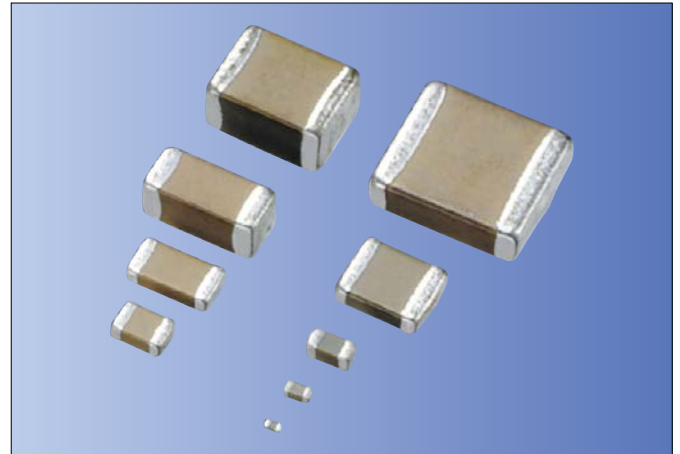


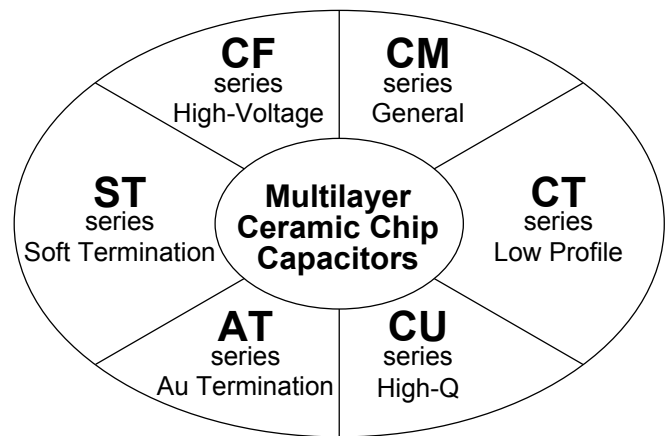
Kyocera's series of Multilayer Ceramic Chip Capacitors are designed to meet a wide variety of needs. We offer a complete range of products for both general and specialized applications, including CM series for general-purpose, CT series for low profile, CU series for Hi-Q, AT series for Au termination, ST series for soft termination, and CF series for high-voltage.

Features

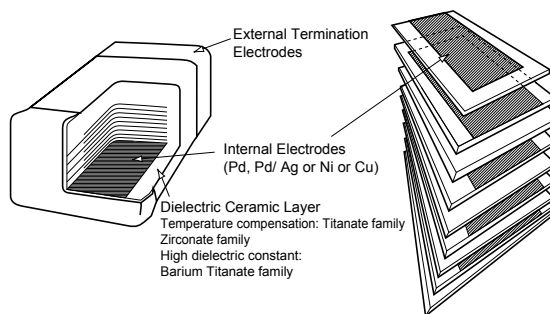
- We have a network worldwide in order to supply our global customer bases quickly and efficiently and to maintain our reputation as one of the highest-volume producers in the industry.
- All our products are highly reliable due to their monolithic structure of high-purity and superfine uniform ceramics and their integral internal electrodes.
- By combining superior manufacturing technology and materials with high dielectric constants, we produce extremely compact components with exceptional specifications.
- Our stringent quality control in every phase of production from material procurement to shipping ensures consistent manufacturing and super quality.
- Kyocera components are available in a wide choice of dimensions, temperature characteristics, rated voltages, and terminations to meet specific configurational requirements.



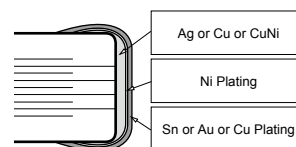
RoHS Compliant



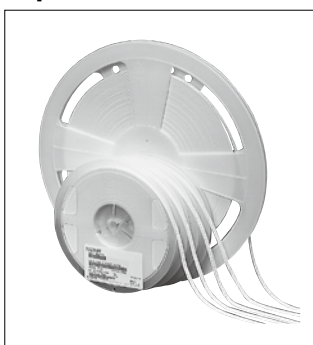
Structure



Nickel Barrier Termination Products



Tape and Reel



Please contact your local AVX, Kyocera sales office or distributor for specifications not covered in this catalog.

Our products are continually being improved. As a result, the capacitance range of each series is subject to change without notice. Please contact a sales representative to confirm compatibility with your application.

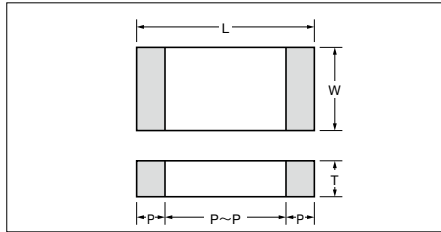
Kyocera Ceramic Chip Capacitors are available for different applications as classified below:

Series	Dielectric Options	Typical Applications	Features	Terminations	Available Size
CM	C0G (NP0) X5R X7R *X6S X7S	General purpose	Wide cap range	Nickel barrier/ Tin	01005, 0201, 0402 0603, 0805, 1206 1210, 1812
CT	X5R X7R	Module / Memory card	Low profile	Nickel barrier/ Tin	0201, 0402, 0603 0805, 1206, 1210
CU	C0G (NP0)	Power amplifier	High-Q	Nickel barrier/ Tin	01005
AT	X5R X7R	Optical communications	Au termination	Nickel barrier/ Au	0201, 0402
ST	X5R X7R X7S	PCB with severe bending conditions	Soft termination	Nickel barrier/ Tin (Soft Termination)	0201, 0402
CF	C0G (NP0) X7R	High voltage & Power circuits	High voltage 250Vdc, 630Vdc 1000Vdc, 2000Vdc 3000Vdc, 4000Vdc	Nickel barrier/ Tin	0805, 1206, 1210 1808, 1812, 2208 2220

* Option

* Negative temperature coefficient dielectric types are available on request.

Dimensions



※Packaging Code

(E 8 / 2)

Taping Material		Taping Width		Pitch	
Code	Material	Code	Width	Code	Pitch
E	Plastic	4	4mm	1	1mm
P	Paper	8	8mm	2	2mm
		12	12mm	4	4mm
				8	8mm

Dimensions and Packaging Quantities

Size	Code		Dimension Code	Dimensions (mm)					Maximum quantity per reel					
	JIS	EIA		L	W	T	P min.	P max.	P to P min.	φ180 Reel*	φ330 Reel*			
02	0402	01005	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)	-			
03	0603	0201	A	0.6±0.03	0.3±0.03	0.22 max.	0.10	0.20	0.20	30kp (P8/1) 15kp (P8/2)	150kp (P8/1) 50kp (P8/2)			
			B			0.3±0.03				30kp (P8/1) 15kp (P8/2)	150kp (P8/1) 50kp (P8/2)			
			C	0.6±0.05	0.3±0.05	0.3±0.05	0.13	0.23	0.19	30kp (P8/1) 15kp (P8/2)	150kp (P8/1) 50kp (P8/2)			
			D	0.6±0.09	0.3±0.09	0.3±0.09	0.13	0.23	0.19	15kp (P8/2)	-			
			E			0.25 max.				15kp (P8/2)	-			
			F	0.6±0.10	0.3±0.10	0.3±0.10	-	-	-	15kp (P8/2)	-			
05	1005	0402	A	1.0±0.05	0.5±0.05	0.22 max.	0.15	0.35	0.30	20kp (P8/1) 10kp (P8/2)	100kp (P8/1) 50kp (P8/2)			
			B			0.25 max.				20kp (P8/1) 10kp (P8/2)	100kp (P8/1) 50kp (P8/2)			
			C			0.33 max.				20kp (P8/1) 10kp (P8/2)	100kp (P8/1) 50kp (P8/2)			
			D			0.35 max.				20kp (P8/1) 10kp (P8/2)	100kp (P8/1) 50kp (P8/2)			
			E	1.0±0.07	0.5±0.07	0.5±0.05	0.15	0.35	0.30	20kp (P8/1) 10kp (P8/2)	100kp (P8/1) 50kp (P8/2)			
			F			0.5±0.07				20kp (P8/1) 10kp (P8/2)	100kp (P8/1) 50kp (P8/2)			
			G	1.0±0.10	0.5±0.10	0.35 max.	0.15	0.35	0.30	20kp (P8/1) 10kp (P8/2)	100kp (P8/1) 50kp (P8/2)			
			H			0.5±0.10				20kp (P8/1) 10kp (P8/2)	100kp (P8/1) 50kp (P8/2)			
			J	1.0±0.15	0.5±0.15	0.5±0.15	-	-	-	20kp (P8/1) 10kp (P8/2)	50kp (P8/2)			
			K	1.0±0.20	0.5±0.20	0.33 max.	-	-	-	10kp (P8/2)	-			
			L			0.5±0.20	10kp (P8/2)	-						
			105	1608	0603	A	1.6±0.10	0.8±0.10	0.55 max.	0.20	0.60	0.50	4kp (P8/4)	10kp (P8/4)
						B			0.8±0.10				8kp (P8/2) 4kp (P8/4)	20kp (P8/2) 10kp (P8/4)
						C	1.6±0.15	0.8±0.15	0.55 max.				8kp (P8/2) 4kp (P8/4)	20kp (P8/2) 10kp (P8/4)
D	0.8±0.15	8kp (P8/2) 4kp (P8/4)				20kp (P8/2) 10kp (P8/4)								
E	1.6±0.20	0.8±0.20				0.55 max.	8kp (P8/2) 4kp (P8/4)	20kp (P8/2) 10kp (P8/4)						
F						0.8±0.20	8kp (P8/2) 4kp (P8/4)	20kp (P8/2) 10kp (P8/4)						
G	-	-				-	-	-	-				-	-
H	-	-				-	-	-	-				-	-
21	2012	0805	A	2.0±0.10	1.25±0.10	0.55 max.	0.20	0.75	0.70	4kp (P8/4)	10kp (P8/4)			
			B			0.95 max.				4kp (P8/4)	10kp (P8/4)			
			C			1.00 max.				4kp (E8/4)	10kp (E8/4)			
			D			0.6±0.1				4kp (P8/4)	10kp (P8/4)			
			E	0.85±0.10	4kp (P8/4)	10kp (P8/4)								
			F	1.05±0.10	3kp (E8/4)	10kp (E8/4)								
			G	1.25±0.10	3kp (E8/4)	10kp (E8/4)								
			H	0.55 max.	4kp (P8/4)	10kp (P8/4)								
			J	2.0±0.15	1.25±0.15	0.95 max.	0.20	0.75	0.70	4kp (P8/4)	10kp (P8/4)			
			K			1.25±0.15				3kp (E8/4)	10kp (E8/4)			
			L	2.0±0.20	1.25±0.20	0.95 max.	0.20	0.75	0.70	4kp (P8/4)	10kp (P8/4)			
			M			1.25±0.20				3kp (E8/4)	10kp (E8/4)			
			316	3216	1206	A	3.2±0.20	1.6±0.15	0.95 max.	0.30	0.85	1.40	4kp (P8/4)	10kp (P8/4)
						B			1.00 max.				4kp (E8/4)	10kp (E8/4)
C	1.15±0.10	3kp (E8/4)				10kp (E8/4)								
D	1.25±0.10	3kp (E8/4)				10kp (E8/4)								
E	1.6±0.15	3kp (E8/4)				10kp (E8/4)								
F	0.95 max.	2.5kp (E8/4)				5kp (E8/4)								
G	3.2±0.20	1.6±0.20				1.00 max.	4kp (P8/4)	10kp (P8/4)						
H						1.6±0.20	4kp (E8/4)	10kp (E8/4)						
J	3.2±0.30	1.6±0.30				1.6±0.30	2.5kp (E8/4)	5kp (E8/4)						
K						1.00 max.	2kp (E8/4)	-						
32	3225	1210	A	3.2±0.30	2.5±0.20	1.40 max.	0.30	1.00	1.40	4kp (E8/4)	10kp (E8/4)			
			B			1.60 max.				3kp (E8/4)	10kp (E8/4)			
			C			1.6±0.15				2.5kp (E8/4)	5kp (E8/4)			
			D			2.20 max.				2.5kp (E8/4)	5kp (E8/4)			
			E	2.0±0.2	2kp (E8/4)	5kp (E8/4)								
			F	2.5±0.2	2kp (E8/4)	5kp (E8/4)								
			G	2.5±0.2	1kp (E8/4)	4kp (E8/4)								
			H	1.6 max.	2kp (E12/4)	-								
42	4520	1808	A	4.5±0.20	2.0±0.20	2.2 max.	0.15	0.85	2.60	2kp (E12/4)	-			
			B			2.0 max.				2kp (E12/4)	-			
43	4532	1812	A	4.5±0.30	3.2±0.20	2.0 max.	0.30	1.10	2.00	1kp (E12/8)	-			
			B			2.0±0.2				1kp (E12/8)	-			
			C			2.5 max.				0.5kp (E12/8)	-			
			D			2.5±0.2				0.5kp (E12/8)	-			
			E			2.8±0.2				0.5kp (E12/8)	-			
52	5720	2208	A	5.7±0.40	2.0±0.20	2.2 max.	0.15	0.85	4.20	2kp (E12/4)	-			
55	5750	2220	A	5.7±0.40	5.0±0.40	2.0 max.	0.30	1.40	2.50	1kp (E12/8)	-			
			B			2.5 max.				0.5kp (E12/8)	-			
			C			2.8 max.				0.5kp (E12/8)	-			

Note: Taping denotes the quantity packaged per reel (kp means 1000 pieces). * Please contact us.

Temperature Compensation Type

Code	ppm/ °C	Temperature Range
CG	0	±30
CH		±60
		-55 to 125°C

Note: 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

EIA Dielectric	Temperature Range	ΔC max.
X5R	-55 to 85°C	±15%
X7R	-55 to 125°C	
X7S	-55 to 125°C	±22%
*X6S	-55 to 105°C	

* option

Available Tolerances

Dielectric materials, capacitance values and tolerances are available in the following combinations only:

EIA Dielectric	Tolerance	Capacitance
C0G	* ₂ A = ±0.05pF	<0.5pF
	B = ±0.1pF	≤5pF
	C = ±0.25pF D = ±0.50pF	* ₁ <10pF
	* ₂ G = ±2% J = ±5% K = ±10%	≥10pF E12 Series
* ₂ X6S X5R X7S X7R	* ₂ J = ±5% K = ±10% M = ±20%	* ₃ E3 Series

Note:
*₁ Nominal values below 10pF are available in the standard values of 0.5pF, 1.0pF, 1.5pF, 2.0pF, 3.0pF, 4.0pF, 5.0pF, 6.0pF, 7.0pF, 8.0pF, 9.0pF
*₂ option
*₃ E6 series is available on request.

E Standard Number

E3	E6	E12	E24 (Option)	
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

Features

We offer a diverse product line ranging from ultra-compact (0.4×0.2mm) to large (4.5×3.2mm) components configured for a variety of temperature characteristics, rated voltages, and packages. We offer the choice and flexibility for almost any applications.

Applications

This standard type is ideal for use in a wide range of applications, from commercial to industrial equipment.

Temperature Compensation Dielectric

Size (EIA Code)	CM02 (01005)		CM03 (0201)		CM05 (0402)	CM105 (0603)	CM21 (0805)		
Temperature	CΔ*1		CΔ*1		CΔ*1	CΔ*1	CΔ*1		
Rated Voltage (Vdc)	16	25	25	50	50	50	16	25	50
Capacitance (pF)									
R20 0.2									
R50 0.5									
1R0 1.0									
1R5 1.5									
2.0									
3.0									
4.0									
5.0									
6.0									
7.0									
8.0									
9.0									
100 10	A		B	B					
120 12									
15									
18									
22									
27									
33									
39									
47									
56									
68									
82									
101 100									
121 120									
150									
180									
220									
270									
330									
390									
470									
560									
680									
820									
102 1000									
122 1200									
1500									
1800									
2200									
2700									
3300									
3900									
4700									
5600									
6800									
8200									
103 10000									
123 12000									
15000									
18000									

<Standard Capacitance Value>

E12 Series

Please contact for capacitance value other than standard.

*1: CG,CH

Alphabets in capacitance chart denote dimensions.

Please refer to the below table for detail.

(Example)

In case of "B" for CM03;

L : 0.6±0.03mm

W : 0.3±0.03mm

T : 0.3±0.03mm

Size	Size Code	Dimension (mm)		
		L	W	T
02	A	0.4±0.02	0.2±0.02	0.2±0.02
03	B	0.6±0.03	0.3±0.03	0.3±0.03
05	E	1.0±0.05	0.5±0.05	0.5±0.05
105	B	1.6±0.10	0.8±0.10	0.8±0.10
21	E	2.0±0.10	1.25±0.10	0.85±0.10
	G	2.0±0.10	1.25±0.10	1.25±0.10

X5R Dielectric

Size (EIA Code)	CM02 (01005)			CM03 (0201)				CM05 (0402)					CM105 (0603)				CM21 (0805)								
Rated Voltage (Vdc)	6.3	10	16	6.3	10	16	25	4	6.3	10	16	25	35	4	6.3	10	16	25	4	6.3	10	16	25	50	
Capacitance (pF)																									
101																									
151																									
102																									
152																									
103																									
153																									
104																									
105																									
106																									
107																									

Size (EIA Code)	CM316 (1206)					CM32 (1210)					CM43 (1812)			
Rated Voltage (Vdc)	6.3	10	16	25	50	100	4	6.3	10	16	25	50	6.3	50
Capacitance (pF)														
105														
106														
107														

<Standard Capacitance Value>

CM21 size and smaller : E6 Series

CM316 size and larger / capacitance value of 0.1µF and larger : E3 Series

Please contact for capacitance value other than standard.

▨ Optional Spec.

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

(Example)

In case of "B3" for CM03;

- L : 0.6±0.03mm
- W : 0.3±0.03mm
- T : 0.3±0.03mm
- Tan δ : 5.0% max.

Size	Size Code	Dimension (mm)		
		L	W	T
02	A	0.4±0.02	0.2±0.02	0.2±0.02
	B	0.6±0.03	0.3±0.03	0.3±0.03
03	C	0.6±0.05	0.3±0.05	0.3±0.05
	D	0.6±0.09	0.3±0.09	0.3±0.09
05	E	1.0±0.05	0.5±0.05	0.5±0.05
	H	1.0±0.10	0.5±0.10	0.5±0.10
	J	1.0±0.15	0.5±0.15	0.5±0.15
	L	1.0±0.20	0.5±0.20	0.5±0.20
105	B	1.6±0.10	0.8±0.10	0.8±0.10
	D	1.6±0.15	0.8±0.15	0.8±0.15
21	G	2.0±0.10	1.25±0.10	1.25±0.10
	K	2.0±0.15	1.25±0.15	1.25±0.15
	M	2.0±0.20	1.25±0.20	1.25±0.20

Size	Size Code	Dimension (mm)		
		L	W	T
316	E	3.2±0.20	1.6±0.15	1.6±0.15
	H	3.2±0.20	1.6±0.20	1.6±0.20
32	B	3.2±0.30	2.5±0.20	1.40 max.
	C	3.2±0.30	2.5±0.20	1.60 max.
	F	3.2±0.30	2.5±0.20	2.0±0.2
43	G	3.2±0.30	2.5±0.20	2.5±0.2
	D	4.5±0.30	3.2±0.20	2.5±0.2
	E	4.5±0.30	3.2±0.20	2.8±0.2

Tan δ Code	Tan δ
3	5.0% max.
4	7.0% max.
5	7.5% max.
7	10.0% max.
8	12.5% max.
9	15.0% max.
10	20.0% max.

X7R Dielectric

Size (EIA Code)	CM02 (01005)	CM03 (0201)			CM05 (0402)		CM105 (0603)			CM21 (0805)				
Rated Voltage (Vdc)	16	10	16	25	16	25	6.3	10	16	6.3	10	16	25	50
Capacitance (pF)														
101 100														
151 150														
220														
330														
470	A8													
680														
1000														
152 1500														
2200														
3300														
4700														
6800														
10000														
103 15000														
22000														
33000														
47000														
68000														
100000														
220000														
470000														
1000000														
2200000														
105 2200000														
4700000														
10000000														
22000000														
106 22000000														

Size (EIA Code)	CM316 (1206)					CM32 (1210)				CM43 (1812)	
Rated Voltage (Vdc)	6.3	10	16	25	50	10	16	25	50	50	100
Capacitance (pF)											
105 220000											
470000											
1000000											
2200000											
4700000											
10000000											
22000000											
106 47000000											
100000000											
220000000											

Optional Spec.

<Standard Capacitance Value>
 CM21 size and smaller : E6 Series
 CM316 size and larger / capacitance value of 0.1µF and larger : E3 Series
 Please contact for capacitance value other than standard.

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

(Example)
 In case of "B3" for CM03;
 L : 0.6±0.03mm
 W : 0.3±0.03mm
 T : 0.3±0.03mm
 Tan δ : 5.0% max.

Size	Size Code	Dimension (mm)		
		L	W	T
02	A	0.4±0.02	0.2±0.02	0.2±0.02
	B	0.6±0.03	0.3±0.03	0.3±0.03
	E	1.0±0.05	0.5±0.05	0.5±0.05
105	B	1.6±0.10	0.8±0.10	0.8±0.10
	D	1.6±0.15	0.8±0.15	0.8±0.15
21	G	2.0±0.10	1.25±0.10	1.25±0.10
	M	2.0±0.20	1.25±0.20	1.25±0.20

Size	Size Code	Dimension (mm)		
		L	W	T
316	C	3.2±0.20	1.6±0.15	1.15±0.10
	E	3.2±0.20	1.6±0.15	1.6±0.15
	H	3.2±0.20	1.6±0.20	1.6±0.20
32	B	3.2±0.30	2.5±0.20	1.40 max.
	F	3.2±0.30	2.5±0.20	2.0±0.2
	G	3.2±0.30	2.5±0.20	2.5±0.2
43	B	4.5±0.30	3.2±0.20	2.0±0.2
	D	4.5±0.30	3.2±0.20	2.5±0.2

Tan δ Code	Tan δ
1	2.5% max.
2	3.5% max.
3	5.0% max.
5	7.5% max.
8	12.5% max.

X7S Dielectric

Size (EIA Code)	CM316 (1206)
Rated Voltage (Vdc)	100
Capacitance (pF)	
104 47000	
100000	
220000	
105 470000	
1000000	
2200000	
4700000	
10000000	
22000000	
47000000	
100000000	
220000000	

Size	Size Code	Dimension (mm)		
		L	W	T
316	H	3.2±0.20	1.6±0.20	1.6±0.20
	J	3.2±0.30	1.6±0.30	1.6±0.30

Tan δ Code	Tan δ
3	5.0% max.

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

Optional Spec.

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

Size (EIA Code)	CT03 (0201)		CT05 (0402)				CT105 (0603)		CT21 (0805)				CT316 (1206)					CT32 (1210)			
Rated Voltage (Vdc) Capacitance (pF)	4	6.3	4	6.3	16	25	4	16	6.3	10	16	25	50	6.3	10	16	25	50	16	25	
103 2200 4700 10000					D3	D3															
104 22000 47000 100000	A8	A8		B8																	
105 220000 470000 1000000	E8	E8	G8	A8/C8			A8			B3	B3				A4	A3	A3	G8			
106 2200000 4700000 10000000				C8			E8		J5	B4 H8/J8	H8/J8	J8		L3	A4 B4	B3 F8/G8	A8 F5	F3	A3 A3/E3	E3	

<Standard Capacitance Value>

E3 Series

Please contact for capacitance value other than standard.

Optional Spec.

X7R Dielectric

Size (EIA Code)	CT05 (0402)		
Rated Voltage (Vdc) Capacitance (pF)	10	16	25
102 220 470 1000			D2
103 2200 4700 10000	D3	D2	
104 22000 47000 100000			
105 220000 470000 1000000			

E6 Series: Option

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

(Example)

In case of "B8" for CT05;
L : 1.0±0.05mm
W : 0.5±0.05mm
T : 0.25 max.
Tan δ : 12.5% max.

Size	Size Code	Dimension (mm)		
		L	W	T
03	A	0.6±0.03	0.3±0.03	0.22 max.
	E	0.6±0.09	0.3±0.09	0.25 max.
05	A	1.0±0.05	0.5±0.05	0.22 max.
	B	1.0±0.05	0.5±0.05	0.25 max.
	C	1.0±0.05	0.5±0.05	0.33 max.
	D	1.0±0.05	0.5±0.05	0.35 max.
	G	1.0±0.10	0.5±0.10	0.35 max.
	K	1.0±0.20	0.5±0.20	0.33 max.
105	A	1.6±0.10	0.8±0.10	0.55 max.
	C	1.6±0.15	0.8±0.15	0.55 max.
	E	1.6±0.20	0.8±0.20	0.55 max.
21	B	2.0±0.10	1.25±0.10	0.95 max.
	H	2.0±0.15	1.25±0.15	0.55 max.
	J	2.0±0.15	1.25±0.15	0.95 max.
	L	2.0±0.20	1.25±0.20	0.95 max.

Size	Size Code	Dimension (mm)			Tan δ Code	Tan δ
		L	W	T		
316	A	3.2±0.20	1.6±0.15	0.95 max.	2	3.5% max.
	B	3.2±0.20	1.6±0.15	1.00 max.	3	5.0% max.
	F	3.2±0.20	1.6±0.20	0.95 max.	4	7.0% max.
	G	3.2±0.20	1.6±0.20	1.00 max.	5	7.5% max.
	32	A	3.2±0.30	2.5±0.20	1.00 max.	8
	E	3.2±0.30	2.5±0.20	2.20 max.	9	15.0% max.

Features

- Ultra-compact size (0.4mm×0.2mm)
- High efficiency in RF transmission circuit performance (High-Q, Low ESR characteristics)

Temperature Compensation Dielectric

Size (EIA Code)	CU02 (01005)
Temperature	CΔ * 1
Rated Voltage (Vdc)	16
Capacitance (pF)	
R20	A
R50	
1R0	
1R5	
2.0	
3.0	
4.0	
5.0	
6.0	
7.0	
8.0	
9.0	
100	
120	
15	
18	
22	

<Standard Capacitance Value>

E12 Series

Please contact for capacitance value other than standard.

*1: CG,CH

Applications

- Peripheral circuits of power amplifier for mobile communication device (Impedance matching etc.)
- Others: RF transmission circuits

Alphabets in capacitance chart denote dimensions. Please refer to the below table for detail.

(Example)

In case of "A" for CU02;

L : 0.4±0.02mm

W : 0.2±0.02mm

T : 0.2±0.02mm

Size	Size Code	Dimension (mm)		
		L	W	T
02	A	0.4±0.02	0.2±0.02	0.2±0.02

AT Series Au Termination

Features

Enables wire bonding, AuSn solder and conductive adhesive assembly by Au plated external termination electrodes.

Applications

- Optical communications
- Inside of IC packages

X5R Dielectric

Size (EIA Code)	AT03 (0201)				AT05 (0402)			
	6.3	10	16	25	6.3	10	16	25
151								
152								
102								
103								
104								
105								
153								
101								
100								
150								
149								
148								
147								
146								
145								
144								
143								
142								
141								
140								
139								
138								
137								
136								
135								
134								
133								
132								
131								
130								
129								
128								
127								
126								
125								
124								
123								
122								
121								
120								
119								
118								
117								
116								
115								
114								
113								
112								
111								
110								
109								
108								
107								
106								
105								
104								
103								
102								
101								
100								
99								
98								
97								
96								
95								
94								
93								
92								
91								
90								
89								
88								
87								
86								
85								
84								
83								
82								
81								
80								
79								
78								
77								
76								
75								
74								
73								
72								
71								
70								
69								
68								
67								
66								
65								
64								
63								
62								
61								
60								
59								
58								
57								
56								
55								
54								
53								
52								
51								
50								
49								
48								
47								
46								
45								
44								
43								
42								
41								
40								
39								
38								
37								
36								
35								
34								
33								
32								
31								
30								
29								
28								
27								
26								
25								
24								
23								
22								
21								
20								
19								
18								
17								
16								
15								
14								
13								
12								
11								
10								
9								
8								
7								
6								
5								
4								
3								
2								
1								

Optional Spec.

<Standard Capacitance Value>

E3 Series

Please contact for capacitance value other than standard.

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

(Example)

In case of "B3" for AT03;

L : 0.6±0.03mm

W : 0.3±0.03mm

T : 0.3±0.03mm

Tan δ : 5.0% max.

X7R Dielectric

Size (EIA Code)	AT03 (0201)			AT05 (0402)	
	10	16	25	16	25
151					
152					
102					
103					
104					
153					
101					
100					
99					
98					
97					
96					
95					
94					
93					
92					
91					
90					
89					
88					
87					
86					

Features

Realizes stress relief effect by soft termination which suppresses cracks in dielectrics.

Applications

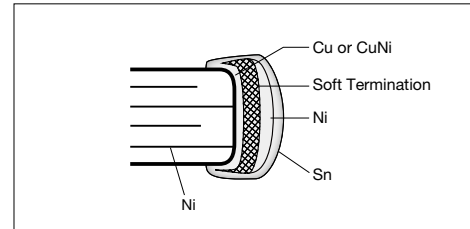
Electronic equipment for applications such as consumer and industrial uses.

X5R Dielectric

Size (EIA Code)	ST03 (0201)		ST05 (0402)	
Rated Voltage (Vdc)	4	6.3	6.3	10
Capacitance (pF)				
105 1000000		C8		
2200000	F8		F8	F8
4700000			J8	
106 10000000			L8	
22000000				

Optional Spec.

Structure



<Standard Capacitance Value>

E3 Series

Please contact for capacitance value other than standard.

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

(Example)

In case of "F8" for ST05;

L : 1.0±0.07mm

W : 0.5±0.07mm

T : 0.5±0.07mm

Tan δ : 12.5% max.

Size	Size Code	Dimension (mm)		
		L	W	T
03	C	0.6±0.05	0.3±0.05	0.3±0.05
	F	0.6±0.10	0.3±0.10	0.3±0.10
05	F	1.0±0.07	0.5±0.07	0.5±0.07
	J	1.0±0.15	0.5±0.15	0.5±0.15
	L	1.0±0.20	0.5±0.20	0.5±0.20

Tan δ Code	Tan δ
8	12.5% max.

Features

Perform less than 1 fit failure ratio by high voltage durability and high reliability which has optimized internal electrode structure based on designing of safety.

	General Spec.	Mid-voltage range		
	Straight structure	Straight structure	Dual cascade	Triple cascade
Internal structure				
Equivalent circuit				

• Mid-voltage range (Straight structure)

Enough break-down voltage margin by taking suitable dielectric thickness for individual rated voltage.

• Mid-voltage range (Dual cascade structure)

Realize high voltage performance by series connection of two multilayer capacitor units in a MLCC to divide applied voltage into two. High durability to surging voltage is guaranteed.

• Mid-voltage range (Triple cascade structure)

Realize high voltage performance by series connection of three multilayer capacitor units in a MLCC to divide applied voltage into three. Excellent safety is secured.

The multi cascade structure is a safety design to avoid short circuit failure.

Applications

- Camera/ Strobe circuit, Surge Killing, Trigger Circuit
- LCD Back light Inverter, Ballast Capacitor
- Power Circuit/ DC-DC Converter, Snubber Circuit

Special specification for individual application

A suitable guaranteeing specification will be examined to satisfy customer's application, such as for AC voltage application.

* Information of usage condition will be necessary to be examined.

Custom specification will be available according to your request. Ex. Specification relating to AC voltage.

* In-use condition shall be confirmed.

Temperature Compensation Dielectric

Size (EIA Code)	CF21 (0805)	CF316 (1206)			CF32 (1210)		CF42 (1808)			CF43 (1812)		CF52 (2208)
Temperature Characteristics	C Δ *	C Δ *			C Δ *		C Δ *			C Δ *		C Δ *
Rated Voltage (Vdc)	250	630	1000	2000	1000	2000	1000	2000	3000	1000	3000	4000
Capacitance (pF)												
R50	0.5											
1R0	1.0											
1R5	1.5											
	2.0											
	3.0											
	4.0											
	5.0	D	C	C				A	A	A		
	6.0											
	7.0											
	8.0											
	9.0											
100	10											A
220	22											
	47											
101	100	E	D	D	E		F	D	B	B	B	
221	220	G										
	470											
102	1000										C	

< Standard Capacitance Value >

E3 Series

Please contact for capacitance value other than standard.

* : CG,CH

Alphabets in capacitance chart denote dimensions. Please refer to the below table for detail.

Size	Size Code	Dimension (mm)		
		L	W	T
21	D	2.0±0.10	1.25±0.10	0.6±0.10
	E	2.0±0.10	1.25±0.10	0.85±0.10
	G	2.0±0.10	1.25±0.10	1.25±0.10
316	C	3.2±0.20	1.6±0.15	1.15±0.10
	D	3.2±0.20	1.6±0.15	1.25±0.10
	E	3.2±0.20	1.6±0.15	1.6±0.15

Size	Size Code	Dimension (mm)		
		L	W	T
32	D	3.2±0.30	2.5±0.20	1.6±0.15
	F	3.2±0.30	2.5±0.20	2.0±0.2
42	A	4.5±0.20	2.0±0.20	1.6 max.
	B	4.5±0.20	2.0±0.20	2.2 max.
43	C	4.5±0.30	3.2±0.20	2.5 max.
52	A	5.7±0.40	2.0±0.20	2.2 max.

Tolerance Code

Temperature Compensation		
Code	Tolerance	Capacitance
C	±0.25pF	C<10pF
D	±0.5pF	
J	±5%	C≥10pF
K	±10%	

X7R Dielectric

Size (EIA Code)	CF21 (0805)	CF316 (1206)			CF32 (1210)			CF42 (1808)		CF43 (1812)				CF55 (2220)			
Rated Voltage (Vdc) Capacitance (pF)	250	250	630	1000	250	630	1000	1000	2000	250	630	1000	2000	250	630	1000	2000
102 220 470 1000	E1		C1	C1 D1 E1					B1								
103 2200 4700 10000	F1 G1	C1	E1				D1	B1					C1				A1 C1
104 22000 47000 100000		E1			F1	D1 F1				A1 C1	A1 C1	C1			A1 C1	A1 B1	
105 220000 470000 1000000										C1				A1	C1		

<Standard Capacitance Value>

E3 Series

Please contact for capacitance value other than standard.

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

(Example)

In case of "E1" for CF21;

- L : 2.0±0.1mm
- W : 1.25±0.1mm
- T : 0.85±0.1mm
- Tan δ : 2.5% max.

Size	Size Code	Dimension (mm)		
		L	W	T
21	E	2.0±0.10	1.25±0.10	0.85±0.10
	F	2.0±0.10	1.25±0.10	1.05±0.10
	G	2.0±0.10	1.25±0.10	1.25±0.10
316	C	3.2±0.20	1.6±0.15	1.15±0.10
	D	3.2±0.20	1.6±0.15	1.25±0.10
	E	3.2±0.20	1.6±0.15	1.6±0.15
32	D	3.2±0.30	2.5±0.20	1.6±0.15
	F	3.2±0.30	2.5±0.20	2.0±0.2

Size	Size Code	Dimension (mm)		
		L	W	T
42	B	4.5±0.20	2.0±0.20	2.2 max.
	C	4.5±0.30	3.2±0.20	2.0 max.
43	A	4.5±0.30	3.2±0.20	2.5 max.
	C	4.5±0.30	3.2±0.20	2.5 max.
55	A	5.7±0.40	5.0±0.40	2.0 max.
	B	5.7±0.40	5.0±0.40	2.5 max.
	C	5.7±0.40	5.0±0.40	2.8 max.

Tan δ Code	Tan δ
1	2.5% max.

Multilayer Ceramic Chip Capacitors

Test Conditions and Standards



Test Conditions and Specifications for Temperature Compensation Type (CΔ Characteristics) CM/ CU/ CF Series

Test Items		Test Conditions	Specifications								
Capacitance Value (C)		<table border="1"> <thead> <tr> <th>Capacitance</th> <th>Frequency</th> <th>Volt</th> </tr> </thead> <tbody> <tr> <td>C≤1000pF</td> <td>1MHz±10%</td> <td rowspan="2">0.5 to 5Vrms</td> </tr> <tr> <td>C>1000pF</td> <td>1kHz±10%</td> </tr> </tbody> </table>	Capacitance	Frequency	Volt	C≤1000pF	1MHz±10%	0.5 to 5Vrms	C>1000pF	1kHz±10%	Within tolerance
Capacitance	Frequency		Volt								
C≤1000pF	1MHz±10%	0.5 to 5Vrms									
C>1000pF	1kHz±10%										
Q			C≥30pF : Q≥1000 C<30pF : Q≥400+20C								
Insulation Resistance (IR)		Measured after the rated voltage is applied for 1 minute at room ambient. For the rated voltage of over 630V, apply 500V for 1 minute at room ambient. The charge and discharge current of the capacitor must not exceed 50mA.	Over 10000MΩ or 500MΩ • μF, whichever is less								
Dielectric Resistance		Apply 3 times of the rated voltage for 1 to 5 seconds. Apply 1.5 times when the rated voltage is 250V or over. Apply 1.2 times when the rated voltage is 630V or over. 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. Apply 2N for 0201, and 1N for 01005 size.	No problem observed								
Bending Strength		Glass epoxy PCB: Fulcrum spacing: 90mm, duration time 10 seconds.	No significant damage at 1mm bent								
Vibration Test	Appearance	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 total.	No problem observed								
	ΔC		Within Tolerance								
	Q		C≥30pF : Q≥1000 C<30pF : Q≥400+20C								
Soldering Heat Resistance	Appearance	Soak the sample in 260°C±5°C solder for 10±0.5 seconds and place in room ambient, and measure after 24±2 hours. (Pre-heating conditions)	No problem observed								
	ΔC		Within ±2.5% or ±0.25pF, whichever is larger								
	Q		C≥30pF : Q≥1000 C<30pF : Q≥400+20C								
	IR		Over 10000MΩ or 500MΩ • μF whichever is less								
	Withstanding Voltage		The charge and discharge current of the capacitor must not exceed 50mA for IR and withstanding voltage measurement.	Resist without problem							
Solderability		Soaking condition	Solder coverage : 90% min.								
		<table border="1"> <thead> <tr> <th></th> <th>Temperature</th> <th>Time</th> </tr> </thead> <tbody> <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> </tbody> </table>			Temperature	Time	Sn-3Ag-0.5Cu	245±5°C	3±0.5 sec.	Sn63 Solder	235±5°C
	Temperature	Time									
Sn-3Ag-0.5Cu	245±5°C	3±0.5 sec.									
Sn63 Solder	235±5°C	2±0.5 sec.									
Temperature Cycle	Appearance	(Cycle)	No problem observed								
	ΔC	Room temperature (3min.)→	Within ±2.5% or ±0.25pF, whichever is larger								
	Q	Lowest operation temperature (30min.)→ Room temperature (3min.)→	C≥30pF : Q≥1000 C<30pF : Q≥400+20C								
	IR	Highest operation temperature(30min.)	Over 10000MΩ or 500MΩ • μF, whichever is less								
	Withstanding Voltage	After 5 cycles, measure after 24±2 hours. The charge and discharge current of the capacitor must not exceed 50mA for IR and withstanding voltage measurement.	Resist without problem								
Load Humidity Test (Except CF Series)	Appearance	After applying rated voltage for 500+12/-0 hours in pre-condition at 40°C±2°C, humidity 90 to 95%RH, allow parts to stabilize for 24±2 hours, at room temperature before measurement. The charge and discharge current of the capacitor must not exceed 50mA for IR measurement.	No problem observed								
	ΔC		Within ±7.5% or ±0.75pF, whichever is larger								
	Q		C≥30pF : Q≥200 C<30pF : Q≥100+10C/ 3								
	IR		Over 500MΩ or 25MΩ • μF, whichever is less								
High-Temperature with Loading	Appearance	After applying twice the rated voltage at the temperature of 125±3°C for 1000+12/-0 hours, measure the sample after 24±2 hours. Apply 1.5 times when the rated voltage is 250V or over. Apply 1.2 times when the rated voltage is 630V or over. The charge and discharge current of the capacitor must not exceed 50mA for IR measurement.	No problem observed.								
	ΔC		Within ±3% or ±0.3pF, whichever is larger								
	Q		C≥30pF : Q≥350 10pF<C<30pF : Q≥275+5C/ 2 C<10pF : Q≥200+10C								
	IR		Over 1000MΩ or 50MΩ • μF, whichever is less								

Please ask for individual specification for the hatched range in previous chart.

Multilayer Ceramic Chip Capacitors

Test Conditions and Standards



Test Conditions and Specifications for High Dielectric Type (X5R, X7R) CM/ CT Series

Test Items		Test Conditions	Specifications									
Capacitance Value (C)		Measure after heat treatment	Within tolerance									
Tanδ (%)	<table border="1"> <thead> <tr> <th>Capacitance</th> <th>Frequency</th> <th>Volt</th> </tr> </thead> <tbody> <tr> <td>C≤10μF</td> <td>1kHz±10%</td> <td>1.0±0.2Vrms</td> </tr> <tr> <td>C>10μF</td> <td>120Hz±10%</td> <td>0.5±0.2Vrms</td> </tr> </tbody> </table>		Capacitance	Frequency	Volt	C≤10μF	1kHz±10%	1.0±0.2Vrms	C>10μF	120Hz±10%	0.5±0.2Vrms	Refer to capacitance chart
	Capacitance	Frequency	Volt									
	C≤10μF	1kHz±10%	1.0±0.2Vrms									
C>10μF	120Hz±10%	0.5±0.2Vrms										
Insulation Resistance (IR)		Measured after the rated voltage is applied for 1 minute at room ambient. The charge and discharge current of the capacitor must not exceed 50mA.	Over 10000MΩ or 500MΩ • μF, whichever is less									
Dielectric Resistance		Apply 2.5 times of the rated voltage for 1 to 5 seconds. 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 at 1mm bent									
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 total.	No problem observed									
	ΔC		Within tolerance									
Soldering Heat Resistance	Tanδ (%)	Take the initial value after heat treatment. Soak the sample in 260°C±5°C solder for 10±0.5 seconds and place in room ambient, and measure after 24±2 hours. (Pre-heating conditions)	Within tolerance									
	Appearance		No problem observed									
	ΔC		Within ±7.5%									
	Tanδ (%)		Within tolerance									
	IR		Over 10000MΩ or 500MΩ • μF, whichever is less									
Withstanding Voltage	<table border="1"> <thead> <tr> <th>Order</th> <th>Temperature</th> <th>Time</th> </tr> </thead> <tbody> <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> </tbody> </table>		Order	Temperature	Time	1	80 to 100°C	2 minutes	2	150 to 200°C	2 minutes	Resist without problem
	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.												
Solderability		Soaking condition	Solder coverage : 90% min.									
Temperature Cycle	<table border="1"> <tbody> <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> </tbody> </table>		Sn-3Ag-0.5Cu	245±5°C	3±0.5 sec.	Sn63 Solder	235±5°C	2±0.5 sec.	No problem observed			
	Sn-3Ag-0.5Cu	245±5°C	3±0.5 sec.									
	Sn63 Solder	235±5°C	2±0.5 sec.									
	Appearance	Take the initial value after heat treatment. (Cycle) Room temperature (3min.)→ Lowest operation temperature (30min.)→ Room temperature (3min.)→ Highest operation temperature(30min.) After 5 cycles, measure after 24±2 hours. The charge and discharge current of the capacitor must not exceed 50mA for IR and withstanding voltage measurement.	Within ±7.5%									
	ΔC		Within tolerance									
Tanδ (%)	Over 10000MΩ or 500MΩ • μF, whichever is less											
IR	Resist without problem											
Withstanding Voltage												
Load Humidity Test	Appearance	Take the initial value after voltage treatment. After applying rated voltage for 500+12/-0 hours in pre-condition at 40°C±2°C, humidity 90 to 95%RH, allow parts to stabilize for 24±2 hours, at room temperature before measurement. 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									
High-Temperature with Loading	IR	Take the initial value after voltage treatment. After applying twice the rated voltage at the highest operation temperature for 1000+12/-0 hours, measure the sample after 24±2 hours. 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 below chart.	Over 500MΩ or 25MΩ • μF, whichever is less									
	Appearance		No problem observed									
	ΔC		Within ±12.5%									
	Tanδ (%)		200% max. of initial value									
			Over 1000MΩ or 50MΩ • μF, whichever is less									

Pre-treatment	Heat	Keep specimen at 150+0/ -10°C for 1 hour, leave specimen at room ambient for 24±2 hours.
	Voltage	Apply the same test condition for 1 hour, then leave the specimen at room ambient for 24±2 hours.

High-temperature with Loading Applied Voltage (Rated Voltage × □)

Applied Voltage	Rated Voltage	Products
×1.3	4V	CT03X5R104
	6.3V	CM105X5R475, CM316X5R476, CM02X5R153-104 CT05X5R104, CT21X5R106, CT03X5R104
×1.5	16V	CM02X7R101-222, CM05X7R333-104, CM105X7R105, CM21X7R105-475, CM316X7R475-106, CM32X7R106-226, CM05X5R224, CM105X5R225, CM21X5R475-106, CM316X5R226 CT105X5R105, CT21X5R225-475, CT316X5R106, CM03X5R332-103, CM02X5R101-103
	25V	CM21X7R105-225, CM316X7R475, CM32X7R106, CM105X5R105, CM21X5R225-106, CM316X5R106, CM32X5R106-226 CT316X5R225-106, CM03X5R152-103, CM05X7R103-104
	50V	CM21X5R105, CM32X5R106, CM32X7R106 CT21X5R225, CT316X5R105-475
	100V	CM43X7R105

Please ask for individual specification for the hatched range in previous chart.

Multilayer Ceramic Chip Capacitors

Test Conditions and Standards

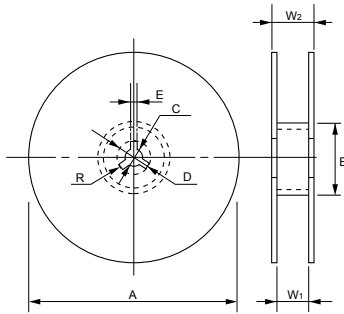


Test Conditions and Specifications for High Dielectric Type (X7R) CF Series

Test Items		Test Conditions	Specifications												
Capacitance Value (C)		Measure after heat treatment	Within tolerance												
Tan δ (%)		<table border="1"> <thead> <tr> <th>Capacitance</th> <th>Frequency</th> <th>Volt</th> </tr> </thead> <tbody> <tr> <td>C\leq10μF</td> <td>1kHz\pm10%</td> <td>1.0\pm0.2Vrms</td> </tr> </tbody> </table>	Capacitance	Frequency	Volt	C \leq 10 μ F	1kHz \pm 10%	1.0 \pm 0.2Vrms	Within 2.5%						
Capacitance	Frequency	Volt													
C \leq 10 μ F	1kHz \pm 10%	1.0 \pm 0.2Vrms													
Insulation Resistance (IR)		<p>Measured after the rated voltage is applied for 1 minute at room ambient.</p> <p>Measured after the 500V is applied for 1 minute at room ambient for the rated voltage over 630V.</p> <p>The charge and discharge current of the capacitor must not exceed 50mA.</p>	<p>Over 10000MΩ or 500MΩ \cdot μF, whichever is less</p> <p>Over 100MΩ \cdot μF for CF316X7R104/ 250V and CF55X7R224/ 630V</p>												
Dielectric Resistance		<p>Apply 1.5 times when the rated voltage is 250V or over, apply 1.2 times when the rated voltage is 630V or over for 1 to 5 seconds.</p> <p>The charge and discharge current of the capacitor must not exceed 50mA.</p>	No problem observed												
Appearance		Microscope	No problem observed												
Termination Strength		Apply a sideward force of 500g (5N) to a PCB-mounted sample.	No problem observed												
Bending Strength		Glass epoxy PCB: Fulcrum spacing: 90mm, duration time 10 seconds.	No significant damage at 1mm bent												
Vibration Test	Appearance	<p>Take the initial value after heat treatment.</p> <p>Vibration frequency: 10 to 55 (Hz)</p> <p>Amplitude: 1.5mm</p> <p>Sweeping condition: 10\rightarrow55\rightarrow10Hz/ 1 minute in X, Y and Z</p> <p>Directions: 2 hours each, 6 hours total.</p>	No problem observed												
	Δ C		Within tolerance												
	Tan δ (%)		Within tolerance												
Soldering Heat Resistance	Appearance	<p>Take the initial value after heat treatment.</p> <p>Soak the sample in 260\pm5$^{\circ}$C solder for 10\pm0.5 seconds and place in room ambient, and measure after 24\pm2 hours.</p> <p>(Pre-heating conditions)</p> <table border="1"> <thead> <tr> <th>Order</th> <th>Temperature</th> <th>Time</th> </tr> </thead> <tbody> <tr> <td>1</td> <td>80 to 100$^{\circ}$C</td> <td>2 minutes</td> </tr> <tr> <td>2</td> <td>150 to 200$^{\circ}$C</td> <td>2 minutes</td> </tr> </tbody> </table> <p>The charge and discharge current of the capacitor must not exceed 50mA for IR and withstanding voltage measurement.</p>	Order	Temperature	Time	1	80 to 100 $^{\circ}$ C	2 minutes	2	150 to 200 $^{\circ}$ C	2 minutes	No problem observed			
	Order		Temperature	Time											
	1		80 to 100 $^{\circ}$ C	2 minutes											
	2		150 to 200 $^{\circ}$ C	2 minutes											
	Δ C		Within \pm 7.5%												
Tan δ (%)	Within tolerance														
IR	Over 10000M Ω or 500M Ω \cdot μ F, whichever is less Over 100M Ω \cdot μ F for CF316X7R104/ 250V and CF55X7R224/ 630V														
Withstanding Voltage	Resist without problem														
Solderability		<p>Soaking condition</p> <table border="1"> <thead> <tr> <th>Sn-3Ag-0.5Cu</th> <th>Temperature</th> <th>Time</th> </tr> </thead> <tbody> <tr> <td></td> <td>245\pm5$^{\circ}$C</td> <td>3\pm0.5 sec.</td> </tr> <tr> <th>Sn63 Solder</th> <th>Temperature</th> <th>Time</th> </tr> <tr> <td></td> <td>235\pm5$^{\circ}$C</td> <td>2\pm0.5 sec.</td> </tr> </tbody> </table>	Sn-3Ag-0.5Cu	Temperature	Time		245 \pm 5 $^{\circ}$ C	3 \pm 0.5 sec.	Sn63 Solder	Temperature	Time		235 \pm 5 $^{\circ}$ C	2 \pm 0.5 sec.	Solder coverage : 90% min.
Sn-3Ag-0.5Cu	Temperature	Time													
	245 \pm 5 $^{\circ}$ C	3 \pm 0.5 sec.													
Sn63 Solder	Temperature	Time													
	235 \pm 5 $^{\circ}$ C	2 \pm 0.5 sec.													
Temperature Cycle	Appearance	<p>Take the initial value after heat treatment.</p> <p>(Cycle)</p> <p>Room temperature (3min.)\rightarrow</p> <p>Lowest operation temperature (30min.)\rightarrow</p> <p>Room temperature (3min.)\rightarrow</p> <p>Highest operation temperature(30min.)</p> <p>After 5 cycles, measure after 24\pm2 hours.</p> <p>The charge and discharge current of the capacitor must not exceed 50mA for IR and withstanding voltage measurement.</p>	No problem observed												
	Δ C		Within \pm 7.5%												
	Tan δ (%)		Within tolerance												
	IR		Over 10000M Ω or 500M Ω \cdot μ F, whichever is less Over 100M Ω \cdot μ F for CF316X7R104/ 250V and CF55X7R224/ 630V												
	Withstanding Voltage		Resist without problem												
High-Temperature with Loading	Appearance	<p>Take the initial value after voltage treatment.</p> <p>After applying specified voltage at the highest operation temperature for 1000+12/ -0 hours, then measure the sample after 24\pm2 hours.</p> <p>The applied voltage shall be;</p> <p>1.5 times the rated voltage when the rated voltage is 250V.</p> <p>1.2 times when the rated voltage is 630V or over.</p> <p>The charge and discharge current of the capacitor must not exceed 50mA for IR measurement.</p>	No problem observed												
	Δ C		Within \pm 12.5%												
	Tan δ (%)		200% max. of initial value												
	IR		Over 1000M Ω or 50M Ω \cdot μ F, whichever is less												
Pre-treatment	Heat	Keep specimen at 150+0/ -10 $^{\circ}$ C for 1 hour, leave specimen at room ambient for 24 \pm 2 hours.													
	Voltage	Apply the same test condition for 1 hour, then leave the specimen at room ambient for 24 \pm 2 hours.													

Tape and Reel

- Reel



Reel

(Unit: mm)

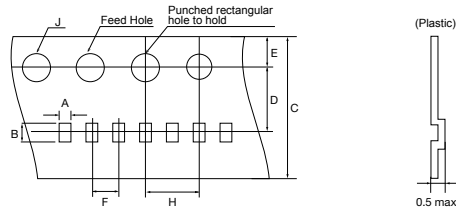
Code Reel	A	B	C	D
7-inch Reel (CODE: T, H, Q)	180 ⁺⁰ _{-2.0}	φ60 min.	13±0.5	21±0.8
7-inch Reel (CODE: P)	178±2.0			
13-inch Reel (CODE: L, N, W)	330±2.0			
Code Reel	E	W ₁	W ₂	R
7-inch Reel (CODE: T, H, Q)	2.0±0.5	10.5±1.5	16.5 max.	1.0
7-inch Reel (CODE: P)		4.35±0.3	6.95±1.0	
13-inch Reel (CODE: L, N, W)		9.5±1.0	16.5 max.	

* Carrier tape width 8mm.

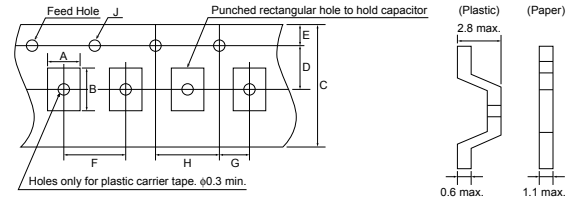
For size 42 (1808) or over, Tape width 12mm and W₁: 14±1.5, W₂: 18.4mm max.

Carrier Tape

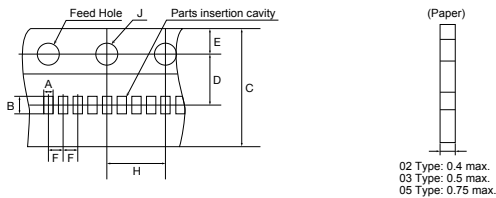
F = 1mm (02 Type)



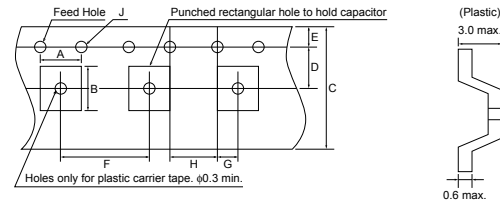
F = 4mm (105, 21, 316, 32, 42, 52 Type)



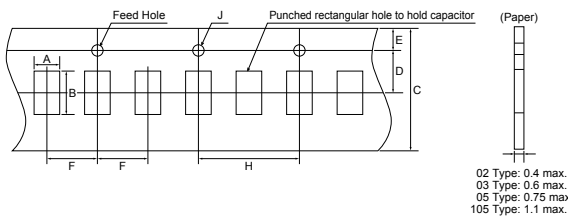
F = 1mm (02, 03, 05 Type)



F = 8mm (43, 55 Type)



F = 2mm (02, 03, 05, 105 Type)



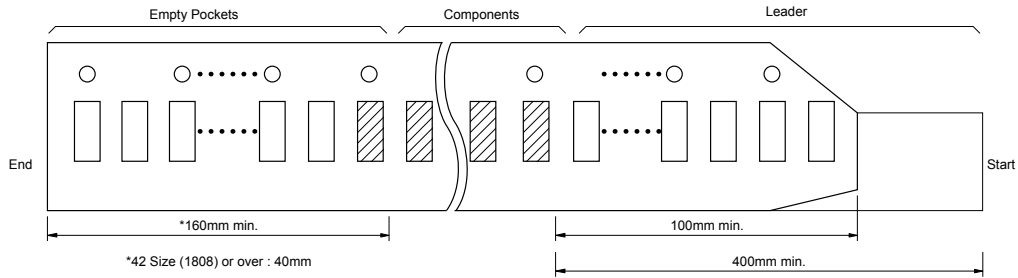
Carrier Tape

(Unit: mm)

Size (EIA Code)	A	B	C	D	E	F	G	H	J	Carrier Tape
02 (01005) *	0.23±0.02	0.43±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
	0.37±0.03	0.67±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
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
	0.65±0.1	1.15±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	8mm, Paper
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
	1.5±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
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, Plastic
	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
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, Plastic
	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
42 (1808)	2.4±0.2	4.9±0.2	12.0±0.3	5.5±0.05	1.75±0.1	4.0±0.1	2.0±0.05	4.0±0.1	1.5+0.1/-0	12mm, Plastic
	3.6±0.2	4.9±0.2	12.0±0.3	5.5±0.05	1.75±0.1	8.0±0.1	2.0±0.05	4.0±0.1	1.5+0.1/-0	12mm, Plastic
43 (1812)	2.4±0.2	6.0±0.2	12.0±0.3	5.5±0.05	1.75±0.1	4.0±0.1	2.0±0.05	4.0±0.1	1.5+0.1/-0	12mm, Plastic
	5.3±0.2	6.0±0.2	12.0±0.3	5.5±0.05	1.75±0.1	8.0±0.1	2.0±0.05	4.0±0.1	1.5+0.1/-0	12mm, Plastic

* Option

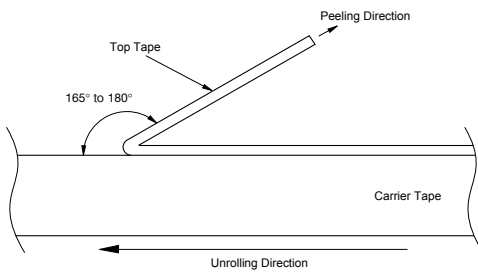
Detail of leader and trailer



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.

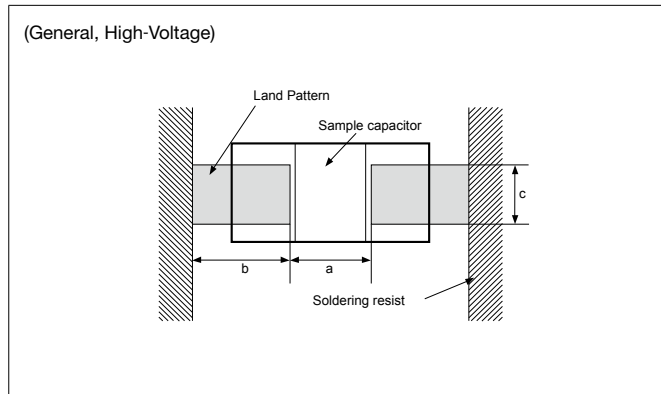
Exfoliating angle: 165 to 180 degrees to the carrier tape.
Exfoliating speed: 300 mm/min .



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, High-Voltage

(Unit: mm)

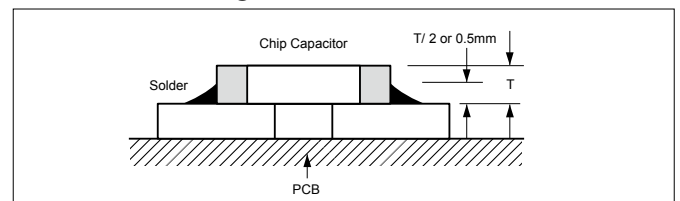
Size (EIA Code)	L×W	a	b	c
02 (01005)	0.4×0.2	0.13 to 0.20	0.12 to 0.18	0.20 to 0.23
03 (0201)	0.6×0.3	0.20 to 0.30	0.25 to 0.35	0.30 to 0.40
05 (0402)	1.0×0.5	0.30 to 0.50	0.35 to 0.45	0.40 to 0.60
105 (0603)	1.6×0.8	0.70 to 1.00	0.80 to 1.00	0.60 to 0.80
21 (0805)	2.0×1.25	1.00 to 1.30	1.00 to 1.20	0.80 to 1.10
316 (1206)	3.2×1.6	2.10 to 2.50	1.10 to 1.30	1.00 to 1.30
32 (1210)	3.2×2.5	2.10 to 2.50	1.10 to 1.30	1.90 to 2.30
42 (1808)	4.5×2.0	2.50 to 3.20 ^{*1}	1.80 to 2.30	1.50 to 1.80
43 (1812)	4.5×3.2	2.50 to 3.20 ^{*1}	1.80 to 2.30	2.60 to 3.00
52 (2208)	5.7×2.0	4.20 to 4.70	2.00 to 2.50	1.50 to 1.80
55 (2220)	5.7×5.0	4.20 to 4.70	2.00 to 2.50	4.20 to 4.70

^{*1} Dimension of 3.0 to 3.5mm is recommended for "a", in the case of High-Voltage products.

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	Not recommended example	Recommended example/ Separated by solder
Multiple parts mount		
Mount with leaded parts		
Wire soldering after mounting		
Overview		

Mounting Design

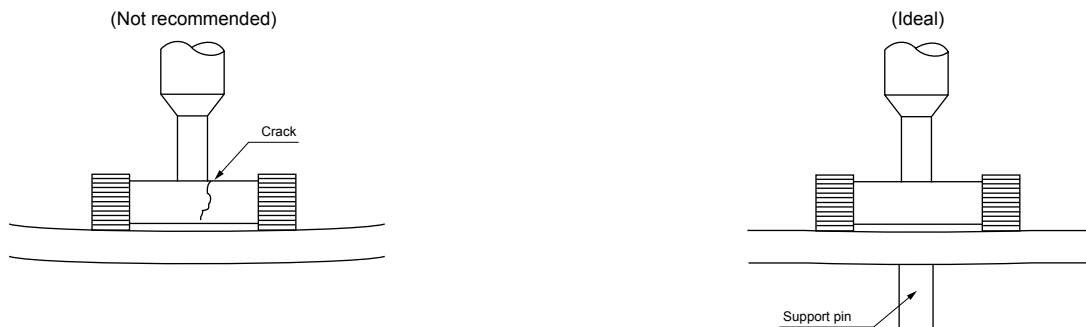
The chip could crack if the PCB warps during processing after the chip has been soldered.

Recommended chip position on PCB to minimize stress from PCB warpage



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 vacuum nozzle, provide a support pin on the back of the PCB to minimize PCB flexure.



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

Resin Mold

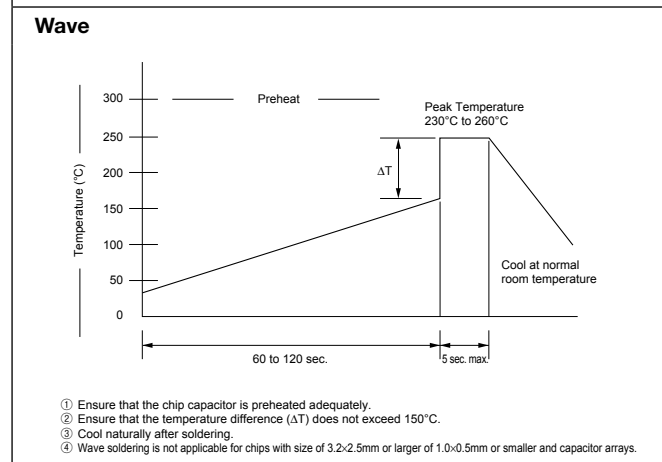
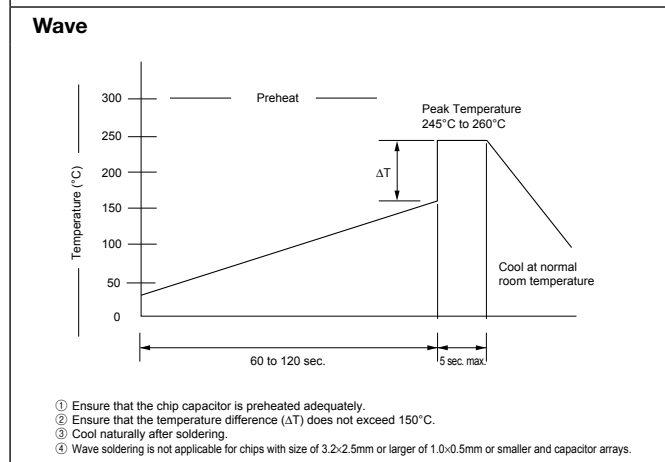
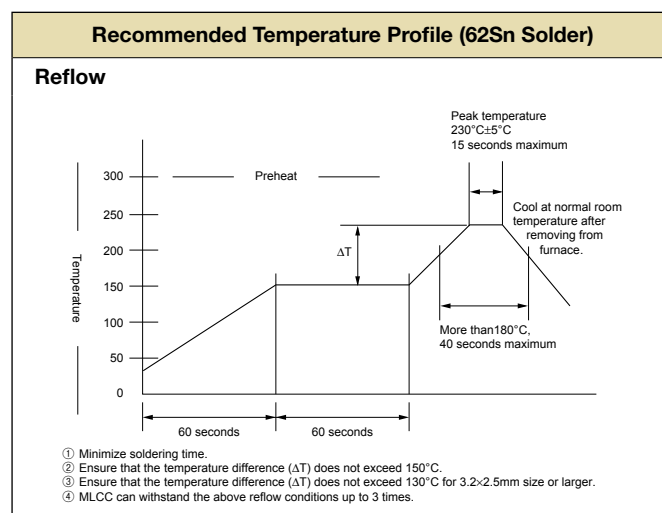
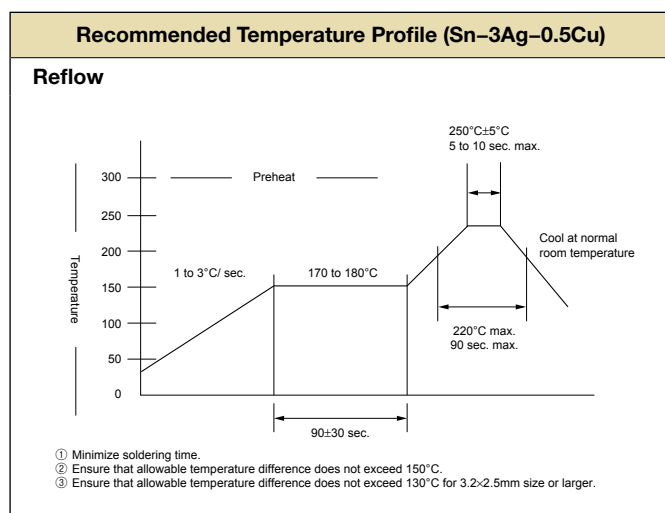
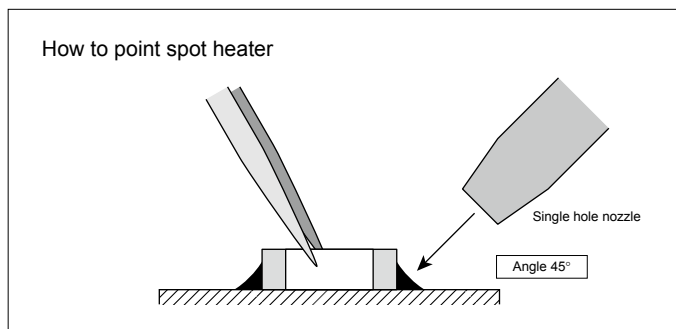
- 1) If a large amount of resin is used for molding the chip, cracks may occur due to contraction stress during curing. To avoid such cracks, use a low shrinkage resin.
- 2) The insulation resistance of the chip will degrade due to moisture absorption. Use a low moisture absorption resin.
- 3) Check 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.

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)



Soldering iron

- | | | |
|--------------------------------|-----------------------------|--|
| 1) Temperature of iron chip | 1206 and smaller 350°C max. | 5) Cautions |
| | 1210 and larger 280°C max. | a) Pre-heating is necessary rapid heating must be avoided.
Delta T ≤ 150°C (product size of bigger than 3.2×1.6mm. Delta T ≤ 130°C) |
| 2) Wattage | 80W max. | b) Avoid direct touching to capacitors. |
| 3) Tip shape of soldering iron | φ3.0mm max. | c) Avoid rapid cooling after soldering. Natural cooling is recommended. |
| 4) Soldering Time | 3 sec. max. | |

* Consult as if it is difficult to keep the temperature 280°C max. for 1210 and larger MLCC'S.

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

1. If the component is stored in minimal packaging (a heat-sealed or zippered plastic bag), the bag should be kept closed. Once the bag has been opened, reseal it or store it in a desiccator.
2. Keep storage place temperature +5 to +40 degree C, humidity 20 to 70% RH. See JIS C 60721-3-1, class 1K2 for other climatic conditions.
3. The storage atmosphere must be free of corrosive gas such as sulfur dioxide and chlorine. Also, avoid exposing the product to saline moisture. If the product is exposed to such atmospheres, the terminals will oxidize and solderability will be effected.
4. Precautions 1) to 3) apply to chip capacitors packaged in carrier tapes.
5. The solderability is assured for 6 months from our shipping date if the above storage precautions are followed.

Safety application guideline and detailed information of electrical properties are also provided in Kyocera home page;
URL: <http://www.kyocera.co.jp/electronic/>