

# 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.

**Multilayer Ceramic Capacitors**

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

**3. APPLICATIONS**

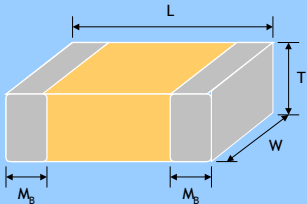
- a. For general digital circuit.
- b. For power supply bypass capacitors.
- c. For consumer electronics.
- d. For telecommunication.

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

Multilayer Ceramic Capacitors

**5. EXTERNAL DIMENSIONS**

Outline	Size Inch (mm)	L (mm)	W (mm)	T (mm)/Symbol	Soldering Method *	M <sub>B</sub> (mm)	
 <p>Fig. 1 The outline of MLCC</p>	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 <sup>#2</sup>	0.3±0.05 <sup>#2</sup>	0.3±0.05 <sup>#2</sup>			0.15±0.1/-0.05
		0.6±0.09 <sup>#3</sup>	0.3±0.09 <sup>#3</sup>	0.3±0.09 <sup>#3</sup>			
	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)	1.60±0.10	0.80±0.10	0.80±0.07	S	R / W	0.40±0.15
				0.50±0.10	H	R / W	
				0.80±0.15/-0.10	X	R / W	
	0805 (2012)	2.00±0.15	1.25±0.10	0.50±0.10	H	R / W	0.50±0.20
				0.60±0.10	A	R / W	
				0.80±0.10	B	R / W	
				1.25±0.10	D	R	
				2.00±0.20	T	R / W	
	1206 (3216)	3.20±0.15	1.60±0.15	0.80±0.10	B	R / W	0.60±0.20 (0.5±0.25) <sup>***</sup>
				0.95±0.10	C	R	
				1.25±0.10	D	R	
				1.15±0.15	J	R	
				3.20±0.20	G	R	
	1210 (3225)	3.20±0.30	2.50±0.20	0.85±0.10	T	R / W	0.75±0.25
1.60±0.20				G	R		
2.00±0.20				K	R		
2.50±0.30				M	R		
3.20±0.60 <sup>#4</sup>						2.50±0.50 <sup>#4</sup>	
1808 (4520)				4.50±0.40 (4.5+0.5/-0.3) <sup>**</sup>	2.03±0.25	1.25±0.10	
	1.40±0.15	F	R				
	1.60±0.20	G	R				
	2.00±0.20	K	R				
1812 (4532)	4.50±0.40 (4.5+0.5/-0.3) <sup>**</sup>	3.20±0.30	1.25±0.10	D	R	0.75±0.25 (0.5±0.25) <sup>***</sup>	
			1.60±0.20	G	R		
		3.20±0.40	2.00±0.20	K	R		
			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.

Multilayer Ceramic Capacitors

**6. GENERAL ELECTRICAL DATA**

<b>Dielectric</b>	NP0	X7R	Y5V	X5R	X6S	X7S
<b>Size</b>	0201, 0402, 0603, 0805, 1206, 1210, 1812					
<b>Capacitance range*</b>	0.1pF to 0.1μF	100pF to 47μF	0.01μF to 100μF	100pF to 220μF	0.1μF to 100μF	1μF to 100μF
<b>Capacitance tolerance**</b>	Cap≤5pF <sup>#1</sup> : 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%)
<b>Rated voltage (WVDC)</b>	10V, 16V, 25V, 50V, 100V	6.3V, 10V, 16V, 25V, 50V, 100V				
<b>Operating temperature</b>	-55 to +125℃	-25 to +85℃	-55 to +85℃	-55 to +105℃	-55 to +125℃	
<b>Capacitance characteristic</b>	±30ppm	±15%	+30/-80%	±15%	±22%	±22%
<b>Termination</b>	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.



Multilayer Ceramic Capacitors

**7. CAPACITANCE RANGE**

**7-1. NPO Dielectric 0201, 0402, 0603, 0805 Sizes**

DIELECTRIC	NPO																				
	SIZE	0201					0402					0603					0805				
	RATED VOLTAGE (VDC)	10	16	25	50	100	10	16	25	50	100	10	16	25	50	100	10	16	25	50	100
0.1pF (0R1)	L	L	L	L	L	N	N	N	N												
0.2pF (0R2)	L	L	L	L	L	N	N	N	N												
0.3pF (0R3)	L	L	L	L	L	N	N	N	N		S	S	S	S							
0.4pF (0R4)	L	L	L	L	L	N	N	N	N		S	S	S	S							
0.5pF (0R5)	L	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	L	N	N	N	N	N	S	S	S	S	S	A	A	A	A	A	
0.7pF (0R7)	L	L	L	L	L	N	N	N	N	N	S	S	S	S	S	A	A	A	A	A	
0.8pF (0R8)	L	L	L	L	L	N	N	N	N	N	S	S	S	S	S	A	A	A	A	A	
0.9pF (0R9)	L	L	L	L	L	N	N	N	N	N	S	S	S	S	S	A	A	A	A	A	
1.0pF (1R0)	L	L	L	L	L	N	N	N	N	N	S	S	S	S	S	A	A	A	A	A	
1.2pF (1R2)	L	L	L	L	L	N	N	N	N	N	S	S	S	S	S	A	A	A	A	A	
1.5pF (1R5)	L	L	L	L	L	N	N	N	N	N	S	S	S	S	S	A	A	A	A	A	
1.8pF (1R8)	L	L	L	L	L	N	N	N	N	N	S	S	S	S	S	A	A	A	A	A	
2.0pF (2R0)	L	L	L	L	L	N	N	N	N	N	S	S	S	S	S	A	A	A	A	A	
2.2pF (2R2)	L	L	L	L	L	N	N	N	N	N	S	S	S	S	S	A	A	A	A	A	
2.7pF (2R7)	L	L	L	L	L	N	N	N	N	N	S	S	S	S	S	A	A	A	A	A	
3.0pF (3R0)	L	L	L	L	L	N	N	N	N	N	S	S	S	S	S	A	A	A	A	A	
3.3pF (3R3)	L	L	L	L	L	N	N	N	N	N	S	S	S	S	S	A	A	A	A	A	
3.9pF (3R9)	L	L	L	L	L	N	N	N	N	N	S	S	S	S	S	A	A	A	A	A	
4.0pF (4R0)	L	L	L	L	L	N	N	N	N	N	S	S	S	S	S	A	A	A	A	A	
4.7pF (4R7)	L	L	L	L	L	N	N	N	N	N	S	S	S	S	S	A	A	A	A	A	
5.0pF (5R0)	L	L	L	L	L	N	N	N	N	N	S	S	S	S	S	A	A	A	A	A	
5.6pF (5R6)	L	L	L	L	L	N	N	N	N	N	S	S	S	S	S	A	A	A	A	A	
6.0pF (6R0)	L	L	L	L	L	N	N	N	N	N	S	S	S	S	S	A	A	A	A	A	
6.8pF (6R8)	L	L	L	L	L	N	N	N	N	N	S	S	S	S	S	A	A	A	A	A	
7.0pF (7R0)	L	L	L	L	L	N	N	N	N	N	S	S	S	S	S	A	A	A	A	A	
8.0pF (8R0)	L	L	L	L	L	N	N	N	N	N	S	S	S	S	S	A	A	A	A	A	
8.2pF (8R2)	L	L	L	L	L	N	N	N	N	N	S	S	S	S	S	A	A	A	A	A	
9.0pF (9R0)	L	L	L	L	L	N	N	N	N	N	S	S	S	S	S	A	A	A	A	A	
10pF (100)	L	L	L	L	L	N	N	N	N	N	S	S	S	S	S	A	A	A	A	A	
12pF (120)	L	L	L	L	L	N	N	N	N	N	S	S	S	S	S	A	A	A	A	A	
15pF (150)	L	L	L	L	L	N	N	N	N	N	S	S	S	S	S	A	A	A	A	A	
18pF (180)	L	L	L	L	L	N	N	N	N	N	S	S	S	S	S	A	A	A	A	A	
22pF (220)	L	L	L	L	L	N	N	N	N	N	S	S	S	S	S	A	A	A	A	A	
27pF (270)	L	L	L	L	L	N	N	N	N	N	S	S	S	S	S	A	A	A	A	A	
33pF (330)	L	L	L	L	L	N	N	N	N	N	S	S	S	S	S	A	A	A	A	A	
39pF (390)	L	L	L	L	L	N	N	N	N	N	S	S	S	S	S	A	A	A	A	A	
47pF (470)	L	L	L	L	L	N	N	N	N	N	S	S	S	S	S	A	A	A	A	A	
56pF (560)	L	L	L	L	L	N	N	N	N	N	S	S	S	S	S	A	A	A	A	A	
68pF (680)	L	L	L	L	L	N	N	N	N	N	S	S	S	S	S	A	A	A	A	A	
82pF (820)	L	L	L	L	L	N	N	N	N	N	S	S	S	S	S	A	A	A	A	A	
100pF (101)	L	L	L	L	L	N	N	N	N	N	S	S	S	S	S	A	A	A	A	A	
120pF (121)	L	L	L	L	L	N	N	N	N	N	S	S	S	S	S	A	A	A	A	A	
150pF (151)	L	L	L	L	L	N	N	N	N	N	S	S	S	S	S	A	A	A	A	A	
180pF (181)	L	L	L	L	L	N	N	N	N	N	S	S	S	S	S	A	A	A	A	A	
220pF (221)	L	L	L	L	L	N	N	N	N	N	S	S	S	S	S	A	A	A	A	A	
270pF (271)			L			N	N	N	N	N	S	S	S	S	S	A	A	A	A	A	
330pF (331)			L			N	N	N	N	N	S	S	S	S	S	A	A	A	A	A	
390pF (391)			L			N	N	N	N	N	S	S	S	S	S	B	B	B	B	B	
470pF (471)			L			N	N	N	N	N	S	S	S	S	S	B	B	B	B	B	
560pF (561)			L			N	N	N	N	N	S	S	S	S	S	B	B	B	B	B	
680pF (681)						N	N	N	N	N	S	S	S	S	S	B	B	B	B	B	
820pF (821)						N	N	N	N	N	S	S	S	S	S	B	B	B	B	B	
1,000pF (102)						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*	T*	
0.015uF (153)																T*	T*	T*	T*	T*	
0.018uF (183)																D*	D*	D*	D*	D*	
0.022uF (223)																D*	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
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	P	K	K	K	K	K	D	D	D	D	
0.033μF (333)	P	P	P	P	P	K	K	K	K	K	D	D	D	D	
0.039μF (393)	P	P	P	P	P	K	K	K	K	K	M	M	M	M	
0.047μF (473)	J*	J*	J*	J*	J*	K	K	K	K	K	M	M	M	M	
0.056μF (563)	J*	J*	J*	J*	J*						M	M	M	M	
0.068μF (683)	G*	G*	G*	G*	G*						M	M	M	M	
0.082μF (823)	G*	G*	G*	G*	G*						M	M	M	M	
0.1μF (104)	G*	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.

Multilayer Ceramic Capacitors

Approval Sheet

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	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	D	I	
0.33μF (334)														X	X	X	X	X		D	D	D	D	I	
0.39μF (394)														X	X	X	X			D	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	I		
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.



Multilayer Ceramic Capacitors

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	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			K	G	M	M				M	M	
3.3μF (335)			P	P	P					K	G	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	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.

Multilayer Ceramic Capacitors

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	L												
	2,200pF (222)		L	L	L	L												
	2,700pF (272)		L	L	L	L												
	3,300pF (332)		L	L	L	L												
	4,700pF (472)		L	L	L	L												
	6,800pF (682)		L	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		E					
	0.056μF (563)	L	L							N	N		E					
	0.068μF (683)	L	L							N	N		E					
	0.082μF (823)	L	L							N	N		E					
	0.10μF (104)	L	L	L	L					N	N	N	E					
	0.15μF (154)									N	N	N	E					
	0.22μF (224)	L	L	L*						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	N	E	E	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
	1.5μF (155)														X			
2.2μF (225)	L*	L*							N	N	E	E		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)								E*					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			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*						

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

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										
	6.8μF (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																					
	1.5μF (155)																							
	2.2μF (225)	E	E					X	X															
	3.3μF (335)																							
	4.7μF (475)					X	X							I										
	6.8μF (685)																							
	10μF (106)												I	I										
	22μF (226)																		P*					
	47μF (476)																		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
1.60+0.30/-0.10	P	-	-	2,000	9,000	
1210 (3225)	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
2.50±0.30	M	-	-	1,000	6,000	
1808 (4520)	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
	2.00±0.20	K	-	-	1,000	6,000
1812 (4532)	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

Multilayer Ceramic Capacitors

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) <sup>#1</sup> , 0402 ≥ 475 (6.3V, 16V), 0402 ≥ 225(10V), 0603=106 (6.3V) TT18X ≥ 475(10V), TT15X series X6S: 0201/474(4V), 0201 ≥ 104 (6.3V, 10V) <sup>#1</sup> , 0402 ≥ 225 (6.3V), 0402/475 (10V), 0603/106 (6.3V), X7S: 0402/225(6.3V)  #1 Excluding X5R/0201/105(6.3V); 225(10V), 0402X475M6R3 X6S/0201/104(10V) (1.0±0.2Vrms · 1KHz±10%)  *Before initial measurement (Class II only): To apply de-aging at 150°C for 1hr then set for 24±2 hrs at room temp.	X7R: <table border="1"> <thead> <tr> <th>Rated vol.</th> <th>D.F. ≤</th> <th>Exception of D.F. ≤</th> </tr> </thead> <tbody> <tr> <td rowspan="3">≥ 100V</td> <td rowspan="3">≤ 2.5%</td> <td>≤ 3% 1206 ≥ 0.47μF</td> </tr> <tr> <td>≤ 5% 0603 ≥ 0.068μF; 0805 &gt; 0.1μF; 1206 ≥ 1μF; 1210 ≥ 2.2μF;</td> </tr> <tr> <td>≤ 10% 0805 &gt; 0.22μF; 1210 ≥ 3.3μF</td> </tr> <tr> <td rowspan="3">50V</td> <td rowspan="3">≤ 2.5%</td> <td>≤ 3% 0201(50V); 0603 ≥ 0.047μF; 0805 ≥ 0.18μF; 1206 ≥ 0.47μF</td> </tr> <tr> <td>≤ 5% 0201 ≥ 0.01μF; 1210 ≥ 3.3μF</td> </tr> <tr> <td>≤ 10% 0402 ≥ 0.012μF; 0603 &gt; 0.1μF; 0805/X7R &gt; 0.47μF; 1206 ≥ 2.2μF; 1210 ≥ 10μF</td> </tr> <tr> <td rowspan="3">35V</td> <td rowspan="3">≤ 3.5%</td> <td>≤ 10% 0603 ≥ 1μF; 0805 ≥ 2.2μF; 1206 ≥ 2.2μF; 1210 ≥ 10μF</td> </tr> <tr> <td>≤ 5% 0201 ≥ 0.01μF; 0805 ≥ 1μF; 1210 ≥ 10μF</td> </tr> <tr> <td>≤ 7% 0603 ≥ 0.33μF</td> </tr> <tr> <td rowspan="3">25V</td> <td rowspan="3">≤ 3.5%</td> <td>≤ 10% 0201 ≥ 0.1μF; 0402 ≥ 0.056μF; 0603 ≥ 0.47μF; 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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;	≤ 10% 0805 > 0.22μF; 1210 ≥ 3.3μF	50V	≤ 2.5%	≤ 3% 0201(50V); 0603 ≥ 0.047μF; 0805 ≥ 0.18μF; 1206 ≥ 0.47μF	≤ 5% 0201 ≥ 0.01μF; 1210 ≥ 3.3μF	≤ 10% 0402 ≥ 0.012μF; 0603 > 0.1μF; 0805/X7R > 0.47μF; 1206 ≥ 2.2μF; 1210 ≥ 10μF	35V	≤ 3.5%	≤ 10% 0603 ≥ 1μF; 0805 ≥ 2.2μF; 1206 ≥ 2.2μF; 1210 ≥ 10μF	≤ 5% 0201 ≥ 0.01μF; 0805 ≥ 1μF; 1210 ≥ 10μF	≤ 7% 0603 ≥ 0.33μF	25V	≤ 3.5%	≤ 10% 0201 ≥ 0.1μF; 0402 ≥ 0.056μF; 0603 ≥ 0.47μF; 0805 ≥ 2.2μF; 1206 ≥ 4.7μF; 1210 ≥ 22μF	≤ 12.5% 0402 ≥ 0.47μF	≤ 5% 0201 ≥ 0.01μF; 0402 ≥ 0.033μF; 0603 ≥ 0.15μF; 0805 ≥ 0.68μF; 1206 ≥ 2.2μF; 1210 ≥ 4.7μF	16V	≤ 3.5%	≤ 10% 0201/X7R ≥ 0.022μF; 0402 ≥ 0.22μF; 0603 > 0.47μF; 0805 ≥ 2.2μF; 1206 ≥ 4.7μF; 1210 ≥ 22μF	≤ 5% 0201 ≥ 0.012μF; 0402 ≥ 0.22μF; 0603 ≥ 0.33μF; 0805 ≥ 2.2μF; 1206 ≥ 2.2μF; 1210 ≥ 22μF	≤ 15% 0201 ≥ 0.1μF; 0402 ≥ 1μF	10V	≤ 5%	≤ 10% 0201 ≥ 0.1μF; 0402 ≥ 1μF; 0603 ≥ 10μF; 0805 ≥ 4.7μF; 1206 ≥ 47μF; 1210 ≥ 100μF	≤ 15% 0201 ≥ 0.1μF; 0402 ≥ 1μF	≤ 20% 0402 ≥ 2.2μF	6.3V	≤ 10%	≤ 15% 0201 ≥ 0.1μF; 0402 ≥ 1μF; 0603 ≥ 10μF; 0805 ≥ 4.7μF; 1206 ≥ 47μF; 1210 ≥ 100μF	≤ 20% 0402 ≥ 2.2μF	---	4V	≤ 15%	---	---	---	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	≤ 10% 0805 > 0.22μF; 1210 ≥ 3.3μF	50V	≤ 2.5%	≤ 3% 0201(50V); 0603 ≥ 0.047μF; 0805 ≥ 0.18μF; 1206 ≥ 0.47μF	≤ 5% 0201 ≥ 0.01μF; 1210 ≥ 3.3μF	≤ 10% 0402 ≥ 0.012μF; 0603 > 0.1μF; 0805 ≥ 1μF; 1206 ≥ 2.2μF; 1210 ≥ 10μF	35V	≤ 3.5%	≤ 10% 0603 ≥ 1μF; 0805 ≥ 2.2μF; 1206 ≥ 2.2μF; 1210 ≥ 10μF	≤ 5% 0201 ≥ 0.01μF; 0805 ≥ 1μF	≤ 7% 0603 ≥ 0.33μF	25V	≤ 3.5%	≤ 10% 0201 ≥ 0.1μF; 0402 ≥ 0.10μF; 0603 ≥ 0.47μF; 0805 ≥ 2.2μF; 1206 ≥ 4.7μF; 1210 ≥ 10μF	≤ 12.5% 0402 ≥ 0.47μF; 0805 = 10μF	≤ 5% 0201 ≥ 0.01μF; 0402 ≥ 0.033μF; 0603 ≥ 0.15μF; 0805 ≥ 0.68μF; 1206 ≥ 2.2μF; 1210 ≥ 4.7μF	16V	≤ 3.5%	≤ 10% 0201 ≥ 0.1μF; 0402 ≥ 0.22μF; 0603 > 0.47μF; 0805 ≥ 2.2μF; 1206 ≥ 4.7μF; 1210 ≥ 22μF	≤ 12.5% 0402 ≥ 1μF; 0805 = 10μF	≤ 10% 0201 ≥ 0.012μF; 0402 ≥ 0.22μF; 0603 ≥ 0.33μF; 0805 ≥ 2.2μF; 1206 ≥ 2.2μF; 1210 ≥ 22μF; 01R5/X5R	10V	≤ 5%	≤ 12.5% 0805 = 10μF	≤ 15% 0201 > 0.1μF; 0402 ≥ 1μF; 0603 ≥ 10μF	≤ 20% 0201 > 0.1μF; 0402 ≥ 1μF; 0603 ≥ 10μF; 0805 ≥ 4.7μF; 1206 ≥ 47μF; 1210 ≥ 100μF	6.3V	≤ 10%	≤ 15% 0201 > 0.1μF; 0402 ≥ 1μF; 0603 ≥ 10μF; 0805 ≥ 4.7μF; 1206 ≥ 47μF; 1210 ≥ 100μF	≤ 20% 0402 ≥ 2.2μF	---	4V	≤ 15%	---	---	---	Rated vol.	D.F. ≤	Exception of D.F. ≤	≥ 50V	≤ 5%	≤ 7% 0603 ≥ 0.1μF; 0805 ≥ 0.47μF; 1206 ≥ 4.7μF	≤ 12.5% 1210 ≥ 6.8μF	35V	≤ 7%	---	25V	≤ 5%	≤ 7% 0402 ≥ 0.047μF; 0603 ≥ 0.1μF; 0805 ≥ 0.33μF; 1206 ≥ 1μF; 1210 ≥ 4.7μF	≤ 9% 0402 ≥ 0.068μF; 0603 ≥ 0.47μF; 1206 ≥ 4.7μF; 1210 ≥ 22μF	16V (C < 1.0μF)	≤ 7%	≤ 9% 0402 ≥ 0.068μF; 0603 ≥ 0.68μF	16V (C ≥ 1.0μF)	≤ 9%	≤ 12.5% 0603 ≥ 2.2μF; 0805 ≥ 3.3μF; 1206 ≥ 10μF; 1210 ≥ 22μF; 1812 ≥ 47μF	10V	≤ 12.5%	≤ 20% 0402 ≥ 0.47μF	6.3V	≤ 20%	---
Rated vol.	D.F. ≤	Exception of D.F. ≤																																																																																																																	
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25V	≤ 3.5%	≤ 10% 0201 ≥ 0.1μF; 0402 ≥ 0.056μF; 0603 ≥ 0.47μF; 0805 ≥ 2.2μF; 1206 ≥ 4.7μF; 1210 ≥ 22μF																																																																																																																	
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16V	≤ 3.5%	≤ 10% 0201/X7R ≥ 0.022μF; 0402 ≥ 0.22μF; 0603 > 0.47μF; 0805 ≥ 2.2μF; 1206 ≥ 4.7μF; 1210 ≥ 22μF																																																																																																																	
		≤ 5% 0201 ≥ 0.012μF; 0402 ≥ 0.22μF; 0603 ≥ 0.33μF; 0805 ≥ 2.2μF; 1206 ≥ 2.2μF; 1210 ≥ 22μF																																																																																																																	
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50V	≤ 2.5%	≤ 3% 0201(50V); 0603 ≥ 0.047μF; 0805 ≥ 0.18μF; 1206 ≥ 0.47μF																																																																																																																	
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6.3V	≤ 10%	≤ 15% 0201 > 0.1μF; 0402 ≥ 1μF; 0603 ≥ 10μF; 0805 ≥ 4.7μF; 1206 ≥ 47μF; 1210 ≥ 100μF																																																																																																																	
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Rated vol.	D.F. ≤	Exception of D.F. ≤																																																																																																																	
≥ 50V	≤ 5%	≤ 7% 0603 ≥ 0.1μF; 0805 ≥ 0.47μF; 1206 ≥ 4.7μF																																																																																																																	
		≤ 12.5% 1210 ≥ 6.8μF																																																																																																																	
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16V (C < 1.0μF)	≤ 7%	≤ 9% 0402 ≥ 0.068μF; 0603 ≥ 0.68μF																																																																																																																	
16V (C ≥ 1.0μF)	≤ 9%	≤ 12.5% 0603 ≥ 2.2μF; 0805 ≥ 3.3μF; 1206 ≥ 10μF; 1210 ≥ 22μF; 1812 ≥ 47μF																																																																																																																	
10V	≤ 12.5%	≤ 20% 0402 ≥ 0.47μF																																																																																																																	
6.3V	≤ 20%	---																																																																																																																	

Multilayer Ceramic Capacitors

Approval Sheet

			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			
		≤ 10%	0805 > 0.22μF; 1210 ≥ 3.3μF			
50V	≤ 2.5%	≤ 3%	0201(50V); 0603 ≥ 0.047μF; 0805 ≥ 0.18μF; 1206 ≥ 0.47μF			
		≤ 5%	0201 ≥ 0.01μF; 1210 ≥ 3.3μF			
		≤ 10%	0402 ≥ 0.012μF; 0603 > 0.1μF; 0805 ≥ 1μF; 1206 ≥ 2.2μF; 1210 ≥ 10μF			
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			
		≤ 12.5%	0402 ≥ 0.47μF			
16V	≤ 3.5%	≤ 5%	0201 ≥ 0.01μF; 0402 ≥ 0.033μF; 0603 ≥ 0.15μF; 0805 ≥ 0.68μF; 1206 ≥ 2.2μF; 1210 ≥ 4.7μF			
		≤ 10%	0201 ≥ 0.1μF; 0402 ≥ 0.22μF; 0603 > 0.47μF; 0805 ≥ 2.2μF; 1206 ≥ 4.7μF; 1210 ≥ 22μF			
10V	≤ 5%	≤ 10%	0201 ≥ 0.012μF; 0402 ≥ 0.22μF; 0603 ≥ 0.33μF; 0805 ≥ 2.2μF; 1206 ≥ 2.2μF; 1210 ≥ 22μF			
		≤ 15%	0201 ≥ 0.1μF; 0402 ≥ 1μF			
		≤ 20%	0201 ≥ 0.1μF; 0402 ≥ 0.47μF; 0603 ≥ 10μF; 0805 ≥ 4.7μF; 1206 ≥ 47μF; 1210 ≥ 100μF			
6.3V	≤ 10%	≤ 15%	0201 ≥ 0.1μF; 0402 ≥ 0.47μF; 0603 ≥ 10μF; 0805 ≥ 4.7μF; 1206 ≥ 47μF; 1210 ≥ 100μF			
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			
		≤ 10%	0805 > 0.22μF; 1210 ≥ 3.3μF			
50V	≤ 2.5%	≤ 3%	0201(50V); 0603 ≥ 0.047μF; 0805 ≥ 0.18μF; 1206 ≥ 0.47μF			
		≤ 5%	0201 ≥ 0.01μF; 1210 ≥ 3.3μF			
		≤ 10%	0402 ≥ 0.012μF; 0603 > 0.1μF; 0805 ≥ 1μF; 1206 ≥ 2.2μF; 1210 ≥ 10μF			
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			
		≤ 12.5%	0402 ≥ 0.47μF			
16V	≤ 3.5%	≤ 5%	0201 ≥ 0.01μF; 0402 ≥ 0.033μF; 0603 ≥ 0.15μF; 0805 ≥ 0.68μF; 1206 ≥ 2.2μF; 1210 ≥ 4.7μF			
		≤ 10%	0201 ≥ 0.1μF; 0402 ≥ 0.22μF; 0603 > 0.47μF; 0805 ≥ 2.2μF; 1206 ≥ 4.7μF; 1210 ≥ 22μF			
10V	≤ 5%	≤ 10%	0201 ≥ 0.012μF; 0402 ≥ 0.22μF; 0603 ≥ 0.33μF; 0805 ≥ 2.2μF; 1206 ≥ 2.2μF; 1210 ≥ 22μF			
		≤ 15%	0201 ≥ 0.1μF; 0402 ≥ 1μF			
		≤ 20%	0201 ≥ 0.1μF; 0402 ≥ 0.47μF; 0603 ≥ 10μF; 0805 ≥ 4.7μF; 1206 ≥ 47μF; 1210 ≥ 100μF			
6.3V	≤ 10%	≤ 15%	0201 ≥ 0.1μF; 0402 ≥ 0.47μF; 0603 ≥ 10μF; 0805 ≥ 4.7μF; 1206 ≥ 47μF; 1210 ≥ 100μF			
4V	≤ 15%	---	---			
<b>4. Dielectric Strength</b>	* 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.			

Multilayer Ceramic Capacitors

Approval Sheet

5.	Insulation Resistance	To apply rated voltage for MAX. 120sec.	10GΩ or $RxC \geq 500\Omega\text{-F}$ whichever is smaller.	
			Class II (X7R, X7E, X5R, X6S, X7S, Y5V:)	
			Rated voltage	Insulation Resistance
			100V: All X7R	10GΩ or $RxC \geq 100\Omega\text{-F}$ whichever is smaller.
			50V: 0402 $\geq 0.01\mu\text{F}$ ; 0603 $\geq 1\mu\text{F}$ ; 0805 $\geq 1\mu\text{F}$ ; 1206 $\geq 4.7\mu\text{F}$ ; 1210 $\geq 4.7\mu\text{F}$	
			35V: 0805 $\geq 2.2\mu\text{F}$ ; 1206 $\geq 2.2\mu\text{F}$ ; 1210 $\geq 10\mu\text{F}$	
			25V: 0402 $\geq 1\mu\text{F}$ ; 0603 $\geq 2.2\mu\text{F}$ ; 0805 $\geq 2.2\mu\text{F}$ ; 1206 $\geq 10\mu\text{F}$ ; 1210 $\geq 10\mu\text{F}$	
			16V: 0201 $\geq 0.1\mu\text{F}$ ; 0402 $\geq 0.22\mu\text{F}$ ; 0603 $\geq 1\mu\text{F}$ ; 0805 $\geq 2.2\mu\text{F}$ ; 1206 $\geq 10\mu\text{F}$ ; 1210 $\geq 47\mu\text{F}$	
			10V: 0201 $\geq 47\text{nF}$ ; 0402 $\geq 0.47\mu\text{F}$ ; 0603 $\geq 0.47\mu\text{F}$ ; 0805 $\geq 2.2\mu\text{F}$ ; 1206 $\geq 4.7\mu\text{F}$ ; 1210 $\geq 47\mu\text{F}$	
			6.3V ; 4V ; Size $\geq 1812$	
			Rated voltage	Insulation Resistance
			All X6S items, All X7S items	$RxC \geq 50\Omega\text{-F}$ .
			100V: 1210 $\geq 3.3\mu\text{F}$	
			50V: 0402 $\geq 0.1\mu\text{F}$ ; 0603 $\geq 2.2\mu\text{F}$ ; 0805 $\geq 10\mu\text{F}$ ; 1206 $\geq 10\mu\text{F}$	
			35V: 0603 $\geq 1\mu\text{F}$ ;	
			25V: 0201 $\geq 0.1\mu\text{F}$ ; 0402 $\geq 2.2\mu\text{F}$ ; 0603 $\geq 10\mu\text{F}$ ; 0805 $\geq 10\mu\text{F}$ ; 1206 $\geq 22\mu\text{F}$	
			16V: 0603 $\geq 10\mu\text{F}$ ; 0402 $\geq 1\mu\text{F}$ ; 0201 $\geq 0.22\mu\text{F}$	
			10V: 0201 $\geq 0.1\mu\text{F}$ ; 0402 $\geq 1\mu\text{F}$ ; 0603 $\geq 10\mu\text{F}$ ; 0805 $\geq 47\mu\text{F}$	
			6.3V: 0201 $\geq 0.1\mu\text{F}$ ; 0402 $\geq 1\mu\text{F}$ ; 0603 $\geq 4.7\mu\text{F}$ ; 0805 $\geq 47\mu\text{F}$ ; 1206 $\geq 10\mu\text{F}$	
			4V: 0603 $\geq 22\mu\text{F}$ ; 0805 $\geq 47\mu\text{F}$ ; 1206 $\geq 100\mu\text{F}$	





Multilayer Ceramic Capacitors

No.	Item	Test Condition	Requirements																																																										
6.	Temperature Coefficient	With no electrical load.																																																											
		<table border="1"> <thead> <tr> <th>T.C.</th> <th>Operating Temp</th> </tr> </thead> <tbody> <tr> <td>NPO</td> <td>-55~125°C at 25°C</td> </tr> <tr> <td>X7R</td> <td>-55~125°C at 25°C</td> </tr> <tr> <td>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> </tbody> </table> <p>* Before initial measurement (Class II only): To apply de-aging at 150°C for 1hr then set for 24±2 hrs at room temp. * Measurement voltage for Class II:</p> <table border="1"> <thead> <tr> <th>01005</th> <th>0201</th> </tr> </thead> <tbody> <tr> <td>Cap≤0.01μF: 0.5V</td> <td>Cap&lt;0.1μF:1V</td> </tr> <tr> <td>Cap&gt;0.01μF: 0.2V</td> <td>0.1μF*≤Cap&lt;1μF: 0.2V</td> </tr> <tr> <td></td> <td>Cap≥1μF: 0.1V</td> </tr> <tr> <td></td> <td>0201X104/16V: 0.5V</td> </tr> <tr> <td></td> <td>0201X224/10V: 0.5V</td> </tr> <tr> <th>0402</th> <th>0603</th> </tr> <tr> <td>Cap&lt;1μF: 1V</td> <td>Cap&lt;1μF: 1V</td> </tr> <tr> <td>Cap=1μF: 0.5V</td> <td>1μF≤Cap≤4.7μF: 0.5V</td> </tr> <tr> <td>0402X475M6R3: 0.5V</td> <td></td> </tr> <tr> <td>1μF&lt;Cap&lt;10μF: 0.2V</td> <td>Cap&gt;4.7μF: 0.2V</td> </tr> <tr> <td>Cap≥10μF: 0.1V</td> <td></td> </tr> <tr> <th>0805</th> <th>1206/1210</th> </tr> <tr> <td>Cap&lt;10μF: 1V</td> <td>Cap≤10μF: 1V</td> </tr> <tr> <td>Cap=10μF: 0.5V</td> <td>10μF&lt;Cap≤100μF: 0.5V</td> </tr> <tr> <td>Cap&gt;10μF: 0.2V</td> <td>Cap&gt;100μF: 0.2V</td> </tr> </tbody> </table>	T.C.	Operating Temp	NPO	-55~125°C at 25°C	X7R	-55~125°C at 25°C	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	01005	0201	Cap≤0.01μF: 0.5V	Cap<0.1μF:1V	Cap>0.01μF: 0.2V	0.1μF*≤Cap<1μF: 0.2V		Cap≥1μF: 0.1V		0201X104/16V: 0.5V		0201X224/10V: 0.5V	0402	0603	Cap<1μF: 1V	Cap<1μF: 1V	Cap=1μF: 0.5V	1μF≤Cap≤4.7μF: 0.5V	0402X475M6R3: 0.5V		1μF<Cap<10μF: 0.2V	Cap>4.7μF: 0.2V	Cap≥10μF: 0.1V		0805	1206/1210	Cap<10μF: 1V	Cap≤10μF: 1V	Cap=10μF: 0.5V	10μF<Cap≤100μF: 0.5V	Cap>10μF: 0.2V	Cap>100μF: 0.2V	<table border="1"> <thead> <tr> <th>T.C.</th> <th>Capacitance Change</th> </tr> </thead> <tbody> <tr> <td>NPO</td> <td>Within ±30ppm/°C</td> </tr> <tr> <td>X7R</td> <td>Within ±15%</td> </tr> <tr> <td>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> </tbody> </table>	T.C.	Capacitance Change	NPO	Within ±30ppm/°C	X7R	Within ±15%	X7S	Within ±22%	X5R	Within ±15%	X6S	Within ±22%
T.C.	Operating Temp																																																												
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7.	Adhesive Strength of Termination	<p>* Pressurizing force : 2N (0201) and 5N (≤0603) and 10N (&gt;0603) * Test time: 10±1 sec.</p>	* No remarkable damage or removal of the terminations.																																																										
8.	Vibration Resistance	<p>* Vibration frequency: 10-55 Hz/min. * Total amplitude: 1.5mm * Test time: 6 hrs. (Two hrs each in three mutually perpendicular directions.) * Before initial measurement (Class II only): To apply de-aging at 150°C for 1hr then set for 24±2 hrs at room temp. * Cap./DF(Q) Measurement to be made after de-aging at 150°C for 1hr then set for 24±2 hrs at room temp.</p>	<p>* No remarkable damage. * Cap change and Q/D.F.: To meet initial spec.</p>																																																										
9.	Solderability	<p>* Solder temperature: 235±5°C * Dipping time: 2±0.5 sec.</p>	95% min. coverage of all metalized area.																																																										
10.	Bending Test	<p>* The middle part of substrate shall be pressurized by means of the pressurizing rod at a rate of about 1 mm per second until the deflection becomes 1 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.</p>	<p>* No remarkable damage. * Cap change : NPO: within ±5% or 0.5pF whichever is larger X7R, X5R, X6S, X7S: within ±12.5% Y5V: within ±30% (This capacitance change means the change of capacitance under specified flexure of substrate from the capacitance measured before the test.)</p>																																																										
11.	Resistance to Soldering Heat	<p>* Solder temperature: 260±5°C * Dipping time: 10±1 sec * Preheating: 120 to 150°C for 1 minute before immerse the capacitor in a eutectic solder. * Before initial measurement (Class II only): To apply de-aging at 150°C for 1hr then set for 24±2 hrs at room temp. * Cap. / DF(Q) / I.R. Measurement to be made after de-aging at 150°C for 1hr then set for 24±2 hrs at room temp.</p>	<p>* No remarkable damage. * Cap change: NPO: within ±2.5% or 0.25pF whichever is larger X7R, X5R, X6S, X7S: within ±7.5% Y5V: within ±20% * Q/D.F., I.R. and dielectric strength: To meet initial requirements. * 25% max. leaching on each edge.</p>																																																										

**Multilayer Ceramic Capacitors**

<b>12.</b>	<b>Temperature Cycle</b>	* Conduct the five cycles according to the temperatures and time.		* No remarkable damage. Cap change : NP0: within $\pm 2.5\%$ or 0.25pF whichever is larger X7R, X5R, X6S, X7S: within $\pm 7.5\%$ Y5V: within $\pm 20\%$ * Q/D.F., I.R. and dielectric strength: To meet initial requirements.	
		Step	Temp. (°C)		Time (min.)
		1	Min. operating temp. +0/-3		30 $\pm$ 3
		2	Room temp.		2~3
		3	Max. operating temp. +3/-0		30 $\pm$ 3
4	Room temp.	2~3			
		* Before initial measurement (Class II only): To apply de-aging at 150°C for 1hr then set for 24 $\pm$ 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 $\pm$ 2 hrs at room temp.			



Multilayer Ceramic Capacitors

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%;
		* 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%;
			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:
			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
			≤20% 0805 >0.22μF; 1210 ≥3.3μF
			50V ≤3% ≤6% 0201(50V); 0603 ≥0.047μF; 0805 ≥0.18μF; 1206 ≥0.47μF
	≤10% 0201 ≥0.01μF; 1210 ≥3.3μF		
	≤20% 0402 ≥0.012μF; 0603 >0.1μF; 0805 ≥1μF(0805/X7R>0.47μF);		
	1206 ≥2.2μF; 1210 ≥10μF		
	35V ≤5% ≤20% 0603 ≥1μF; 0805 ≥2.2μF; 1206 ≥2.2μF; 1210 ≥10μF		
	≤10% 0201 ≥0.01μF; 0805 ≥1μF; 1210 ≥10μF		
	≤14% 0603 ≥0.33μF		
	25V ≤5% ≤10% 0603 ≥0.15μF; 0805 ≥0.68μF; 1206 ≥2.2μF; 1210 ≥4.7μF		
	≤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)		
	≤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		
	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 (0201/X5R >0.1μF); 0402 ≥1μF;		
	(0603/X5R ≥10μF); 01R5/X5R		
	6.3V ≤15% ≤30% 0201 ≥0.1μF (0201/X5R >0.1μF); 0402 ≥1μF (0402/X6S ≥0.47μF);		
	0603 ≥10μF; 0805 ≥4.7μF; 1206 ≥47μF; 1210 ≥100μF		
	4V ≤20% --- ---		
	Y5V:		
	Rated vol. D.F. ≤ Exception of D.F. ≤		
	≥50V ≤7.5% ≤10% 0603 ≥0.1μF; 0805 ≥0.47μF; 1206 ≥4.7μF		
	≤20% 1210 ≥6.8μF		
	35V ≤10% --- ---		
	25V ≤7.5% ≤10% 0402 ≥0.047μF; 0603 ≥0.1μF;		
	0805 ≥0.33μF; 1206 ≥1μF; 1210 ≥4.7μF		
	≤15% 0402 ≥0.068μF; 0603 ≥0.47μF;		
	1206 ≥4.7μF; 1210 ≥22μF		
	16V (C<1.0μF) ≤10% ≤12.5% 0402 ≥0.068μF; 0603 ≥0.68μF		
	≤20% 0402 ≥0.22μF		
	16V (C≥1.0μF) ≤12.5% ≤20% 0603 ≥2.2μF; 0805 ≥3.3μF;		
	1206 ≥10μF; 1210 ≥22μF; 1812 ≥47μF		
	10V ≤20% ≤30% 0402 ≥0.47μF		
	6.3V ≤30% --- ---		
	I.R.: ≥10V, 1GΩ or 50 Ω-F whichever is smaller.		
	Class II (X7R, X5R, X6S, X7S, Y5V)		
	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; All X6S/X7S items; Size ≥1812		

Multilayer Ceramic Capacitors

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

Multilayer Ceramic Capacitors

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 : 150% of rated voltage. (2) 10V ≤ Ur < 500V: 200% of rated voltage. (3) 500V: 150% of rated voltage. (4) Ur ≥ 630V: 120% of rated voltage. (5) 100% of rated voltage for below range.	No remarkable damage. Cap change: NP0: ±3.0% or ±0.3pF whichever is larger X7R, X5R, X6S, X7S: ≥10V**, within ±12.5%; ≤ 6.3V within ±25%; **10V: 0603≥4.7μF;0402≥1μF;0201≥0.1μF, within ±25% Y5V: ≥10V, within ±30%; ≤ 6.3V, within +30/-40% Q/D.F. value: NP0: More than 30pF, Q≥350 10pF≤C<30pF, Q≥275+2.5C Less than 10pF, Q≥200+10C X7R, X5R, X6S, X7S:																																																																																																																																									
		<table border="1"> <thead> <tr> <th>Size</th> <th>Dielectric</th> <th>Rated voltage</th> <th>Capacitance</th> </tr> </thead> <tbody> <tr> <td rowspan="2">0201</td> <td rowspan="2">X5R/X7R/X6S</td> <td>≤ 10V</td> <td>C ≥ 0.1μF</td> </tr> <tr> <td>≥ 16V</td> <td>C &gt; 0.1μF</td> </tr> <tr> <td rowspan="4">0402</td> <td rowspan="2">X5R</td> <td>≤ 16V</td> <td>C &gt; 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 &gt; 1.0μF</td> </tr> <tr> <td>16V, 25V</td> <td>C ≥ 1.0μF</td> </tr> <tr> <td rowspan="3">0603</td> <td rowspan="2">X7R/X7S/Y5V</td> <td>6.3V, 10V</td> <td>C ≥ 1.0μF</td> </tr> <tr> <td>4V</td> <td>C ≥ 22μF</td> </tr> <tr> <td>X5R/X6S/X7S</td> <td>25V</td> <td>C ≥ 1.0μF</td> </tr> <tr> <td rowspan="4">0805</td> <td rowspan="2">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 rowspan="2">X7R/X6S/X7S</td> <td>6.3V</td> <td>C ≥ 22μF</td> </tr> <tr> <td>10V, 50V</td> <td>C ≥ 10μF</td> </tr> <tr> <td>1206</td> <td>X5R/X7R/X6S</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 rowspan="2">TT15</td> <td rowspan="2">X5R</td> <td>16V</td> <td>C ≥ 47μF</td> </tr> <tr> <td>100V</td> <td>C ≥ 3.3μF</td> </tr> <tr> <td rowspan="2">TT18</td> <td rowspan="2">Y5V</td> <td>6.3V, 10V</td> <td>C ≥ 2.2μF</td> </tr> <tr> <td>6.3V</td> <td>C ≥ 10μF</td> </tr> <tr> <td rowspan="2">TT21</td> <td rowspan="2">X5R/X7R/X6S</td> <td>≤ 10V</td> <td>C ≥ 10μF</td> </tr> <tr> <td>Y5V</td> <td>C ≥ 22μF</td> </tr> <tr> <td>TT31</td> <td>Y5V</td> <td>6.3V</td> <td>C ≥ 22μF</td> </tr> </tbody> </table> <p>**1WV items must follow de-rating conditions. 6) 150% of rated voltage for below range.</p> <table border="1"> <thead> <tr> <th>Size</th> <th>Dielectric</th> <th>Rated voltage</th> <th>Capacitance</th> </tr> </thead> <tbody> <tr> <td rowspan="2">0201</td> <td rowspan="2">X5R/X6S</td> <td>16V, 25V</td> <td>C=0.1μF</td> </tr> <tr> <td>X7R</td> <td>C ≥ 0.022μF</td> </tr> <tr> <td rowspan="3">0402</td> <td rowspan="2">X7R/X5R/X6S</td> <td>50V</td> <td>C &gt; 0.01μF</td> </tr> <tr> <td>10~25V</td> <td>C ≥ 0.22μF</td> </tr> <tr> <td>Y5V</td> <td>16V</td> <td>C ≥ 0.47μF</td> </tr> <tr> <td rowspan="5">0603</td> <td rowspan="2">X7S</td> <td>50V~100V</td> <td>C &gt; 0.22μF</td> </tr> <tr> <td>50V</td> <td>C &gt; 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/X7R/X6S/X7S</td> <td>10V, 16V</td> <td>C ≥ 1.0μF</td> </tr> <tr> <td>Y5V</td> <td>16V</td> <td>C ≥ 2.2μF</td> </tr> <tr> <td rowspan="4">0805</td> <td rowspan="2">X5R/X7R/X6S/X7S</td> <td>100V</td> <td>C ≥ 0.47μF</td> </tr> <tr> <td>50V</td> <td>C ≥ 0.68μF</td> </tr> <tr> <td>35V</td> <td>C ≥ 2.2μF</td> </tr> <tr> <td>10~25V</td> <td>C ≥ 4.7μF</td> </tr> <tr> <td rowspan="2">1206</td> <td rowspan="2">X7R</td> <td>100V</td> <td>C ≥ 1.0μF</td> </tr> <tr> <td>50V</td> <td>C = 4.7μF</td> </tr> <tr> <td rowspan="2">1210</td> <td rowspan="2">X5R/X6S/X7S</td> <td>100V</td> <td>C &gt; 1.0μF</td> </tr> <tr> <td>50V</td> <td>C = 4.7μF</td> </tr> <tr> <td>1825</td> <td>X5R/X7R/X6S/X7S</td> <td>50V~100V</td> <td>C ≥ 2.2μF</td> </tr> <tr> <td>2220</td> <td rowspan="2">X7R</td> <td rowspan="2">100V~250V</td> <td rowspan="2">C ≥ 1.0μF</td> </tr> <tr> <td>2225</td> </tr> </tbody> </table>	Size	Dielectric	Rated voltage	Capacitance	0201	X5R/X7R/X6S	≤ 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/Y5V	6.3V, 10V	C ≥ 1.0μF	4V	C ≥ 22μF	X5R/X6S/X7S	25V	C ≥ 1.0μF	0805	X5R/X7R/X6S/X7S	35V	C ≥ 1.0μF	4V	C ≥ 47μF	X7R/X6S/X7S	6.3V	C ≥ 22μF	10V, 50V	C ≥ 10μF	1206	X5R/X7R/X6S	16V, 25V	C ≥ 10μF C ≥ 22μF	1210	X5R/X7R/X6S	≤ 6.3V	C ≥ 47μF	TT15	X5R	16V	C ≥ 47μF	100V	C ≥ 3.3μF	TT18	Y5V	6.3V, 10V	C ≥ 2.2μF	6.3V	C ≥ 10μF	TT21	X5R/X7R/X6S	≤ 10V	C ≥ 10μF	Y5V	C ≥ 22μF	TT31	Y5V	6.3V	C ≥ 22μF	Size	Dielectric	Rated voltage	Capacitance	0201	X5R/X6S	16V, 25V	C=0.1μF	X7R	C ≥ 0.022μF	0402	X7R/X5R/X6S	50V	C > 0.01μF	10~25V	C ≥ 0.22μF	Y5V	16V	C ≥ 0.47μF	0603	X7S	50V~100V	C > 0.22μF	50V	C > 0.1μF	X7R	25V	C = 1.0μF	50V	C ≥ 1.0μF	X5R/X7R/X6S/X7S	10V, 16V	C ≥ 1.0μF	Y5V	16V	C ≥ 2.2μF	0805	X5R/X7R/X6S/X7S	100V	C ≥ 0.47μF	50V	C ≥ 0.68μF	35V	C ≥ 2.2μF	10~25V	C ≥ 4.7μF	1206	X7R	100V	C ≥ 1.0μF	50V	C = 4.7μF	1210	X5R/X6S/X7S	100V	C > 1.0μF	50V	C = 4.7μF	1825	X5R/X7R/X6S/X7S	50V~100V	C ≥ 2.2μF	2220	X7R	100V~250V	C ≥ 1.0μF	2225
		Size	Dielectric	Rated voltage	Capacitance																																																																																																																																							
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		1210	X5R/X7R/X6S	≤ 6.3V	C ≥ 47μF																																																																																																																																							
		TT15	X5R	16V	C ≥ 47μF																																																																																																																																							
				100V	C ≥ 3.3μF																																																																																																																																							
		TT18	Y5V	6.3V, 10V	C ≥ 2.2μF																																																																																																																																							
				6.3V	C ≥ 10μF																																																																																																																																							
		TT21	X5R/X7R/X6S	≤ 10V	C ≥ 10μF																																																																																																																																							
				Y5V	C ≥ 22μF																																																																																																																																							
		TT31	Y5V	6.3V	C ≥ 22μF																																																																																																																																							
		Size	Dielectric	Rated voltage	Capacitance																																																																																																																																							
		0201	X5R/X6S	16V, 25V	C=0.1μF																																																																																																																																							
				X7R	C ≥ 0.022μF																																																																																																																																							
0402	X7R/X5R/X6S	50V	C > 0.01μF																																																																																																																																									
		10~25V	C ≥ 0.22μF																																																																																																																																									
	Y5V	16V	C ≥ 0.47μF																																																																																																																																									
0603	X7S	50V~100V	C > 0.22μF																																																																																																																																									
		50V	C > 0.1μF																																																																																																																																									
	X7R	25V	C = 1.0μF																																																																																																																																									
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	X5R/X7R/X6S/X7S	10V, 16V	C ≥ 1.0μF																																																																																																																																									
Y5V	16V	C ≥ 2.2μF																																																																																																																																										
0805	X5R/X7R/X6S/X7S	100V	C ≥ 0.47μF																																																																																																																																									
		50V	C ≥ 0.68μF																																																																																																																																									
	35V	C ≥ 2.2μF																																																																																																																																										
	10~25V	C ≥ 4.7μF																																																																																																																																										
1206	X7R	100V	C ≥ 1.0μF																																																																																																																																									
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1210	X5R/X6S/X7S	100V	C > 1.0μF																																																																																																																																									
		50V	C = 4.7μF																																																																																																																																									
1825	X5R/X7R/X6S/X7S	50V~100V	C ≥ 2.2μF																																																																																																																																									
2220	X7R	100V~250V	C ≥ 1.0μF																																																																																																																																									
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<p>* Before initial measurement (Class II only): To apply de-aging at 150°C for 1hr then set for 24±2 hrs at room temp. * Cap. / DF(Q) / I.R. Measurement to be made after de-aging at 150°C for 1hr then set for 24±2 hrs at room temp. * De-rating conditions:</p>																																																																																																																																												

Multilayer Ceramic Capacitors

**APPENDIXES**

■ Tape & reel dimensions

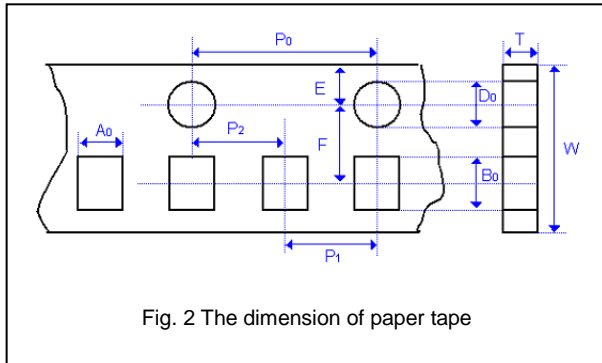


Fig. 2 The dimension of paper tape

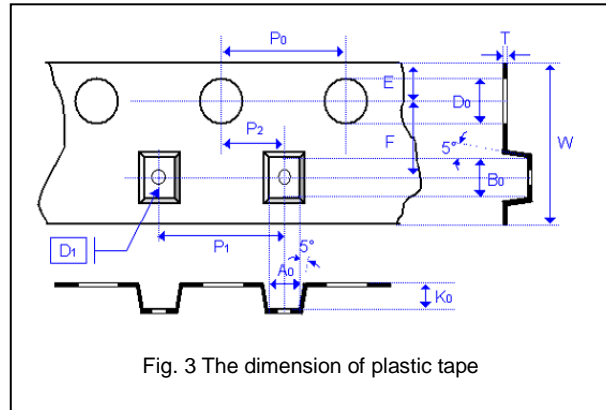


Fig. 3 The dimension of plastic tape

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	
<b>A<sub>0</sub></b>	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	< 3.05	< 3.20	< 2.50	< 2.50	< 3.90	< 3.90	< 3.90	
<b>B<sub>0</sub></b>	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	< 3.80	< 4.00	< 5.30	< 5.30	< 5.30	< 5.30	< 5.30	
<b>T</b>	≤ 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	0.23 +/-0.1	0.25 +/-0.1	0.25 +/-0.1	0.25 +/-0.1	0.25 +/-0.1	0.25 +/-0.1	
<b>K<sub>0</sub></b>	-	-	-	-	-	< 2.00	-	< 2.00	< 2.50	< 1.50	< 2.00	< 2.50	< 3.20	< 2.00	< 2.50	< 2.00	< 2.50	< 3.50	
<b>W</b>	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	8.00 +/-0.30	12.00 +/-0.30	12.00 +/-0.30	12.00 +/-0.30	12.00 +/-0.30	12.00 +/-0.30	
<b>P<sub>0</sub></b>	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	
<b>10xP<sub>0</sub></b>	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	40.00 +/-0.20	40.00 +/-0.20	40.00 +/-0.20	
<b>P<sub>1</sub></b>	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	4.00 +/-0.10	4.00 +/-0.10	8.00 +/-0.10	8.00 +/-0.10	8.00 +/-0.10	
<b>P<sub>2</sub></b>	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 +/-0.05	2.00 +/-0.10	2.00 +/-0.10	2.00 +/-0.10	2.00 +/-0.10	2.00 +/-0.10	
<b>D<sub>0</sub></b>	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	
<b>D<sub>1</sub></b>	-	-	-	-	-	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	1.00 +/-0.10	1.00 +/-0.10	1.00 +/-0.10	1.50 +/-0.10	1.50 +/-0.10	1.50 +/-0.10	
<b>E</b>	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	
<b>F</b>	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	3.50 +/-0.05	5.50 +/-0.10	5.50 +/-0.10	5.50 +/-0.10	5.50 +/-0.10	5.50 +/-0.10	

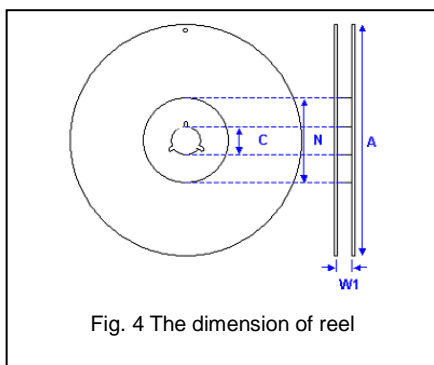


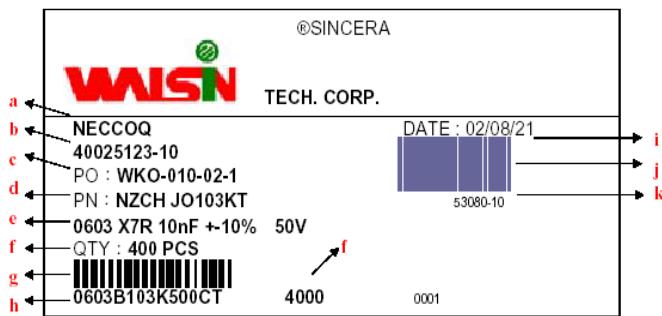
Fig. 4 The dimension of reel

Size	0201, 0402, 0603, 0805, 1206, 1210			1812
<b>Reel size</b>	7"	10"	13"	7"
<b>C</b>	13.0±0.5	13.0±0.5	13.0±0.5	13.0±0.5
<b>W<sub>1</sub></b>	10.0±1.5	10.0±1.5	10.0±1.5	12.4±2.0/-0
<b>A</b>	178.0±2.0	250.0±2.0	330.0±2.0	178.0±2.0
<b>N</b>	60.0+1.0/-0	50 min	50 min	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 <sub>3</sub> based	BaTiO <sub>3</sub> based
②	Inner electrode		Ni
③	Termination	Inner layer	Cu
④		Middle layer	Ni
⑤		Outer layer	Sn

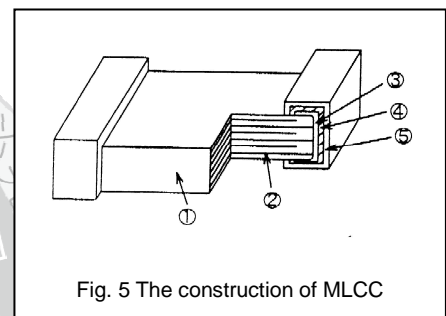


Fig. 5 The construction of MLCC

**Storage and handling conditions**

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

**Cautions:**

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



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<sub>2</sub> within oven are recommended.

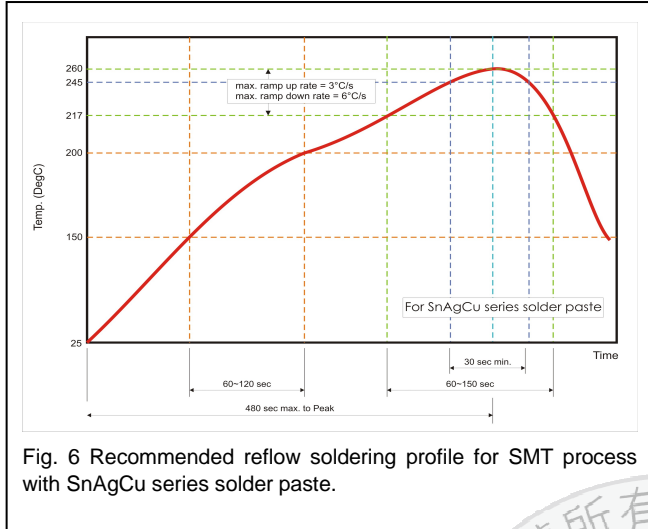


Fig. 6 Recommended reflow soldering profile for SMT process with SnAgCu series solder paste.

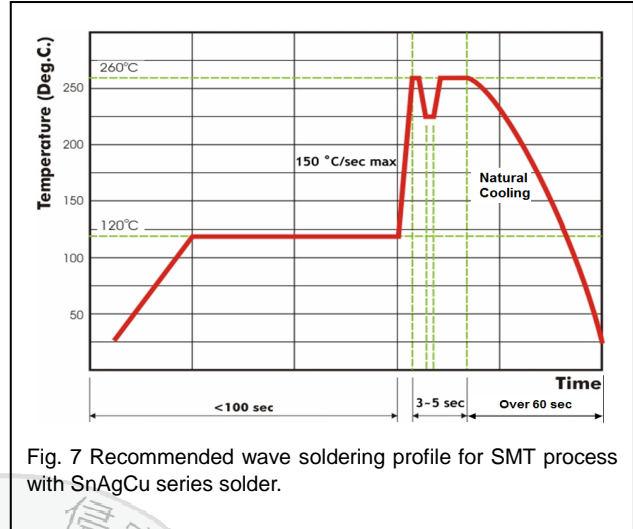


Fig. 7 Recommended wave soldering profile for SMT process with SnAgCu series solder.



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[0603B204K160CT](#) [0603B225M160CT](#) [0603F123Z160CT](#) [0603F124Z160CT](#) [0603F184Z160CT](#) [0603F824Z160CT](#)  
[0201B122M160CT](#) [0201B182J160CT](#) [0201B182M160CT](#) [0201B271M160CT](#) [0201B272M160CT](#) [0201B391M160CT](#)  
[0201B392M160CT](#) [0201B561M160CT](#)

## Walsin:

[0402N1R2C500LT](#) [0402N1R5C500LT](#) [0402N3R3C500LT](#) [0402N4R7C500LT](#) [0402N5R6C500LT](#)  
[0603N1R0C500LT](#) [0402B471K500CT](#) [0402B102K500CT](#) [0402B152K500CT](#) [0402B222K500CT](#) [0402B392K500CT](#)  
[0402B103K500CT](#) [0402B103K250CT](#) [0402B103K160CT](#) [0402B123K160CT](#) [0603B103K500CT](#) [0402X104K160CT](#)  
[0402N101J500CT](#) [0402N150J500CT](#) [0402N330J500CT](#) [0402N2R2C500LT](#) [0402X106M6R3CT](#) [0402N5R6C500CT](#)  
[0603N1R0C500CT](#) [0402N100J500CT](#) [0603N150F500CT](#) [0402N220G500CT](#) [0603N120J500CT](#) [0402N2R2C500CT](#)  
[0402X105K100CT](#) [1206B104K500CT](#) [1206B105K500CT](#) [1206B103K500CT](#) [0805B102K500CT](#) [1206B475K250CT](#)  
[0603N180J500CT](#) [0603B682K500CT](#) [0603B393K500CT](#) [0603B104K160CT](#) [0402B333K100CT](#) [0402N0R5B500CT](#)  
[0402N120F500CT](#) [0402B473K500CT](#) [0201X223K6R3CT](#) [0402N271J500CT](#) [0603B202K500CT](#) [0603N511J500CT](#)  
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[0603N121J500CT](#) [0603N180J101CT](#) [0603N220J500CT](#) [0402B561K500CT](#) [0603B152K500CT](#) [0603B273K500CT](#)  
[0603B183J500CT](#) [0603B183K500CT](#) [0603B223K500CT](#) [0603B473J500CT](#) [0402B104K100CT](#) [0402N2R4C500CT](#)  
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