

APPROVAL SHEET

MULTILAYER CERAMIC CAPACITORS

Soft Termination Series (SH Series)

NP0, X7R, X5R & Y5V Dielectrics

0402 to 1812 Sizes, 6.3V to 100V

RoHS Compliance

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

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.

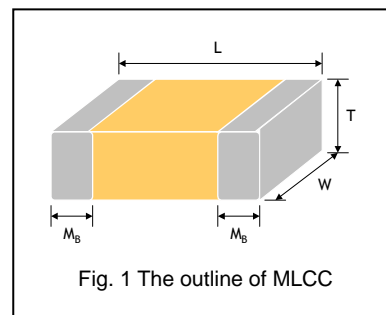
4. HOW TO ORDER

<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 (C0G) 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 ⁴ =100nF	B=±0.1pF C=±0.25pF D=±0.5pF F=±1% G=±2% J=±5% K=±10% M=±20% Z=-20/+80%	Two significant digits followed by no. of zeros. And R is in place of decimal point. 6R3=6.3 VDC 100=10 VDC 160=16 VDC 250=25 VDC 500=50 VDC 101=100 VDC	C=Ag Polymer /Ni/Sn	T=7" reeled G=13" reeled

Note 1: Please see below product range to find right termination code.

5. EXTERNAL DIMENSIONS & CONSTRUCTIONS

Size Inch (mm)	L (mm)	W (mm)	T (mm)/Symbol	Remark	M _B (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
			0.95±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 #	
1812 (4532)	4.50+0.6/-0.4	3.20±0.30	1.25±0.10	D #	0.75±0.25
			1.60±0.20	G #	
		3.20±0.40	2.00±0.20	K #	
			2.50±0.50	M #	



Reflow soldering only is recommended.

6. GENERAL ELECTRICAL DATA

Dielectric	NP0	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, 10V, 16V, 25V, 50V, 100V			
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.

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, X5R: Apply 1.0±0.2Vrms, 1.0kHz±10%, at 25°C ambient temperature.

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

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

7. CAPACITANCE RANGE (NP0 Dielectric)

0402, 0603, 0805 Sizes

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

1206, 1210, 1812 Sizes

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

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7-1. CAPACITANCE RANGE (X7R Dielectric)

0402, 0603, 0805 Sizes

DIELECTRIC		X7R														
SIZE		0402					0603					0805				
RATED VOLTAGE		10	16	25	50	100	10	16	25	50	100	10	16	25	50	100
Capacitance	100pF (101)	E	E	E	E	E	S	S	S	S	S	D	D	D	D	D
	120pF (121)	E	E	E	E	E	S	S	S	S	S	D	D	D	D	D
	150pF (151)	E	E	E	E	E	S	S	S	S	S	D	D	D	D	D
	180pF (181)	E	E	E	E	E	S	S	S	S	S	D	D	D	D	D
	220pF (221)	E	E	E	E	E	S	S	S	S	S	D	D	D	D	D
	270pF (271)	E	E	E	E	E	S	S	S	S	S	D	D	D	D	D
	330pF (331)	E	E	E	E	E	S	S	S	S	S	D	D	D	D	D
	390pF (391)	E	E	E	E	E	S	S	S	S	S	D	D	D	D	D
	470pF (471)	E	E	E	E	E	S	S	S	S	S	D	D	D	D	D
	560pF (561)	E	E	E	E	E	S	S	S	S	S	D	D	D	D	D
	680pF (681)	E	E	E	E	E	S	S	S	S	S	D	D	D	D	D
	820pF (821)	E	E	E	E	E	S	S	S	S	S	D	D	D	D	D
	1,000pF (102)	E	E	E	E	E	S	S	S	S	S	D	D	D	D	D
	1,200pF (122)	E	E	E	E	E	S	S	S	S	S	D	D	D	D	D
	1,500pF (152)	E	E	E	E	E	S	S	S	S	S	D	D	D	D	D
	1,800pF (182)	E	E	E	E	E	S	S	S	S	S	D	D	D	D	D
	2,200pF (222)	E	E	E	E	E	S	S	S	S	S	D	D	D	D	D
	2,700pF (272)	E	E	E	E	E	S	S	S	S	S	D	D	D	D	D
	3,300pF (332)	E	E	E	E	E	S	S	S	S	S	D	D	D	D	D
	3,900pF (392)	E	E	E	E	E	S	S	S	S	S	D	D	D	D	D
	4,700pF (472)	E	E	E	E	E	S	S	S	S	S	D	D	D	D	D
	5,600pF (562)	E	E	E	E		S	S	S	S	S	D	D	D	D	D
	6,800pF (682)	E	E	E	E		S	S	S	S	S	D	D	D	D	D
	8,200pF (822)	E	E	E	E		S	S	S	S	S	D	D	D	D	D
	0.010μF (103)	E	E	E	E		S	S	S	S	S	D	D	D	D	D
	0.012μF (123)	E	E	E			S	S	S	S	X	D	D	D	D	D
	0.015μF (153)	E	E	E			S	S	S	S	X	D	D	D	D	D
	0.018μF (183)	E	E	E			S	S	S	S	X	D	D	D	D	D
	0.022μF (223)	E	E	E			S	S	S	S	X	D	D	D	D	D
	0.027μF (273)	E	E	E			S	S	S	S	X	D	D	D	D	D
	0.033μF (333)	E	E	E			S	S	S	X	X	D	D	D	D	D
	0.039μF (393)	E	E	E			S	S	S	X	X	D	D	D	D	D
	0.047μF (473)	E	E	E			S	S	S	X	X	D	D	D	D	D
	0.056μF (563)	E	E				S	S	S	X	X	D	D	D	D	D
	0.068μF (683)	E	E				S	S	S	X	X	D	D	D	D	D
	0.082μF (823)	E	E				S	S	S	X	X	D	D	D	D	D
	0.10μF (104)	E	E				S	S	S	X	X	D	D	D	D	D
	0.12μF (124)						S	S	X			D	D	D	D	
	0.15μF (154)						S	S	X			D	D	D	D	
	0.18μF (184)						S	S	X			D	D	D	D	
	0.22μF (224)						S	S	X			D	D	D	D	I
	0.27μF (274)						X	X	X			I	I	I	I	
	0.33μF (334)						X	X	X			I	I	I	I	
	0.39μF (394)						X	X	X			I	I	I	I	
	0.47μF (474)						X	X	X			I	I	I	I	
	0.56μF (564)						X	X				I	I	I		
	0.68μF (684)						X	X				I	I	I		
0.82μF (824)						X	X				I	I	I			
1.0μF (105)						X	X				I	I	I	I		
1.5μF (155)											I	I	I			
2.2μF (225)											I	I	I			
4.7μF (475)												I				

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1206, 1210, 1812 Sizes

DIELECTRIC		X7R															
SIZE		1206					1210					1812					
RATED VOLTAGE		10	16	25	50	100	6.3	10	16	25	50	100	10	16	25	50	100
Capacitance	100pF (101)																
	120pF (121)																
	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)	D	D	D	D	D		C	C	C	C	C	D	D	D	D	D
	1,200pF (122)	D	D	D	D	D		C	C	C	C	C	D	D	D	D	D
	1,500pF (152)	D	D	D	D	D		C	C	C	C	C	D	D	D	D	D
	1,800pF (182)	D	D	D	D	D		C	C	C	C	C	D	D	D	D	D
	2,200pF (222)	D	D	D	D	D		C	C	C	C	C	D	D	D	D	D
	2,700pF (272)	D	D	D	D	D		C	C	C	C	C	D	D	D	D	D
	3,300pF (332)	D	D	D	D	D		C	C	C	C	C	D	D	D	D	D
	3,900pF (392)	D	D	D	D	D		C	C	C	C	C	D	D	D	D	D
	4,700pF (472)	D	D	D	D	D		C	C	C	C	C	D	D	D	D	D
	5,600pF (562)	D	D	D	D	D		C	C	C	C	C	D	D	D	D	D
	6,800pF (682)	D	D	D	D	D		C	C	C	C	C	D	D	D	D	D
	8,200pF (822)	D	D	D	D	D		C	C	C	C	C	D	D	D	D	D
	0.010μF (103)	D	D	D	D	D		C	C	C	C	C	D	D	D	D	D
	0.012μF (123)	D	D	D	D	D		C	C	C	C	C	D	D	D	D	D
	0.015μF (153)	D	D	D	D	D		C	C	C	C	C	D	D	D	D	D
	0.018μF (183)	D	D	D	D	D		C	C	C	C	C	D	D	D	D	D
	0.022μF (223)	D	D	D	D	D		C	C	C	C	C	D	D	D	D	D
	0.027μF (273)	D	D	D	D	D		C	C	C	C	C	D	D	D	D	D
	0.033μF (333)	D	D	D	D	D		C	C	C	C	C	D	D	D	D	D
	0.039μF (393)	D	D	D	D	D		C	C	C	C	C	D	D	D	D	D
	0.047μF (473)	D	D	D	D	D		C	C	C	C	C	D	D	D	D	D
	0.056μF (563)	D	D	D	D	D		C	C	C	C	C	D	D	D	D	D
	0.068μF (683)	D	D	D	D	D		C	C	C	C	C	D	D	D	D	D
	0.082μF (823)	D	D	D	D	D		C	C	C	C	C	D	D	D	D	D
	0.10μF (104)	D	D	D	D	D		C	C	C	C	C	D	D	D	D	D
	0.12μF (124)	D	D	D	D	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	P						K	G	M	M				K	
2.2μF (225)	J	J	P	P					K	G	M	M			M	M	
3.3μF (335)	P	P	P						K	G	M						
4.7μF (475)	P	P	P						K	K	M						
10μF (106)	P	P	P						K	K	M						
22μF (226)	P									M							
47μF (476)							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.

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

9. RELIABILITY TEST CONDITIONS AND REQUIREMENTS

No.	Item	Test Condition	Requirements																																																																																																		
1.	Visual and Mechanical	---	* No remarkable defect. * Dimensions to conform to individual specification sheet.																																																																																																		
2.	Capacitance	Class I: (NP0) ≤ 1000pF, 1.0±0.2Vrms · 1MHz±10% > 1000pF, 1.0±0.2Vrms · 1KHz±10% Class II: (X7R, X7E, X6S, X5R,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: 01R5 ≥ 103, 0201 ≥ 224 (6.3V,10V,16V) #1, 0402 ≥ 475 (6.3V,16V), 0402 ≥ 225(10V), 0603=106 (6.3V,10V), TT 18X ≥ 475(10V) , TT 15X series X6S: 0201 ≥ 104 (6.3V,10V), 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), (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.	<table border="1"> <thead> <tr> <th>Rated vol.</th> <th>D.F. ≤</th> <th colspan="2">Exception of D.F. ≤</th> </tr> </thead> <tbody> <tr> <td rowspan="3">≥ 100V</td> <td rowspan="3">≤ 2.5%</td> <td>≤ 3%</td> <td>1206 ≥ 0.47μF</td> </tr> <tr> <td>≤ 5%</td> <td>0805 > 0.1μF;0603 ≥ 0.068μF;1206>1μF;1210 ≥ 2.2μF;TT series</td> </tr> <tr> <td>≤ 10%</td> <td>0805 > 0.22μF;1210 ≥ 3.3μF</td> </tr> <tr> <td rowspan="3">50V</td> <td rowspan="3">≤ 2.5%</td> <td>≤ 3%</td> <td>0201(50V); 0603 ≥ 0.047μF; 0805 ≥ 0.18μF;1206 ≥ 0.47μF</td> </tr> <tr> <td>≤ 5%</td> <td>0201 ≥ 0.01μF; 1210 ≥ 4.7μF</td> </tr> <tr> <td>≤ 10%</td> <td>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%</td> <td>0603 ≥ 1μF;0805≥2.2μF;1206 ≥ 2.2μF;1210 ≥ 10μF</td> </tr> <tr> <td>≤ 5%</td> <td>0201 ≥ 0.01μF;0805 ≥ 1μF; 1210 ≥ 10μF</td> </tr> <tr> <td>≤ 7%</td> <td>0603 ≥ 0.33μF; 1206 ≥ 4.7μF</td> </tr> <tr> <td rowspan="3">25V</td> <td rowspan="3">≤ 3.5%</td> <td>≤ 10%</td> <td>0201 ≥ 0.1μF;0402 ≥ 0.10μF;0603 ≥ 0.47μF; 0805 ≥ 2.2μF; 1206 ≥ 6.8μF; 1210 ≥ 22μF; TT series</td> </tr> <tr> <td>≤ 12.5%</td> <td>0402 ≥ 0.47μF</td> </tr> <tr> <td>≤ 5%</td> <td>0201 ≥ 0.01μF;0402 ≥ 0.033μF;0603 ≥ 0.15μF; 0805 ≥ 0.68μF;1206 ≥ 2.2μF;1210 ≥ 4.7μF</td> </tr> <tr> <td rowspan="3">16V</td> <td rowspan="3">≤ 3.5%</td> <td>≤ 10%</td> <td>0201 ≥ 0.1μF(0201/X7R ≥ 0.022μF); 0402 ≥ 0.22μF; 0603 ≥ 0.68μF;0805 ≥ 2.2μF;1206 ≥ 4.7μF; 1210 ≥ 22μF; TT series</td> </tr> <tr> <td>≤ 10%</td> <td>0201 ≥ 0.012μF;0402 ≥ 0.33μF(0402/X7R ≥ 0.22μF); TT series</td> </tr> <tr> <td>≤ 15%</td> <td>0603 ≥ 0.33μF; 0805 ≥ 2.2μF;1206 ≥ 2.2μF;1210 ≥ 22μF;01R5</td> </tr> <tr> <td rowspan="3">10V</td> <td rowspan="3">≤ 5%</td> <td>≤ 15%</td> <td>0201 ≥ 0.1μF; 0402 ≥ 1μF</td> </tr> <tr> <td>≤ 15%</td> <td>0201 ≥ 0.1μF;0402 ≥ 1μF;0603 ≥ 10μF; 0805 ≥ 4.7μF; 1206 ≥ 47μF ;1210 ≥ 100μF; TT series</td> </tr> <tr> <td>≤ 20%</td> <td>0402 ≥ 2.2μF</td> </tr> <tr> <td>6.3V</td> <td>≤ 10%</td> <td>---</td> <td>---</td> </tr> <tr> <td>4V</td> <td>≤ 15%</td> <td>---</td> <td>---</td> </tr> </tbody> </table> <table border="1"> <thead> <tr> <th>Rated vol.</th> <th>D.F. ≤</th> <th colspan="2">Exception of D.F. ≤</th> </tr> </thead> <tbody> <tr> <td rowspan="2">≥ 50V</td> <td rowspan="2">≤ 5%</td> <td>≤ 7%</td> <td>0603 ≥ 0.1μF; 0805 ≥ 0.47μF; 1206 ≥ 4.7μF; TT series</td> </tr> <tr> <td>≤ 12.5%</td> <td>1210 ≥ 6.8μF</td> </tr> <tr> <td>35V</td> <td>≤ 7%</td> <td>---</td> <td>---</td> </tr> <tr> <td rowspan="3">25V</td> <td rowspan="3">≤ 5%</td> <td>≤ 7%</td> <td>0402 ≥ 0.047μF;0603 ≥ 0.1μF; 0805 ≥ 0.33μF; 1206 ≥ 1μF; 1210 ≥ 4.7μF</td> </tr> <tr> <td>≤ 9%</td> <td>0402 ≥ 0.068μF;0603 ≥ 0.47μF; 1206 ≥ 4.7μF; 1210 ≥ 22μF; TT series</td> </tr> <tr> <td>≤ 9%</td> <td>0402 ≥ 0.068μF; 0603 ≥ 0.68μF</td> </tr> <tr> <td>16V (C<1.0μF)</td> <td>≤ 7%</td> <td>≤ 12.5%</td> <td>0402 ≥ 0.22μF</td> </tr> <tr> <td>16V (C ≥ 1.0μF)</td> <td>≤ 9%</td> <td>≤ 12.5%</td> <td>0603 ≥ 2.2μF; 0805 ≥ 3.3μF;1206 ≥ 10μF; 1210 ≥ 22μF; 1812 ≥ 47μF; TT series</td> </tr> <tr> <td>10V</td> <td>≤ 12.5%</td> <td>≤ 20%</td> <td>0402 ≥ 0.47μF</td> </tr> <tr> <td>6.3V</td> <td>≤ 20%</td> <td>---</td> <td>---</td> </tr> </tbody> </table>	Rated vol.	D.F. ≤	Exception of D.F. ≤		≥ 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;0603 ≥ 0.47μF; 0805 ≥ 2.2μF; 1206 ≥ 6.8μF; 1210 ≥ 22μF; TT series	≤ 12.5%	0402 ≥ 0.47μF	≤ 5%	0201 ≥ 0.01μF;0402 ≥ 0.033μF;0603 ≥ 0.15μF; 0805 ≥ 0.68μF;1206 ≥ 2.2μF;1210 ≥ 4.7μF	16V	≤ 3.5%	≤ 10%	0201 ≥ 0.1μF(0201/X7R ≥ 0.022μF); 0402 ≥ 0.22μF; 0603 ≥ 0.68μF;0805 ≥ 2.2μF;1206 ≥ 4.7μF; 1210 ≥ 22μF; TT series	≤ 10%	0201 ≥ 0.012μF;0402 ≥ 0.33μF(0402/X7R ≥ 0.22μF); TT series	≤ 15%	0603 ≥ 0.33μF; 0805 ≥ 2.2μF;1206 ≥ 2.2μF;1210 ≥ 22μF;01R5	10V	≤ 5%	≤ 15%	0201 ≥ 0.1μF; 0402 ≥ 1μF	≤ 15%	0201 ≥ 0.1μF;0402 ≥ 1μF;0603 ≥ 10μF; 0805 ≥ 4.7μF; 1206 ≥ 47μF ;1210 ≥ 100μF; TT series	≤ 20%	0402 ≥ 2.2μF	6.3V	≤ 10%	---	---	4V	≤ 15%	---	---	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	≤ 5%	≤ 7%	0402 ≥ 0.047μF;0603 ≥ 0.1μF; 0805 ≥ 0.33μF; 1206 ≥ 1μF; 1210 ≥ 4.7μF	≤ 9%	0402 ≥ 0.068μF;0603 ≥ 0.47μF; 1206 ≥ 4.7μF; 1210 ≥ 22μF; 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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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>	75% 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 : 5 mm / 3 mm** and then the pressure shall be maintained for 5±1 sec. *Measurement to be made after keeping at room temp. for 24±2 hrs.. **SH21B224_101/SH31B226_100/SH31B106_160/SH31B106_250/SH31B225_500/SH31B474_101/SH31B105_101/SH32B476_6R3/SH32B226_160/SH32B106_250/S H32B225_500/SH32B475_500/SH32B106_500/SH32B225_101/SH21B105_500/SH21B225_250/SH21B475_160</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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13.	Humidity (Damp Heat) Steady State	*Test temp.: 40±2°C	* 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 colspan="2">Exception of D.F. ≤</th> </tr> </thead> <tbody> <tr> <td rowspan="3">≥ 100V</td> <td rowspan="3">≤ 3%</td> <td>≤ 6%</td> <td>1206 ≥ 0.47μF</td> </tr> <tr> <td>≤ 7.5%</td> <td>0805 > 0.1μF; 0603 ≥ 0.068μF; 1206 > 1μF; 1210 ≥ 2.2μF; TT series</td> </tr> <tr> <td>≤ 20%</td> <td>0805 > 0.22μF; 1210 ≥ 3.3μF</td> </tr> <tr> <td rowspan="3">≥ 50V</td> <td rowspan="3">≤ 3%</td> <td>≤ 6%</td> <td>0201(50V); 0603 ≥ 0.047μF; 0805 ≥ 0.18μF; 1206 ≥ 0.47μF</td> </tr> <tr> <td>≤ 10%</td> <td>0201 ≥ 0.01μF; 1210 ≥ 4.7μF</td> </tr> <tr> <td>≤ 20%</td> <td>0402 ≥ 0.012μF; 0603 > 0.1μF; 0805 ≥ 1μF; 1206 ≥ 2.2μF; 1210 ≥ 10μF; TT series</td> </tr> <tr> <td>35V</td> <td>≤ 5%</td> <td>≤ 20%</td> <td>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%</td> <td>0201 ≥ 0.01μF; 0805 ≥ 1μF; 1210 ≥ 10μF</td> </tr> <tr> <td>≤ 14%</td> <td>0603 ≥ 0.33μF; 1206 ≥ 4.7μF</td> </tr> <tr> <td>≤ 15%</td> <td>0201 ≥ 0.1μF; 0402 ≥ 0.10μF; 0603 ≥ 0.47μF; 0805 ≥ 2.2μF; 1206 ≥ 6.8μF; 1210 ≥ 22μF; TT series</td> </tr> <tr> <td rowspan="3">16V</td> <td rowspan="3">≤ 5%</td> <td>≤ 10%</td> <td>0402 ≥ 0.47μF</td> </tr> <tr> <td>≤ 15%</td> <td>0603 ≥ 0.15μF; 0805 ≥ 0.68μF; 1206 ≥ 2.2μF; 1210 ≥ 4.7μF</td> </tr> <tr> <td>≤ 15%</td> <td>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="3">10V</td> <td rowspan="3">≤ 7.5%</td> <td>≤ 15%</td> <td>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%</td> <td>0201 ≥ 0.1μF; 0402 ≥ 1μF; TT series; 01R5</td> </tr> <tr> <td>≤ 30%</td> <td>0201 ≥ 0.1μF; 0402 ≥ 1μF; 0603 ≥ 10μF; 0805 ≥ 4.7μF; 1206 ≥ 47μF; 1210 ≥ 100μF; TT series</td> </tr> <tr> <td>4V</td> <td>≤ 20%</td> <td>---</td> <td>---</td> </tr> </tbody> </table> Y5V: <table border="1"> <thead> <tr> <th>Rated vol.</th> <th>D.F. ≤</th> <th colspan="2">Exception of D.F. ≤</th> </tr> </thead> <tbody> <tr> <td rowspan="2">≥ 50V</td> <td rowspan="2">≤ 7.5%</td> <td>≤ 10%</td> <td>0603 ≥ 0.1μF; 0805 ≥ 0.47μF; 1206 ≥ 4.7μF</td> </tr> <tr> <td>≤ 20%</td> <td>1210 ≥ 6.8μF</td> </tr> <tr> <td>35V</td> <td>≤ 10%</td> <td>---</td> <td>---</td> </tr> <tr> <td rowspan="3">25V</td> <td rowspan="3">≤ 7.5%</td> <td>≤ 10%</td> <td>0402 ≥ 0.047μF; 0603 ≥ 0.1μF; 0805 ≥ 0.33μF; 1206 ≥ 1μF; 1210 ≥ 4.7μF</td> </tr> <tr> <td>≤ 15%</td> <td>0402 ≥ 0.068μF; 0603 ≥ 0.47μF; 1206 ≥ 4.7μF; 1210 ≥ 22μF</td> </tr> <tr> <td>≤ 20%</td> <td>0402 ≥ 0.068μF; 0603 ≥ 0.68μF</td> </tr> <tr> <td>16V (C < 1.0μF)</td> <td>≤ 10%</td> <td>≤ 12.5%</td> <td>0402 ≥ 0.22μF</td> </tr> <tr> <td rowspan="2">16V (C ≥ 1.0μF)</td> <td rowspan="2">≤ 12.5%</td> <td>≤ 20%</td> <td>0603 ≥ 2.2μF; 0805 ≥ 3.3μF; 1206 ≥ 10μF; 1210 ≥ 22μF; 1812 ≥ 47μF;</td> </tr> <tr> <td>≤ 30%</td> <td>0402 ≥ 0.47μF</td> </tr> <tr> <td>10V</td> <td>≤ 20%</td> <td>≤ 30%</td> <td>---</td> </tr> <tr> <td>6.3V</td> <td>≤ 30%</td> <td>---</td> <td>---</td> </tr> </tbody> </table>	Rated vol.	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No	Item	Test Condition	Requirements		
14	Humidity (Damp Heat) Load	*Test temp. : 40±2°C	* No remarkable damage.		
		*Humidity : 90~95%RH	Cap change:		
		*Test time : 500+24/-0 hrs.	NP0: ±7.5% or 0.75pF whichever is larger.		
		*To apply voltage :	X7R, X5R, X6S, X7S: ≥10V**, within ±12.5%; ≤6.3V within ±25%;		
		Rated voltage (MAX. 500V)	TT series & C≥ 1uF, within ±25%		
		*Before initial measurement (Class II only): To apply de-aging at 150°C for 1hr then set for 24±2 hrs at room temp.	**10V: 0603 ≥4.7μF; 0402 ≥ 1μF; 0201 ≥ 0.1μF, within ±25%;		
		* 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.	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:		
			Rated V. D.F. ≤		
			Exception of D.F. ≤		
			≤6%	1206 ≥ 0.47μF	
			≤7.5%	0805 > 0.1μF; 0603 ≥ 0.068μF; 1206 > 1μF; 1210 ≥ 2.2μF; TT series	
			≤20%	0805 > 0.22μF; 1210 ≥ 3.3μF	
	≤6%	0201(50V); 0603 ≥ 0.047μF; 0805 ≥ 0.18μF; 1206 ≥ 0.47μF			
	≤10%	0201 ≥ 0.01μF; 1210 ≥ 4.7μF			
	≤20%	0402 ≥ 0.012μF; 0603 > 0.1μF; 0805 ≥ 1μF; 1206 ≥ 2.2μF; 1210 ≥ 10μF; TT series			
	35V	≤5%	≤20%	0603 ≥ 1μF; 0805 ≥ 2.2μF; 1206 ≥ 2.2μF; 1210 ≥ 10μF	
		≤10%	0201 ≥ 0.01μF; 0805 ≥ 1μF; 1210 ≥ 10μF		
	25V	≤5%	≤14%	0603 ≥ 0.33μF; 1206 ≥ 4.7μF	
		≤15%	0201 ≥ 0.1μF; 0402 ≥ 0.10μF; 0603 ≥ 0.47μF; 0805 ≥ 2.2μF; 1206 ≥ 6.8μF; 1210 ≥ 22μF; TT series		
		≤20%	0402 ≥ 0.47μF		
	16V	≤5%	≤10%	0603 ≥ 0.15μF; 0805 ≥ 0.68μF; 1206 ≥ 2.2μF; 1210 ≥ 4.7μF	
		≤15%	0201 ≥ 0.01μF (0201/X7R ≥ 0.022μF); 0402 ≥ 0.033μF; 0603 ≥ 0.68μF; 0805 ≥ 2.2μF; 1206 ≥ 4.7μF; 1210 ≥ 22μF; TT series		
	10V	≤7.5%	≤15%	0201 ≥ 0.012μF; 0402 ≥ 0.33μF (0402/X7R ≥ 0.22μF); 0603 ≥ 0.33μF; 0805 ≥ 2.2μF; 1206 ≥ 2.2μF; 1210 ≥ 22μF	
		≤20%	0201 ≥ 0.1μF; 0402 ≥ 1μF; TT series; 01R5		
	6.3V	≤15%	≤30%	0201 ≥ 0.1μF; 0402 ≥ 1μF; 0603 ≥ 10μF; 0805 ≥ 4.7μF; 1206 ≥ 47μF; 1210 ≥ 100μF; TT series	
	4V	≤20%	---	---	
			Y5V:		
		Rated vol.	D.F. ≤	Exception of D.F. ≤	
		≥50V	≤7.5%	≤10%	0603 ≥ 0.1μF; 0805 ≥ 0.47μF; 1206 ≥ 4.7μF
			≤20%	1210 ≥ 6.8μF	
		35V	≤10%	---	---
		25V	≤7.5%	≤10%	0402 ≥ 0.047μF; 0603 ≥ 0.1μF; 0805 ≥ 0.33μF; 1206 ≥ 1μF; 1210 ≥ 4.7μF
			≤15%	0402 ≥ 0.068μF; 0603 ≥ 0.47μF; 1206 ≥ 4.7μF; 1210 ≥ 22μF	
		16V (C<1.0μF)	≤10%	≤12.5%	0402 ≥ 0.068μF; 0603 ≥ 0.68μF
			≤20%	0402 ≥ 0.22μF	
		16V (C≥1.0μF)	≤12.5%	≤20%	0603 ≥ 2.2μF; 0805 ≥ 3.3μF; 1206 ≥ 10μF; 1210 ≥ 22μF; 1812 ≥ 47μF;
		10V	≤20%	≤30%	0402 ≥ 0.47μF
		6.3V	≤30%	---	---
					*I.R.: ≥10V, 500MΩ or 25 Ω-F whichever is smaller.
					Class II (X7R, X5R, X6S, X7S, Y5V)
		Rated voltage	Insulation Resistance		
		100V: All X7R; 1210 ≥ 3.3μF	500MΩ or RxC ≥ 5 Ω-F whichever is smaller.		
		50V: 0402 > 0.01μF; 0603 ≥ 1μF; 0805 ≥ 1μF; 1206 ≥ 4.7μF; 1210 ≥ 4.7μF			
		35V: 0603 ≥ 1μF; 0805 ≥ 2.2μF; 1206 ≥ 2.2μF; 1210 ≥ 10μF			
		25V: 0201 ≥ 0.1μF; 0402 ≥ 0.22μF; 0603 ≥ 2.2μF; 0805 ≥ 2.2μF; 1206 ≥ 10μF; 1210 ≥ 10μF			
		16V: 0201 ≥ 0.1μF; 0402 ≥ 0.22μF; 0603 ≥ 1μF; 0805 ≥ 2.2μF; 1206 ≥ 10μF; 1210 ≥ 47μF			
		10V: 0201 ≥ 47nF; 0402 ≥ 0.47μF; 0603 ≥ 0.47μF; 0805 ≥ 2.2μF; 1206 ≥ 4.7μF; 1210 ≥ 47μF			
		6.3V ; 4V ; TT series ; All X6S/X7S items; Size ≥ 1812			

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																																																																																			
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Rated voltage	Insulation Resistance																																																																																					
100V: All X7R; 1210 ≥ 3.3μF	1GΩ or RxC ≥ 10 Ω-F whichever is smaller.																																																																																					
50V: 0402 > 0.01μF; 0603 ≥ 1μF; 0805 ≥ 1μF; 1206 ≥ 4.7μF; 1210 ≥ 4.7μF																																																																																						
35V: 0603 ≥ 1μF; 0805 ≥ 2.2μF; 1206 ≥ 2.2μF; 1210 ≥ 10μF																																																																																						
25V: 0201 ≥ 0.1μF; 0402 ≥ 0.22μF; 0603 ≥ 2.2μF; 0805 ≥ 2.2μF; 1206 ≥ 10μF; 1210 ≥ 10μF																																																																																						
16V: 0201 ≥ 0.1μF; 0402 ≥ 0.22μF; 0603 ≥ 1μF; 0805 ≥ 2.2μF; 1206 ≥ 10μF; 1210 ≥ 47μF																																																																																						
10V: 0201 ≥ 47nF; 0402 ≥ 0.47μF; 0603 ≥ 0.47μF; 0805 ≥ 2.2μF; 1206 ≥ 4.7μF; 1210 ≥ 47μF																																																																																						
6.3V; 4V; TT series; All X6S/X7S items; Size ≥ 1812																																																																																						
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.																																																																																						
* De-rating conditions:																																																																																						

APPENDIXES

▣ Tape & reel dimensions

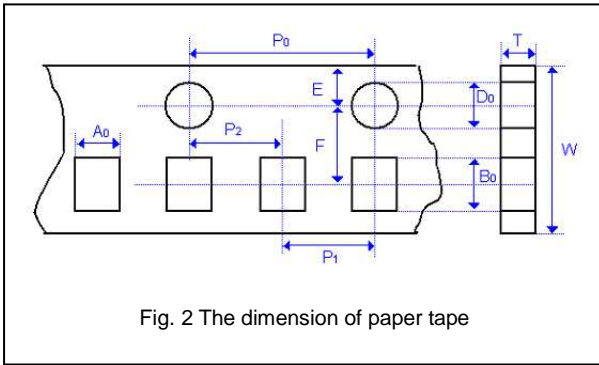


Fig. 2 The dimension of paper tape

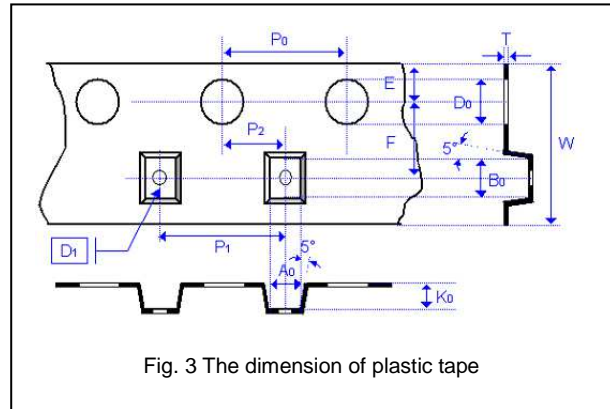


Fig. 3 The dimension of plastic tape

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 ₀	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	< 3.20	< 2.50	< 3.90	< 3.90
B ₀	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	<3.95	< 5.30	< 5.30	< 5.30
T	≤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	0.25 +/-0.1	0.25 +/-0.1	0.25 +/-0.1
K ₀	-	-	-	-	< 2.50	-	< 2.50	< 2.50	< 2.50	< 3.00	< 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 +/-0.20	8.00 +/-0.10	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
10xP ₀	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 ₁	2.00 +/-0.05	4.00 +/-0.10	4.00 +/-0.10	4.00 +/-0.10	4.00 +/-0.10	4.00 +/-0.10	4.00 +/-0.10	4.00 +/-0.10	4.00 +/-0.10	4.00 +/-0.10	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 +/-0.10	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	1.50 +0.10/-0	1.55 +/-0.05	1.50 +0.10/-0	1.50 +0.10/-0	1.50 +0.10/-0	1.50 +0.10/-0	1.50 +0.10/-0	1.50 +0.10/-0	1.50 +0.10/-0
D ₁	-	-	-	-	1.00 +/-0.10	-	1.00 +/-0.10	1.00 +/-0.10	1.00 +/-0.10	1.00 +/-0.10	1.50 +/-0.10	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 +/-0.10	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
F	3.50 +/-0.05	3.50 +/-0.05	3.50 +/-0.05	3.50 +/-0.05	3.50 +/-0.05	3.50 +/-0.05	3.50 +/-0.05	3.50 +/-0.05	3.50 +/-0.05	3.50 +/-0.05	5.50 +/-0.10	5.50 +/-0.10	5.50 +/-0.10

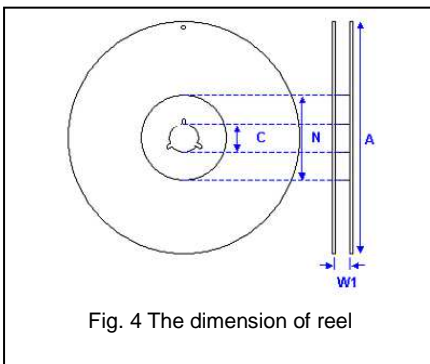
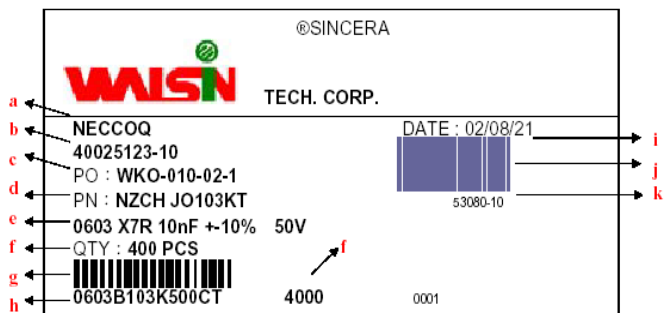


Fig. 4 The dimension of reel

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 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±1.00
N	60.0+1.0/-0	100.0±1.0	100±1.0	60.0+1.0/-0

▣ Description of customer label



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

▣ Constructions

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

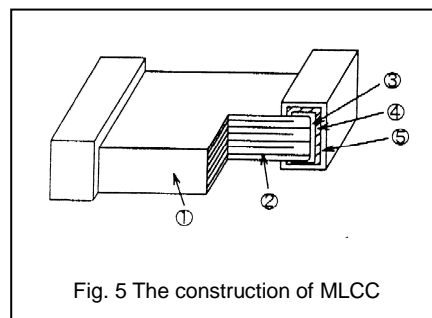


Fig. 5 The construction of MLCC

▣ Storage and handling conditions

- (1) To store products at 5 to 40°C ambient temperature and 20 to 70% related humidity conditions.
- (2) The product is recommended to be used within one year after shipment. Check solderability in case of shelf life extension is needed.

Cautions:

- a. The corrosive gas reacts on the terminal electrodes of capacitors, and results in the poor solderability. Do not store the capacitors in the ambience of corrosive gas (e.g., hydrogen sulfide, sulfur dioxide, chlorine, ammonia gas etc.)
- b. In corrosive atmosphere, solderability might be degraded, and silver migration might occur to cause low reliability.
- c. Due to the dewing by rapid humidity change, or the photochemical change of the terminal electrode by direct sunlight, the solderability and electrical performance may deteriorate. Do not store capacitors under direct sunlight or dewing condition. To store products on the shelf and avoid exposure to moisture.

☑ Recommended soldering conditions

The lead-free termination MLCCs are not only to be used on SMT against lead-free solder paste, but also suitable against lead-containing solder paste. If the optimized solder joint is requested, increasing soldering time, temperature and concentration of N₂ within oven are recommended.

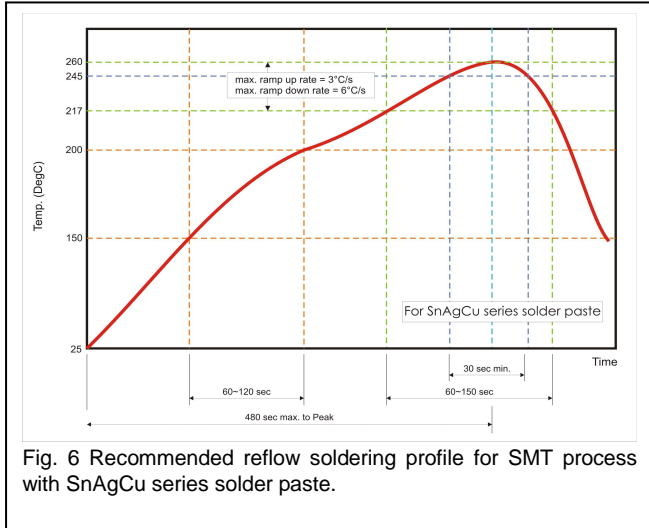


Fig. 6 Recommended reflow soldering profile for SMT process with SnAgCu series solder paste.

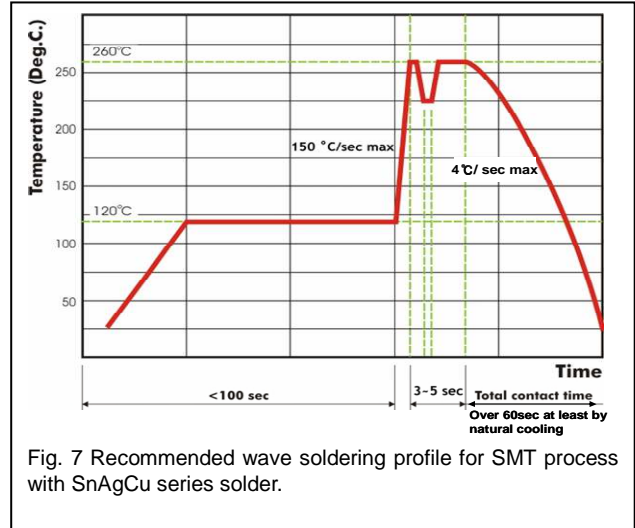


Fig. 7 Recommended wave soldering profile for SMT process with SnAgCu series solder.