbody> </table>	Step	Temperature(°C)	1	25 ± 2	2	-55 ± 3	3	25 ± 2	4	125 ± 2
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9	Robustness of Terminations	<p data-bbox="499 1043 909 1137">No sign of termination coming off, breakage of ceramic, or other abnormal signs.</p>	<p data-bbox="948 1043 1385 1173">Reflow solder the capacitors on a P.C.Board shown in Appendix 1 and apply a pushing force of 17.7N with 10±1s.</p> 										
10	Solderability	<p data-bbox="499 1420 909 1485">New solder to cover over 75% of termination.</p> <p data-bbox="499 1485 909 1585">25% may have pin holes or rough spots but not concentrated in one spot.</p> <p data-bbox="499 1585 909 1720">Ceramic surface of A sections shall not be exposed due to melting or shifting of termination material.</p> 	<p data-bbox="948 1420 1401 1485">Completely soak both terminations in solder at 235±5°C for 2±0.5s.</p> <p data-bbox="948 1525 1278 1559">Solder : H63A (JIS Z 3282)</p> <p data-bbox="948 1592 1390 1693">Flux : Isopropyl alcohol (JIS K 8839) Rosin(JIS K 5902) 25% solid solution.</p>										

(continued)

No.	Item		Performance	Test or inspection method										
11	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 to 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 capacitors in ambient condition for 6 to 24h (Class1) or 24±2h (Class2) before measurement.</p>										
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D.F. (Class2)	Meet the initial spec.													
Insulation Resistance	Meet the initial spec.													
Voltage proof	No insulation breakdown or other damage.													
12	Vibration	External appearance	No mechanical damage.	<p>Reflow solder the capacitors on a P.C.Board shown in Appendix 1 before testing.</p> <p>Vibrate the capacitor with following conditions.</p> <p>Applied force : 5G max. Frequency : 10-2000Hz Duration : 20 min. Cycle : 12 cycles in each 3 mutually perpendicular directions.</p>										
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D.F. (Class2)	Meet the initial spec.													

(continued)

No.	Item	Performance	Test or inspection method															
13	Temperature cycle	External appearance	<p>Reflow solder the capacitors on a P.C.Board shown in Appendix 1 before testing.</p> <p>Expose the capacitors in the condition step1 through step 4 and repeat 1,000 times consecutively.</p> <p>Leave the capacitors in ambient condition for 6 to 24h (Class 1) or 24±2h (Class 2) before measurement.</p> <table border="1"> <thead> <tr> <th>Step</th> <th>Temperature(°C)</th> <th>Time (min.)</th> </tr> </thead> <tbody> <tr> <td>1</td> <td>-55 ± 3</td> <td>30 ± 3</td> </tr> <tr> <td>2</td> <td>25 ± 2</td> <td>2 - 5</td> </tr> <tr> <td>3</td> <td>125 ± 2</td> <td>30 ± 2</td> </tr> <tr> <td>4</td> <td>25 ± 2</td> <td>2 - 5</td> </tr> </tbody> </table>	Step	Temperature(°C)	Time (min.)	1	-55 ± 3	30 ± 3	2	25 ± 2	2 - 5	3	125 ± 2	30 ± 2	4	25 ± 2	2 - 5
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D.F. (Class2)	Meet the initial spec.																	
Insulation Resistance	Meet the initial spec.																	
Voltage proof	No insulation breakdown or other damage.																	
14	Moisture Resistance (Steady State)	External appearance	<p>Reflow solder the capacitors on a P.C.Board shown in Appendix 1 before testing.</p> <p>Leave at temperature 40±2°C, 90 to 95%RH for 500 +24,0h.</p> <p>Leave the capacitors in ambient condition for 6 to 24h (Class1) or 24±2h (Class2) before measurement.</p>															
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D.F. (Class2)	Characteristics 200% of initial spec. max.																	
Insulation Resistance	1,000MΩ min.																	



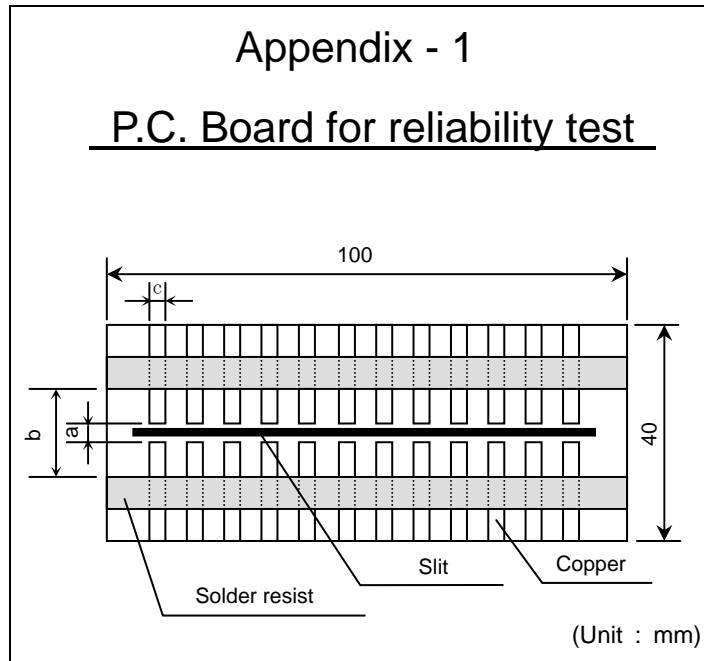
(continued)

No.	Item	Performance	Test or inspection method									
15	Life	No mechanical damage.	Reflow solder the capacitors on a P.C.Board shown in Appendix 1 before testing.  Apply rated voltage at maximum operating temperature $\pm 2^{\circ}\text{C}$ for 1,000 +48, 0h.  Charge/discharge current shall not exceed 50mA.  Leave the capacitors in ambient condition for 6 to 24h (Class1) or 24 $\pm$ 2h (Class2) before measurement.  Voltage conditioning (only for class 2) Voltage treat the capacitors under testing temperature and voltage for 1 hour. Leave the capacitors in ambient condition for 24 $\pm$ 2h before measurement. Use this measurement for initial value.									
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D.F. (Class2)	Characteristics 200% of initial spec. max.											
Insulation Resistance	1,000M $\Omega$ min.											

\*As for the initial measurement of capacitors (Class2) on number 8, 11, 12, 13 and 14, leave capacitors at 150  $-10,0^{\circ}\text{C}$  for 1 hour and measure the value after leaving capacitors for 24 $\pm$ 2h in ambient condition.



## Appendix - 1

### P.C. Board for reliability test



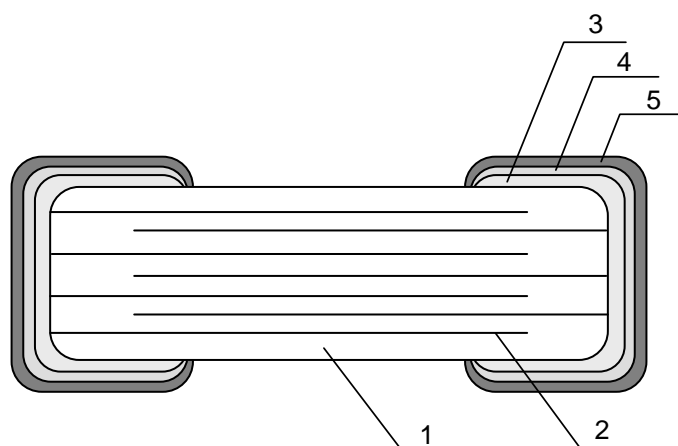
Material : Glass Epoxy ( As per JIS C6484 GE4 )

P.C. Board thickness : 1.6mm

-  Copper ( thickness 0.035mm )
-  Solder resist

TDK (EIA style)	Dimensions (mm)		
	a	b	c
CGA5 (CC1206)	2.2	5.0	2.0
CGA6 (CC1210)	2.2	5.0	2.9
CGA7 (CC1808)	3.5	7.0	2.5
CGA8 (CC1812)	3.5	7.0	3.7
CGA9 (CC2220)	4.5	8.0	5.6

## 9. INSIDE STRUCTURE AND MATERIAL



No.	NAME	MATERIAL	
		Class1	Class2
1	Dielectric	CaZrO <sub>3</sub>	BaTiO <sub>3</sub>
2	Electrode	Nickel (Ni)	
3	Termination	Copper (Cu)	
4		Nickel (Ni)	
5		Tin (Sn)	

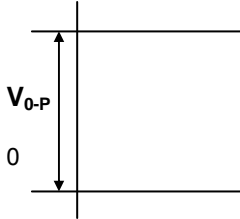
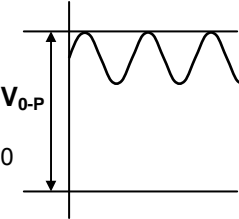
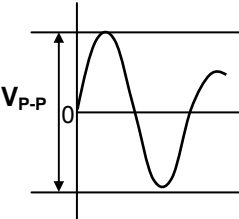
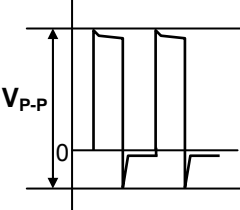
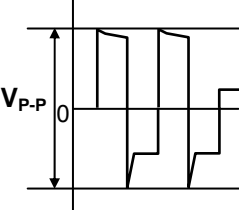
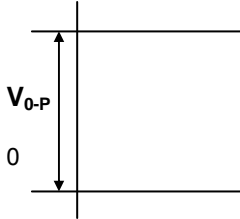
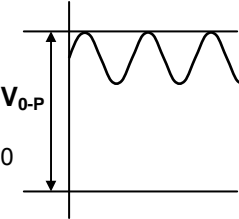
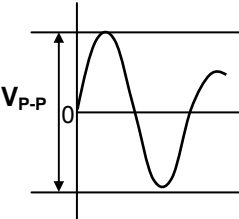
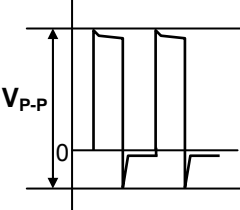
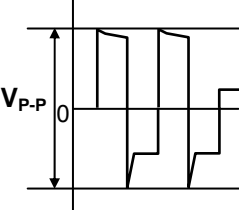
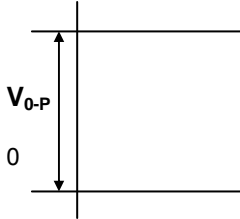
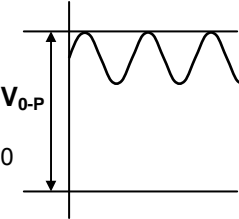
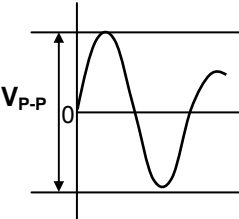
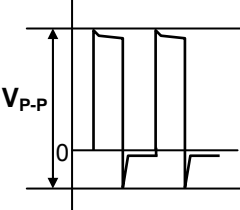
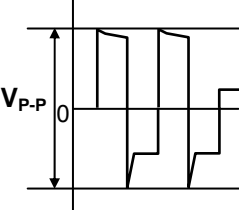
## 10. RECOMMENDATION

It is recommended to provide a slit (about 1mm wide) in the board under the components to improve washing Flux. And please make sure to dry detergent up completely before.

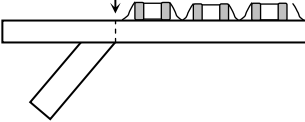
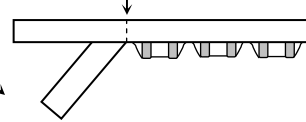
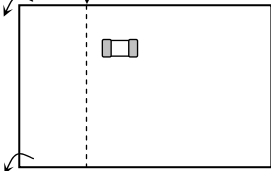
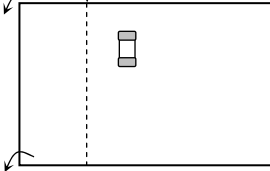
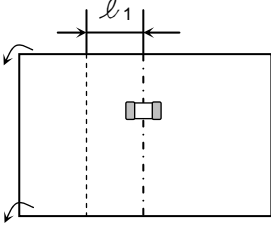
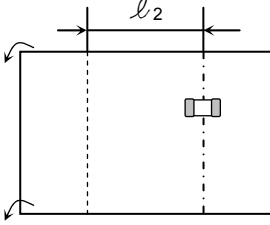
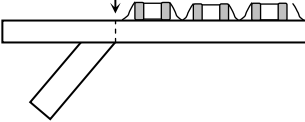
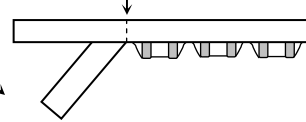
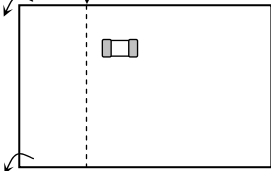
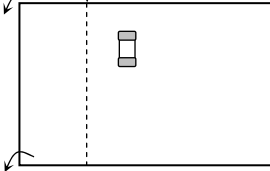
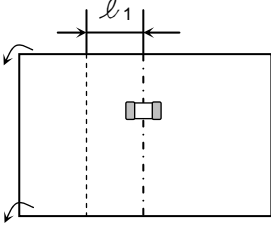
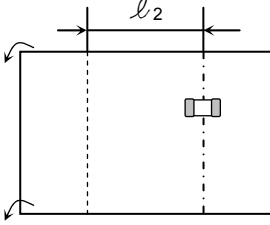
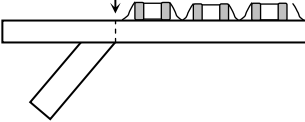
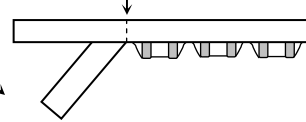
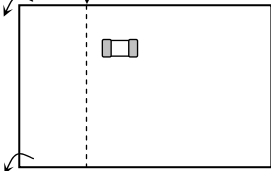
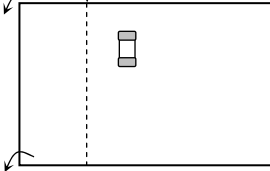
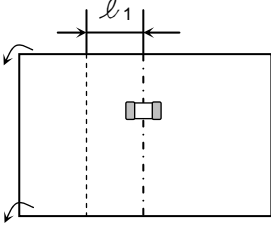
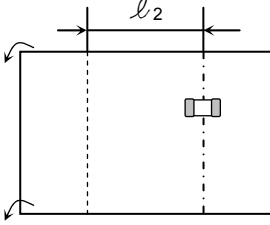
## 11. SOLDERING CONDITION

Reflow soldering only.

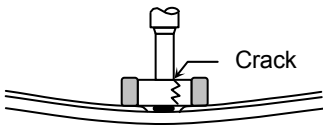
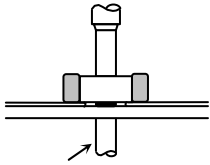
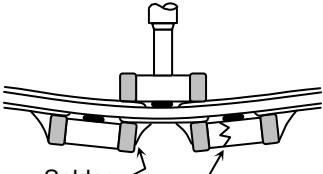
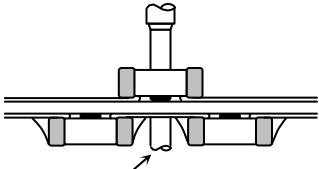
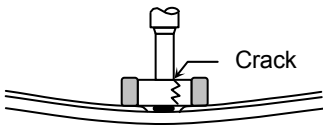
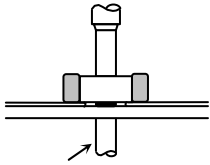
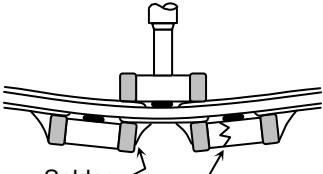
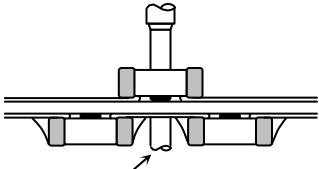
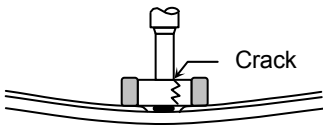
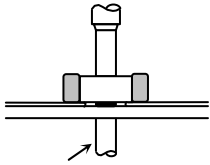
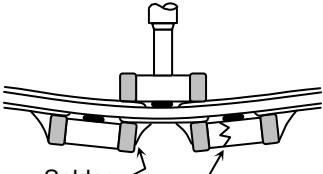
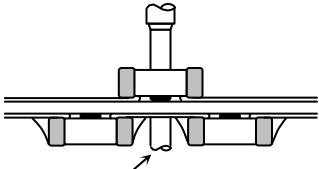
## 12. Caution

No.	Process	Condition														
1	Operating Condition (Storage, Transportation)	<p>1-1. Storage</p> <ol style="list-style-type: none"> <li>1) The capacitors must be stored in an ambient temperature of 5 to 40°C with a relative humidity of 20 to 70%RH. The products should be used within 6 months upon receipt.</li> <li>2) The capacitors must be operated and stored in an environment free of dew condensation and these gases such as Hydrogen Sulphide, Hydrogen Sulphate, Chlorine, Ammonia and sulfur.</li> <li>3) Avoid storing in sun light and falling of dew.</li> <li>4) Do not use capacitors under high humidity and high and low atmospheric pressure which may affect capacitors reliability.</li> <li>5) Capacitors should be tested for the solderability when they are stored for long time.</li> </ol> <p>1-2. Handling in transportation</p> <p>In case of the transportation of the capacitors, the performance of the capacitors may be deteriorated depending on the transportation condition. (Refer to JEITA RCR-2335B 9.2 Handling in transportation)</p>														
2	Circuit design ⚠ Caution	<p>2-1. Operating temperature</p> <p>Operating temperature should be followed strictly within this specification, especially be careful with maximum temperature.</p> <ol style="list-style-type: none"> <li>1) Do not use capacitors above the maximum allowable operating temperature.</li> <li>2) 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 mounted on. Please design the circuit so that the maximum temperature of the capacitors including the self heating to be below the maximum allowable operating temperature. Temperature rise at capacitor surface shall be below 20°C)</li> <li>3) The electrical characteristics of the capacitors will vary depending on the temperature. The capacitors should be selected and designed in taking the temperature into consideration.</li> </ol> <p>2-2. Operating voltage</p> <ol style="list-style-type: none"> <li>1) 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. _____ (1) and (2) AC or pulse with overshooting, <math>V_{P-P}</math> must be below the rated voltage. _____ (3), (4) and (5) When the voltage is started to apply to the circuit or it is stopped applying, the irregular voltage may be generated for a transit period because of resonance or switching. Be sure to use the capacitors within rated voltage containing these Irregular voltage.</li> </ol> <table border="1" data-bbox="472 1451 1445 1727"> <thead> <tr> <th data-bbox="472 1451 660 1496">Voltage</th> <th data-bbox="660 1451 922 1496">(1) DC voltage</th> <th data-bbox="922 1451 1184 1496">(2) DC+AC voltage</th> <th data-bbox="1184 1451 1445 1496">(3) AC voltage</th> </tr> </thead> <tbody> <tr> <td data-bbox="472 1496 660 1727">Positional Measurement (Rated voltage)</td> <td data-bbox="660 1496 922 1727">  </td> <td data-bbox="922 1496 1184 1727">  </td> <td data-bbox="1184 1496 1445 1727">  </td> </tr> </tbody> </table> <table border="1" data-bbox="472 1753 1445 2020"> <thead> <tr> <th data-bbox="472 1753 660 1798">Voltage</th> <th data-bbox="660 1753 922 1798">(4) Pulse voltage (A)</th> <th data-bbox="922 1753 1445 1798">(5) Pulse voltage (B)</th> </tr> </thead> <tbody> <tr> <td data-bbox="472 1798 660 2020">Positional Measurement (Rated voltage)</td> <td data-bbox="660 1798 922 2020">  </td> <td data-bbox="922 1798 1445 2020">  </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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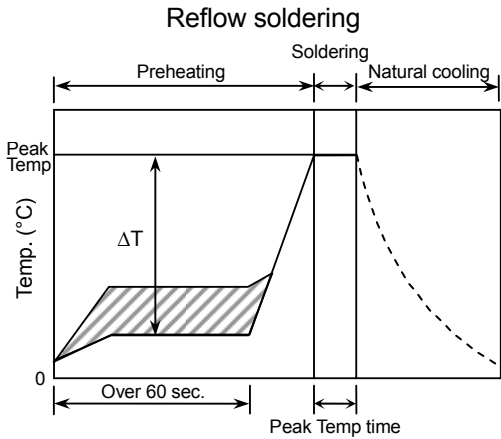
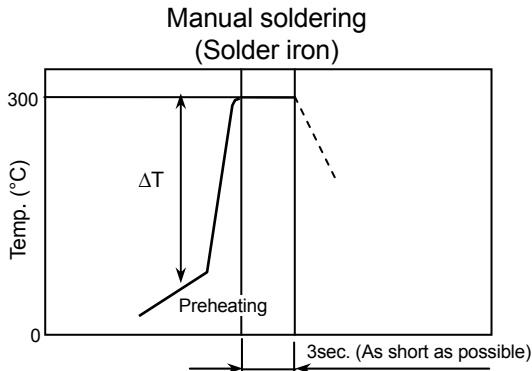
No.	Process	Condition																																					
2	Circuit design ⚠ Caution	<p>2) Even below the rated voltage, if repetitive high frequency AC or pulse is applied, the reliability of the capacitors may be reduced.</p> <p>3) The effective capacitance will vary depending on applied DC and AC voltages. The capacitors should be selected and designed in taking the voltages into consideration.</p> <p>2-3. Frequency When the capacitors (Class 2) are used in AC and/or pulse voltages, the capacitors may vibrate themselves and generate audible sound.</p>																																					
3	Designing P.C.board	<p>The amount of solder at the terminations has a direct effect on the reliability of the capacitors.</p> <p>1) The greater the amount of solder, the higher the stress on the chip capacitors, 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.</p> <p>2) Avoid using common solder land for multiple terminations and provide individual solder land for each terminations.</p> <p>3) Size and recommended land dimensions.</p> <div data-bbox="694 824 1236 1220" data-label="Diagram"> </div> <table border="1" data-bbox="470 1243 1444 1556"> <thead> <tr> <th colspan="2" data-bbox="470 1243 790 1288">Reflow soldering</th> <th colspan="5" data-bbox="1364 1243 1444 1288">(mm)</th> </tr> <tr> <th data-bbox="470 1288 630 1366">Type Symbol</th> <th data-bbox="630 1288 790 1366">CGA5 (CC1206)</th> <th data-bbox="790 1288 949 1366">CGA6 (CC1210)</th> <th data-bbox="949 1288 1109 1366">CGA7 (CC1808)</th> <th data-bbox="1109 1288 1268 1366">CGA8 (CC1812)</th> <th data-bbox="1268 1288 1444 1366">CGA9 (CC2220)</th> </tr> </thead> <tbody> <tr> <td data-bbox="470 1366 630 1411">A</td> <td data-bbox="630 1366 790 1411">2.0 - 2.4</td> <td data-bbox="790 1366 949 1411">2.0 - 2.4</td> <td data-bbox="949 1366 1109 1411">3.1 - 3.7</td> <td data-bbox="1109 1366 1268 1411">3.1 - 3.7</td> <td data-bbox="1268 1366 1444 1411">4.1 - 4.8</td> </tr> <tr> <td data-bbox="470 1411 630 1456">B</td> <td data-bbox="630 1411 790 1456">1.0 - 1.2</td> <td data-bbox="790 1411 949 1456">1.0 - 1.2</td> <td data-bbox="949 1411 1109 1456">1.2 - 1.4</td> <td data-bbox="1109 1411 1268 1456">1.2 - 1.4</td> <td data-bbox="1268 1411 1444 1456">1.2 - 1.4</td> </tr> <tr> <td data-bbox="470 1456 630 1500">C</td> <td data-bbox="630 1456 790 1500">1.1 - 1.6</td> <td data-bbox="790 1456 949 1500">1.9 - 2.5</td> <td data-bbox="949 1456 1109 1500">1.5 - 2.0</td> <td data-bbox="1109 1456 1268 1500">2.4 - 3.2</td> <td data-bbox="1268 1456 1444 1500">4.0 - 5.0</td> </tr> <tr> <td data-bbox="470 1500 630 1545">D</td> <td data-bbox="630 1500 790 1545">1.0 - 1.3</td> <td data-bbox="790 1500 949 1545">1.0 - 1.3</td> <td data-bbox="949 1500 1109 1545">1.0 - 1.3</td> <td data-bbox="1109 1500 1268 1545">1.0 - 1.3</td> <td data-bbox="1268 1500 1444 1545">1.0 - 1.3</td> </tr> </tbody> </table> <p>4) It is recommended to provide a slit (about 1mm width) in the board under the components to improve washing flux. And please make sure to dry detergent up completely before.</p> <p>It is recommended to use low activated flux ( Chlorine content : less than 0.1wt% ) such Rosin due to high voltage usage.</p>	Reflow soldering		(mm)					Type Symbol	CGA5 (CC1206)	CGA6 (CC1210)	CGA7 (CC1808)	CGA8 (CC1812)	CGA9 (CC2220)	A	2.0 - 2.4	2.0 - 2.4	3.1 - 3.7	3.1 - 3.7	4.1 - 4.8	B	1.0 - 1.2	1.0 - 1.2	1.2 - 1.4	1.2 - 1.4	1.2 - 1.4	C	1.1 - 1.6	1.9 - 2.5	1.5 - 2.0	2.4 - 3.2	4.0 - 5.0	D	1.0 - 1.3	1.0 - 1.3	1.0 - 1.3	1.0 - 1.3	1.0 - 1.3
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B	1.0 - 1.2	1.0 - 1.2	1.2 - 1.4	1.2 - 1.4	1.2 - 1.4																																		
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D	1.0 - 1.3	1.0 - 1.3	1.0 - 1.3	1.0 - 1.3	1.0 - 1.3																																		

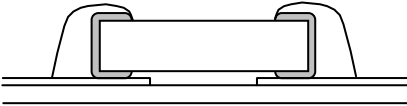
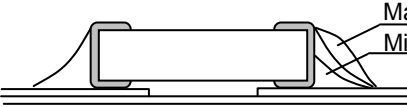
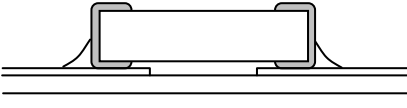
No.	Process	Condition												
3	Designing P.C.board	<p data-bbox="437 188 1098 219">5) Recommended chip capacitors layout is as following.</p> <table border="1" data-bbox="475 255 1430 1675"> <thead> <tr> <th data-bbox="475 255 660 331"></th> <th data-bbox="660 255 1043 331">Disadvantage against bending stress</th> <th data-bbox="1043 255 1430 331">Advantage against bending stress</th> </tr> </thead> <tbody> <tr> <td data-bbox="475 331 660 748">Mounting face</td> <td data-bbox="660 331 1043 748"> <p data-bbox="746 376 954 407">Perforation or slit</p>  <p data-bbox="699 645 948 712">Break P.C.board with mounted side up.</p> </td> <td data-bbox="1043 331 1430 748"> <p data-bbox="1136 376 1343 407">Perforation or slit</p>  <p data-bbox="1088 645 1337 712">Break P.C.board with mounted side down.</p> </td> </tr> <tr> <td data-bbox="475 748 660 1196">Chip arrangement (Direction)</td> <td data-bbox="660 748 1043 1196"> <p data-bbox="746 869 954 900">Perforation or slit</p>  </td> <td data-bbox="1043 748 1430 1196"> <p data-bbox="1136 869 1343 900">Perforation or slit</p>  </td> </tr> <tr> <td data-bbox="475 1196 660 1675">Distance from slit</td> <td data-bbox="660 1196 1043 1675"> <p data-bbox="673 1205 1002 1236">Closer to slit is higher stress</p>  <p data-bbox="880 1576 1008 1608"><math>(l_1 &lt; l_2)</math></p> </td> <td data-bbox="1043 1196 1430 1675"> <p data-bbox="1056 1205 1385 1236">Away from slit is less stress</p>  <p data-bbox="1270 1576 1398 1608"><math>(l_1 &lt; l_2)</math></p> </td> </tr> </tbody> </table>		Disadvantage against bending stress	Advantage against bending stress	Mounting face	<p data-bbox="746 376 954 407">Perforation or slit</p>  <p data-bbox="699 645 948 712">Break P.C.board with mounted side up.</p>	<p data-bbox="1136 376 1343 407">Perforation or slit</p>  <p data-bbox="1088 645 1337 712">Break P.C.board with mounted side down.</p>	Chip arrangement (Direction)	<p data-bbox="746 869 954 900">Perforation or slit</p> 	<p data-bbox="1136 869 1343 900">Perforation or slit</p> 	Distance from slit	<p data-bbox="673 1205 1002 1236">Closer to slit is higher stress</p>  <p data-bbox="880 1576 1008 1608"><math>(l_1 &lt; l_2)</math></p>	<p data-bbox="1056 1205 1385 1236">Away from slit is less stress</p>  <p data-bbox="1270 1576 1398 1608"><math>(l_1 &lt; l_2)</math></p>
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Distance from slit	<p data-bbox="673 1205 1002 1236">Closer to slit is higher stress</p>  <p data-bbox="880 1576 1008 1608"><math>(l_1 &lt; l_2)</math></p>	<p data-bbox="1056 1205 1385 1236">Away from slit is less stress</p>  <p data-bbox="1270 1576 1398 1608"><math>(l_1 &lt; l_2)</math></p>												

No.	Process	Condition												
3	Designing P.C.board	<p data-bbox="384 181 1390 215">6) Mechanical stress varies according to location of chip capacitors on the P.C.board.</p> <div data-bbox="491 271 1299 826" style="text-align: center;"> </div> <p data-bbox="842 887 1469 943" style="text-align: right;">The stress in capacitors is in the following order. A &gt; B = C &gt; D &gt; E</p> <p data-bbox="384 965 711 999">7) Layout recommendation</p> <table border="1" data-bbox="379 1010 1481 1917"> <thead> <tr> <th data-bbox="379 1010 539 1122">Example</th> <th data-bbox="539 1010 842 1122">Use of common solder land</th> <th data-bbox="842 1010 1150 1122">Soldering with chassis</th> <th data-bbox="1150 1010 1481 1122">Use of common solder land with other SMD</th> </tr> </thead> <tbody> <tr> <td data-bbox="379 1122 539 1503">Need to avoid</td> <td data-bbox="539 1122 842 1503"> </td> <td data-bbox="842 1122 1150 1503"> </td> <td data-bbox="1150 1122 1481 1503"> </td> </tr> <tr> <td data-bbox="379 1503 539 1917">Recommendation</td> <td data-bbox="539 1503 842 1917"> </td> <td data-bbox="842 1503 1150 1917"> </td> <td data-bbox="1150 1503 1481 1917"> </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			
Example	Use of common solder land	Soldering with chassis	Use of common solder land with other SMD											
Need to avoid														
Recommendation														

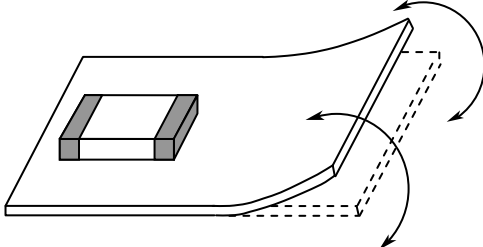
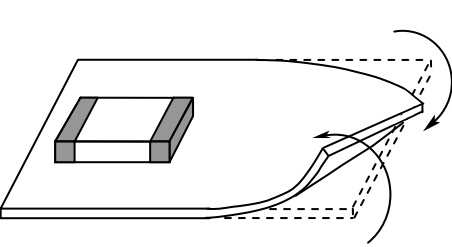
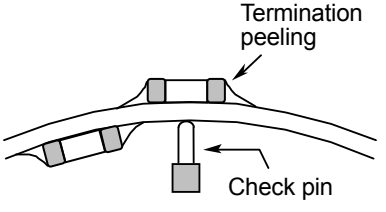
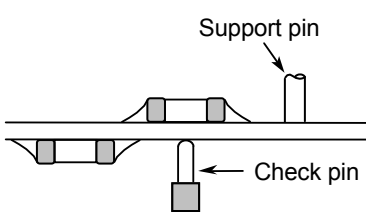
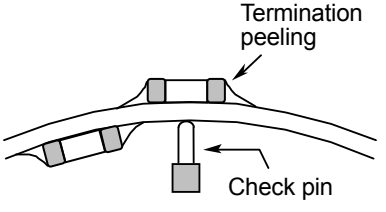
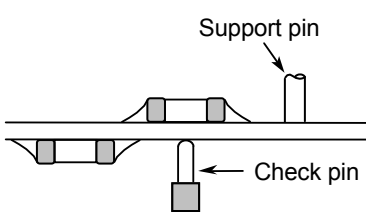
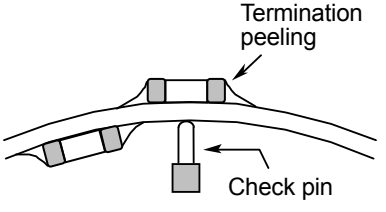
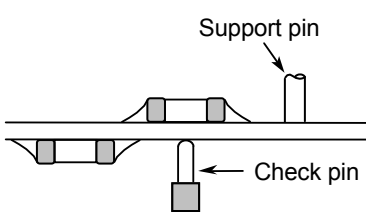
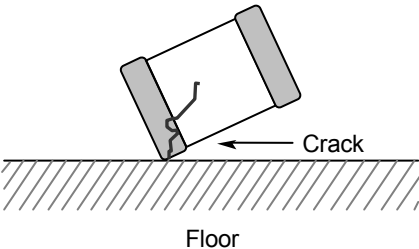
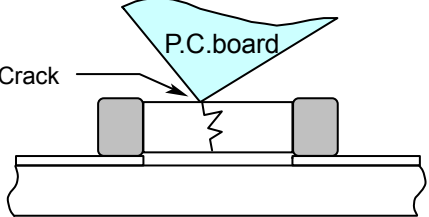
No.	Process	Condition									
4	Mounting	<p>4-1. Stress from mounting head</p> <p>If the mounting head is adjusted too low, it may induce excessive stress in the chip capacitors to result in cracking. Please take following precautions.</p> <ol style="list-style-type: none"> <li>1) Adjust the bottom dead center of the mounting head to reach on the P.C.board surface and not press 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.</li> </ol> <p>See following examples.</p> <table border="1" data-bbox="480 600 1433 1160"> <thead> <tr> <th data-bbox="480 600 663 647"></th> <th data-bbox="663 600 1059 647">Not recommended</th> <th data-bbox="1059 600 1433 647">Recommended</th> </tr> </thead> <tbody> <tr> <td data-bbox="480 647 663 896">Single sided mounting</td> <td data-bbox="663 647 1059 896">  <p>Crack</p> </td> <td data-bbox="1059 647 1433 896">  <p>Support pin</p> </td> </tr> <tr> <td data-bbox="480 896 663 1160">Double-sides mounting</td> <td data-bbox="663 896 1059 1160">  <p>Solder peeling</p> <p>Crack</p> </td> <td data-bbox="1059 896 1433 1160">  <p>Support pin</p> </td> </tr> </tbody> </table> <p>When the centering jaw is worn out, it may give mechanical impact on the capacitors to cause crack. Please control the close up dimension of the centering jaw and provide sufficient preventive maintenance and replacement of it.</p>		Not recommended	Recommended	Single sided mounting	 <p>Crack</p>	 <p>Support pin</p>	Double-sides mounting	 <p>Solder peeling</p> <p>Crack</p>	 <p>Support pin</p>
	Not recommended	Recommended									
Single sided mounting	 <p>Crack</p>	 <p>Support pin</p>									
Double-sides mounting	 <p>Solder peeling</p> <p>Crack</p>	 <p>Support pin</p>									



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 capacitors. To avoid such degradation, it is recommended following.</p> <ol style="list-style-type: none"> <li>1) It is recommended to use a mildly activated rosin flux (less than 0.1wt% chlorine). Strong flux is not recommended.</li> <li>2) Excessive flux must be avoided. Please provide proper amount of flux.</li> <li>3) When water-soluble flux is used, enough washing is necessary.</li> </ol> <p>5-2. Recommended soldering profile by various methods</p> <div style="text-align: center;"> <p>Reflow soldering</p>  </div> <div style="text-align: center; margin-top: 20px;"> <p>Manual soldering (Solder iron)</p>  </div> <p>5-3. Recommended soldering peak temp and peak temp 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;">Reflow soldering</th> </tr> <tr> <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;">Solder</td> <td></td> <td></td> </tr> <tr> <td style="text-align: center;">Sn-Pb Solder</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;">10 max.</td> </tr> </tbody> </table> <p>Recommended solder compositions</p> <p>Sn-37Pb (Sn-Pb solder)</p> <p>Sn-3.0Ag-0.5Cu (Lead Free Solder)</p>	Temp./Duration	Reflow soldering		Peak temp(°C)	Duration(sec.)	Solder			Sn-Pb Solder	230 max.	20 max.	Lead Free Solder	260 max.	10 max.
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No.	Process	Condition																							
5	Soldering	<p>5-4. Avoiding thermal shock</p> <p>1) Preheating condition</p> <table border="1" data-bbox="552 264 1449 501"> <thead> <tr> <th data-bbox="552 264 783 304">Soldering</th> <th data-bbox="783 264 1206 304">Type</th> <th data-bbox="1206 264 1449 304">Temp. (°C)</th> </tr> </thead> <tbody> <tr> <td data-bbox="552 304 783 344">Reflow soldering</td> <td data-bbox="783 304 1206 344">CGA5(CC1206)</td> <td data-bbox="1206 304 1449 344"><math>\Delta T \leq 150</math></td> </tr> <tr> <td data-bbox="552 344 783 405">Reflow soldering</td> <td data-bbox="783 344 1206 405">CGA6(CC1210),CGA7(CC1808) CGA8(CC1812),CGA9(CC2220)</td> <td data-bbox="1206 344 1449 405"><math>\Delta T \leq 130</math></td> </tr> <tr> <td data-bbox="552 405 783 445">Manual soldering</td> <td data-bbox="783 405 1206 445">CGA5(CC1206)</td> <td data-bbox="1206 405 1449 445"><math>\Delta T \leq 150</math></td> </tr> <tr> <td data-bbox="552 445 783 501">Manual soldering</td> <td data-bbox="783 445 1206 501">CGA6(CC1210),CGA7(CC1808) CGA8(CC1812),CGA9(CC2220)</td> <td data-bbox="1206 445 1449 501"><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 in chip capacitors when temperature changes and it may result in chip cracking. In sufficient solder may detach the capacitors from the P.C.board.</p> <div style="display: flex; justify-content: space-between; align-items: flex-start;"> <div data-bbox="507 913 632 981" style="width: 30%;">Excessive solder</div> <div data-bbox="699 898 1107 1003" style="width: 35%; text-align: center;">  </div> <div data-bbox="1134 898 1422 992" style="width: 30%;">Higher tensile force in chip capacitors to cause crack</div> </div> <hr/> <div style="display: flex; justify-content: space-between; align-items: center;"> <div data-bbox="507 1081 632 1115" style="width: 30%;">Adequate</div> <div data-bbox="699 1043 1107 1149" style="width: 35%; text-align: center;">  </div> </div> <hr/> <div style="display: flex; justify-content: space-between; align-items: flex-start;"> <div data-bbox="507 1216 632 1283" style="width: 30%;">Insufficient solder</div> <div data-bbox="699 1211 1107 1317" style="width: 35%; text-align: center;">  </div> <div data-bbox="1134 1193 1422 1310" style="width: 30%;">Low robustness may cause contact failure or chip capacitors come off 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 solder iron varies by its type, P.C.board material and solder land size. The higher the tip temperature, the quicker the operation. However, heat shock may cause a crack in the chip capacitors. Please make sure the tip temp. before soldering and keep the peak temp 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> <p>Recommended solder iron condition (Sn-Pb Solder and Lead Free Solder)</p> <table border="1" data-bbox="552 1697 1390 1809"> <thead> <tr> <th data-bbox="552 1697 762 1753">Temp. (°C)</th> <th data-bbox="762 1697 970 1753">Duration (sec.)</th> <th data-bbox="970 1697 1177 1753">Wattage (W)</th> <th data-bbox="1177 1697 1390 1753">Shape (mm)</th> </tr> </thead> <tbody> <tr> <td data-bbox="552 1753 762 1809">300 max.</td> <td data-bbox="762 1753 970 1809">3 max.</td> <td data-bbox="970 1753 1177 1809">20 max.</td> <td data-bbox="1177 1753 1390 1809">Ø 3.0 max.</td> </tr> </tbody> </table>	Soldering	Type	Temp. (°C)	Reflow soldering	CGA5(CC1206)	$\Delta T \leq 150$	Reflow soldering	CGA6(CC1210),CGA7(CC1808) CGA8(CC1812),CGA9(CC2220)	$\Delta T \leq 130$	Manual soldering	CGA5(CC1206)	$\Delta T \leq 150$	Manual soldering	CGA6(CC1210),CGA7(CC1808) CGA8(CC1812),CGA9(CC2220)	$\Delta T \leq 130$	Temp. (°C)	Duration (sec.)	Wattage (W)	Shape (mm)	300 max.	3 max.	20 max.	Ø 3.0 max.
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Temp. (°C)	Duration (sec.)	Wattage (W)	Shape (mm)																						
300 max.	3 max.	20 max.	Ø 3.0 max.																						

No.	Process	Condition
5	Soldering	<p>2) Direct contact of the soldering iron with ceramic dielectric of chip capacitors may cause crack. Do not touch the ceramic dielectric and the terminations by solder iron.</p> <p>5-7. Sn-Zn solder Sn-Zn solder affects product reliability. Please contact TDK in advance when utilize Sn-Zn solder.</p> <p>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 the capacitors are mounted (in longitudinal direction) in the same direction of the reflow soldering. (Refer to JEITA RCR-2335B Annex 1 (Informative) Recommendations to prevent the tombstone phenomenon)</p>
6	Cleaning	<p>1) If an unsuitable cleaning fluid is used, flux residue or some foreign articles may stick to chip capacitors surface to deteriorate especially the insulation resistance.</p> <p>2) If cleaning condition is not suitable, it may damage the chip capacitors.</p> <p>2)-1. Insufficient washing</p> <p>(1) Terminal electrodes may corrode by Halogen in the flux.</p> <p>(2) Halogen in the flux may adhere on the surface of capacitors, and lower the insulation resistance.</p> <p>(3) Water soluble flux has higher tendency to have above mentioned problems (1) and (2).</p> <p>2)-2. Excessive washing</p> <p>When ultrasonic cleaning is used, excessively high ultrasonic energy output can affect the connection between the ceramic chip capacitor's body and the terminal electrode. To avoid this, following is the recommended condition.</p> <p style="text-align: center;">Power : 20 W/l max. Frequency : 40 kHz max. Washing time : 5 minutes max.</p> <p>2)-3. If the cleaning fluid is contaminated, density of Halogen increases, and it may bring the same result as insufficient cleaning.</p>
7	Coating and molding of the P.C.board	<p>1) When the P.C.board is coated, please verify the quality influence on the product.</p> <p>2) Please verify carefully that there is no harmful decomposing or reaction gas emission during curing which may damage the chip capacitors.</p> <p>3) Please verify the curing temperature.</p>

No.	Process	Condition						
8	Handling after chip mounted ⚠ Caution	<p>1) Please pay attention not to bend or distort the P.C.board after soldering in handling otherwise the chip capacitors may crack.</p> <div style="display: flex; justify-content: space-around; align-items: center;"> <div style="text-align: center;"> <p>Bend</p>  </div> <div style="text-align: center;"> <p>Twist</p>  </div> </div> <p>2) When functional check of the P.C.board is performed, check pin pressure tends to be adjusted higher for fear of loose contact. But if the pressure is excessive and bend the P.C.board, it may crack the chip capacitors or peel the terminations off. Please adjust the check pins not to bend the P.C.board.</p> <table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th data-bbox="491 878 628 936">Item</th> <th data-bbox="628 878 1046 936">Not recommended</th> <th data-bbox="1046 878 1445 936">Recommended</th> </tr> </thead> <tbody> <tr> <td data-bbox="491 936 628 1236" style="text-align: center; vertical-align: middle;">Board bending</td> <td data-bbox="628 936 1046 1236" style="text-align: center;">  </td> <td data-bbox="1046 936 1445 1236" style="text-align: center;">  </td> </tr> </tbody> </table>	Item	Not recommended	Recommended	Board bending		
Item	Not recommended	Recommended						
Board bending								
9	Handling of loose chip capacitors	<p>1) If dropped the chip capacitors may crack. Once dropped do not use it. Especially, the large case sized chip capacitors are tendency to have cracks easily, so please handle with care.</p> <div style="text-align: center;">  <p>Floor</p> </div> <p>2) Piling the P.C.board after mounting for storage or handling, the corner of the P.C. board may hit the chip capacitors of another board to cause crack.</p> <div style="text-align: center;">  </div>						

No.	Process	Condition
10	Capacitance aging	The capacitors (Class 2) have aging in the capacitance. They may not be used in precision time constant circuit. In case of the time constant circuit, the evaluation should be done well.
11	Estimated life and estimated failure rate of capacitors	As per the estimated life and the estimated failure rate depend on the temperature and the voltage. This can be calculated by the equation described in JEITA RCR-2335B Annex 6 (Informative) Calculation of the estimated lifetime and the estimated failure rate ( Voltage acceleration coefficient : 3 multiplication rule, Temperature acceleration coefficient : 10°C rule) The failure rate can be decreased by reducing the temperature and the voltage but they will not be guaranteed.
12	Others ⚠ Caution	<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 we are not responsible for any damage or liability caused by use of the products in any of the applications below or for any other use exceeding the range or conditions set forth in this specification sheet. If you intend to use the products in the applications listed below or if you have special requirements exceeding the range or conditions set forth in this specification, please contact us.</p> <p>(1) Aerospace/Aviation equipment  (2) Transportation equipment (electric trains, ships, etc.)  (3) Medical equipment  (4) Power-generation control equipment  (5) Atomic energy-related equipment  (6) Seabed equipment  (7) Transportation control equipment  (8) Public information-processing equipment  (9) Military equipment  (10) Electric heating apparatus, burning equipment  (11) Disaster prevention/crime prevention equipment  (12) Safety equipment  (13) Other applications that are not considered general-purpose applications</p> <p>When designing your equipment even for general-purpose applications, you are kindly requested to take into consideration securing protection circuit/device or providing backup circuits in your equipment.</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    F 2 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.

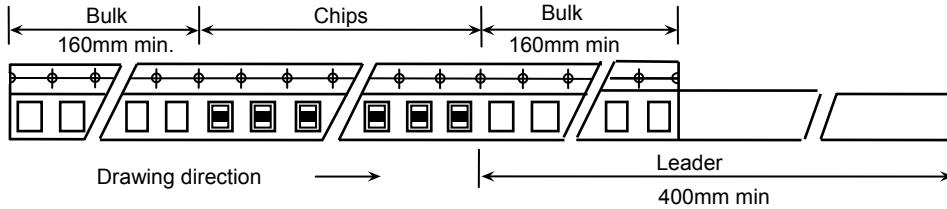
# 15. TAPE PACKAGING SPECIFICATION

## 1. CONSTRUCTION AND DIMENSION OF TAPING

### 1-1. Dimensions of carrier tape

Dimensions of paper tape shall be according to Appendix 2.  
 Dimensions of plastic tape shall be according to Appendix 3, 4.

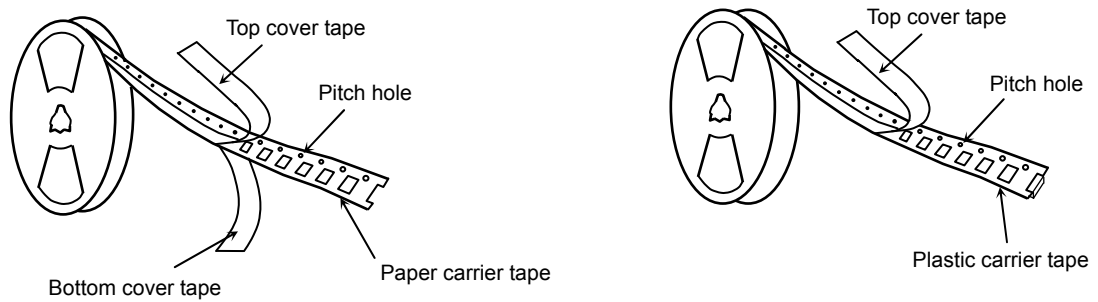
### 1-2. Bulk part and leader of taping



### 1-3. Dimensions of reel

Dimensions of  $\varnothing 178$  reel shall be according to Appendix 5, 6.  
 Dimensions of  $\varnothing 330$  reel shall be according to Appendix 7, 8.

### 1-4. Structure of taping



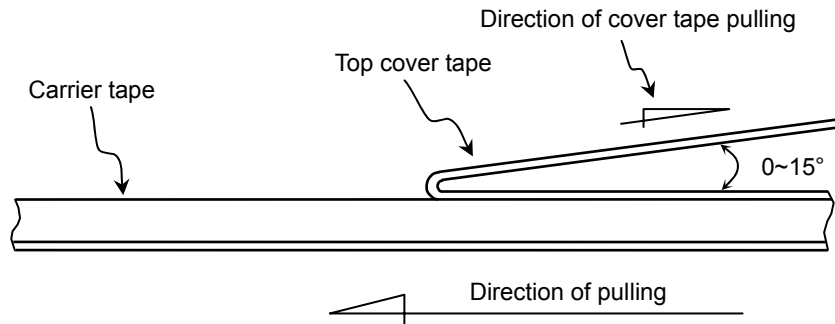
## 2. CHIP QUANTITY

Type	Thickness of chip	Taping Material	Chip quantity(pcs.)	
			$\varphi 178\text{mm}$ reel	$\varphi 330\text{mm}$ reel
CGA5 (CC1206)	0.85 mm	paper	4,000	10,000
	1.30 mm	plastic	2,000	
CGA6 (CC1210)	1.60 mm	plastic	2,000	8,000
	2.00 mm		1,000	
	2.50 mm			
CGA7 (CC1808)	0.85 mm	plastic	1,000	5,000
	1.10 mm			
	1.30 mm			3,000
	1.60 mm			
CGA8 (CC1812)	2.00 mm	plastic	1,000	5,000
	1.30 mm			
	1.60 mm			3,000
	2.30 mm			
	2.50 mm			
CGA9 (CC2220)	1.60 mm	plastic	1,000	3,000
	2.00 mm		500	
	2.50 mm			

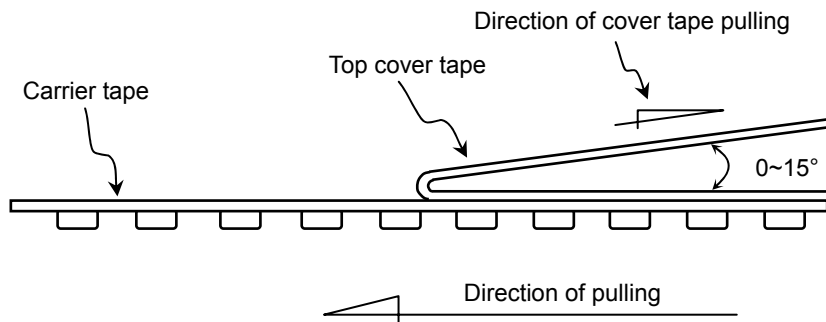
### 3. PERFORMANCE SPECIFICATIONS

- 3-1. Fixing peeling strength (top tape)  
0.05-0.7N. (See the following figure.)

TYPE 1 (Paper)



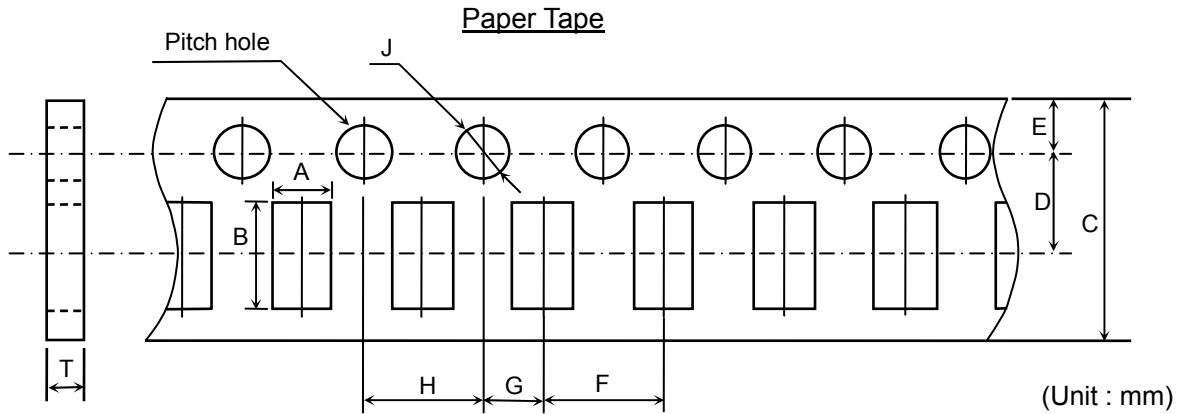
TYPE 2 (Plastic)



- 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 fixing tape.
- 3-5. The fixing tapes shall not protrude beyond the edges of the carrier tape not shall cover the sprocket holes.



## Appendix 2

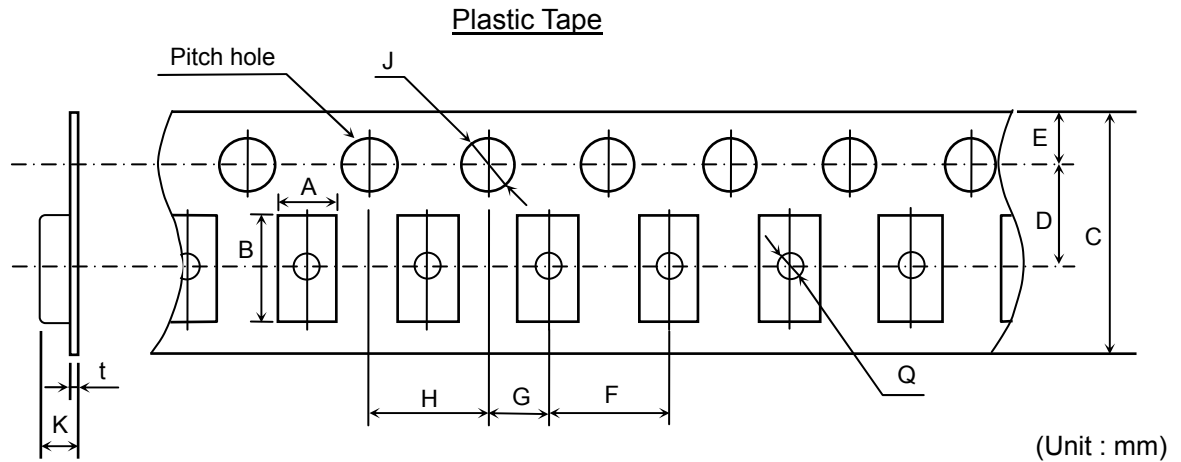


Symbol	A	B	C	D	E	F
Type						
CGA5 (CC1206)	( 1.90 )	( 3.50 )	$8.00 \pm 0.30$	$3.50 \pm 0.05$	$1.75 \pm 0.10$	$4.00 \pm 0.10$

Symbol	G	H	J	T
Type				
CGA5 (CC1206)	$2.00 \pm 0.05$	$4.00 \pm 0.10$	$\varnothing 1.5 \begin{matrix} +0.10 \\ 0 \end{matrix}$	1.20 max.

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

## Appendix 3



Symbol	A	B	C	D	E	F
Type						
CGA5 (CC1206)	( 1.90 )	( 3.50 )	$8.00 \pm 0.30$	$3.50 \pm 0.05$	$1.75 \pm 0.10$	$4.00 \pm 0.10$
CGA6 (CC1210)	( 2.90 )	( 3.60 )	[ $12.0 \pm 0.30$ ]	[ $5.50 \pm 0.05$ ]		

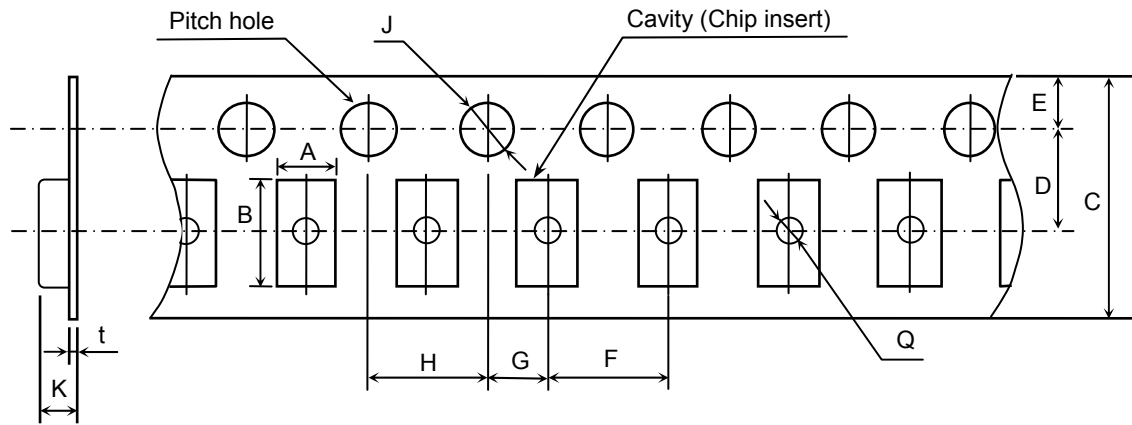
Symbol	G	H	J	K	t	Q
Type						
CGA5 (CC1206)	$2.00 \pm 0.05$	$4.00 \pm 0.10$	$\varnothing 1.5 \begin{matrix} +0.10 \\ 0 \end{matrix}$	2.50 max.	0.30 max.	$\varnothing 0.50$ min.
CGA6 (CC1210)				3.20 max.	0.60 max.	

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

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

## Appendix 4

### Plastic Tape



(Unit : mm)

Symbol Type	A	B	C	D	E	F
CGA7 (CC1808)	( 2.50 )	( 5.10 )	12.0 ± 0.30	5.50 ± 0.05	1.75 ± 0.10	8.00 ± 0.10
CGA8 (CC1812)	( 3.60 )	( 4.90 )				
CGA9 (CC2220)	( 5.40 )	( 6.10 )				

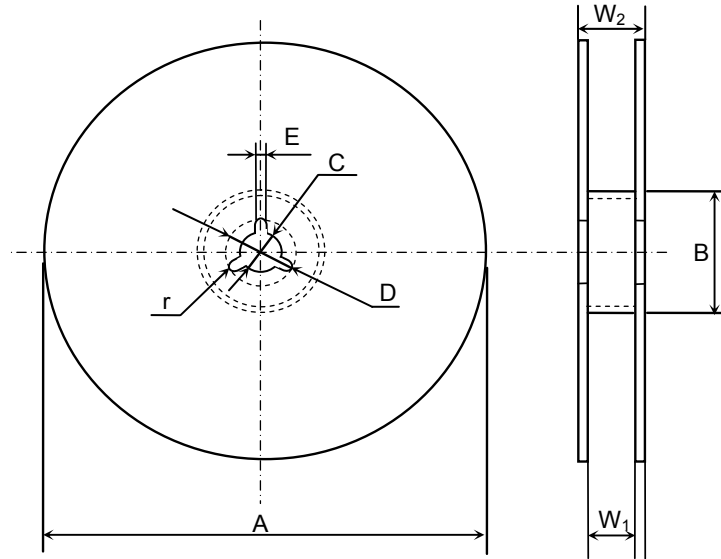
Symbol Type	G	H	J	K	t	Q
CGA7 (CC1808)	2.00 ± 0.05	4.00 ± 0.10	∅ 1.5 <sup>+0.10</sup> <sub>0</sub>	6.50 max.	0.60 max.	∅ 1.50 min.
CGA8 (CC1812)						
CGA9 (CC2220)						

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

## Appendix 5

CGA5, CGA6 ( As for CGA6 type, any thickness of the item except 2.5mm )

(Material : Polystyrene)



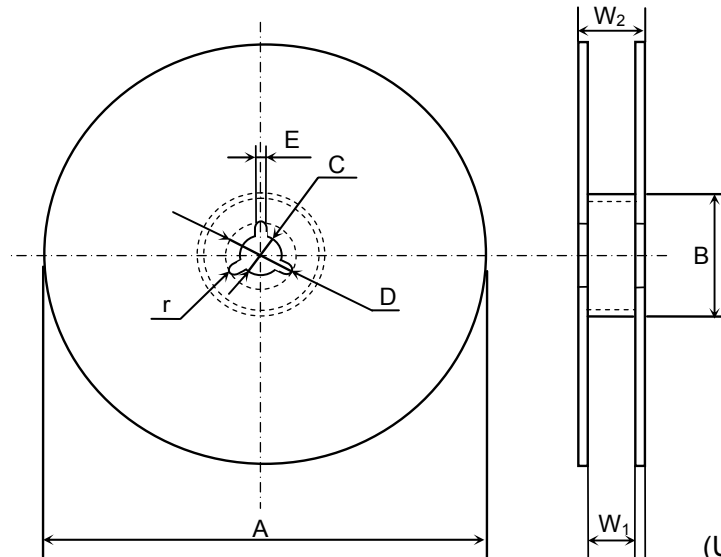
(Unit : mm)

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 6

CGA6, CGA7, CGA8, CGA9 ( As for CGA6 type, applied to 2.5mm thickness products )

(Material : Polystyrene)



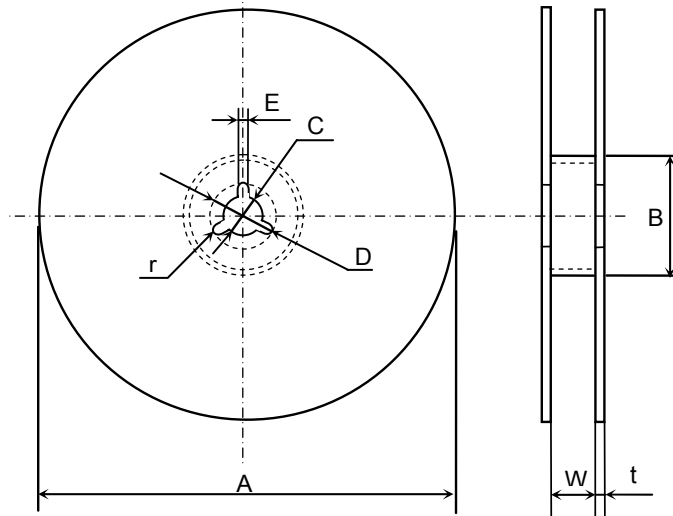
(Unit : mm)

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 7

CGA5, CGA6 (As for CGA6 type, any thickness of the item except 2.5mm)

(Material : Polystyrene)



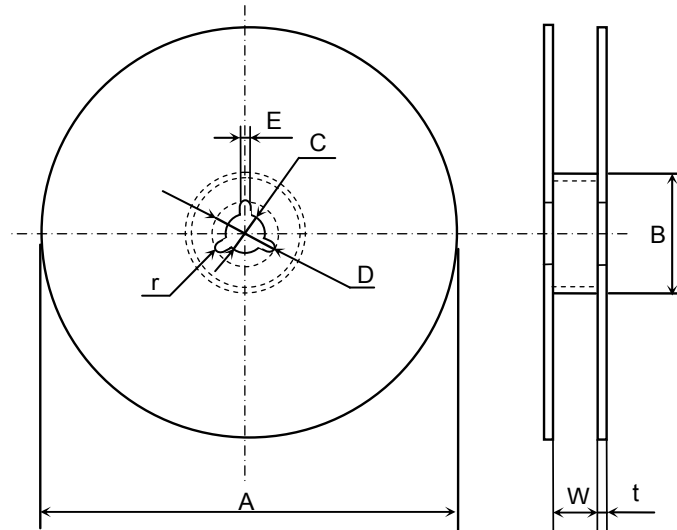
(Unit : mm)

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 8

CGA6, CGA7, CGA8, CGA9 (As for CGA6 type, applied to 2.5mm thickness products)

(Material : Polystyrene)



(Unit : mm)

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				