此商品编号的参数规格是： CL05B333KO5NNNC/0402
33nF, 0402封装

CL	10	A	106	M	P	8	N	N	N	C
1	2	3	4	5	6	7	8	9	10	11

1. SERIES CODE

CL = Multi layer Ceramic Capacitors

2. SIZE CODE — inch(㎜)

02 = 01005(0402) 21 = 0805(2012) 43 = 1812(4532)
03 = 0201(0603) 31 = 1206(3216) 55 = 2220(5750)
05 = 0402(1005) 32 = 1210(3225)
10 = 0603(1608) 42 = 1808(4520)

★

3. DIELECTRIC CODE

Class I	Class II
C = C0G	A = X5R F = Y5V B = X7R X = X6S Y = X7S Z = X7T

★★

4. CAPACITANCE CODE

Capacitance expressed in pF. 2 significant digits plus number of zeros.
example) 106 = 10×10^6 = 10000000pF
For Values < 10pF, Letter R denotes decimal point
example) 1R5 = 1.5pF

5. TOLERANCE CODE

B = ±0.1pF F = ±1pF, ±1%* K = ±10%
C = ±0.25pF G = ±2% M = ±20%
D = ±0.5pF J = ±5% Z = +80/–20%

*For Values ≤ 10pF, F = ±1pF
Values > 10pF, F = ±1%

6. RATED VOLTAGE CODE

R = 4V O = 16V B = 50V E = 250V H = 630V K = 3000V
Q = 6.3V A = 25V C = 100V F = 350V I = 1000V
P = 10V L = 35V D = 200V G = 500V J = 2000V

★★★

7. THICKNESS CODE

2 = 0.20㎜ A = 0.65㎜ F = 1.25㎜ L = 3.20㎜ S = 1.35㎜
3 = 0.30㎜ C = 0.85㎜ H = 1.60㎜ M = 1.15㎜ U = 1.80㎜
5 = 0.50㎜ D = 1.00㎜ I = 2.00㎜ P = 1.15㎜ V = 2.50㎜
8 = 0.80㎜ E = 1.10㎜ J = 2.50㎜ Q = 1.25㎜ Y = 1.25㎜
9 = 0.90㎜

8. INNER ELECTRODE / TERMINATION / PLATING CODE

A = Normal Product Pd / Ag / Ni barrier / Sn 100%
N = Normal Product Ni / Cu / Ni barrier / Sn 100%
G = Normal Product Cu / Cu / Ni barrier / Sn 100%
L = Low profile Ni / Cu / Ni barrier / Sn 100%
S = Nomal Product Ni / Cu / Soft termination / Ni barrier / Sn100%

9. PRODUCT CODE

N = Normal
A = Array(4-element)
B = Array(4-element)
L = LICC
J = SLIC

*Size tolerance

Code \ Size	01005(0402)	0201(0603)	0402(1005)	0603(1608)	0805(2012)	1206(3216)
S	±0.03	±0.05	±0.07	±0.07		±0.30
Q	±0.05	±0.07	±0.10	±0.15	±0.15	
R	±0.07	±0.09	±0.15	±0.20	±0.20	
U	±0.09		±0.20	±0.25	±0.30	
Z			±0.40	±0.30		
9			±0.30			

10. CONTROL CODE

N = Reserved for future use

11. PACKAGING CODE

B = Bulk
P = Bulk Case
C = Cardboard Tape, 7"Reel
H = Cardboard Tape, 7"Reel(15,000ea)
8 = Cardboard Tape, 7"Reel
O = Cardboard Tape, 10"Reel
D = Cardboard Tape, 13"Reel(10,000ea)
L = Cardboard Tape, 13"Reel(15,000ea)
Z = Cardboard Type, 7"Reel(Chip aligned for horizontal SMT)
Y = Cardboard Type, 7"Reel(Chip aligned for vertical SMT)
E = Embossed Type, 7"Reel
G = Embossed Type, 7"Reel(3,000ea)
F = Embossed Type, 13"Reel
S = Embossed Type, 10"Reel

Class I (Temperature Compensation)

Symbol	EIA Code	Operation Temperature Range(℃)	Temperature Coefficient Range(ppm/℃)
C	C0G	−55 ~ +125	0±30

★ Class II (High Dielectric Constant)

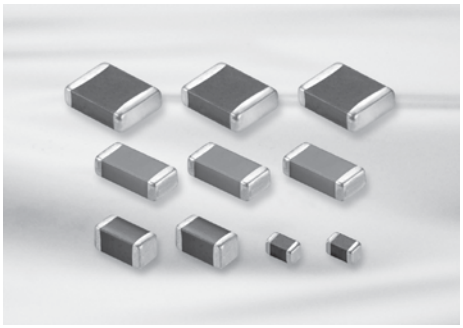
Symbol	EIA Code	Operation Temperature Range(℃)	Capacitance Change(△℃%)
A	X5R	−55 ~ + 85	±15
B	X7R	−55 ~ +125	±15
X	X6S	−55 ~ +105	±22
F	Y5V	−30 ~ + 85	−82 ~ +22
Y	X7S	−55 ~ +125	±22
Z	X7T	−55 ~ +125	−33 ~ +22

★★

Series	TC	Capacitance Step											
E-3	Y5V	1.0				2.2				4.7			
E-6	X5R X7R X6S X7S X7T	1.0		1.5		2.2		3.3		4.7		6.8	
E-12	C0G	1.0	1.2	1.5	1.8	2.2	2.7	3.3	3.9	4.7	5.6	6.8	8.2

★★★

Size	Code	Thickness(mm)	Spec(mm)	Size	Code	Thickness(mm)	Spec(mm)
01005(0402)	2	0.20	±0.02	1210(3225)	C	0.85	±0.10*
0201(0603)	3	0.30	±0.03		9	0.90	±0.10*
0402(1005)	3	0.30	±0.03*		F	1.25	±0.20
	5	0.50	±0.05		S	1.35	±0.15
0603(1608)	5	0.50	+0.0/−0.1*		H	1.60	±0.20
	8	0.80	±0.10		U	1.80	±0.20*
0805(2012)	A	0.65	±0.10		I	2.00	±0.20
	C	0.85	±0.10		J	2.50	±0.20
	C	0.85	±0.10*		V	2.50	±0.30
	M	1.15	±0.10	1808(4520)	F	1.25	±0.20
	F	1.25	±0.10		H	1.60	±0.20
	Q	1.25	±0.15		I	2.00	±0.20
	Y	1.25	±0.20	1812(4532)	F	1.25	±0.20
1206(3216)	C	0.85	±0.15		H	1.60	±0.20
	C	0.85	±0.10*		I	2.00	±0.20
	E	1.10	±0.15		J	2.50	±0.20
	E	1.10	±0.10*		L	3.20	±0.30
	P	1.15	±0.10*	2220(5750)	H	1.60	±0.20
	M	1.15	±0.15		I	2.00	±0.20
	F	1.25	±0.15		J	2.50	±0.20
	H	1.60	±0.20		L	3.00	±0.30



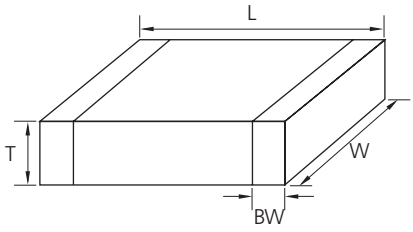
Feature

- Wide selection of size : from 0402 to 2220
- Highly reliable tolerance and high speed automatic chip placement on PCBs
- Wide capacitance range
- Wide temperature compensation and voltage range
  : from C0G to Y5V and from 6.3V to 50V
- Highly reliable performance
- Highly resistant termination metal
- Tape & reel for surface mount assembly

Application

- HHP, DSC, DVC, LCD, TV, Memory Module, PDA, Game Machine
- Desktop PC, Note PC, HHP, DC-DC Converter, DSC
- Tuner (Product code C is suitable.)

Structure and Dimensions

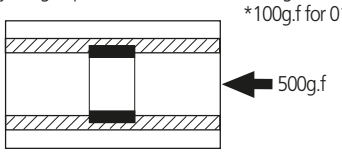
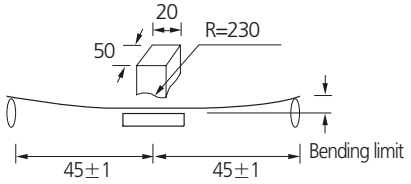


Size Code	EIA Code	Dimension(mm)				
		L	W	T	Thickness Code	BW
05	0402	1.00±0.05	0.50±0.05	0.50±0.05	5	0.25±0.10
10	0603	1.60±0.10	0.80±0.10	0.50+0.0/–0.1(*)	5	0.30±0.20
		1.60±0.10	0.80±0.10	0.80±0.10	8	
21	0805	2.00±0.10	1.25±0.10	0.85±0.10	C	0.5+0.2/–0.3
		2.00±0.10	1.25±0.10	1.15±0.10	M	
		2.00±0.10	1.25±0.10	1.25±0.10	F	
		2.00±0.15	1.25±0.15	1.25±0.15	Q	
		2.00±0.20	1.25±0.20	1.25±0.20	Y	
31	1206	3.20±0.20	1.60±0.20	0.60±0.10(*)	6	0.50±0.30
		3.20±0.15	1.60±0.15	0.85±0.15	C	
		3.20±0.20	1.60±0.20	0.85±0.10(*)	C	
		3.20±0.20	1.60±0.20	1.15±0.10(*)	P	
		3.20±0.15	1.60±0.15	1.25±0.15	F	
		3.20±0.20	1.60±0.20	1.60±0.20	H	
32	1210	3.20±0.30	2.50±0.20	0.85±0.10(*)	C	0.60±0.30
		3.20±0.30	2.50±0.20	0.90±0.10(*)	9	
		3.20±0.30	2.50±0.20	1.60±0.20	H	
		3.20±0.30	2.50±0.20	1.80±0.20(*)	U	
		3.20±0.30	2.50±0.20	2.00±0.20	I	
		3.20±0.30	2.50±0.20	2.50±0.20	J	
		3.20±0.40	2.50±0.30	2.50±0.30	V	
42	1808	4.50±0.40	2.00±0.20	1.25±0.20	F	0.80±0.30
		4.50±0.40	2.00±0.20	1.40±0.20	G	
		4.50±0.40	2.00±0.20	2.00±0.20	I	
43	1812	4.50±0.40	3.20±0.30	1.25±0.20	F	0.80±0.30
		4.50±0.40	3.20±0.30	2.50±0.20	J	
		4.50±0.40	3.20±0.30	3.20±0.30	L	
55	2220	5.70±0.40	5.00±0.40	2.50±0.20	J	1.00±0.30
		5.70±0.40	5.00±0.40	3.20±0.30	L	

Product Lineup (Standard & High Capacitors-X7R, X7S)

	Part Number	Size L x W (mm)	Capacitance	Rated Voltage (Vdc)	Capacitance Tolerance	Thickness Max.(mm)
1	CL05B151KB5NNN □	1.00×0.50	150pF	50	±10%	0.55
2	CL05B181KB5NNN □		180pF	50	±10%	0.55
3	CL05B221KB5NNN □		220pF	50	±10%	0.55
4	CL05B271KB5NNN □		270pF	50	±10%	0.55
5	CL05B331KB5NNN □		330pF	50	±10%	0.55
6	CL05B391KB5NNN □		390nF	50	±10%	0.55
7	CL05B471KB5NNN □		470pF	50	±10%	0.55
8	CL05B561KB5NNN □		560pF	50	±10%	0.55
9	CL05B681KB5NNN □		680pF	50	±10%	0.55
10	CL05B102KB5NNN □		1nF	50	±10%	0.55
11	CL05B122KB5NNN □		1.2nF	50	±10%	0.55
12	CL05B152KB5NNN □		1.5nF	50	±10%	0.55
13	CL05B182KB5NNN □		1.8nF	50	±10%	0.55
14	CL05B222KB5NNN □		2.2nF	50	±10%	0.55
15	CL05B272KB5NNN □		2.7nF	50	±10%	0.55
16	CL05B332KB5NNN □		3.3nF	50	±10%	0.55
17	CL05B472KB5NNN □		4.7nF	50	±10%	0.55
18	CL05B562KB5NNN □		5.6nF	50	±10%	0.55
19	CL05B682KB5NNN □		6.8nF	50	±10%	0.55
20	CL05B822KB5NNN □		8.2nF	50	±10%	0.55
21	CL05B103KB5NNN □		10nF	50	±10%	0.55
22	CL05B123KA5NNN □		12nF	25	±10%	0.55
23	CL05B153KA5NNN □		15nF	25	±10%	0.55
24	CL05B223KA5NNN □		22nF	25	±10%	0.55
25	CL05B273KO5NNN □		27nF	16	±10%	0.55
26	CL05B333KO5NNN □		33nF	16	±10%	0.55
27	CL05B393KO5NNN □		39nF	16	±10%	0.55
28	CL05B473KO5NNN □		47nF	16	±10%	0.55
29	CL05B563KO5NNN □		56nF	16	±10%	0.55
30	CL05B683KO5NNN □		68nF	16	±10%	0.55
31	CL05B823KO5NNN □		82nF	16	±10%	0.55
32	CL05B104KO5NNN □		100nF	16	±10%	0.55
33	CL05B224KO5NNN □		220nF	16	±10%	0.55
34	CL05B474KP5NNN □		470nF	10	±10%	0.55
35	CL05B105KQ5NQN □		1㎌	6.3	±10%	0.60
1	CL05Y474KP5NNN □	1.00×0.50	470nF	10	±10%	0.55
37	CL10B101KB8NNN □	1.60×0.80	100pF	50	±10%	0.90
38	CL10B121KB8NNN □		120pF	50	±10%	0.90
39	CL10B151KB8NNN □		150pF	50	±10%	0.90
40	CL10B181KB8NNN □		180pF	50	±10%	0.90
41	CL10B201KB8NNN □		200pF	50	±10%	0.90
42	CL10B221KB8NNN □		220pF	50	±10%	0.90
43	CL10B271KB8NNN □		270pF	50	±10%	0.90
44	CL10B331KB8NNN □		330pF	50	±10%	0.90
45	CL10B391KB8NNN □		390pF	50	±10%	0.90
46	CL10B471KB8NNN □		470pF	50	±10%	0.90
47	CL10B561KB8NNN □		560pF	50	±10%	0.90
48	CL10B681KB8NNN □		680pF	50	±10%	0.90
49	CL10B751KB8NNN □		750pF	50	±10%	0.90
50	CL10B821KB8NNN □		820pF	50	±10%	0.90
51	CL10B102KB8NNN □		1nF	50	±10%	0.90
52	CL10B122KB8NNN □		1.2nF	50	±10%	0.90

<table>
<tr><th>No</th><th colspan="2">Item</th><th>Performance</th><th>Test Condition</th></tr>
<tr><td>1</td><td colspan="2">Appearance</td><td>No abnormal exterior appearance</td><td>Visual Inspection through Microscope (x10)</td></tr>
<tr><td>2</td><td colspan="2">Insulation Resistance</td><td>10,000MΩ min. or 500MΩ · μF min. (or *100MΩ · μF) product whichever is smaller
(Rated voltage ≤16V:10,000MΩ min. or 100MΩ · μF min. product whichever is smaller)</td><td>Apply the rated voltage for 60~120 sec.
Rated voltage > 500V: Insulation Resistance shall be measured with 500 ± 50Vdc</td></tr>
<tr><td>3</td><td colspan="2">Withstanding Voltage</td><td>No dielectric breakdown or mechanical breakdown</td><td>Apply the specified voltage* for 1~5 sec.
Charge / Discharge current limit: 50mA max.
*CLASS I (Rated Voltage < 100V) : 300% of the rated Voltage
CLASS II (Rated Voltage < 100V) : 250% of the rated Voltage
In the case of Vr ≥ 100V products, following condition should be applied.
100V ≤ Rated Voltage < 500V : 200% of the rated Voltage
500V ≤ Rated Voltage < 1000V : 150% of the rated Voltage
Rated Voltage ≥ 1000V : 120% of the rated Voltage</td></tr>
<tr><td rowspan="2">4</td><td rowspan="2">Capacitance</td><td>CLASS I</td><td>Within the specified tolerance</td><td>Capacitance | Frequency | Voltage
≤1,000pF | 1MHz±10% | 0.5 ~ 5 Vrms
>1,000pF | 1KHz±10%</td></tr>
<tr><td>CLASS II</td><td>Within the specified tolerance</td><td>Capacitance | Frequency | Voltage
≤10μF | 1KHz±10% | 1.0±0.2 Vrms
>10μF | 120Hz±20% | 0.5±0.1Vrms
* | 1KHz±10% | 0.5±0.1Vrms
* A capacitor prior to measuring the capacitance is heat treated at 150℃+0/−10℃ and maintained in ambient air for 24±2 hours.</td></tr>
<tr><td rowspan="2">5</td><td>Q</td><td>CLASS I</td><td>Capacitance ≥ 30pF : Q ≥1,000
< 30pF : Q ≥400 +20 × C
(C : Capacitance)</td><td>Capacitance | Frequency | Voltage
≤1,000pF | 1MHz±10% | 0.5 ~ 5 Vrms
>1,000pF | 1KHz±10%</td></tr>
<tr><td>Tanδ</td><td>CLASS II</td><td>1. Characteristic : A(X5R)
Rated Voltage | Spec
50V/35V | 0.025 max / 0.05 max*
25V | 0.025 max / 0.05 max* / 0.10 max*
16V | 0.035 max / 0.05 max* / 0.10 max*
≤10V | 0.05 max / 0.10 max*
2. Characteristic : B(X7R), X(X6S), Y(X7S)
Rated Voltage | Spec
50V≥ / 35V / 25V | 0.025 max / 0.05 max* / 0.10 max*
16V | 0.035 max / 0.10 max*
≤10V | 0.05 max / 0.10 max*
3. Characteristic : F(Y5V)
Rated Voltage | Spec
50V / 35V / 25V | 0.05 max / 0.07 max* / 0.09 max*
16V | 0.07 max / 0.09 max* / 0.125 max*
10V | 0.125 max / 0.16 max*
≤6.3V | 0.16 max</td><td>Capacitance | Frequency | Voltage
≤10μF | 1KHz±10% | 1.0±0.2 Vrms
>10μF | 120Hz±20% | 0.5±0.1Vrms
* | 1KHz±10% | 0.5±0.1Vrms
You can check the specification at the web site or contact sales people for each product with mark*</td></tr>
</table>

<table>
<tr><th>No</th><th colspan="2">Item</th><th>Performance</th><th>Test Condition</th></tr>
<tr><td rowspan="2">6</td><td rowspan="2">Temperature Characteristics of Capacitance</td><td>CLASS I</td><td><table><tr><td>Characteristic</td><td>Temp.Coefficient(PPM/℃)</td></tr><tr><td>C</td><td>0±30</td></tr></table></td><td>Capacitance shall be measured by the steps shown in the following table.<table><tr><td>Step</td><td>Temperature(℃)</td></tr><tr><td>1</td><td>25±2</td></tr><tr><td>2</td><td>Min. Operating Temp. ±2</td></tr><tr><td>3</td><td>25±2</td></tr><tr><td>4</td><td>Max. Operating Temp. ±2</td></tr><tr><td>5</td><td>25±2</td></tr></table>(1) CLASS I
Temperature Coefficient shall be calculated from the formula as below
$\text{Temp. Coefficient} = \frac{C2-C1}{C1\times\triangle T}\times 10^6 [\text{ppm/℃}]$
C1: Capacitance at step 3
C2: Capacitance at 125℃
△T: 100℃ (=125℃−25℃)
(2) CLASS II
Capacitance Change shall be calculated from the formula as below
$\triangle C = \frac{C2-C1}{C1}\times 100(\%)$
C1: Capacitance at step 3
C2: Capacitance at step 2 or 4</td></tr>
<tr><td>CLASS II</td><td><table><tr><td>Characteristic</td><td>Capacitance Change(%) with No bias</td></tr><tr><td>A(X5R)/ B(X7R)</td><td>±15%</td></tr><tr><td>X(X6S), Y(X7S)</td><td>±22%</td></tr><tr><td>Z(X7T)</td><td>+22%~−33%</td></tr><tr><td>F(Y5V)</td><td>+22%~−82%</td></tr></table></td></tr>
<tr><td>7</td><td colspan="2">Adhesive Strength of Termination</td><td>No indication of peeling shall occur on the terminal electrode</td><td>Apply 500g.f* pressure for 10±1 sec. *200g.f for 0201
*100g.f for 01005
  </td></tr>
<tr><td rowspan="4">8</td><td rowspan="4">Bending Strength</td><td>Appearance</td><td colspan="3">No indication of peeling shall occur</td><td rowspan="4">• Bending Limit: 1mm • Test Speed: 1.0mm/sec.
• Keep the test board at the limit point in 5 sec.
• Then Measure Capacitance
  </td></tr>
<tr><td rowspan="3">Capacitance</td><td colspan="2">Characteristic</td><td>Capacitance Change</td></tr>
<tr><td colspan="2">CLASS I</td><td>±5% or ± 0.5 pF whichever is larger</td></tr>
<tr><td rowspan="2">CLASS II</td><td>A(X5R), B(X7R), X(X6S), Y(X7S) Z(X7T)</td><td>±12.5%</td></tr>
<tr><td>F(Y5V)</td><td>±30%</td></tr>
<tr><td>9</td><td colspan="2">Solderability</td><td>More than 75% of the terminal surface is to be soldered newly, so metal part does not come out or dissolve
  </td><td><table><tr><td>Solder</td><td>Sn−3Ag−0.5Cu</td></tr><tr><td>Solder Temp.</td><td>245±5℃</td></tr><tr><td>Flux</td><td>RMA Type</td></tr><tr><td>Dip time</td><td>3±0.3 sec.</td></tr><tr><td>Pre-heating</td><td>at 80~120℃ for 10~30 sec.</td></tr></table></td></tr>
<tr><td rowspan="6">10</td><td rowspan="6">Resistance to Soldering Heat</td><td>Appearance</td><td colspan="3">No mechanical damage shall occur</td><td rowspan="6">Solder temperature: 270±5℃ DIP TIME:10±1 sec.
Each termination shall be fully immersed and preheated as below:<table><tr><td>Step</td><td>Temperature(℃)</td><td>Time (sec.)</td></tr><tr><td>1</td><td>80~100</td><td>60</td></tr><tr><td>2</td><td>150~180</td><td>60</td></tr></table>
Leave the capacitor in ambient condition for specified time* before measurement
*24 ± 2 hours(CLASS I)
24 ± 2 hours(CLASS II)</td></tr>
<tr><td rowspan="3">Capacitance</td><td colspan="2">Characteristic</td><td>Capacitance Change</td></tr>
<tr><td colspan="2">CLASS I</td><td>±2.5% or ± 0.25 pF whichever is larger</td></tr>
<tr><td rowspan="2">CLASS II</td><td>A(X5R), B(X7R), X(X6S), Y(X7S) Z(X7T)</td><td>±7.5%</td></tr>
<tr><td>F(Y5V)</td><td>±20%</td></tr>
<tr><td>Q (CLASS I)</td><td colspan="3">Within the specified initial value</td></tr>
<tr><td>Tanδ (CLASS II)</td><td colspan="3">Within the specified initial value</td></tr>
<tr><td>Insulation resistance</td><td colspan="3">Within the specified initial value</td></tr>
<tr><td>Withstanding voltage</td><td colspan="3">Within the specified initial value</td></tr>
</table>

No	Item		Performance			Test Condition
11	Vibration Test	Appearance	No mechanical damage shall occur			The capacitor shall be subjected to a harmonic motion having a total amplitude of 1.5mm changing frequency from 10Hz to 55Hz and back to 10Hz in about 1 min. Repeat this for 2hours each in 3 mutually perpendicular directions.
		Capacitance	Characteristic		Capacitance Change	
			CLASS I		±2.5% or ± 0.25 pF whichever is larger	
			CLASS II	A(X5R), B(X7R)	±5%	
				X(X6S), Y(X7S) Z(X7T)	±10%	
				F(Y5V)	±20%	
		Q (CLASS I)	Within the specified initial value			
		Tanδ (CLASS II)	Within the specified initial value			
		Insulation resistance	Within the specified initial value			
12	Moisture Resistance	Appearance	No mechanical damage shall occur			Applied Voltage: rated voltage Temperature: 40±2℃ Humidity: 90~95% RH Duration Time: 500+12/–0 Hr. Charge/Discharge Current: 50㎃ max. Perform the initial measurement according to Note1. Perform the final measurement according to Note2. This test is only applied to Vr≤500V products. You can check the specification at the web site or contact sales people for each product with mark*
		Capacitance	Characteristic		Capacitance Change	
			CLASS I		±7.5% or ± 0.75pF whichever is larger	
			CLASS II	A(X5R), B(X7R), X(X6S), Y(X7S) Z(X7T)	±12.5%	
				F(Y5V)	±30%	
		Q (CLASS I)	Capacitance ≥ 30pF : Q≥200 < 30pF : Q≥100+10/3×C (C: Capacitance)			
		Tanδ (CLASS II)	1. Capacitance: A(X5R) 0.05 max / 0.075 max* (35V / 50V) 0.05 max / 0.075 max* / 0.125 max*(16V / 25V) 0.075 max / 0.125 max* (≤10V) 2. Capacitance: B(X7R), X(X6S) 0.05 max / 0.125 max* (16V / 25V / 35V / 50V≥) 0.075 max / 0.125 max* (≤10V) 3. Capacitance: F(Y5V) 0.09 max (50V) 0.09 max / 0.125 max* (25V / 35V) 0.09 max / 0.125 max* / 0.16 max* (16V) 0.16 max / 0.195 max* (10V) 0.195 max (4V / 6.3V)			
		Insulation resistance	500MΩ min. or 25MΩ·㎌ min. product whichever is smaller / 12.5MΩ·㎌ or over*			
13	High Temperature Resistance	Appearance	No mechanical damage shall occur			Temperature : max. operating temperature Duration Time: 1000+48/–0 Hr. Charge/Discharge Current: 50㎃ max. Vr≤200V : 200% of the rated Voltage 250V≤Vr≤500V: 150% of the rated Voltage Vr=630V : 120% of the rated Voltage 1000V≤Vr≤3000V: 100% of the rated Voltage * : 150% or 100% of the rated Voltage Perform the initial measurement according to Note1 for class II Perform the final measurement according to Note2. You can check the specification at the web site or contact sales people for each product with mark*
		Capacitance	Characteristic		Capacitance Change	
			CLASS I		±3% or ± 0.3 pF whichever is larger	
			CLASS II	A(X5R), B(X7R), X(X6S), Y(X7S) Z(X7T)	±12.5%	
				F(Y5V)	±30%	
		Q (CLASS I)	Capacitance≥30pF : Q≥350 10≤Capacitance< 30pF : Q≥275+2.5×C Capacitance< 10pF : Q≥200+10×C (C: Capacitance)			
		Tanδ (CLASS II)	1. Capacitance : A(X5R) 0.05 max / 0.075 max* (35V / 50V) 0.05 max / 0.075 max* / 0.125 max*(16V / 25V) 0.075 max / 0.125 max* (≤10V) 2. Capacitance : B(X7R), X(X6S) 0.05 max / 0.125 max* (16V / 25V / 35V / 50V≥) 0.075 max / 0.125 max* (≤10V) 3. Capacitance : F(Y5V) 0.09 max (50V) 0.09 max / 0.125 max* (25V / 35V) 0.09 max / 0.125 max* / 0.16 max* (16V) 0.16 max / 0.195 max* (10V) 0.195 max (4V / 6.3V)			
		Insulation resistance	1,000MΩ min. or 50MΩ·㎌ min. product whichever is smaller / 25MΩ·㎌ or over*			

No	Item		Performance			Test Condition
14	Temperature Cycle	Appearance	No mechanical damage shall occur			Capacitor shall be subjected to 5 cycles. Condition for 1 cycle:
		Capacitance	Characteristic		Capacitance Change	
			CLASS I		±2.5% or ±0.25pF whichever is larger	
			CLASS II	A(X5R), B(X7R)	±7.5%	
				X(X6S), Y(X7S) Z(X7T)	±15%	
				F(Y5V)	±20%	
		Q (CLASS I)	Within the specified initial value			
		Tanδ (CLASS II)	Within the specified initial value			
		Insulation resistance	Within the specified initial value			

Step	Temperature(℃)	Time(min.)
1	min. operating temperature +0/–3	30
2	25	2~3
3	max. operating temperature +0/–3	30
4	25	2~3

Leave the capacitor in ambient condition for specified time* before measurenment
*24 ±2 hours(CLASS I)
24 ±2 hours(CLASS II)

No	Recommended Soldering Method					
15	Recommended Soldering Method By Size & Capacitance	Size inch(mm)	Temperature Characteristic	Capacitance	Condition	
					Flow	Reflow
		01005(0402)	–	–	–	○
		0201 (0603)				
		0402 (1005)				
		0603(1608)	Class I	–	○	○
			Class II	C <1 μF	○	○
				C ≥1 μF	–	○
		0805 (2012)	Class I	–	○	○
			Class II	C <4.7 μF	○	○
				C ≥4.7 μF	–	○
			Array	–	–	○
		1206 (3216)	Class I	–	○	○
			Class II	C <10 μF	○	○
				C ≥10 μF	–	○
			Array	–	–	○
		1210 (3225)	–	–	–	○
		1808 (4520)				○
		1812 (4532)				○
		2220 (5750)				○

Note 1. Initial Measurement For Class II

Perform the heat treatment at 150℃ +0/–10℃ for 1 hour. Then Leave the capacitor in ambient condition for 24 ±2 hours before measurement. Then perform the measurement.

Note 2. Latter Measurement

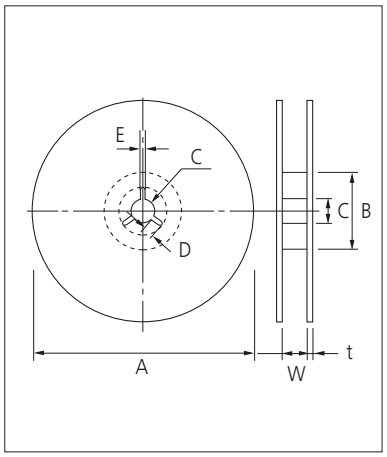
1. CLASS I
Leave the capacitor in ambient condition for 24 ±2 hours before measurement. Then perform the measurement.

2. CLASS II
Perform the heat treatment at 150℃+0/–10℃ for 1 hour. Then Leave the capacitor in ambient condition for 24 ±2 hours before measurement. Then perform the measurement.

Note 3. All Size in Reliability Test Condition Section is "inch"

Note 4. Camera Strobe Circuit Capacitors Should be Following a Special Reliability Test Condition.
Please check with our sales representatives or product engineers.

Reel Dimensions



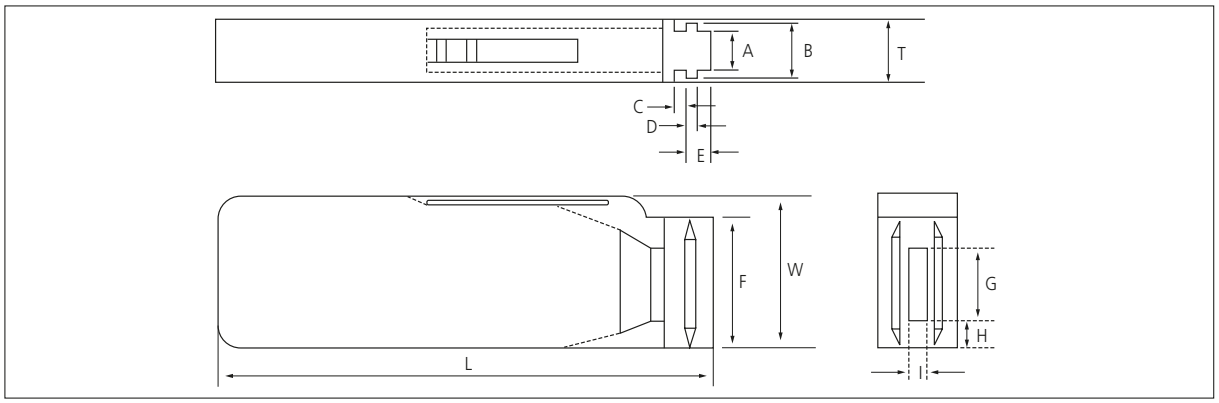
Unit: mm

Symbol	Tape Width	A	B	C	D
7" Reel	8mm	Ø180+0/–3	Ø60±1.0	Ø13±0.3	4±0.2
	12mm	Ø180+0/–3	Ø60+1/–0	Ø13±0.3	4±0.2
10" Reel	8mm	Ø258+0/–3	Ø80+1/–0	Ø13±0.3	4±0.2
	12mm	Ø258+0/–3	Ø80+1/–0	Ø13±0.3	4±0.2
13" Reel	8mm	Ø330±2.0	Ø80±1.0	Ø13±0.3	4±0.2
	12mm	Ø330±2.0	Ø80±1.0	Ø13±0.3	4±0.2

Symbol	Tape Width	E	W	t
7" Reel	8mm	2.0±0.5	9±0.5	1.2±0.2
	12mm	2.0±0.5	13±0.5	1.2±0.2
10" Reel	8mm	2.0±0.5	9±0.5	1.8±0.2
	12mm	2.0±0.5	13±0.5	1.8±0.2
13" Reel	8mm	2.0±0.5	9±0.5	2.2±0.2
	12mm	2.0±0.5	13±0.5	2.2±0.2

Bulk Case Packaging

- Bulk case packaging can reduce the stock space and transportation costs.
- The bulk feeding system can increase the productivity.
- It can eliminate the components loss.



Unit: mm

Symbol	A	B	T	C	D	E
Dimension	6.8±0.1	8.8±0.1	12±0.1	1.5+0.1/–0	2+0/–0.1	3.0+0.2/–0

Symbol	F	W	G	H	L	I
Dimension	31.5+0.2/–0	36+0/–0.2	19±0.35	7±0.35	110±0.7	5±0.35

• **QUANTITY**

Unit: inch(mm) and pcs

Size	0402(1005)	0603(1608)	0805(2012)	
			T≤0.85mm	T≥1.0mm
Quantity	50,000	10,000 or 15,000	10,000	5,000

1.Storage of products

1-1. Storage Environment
Tape packing materials are designed to withstand long-term storage, but they will degrade more rapidly in the presence of high temperature or high humidity, Therefore, the products must be stored in an ambient 5~40℃ with a relative humidity of 20~70%. Allowable storage period is within 6 months from the outgoing date of delivery.

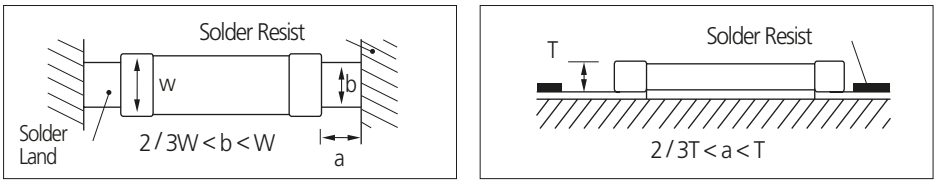
1-2. Corrosive Gases
Since sulfur and chlorine may degrade the solderability of the end termination, it is important to store the capacitors in an environment free of these gases

1-3. Temperature Fluctuations
Since dew condensation may occur by the differences in temperature when the products are taken out of storage, it is important to maintain a temperature-controlled environment.

2.Design of Solder Land Pattern

When designing printed circuit boards, the shape and size of the solder lands must allow for the proper amount of solder on the capacitor. The amount of solder at the end terminations has a direct effect on the probability that the chip will crack. The greater amount of solder, the larger amount of stress on the chip, and the more likely that it will break. Use the following illustrations as guidelines for proper Solder land design.

Recommendation of solder Land Shape and Size

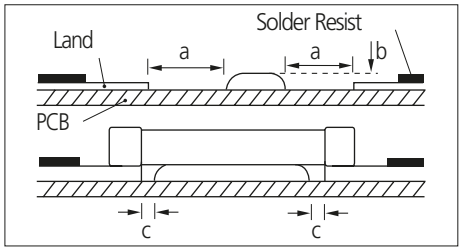


3.Adhesives

MLCCs generally require the use of an adhesive to position the chips to the circuit board prior to soldering.

3-1. Requirements for Adhesives
They must have enough adhesion so that the chips will not fall off or move during the handling of the circuit board.
They must maintain their adhesive strength when exposed to soldering temperatures.
They should not spread or run when applied to the circuit board.
They should have a long pot life.
They should harden quickly.
They should not corrode the circuit board or chip material.
They should be a good insulator.
They should be non-toxic, and not produce harmful gases, nor be harmful when touched.

3-2. Application Method
It is important to use the proper amount of adhesive. Too little will cause poor adhesion to the circuit board, and too much may strain theconductor pattern, thereby causing defective soldering. The following illustrations show the proper quantity of adhesive.



Unit: mm

Type	21	31
a	0.2min	0.2min
b	70~100 μm	70~100 μm
c	>0	>0

3-3. Adhesive hardening Characteristics
To prevent oxidation of the terminations, the adhesive must harden at 160℃ or less, within 2 minutes or less.