

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>F</u>	<u>104</u>	<u>Z</u>	<u>500</u>	<u>C</u>	<u>T</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 (COG) 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 #	0.25 +0.05/-0.10
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 #	
			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 #	
			1.60±0.20	G #	
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±0.40	2.50±0.30	0.95±0.10	C #	0.75±0.25
			1.25±0.10	D #	
			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.

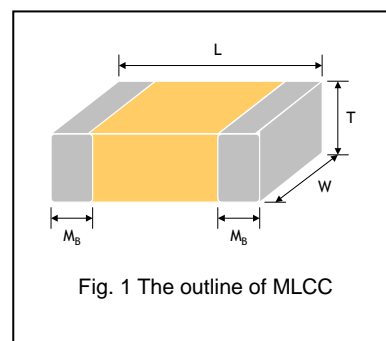


Fig. 1 The outline of MLCC

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°C		-25 to +85°C
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≥0.47μF; 0603≥0.68μF; 0805≥2.2μF; 1206≥4.7μF; 1210≥22μF
	≤5%	0402≥0.33μF; 0603≥0.33μF; 0805≥2.2μF; 1206≥2.2μF; 1210≥22μF
10V	≤5%	0201≥0.1μF; 0402≥1μF
	≤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%
	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
	7%	9% 0402≥0.068μF; 0603≥0.68μF
16V (C<1.0μF)	7%	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^												

1. The letter in cell is expressed the symbol of product thickness.
2. The letter in cell with "A" 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.

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
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	

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.

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
1812 (4532)	2.50±0.30 M	-	-	1k	-
	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: NPO 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), 0603 ≥ 475(10V)	NPO: Cap≥30pF, Q≥1000; Cap<30pF, Q≥400+20C X7R, X5R: <table border="1"> <thead> <tr> <th>Rated vol.</th> <th>D.F. ≤</th> <th colspan="2">Exception of D.F. ≤</th> </tr> </thead> <tbody> <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>0603 ≥ 1μF; 0805 ≥ 1μF; 1206 ≥ 4.7μF; 1210 ≥ 10μF</td> </tr> <tr> <td>35V</td> <td>≤ 3.5%</td> <td>≤ 10%</td> <td>0805 ≥ 2.2μF; 1210 ≥ 10μF</td> </tr> <tr> <td rowspan="3">25V</td> <td rowspan="3">≤ 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</td> </tr> <tr> <td rowspan="2">16V</td> <td rowspan="2">≤ 3.5%</td> <td>≤ 5%</td> <td>0201 ≥ 0.01μF; 0402 ≥ 0.033μF; 0805 ≥ 0.68μF; 1206 ≥ 2.2μF; 1210 ≥ 4.7μF</td> </tr> <tr> <td>≤ 10%</td> <td>0402 ≥ 0.47μF; 0603 ≥ 0.68μF; 0805 ≥ 2.2μF; 1206 ≥ 4.7μF; 1210 ≥ 22μF</td> </tr> <tr> <td rowspan="2">10V</td> <td rowspan="2">≤ 5%</td> <td>≤ 10%</td> <td>0402 ≥ 0.33μF; 0603 ≥ 0.33μF; 0805 ≥ 2.2μF; 1206 ≥ 2.2μF; 1210 ≥ 22μF</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</td> </tr> <tr> <td>≤ 20%</td> <td>0402 ≥ 2.2μF</td> </tr> <tr> <td>4V</td> <td>≤ 15%</td> <td>---</td> <td>---</td> </tr> </tbody> </table> Y5V: <table border="1"> <thead> <tr> <th>Rated vol.</th> <th>D.F. ≤</th> <th colspan="2">Exception of D.F. ≤</th> </tr> </thead> <tbody> <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>16V (C<1.0μF)</td> <td>7%</td> <td>9%</td> <td>0402 ≥ 0.068μF; 0603 ≥ 0.68μF</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> </tbody> </table>	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 ≥ 0.47μF; 0603 ≥ 0.68μF; 0805 ≥ 2.2μF; 1206 ≥ 4.7μF; 1210 ≥ 22μF	10V	≤ 5%	≤ 10%	0402 ≥ 0.33μF; 0603 ≥ 0.33μF; 0805 ≥ 2.2μF; 1206 ≥ 2.2μF; 1210 ≥ 22μF	≤ 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%	---	---	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	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%	---	---
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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) <table border="1"> <thead> <tr> <th>Rated voltage</th> <th>Insulation Resistance</th> </tr> </thead> <tbody> <tr> <td>100V: X7R</td> <td rowspan="6">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> <td></td> </tr> </tbody> </table>	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																																																																						
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6.	Temperature Coefficient	With no electrical load. <table border="1"> <thead> <tr> <th>T.C.</th> <th>Operating Temp</th> </tr> </thead> <tbody> <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>Y5V</td> <td>-25~ 85°C at 20°C</td> </tr> </tbody> </table>	T.C.	Operating Temp	NPO	-55~125°C at 25°C	X7R	-55~125°C at 25°C	X5R	-55~ 85°C at 25°C	Y5V	-25~ 85°C at 20°C	<table border="1"> <thead> <tr> <th>T.C.</th> <th>Capacitance Change</th> </tr> </thead> <tbody> <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>Y5V</td> <td>Within +30%/-80%</td> </tr> </tbody> </table>	T.C.	Capacitance Change	NPO	Within ±30ppm/°C	X7R	Within ±15%	X5R	Within ±15%	Y5V	Within +30%/-80%																																																												
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7.	Adhesive Strength of Termination	<p>* Pressurizing force : 5N (≤ 0603) and 10N (> 0603)</p> <p>* Test time: 10\pm1 sec.</p>	<p>* No remarkable damage or removal of the terminations.</p>															
8.	Vibration Resistance	<p>* Vibration frequency: 10~55 Hz/min.</p> <p>* Total amplitude: 1.5mm</p> <p>* Test time: 6 hrs. (Two hrs each in three mutually perpendicular directions.)</p>	<p>* No remarkable damage.</p> <p>* Cap change and Q/D.F.: To meet initial spec.</p>															
9.	Solderability	<p>* Solder temperature: 235\pm5$^{\circ}$C</p> <p>* Dipping time: 2\pm0.5 sec.</p>	<p>95% min. coverage of all metalized area.</p>															
10.	Bending Test	<p>* 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\pm1 sec.</p> <p>* Measurement to be made after keeping at room temp. for 24\pm2 hrs. (Class I) or 48\pm4 hrs. (Class II).</p>	<p>* No remarkable damage.</p> <p>* Cap change :</p> <p>NP0: within $\pm 5\%$ or 0.5pF whichever is larger</p> <p>X7R, X5R: within $\pm 12.5\%$</p> <p>Y5V: within $\pm 30\%$</p> <p>(This capacitance change means the change of capacitance under specified flexure of substrate from the capacitance measured before the test.)</p>															
11.	Resistance to Soldering Heat	<p>* Solder temperature: 260\pm5$^{\circ}$C</p> <p>* Dipping time: 10\pm1 sec</p> <p>* Preheating: 120 to 150$^{\circ}$C for 1 minute before immerse the capacitor in a eutectic solder.</p> <p>* Before initial measurement (Class II only): Perform 150+0/-10$^{\circ}$C for 1 hr and then set for 48\pm4 hrs at room temp.</p> <p>* Measurement to be made after keeping at room temp. for 24\pm2 hrs. (Class I) or 48\pm4 hrs. (Class II).</p>	<p>* No remarkable damage.</p> <p>* Cap change:</p> <p>NP0: within $\pm 2.5\%$ or 0.25pF whichever is larger</p> <p>X7R, X5R: within $\pm 7.5\%$</p> <p>Y5V: within $\pm 20\%$</p> <p>* Q/D.F., I.R. and dielectric strength: To meet initial requirements.</p> <p>* 25% max. leaching on each edge.</p>															
12.	Temperature Cycle	<p>* Conduct the five cycles according to the temperatures and time.</p> <table border="1" data-bbox="411 1093 849 1243"> <thead> <tr> <th>Step</th> <th>Temp. ($^{\circ}$C)</th> <th>Time (min.)</th> </tr> </thead> <tbody> <tr> <td>1</td> <td>Min. operating temp. +0/-3</td> <td>30\pm3</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\pm3</td> </tr> <tr> <td>4</td> <td>Room temp.</td> <td>2~3</td> </tr> </tbody> </table> <p>* Before initial measurement (Class II only): Perform 150+0/-10$^{\circ}$C for 1 hr and then set for 48\pm4 hrs at room temp.</p> <p>* Measurement to be made after keeping at room temp. for 24\pm2 hrs. (Class I) or 48\pm4 hrs. (Class II).</p>	Step	Temp. ($^{\circ}$ C)	Time (min.)	1	Min. operating temp. +0/-3	30 \pm 3	2	Room temp.	2~3	3	Max. operating temp. +3/-0	30 \pm 3	4	Room temp.	2~3	<p>* No remarkable damage.</p> <p>* Cap change :</p> <p>NP0: within $\pm 2.5\%$ or 0.25pF whichever is larger</p> <p>X7R, X5R: within $\pm 7.5\%$</p> <p>Y5V: within $\pm 20\%$</p> <p>* Q/D.F., I.R. and dielectric strength: To meet initial requirements.</p>
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13.	Humidity (Damp Heat) Steady State	* Test temp.: 40±2°C * Humidity: 90~95% RH * Test time: 500+24/-0hrs. * Measurement to be made after keeping at room temp. for 24±2 hrs. (Class I) or 48±4 hrs. (Class II).	* 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≥ 1μF, 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 border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th>Rated vol.</th> <th>D.F. ≤</th> <th colspan="2">Exception of D.F. ≤</th> </tr> </thead> <tbody> <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>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> </tbody> </table> Y5V: <table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th>Rated vol.</th> <th>D.F. ≤</th> <th colspan="2">Exception of D.F. ≤</th> </tr> </thead> <tbody> <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> </tbody> </table> *I.R.: ≥10V, 1GΩ or 50 Ω-F whichever is smaller. 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15.	High Temperature Load (Endurance)	Test temp. : NP0, X7R/X7E: 125±3°C X5R, Y5V: 85±3°C 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 ≥ 1µF, 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:																																																																							
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APPENDIXES

■ **Tape & reel dimensions**

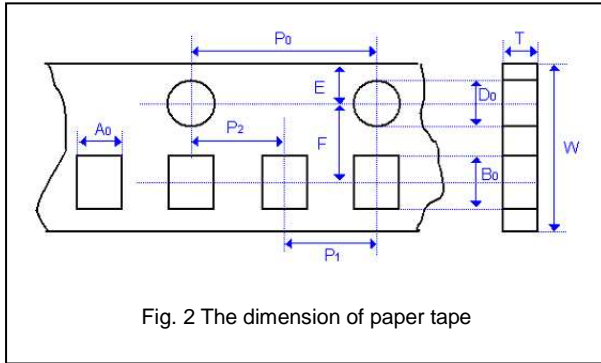


Fig. 2 The dimension of paper tape

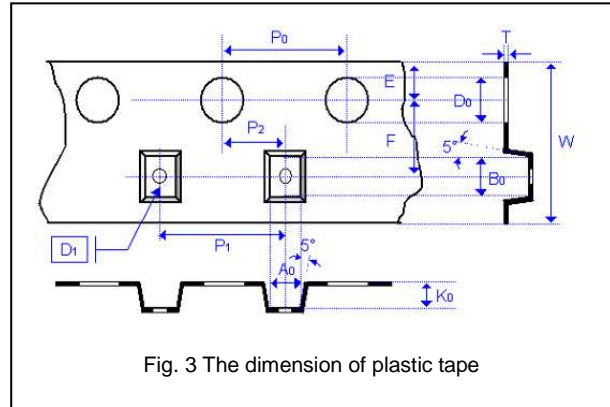


Fig. 3 The dimension of plastic tape

Size	0402	0603	0805			1206			1210		1812
Thickness	N	S, X	A	B	C, D, I	B	C, J, D	G	C, D, G	M	D, K
A ₀	0.62±0.05	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	<3.81
B ₀	1.12±0.05	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	<5.30
T	0.60±0.05	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	0.25±0.05
K ₀	-	-	-	-	<2.50	-	<2.50	<2.50	<2.50	<3.00	<2.50
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	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
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
P ₁	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	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
D ₀	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
D ₁	-	-	-	-	1.00±0.10	-	1.00±0.10	1.00±0.10	1.00±0.10	1.00±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±0.10	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	5.50±0.05

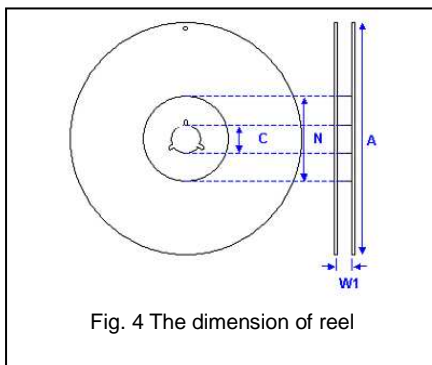
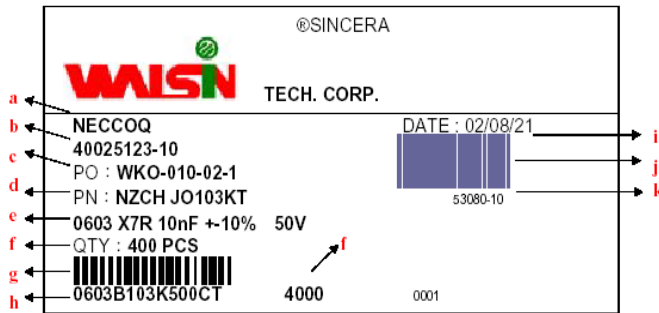


Fig. 4 The dimension of reel

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	NPO*	NPO, X7R, Y5V
①	Ceramic material	BaTiO ₃ based	
②	Inner electrode	AgPd alloy	Ni
③	Termination	Inner layer	Ag Cu
④		Middle layer	Ni
⑤		Outer layer	Sn

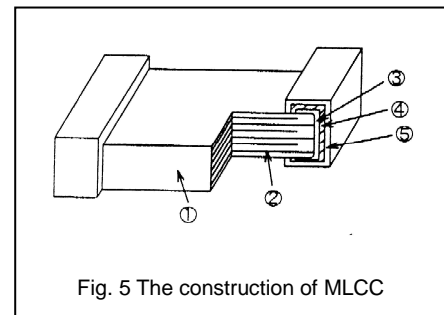


Fig. 5 The construction of MLCC

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

▣ 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 N₂ within oven are recommended.

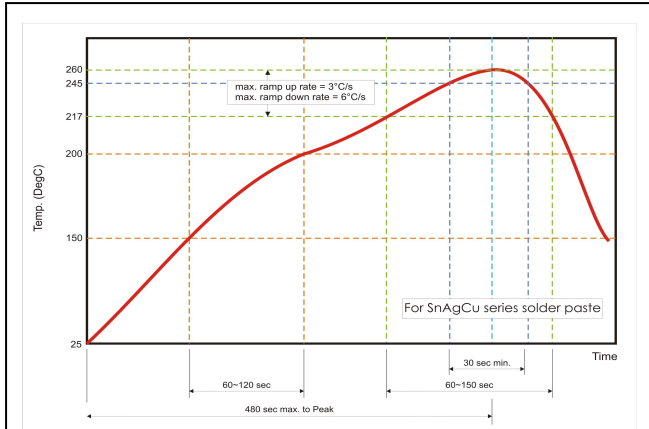


Fig. 6 Recommended reflow soldering profile for SMT process with SnAgCu series solder paste.

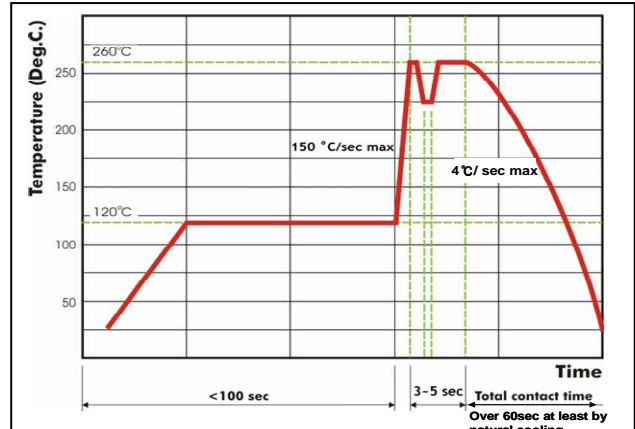


Fig. 7 Recommended wave soldering profile for SMT process with SnAgCu series solder.