



MULTILAYER CERAMIC CHIP CAPACITORS



C Series High Voltage Application

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

Issue date: April 2011



**TDK MLCC
US Catalog**

Version B11

REMINDERS

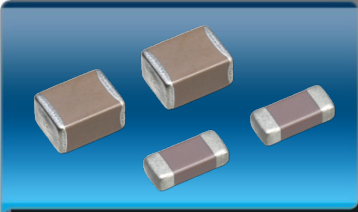
Please read before using this product

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.

Cautions



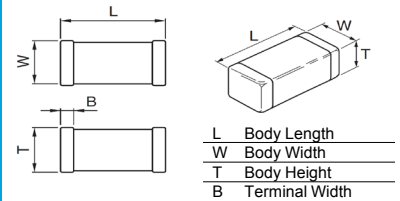
- This product intended solely for reflow soldering.
- A slit of about 1mm on the circuit board is recommended to improve removal of the flux after soldering.
- Ensure that this product is completely dried following washing.
- Because this product will be subjected to high voltages, use only low-activity 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.

Applications



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

Shape & Dimensions



Dimensions in mm



Part Number Construction

Series Name	C	4532	X7R	3D	222	K	T	XXXX
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/°C	-55 to +125°C					
	X7R	±15%	-55 to +125°C					
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 & 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/°C), X7R (± 15%)
 Rated Voltage: 3,000 (3F), 2,000V (3D), 1,000V (3A)

Capacitance (pF)	Cap Code	Tolerance	C0G		X7R	
			3F (3000V)	3D (2000V)	3A (1000V)	
10	100	F: ± 1pF K: ± 10%				
12	120					
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 mm
	1.10 mm
	1.30 mm
	1.60 mm
	2.00 mm



Capacitance Range Table

C4520 [EIA CC1808]

Class 1 (Temperature Compensating)

Temperature Characteristics: C0G (-55 to 125°C, 0±30 ppm/°C)

TDK Part Number (Ordering Code)	Temperature Characteristics	Rated Voltage	Capacitance (pF)	Capacitance Tolerance	Thickness (mm)
C4520C0G3F100F	C0G	3000V	10	± 1%	0.85 ± 0.10
C4520C0G3F120K	C0G	3000V	12	± 10%	0.85 ± 0.10
C4520C0G3F150K	C0G	3000V	15	± 10%	1.10 ± 0.15
C4520C0G3F180K	C0G	3000V	18	± 10%	1.10 ± 0.15
C4520C0G3F220K	C0G	3000V	22	± 10%	1.10 ± 0.15
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 (-55 to +125°C, ±15%)

TDK Part Number (Ordering Code)	Temperature Characteristics	Rated Voltage	Capacitance (pF)	Capacitance Tolerance	Thickness (mm)
C4520X7R3A471K	X7R	1000V	470	± 10%	1.30 ± 0.15
C4520X7R3A102K	X7R	1000V	1,000	± 10%	1.30 ± 0.15
C4520X7R3D471K	X7R	2000V	470	± 10%	1.30 ± 0.15
C4520X7R3D102K	X7R	2000V	1,000	± 10%	1.30 ± 0.15



Capacitance Range Chart

C4532 [EIA CC1812]

Capacitance Range Chart

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

Capacitance (pF)	Cap Code	Tolerance	C0G		X7R	
			3F (3000V)	3D (2000V)	3A (1000V)	
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 mm
	1.60 mm
	2.00 mm
	2.30 mm
	2.50 mm



Capacitance Range Table

C4532 [EIA CC1812]

Class 1 (Temperature Compensating)

Temperature Characteristics: C0G (-55 to 125°C, 0±30 ppm/°C)

TDK Part Number (Ordering Code)	Temperature Characteristics	Rated Voltage	Capacitance (pF)	Capacitance Tolerance	Thickness (mm)
C4532C0G3F101K	C0G	3000V	100	± 10%	1.60 ± 0.30
C4532C0G3F121K	C0G	3000V	120	± 10%	1.60 ± 0.30
C4532C0G3F151K	C0G	3000V	150	± 10%	1.60 ± 0.30
C4532C0G3F181K	C0G	3000V	180	± 10%	1.60 ± 0.30
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 (-55 to +125°C, ±15%)

TDK Part Number (Ordering Code)	Temperature Characteristics	Rated Voltage	Capacitance (pF)	Capacitance Tolerance	Thickness (mm)
C4532X7R3A472K	X7R	1000V	4,700	± 10%	1.60 ± 0.30
C4532X7R3A103K	X7R	1000V	10,000	± 10%	2.00 ± 0.20
C4532X7R3D222K	X7R	2000V	2,200	± 10%	1.30 ± 0.15



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.	<table border="1"> <thead> <tr> <th>Class</th> <th>Measuring Frequency</th> <th>Measuring Voltage</th> </tr> </thead> <tbody> <tr> <td>Class 1</td> <td>1MHz±10%</td> <td>0.5 - 5 V_{rms}</td> </tr> <tr> <td>Class 2</td> <td>1kHz±10%</td> <td>1.0±0.2V_{rms}</td> </tr> </tbody> </table>	Class	Measuring Frequency	Measuring Voltage	Class 1	1MHz±10%	0.5 - 5 V _{rms}	Class 2	1kHz±10%	1.0±0.2V _{rms}				
			Class	Measuring Frequency	Measuring Voltage											
			Class 1	1MHz±10%	0.5 - 5 V _{rms}											
Class 2	1kHz±10%	1.0±0.2V _{rms}														
<table border="1"> <thead> <tr> <th>Rated Capacitance</th> <th>Q</th> </tr> </thead> <tbody> <tr> <td>30pF and over</td> <td>1,000 min.</td> </tr> <tr> <td>Under 30pF</td> <td>400+20×C min.</td> </tr> </tbody> </table>	Rated Capacitance	Q	30pF and over	1,000 min.	Under 30pF	400+20×C min.	See No.4 in this table for measuring condition.									
Rated Capacitance	Q															
30pF and over	1,000 min.															
Under 30pF	400+20×C min.															
<p style="text-align: center;">C : Rated capacitance (pF)</p>																
6	Dissipation Factor (Class 2)	<table border="1"> <thead> <tr> <th>T.C.</th> <th>D.F.</th> </tr> </thead> <tbody> <tr> <td>X7R</td> <td>0.03 max.</td> </tr> </tbody> </table>	T.C.	D.F.	X7R	0.03 max.	See No.4 in this table for measuring condition.									
		T.C.	D.F.													
X7R	0.03 max.															
7	Temperature Characteristics of Capacitance (Class 1)	<table border="1"> <thead> <tr> <th>T.C.</th> <th>Temperature Coefficient</th> </tr> </thead> <tbody> <tr> <td>C0G</td> <td>0 ± 30 (ppm/°C)</td> </tr> </tbody> </table>	T.C.	Temperature Coefficient	C0G	0 ± 30 (ppm/°C)	Temperature coefficient shall be calculated based on values at 25°C and 85°C temperature. Measuring temperature below 20°C shall be -10°C and -25°C.									
		T.C.	Temperature Coefficient													
C0G	0 ± 30 (ppm/°C)															
Capacitance drift within ± 0.2% or ± 0.05pF, whichever larger.																
8	Temperature Characteristics of Capacitance (Class 2)	<table border="1"> <thead> <tr> <th>Capacitance Change (%)</th> </tr> </thead> <tbody> <tr> <td style="text-align: center;">No Voltage Applied</td> </tr> <tr> <td style="text-align: center;">X7R: ± 15%</td> </tr> </tbody> </table>	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 <table border="1"> <thead> <tr> <th>Step</th> <th>Temperature (°C)</th> </tr> </thead> <tbody> <tr> <td>1</td> <td>Reference temp. ± 2</td> </tr> <tr> <td>2</td> <td>Min. operating temp. ± 2</td> </tr> <tr> <td>3</td> <td>Reference temp. ± 2</td> </tr> <tr> <td>4</td> <td>Max. operating temp. ± 2</td> </tr> </tbody> </table>	Step	Temperature (°C)	1	Reference temp. ± 2	2	Min. operating temp. ± 2	3	Reference temp. ± 2	4	Max. operating temp. ± 2
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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. <div style="text-align: right;"> <p>Pushing force</p> <p>Capacitor</p> <p>P.C. board</p> </div>													

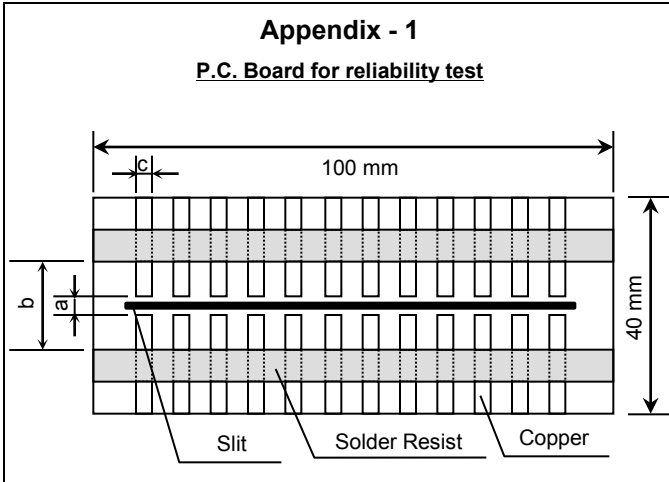


No.	Item	Performance	Test or Inspection Method																				
10	Solderability	New solder to cover over 75% of termination.	Completely soak both terminations in solder at $235 \pm 5^\circ\text{C}$ for $2 \pm 0.5\text{s}$.																				
		25% may have pin holes or rough spots but not concentrated in one spot. Ceramic surface of "A sections" shall not be exposed due to melting or shifting of termination material.	Solder: H63A (JIS Z 3282) Flux: Isopropyl alcohol (JIS K 8839) Rosin (JIS K 5902) 25% solid solution.																				
11	Vibration	No mechanical damage.	Completely soak both terminations in solder at $260 \pm 5^\circ\text{C}$ for $5 \pm 1\text{s}$.																				
	External appearance		Preheating condition Temp.: $150 \pm 10^\circ\text{C}$ Time: 1 to 2min.																				
	Capacitance	<table border="1"> <thead> <tr> <th colspan="2">Characteristics</th> <th>Change from the value before test</th> </tr> </thead> <tbody> <tr> <td>Class 1</td> <td>C0G</td> <td>$\pm 2.5\%$</td> </tr> <tr> <td>Class 2</td> <td>X7R</td> <td>$\pm 7.5\%$</td> </tr> </tbody> </table>	Characteristics		Change from the value before test	Class 1	C0G	$\pm 2.5\%$	Class 2	X7R	$\pm 7.5\%$	Flux: Isopropyl alcohol (JIS K 8839) Rosin (JIS K 5902) 25% solid solution.											
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Rated Capacitance	Q																						
30pF and over	1,000 min.																						
Under 30pF	$400 + 20 \times C$ min.																						
D.F. (Class 2)	Meet the initial spec.	Leave the capacitor in ambient conditions for 6 to 24h (Class 1) or $24 \pm 2\text{h}$ (Class 2) before measurement.																					
12	Temperature cycle	No mechanical damage.	Reflow solder the capacitor on P.C. board (shown in Appendix 1) before testing.																				
	External appearance		Expose the capacitor in the conditions step1 through step 4 and repeat 5 times consecutively.																				
	Capacitance	<table border="1"> <thead> <tr> <th colspan="2">Characteristics</th> <th>Change from the value before test</th> </tr> </thead> <tbody> <tr> <td>Class 1</td> <td>C0G</td> <td>$\pm 2.5\%$</td> </tr> <tr> <td>Class 2</td> <td>X7R</td> <td>$\pm 7.5\%$</td> </tr> </tbody> </table>	Characteristics		Change from the value before test	Class 1	C0G	$\pm 2.5\%$	Class 2	X7R	$\pm 7.5\%$	Leave the capacitor in ambient conditions for 6 to 24h (Class 1) or $24 \pm 2\text{h}$ (Class 2) before measurement.											
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Rated Capacitance	Q																						
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3	Max. operating temp. ± 2	30 ± 2																					
4	Reference Temp.	2 - 5																					
D.F. (Class 2)	Meet the initial spec.																						
Insulation Resistance	Meet the initial spec.																						
Voltage Proof	No insulation breakdown or other damage.																						



No.	Item	Performance	Test or Inspection Method	
13	Moisture Resistance (Steady State)			
	External appearance	No mechanical damage.	Reflow solder the capacitors on P.C. board (shown in Appendix 1) before testing. Leave at temperature $40 \pm 2^\circ\text{C}$, 90 to 95%RH for 500 +24,0h.	
	Capacitance	Characteristics		Leave the capacitors in ambient conditions for 6 to 24h (Class 1) or $24 \pm 2\text{h}$ (Class 2) before measurement.
		Change from the value before test		
		Class 1	C0G	
		Class 2	X7R	$\pm 12.5 \%$
Q (Class 1)	Rated Capacitance		Q	
	30pF and over			350 min.
	10pF and over to under 30pF			$275+5/2 \times C$ min.
C : Rated capacitance (pF)				
D.F. (Class 2)	Characteristics	X7R: 200% of initial spec. max.		
Insulation Resistance		1,000M Ω min.		
14	Life			
	External appearance	No mechanical damage.	Reflow solder the capacitors on P.C. board (shown in Appendix 1) before testing. Apply rated voltage at maximum operating temperature $\pm 2^\circ\text{C}$ for 1,000 +48, 0h.	
	Capacitance	Characteristics		Charge/discharge current shall not exceed 50mA. Leave the capacitor in ambient conditions for 6 to 24h (Class1) or $24 \pm 2\text{h}$ (Class2) before measurement.
		Change from the value before test		
		Class 1	C0G	
		Class 2	X7R	$\pm 15 \%$
Q (Class 1)	Rated Capacitance		Q	
	30pF and over			350 min.
	10pF and over to under 30pF			$275+5/2 \times C$ min.
C : Rated capacitance (pF)				
D.F. (Class 2)	Characteristics	X7R: 200% of initial spec. max.	Voltage conditioning: Voltage treat the capacitors under testing temperature and voltage for 1 hour. Leave the capacitors in ambient conditions for $24 \pm 2\text{h}$ before measurement.	
Insulation Resistance		1,000M Ω min.	Use this measurement for initial value.	

***As for the initial measurement of capacitors (Class 2) on number 8, 11, 12 and 13, leave capacitors at $150 -10, 0^\circ\text{C}$ for 1 hour and measure the value after leaving capacitor for $24 \pm 2\text{h}$ in ambient condition.**


Appendix - 1
P.C. Board for reliability test


Material : Glass Epoxy (As per JIS C6484 GE4)

P.C. Board thickness : 1.6mm

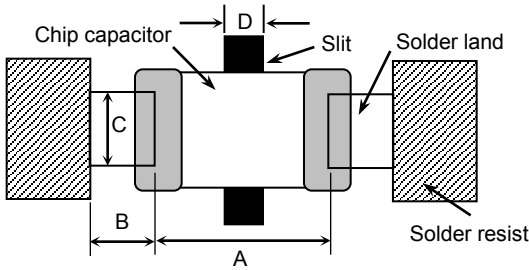
- Copper (thickness 0.035mm)
- Solder resist

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

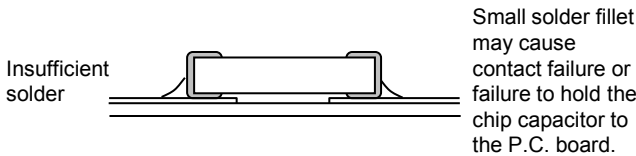
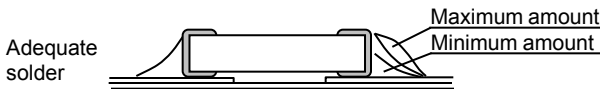
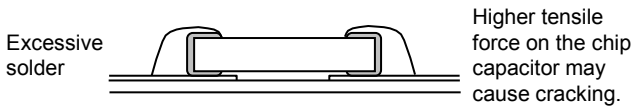
Recommended Soldering Land Pattern



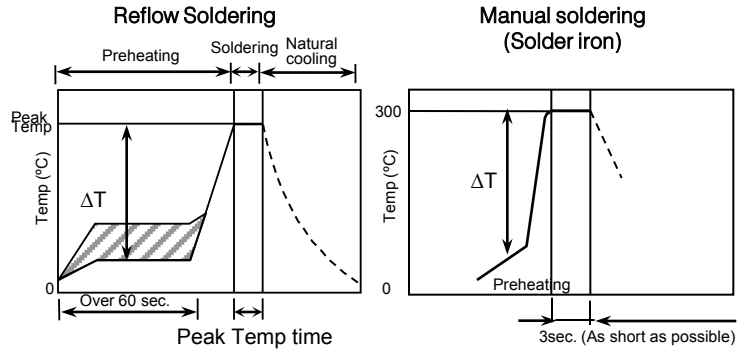
- This product intended solely for reflow soldering.
- A slit of about 1mm on the circuit board is recommended to improve removal of the flux after soldering.
- Ensure that this product is completely dried following washing.
- Because this product will be subjected to high voltages, use only low-activity 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	
Type	C4520 [CC1808]	C4532 [CC1812]	
Symbol			
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 Solder Amount



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

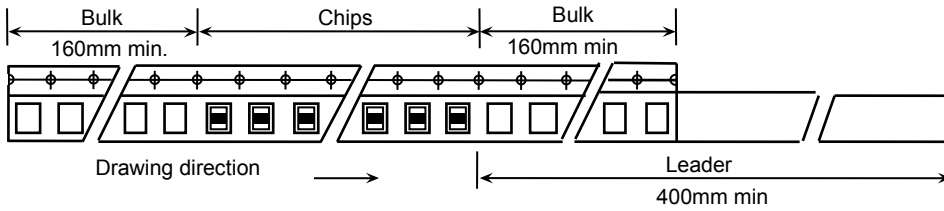
Soldering	Temp. (°C)
Reflow soldering	$\Delta T \leq 130$
Manual soldering	$\Delta T \leq 130$



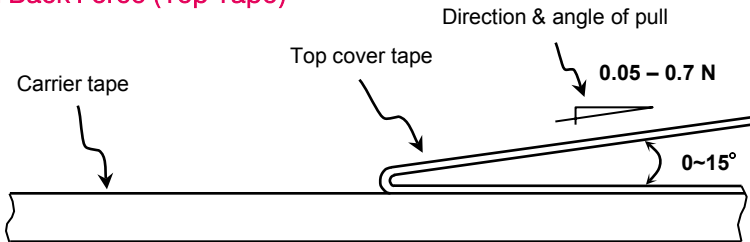
Packaging Information

C Series – High Voltage Application

Carrier Tape Configuration

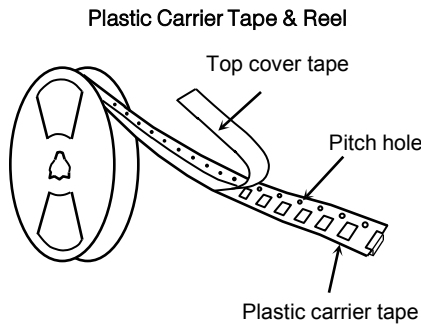


Peel Back Force (Top Tape)



- 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



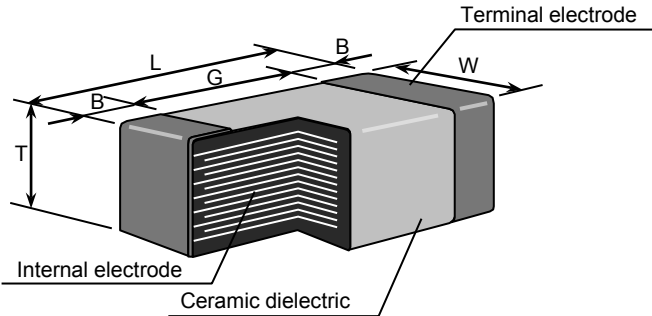
Case Code		Chip Thickness	Taping Material	Chip quantity (pcs.)	
JIS	EIA			φ178mm (7") reel	Φ330mm (13") reel
C4520	CC1808	0.85 mm	Plastic	1,000	5,000
		1.10 mm			
		1.30 mm			3,000
		1.60 mm			
		2.00 mm			
C4532	CC1812	1.30 mm	Plastic	1,000	5,000
		1.60 mm			
		2.00 mm			3,000
		2.30 mm			
		3.20 mm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



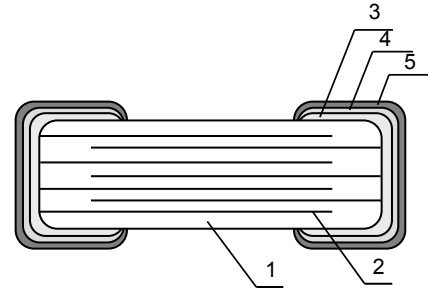
Additional Information

C Series – High Voltage Application

• Shape & Dimensions



• Inside Structure & Material System



Case Code		Dimensions (mm)				
JIS	EIA	L	W	T	B	G
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		
				2.00 mm		
C4532	CC1812	4.50	3.20	1.30 mm	0.30 min.	2.00 min
				1.60 mm		
				2.00 mm	0.20 min	
				2.30 mm		
3.20 mm	0.30 min.					

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 Directive¹ 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 Directive².

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.