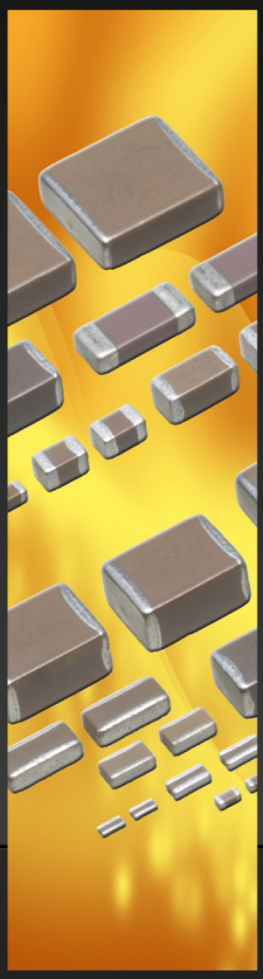
TDK

MULTILAYER CERAMIC CHIP CAPACITORS



C Series
Low ESL Flip Type

Type: C0510 [EIA CC0204]
C0816 [EIA CC0306]
C1220 [EIA CC0508]
C1632 [EIA CC0612]

Issue date: April 2011

TDK MLCC
US Catalog

Version B11

REMINDERS

Please read before using this product

SAFETY REMINDERS

REMINDERS

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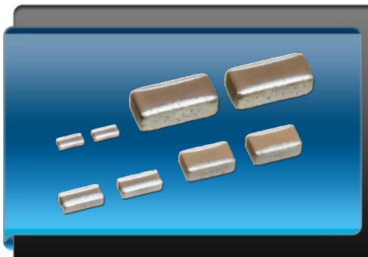


C Series

Low ESL Flip Type

Type: C0510, C0816, C1220, C1632

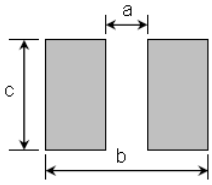
Features

- Positioning the electrodes along the length of the chip device, reduces ESR and ESL components over conventional products.
- Provides high frequency noise suppression effect because the resonating frequency is high.
- Flipped geometry provides low inductance (less than 400 pH).
- Provides stabilization of power line voltage.
- Suitable for IC decoupling application.

Applications

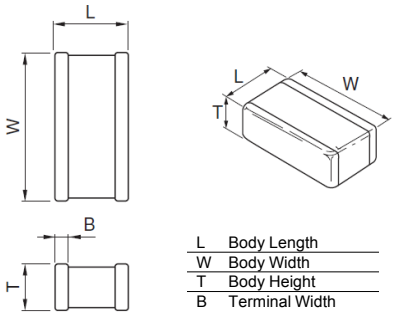
- Decoupling CPU power line
- Bias line in CPU
- High speed digital IC/decoupling
- PC, cell phones, camcorders, etc.

PC Board Pattern



Case Size	Dimensions (mm) a	b	c
C0510	0.2	0.6	1.0
C0816	0.3	1.0	1.6
C1220	0.5	1.6	2.0
C1632	0.75	2.2	3.2

Shape & Dimensions



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

Dimensions in mm

Part Number Construction

C 1632 X5R 0J 106 M T XXXX

Series Name — C

Dimensions L x W (mm) — 1632

Case Code	Length	Width
C0510	0.52 ± 0.05	1.00 ± 0.05
C0816 (C<1µF)	0.80 ± 0.10	1.60 ± 0.10
C0816 (C≥1µF)	0.80 ± 0.15	1.60 ± 0.20
C1220	1.25 ± 0.20	2.00 ± 0.20
C1608	1.60 ± 0.20	3.20 ± 0.20

Temperature Characteristic — X5R

Temperature Characteristics	Capacitance Change	Temperature Range
X5R	± 15%	-55 to +85ºC
X6S	± 22%	-55 to +105ºC
X7R	± 15%	-55 to +125ºC
X7S	± 22%	-55 to +125ºC

Rated Voltage (DC) — 0J

Voltage Code	Voltage (DC)
0G	4V
0J	6.3V
1A	10V
1C	16V
1E	25V
1H	50V

Nominal Capacitance (pF) — 106

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 Tolerance — M

Tolerance Code	Tolerance
K	±15%
M	± 20%

Packaging Style — T

Packaging Code	Style
T	Tape & Reel

Internal Codes — XXXX

Capacitance Range Chart

C0510 [EIA CC0204]

Capacitance Range Chart

Temperature Characteristics: X6S (± 22%)

Rated Voltage: 4V (0G)

Capacitance (pF)	Cap Code	Tolerance	X6S 0G (4V)
10,000	103	M: ± 20%	
22,000	223		
47,000	473		
100,000	104		
220,000	224		
470,000	474		
1,000,000	105		
2,200,000	225		

Standard Thickness

0.30 mm

Capacitance Range Table

C0510 [EIA CC0204]

Class 2 (Temperature Stable)

Temperature Characteristics X6S (-55 to +105ºC, ±22%)

TDK Part Number (Ordering Code)	Temperature Characteristics	Rated Voltage	Capacitance (pF)	Capacitance Tolerance	Thickness (mm)
C0510X6S0G104M	X6S	4V	100,000	± 20%	0.30 ± 0.05
C0510X6S0G224M	X6S	4V	220,000	± 20%	0.30 ± 0.05
C0510X6S0G474M	X6S	4V	470,000	± 20%	0.30 ± 0.05

Capacitance Range Chart

C0816 [EIA CC0306]

Capacitance Range Chart

Temperature Characteristics: X7R, (± 15%), X7S (± 22%), X5R (± 15%), X6S (± 22%)

Rated Voltage: 16V (1C), 10V (1A), 6.3V (0J), 4V (0G)

Capacitance (pF)	Cap Code	Tolerance	X7R		X7S	X5R		X6S
			1C (16V)	0J (6.3V)	0G (4V)	1A (10V)	0J (6.3V)	0G (4V)
10,000	103	K: ± 10%	■					
22,000	223	M: ± 20%	■					
47,000	473		■					
100,000	104		■			■		
220,000	224			■		■		
470,000	474				■		■	■
1,000,000	105				■		■	
2,200,000	225				■		■	

Standard Thickness

■ 0.50 mm

Capacitance Range Table

C0816 [EIA CC0306]

Class 2 (Temperature Stable)

Temperature Characteristics X7R (-55 to +125ºC, ±15%), X7S (-55 to +125ºC, ±2%), X5R (-55 to +85ºC, ±15%)

TDK Part Number (Ordering Code)	Temperature Characteristics	Rated Voltage	Capacitance (pF)	Capacitance Tolerance	Thickness (mm)
C0816X7R1C103K	X7R	16V	10,000	± 10%	0.50 ± 0.10
C0816X7R1C223K	X7R	16V	22,000	± 10%	0.50 ± 0.10
C0816X7R1C473K	X7R	16V	47,000	± 10%	0.50 ± 0.10
C0816X7R1C104K	X7R	16V	100,000	± 10%	0.50 ± 0.10
C0816X7R0J224K	X7R	6.3V	220,000	± 10%	0.50 ± 0.10
C0816X7S0G474K	X7S	4V	470,000	± 10%	0.50 ± 0.10
C0816X7S0G105M	X7S	4V	1,000,000	± 20%	0.50 ± 0.10
C0816X7S0G225M	X7S	4V	2,200,000	± 20%	0.50 ± 0.10
C0816X5R1A224K	X5R	10V	220,000	± 10%	0.50 ± 0.10
C0816X5R1A474K	X5R	10V	470,000	± 10%	0.50 ± 0.10
C0816X5R0J474K	X5R	6.3V	470,000	± 10%	0.50 ± 0.10
C0816X5R0J105M	X5R	6.3V	1,000,000	± 20%	0.50 ± 0.10
C0816X5R0J225M	X5R	6.3V	2,200,000	± 20%	0.50 ± 0.10

Capacitance Range Chart

C1220 [EIA CC0508]

Capacitance Range Chart

Temperature Characteristics: X7R, (± 15%), X5R (± 15%)

Rated Voltage: 50V (1H), 25V (1E), 16V (1C), 10V (1A), 6.3V (0J)

Capacitance (pF)	Cap Code	Tolerance	X7R				X5R
			1H (50V)	1E (25V)	1C (16V)	0J (6.3V)	1A (10V)
10,000	103	K: ± 10%					
22,000	223	M: ± 20%					
47,000	473						
100,000	104						
220,000	224						
470,000	474						
1,000,000	105						

Standard Thickness

0.85 mm

Capacitance Range Table

C1220 [EIA CC0508]

Class 2 (Temperature Stable)

Temperature Characteristics X7R (-55 to +125ºC, ±15%), X5R (-55 to +85ºC, ±15%)

TDK Part Number (Ordering Code)	Temperature Characteristics	Rated Voltage	Capacitance (pF)	Capacitance Tolerance	Thickness (mm)
C1220X7R1H103K	X7R	50V	10,000	± 10%	0.85 ± 0.10
C1220X7R1H223K	X7R	50V	22,000	± 10%	0.85 ± 0.10
C1220X7R1H473K	X7R	50V	47,000	± 10%	0.85 ± 0.10
C1220X7R1E104K	X7R	25V	100,000	± 10%	0.85 ± 0.10
C1220X7R1C224K	X7R	16V	220,000	± 10%	0.85 ± 0.10
C1220X7R0J474K	X7R	6.3V	470,000	± 10%	0.85 ± 0.10
C1220X7R0J105M	X7R	6.3V	1,000,000	± 20%	0.85 ± 0.10
C1220X5R1A474K	X5R	10V	470,000	± 10%	0.85 ± 0.10
C1220X5R1A105M	X5R	10V	1,000,000	± 20%	0.85 ± 0.10

Capacitance Range Chart

C1632 [EIA CC0612]

Capacitance Range Chart

Temperature Characteristics: X7R, (± 15%), X7S (± 22%), X5R (± 15%)

Rated Voltage: 50V (1H), 25V (1E), 16V (1C), 10V (1A), 6.3 (0J), 4V (0G)

Capacitance (pF)	Cap Code	Tolerance	X7R				X7S	X5R	
			1H (50V)	1E (25V)	1C (16V)	0J (6.3V)	0G (4V)	1A (10V)	0J (6.3V)
10,000	103	K: ± 10%							
22,000	223	M: ± 20%							
47,000	473								
100,000	104								
220,000	224								
470,000	474								
1,000,000	105								
2,200,000	225								
4,700,000	475								
10,000,000	106								

Standard Thickness

0.70 mm 1.15 mm 1.30 mm

Capacitance Range Table

C1632 [EIA CC0612]

Class 2 (Temperature Stable)

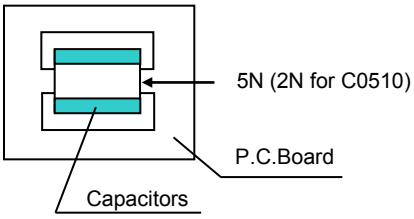
Temperature Characteristics X7R (-55 to +125ºC, ±15%), X7S (-55 to +125ºC, ±2%), X5R (-55 to +85ºC, ±15%)

TDK Part Number (Ordering Code)	Temperature Characteristics	Rated Voltage	Capacitance (pF)	Capacitance Tolerance	Thickness (mm)
C1632X7R1H103K	X7R	50V	10,000	± 10%	0.70 ± 0.10
C1632X7R1H223K	X7R	50V	22,000	± 10%	0.70 ± 0.10
C1632X7R1H473K	X7R	50V	47,000	± 10%	0.70 ± 0.10
C1632X7R1H104K	X7R	50V	100,000	± 10%	0.70 ± 0.10
C1632X7R1H224K	X7R	50V	220,000	± 10%	1.15 ± 0.10
C1632X7R1E224K	X7R	25V	220,000	± 10%	0.70 ± 0.10
C1632X7R1E474K	X7R	25V	470,000	± 10%	1.15 ± 0.10
C1632X7R1C474K	X7R	16V	470,000	± 10%	0.70 ± 0.10
C1632X7R1C105K	X7R	16V	1,000,000	± 10%	1.15 ± 0.10
C1632X7R0J105M	X7R	6.3V	1,000,000	± 20%	0.70 ± 0.10
C1632X7R0J225M	X7R	6.3V	2,200,000	± 20%	1.15 ± 0.10
C1632X7S0G475M	X7S	4V	4,700,000	± 20%	1.30 ± 0.10
C1632X7S0G106M	X7S	4V	10,000,000	± 20%	1.30 ± 0.10
C1632X5R1A105M	X5R	10V	1,000,000	± 20%	0.70 ± 0.10
C1632X5R1A225M	X5R	10V	2,200,000	± 20%	1.15 ± 0.10
C1632X5R0J475M	X5R	6.3V	4,700,000	± 20%	1.30 ± 0.10
C1632X5R0J106M	X5R	6.3V	10,000,000	± 20%	1.30 ± 0.10

General Specifications

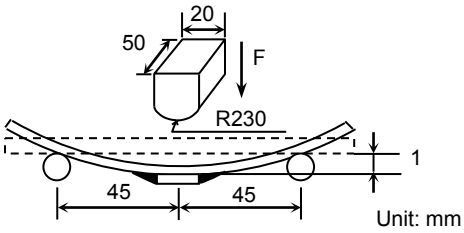
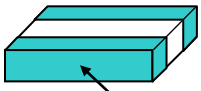
C Series – Low ESL Flip Type

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 capacitor of rated voltage 16, 10, 6.3 and 4V DC, 100MΩ•μF min.	Apply rated voltage for 60s.
3	**Voltage Proof**	Withstand test voltage without insulation breakdown or other damage.	Apply 2.5 x rated voltage for 1 ~ 5s. Charge / discharge current shall not exceed 50mA.
4	**Capacitance**	Within the specified tolerance.	**Measuring Frequency**: 1kHz±10% **Rated Voltage** / **Measuring Voltage**: 50V ~ 6.3V: 1.0±0.2 V_{rms} 4V: 0.5 - 5 V_{rms}
5	**Dissipation Factor (Class 2)**	**T.C.** / **Rated Voltage** / **D.F.** X7R: 50V, 25V DC: 0.03 max. X7R, X5R: 16V, 10V, 6.3V DC: 0.05 max. X7S, X6S, X5S: 4V DC: 0.12 max.	See No.4 in this table for measuring condition.
6	**Temperature Characteristics of Capacitance (Class 2)**	Capacitance Change (%) **No Voltage Applied** **T.C.** / **Δ C Percent** X5R, X7R: ±15% X5S, X6S, X7S: ±22%	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
7	**Robustness of Terminations**	No sign of termination coming off, breakage of ceramic, or other abnormal signs.	Reflow solder the capacitor on P.C. board (shown in Appendix 1) and apply a pushing force of 5N (C0510: 2N) for 10 ± 1s.



General Specifications

C Series – Low ESL Flip Type

No.	Item	Performance	Test or Inspection Method
8	**Bending**	No mechanical damage.	Reflow solder the capacitor on P.C. board (shown in Appendix 2) and bend it for 1mm. 
9	**Solderability**	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.  	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.
10	**Resistance to solder heat**		Completely soak both terminations in solder at 260 ± 5ºC for 5 ± 1s. Preheating condition Temp. : 150 ± 10ºC Time: 1 ~ 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 24 ± 2h before measurement.
	External appearance	No cracks are allowed and terminations shall be covered at least 60% with new solder.	
	Capacitance	**Characteristics**: Class 2 — X7R, X7S, X5R, X6S; **Change from the value before test**: ± 7.5 %	
	D.F. (Class 2)	Meet the initial spec.	
	Insulation Resistance	Meet the initial spec.	
	Voltage proof	No insulation breakdown or other damage.	

General Specifications

C Series – Low ESL Flip Type

No.	Item	Performance	Test or Inspection Method
11	**Vibration**		Solder the capacitors on P.C. board (shown in Appendix 1) before testing. Vibrate the capacitor with amplitude of 1.5mm P-P changing the frequencies from 10Hz to 55Hz and back to 10Hz in about 1min. Repeat this for 2h each in 3 perpendicular directions.
	External appearance	No mechanical damage.	
	Capacitance	**Characteristics**: Class 2 – X7R, X7S, X5R, X6S; **Change from the value before test**: ± 7.5 %	
	D.F. (Class 2)	Meet the initial spec.	
12	**Temperature cycle**		Solder the capacitors on P.C. board (shown in Appendix 1) before testing. Expose the capacitor in the conditions step1 through 4 and repeat 5 times consecutively. Leave the capacitor in ambient conditions for 24 ± 2h before measurement.
	External appearance	No mechanical damage.	
	Capacitance	**Characteristics**: Class 2 – X7R, X7S, X5R, X6S; **Change from the value before test**: ± 7.5 %	
	D.F. (Class 2)	Meet the initial spec.	
	Insulation Resistance	1,000MΩ or 50MΩ•μF min. whichever smaller.	
	Voltage Proof	No insulation breakdown or other damage.	
13	**Moisture Resistance (Steady State)**		Solder the capacitor 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 capacitor in ambient conditions for 24 ± 2h before measurement.
	External appearance	No mechanical damage.	
	Capacitance	**Characteristics**: Class 2 – X7R, X7S, X5R, X6S; **Change from the value before test**: ± 12.5 %	
	D.F. (Class 2)	Characteristics X7R: 200% of initial spec. max. X7S: 200% of initial spec. max. X5R: 200% of initial spec. max. X6S: 200% of initial spec. max.	
	Insulation Resistance	1,000MΩ or 50MΩ•μF min. (whichever smaller). As for the capacitor of rated voltage 16, 10, 6.3 and 4V DC, 10MΩ•μF min.	

Test or Inspection Method – Step 12:

Step	Temperature (ºC)	Time (min.)
1	Min. operating temp. ±3	30 ± 3
2	Reference Temp.	2 – 5
3	Max. operating temp. ± 2	30 ± 2
4	Reference Temp.	2 - 5

General Specifications

C Series – Low ESL Flip Type

No.	Item	Performance	Test or Inspection Method
14	**Moisture Resistance**		Solder the capacitors on P.C. board (shown in Appendix 1) 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 48 ± 4h before measurement. Voltage conditioning: Voltage treats the capacitor under testing temperature and voltage for 1hour. Leave the capacitor in ambient conditions for 24 ± 2h before measurement. Use this measurement for initial value.
	External appearance	No mechanical damage.	
	Capacitance	**Characteristics**: Class 2 (X7R, X7S, X5R, X6S); **Change from the value before test**: ± 12.5 %	
	D.F. (Class 2)	Characteristics X7R: 200% of initial spec. max. X7S: 200% of initial spec. max. X5R: 200% of initial spec. max. X6S: 200% of initial spec. max.	
	Insulation Resistance	500MΩ or 25MΩ•μF min. (whichever smaller). As for the capacitor of rated voltage 16, 10, 6.3 and 4V DC, 5MΩ•μF min.	
15	**Life**		Reflow Solder the capacitor 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 24 ± 2h before measurement. Voltage conditioning: Voltage treats the capacitor under testing temperature and voltage for 1hour. Leave the capacitor in ambient conditions for 48 ± 4h before measurement. Use this measurement for initial value.
	External appearance	No mechanical damage.	
	Capacitance	**Characteristics**: Class 2 (X7R, X7S, X5R, X6S); **Change from the value before test**: ± 15 %	
	D.F. (Class 2)	Characteristics X7R: 200% of initial spec. max. X7S: 200% of initial spec. max. X5R: 200% of initial spec. max. X6S: 200% of initial spec. max.	
	Insulation Resistance	1,000MΩ or 50MΩ•μF min. whichever smaller. As for the capacitor of rated voltage 16, 10, 6.3 and 4V DC, 10MΩ•μF min.	

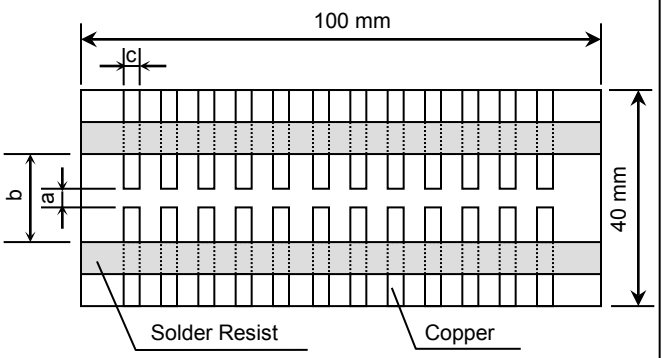
***As for the initial measurement of capacitors on number 6, 10, 11, 12 and 13, leave capacitor at 150 -10, 0°C for 1h and measure the value after leaving capacitor for 24 ± 2h in ambient condition.**

General Specifications

C Series – Low ESL Flip Type

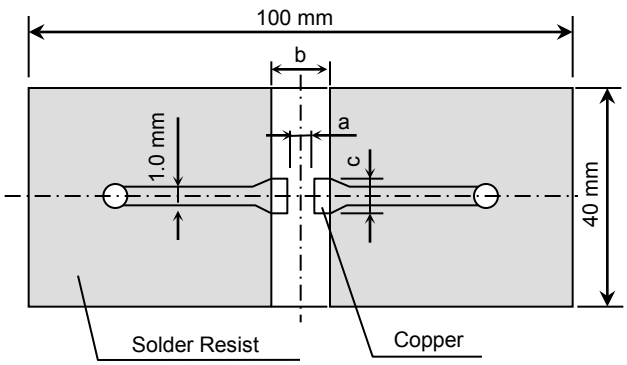
Appendix - 1

P.C. Board for reliability test



Appendix - 2

P.C. Board for bending test



Material : Glass Epoxy (As per JIS C6484 GE4)

P.C. Board thickness : Appendix 1,2 1.6mm

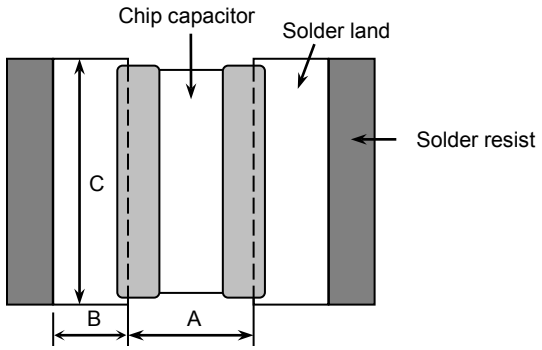
Copper (thickness 0.035mm)
Solder resist

Case Code		Dimensions (mm)		
JIS	EIA	a	b	c
C0510	CC0204	0.2	0.6	1.0
C0816	CC0306	0.3	1.0	1.6
C1220	CC0508	0.5	1.6	2.0
C1632	CC0612	0.75	2.2	3.2

Soldering Information

C Series – Low ESL Flip Type

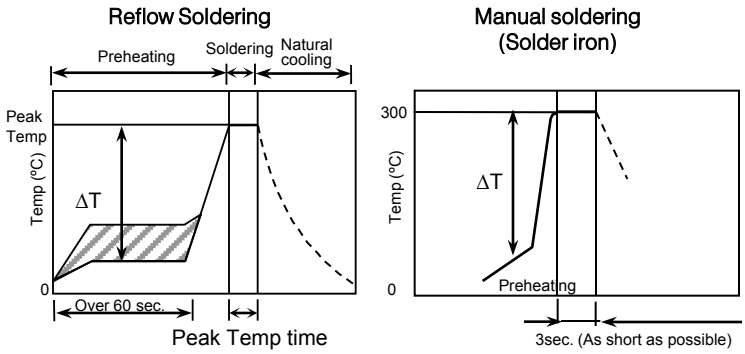
• Recommended Soldering Land Pattern



Reflow Soldering Unit: mm

Symbol \ Type	C0510 [CC0204]	C0816 [CC0306]	C1220 [CC0508]	C1632 [CC0612]
A	0.20	0.30	0.50	0.75
B	0.20	0.35	0.55	0.725
C	1.00	1.60	2.00	3.20

• 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.

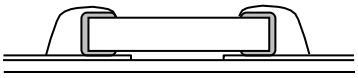
Recommended solder compositions
Sn-37Pb (Sn-Pb solder)
Sn-3.0Ag-0.5Cu (Lead Free Solder)

Preheating Condition

Soldering	Temp. (°C)
Reflow soldering	ΔT ≤ 150
Manual soldering	ΔT ≤ 150

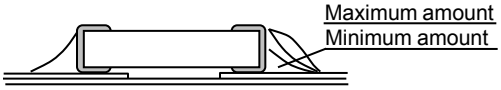
• Recommended Solder Amount

Excessive solder

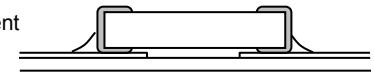


Higher tensile force on the chip capacitor may cause cracking.

Adequate solder



Insufficient solder

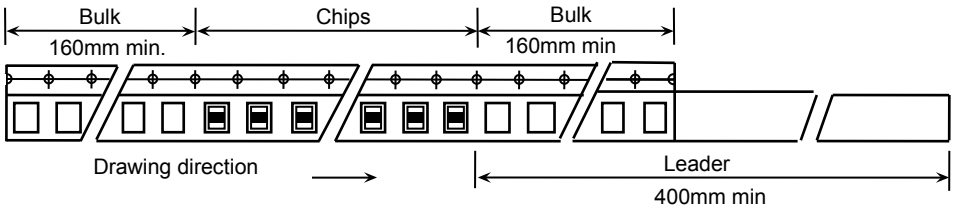


Small solder fillet may cause contact failure or failure to hold the chip capacitor to the P.C. board.

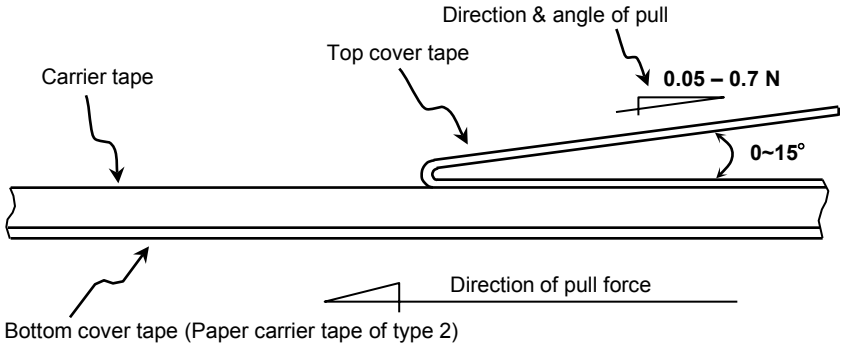
Packaging Information

C Series – Low ESL Flip Type

• Carrier Tape Configuration



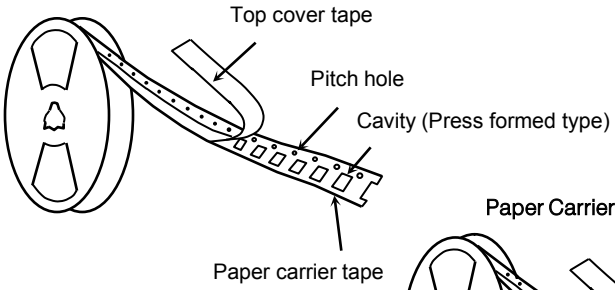
• Peel Back Force (Top Tape)



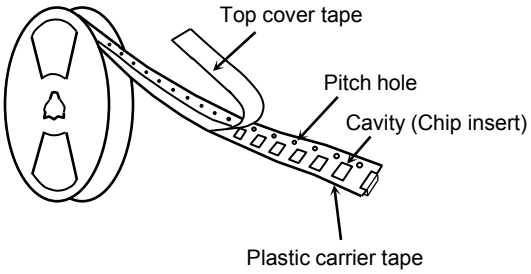
- Carrier tape shall be flexible enough to be wound around a minimum radius of 30mm with components in tape.
- The missing of components shall be less than 0.1%
- Components shall not stick to the cover tape.
- The cover tape shall not protrude beyond the edges of the carrier tape not shall cover the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

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

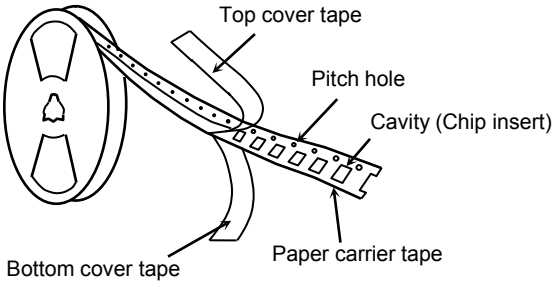
Paper Carrier Tape & Reel (Type 1)



Paper Carrier Tape & Reel (Type 2)



Paper Carrier Tape & Reel (Type 3)

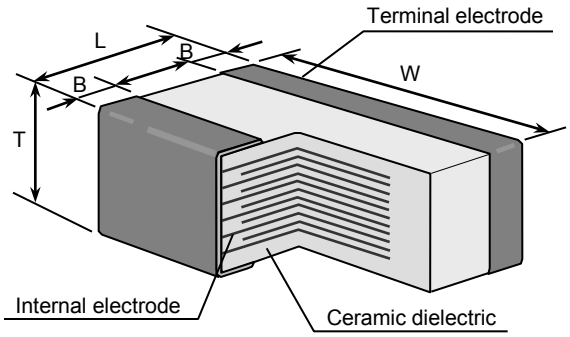


Case Code		Chip Thickness	Taping Material	Chip quantity (pcs.)	
JIS	EIA			φ178mm (7") reel	φ330mm (13") reel
C0510	CC0204	0.50 mm	Paper (Type 1)	15,000	50,000
C0816	CC0306	0.80 mm	Plastic (Type 3)	4,000	10,000
C1220	CC0508	0.85 mm	Paper (Type 2)	4,000	10,000
C1632	CC0612	0.70 mm	Plastic (Type 3)	4,000	10,000
		1.15 mm		2,000	
		1.30 mm			

Additional Information

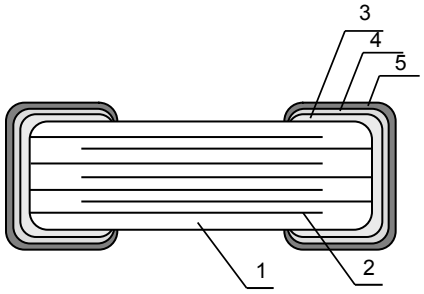
C Series – Low ESL Flip Type

• Shape & Dimensions



Case Code		Dimensions (mm)				
JIS	EIA	L	W	T	B	G
C0510	CC0204	0.52	1.00	0.50	0.10 min.	0.09 min.
C0816	CC0306	0.80	1.60	0.80	0.10 min.	-
C1220	CC0508	1.25	2.00	0.85	0.20 min.	0.40 min.
C1632	CC0612	1.60	3.20	0.70	0.20 min.	0.50 min.
				1.15		
				1.30		

• Inside Structure & Material System



No.	NAME	MATERIAL
		Class 2
(1)	Ceramic Dielectric	$BaTiO_3$
(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.