TDK

MULTILAYER CERAMIC CHIP CAPACITORS

C Series
High Voltage Application

Type: C4520 [EIA CC1808]
C4532 [EIA CC1812]

Issue date: January 2011

TDK MLCC
US Catalog

Version A11

REMINDERS

Please read before using this product

SAFETY REMINDERS

REMINDERS

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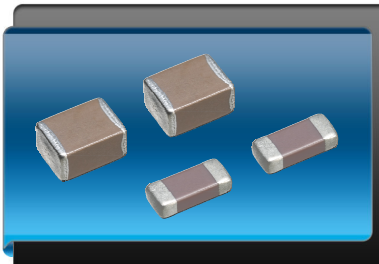


C Series

High Voltage Application

Type: C4520, C4532

Features

- Advanced design provides improved withstand voltage characteristics.
- TDK's proprietary internal electrode structure and the use of low-dielectric-strength material result in highly reliable performance in high-voltage applications.
- Complies with ISO8802-3 for LAN applications.
- Designed exclusively for reflow soldering.

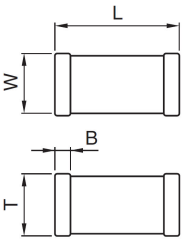
Applications

- Inverter circuits with a liquid crystal backlight
- LAN card
- General high voltage circuits.
- Noise bypass for power supply
- Transceiver for LAN
- Hub, etc.

Cautions

- This product intended solely for reflow soldering.
- A slit of about 1mm on the circuit board is recommended to improve removal of the flux after soldering.
- Ensure that this product is completely dried following washing.
- Because this product will be subjected to high voltages, use only low-activity rosin flux (with 0.2% max. of chlorine).
- Using this product with aluminum circuit boards must be considered a special implementation because the high heat stress levels are involved. In case of using aluminum circuit boards, please contact TDK.

Shape & Dimensions



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

Dimensions in mm

Part Number Construction

C 4532 X7R 3D 222 K T XXXX

Series Name

Dimensions L x W (mm)

Case Code	Length	Width
C4520	4.50 ± 0.40	2.00 ± 0.30
C4532	4.50 ± 0.40	3.20 ± 0.40

Temperature Characteristic

Temperature Characteristics	Capacitance Change	Temperature Range
C0G	0±30 ppm/ºC	-55 to +125ºC
X7R	±15%	-55 to +125ºC

Rated Voltage (DC)

Voltage Code	Voltage(DC)
3A	1,000V
3D	2,000V
3F	3,000V

Internal Codes

Packaging Style

Packaging Code	Style
T	Tape and Reel

Capacitance Tolerance

Tolerance Code	Tolerance
F	± 1pF
K	± 10%

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)

Capacitance Range Chart

C4520 [EIA CC1808]

Capacitance Range Chart

Temperature Characteristics: C0G (0 ± 30ppm/ºC), X7R (± 15%)
Rated Voltage: 3,000 (3F), 2,000V (3D), 1,000V (3A)

Capacitance (pF)	Cap Code	Tolerance	C0G	X7R	
			3F (3,000V)	3D (2,000V)	3A (1,000V)
10	100	F: ± 1pF			
12	120	K: ± 10%			
15	150				
18	180				
22	220				
27	270				
33	330				
39	390				
47	470				
56	560				
68	680				
82	820				
100	101				
470	471				
1,000	102				

Standard Thickness

- 0.85 ± 0.15 mm
- 1.10 ± 0.20 mm
- 1.30 ± 0.20 mm
- 1.60 ± 0.20 mm
- 2.00 ± 0.20 mm

Capacitance Range Table

Class 1 (Temperature Compensating)

Temperature Characteristics: C0G (0 ± 30 ppm/ºC)

TDK Part Number (Ordering Code)	Temperature Characteristics	Rated Voltage	Capacitance (pF)	Capacitance Tolerance	Thickness (mm)
C4520C0G3F100F	C0G	3000V	10	± 1pF	0.85 ± 0.15
C4520C0G3F120K	C0G	3000V	12	± 10%	0.85 ± 0.15
C4520C0G3F150K	C0G	3000V	15	± 10%	1.10 ± 0.20
C4520C0G3F180K	C0G	3000V	18	± 10%	1.10 ± 0.20
C4520C0G3F220K	C0G	3000V	22	± 10%	1.10 ± 0.20
C4520C0G3F270K	C0G	3000V	27	± 10%	1.60 ± 0.20
C4520C0G3F330K	C0G	3000V	33	± 10%	1.60 ± 0.20
C4520C0G3F390K	C0G	3000V	39	± 10%	1.60 ± 0.20
C4520C0G3F470K	C0G	3000V	47	± 10%	1.60 ± 0.20
C4520C0G3F560K	C0G	3000V	56	± 10%	2.00 ± 0.20
C4520C0G3F680K	C0G	3000V	68	± 10%	2.00 ± 0.20
C4520C0G3F820K	C0G	3000V	82	± 10%	2.00 ± 0.20
C4520C0G3F101K	C0G	3000V	100	± 10%	2.00 ± 0.20

Class 2 (Temperature Stable)

Temperature Characteristics: X7R (± 15%)

TDK Part Number (Ordering Code)	Temperature Characteristics	Rated Voltage	Capacitance (pF)	Capacitance Tolerance	Thickness (mm)
C4520X7R3A471K	X7R	1000V	470	± 10%	1.30 ± 0.20
C4520X7R3A102K	X7R	1000V	1,000	± 10%	1.30 ± 0.20
C4520X7R3D471K	X7R	2000V	470	± 10%	1.30 ± 0.20
C4520X7R3D102K	X7R	2000V	1,000	± 10%	1.30 ± 0.20

Capacitance Range Chart

C4532 [EIA CC1812]

Capacitance Range Chart

Temperature Characteristics: C0G (0 ± 30ppm/ºC), X7R (± 15%)
Rated Voltage: 3,000 (3F), 2,000V (3D), 1,000V (3A)

Capacitance (pF)	Cap Code	Tolerance	C0G	X7R	
			3F (3,000V)	3D (2,000V)	3A (1,000V)
100	101	K: ± 10%			
120	121				
150	151				
180	181				
220	221				
270	271				
330	331				
2,200	222				
4,700	472				
10,000	103				

Standard Thickness

- 1.30 ± 0.20 mm
- 1.60 ± 0.20 mm
- 2.00 ± 0.20 mm
- 2.30 ± 0.20 mm
- 2.50 ± 0.30 mm

Capacitance Range Table

Class 1 (Temperature Compensating)

Temperature Characteristics: C0G (0 ± 30 ppm/ºC)

TDK Part Number (Ordering Code)	Temperature Characteristics	Rated Voltage	Capacitance (pF)	Capacitance Tolerance	Thickness (mm)
C4532C0G3F101K	C0G	3000V	100	± 10%	1.60 ± 0.20
C4532C0G3F121K	C0G	3000V	120	± 10%	1.60 ± 0.20
C4532C0G3F151K	C0G	3000V	150	± 10%	1.60 ± 0.20
C4532C0G3F181K	C0G	3000V	180	± 10%	1.60 ± 0.20
C4532C0G3F221K	C0G	3000V	220	± 10%	2.00 ± 0.20
C4532C0G3F271K	C0G	3000V	270	± 10%	2.30 ± 0.20
C4532C0G3F331K	C0G	3000V	330	± 10%	2.50 ± 0.30

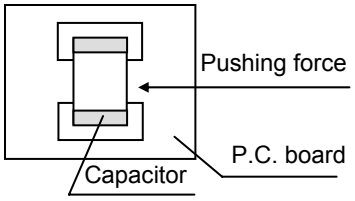
Class 2 (Temperature Stable)

Temperature Characteristics: X7R (± 15%)

TDK Part Number (Ordering Code)	Temperature Characteristics	Rated Voltage	Capacitance (pF)	Capacitance Tolerance	Thickness (mm)
C4532X7R3A472K	X7R	1000V	4,700	± 10%	1.60 ± 0.20
C4532X7R3A103K	X7R	1000V	10,000	± 10%	2.00 ± 0.20
C4532X7R3D222K	X7R	2000V	2,200	± 10%	1.30 ± 0.20

General Specifications

C Series – High Voltage Application

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 min.	Apply 500V DC for 60s.
3	**Voltage Proof**	Withstand test voltage without insulation breakdown or other damage.	1.2 × rated voltage (DC) shall be applied for 1 to 5s. Charge / discharge current shall not exceed 50mA.
4	**Capacitance**	Within the specified tolerance.	**Class** / **Measuring Frequency** / **Measuring Voltage** Class 1: 1MHz±10% / 0.5 - 5 V_{rms} Class 2: 1kHz±10% / 1.0±0.2V_{rms}
5	**Q (Class 1)**	**Rated Capacitance** / **Q** 30pF and over: 1,000 min. Under 30pF: 400+20×C min. C : Rated capacitance (pF)	See No.4 in this table for measuring condition.
6	**Dissipation Factor (Class 2)**	**T.C.** / **D.F.** X7R: 0.03 max.	See No.4 in this table for measuring condition.
7	**Temperature Characteristics of Capacitance (Class 1)**	**T.C.** / **Temperature Coefficient** C0G: 0 ± 30 (ppm/ºC) Capacitance drift within ± 0.2% or ± 0.05pF, whichever larger.	Temperature coefficient shall be calculated based on values at 25ºC and 85ºC temperature. Measuring temperature below 20ºC shall be -10ºC and -25ºC.
8	**Temperature Characteristics of Capacitance (Class 2)**	Capacitance Change (%) **No Voltage Applied** X7R: ± 15%	Capacitance shall be measured by the steps shown in the following table after thermal equilibrium is obtained for each step. ΔC be calculated ref. STEP3 reading **Step** / **Temperature (ºC)** 1: Reference temp. ± 2 2: Min. operating temp. ± 2 3: Reference temp. ± 2 4: Max. operating temp. ± 2
9	**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 1) and apply a pushing force of 5N with 10±1s. 

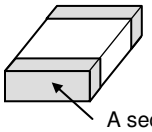
General Specifications

C Series – High Voltage Application

<table>
<tr><th>No.</th><th>Item</th><th>Performance</th><th>Test or Inspection Method</th></tr>
<tr><td>10</td><td>Solderability</td><td>New solder to cover over 75% of termination.

25% may have pin holes 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>11</td><td>Vibration</td><td></td><td>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 (Class 1) or 24±2h (Class 2) before measurement.</td></tr>
<tr><td></td><td>External appearance</td><td>No mechanical damage.</td><td></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 1</td><td>C0G</td><td>±2.5 %</td></tr><tr><td>Class 2</td><td>X7R</td><td>± 7.5 %</td></tr></table></td><td></td></tr>
<tr><td></td><td>Q (Class 1)</td><td><table><tr><th>Rated Capacitance</th><th>Q</th></tr><tr><td>30pF and over</td><td>1,000 min.</td></tr><tr><td>Under 30pF</td><td>400+20×C min.</td></tr></table>C : Rated capacitance (pF)</td><td></td></tr>
<tr><td></td><td>D.F. (Class 2)</td><td>Meet the initial spec.</td><td></td></tr>
<tr><td>12</td><td>Temperature cycle</td><td></td><td>Reflow solder the capacitor on P.C. board (shown in Appendix 1) before testing.

Expose the capacitor in the conditions step1 through step 4 and repeat 5 times consecutively.

Leave the capacitor in ambient conditions for 6 to 24h (Class 1) or 24±2h (Class 2) 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><td></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 1</td><td>C0G</td><td>±2.5 %</td></tr><tr><td>Class 2</td><td>X7R</td><td>± 7.5 %</td></tr></table></td><td></td></tr>
<tr><td></td><td>Q (Class 1)</td><td><table><tr><th>Rated Capacitance</th><th>Q</th></tr><tr><td>30pF and over</td><td>1,000 min.</td></tr><tr><td>Under 30pF</td><td>400+20×C min.</td></tr></table>C : Rated capacitance (pF)</td><td></td></tr>
<tr><td></td><td>D.F. (Class 2)</td><td>Meet the initial spec.</td><td></td></tr>
<tr><td></td><td>Insulation Resistance</td><td>Meet the initial spec.</td><td></td></tr>
<tr><td></td><td>Voltage Proof</td><td>No insulation breakdown or other damage.</td><td></td></tr>
</table>

General Specifications

C Series – High Voltage Application

<table>
<tr><th>No.</th><th>Item</th><th>Performance</th><th>Test or Inspection Method</th></tr>
<tr><td>13</td><td>Moisture Resistance (Steady State)</td><td></td><td rowspan="5">Reflow solder the capacitors on P.C. board (shown in Appendix 1) before testing.
Leave at temperature 40±2ºC, 90 to 95%RH for 500 +24,0h.
Leave the capacitors in ambient conditions for 6 to 24h (Class 1) or 24±2h (Class 2) 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 1</td><td>C0G</td><td>±5 %</td></tr><tr><td>Class 2</td><td>X7R</td><td>±12.5 %</td></tr></table></td></tr>
<tr><td></td><td>Q (Class 1)</td><td><table><tr><th>Rated Capacitance</th><th>Q</th></tr><tr><td>30pF and over</td><td>350 min.</td></tr><tr><td>10pF and over to under 30pF</td><td>275+5/2×C min.</td></tr></table>C : Rated capacitance (pF)</td></tr>
<tr><td></td><td>D.F. (Class 2)</td><td>Characteristics
X7R: 200% of initial spec. max.</td></tr>
<tr><td></td><td>Insulation Resistance</td><td>1,000MΩ min.</td></tr>
<tr><td>14</td><td>Life</td><td></td><td rowspan="5">Reflow solder the capacitors on P.C. board (shown in Appendix 1) before testing.
Apply rated voltage at maximum operating temperature ±2ºC for 1,000 +48, 0h.
Charge/discharge current shall not exceed 50mA.
Leave the capacitor in ambient conditions for 6 to 24h (Class1) or 24±2h (Class2) before measurement.
Voltage conditioning:
Voltage treat the capacitors under testing temperature and voltage for 1 hour.
Leave the capacitors in ambient conditions for 24±2h before measurement.
Use this measurement for initial value.</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 1</td><td>C0G</td><td>±3 %</td></tr><tr><td>Class 2</td><td>X7R</td><td>±15 %</td></tr></table></td></tr>
<tr><td></td><td>Q (Class 1)</td><td><table><tr><th>Rated Capacitance</th><th>Q</th></tr><tr><td>30pF and over</td><td>350 min.</td></tr><tr><td>10pF and over to under 30pF</td><td>275+5/2×C min.</td></tr></table>C : Rated capacitance (pF)</td></tr>
<tr><td></td><td>D.F. (Class 2)</td><td>Characteristics
X7R: 200% of initial spec. max.</td></tr>
<tr><td></td><td>Insulation Resistance</td><td>1,000MΩ min.</td></tr>
</table>

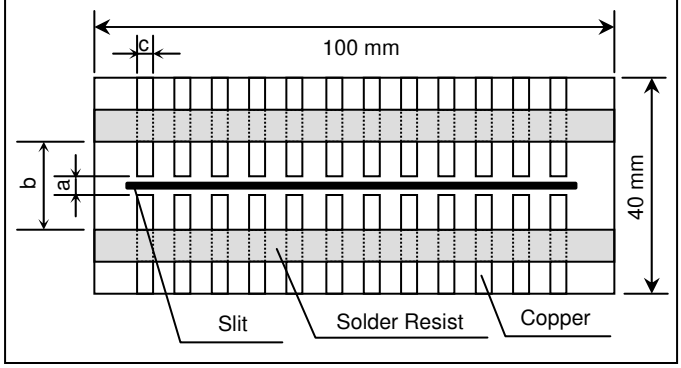
***As for the initial measurement of capacitors (Class 2) on number 8, 11, 12 and 13, leave capacitors at 150 –10, 0°C for 1 hour and measure the value after leaving capacitor for 24±2h in ambient condition.**

General Specifications

C Series – High Voltage Application

Appendix - 1

P.C. Board for reliability test



Material : Glass Epoxy (As per JIS C6484 GE4)

P.C. Board thickness : 1.6mm

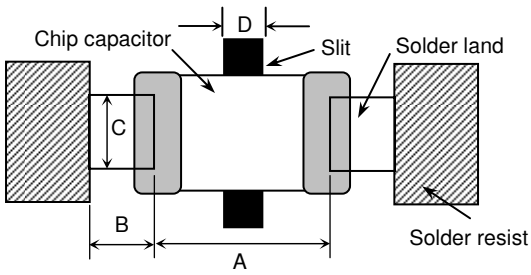
Copper (thickness 0.035mm)
Solder resist

Case Code		Dimensions (mm)		
JIS	EIA	a	b	c
C4520	CC1808	3.5	7.0	2.5
C4532	CC1812	3.5	7.0	3.7

Soldering Information

C Series – High Voltage Application

• Recommended Soldering Land Pattern

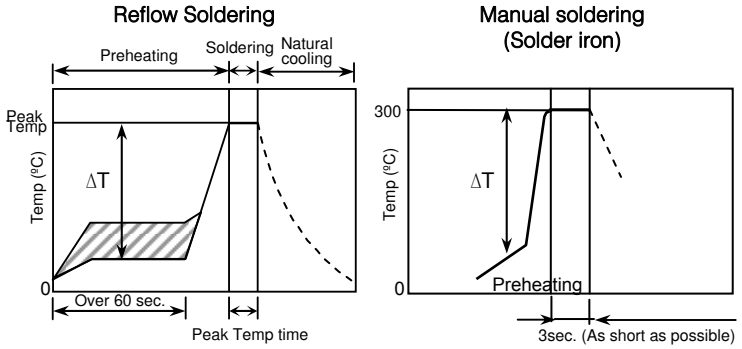


- This product intended solely for reflow soldering.
- A slit of about 1mm on the circuit board is recommended to improve removal of the flux after soldering.
- Ensure that this product is completely dried following washing.
- Because this product will be subjected to high voltages, use only low-activity rosin flux (with 0.2% max. of chlorine).
- Using this product with aluminum circuit boards must be considered a special implementation because the high heat stress levels are involved. In case of using aluminum circuit boards, please contact TDK.

Reflow Soldering Unit: mm

Symbol \ Type	C4520 [CC1808]	C4532 [CC1812]
A	3.1 – 3.7	3.1 – 3.7
B	1.2 – 1.4	1.2 – 1.4
C	1.5 – 2.0	2.4 – 3.2
D	1.0 – 1.3	1.0 – 1.3

• Recommended Soldering Profile



Recommended soldering duration

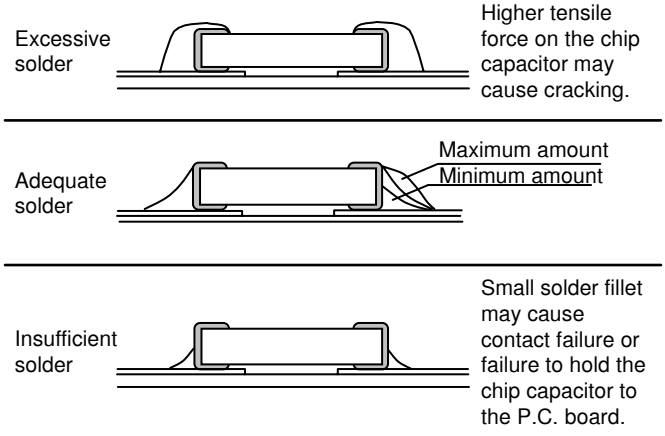
Solder \ Temp./Dura.	Reflow Soldering	
	Peak temp (°C)	Duration (sec.)
Sn-Pb Solder	230 max.	20 max.
Lead-Free Solder	260 max.	10 max.

Recommended solder compositions
Sn-37Pb (Sn-Pb solder)
Sn-3.0Ag-0.5Cu (Lead Free Solder)

Preheating Condition

Soldering	Temp. (ºC)
Reflow soldering	ΔT ≤ 130
Manual soldering	ΔT ≤ 130

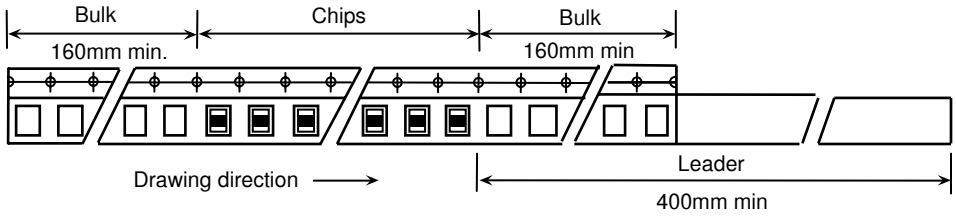
• Recommended Solder Amount



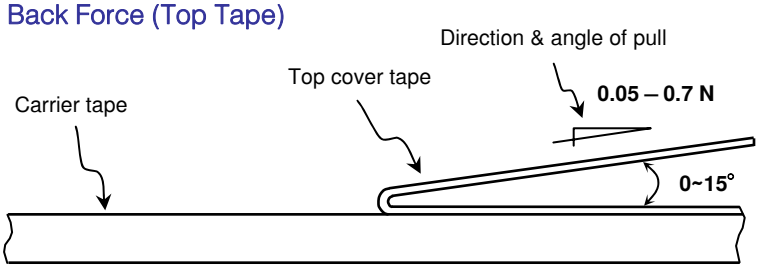
Packaging Information

C Series – High Voltage Application

• Carrier Tape Configuration

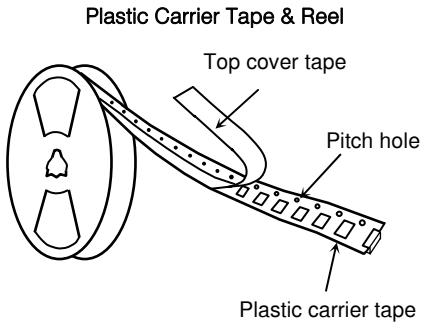


• Peel Back Force (Top Tape)



• 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 not shall cover the sprocket holes.

• Chip Quantity Per Reel and Structure of Reel

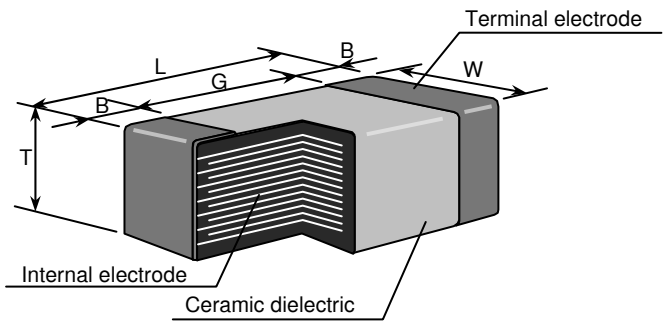


Case Code		Chip Thickness	Taping Material	Chip quantity (pcs.)	
JIS	EIA			φ178mm (7") reel	Φ330mm (13") reel
C4520	CC1808	0.85 mm	Plastic	1,000	5,000
		1.10 mm			
		1.30 mm			
		1.60 mm			3,000
		2.00 mm			
C4532	CC1812	1.30 mm	Plastic	1,000	5,000
		1.60 mm			3,000
		2.00 mm			
		2.30 mm		500	
		3.20 mm			

Additional Information

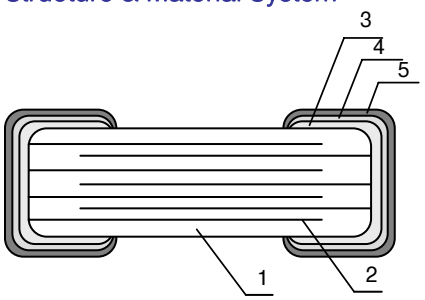
C Series – High Voltage Application

• Shape & Dimensions



Case Code		Dimensions (mm)				
C4520	CC1808	4.50	2.00	0.85 mm	0.30 min	2.00 min
				1.10 mm		
				1.30 mm	2.00 min	
				1.60 mm	0.30 min	
				2.00 mm		
C4532	CC1812	4.50	3.20	1.30 mm	0.30 min.	2.00 min
				1.60 mm	0.20 min	
				2.00 mm		
				2.30 mm		
				3.20 mm	0.30 min.	

• 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.