



MULTILAYER CERAMIC CHIP CAPACITORS



C Series Tight Tolerance Capacitors

Type: C1005 [EIA CC0402]
C1608 [EIA CC0603]

Issue date: January 2011



**TDK MLCC
US Catalog**

Version A11

REMINDERS

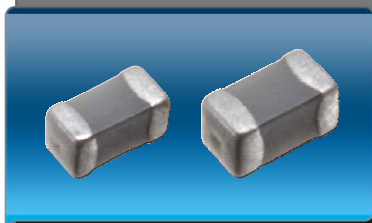
Please read before using this product

SAFETY REMINDERS



REMINDERS

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C Series Tight Tolerance Capacitors

Type: C1005, C1608

Available Through Distribution Only*

Features



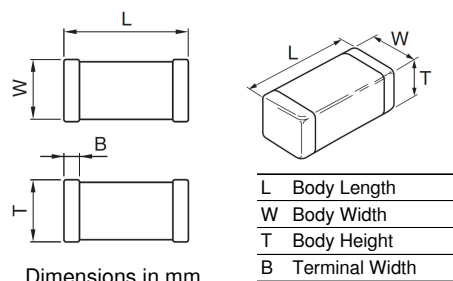
- Available in 1% and 2% capacitance tolerance
- Suitable for high frequency applications
- A monolithic structure ensures superior mechanical strength and reliability
- High-accuracy automatic mounting is facilitated through the maintenance of very precise dimensional tolerances
- Composed of only ceramics and metals, these capacitors provide extremely dependable performance, exhibiting virtually no degradation even when subjected to temperature extremes
- Low stray capacitance ensures high conformity with nominal values, thereby simplifying the circuit design process
- Low residual inductance assures superior frequency characteristics
- Owing to their low ESR and excellent frequency characteristics, these products are optimally suited for high frequency and high-density type power supplies

Applications



- Electronics equipment
- Mobile communications equipment
- LTE/WiMAX base stations
- High frequency RF modules
- Test and measurement equipment
- Matching/Coupling circuits
- Tuning circuits

Shape & Dimensions



Part Number Construction

Series Name: C 1608 C0G 2A 102 F T XXXX

Series Name

Dimensions L x W (mm)

Case Code	Length	Width
C1005	1.00 ± 0.05	0.50 ± 0.05
C1608	1.60 ± 0.10	0.80 ± 0.10

Temperature Characteristic

Temperature Characteristics	Capacitance Change	Temperature Range
C0G	0±30 ppm/°C	-55 to +125°C

Rated Voltage (DC)

Voltage Code	Voltage(DC)
1H	50V
2A	100V

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)

Internal Codes

Packaging Style

Packaging Code	Style
T	Tape and Reel

Capacitance Tolerance

Tolerance Code	Tolerance
F	± 1%
G	± 2%

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Capacitance Range Table

C1005 [EIA CC0402]

Available Through Distribution Only*

Class 1 (Temperature Compensating)

Temperature Characteristics: C0G (0 ± 30 ppm/°C)

TDK Part Number (Ordering Code)	Temperature Characteristics	Rated Voltage	Capacitance (pF)	Capacitance Tolerance	Thickness (mm)
C1005C0G1H220F	C0G	50V	22	1%	0.50 ± 0.05
C1005C0G1H220G	C0G	50V	22	2%	0.50 ± 0.05
C1005C0G1H470F	C0G	50V	47	1%	0.50 ± 0.05
C1005C0G1H470G	C0G	50V	47	2%	0.50 ± 0.05
C1005C0G1H101F	C0G	50V	100	1%	0.50 ± 0.05
C1005C0G1H101G	C0G	50V	100	2%	0.50 ± 0.05



Capacitance Range Table

C1608 [EIA CC0603]

Available Through Distribution Only*

Class 1 (Temperature Compensating)

Temperature Characteristics: C0G (0 ± 30 ppm/°C)

TDK Part Number (Ordering Code)	Temperature Characteristics	Rated Voltage	Capacitance (pF)	Capacitance Tolerance	Thickness (mm)
C1608C0G1H220F	C0G	50V	22	1%	0.80 ± 0.08
C1608C0G1H220G	C0G	50V	22	2%	0.80 ± 0.08
C1608C0G1H470F	C0G	50V	47	1%	0.80 ± 0.08
C1608C0G1H470G	C0G	50V	47	2%	0.80 ± 0.08
C1608C0G1H101F	C0G	50V	100	1%	0.80 ± 0.08
C1608C0G1H101G	C0G	50V	100	2%	0.80 ± 0.08
C1608C0G1H221F	C0G	50V	220	1%	0.80 ± 0.08
C1608C0G1H221G	C0G	50V	220	2%	0.80 ± 0.08
C1608C0G1H471F	C0G	50V	470	1%	0.80 ± 0.08
C1608C0G1H471G	C0G	50V	470	2%	0.80 ± 0.08
C1608C0G1H102F	C0G	50V	1,000	1%	0.80 ± 0.08
C1608C0G1H102G	C0G	50V	1,000	2%	0.80 ± 0.08
C1608C0G2A101F	C0G	100V	100	1%	0.80 ± 0.08
C1608C0G2A101G	C0G	100V	100	2%	0.80 ± 0.08
C1608C0G2A102F	C0G	100V	1,000	1%	0.80 ± 0.08
C1608C0G2A102G	C0G	100V	1,000	2%	0.80 ± 0.08

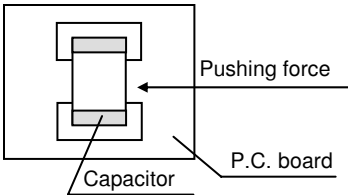
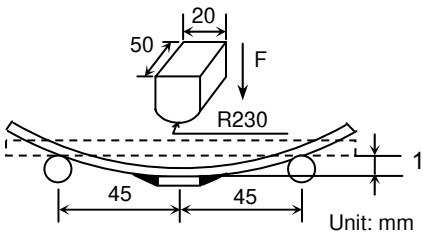
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General Specifications

C Series – Tight Tolerance Capacitors

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 rated voltage for 60s.										
3	Voltage Proof	Withstand test voltage without insulation breakdown or other damage.	<table border="1"> <thead> <tr> <th>Class</th> <th>Apply voltage</th> </tr> </thead> <tbody> <tr> <td>Class 1</td> <td>3 × rated voltage</td> </tr> </tbody> </table> <p>Above DC voltage shall be applied for 1 to 5s. Charge / discharge current shall not exceed 50mA.</p>	Class	Apply voltage	Class 1	3 × rated voltage						
Class	Apply voltage												
Class 1	3 × rated voltage												
4	Capacitance	Within the specified tolerance.	<table border="1"> <thead> <tr> <th>Class</th> <th>Rated Capacitance</th> <th>Measuring Frequency</th> <th>Measuring voltage</th> </tr> </thead> <tbody> <tr> <td rowspan="2">Class 1</td> <td>1000pF and under</td> <td>1MHz±10%</td> <td rowspan="2">0.5 - 5 V_{rms}</td> </tr> <tr> <td>Over 1000pF</td> <td>1kHz±10%</td> </tr> </tbody> </table>	Class	Rated Capacitance	Measuring Frequency	Measuring voltage	Class 1	1000pF and under	1MHz±10%	0.5 - 5 V _{rms}	Over 1000pF	1kHz±10%
Class	Rated Capacitance	Measuring Frequency	Measuring voltage										
Class 1	1000pF and under	1MHz±10%	0.5 - 5 V _{rms}										
	Over 1000pF	1kHz±10%											
5	Q (Class 1)	<table border="1"> <thead> <tr> <th>Rated Capacitance</th> <th>Q</th> </tr> </thead> <tbody> <tr> <td>C ≥ 30pF</td> <td>1,000 min.</td> </tr> <tr> <td>C < 30pF</td> <td>400+20×C min.</td> </tr> </tbody> </table> <p>C : Rated capacitance (pF)</p>	Rated Capacitance	Q	C ≥ 30pF	1,000 min.	C < 30pF	400+20×C min.	See No.4 in this table for measuring condition.				
Rated Capacitance	Q												
C ≥ 30pF	1,000 min.												
C < 30pF	400+20×C min.												
6	Temperature Characteristics of Capacitance (Class 1)	<table border="1"> <thead> <tr> <th>T.C.</th> <th>Temperature Coefficient</th> </tr> </thead> <tbody> <tr> <td>COG</td> <td>0 ± 30 ppm/°C</td> </tr> </tbody> </table> <p>Capacitance drift Within ± 0.2% or ±0.05pF, whichever larger.</p>	T.C.	Temperature Coefficient	COG	0 ± 30 ppm/°C	<p>Temperature coefficient shall be calculated based on values at 25°C and 85°C temperature.</p> <p>Measuring temperature below 20°C shall be -10°C and -25°C.</p>						
T.C.	Temperature Coefficient												
COG	0 ± 30 ppm/°C												
7	Robustness of Terminations	No sign of termination coming off, breakage of ceramic, or other abnormal signs.	<p>Reflow solder the capacitor on P.C. board (shown in Appendix 1) and apply a pushing force of 2N (C1005) or 5N (C1608) for 10 ± 1s.</p> 										
8	Bending	No mechanical damage.	<p>Reflow solder the capacitor on P.C. board (shown in Appendix 2a or Appendix 2b) and bend it for 1mm.</p>  <p>Unit: mm</p>										

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General Specifications

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No.	Item	Performance	Test or Inspection Method							
9	Solderability	New solder to cover over 75% of termination.	Completely soak both terminations in solder at $235 \pm 5^\circ\text{C}$ for $2 \pm 0.5\text{s}$. Solder: H63A (JIS Z 3282) Flux: Isopropyl alcohol (JIS K 8839) Rosin (JIS K 5902) 25% solid solution.							
		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.								
10	Resistance to solder heat		Completely soak both terminations in solder at $260 \pm 5^\circ\text{C}$ for $5 \pm 1\text{s}$. Preheating condition Temp.: $150 \pm 10^\circ\text{C}$ 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.							
	External appearance	No cracks are allowed and terminations shall be covered at least 60% with new solder.								
	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>Capacitance drift within $\pm 2.5\%$ or $\pm 0.25\text{pF}$, whichever larger.</td> </tr> </tbody> </table>		Characteristics		Change from the value before test	Class 1	C0G	Capacitance drift within $\pm 2.5\%$ or $\pm 0.25\text{pF}$, whichever larger.	
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Rated Capacitance		Q								
$C \geq 30\text{pF}$		1,000 min.								
$C < 30\text{pF}$	$400 + 20 \times C$ min.									
C : Rated capacitance (pF)										
Insulation Resistance	Meet the initial spec.									
Voltage Proof	No insulation breakdown or other damage.									
11	Vibration		Reflow solder the capacitor on P.C. board (shown in Appendix 1) 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.							
	External appearance	No mechanical damage.								
	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>Capacitance drift within $\pm 2.5\%$ or $\pm 0.25\text{pF}$, whichever larger.</td> </tr> </tbody> </table>		Characteristics		Change from the value before test	Class 1	C0G	Capacitance drift within $\pm 2.5\%$ or $\pm 0.25\text{pF}$, whichever larger.	
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C Series – Tight Tolerance Capacitors

No.	Item	Performance	Test or Inspection Method							
12	Temperature cycle		Reflow solder the capacitors on a P.C. board (shown in Appendix 1) 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 6 to 24h before measurement.							
	External appearance	No mechanical damage.								
	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>Capacitance drift within $\pm 2.5\%$ or $\pm 0.25\text{pF}$, whichever larger.</td> </tr> </tbody> </table>		Characteristics		Change from the value before test	Class 1	C0G	Capacitance drift within $\pm 2.5\%$ or $\pm 0.25\text{pF}$, whichever larger.	
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Rated Capacitance		Q								
$C \geq 30\text{pF}$		1,000 min.								
$C < 30\text{pF}$	$400 + 20 \times C$ min.									
C : Rated capacitance (pF)										
Insulation Resistance	Meet the initial spec.									
Voltage Proof	No insulation breakdown or other damage.									
13	Moisture Resistance (Steady State)		Reflow solder the capacitor 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. Leave the capacitor in ambient condition for 6 to 24h before measurement.							
	External appearance	No mechanical damage.								
	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>Capacitance drift within $\pm 5\%$ or $\pm 0.5\text{pF}$, whichever larger.</td> </tr> </tbody> </table>		Characteristics		Change from the value before test	Class 1	C0G	Capacitance drift within $\pm 5\%$ or $\pm 0.5\text{pF}$, whichever larger.	
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Rated Capacitance		Q								
$C \geq 30\text{pF}$		350 min.								
$10\text{pF} \leq C < 30\text{pF}$	$275 + 5/2 \times C$ min.									
$C < 10\text{pF}$	$200 + 10 \times C$ min.									
C : Rated capacitance (pF)										
Insulation Resistance	1,000M Ω min.									

Step	Temperature ($^\circ\text{C}$)	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

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C Series – Tight Tolerance Capacitors

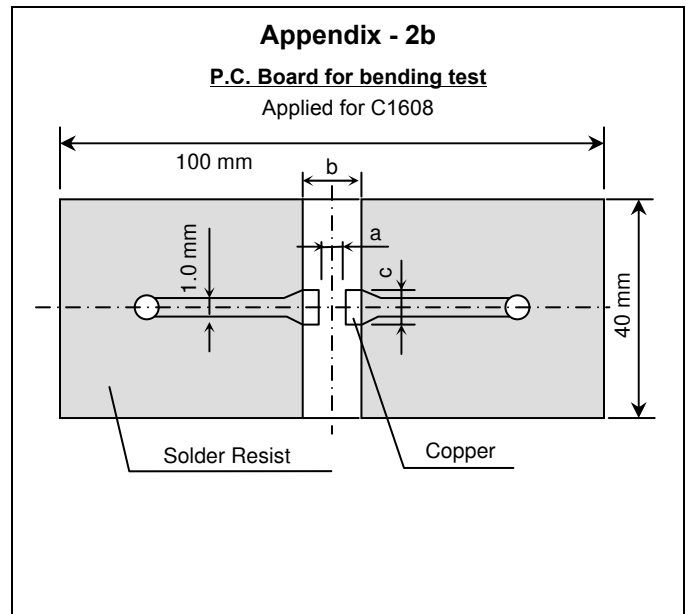
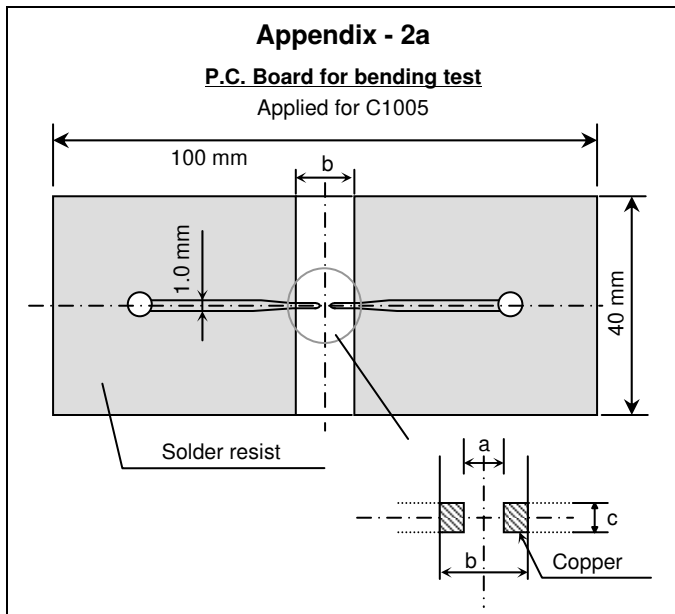
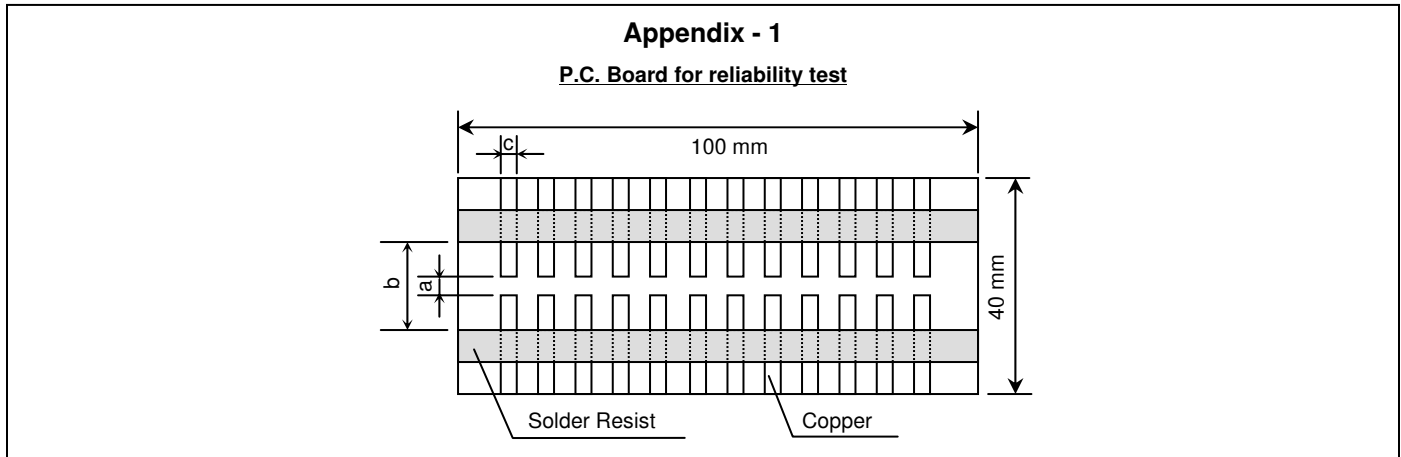
No.	Item	Performance	Test or Inspection Method							
14	Moisture Resistance									
	External appearance	No mechanical damage.	Reflow solder the capacitors on P.C. board (shown in Appendix 1) before testing.							
	Capacitance	<table border="1"> <thead> <tr> <th colspan="2">Characteristics</th> <th>Change from the value before test</th> </tr> </thead> <tbody> <tr> <td>Class 1</td> <td>C0G</td> <td>Capacitance drift within $\pm 7.5\%$ or $\pm 0.75\text{pF}$, whichever larger.</td> </tr> </tbody> </table>		Characteristics		Change from the value before test	Class 1	C0G	Capacitance drift within $\pm 7.5\%$ or $\pm 0.75\text{pF}$, whichever larger.	Apply the rated voltage at temperature $40 \pm 2^\circ\text{C}$ and 90 to 95%RH for 500 +24,0h.
		Characteristics		Change from the value before test						
		Class 1	C0G	Capacitance drift within $\pm 7.5\%$ or $\pm 0.75\text{pF}$, whichever larger.						
<table border="1"> <thead> <tr> <th>Rated Capacitance</th> <th>Q</th> </tr> </thead> <tbody> <tr> <td>$C \geq 30\text{pF}$</td> <td>200 min.</td> </tr> <tr> <td>$C < 30\text{pF}$</td> <td>$100 + 10/3 \times C$ min.</td> </tr> </tbody> </table>		Rated Capacitance	Q	$C \geq 30\text{pF}$	200 min.	$C < 30\text{pF}$	$100 + 10/3 \times C$ min.	Charge/discharge current shall not exceed 50mA.		
Rated Capacitance	Q									
$C \geq 30\text{pF}$	200 min.									
$C < 30\text{pF}$	$100 + 10/3 \times C$ min.									
C : Rated capacitance (pF)		Leave the capacitor in ambient conditions for 6 to 24h before measurement.								
Q (Class 1)		Use this measurement for initial value.								
	Insulation Resistance	500M Ω min.								
15	Life									
	External appearance	No mechanical damage.	Reflow solder the capacitor on P.C. board (shown in Appendix 1) before testing.							
	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>Capacitance drift within $\pm 3\%$ or $\pm 0.3\text{pF}$, whichever larger.</td> </tr> </tbody> </table>		Characteristics		Change from the value before test	Class 1	C0G	Capacitance drift within $\pm 3\%$ or $\pm 0.3\text{pF}$, whichever larger.	Apply 2x rated voltage at $125 \pm 2^\circ\text{C}$ for 1,000 +48, 0h.
		Characteristics		Change from the value before test						
		Class 1	C0G	Capacitance drift within $\pm 3\%$ or $\pm 0.3\text{pF}$, whichever larger.						
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Rated Capacitance	Q									
$C \geq 30\text{pF}$	350 min.									
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$C < 10\text{pF}$	$200 + 10 \times C$ min.									
C : Rated capacitance (pF)		Leave the capacitors in ambient condition for 6 to 24h before measurement.								
Q (Class 1)		Use this measurement for initial value.								
	Insulation Resistance	1,000M Ω min.								

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C Series – Tight Tolerance Capacitors



Material : Glass Epoxy (As per JIS C6484 GE4)

P.C. Board thickness : Appendix-2a 0.8mm
 Appendix-1, 2b 1.6mm

Copper (thickness 0.035mm)
 Solder resist

Case Code		Dimensions (mm)		
JIS	EIA	a	b	c
C1005	CC0402	0.4	1.5	0.5
C1608	CC0603	1.0	3.0	1.2

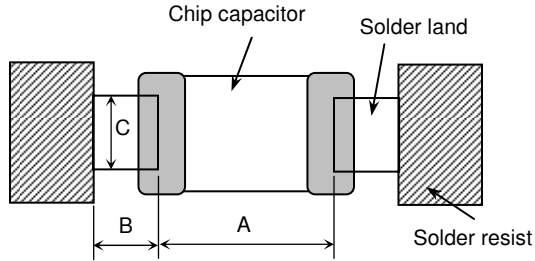
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C Series – Tight Tolerance Capacitors

Recommended Soldering Land Pattern



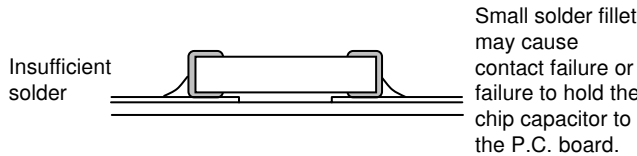
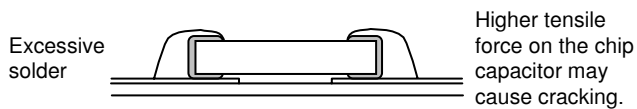
Wave Soldering Unit: mm

Type	C1608
Symbol	[CC0603]
A	0.7 - 1.0
B	0.8 - 1.0
C	0.6 - 0.8

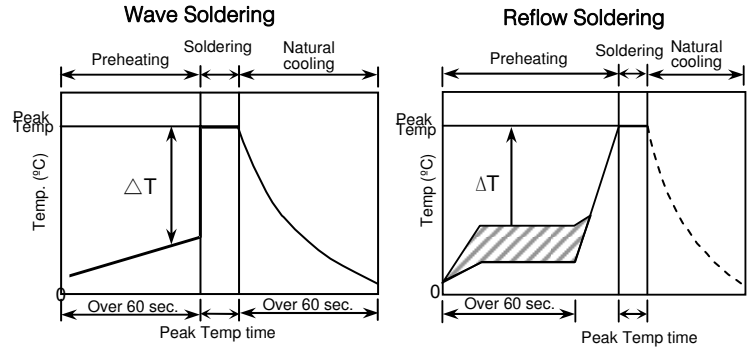
Reflow Soldering Unit: mm

Type	C1005 [CC0402]	C1608 [CC0603]
Symbol		
A	0.3 - 0.5	0.6 - 0.8
B	0.35 - 0.45	0.6 - 0.8
C	0.4 - 0.6	0.6 - 0.8

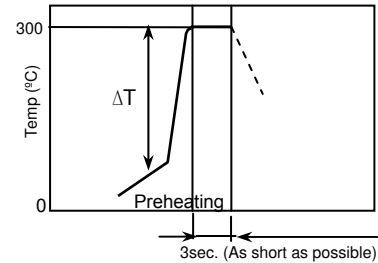
Recommended Solder Amount



Recommended Soldering Profile



Manual soldering (Solder iron)



Recommended soldering duration

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

Recommended solder compositions

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

Preheating Condition

Soldering	Case Size - JIS (EIA)	Temp. (°C)
Wave soldering	C1608(CC0603)	$\Delta T \leq 150$
Reflow soldering	C1005(CC0402), C1608(CC0603)	$\Delta T \leq 150$
Manual soldering	C1005(CC0402), C1608(CC0603)	$\Delta T \leq 150$

* This series is available through the distribution channel only. Please see www.tdk.com/distributor.php for a list of authorized distributors.

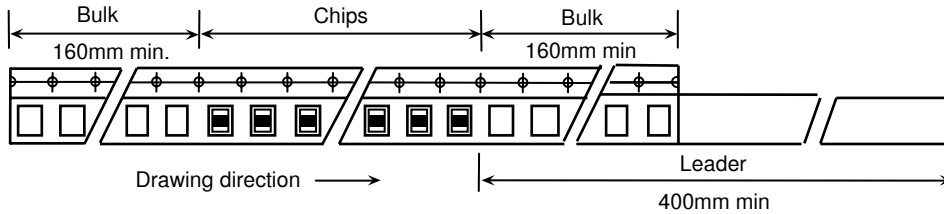
• All specifications are subject to change without notice. Please read the precautions before using the product.



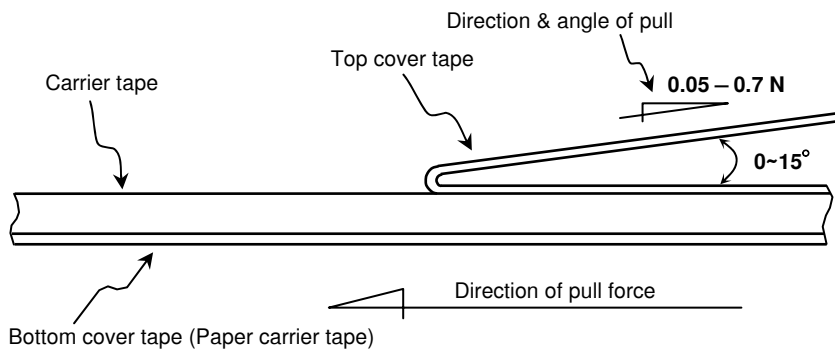
Packaging Information

C Series – Tight Tolerance Capacitors

Carrier Tape Configuration

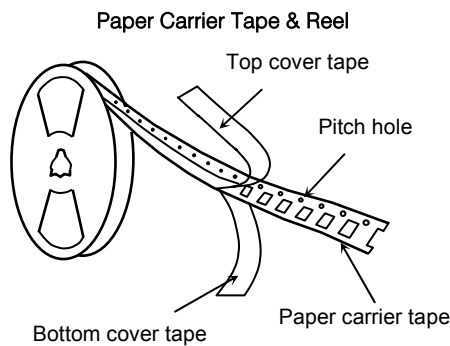


Peel Back Force (Top Tape)



- 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



Case Code		Chip Thickness (mm)	Taping Material	Chip quantity (pcs.)	
JIS	EIA			φ178mm (7") reel	φ330mm (13") reel
C1005	CC0402	0.50	Paper	10,000	50,000
C1608	CC0603	0.80		4,000	10,000

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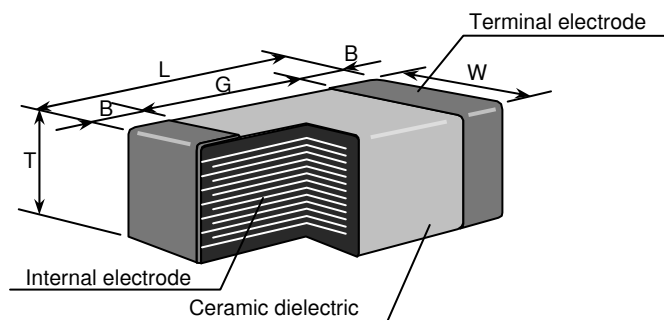
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Additional Information

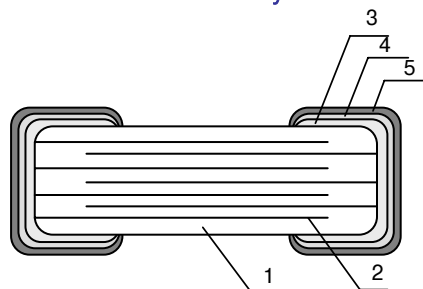
C Series – Tight Tolerance Capacitors

• Shape & Dimensions



Case Code		Dimensions (mm)				
JIS	EIA	L	W	T	B	G
C1005	CC0402	1.00	0.50	0.50	0.25	0.35 min.
C1608	CC0603	1.60	0.80	0.80	0.20 min.	0.50 min.

• Inside Structure & Material System



No.	NAME	MATERIAL
		Class 1
(1)	Ceramic Dielectric	CaZrO 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.

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