

DELIVERY SPECIFICATION

SPEC. No. A-RGC-c

D A T E : Jan, 2020

To

Non-Controlled Copy

CUSTOMER'S PRODUCT NAME

TDK PRODUCT NAME

MULTILAYER CERAMIC CHIP CAPACITORS
Low ESL Reverse Geometry
Tape packaging【RoHS compliant】
CGAE Type
X7R, X7T Characteristics

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 _____

Test conditions in this specification based on AEC-Q200 for automotive application.

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

■ CATALOG NUMBER CONSTRUCTION

CGA	E	B	1	X7T	0G	105	M	050	B	C
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)

(1) Series

(2) Dimensions L x W (mm)

Dimensions code	EIA	Length	Width	Terminal width
E	CC0204	0.50	1.00	0.10

(3) Thickness code

Code	Thickness
A	0.30mm
B	0.50mm

(4) Voltage condition for life test

Symbol	Condition
1	1 x R.V.
2	2 x R.V.
3	1.5 x R.V.

(5) Temperature characteristics

Temperature characteristics	Capacitance change	Temperature range
X7R	±15%	-55 to +125°C
X7T	+22,-33%	-55 to +125°C

(6) Rated voltage (DC)

Code	Voltage (DC)
1H	50V
1E	25V
0J	6.3V
0G	4V

(7) Nominal capacitance (pF)

The capacitance is expressed in three digit codes 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 designates a decimal point.

(Example) 0R5 = 0.5pF
 101 = 100pF
 225 = 2,200,000pF = 2.2μF

(8) Capacitance tolerance

Code	Tolerance
M	±20%

(9) Thickness

Code	Thickness
030	0.30mm
050	0.50mm

(10) Packaging style

Code	Style
B	178mm reel, 2mm pitch

(11) Special reserved code

Code	Tolerance
A,B,C	TDK internal code

SCOPE

This delivery specification shall be applied to Multilayer ceramic chip capacitors to be delivered to _____.

PRODUCTION PLACES

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

PRODUCT NAME

The name of the product to be defined in this specifications shall be CGAE◇◇○○○△△□□□ x.

REFERENCE STANDARD

- JIS C 5101-1 : 2010 Fixed capacitors for use in electronic equipment-Part 1: Generic specification
- C 5101-22 : 2014 Fixed capacitors for use in electronic equipment-Part22 : Sectional specification : Fixed surface mount multilayer capacitors of ceramic dielectric,Class2
- C 0806-3 : 2014 Packaging of components for automatic handling - Part 3: Packaging of surface mount components on continuous tapes
- JEITA RCR-2335 C 2014 Safety application guide for fixed ceramic capacitors for use in electronic equipment

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- 2. OPERATING TEMPERATURE RANGE
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- 6. INSIDE STRUCTURE AND MATERIAL
- 7. PACKAGING
- 8. SOLDERING CONDITION
- 9. CAUTION
- 10. TAPE PACKAGING SPECIFICATION

<EXPLANATORY NOTE>

When the mistrust in the spec arises, this specification is given priority. And it will be confirmed by written spec change after conference of both posts involved.

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

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

Division	Date	SPEC. No.
Ceramic Capacitors Business Group	Jan, 2020	A-RGC-c

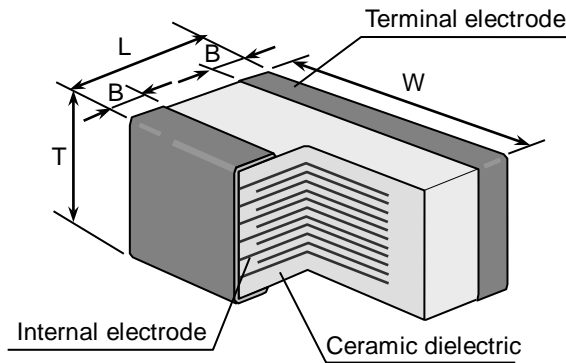
1. CODE CONSTRUCTION

(Example) $\frac{CGA}{(1)} \quad \frac{E}{(2)} \quad \frac{A}{(3)} \quad \frac{1}{(4)} \quad \frac{X7R}{(5)} \quad \frac{1H}{(6)} \quad \frac{473}{(7)} \quad \frac{M}{(8)} \quad \frac{T}{(9)} \quad \frac{0000}{(10)}$

(1) Series

Symbol	Series
CGA	Ceramic chip capacitor for automotive application

(2) Type



Symbol	Type	Dimensions (Unit : mm)			
	TDK(EIA style)	L	W	T	B
E	CGAEA(CC0204)	0.52±0.05	1.00±0.05	0.30±0.05	0.10 min.
	CGAEB(CC0204)	0.58±0.10	1.10±0.10	0.58±0.10	0.10 min.

*As for each item, please refer to detail page on TDK Web.

(3) Thickness

Symbol	Dimension(mm)
A	0.30
B	0.50

(4) Voltage condition in the life test

Symbol	Condition
1	Rated Voltage
2	Rated Voltage x 2
3	Rated Voltage x 1.5

(5) Temperature Characteristics

* Details are shown in table 1 No.6 at 5.PERFORMANCE.

(6) Rated Voltage

Symbol	Rated Voltage
1 H	DC 50 V
1 E	DC 25 V
0 J	DC 6.3V
0 G	DC 4 V

(7) 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.

Symbol	Rated Capacitance
473	47,000 pF

(8) Capacitance tolerance

Symbol	Tolerance
M	± 20 %

(9) Packaging

Symbol	Packaging
T	Taping

(10) TDK Internal code

2. OPERATING TEMPERATURE RANGE

Min. operating Temperature	Max. operating Temperature	Reference Temperature
-55°C	125°C	25°C

3. STORING CONDITION AND TERM

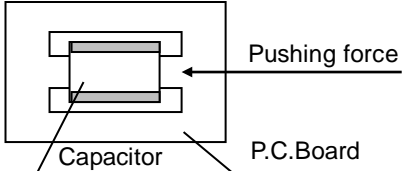
Storing temperature	Storing humidity	Storing term
5~40°C	20~70%RH	Within 6 months upon receipt.

4. INDUSTRIAL WASTE DISPOSAL

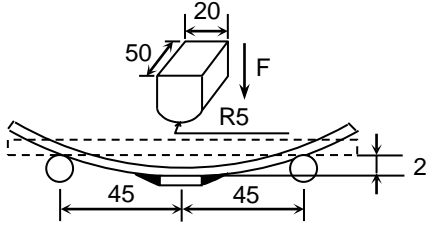
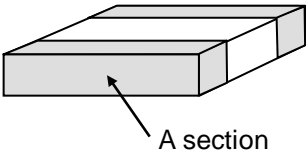
Dispose this product as industrial waste in accordance with the Industrial Waste Law.

5. 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 500MΩ·μF min. (As for the capacitors of rated voltage 6.3V DC and lower, 100MΩ·μF min.), whichever smaller.	Measuring voltage : Rated voltage Voltage application time : 60s.													
3	Voltage Proof	Withstand test voltage without insulation breakdown or other damage.	Apply voltage : 2.5 × rated voltage Voltage application time : 1s. Charge/discharge current : 50mA or lower													
4	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>1.0 ± 0.2Vrms.</td> </tr> </tbody> </table> <p>As for CGAEA1X7T0J104M and CGAEA3X7T0G104M, 0.5Vrms is applied.</p>	Measuring frequency	Measuring voltage	1kHz ± 10%	1.0 ± 0.2Vrms.									
Measuring frequency	Measuring voltage															
1kHz ± 10%	1.0 ± 0.2Vrms.															
5	Dissipation Factor	Please refer to detail page on TDK Web.	See No.4 in this table for measuring condition.													
6	Temperature Characteristics of Capacitance	<p>Capacitance Change (%)</p> <table border="1"> <thead> <tr> <th>No voltage applied</th> </tr> </thead> <tbody> <tr> <td>X7R : ± 15</td> </tr> <tr> <td>X7T : +22 -33</td> </tr> </tbody> </table>	No voltage applied	X7R : ± 15	X7T : +22 -33	<p>Capacitance shall be measured by the steps shown in the following table, after thermal equilibrium is obtained for each step.</p> <p>ΔC be calculated ref. STEP3 reading.</p> <table border="1"> <thead> <tr> <th>Step</th> <th>Temperature (°C)</th> </tr> </thead> <tbody> <tr> <td>1</td> <td>25 ± 2</td> </tr> <tr> <td>2</td> <td>-55 ± 2</td> </tr> <tr> <td>3</td> <td>25 ± 2</td> </tr> <tr> <td>4</td> <td>125 ± 2</td> </tr> </tbody> </table> <p>As for measuring voltage, please contact with our sales representative.</p>	Step	Temperature (°C)	1	25 ± 2	2	-55 ± 2	3	25 ± 2	4	125 ± 2
No voltage applied																
X7R : ± 15																
X7T : +22 -33																
Step	Temperature (°C)															
1	25 ± 2															
2	-55 ± 2															
3	25 ± 2															
4	125 ± 2															
7	Robustness of Terminations	No sign of termination coming off, breakage of ceramic, or other abnormal signs.	<p>Reflow solder the capacitor on a P.C.Board shown in Appendix 2.</p> <p>Apply a pushing force gradually at the center of a specimen in a horizontal direction of P.C.board.</p> <p>Pushing force : 2N Holding time : 10±1s.</p> 													

(continued)

No.	Item		Performance	Test or inspection method			
8	Bending	Capacitance	<p>No mechanical damage.</p> <hr/> <p>Change from the value before test</p> <hr/> <p style="text-align: center;">± 12.5 %</p> <hr/>	<p>Reflow solder the capacitor on a P.C.Board shown in Appendix 1.</p>  <p style="text-align: right;">(Unit: mm)</p>			
9	Solderability		<p>New solder to cover over 75% of termination.</p> <p>25% may have pinholes or rough spots but not concentrated in one spot.</p> <p>Ceramic surface of A sections shall not be exposed due to melting or shifting of termination material.</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>Solder temp. : 245±5°C (Sn-3.0Ag-0.5Cu) 235±5°C (Sn-37Pb)</p> <p>Dwell time : 3±0.3s.(Sn-3.0Ag-0.5Cu) 2±0.2s.(Sn-37Pb)</p> <p>Solder position : Until both terminations are completely soaked.</p>			
10	Resistance to solder heat	External appearance	No cracks are allowed and terminations shall be covered at least 60% with new solder.	<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>Solder temp. : 260±5°C</p> <p>Dwell time : 10±1s.</p> <p>Solder position : Until both terminations are completely soaked.</p> <p>Pre-heating : Temp. — 110~140°C Time — 30~60s.</p> <p>Leave the capacitors in ambient condition for 24±2h before measurement.</p>			
Capacitance		<table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th style="width: 50%;">Characteristics</th> <th style="width: 50%;">Change from the value before test</th> </tr> </thead> <tbody> <tr> <td style="text-align: center;">X7R X7T</td> <td style="text-align: center;">± 7.5 %</td> </tr> </tbody> </table>	Characteristics		Change from the value before test	X7R X7T	± 7.5 %
Characteristics		Change from the value before test					
X7R X7T		± 7.5 %					
D.F.		Meet the initial spec.					
Insulation resistance	Meet the initial spec.						
Voltage proof	No insulation breakdown or other damage.						

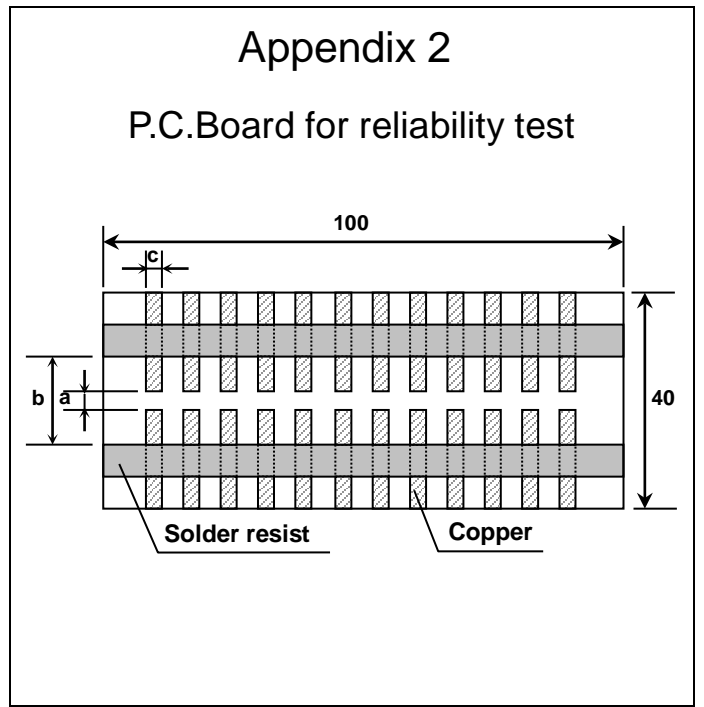
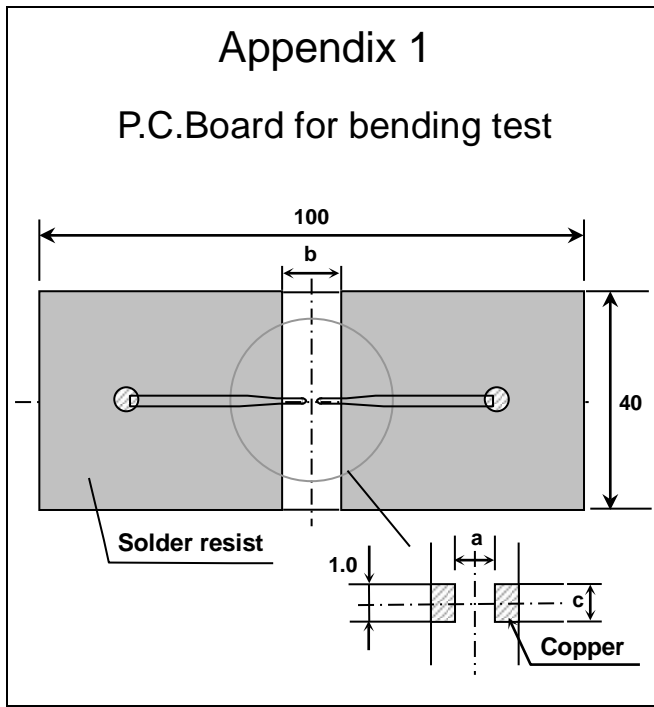
(continued)

No.	Item	Performance	Test or inspection method															
11	Vibration	External appearance	<p>Applied force : 5G max. Frequency : 10~2,000Hz Reciprocating sweep time : 20 min. Cycle : 12 cycles in each 3 mutually perpendicular directions.</p> <p>Reflow solder the capacitors on a P.C.Board shown in Appendix 2 before testing.</p>															
		Capacitance		<table border="1"> <thead> <tr> <th>Characteristics</th> <th>Change from the value before test</th> </tr> </thead> <tbody> <tr> <td>X7R X7T</td> <td>± 7.5 %</td> </tr> </tbody> </table>	Characteristics	Change from the value before test	X7R X7T	± 7.5 %										
		Characteristics		Change from the value before test														
X7R X7T	± 7.5 %																	
D.F.	Meet the initial spec.																	
12	Temperature cycle	External appearance	<p>Expose the capacitors in the condition step1 through step 4 listed in the following table.</p> <p>Temp. cycle : 1,000 cycles</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>Ambient Temp.</td> <td>2 ~ 5</td> </tr> <tr> <td>3</td> <td>125 ± 2</td> <td>30 ± 2</td> </tr> <tr> <td>4</td> <td>Ambient Temp.</td> <td>2 ~ 5</td> </tr> </tbody> </table> <p>Leave the capacitors in ambient condition for 24±2h before measurement.</p> <p>Reflow solder the capacitors on a P.C.Board shown in Appendix 2 before testing.</p>	Step	Temperature (°C)	Time (min.)	1	-55 ± 3	30 ± 3	2	Ambient Temp.	2 ~ 5	3	125 ± 2	30 ± 2	4	Ambient Temp.	2 ~ 5
		Step		Temperature (°C)	Time (min.)													
		1		-55 ± 3	30 ± 3													
		2		Ambient Temp.	2 ~ 5													
		3		125 ± 2	30 ± 2													
		4		Ambient Temp.	2 ~ 5													
Capacitance	<table border="1"> <thead> <tr> <th>Characteristics</th> <th>Change from the value before test</th> </tr> </thead> <tbody> <tr> <td>X7R X7T</td> <td>Please contact with our sales representative.</td> </tr> </tbody> </table>	Characteristics	Change from the value before test	X7R X7T	Please contact with our sales representative.													
Characteristics	Change from the value before test																	
X7R X7T	Please contact with our sales representative.																	
D.F.	Meet the initial spec.																	
Insulation resistance	Meet the initial spec.																	
Voltage proof	No insulation breakdown or other damage.																	
13	Moisture Resistance (Steady State)	External appearance	<p>Test temp. : 40±2°C Test humidity : 90~95%RH Test time : 500 +24,0h</p> <p>Leave the capacitors in ambient condition for 24±2h before measurement.</p> <p>Reflow solder the capacitors on a P.C.Board shown in Appendix2 before testing.</p>															
		Capacitance		<table border="1"> <thead> <tr> <th>Characteristics</th> <th>Change from the value before test</th> </tr> </thead> <tbody> <tr> <td>X7R X7T</td> <td>Please contact with our sales representative.</td> </tr> </tbody> </table>	Characteristics	Change from the value before test	X7R X7T	Please contact with our sales representative.										
		Characteristics		Change from the value before test														
		X7R X7T		Please contact with our sales representative.														
D.F.	200% of Initial spec max.																	
Insulation resistance	1,000MΩ or 50MΩ·μF min. (As for the capacitors of rated voltage 6.3V DC and lower, 10MΩ·μF min.), whichever smaller.																	

(continued)

No.	Item		Performance	Test or inspection method				
14	Moisture Resistance	External appearance	No mechanical damage.	Test temp. : 85±2°C Test humidity : 85%RH Applied voltage : Rated voltage Test time : 1,000 +48,0h Charge/discharge current : 50mA or lower Leave the capacitors in ambient condition for 24±2h before measurement. Reflow solder the capacitors on a P.C.Board shown in Appendix2 before testing. Initial value setting Voltage conditioning «After voltage treat the capacitors under testing temperature and voltage for 1 hour,» leave the capacitors in ambient condition for 24±2h before measurement. Use this measurement for initial value.				
		Capacitance	<table border="1" data-bbox="539 416 916 609"> <tr> <td data-bbox="539 416 721 488">Characteristics</td> <td data-bbox="721 416 916 488">Change from the value before test</td> </tr> <tr> <td data-bbox="539 488 721 609">X7R X7T</td> <td data-bbox="721 488 916 609">Please contact with our sales representative.</td> </tr> </table>		Characteristics	Change from the value before test	X7R X7T	Please contact with our sales representative.
		Characteristics	Change from the value before test					
		X7R X7T	Please contact with our sales representative.					
D.F.	200% of Initial spec max.							
Insulation resistance	500MΩ or 25MΩ·μF min. (As for the capacitors of rated voltage 6.3V DC and lower, 5MΩ·μF min.), whichever smaller.							
15	Life	External appearance	No mechanical damage.	Test temp. : 125±2°C Applied voltage : Please contact with our sales representative. Test time : 1,000 +48,0h Charge/discharge current : 50mA or lower Leave the capacitors in ambient condition for 24±2h before measurement. Reflow solder the capacitors on a P.C.Board shown in Appendix2 before testing. Initial value setting Voltage conditioning «After voltage treat the capacitors under testing temperature and voltage for 1 hour,» leave the capacitors in ambient condition for 24±2h before measurement. Use this measurement for initial value.				
		Capacitance	<table border="1" data-bbox="539 1164 916 1357"> <tr> <td data-bbox="539 1164 721 1236">Characteristics</td> <td data-bbox="721 1164 916 1236">Change from the value before test</td> </tr> <tr> <td data-bbox="539 1236 721 1357">X7R X7T</td> <td data-bbox="721 1236 916 1357">Please contact with our sales representative.</td> </tr> </table>		Characteristics	Change from the value before test	X7R X7T	Please contact with our sales representative.
		Characteristics	Change from the value before test					
		X7R X7T	Please contact with our sales representative.					
D.F.	200% of Initial spec max.							
Insulation resistance	1,000MΩ or 50MΩ·μF min. (As for the capacitors of rated voltage 6.3V DC and lower, 10MΩ·μF min.), whichever smaller.							

*As for the initial measurement of capacitors on number 6,10,11,12 and 13 leave capacitors at 150 –10, 0°C for 1h and measure the value after leaving capacitors for 24 ± 2h in ambient condition.



(Unit:mm)

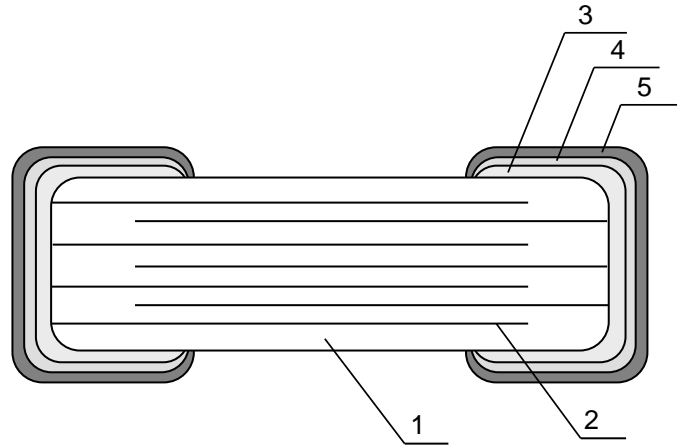
Symbol	Dimensions		
	a	b	c
CGAEA (CC0204)	0.2	0.6	1.0
CGAEB (CC0204)	0.2	0.65	1.1

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

2. Thickness : Appendix 1 — 0.8mm
Appendix 2 — 1.6mm

Copper(Thickness:0.035mm)
 Solder resist

6. INSIDE STRUCTURE AND MATERIAL



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

7. 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 10. TAPE PACKAGING SPECIFICATION.

Information on label

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

*Composition of Inspection No.

Example E 9 A - 23 - 001
 (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

*Composition of new Inspection No.

(Will be implemented on and after May 1, 2019)

Example

I	F	9	E	2	3	A	0	0	1
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 (a) (b) (c) (d) (e) (f) (g)

- (a) Prefix
- (b) Line code
- (c) Last digit of the year
- (d) Month and A for January and B for February and so on. (Skip I)
- (e) Inspection Date of the month.
- (f) Serial No. of the day(00 ~ ZZ)
- (g) Suffix(00 ~ ZZ)

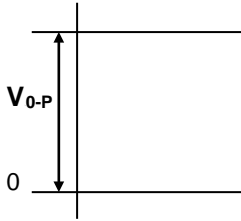
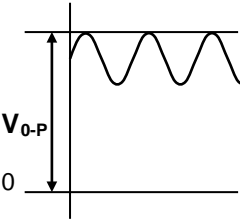
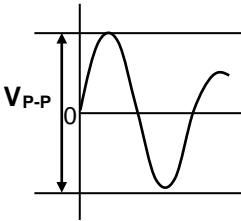
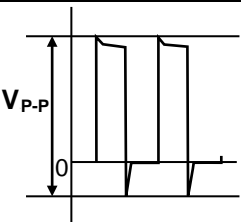
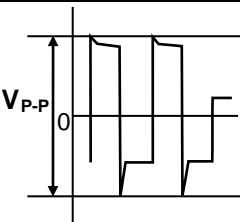
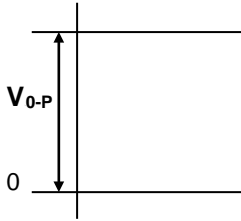
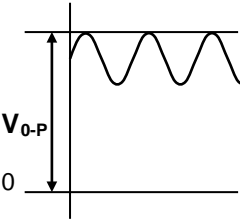
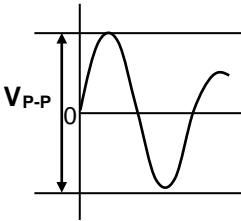
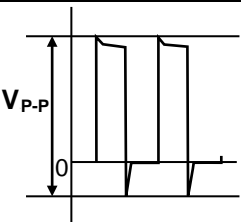
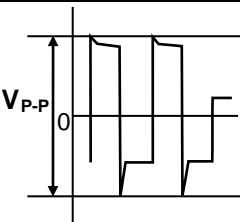
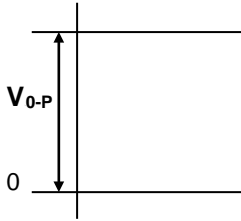
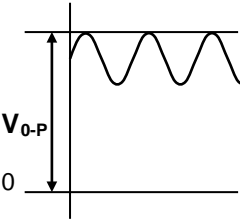
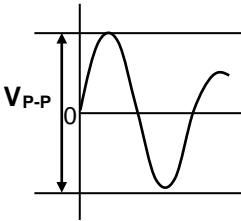
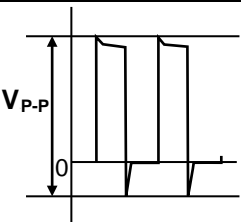
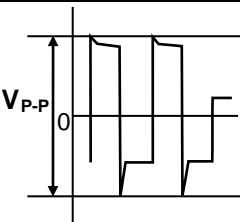
* It is planned to shift to the new inspection No. on and after May 2019, but the implementation timing may be different depending on shipment bases.

Until the shift is completed, either current or new composition of inspection No. will be applied.

8. SOLDERING CONDITION

Reflow soldering only.

9. CAUTION

No.	Process	Condition																
1	Operating Condition (Storage, Use, Transportation)	<p>1-1. Storage, Use</p> <ol style="list-style-type: none"> 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. 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. 3) Avoid storing in sun light and falling of dew. 4) Do not use capacitors under high humidity and high and low atmospheric pressure which may affect capacitors reliability. 5) Capacitors 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 capacitors, the performance of the capacitors 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 capacitors above the maximum allowable operating temperature. 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) 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. <p>2-2. Operating voltage</p> <ol style="list-style-type: none"> 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) AC or pulse with overshooting, V_{P-P} 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. <table border="1" data-bbox="475 1507 1444 2033"> <thead> <tr> <th data-bbox="475 1507 662 1536">Voltage</th> <th data-bbox="662 1507 922 1536">(1) DC voltage</th> <th data-bbox="922 1507 1182 1536">(2) DC+AC voltage</th> <th data-bbox="1182 1507 1444 1536">(3) AC voltage</th> </tr> </thead> <tbody> <tr> <td data-bbox="475 1536 662 1765">Positional Measurement (Rated voltage)</td> <td data-bbox="662 1536 922 1765">  </td> <td data-bbox="922 1536 1182 1765">  </td> <td data-bbox="1182 1536 1444 1765">  </td> </tr> <tr> <th data-bbox="475 1776 662 1805">Voltage</th> <th data-bbox="662 1776 922 1805">(4) Pulse voltage (A)</th> <th data-bbox="922 1776 1182 1805">(5) Pulse voltage (B)</th> <td></td> </tr> <tr> <td data-bbox="475 1805 662 2033">Positional Measurement (Rated voltage)</td> <td data-bbox="662 1805 922 2033">  </td> <td data-bbox="922 1805 1182 2033">  </td> <td></td> </tr> </tbody> </table>	Voltage	(1) DC voltage	(2) DC+AC voltage	(3) AC voltage	Positional Measurement (Rated voltage)				Voltage	(4) Pulse voltage (A)	(5) Pulse voltage (B)		Positional Measurement (Rated voltage)			
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Voltage	(4) Pulse voltage (A)	(5) Pulse voltage (B)																
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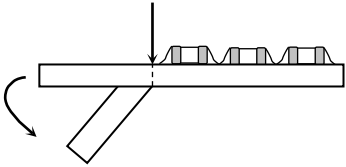
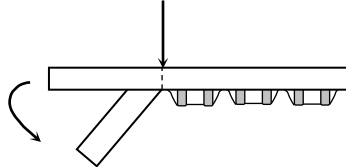
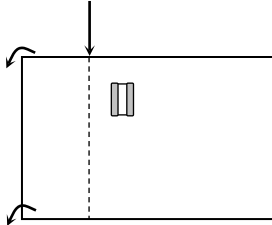
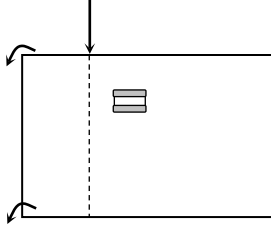
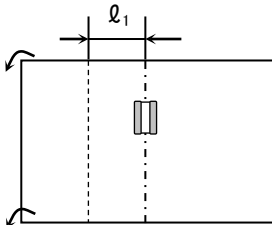
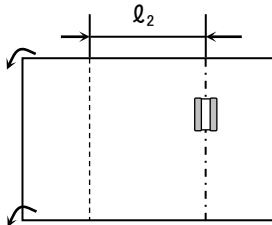
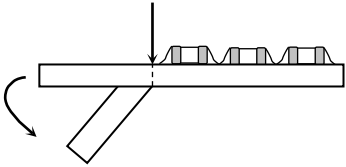
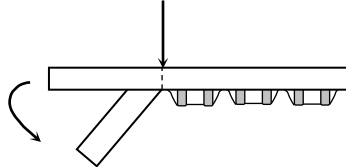
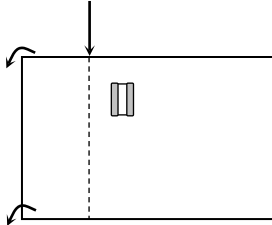
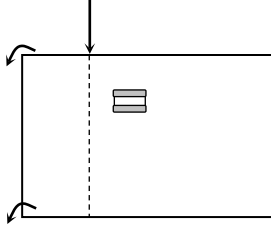
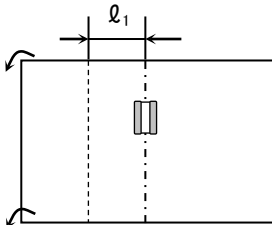
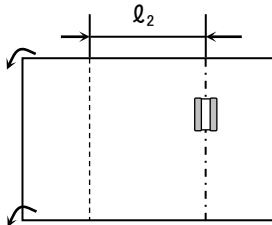
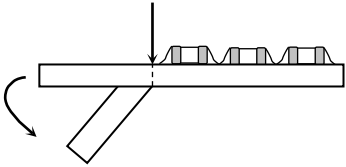
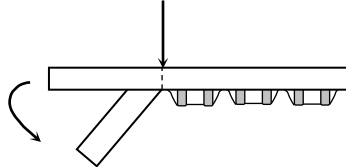
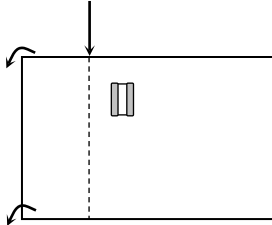
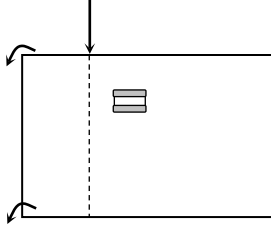
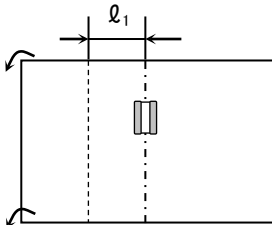
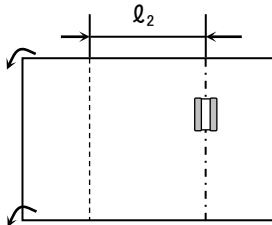
No.	Process	Condition
2	Circuit design ⚠ Caution	<p>2) Even below the rated voltage, if repetitive high frequency AC or pulse is applied, the reliability of the capacitors may be reduced.</p> <p>3) The effective capacitance will vary depending on applied DC and AC voltages. The capacitors should be selected 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>

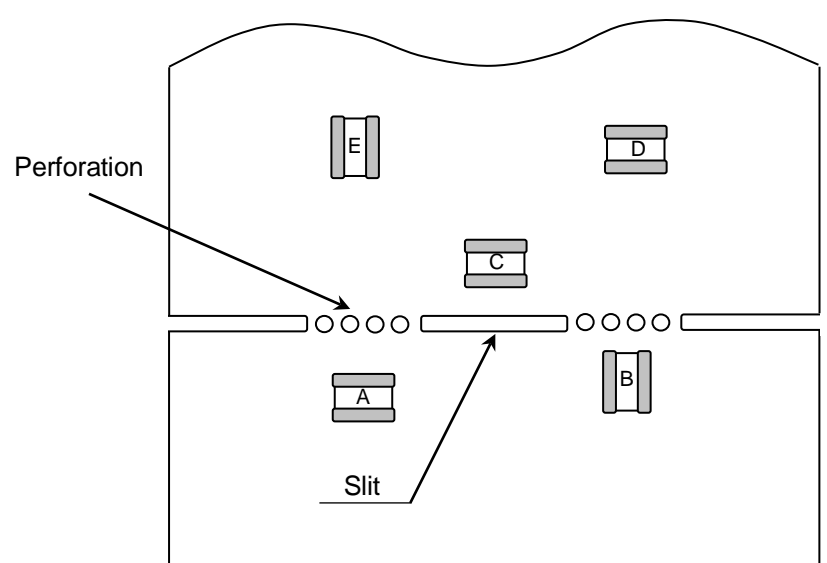
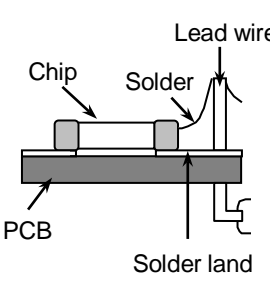
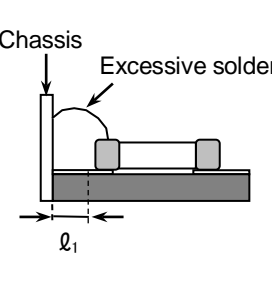
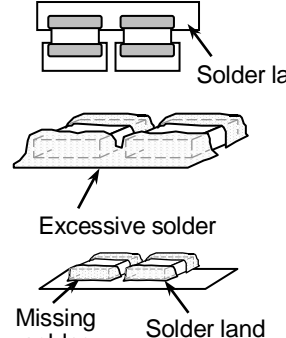
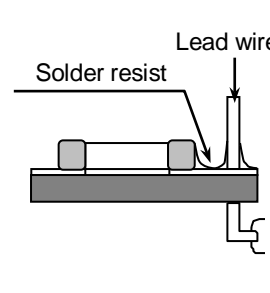
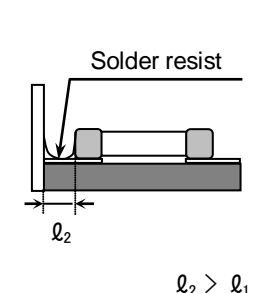
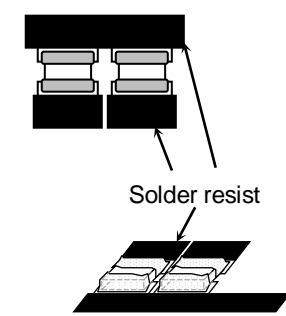
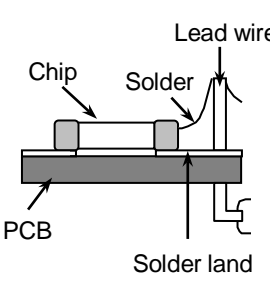
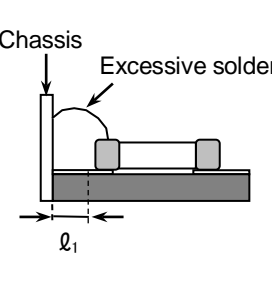
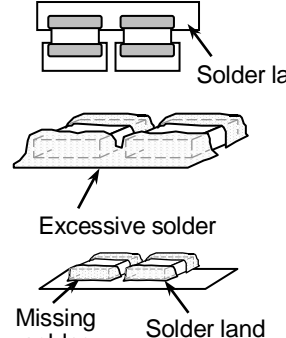
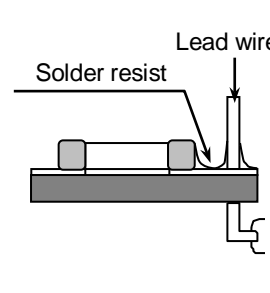
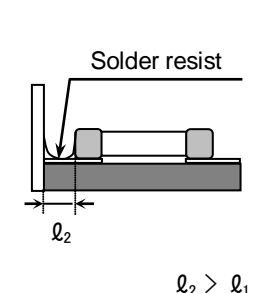
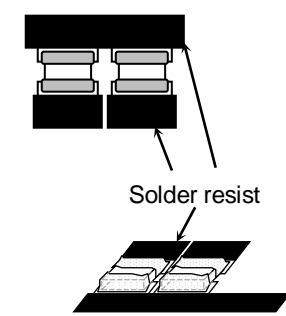
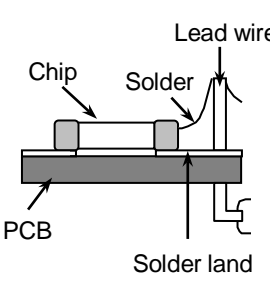
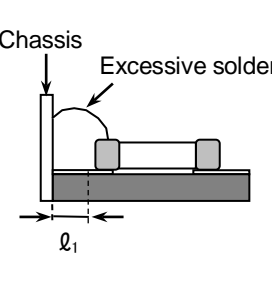
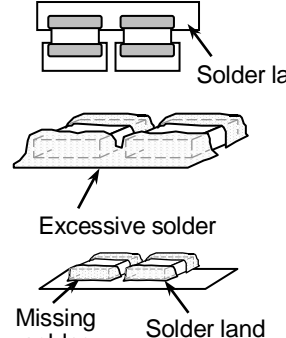
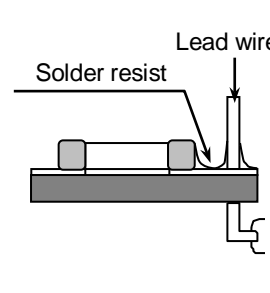
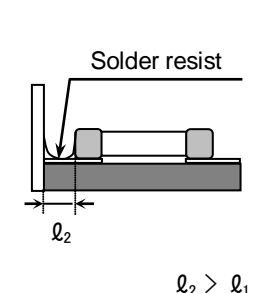
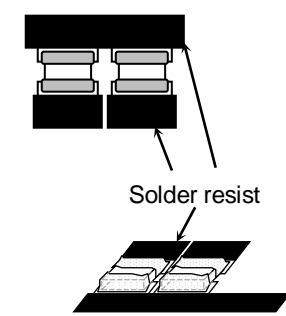
3	Designing P.C.board	<p>The amount of solder at the terminations has a direct effect on the reliability of the capacitors.</p> <ol style="list-style-type: none"> 1) The greater the amount of solder, the higher the stress on the chip capacitors, and the more likely that it will break. When designing a P.C.board, determine the shape and size of the solder lands to have proper amount of solder on the terminations. 2) Avoid using common solder land for multiple terminations and provide individual solder land for each terminations. 3) Size and recommended land dimensions.
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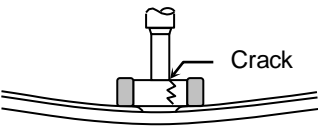
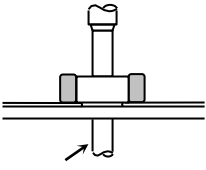
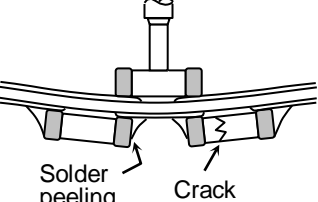
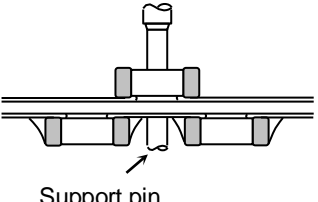
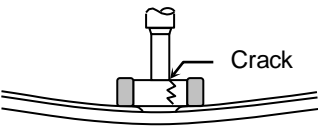
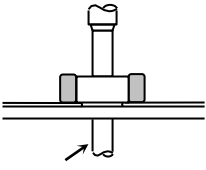
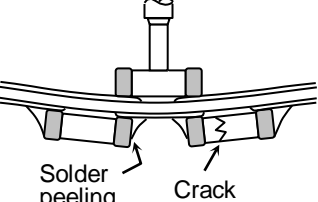
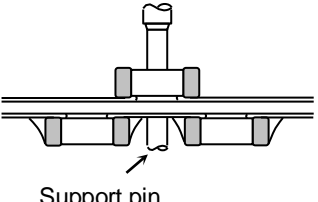
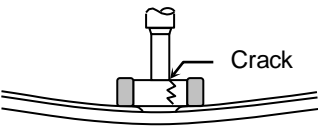
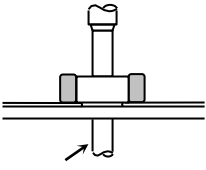
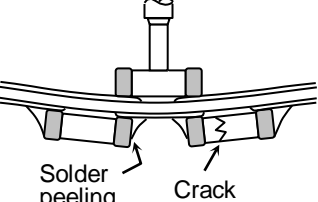
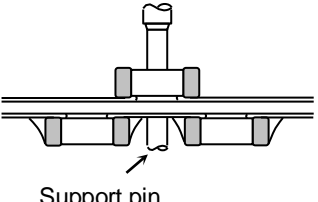
The diagram shows a cross-section of a chip capacitor on a PCB. The capacitor is a small rectangular component with two leads. The solder land is the area of the PCB that is soldered to the leads. Dimension A is the width of the solder land, B is the width of the capacitor body, and C is the height of the capacitor. Labels include 'Chip capacitor', 'Solder land', and 'Solder resist'.

Reflow soldering

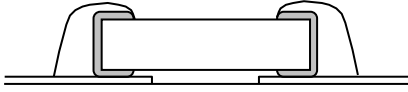
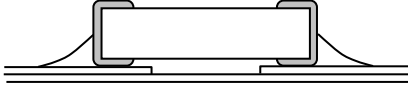
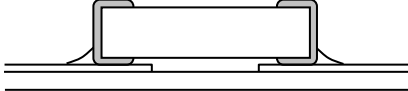
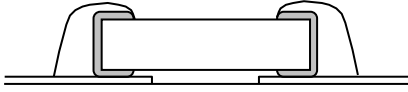
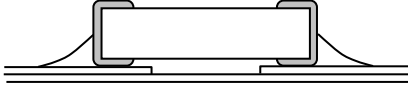
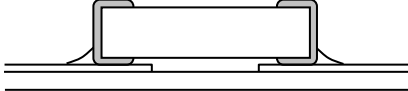
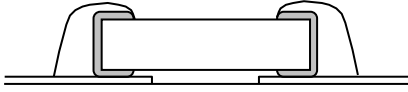
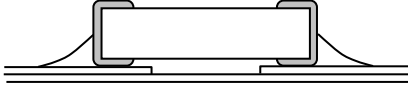
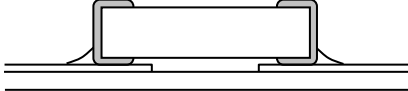
		(mm)	
Type	CGAEA (CC0204)	CGAEB (CC0204)	
A	0.2	0.2	
B	0.2	0.225	
C	1.0	1.1	


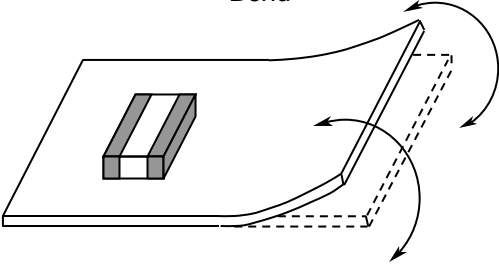
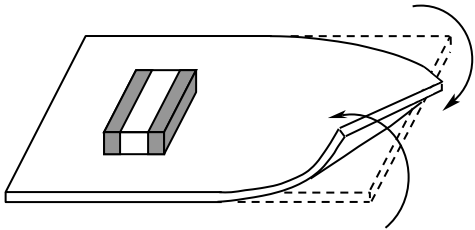
No.	Process	Condition												
3	Designing P.C.Board	<p data-bbox="437 226 1086 257">4) Recommended chip capacitor layout is as following.</p> <table border="1" data-bbox="475 297 1425 1720"> <thead> <tr> <th data-bbox="475 297 660 376"></th> <th data-bbox="660 297 1043 376">Disadvantage against bending stress</th> <th data-bbox="1043 297 1425 376">Advantage against bending stress</th> </tr> </thead> <tbody> <tr> <td data-bbox="475 376 660 790">Mounting face</td> <td data-bbox="660 376 1043 790"> <p data-bbox="751 409 952 441">Perforation or slit</p>  <p data-bbox="724 689 975 757">Break P.C.Board with mounted side up.</p> </td> <td data-bbox="1043 376 1425 790"> <p data-bbox="1129 409 1331 441">Perforation or slit</p>  <p data-bbox="1107 689 1358 757">Break P.C.Board with mounted side down.</p> </td> </tr> <tr> <td data-bbox="475 790 660 1238">Chip arrangement (Direction)</td> <td data-bbox="660 790 1043 1238"> <p data-bbox="699 824 991 855">Mount perpendicularly to perforation or slit</p> <p data-bbox="751 925 952 956">Perforation or slit</p>  </td> <td data-bbox="1043 790 1425 1238"> <p data-bbox="1091 824 1351 855">Mount in parallel with perforation or slit</p> <p data-bbox="1129 925 1331 956">Perforation or slit</p>  </td> </tr> <tr> <td data-bbox="475 1238 660 1720">Distance from slit</td> <td data-bbox="660 1238 1043 1720"> <p data-bbox="687 1272 1018 1303">Closer to slit is higher stress</p>  <p data-bbox="874 1630 991 1662">$(l_1 < l_2)$</p> </td> <td data-bbox="1043 1238 1425 1720"> <p data-bbox="1070 1272 1401 1303">Away from slit is less stress</p>  <p data-bbox="1257 1630 1374 1662">$(l_1 < l_2)$</p> </td> </tr> </tbody> </table>		Disadvantage against bending stress	Advantage against bending stress	Mounting face	<p data-bbox="751 409 952 441">Perforation or slit</p>  <p data-bbox="724 689 975 757">Break P.C.Board with mounted side up.</p>	<p data-bbox="1129 409 1331 441">Perforation or slit</p>  <p data-bbox="1107 689 1358 757">Break P.C.Board with mounted side down.</p>	Chip arrangement (Direction)	<p data-bbox="699 824 991 855">Mount perpendicularly to perforation or slit</p> <p data-bbox="751 925 952 956">Perforation or slit</p> 	<p data-bbox="1091 824 1351 855">Mount in parallel with perforation or slit</p> <p data-bbox="1129 925 1331 956">Perforation or slit</p> 	Distance from slit	<p data-bbox="687 1272 1018 1303">Closer to slit is higher stress</p>  <p data-bbox="874 1630 991 1662">$(l_1 < l_2)$</p>	<p data-bbox="1070 1272 1401 1303">Away from slit is less stress</p>  <p data-bbox="1257 1630 1374 1662">$(l_1 < l_2)$</p>
	Disadvantage against bending stress	Advantage against bending stress												
Mounting face	<p data-bbox="751 409 952 441">Perforation or slit</p>  <p data-bbox="724 689 975 757">Break P.C.Board with mounted side up.</p>	<p data-bbox="1129 409 1331 441">Perforation or slit</p>  <p data-bbox="1107 689 1358 757">Break P.C.Board with mounted side down.</p>												
Chip arrangement (Direction)	<p data-bbox="699 824 991 855">Mount perpendicularly to perforation or slit</p> <p data-bbox="751 925 952 956">Perforation or slit</p> 	<p data-bbox="1091 824 1351 855">Mount in parallel with perforation or slit</p> <p data-bbox="1129 925 1331 956">Perforation or slit</p> 												
Distance from slit	<p data-bbox="687 1272 1018 1303">Closer to slit is higher stress</p>  <p data-bbox="874 1630 991 1662">$(l_1 < l_2)$</p>	<p data-bbox="1070 1272 1401 1303">Away from slit is less stress</p>  <p data-bbox="1257 1630 1374 1662">$(l_1 < l_2)$</p>												


No.	Process	Condition												
3	Designing P.C.Board	<p>5) Mechanical stress varies according to location of chip capacitors on the P.C.Board.</p>  <p>The stress in capacitors is in the following order. $A > B$ $A > C$ $A > D$ $B > E$ $D > E$</p> <p>6) Layout recommendation</p> <table border="1" data-bbox="375 1115 1495 2098"> <thead> <tr> <th data-bbox="375 1115 539 1232">Example</th> <th data-bbox="539 1115 845 1232">Use of common solder land</th> <th data-bbox="845 1115 1152 1232">Soldering with chassis</th> <th data-bbox="1152 1115 1495 1232">Use of common solder land with other SMD</th> </tr> </thead> <tbody> <tr> <td data-bbox="375 1232 539 1612">Need to avoid</td> <td data-bbox="539 1232 845 1612">  </td> <td data-bbox="845 1232 1152 1612">  </td> <td data-bbox="1152 1232 1495 1612">  </td> </tr> <tr> <td data-bbox="375 1612 539 2098">Recommendation</td> <td data-bbox="539 1612 845 2098">  </td> <td data-bbox="845 1612 1152 2098">  <p>$l_2 > l_1$</p> </td> <td data-bbox="1152 1612 1495 2098">  </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		 <p>$l_2 > l_1$</p>	
Example	Use of common solder land	Soldering with chassis	Use of common solder land with other SMD											
Need to avoid														
Recommendation		 <p>$l_2 > l_1$</p>												

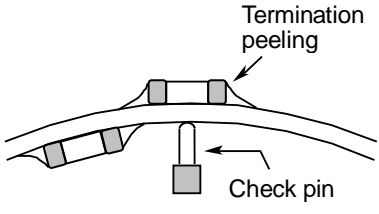
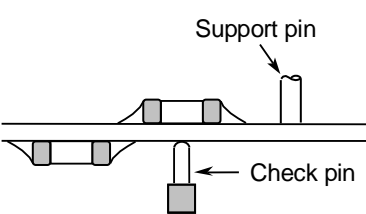
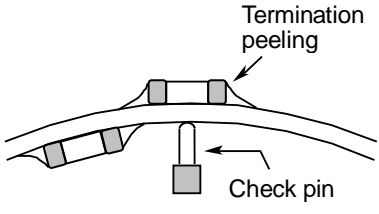
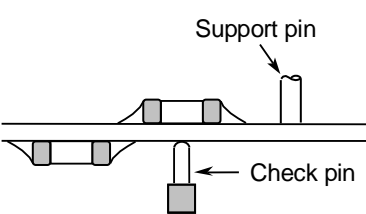
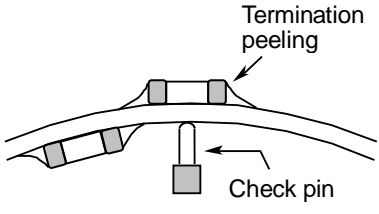
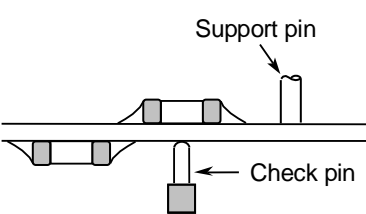
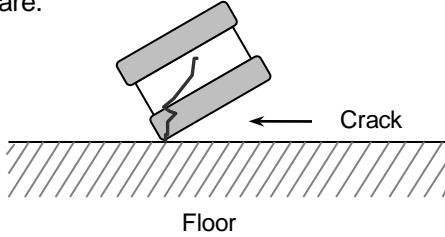
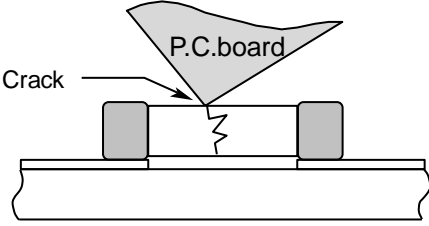
No.	Process	Condition									
4	Mounting	<p>4-1. Stress from mounting head If the mounting head is adjusted too low, it may induce excessive stress in the chip capacitors to result in cracking. Please take following precautions.</p> <ol style="list-style-type: none"> 1) Adjust the bottom dead center 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 and below 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="486 609 1439 1182"> <thead> <tr> <th data-bbox="486 609 668 660"></th> <th data-bbox="668 609 1062 660">Not recommended</th> <th data-bbox="1062 609 1439 660">Recommended</th> </tr> </thead> <tbody> <tr> <td data-bbox="486 660 668 922">Single sided mounting</td> <td data-bbox="668 660 1062 922">  </td> <td data-bbox="1062 660 1439 922">  </td> </tr> <tr> <td data-bbox="486 922 668 1182">Double-sides mounting</td> <td data-bbox="668 922 1062 1182">  </td> <td data-bbox="1062 922 1439 1182">  </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</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"> 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> </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;">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 Lead Free Solder : Sn-3.0Ag-0.5Cu Sn-Pb solder : Sn-37Pb</p>	Temp./Duration	Reflow soldering		Peak temp(°C)	Duration(sec)	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="523 255 1098 394"> <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 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> <table border="1" data-bbox="469 712 1449 1146"> <tbody> <tr> <td data-bbox="507 734 635 801">Excessive solder</td> <td data-bbox="689 725 1098 815">  </td> <td data-bbox="1136 716 1426 806">Higher tensile force in chip capacitors to cause crack</td> </tr> <tr> <td data-bbox="507 900 635 936">Adequate</td> <td data-bbox="689 891 1098 981">  </td> <td></td> </tr> <tr> <td data-bbox="507 1048 635 1115">Insufficient solder</td> <td data-bbox="689 1025 1098 1115">  </td> <td data-bbox="1136 1012 1426 1128">Low robustness may cause contact failure or chip capacitors come off the P.C.board.</td> </tr> </tbody> </table> <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.</p> <p>Recommended solder iron condition (Sn-Pb Solder and Lead Free Solder)</p> <table border="1" data-bbox="469 1451 1391 1550"> <thead> <tr> <th>Temp. (°C)</th> <th>Duration (sec.)</th> <th>Wattage (W)</th> <th>Shape (mm)</th> </tr> </thead> <tbody> <tr> <td>350 max.</td> <td>3 max.</td> <td>20 max.</td> <td>φ3.0 max.</td> </tr> </tbody> </table> <p>* Please preheat the chip capacitors with the condition in 5-4 to avoid the thermal shock.</p> <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-2335C Annex A (Informative) Recommendations to prevent the tombstone phenomenon)</p>	Soldering	Temp. (°C)	Reflow soldering	$\Delta T \leq 150$	Manual soldering	$\Delta T \leq 150$	Excessive solder		Higher tensile force in chip capacitors to cause crack	Adequate			Insufficient solder		Low robustness may cause contact failure or chip capacitors come off the P.C.board.	Temp. (°C)	Duration (sec.)	Wattage (W)	Shape (mm)	350 max.	3 max.	20 max.	φ3.0 max.
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350 max.	3 max.	20 max.	φ3.0 max.																						

No.	Process	Condition
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 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="padding-left: 40px;">Power : 20W/ℓ max. Frequency : 40kHz 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>
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>

No.	Process	Condition																
8	Handling after chip mounted  Caution	<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>Recommended example: 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>Unrecommended example: 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;"> <div data-bbox="454 571 758 851"> <p>Outline of jig</p> </div> <div data-bbox="758 560 1444 817"> <table border="1"> <thead> <tr> <th data-bbox="762 566 1098 611">Recommended</th> <th data-bbox="1098 566 1439 611">Unrecommended</th> </tr> </thead> <tbody> <tr> <td data-bbox="762 611 1098 810"> </td> <td data-bbox="1098 611 1439 810"> </td> </tr> </tbody> </table> </div> </div> <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>Unrecommended example: 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="550 1153 965 1422"> <p>Outline of machine</p> </div> <div data-bbox="965 1153 1412 1411"> <p>Principle of operation</p> </div> </div> <div style="text-align: center; margin-top: 20px;"> <p>Cross-section diagram</p> </div> <table border="1" style="width: 100%; text-align: center; margin-top: 20px;"> <thead> <tr> <th data-bbox="641 1639 821 1684">Recommended</th> <th colspan="3" data-bbox="821 1639 1353 1684">Unrecommended</th> </tr> <tr> <th data-bbox="641 1684 821 1765"></th> <th data-bbox="821 1684 1002 1765">Top-bottom misalignment</th> <th data-bbox="1002 1684 1168 1765">Left-right misalignment</th> <th data-bbox="1168 1684 1353 1765">Front-rear misalignment</th> </tr> </thead> <tbody> <tr> <td data-bbox="641 1765 821 2065"> </td> <td data-bbox="821 1765 1002 2065"> </td> <td data-bbox="1002 1765 1168 2065"> </td> <td data-bbox="1168 1765 1353 2065"> </td> </tr> </tbody> </table>	Recommended	Unrecommended			Recommended	Unrecommended				Top-bottom misalignment	Left-right misalignment	Front-rear misalignment				
Recommended	Unrecommended																	
Recommended	Unrecommended																	
	Top-bottom misalignment	Left-right misalignment	Front-rear misalignment															

No.	Process	Condition						
8	Handling after chip mounted ⚠ Caution	<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 chip capacitors or peel the terminations off. Please adjust the check pins not to bend the P.C.board.</p> <table border="1" data-bbox="475 383 1433 680"> <thead> <tr> <th data-bbox="475 383 616 443">Item</th> <th data-bbox="616 383 1034 443">Not recommended</th> <th data-bbox="1034 383 1433 443">Recommended</th> </tr> </thead> <tbody> <tr> <td data-bbox="475 443 616 680">Board bending</td> <td data-bbox="616 443 1034 680">  <p>Termination peeling</p> <p>Check pin</p> </td> <td data-bbox="1034 443 1433 680">  <p>Support pin</p> <p>Check pin</p> </td> </tr> </tbody> </table>	Item	Not recommended	Recommended	Board bending	 <p>Termination peeling</p> <p>Check pin</p>	 <p>Support pin</p> <p>Check pin</p>
Item	Not recommended	Recommended						
Board bending	 <p>Termination peeling</p> <p>Check pin</p>	 <p>Support pin</p> <p>Check pin</p>						
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>  <p>Crack</p> <p>Floor</p> <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>  <p>Crack</p> <p>P.C.board</p>						
10	Capacitance aging	<p>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.</p>						
11	Estimated life and estimated failure rate of capacitors	<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) 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	<ol style="list-style-type: none"> 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. 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 3) Confirm that the environment to which the equipment will be exposed during transportation and operation meets the specified conditions. Do not to use the equipment in the following environments. <ol style="list-style-type: none"> (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
13	Others  Caution	<p>The product listed in this specification is intended for use in automotive applications under-normal operation and usage conditions.</p> <p>The product is not designed or warranted to meet the requirements of application listed below, whose performance and/or quality requires a more stringent level of safety or reliability, or whose failure, malfunction or defect 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> <ol style="list-style-type: none"> (1) Aerospace/Aviation equipment (2) Transportation equipment (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>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> <p>In addition, although the product listed in this specification is intended for use in automotive applications as described above, it is not prohibited to use for general electronic equipment, whose performance and/or quality doesn't require a more stringent level of safety or reliability, or whose failure, malfunction or defect could not cause serious damage to society, person or property.</p> <p>Therefore, the description of this caution will be applied, when the product is used in general electronic equipment under a normal operation and usage conditions.</p>

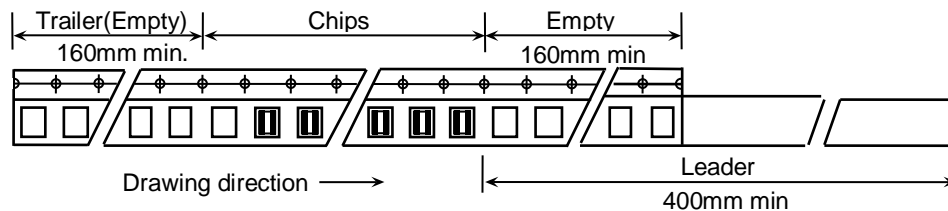
10. TAPE PACKAGING SPECIFICATION

1. CONSTRUCTION AND DIMENSION OF TAPING

1-1. Dimensions of carrier tape

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

1-2. Bulk part and leader of taping

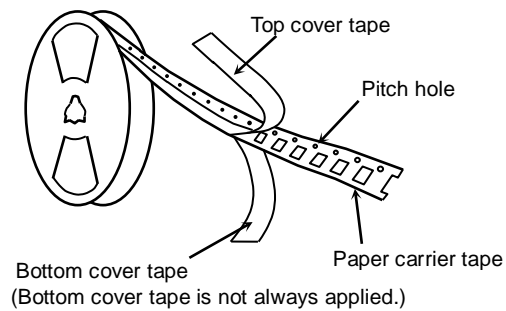


1-3. Dimensions of reel

Dimensions of $\phi 178$ reel shall be according to Appendix 5.

Dimensions of $\phi 330$ reel shall be according to Appendix 6.

1-4. Structure of taping



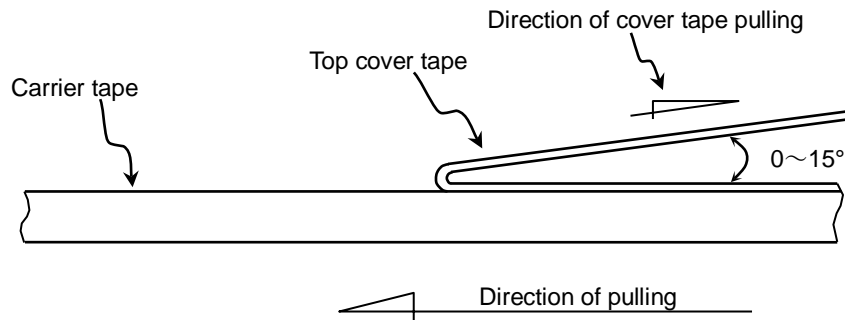
2. CHIP QUANTITY

Please refer to detail page on TDK Web.

3. PERFORMANCE SPECIFICATIONS

3-1. Fixing peeling strength (top tape)

$$0.05\text{N} < \text{Peeling strength} < 0.7\text{N}$$



〔 Paper tape should not adhere to top cover tape when pull the cover tape. 〕

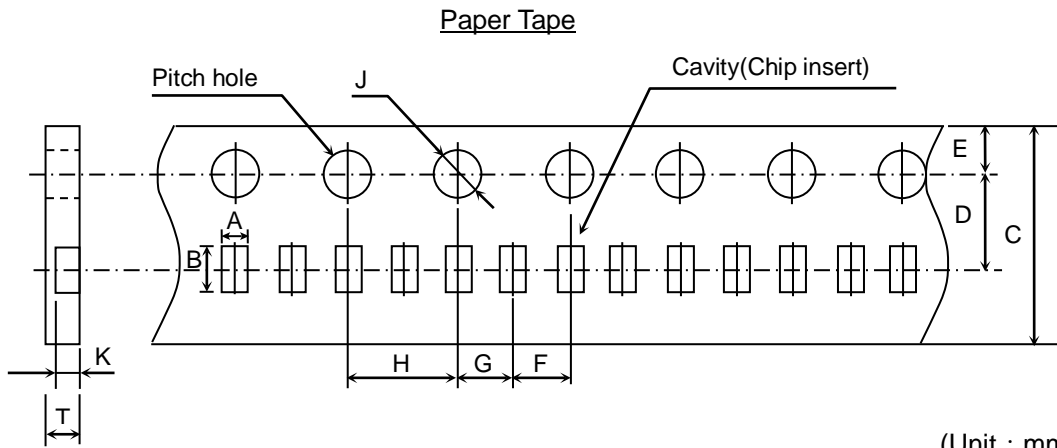
3-2. Carrier tape shall be flexible enough to be wound around a minimum radius of 30mm with components in tape.

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

3-4. Components shall not stick to fixing tape.

3-5. When removing the cover tape, there shall not be difficulties by unfitting clearance gap, burrs and crushes of cavities. Also the sprocket holes shall not be covered by absorbing dust into the suction nozzle.

Appendix 3



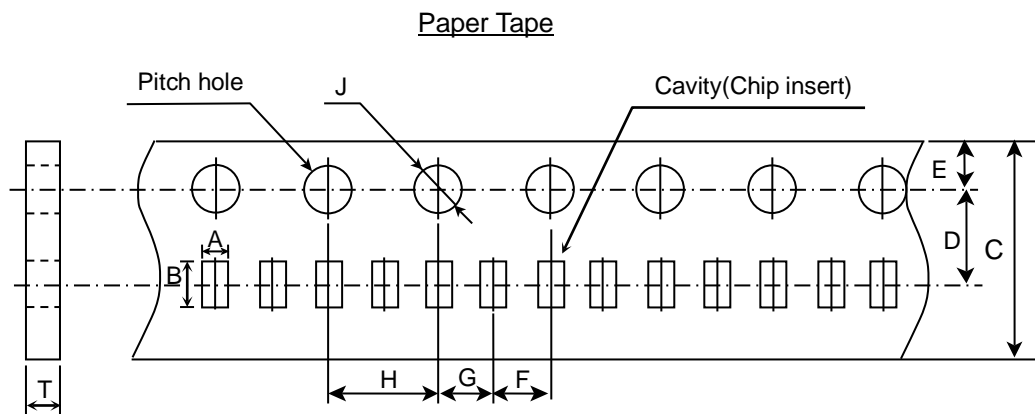
(Unit : mm)

Symbol Type	A	B	C	D	E	F
CGAEA (CC0204)	(0.62)	(1.12)	8.00±0.30	3.50±0.05	1.75±0.10	2.00±0.05

Symbol Type	G	H	J	K	T
CGAEA (CC0204)	2.00±0.05	4.00±0.10	$\phi 1.50 \begin{smallmatrix} +0.10 \\ 0 \end{smallmatrix}$	(0.38)	0.50 max.

() Reference value.

Appendix 4



(Unit : mm)

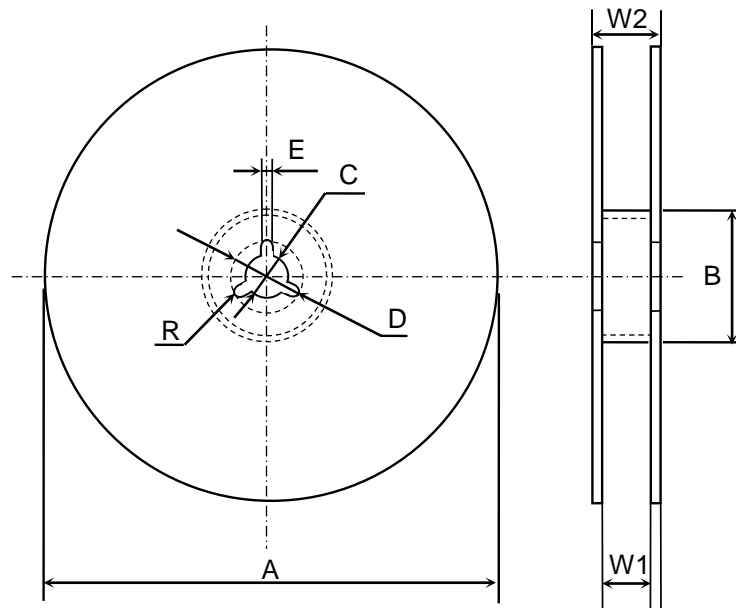
Symbol Type	A	B	C	D	E	F
CGAEB (CC0204)	(0.75)	(1.30)	8.00±0.30	3.50±0.05	1.75±0.10	2.00±0.05

Symbol Type	G	H	J	T
CGAEB (CC0204)	2.00±0.05	4.00±0.10	$\phi 1.50 \begin{smallmatrix} +0.10 \\ 0 \end{smallmatrix}$	0.80 max.

() Reference value.

Appendix 5

Dimensions of reel (Material : Polystyrene)

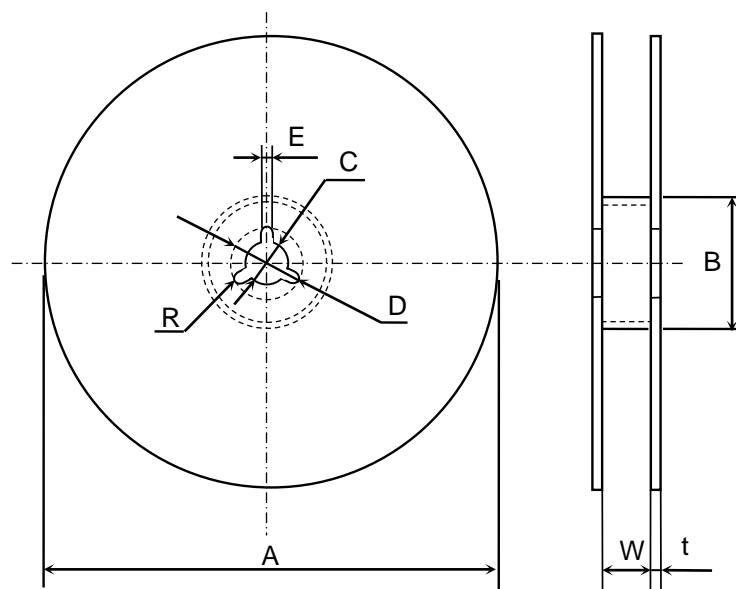


(Unit : mm)

Symbol	A	B	C	D	E	W1
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	W2	R				
Dimension	13.0 ± 1.4	1.0				

Appendix 6

Dimensions of 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				