

APPROVAL SHEET

MULTILAYER CERAMIC CAPACITORS

General Purpose Series (4V to 100V)

0201 to 1812 Sizes

NP0, X7R, Y5V, X6S, X7S & X5R Dielectrics

Halogen Free & RoHS Compliance

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

1. DESCRIPTION

MLCC consists of a conducting material and electrodes. To manufacture a chip-type SMT and achieve miniaturization, high density and high efficiency, ceramic condensers are used.

WTC's MLCC is made by NP0, X7R, X6S, X5R and Y5V dielectric material and which provides product with high electrical precision, stability and reliability.

2. FEATURES

- A wide selection of sizes is available (0201 to 1812).
- High capacitance in given case size.
- Capacitor with lead-free termination (pure Tin).

3. APPLICATIONS

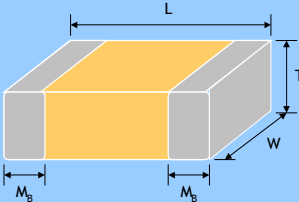
- For general digital circuit.
- For power supply bypass capacitors.
- For consumer electronics.
- For telecommunication.

4. HOW TO ORDER

<u>1206</u>	<u>B</u>	<u>104</u>	<u>K</u>	<u>500</u>	<u>C</u>	<u>I</u>
<u>Size</u>	<u>Dielectric</u>	<u>Capacitance</u>	<u>Tolerance</u>	<u>Rated voltage</u>	<u>Termination</u>	<u>Packaging style</u>
Inch (mm)	N=NP0 (C0G)	Two significant digits followed by no. of zeros. And R is in place of decimal point.	A=±0.05pF B=±0.1pF C=±0.25pF D=±0.5pF F=±1% G=±2% J=±5% K=±10% M=±20% Z=-20/+80%	Two significant digits followed by no. of zeros. And R is in place of decimal point. 4R0=4 VDC 6R3=6.3 VDC 100=10 VDC 160=16 VDC 250=25 VDC 500=50 VDC 101=100 VDC	C=Cu/Ni/Sn	T=7" reeled G=13" reeled
0201 (0603)						
0402 (1005)	B=X7R					
0603 (1608)	F=Y5V					
0805 (2012)	X=X5R					
1206 (3216)	S=X6S					
1210 (3225)	A=X7S	eg.: 0R5=0.5pF 1R0=1.0pF 104=10x10 ⁴ =100nF				
1812 (4532)						

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5. EXTERNAL DIMENSIONS

Outline	Size Inch (mm)	L (mm)	W (mm)	T (mm)/Symbol	Soldering Method *	M _B (mm)	
 Fig. 1 The outline of MLCC	01R5 (0402)	0.4±0.02	0.2±0.02	0.2±0.02	V	R	0.10±0.03
	0201 (0603)	0.6±0.03	0.3±0.03	0.3±0.03	L	R	0.15±0.05
		0.6±0.05 ^{#2}	0.3±0.05 ^{#2}	0.3±0.05 ^{#2}			0.15+0.1/-0.05
		0.6±0.09 ^{#3}	0.3±0.09 ^{#3}	0.3±0.09 ^{#3}			
	0402 (1005)	1.00±0.05	0.50±0.05	0.50±0.05	N	R	0.25 +0.05/-0.10
				0.50+0.02/-0.05	Q	R	
	0603 (1608)	1.00±0.20	0.50±0.20	0.5±0.20	E	R	0.40±0.15
		1.60±0.10	0.80±0.10	0.80±0.07	S	R / W	
		1.60+0.15/-0.10	0.80+0.15/-0.10	0.50±0.10	H	R / W	
	0805 (2012)	1.60±0.20 ^{#1}	0.80±0.20 ^{#1}	0.80+0.15/-0.10	X	R / W	0.50±0.20
		2.00±0.15	1.25±0.10	0.50±0.10	H	R / W	
				0.60±0.10	A	R / W	
				0.80±0.10	B	R / W	
	1206 (3216)	2.00±0.20	1.25±0.20	0.85±0.10	T	R / W	0.60±0.20 (0.5±0.25) ^{***}
		3.20±0.15	1.60±0.15	1.25±0.10	D	R	
				0.80±0.10	B	R / W	
				0.95±0.10	C	R	
		3.20±0.20	1.60±0.20	1.15±0.15	J	R	
		0.85±0.10	T	R / W			
	1210 (3225)	3.20+0.30/-0.10	1.60+0.30/-0.10	1.60+0.30/-0.10	P	R	0.75±0.25
		3.20±0.30	2.50±0.20	0.95±0.10	C	R	
				0.85±0.10	T	R	
				1.25±0.10	D	R	
		3.20±0.40	2.50±0.30	1.60±0.20	G	R	
				2.00±0.20	K	R	
				2.50±0.30	M	R	
	1808 (4520)	3.20±0.60 ^{#4}	2.50±0.50 ^{#4}	2.50±0.50 ^{#4}			0.75±0.25 (0.5±0.25) ^{***}
		4.50±0.40 (4.5+0.5/-0.3) ^{**}	2.03±0.25	1.25±0.10	D	R	
				1.40±0.15	F	R	
				1.60±0.20	G	R	
	1812 (4532)	4.50±0.40 (4.5+0.5/-0.3) ^{**}	3.20±0.30	2.00±0.20	K	R	0.75±0.25 (0.5±0.25) ^{***}
				1.25±0.10	D	R	
				1.60±0.20	G	R	
			3.20±0.40	2.50±0.30	M	R	
				2.80±0.30	U	R	

* R = Reflow soldering process ; W = Wave soldering process.

** For 1808/1812/1825_200V~4000V and safety certificated products.

*** For 1206_≥1000V, 1808/1812_200V~4000V and safety certificated products.

#1: For 0603/Cap ≥ 10μF or 0603(≤ 6.3V)/Cap ≥ 4.7μF or 0603(>10V)/Cap > 1μF products.

#2: For 0201/ 0.1uF < Cap < 0.68uF products.

#3: For 0201/Cap ≥ 0.68μF products.

#4: For 1210(100V)/Cap > 1μF or 1210(250V)/Cap > 0.47μF or 1210(400V~630V)/Cap > 0.22μF.

6. GENERAL ELECTRICAL DATA

Dielectric	NP0	X7R	Y5V	X5R	X6S	X7S
Size	0201, 0402, 0603, 0805, 1206, 1210, 1812					
Capacitance range*	0.1pF to 0.1μF	100pF to 47μF	0.01μF to 100μF	100pF to 220μF	0.1μF to 100μF	1μF to 100μF
Capacitance tolerance**	Cap≤5pF ^{#1} : A (±0.05pF), B (±0.1pF), C (±0.25pF) 5pF<Cap<10pF: C (±0.25pF), D (±0.5pF) Cap≥10pF: F (±1%), G (±2%), J (±5%), K (±10%)	J (±5%), K (±10%), M (±20%)	M (±20%), Z (-20/+80%)	K (±10%), M (±20%)	K (±10%), M (±20%)	K (±10%), M (±20%)
Rated voltage (WVDC)	10V, 16V, 25V, 50V, 100V	6.3V, 10V, 16V, 25V, 50V, 100V				
Operating temperature	-55 to +125℃		-25 to +85℃	-55 to +85℃	-55 to +105℃	-55 to +125℃
Capacitance characteristic	±30ppm	±15%	+30/-80%	±15%	±22%	±22%
Termination	Ni/Sn (lead-free termination)					

#1: NP0, 0.1pF product only provide B tolerance; 0603N0R4 provide B&C tolerance; 0603N0R3 only provide C tolerance.

* 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℃ at ambient temperature

X7R/X6S/X5R/X7S: Please refer to page 13 "Reliability test conditions and requirements" for detail.

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

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



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7. CAPACITANCE RANGE

7-1. NP0 Dielectric 0201, 0402, 0603, 0805 Sizes

DIELECTRIC		NP0																			
SIZE		0201				0402					0603					0805					
RATED VOLTAGE (VDC)		10	16	25	50	10	16	25	50	100	10	16	25	50	100	10	16	25	50	100	
Capacitance	0.1pF (0R1)	L	L	L	L	N	N	N	N												
	0.2pF (0R2)	L	L	L	L	N	N	N	N	N											
	0.3pF (0R3)	L	L	L	L	N	N	N	N	N	S	S	S	S							
	0.4pF (0R4)	L	L	L	L	N	N	N	N	N	S	S	S	S							
	0.5pF (0R5)	L	L	L	L	N	N	N	N	N	S	S	S	S	S	A	A	A	A	A	
	0.6pF (0R6)	L	L	L	L	N	N	N	N	N	N	S	S	S	S	S	A	A	A	A	A
	0.7pF (0R7)	L	L	L	L	N	N	N	N	N	N	S	S	S	S	S	A	A	A	A	A
	0.8pF (0R8)	L	L	L	L	N	N	N	N	N	N	S	S	S	S	S	A	A	A	A	A
	0.9pF (0R9)	L	L	L	L	N	N	N	N	N	N	S	S	S	S	S	A	A	A	A	A
	1.0pF (1R0)	L	L	L	L	N	N	N	N	N	N	S	S	S	S	S	A	A	A	A	A
	1.2pF (1R2)	L	L	L	L	N	N	N	N	N	N	S	S	S	S	S	A	A	A	A	A
	1.5pF (1R5)	L	L	L	L	N	N	N	N	N	N	S	S	S	S	S	A	A	A	A	A
	1.8pF (1R8)	L	L	L	L	N	N	N	N	N	N	S	S	S	S	S	A	A	A	A	A
	2.0pF (2R0)	L	L	L	L	N	N	N	N	N	N	S	S	S	S	S	A	A	A	A	A
	2.2pF (2R2)	L	L	L	L	N	N	N	N	N	N	S	S	S	S	S	A	A	A	A	A
	2.7pF (2R7)	L	L	L	L	N	N	N	N	N	N	S	S	S	S	S	A	A	A	A	A
	3.0pF (3R0)	L	L	L	L	N	N	N	N	N	N	S	S	S	S	S	A	A	A	A	A
	3.3pF (3R3)	L	L	L	L	N	N	N	N	N	N	S	S	S	S	S	A	A	A	A	A
	3.9pF (3R9)	L	L	L	L	N	N	N	N	N	N	S	S	S	S	S	A	A	A	A	A
	4.0pF (4R0)	L	L	L	L	N	N	N	N	N	N	S	S	S	S	S	A	A	A	A	A
	4.7pF (4R7)	L	L	L	L	N	N	N	N	N	N	S	S	S	S	S	A	A	A	A	A
	5.0pF (5R0)	L	L	L	L	N	N	N	N	N	N	S	S	S	S	S	A	A	A	A	A
	5.6pF (5R6)	L	L	L	L	N	N	N	N	N	N	S	S	S	S	S	A	A	A	A	A
	6.0pF (6R0)	L	L	L	L	N	N	N	N	N	N	S	S	S	S	S	A	A	A	A	A
	6.8pF (6R8)	L	L	L	L	N	N	N	N	N	N	S	S	S	S	S	A	A	A	A	A
	7.0pF (7R0)	L	L	L	L	N	N	N	N	N	N	S	S	S	S	S	A	A	A	A	A
	8.0pF (8R0)	L	L	L	L	N	N	N	N	N	N	S	S	S	S	S	A	A	A	A	A
	8.2pF (8R2)	L	L	L	L	N	N	N	N	N	N	S	S	S	S	S	A	A	A	A	A
	9.0pF (9R0)	L	L	L	L	N	N	N	N	N	N	S	S	S	S	S	A	A	A	A	A
	10pF (100)	L	L	L	L	N	N	N	N	N	N	S	S	S	S	S	A	A	A	A	A
	12pF (120)	L	L	L	L	N	N	N	N	N	N	S	S	S	S	S	A	A	A	A	A
	15pF (150)	L	L	L	L	N	N	N	N	N	N	S	S	S	S	S	A	A	A	A	A
	18pF (180)	L	L	L	L	N	N	N	N	N	N	S	S	S	S	S	A	A	A	A	A
	22pF (220)	L	L	L	L	N	N	N	N	N	N	S	S	S	S	S	A	A	A	A	A
	27pF (270)	L	L	L	L	N	N	N	N	N	N	S	S	S	S	S	A	A	A	A	A
	33pF (330)	L	L	L	L	N	N	N	N	N	N	S	S	S	S	S	A	A	A	A	A
	39pF (390)	L	L	L	L	N	N	N	N	N	N	S	S	S	S	S	A	A	A	A	A
	47pF (470)	L	L	L	L	N	N	N	N	N	N	S	S	S	S	S	A	A	A	A	A
	56pF (560)	L	L	L	L	N	N	N	N	N	N	S	S	S	S	S	A	A	A	A	A
	68pF (680)	L	L	L	L	N	N	N	N	N	N	S	S	S	S	S	A	A	A	A	A
	82pF (820)	L	L	L	L	N	N	N	N	N	N	S	S	S	S	S	A	A	A	A	A
	100pF (101)	L	L	L	L	N	N	N	N	N	N	S	S	S	S	S	A	A	A	A	A
	120pF (121)	L	L	L	L	N	N	N	N	N	N	S	S	S	S	S	A	A	A	A	A
	150pF (151)			L	L	N	N	N	N	N	N	S	S	S	S	S	A	A	A	A	A
	180pF (181)					N	N	N	N	N	N	S	S	S	S	S	A	A	A	A	A
220pF (221)					N	N	N	N	N	N	S	S	S	S	S	A	A	A	A	A	
270pF (271)			L		N	N	N	N	N	N	S	S	S	S	S	A	A	A	A	A	
330pF (331)			L		N	N	N	N	N	N	S	S	S	S	S	A	A	A	A	A	
390pF (391)			L		N	N	N	N	N	N	S	S	S	S	S	B	B	B	B	B	
470pF (471)			L		N	N	N	N	N	N	S	S	S	S	S	B	B	B	B	B	
560pF (561)			L		N	N	N	N	N	N	S	S	S	S	S	B	B	B	B	B	
680pF (681)					N	N	N	N	N	N	S	S	S	S	S	B	B	B	B	B	
820pF (821)					N	N	N	N	N	N	S	S	S	S	S	B	B	B	B	B	
1,000pF (102)					N	N	N	N	N	N	S	S	S	S	S	B	B	B	B	B	
1,200pF (122)											X	X	X	X	X*	B	B	B	B	B	
1,500pF (152)											X	X	X	X	X*	B	B	B	B	B	
1,800pF (182)											X	X	X	X		B	B	B	B	B	
2,200pF (222)											X	X	X	X		B	B	B	B	B	
2,700pF (272)											X	X	X	X		D	D	D	D	D	
3,300pF (332)											X	X	X	X		D	D	D	D	D	
3,900pF (392)											X	X	X	X		D	D	D	D	D	
4,700pF (472)											X	X	X	X		D	D	D	D	D	
5,600pF (562)											X*	X*	X*	X*		D	D	D	D	D	
6,800pF (682)											X*	X*	X*	X*		D	D	D	D	D	
8,200pF (822)											X*	X*	X*	X*		D	D	D	D	D	
0.010uF (103)											X*	X*	X*	X*		D	D	D	D	D	
0.012uF (123)																T*	T*	T*	T*		
0.015uF (153)																T*	T*	T*	T*		
0.018uF (183)																D*	D*	D*	D*		
0.022uF (223)																D*	D*	D*	D*		

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

2. The letter in cell with " * " mark is expressed capacitance tolerance "J" (±5%) only.

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

Multilayer Ceramic Capacitors

Approval Sheet

7-1. NP0 Dielectric 1206, 1210, 1812 Sizes

DIELECTRIC		NP0													
SIZE		1206					1210					1812			
RATED VOLTAGE (VDC)		10	16	25	50	100	10	16	25	50	100	16	25	50	100
Capacitance	1.0pF (1R0)														
	1.2pF (1R2)	B	B	B	B	B									
	1.5pF (1R5)	B	B	B	B	B									
	1.8pF (1R8)	B	B	B	B	B									
	2.2pF (2R2)	B	B	B	B	B									
	2.7pF (2R7)	B	B	B	B	B									
	3.3pF (3R3)	B	B	B	B	B									
	3.9pF (3R9)	B	B	B	B	B									
	4.7pF (4R7)	B	B	B	B	B									
	5.6pF (5R6)	B	B	B	B	B									
	6.8pF (6R8)	B	B	B	B	B									
	8.2pF (8R2)	B	B	B	B	B									
	10pF (100)	B	B	B	B	B	C	C	C	C	C	D	D	D	D
	12pF (120)	B	B	B	B	B	C	C	C	C	C	D	D	D	D
	15pF (150)	B	B	B	B	B	C	C	C	C	C	D	D	D	D
	18pF (180)	B	B	B	B	B	C	C	C	C	C	D	D	D	D
	22pF (220)	B	B	B	B	B	C	C	C	C	C	D	D	D	D
	27pF (270)	B	B	B	B	B	C	C	C	C	C	D	D	D	D
	33pF (330)	B	B	B	B	B	C	C	C	C	C	D	D	D	D
	39pF (390)	B	B	B	B	B	C	C	C	C	C	D	D	D	D
	47pF (470)	B	B	B	B	B	C	C	C	C	C	D	D	D	D
	56pF (560)	B	B	B	B	B	C	C	C	C	C	D	D	D	D
	68pF (680)	B	B	B	B	B	C	C	C	C	C	D	D	D	D
	82pF (820)	B	B	B	B	B	C	C	C	C	C	D	D	D	D
	100pF (101)	B	B	B	B	B	C	C	C	C	C	D	D	D	D
	120pF (121)	B	B	B	B	B	C	C	C	C	C	D	D	D	D
	150pF (151)	B	B	B	B	B	C	C	C	C	C	D	D	D	D
	180pF (181)	B	B	B	B	B	C	C	C	C	C	D	D	D	D
	220pF (221)	B	B	B	B	B	C	C	C	C	C	D	D	D	D
	270pF (271)	B	B	B	B	B	C	C	C	C	C	D	D	D	D
	330pF (331)	B	B	B	B	B	C	C	C	C	C	D	D	D	D
	390pF (391)	B	B	B	B	B	C	C	C	C	C	D	D	D	D
	470pF (471)	B	B	B	B	B	C	C	C	C	C	D	D	D	D
	560pF (561)	B	B	B	B	B	C	C	C	C	C	D	D	D	D
	680pF (681)	B	B	B	B	B	C	C	C	C	C	D	D	D	D
	820pF (821)	B	B	B	B	B	C	C	C	C	C	D	D	D	D
	1,000pF (102)	B	B	B	B	B	C	C	C	C	C	D	D	D	D
	1,200pF (122)	B	B	B	B	B	C	C	C	C	C	D	D	D	D
	1,500pF (152)	B	B	B	B	B	C	C	C	C	C	D	D	D	D
	1,800pF (182)	B	B	B	B	B	C	C	C	C	C	D	D	D	D
	2,200pF (222)	B	B	B	B	B	C	C	C	C	C	D	D	D	D
	2,700pF (272)	B	B	B	B	B	C	C	C	C	C	D	D	D	D
	3,300pF (332)	B	B	B	B	B	C	C	C	C	C	D	D	D	D
	3,900pF (392)	B	B	B	B	B	C	C	C	C	C	D	D	D	D
	4,700pF (472)	B	B	B	B	B	C	C	C	C	C	D	D	D	D
	5,600pF (562)	B	B	B	B	B	C	C	C	C	C	D	D	D	D
	6,800pF (682)	C	C	C	C	C	C	C	C	C	C	D	D	D	D
	8,200pF (822)	D	D	D	D	D	C	C	C	C	C	D	D	D	D
	0.010μF (103)	D	D	D	D	D	C	C	C	C	C	D	D	D	D
	0.012μF (123)	P	P	P	P	P	D	D	D	D	D	D	D	D	D
	0.015μF (153)	P	P	P	P	P	D	D	D	D	D	D	D	D	D
	0.018μF (183)	P	P	P	P	P	K	K	K	K	K	D	D	D	D
	0.022μF (223)	P	P	P	P	P	K	K	K	K	K	D	D	D	D
	0.027μF (273)	P	P	P	P		K	K	K	K	K	D	D	D	D
	0.033μF (333)	P	P	P	P		K	K	K	K	K	D	D	D	D
	0.039μF (393)	P	P	P	P		K	K	K	K	K	M	M	M	M
	0.047μF (473)	J*	J*	J*	J*		K	K	K	K	K	M	M	M	M
	0.056μF (563)	J*	J*	J*	J*							M	M	M	M
	0.068μF (683)	G*	G*	G*	G*							M	M	M	M
	0.082μF (823)	G*	G*	G*	G*							M	M	M	M
	0.1μF (104)	G*	G*	G*	G*							M	M	M	M

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

2. The letter in cell with “*” mark is expressed capacitance tolerance “J” (±5%) only.

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

7-2. X7R Dielectric 0201, 0402, 0603, 0805 Sizes

DIELECTRIC		X7R																							
SIZE		0201					0402						0603						0805						
RATED VOLTAGE (VDC)		6.3	10	16	25	50	6.3	10	16	25	50	100	6.3	10	16	25	50	100	6.3	10	16	25	50	100	
Capacitance	100pF (101)			L	L	L		N	N	N	N	N		S	S	S	S	S		B	B	B	B	B	
	120pF (121)			L	L	L		N	N	N	N	N		S	S	S	S	S		B	B	B	B	B	
	150pF (151)			L	L	L		N	N	N	N	N		S	S	S	S	S		B	B	B	B	B	
	180pF (181)			L	L	L		N	N	N	N	N		S	S	S	S	S		B	B	B	B	B	
	220pF (221)			L	L	L		N	N	N	N	N		S	S	S	S	S		B	B	B	B	B	
	270pF (271)			L	L	L		N	N	N	N	N		S	S	S	S	S		B	B	B	B	B	
	330pF (331)			L	L	L		N	N	N	N	N		S	S	S	S	S		B	B	B	B	B	
	390pF (391)			L	L	L		N	N	N	N	N		S	S	S	S	S		B	B	B	B	B	
	470pF (471)			L	L	L		N	N	N	N	N		S	S	S	S	S		B	B	B	B	B	
	560pF (561)			L	L	L		N	N	N	N	N		S	S	S	S	S		B	B	B	B	B	
	680pF (681)			L	L	L		N	N	N	N	N		S	S	S	S	S		B	B	B	B	B	
	820pF (821)			L	L	L		N	N	N	N	N		S	S	S	S	S		B	B	B	B	B	
	1,000pF (102)	L	L	L	L	L		N	N	N	N	N		S	S	S	S	S		B	B	B	B	B	
	1,200pF (122)	L	L	L	L			N	N	N	N	N		S	S	S	S	S		B	B	B	B	B	
	1,500pF (152)	L	L	L	L			N	N	N	N	N		S	S	S	S	S		B	B	B	B	B	
	1,800pF (182)	L	L	L	L			N	N	N	N	N		S	S	S	S	S		B	B	B	B	B	
	2,200pF (222)	L	L	L	L			N	N	N	N	N		S	S	S	S	S		B	B	B	B	B	
	2,700pF (272)	L	L	L	L			N	N	N	N	N		S	S	S	S	S		B	B	B	B	B	
	3,300pF (332)	L	L	L	L			N	N	N	N	N		S	S	S	S	S		B	B	B	B	B	
	3,900pF (392)	L	L	L	L			N	N	N	N	N		S	S	S	S	S		B	B	B	B	B	
	4,700pF (472)	L	L	L	L			N	N	N	N	N		S	S	S	S	S		B	B	B	B	B	
	5,600pF (562)	L	L	L	L			N	N	N	N	N		S	S	S	S	S		B	B	B	B	B	
	6,800pF (682)	L	L	L				N	N	N	N			S	S	S	S	S		B	B	B	B	B	
	8,200pF (822)	L	L	L				N	N	N	N			S	S	S	S	S		B	B	B	B	B	
	0.010μF (103)	L	L	L	L			N	N	N	N			S	S	S	S	S		B	B	B	B	B	
	0.012μF (123)							N	N	N	E			S	S	S	S	X		B	B	B	B	B	
	0.015μF (153)							N	N	N	E			S	S	S	S	X		B	B	B	B	B	
	0.018μF (183)							N	N	N	E			S	S	S	S	X		B	B	B	B	B	
	0.022μF (223)		L	L				N	N	N	E			S	S	S	S	X		B	B	B	B	B	
	0.027μF (273)							N	N	N	E			S	S	S	S	X		B	B	B	B	D	
	0.033μF (333)							N	N	N	E			S	S	S	S	X	X		B	B	B	B	D
	0.039μF (393)							N	N	N	E			S	S	S	S	X	X		B	B	B	B	D
	0.047μF (473)							N	N	N	E			S	S	S	S	X	X		B	B	B	B	D
	0.056μF (563)							N	N	N	E			S	S	S	S	X	X		B	B	B	B	D
	0.068μF (683)							N	N	N	E			S	S	S	S	X	X		B	B	B	B	D
	0.082μF (823)							N	N	N	E			S	S	S	S	X	X		B	B	B	B	D
	0.10μF (104)						N	N	N	N	E			S	S	S	S	X	X		B	B	B	B	D
	0.12μF (124)													S	S	S	X				B	B	B	D	I
	0.15μF (154)													S	S	S	X				D	D	D	D	I
	0.18μF (184)													S	S	S	X				D	D	D	D	I
0.22μF (224)						N	N	N	N				S	S	S	X	X			D	D	D	D	I	
0.27μF (274)												X	X	X	X					D	D	D	I		
0.33μF (334)												X	X	X	X	X				D	D	D	I		
0.39μF (394)												X	X	X	X					D	D	D	I		
0.47μF (474)						N	N					X	X	X	X	X				D	D	D	I	I	
0.56μF (564)												X	X	X						D	D	D			
0.68μF (684)												X	X	X						D	D	D			
0.82μF (824)												X	X	X						D	D	D			
1.0μF (105)						N						X	X	X	X	X				D	D	D	I		
1.5μF (155)																				I	I	I			
2.2μF (225)												X	X	X					I	I	I	I			
3.3μF (335)																									
4.7μF (475)												X							I	I	I	I			
6.8μF (685)																									
10μF (106)																			I	I	I*				
22μF (226)																									

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

2. The letter in cell with “*” mark is expressed product not in 10% (code “K”) tolerance.

7-2. X7R Dielectric 1206, 1210, 1812 Sizes

DIELECTRIC		X7R																	
SIZE		1206							1210						1812				
RATED VOLTAGE (VDC)		6.3	10	16	25	35	50	100	6.3	10	16	25	50	100	10	16	25	50	100
Capacitance	100pF (101)																		
	120pF (121)																		
	150pF (151)		B	B	B		B	B											
	180pF (181)		B	B	B		B	B											
	220pF (221)		B	B	B		B	B											
	270pF (271)		B	B	B		B	B											
	330pF (331)		B	B	B		B	B											
	390pF (391)		B	B	B		B	B											
	470pF (471)		B	B	B		B	B											
	560pF (561)		B	B	B		B	B											
	680pF (681)		B	B	B		B	B											
	820pF (821)		B	B	B		B	B											
	1,000pF (102)		B	B	B		B	B		C	C	C	C	C	D	D	D	D	D
	1,200pF (122)		B	B	B		B	B		C	C	C	C	C	D	D	D	D	D
	1,500pF (152)		B	B	B		B	B		C	C	C	C	C	D	D	D	D	D
	1,800pF (182)		B	B	B		B	B		C	C	C	C	C	D	D	D	D	D
	2,200pF (222)		B	B	B		B	B		C	C	C	C	C	D	D	D	D	D
	2,700pF (272)		B	B	B		B	B		C	C	C	C	C	D	D	D	D	D
	3,300pF (332)		B	B	B		B	B		C	C	C	C	C	D	D	D	D	D
	3,900pF (392)		B	B	B		B	B		C	C	C	C	C	D	D	D	D	D
	4,700pF (472)		B	B	B		B	B		C	C	C	C	C	D	D	D	D	D
	5,600pF (562)		B	B	B		B	B		C	C	C	C	C	D	D	D	D	D
	6,800pF (682)		B	B	B		B	B		C	C	C	C	C	D	D	D	D	D
	8,200pF (822)		B	B	B		B	B		C	C	C	C	C	D	D	D	D	D
	0.010μF (103)		B	B	B		B	B		C	C	C	C	C	D	D	D	D	D
	0.012μF (123)		B	B	B		B	B		C	C	C	C	C	D	D	D	D	D
	0.015μF (153)		B	B	B		B	B		C	C	C	C	C	D	D	D	D	D
	0.018μF (183)		B	B	B		B	B		C	C	C	C	C	D	D	D	D	D
	0.022μF (223)		B	B	B		B	B		C	C	C	C	C	D	D	D	D	D
	0.027μF (273)		B	B	B		B	B		C	C	C	C	C	D	D	D	D	D
	0.033μF (333)		B	B	B		B	B		C	C	C	C	C	D	D	D	D	D
	0.039μF (393)		B	B	B		B	B		C	C	C	C	C	D	D	D	D	D
	0.047μF (473)		B	B	B		B	B		C	C	C	C	C	D	D	D	D	D
	0.056μF (563)		B	B	B		B	B		C	C	C	C	C	D	D	D	D	D
	0.068μF (683)		B	B	B		B	B		C	C	C	C	C	D	D	D	D	D
	0.082μF (823)		B	B	B		B	D		C	C	C	C	C	D	D	D	D	D
	0.10μF (104)		B	B	B		B	D		C	C	C	C	C	D	D	D	D	D
	0.12μF (124)		B	B	B		B	D		C	C	C	C	C	D	D	D	D	D
	0.15μF (154)		C	C	C		C	G		C	C	C	C	C	D	D	D	D	D
	0.18μF (184)		C	C	C		C	G		C	C	C	C	C	D	D	D	D	D
0.22μF (224)		C	C	C		C	G		C	C	C	C	C	D	D	D	D	D	
0.27μF (274)		C	C	C		D	G		C	C	C	C	G	D	D	D	D	D	
0.33μF (334)		C	C	C		D	G		C	C	C	D	G	D	D	D	D	D	
0.39μF (394)		C	C	J		P	G		C	C	C	D	M	D	D	D	D	D	
0.47μF (474)		J	J	J		P	G		C	C	C	D	M	D	D	D	D	K	
0.56μF (564)		J	J	J		P	P		D	D	D	D	M	D	D	D	D	K	
0.68μF (684)		J	J	J		P	P		D	D	D	D	K	D	D	D	K	K	
0.82μF (824)		J	J	J		P	P		D	D	D	D	K	D	D	D	K	K	
1.0μF (105)		J	J	J		P	P		D	D	D	D	K	D	D	D	K	K	
1.5μF (155)	J	J	J	P						K	G	M	M					K	
2.2μF (225)	J	J	J	P		P	P			K	G	M	M				M	M	
3.3μF (335)		P	P	P						K	G	M	M						
4.7μF (475)	P	P	P	P		P			K	K	K	M	M						
6.8μF (685)																			
10μF (106)	P	P	P	P	P				K	K	K	M							
22μF (226)	P	P	P*						M	M	M								
47μF (476)								M	M										
100μF (107)																			

1. The letter in cell is expressed the symbol of product thickness.
2. The letter in cell with “*” mark is expressed product not in 10% (code “K”) tolerance.

Multilayer Ceramic Capacitors

Approval Sheet

7-3. Y5V Dielectric 0402, 0603, 0805 Sizes

DIELECTRIC		Y5V															
SIZE		0402					0603					0805					
RATED VOLTAGE (VDC)		6.3	10	16	25	50	6.3	10	16	25	50	6.3	10	16	25	50	100
Capacitance	0.010μF (103)		N	N	N	N		S	S	S	S		A	A	A	A	B
	0.015μF (153)		N	N	N	N		S	S	S	S		A	A	A	A	B
	0.022μF (223)		N	N	N	N		S	S	S	S		A	A	A	A	B
	0.033μF (333)		N	N	N	N		S	S	S	S		A	A	A	A	B
	0.047μF (473)		N	N	N			S	S	S	S		A	A	A	A	B
	0.068μF (683)		N	N	N			S	S	S	S		A	A	A	A	B
	0.10μF (104)		N	N	N			S	S	S	S		A	A	A	A	B
	0.15μF (154)		N					S	S	S	S		A	A	A	A	
	0.22μF (224)	N	N					S	S	S	S		A	A	A	A	
	0.33μF (334)	N	N					S	S	S			B	B	B	B	
	0.47μF (474)	N	N					S	S				B	B	B	B	
	0.68μF (684)							S	X				B	B	D	D	
	1.0μF (105)							S	X				B	B	D	D	
	1.5μF (155)							S					D	D			
	2.2μF (225)						S	S					D	D			
	3.3μF (335)												D	D			
	4.7μF (475)												D	D			
	6.8μF (685)												I				
10μF (106)											I	I					
22μF (226)																	

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

7-3. Y5V Dielectric 1206, 1210, 1812 Sizes

DIELECTRIC		Y5V																	
SIZE		1206						1210							1812				
RATED VOLTAGE (VDC)		6.3	10	16	25	50	100	6.3	10	16	25	35	50	100	10	16	25	50	100
Capacitance	0.010μF (103)		B	B	B	B	B							C					D
	0.015μF (153)		B	B	B	B	B							C					D
	0.022μF (223)		B	B	B	B	B							C					D
	0.033μF (333)		B	B	B	B	B							C					D
	0.047μF (473)		B	B	B	B	B							C					D
	0.068μF (683)		B	B	B	B	B							C					D
	0.10μF (104)		B	B	B	B	B		C	C	C		C	C	D	D	D	D	D
	0.15μF (154)		B	B	B	B	C		C	C	C		C	C	D	D	D	D	D
	0.22μF (224)		B	B	B	B	C		C	C	C		C	C	D	D	D	D	D
	0.33μF (334)		B	B	B	B			C	C	C		C	C	D	D	D	D	D
	0.47μF (474)		B	B	B	B			C	C	C		C		D	D	D	D	D
	0.68μF (684)		B	B	B	B			C	C	C		C		D	D	D	D	D
	1.0μF (105)		C	C	C	C			C	C	C		C		D	D	D	D	D
	1.5μF (155)		C	C	C				C	C	C				D	D	D	D	
	2.2μF (225)		C	C	C				C	C	C		G		D	D	D	D	
	3.3μF (335)		J	J	J				C	C	C				D	D	D	D	
	4.7μF (475)		J	J	J				C	C	D		G		D	D	D	D	
	6.8μF (685)		J	J					C	C	D				D	D	D	D	
	10μF (106)		J	J					D	D	G	K			D	D	D		
22μF (226)		P							K	K									
47μF (476)								K	K						M				
100μF (107)								M											

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

7-4. X5R Dielectric 0201, 0402, 0603, 0805, 1206, 1210 Sizes

Dielectric		X5R																
Size		0201					0402						0603					
Rated Voltage (VDC)		6.3	10	16	25	50	4	6.3	10	16	25	50	4	6.3	10	16	25	50
Capacitance	100pF (101)			L	L	L												
	120pF (121)			L	L	L												
	150pF (151)			L	L	L												
	180pF (181)			L	L	L												
	220pF (221)			L	L	L												
	270pF (271)			L	L	L												
	330pF (331)			L	L	L												
	390pF (391)			L	L	L												
	470pF (471)			L	L	L												
	560pF (561)			L	L	L												
	680pF (681)			L	L	L												
	820pF (821)			L	L	L												
	1,000pF (102)		L	L	L	L												
	1,500pF (152)		L	L	L													
	2,200pF (222)		L	L	L													
	2,700pF (272)		L	L	L													
	3,300pF (332)		L	L	L													
	4,700pF (472)		L	L	L													
	6,800pF (682)		L	L	L													
	0.010μF (103)	L	L	L	L	L												
	0.015μF (153)	L	L									E						
	0.022μF (223)	L	L									E						
	0.027μF (273)	L	L							N		E						
	0.033μF (333)	L	L							N		E						
	0.039μF (393)	L	L							N		E						
	0.047μF (473)	L	L						N	N	N	E						
	0.056μF (563)	L	L						N	N	N	E						
	0.068μF (683)	L	L						N	N	N	E						
	0.082μF (823)	L	L						N	N	N	E						
	0.10μF (104)	L	L	L	L				N	N	N	N	E					
	0.15μF (154)								N	N	N	N						
	0.22μF (224)	L	L	L*					N	N	N	N	N	X	X	X	X	
	0.27μF (274)														X	X	X	
	0.33μF (334)	L*							N	N				X	X	X	X	
	0.39μF (394)														X	X	X	
	0.47μF (474)	L							N	N	E	E	E	X	X	X	X	X
	0.68μF (684)								N	N				X	X	X	X	
	0.82μF (824)													X	X	X	X	
	1.0μF (105)	L*	L*	L*					N	N	N	N	E	X	X	X	X	X
	1.5μF (155)													X				
	2.2μF (225)	L*	L*						N	N	E	E		X	X	X	X	X
	3.3μF (335)													X	X			
	4.7μF (475)								E	E	E*			X	X	X	X	
	6.8μF (685)																	
	10μF (106)						E*	E*	E*					X	X	X	X	X*
	22μF (226)													X*	X*	X*		
	47μF (476)													X*	X*			

Dielectric		X5R																			
Size		0805						1206						1210							
Rated Voltage (VDC)		4	6.3	10	16	25	50	4	6.3	10	16	25	50	4	6.3	10	16	25	35	50	
Capacitance	1.0μF (105)			D	D	D	I														
	1.5μF (155)		I	I	I	I				J	J					K	K				
	2.2μF (225)		I	I	I	I	I			J	J	P	P			K	K				
	3.3μF (335)		I	I	I	I				P	P	P									
	4.7μF (475)		I	I	I	I	I			P	P	P	P			K	K	K			
	6.8μF (685)								P	P											
	10μF (106)		I	I	I	I	I			P	P	P	P	P		K	K	K	K	M	M
	22μF (226)		I	I*	I*	I*				P	P	P	P			M	M	M	M	M	
	47μF (476)		I*	I*						P	P	P*				M	M	M	M*		
	100μF (107)	I*	I*							P						M*	M*	M*			
220μF (227)							P*							M*	M*						

- The letter in cell is expressed the symbol of product thickness.
- The letter in cell with " * " mark is expressed product not in 10% (code "K") tolerance.

7-5. X6S Dielectric 0201, 0402, 0603, 0805, 1206, 1210 Sizes

Dielectric		X6S																													
Size		0201				0402				0603					0805					1206					1210						
Rated Voltage (VDC)		6.3	10	16	25	6.3	10	16	25	4	6.3	10	16	25	4	6.3	10	16	25	50	6.3	10	16	25	50	6.3	10	16	25	50	
Capacitance	0.10μF (104)	L	L	L	L																										
	0.15μF (154)																														
	0.22μF (224)	L	L*																												
	0.33μF (334)																														
	0.47μF (474)					E																									
	0.68μF (684)																														
	1.0μF (105)	L*				E	E	E	E																						
	1.5μF (155)																														
	2.2μF (225)					E	E	E					X	X																	
	3.3μF (335)																														
	4.7μF (475)										X	X	X	X						I	I										
	6.8uF (685)																														
	10μF (106)					E*					X*	X*	X*	X*		I	I	I	I	I					P						
	22μF (226)										X*	X*					I*	I*	I*	I*			P	P*	P					M	
	47μF (476)															I*	I*					P							M	M	M
100μF (107)																												M*	M*		

1. The letter in cell is expressed the symbol of product thickness.
2. The letter in cell with “*” mark is expressed product not in 10% (code “K”) tolerance.

7-6. X7S Dielectric 0402, 0603, 0805, 1206, 1210 Sizes

Dielectric		X7S																							
Size		0402				0603				0805					1206					1210					
Rated Voltage (VDC)		6.3	10	16	25	6.3	10	16	25	10	16	25	50	100	6.3	10	16	25	50	6.3	10	16	25	50	
Capacitance	1.0μF (105)		E											I											
	1.5μF (155)																								
	2.2μF (225)	E	E					X	X																
	3.3μF (335)																								
	4.7μF (475)						X	X					I												
	6.8uF (685)																								
	10μF (106)											I	I												
	22μF (226)																								
	47μF (476)															P*			P*						
100μF (107)																							M*		

1. The letter in cell is expressed the symbol of product thickness.
2. The letter in cell with “*” mark is expressed product not in 10% (code “K”) tolerance.

8. PACKAGING STYLE AND QUANTITY

Size	Thickness (mm)/Symbol		Paper tape		Plastic tape	
			7" reel	13" reel	7" reel	13" reel
0201 (0603)	0.30±0.03	L	15,000	70,000	-	-
	0.30±0.05	L	15,000	-	-	-
	0.30±0.09	L	15,000	-	-	-
0402 (1005)	0.50±0.05	N	10,000	50,000	-	-
	0.50±0.02/-0.05	Q	10,000	50,000	-	-
	0.50±0.20	E	10,000	-	-	-
0603 (1608)	0.50±0.10	H	4,000	-	-	-
	0.80±0.07	S	4,000	15,000	-	-
	0.80±0.15/-0.10	X	4,000	15,000	-	-
0805 (2012)	0.50±0.10	H	4,000	15,000	-	-
	0.60±0.10	A	4,000	15,000	-	-
	0.80±0.10	B	4,000	15,000	-	-
	0.85±0.10	T	4,000	15,000	-	-
	1.25±0.10	D	-	-	3,000	10,000
	1.25±0.20	I	-	-	3,000	10,000
1206 (3216)	0.80±0.10	B	4,000	15,000	-	-
	0.85±0.10	T	4,000	15,000	-	-
	0.95±0.10	C	-	-	3,000	10,000
	1.15±0.15	J	-	-	3,000	10,000
	1.25±0.10	D	-	-	3,000	10,000
	1.60±0.20	G	-	-	2,000	10,000
1210 (3225)	1.60±0.30/-0.10	P	-	-	2,000	9,000
	0.85±0.10	T	-	-	3,000	10,000
	0.95±0.10	C	-	-	3,000	10,000
	1.25±0.10	D	-	-	3,000	10,000
	1.60±0.20	G	-	-	2,000	-
	2.00±0.20	K	-	-	1,000	6,000
1808 (4520)	2.50±0.30	M	-	-	1,000	6,000
	1.25±0.10	D	-	-	2,000	10,000
	1.40±0.15	F	-	-	2,000	10,000
	1.60±0.20	G	-	-	2,000	8,000
1812 (4532)	2.00±0.20	K	-	-	1,000	6,000
	1.25±0.10	D	-	-	1,000	5,000
	1.60±0.20	G	-	-	1,000	-
	2.00±0.20	K	-	-	1,000	-
	2.50±0.30	M	-	-	500	3,000
	2.80±0.30	U	-	-	500	-

Unit: pieces

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9. RELIABILITY TEST CONDITIONS AND REQUIREMENTS

No.	Item	Test Condition	Requirements			
1.	Visual and Mechanical	---	* No remarkable defect. * Dimensions to conform to individual specification sheet.			
2.	Capacitance	Class I: (NP0) ≤ 1000pF, 1.0±0.2Vrms · 1MHz±10% > 1000pF, 1.0±0.2Vrms · 1KHz±10% Class II: (X7R, X7E, X6S, X5R,X7S,Y5V) C ≤ 10μF, 1.0±0.2Vrms · 1KHz±10% ** C > 10μF, 0.5±0.2Vrms · 120Hz±20%	* Shall not exceed the limits given in the detailed spec. NP0: Cap≥30pF, Q≥1000; Cap<30pF,Q≥400+20C			
3.	Q/ D.F. (Dissipation Factor)	** Test condition: 0.5±0.2Vrms · 1KHz±10% X7R: 0805=106(6.3V), 0603/475(6.3V) X5R: 0201 ≥ 224 (6.3V,10V,16V) ^{#1} , 0402 ≥ 475 (6.3V,16V), 0402 ≥ 225(10V), 0603=106 (6.3V,10V), TT18X ≥ 475(10V) , TT15X series X6S: 0201/474(4V),0201 ≥ 104 (6.3V,10V) ^{#1} , 0402 ≥ 225 (6.3V), 0402/475 (10V), 0603/106 (6.3V), X7S: 0402/225(6.3V) #1 Excluding X5R/0201/105(6.3V);225(10V), X6S/0201/104(10V) (1.0±0.2Vrms · 1KHz±10%) *Before initial measurement (Class II only): To apply de-aging at 150℃ for 1hr then set for 24±2 hrs at room temp.	X7R:			
			Rated vol.	D.F. ≤	Exception of D.F. ≤	
			≥ 100V	≤ 2.5%	≤ 3%	1206 ≥ 0.47μF
			50V	≤ 2.5%	≤ 5%	0603 ≥ 0.068μF;0805 > 0.1μF;1206 ≥ 1μF;1210 ≥ 2.2μF;TT series
					≤ 10%	0805 > 0.22μF;1210 ≥ 3.3μF
					≤ 3%	0201(50V); 0603 ≥ 0.047μF; 0805 ≥ 0.18μF;1206 ≥ 0.47μF
			35V	≤ 3.5%	≤ 5%	0201 ≥ 0.01μF; 1210 ≥ 4.7μF
					≤ 10%	0402 ≥ 0.012μF;0603>0.1μF; 0805/X7R>0.47μF; 1206 ≥ 2.2μF;1210 ≥ 10μF; TT series
					≤ 10%	0603 ≥ 1μF;0805≥2.2μF;1206 ≥ 2.2μF;1210 ≥ 10μF
			25V	≤ 3.5%	≤ 5%	0201 ≥ 0.01μF;0805 ≥ 1μF;1210 ≥ 10μF
					≤ 7%	0603 ≥ 0.33μF
					≤ 10%	0201 ≥ 0.1μF;0402/X7R ≥ 0.056μF;0603 ≥ 0.47μF; 0805 ≥ 2.2μF; 1206 ≥ 4.7μF;1210 ≥ 22μF; TT series
			16V	≤ 3.5%	≤ 12.5%	0402 ≥ 0.47μF
					≤ 5%	0201 ≥ 0.01μF;0402 ≥ 0.033μF;0603 ≥ 0.15μF; 0805 ≥ 0.68μF;1206 ≥ 2.2μF;1210 ≥ 4.7μF
					≤ 10%	0201/X7R ≥ 0.022μF; 0402 ≥ 0.22μF; 0603>0.47μF;0805 ≥ 2.2μF;1206 ≥ 4.7μF; 1210 ≥ 22μF; TT series
			10V	≤ 5%	≤ 10%	0201 ≥ 0.012μF;0402 ≥ 0.22μF; TT series
					≤ 15%	0603 ≥ 0.33μF; 0805 ≥ 2.2μF;1206 ≥ 2.2μF;1210 ≥ 22μF;01R5/X5R
					≤ 15%	0201 ≥ 0.1μF; 0402 ≥ 1μF
			6.3V	≤ 10%	≤ 15%	0201 ≥ 0.1μF;0402 ≥ 1μF;0603 ≥ 10μF; 0805 ≥ 4.7μF; 1206 ≥ 47μF :1210 ≥ 100μF; TT series
					≤ 20%	0402 ≥ 2.2μF
					---	---
			4V	≤ 15%	---	---
			X5R:			
			Rated vol.	D.F. ≤	Exception of D.F. ≤	
			≥ 100V	≤ 2.5%	≤ 3%	1206 ≥ 0.47μF
			50V	≤ 2.5%	≤ 5%	0603 ≥ 0.068μF;0805 > 0.1μF;1206 ≥ 1μF;1210 ≥ 2.2μF;TT series
					≤ 10%	0805 > 0.22μF;1210 ≥ 3.3μF
					≤ 3%	0201(50V); 0603 ≥ 0.047μF; 0805 ≥ 0.18μF;1206 ≥ 0.47μF
			35V	≤ 3.5%	≤ 5%	0201 ≥ 0.01μF; 1210 ≥ 4.7μF
					≤ 10%	0402 ≥ 0.012μF;0603>0.1μF; 0805 ≥ 1μF; 1206 ≥ 2.2μF;1210 ≥ 10μF; TT series
					≤ 10%	0603 ≥ 1μF;0805≥2.2μF;1206 ≥ 2.2μF;1210 ≥ 10μF
			25V	≤ 3.5%	≤ 5%	0201 ≥ 0.01μF;0805 ≥ 1μF
					≤ 7%	0603 ≥ 0.33μF
≤ 10%	0201 ≥ 0.1μF;0402 ≥ 0.10μF;0603 ≥ 0.47μF; 0805 ≥ 2.2μF; 1206 ≥ 4.7μF; 1210 ≥ 10μF; TT series					
16V	≤ 3.5%	≤ 12.5%	0402 ≥ 0.47μF			
		≤ 5%	0201 ≥ 0.01μF;0402 ≥ 0.033μF;0603 ≥ 0.15μF; 0805 ≥ 0.68μF;1206 ≥ 2.2μF;1210 ≥ 4.7μF			
		≤ 10%	0201 ≥ 0.1μF; 0402 ≥ 0.22μF; 0603>0.47μF;0805 ≥ 2.2μF;1206 ≥ 4.7μF; 1210 ≥ 22μF; TT series			
10V	≤ 5%	≤ 10%	0201 ≥ 0.012μF;0402 ≥ 0.22μF; TT series			
		≤ 15%	0603 ≥ 0.33μF; 0805 ≥ 2.2μF;1206 ≥ 2.2μF;1210 ≥ 22μF;01R5/X5R			
		≤ 15%	0201 ≥ 0.1μF; 0402 ≥ 1μF			
6.3V	≤ 10%	≤ 15%	0201 ≥ 0.1μF;0402 ≥ 1μF;0603 ≥ 10μF; 0805 ≥ 4.7μF; 1206 ≥ 47μF :1210 ≥ 100μF; TT series			
		≤ 20%	0402 ≥ 2.2μF			
		---	---			
4V	≤ 15%	---	---			
Y5V:						
Rated vol.	D.F. ≤	Exception of D.F. ≤				
≥ 50V	≤ 5%	≤ 7%	0603 ≥ 0.1μF; 0805 ≥ 0.47μF; 1206 ≥ 4.7μF; TT series			
35V	≤ 7%	≤ 12.5%	1210 ≥ 6.8μF			
		---	---			
25V	≤ 5%	≤ 7%	0402 ≥ 0.047μF;0603 ≥ 0.1μF; 0805 ≥ 0.33μF; 1206 ≥ 1μF; 1210 ≥ 4.7μF			
		≤ 9%	0402 ≥ 0.068μF;0603 ≥ 0.47μF; 1206 ≥ 4.7μF; 1210 ≥ 22μF; TT series			
		≤ 9%	0402 ≥ 0.068μF; 0603 ≥ 0.68μF			
16V (C<1.0μF)	≤ 7%	≤ 12.5%	0402 ≥ 0.22μF			
16V (C ≥ 1.0μF)	≤ 9%	≤ 12.5%	0603 ≥ 2.2μF; 0805 ≥ 3.3μF;1206 ≥ 10μF; 1210 ≥ 22μF; 1812 ≥ 47μF; TT series			
10V	≤ 12.5%	≤ 20%	0402 ≥ 0.47μF			
6.3V	≤ 20%	---	---			

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	X6S:			
	Rated vol.	D.F. ≤	Exception of D.F. ≤	
	≥ 100V	≤ 2.5%	≤ 3%	1206 ≥ 0.47μF
			≤ 5%	0603 ≥ 0.068μF; 0805 > 0.1μF; 1206 ≥ 1μF; 1210 ≥ 2.2μF; TT series
			≤ 10%	0805 > 0.22μF; 1210 ≥ 3.3μF
	50V	≤ 2.5%	≤ 3%	0201(50V); 0603 ≥ 0.047μF; 0805 ≥ 0.18μF; 1206 ≥ 0.47μF
			≤ 5%	0201 ≥ 0.01uF; 1210 ≥ 4.7μF
			≤ 10%	0402 ≥ 0.012μF; 0603 > 0.1μF; 0805 ≥ 1μF; 1206 ≥ 2.2μF; 1210 ≥ 10μF; TT series
	35V	≤ 3.5%	≤ 10%	0603 ≥ 1μF; 0805 ≥ 2.2μF; 1206 ≥ 2.2μF; 1210 ≥ 10μF
	25V	≤ 3.5%	≤ 5%	0201 ≥ 0.01μF; 0805 ≥ 1μF; 1210 ≥ 10μF
			≤ 7%	0603 ≥ 0.33μF
			≤ 10%	0201 ≥ 0.1μF; 0402 ≥ 0.10μF; 0603 ≥ 0.47μF; 0805 ≥ 2.2μF; 1206 ≥ 4.7μF; 1210 ≥ 22μF; TT series
			≤ 12.5%	0402 ≥ 0.47μF
	16V	≤ 3.5%	≤ 5%	0201 ≥ 0.01μF; 0402 ≥ 0.033μF; 0603 ≥ 0.15μF; 0805 ≥ 0.68μF; 1206 ≥ 2.2μF; 1210 ≥ 4.7μF
			≤ 10%	0201 ≥ 0.1uF; 0402 ≥ 0.22uF; 0603 > 0.47μF; 0805 ≥ 2.2μF; 1206 ≥ 4.7μF; 1210 ≥ 22μF; TT series
	10V	≤ 5%	≤ 10%	0201 ≥ 0.012μF; 0402 ≥ 0.22μF; TT series
			≤ 15%	0603 ≥ 0.33μF; 0805 ≥ 2.2μF; 1206 ≥ 2.2μF; 1210 ≥ 22μF; 01R5/X5R
	6.3V	≤ 10%	≤ 15%	0201 ≥ 0.1μF; 0402/X6S ≥ 0.47μF; 0603 ≥ 10μF; 0805 ≥ 4.7μF; 1206 ≥ 47μF :1210 ≥ 100μF; TT series
			≤ 20%	0402 ≥ 2.2μF
	4V	≤ 15%	---	---
	X7S:			
	Rated vol.	D.F. ≤	Exception of D.F. ≤	
	≥ 100V	≤ 2.5%	≤ 3%	1206 ≥ 0.47μF
			≤ 5%	0603 ≥ 0.068μF; 0805 > 0.1μF; 1206 ≥ 1μF; 1210 ≥ 2.2μF; TT series
			≤ 10%	0805 > 0.22μF; 1210 ≥ 3.3μF
50V	≤ 2.5%	≤ 3%	0201(50V); 0603 ≥ 0.047μF; 0805 ≥ 0.18μF; 1206 ≥ 0.47μF	
		≤ 5%	0201 ≥ 0.01uF; 1210 ≥ 4.7μF	
		≤ 10%	0402 ≥ 0.012μF; 0603 > 0.1μF; 0805 ≥ 1μF; 1206 ≥ 2.2μF; 1210 ≥ 10μF; TT series	
35V	≤ 3.5%	≤ 10%	0603 ≥ 1μF; 0805 ≥ 2.2μF; 1206 ≥ 2.2μF; 1210 ≥ 10μF	
25V	≤ 3.5%	≤ 5%	0201 ≥ 0.01μF; 0805 ≥ 1μF; 1210 ≥ 10μF	
		≤ 7%	0603 ≥ 0.33μF	
		≤ 10%	0201 ≥ 0.1μF; 0402 ≥ 0.10μF; 0603 ≥ 0.47μF; 0805 ≥ 2.2μF; 1206 ≥ 4.7μF; 1210 ≥ 22μF; TT series	
		≤ 12.5%	0402 ≥ 0.47μF	
16V	≤ 3.5%	≤ 5%	0201 ≥ 0.01μF; 0402 ≥ 0.033μF; 0603 ≥ 0.15μF; 0805 ≥ 0.68μF; 1206 ≥ 2.2μF; 1210 ≥ 4.7μF	
		≤ 10%	0201 ≥ 0.1uF; 0402 ≥ 0.22uF; 0603 > 0.47μF; 0805 ≥ 2.2μF; 1206 ≥ 4.7μF; 1210 ≥ 22μF; TT series	
10V	≤ 5%	≤ 10%	0201 ≥ 0.012μF; 0402 ≥ 0.22μF; TT series	
		≤ 15%	0603 ≥ 0.33μF; 0805 ≥ 2.2μF; 1206 ≥ 2.2μF; 1210 ≥ 22μF; 01R5/X5R	
6.3V	≤ 10%	≤ 15%	0201 ≥ 0.1μF; 0402 ≥ 1μF; 0603 ≥ 10μF; 0805 ≥ 4.7μF; 1206 ≥ 47μF :1210 ≥ 100μF; TT series	
		≤ 20%	0402 ≥ 2.2μF	
4V	≤ 15%	---	---	
4.	Dielectric Strength	* To apply voltage (≤100V) 250%. * Duration: 1 to 5 sec. * Charge and discharge current less than 50mA.		* No evidence of damage or flash over during test.

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5.	Insulation Resistance	To apply rated voltage for MAX. 120sec.	10GΩ or RxC ≥ 500Ω·F whichever is smaller. Class II (X7R, X7E, X5R,X6S,X7S,Y5V:)																						
			<table><tr><th>Rated voltage</th><th>Insulation Resistance</th></tr><tr><td>100V: All X7R</td><td rowspan="7">10GΩ or RxC ≥ 100Ω·F whichever is smaller.</td></tr><tr><td>50V:0402>0.01μF;0603≥1μF;0805≥1μF;1206≥4.7μF;1210≥4.7μF</td></tr><tr><td>35V:0805≥2.2μF;1206 ≥ 2.2μF;1210 ≥ 10μF</td></tr><tr><td>25V:0402≥1μF;0603≥2.2μF;0805≥2.2μF;1206≥10μF;1210≥10μF</td></tr><tr><td>16V: 0201≥0.1μF,0402≥0.22μF;0603≥1μF; 0805≥2.2μF;1206≥10μF;1210≥47μF</td></tr><tr><td>10V:0201≥47nF;0402≥0.47μF;0603≥0.47μF;0805≥2.2μF; 1206≥4.7μF;1210≥47μF</td></tr><tr><td>6.3V ; 4V ; TT series; Size≥1812</td></tr><tr><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; 0603>4.7μF; 0805≥47μF;1206≥10μF; TT15>1.0μF</td></tr><tr><td>4V:0603≥22μF; 0805≥47μF; 1206≥100μF</td></tr></table>	Rated voltage	Insulation Resistance	100V: All X7R	10GΩ or RxC ≥ 100Ω·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	Rated voltage	Insulation Resistance	All X6S items, All X7S items	RxC ≥ 50 Ω·F.	100V: 1210≥3.3μF	50V: 0402≥0.1μF; 0603≥2.2μF; 0805≥10μF;1206≥10μF	35V: 0603≥1μF;	25V: 0201≥0.1μF; 0402≥2.2μF;0603≥10μF; 0805≥10μF;1206≥22μF	16V: 0603≥10μF; 0402≥1μF; 0201≥0.22μF	10V: 0201>0.1μF; 0402≥1μF; 0603≥10μF; 0805≥47μF; TT21>4.7μF	6.3V: 0201≥0.1μF; 0603>4.7μF; 0805≥47μF;1206≥10μF; TT15>1.0μF	4V:0603≥22μF; 0805≥47μF; 1206≥100μF
Rated voltage	Insulation Resistance																								
100V: All X7R	10GΩ or RxC ≥ 100Ω·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																									
Rated voltage	Insulation Resistance																								
All X6S items, All X7S items	RxC ≥ 50 Ω·F.																								
100V: 1210≥3.3μF																									
50V: 0402≥0.1μF; 0603≥2.2μF; 0805≥10μF;1206≥10μF																									
35V: 0603≥1μF;																									
25V: 0201≥0.1μF; 0402≥2.2μF;0603≥10μF; 0805≥10μF;1206≥22μF																									
16V: 0603≥10μF; 0402≥1μF; 0201≥0.22μF																									
10V: 0201>0.1μF; 0402≥1μF; 0603≥10μF; 0805≥47μF; TT21>4.7μF																									
6.3V: 0201≥0.1μF; 0603>4.7μF; 0805≥47μF;1206≥10μF; TT15>1.0μF																									
4V:0603≥22μF; 0805≥47μF; 1206≥100μF																									



No.	Item	Test Condition	Requirements																												
6.	Temperature Coefficient	With no electrical load.																													
		<table><tr><th>T.C.</th><th>Operating Temp</th></tr><tr><td>NPO</td><td>-55~125°C at 25°C</td></tr><tr><td>X7R</td><td>-55~125°C at 25°C</td></tr><tr><td>X7S</td><td>-55 ~ 125°C at 25°C</td></tr><tr><td>X5R</td><td>-55~ 85°C at 25°C</td></tr><tr><td>X6S</td><td>-55~105°C at 25°C</td></tr><tr><td>Y5V</td><td>-25~ 85°C at 20°C</td></tr></table>	T.C.	Operating Temp	NPO	-55~125°C at 25°C	X7R	-55~125°C at 25°C	X7S	-55 ~ 125°C at 25°C	X5R	-55~ 85°C at 25°C	X6S	-55~105°C at 25°C	Y5V	-25~ 85°C at 20°C	<table><tr><th>T.C.</th><th>Capacitance Change</th></tr><tr><td>NPO</td><td>Within ±30ppm/°C</td></tr><tr><td>X7R</td><td>Within ±15%</td></tr><tr><td>X7S</td><td>Within ±22%</td></tr><tr><td>X5R</td><td>Within ±15%</td></tr><tr><td>X6S</td><td>Within ±22%</td></tr><tr><td>Y5V</td><td>Within +30%/-80%</td></tr></table>	T.C.	Capacitance Change	NPO	Within ±30ppm/°C	X7R	Within ±15%	X7S	Within ±22%	X5R	Within ±15%	X6S	Within ±22%	Y5V	Within +30%/-80%
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No.	Item	Test Condition	Requirements																																																																																																						
13.	Humidity (Damp Heat) Steady State	*Test temp.: 40±2℃ *Humidity: 90~95%RH *Test time: 500+24/-0hrs. *Before initial measurement (Class II only): To apply de-aging at 150℃ for 1hr then set for 24±2 hrs at room temp. * Cap. / DF(Q) / I.R. Measurement to be made after de-aging at 150℃ for 1hr then set for 24±2 hrs at room temp.	* No remarkable damage. * Cap change: NP0: within ±5% or 0.5pF whichever is larger X7R, X5R, X6S, X7S: ≥10V**,within ±12.5%; ≤ 6.3V within ±25%; TT series & C≥ 1uF,within ±25% **10V: 0603≥4.7μF;0402≥ 1μF;0201≥ 0.1μF, within ±25%; Y5V: ≥10V, within ±30%; ≤ 6.3V, within +30/-40% * Q/D.F. value: NP0: More than 30pF Q≥350, 10pF≤C≤30pF, Q≥275+2.5C Less than 10pF Q≥200+10C X7R, X5R, X6S, X7S: <table><tr><th>Rated vol.</th><th>D.F.≤</th><th colspan="2">Exception of D.F. ≤</th></tr><tr><td rowspan="3">≥100V</td><td rowspan="3">≤3%</td><td>≤6%</td><td>1206≥0.47μF</td></tr><tr><td>≤7.5%</td><td>0603≥0.068μF, 0805>0.1μF, 1206≥1μF;1210≥2.2μF;TT series</td></tr><tr><td>≤20%</td><td>0805>0.22μF;1210≥3.3μF</td></tr><tr><td rowspan="3">50V</td><td rowspan="3">≤3%</td><td>≤6%</td><td>0201(50V);0603≥0.047μF; 0805≥0.18μF; 1206≥0.47μF</td></tr><tr><td>≤10%</td><td>0201≥0.01uF;1210≥4.7μF</td></tr><tr><td>≤20%</td><td>0402≥0.012μF;0603>0.1μF; 0805≥1μF(0805/X7R>0.47μF); 1206≥2.2μF;1210≥10μF; TT series</td></tr><tr><td>35V</td><td>≤5%</td><td>≤20%</td><td>0603≥1μF;0805≥2.2μF;1206≥2.2μF;1210≥10μF</td></tr><tr><td rowspan="4">25V</td><td rowspan="4">≤5%</td><td>≤10%</td><td>0201≥0.01μF;0805≥1μF;1210≥10μF</td></tr><tr><td>≤14%</td><td>0603≥0.33μF</td></tr><tr><td>≤15%</td><td>0201≥0.1μF;0402≥0.10μF&(0402/X7R≥0.056μF);0603≥0.47μF; 0805≥2.2μF; 1206≥4.7μF;1210≥22μF(1210/X5R≥10μF);TT series</td></tr><tr><td>≤20%</td><td>0402≥0.47μF</td></tr><tr><td>16V</td><td>≤5%</td><td>≤10%</td><td>0603≥0.15μF;0805≥0.68μF;1206≥2.2μF;1210≥4.7μF</td></tr><tr><td rowspan="3">10V</td><td rowspan="3">≤7.5%</td><td>≤15%</td><td>0201≥0.01μF(0201/X7R≥0.022μF);0402≥0.033μF; 0603>0.47μF;0805≥2.2μF;1206≥4.7μF; 1210≥22μF; TT series</td></tr><tr><td>≤15%</td><td>0201≥0.012μF; 0402≥0.22μF;</td></tr><tr><td>≤20%</td><td>0603≥0.33μF;0805≥2.2μF;1206≥2.2μF; 1210≥22μF</td></tr><tr><td>6.3V</td><td>≤15%</td><td>≤30%</td><td>0201≥0.1μF;0402≥1μF; TT series; 01R5/X5R</td></tr><tr><td>4V</td><td>≤20%</td><td>---</td><td>---</td></tr></table> Y5V: <table><tr><th>Rated vol.</th><th>D.F.≤</th><th colspan="2">Exception of D.F.≤</th></tr><tr><td rowspan="2">≥50V</td><td rowspan="2">≤7.5%</td><td>≤10%</td><td>0603≥0.1μF; 0805≥0.47μF; 1206≥4.7μF</td></tr><tr><td>≤20%</td><td>1210≥6.8μF</td></tr><tr><td>35V</td><td>≤10%</td><td>---</td><td>---</td></tr><tr><td rowspan="3">25V</td><td rowspan="3">≤7.5%</td><td>≤10%</td><td>0402≥0.047μF;0603≥0.1μF; 0805≥0.33μF; 1206≥1μF; 1210≥4.7μF</td></tr><tr><td>≤15%</td><td>0402≥0.068μF;0603≥0.47μF; 1206≥4.7μF; 1210≥22μF</td></tr><tr><td>≤12.5%</td><td>0402≥0.068μF; 0603≥0.68μF</td></tr><tr><td>16V (C<1.0μF)</td><td>≤10%</td><td>≤20%</td><td>0402≥0.22μF</td></tr><tr><td>16V (C≥1.0μF)</td><td>≤12.5%</td><td>≤20%</td><td>0603≥2.2μF; 0805≥3.3μF; 1206≥10μF;1210≥22μF; 1812≥47μF;</td></tr><tr><td>10V</td><td>≤20%</td><td>≤30%</td><td>0402≥0.47μF</td></tr><tr><td>6.3V</td><td>≤30%</td><td>---</td><td>---</td></tr></table> *I.R.: ≥10V, 1GΩ or 50 Ω-F whichever is smaller. Class II (X7R, X5R, X6S, X7S, Y5V) <table><tr><th>Rated voltage</th><th>Insulation Resistance</th></tr><tr><td>100V: All X7R;1210≥3.3μF</td><td rowspan="7">1GΩ or RxC ≥ 10 Ω-F whichever is smaller.</td></tr><tr><td>50V: 0402>0.01μF;0603≥1μF;0805≥1μF;1206≥4.7μF;1210≥4.7μF</td></tr><tr><td>35V:0603≥1μF;0805≥2.2μF; 1206≥2.2μF;1210≥10μF</td></tr><tr><td>25V:0201≥0.1uF; 0402≥0.22μF; 0603≥2.2μF;0805≥2.2μF; 1206≥10μF;1210≥10μF</td></tr><tr><td>16V: 0201≥0.1uF;0402≥0.22μF;0603≥1μF;0805≥2.2μF; 1206≥10μF;1210≥47μF</td></tr><tr><td>10V:0201≥47nF;0402≥0.47μF;0603≥0.47μF;0805≥2.2μF; 1206≥4.7μF;1210≥47μF</td></tr><tr><td>6.3V ; 4V ; TT series ; All X6S/X7S items; Size≥1812</td></tr></table>	Rated vol.	D.F.≤	Exception of D.F. ≤		≥100V	≤3%	≤6%	1206≥0.47μF	≤7.5%	0603≥0.068μF, 0805>0.1μF, 1206≥1μF;1210≥2.2μF;TT series	≤20%	0805>0.22μF;1210≥3.3μF	50V	≤3%	≤6%	0201(50V);0603≥0.047μF; 0805≥0.18μF; 1206≥0.47μF	≤10%	0201≥0.01uF;1210≥4.7μF	≤20%	0402≥0.012μF;0603>0.1μF; 0805≥1μF(0805/X7R>0.47μF); 1206≥2.2μF;1210≥10μF; TT series	35V	≤5%	≤20%	0603≥1μF;0805≥2.2μF;1206≥2.2μF;1210≥10μF	25V	≤5%	≤10%	0201≥0.01μF;0805≥1μF;1210≥10μF	≤14%	0603≥0.33μF	≤15%	0201≥0.1μF;0402≥0.10μF&(0402/X7R≥0.056μF);0603≥0.47μF; 0805≥2.2μF; 1206≥4.7μF;1210≥22μF(1210/X5R≥10μF);TT series	≤20%	0402≥0.47μF	16V	≤5%	≤10%	0603≥0.15μF;0805≥0.68μF;1206≥2.2μF;1210≥4.7μF	10V	≤7.5%	≤15%	0201≥0.01μF(0201/X7R≥0.022μF);0402≥0.033μF; 0603>0.47μF;0805≥2.2μF;1206≥4.7μF; 1210≥22μF; TT series	≤15%	0201≥0.012μF; 0402≥0.22μF;	≤20%	0603≥0.33μF;0805≥2.2μF;1206≥2.2μF; 1210≥22μF	6.3V	≤15%	≤30%	0201≥0.1μF;0402≥1μF; TT series; 01R5/X5R	4V	≤20%	---	---	Rated vol.	D.F.≤	Exception of D.F.≤		≥50V	≤7.5%	≤10%	0603≥0.1μF; 0805≥0.47μF; 1206≥4.7μF	≤20%	1210≥6.8μF	35V	≤10%	---	---	25V	≤7.5%	≤10%	0402≥0.047μF;0603≥0.1μF; 0805≥0.33μF; 1206≥1μF; 1210≥4.7μF	≤15%	0402≥0.068μF;0603≥0.47μF; 1206≥4.7μF; 1210≥22μF	≤12.5%	0402≥0.068μF; 0603≥0.68μF	16V (C<1.0μF)	≤10%	≤20%	0402≥0.22μF	16V (C≥1.0μF)	≤12.5%	≤20%	0603≥2.2μF; 0805≥3.3μF; 1206≥10μF;1210≥22μF; 1812≥47μF;	10V	≤20%	≤30%	0402≥0.47μF	6.3V	≤30%	---	---	Rated voltage	Insulation Resistance	100V: All X7R;1210≥3.3μF	1GΩ or RxC ≥ 10 Ω-F whichever is smaller.	50V: 0402>0.01μF;0603≥1μF;0805≥1μF;1206≥4.7μF;1210≥4.7μF	35V:0603≥1μF;0805≥2.2μF; 1206≥2.2μF;1210≥10μF	25V:0201≥0.1uF; 0402≥0.22μF; 0603≥2.2μF;0805≥2.2μF; 1206≥10μF;1210≥10μF	16V: 0201≥0.1uF;0402≥0.22μF;0603≥1μF;0805≥2.2μF; 1206≥10μF;1210≥47μF	10V:0201≥47nF;0402≥0.47μF;0603≥0.47μF;0805≥2.2μF; 1206≥4.7μF;1210≥47μF	6.3V ; 4V ; TT series ; All X6S/X7S items; Size≥1812
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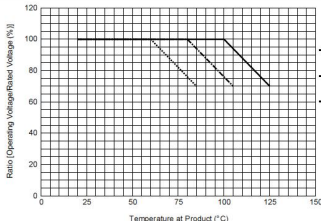
Multilayer Ceramic Capacitors

Approval Sheet

No	Item	Test Condition	Requirements																																																																																																																		
14	Humidity (Damp Heat) Load	*Test temp. : 40±2℃ *Humidity : 90~95%RH *Test time : 500+24/-0 hrs. *To apply voltage : Rated voltage (MAX. 500V) *Before initial measurement (Class II only): To apply de-aging at 150℃ for 1hr then set for 24±2 hrs at room temp. *Cap. / DF(Q) / I.R. Measurement to be made after de-aging at 150℃ for 1hr then set for 24±2 hrs at room temp.	* No remarkable damage. Cap change: NP0: ±7.5% or 0.75pF whichever is larger. X7R, X5R, X6S, X7S: ≥10V**,within ±12.5%; ≤6.3V within ±25%; TT series & C≥ 1uF,within ±25% **10V: 0603≥4.7μF;0402≥ 1μF;0201≥ 0.1μF, within ±25%; Y5V: ≥10V, within ±30%; ≤6.3V, within +30/-40% Q/D.F. value: NP0: C≥30pF,Q≥200;C<30pF, Q≥100+10/3C X7R, X5R, X6S, X7S: <table><tr><th>Rated vol.</th><th>D.F.≤</th><th colspan="2">Exception of D.F. ≤</th></tr><tr><td rowspan="3">≥100V</td><td rowspan="3">≤3%</td><td>≤6%</td><td>1206≥0.47μF</td></tr><tr><td>≤7.5%</td><td>0603≥0.068μF, 0805>0.1μF, 1206≥1μF;1210≥2.2μF;TT series</td></tr><tr><td>≤20%</td><td>0805>0.22μF;1210≥3.3μF</td></tr><tr><td rowspan="3">50V</td><td rowspan="3">≤3%</td><td>≤6%</td><td>0201(50V);0603≥0.047μF; 0805≥0.18μF; 1206≥0.47μF</td></tr><tr><td>≤10%</td><td>0201≥0.01uF;1210≥4.7μF</td></tr><tr><td>≤20%</td><td>0402≥0.012μF;0603>0.1μF; 0805≥1μF(0805/X7R>0.47μF); 1206≥2.2μF;1210≥10μF; TT series</td></tr><tr><td>35V</td><td>≤5%</td><td>≤20%</td><td>0603≥1μF;0805≥2.2μF;1206≥2.2μF;1210≥10μF</td></tr><tr><td rowspan="4">25V</td><td rowspan="4">≤5%</td><td>≤10%</td><td>0201≥0.01μF;0805≥1μF;1210≥10μF</td></tr><tr><td>≤14%</td><td>0603≥0.33μF</td></tr><tr><td>≤15%</td><td>0201≥0.1μF;0402≥0.10μF&(0402/X7R≥0.056μF);0603≥0.47μF; 0805≥2.2μF; 1206≥4.7μF;1210≥22μF(1210/X5R≥10μF);TT series</td></tr><tr><td>≤20%</td><td>0402≥0.47μF</td></tr><tr><td>16V</td><td>≤5%</td><td>≤10%</td><td>0603≥0.15μF;0805≥0.68μF;1206≥2.2μF;1210≥4.7μF</td></tr><tr><td rowspan="2"></td><td rowspan="2"></td><td>≤15%</td><td>0201≥0.01μF(0201/X7R≥0.022μF);0402≥0.033μF; 0603>0.47μF;0805≥2.2μF;1206≥4.7μF; 1210≥22μF; TT series</td></tr><tr><td></td><td></td></tr><tr><td>10V</td><td>≤7.5%</td><td>≤15%</td><td>0201≥0.012μF; 0402≥0.22μF; 0603≥0.33μF;0805≥2.2μF;1206≥2.2μF; 1210≥22μF</td></tr><tr><td rowspan="2"></td><td rowspan="2"></td><td>≤20%</td><td>0201≥0.1μF ;0402≥1μF; TT series; 01R5/X5R</td></tr><tr><td></td><td></td></tr><tr><td>6.3V</td><td>≤15%</td><td>≤30%</td><td>0201≥0.1μF;0402≥1μF(0402/X6S≥0.47μF);0603≥10μF; 0805≥4.7μF;1206≥47μF;1210≥100μF;TT series</td></tr><tr><td>4V</td><td>≤20%</td><td>---</td><td>---</td></tr></table> Y5V: <table><tr><th>Rated vol.</th><th>D.F.≤</th><th colspan="2">Exception of D.F.≤</th></tr><tr><td rowspan="2">≥50V</td><td rowspan="2">≤7.5%</td><td>≤10%</td><td>0603≥0.1μF; 0805≥0.47μF;1206≥4.7μF</td></tr><tr><td>≤20%</td><td>1210≥6.8μF</td></tr><tr><td>35V</td><td>≤10%</td><td>---</td><td>---</td></tr><tr><td rowspan="3">25V</td><td rowspan="3">≤7.5%</td><td>≤10%</td><td>0402≥0.047μF;0603≥0.1μF; 0805≥0.33μF;1206≥1μF; 1210≥4.7μF</td></tr><tr><td>≤15%</td><td>0402≥0.068μF;0603≥0.47μF; 1206≥4.7μF; 1210≥22μF</td></tr><tr><td></td><td></td></tr><tr><td>16V (C<1.0μF)</td><td>≤10%</td><td>≤12.5%</td><td>0402≥0.068μF; 0603≥0.68μF</td></tr><tr><td></td><td></td><td>≤20%</td><td>0402≥0.22μF</td></tr><tr><td>16V (C≥1.0μF)</td><td>≤12.5%</td><td>≤20%</td><td>0603≥2.2μF; 0805≥3.3μF; 1206≥10μF;1210≥22μF; 1812≥47μF;</td></tr><tr><td>10V</td><td>≤20%</td><td>≤30%</td><td>0402≥0.47μF</td></tr><tr><td>6.3V</td><td>≤30%</td><td>---</td><td>---</td></tr></table> *I.R.: ≥10V, 500MΩ or 25 Ω-F whichever is smaller. Class II (X7R, X5R, X6S, X7S, Y5V) <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	≤7.5%	0603≥0.068μF, 0805>0.1μF, 1206≥1μF;1210≥2.2μF;TT series	≤20%	0805>0.22μF;1210≥3.3μF	50V	≤3%	≤6%	0201(50V);0603≥0.047μF; 0805≥0.18μF; 1206≥0.47μF	≤10%	0201≥0.01uF;1210≥4.7μF	≤20%	0402≥0.012μF;0603>0.1μF; 0805≥1μF(0805/X7R>0.47μF); 1206≥2.2μF;1210≥10μF; TT series	35V	≤5%	≤20%	0603≥1μF;0805≥2.2μF;1206≥2.2μF;1210≥10μF	25V	≤5%	≤10%	0201≥0.01μF;0805≥1μF;1210≥10μF	≤14%	0603≥0.33μF	≤15%	0201≥0.1μF;0402≥0.10μF&(0402/X7R≥0.056μF);0603≥0.47μF; 0805≥2.2μF; 1206≥4.7μF;1210≥22μF(1210/X5R≥10μF);TT series	≤20%	0402≥0.47μF	16V	≤5%	≤10%	0603≥0.15μF;0805≥0.68μF;1206≥2.2μF;1210≥4.7μF			≤15%	0201≥0.01μF(0201/X7R≥0.022μF);0402≥0.033μF; 0603>0.47μF;0805≥2.2μF;1206≥4.7μF; 1210≥22μF; TT series			10V	≤7.5%	≤15%	0201≥0.012μF; 0402≥0.22μF; 0603≥0.33μF;0805≥2.2μF;1206≥2.2μF; 1210≥22μF			≤20%	0201≥0.1μF ;0402≥1μF; TT series; 01R5/X5R			6.3V	≤15%	≤30%	0201≥0.1μF;0402≥1μF(0402/X6S≥0.47μF);0603≥10μF; 0805≥4.7μF;1206≥47μF;1210≥100μF;TT series	4V	≤20%	---	---	Rated vol.	D.F.≤	Exception of D.F.≤		≥50V	≤7.5%	≤10%	0603≥0.1μF; 0805≥0.47μF;1206≥4.7μF	≤20%	1210≥6.8μF	35V	≤10%	---	---	25V	≤7.5%	≤10%	0402≥0.047μF;0603≥0.1μF; 0805≥0.33μF;1206≥1μF; 1210≥4.7μF	≤15%	0402≥0.068μF;0603≥0.47μF; 1206≥4.7μF; 1210≥22μF			16V (C<1.0μF)	≤10%	≤12.5%	0402≥0.068μF; 0603≥0.68μF			≤20%	0402≥0.22μF	16V (C≥1.0μF)	≤12.5%	≤20%	0603≥2.2μF; 0805≥3.3μF; 1206≥10μF;1210≥22μF; 1812≥47μF;	10V	≤20%	≤30%	0402≥0.47μF	6.3V	≤30%	---	---	Rated voltage	Insulation Resistance	100V: All X7R;1210≥3.3μF	500MΩ or RxC≥5 Ω-F whichever is smaller.	50V: 0402>0.01μF;0603≥1μF;0805≥1μF;1206≥4.7μF;1210≥4.7μF	35V:0603≥1μF;0805≥2.2μF; 1206≥2.2μF;1210≥10μF	25V:0201≥0.1uF; 0402≥0.22μF; 0603≥2.2μF;0805≥2.2μF; 1206≥10μF;1210≥10μF	16V: 0201≥0.1uF;0402≥0.22μF;0603≥1μF;0805≥2.2μF; 1206≥10μF;1210≥47μF	10V:0201≥47nF;0402≥0.47μF;0603≥0.47μF;0805≥2.2μF; 1206≥4.7μF;1210≥47μF	6.3V ; 4V ; TT series ; All X6S/X7S items; Size≥1812
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Multilayer Ceramic Capacitors

Approval Sheet

No	Item	Test Condition	Requirements																																																																																																																																																																												
15.	High Temperature Load (Endurance)	Test temp. : NP0, X7R/X7E/X7S: 125±3°C X6S: 105±3°C X5R, Y5V: 85±3°C Test time: 1000+24/-0 hrs. To apply voltage: (1) ≤ 6.3V or C ≥10μF or TT series: 150% of rated voltage. (2) 10V ≤ Ur < 500V: 200% of rated voltage. (3) 500V: 150% of rated voltage. (4) Ur ≥ 630V: 120% of rated voltage. (5) 100% of rated voltage for below range. <table><tr><th>Size</th><th>Dielectric</th><th>Rated voltage</th><th>Capacitance</th></tr><tr><td>0201</td><td>X5R/X7R/X6S</td><td>≤10V ≥16V</td><td>C ≥ 0.1μF C >0.1μF</td></tr><tr><td rowspan="2">0402</td><td>X5R</td><td>≤16V 25V,50V</td><td>C >1.0μF C ≥ 1.0μF</td></tr><tr><td>X6S</td><td>6.3V,10V 16V,25V</td><td>C >1.0μF C ≥ 1.0μF</td></tr><tr><td rowspan="2">0603</td><td>X7R/X7S/Y5V</td><td>6.3V,10V 4V</td><td>C ≥ 1.0μF C ≥ 22μF</td></tr><tr><td>X5R/X7R/X6S/X7S</td><td>6.3V,10V 25V</td><td>C ≥ 4.7μF C ≥ 1.0μF</td></tr><tr><td rowspan="2">0805</td><td>X5R/X6S/X7S</td><td>35V 4V</td><td>C ≥ 1.0μF C ≥ 47μF</td></tr><tr><td>X5R/X7R/X6S/X7S</td><td>6.3V 10V,50V</td><td>C ≥ 22μF C ≥ 10μF</td></tr><tr><td>1206</td><td>X7R/X6S/X7S</td><td>16V,25V</td><td>C ≥ 10μF C ≥ 22μF</td></tr><tr><td>1210</td><td>X5R/X7R/X6S</td><td>≤6.3V</td><td>C ≥ 47μF</td></tr><tr><td>TT15</td><td>X7R</td><td>16V</td><td>C ≥ 47μF</td></tr><tr><td>TT18</td><td>X5R</td><td>100V</td><td>C ≥ 3.3μF</td></tr><tr><td>TT21</td><td>X5R</td><td>6.3V</td><td>C >1.0μF</td></tr><tr><td>TT31</td><td>Y5V</td><td>6.3V,10V</td><td>C ≥ 2.2μF</td></tr><tr><td>TT31</td><td>X5R/X7R/X6S</td><td>6.3V</td><td>C ≥ 10μF</td></tr><tr><td>TT31</td><td>Y5V</td><td>≤10V</td><td>C ≥ 10μF</td></tr><tr><td>TT31</td><td>Y5V</td><td>6.3V</td><td>C ≥ 22μF</td></tr></table> **1WV items must follow de-rating conditions. 6) 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>0201</td><td>X5R/X6S</td><td>16V,25V</td><td>C=0.1μF</td></tr><tr><td rowspan="2">0402</td><td>X7R</td><td>16V</td><td>C ≥ 0.022μF</td></tr><tr><td>X7R/X5R/X6S</td><td>50V</td><td>C >0.01μF</td></tr><tr><td rowspan="2">0603</td><td>Y5V</td><td>10-25V</td><td>C ≥ 0.22μF</td></tr><tr><td>X7S</td><td>16V</td><td>C ≥ 0.47μF</td></tr><tr><td rowspan="2">0805</td><td>X7S</td><td>50V~100V</td><td>C >0.22μF</td></tr><tr><td>X7R</td><td>50V</td><td>C >0.1μF</td></tr><tr><td rowspan="2">1206</td><td>X5R</td><td>25V</td><td>C=1.0μF</td></tr><tr><td>X5R/X7R/X6S/X7S</td><td>50V</td><td>C ≥ 1.0μF</td></tr><tr><td rowspan="2">1210</td><td>Y5V</td><td>10V,16V</td><td>C ≥ 1.0μF</td></tr><tr><td>X5R/X7R/X6S/X7S</td><td>16V</td><td>C ≥ 2.2μF</td></tr><tr><td rowspan="2">1825</td><td>Y5V</td><td>100V</td><td>C ≥ 0.47μF</td></tr><tr><td>X5R/X7R/X6S/X7S</td><td>50V</td><td>C ≥ 1.0μF</td></tr><tr><td rowspan="2">2220</td><td>X5R/X7R/X6S/X7S</td><td>35V</td><td>C ≥ 2.2μF</td></tr><tr><td>Y5V</td><td>10-25V</td><td>C ≥ 4.7μF</td></tr><tr><td rowspan="2">2225</td><td>X7R</td><td>16V</td><td>C ≥ 4.7μF</td></tr><tr><td>X5R/X6S/X7S</td><td>100V</td><td>C ≥ 1.0μF</td></tr><tr><td rowspan="2">2225</td><td>X5R/X6S/X7S</td><td>50V</td><td>C=4.7μF</td></tr><tr><td>X7R</td><td>100V</td><td>C >1.0μF</td></tr><tr><td rowspan="2">2225</td><td>X5R/X7R/X6S/X7S</td><td>50V~100V</td><td>C ≥ 2.2μF</td></tr><tr><td>X7R</td><td>100V~250V</td><td>C ≥ 1.0μF</td></tr></table>	Size	Dielectric	Rated voltage	Capacitance	0201	X5R/X7R/X6S	≤10V ≥16V	C ≥ 0.1μF C >0.1μF	0402	X5R	≤16V 25V,50V	C >1.0μF C ≥ 1.0μF	X6S	6.3V,10V 16V,25V	C >1.0μF C ≥ 1.0μF	0603	X7R/X7S/Y5V	6.3V,10V 4V	C ≥ 1.0μF C ≥ 22μF	X5R/X7R/X6S/X7S	6.3V,10V 25V	C ≥ 4.7μF C ≥ 1.0μF	0805	X5R/X6S/X7S	35V 4V	C ≥ 1.0μF C ≥ 47μF	X5R/X7R/X6S/X7S	6.3V 10V,50V	C ≥ 22μF C ≥ 10μF	1206	X7R/X6S/X7S	16V,25V	C ≥ 10μF C ≥ 22μF	1210	X5R/X7R/X6S	≤6.3V	C ≥ 47μF	TT15	X7R	16V	C ≥ 47μF	TT18	X5R	100V	C ≥ 3.3μF	TT21	X5R	6.3V	C >1.0μF	TT31	Y5V	6.3V,10V	C ≥ 2.2μF	TT31	X5R/X7R/X6S	6.3V	C ≥ 10μF	TT31	Y5V	≤10V	C ≥ 10μF	TT31	Y5V	6.3V	C ≥ 22μF	Size	Dielectric	Rated voltage	Capacitance	0201	X5R/X6S	16V,25V	C=0.1μF	0402	X7R	16V	C ≥ 0.022μF	X7R/X5R/X6S	50V	C >0.01μF	0603	Y5V	10-25V	C ≥ 0.22μF	X7S	16V	C ≥ 0.47μF	0805	X7S	50V~100V	C >0.22μF	X7R	50V	C >0.1μF	1206	X5R	25V	C=1.0μF	X5R/X7R/X6S/X7S	50V	C ≥ 1.0μF	1210	Y5V	10V,16V	C ≥ 1.0μF	X5R/X7R/X6S/X7S	16V	C ≥ 2.2μF	1825	Y5V	100V	C ≥ 0.47μF	X5R/X7R/X6S/X7S	50V	C ≥ 1.0μF	2220	X5R/X7R/X6S/X7S	35V	C ≥ 2.2μF	Y5V	10-25V	C ≥ 4.7μF	2225	X7R	16V	C ≥ 4.7μF	X5R/X6S/X7S	100V	C ≥ 1.0μF	2225	X5R/X6S/X7S	50V	C=4.7μF	X7R	100V	C >1.0μF	2225	X5R/X7R/X6S/X7S	50V~100V	C ≥ 2.2μF	X7R	100V~250V	C ≥ 1.0μF	* No remarkable damage. Cap change: NP0: ±3.0% or ±0.3pF whichever is larger X7R, X5R, X6S, X7S: ≥10V**, within ±12.5%; ≤ 6.3V within ±25%; TT series & C ≥ 1μF, within ±25% **10V: 0603 ≥ 4.7μF; 0402 ≥ 1μF; 0201 ≥ 0.1μF, within ±25%; Y5V: ≥10V, within ±30%; ≤ 6.3V, within +30/-40% Q/D.F. value: NP0: More than 30pF, Q ≥ 350 10pF ≤ C < 30pF, Q ≥ 275+2.5C Less than 10pF, Q ≥ 200+10C X7R, X5R, X6S, X7S: <table><tr><th>Rated vol.</th><th>D.F. ≤</th><th>Exception of D.F. ≤</th></tr><tr><td>≥ 100V</td><td>≤ 3%</td><td>≤ 6% 1206 ≥ 0.47μF ≤ 7.5% 0603 ≥ 0.068μF, 0805 > 0.1μF, 1206 ≥ 1μF; 1210 ≥ 2.2μF; TT series ≤ 20% 0805 > 0.22μF; 1210 ≥ 3.3μF ≤ 6% 0201(50V); 0603 ≥ 0.047μF; 0805 ≥ 0.18μF; 1206 ≥ 0.47μF ≤ 10% 0201 ≥ 0.01μF; 1210 ≥ 4.7μF ≤ 20% 0402 ≥ 0.012μF; 0603 > 0.1μF; 0805 ≥ 1μF (0805/X7R > 0.47μF); 1206 ≥ 2.2μF; 1210 ≥ 10μF; TT series 35V ≤ 5% ≤ 20% 0603 ≥ 1μF; 0805 ≥ 2.2μF; 1206 ≥ 2.2μF; 1210 ≥ 10μF 25V ≤ 5% ≤ 10% 0201 ≥ 0.01μF; 0805 ≥ 1μF; 1210 ≥ 10μF ≤ 14% 0603 ≥ 0.33μF ≤ 15% 0201 ≥ 0.1μF; 0402 ≥ 0.10μF & (0402/X7R ≥ 0.056μF); 0603 ≥ 0.47μF; 0805 ≥ 2.2μF; 1206 ≥ 4.7μF; 1210 ≥ 22μF (1210/X5R ≥ 10μF); TT series ≤ 20% 0402 ≥ 0.47μF 16V ≤ 5% ≤ 10% 0603 ≥ 0.15μF; 0805 ≥ 0.68μF; 1206 ≥ 2.2μF; 1210 ≥ 4.7μF ≤ 15% 0201 ≥ 0.01μF (0201/X7R ≥ 0.022μF); 0402 ≥ 0.033μF; 0603 > 0.47μF; 0805 ≥ 2.2μF; 1206 ≥ 4.7μF; 1210 ≥ 22μF; TT series 10V ≤ 7.5% ≤ 15% 0201 ≥ 0.012μF; 0402 ≥ 0.22μF; 0603 ≥ 0.33μF; 0805 ≥ 2.2μF; 1206 ≥ 2.2μF; 1210 ≥ 22μF ≤ 20% 0201 ≥ 0.1μF; 0402 ≥ 1μF; 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% ---</td></tr></table> Y5V: <table><tr><th>Rated vol.</th><th>D.F. ≤</th><th>Exception of D.F. ≤</th></tr><tr><td>≥ 50V</td><td>≤ 7.5%</td><td>≤ 10% 0603 ≥ 0.1μF; 0805 ≥ 0.47μF; 1206 ≥ 4.7μF ≤ 20% 1210 ≥ 6.8μF</td></tr><tr><td>35V</td><td>≤ 10%</td><td>---</td></tr><tr><td>25V</td><td>≤ 7.5%</td><td>≤ 10% 0402 ≥ 0.047μF; 0603 ≥ 0.1μF; 0805 ≥ 0.33μF; 1206 ≥ 1μF; 1210 ≥ 4.7μF ≤ 15% 0402 ≥ 0.068μF; 0603 ≥ 0.47μF; 1206 ≥ 4.7μF; 1210 ≥ 22μF ≤ 12.5% 0402 ≥ 0.068μF; 0603 ≥ 0.68μF ≤ 20% 0402 ≥ 0.22μF ≤ 12.5% ≤ 20% 0603 ≥ 2.2μF; 0805 ≥ 3.3μF; 1206 ≥ 10μF; 1210 ≥ 22μF; 1812 ≥ 47μF; 10V ≤ 20% ≤ 30% 0402 ≥ 0.47μF 6.3V ≤ 30% ---</td></tr></table> *I.R.: ≥10V, 1GΩ or 50 Ω·F whichever is smaller. Class II (X7R, X5R, X6S, X7S, Y5V) <table><tr><th>Rated voltage</th><th>Insulation Resistance</th></tr><tr><td>100V: All X7R; 1210 ≥ 3.3μF</td><td rowspan="6">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><td></td></tr></table>	Rated vol.	D.F. ≤	Exception of D.F. ≤	≥ 100V	≤ 3%	≤ 6% 1206 ≥ 0.47μF ≤ 7.5% 0603 ≥ 0.068μF, 0805 > 0.1μF, 1206 ≥ 1μF; 1210 ≥ 2.2μF; TT series ≤ 20% 0805 > 0.22μF; 1210 ≥ 3.3μF ≤ 6% 0201(50V); 0603 ≥ 0.047μF; 0805 ≥ 0.18μF; 1206 ≥ 0.47μF ≤ 10% 0201 ≥ 0.01μF; 1210 ≥ 4.7μF ≤ 20% 0402 ≥ 0.012μF; 0603 > 0.1μF; 0805 ≥ 1μF (0805/X7R > 0.47μF); 1206 ≥ 2.2μF; 1210 ≥ 10μF; TT series 35V ≤ 5% ≤ 20% 0603 ≥ 1μF; 0805 ≥ 2.2μF; 1206 ≥ 2.2μF; 1210 ≥ 10μF 25V ≤ 5% ≤ 10% 0201 ≥ 0.01μF; 0805 ≥ 1μF; 1210 ≥ 10μF ≤ 14% 0603 ≥ 0.33μF ≤ 15% 0201 ≥ 0.1μF; 0402 ≥ 0.10μF & (0402/X7R ≥ 0.056μF); 0603 ≥ 0.47μF; 0805 ≥ 2.2μF; 1206 ≥ 4.7μF; 1210 ≥ 22μF (1210/X5R ≥ 10μF); TT series ≤ 20% 0402 ≥ 0.47μF 16V ≤ 5% ≤ 10% 0603 ≥ 0.15μF; 0805 ≥ 0.68μF; 1206 ≥ 2.2μF; 1210 ≥ 4.7μF ≤ 15% 0201 ≥ 0.01μF (0201/X7R ≥ 0.022μF); 0402 ≥ 0.033μF; 0603 > 0.47μF; 0805 ≥ 2.2μF; 1206 ≥ 4.7μF; 1210 ≥ 22μF; TT series 10V ≤ 7.5% ≤ 15% 0201 ≥ 0.012μF; 0402 ≥ 0.22μF; 0603 ≥ 0.33μF; 0805 ≥ 2.2μF; 1206 ≥ 2.2μF; 1210 ≥ 22μF ≤ 20% 0201 ≥ 0.1μF; 0402 ≥ 1μF; TT series; 01R5/X5R 6.3V ≤ 15% ≤ 30% 0201 ≥ 0.1μF; 0402 ≥ 1μF (0402/X6S ≥ 0.47μF); 0603 ≥ 10μF; 0805 ≥ 4.7μF; 1206 ≥ 47μF; 1210 ≥ 100μF; TT series 4V ≤ 20% ---	Rated vol.	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	X7R	100V~250V	C ≥ 1.0μF																																																																																																																																																																												
Rated vol.	D.F. ≤	Exception of D.F. ≤																																																																																																																																																																													
≥ 100V	≤ 3%	≤ 6% 1206 ≥ 0.47μF ≤ 7.5% 0603 ≥ 0.068μF, 0805 > 0.1μF, 1206 ≥ 1μF; 1210 ≥ 2.2μF; TT series ≤ 20% 0805 > 0.22μF; 1210 ≥ 3.3μF ≤ 6% 0201(50V); 0603 ≥ 0.047μF; 0805 ≥ 0.18μF; 1206 ≥ 0.47μF ≤ 10% 0201 ≥ 0.01μF; 1210 ≥ 4.7μF ≤ 20% 0402 ≥ 0.012μF; 0603 > 0.1μF; 0805 ≥ 1μF (0805/X7R > 0.47μF); 1206 ≥ 2.2μF; 1210 ≥ 10μF; TT series 35V ≤ 5% ≤ 20% 0603 ≥ 1μF; 0805 ≥ 2.2μF; 1206 ≥ 2.2μF; 1210 ≥ 10μF 25V ≤ 5% ≤ 10% 0201 ≥ 0.01μF; 0805 ≥ 1μF; 1210 ≥ 10μF ≤ 14% 0603 ≥ 0.33μF ≤ 15% 0201 ≥ 0.1μF; 0402 ≥ 0.10μF & (0402/X7R ≥ 0.056μF); 0603 ≥ 0.47μF; 0805 ≥ 2.2μF; 1206 ≥ 4.7μF; 1210 ≥ 22μF (1210/X5R ≥ 10μF); TT series ≤ 20% 0402 ≥ 0.47μF 16V ≤ 5% ≤ 10% 0603 ≥ 0.15μF; 0805 ≥ 0.68μF; 1206 ≥ 2.2μF; 1210 ≥ 4.7μF ≤ 15% 0201 ≥ 0.01μF (0201/X7R ≥ 0.022μF); 0402 ≥ 0.033μF; 0603 > 0.47μF; 0805 ≥ 2.2μF; 1206 ≥ 4.7μF; 1210 ≥ 22μF; TT series 10V ≤ 7.5% ≤ 15% 0201 ≥ 0.012μF; 0402 ≥ 0.22μF; 0603 ≥ 0.33μF; 0805 ≥ 2.2μF; 1206 ≥ 2.2μF; 1210 ≥ 22μF ≤ 20% 0201 ≥ 0.1μF; 0402 ≥ 1μF; TT series; 01R5/X5R 6.3V ≤ 15% ≤ 30% 0201 ≥ 0.1μF; 0402 ≥ 1μF (0402/X6S ≥ 0.47μF); 0603 ≥ 10μF; 0805 ≥ 4.7μF; 1206 ≥ 47μF; 1210 ≥ 100μF; TT series 4V ≤ 20% ---																																																																																																																																																																													
Rated vol.	D.F. ≤	Exception of D.F. ≤																																																																																																																																																																													
≥ 50V	≤ 7.5%	≤ 10% 0603 ≥ 0.1μF; 0805 ≥ 0.47μF; 1206 ≥ 4.7μF ≤ 20% 1210 ≥ 6.8μF																																																																																																																																																																													
35V	≤ 10%	---																																																																																																																																																																													
25V	≤ 7.5%	≤ 10% 0402 ≥ 0.047μF; 0603 ≥ 0.1μF; 0805 ≥ 0.33μF; 1206 ≥ 1μF; 1210 ≥ 4.7μF ≤ 15% 0402 ≥ 0.068μF; 0603 ≥ 0.47μF; 1206 ≥ 4.7μF; 1210 ≥ 22μF ≤ 12.5% 0402 ≥ 0.068μF; 0603 ≥ 0.68μF ≤ 20% 0402 ≥ 0.22μF ≤ 12.5% ≤ 20% 0603 ≥ 2.2μF; 0805 ≥ 3.3μF; 1206 ≥ 10μF; 1210 ≥ 22μF; 1812 ≥ 47μF; 10V ≤ 20% ≤ 30% 0402 ≥ 0.47μF 6.3V ≤ 30% ---																																																																																																																																																																													
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																																																																																																																																																																															
		* 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: 																																																																																																																																																																													

APPENDIXES

■ Tape & reel dimensions

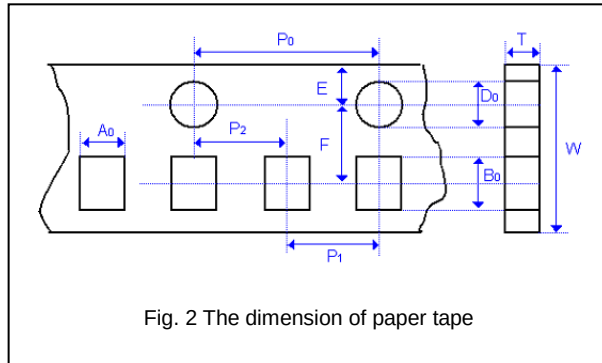


Fig. 2 The dimension of paper tape

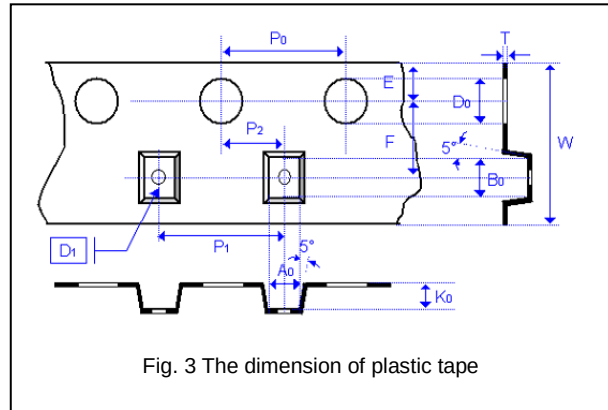


Fig. 3 The dimension of plastic tape

Size	0201	0402	0603	0805			1206			1210			1808	1812	
Thickness	L	N,E	S,H,X	A,H	B,T	D,I	B,T	C,J,D	G,P	T	C,D,G,K	M	D,F, G,K	D,F, G,K	M,U
A ₀	0.40 +/-0.10	0.70 +/-0.20	1.05 +/-0.30	1.50 +/-0.20	1.50 +/-0.20	< 1.80	1.90 +/-0.50	< 2.00	< 2.30	< 3.05	< 3.05	< 3.20	< 2.50	< 3.90	< 3.90
B ₀	0.70 +/-0.10	1.20 +/-0.20	1.80 +/-0.30	2.30 +/-0.20	2.30 +/-0.20	< 2.70	3.50 +/-0.50	< 3.70	< 4.00	< 3.80	< 3.80	< 4.00	< 5.30	< 5.30	< 5.30
T	≤ 0.55	≤ 0.80	≤ 1.20	≤ 1.15	≤ 1.20	0.23 +/-0.1	≤ 1.20	0.23 +/-0.1	0.23 +/-0.1	0.23 +/-0.1	0.23 +/-0.1	0.23 +/-0.1	0.25 +/-0.1	0.25 +/-0.1	0.25 +/-0.1
K ₀	-	-	-	-	-	< 2.50	-	< 2.50	< 2.50	< 1.50	< 2.50	< 3.20	< 2.50	< 2.50	< 3.50
W	8.00 +/-0.30	8.00 +/-0.30	8.00 +/-0.30	8.00 +/-0.30	8.00 +/-0.30	8.00 +/-0.30	8.00 +/-0.30	8.00 +/-0.30	8.00 +/-0.30	8.00 +/-0.30	8.00 +/-0.30	8.00 +/-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
10xP ₀	40.00 +/-0.10	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
P ₁	2.00 +/-0.05	2.00 +/-0.05	4.00 +/-0.10	4.00 +/-0.10	4.00 +/-0.10	4.00 +/-0.10	4.00 +/-0.10	4.00 +/-0.10	4.00 +/-0.10	4.00 +/-0.10	4.00 +/-0.10	4.00 +/-0.10	4.00 +/-0.10	8.00 +/-0.10	8.00 +/-0.10
P ₂	2.00 +/-0.05	2.00 +/-0.05	2.00 +/-0.05	2.00 +/-0.05	2.00 +/-0.05	2.00 +/-0.05	2.00 +/-0.05	2.00 +/-0.05	2.00 +/-0.05	2.00 +/-0.05	2.00 +/-0.05	2.00 +/-0.05	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
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
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
F	3.50 +/-0.05	3.50 +/-0.05	3.50 +/-0.05	3.50 +/-0.05	3.50 +/-0.05	3.50 +/-0.05	3.50 +/-0.05	3.50 +/-0.05	3.50 +/-0.05	3.50 +/-0.05	3.50 +/-0.05	3.50 +/-0.05	5.50 +/-0.10	5.50 +/-0.10	5.50 +/-0.10

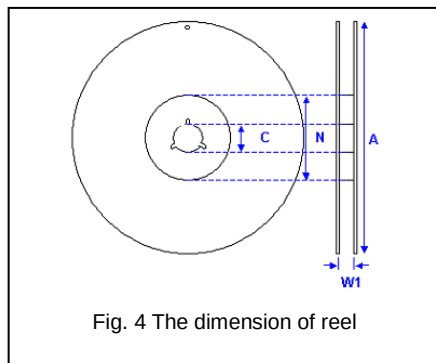
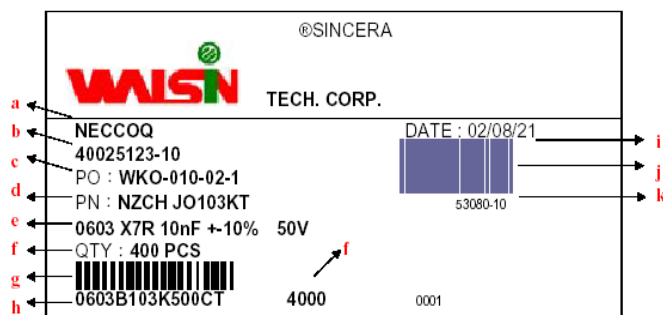


Fig. 4 The dimension of reel

Size	0201, 0402, 0603, 0805, 1206, 1210			1812
Reel size	7"	10"	13"	7"
C	13.0+0.5/-0.2	13.0+0.5/-0.2	13.0+0.5/-0.2	13.0+0.5/-0.2
W ₁	8.4+1.5/-0	8.4+1.5/-0	8.4+1.5/-0	12.4+2.0/-0
A	178.0±1.0	250.0±1.0	330.0±1.0	178.0±1.0
N	60.0+1.0/-0	100.0±1.0	100±1.0	60.0+1.0/-0

Multilayer Ceramic Capacitors

Example of customer label

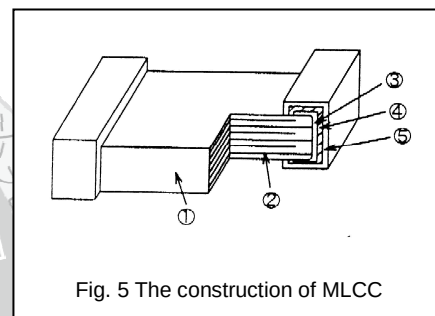


*Customized label is available upon request

- 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, X6S, X7S, Y5V
①	Ceramic material	CaZrO ₃ based	BaTiO ₃ based
②	Inner electrode		Ni
③	Termination	Inner layer	Cu
④		Middle layer	Ni
⑤		Outer layer	Sn



Storage and handling conditions

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

Cautions:

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

Multilayer Ceramic Capacitors

Recommended soldering conditions

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

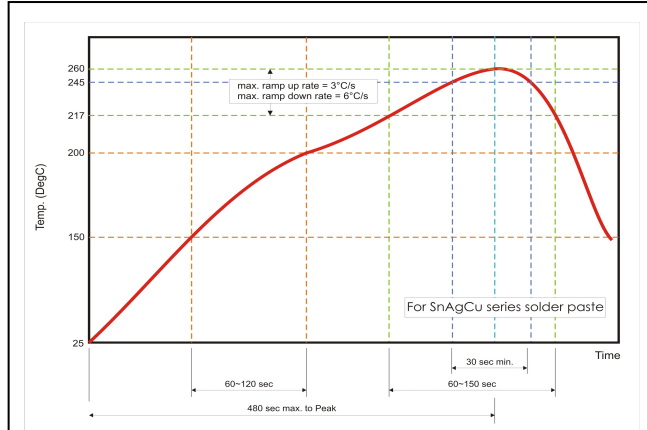


Fig. 6 Recommended reflow soldering profile for SMT process with SnAgCu series solder paste.

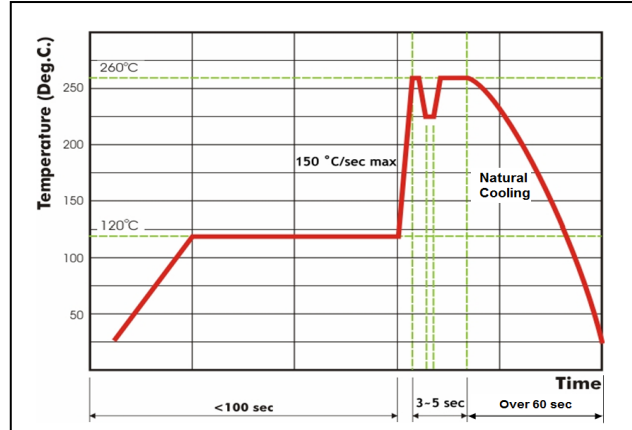


Fig. 7 Recommended wave soldering profile for SMT process with SnAgCu series solder.

