

APPROVAL SHEET

MULTILAYER CERAMIC CAPACITORS

Soft Termination Series

(SG_6.3V to 2000V)

X7R Dielectric

0603 to 1206 Sizes

Halogen Free & 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

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

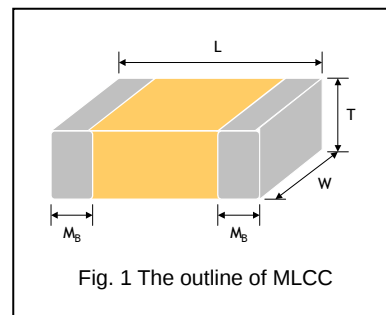
4. HOW TO ORDER

<u>SG</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>
SG=Soft termination	18=0603 (1608) 21=0805 (2012) 31=1206 (3216)	B=X7R	Two significant digits followed by no. of zeros. And R is in place of decimal point. Eg. 104=10x10 ⁴ =100nF	J=±5% K=±10% M=±20%	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	C=Cu 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 _B (mm)
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 #	
			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 (0.5±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 #	
			1.60±0.50	P #	
	3.20±0.50	1.60±0.50	1.60±0.50	P #	



Reflow soldering only is recommended.

* For 1206_≥1000V products.

6. GENERAL ELECTRICAL DATA

Dielectric	X7R
Size	0603, 0805, 1206
Capacitance range*	100pF to 10μF
Capacitance tolerance**	J (±5%), K (±10%), M (±20%)
Rated voltage (WVDC)	6.3V to 2000V
Operating temperature	-55 to +125°C
Capacitance characteristic	±15%
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.

** 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.

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7. CAPACITANCE RANGE

X7R Dielectric 0402, 0603 Sizes

DIELECTRIC		X7R						
SIZE		0603						
RATED VOLTAGE		10	16	25	50	100	200	250
Capacitance	100pF (101)	S	S	S	S	S	X	X
	120pF (121)	S	S	S	S	S	X	X
	150pF (151)	S	S	S	S	S	X	X
	180pF (181)	S	S	S	S	S	X	X
	220pF (221)	S	S	S	S	S	X	X
	270pF (271)	S	S	S	S	S	X	X
	330pF (331)	S	S	S	S	S	X	X
	390pF (391)	S	S	S	S	S	X	X
	470pF (471)	S	S	S	S	S	X	X
	560pF (561)	S	S	S	S	S	X	X
	680pF (681)	S	S	S	S	S	X	X
	820pF (821)	S	S	S	S	S	X	X
	1,000pF (102)	S	S	S	S	S	X	X
	1,200pF (122)	S	S	S	S	S	X	X
	1,500pF (152)	S	S	S	S	S	X	X
	1,800pF (182)	S	S	S	S	S	X	X
	2,200pF (222)	S	S	S	S	S	X	X
	2,700pF (272)	S	S	S	S	S	X	X
	3,300pF (332)	S	S	S	S	S	X	X
	3,900pF (392)	S	S	S	S	S	X	X
	4,700pF (472)	S	S	S	S	S	X	X
	5,600pF (562)	S	S	S	S	S	X	X
	6,800pF (682)	S	S	S	S	S	X	X
	8,200pF (822)	S	S	S	S	S	X	X
	0.010μF (103)	S	S	S	S	S	X	X
	0.012μF (123)	S	S	S	S	X		
	0.015μF (153)	S	S	S	S	X		
	0.018μF (183)	S	S	S	S	X		
	0.022μF (223)	S	S	S	S	X		
	0.027μF (273)	S	S	S	S	X		
	0.033μF (333)	S	S	S	X	X		
	0.039μF (393)	S	S	S	X	X		
	0.047μF (473)	S	S	S	X	X		
	0.056μF (563)	S	S	S	X	X		
	0.068μF (683)	S	S	S	X	X		
	0.082μF (823)	S	S	S	X	X		
	0.10μF (104)	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)							

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.

X7R Dielectric 0805 Size

DIELECTRIC		X7R									
SIZE		0805									
RATED VOLTAGE		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	B	B	B
	1,500pF (152)	D	D	D	D	D	D	D	B	B	D
	1,800pF (182)	D	D	D	D	D	D	D	B	B	D
	2,200pF (222)	D	D	D	D	D	D	D	B	B	D
	2,700pF (272)	D	D	D	D	D	D	D	B	B	
	3,300pF (332)	D	D	D	D	D	D	D	B	B	
	3,900pF (392)	D	D	D	D	D	D	D	B	B	
	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	D	D	
	0.015μF (153)	D	D	D	D	D	D	D	D	D	
	0.018μF (183)	D	D	D	D	D	D	D	D	D	
	0.022μF (223)	D	D	D	D	D	D	D	D	D	
	0.027μF (273)	D	D	D	D	D	D	D	D	D	
	0.033μF (333)	D	D	D	D	D	D	D	D		
	0.039μF (393)	D	D	D	D	D	D	D			
	0.047μF (473)	D	D	D	D	D	D	D			
	0.056μF (563)	D	D	D	D	D	D	D			
	0.068μF (683)	D	D	D	D	D	D	D			
	0.082μF (823)	D	D	D	D	D	D				
	0.10μF (104)	D	D	D	D	D	D				
	0.12μF (124)	D	D	D	D	I					
	0.15μF (154)	D	D	D	D	I					
	0.18μF (184)	D	D	D	D	I					
	0.22μF (224)	D	D	D	D	I					
	0.27μF (274)	I	I	I	I						
	0.33μF (334)	I	I	I	I						
	0.39μF (394)	I	I	I	I						
	0.47μF (474)	I	I	I	I						
	0.56μF (564)	I	I	I							
	0.68μF (684)	I	I	I							
	0.82μF (824)	I	I	I							
	1.0μF (105)	I	I	I	I						
	1.5μF (155)	I	I	I							
	2.2μF (225)	I	I	I							
	3.3μF (335)										
	4.7μF (475)										
	10μF (106)										
	22μF (226)										
	47μF (476)										

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Approval Sheet

X7R Dielectric 1206 Size

DIELECTRIC		X7R													
SIZE		1206													
RATED VOLTAGE		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										
	1.5μF (155)	J	J	P											
	2.2μF (225)	J	J	P											
	3.3μF (335)	P	P	P											
	4.7μF (475)	P	P	P											
	10μF (106)	P													
	22μF (226)														
	47μF (476)														

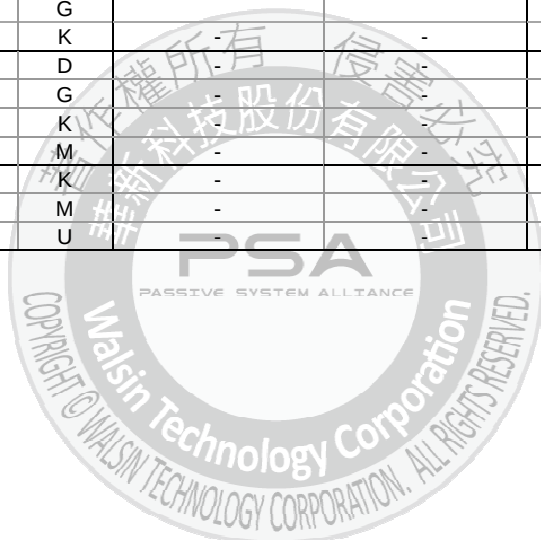
1. The letter in cell is expressed the symbol of product thickness.

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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	8k
	2.00±0.20	K	-	-	1k	6k
	2.50±0.50	M	-	-	1k	6k
1808 (4520)	1.25±0.10	D	-	-	2k	10k
	1.60±0.20	G	-	-	2k	8k
	2.00±0.20	K	-	-	1k	6k
1812 (4532)	1.25±0.10	D	-	-	1k	5k
	1.60±0.20	G	-	-	1k	4k
	2.00±0.20	K	-	-	1k	3k
	2.50±0.50	M	-	-	0.5k	3k
1825 (4563)	2.00±0.20	K	-	-	1k	-
2220 (5750)	2.50±0.30	M	-	-	0.5k	-
2225 (5763)	2.80±0.30	U	-	-	0.5k	-

Unit: pieces



Multilayer Ceramic Capacitors

Approval Sheet

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	*Test temp.: Room Temperature.	* Shall not exceed the limits given in the detailed spec.																																																														
3.	Q/ D.F. (Dissipation Factor)	*Class I: (NP0) ≤ 1000pF, 1.0±0.2Vrms , 1MHz±10% > 1000pF, 1.0±0.2Vrms , 1KHz±10% Class II: (X7R, X7E, X6S, X5R,X7S) C ≤ 10μF, 1.0±0.2Vrms , 1KHz±10% ** C > 10μF, 0.5±0.2Vrms , 120Hz±20% ** Test condition: 0.5±0.2Vrms·1KHz±10% X7R: 0603/475(6.3V) X5R: 0201 ≥ 224 (6.3V,10V,16V) ^{#1} , 0402 ≥ 475 (6.3V,16V), 0402 ≥ 225(10V), 0603=106 (6.3V) TT18X ≥ 475(10V) , TT15X series X6S: 0201/474(4V),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) , 0402X475M6R3 (1.0±0.2Vrms , 1KHz±10%) *Before initial measurement (Class II only): To apply de-aging at 150℃ for 1hr then set for 24±2 hrs at room temp.	* NP0: Cap≥30pF, Q≥1000; Cap<30pF,Q≥400+20C X7R,X5R,X6S,X7S: <table><tr><th>Rated vol.</th><th>D.F. ≤</th><th colspan="2">Exception of D.F. ≤</th></tr><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>0603 ≥ 0.068μF;0805 > 0.1μF;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 ≥ 0.01uF;1210 ≥ 3.3μF</td></tr><tr><td>≤ 10%</td><td>0402 ≥ 0.012μF;0603>0.1μF;0805 ≥ 1μF(0805/X7R>0.47μF); 1206 ≥ 2.2μF;1210 ≥ 10μF;TT series</td></tr><tr><td rowspan="3">35V</td><td rowspan="3">≤ 3.5%</td><td>≤ 12.5%</td><td>1206/X5R=10μF</td></tr><tr><td>≤ 10%</td><td>0603 ≥ 1μF;0805≥2.2μF;1206 ≥ 2.2μF;1210 ≥ 10μF</td></tr><tr><td>≤ 5%</td><td>0201 ≥ 0.01μF(0201/X5R=0.01μF);0805 ≥ 1μF;1210 ≥ 10μF*</td></tr><tr><td rowspan="3">25V</td><td rowspan="3">≤ 3.5%</td><td>≤ 7%</td><td>0603 ≥ 0.33μF</td></tr><tr><td>≤ 10%</td><td>0201 ≥ 0.1μF(0201/X5R>0.01μF);0603 ≥ 0.47μF;TT series; 0402 ≥ 0.10μF(0402/X7R ≥ 0.056μF);0805 ≥ 2.2μF; 1206 ≥ 4.7μF;1210 ≥ 22μF(1210/X5R ≥ 10μF)*</td></tr><tr><td>≤ 12.5%</td><td>0402 ≥ 0.47μF;0805/X5R/X6S=10μF</td></tr><tr><td rowspan="3">16V</td><td rowspan="3">≤ 3.5%</td><td>≤ 5%</td><td>0201 ≥ 0.01μF(0201/X5R=0.01μF);0402 ≥ 0.033μF; 0603 ≥ 0.15μF;0805 ≥ 0.68μF;1206 ≥ 2.2μF;1210 ≥ 4.7μF</td></tr><tr><td>≤ 10%</td><td>0201 ≥ 0.1μ(0201/X5R>0.01μF;0201/X7R ≥ 0.022μF);0402 ≥ 0.22uF; 0603>0.47μF;0805 ≥ 2.2μF;1206 ≥ 4.7μF;1210 ≥ 22μF;TT series</td></tr><tr><td>≤ 12.5%</td><td>0402/X5R ≥ 1μF;0402/X6S=1μF;0805/X5R/X6S=10μF</td></tr><tr><td rowspan="3">10V</td><td rowspan="3">≤ 5%</td><td>≤ 10%</td><td>0201 ≥ 0.012μF;0402 ≥ 0.22μF;0603 ≥ 0.33μF;TT series; 0805 ≥ 2.2μF;1206 ≥ 2.2μF;1210 ≥ 22μF;01R5/X5R</td></tr><tr><td>≤ 12.5%</td><td>0805/X5R/X6S=10μF</td></tr><tr><td>≤ 15%</td><td>0201 ≥ 0.1μF(0201/X5R>0.1μF);0402 ≥ 1μF;0603/X5R ≥ 10μF</td></tr><tr><td rowspan="2">6.3V</td><td rowspan="2">≤ 10%</td><td>≤ 15%</td><td>0201 ≥ 0.1μF(0201/X5R>0.1μF);0402 ≥ 1μF(0402/X6S ≥ 0.47μF); 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>4V</td><td>≤ 15%</td><td>---</td><td>---</td></tr></table>	Rated vol.	D.F. ≤	Exception of D.F. ≤		≥ 100V	≤ 2.5%	≤ 3%	1206 ≥ 0.47μF	≤ 5%	0603 ≥ 0.068μF;0805 > 0.1μF;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 ≥ 0.01uF;1210 ≥ 3.3μF	≤ 10%	0402 ≥ 0.012μF;0603>0.1μF;0805 ≥ 1μF(0805/X7R>0.47μF); 1206 ≥ 2.2μF;1210 ≥ 10μF;TT series	35V	≤ 3.5%	≤ 12.5%	1206/X5R=10μF	≤ 10%	0603 ≥ 1μF;0805≥2.2μF;1206 ≥ 2.2μF;1210 ≥ 10μF	≤ 5%	0201 ≥ 0.01μF(0201/X5R=0.01μF);0805 ≥ 1μF;1210 ≥ 10μF*	25V	≤ 3.5%	≤ 7%	0603 ≥ 0.33μF	≤ 10%	0201 ≥ 0.1μF(0201/X5R>0.01μF);0603 ≥ 0.47μF;TT series; 0402 ≥ 0.10μF(0402/X7R ≥ 0.056μF);0805 ≥ 2.2μF; 1206 ≥ 4.7μF;1210 ≥ 22μF(1210/X5R ≥ 10μF)*	≤ 12.5%	0402 ≥ 0.47μF;0805/X5R/X6S=10μF	16V	≤ 3.5%	≤ 5%	0201 ≥ 0.01μF(0201/X5R=0.01μF);0402 ≥ 0.033μF; 0603 ≥ 0.15μF;0805 ≥ 0.68μF;1206 ≥ 2.2μF;1210 ≥ 4.7μF	≤ 10%	0201 ≥ 0.1μ(0201/X5R>0.01μF;0201/X7R ≥ 0.022μF);0402 ≥ 0.22uF; 0603>0.47μF;0805 ≥ 2.2μF;1206 ≥ 4.7μF;1210 ≥ 22μF;TT series	≤ 12.5%	0402/X5R ≥ 1μF;0402/X6S=1μF;0805/X5R/X6S=10μF	10V	≤ 5%	≤ 10%	0201 ≥ 0.012μF;0402 ≥ 0.22μF;0603 ≥ 0.33μF;TT series; 0805 ≥ 2.2μF;1206 ≥ 2.2μF;1210 ≥ 22μF;01R5/X5R	≤ 12.5%	0805/X5R/X6S=10μF	≤ 15%	0201 ≥ 0.1μF(0201/X5R>0.1μF);0402 ≥ 1μF;0603/X5R ≥ 10μF	6.3V	≤ 10%	≤ 15%	0201 ≥ 0.1μF(0201/X5R>0.1μF);0402 ≥ 1μF(0402/X6S ≥ 0.47μF); 0603 ≥ 10μF;0805 ≥ 4.7μF;1206 ≥ 47μF;1210 ≥ 100μF;TT series	≤ 20%	0402 ≥ 2.2μF	4V	≤ 15%	---	---
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16V	≤ 3.5%	≤ 5%	0201 ≥ 0.01μF(0201/X5R=0.01μF);0402 ≥ 0.033μF; 0603 ≥ 0.15μF;0805 ≥ 0.68μF;1206 ≥ 2.2μF;1210 ≥ 4.7μF																																																														
		≤ 10%	0201 ≥ 0.1μ(0201/X5R>0.01μF;0201/X7R ≥ 0.022μF);0402 ≥ 0.22uF; 0603>0.47μF;0805 ≥ 2.2μF;1206 ≥ 4.7μF;1210 ≥ 22μF;TT series																																																														
		≤ 12.5%	0402/X5R ≥ 1μF;0402/X6S=1μF;0805/X5R/X6S=10μF																																																														
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6.3V	≤ 10%	≤ 15%	0201 ≥ 0.1μF(0201/X5R>0.1μF);0402 ≥ 1μF(0402/X6S ≥ 0.47μF); 0603 ≥ 10μF;0805 ≥ 4.7μF;1206 ≥ 47μF;1210 ≥ 100μF;TT series																																																														
		≤ 20%	0402 ≥ 2.2μF																																																														
4V	≤ 15%	---	---																																																														
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.																																																														

* "Room condition" Temperature: 15 to 35°C, Relative humidity: 25 to 75%, Atmospheric pressure: 86 to 106kPa.

Multilayer Ceramic Capacitors

Approval Sheet

No.	Item	Test Condition	Requirements																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																				
5.	Insulation Resistance	*Test temp.: Room Temperature.	10GΩ or RxC ≥ 500Ω-F whichever is smaller.																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																				
		*To apply rated voltage for MAX. 120sec.	Class II (X7R, X7E, X5R,X6S,X7S)																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																				
			<table><tr><th>Rated voltage</th><th>Insulation Resistance</th></tr><tr><td>100V: All X7R</td><td rowspan="7">10GΩ or RxC ≥ 100 Ω-F whichever is smaller.</td></tr><tr><td>50V:0402>0.01μF;0603≥1μF;0805≥1μF;1206≥4.7μF;1210≥4.7μF</td></tr><tr><td>35V:0805≥2.2μF;1206 ≥ 2.2μF;1210 ≥ 10μF</td></tr><tr><td>25V:0402≥1μF;0603≥2.2μF;0805≥2.2μF;1206≥10μF;1210≥10μF</td></tr><tr><td>16V: 0201≥0.1μF;0402≥0.22μF;0603≥1μF;0805≥2.2μF;1206≥10μF;1210≥47μF</td></tr><tr><td>10V:0201≥47nF;0402≥0.47μF;0603≥0.47μF;0805≥2.2μF;1206≥4.7μF;1210≥47μF</td></tr><tr><td>6.3V ; 4V ; TT series; Size≥1812</td></tr><tr><td></td><td><table><tr><th>Rated voltage</th><th>Insulation Resistance</th></tr><tr><td>All X6S items, All X7S items</td><td rowspan="7">RxC ≥ 50 Ω-F.</td></tr><tr><td>100V: 1210≥3.3μF</td></tr><tr><td>50V: 0402≥0.1μF; 0603≥2.2μF; 0805≥10μF;1206≥10μF</td></tr><tr><td>35V: 0603≥1μF;</td></tr><tr><td>25V: 0201≥0.1μF; 0402≥2.2μF;0603≥10μF; 0805≥10μF;1206≥22μF</td></tr><tr><td>16V: 0603≥10μF; 0402≥1μF; 0201≥0.22μF</td></tr><tr><td>10V: 0201>0.1μF; 0402≥1μF; 0603≥10μF; 0805≥47μF; TT21>4.7μF</td></tr><tr><td></td><td></td><td>6.3V: 0201≥0.1μF; 0402≥1μF;0603>4.7μF;0805≥47μF;1206≥10μF;</td></tr><tr><td></td><td></td><td>4V:0603≥22μF; 0805≥47μF; 1206≥100μF</td></tr></table></td></tr><tr><td></td><td></td><td></td></tr><tr><td></td><td></td><td></td></tr><tr><td></td><td></td><td></td></tr><tr><td></td><td></td><td></td></tr><tr><td></td><td></td><td></td></tr><tr><td></td><td></td><td></td></tr><tr><td></td><td></td><td></td></tr><tr><td></td><td></td><td></td></tr><tr><td></td><td></td><td></td></tr><tr><td></td><td></td><td></td></tr><tr><td></td><td></td><td></td></tr><tr><td></td><td></td><td></td></tr><tr><td></td><td></td><td></td></tr><tr><td></td><td></td><td></td></tr><tr><td></td><td></td><td></td></tr><tr><td></td><td></td><td></td></tr><tr><td></td><td></td><td></td></tr><tr><td></td><td></td><td></td></tr><tr><td></td><td></td><td></td></tr><tr><td></td><td></td><td></td></tr><tr><td></td><td></td><td></td></tr><tr><td></td><td></td><td></td></tr><tr><td></td><td></td><td></td></tr><tr><td></td><td></td><td></td></tr><tr><td></td><td></td><td></td></tr><tr><td></td><td></td><td></td></tr><tr><td></td><td></td><td></td></tr><tr><td></td><td></td><td></td></tr><tr><td></td><td></td><td></td></tr><tr><td></td><td></td><td></td></tr><tr><td></td><td></td><td></td></tr><tr><td></td><td></td><td></td></tr><tr><td></td><td></td><td></td></tr><tr><td></td><td></td><td></td></tr><tr><td></td><td></td><td></td></tr><tr><td></td><td></td><td></td></tr><tr><td></td><td></td><td></td></tr><tr><td></td><td></td><td></td></tr><tr><td></td><td></td><td></td></tr><tr><td></td><td></td><td></td></tr><tr><td></td><td></td><td></td></tr><tr><td></td><td></td><td></td></tr><tr><td></td><td></td><td></td></tr><tr><td></td><td></td><td></td></tr><tr><td></td><td></td><td></td></tr><tr><td></td><td></td><td></td></tr><tr><td></td><td></td><td></td></tr><tr><td></td><td></td><td></td></tr><tr><td></td><td></td><td></td></tr><tr><td></td><td></td><td></td></tr><tr><td></td><td></td><td></td></tr><tr><td></td><td></td><td></td></tr><tr><td></td><td></td><td></td></tr><tr><td></td><td></td><td></td></tr><tr><td></td><td></td><td></td></tr><tr><td></td><td></td><td></td></tr><tr><td></td><td></td><td></td></tr><tr><td></td><td></td><td></td></tr><tr><td></td><td></td><td></td></tr><tr><td></td><td></td><td></td></tr><tr><td></td><td></td><td></td></tr><tr><td></td><td></td><td></td></tr><tr><td></td><td></td><td></td></tr><tr><td></td><td></td><td></td></tr><tr><td></td><td></td><td></td></tr><tr><td></td><td></td><td></td></tr><tr><td></td><td></td><td></td></tr><tr><td></td><td></td><td></td></tr><tr><td></td><td></td><td></td></tr><tr><td></td><td></td><td></td></tr><tr><td></td><td></td><td></td></tr><tr><td></td><td></td><td></td></tr><tr><td></td><td></td><td></td></tr><tr><td></td><td></td><td></td></tr><tr><td></td><td></td><td></td></tr><tr><td></td><td></td><td></td></tr><tr><td></td><td></td><td></td></tr><tr><td></td><td></td><td></td></tr><tr><td></td><td></td><td></td></tr><tr><td></td><td></td><td></td></tr><tr><td></td><td></td><td></td></tr><tr><td></td><td></td><td></td></tr><tr><td></td><td></td><td></td></tr><tr><td></td><td></td><td></td></tr><tr><td></td><td></td><td></td></tr><tr><td></td><td></td><td></td></tr><tr><td></td><td></td><td></td></tr><tr><td></td><td></td><td></td></tr><tr><td></td><td></td><td></td></tr><tr><td></td><td></td><td></td></tr><tr><td></td><td></td><td></td></tr><tr><td></td><td></td><td></td></tr><tr><td></td><td></td><td></td></tr><tr><td></td><td></td><td></td></tr><tr><td></td><td></td><td></td></tr><tr><td></td><td></td><td></td></tr><tr><td></td><td></td><td></td></tr><tr><td></td><td></td><td></td></tr><tr><td></td><td></td><td></td></tr><tr><td></td><td></td><td></td></tr><tr><td></td><td></td><td></td></tr><tr><td></td><td></td><td></td></tr><tr><td></td><td></td><td></td></tr><tr><td></td><td></td><td></td></tr><tr><td></td><td></td><td></td></tr><tr><td></td><td></td><td></td></tr><tr><td></td><td></td><td></td></tr><tr><td></td><td></td><td></td></tr><tr><td></td><td></td><td></td></tr><tr><td></td><td></td><td></td></tr><tr><td></td><td></td><td></td></tr><tr><td></td><td></td><td></td></tr><tr><td></td><td></td><td></td></tr><tr><td></td><td></td><td></td></tr><tr><td></td><td></td><td></td></tr><tr><td></td><td></td><td></td></tr><tr><td></td><td></td><td></td></tr><tr><td></td><td></td><td></td></tr><tr><td></td><td></td><td></td></tr><tr><td></td><td></td><td></td></tr><tr><td></td><td></td><td></td></tr><tr><td></td><td></td><td></td></tr><tr><td></td><td></td><td></td></tr><tr><td></td><td></td><td></td></tr><tr><td></td><td></td><td></td></tr><tr><td></td><td></td><td></td></tr><tr><td></td><td></td><td></td></tr><tr><td></td><td></td><td></td></tr><tr><td></td><td></td><td></td></tr><tr><td></td><td></td><td></td></tr><tr><td></td><td></td><td></td></tr><tr><td></td><td></td><td></td></tr><tr><td></td><td></td><td></td></tr><tr><td></td><td></td><td></td></tr><tr><td></td><td></td><td></td></tr><tr><td></td><td></td><td></td></tr><tr><td></td><td></td><td></td></tr><tr><td></td><td></td><td></td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voltage	Insulation Resistance	100V: All X7R	10GΩ or RxC ≥ 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;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; Size≥1812		<table><tr><th>Rated voltage</th><th>Insulation Resistance</th></tr><tr><td>All X6S items, All X7S items</td><td rowspan="7">RxC ≥ 50 Ω-F.</td></tr><tr><td>100V: 1210≥3.3μF</td></tr><tr><td>50V: 0402≥0.1μF; 0603≥2.2μF; 0805≥10μF;1206≥10μF</td></tr><tr><td>35V: 0603≥1μF;</td></tr><tr><td>25V: 0201≥0.1μF; 0402≥2.2μF;0603≥10μF; 0805≥10μF;1206≥22μF</td></tr><tr><td>16V: 0603≥10μF; 0402≥1μF; 0201≥0.22μF</td></tr><tr><td>10V: 0201>0.1μF; 0402≥1μF; 0603≥10μF; 0805≥47μF; TT21>4.7μF</td></tr><tr><td></td><td></td><td>6.3V: 0201≥0.1μF; 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* "Room condition" Temperature: 15 to 35°C, Relative humidity: 25 to 75%, Atmospheric pressure: 86 to 106kPa.

Multilayer Ceramic Capacitors

Approval Sheet

No.	Item	Test Condition	Requirements															
7.	Adhesive Strength of Termination	* Pressurizing force : 2N (0201) and 5N (≤0603) and 10N (>0603) * Test time: 10±1 sec.	* No remarkable damage or removal of the terminations.															
8.	Vibration Resistance	* 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.	* No remarkable damage. * Cap change and Q/D.F.: To meet initial spec.															
9.	Solderability	* Solder temperature: 235±5°C * Dipping time: 2±0.5 sec.	* 75% min. coverage of all metalized area.															
10.	Bending Test	* The middle part of substrate shall be pressurized by means of the pressurizing rod at a rate of about 1 mm per second until the deflection becomes 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.	* No remarkable damage. * Cap change : NP0: within ±5% or 0.5pF whichever is larger X7R, X5R, X6S, X7S: within ±12.5% (This capacitance change means the change of capacitance under specified flexure of substrate from the capacitance measured before the test.)															
11.	Resistance to Soldering Heat	* Solder temperature: 260±5°C * 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.	* No remarkable damage. * Cap change: NP0: within ±2.5% or 0.25pF whichever is larger X7R, X5R, X6S, X7S: within ±7.5% * Q/D.F., I.R. and dielectric strength: To meet initial requirements. * 25% max. leaching on each edge.															
12.	Temperature Cycle	* Conduct the five cycles according to the temperatures and time. <table><tr><th>Step</th><th>Temp. (°C)</th><th>Time (min.)</th></tr><tr><td>1</td><td>Min. operating temp. +0/-3</td><td>30±3</td></tr><tr><td>2</td><td>Room temp.</td><td>2-3</td></tr><tr><td>3</td><td>Max. operating temp. +3/-0</td><td>30±3</td></tr><tr><td>4</td><td>Room temp.</td><td>2-3</td></tr></table> *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.	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	* No remarkable damage. * Cap change : NP0: within ±2.5% or 0.25pF whichever is larger X7R, X5R, X6S, X7S: within ±7.5% * Q/D.F., I.R. and dielectric strength: To meet initial requirements.
Step	Temp. (°C)	Time (min.)																
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2	Room temp.	2-3																
3	Max. operating temp. +3/-0	30±3																
4	Room temp.	2-3																

* "Room condition" Temperature: 15 to 35°C, Relative humidity: 25 to 75%, Atmospheric pressure: 86 to 106kPa.

No.	Item	Test Condition	Requirements																																																																
13.	Humidity (Damp Heat) Steady State	*Test temp.: 40±2℃ *Humidity: 90~95%RH *Test time: 500+24/-0hrs. *Before initial measurement (Class II only): To apply de-aging at 150℃ 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℃ 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%; * 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><tr><th>Rated vol.</th><th>D.F. ≤</th><th colspan="2">Exception of D.F. ≤</th></tr><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>0603≥0.068μF;0805>0.1μF;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≥0.01uF;1210≥3.3μF</td></tr><tr><td>≤20%</td><td>0402≥0.012μF;0603>0.1μF;0805≥1μF(0805/X7R>0.47μF); 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="4">25V</td><td rowspan="4">≤5%</td><td>≤10%</td><td>0201≥0.01μF(0201/X5R=0.01μF);0805≥1μF;1210≥10μF*</td></tr><tr><td>≤14%</td><td>0603≥0.33μF</td></tr><tr><td>≤15%</td><td>0201≥0.1μF(0201/X5R>0.01μF); 0603≥0.47μF;TTseries 0402≥0.10μF(0402/X7R≥0.056μF);0805≥2.2μF; 1206≥4.7μF;1210≥22μF(1210/X5R≥10μF)*;</td></tr><tr><td>≤20%</td><td>0402≥0.47μF</td></tr><tr><td>16V</td><td>≤5%</td><td>≤10%</td><td>0603≥0.15μF;0805≥0.68μF;1206≥2.2μF;1210≥4.7μF</td></tr><tr><td rowspan="3">10V</td><td rowspan="3">≤7.5%</td><td>≤15%</td><td>0201≥0.01μF(0201/X7R≥0.022μF);0402≥0.033μF; 0603>0.47μF;0805≥2.2μF;1206≥4.7μF;1210≥22μF;TT series</td></tr><tr><td>≤15%</td><td>0201≥0.012μF;0402≥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;0603/X5R≥10μF;TT series;01R5/X5R</td></tr><tr><td>6.3V</td><td>≤15%</td><td>≤30%</td><td>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><td></td></tr></table> *I.R.: ≥10V, 1GΩ or 50 Ω-F whichever is smaller. Class II (X7R, X5R, X6S, X7S) <table><tr><th>Rated voltage</th><th>Insulation Resistance</th></tr><tr><td>100V: All X7R;1210≥3.3μF</td><td rowspan="7">1GΩ or RxC≥10 Ω-F whichever is smaller.</td></tr><tr><td>50V: 0402>0.01μF;0603≥1μF;0805≥1μF;1206≥4.7μF;1210≥4.7μF</td></tr><tr><td>35V:0603≥1μF;0805≥2.2μF; 1206≥2.2μF;1210≥10μF</td></tr><tr><td>25V:0201≥0.1uF; 0402≥0.22μF; 0603≥2.2μF;0805≥2.2μF; 1206≥10μF;1210≥10μF</td></tr><tr><td>16V: 0201≥0.1uF;0402≥0.22μF;0603≥1μF;0805≥2.2μF; 1206≥10μF;1210≥47μF</td></tr><tr><td>10V:0201≥47nF;0402≥0.47μF;0603≥0.47μF;0805≥2.2μF; 1206≥4.7μF;1210≥47μF</td></tr><tr><td>6.3V ; 4V ; TT series ; All X6S/X7S items; Size≥1812</td></tr></table>	Rated vol.	D.F. ≤	Exception of D.F. ≤		≥100V	≤3%	≤6%	1206≥0.47μF	≤7.5%	0603≥0.068μF;0805>0.1μF;1206≥1μF;1210≥2.2μF;TT series	≤20%	0805>0.22μF;1210≥3.3μF	50V	≤3%	≤6%	0201(50V);0603≥0.047μF;0805≥0.18μF;1206≥0.47μF	≤10%	0201≥0.01uF;1210≥3.3μF	≤20%	0402≥0.012μF;0603>0.1μF;0805≥1μF(0805/X7R>0.47μF); 1206≥2.2μF;1210≥10μF; TT series	35V	≤5%	≤20%	0603≥1μF;0805≥2.2μF;1206≥2.2μF;1210≥10μF	25V	≤5%	≤10%	0201≥0.01μF(0201/X5R=0.01μF);0805≥1μF;1210≥10μF*	≤14%	0603≥0.33μF	≤15%	0201≥0.1μF(0201/X5R>0.01μF); 0603≥0.47μF;TTseries 0402≥0.10μF(0402/X7R≥0.056μF);0805≥2.2μF; 1206≥4.7μF;1210≥22μF(1210/X5R≥10μF)*;	≤20%	0402≥0.47μF	16V	≤5%	≤10%	0603≥0.15μF;0805≥0.68μF;1206≥2.2μF;1210≥4.7μF	10V	≤7.5%	≤15%	0201≥0.01μF(0201/X7R≥0.022μF);0402≥0.033μF; 0603>0.47μF;0805≥2.2μF;1206≥4.7μF;1210≥22μF;TT series	≤15%	0201≥0.012μF;0402≥0.22μF; 0603≥0.33μF;0805≥2.2μF;1206≥2.2μF;1210≥22μF	≤20%	0201≥0.1μF;0402≥1μF;0603/X5R≥10μF;TT series;01R5/X5R	6.3V	≤15%	≤30%	0201≥0.1μF;0402≥1μF(0402/X6S≥0.47μF); 0603≥10μF;0805≥4.7μF;1206≥47μF;1210≥100μF;TT series	4V	≤20%	---		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≥0.1uF; 0402≥0.22μF; 0603≥2.2μF;0805≥2.2μF; 1206≥10μF;1210≥10μF	16V: 0201≥0.1uF;0402≥0.22μF;0603≥1μF;0805≥2.2μF; 1206≥10μF;1210≥47μF	10V:0201≥47nF;0402≥0.47μF;0603≥0.47μF;0805≥2.2μF; 1206≥4.7μF;1210≥47μF	6.3V ; 4V ; TT series ; All X6S/X7S items; Size≥1812
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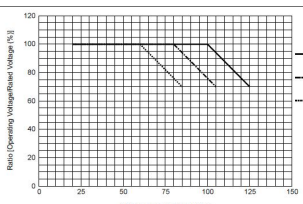
* "Room condition" Temperature: 15 to 35°C, Relative humidity: 25 to 75%, Atmospheric pressure: 86 to 106kPa.

No	Item	Test Condition	Requirements																																																											
14	Humidity (Damp Heat) Load	*Test temp. : 40±2℃ *Humidity : 90~95%RH *Test time : 500+24/-0 hrs. *To apply voltage : Rated voltage (MAX. 500V) *Before initial measurement (Class II only): To apply de-aging at 150℃ for 1hr then set for 24±2 hrs at room temp. * Cap. / DF(Q) / I.R. Measurement to be made after de-aging at 150℃ 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%; Q/D.F. value: NP0: C≥30pF,Q≥200;C<30pF, Q≥100+10/3C X7R, X5R, X6S, X7S: <table><tr><th>Rated vol.</th><th>D.F. ≤</th><th>Exception of D.F. ≤</th></tr><tr><td rowspan="3">≥100V</td><td>≤6%</td><td>1206≥0.47μF</td></tr><tr><td>≤7.5%</td><td>0603≥0.068μF;0805>0.1μF;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>≤6%</td><td>0201(50V);0603≥0.047μF;0805≥0.18μF;1206≥0.47μF</td></tr><tr><td>≤10%</td><td>0201≥0.01uF;1210≥3.3μF</td></tr><tr><td>≤20%</td><td>0402≥0.012μF;0603>0.1μF;0805≥1μF(0805/X7R>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="5">25V</td><td rowspan="5">≤5%</td><td>≤10%</td><td>0201≥0.01μF(0201/X5R=0.01μF);0805≥1μF;1210≥10μF*</td></tr><tr><td>≤14%</td><td>0603≥0.33μF</td></tr><tr><td>≤15%</td><td>0201≥0.1μF(0201/X5R>0.01μF); 0603≥0.47μF;TTseries</td></tr><tr><td>≤20%</td><td>0402≥0.10μF(0402/X7R≥0.056μF);0805≥2.2μF;1206≥4.7μF;1210≥22μF(1210/X5R≥10μF)*;</td></tr><tr><td>≤20%</td><td>0402≥0.47μF</td></tr><tr><td>16V</td><td>≤5%</td><td>≤10% 0603≥0.15μF;0805≥0.68μF;1206≥2.2μF;1210≥4.7μF</td></tr><tr><td rowspan="3">10V</td><td rowspan="3">≤7.5%</td><td>≤15%</td><td>0201≥0.012μF;0402≥0.22μF;</td></tr><tr><td>≤20%</td><td>0603≥0.33μF;0805≥2.2μF;1206≥2.2μF;1210≥22μF</td></tr><tr><td>0201≥0.1μF;0402≥1μF;0603/X5R≥10μF;TT series;01R5/X5R</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></table> *I.R. : ≥10V, 500MΩ or 25 Ω·F whichever is smaller. Class II (X7R, X5R, X6S, X7S) <table><tr><th>Rated voltage</th><th>Insulation Resistance</th></tr><tr><td>100V: All X7R;1210≥3.3μF</td><td rowspan="6">500MΩ or RxC≥5 Ω·F whichever is smaller.</td></tr><tr><td>50V: 0402>0.01μF;0603≥1μF;0805≥1μF;1206≥4.7μF;1210≥4.7μF</td></tr><tr><td>35V:0603≥1μF;0805≥2.2μF; 1206≥2.2μF;1210≥10μF</td></tr><tr><td>25V:0201≥0.1uF; 0402≥0.22μF; 0603≥2.2μF;0805≥2.2μF; 1206≥10μF;1210≥10μF</td></tr><tr><td>16V: 0201≥0.1uF;0402≥0.22μF;0603≥1μF;0805≥2.2μF; 1206≥10μF;1210≥47μF</td></tr><tr><td>10V:0201≥47nF;0402≥0.47μF;0603≥0.47μF;0805≥2.2μF; 1206≥4.7μF;1210≥47μF</td></tr><tr><td colspan="2">6.3V ; 4V ; TT series ; All X6S/X7S items; Size≥1812</td></tr></table>	Rated vol.	D.F. ≤	Exception of D.F. ≤	≥100V	≤6%	1206≥0.47μF	≤7.5%	0603≥0.068μF;0805>0.1μF;1206≥1μF;1210≥2.2μF;TT series	≤20%	0805>0.22μF;1210≥3.3μF	50V	≤6%	0201(50V);0603≥0.047μF;0805≥0.18μF;1206≥0.47μF	≤10%	0201≥0.01uF;1210≥3.3μF	≤20%	0402≥0.012μF;0603>0.1μF;0805≥1μF(0805/X7R>0.47μF);1206≥2.2μF;1210≥10μF; TT series	35V	≤5%	≤20% 0603≥1μF;0805≥2.2μF;1206≥2.2μF;1210≥10μF	25V	≤5%	≤10%	0201≥0.01μF(0201/X5R=0.01μF);0805≥1μF;1210≥10μF*	≤14%	0603≥0.33μF	≤15%	0201≥0.1μF(0201/X5R>0.01μF); 0603≥0.47μF;TTseries	≤20%	0402≥0.10μF(0402/X7R≥0.056μF);0805≥2.2μF;1206≥4.7μF;1210≥22μF(1210/X5R≥10μF)*;	≤20%	0402≥0.47μF	16V	≤5%	≤10% 0603≥0.15μF;0805≥0.68μF;1206≥2.2μF;1210≥4.7μF	10V	≤7.5%	≤15%	0201≥0.012μF;0402≥0.22μF;	≤20%	0603≥0.33μF;0805≥2.2μF;1206≥2.2μF;1210≥22μF	0201≥0.1μF;0402≥1μF;0603/X5R≥10μF;TT series;01R5/X5R	6.3V	≤15%	≤30% 0201≥0.1μF;0402≥1μF(0402/X6S≥0.47μF);0603≥10μF;0805≥4.7μF;1206≥47μF;1210≥100μF;TT series	4V	≤20%	---	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≥0.1uF; 0402≥0.22μF; 0603≥2.2μF;0805≥2.2μF; 1206≥10μF;1210≥10μF	16V: 0201≥0.1uF;0402≥0.22μF;0603≥1μF;0805≥2.2μF; 1206≥10μF;1210≥47μF	10V:0201≥47nF;0402≥0.47μF;0603≥0.47μF;0805≥2.2μF; 1206≥4.7μF;1210≥47μF	6.3V ; 4V ; TT series ; All X6S/X7S items; Size≥1812	
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* "Room condition" Temperature: 15 to 35℃, Relative humidity: 25 to 75%, Atmospheric pressure: 86 to 106kPa.

Multilayer Ceramic Capacitors

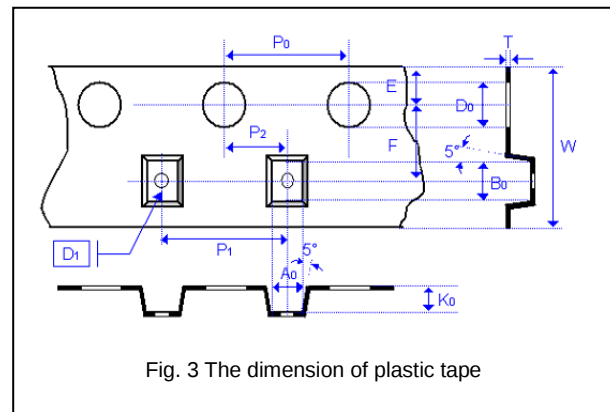
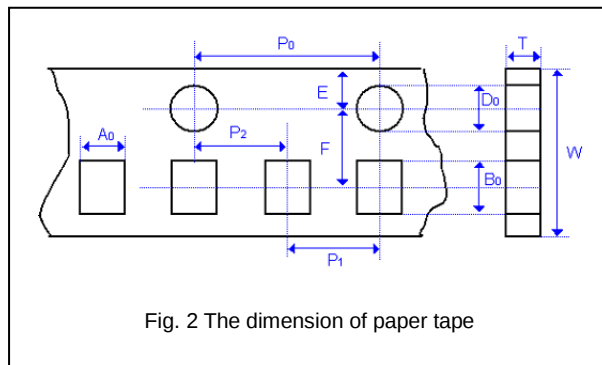
Approval Sheet

No	Item	Test Condition	Requirements																																																																																																																																																										
15.	High Temperature Load (Endurance)	Test temp. : NP0, X7R/X7E/X7S: 125±3°C X6S: 105±3°C X5R: 85±3°C Test time: 1000+24/-0 hrs. To apply voltage: (1) 100% of rated voltage for below range. <table><tr><th>Size</th><th>Dielectric</th><th>Rated voltage</th><th>Capacitance</th></tr><tr><td rowspan="2">0201</td><td rowspan="2">X5R/X7R/ X6S/X7S</td><td>≤10V</td><td>C ≥ 0.1μF</td></tr><tr><td>≥16V</td><td>C > 0.1μF</td></tr><tr><td rowspan="4">0402</td><td rowspan="2">X5R</td><td>≤16V</td><td>C > 1.0μF</td></tr><tr><td>25V, 50V</td><td>C ≥ 1.0μF</td></tr><tr><td rowspan="2">X6S</td><td>6.3V, 10V</td><td>C > 1.0μF</td></tr><tr><td>16V, 25V</td><td>C ≥ 1.0μF</td></tr><tr><td rowspan="4">0603</td><td rowspan="2">X5R/X7R/ X6S/X7S</td><td>6.3V, 10V</td><td>C ≥ 4.7μF¹⁾</td></tr><tr><td>25V</td><td>C ≥ 1.0μF</td></tr><tr><td rowspan="2">X7R</td><td>35V</td><td>C ≥ 1.0μF</td></tr><tr><td rowspan="4">0805</td><td rowspan="2">X5R/X7R/ X6S/X7S</td><td>4V</td><td>C ≥ 47μF</td></tr><tr><td>6.3V</td><td>C ≥ 22μF</td></tr><tr><td rowspan="2">X6S</td><td>10V, 50V</td><td>C ≥ 10μF</td></tr><tr><td>16V</td><td>C > 10μF</td></tr><tr><td rowspan="3">1206</td><td rowspan="2">X5R/X7R/X6S</td><td>≤6.3V</td><td>C ≥ 47μF</td></tr><tr><td>16V</td><td>C ≥ 47μF</td></tr><tr><td>X7R</td><td>100V</td><td>C ≥ 3.3μF</td></tr></table> **1WV items must follow de-rating conditions. #1. 0603X106(10V)&0603S106(4V&6.3V): 150% of rated voltage (2) 150% of rated voltage for below range. <table><tr><th>Size</th><th>Dielectric</th><th>Rated voltage</th><th>Capacitance</th></tr><tr><td rowspan="2">0201</td><td rowspan="2">X5R/X6S</td><td>16V, 25V</td><td>C=0.1μF</td></tr><tr><td>X7R</td><td>16V</td><td>C ≥ 0.022μF</td></tr><tr><td rowspan="2">0402</td><td rowspan="2">X7R/X5R/ X6S</td><td>50V</td><td>C > 0.01μF</td></tr><tr><td>10~25V</td><td>C ≥ 0.22μF</td></tr><tr><td rowspan="4">0603</td><td rowspan="2">X7S</td><td>50V~100V</td><td>C > 0.22μF</td></tr><tr><td>50V</td><td>C > 0.1μF</td></tr><tr><td rowspan="2">X7R</td><td>25V</td><td>C = 1.0μF</td></tr><tr><td>X5R</td><td>50V</td><td>C ≥ 1.0μF</td></tr><tr><td rowspan="4">0805</td><td rowspan="2">X5R/X7R/ X6S/X7S</td><td>10V, 16V</td><td>C ≥ 1.0μF</td></tr><tr><td>100V</td><td>C ≥ 0.47μF</td></tr><tr><td rowspan="2">X7R</td><td>50V</td><td>C ≥ 0.68μF</td></tr><tr><td>35V</td><td>C ≥ 2.2μF</td></tr><tr><td rowspan="4">1206</td><td rowspan="2">X7R</td><td>10~25V</td><td>C ≥ 4.7μF</td></tr><tr><td>100V</td><td>C ≥ 1.0μF</td></tr><tr><td rowspan="2">X5R/X6S/ X7S</td><td>50V</td><td>C ≥ 2.2μF</td></tr><tr><td>100V</td><td>C > 1.0μF</td></tr><tr><td rowspan="2">1210</td><td rowspan="2">X5R/X7R/ X6S/X7S</td><td>50V</td><td>C = 4.7μF</td></tr><tr><td>50V~100V</td><td>C ≥ 2.2μF</td></tr><tr><td>1825 2220 2225</td><td>X7R</td><td>100V~250V</td><td>C ≥ 1.0μF</td></tr></table> (3) ≤6.3V or C ≥ 10μF: 150% of rated voltage. (4) 10V~250V: 200% of rated voltage. (5) 400V~450V: 120% of rated voltage. (6) 500V: 150% of rated voltage. (7) 630V~3000V: 120% of rated voltage, Excluding 1210/X7R/103/2KV(110% of rated voltage) (8) 4000V: 110% of rated voltage * 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. * De-rating conditions:  Rated (Operating) Voltage (V) Temperature at Product (°C) Product for 125°C Product for 105°C Product for 85°C	Size	Dielectric	Rated voltage	Capacitance	0201	X5R/X7R/ X6S/X7S	≤10V	C ≥ 0.1μF	≥16V	C > 0.1μF	0402	X5R	≤16V	C > 1.0μF	25V, 50V	C ≥ 1.0μF	X6S	6.3V, 10V	C > 1.0μF	16V, 25V	C ≥ 1.0μF	0603	X5R/X7R/ X6S/X7S	6.3V, 10V	C ≥ 4.7μF ¹⁾	25V	C ≥ 1.0μF	X7R	35V	C ≥ 1.0μF	0805	X5R/X7R/ X6S/X7S	4V	C ≥ 47μF	6.3V	C ≥ 22μF	X6S	10V, 50V	C ≥ 10μF	16V	C > 10μF	1206	X5R/X7R/X6S	≤6.3V	C ≥ 47μF	16V	C ≥ 47μF	X7R	100V	C ≥ 3.3μF	Size	Dielectric	Rated voltage	Capacitance	0201	X5R/X6S	16V, 25V	C=0.1μF	X7R	16V	C ≥ 0.022μF	0402	X7R/X5R/ X6S	50V	C > 0.01μF	10~25V	C ≥ 0.22μF	0603	X7S	50V~100V	C > 0.22μF	50V	C > 0.1μF	X7R	25V	C = 1.0μF	X5R	50V	C ≥ 1.0μF	0805	X5R/X7R/ X6S/X7S	10V, 16V	C ≥ 1.0μF	100V	C ≥ 0.47μF	X7R	50V	C ≥ 0.68μF	35V	C ≥ 2.2μF	1206	X7R	10~25V	C ≥ 4.7μF	100V	C ≥ 1.0μF	X5R/X6S/ X7S	50V	C ≥ 2.2μF	100V	C > 1.0μF	1210	X5R/X7R/ X6S/X7S	50V	C = 4.7μF	50V~100V	C ≥ 2.2μF	1825 2220 2225	X7R	100V~250V	C ≥ 1.0μF	* 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%; 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><tr><th>Rated vol.</th><th>D.F. ≤</th><th>Exception of D.F. ≤</th></tr><tr><td rowspan="3">≥ 100V</td><td rowspan="3">≤ 3%</td><td>≤ 6% 1206 ≥ 0.47μF ≤ 7.5% 0603 ≥ 0.068μF; 0805 > 0.1μF; 1206 ≥ 1μF; 1210 ≥ 2.2μF; TT series ≤ 20% 0805 > 0.22μF; 1210 ≥ 3.3μF</td></tr><tr><td>≤ 6% 0201(50V); 0603 ≥ 0.047μF; 0805 ≥ 0.18μF; 1206 ≥ 0.47μF ≤ 10% 0201 ≥ 0.01μF; 1210 ≥ 3.3μF</td></tr><tr><td>≤ 20% 0402 ≥ 0.012μF; 0603 > 0.1μF; 0805 ≥ 1μF(0805/X7R > 0.47μF); 1206 ≥ 2.2μF; 1210 ≥ 10μF; TT series</td></tr><tr><td rowspan="3">50V</td><td rowspan="3">≤ 3%</td><td>≤ 20% 0603 ≥ 1μF; 0805 ≥ 2.2μF; 1206 ≥ 2.2μF; 1210 ≥ 10μF ≤ 10% 0201 ≥ 0.01μF(0201/X5R = 0.01μF); 0805 ≥ 1μF; 1210 ≥ 10μF*</td></tr><tr><td>≤ 14% 0603 ≥ 0.33μF ≤ 15% 0201 ≥ 0.1μF(0201/X5R > 0.01μF); 0603 ≥ 0.47μF; TT series</td></tr><tr><td>≤ 20% 0402 ≥ 0.10μF(0402/X7R ≥ 0.056μF); 0805 ≥ 2.2μF; 1206 ≥ 4.7μF; 1210 ≥ 22μF(1210/X5R ≥ 10μF)*;</td></tr><tr><td rowspan="3">35V</td><td rowspan="3">≤ 5%</td><td>≤ 20% 0402 ≥ 0.47μF ≤ 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 > 0.47μF; 0805 ≥ 2.2μF; 1206 ≥ 4.7μF; 1210 ≥ 22μF; TT series</td></tr><tr><td>≤ 20% 0201 ≥ 0.012μF; 0402 ≥ 0.22μF; 0603 ≥ 0.33μF; 0805 ≥ 2.2μF; 1206 ≥ 2.2μF; 1210 ≥ 22μF</td></tr><tr><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>25V</td><td>≤ 5%</td><td>≤ 20% 0402 ≥ 0.47μF</td></tr><tr><td>16V</td><td>≤ 5%</td><td>≤ 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 > 0.47μF; 0805 ≥ 2.2μF; 1206 ≥ 4.7μF; 1210 ≥ 22μF; TT series</td></tr><tr><td>10V</td><td>≤ 7.5%</td><td>≤ 20% 0201 ≥ 0.012μF; 0402 ≥ 0.22μF; 0603 ≥ 0.33μF; 0805 ≥ 2.2μF; 1206 ≥ 2.2μF; 1210 ≥ 22μF ≤ 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>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></table> *I.R.: ≥10V, 1GΩ or 50 Ω-F whichever is smaller. Class II (X7R, X5R, X6S, X7S) <table><tr><th>Rated voltage</th><th>Insulation Resistance</th></tr><tr><td>100V: All X7R; 1210 ≥ 3.3μF</td><td rowspan="7">1GΩ or RxC ≥ 10 Ω-F whichever is smaller.</td></tr><tr><td>50V: 0402 > 0.01μF; 0603 ≥ 1μF; 0805 ≥ 1μF; 1206 ≥ 4.7μF; 1210 ≥ 4.7μF</td></tr><tr><td>35V: 0603 ≥ 1μF; 0805 ≥ 2.2μF; 1206 ≥ 2.2μF; 1210 ≥ 10μF</td></tr><tr><td>25V: 0201 ≥ 0.1μF; 0402 ≥ 0.22μF; 0603 ≥ 2.2μF; 0805 ≥ 2.2μF; 1206 ≥ 10μF; 1210 ≥ 10μF</td></tr><tr><td>16V: 0201 ≥ 0.1μF; 0402 ≥ 0.22μF; 0603 ≥ 1μF; 0805 ≥ 2.2μF; 1206 ≥ 10μF; 1210 ≥ 47μF</td></tr><tr><td>10V: 0201 ≥ 47nF; 0402 ≥ 0.47μF; 0603 ≥ 0.47μF; 0805 ≥ 2.2μF; 1206 ≥ 4.7μF; 1210 ≥ 47μF</td></tr><tr><td>6.3V; 4V; TT series; All X6S/X7S items; Size ≥ 1812</td></tr></table>	Rated vol.	D.F. ≤	Exception of D.F. ≤	≥ 100V	≤ 3%	≤ 6% 1206 ≥ 0.47μF ≤ 7.5% 0603 ≥ 0.068μF; 0805 > 0.1μF; 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 ≥ 3.3μF	≤ 20% 0402 ≥ 0.012μF; 0603 > 0.1μF; 0805 ≥ 1μF(0805/X7R > 0.47μF); 1206 ≥ 2.2μF; 1210 ≥ 10μF; TT series	50V	≤ 3%	≤ 20% 0603 ≥ 1μF; 0805 ≥ 2.2μF; 1206 ≥ 2.2μF; 1210 ≥ 10μF ≤ 10% 0201 ≥ 0.01μF(0201/X5R = 0.01μF); 0805 ≥ 1μF; 1210 ≥ 10μF*	≤ 14% 0603 ≥ 0.33μF ≤ 15% 0201 ≥ 0.1μF(0201/X5R > 0.01μF); 0603 ≥ 0.47μF; TT series	≤ 20% 0402 ≥ 0.10μF(0402/X7R ≥ 0.056μF); 0805 ≥ 2.2μF; 1206 ≥ 4.7μF; 1210 ≥ 22μF(1210/X5R ≥ 10μF)*;	35V	≤ 5%	≤ 20% 0402 ≥ 0.47μF ≤ 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 > 0.47μF; 0805 ≥ 2.2μF; 1206 ≥ 4.7μF; 1210 ≥ 22μF; TT series	≤ 20% 0201 ≥ 0.012μF; 0402 ≥ 0.22μF; 0603 ≥ 0.33μF; 0805 ≥ 2.2μF; 1206 ≥ 2.2μF; 1210 ≥ 22μF	≤ 30% 0201 ≥ 0.1μF; 0402 ≥ 1μF(0402/X6S ≥ 0.47μF); 0603 ≥ 10μF; 0805 ≥ 4.7μF; 1206 ≥ 47μF; 1210 ≥ 100μF; TT series	25V	≤ 5%	≤ 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 > 0.47μF; 0805 ≥ 2.2μF; 1206 ≥ 4.7μF; 1210 ≥ 22μF; TT series	10V	≤ 7.5%	≤ 20% 0201 ≥ 0.012μF; 0402 ≥ 0.22μF; 0603 ≥ 0.33μF; 0805 ≥ 2.2μF; 1206 ≥ 2.2μF; 1210 ≥ 22μF ≤ 30% 0201 ≥ 0.1μF; 0402 ≥ 1μF(0402/X6S ≥ 0.47μF); 0603 ≥ 10μF; 0805 ≥ 4.7μF; 1206 ≥ 47μF; 1210 ≥ 100μF; TT series	6.3V	≤ 15%	≤ 30% 0201 ≥ 0.1μF; 0402 ≥ 1μF(0402/X6S ≥ 0.47μF); 0603 ≥ 10μF; 0805 ≥ 4.7μF; 1206 ≥ 47μF; 1210 ≥ 100μF; TT series	4V	≤ 20%	--	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
Size	Dielectric	Rated voltage	Capacitance																																																																																																																																																										
0201	X5R/X7R/ X6S/X7S	≤10V	C ≥ 0.1μF																																																																																																																																																										
		≥16V	C > 0.1μF																																																																																																																																																										
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	X6S	6.3V, 10V	C > 1.0μF																																																																																																																																																										
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0603	X5R/X7R/ X6S/X7S	6.3V, 10V	C ≥ 4.7μF ¹⁾																																																																																																																																																										
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	X7R	35V	C ≥ 1.0μF																																																																																																																																																										
		0805	X5R/X7R/ X6S/X7S	4V	C ≥ 47μF																																																																																																																																																								
6.3V	C ≥ 22μF																																																																																																																																																												
X6S	10V, 50V		C ≥ 10μF																																																																																																																																																										
	16V		C > 10μF																																																																																																																																																										
1206	X5R/X7R/X6S	≤6.3V	C ≥ 47μF																																																																																																																																																										
		16V	C ≥ 47μF																																																																																																																																																										
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		10~25V	C ≥ 0.22μF																																																																																																																																																										
0603	X7S	50V~100V	C > 0.22μF																																																																																																																																																										
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	X7R	25V	C = 1.0μF																																																																																																																																																										
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0805	X5R/X7R/ X6S/X7S	10V, 16V	C ≥ 1.0μF																																																																																																																																																										
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1210	X5R/X7R/ X6S/X7S	50V	C = 4.7μF																																																																																																																																																										
		50V~100V	C ≥ 2.2μF																																																																																																																																																										
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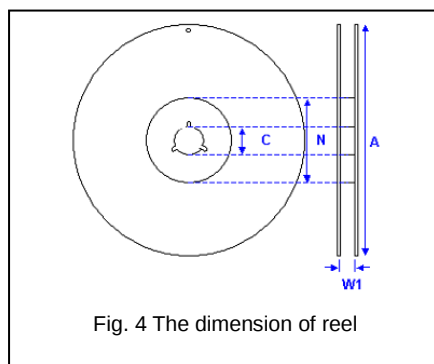
* "Room condition" Temperature: 15 to 35°C, Relative humidity: 25 to 75%, Atmospheric pressure: 86 to 106kPa.

APPENDIXES

■ Tape & reel dimensions

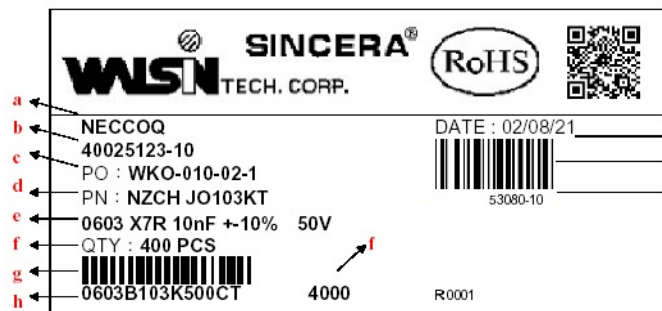


Size	0402	0603	0805			1206			1210		1808	1812		1825		2220		2225	
Thickness	N,E	S,X	A,H	B,T	D,I	B,T	C,J, D	G,P	C,D, G,K	M	D,F, G,K	D,F, G,K	M,U	K	M,U	K	M,U	K	M,U
A ₀	0.70 +/-0.20	1.05 +/-0.30	1.50 +/-0.20	1.50 +/-0.20	< 1.80	1.90 +/-0.50	< 2.00	< 2.30	< 3.05	< 3.20	< 2.50	< 3.90	< 3.90	< 6.80	< 6.80	< 5.80	< 5.80	< 6.80	< 6.80
B ₀	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	< 4.00	< 5.30	< 5.30	< 5.30	< 5.30	< 5.30	< 6.50	< 6.50	< 6.50	< 6.50
T	≤ 0.80	≤ 1.20	≤ 1.15	≤ 1.20	0.23 +/-0.1	≤ 1.20	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	0.30 +/-0.1	0.30 +/-0.1	0.30 +/-0.1	0.30 +/-0.1	0.30 +/-0.1	0.30 +/-0.1
K ₀	-	-	-	-	< 2.50	-	< 2.50	< 2.50	< 2.50	< 3.20	< 2.50	< 2.50	< 3.50	< 2.50	< 3.50	< 2.50	< 3.50	< 2.50	< 3.50
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	12.00 +/-0.30	12.00 +/-0.30	12.00 +/-0.30	12.00 +/-0.30	12.00 +/-0.30	12.00 +/-0.30	12.00 +/-0.30	12.00 +/-0.30	12.00 +/-0.30
P ₀	4.00 +/-0.10	4.00 +/-0.10	4.00 +/-0.10	4.00 +/-0.10	4.00 +/-0.10	4.00 +/-0.10	4.00 +/-0.10	4.00 +/-0.10	4.00 +/-0.10	4.00 +/-0.10	4.00 +/-0.10	4.00 +/-0.10	4.00 +/-0.10	4.00 +/-0.10	4.00 +/-0.10	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	40.00 +/-0.20	40.00 +/-0.20	40.00 +/-0.20	40.00 +/-0.20	40.00 +/-0.20	40.00 +/-0.20
	2.00 +/-0.05	4.00 +/-0.10	4.00 +/-0.10	4.00 +/-0.10	4.00 +/-0.10	4.00 +/-0.10	4.00 +/-0.10	4.00 +/-0.10	4.00 +/-0.10	4.00 +/-0.10	4.00 +/-0.10	8.00 +/-0.10	8.00 +/-0.10	8.00 +/-0.10	8.00 +/-0.10	8.00 +/-0.10	8.00 +/-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	2.00 +/-0.10	2.00 +/-0.10	2.00 +/-0.10	2.00 +/-0.10	2.00 +/-0.10	2.00 +/-0.10
D ₀	1.50 +/-0.10	1.50 +/-0.10	1.50 +/-0.10	1.50 +/-0.10	1.50 +/-0.10	1.50 +/-0.10	1.50 +/-0.10	1.50 +/-0.10	1.50 +/-0.10	1.50 +/-0.10	1.50 +/-0.10	1.50 +/-0.10	1.50 +/-0.10	1.50 +/-0.10	1.50 +/-0.10	1.50 +/-0.10	1.50 +/-0.10	1.50 +/-0.10	1.50 +/-0.10
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	1.50 +/-0.10	1.50 +/-0.10	1.50 +/-0.10	1.50 +/-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	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	5.50 +/-0.10	5.50 +/-0.10	5.50 +/-0.10	5.50 +/-0.10	5.50 +/-0.10	5.50 +/-0.10



Size	0402, 0603, 0805, 1206, 1210	1808 to 2225
Reel size	7"	10"
C	13.0±0.5	13.0±0.5
W ₁	10.0±1.5	10.0±1.5
A	178.0±2.0	250.0±2.0
N	60.0±1.0/-0	50 min

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		X7R
①	Ceramic material		BaTiO ₃ based
②	Inner electrode		Ni
③	Termination	Inner layer	Cu + Cu Polymer
④		Middle layer	Ni
⑤		Outer layer	Sn

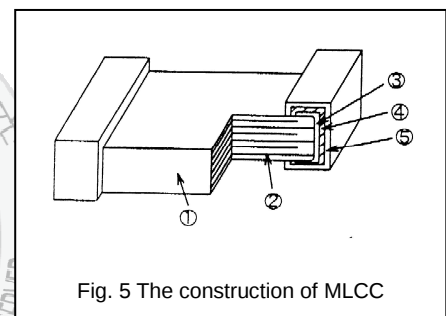


Fig. 5 The construction of MLCC

Storage and handling conditions

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

Cautions:

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

Recommended soldering conditions

The lead-free termination MLCCs are not only to be used on SMT against lead-free solder paste, but also suitable against lead-containing solder paste. If the optimized solder joint is requested, increasing soldering time, temperature and concentration of N_2 within oven are recommended.

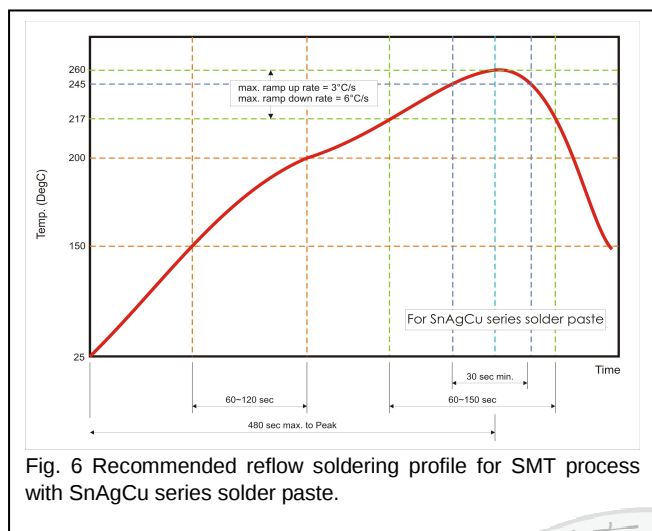


Fig. 6 Recommended reflow soldering profile for SMT process with SnAgCu series solder paste.

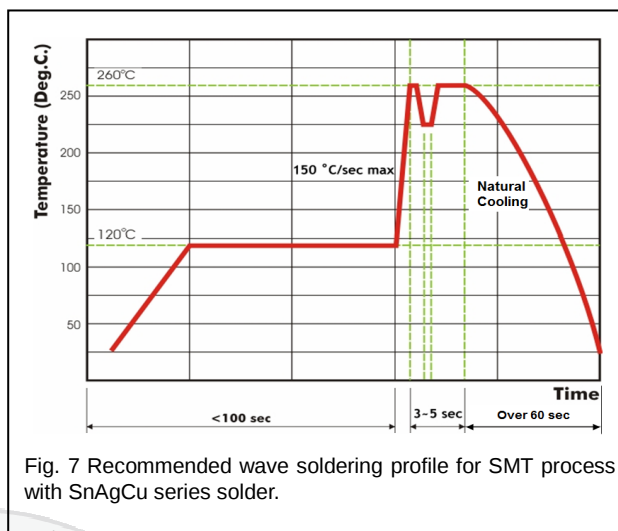


Fig. 7 Recommended wave soldering profile for SMT process with SnAgCu series solder.



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