# DELIVERY SPECIFICATION

SPEC. No. C-SOFT-d

D A T E : Jun, 2019

To



| CUSTOMER'S PRODUCT NAME | TDK PRODUCT NAME<br>MULTILAYER CERAMIC CHIP CAPACITORS(Soft Termination)<br>Bulk and Tape packaging【RoHS compliant】<br>C1005,C1608,C2012,C3216,C3225,C4532,C5750,C7563 Type<br>C0G,X5R,X7R,X7S,X7T,X8R Characteristics |
|---|---|

Please return this specification to TDK representatives with your signature.
If orders are placed without returned specification, please allow us to judge that specification is accepted by your side.

## RECEIPT CONFIRMATION

DATE: YEAR MONTH DAY

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

| C | 7563 | X7S | 1C | 107 | M | 280 | L | E |
|---|---|---|---|---|---|---|---|---|
| (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) | (9) |

(1) Series

(2) Dimensions L x W (mm)

| Code | EIA | Length | Width | Terminal width |
|---|---|---|---|---|
| 1005 | CC0402 | 1.00 | 0.50 | 0.10 |
| 1608 | CC0603 | 1.60 | 0.80 | 0.20 |
| 2012 | CC0805 | 2.00 | 1.25 | 0.20 |
| 3216 | CC1206 | 3.20 | 1.60 | 0.20 |
| 3225 | CC1210 | 3.20 | 2.50 | 0.20 |
| 4520 | CC1808 | 4.50 | 2.00 | 0.20 |
| 4532 | CC1812 | 4.50 | 3.20 | 0.20 |
| 5750 | CC2220 | 5.70 | 5.00 | 0.20 |
| 7563 | CC3025 | 7.50 | 6.30 | 0.30 |

(3) Temperature characteristics

| Temperature characteristics | Temperature coefficient or capacitance change | Temperature range |
|---|---|---|
| C0G | 0±30 ppm/°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 |
| X8R | ±15% | –55 to +150°C |

(4) Rated voltage (DC)

| Code | Voltage (DC) |
|---|---|
| 0J | 6.3V |
| 1A | 10V |
| 1C | 16V |
| 1E | 25V |
| 1V | 35V |
| 1H | 50V |
| 2A | 100V |
| 2E | 250V |
| 2W | 450V |
| 2J | 630V |
| 3A | 1000V |
| 3D | 2000V |
| 3F | 3000V |

(5) 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

(6) Capacitance tolerance

| Code | Tolerance |
|---|---|
| J | ±5% |
| K | ±10% |
| M | ±20% |

(7) Thickness

| Code | Thickness |
|---|---|
| 050 | 0.50 mm |
| 060 | 0.60 mm |
| 080 | 0.80 mm |
| 085 | 0.85 mm |
| 115 | 1.15 mm |
| 125 | 1.25 mm |
| 130 | 1.30 mm |
| 160 | 1.60 mm |
| 200 | 2.00 mm |
| 230 | 2.30 mm |
| 250 | 2.50 mm |
| 280 | 2.80 mm |

(8) Packaging style

| Code | Style |
|---|---|
| A | 178mm reel, 4mm pitch |
| B | 178mm reel, 2mm pitch |
| K | 178mm reel, 8mm pitch |
| L | 330mm reel, 12mm pitch |

(9) Special reserved code

| Code | Description |
|---|---|
| E | Soft termination |

1. SCOPE

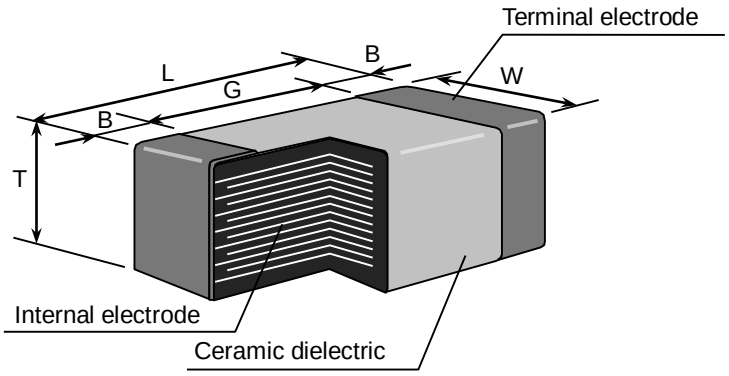
This specification is applicable to chip type multilayer ceramic capacitors with a priority over the other relevant specifications.
Production places defined in this specification shall be TDK Corporation Japan, TDK(Suzhou)Co.,Ltd and TDK Components U.S.A. Inc.

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

2. CODE CONSTRUCTION

(Example) C2012 (1) X7R (2) 1H (3) 105 (4) K (5) T (6) ※※※S (7)

(1) Type




| Type | Dimensions (Unit : mm) | | | | |
|---|---|---|---|---|---|
| TDK[EIA style] | L | W | T | B | G |
| C1005 [CC0402] | $1.00^{+0.15}_{-0.05}$ | $0.50^{+0.10}_{-0.05}$ | $0.50^{+0.10}_{-0.05}$ | 0.10 min. | 0.30 min. |
| | $1.00^{+0.25}_{-0.10}$ | $0.50^{+0.20}_{-0.10}$ | $0.50^{+0.20}_{-0.10}$ | | |
| C1608 [CC0603] | $1.60^{+0.20}_{-0.10}$ | $0.80^{+0.15}_{-0.10}$ | $0.80^{+0.15}_{-0.10}$ | 0.20 min. | 0.30 min. |
| C2012 [CC0805] | $2.00^{+0.45}_{-0.20}$ | $1.25^{+0.25}_{-0.20}$ | 0.60±0.15 | 0.20 min. | 0.50 min. |
| | | | 0.85±0.15 | | |
| | | | $1.25^{+0.25}_{-0.20}$ | | |
| C3216 [CC1206] | $3.20^{+0.40}_{-0.20}$ | $1.60^{+0.30}_{-0.20}$ | 0.85±0.15 | 0.20 min. | 1.00 min. |
| | | | 1.15±0.15 | | |
| | | | 1.30±0.20 | | |
| | | | $1.60^{+0.30}_{-0.20}$ | | |
| C3225 [CC1210] | $3.20^{+0.50}_{-0.40}$ | 2.50±0.30 | $1.60^{+0.30}_{-0.20}$ | 0.20 min. | —— |
| | | | $2.00^{+0.30}_{-0.20}$ | | |
| | | | $2.30^{+0.30}_{-0.20}$ | | |
| | | | 2.50±0.30 | | |
| C4532 [CC1812] | $4.50^{+0.50}_{-0.40}$ | 3.20±0.40 | $2.00^{+0.30}_{-0.20}$ | 0.20 min. | —— |
| | | | $2.30^{+0.30}_{-0.20}$ | | |
| | | | 2.50±0.30 | | |

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

| Type | Dimensions (Unit : mm) | | | | |
|---|---|---|---|---|---|
| TDK[EIA style] | L | W | T | B | G |
| C5750 [CC2220] | $5.70^{+0.50}_{-0.40}$ | 5.00±0.40 | $2.30^{+0.30}_{-0.20}$<br>2.50±0.30 | 0.20 min. | —— |
| C7563 [CC3025] | 7.50±0.50 | 6.30±0.50 | 2.50 max.<br>3.00 max. | 0.30 min. | —— |

*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 8.PERFORMANCE

(3) Rated Voltage

| Symbol | Rated Voltage |
|---|---|
| 2 J | DC 630 V |
| 2 W | DC 450 V |
| 2 E | DC 250 V |
| 2 A | DC 100 V |
| 1 H | DC 50 V |

| Symbol | Rated Voltage |
|---|---|
| 1 V | DC 35 V |
| 1 E | DC 25 V |
| 1 C | DC 16 V |
| 1 A | DC 10 V |
| 0 J | DC 6.3 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.

| Symbol | Rated Capacitance |
|---|---|
| 105 | 1,000,000 pF |

(5) Capacitance tolerance

* M tolerance shall be standard for over 10uF.

| Symbol | Tolerance |
|---|---|
| J | ± 5 % |
| K | ± 10 % |
| *M | ± 20 % |

(6) Packaging

* C1005 type is applicable to tape packaging only.

| Symbol | Packaging |
|---|---|
| B | Bulk |
| T | Taping |

(7) TDK internal code

※※※ S
S : Soft Termination
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 | J (± 5 %) | E – 12 series |
| 2 | X5R<br>X7R<br>X7S<br>X7T<br>X8R | K (± 10 %)<br>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 |
|---|---|---|---|
| X5R | -55°C | 85°C | 25°C |
| C0G/X7R/X7S/X7T | -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. upon receipt

## 6. P.C. BOARD

When mounting on an aluminum substrate, large case size such as C3225 and larger are more likely to be affected by heat stress from the substrate.
Please inquire separate specification for the large case sizes when mounted on the substrate.

## 7. INDUSTRIAL WASTE DISPOSAL

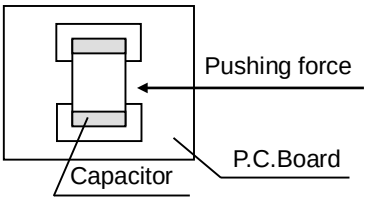
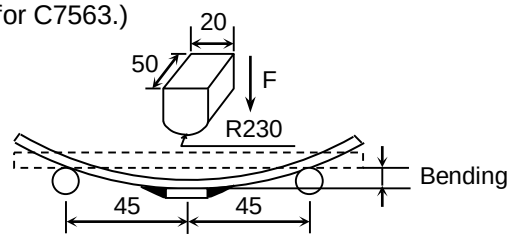
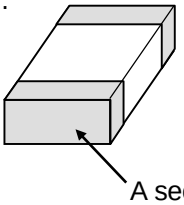
Dispose this product as industrial waste in accordance with the Industrial Waste Law.

8. PERFORMANCE

table 1

<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.<br>(As for the capacitors of rated voltage 16V DC and lower, 10,000 MΩ or 100MΩ·μF min.), whichever smaller.</td><td>Apply rated voltage for 60s.<br>As for the capacitor of rated voltage 630V DC, apply 500V DC.</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>Rated voltage(RV)</th><th>Apply voltage</th></tr>
<tr><td rowspan="3">1</td><td>RV≦100V</td><td>3 × rated voltage</td></tr>
<tr><td>100V＜RV≦500V</td><td>1.5 × rated voltage</td></tr>
<tr><td>500V＜RV</td><td>1.3 × rated voltage</td></tr>
<tr><td rowspan="3">2</td><td>RV≦100V</td><td>2.5 × rated voltage</td></tr>
<tr><td>100V＜RV≦500V</td><td>1.5 × rated voltage</td></tr>
<tr><td>500V＜RV</td><td>1.3 × rated voltage</td></tr>
</table>
Above DC voltage shall be applied for 1s.<br>Charge / discharge current shall not exceed 50mA.</td></tr>
<tr><td>4</td><td>Capacitance</td><td>Within the specified tolerance.</td><td>《Class1》
<table>
<tr><th>Capacitance</th><th>Measuring frequency</th><th>Measuring voltage</th></tr>
<tr><td>1000pF and under</td><td>1MHz±10%</td><td rowspan="2">0.5 - 5 Vrms.</td></tr>
<tr><td>Over 1000pF</td><td>1kHz±10%</td></tr>
</table>
《Class2》
<table>
<tr><th>Capacitance</th><th>Measuring frequency</th><th>Measuring voltage</th></tr>
<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>
</table>
As for the capacitors of rated voltage 6.3V DC, 0.5Vrms is applied.</td></tr>
<tr><td>5</td><td>Q<br>(Class1)<br><br>Dissipation Factor<br>(Class2)</td><td>Please refer to detail page 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<br>(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.<br><br>Measuring temperature below 25°C shall be -10°C and -25°C.</td></tr>
</table>

(continued)

<table>
<tr><th>No.</th><th>Item</th><th>Performance</th><th>Test or inspection method</th></tr>
<tr><td>7</td><td>Temperature Characteristics of Capacitance (Class2)</td><td>Capacitance Change (%)<br>No voltage applied<br>X5R : ± 15<br>X7R : ± 15<br>X7S : ± 22<br>X7T : +22 / - 33<br>X8R : ± 15</td><td>Capacitance shall be measured by the steps shown in the following table after thermal equilibrium is obtained for each step.<br>ΔC be calculated ref. STEP3 reading<br><table><tr><th>Step</th><th>Temperature(°C)</th></tr><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></table>As for Min./Max operating temp and Reference temp., please refer to “4. OPERATING TEMPERATURE RANGE”<br>As for measuring voltage, please contact with our sales representative.</td></tr>
<tr><td>8</td><td>Robustness of Terminations</td><td>No sign of termination coming off, breakage of ceramic, or other abnormal signs.</td><td>Reflow solder the capacitors on a P.C.Board shown in Appendix2 and apply a pushing force of 5N with 10±1s.<br>(2N is applied for C1005 type)<br> 
</td></tr>
<tr><td>9</td><td>Bending</td><td>No mechanical damage.</td><td>Reflow solder the capacitors on a P.C.Board shown in Appendix 1 and bend it for 5mm. (2mm is applied for C4532 and C5750. 1mm is applied for C7563.)<br> 
<br>(Unit : mm)</td></tr>
<tr><td>10</td><td>Solderability</td><td>New solder to cover over 75% of termination.<br>25% may have pin holes or rough spots but not concentrated in one spot.<br>Ceramic surface of A sections shall not be exposed due to melting or shifting of termination material.<br> 
</td><td>Completely soak both terminations in solder at the following conditions.<br><br>Solder : Sn-3.0Ag-0.5Cu or Sn-37Pb<br>Temperature : 245±5°C(Sn-3.0Ag-0.5Cu)<br>235±5°C(Sn-37Pb)<br>Soaking time : 3±0.3s(Sn-3.0Ag-0.5Cu)<br>2±0.2s(Sn-37Pb)<br><br>Flux : Isopropyl alcohol (JIS K 8839)<br>Rosin (JIS K 5902) 25% solid solution.</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 rowspan="7">11</td><td rowspan="7">Resistance to solder heat</td><td>External appearance</td><td>No cracks are allowed and terminations shall be covered at least 60% with new solder.</td><td rowspan="7">Completely soak both terminations in solder at the following conditions.<br>260±5°C for 10±1s.<br><br>Preheating condition<br>Temp.: 110 ~ 140°C<br>Time : 30 ~ 60s.<br><br>Solder : Sn-3.0Ag-0.5Cu or Sn-37Pb<br><br>Flux : Isopropyl alcohol (JIS K 8839)<br>Rosin (JIS K 5902) 25% solid solution.<br><br>Leave the capacitors in ambient condition for 6 to 24h (Class1) or 24±2h (Class2) before measurement.</td></tr>
<tr><td>Capacitance</td><td><table><tr><th colspan="2">Characteristics</th><th>Change from the value before test</th></tr><tr><td>Class1</td><td>C0G</td><td>± 2.5 %</td></tr><tr><td>Class2</td><td>X5R<br>X7R<br>X7S<br>X7T<br>X8R</td><td>± 7.5 %</td></tr></table></td></tr>
<tr><td>Q<br>(Class1)</td><td>Meet the initial spec.</td></tr>
<tr><td>D.F.<br>(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="5">12</td><td rowspan="5">Vibration</td><td>External appearance</td><td>No mechanical damage.</td><td rowspan="5">Reflow solder the capacitors on a P.C.Board shown in Appendix 2 before testing.<br><br>Vibrate the capacitors with amplitude of 1.5mm P-P changing the frequencies from 10Hz to 55Hz and back to 10Hz in about 1min.<br>Repeat this for 2h each in 3 perpendicular directions.</td></tr>
<tr><td>Capacitance</td><td><table><tr><th colspan="2">Characteristics</th><th>Change from the value before test</th></tr><tr><td>Class1</td><td>C0G</td><td>± 2.5 %</td></tr><tr><td>Class2</td><td>X5R<br>X7R<br>X7S<br>X7T<br>X8R</td><td>± 7.5 %</td></tr></table></td></tr>
<tr><td>Q<br>(Class1)</td><td>Meet the initial spec.</td></tr>
<tr><td>D.F.<br>(Class2)</td><td>Meet the initial spec.</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 rowspan="6">13</td><td rowspan="6">Temperature cycle</td><td>External appearance</td><td>No mechanical damage.</td><td rowspan="6">Reflow solder the capacitors on a P.C.Board shown in Appendix 2 before testing.<br><br>Expose the capacitors in the condition step1 through step 4 and repeat 5 times consecutively.<br><br>Leave the capacitors in ambient condition for 6 to 24h (Class 1) or 24±2h (Class 2) before measurement.<br><br>
<table>
<tr><th>Step</th><th>Temperature(°C)</th><th>Time (min.)</th></tr>
<tr><td>1</td><td>Min. operating temp.±3</td><td>30 ± 3</td></tr>
<tr><td>2</td><td>Ambient Temp.</td><td>2 - 5</td></tr>
<tr><td>3</td><td>Max. operating temp.±2</td><td>30 ± 2</td></tr>
<tr><td>4</td><td>Ambient Temp.</td><td>2 - 5</td></tr>
</table>
<br>As for Min./Max operating temp., please refer to “4. OPERATING TEMPERATURE RANGE”</td></tr>
<tr><td>Capacitance</td><td>
<table>
<tr><th colspan="2">Characteristics</th><th>Change from the value before test</th></tr>
<tr><td>Class1</td><td>C0G</td><td rowspan="2">Please contact with our sales representative</td></tr>
<tr><td>Class2</td><td>X5R<br>X7R<br>X7S<br>X7T<br>X8R</td></tr>
</table>
</td></tr>
<tr><td>Q<br>(Class1)</td><td>Meet the initial spec.</td></tr>
<tr><td>D.F.<br>(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">14</td><td rowspan="6">Moisture Resistance (Steady State)</td><td>External appearance</td><td>No mechanical damage.</td><td rowspan="6">Reflow solder the capacitors on a P.C.Board shown in Appendix 2 before testing.<br><br>Leave at temperature 40±2°C, 90 to 95%RH for 500 +24,0h.<br><br>Leave the capacitors in ambient condition for 6 to 24h (Class1) or 24±2h (Class2) before measurement.</td></tr>
<tr><td>Capacitance</td><td>
<table>
<tr><th colspan="2">Characteristics</th><th>Change from the value before test</th></tr>
<tr><td>Class1</td><td>C0G</td><td rowspan="2">Please contact with our sales representative</td></tr>
<tr><td>Class2</td><td>X5R<br>X7R<br>X7S<br>X7T<br>X8R</td></tr>
</table>
</td></tr>
<tr><td>Q<br>(Class1)</td><td>350 min.</td></tr>
<tr><td>D.F.<br>(Class2)</td><td>200% of initial spec. max.</td></tr>
<tr><td>Insulation Resistance</td><td>1,000MΩ or 50MΩ·μF min.<br>(As for the capacitors of rated voltage 16V DC and lower, 1,000MΩ or 10MΩ·μF min.), whichever smaller.</td></tr>
</table>

(continued)

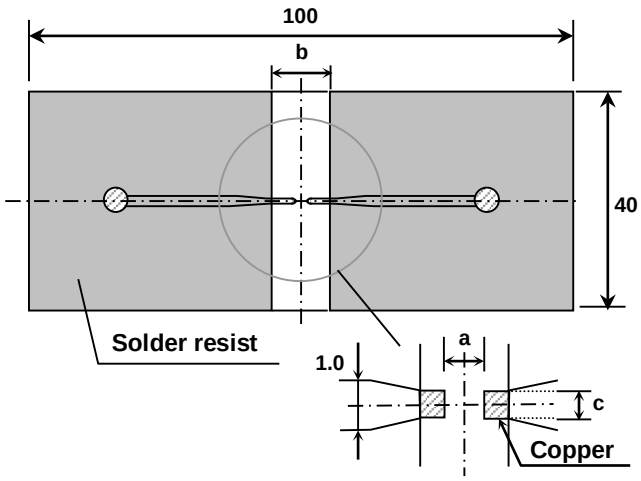
<table>
<tr><th>No.</th><th colspan="2">Item</th><th>Performance</th><th>Test or inspection method</th></tr>
<tr><td rowspan="5">15</td><td rowspan="5">Moisture Resistance</td><td>External appearance</td><td>No mechanical damage.</td><td rowspan="5">Reflow solder the capacitors on a P.C.Board shown in Appendix2 before testing.<br><br>Apply the rated voltage at temperature 40±2°C, 90 to 95%RH for 500 +24,0h.<br><br>Charge/discharge current shall not exceed 50mA.<br><br>Leave the capacitors in ambient condition for 6 to 24h (Class1) or 24±2h (Class2) before measurement.<br><br>Voltage conditioning (only for class 2)<br>Voltage treat the capacitors under testing temperature and voltage for 1 hour.<br>Leave the capacitors in ambient condition for 24±2h before measurement.<br>Use this measurement for initial value.</td></tr>
<tr><td>Capacitance</td><td><table><tr><th colspan="2">Characteristics</th><th>Change from the value before test</th></tr><tr><td>Class1</td><td>C0G</td><td rowspan="2">Please contact with our sales representative</td></tr><tr><td>Class2</td><td>X5R<br>X7R<br>X7S<br>X7T<br>X8R</td></tr></table></td></tr>
<tr><td>Q<br>(Class1)</td><td>200 min.</td></tr>
<tr><td>D.F.<br>(Class2)</td><td>200% of initial spec. max.</td></tr>
<tr><td>Insulation Resistance</td><td>500MΩ or 25MΩ·μF min.<br>(As for the capacitors of rated voltage 16V DC and lower, 500MΩ or 5MΩ·μF min.), whichever smaller.</td></tr>
<tr><td rowspan="5">16</td><td rowspan="5">Life</td><td>External appearance</td><td>No mechanical damage.</td><td rowspan="5">Reflow solder the capacitors on a P.C.Board shown in Appendix2 before testing.<br><br>Test condition : Maximum operating temperature ±2°C for 1,000 +48,0h<br>As for applied voltage, please contact with our sales representative.<br><br>Charge/discharge current shall not exceed 50mA.<br><br>Leave the capacitors in ambient condition for 6 to 24h (Class1) or 24±2h (Class2) before measurement.<br><br>Voltage conditioning (only for class 2)<br>Voltage treat the capacitors under testing temperature and voltage for 1 hour.<br>Leave the capacitors in ambient condition for 24±2h before measurement.<br>Use this measurement for initial value.</td></tr>
<tr><td>Capacitance</td><td><table><tr><th colspan="2">Characteristics</th><th>Change from the value before test</th></tr><tr><td>Class1</td><td>C0G</td><td rowspan="2">Please contact with our sales representative</td></tr><tr><td>Class2</td><td>X5R<br>X7R<br>X7S<br>X7T<br>X8R</td></tr></table></td></tr>
<tr><td>Q<br>(Class1)</td><td>350 min.</td></tr>
<tr><td>D.F.<br>(Class2)</td><td>200% of initial spec. max.</td></tr>
<tr><td>Insulation Resistance</td><td>1,000MΩ or 50MΩ·μF min.<br>(As for the capacitors of rated voltage 16V DC and lower, 1,000MΩ or 10MΩ·μF min.), whichever smaller.</td></tr>
</table>

*As for the initial measurement of capacitors (Class2) on number 7,11,12,13 and 14 leave capacitors at 150 –10,0°C for 1 hour and measure the value after leaving capacitors for 24±2h in ambient condition.

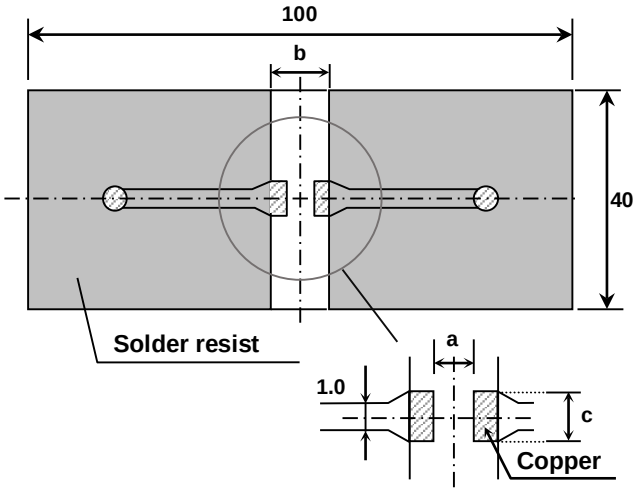
# Appendix1

## P.C.Board for bending test

(C1005)

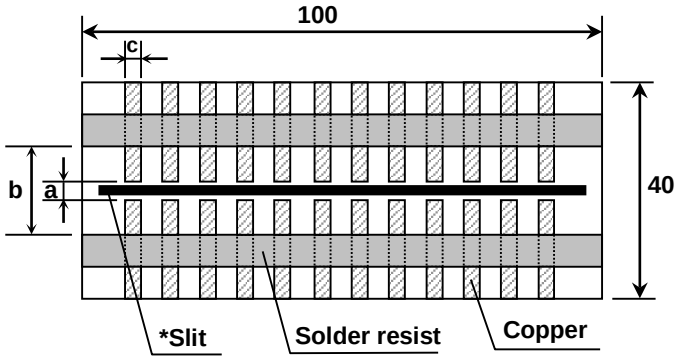



(C1608,C2012,C3216,C3225,C4532,C5750,C7563)




# Appendix2

## P.C. Board for reliability test




* It is recommended to provide a slit on P.C.Board for C3225,C4532,C5750 and C7563.

(Unit : mm)

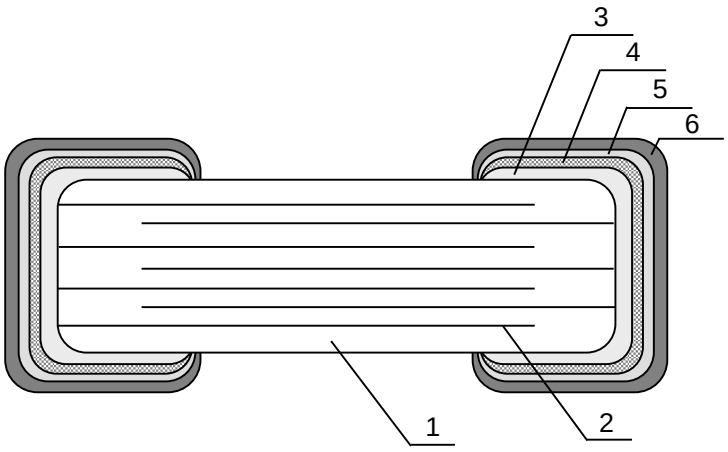
| Type | Dimensions | | |
|---|---|---|---|
| TDK [EIA style] | a | b | c |
| C1005 [CC0402] | 0.4 | 1.5 | 0.5 |
| C1608 [CC0603] | 1.0 | 3.0 | 1.2 |
| C2012 [CC0805] | 1.2 | 4.0 | 1.65 |
| C3216 [CC1206] | 2.2 | 5.0 | 2.0 |
| C3225 [CC1210] | 2.2 | 5.0 | 2.9 |
| C4532 [CC1812] | 3.5 | 7.0 | 3.7 |
| C5750 [CC2220] | 4.5 | 8.0 | 5.6 |
| C7563 [CC3025] | 5.5 | 9.1 | 6.9 |

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

Copper(Thickness:0.035mm)
Solder resist

2. Thickness : Appendix 1 — 0.8mm (C1005)
— 1.6mm (C1608,C2012,C3216,C3225,C4532,C5750,C7563)
: Appendix 2 — 1.6mm

# 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 | | Conductive resin (Filler : Ag) | |
| 5 | | Nickel (Ni) | |
| 6 | | Tin (Sn) | |

# 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 14.TAPE PACKAGING SPECIFICATION.
*C1005[CC0402] type is applicable to tape packaging only.

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

*Composition of Inspection No.

Example F 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 | F | 9 | A | 2 | 3 | A | 8 | 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.

# 11. RECOMMENDATION

As for C3225 [CC1210] and larger, 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.

# 12. SOLDERING CONDITION

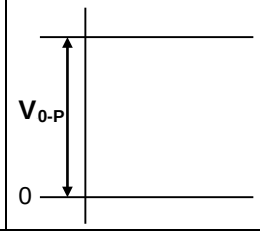
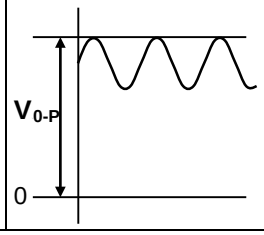
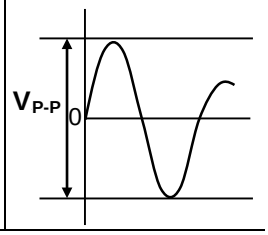
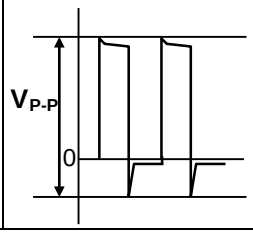
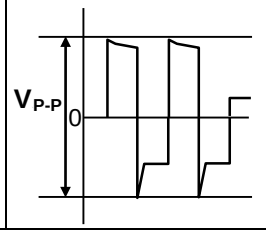
As for C1005 [CC0402], C3225 [CC1210] and larger, reflow soldering only.

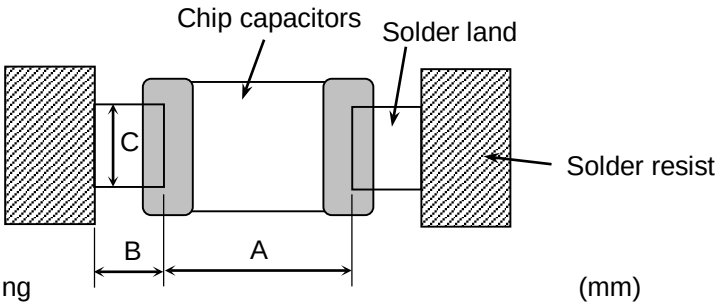
# 13. CAUTION FOR SOFT TERMINATION PRODUCTS

This product contains Ag (Silver) at the middle layer of terminal electrodes.

To avoid electromigration of Ag under high temperature and humidity, and failures caused by corrosive gas, chip capacitors on P.C. boards should be protected by moisture proof-sealing.

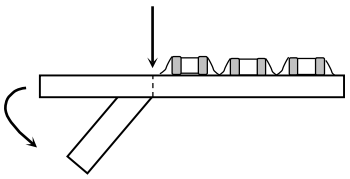
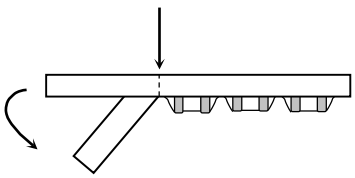
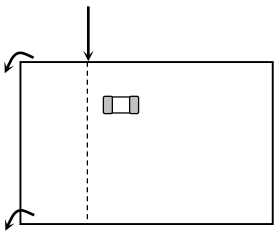
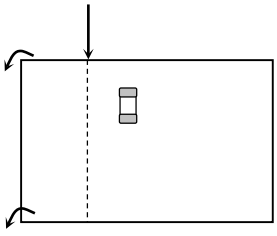
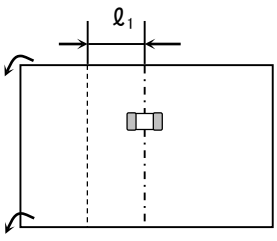
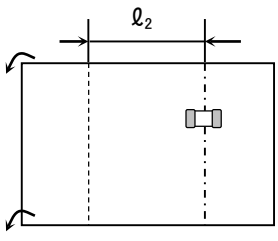
# 14. CAUTION

<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<br>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.<br>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.<br>3) Avoid storing in sun light and falling of dew.<br>4) Do not use capacitors under high humidity and high and low atmospheric pressure which may affect capacitors reliability.<br>5) Capacitors should be tested for the solderability when they are stored for long time.<br>1-2. Handling in transportation<br>In case of the transportation of the capacitors, the performance of the capacitors may be deteriorated depending on the transportation condition.<br>(Refer to JEITA RCR-2335C 9.2 Handling in transportation)</td></tr>
<tr><td>2</td><td>Circuit design<br>⚠ Caution</td><td>2-1. Operating temperature<br>Operating temperature should be followed strictly within this specification, especially be careful with maximum temperature.<br>1) Do not use capacitors above the maximum allowable operating temperature.<br>2) Surface temperature including self heating should be below maximum operating temperature.<br>(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)<br>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.<br>2-2. Operating voltage<br>1) Operating voltage across the terminals should be below the rated voltage.<br>When AC and DC are super imposed, $V_{0\text{-}P}$ must be below the rated voltage.<br>— (1) and (2)<br>AC or pulse with overshooting, $V_{P\text{-}P}$ must be below the rated voltage.<br>— (3), (4) and (5)<br>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.<br><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><br><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>

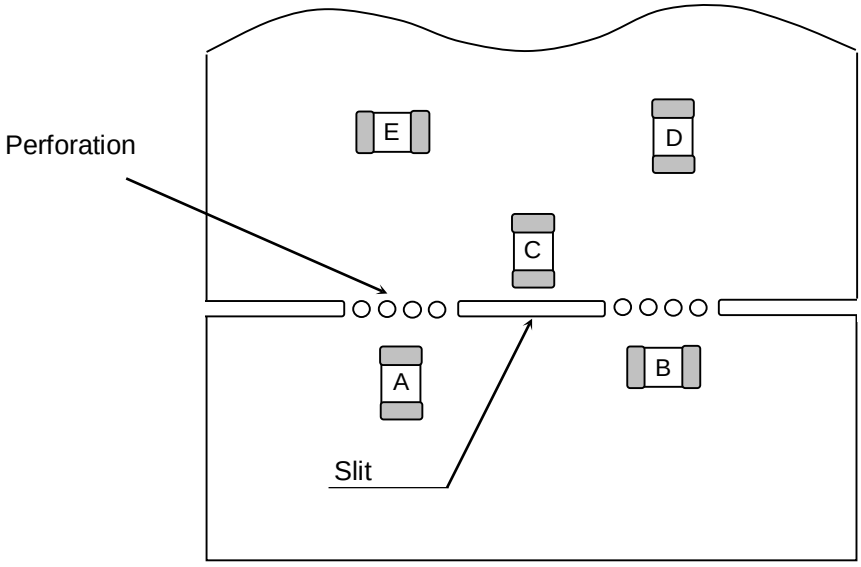
<table>
<tr><th>No.</th><th>Process</th><th>Condition</th></tr>
<tr><td>2</td><td>Circuit design<br>⚠ Caution</td><td>2) Even below the rated voltage, if repetitive high frequency AC or pulse is applied, the reliability of the capacitors may be reduced.<br><br>3) The effective capacitance will vary depending on applied DC and AC voltages. The capacitors should be selected and designed in taking the voltages into consideration.<br><br>2-3. Frequency<br>When the capacitors (Class 2) are used in AC and/or pulse voltages, the capacitors may vibrate themselves and generate audible sound.</td></tr>
<tr><td>3</td><td>Designing<br>P.C.board</td><td>The amount of solder at the terminations has a direct effect on the reliability of the capacitors.<br>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.<br><br>2) Avoid using common solder land for multiple terminations and provide individual solder land for each terminations.<br><br>3) Size and recommended land dimensions.<br><br> 

Flow soldering (mm)
<table>
<tr><th>Type / Symbol</th><th>C1608 [CC0603]</th><th>C2012 [CC0805]</th><th>C3216 [CC1206]</th></tr>
<tr><td>A</td><td>0.7 ~ 1.0</td><td>1.0 ~ 1.3</td><td>2.1 ~ 2.5</td></tr>
<tr><td>B</td><td>0.8 ~ 1.0</td><td>1.0 ~ 1.2</td><td>1.1 ~ 1.3</td></tr>
<tr><td>C</td><td>0.6 ~ 0.8</td><td>0.8 ~ 1.1</td><td>1.0 ~ 1.3</td></tr>
</table>
Reflow soldering (mm)
<table>
<tr><th>Type / Symbol</th><th>C1005 [CC0402]</th><th>C1608 [CC0603]</th><th>C2012 [CC0805]</th><th>C3216 [CC1206]</th></tr>
<tr><td>A</td><td>0.3 ~ 0.5</td><td>0.6 ~ 0.8</td><td>0.9 ~ 1.2</td><td>2.0 ~ 2.4</td></tr>
<tr><td>B</td><td>0.35 ~ 0.45</td><td>0.6 ~ 0.8</td><td>0.7 ~ 0.9</td><td>1.0 ~ 1.2</td></tr>
<tr><td>C</td><td>0.4 ~ 0.6</td><td>0.6 ~ 0.8</td><td>0.9 ~ 1.2</td><td>1.1 ~ 1.6</td></tr>
</table>
<table>
<tr><th>Type / Symbol</th><th>C3225 [CC1210]</th><th>C4532 [CC1812]</th><th>C5750 [CC2220]</th><th>C7563 [CC3025]</th></tr>
<tr><td>A</td><td>2.0 ~ 2.4</td><td>3.1 ~ 3.7</td><td>4.1 ~ 4.8</td><td>5.2 ~ 5.8</td></tr>
<tr><td>B</td><td>1.0 ~ 1.2</td><td>1.2 ~ 1.4</td><td>1.2 ~ 1.4</td><td>1.7 ~ 1.9</td></tr>
<tr><td>C</td><td>1.9 ~ 2.5</td><td>2.4 ~ 3.2</td><td>4.0 ~ 5.0</td><td>6.4 ~ 7.4</td></tr>
</table></td></tr>
</table>

| No. | Process | Condition |
|---|---|---|
| 3 | Designing P.C.board | 4) Recommended chip capacitors layout is as following. |

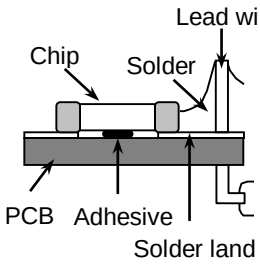
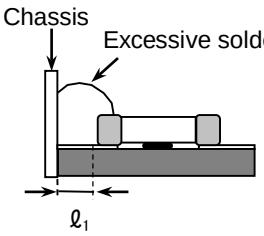
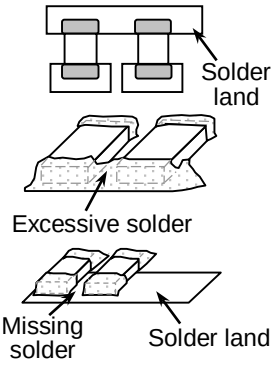
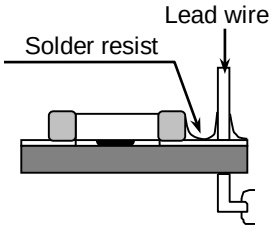
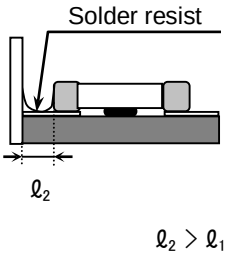
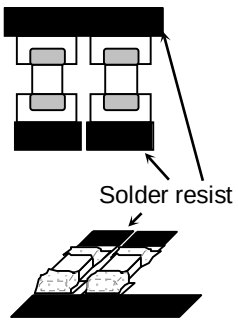
| | Disadvantage against bending stress | Advantage against bending stress |
|---|---|---|
| Mounting face | Perforation or slit<br>  <br>Break P.C.board with mounted side up. | Perforation or slit<br>  <br>Break P.C.board with mounted side down. |
| Chip arrangement (Direction) | Mount perpendicularly to perforation or slit<br>Perforation or slit<br>  | Mount in parallel with perforation or slit<br>Perforation or slit<br>  |
| Distance from slit | Closer to slit is higher stress<br>  <br>( $\ell_1 < \ell_2$ ) | Away from slit is less stress<br>  <br>( $\ell_1 < \ell_2$ ) |

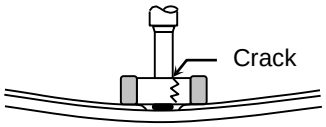
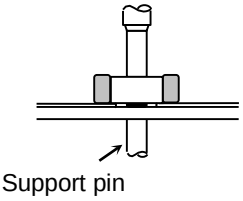
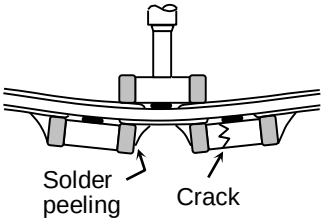
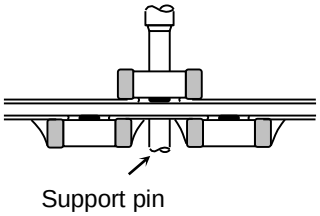
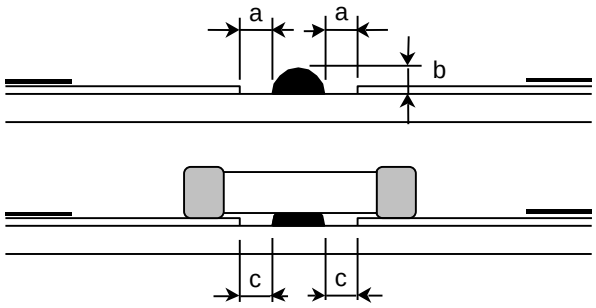
| No. | Process | Condition |
|---|---|---|
| 3 | Designing P.C.board | 5) Mechanical stress varies according to location of chip capacitors on the P.C.board. |




The stress in capacitors is in the following order.
A > B = C > D > E

6) Layout recommendation

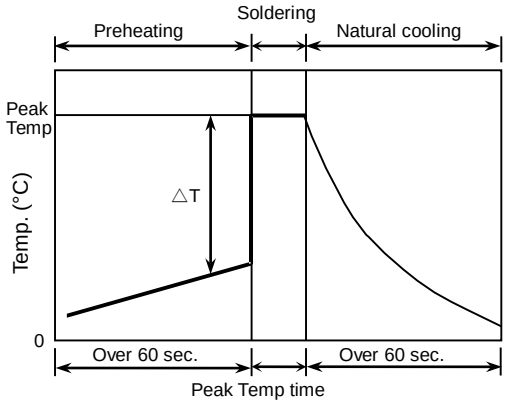
| Example | Use of common solder land | Soldering with chassis | Use of common solder land with other SMD |
|---|---|---|---|
| Need to avoid |   |   |   |
| Recommen-dation |   |   |   |

<table>
<tr><th>No.</th><th>Process</th><th>Condition</th></tr>
<tr><td>4</td><td>Mounting</td><td>
4-1. Stress from mounting head<br>
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.<br><br>
1) Adjust the bottom dead center of the mounting head to reach on the P.C.board surface and not press it.<br><br>
2) Adjust the mounting head pressure to be 1 to 3N of static weight.<br><br>
3) To minimize the impact energy from mounting head, it is important to provide support from the bottom side of the P.C.board.<br>
See following examples.<br>
<table>
<tr><th></th><th>Not recommended</th><th>Recommended</th></tr>
<tr><td>Single-sided mounting</td><td> 
</td><td> 
</td></tr>
<tr><td>Double-sides mounting</td><td> 
</td><td> 
</td></tr>
</table>
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.<br><br>
4-2. Amount of adhesive<br>


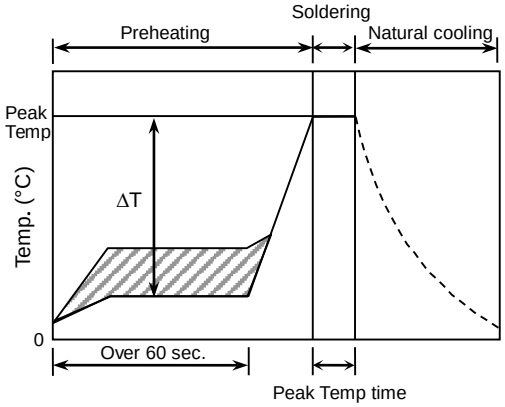
<br>
Example : C2012 [CC0805], C3216 [CC1206]
<table>
<tr><td>a</td><td>0.2mm min.</td></tr>
<tr><td>b</td><td>70 ~ 100μm</td></tr>
<tr><td>c</td><td>Do not touch the solder land</td></tr>
</table>
</td></tr>
</table>

| No. | Process | Condition |
|---|---|---|
| 5 | Soldering | 5-1. Flux selection<br>Flux can seriously affect the performance of capacitors. Confirm the following to select the appropriate flux.<br><br>1) It is recommended to use a mildly activated rosin flux (less than 0.1wt% chlorine). Strong flux is not recommended.<br><br>2) Excessive flux must be avoided. Please provide proper amount of flux.<br><br>3) When water-soluble flux is used, enough washing is necessary.<br><br>5-2. Recommended soldering profile by various methods |

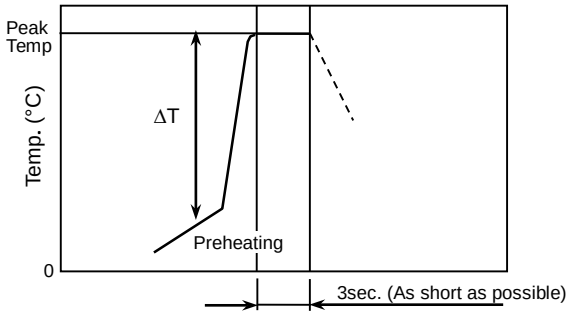
Wave soldering




Reflow soldering




Manual soldering
(Solder iron)




APPLICATION

As for C1608 [CC0603], C2012 [CC0805] and C3216 [CC1206], applied to wave soldering and reflow soldering.

As for other case sizes, applied only to reflow soldering.

*As for peak temperature of manual soldering, please refer “5-6. Solder repair by solder iron”.

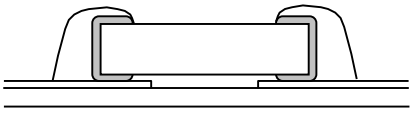
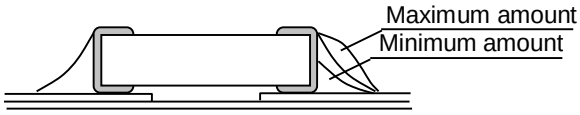
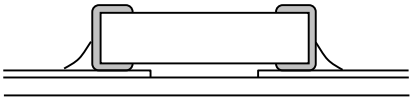
5-3. Recommended soldering peak temp and peak temp duration

| Temp./Duration / Solder | Wave soldering | | Reflow soldering | |
|---|---|---|---|---|
| | Peak temp(°C) | Duration(sec.) | Peak temp(°C) | Duration(sec.) |
| Sn-Pb Solder | 250 max. | 3 max. | 230 max. | 20 max. |
| Lead Free Solder | 260 max. | 5 max. | 260 max. | 10 max. |

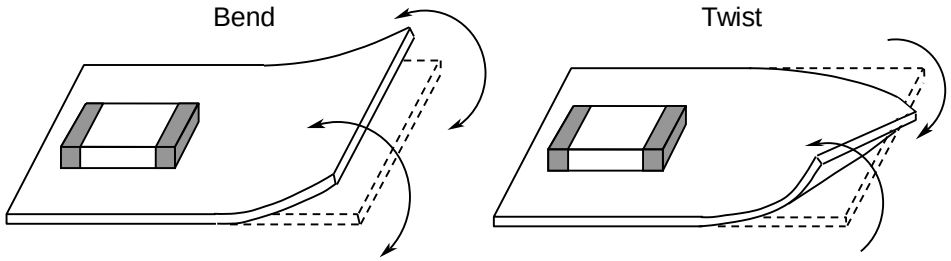
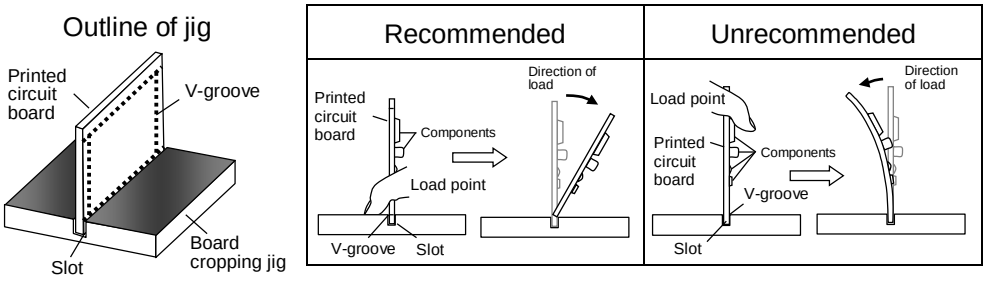
Recommended solder compositions

Lead Free Solder : Sn-3.0Ag-0.5Cu

Sn-Pb Solder : Sn-37Pb

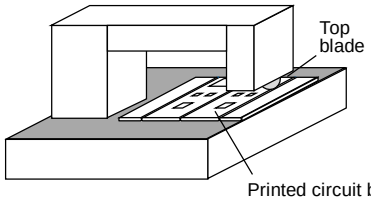
<table>
<tr><th>No.</th><th>Process</th><th>Condition</th></tr>
<tr><td>5</td><td>Soldering</td><td>
5-4. Avoiding thermal shock<br>
1) Preheating condition
<table>
<tr><th>Soldering</th><th>Type</th><th>Temp. (°C)</th></tr>
<tr><td>Wave soldering</td><td>C1608[CC0603], C2012[CC0805], C3216[CC1206]</td><td>ΔT ≦ 150</td></tr>
<tr><td rowspan="2">Reflow soldering</td><td>C1005[CC0402], C1608[CC0603], C2012[CC0805], C3216[CC1206]</td><td>ΔT ≦ 150</td></tr>
<tr><td>C3225[CC1210], C4532[CC1812], C5750[CC2220], C7563[CC3025]</td><td>ΔT ≦ 130</td></tr>
<tr><td rowspan="2">Manual soldering</td><td>C1005[CC0402], C1608[CC0603], C2012[CC0805], C3216[CC1206]</td><td>ΔT ≦ 150</td></tr>
<tr><td>C3225[CC1210], C4532[CC1812], C5750[CC2220], C7563[CC3025]</td><td>ΔT ≦ 130</td></tr>
</table>
2) Cooling condition<br>
Natural cooling using air is recommended. If the chips are dipped into a solvent for cleaning, the temperature difference (ΔT) must be less than 100°C.<br><br>
5-5. Amount of solder<br>
Excessive solder will induce higher tensile force in chip capacitors when temperature changes and it may result in chip cracking. In sufficient solder may detach the capacitors from the P.C.board.
<table>
<tr><td>Excessive solder</td><td>  </td><td>Higher tensile force in chip capacitors to cause crack</td></tr>
<tr><td>Adequate</td><td> 
</td><td></td></tr>
<tr><td>Insufficient solder</td><td>  </td><td>Low robustness may cause contact failure or chip capacitors come off the P.C.board.</td></tr>
</table>
5-6. Solder repair by solder iron<br>
1) Selection of the soldering iron tip<br>
Tip temperature of solder iron varies by its type, P.C.board material and solder land size. The higher the tip temperature, the quicker the operation.<br>
However, heat shock may cause a crack in the chip capacitors.<br>
Please make sure the tip temp. before soldering and keep the peak temp and time in accordance with following recommended condition.<br><br>
Recommended solder iron condition (Sn-Pb Solder and Lead Free Solder)
<table>
<tr><th>Type</th><th>Temp. (°C)</th><th>Duration (sec.)</th><th>Wattage (W)</th><th>Shape (mm)</th></tr>
<tr><td>C1005[CC0402]<br>C1608[CC0603]<br>C2012[CC0805]<br>C3216[CC1206]</td><td>350 max.</td><td rowspan="2">3 max.</td><td rowspan="2">20 max.</td><td rowspan="2">Ø 3.0 max.</td></tr>
<tr><td>C3225[CC1210]<br>C4532[CC1812]<br>C5750[CC2220]<br>C7563[CC3025]</td><td>280 max.</td></tr>
</table>
* Please preheat the chip capacitors with the condition in 5-4 to avoid the thermal shock.
</td></tr>
</table>

| No. | Process | Condition |
|---|---|---|
| 5 | Soldering | 2) Direct contact of the soldering iron with ceramic dielectric of chip capacitors may cause crack. Do not touch the ceramic dielectric and the terminations by solder iron.<br><br>3) It is not recommended to reuse dismounted capacitors.<br><br>5-7. Sn-Zn solder<br>Sn-Zn solder affects product reliability.<br>Please contact TDK in advance when utilize Sn-Zn solder.<br><br>5-8. Countermeasure for tombstone<br>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.<br>(Refer to JEITA RCR-2335C Annex A (Informative) Recommendations to prevent the tombstone phenomenon) |
| 6 | Cleaning | 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.<br><br>2) If cleaning condition is not suitable, it may damage the chip capacitors.<br><br>2)-1. Insufficient washing<br>(1) Terminal electrodes may corrode by Halogen in the flux.<br><br>(2) Halogen in the flux may adhere on the surface of capacitors, and lower the insulation resistance.<br><br>(3) Water soluble flux has higher tendency to have above mentioned problems (1) and (2).<br><br>2)-2. Excessive washing<br>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.<br><br>Power : 20 W/ℓ max.<br>Frequency : 40 kHz max.<br>Washing time : 5 minutes max.<br><br>2)-3. If the cleaning fluid is contaminated, density of Halogen increases, and it may bring the same result as insufficient cleaning. |

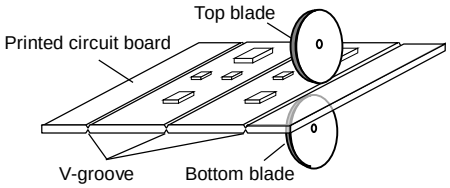
| No. | Process | Condition |
|---|---|---|
| 7 | Coating and molding of the P.C.board | 1) This product contains Ag (Silver) at the middle layer of terminal electrodes. To avoid electromigration of Ag under high temperature and humidity, and failures caused by corrosive gas, chip capacitors on P.C. boards should be protected by moisture proof-sealing.<br>2) When the P.C.board is coated, please verify the quality influence on the product.<br>3) Please verify carefully that there is no harmful decomposing or reaction gas emission during curing which may damage the chip capacitors.<br>4) Please verify the curing temperature. |
| 8 | Handling after chip mounted<br>⚠ Caution | 1) Please pay attention not to bend or distort the P.C.board after soldering in handling otherwise the chip capacitors may crack.<br>  <br>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.<br>(1)Example of a board cropping jig<br>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.<br>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.<br>  |

| No. | Process | Condition |
|---|---|---|
| 8 | Handling after chip mounted<br>⚠ Caution | (2)Example of a board cropping machine<br>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.<br>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. |

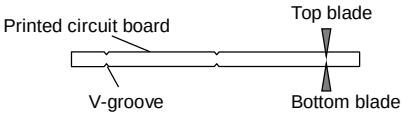
Outline of machine




Principle of operation



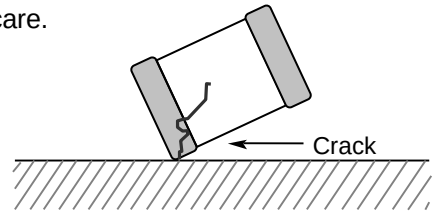
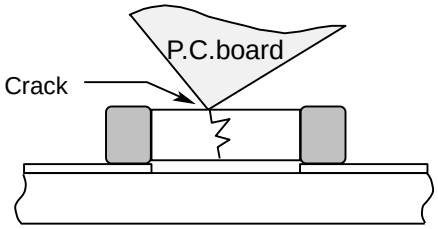

Cross-section diagram




| Recommended | Unrecommended | | |
|---|---|---|---|
| | Top-bottom misalignment | Left-right misalignment | Front-rear misalignment |
| Top blade<br>Board<br>Bottom blade | Top blade<br>Bottom blade | Top blade<br>Bottom blade | Top blade<br>Bottom blade |

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.

| Item | Not recommended | Recommended |
|---|---|---|
| Board bending | Termination peeling<br>Check pin | Support pin<br>Check pin |

| No. | Process | Condition |
|---|---|---|
| 9 | 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.<br>  <br><br>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.<br>  <br> |
| 10 | Capacitance aging | The capacitors (Class 2) have aging in the capacitance. They may not be used in precision time constant circuit. In case of the time constant circuit, the evaluation should be done well. |
| 11 | Estimated life and estimated failure rate of capacitors | As per the estimated life and the estimated failure rate depend on the temperature and the voltage. This can be calculated by the equation described in JEITA RCR-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)<br>The failure rate can be decreased by reducing the temperature and the voltage but they will not be guaranteed. |

| No. | Process | Condition |
|---|---|---|
| 12 | Caution during operation of equipment | 1) A capacitor shall not be touched directly with bare hands during operation in order to avoid electric shock.<br>Electric energy held by the capacitor may be discharged through the human body when touched with a bare hand.<br>Even when the equipment is off, a capacitor may stay charged. The capacitor should be handled after being completely discharged using a resistor.<br><br>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<br><br>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.<br>(1) Environment where a capacitor is spattered with water or oil<br>(2) Environment where a capacitor is exposed to direct sunlight<br>(3) Environment where a capacitor is exposed to Ozone, ultraviolet rays or radiation<br>(4) Environment where a capacitor exposed to corrosive gas(e.g. hydrogen sulfide, sulfur dioxide, chlorine. ammonia gas etc.)<br>(5) Environment where a capacitor exposed to vibration or mechanical shock exceeding the specified limits.<br>(6) Atmosphere change with causes condensation |
| 13 | Others<br>⚠ 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) and automotive application under a normal operation and use condition.<br><br>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.<br><br>(1) Aerospace/Aviation equipment<br>(2) Transportation equipment (electric trains, ships, etc. except automotive application)<br>(3) Medical equipment (Excepting Pharmaceutical Affairs Law classification Class1, 2)<br>(4) Power-generation control equipment<br>(5) Atomic energy-related equipment<br>(6) Seabed equipment<br>(7) Transportation control equipment<br>(8) Public information-processing equipment<br>(9) Military equipment<br>(10) Electric heating apparatus, burning equipment<br>(11) Disaster prevention/crime prevention equipment<br>(12) Safety equipment<br>(13) Other applications that are not considered general-purpose applications<br><br>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. |

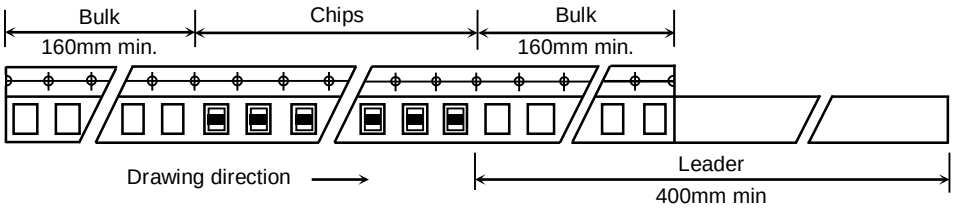
# 15. TAPE PACKAGING SPECIFICATION

## 1. CONSTRUCTION AND DIMENSION OF TAPING

### 1-1. Dimensions of carrier tape

Dimensions of paper tape shall be according to Appendix 3, 4.
Dimensions of plastic tape shall be according to Appendix 5, 6.

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

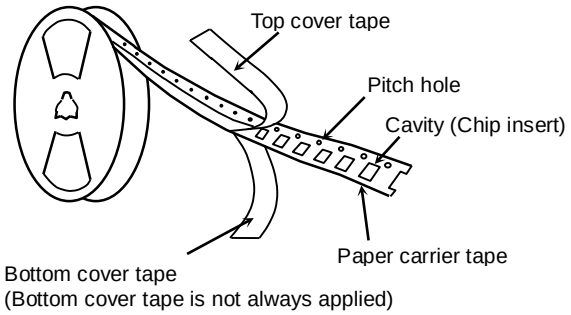



### 1-3. Dimensions of reel

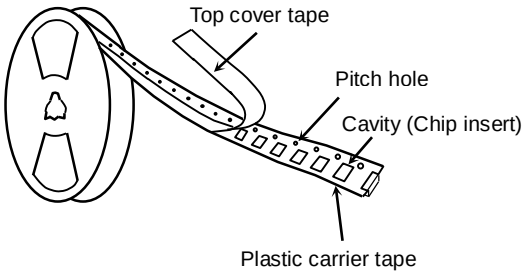
Dimensions of Ø178 reel shall be according to Appendix 7, 8.
Dimensions of Ø330 reel shall be according to Appendix 9, 10.

### 1-4. Structure of taping

<Paper>




<Plastic>




## 2. CHIP QUANTITY

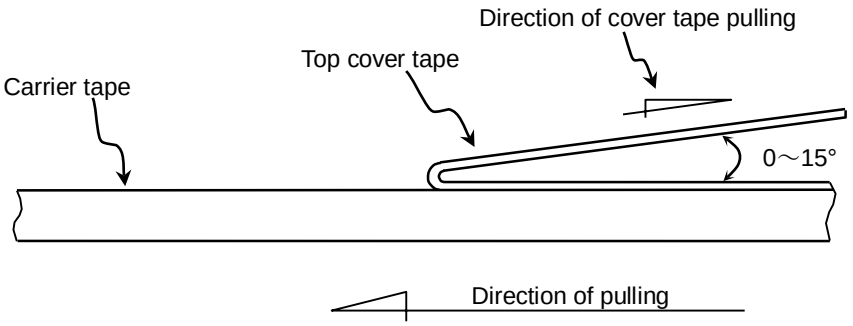
Please refer to detail page on TDK Web.

## 3. PERFORMANCE SPECIFICATIONS

3-1. Fixing peeling strength (top tape)

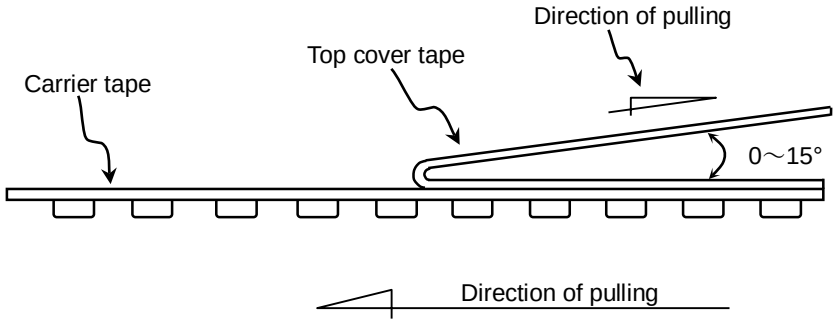
0.05N < Peeling strength < 0.7N

〈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.

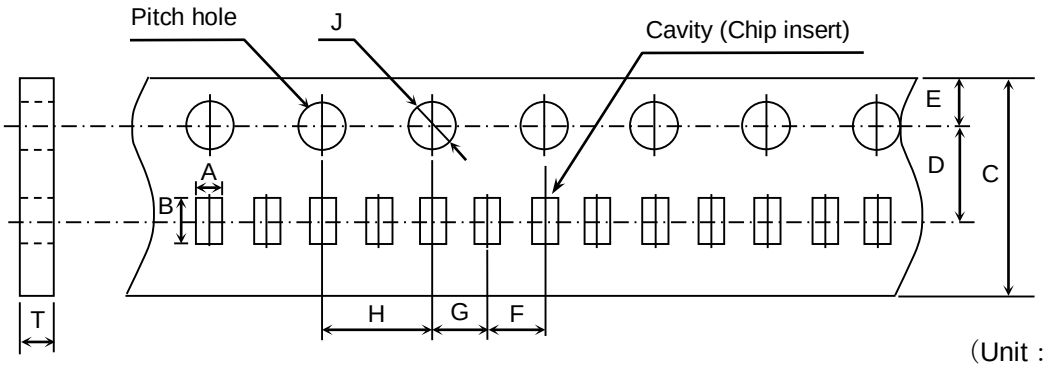
3-3. The missing of components shall be less than 0.1%

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

3-5. 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

Paper Tape




(Unit : mm)

| Type \ Symbol | A | B | C | D | E | F |
|---|---|---|---|---|---|---|
| C1005 [CC0402] | ( 0.65 ) | ( 1.15 ) | 8.00 ± 0.30 | 3.50 ± 0.05 | 1.75 ± 0.10 | 2.00 ± 0.05 |

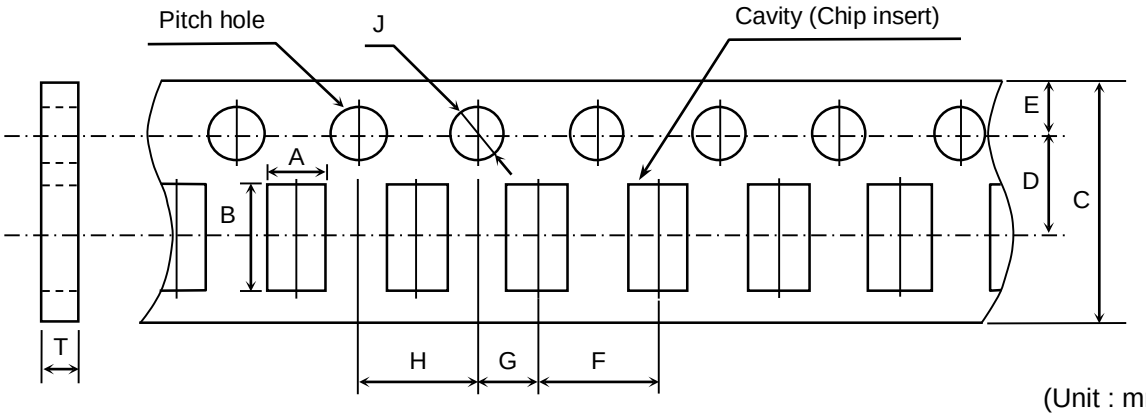
| Type \ Symbol | G | H | J | T |
|---|---|---|---|---|
| C1005 [CC0402] | 2.00 ± 0.05 | 4.00 ± 0.10 | $\phi 1.50^{+0.10}_{0}$ | 0.60±0.15 |

( ) Reference value.

# Appendix 4

Paper Tape

(Applied to products having a thickness of less than 1.0mm)




(Unit : mm)

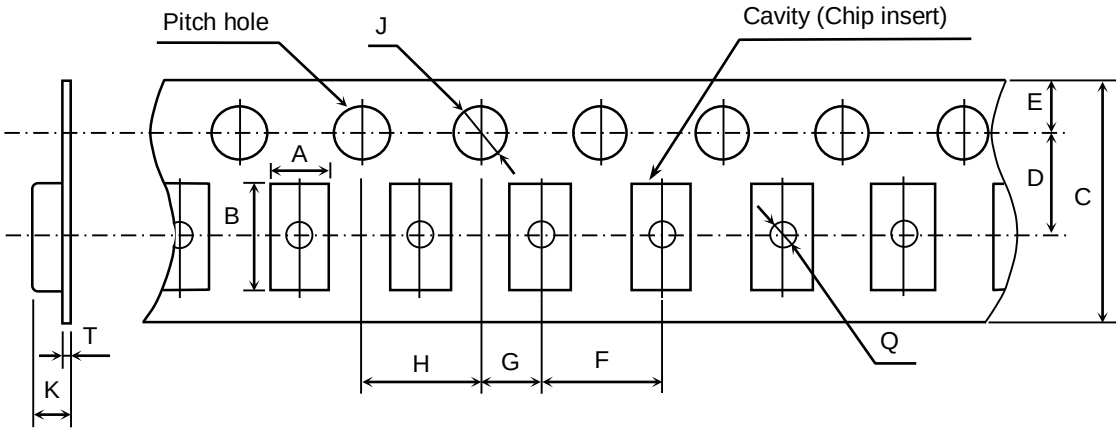
| Type \ Symbol | A | B | C | D | E | F |
|---|---|---|---|---|---|---|
| C1608 [CC0603] | ( 1.10 ) | ( 1.90 ) | 8.00 ± 0.30 | 3.50 ± 0.05 | 1.75 ± 0.10 | 4.00 ± 0.10 |
| C2012 [CC0805] | ( 1.50 ) | ( 2.30 ) | | | | |
| C3216 [CC1206] | ( 1.90 ) | ( 3.50 ) | | | | |

| Type \ Symbol | G | H | J | T |
|---|---|---|---|---|
| C1608 [CC0603] | 2.00 ± 0.05 | 4.00 ± 0.10 | $\phi 1.50^{+0.10}_{0}$ | 1.20 max. |
| C2012 [CC0805] | | | | |
| C3216 [CC1206] | | | | |

( ) Reference value.

# Appendix 5

Plastic Tape




(Unit : mm)

| Symbol / Type | A | B | C | D | E | F |
|---|---|---|---|---|---|---|
| C2012 [CC0805] | ( 1.50 ) | ( 2.30 ) | 8.00 ± 0.30 | 3.50 ± 0.05 | 1.75 ± 0.10 | 4.00 ± 0.10 |
| C3216 [CC1206] | ( 1.90 ) | ( 3.50 ) | | | | |
| C3225 [CC1210] | ( 2.90 ) | ( 3.60 ) | 8.00 ± 0.30 or 12.00 ± 0.30 | 3.50 ± 0.05 or 5.50 ± 0.05 | | |

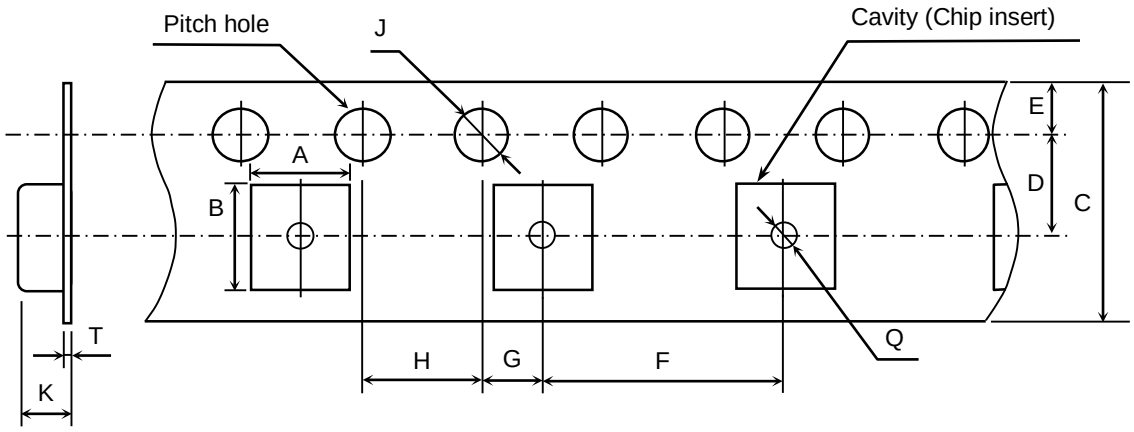
| Symbol / Type | G | H | J | K | T | Q |
|---|---|---|---|---|---|---|
| C2012 [CC0805] | 2.00 ± 0.05 | 4.00 ± 0.10 | $\phi 1.50^{+0.10}_{0}$ | 2.50 max. | 0.60 max. | Ø 0.50 min. |
| C3216 [CC1206] | | | | | | |
| C3225 [CC1210] | | | | 3.40 max. | | |

( ) Reference value.

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

# Appendix 6

Plastic Tape




(Unit : mm)

| Symbol / Type | A | B | C | D | E | F |
|---|---|---|---|---|---|---|
| C4532 [CC1812] | ( 3.60 ) | ( 4.90 ) | 12.00 ± 0.30 | 5.50 ± 0.05 | 1.75 ± 0.10 | 8.00 ± 0.10 |
| C5750 [CC2220] | ( 5.40 ) | ( 6.10 ) | | | | |
| C7563 [CC3025] | ( 6.90 ) | ( 8.00 ) | 16.00 ± 0.30 | 7.50 ± 0.05 | | 12.00 ± 0.10 |

| Symbol / Type | G | H | J | K | T | Q |
|---|---|---|---|---|---|---|
| C4532 [CC1812] | 2.00 ± 0.05 | 4.00 ± 0.10 | Ø1.50 $^{+0.10}_{0}$ | 6.50 max. | 0.60 max. | Ø 1.50 min. |
| C5750 [CC2220] | | | | | | |
| C7563 [CC3025] | 2.00 ± 0.10 | | | 5.00 max. | | — |

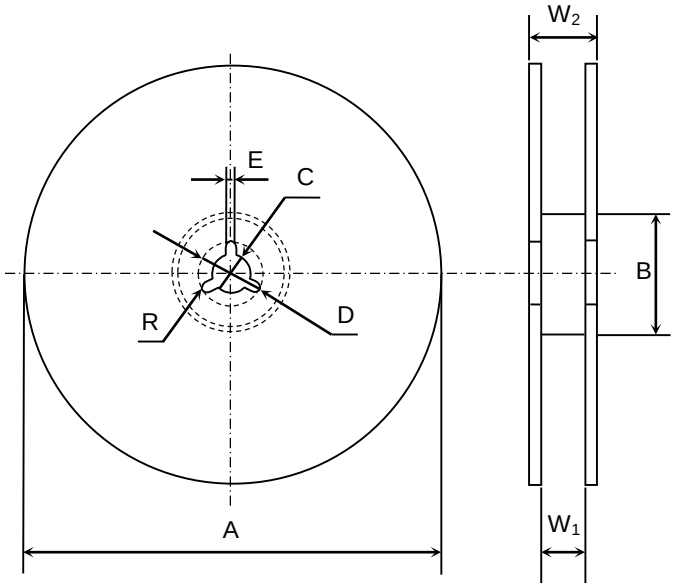
( ) Reference value.

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

# Appendix 7

Dimensions of reel (Material : Polystyrene)

C1005, C1608, C2012, C3216, C3225(8mm width taping type)




(Unit : mm)

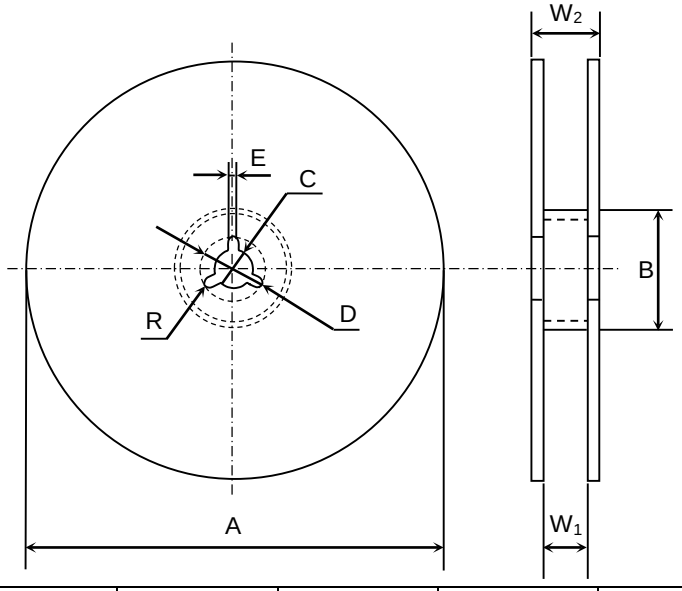
| Symbol | A | B | C | D | E | $W_1$ |
|---|---|---|---|---|---|---|
| Dimension | Ø178 ± 2.0 | Ø60 ± 2.0 | Ø13 ± 0.5 | Ø21 ± 0.8 | 2.0 ± 0.5 | 9.0 ± 0.3 |

| Symbol | $W_2$ | R |
|---|---|---|
| Dimension | 13.0 ± 1.4 | 1.0 |

# Appendix 8

Dimensions of reel (Material : Polystyrene)

C3225(12mm width taping type), C4532, C5750



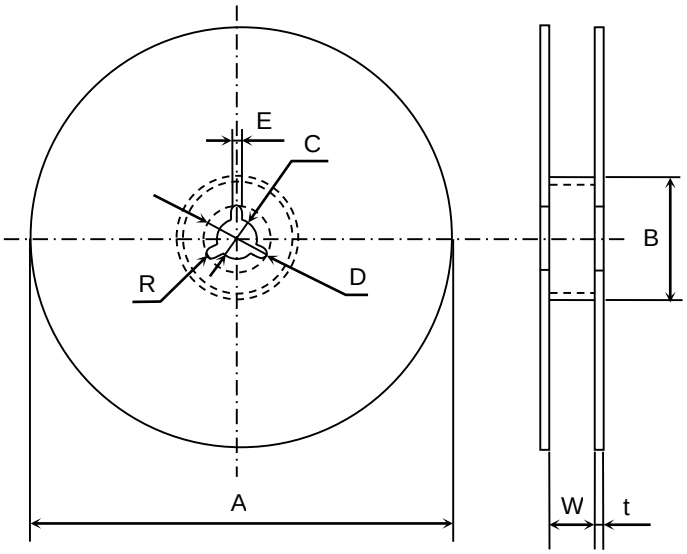

(Unit : mm)

| 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 9

Dimensions of reel ( Material : Polystyrene )
C1005, C1608, C2012, C3216, C3225(8mm width taping type)



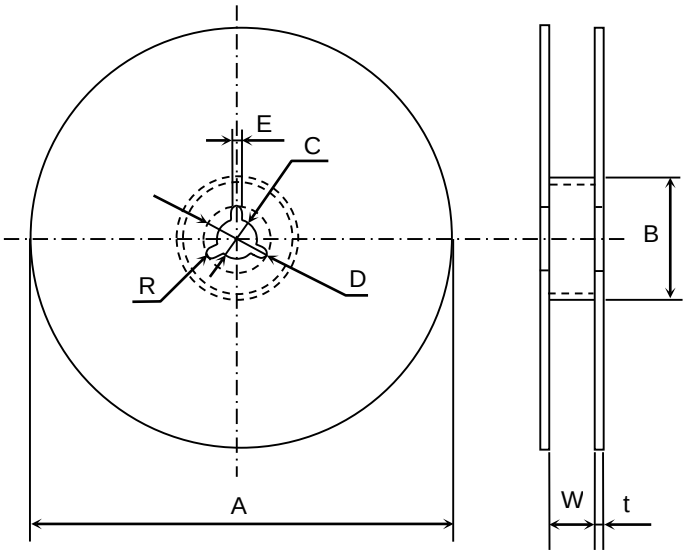

(Unit : mm)

| 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 10

Dimensions of reel ( Material : Polystyrene )
C3225(12mm width taping type), C4532, C5750, C7563




(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<br>*17.5 ± 1.5 |

| Symbol | t | R |
|---|---|---|
| Dimension | 2.0 ± 0.5 | 1.0 |

* Applied to C7563.