SPECIFICATION

SPEC. No. A-Glue-c

D A T E : 2016 Nov.

To

CUSTOMER'S PRODUCT NAME	TDK'S PRODUCT NAME Multilayer Ceramic Chip Capacitors CGA series/ Automotive grade Conductive Epoxy application

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

1. SCOPE

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

EXPLANATORY NOTE:
This specification warrant the quality of the ceramic chip capacitor. The chips should be evaluated or confirmed a state of mounted on your product.
If the use of the chips go beyond the bounds of this specification, we can not afford to guarantee.

2. CODE CONSTRUCTION

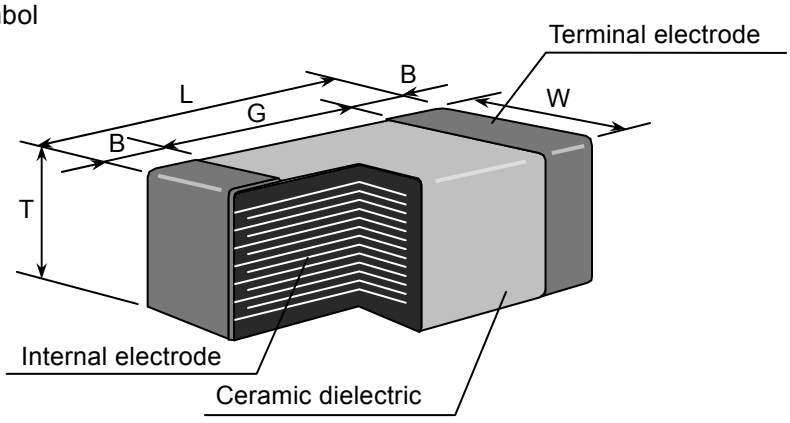
(Example)

Catalog Number:	CGA	5	L	1	X7R	1E	106	K	160	A	D
(Web)	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
Item Description:	CGA	5	L	1	X7R	1E	106	K	T	xxxB	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(12)	(13)	

(1) Series

Symbol	Series
CGA	For Automotive application

(2) Case size symbol



Symbol	Type (EIA style)
2	CC0402
3	CC0603
4	CC0805
5	CC1206
6	CC1210

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

(3) Thickness

Symbol	Dimension (mm)
B	0.50
C	0.60
E	0.80
F	0.85
H	1.15

Symbol	Dimension (mm)
J	1.25
L	1.60
M	2.00
P	2.50

(4) Voltage condition in the life test
(Details are shown in table 1 No.16 at 8.PERFORMANCE.)

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 and No.7 at 8.PERFORMANCE.)

(6) Rated Voltage

Symbol	Rated Voltage
0 J	DC 6.3 V
1 C	DC 16 V
1 E	DC 25 V
1 V	DC 35 V
1 H	DC 50 V
2 A	DC 100 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.
R is designated for a decimal point.

Symbol	Rated Capacitance
1R5	1.5pF
225	2,200,000pF (=2.2μF)

(8) Capacitance tolerance

Symbol	Tolerance	Capacitance
C	± 0.25 pF	Cap≦5pF
D	± 0.5 pF	5pF＜Cap≦10pF
J	± 5 %	10pF＜Cap
K	± 10 %	
M	± 20 %	

(9) Thickness code (Only catalog number)

(10) Package code (Only catalog number)

(11) Special code (Only catalog number)

Symbol	Description
D	Conductive epoxy

(12) Packaging (Only item description)
(Bulk is not applicable for CGA2 [CC0402] type.)

Symbol	Packaging
B	Bulk
T	Taping

(13) TDK internal code (Only item description)

xxx B
B: For Conductive glue mounting
These TDK internal codes are subject to change without notice.

3. RATED CAPACITANCE AND TOLERANCE

3.1 Standard combination of rated capacitance and tolerances

Class	Temperature Characteristics	Capacitance tolerance		Rated capacitance
1	C0G	Cap≦5pF	C (± 0.25pF)	1, 1.5, 2, 2.2, 3, 3.3, 4, 4.7, 5
		5pF＜Cap≦10pF	D (± 0.5pF)	6, 6.8, 7, 8, 9, 10
		10pF＜Cap	J (± 5%) K (± 10%)	E – 12 series
2	X7R X8R	K (± 10%) M (± 20%)		E – 6 series

3.2 Capacitance Step in E series

E series	Capacitance Step											
E- 6	1.0		1.5		2.2		3.3		4.7		6.8	
E- 12	1.0	1.2	1.5	1.8	2.2	2.7	3.3	3.9	4.7	5.6	6.8	8.2

4. OPERATING TEMPERATURE RANGE

T.C.	Min. operating Temperature	Max. operating Temperature	Reference Temperature
C0G, X7R,	-55°C	125°C	25°C
X8R	-55°C	150°C	25°C

5. STORING CONDITION AND TERM

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

6. INDUSTRIAL WASTE DISPOSAL

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

7. CAUTION FOR CONDUCTIVE GLUE MOUNTING PRODUCTS

This product is to be mounted by glue including Ag (Silver) as a conductive material.
To avoid electromigration of Ag and failures caused by corrosive gas, chip capacitors on P.C. boards should be protected by moisture proof-sealing, such as silicon or equivalent, and/or a sealed package.

8. PERFORMANCE

table 1

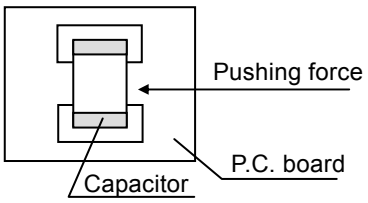
<table>
<tr><th>No.</th><th>Item</th><th>Performance</th><th>Test or inspection method</th></tr>
<tr><td>1</td><td>External Appearance</td><td>No defects which may affect performance.</td><td>Inspect with magnifying glass (3×)</td></tr>
<tr><td>2</td><td>Insulation Resistance</td><td>10,000MΩ or 500MΩ·μF min.
(As for the capacitors of rated voltage 16V DC and,10,000 MΩ or 100MΩ·μF min.,) whichever smaller.</td><td>Apply rated voltage for 60s.</td></tr>
<tr><td>3</td><td>Voltage Proof</td><td>Withstand test voltage without insulation breakdown or other damage.</td><td><table><tr><th>Class</th><th>Apply voltage</th></tr><tr><td>Class 1</td><td>3 × rated voltage</td></tr><tr><td>Class 2</td><td>2.5 × rated voltage</td></tr></table>Above DC voltage shall be applied for 1s. Charge/ discharge current shall not exceed 50mA.</td></tr>
<tr><td>4</td><td>Capacitance</td><td>Within the specified tolerance.</td><td><table><tr><th>Class</th><th>Capacitance</th><th>Measuring frequency</th><th>Measuring voltage</th></tr><tr><td rowspan="2">1</td><td>Cap≦ 1000pF</td><td>1MHz±10%</td><td rowspan="2">0.5-5Vrms.</td></tr><tr><td>1000pF ＜Cap</td><td>1kHz±10%</td></tr><tr><td>2</td><td>All</td><td>1kHz±10%</td><td>1.0±0.2Vrms</td></tr></table>For information which product has which measuring voltage, please contact with our sales representative.</td></tr>
<tr><td>5</td><td>Q
(Class1)

Dissipation Factor
(Class2)</td><td>As for spec of each product, please refer to detailed information on TDK web.</td><td>See No.4 in this table for measuring condition.</td></tr>
<tr><td>6</td><td>Temperature Characteristics of Capacitance
(Class1)</td><td><table><tr><th>T. C.</th><th>Temperature Coefficient</th></tr><tr><td>C0G</td><td>0 ± 30 (ppm/°C)</td></tr></table>Capacitance drift within ± 0.2% or ± 0.05pF, whichever larger.</td><td>Temperature coefficient shall be calculated based on values at 25°C and 85°C temperature.

Measuring temperature below 20°C shall be -10°C and -25°C.</td></tr>
</table>

(continued)

<table>
<tr><th>No.</th><th colspan="2">Item</th><th>Performance</th><th>Test or inspection method</th></tr>
<tr><td>7</td><td colspan="2">Temperature Characteristics of Capacitance (Class2)</td><td>Capacitance Change (%)
No voltage applied
X7R: ±15
X8R: ±15</td><td>Capacitance shall be measured by the steps shown in the following table after thermal equilibrium is obtained for each step.

ΔC be calculated ref. STEP3 reading
<table><tr><th>Step</th><th>Temperature(°C)</th></tr><tr><td>1</td><td>25 ± 2</td></tr><tr><td>2</td><td>-55 ± 3</td></tr><tr><td>3</td><td>25 ± 2</td></tr><tr><td>4*</td><td>Max. operating Temp. ± 2</td></tr></table>*X7R: 125°C
X8R: 150°C</td></tr>
<tr><td>8</td><td colspan="2">Robustness of Terminations</td><td>No sign of termination coming off, breakage of ceramic, or other abnormal signs.</td><td>Mount the capacitors on an Alumina substrate shown in Appendix1 with conductive glue and apply a pushing force of 5N with 10±1s.
(2N is applied for CGA2 [CC0402] type)
  </td></tr>
<tr><td rowspan="4">9</td><td rowspan="4">Vibration</td><td>External appearance</td><td>No mechanical damage.</td><td rowspan="4">Mount the capacitors on an Alumina substrate shown in Appendix1 with conductive glue before testing.

Vibrate the capacitors with following conditions.
Applied force : 5G max.
Frequency : 10 - 2,000Hz
Duration : 20 min.
Cycle : 12 cycles in each 3 mutually perpendicular directions.</td></tr>
<tr><td>Capacitance</td><td><table><tr><th>Characteristics</th><th>Change from the value before test*</th></tr><tr><td>C0G</td><td>±2.5% or ±0.25pF, whichever larger</td></tr><tr><td>X7R,X8R</td><td>±7.5%</td></tr></table></td></tr>
<tr><td>Q
(Class 1)</td><td><table><tr><th>Capacitance</th><th>Q</th></tr><tr><td>Cap≧30pF</td><td>1,000 min.</td></tr><tr><td>30pF＞Cap</td><td>400 + 20xC min.</td></tr></table>C: Rated capacitance (pF)</td></tr>
<tr><td>D.F.
(Class 2)</td><td>Meet the initial spec.</td></tr>
</table>

*Typical SPEC.

(continued)

<table>
<tr><th>No.</th><th colspan="2">Item</th><th>Performance</th><th>Test or inspection method</th></tr>
<tr><td rowspan="6">10</td><td rowspan="6">Temperature cycle</td><td>External appearance</td><td>No mechanical damage.</td><td rowspan="6">Mount the capacitors on an Alumina substrate shown in Appendix1 with conductive glue before testing.

Expose the capacitors in the condition step1 through step 4 and repeat 1,000 times consecutively.

Leave the capacitors in ambient condition for 6 to 24h (Class1) or 24±2h (Class2) before measurement.

Step | Temperature(°C) | Time (min.)
1 | -55 ±3 | 30 ± 3
2 | 25 | 2 - 5
3* | Max. operating Temp. ±2 | 30 ± 2
4 | 25 | 2 - 5

*C0G, X7R: 125°C
X8R: 150°C</td></tr>
<tr><td>Capacitance</td><td>Characteristics | Change from the value before test*
Class1/ C0G | ±2.5% or ±0.25pF, whichever larger
Class2/ X7R, X8R | ± 7.5 %</td></tr>
<tr><td>Q (Class1)</td><td>Meet the initial spec.</td></tr>
<tr><td>D.F. (Class2)</td><td>Meet the initial spec.</td></tr>
<tr><td>Insulation Resistance</td><td>Meet the initial spec.</td></tr>
<tr><td>Voltage proof</td><td>No insulation breakdown or other damage.</td></tr>
<tr><td rowspan="6">11</td><td rowspan="6">Moisture Resistance (Steady State)</td><td>External appearance</td><td>No mechanical damage.</td><td rowspan="6">Mount the capacitors on an Alumina substrate shown in Appendix1 with conductive glue before testing.

Leave at temperature 40±2°C, 90 to 95%RH for 500 +24,0h.

Leave the capacitors in ambient condition for 6 to 24h (Class1) or 24±2h (Class2) before measurement.</td></tr>
<tr><td>Capacitance</td><td>Characteristics | Change from the value before test*
Class1/ C0G | ±5% or ±0.5pF, whichever larger
Class2/ X7R, X8R | ± 12.5 %</td></tr>
<tr><td>Q (Class1)</td><td>Capacitance | Q
Cap≧30pF | 350 min.
10pF≦Cap＜30pF | 275 + 5/2xC min.
10pF＞Cap | 200 + 10xC min.

C: Rated capacitance (pF)</td></tr>
<tr><td>D.F. (Class2)</td><td>200% of initial spec. max.</td></tr>
<tr><td>Insulation Resistance</td><td>1,000MΩ or 50MΩ·μF min. (As for the capacitors of rated voltage 16V DC, 1,000 MΩ or 10MΩ·μF min.,) whichever smaller.</td></tr>
</table>

*Typical SPEC.

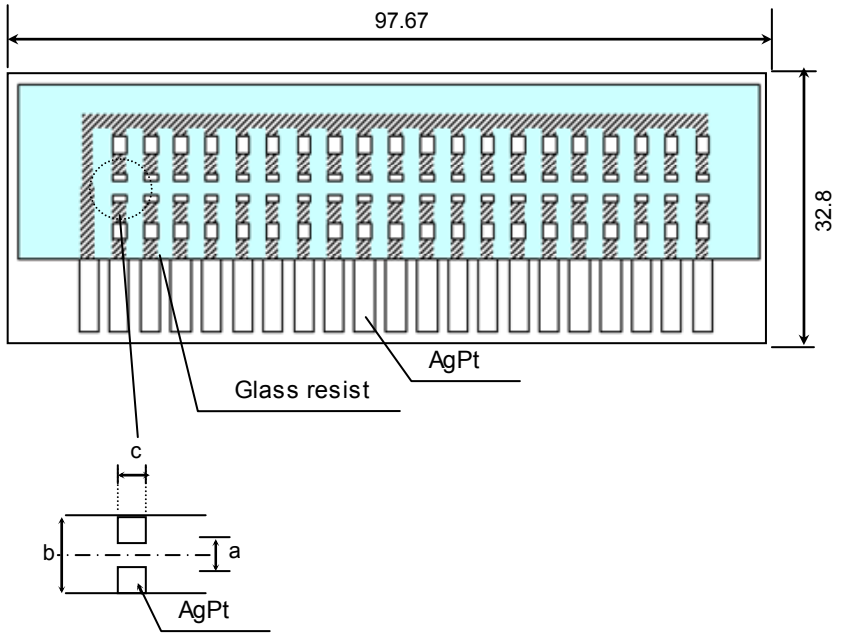
(continued)

<table>
<tr><th>No.</th><th colspan="2">Item</th><th>Performance</th><th>Test or inspection method</th></tr>
<tr><td rowspan="5">12</td><td rowspan="5">Moisture Resistance</td><td>External appearance</td><td>No mechanical damage.</td><td rowspan="5">Mount the capacitors on an Alumina substrate shown in Appendix1 with conductive glue before testing.
Apply the rated voltage at temperature 85°C and 85%RH for 1,000 +48,0h.
Charge/ discharge current shall not exceed 50mA.
Leave the capacitors in ambient condition for 6 to 24h (Class1) or 24±2h (Class2) before measurement.
Voltage conditioning (only for Class2) 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.</td></tr>
<tr><td>Capacitance</td><td><table><tr><th>Characteristics</th><th>Change from the value before test*</th></tr><tr><td>Class1/ C0G</td><td>±7.5% or ±0.75pF, whichever larger</td></tr><tr><td>Class2/ X7R, X8R</td><td>± 12.5 %</td></tr></table></td></tr>
<tr><td>Q (Class1)</td><td><table><tr><th>Capacitance</th><th>Q</th></tr><tr><td>Cap≧30pF</td><td>200 min.</td></tr><tr><td>30pF＞Cap</td><td>100 + 10/3xC min.</td></tr></table>C: Rated capacitance (pF)</td></tr>
<tr><td>D.F. (Class2)</td><td>200% of initial spec. max.</td></tr>
<tr><td>Insulation Resistance</td><td>500MΩ or 25MΩ·μF min.
(As for the capacitors of rated voltage 16V DC, 500 MΩ or 5MΩ·μF min.,) whichever smaller.</td></tr>
<tr><td rowspan="5">13</td><td rowspan="5">Life</td><td>External appearance</td><td>No mechanical damage.</td><td rowspan="5">Mount the capacitors on an Alumina substrate shown in Appendix1 with conductive glue before testing.
Below the voltage shall be applied at Max. operating Temp. ±2°C for 1,000 +48,0h.<table><tr><th>Applied Voltage</th></tr><tr><td>Rated voltage x2</td></tr><tr><td>Rated voltage x1.5</td></tr><tr><td>Rated voltage x1</td></tr></table>As for applied voltage, please refer “Voltage condition in the life test” on p-2.
Charge/ discharge current shall not exceed 50mA.
Leave the capacitors in ambient condition for 6 to 24h (Class1) or 24±2h (Class2) before measurement.
Voltage conditioning (only for Class2) 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.</td></tr>
<tr><td>Capacitance</td><td><table><tr><th>Characteristics</th><th>Change from the value before test*</th></tr><tr><td>Class1/ C0G</td><td>±3% or ±0.3pF, whichever larger</td></tr><tr><td>Class2/ X7R, X8R</td><td>± 15 %</td></tr></table></td></tr>
<tr><td>Q (Class1)</td><td><table><tr><th>Capacitance</th><th>Q</th></tr><tr><td>Cap≧30pF</td><td>350 min.</td></tr><tr><td>10pF≦Cap＜30pF</td><td>275 + 5/2xC min.</td></tr><tr><td>10pF＞Cap</td><td>200 + 10xC min.</td></tr></table>C: Rated capacitance (pF)</td></tr>
<tr><td>D.F. (Class2)</td><td>200% of initial spec. max.</td></tr>
<tr><td>Insulation Resistance</td><td>1,000MΩ or 50MΩ·μF min.
(As for the capacitors of rated voltage 16V DC,1,000 MΩ or 10MΩ·μF min.,) whichever smaller.</td></tr>
</table>

*Typical SPEC.

**As for the initial measurement of capacitors (Class2) on number 7, 9, 10 and 11 leave capacitors at 150 –10,0°C for 1 hour and measure the value after leaving capacitors for 24±2h in ambient condition.

Appendix1
P.C. board for bending test



（Unit：mm）

Type	Dimensions		
TDK(EIA style)	a	b	c
CGA2 [CC0402]	0.5	1.4	0.5
CGA3 [CC0603]	0.9	2.7	1.2
CGA4 [CC0805]	0.9	2.7	1.9
CGA5 [CC1206]	1.8	4.0	2.0
CGA6 [CC1210]	1.8	4.4	3.0

1. Material: Alumina substrate

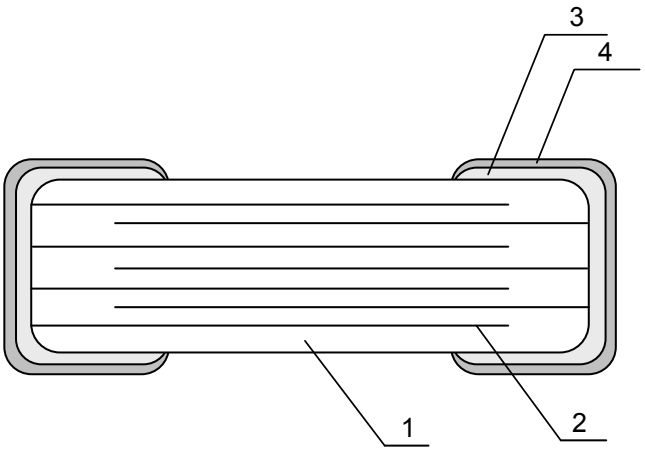
2. Thickness: 0.8mm

AgPt

Glass resist

3. Caution for mounting with conductive glue
(Refer to page11.)

9. INSIDE STRUCTURE AND MATERIAL



No.	NAME	MATERIAL	
		Class1	Class2
1	Dielectric	$CaZrO_3$	$BaTiO_3$
2	Electrode	Nickel (Ni)	
3	Termination	Copper (Cu)	
4		AgPdCu	

10. 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.

1) Total number of components in a plastic bag for bulk packaging: 1000pcs
2) Tape packaging is as per 12. TAPE PACKAGING SPECIFICATION.
(CGA2 [CC0402] types are applicable only to tape packaging.)

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

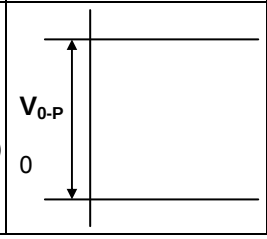
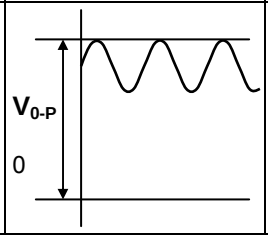
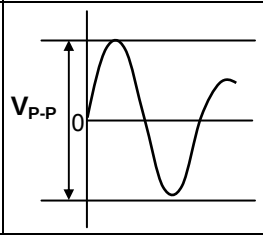
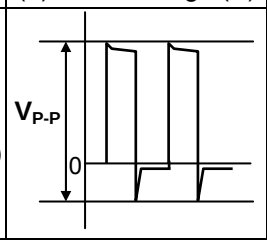
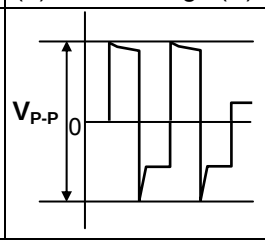
*Composition of Inspection No.

Example F 6 A – OO – OOO
(a) (b) (c) (d) (e)

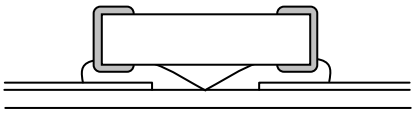
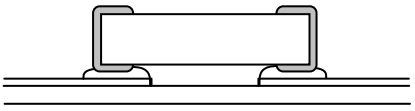
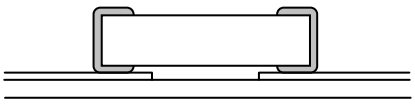
a) Line code
b) Last digit of the year
c) Month and A for January and B for February and so on. (Skip I)
d) Inspection Date of the month.
e) Serial No. of the day

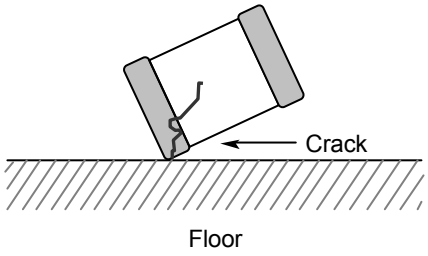
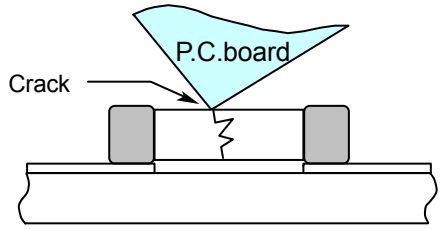
11. Caution

<table>
<tr><th>No.</th><th>Process</th><th>Condition</th></tr>
<tr><td>1</td><td>Operating Condition (Storage, Transportation)</td><td>1-1. Storage
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.

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)</td></tr>
<tr><td>2</td><td>Circuit design
⚠ Caution</td><td>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, $V_{0\text{-}P}$ must be below the rated voltage.
— (1) and (2)
AC or pulse with overshooting, $V_{P\text{-}P}$ 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><tr><th>Voltage</th><th>(1) DC voltage</th><th>(2) DC+AC voltage</th><th>(3) AC voltage</th></tr><tr><td>Positional Measurement (Rated voltage)</td><td>  </td><td>  </td><td>  </td></tr></table><table><tr><th>Voltage</th><th>(4) Pulse voltage (A)</th><th>(5) Pulse voltage (B)</th></tr><tr><td>Positional Measurement (Rated voltage)</td><td>  </td><td>  </td></tr></table></td></tr>
</table>

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 Alumina Substrate	The amount of glue at the terminations has a direct effect on the reliability of the capacitors. 1) The greater the amount of glue with low thickness of land, the higher risk of electrical connection by conductive glue. Design of land and the amount of glue must be considered well. 2) Avoid using common land for multiple terminations and provide individual land for each terminations.
4	Mounting	4-1. Stress from mounting head 1) If the mounting head is adjusted too low, it may induce excessive stress in the chip capacitor to result in cracking. Please take following precautions. 2) Adjust the bottom dead center of the mounting head to reach on the Alumina substrate surface and not press it. 3) Adjust the mounting head pressure to be 1 to 3N of static weight. 4-2. Amount of conductive glue Excessive glue will make a electrical connection under the chip. In sufficient glue may detach the capacitor from the Alumina substrate.

Excessive glue		Electrical connection will be made under the chip.
Adequate		
Insufficient glue		Low robustness may cause contact failure or chip capacitor comes off the Alumina substrate.

No.	Process	Condition
5	Coating and molding of the Alumina substrate	1) When the Alumina substrate is coated, please verify the quality influence on the product. 2) Please verify carefully that there is no harmful decomposing or reaction gas emission during curing which may damage the chip capacitors. 3) Please verify the curing temperature.
6	Handling of loose chip capacitors	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.  2) Piling the Alumina substrate after mounting for storage or handling, the corner of the Alumina substrate may hit the chip capacitors of another board to cause crack. 
7	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.
8	Estimated life and estimated failure rate of capacitors	As per the estimated life and the estimated failure rate depend on the temperature and the voltage. This can be calculated by the equation described in JEITA RCR-2335C Annex F (Informative) Calculation of the estimated life time 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.

No.	Process	Condition
9	Caution during operation of equipment	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. (1) Environment where a capacitor is spattered 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
10	Others ⚠ Caution	The products listed on this specification sheet are intended for use in general electronic equipment (AV equipment, telecommunications equipment, home appliances, amusement equipment, computer equipment, personal equipment, office equipment, measurement equipment, industrial robots) under a normal operation and use condition. The products are not designed or warranted to meet the requirements of the applications listed below, whose performance and/or quality require a more stringent level of safety or reliability, or whose failure, malfunction or trouble could cause serious damage to society, person or property. Please understand that we are not responsible for any damage or liability caused by use of the products in any of the applications below or for any other use exceeding the range or conditions set forth in this specification sheet. If you intend to use the products in the applications listed below or if you have special requirements exceeding the range or conditions set forth in this specification, please contact us. (1) Aerospace/Aviation equipment (2) Transportation equipment (electric trains, ships, etc. except automotive application) (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 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.

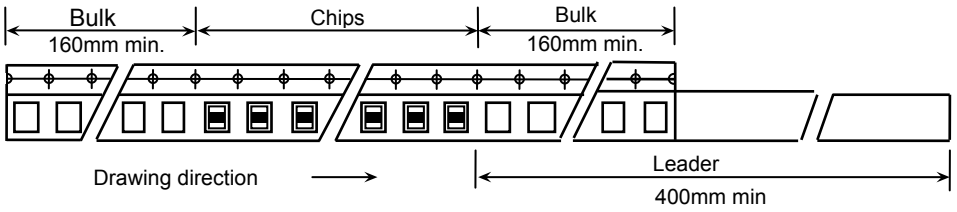
12. TAPE PACKAGING SPECIFICATION

1. CONSTRUCTION AND DIMENSION OF TAPING

1-1. Dimensions of carrier tape

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

1-2. Bulk part and leader of taping

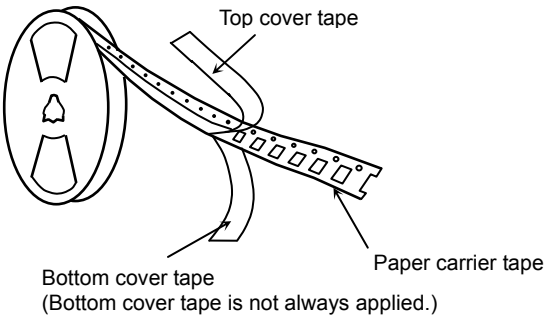


1-3. Dimensions of reel

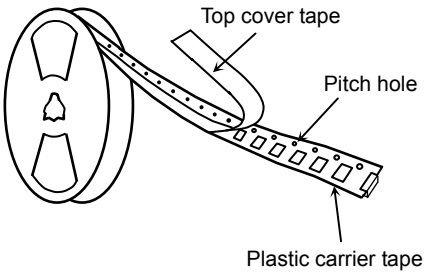
Dimensions of Ø178 reel shall be according to Appendix 5, 6.
Dimensions of Ø330 reel shall be according to Appendix 7, 8.

1-4. Structure of taping

(a) Paper



(b) Plastic



2. CHIP QUANTITY

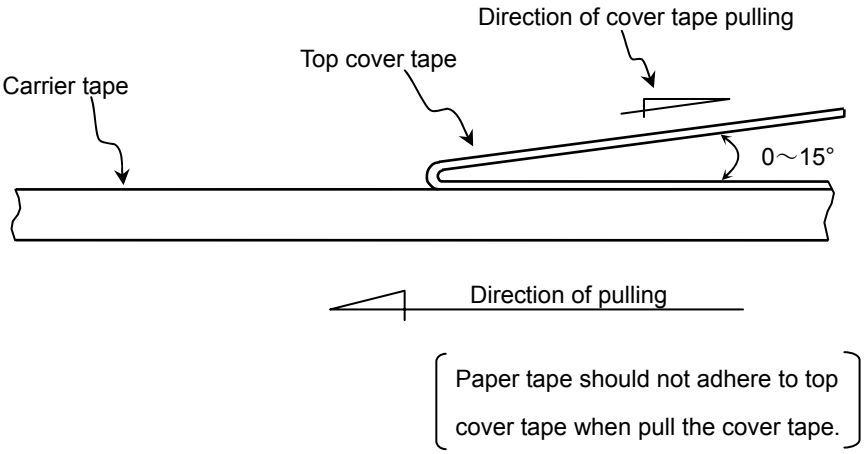
As for chip quantity and taping material of each product, please refer to detailed information on TDK web.

3. PERFORMANCE SPECIFICATIONS

3-1. Fixing peeling strength (top tape)

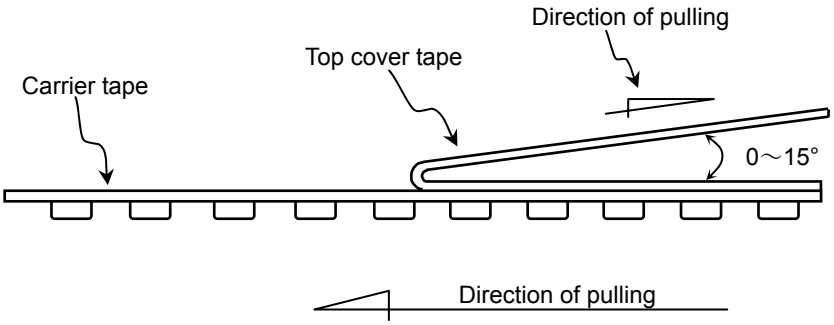
0.05 - 0.7N. (See the following figure.)

〈Paper〉



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

〈Plastic〉



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

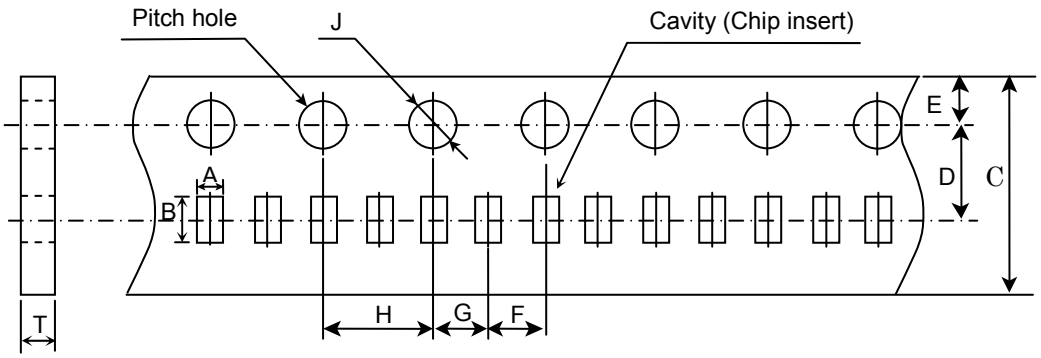
3-3. The missing of components shall be less than 0.1%

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

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

Appendix 2

Paper Tape



(Unit : mm)

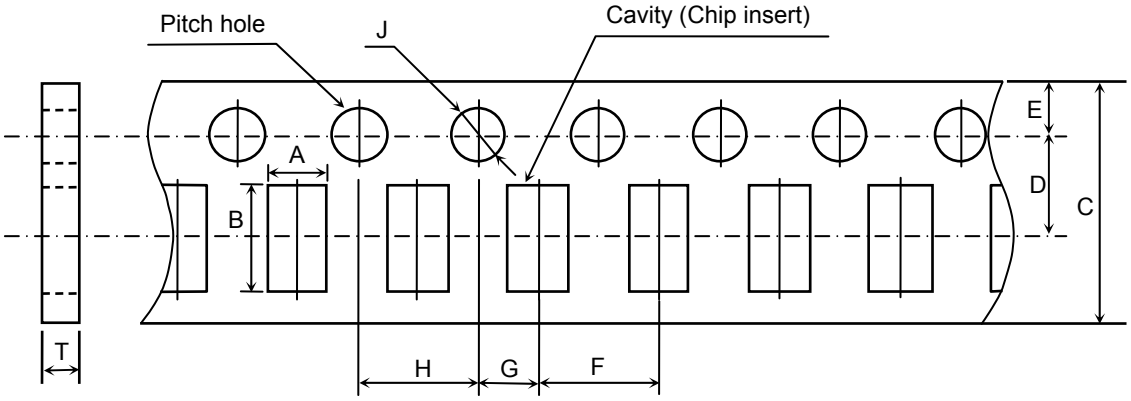
Symbol / Type	A	B	C	D	E	F
CGA2 [CC0402]	(0.65)	(1.15)	8.00 ± 0.30	3.50 ± 0.05	1.75 ± 0.10	2.00 ± 0.05

Symbol / Type	G	H	J	T
CGA2 [CC0402]	2.00 ± 0.05	4.00 ± 0.10	Ø 1.50 $^{+0.10}_{0}$	0.60 ± 0.15

( ) Reference value.

Appendix 3

Paper Tape



(Unit : mm)

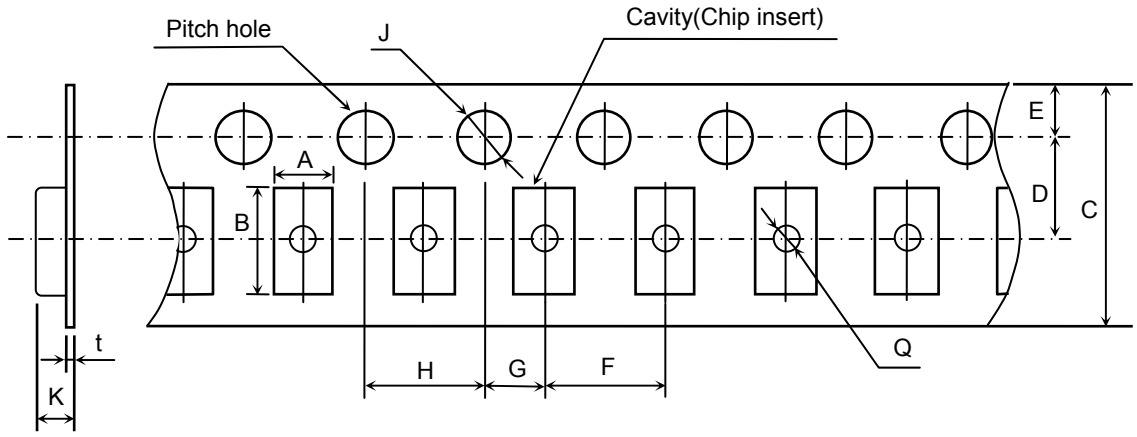
Symbol / Type	A	B	C	D	E	F
CGA3 [CC0603]	(1.10)	(1.90)	8.00 ± 0.30	3.50 ± 0.05	1.75 ± 0.10	4.00 ± 0.10
CGA4 [CC0805]	(1.50)	(2.30)				
CGA5 [CC1206]	(1.90)	(3.50)				

Symbol / Type	G	H	J	T
CGA3 [CC0603]	2.00 ± 0.05	4.00 ± 0.10	Ø 1.50 $^{+0.10}_{0}$	1.20 max.
CGA4 [CC0805]				
CGA5 [CC1206]				

( ) Reference value.

Appendix 4

Plastic Tape



(Unit : mm)

Symbol / Type	A	B	C	D	E	F
CGA3 [CC0603]	(1.10)	(1.90)	8.00 ± 0.30 ∗ 12.00 ± 0.30	3.50 ± 0.05 ∗5.50 ± 0.05	1.75 ± 0.10	4.00 ± 0.10
CGA4 [CC0805]	(1.50)	(2.30)				
CGA5 [CC1206]	(1.90)	(3.50)				
CGA6 [CC1210]	(2.90)	(3.60)				

Symbol / Type	G	H	J	K	t	Q
CGA3 [CC0603]	2.00 ± 0.05	4.00 ± 0.10	Ø 1.50 $^{+0.10}_{0}$	1.50 max.	0.60 max.	Ø 0.50 min.
CGA4 [CC0805]				2.50 max.		
CGA5 [CC1206]						
CGA6 [CC1210]				3.40 max.		

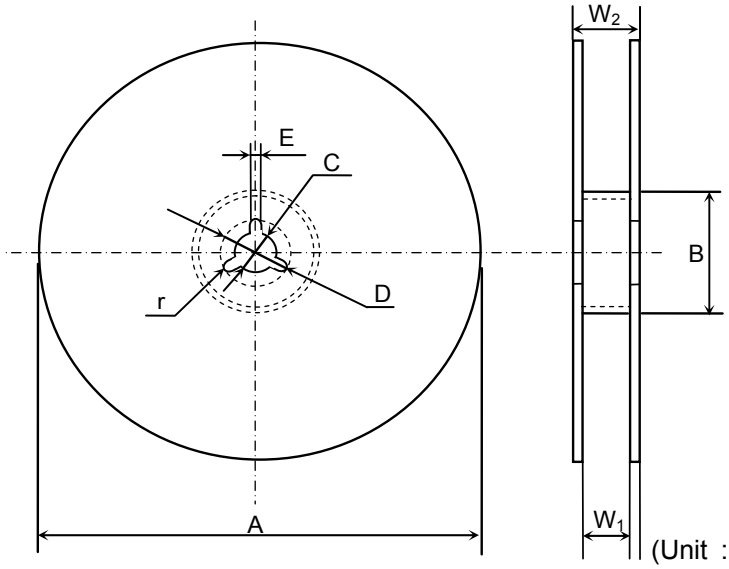
( ) Reference value.

∗ Applied to thickness, 2.5mm products.

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

Appendix 5

CGA2 [CC0402] ~ CGA6 [CC1210]
(As for CGA6 type, any thickness of the item except 2.5mm)
(Material: Polystyrene)



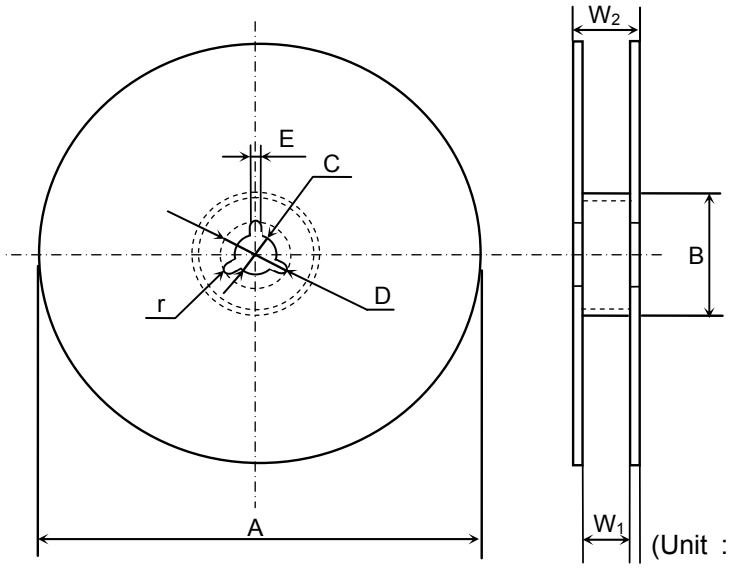
(Unit : mm)

Symbol	A	B	C	D	E	W_1
Dimension	Ø178 ± 2.0	Ø60 ± 2.0	Ø13 ± 0.5	Ø21 ± 0.8	2.0 ± 0.5	9.0 ± 0.3

Symbol	W_2	r
Dimension	13.0 ± 1.4	1.0

Appendix 6

CGA6 [CC1210] ~ CGA9 [CC2220]
(As for CGA6 type, applied to 2.5mm thickness products)
(Material: Polystyrene)



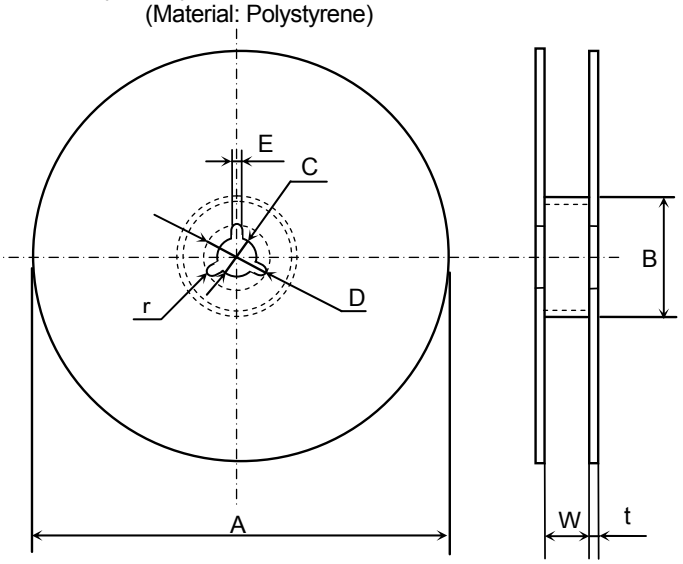
(Unit : mm)

Symbol	A	B	C	D	E	W_1
Dimension	Ø178 ± 2.0	Ø60 ± 2.0	Ø13 ± 0.5	Ø21 ± 0.8	2.0 ± 0.5	13.0 ± 0.3

Symbol	W_2	r
Dimension	17.0 ± 1.4	1.0

Appendix 7

CGA2 [CC0402] ~ CGA6 [CC1210]
(As for CGA6 type, any thickness of the item except 2.5mm)
(Material: Polystyrene)



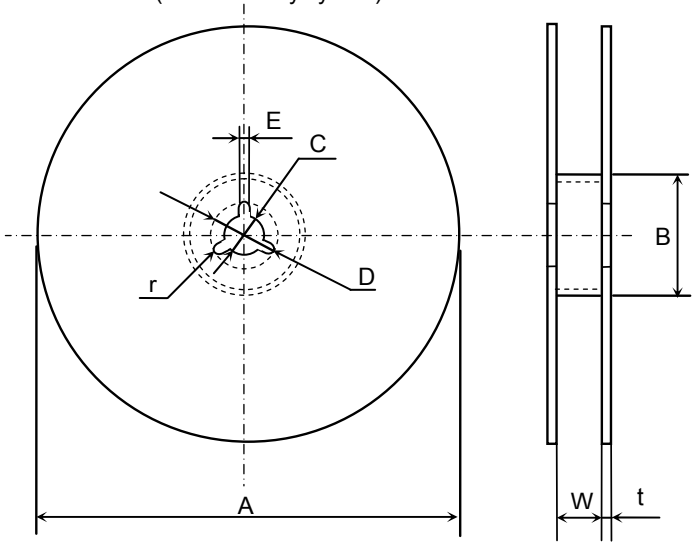
(Unit : mm)

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

Symbol	t	r
Dimension	2.0 ± 0.5	1.0

Appendix 8

CGA6 [CC1210] ~ CGA9 [CC2220]
(As for CGA6 type, applied to 2.5mm thickness products)
(Material: Polystyrene)



(Unit : mm)

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

Symbol	t	r
Dimension	2.0 ± 0.5	1.0