

# APPROVAL SHEET

## MULTILAYER CERAMIC CAPACITORS

Soft Termination Series

(SH\_6.3V to 3000V)

NP0, X7R, X5R & Y5V Dielectrics

0402 to 1812 Sizes

Halogen Free & RoHS Compliance

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

**Multilayer Ceramic Capacitors**

**1. INTRODUCTION**

WTC soft termination series MLCC is designed and with a polymer layer within end terminations of product, which can absorb mechanical stress caused by PCB handling in SMT line and reduce the mechanical impact for product. It will offer more robust and reliable performance in applications.

**2. FEATURES**

- a. MLCC's termination are with a soft & flexible polymer layer to withstand high bending stress in SMT line.
- b. Available for any item in standard series range.

**3. APPLICATIONS**

- a. Automotive industry.
- b. Power supply and related industries.
- c. Lighting industry.
- d. The other mechanical stress concerned products.

**4. HOW TO ORDER**

<u>SH</u>	<u>31</u>	<u>B</u>	<u>104</u>	<u>K</u>	<u>500</u>	<u>C</u>	<u>I</u>
<u>Series</u>	<u>Size</u>	<u>Dielectric</u>	<u>Capacitance</u>	<u>Tolerance</u>	<u>Rated voltage</u>	<u>Termination</u>	<u>Packaging</u>
SH=Soft termination	15=0402 (1005) 18=0603 (1608) 21=0805 (2012) 31=1206 (3216) 32=1210 (3225) 43=1812 (4532)	N=NP0 (COG) B=X7R X=X5R F=Y5V	Two significant digits followed by no. of zeros. And R is in place of decimal point. Eg: 104=10x10 <sup>4</sup> =100nF	B=±0.1pF C=±0.25pF D=±0.5pF F=±1% G=±2% J=±5% K=±10% M=±20% Z=-20/+80%	Two significant digits followed by no. of zeros. And R is in place of decimal point.  6R3=6.3 VDC 100=10 VDC 160=16 VDC 250=25 VDC 500=50 VDC 101=100 VDC 201=200 VDC 251=250 VDC 401=400 VDC 451=450 VDC 501=500 VDC 631=630 VDC 102=1000 VDC 152=1500 VDC 202=2000 VDC 302=3000 VDC	C=Ag Polymer /Ni/Sn	T=7" reeled G=13" reeled

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**5. EXTERNAL DIMENSIONS & CONSTRUCTIONS**

Size Inch (mm)	L (mm)	W (mm)	T (mm)/Symbol	Remark	M <sub>B</sub> (mm)
0402 (1005)	1.00±0.20	0.50±0.20	0.50±0.20	E #	0.25 +0.05/-0.10
0603 (1608)	1.60±0.20	0.80±0.10	0.80±0.07	S	0.40±0.15
	1.60±0.30	0.80±0.30	0.80±0.30	X	
0805 (2012)	2.00±0.20	1.25±0.10	0.60±0.10	A	0.50±0.20
			0.80±0.10	B	
	1.25±0.10	D #			
	2.00±0.30	1.25±0.30	1.25±0.30	I #	
1206 (3216)	3.20+0.4/-0.1	1.60±0.15	0.80±0.10	B	0.60±0.20 (0.50±0.25)*
			0.95±0.10	C #	
			1.15±0.15	J #	
			1.25±0.10	D #	
	3.20+0.4/-0.1	1.60±0.20	1.60±0.20	G #	
3.20±0.50	1.60±0.50	1.60±0.50	P #		
1210 (3225)	3.20±0.40	2.50±0.20	0.95±0.10	C #	0.75±0.25
			1.25±0.10	D #	
	3.20±0.60	2.50±0.50	1.60±0.20	G #	
			2.00±0.20	K #	
2.50±0.50	M #				
1808 (4520)	4.50+0.6/-0.4	2.03±0.25	1.25±0.10	D #	0.50±0.25
			2.00±0.20	K #	
1812 (4532)	4.50+0.6/-0.4	3.20±0.30	1.25±0.10	D #	0.75±0.25 (0.50±0.25)*
			1.60±0.20	G #	
		2.00±0.20	K #		
		3.20±0.40	2.50±0.50	M #	

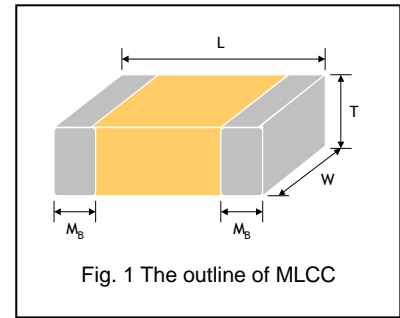


Fig. 1 The outline of MLCC

# Reflow soldering only is recommended.

\* For 1206 ≥ 1000V, 1812\_200V~4000V products.

**6. GENERAL ELECTRICAL DATA**

Dielectric	NPO	X7R	X5R	Y5V
Size	0402, 0603, 0805, 1206, 1210, 1812			
Capacitance range*	0.1pF to 0.039μF	100pF to 47μF	0.027μF to 10μF	0.01μF to 4.7μF
Capacitance tolerance**	Cap ≤ 5pF: B (±0.1pF), C (±0.25pF) 5pF < Cap < 10pF: C (±0.25pF), D (±0.5pF) Cap ≥ 10pF: F (±1%), G (±2%), J (±5%), K (±10%)	K (±10%), M (±20%)		Z (-20/+80%)
Rated voltage (WVDC)	6.3V to 3000V			
Operating temperature	-55 to +125°C	-55 to +125°C	-55 to +85°C	-25 to +85 °C
Capacitance characteristic	±30ppm	±15%	±15%	+30/-80%
Termination	Ni/Sn (lead-free termination)			

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

NPO: 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, 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 a mbient condition for 24±2 hours before measurement.

Multilayer Ceramic Capacitors

**7. CAPACITANCE RANGE (NP0 Dielectric)**

**NP0 Dielectric 0402, 0603 Sizes**

DIELECTRIC		NP0											
SIZE		0402					0603						
RATED VOLTAGE (VDC)		10	16	25	50	100	10	16	25	50	100	200	250
Capacitance	0.1pF (0R1)	E	E	E	E								
	0.2pF (0R2)	E	E	E	E								
	0.3pF (0R3)	E	E	E	E		S	S	S	S			
	0.4pF (0R4)	E	E	E	E		S	S	S	S			
	0.5pF (0R5)	E	E	E	E	E	S	S	S	S	S	S	S
	0.6pF (0R6)	E	E	E	E	E	S	S	S	S	S	S	S
	0.7pF (0R7)	E	E	E	E	E	S	S	S	S	S	S	S
	0.8pF (0R8)	E	E	E	E	E	S	S	S	S	S	S	S
	0.9pF (0R9)	E	E	E	E	E	S	S	S	S	S	S	S
	1.0pF (1R0)	E	E	E	E	E	S	S	S	S	S	S	S
	1.2pF (1R2)	E	E	E	E	E	S	S	S	S	S	S	S
	1.5pF (1R5)	E	E	E	E	E	S	S	S	S	S	S	S
	1.8pF (1R8)	E	E	E	E	E	S	S	S	S	S	S	S
	2.2pF (2R2)	E	E	E	E	E	S	S	S	S	S	S	S
	2.7pF (2R7)	E	E	E	E	E	S	S	S	S	S	S	S
	3.3pF (3R3)	E	E	E	E	E	S	S	S	S	S	S	S
	3.9pF (3R9)	E	E	E	E	E	S	S	S	S	S	S	S
	4.7pF (4R7)	E	E	E	E	E	S	S	S	S	S	S	S
	5.6pF (5R6)	E	E	E	E	E	S	S	S	S	S	S	S
	6.8pF (6R8)	E	E	E	E	E	S	S	S	S	S	S	S
	8.2pF (8R2)	E	E	E	E	E	S	S	S	S	S	S	S
	10pF (100)	E	E	E	E	E	S	S	S	S	S	S	S
	12pF (120)	E	E	E	E	E	S	S	S	S	S	S	S
	15pF (150)	E	E	E	E	E	S	S	S	S	S	S	S
	18pF (180)	E	E	E	E	E	S	S	S	S	S	S	S
	22pF (220)	E	E	E	E	E	S	S	S	S	S	S	S
	27pF (270)	E	E	E	E	E	S	S	S	S	S	S	S
	33pF (330)	E	E	E	E	E	S	S	S	S	S	S	S
	39pF (390)	E	E	E	E	E	S	S	S	S	S	S	S
	47pF (470)	E	E	E	E	E	S	S	S	S	S	S	S
	56pF (560)	E	E	E	E	E	S	S	S	S	S	S	S
	68pF (680)	E	E	E	E	E	S	S	S	S	S	S	S
	82pF (820)	E	E	E	E	E	S	S	S	S	S	S	S
	100pF (101)	E	E	E	E	E	S	S	S	S	S	S	S
	120pF (121)	E	E	E	E	E	S	S	S	S	S	S	S
	150pF (151)	E	E	E	E	E	S	S	S	S	S	S	S
	180pF (181)	E	E	E	E	E	S	S	S	S	S	S	S
	220pF (221)	E	E	E	E	E	S	S	S	S	S	S	S
	270pF (271)	E	E	E	E	E	S	S	S	S	S	X	X
	330pF (331)	E	E	E	E	E	S	S	S	S	S	X	X
	390pF (391)	E	E	E	E	E	S	S	S	S	S	X	X
	470pF (471)	E	E	E	E	E	S	S	S	S	S	X	X
560pF (561)	E	E	E	E	E	S	S	S	S	S			
680pF (681)	E	E	E	E	E	S	S	S	S	S			
820pF (821)	E	E	E	E	E	S	S	S	S	S			
1,000pF (102)	E	E	E	E	E	S	S	S	S	S			
1,200pF (122)						X	X	X	X				
1,500pF (152)						X	X	X	X				
1,800pF (182)						X	X	X	X				
2,200pF (222)						X	X	X	X				
2,700pF (272)						X	X	X	X				
3,300pF (332)						X	X	X	X				
3,900pF (392)													
4,700pF (472)													
5,600pF (562)													
6,800pF (682)													
8,200pF (822)													
0.010uF (103)													
0.012uF (123)													

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

**NP0 Dielectric 0805 Size**

DIELECTRIC		NP0									
SIZE		0805									
RATED VOLTAGE (VDC)		10	16	25	50	100	200	250	500	630	1000
Capacitance	0.5pF (0R5)	A	A	A	A	A	A	A	A	A	D
	0.6pF (0R6)	A	A	A	A	A	A	A	A	A	D
	0.7pF (0R7)	A	A	A	A	A	A	A	A	A	D
	0.8pF (0R8)	A	A	A	A	A	A	A	A	A	D
	0.9pF (0R9)	A	A	A	A	A	A	A	A	A	D
	1.0pF (1R0)	A	A	A	A	A	A	A	A	A	D
	1.2pF (1R2)	A	A	A	A	A	A	A	A	A	D
	1.5pF (1R5)	A	A	A	A	A	A	A	A	A	D
	1.8pF (1R8)	A	A	A	A	A	A	A	A	A	D
	2.2pF (2R2)	A	A	A	A	A	A	A	A	A	D
	2.7pF (2R7)	A	A	A	A	A	A	A	A	A	D
	3.3pF (3R3)	A	A	A	A	A	A	A	A	A	D
	3.9pF (3R9)	A	A	A	A	A	A	A	A	A	D
	4.7pF (4R7)	A	A	A	A	A	A	A	A	A	D
	5.6pF (5R6)	A	A	A	A	A	A	A	A	A	D
	6.8pF (6R8)	A	A	A	A	A	A	A	A	A	D
	8.2pF (8R2)	A	A	A	A	A	A	A	A	A	D
	10pF (100)	A	A	A	A	A	A	A	A	A	D
	12pF (120)	A	A	A	A	A	A	A	A	A	D
	15pF (150)	A	A	A	A	A	A	A	A	A	D
	18pF (180)	A	A	A	A	A	A	A	A	A	D
	22pF (220)	A	A	A	A	A	A	A	A	A	D
	27pF (270)	A	A	A	A	A	A	A	A	A	D
	33pF (330)	A	A	A	A	A	A	A	A	A	D
	39pF (390)	A	A	A	A	A	A	A	A	A	D
	47pF (470)	A	A	A	A	A	A	A	A	A	D
	56pF (560)	A	A	A	A	A	A	A	A	A	D
	68pF (680)	A	A	A	A	A	A	A	A	A	D
	82pF (820)	A	A	A	A	A	A	A	B	B	D
	100pF (101)	A	A	A	A	A	A	A	B	B	D
	120pF (121)	A	A	A	A	A	A	A	B	D	D
	150pF (151)	A	A	A	A	A	A	B	D	D	D
	180pF (181)	A	A	A	A	A	A	B	D	D	D
	220pF (221)	A	A	A	A	A	A	D	D	D	D
	270pF (271)	A	A	A	A	A	A	D	D	D	D
	330pF (331)	A	A	A	A	A	A	D	D	D	D
	390pF (391)	B	B	B	B	B	B	D	D	D	D
	470pF (471)	B	B	B	B	B	B	D	D	I	I
	560pF (561)	B	B	B	B	B	B	D	D	I	I
	680pF (681)	B	B	B	B	B	B	D	D	I	I
820pF (821)	B	B	B	B	B	B	D	D	I	I	
1,000pF (102)	B	B	B	B	B	B	D	D	I	I	
1,200pF (122)	B	B	B	B	B	B	D	D			
1,500pF (152)	B	B	B	B	B	B	D	D			
1,800pF (182)	B	B	B	B	B	B	D	D			
2,200pF (222)	B	B	B	B	B	B	D	D			
2,700pF (272)	D	D	D	D	D	D					
3,300pF (332)	D	D	D	D	D	D					
3,900pF (392)	D	D	D	D	D	D					
4,700pF (472)	D	D	D	D	D	D					
5,600pF (562)	D	D	D	D	D	D					
6,800pF (682)	D	D	D	D	D	D					
8,200pF (822)	D	D	D	D	D	D					
0.010μF (103)	D	D	D	D	D	D					

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Multilayer Ceramic Capacitors

**NP0 Dielectric 1206 Size**

DIELECTRIC		NP0											
SIZE		1206											
RATED VOLTAGE (VDC)		10	16	25	50	100	200	250	500	630	1000	1500	2000
Capacitance	1.0pF (1R0)												
	1.2pF (1R2)	B	B	B	B	B							
	1.5pF (1R5)	B	B	B	B	B	B	B	B	B	B	B	B
	1.8pF (1R8)	B	B	B	B	B	B	B	B	B	B	B	B
	2.2pF (2R2)	B	B	B	B	B	B	B	B	B	B	B	B
	2.7pF (2R7)	B	B	B	B	B	B	B	B	B	B	B	B
	3.3pF (3R3)	B	B	B	B	B	B	B	B	B	B	B	B
	3.9pF (3R9)	B	B	B	B	B	B	B	B	B	B	B	B
	4.7pF (4R7)	B	B	B	B	B	B	B	B	B	B	B	B
	5.6pF (5R6)	B	B	B	B	B	B	B	B	B	B	B	B
	6.8pF (6R8)	B	B	B	B	B	B	B	B	B	B	B	B
	8.2pF (8R2)	B	B	B	B	B	B	B	B	B	B	B	B
	10pF (100)	B	B	B	B	B	B	B	B	B	B	B	B
	12pF (120)	B	B	B	B	B	B	B	B	B	B	B	B
	15pF (150)	B	B	B	B	B	B	B	B	B	B	B	B
	18pF (180)	B	B	B	B	B	B	B	B	B	B	B	B
	22pF (220)	B	B	B	B	B	B	B	B	B	B	B	B
	27pF (270)	B	B	B	B	B	B	B	B	B	B	B	B
	33pF (330)	B	B	B	B	B	B	B	B	B	B	C	C
	39pF (390)	B	B	B	B	B	B	B	B	B	B	C	C
	47pF (470)	B	B	B	B	B	B	B	B	B	C	C	C
	56pF (560)	B	B	B	B	B	B	B	B	B	C	D	D
	68pF (680)	B	B	B	B	B	B	B	B	B	C	D	D
	82pF (820)	B	B	B	B	B	B	B	B	B	D	D	D
	100pF (101)	B	B	B	B	B	B	B	B	B	D	D	D
	120pF (121)	B	B	B	B	B	B	B	B	B	D	G	G
	150pF (151)	B	B	B	B	B	B	B	B	B	D	G	G
	180pF (181)	B	B	B	B	B	B	B	B	B	G	G	G
	220pF (221)	B	B	B	B	B	B	B	B	B	G	G	G
	270pF (271)	B	B	B	B	B	B	C	C	C	G	P	P
	330pF (331)	B	B	B	B	B	B	C	C	C	G	P	P
	390pF (391)	B	B	B	B	B	B	C	C	C	G	P	P
	470pF (471)	B	B	B	B	B	C	C	C	C	G		
	560pF (561)	B	B	B	B	B	C	D	D	D	G		
	680pF (681)	B	B	B	B	B	C	D	D	D	G		
	820pF (821)	B	B	B	B	B	C	G	G	G	G		
	1,000pF (102)	B	B	B	B	B	C	G	G	G	G		
	1,200pF (122)	B	B	B	B	B	C	G	G	G			
	1,500pF (152)	B	B	B	B	B	D	G	G	G			
	1,800pF (182)	B	B	B	B	B	D	G	G	G			
2,200pF (222)	B	B	B	B	B	D	G	G	G				
2,700pF (272)	B	B	B	B	B	D	G	G	G				
3,300pF (332)	B	B	B	B	B	D	G	G	G				
3,900pF (392)	B	B	B	B	B	D	G	G	G				
4,700pF (472)	B	B	B	B	B	D	G	G	G				
5,600pF (562)	B	B	B	B	B								
6,800pF (682)	C	C	C	C	C								
8,200pF (822)	D	D	D	D	D								
0.010μF (103)	D	D	D	D	D								
0.012μF (123)	P	P	P	P	P								
0.015μF (153)	P	P	P	P	P								
0.018μF (183)	P	P	P	P	P								
0.022μF (223)	P	P	P	P	P								
0.027μF (273)	P	P	P	P	P								
0.033μF (333)	P	P	P	P	P								
0.039μF (393)	P	P	P	P	P								

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Multilayer Ceramic Capacitors

**NP0 Dielectric 1210 Size**

DIELECTRIC		NP0											
SIZE		1210											
RATED VOLTAGE (VDC)		10	16	25	50	100	200	250	500	630	1000	1500	2000
Capacitance	10pF (100)	C	C	C	C	C	C	C	C	C	C	C	C
	12pF (120)	C	C	C	C	C	C	C	C	C	C	C	C
	15pF (150)	C	C	C	C	C	C	C	C	C	C	C	C
	18pF (180)	C	C	C	C	C	C	C	C	C	C	C	C
	22pF (220)	C	C	C	C	C	C	C	C	C	C	C	C
	27pF (270)	C	C	C	C	C	C	C	C	C	C	C	C
	33pF (330)	C	C	C	C	C	C	C	C	C	C	C	C
	39pF (390)	C	C	C	C	C	C	C	C	C	C	C	C
	47pF (470)	C	C	C	C	C	C	C	C	C	C	C	C
	56pF (560)	C	C	C	C	C	C	C	C	C	C	D	D
	68pF (680)	C	C	C	C	C	C	C	C	C	C	D	D
	82pF (820)	C	C	C	C	C	C	C	C	C	C	D	D
	100pF (101)	C	C	C	C	C	C	C	C	C	D	D	D
	120pF (121)	C	C	C	C	C	C	C	C	C	D	D	D
	150pF (151)	C	C	C	C	C	C	C	C	C	D	G	G
	180pF (181)	C	C	C	C	C	C	C	C	C	D	G	G
	220pF (221)	C	C	C	C	C	C	C	C	C	G	G	G
	270pF (271)	C	C	C	C	C	C	C	C	C	G	K	K
	330pF (331)	C	C	C	C	C	C	C	C	C	G	K	K
	390pF (391)	C	C	C	C	C	C	C	C	C	G	M	M
	470pF (471)	C	C	C	C	C	C	C	C	C	G	M	M
	560pF (561)	C	C	C	C	C	C	C	C	C	G		
	680pF (681)	C	C	C	C	C	C	C	C	C	G		
	820pF (821)	C	C	C	C	C	C	C	C	C	G		
	1,000pF (102)	C	C	C	C	C	D	D	D	D	G		
	1,200pF (122)	C	C	C	C	C	D	D	D	D	G		
	1,500pF (152)	C	C	C	C	C	D	D	D	D	K		
	1,800pF (182)	C	C	C	C	C	D	D	D	D	M		
	2,200pF (222)	C	C	C	C	C	D	D	D	D	M		
	2,700pF (272)	C	C	C	C	C	D	D	D	D	M		
	3,300pF (332)	C	C	C	C	C	D	D	D	D	M		
	3,900pF (392)	C	C	C	C	C	D	D	D	D	M		
	4,700pF (472)	C	C	C	C	C	G	G					
	5,600pF (562)	C	C	C	C	C	G	G					
	6,800pF (682)	C	C	C	C	C	G	G					
	8,200pF (822)	C	C	C	C	C	G	G					
	0.010μF (103)	C	C	C	C	C	G	G					
	0.012μF (123)	D	D	D	D	D							
	0.015μF (153)	D	D	D	D	D							
	0.018μF (183)												
0.022μF (223)													
0.027μF (273)													
0.033μF (333)													
0.039μF (393)													
0.047μF (473)													

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

**NP0 Dielectric 1808 Size**

DIELECTRIC		NP0					
SIZE		1808					
RATED VOLTAGE (VDC)		500	630	1000	1500	2000	3000
Capacitance	2.0pF (2R0)						
	2.2pF (2R2)	D	D	D	D	D	D
	2.7pF (2R7)	D	D	D	D	D	D
	3.3pF (3R3)	D	D	D	D	D	D
	3.9pF (3R9)	D	D	D	D	D	D
	4.7pF (4R7)	D	D	D	D	D	D
	5.6pF (5R6)	D	D	D	D	D	D
	6.8pF (6R8)	D	D	D	D	D	D
	8.2pF (8R2)	D	D	D	D	D	D
	10pF (100)	D	D	D	D	D	D
	12pF (120)	D	D	D	D	D	D
	15pF (150)	D	D	D	D	D	D
	18pF (180)	D	D	D	D	D	D
	22pF (220)	D	D	D	D	D	D
	27pF (270)	D	D	D	D	D	D
	33pF (330)	D	D	D	D	D	D
	39pF (390)	D	D	D	D	D	D
	47pF (470)	D	D	D	D	D	D
	56pF (560)	D	D	D	D	D	D
	68pF (680)	D	D	D	D	D	D
	82pF (820)	D	D	D	D	D	D
	100pF (101)	D	D	D	D	D	K
	120pF (121)	D	D	D	D	D	K
	150pF (151)	D	D	D	K	K	K
	180pF (181)	D	D	D	K	K	K
	220pF (221)	D	D	D	K	K	K
	270pF (271)	K	K	K	K	K	K
	330pF (331)	K	K	K	K	K	K
	390pF (391)	K	K	K	K	K	K
	470pF (471)	K	K	K	K	K	
	560pF (561)	K	K	K	K	K	
	680pF (681)	K	K	K	K	K	
	820pF (821)	K	K	K	D	D	
1,000pF (102)	K	K	K	G	G		
1,200pF (122)	K	K	G				
1,500pF (152)	K	K	G				
1,800pF (182)	K	K	K				
2,200pF (222)	K	K	K				
2,700pF (272)	K	K					
3,300pF (332)	K	K					
3,900pF (392)							

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Multilayer Ceramic Capacitors

**NP0 Dielectric 1812 Size**

DIELECTRIC		NP0												
SIZE		1812												
RATED VOLTAGE (VDC)		10	16	25	50	100	200	250	500	630	1000	1500	2000	3000
Capacitance	10pF (100)	D	D	D	D	D	D	D	D	D	D	D	D	D
	12pF (120)	D	D	D	D	D	D	D	D	D	D	D	D	D
	15pF (150)	D	D	D	D	D	D	D	D	D	D	D	D	D
	18pF (180)	D	D	D	D	D	D	D	D	D	D	D	D	D
	22pF (220)	D	D	D	D	D	D	D	D	D	D	D	D	D
	27pF (270)	D	D	D	D	D	D	D	D	D	D	D	D	D
	33pF (330)	D	D	D	D	D	D	D	D	D	D	D	D	D
	39pF (390)	D	D	D	D	D	D	D	D	D	D	D	D	D
	47pF (470)	D	D	D	D	D	D	D	D	D	D	D	D	D
	56pF (560)	D	D	D	D	D	D	D	D	D	D	D	D	D
	68pF (680)	D	D	D	D	D	D	D	D	D	D	D	D	D
	82pF (820)	D	D	D	D	D	D	D	D	D	D	D	D	D
	100pF (101)	D	D	D	D	D	D	D	D	D	D	D	D	D
	120pF (121)	D	D	D	D	D	D	D	D	D	D	D	D	D
	150pF (151)	D	D	D	D	D	D	D	D	D	D	D	D	D
	180pF (181)	D	D	D	D	D	D	D	D	D	D	D	D	K
	220pF (221)	D	D	D	D	D	D	D	D	D	D	D	D	K
	270pF (271)	D	D	D	D	D	D	D	D	D	D	K	K	K
	330pF (331)	D	D	D	D	D	D	D	D	D	D	K	K	K
	390pF (391)	D	D	D	D	D	D	D	D	D	D	K	K	K
	470pF (471)	D	D	D	D	D	D	D	D	D	K	K	K	K
	560pF (561)	D	D	D	D	D	D	D	D	D	K	K	K	
	680pF (681)	D	D	D	D	D	D	D	D	D	K	K	K	
	820pF (821)	D	D	D	D	D	D	D	D	D	K	K	K	
	1,000pF (102)	D	D	D	D	D	D	D	D	D	K	K	K	
	1,200pF (122)	D	D	D	D	D	D	D	D	D	K			
	1,500pF (152)	D	D	D	D	D	D	D	D	D	K			
	1,800pF (182)	D	D	D	D	D	D	D	D	D	K			
	2,200pF (222)	D	D	D	D	D	D	D	D	D	K			
	2,700pF (272)	D	D	D	D	D	D	D	D	D	K			
	3,300pF (332)	D	D	D	D	D	D	D	D	D	K			
	3,900pF (392)	D	D	D	D	D	D	D	D	D	M			
	4,700pF (472)	D	D	D	D	D	D	D	D	D				
	5,600pF (562)	D	D	D	D	D	D	D	D	D				
	6,800pF (682)	D	D	D	D	D	D	D	D	D				
	8,200pF (822)	D	D	D	D	D	D	D	D	D				
	0.010μF (103)	D	D	D	D	D	D	D	D	D				
	0.012μF (123)	D	D	D	D	D	D	D	G	G				
	0.015μF (153)	D	D	D	D	D	D	D	G	G				
	0.018μF (183)	D	D	D	D	D	D	D	K	K				
0.022μF (223)	D	D	D	D	D	D	D	K	K					
0.027μF (273)	D	D	D	D	D	D	D							
0.033μF (333)	D	D	D	D	D	D	D							
0.039μF (393)														
0.047μF (473)														

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Multilayer Ceramic Capacitors

**7-1. CAPACITANCE RANGE (X7R Dielectric)**

**0402, 0603 Sizes**

DIELECTRIC		X7R											
SIZE		0402					0603						
RATED VOLTAGE (VDC)		10	16	25	50	100	10	16	25	50	100	200	250
Capacitance	100pF (101)	E	E	E	E	E	S	S	S	S	S	X	X
	120pF (121)	E	E	E	E	E	S	S	S	S	S	X	X
	150pF (151)	E	E	E	E	E	S	S	S	S	S	X	X
	180pF (181)	E	E	E	E	E	S	S	S	S	S	X	X
	220pF (221)	E	E	E	E	E	S	S	S	S	S	X	X
	270pF (271)	E	E	E	E	E	S	S	S	S	S	X	X
	330pF (331)	E	E	E	E	E	S	S	S	S	S	X	X
	390pF (391)	E	E	E	E	E	S	S	S	S	S	X	X
	470pF (471)	E	E	E	E	E	S	S	S	S	S	X	X
	560pF (561)	E	E	E	E	E	S	S	S	S	S	X	X
	680pF (681)	E	E	E	E	E	S	S	S	S	S	X	X
	820pF (821)	E	E	E	E	E	S	S	S	S	S	X	X
	1,000pF (102)	E	E	E	E	E	S	S	S	S	S	X	X
	1,200pF (122)	E	E	E	E	E	S	S	S	S	S	X	X
	1,500pF (152)	E	E	E	E	E	S	S	S	S	S	X	X
	1,800pF (182)	E	E	E	E	E	S	S	S	S	S	X	X
	2,200pF (222)	E	E	E	E	E	S	S	S	S	S	X	X
	2,700pF (272)	E	E	E	E	E	S	S	S	S	S	X	X
	3,300pF (332)	E	E	E	E	E	S	S	S	S	S	X	X
	3,900pF (392)	E	E	E	E	E	S	S	S	S	S	X	X
	4,700pF (472)	E	E	E	E	E	S	S	S	S	S	X	X
	5,600pF (562)	E	E	E	E	E	S	S	S	S	S	X	X
	6,800pF (682)	E	E	E	E	E	S	S	S	S	S	X	X
	8,200pF (822)	E	E	E	E	E	S	S	S	S	S	X	X
	0.010μF (103)	E	E	E	E	E	S	S	S	S	S	X	X
	0.012μF (123)	E	E	E	E	E	S	S	S	S	S	X	
	0.015μF (153)	E	E	E	E	E	S	S	S	S	S	X	
	0.018μF (183)	E	E	E	E	E	S	S	S	S	S	X	
	0.022μF (223)	E	E	E	E	E	S	S	S	S	S	X	
	0.027μF (273)	E	E	E	E	E	S	S	S	S	S	X	
	0.033μF (333)	E	E	E	E	E	S	S	S	X	X		
	0.039μF (393)	E	E	E	E	E	S	S	S	X	X		
	0.047μF (473)	E	E	E	E	E	S	S	S	X	X		
	0.056μF (563)	E	E				S	S	S	X	X		
	0.068μF (683)	E	E				S	S	S	X	X		
	0.082μF (823)	E	E				S	S	S	X	X		
	0.10μF (104)	E	E				S	S	S	X	X		
	0.12μF (124)						S	S	X				
	0.15μF (154)						S	S	X				
	0.18μF (184)						S	S	X				
	0.22μF (224)						S	S	X	X			
	0.27μF (274)						X	X	X				
	0.33μF (334)						X	X	X				
	0.39μF (394)						X	X	X				
	0.47μF (474)						X	X	X				
	0.56μF (564)						X	X					
	0.68μF (684)						X	X					
0.82μF (824)						X	X						
1.0μF (105)						X	X	X					
1.5μF (155)													
2.2μF (225)													
4.7μF (475)													

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Multilayer Ceramic Capacitors

Approval Sheet

X7R Dielectric 0805 Size

DIELECTRIC		X7R										
SIZE		0805										
RATED VOLTAGE (VDC)		10	16	25	50	100	200	250	500	630	1000	
Capacitance	100pF (101)	D	D	D	D	D	D	D	B	B	B	
	120pF (121)	D	D	D	D	D	D	D	B	B	B	
	150pF (151)	D	D	D	D	D	D	D	B	B	B	
	180pF (181)	D	D	D	D	D	D	D	B	B	B	
	220pF (221)	D	D	D	D	D	D	D	B	B	B	
	270pF (271)	D	D	D	D	D	D	D	B	B	B	
	330pF (331)	D	D	D	D	D	D	D	B	B	B	
	390pF (391)	D	D	D	D	D	D	D	B	B	B	
	470pF (471)	D	D	D	D	D	D	D	B	B	B	
	560pF (561)	D	D	D	D	D	D	D	B	B	B	
	680pF (681)	D	D	D	D	D	D	D	B	B	B	
	820pF (821)	D	D	D	D	D	D	D	B	B	B	
	1,000pF (102)	D	D	D	D	D	D	D	B	B	B	
	1,200pF (122)	D	D	D	D	D	D	D	D	B	B	B
	1,500pF (152)	D	D	D	D	D	D	D	D	B	B	D
	1,800pF (182)	D	D	D	D	D	D	D	D	B	B	D
	2,200pF (222)	D	D	D	D	D	D	D	D	B	B	D
	2,700pF (272)	D	D	D	D	D	D	D	D	B	B	
	3,300pF (332)	D	D	D	D	D	D	D	D	B	B	
	3,900pF (392)	D	D	D	D	D	D	D	D	B	B	
	4,700pF (472)	D	D	D	D	D	D	D	D	D	D	
	5,600pF (562)	D	D	D	D	D	D	D	D	D	D	
	6,800pF (682)	D	D	D	D	D	D	D	D	D	D	
	8,200pF (822)	D	D	D	D	D	D	D	D	D	D	
	0.010μF (103)	D	D	D	D	D	D	D	D	D	D	
	0.012μF (123)	D	D	D	D	D	D	D	D	D	D	
	0.015μF (153)	D	D	D	D	D	D	D	D	D	D	
	0.018μF (183)	D	D	D	D	D	D	D	D	D	D	
	0.022μF (223)	D	D	D	D	D	D	D	D	D	D	
	0.027μF (273)	D	D	D	D	D	D	D	D	D	D	
	0.033μF (333)	D	D	D	D	D	D	D	D	D	D	
	0.039μF (393)	D	D	D	D	D	D	D	D	D	D	
	0.047μF (473)	D	D	D	D	D	D	D	D	D	D	
	0.056μF (563)	D	D	D	D	D	D	D	D	D	D	
	0.068μF (683)	D	D	D	D	D	D	D	D	D	D	
	0.082μF (823)	D	D	D	D	D	D	D	D	D	D	
	0.10μF (104)	D	D	D	D	D	D	D	D	D	D	
	0.12μF (124)	D	D	D	D	D	I					
	0.15μF (154)	D	D	D	D	D	I					
	0.18μF (184)	D	D	D	D	D	I					
	0.22μF (224)	D	D	D	D	D	I					
	0.27μF (274)	I	I	I	I	I						
	0.33μF (334)	I	I	I	I	I						
	0.39μF (394)	I	I	I	I	I						
	0.47μF (474)	I	I	I	I	I						
0.56μF (564)	I	I	I	I	I							
0.68μF (684)	I	I	I	I	I							
0.82μF (824)	I	I	I	I	I							
1.0μF (105)	I	I	I	I	I							
1.5μF (155)	I	I	I	I	I							
2.2μF (225)	I	I	I	I	I							
4.7μF (475)		I										
10μF (106)												

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Multilayer Ceramic Capacitors

Approval Sheet

X7R Dielectric 1206 Size

DIELECTRIC		X7R													
SIZE		1206													
RATED VOLTAGE (VDC)		10	16	25	50	100	200	250	400	450	500	630	1000	1500	2000
Capacitance	100pF (101)						D	D			D	D	D	D	D
	120pF (121)						D	D			D	D	D	D	D
	150pF (151)	D	D	D	D	D	D	D			D	D	D	D	D
	180pF (181)	D	D	D	D	D	D	D			D	D	D	D	D
	220pF (221)	D	D	D	D	D	D	D			D	D	D	D	D
	270pF (271)	D	D	D	D	D	D	D			D	D	D	D	D
	330pF (331)	D	D	D	D	D	D	D			D	D	D	D	D
	390pF (391)	D	D	D	D	D	D	D			D	D	D	D	D
	470pF (471)	D	D	D	D	D	D	D			D	D	D	D	D
	560pF (561)	D	D	D	D	D	D	D			D	D	D	D	D
	680pF (681)	D	D	D	D	D	D	D			D	D	D	D	D
	820pF (821)	D	D	D	D	D	D	D			D	D	D	G	G
	1,000pF (102)	D	D	D	D	D	D	D			D	D	D	G	G
	1,200pF (122)	D	D	D	D	D	D	D			D	D	D	G	G
	1,500pF (152)	D	D	D	D	D	D	D			D	D	D	G	G
	1,800pF (182)	D	D	D	D	D	D	D			D	D	D	G	G
	2,200pF (222)	D	D	D	D	D	D	D			D	D	D	G	G
	2,700pF (272)	D	D	D	D	D	D	D			D	D	D	G	G
	3,300pF (332)	D	D	D	D	D	D	D			D	D	D	G	G
	3,900pF (392)	D	D	D	D	D	D	D			D	D	D	G	
	4,700pF (472)	D	D	D	D	D	D	D			D	D	D	G	
	5,600pF (562)	D	D	D	D	D	D	D			D	D	D	G	
	6,800pF (682)	D	D	D	D	D	D	D			D	D	D	G	
	8,200pF (822)	D	D	D	D	D	D	D			D	D	D	G	
	0.010μF (103)	D	D	D	D	D	D	D			D	D	D	G	
	0.012μF (123)	D	D	D	D	D	D	D			D	D	G		
	0.015μF (153)	D	D	D	D	D	D	D			D	D	G		
	0.018μF (183)	D	D	D	D	D	D	D			D	D			
	0.022μF (223)	D	D	D	D	D	D	D			G	G			
	0.027μF (273)	D	D	D	D	D	D	D			G	G			
	0.033μF (333)	D	D	D	D	D	G	G			G	G			
	0.039μF (393)	D	D	D	D	D	G	G			G	G			
	0.047μF (473)	D	D	D	D	D	G	G			G	G			
	0.056μF (563)	D	D	D	D	D	G	G			G	G			
	0.068μF (683)	D	D	D	D	D	G	G	G	G					
	0.082μF (823)	D	D	D	D	D	G	G	G	G					
	0.10μF (104)	D	D	D	D	D	G	G	G	G					
	0.12μF (124)	D	D	D	D	D									
	0.15μF (154)	C	C	C	C	G									
	0.18μF (184)	C	C	C	C	G									
	0.22μF (224)	C	C	C	C	G									
	0.27μF (274)	C	C	C	D	G									
	0.33μF (334)	C	C	C	D	G									
	0.39μF (394)	C	C	J	P	G									
	0.47μF (474)	J	J	J	P	G									
	0.56μF (564)	J	J	J	P	P									
	0.68μF (684)	J	J	J	P	P									
0.82μF (824)	J	J	J	P	P										
1.0μF (105)	J	J	J	P	P										
1.5μF (155)	J	J	P												
2.2μF (225)	J	J	P	P											
3.3μF (335)	P	P	P												
4.7μF (475)	P	P	P												
10μF (106)	P	P	P												
22μF (226)	P														
47μF (476)															

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

Multilayer Ceramic Capacitors

Approval Sheet

X7R Dielectric 1210 Size

DIELECTRIC		X7R															
SIZE		1210															
RATED VOLTAGE (VDC)		6.3	10	16	25	50	100	200	250	400	450	500	630	1000	1500	2000	
Capacitance	100pF (101)											D	D	D	D	D	
	120pF (121)											D	D	D	D	D	
	150pF (151)											D	D	D	D	D	
	180pF (181)											D	D	D	D	D	
	220pF (221)											D	D	D	D	D	
	270pF (271)											D	D	D	D	D	
	330pF (331)											D	D	D	D	D	
	390pF (391)											D	D	D	D	D	
	470pF (471)											D	D	D	D	D	
	560pF (561)											D	D	D	D	D	
	680pF (681)											D	D	D	D	D	
	820pF (821)											D	D	D	D	D	
	1,000pF (102)			C	C	C	C	C	C	C			D	D	D	D	D
	1,200pF (122)			C	C	C	C	C	C	C			D	D	D	M	M
	1,500pF (152)			C	C	C	C	C	C	C			D	D	D	M	M
	1,800pF (182)			C	C	C	C	C	C	C			D	D	D	M	M
	2,200pF (222)			C	C	C	C	C	C	C			D	D	D	M	M
	2,700pF (272)			C	C	C	C	C	C	C			D	D	D	M	M
	3,300pF (332)			C	C	C	C	C	C	C			D	D	D	M	M
	3,900pF (392)			C	C	C	C	C	C	C			D	D	G	M	M
	4,700pF (472)			C	C	C	C	C	C	C			D	D	G	M	M
	5,600pF (562)			C	C	C	C	C	C	C			D	D	G	M	M
	6,800pF (682)			C	C	C	C	C	C	C			D	D	G	M	M
	8,200pF (822)			C	C	C	C	C	C	C			D	D	G	M	M
	0.010μF (103)			C	C	C	C	C	C	C			D	D	G		
	0.012μF (123)			C	C	C	C	C	C	C			D	D	G		
	0.015μF (153)			C	C	C	C	C	C	C			D	D	G		
	0.018μF (183)			C	C	C	C	C	C	C			D	D	G		
	0.022μF (223)			C	C	C	C	C	C	C			D	D	G		
	0.027μF (273)			C	C	C	C	C	C	C			G	G	G		
	0.033μF (333)			C	C	C	C	C	C	C			G	G	G		
	0.039μF (393)			C	C	C	C	C	C	C			G	G	K		
	0.047μF (473)			C	C	C	C	C	D	D			G	G	M		
	0.056μF (563)			C	C	C	C	C	D	D			G	G			
	0.068μF (683)			C	C	C	C	C	G	G			K	K			
	0.082μF (823)			C	C	C	C	C	G	G			K	K			
	0.10μF (104)			C	C	C	C	C	G	G			K	K			
	0.12μF (124)			C	C	C	C	C	G	G	M	M					
	0.15μF (154)			C	C	C	C	D	M	M	M	M					
	0.18μF (184)			C	C	C	C	D	M	M	M	M					
	0.22μF (224)			C	C	C	C	D	M	M	M	M					
	0.27μF (274)			C	C	C	C	G	M	M	M	M					
	0.33μF (334)			C	C	C	D	G	M	M	M	M					
	0.39μF (394)			C	C	C	D	M	M	M							
	0.47μF (474)			C	C	C	D	M	M	M							
	0.56μF (564)			D	D	D	D	M	M	M							
	0.68μF (684)			D	D	D	D	K	M	M							
0.82μF (824)			D	D	D	D	K										
1.0μF (105)			D	D	D	D	K										
1.5μF (155)				K	G	M	M										
2.2μF (225)				K	G	M	M										
3.3μF (335)				K	G	M											
4.7μF (475)			K	K	K												
10μF (106)			K	K	M	M											
22μF (226)				M													
47μF (476)		M															

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X7R Dielectric 1808, 1812 Sizes

DIELECTRIC		X7R																				
SIZE		1808						1812														
RATED VOLTAGE (VDC)		500	630	1000	1500	2000	3000	10	16	25	50	100	200	250	500	630	1000	1500	2000	3000		
Capacitance	100pF (101)																					
	120pF (121)																					
	150pF (151)	D	D	D	D	D	D															
	180pF (181)	D	D	D	D	D	D															
	220pF (221)	D	D	D	D	D	D															
	270pF (271)	D	D	D	D	D	D						D	D	D	D	D	D	D	D	K	
	330pF (331)	D	D	D	D	D	K						D	D	D	D	D	D	D	D	K	
	390pF (391)	D	D	D	D	D	K						D	D	D	D	D	D	D	D	K	
	470pF (471)	D	D	D	D	D	K						D	D	D	D	D	D	D	D	K	
	560pF (561)	D	D	D	D	D	K						D	D	D	D	D	D	D	D	K	
	680pF (681)	D	D	D	D	D	K						D	D	D	D	D	D	D	D	K	
	820pF (821)	D	D	D	D	D	K						D	D	D	D	D	D	D	D	K	
	1,000pF (102)	D	D	D	K	K	K	D	D	D	D	D	D	D	D	D	D	D	D	D	K	
	1,200pF (122)	D	D	D	K	K	K	D	D	D	D	D	D	D	D	D	D	D	D	D	K	
	1,500pF (152)	D	D	D	K	K	K	D	D	D	D	D	D	D	D	D	D	D	D	D	K	
	1,800pF (182)	D	D	D	K	K	K	D	D	D	D	D	D	D	D	D	D	D	D	G	G	M
	2,200pF (222)	D	D	D	K	K		D	D	D	D	D	D	D	D	D	D	D	D	G	G	M
	2,700pF (272)	D	D	D	K	K		D	D	D	D	D	D	D	D	D	D	D	D	G	G	M
	3,300pF (332)	D	D	D	K	K		D	D	D	D	D	D	D	D	D	D	D	D	K	K	M
	3,900pF (392)	D	D	D	K	K		D	D	D	D	D	D	D	D	D	D	D	D	K	K	M
	4,700pF (472)	D	D	D	K	K		D	D	D	D	D	D	D	D	D	D	D	D	K	K	M
	5,600pF (562)	K	K	K	K	K		D	D	D	D	D	D	D	D	D	D	D	D	M	M	M
	6,800pF (682)	K	K	K	K	K		D	D	D	D	D	D	D	D	D	D	D	D	M	M	M
	8,200pF (822)	K	K	K				D	D	D	D	D	D	D	D	D	D	D	D	M	M	
	0.010μF (103)	K	K	K				D	D	D	D	D	D	D	D	D	D	D	D	M	M	
	0.012μF (123)	K	K	K				D	D	D	D	D	D	D	D	D	D	D	D	K		
	0.015μF (153)	K	K	K				D	D	D	D	D	D	D	D	D	D	D	D	K		
	0.018μF (183)	K	K	K				D	D	D	D	D	D	D	D	D	D	D	D	M		
	0.022μF (223)	K	K	K				D	D	D	D	D	D	D	D	D	D	D	D	M		
	0.027μF (273)	K	K	K				D	D	D	D	D	D	D	D	D	D	D	D	M		
	0.033μF (333)	K	K	K				D	D	D	D	D	D	D	D	D	D	D	D	M		
	0.039μF (393)	K	K	K				D	D	D	D	D	D	D	D	D	D	D	D	M		
	0.047μF (473)	K	K	K				D	D	D	D	D	D	D	D	D	D	D	D	M		
	0.056μF (563)	K	K	K				D	D	D	D	D	D	D	D	D	K	K	M			
	0.068μF (683)	K	K					D	D	D	D	D	D	D	D	D	K	K	M			
	0.082μF (823)	K	K					D	D	D	D	D	D	D	D	D	K	K	M			
	0.10μF (104)							D	D	D	D	D	D	D	D	D	K	K	M			
	0.12μF (124)							D	D	D	D	D	D	D	D	D	M	M				
	0.15μF (154)							D	D	D	D	D	D	D	D	D	K	M	M			
	0.18μF (184)							D	D	D	D	D	D	D	D	D	K	M	M			
0.22μF (224)							D	D	D	D	D	D	D	D	D	K	M	M				
0.27μF (274)							D	D	D	D	D	D	D	D	D	K	M					
0.33μF (334)							D	D	D	D	D	D	D	D	D	K	M					
0.39μF (394)							D	D	D	D	D	D	D	D	D	K	M					
0.47μF (474)							D	D	D	D	D	D	D	D	D	K	M					
0.56μF (564)							D	D	D	D	D	D	D	D	D	K	M					
0.68μF (684)							D	D	D	D	D	D	D	D	D	K	M					
0.82μF (824)							D	D	D	D	D	D	D	D	D	K	M					
1.0μF (105)							D	D	D	D	D	D	D	D	D	K	M					
1.5μF (155)																K						
2.2μF (225)																M	M					
3.3μF (335)																						
4.7μF (475)																						

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

**7-2. CAPACITANCE RANGE (X5R Dielectric)**

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

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. CAPACITANCE RANGE (Y5V Dielectric)**

DIELECTRIC		Y5V								
SIZE		0402				0603				
RATED VOLTAGE		6.3	10	16	25	50	10	16	25	50
Capacitance	0.010µF (103)		E	E	E	E	S	S	S	S
	0.015µF (153)		E	E	E	E	S	S	S	S
	0.022µF (223)		E	E	E	E	S	S	S	S
	0.033µF (333)		E	E	E	E	S	S	S	S
	0.047µF (473)		E	E	E		S	S	S	S
	0.068µF (683)		E	E	E		S	S	S	S
	0.10µF (104)		E	E	E		S	S	S	S
	0.15µF (154)			E			S	S	S	S
	0.22µF (224)		E	E			S	S	S	S
	0.33µF (334)	E	E				S	S	S	
	0.47µF (474)						S	S		
	0.68µF (684)						S	X		
	1.0µF (105)						S	X		
	2.2µF (225)						S			
4.7µF (475)										

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



**8. PACKAGING STYLE AND QUANTITY**

Size	Thickness (mm)/Symbol		Paper tape		Plastic tape	
			7" reel	13" reel	7" reel	13" reel
0402 (1005)	0.50±0.20	E	10k	-	-	-
0603 (1608)	0.80±0.07	S	4k	15k	-	-
	0.80±0.30	X	4k	15k	-	-
0805 (2012)	0.60±0.10	A	4k	15k	-	-
	0.80±0.10	B	4k	15k	-	-
	1.25±0.10	D	-	-	3k	10k
	1.25±0.30	I	-	-	3k	10k
1206 (3216)	0.80±0.10	B	4k	15k	-	-
	0.95±0.10	C	-	-	3k	10k
	1.15±0.15	J	-	-	3k	10k
	1.25±0.10	D	-	-	3k	10k
	1.60±0.20	G	-	-	2k	10k
	1.60±0.50	P	-	-	2k	9k
1210 (3225)	0.95±0.10	C	-	-	3k	10k
	1.25±0.10	D	-	-	3k	10k
	1.60±0.20	G	-	-	2k	-
	2.00±0.20	K	-	-	1k	6k
	2.50±0.50	M	-	-	1k	6k
1812 (4532)	1.25±0.10	D	-	-	1k	5k
	1.60±0.20	G	-	-	1k	-
	2.00±0.20	K	-	-	1k	-
	2.50±0.50	M	-	-	0.5k	3k

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) C ≤ 1000pF, 1.0±0.2Vrms · 1MHz±10% C > 1000pF, 1.0±0.2Vrms · 1KHz±10% Class II: (X7R, X7E, X6S, X5R, X7S, 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, X7S:																																																																																						
3.	Q/ D.F. (Dissipation Factor)	** Test condition: 0.5±0.2Vrms · 1KHz±10% X7R: 0805=106(6.3V), 0603/475(6.3V) X5R: 0201 ≥ 224 (6.3V, 10V, 16V) <sup>#1</sup> , 0402 ≥ 475 (6.3V, 16V), 0402 ≥ 225(10V), 0603=106 (6.3V, 10V), TT18X ≥ 475(10V), TT15X series X6S: 0201/474(4V), 0201 ≥ 104 (6.3V, 10V) <sup>#1</sup> , 0402 ≥ 225 (6.3V), 0402/475 (10V), 0603/106 (6.3V), X7S: 0402/225(6.3V)  #1 Excluding X5R/0201/105(6.3V); 225(10V), X6S/0201/104(10V) (1.0±0.2Vrms · 1KHz±10%)  *Before initial measurement (Class II only): To apply de-aging at 150°C for 1hr then set for 24±2 hrs at room temp.	Rated vol.   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4.	Dielectric Strength	*To apply voltage: ≤ 100V: 250% of rated voltage. 200V ~ 300V: 200% of rated voltage. 400V ~ 450V: 120% of rated voltage. 500V ~ 999V: 150% of rated voltage. 1000V ~ 3000V: 120% of rated voltage. 4000V: 110% of rated voltage. *Duration: 1 to 5 sec. *Charge & discharge current less than 50mA.	* No evidence of damage or flash over during test.																																																																																						

Multilayer Ceramic Capacitors

No.	Item	Test Condition	Requirements	
5.	Insulation Resistance	To apply rated voltage for MAX. 120sec.	10GΩ or $RxC \geq 500\Omega\text{-F}$ whichever is smaller. Class II (X7R, X7E, X5R, X6S, X7S, Y5V:)	
			Rated voltage	Insulation Resistance
			100V: All X7R	10GΩ or $RxC \geq 100\Omega\text{-F}$ whichever is smaller.
			50V: 0402 $\geq 0.01\mu\text{F}$ ; 0603 $\geq 1\mu\text{F}$ ; 0805 $\geq 1\mu\text{F}$ ; 1206 $\geq 4.7\mu\text{F}$ ; 1210 $\geq 4.7\mu\text{F}$	
			35V: 0805 $\geq 2.2\mu\text{F}$ ; 1206 $\geq 2.2\mu\text{F}$ ; 1210 $\geq 10\mu\text{F}$	
			25V: 0402 $\geq 1\mu\text{F}$ ; 0603 $\geq 2.2\mu\text{F}$ ; 0805 $\geq 2.2\mu\text{F}$ ; 1206 $\geq 10\mu\text{F}$ ; 1210 $\geq 10\mu\text{F}$	
			16V: 0201 $\geq 0.1\mu\text{F}$ ; 0402 $\geq 0.22\mu\text{F}$ ; 0603 $\geq 1\mu\text{F}$ ; 0805 $\geq 2.2\mu\text{F}$ ; 1206 $\geq 10\mu\text{F}$ ; 1210 $\geq 47\mu\text{F}$	
			10V: 0201 $\geq 47\text{nF}$ ; 0402 $\geq 0.47\mu\text{F}$ ; 0603 $\geq 0.47\mu\text{F}$ ; 0805 $\geq 2.2\mu\text{F}$ ; 1206 $\geq 4.7\mu\text{F}$ ; 1210 $\geq 47\mu\text{F}$	
			6.3V ; 4V ; TT series; Size $\geq 1812$	
			Rated voltage	
All X6S items, All X7S items	RxC $\geq 50\Omega\text{-F}$ .			
100V: 1210 $\geq 3.3\mu\text{F}$				
50V: 0402 $\geq 0.1\mu\text{F}$ ; 0603 $\geq 2.2\mu\text{F}$ ; 0805 $\geq 10\mu\text{F}$ ; 1206 $\geq 10\mu\text{F}$				
35V: 0603 $\geq 1\mu\text{F}$ ;				
25V: 0201 $\geq 0.1\mu\text{F}$ ; 0402 $\geq 2.2\mu\text{F}$ ; 0603 $\geq 10\mu\text{F}$ ; 0805 $\geq 10\mu\text{F}$ ; 1206 $\geq 22\mu\text{F}$				
16V: 0603 $\geq 10\mu\text{F}$ ; 0402 $\geq 1\mu\text{F}$ ; 0201 $\geq 0.22\mu\text{F}$				
10V: 0201 $\geq 0.1\mu\text{F}$ ; 0402 $\geq 1\mu\text{F}$ ; 0603 $\geq 10\mu\text{F}$ ; 0805 $\geq 47\mu\text{F}$ ; TT21 $\geq 4.7\mu\text{F}$				
6.3V: 0201 $\geq 0.1\mu\text{F}$ ; 0603 $\geq 4.7\mu\text{F}$ ; 0805 $\geq 47\mu\text{F}$ ; 1206 $\geq 10\mu\text{F}$ ; TT15 $\geq 1.0\mu\text{F}$				
4V: 0603 $\geq 22\mu\text{F}$ ; 0805 $\geq 47\mu\text{F}$ ; 1206 $\geq 100\mu\text{F}$				
Rated voltage: 200~630V	To apply rated voltage (500V max.) for 60 sec.	$\geq 10G\Omega$ or $RxC \geq 100\Omega\text{-F}$ whichever is smaller		
Rated voltage: >630V	To apply 500V for 60 sec.			



Multilayer Ceramic Capacitors

No.	Item	Test Condition	Requirements																																																								
6.	Temperature Coefficient	<p>With no electrical load.</p> <table border="1"> <thead> <tr> <th>T.C.</th> <th>Operating Temp</th> </tr> </thead> <tbody> <tr> <td>NPO</td> <td>-55~125°C at 25°C</td> </tr> <tr> <td>X7R</td> <td>-55~125°C at 25°C</td> </tr> <tr> <td>X7S</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> </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.</p> <p>* Measurement voltage for Class II:</p> <table border="1"> <thead> <tr> <th>01005</th> <th>0201</th> </tr> </thead> <tbody> <tr> <td>Cap≤0.01μF: 0.5V</td> <td>Cap&lt;0.1μF:1V</td> </tr> <tr> <td>Cap&gt;0.01μF: 0.2V</td> <td>0.1μF*≤Cap&lt;1μF: 0.2V</td> </tr> <tr> <td></td> <td>Cap≥1μF: 0.1V</td> </tr> <tr> <td></td> <td>*0201X104/16V: 0.5V</td> </tr> <tr> <th>0402</th> <th>0603</th> </tr> <tr> <td>Cap&lt;1μF: 1V</td> <td>Cap≤1μF: 1V</td> </tr> <tr> <td>Cap=1μF: 0.5V</td> <td>1μF&lt;Cap≤4.7μF: 0.5V</td> </tr> <tr> <td>1μF&lt;Cap&lt;10μF: 0.2V</td> <td>Cap&gt;4.7μF: 0.2V</td> </tr> <tr> <td>Cap≥10μF: 0.1V</td> <td></td> </tr> <tr> <th>0805</th> <th>1206/1210</th> </tr> <tr> <td>Cap&lt;10μF: 1V</td> <td>Cap≤10μF: 1V</td> </tr> <tr> <td>Cap=10μF: 0.5V</td> <td>10μF&lt;Cap≤100μF: 0.5V</td> </tr> <tr> <td>Cap&gt;10μF: 0.2V</td> <td>Cap&gt;100μF: 0.2V</td> </tr> </tbody> </table>	T.C.	Operating Temp	NPO	-55~125°C at 25°C	X7R	-55~125°C at 25°C	X7S	-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	01005	0201	Cap≤0.01μF: 0.5V	Cap<0.1μF:1V	Cap>0.01μF: 0.2V	0.1μF*≤Cap<1μF: 0.2V		Cap≥1μF: 0.1V		*0201X104/16V: 0.5V	0402	0603	Cap<1μF: 1V	Cap≤1μF: 1V	Cap=1μF: 0.5V	1μF<Cap≤4.7μF: 0.5V	1μF<Cap<10μF: 0.2V	Cap>4.7μF: 0.2V	Cap≥10μF: 0.1V		0805	1206/1210	Cap<10μF: 1V	Cap≤10μF: 1V	Cap=10μF: 0.5V	10μF<Cap≤100μF: 0.5V	Cap>10μF: 0.2V	Cap>100μF: 0.2V	<table border="1"> <thead> <tr> <th>T.C.</th> <th>Capacitance Change</th> </tr> </thead> <tbody> <tr> <td>NPO</td> <td>Within ±30ppm/°C</td> </tr> <tr> <td>X7R</td> <td>Within ±15%</td> </tr> <tr> <td>X7S</td> <td>Within ±22%</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> </tbody> </table>	T.C.	Capacitance Change	NPO	Within ±30ppm/°C	X7R	Within ±15%	X7S	Within ±22%	X5R	Within ±15%	X6S	Within ±22%	Y5V	Within +30%/-80%
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7.	Adhesive Strength of Termination	<p>* Pressurizing force : 2N (0201) and 5N (≤0603) and 10N (&gt;0603)</p> <p>* Test time: 10±1 sec.</p>	<p>* No remarkable damage or removal of the terminations.</p>																																																								
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.)</p> <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.</p> <p>*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>	<p>* 75% min. coverage of all metalized area.</p>																																																								
10.	Bending Test	<p>* The middle part of substrate shall be pressurized by means of the pressurizing rod at a rate of about 1 mm per second until the deflection becomes 5 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

No.	Item	Test Condition	Requirements																																																																													
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: <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">≤ 3%</td> <td>≤ 6% 1206 ≥ 0.47μF</td> </tr> <tr> <td>≤ 7.5% 0805 &gt; 0.1μF, 0603 ≥ 0.068μF, 1206 &gt; 1μF; 1210 ≥ 2.2μF; TT series</td> </tr> <tr> <td>≤ 20% 0805 ≥ 0.22μF; 1210 ≥ 3.3μF</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% 0201 ≥ 0.01μF; 1210 ≥ 4.7μF</td> </tr> <tr> <td>≤ 20% 0402 ≥ 0.012μF; 0603 &gt; 0.1μF; 0805 ≥ 1μF (0805/X7R &gt; 0.47μF); 1206 ≥ 2.2μF; 1210 ≥ 10μF; TT series</td> </tr> <tr> <td>35V</td> <td>≤ 5%</td> <td>≤ 20% 0603 ≥ 1μF; 0805 ≥ 2.2μF; 1206 ≥ 2.2μF; 1210 ≥ 10μF</td> </tr> <tr> <td rowspan="3">25V</td> <td rowspan="3">≤ 5%</td> <td>≤ 10% 0201 ≥ 0.01μF; 0805 ≥ 1μF; 1210 ≥ 10μF</td> </tr> <tr> <td>≤ 14% 0603 ≥ 0.33μF</td> </tr> <tr> <td>≤ 15% 0201 ≥ 0.1μF; 0402 ≥ 0.10μF &amp; (0402/X7R ≥ 0.056μF); TT series</td> </tr> <tr> <td>≤ 20% 0603 ≥ 0.47μF; 0805 ≥ 2.2μF; 1206 ≥ 4.7μF; 1210 ≥ 22μF</td> </tr> <tr> <td rowspan="2">16V</td> <td rowspan="2">≤ 5%</td> <td>≤ 10% 0603 ≥ 0.15μF; 0805 ≥ 0.68μF; 1206 ≥ 2.2μF; 1210 ≥ 4.7μF</td> </tr> <tr> <td>≤ 15% 0201 ≥ 0.01μF (0201/X7R ≥ 0.022μF); 0402 ≥ 0.033μF; 0603 ≥ 0.68μF; 0805 ≥ 2.2μF; 1206 ≥ 4.7μF; 1210 ≥ 22μF; TT series</td> </tr> <tr> <td rowspan="2">10V</td> <td rowspan="2">≤ 7.5%</td> <td>≤ 15% 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>≤ 20% 0201 ≥ 0.1μF; 0402 ≥ 1μF; TT series: 01R5</td> </tr> <tr> <td>6.3V</td> <td>≤ 15%</td> <td>≤ 30% 0201 ≥ 0.1μF; 0402 ≥ 1μF (0402/X6S ≥ 0.47μF); 0603 ≥ 10μF; 0805 ≥ 4.7μF; 1206 ≥ 47μF; 1210 ≥ 100μF; TT series</td> </tr> <tr> <td>4V</td> <td>≤ 20%</td> <td>---</td> </tr> </tbody> </table> Y5V: <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="2">≥ 50V</td> <td rowspan="2">≤ 7.5%</td> <td>≤ 10% 0603 ≥ 0.1μF; 0805 ≥ 0.47μF;</td> </tr> <tr> <td>1206 ≥ 4.7μF</td> </tr> <tr> <td rowspan="2">35V</td> <td rowspan="2">≤ 10%</td> <td>≤ 20% 1210 ≥ 6.8μF</td> </tr> <tr> <td>---</td> </tr> <tr> <td rowspan="3">25V</td> <td rowspan="3">≤ 7.5%</td> <td>≤ 10% 0402 ≥ 0.047μF; 0603 ≥ 0.1μF;</td> </tr> <tr> <td>0805 ≥ 0.33μF; 1206 ≥ 1μF; 1210 ≥ 4.7μF</td> </tr> <tr> <td>≤ 15% 0402 ≥ 0.068μF; 0603 ≥ 0.47μF;</td> </tr> <tr> <td>1206 ≥ 4.7μF; 1210 ≥ 22μF</td> </tr> <tr> <td rowspan="2">16V (C &lt; 1.0μF)</td> <td rowspan="2">≤ 10%</td> <td>≤ 12.5% 0402 ≥ 0.068μF; 0603 ≥ 0.68μF</td> </tr> <tr> <td>≤ 20% 0402 ≥ 0.22μF</td> </tr> <tr> <td rowspan="2">16V (C ≥ 1.0μF)</td> <td rowspan="2">≤ 12.5%</td> <td>≤ 20% 0603 ≥ 2.2μF; 0805 ≥ 3.3μF;</td> </tr> <tr> <td>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> </tbody> </table> *I.R.: ≥10V, 1GΩ or 50 Ω-F whichever is smaller. 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No	Item	Test Condition	Requirements																																																																										
14	Humidity (Damp Heat) Load	*Test temp. : 40±2°C *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°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: ±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: <table border="1" style="width: 100%; border-collapse: collapse;"> <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">≤3%</td> <td>≤6% 1206 ≥ 0.47μF</td> </tr> <tr> <td>≤7.5% 0805 &gt; 0.1μF, 0603 ≥ 0.068μF, 1206 &gt; 1μF; 1210 ≥ 2.2μF; TT series</td> </tr> <tr> <td>≤20% 0805 &gt; 0.22μF; 1210 ≥ 3.3μF</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% 0201 ≥ 0.01μF; 1210 ≥ 4.7μF</td> </tr> <tr> <td>≤20% 0402 ≥ 0.012μF; 0603 &gt; 0.1μF; 0805 ≥ 1μF (0805/X7R &gt; 0.47μF); 1206 ≥ 2.2μF; 1210 ≥ 10μF; TT series</td> </tr> <tr> <td rowspan="2">35V</td> <td rowspan="2">≤5%</td> <td>≤20% 0603 ≥ 1μF; 0805 ≥ 2.2μF; 1206 ≥ 2.2μF; 1210 ≥ 10μF</td> </tr> <tr> <td>≤10% 0201 ≥ 0.01μF; 0805 ≥ 1μF; 1210 ≥ 10μF</td> </tr> <tr> <td rowspan="3">25V</td> <td rowspan="3">≤5%</td> <td>≤14% 0603 ≥ 0.33μF</td> </tr> <tr> <td>≤15% 0201 ≥ 0.1μF; 0402 ≥ 0.10μF &amp; (0402/X7R ≥ 0.056μF); TT series</td> </tr> <tr> <td>≤20% 0603 ≥ 0.47μF; 0805 ≥ 2.2μF; 1206 ≥ 4.7μF; 1210 ≥ 22μF</td> </tr> <tr> <td rowspan="2">16V</td> <td rowspan="2">≤5%</td> <td>≤10% 0603 ≥ 0.15μF; 0805 ≥ 0.68μF; 1206 ≥ 2.2μF; 1210 ≥ 4.7μF</td> </tr> <tr> <td>≤15% 0201 ≥ 0.01μF (0201/X7R ≥ 0.022μF); 0402 ≥ 0.033μF; 0603 ≥ 0.68μF; 0805 ≥ 2.2μF; 1206 ≥ 4.7μF; 1210 ≥ 22μF; TT series</td> </tr> <tr> <td rowspan="2">10V</td> <td rowspan="2">≤7.5%</td> <td>≤15% 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>≤20% 0201 ≥ 0.1μF; 0402 ≥ 1μF; TT series; 01R5</td> </tr> <tr> <td>6.3V</td> <td>≤15%</td> <td>≤30% 0201 ≥ 0.1μF; 0402 ≥ 1μF (0402/X6S ≥ 0.47μF); 0603 ≥ 10μF; 0805 ≥ 4.7μF; 1206 ≥ 4.7μF; 1210 ≥ 100μF; TT series</td> </tr> <tr> <td>4V</td> <td>≤20%</td> <td>---</td> </tr> </tbody> </table> <p>Y5V:</p> <table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th>Rated vol.</th> <th>D.F. ≤</th> <th>Exception of D.F. ≤</th> </tr> </thead> <tbody> <tr> <td rowspan="2">≥50V STEK</td> <td rowspan="2">≤7.5%</td> <td>≤10% 0603 ≥ 0.1μF; 0805 ≥ 0.47μF; 1206 ≥ 4.7μF</td> </tr> <tr> <td>≤20% 1210 ≥ 6.8μF</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 rowspan="2">16V (C≥1.0μF)</td> <td rowspan="2">≤12.5%</td> <td>≤20% 0402 ≥ 0.22μF</td> </tr> <tr> <td>≤30% 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> </tbody> </table> <p>*I.R.: ≥10V, 500MΩ or 25 Ω-F whichever is smaller. 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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~250V: 200% of rated voltage. (3) 400V~450V: 120% of rated voltage. (4) 500V: 150% of rated voltage. (5) 630V~3000V: 120% of rated voltage. (6) 4000V: 110% of rated voltage (7) 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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Multilayer Ceramic Capacitors

**APPENDIXES**

■ Tape & reel dimensions

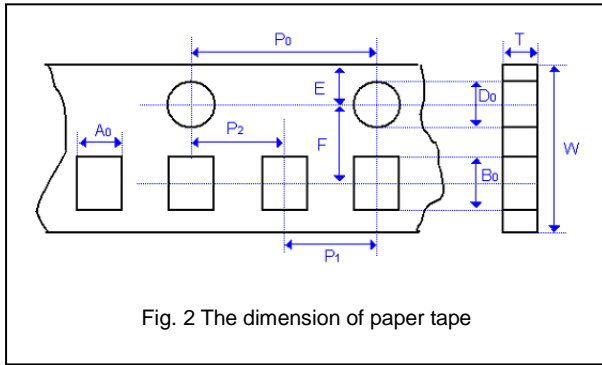


Fig. 2 The dimension of paper tape

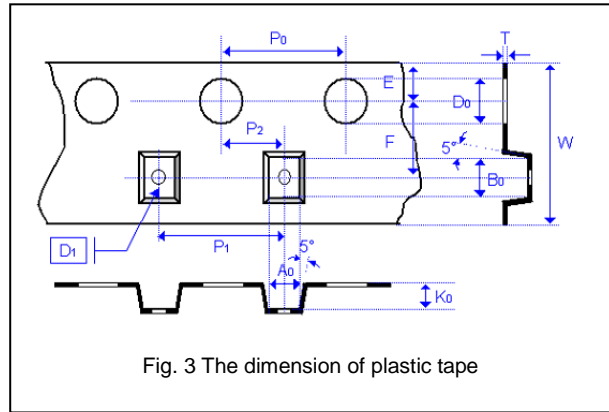


Fig. 3 The dimension of plastic tape

Size	0402	0603	0805			1206			1210		1808	1812	
Thickness	E	S, X	A	B	C, D, I	B	C, J, D	G, P	C, D, G, K	M	D, G, K	D, G, K	M, U
A <sub>0</sub>	0.70 +/-0.20	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
B <sub>0</sub>	1.20 +/-0.20	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	< 4.00	< 5.30	< 5.30
T	≤ 0.80	≤ 1.20	≤ 1.15	≤ 1.20	0.23 +/-0.1	≤ 1.20 +/-0.1	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
K <sub>0</sub>	-	-	-	-	< 2.50	-	< 2.50	< 2.50	< 1.50	< 2.50	< 3.20	< 2.50	< 2.50
W	8.00 +/-0.30	8.00 +/-0.30	8.00 +/-0.30	8.00 +/-0.30	8.00 +/-0.30	8.00 +/-0.30	8.00 +/-0.30	8.00 +/-0.30	8.00 +/-0.30	8.00 +/-0.30	8.00 +/-0.30	12.00 +/-0.30	12.00 +/-0.30
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
10xP <sub>0</sub>	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
P <sub>1</sub>	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
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 +/-0.10	2.00 +/-0.10
D <sub>0</sub>	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	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 <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
E	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	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	5.50 +/-0.10	5.50 +/-0.10

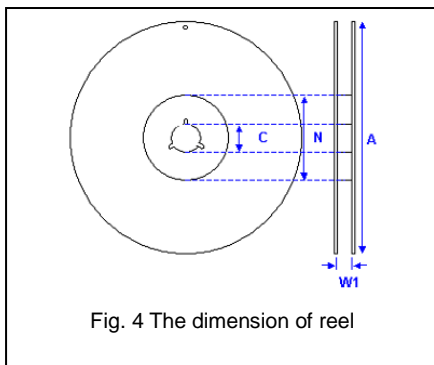
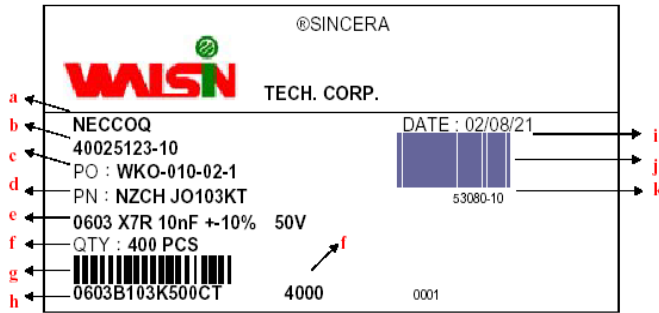


Fig. 4 The dimension of reel

Size	0402, 0603, 0805, 1206, 1210			1808, 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>1</sub>	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±1.00
N	60.0+1.0/-0	100.0±1.0	100±1.0	60.0+1.0/-0

Multilayer Ceramic Capacitors

Example of customer label

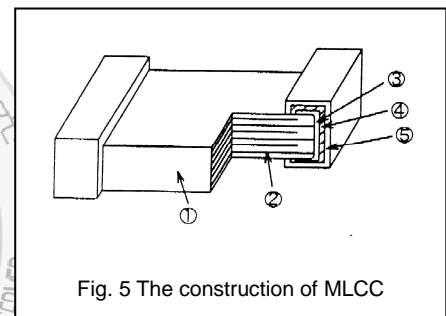


- a. Customer name
- b. WTC order series and item number
- c. Customer P/O
- d. Customer P/N
- e. Description of product
- f. Quantity
- g. Bar code including quantity & WTC P/N or customer
- h. WTC P/N
- i. Shipping date
- j. Order bar code including series and item numbers
- k. Serial number of label

\*Customized label is available upon request

Constructions

No.	Name	NPO	X7R, X5R, Y5V
①	Ceramic material	CaZrO <sub>3</sub> based	BaTiO <sub>3</sub> based
②	Inner electrode	Ni	
③	Termination	Inner layer	Cu + Ag Polymer
④		Middle layer	Ni
⑤		Outer layer	Sn



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 N<sub>2</sub> within oven are recommended.

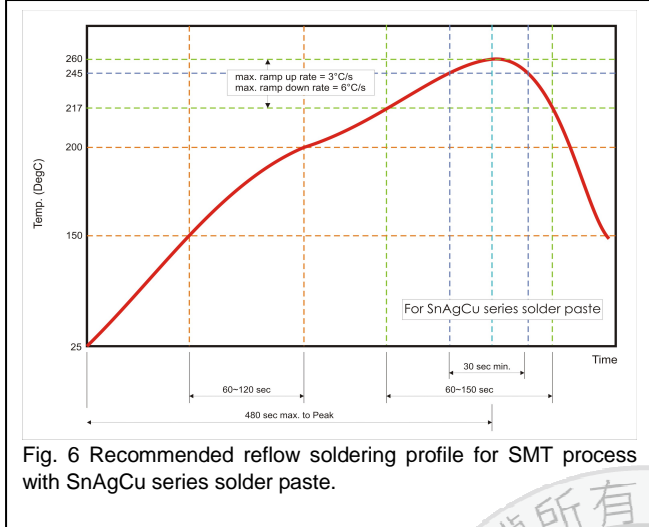


Fig. 6 Recommended reflow soldering profile for SMT process with SnAgCu series solder paste.

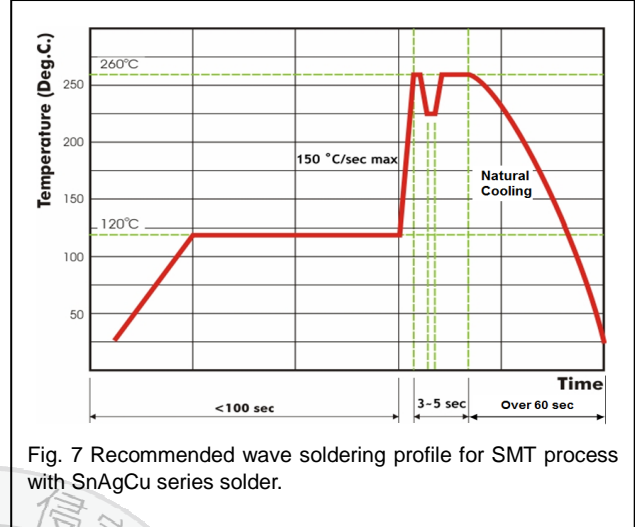


Fig. 7 Recommended wave soldering profile for SMT process with SnAgCu series solder.



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