

# APPROVAL SHEET

## MULTILAYER CERAMIC CAPACITORS

General Purpose Series (4V to 100V)

0201 to 1812 Sizes

NP0, X7R, Y5V, X6S & X5R 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, X6S, X5R and Y5V dielectric material and which provides product with high electrical precision, stability and reliability.

## 2. FEATURES

- a. A wide selection of sizes is available (0201 to 1812).
- b. High capacitance in given case size.
- c. Capacitor with lead-free termination (pure Tin).

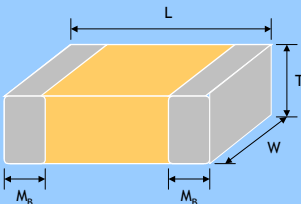
## 3. APPLICATIONS

- a. For general digital circuit.
- b. For power supply bypass capacitors.
- c. For consumer electronics.
- d. For telecommunication.

## 4. HOW TO ORDER

<u>1206</u>	<u>B</u>	<u>104</u>	<u>K</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)	N=NP0	Two significant	A=±0.05pF	Two significant	C=Cu/Ni/Sn	T=7" reeled
0201 (0603)	(C0G)	digits followed by	B=±0.1pF	digits followed by		R=7" reeled (2mm
0402 (1005)	B=X7R	no. of zeros. And	C=±0.25pF	no. of zeros. And		pitch for 0603 size;
0603 (1608)	F=Y5V	R is in place of	D=±0.5pF	R is in place of		paper tape)
0805 (2012)	X=X5R	decimal point.	F=±1%	decimal point.		G=13" reeled
1206 (3216)	S=X6S		G=±2%			
1210 (3225)		eg.:	J=±5%	4R0=4 VDC		
1812 (4532)		0R5=0.5pF	K=±10%	6R3=6.3 VDC		
		1R0=1.0pF	M=±20%	100=10 VDC		
		104=10x10 <sup>4</sup>	Z=-20/+80%	160=16 VDC		
		=100nF		250=25 VDC		
				500=50 VDC		
				101=100 VDC		

## 5. EXTERNAL DIMENSIONS

Outline	Size Inch (mm)	L (mm)	W (mm)	T (mm)/Symbol	Soldering Method <sup>?</sup>	M <sub>B</sub> (mm)	
<div></div> <p>Fig. 1 The outline of MLCC</p>	01R5 (0402)	0.4±0.02	0.2±0.02	0.2±0.02	V	R	0.10±0.03
	0201 (0603)	0.6±0.03	0.3±0.03	0.3±0.03	L	R	0.15±0.05
		0.6±0.05 <sup>#2</sup>	0.3±0.05 <sup>#2</sup>	0.3±0.05 <sup>#2</sup>			0.15±0.1/-0.05
		0.6±0.09 <sup>#3</sup>	0.3±0.09 <sup>#3</sup>	0.3±0.09 <sup>#3</sup>			
	0402 (1005)	1.00±0.05	0.50±0.05	0.50±0.05	N	R	0.25 +0.05/-0.10
				0.50+0.02/-0.05	Q	R	
		1.00±0.20	0.50±0.20	0.5±0.20	E	R	
	0603 (1608)	1.60±0.10	0.80±0.10	0.80±0.07	S	R / W	0.40±0.15
		1.60+0.15/-0.10	0.80+0.15/-0.10	0.50±0.10	H	R / W	
		1.60±0.20 <sup>#1</sup>	0.80±0.20 <sup>#1</sup>	0.8±0.20 <sup>#1</sup>	X	R / W	
	0805 (2012)	2.00±0.15	1.25±0.10	0.50±0.10	H	R / W	0.50±0.20
				0.60±0.10	A	R / W	
				0.80±0.10	B	R / W	
				1.25±0.10	D	R	
		2.00±0.20	1.25±0.20	0.85±0.10	T	R / W	
				1.25±0.20	I	R	
	1206 (3216)	3.20±0.15	1.60±0.15	0.80±0.10	B	R / W	0.60±0.20 (0.5±0.25) <sup>***</sup>
				0.95±0.10	C	R	
				1.25±0.10	D	R	
		3.20±0.20	1.60±0.20	1.15±0.15	J	R	
				1.60±0.20	G	R	
				0.85±0.10	T	R / W	
		3.20+0.30/-0.10	1.60+0.30/-0.10	1.60+0.30/-0.10	P	R	
	1210 (3225)	3.20±0.30	2.50±0.20	0.95±0.10	C	R	0.75±0.25
				0.85±0.10	T	R	
				1.25±0.10	D	R	
		3.20±0.40	2.50±0.30	1.60±0.20	G	R	
				2.00±0.20	K	R	
				2.50±0.30	M	R	
	1808 (4520)	4.50±0.40 (4.5+0.5/-0.3) <sup>**</sup>	2.03±0.25	1.25±0.10	D	R	0.75±0.25 (0.5±0.25) <sup>***</sup>
				1.40±0.15	F	R	
				1.60±0.20	G	R	
				2.00±0.20	K	R	
	1812 (4532)	4.50±0.40 (4.5+0.5/-0.3) <sup>**</sup>	3.20±0.30	1.25±0.10	D	R	0.75±0.25 (0.5±0.25) <sup>***</sup>
				1.60±0.20	G	R	
			3.20±0.40	2.00±0.20	K	R	
				2.50±0.30	M	R	
2.80±0.30		U		R			

\* R = Reflow soldering process; W = Wave soldering process.

\*\* For 1808\_200V ~3kV, 1812\_200V~3kV and safety certificated products.

\*\*\* For 1206\_1000V ~3kV, 1808\_200V ~3kV, 1812\_200V~3kV and safety certificated products.

#1: For 0603/Cap ≥ 10μF or 0603(>10V)/Cap>1μF products.

#2: For 0201/Cap ≥ 0.68μF products.

#3: For 0201/Cap >1μF products.

## 6. GENERAL ELECTRICAL DATA

Dielectric	NP0	X7R	Y5V	X5R	X6S
Size	0402, 0603, 0805, 1206, 1210, 1812				
Capacitance range*	0.1pF to 0.1μF	100pF to 47μF	0.01μF to 100μF	100pF to 220μF	0.1μF to 100μF
Capacitance tolerance**	Cap≤5pF <sup>#1</sup> : A (±0.05pF), 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%)	K (±10%), M (±20%)	K (±10%), M (±20%)
Rated voltage (WVDC)	10V, 16V, 25V, 50V,100V	6.3V, 10V, 16V, 25V, 50V, 100V		4V, 6.3V, 10V, 16V, 25V, 50V	
DF(Tan δ)*	Cap<30pF: Q≥400+20C Cap≥30pF: Q≥1000	Note 1			
Operating temperature	-55 to +125°C		-25 to +85°C	-55 to +85°C	-55 to +105°C
Capacitance characteristic	±30ppm	±15%	+30/-80%	±15%	±22%
Termination	Ni/Sn (lead-free termination)				

#1: NP0, 0.1pF product only provide B tolerance

\* 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/X6S/X5R: 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 ambient condition for 24±2 hours before measurement.

Note 1:

X7R/X5R/X6S

Rated vol.	D.F. ≤	Exception of D.F. ≤	
≥100V	≤2.5%	≤3%	1206 ≥ 0.47μF
		≤5%	0805 ≥ 0.1μF; 0603 ≥ 0.068μF; 1206 ≥ 1μF; TT series
50V	≤2.5%	≤3%	0201(50V); 0603 ≥ 0.047μF; 0805 ≥ 0.18μF; 1206 ≥ 0.47μF
		≤5%	1210 ≥ 4.7μF
		≤10%	0402 ≥ 0.1μF; 0603 ≥ 0.1μF; 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 ≥ 0.68μF; 1206 ≥ 2.2μF; 1210 ≥ 4.7μF
		≤10%	0201 ≥ 0.1μF; 0402 ≥ 0.22μF; 0603 ≥ 0.68μF; 0805 ≥ 2.2μF; 1206 ≥ 4.7μF; 1210 ≥ 22μF; TT series
10V	≤5%	≤10%	0201 ≥ 0.012μF; 0402 ≥ 0.33μF (0402/X7R ≥ 0.22μF); TT series
		≤15%	0603 ≥ 0.33μF; 0805 ≥ 2.2μF; 1206 ≥ 2.2μF; 1210 ≥ 22μF
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
16V (C≥1.0μF)	9%	12.5%	0402 ≥ 0.22μF
		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. NP0 Dielectric 0201, 0402, 0603, 0805 Sizes

DIELECTRIC		NP0																	
SIZE		0201			0402					0603					0805				
RATED VOLTAGE (VDC)		16	25	50	10	16	25	50	100	10	16	25	50	100	10	16	25	50	100
Capacitance	0.1pF (0R1)	L	L	L	N	N	N	N											
	0.2pF (0R2)	L	L	L	N	N	N	N	N										
	0.3pF (0R3)	L	L	L	N	N	N	N	N										
	0.4pF (0R4)	L	L	L	N	N	N	N	N										
	0.5pF (0R5)	L	L	L	N	N	N	N	N	N	S	S	S	S	S	A	A	A	A
	0.6pF (0R6)	L	L	L	N	N	N	N	N	N	S	S	S	S	S	A	A	A	A
	0.7pF (0R7)	L	L	L	N	N	N	N	N	N	S	S	S	S	S	A	A	A	A
	0.8pF (0R8)	L	L	L	N	N	N	N	N	N	S	S	S	S	S	A	A	A	A
	0.9pF (0R9)	L	L	L	N	N	N	N	N	N	S	S	S	S	S	A	A	A	A
	1.0pF (1R0)	L	L	L	N	N	N	N	N	N	S	S	S	S	S	A	A	A	A
	1.2pF (1R2)	L	L	L	N	N	N	N	N	N	S	S	S	S	S	A	A	A	A
	1.5pF (1R5)	L	L	L	N	N	N	N	N	N	S	S	S	S	S	A	A	A	A
	1.8pF (1R8)	L	L	L	N	N	N	N	N	N	S	S	S	S	S	A	A	A	A
	2.0pF (2R0)	L	L	L	N	N	N	N	N	N	S	S	S	S	S	A	A	A	A
	2.2pF (2R2)	L	L	L	N	N	N	N	N	N	S	S	S	S	S	A	A	A	A
	2.7pF (2R7)	L	L	L	N	N	N	N	N	N	S	S	S	S	S	A	A	A	A
	3.0pF (3R0)	L	L	L	N	N	N	N	N	N	S	S	S	S	S	A	A	A	A
	3.3pF (3R3)	L	L	L	N	N	N	N	N	N	S	S	S	S	S	A	A	A	A
	3.9pF (3R9)	L	L	L	N	N	N	N	N	N	S	S	S	S	S	A	A	A	A
	4.0pF (4R0)	L	L	L	N	N	N	N	N	N	S	S	S	S	S	A	A	A	A
	4.7pF (4R7)	L	L	L	N	N	N	N	N	N	S	S	S	S	S	A	A	A	A
	5.0pF (5R0)	L	L	L	N	N	N	N	N	N	S	S	S	S	S	A	A	A	A
	5.6pF (5R6)	L	L	L	N	N	N	N	N	N	S	S	S	S	S	A	A	A	A
	6.0pF (6R0)	L	L	L	N	N	N	N	N	N	S	S	S	S	S	A	A	A	A
	6.8pF (6R8)	L	L	L	N	N	N	N	N	N	S	S	S	S	S	A	A	A	A
	7.0pF (7R0)	L	L	L	N	N	N	N	N	N	S	S	S	S	S	A	A	A	A
	8.0pF (8R0)	L	L	L	N	N	N	N	N	N	S	S	S	S	S	A	A	A	A
	8.2pF (8R2)	L	L	L	N	N	N	N	N	N	S	S	S	S	S	A	A	A	A
	9.0pF (9R0)	L	L	L	N	N	N	N	N	N	S	S	S	S	S	A	A	A	A
	10pF (100)	L	L	L	N	N	N	N	N	N	S	S	S	S	S	A	A	A	A
	12pF (120)	L	L	L	N	N	N	N	N	N	S	S	S	S	S	A	A	A	A
	15pF (150)	L	L	L	N	N	N	N	N	N	S	S	S	S	S	A	A	A	A
	18pF (180)	L	L	L	N	N	N	N	N	N	S	S	S	S	S	A	A	A	A
	22pF (220)	L	L	L	N	N	N	N	N	N	S	S	S	S	S	A	A	A	A
	27pF (270)	L	L	L	N	N	N	N	N	N	S	S	S	S	S	A	A	A	A
	33pF (330)	L	L	L	N	N	N	N	N	N	S	S	S	S	S	A	A	A	A
	39pF (390)	L	L	L	N	N	N	N	N	N	S	S	S	S	S	A	A	A	A
	47pF (470)	L	L	L	N	N	N	N	N	N	S	S	S	S	S	A	A	A	A
	56pF (560)	L	L	L	N	N	N	N	N	N	S	S	S	S	S	A	A	A	A
	68pF (680)	L	L	L	N	N	N	N	N	N	S	S	S	S	S	A	A	A	A
	82pF (820)	L	L	L	N	N	N	N	N	N	S	S	S	S	S	A	A	A	A
	100pF (101)	L	L	L	N	N	N	N	N	N	S	S	S	S	S	A	A	A	A
	120pF (121)	L	L	L	N	N	N	N	N	N	S	S	S	S	S	A	A	A	A
	150pF (151)				N	N	N	N	N	N	S	S	S	S	S	A	A	A	A
	180pF (181)				N	N	N	N	N	N	S	S	S	S	S	A	A	A	A
	220pF (221)				N	N	N	N	N	N	S	S	S	S	S	A	A	A	A
270pF (271)				N	N	N	N	N	N	S	S	S	S	S	A	A	A	A	
330pF (331)				N	N	N	N	N	N	S	S	S	S	S	A	A	A	A	
390pF (391)				N	N	N	N	N	N	S	S	S	S	S	B	B	B	B	
470pF (471)				N	N	N	N	N	N	S	S	S	S	S	B	B	B	B	
560pF (561)				N	N	N	N	N	N	S	S	S	S	S	B	B	B	B	
680pF (681)				N	N	N	N	N	N	S	S	S	S	S	B	B	B	B	
820pF (821)				N	N	N	N	N	N	S	S	S	S	S	B	B	B	B	
1,000pF (102)				N	N	N	N	N	N	S	S	S	S	S	B	B	B	B	
1,200pF (122)										X	X	X	X	X	B	B	B	B	
1,500pF (152)										X	X	X	X	X	B	B	B	B	
1,800pF (182)										X	X	X	X	X	B	B	B	B	
2,200pF (222)										X	X	X	X	X	B	B	B	B	
2,700pF (272)										X	X	X	X	X	D	D	D	D	
3,300pF (332)										X	X	X	X	X	D	D	D	D	
3,900pF (392)										X	X	X	X	X	D	D	D	D	
4,700pF (472)										X	X	X	X	X	D	D	D	D	
5,600pF (562)										X	X	X	X	X	D	D	D	D	
6,800pF (682)										X	X	X	X	X	D	D	D	D	
8,200pF (822)										X	X	X	X	X	D	D	D	D	
0.010uF (103)										X	X	X	X	X	D	D	D	D	
0.012uF (123)															T	T	T	T	
0.018uF (183)															D	D	D	D	
0.022uF (223)															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.

### 7-1. NP0 Dielectric 1206, 1210, 1812 Sizes

DIELECTRIC		NP0												
SIZE		1206					1210					1812		
RATED VOLTAGE (VDC)		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)	T	T	T	T	T	D	D	D	D	D	D	D	D
0.015μF (153)	T	T	T	T	T	D	D	D	D	D	D	D	D	
0.018μF (183)	T	T	T	T	T						D	D	D	
0.022μF (223)	T	T	T	T	T						D	D	D	
0.027μF (273)	T	T	T	T							D	D	D	
0.033μF (333)	T	T	T	T							D	D	D	
0.039μF (393)	J	J	J	J										
0.047μF (473)	J	J	J	J										
0.056μF (563)	J	J	J	J										
0.068μF (683)	G	G	G	G										
0.082μF (823)	G	G	G	G										
0.1μF (104)	G	G	G	G										

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.

7-2. X7R Dielectric 0201, 0402, 0603, 0805 Sizes

DIELECTRIC		X7R																							
SIZE		0201					0402					0603						0805							
RATED VOLTAGE (VDC)		6.3	10	16	25	50	6.3	10	16	25	50	100	6.3	10	16	25	50	100	6.3	10	16	25	50	100	
Capacitance	100pF (101)			L	L	L		N	N	N	N	N		S	S	S	S	S		B	B	B	B	B	
	120pF (121)			L	L	L		N	N	N	N	N		S	S	S	S	S		B	B	B	B	B	
	150pF (151)			L	L	L		N	N	N	N	N		S	S	S	S	S		B	B	B	B	B	
	180pF (181)			L	L	L		N	N	N	N	N		S	S	S	S	S		B	B	B	B	B	
	220pF (221)			L	L	L		N	N	N	N	N		S	S	S	S	S		B	B	B	B	B	
	270pF (271)			L	L	L		N	N	N	N	N		S	S	S	S	S		B	B	B	B	B	
	330pF (331)			L	L	L		N	N	N	N	N		S	S	S	S	S		B	B	B	B	B	
	390pF (391)			L	L	L		N	N	N	N	N		S	S	S	S	S		B	B	B	B	B	
	470pF (471)			L	L	L		N	N	N	N	N		S	S	S	S	S		B	B	B	B	B	
	560pF (561)			L	L	L		N	N	N	N	N		S	S	S	S	S		B	B	B	B	B	
	680pF (681)			L	L	L		N	N	N	N	N		S	S	S	S	S		B	B	B	B	B	
	820pF (821)			L	L	L		N	N	N	N	N		S	S	S	S	S		B	B	B	B	B	
	1,000pF (102)	L	L	L	L	L		N	N	N	N	N		S	S	S	S	S		B	B	B	B	B	
	1,200pF (122)	L	L	L	L			N	N	N	N			S	S	S	S	S		B	B	B	B	B	
	1,500pF (152)	L	L	L	L			N	N	N	N			S	S	S	S	S		B	B	B	B	B	
	1,800pF (182)	L	L	L				N	N	N	N			S	S	S	S	S		B	B	B	B	B	
	2,200pF (222)	L	L	L				N	N	N	N			S	S	S	S	S		B	B	B	B	B	
	2,700pF (272)	L	L	L				N	N	N	N			S	S	S	S	S		B	B	B	B	B	
	3,300pF (332)	L	L	L				N	N	N	N			S	S	S	S	S		B	B	B	B	B	
	3,900pF (392)	L	L	L				N	N	N	N			S	S	S	S	S		B	B	B	B	B	
	4,700pF (472)	L	L	L				N	N	N	N			S	S	S	S	S		B	B	B	B	B	
	5,600pF (562)	L	L					N	N	N	N			S	S	S	S	S		B	B	B	B	B	
	6,800pF (682)	L	L					N	N	N	N			S	S	S	S	S		B	B	B	B	B	
	8,200pF (822)	L	L					N	N	N	N			S	S	S	S	S		B	B	B	B	B	
	0.010μF (103)	L	L	L				N	N	N	N			S	S	S	S	S		B	B	B	B	B	
	0.012μF (123)							N	N	N				S	S	S	S	X		B	B	B	B	B	
	0.015μF (153)							N	N	N				S	S	S	S	X		B	B	B	B	B	
	0.018μF (183)							N	N	N				S	S	S	S	X		B	B	B	B	B	
	0.022μF (223)							N	N	N	N			S	S	S	S	X		B	B	B	B	B	
	0.027μF (273)							N	N	N				S	S	S	S	X		B	B	B	B	D	
	0.033μF (333)							N	N	N	N			S	S	S	X	X		B	B	B	B	D	
	0.039μF (393)							N	N	N				S	S	S	X	X		B	B	B	B	D	
	0.047μF (473)							N	N	N	N			S	S	S	X	X		B	B	B	B	D	
	0.056μF (563)							N	N					S	S	S	X	X		B	B	B	B	D	
	0.068μF (683)							N	N		N			S	S	S	X	X		B	B	B	B	D	
	0.082μF (823)							N	N					S	S	S	X	X		B	B	B	B	D	
	0.10μF (104)						N	N	N	N	N			S	S	S	X	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)						N	N	N	N				S	S	X	X			D	D	D	D	T		
0.27μF (274)												X	X	X	X				D	D	D	I			
0.33μF (334)												X	X	X	X				D	D	D	I			
0.39μF (394)												X	X	X	X				D	D	D	I			
0.47μF (474)						N	N					X	X	X	X	X			D	D	D	I	I		
0.56μF (564)												X	X	X					D	D	D				
0.68μF (684)												X	X	X					D	D	D				
0.82μF (824)												X	X	X					D	D	D				
1.0μF (105)						N						X	X	X	X	X			D	D	D	I			
1.5μF (155)																			I	I	I				
2.2μF (225)												X	X						I	I	I	I			
3.3μF (335)																									
4.7μF (475)																			I	I	I	I			
6.8μF (685)																									
10μF (106)																			I	I	I*				
22μF (226)																									

1. The letter in cell is expressed the symbol of product thickness.
2. The letter in cell with " \* " mark is expressed product not in 10% (code "K") tolerance.

## 7-2. X7R Dielectric 1206, 1210, 1812 Sizes

DIELECTRIC		X7R																
SIZE		1206						1210						1812				
RATED VOLTAGE (VDC)		6.3	10	16	25	50	100	6.3	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	
1.0μF (105)		J	J	J	P	P		D	D	D	D	K	D	D	D	K	K	
1.5μF (155)	J	J	J	P					K	G	M	M					K	
2.2μF (225)	J	J	J	P	P	P			K	G	M	M				M	M	
3.3μF (335)		P	P	P					K	G								
4.7μF (475)	P	P	P	P	P			K	K	K	M							
6.8μF (685)																		
10μF (106)	P	P	P	P				K	K	K	M							
22μF (226)	P	P	P*					M	M	M								
47μF (476)							M	M										
100μF (107)																		

1. The letter in cell is expressed the symbol of product thickness.
2. The letter in cell with " \* " mark is expressed product not in 10% (code "K") tolerance.



### 7-3. Y5V Dielectric 0402, 0603, 0805 Sizes

DIELECTRIC SIZE		Y5V															
RATED VOLTAGE (VDC)		0402					0603					0805					
		6.3	10	16	25	50	6.3	10	16	25	50	6.3	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				S	S	S	S		A	A	A	A	
	0.33μF (334)	N	N	N				S	S	S	X		B	B	B	B	
	0.47μF (474)	N	N	N				S	S	X	X		B	B	B	B	
	0.68μF (684)	N						S	X	X			B	B	D	D	
	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				

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.

### 7-3. Y5V Dielectric 1206, 1210, 1812 Sizes

DIELECTRIC		Y5V																
SIZE		1206						1210						1812				
RATED VOLTAGE (VDC)		6.3	10	16	25	50	100	6.3	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
	1.0μF (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	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			D	D	D	K	
22μF (226)		P	P					K	K									
47μF (476)	P						K	K						M				
100μF (107)							M											

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.

7-4. X5R Dielectric 0201, 0402, 0603, 0805, 1206, 1210 Sizes

Dielectric		X5R														
Size		0201					0402					0603				
Rated Voltage (VDC)		6.3	10	16	25	50	6.3	10	16	25	50	6.3	10	16	25	50
Capacitance	100pF (101)			L	L	L										
	120pF (121)			L	L	L										
	150pF (151)			L	L	L										
	180pF (181)			L	L	L										
	220pF (221)			L	L	L										
	270pF (271)			L	L	L										
	330pF (331)			L	L	L										
	390pF (391)			L	L	L										
	470pF (471)			L	L	L										
	560pF (561)			L	L	L										
	680pF (681)			L	L	L										
	820pF (821)			L	L	L										
	1,000pF (102)		L	L	L	L										
	1,500pF (152)		L	L												
	2,200pF (222)		L	L												
	2,700pF (272)		L	L												
	3,300pF (332)		L	L												
	4,700pF (472)		L	L												
	6,800pF (682)		L													
	0.010μF (103)	L	L	L	L											
	0.015μF (153)	L	L													
	0.022μF (223)	L	L													
	0.027μF (273)	L	L						N							
	0.033μF (333)	L	L						N							
	0.039μF (393)	L	L						N							
	0.047μF (473)	L	L						N							
	0.056μF (563)	L	L					N	N							
	0.068μF (683)	L	L					N	N							
	0.082μF (823)	L	L				N	N	N							
	0.10μF (104)	L	L	L	L		N	N	N	N	N					
	0.15μF (154)						N	N	N	N						
	0.22μF (224)	L	L				N	N	N	N	N			X	X	
	0.27μF (274)												X	X	X	
	0.33μF (334)						N	N				X	X	X	X	
	0.39μF (394)												X	X	X	
	0.47μF (474)	L					N	N	E	E	E	X	X	X	X	X
	0.68μF (684)						N	N				X	X	X	X	
	0.82μF (824)											X	X	X		
	1.0μF (105)	L	L*				N	N	N	N		X	X	X	X	X
	1.5μF (155)											X				
	2.2μF (225)	L*					N	N	E*	E		X	X	X	X	X
	3.3μF (335)											X	X			
	4.7μF (475)						E*	E*				X	X	X	X	
	6.8μF (685)															
	10μF (106)						E*	E*				X	X	X	X*	
	22μF (226)											X*	X*			

Dielectric		X5R																
Size		0805					1206					1210						
Rated Voltage (VDC)		4	6.3	10	16	25	50	6.3	10	16	25	50	4	6.3	10	16	25	50
Capacitance	1.0μF (105)			D	D	D	I											
	1.5μF (155)		I	I	I	I			J	J					K	K		
	2.2μF (225)		I	I	I	I	I		J	J	P	P			K	K		
	3.3μF (335)		I	I	I	I			P	P	P							
	4.7μF (475)		I	I	I	I	I	P	P	P	P	P			K	K	K	
	6.8μF (685)							P	P									
	10μF (106)		I	I	I	I	I	P	P	P	P	P		K	K	K	K	M
	22μF (226)		I*	I*	I*			P	P	P	P			M	M	M	M	
	47μF (476)		I*	I*				P	P					M	M	M		
	100μF (107)	I*						P*						M*	M*			
220μF (227)												M*						

1. The letter in cell is expressed the symbol of product thickness.
2. The letter in cell with " \* " mark is expressed product not in 10% (code "K") tolerance.

### 7-5. X6S Dielectric 0201, 0402, 0603, 0805, 1206, 1210 Sizes

Dielectric		X6S																												
Size		0201		0402			0603					0805						1206					1210							
Rated Voltage (VDC)		4	6.3	6.3	10	16	25	4	6.3	10	16	25	4	6.3	10	16	25	50	6.3	10	16	25	50	6.3	10	16	25	50		
Capacitance	0.10μF (104)	L	L																											
	0.15μF (154)																													
	0.22μF (224)		L																											
	0.33μF (334)																													
	0.47μF (474)			N																										
	0.68μF (684)																													
	1.0μF (105)	L*		N	E	E	E																							
	1.5μF (155)																													
	2.2μF (225)			N	E	E					X																			
	3.3μF (335)																													
	4.7μF (475)								X		X	X						I	I											
	6.8uF (685)																													
	10μF (106)								X*	X*	X*			I	I	I	I	I					G							
	22μF (226)							X*	X*						I*	I*	I*				P	P*					M			
	47μF (476)													I*						P						M	M	M		
100μF (107)																									M*					

1. The letter in cell is expressed the symbol of product thickness.
2. The letter in cell with " \* " mark is expressed product not in 10% (code "K") tolerance.

### 8. PACKAGING STYLE AND QUANTITY

Size	Thickness (mm)/Symbol		Paper tape		Plastic tape	
			7" reel	13" reel	7" reel	13" reel
0201 (0603)	0.30±0.03	L	15,000	70,000	-	-
	0.30±0.05	L	15,000	-	-	-
	0.30±0.09	L	15,000	-	-	-
0402 (1005)	0.50±0.05	N	10,000	50,000	-	-
	0.50+0.02/-0.05	Q	10,000	50,000	-	-
	0.50±0.20	E	10,000	-	-	-
0603 (1608)	0.50±0.10	H	4,000	-	-	-
	0.80±0.07	S	4,000	15,000	-	-
	0.80+0.15/-0.10	X	4,000	15,000	-	-
0805 (2012)	0.50±0.10	H	4,000	15,000	-	-
	0.60±0.10	A	4,000	15,000	-	-
	0.80±0.10	B	4,000	15,000	-	-
	0.85±0.10	T	4,000	15,000	-	-
	1.25±0.10	D	-	-	3,000	10,000
	1.25±0.20	I	-	-	3,000	10,000
1206 (3216)	0.80±0.10	B	4,000	15,000	-	-
	0.85±0.10	T	4,000	15,000	-	-
	0.95±0.10	C	-	-	3,000	10,000
	1.15±0.15	J	-	-	3,000	10,000
	1.25±0.10	D	-	-	3,000	10,000
	1.60±0.20	G	-	-	2,000	10,000
1210 (3225)	1.60+0.30/-0.10	P	-	-	2,000	9,000
	0.85±0.10	T	-	-	3,000	10,000
	0.95±0.10	C	-	-	3,000	10,000
	1.25±0.10	D	-	-	3,000	10,000
	1.60±0.20	G	-	-	2,000	-
	2.00±0.20	K	-	-	1,000	6,000
1808 (4520)	2.50±0.30	M	-	-	1,000	6,000
	1.25±0.10	D	-	-	2,000	10,000
	1.10±0.15	F	-	-	2,000	10,000
1812 (4532)	1.60±0.20	G	-	-	2,000	8,000
	2.00±0.20	K	-	-	1,000	6,000
	1.25±0.10	D	-	-	1,000	5,000
	1.60±0.20	G	-	-	1,000	-
	2.00±0.20	K	-	-	1,000	-
1812 (4532)	2.50±0.30	M	-	-	500	3,000
	2.80±0.30	U	-	-	500	-

Unit: pieces

## 9. RELIABILITY TEST CONDITIONS AND REQUIREMENTS

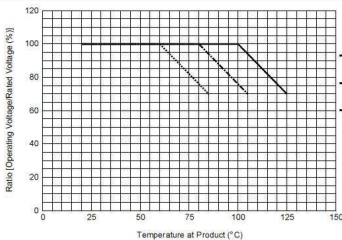
No.	Item	Test Condition	Requirements					
1.	Visual and Mechanical	---	* No remarkable defect. * Dimensions to conform to individual specification sheet.					
2.	Capacitance	Class I: (NP0) ≤ 1000pF, 1.0±0.2Vrms · 1MHz±10% > 1000pF, 1.0±0.2Vrms · 1KHz±10% Class II: (X7R, X7E, X6S, X5R, Y5V) C ≤ 10μF, 1.0±0.2Vrms · 1KHz±10% ** C > 10μF, 0.5±0.2Vrms · 120Hz±20%	* Shall not exceed the limits given in the detailed spec. NP0: Cap≥30pF, Q≥1000; Cap<30pF,Q≥400+20C X7R,X5R,X6S:					
3.	Q/ D.F. (Dissipation Factor)	** Test condition: 0.5±0.2Vrms · 1KHz±10% X7R: 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 ≥ 104 (6.3V),0402 ≥ 225 (6.3V), 0603 ≥ 106 (6.3V),	Rated vol.	D.F. ≤	Exception of D.F. ≤			
			≥ 100V	≤ 2.5%	≤ 3%	1206 ≥ 0.47μF		
					≤ 5%	0805 > 0.1μF, 0603 ≥ 0.068μF, 1206>1μF; TT series		
					≤ 3%	0201(50V); 0603 ≥ 0.047μF; 0805 ≥ 0.18μF;1206 ≥ 0.47μF		
					≤ 5%	1210 ≥ 4.7μF		
			50V	≤ 2.5%	≤ 10%	0402 ≥ 0.1μF;0603>0.1μF; 0805 ≥ 1μF;1206 ≥ 2.2μF; 1210 ≥ 10μF; TT series		
			35V	≤ 3.5%	≤ 10%	0603 ≥ 1μF;0805≥2.2μF; 1210 ≥ 10μF		
					≤ 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 ≥ 0.68μF;1206 ≥ 2.2μF;1210 ≥ 4.7μF		
					≤ 10%	0201 ≥ 0.1μF; 0402 ≥ 0.22μF; 0603 ≥ 0.68μF;0805 ≥ 2.2μF; 1206 ≥ 4.7μF; 1210 ≥ 22μF; TT series		
			10V	≤ 5%	≤ 10%	0201 ≥ 0.012μF;0402 ≥ 0.33μF(0402/X7R ≥ 0.22μF); TT series		
					≤ 15%	0603 ≥ 0.33μF; 0805 ≥ 2.2μF;1206 ≥ 2.2μF;1210 ≥ 22μF		
						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%	---	---
			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, X6S, 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					
			Rated voltage	Insulation Resistance				
			All X6S items	RxC ≥ 50 Ω·F.				
			50V: 0402≥0.1μF; 0603≥2.2μF; 0805≥10μF;1206≥10μF					
			35V: 0603≥1μF;					
			25V: 0201≥0.1μF; 0402≥0.22μF;0603≥10μF;1206≥22μF					
			16V: 0603≥10μF					
			10V: 0201>0.1μF; 0603≥10μF; 0805≥47μF					
			6.3V: 0201≥0.1μF; 1206≥10μF					
			4V:0603≥22μF; 0805≥47μF					

No.	Item	Test Condition	Requirements																								
6.	Temperature Coefficient	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>	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	X6S	-55~105°C at 25°C	Y5V	-25~ 85°C at 20°C	<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>	T.C.	Capacitance Change	NPO	Within ±30ppm/°C	X7R	Within ±15%	X5R	Within ±15%	X6S	Within ±22%	Y5V	Within +30%/-80%
		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																								
		X6S	-55~105°C at 25°C																								
Y5V	-25~ 85°C at 20°C																										
T.C.	Capacitance Change																										
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X7R	Within ±15%																										
X5R	Within ±15%																										
X6S	Within ±22%																										
Y5V	Within +30%/-80%																										
7.	Adhesive Strength of Termination	* Pressurizing force : 1N (0201) and 5N (≤0603) and 10N (>0603)	* No remarkable damage or removal of the terminations.																								
		* Test time: 10±1 sec.																									
8.	Vibration Resistance	* Vibration frequency: 10~55 Hz/min.	* No remarkable damage.																								
		* Total amplitude: 1.5mm	* Cap change and Q/D.F.: To meet initial spec.																								
		* 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.																									
9.	Solderability	* Solder temperature: 235±5°C * 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.	* No remarkable damage.																								
		* Measurement to be made after keeping at room temp. for 24±2 hrs.	* Cap change : NPO: 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.)																								
11.	Resistance to Soldering Heat	* Solder temperature: 260±5°C	* No remarkable damage.																								
		* Dipping time: 10±1 sec	* Cap change:																								
		* Preheating: 120 to 150°C for 1 minute before immerse the capacitor in a eutectic solder.	NPO: within ±2.5% or 0.25pF whichever is larger X7R, X5R, X6S: within ±7.5% Y5V: within ±20%																								
		* Before initial measurement (Class II only): Perform 150+0/-10°C for 1 hr and then set for 24±2 hrs at room temp.	* Q/D.F., I.R. and dielectric strength: To meet initial requirements.																								
		* Measurement to be made after keeping at room temp. for 24±2 hrs.	* 25% max. leaching on each edge.																								
12.	Temperature Cycle	* Conduct the five cycles according to the temperatures and time.	* No remarkable damage.																								
		<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>	Step	Temp. (°C)	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	* Cap change : NPO: within ±2.5% or 0.25pF whichever is larger X7R, X5R, X6S: within ±7.5% Y5V: within ±20%									
		Step	Temp. (°C)	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																							
* Before initial measurement (Class II only): Perform 150+0/-10°C for 1 hr and then set for 24±2 hrs at room temp.	* Q/D.F., I.R. and dielectric strength: To meet initial requirements.																										
* Measurement to be made after keeping at room temp. for 24±2 hrs.																											

No.	Item	Test Condition	Requirements																																																																														
13.	Humidity (Damp Heat) Steady State	<p>* Test temp.: 40±2°C</p> <p>* Humidity: 90~95% RH</p> <p>* Test time: 500+24/-0hrs.</p> <p>* Before initial measurement (Class II only): Perform 150+0/-10°C for 1 hr and then set for 24±2 hrs at room temp.</p> <p>* Measurement to be made after keeping at room temp. for 24±2 hrs.</p>	<p>* No remarkable damage.</p> <p>* Cap change: NP0: within ±5% or 0.5pF whichever is larger X7R, X5R, X6S: ≥10V**, within ±12.5%; ≤6.3V within ±25%; TT series &amp; C≥1μF, within ±25%</p> <p>**10V: 0603≥4.7μF; 0402≥1μF; 0201≥0.1μF, within ±25%; Y5V: ≥10V, within ±30%; ≤6.3V, within +30/-40%</p> <p>* Q/D.F. value: NP0: More than 30pF Q≥350, 10pF≤C≤30pF, Q≥275+2.5C Less than 10pF Q≥200+10C</p> <p>X7R, X5R, X6S:</p> <table><tr><th>Rated vol.</th><th>D.F. ≤</th><th>Exception of D.F. ≤</th></tr><tr><td rowspan="2">≥100V</td><td rowspan="2">≤3%</td><td>≤6% 1206≥0.47μF</td></tr><tr><td>≤7.5% 0805&gt;0.1μF, 0603≥0.068μF, 1206&gt;1μF; TT series</td></tr><tr><td rowspan="3">≥50V</td><td rowspan="3">≤3%</td><td>≤6% 0201(50V); 0603≥0.047μF; 0805≥0.18μF; 1206≥0.47μF</td></tr><tr><td>≤10% 1210≥4.7μF</td></tr><tr><td>≤20% 0402≥0.1μF; 0603&gt;0.1μF; 0805≥1μF; 1206≥2.2μF; 1210≥10μF; TT series</td></tr><tr><td>35V</td><td>≤5%</td><td>≤20% 0603≥1μF; 0805≥2.2μF; 1210≥10μF</td></tr><tr><td rowspan="4">25V</td><td rowspan="4">≤5%</td><td>≤10% 0201≥0.01μF; 0805≥1μF; 1210≥10μF</td></tr><tr><td>≤14% 0603≥0.33μF; 1206≥4.7μF</td></tr><tr><td>≤15% 0402≥0.10μF; 0603≥0.47μF; 0805≥2.2μF; 1206≥6.8μF; 1210≥22μF; TT series</td></tr><tr><td>≤20% 0402≥1μF</td></tr><tr><td>16V</td><td>≤5%</td><td>≤10% 0603≥0.15μF; 0805≥0.68μF; 1206≥2.2μF; 1210≥4.7μF</td></tr><tr><td rowspan="2"></td><td rowspan="2"></td><td>≤15% 0201≥0.01μF; 0402≥0.033μF; 0603≥0.68μF; 0805≥2.2μF; 1206≥4.7μF; 1210≥22μF; TT series</td></tr><tr><td></td></tr><tr><td>10V</td><td>≤7.5%</td><td>≤15% 0201≥0.012μF; 0402≥0.33μF(0402/X7R≥0.22μF); 0603≥0.33μF; 0805≥2.2μF; 1206≥2.2μF; 1210≥22μF</td></tr><tr><td></td><td></td><td>≤20% 0201≥0.1μF; 0402≥1μF; TT series</td></tr><tr><td>6.3V</td><td>≤15%</td><td>≤30% 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></tr></table> <p>Y5V:</p> <table><tr><th>Rated vol.</th><th>D.F. ≤</th><th>Exception of D.F. ≤</th></tr><tr><td>≥50V</td><td>7.5%</td><td>10% 0603≥0.1μF; 0805≥0.47μF; 1206≥4.7μF</td></tr><tr><td>35V</td><td>10%</td><td>---</td></tr><tr><td rowspan="2">25V</td><td rowspan="2">7.5%</td><td>10% 0402≥0.047μF; 0603≥0.1μF; 0805≥0.33μF; 1206≥1μF; 1210≥4.7μF</td></tr><tr><td>15% 0402≥0.068μF; 0603≥0.47μF; 1206≥4.7μF; 1210≥22μF</td></tr><tr><td>16V (C&lt;1.0μF)</td><td>10%</td><td>12.5% 0402≥0.068μF; 0603≥0.68μF</td></tr><tr><td></td><td></td><td>20% 0402≥0.22μF</td></tr><tr><td>16V (C≥1.0μF)</td><td>12.5%</td><td>20% 0603≥2.2μF; 0805≥3.3μF; 1206≥10μF; 1210≥22μF; 1812≥47μF;</td></tr><tr><td>10V</td><td>20%</td><td>30% 0402≥0.47μF</td></tr><tr><td>6.3V</td><td>30%</td><td>---</td></tr></table> <p>*I.R.: ≥10V, 1GΩ or 50 Ω-F whichever is smaller.</p> <p>Class II (X7R, X5R, X6S, Y5V)</p> <table><tr><th>Rated voltage</th><th>Insulation Resistance</th></tr><tr><td>100V: X7R</td><td rowspan="8">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: 0201≥0.1uF; 0402≥0.22μF; 0603≥2.2μF; 0805≥2.2μF; 1206≥10μF; 1210≥10μF</td></tr><tr><td>16V: 0201≥0.1uF; 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 ; TT series ; All X6S items</td></tr></table>	Rated vol.	D.F. ≤	Exception of D.F. ≤	≥100V	≤3%	≤6% 1206≥0.47μF	≤7.5% 0805>0.1μF, 0603≥0.068μF, 1206>1μF; TT series	≥50V	≤3%	≤6% 0201(50V); 0603≥0.047μF; 0805≥0.18μF; 1206≥0.47μF	≤10% 1210≥4.7μF	≤20% 0402≥0.1μF; 0603>0.1μF; 0805≥1μF; 1206≥2.2μF; 1210≥10μF; TT series	35V	≤5%	≤20% 0603≥1μF; 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; TT series	≤20% 0402≥1μF	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; TT series		10V	≤7.5%	≤15% 0201≥0.012μF; 0402≥0.33μF(0402/X7R≥0.22μF); 0603≥0.33μF; 0805≥2.2μF; 1206≥2.2μF; 1210≥22μF			≤20% 0201≥0.1μF; 0402≥1μF; TT series	6.3V	≤15%	≤30% 0201≥0.1μF; 0402≥1μF; 0603≥10μF; 0805≥4.7μF; 1206≥47μF; 1210≥100μF; TT series	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			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%	---	Rated voltage	Insulation Resistance	100V: X7R	1GΩ or RxC≥10 Ω-F whichever is smaller.	50V: 0402≥0.1μF; 0603≥1μF; 0805≥1μF; 1206≥4.7μF; 1210≥4.7μF	35V: 0603≥1μF; 0805≥2.2μF; 1210≥10μF	25V: 0201≥0.1uF; 0402≥0.22μF; 0603≥2.2μF; 0805≥2.2μF; 1206≥10μF; 1210≥10μF	16V: 0201≥0.1uF; 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 ; TT series ; All X6S items
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No	Item	Test Condition	Requirements																																																		
14	Humidity (Damp Heat) Load	* Test temp.: 40±2°C	* No remarkable damage.																																																		
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		* Test time: 500+24/-0 hrs.	NP0: ±7.5% or 0.75pF whichever is larger.																																																		
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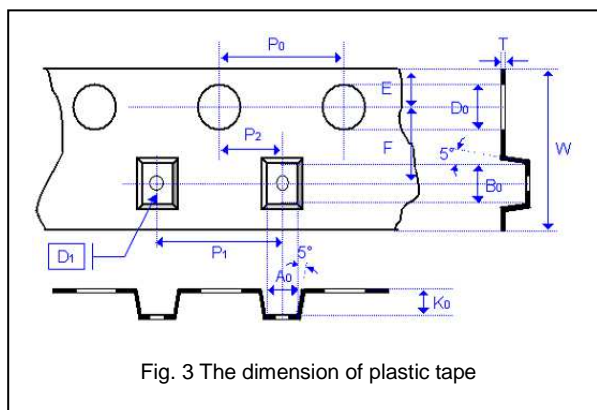
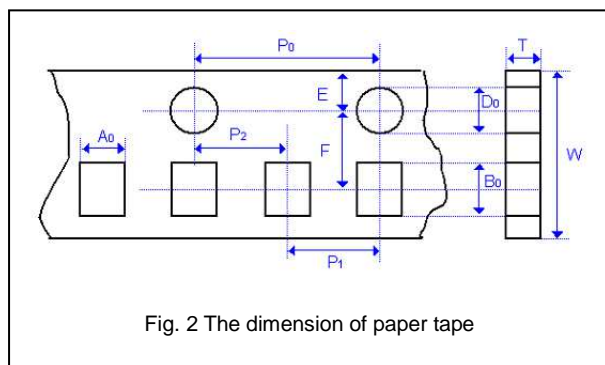


No	Item	Test Condition	Requirements																																																																			
15.	High Temperature Load (Endurance)	Test temp. : NP0, X7R/X7E: 125±3°C X6S: 105±3°C X5R, Y5V: 85±3°C Test time: 1000+24/-0 hrs. To apply voltage: (1) ≤6.3V or C≥10μF or TT series: 150% of rated voltage. (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, 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:																																																																			
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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 ** De-rating conditions:																																																																						
																																																																						
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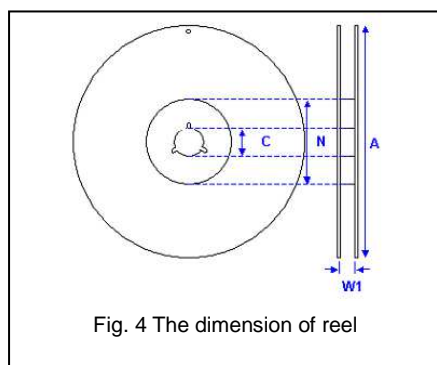


## APPENDIXES

### ■ Tape & reel dimensions

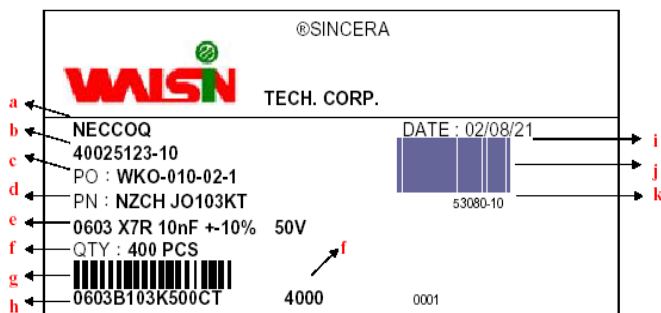


Size	0201	0402		0603	0805			1206			1210			1812		
Thickness	L	N	E	S, X	A, H	B, T	C, D, I	B, T	C, J, D	G,P	C, D	F, G, K	M	D, F, G, K	M	U
A <sub>0</sub>	0.38±0.05	0.62±0.05	0.70±0.10	1.02±0.05	1.50±0.10	1.50±0.10	<1.57	2.00±0.10	<1.85	<1.95	<2.97	<2.97	<2.97	<3.81	<3.81	<3.90
B <sub>0</sub>	0.68±0.05	1.12±0.05	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	0.42±0.05	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 <sub>0</sub>	-	-	-	-	-	-	<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	8.00±0.10	12.0±0.20	12.0±0.20	12.0±0.20
P <sub>0</sub>	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	4.00±0.10
10xP <sub>0</sub>	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±0.10	40.0±0.20
P <sub>1</sub>	2.00±0.05	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 <sub>2</sub>	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	2.00±0.05
D <sub>0</sub>	1.55±0.05	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 <sub>1</sub>	-	-	-	-	-	-	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±0.05	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	3.50±0.05	5.50±0.05	5.50±0.05	5.50±0.05



Size	0201, 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 <sub>i</sub>	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, X7R, X5R, X6S, Y5V
①	Ceramic material		BaTiO <sub>3</sub> based
②	Inner electrode		Ni
③	Termination	Inner layer	Cu
④		Middle layer	Ni
⑤		Outer layer	Sn

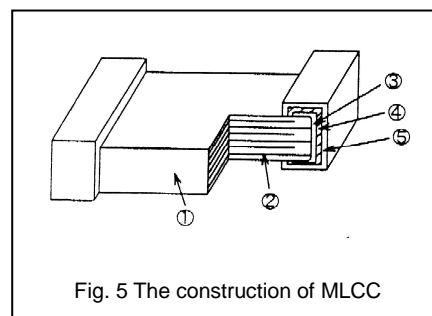


Fig. 5 The construction of MLCC

## ■ 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.

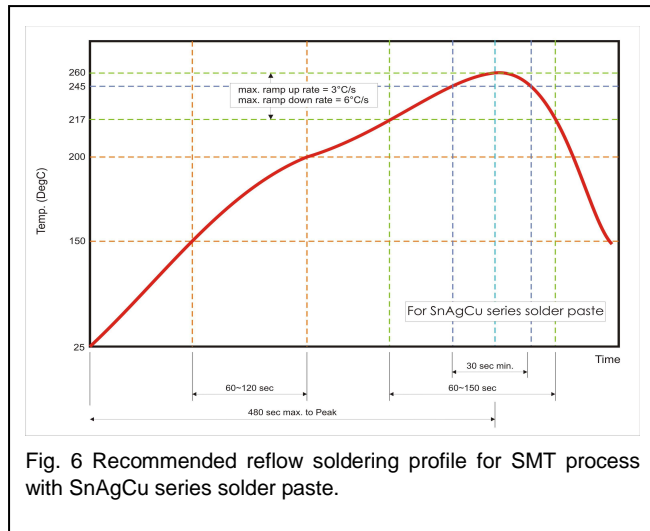


Fig. 6 Recommended reflow soldering profile for SMT process with SnAgCu series solder paste.

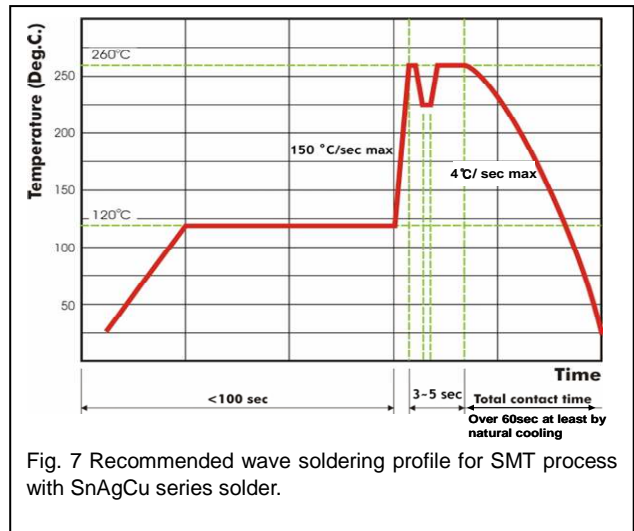


Fig. 7 Recommended wave soldering profile for SMT process with SnAgCu series solder.