

APPROVAL SHEET

MULTILAYER CERAMIC CAPACITORS

General Purpose Series (4V to 100V)

0201 to 1812 Sizes

NP0, X7R, Y5V, X6S, X7S & X5R Dielectrics

Halogen Free & RoHS Compliance

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

Multilayer Ceramic Capacitors

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

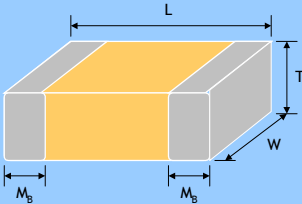
- a. For general digital circuit.
- b. For power supply bypass capacitors.
- c. For consumer electronics.
- d. For telecommunication.

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 (C0G)	Two significant digits followed by no. of zeros. And R is in place of decimal point.	A=±0.05pF B=±0.1pF C=±0.25pF D=±0.5pF F=±1% G=±2% J=±5%	Two significant digits followed by no. of zeros. And R is in place of decimal point.	C=Cu/Ni/Sn	T=7" reeled G=13" reeled
0201 (0603)	B=X7R	eg.: 0R5=0.5pF 1R0=1.0pF 104=10x10 ⁴ =100nF	K=±10% M=±20% Z=-20/+80%	4R0 =4 VDC 6R3 =6.3 VDC 100 =10 VDC 160 =16 VDC 250 =25 VDC 500 =50 VDC 101 =100 VDC		
0402 (1005)	F=Y5V					
0603 (1608)	X=X5R					
0805 (2012)	S=X6S					
1206 (3216)	A=X7S					
1210 (3225)						
1812 (4532)						

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5. EXTERNAL DIMENSIONS

Outline	Size Inch (mm)	L (mm)	W (mm)	T (mm)/Symbol	Soldering Method *	M _B (mm)	
 <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	R	0.15±0.05
		0.6±0.05 ^{#2}	0.3±0.05 ^{#2}	0.3±0.05 ^{#2}			0.15+0.1/-0.05
		0.6±0.09 ^{#3}	0.3±0.09 ^{#3}	0.3±0.09 ^{#3}			
	0402 (1005)	1.00±0.05	0.50±0.05	0.50±0.05	N R	R	0.25 +0.05/-0.10
		1.00±0.20	0.50±0.20	0.50+0.02/-0.05	Q R		
	0603 (1608)	1.60±0.10	0.80±0.10	0.80±0.07	S R / W	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		
				0.80+0.15/-0.10	X R / W		
	0805 (2012)	2.00±0.15	1.25±0.10	0.50±0.10	H R / W	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		
	1206 (3216)	3.20±0.15	1.60±0.15	0.80±0.10	B R / W	R / W	0.60±0.20 (0.5±0.25) ^{***}
				0.95±0.10	C R		
				1.25±0.10	D R		
		1.15±0.15	J R				
		3.20±0.20	1.60±0.20	1.60±0.20	G R		
	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	R	0.75±0.25	
			0.85±0.10	T R			
			1.25±0.10	D R			
	1.60±0.20	G R					
	3.20±0.40	2.50±0.30	2.00±0.20	K R			
3.20±0.60 ^{#4}	2.50±0.50 ^{#4}	2.50±0.30	M R				
		2.50±0.50 ^{#4}					
1808 (4520)	4.50±0.40 (4.5+0.5/-0.3) ^{**}	2.03±0.25	1.25±0.10	D R	R	0.75±0.25 (0.5±0.25) ^{***}	
			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) ^{**}	3.20±0.30	1.25±0.10	D R	R	0.75±0.25 (0.5±0.25) ^{***}	
			1.60±0.20	G R			
			2.00±0.20	K R			
	3.20±0.40	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/Cap ≥ 4.7μF (≤ 6.3V) or 0603/Cap > 1μF (> 10V) products.

#2 : For 0201/Cap ≥ 0.68μF products.

#3 : For 0201/Cap ≥ 1μF products.

#4 : For 1210_100V: Cap > 1μF, 250V: Cap > 0.47μF, 400V~630V: Cap > 0.22μF.

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6. GENERAL ELECTRICAL DATA

Dielectric	NP0	X7R	Y5V	X5R	X6S	X7S
Size	0201, 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	1μF to 100μF
Capacitance tolerance**	Cap≤5pF ^{#1} : 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%)	K (±10%), M (±20%)
Rated voltage (WVDC)	10V, 16V, 25V, 50V, 100V		6.3V, 10V, 16V, 25V, 50V, 100V			
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	-55 to +125°C
Capacitance characteristic	±30ppm	±15%	+30/-80%	±15%	±22%	±22%
Termination	Ni/Sn (lead-free termination)					

#1: NP0, 0.1pF product only provide B tolerance; 0603N0R4 provide B&C tolerance; 0603N0R3 only provide C 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/X7S: Please refer to page 13 "Reliability test conditions and requirements" for detail.

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 and then leave in ambient condition for 24±2 hours before measurement.

Note 1:

X7R/X5R/X6S/X7S

Rated vol.	D.F. ≤	Exception of D.F. ≤
≥ 100V	≤ 3%	1206 ≥ 0.47μF
	≤ 2.5%	≤ 5% 0805 > 0.1μF; 0603 ≥ 0.068μF; 1206 > 1μF; 1210 ≥ 2.2μF; TT series
	≤ 10%	0805 > 0.22μF; 1210 ≥ 3.3μF
50V	≤ 3%	0201(50V); 0603 ≥ 0.047μF; 0805 ≥ 0.18μF; 1206 ≥ 0.47μF
	≤ 2.5%	≤ 5% 0201 ≥ 0.01μF; 1210 ≥ 4.7μF
	≤ 10%	0402 ≥ 0.012μF; 0603 > 0.1μF; 0805 ≥ 1μF; 1206 ≥ 2.2μF; 1210 ≥ 10μF; TT series
35V	≤ 3.5%	≤ 10% 0603 ≥ 1μF; 0805 ≥ 2.2μF; 1206 ≥ 2.2μF; 1210 ≥ 10μF
25V	≤ 5%	0201 ≥ 0.01μF; 0805 ≥ 1μF; 1210 ≥ 10μF
	≤ 7%	0603 ≥ 0.33μF; 1206 ≥ 4.7μF
	≤ 10%	0201 ≥ 0.1μF; 0402 ≥ 0.10μF & (0402/X7R ≥ 0.056μF); TT series
	≤ 12.5%	0603 ≥ 0.47μF; 0805 ≥ 2.2μF; 1206 ≥ 6.8μF; 1210 ≥ 22μF
16V	≤ 5%	0201 ≥ 0.01μF; 0402 ≥ 0.033μF; 0603 ≥ 0.15μF; 0805 ≥ 0.68μF; 1206 ≥ 2.2μF; 1210 ≥ 4.7μF
	≤ 3.5%	≤ 10% 0201 ≥ 0.1μF; 0402 ≥ 0.022μF; 0402 ≥ 0.22μF; 0603 ≥ 1206 ≥ 4.7μF; 1210 ≥ 22μF; TT series
	≤ 15%	0201 ≥ 0.012μF; 0402 ≥ 0.33μF (0402/X7R ≥ 0.22μF); TT series
10V	≤ 5%	≤ 10% 0603 ≥ 0.33μF; 0805 ≥ 2.2μF; 1206 ≥ 2.2μF; 1210 ≥ 22μF; 01R5
	≤ 15%	0201 ≥ 0.1μF; 0402 ≥ 1μF
6.3V	≤ 10%	≤ 15% 0201 ≥ 0.1μF; 0402 ≥ 1μF; 0603 ≥ 10μF; 0805 ≥ 4.7μF; 1206 ≥ 47μF; 1210 ≥ 100μF; TT series
	≤ 20%	0402 ≥ 2.2μF
4V	≤ 15%	--

Y5V

Rated vol.	D.F. ≤	Exception of D.F. ≤
≥ 50V	≤ 5%	≤ 7% 0603 ≥ 0.1μF; 0805 ≥ 0.47μF; 1206 ≥ 4.7μF; TT series
	≤ 12.5%	1210 ≥ 6.8μF
35V	≤ 7%	--
25V	≤ 7%	0402 ≥ 0.047μF; 0603 ≥ 0.1μF; 0805 ≥ 0.33μF; 1206 ≥ 1μF; 1210 ≥ 4.7μF
	≤ 5%	≤ 9% 0402 ≥ 0.068μF; 0603 ≥ 0.47μF; 1206 ≥ 4.7μF; 1210 ≥ 22μF; TT series
	≤ 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; TT series
10V	≤ 12.5%	≤ 20% 0402 ≥ 0.47μF
6.3V	≤ 20%	--

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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											
	0.3pF (0R3)	L	L	L	N	N	N	N		S	S	S	S						
	0.4pF (0R4)	L	L	L	N	N	N	N		S	S	S	S						
	0.5pF (0R5)	L	L	L	N	N	N	N	N	S	S	S	S	S	A	A	A	A	A
	0.6pF (0R6)	L	L	L	N	N	N	N	N	S	S	S	S	S	A	A	A	A	A
	0.7pF (0R7)	L	L	L	N	N	N	N	N	S	S	S	S	S	A	A	A	A	A
	0.8pF (0R8)	L	L	L	N	N	N	N	N	S	S	S	S	S	A	A	A	A	A
	0.9pF (0R9)	L	L	L	N	N	N	N	N	S	S	S	S	S	A	A	A	A	A
	1.0pF (1R0)	L	L	L	N	N	N	N	N	S	S	S	S	S	A	A	A	A	A
	1.2pF (1R2)	L	L	L	N	N	N	N	N	S	S	S	S	S	A	A	A	A	A
	1.5pF (1R5)	L	L	L	N	N	N	N	N	S	S	S	S	S	A	A	A	A	A
	1.8pF (1R8)	L	L	L	N	N	N	N	N	S	S	S	S	S	A	A	A	A	A
	2.0pF (2R0)	L	L	L	N	N	N	N	N	S	S	S	S	S	A	A	A	A	A
	2.2pF (2R2)	L	L	L	N	N	N	N	N	S	S	S	S	S	A	A	A	A	A
	2.7pF (2R7)	L	L	L	N	N	N	N	N	S	S	S	S	S	A	A	A	A	A
	3.0pF (3R0)	L	L	L	N	N	N	N	N	S	S	S	S	S	A	A	A	A	A
	3.3pF (3R3)	L	L	L	N	N	N	N	N	S	S	S	S	S	A	A	A	A	A
	3.9pF (3R9)	L	L	L	N	N	N	N	N	S	S	S	S	S	A	A	A	A	A
	4.0pF (4R0)	L	L	L	N	N	N	N	N	S	S	S	S	S	A	A	A	A	A
	4.7pF (4R7)	L	L	L	N	N	N	N	N	S	S	S	S	S	A	A	A	A	A
	5.0pF (5R0)	L	L	L	N	N	N	N	N	S	S	S	S	S	A	A	A	A	A
	5.6pF (5R6)	L	L	L	N	N	N	N	N	S	S	S	S	S	A	A	A	A	A
	6.0pF (6R0)	L	L	L	N	N	N	N	N	S	S	S	S	S	A	A	A	A	A
	6.8pF (6R8)	L	L	L	N	N	N	N	N	S	S	S	S	S	A	A	A	A	A
	7.0pF (7R0)	L	L	L	N	N	N	N	N	S	S	S	S	S	A	A	A	A	A
	8.0pF (8R0)	L	L	L	N	N	N	N	N	S	S	S	S	S	A	A	A	A	A
	8.2pF (8R2)	L	L	L	N	N	N	N	N	S	S	S	S	S	A	A	A	A	A
	9.0pF (9R0)	L	L	L	N	N	N	N	N	S	S	S	S	S	A	A	A	A	A
	10pF (100)	L	L	L	N	N	N	N	N	S	S	S	S	S	A	A	A	A	A
	12pF (120)	L	L	L	N	N	N	N	N	S	S	S	S	S	A	A	A	A	A
	15pF (150)	L	L	L	N	N	N	N	N	S	S	S	S	S	A	A	A	A	A
	18pF (180)	L	L	L	N	N	N	N	N	S	S	S	S	S	A	A	A	A	A
	22pF (220)	L	L	L	N	N	N	N	N	S	S	S	S	S	A	A	A	A	A
	27pF (270)	L	L	L	N	N	N	N	N	S	S	S	S	S	A	A	A	A	A
	33pF (330)	L	L	L	N	N	N	N	N	S	S	S	S	S	A	A	A	A	A
	39pF (390)	L	L	L	N	N	N	N	N	S	S	S	S	S	A	A	A	A	A
	47pF (470)	L	L	L	N	N	N	N	N	S	S	S	S	S	A	A	A	A	A
	56pF (560)	L	L	L	N	N	N	N	N	S	S	S	S	S	A	A	A	A	A
	68pF (680)	L	L	L	N	N	N	N	N	S	S	S	S	S	A	A	A	A	A
	82pF (820)	L	L	L	N	N	N	N	N	S	S	S	S	S	A	A	A	A	A
	100pF (101)	L	L	L	N	N	N	N	N	S	S	S	S	S	A	A	A	A	A
120pF (121)	L	L	L	N	N	N	N	N	S	S	S	S	S	A	A	A	A	A	
150pF (151)		L	L	N	N	N	N	N	S	S	S	S	S	A	A	A	A	A	
180pF (181)			L	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)			L	N	N	N	N	N	S	S	S	S	S	A	A	A	A	A	
330pF (331)			L	N	N	N	N	N	S	S	S	S	S	A	A	A	A	A	
390pF (391)			L	N	N	N	N	N	S	S	S	S	S	B	B	B	B	B	
470pF (471)			L	N	N	N	N	N	S	S	S	S	S	B	B	B	B	B	
560pF (561)			L	N	N	N	N	N	S	S	S	S	S	B	B	B	B	B	
680pF (681)				N	N	N	N	N	S	S	S	S	S	B	B	B	B	B	
820pF (821)				N	N	N	N	N	S	S	S	S	S	B	B	B	B	B	
1,000pF (102)				N	N	N	N	N	S	S	S	S	S	B	B	B	B	B	
1,200pF (122)									X	X	X	X	X*	B	B	B	B	B	
1,500pF (152)									X	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)									X*	X*	X*	X*		D	D	D	D	D	
4,700pF (472)									X*	X*	X*	X*		D	D	D	D	D	
5,600pF (562)									X*	X*	X*	X*		D	D	D	D	D	
6,800pF (682)									X*	X*	X*	X*		D	D	D	D	D	
8,200pF (822)									X*	X*	X*	X*		D	D	D	D	D	
0.010uF (103)									X*	X*	X*	X*		D	D	D	D	D	
0.012uF (123)														T*	T*	T*	T*	T*	
0.015uF (153)														T*	T*	T*	T*	T*	
0.018uF (183)														D*	D*	D*	D*	D*	
0.022uF (223)														D*	D*	D*	D*	D*	

1. The letter in cell is expressed the symbol of product thickness.
2. The letter in cell with "*" mark is expressed capacitance tolerance "J" (±5%) only.
3. 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	25	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	B	C	C	C	C	C	D	D	D	D
	12pF (120)	B	B	B	B	B	B	C	C	C	C	C	D	D	D	D
	15pF (150)	B	B	B	B	B	B	C	C	C	C	C	D	D	D	D
	18pF (180)	B	B	B	B	B	B	C	C	C	C	C	D	D	D	D
	22pF (220)	B	B	B	B	B	B	C	C	C	C	C	D	D	D	D
	27pF (270)	B	B	B	B	B	B	C	C	C	C	C	D	D	D	D
	33pF (330)	B	B	B	B	B	B	C	C	C	C	C	D	D	D	D
	39pF (390)	B	B	B	B	B	B	C	C	C	C	C	D	D	D	D
	47pF (470)	B	B	B	B	B	B	C	C	C	C	C	D	D	D	D
	56pF (560)	B	B	B	B	B	B	C	C	C	C	C	D	D	D	D
	68pF (680)	B	B	B	B	B	B	C	C	C	C	C	D	D	D	D
	82pF (820)	B	B	B	B	B	B	C	C	C	C	C	D	D	D	D
	100pF (101)	B	B	B	B	B	B	C	C	C	C	C	D	D	D	D
	120pF (121)	B	B	B	B	B	B	C	C	C	C	C	D	D	D	D
	150pF (151)	B	B	B	B	B	B	C	C	C	C	C	D	D	D	D
	180pF (181)	B	B	B	B	B	B	C	C	C	C	C	D	D	D	D
	220pF (221)	B	B	B	B	B	B	C	C	C	C	C	D	D	D	D
	270pF (271)	B	B	B	B	B	B	C	C	C	C	C	D	D	D	D
	330pF (331)	B	B	B	B	B	B	C	C	C	C	C	D	D	D	D
	390pF (391)	B	B	B	B	B	B	C	C	C	C	C	D	D	D	D
	470pF (471)	B	B	B	B	B	B	C	C	C	C	C	D	D	D	D
	560pF (561)	B	B	B	B	B	B	C	C	C	C	C	D	D	D	D
	680pF (681)	B	B	B	B	B	B	C	C	C	C	C	D	D	D	D
	820pF (821)	B	B	B	B	B	B	C	C	C	C	C	D	D	D	D
	1,000pF (102)	B	B	B	B	B	B	C	C	C	C	C	D	D	D	D
	1,200pF (122)	B	B	B	B	B	B	C	C	C	C	C	D	D	D	D
	1,500pF (152)	B	B	B	B	B	B	C	C	C	C	C	D	D	D	D
	1,800pF (182)	B	B	B	B	B	B	C	C	C	C	C	D	D	D	D
	2,200pF (222)	B	B	B	B	B	B	C	C	C	C	C	D	D	D	D
	2,700pF (272)	B	B	B	B	B	B	C	C	C	C	C	D	D	D	D
	3,300pF (332)	B	B	B	B	B	B	C	C	C	C	C	D	D	D	D
	3,900pF (392)	B	B	B	B	B	B	C	C	C	C	C	D	D	D	D
	4,700pF (472)	B	B	B	B	B	B	C	C	C	C	C	D	D	D	D
	5,600pF (562)	B	B	B	B	B	B	C	C	C	C	C	D	D	D	D
	6,800pF (682)	C	C	C	C	C	C	C	C	C	C	C	D	D	D	D
	8,200pF (822)	D	D	D	D	D	D	C	C	C	C	C	D	D	D	D
0.010μF (103)	D	D	D	D	D	D	C	C	C	C	C	D	D	D	D	
0.012μF (123)	P	P	P	P	P	P	D	D	D	D	D	D	D	D	D	
0.015μF (153)	P	P	P	P	P	P	D	D	D	D	D	D	D	D	D	
0.018μF (183)	P	P	P	P	P	P	K	K	K	K	K	D	D	D	D	
0.022μF (223)	P	P	P	P	P	P	K	K	K	K	K	D	D	D	D	
0.027μF (273)	P	P	P	P	P	P	K	K	K	K	K	D	D	D	D	
0.033μF (333)	P	P	P	P	P	P	K	K	K	K	K	D	D	D	D	
0.039μF (393)	P	P	P	P	P	P	K	K	K	K	K	M	M	M	M	
0.047μF (473)	J*	J*	J*	J*	J*	J*	K	K	K	K	K	M	M	M	M	
0.056μF (563)	J*	J*	J*	J*	J*	J*						M	M	M	M	
0.068μF (683)	G*	G*	G*	G*	G*	G*						M	M	M	M	
0.082μF (823)	G*	G*	G*	G*	G*	G*						M	M	M	M	
0.1μF (104)	G*	G*	G*	G*	G*	G*						M	M	M	M	

1. The letter in cell is expressed the symbol of product thickness.
2. The letter in cell with " * " mark is expressed capacitance tolerance "J" (±5%) only.
3. 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		N	N	N	N	N		S	S	S	S	S		B	B	B	B	B
	1,200pF (122)	L	L	L	L	L			N	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	N		S	S	S	S	S		B	B	B	B	B
	1,800pF (182)	L	L	L	L				N	N	N	N	N		S	S	S	S	S		B	B	B	B	B
	2,200pF (222)	L	L	L	L				N	N	N	N	N		S	S	S	S	S		B	B	B	B	B
	2,700pF (272)	L	L	L	L				N	N	N	N	N		S	S	S	S	S		B	B	B	B	B
	3,300pF (332)	L	L	L	L				N	N	N	N	N		S	S	S	S	S		B	B	B	B	B
	3,900pF (392)	L	L	L	L				N	N	N	N	N		S	S	S	S	S		B	B	B	B	B
	4,700pF (472)	L	L	L	L				N	N	N	N	N		S	S	S	S	S		B	B	B	B	B
	5,600pF (562)	L	L	L	L				N	N	N	N	N		S	S	S	S	S		B	B	B	B	B
	6,800pF (682)	L	L	L					N	N	N	N	N		S	S	S	S	S		B	B	B	B	B
	8,200pF (822)	L	L	L					N	N	N	N	N		S	S	S	S	S		B	B	B	B	B
	0.010μF (103)	L	L	L	L				N	N	N	N	N		S	S	S	S	S		B	B	B	B	B
	0.012μF (123)								N	N	N	E			S	S	S	S	X		B	B	B	B	B
	0.015μF (153)								N	N	N	E			S	S	S	S	X		B	B	B	B	B
	0.018μF (183)								N	N	N	E			S	S	S	S	X		B	B	B	B	B
	0.022μF (223)		L	L					N	N	N	E			S	S	S	S	X		B	B	B	B	B
	0.027μF (273)								N	N	N	E			S	S	S	S	X		B	B	B	B	D
	0.033μF (333)								N	N	N	E			S	S	S	X	X		B	B	B	B	D
	0.039μF (393)								N	N	N	E			S	S	S	X	X		B	B	B	B	D
	0.047μF (473)								N	N	N	E			S	S	S	X	X		B	B	B	B	D
	0.056μF (563)								N	N	N	E			S	S	S	X	X		B	B	B	B	D
	0.068μF (683)								N	N	N	E			S	S	S	X	X		B	B	B	B	D
	0.082μF (823)								N	N	N	E			S	S	S	X	X		B	B	B	B	D
	0.10μF (104)							N	N	N	N	E			S	S	S	X	X		B	B	B	B	D
	0.12μF (124)														S	S	X				B	B	B	D	I
	0.15μF (154)														S	S	X				D	D	D	D	I
	0.18μF (184)														S	S	X				D	D	D	D	I
	0.22μF (224)							N	N	N	N				S	S	X	X			D	D	D	D	I
	0.27μF (274)														X	X	X	X			D	D	D	I	
0.33μF (334)														X	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	X				I	I	I	I		
3.3μF (335)																									
4.7μF (475)														X						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.

Multilayer Ceramic Capacitors

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

DIELECTRIC		X7R																	
SIZE		1206						1210						1812					
RATED VOLTAGE (VDC)		6.3	10	16	25	35	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	M						
4.7µF (475)		P	P	P	P		P				K	K	K	M	M				
6.8µF (685)																			
10µF (106)		P	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.

Multilayer Ceramic Capacitors

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

DIELECTRIC		Y5V															
SIZE		0402					0603					0805					
RATED VOLTAGE (VDC)		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/E	N/E				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	35	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		K		D	D	D	D	
10μF (106)		J	J	P				D	D	G	K	K		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.

Multilayer Ceramic Capacitors

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

Dielectric		X5R																
		0201					0402					0603						
Size		6.3	10	16	25	50	4	6.3	10	16	25	50	4	6.3	10	16	25	50
Rated Voltage (VDC)		6.3	10	16	25	50	4	6.3	10	16	25	50	4	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	L											
	1,500pF (152)		L	L	L													
	2,200pF (222)		L	L	L													
	2,700pF (272)		L	L	L													
	3,300pF (332)		L	L	L													
	4,700pF (472)		L	L	L													
	6,800pF (682)		L	L	L													
	0.010μF (103)	L	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	N							
	0.056μF (563)	L	L							N	N	N						
	0.068μF (683)	L	L							N	N	N						
	0.082μF (823)	L	L							N	N	N						
	0.10μF (104)	L	L	L	L					N	N	N	N	E				
	0.15μF (154)									N	N	N	N					
	0.22μF (224)	L	L	L*						N	N	N	N		X	X	X	X
	0.27μF (274)															X	X	X
	0.33μF (334)	L*								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
	0.68μF (684)									N	N				X	X	X	X
	0.82μF (824)														X	X	X	X
	1.0μF (105)	L*	L*	L*						N/E	N/E	N	N	E	X	X	X	X
	1.5μF (155)														X			
2.2μF (225)	L*	L*							N	N	E	E		X	X	X	X	
3.3μF (335)														X	X			
4.7μF (475)									E	E	E*			X	X	X	X	
6.8μF (685)																		
10μF (106)									E*	E*	E*			X	X	X	X*	
22μF (226)														X*	X*	X*		
47μF (476)														X*	X*			

Dielectric		X5R																			
		0805					1206					1210									
Size		4	6.3	10	16	25	50	4	6.3	10	16	25	50	4	6.3	10	16	25	35	50	
Rated Voltage (VDC)		4	6.3	10	16	25	50	4	6.3	10	16	25	50	4	6.3	10	16	25	35	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			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	M
	22μF (226)		I	I*	I*	I*				P	P	P	P			M	M	M	M	M	
	47μF (476)		I*	I*						P	P	P*				M	M	M	M*		
	100μF (107)	I*	I*							P						M*	M*	M*			
220μF (227)								P*							M*	M*					

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

Multilayer Ceramic Capacitors

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

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

7-6. X7S Dielectric 0402, 0603, 0805, 1206, 1210 Sizes

Dielectric		X7S																											
Size		0402				0603				0805					1206					1210									
Rated Voltage (VDC)		6.3	10	16	25	6.3	10	16	25	10	16	25	50	100	6.3	10	16	25	50	6.3	10	16	25	50					
Capacitance	1.0μF (105)		E																										
	1.5μF (155)																												
	2.2μF (225)	E	E					X	X																				
	3.3μF (335)																												
	4.7μF (475)						X	X																					
	6.8uF (685)																												
	10μF (106)																												
	22μF (226)																												
	47μF (476)																												
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.

Multilayer Ceramic Capacitors

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
1206 (3216)	1.25±0.20	I	-	-	3,000	10,000
	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
1210 (3225)	1.60±0.20	G	-	-	2,000	10,000
	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
1808 (4520)	1.60±0.20	G	-	-	2,000	8,000
	2.00±0.20	K	-	-	1,000	6,000
	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	-
1812 (4532)	2.00±0.20	K	-	-	1,000	-
	2.50±0.30	M	-	-	500	3,000
	2.80±0.30	U	-	-	500	-
	2.80±0.30	U	-	-	500	-

Unit: pieces

Multilayer Ceramic Capacitors

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%	* Shall not exceed the limits given in the detailed spec. NP0: Cap≥30pF, Q≥1000; Cap<30pF, Q≥400+20C																																											
3.	Q/ D.F. (Dissipation Factor)	Class II: (X7R, X7E, X6S, X5R, X7S, Y5V) C ≤ 10μF, 1.0±0.2Vrms · 1KHz±10% ** C > 10μF, 0.5±0.2Vrms · 120Hz±20%	NP0: Cap≥30pF, Q≥1000; Cap<30pF, Q≥400+20C X7R, X5R, X6S, X7S:																																											
			<table border="1"> <thead> <tr> <th>Rated vol.</th> <th>D.F. ≤</th> <th>Exception of D.F. ≤</th> </tr> </thead> <tbody> <tr> <td rowspan="3">≥ 100V</td> <td rowspan="3">≤ 2.5%</td> <td>≤ 3% 1206 ≥ 0.47μF</td> </tr> <tr> <td>≤ 5% 0805 > 0.1μF; 0603 ≥ 0.068μF; 1206 > 1μF; 1210 ≥ 2.2μF; TT series</td> </tr> <tr> <td>≤ 10% 0805 > 0.22μF; 1210 ≥ 3.3μF</td> </tr> <tr> <td rowspan="3">50V</td> <td rowspan="3">≤ 2.5%</td> <td>≤ 3% 0201(50V); 0603 ≥ 0.047μF; 0805 ≥ 0.18μF; 1206 ≥ 0.47μF</td> </tr> <tr> <td>≤ 5% 0201 ≥ 0.01μF; 1210 ≥ 4.7μF</td> </tr> <tr> <td>≤ 10% 0402 ≥ 0.012μF; 0603 > 0.1μF; 0805 ≥ 1μF; 1206 ≥ 2.2μF; 1210 ≥ 10μF; TT series</td> </tr> <tr> <td rowspan="3">35V</td> <td rowspan="3">≤ 3.5%</td> <td>≤ 10% 0603 ≥ 1μF; 0805 ≥ 2.2μF; 1206 ≥ 2.2μF; 1210 ≥ 10μF</td> </tr> <tr> <td>≤ 5% 0201 ≥ 0.01μF; 0805 ≥ 1μF; 1210 ≥ 10μF</td> </tr> <tr> <td>≤ 7% 0603 ≥ 0.33μF; 1206 ≥ 4.7μF</td> </tr> <tr> <td rowspan="3">25V</td> <td rowspan="3">≤ 3.5%</td> <td>≤ 10% 0201 ≥ 0.1μF; 0402 ≥ 0.10μF & (0402/X7R ≥ 0.056μF); TT series</td> </tr> <tr> <td>≤ 12.5% 0603 ≥ 0.47μF; 0805 ≥ 2.2μF; 1206 ≥ 6.8μF; 1210 ≥ 22μF</td> </tr> <tr> <td>0402 ≥ 0.47μF</td> </tr> <tr> <td rowspan="3">16V</td> <td rowspan="3">≤ 3.5%</td> <td>≤ 5% 0201 ≥ 0.01μF; 0402 ≥ 0.033μF; 0603 ≥ 0.15μF; 0805 ≥ 0.68μF; 1206 ≥ 2.2μF; 1210 ≥ 4.7μF</td> </tr> <tr> <td>≤ 10% 0201 ≥ 0.1μF; 0402 ≥ 0.22μF; 0603 ≥ 0.68μF; 0805 ≥ 2.2μF; 1206 ≥ 4.7μF; 1210 ≥ 22μF; TT series</td> </tr> <tr> <td>0201 ≥ 0.012μF; 0402 ≥ 0.33μF (0402/X7R ≥ 0.22μF); TT series</td> </tr> <tr> <td rowspan="3">10V</td> <td rowspan="3">≤ 5%</td> <td>≤ 15% 0201 ≥ 0.1μF; 0402 ≥ 1μF</td> </tr> <tr> <td>0201 ≥ 0.012μF; 0402 ≥ 0.33μF (0402/X7R ≥ 0.22μF); TT series</td> </tr> <tr> <td>0603 ≥ 0.33μF; 0805 ≥ 2.2μF; 1206 ≥ 2.2μF; 1210 ≥ 22μF; 01R5</td> </tr> <tr> <td rowspan="3">6.3V</td> <td rowspan="3">≤ 10%</td> <td>≤ 15% 0201 ≥ 0.1μF; 0402 ≥ 1μF; 0603 ≥ 10μF; 0805 ≥ 4.7μF; 1206 ≥ 47μF; 1210 ≥ 100μF; TT series</td> </tr> <tr> <td>≤ 20% 0402 ≥ 2.2μF</td> </tr> <tr> <td>---</td> </tr> <tr> <td rowspan="3">4V</td> <td rowspan="3">≤ 15%</td> <td>---</td> </tr> <tr> <td>---</td> </tr> <tr> <td>---</td> </tr> </tbody> </table>	Rated vol.	D.F. ≤	Exception of D.F. ≤	≥ 100V	≤ 2.5%	≤ 3% 1206 ≥ 0.47μF	≤ 5% 0805 > 0.1μF; 0603 ≥ 0.068μF; 1206 > 1μF; 1210 ≥ 2.2μF; TT series	≤ 10% 0805 > 0.22μF; 1210 ≥ 3.3μF	50V	≤ 2.5%	≤ 3% 0201(50V); 0603 ≥ 0.047μF; 0805 ≥ 0.18μF; 1206 ≥ 0.47μF	≤ 5% 0201 ≥ 0.01μF; 1210 ≥ 4.7μF	≤ 10% 0402 ≥ 0.012μF; 0603 > 0.1μF; 0805 ≥ 1μF; 1206 ≥ 2.2μF; 1210 ≥ 10μF; TT series	35V	≤ 3.5%	≤ 10% 0603 ≥ 1μF; 0805 ≥ 2.2μF; 1206 ≥ 2.2μF; 1210 ≥ 10μF	≤ 5% 0201 ≥ 0.01μF; 0805 ≥ 1μF; 1210 ≥ 10μF	≤ 7% 0603 ≥ 0.33μF; 1206 ≥ 4.7μF	25V	≤ 3.5%	≤ 10% 0201 ≥ 0.1μF; 0402 ≥ 0.10μF & (0402/X7R ≥ 0.056μF); TT series	≤ 12.5% 0603 ≥ 0.47μF; 0805 ≥ 2.2μF; 1206 ≥ 6.8μF; 1210 ≥ 22μF	0402 ≥ 0.47μF	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	0201 ≥ 0.012μF; 0402 ≥ 0.33μF (0402/X7R ≥ 0.22μF); TT series	10V	≤ 5%	≤ 15% 0201 ≥ 0.1μF; 0402 ≥ 1μF	0201 ≥ 0.012μF; 0402 ≥ 0.33μF (0402/X7R ≥ 0.22μF); TT series	0603 ≥ 0.33μF; 0805 ≥ 2.2μF; 1206 ≥ 2.2μF; 1210 ≥ 22μF; 01R5	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%	---	---	---
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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. 120sec. * Before initial measurement (Class II only): To apply de-aging at 150°C for 1hr then set for 24±2 hrs at room temp.	10GΩ or RxC ≥ 500Ω·F whichever is smaller. Class II (X7R, X7E, X5R, X6S, X7S, Y5V):																																											
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7.	Adhesive Strength of Termination	<p>* Pressurizing force : 1N (0201) and 5N (≤0603) and 10N (>0603) * Test time: 10±1 sec.</p>	* No remarkable damage or removal of the terminations.																																																						
8.	Vibration Resistance	<p>* Vibration frequency: 10~55 Hz/min. * Total amplitude: 1.5mm * Test time: 6 hrs. (Two hrs each in three mutually perpendicular directions.) *Before initial measurement (Class II only): To apply de-aging at 150°C for 1hr then set for 24± 2 hrs at room temp. *Cap./DF(Q) Measurement to be made after de-aging at 150°C for 1hr then set for 24±2 hrs at room temp.</p>	<p>* No remarkable damage. * Cap change and Q/D.F.: To meet initial spec.</p>																																																						
9.	Solderability	<p>* Solder temperature: 235±5°C * Dipping time: 2±0.5 sec.</p>	95% min. coverage of all metalized area.																																																						
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±1 sec. *Before initial measurement (Class II only): To apply de-aging at 150°C for 1hr then set for 24± 2 hrs at room temp. * Measurement to be made after keeping at room temp. for 24±2 hrs.</p>	<p>* No remarkable damage. * Cap change : NPO: within ±5% or 0.5pF whichever is larger X7R, X5R, X6S, X7S: 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.)</p>																																																						
11.	Resistance to Soldering Heat	<p>* Solder temperature: 260±5°C * Dipping time: 10±1 sec * Preheating: 120 to 150°C for 1 minute before immerse the capacitor in a eutectic solder. *Before initial measurement (Class II only): To apply de-aging at 150°C for 1hr then set for 24±2 hrs at room temp. *Cap. / DF(Q) / I.R. Measurement to be made after de-aging at 150°C for 1hr then set for 24±2 hrs at room temp.</p>	<p>* No remarkable damage. * Cap change: NPO: within ±2.5% or 0.25pF whichever is larger X7R, X5R, X6S, X7S: within ±7.5% Y5V: within ±20% * Q/D.F., I.R. and dielectric strength: To meet initial requirements. * 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"> <thead> <tr> <th>Step</th> <th>Temp. (°C)</th> <th>Time (min.)</th> </tr> </thead> <tbody> <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> </tbody> </table> <p>*Before initial measurement (Class II only): To apply de-aging at 150°C for 1hr then set for 24±2 hrs at room temp. * Cap. / DF(Q) / I.R. Measurement to be made after de-aging at 150°C for 1hr then set for 24±2 hrs at room temp.</p>	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	<p>No remarkable damage. * Cap change : NPO: within ±2.5% or 0.25pF whichever is larger X7R, X5R, X6S, X7S: within ±7.5% Y5V: within ±20% * Q/D.F., I.R. and dielectric strength: To meet initial requirements.</p>																																							
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Multilayer Ceramic Capacitors

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13.	Humidity (Damp Heat) Steady State	*Test temp.: 40±2°C *Humidity: 90~95%RH *Test time: 500+24/-0hrs. *Before initial measurement (Class II only): To apply de-aging at 150°C for 1hr then set for 24±2 hrs at room temp. * Cap. / DF(Q) / I.R. Measurement to be made after de-aging at 150°C for 1hr then set for 24±2 hrs at room temp.	* No remarkable damage. * Cap change: NP0: within ±5% or 0.5pF whichever is larger X7R, X5R, X6S, X7S: ≥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, X7S:																																																	
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Multilayer Ceramic Capacitors

No	Item	Test Condition	Requirements																																	
14	Humidity (Damp Heat) Load	*Test temp. : 40±2℃	* No remarkable damage. Cap change: NP0: ±7.5% or 0.75pF whichever is larger. X7R, X5R, X6S, X7S: ≥10V**, within ±12.5%; ≤6.3V within ±25%; TT series & C ≥ 1uF, within ±25% **10V: 0603 ≥4.7μF; 0402 ≥ 1μF; 0201 ≥ 0.1μF, within ±25%; Y5V: ≥10V, within ±30%; ≤6.3V, within +30/-40% Q/D.F. value: NP0: C≥30pF, Q≥200; C<30pF, Q≥100+10/3C X7R, X5R, X6S, X7S:																																	
		*Humidity : 90~95%RH																																		
		*Test time : 500+24/-0 hrs.																																		
		*To apply voltage :																																		
		Rated voltage (MAX. 500V)																																		
		*Before initial measurement (Class II only): To apply de-aging at 150℃ for 1hr then set for 24±2 hrs at room temp.																																		
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Multilayer Ceramic Capacitors

No	Item	Test Condition	Requirements																																																																																																																																																																																																						
15.	High Temperature Load (Endurance)	Test temp. : NP0, X7R/X7E/X7S: 125±3°C X6S: 105±3°C X5R, Y5V: 85±3°C 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, X7S: ≥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, X6S, X7S:																																																																																																																																																																																																						
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		NP0	3000V	C ≥ 1.5pF	≤ 20% 0201 ≥ 0.1µF; 0402 ≥ 0.10µF & (0402/X7R ≥ 0.056µF); TT series																																																																																																																																																																																																				
		1210	X5R/X7R/X6S	16V	C ≥ 47µF	10V	≤ 7.5%	≤ 15% 0603 ≥ 0.47µF; 0805 ≥ 2.2µF; 1206 ≥ 6.8µF; 1210 ≥ 22µF																																																																																																																																																																																																	
				100V	C ≥ 3.3µF			≤ 20% 0402 ≥ 0.47µF																																																																																																																																																																																																	
		TT15	X5R	6.3V	C > 1.0µF	6.3V	≤ 15%	≤ 30% 0603 ≥ 0.15µF; 0805 ≥ 0.68µF; 1206 ≥ 2.2µF; 1210 ≥ 4.7µF																																																																																																																																																																																																	
		TT18	Y5V	6.3V, 10V	C ≥ 2.2µF			≤ 15% 0201 ≥ 0.01µF; 0402 ≥ 0.022µF; 0402 ≥ 0.033µF; 0603 ≥ 0.68µF; 0805 ≥ 2.2µF; 1206 ≥ 4.7µF; 1210 ≥ 22µF; TT series																																																																																																																																																																																																	
		TT21	Y5V	6.3V	C ≥ 10µF	4V	≤ 20%	≤ 15% 0201 ≥ 0.012µF; 0402 ≥ 0.33µF; 0402/X7R ≥ 0.22µF; 0603 ≥ 0.33µF; 0805 ≥ 2.2µF; 1206 ≥ 2.2µF; 1210 ≥ 22µF																																																																																																																																																																																																	
		TT31	X5R/X7R/X6S	≤ 10V	C ≥ 10µF			≤ 20% 0201 ≥ 0.1µF; 0402 ≥ 1µF; TT series: 01R5																																																																																																																																																																																																	
		**1WV items must follow de-rating conditions				4V	≤ 15%	≤ 30% 0201 ≥ 0.1µF; 0402 ≥ 1µF; 0603 ≥ 10µF; 0805 ≥ 4.7µF; 1206 ≥ 47µF; 1210 ≥ 100µF; TT series																																																																																																																																																																																																	
		(6) 150% of rated voltage for below range.						≤ 20% ---	---																																																																																																																																																																																																
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Multilayer Ceramic Capacitors

APPENDICES

■ Tape & reel dimensions

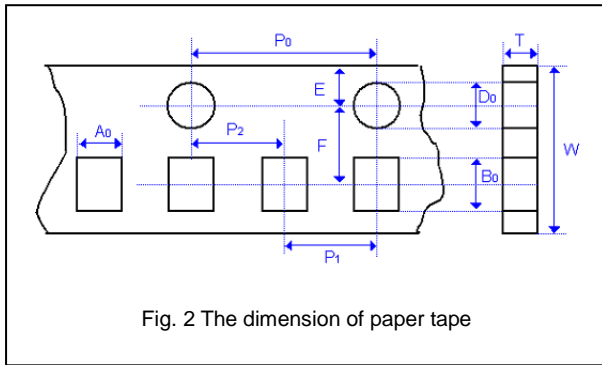


Fig. 2 The dimension of paper tape

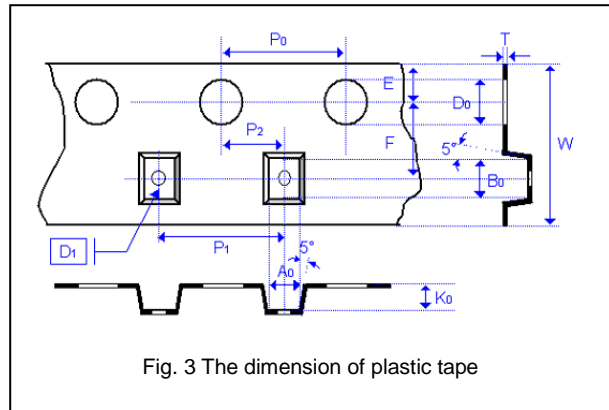


Fig. 3 The dimension of plastic tape

Size	0201	0402	0603	0805			1206			1210			1808	1812	
Thickness	L	N,E	S,H,X	A,H	B,T	D,I	B,T	C,J,D	G,P	T	C,D,G,K	M	D,F,G,K	D,F,G,K	M,U
A ₀	0.39 +/-0.07	0.70 +/-0.2	1.05 +/-0.30	1.50 +/-0.20	1.50 +/-0.20	< 1.80	1.90 +/-0.50	< 2.00	< 2.30	< 3.05	< 3.05	< 3.20	< 2.50	< 3.90	< 3.90
B ₀	0.69 +/-0.07	1.20 +/-0.2	1.80 +/-0.30	2.30 +/-0.20	2.30 +/-0.20	< 2.70	3.50 +/-0.50	< 3.70	< 4.00	< 3.80	< 3.80	< 3.95	< 5.30	< 5.30	< 5.30
T	≤ 0.50	≤ 0.80	≤ 1.20	≤ 1.15	≤ 1.30	0.23 +/-0.1	≤ 1.30	0.23 +/-0.1	0.23 +/-0.1	0.23 +/-0.1	0.23 +/-0.1	0.23 +/-0.1	0.25 +/-0.1	0.25 +/-0.1	0.25 +/-0.1
K ₀	-	-	-	-	-	< 2.50	-	< 2.50	< 2.50	< 1.50	< 2.50	< 3.20	< 2.50	< 2.50	< 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 +/-0.20	8.00 +/-0.10	8.00 +/-0.20	8.00 +/-0.20	8.00 +/-0.20	8.00 +/-0.20	8.00 +/-0.20	12.00 +/-0.20	12.00 +/-0.20	12.00 +/-0.20
P ₀	4.00 +/-0.10	4.00 +/-0.10	4.00 +/-0.10	4.00 +/-0.10	4.00 +/-0.10	4.00 +/-0.10	4.00 +/-0.10	4.00 +/-0.10	4.00 +/-0.10	4.00 +/-0.10	4.00 +/-0.10	4.00 +/-0.10	4.00 +/-0.10	4.00 +/-0.10	4.00 +/-0.10
10xP ₀	40.00 +/-0.10	40.00 +/-0.10	40.00 +/-0.20	40.00 +/-0.20	40.00 +/-0.20	40.00 +/-0.20	40.00 +/-0.20	40.00 +/-0.20	40.00 +/-0.20	40.00 +/-0.20	40.00 +/-0.20	40.00 +/-0.20	40.00 +/-0.20	40.00 +/-0.20	40.00 +/-0.20
P ₁	2.00 +/-0.05	2.00 +/-0.05	4.00 +/-0.10	4.00 +/-0.10	4.00 +/-0.10	4.00 +/-0.10	4.00 +/-0.10	4.00 +/-0.10	4.00 +/-0.10	4.00 +/-0.10	4.00 +/-0.10	4.00 +/-0.10	4.00 +/-0.10	8.00 +/-0.10	8.00 +/-0.10
P ₂	2.00 +/-0.05	2.00 +/-0.05	2.00 +/-0.05	2.00 +/-0.05	2.00 +/-0.05	2.00 +/-0.05	2.00 +/-0.05	2.00 +/-0.05	2.00 +/-0.05	2.00 +/-0.05	2.00 +/-0.05	2.00 +/-0.05	2.00 +/-0.10	2.00 +/-0.10	2.00 +/-0.10
D ₀	1.55 +/-0.05	1.55 +/-0.05	1.55 +/-0.05	1.55 +/-0.05	1.55 +/-0.05	1.50 +0.1/-0	1.55 +/-0.05	1.50 +0.1/-0	1.50 +0.1/-0	1.50 +0.1/-0	1.50 +0.1/-0	1.50 +0.1/-0	1.50 +0.1/-0	1.50 +0.1/-0	1.50 +0.1/-0
D ₁	-	-	-	-	-	1.00 +/-0.10	-	1.00 +/-0.10	1.00 +/-0.10	1.00 +/-0.10	1.00 +/-0.10	1.00 +/-0.10	1.50 +/-0.10	1.50 +/-0.10	1.50 +/-0.10
E	1.75 +/-0.05	1.75 +/-0.05	1.75 +/-0.05	1.75 +/-0.05	1.75 +/-0.05	1.75 +/-0.10	1.75 +/-0.05	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
F	3.50 +/-0.05	3.50 +/-0.05	3.50 +/-0.05	3.50 +/-0.05	3.50 +/-0.05	3.50 +/-0.05	3.50 +/-0.05	3.50 +/-0.05	3.50 +/-0.05	3.50 +/-0.05	3.50 +/-0.05	3.50 +/-0.05	5.50 +/-0.10	5.50 +/-0.10	5.50 +/-0.10

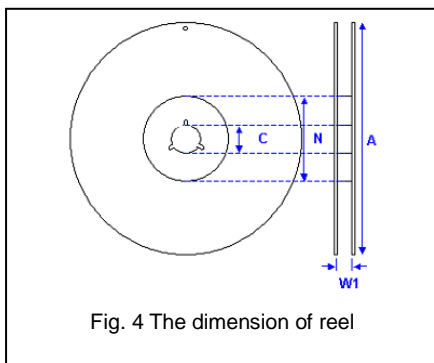
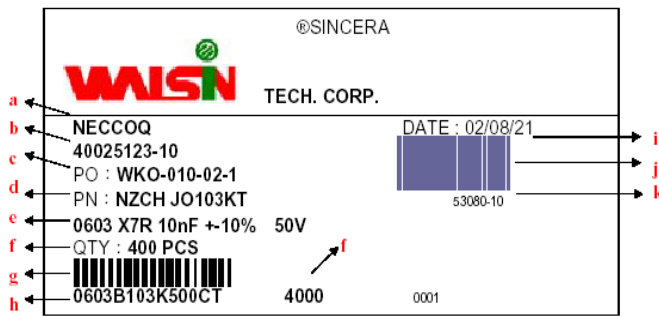


Fig. 4 The dimension of reel

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 ₁	8.4+1.5/-0	8.4+1.5/-0	8.4+1.5/-0	12.4+2.0/-0
A	178.0±1.0	250.0±1.0	330.0±1.0	178.0±1.0
N	60.0+1.0/-0	100.0±1.0	100±1.0	60.0+1.0/-0

Multilayer Ceramic Capacitors

▣ 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, X7S, Y5V
①	Ceramic material	BaTiO ₃ based
②	Inner electrode	Ni
③	Termination	Inner layer
④		Middle layer
⑤		Outer layer
		Sn

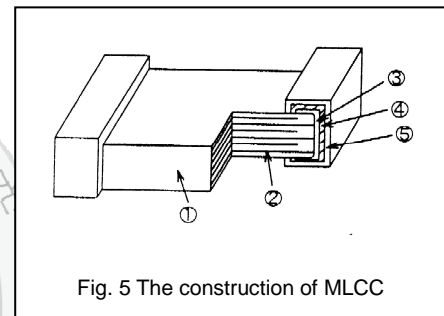


Fig. 5 The construction of MLCC

▣ 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.

Multilayer Ceramic Capacitors

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.

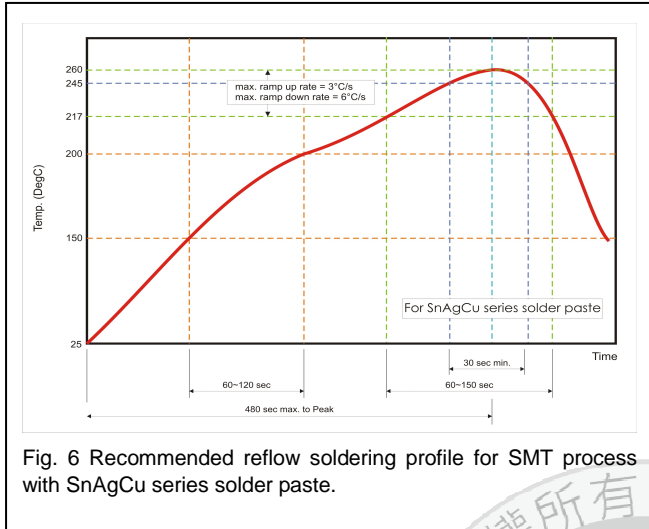


Fig. 6 Recommended reflow soldering profile for SMT process with SnAgCu series solder paste.

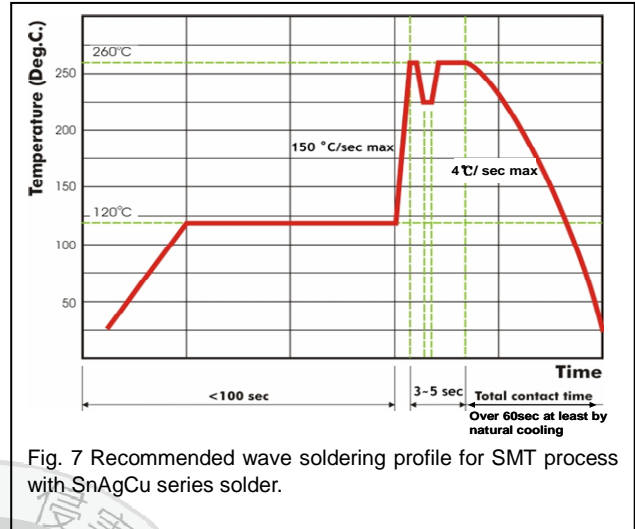


Fig. 7 Recommended wave soldering profile for SMT process with SnAgCu series solder.



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[KHC201E225M76N0T00](#) [1812J1K00222JCT](#) [1812J2K00102KXT](#) [1812J2K00222KXT](#) [1812J2K00472KXT](#) [2-1622820-7-CUT-TAPE](#)
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[CGA2B2C0G1H060D](#) [CGA2B2C0G1H070D](#) [CGA2B2C0G1H151J](#) [CGA2B2C0G1H1R5C](#) [CGA2B2C0G1H2R2C](#) [CGA2B2C0G1H3R3C](#)
[CGA2B2C0G1H680J](#) [CGA2B2C0G1H6R8D](#) [CGA2B2X8R1H221K](#) [CGA2B2X8R1H472K](#) [CGA3E1X7R1C474K](#)
[CGA3E2C0G1H561JT0Y0N](#)