

SPECIFICATION

SPEC. No. C-CKD-c

D A T E : 2017 Jan.

To

Non-Controlled Copy

CUSTOMER'S PRODUCT NAME

TDK'S PRODUCT NAME

Multilayer Ceramic Chip Capacitors
CKD Series/ Commercial grade
(Low ESL Feed Through)

Please return this specification to TDK representatives with your signature.
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

Engineering
Electronic Components Business Company
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 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.

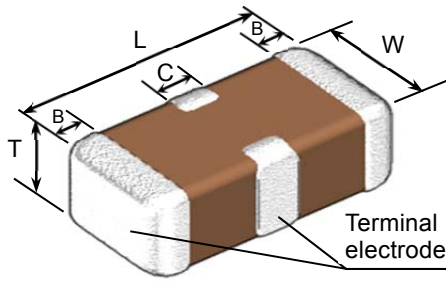
2. CODE CONSTRUCTION

(Example)

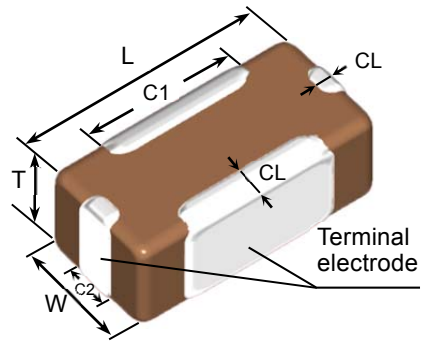
Catalog Number:	<u>CKD710JB</u>	<u>0G</u>	<u>435</u>	<u>M</u>	<u>045</u>	<u>B</u>	<u>A</u>
(Web)	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Item Description:	<u>CKD710JB</u>	<u>0G</u>	<u>435</u>	<u>M</u>	<u>T</u>	<u>xxxx</u>	
	(1)	(2)	(3)	(4)	(8)	(9)	

(1) Type

<CKD710JB, CKD610JB>



<CKD61BJB>



*As for dimensions of each product, please refer to detailed information on TDK web.

(2) Rated Voltage

Symbol	Rated Voltage
0 J	DC 6.3 V
0 G	DC 4.0 V

(3) 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 105 → 1,000,000pF = 1.0μF

435 → 4,300,000pF = 4.3μF

(4) Capacitance tolerance

Symbol	Tolerance
M	±20 %
S	+50%, -20%

(5) Thickness code (Only catalog number)

(6) Package code (Only catalog number)

(7) Special code (Only catalog number)

(8) Packaging (Only item description)

Symbol	Packaging
T	Taping

(9) Internal code (Only item description)

3. RATED CURRENT

As for Rated Current of each product, please refer to detailed information on TDK web.

4. OPERATING TEMPERATURE RANGE

As for Operating Temperature range of each product, please refer to detailed information on TDK web.

5. STORING CONDITION AND TERM

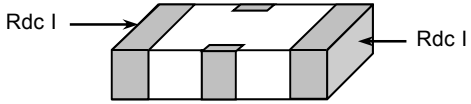
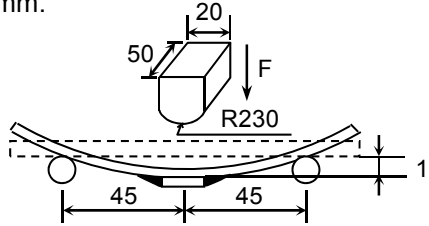
5 to 40°C at 20 to 70%RH
6 months Max.

6. INDUSTRIAL WASTE DISPOSAL

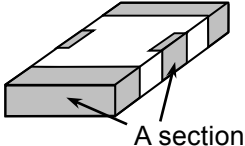
Dispose this product as industrial waste in accordance with the Industrial Waste Law.

7. 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 or 100MΩ·μF min.	Apply rated voltage for 60s.				
3	Direct Current Resistance (Rdc I)	As for Direct Current spec of each product, please refer to detailed information on TDK web.	Measuring current shall be 100mA max.. 				
4	Voltage Proof	Withstand test voltage without insulation breakdown or other damage.	2.5 times of rated voltage. Above DC voltage shall be applied for 1s. Charge/ discharge current shall not exceed 50mA.				
5	Capacitance	Within the specified tolerance.	<table border="1"> <thead> <tr> <th>Measuring frequency</th> <th>Measuring voltage</th> </tr> </thead> <tbody> <tr> <td>1kHz ± 10%</td> <td>0.5 ± 0.2Vrms</td> </tr> </tbody> </table> <p><u>CKD710JB0G435M:</u> Heat treat the capacitor at 150°C for 1h and measure the value after leaving capacitor for 250±4h in ambient condition.</p> <p><u>CKD710JB0G755M,106M:</u> Heat treat the capacitor at 150°C for 1h and measure the value after leaving capacitor for 24±2h in ambient condition.</p>	Measuring frequency	Measuring voltage	1kHz ± 10%	0.5 ± 0.2Vrms
Measuring frequency	Measuring voltage						
1kHz ± 10%	0.5 ± 0.2Vrms						
6	Dissipation Factor	As for D.F. spec of each product, please refer to detailed information on TDK web.	See No.5 in this table for measuring condition.				
7	Bending	No mechanical damage.	Reflow solder the capacitors on a P.C. board shown in Appendix1 and bend it for 1mm.  <p>(Unit : mm)</p>				

(continued)

No.	Item	Performance	Test or inspection method		
8	Solderability	<p>New solder to cover over 75% of termination. 25% may have pin holes 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>Completely soak both terminations in solder at the following conditions.</p> <p>Solder : Sn-3.0Ag-0.5Cu or Sn-37Pb Temperature : 245±5°C(Sn-3.0Ag-0.5Cu) 235±5°C(Sn-37Pb) Soaking time : 3±0.3s(Sn-3.0Ag-0.5Cu) 2±0.2s(Sn-37Pb)</p> <p>Flux: Isopropyl alcohol (JIS K 8839) Rosin (JIS K 5902) 25% solid solution.</p>		
9	Resistance to solder heat	External appearance	No mechanical damage.		
		Capacitance	<table border="1"><tr><td>Change from the value before test</td></tr><tr><td>± 7.5 %</td></tr></table>	Change from the value before test	± 7.5 %
		Change from the value before test			
		± 7.5 %			
		D.F.	Meet the initial spec.		
Insulation Resistance	Meet the initial spec.				
Resistance For DC (Rdc I)	1.0Ω max.				
			<p>Completely soak both terminations in solder at the following conditions. 260±5°C for 10±1s.</p> <p>Preheating condition Temp.: 110~140°C Time : 30~60s.</p> <p>Solder : Sn-3.0Ag-0.5Cu or Sn-37Pb</p> <p>Flux : Isopropyl alcohol (JIS K 8839) Rosin (JIS K 5902) 25% solid solution.</p> <p>Leave the capacitors in ambient condition for 24±2h before measurement.</p>		

(continued)

No.	Item		Performance	Test or inspection method															
10	Temperature cycle	External appearance	No mechanical damage.	<p>Reflow solder the capacitors on a P.C. board shown in Appendix2 before testing.</p> <p>Expose the capacitors in the condition step1 through step 4 and repeat 5 times consecutively.</p> <p>Leave the capacitors in ambient condition for 24±2h 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</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>25</td> <td>2 - 5</td> </tr> </tbody> </table>	Step	Temperature(°C)	Time(min.)	1	-55 ± 3	30 ± 3	2	25	2 - 5	3	Max. operating Temp. ±2	30 ± 2	4	25	2 - 5
		Step	Temperature(°C)		Time(min.)														
		1	-55 ± 3		30 ± 3														
		2	25		2 - 5														
		3	Max. operating Temp. ±2		30 ± 2														
4	25	2 - 5																	
Capacitance	<div style="border: 1px solid black; padding: 2px; width: fit-content; margin: 0 auto;"> Change from the value before test* </div> <div style="border: 1px solid black; padding: 2px; width: fit-content; margin: 0 auto;"> ±12.5 % </div>																		
D.F.	Meet the initial spec.																		
Insulation Resistance	Meet the initial spec.																		
Resistance For DC (Rdc l)	1.0Ω max.																		
11	Moisture Resistance (Steady State)	External appearance	No mechanical damage.	<p>Reflow solder the capacitors on a P.C. board shown in Appendix2 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 24±2h before measurement.</p>															
		Capacitance	<div style="border: 1px solid black; padding: 2px; width: fit-content; margin: 0 auto;"> Change from the value before test* </div> <div style="border: 1px solid black; padding: 2px; width: fit-content; margin: 0 auto;"> ±25 % </div>																
		D.F.	200% of initial spec. max.																
		Insulation Resistance	1,000MΩ or 10MΩ·μF min.																
		Resistance For DC (Rdc l)	1.0Ω max.																

*Typical SPEC.

(continued)

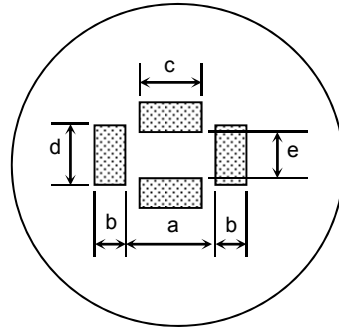
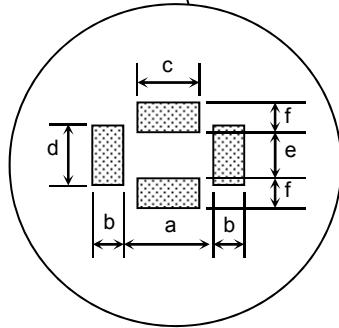
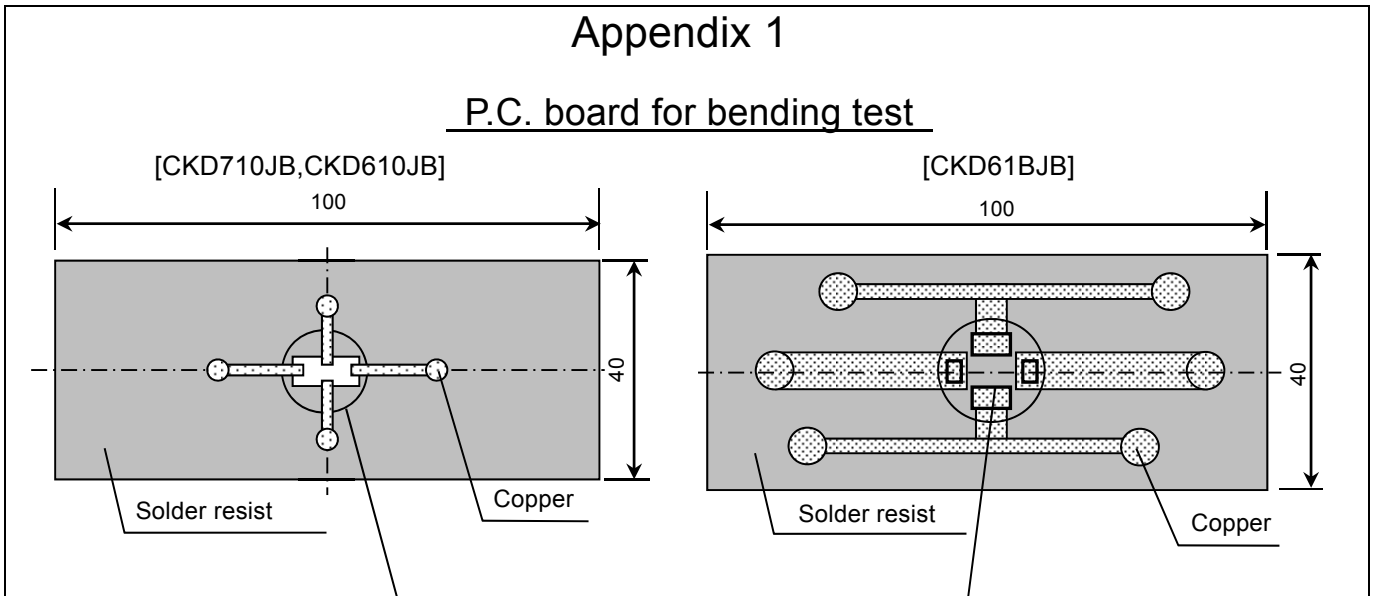
No.	Item	Performance	Test or inspection method
12	Life	External appearance	<p>Reflow solder the capacitors on a P.C. board shown in Appendix2 before testing.</p> <p>Apply the rated voltage at maximum operating temperature$\pm 2^{\circ}\text{C}$ for 1,000+48,0h with rated current.</p> <p>Charge/discharge current shall not exceed 50mA.</p> <p>Voltage conditioning: Voltage treat the capacitors under testing temperature and voltage for 1h.</p> <p>Leave the capacitors in ambient condition for 24\pm2h before measurement.</p> <p>Use this measurement for initial value.</p>
	Capacitance	<p>Change from the value before test*</p> <p>$\pm 25\%$</p>	
	D.F.	200% of initial spec. max.	
	Insulation Resistance	1,000M Ω or 10M Ω · μF min.	
	Resistance For DC (Rdc I)	1.0 Ω max.	

*Typical SPEC

**As for the initial measurement of capacitors on number 9,10 and 11, 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 bending test



(Unit : mm)

Symbol	a	b	c	d	e	f
Type CKD710JB	0.7	0.3	0.19	0.6	0.25	0.25
CKD610JB	1.0	0.6	0.4	0.6	0.4	0.4

Symbol	a	b	c	d	e
Type CKD61BJB	1.2	0.4	0.8	0.4	0.4

1. Material : Glass Epoxy (As per JIS C6484 GE4)

2. Thickness : 0.8mm (CKD710JB)

1.6mm (Others)

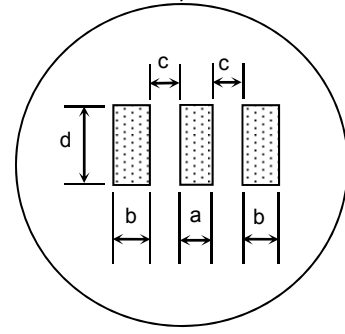
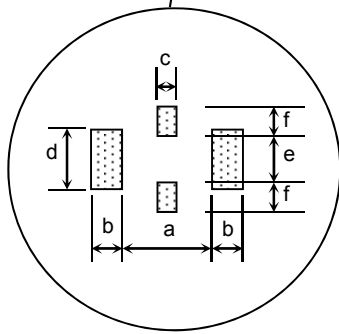
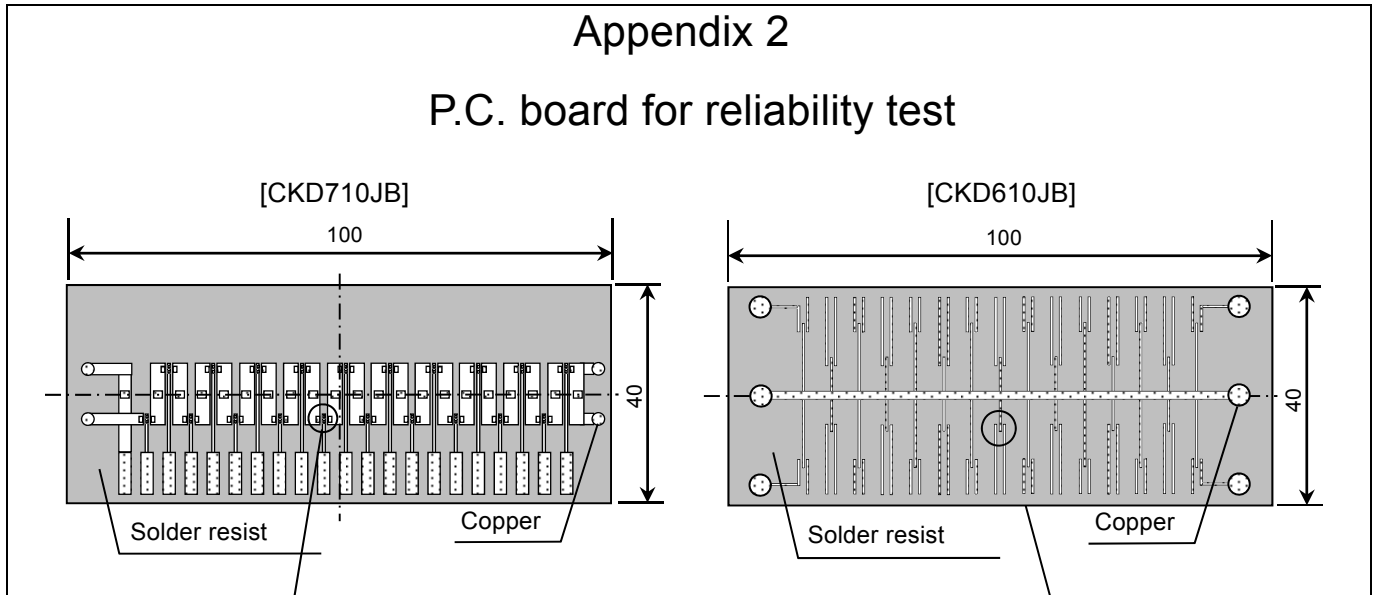


Copper (Thickness : CKD710JB 0.07mm, Others 0.035mm)

Solder resist

Appendix 2

P.C. board for reliability test



(Unit : mm)

Type \ Symbol	a	b	c	d	e	f
CKD710JB	0.7	0.3	0.19	0.6	0.25	0.25

Type \ Symbol	a	b	c	d
CKD610JB	0.4	0.5	0.4	2.0

1. Material : Glass Epoxy (As per JIS C6484 GE4)

2. Thickness : 1.6mm



Copper (Thickness : CKD710JB 0.07mm
Others 0.035mm)

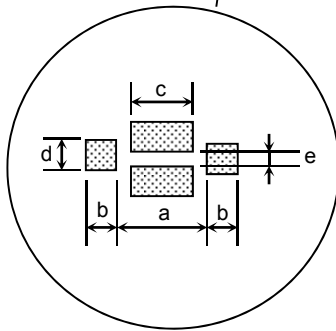
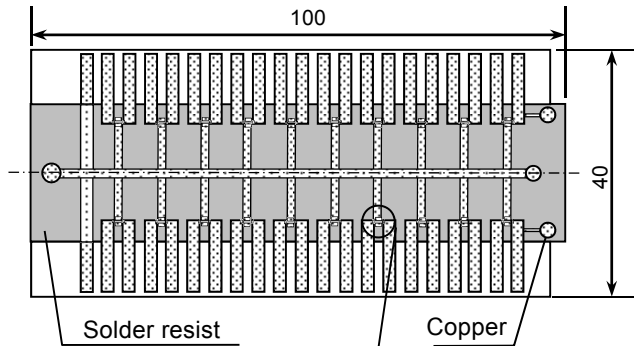


Solder resist

Appendix 2

P.C. board for reliability test

[CKD61BJB]



(Unit : mm)

Symbol	a	b	c	d	e
Type					
CKD61BJB	1.2	0.4	0.8	0.4	0.4

1. Material : Glass Epoxy (As per JIS C6484 GE4)

2. Thickness : 1.6mm

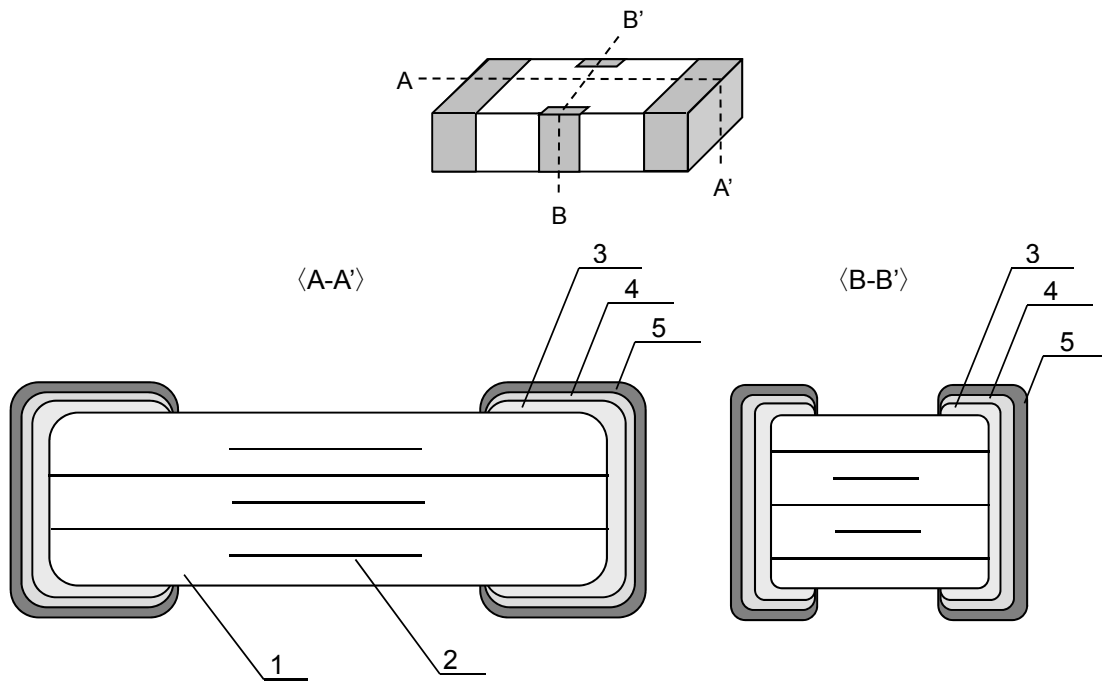


Copper (Thickness: 0.035mm)



Solder resist

8. INSIDE STRUCTURE AND MATERIAL



No.	NAME	MATERIAL
1	Dielectric	BaTiO ₃
2	Electrode	Ni
3	Termination	Cu
4		Ni
5		Sn

9. PACKAGING

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.

Tape packaging is as per TDK tape packaging specification.

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

*Composition of Inspection No.


Example E 6 A - 00 - 000
 (a) (b) (c) (d) (e)


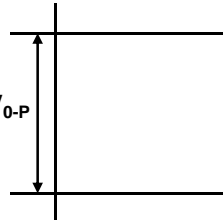
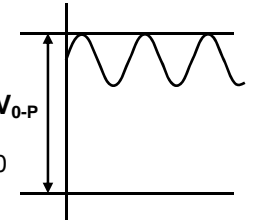
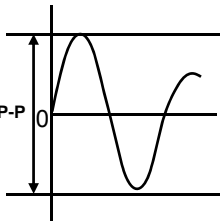
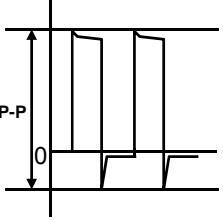
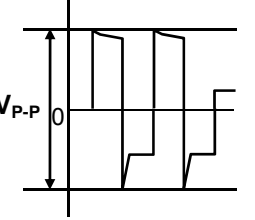
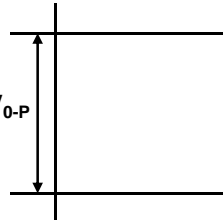
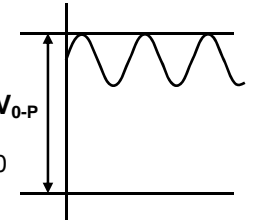
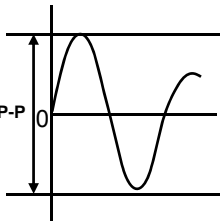
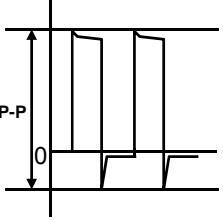
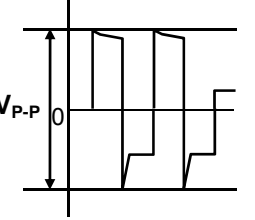
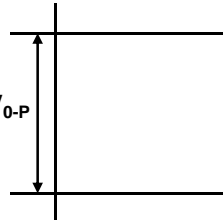
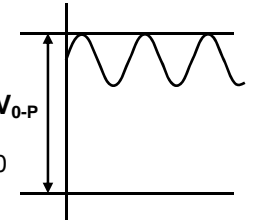
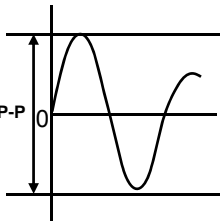
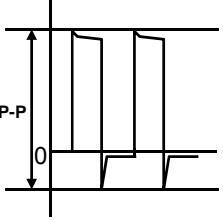
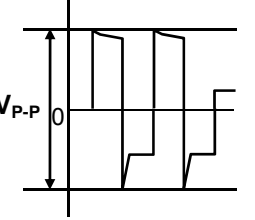
- a) Line code
- b) Last digit of the year
- c) Month and A for January and B for February and so on. (Skip I)
- d) Inspection Date of the month.
- e) Serial No. of the day

10. SOLDERING CONDITION

Soldering is limited to Reflow soldering.

11. Caution

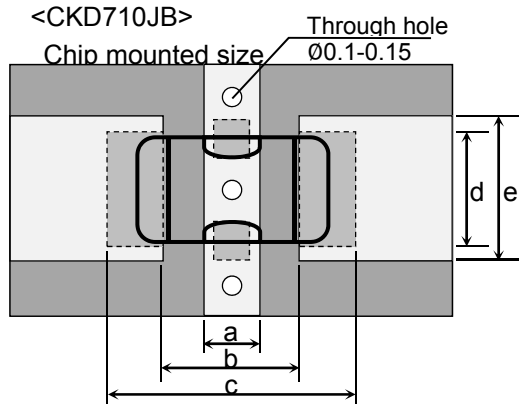
No.	Process	Condition
1	Operating Condition (Storage, Transportation)	<p>1-1. Storage</p> <ol style="list-style-type: none"> 1) The product must be stored in an ambient temperature of 5 to 40°C with a relative humidity of 20 to 70%RH. The products should be used within 6 months upon receipt. 2) The product 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. 3) Avoid storing in sun light and falling of dew. 4) Do not use product under high humidity and high and low atmospheric pressure which may affect product reliability. 5) Product should be tested for the solderability when they are stored for long time. <p>1-2. Handling in transportation In case of the transportation of the product, the performance of the product may be deteriorated depending on the transportation condition. (Refer to JEITA RCR-2335C 9.2 Handling in transportation)</p>
2	Circuit design  Caution	<p>2-1. Operating temperature Operating temperature should be followed strictly within this specification, especially be careful with maximum temperature.</p> <ol style="list-style-type: none"> 1) Do not use product above the maximum allowable operating temperature. 2) Surface temperature including self heating should be below maximum operating temperature. (Due to dielectric loss, product 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 product including the self heating to be below the maximum allowable operating temperature. Temperature rise at product's surface shall be below 20°C) <p>The electrical characteristics of the product will vary depending on the</p> <ol style="list-style-type: none"> 3) temperature. The product should be selected and designed in taking the temperature into consideration.

No	Process	Condition																
2	Circuit design  Caution	<p>2-2. Operating voltage</p> <p>1) Operating voltage across the terminals should be below the rated voltage. When AC and DC are super imposed, V_{0-P} must be below the rated voltage. — (1) and (2)</p> <p>AC or pulse with overshooting, V_{P-P} must be below the rated voltage. — (3), (4) and (5)</p> <p>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 product within rated voltage containing these Irregular voltage.</p> <table border="1" data-bbox="427 477 1497 1048"> <thead> <tr> <th data-bbox="427 477 651 517">Voltage</th> <th data-bbox="651 477 938 517">(1) DC voltage</th> <th data-bbox="938 477 1241 517">(2) DC+AC voltage</th> <th data-bbox="1241 477 1497 517">(3) AC voltage</th> </tr> </thead> <tbody> <tr> <td data-bbox="427 517 651 745">Positional Measurement (Rated voltage)</td> <td data-bbox="651 517 938 745">  </td> <td data-bbox="938 517 1241 745">  </td> <td data-bbox="1241 517 1497 745">  </td> </tr> <tr> <th data-bbox="427 779 651 819">Voltage</th> <th data-bbox="651 779 938 819">(4) Pulse voltage (A)</th> <th data-bbox="938 779 1241 819">(5) Pulse voltage (B)</th> <td></td> </tr> <tr> <td data-bbox="427 819 651 1048">Positional Measurement (Rated voltage)</td> <td data-bbox="651 819 938 1048">  </td> <td data-bbox="938 819 1241 1048">  </td> <td></td> </tr> </tbody> </table> <p>2) Even below the rated voltage, if repetitive high frequency AC or pulse is applied, the reliability of the products may be reduced.</p> <p>3) The effective capacitance will vary depending on applied DC and AC voltages. The products should be selected and designed in taking the voltages into consideration.</p> <p>2-3. Frequency</p> <p>When the products are used in AC and/or pulse voltages, the products may vibrate themselves and generate audible sound.</p>	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)			
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)																		
3	Designing P.C. board	<p>The amount of solder at the terminations has a direct effect on the reliability of the products.</p> <p>1) The greater the amount of solder, the higher the stress on the products, 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>																

No	Process	Condition
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3 Designing P.C.board

3) Size and recommended land dimensions.

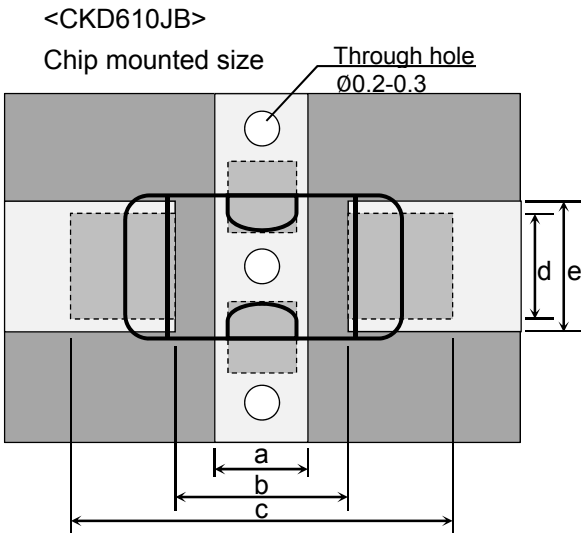


Connect to the ground pattern of the chip mounted side.

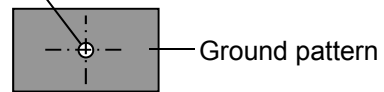
"Through hole" should be designed as close to GND terminal as possible.

Back side

Back side shall be connected to the ground pattern of the chip mounted side. Please design the ground of back side as big as possible.

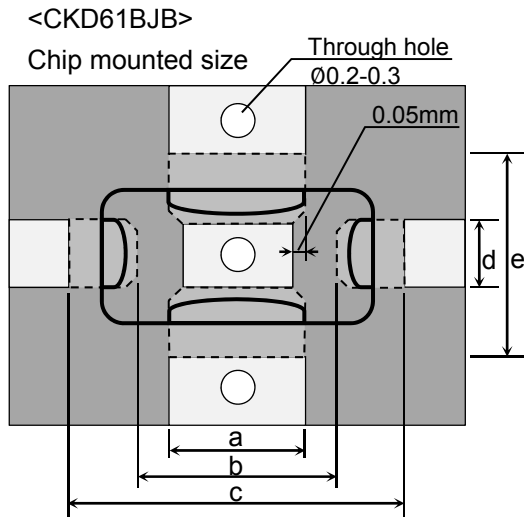


Connect to the ground pattern of the chip mounted side.

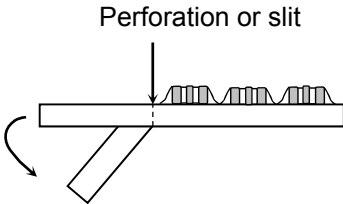
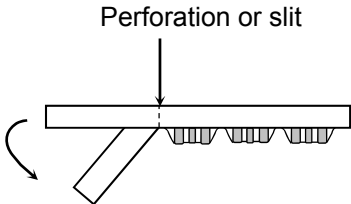
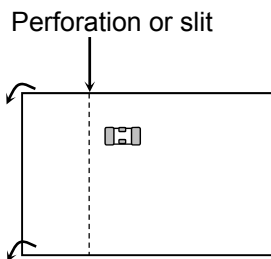
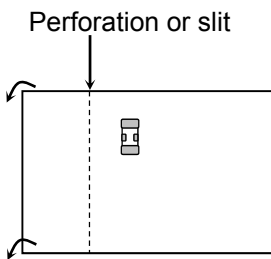
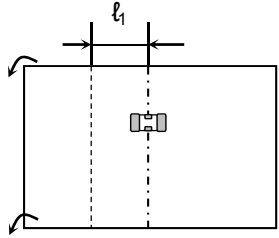
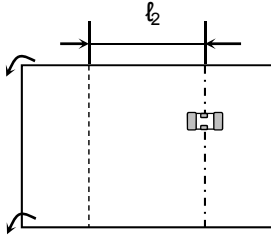


*If through hole is too big, solder paste way came into the hole and make bad connection with the ground pattern.

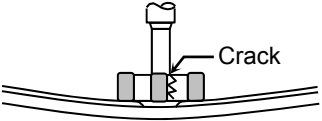
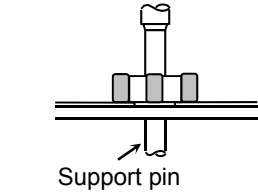
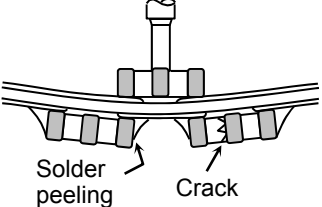
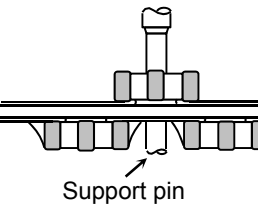
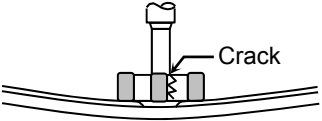
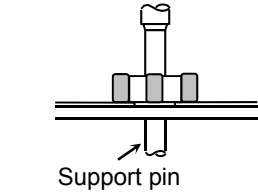
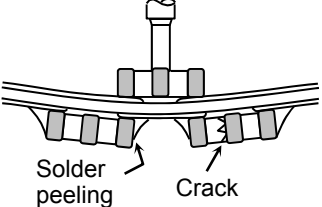
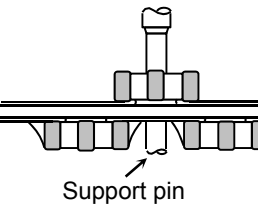
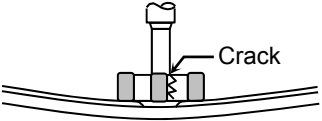
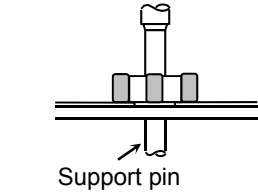
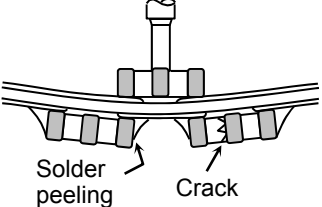
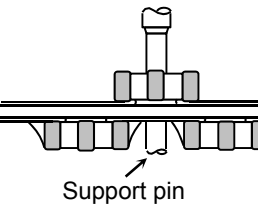
- Resist
- Land pattern
- Land pattern & Resist

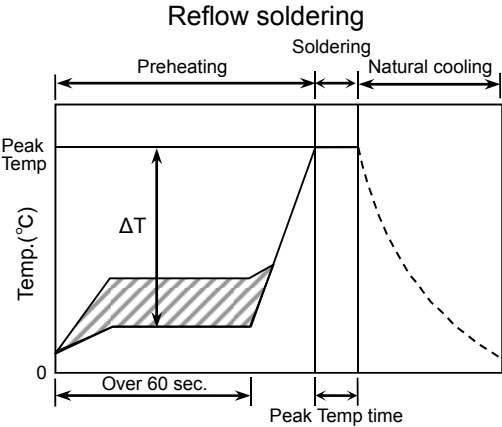
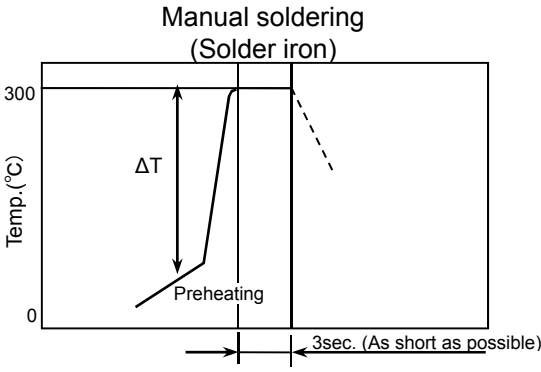


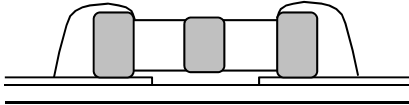
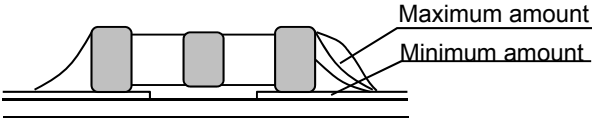
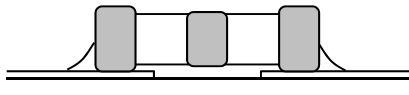
		(mm)				
Symbol	Type	a	b	c	d	e
CKD710JB		0.19	0.7	1.3	0.6	0.75
CKD610JB		0.4	1.2	2.2	0.7	1.4
CKD61BJB		0.8	1.2	2.2	0.5	1.4

No	Process	Condition		
3	Designing P.C. board	4) Recommended capacitors layout is as following.		
		Disadvantage against bending stress	Advantage against bending stress	
Mounting face	<p style="text-align: center;">Perforation or slit</p>  <p style="text-align: center;">Break P.C. board with mounted side up.</p>		<p style="text-align: center;">Perforation or slit</p>  <p style="text-align: center;">Break P.C. board with mounted side down.</p>	
Chip arrangement (Direction)	<p style="text-align: center;">Perforation or slit</p> 		<p style="text-align: center;">Perforation or slit</p> 	
Distance from slit	<p style="text-align: center;">Closer to slit is higher stress</p>  <p style="text-align: center;">$(l_1 < l_2)$</p>		<p style="text-align: center;">Away from slit is less stress</p>  <p style="text-align: center;">$(l_1 < l_2)$</p>	


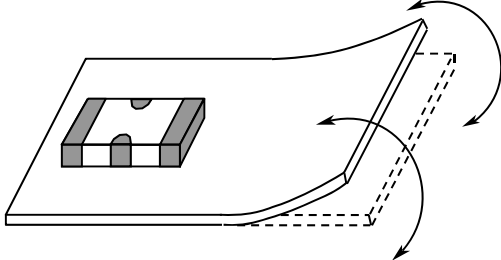
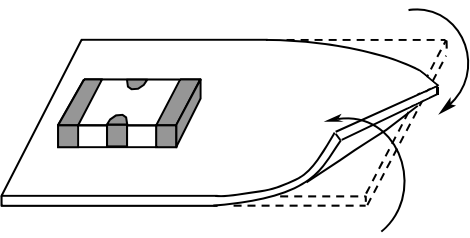
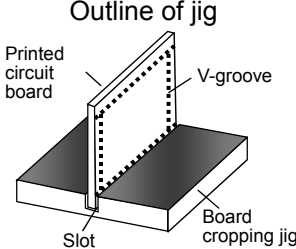
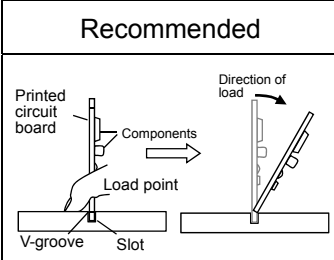
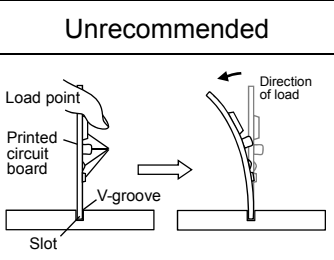
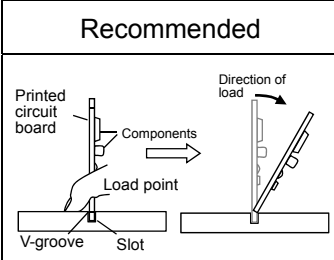
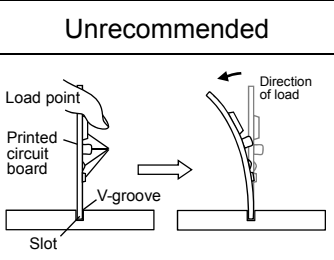
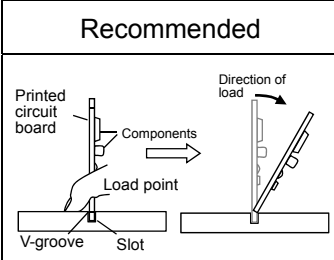
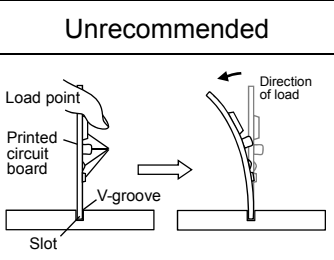
No	Process	Condition									
3	Designing P.C. board	<p data-bbox="475 152 1449 183">5) Mechanical stress varies according to location of capacitors on the P.C. board.</p> <div data-bbox="564 203 1406 763" style="text-align: center;"> </div> <p data-bbox="863 779 1437 842" style="text-align: center;">The stress in capacitors is in the following order. A > B = C > D > E</p> <p data-bbox="475 869 815 900">6) Layout recommendation</p> <table border="1" data-bbox="469 913 1576 1827"> <thead> <tr> <th data-bbox="469 913 719 1032">Example</th> <th data-bbox="719 913 1129 1032">Use of common solder land</th> <th data-bbox="1129 913 1576 1032">Soldering with chassis</th> </tr> </thead> <tbody> <tr> <td data-bbox="469 1032 719 1413">Need to avoid</td> <td data-bbox="719 1032 1129 1413"> </td> <td data-bbox="1129 1032 1576 1413"> </td> </tr> <tr> <td data-bbox="469 1413 719 1827">Recommendation</td> <td data-bbox="719 1413 1129 1827"> </td> <td data-bbox="1129 1413 1576 1827"> </td> </tr> </tbody> </table>	Example	Use of common solder land	Soldering with chassis	Need to avoid			Recommendation		
Example	Use of common solder land	Soldering with chassis									
Need to avoid											
Recommendation											


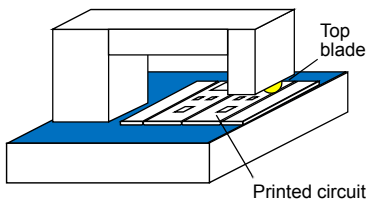
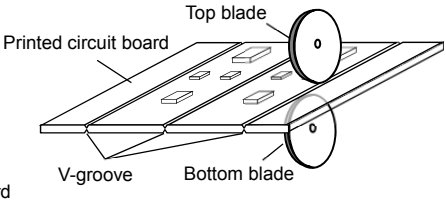
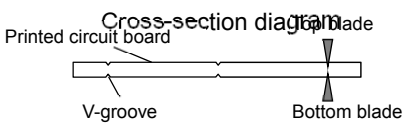
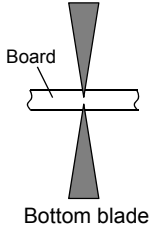
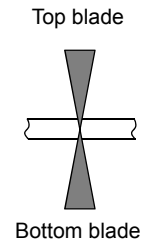
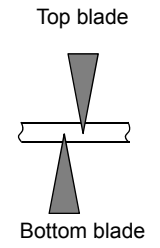
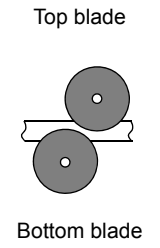
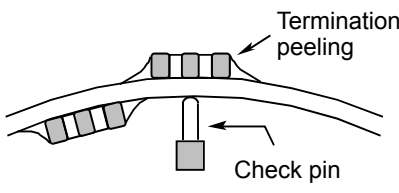
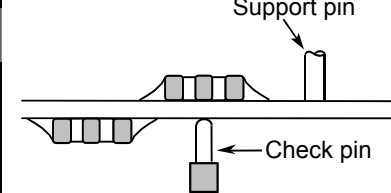
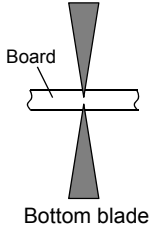
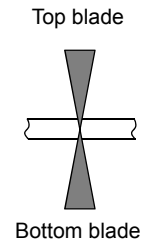
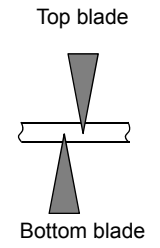
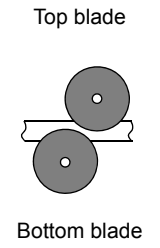
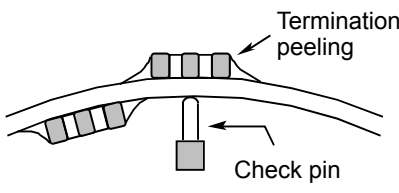
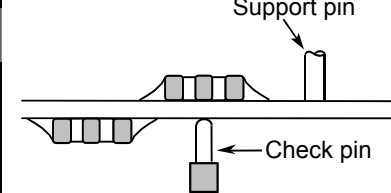
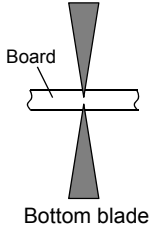
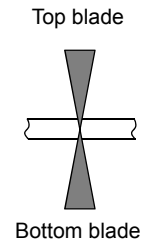
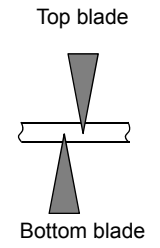
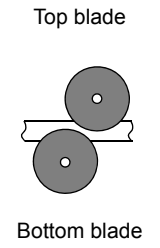
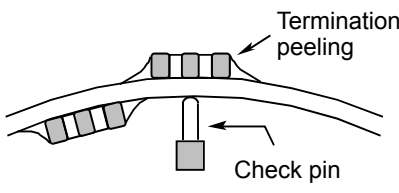
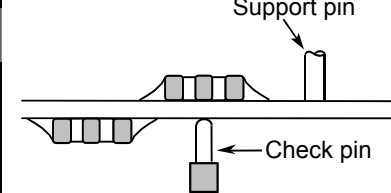
No	Process	Condition									
4	Mounting	<p>4-1. Stress from mounting head</p> <p>If the mounting head is adjusted too low, it may induce excessive stress in the capacitors to result in cracking. Please take following precautions.</p> <ol style="list-style-type: none"> 1) Adjust the bottom dead center of the mounting head to reach on the P.C. board surface and not press it. 2) Adjust the mounting head pressure to be 1 to 3N of static weight. 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. <table border="1" data-bbox="384 577 1337 1137"> <thead> <tr> <th data-bbox="384 577 595 629"></th> <th data-bbox="595 577 965 629">Not recommended</th> <th data-bbox="965 577 1337 629">Recommended</th> </tr> </thead> <tbody> <tr> <td data-bbox="384 629 595 875">Single sided mounting</td> <td data-bbox="595 629 965 875">  </td> <td data-bbox="965 629 1337 875">  </td> </tr> <tr> <td data-bbox="384 875 595 1137">Double-sides mounting</td> <td data-bbox="595 875 965 1137">  </td> <td data-bbox="965 875 1337 1137">  </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			Double-sides mounting		
	Not recommended	Recommended									
Single sided mounting											
Double-sides mounting											

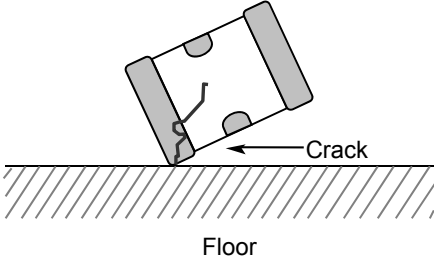
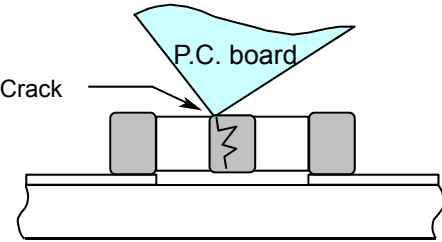
No.	Process	Condition														
5	Soldering	<p>5-1. Flux selection Although highly-activated flux gives better solderability, substances which increase activity may also have a serious effect on the capacitor. To avoid such degradation, it is recommended following.</p> <ol style="list-style-type: none"> 1) It is recommended to use a mildly activated rosin flux (less than 0.1wt% chlorine). Strong flux is not recommended. 2) Excessive flux must be avoided. Please provide proper amount of flux. 3) When water-soluble flux is used, enough washing is necessary. <p>5-2. Recommended soldering profile by various methods</p> <div style="text-align: center;"> <p>Reflow soldering</p>  <p>Manual soldering (Solder iron)</p>  </div> <p>5-3. Recommended soldering peak temp and peak temp duration</p> <table border="1" data-bbox="470 1489 1197 1680"> <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 Sn-37Pb (Sn-Pb solder) 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.
Temp./Duration	Reflow soldering															
	Peak temp(°C)	Duration(sec.)														
Solder																
Sn-Pb Solder	230 max.	20 max.														
Lead Free Solder	260 max.	10 max.														


No.	Process	Condition														
5	Soldering	<p>5-4. Avoiding thermal shock</p> <p>1) Preheating condition</p> <table border="1" data-bbox="566 230 1003 389"> <thead> <tr> <th>Soldering</th> <th>Temp. (°C)</th> </tr> </thead> <tbody> <tr> <td>Reflow soldering</td> <td>$\Delta T \leq 150$</td> </tr> <tr> <td>Manual soldering</td> <td>$\Delta T \leq 150$</td> </tr> </tbody> </table> <p>2) Cooling condition Natural cooling using air is recommended. If the chips are dipped into a solvent for cleaning, the temperature difference (ΔT) must be less than 100°C.</p> <p>5-5. Amount of solder</p> <p>Excessive solder will induce higher tensile force in 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 style="width: 30%;">Excessive solder</div> <div style="width: 30%; text-align: center;">  </div> <div 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: flex-start;"> <div style="width: 30%;">Adequate</div> <div style="width: 30%; text-align: center;">  </div> </div> <hr/> <div style="display: flex; justify-content: space-between; align-items: flex-start;"> <div style="width: 30%;">Insufficient solder</div> <div style="width: 30%; text-align: center;">  </div> <div 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 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 style="text-align: center;">Recommended solder iron condition (Sn-Pb Solder and Lead Free Solder)</p> <table border="1" data-bbox="566 1585 1404 1693"> <thead> <tr> <th>Temp. (°C)</th> <th>Duration (sec.)</th> <th>Wattage (W)</th> <th>Shape (mm)</th> </tr> </thead> <tbody> <tr> <td>300 max.</td> <td>3 max.</td> <td>20 max.</td> <td>Ø 3.0 max.</td> </tr> </tbody> </table> <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>	Soldering	Temp. (°C)	Reflow soldering	$\Delta T \leq 150$	Manual soldering	$\Delta T \leq 150$	Temp. (°C)	Duration (sec.)	Wattage (W)	Shape (mm)	300 max.	3 max.	20 max.	Ø 3.0 max.
Soldering	Temp. (°C)															
Reflow soldering	$\Delta T \leq 150$															
Manual soldering	$\Delta T \leq 150$															
Temp. (°C)	Duration (sec.)	Wattage (W)	Shape (mm)													
300 max.	3 max.	20 max.	Ø 3.0 max.													

No.	Process	Condition
5	Soldering	<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-2335C Annex A (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 product surface to deteriorate especially the insulation resistance.</p> <p>2) If cleaning condition is not suitable, it may damage the product.</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 product, 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 product body and the terminal electrode. To avoid this, following is the recommended condition.</p> <p style="text-align: center;">Power : 20 W/lmax. 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 product.</p> <p>3) Please verify the curing temperature.</p>

No.	Process	Condition				
8	Handling after product mounted  Caution	<p>1) Please pay attention not to bend or distort the P.C. board after soldering in handling otherwise the product 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) Printed circuit board cropping should not be carried out by hand, but by using the proper tooling. Printed circuit board cropping should be carried out using a board cropping jig as shown in the following figure or a board cropping apparatus to prevent inducing mechanical stress on the board.</p> <p>(1) Example of a board cropping jig</p> <p><u>Recommended example:</u> The board should be pushed from the back side, close to the cropping jig so that the board is not bent and the stress applied to the capacitor is compressive.</p> <p><u>Unrecommended example:</u> If the pushing point is far from the cropping jig and the pushing direction is from the front side of the board, large tensile stress is applied to the capacitor, which may cause cracks.</p> <div style="display: flex; justify-content: space-around; align-items: center;"> <div style="text-align: center;"> <p>Outline of jig</p>  </div> <table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th style="width: 50%; text-align: center;">Recommended</th> <th style="width: 50%; text-align: center;">Unrecommended</th> </tr> </thead> <tbody> <tr> <td style="text-align: center;">  </td> <td style="text-align: center;">  </td> </tr> </tbody> </table> </div>	Recommended	Unrecommended		
Recommended	Unrecommended					
						

No.	Process	Condition																		
8	Handling after chip mounted  Caution	<p>(2) Example of a board cropping machine</p> <p>An outline of a printed circuit board cropping machine is shown below. The top and bottom blades are aligned with one another along the lines with the V-grooves on printed circuit board when cropping the board.</p> <p><u>Unrecommended example:</u> Misalignment of blade position between top and bottom, right and left, or front and rear blades may cause a crack in the capacitor.</p> <div style="display: flex; justify-content: space-around;"> <div data-bbox="555 414 976 672"> <p>Outline of machine</p>  </div> <div data-bbox="997 414 1412 672"> <p>Principle of operation</p>  </div> </div> <div style="text-align: center; margin-top: 10px;"> <p>Cross-section diagram</p>  </div> <table border="1" style="width: 100%; text-align: center; border-collapse: collapse; margin-top: 20px;"> <thead> <tr> <th data-bbox="635 929 821 1019">Recommended</th> <th colspan="3" data-bbox="821 929 1380 974">Unrecommended</th> </tr> <tr> <th data-bbox="635 974 821 1064"></th> <th data-bbox="821 974 997 1064">Top-bottom misalignment</th> <th data-bbox="997 974 1189 1064">Left-right misalignment</th> <th data-bbox="1189 974 1380 1064">Front-rear misalignment</th> </tr> </thead> <tbody> <tr> <td data-bbox="635 1064 821 1355">  </td> <td data-bbox="821 1064 997 1355">  </td> <td data-bbox="997 1064 1189 1355">  </td> <td data-bbox="1189 1064 1380 1355">  </td> </tr> </tbody> </table> <p>3) 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 product or peel the terminations off. Please adjust the check pins not to bend the P.C. board.</p> <table border="1" style="width: 100%; text-align: center; border-collapse: collapse; margin-top: 20px;"> <thead> <tr> <th data-bbox="475 1601 614 1668">Item</th> <th data-bbox="614 1601 1029 1668">Not recommended</th> <th data-bbox="1029 1601 1436 1668">Recommended</th> </tr> </thead> <tbody> <tr> <td data-bbox="475 1668 614 1960">Board bending</td> <td data-bbox="614 1668 1029 1960">  </td> <td data-bbox="1029 1668 1436 1960">  </td> </tr> </tbody> </table>	Recommended	Unrecommended				Top-bottom misalignment	Left-right misalignment	Front-rear misalignment					Item	Not recommended	Recommended	Board bending		
Recommended	Unrecommended																			
	Top-bottom misalignment	Left-right misalignment	Front-rear misalignment																	
																				
Item	Not recommended	Recommended																		
Board bending																				

No.	Process	Condition
9	Handling of loose product	<p>1) If dropped the product may crack. Once dropped do not use it. Especially, the large case sized products are tendency to have cracks easily, so please handle with care.</p>  <p>2) Piling the P.C.board after mounting for storage or handling, the corner of the P.C. board may hit the product of another board to cause crack.</p> 
10	Capacitance aging	The products 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 product	<p>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-2335C Annex F (Informative) Calculation of the estimated lifetime and the estimated failure rate (Voltage acceleration coefficient : 3 multiplication rule, Temperature acceleration coefficient : 10°C rule)</p> <p>The failure rate can be decreased by reducing the temperature and the voltage but they will not be guaranteed.</p>

No.	Process	Condition
12	Caution during operation of equipment	<p>1) A capacitor shall not be touched directly with bare hands during operation in order to avoid electric shock. Electric energy held by the capacitor may be discharged through the human body when touched with a bare hand. Even when the equipment is off, a capacitor may stay charged. The capacitor should be handled after being completely discharged using a resistor.</p> <p>2) The terminals of a capacitor shall not be short-circuited by any accidental contact with a conductive object. A capacitor shall not be exposed to a conductive liquid such as an acid or alkali solution. A conductive object or liquid, such as acid and alkali, between the terminals may lead to the breakdown of a capacitor due to short circuit</p> <p>Confirm that the environment to which the equipment will be exposed during</p> <p>3) transportation and operation meets the specified conditions. Do not to use the equipment in the following environments.</p> <p>(1) Environment where a capacitor is splattered with water or oil (2) Environment where a capacitor is exposed to direct sunlight (3) Environment where a capacitor is exposed to Ozone, ultraviolet rays or radiation (4) Environment where a capacitor exposed to corrosive gas (e.g. hydrogen sulfide, sulfur dioxide, chlorine, ammonia gas etc.) (5) Environment where a capacitor exposed to vibration or mechanical shock exceeding the specified limits. (6) Atmosphere change with causes condensation</p>
13	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 (cars, electric trains, ships, etc.) (3) Medical equipment (Excepting Pharmaceutical Affairs Law classification Class1, 2) (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>

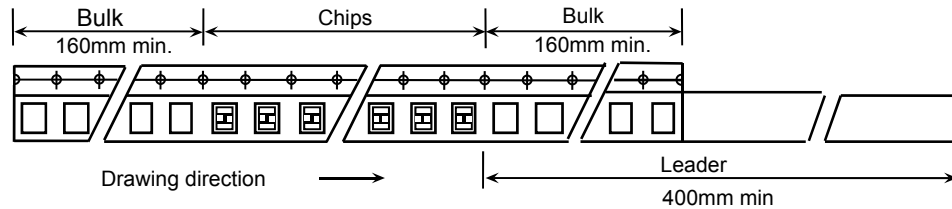
12. TAPE PACKAGING SPECIFICATION

1. CONSTRUCTION AND DIMENSION OF TAPING

1-1. Dimensions of carrier tape

Dimensions of paper tape shall be according to Appendix 3.

1-2. Bulk part and leader of taping

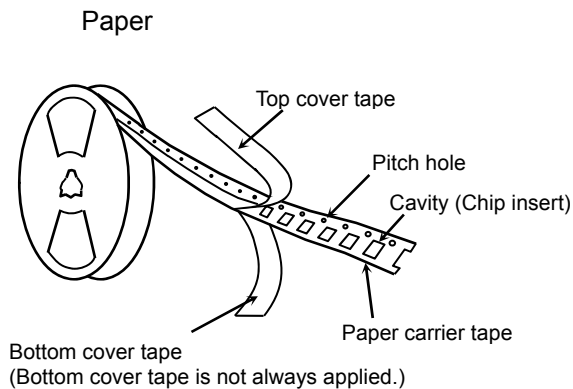


1-3. Dimensions of reel

Dimensions of $\varnothing 178\text{mm}$ reel shall be according to Appendix 4.

Dimensions of $\varnothing 330\text{mm}$ reel shall be according to Appendix 5.

1-4. Structure of taping



2. CHIP QUANTITY

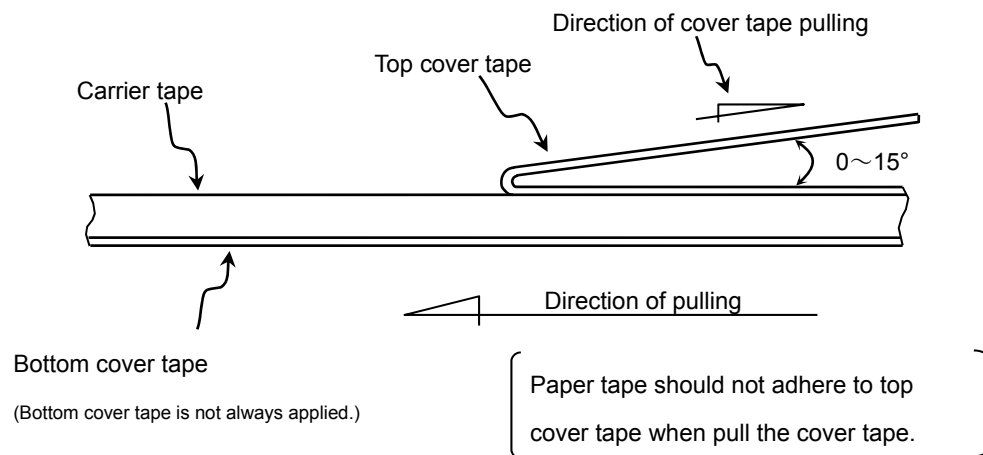
As for chip quantity and taping material of each product, please refer to detailed information on TDK web.

3. PERFORMANCE SPECIFICATIONS

3-1. Fixing peeling strength (top tape)

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

〈Paper〉



3-2. Carrier tape shall be flexible enough to be wound around a minimum radius of 30mm with components in tape.

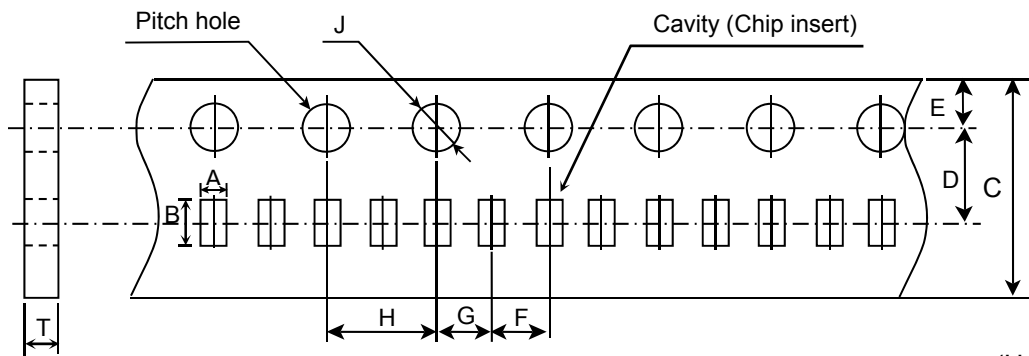
3-3. The missing of components shall be less than 0.1%

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 3

Paper Tape



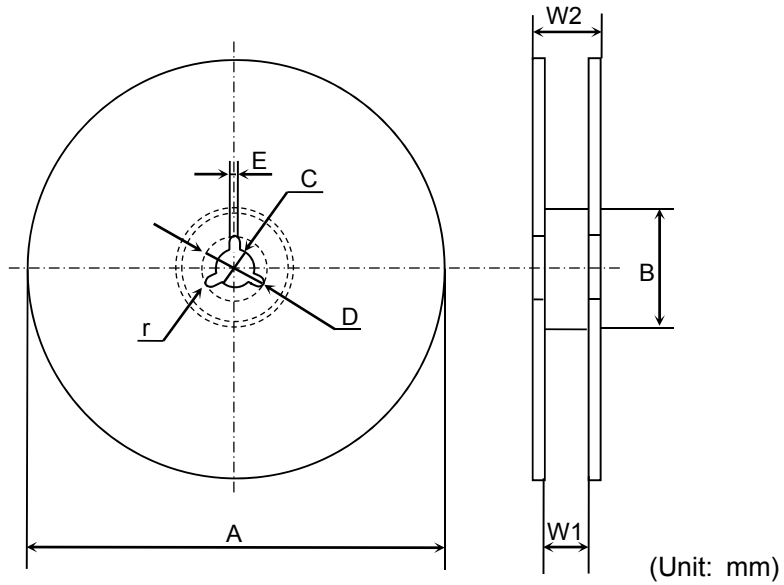
(Unit: mm)

Type	Symbol	A	B	C	D	E	F
CKD710JB		0.62 typ.	1.12 typ.	8.00 ± 0.30	3.50 ± 0.05	1.75 ± 0.10	2.00 ± 0.05
CKD710JB0G435M		0.75 typ.	1.18 typ.				
CKD710JB0G755M			1.30 typ.				
CKD710JB0G106M		0.77 typ.					
CKD610		1.10 typ.	1.90 typ.				4.00 ± 0.10
CKD61B							

Type	Symbol	G	H	J	T
CKD710JB		2.00 ± 0.05	4.00 ± 0.10	∅ 1.5+0.1/-0	0.7 max.
CKD710JB0G435M					
CKD710JB0G755M					
CKD710JB0G106M					
CKD610					1.1 max.
CKD61B					

Appendix 4

Dimensions of $\phi 178\text{mm}$ reel (Material : Polystyrene)

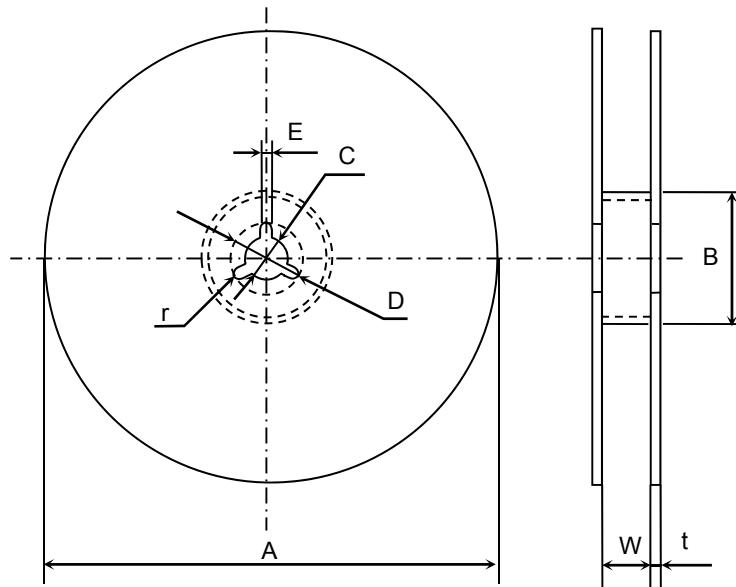


(Unit: mm)

Symbol	A	B	C	D	E	W_1
Dimension	$\phi 178 \pm 2.0$	$\phi 60 \pm 2.0$	$\phi 13 \pm 0.5$	$\phi 21 \pm 0.8$	2.0 ± 0.5	9.0 ± 0.3
Symbol	W_2	r				
Dimension	13.0 ± 1.4	1.0				

Appendix 5

Dimensions of $\phi 330\text{mm}$ reel (Material : Polystyrene)



(Unit: mm)

Symbol	A	B	C	D	E	W
Dimension	$\phi 382$ max. (Nominal $\phi 330$)	$\phi 50$ min.	$\phi 13 \pm 0.5$	$\phi 21 \pm 0.8$	2.0 ± 0.5	10.0 ± 1.5
Symbol	t	r				
Dimension	2.0 ± 0.5	1.0				