

APPROVAL SHEET

MULTILAYER CERAMIC CAPACITORS

Soft Termination Series

(SH_6.3V to 4000V)

NP0, X7R & X5R Dielectrics

0402 to 2225 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>SH</u>	<u>31</u>	<u>B</u>	<u>104</u>	<u>K</u>	<u>500</u>	<u>C</u>	<u>I</u>
Series	Size	Dielectric	Capacitance	Tolerance	Rated voltage	Termination	Packaging
SH=Soft termination	15=0402 (1005) 18=0603 (1608) 21=0805 (2012) 31=1206 (3216) 32=1210 (3225) 42=1808 (4520) 43=1812 (4532) 46=1825 (4563) 55=2220 (5750) 56=2225 (5763)	N=NP0 (C0G) B=X7R X=X5R	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%	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 350=35 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 252=2500 VDC 302=3000 VDC 402=4000 VDC	C=Ag Polymer /Ni/Sn	T=7" reeled G=13" reeled

5. EXTERNAL DIMENSIONS & CONSTRUCTIONS

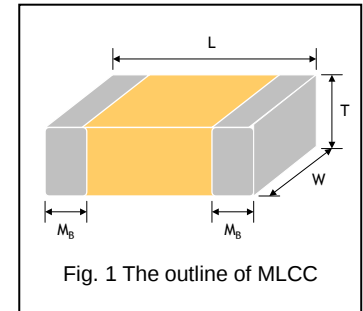
Size Inch (mm)	L (mm)	W (mm)	T (mm)/Symbol	Remark	M _B (mm)
0402 (1005)	1.00±0.20	0.50±0.20	0.50±0.20 E	#	0.25 +0.05/-0.10
0603 (1608)	1.60±0.20	0.80±0.10	0.80±0.07 S		0.40±0.15
	1.60±0.30	0.80±0.30	0.80±0.30 X		
0805 (2012)	2.00±0.20	1.25±0.10	0.60±0.10 A		0.50±0.20
			0.80±0.10 B		
			1.25±0.10 D	#	
	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 (0.50±0.25)*
			0.95±0.10 C	#	
			1.15±0.15 J	#	
			1.25±0.10 D	#	
	3.20+0.4/-0.1 3.30±0.30#2	1.60±0.20	1.60±0.20 G	#	
			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	#	
			2.50±0.30#1		
1808 (4520)	4.50+0.6/-0.4	2.03±0.25	1.25±0.10 D	#	0.50±0.25
			2.00±0.20 K	#	
1812 (4532)	4.50+0.6/-0.4	3.20±0.30	0.95±0.10 C	#	0.75±0.25 (0.50±0.25)*
			1.25±0.10 D	#	
			1.60±0.20 G	#	
			2.00±0.20 K	#	
		3.20±0.40	2.50±0.50 M	#	
			2.80±0.30 U	#	
			3.10±0.30 R		
1825 (4563)	4.50+0.6/-0.4	6.30±0.40	2.00±0.20 (K)	#	0.75±0.35
2220 (5750)	5.70±0.50	5.00±0.40	2.50±0.30 (M)	#	0.85±0.35
2225 (5763)	5.70±0.50	6.30±0.40	2.80±0.30 (U)	#	0.85±0.35
			3.10±0.30 (R)	#	

Reflow soldering only is recommended.

* For 1206 ≥ 1000V, 1808/1812 200V~4000V products. Excluding: 1206B183~223/1000V

#1 For 1210N563 to 1210N104/200V~250V

#2 For 1206B183~223/1000V



6. GENERAL ELECTRICAL DATA

Dielectric	NP0	X7R	X5R
Size	0402, 0603, 0805, 1206, 1210, 1808, 1812, 1825, 2220, 2225		
Capacitance range*	0.1pF to 0.1μF	100pF to 47μF	0.033μF to 10μF
Capacitance tolerance**	Cap≤5pF ^{#1} : B (±0.1pF), C (±0.25pF) 5pF<Cap<10pF ^{#1} : A (±0.05pF), B (±0.1pF) , C (±0.25pF), D (±0.5pF) Cap≥10pF: F (±1%), G (±2%), J (±5%), K (±10%)	K (±10%), M (±20%)	
Rated voltage (WVDC)	6.3V to 4000V		
Operating temperature	-55 to +125°C	-55 to +125°C	-55 to +85°C
Capacitance characteristic	±30ppm	±15%	±15%
Termination	Ni/Sn (lead-free termination)		

#1: NP0, 0.1pF and 5pF < Cap < 10pF products need to check with sales if it can supply A (±0.05pF).

* 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.

7. CAPACITANCE RANGE (NP0 Dielectric)

NP0 Dielectric 0402, 0603 Sizes

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

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

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

Multilayer Ceramic Capacitors

Approval Sheet

NP0 Dielectric 0805 Size

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

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

Approval Sheet

NP0 Dielectric 1206 Size

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

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Multilayer Ceramic Capacitors

Approval Sheet

NP0 Dielectric 1210 Size

DIELECTRIC		NP0											
SIZE		1210											
RATED VOLTAGE (VDC)		10	16	25	50	100	200	250	500	630	1000	1500	2000
Capacitance	10pF (100)	C	C	C	C	C	C	C	C	C	C	C	C
	12pF (120)	C	C	C	C	C	C	C	C	C	C	C	C
	15pF (150)	C	C	C	C	C	C	C	C	C	C	C	C
	18pF (180)	C	C	C	C	C	C	C	C	C	C	C	C
	22pF (220)	C	C	C	C	C	C	C	C	C	C	C	C
	27pF (270)	C	C	C	C	C	C	C	C	C	C	C	C
	33pF (330)	C	C	C	C	C	C	C	C	C	C	C	C
	39pF (390)	C	C	C	C	C	C	C	C	C	C	C	C
	47pF (470)	C	C	C	C	C	C	C	C	C	C	C	C
	56pF (560)	C	C	C	C	C	C	C	C	C	C	D	D
	68pF (680)	C	C	C	C	C	C	C	C	C	C	D	D
	82pF (820)	C	C	C	C	C	C	C	C	C	C	D	D
	100pF (101)	C	C	C	C	C	C	C	C	C	D	D	D
	120pF (121)	C	C	C	C	C	C	C	C	C	D	D	D
	150pF (151)	C	C	C	C	C	C	C	C	C	D	G	G
	180pF (181)	C	C	C	C	C	C	C	C	C	D	G	G
	220pF (221)	C	C	C	C	C	C	C	C	C	G	G	G
	270pF (271)	C	C	C	C	C	C	C	C	C	G	K	K
	330pF (331)	C	C	C	C	C	C	C	C	C	G	K	K
	390pF (391)	C	C	C	C	C	C	C	C	C	G	M	M
	470pF (471)	C	C	C	C	C	C	C	C	C	G	M	M
	560pF (561)	C	C	C	C	C	C	C	C	C	G		
	680pF (681)	C	C	C	C	C	C	C	C	C	G		
	820pF (821)	C	C	C	C	C	C	C	C	C	G		
	1,000pF (102)	C	C	C	C	C	D	D	D	D	G		
	1,200pF (122)	C	C	C	C	C	D	D	D	D	G		
	1,500pF (152)	C	C	C	C	C	D	D	D	D	K		
	1,800pF (182)	C	C	C	C	C	D	D	D	D	M		
	2,200pF (222)	C	C	C	C	C	D	D	D	D	M		
	2,700pF (272)	C	C	C	C	C	D	D	D	D	M		
	3,300pF (332)	C	C	C	C	C	D	D	D	D	M		
	3,900pF (392)	C	C	C	C	C	D	D	D	D	M		
	4,700pF (472)	C	C	C	C	C	G	G	G	G	M		
	5,600pF (562)	C	C	C	C	C	G	G	G	G	M		
	6,800pF (682)	C	C	C	C	C	G	G	G	G	M		
	8,200pF (822)	C	C	C	C	C	G	G	G	G	M		
	0.010μF (103)	C	C	C	C	C	G	G	K	K	M		
	0.012μF (123)	D	D	D	D	D	K	K	M	M	M		
	0.015μF (153)	D	D	D	D	D	K	K	M	M	M		
	0.018μF (183)	K	K	K	K	K	K	K	M	M	M		
	0.022μF (223)	K	K	K	K	K	K	K	M	M	M		
	0.027μF (273)	K	K	K	K	K	K	K	M	M			
	0.033μF (333)	K	K	K	K	K	K	K	M	M			
	0.039μF (393)	K	K	K	K	K	K	K					
	0.047μF (473)	K	K	K	K	K	K	K					
	0.056μF (563)						M	M					
	0.068μF (683)						M	M					
	0.082μF (823)						M	M					
	0.1μF (104)						M	M					

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

Approval Sheet

NP0 Dielectric 1808 Size

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

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Multilayer Ceramic Capacitors

Approval Sheet

NP0 Dielectric 1812 Size

DIELECTRIC		NP0												
SIZE		1812												
RATED VOLTAGE (VDC)		10	16	25	50	100	200	250	500	630	1000	1500	2000	3000
Capacitance	10pF (100)	D	D	D	D	D	D	D	D	D	D	D	D	D
	12pF (120)	D	D	D	D	D	D	D	D	D	D	D	D	D
	15pF (150)	D	D	D	D	D	D	D	D	D	D	D	D	D
	18pF (180)	D	D	D	D	D	D	D	D	D	D	D	D	D
	22pF (220)	D	D	D	D	D	D	D	D	D	D	D	D	D
	27pF (270)	D	D	D	D	D	D	D	D	D	D	D	D	D
	33pF (330)	D	D	D	D	D	D	D	D	D	D	D	D	D
	39pF (390)	D	D	D	D	D	D	D	D	D	D	D	D	D
	47pF (470)	D	D	D	D	D	D	D	D	D	D	D	D	D
	56pF (560)	D	D	D	D	D	D	D	D	D	D	D	D	D
	68pF (680)	D	D	D	D	D	D	D	D	D	D	D	D	D
	82pF (820)	D	D	D	D	D	D	D	D	D	D	D	D	D
	100pF (101)	D	D	D	D	D	D	D	D	D	D	D	D	D
	120pF (121)	D	D	D	D	D	D	D	D	D	D	D	D	D
	150pF (151)	D	D	D	D	D	D	D	D	D	D	D	D	D
	180pF (181)	D	D	D	D	D	D	D	D	D	D	D	D	K
	220pF (221)	D	D	D	D	D	D	D	D	D	D	D	D	K
	270pF (271)	D	D	D	D	D	D	D	D	D	D	K	K	K
	330pF (331)	D	D	D	D	D	D	D	D	D	D	K	K	K
	390pF (391)	D	D	D	D	D	D	D	D	D	D	K	K	K
	470pF (471)	D	D	D	D	D	D	D	D	D	K	K	K	K
	560pF (561)	D	D	D	D	D	D	D	D	D	K	K	K	G
	680pF (681)	D	D	D	D	D	D	D	D	D	K	K	K	K
	820pF (821)	D	D	D	D	D	D	D	D	D	K	K	K	M
	1,000pF (102)	D	D	D	D	D	D	D	D	D	K	K	K	M
	1,200pF (122)	D	D	D	D	D	D	D	D	D	K			U
	1,500pF (152)	D	D	D	D	D	D	D	D	D	K			
	1,800pF (182)	D	D	D	D	D	D	D	D	D	K			
	2,200pF (222)	D	D	D	D	D	D	D	D	D	K			
	2,700pF (272)	D	D	D	D	D	D	D	D	D	K			
	3,300pF (332)	D	D	D	D	D	D	D	D	D	K			
	3,900pF (392)	D	D	D	D	D	D	D	D	D	M			
	4,700pF (472)	D	D	D	D	D	D	D	D	D	M			
	5,600pF (562)	D	D	D	D	D	D	D	D	D	M			
	6,800pF (682)	D	D	D	D	D	D	D	D	D				
	8,200pF (822)	D	D	D	D	D	C	C	D	D				
	0.010μF (103)	D	D	D	D	D	C	C	D	D				
	0.012μF (123)	D	D	D	D	D	G	G	G	G				
	0.015μF (153)	D	D	D	D	D	G	G	G	G				
	0.018μF (183)	D	D	D	D	D	K	K	K	K				
	0.022μF (223)	D	D	D	D	D	K	K	K	K				
	0.027μF (273)	D	D	D	D	D	M	M						
	0.033μF (333)	D	D	D	D	D	M	M						
	0.039μF (393)						M	M						
	0.047μF (473)						M	M						
	0.056μF (563)						M	M						
	0.068μF (683)						M	M						
	0.082μF (823)						U	U						
	0.1μF (104)						R	R						

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.

NP0 Dielectric 1825 to 2225 Sizes

DIELECTRIC		NP0																				
SIZE		1825						2220						2225								
RATED VOLTAGE (VDC)		100	200	500	1000	2000	3000	100	200	500	630	1000	2000	3000	100	200	500	630	1000	2000	3000	4000
Capacitance	10pF (100)	K	K	K	K	K	K	K	K	K	K	K	K	K	K	K	K	K	K	K	K	K
	12pF (120)	K	K	K	K	K	K	K	K	K	K	K	K	K	K	K	K	K	K	K	K	K
	15pF (150)	K	K	K	K	K	K	K	K	K	K	K	K	K	K	K	K	K	K	K	K	K
	18pF (180)	K	K	K	K	K	K	K	K	K	K	K	K	K	K	K	K	K	K	K	K	K
	22pF (220)	K	K	K	K	K	K	K	K	K	K	K	K	K	K	K	K	K	K	K	K	K
	27pF (270)	K	K	K	K	K	K	K	K	K	K	K	K	K	K	K	K	K	K	K	K	K
	33pF (330)	K	K	K	K	K	K	K	K	K	K	K	K	K	K	K	K	K	K	K	K	K
	39pF (390)	K	K	K	K	K	K	K	K	K	K	K	K	K	K	K	K	K	K	K	K	K
	47pF (470)	K	K	K	K	K	K	K	K	K	K	K	K	K	K	K	K	K	K	K	K	K
	56pF (560)	K	K	K	K	K	K	K	K	K	K	K	K	K	K	K	K	K	K	K	K	K
	68pF (680)	K	K	K	K	K	K	K	K	K	K	K	K	K	K	K	K	K	K	K	K	K
	82pF (820)	K	K	K	K	K	K	K	K	K	K	K	K	K	K	K	K	K	K	K	K	K
	100pF (101)	K	K	K	K	K	K	K	K	K	K	K	K	K	K	K	K	K	K	K	K	K
	120pF (121)	K	K	K	K	K	K	K	K	K	K	K	K	K	K	K	K	K	K	K	K	
	150pF (151)	K	K	K	K	K	K	K	K	K	K	K	K	K	K	K	K	K	K	K	K	
	180pF (181)	K	K	K	K	K	K	K	K	K	K	K	K	K	K	K	K	K	K	K	K	
	220pF (221)	K	K	K	K	K	K	K	K	K	K	K	K	K	K	K	K	K	K	K	K	
	270pF (271)	K	K	K	K	K	K	K	K	K	K	K	K	K	K	K	K	K	K	K	K	
	330pF (331)	K	K	K	K	K	K	K	K	K	K	K	K	K	M	K	K	K	K	K	K	
	390pF (391)	K	K	K	K	K	K	K	K	K	K	K	K	K	M	K	K	K	K	K	K	
	470pF (471)	K	K	K	K	K	K	K	K	K	K	K	K	K	M	K	K	K	K	K	K	
	560pF (561)	K	K	K	K	K	K	K	K	K	K	K	K	K	M	K	K	K	K	K	K	
	680pF (681)	K	K	K	K	K	M	K	K	K	K	K	K	K	M	K	K	K	K	K	K	
	820pF (821)	K	K	K	K	K	M	K	K	K	K	K	K	K	M	K	K	K	K	K	M	
	1,000pF (102)	K	K	K	K	K	M	K	K	K	K	K	K	K	M	K	K	K	K	K	M	
	1,200pF (122)	K	K	K	K	K		K	K	K	K	M	M	M	M	K	K	K	K	K	M	
	1,500pF (152)	K	K	K	K	M		K	K	K	K	M	M	M	M	K	K	K	K	K	M	
	1,800pF (182)	K	K	K	K	M		K	K	K	K	M	M			K	K	K	K	K	M	
	2,200pF (222)	K	K	K	K	M		K	K	K	K	M	M			K	K	K	K	K	M	
	2,700pF (272)	K	K	K	K	M		K	K	K	K	M	M			K	K	K	K	K	M	
	3,300pF (332)	K	K	K	K	M		K	K	K	K	M	M			K	K	K	K	K	M	
	3,900pF (392)	K	K	K	M	M		K	K	K	K	M	M			K	K	K	K	K	M	
	4,700pF (472)	K	K	K	M	M		K	K	K	K	M	M			K	K	K	K	K	M	
	5,600pF (562)	K	K	K	M			K	K	K	K	M				K	K	K	K	M	M	
	6,800pF (682)	K	K	K	M			K	K	K	K	M				K	K	K	K	M	M	
	8,200pF (822)	K	K	K	M			K	K	K	K	M				K	K	K	K	M	M	
0.010uF (103)	K	K	K	M			K	K	K	K	M				K	K	K	K	M	M		
0.012uF (123)	K	K	K				K	K	K	K					K	K	K	K				
0.015uF (153)	K	K	K				K	K	K	K					K	K	K	K				
0.018uF (183)	K	K	K				K	K	K	K					K	K	K	K				
0.022uF (223)	K	K	K				K	K	K	K					K	K	K	K				
0.027uF (273)	K	K	K				K	K	K	K					K	K	K	K				
0.033uF (333)	K	K	K				K	K	K	K					K	K	K	K				
0.039uF (393)	K	K	K				K	K	K	K					K	K	K	K				
0.047uF (473)	K	K	K				K	M	M	M					K	K	K	K				
0.056uF (563)	K	M	K				K	M	M	M					K	M	M	M				
0.068uF (683)	K	M	K				K	M	U	U					K	M	M	M				
0.082uF (823)	M						M		U	U					K	M	M					
0.1uF (104)	M						M		U	U					M	M						
0.12uF (124)																						
0.15uF (154)																						
0.18uF (184)																						
0.22uF (224)																						
0.27uF (274)																						

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7-1. CAPACITANCE RANGE (X7R Dielectric)

0402, 0603 Sizes

DIELECTRIC		X7R												
SIZE		0402					0603							
RATED VOLTAGE (VDC)		10	16	25	50	100	6.3	10	16	25	50	100	200	250
Capacitance	100pF (101)	E	E	E	E	E		S	S	S	S	S	X	X
	120pF (121)	E	E	E	E	E		S	S	S	S	S	X	X
	150pF (151)	E	E	E	E	E		S	S	S	S	S	X	X
	180pF (181)	E	E	E	E	E		S	S	S	S	S	X	X
	220pF (221)	E	E	E	E	E		S	S	S	S	S	X	X
	270pF (271)	E	E	E	E	E		S	S	S	S	S	X	X
	330pF (331)	E	E	E	E	E		S	S	S	S	S	X	X
	390pF (391)	E	E	E	E	E		S	S	S	S	S	X	X
	470pF (471)	E	E	E	E	E		S	S	S	S	S	X	X
	560pF (561)	E	E	E	E	E		S	S	S	S	S	X	X
	680pF (681)	E	E	E	E	E		S	S	S	S	S	X	X
	820pF (821)	E	E	E	E	E		S	S	S	S	S	X	X
	1,000pF (102)	E	E	E	E	E		S	S	S	S	S	X	X
	1,200pF (122)	E	E	E	E	E		S	S	S	S	S	X	X
	1,500pF (152)	E	E	E	E	E		S	S	S	S	S	X	X
	1,800pF (182)	E	E	E	E	E		S	S	S	S	S	X	X
	2,200pF (222)	E	E	E	E	E		S	S	S	S	S	X	X
	2,700pF (272)	E	E	E	E	E		S	S	S	S	S	X	X
	3,300pF (332)	E	E	E	E	E		S	S	S	S	S	X	X
	3,900pF (392)	E	E	E	E	E		S	S	S	S	S	X	X
	4,700pF (472)	E	E	E	E	E		S	S	S	S	S	X	X
	5,600pF (562)	E	E	E	E	E		S	S	S	S	S	X	X
	6,800pF (682)	E	E	E	E	E		S	S	S	S	S	X	X
	8,200pF (822)	E	E	E	E	E		S	S	S	S	S	X	X
	0.010μF (103)	E	E	E	E	E		S	S	S	S	S	X	X
	0.012μF (123)	E	E	E	E	E		S	S	S	S	X		
	0.015μF (153)	E	E	E	E	E		S	S	S	S	X		
	0.018μF (183)	E	E	E	E	E		S	S	S	S	X		
	0.022μF (223)	E	E	E	E	E		S	S	S	S	X		
	0.027μF (273)	E	E	E	E	E		S	S	S	S	X		
	0.033μF (333)	E	E	E	E	E		S	S	S	X	X		
	0.039μF (393)	E	E	E	E	E		S	S	S	X	X		
	0.047μF (473)	E	E	E	E	E		S	S	S	X	X		
	0.056μF (563)	E	E	E	E	E		S	S	S	X	X		
	0.068μF (683)	E	E	E	E	E		S	S	S	X	X		
	0.082μF (823)	E	E	E	E	E		S	S	S	X	X		
	0.10μF (104)	E	E	E	E	E		S	S	S	X	X		
	0.12μF (124)							S	S	X				
	0.15μF (154)							S	S	X				
	0.18μF (184)							S	S	X				
	0.22μF (224)							S	S	X	X			
	0.27μF (274)						X	X	X	X				
	0.33μF (334)							X	X	X	X			
	0.39μF (394)							X	X	X				
	0.47μF (474)						X	X	X	X	X			
	0.56μF (564)							X	X					
	0.68μF (684)						X	X	X					
	0.82μF (824)							X	X					
	1.0μF (105)						X	X	X	X	X			
	1.5μF (155)													
	2.2μF (225)						X	X	X					
	4.7μF (475)													

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Multilayer Ceramic Capacitors

Approval Sheet

X7R Dielectric 0805 Size

DIELECTRIC SIZE		X7R 0805									
RATED VOLTAGE (VDC)		10	16	25	50	100	200	250	500	630	1000
Capacitance	100pF (101)	D	D	D	D	D	D	D	B	B	B
	120pF (121)	D	D	D	D	D	D	D	B	B	B
	150pF (151)	D	D	D	D	D	D	D	B	B	B
	180pF (181)	D	D	D	D	D	D	D	B	B	B
	220pF (221)	D	D	D	D	D	D	D	B	B	B
	270pF (271)	D	D	D	D	D	D	D	B	B	B
	330pF (331)	D	D	D	D	D	D	D	B	B	B
	390pF (391)	D	D	D	D	D	D	D	B	B	B
	470pF (471)	D	D	D	D	D	D	D	B	B	B
	560pF (561)	D	D	D	D	D	D	D	B	B	B
	680pF (681)	D	D	D	D	D	D	D	B	B	B
	820pF (821)	D	D	D	D	D	D	D	B	B	B
	1,000pF (102)	D	D	D	D	D	D	D	B	B	B
	1,200pF (122)	D	D	D	D	D	D	D	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	I					
	0.33μF (334)	I	I	I	I	I					
	0.39μF (394)	I	I	I	I	I					
	0.47μF (474)	I	I	I	I	I					
	0.56μF (564)	I	I	I							
	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							
	4.7μF (475)	I	I	I							
	10μF (106)	I									

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

Multilayer Ceramic Capacitors

Approval Sheet

X7R Dielectric 1206 Size

DIELECTRIC		X7R														
SIZE		1206														
RATED VOLTAGE (VDC)		10	16	25	35	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	D	D
	1,000pF (102)	D	D	D		D	D	D	D			D	D	D	D	D
	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	G		
	0.022μF (223)	D	D	D		D	D	D	D			G	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	G	G							
	0.27μF (274)	C	C	C		D	G									
	0.33μF (334)	C	C	C		D	G									
	0.39μF (394)	C	C	J		P	G									
	0.47μF (474)	J	J	J		P	G									
	0.56μF (564)	J	J	J		P	P									
0.68μF (684)	J	J	J		P	P										
0.82μF (824)	J	J	J		P	P										
1.0μF (105)	J	J	J		P	P										
1.5μF (155)	J	J	P		P	P										
2.2μF (225)	J	J	P		P	P										
3.3μF (335)	P	P	P		P											
4.7μF (475)	P	P	P		P											
10μF (106)	P	P	P	P												
22μF (226)	P															
47μF (476)																

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Multilayer Ceramic Capacitors

Approval Sheet

X7R Dielectric 1210 Size

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

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X7R Dielectric 1808, 1812 Sizes

DIELECTRIC		X7R																			
SIZE		1808						1812													
RATED VOLTAGE (VDC)		500	630	1000	1500	2000	2500 3000	10	16	25	50	100	200	250	500	630	1000	1500	2000	3000	
Capacitance	100pF (101)																				
	150pF (151)	D	D	D	D	D	D														
	180pF (181)	D	D	D	D	D	D														
	220pF (221)	D	D	D	D	D	D														
	270pF (271)	D	D	D	D	D	D						D	D	D	D	D	D	D	K	
	330pF (331)	D	D	D	D	D	K						D	D	D	D	D	D	D	K	
	390pF (391)	D	D	D	D	D	K						D	D	D	D	D	D	D	K	
	470pF (471)	D	D	D	D	D	K						D	D	D	D	D	D	D	K	
	560pF (561)	D	D	D	D	D	K						D	D	D	D	D	D	D	K	
	680pF (681)	D	D	D	D	D	K						D	D	D	D	D	D	D	K	
	820pF (821)	D	D	D	D	D	K						D	D	D	D	D	D	D	K	
	1,000pF (102)	D	D	D	K	K	K	D	D	D	D	D	D	D	D	D	D	D	D	K	
	1,200pF (122)	D	D	D	K	K	K	D	D	D	D	D	D	D	D	D	D	D	D	K	
	1,500pF (152)	D	D	D	K	K	K	D	D	D	D	D	D	D	D	D	D	D	D	K	
	1,800pF (182)	D	D	D	K	K	K	D	D	D	D	D	D	D	D	D	D	D	G	M	
	2,200pF (222)	D	D	D	K	K	K	D	D	D	D	D	D	D	D	D	D	D	G	M	
	2,700pF (272)	D	D	D	K	K	K	D	D	D	D	D	D	D	D	D	D	D	G	M	
	3,300pF (332)	D	D	D	K	K	K	D	D	D	D	D	D	D	D	D	D	D	K	M	
	3,900pF (392)	D	D	D	K	K		D	D	D	D	D	D	D	D	D	D	D	K	M	
	4,700pF (472)	D	D	D	K	K		D	D	D	D	D	D	D	D	D	D	D	K	M	
	5,600pF (562)	K	K	K	K	K		D	D	D	D	D	D	D	D	D	D	D	M	M	
	6,800pF (682)	K	K	K	K	K		D	D	D	D	D	D	D	D	D	D	D	M	M	
	8,200pF (822)	K	K	K				D	D	D	D	D	D	D	D	D	D	D	M	M	
	0.010μF (103)	K	K	K				D	D	D	D	D	D	D	D	D	D	D	M	M	
	0.012μF (123)	K	K	K				D	D	D	D	D	D	D	D	D	D	K			
	0.015μF (153)	K	K	K				D	D	D	D	D	D	D	D	D	D	K			
	0.018μF (183)	K	K	K				D	D	D	D	D	D	D	D	D	D	M			
	0.022μF (223)	K	K	K				D	D	D	D	D	D	D	D	D	D	M			
	0.027μF (273)	K	K	K				D	D	D	D	D	D	D	D	D	D	M			
	0.033μF (333)	K	K	K				D	D	D	D	D	D	D	D	D	D	M			
	0.039μF (393)	K	K	K				D	D	D	D	D	D	D	D	D	D	M			
	0.047μF (473)	K	K	K				D	D	D	D	D	D	D	D	D	D	M			
	0.056μF (563)	K	K	K				D	D	D	D	D	D	D	D	K	K	M			
	0.068μF (683)	K	K					D	D	D	D	D	D	D	D	K	K	M			
	0.082μF (823)	K	K					D	D	D	D	D	D	D	D	K	K	M			
	0.10μF (104)							D	D	D	D	D	D	D	D	K	K	M			
	0.12μF (124)							D	D	D	D	D	D	D	D	M	M				
	0.15μF (154)							D	D	D	D	D	K	K	M	M					
	0.18μF (184)							D	D	D	D	D	K	K	M	M					
	0.22μF (224)							D	D	D	D	D	K	K	M	M					
	0.27μF (274)							D	D	D	D	D	K	K	M						
	0.33μF (334)							D	D	D	D	D	K	K	M						
	0.39μF (394)							D	D	D	D	D	K	K	M						
	0.47μF (474)							D	D	D	D	K	K	K	M						
	0.56μF (564)							D	D	D	D	K	M	M							
	0.68μF (684)							D	D	D	K	K	M	M							
	0.82μF (824)							D	D	D	K	K	M	M							
1.0μF (105)							D	D	D	K	K	M	M								
1.5μF (155)							D	D	D	K	K										
2.2μF (225)							G	G	G	M	M										
3.3μF (335)							K	K	K	K											
4.7μF (475)							M	M	M	M											
6.8μF (685)							M	M	M	M											
10μF (106)							M	M	M	M											
15μF (156)							M	M	M												
22μF (226)							M	M	M												
47μF (476)																					

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Multilayer Ceramic Capacitors

Approval Sheet

X7R Dielectric 1825 to 2225 Sizes

DIELECTRIC		X7R																							
SIZE		1825						2220										2225							
RATED VOLTAGE (VDC)		250	500	630	1000	2000	3000	25	50	100	250	500	630	1000	1500	2000	3000	500	630	1000	1500	2000	3000		
Capacitance	1,000pF (102)	K	K	K	K	K	K	K	K	K	K	K	K	K	K	K	K	K	K	K	K	K	K		
	1,200pF (122)	K	K	K	K	K	K	K	K	K	K	K	K	K	K	K	K	K	K	K	K	K	K		
	1,500pF (152)	K	K	K	K	K	K	K	K	K	K	K	K	K	K	K	K	K	K	K	K	K	K		
	1,800pF (182)	K	K	K	K	K	K	K	K	K	K	K	K	K	K	K	K	K	K	K	K	K	K		
	2,200pF (222)	K	K	K	K	K	K	K	K	K	K	K	K	K	K	K	K	K	K	K	K	K	K		
	2,700pF (272)	K	K	K	K	K	K	K	K	K	K	K	K	K	K	K	K	K	K	K	K	K	K		
	3,300pF (332)	K	K	K	K	K	K	K	K	K	K	K	K	K	K	K	K	K	K	K	K	K	K		
	3,900pF (392)	K	K	K	K	K	K	K	K	K	K	K	K	K	K	K	K	K	K	K	K	K	K		
	4,700pF (472)	K	K	K	K	K	K	K	K	K	K	K	K	K	K	K	K	K	K	K	K	K	K		
	5,600pF (562)	K	K	K	K	K	M	K	K	K	K	K	K	K	K	K	K	K	K	K	K	K	M		
	6,800pF (682)	K	K	K	K	K	M	K	K	K	K	K	K	K	K	K	M	K	K	K	K	K	M		
	8,200pF (822)	K	K	K	K	K	M	K	K	K	K	K	K	K	M	M	M	K	K	K	K	K	M		
	0.010μF (103)	K	K	K	K	K	M	K	K	K	K	K	K	K	M	M	M	K	K	K	K	K	M		
	0.012μF (123)	K	K	K	K	M	U	K	K	K	K	K	K	K	M	M	U	K	K	K	M	M	M		
	0.015μF (153)	K	K	K	K	M	U	K	K	K	K	K	K	K	M	M	U	K	K	K	M	M	M		
	0.018μF (183)	K	K	K	K	M	U	K	K	K	K	K	K	K	U	U	U	K	K	K	M	M	U		
	0.022μF (223)	K	K	K	K	M		K	K	K	K	K	K	K	U	U		K	K	K	M	M			
	0.027μF (273)	K	K	K	K	U		K	K	K	K	K	K	K	U	U		K	K	K	M	M			
	0.033μF (333)	K	K	K	K	U		K	K	K	K	K	K	K	U	U		K	K	K	M	M			
	0.039μF (393)	K	K	K	K	U		K	K	K	K	K	K	K	U	U		K	K	K	M	U			
	0.047μF (473)	K	K	K	K	U		K	K	K	K	K	K	K	U	U		K	K	K	M	U			
	0.056μF (563)	K	K	K	K			K	K	K	K	K	K	K	U	U		K	K	K	M	U			
	0.068μF (683)	K	K	K	K			K	K	K	K	K	K	K				K	K	K	M				
	0.082μF (823)	K	K	K	M			K	K	K	K	K	K	K				K	K	K	M				
	0.10μF (104)	K	K	K	M			K	K	K	K	K	K	K				K	K	K	M				
	0.12μF (124)	K	K	K				K	K	K	K	K	K	M				K	K	U					
	0.15μF (154)	K	K	K				K	K	K	K	K	K	U				K	K	U					
	0.18μF (184)	K	K	K				K	K	K	K	K	K	U				K	K	U					
	0.22μF (224)	K	K	K				K	K	K	K	K	K	U				K	K	U					
	0.27μF (274)	K	K	K				K	K	K	K	K	K					K	K						
	0.33μF (334)	K	K	K				K	K	K	K	K	K					K	K						
	0.39μF (394)	K	K	K				K	K	K	K	K	K					K	K						
	0.47μF (474)	K	K	K				K	K	K	K	K	K					K	K						
	0.56μF (564)	K	M	M				K	K	K	K	M	M					K	K						
	0.68μF (684)	K						K	K	K	K	M	M												
	0.82μF (824)	K						K	K	K	K	U	U												
1.0μF (105)	K						K	K	K	K	U	U													
1.5μF (155)							K	K	K	M															
2.2μF (225)							K	K	K	M															
3.3μF (335)							K	K	K																
4.7μF (475)							K	K	M																
6.8μF (685)							M	M	M																
10μF (106)							M	M	M																
15μF (156)							U	U	U																
22μF (226)							U	U	R																
47μF (476)							R																		

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

7-2. CAPACITANCE RANGE (X5R Dielectric)

Dielectric		X5R																												
Size		0402				0603					0805					1206					1210									
Rated Voltage		6.3	10	16	25	6.3	10	16	25	50	6.3	10	16	25	50	6.3	10	16	25	50	6.3	10	16	25	50	6.3	10	16	25	50
Capacitance	0.033μF (333)			E																										
	0.047μF (473)			E																										
	0.068μF (683)		E	E																										
	0.10μF (104)	E	E	E	E																									
	0.15μF (154)	E	E	E	E																									
	0.22μF (224)	E	E	E	E				X	X																				
	0.33μF (334)	E	E			X	X	X	X	X																				
	0.47μF (474)	E	E				X	X	X	X																				
	0.68μF (684)	E	E			X	X	X	X	X																				
	1.0μF (105)	E	E			X	X	X	X	X			I	I	I															
	1.5μF (155)					X						I	I	I	I			J	J								K	K		
	2.2μF (225)					X	X	X				I	I	I	I			J	J	P						K	K			
	3.3μF (335)					X						I	I	I	I			P	P	P	P						K	K		
	4.7μF (475)					X	X										P	P	P	P	P						K	K	K	
	6.8uF (685)																P	P												
	10μF (106)											I	I	I	I		P	P	P	P	P		K	K	K					
22μF (226)																														

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

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



Multilayer Ceramic Capacitors

Approval Sheet

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
	2.80±0.30	U	-	-	0.5k	1.5k
	3.10±0.30	R	-	-	0.5k	-
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	-
	3.10±0.30	R	-	-	-	1k

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	*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%	NP0: Cap≥30pF, Q≥1000; Cap<30pF,Q≥400+20C X7R, X5R, X6S, X7S:		
		Rated vol.	D.F. ≤	Exception of D.F. ≤	
		≥ 100V	≤ 2.5%	≤ 3%	1206 ≥ 0.47μF
				≤ 3.5%	1812 ≥ 4.7μF; 1825≥4.7μF; 2220≥4.7μF; 2225≥4.7μF
				≤ 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
				≤ 3.5%	1812 ≥ 4.7μF; 1825≥4.7μF; 2220≥4.7μF; 2225≥4.7μF
				≤ 5%	0201 ≥ 0.01μF; 0402≥0.012μF; 1210 ≥ 3.3μF
				≤ 10%	0402 ≥ 0.047μF; 0603>0.1μF; 0805 ≥ 1μF(0805/X7R>0.47μF); 1206 ≥ 2.2μF; 1210 ≥ 10μF; TT series
		35V	≤ 3.5%	≤ 12.5%	1206/X5R=10μF
		25V	≤ 3.5%	≤ 10%	0603 ≥ 1μF; 0805≥2.2μF; 1206 ≥ 2.2μF; 1210 ≥ 10μF
≤ 5%	0201 ≥ 0.01μF(0201/X5R=0.01μF); 0805 ≥ 1μF; 1210 ≥ 10μF*				
≤ 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)*				
16V	≤ 3.5%	≤ 12.5%	0402 ≥ 0.33μF; 0805/X5R/X6S=10μF		
		≤ 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(0402/X7R ≥ 0.15μF); 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(0402/X7R ≥ 0.15μF); 0603 ≥ 0.33μF; 0805 ≥ 2.2μF; 1206 ≥ 2.2μF; 1210 ≥ 22μF; 01R5/X5R; TT series		
		≤ 12.5%	0805/X5R/X6S=10μF		
		≤ 15%	0201 ≥ 0.1μF(0201/X5R>0.1μF); 0402 ≥ 1μF; 0603/X5R ≥ 10μF		
		≤ 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		
6.3V	≤ 10%	≤ 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 $RxC \geq 500\Omega \cdot F$ 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="6">10GΩ or $RxC \geq 100 \Omega \cdot F$ 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><td></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="9">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>6.3V: 0201≥0.1μF; 0402≥1μF;0603>4.7μF;0805≥47μF;1206≥10μF;</td></tr><tr><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 $RxC \geq 100 \Omega \cdot F$ 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="9">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>6.3V: 0201≥0.1μF; 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10V: 0201>0.1μF; 0402≥1μF; 0603≥10μF; 0805≥47μF; TT21>4.7μF																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																	
6.3V: 0201≥0.1μF; 0402≥1μF;0603>4.7μF;0805≥47μF;1206≥10μF;																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																	
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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.)																
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																

* "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	
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): To apply de-aging at 150°C for 1hr then set for 24±2 hrs at room temp.	X7R, X5R, X6S, X7S: ≥10V**, within ±12.5%; ≤6.3V within ±25%; TT series & C≥ 1uF, within ±25%	
		* Cap. / DF(Q) / I.R. Measurement to be made after de-aging at 150°C for 1hr then set for 24±2 hrs at room temp.	**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:		
		Rated vol.	D.F. ≤	Exception of D.F. ≤
		≥ 100V	≤ 3%	≤ 6% 1206 ≥ 0.47μF ≤ 7% 1812 ≥ 4.7μF; 1825 ≥ 4.7μF; 2220 ≥ 4.7μF; 2225 ≥ 4.7μF ≤ 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 ≤ 7% 1812 ≥ 4.7μF; 1825 ≥ 4.7μF; 2220 ≥ 4.7μF; 2225 ≥ 4.7μF ≤ 10% 0201 ≥ 0.01uF; 0402 ≥ 0.012μF; 1210 ≥ 3.3μF ≤ 20% 0402 ≥ 0.047μF; 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 ≤ 10% 0201 ≥ 0.01μF(0201/X5R=0.01μF); 0805 ≥ 1μF; 1210 ≥ 10μF* ≤ 14% 0603 ≥ 0.33μF
		25V	≤ 5%	0201 ≥ 0.1μF(0201/X5R>0.01μF); 0603 ≥ 0.47μF; TTseries ≤ 15% 0402 ≥ 0.10μF(0402/X7R ≥ 0.056μF); 0805 ≥ 2.2μF; 1206 ≥ 4.7μF; 1210 ≥ 22μF(1210/X5R ≥ 10μF)* ≤ 20% 0402 ≥ 0.33μF
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%	≤ 15% 0201 ≥ 0.012μF; 0402 ≥ 0.22μF(0402/X7R ≥ 0.15μF); 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%	---		
*I.R.: ≥10V, 1GΩ or 50 Ω-F whichever is smaller.				
Class II (X7R, X5R, X6S, X7S)				
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				

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

Multilayer Ceramic Capacitors

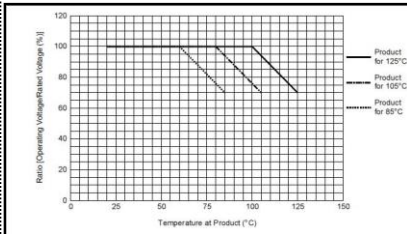
Approval Sheet

No	Item	Test Condition	Requirements																																																	
14	Humidity (Damp Heat) Load	*Test temp. : 40±2°C *Humidity : 90~95%RH *Test time : 500+24/-0 hrs. *To apply voltage : Rated voltage (MAX. 500V) *Before initial measurement (Class II only): To apply de-aging at 150°C for 1hr then set for 24±2 hrs at room temp. * Cap. / DF(Q) / I.R. Measurement to be made after de-aging at 150°C for 1hr then set for 24±2 hrs at room temp.	* No remarkable damage. Cap change: NP0: ±7.5% or 0.75pF whichever is larger. X7R, X5R, X6S, X7S: ≥10V**,within ±12.5%; ≤6.3V within ±25%; TT series & C≥ 1uF,within ±25% **10V: 0603≥4.7μF;0402≥1μF;0201≥0.1μF, within ±25%; 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="5">≥ 100V</td><td rowspan="5">≤ 3%</td><td>≤ 6% 1206 ≥ 0.47μF</td></tr><tr><td>≤ 7% 1812 ≥ 4.7μF;1825≥4.7μF; 2220≥4.7μF; 2225≥4.7μF</td></tr><tr><td>≤ 7.5% 0603 ≥ 0.068μF;0805 > 0.1μF;1206 ≥ 1μF;1210 ≥ 2.2μF;TT series</td></tr><tr><td>≤ 20% 0805 > 0.22μF;1210 ≥ 3.3μF</td></tr><tr><td>≤ 20% 0201(50V);0603 ≥ 0.047μF;0805 ≥ 0.18μF;1206 ≥ 0.47μF</td></tr><tr><td rowspan="5">50V</td><td rowspan="5">≤ 3%</td><td>≤ 6% 1812 ≥ 4.7μF;1825≥4.7μF; 2220≥4.7μF; 2225≥4.7μF</td></tr><tr><td>≤ 7% 1812 ≥ 4.7μF;1825≥4.7μF; 2220≥4.7μF; 2225≥4.7μF</td></tr><tr><td>≤ 10% 0201 ≥ 0.01uF;0402 ≥ 0.012μF;1210 ≥ 3.3μF</td></tr><tr><td>≤ 20% 0402 ≥ 0.047μF;0603>0.1μF;0805 ≥ 1μF(0805/X7R>0.47μF); 1206 ≥ 2.2μF;1210 ≥ 10μF; TT series</td></tr><tr><td>≤ 20% 0603 ≥ 1μF;0805≥2.2μF;1206 ≥ 2.2μF;1210 ≥ 10μF</td></tr><tr><td rowspan="5">35V</td><td rowspan="5">≤ 5%</td><td>≤ 10% 0201 ≥ 0.01μF(0201/X5R=0.01μF);0805 ≥ 1μF;1210 ≥ 10μF*</td></tr><tr><td>≤ 14% 0603 ≥ 0.33μF</td></tr><tr><td>≤ 15% 0201 ≥ 0.1μF(0201/X5R>0.01μF); 0603 ≥ 0.47μF;TTseries</td></tr><tr><td>≤ 15% 0402 ≥ 0.10μF(0402/X7R ≥ 0.056μF);0805 ≥ 2.2μF; 1206 ≥ 4.7μF;1210 ≥ 22μF(1210/X5R ≥ 10μF)*</td></tr><tr><td>≤ 20% 0402 ≥ 0.33μF</td></tr><tr><td rowspan="5">25V</td><td rowspan="5">≤ 5%</td><td>≤ 10% 0603 ≥ 0.15μF;0805 ≥ 0.68μF;1206 ≥ 2.2μF;1210 ≥ 4.7μF</td></tr><tr><td>≤ 15% 0201 ≥ 0.01μF(0201/X7R ≥ 0.022μF);0402 ≥ 0.033μF; 0603>0.47μF;0805 ≥ 2.2μF;1206 ≥ 4.7μF;1210 ≥ 22μF;TT series</td></tr><tr><td>≤ 15% 0201 ≥ 0.012μF;0402 ≥ 0.22μF(0402/X7R ≥ 0.15μF); 0603 ≥ 0.33μF;0805 ≥ 2.2μF;1206 ≥ 2.2μF;1210 ≥ 22μF</td></tr><tr><td>≤ 20% 0201 ≥ 0.1μF;0402 ≥ 1μF;0603/X5R ≥ 10μF;TT series;01R5/X5R</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>6.3V</td><td>≤ 15%</td><td>≤ 30%</td><td>---</td></tr><tr><td>4V</td><td>≤ 20%</td><td>---</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="7">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>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% 1812 ≥ 4.7μF;1825≥4.7μF; 2220≥4.7μF; 2225≥4.7μF	≤ 7.5% 0603 ≥ 0.068μF;0805 > 0.1μF;1206 ≥ 1μF;1210 ≥ 2.2μF;TT series	≤ 20% 0805 > 0.22μF;1210 ≥ 3.3μF	≤ 20% 0201(50V);0603 ≥ 0.047μF;0805 ≥ 0.18μF;1206 ≥ 0.47μF	50V	≤ 3%	≤ 6% 1812 ≥ 4.7μF;1825≥4.7μF; 2220≥4.7μF; 2225≥4.7μF	≤ 7% 1812 ≥ 4.7μF;1825≥4.7μF; 2220≥4.7μF; 2225≥4.7μF	≤ 10% 0201 ≥ 0.01uF;0402 ≥ 0.012μF;1210 ≥ 3.3μF	≤ 20% 0402 ≥ 0.047μF;0603>0.1μF;0805 ≥ 1μF(0805/X7R>0.47μF); 1206 ≥ 2.2μF;1210 ≥ 10μF; TT series	≤ 20% 0603 ≥ 1μF;0805≥2.2μF;1206 ≥ 2.2μF;1210 ≥ 10μF	35V	≤ 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	≤ 15% 0402 ≥ 0.10μF(0402/X7R ≥ 0.056μF);0805 ≥ 2.2μF; 1206 ≥ 4.7μF;1210 ≥ 22μF(1210/X5R ≥ 10μF)*	≤ 20% 0402 ≥ 0.33μF	25V	≤ 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	≤ 15% 0201 ≥ 0.012μF;0402 ≥ 0.22μF(0402/X7R ≥ 0.15μF); 0603 ≥ 0.33μF;0805 ≥ 2.2μF;1206 ≥ 2.2μF;1210 ≥ 22μF	≤ 20% 0201 ≥ 0.1μF;0402 ≥ 1μF;0603/X5R ≥ 10μF;TT series;01R5/X5R	≤ 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%	---	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
Rated vol.	D.F. ≤	Exception of D.F. ≤																																																		
≥ 100V	≤ 3%	≤ 6% 1206 ≥ 0.47μF																																																		
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		≤ 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(0402/X7R ≥ 0.15μF); 0603 ≥ 0.33μF;0805 ≥ 2.2μF;1206 ≥ 2.2μF;1210 ≥ 22μF																																																		
		≤ 20% 0201 ≥ 0.1μF;0402 ≥ 1μF;0603/X5R ≥ 10μF;TT series;01R5/X5R																																																		
		≤ 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%	---																																																	
4V	≤ 20%	---	---																																																	
Rated voltage	Insulation Resistance																																																			
100V: All X7R;1210≥3.3μF	500MΩ or RxC ≥ 5 Ω-F whichever is smaller.																																																			
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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																																																				

* "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																																																																																																																																																																																																							
15.	High Temperature Load (Endurance)	Test temp. : NP0, X7R/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>01R5</td><td>X5R</td><td>≤10V</td><td>C≥0.1μF</td></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">X7R/X7S</td><td>6.3V, 10V</td><td>C≥1.0μF</td></tr><tr><td>4V</td><td>C≥22μF</td></tr><tr><td rowspan="2">X5R/X7R/ X6S/X7S</td><td>6.3V, 10V</td><td>C≥4.7μF^{#1}</td></tr><tr><td>25V</td><td>C≥1.0μF</td></tr><tr><td rowspan="8">0805</td><td rowspan="4">X5R/X7R/ X6S/X7S</td><td>35V</td><td>C≥1.0μF</td></tr><tr><td>4V</td><td>C≥47μF</td></tr><tr><td>6.3V</td><td>C≥22μF</td></tr><tr><td>10V, 50V</td><td>C≥10μF</td></tr><tr><td rowspan="4">X6S</td><td>16V</td><td>C>10μF</td></tr><tr><td>25V</td><td>C≥10μF</td></tr><tr><td>16V, 25V</td><td>C≥10μF</td></tr><tr><td>X7R/X7S</td><td>C≥10μF</td></tr><tr><td>1206</td><td>X5R/X7R/X6S</td><td>≤6.3V</td><td>C≥47μF</td></tr><tr><td rowspan="2">1210</td><td rowspan="2">X5R/X7R/X6S</td><td>16V</td><td>C≥47μF</td></tr><tr><td>100V</td><td>C≥3.3μF</td></tr><tr><td>TT15</td><td>X5R</td><td>6.3V</td><td>C>1.0μF</td></tr><tr><td>TT21</td><td>X5R/X7R/X6S</td><td>≤10V</td><td>C≥10μF</td></tr></table> **1WV items must follow de-rating conditions. #1. 0603X106/475(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>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="5">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>50V</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 rowspan="2">1812</td><td rowspan="2">X7R</td><td>≤50V</td><td>C≥4.7μF</td></tr><tr><td>100V</td><td>C≥1.0μF</td></tr><tr><td>1825</td><td rowspan="3">X7R</td><td rowspan="3">100V~250V</td><td rowspan="3">C≥1.0μF^{#2}</td></tr><tr><td>2220</td></tr><tr><td>2225</td></tr></table> #2. 2220/X7R/126~226(100V): 120% of rated voltage. (3) ≤6.3V or C≥10μF: 150% of rated voltage. (4) 10V~250V: 200% of rated voltage. Excluding 1210/NP0(200V&250V)/104: 100% of rated voltage. 1210/NP0(200V&250V)/563~823: 150% of rated voltage. 1812/NP0(200V&250V)/822~104: 150% of rated voltage. (5) 400V~450V: 120% of rated voltage. (6) 500V: 150% of rated voltage. (7) 630V~3kV: 120% of rated voltage. Excluding 1206/NP0(1kV)/122~332/183~223: 110% of rated voltage. 1210/X7R(2kV)/103: 110% of rated voltage. 1808/X7R(3kV)/102(T:1.25mm):: 110% of rated voltage. 1210/NP0(1kV)/333: 100% of rated voltage. 1812/NP0(1kV)/472~562: 100% of rated voltage. (8) Ur=3.5kV & 4kV: 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:	Size	Dielectric	Rated voltage	Capacitance	01R5	X5R	≤10V	C≥0.1μF	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	X7R/X7S	6.3V, 10V	C≥1.0μF	4V	C≥22μF	X5R/X7R/ X6S/X7S	6.3V, 10V	C≥4.7μF ^{#1}	25V	C≥1.0μF	0805	X5R/X7R/ X6S/X7S	35V	C≥1.0μF	4V	C≥47μF	6.3V	C≥22μF	10V, 50V	C≥10μF	X6S	16V	C>10μF	25V	C≥10μF	16V, 25V	C≥10μF	X7R/X7S	C≥10μF	1206	X5R/X7R/X6S	≤6.3V	C≥47μF	1210	X5R/X7R/X6S	16V	C≥47μF	100V	C≥3.3μF	TT15	X5R	6.3V	C>1.0μF	TT21	X5R/X7R/X6S	≤10V	C≥10μF	Size	Dielectric	Rated voltage	Capacitance	0201	X5R/X6S	16V, 25V	C=0.1μF	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	50V	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	1812	X7R	≤50V	C≥4.7μF	100V	C≥1.0μF	1825	X7R	100V~250V	C≥1.0μF ^{#2}	2220	2225	* 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="4">100V</td><td rowspan="4">≤3%</td><td>≤6% 1206≥0.47μF</td></tr><tr><td>≤7% 1812≥4.7μF; 1825≥4.7μF; 2220≥4.7μF; 2225≥4.7μF</td></tr><tr><td>≤7.5% 0603≥0.068μF; 0805>0.1μF; 1206≥1μF; 1210≥2.2μF; TT series</td></tr><tr><td>≤20% 0805>0.22μF; 1210≥3.3μF</td></tr><tr><td rowspan="4">50V</td><td rowspan="4">≤3%</td><td>≤6% 0201(50V); 0603≥0.047μF; 0805≥0.18μF; 1206≥0.47μF</td></tr><tr><td>≤7% 1812≥4.7μF; 1825≥4.7μF; 2220≥4.7μF; 2225≥4.7μF</td></tr><tr><td>≤10% 0201≥0.01μF; 0402≥0.012μF; 1210≥3.3μF</td></tr><tr><td>≤20% 0402≥0.047μF; 0603>0.1μF; 0805≥1μF(0805/X7R>0.47μF); 1206≥2.2μF; 1210≥10μF; TT series</td></tr><tr><td rowspan="4">35V</td><td rowspan="4">≤5%</td><td>≤20% 0603≥1μF; 0805≥2.2μF; 1206≥2.2μF; 1210≥10μF</td></tr><tr><td>≤10% 0201≥0.01μF(0201/X5R=0.01μF); 0805≥1μF; 1210≥10μF*</td></tr><tr><td>≤14% 0603≥0.33μF</td></tr><tr><td>≤15% 0201≥0.1μF(0201/X5R>0.01μF); 0603≥0.47μF; TTseries</td></tr><tr><td rowspan="4">25V</td><td rowspan="4">≤5%</td><td>≤15% 0402≥0.10μF(0402/X7R≥0.056μF); 0805≥2.2μF; 1206≥4.7μF; 1210≥22μF(1210/X5R≥10μF)*</td></tr><tr><td>≤20% 0402≥0.33μF</td></tr><tr><td>≤10% 0603≥0.15μF; 0805≥0.68μF; 1206≥2.2μF; 1210≥4.7μF</td></tr><tr><td>≤15% 0201≥0.01μF(0201/X7R≥0.022μF); 0402≥0.033μF; 0603>0.47μF; 0805≥2.2μF; 1206≥4.7μF; 1210≥22μF; TT series</td></tr><tr><td rowspan="4">16V</td><td rowspan="4">≤5%</td><td>≤15% 0201≥0.012μF; 0402≥0.22μF(0402/X7R≥0.15μF); 0603≥0.33μF; 0805≥2.2μF; 1206≥2.2μF; 1210≥22μF</td></tr><tr><td>≤20% 0201≥0.1μF; 0402≥1μF; 0603/X5R≥10μF; TT series; 01R5/X5R</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>≤20% ---</td></tr><tr><td rowspan="4">10V</td><td rowspan="4">≤7.5%</td><td>≤15% 0201≥0.1μF; 0402≥1μF(0402/X6S≥0.47μF); 0603≥10μF; 0805≥4.7μF; 1206≥47μF; 1210≥100μF; TT series</td></tr><tr><td>≤30% ---</td></tr><tr><td>≤20% ---</td></tr><tr><td>≤30% ---</td></tr><tr><td>6.3V</td><td>≤15%</td><td>≤30%</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="8">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><tr><td></td></tr></table> **De-rating conditions: 	Rated vol.	D.F. ≤	Exception of D.F. ≤	100V	≤3%	≤6% 1206≥0.47μF	≤7% 1812≥4.7μF; 1825≥4.7μF; 2220≥4.7μF; 2225≥4.7μF	≤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	≤7% 1812≥4.7μF; 1825≥4.7μF; 2220≥4.7μF; 2225≥4.7μF	≤10% 0201≥0.01μF; 0402≥0.012μF; 1210≥3.3μF	≤20% 0402≥0.047μF; 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	≤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	25V	≤5%	≤15% 0402≥0.10μF(0402/X7R≥0.056μF); 0805≥2.2μF; 1206≥4.7μF; 1210≥22μF(1210/X5R≥10μF)*	≤20% 0402≥0.33μF	≤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	16V	≤5%	≤15% 0201≥0.012μF; 0402≥0.22μF(0402/X7R≥0.15μF); 0603≥0.33μF; 0805≥2.2μF; 1206≥2.2μF; 1210≥22μF	≤20% 0201≥0.1μF; 0402≥1μF; 0603/X5R≥10μF; TT series; 01R5/X5R	≤30% 0201≥0.1μF; 0402≥1μF(0402/X6S≥0.47μF); 0603≥10μF; 0805≥4.7μF; 1206≥47μF; 1210≥100μF; TT series	≤20% ---	10V	≤7.5%	≤15% 0201≥0.1μF; 0402≥1μF(0402/X6S≥0.47μF); 0603≥10μF; 0805≥4.7μF; 1206≥47μF; 1210≥100μF; TT series	≤30% ---	≤20% ---	≤30% ---	6.3V	≤15%	≤30%	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	
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1210	X5R/X7R/X6S	16V	C≥47μF																																																																																																																																																																																																							
		100V	C≥3.3μF																																																																																																																																																																																																							
TT15	X5R	6.3V	C>1.0μF																																																																																																																																																																																																							
TT21	X5R/X7R/X6S	≤10V	C≥10μF																																																																																																																																																																																																							
Size	Dielectric	Rated voltage	Capacitance																																																																																																																																																																																																							
0201	X5R/X6S	16V, 25V	C=0.1μF																																																																																																																																																																																																							
		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																																																																																																																																																																																																							
		50V	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																																																																																																																																																																																																							
1812	X7R	≤50V	C≥4.7μF																																																																																																																																																																																																							
		100V	C≥1.0μF																																																																																																																																																																																																							
1825	X7R	100V~250V	C≥1.0μF ^{#2}																																																																																																																																																																																																							
2220																																																																																																																																																																																																										
2225																																																																																																																																																																																																										
Rated vol.	D.F. ≤	Exception of D.F. ≤																																																																																																																																																																																																								
100V	≤3%	≤6% 1206≥0.47μF																																																																																																																																																																																																								
		≤7% 1812≥4.7μF; 1825≥4.7μF; 2220≥4.7μF; 2225≥4.7μF																																																																																																																																																																																																								
		≤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																																																																																																																																																																																																								
		≤7% 1812≥4.7μF; 1825≥4.7μF; 2220≥4.7μF; 2225≥4.7μF																																																																																																																																																																																																								
		≤10% 0201≥0.01μF; 0402≥0.012μF; 1210≥3.3μF																																																																																																																																																																																																								
		≤20% 0402≥0.047μF; 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																																																																																																																																																																																																								
		≤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																																																																																																																																																																																																								
25V	≤5%	≤15% 0402≥0.10μF(0402/X7R≥0.056μF); 0805≥2.2μF; 1206≥4.7μF; 1210≥22μF(1210/X5R≥10μF)*																																																																																																																																																																																																								
		≤20% 0402≥0.33μF																																																																																																																																																																																																								
		≤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																																																																																																																																																																																																								
16V	≤5%	≤15% 0201≥0.012μF; 0402≥0.22μF(0402/X7R≥0.15μF); 0603≥0.33μF; 0805≥2.2μF; 1206≥2.2μF; 1210≥22μF																																																																																																																																																																																																								
		≤20% 0201≥0.1μF; 0402≥1μF; 0603/X5R≥10μF; TT series; 01R5/X5R																																																																																																																																																																																																								
		≤30% 0201≥0.1μF; 0402≥1μF(0402/X6S≥0.47μF); 0603≥10μF; 0805≥4.7μF; 1206≥47μF; 1210≥100μF; TT series																																																																																																																																																																																																								
		≤20% ---																																																																																																																																																																																																								
10V	≤7.5%	≤15% 0201≥0.1μF; 0402≥1μF(0402/X6S≥0.47μF); 0603≥10μF; 0805≥4.7μF; 1206≥47μF; 1210≥100μF; TT series																																																																																																																																																																																																								
		≤30% ---																																																																																																																																																																																																								
		≤20% ---																																																																																																																																																																																																								
		≤30% ---																																																																																																																																																																																																								
6.3V	≤15%	≤30%																																																																																																																																																																																																								
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																																																																																																																																																																																																										

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

APPENDIXES

■ Tape & reel dimensions

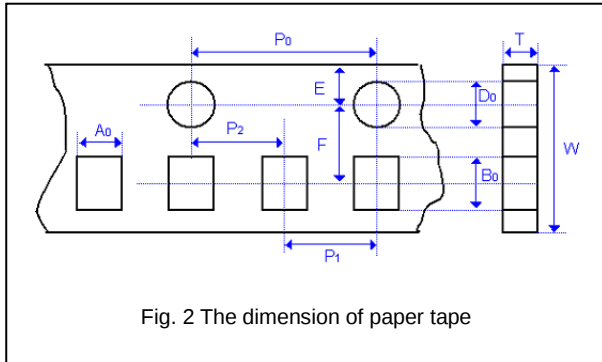


Fig. 2 The dimension of paper tape

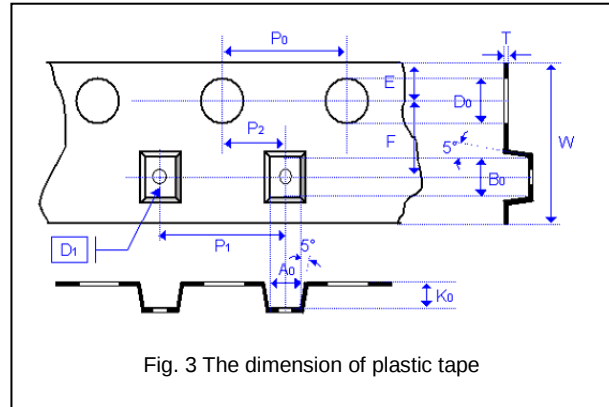


Fig. 3 The dimension of plastic tape

Size	0402	0603	0805			1206			1210		1808	1812		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	R	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	< 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	< 6.50
T	≤ 0.80	≤ 1.20	≤ 1.15	≤ 1.20	0.23 +/-0.1	0.23 +/-0.1	0.23 +/-0.1	0.23 +/-0.1	0.23 +/-0.1	0.23 +/-0.1	0.25 +/-0.1	0.25 +/-0.1	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	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	< 4.20	< 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	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	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	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	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	2.00 +/-0.10
D ₀	1.50 +0.1/-0	1.50 +0.1/-0	1.50 +0.1/-0	1.50 +0.1/-0	1.50 +0.1/-0	1.50 +0.1/-0	1.50 +0.1/-0	1.50 +0.1/-0	1.50 +0.1/-0	1.50 +0.1/-0	1.50 +0.1/-0	1.50 +0.1/-0	1.50 +0.1/-0	1.50 +0.1/-0	1.50 +0.1/-0	1.50 +0.1/-0	1.50 +0.1/-0	1.50 +0.1/-0	1.50 +0.1/-0	1.50 +0.1/-0
D ₁	-	-	-	-	1.00 +/-0.10	1.00 +/-0.10	1.00 +/-0.10	1.00 +/-0.10	1.00 +/-0.10	1.00 +/-0.10	1.00 +/-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	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 +/-0.05	5.50 +/-0.05	5.50 +/-0.05	5.50 +/-0.05	5.50 +/-0.05	5.50 +/-0.05	5.50 +/-0.05

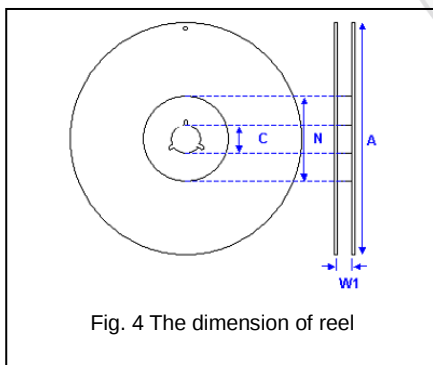
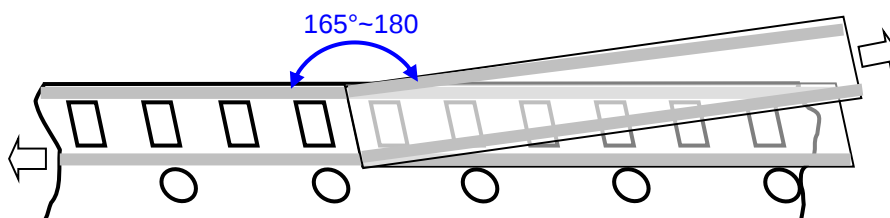


Fig. 4 The dimension of reel

Size	0402, 0603, 0805, 1206, 1210			1808 to 2225	
Reel size	7"	10"	13"	7"	13"
C	13.0±0.5	13.0±0.5	13.0±0.5	13.0±0.5	13.0±0.5
W ₁	10.0±1.5	10.0±1.5	10.0±1.5	12.4+2.0/-0	12.4+2.0/-0
A	178.0±2.0	250.0±2.0	330.0±2.0	178.0±2.0	330.0±2.0
N	60.0+1.0/-0	50 min	50 min	60.0+1.0/-0	100.0±2.0

■ Peeling force (EIA-481)

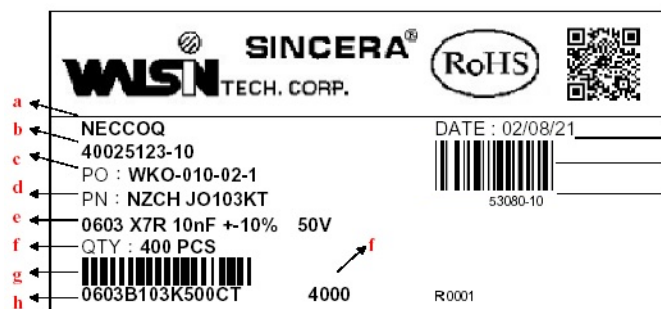
Peel-off force should be in the range of 10 grams to 100 grams at a peel-off speed of 300±10 mm/min.



Multilayer Ceramic Capacitors

Approval Sheet

Example of customer label



*Customized label is available upon request

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

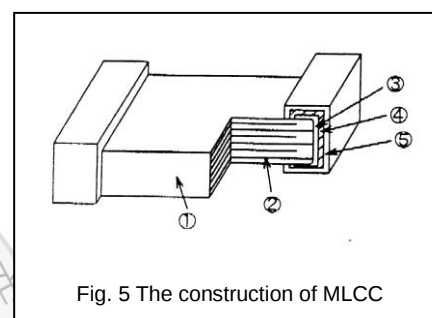


Fig. 5 The construction of MLCC

Storage and handling conditions

- (1) To store products at 5 to 40°C ambient temperature and 20 to 70% related humidity conditions; 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.

Caution for SOFT TERMINATION Products

Since the middle layer of the terminal electrode contains Ag (silver), when chip capacitors on printed circuit board (PCB), it should be protected by moisture proof-sealing to prevent electromigration of Ag under high temperature, high humidity and failure due to corrosive gas.

Recommended soldering conditions

Multilayer Ceramic Capacitors

Approval Sheet

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.

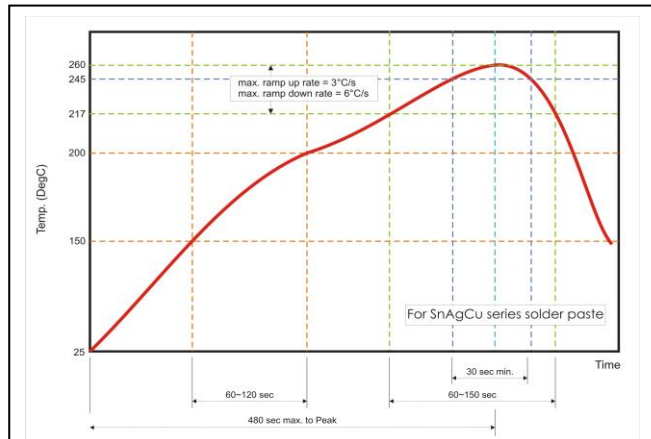


Fig. 6 Recommended reflow soldering profile for SMT process with SnAgCu series solder paste.

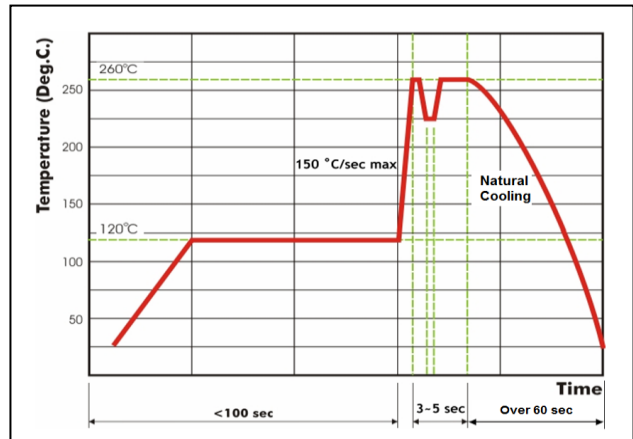


Fig. 7 Recommended wave soldering profile for SMT process with SnAgCu series solder.

