

APPROVAL SHEET

MULTILAYER CERAMIC CAPACITORS

General Purpose Series (10V to 100V)

0402 to 1812 Sizes

NP0, X7R & 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's MLCC is made by NP0, X7R and Y5V dielectric material and which provides product with high electrical precision, stability and reliability.

2. FEATURES

- A wide selection of sizes is available (0402 to 1812).
- High capacitance in given case size.
- Capacitor with lead-free termination (pure Tin).

3. APPLICATIONS

- For general digital circuit.
- For power supply bypass capacitors.
- For consumer electronics.
- For telecommunication.

4. HOW TO ORDER

<u>1206</u>	<u>E</u>	<u>104</u>	<u>Z</u>	<u>500</u>	<u>C</u>	<u>I</u>
<u>Size</u>	<u>Dielectric</u>	<u>Capacitance</u>	<u>Tolerance</u>	<u>Rated voltage</u>	<u>Termination</u>	<u>Packaging style</u>
Inch (mm) 0402 (1005) 0603 (1608) 0805 (2012) 1206 (3216) 1210 (3225) 1812 (4532)	N =NP0 (C0G) B =X7R F =Y5V	Two significant digits followed by no. of zeros. And R is in place of decimal point. eg.: 0R5=0.5pF 1R0=1.0pF 104=10x10 ⁴ =100nF	B =±0.1pF C =±0.25pF D =±0.5pF F =±1% G =±2% J =±5% K =±10% M =±20% Z =-20/+80%	Two significant digits followed by no. of zeros. And R is in place of decimal point. 100 =10 VDC 160 =16 VDC 250 =25 VDC 500 =50 VDC 101 =100 VDC	C =Cu/Ni/Sn (for NP0, X7R, Y5V dielectric) L =Ag/Ni/Sn (for partial NP0 items)	T =7" reeled R =7" reeled (2mm pitch for 0603 size; paper tape) G =13" reeled

* Partial NP0 items are with Ag/Ni/Sn terminations, please ref to below product range of NPO dielectric for detail.

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	#
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	
0805 (2012)	2.00±0.15	1.25±0.10	0.60±0.10	A	0.50±0.20
			0.80±0.10	B	
			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	0.80±0.10	B	0.60±0.20
			0.95±0.10	C	
			1.15±0.15	J	
			1.25±0.10	D	
	3.20±0.20	1.60±0.20	1.60±0.20	G	
	3.20+0.3/-0.1	1.60+0.3/0.1	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	

Reflow soldering only is recommended.

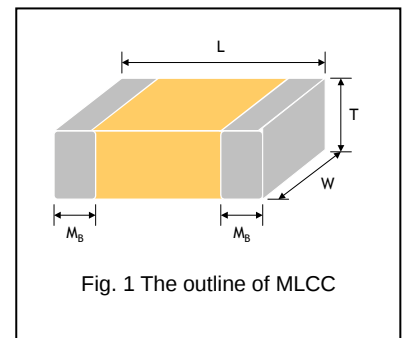


Fig. 1 The outline of MLCC

6. GENERAL ELECTRICAL DATA

Dielectric	NP0	X7R	Y5V
Size	0402, 0603, 0805, 1206, 1210, 1812		
Capacitance range*	0.5pF to 0.039μF	100pF to 0.82μF	10nF to 0.68μF
Capacitance tolerance**	Cap≤5pF: B (±0.1pF), C (±0.25pF) 5pF<Cap<10pF: C (±0.25pF), D (±0.5pF) Cap≥10pF: F (±1%), G (±2%), J (±5%), K (±10%)	J (±5%), K (±10%), M (±20%)	M (±20%), Z (-20/+80%)
Rated voltage (WVDC)	10V, 16V, 25V, 50V, 100V	6.3V, 10V, 16V, 25V, 50V, 100V	
Tan δ*	Cap<30pF: Q≥400+20C Cap≥30pF: Q≥1000	Note 1	
Insulation resistance at Ur	≥10GΩ or RxC≥500Ω·F whichever is less		
Operating temperature	-55 to +125℃		-25 to +85℃
Capacitance characteristic	±30ppm	±15%	+30/-80%
Termination	Ni/Sn (lead-free termination)		

* Measured at the condition of 30~70% related humidity.

NP0: Apply 1.0±0.2Vrms, 1.0MHz±10% for Cap≤1000pF and 1.0±0.2Vrms, 1.0kHz±10% for Cap>1000pF, 25°C at ambient temperature

X7R: Apply 1.0±0.2Vrms, 1.0kHz±10%, at 25°C ambient temperature.

Y5V: Apply 1.0±0.2Vrms, 1.0kHz±10%, at 20°C ambient temperature.

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

Note 1:

X7R/X5R

Rated vol.	D.F. ≤	Exception of D.F. ≤
≥50V	≤2.5%	≤3% 0201(50V); 0603≥0.047μF; 0805≥0.18μF; 1206≥0.47μF
		≤5% 1210≥4.7μF
		≤10% 0603≥1μF; 0805≥1μF; 1206≥4.7μF; 1210≥10μF
35V	≤3.5%	≤10% 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
16V	≤3.5%	≤5% 0201≥0.01μF; 0402≥0.033μF; 0805≥0.68μF; 1206≥2.2μF; 1210≥4.7μF
		≤10% 0402≥0.22μF; 0603≥0.68μF; 0805≥2.2μF; 1206≥4.7μF; 1210≥22μF; TT series
		≤15% 0201≥0.012μF; 0402≥0.33μF; 0603≥0.33μF; 0805≥2.2μF; 1206≥2.2μF; 1210≥22μF; TT series
10V	≤5%	≤15% 0201≥0.1μF; 0402≥1μF
6.3V	≤10%	≤15% 0201≥0.1μF; 0402≥1μF; 0603≥10μF; 0805≥4.7μF; 1206≥47μF; 1210≥100μF
		≤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 (NP0 Dielectric)

7-1 0402, 0603, 0805 Sizes

DIELECTRIC		NP0														
SIZE		0402					0603					0805				
RATED VOLTAGE		10	16	25	50	100	10	16	25	50	100	10	16	25	50	100
Capacitance	0.1pF (0R1)	N	N	N	N											
	0.2pF (0R2)	N	N	N	N											
	0.3pF (0R3)	N	N	N	N											
	0.4pF (0R4)	N	N	N	N											
	0.5pF (0R5)	N	N	N	N	N	S	S	S	S	S	A	A	A	A	A
	0.6pF (0R6)	N	N	N	N	N	S	S	S	S	S	A	A	A	A	A
	0.7pF (0R7)	N	N	N	N	N	S	S	S	S	S	A	A	A	A	A
	0.8pF (0R8)	N	N	N	N	N	S	S	S	S	S	A	A	A	A	A
	0.9pF (0R9)	N	N	N	N	N	S	S	S	S	S	A	A	A	A	A
	1.0pF (1R0)	N	N	N	N	N	S	S	S	S	S	A	A	A	A	A
	1.2pF (1R2)	N	N	N	N	N	S	S	S	S	S	A	A	A	A	A
	1.5pF (1R5)	N	N	N	N	N	S	S	S	S	S	A	A	A	A	A
	1.8pF (1R8)	N	N	N	N	N	S	S	S	S	S	A	A	A	A	A
	2.2pF (2R2)	N	N	N	N	N	S	S	S	S	S	A	A	A	A	A
	2.7pF (2R7)	N	N	N	N	N	S	S	S	S	S	A	A	A	A	A
	3.3pF (3R3)	N	N	N	N	N	S	S	S	S	S	A	A	A	A	A
	3.9pF (3R9)	N	N	N	N	N	S	S	S	S	S	A	A	A	A	A
	4.7pF (4R7)	N	N	N	N	N	S	S	S	S	S	A	A	A	A	A
	5.6pF (5R6)	N	N	N	N	N	S	S	S	S	S	A	A	A	A	A
	6.8pF (6R8)	N	N	N	N	N	S	S	S	S	S	A	A	A	A	A
	8.2pF (8R2)	N	N	N	N	N	S	S	S	S	S	A	A	A	A	A
	10pF (100)	N	N	N	N	N	S	S	S	S	S	A	A	A	A	A
	12pF (120)	N	N	N	N	N	S	S	S	S	S	A	A	A	A	A
	15pF (150)	N	N	N	N	N	S	S	S	S	S	A	A	A	A	A
	18pF (180)	N	N	N	N	N	S	S	S	S	S	A	A	A	A	A
	22pF (220)	N	N	N	N	N	S	S	S	S	S	A	A	A	A	A
	27pF (270)	N	N	N	N	N	S	S	S	S	S	A	A	A	A	A
	33pF (330)	N	N	N	N	N	S	S	S	S	S	A	A	A	A	A
	39pF (390)	N	N	N	N	N	S	S	S	S	S	A	A	A	A	A
	47pF (470)	N	N	N	N	N	S	S	S	S	S	A	A	A	A	A
	56pF (560)	N	N	N	N	N	S	S	S	S	S	A	A	A	A	A
	68pF (680)	N	N	N	N	N	S	S	S	S	S	A	A	A	A	A
	82pF (820)	N	N	N	N	N	S	S	S	S	S	A	A	A	A	A
	100pF (101)	N	N	N	N	N	S	S	S	S	S	A	A	A	A	A
	120pF (121)	N	N	N	N	N	S	S	S	S	S	A	A	A	A	A
	150pF (151)	N	N	N	N	N	S	S	S	S	S	A	A	A	A	A
	180pF (181)	N	N	N	N	N	S	S	S	S	S	A	A	A	A	A
	220pF (221)	N	N	N	N	N	S	S	S	S	S	A	A	A	A	A
	270pF (271)	N	N	N	N		S	S	S	S	S	A	A	A	A	A
	330pF (331)	N	N	N	N		S	S	S	S	S	A	A	A	A	A
	390pF (391)	N	N	N	N		S	S	S	S	S	B	B	B	B	B
	470pF (471)	N	N	N	N		S	S	S	S	S	B	B	B	B	B
	560pF (561)	N	N	N	N		S	S	S	S	S	B	B	B	B	B
	680pF (681)	N	N	N	N		S	S	S	S	S	B	B	B	B	B
	820pF (821)	N	N	N	N		S	S	S	S	S	B	B	B	B	B
	1,000pF (102)	N	N	N	N		S	S	S	S	S	B	B	B	B	B
1,200pF (122)						X	X	X	X		B	B	B	B	B	
1,500pF (152)						X	X	X	X		B	B	B	B	B	
1,800pF (182)						X	X	X	X		B	B	B	B	B	
2,200pF (222)						X	X	X	X		B	B	B	B	B	
2,700pF (272)						X	X	X	X		D	D	D	D	D	
3,300pF (332)						X	X	X	X		D	D	D	D	D	
3,900pF (392)											D	D	D	D	D	
4,700pF (472)											D	D	D	D	D	
5,600pF (562)											D	D	D	D		
6,800pF (682)											D	D	D	D		
8,200pF (822)											D	D	D	D		
0.010uF (103)											D	D	D	D		
0.012uF (123)											D^	D^				

1. The letter in cell is expressed the symbol of product thickness.
2. The letter in cell with "^^" mark is expressed product with Ag/Ni/Sn terminations.
3. For more information about products with special capacitance or other data, please contact WTC local representative.

7-2 1206, 1210, 1812 Sizes

DIELECTRIC		NP0												
SIZE		1206					1210					1812		
RATED VOLTAGE		10	16	25	50	100	10	16	25	50	100	16	50	100
Capacitance	1.0pF (1R0)													
	1.2pF (1R2)	B	B	B	B	B								
	1.5pF (1R5)	B	B	B	B	B								
	1.8pF (1R8)	B	B	B	B	B								
	2.2pF (2R2)	B	B	B	B	B								
	2.7pF (2R7)	B	B	B	B	B								
	3.3pF (3R3)	B	B	B	B	B								
	3.9pF (3R9)	B	B	B	B	B								
	4.7pF (4R7)	B	B	B	B	B								
	5.6pF (5R6)	B	B	B	B	B								
	6.8pF (6R8)	B	B	B	B	B								
	8.2pF (8R2)	B	B	B	B	B								
	10pF (100)	B	B	B	B	B	C	C	C	C	C	D	D	D
	12pF (120)	B	B	B	B	B	C	C	C	C	C	D	D	D
	15pF (150)	B	B	B	B	B	C	C	C	C	C	D	D	D
	18pF (180)	B	B	B	B	B	C	C	C	C	C	D	D	D
	22pF (220)	B	B	B	B	B	C	C	C	C	C	D	D	D
	27pF (270)	B	B	B	B	B	C	C	C	C	C	D	D	D
	33pF (330)	B	B	B	B	B	C	C	C	C	C	D	D	D
	39pF (390)	B	B	B	B	B	C	C	C	C	C	D	D	D
	47pF (470)	B	B	B	B	B	C	C	C	C	C	D	D	D
	56pF (560)	B	B	B	B	B	C	C	C	C	C	D	D	D
	68pF (680)	B	B	B	B	B	C	C	C	C	C	D	D	D
	82pF (820)	B	B	B	B	B	C	C	C	C	C	D	D	D
	100pF (101)	B	B	B	B	B	C	C	C	C	C	D	D	D
	120pF (121)	B	B	B	B	B	C	C	C	C	C	D	D	D
	150pF (151)	B	B	B	B	B	C	C	C	C	C	D	D	D
	180pF (181)	B	B	B	B	B	C	C	C	C	C	D	D	D
	220pF (221)	B	B	B	B	B	C	C	C	C	C	D	D	D
	270pF (271)	B	B	B	B	B	C	C	C	C	C	D	D	D
	330pF (331)	B	B	B	B	B	C	C	C	C	C	D	D	D
	390pF (391)	B	B	B	B	B	C	C	C	C	C	D	D	D
	470pF (471)	B	B	B	B	B	C	C	C	C	C	D	D	D
	560pF (561)	B	B	B	B	B	C	C	C	C	C	D	D	D
	680pF (681)	B	B	B	B	B	C	C	C	C	C	D	D	D
	820pF (821)	B	B	B	B	B	C	C	C	C	C	D	D	D
	1,000pF (102)	B	B	B	B	B	C	C	C	C	C	D	D	D
	1,200pF (122)	B	B	B	B	B	C	C	C	C	C	D	D	D
	1,500pF (152)	B	B	B	B	B	C	C	C	C	C	D	D	D
	1,800pF (182)	B	B	B	B	B	C	C	C	C	C	D	D	D
2,200pF (222)	B	B	B	B	B	C	C	C	C	C	D	D	D	
2,700pF (272)	B	B	B	B	B	C	C	C	C	C	D	D	D	
3,300pF (332)	B	B	B	B	B	C	C	C	C	C	D	D	D	
3,900pF (392)	B	B	B	B	B	C	C	C	C	C	D	D	D	
4,700pF (472)	B	B	B	B	B	C	C	C	C	C	D	D	D	
5,600pF (562)	B	B	B	B	B	C	C	C	C	C	D	D	D	
6,800pF (682)	C	C	C	C	C	C	C	C	C	C	D	D	D	
8,200pF (822)	D	D	D	D	D	C	C	C	C	C	D	D	D	
0.010μF (103)	D	D	D	D	D	C	C	C	C	C	D	D	D	
0.012μF (123)	D^	D^				C	C	D	D	D	D	D	D	
0.015μF (153)	D^	D^				C	C	D	D	D	D	D	D	
0.018μF (183)	D^	D^									D	D	D	
0.022μF (223)	D^	D^									D	D	D	
0.027μF (273)	D^	D^									D	D	D	
0.033μF (333)	D^	D^									D	D	D	
0.039μF (393)	G^	G^												

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2. The letter in cell with "^" mark is expressed product with Ag/Ni/Sn terminations.
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8. CAPACITANCE RANGE (X7R Dielectric)

8-1 0402, 0603, 0805 Sizes

DIELECTRIC		X7R													
SIZE		0402				0603					0805				
RATED VOLTAGE (VDC)		10	16	25	50	10	16	25	50	100	10	16	25	50	100
Capacitance	100pF (101)	N	N	N	N	S	S	S	S	S	B	B	B	B	B
	120pF (121)	N	N	N	N	S	S	S	S	S	B	B	B	B	B
	150pF (151)	N	N	N	N	S	S	S	S	S	B	B	B	B	B
	180pF (181)	N	N	N	N	S	S	S	S	S	B	B	B	B	B
	220pF (221)	N	N	N	N	S	S	S	S	S	B	B	B	B	B
	270pF (271)	N	N	N	N	S	S	S	S	S	B	B	B	B	B
	330pF (331)	N	N	N	N	S	S	S	S	S	B	B	B	B	B
	390pF (391)	N	N	N	N	S	S	S	S	S	B	B	B	B	B
	470pF (471)	N	N	N	N	S	S	S	S	S	B	B	B	B	B
	560pF (561)	N	N	N	N	S	S	S	S	S	B	B	B	B	B
	680pF (681)	N	N	N	N	S	S	S	S	S	B	B	B	B	B
	820pF (821)	N	N	N	N	S	S	S	S	S	B	B	B	B	B
	1,000pF (102)	N	N	N	N	S	S	S	S	S	B	B	B	B	B
	1,200pF (122)	N	N	N	N	S	S	S	S	S	B	B	B	B	B
	1,500pF (152)	N	N	N	N	S	S	S	S	S	B	B	B	B	B
	1,800pF (182)	N	N	N	N	S	S	S	S	S	B	B	B	B	B
	2,200pF (222)	N	N	N	N	S	S	S	S	S	B	B	B	B	B
	2,700pF (272)	N	N	N	N	S	S	S	S	S	B	B	B	B	B
	3,300pF (332)	N	N	N	N	S	S	S	S	S	B	B	B	B	B
	3,900pF (392)	N	N	N	N	S	S	S	S	S	B	B	B	B	B
	4,700pF (472)	N	N	N	N	S	S	S	S	S	B	B	B	B	B
	5,600pF (562)	N	N	N	N	S	S	S	S	S	B	B	B	B	B
	6,800pF (682)	N	N	N	N	S	S	S	S	S	B	B	B	B	B
	8,200pF (822)	N	N	N	N	S	S	S	S	S	B	B	B	B	B
	0.010μF (103)	N	N	N	N	S	S	S	S	S	B	B	B	B	B
	0.012μF (123)	N	N	N		S	S	S	S		B	B	B	B	B
	0.015μF (153)	N	N	N		S	S	S	S		B	B	B	B	B
	0.018μF (183)	N	N	N		S	S	S	S		B	B	B	B	B
	0.022μF (223)	N	N	N		S	S	S	S		B	B	B	B	B
	0.027μF (273)	N	N	N		S	S	S	S		B	B	B	B	D
	0.033μF (333)	N	N	N		S	S	S	X		B	B	B	B	D
	0.039μF (393)	N	N	N		S	S	S	X		B	B	B	B	D
	0.047μF (473)	N	N	N		S	S	S	X		B	B	B	B	D
	0.056μF (563)	N	N			S	S	S	X		B	B	B	B	D
	0.068μF (683)	N	N			S	S	S	X		B	B	B	B	D
	0.082μF (823)	N	N			S	S	S	X		B	B	B	B	D
	0.10μF (104)	N	N	N		S	S	S	X		B	B	B	B	D
	0.12μF (124)					S	S	X			B	B	B	D	
	0.15μF (154)					S	S	X			D	D	D	D	
	0.18μF (184)					S	S	X			D	D	D	D	
	0.22μF (224)					S	S	X			D	D	D	D	
	0.27μF (274)					X	X	X			D	D	D	I	
	0.33μF (334)					X	X	X			D	D	D	I	
	0.39μF (394)					X	X	X			D	D	D	I	
	0.47μF (474)					X	X	X			D	D	D	I	
	0.56μF (564)										D	D	D		
	0.68μF (684)										D	D	D		
	0.82μF (824)										D	D	D		

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

2. For more information about products with special capacitance or other data, please contact WTC local representative.

8-2 1206, 1210, 1812 Sizes

DIELECTRIC		X7R														
SIZE		1206					1210					1812				
RATED VOLTAGE		10	16	25	50	100	10	16	25	50	100	10	16	25	50	100
Capacitance	100pF (101)															
	120pF (121)															
	150pF (151)	B	B	B	B	B										
	180pF (181)	B	B	B	B	B										
	220pF (221)	B	B	B	B	B										
	270pF (271)	B	B	B	B	B										
	330pF (331)	B	B	B	B	B										
	390pF (391)	B	B	B	B	B										
	470pF (471)	B	B	B	B	B										
	560pF (561)	B	B	B	B	B										
	680pF (681)	B	B	B	B	B										
	820pF (821)	B	B	B	B	B										
	1,000pF (102)	B	B	B	B	B	C	C	C	C	C	D	D	D	D	D
	1,200pF (122)	B	B	B	B	B	C	C	C	C	C	D	D	D	D	D
	1,500pF (152)	B	B	B	B	B	C	C	C	C	C	D	D	D	D	D
	1,800pF (182)	B	B	B	B	B	C	C	C	C	C	D	D	D	D	D
	2,200pF (222)	B	B	B	B	B	C	C	C	C	C	D	D	D	D	D
	2,700pF (272)	B	B	B	B	B	C	C	C	C	C	D	D	D	D	D
	3,300pF (332)	B	B	B	B	B	C	C	C	C	C	D	D	D	D	D
	3,900pF (392)	B	B	B	B	B	C	C	C	C	C	D	D	D	D	D
	4,700pF (472)	B	B	B	B	B	C	C	C	C	C	D	D	D	D	D
	5,600pF (562)	B	B	B	B	B	C	C	C	C	C	D	D	D	D	D
	6,800pF (682)	B	B	B	B	B	C	C	C	C	C	D	D	D	D	D
	8,200pF (822)	B	B	B	B	B	C	C	C	C	C	D	D	D	D	D
	0.010μF (103)	B	B	B	B	B	C	C	C	C	C	D	D	D	D	D
	0.012μF (123)	B	B	B	B	B	C	C	C	C	C	D	D	D	D	D
	0.015μF (153)	B	B	B	B	B	C	C	C	C	C	D	D	D	D	D
	0.018μF (183)	B	B	B	B	B	C	C	C	C	C	D	D	D	D	D
	0.022μF (223)	B	B	B	B	B	C	C	C	C	C	D	D	D	D	D
	0.027μF (273)	B	B	B	B	B	C	C	C	C	C	D	D	D	D	D
	0.033μF (333)	B	B	B	B	B	C	C	C	C	C	D	D	D	D	D
	0.039μF (393)	B	B	B	B	B	C	C	C	C	C	D	D	D	D	D
	0.047μF (473)	B	B	B	B	B	C	C	C	C	C	D	D	D	D	D
	0.056μF (563)	B	B	B	B	B	C	C	C	C	C	D	D	D	D	D
	0.068μF (683)	B	B	B	B	B	C	C	C	C	C	D	D	D	D	D
	0.082μF (823)	B	B	B	B	D	C	C	C	C	C	D	D	D	D	D
	0.10μF (104)	B	B	B	B	D	C	C	C	C	C	D	D	D	D	D
	0.12μF (124)	B	B	B	B	D	C	C	C	C	C	D	D	D	D	D
	0.15μF (154)	C	C	C	C	G	C	C	C	C	D	D	D	D	D	D
	0.18μF (184)	C	C	C	C	G	C	C	C	C	D	D	D	D	D	D
	0.22μF (224)	C	C	C	C	G	C	C	C	C	D	D	D	D	D	D
	0.27μF (274)	C	C	C	D	G	C	C	C	C	G	D	D	D	D	D
	0.33μF (334)	C	C	C	D	G	C	C	C	D	G	D	D	D	D	D
	0.39μF (394)	C	C	J	P	G	C	C	C	D	M	D	D	D	D	D
	0.47μF (474)	J	J	J	P	G	C	C	C	D	M	D	D	D	D	K
	0.56μF (564)	J	J	J	P	P	D	D	D	D	M	D	D	D	D	K
	0.68μF (684)	J	J	J	P	P	D	D	D	D	K	D	D	D	K	K
	0.82μF (824)	J	J	J	P	P	D	D	D	D	K	D	D	D	K	K

1. The letter in cell is expressed the symbol of product thickness.
2. For more information about products with special capacitance or other data, please contact WTC local representative.

9. CAPACITANCE RANGE (Y5V Dielectric)

9-1 0402, 0603, 0805 Sizes

DIELECTRIC		Y5V													
SIZE		0402					0603				0805				
RATED VOLTAGE		6.3	10	16	25	50	10	16	25	50	10	16	25	50	100
Capacitance	0.010μF (103)		N	N	N	N	S	S	S	S	A	A	A	A	B
	0.015μF (153)		N	N	N	N	S	S	S	S	A	A	A	A	B
	0.022μF (223)		N	N	N	N	S	S	S	S	A	A	A	A	B
	0.033μF (333)		N	N	N	N	S	S	S	S	A	A	A	A	B
	0.047μF (473)		N	N	N		S	S	S	S	A	A	A	A	B
	0.068μF (683)		N	N	N		S	S	S	S	A	A	A	A	B
	0.10μF (104)		N	N	N		S	S	S	S	A	A	A	A	B
	0.15μF (154)		N	N			S	S	S	S	A	A	A	A	
	0.22μF (224)	N	N	N	N		S	S	S	S	A	A	A	A	
	0.33μF (334)	N	N	N			S	S	S		B	B	B	B	
	0.47μF (474)	N	N	N			S	S	X	S	B	B	B	B	
	0.68μF (684)	N					S	X			B	B	D	D	

9-2 1206, 1210, 1812 Sizes

DIELECTRIC		Y5V														
SIZE		1206					1210					1812				
RATED VOLTAGE		10	16	25	50	100	10	16	25	50	100	10	16	25	50	100
Capacitance	0.010μF (103)	B	B	B	B	B					C					D
	0.015μF (153)	B	B	B	B	B					C					D
	0.022μF (223)	B	B	B	B	B					C					D
	0.033μF (333)	B	B	B	B	B					C					D
	0.047μF (473)	B	B	B	B	B					C					D
	0.068μF (683)	B	B	B	B	B					C					D
	0.10μF (104)	B	B	B	B	B	C	C	C	C	C	D	D	D	D	D
	0.15μF (154)	B	B	B	B	C	C	C	C	C	C	D	D	D	D	D
	0.22μF (224)	B	B	B	B	C	C	C	C	C	C	D	D	D	D	D
	0.33μF (334)	B	B	B	B		C	C	C	C	C	D	D	D	D	D
	0.47μF (474)	B	B	B	B		C	C	C	C		D	D	D	D	D
0.68μF (684)	B	B	B	B		C	C	C	C		D	D	D	D	D	

- The letter in cell is expressed the symbol of product thickness.
- For more information about products with special capacitance or other data, please contact WTC local representative.

10. 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	-	-
0603 (1608)	0.80±0.07	S	4k	15k	-	-
	0.80+0.15/-0.10	X	4k	15k	-	-
0805 (2012)	0.60±0.10	A	4k	15k	-	-
	0.80±0.10	B	4k	15k	-	-
	1.25±0.10	D	-	-	3k	10k
	1.25±0.20	I	-	-	3k	10k
1206 (3216)	0.80±0.10	B	4k	15k	-	-
	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	-
1812 (4532)	1.25±0.10	D	-	-	1k	5k
	2.00±0.20	K	-	-	1k	-

Unit: pieces

11. RELIABILITY TEST CONDITIONS AND REQUIREMENTS

No.	Item	Test Condition	Requirements			
1.	Visual and Mechanical	---	* No remarkable defect. * Dimensions to conform to individual specification sheet.			
2.	Capacitance	Class I: NP0 Cap≤1000pF 1.0±0.2Vrms, 1MHz±10% Cap>1000pF 1.0±0.2Vrms, 1kHz±10%	* Shall not exceed the limits given in the detailed spec.			
3.	Q/ D.F. (Dissipation Factor)	Class II: X7R,X7E, X5R,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), 0402 ≥ 475 (6.3V), 0402 ≥ 225(10V), 0603=106 (6.3V), TT18X ≥ 475(10V) , TT15X series	NP0: Cap≥30pF, Q≥1000; Cap<30pF,Q≥400+20C X7R, X5R:			
			Rated vol.	D.F. ≤	Exception of D.F. ≤	
			≥ 50V	≤ 2.5%	≤ 3%	0201(50V); 0603 ≥ 0.047μF; 0805 ≥ 0.18μF;1206 ≥ 0.47μF
					≤ 5%	1210 ≥ 4.7μF
					≤ 10%	0603 ≥ 1μF; 0805 ≥ 1μF;1206 ≥ 4.7μF; 1210 ≥ 10μF
			35V	≤ 3.5%	≤ 10%	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
			16V	≤ 3.5%	≤ 5%	0201 ≥ 0.01μF;0402 ≥ 0.033μF; 0805 ≥ 0.68μF;1206 ≥ 2.2μF;1210 ≥ 4.7μF
					≤ 10%	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%
	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%	---	---		
4.	Dielectric Strength	* To apply voltage (≤100V) 250%. * Duration: 1 to 5 sec. * Charge and discharge current less than 50mA.	* No evidence of damage or flash over during test.			
5.	Insulation Resistance	To apply rated voltage for max. 120 sec.	10GΩ or RxC ≥ 500Ω·F whichever is smaller. Class II (X7R, X5R, Y5V)			
			Rated voltage	Insulation Resistance		
			100V: X7R	10GΩ or RxC ≥ 100 Ω·F whichever is smaller.		
			50V:0603≥1μF;0805≥1μF;1206≥4.7μF;1210≥4.7μF			
			35V:0805≥2.2μF;1210 ≥ 10μF			
			25V:0402≥1μF;0603≥2.2μF;0805≥2.2μF;1206≥10μF;1210≥10μF			
			16V:0402≥0.22μF;0603≥1μF;0805≥2.2μF;1206≥10μF;1210≥47μF			
			10V:0201≥47nF;0402≥0.47μF;0603≥0.47μF;0805≥2.2μF; 1206≥4.7μF;1210≥47μF			
			6.3V ; 4V			
6.	Temperature Coefficient	With no electrical load.	T.C.	Capacitance Change		
		T.C.	Operating Temp	NPO	Within ±30ppm/°C	
		X7R	-55~125°C at 25°C	X7R	Within ±15%	
		X5R	-55~ 85°C at 25°C	X5R	Within ±15%	
		Y5V	-25~ 85°C at 20°C	Y5V	Within +30%/-80%	
No.	Item	Test Condition	Requirements			

7.	Adhesive Strength of Termination	* Pressurizing force : 5N (≤0603) and 10N (>0603) * Test time: 10±1 sec.	* No remarkable damage or removal of the terminations.															
8.	Vibration Resistance	* 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.	* No remarkable damage. * Cap change and Q/D.F.: To meet initial spec.															
9.	Solderability	* Solder temperature: 235±5℃ * Dipping time: 2±0.5 sec.	95% min. coverage of all metalized area.															
10.	Bending Test	* 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.	* No remarkable damage. * Cap change : NP0: within ±5% or 0.5pF whichever is larger X7R, X5R: 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.)															
11.	Resistance to Soldering Heat	* Solder temperature: 260±5℃ * Dipping time: 10±1 sec * Preheating: 120 to 150℃ for 1 minute before immerse the capacitor in a eutectic solder. * Before initial measurement (Class II only): Perform 150+0/-10℃ 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.	* No remarkable damage. * Cap change: NP0: within ±2.5% or 0.25pF whichever is larger X7R, X5R: within ±7.5% Y5V: within ±20% * Q/D.F., I.R. and dielectric strength: To meet initial requirements. * 25% max. leaching on each edge.															
12.	Temperature Cycle	* Conduct the five cycles according to the temperatures and time. <table><tr><th>Step</th><th>Temp. (℃)</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℃ 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.	Step	Temp. (℃)	Time (min.)	1	Min. operating temp. +0/-3	30±3	2	Room temp.	2~3	3	Max. operating temp. +3/-0	30±3	4	Room temp.	2~3	* No remarkable damage. * Cap change : NP0: within ±2.5% or 0.25pF whichever is larger X7R, X5R: within ±7.5% Y5V: within ±20% * Q/D.F., I.R. and dielectric strength: To meet initial requirements.
Step	Temp. (℃)	Time (min.)																
1	Min. operating temp. +0/-3	30±3																
2	Room temp.	2~3																
3	Max. operating temp. +3/-0	30±3																
4	Room temp.	2~3																

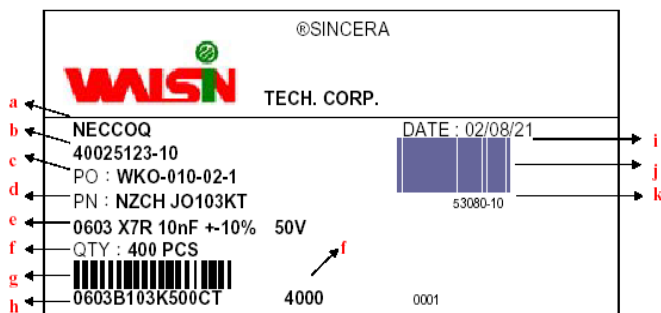
No.	Item	Test Condition	Requirements																																																																																												
13.	Humidity (Damp Heat) Steady State	* Test temp.: 40±2℃ * Humidity: 90~95% RH * Test time: 500+24/-0hrs. * Before initial measurement (Class II only): Perform 150+0/-10℃ 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.	* No remarkable damage. * Cap change: NP0: within ±5% or 0.5pF whichever is larger X7R, X7E, X5R: ≥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: <table><tr><th>Rated vol.</th><th>D.F. ≤</th><th colspan="2">Exception of D.F. ≤</th></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>0603 ≥ 1μF; 0805 ≥ 1μF; 1206 ≥ 4.7μF; 1210 ≥ 10μF</td></tr><tr><td>35V</td><td>≤ 5%</td><td>≤ 20%</td><td>0805 ≥ 2.2μF; 1210 ≥ 10μF</td></tr><tr><td rowspan="3">25V</td><td rowspan="3">≤ 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</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</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</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</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>16V (C<1.0μF)</td><td>10%</td><td>12.5%</td><td>0402 ≥ 0.068μF; 0603 ≥ 0.68μF</td></tr><tr><td></td><td></td><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, 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: 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>	Rated vol.	D.F. ≤	Exception of D.F. ≤		≥ 50V	≤ 3%	≤ 6%	0201(50V); 0603 ≥ 0.047μF; 0805 ≥ 0.18μF; 1206 ≥ 0.47μF	≤ 10%	1210 ≥ 4.7μF	≤ 20%	0603 ≥ 1μF; 0805 ≥ 1μF; 1206 ≥ 4.7μF; 1210 ≥ 10μF	35V	≤ 5%	≤ 20%	0805 ≥ 2.2μF; 1210 ≥ 10μF	25V	≤ 5%	≤ 10%	0201 ≥ 0.01μF; 0805 ≥ 1μF; 1210 ≥ 10μF	≤ 14%	0603 ≥ 0.33μF; 1206 ≥ 4.7μF	≤ 15%	0402 ≥ 0.10μF; 0603 ≥ 0.47μF; 0805 ≥ 2.2μF; 1206 ≥ 6.8μF; 1210 ≥ 22μF	16V	≤ 5%	≤ 10%	0603 ≥ 0.15μF; 0805 ≥ 0.68μF; 1206 ≥ 2.2μF; 1210 ≥ 4.7μF	≤ 15%	0201 ≥ 0.01μF; 0402 ≥ 0.033μF; 0603 ≥ 0.68μF; 0805 ≥ 2.2μF; 1206 ≥ 4.7μF; 1210 ≥ 22μF	10V	≤ 7.5%	≤ 15%	0201 ≥ 0.012μF; 0402 ≥ 0.33μF; 0603 ≥ 0.33μF; 0805 ≥ 2.2μF; 1206 ≥ 2.2μF; 1210 ≥ 22μF	≤ 20%	0201 ≥ 0.1μF ; 0402 ≥ 1μF	6.3V	≤ 15%	≤ 30%	0201 ≥ 0.1μF; 0402 ≥ 1μF; 0603 ≥ 10μF; 0805 ≥ 4.7μF; 1206 ≥ 47μF; 1210 ≥ 100μF	4V	≤ 20%	---	---	Rated vol.	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14	Humidity (Damp Heat) Load	* Test temp.: 40±2℃ * 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℃ and then set for 24±2 hrs at room temp. * Measurement to be made after keeping at room temp. for 24±2 hrs.	* No remarkable damage. Cap change: NP0: ±7.5% or 0.75pF whichever is larger. X7R, X7E, X5R: ≥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: <table><tr><th>Rated vol.</th><th>D.F. ≤</th><th colspan="2">Exception of D.F. ≤</th></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>0603 ≥ 1μF; 0805 ≥ 1μF;1206 ≥ 4.7μF; 1210 ≥ 10μF</td></tr><tr><td>35V</td><td>≤ 5%</td><td>≤ 20%</td><td>0805≥2.2μF;1210 ≥ 10μF</td></tr><tr><td rowspan="3">25V</td><td rowspan="3">≤ 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</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</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</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</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>16V (C<1.0μF)</td><td>10%</td><td>12.5%</td><td>0402 ≥ 0.068μF; 0603 ≥ 0.68μF</td></tr><tr><td rowspan="2">16V (C≥ 1.0μF)</td><td rowspan="2">12.5%</td><td>20%</td><td>0603 ≥ 2.2μF; 0805 ≥ 3.3μF; 1206 ≥ 10μF;1210 ≥ 22μF; 1812 ≥ 47μF;</td></tr><tr><td>30%</td><td>0402 ≥ 0.47μF</td></tr><tr><td>10V</td><td>20%</td><td>---</td><td>---</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, Y5V)	Rated vol.	D.F. ≤	Exception of D.F. ≤		≥ 50V	≤ 3%	≤ 6%	0201(50V);0603 ≥ 0.047μF; 0805 ≥ 0.18μF; 1206 ≥ 0.47μF	≤ 10%	1210 ≥ 4.7μF	≤ 20%	0603 ≥ 1μF; 0805 ≥ 1μF;1206 ≥ 4.7μF; 1210 ≥ 10μF	35V	≤ 5%	≤ 20%	0805≥2.2μF;1210 ≥ 10μF	25V	≤ 5%	≤ 10%	0201 ≥ 0.01μF;0805 ≥ 1μF; 1210 ≥ 10μF	≤ 14%	0603 ≥ 0.33μF;1206 ≥ 4.7μF	≤ 15%	0402 ≥ 0.10μF;0603 ≥ 0.47μF;0805 ≥ 2.2μF;1206 ≥ 6.8μF; 1210 ≥ 22μF	16V	≤ 5%	≤ 10%	0603 ≥ 0.15μF;0805 ≥ 0.68μF;1206 ≥ 2.2μF;1210 ≥ 4.7μF	≤ 15%	0201 ≥ 0.01μF;0402 ≥ 0.033μF;0603 ≥ 0.68μF;0805 ≥ 2.2μF 1206 ≥ 4.7μF; 1210 ≥ 22μF	10V	≤ 7.5%	≤ 15%	0201 ≥ 0.012μF;0402 ≥ 0.33μF; 0603 ≥ 0.33μF; 0805 ≥ 2.2μF; 1206 ≥ 2.2μF; 1210 ≥ 22μF	≤ 20%	0201 ≥ 0.1μF ;0402 ≥ 1μF	6.3V	≤ 15%	≤ 30%	0201 ≥ 0.1μF;0402 ≥ 1μF;0603 ≥ 10μF; 0805 ≥ 4.7μF;1206 ≥ 47μF;1210 ≥ 100μF	4V	≤ 20%	---	---	Rated vol.	D.F. ≤	Exception of D.F. ≤		≥ 50V	7.5%	10%	0603 ≥ 0.1μF; 0805 ≥ 0.47μF; 1206 ≥ 4.7μF	35V	10%	---	---	25V	7.5%	10%	0402 ≥ 0.047μF;0603 ≥ 0.1μF; 0805 ≥ 0.33μF;1206 ≥ 1μF; 1210 ≥ 4.7μF	15%	0402 ≥ 0.068μF;0603 ≥ 0.47μF; 1206 ≥ 4.7μF; 1210 ≥ 22μF	16V (C<1.0μF)	10%	12.5%	0402 ≥ 0.068μF; 0603 ≥ 0.68μF	16V (C≥ 1.0μF)	12.5%	20%	0603 ≥ 2.2μF; 0805 ≥ 3.3μF; 1206 ≥ 10μF;1210 ≥ 22μF; 1812 ≥ 47μF;	30%	0402 ≥ 0.47μF	10V	20%	---	---	6.3V	30%	---	---
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Rated voltage	Insulation Resistance
100V: X7R	500MΩ or Rx C ≥ 5 Ω-F whichever is smaller.
50V:0603≥1μF;0805≥1μF;1206≥4.7μF;1210≥4.7μF	
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25V:0402≥1μF;0603≥2.2μF;0805≥2.2μF;1206≥10μF;1210≥10μF	
16V:0402≥0.22μF;0603≥1μF;0805≥2.2μF;1206≥10μF;1210≥47μF	
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6.3V ; 4V	

No	Item	Test Condition	Requirements																																																																								
15.	High Temperature Load (Endurance)	Test temp. : NP0, X7R/X7E: 125±3℃ X5R, Y5V: 85±3℃ Test time: 1000+24/-0 hrs. *To apply voltage: (1) 6.3V or C≥10μF or TT series: 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.	* No remarkable damage. Cap change: NP0: ±3.0% or ±0.3pF whichever is larger X7R, X7E, X5R: ≥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:																																																																								
		<table><tr><th>Size</th><th>Dielectric</th><th>Rated voltage</th><th>Capacitance range</th></tr><tr><td>0201</td><td>X5R/X7R</td><td>6.3V,10V</td><td>C≥0.1μF</td></tr><tr><td>0402</td><td>X5R/X7R</td><td>6.3V,10V</td><td>C≥1.0μF</td></tr><tr><td>0603</td><td>X5R/X7R</td><td>6.3V,10V</td><td>C≥4.7μF</td></tr><tr><td>0805</td><td>X5R/X7R</td><td>6.3V</td><td>C≥22μF</td></tr><tr><td>1206</td><td>X5R/X7R</td><td>6.3V</td><td>C≥47μF</td></tr><tr><td></td><td>NP0</td><td>3000V</td><td>C≥1.5pF</td></tr></table>	Size	Dielectric	Rated voltage	Capacitance range	0201	X5R/X7R	6.3V,10V	C≥0.1μF	0402	X5R/X7R	6.3V,10V	C≥1.0μF	0603	X5R/X7R	6.3V,10V	C≥4.7μF	0805	X5R/X7R	6.3V	C≥22μF	1206	X5R/X7R	6.3V	C≥47μF		NP0	3000V	C≥1.5pF	<table><tr><th>Rated vol.</th><th>D.F. ≤</th><th colspan="2">Exception of D.F. ≤</th></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>0603≥1μF; 0805≥1μF;1206≥4.7μF; 1210≥10μF</td></tr><tr><td>35V</td><td>≤5%</td><td>≤20%</td><td>0805≥2.2μF;1210≥10μF</td></tr><tr><td rowspan="3">25V</td><td rowspan="3">≤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</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</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</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</td></tr><tr><td>4V</td><td>≤20%</td><td>---</td><td>---</td></tr></table>	Rated vol.	D.F. ≤	Exception of D.F. ≤		≥50V	≤3%	≤6%	0201(50V);0603≥0.047μF; 0805≥0.18μF; 1206≥0.47μF	≤10%	1210≥4.7μF	≤20%	0603≥1μF; 0805≥1μF;1206≥4.7μF; 1210≥10μF	35V	≤5%	≤20%	0805≥2.2μF;1210≥10μF	25V	≤5%	≤10%	0201≥0.01μF;0805≥1μF; 1210≥10μF	≤14%	0603≥0.33μF;1206≥4.7μF	≤15%	0402≥0.10μF;0603≥0.47μF;0805≥2.2μF;1206≥6.8μF; 1210≥22μF	16V	≤5%	≤10%	0603≥0.15μF;0805≥0.68μF;1206≥2.2μF;1210≥4.7μF	≤15%	0201≥0.01μF;0402≥0.033μF;0603≥0.68μF;0805≥2.2μF 1206≥4.7μF; 1210≥22μF	10V	≤7.5%	≤15%	0201≥0.012μF;0402≥0.33μF; 0603≥0.33μF; 0805≥2.2μF; 1206≥2.2μF; 1210≥22μF	≤20%	0201≥0.1μF ;0402≥1μF	6.3V	≤15%	≤30%	0201≥0.1μF;0402≥1μF;0603≥10μF; 0805≥4.7μF;1206≥47μF;1210≥100μF	4V	≤20%	---	---
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		*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	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>16V (C<1.0μF)</td><td>10%</td><td>12.5%</td><td>0402≥0.068μF; 0603≥0.68μF</td></tr><tr><td></td><td></td><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>	Rated vol.	D.F. ≤	Exception of D.F. ≤		≥50V	7.5%	10%	0603≥0.1μF; 0805≥0.47μF; 1206≥4.7μF	35V	10%	---	---	25V	7.5%	10%	0402≥0.047μF;0603≥0.1μF; 0805≥0.33μF;1206≥1μF; 1210≥4.7μF	15%	0402≥0.068μF;0603≥0.47μF; 1206≥4.7μF; 1210≥22μF	16V (C<1.0μF)	10%	12.5%	0402≥0.068μF; 0603≥0.68μF			20%	0402≥0.22μF	16V (C≥1.0μF)	12.5%	20%	0603≥2.2μF; 0805≥3.3μF; 1206≥10μF;1210≥22μF; 1812≥47μF;	10V	20%	30%	0402≥0.47μF	6.3V	30%	---	---																																		
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■ 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	NPO*	NPO, X7R, Y5V
①	Ceramic material	BaTiO ₃ based	
②	Inner electrode	AgPd alloy	Ni
③	Termination	Inner layer	Ag
④		Middle layer	Ni
⑤		Outer layer	Sn

* Partial NPO items are with Ag/Ni/Sn terminations, please ref to product range of NPO dielectric for detail.

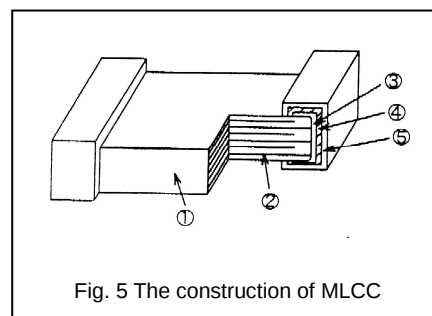


Fig. 5 The construction of MLCC

■ 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.

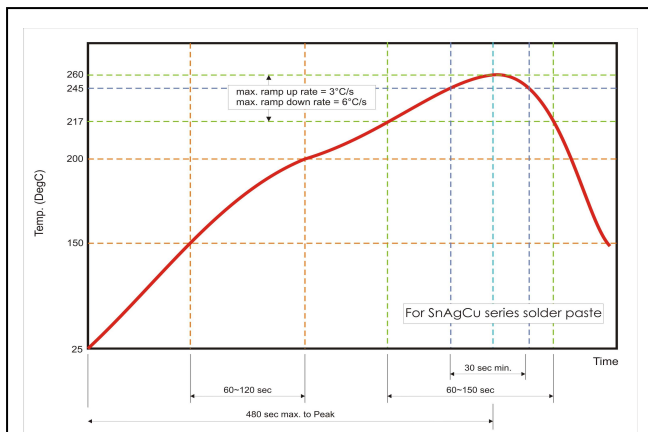


Fig. 6 Recommended reflow soldering profile for SMT process with SnAgCu series solder paste.

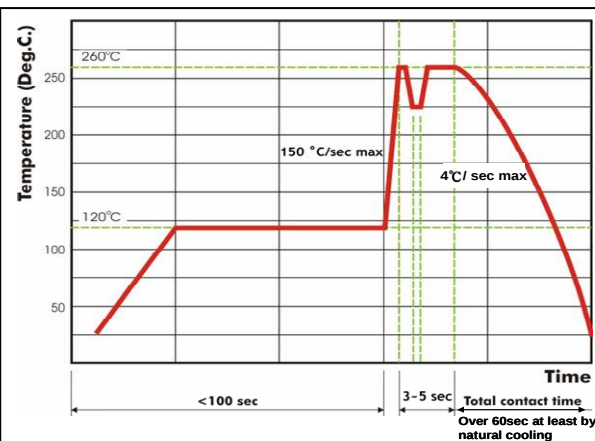


Fig. 7 Recommended wave soldering profile for SMT process with SnAgCu series solder.