TDK

MULTILAYER CERAMIC CHIP CAPACITORS

C Series
Open Mode Design

Type: C2012 [EIA CC0805]
C3216 [EIA CC1206]
C3225 [EIA CC1210]
C4532 [EIA CC1812]
C5750 [EIA CC2220]

Issue date: January 2011

TDK MLCC
US Catalog

Version A11

REMINDERS

Please read before using this product

SAFETY REMINDERS

REMINDERS

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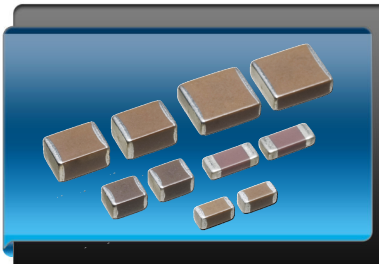


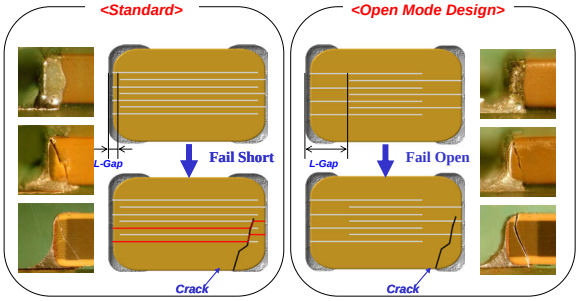
C Series

Open Mode Design

Type: C2012, C3216, C3225, C4532, C5750

Features

- Increase resistance to mechanical bending, temperature cycle, vibration, and electrical stresses
- Available in X7R and X8R dielectrics
- When a chip capacitor is cracked by mechanical stress such as board bending, open mode construction helps user reduce the risk of short circuits
- The Open Mode design defines that the L-Gap length shall be wider than the terminal band width

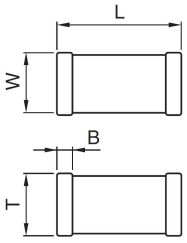


- The Open Mode concept does not guaranteed MLCC will always fail open. This design is intended to reduce the risk of the MLCC failing short. All MLCC caution guidelines apply.

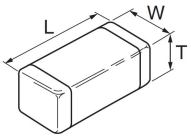
Applications

- Automotive and other high stress applications
- Battery line circuits with high board flex stress

Shape & Dimensions



Dimensions in mm



L	Body Length
W	Body Width
T	Body Height
B	Terminal Width

Part Number Construction

C 3216 X7R 2A 105 K T 5XXX

Series Name

Dimensions L x W (mm)

Case Code	Length	Width
C2012	2.00 ± 0.20	1.25 ± 0.20
C3216	3.20 ± 0.20	1.60 ± 0.20
C3225	3.20 ± 0.40	2.50 ± 0.30
C4532	4.50 ± 0.40	3.20 ± 0.40
C5750	5.70 ± 0.40	5.00 ± 0.40

Temperature Characteristic

Temperature Characteristics	Capacitance Change	Temperature Range
X7R	±15%	-55 to +125ºC
X8R	±15%	-55 to +150ºC

Rated Voltage (DC)

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

Internal Codes

Symbol	Design
5	Open Mode

Packaging Style

Packaging Code	Style
T	Tape and Reel

Capacitance Tolerance

Tolerance Code	Tolerance
K	± 10%
M	± 20%

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.

Capacitance Code	Capacitance
0R5	0.5pF
010	1pF
102	1,000pF (1nF)
105	1,000,000pF (1µF)

• All specifications are subject to change without notice. Please read the precautions before using the product.

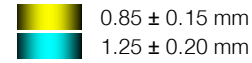
Capacitance Range Chart

C2012 [EIA CC0805]

Capacitance Range Chart

Temperature Characteristics: X7R, (± 15%), X8R (± 15%)
Rated Voltage: 250V (2E), 100V (2A), 50V (1H)

Capacitance (pF)	Cap Code	Tolerance	X7R			X8R
			2E (250V)	2A (100V)	1H (50V)	1H (50V)
1,000	102	K: ± 10%				
1,500	152					
2,200	222					
3,300	332					
4,700	472					
6,800	682					
10,000	103					
15,000	153					
22,000	223					
33,000	333					
47,000	473					
68,000	683					
100,000	104					



Capacitance Range Table

Class 2 (Temperature Stable)

Temperature Characteristics: X7R (± 15%), X8R (± 15%)

TDK Part Number (Ordering Code)	Temperature Characteristics	Rated Voltage	Capacitance (pF)	Capacitance Tolerance	Thickness (mm)
C2012X7R1H104KT5	X7R	50V	100,000	± 10%	1.25 ± 0.20
C2012X7R2A102KT5	X7R	100V	1,000	± 10%	0.85 ± 0.15
C2012X7R2A152KT5	X7R	100V	1,500	± 10%	0.85 ± 0.15
C2012X7R2A222KT5	X7R	100V	2,200	± 10%	0.85 ± 0.15
C2012X7R2A332KT5	X7R	100V	3,300	± 10%	0.85 ± 0.15
C2012X7R2A472KT5	X7R	100V	4,700	± 10%	0.85 ± 0.15
C2012X7R2A682KT5	X7R	100V	6,800	± 10%	0.85 ± 0.15
C2012X7R2A103KT5	X7R	100V	10,000	± 10%	0.85 ± 0.15
C2012X7R2A153KT5	X7R	100V	15,000	± 10%	1.25 ± 0.20
C2012X7R2A223KT5	X7R	100V	22,000	± 10%	1.25 ± 0.20
C2012X7R2E102KT5	X7R	250V	1,000	± 10%	0.85 ± 0.15
C2012X7R2E152KT5	X7R	250V	1,500	± 10%	0.85 ± 0.15
C2012X7R2E222KT5	X7R	250V	2,200	± 10%	0.85 ± 0.15
C2012X7R2E332KT5	X7R	250V	3,300	± 10%	0.85 ± 0.15
C2012X7R2E472KT5	X7R	250V	4,700	± 10%	0.85 ± 0.15
C2012X7R2E682KT5	X7R	250V	6,800	± 10%	1.25 ± 0.20
C2012X7R2E103KT5	X7R	250V	10,000	± 10%	1.25 ± 0.20
C2012X7R2E153KT5	X7R	250V	15,000	± 10%	1.25 ± 0.20
C2012X8R1H223KT5	X8R	50V	22,000	± 10%	0.85 ± 0.15
C2012X8R1H333KT5	X8R	50V	33,000	± 10%	0.85 ± 0.15
C2012X8R1H473KT5	X8R	50V	47,000	± 10%	1.25 ± 0.20
C2012X8R1H683KT5	X8R	50V	68,000	± 10%	1.25 ± 0.20

Capacitance Range Chart

C3216 [EIA CC1206]

Capacitance Range Chart

Temperature Characteristics: X7R, (± 15%)
Rated Voltage: 630V (2J), 250V (2E), 100V (2A), 16V (1C)

Capacitance (pF)	Cap Code	Tolerance	X7R			
			2J (630V)	2E (250V)	2A (100V)	1C (16V)
1,000	102	K: ± 10%				
1,500	152					
2,200	222					
3,300	332					
4,700	472					
6,800	682					
10,000	103					
15,000	153					
22,000	223					
33,000	333					
47,000	473					
68,000	683					
100,000	104					
150,000	154					
1,000,000	105					
4,700,000	475	M: ± 20%				

Standard Thickness
1.15 ± 0.15 mm
1.30 ± 0.20 mm
1.60 ± 0.20 mm

Capacitance Range Table

Class 2 (Temperature Stable)

Temperature Characteristics: X7R (± 15%)

TDK Part Number (Ordering Code)	Temperature Characteristics	Rated Voltage	Capacitance (pF)	Capacitance Tolerance	Thickness (mm)
C3216X7R1C475MT5	X7R	16V	4,700,000	± 20%	1.60 ± 0.20
C3216X7R2A333KT5	X7R	100V	33,000	± 10%	1.15 ± 0.15
C3216X7R2A473KT5	X7R	100V	47,000	± 10%	1.15 ± 0.15
C3216X7R2A683KT5	X7R	100V	68,000	± 10%	1.60 ± 0.20
C3216X7R2A104KT5	X7R	100V	100,000	± 10%	1.60 ± 0.20
C3216X7R2A154KT5	X7R	100V	150,000	± 10%	1.60 ± 0.20
C3216X7R2A105KT5	X7R	100V	1,000,000	± 10%	1.60 ± 0.20
C3216X7R2E153KT5	X7R	250V	15,000	± 10%	1.15 ± 0.15
C3216X7R2E223KT5	X7R	250V	22,000	± 10%	1.15 ± 0.15
C3216X7R2E333KT5	X7R	250V	33,000	± 10%	1.60 ± 0.20
C3216X7R2E473KT5	X7R	250V	47,000	± 10%	1.60 ± 0.20
C3216X7R2E683KT5	X7R	250V	68,000	± 10%	1.60 ± 0.20
C3216X7R2E104KT5	X7R	250V	100,000	± 10%	1.60 ± 0.20
C3216X7R2J102KT5	X7R	630V	1,000	± 10%	1.15 ± 0.15
C3216X7R2J152KT5	X7R	630V	1,500	± 10%	1.15 ± 0.15
C3216X7R2J222KT5	X7R	630V	2,200	± 10%	1.15 ± 0.15
C3216X7R2J332KT5	X7R	630V	3,300	± 10%	1.15 ± 0.15
C3216X7R2J472KT5	X7R	630V	4,700	± 10%	1.15 ± 0.15
C3216X7R2J682KT5	X7R	630V	6,800	± 10%	1.15 ± 0.15
C3216X7R2J103KT5	X7R	630V	10,000	± 10%	1.15 ± 0.15
C3216X7R2J153KT5	X7R	630V	15,000	± 10%	1.30 ± 0.20
C3216X7R2J223KT5	X7R	630V	22,000	± 10%	1.30 ± 0.20
C3216X7R2J333KT5	X7R	630V	33,000	± 10%	1.60 ± 0.20

Capacitance Range Chart

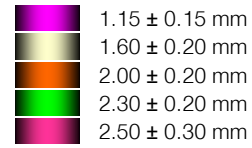
C3225 [EIA CC1210]

Capacitance Range Chart

Temperature Characteristics: X7R, (± 15%)

Rated Voltage: 630V (2J), 250V (2E), 100V (2A), 50V (1H), 25V (1E), 16V (1C)

Capacitance (pF)	Cap Code	Tolerance	X7R					
			2J (630V)	2E (250V)	2A (100V)	1H (50V)	1E (25V)	1C (16V)
47,000	473	K: ± 10%						
68,000	683							
100,000	104							
150,000	154							
220,000	224							
330,000	334							
470,000	474							
680,000	684							
1,000,000	105							
1,500,000	155							
2,200,000	225							
3,300,000	335							
4,700,000	475							



Capacitance Range Table

Class 2 (Temperature Stable)

Temperature Characteristics: X7R (± 15%)

TDK Part Number (Ordering Code)	Temperature Characteristics	Rated Voltage	Capacitance (pF)	Capacitance Tolerance	Thickness (mm)
C3225X7R1C335KT5	X7R	16V	3,300,000	± 10%	2.00 ± 0.20
C3225X7R1C475KT5	X7R	16V	4,700,000	± 10%	2.50 ± 0.30
C3225X7R1E105KT5	X7R	25V	1,000,000	± 10%	1.15 ± 0.15
C3225X7R1E155KT5	X7R	25V	1,500,000	± 10%	1.60 ± 0.20
C3225X7R1E225KT5	X7R	25V	2,200,000	± 10%	2.00 ± 0.20
C3225X7R1H474KT5	X7R	50V	470,000	± 10%	1.60 ± 0.20
C3225X7R1H684KT5	X7R	50V	680,000	± 10%	2.00 ± 0.20
C3225X7R2A334KT5	X7R	100V	330,000	± 10%	2.00 ± 0.20
C3225X7R2A225KT5	X7R	100V	2,200,000	± 10%	2.30 ± 0.20
C3225X7R2E104KT5	X7R	250V	100,000	± 10%	2.00 ± 0.20
C3225X7R2E154KT5	X7R	250V	150,000	± 10%	2.00 ± 0.20
C3225X7R2E224KT5	X7R	250V	220,000	± 10%	2.00 ± 0.20
C3225X7R2J473KT5	X7R	630V	47,000	± 10%	2.00 ± 0.20
C3225X7R2J683KT5	X7R	630V	68,000	± 10%	2.00 ± 0.20

Capacitance Range Chart

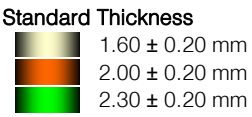
C4532 [EIA CC1812]

Capacitance Range Chart

Temperature Characteristics: X7R, (± 15%)

Rated Voltage: 630V (2J), 250V (2E), 100V (2A), 50V (1H), 25V (1E), 16V (1C)

Capacitance (pF)	Cap Code	Tolerance	X7R					
			2J (630V)	2E (250V)	2A (100V)	1H (50V)	1E (25V)	1C (16V)
68,000	683	K: ± 10%						
100,000	104							
150,000	154							
220,000	224							
330,000	334							
470,000	474							
680,000	684							
1,000,000	105							
1,500,000	155							
3,300,000	335							
4,700,000	475							
6,800,000	685							
10,000,000	106							



Capacitance Range Table

Class 2 (Temperature Stable)

Temperature Characteristics: X7R (± 15%)

TDK Part Number (Ordering Code)	Temperature Characteristics	Rated Voltage	Capacitance (pF)	Capacitance Tolerance	Thickness (mm)
C4532X7R1C685KT5	X7R	16V	6,800,000	± 10%	2.00 ± 0.20
C4532X7R1C106KT5	X7R	16V	10,000,000	± 10%	2.30 ± 0.20
C4532X7R1E335KT5	X7R	25V	3,300,000	± 10%	1.60 ± 0.20
C4532X7R1E475KT5	X7R	25V	4,700,000	± 10%	2.00 ± 0.20
C4532X7R1H105KT5	X7R	50V	1,000,000	± 10%	1.60 ± 0.20
C4532X7R1H155KT5	X7R	50V	1,500,000	± 10%	2.30 ± 0.20
C4532X7R2A684KT5	X7R	100V	680,000	± 10%	2.30 ± 0.20
C4532X7R2E154KT5	X7R	250V	150,000	± 10%	1.60 ± 0.20
C4532X7R2E224KT5	X7R	250V	220,000	± 10%	2.30 ± 0.20
C4532X7R2E334KT5	X7R	250V	330,000	± 10%	2.30 ± 0.20
C4532X7R2E474KT5	X7R	250V	470,000	± 10%	2.30 ± 0.20
C4532X7R2J683KT5	X7R	630V	68,000	± 10%	1.60 ± 0.20
C4532X7R2J104KT5	X7R	630V	100,000	± 10%	2.30 ± 0.20

Capacitance Range Chart

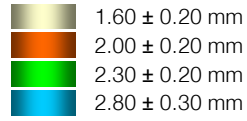
C5750 [EIA CC2220]

Capacitance Range Chart

Temperature Characteristics: X7R, (± 15%)

Rated Voltage: 630V (2J), 250V (2E), 100V (2A), 50V (1H), 25V (1E), 16V (1C)

Capacitance (pF)	Cap Code	Tolerance	X7R					
			2J (630V)	2E (250V)	2A (100V)	1H (50V)	1E (25V)	1C (16V)
150,000	154	K: ± 10%						
220,000	224							
330,000	334							
470,000	474							
680,000	684							
1,000,000	105							
1,500,000	155							
2,200,000	225							
3,300,000	335							
4,700,000	475							
6,800,000	685							
10,000,000	106							
15,000,000	156							
22,000,000	226	M: ± 20%						



Capacitance Range Table

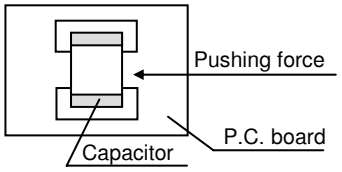
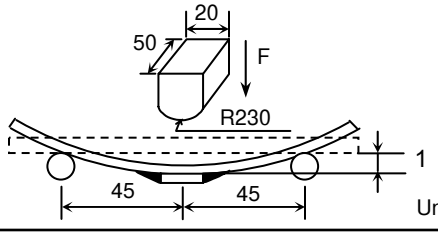
Class 2 (Temperature Stable)

Temperature Characteristics: X7R (± 15%)

TDK Part Number (Ordering Code)	Temperature Characteristics	Rated Voltage	Capacitance (pF)	Capacitance Tolerance	Thickness (mm)
C5750X7R1C226MT5	X7R	16V	22,000,000	± 20%	2.80 ± 0.30
C5750X7R1E685KT5	X7R	25V	6,800,000	± 10%	1.60 ± 0.20
C5750X7R1E106KT5	X7R	25V	10,000,000	± 10%	2.00 ± 0.20
C5750X7R1E156MT5	X7R	25V	15,000,000	± 20%	2.80 ± 0.30
C5750X7R1H225KT5	X7R	50V	2,200,000	± 10%	1.60 ± 0.20
C5750X7R1H335KT5	X7R	50V	3,300,000	± 10%	2.30 ± 0.20
C5750X7R1H475KT5	X7R	50V	4,700,000	± 10%	2.80 ± 0.30
C5750X7R2A684KT5	X7R	100V	680,000	± 10%	1.60 ± 0.20
C5750X7R2A105KT5	X7R	100V	1,000,000	± 10%	2.30 ± 0.20
C5750X7R2A155KT5	X7R	100V	1,500,000	± 10%	2.30 ± 0.20
C5750X7R2E334KT5	X7R	250V	330,000	± 10%	1.60 ± 0.20
C5750X7R2E474KT5	X7R	250V	470,000	± 10%	2.30 ± 0.20
C5750X7R2E684KT5	X7R	250V	680,000	± 10%	2.30 ± 0.20
C5750X7R2E105KT5	X7R	250V	1,000,000	± 10%	2.30 ± 0.20
C5750X7R2J154KT5	X7R	630V	150,000	± 10%	1.60 ± 0.20
C5750X7R2J224KT5	X7R	630V	220,000	± 10%	2.30 ± 0.20

General Specifications

C Series – Open Mode Design

No.	Item	Performance	Test or Inspection Method
1	**External Appearance**	No defects which may affect performance.	Inspect with magnifying glass (3×).
2	**Insulation Resistance**	10,000MΩ or 500MΩ•μF min., whichever smaller. (As for the capacitors of rated voltage 16V DC, 10,000 MΩ or 100MΩ•μF min.,)	Apply rated voltage for 60s. As for the rated voltage 630V DC, apply 500V DC.
3	**Voltage Proof**	Withstand test voltage without insulation breakdown or other damage.	**Rated Voltage** / **Apply voltage** RV ≤ 100V: 2.5 ×rated voltage RV > 100V: 1.5 ×rated voltage Above DC voltage shall be applied for 1 to 5s. Charge / discharge current shall not exceed 50mA.
4	**Capacitance**	Within the specified tolerance.	**Class** / **Rated Capacitance** / **Measuring Frequency** / **Measuring voltage** Class 2: C ≤ 10uF: 1kHz±10%: 1.0±0.2V_{rms} Class 2: C > 10uF: 120Hz±20%: 0.5±0.2 V_{rms}
5	**Dissipation Factor (Class 2)**	**T.C.** / **Rated Voltage (DC)** / **D.F.** X7R: RV = 25V& 50V: 3% max. X8R: RV ≤ 16V: 5% max.	See No.4 in this table for measuring condition.
6	**Temperature Characteristics of Capacitance (Class 2)**	Capacitance Change (%) **No Voltage Applied** X7R: ± 15% X8R: ± 15%	Capacitance shall be measured by the steps shown in the following table after thermal equilibrium is obtained for each step. △C be calculated ref. STEP 3 reading **Step** / **Temperature (ºC)** 1: Reference temp. ± 2 2: Min. operating temp. ± 2 3: Reference temp. ± 2 4: Max. operating temp. ± 2
7	**Robustness of Terminations**	No sign of termination coming off, breakage of ceramic, or other abnormal signs.	Reflow solder the capacitors on P.C. board (shown in Appendix 1a or Appendix 1b) and apply a pushing force of 5N for 10±1s. 
8	**Bending**	No mechanical damage.	Reflow solder the capacitor on P.C. board (shown in Appendix 2a or Appendix 2b) and bend it for 1mm.  Unit: mm

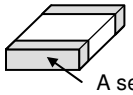
General Specifications

C Series – Open Mode Design

<table>
<tr><th>No.</th><th>Item</th><th>Performance</th><th>Test or Inspection Method</th></tr>
<tr><td>9</td><td>Solderability</td><td>New solder to cover over 75% of termination.

25% may have pinholes or rough spots but not concentrated in one spot.

Ceramic surface of “A sections” shall not be exposed due to melting or shifting of termination material.

 
A section</td><td>Completely soak both terminations in solder at 235±5ºC for 2±0.5s.

Solder: H63A (JIS Z 3282)

Flux: Isopropyl alcohol (JIS K 8839)
Rosin (JIS K 5902) 25% solid solution.</td></tr>
<tr><td>10</td><td colspan="2">Resistance to solder heat</td><td rowspan="5">Completely soak both terminations in solder at 260±5ºC for 5±1s.

Preheating condition
Temp.: 150±10ºC
Time : 1 to 2min.

Flux: Isopropyl alcohol (JIS K 8839)
Rosin (JIS K 5902) 25% solid solution.

Solder: H63A (JIS Z 3282)

Leave the capacitor in ambient conditions for 6 to 24h before measurement.</td></tr>
<tr><td></td><td>External appearance</td><td>No cracks are allowed and terminations shall be covered at least 60% with new solder.</td></tr>
<tr><td></td><td>Capacitance</td><td><table><tr><th colspan="2">Characteristics</th><th>Change from the value before test</th></tr><tr><td>Class 2</td><td>X7R
X8R</td><td>± 7.5%</td></tr></table></td></tr>
<tr><td></td><td>D.F. (Class 2)</td><td>Meet the initial spec.</td></tr>
<tr><td></td><td>Insulation Resistance</td><td>Meet the initial spec.</td></tr>
<tr><td></td><td>Voltage Proof</td><td>No insulation breakdown or other damage.</td></tr>
<tr><td>11</td><td colspan="2">Vibration</td><td rowspan="4">Reflow solder the capacitor on P.C. board (shown in Appendix 1a or Appendix 1b) before testing.

Vibrate the capacitor with amplitude of 1.5mm P-P sweeping the frequencies from 10Hz to 55Hz and back to 10Hz after 1min.

Repeat this for 2h each in 3 perpendicular directions.</td></tr>
<tr><td></td><td>External appearance</td><td>No mechanical damage.</td></tr>
<tr><td></td><td>Capacitance</td><td><table><tr><th colspan="2">Characteristics</th><th>Change from the value before test</th></tr><tr><td>Class 2</td><td>X7R
X8R</td><td>± 7.5%</td></tr></table></td></tr>
<tr><td></td><td>D.F. (Class 2)</td><td>Meet the initial spec.</td></tr>
</table>

General Specifications

C Series – Open Mode Design

<table>
<tr><th>No.</th><th>Item</th><th>Performance</th><th>Test or Inspection Method</th></tr>
<tr><td>12</td><td>Temperature cycle</td><td></td><td rowspan="5">Reflow solder the capacitors on a P.C. board (shown in Appendix 1a or Appendix 1b) before testing.

Expose the capacitor in the conditions in step 1 through step 4, and repeat 5 times consecutively.

Leave the capacitor in ambient conditions for 24±2h before measurement.

<table><tr><th>Step</th><th>Temperature (ºC)</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>Reference 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>Reference Temp.</td><td>2 - 5</td></tr></table></td></tr>
<tr><td></td><td>External appearance</td><td>No mechanical damage.</td></tr>
<tr><td></td><td>Capacitance</td><td><table><tr><th colspan="2">Characteristics</th><th>Change from the value before test</th></tr><tr><td>Class 2</td><td>X7R
X8R</td><td>± 7.5%</td></tr></table></td></tr>
<tr><td></td><td>D.F. (Class 2)</td><td>Meet the initial spec.</td></tr>
<tr><td></td><td>Insulation Resistance</td><td>Meet the initial spec.</td></tr>
<tr><td></td><td>Voltage Proof</td><td>No insulation breakdown or other damage.</td></tr>
<tr><td>13</td><td>Moisture Resistance (Steady State)</td><td></td><td rowspan="4">Reflow solder the capacitor on P.C. board (shown in Appendix 1a or Appendix 1b) before testing.

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

Leave the capacitor in ambient condition for 24±2h before measurement.</td></tr>
<tr><td></td><td>External appearance</td><td>No mechanical damage.</td></tr>
<tr><td></td><td>Capacitance</td><td><table><tr><th colspan="2">Characteristics</th><th>Change from the value before test</th></tr><tr><td>Class 2</td><td>X7R
X8R</td><td>± 12.5%</td></tr></table></td></tr>
<tr><td></td><td>D.F. (Class 2)</td><td>Characteristics
X7R: 200% of initial spec. max.
X8R: 200% of initial spec. max.</td></tr>
<tr><td></td><td>Insulation Resistance</td><td>1,000MΩ or 50MΩ•μF min., whichever smaller. (As for the capacitors of rated voltage 16V DC, 1,000 MΩ or 10MΩ•μF min.,)</td></tr>
</table>

General Specifications

C Series – Open Mode Design

No.	Item	Performance	Test or Inspection Method
14	**Moisture Resistance**		Reflow solder the capacitors on P.C. board (shown in Appendix 1a or Appendix 1b) before testing. Apply the rated voltage at temperature 40±2ºC and 90 to 95%RH for 500 +24,0h. Charge/discharge current shall not exceed 50mA. Leave the capacitor in ambient conditions for 24±2h before measurement. Voltage conditioning: 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.
	External appearance	No mechanical damage.	
	Capacitance	**Characteristics**: Class 2 (X7R, X8R); **Change from the value before test**: ± 12.5%	
	D.F. (Class 2)	Characteristics X7R: 200% of initial spec. max. X8R: 200% of initial spec. max.	
	Insulation Resistance	500MΩ or 25MΩ•μF min., whichever smaller. (As for the capacitors of rated voltage 16V DC, 500 MΩ or 5MΩ•μF min.,)	
15	**Life**		Reflow solder the capacitors on P.C. board (shown in Appendix 1a or Appendix 1b) before testing. Apply rated voltage at maximum operating temperature ±2ºC for 1,000 +48, 0h. Some items may be tested at higher voltage (1.2x, 1.5x or 2xRV). Charge/discharge current shall not exceed 50mA. Leave the capacitor in ambient conditions for 24±2h before measurement. Voltage conditioning: 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.
	External appearance	No mechanical damage.	
	Capacitance	**Characteristics**: Class 2 (X7R, X8R); **Change from the value before test**: ± 15%	
	D.F. (Class 2)	Characteristics X7R: 200% of initial spec. max. X8R: 200% of initial spec. max.	
	Insulation Resistance	1,000MΩ or 50MΩ•μF min., whichever smaller. (As for the capacitors of rated voltage 16V DC, 1,000 MΩ or 10MΩ•μF min.,)	

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

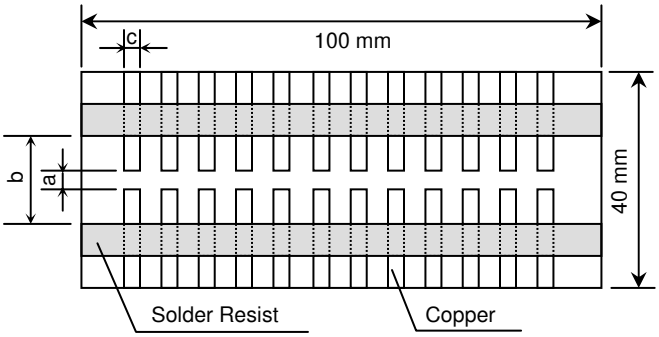
General Specifications

C Series – Open Mode Design

Appendix - 1a

P.C. Board for reliability test

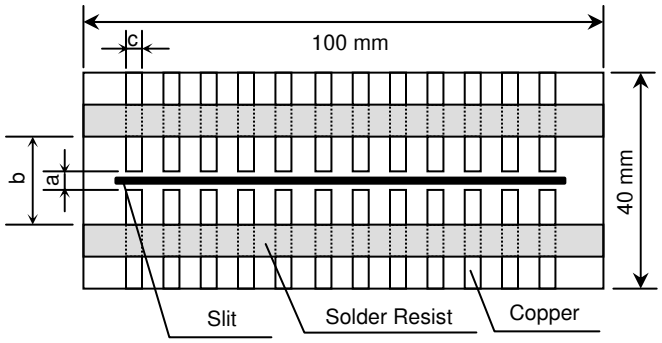
Applied for C2012, C3216



Appendix - 1b

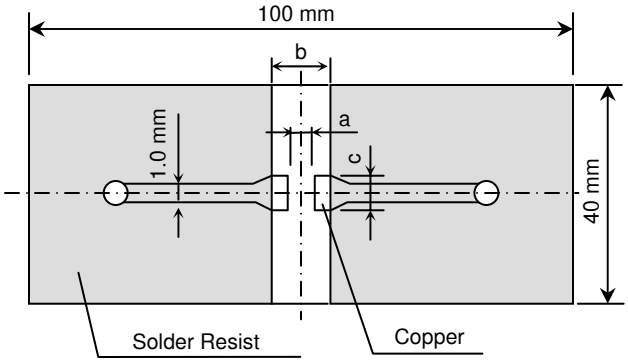
P.C. Board for reliability test

Applied for C3225, C4532, C5750



Appendix - 2b

P.C. Board for bending test



Material : Glass Epoxy (As per JIS C6484 GE4)

P.C. Board thickness: 1.6mm

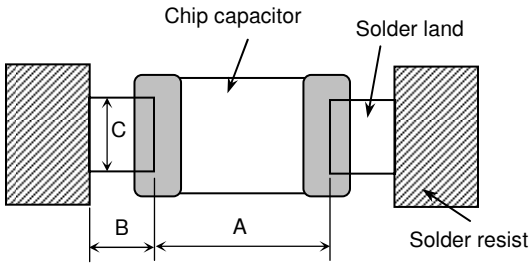
Copper (thickness 0.035mm)
Solder resist

Case Code		Dimensions (mm)		
JIS	EIA	a	b	c
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

Soldering Information

C Series – Open Mode Design

• Recommended Soldering Land Pattern



Wave Soldering Unit: mm

Type / Symbol	C2012 [CC0805]	C3216 [CC1206]
A	1.0 - 1.3	2.1 - 2.5
B	1.0 - 1.2	1.1 - 1.3
C	0.8 - 1.1	1.0 - 1.3

Reflow Soldering Unit: mm

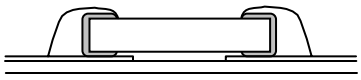
Type / Symbol	C2012 [CC0805]	C3216 [CC1206]
A	0.9 - 1.2	2.0 - 2.4
B	0.7 - 0.9	1.0 - 1.2
C	0.9 - 1.2	1.1 - 1.6

Reflow Soldering Unit: mm

Type / Symbol	C3225 [CC1210]	C4532 [CC1812]	C5750 [CC2220]
A	2.0 - 2.4	3.1 - 3.7	4.1 - 4.8
B	1.0 - 1.2	1.2 - 1.4	1.2 - 1.4
C	1.9 - 2.5	2.4 - 3.2	4.0 - 5.0

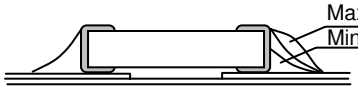
• Recommended Solder Amount

Excessive solder

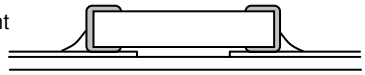


Higher tensile force on the chip capacitor may cause cracking.

Adequate solder

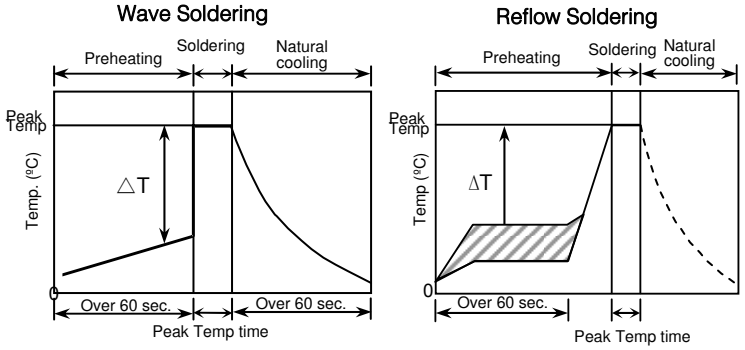


Insufficient solder

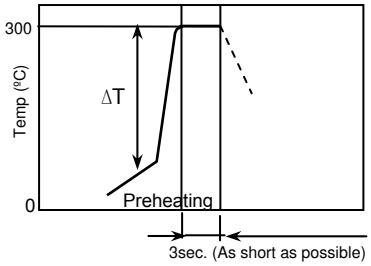


Small solder fillet may cause contact failure or failure to hold the chip capacitor to the P.C. board.

• Recommended Soldering Profile



Manual soldering (Solder iron)



Recommended soldering duration

Solder \ Temp./Dura.	Wave Soldering Peak temp (°C)	Wave Soldering Duration (sec.)	Reflow Soldering Peak temp (°C)	Reflow Soldering 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
Sn-37Pb (Sn-Pb solder)
Sn-3.0Ag-0.5Cu (Lead Free Solder)

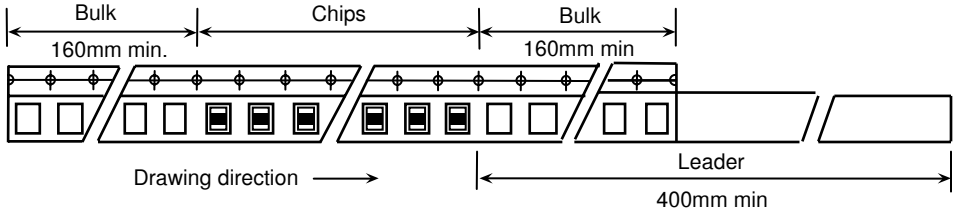
Preheating Condition

Soldering	Case Size - JIS (EIA)	Temp. (ºC)
Wave soldering	C2012(CC0805), C3216(CC1206)	ΔT ≤ 150
Reflow soldering	C2012(CC0805), C3216(CC1206)	ΔT ≤ 150
	C3225(CC1210), C4532(CC1812), C5750(CC2220)	ΔT ≤ 130
Manual soldering	C2012(CC0805), C3216(CC1206)	ΔT ≤ 150
	C3225(CC1210), C4532(CC1812), C5750(CC2220)	ΔT ≤ 130

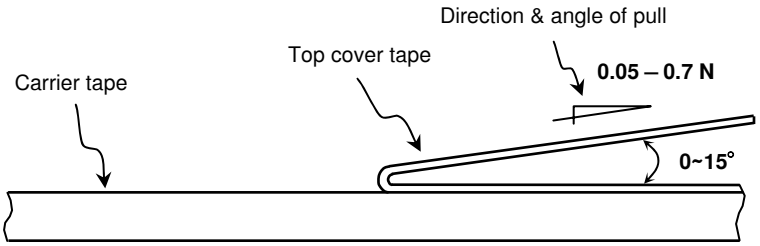
Packaging Information

C Series – Open Mode Design

- Carrier Tape Configuration



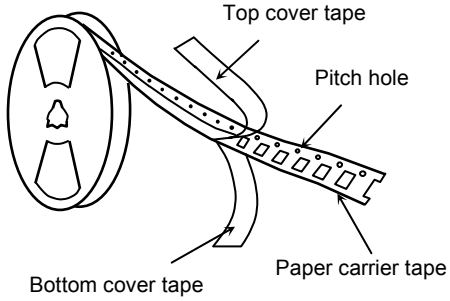
- Peel Back Force (Top Tape)



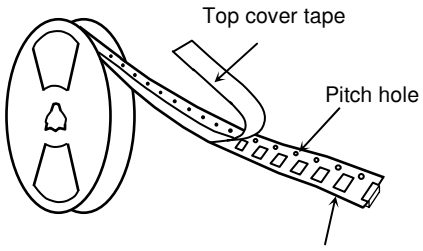
• Carrier tape shall be flexible enough to be wound around a minimum radius of 30mm with components in tape.
• The missing of components shall be less than 0.1%
• Components shall not stick to the cover tape.
• The cover tape shall not protrude beyond the edges of the carrier tape and shall not cover the sprocket holes.

- Chip Quantity Per Reel and Structure of Reel (Paper & Plastic)

Paper Carrier Tape & Reel



Plastic Carrier Tape & Reel



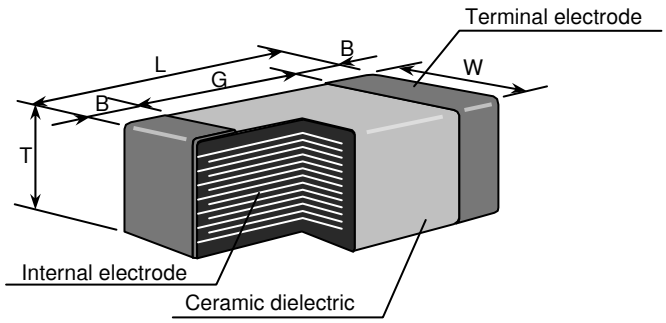
Case Code		Chip Thickness	Taping Material	Chip quantity (pcs.)	
JIS	EIA			φ178mm (7") reel	φ330mm (13") reel
C2012	CC0805	0.85 mm	Paper/Plastic	4,000	10,000
		1.25 mm	Plastic	2,000	
C3216	CC1206	1.15 mm	Plastic	2,000	10,000
		1.30 mm			
		1.60 mm			8,000
C3225	CC1210	1.15 mm	Plastic	2,000	10,000
		1.60 mm			8,000
		2.00 mm		1,000	5,000
		2.30 mm			
		2.50 mm			
C4532	CC1812	1.60 mm	Plastic	1,000	3,000
		2.00 mm			
		2.30 mm		500	
C5750	CC2220	1.60 mm	Plastic	1,000	3,000
		2.00 mm		500	
		2.30 mm			
		2.80 mm			2,000

• All specifications are subject to change without notice. Please read the precautions before using the product.

Additional Information

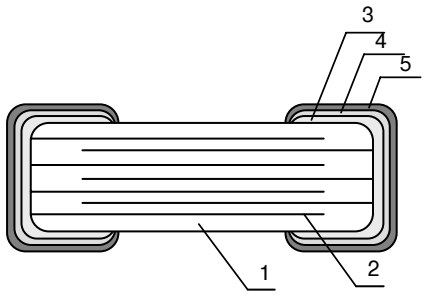
C Series – Open Mode Design

• Shape & Dimensions



Case Code		Dimensions (mm)				
JIS	EIA	L	W	T	B	G
C2012	CC0805	2.00	1.20	0.85	0.20 min.	0.50 min.
				1.25		
C3216	CC1206	3.20	1.60	1.15	0.20 min.	1.00 min.
				1.30		
				1.60		
C3225	CC1210	3.20	2.50	1.15	0.20 min.	1.00 min.
				1.60		
				2.00		
				2.30	0.30 min.	
				2.50		
C4532	CC1812	3.20	2.50	1.60	0.20 min.	2.00 min.
				2.00		
				2.30		
C5750	CC2220	5.70	5.00	1.60	0.20 min.	2.00 min.
				2.00		
				2.30		
				2.80		

• Inside Structure & Material System



No.	NAME	MATERIAL	
		Class 1	Class 2
(1)	Ceramic Dielectric	$CaZrO_3$	$BaTiO_3$
(2)	Internal Electrode	Nickel (Ni)	
(3)	Termination	Copper (Cu)	
(4)		Nickel (Ni)	
(5)		Tin (Sn)	

• Environmental Information

TDK Corporation established internal product environmental assurance standards that include the six hazardous substances banned by the EU RoHS Directive[1] enforced on July 1, 2006 along with additional substances independently banned by TDK and has successfully completed making general purpose electronic components conform to the RoHS Directive[2].

1. Abbreviation for Restriction on Hazardous Substances, which refers to the regulation EU Directive 2002/95/EC on hazardous substances by the European Union (EU) effective from July 1, 2006. The Directive bans the use of six specific hazardous substances in electric and electronic devices and products handled within the EU. The six substances are lead, mercury, cadmium, hexavalent chromium, PBB (polybrominated biphenyls), and PBDE (polybrominated diphenyl ethers).

2. This means that, in conformity with the EU Directive 2002/95/EC, lead, cadmium, mercury, hexavalent chromium, and specific bromine-based flame retardants, PBB and PBDE, have not been used, except for exempted applications.

For REACH (SVHC : 15 substances according to ECHA / October 2008) : All TDK MLCC do not contain these 15 substances.

For European Directive 2000/53/CE and 2005/673/CE : Cadmium, Hexavalent Chromium, Mercury, Lead are not contained in all TDK MLCC.

For European Directive 2003/11/CE : Pentabromodiphenyl-ether, Octabromodiphenyl-ether are not contained in all TDK MLCC.