

DELIVERY SPECIFICATION

SPEC. No. A-MEGA-d

D A T E : Jun, 2019

To

Non-Controlled Copy

CUSTOMER'S PRODUCT NAME	TDK'S PRODUCT NAME Multilayer Ceramic Chip Capacitors Mega Cap Series Tape packaging 【RoHS compliant】 CKG32K,CKG45K,CKG57K,CKG45N,CKG57N Type C0G,NP0,X5R,X7R,X7S,X7T Characteristics
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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

CKG	57	N	X7R	1E	107	M	500	J	J
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)

(1) Series

(2) Dimensions L x W (mm)

Code	EIA	Length	Width	Metal frame width
32	CC1210	3.60	2.60	0.80
45	CC1812	5.00	3.50	1.10
57	CC2220	6.00	5.00	1.60

(3) Structure

Code	Description
K	Single type
N	Stacked type

(4) Temperature characteristics

Temperature characteristics	Temperature coefficient or capacitance change	Temperature range
C0G	0±30ppm/°C	-55 to +125°C
X5R	±15%	-55 to +85°C
X7R	±15%	-55 to +125°C
X7S	±22%	-55 to +125°C
X7T	+22, -33%	-55 to +125°C

(5) Rated voltage (DC)

Code	Voltage (DC)
1C	16V
1E	25V
1H	50V
2A	100V
2E	250V
2W	450V
2J	630V
3A	1000V

(6) 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

(7) Capacitance tolerance

Code	Tolerance
J	± 5%
K	± 10%
M	± 20%

(8) Thickness

Code	Thickness
290	2.90 mm
335	3.35 mm
500	5.00 mm

(9) Packaging style

Code	Style
A	178mm reel, 4mm pitch
J	330mm reel, 8mm pitch

(10) Special reserved code

Code	Description
J	MEGACAP type

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, TDK Xiamen Co.,Ltd, and TDK Components U.S.A.Inc.

EXPLANATORY NOTE:

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

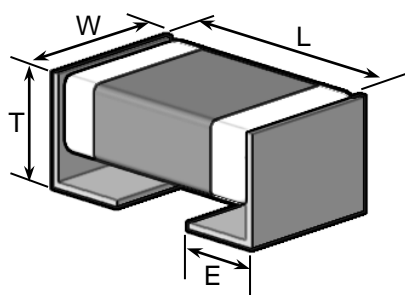
If the use of the capacitors goes beyond the bounds of the specification, we can not afford to guarantee.

2. CODE CONSTRUCTION

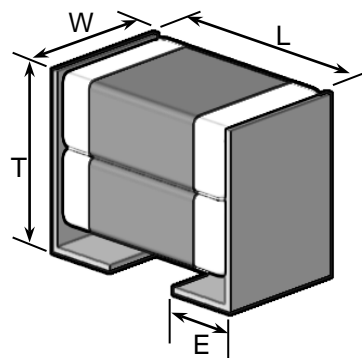
(Example)	<u>CKG32K</u>	<u>X7S</u>	<u>1H</u>	<u>106</u>	<u>K</u>	<u>T</u>	OOOO
	<u>CKG57N</u>	<u>X7R</u>	<u>1E</u>	<u>226</u>	<u>M</u>	<u>T</u>	OOOO
	(1)	(2)	(3)	(4)	(5)	(6)	(7)

(1) Type

Single type
CKG**K: 1 chip capacitor.



Stacked type
CKG**N: 2 chip capacitors.



Type		Dimensions (Unit : mm)			
		L	W	T	E
Single type	CKG32K	3.60±0.30	2.60±0.30	3.35±0.10	0.80±0.15
	CKG45K	5.00±0.50	3.50±0.50	2.90±0.10	1.10±0.30
	CKG57K	6.00±0.50	5.00±0.50	3.35±0.15	1.60±0.30
Stacked type	CKG45N	5.00±0.50	3.50±0.50	5.00±0.50	1.10±0.30
	CKG57N	6.00±0.50	5.00±0.50	5.00±0.50	1.60±0.30

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

(2) Temperature Characteristics

* Details are shown in table 1 No.6 and No.7 at 6.PERFORMANCE.

(3) Rated Voltage

Symbol	Rated Voltage	Symbol	Rated Voltage
3 A	DC 1 kV	1 H	DC 50 V
2 J	DC 630 V	1 V	DC 35 V
2 W	DC 450 V	1 E	DC 25 V
2 E	DC 250 V	1 C	DC 16 V
2 A	DC 100 V		

(4) Rated Capacitance

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

(Example)

Symbol	Rated Capacitance
106	10,000,000 pF
226	22,000,000 pF

(5) Capacitance tolerance

* K ($\pm 10\%$) tolerance is available only for CKG**K single type (10 μ F and under).

Symbol	Tolerance
J	$\pm 5\%$
K*	$\pm 10\%$
M	$\pm 20\%$

(6) Packaging

Symbol	Packaging
T	Taping

(7) TDK internal code

3. OPERATING TEMPERATURE RANGE

T.C.	Min. operating Temperature	Max. operating Temperature	Reference Temperature
X5R	-55°C	85°C	25°C
C0G	-55°C	125°C	25°C
NP0	-55°C	150°C	25°C
X7R, X7S, X7T	-55°C	125°C	25°C

4. STORING CONDITION AND TERM

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

5. INDUSTRIAL WASTE DISPOSAL

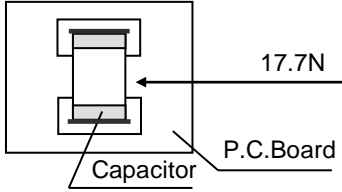
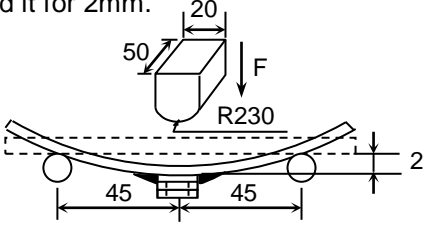
Dispose this product as industrial waste in accordance with the Industrial Waste Law.

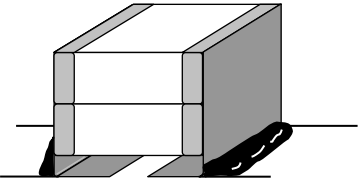
6. PERFORMANCE

table 1

No.	Item	Performance	Test or inspection method																			
1	External Appearance	No defects which may affect performance.	Inspect with magnifying glass (3x)																			
2	Insulation Resistance	10,000MΩ or 500MΩ·μF min. (As for the capacitors of rated voltage 16V DC, 100MΩ·μF min.)	Apply rated voltage for 60s. As for the rated voltage 630V DC and higher, apply 500V DC.																			
3	Voltage Proof	Withstand test voltage without insulation breakdown or other damage.	<table border="1"> <thead> <tr> <th>Class</th> <th>Rated voltage(RV)</th> <th>Apply voltage</th> </tr> </thead> <tbody> <tr> <td rowspan="4">1</td> <td>$RV \leq 100V$</td> <td>3 × rated voltage</td> </tr> <tr> <td>$100V < RV \leq 500V$</td> <td>1.5 × rated voltage</td> </tr> <tr> <td>$500V < RV < 1kV$</td> <td>1.3 × rated voltage</td> </tr> <tr> <td>1kV</td> <td>1.2 × rated voltage</td> </tr> <tr> <td rowspan="3">2</td> <td>$RV \leq 100V$</td> <td>2.5 × rated voltage</td> </tr> <tr> <td>$100V < RV \leq 500V$</td> <td>1.5 × rated voltage</td> </tr> <tr> <td>$500V < RV < 1kV$</td> <td>1.3 × rated voltage</td> </tr> </tbody> </table> <p>Above DC voltage shall be applied for 1s. Charge / discharge current shall not exceed 50mA.</p>	Class	Rated voltage(RV)	Apply voltage	1	$RV \leq 100V$	3 × rated voltage	$100V < RV \leq 500V$	1.5 × rated voltage	$500V < RV < 1kV$	1.3 × rated voltage	1kV	1.2 × rated voltage	2	$RV \leq 100V$	2.5 × rated voltage	$100V < RV \leq 500V$	1.5 × rated voltage	$500V < RV < 1kV$	1.3 × rated voltage
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4	Capacitance	Within the specified tolerance.	<p>《Class 1》</p> <table border="1"> <thead> <tr> <th>Capacitance</th> <th>Measuring frequency</th> <th>Measuring voltage</th> </tr> </thead> <tbody> <tr> <td>1000pF</td> <td>1MHz±10%</td> <td rowspan="2">0.5 ~ 5 Vrms.</td> </tr> <tr> <td>Over 1000pF</td> <td>1kHz±10%</td> </tr> </tbody> </table> <p>《Class 2》</p> <table border="1"> <thead> <tr> <th>Capacitance</th> <th>Measuring frequency</th> <th>Measuring voltage</th> </tr> </thead> <tbody> <tr> <td>10uF and under</td> <td>1kHz±10%</td> <td>1.0±0.2Vrms</td> </tr> <tr> <td>Over 10uF</td> <td>120Hz±20%</td> <td>0.5±0.2Vrms.</td> </tr> </tbody> </table>	Capacitance	Measuring frequency	Measuring voltage	1000pF	1MHz±10%	0.5 ~ 5 Vrms.	Over 1000pF	1kHz±10%	Capacitance	Measuring frequency	Measuring voltage	10uF and under	1kHz±10%	1.0±0.2Vrms	Over 10uF	120Hz±20%	0.5±0.2Vrms.		
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5	Q (Class1) Dissipation Factor (Class2)	Please refer to detail page on TDK Web.	See No.4 in this table for measuring condition.																			
6	Temperature Characteristics of Capacitance (Class1)	<table border="1"> <thead> <tr> <th>T.C.</th> <th>Temperature Coefficient (ppm/°C)</th> </tr> </thead> <tbody> <tr> <td>C0G</td> <td>0 ± 30</td> </tr> <tr> <td>NPO</td> <td>0 ± 30</td> </tr> </tbody> </table> <p>Capacitance drift within ± 0.2%</p>	T.C.	Temperature Coefficient (ppm/°C)	C0G	0 ± 30	NPO	0 ± 30	<p>Temperature coefficient shall be calculated based on values at 25°C and 85°C temperature.</p> <p>Measuring temperature below 25°C shall be -10°C and -25°C.</p>													
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(continued)

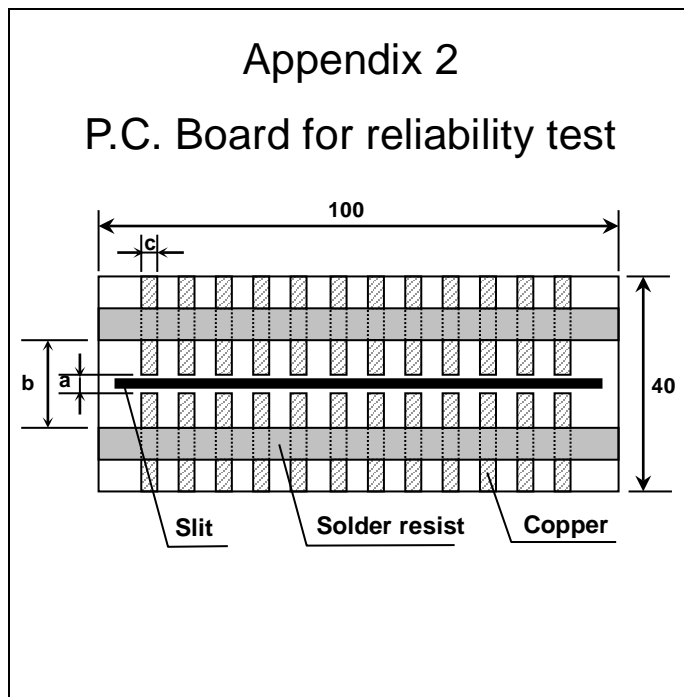
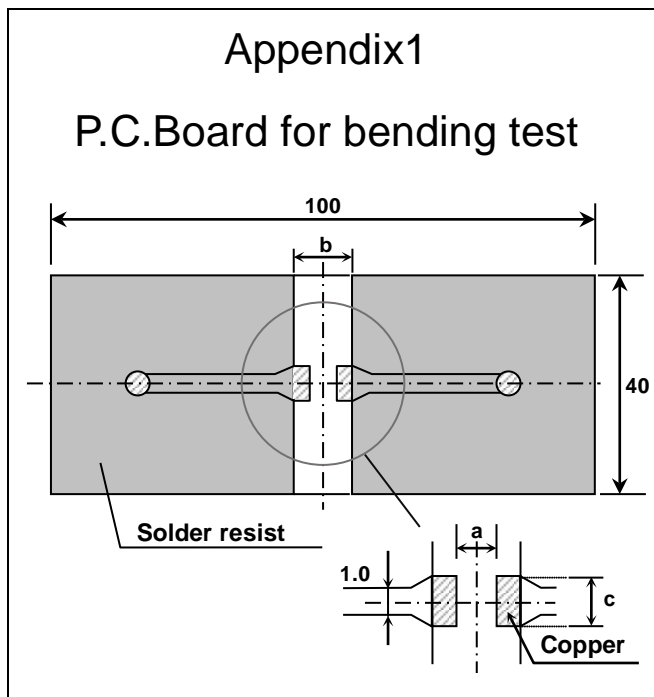
No.	Item	Performance	Test or inspection method										
7	Temperature Characteristics of Capacitance	<p style="text-align: center;">Capacitance Change (%)</p> <hr/> <p style="text-align: center;">No voltage applied</p> <hr/> <p style="text-align: center;">X5R : ±15</p> <p style="text-align: center;">X7R : ±15</p> <p style="text-align: center;">X7S : ±22</p> <p style="text-align: center;">X7T : +22 -33</p> <hr/>	<p>Capacitance shall be measured by the steps shown in the following table after thermal equilibrium is obtained for each step. ΔC be calculated ref. STEP3 reading</p> <table border="1" data-bbox="986 387 1433 651"> <thead> <tr> <th>Step</th> <th>Temperature(°C)</th> </tr> </thead> <tbody> <tr> <td>1</td> <td>Reference temp. ± 2</td> </tr> <tr> <td>2</td> <td>Min. operating temp. ± 2</td> </tr> <tr> <td>3</td> <td>Reference temp. ± 2</td> </tr> <tr> <td>4</td> <td>Max. operating temp. ± 2</td> </tr> </tbody> </table> <p>As for Min./ Max. operating temp. and Reference temp., please refer to "3.OPERATING TEMPERATURE RANGE". As for measuring voltage, please contact with our sales representative.</p>	Step	Temperature(°C)	1	Reference temp. ± 2	2	Min. operating temp. ± 2	3	Reference temp. ± 2	4	Max. operating temp. ± 2
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8	Robustness of Terminations	No sign of termination coming off, breakage of ceramic, or other abnormal signs.	<p>Reflow solder the capacitors on a P.C.Board shown in Appendix 2 and apply a pushing force of 17.7N with 10±1s.</p>  <p>The diagram shows a cross-section of a capacitor mounted on a P.C. Board. A downward arrow labeled '17.7N' indicates the force applied to the top of the capacitor. Labels include 'Capacitor' and 'P.C.Board'.</p>										
9	Bending	No mechanical damage.	<p>Reflow solder the capacitors on a P.C.Board shown in Appendix 1 and bend it for 2mm.</p>  <p>The diagram shows a top-down view of a capacitor on a P.C. Board being bent. The board is curved downwards. Dimensions include a 20mm width for the capacitor, a 50mm distance from the center to the edge of the board, and a 45mm distance from the center to the support points. A force 'F' is applied downwards. The board has a radius of curvature 'R230'. The final bend is 2mm. (Unit : mm)</p>										

No.	Item	Performance	Test or inspection method																																									
10	Solderability	<p>Both end faces and the contact areas shall be covered with a smooth and bright solder coating with no more than a small amount of scattered imperfections such as pinholes or un-wetted or de-wetted areas. These imperfections shall not be concentrated in one area.</p> 	<p>Reflow solder the capacitor on a P.C.Board shown in Appendix2.</p> <p>Solder : Sn-3.0Ag-0.5Cu or Sn-37Pb</p> <p>Please refer to No.5 Soldering in 11.CAUTION for soldering condition.</p>																																									
11	Vibration	<table border="1"> <tr> <td data-bbox="352 752 517 837">External appearance</td> <td colspan="2" data-bbox="517 752 962 837">No mechanical damage.</td> </tr> <tr> <td data-bbox="352 837 517 1160">Capacitance</td> <td data-bbox="517 837 715 1160"> <table border="1"> <tr> <th colspan="2" data-bbox="544 869 687 913">Characteristics</th> <th data-bbox="715 837 962 913">Change from the value before test</th> </tr> <tr> <td data-bbox="544 936 635 1003">Class1</td> <td data-bbox="635 936 715 1003">C0G NP0</td> <td data-bbox="715 936 962 1003">± 2.5 %</td> </tr> <tr> <td data-bbox="544 1025 635 1160">Class2</td> <td data-bbox="635 1025 715 1160">X5R X7R X7S X7T</td> <td data-bbox="715 1025 962 1160">± 7.5 %</td> </tr> </table> </td> <td data-bbox="715 837 962 1160"></td> </tr> <tr> <td data-bbox="352 1160 517 1234">Q (Class1)</td> <td colspan="2" data-bbox="517 1160 962 1234">Meet the initial spec.</td> </tr> <tr> <td data-bbox="352 1234 517 1317">D.F. (Class2)</td> <td colspan="2" data-bbox="517 1234 962 1317">Meet the initial spec.</td> </tr> </table>	External appearance	No mechanical damage.		Capacitance	<table border="1"> <tr> <th colspan="2" data-bbox="544 869 687 913">Characteristics</th> <th data-bbox="715 837 962 913">Change from the value before test</th> </tr> <tr> <td data-bbox="544 936 635 1003">Class1</td> <td data-bbox="635 936 715 1003">C0G NP0</td> <td data-bbox="715 936 962 1003">± 2.5 %</td> </tr> <tr> <td data-bbox="544 1025 635 1160">Class2</td> <td data-bbox="635 1025 715 1160">X5R X7R X7S X7T</td> <td data-bbox="715 1025 962 1160">± 7.5 %</td> </tr> </table>	Characteristics		Change from the value before test	Class1	C0G NP0	± 2.5 %	Class2	X5R X7R X7S X7T	± 7.5 %		Q (Class1)	Meet the initial spec.		D.F. (Class2)	Meet the initial spec.		<p>Reflow solder the capacitors on a P.C.Board shown in Appendix 2 before testing.</p> <p>Vibrate the capacitors with following conditions.</p> <p>Applied force : 5G max. Frequency : 10~2,000Hz Duration : 20 min. Cycle : 12 cycles in each 3 mutually perpendicular directions.</p>																				
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(continued)

No.	Item		Performance	Test or inspection method	
13	Moisture Resistance	External appearance	No mechanical damage.	<p>Reflow solder the capacitors on a P.C.Board shown in Appendix2 before testing.</p> <p>Apply the rated voltage at temperature $85 \pm 2^\circ\text{C}$ and 85%RH for 1,000 +48,0h. (For X5R, the rated voltage at $40 \pm 2^\circ\text{C}$, 90 to 95%RH for 500 +24,0h is applied.)</p> <p>Charge/discharge current shall not exceed 50mA.</p> <p>Leave the capacitors in ambient condition for 6 to 24h (Class1) or 24 ± 2h (Class2) before measurement.</p> <p>Voltage conditioning (only for class 2) Voltage treat the capacitors under testing temperature and voltage for 1 hour.</p> <p>Leave the capacitors in ambient condition for 24 ± 2h before measurement.</p> <p>Use this measurement for initial value.</p>	
		Capacitance	Characteristics		Change from the value before test
			Class 1		C0G NP0
		Class 2	X5R X7R X7S X7T		
		Q (Class1)	200 min.		
D.F. (Class2)	200% of initial spec. max.				
Insulation Resistance	500M Ω or 25M Ω · μF min. (As for the capacitors of rated voltage 16V DC, 5M Ω · μF min.,).				
14	Life	External appearance	No mechanical damage.	<p>Reflow solder the capacitors on a P.C.Board shown in Appendix2 before testing.</p> <p>Test condition : maximum operating temperature $\pm 2^\circ\text{C}$ for 1,000 +48,0h As for applied voltage, please contact with our sales representative.</p> <p>Charge/discharge current shall not exceed 50mA.</p> <p>Leave the capacitors in ambient condition for 6 to 24h (Class1) or 24 ± 2h (Class2) before measurement.</p> <p>Voltage conditioning (only for class 2) Voltage treat the capacitors under testing temperature and voltage for 1 hour.</p> <p>Leave the capacitors in ambient condition for 24 ± 2h before measurement.</p> <p>Use this measurement for initial value.</p>	
		Capacitance	Characteristics		Change from the value before test
			Class1		C0G NP0
		Class2	X5R X7R X7S X7T		
		Q (Class1)	350 min.		
D.F. (Class2)	200% of initial spec. max.				
Insulation Resistance	1,000M Ω or 50M Ω · μF min. (As for the capacitors of rated voltage 16V DC, 10M Ω · μF min.,)				

*As for the initial measurement of capacitors (Class2) on number 7,11 and 12 leave capacitors at $150 - 10,0^\circ\text{C}$ for 1 hour and measure the value after leaving capacitors for 24 ± 2 h in ambient condition.



(Unit : mm)

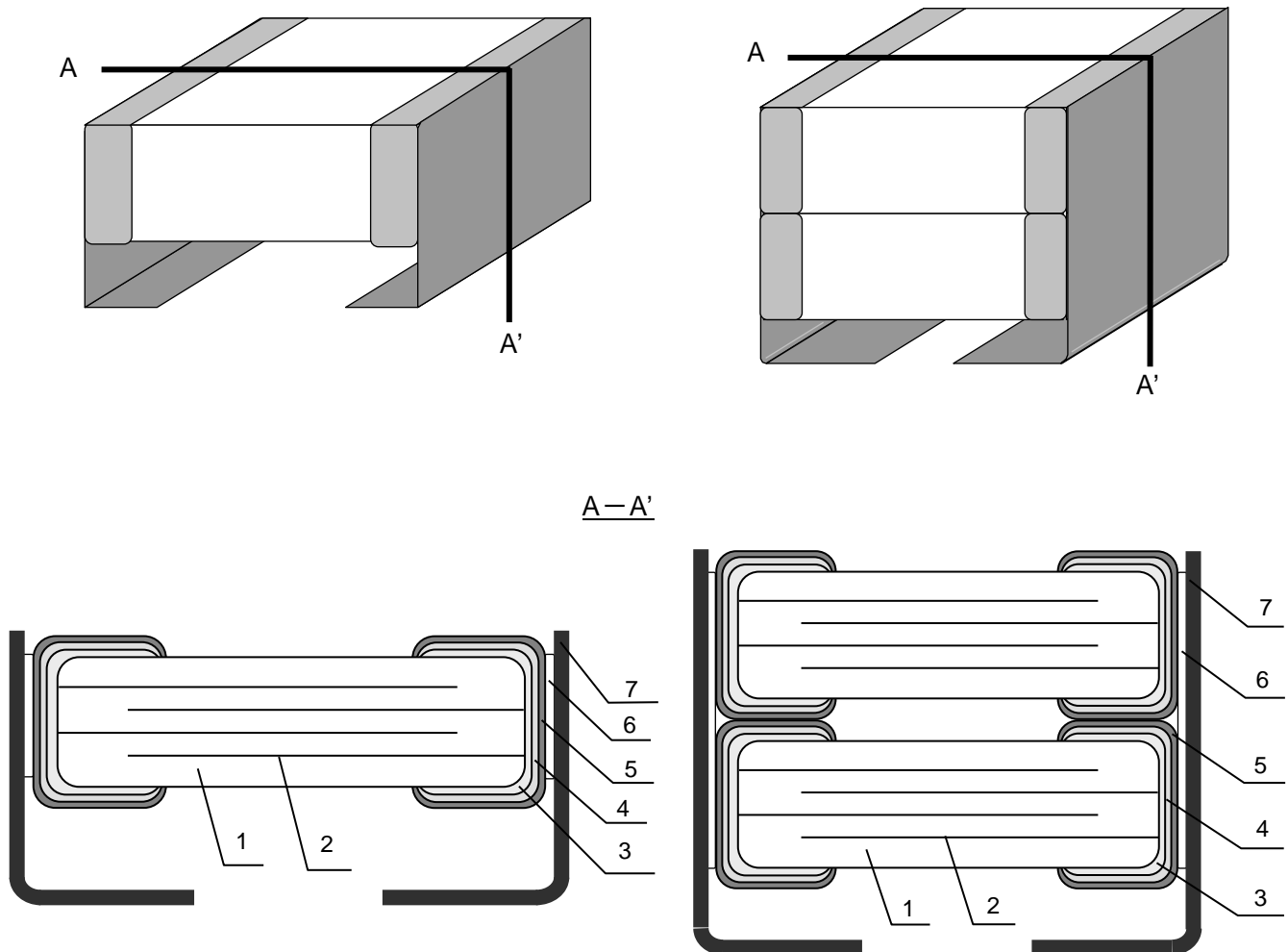
Type	Dimensions		
	a	b	c
TDK(EIA style)			
CKG32K	2.2	5.0	2.9
CKG45K	3.5	6.1	2.9
CKG57K	4.1	7.6	4.7
CKG45N	3.5	6.1	2.9
CKG57N	4.1	7.6	4.7

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

2. Thickness : 1.6mm

- Copper(Thickness:0.035mm)
- Solder resist

7. INSIDE STRUCTURE AND MATERIAL



No.	NAME	MATERIAL	
		Class1	Class2
1	Dielectric	CaZrO ₃	BaTiO ₃
2	Electrode	Nickel (Ni)	
3	Termination	Copper (Cu)	
4		Nickel (Ni)	
5		Tin (Sn)	
6	Metal cap joint	High temp solder	
7	Metal cap	42 Alloy	

8. 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 12. TAPE PACKAGING SPECIFICATION.

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

*Composition of Inspection No.

Example A 8 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 Jan. 1, 2019)

Example

I	A	9	A	2	3	A	0	0	1
(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 January 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.

9. RECOMMENDATION

It is recommended to provide a slit (about 1mm wide) in the board under the components to improve washing Flux.

And please make sure to dry detergent up completely before.


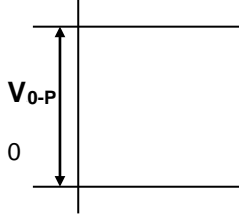
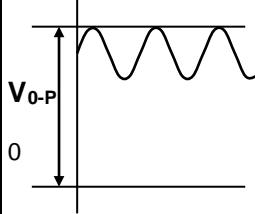
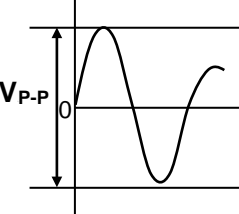
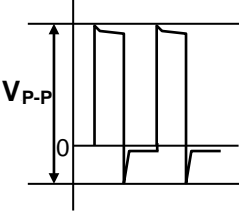
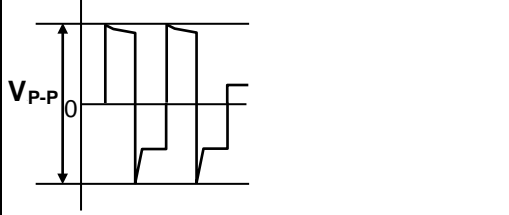
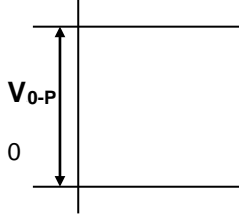
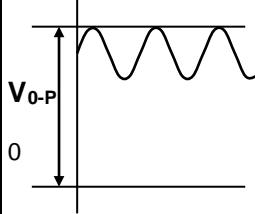
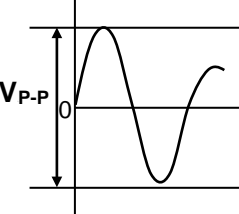
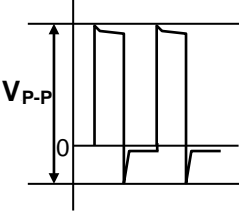
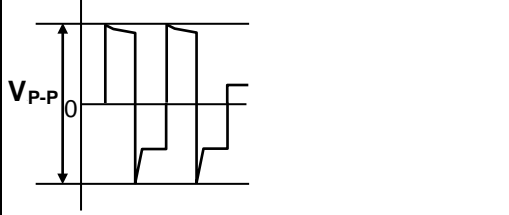
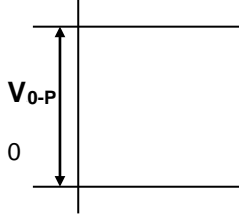
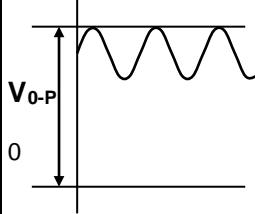
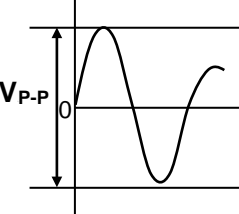
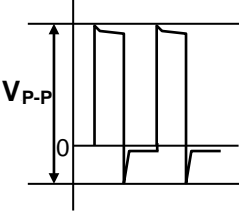
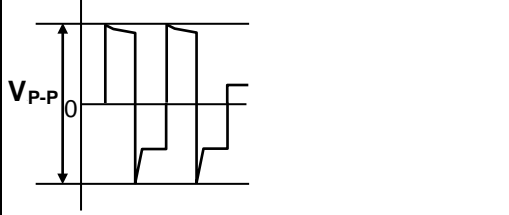
10. SOLDERING CONDITION


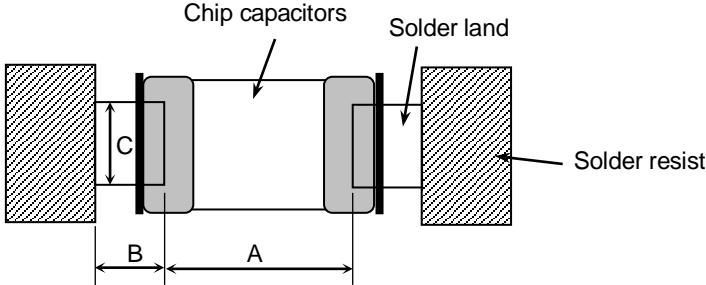
Reflow soldering only.

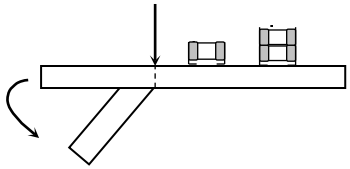
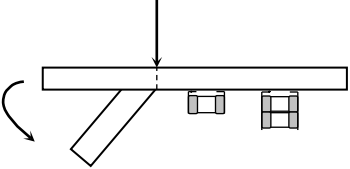
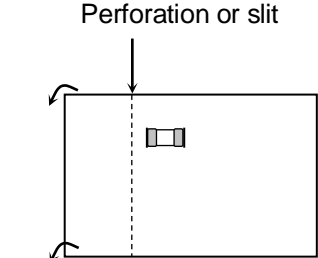
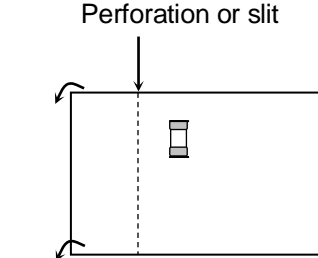
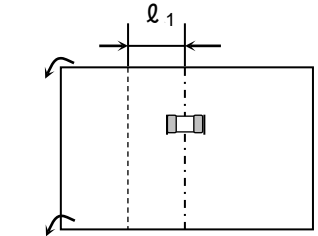
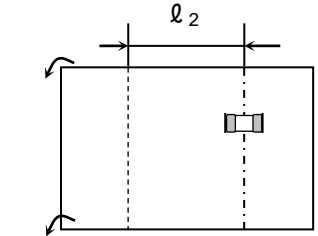
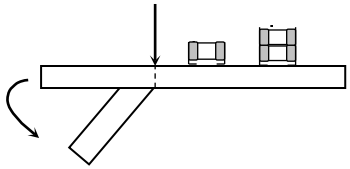
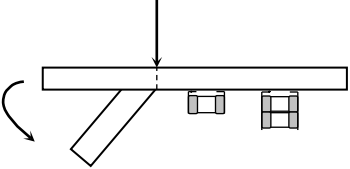
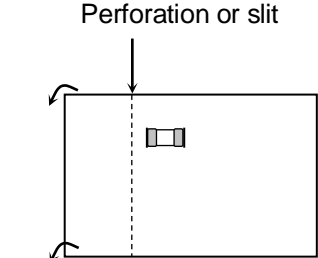
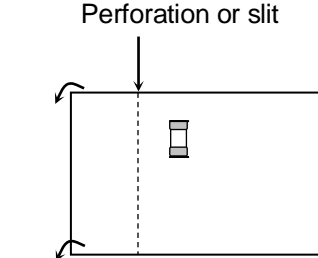
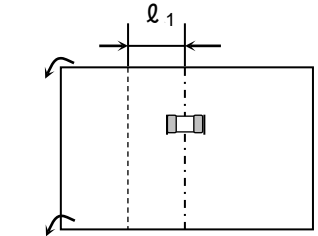
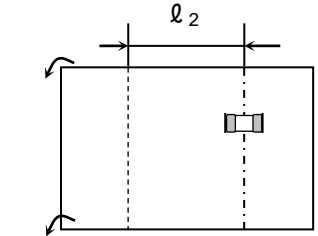
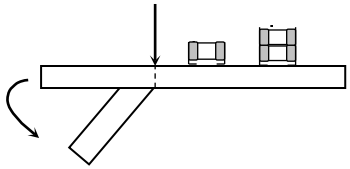
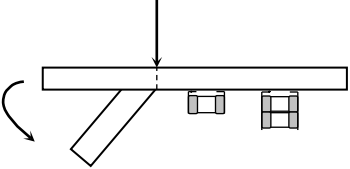
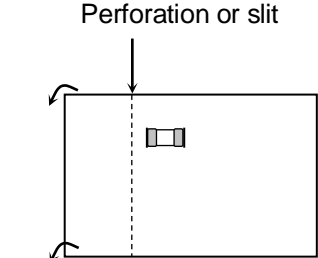
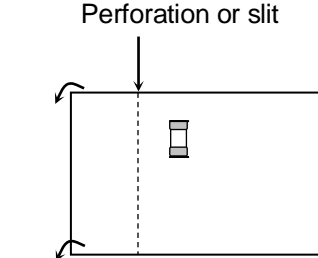
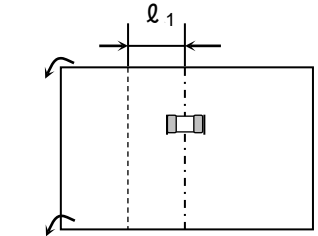
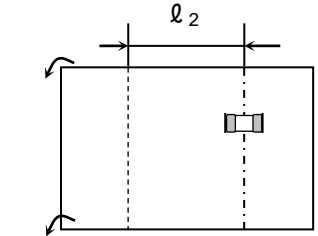
Metal cap is jointed by high temp solder, however the solder temperature must be less than 250°C to avoid melting the solder.

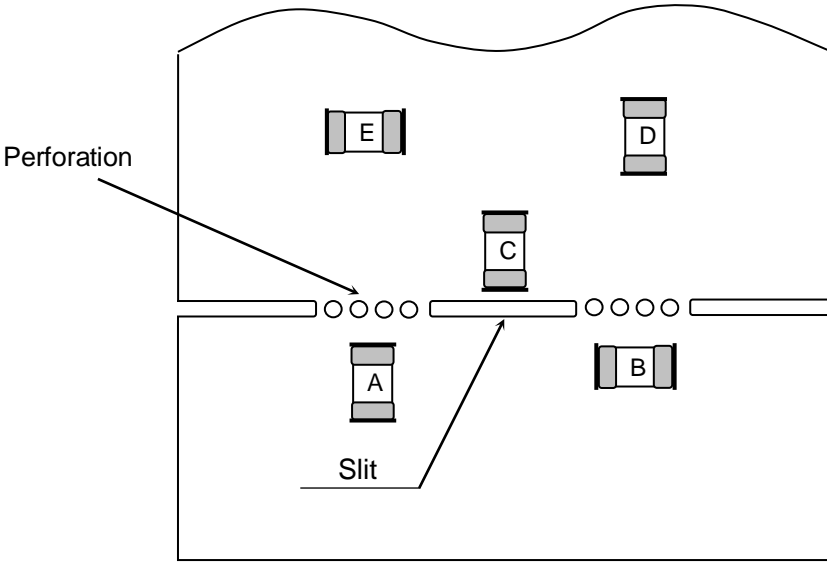
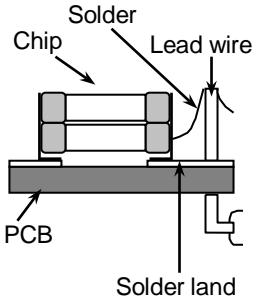
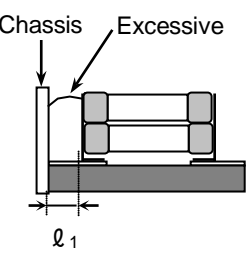
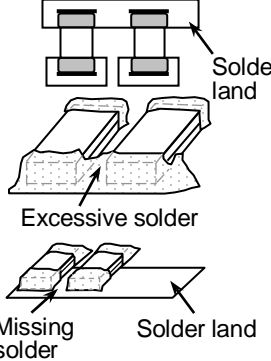
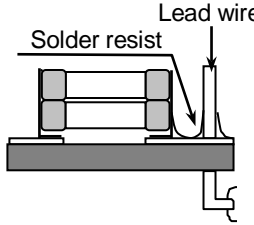
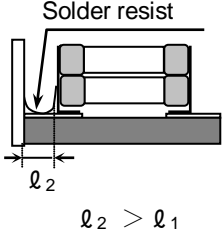
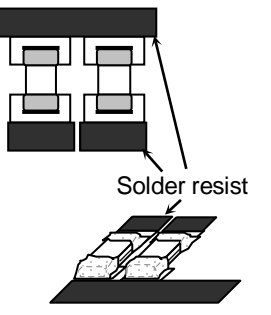
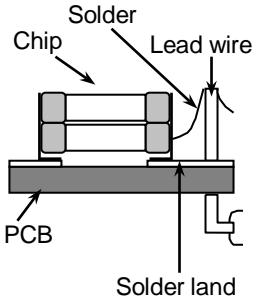
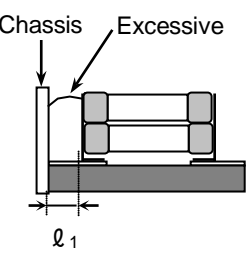
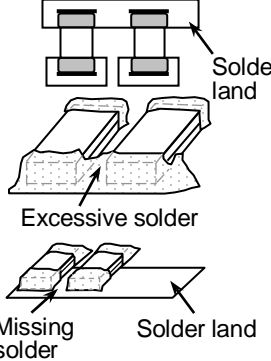
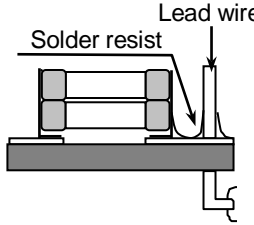
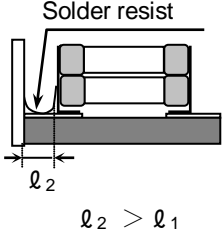
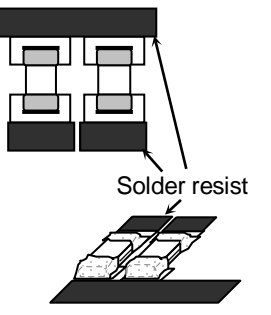
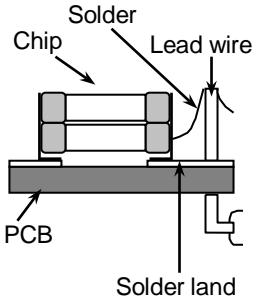
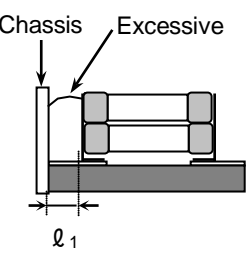
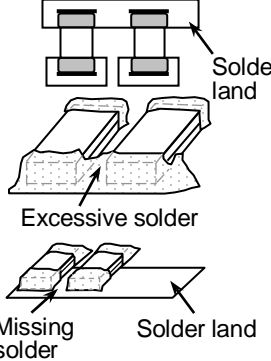
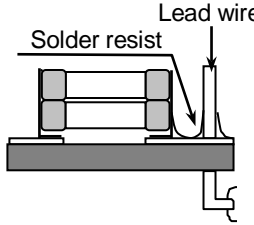
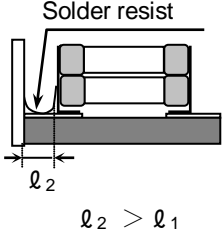
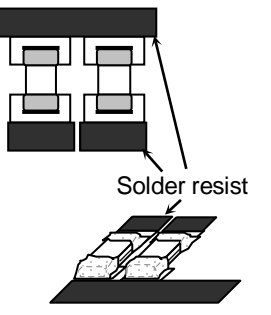
Please refer to No.5 Soldering in 11. CAUTION for recommended soldering condition.

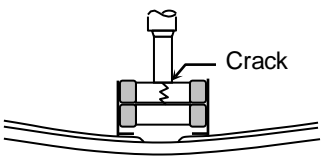
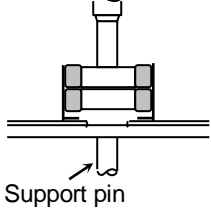
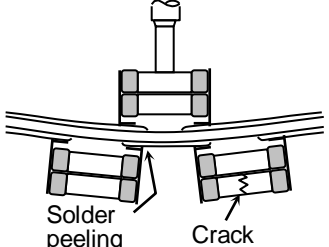
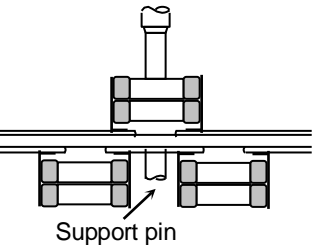
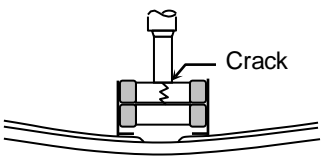
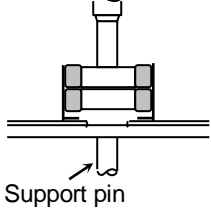
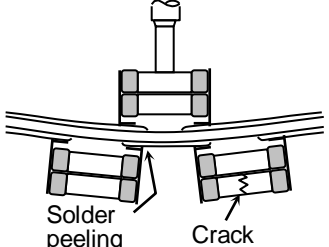
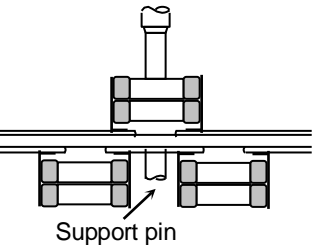
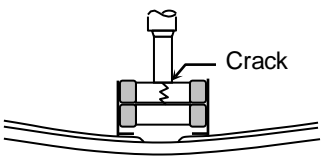
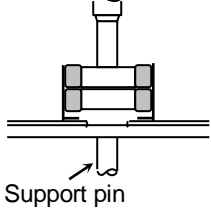
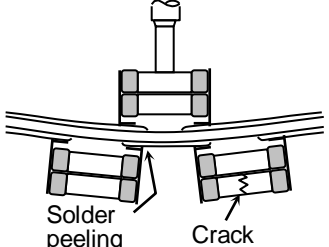
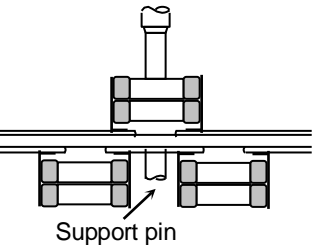
11. CAUTION

No.	Process	Condition														
1	Operating Condition (Storage, Use, Transportation)	1-1. Storage, Use 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. 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)														
2	Circuit design  Caution	2-1. Operating temperature Operating temperature should be followed strictly within this specification, especially be careful with maximum temperature. 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. 2-2. Operating voltage 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="470 1456 1444 1736"> <thead> <tr> <th data-bbox="470 1456 662 1500">Voltage</th> <th data-bbox="662 1456 917 1500">(1) DC voltage</th> <th data-bbox="917 1456 1189 1500">(2) DC+AC voltage</th> <th data-bbox="1189 1456 1444 1500">(3) AC voltage</th> </tr> </thead> <tbody> <tr> <td data-bbox="470 1500 662 1736">Positional Measurement (Rated voltage)</td> <td data-bbox="662 1500 917 1736">  </td> <td data-bbox="917 1500 1189 1736">  </td> <td data-bbox="1189 1500 1444 1736">  </td> </tr> </tbody> </table> <table border="1" data-bbox="470 1758 1444 2038"> <thead> <tr> <th data-bbox="470 1758 662 1803">Voltage</th> <th data-bbox="662 1758 917 1803">(4) Pulse voltage (A)</th> <th data-bbox="917 1758 1444 1803">(5) Pulse voltage (B)</th> </tr> </thead> <tbody> <tr> <td data-bbox="470 1803 662 2038">Positional Measurement (Rated voltage)</td> <td data-bbox="662 1803 917 2038">  </td> <td data-bbox="917 1803 1444 2038">  </td> </tr> </tbody> </table>	Voltage	(1) DC voltage	(2) DC+AC voltage	(3) AC voltage	Positional Measurement (Rated voltage)				Voltage	(4) Pulse voltage (A)	(5) Pulse voltage (B)	Positional Measurement (Rated voltage)		
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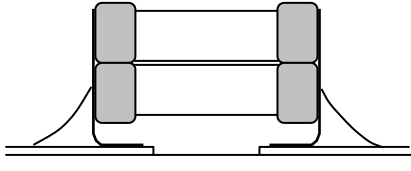
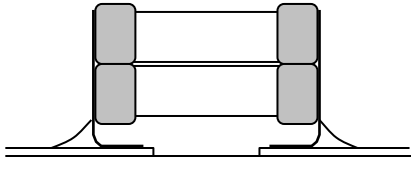
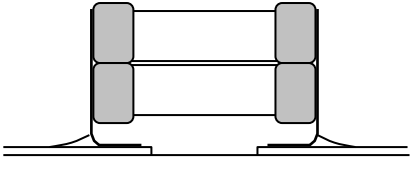
No.	Process	Condition																																			
2	Circuit design  Caution	2) Even below the rated voltage, if repetitive high frequency AC or pulse is applied, the reliability of the capacitors may be reduced. 3) The effective capacitance will vary depending on applied DC and AC voltages. The capacitors should be selected and designed in taking the voltages into consideration. 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.																																			
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. <div style="text-align: center;">  </div> <p style="text-align: right;">(mm)</p> <table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th style="text-align: center;">Type</th> <th style="text-align: center;">CKG32K</th> <th style="text-align: center;">CKG45K</th> <th style="text-align: center;">CKG57K</th> </tr> </thead> <tbody> <tr> <td style="text-align: center;">Symbol</td> <td></td> <td></td> <td></td> </tr> <tr> <td style="text-align: center;">A</td> <td style="text-align: center;">2.0 ~ 2.2</td> <td style="text-align: center;">3.3 ~ 3.7</td> <td style="text-align: center;">3.9 ~ 4.3</td> </tr> <tr> <td style="text-align: center;">B</td> <td style="text-align: center;">1.1 ~ 1.3</td> <td style="text-align: center;">1.2 ~ 1.5</td> <td style="text-align: center;">1.5 ~ 2.0</td> </tr> <tr> <td style="text-align: center;">C</td> <td style="text-align: center;">2.3 ~ 2.5</td> <td style="text-align: center;">2.7 ~ 3.2</td> <td style="text-align: center;">4.5 ~ 5.0</td> </tr> </tbody> </table> <table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th style="text-align: center;">Type</th> <th style="text-align: center;">CKG45N</th> <th style="text-align: center;">CKG57N</th> </tr> </thead> <tbody> <tr> <td style="text-align: center;">Symbol</td> <td></td> <td></td> </tr> <tr> <td style="text-align: center;">A</td> <td style="text-align: center;">3.3 ~ 3.7</td> <td style="text-align: center;">3.9 ~ 4.3</td> </tr> <tr> <td style="text-align: center;">B</td> <td style="text-align: center;">1.2 ~ 1.5</td> <td style="text-align: center;">1.5 ~ 2.0</td> </tr> <tr> <td style="text-align: center;">C</td> <td style="text-align: center;">2.7 ~ 3.2</td> <td style="text-align: center;">4.5 ~ 5.0</td> </tr> </tbody> </table>	Type	CKG32K	CKG45K	CKG57K	Symbol				A	2.0 ~ 2.2	3.3 ~ 3.7	3.9 ~ 4.3	B	1.1 ~ 1.3	1.2 ~ 1.5	1.5 ~ 2.0	C	2.3 ~ 2.5	2.7 ~ 3.2	4.5 ~ 5.0	Type	CKG45N	CKG57N	Symbol			A	3.3 ~ 3.7	3.9 ~ 4.3	B	1.2 ~ 1.5	1.5 ~ 2.0	C	2.7 ~ 3.2	4.5 ~ 5.0
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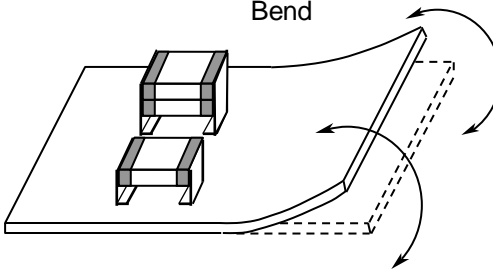
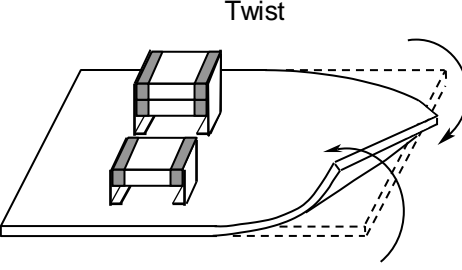
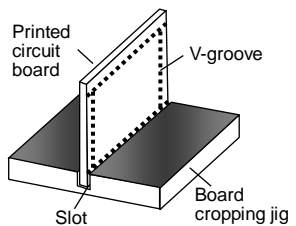
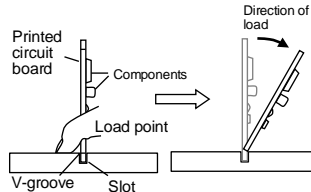
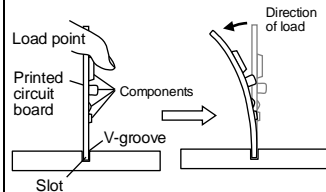
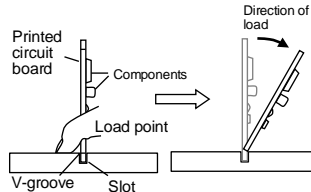
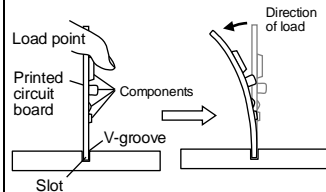
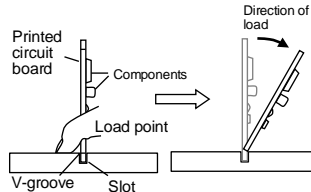
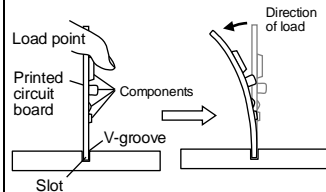
No.	Process	Condition												
3	Designing P.C.board	<p>5) Mechanical stress varies according to location of chip capacitors on the P.C.board.</p>  <p>The stress in capacitors is in the following order. $A > B = C > D > E$</p> <p>6) Layout recommendation</p> <table border="1" data-bbox="379 1008 1481 1937"> <thead> <tr> <th data-bbox="379 1008 539 1124">Example</th> <th data-bbox="539 1008 845 1124">Use of common solder land</th> <th data-bbox="845 1008 1152 1124">Soldering with chassis</th> <th data-bbox="1152 1008 1481 1124">Use of common solder land with other SMD</th> </tr> </thead> <tbody> <tr> <td data-bbox="379 1124 539 1523">Need to avoid</td> <td data-bbox="539 1124 845 1523">  </td> <td data-bbox="845 1124 1152 1523">  </td> <td data-bbox="1152 1124 1481 1523">  </td> </tr> <tr> <td data-bbox="379 1523 539 1937">Recommendation</td> <td data-bbox="539 1523 845 1937">  </td> <td data-bbox="845 1523 1152 1937">  </td> <td data-bbox="1152 1523 1481 1937">  </td> </tr> </tbody> </table>	Example	Use of common solder land	Soldering with chassis	Use of common solder land with other SMD	Need to avoid				Recommendation			
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4	Mounting	<p>4-1. Stress from mounting head</p> <p>If the mounting head is adjusted too low, it may induce excessive stress in the chip capacitors to result in cracking. Please take following precautions.</p> <ol style="list-style-type: none"> 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. <p>See following examples.</p> <table border="1" data-bbox="481 600 1433 1160"> <thead> <tr> <th data-bbox="481 600 667 645"></th> <th data-bbox="667 600 1061 645">Not recommended</th> <th data-bbox="1061 600 1433 645">Recommended</th> </tr> </thead> <tbody> <tr> <td data-bbox="481 645 667 896">Single sided mounting</td> <td data-bbox="667 645 1061 896">  </td> <td data-bbox="1061 645 1433 896">  </td> </tr> <tr> <td data-bbox="481 896 667 1160">Double-sides mounting</td> <td data-bbox="667 896 1061 1160">  </td> <td data-bbox="1061 896 1433 1160">  </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		
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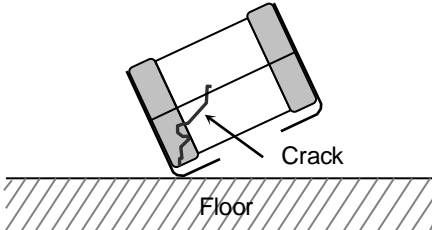
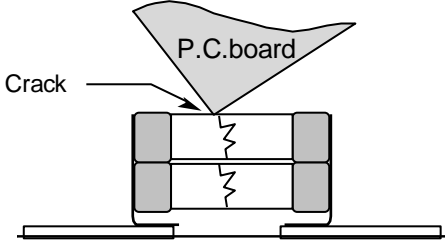
No.	Process	Condition											
5	Soldering	<p>5-1. Flux selection Flux can seriously affect the performance of capacitors. Confirm the following to select the appropriate flux.</p> <ol style="list-style-type: none"> 1) It is recommended to use a mildly activated rosin flux (less than 0.1wt% chlorine). 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> <ol style="list-style-type: none"> 1) Soldering condition (Pre heating temperature, soldering temperature and these times) is limited to reflow soldering method which is stipulated on the specification. 2) Chips should be mounted, shortly after a solder is on a P.C.Board. 3) Temperature of metal cap surface must not exceed 250°C. (Metal frames are jointed by high temp solder, however the solder temperature must be less than 250°C to avoid melting the solder.) <div style="display: flex; justify-content: space-around; align-items: flex-start;"> <div style="text-align: center;"> <p>Reflow soldering</p> </div> <div style="text-align: center;"> <p>Manual soldering (Solder iron)</p> </div> </div> <p>5-3. Recommended soldering peak temp and peak temp duration</p> <table border="1" style="margin-left: auto; margin-right: auto;"> <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;">250 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	250 max.	10 max.
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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 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 (1) Terminal electrodes may corrode by Halogen in the flux. (2) Halogen in the flux may adhere on the surface of capacitors, and lower the insulation resistance. (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. Power: 20 W/ℓ max. Frequency: 40 kHz max. Washing time: 5 minutes max.</p> <p>2)-3. If the cleaning fluid is contaminated, density of Halogen increases, and it may bring the same result as insufficient cleaning.</p>
7	Coating and molding of the P.C.board	<p>1) When the P.C.board is coated, please verify the quality influence on the product.</p> <p>2) Please verify carefully that there is no harmful decomposing or reaction gas emission during curing which may damage the chip capacitors.</p> <p>3) Please verify the curing temperature.</p>

No.	Process	Condition				
8	Handling after chip mounted ⚠ Caution	<p>1) Please pay attention not to bend or distort the P.C.board after soldering in handling otherwise the chip capacitors may crack.</p> <div style="display: flex; justify-content: space-around;"> <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 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. 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 style="text-align: center;"> <p>Outline of jig</p>  </div> <table border="1" style="width: 100%;"> <thead> <tr> <th data-bbox="766 974 1093 1019">Recommended</th> <th data-bbox="1093 974 1444 1019">Unrecommended</th> </tr> </thead> <tbody> <tr> <td data-bbox="766 1019 1093 1232">  </td> <td data-bbox="1093 1019 1444 1232">  </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>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="555 488 965 743"> <p>Outline of machine</p> </div> <div data-bbox="965 488 1407 728"> <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%; border-collapse: collapse; margin-top: 10px;"> <thead> <tr> <th data-bbox="641 965 820 1010">Recommended</th> <th colspan="3" data-bbox="820 965 1353 1010">Unrecommended</th> </tr> <tr> <td></td> <th data-bbox="820 1010 999 1093">Top-bottom misalignment</th> <th data-bbox="999 1010 1166 1093">Left-right misalignment</th> <th data-bbox="1166 1010 1353 1093">Front-rear misalignment</th> </tr> </thead> <tbody> <tr> <td data-bbox="641 1093 820 1391"> <p>Top blade</p> <p>Board</p> <p>Bottom blade</p> </td> <td data-bbox="820 1093 999 1391"> <p>Top blade</p> <p>Bottom blade</p> </td> <td data-bbox="999 1093 1166 1391"> <p>Top blade</p> <p>Bottom blade</p> </td> <td data-bbox="1166 1093 1353 1391"> <p>Top blade</p> <p>Bottom blade</p> </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 chip capacitors or peel the terminations off. Please adjust the check pins not to bend the P.C. board.</p> <table border="1" style="width: 100%; border-collapse: collapse; margin-top: 10px;"> <thead> <tr> <th data-bbox="475 1621 616 1682">Item</th> <th data-bbox="616 1621 1034 1682">Not recommended</th> <th data-bbox="1034 1621 1433 1682">Recommended</th> </tr> </thead> <tbody> <tr> <td data-bbox="475 1682 616 1951">Board bending</td> <td data-bbox="616 1682 1034 1951"> <p>Termination peeling</p> <p>Check pin</p> </td> <td data-bbox="1034 1682 1433 1951"> <p>Support pin</p> <p>Check pin</p> </td> </tr> </tbody> </table>	Recommended	Unrecommended				Top-bottom misalignment	Left-right misalignment	Front-rear misalignment	<p>Top blade</p> <p>Board</p> <p>Bottom blade</p>	<p>Top blade</p> <p>Bottom blade</p>	<p>Top blade</p> <p>Bottom blade</p>	<p>Top blade</p> <p>Bottom blade</p>	Item	Not recommended	Recommended	Board bending	<p>Termination peeling</p> <p>Check pin</p>	<p>Support pin</p> <p>Check pin</p>
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Item	Not recommended	Recommended																		
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No.	Process	Condition
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>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> 
10	Capacitance aging	The capacitors (Class 2) have aging in the capacitance. They may not be used in precision time constant circuit. In case of the time constant circuit, the evaluation should be done well.
11	Estimated life and estimated failure rate of capacitors	<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>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.</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 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> <p>(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> <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. 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. 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>

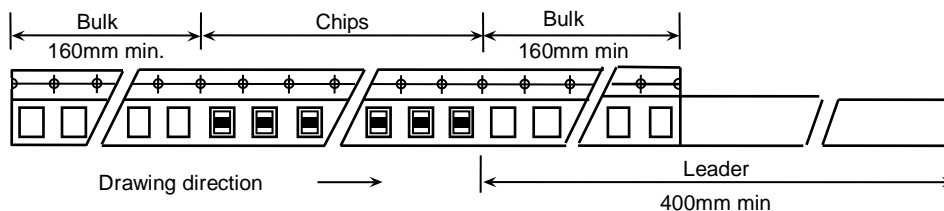
12. TAPE PACKAGING SPECIFICATION

1. CONSTRUCTION AND DIMENSION OF TAPING

1-1. Dimensions of carrier tape

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

1-2. Bulk part and leader of taping

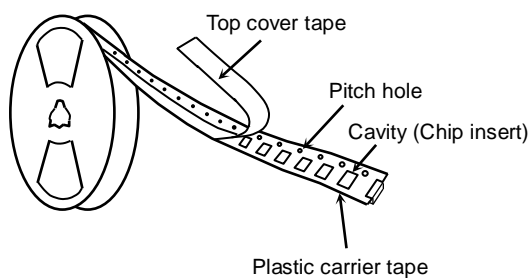


1-3. Dimensions of reel

Dimensions of Ø178 reel shall be according to Appendix 5.

Dimensions of Ø330 reel shall be according to Appendix 6.

1-4. Structure of taping



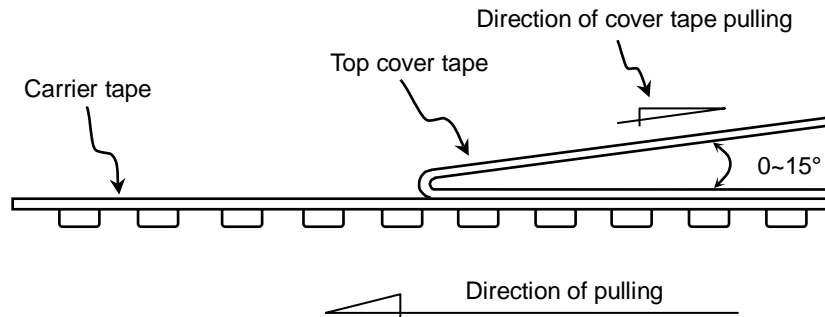
2. CHIP QUANTITY

Please refer to detail page on TDK Web.

3. PERFORMANCE SPECIFICATIONS

3-1. Fixing peeling strength (top tape)

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



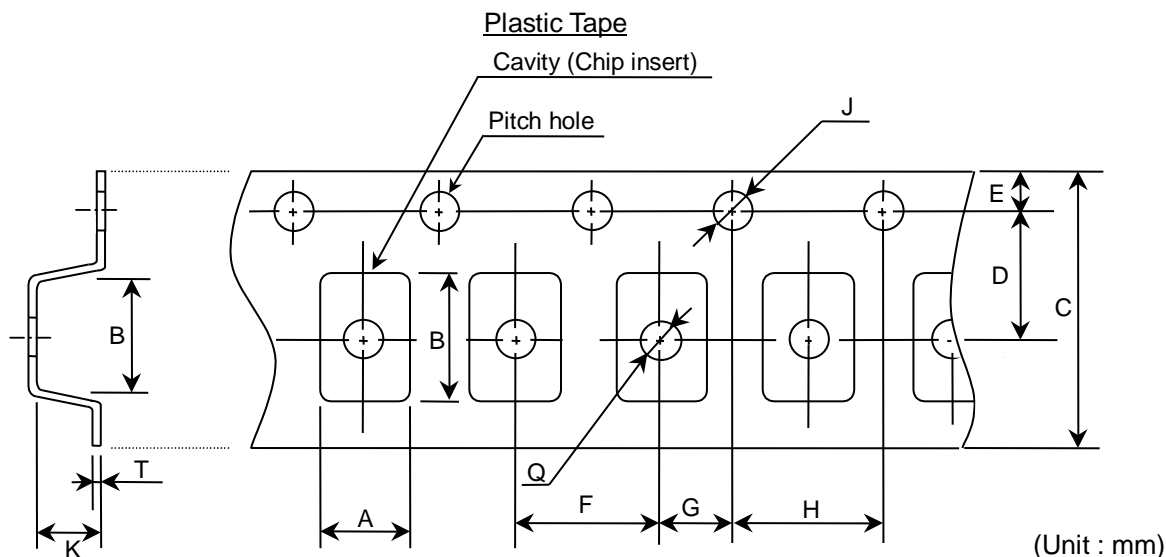
3-2. Carrier tape shall be flexible enough to be wound around a minimum radius of 30mm with components in tape.

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



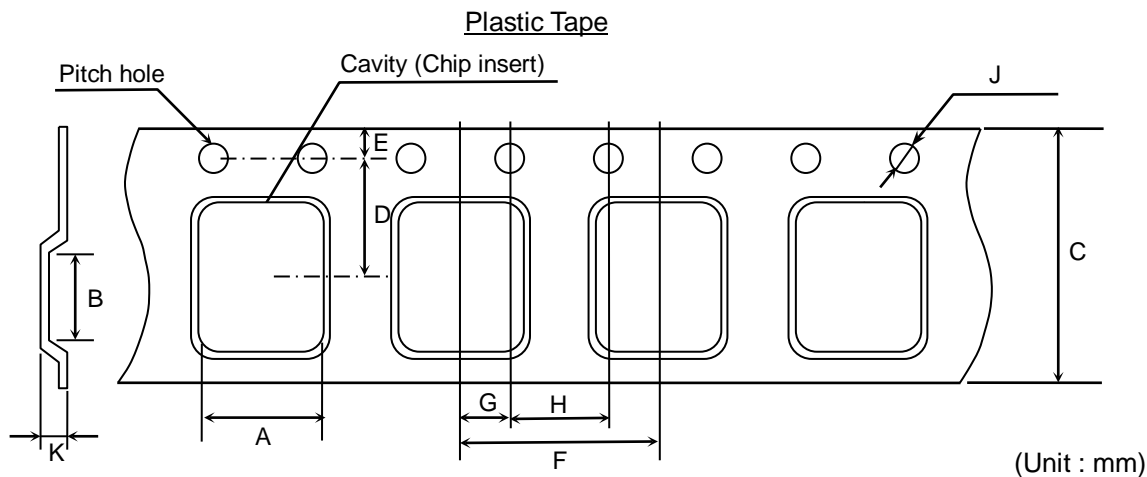
Symbol Type	A	B	C	D	E	F
CKG32K	(3.00)	(3.90)	12.0 ± 0.25	5.50 ± 0.05	1.75 ± 0.10	4.00 ± 0.10

Symbol Type	G	H	J	K	T	Q
CKG32K	2.00 ± 0.10	4.00 ± 0.10	∅ 1.5 ^{+0.10} ₀	3.75 max.	0.50 ± 0.05	∅ 1.65 ± 0.10

() Reference value.

Exceptionally no hole in the cavity is applied. Please inquire if hole in cavity is mandatory.

Appendix 4



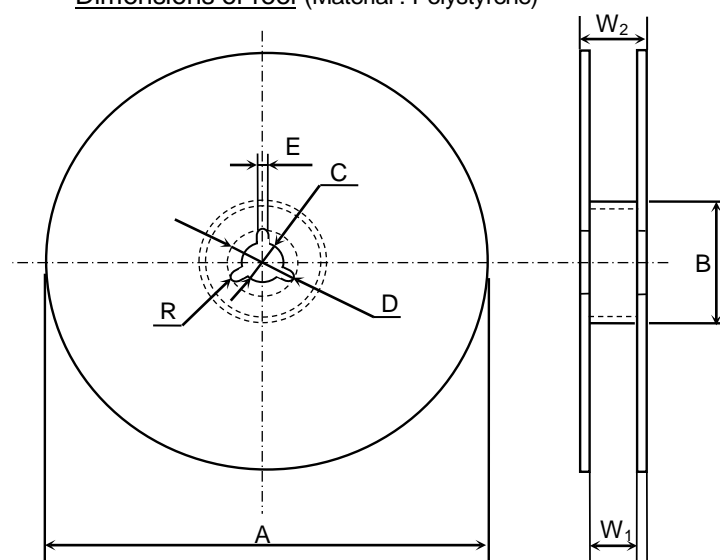
Symbol Type	A	B	C	D	E	F
CKG45K	(3.90)	(5.60)	12.0 ± 0.30	5.50 ± 0.10	1.75 ± 0.10	8.00 ± 0.10
CKG45N						8.00 ± 0.10
CKG57K	(5.60)	(6.60)	16.0 ± 0.30	7.50 ± 0.10	1.75 ± 0.10	8.00 ± 0.10
CKG57N						8.00 ± 0.10

Symbol Type	G	H	J	K
CKG45K	2.00 ± 0.10	4.00 ± 0.10	∅ 1.5 ^{+0.10} ₀	3.75 max.
CKG45N				6.15 max.
CKG57K	2.00 ± 0.10	4.00 ± 0.10	∅ 1.5 ^{+0.10} ₀	4.15 max.
CKG57N				6.15 max.

() Reference value.

Appendix 5

Dimensions of reel (Material : Polystyrene)



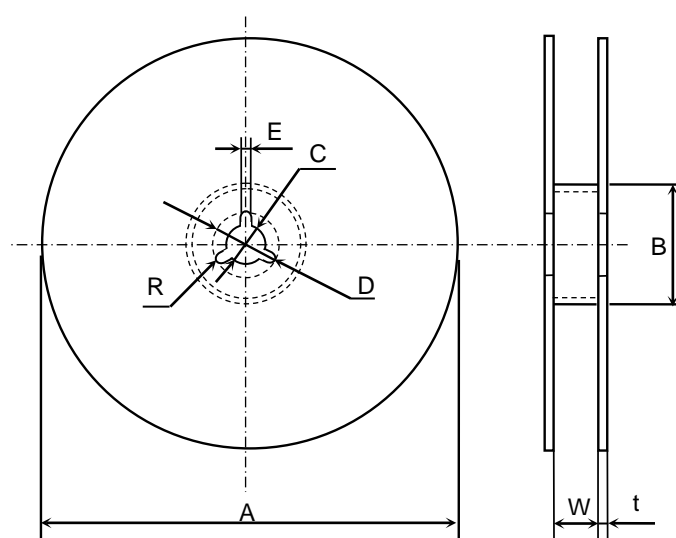
(Unit : mm)

Symbol Dimension	A	B	C	D	E	W ₁
CKG32	Ø178 ± 2.0	Ø60 ± 2.0	Ø13 ± 0.5	Ø21 ± 0.8	2.0 ± 0.5	13.0 ± 0.3

Symbol Dimension	W ₂	R
CKG32	17.0 ± 1.4	1.0

Appendix 6

Dimensions of reel (Material : Polystyrene)



(Unit : mm)

Symbol Dimension	A	B	C	D	E	W
CKG32K	Ø382 max. (Nominal Ø330)	Ø50 min.	Ø13 ± 0.5	Ø21 ± 0.8	2.0 ± 0.5	14.0 ± 1.5
CKG45K, CKG45N						13.5 ± 1.5
CKG57K, CKG57N						17.5 ± 1.5

Symbol Dimension	t	R
CKG32	2.0 ± 0.5	1.0
CKG45K, CKG45N		
CKG57K, CKG57N		