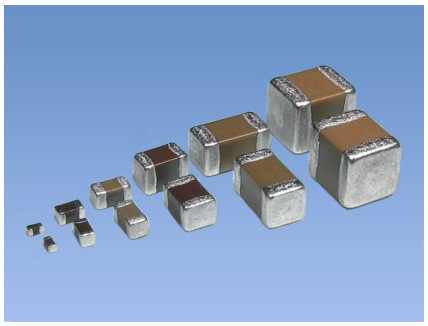
Multilayer Ceramic Chip Capacitors



■Features

- ●Kyocera's series of Multilayer Ceramic Chip Capacitors are designed to meet a wide variety of needs. We offer a complete range of products for both general and specialized applications.
- ●We have a network worldwide in order to supply our global customer bases quickly and efficiently.
- ●All our products are highly reliable due to their monolithic structure of high-purity and superfine uniform ceramics and their integral internal electrodes.
- ●Our stringent quality control in every phase of production from material procurement to shipping ensures consistent manufacturing and superior quality.
- ●Kyocera components are available in a wide choice of dimensions, temperature characteristics, rated voltages, and terminations to meet specific configurational requirements.

■KYOCERA PART NUMBER

CM	03	X5R	225	M	06	A	H	□□□
①	②	③	④	⑤	⑥	⑦	⑧	

OPTION：
Above digits are used to track individual specification or thickness.

(Example)
①Series ：CM Series(General)
②Size ：0201
③Dielectric ：X5R
④Capacitance：2.2μF
⑤Tolerance ：±20%
⑥Voltage ：6.3Vdc
⑦Termination：Sn
⑧Packaging ：Cavity pitch 2mm / Reel Size φ180

①SERIES CODE

CODE	Type
CM	General
CT	Low Profile
CU	High-Q
KNH	Three Terminal Capacitors

②SIZE CODE

CODE	EIA	JIS
02	01005	0402
03	0201	0603
05	0402	1005
105	0603	1608
21	0805	2012
316	1206	3216
32	1210	3225

③DIELECTRIC CODE

Temperature Compensation Type			
CODE	Temperature Range (°C)	ppm/°C	
CG	-55 to 125	0	±30
CH			±60

- All parts of C0G will be marked as "CG" but will conform to the above table.
- Temperature coefficients are determined by calculation based on measurement at 20°C and 85°C.

High Dielectric Constant Type			
CODE	Temperature Range (°C)	ΔC max. (%)	Standard Temperature (°C)
X5R	-55 to 85	±15	25
X6S	-55 to 105	±22	
X6T		+22/-33	
X7R	-55 to 125	±15	
X7S		±22	
X7T		+22/-33	

④CAPACITANCE CODE

Capacitance expressed in pF.
Two significant digits plus number of zeros.
For Values < 10pF, Letter R denotes decimal point,
<1,000pF＝1nF、1,000nF＝1μF>

(Example)

CODE	Capacitance
R50	0.5pF
1R0	1pF
100	10pF
101	100pF
102	1nF
103	10nF
104	100nF
105	1μF
106	10μF
107	100μF

E STANDARD NUMBER				
E3	E6	E12	E24	
1.0	1.0	1.0	1.0	1.1
		1.2	1.2	1.3
	1.5	1.5	1.5	1.6
		1.8	1.8	2.0
2.2	2.2	2.2	2.2	2.4
		2.7	2.7	3.0
	3.3	3.3	3.3	3.6
		3.9	3.9	4.3
4.7	4.7	4.7	4.7	5.1
		5.6	5.6	6.2
	6.8	6.8	6.8	7.5
		8.2	8.2	9.1

⑤TOLERANCE CODE

Temperature Compensation Type (C0G)	
CODE	Tolerance
A*	±0.05pF
B	±0.1pF
C	±0.25pF
D	±0.5pF
G*	±2%
J	±5%
K	±10%

*：Option

High Dielectric Constant Type (X5R/X6S/X6T/X7R/X7S/X7T)	
CODE	Tolerance
J*	±5%
K	±10%
M	±20%

*：Option

⑥VOLTAGE CODE

CODE	Rated Voltage
02	2.5Vdc
04	4Vdc
06	6.3Vdc
10	10Vdc
16	16Vdc
25	25Vdc
35	35Vdc
50	50Vdc
100	100Vdc

⑦TERMINATION CODE

CODE	Termination
A	Nickel Barrier/ Tin

- Please contact us if Au termination is needed.

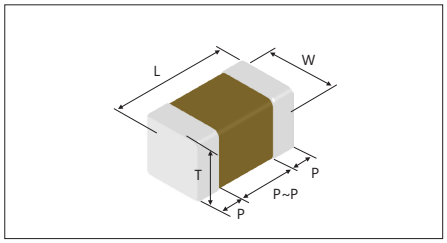
⑧PACKAGING CODE

CODE	Size Code	Cavity pitch	Reel size
T	105 to 32	4mm	φ180
H	02 to 05	2mm	
Q	03/05	1mm	
P	02	1mm	
L	105 to 32	4mm	φ330
N	02 to 05	2mm	
W	03/05	1mm	

CATM2110MH29091E
As of February 2022

Dimension

■CM/CT/CU Series



■Packaging Code

20kp（E 8 / 2）

kp means 1000 pieces

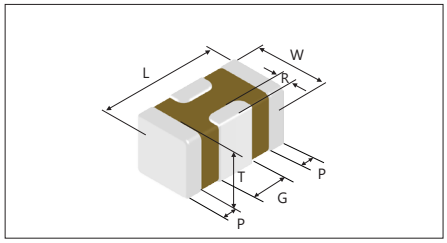
Taping Material	
Code	Material
E	Plastic
P	Paper

Taping Width	
Code	Width
4	4mm
8	8mm

Pitch	
Code	Pitch
1	1mm
2	2mm
4	4mm

Size	Code		Dimension Code	Dimension (mm)						Quantity per reel	
	EIA	JIS		L	W	T	P min.	P max.	P to P min.	φ180 Reel	φ330 Reel
02	01005	0402	A	0.4±0.02	0.2±0.02	0.2±0.02	0.07	0.14	0.13	40kp(E4/1) 20kp(P8/2)	— 80kp(P8/2)
03	0201	0603	A	0.6±0.03	0.3±0.03	0.22 max.	0.1	0.2	0.2	30kp(P8/1) 15kp(P8/2)	150kp(P8/1) 50kp(P8/2)
			B			0.3±0.03					
			C	0.6±0.05	0.3±0.05	0.3±0.05	0.13	0.23	0.19		
			D	0.6±0.09	0.3±0.09	0.22 max.				15kp(P8/2)	50kp(P8/2)
			E			0.3±0.09					
			F			0.5±0.05				10kp(P8/2)	—
05	0402	1005	A	1.0±0.05	0.5±0.05	0.22 max.	0.15	0.35	0.3	20kp(P8/1) 10kp(P8/2)	100kp(P8/1) 50kp(P8/2)
			B			0.33 max.					
			C			0.5±0.05					
			D	1.0±0.1	0.5±0.05	0.22 max.				10kp(P8/2)	50kp(P8/2)
			E	1.0±0.15	0.5±0.15	0.5±0.15				10kp(P8/2)	40kp(P8/2)
			F	1.0±0.2	0.5±0.2	0.33 max.				10kp(P8/2)	—
			G			0.5 max.				10kp(P8/2)	50kp(P8/2)
			H			0.55 max.				10kp(P8/2)	50kp(P8/2)
			J			0.5±0.2				10kp(P8/2)	40kp(P8/2)
			K			0.8 max.				10kp(P8/2)	30kp(P8/2)
105	0603	1608	A	1.6±0.1	0.8±0.1	0.55 max.	0.2	0.6	0.5	4kp(P8/4)	10kp(P8/4)
			B			0.8±0.1					
			C	1.6±0.15	0.8±0.15	0.8±0.15					
			D	1.6±0.2	0.8±0.2	0.8±0.2					
21	0805	2012	B	2.0±0.1	1.25±0.1	1.25±0.1	0.2	0.75	0.7	3kp(E8/4)	10kp(E8/4)
			C	2.0±0.15	1.25±0.15	0.95 max.				4kp(P8/4)	10kp(P8/4)
			E	2.0±0.2	1.25±0.2	0.95 max.				4kp(P8/4)	10kp(P8/4)
			F			1.25±0.2				3kp(E8/4)	10kp(E8/4)
316	1206	3216	A	3.2±0.2	1.6±0.15	1.6±0.15	0.3	0.85	1.4	2.5kp(E8/4)	5kp(E8/4)
			B		1.6±0.2	1.6±0.2					
			C	3.2±0.3	1.6±0.3	1.6±0.3	0.3	0.85	1.9	2kp(E8/4)	—
32	1210	3225	A	3.2±0.3	2.5±0.2	2.5±0.2	0.3	1.0	1.4	1kp(E8/4)	4kp(E8/4)

■KNH Series



Size	Code		Dimension Code	Dimension (mm)						Packaging	
	EIA	JIS		L	W	T	G	P	R	φ180 Reel	φ330 Reel
KNH 05	0402	1005	A	1.0±0.1	0.5±0.2	0.5 max.	0.3±0.1	0.15±0.1	≧0.05	10kp(P8/2)	—
			B	1.0±0.15	0.5±0.15	0.5±0.15					
			C	1.0±0.2	0.5±0.2	0.5±0.2					

Low Profile **CT Series** RoHS Compliant Products

■Features

This low profile series is ideal where height clearance is limited

■Applications

Circuits requiring a compact, low-profile design, such as module and memory cards.

X5R Dielectric

●Capacitance chart ■ Standard Spec.1 ■ Standard Spec.2 ▨ Optional Spec.

Size (EIA Code)		CT03 (0201)	CT05 (0402)	CT105 (0603)	CT21 (0805)	
Rated Voltage(Vdc) / Capacitance		6.3	6.3	16	16	50
104	0.1 μF	A8				
224	0.22 μF					
474	0.47 μF					
105	1 μF	D7	B8 F9 G9	A8		
225	2.2 μF				C8	E3
475	4.7 μF					
106	10 μF					

<Standard Capacitor Value : E3 Series>
Please contact for capacitance value other than standard.
Please refer to here for the test method and specifications of Standard Specification 1.
Please refer to here for the test method and specifications of Standard Specification 2.

Two digits alphanumerics in capacitance chart denote dimensions and tan δ. Please refer to the above table for detail.

(Example) In case of "A8" for CT03;
L: 0.6±0.03mm, W: 0.3±0.03mm, T: 0.22mm max., Tanδ: 12.5% max.

Tan δ Code	Tan δ
3	5.0% max.
7	10.0% max.
8	12.5% max.
9	15.0% max.

Size	Dimension Code	Dimension (mm)			Packaging									
					φ180 Reel					φ330 Reel				
		L	W	T	Code	Quantity	Taping Material	Taping Width	Cavity Pitch	Code	Quantity	Taping Material	Taping Width	Cavity Pitch
03	A	0.6±0.03	0.3±0.03	0.22 max.	Q	30,000	Paper	8mm	1mm	W	150,000	Paper	8mm	1mm
					H	15,000	Paper	8mm	2mm	N	50,000	Paper	8mm	2mm
	D	0.6±0.09	0.3±0.09	0.22 max.	H	15,000	Paper	8mm	2mm	N	50,000	Paper	8mm	2mm
05	B	1.0±0.05	0.5±0.05	0.33 max.	Q	20,000	Paper	8mm	1mm	W	100,000	Paper	8mm	1mm
					H	10,000	Paper	8mm	2mm	N	50,000	Paper	8mm	2mm
	F	1.0±0.2	0.5±0.2	0.33 max.	H	10,000	Paper	8mm	2mm	—	—	—	—	—
	G	1.0±0.2	0.5±0.2	0.5 max.	H	10,000	Paper	8mm	2mm	N	50,000	Paper	8mm	2mm
105	A	1.6±0.1	0.8±0.1	0.55 max.	T	4,000	Paper	8mm	4mm	L	10,000	Paper	8mm	4mm
21	C	2.0±0.15	1.25±0.15	0.95 max.	T	4,000	Paper	8mm	4mm	L	10,000	Paper	8mm	4mm
	E	2.0±0.2	1.25±0.2	0.95 max.	T	4,000	Paper	8mm	4mm	L	10,000	Paper	8mm	4mm

X6S/X6T Dielectric

●Capacitance chart ▨ Optional Spec.

		X6S	X6T		
Size (EIA Code)		CT03 (0201)	CT03 (0201)	CT05 (0402)	
Rated Voltage(Vdc) / Capacitance		4	4	2.5	4
104	0.1 μF	A8			
224	0.22 μF				
474	0.47 μF				
105	1 μF		D8		D8
225	2.2 μF				
475	4.7 μF			G8	
106	10 μF				

<Standard Capacitor Value : E3 Series>
Please contact for capacitance value other than standard.

Two digits alphanumerics in capacitance chart denote dimensions and tan δ. Please refer to the above table for detail.

(Example) In case of "D8" for CT03;
L: 0.6±0.09mm, W: 0.3±0.09mm, T: 0.22mm max., Tanδ: 12.5% max.

Tan δ Code	Tan δ
8	12.5% max.

Size	Dimension Code	Dimension (mm)			Packaging									
					φ180 Reel					φ330 Reel				
		L	W	T	Code	Quantity	Taping Material	Taping Width	Cavity Pitch	Code	Quantity	Taping Material	Taping Width	Cavity Pitch
03	A	0.6±0.03	0.3±0.03	0.22 max.	Q	30,000	Paper	8mm	1mm	W	150,000	Paper	8mm	1mm
					H	15,000	Paper	8mm	2mm	N	50,000	Paper	8mm	2mm
	D	0.6±0.09	0.3±0.09	0.22 max.	H	15,000	Paper	8mm	2mm	N	50,000	Paper	8mm	2mm
05	D	1.0±0.1	0.5±0.05	0.22 max.	H	10,000	Paper	8mm	2mm	N	50,000	Paper	8mm	2mm
	G	1.0±0.2	0.5±0.2	0.5 max.	H	10,000	Paper	8mm	2mm	N	50,000	Paper	8mm	2mm

Test Conditions and Standards

Test Conditions and Specifications for High Dielectric Type (X5R, X7R, X7S)
CM / CT Series (Standard Spec.1)

<table>
<tr><th colspan="2">Test Items</th><th>Test Conditions</th><th>Specifications</th></tr>
<tr><td colspan="2">Capacitance Value (C)</td><td rowspan="2">Measure after heat treatment
<table><tr><th>Capacitance</th><th>Frequency</th><th>Volt</th></tr><tr><td rowspan="2">C≤10μF</td><td>1kHz±10%</td><td>1.0±0.2Vrms</td></tr><tr><td>*1kHz±10%</td><td>0.5±0.2Vrms</td></tr><tr><td>C>10μF</td><td>120Hz±10%</td><td>0.5±0.2Vrms</td></tr></table>*CM02X5R104□06A#
The charge and discharge current of the capacitor must not exceed 50mA.</td><td>Within tolerance</td></tr>
<tr><td colspan="2">Tanδ</td><td>Refer to capacitance chart</td></tr>
<tr><td colspan="2">Insulation Resistance (IR)</td><td>Apply the rated voltage for 1 minute, and measure it in normal temperature and humidity.
The charge and discharge current of the capacitor must not exceed 50mA.</td><td>Over 10000MΩ or 500MΩ•μF, whichever is less</td></tr>
<tr><td colspan="2">Dielectric Resistance</td><td>Apply *2.5 times of the rated voltage for 1 to 5 seconds.
*CM316X5R225, CM316X7S225/100V: twice
The charge and discharge current of the capacitor must not exceed 50mA.</td><td>No problem observed</td></tr>
<tr><td colspan="2">Appearance</td><td>Microscope</td><td>No problem observed</td></tr>
<tr><td colspan="2">Termination Strength</td><td>Apply a sideward force of 500g (5N) to a PCB-mounted sample.
note : 2N for 0201 size, and 1N for 01005 size.
Exclude CT series with thickness of less than 0.66mm.</td><td>No problem observed</td></tr>
<tr><td colspan="2">Bending Strength</td><td>Glass epoxy PCB: Fulcrum spacing: 90mm, duration time 10 seconds.
Exclude CT series with thickness of less than 0.66mm.</td><td>No significant damage with 1mm bending</td></tr>
<tr><td rowspan="3">Vibration Test</td><td>Appearance</td><td rowspan="3">Take the initial value after heat treatment.
Vibration frequency: 10 to 55 (Hz)
Amplitude: 1.5mm
Sweeping condition: 10→55→10Hz/ 1 minute in X, Y and Z directions: 2 hours each, 6 hours in total, and place in normal temperature and humidity, then measure the sample after heat treatment.</td><td>No problem observed</td></tr>
<tr><td>ΔC</td><td>Within tolerance</td></tr>
<tr><td>Tanδ</td><td>Within tolerance</td></tr>
<tr><td rowspan="5">Soldering Heat Resistant</td><td>Appearance</td><td rowspan="5">Take the initial value after heat treatment.
Soak the sample in 260°C±5°C solder for 10±0.5 seconds and place in normal temperature and humidity, and measure after heat treatment.
(Pre-heating conditions)
<table><tr><th>Order</th><th>Temperature</th><th>Time</th></tr><tr><td>1</td><td>80 to 100°C</td><td>2 minutes</td></tr><tr><td>2</td><td>150 to 200°C</td><td>2 minutes</td></tr></table>The charge and discharge current of the capacitor must not exceed 50mA for IR and withstanding voltage measurement.</td><td>No problem observed</td></tr>
<tr><td>ΔC</td><td>Within±7.5%</td></tr>
<tr><td>Tanδ</td><td>Within tolerance</td></tr>
<tr><td>IR</td><td>Over 10000MΩ or 500MΩ•μF, whichever is less</td></tr>
<tr><td>Withstanding Voltage</td><td>Resist without problem</td></tr>
<tr><td colspan="2">Solderablity</td><td>Soaking condition
<table><tr><td>Sn-3Ag-0.5Cu</td><td>245±5°C</td><td>3±0.5 sec.</td></tr><tr><td>Sn63 Solder</td><td>235±5°C</td><td>2±0.5 sec.</td></tr></table></td><td>Solder coverage : 95% min.</td></tr>
<tr><td rowspan="5">Temperature Cycle</td><td>Appearance</td><td rowspan="5">Take the initial value after heat treatment.
(Cycle)
Room temperature (3 min.)→
Lowest operation temperature (30 min.)→
Room temperature (3 min.)→
Highest operation temperature(30 min.)
After 5 cycles, measure after heat treatment.
The charge and discharge current of the capacitor must not exceed 50mA for IR and withstanding voltage measurement.</td><td>No problem observed</td></tr>
<tr><td>ΔC</td><td>Within±7.5%</td></tr>
<tr><td>Tanδ</td><td>Within tolerance</td></tr>
<tr><td>IR</td><td>Over 10000MΩ or 500MΩ•μF, whichever is less</td></tr>
<tr><td>Withstanding Voltage</td><td>Resist without problem</td></tr>
<tr><td rowspan="4">Moisture Resistant Load</td><td>Appearance</td><td rowspan="4">Take the initial value after heat treatment.
After applying rated voltage for 500+12/ −0 hours in the condition of 40°C±2°C and 90 to 95%RH, and place in normal temperature and humidity, then measure the sample after heat treatment.
The charge and discharge current of the capacitor must not exceed 50mA for IR measurement.</td><td>No problem observed</td></tr>
<tr><td>ΔC</td><td>Within±12.5%</td></tr>
<tr><td>Tanδ</td><td>200% max. of initial value</td></tr>
<tr><td>IR</td><td>Over 500MΩ or 25MΩ•μF, whichever is less</td></tr>
<tr><td rowspan="4">High-Temperature Load</td><td>Appearance</td><td rowspan="4">Take the initial value after heat treatment.
After applying *twice the rated voltage at the highest operation temperature for 1000+12/ −0 hours, and measure the sample after heat treatment in normal temperature and humidity.
The charge and discharge current of the capacitor must not exceed 50mA for IR measurement.
*Apply 1.5 times when the rated voltage is 10V or less. Applied voltages for respective products are indicated in the chart below.</td><td>No problem observed</td></tr>
<tr><td>ΔC</td><td>Within±12.5%</td></tr>
<tr><td>Tanδ</td><td>200% max. of initial value</td></tr>
<tr><td>IR</td><td>Over 1000MΩ or 50MΩ•μF, whichever is less</td></tr>
</table>

Heat treatment	Expose sample in the temperature of 150+0/ −10°C for 1 hour and leave the sample in normal temperature and humidity for 24±2 hours.

Voltage to be applied in the High Temperature Load (Applied voltage is the multiple of the rated voltage)

Applied Voltage	Rated Voltage	Products
×1.0	10V	CM02X5R104
	100V	CM316X5R225, CM316X7S225
×1.3	6.3V	CM02X5R153-104, CT03X5R104
×1.5	16V	CM02X5R101-103, CM05X5R224, CM105X5R225, CM21X5R106, CM316X5R226, CM02X7R101-222, CM105X7R105, CM316X7R106, CM32X7R226, CT105X5R105, CT21X5R475
	25V	CM03X5R332-103, CM105X5R105, CM21X5R225-475, CM316X5R106, CM32X5R106-226, CM05X7R104, CM21X7R105-225, CM316X7R475, CM32X7R106
	50V	CM21X5R105, CM316X5R475, CM32X5R106, CM21X7R105, CM32X7R106, CT21X5R225,

Please contact us for the optional specifications of the capacitance chart.

Test Conditions and Standards

Test Conditions and Specifications for High Dielectric Type (X5R, X6S, X7R, X7S, X7T) CM / CT Series (Standard Spec.2)

Test Items		Test Conditions	Specifications
Capacitance Value (C)		Measure after heat treatment Capacitance / Frequency / Volt: C≤10μF: 1kHz±10% 1.0±0.2Vrms; *1kHz±10% 0.5±0.2Vrms; C>10μF: 120Hz±10% 0.5±0.2Vrms *CM02X5R474M06A#, CM03X5R225□06A#, CM03X5R225M06A#035, CM03X5R475M06A#055, CM03X5R475M04A#, CM05X5R106M06A#, CT05X5R475M06A#033 The charge and discharge current of the capacitor must not exceed 50mA.	Within tolerance
Tanδ			Refer to capacitance chart
Insulation Resistance (IR)		Apply the rated voltage for 1minute, and measure it in normal temperature and humidity. The charge and discharge current of the capacitor must not exceed 50mA.	Over 50MΩ･μF
Dielectric Resistance		Apply *2.5 times of the rated voltage for 1 to 5 seconds. *CM21X7S105, CM316X7S475/100V: twice The charge and discharge current of the capacitor must not exceed 50mA.	No problem observed
Appearance		Microscope	No problem observed
Termination Strength		Apply a sideward force of 500g (5N) to a PCB-mounted sample. note : 2N for 0201 size, and 1N for 01005 size. Exclude CT series with thickness of less than 0.66mm.	No problem observed
Bending Strength		Glass epoxy PCB: Fulcrum spacing: 90mm, duration time 10 seconds. Exclude CT series with thickness of less than 0.66mm.	No significant damage with 1mm bending
Vibration Test	Appearance	Take the initial value after heat treatment. Vibration frequency: 10 to 55 (Hz) Amplitude: 1.5mm Sweeping condition: 10→55→10Hz/ 1 minute in X, Y and Z directions: 2 hours each, 6 hours in total, and place in normal temperature and humidity, then measure the sample after heat treatment.	No problem observed
	ΔC		Within tolerance
	Tanδ		Within tolerance
Soldering Heat Resistant	Appearance	Take the initial value after heat treatment. Soak the sample in 260°C±5°C solder for 10±0.5 seconds and place in normal temperature and humidity, and measure after heat treatment. (Pre-heating conditions) Order / Temperature / Time: 1: 80 to 100°C 2 minutes; 2: 150 to 200°C 2 minutes The charge and discharge current of the capacitor must not exceed 50mA for IR and withstanding voltage measurement.	No problem observed
	ΔC		Within±7.5%
	Tanδ		Within tolerance
	IR		Over 50MΩ･μF
	Withstanding Voltage		Resist without problem
Solderablity		Soaking condition Sn-3Ag-0.5Cu: 245±5°C 3±0.5 sec.; Sn63 Solder: 235±5°C 2±0.5 sec.	Solder coverage : 95% min.
Temperature Cycle	Appearance	Take the initial value after heat treatment. (Cycle) Room temperature (3 min.)→Lowest operation temperature (30 min.)→Room temperature (3 min.)→Highest operation temperature(30 min.) After 5 cycles, measure after heat treatment. The charge and discharge current of the capacitor must not exceed 50mA for IR and withstanding voltage measurement.	No problem observed
	ΔC		Within±7.5%
	Tanδ		Within tolerance
	IR		Over 50MΩ･μF
	Withstanding Voltage		Resist without problem
Moisture Resistant Load	Appearance	Take the initial value after heat treatment. After applying rated voltage for 500+12/ −0 hours in the condition of 40°C±2°C and 90 to 95%RH, and place in normal temperature and humidity, then measure the sample after heat treatment. The charge and discharge current of the capacitor must not exceed 50mA for IR measurement.	No problem observed
	ΔC		Within±12.5%
	Tanδ		200% max. of initial value
	IR		Over 10MΩ･μF
High-Temperature Load	Appearance	Take the initial value after heat treatment. After applying *□ times the rated voltage at the highest operation temperature for 1000+12/ −0 hours, and measure the sample after heat treatment in normal temperature and humidity. The charge and discharge current of the capacitor must not exceed 50mA for IR measurement. *Apply 1.0 times when the rated voltage is 4V or less. Applied voltages for respective products are indicated in the chart below.	No problem observed
	ΔC		Within±12.5%
	Tanδ		200% max. of initial value
	IR		Over 10MΩ･μF

Heat treatment	Expose sample in the temperature of 150+0/ −10°C for 1 hour and leave the sample in normal temperature and humidity for 24±2 hours.

Voltage to be applied in the High Temperature Load (Applied voltage is the multiple of the rated voltage)

Applied Voltage	Rated Voltage	Products
×1.0	6.3V	CM02X5R224, CM02X5R474, CM03X5R225, CM03X5R475, CM05X5R106
		CM05X5R156, CM05X5R226, CM21X5R476, CM03X6S105, CM105X6S226
		CT05X5R105, CT05X5R225, CT05X5R475
	10V	CM03X5R225, CM105X5R226, CM21X6S226
	16V	CM03X5R105, CM05X5R225, CM05X5R475, CM105X5R226
		CM21X6S226, CM21X7R475
	25V	CM05X5R105, CM05X5R225, CM05X5R475,CM105X5R475
		CM105X5R106, CM21X5R226
	35V	CM05X5R105, CM105X5R475, CM105X5R106
	100V	CM21X7S105, CM316X7S475

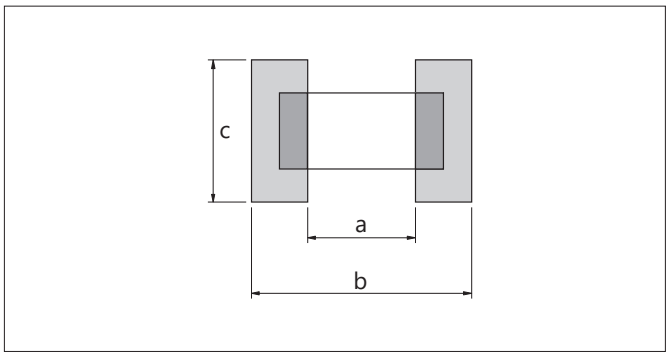
Applied Voltage	Rated Voltage	Products
×1.2	6.3V	CM03X5R105
×1.3	6.3V	CM03X5R474
	10V	CM03X5R223-224, CM05X5R105-225
	16V	CM05X5R105
×1.5	6.3V	CM21X6S226, CM05X7S105
		CM105X7T106, CM21X7T226
	10V	CM03X5R105, CM05X5R474, CM05X5R475,
		CM21X5R226, CM105X6S106, CM105X7T475
	25V	CM105X7R105, CM316X7R106
	50V	CM316X7R475

Please contact us for the optional specifications of the capacitance chart.

Test Conditions and Standards

Substrate for Adhesion Strength Test, Vibration Test, Soldering Heat Resistance Test, Temperature Cycle Test,Load Humidity Test, High-Temperature with Loading Test.

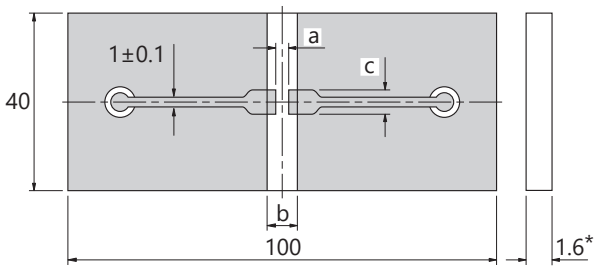
(Unit: mm)

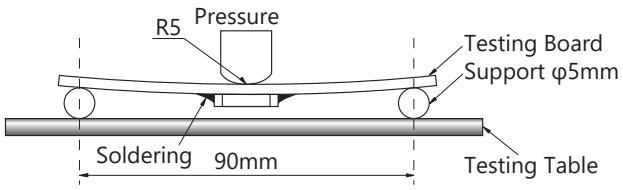


Size (EIA Code)	a	b	c
02 (01005)	0.15	0.5	0.2
03 (0201)	0.26	0.92	0.32
05 (0402)	0.4	1.4	0.5
105 (0603)	1.0	3.0	1.2
21 (0805)	1.2	4.0	1.65
316 (1206)	2.2	5.0	2.0
32 (1210)	2.2	5.0	2.9

Substrate for Bending Test

(Unit: mm)



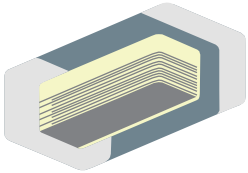


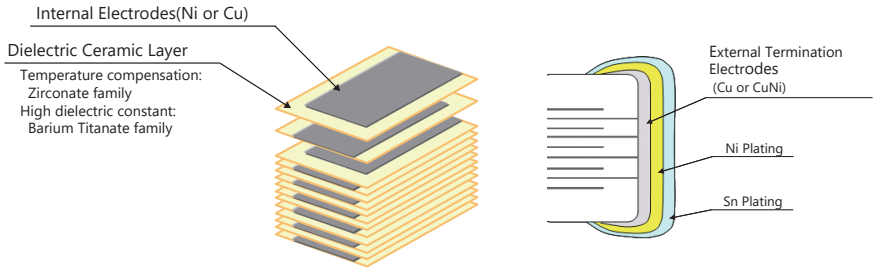
Testing Board : Glass Epoxy Board (GE4 or FR4)
Testing Board Thickness : 1.6±0.2mm*
Circuit Thickness : 0.04±0.01mm

*02, 03, 05 size 0.8±0.1mm

Structure

Plated Termination



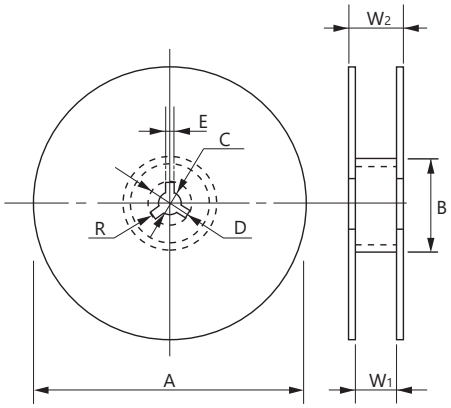


About official Standards Certification
- The sites that manufacture the products listed in this catalog have acquired ISO 9001 quality management system (certification).
- The production site is Kagoshima Kokubu Plant.

Packaging Options Tape and Reel

Reel

(Unit: mm)



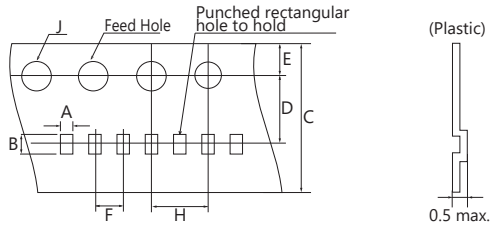
Code / Reel	A	B	C	D
7-inch Reel (CODE: T, H, Q)	180 +0 −2.0	φ60 min.	13±0.5	21±0.8
7-inch Reel (CODE: P)	178±2.0			
13-inch Reel (CODE: L, N, W)	330±2.0			

Code / Reel	E	W1	W2	R
7-inch Reel (CODE: T, H, Q)	2.0±0.5	10.5±1.5	16.5 max.	1.0
7-inch Reel (CODE: P)		4.35±0.3	6.95±1.0	
13-inch Reel (CODE: L, N, W)		9.5±1.0	16.5 max.	

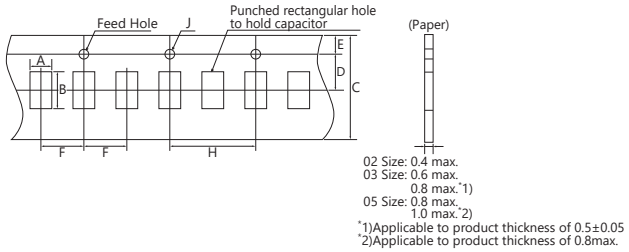
Carrier Tape

(Unit: mm)

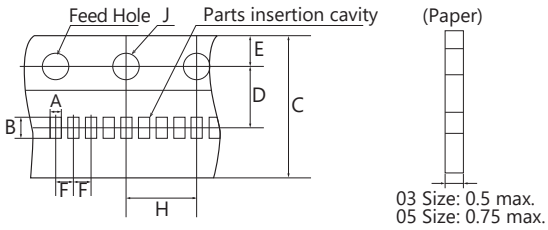
F=1mm (02 Size)



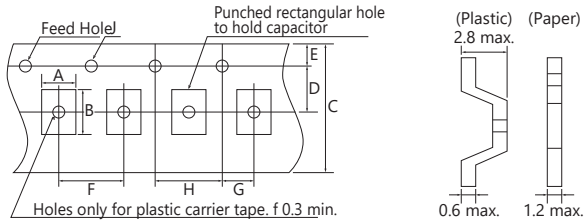
F=2mm (02, 03, 05 Size)



F=1mm (03, 05 Size)



F=4mm (105, 21, 316, 32 Size)



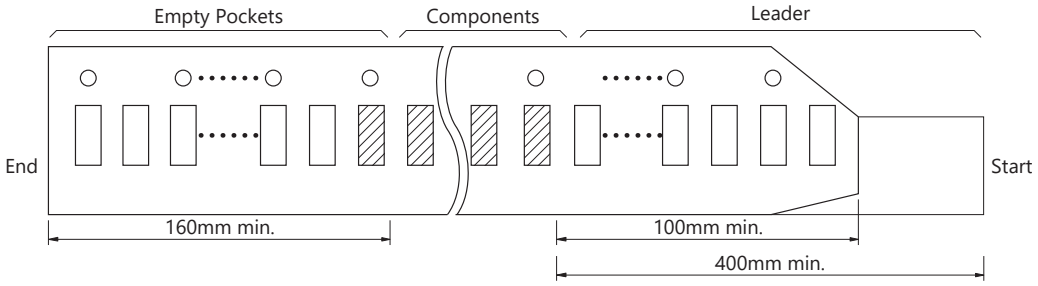
(Unit: mm)

Size (EIA Code)	A	B	C	D	E	F	G	H	J	Carrier Tape Width	Carrier Tape Material
02 (01005)*	0.24±0.02	0.44±0.02	4.0±0.08	1.8±0.02	0.9±0.05	1.0±0.02	—	2.0±0.04	0.8±0.04	4mm	Plastic
	0.25±0.03	0.45±0.03	8.0±0.3	3.5±0.05	1.75±0.1	2.0±0.05		4.0±0.1	1.5+0.1/-0	8mm	Paper
03 (0201)*	0.37±0.03	0.67±0.03	8.0+0.3/-0.1	3.5±0.05	1.75±0.1	1.0±0.05	—	4.0±0.05	1.5+0.1/-0	8mm	Paper
			8.0±0.3			2.0±0.05		4.0±0.1			
	0.39±0.03	0.69±0.03	8.0±0.3	3.5±0.05	1.75±0.1	2.0±0.05	—	4.0±0.1	1.5+0.1/-0		
	0.42±0.03	0.72±0.03	8.0±0.3	3.5±0.05	1.75±0.1	2.0±0.05	—	4.0±0.1	1.5+0.1/-0		
	0.44±0.05	0.74±0.05	8.0±0.3	3.5±0.05	1.75±0.1	2.0±0.05	—	4.0±0.1	1.5+0.1/-0		
05 (0402)*	0.65±0.1	1.15±0.1	8.0+0.3/-0.1	3.5±0.05	1.75±0.1	1.0±0.05	—	4.0±0.05	1.5+0.1/-0	8mm	Paper
	0.75±0.1		8.0±0.3			2.0±0.05	—	4.0±0.1			
	0.8±0.1	1.3±0.1	8.0±0.3	3.5±0.05	1.75±0.1	2.0±0.05	—	4.0±0.1	1.5+0.1/-0		
105 (0603)*	1.0±0.2	1.8±0.2	8.0±0.3	3.5±0.05	1.75±0.1	4.0±0.1	2.0±0.05	4.0±0.1	1.5+0.1/-0	8mm	Paper
	1.1±0.2	1.9±0.2	8.0±0.3	3.5±0.05	1.75±0.1	4.0±0.1	2.0±0.05	4.0±0.1	1.5+0.1/-0		
21 (0805)	1.5±0.2	2.3±0.2	8.0±0.3	3.5±0.05	1.75±0.1	4.0±0.1	2.0±0.05	4.0±0.1	1.5+0.1/-0	8mm	Paper
										8mm	Plastic
316 (1206)	2.0±0.2	3.6±0.2	8.0±0.3	3.5±0.05	1.75±0.1	4.0±0.1	2.0±0.05	4.0±0.1	1.5+0.1/-0	8mm	Paper
										8mm	Plastic
32 (1210)	2.9±0.2	3.6±0.2	8.0±0.3	3.5±0.05	1.75±0.1	4.0±0.1	2.0±0.05	4.0±0.1	1.5+0.1/-0	8mm	Plastic

* Option

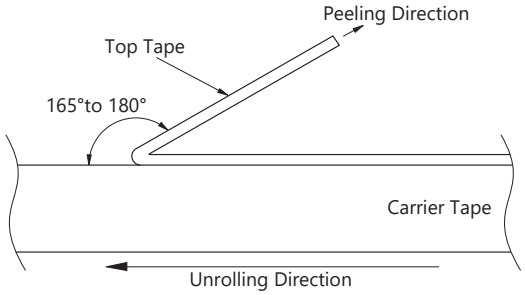
Packaging Options

Detail of leader and trailer



Adhesive tape

1) The exfoliative strength when peeling off the top tape from the carrier tape by the method of the following figure shall be *0.1 to 0.7N. *02 Size: 0.1 to 0.5N
2) When the top tape is peeled off, the adhesive stays on the top tape.
3) Chip capacitors will be in a state free without being stuck on the thermal adhesive tape.



Exfoliating angle: 165 to 180 degrees to the carrier tape.
Exfoliating speed: 300 mm/min.

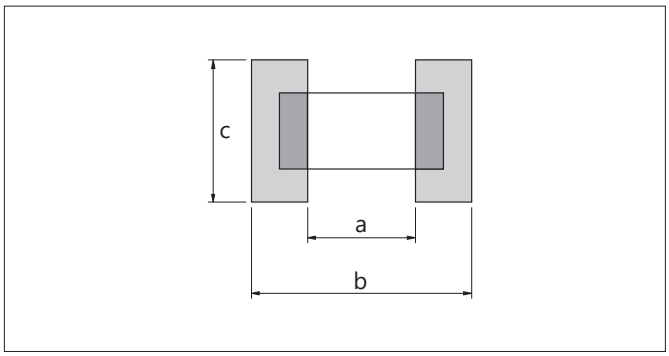
Carrier tape

1) Chip will not fall off from carrier tape or carrier tape will not be damaged by bending than within a radius of 25mm.
2) The chip are inserted continuously without any empty pocket.
3) Chip will not be mis-mounted because of too big clearance between components and cavity. Also the waste of carrier tape will not fill a nozzle hole of mounting machine.

Test Conditions and Standards

Substrate for Adhesion Strength Test, Vibration Test, Soldering Heat Resistance Test, Temperature Cycle Test,Load Humidity Test, High-Temperature with Loading Test.

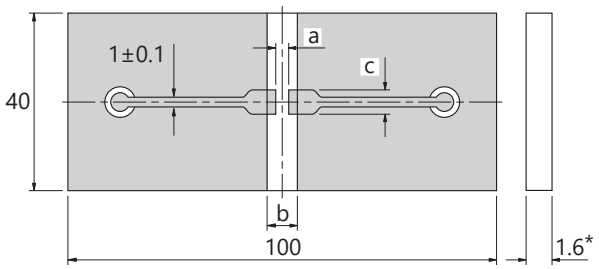
(Unit: mm)

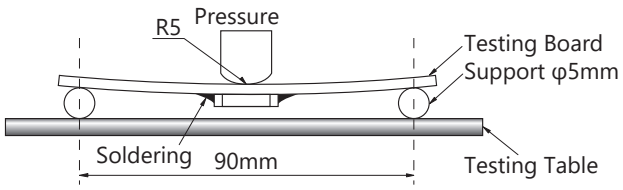


Size (EIA Code)	a	b	c
02 (01005)	0.15	0.5	0.2
03 (0201)	0.26	0.92	0.32
05 (0402)	0.4	1.4	0.5
105 (0603)	1.0	3.0	1.2
21 (0805)	1.2	4.0	1.65
316 (1206)	2.2	5.0	2.0
32 (1210)	2.2	5.0	2.9

Substrate for Bending Test

(Unit: mm)



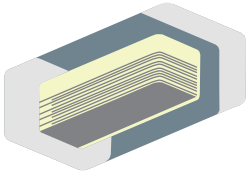


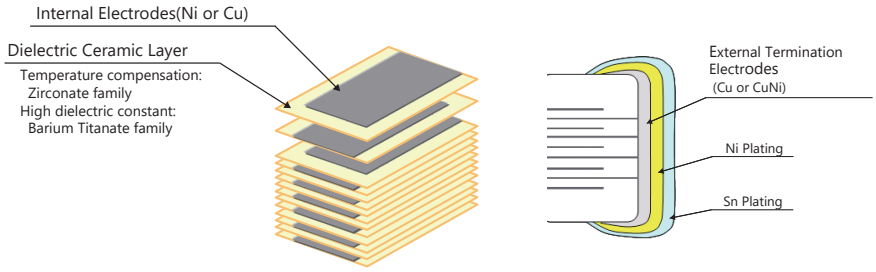
Testing Board : Glass Epoxy Board (GE4 or FR4)
Testing Board Thickness : 1.6±0.2mm*
Circuit Thickness : 0.04±0.01mm

*02, 03, 05 size 0.8±0.1mm

Structure

Plated Termination





About official Standards Certification
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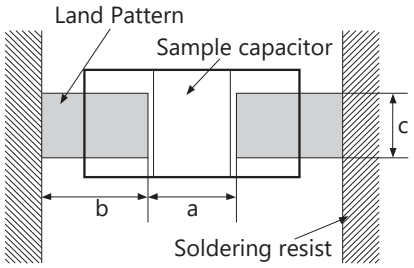
- The production site is Kagoshima Kokubu Plant.

Surface Mounting Information

Dimensions for recommended typical land

Since the amount of solder (size of fillet) to be used has direct influence on the capacitor after mounting, the sufficient consideration is necessary.
When the amounts of solder is too much, the stress that a capacitor receives becomes larger. It may become the cause of a crack in the capacitor. When the land design of printed wiring board is considered, it is necessary to set up the form and size of land pattern so that the amount of solder is suitable.

(General)



General

(Unit: mm)

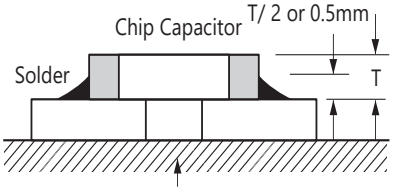
Size (EIA Code)	Dimension		Recommended land dimensions		
	L	W	a	b	c
02 (01005)	0.4±0.02	0.2±0.02	0.13 to 0.2	0.12 to 0.18	0.2 to 0.23
03 (0201)	0.6±0.03	0.3±0.03	0.2 to 0.25	0.25 to 0.35	0.3 to 0.4
	0.6±0.05	0.3±0.05			
	0.6±0.09	0.3±0.09	0.23 to 0.3	0.25 to 0.35	0.3 to 0.45
05 (0402)	1.0±0.05	0.5±0.05	0.3 to 0.5	0.35 to 0.45	0.4 to 0.6
	1.0±0.15	0.5±0.15	0.4 to 0.6	0.4 to 0.5	0.5 to 0.75
	1.0±0.2	0.5±0.2			
105 (0603)	1.6±0.1	0.8±0.1	0.7 to 1.0	0.8 to 1.0	0.6 to 0.9
	1.6±0.15	0.8±0.15	0.8 to 1.0	0.8 to 1.0	0.8 to 1.1
	1.6±0.2	0.8±0.2			
	1.6±0.25	0.8±0.25			
21 (0805)	2.0±0.1	1.25±0.1	1.0 to 1.3	1.0 to 1.2	1.0 to 1.45
	2.0±0.15	1.25±0.15	1.0 to 1.3	1.0 to 1.2	1.25 to 1.55
	2.0±0.2	1.25±0.2			
316 (1206)	3.2±0.2	1.6±0.15	2.1 to 2.5	1.1 to 1.3	1.4 to 1.9
	3.2±0.2	1.6±0.2	2.1 to 2.5	1.1 to 1.3	1.6 to 2.0
	3.2±0.3	1.6±0.3			
32 (1210)	3.2±0.3	2.5±0.2	2.1 to 2.5	1.1 to 1.3	1.9 to 2.8

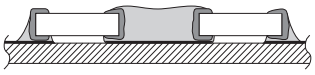
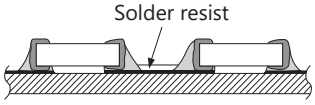
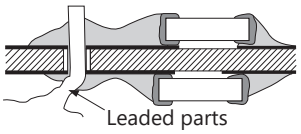
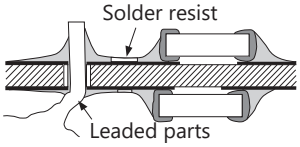
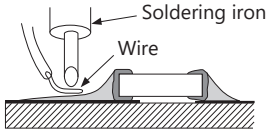
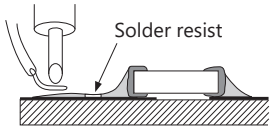
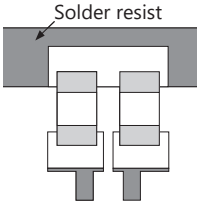
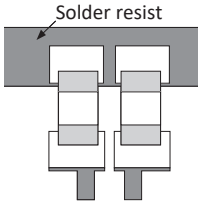
* Recommended land dimensions may differ depending on dimensional tolerance.

Design of printed circuit and Soldering

The recommended fillet height shall be 1/2 of the thickness of capacitors or 0.5mm. When mounting two or more capacitors in the common land, it is necessary to separate the land with the solder resist strike so that it may become the exclusive land of each capacitor.

Ideal Solder Height



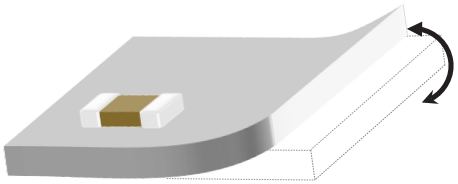
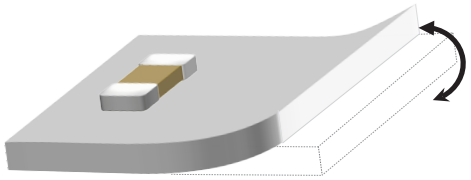
Item	Prohibited	Recommended example : Separation by solder resist
Multiple parts mount		
Mount with leaded parts		
Wire soldering after mounting		
Side by side layout		

Surface Mounting Information

Mounting Design

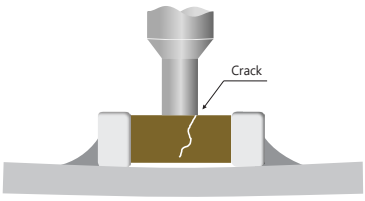
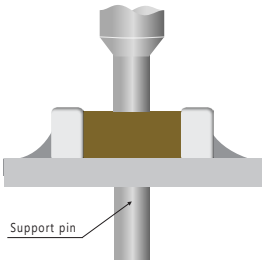
The chip could crack if the PCB warps during processing after the chip has been soldered.

Recommended chip position on PCB to minimize stress from PCB warpage

Not recommended	Ideal
	

Actual Mounting

1) If the position of the vacuum nozzle is too low, a large force may be applied to the chip capacitor during mounting, resulting in cracking.
2) During mounting, set the nozzle pressure to a static load of 1 to 3 N.
3) To minimize the shock of the vaccum nozzle, provide a support pin on the back of the PCB to minimize PCB flexture.

Not recommended	Ideal
	

4) Bottom position of pick up nozzle should be adjusted to the top surface of a substrate which camber is corrected.

Resin Mold

1) If a large amount of resin is used for molding the chip, cracks may occur due to contraction stress during curing. To avoid such cracks, use a low shrinkage resin.
2) The insulation resistance of the chip will degrade due to moisture absorption. Use a low moisture absorption resin.
3) Check carefully that the resin does not generate a decomposition gas or reaction gas during the curing process or during normal storage. Such gases may crack the chip capacitor or damage the device itself.

Surface Mounting Information

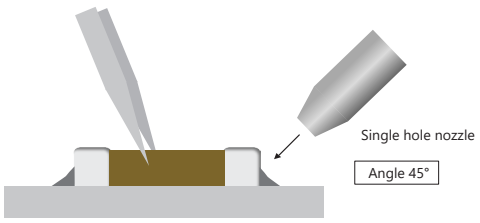
Soldering Method

1) Ceramic is easily damaged by rapid heating or cooling. If some heat shock is unavoidable, preheat enough to limit the temperature difference (Delta T) to within 150 degree Celsius.
2) The product size 1.6×0.8mm to 3.2×1.6mm can be used in reflow and wave soldering, and the product size of bigger than 3.2×1.6mm, or smaller than 1.6×0.8mm can be used in reflow.
   Circuit shortage and smoking can be created by using capacitors which are used neglecting the above caution.
3) Please see our recommended soldering conditions.
4) In case of using Sn-Zn Solder, please contact us in advance.
5) The following condition is recommended for spot heater application.

▪ Recommended spot heater condition

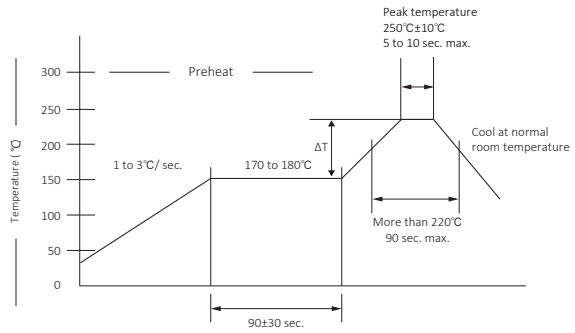
Item	Condition
Distance	5mm min.
Angle	45°
Projection Temp.	400°C max.
Flow rate	Set at the minimum
Nozzle diameter	2φ to 4φ (Single hole type)
Application time	10 sec. max. (1206 and smaller) 30 sec. max. (1210 and larger)

How to point spot heater



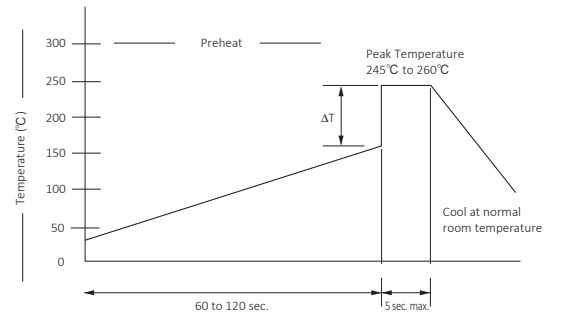
Recommended Temperature Profile (Sn-3Ag-0.5Cu)

Reflow



① Minimize soldering time.
② Ensure that allowable temperature difference does not exceed 150℃.
③ Ensure that allowable temperature difference does not exceed 130℃ for 3.2×2.5mm size or larger.
④ MLCC can withstand the above reflow conditions up to 3 times.
⑤ N_2 atmosphere is recommended for reflow of products of 0.4mm×0.2mm size or smaller.

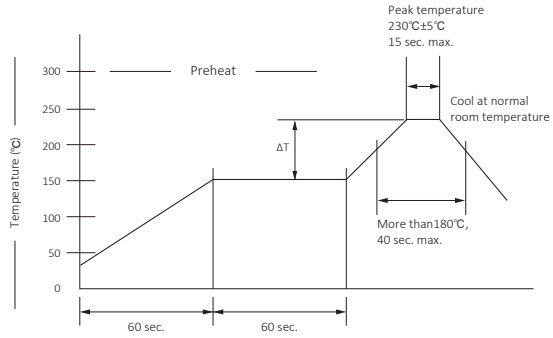
Wave



① Ensure that the chip capacitor is preheated adequately.
② Ensure that the temperature difference (ΔT) does not exceed 150℃.
③ Cool naturally after soldering.
④ Wave soldering is not applicable for chips with size of 3.2×2.5mm or larger of 1.0×0.5mm or smaller and capacitor arrays.

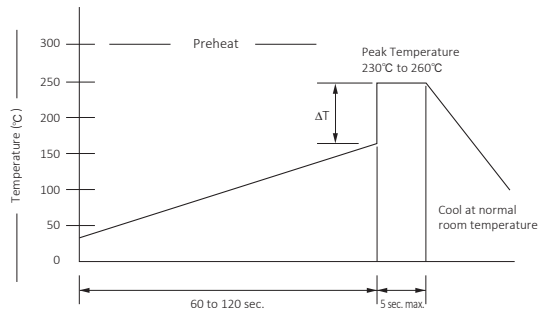
Recommended Temperature Profile (63Sn Solder)

Reflow



① Minimize soldering time.
② Ensure that the temperature difference (ΔT) does not exceed 150℃.
③ Ensure that the temperature difference (ΔT) does not exceed 130℃ for 3.2×2.5mm size or larger.
④ MLCC can withstand the above reflow conditions up to 3 times.

Wave



① Ensure that the chip capacitor is preheated adequately.
② Ensure that the temperature difference (ΔT) does not exceed 150℃.
③ Cool naturally after soldering.
④ Wave soldering is not applicable for chips with size of 3.2×2.5mm or larger of 1.0×0.5mm or smaller and capacitor arrays.

Precautions

Circuit Design

1. Once application and assembly environments have been checked, the capacitor may be used in conformance with the rating and performance which are provided in both the catalog and the specifications. Use exceeding that which is specified may result in inferior performance or cause a short, open, smoking, or flaming to occur, etc.

2. Please consult the manufacturer in advance when the capacitor is used in devices such as: devices which deal with human life, i.e. medical devices; devices which are highly public orientated; and devices which demand a high standard of liability.
   Accident or malfunction of devices such as medical devices, space equipment and devices having to do with atomic power could generate grave consequence with respect to human lives or, possibly, a portion of the public. Capacitors used in these devices may require high reliability design different from that of general purpose capacitors.

3. Please use the capacitors in conformance with the operating temperature provided in both the catalog and the specifications.
   Be especially cautious not to exceed the maximum temperature. In the situation the maximum temperature set forth in both the catalog and specifications is exceeded, the capacitor's insulation resistance may deteriorate, power may suddenly surge and short-circuit may occur.
   The capacitor has a loss, and may self-heat due to equivalent series resistance when alternating electric current is passed therethrough. As this effect becomes especially pronounced in high frequency circuits, please exercise caution.
   When using the capacitor in a (self-heating) circuit, please make sure the surface of the capacitor remains under the maximum temperature for usage. Also, please make certain temperature rises remain below 20°C.

4. Please keep voltage under the rated voltage which is applied to the capacitor. Also, please make certain the peak voltage remains below the rated voltage when AC voltage is super-imposed to the DC voltage.
   In the situation where AC or pulse voltage is employed, ensure average peak voltage does not exceed the rated voltage.
   Exceeding the rated voltage provided in both catalog and specifications may lead to defective withstanding voltage or, in worst case situations, may cause the capacitor to smoke or flame.

5. When the capacitor is to be employed in a circuit in which there is continuous application of a high frequency voltage or a steep pulse voltage, even though it is within the rated voltage, please inquire to the manufacturer.
   In the situation the capacitor is to be employed using a high frequency AC voltage or a extremely fast rising pulse voltage, even though it is within the rated voltage, it is possible capacitor reliability will deteriorate.

6. It is a common phenomenon of high-dielectric products to have a deteriorated amount of static electricity due to the application of DC voltage.
   Due caution is necessary as the degree of deterioration varies depending on the quality of capacitor materials, capacity, as well as the load voltage at the time of operation.

7. Do not use the capacitor in an environment where it might easily exceed the respective provisions concerning shock and vibration specified in the catalog and specifications.
   In addition, it is a common piezo phenomenon of high dielectric products to have some voltage due to vibration or to have noise due to voltage change. Please contact sales in such case.

8. If the electrostatic capacity value of the delivered capacitor is within the specified tolerance, please consider this when designing the respective product in order that the assembled product function appropriately.

9. Please contact us upon using conductive adhesives.

Storage

Please note the following regarding the storage of delivered products.

1. Set the storage temperature to + 5 to + 40 °C and humidity to 20 ~ 70% RH. Other meteorological conditions are in accordance with classification 1 K2 of JIS C 60721 -3 -1.

2. Store in a place where corrosive gas (H_2S, SO_2, NO_2, Cl_2, etc.) does not exist in the atmosphere. Also, avoid exposure to salty moisture. In either case, this may cause
   oxidation corrosion of the terminal electrode, reducing solderability.

If you store the above delivered products according to the conditions listed above, it will satisfy the solderability standard for 6 months from the shipping date.

Safety application guideline and detailed information of electrical properties are also provided in kyocera web site;
URL: https://ele.kyocera.com/en/product/capacitor/

Part Number List

Low Profile CT03Series Size (JIS Code)：0201(0603) # Packaging Code (Packaging quantity)：H(15,000pcs.) / N(50,000pcs.) / Q(30,000pcs.) / W(150,000pcs.)

Dielectric code	Capacitance	□:Tolerance	Voltage [V]	Part Number	Tanδ [%]	Dimension			# Packaging Code (quantity)
						L[mm]	W[mm]	T[mm]	
X5R	0.1μF	K:±10% / M:±20%	6.3	CT03X5R104□06A#022	12.5	0.6±0.03	0.3±0.03	0.22 max.	H / N / Q / W
	1μF			CT03X5R105□06A#022	10.0	0.6±0.09	0.3±0.09	0.22 max.	H / N
X6S	0.1μF	K:±10% / M:±20%	4	CT03X6S104□04A#022	12.5	0.6±0.03	0.3±0.03	0.22 max.	H / N / Q / W
X6T	1μF	M:±20%	4	CT03X6T105M04A#022	12.5	0.6±0.09	0.3±0.09	0.22 max.	H / N

Low Profile CT05 Series Size (JIS Code)：0402(1005) # Packaging Code (Packaging quantity)：H(10,000pcs.) / N(50,000pcs.) / Q(20,000pcs.) / W(100,000pcs.)

Dielectric code	Capacitance	□:Tolerance	Voltage [V]	Part Number	Tanδ [%]	Dimension			# Packaging Code (quantity)
						L[mm]	W[mm]	T[mm]	
X5R	1μF	K:±10% / M:±20%	6.3	CT05X5R105□06A#033	12.5	1.0±0.05	0.5±0.05	0.33 max.	H / N / Q / W
	2.2μF	M:±20%		CT05X5R225M06A#033	12.5	1.0±0.05	0.5±0.05	0.33 max.	H / N / Q / W
	4.7μF			CT05X5R475M06AH033	15.0	1.0±0.2	0.5±0.2	0.33 max.	H
	10μF			CT05X5R106M06A#050	15.0	1.0±0.2	0.5±0.2	0.5 max.	H / N
X6T	1μF	M:±20%	4	CT05X6T105M04A#022	12.5	1.0±0.1	0.5±0.05	0.22 max.	H / N
	10μF		2.5	CT05X6T106M02A#050	12.5	1.0±0.2	0.5±0.2	0.5 max.	H / N

Low Profile CT105 Series Size (JIS Code)：0603(1608) # Packaging Code (Packaging quantity)：T(4,000pcs.) / L(10,000pcs.)

Dielectric code	Capacitance	□:Tolerance	Voltage [V]	Part Number	Tanδ [%]	Dimension			# Packaging Code (quantity)
						L[mm]	W[mm]	T[mm]	
X5R	1μF	K:±10%/M:±20%	16	CT105X5R105□16A#055	12.5	1.6±0.1	0.8±0.1	0.55 max.	T / L

Low Profile CT21 Series Size (JIS Code)：0805(2012) # Packaging Code (Packaging quantity)：T(4,000pcs.) / L(10,000pcs.)

Dielectric code	Capacitance	□:Tolerance	Voltage [V]	Part Number	Tanδ [%]	Dimension			# Packaging Code (quantity)
						L[mm]	W[mm]	T[mm]	
X5R	2.2μF	K:±10% / M:±20%	50	CT21X5R225□50A#095	5.0	2.0±0.2	1.25±0.2	0.95 max.	T / L
	4.7μF		16	CT21X5R475□16A#095	12.5	2.0±0.15	1.25±0.15	0.95 max.	T / L

1. Specifications described in this catalog are for references. Products specifications shall be based on written documents agreed by each party.

2. Contents in this catalog are subject to change without notice. It is recommended to confirm the latest information at the time of usage. Also, Kyocera Electronic Components Catalog is revised once a year. We may not be able to accept requests based on old catalogs.

3. Products in this catalog are intended to be used in general electronic equipment such as office equipment, audio and visual equipment, communication equipment, measurement instrument and home appliances. It is absolutely recommended to consult with our sales representatives in advance upon planning to use our products in applications which require extremely high quality and reliability such as aircraft and aerospace equipment, traffic systems, safety systems, power plant and medical equipment including life maintenance systems.

4. Even though we strive for improvements of quality and reliability of products, it is requested to design with enough safety margin in equipment or systems in order not to threaten human lives directly or damage human bodies or properties by an accidental result of products.

5. It is requested to design based on guaranteed specifications for such as maximum ratings, operating voltage and operating temperature. It is not the scope of our guarantee for unsatisfactory results due to misuse or inadequate usage of products in the catalog.

6. Operation summaries and circuit examples in this catalog are intended to explain typical operation and usage of the product. It is recommended to perform circuit and assembly design considering surrounding conditions upon using products in this catalog.

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11. Contents described herein are as of February 2022.

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