APPROVAL SHEET

MULTILAYER CERAMIC CAPACITORS

High Capacitance Series

0402 to 1812 Sizes

X7R, X5R, X6S & Y5V Dielectrics

RoHS Compliance

*Contents in this sheet are subject to change without prior notice.

1. DESCRIPTION

MLCC consists of a conducting material and electrodes. To manufacture a chip-type SMT and achieve miniaturization, high density and high efficiency, ceramic condensers are used.

WTC high capacitance MLCC offers low ESR and excellent frequency characteristics to be suited for coupling and decoupling applications in circuit. The high dielectric constant material X7R, X5R and Y5V are used for this series product.

2. FEATURES

a. Small size with high capacitance.
b. Capacitor with lead-free termination (pure Tin).

3. APPLICATIONS

a. Digital circuit coupling or decoupling applications.
b. For high frequency and high-density type power suppliers.
c. For bypassing.

4. HOW TO ORDER

1206	F	106	Z	100	C	T
Size	**Dielectric**	**Capacitance**	**Tolerance**	**Rated voltage**	**Termination**	**Packaging**
Inch (mm) **0402** (1005) **0603** (1608) **0805** (2012) **1206** (3216) **1210** (3225) **1812** (4532)	**B**=X7R **X**=X5R **S**=X6S **F**=Y5V	Two significant digits followed by no. of zeros. And R is in place of decimal point. eg.: 106=10x10^6 =10μF	**K**=±10% **M**=±20% **Z**=-20/+80%	Two significant digits followed by no. of zeros. And R is in place of decimal point. **6R3**=6.3 VDC **100**=10 VDC **160**=16 VDC **250**=25 VDC **500**=50 VDC **101**=100 VDC	**C**=Cu/Ni/Sn	**T**=7” reeled **G**=13” reeled

5. EXTERNAL DIMENSIONS

Size Inch (mm)	L (mm)	W (mm)	T (mm)/Symbol		Remark	M_B (mm)
0402 (1005)	1.00±0.05	0.50±0.05	0.50±0.05	N	#	0.25 +0.05/-0.10
	1.00±0.20	0.50±0.20	0.50±0.20	E		
0603 (1608)	1.60±0.10	0.80±0.10	0.80±0.07	S		0.40±0.15
	1.60+0.15/-0.10	0.80+0.15/-0.10	0.80+0.15/-0.10	X		
	1.60±0.20*1	0.80±0.20*1	0.80±0.20*1			
0805 (2012)	2.00±0.15	1.25±0.10	0.80±0.10	B		0.50±0.20
			1.25±0.10	D	#	
	2.00±0.20	1.25±0.20	1.25±0.20	I	#	
1206 (3216)	3.20±0.15	1.60±0.15	0.95±0.10	C	#	0.60±0.20
			1.25±0.10	D	#	
	3.20±0.20		1.15±0.15	J	#	
		1.60±0.20	1.60±0.20	G	#	
	3.20+0.30/-0.10	1.60+0.30/-0.10	1.60+0.30/-0.10	P	#	
1210 (3225)	3.20±0.30	2.50±0.20	0.95±0.10	C	#	0.75±0.25
			1.25±0.10	D	#	
	3.20±0.40	2.50±0.30	1.60±0.20	G	#	
			2.00±0.20	K	#	
			2.50±0.30	M	#	
1812 (4532)	4.50±0.40	3.20±0.30	1.25±0.10	D	#	0.75±0.25
			2.00±0.20	K	#	
	4.50±0.40	3.20±0.40	2.50±0.30	M	#	
			2.80±0.30	U	#	

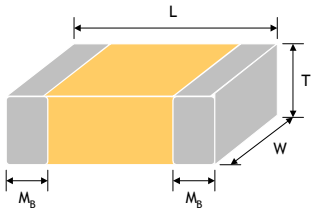


Fig. 1 The outline of MLCC

Reflow soldering only is recommended.

*1 : For 0603/Cap≧10μF products

6. GENERAL ELECTRICAL DATA

Dielectric	X7R	X5R	X6S	Y5V
Size	0402, 0603, 0805, 1206, 1210, 1812			
Capacitance range*	0.56μF to 47μF	0.027μF to 100μF	0.47μF to 100μF	1μF to 100μF
Capacitance tolerance**	K (±10%), M (±20%)			Z (-20/+80%)
Rated voltage (WVDC)	6.3V, 10V, 16V, 25V, 50V, 100V			
DF(Tan δ)*	Note 1			
Operating temperature	-55 to +125°C	-55 to +85°C	-55 to +105°C	-25 to +85°C
Capacitance characteristic	±15%		±22%	+30/-80%
Termination	Ni/Sn (lead-free termination)			

* Measured at 1.0±0.2Vrms, 1.0kHz±10% for C≤10μF; 0.5±0.2Vrms, 120Hz±20% for C>10μF, 30~70% related humidity, 25°C ambient temperature for X7R, X5R and at 20°C for Y5V.

** Preconditioning for Class II MLCC: Perform a heat treatment at 150±10°C for 1 hour, then leave in ambient condition for 24±2 hours before measurement.

Note 1:

X7R/X5R/X6S

Rated vo	D.F. ≦	Exception of D.F.≦	
≧100V	≦2.5%	≦3%	1206≧0.47μF
		≦5%	0805＞0.1μF, 0603≧0.068μF
50V	≦2.5%	≦3%	0201(50V); 0603≧0.047μF; 0805≧0.18μF;1206≧0.47μF
		≦5%	1210≧4.7μF
		≦10%	0402≧0.1μF ;0603≧1μF;0805≧1μF;1206≧2.2μF; 1210≧10μF;TT series
35V	≦3.5%	≦10%	0603≧1μF;0805≥2.2μF; 1210≧10μF
25V	≦3.5%	≦5%	0201≧0.01μF;0805≧1μF; 1210≧10μF
		≦7%	0603≧0.33μF; 1206≧4.7μF
		≦10%	0402≧0.10μF;0603≧0.47μF; 0805≧2.2μF; 1206≧6.8μF ; 1210≧22μF ; TT series
		≦12.5%	0402≧1μF
16V	≦3.5%	≦5%	0201≧0.01μF;0402≧0.033μF; 0603≧0.15μF; 0805≧0.68μ 1206≧2.2μF;1210≧4.7μF
		≦10%	0201≧0.1μF;0402≧ 0.22uF; 0603≧0.68μF;0805≧2.2μF; 1206≧4.7μF; 1210≧22μF; TT series
10V	≦5%	≦10%	0201≧0.012μF;0402≧0.33μF;0603≧0.33μF; 0805≧2.2μF; 1206≧2.2μF;1210≧22μF; TT series
		≦15%	0201≧0.1μF; 0402≧1μF
6.3V	≦10%	≦15%	0201≧0.1μF;0402≧1μF;0603≧10μF; 0805≧4.7μF; 1206≧47μF :1210≧100μF; TT series
		≦20%	0402≧2.2μF
4V	≦15%	---	---

Y5V

Rated vol.	D.F.≦	Exception of D.F.≦	
≧50V	5%	7%	0603≧0.1μF; 0805≧0.47μF; 1206≧4.7μF
35V	7%	---	---
25V	5%	7%	0402≧0.047μF;0603≧0.1μF; 0805≧0.33μF;1206≧1μF; 1210≧4.7μF
		9%	0402≧0.068μF;0603≧0.47μF; 1206≧4.7μF; 1210≧22μF
16V (C<1.0μF)	7%	9%	0402≧0.068μF; 0603≧0.68μF
		12.5%	0402≧0.22μF
16V (C≧1.0μF)	9%	12.5%	0603≧2.2μF; 0805≧3.3μF; 1206≧10μF; 1210≧22μF; 1812≧47μF
10V	12.5%	20%	0402≧0.47μF
6.3V	20%	---	---

7. CAPACITANCE RANGE

7-1 X7R Dielectric

DIELECTRIC		X7R														
SIZE		0603					0805					1206					
Rated Voltage (VDC)		6.3	10	16	25	50	6.3	10	16	25	50	6.3	10	16	25	50	100
Capacitance	0.56μF (564)	X	X	X													
	0.68μF (684)	X	X	X													
	0.82μF (824)	X	X	X													
	1.0μF (105)	X	X	X	X	X		D	D	D	I		J	J	J	P	P
	1.5μF (155)							I	I	I		J	J	J	P		
	2.2μF (225)		X				I	I	I	I	I	J	J	J	P	P	
	3.3μF (335)											P	P	P	P		
	4.7μF (475)						I	I	I	I		P	P	P	P	P	
	6.8μF (685)																
	10μF (106)						I	I	I			P	P	P	P		
	22μF (226)											P	P				
	47μF (476)																

The letter in cell is expressed the symbol of product thickness.

DIELECTRIC		X7R										
SIZE		1210						1812				
Rated Voltage (VDC)		10	16	25	35	50	100	10	16	25	50	100
Capacitance	0.56μF (564)											
	0.68μF (684)											
	0.82μF (824)											
	1.0μF (105)	D	D	D		D	K	D	D	D	K	K
	1.5μF (155)						M					K
	2.2μF (225)		K	G			M				M	M
	3.3μF (335)			G								
	4.7μF (475)	K	K	K		M						
	6.8μF (685)											
	10μF (106)	K	K	K	M	M						
	22μF (226)	M	M	M								
	47μF (476)	M										

The letter in cell is expressed the symbol of product thickness.

7-2 X5R Dielectric

Dielectric		X5R																									
Size		0402					0603					0805					1206					1210					
Rated Voltage (VDC)		6.3	10	16	25	50	6.3	10	16	25	50	6.3	10	16	25	50	6.3	10	16	25	50	4	6.3	10	16	25	50
Capacitance	0.027μF (273)			N																							
	0.033μF (333)			N																							
	0.039μF (393)			N																							
	0.047μF (473)			N																							
	0.056μF (563)		N	N																							
	0.068μF (683)		N	N																							
	0.082μF (823)	N	N	N																							
	0.10μF (104)	N	N	N	N	N																					
	0.15μF (154)	N	N	N	N																						
	0.22μF (224)	N	N	N	N	N			X	X																	
	0.27uF (274)							X	X	X																	
	0.33μF (334)	N	N				X	X	X	X																	
	0.39μF (394)							X	X	X																	
	0.47μF (474)	N	N		E	E		X	X	X	X																
	0.68μF (684)	N	N				X	X	X	X																	
	0.82uF (824)						X	X	X																		
	1.0μF (105)	N	N	N	N		X	X	X	X	X		D	D	D	I											
	1.5μF (155)						X					I	I	I	I			J	J					K	K		
	2.2μF (225)	N	N	E			X	X	X	X		I	I	I	I	I		J	J	P				K	K		
	3.3μF (335)						X	X				I	I	I	I			P	P	P							
	4.7μF (475)	E	E				X	X	X			I	I	I	I	I	P	P	P	P	P			K	K	K	
	6.8uF (685)																P	P									
	10μF (106)	E					X	X	X			I	I	I	I		P	P	P	P			K	K	K	K	M
	22μF (226)						X					I	I	I			P	P	P	P			M	M	M	M	
	47μF (476)											I					P	P					M	M	M		
	100μF (107)																P						M	M			
	220μF (227)																										

The letter in cell is expressed the symbol of product thickness.

7-3 X6S Dielectric

Dielectric		X6S																									
Size		0402					0603					0805					1206					1210					
Rated Voltage (VDC)		6.3	10	16	25	4	6.3	10	25	50	4	6.3	16	25	50	6.3	10	16	25	50	6.3	10	16	25	50	
Capacitance	0.10μF (104)																										
	0.15μF (154)																										
	0.22μF (224)																										
	0.33μF (334)																										
	0.47μF (474)	N																									
	0.68μF (684)																										
	1.0μF (105)	N																									
	1.5μF (155)																										
	2.2μF (225)	N	E																								
	3.3μF (335)																										
	4.7μF (475)						X							I													
	6.8uF (685)																										
	10μF (106)						X	X			I	I								G							
	22μF (226)					X						I						P	P								
	47μF (476)															P											
	100μF (107)																				M						

The letter in cell is expressed the symbol of product thickness.

7-4 Y5V Dielectric

DIELECTRIC		Y5V										
SIZE		0402		0603				0805				
RATED VOLTAGE (VDC)		63	10	63	10	16	25	6.3	10	16	25	50
Capacitance	1.0μF (105)	N	N		S	X	X		B	B	D	D
	1.5μF (155)				S				D	D		
	2.2μF (225)			S	S	X			D	D	I	
	3.3μF (335)								D	D		
	4.7μF (475)			X	X				D	D	I	
	6.8μF (685)								I			
	10μF (106)							I	I	I		
	22μF (226)							I	I			

DIELECTRIC		Y5V															
SIZE		1206						1210						1812				
RATED VOLTAGE (VDC)		6.3	10	16	25	35	50	6.3	10	16	25	35	50	10	16	25	50	100
Capacitance	1.0μF (105)		C	C	C		C		C	C	C		C	D	D	D	D	D
	1.5μF (155)		C	C	C				C	C	C			D	D	D	D	
	2.2μF (225)		C	C	C		J		C	C	C		G	D	D	D	D	
	3.3μF (335)		J	J	J				C	C	C			D	D	D	D	
	4.7μF (475)		J	J	J	J	P		C	C	D		G	D	D	D	D	
	6.8μF (685)		J	J					C	C	D			D	D	D	D	
	10μF (106)		J	J	P				D	D	G	K		D	D	D	K	
	22μF (226)		P	P					K	K								
	47μF (476)	P						K	K						M			
	100μF (107)							M										

The letter in cell is expressed the symbol of product thickness.

8. PACKAGING STYLE AND QUANTITY

Size	Thickness (mm)/Symbol		Paper tape		Plastic tape	
			7" reel	13" reel	7" reel	13" reel
0402 (1005)	0.50±0.05	N	10k	50k	-	-
	0.50±0.20	E	10k	-	-	-
0603 (1608)	0.80±0.07	S	4k	15k	-	-
	0.80±0.20	X	4k	15k	-	-
0805 (2012)	0.80±0.10	B	4k	15k	-	-
	1.25±0.10	D	-	-	3k	10k
	1.25±0.20	I	-	-	3k	10k
1206 (3216)	0.95±0.10	C	-	-	3k	10k
	1.15±0.15	J	-	-	3k	10K
	1.25±0.10	D	-	-	3k	10k
	1.60±0.20	G	-	-	2k	10k
	1.60+0.30/-0.10	P	-	-	2k	9k
1210 (3225)	0.95±0.10	C	-	-	3k	10k
	1.25±0.10	D	-	-	3k	10k
	1.60±0.20	G	-	-	2k	-
	2.00±0.20	K	-	-	1k	6k
	2.50±0.30	M	-	-	1k	6k
1812 (4532)	1.25±0.10	D	-	-	1k	5k
	2.00±0.20	K	-	-	1k	-
	2.50±0.30	M	-	-	0.5k	3k
	2.80±0.30	U	-	-	0.5k	-

Unit: pieces

9. RELIABILITY TEST CONDITIONS AND REQUIREMENTS

<table>
<tr><th>No.</th><th>Item</th><th>Test Condition</th><th>Requirements</th></tr>
<tr><td>1.</td><td>Visual and Mechanical</td><td>---</td><td>* No remarkable defect.
* Dimensions to conform to individual specification sheet.</td></tr>
<tr><td>2.</td><td>Capacitance</td><td rowspan="2">Class I: NP0
Cap≤1000pF 1.0±0.2Vrms, 1MHz±10%
Cap>1000pF 1.0±0.2Vrms, 1KHz±10%

Class II: X7R, X5R, X6S,Y5V
Cap≤10μF, 1.0±0.2Vrms, 1kHz±10% **
Cap>10μF, 0.5±0.2Vrms, 120Hz±20%

** Test condition: 0.5±0.2Vrms，1KHz±10%
X7R: 0603≧225(10V),
0805=106(6.3V&10V)
X5R: 01R5≧103, 0201≧224 (6.3V,10V),
0402≧475 (6.3V), 0402≧225(10V),
0603=106 (6.3V,10V),
TT18X≧475(10V) , TT15X series
X6S:0201≧224 (6.3V),0402≧225 (6.3V)
0603≧106 (6.3V),</td><td>* Shall not exceed the limits given in the detailed spec.</td></tr>
<tr><td>3.</td><td>Q/ D.F. (Dissipation Factor)</td><td>NP0: Cap≥30pF, Q≥1000; Cap<30pF,Q≥400+20C
X7R,X5R,X6S:
<table>
<tr><th>Rated v</th><th>D.F. ≦</th><th>Exception of D.F.≦</th><th></th></tr>
<tr><td rowspan="2">≧100V</td><td rowspan="2">≦2.5%</td><td>≦3%</td><td>1206≧0.47μF</td></tr>
<tr><td>≦5%</td><td>0805＞0.1μF, 0603≧0.068μF</td></tr>
<tr><td rowspan="3">50V</td><td rowspan="3">≦2.5%</td><td>≦3%</td><td>0201(50V); 0603≧0.047μF; 0805≧0.18μF;1206≧0.47μF</td></tr>
<tr><td>≦5%</td><td>1210≧4.7μF</td></tr>
<tr><td>≦10%</td><td>0402≧0.1μF ;0603≧1μF;0805≧1μF;1206≧2.2μF;
1210≧10μF;TT series</td></tr>
<tr><td>35V</td><td>≦3.5%</td><td>≦10%</td><td>0603≧1μF;0805≧2.2μF; 1210≧10μF</td></tr>
<tr><td rowspan="4">25V</td><td rowspan="4">≦3.5%</td><td>≦5%</td><td>0201≧0.01μF;0805≧1μF; 1210≧10μF</td></tr>
<tr><td>≦7%</td><td>0603≧0.33μF; 1206≧4.7μF</td></tr>
<tr><td>≦10%</td><td>0402≧0.10μF;0603≧0.47μF; 0805≧2.2μF;
1206≧6.8μF ; 1210≧22μF ; TT series</td></tr>
<tr><td>≦12.5%</td><td>0402≧1μF</td></tr>
<tr><td rowspan="2">16V</td><td rowspan="2">≦3.5%</td><td>≦5%</td><td>0201≧0.01μF;0402≧0.033μF; 0603≧0.15μF; 0805≧0.68μ
1206≧2.2μF;1210≧4.7μF</td></tr>
<tr><td>≦10%</td><td>0201≧0.1μF;0402≧ 0.22uF; 0603≧0.68μF;0805≧2.2μF;
1206≧4.7μF; 1210≧22μF; TT series</td></tr>
<tr><td rowspan="2">10V</td><td rowspan="2">≦5%</td><td>≦10%</td><td>0201≧0.012μF;0402≧0.33μF;0603≧0.33μF; 0805≧2.2μF;
1206≧2.2μF;1210≧22μF; TT series</td></tr>
<tr><td>≦15%</td><td>0201≧0.1μF; 0402≧1μF</td></tr>
<tr><td rowspan="2">6.3V</td><td rowspan="2">≦10%</td><td>≦15%</td><td>0201≧0.1μF;0402≧1μF;0603≧10μF; 0805≧4.7μF;
1206≧47μF :1210≧100μF; TT series</td></tr>
<tr><td>≦20%</td><td>0402≧2.2μF</td></tr>
<tr><td>4V</td><td>≦15%</td><td>---</td><td>---</td></tr>
</table>
Y5V:
<table>
<tr><th>Rated vol.</th><th>D.F.≦</th><th>Exception of D.F.≦</th><th></th></tr>
<tr><td>≧50V</td><td>5%</td><td>7%</td><td>0603≧0.1μF; 0805≧0.47μF;
1206≧4.7μF</td></tr>
<tr><td>35V</td><td>7%</td><td>---</td><td>---</td></tr>
<tr><td rowspan="2">25V</td><td rowspan="2">5%</td><td>7%</td><td>0402≧0.047μF;0603≧0.1μF;
0805≧0.33μF;1206≧1μF;1210≧4.7μF</td></tr>
<tr><td>9%</td><td>0402≧0.068μF;0603≧0.47μF;
1206≧4.7μF; 1210≧22μF</td></tr>
<tr><td rowspan="2">16V
(C<1.0μF)</td><td rowspan="2">7%</td><td>9%</td><td>0402≧0.068μF; 0603≧0.68μF</td></tr>
<tr><td>12.5%</td><td>0402≧0.22μF</td></tr>
<tr><td>16V
(C≧1.0μF)</td><td>9%</td><td>12.5%</td><td>0603≧2.2μF; 0805≧3.3μF;
1206≧10μF; 1210≧22μF;1812≧47μF</td></tr>
<tr><td>10V</td><td>12.5%</td><td>20%</td><td>0402≧0.47μF</td></tr>
<tr><td>6.3V</td><td>20%</td><td>---</td><td>---</td></tr>
</table></td></tr>
<tr><td>4.</td><td>Dielectric Strength</td><td>* To apply voltage (≤100V) 250%.
* Duration: 1 to 5 sec.
* Charge and discharge current less than 50mA.</td><td>* No evidence of damage or flash over during test.</td></tr>
<tr><td>5.</td><td>Insulation Resistance</td><td>To apply rated voltage for max. 120 sec.</td><td>10GΩ or RxC≧500Ω-F whichever is smaller.
Class II (X7R, X5R, X6S, Y5V)
<table>
<tr><th>Rated voltage</th><th>Insulation Resistance</th></tr>
<tr><td>100V: X7R</td><td rowspan="7">10GΩ or RxC≧100 Ω-F whichever is smaller.</td></tr>
<tr><td>50V:0603≥1μF;0805≥1μF;1206≥4.7μF;1210≥4.7μF</td></tr>
<tr><td>35V:0805≥2.2μF;1210≧10μF</td></tr>
<tr><td>25V:0402≥1μF;0603≥2.2μF;0805≥2.2μF;1206≥10μF;1210≥10μF</td></tr>
<tr><td>16V:0402≥0.22μF;0603≥1μF;0805≥2.2μF;1206≥10μF;1210≥47μF</td></tr>
<tr><td>10V:0201≥47nF;0402≥0.47μF;0603≥0.47μF;0805≥2.2μF;
1206≥4.7μF;1210≥47μF</td></tr>
<tr><td>6.3V ; 4V</td></tr>
<tr><td>50V: 0402≥0.1μF</td><td rowspan="4">10GΩ or RxC≧50 Ω-F whichever is smaller.</td></tr>
<tr><td>35V:0603≥1μF</td></tr>
<tr><td>10V:0603≥10μF</td></tr>
<tr><td>4V:0603≥22μF; 0805≥47μF</td></tr>
</table></td></tr>
</table>

<table>
<tr><th>No.</th><th>Item</th><th>Test Condition</th><th>Requirements</th></tr>
<tr><td>6.</td><td>Temperature Coefficient</td><td>With no electrical load.
<table>
<tr><th>T.C.</th><th>Operating Temp</th></tr>
<tr><td>NPO</td><td>-55~125°C at 25°C</td></tr>
<tr><td>X7R</td><td>-55~125°C at 25°C</td></tr>
<tr><td>X5R</td><td>-55~ 85°C at 25°C</td></tr>
<tr><td>X6S</td><td>-55~105°C at 25°C</td></tr>
<tr><td>Y5V</td><td>-25~ 85°C at 20°C</td></tr>
</table></td><td><table>
<tr><th>T.C.</th><th>Capacitance Change</th></tr>
<tr><td>NPO</td><td>Within ±30ppm/°C</td></tr>
<tr><td>X7R</td><td>Within ±15%</td></tr>
<tr><td>X5R</td><td>Within ±15%</td></tr>
<tr><td>X6S</td><td>Within ±22%</td></tr>
<tr><td>Y5V</td><td>Within +30%/-80%</td></tr>
</table></td></tr>
<tr><td>7.</td><td>Adhesive Strength of Termination</td><td>* Pressurizing force：
5N (≤0603) and 10N (>0603)
* Test time: 10±1 sec.</td><td>* No remarkable damage or removal of the terminations.</td></tr>
<tr><td>8.</td><td>Vibration Resistance</td><td>* Vibration frequency: 10~55 Hz/min.
* Total amplitude: 1.5mm
* Test time: 6 hrs. (Two hrs each in three mutually perpendicular directions.)
* Measurement to be made after keeping at room temp. for 24±2 hrs.</td><td>* No remarkable damage.
* Cap change and Q/D.F.: To meet initial spec.</td></tr>
<tr><td>9.</td><td>Solderability</td><td>* Solder temperature: 235±5°C
* Dipping time: 2±0.5 sec.</td><td>95% min. coverage of all metalized area.</td></tr>
<tr><td>10.</td><td>Bending Test</td><td>* The middle part of substrate shall be pressurized by means of the pressurizing rod at a rate of about 1 mm per second until the deflection becomes 1 mm and then the pressure shall be maintained for 5±1 sec.
* Measurement to be made after keeping at room temp. for 24±2 hrs.</td><td>* No remarkable damage.
* Cap change：
NP0: within ±5% or 0.5pF whichever is larger
X7R, X5R, X6S: within ±12.5%
Y5V: within ±30%
(This capacitance change means the change of capacitance under specified flexure of substrate from the capacitance measured before the test.)</td></tr>
<tr><td>11.</td><td>Resistance to Soldering Heat</td><td>* Solder temperature: 260±5°C
* Dipping time: 10±1 sec
* Preheating: 120 to 150°C for 1 minute before immerse the capacitor in a eutectic solder.
* Before initial measurement (Class II only): Perform 150+0/-10°C for 1 hr and then set for 24±2 hrs at room temp.
* Measurement to be made after keeping at room temp. for 24±2 hrs.</td><td>* No remarkable damage.
* Cap change:
NP0: within ±2.5% or 0.25pF whichever is larger
X7R, X5R, X6S: within ±7.5%
Y5V: within ±20%
* Q/D.F., I.R. and dielectric strength: To meet initial requirements.
* 25% max. leaching on each edge.</td></tr>
<tr><td>12.</td><td>Temperature Cycle</td><td>* Conduct the five cycles according to the temperatures and time.
<table>
<tr><th>Step</th><th>Temp. (°C)</th><th>Time (min.)</th></tr>
<tr><td>1</td><td>Min. operating temp. +0/-3</td><td>30±3</td></tr>
<tr><td>2</td><td>Room temp.</td><td>2~3</td></tr>
<tr><td>3</td><td>Max. operating temp. +3/-0</td><td>30±3</td></tr>
<tr><td>4</td><td>Room temp.</td><td>2~3</td></tr>
</table>
* Before initial measurement (Class II only): Perform 150+0/-10°C for 1 hr and then set for 24±2 hrs at room temp.
* Measurement to be made after keeping at room temp. for 24±2 hrs.</td><td>* No remarkable damage.
* Cap change：
NP0: within ±2.5% or 0.25pF whichever is larger
X7R, X5R, X6S: within ±7.5%
Y5V: within ±20%
* Q/D.F., I.R. and dielectric strength: To meet initial requirements.</td></tr>
</table>

<table>
<tr><th>No.</th><th>Item</th><th>Test Condition</th><th>Requirements</th></tr>
<tr><td>13.</td><td>Humidity (Damp Heat) Steady State</td><td>* Test temp.: 40±2°C
* Humidity: 90~95% RH
* Test time: 500+24/-0hrs.
*Before initial measurement (Class II only): Perform 150+0/-10°C for 1 hr and then set for 24±2 hrs at room temp.
* Measurement to be made after keeping at room temp. for 24±2 hrs.</td><td>* No remarkable damage.
* Cap change:
NP0: within ±5% or 0.5pF whichever is larger
X7R, X5R, X6S: ≥10V**,within ±12.5%; ≦6.3V within ±25%;
TT series & C≥ 1uF,within ±25%
**10V: 0603≧4.7μF;0402≧1μF;0201≧0.1μF, within ±25%;
Y5V: ≥10V, within ±30%; ≦6.3V, within +30/-40%
* Q/D.F. value:
NP0: More than 30pF Q≥350, 10pF≤C≤30pF, Q≥275+2.5C
Less than 10pF Q≥200+10C
X7R, X5R, X6S:
<table>
<tr><th>Rated V</th><th>D.F.≦</th><th colspan="2">Exception of D.F.≦</th></tr>
<tr><td rowspan="2">≧100V</td><td rowspan="2">≦3%</td><td>≦6%</td><td>1206≧0.47μF</td></tr>
<tr><td>≦7.5%</td><td>0805＞0.1μF, 0603≧0.068μF</td></tr>
<tr><td rowspan="3">≧50V</td><td rowspan="3">≦3%</td><td>≦6%</td><td>0201(50V);0603≧0.047μF; 0805≧0.18μF; 1206≧0.47μF</td></tr>
<tr><td>≦10%</td><td>1210≧4.7μF</td></tr>
<tr><td>≦20%</td><td>0402≧0.1μF;0603≧1μF; 0805≧1μF; 1206≧2.2μF;
1210≧10μF; TT series</td></tr>
<tr><td>35V</td><td>≦5%</td><td>≦20%</td><td>0603≧1μF; 0805≥2.2μF;1210≧10μF</td></tr>
<tr><td rowspan="4">25V</td><td rowspan="4">≦5%</td><td>≦10%</td><td>0201≧0.01μF;0805≧1μF; 1210≧10μF</td></tr>
<tr><td>≦14%</td><td>0603≧0.33μF;1206≧4.7μF</td></tr>
<tr><td>≦15%</td><td>0402≧0.10μF;0603≧0.47μF;0805≧2.2μF;1206≧6.8μF;
1210≧22μF; TT series</td></tr>
<tr><td>≦20%</td><td>0402≧1μF</td></tr>
<tr><td rowspan="2">16V</td><td rowspan="2">≦5%</td><td>≦10%</td><td>0603≧0.15μF;0805≧0.68μF;1206≧2.2μF;1210≧4.7μF</td></tr>
<tr><td>≦15%</td><td>0201≧0.01μF;0402≧0.033μF;0603≧0.68μF;0805≧2.2μF;
1206≧4.7μF; 1210≧22μF; TT series</td></tr>
<tr><td rowspan="2">10V</td><td rowspan="2">≦7.5%</td><td>≦15%</td><td>0201≧0.012μF; 0402≧0.33μF; 0603≧0.33μF;0805≧2.2μF;
1206≧2.2μF; 1210≧22μF</td></tr>
<tr><td>≦20%</td><td>0201≧0.1μF ;0402≧1μF; TT series</td></tr>
<tr><td>6.3V</td><td>≦15%</td><td>≦30%</td><td>0201≧0.1μF;0402≧1μF;0603≧10μF;
0805≧4.7μF;1206≧47μF;1210≧100μF;TT series</td></tr>
<tr><td>4V</td><td>≦20%</td><td>---</td><td>---</td></tr>
</table>
Y5V:
<table>
<tr><th>Rated vol.</th><th>D.F.≦</th><th colspan="2">Exception of D.F.≦</th></tr>
<tr><td>≧50V</td><td>7.5%</td><td>10%</td><td>0603≧0.1μF; 0805≧0.47μF;
1206≧4.7μF</td></tr>
<tr><td>35V</td><td>10%</td><td>---</td><td>---</td></tr>
<tr><td rowspan="2">25V</td><td rowspan="2">7.5%</td><td>10%</td><td>0402≧0.047μF;0603≧0.1μF;
0805≧0.33μF;1206≧1μF;
1210≧4.7μF</td></tr>
<tr><td>15%</td><td>0402≧0.068μF;0603≧0.47μF;
1206≧4.7μF; 1210≧22μF</td></tr>
<tr><td rowspan="2">16V
(C<1.0μF)</td><td rowspan="2">10%</td><td>12.5%</td><td>0402≧0.068μF; 0603≧0.68μF</td></tr>
<tr><td>20%</td><td>0402≧0.22μF</td></tr>
<tr><td>16V
(C≧1.0μF)</td><td>12.5%</td><td>20%</td><td>0603≧2.2μF; 0805≧3.3μF;
1206≧10μF;1210≧22μF;
1812≧47μF;</td></tr>
<tr><td>10V</td><td>20%</td><td>30%</td><td>0402≧0.47μF</td></tr>
<tr><td>6.3V</td><td>30%</td><td>---</td><td>---</td></tr>
</table>
*I.R.: ≥10V, 1GΩ or 50 Ω-F whichever is smaller.
Class II (X7R, X5R, X6S, Y5V)
<table>
<tr><th>Rated voltage</th><th>Insulation Resistance</th></tr>
<tr><td>100V: X7R</td><td rowspan="6">1GΩ or RxC≧10 Ω-F whichever is smaller.</td></tr>
<tr><td>50V: 0402≥0.1μF;0603≥1μF;0805≥1μF;1206≥4.7μF;1210≥4.7μF</td></tr>
<tr><td>35V: 0603≥1μF; 0805≥2.2μF;1210≧10μF</td></tr>
<tr><td>25V:0402≥1μF;0603≥2.2μF;0805≥2.2μF;1206≥10μF;1210≥10μF</td></tr>
<tr><td>16V:0402≥0.22μF;0603≥1μF;0805≥2.2μF;1206≥10μF;1210≥47μF</td></tr>
<tr><td>10V:0201≥47nF;0402≥0.47μF;0603≥0.47μF;0805≥2.2μF;
1206≥4.7μF;1210≥47μF</td></tr>
<tr><td>6.3V ; 4V</td><td></td></tr>
</table></td></tr>
</table>

<table>
<tr><th>No</th><th>Item</th><th>Test Condition</th><th>Requirements</th></tr>
<tr><td>14</td><td>Humidity (Damp Heat) Load</td><td>* Test temp.: 40±2°C
* Humidity: 90~95%RH
* Test time: 500+24/-0 hrs.
* To apply voltage：rated voltage.
* Before initial measurement (Class II only): To apply test voltage for 1hr at 40°C and then set for 24±2 hrs at room temp.
* Measurement to be made after keeping at room temp. for 24±2 hrs.</td><td>* No remarkable damage.
Cap change:
NP0: ±7.5% or 0.75pF whichever is larger.
X7R, X5R, X6S: ≥10V**,within ±12.5%; ≦6.3V within ±25%;
TT series & C≥ 1uF,within ±25%
**10V: 0603≧4.7μF;0402≧1μF;0201≧0.1μF, within ±25%;
Y5V: ≥10V, within ±30%; ≦6.3V, within +30/-40%
Q/D.F. value:
NP0: C≥30pF,Q≥200;C<30pF, Q≥100+10/3C
X7R, X5R, X6S:
<table>
<tr><th>Rated V</th><th>D.F.≦</th><th colspan="2">Exception of D.F.≦</th></tr>
<tr><td rowspan="2">≧100V</td><td rowspan="2">≦3%</td><td>≦6%</td><td>1206≧0.47μF</td></tr>
<tr><td>≦7.5%</td><td>0805＞0.1μF, 0603≧0.068μF</td></tr>
<tr><td rowspan="3">≧50V</td><td rowspan="3">≦3%</td><td>≦6%</td><td>0201(50V);0603≧0.047μF; 0805≧0.18μF; 1206≧0.47μF</td></tr>
<tr><td>≦10%</td><td>1210≧4.7μF</td></tr>
<tr><td>≦20%</td><td>0402≧0.1μF;0603≧1μF; 0805≧1μF; 1206≧2.2μF;
1210≧10μF; TT series</td></tr>
<tr><td>35V</td><td>≦5%</td><td>≦20%</td><td>0603≧1μF; 0805≥2.2μF;1210≧10μF</td></tr>
<tr><td rowspan="4">25V</td><td rowspan="4">≦5%</td><td>≦10%</td><td>0201≧0.01μF;0805≧1μF; 1210≧10μF</td></tr>
<tr><td>≦14%</td><td>0603≧0.33μF;1206≧4.7μF</td></tr>
<tr><td>≦15%</td><td>0402≧0.10μF;0603≧0.47μF;0805≧2.2μF;1206≧6.8μF;
1210≧22μF; TT series</td></tr>
<tr><td>≦20%</td><td>0402≧1μF</td></tr>
<tr><td rowspan="2">16V</td><td rowspan="2">≦5%</td><td>≦10%</td><td>0603≧0.15μF;0805≧0.68μF;1206≧2.2μF;1210≧4.7μF</td></tr>
<tr><td>≦15%</td><td>0201≧0.01μF;0402≧0.033μF;0603≧0.68μF;0805≧2.2μF;
1206≧4.7μF; 1210≧22μF; TT series</td></tr>
<tr><td rowspan="2">10V</td><td rowspan="2">≦7.5%</td><td>≦15%</td><td>0201≧0.012μF; 0402≧0.33μF; 0603≧0.33μF;0805≧2.2μF;
1206≧2.2μF; 1210≧22μF</td></tr>
<tr><td>≦20%</td><td>0201≧0.1μF ;0402≧1μF; TT series</td></tr>
<tr><td>6.3V</td><td>≦15%</td><td>≦30%</td><td>0201≧0.1μF;0402≧1μF;0603≧10μF;
0805≧4.7μF;1206≧47μF;1210≧100μF;TT series</td></tr>
<tr><td>4V</td><td>≦20%</td><td>---</td><td>---</td></tr>
</table>
Y5V:
<table>
<tr><th>Rated vol.</th><th>D.F.≦</th><th colspan="2">Exception of D.F.≦</th></tr>
<tr><td>≧50V</td><td>7.5%</td><td>10%</td><td>0603≧0.1μF; 0805≧0.47μF;
1206≧4.7μF</td></tr>
<tr><td>35V</td><td>10%</td><td>---</td><td>---</td></tr>
<tr><td rowspan="2">25V</td><td rowspan="2">7.5%</td><td>10%</td><td>0402≧0.047μF;0603≧0.1μF;
0805≧0.33μF;1206≧1μF;
1210≧4.7μF</td></tr>
<tr><td>15%</td><td>0402≧0.068μF;0603≧0.47μF;
1206≧4.7μF; 1210≧22μF</td></tr>
<tr><td rowspan="2">16V
(C<1.0μF)</td><td rowspan="2">10%</td><td>12.5%</td><td>0402≧0.068μF; 0603≧0.68μF</td></tr>
<tr><td>20%</td><td>0402≧0.22μF</td></tr>
<tr><td>16V
(C≧1.0μF)</td><td>12.5%</td><td>20%</td><td>0603≧2.2μF; 0805≧3.3μF;
1206≧10μF;1210≧22μF;
1812≧47μF;</td></tr>
<tr><td>10V</td><td>20%</td><td>30%</td><td>0402≧0.47μF</td></tr>
<tr><td>6.3V</td><td>30%</td><td>---</td><td>---</td></tr>
</table>
*I.R.: ≥10V, 500MΩ or 25 Ω-F whichever is smaller.
Class II (X7R, X5R, X6S, Y5V)
<table>
<tr><th>Rated voltage</th><th>Insulation Resistance</th></tr>
<tr><td>100V: X7R</td><td rowspan="7">500MΩ or RxC≧5 Ω-F whichever is smaller.</td></tr>
<tr><td>50V:0603≥1μF;0805≥1μF;1206≥4.7μF;1210≥4.7μF</td></tr>
<tr><td>35V:0805≥2.2μF;1210≧10μF</td></tr>
<tr><td>25V:0402≥1μF;0603≥2.2μF;0805≥2.2μF;1206≥10μF;1210≥10μF</td></tr>
<tr><td>16V:0402≥0.22μF;0603≥1μF;0805≥2.2μF;1206≥10μF;1210≥47μF</td></tr>
<tr><td>10V:0201≥47nF;0402≥0.47μF;0603≥0.47μF;0805≥2.2μF;
1206≥4.7μF;1210≥47μF</td></tr>
<tr><td>6.3V ; 4V</td></tr>
</table></td></tr>
</table>

<table>
<tr><th>No</th><th>Item</th><th>Test Condition</th><th>Requirements</th></tr>
<tr><td>15.</td><td>High Temperature Load (Endurance)</td><td>
*Test temp. :
NP0, X7R/X7E: 125±3°C
X6S: 105±3°C
X5R, Y5V: 85±3°C
*Test time: 1000+24/-0 hrs.
*To apply voltage:
(1) ≦6.3V or C≧10μF :
150% of rated voltage.
(2) 10V≦Ur<500V:
200% of rated voltage.
(3) 500V: 150% of rated voltage.
(4) Ur≧630V:
120% of rated voltage.
(5) 100% of rated voltage for below range.
<table>
<tr><th>Size</th><th>Dielectric</th><th>Rated</th><th>Capacitance</th></tr>
<tr><td>0201</td><td>X5R/X7R/ X6S</td><td>6.3V, 10V</td><td>C≧0.1μF</td></tr>
<tr><td>0402</td><td>X5R/X7R/ X6S</td><td>6.3V, 10V</td><td>C≧1.0μF</td></tr>
<tr><td rowspan="3">0603</td><td rowspan="3">X5R/X7R/ X6S</td><td>4V</td><td>C≧22μF</td></tr>
<tr><td>6.3V, 10V</td><td>C≧4.7μF</td></tr>
<tr><td>35V</td><td>C≧1.0μF</td></tr>
<tr><td rowspan="2">0805</td><td rowspan="2">X5R/X7R/ X6S</td><td>4V</td><td>C≧47μF</td></tr>
<tr><td>6.3V</td><td>C≧22μF</td></tr>
<tr><td rowspan="2">1206</td><td>X5R/X7R/</td><td>6.3V</td><td>C≧47μF</td></tr>
<tr><td>NP0</td><td>3000V</td><td>C≧1.5pF</td></tr>
<tr><td>TT18</td><td>Y5V</td><td>6.3V,10</td><td>C≧2.2μF</td></tr>
<tr><td>TT21</td><td>Y5V</td><td>6.3V</td><td>C≧10μF</td></tr>
<tr><td>TT31</td><td>Y5V</td><td>6.3V</td><td>C≧22μF</td></tr>
</table>
(6)150% of rated voltage for below range.
<table>
<tr><th>Size</th><th>Dielectric</th><th>Rated voltage</th><th>Capacitance range</th></tr>
<tr><td>0201</td><td>X5R/X7R/ X6S</td><td>16V</td><td>C≧0.1μF</td></tr>
<tr><td rowspan="3">0402</td><td rowspan="2">X5R/X7R/ X6S</td><td>50V</td><td>C≧0.1μF</td></tr>
<tr><td>10V~25V</td><td>C≧0.22μF</td></tr>
<tr><td>Y5V</td><td>16V</td><td>C≧0.47μF</td></tr>
<tr><td rowspan="2">0603</td><td>X5R/X7R/ X6S</td><td>10V,50V</td><td>C≧1.0μF</td></tr>
<tr><td>Y5V</td><td>16V</td><td>C≧2.2μF</td></tr>
<tr><td rowspan="4">0805</td><td rowspan="2">X5R/X7R/ X6S</td><td>10~50V</td><td>C≧4.7μF</td></tr>
<tr><td rowspan="2">X5R/X7R</td><td>50V</td><td>C≧2.2μF</td></tr>
<tr><td>100V</td><td>C≧0.47μF</td></tr>
<tr><td>Y5V</td><td>16V</td><td>C≧4.7μF</td></tr>
<tr><td>2220</td><td>X7R</td><td>100V</td><td>C≧6.8μF</td></tr>
</table>
*Before initial measurement (Class II only): To apply test voltage for 1hr at test temp. and then set for 24±2 hrs at room temp.
*Measurement to be made after keeping at room temp. for 24±2 hrs
</td><td>
* No remarkable damage.
Cap change:
NP0: ±3.0% or ±0.3pF whichever is larger
X7R, X5R, X6S: ≥10V**,within ±12.5%; ≦6.3V within ±25%;
TT series & C≥ 1uF,within ±25%
**10V: 0603≧4.7μF;0402≧1μF;0201≧0.1μF, within ±25%;
Y5V: ≥10V, within ±30%; ≦6.3V, within +30/-40%
Q/D.F. value:
NP0: More than 30pF, Q≥350
10pF≤C<30pF, Q≥275+2.5C
Less than 10pF, Q≥200+10C
X7R, X5R, X6S:
<table>
<tr><th>Rated V</th><th>D.F.≦</th><th>Exception of D.F.≦</th><th></th></tr>
<tr><td rowspan="2">≧100V</td><td rowspan="2">≦3%</td><td>≦6%</td><td>1206≧0.47μF</td></tr>
<tr><td>≦7.5%</td><td>0805＞0.1μF, 0603≧0.068μF</td></tr>
<tr><td rowspan="3">≧50V</td><td rowspan="3">≦3%</td><td>≦6%</td><td>0201(50V);0603≧0.047μF; 0805≧0.18μF; 1206≧0.47μF</td></tr>
<tr><td>≦10%</td><td>1210≧4.7μF</td></tr>
<tr><td>≦20%</td><td>0402≧0.1μF;0603≧1μF; 0805≧1μF; 1206≧2.2μF;
1210≧10μF; TT series</td></tr>
<tr><td>35V</td><td>≦5%</td><td>≦20%</td><td>0603≧1μF; 0805≧2.2μF;1210≧10μF</td></tr>
<tr><td rowspan="4">25V</td><td rowspan="4">≦5%</td><td>≦10%</td><td>0201≧0.01μF;0805≧1μF; 1210≧10μF</td></tr>
<tr><td>≦14%</td><td>0603≧0.33μF;1206≧4.7μF</td></tr>
<tr><td>≦15%</td><td>0402≧0.10μF;0603≧0.47μF;0805≧2.2μF;1206≧6.8μF;
1210≧22μF; TT series</td></tr>
<tr><td>≦20%</td><td>0402≧1μF</td></tr>
<tr><td rowspan="2">16V</td><td rowspan="2">≦5%</td><td>≦10%</td><td>0603≧0.15μF;0805≧0.68μF;1206≧2.2μF;1210≧4.7μF</td></tr>
<tr><td>≦15%</td><td>0201≧0.01μF;0402≧0.033μF;0603≧0.68μF;0805≧2.2μF;
1206≧4.7μF; 1210≧22μF; TT series</td></tr>
<tr><td rowspan="2">10V</td><td rowspan="2">≦7.5%</td><td>≦15%</td><td>0201≧0.012μF; 0402≧0.33μF; 0603≧0.33μF;0805≧2.2μF;
1206≧2.2μF; 1210≧22μF</td></tr>
<tr><td>≦20%</td><td>0201≧0.1μF ;0402≧1μF; TT series</td></tr>
<tr><td>6.3V</td><td>≦15%</td><td>≦30%</td><td>0201≧0.1μF;0402≧1μF;0603≧10μF;
0805≧4.7μF;1206≧47μF;1210≧100μF;TT series</td></tr>
<tr><td>4V</td><td>≦20%</td><td>---</td><td>---</td></tr>
</table>
Y5V:
<table>
<tr><th>Rated vol.</th><th>D.F.≦</th><th>Exception of D.F.≦</th><th></th></tr>
<tr><td>≧50V</td><td>7.5%</td><td>10%</td><td>0603≧0.1μF; 0805≧0.47μF;
1206≧4.7μF</td></tr>
<tr><td>35V</td><td>10%</td><td>---</td><td>---</td></tr>
<tr><td rowspan="2">25V</td><td rowspan="2">7.5%</td><td>10%</td><td>0402≧0.047μF;0603≧0.1μF;
0805≧0.33μF;1206≧1μF;
1210≧4.7μF</td></tr>
<tr><td>15%</td><td>0402≧0.068μF;0603≧0.47μF;
1206≧4.7μF; 1210≧22μF</td></tr>
<tr><td rowspan="2">16V
(C<1.0μF)</td><td rowspan="2">10%</td><td>12.5%</td><td>0402≧0.068μF; 0603≧0.68μF</td></tr>
<tr><td>20%</td><td>0402≧0.22μF</td></tr>
<tr><td>16V
(C≧1.0μF)</td><td>12.5%</td><td>20%</td><td>0603≧2.2μF; 0805≧3.3μF;
1206≧10μF;1210≧22μF;
1812≧47μF;</td></tr>
<tr><td>10V</td><td>20%</td><td>30%</td><td>0402≧0.47μF</td></tr>
<tr><td>6.3V</td><td>30%</td><td>---</td><td>---</td></tr>
</table>
*I.R.: ≥10V, 1GΩ or 50 Ω-F whichever is smaller.
Class II (X7R, X5R, X6S, Y5V)
<table>
<tr><th>Rated voltage</th><th>Insulation Resistance</th></tr>
<tr><td>100V: X7R</td><td rowspan="7">1GΩ or RxC≧10 Ω-F whichever is smaller.</td></tr>
<tr><td>50V: 0402≥0.1μF;0603≥1μF;0805≥1μF;1206≥4.7μF;1210≥4.7μF</td></tr>
<tr><td>35V: 0603≥1μF; 0805≥2.2μF;1210≧10μF</td></tr>
<tr><td>25V:0402≥1μF;0603≥2.2μF;0805≥2.2μF;1206≥10μF;1210≥10μF</td></tr>
<tr><td>16V:0402≥0.22μF;0603≥1μF;0805≥2.2μF;1206≥10μF;1210≥47μF</td></tr>
<tr><td>10V:0201≥47nF;0402≥0.47μF;0603≥0.47μF;0805≥2.2μF;
1206≥4.7μF;1210≥47μF</td></tr>
<tr><td>6.3V ; 4V</td></tr>
</table>
</td></tr>
</table>

APPENDIXES

◙ Tape & reel dimensions

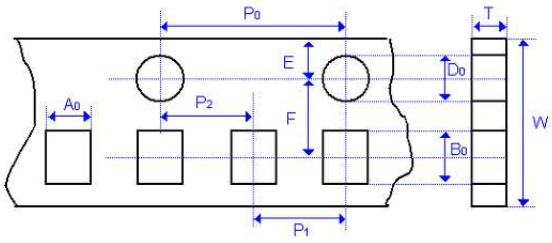


Fig. 2 The dimension of paper tape

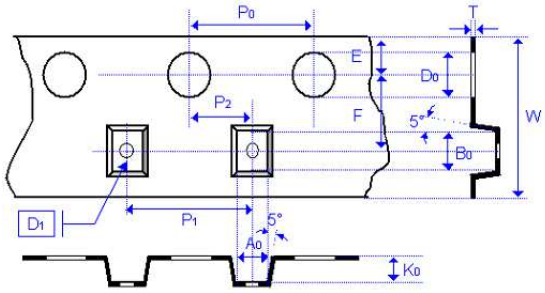


Fig. 3 The dimension of plastic tape

Size	0402		0603	0805			1206			1210			1812		
Thickness	N	E	S, X	A	B	C, D, I	B	C, J, D	G,P	C, D	G, K	M	D, K	M	U
A_0	0.62±0.05	0.70±0.10	1.02±0.05	1.50±0.10	1.50±0.10	<1.57	2.00±0.10	<1.85	<1.95	<2.97	<2.97	<2.97	<3.81	<3.81	<3.90
B_0	1.12±0.05	1.20±0.10	1.80±0.05	2.30±0.10	2.30±0.10	<2.40	3.50±0.10	<3.46	<3.67	<3.73	<3.73	<3.73	<5.30	<5.30	<5.30
T	0.60±0.05	0.70±0.10	0.95±0.05	0.75±0.05	0.95±0.05	0.23±0.05	0.95±0.05	0.23±0.05	0.23±0.05	0.23±0.05	0.23±0.05	0.23±0.05	0.25±0.05	0.25±0.05	0.25±0.05
K_0	-	-	-	-	-	<2.50	-	<2.50	<2.50	<2.50	<2.50	<3.00	<2.50	<3.00	<3.50
W	8.00±0.10	8.00±0.10	8.00±0.10	8.00±0.10	8.00±0.10	8.00±0.10	8.00±0.10	8.00±0.10	8.00±0.10	8.00±0.10	8.00±0.10	8.00±0.10	12.0±0.20	12.0±0.20	12.0±0.20
P_0	4.00±0.10	4.00±0.10	4.00±0.10	4.00±0.10	4.00±0.10	4.00±0.10	4.00±0.10	4.00±0.10	4.00±0.10	4.00±0.10	4.00±0.10	4.00±0.10	4.00±0.10	4.00±0.10	4.00±0.10
$10xP_0$	40.0±0.10	40.0±0.10	40.0±0.10	40.0±0.10	40.0±0.10	40.0±0.10	40.0±0.10	40.0±0.10	40.0±0.10	40.0±0.10	40.0±0.10	40.0±0.10	40.0±0.10	40.0±0.10	40.0±0.20
P_1	2.00±0.05	2.00±0.05	4.00±0.10	4.00±0.10	4.00±0.10	4.00±0.10	4.00±0.10	4.00±0.10	4.00±0.10	4.00±0.10	4.00±0.10	4.00±0.10	8.00±0.10	8.00±0.10	8.00±0.10
P_2	2.00±0.05	2.00±0.05	2.00±0.05	2.00±0.05	2.00±0.05	2.00±0.05	2.00±0.05	2.00±0.05	2.00±0.05	2.00±0.05	2.00±0.05	2.00±0.05	2.00±0.05	2.00±0.05	2.00±0.05
D_0	1.55±0.05	1.55±0.05	1.55±0.05	1.55±0.05	1.55±0.05	1.50±0.05	1.50±0.05	1.50±0.05	1.50±0.05	1.50±0.05	1.50±0.05	1.50±0.05	1.50±0.05	1.50±0.05	1.50±0.10
D_1	-	-	-	-	-	1.00±0.10	-	1.00±0.10	1.00±0.10	1.00±0.10	1.00±0.10	1.00±0.10	1.50±0.10	1.50±0.10	1.50±0.10
E	1.75±0.05	1.75±0.05	1.75±0.05	1.75±0.05	1.75±0.05	1.75±0.10	1.75±0.10	1.75±0.10	1.75±0.10	1.75±0.10	1.75±0.10	1.75±0.10	1.75±0.10	1.75±0.10	1.75±0.10
F	3.50±0.05	3.50±0.05	3.50±0.05	3.50±0.05	3.50±0.05	3.50±0.05	3.50±0.05	3.50±0.05	3.50±0.05	3.50±0.05	3.50±0.05	3.50±0.05	5.50±0.05	5.50±0.05	5.50±0.05

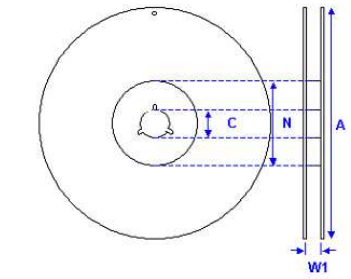
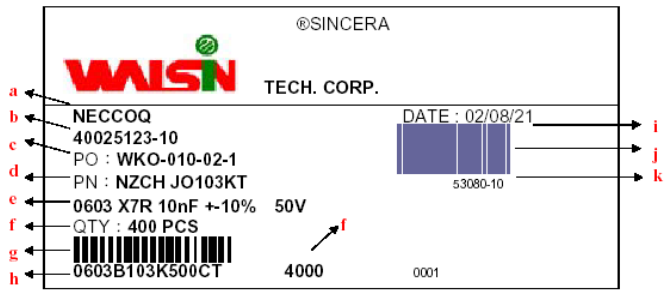


Fig. 4 The dimension of reel

Size	0402, 0603, 0805, 1206, 1210			1812
Reel size	7”	10”	13”	7”
C	13.0+0.5/-0.2	13.0+0.5/-0.2	13.0+0.5/-0.2	13.0+0.5/-0.2
W_1	8.4+1.5/-0	8.4+1.5/-0	8.4+1.5/-0	12.4+2.0/-0
A	178.0±0.10	250.0±1.0	330.0±1.0	178.0±0.10
N	60.0+1.0/-0	100.0±1.0	100±1.0	60.0+1.0/-0

◙ Description of customer label



a. Customer name
b. WTC order series and item number
c. Customer P/O
d. Customer P/N
e. Description of product
f. Quantity
g. Bar code including quantity & WTC P/N or customer
h. WTC P/N
i. Shipping date
j. Order bar code including series and item numbers
k. Serial number of label

◙ Constructions

No.	Name		X7R, X5R, X6S, Y5V
①	Ceramic material		$BaTiO_3$ based
②	Inner electrode		Ni
③	Termination	Inner layer	Cu
④		Middle layer	Ni
⑤		Outer layer	Sn (Matt)

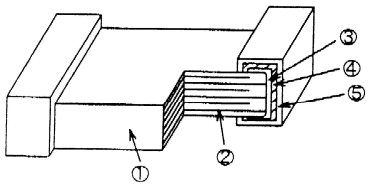


Fig. 5 The construction of MLCC

◙ Storage and handling conditions

(1) To store products at 5 to 40°C ambient temperature and 20 to 70%. related humidity conditions.
(2) The product is recommended to be used within one year after shipment. Check solderability in case of shelf life extension is needed.

Cautions:

a. The corrosive gas reacts on the terminal electrodes of capacitors, and results in the poor solderability. Do not store the capacitors in the ambience of corrosive gas (e.g., hydrogen sulfide, sulfur dioxide, chlorine, ammonia gas etc.)
b. In corrosive atmosphere, solderability might be degraded, and silver migration might occur to cause low reliability.
c. Due to the dewing by rapid humidity change, or the photochemical change of the terminal electrode by direct sunlight,the solderability and electrical performance may deteriorate. Do not store capacitors under direct sunlight or dewing condition. To store products on the shelf and avoid exposure to moisture.

.

◙ Recommended soldering conditions

The lead-free termination MLCCs are not only to be used on SMT against lead-free solder paste, but also suitable against lead-containing solder paste. If the optimized solder joint is requested, increasing soldering time, temperature and concentration of N_2 within oven are recommended.

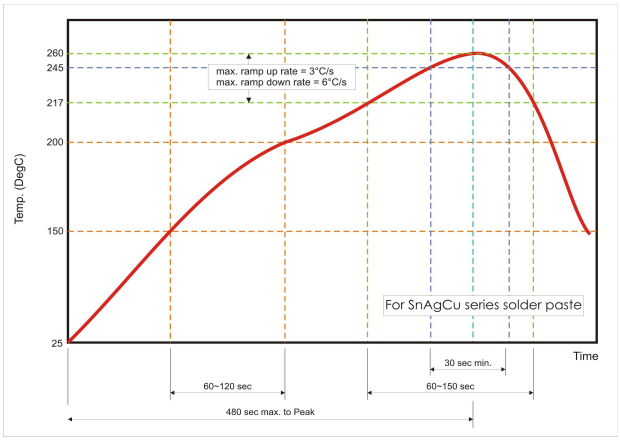


Fig. 6 Recommended reflow soldering profile for SMT process with SnAgCu series solder paste.

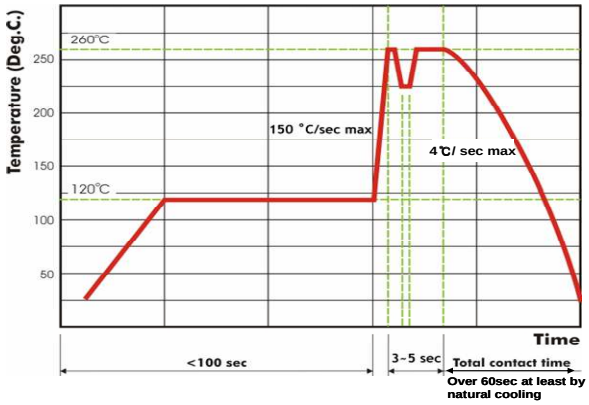


Fig. 7 Recommended wave soldering profile for SMT process with SnAgCu series solder.

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