

# APPROVAL SHEET

## MULTILAYER CERAMIC CAPACITORS

General Purpose Series (4V to 100V)

0201 to 1812 Sizes

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

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) <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 (C0G) <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

## 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
				0.50+0.02/-0.05	Q	R	
		1.00±0.20	0.50±0.20	0.5±0.20	E	R	+0.05/-0.10
	0603 (1608)	1.60+0.15/-0.10	0.80+0.15/-0.10	0.80±0.07	S	R / W	0.40±0.15
				0.50±0.10	H	R / W	
		1.60±0.20 <sup>#1</sup>	0.80±0.20 <sup>#1</sup>	0.8±0.20 <sup>#1</sup>	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	1.25±0.20	0.85±0.10	T	R / W	
			1.25±0.20	I	R		
	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	
		3.20±0.20	1.60±0.20	1.15±0.15	J	R	
1.60±0.20				G	R		
0.85±0.10				T	R / W		
3.20+0.30/-0.10	1.60+0.30/-0.10	1.60+0.30/-0.10	P	R			
1210 (3225)	3.20±0.30	2.50±0.20	0.95±0.10	C	R	0.75±0.25	
			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		
			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	D	R	0.75±0.25 (0.5±0.25) <sup>***</sup>	
			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		
			2.00±0.20	K	R		
	3.20±0.40	2.50±0.30	2.50±0.30	M	R		
			2.80±0.30				U

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

\*\* For 1808\_200V ~3kV, 1812\_200V~3kV and safety certificated products.

\*\*\* For 1206\_1000V ~3kV,1808\_200V ~3kV, 1812\_200V~3kV and safety certificated products.

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

#2 : For 0201/Cap ≥ 0.68μF products.

#3 : For 0201/Cap ≥ 1μF products.

#4 : For 1210\_100V: Cap > 1μF, 250V: Cap > 0.47μF, 400V~630V: Cap > 0.22μF.

## 6. GENERAL ELECTRICAL DATA

Dielectric	NPO	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 <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%)
Rated voltage (WVDC)	10V, 16V, 25V, 50V, 100V	6.3V, 10V, 16V, 25V, 50V, 100V				
DF(Tan δ)*	Cap<30pF: Q≥400+20C Cap≥30pF: Q≥1000	Note 1				
Operating temperature	-55 to +125°C		-25 to +85°C	-55 to +85°C	-55 to +105°C	-55 to +125°C
Capacitance characteristic	±30ppm	±15%	+30/-80%	±15%	±22%	±22%
Termination	Ni/Sn (lead-free termination)					

#1: NPO, 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.

NPO: Apply 1.0±0.2Vrms, 1.0MHz±10% for Cap≤1000pF and 1.0±0.2Vrms, 1.0kHz±10% for Cap>1000pF, 25°C at ambient temperature

X7R/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°C ambient temperature.

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

Note 1:

### X7R/X5R/X6S/X7S

Rated vol.	D.F. ≤	Exception of D.F. ≤
≥ 100V	≤ 2.5%	≤ 3% 1206 ≥ 0.47μF
		≤ 5% 0805 > 0.1μF; 0603 ≥ 0.068μF; 1206 > 1μF; 1210 ≥ 2.2μF; TT series
		≤ 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 ≥ 4.7μF
		≤ 10% 0402 ≥ 0.012μF; 0603 > 0.1μF; 0805 ≥ 1μF; 1206 ≥ 2.2μF; 1210 ≥ 10μF; TT series
35V	≤ 3.5%	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; 1206 ≥ 4.7μF
		≤ 10% 0201 ≥ 0.1μF; 0402 ≥ 0.10μF; 0603 ≥ 0.47μF; 0805 ≥ 2.2μF; 1206 ≥ 6.8μF; 1210 ≥ 22μF; TT series
	≤ 12.5%	0402 ≥ 0.47μF
16V	≤ 3.5%	≤ 5% 0201 ≥ 0.01μF; 0402 ≥ 0.033μF; 0603 ≥ 0.15μF; 0805 ≥ 0.68μF; 1206 ≥ 2.2μF; 1210 ≥ 4.7μF
		≤ 10% 0201 ≥ 0.1μF (0201/X7R ≥ 0.022μF); 0402 ≥ 0.22μF; 0603 ≥ 1206 ≥ 4.7μF; 1210 ≥ 22μF; TT series
10V	≤ 5%	≤ 10% 0201 ≥ 0.012μF; 0402 ≥ 0.33μF (0402/X7R ≥ 0.22μF); TT series
		≤ 15% 0603 ≥ 0.33μF; 0805 ≥ 2.2μF; 1206 ≥ 2.2μF; 1210 ≥ 22μF; 01R5
6.3V	≤ 10%	≤ 15% 0201 ≥ 0.1μF; 0402 ≥ 1μF; 0603 ≥ 10μF; 0805 ≥ 4.7μF; 1206 ≥ 47μF; 1210 ≥ 100μF; TT series
		≤ 20% 0402 ≥ 2.2μF
4V	≤ 15%	---

### Y5V

Rated vol.	D.F. ≤	Exception of D.F. ≤
≥ 50V	≤ 5%	≤ 7% 0603 ≥ 0.1μF; 0805 ≥ 0.47μF; 1206 ≥ 4.7μF; TT series
		≤ 12.5% 1210 ≥ 6.8μF
35V	≤ 7%	---
25V	≤ 5%	≤ 7% 0402 ≥ 0.047μF; 0603 ≥ 0.1μF; 0805 ≥ 0.33μF; 1206 ≥ 1μF; 1210 ≥ 4.7μF
		≤ 9% 0402 ≥ 0.068μF; 0603 ≥ 0.47μF; 1206 ≥ 4.7μF; 1210 ≥ 22μF; TT series
16V (C<1.0μF)	≤ 7%	≤ 9% 0402 ≥ 0.068μF; 0603 ≥ 0.68μF
16V (C ≥ 1.0μF)	≤ 9%	≤ 12.5% 0402 ≥ 0.22μF
		≤ 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%	---

## 7. CAPACITANCE RANGE

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

DIELECTRIC		NP0																	
SIZE		0201			0402				0603					0805					
RATED VOLTAGE (VDC)		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	N	N	N	N											
	0.2pF (0R2)	L	L	L	N	N	N	N											
	0.3pF (0R3)	L	L	L	N	N	N	N		S	S	S	S						
	0.4pF (0R4)	L	L	L	N	N	N	N		S	S	S	S						
	0.5pF (0R5)	L	L	L	N	N	N	N	N	S	S	S	S	S	A	A	A	A	A
	0.6pF (0R6)	L	L	L	N	N	N	N	N	S	S	S	S	S	A	A	A	A	A
	0.7pF (0R7)	L	L	L	N	N	N	N	N	S	S	S	S	S	A	A	A	A	A
	0.8pF (0R8)	L	L	L	N	N	N	N	N	S	S	S	S	S	A	A	A	A	A
	0.9pF (0R9)	L	L	L	N	N	N	N	N	S	S	S	S	S	A	A	A	A	A
	1.0pF (1R0)	L	L	L	N	N	N	N	N	S	S	S	S	S	A	A	A	A	A
	1.2pF (1R2)	L	L	L	N	N	N	N	N	S	S	S	S	S	A	A	A	A	A
	1.5pF (1R5)	L	L	L	N	N	N	N	N	S	S	S	S	S	A	A	A	A	A
	1.8pF (1R8)	L	L	L	N	N	N	N	N	S	S	S	S	S	A	A	A	A	A
	2.0pF (2R0)	L	L	L	N	N	N	N	N	S	S	S	S	S	A	A	A	A	A
	2.2pF (2R2)	L	L	L	N	N	N	N	N	S	S	S	S	S	A	A	A	A	A
	2.7pF (2R7)	L	L	L	N	N	N	N	N	S	S	S	S	S	A	A	A	A	A
	3.0pF (3R0)	L	L	L	N	N	N	N	N	S	S	S	S	S	A	A	A	A	A
	3.3pF (3R3)	L	L	L	N	N	N	N	N	S	S	S	S	S	A	A	A	A	A
	3.9pF (3R9)	L	L	L	N	N	N	N	N	S	S	S	S	S	A	A	A	A	A
	4.0pF (4R0)	L	L	L	N	N	N	N	N	S	S	S	S	S	A	A	A	A	A
	4.7pF (4R7)	L	L	L	N	N	N	N	N	S	S	S	S	S	A	A	A	A	A
	5.0pF (5R0)	L	L	L	N	N	N	N	N	S	S	S	S	S	A	A	A	A	A
	5.6pF (5R6)	L	L	L	N	N	N	N	N	S	S	S	S	S	A	A	A	A	A
	6.0pF (6R0)	L	L	L	N	N	N	N	N	S	S	S	S	S	A	A	A	A	A
	6.8pF (6R8)	L	L	L	N	N	N	N	N	S	S	S	S	S	A	A	A	A	A
	7.0pF (7R0)	L	L	L	N	N	N	N	N	S	S	S	S	S	A	A	A	A	A
	8.0pF (8R0)	L	L	L	N	N	N	N	N	S	S	S	S	S	A	A	A	A	A
	8.2pF (8R2)	L	L	L	N	N	N	N	N	S	S	S	S	S	A	A	A	A	A
	9.0pF (9R0)	L	L	L	N	N	N	N	N	S	S	S	S	S	A	A	A	A	A
	10pF (100)	L	L	L	N	N	N	N	N	S	S	S	S	S	A	A	A	A	A
	12pF (120)	L	L	L	N	N	N	N	N	S	S	S	S	S	A	A	A	A	A
	15pF (150)	L	L	L	N	N	N	N	N	S	S	S	S	S	A	A	A	A	A
	18pF (180)	L	L	L	N	N	N	N	N	S	S	S	S	S	A	A	A	A	A
	22pF (220)	L	L	L	N	N	N	N	N	S	S	S	S	S	A	A	A	A	A
	27pF (270)	L	L	L	N	N	N	N	N	S	S	S	S	S	A	A	A	A	A
	33pF (330)	L	L	L	N	N	N	N	N	S	S	S	S	S	A	A	A	A	A
	39pF (390)	L	L	L	N	N	N	N	N	S	S	S	S	S	A	A	A	A	A
	47pF (470)	L	L	L	N	N	N	N	N	S	S	S	S	S	A	A	A	A	A
	56pF (560)	L	L	L	N	N	N	N	N	S	S	S	S	S	A	A	A	A	A
	68pF (680)	L	L	L	N	N	N	N	N	S	S	S	S	S	A	A	A	A	A
	82pF (820)	L	L	L	N	N	N	N	N	S	S	S	S	S	A	A	A	A	A
	100pF (101)	L	L	L	N	N	N	N	N	S	S	S	S	S	A	A	A	A	A
	120pF (121)	L	L	L	N	N	N	N	N	S	S	S	S	S	A	A	A	A	A
	150pF (151)		L	L	N	N	N	N	N	S	S	S	S	S	A	A	A	A	A
	180pF (181)				N	N	N	N	N	S	S	S	S	S	A	A	A	A	A
220pF (221)				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		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.

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	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						M	M	M	M		
0.047μF (473)	J*	J*	J*	J*	J*						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.

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				N	N	N	N	N		S	S	S	S	S		B	B	B	B	B
	2,200pF (222)	L	L	L				N	N	N	N	N		S	S	S	S	S		B	B	B	B	B
	2,700pF (272)	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				N	N	N	N	N		S	S	S	S	S		B	B	B	B	B
	4,700pF (472)	L	L	L				N	N	N	N	N		S	S	S	S	S		B	B	B	B	B
	5,600pF (562)	L	L					N	N	N	N	N		S	S	S	S	S		B	B	B	B	B
	6,800pF (682)	L	L					N	N	N	N	N		S	S	S	S	S		B	B	B	B	B
	8,200pF (822)	L	L					N	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	N		S	S	S	S	S		B	B	B	B	B
	0.012μF (123)							N	N	N				S	S	S	S	X		B	B	B	B	B
	0.015μF (153)							N	N	N				S	S	S	S	X		B	B	B	B	B
	0.018μF (183)							N	N	N				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				S	S	S	S	X		B	B	B	B	D
	0.033μF (333)							N	N	N	E			S	S	S	X	X		B	B	B	B	D
	0.039μF (393)							N	N	N				S	S	S	X	X		B	B	B	B	D
0.047μF (473)							N	N	N	E			S	S	S	X	X		B	B	B	B	D	
0.056μF (563)							N	N	N				S	S	S	X	X		B	B	B	B	D	
0.068μF (683)							N	N	N	E			S	S	S	X	X		B	B	B	B	D	
0.082μF (823)							N	N	N				S	S	S	X	X		B	B	B	B	D	
0.10μF (104)						N	N	N	N	E			S	S	S	X	X		B	B	B	B	D	
0.12μF (124)													S	S	X				B	B	B	B	I	
0.15μF (154)													S	S	X				D	D	D	D	I	
0.18μF (184)													S	S	X				D	D	D	D	I	
0.22μF (224)						N	N	N	N				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	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																		
	1206							1210					1812						
	SIZE	6.3	10	16	25	35	50	100	6.3	10	16	25	50	100	10	16	25	50	100
RATED VOLTAGE (VDC)																			
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	D	D	D	D	D	D
	0.18μF (184)		C	C	C		C	G		C	C	C	C	D	D	D	D	D	D
	0.22μF (224)		C	C	C		C	G		C	C	C	C	D	D	D	D	D	D
	0.27μF (274)		C	C	C		D	G		C	C	C	C	G	D	D	D	D	D
	0.33μF (334)		C	C	C		D	G		C	C	C	D	G	D	D	D	D	D
	0.39μF (394)		C	C	J		P	G		C	C	C	D	M	D	D	D	D	D
	0.47μF (474)		J	J	J		P	G		C	C	C	D	M	D	D	D	D	K
0.56μF (564)		J	J	J		P	P		D	D	D	D	M	D	D	D	D	K	
0.68μF (684)		J	J	J		P	P		D	D	D	D	K	D	D	D	K	K	
0.82μF (824)		J	J	J		P	P		D	D	D	D	K	D	D	D	K	K	
1.0μF (105)		J	J	J		P	P		D	D	D	D	K	D	D	D	K	K	
1.5μF (155)	J	J	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							
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.



**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	N			S	S	S	S		A	A	A	A	
	0.22μF (224)	N	N	N				S	S	S	S		A	A	A	A	
	0.33μF (334)	N	N	N				S	S	S	X		B	B	B	B	
	0.47μF (474)	N	N	N				S	S	X	X		B	B	B	B	
	0.68μF (684)	N						S	X	X			B	B	D	D	
	1.0μF (105)	N	N					S	X	X			B	B	D	D	
	1.5μF (155)							S					D	D			
	2.2μF (225)						S	S	X				D	D	I		
	3.3μF (335)												D	D			
	4.7μF (475)						X	X					D	D	I		
	6.8μF (685)												I				
10μF (106)											I	I	I				
22μF (226)											I	I					

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

**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	J			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	P			C	C	D		G		D	D	D	D	
	6.8μF (685)		J	J					C	C	D		K		D	D	D	D	
10μF (106)		J	J	P				D	D	G	K	K		D	D	D	K		
22μF (226)		P	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	L												
	0.010μF (103)	L	L	L	L	L												
	0.015μF (153)	L	L															
	0.022μF (223)	L	L															
	0.027μF (273)	L	L							N								
	0.033μF (333)	L	L							N								
	0.039μF (393)	L	L							N								
	0.047μF (473)	L	L						N	N	N							
	0.056μF (563)	L	L						N	N	N							
	0.068μF (683)	L	L						N	N	N							
	0.082μF (823)	L	L						N	N	N							
	0.10μF (104)	L	L	L	L				N	N	N	N						
	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
	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			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)													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	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	I			P	P	P	P								
	4.7μF (475)		I	I	I	I	I		P	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*						

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.

**7-5. 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*			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)																		P*					
	47μF (476)																		P*					
100μF (107)																							P*	

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
	1.10±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

**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 X7R, X5R, X6S, X7S:																																																																																																				
3.	Q/ D.F. (Dissipation Factor)	** Test condition: 0.5±0.2Vrms · 1KHz±10% X7R: 0805=106(6.3V), 0603/475(6.3V) X5R: 01R5 ≥ 103, 0201 ≥ 224 (6.3V, 10V, 16V) #1, 0402 ≥ 475 (6.3V, 16V), 0402 ≥ 225(10V), 0603=106 (6.3V, 10V), TT 18X ≥ 475(10V) , TT 15X series X6S: 0201 ≥ 104 (6.3V, 10V), 0402 ≥ 225 (6.3V), 0402/475 (10V), 0603/106 (6.3V), X7S: 0402/225(6.3V)  #1 Excluding X5R/0201/105(6.3V);225(10V), (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.	<table border="1"> <thead> <tr> <th>Rated vol.</th> <th>D.F. ≤</th> <th colspan="2">Exception of D.F. ≤</th> </tr> </thead> <tbody> <tr> <td rowspan="3">≥ 100V</td> <td rowspan="3">≤ 2.5%</td> <td>≤ 3%</td> <td>1206 ≥ 0.47μF</td> </tr> <tr> <td>≤ 5%</td> <td>0805 &gt; 0.1μF; 0603 ≥ 0.068μF; 1206 &gt; 1μF; 1210 ≥ 2.2μF; TT series</td> </tr> <tr> <td>≤ 10%</td> <td>0805 &gt; 0.22μF; 1210 ≥ 3.3μF</td> </tr> <tr> <td rowspan="3">50V</td> <td rowspan="3">≤ 2.5%</td> <td>≤ 3%</td> <td>0201(50V); 0603 ≥ 0.047μF; 0805 ≥ 0.18μF; 1206 ≥ 0.47μF</td> </tr> <tr> <td>≤ 5%</td> <td>0201 ≥ 0.01μF; 1210 ≥ 4.7μF</td> </tr> <tr> <td>≤ 10%</td> <td>0402 ≥ 0.012μF; 0603 &gt; 0.1μF; 0805 ≥ 1μF; 1206 ≥ 2.2μF; 1210 ≥ 10μF; TT series</td> </tr> <tr> <td rowspan="3">35V</td> <td rowspan="3">≤ 3.5%</td> <td>≤ 10%</td> <td>0603 ≥ 1μF; 0805 ≥ 2.2μF; 1206 ≥ 2.2μF; 1210 ≥ 10μF</td> </tr> <tr> <td>≤ 5%</td> <td>0201 ≥ 0.01μF; 0805 ≥ 1μF; 1210 ≥ 10μF</td> </tr> <tr> <td>≤ 7%</td> <td>0603 ≥ 0.33μF; 1206 ≥ 4.7μF</td> </tr> <tr> <td rowspan="3">25V</td> <td rowspan="3">≤ 3.5%</td> <td>≤ 10%</td> <td>0201 ≥ 0.1μF; 0402 ≥ 0.10μF; 0603 ≥ 0.47μF; 0805 ≥ 2.2μF; 1206 ≥ 6.8μF; 1210 ≥ 22μF; TT series</td> </tr> <tr> <td>≤ 12.5%</td> <td>0402 ≥ 0.47μF</td> </tr> <tr> <td>≤ 5%</td> <td>0201 ≥ 0.01μF; 0402 ≥ 0.033μF; 0603 ≥ 0.15μF; 0805 ≥ 0.68μF; 1206 ≥ 2.2μF; 1210 ≥ 4.7μF</td> </tr> <tr> <td rowspan="3">16V</td> <td rowspan="3">≤ 3.5%</td> <td>≤ 10%</td> <td>0201 ≥ 0.1μF(0201/X7R ≥ 0.022μF); 0402 ≥ 0.22μF; 0603 ≥ 0.68μF; 0805 ≥ 2.2μF; 1206 ≥ 4.7μF; 1210 ≥ 22μF; TT series</td> </tr> <tr> <td>≤ 15%</td> <td>0201 ≥ 0.012μF; 0402 ≥ 0.33μF(0402/X7R ≥ 0.22μF); TT series</td> </tr> <tr> <td>≤ 15%</td> <td>0603 ≥ 0.33μF; 0805 ≥ 2.2μF; 1206 ≥ 2.2μF; 1210 ≥ 22μF; 01R5</td> </tr> <tr> <td rowspan="3">10V</td> <td rowspan="3">≤ 5%</td> <td>≤ 15%</td> <td>0201 ≥ 0.1μF; 0402 ≥ 1μF; 0603 ≥ 10μF; 0805 ≥ 4.7μF; 1206 ≥ 47μF; 1210 ≥ 100μF; TT series</td> </tr> <tr> <td>≤ 20%</td> <td>0402 ≥ 2.2μF</td> </tr> <tr> <td>---</td> <td>---</td> </tr> <tr> <td rowspan="2">6.3V</td> <td rowspan="2">≤ 10%</td> <td>≤ 15%</td> <td>0201 ≥ 0.1μF; 0402 ≥ 1μF; 0603 ≥ 10μF; 0805 ≥ 4.7μF; 1206 ≥ 47μF; 1210 ≥ 100μF; TT series</td> </tr> <tr> <td>≤ 20%</td> <td>0402 ≥ 2.2μF</td> </tr> <tr> <td>4V</td> <td>≤ 15%</td> <td>---</td> <td>---</td> </tr> </tbody> </table> <table border="1"> <thead> <tr> <th>Rated vol.</th> <th>D.F. ≤</th> <th colspan="2">Exception of D.F. ≤</th> </tr> </thead> <tbody> <tr> <td rowspan="2">≥ 50V</td> <td rowspan="2">≤ 5%</td> <td>≤ 7%</td> <td>0603 ≥ 0.1μF; 0805 ≥ 0.47μF; 1206 ≥ 4.7μF; TT series</td> </tr> <tr> <td>≤ 12.5%</td> <td>1210 ≥ 6.8μF</td> </tr> <tr> <td>35V</td> <td>≤ 7%</td> <td>---</td> <td>---</td> </tr> <tr> <td rowspan="3">25V</td> <td rowspan="3">≤ 5%</td> <td>≤ 7%</td> <td>0402 ≥ 0.047μF; 0603 ≥ 0.1μF; 0805 ≥ 0.33μF; 1206 ≥ 1μF; 1210 ≥ 4.7μF</td> </tr> <tr> <td>≤ 9%</td> <td>0402 ≥ 0.068μF; 0603 ≥ 0.47μF; 1206 ≥ 4.7μF; 1210 ≥ 22μF; TT series</td> </tr> <tr> <td>≤ 9%</td> <td>0402 ≥ 0.068μF; 0603 ≥ 0.68μF</td> </tr> <tr> <td>16V (C&lt;1.0μF)</td> <td>≤ 7%</td> <td>≤ 12.5%</td> <td>0402 ≥ 0.22μF</td> </tr> <tr> <td>16V (C&gt;1.0μF)</td> <td>≤ 9%</td> <td>≤ 12.5%</td> <td>0603 ≥ 2.2μF; 0805 ≥ 3.3μF; 1206 ≥ 10μF; 1210 ≥ 22μF; 1812 ≥ 47μF; TT series</td> </tr> <tr> <td>10V</td> <td>≤ 12.5%</td> <td>≤ 20%</td> <td>0402 ≥ 0.47μF</td> </tr> <tr> <td>6.3V</td> <td>≤ 20%</td> <td>---</td> <td>---</td> </tr> </tbody> </table>	Rated vol.	D.F. ≤	Exception of D.F. ≤		≥ 100V	≤ 2.5%	≤ 3%	1206 ≥ 0.47μF	≤ 5%	0805 > 0.1μF; 0603 ≥ 0.068μF; 1206 > 1μF; 1210 ≥ 2.2μF; TT series	≤ 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 ≥ 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	≤ 5%	0201 ≥ 0.01μF; 0805 ≥ 1μF; 1210 ≥ 10μF	≤ 7%	0603 ≥ 0.33μF; 1206 ≥ 4.7μF	25V	≤ 3.5%	≤ 10%	0201 ≥ 0.1μF; 0402 ≥ 0.10μF; 0603 ≥ 0.47μF; 0805 ≥ 2.2μF; 1206 ≥ 6.8μF; 1210 ≥ 22μF; TT series	≤ 12.5%	0402 ≥ 0.47μF	≤ 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(0201/X7R ≥ 0.022μF); 0402 ≥ 0.22μF; 0603 ≥ 0.68μF; 0805 ≥ 2.2μF; 1206 ≥ 4.7μF; 1210 ≥ 22μF; TT series	≤ 15%	0201 ≥ 0.012μF; 0402 ≥ 0.33μF(0402/X7R ≥ 0.22μF); TT series	≤ 15%	0603 ≥ 0.33μF; 0805 ≥ 2.2μF; 1206 ≥ 2.2μF; 1210 ≥ 22μF; 01R5	10V	≤ 5%	≤ 15%	0201 ≥ 0.1μF; 0402 ≥ 1μF; 0603 ≥ 10μF; 0805 ≥ 4.7μF; 1206 ≥ 47μF; 1210 ≥ 100μF; TT series	≤ 20%	0402 ≥ 2.2μF	---	---	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%	---	---	Rated vol.	D.F. ≤	Exception of D.F. ≤		≥ 50V	≤ 5%	≤ 7%	0603 ≥ 0.1μF; 0805 ≥ 0.47μF; 1206 ≥ 4.7μF; TT series	≤ 12.5%	1210 ≥ 6.8μF	35V	≤ 7%	---	---	25V	≤ 5%	≤ 7%	0402 ≥ 0.047μF; 0603 ≥ 0.1μF; 0805 ≥ 0.33μF; 1206 ≥ 1μF; 1210 ≥ 4.7μF	≤ 9%	0402 ≥ 0.068μF; 0603 ≥ 0.47μF; 1206 ≥ 4.7μF; 1210 ≥ 22μF; TT series	≤ 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%	---	---
			Rated vol.	D.F. ≤	Exception of D.F. ≤																																																																																																		
≥ 100V	≤ 2.5%	≤ 3%	1206 ≥ 0.47μF																																																																																																				
		≤ 5%	0805 > 0.1μF; 0603 ≥ 0.068μF; 1206 > 1μF; 1210 ≥ 2.2μF; TT series																																																																																																				
		≤ 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 ≥ 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																																																																																																				
		≤ 5%	0201 ≥ 0.01μF; 0805 ≥ 1μF; 1210 ≥ 10μF																																																																																																				
		≤ 7%	0603 ≥ 0.33μF; 1206 ≥ 4.7μF																																																																																																				
25V	≤ 3.5%	≤ 10%	0201 ≥ 0.1μF; 0402 ≥ 0.10μF; 0603 ≥ 0.47μF; 0805 ≥ 2.2μF; 1206 ≥ 6.8μF; 1210 ≥ 22μF; TT series																																																																																																				
		≤ 12.5%	0402 ≥ 0.47μF																																																																																																				
		≤ 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(0201/X7R ≥ 0.022μF); 0402 ≥ 0.22μF; 0603 ≥ 0.68μF; 0805 ≥ 2.2μF; 1206 ≥ 4.7μF; 1210 ≥ 22μF; TT series																																																																																																				
		≤ 15%	0201 ≥ 0.012μF; 0402 ≥ 0.33μF(0402/X7R ≥ 0.22μF); TT series																																																																																																				
		≤ 15%	0603 ≥ 0.33μF; 0805 ≥ 2.2μF; 1206 ≥ 2.2μF; 1210 ≥ 22μF; 01R5																																																																																																				
10V	≤ 5%	≤ 15%	0201 ≥ 0.1μF; 0402 ≥ 1μF; 0603 ≥ 10μF; 0805 ≥ 4.7μF; 1206 ≥ 47μF; 1210 ≥ 100μF; TT series																																																																																																				
		≤ 20%	0402 ≥ 2.2μF																																																																																																				
		---	---																																																																																																				
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%	---	---																																																																																																				
Rated vol.	D.F. ≤	Exception of D.F. ≤																																																																																																					
≥ 50V	≤ 5%	≤ 7%	0603 ≥ 0.1μF; 0805 ≥ 0.47μF; 1206 ≥ 4.7μF; TT series																																																																																																				
		≤ 12.5%	1210 ≥ 6.8μF																																																																																																				
35V	≤ 7%	---	---																																																																																																				
25V	≤ 5%	≤ 7%	0402 ≥ 0.047μF; 0603 ≥ 0.1μF; 0805 ≥ 0.33μF; 1206 ≥ 1μF; 1210 ≥ 4.7μF																																																																																																				
		≤ 9%	0402 ≥ 0.068μF; 0603 ≥ 0.47μF; 1206 ≥ 4.7μF; 1210 ≥ 22μF; TT series																																																																																																				
		≤ 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%	---	---																																																																																																				
4.	Dielectric Strength	To apply voltage (≤100V) 250%. Duration: 1 to 5 sec. Charge and discharge current less than 50mA.	* No evidence of damage or flash over during test.																																																																																																				
5.	Insulation Resistance	To apply rated voltage for MAX. 120sec. *Before initial measurement (Class II only): To apply de-aging at 150°C for 1hr then set for 24±2 hrs at room temp.	10GΩ or RxC ≥ 500Ω-F whichever is smaller. Class II (X7R, X7E, X5R, X6S, X7S, Y5V):																																																																																																				
			<table border="1"> <thead> <tr> <th>Rated voltage</th> <th>Insulation Resistance</th> </tr> </thead> <tbody> <tr> <td>100V: All X7R</td> <td rowspan="6">10GΩ or RxC ≥ 100 Ω-F whichever is smaller.</td> </tr> <tr> <td>50V: 0402 &gt; 0.01μF; 0603 ≥ 1μF; 0805 ≥ 1μF; 1206 ≥ 4.7μF; 1210 ≥ 4.7μF</td> </tr> <tr> <td>35V: 0805 ≥ 2.2μF; 1206 ≥ 2.2μF; 1210 ≥ 10μF</td> </tr> <tr> <td>25V: 0402 ≥ 1μF; 0603 ≥ 2.2μF; 0805 ≥ 2.2μF; 1206 ≥ 10μF; 1210 ≥ 10μF</td> </tr> <tr> <td>16V: 0201 ≥ 0.1μF; 0402 ≥ 0.22μF; 0603 ≥ 1μF; 0805 ≥ 2.2μF; 1206 ≥ 10μF; 1210 ≥ 47μF</td> </tr> <tr> <td>10V: 0201 ≥ 47nF; 0402 ≥ 0.47μF; 0603 ≥ 0.47μF; 0805 ≥ 2.2μF; 1206 ≥ 4.7μF; 1210 ≥ 47μF</td> </tr> <tr> <td>6.3V; 4V; TT series; Size ≥ 1812</td> <td></td> </tr> <tr> <td>Rated voltage</td> <td>Insulation Resistance</td> </tr> <tr> <td>All X6S items, All X7S items</td> <td rowspan="8">Rx C ≥ 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 &gt; 0.1μF; 0402 ≥ 1μF; 0603 ≥ 10μF; 0805 ≥ 47μF; TT 21 &gt; 4.7μF</td> </tr> <tr> <td>6.3V: 0201 ≥ 0.1μF; 0603 &gt; 4.7μF; 0805 ≥ 47μF; 1206 ≥ 10μF; TT 15 &gt; 1.0μF</td> </tr> <tr> <td>4V: 0603 ≥ 22μF; 0805 ≥ 47μF; 1206 ≥ 100μF</td> </tr> </tbody> </table>	Rated voltage	Insulation Resistance	100V: All X7R	10GΩ or RxC ≥ 100 Ω-F whichever is smaller.	50V: 0402 > 0.01μF; 0603 ≥ 1μF; 0805 ≥ 1μF; 1206 ≥ 4.7μF; 1210 ≥ 4.7μF	35V: 0805 ≥ 2.2μF; 1206 ≥ 2.2μF; 1210 ≥ 10μF	25V: 0402 ≥ 1μF; 0603 ≥ 2.2μF; 0805 ≥ 2.2μF; 1206 ≥ 10μF; 1210 ≥ 10μF	16V: 0201 ≥ 0.1μF; 0402 ≥ 0.22μF; 0603 ≥ 1μF; 0805 ≥ 2.2μF; 1206 ≥ 10μF; 1210 ≥ 47μF	10V: 0201 ≥ 47nF; 0402 ≥ 0.47μF; 0603 ≥ 0.47μF; 0805 ≥ 2.2μF; 1206 ≥ 4.7μF; 1210 ≥ 47μF	6.3V; 4V; TT series; Size ≥ 1812		Rated voltage	Insulation Resistance	All X6S items, All X7S items	Rx C ≥ 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; TT 21 > 4.7μF	6.3V: 0201 ≥ 0.1μF; 0603 > 4.7μF; 0805 ≥ 47μF; 1206 ≥ 10μF; TT 15 > 1.0μF	4V: 0603 ≥ 22μF; 0805 ≥ 47μF; 1206 ≥ 100μF																																																																													
Rated voltage	Insulation Resistance																																																																																																						
100V: All X7R	10GΩ or RxC ≥ 100 Ω-F whichever is smaller.																																																																																																						
50V: 0402 > 0.01μF; 0603 ≥ 1μF; 0805 ≥ 1μF; 1206 ≥ 4.7μF; 1210 ≥ 4.7μF																																																																																																							
35V: 0805 ≥ 2.2μF; 1206 ≥ 2.2μF; 1210 ≥ 10μF																																																																																																							
25V: 0402 ≥ 1μF; 0603 ≥ 2.2μF; 0805 ≥ 2.2μF; 1206 ≥ 10μF; 1210 ≥ 10μF																																																																																																							
16V: 0201 ≥ 0.1μF; 0402 ≥ 0.22μF; 0603 ≥ 1μF; 0805 ≥ 2.2μF; 1206 ≥ 10μF; 1210 ≥ 47μF																																																																																																							
10V: 0201 ≥ 47nF; 0402 ≥ 0.47μF; 0603 ≥ 0.47μF; 0805 ≥ 2.2μF; 1206 ≥ 4.7μF; 1210 ≥ 47μF																																																																																																							
6.3V; 4V; TT series; Size ≥ 1812																																																																																																							
Rated voltage	Insulation Resistance																																																																																																						
All X6S items, All X7S items	Rx C ≥ 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; TT 21 > 4.7μF																																																																																																							
6.3V: 0201 ≥ 0.1μF; 0603 > 4.7μF; 0805 ≥ 47μF; 1206 ≥ 10μF; TT 15 > 1.0μF																																																																																																							
4V: 0603 ≥ 22μF; 0805 ≥ 47μF; 1206 ≥ 100μF																																																																																																							

No.	Item	Test Condition	Requirements																																																						
6.	Temperature Coefficient	<p>With no electrical load.</p> <table border="1"> <thead> <tr> <th>T.C.</th> <th>Operating Temp</th> </tr> </thead> <tbody> <tr> <td>NPO</td> <td>-55~125°C at 25°C</td> </tr> <tr> <td>X7R</td> <td>-55~125°C at 25°C</td> </tr> <tr> <td>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> <th>0402</th> <th>0603</th> </tr> <tr> <td>Cap&lt;1μF: 1V</td> <td>Cap≤1μF: 1V</td> </tr> <tr> <td>Cap=1μF: 0.5V</td> <td>1μF&lt;Cap≤4.7μF: 0.5V</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	0402	0603	Cap<1μF: 1V	Cap≤1μF: 1V	Cap=1μF: 0.5V	1μF<Cap≤4.7μF: 0.5V	1μF<Cap<10μF: 0.2V	Cap>4.7μF: 0.2V	Cap≥10μF: 0.1V		0805	1206/1210	Cap<10μF: 1V	Cap≤10μF: 1V	Cap=10μF: 0.5V	10μF<Cap≤100μF: 0.5V	Cap>10μF: 0.2V	Cap>100μF: 0.2V	<table border="1"> <thead> <tr> <th>T.C.</th> <th>Capacitance Change</th> </tr> </thead> <tbody> <tr> <td>NPO</td> <td>Within ±30ppm/°C</td> </tr> <tr> <td>X7R</td> <td>Within ±15%</td> </tr> <tr> <td>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%	Y5V	Within +30%/-80%
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																																																								
0402	0603																																																								
Cap<1μF: 1V	Cap≤1μF: 1V																																																								
Cap=1μF: 0.5V	1μF<Cap≤4.7μF: 0.5V																																																								
1μF<Cap<10μF: 0.2V	Cap>4.7μF: 0.2V																																																								
Cap≥10μF: 0.1V																																																									
0805	1206/1210																																																								
Cap<10μF: 1V	Cap≤10μF: 1V																																																								
Cap=10μF: 0.5V	10μF<Cap≤100μF: 0.5V																																																								
Cap>10μF: 0.2V	Cap>100μF: 0.2V																																																								
T.C.	Capacitance Change																																																								
NPO	Within ±30ppm/°C																																																								
X7R	Within ±15%																																																								
X7S	Within ±22%																																																								
X5R	Within ±15%																																																								
X6S	Within ±22%																																																								
Y5V	Within +30%/-80%																																																								
7.	Adhesive Strength of Termination	<p>* Pressurizing force : 1N (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>																																																						
12.	Temperature Cycle	<p>* Conduct the five cycles according to the temperatures and time.</p> <table border="1"> <thead> <tr> <th>Step</th> <th>Temp. (°C)</th> <th>Time (min.)</th> </tr> </thead> <tbody> <tr> <td>1</td> <td>Min. operating temp. +0/-3</td> <td>30±3</td> </tr> <tr> <td>2</td> <td>Room temp.</td> <td>2~3</td> </tr> <tr> <td>3</td> <td>Max. operating temp. +3/-0</td> <td>30±3</td> </tr> <tr> <td>4</td> <td>Room temp.</td> <td>2~3</td> </tr> </tbody> </table> <p>*Before initial measurement (Class II only): 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>	Step	Temp. (°C)	Time (min.)	1	Min. operating temp. +0/-3	30±3	2	Room temp.	2~3	3	Max. operating temp. +3/-0	30±3	4	Room temp.	2~3	<p>* No remarkable damage. * Cap change : NPO: within ±2.5% or 0.25pF whichever is larger X7R, X5R, X6S, X7S: within ±7.5% Y5V: within ±20% * Q/D.F., I.R. and dielectric strength: To meet initial requirements.</p>																																							
Step	Temp. (°C)	Time (min.)																																																							
1	Min. operating temp. +0/-3	30±3																																																							
2	Room temp.	2~3																																																							
3	Max. operating temp. +3/-0	30±3																																																							
4	Room temp.	2~3																																																							

No.	Item	Test Condition	Requirements																																																																												
13.	Humidity (Damp Heat) Steady State	*Test temp.: 40±2°C	* 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≥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 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">≤3%</td> <td>≤6% 1206 ≥0.47μF</td> </tr> <tr> <td>≤7.5% 0805 &gt;0.1μF; 0603 ≥0.068μF; 1206 &gt;1μF; 1210 ≥2.2μF; TT series</td> </tr> <tr> <td>≤20% 0805 &gt;0.22μF; 1210 ≥3.3μF</td> </tr> <tr> <td rowspan="3">≥50V</td> <td rowspan="3">≤3%</td> <td>≤6% 0201(50V); 0603 ≥0.047μF; 0805 ≥0.18μF; 1206 ≥0.47μF</td> </tr> <tr> <td>≤10% 0201 ≥0.01μF; 1210 ≥4.7μF</td> </tr> <tr> <td>≤20% 0402 ≥0.012μF; 0603 &gt;0.1μF; 0805 ≥1μF; 1206 ≥2.2μF; 1210 ≥10μF; TT series</td> </tr> <tr> <td>35V</td> <td>≤5%</td> <td>≤20% 0603 ≥1μF; 0805 ≥2.2μF; 1206 ≥2.2μF; 1210 ≥10μF</td> </tr> <tr> <td rowspan="3">25V</td> <td rowspan="3">≤5%</td> <td>≤10% 0201 ≥0.01μF; 0805 ≥1μF; 1210 ≥10μF</td> </tr> <tr> <td>≤14% 0603 ≥0.33μF; 1206 ≥4.7μF</td> </tr> <tr> <td>≤15% 0201 ≥0.1μF; 0402 ≥0.10μF; 0603 ≥0.47μF; 0805 ≥2.2μF; 1206 ≥6.8μF; 1210 ≥22μF; TT series</td> </tr> <tr> <td rowspan="3">16V</td> <td rowspan="3">≤5%</td> <td>≤10% 0402 ≥0.47μF</td> </tr> <tr> <td>≤15% 0603 ≥0.15μF; 0805 ≥0.68μF; 1206 ≥2.2μF; 1210 ≥4.7μF</td> </tr> <tr> <td>0201 ≥0.01μF (0201/X7R ≥0.022μF); 0402 ≥0.033μF; 0603 ≥0.68μF; 0805 ≥2.2μF; 1206 ≥4.7μF; 1210 ≥22μF; TT series</td> </tr> <tr> <td rowspan="3">10V</td> <td rowspan="3">≤7.5%</td> <td>≤15% 0201 ≥0.012μF; 0402 ≥0.33μF (0402/X7R ≥0.22μF); 0603 ≥0.33μF; 0805 ≥2.2μF; 1206 ≥2.2μF; 1210 ≥22μF</td> </tr> <tr> <td>≤20% 0201 ≥0.1μF; 0402 ≥1μF; TT series; 01R5</td> </tr> <tr> <td>≤30% 0201 ≥0.1μF; 0402 ≥1μF; 0603 ≥10μF; 0805 ≥4.7μF; 1206 ≥47μF; 1210 ≥100μF; TT series</td> </tr> <tr> <td>6.3V</td> <td>≤15%</td> <td>≤30%</td> </tr> <tr> <td>4V</td> <td>≤20%</td> <td>---</td> </tr> </tbody> </table> Y5V: <table border="1"> <thead> <tr> <th>Rated vol.</th> <th>D.F. ≤</th> <th>Exception of D.F. ≤</th> </tr> </thead> <tbody> <tr> <td rowspan="3">≥50V</td> <td rowspan="3">≤7.5%</td> <td>≤10% 0603 ≥0.1μF; 0805 ≥0.47μF; 1206 ≥4.7μF</td> </tr> <tr> <td>≤20% 1210 ≥6.8μF</td> </tr> <tr> <td>---</td> </tr> <tr> <td>35V</td> <td>≤10%</td> <td>---</td> </tr> <tr> <td rowspan="3">25V</td> <td rowspan="3">≤7.5%</td> <td>≤10% 0402 ≥0.047μF; 0603 ≥0.1μF; 0805 ≥0.33μF; 1206 ≥1μF; 1210 ≥4.7μF</td> </tr> <tr> <td>≤15% 0402 ≥0.068μF; 0603 ≥0.47μF; 1206 ≥4.7μF; 1210 ≥22μF</td> </tr> <tr> <td>---</td> </tr> <tr> <td>16V (C&lt;1.0μF)</td> <td>≤10%</td> <td>≤12.5% 0402 ≥0.068μF; 0603 ≥0.68μF</td> </tr> <tr> <td>16V (C≥1.0μF)</td> <td>≤12.5%</td> <td>≤20% 0402 ≥0.22μF</td> </tr> <tr> <td rowspan="2">10V</td> <td rowspan="2">≤20%</td> <td>≤30% 0603 ≥2.2μF; 0805 ≥3.3μF; 1206 ≥10μF; 1210 ≥22μF; 1812 ≥47μF;</td> </tr> <tr> <td>0402 ≥0.47μF</td> </tr> <tr> <td>6.3V</td> <td>≤30%</td> <td>---</td> </tr> </tbody> </table> *I.R.: ≥10V, 1GΩ or 50 Ω-F whichever is smaller. Class II (X7R, X5R, X6S, X7S, Y5V) <table border="1"> <thead> <tr> <th>Rated voltage</th> <th>Insulation Resistance</th> </tr> </thead> <tbody> <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 &gt;0.01μF; 0603 ≥1μF; 0805 ≥1μF; 1206 ≥4.7μF; 1210 ≥4.7μF</td> </tr> <tr> <td>35V: 0603 ≥1μF; 0805 ≥2.2μF; 1206 ≥2.2μF; 1210 ≥10μF</td> </tr> <tr> <td>25V: 0201 ≥0.1μF; 0402 ≥0.22μF; 0603 ≥2.2μF; 0805 ≥2.2μF; 1206 ≥10μF; 1210 ≥10μF</td> </tr> <tr> <td>16V: 0201 ≥0.1μF; 0402 ≥0.22μF; 0603 ≥1μF; 0805 ≥2.2μF; 1206 ≥10μF; 1210 ≥47μF</td> </tr> <tr> <td>10V: 0201 ≥47nF; 0402 ≥0.47μF; 0603 ≥0.47μF; 0805 ≥2.2μF; 1206 ≥4.7μF; 1210 ≥47μF</td> </tr> <tr> <td>6.3V ; 4V ; TT series ; All X6S/X7S items; Size ≥1812</td> </tr> </tbody> </table>	Rated vol.	D.F. ≤	Exception of D.F. ≤	≥100V	≤3%	≤6% 1206 ≥0.47μF	≤7.5% 0805 >0.1μF; 0603 ≥0.068μF; 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 ≥0.01μF; 1210 ≥4.7μF	≤20% 0402 ≥0.012μF; 0603 >0.1μF; 0805 ≥1μF; 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; 1206 ≥4.7μF	≤15% 0201 ≥0.1μF; 0402 ≥0.10μF; 0603 ≥0.47μF; 0805 ≥2.2μF; 1206 ≥6.8μF; 1210 ≥22μF; TT series	16V	≤5%	≤10% 0402 ≥0.47μF	≤15% 0603 ≥0.15μF; 0805 ≥0.68μF; 1206 ≥2.2μF; 1210 ≥4.7μF	0201 ≥0.01μF (0201/X7R ≥0.022μF); 0402 ≥0.033μF; 0603 ≥0.68μF; 0805 ≥2.2μF; 1206 ≥4.7μF; 1210 ≥22μF; TT series	10V	≤7.5%	≤15% 0201 ≥0.012μF; 0402 ≥0.33μF (0402/X7R ≥0.22μF); 0603 ≥0.33μF; 0805 ≥2.2μF; 1206 ≥2.2μF; 1210 ≥22μF	≤20% 0201 ≥0.1μF; 0402 ≥1μF; TT series; 01R5	≤30% 0201 ≥0.1μF; 0402 ≥1μF; 0603 ≥10μF; 0805 ≥4.7μF; 1206 ≥47μF; 1210 ≥100μF; TT series	6.3V	≤15%	≤30%	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	16V (C≥1.0μF)	≤12.5%	≤20% 0402 ≥0.22μF	10V	≤20%	≤30% 0603 ≥2.2μF; 0805 ≥3.3μF; 1206 ≥10μF; 1210 ≥22μF; 1812 ≥47μF;	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
		Rated vol.		D.F. ≤	Exception of D.F. ≤																																																																										
		≥100V		≤3%	≤6% 1206 ≥0.47μF																																																																										
					≤7.5% 0805 >0.1μF; 0603 ≥0.068μF; 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 ≥0.01μF; 1210 ≥4.7μF																																																																										
					≤20% 0402 ≥0.012μF; 0603 >0.1μF; 0805 ≥1μF; 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; 1206 ≥4.7μF																																																																										
					≤15% 0201 ≥0.1μF; 0402 ≥0.10μF; 0603 ≥0.47μF; 0805 ≥2.2μF; 1206 ≥6.8μF; 1210 ≥22μF; TT series																																																																										
		16V		≤5%	≤10% 0402 ≥0.47μF																																																																										
≤15% 0603 ≥0.15μF; 0805 ≥0.68μF; 1206 ≥2.2μF; 1210 ≥4.7μF																																																																															
0201 ≥0.01μF (0201/X7R ≥0.022μF); 0402 ≥0.033μF; 0603 ≥0.68μF; 0805 ≥2.2μF; 1206 ≥4.7μF; 1210 ≥22μF; TT series																																																																															
10V	≤7.5%	≤15% 0201 ≥0.012μF; 0402 ≥0.33μF (0402/X7R ≥0.22μF); 0603 ≥0.33μF; 0805 ≥2.2μF; 1206 ≥2.2μF; 1210 ≥22μF																																																																													
		≤20% 0201 ≥0.1μF; 0402 ≥1μF; TT series; 01R5																																																																													
		≤30% 0201 ≥0.1μF; 0402 ≥1μF; 0603 ≥10μF; 0805 ≥4.7μF; 1206 ≥47μF; 1210 ≥100μF; TT series																																																																													
6.3V	≤15%	≤30%																																																																													
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																																																																													
16V (C≥1.0μF)	≤12.5%	≤20% 0402 ≥0.22μF																																																																													
10V	≤20%	≤30% 0603 ≥2.2μF; 0805 ≥3.3μF; 1206 ≥10μF; 1210 ≥22μF; 1812 ≥47μF;																																																																													
		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																																																																															

No	Item	Test Condition	Requirements	
14	Humidity (Damp Heat) Load	*Test temp. : 40±2°C	* 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≥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: C≥30pF, Q≥200; C<30pF, Q≥100+10/3C X7R, X5R, X6S, X7S:	
		*Humidity : 90-95%RH		
		*Test time : 500+24/-0 hrs.		
		*To apply voltage : Rated voltage (MAX. 500V)		
		*Before initial measurement (Class II only): To apply de-aging at 150°C for 1hr then set for 24±2 hrs at room temp		
		* Cap. / DF(Q) / I.R. Measurement to be made after de-aging at 150°C for 1hr then set for 24±2 hrs at room temp.		
		<b>Rated vol. ≤ D.F. ≤ Exception of D.F. ≤</b>		
		≥100V ≤3%		≤6% 1206 ≥0.47μF ≤7.5% 0805 > 0.1μF, 0603 ≥0.068μF, 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 ≥0.01μF; 1210 ≥4.7μF ≤20% 0402 ≥0.012μF; 0603 > 0.1μF; 0805 ≥1μF; 1206 ≥2.2μF; 1210 ≥10μF; TT series
		35V ≤5%		≤20% 0603 ≥1μF; 0805 ≥2.2μF; 1206 ≥2.2μF; 1210 ≥10μF ≤10% 0201 ≥0.01μF; 0805 ≥1μF; 1210 ≥10μF
		25V ≤5%		≤14% 0603 ≥0.33μF; 1206 ≥4.7μF ≤15% 0201 ≥0.1μF; 0402 ≥0.10μF; 0603 ≥0.47μF; 0805 ≥2.2μF; 1206 ≥6.8μF; 1210 ≥22μF; 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 ≥0.68μF; 0805 ≥2.2μF; 1206 ≥4.7μF; 1210 ≥22μF; TT series
		10V ≤7.5%		≤15% 0201 ≥0.012μF; 0402 ≥0.33μF (0402/X7R ≥0.22μF); 0603 ≥0.33μF; 0805 ≥2.2μF; 1206 ≥2.2μF; 1210 ≥22μF ≤20% 0201 ≥0.1μF; 0402 ≥1μF; TT series; 01R5
		6.3V ≤15%		≤30% 0201 ≥0.1μF; 0402 ≥1μF; 0603 ≥10μF; 0805 ≥4.7μF; 1206 ≥47μF; 1210 ≥100μF; TT series
4V ≤20%	---			
Y5V:				
<b>Rated vol. D.F. ≤ Exception of D.F. ≤</b>				
≥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)				
<b>Rated voltage</b>		<b>Insulation Resistance</b>		
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 ; TT series ; All X6S/X7S items; Size ≥1812				



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 To apply voltage: (1) ≤6.3V or C ≥ 10µF or TT series: 150% of rated voltage. (2) 10V ≤ Ur < 500V: 200% of rated voltage. (3) 500V: 150% of rated voltage. (4) Ur ≥ 630V: 120% of rated voltage. (5) 100% of rated voltage for below range.	* No remarkable damage. Cap change: NP0: ±3.0% or ±0.3pF whichever is larger X7R, X5R, X6S, 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																																																																																															
		<table border="1"> <thead> <tr> <th>Size</th> <th>Dielectric</th> <th>Rated voltage</th> <th>Capacitance range</th> <th>Rated V.D.F. ≤</th> <th>Exception of D.F. ≤</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> <td rowspan="2">≥ 100V ≤ 3%</td> <td>≤ 6% 1206 ≥ 0.47µF</td> </tr> <tr> <td>≥ 16V</td> <td>C &gt; 0.1µF</td> <td>≤ 7.5% 0805 &gt; 0.1µF, 0603 ≥ 0.068µF, 1206 &gt; 1µF; 1210 ≥ 2.2µF; TT series</td> </tr> <tr> <td rowspan="2">0402</td> <td rowspan="2">X5R/X7R/X6S/X7S/Y5V</td> <td>6.3V, 10V, 16V, 25V</td> <td>C ≥ 1.0µF</td> <td rowspan="2">≥ 50V ≤ 3%</td> <td>≤ 20% 0805 &gt; 0.22µF; 1210 ≥ 3.3µF</td> </tr> <tr> <td>4V</td> <td>C ≥ 22µF</td> <td>≤ 6% 0201(50V); 0603 ≥ 0.047µF; 0805 ≥ 0.18µF; 1206 ≥ 0.47µF</td> </tr> <tr> <td rowspan="2">0603</td> <td rowspan="2">X5R/X7R/X6S/X7S</td> <td>6.3V, 10V, 25V, 35V</td> <td>C ≥ 4.7µF C ≥ 1.0µF</td> <td rowspan="2">≥ 50V ≤ 3%</td> <td>≤ 10% 0201 ≥ 0.01µF; 1210 ≥ 4.7µF</td> </tr> <tr> <td>4V</td> <td>C ≥ 47µF</td> <td>≤ 20% 0402 ≥ 0.012µF; 0603 ≥ 0.1µF; 0805 ≥ 1µF; 1206 ≥ 2.2µF; 1210 ≥ 10µF; TT series</td> </tr> <tr> <td rowspan="2">0805</td> <td rowspan="2">X5R/X7R/X6S/X7S</td> <td>4V, 6.3V, 10V-50V</td> <td>C ≥ 22µF C ≥ 10µF</td> <td rowspan="2">35V ≤ 5%</td> <td>≤ 20% 0603 ≥ 1µF; 0805 ≥ 2.2µF; 1206 ≥ 2.2µF; 1210 ≥ 10µF</td> </tr> <tr> <td>≤ 6.3V</td> <td>C ≥ 47µF</td> <td>≤ 10% 0201 ≥ 0.01µF; 0805 ≥ 1µF; 1210 ≥ 10µF</td> </tr> <tr> <td rowspan="2">1206</td> <td rowspan="2">X5R/X7R/X6S NP0</td> <td>≤ 6.3V, 3000V</td> <td>C ≥ 47µF C ≥ 1.5pF</td> <td rowspan="2">25V ≤ 5%</td> <td>≤ 14% 0603 ≥ 0.33µF; 1206 ≥ 4.7µF</td> </tr> <tr> <td>16V</td> <td>C ≥ 47µF</td> <td>≤ 15% 0201 ≥ 0.1µF; 0402 ≥ 0.10µF; 0603 ≥ 0.47µF; 0805 ≥ 2.2µF; 1206 ≥ 6.8µF; 1210 ≥ 22µF; TT series</td> </tr> <tr> <td rowspan="2">1210</td> <td rowspan="2">X5R/X7R/X6S X7R</td> <td>16V, 100V</td> <td>C ≥ 3.3µF</td> <td rowspan="2">16V ≤ 5%</td> <td>≤ 20% 0402 ≥ 0.47µF</td> </tr> <tr> <td>6.3V</td> <td>C &gt; 1.0µF</td> <td>≤ 10% 0603 ≥ 0.15µF; 0805 ≥ 0.68µF; 1206 ≥ 2.2µF; 1210 ≥ 4.7µF</td> </tr> <tr> <td rowspan="2">TT15</td> <td rowspan="2">X5R</td> <td>6.3V</td> <td>C &gt; 1.0µF</td> <td rowspan="2">16V ≤ 5%</td> <td>≤ 15% 0201 ≥ 0.01µF (0201/X7R ≥ 0.022µF); 0402 ≥ 0.033µF; 0603 ≥ 0.68µF; 0805 ≥ 2.2µF; 1206 ≥ 4.7µF; 1210 ≥ 22µF; TT series</td> </tr> <tr> <td>6.3V, 10V</td> <td>C ≥ 2.2µF</td> <td>≤ 15% 0201 ≥ 0.012µF; 0402 ≥ 0.33µF (0402/X7R ≥ 0.22µF); 0603 ≥ 0.33µF; 0805 ≥ 2.2µF; 1206 ≥ 2.2µF; 1210 ≥ 22µF</td> </tr> <tr> <td rowspan="2">TT18</td> <td rowspan="2">Y5V</td> <td>6.3V, 10V</td> <td>C ≥ 2.2µF</td> <td rowspan="2">10V ≤ 7.5%</td> <td>≤ 15% 0201 ≥ 0.1µF; 0402 ≥ 1µF; TT series; 01R5</td> </tr> <tr> <td>6.3V</td> <td>C ≥ 10µF</td> <td>≤ 20% 0201 ≥ 0.1µF; 0402 ≥ 1µF; TT series; 01R5</td> </tr> <tr> <td rowspan="2">TT21</td> <td rowspan="2">X5R/X7R/X6S</td> <td>≤ 10V</td> <td>C ≥ 10µF</td> <td rowspan="2">6.3V ≤ 15%</td> <td>≤ 30% 0201 ≥ 0.1µF; 0402 ≥ 1µF; 0603 ≥ 10µF; 0805 ≥ 4.7µF; 1206 ≥ 47µF; 1210 ≥ 100µF; TT series</td> </tr> <tr> <td>6.3V</td> <td>C ≥ 22µF</td> <td>≤ 20% ---</td> </tr> <tr> <td rowspan="2">TT31</td> <td rowspan="2">Y5V</td> <td>6.3V</td> <td>C ≥ 22µF</td> <td rowspan="2">4V ≤ 20%</td> <td>---</td> </tr> <tr> <td>---</td> <td>---</td> <td>---</td> </tr> </tbody> </table>	Size	Dielectric	Rated voltage	Capacitance range	Rated V.D.F. ≤	Exception of D.F. ≤	0201	X5R/X7R/X6S	≤ 10V	C ≥ 0.1µF	≥ 100V ≤ 3%	≤ 6% 1206 ≥ 0.47µF	≥ 16V	C > 0.1µF	≤ 7.5% 0805 > 0.1µF, 0603 ≥ 0.068µF, 1206 > 1µF; 1210 ≥ 2.2µF; TT series	0402	X5R/X7R/X6S/X7S/Y5V	6.3V, 10V, 16V, 25V	C ≥ 1.0µF	≥ 50V ≤ 3%	≤ 20% 0805 > 0.22µF; 1210 ≥ 3.3µF	4V	C ≥ 22µF	≤ 6% 0201(50V); 0603 ≥ 0.047µF; 0805 ≥ 0.18µF; 1206 ≥ 0.47µF	0603	X5R/X7R/X6S/X7S	6.3V, 10V, 25V, 35V	C ≥ 4.7µF C ≥ 1.0µF	≥ 50V ≤ 3%	≤ 10% 0201 ≥ 0.01µF; 1210 ≥ 4.7µF	4V	C ≥ 47µF	≤ 20% 0402 ≥ 0.012µF; 0603 ≥ 0.1µF; 0805 ≥ 1µF; 1206 ≥ 2.2µF; 1210 ≥ 10µF; TT series	0805	X5R/X7R/X6S/X7S	4V, 6.3V, 10V-50V	C ≥ 22µF C ≥ 10µF	35V ≤ 5%	≤ 20% 0603 ≥ 1µF; 0805 ≥ 2.2µF; 1206 ≥ 2.2µF; 1210 ≥ 10µF	≤ 6.3V	C ≥ 47µF	≤ 10% 0201 ≥ 0.01µF; 0805 ≥ 1µF; 1210 ≥ 10µF	1206	X5R/X7R/X6S NP0	≤ 6.3V, 3000V	C ≥ 47µF C ≥ 1.5pF	25V ≤ 5%	≤ 14% 0603 ≥ 0.33µF; 1206 ≥ 4.7µF	16V	C ≥ 47µF	≤ 15% 0201 ≥ 0.1µF; 0402 ≥ 0.10µF; 0603 ≥ 0.47µF; 0805 ≥ 2.2µF; 1206 ≥ 6.8µF; 1210 ≥ 22µF; TT series	1210	X5R/X7R/X6S X7R	16V, 100V	C ≥ 3.3µF	16V ≤ 5%	≤ 20% 0402 ≥ 0.47µF	6.3V	C > 1.0µF	≤ 10% 0603 ≥ 0.15µF; 0805 ≥ 0.68µF; 1206 ≥ 2.2µF; 1210 ≥ 4.7µF	TT15	X5R	6.3V	C > 1.0µF	16V ≤ 5%	≤ 15% 0201 ≥ 0.01µF (0201/X7R ≥ 0.022µF); 0402 ≥ 0.033µF; 0603 ≥ 0.68µF; 0805 ≥ 2.2µF; 1206 ≥ 4.7µF; 1210 ≥ 22µF; TT series	6.3V, 10V	C ≥ 2.2µF	≤ 15% 0201 ≥ 0.012µF; 0402 ≥ 0.33µF (0402/X7R ≥ 0.22µF); 0603 ≥ 0.33µF; 0805 ≥ 2.2µF; 1206 ≥ 2.2µF; 1210 ≥ 22µF	TT18	Y5V	6.3V, 10V	C ≥ 2.2µF	10V ≤ 7.5%	≤ 15% 0201 ≥ 0.1µF; 0402 ≥ 1µF; TT series; 01R5	6.3V	C ≥ 10µF	≤ 20% 0201 ≥ 0.1µF; 0402 ≥ 1µF; TT series; 01R5	TT21	X5R/X7R/X6S	≤ 10V	C ≥ 10µF	6.3V ≤ 15%	≤ 30% 0201 ≥ 0.1µF; 0402 ≥ 1µF; 0603 ≥ 10µF; 0805 ≥ 4.7µF; 1206 ≥ 47µF; 1210 ≥ 100µF; TT series	6.3V	C ≥ 22µF	≤ 20% ---	TT31	Y5V	6.3V	C ≥ 22µF	4V ≤ 20%	---	---	---	---
		Size	Dielectric	Rated voltage	Capacitance range	Rated V.D.F. ≤	Exception of D.F. ≤																																																																																											
		0201	X5R/X7R/X6S	≤ 10V	C ≥ 0.1µF	≥ 100V ≤ 3%	≤ 6% 1206 ≥ 0.47µF																																																																																											
				≥ 16V	C > 0.1µF		≤ 7.5% 0805 > 0.1µF, 0603 ≥ 0.068µF, 1206 > 1µF; 1210 ≥ 2.2µF; TT series																																																																																											
		0402	X5R/X7R/X6S/X7S/Y5V	6.3V, 10V, 16V, 25V	C ≥ 1.0µF	≥ 50V ≤ 3%	≤ 20% 0805 > 0.22µF; 1210 ≥ 3.3µF																																																																																											
				4V	C ≥ 22µF		≤ 6% 0201(50V); 0603 ≥ 0.047µF; 0805 ≥ 0.18µF; 1206 ≥ 0.47µF																																																																																											
		0603	X5R/X7R/X6S/X7S	6.3V, 10V, 25V, 35V	C ≥ 4.7µF C ≥ 1.0µF	≥ 50V ≤ 3%	≤ 10% 0201 ≥ 0.01µF; 1210 ≥ 4.7µF																																																																																											
				4V	C ≥ 47µF		≤ 20% 0402 ≥ 0.012µF; 0603 ≥ 0.1µF; 0805 ≥ 1µF; 1206 ≥ 2.2µF; 1210 ≥ 10µF; TT series																																																																																											
		0805	X5R/X7R/X6S/X7S	4V, 6.3V, 10V-50V	C ≥ 22µF C ≥ 10µF	35V ≤ 5%	≤ 20% 0603 ≥ 1µF; 0805 ≥ 2.2µF; 1206 ≥ 2.2µF; 1210 ≥ 10µF																																																																																											
				≤ 6.3V	C ≥ 47µF		≤ 10% 0201 ≥ 0.01µF; 0805 ≥ 1µF; 1210 ≥ 10µF																																																																																											
		1206	X5R/X7R/X6S NP0	≤ 6.3V, 3000V	C ≥ 47µF C ≥ 1.5pF	25V ≤ 5%	≤ 14% 0603 ≥ 0.33µF; 1206 ≥ 4.7µF																																																																																											
				16V	C ≥ 47µF		≤ 15% 0201 ≥ 0.1µF; 0402 ≥ 0.10µF; 0603 ≥ 0.47µF; 0805 ≥ 2.2µF; 1206 ≥ 6.8µF; 1210 ≥ 22µF; TT series																																																																																											
		1210	X5R/X7R/X6S X7R	16V, 100V	C ≥ 3.3µF	16V ≤ 5%	≤ 20% 0402 ≥ 0.47µF																																																																																											
				6.3V	C > 1.0µF		≤ 10% 0603 ≥ 0.15µF; 0805 ≥ 0.68µF; 1206 ≥ 2.2µF; 1210 ≥ 4.7µF																																																																																											
TT15	X5R	6.3V	C > 1.0µF	16V ≤ 5%	≤ 15% 0201 ≥ 0.01µF (0201/X7R ≥ 0.022µF); 0402 ≥ 0.033µF; 0603 ≥ 0.68µF; 0805 ≥ 2.2µF; 1206 ≥ 4.7µF; 1210 ≥ 22µF; TT series																																																																																													
		6.3V, 10V	C ≥ 2.2µF		≤ 15% 0201 ≥ 0.012µF; 0402 ≥ 0.33µF (0402/X7R ≥ 0.22µF); 0603 ≥ 0.33µF; 0805 ≥ 2.2µF; 1206 ≥ 2.2µF; 1210 ≥ 22µF																																																																																													
TT18	Y5V	6.3V, 10V	C ≥ 2.2µF	10V ≤ 7.5%	≤ 15% 0201 ≥ 0.1µF; 0402 ≥ 1µF; TT series; 01R5																																																																																													
		6.3V	C ≥ 10µF		≤ 20% 0201 ≥ 0.1µF; 0402 ≥ 1µF; TT series; 01R5																																																																																													
TT21	X5R/X7R/X6S	≤ 10V	C ≥ 10µF	6.3V ≤ 15%	≤ 30% 0201 ≥ 0.1µF; 0402 ≥ 1µF; 0603 ≥ 10µF; 0805 ≥ 4.7µF; 1206 ≥ 47µF; 1210 ≥ 100µF; TT series																																																																																													
		6.3V	C ≥ 22µF		≤ 20% ---																																																																																													
TT31	Y5V	6.3V	C ≥ 22µF	4V ≤ 20%	---																																																																																													
		---	---		---																																																																																													
**1WV items must follow de-rating conditions																																																																																																		
(6) 150% of rated voltage for below range.																																																																																																		
<table border="1"> <thead> <tr> <th>Size</th> <th>Dielectric</th> <th>Rated voltage</th> <th>Capacitance range</th> <th>Rated vol.</th> <th>D.F. ≤</th> <th>Exception of D.F. ≤</th> </tr> </thead> <tbody> <tr> <td rowspan="2">0201</td> <td rowspan="2">X5R/X7R/X6S X7R</td> <td>16V/25V, 16V</td> <td>C ≥ 0.1µF C ≥ 0.022µF</td> <td rowspan="2">Y5V: ≥ 50V</td> <td>≤ 10%</td> <td>0603 ≥ 0.1µF; 0805 ≥ 0.47µF; 1206 ≥ 4.7µF</td> </tr> <tr> <td>50V</td> <td>C ≥ 0.1µF</td> <td>≤ 20%</td> <td>1210 ≥ 6.8µF</td> </tr> <tr> <td rowspan="2">0402</td> <td rowspan="2">S Y5V</td> <td>10~25V, 16V</td> <td>C ≥ 0.22µF C ≥ 0.47µF</td> <td rowspan="2">35V</td> <td>≤ 10%</td> <td>---</td> </tr> <tr> <td>50V</td> <td>C &gt; 0.1µF</td> <td>≤ 7.5%</td> <td>0402 ≥ 0.047µF; 0603 ≥ 0.1µF; 0805 ≥ 0.33µF; 1206 ≥ 1µF; 1210 ≥ 4.7µF</td> </tr> <tr> <td rowspan="2">0603</td> <td rowspan="2">X5R/X7R/X6S/X7S Y5V</td> <td>10V, 16V, 50V, 16V</td> <td>C ≥ 1.0µF C ≥ 2.2µF</td> <td rowspan="2">25V</td> <td>≤ 7.5%</td> <td>0402 ≥ 0.068µF; 0603 ≥ 0.47µF; 1206 ≥ 4.7µF; 1210 ≥ 22µF</td> </tr> <tr> <td>10~50V</td> <td>C ≥ 4.7µF</td> <td>≤ 12.5%</td> <td>0402 ≥ 0.068µF; 0603 ≥ 0.68µF</td> </tr> <tr> <td rowspan="2">0805</td> <td rowspan="2">X5R/X7R/X6S/X7S S</td> <td>10~50V, 50V</td> <td>C ≥ 2.2µF C ≥ 0.47µF</td> <td rowspan="2">16V (C &lt; 1.0µF) 16V (C ≥ 1.0µF)</td> <td>≤ 10%</td> <td>0402 ≥ 0.22µF</td> </tr> <tr> <td>100V</td> <td>C ≥ 4.7µF</td> <td>≤ 12.5%</td> <td>0603 ≥ 2.2µF; 0805 ≥ 3.3µF; 1206 ≥ 10µF; 1210 ≥ 22µF; 1812 ≥ 47µF;</td> </tr> <tr> <td>1206</td> <td>X5R/X7R/X6S</td> <td>100V</td> <td>C ≥ 1.0µF</td> <td>10V</td> <td>≤ 20%</td> <td>0402 ≥ 0.47µF</td> </tr> <tr> <td>1210</td> <td>X5R/X7R/X6S</td> <td>50V~100V</td> <td>C ≥ 2.2µF</td> <td>6.3V</td> <td>≤ 30%</td> <td>---</td> </tr> <tr> <td>1825 2220 2225</td> <td>X7R</td> <td>100V~250V</td> <td>C ≥ 1.0µF</td> <td></td> <td></td> <td></td> </tr> </tbody> </table>	Size	Dielectric	Rated voltage	Capacitance range	Rated vol.	D.F. ≤	Exception of D.F. ≤	0201	X5R/X7R/X6S X7R	16V/25V, 16V	C ≥ 0.1µF C ≥ 0.022µF	Y5V: ≥ 50V	≤ 10%	0603 ≥ 0.1µF; 0805 ≥ 0.47µF; 1206 ≥ 4.7µF	50V	C ≥ 0.1µF	≤ 20%	1210 ≥ 6.8µF	0402	S Y5V	10~25V, 16V	C ≥ 0.22µF C ≥ 0.47µF	35V	≤ 10%	---	50V	C > 0.1µF	≤ 7.5%	0402 ≥ 0.047µF; 0603 ≥ 0.1µF; 0805 ≥ 0.33µF; 1206 ≥ 1µF; 1210 ≥ 4.7µF	0603	X5R/X7R/X6S/X7S Y5V	10V, 16V, 50V, 16V	C ≥ 1.0µF C ≥ 2.2µF	25V	≤ 7.5%	0402 ≥ 0.068µF; 0603 ≥ 0.47µF; 1206 ≥ 4.7µF; 1210 ≥ 22µF	10~50V	C ≥ 4.7µF	≤ 12.5%	0402 ≥ 0.068µF; 0603 ≥ 0.68µF	0805	X5R/X7R/X6S/X7S S	10~50V, 50V	C ≥ 2.2µF C ≥ 0.47µF	16V (C < 1.0µF) 16V (C ≥ 1.0µF)	≤ 10%	0402 ≥ 0.22µF	100V	C ≥ 4.7µF	≤ 12.5%	0603 ≥ 2.2µF; 0805 ≥ 3.3µF; 1206 ≥ 10µF; 1210 ≥ 22µF; 1812 ≥ 47µF;	1206	X5R/X7R/X6S	100V	C ≥ 1.0µF	10V	≤ 20%	0402 ≥ 0.47µF	1210	X5R/X7R/X6S	50V~100V	C ≥ 2.2µF	6.3V	≤ 30%	---	1825 2220 2225	X7R	100V~250V	C ≥ 1.0µF																													
Size	Dielectric	Rated voltage	Capacitance range	Rated vol.	D.F. ≤	Exception of D.F. ≤																																																																																												
0201	X5R/X7R/X6S X7R	16V/25V, 16V	C ≥ 0.1µF C ≥ 0.022µF	Y5V: ≥ 50V	≤ 10%	0603 ≥ 0.1µF; 0805 ≥ 0.47µF; 1206 ≥ 4.7µF																																																																																												
		50V	C ≥ 0.1µF		≤ 20%	1210 ≥ 6.8µF																																																																																												
0402	S Y5V	10~25V, 16V	C ≥ 0.22µF C ≥ 0.47µF	35V	≤ 10%	---																																																																																												
		50V	C > 0.1µF		≤ 7.5%	0402 ≥ 0.047µF; 0603 ≥ 0.1µF; 0805 ≥ 0.33µF; 1206 ≥ 1µF; 1210 ≥ 4.7µF																																																																																												
0603	X5R/X7R/X6S/X7S Y5V	10V, 16V, 50V, 16V	C ≥ 1.0µF C ≥ 2.2µF	25V	≤ 7.5%	0402 ≥ 0.068µF; 0603 ≥ 0.47µF; 1206 ≥ 4.7µF; 1210 ≥ 22µF																																																																																												
		10~50V	C ≥ 4.7µF		≤ 12.5%	0402 ≥ 0.068µF; 0603 ≥ 0.68µF																																																																																												
0805	X5R/X7R/X6S/X7S S	10~50V, 50V	C ≥ 2.2µF C ≥ 0.47µF	16V (C < 1.0µF) 16V (C ≥ 1.0µF)	≤ 10%	0402 ≥ 0.22µF																																																																																												
		100V	C ≥ 4.7µF		≤ 12.5%	0603 ≥ 2.2µF; 0805 ≥ 3.3µF; 1206 ≥ 10µF; 1210 ≥ 22µF; 1812 ≥ 47µF;																																																																																												
1206	X5R/X7R/X6S	100V	C ≥ 1.0µF	10V	≤ 20%	0402 ≥ 0.47µF																																																																																												
1210	X5R/X7R/X6S	50V~100V	C ≥ 2.2µF	6.3V	≤ 30%	---																																																																																												
1825 2220 2225	X7R	100V~250V	C ≥ 1.0µF																																																																																															
*I.R.: ≥10V, 1GΩ or 50 Ω-F whichever is smaller.																																																																																																		
*Test time: 1000+24/-0 hrs.																																																																																																		
*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:																																																																																																		
Class II (X7R, X5R, X6S, X7S, Y5V)																																																																																																		
<table border="1"> <thead> <tr> <th>Rated voltage</th> <th>Insulation Resistance</th> </tr> </thead> <tbody> <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 &gt; 0.01µF; 0603 ≥ 1µF; 0805 ≥ 1µF; 1206 ≥ 4.7µF; 1210 ≥ 4.7µF</td> </tr> <tr> <td>35V: 0603 ≥ 1µF; 0805 ≥ 2.2µF; 1206 ≥ 2.2µF; 1210 ≥ 10µF</td> </tr> <tr> <td>25V: 0201 ≥ 0.1µF; 0402 ≥ 0.22µF; 0603 ≥ 2.2µF; 0805 ≥ 2.2µF; 1206 ≥ 10µF; 1210 ≥ 10µF</td> </tr> <tr> <td>16V: 0201 ≥ 0.1µF; 0402 ≥ 0.22µF; 0603 ≥ 1µF; 0805 ≥ 2.2µF; 1206 ≥ 10µF; 1210 ≥ 47µF</td> </tr> <tr> <td>10V: 0201 ≥ 47nF; 0402 ≥ 0.47µF; 0603 ≥ 0.47µF; 0805 ≥ 2.2µF; 1206 ≥ 4.7µF; 1210 ≥ 47µF</td> </tr> <tr> <td>6.3V ; 4V ; TT series ; All X6S/X7S items; Size ≥ 1812</td> </tr> </tbody> </table>		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																																																																																							
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																																																																																																		

**APPENDIXES**

■ Tape & reel dimensions



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>	0.39 +/-0.07	0.70 +/-0.2	1.05 +/-0.30	1.50 +/-0.20	1.50 +/-0.20	< 1.80	1.90 +/-0.50	< 2.00	<2.30	< 3.05	< 3.05	< 3.20	< 2.50	< 3.90	< 3.90
<b>B<sub>0</sub></b>	0.69 +/-0.07	1.20 +/-0.2	1.80 +/-0.30	2.30 +/-0.20	2.30 +/-0.20	< 2.70	3.50 +/-0.50	< 3.70	< 4.00	< 3.80	< 3.80	<3.95	< 5.30	< 5.30	< 5.30
<b>T</b>	≤ 0.50	≤ 0.80	≤ 1.20	≤ 1.15	≤ 1.30	0.23 +/-0.1	≤ 1.30	0.23 +/-0.1	0.23 +/-0.1	0.23 +/-0.1	0.23 +/-0.1	0.23 +/-0.1	0.25 +/-0.1	0.25 +/-0.1	0.25 +/-0.1
<b>K<sub>0</sub></b>	-	-	-	-	-	< 2.50	-	< 2.50	< 2.50	< 1.50	< 2.50	< 3.20	< 2.50	< 2.50	< 3.50
<b>W</b>	8.00 +/-0.10	8.00 +/-0.10	8.00 +/-0.10	8.00 +/-0.10	8.00 +/-0.10	8.00 +/-0.20	8.00 +/-0.10	8.00 +/-0.20	8.00 +/-0.20	8.00 +/-0.20	8.00 +/-0.20	8.00 +/-0.20	12.00 +/-0.20	12.00 +/-0.20	12.00 +/-0.20
<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
<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
<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	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 +/-0.10	2.00 +/-0.10	2.00 +/-0.10
<b>D<sub>0</sub></b>	1.55 +/-0.05	1.55 +/-0.05	1.55 +/-0.05	1.55 +/-0.05	1.55 +/-0.05	1.50 +0.1/-0	1.55 +/-0.05	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	1.50 +/-0.10	1.50 +/-0.10	1.50 +/-0.10
<b>E</b>	1.75 +/-0.05	1.75 +/-0.05	1.75 +/-0.05	1.75 +/-0.05	1.75 +/-0.05	1.75 +/-0.10	1.75 +/-0.05	1.75 +/-0.10	1.75 +/-0.10	1.75 +/-0.10	1.75 +/-0.10	1.75 +/-0.10	1.75 +/-0.10	1.75 +/-0.10	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	5.50 +/-0.10	5.50 +/-0.10	5.50 +/-0.10



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

▣ Description of customer label



- a. Customer name
- b. WTC order series and item number
- c. Customer P/O
- d. Customer P/N
- e. Description of product
- f. Quantity
- g. Bar code including quantity & WTC P/N or customer
- h. WTC P/N
- i. Shipping date
- j. Order bar code including series and item numbers
- k. Serial number of label

▣ Constructions

No.	Name	NPO, X7R, X5R, X6S, X7S, Y5V
①	Ceramic material	BaTiO <sub>3</sub> based
②	Inner electrode	Ni
③	Termination	Inner layer
④		Middle layer
⑤		Outer layer



Fig. 5 The construction of MLCC

▣ Storage and handling conditions

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

Cautions:

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

☑ **Recommended soldering conditions**

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