

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

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

3. APPLICATIONS

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

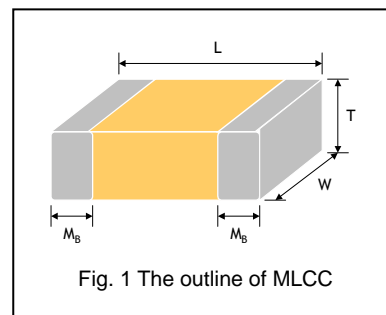
4. HOW TO ORDER

<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=Cu/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	2.50±0.50	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 22μF	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							1210									
RATED VOLTAGE		10	16	25	50	100	10	16	25	50	100	10	16	25	50	100
Capacitance	1.0pF (1R0)															
	1.2pF (1R2)	B	B	B	B	B										
	1.5pF (1R5)	B	B	B	B	B										
	1.8pF (1R8)	B	B	B	B	B										
	2.2pF (2R2)	B	B	B	B	B										
	2.7pF (2R7)	B	B	B	B	B										
	3.3pF (3R3)	B	B	B	B	B										
	3.9pF (3R9)	B	B	B	B	B										
	4.7pF (4R7)	B	B	B	B	B										
	5.6pF (5R6)	B	B	B	B	B										
	6.8pF (6R8)	B	B	B	B	B										
	8.2pF (8R2)	B	B	B	B	B										
	10pF (100)	B	B	B	B	B	C	C	C	C	C	D	D	D	D	D
	12pF (120)	B	B	B	B	B	C	C	C	C	C	D	D	D	D	D
	15pF (150)	B	B	B	B	B	C	C	C	C	C	D	D	D	D	D
	18pF (180)	B	B	B	B	B	C	C	C	C	C	D	D	D	D	D
	22pF (220)	B	B	B	B	B	C	C	C	C	C	D	D	D	D	D
	27pF (270)	B	B	B	B	B	C	C	C	C	C	D	D	D	D	D
	33pF (330)	B	B	B	B	B	C	C	C	C	C	D	D	D	D	D
	39pF (390)	B	B	B	B	B	C	C	C	C	C	D	D	D	D	D
	47pF (470)	B	B	B	B	B	C	C	C	C	C	D	D	D	D	D
	56pF (560)	B	B	B	B	B	C	C	C	C	C	D	D	D	D	D
	68pF (680)	B	B	B	B	B	C	C	C	C	C	D	D	D	D	D
	82pF (820)	B	B	B	B	B	C	C	C	C	C	D	D	D	D	D
	100pF (101)	B	B	B	B	B	C	C	C	C	C	D	D	D	D	D
	120pF (121)	B	B	B	B	B	C	C	C	C	C	D	D	D	D	D
	150pF (151)	B	B	B	B	B	C	C	C	C	C	D	D	D	D	D
	180pF (181)	B	B	B	B	B	C	C	C	C	C	D	D	D	D	D
	220pF (221)	B	B	B	B	B	C	C	C	C	C	D	D	D	D	D
	270pF (271)	B	B	B	B	B	C	C	C	C	C	D	D	D	D	D
	330pF (331)	B	B	B	B	B	C	C	C	C	C	D	D	D	D	D
	390pF (391)	B	B	B	B	B	C	C	C	C	C	D	D	D	D	D
	470pF (471)	B	B	B	B	B	C	C	C	C	C	D	D	D	D	D
	560pF (561)	B	B	B	B	B	C	C	C	C	C	D	D	D	D	D
	680pF (681)	B	B	B	B	B	C	C	C	C	C	D	D	D	D	D
	820pF (821)	B	B	B	B	B	C	C	C	C	C	D	D	D	D	D
	1,000pF (102)	B	B	B	B	B	C	C	C	C	C	D	D	D	D	D
	1,200pF (122)	B	B	B	B	B	C	C	C	C	C	D	D	D	D	D
	1,500pF (152)	B	B	B	B	B	C	C	C	C	C	D	D	D	D	D
1,800pF (182)	B	B	B	B	B	C	C	C	C	C	D	D	D	D	D	
2,200pF (222)	B	B	B	B	B	C	C	C	C	C	D	D	D	D	D	
2,700pF (272)	B	B	B	B	B	C	C	C	C	C	D	D	D	D	D	
3,300pF (332)	B	B	B	B	B	C	C	C	C	C	D	D	D	D	D	
3,900pF (392)	B	B	B	B	B	C	C	C	C	C	D	D	D	D	D	
4,700pF (472)	B	B	B	B	B	C	C	C	C	C	D	D	D	D	D	
5,600pF (562)	B	B	B	B	B	C	C	C	C	C	D	D	D	D	D	
6,800pF (682)	C	C	C	C	C	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)	P	P	P	P	P	D	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	D	
0.018μF (183)	P	P	P	P	P						D	D	D	D	D	
0.022μF (223)	P	P	P	P	P						D	D	D	D	D	
0.027μF (273)	P	P	P	P							D	D	D	D	D	
0.033μF (333)	P	P	P	P							D	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				

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	X7R														
	1206					1210					1812				
	10	16	25	50	100	10	16	25	50	100	10	16	25	50	100
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							
4.7μF (475)	P	P	P				K	K	K	M					
10μF (106)	P	P	P				K	K	K	M					
22μF (226)	P						M								
47μF (476)															

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, Y5V) C ≤ 10μF, 1.0±0.2Vrms · 1KHz±10% ** C > 10μF, 0.5±0.2Vrms · 120Hz±20%	* Shall not exceed the limits given in the detailed spec. NP0: Cap≥30pF, Q≥1000; Cap<30pF, Q≥400+20C X7R, X5R, X6S:					
3.	Q/ D.F. (Dissipation Factor)	** Test condition: 0.5±0.2Vrms · 1KHz±10% X7R: 0805=106(6.3V&10V) X5R: 01R5 ≥ 103, 0201 ≥ 224 (6.3V, 10V) #1, 0402 ≥ 475 (6.3V, 16V), 0402 ≥ 225(10V), 0603=106 (6.3V, 10V), TT18X ≥ 475(10V) , TT15X series X6S: 0201 ≥ 104 (6.3V), 0402 ≥ 225 (6.3V), 0603 ≥ 106 (6.3V), #1 Excluding 0201X105K6R3(1.0±0.2Vrms · 1KHz±10%)	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			
			50V	≤ 2.5%	≤ 3%	0201(50V); 0603 ≥ 0.047μF; 0805 ≥ 0.18μF; 1206 ≥ 0.47μF		
					≤ 5%	1210 ≥ 4.7μF		
			35V	≤ 3.5%	≤ 10%	0402 ≥ 0.1μF; 0603 > 0.1μF; 0805 ≥ 1μF; 1206 ≥ 2.2μF; 1210 ≥ 10μF; TT series		
					≤ 5%	0201 ≥ 0.01μF; 0805 ≥ 1μF; 1210 ≥ 10μF		
			25V	≤ 3.5%	≤ 7%	0603 ≥ 0.33μF; 1206 ≥ 4.7μF		
					≤ 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		
			16V	≤ 3.5%	≤ 5%	0201 ≥ 0.01μF; 0402 ≥ 0.033μF; 0603 ≥ 0.15μF; 0805 ≥ 0.68μF; 1206 ≥ 2.2μF; 1210 ≥ 4.7μF		
					≤ 10%	0201 ≥ 0.1μF; 0402 ≥ 0.22μF; 0603 ≥ 0.68μF; 0805 ≥ 2.2μF; 1206 ≥ 4.7μF; 1210 ≥ 22μF; TT series		
			10V	≤ 5%	≤ 10%	0201 ≥ 0.012μF; 0402 ≥ 0.33μF(0402/X7R ≥ 0.22μF); TT series 0603 ≥ 0.33μF; 0805 ≥ 2.2μF; 1206 ≥ 2.2μF; 1210 ≥ 22μF; 01R5		
					≤ 15%	0201 ≥ 0.1μF; 0402 ≥ 1μF		
			6.3V	≤ 10%	≤ 15%	0201 ≥ 0.1μF; 0402 ≥ 1μF; 0603 ≥ 10μF; 0805 ≥ 4.7μF; 1206 ≥ 47μF; 1210 ≥ 100μF; TT series		
					≤ 20%	0402 ≥ 2.2μF		
			4V	≤ 15%	---	---		
			Y5V:					
			Rated vol.				D.F. ≤	Exception of D.F. ≤
			≥ 50V				≤ 5%	≤ 7% 0603 ≥ 0.1μF; 0805 ≥ 0.47μF; 1206 ≥ 4.7μF; TT series ≤ 12.5% 1210 ≥ 6.8μF
			35V				≤ 7%	---
25V	≤ 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					
16V (C < 1.0μF)	≤ 7%	≤ 9%	0402 ≥ 0.068μF; 0603 ≥ 0.68μF					
		≤ 12.5%	0402 ≥ 0.22μF					
16V (C ≥ 1.0μF)	≤ 9%	≤ 12.5%	0603 ≥ 2.2μF; 0805 ≥ 3.3μF; 1206 ≥ 10μF; 1210 ≥ 22μF; 1812 ≥ 47μF; TT series					
		≤ 20%	0402 ≥ 0.47μF					
6.3V	≤ 20%	---	---					
4.	Dielectric Strength	To apply voltage (≤ 100V) 250%. Duration: 1 to 5 sec. Charge and discharge current less than 50mA.	* No evidence of damage or flash over during test.					
5.	Insulation Resistance	To apply rated voltage for max. 120 sec.	10GΩ or Rx C ≥ 500Ω-F whichever is smaller. Class II (X7R, X5R, X6S, Y5V)					
			Rated voltage	Insulation Resistance				
			100V: X7R	10GΩ or Rx C ≥ 100 Ω-F whichever is smaller.				
			50V: 0402 > 0.01μF; 0603 ≥ 1μF; 0805 ≥ 1μF; 1206 ≥ 4.7μF; 1210 ≥ 4.7μF					
			35V: 0805 ≥ 2.2μF; 1206 ≥ 2.2μF; 1210 ≥ 10μF					
			25V: 0402 ≥ 1μF; 0603 ≥ 2.2μF; 0805 ≥ 2.2μF; 1206 ≥ 10μF; 1210 ≥ 10μF					
			16V: 0201 ≥ 0.1μF; 0402 ≥ 0.22μF; 0603 ≥ 1μF;					
			10V: 0201 ≥ 47nF; 0402 ≥ 0.47μF; 0603 ≥ 0.47μF; 0805 ≥ 2.2μF; 1206 ≥ 4.7μF; 1210 ≥ 47μF					
			6.3V ; 4V ; TT series	Rx C ≥ 50 Ω-F.				
			Rated voltage		Insulation Resistance			
			All X6S items		Rx C ≥ 50 Ω-F.			
			50V: 0402 ≥ 0.1μF; 0603 ≥ 2.2μF; 0805 ≥ 10μF; 1206 ≥ 10μF					
35V: 0603 ≥ 1μF;								
25V: 0201 ≥ 0.1μF; 0402 ≥ 0.22μF; 0603 ≥ 10μF; 0805 ≥ 10μF; 1206 ≥ 22μF								
16V: 0603 ≥ 10μF								
10V: 0201 > 0.1μF; 0603 ≥ 10μF; 0805 ≥ 47μF; TT21 > 4.7μF								
6.3V: 0201 ≥ 0.1μF; 0603 > 4.7μF; 1206 ≥ 10μF	Rx C ≥ 50 Ω-F.							
4V: 0603 ≥ 22μF; 0805 ≥ 47μF; 1206 ≥ 100μF								

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>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>*To apply voltage :</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<0.1μF:1V</td> </tr> <tr> <td>Cap>0.01μF: 0.2V</td> <td>0.1μF≤Cap<1μF: 0.2V</td> </tr> <tr> <td></td> <td>Cap≥1μF: 0.1V</td> </tr> <tr> <th>0402</th> <th>0603</th> </tr> <tr> <td>Cap<1μF: 1V</td> <td>Cap≤1μF: 1V</td> </tr> <tr> <td>Cap=1μF: 0.5V</td> <td>1μF<Cap≤4.7μF: 0.5V</td> </tr> <tr> <td>1μF<Cap<10μF: 0.2V</td> <td>Cap>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<10μF: 1V</td> <td>Cap≤10μF: 1V</td> </tr> <tr> <td>Cap=10μF: 0.5V</td> <td>10μF<Cap≤100μF: 0.5V</td> </tr> <tr> <td>Cap>10μF: 0.2V</td> <td>Cap>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	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	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>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%	X5R	Within ±15%	X6S	Within ±22%	Y5V	Within +30%/-80%
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7.	Adhesive Strength of Termination	<p>Pressurizing force : 1N (0201) and 5N (≤0603) and 10N (>0603)</p> <p>* 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.) * Measurement to be made after keeping at room temp. for 24±2 hrs.</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 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: 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): Perform 150+0/-10°C for 1 hr and 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 ±2.5% or 0.25pF whichever is larger X7R, X5R, X6S: 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): Perform 150+0/-10°C for 1 hr and then set for 24±2 hrs at room temp. * Measurement to be made after keeping at room temp. for 24±2 hrs.</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: within ±7.5% Y5V: within ±20% * Q/D.F., I.R. and dielectric strength: To meet initial requirements.</p>																																			
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No.	Item	Test Condition	Requirements																																		
13.	Humidity (Damp Heat) Steady State	* Test temp.: 40±2°C	* No remarkable damage.																																		
		* Humidity: 90~95% RH	* Cap change:																																		
		* Test time: 500+24/0hrs.	NP0: within ±5% or 0.5pF whichever is larger																																		
		*Before initial measurement (Class II only): Perform 150+0/-10°C for 1 hr and then set for 24±2 hrs at room temp.	X7R, X5R, X6S: ≥10V**, within ±12.5%; ≤6.3V within ±25%; TT series & C≥ 1uF, within ±25%																																		
		* Measurement to be made after keeping at room temp. for 24±2 hrs.	**10V: 0603 ≥4.7μF; 0402 ≥ 1μF; 0201 ≥ 0.1μF, within ±25%; Y5V: ≥10V, within ±30%; ≤6.3V, within +30/-40%																																		
			* Q/D.F. value:																																		
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X7R, X5R, X6S: ≥10V**, within ±12.5%; ≤6.3V within ±25%; TT series & C≥1uF, within ±25% **10V: 0603 ≥4.7μF; 0402 ≥1μF; 0201 ≥0.1μF, within ±25%; Y5V: ≥10V, within ±30%; ≤6.3V, within +30/-40% Q/D.F. value: NP0: C≥30pF, Q≥200; C<30pF, Q≥100+10/3C X7R, X5R, X6S: <table border="1"> <thead> <tr> <th>Rated V</th> <th>D.F. ≤</th> <th>Exception of D.F. ≤</th> </tr> </thead> <tbody> <tr> <td rowspan="2">≥100V</td> <td rowspan="2">≤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 rowspan="3">≥50V</td> <td rowspan="3">≤3%</td> <td>≤6%</td> <td>0201(50V); 0603 ≥0.047μF; 0805 ≥0.18μF; 1206 ≥0.47μF</td> </tr> <tr> <td>≤10%</td> <td>1210 ≥4.7μF</td> </tr> <tr> <td>≤20%</td> <td>0402 ≥0.1μF; 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="2">16V</td> <td rowspan="2">≤5%</td> <td>≤20%</td> <td>0402 ≥0.47μF</td> </tr> <tr> <td>≤10%</td> <td>0603 ≥0.15μF; 0805 ≥0.68μF; 1206 ≥2.2μF; 1210 ≥4.7μF</td> </tr> <tr> <td rowspan="2">10V</td> <td rowspan="2">≤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>6.3V</td> <td>≤15%</td> <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>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="2">25V</td> <td rowspan="2">≤7.5%</td> <td>≤10%</td> <td>0402 ≥0.047μF; 0603 ≥0.1μF; 0805 ≥0.33μF; 1206 ≥1μF; 1210 ≥4.7μF</td> </tr> <tr> <td>≤15%</td> <td>0402 ≥0.068μF; 0603 ≥0.47μF; 1206 ≥4.7μF; 1210 ≥22μF</td> </tr> <tr> <td>16V (C<1.0μF)</td> <td>≤10%</td> <td>≤12.5%</td> <td>0402 ≥0.068μF; 0603 ≥0.68μF</td> </tr> <tr> <td></td> <td></td> <td>≤20%</td> <td>0402 ≥0.22μF</td> </tr> <tr> <td>16V (C≥1.0μF)</td> <td>≤12.5%</td> <td>≤20%</td> <td>0603 ≥2.2μF; 0805 ≥3.3μF; 1206 ≥10μF; 1210 ≥22μF; 1812 ≥47μF;</td> </tr> <tr> <td>10V</td> <td>≤20%</td> <td>≤30%</td> <td>0402 ≥0.47μF</td> </tr> <tr> <td>6.3V</td> <td>≤30%</td> <td>---</td> <td>---</td> </tr> </tbody> </table> *I.R.: ≥10V, 500MΩ or 25 Ω-F whichever is smaller. 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15.	High Temperature Load (Endurance)	Test temp. : NP0, X7R/X7E: 125±3°C X6S: 105±3°C X5R, Y5V: 85±3°C Test time: 1000+24/-0 hrs. To apply voltage: (1) ≤ 6.3V or C ≥ 10μF or TT series: 150% of rated voltage. (2) 10V ≤ Ur < 500V: 200% of rated voltage. (3) 500V: 150% of rated voltage. (4) Ur ≥ 630V: 120% of rated voltage. (5) 100% of rated voltage for below range.	* No remarkable damage. Cap change: NP0: ±3.0% or ±0.3pF whichever is larger X7R, X5R, X6S: ≥10V**, within ±12.5%; ≤ 6.3V within ±25%; TT series & C ≥ 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:																																																																																																																																																																																							
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D.F. ≤	Exception of D.F. ≤	0201	X5R/X7R/X6S	≤ 10V	C ≥ 0.1μF	≥ 100V	≤ 3%	≤ 6% 1206 ≥ 0.47μF	0402	X5R/X7R/X6S Y5V	6.3V, 10V	C ≥ 1.0μF	≥ 50V	≤ 3%	≤ 7.5% 0805 > 0.1μF, 0603 ≥ 0.068μF, 1206 > 1μF; 1210 ≥ 2.2μF; TT series	16V, 25V	C ≥ 1.0μF	≤ 6% 0201 (50V); 0603 ≥ 0.047μF; 0805 ≥ 0.18μF; 1206 ≥ 0.47μF	0603	X5R/X7R/X6S	4V	C ≥ 22μF	≥ 50V	≤ 3%	≤ 10% 1210 ≥ 4.7μF	6.3V, 10V	C ≥ 4.7μF	≤ 20% 0402 ≥ 0.1μF; 0603 > 0.1μF; 0805 ≥ 1μF; 1206 ≥ 2.2μF; 1210 ≥ 10μF; TT series	0805	X5R/X7R/X6S	25V, 35V	C ≥ 1.0μF	35V	≤ 5%	≤ 20% 0603 ≥ 1μF; 0805 ≥ 2.2μF; 1206 ≥ 2.2μF; 1210 ≥ 10μF	4V	C ≥ 47μF	≤ 10% 0201 ≥ 0.01μF; 0805 ≥ 1μF; 1210 ≥ 10μF	1206	X5R/X7R/X6S	6.3V	C ≥ 22μF	25V	≤ 5%	≤ 14% 0603 ≥ 0.33μF; 1206 ≥ 4.7μF	10V~50V	C ≥ 10μF	≤ 15% 0201 ≥ 0.1μF; 0402 ≥ 0.10μF; 0603 ≥ 0.47μF; 0805 ≥ 2.2μF; 1206 ≥ 6.8μF; 1210 ≥ 22μF; TT series	1210	X5R/X7R/X6S	≤ 6.3V	C ≥ 47μF	16V	≤ 5%	≤ 20% 0402 ≥ 0.47μF	NP0	3000V	C ≥ 1.5pF	≤ 10% 0603 ≥ 0.15μF; 0805 ≥ 0.68μF; 1206 ≥ 2.2μF; 1210 ≥ 4.7μF	TT18	Y5V	6.3V, 10V	C ≥ 2.2μF	10V	≤ 7.5%	≤ 15% 0201 ≥ 0.01μF; 0402 ≥ 0.033μF; 0603 ≥ 0.68μF; 0805 ≥ 2.2μF; 1206 ≥ 4.7μF; 1210 ≥ 22μF; TT series	TT21	Y5V	6.3V	C ≥ 10μF	≤ 15% 0201 ≥ 0.012μF; 0402 ≥ 0.33μF (0402/X7R ≥ 0.22μF); 0603 ≥ 0.33μF; 0805 ≥ 2.2μF; 1206 ≥ 2.2μF; 1210 ≥ 22μF	TT31	Y5V	6.3V	C ≥ 22μF	6.3V	≤ 15%	≤ 20% 0201 ≥ 0.1μF; 0402 ≥ 1μF; TT series: 01R5	**1WV items must follow de-rating conditions				≤ 30% 0201 ≥ 0.1μF; 0402 ≥ 1μF; 0603 ≥ 10μF; 0805 ≥ 4.7μF; 1206 ≥ 47μF; 1210 ≥ 100μF; TT series	(6) 150% of rated voltage for below range.				4V	≤ 20%	---					Y5V:							Rated vol.	D.F. ≤	Exception of D.F. ≤	0201	X5R/X7R/X6S	16V/25V	C ≥ 0.1μF	≥ 50V	≤ 7.5%	≤ 10% 0603 ≥ 0.1μF; 0805 ≥ 0.47μF; 1206 ≥ 4.7μF	0402	X5R/X7R/X6S	50V	C ≥ 0.1μF	35V	≤ 10%	≤ 20% 1210 ≥ 6.8μF	10~25V	C ≥ 0.22μF	≤ 10% 0402 ≥ 0.047μF; 0603 ≥ 0.1μF; 0805 ≥ 0.33μF; 1206 ≥ 1μF; 1210 ≥ 4.7μF	0603	X5R/X7R/X6S	Y5V	C ≥ 0.47μF	25V	≤ 7.5%	≤ 10% 0402 ≥ 0.068μF; 0603 ≥ 0.47μF; 1206 ≥ 4.7μF; 1210 ≥ 22μF	X7R	C > 0.1μF	≤ 15% 0402 ≥ 0.068μF; 0603 ≥ 0.47μF; 1206 ≥ 4.7μF; 1210 ≥ 22μF	0805	X5R/X7R	10V, 16V, 50V	C ≥ 1.0μF	16V (C < 1.0μF)	≤ 10%	≤ 12.5% 0402 ≥ 0.068μF; 0603 ≥ 0.68μF	Y5V	C ≥ 2.2μF	≤ 20% 0402 ≥ 0.22μF	1206	X5R/X7R/X6S	10~50V	C ≥ 4.7μF	16V (C ≥ 1.0μF)	≤ 12.5%	≤ 20% 0603 ≥ 2.2μF; 0805 ≥ 3.3μF; 1206 ≥ 10μF; 1210 ≥ 22μF; 1812 ≥ 47μF;	50V	C ≥ 2.2μF	≤ 30% 0402 ≥ 0.47μF	1210	X5R/X7R/X6S	100V	C ≥ 4.7μF	10V	≤ 20%	≤ 30%	Y5V	C ≥ 4.7μF	6.3V	≤ 30%	---	1825	X7R	100V~250V	C ≥ 1.0μF	---			2220	---			2225	---		
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		TT18	Y5V	6.3V, 10V	C ≥ 2.2μF	10V	≤ 7.5%	≤ 15% 0201 ≥ 0.01μF; 0402 ≥ 0.033μF; 0603 ≥ 0.68μF; 0805 ≥ 2.2μF; 1206 ≥ 4.7μF; 1210 ≥ 22μF; TT series																																																																																																																																																																																		
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		<p>* Before initial measurement (Class II only): To apply test voltage for 1hr at test temp. and then set for 24±2 hrs at room temp.</p> <p>* Measurement to be made after keeping at room temp. for 24±2 hrs</p> <p>** De-rating conditions:</p>																																																																																																																																																																																								

APPENDIXES

▣ Tape & reel dimensions

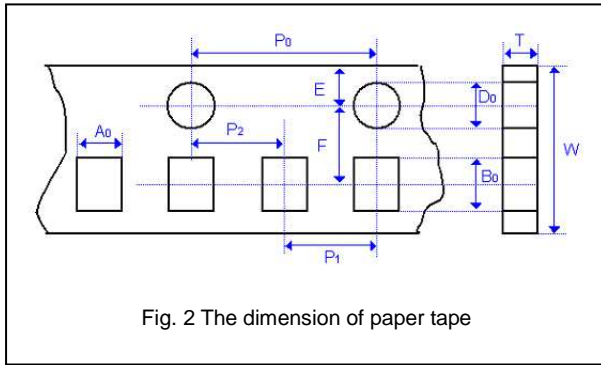


Fig. 2 The dimension of paper tape

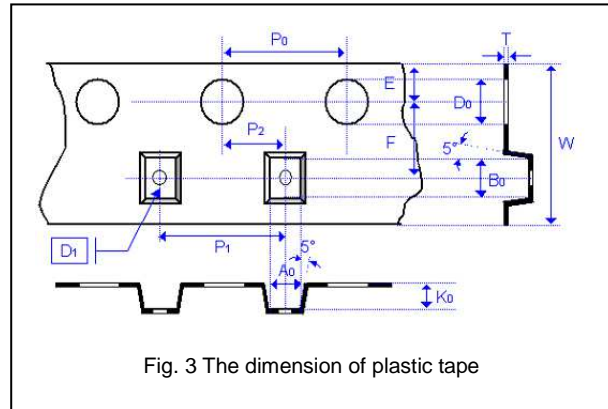


Fig. 3 The dimension of plastic tape

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 +/-0.05	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

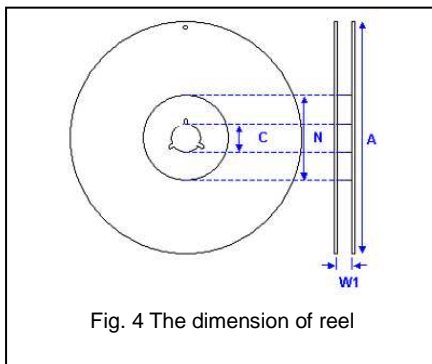
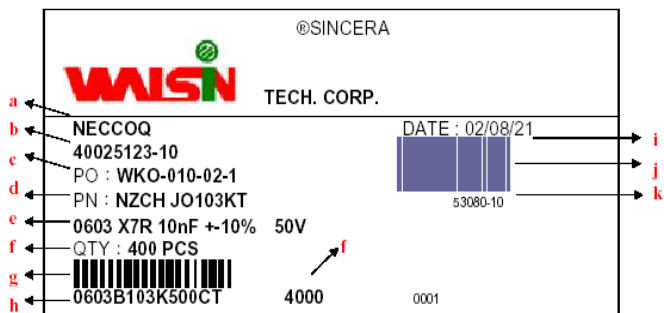


Fig. 4 The dimension of reel

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
④		Middle layer
⑤		Outer layer
		Cu
		Ni
		Sn

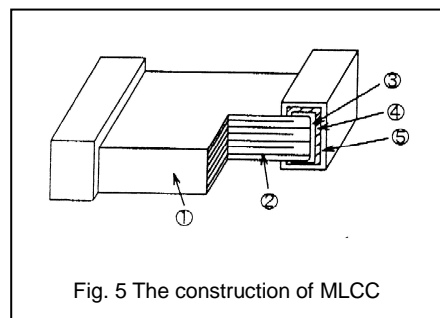


Fig. 5 The construction of MLCC

▣ 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.

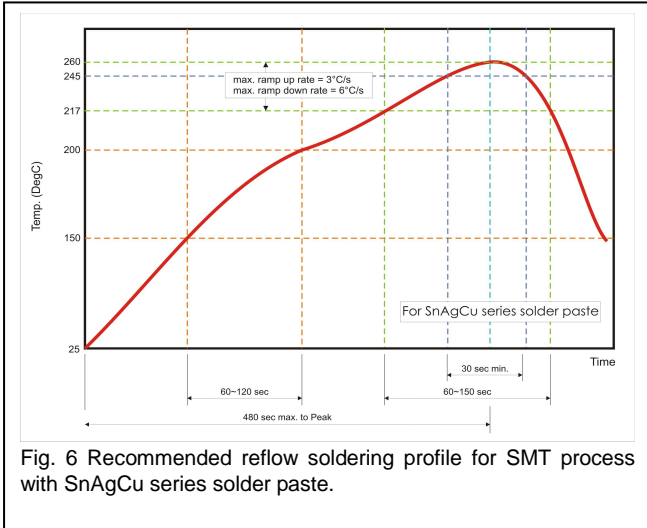


Fig. 6 Recommended reflow soldering profile for SMT process with SnAgCu series solder paste.

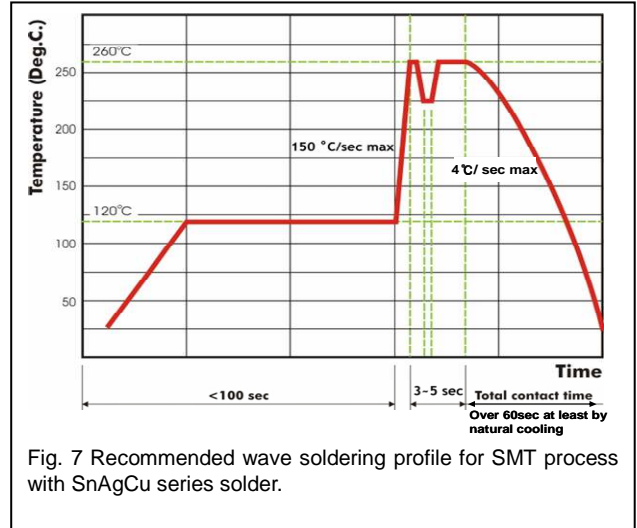


Fig. 7 Recommended wave soldering profile for SMT process with SnAgCu series solder.

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[CGA2B2C0G1H040C](#) [CGA2B2C0G1H050C](#) [CGA2B2C0G1H060D](#) [CGA2B2C0G1H070D](#) [CGA2B2C0G1H151J](#) [CGA2B2C0G1H1R5C](#)
[CGA2B2C0G1H2R2C](#) [CGA2B2C0G1H3R3C](#) [CGA2B2C0G1H680J](#) [CGA2B2C0G1H6R8D](#) [CGA2B2X8R1H221K](#) [CGA2B2X8R1H472K](#)
[CGA3E1X7R1C474K](#)