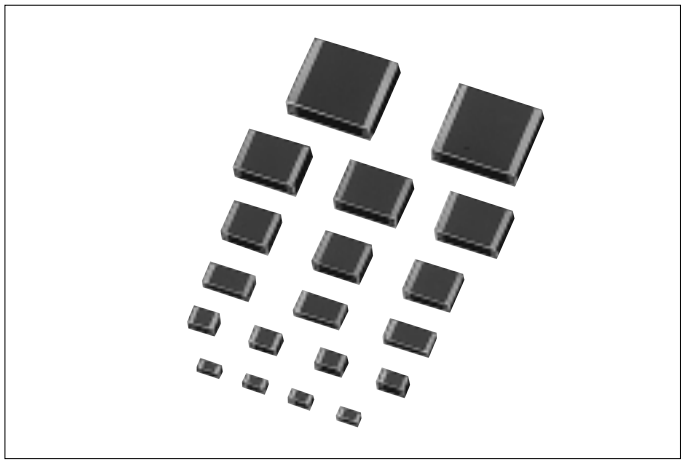
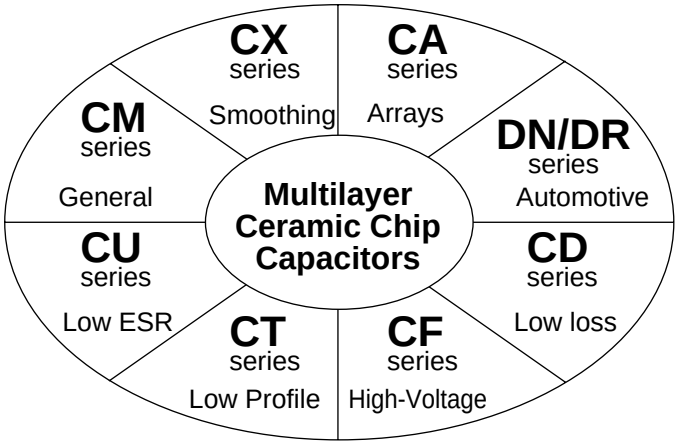
Kyocera's series of Multilayer Ceramic Chip Capacitors are designed to meet a wide variety of needs. We offer a complete range of products for both general and specialized applications, including the general-purpose CM series, the high-voltage CF series , the low profile CT series, and the DN series for automotive uses.

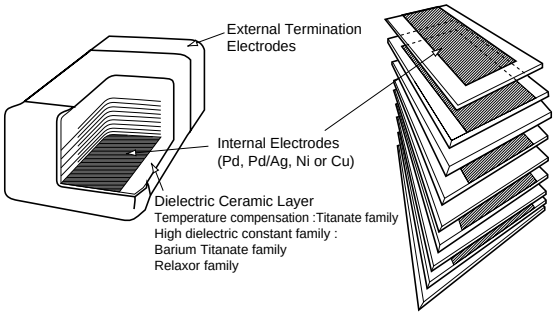


Features

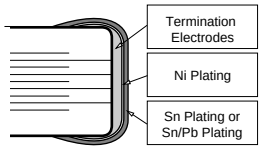
- We maintain factories worldwide in order to supply our global customer bases quickly and efficiently and to maintain our reputation as the highest-volume producer in the industry.
- All our products are highly reliable due to their monolithic structure of high-purity and superfine uniform ceramics 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 superb quality.
- Kyocera components are available in a wide choice of dimensions, temperature characteristics, rated voltages, and terminations to meet specific configurational requirements.



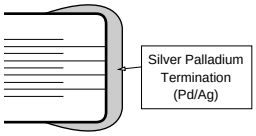
Structure



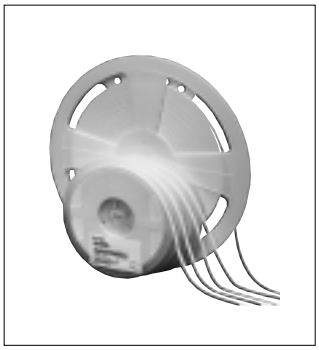
Nickel Barrier Termination Products



Silver Palladium Termination Products



Tape and Reel



Bulk Cassette

Please contact your local AVX 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 an AVX sales representative to confirm compatibility with your application.

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

Series	Dieletric Options	Typical Applications	Features	Terminations	Available Size (EIA)
CM	C0G (NP0) X5R X7R Y5V NTC*	General Purpose	Wide Cap Range	Nickel Barrier	0201, 0402, 0603 0805, 1206, 1210 1812, 2220
CF	C0G (NP0) X7R	High Voltage & Power Circuits	High Voltage 500VDC, 630VDC 1000VDC, 2000VDC 3000VDC, 4000VDC	Nickel Barrier	1206, 1210, 1808 1812, 2208, 2220
CT	C0G (NP0) X5R X7R Y5V	PLCC (Decoupling)	Low Profile	Nickel Barrier	0402, 0805 1206, 1210
***DN/DR**	C0G (NP0) U (750) X7R, X8R	Automotive	Thermal shock Resistivity High Reliability	Nickel Barrier	0603, 0805, 1206
CD	X5R	PDP PBX Inverters	Low Loss Excellent DC bias	Nickel Barrier	1206, 1210 1812, 2220
CU	C0G (NP0)	RF Circuit	Low ESR	Nickel Barrier	0402, 0603
CA	C0G (NP0) X7R Y5V	Digital Signal Pass line	Reduction in Placing Costs	Nickel Barrier	0508, 0612
CX	Y5U	Power Supply Circuit	Smoothing	Nickel Barrier	1210, 1812 2220

* NTC: Negative Temperature coefficient types are available on request.
* DN, CX Series: Silver Palladium termination is available on request.

KYOCERA

Multilayer Ceramic Chip Capacitors
Ordering Information

KYOCERA PART NUMBER: CM 21 X7R 104 K 50 A T

SERIES CODE

CM	=	General Purpose	CA	=	Capacitor Arrays
CF	=	High Voltage	CD	=	Low Loss
CT	=	Low Profile	CU	=	Low ESR
DN/DR	=	Automotive	CX	=	Smoothing

SIZE CODE

SIZE		EIA (EIAJ)	SIZE		EIA (EIAJ)	SIZE		EIA (EIAJ)
03	=	0201 (0603)	21	=	0805 (2012)	52	=	2208 (5720)
05	=	0402 (1005)	316	=	1206 (3216)	55	=	2220 (5750)
105	=	0603 (1608)	32	=	1210 (3225)			
F12	=	0508 (1220)	42	=	1808 (4520)			
F13	=	0612 (1632)	43	=	1812 (4532)			

DIELECTRIC CODE

CODE		EIA CODE
CG	=	C0G (NPO)
X5R	=	X5R
X7R	=	X7R
X8R	=	X8R
Y5V	=	Y5V
Y5U	=	Y5U

Negative dielectric types are available on request.

CAPACITANCE CODE

Capacitance expressed in pF. 2 significant digits plus number of zeros.
For Values < 10pF, Letter R denotes decimal point,

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

TOLERANCE CODE

B = ±0.1pF	F = ±1%	K = ±10%
C = ±0.25pF	G = ±2%	M = ±20%
D = ±0.5pF	J = ±5%	Z = -20 to +80%

VOLTAGE CODE

06	=	6.3VDC	100	=	100VDC	1000	=	1000VDC
10	=	10VDC	200	=	200VDC	2000	=	2000VDC
16	=	16VDC	250	=	250VDC	3000	=	3000VDC
25	=	25VDC	500	=	500VDC	4000	=	4000VDC
50	=	50VDC	630	=	630VDC			

TERMINATION CODE

A = Nickel Barrier	C = Silver (∗option)
B = Silver Palladium (∗option)	

PACKAGING CODE

B = Bulk
C = Bulk Cassette
T = 7" Reel Taping & 4mm Cavity pitch
L = 13" Reel Taping & 4mm Cavity pitch
H = 7" Reel Taping & 2mm Cavity pitch
N = 13" Reel Taping & 2mm Cavity pitch

High Dielectric Constant

EIA Dielectric	Temperature Range	ΔCmax
X5R	–55 to 85°C	±15%
X7R	–55 to 125°C	
X8R	–55 to 150°C	
Y5U	–30 to 85°C	+22 to –56%
Y5V	–30 to 85°C	+22 to –82%

Temperature Compensation Type

Electric Code Value (pF)	1B/C0G	PΔ N150	RΔ N220	SΔ N330	TΔ N470	UΔ N750	SL +350 to –1000
0.5-2.7	CK	PK	RK	SK	TK	UK	SL
3.0-3.9	CJ	PJ	RJ	SJ	TJ	UJ	SL
4.0-9.0	CH	PH	RH	SH	TH	UJ	SL
≥10	CG	PH	RH	SH	TH	UJ	SL

K = ±250ppm/°C, J = ±120ppm/°C, H = ±60ppm/°C, G = ±30ppm/°C
e.g. CG = 0±30ppm/°C, PH = –150±60ppm/°C

Note: All parts will be marked as "CG" but will conform to the above table.

Available Tolerances

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

EIA Dielectric	Standard Tolerance	Capacitance
COG NTC *1	*3 C=±0.25pF	≤5pF
	*5 D=±0.50pF	*2 <10pF
	*4 J=±5% K=±10% M=±20%	≥10pF E12 Series
X5R **X7R**	*6 K=±10% M=±20%	E6 Series
Y5U	M=±20% Z=–20% to +80%	E3 Series
Y5V	Z=–20% to +80%	E3 Series

Note:
*1 NTC : Negative Temperature Compensation types are available on request as shown on product pages.
*2 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, 10pF.
*3 B = ±0.1pF is available for 5pF and below on request.
*4 F = ±1% or G = ±2% is available for C >10pF on request.
*5 C = ±0.25pF is available for values 5pF< C < 10pF on request.
*6 J = ±5% for X7R(X5R) 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 (0.6×0.3 mm) to large (5.7×5.0 mm) components configured for a variety of temperature characteristics, rated voltages, and packages. We offer the choice and flexibility for almost any applications.

Application

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

Temperature Compensation Dielectrics

Size (mm)	CM03 0.6±0.03 (0201) 0.3±0.03			CM05 (0402) 1.0±0.05 0.5±0.05					CM105 (0603) 1.6±0.1 0.8±0.1				CM21 (0805) 2.0±0.1 1.25±0.1							CM316 (1206) 3.2±0.2 1.6±0.15						CM32 (1210) 3.2±0.2 2.5±0.2					CM43 4.5 ±0.3 3.2 ±0.2		CM55 5.7 ±0.4 5.0 ±0.4	
Temperature Characteristics	COG			COG			P to T∗	U •SL	COG		P to T∗	U •SL	COG					P to T∗	U •SL	COG				P to T∗	U •SL	COG			P to T∗	U •SL	COG		COG	
Rated Voltage (VDC) / Capacitance (pF)	10	16	25	16	25	50	50	50	50	100	50	50	16	25	50	100	200	50	50	25	50	100	200	50	50	50	100	200	50	50	100	200	100	200
R50 0.5	M	M	M	A	A	A	A	A	B	B	B	B	C	C	C	C	C	C	C				C											
1R0 1.0																																		
1R5 1.5																																		
2.0																																		
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101 100																	D																	
121 120																																		
150																	F																	
180																							D											
220																																		
270																							E											
330																																		
390																																		
470																																		
560																							H											
680													D	D	D			D		C	C	C		C										
820																				D	D	D												
102 1000																																		
122 1200																			D									G						
1500																			F									I						
1800																																		
2200																								C			G			G				
2700																																		
3300													F	F										D										
3900																									G					G		E	G	
4700																																	I	
5600																																		
6800																																		E
8200																																		I
103 10000																				E											G			
123 12000																																	E	
15000																																		
18000																																		
22000																																	G	

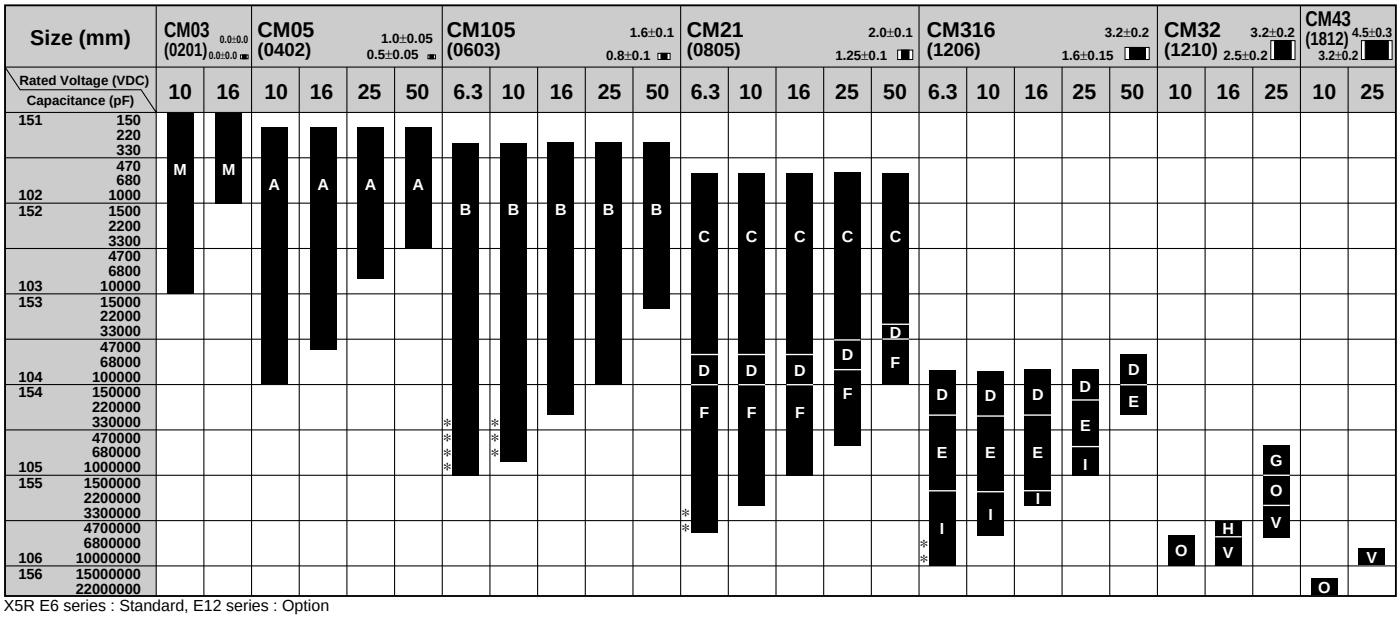
E12 series:Standard, E24 series:Option P TΔ:Option

Size	CM03	CM05	CM105	CM21, CM316, CM32								
Thickness (mm)	M	A	B	C	D	E	F	G	H	I	O	V
	0.3±0.03	0.5±0.05	0.8±0.1	0.6±0.1	0.85±0.1	1.15±0.1	1.25±0.1	1.4max	1.6 max	1.6±0.15	2.0±0.2	2.5±0.2
Taping(178 dia reel)	15kp(P8)	10kp(P8)	4kp(P8)	4kp(P8)	4kp(P8)	3kp(E8)	3kp(E8)	3kp(E8)	2.5kp(E8)	2.5kp(E8)	2kp(E8)	1kp(E8)
Taping(330 dia reel)	———	50kp(P8)	10kp(P8)	10kp(P8)	10kp(P8)	10kp(E8)	10kp(E8)	10kp(E8)	5kp(E8)	5kp(E8)	5kp(E8)	———

Size	CM43, CM55						
Thickness (mm)	E	G	I	J	O	K	V
	1.15±0.1	1.4max	1.6±0.15	2.0max	2.0±0.2	2.5max	2.5±0.2
Taping(178 dia reel)	1.5kp(E12)	∗1 1.5kp(E12)	1kp(E12)	1kp(E12)	1kp(E12)	0.5kp(E12)	0.5kp(E12)
Taping(330 dia reel)	———	———	———	———	———	———	———

Note : P8 = 8mm width paper tape
E8 = 8mm width plastic tape
E12 = 12mm width plastic tape
∗1 1kp for CM55

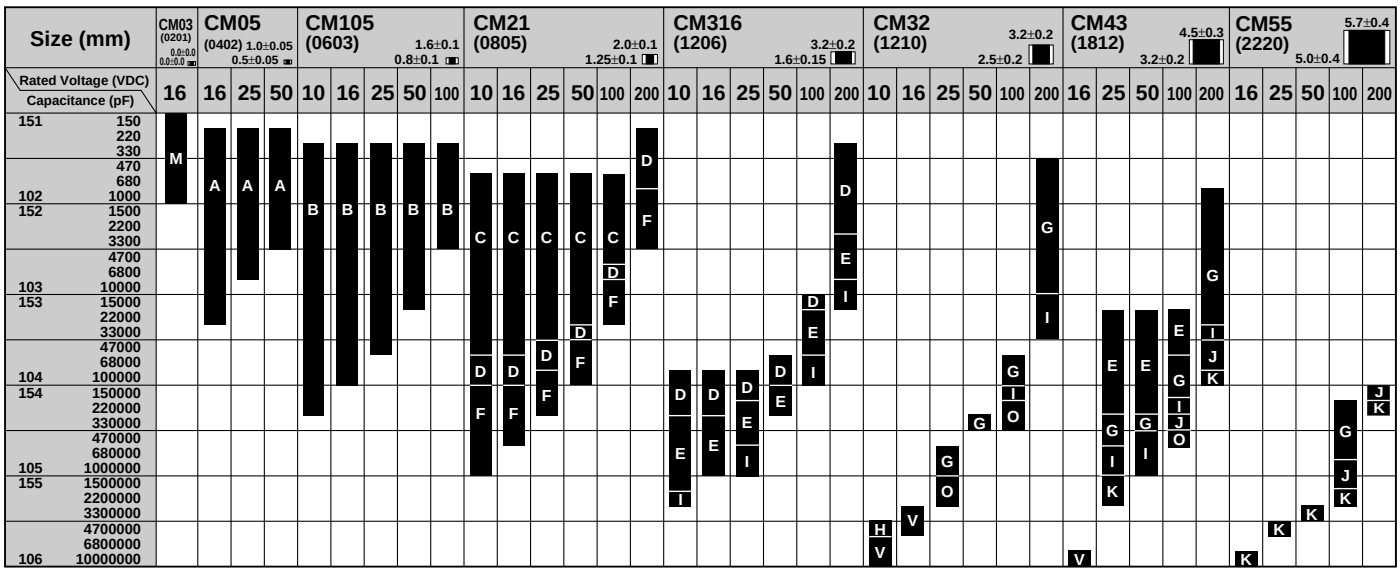
X5R Dielectric



X5R E6 series : Standard, E12 series : Option

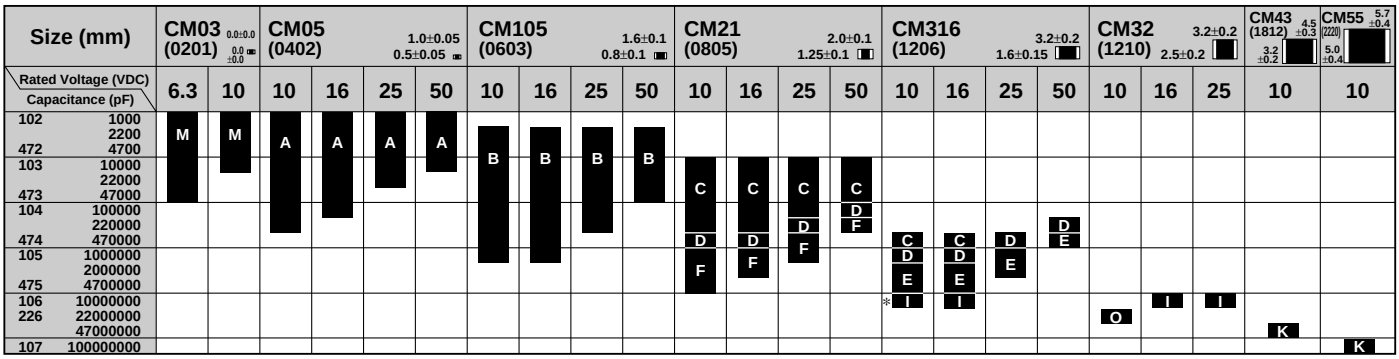
∗ Dimentional tolerances (L, W, T) is ±0.15mm for 105X5R334 to 105, 21X5R335 to 475. ±0.2mm for 316X5R685 to106

X7R Dielectric



X7R E6 series : Standard, E12 series : Option

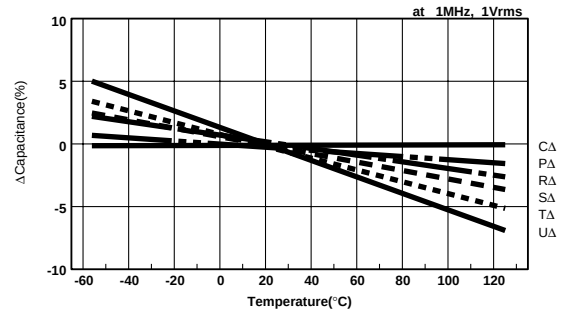
Y5V Dielectric



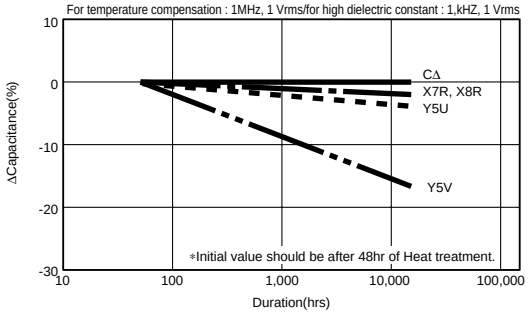
Y5V E3 series : Standard, E6 series : Option

∗ Tolerance (W, T) for CM316Y5V106 is ±0.20mm.

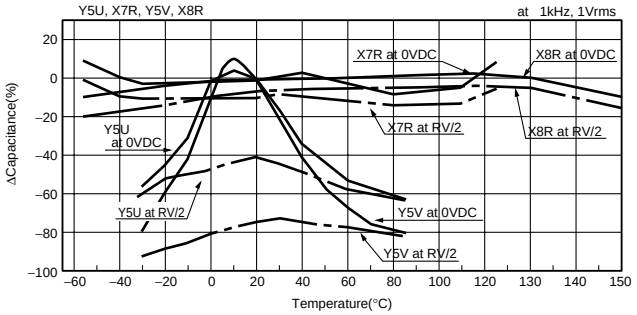
Capacitance-Temperature (temperature compensation)



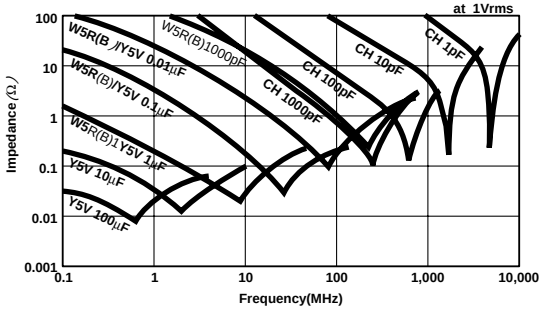
Aging (change of capacitance over time)



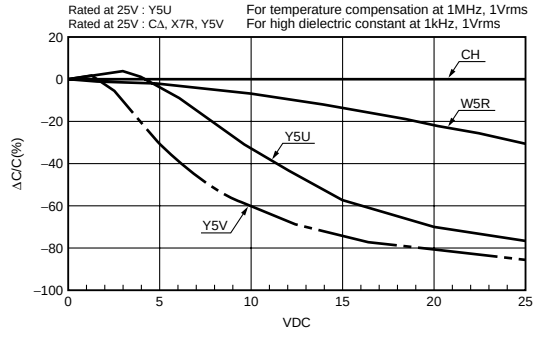
Capacitance-Temperature (high dielectric constant)



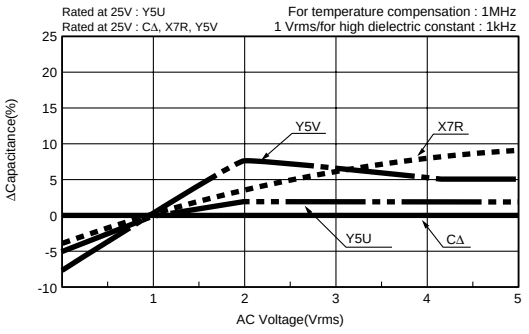
Impedance-Frequency



DC Bias



AC Voltage



Please verify individual characteristics at the design stage to ensure total suitability

Test conditions and Specification for Temperature Compensation type(C* to U* • SL characteristics)

Test Items		Specification (C: nominal capacitance)	Test Conditions
Capacitance Value		Within tolerance	C≤1000pF: 1MHz±10%, 0.5 to 5Vrms C>1000pF: 1kHz±10%, 0.5 to 5Vrms
Q		C≥30pF: Q≥1000 C<30pF: Q≥400+20C	
Insulation resistance (IR)		10,000MΩ or 500MΩ•μF min, whichever is less	Measured after the rated voltage is applied for one minute at normal room temperature and humidity. (*5)
Dielectric Resistance		No problem observed	(*1) Apply 3 times of the rated voltage for 1 to 5 seconds.
Appearance		No problem observed	Microscope(10×magnification)
Termination strength *2		No problem observed	Apply a sideward force of 500g(5N) to a PCB-mounted sample.
Bending strength *2		No mechanical damage at 1mm bent	Glass epoxy PCB (t=1.6mm); fulcrum Spacing: 90mm; for 10 seconds.
Vibration test	**Appearance**	No significant change is detected.	Vibration frequency: 10 to 55(Hz) Amplitude: 1.5mm Sweeping condition: 10→55→10Hz/min In X, Y and Z directions: 2 hours each Total 6 hours
	ΔC	Within tolerance	
	Q	C≥30pF: Q≥1000 C<30pF: Q≥400+20C	
Soldering heat resistance	**Appearance**	No significant change is detected.	Soak the sample in 270°C±5°C solder for 10±0.5seconds(*3) and place in a room at normal temperature and humidity; measure after 24±2hours. (Preheating Conditions) Order 1: 80 to 100°C, 2minutes Order 2: 150 to 200°C, 2minutes
	ΔC	±2.5% or ±0.25pF max, whichever is larger.	
	Q	C≥30pF: Q≥1000 C<30pF: Q≥400+20C	
	IR	10,000MΩ or 500MΩ•μF min, whichever is smaller	
	Withstand voltage	Resists without problem	
Solderability		Ni/Br termination: 90% min Ag/Pd termination: 75% min	Soak the sample in 230°C±5°C Sn62 solder for 4±1second
Temperature cycle *4	**Appearance**	No significant change is detected.	(Cycle) Normal room temperature (3min)→ Lowest operation temperature (30min)→ Normal room temperature (3min)→ Highest operation temperature (30min)→ After five cycles(*4), measure after 24±2hours.
	ΔC	±2.5% or ±0.25pF max, whichever is larger.	
	Q	C≥30pF: Q≥1000 C<30pF: Q≥400+20C	
	IR	10,000MΩ or 500MΩ•μF min, whichever is samller	
	Withstand voltage	Resists without problem	
Humidity test *6	**Appearance**	No significant change is detected.	Measure the test sample after storing it 24±2hours at a temperature of 40°C±2°C and a relative humidity of 90-95% Rh. for 500+24/–0hours.
	ΔC	±7.5% or ±0.75pF max, whichever is larger.	
	Q	C≥30pF: Q≥200 C<30pF: Q≥100+10C/3	
	IR	500MΩ or 25MΩ•μF min, whichever is smaller	
High-temperature with loading	**Appearance**	No significant change is detected.	After applying(*1) twice of the rated voltage at a temperature of 125±3 for 1000+48/–0hours, measure the sample after storing 24±2hours.
	ΔC	±3% or ±0.3pF max, whichever is larger.	
	Q	C≥30pF: Q≥350 10pF≤C<30pF: Q≥275+5C/2 C<10pF: Q≥200+10C	
	IR	1,000MΩ or 50MΩ•μF min, whichever is smaller	

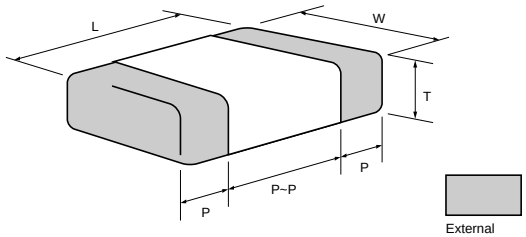
*1 For the CF series, use 1.5 times when the rated voltage is 500V; use a 1.2 times when the rated voltage exceeds 1000V. The charge and discharge current of the capacitor must not exceed 50mA.
*2 Except CT series
*3 3±0.5 seconds for Silver Palladium terminations.
*4 1000 cycles for Nickel Barrier termination DN series. (Alumina Substrate)
*5 For the CF series over 1000V, apply 500V for 1minute at normal room temperature and humidity.
*6 Exclude capacitors with rated voltage of over 200V.

Test conditions and Specification for High Dielectric Type (X5R, X7R, Y5V & Y5U)

Test Items		Specification			Test Condition
		X7R/X5R	Y5U	Y5V	
Capacitance Value		Within tolerance			Do previous treatment(∗9, ∗15) Capacitance / Fire / Vol C≤10μF / 1kHz±10% / 1.0±0.1Vrms C>10μF / 120Hz±10% / 0.5±0.1Vrms
tanδ(%)		2.5%max, 3.5%max(∗2) 0.4%max(∗13), 5.0%max(∗3)	5.0%max(∗12)	5.0%max, 7.0%max(∗14) 9.0%max(∗4), 12.5%max(∗5)	
Insulation resistance (IR)		10,000MΩ or 500MΩ•μF max, whichever is less			Measured after the rated voltage is applied for 2minutes at normal room temperature and humidity. (∗11)
Dielectric Resistance ∗1		No problem observed			(∗1) Apply 2.5 times of the rated voltage for 1 to 5 seconds.
Appearance		No problem observed			Microscope(10×magnification)
Termination strength ∗6		No problem observed			Apply a sideward force of 500g(5N) to a PCB-mounted sample.
Bending strength test ∗6		No problem observed at 1mm bent			Glass epoxy PCB (t=1.6mm); fulcrum Spacing: 90mm; for 10 seconds.
Vibration test	**Appearance**	No significant change is detected.			Vibration frequency: 10 to 55(Hz) Amplitude: 1.5mm Sweeping condition: 10→55→10Hz/min In X, Y and Z directions: 2 hours each Total 6 hours
	ΔC	Within tolerance			
	tanδ(%)	Satisfies the initial value.			
Soldering heat resistance	**Appearance**	No significant change is detected.			Do previous treatment(∗9) Soak the sample in 270°C±5°C solder for 10±0.5seconds(∗7) and place in a room at normal temperature and humidity; measure after 48±4hours. (Preheating Conditions) Order / Temperature / Time 1 / 80 to 100°C / 2minutes 2 / 150 to 200°C / 2minutes
	ΔC	Within ±7.5%	Within ±20%	Within ±20%	
	tanδ(%)	Satisfies the initial value.			
	IR	10,000MΩ or 500MΩ•μF max, whichever is smaller			
	Withstand voltage	Resists without problem			
Solderability		Ni/Br termination: 90% min Ag/Pd termination: 75%min			Soak the sample in 230°C±5°C Sn62 solder for 4±1second
Temperature cycle ∗8	**Appearance**	No significant change is detected.			Do previous treatment(∗9) (Cycle) Normal room temperature (3min)→ Lowest operation temperature (30min)→ Normal room temperature (3min)→ Highest operation temperature (30min)→ After five cycles(∗8), measure after 48±4hours.
	ΔC	Within ±7.5%	Within ±20%	Within ±20%	
	tanδ(%)	Satisfies the initial value.			
	IR	10,000MΩ or 500MΩ•μF max, whichever is smaller			
	Withstand voltage	Resists without problem			
Humidity test ∗12	**Appearance**	No significant change is detected.			Do previous treatment(∗10) After storing it at a temperature of 40°C±2°C and a relative humidity of 90-95% for 500+24/–0hours, measure the sample after storing 48±4hours.
	ΔC	Within ±12.5%	Within ±30%	Within ±30%	
	tanδ(%)	200% max of initial value	150% max of initial value		
	IR	500MΩ or 25MΩ•μF max, whichever is smaller			
High-temperature with loading	**Appearance**	No significant change is detected.			Do previous treatment(∗10) After applying twice (∗1) of the rated voltage at the highest operating temperature for 1000+48/–0hours, measure the sample after storing 48±4hours.
	ΔC	Within ±12.5%	Within ±30%	Within ±30%	
	tanδ(%)	200% max of initial value	150% max of initial value		
	IR	1,000MΩ or 50MΩ•μF max, whichever is smaller			

*1 For CF series, use 1.5 times when the rated voltage is 250V and 500V; Use 1.2 times when the rated voltage exceeds 630V. The charge/discharge current of the capacitor must not exceed 50mA.
*2 Apply to X5R 16V/25V type, X7R 10V/16V type, CM316X7R564 to 105(25V type).
*3 Apply to X5R 6.3V/10V type, CT05X7R123 to 223(10V type),X7R 6.3V type.
*4 Apply to Y5V 16V type, CM32Y5V335 to 106 (25V Type). Except 12.5% for CT21Y5V105/16V.
*5 Apply to Y5V 6.3V/10V type.
*6 Exclude CT series with thickness of less than 0.66mm.
*7 3±0.5 sec. for AgPd termination.
*8 1000 cycles for Nickel Barrier termination DN/DR series. (Alumina Substrate)
*9 Keep specimen at 150°C+0/–10°C for one hour, leave specimen at room ambient for 48±4 hours.
*10 Apply the same test condition for one hour, then leave the specimen at room ambient for 48±4 hours.
*11 For the CF series over 1000V, apply 500V for 1 minutes at room ambient.
*12 Exclude capacitors with rated voltage of over 200V.
*13 apply to CD series.
*14 Apply to 25V series of CM105 Y5V 154 over, CM21Y5V105 over, 316Y5V155 over.
*15 Measurement condition 1kHz, 1Vrms for Y5V, C < 47μF type.

Dimensions



External Dimensions

Tape & Reel

Size	EIA CODE	EIAJ CODE	Dimensions (mm)					
			L	W	P min	P max	P to P min	T max
03	0201	0603	0.6±0.03	0.3±0.03	0.10	0.20	0.20	0.33
05	0402	1005	1.0±0.05	0.5±0.05	0.10	0.35	0.30	0.55
105	0603	1608	1.6±0.10	0.8±0.10	0.20	0.60	0.50	0.90
21	0805	2012	2.0±0.10	1.25±0.10	0.20	0.75	0.70	1.35
316	1206	3216	3.2±0.20	1.60±0.15	0.30	0.85	1.40	1.80
32	1210	3225	3.2±0.20	2.50±0.20	0.30	1.00	1.40	2.70
42	1808	4520	4.5±0.30	2.00±0.20	0.15	0.85	2.00	2.20
43	1812	4532	4.5±0.30	3.20±0.20	0.30	1.10	2.00	2.70
52	2208	5720	5.7±0.40	2.00±0.20	0.15	0.85	4.20	2.20
55	2220	5750	5.7±0.40	5.00±0.40	0.30	1.40	2.50	2.80

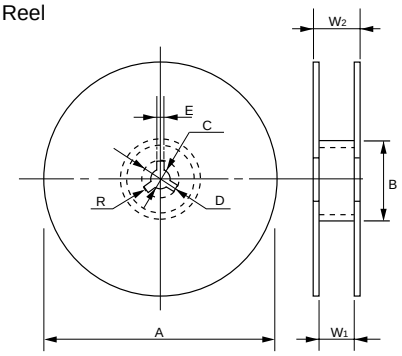
- CX43 Type L : 4.7±0.4mm
- CT21, CT316 : (L) 3.2±0.2mm and (W)1.6±0.2mm
- T (Thickness) depends on capacitance value.
  Standard thickness is shown on the appropriate product pages.
- DR series 105, 21 size (L)(W)(T) Tolerance ±0.15mm
- CA series (please refer product specifications)

Bulk Cassette

Size (mm)	L	W	T	P		P to P
				min	max	min
0603	1.6±0.07	0.8±0.07	0.8±0.07	0.10	0.60	0.50
0805	2.0±0.1	1.25±0.1	0.6±0.1/1.25±0.1	0.25	0.75	0.80
1206	3.2±0.1	1.6±0.1	0.6±0.1	0.25	0.85	1.50

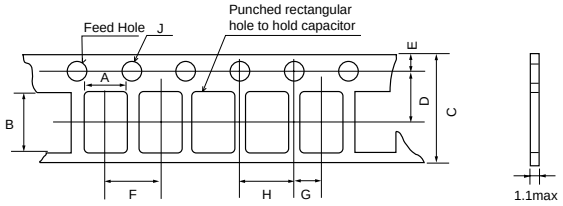
Tape and Reel

• Reel

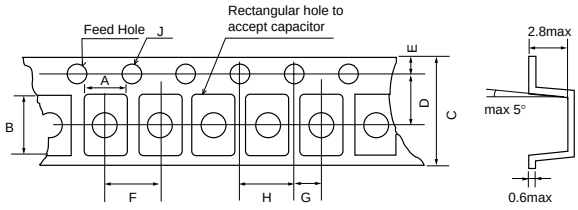


• Carrier tape

(Paper Carrier Tape)

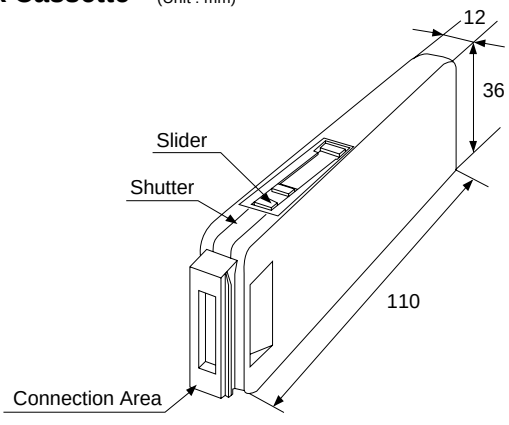


(Plastic Carrier Tape)



• Package quantity (Shown on the appropriate product pages.)

Bulk Cassette (Unit : mm)



Reel (code : T)

(Unit : mm)

Code / Reel	A	B	C	D
7-inch Reel (CODE : T, H)	178±2.0	ϕ60min	13±0.5	21±0.8
13-inch Reel (CODE : L, N)	330±2.0	ϕ100±1.0		
Code / Reel	**E**	**W1**	**W2**	**R**
7-inch Reel (CODE : T, H)	2.0±0.5	10.0±1.5	16.5max	1.0
13-inch Reel (CODE : L, N)		9.5±1.0		

∗Carrier tape width 8mm. For size 42(1808) or over, Tape width 12mm and W1 : 14±1.5, W2 : 20.5mm max

Carrier Tape

(Unit : mm)

Type \ Code	A	B
03 (0.6×0.3)	0.37±0.03	0.67±0.03
05 (1.0×0.5)	0.65±0.1	1.15±0.1
105 (1.6×0.8)	1.0±0.2	1.8±0.2
12 (2.0×1.25)	1.5±0.2	2.3±0.2
13 (3.2×1.6)	2.0±0.2	3.6±0.2
21 (2.0×1.25)	1.50±0.2	2.3±0.2
316 (3.2×1.6)	2.0±0.2	3.6±0.2
32 (3.2×2.5)	2.9±0.2	3.6±0.2
42 (4.5×2.0)	2.4±0.2	4.9±0.2
43 (4.5×3.2)	3.6±0.2	4.9±0.2*
52 (5.7×2.0)	2.4±0.2	6.0±0.2
55 (5.7×5.0)	5.3±0.2	6.0±0.2

∗For CX type, B : 5.2±0.2mm

(Unit : mm)

Code / Carrier Tape		C	D	E	F*
Paper	8mm	8.0±0.3	3.5±0.05	1.75±0.1	4.0±0.1
Plastic	8mm				
	12mm	12.0±0.3	5.5±0.05		8.0±0.1
Code / Carrier Tape		**G**	**H**	**J**	
Paper	8mm	2.0±0.05	4.0±0.1	$1.5^{+0.1}_{0}$	
Plastic	8mm				
	12mm				

∗For 03, 05type, F : 2.0±0.05mm For 42type, 52type F : 4.0±0.1mm

Package Quantity

Type	Thickness (mm)	Quantity per case (pcs)
05	0.5	50,000
105	0.8	15,000
21	0.6	10,000
	1.25	5,000

∗CM05 is optional

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 20ºC.

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.

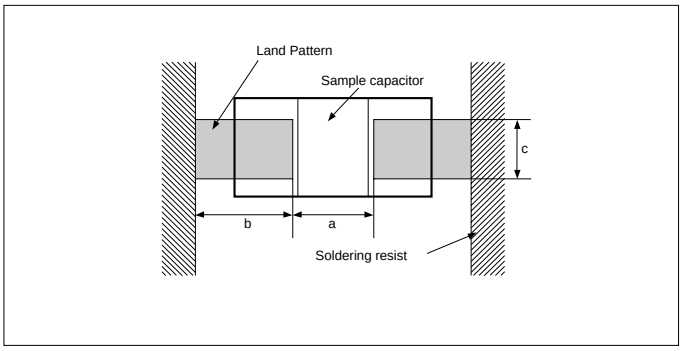
7. Do not use the capacitor in an environment where it might easily exceed the respective provisions concerning shock and vibration specified in the catalog and specifications.
   In addition, it is a common piezo phenomenon of high dielectric products to have some Voltage due to vibration or to have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

Storage

1. If the component is stored in minimal packaging (a heat-sealed or chuck-type 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 +35 degree C, humidity 45 to 70% RH.
3. The storage atmosphere must be free of gas containing sulfur 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)-3) apply to chip capacitors packaged in carrier tapes and bulk cases.
5. The solderability is assured for 12 months from our final inspection date (six months for silver palladium) 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.

Dimensions for recommended typical land



(Unit : mm)

Size	L×W	a	b	c
03	0.6×0.3	0.15 to 0.35	0.20 to 0.30	0.25 to 0.35
05	1.0×0.5	0.30 to 0.50	0.35 to 0.45	0.40 to 0.60
105	1.6×0.8	0.70 to 1.00	0.80 to 1.00	0.60 to 0.80
21	2.0×1.25	1.00 to 1.30	1.00 to 1.20	0.80 to 1.10
316	3.2×1.6	2.10 to 2.50	1.10 to 1.30	1.00 to 1.30
32	3.2×2.5	2.10 to 2.50	1.10 to 1.30	1.90 to 2.30
42	4.5×2.0	2.50 to 3.20	1.80 to 2.30	1.50 to 1.80
43	4.5×3.2	2.50 to 3.20	1.80 to 2.30	2.60 to 3.00
52	5.7×2.0	4.20 to 4.70	2.00 to 2.50	1.50 to 1.80
55	5.7×5.0	4.20 to 4.70	2.00 to 2.50	4.20 to 4.70

∗ CA series : Please refer product specifications.

When mounting the capacitor to the substrate, it is important to consider carefully that the amount of solder (size of fillet) used has a direct effect upon the capacitor once it is mounted.

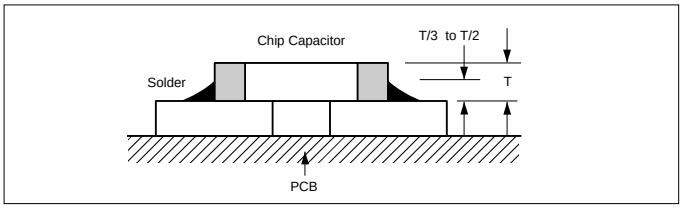
a) The greater the amount of solder, the greater the stress to the elements. As this may cause the substrate to break or crack, it is important to establish the appropriate dimensions with regard to the amount of solder when designing the land of the substrate.
b) In the situation where two or more devices are mounted onto a common land, separate the device into exclusive pads by using soldering resist

DN/DR Automotire Series

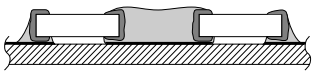
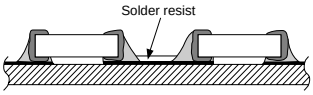
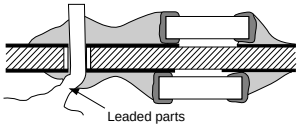
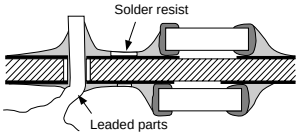
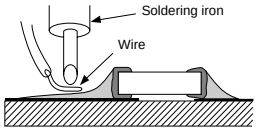
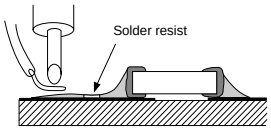
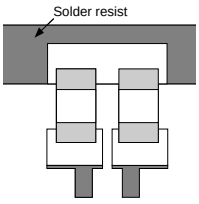
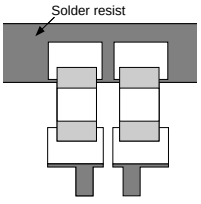
(Unit : mm)

Size	L×W	a	b	c
105	1.6×0.8	0.60 to 0.90	0.80 to 1.00	0.70 to 1.00
21	2.0×1.25	0.90 to 1.20	0.80 to 1.20	0.90 to 1.40
316	3.2×1.6	1.40 to 1.90	1.00 to 1.30	1.30 to 1.80

Ideal Solder Thickness



Typical mounting problems

Item	Poor example	Recommended example/Separated by solder resist
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 100 to 300 gf.
3) To minimize warpage of the PCB from the shock of the vaccum nozzle, provide a support pin on the back of the PCB to minimize PCB flexture.

4) When the positioning hook begins to wear, unstable force may be applied to the chip, resulting in cracking.
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.

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, limit the temperature difference (ΔT) to within 130°C.
2) Please see our recommended soldering conditions.

PCB Mounting Precautions

If the PCB becomes excessively bent either before or after mounting of the chip capacitor, the chip capacitor may crack or chip. Take precautions to reduce PCB flexure.

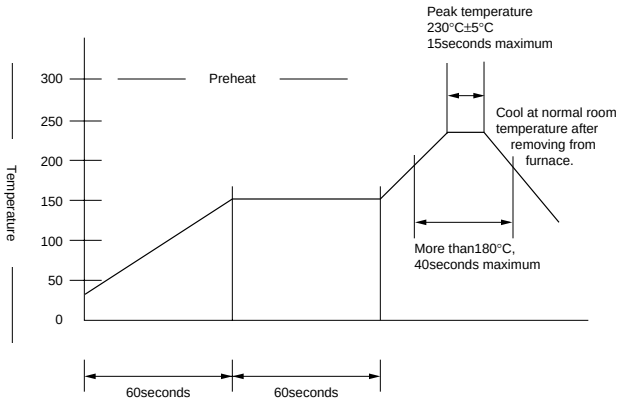
Special Precautions for Using Soldering Irons

Preheat the capacitors to approx. 150°C.

Solder quickly on a hot plate using a soldering iron adjusted to 250 to 280°C.

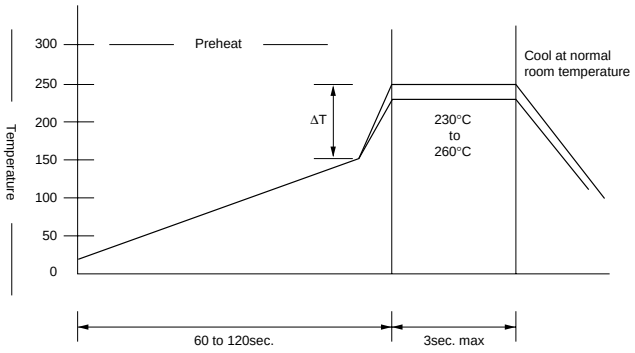
Recommendable Temperature Profile

Reflow



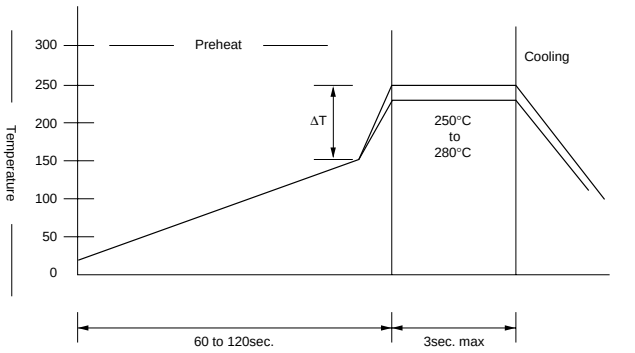
Minimize soldering time.

Wave



① If a chip capacitor smaller than type CM316 is used with a wave soldering tank, use the Nickel-barrier type to minimize solder leaching. This may not be necessary with a static soldering tank.)
② Ensure that the chip capacitor is preheated adequately.
③ Ensure that the temperature difference (ΔT) does not exceed 130°C.
④ Cooling after soldering should be as slow as possible.

Solding Iron



Do not place the soldering iron on the chip.