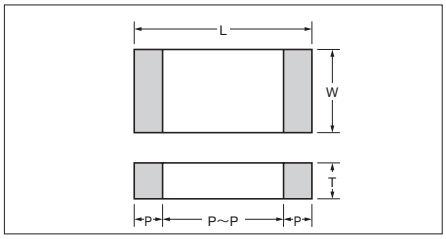
Kyocera Ceramic Chip Capacitors are available for different applications as classified below:

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	IC card (Decoupling)	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 1206, 1210
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

Code	Material
E	Plastic
P	Paper

Taping Width

Code	Width
4	4mm
8	8mm
12	12mm

Pitch

Code	Pitch
1	1mm
2	2mm
4	4mm
8	8mm

Dimensions and Packaging Quantities

Size	Code JIS	Code EIA	Dimension Code	Dimensions (mm) L	W	T	P min.	P max.	P to P min.	Maximum quantity per reel 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			0.5±0.05				20kp (P8/1) 10kp (P8/2)	100kp (P8/1) 50kp (P8/2)
			F	1.0±0.07	0.5±0.07	0.5±0.07				20kp (P8/1) 10kp (P8/2)	50kp (P8/2)
			G	1.0±0.10	0.5±0.10	0.35 max.				20kp (P8/1) 10kp (P8/2)	100kp (P8/1) 50kp (P8/2)
			H			0.5±0.10				20kp (P8/1) 10kp (P8/2)	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				*	-
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	2.0±0.15	1.25±0.15	0.55 max.				4kp (P8/4)	10kp (P8/4)
			J			0.95 max.				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.				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				2.5kp (E8/4)	5kp (E8/4)
			F	3.2±0.20	1.6±0.20	0.95 max.				4kp (P8/4)	10kp (P8/4)
			G			1.00 max.				4kp (E8/4)	10kp (E8/4)
			H			1.6±0.20				2.5kp (E8/4)	5kp (E8/4)
			J	3.2±0.30	1.6±0.30	1.6±0.30	0.30	0.85	1.90	2kp (E8/4)	-
			K	3.2±0.35						2kp (E8/4)	-
32	3225	1210	A	3.2±0.30	2.5±0.20	1.00 max.	0.30	1.00	1.40	4kp (E8/4)	10kp (E8/4)
			B			1.40 max.				3kp (E8/4)	10kp (E8/4)
			C			1.60 max.				2.5kp (E8/4)	5kp (E8/4)
			D			1.6±0.15				2.5kp (E8/4)	5kp (E8/4)
			E			2.20 max.				2kp (E8/4)	5kp (E8/4)
			F			2.0±0.2				2kp (E8/4)	5kp (E8/4)
			G			2.5±0.2				1kp (E8/4)	4kp (E8/4)
42	4520	1808	A	4.5±0.20	2.0±0.20	1.6 max.	0.15	0.85	2.60	2kp (E12/4)	-
			B			2.2 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.

Multilayer Ceramic Chip Capacitors
Ordering Information

KYOCERA

KYOCERA PART NUMBER

CM 03 X5R 225 M 06 A H □□□

SERIES CODE

CM	=	General Purpose	AT	=	Au termination
CT	=	Low Profile	ST	=	Soft termination
CU	=	High-Q	CF	=	High Voltage

SIZE CODE

SIZE		EIA (JIS)	SIZE		EIA (JIS)
02	=	01005 (0402)	32	=	1210 (3225)
03	=	0201 (0603)	42	=	1808 (4520)
05	=	0402 (1005)	43	=	1812 (4532)
105	=	0603 (1608)	52	=	2208 (5720)
21	=	0805 (2012)	55	=	2220 (5750)
316	=	1206 (3216)			

DIELECTRIC CODE

CODE		EIA CODE			
CG	=	C0G (NPO)	X7S	=	X7S (Option)
X5R	=	X5R	X6S	=	X6S (Option)
X7R	=	X7R			

Negative temperature coefficient dielectric types are available on request.

CAPACITANCE CODE

Capacitance expressed in pF.
Two significant digits plus number of zeros.
For Values < 10pF, Letter R denotes decimal point,

eg.	100000pF	=	104	1.5pF	=	1R5
	0.1μF	=	104	0.5pF	=	R50
	4700pF	=	472	100μF	=	107

TOLERANCE CODE

A = ±0.05pF (option)	D = ±0.5pF	K = ±10%
B = ±0.1pF	G = ±2% (option)	M = ±20%
C = ±0.25pF	J = ±5%	

VOLTAGE CODE

04 = 4VDC	100 = 100VDC	1000 = 1000VDC
06 = 6.3VDC	250 = 250VDC	2000 = 2000VDC
10 = 10VDC	630 = 630VDC	3000 = 3000VDC
16 = 16VDC		4000 = 4000VDC
25 = 25VDC		
35 = 35VDC		
50 = 50VDC		

TERMINATION CODE

A = Nickel Barrier/ Tin	*G = Nickel Barrier/ Au	Y = Nickel Barrier/ Cu
	*K = Nickel Barrier/ Au	S = Nickel Barrier/ Tin (Soft Termination)

G : AuSn solder and conductive adhesive.
K : Wire bonding and conductive adhesive.

PACKAGING CODE

B = Bulk	H = 7" Reel Taping & 2mm Cavity pitch
C = Bulk Cassette (option)	N = 13" Reel Taping & 2mm Cavity pitch
T = 7" Reel Taping & 4mm or 8mm*1 Cavity pitch	W = 13" Reel Taping & 1mm Cavity pitch
Q = 7" Reel Taping & 1mm Cavity pitch	*P = 7" Reel Taping & 1mm Cavity pitch
L = 13" Reel Taping & 4mm Cavity pitch	* Carrier tape width 4mm.
	*1 Applied for size 43 to 55.

OPTION

Thickness max. value is indicated in CT series
EX. 125 → 1.25mm max.
095 → 0.95mm max.

Temperature Compensation Type

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

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	*3 A=±0.05pF	<0.5pF
	B=±0.1pF	≤5pF
	C=±0.25pF	*1 <10pF
	D=±0.50pF	
	*3 G=±2%	≥10pF
	J=±5%	E12 Series
	K=±10%	
*3 **X6S X5R X7S X7R**	*2 K=±10%	*4 E3 Series
	M=±20%	

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 J = ±5% for X7R (X5R) is available on request.
*3 option
*4 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

[RoHS Compliant Products]

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) / Capacitance (pF)		16	25	25	50	50	50	16	25	50
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	A	B	B					
120	12									
	15									
	18									
	22									
	27									
	33									
	39									
	47									
	56									
	68									
	82									
101	100									
121	120					E				
	150									
	180									
	220									
	270									
	330									
	390									
	470									
	560						B			
	680									
	820									
102	1000									E
122	1200									
	1500									
	1800									
	2200								E	
	2700									
	3300								G	
	3900									
	4700									
	5600							G		
	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

[RoHS Compliant Products]

X5R Dielectric

Size (EIA Code)	CM02 (01005)			CM03 (0201)				CM05 (0402)						CM105 (0603)						CM21 (0805)					
Rated Voltage (VDC) / Capacitance (pF)	6.3	10	16	6.3	10	16	25	4	6.3	10	16	25	35	4	6.3	10	16	25	50	4	6.3	10	16	25	50
101 100																									
151 150																									
220																									
330																									
470																									
680																									
102 1000	A8	A8	A8				B3																		
152 1500					B4	B3																			
2200																									
3300																									
4700																									
6800																									
103 10000																									
153 15000				B7	B7						E3	E3							B1						
22000																		B3							
33000																		D8							
47000																								G3	G1
68000																	B4								
104 100000	A8								E5	E8	E8						B8	B3							G8
220000				B8	D10	D10			E7						B5		D8	B8			G5	G4	G3		
470000				C8	D9										D5			B8			M5	M8	K8	M8	
105 1000000				D8				H8	E8			H7	H7		D8					M7					
2200000								J10	J8		L8														
4700000																									
106 10000000																									
22000000																									
47000000																									
107 100000000																									

Size (EIA Code)	CM316 (1206)						CM32 (1210)						CM43 (1812)	
Rated Voltage (VDC) / Capacitance (pF)	6.3	10	16	25	50	100	4	6.3	10	16	25	50	6.3	50
220000														
470000														
105 1000000						H3					B3	F1		
2200000				E3							F3			
4700000	E5	E4	E3	H8	H3				F4	C3	G3			D1
106 10000000			H8					G5		G3	G8	G3		
22000000	H5	H8					G5		G4				E5	
47000000														
107 100000000														

<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 alphanumerics 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
03	B	0.6±0.03	0.3±0.03	0.3±0.03
	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
	G	3.2±0.30	2.5±0.20	2.5±0.2
43	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
1	2.5% max.
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) / Capacitance (pF)	16	10	16	25	16	25	6.3	10	16	25	50	6.3	10	16	25	50
101 100	A8															
151 150			B2	B2												
220																
330																
470		B3				E3					B1					G1
680					E2											
102 1000						E8		B3	B2	B2					G2	
152 1500								B8	B8	D8			G3	G2	G8	M3
2200							D8					M8	M8	M8	M8	
3300													M8			
4700																
6800																
103 10000																
153 15000					E2											
22000						E8					B1				G2	
33000					E8											G1
47000								B3	B2	B2						
68000								B8	B8	D8			G3	G2	G8	M3
104 100000							D8					M8	M8	M8	M8	
220000																
470000																
105 1000000																
2200000																
4700000																
106 10000000																
22000000																

Size (EIA Code)	CM316 (1206)						CM32 (1210)					CM43 (1812)	
Rated Voltage (VDC) / Capacitance (pF)	6.3	10	16	25	50	100	10	16	25	50	100	50	100
47000						C1							
104 100000						E1							
220000													
470000			C2	E2					B2	B1 F1	G1	B1	D1
105 1000000		E3							F2			D1	
2200000		H8	H8	H8 H3	H3			G2	G8	G3			
4700000		H5					G8	G8					
106 10000000	H8												
22000000													

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 alphanumerics 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
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
	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) / Capacitance (pF)	100
47000	
104 100000	
220000	
470000	
105 1000000	
2200000	H3 J3
4700000	
106 10000000	
22000000	

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

Optional Spec.

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

Test Items		Test Conditions	Specifications
Capacitance Value (C)		Capacitance: C≤1000pF, Frequency: 1MHz±10%, Volt: 0.5 to 5Vrms; C>1000pF, 1kHz±10%, 0.5 to 5Vrms	Within tolerance
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) Order 1: 80 to 100°C, 2 minutes; Order 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 ±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		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 : 90% min.
Temperature Cycle	Appearance	(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.	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		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.

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 (%)		Capacitance: C≤10μF — Frequency: 1kHz±10% — Volt: 1.0±0.2Vrms; C>10μF — 120Hz±10% — 0.5±0.2Vrms	Refer to capacitance chart
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 in 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
	Tanδ (%)		Within tolerance
Soldering Heat Resistance	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 room ambient, and measure after 24±2 hours. (Pre-heating conditions) Order 1: 80 to 100°C, 2 minutes; Order 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 10000MΩ or 500MΩ • μF, whichever is less
	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 : 90% min.
Temperature Cycle	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.	No problem observed
	ΔC		Within ±7.5%
	Tanδ (%)		Within tolerance
	IR		Over 10000MΩ or 500MΩ • μF, whichever is less
	Withstanding Voltage		Resist without problem
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
	IR		Over 500MΩ or 25MΩ • μF, whichever is less
High-Temperature with Loading	Appearance	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.	No problem observed
	ΔC		Within ±12.5%
	Tanδ (%)		200% max. of initial value
	IR		Over 1000MΩ or 50MΩ • μF, whichever is less

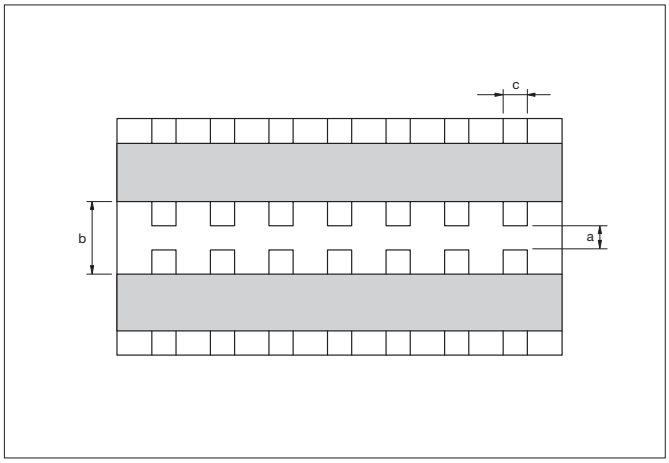
Pre-treat-ment	Heat	Keep specimen at 150+0/ −10°C for 1 hour, leave specimen at room ambient for 24±2 hours.
	Voltage	Apply the same test condition for 1 hour, then leave the specimen at room ambient for 24±2 hours.

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, CM105X7R474-105, CM21X7R105-475, CM316X7R475-106, CM32X7R106-226, CM05X5R224, CM105X5R225, CM21X5R475-106, CM316X5R226
		CT105X5R105, CT21X5R225-475, CT316X5R106, CM03X5R332-103, CM02X5R101-103
	25V	CM105X7R474, CM21X7R105-225, CM316X7R475, CM32X7R106, CM105X5R474-105, CM21X5R225-106, CM316X5R106, CM32X5R106-226
		CT316X5R225-106, CM03X5R152-103, CM05X7R103-104
	50V	CM21X5R105, CM32X5R106, CM32X7R106
		CT21X5R225, CT316X5R105-475
	100V	CM32X7RK74, CM43X7R105

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

Substrate for Electrical Tests

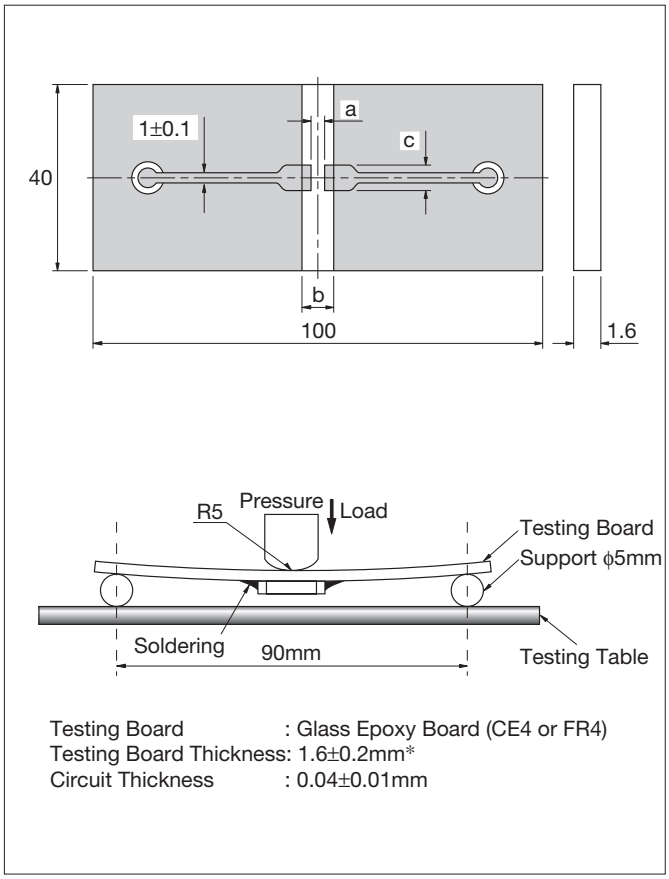


(Unit: mm)

Size (EIA Code)	a	b	c
02 (01005)	0.15	0.50	0.20
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
42 (1808)	3.5	7.0	3.7
43 (1812)	3.5	7.0	3.7
52 (2208)	4.5	8.0	5.6
55 (2220)	4.5	8.0	5.6

Substrate for Bending Test

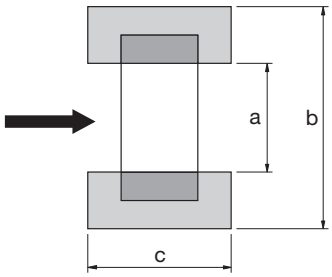
(Unit: mm)



Testing Board : Glass Epoxy Board (CE4 or FR4)
Testing Board Thickness: 1.6±0.2mm*
Circuit Thickness : 0.04±0.01mm

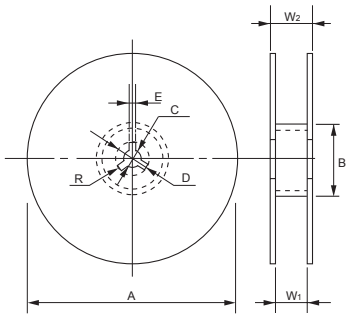
* 02, 03, 05 size 0.8±0.1mm

Substrate for Adhesion Strength Test

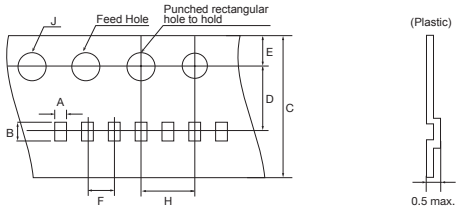


Tape and Reel

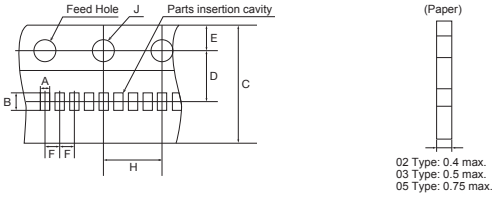
• Reel



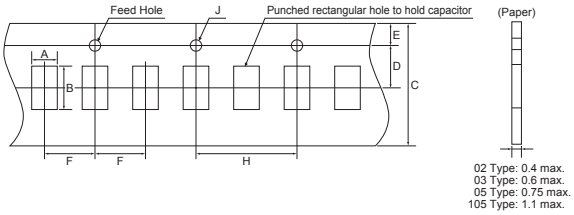
F=1mm (02 Type)



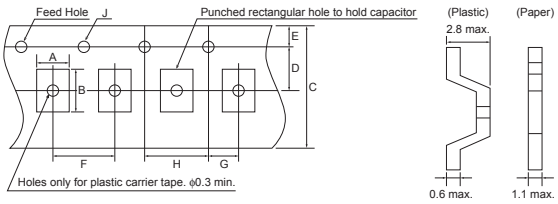
F=1mm (02, 03, 05 Type)



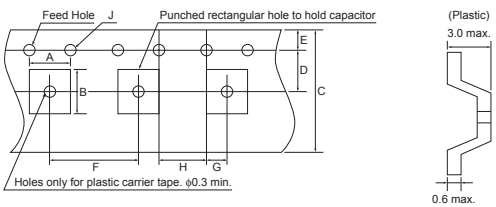
F=2mm (02, 03, 05, 105 Type)



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



F=8mm (43, 55 Type)



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

(Unit: mm)

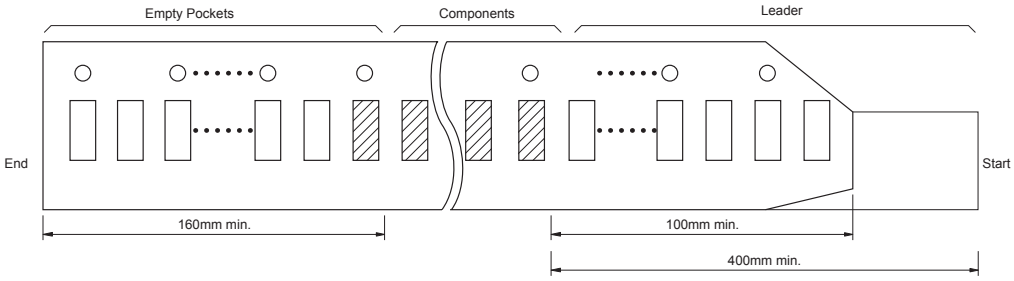
Size (EIA Code)	A	B	F
02 (01005)∗	0.23±0.02	0.43±0.02	1.0±0.02
	0.25±0.03	0.45±0.03	2.0±0.05
03 (0201)∗	0.37±0.03	0.67±0.03	1.0±0.05
			2.0±0.05
05 (0402)∗	0.65±0.1	1.15±0.1	1.0±0.05
			2.0±0.05
105 (0603)	1.0±0.2	1.8±0.2	4.0±0.1
21 (0805)	1.5±0.2	2.3±0.2	4.0±0.1
316 (1206)	2.0±0.2	3.6±0.2	4.0±0.1
32 (1210)	2.9±0.2	3.6±0.2	4.0±0.1
42 (1808)	2.4±0.2	4.9±0.2	4.0±0.1
43 (1812)	3.6±0.2	4.9±0.2	8.0±0.1
52 (2208)	2.4±0.2	6.0±0.2	4.0±0.1
55 (2220)	5.3±0.2	6.0±0.2	8.0±0.1

∗ Option

(Unit: mm)

F	Carrier Tape	C	D	E	G	H	J
1.0 ±0.02	4mm Plastic	4.0 +0.08	1.8 ±0.02	0.9 ±0.05	–	2.0 ±0.04	0.8 ±0.04
1.0 ±0.05	8mm Paper	8.0 +0.3/ −0.1	3.5 ±0.05	1.75 ±0.1	2.0 ±0.05	4.0 ±0.05	1.5 +0.1/ −0
2.0 ±0.05		8.0 ±0.3				4.0 ±0.1	
4.0 ±0.1	8mm Plastic						
	12mm Plastic	12.0 ±0.3	5.5 ±0.05				
8.0 ±0.1							

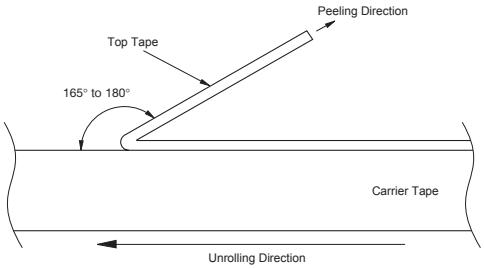
Detail of leader and trailer



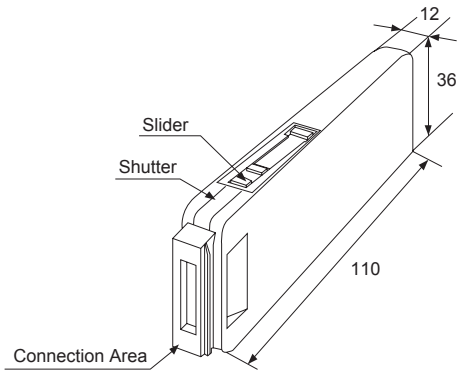
Adhesive tape

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.



Bulk Case (Unit: mm)

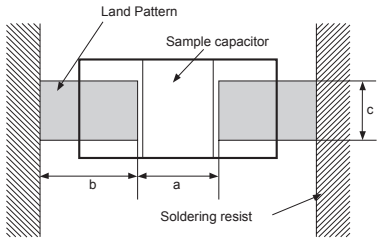


• Please contact Kyocera for details.

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)



General, High-Voltage

(Unit: mm)

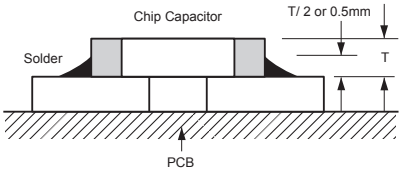
Size (EIA Code)	L×W	a	b	c
02 (01005)	0.4×0.2	0.13 to 0.20	0.12 to 0.18	0.20 to 0.23
03 (0201)	0.6×0.3	0.20 to 0.30	0.25 to 0.35	0.30 to 0.40
05 (0402)	1.0×0.5	0.30 to 0.50	0.35 to 0.45	0.40 to 0.60
105 (0603)	1.6×0.8	0.70 to 1.00	0.80 to 1.00	0.60 to 0.80
21 (0805)	2.0×1.25	1.00 to 1.30	1.00 to 1.20	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

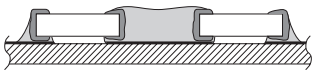
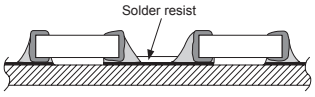
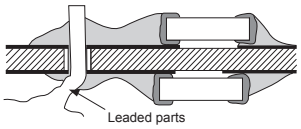
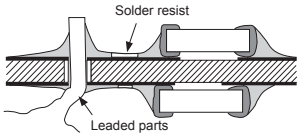
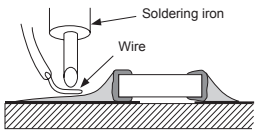
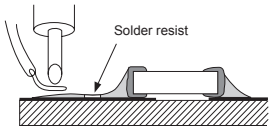
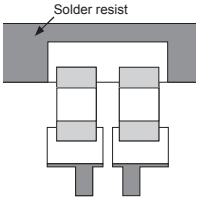
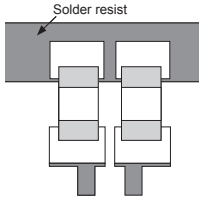
*1 Dimension of 3.0 to 3.5mm is recommended for “a”, in the case of High-Voltage products.

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 vaccum nozzle, provide a support pin on the back of the PCB to minimize PCB flexture.

4) Bottom position of pick up nozzle should be adjusted to the top surface of a substrate which camber is corrected.
5) To reduce the possibility of chipping and cracks, minimize vibration to chips stored in a bulk case.
6) The discharge pressure must be adjusted to the part size. Verify the pressure during setup to avoid fracturing or cracking the chips capacitors.

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.

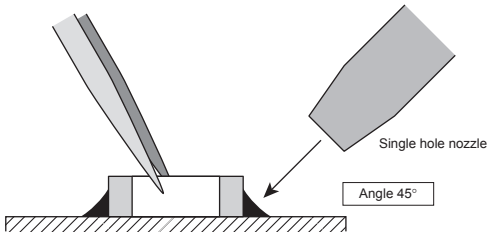
Soldering Method

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

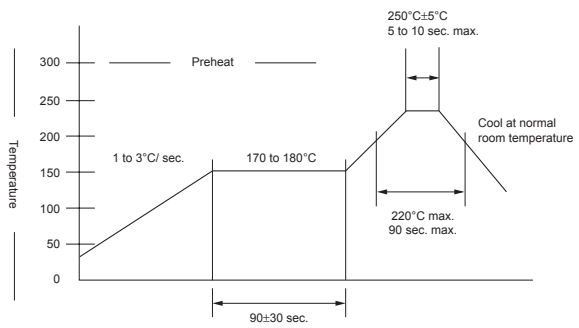
Item	Condition
Distance	5mm min.
Angle	45°
Projection Temp.	400°C max.
Flow rate	Set at the minimum
Nozzle diameter	2ϕ to 4ϕ (Single hole type)
Application time	10 sec. max. (1206 and smaller) 30 sec.max. (1210 and larger)

How to point spot heater



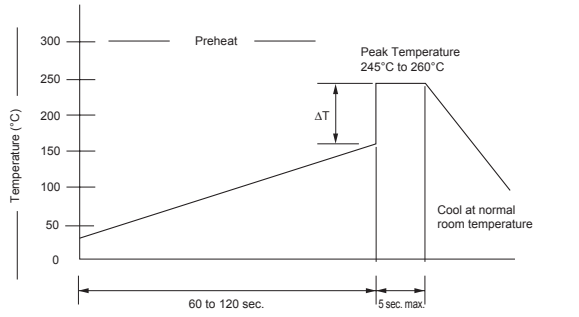
Recommended Temperature Profile (Sn–3Ag–0.5Cu)

Reflow



① Minimize soldering time.
② Ensure that allowable temperature difference does not exceed 150°C.
③ Ensure that allowable temperature difference does not exceed 130°C for 3.2×2.5mm size or larger.

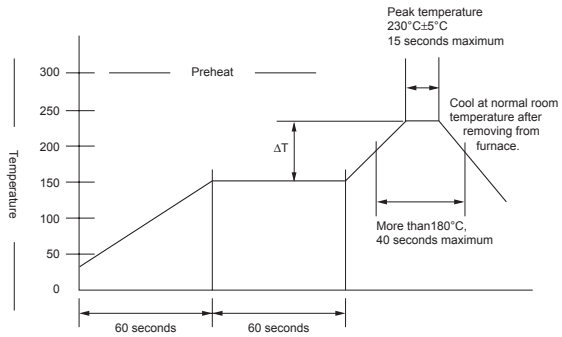
Wave



① Ensure that the chip capacitor is preheated adequately.
② Ensure that the temperature difference (ΔT) does not exceed 150°C.
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.

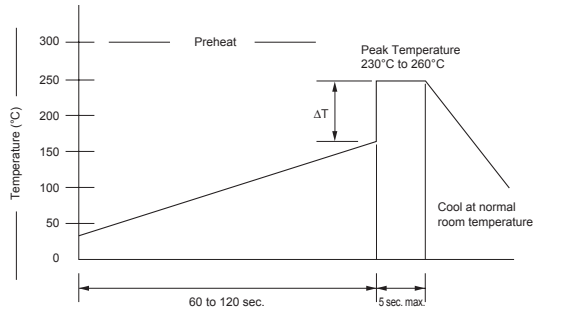
Recommended Temperature Profile (62Sn Solder)

Reflow



① Minimize soldering time.
② Ensure that the temperature difference (ΔT) does not exceed 150°C.
③ Ensure that the temperature difference (ΔT) does not exceed 130°C 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°C.
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.

Soldering iron

1) Temperature of iron chip — 1206 and smaller 350°C max.; 1210 and larger 280°C max.
2) Wattage — 80W max.
3) Tip shape of soldering iron — ϕ3.0mm max.
4) Soldering Time — 3 sec. max.

5) Cautions
   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)
   b) Avoid direct touching to capacitors.
   c) Avoid rapid cooling after soldering. Natural cooling is recommended.

*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 and bulk cases.
5. The solderability is assured for 6 months from our shipping date if the above storage precautions are followed.
6. Chip capacitors may crack if exposed to hydrogen (H_2) gas while sealed or if coated with silicon, which generates hydrogen gas.

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