

# APPROVAL SHEET

## MULTILAYER CERAMIC CAPACITORS

General Purpose Series (4V to 100V)

0201 to 1812 Sizes

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

Halogen Free & RoHS Compliance



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

Multilayer Ceramic Capacitors

## 1. DESCRIPTION

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

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

## 2. FEATURES

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

## 3. APPLICATIONS

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

## 4. HOW TO ORDER

<b>1206</b>	<b>B</b>	<b>104</b>	<b>K</b>	<b>500</b>	<b>C</b>	<b>I</b>
<b>Size</b> Inch (mm)	<b>Dielectric</b> N=NP0 (C0G)	<b>Capacitance</b> 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>Tolerance</b> A=±0.05pF B=±0.1pF C=±0.25pF D=±0.5pF F=±1% G=±2% J=±5% K=±10% M=±20% Z=20/+80%	<b>Rated voltage</b> Two significant digits followed by no. of zeros. And R is in place of decimal point. 4R0=4 VDC 6R3=6.3 VDC 100=10 VDC 160=16 VDC 250=25 VDC 500=50 VDC 101=100 VDC	<b>Termination</b> C=Cu/Ni/Sn	<b>Packaging style</b> T=7" reeled G=13" reeled
<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)						

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**5. EXTERNAL DIMENSIONS**

Outline	Size Inch (mm)	L (mm)	W (mm)	T (mm)/Symbol	Soldering Method *	M <sub>B</sub> (mm)
	01R5 (0402)	0.4±0.02	0.2±0.02	0.2±0.02	V	0.10±0.03
	0201 (0603)	0.6±0.03	0.3±0.03	0.3±0.03	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	0.25
				0.50+0.02/-0.05	Q	
		1.00±0.20	0.50±0.20	0.5±0.20	E	+0.05/-0.10
	0603 (1608)	1.60±0.10	0.80±0.10	0.80±0.07	S	R / W
		1.60+0.15/-0.10	0.80+0.15/-0.10	0.50±0.10	H	
		1.60±0.20 <sup>#1</sup>	0.80±0.20 <sup>#1</sup>	0.80+0.15/-0.10	X	
				0.8±0.20 <sup>#1</sup>		
	0805 (2012)	2.00±0.15	1.25±0.10	0.50±0.10	H	R / W
				0.60±0.10	A	
				0.80±0.10	B	
				1.25±0.10	D	
				0.85±0.10	T	
		2.00±0.20	1.25±0.20	1.25±0.20	I	R
	1206 (3216)	3.20±0.15	1.60±0.15	0.80±0.10	B	R / W
				0.95±0.10	C	
				1.25±0.10	D	
				1.15±0.15	J	
				1.60±0.20	G	
		3.20±0.20	1.60±0.20	0.85±0.10	T	R / W
				1.60+0.30/-0.10	P	
	1210 (3225)	3.20±0.30	2.50±0.20	0.95±0.10	C	R
				0.85±0.10	T	
				1.25±0.10	D	
		3.20±0.40	2.50±0.30	1.60±0.20	G	R
				2.00±0.20	K	
				2.50±0.30	M	
		3.20±0.60 <sup>#4</sup>	2.50±0.50 <sup>#4</sup>	2.50±0.50 <sup>#4</sup>		R
	1808 (4520)	4.50±0.40 (4.5+0.5/-0.3)**	2.03±0.25	1.25±0.10	D	R
				1.40±0.15	F	
				1.60±0.20	G	
				2.00±0.20	K	
	1812 (4532)	4.50±0.40 (4.5+0.5/-0.3)**	3.20±0.30	1.25±0.10	D	R
				1.60±0.20	G	
				2.00±0.20	K	
		4.50±0.40 (4.5+0.5/-0.3)**	3.20±0.40	2.50±0.30	M	R
				2.80±0.30	U	

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

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

\*\*\* For 1206<sub>≥</sub>1000V, 1808/1812\_200V~4000V and safety certificated products.

#1: For 0603/Cap $\geq$ 10 $\mu$ F or 0603( $\leq$ 6.3V)/Cap $\geq$ 4.7 $\mu$ F For 0603(>10V)/Cap $>$ 1 $\mu$ F products.

#2: For 0201/ 0.1 $\mu$ F < Cap < 0.68 $\mu$ F products, Excluding 0201X334~474( $\leq$ 6.3V) & 0201X224( $\leq$ 10V).

#3: For 0201/Cap $\geq$ 0.68 $\mu$ F products.

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

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**6. GENERAL ELECTRICAL DATA**

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

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

\* Measured at the condition of 30~70% related humidity.

NP0: Apply 1.0 $\pm 0.2$ Vrms, 1.0MHz $\pm 10$ % for Cap $\leq$ 1000pF and 1.0 $\pm 0.2$ Vrms, 1.0kHz $\pm 10$ % 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 $\pm 0.2$ Vrms, 1.0kHz $\pm 10$ %, at 20°C ambient temperature.

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



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**7. CAPACITANCE RANGE**

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

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

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

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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	
	12pF (120)	B	B	B	B	B	C	C	C	C	C	D	D	D	
	15pF (150)	B	B	B	B	B	C	C	C	C	C	D	D	D	
	18pF (180)	B	B	B	B	B	C	C	C	C	C	D	D	D	
	22pF (220)	B	B	B	B	B	C	C	C	C	C	D	D	D	
	27pF (270)	B	B	B	B	B	C	C	C	C	C	D	D	D	
	33pF (330)	B	B	B	B	B	C	C	C	C	C	D	D	D	
	39pF (390)	B	B	B	B	B	C	C	C	C	C	D	D	D	
	47pF (470)	B	B	B	B	B	C	C	C	C	C	D	D	D	
	56pF (560)	B	B	B	B	B	C	C	C	C	C	D	D	D	
	68pF (680)	B	B	B	B	B	C	C	C	C	C	D	D	D	
	82pF (820)	B	B	B	B	B	C	C	C	C	C	D	D	D	
	100pF (101)	B	B	B	B	B	C	C	C	C	C	D	D	D	
	120pF (121)	B	B	B	B	B	C	C	C	C	C	D	D	D	
	150pF (151)	B	B	B	B	B	C	C	C	C	C	D	D	D	
	180pF (181)	B	B	B	B	B	C	C	C	C	C	D	D	D	
	220pF (221)	B	B	B	B	B	C	C	C	C	C	D	D	D	
	270pF (271)	B	B	B	B	B	C	C	C	C	C	D	D	D	
	330pF (331)	B	B	B	B	B	C	C	C	C	C	D	D	D	
	390pF (391)	B	B	B	B	B	C	C	C	C	C	D	D	D	
	470pF (471)	B	B	B	B	B	C	C	C	C	C	D	D	D	
	560pF (561)	B	B	B	B	B	C	C	C	C	C	D	D	D	
	680pF (681)	B	B	B	B	B	C	C	C	C	C	D	D	D	
	820pF (821)	B	B	B	B	B	C	C	C	C	C	D	D	D	
	1.000pF (102)	B	B	B	B	B	C	C	C	C	C	D	D	D	
	1,200pF (122)	B	B	B	B	B	C	C	C	C	C	D	D	D	
	1,500pF (152)	B	B	B	B	B	C	C	C	C	C	D	D	D	
	1,800pF (182)	B	B	B	B	B	C	C	C	C	C	D	D	D	
	2,200pF (222)	B	B	B	B	B	C	C	C	C	C	D	D	D	
	2,700pF (272)	B	B	B	B	B	C	C	C	C	C	D	D	D	
	3,300pF (332)	B	B	B	B	B	C	C	C	C	C	D	D	D	
	3,900pF (392)	B	B	B	B	B	C	C	C	C	C	D	D	D	
	4,700pF (472)	B	B	B	B	B	C	C	C	C	C	D	D	D	
	5,600pF (562)	B	B	B	B	B	C	C	C	C	C	D	D	D	
	6,800pF (682)	C	C	C	C	C	C	C	C	C	C	D	D	D	
	8,200pF (822)	D	D	D	D	D	C	C	C	C	C	D	D	D	
	0.010μF (103)	D	D	D	D	D	C	C	C	C	C	D	D	D	
	0.012μF (123)	P	P	P	P	P	D	D	D	D	D	D	D	D	
	0.015μF (153)	P	P	P	P	P	D	D	D	D	D	D	D	D	
	0.018μF (183)	P	P	P	P	P	K	K	K	K	K	D	D	D	
	0.022μF (223)	P	P	P	P	P	K	K	K	K	K	D	D	D	
	0.027μF (273)	P	P	P	P		K	K	K	K	K	D	D	D	
	0.033μF (333)	P	P	P	P	T	K	K	K	K	K	D	D	D	
	0.039μF (393)	P	P	P	P		K	K	K	K	K	M	M	M	
	0.047μF (473)	J*	J*	J*	J*		K	K	K	K	K	M	M	M	
	0.056μF (563)	J*	J*	J*	J*							M	M	M	
	0.068μF (683)	G*	G*	G*	G*							M	M	M	
	0.082μF (823)	G*	G*	G*	G*							M	M	M	
	0.1μF (104)	G*	G*	G*	G*							M	M	M	

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

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

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

Multilayer Ceramic Capacitors

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	N		S	S	S	S	S		B	B	B	B	B
	120pF (121)		L	L	L		N	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	N		S	S	S	S	S		B	B	B	B	B
	180pF (181)		L	L	L		N	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	N		S	S	S	S	S		B	B	B	B	B
	270pF (271)		L	L	L		N	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	N		S	S	S	S	S		B	B	B	B	B
	390pF (391)		L	L	L		N	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	N		S	S	S	S	S		B	B	B	B	B
	560pF (561)		L	L	L		N	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	N		S	S	S	S	S		B	B	B	B	B
	820pF (821)		L	L	L		N	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	N		S	S	S	S	S		B	B	B	B	B
	1,200pF (122)	L	L	L	L	L	N	N	N	N	N	N		S	S	S	S	S		B	B	B	B	B
	1,500pF (152)	L	L	L	L	L	N	N	N	N	N	N		S	S	S	S	S		B	B	B	B	B
	1,800pF (182)	L	L	L	L	L	N	N	N	N	N	N		S	S	S	S	S		B	B	B	B	B
	2,200pF (222)	L	L	L	L	L	N	N	N	N	N	N		S	S	S	S	S		B	B	B	B	B
	2,700pF (272)	L	L	L	L	L	N	N	N	N	N	N		S	S	S	S	S		B	B	B	B	B
	3,300pF (332)	L	L	L	L	L	N	N	N	N	N	N		S	S	S	S	S		B	B	B	B	B
	3,900pF (392)	L	L	L	L	L	N	N	N	N	N	N		S	S	S	S	S		B	B	B	B	B
	4,700pF (472)	L	L	L	L	L	N	N	N	N	N	N		S	S	S	S	S		B	B	B	B	B
	5,600pF (562)	L	L	L	L	L	N	N	N	N	N	N		S	S	S	S	S		B	B	B	B	B
	6,800pF (682)	L	L	L	L	L	N	N	N	N	N	N		S	S	S	S	S		B	B	B	B	B
	8,200pF (822)	L	L	L	L	L	N	N	N	N	N	N		S	S	S	S	S		B	B	B	B	B
	0.010μF (103)	L	L	L	L	L	N	N	N	N	N	N		S	S	S	S	S		B	B	B	B	B
	0.012μF (123)						N	N	N	N	N	N		S	S	S	S	X		B	B	B	B	B
	0.015μF (153)						N	N	N	N	N	N		S	S	S	S	X		B	B	B	B	B
	0.018μF (183)						N	N	N	N	N	N		S	S	S	S	X		B	B	B	B	B
	0.022μF (223)	L	L				N	N	N	N	N	N		S	S	S	S	X		B	B	B	B	B
	0.027μF (273)						N	N	N	N	N	N		S	S	S	S	X		B	B	B	B	D
	0.033μF (333)						N	N	N	N	N	N		S	S	S	S	X	X	B	B	B	B	D
	0.039μF (393)						N	N	N	N	N	N		S	S	S	S	X	X	B	B	B	B	D
	0.047μF (473)						N	N	N	N	N	N		S	S	S	X	X		B	B	B	B	D
	0.056μF (563)						N	N	N	E				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	E				S	S	S	X	X		B	B	B	B	D
	0.10μF (104)						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	X			D	D	D	D	I
	0.18μF (184)													S	S	X				D	D	D	D	I
	0.22μF (224)						N	N	N	N	N	N		S	S	X	X			D	D	D	D	I
	0.27μF (274)													X	X	X	X			D	D	D	I	I
	0.33μF (334)													X	X	X	X	X		D	D	D	I	I
	0.39μF (394)													X	X	X	X	X		D	D	D	I	I
	0.47μF (474)						N	N						X	X	X	X	X		D	D	D	I	I
	0.56μF (564)													X	X	X				D	D	D		
	0.68μF (684)													X	X	X				D	D	D	I	
	0.82μF (824)													X	X	X				D	D	D		
	1.0μF (105)						N							X	X	X	X	X		D	D	D	I	
	1.5μF (155)																			I	I	I		
	2.2μF (225)													X	X	X				I	I	I	I	I
	3.3μF (335)													X						I	I	I	I	I
	4.7μF (475)																							
	6.8μF (685)																							
	10μF (106)																			I	I	I	I*	
	22μF (226)																							

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

Multilayer Ceramic Capacitors

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

Capacitance	DIELECTRIC	X7R																		
		1206						1210						1812						
		6.3	10	16	25	35	50	100	6.3	10	16	25	35	50	100	10	16	25	50	100
	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	C		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				G	G		M	M						K	
	2.2μF (225)	J	J	J	P	P			G	G		M	M				M	M		
	3.3μF (335)	P	P	P	P				G	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	M							
	22μF (226)	P	P	P	P	P			M	M	M									
	47μF (476)								M	M										
	100μF (107)																			

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

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

Multilayer Ceramic Capacitors

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

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

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

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

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

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

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

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

Multilayer Ceramic Capacitors

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

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

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

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

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

Multilayer Ceramic Capacitors

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

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

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

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

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

Dielectric		X7S																											
Size		0201				0402				0603				0805				1206				1210							
Rated Voltage (VDC)		10V	6.3	10	16	6.3	10	16	25	10	16	25	50	100	6.3	10	16	25	50	6.3	10	16	25	50	6.3	10	16	25	50
Capacitance	0.1μF (104)	L													I														
	1.0μF (105)		E																										
	1.5μF (155)																												
	2.2μF (225)	E	E			X	X																						
	3.3μF (335)					X	X							I															
	4.7μF (475)																												
	6.8μF (685)																												
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	100μF (107)																												

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

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

Multilayer Ceramic Capacitors

**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
	1.25±0.20	I	-	-	3,000
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
	1.15±0.15	J	-	-	3,000
	1.25±0.10	D	-	-	3,000
	1.60±0.20	G	-	-	2,000
1210 (3225)	1.60+0.30/-0.10	P	-	-	2,000
	0.85±0.10	T	-	-	3,000
	0.95±0.10	C	-	-	3,000
	1.25±0.10	D	-	-	3,000
	1.60±0.20	G	-	-	2,000
	2.00±0.20	K	-	-	1,000
1808 (4520)	2.50±0.30	M	-	-	1,000
	1.25±0.10	D	-	-	2,000
	1.40±0.15	F	-	-	2,000
	1.60±0.20	G	-	-	2,000
	2.00±0.20	K	-	-	1,000
	1.25±0.10	D	-	-	5,000
1812 (4532)	1.60±0.20	G	-	-	1,000
	2.00±0.20	K	-	-	1,000
	2.50±0.30	M	-	-	500
	2.80±0.30	U	-	-	500
	1.25±0.10	D	-	-	1,000
	1.60±0.20	G	-	-	-

Unit: pieces

Multilayer Ceramic Capacitors

9. RELIABILITY TEST CONDITIONS AND REQUIREMENTS

No.	Item	Test Condition	Requirements																																																																																																																																																																																																
1.	Visual and Mechanical	---	* No remarkable defect. * Dimensions to conform to individual specification sheet.																																																																																																																																																																																																
2.	Capacitance	Class I: (NPO)  3. Q/D.F. (Dissipation Factor)	* Shall not exceed the limits given in the detailed spec.  NPO: Cap $\geq$ 30pF, Q $\geq$ 1000; Cap $<$ 30pF, Q $\geq$ 400+20C																																																																																																																																																																																																
		$\leq 1000\text{pF}, 1.0\pm 0.2\text{VRms}, 1\text{MHz}\pm 10\%$ $> 1000\text{pF}, 1.0\pm 0.2\text{VRms}, 1\text{KHz}\pm 10\%$ Class II: (X7R, X7E, X6S, X5R, X7S, Y5V) $C \leq 10\mu\text{F}, 1.0\pm 0.2\text{VRms}, 1\text{KHz}\pm 10\% **$ $C > 10\mu\text{F}, 0.5\pm 0.2\text{VRms}, 120\text{Hz}\pm 20\%$  ** Test condition: $0.5\pm 0.2\text{VRms}, 1\text{KHz}\pm 10\%$ X7R: 0805=106(6.3V), 0603/475(6.3V) X5R: 0201 $\geq$ 224 (6.3V, 10V, 16V) <sup>#1</sup> , 0402 $\geq$ 475 (6.3V, 16V), 0402 $\geq$ 225(10V), 0603=106 (6.3V) TT18X $\geq$ 475(10V), TT15X series X6S: 0201/474(4V), 0201 $\geq$ 104 (6.3V, 10V) <sup>#1</sup> , 0402 $\geq$ 225 (6.3V), 0402/475 (10V), 0603/106 (6.3V), X7S: 0402/225(6.3V)  #1 Excluding X5R/0201/105(6.3V); 225(10V), 0402X475M6R3 X6S/0201/104(10V) ( $1.0\pm 0.2\text{VRms}, 1\text{KHz}\pm 10\%$ )	X7R: <table border="1"> <thead> <tr> <th>Rated vol.</th> <th>D.F. <math>\leq</math></th> <th colspan="2">Exception of D.F. <math>\leq</math></th> </tr> </thead> <tbody> <tr> <td><math>\geq 100\text{V}</math></td> <td><math>\leq 2.5\%</math></td> <td><math>\leq 3\%</math></td> <td>1206<math>\geq 0.47\mu\text{F}</math></td> </tr> <tr> <td></td> <td></td> <td><math>\leq 5\%</math></td> <td>0603<math>\geq 0.068\mu\text{F}</math>; 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0805<math>\geq 3.3\mu\text{F}</math>; 1206<math>\geq 10\mu\text{F}</math></td> </tr> <tr> <td>(C<math>\geq</math>1.0<math>\mu\text{F}</math>)</td> <td><math>\leq 9\%</math></td> <td><math>\leq 20\%</math></td> <td>1210<math>\geq 22\mu\text{F}</math>; 1812<math>\geq 47\mu\text{F}</math></td> </tr> <tr> <td>10V</td> <td><math>\leq 12.5\%</math></td> <td><math>\leq 20\%</math></td> <td>0402<math>\geq 0.47\mu\text{F}</math></td> </tr> <tr> <td>6.3V</td> <td><math>\leq 20\%</math></td> <td>---</td> <td>---</td> </tr> </tbody> </table>	Rated vol.	D.F. $\leq$	Exception of D.F. $\leq$		$\geq 100\text{V}$	$\leq 2.5\%$	$\leq 3\%$	1206 $\geq 0.47\mu\text{F}$			$\leq 5\%$	0603 $\geq 0.068\mu\text{F}$ ; 0805 $> 0.1\mu\text{F}$ ; 1206 $\geq 1\mu\text{F}$ ; 1210 $\geq 2.2\mu\text{F}$			$\leq 10\%$	0805 $> 0.22\mu\text{F}$ ; 1210 $\geq 3.3\mu\text{F}$	50V	$\leq 2.5\%$	$\leq 3\%$	0201(50V); 0603 $\geq 0.047\mu\text{F}$ ; 0805 $\geq 0.18\mu\text{F}$ ; 1206 $\geq 0.47\mu\text{F}$			$\leq 5\%$	0201 $\geq 0.01\mu\text{F}$ ; 1210 $\geq 3.3\mu\text{F}$			$\leq 10\%$	0402 $\geq 0.012\mu\text{F}$ ; 0603 $> 0.1\mu\text{F}$ ; 0805/X7R $> 0.47\mu\text{F}$ ; 1206 $\geq 2.2\mu\text{F}$ ; 1210 $\geq 10\mu\text{F}$	35V	$\leq 3.5\%$	$\leq 10\%$	0603 $\geq 1\mu\text{F}$ ; 0805 $> 2.2\mu\text{F}$ ; 1206 $\geq 2.2\mu\text{F}$ ; 1210 $\geq 10\mu\text{F}$			$\leq 5\%$	0201 $\geq 0.01\mu\text{F}$ ; 0805 $\geq 1\mu\text{F}$ ; 1210 $\geq 10\mu\text{F}$	25V	$\leq 3.5\%$	$\leq 7\%$	0603 $\geq 0.33\mu\text{F}$			$\leq 10\%$	0201 $\geq 0.1\mu\text{F}$ ; 0402 $\geq 0.056\mu\text{F}$ ; 0603 $\geq 0.47\mu\text{F}$ ; 0805 $\geq 2.2\mu\text{F}$ ; 1206 $\geq 4.7\mu\text{F}$ ; 1210 $\geq 22\mu\text{F}$	16V	$\leq 3.5\%$	$\leq 5\%$	0201 $\geq 0.01\mu\text{F}$ ; 0402 $\geq 0.033\mu\text{F}$ ; 0603 $\geq 0.15\mu\text{F}$ ; 0805 $\geq 0.68\mu\text{F}$ ; 1206 $\geq 2.2\mu\text{F}$ ; 1210 $\geq 4.7\mu\text{F}$			$\leq 10\%$	0201/X7R $\geq 0.22\mu\text{F}$ ; 0402 $\geq 0.22\mu\text{F}$ ; 0603 $> 0.47\mu\text{F}$ ; 0805 $\geq 2.2\mu\text{F}$ ; 1206 $\geq 4.7\mu\text{F}$ ; 1210 $\geq 22\mu\text{F}$	10V	$\leq 5\%$	$\leq 10\%$	0201 $\geq 0.012\mu\text{F}$ ; 0402 $\geq 0.22\mu\text{F}$ ; 0603 $\geq 0.33\mu\text{F}$ ; 0805 $\geq 2.2\mu\text{F}$ ; 1206 $\geq 2.2\mu\text{F}$ ; 1210 $\geq 22\mu\text{F}$			$\leq 15\%$	0201 $\geq 0.1\mu\text{F}$ ; 0402 $\geq 1\mu\text{F}$	6.3V	$\leq 10\%$	$\leq 15\%$	0201 $\geq 0.1\mu\text{F}$ ; 0402 $\geq 1\mu\text{F}$ ; 0603 $\geq 10\mu\text{F}$ ; 0805 $\geq 4.7\mu\text{F}$ ; 1206 $\geq 47\mu\text{F}$ ; 1210 $\geq 100\mu\text{F}$			$\leq 20\%$	0402 $\geq 2.2\mu\text{F}$	4V	$\leq 15\%$	---	---	Rated vol.	D.F. $\leq$	Exception of D.F. $\leq$		$\geq 100\text{V}$	$\leq 2.5\%$	$\leq 3\%$	1206 $\geq 0.47\mu\text{F}$			$\leq 5\%$	0603 $\geq 0.068\mu\text{F}$ ; 0805 $> 0.1\mu\text{F}$ ; 1206 $\geq 1\mu\text{F}$ ; 1210 $\geq 2.2\mu\text{F}$			$\leq 10\%$	0805 $> 0.22\mu\text{F}$ ; 1210 $\geq 3.3\mu\text{F}$	50V	$\leq 2.5\%$	$\leq 3\%$	0201(50V); 0603 $\geq 0.047\mu\text{F}$ ; 0805 $\geq 0.18\mu\text{F}$ ; 1206 $\geq 0.47\mu\text{F}$			$\leq 5\%$	0201 $\geq 0.01\mu\text{F}$ ; 1210 $\geq 3.3\mu\text{F}$			$\leq 10\%$	0402 $\geq 0.012\mu\text{F}$ ; 0603 $> 0.1\mu\text{F}$ ; 0805 $\geq 1\mu\text{F}$ ; 1206 $\geq 2.2\mu\text{F}$ ; 1210 $\geq 10\mu\text{F}$	35V	$\leq 3.5\%$	$\leq 10\%$	0603 $\geq 1\mu\text{F}$ ; 0805 $> 2.2\mu\text{F}$ ; 1206 $\geq 2.2\mu\text{F}$ ; 1210 $\geq 10\mu\text{F}$			$\leq 5\%$	0201 $\geq 0.01\mu\text{F}$ ; 0805 $\geq 1\mu\text{F}$	25V	$\leq 3.5\%$	$\leq 7\%$	0603 $\geq 0.33\mu\text{F}$			$\leq 10\%$	0201 $\geq 0.1\mu\text{F}$ ; 0402 $\geq 0.10\mu\text{F}$ ; 0603 $\geq 0.47\mu\text{F}$ ; 0805 $\geq 2.2\mu\text{F}$ ; 1206 $\geq 4.7\mu\text{F}$ ; 1210 $\geq 10\mu\text{F}$	16V	$\leq 3.5\%$	$\leq 5\%$	0201 $\geq 0.01\mu\text{F}$ ; 0402 $\geq 0.033\mu\text{F}$ ; 0603 $\geq 0.15\mu\text{F}$ ; 0805 $\geq 0.68\mu\text{F}$ ; 1206 $\geq 2.2\mu\text{F}$ ; 1210 $\geq 4.7\mu\text{F}$			$\leq 10\%$	0201 $\geq 0.1\mu\text{F}$ ; 0402 $\geq 0.22\mu\text{F}$ ; 0603 $> 0.47\mu\text{F}$ ; 0805 $\geq 2.2\mu\text{F}$ ; 1206 $\geq 4.7\mu\text{F}$ ; 1210 $\geq 22\mu\text{F}$	10V	$\leq 5\%$	$\leq 10\%$	0201 $\geq 0.012\mu\text{F}$ ; 0402 $\geq 0.22\mu\text{F}$ ; 0603 $\geq 0.33\mu\text{F}$ ; 0805 $\geq 2.2\mu\text{F}$ ; 1206 $\geq 2.2\mu\text{F}$ ; 1210 $\geq 22\mu\text{F}$ ; 01R5/X5R			$\leq 12.5\%$	0805 $\geq 10\mu\text{F}$	6.3V	$\leq 10\%$	$\leq 15\%$	0201 $\geq 0.1\mu\text{F}$ ; 0402 $\geq 1\mu\text{F}$ ; 0603 $\geq 10\mu\text{F}$ ; 0805 $\geq 4.7\mu\text{F}$ ; 1206 $\geq 47\mu\text{F}$ ; 1210 $\geq 100\mu\text{F}$			$\leq 20\%$	0402 $\geq 2.2\mu\text{F}$	4V	$\leq 15\%$	---	---	Rated vol.	D.F. $\leq$	Exception of D.F. $\leq$		$\geq 50\text{V}$	$\leq 5\%$	$\leq 7\%$	0603 $\geq 0.1\mu\text{F}$ ; 0805 $\geq 0.47\mu\text{F}$ ; 1206 $\geq 4.7\mu\text{F}$			$\leq 12.5\%$	1210 $\geq 6.8\mu\text{F}$	35V	$\leq 7\%$	---	---	25V	$\leq 5\%$	$\leq 7\%$	0402 $\geq 0.047\mu\text{F}$ ; 0603 $\geq 0.1\mu\text{F}$ ; 0805 $\geq 0.33\mu\text{F}$ ; 1206 $\geq 1\mu\text{F}$ ; 1210 $\geq 4.7\mu\text{F}$			$\leq 9\%$	0402 $\geq 0.068\mu\text{F}$ ; 0603 $\geq 0.47\mu\text{F}$ ; 1206 $\geq 4.7\mu\text{F}$ ; 1210 $\geq 22\mu\text{F}$	16V	$\leq 7\%$	$\leq 9\%$	0402 $\geq 0.068\mu\text{F}$ ; 0603 $\geq 0.68\mu\text{F}$	(C $<$ 1.0 $\mu\text{F}$ )	$\leq 7\%$	$\leq 12.5\%$	0402 $\geq 0.22\mu\text{F}$	16V	$\leq 9\%$	$\leq 12.5\%$	0603 $\geq 2.2\mu\text{F}$ ; 0805 $\geq 3.3\mu\text{F}$ ; 1206 $\geq 10\mu\text{F}$	(C $\geq$ 1.0 $\mu\text{F}$ )	$\leq 9\%$	$\leq 20\%$	1210 $\geq 22\mu\text{F}$ ; 1812 $\geq 47\mu\text{F}$	10V	$\leq 12.5\%$	$\leq 20\%$	0402 $\geq 0.47\mu\text{F}$	6.3V	$\leq 20\%$	---	---
Rated vol.	D.F. $\leq$	Exception of D.F. $\leq$																																																																																																																																																																																																	
$\geq 100\text{V}$	$\leq 2.5\%$	$\leq 3\%$	1206 $\geq 0.47\mu\text{F}$																																																																																																																																																																																																
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50V	$\leq 2.5\%$	$\leq 3\%$	0201(50V); 0603 $\geq 0.047\mu\text{F}$ ; 0805 $\geq 0.18\mu\text{F}$ ; 1206 $\geq 0.47\mu\text{F}$																																																																																																																																																																																																
		$\leq 5\%$	0201 $\geq 0.01\mu\text{F}$ ; 1210 $\geq 3.3\mu\text{F}$																																																																																																																																																																																																
		$\leq 10\%$	0402 $\geq 0.012\mu\text{F}$ ; 0603 $> 0.1\mu\text{F}$ ; 0805/X7R $> 0.47\mu\text{F}$ ; 1206 $\geq 2.2\mu\text{F}$ ; 1210 $\geq 10\mu\text{F}$																																																																																																																																																																																																
35V	$\leq 3.5\%$	$\leq 10\%$	0603 $\geq 1\mu\text{F}$ ; 0805 $> 2.2\mu\text{F}$ ; 1206 $\geq 2.2\mu\text{F}$ ; 1210 $\geq 10\mu\text{F}$																																																																																																																																																																																																
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25V	$\leq 3.5\%$	$\leq 7\%$	0603 $\geq 0.33\mu\text{F}$																																																																																																																																																																																																
		$\leq 10\%$	0201 $\geq 0.1\mu\text{F}$ ; 0402 $\geq 0.056\mu\text{F}$ ; 0603 $\geq 0.47\mu\text{F}$ ; 0805 $\geq 2.2\mu\text{F}$ ; 1206 $\geq 4.7\mu\text{F}$ ; 1210 $\geq 22\mu\text{F}$																																																																																																																																																																																																
16V	$\leq 3.5\%$	$\leq 5\%$	0201 $\geq 0.01\mu\text{F}$ ; 0402 $\geq 0.033\mu\text{F}$ ; 0603 $\geq 0.15\mu\text{F}$ ; 0805 $\geq 0.68\mu\text{F}$ ; 1206 $\geq 2.2\mu\text{F}$ ; 1210 $\geq 4.7\mu\text{F}$																																																																																																																																																																																																
		$\leq 10\%$	0201/X7R $\geq 0.22\mu\text{F}$ ; 0402 $\geq 0.22\mu\text{F}$ ; 0603 $> 0.47\mu\text{F}$ ; 0805 $\geq 2.2\mu\text{F}$ ; 1206 $\geq 4.7\mu\text{F}$ ; 1210 $\geq 22\mu\text{F}$																																																																																																																																																																																																
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		$\leq 15\%$	0201 $\geq 0.1\mu\text{F}$ ; 0402 $\geq 1\mu\text{F}$																																																																																																																																																																																																
6.3V	$\leq 10\%$	$\leq 15\%$	0201 $\geq 0.1\mu\text{F}$ ; 0402 $\geq 1\mu\text{F}$ ; 0603 $\geq 10\mu\text{F}$ ; 0805 $\geq 4.7\mu\text{F}$ ; 1206 $\geq 47\mu\text{F}$ ; 1210 $\geq 100\mu\text{F}$																																																																																																																																																																																																
		$\leq 20\%$	0402 $\geq 2.2\mu\text{F}$																																																																																																																																																																																																
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Rated vol.	D.F. $\leq$	Exception of D.F. $\leq$																																																																																																																																																																																																	
$\geq 100\text{V}$	$\leq 2.5\%$	$\leq 3\%$	1206 $\geq 0.47\mu\text{F}$																																																																																																																																																																																																
		$\leq 5\%$	0603 $\geq 0.068\mu\text{F}$ ; 0805 $> 0.1\mu\text{F}$ ; 1206 $\geq 1\mu\text{F}$ ; 1210 $\geq 2.2\mu\text{F}$																																																																																																																																																																																																
		$\leq 10\%$	0805 $> 0.22\mu\text{F}$ ; 1210 $\geq 3.3\mu\text{F}$																																																																																																																																																																																																
50V	$\leq 2.5\%$	$\leq 3\%$	0201(50V); 0603 $\geq 0.047\mu\text{F}$ ; 0805 $\geq 0.18\mu\text{F}$ ; 1206 $\geq 0.47\mu\text{F}$																																																																																																																																																																																																
		$\leq 5\%$	0201 $\geq 0.01\mu\text{F}$ ; 1210 $\geq 3.3\mu\text{F}$																																																																																																																																																																																																
		$\leq 10\%$	0402 $\geq 0.012\mu\text{F}$ ; 0603 $> 0.1\mu\text{F}$ ; 0805 $\geq 1\mu\text{F}$ ; 1206 $\geq 2.2\mu\text{F}$ ; 1210 $\geq 10\mu\text{F}$																																																																																																																																																																																																
35V	$\leq 3.5\%$	$\leq 10\%$	0603 $\geq 1\mu\text{F}$ ; 0805 $> 2.2\mu\text{F}$ ; 1206 $\geq 2.2\mu\text{F}$ ; 1210 $\geq 10\mu\text{F}$																																																																																																																																																																																																
		$\leq 5\%$	0201 $\geq 0.01\mu\text{F}$ ; 0805 $\geq 1\mu\text{F}$																																																																																																																																																																																																
25V	$\leq 3.5\%$	$\leq 7\%$	0603 $\geq 0.33\mu\text{F}$																																																																																																																																																																																																
		$\leq 10\%$	0201 $\geq 0.1\mu\text{F}$ ; 0402 $\geq 0.10\mu\text{F}$ ; 0603 $\geq 0.47\mu\text{F}$ ; 0805 $\geq 2.2\mu\text{F}$ ; 1206 $\geq 4.7\mu\text{F}$ ; 1210 $\geq 10\mu\text{F}$																																																																																																																																																																																																
16V	$\leq 3.5\%$	$\leq 5\%$	0201 $\geq 0.01\mu\text{F}$ ; 0402 $\geq 0.033\mu\text{F}$ ; 0603 $\geq 0.15\mu\text{F}$ ; 0805 $\geq 0.68\mu\text{F}$ ; 1206 $\geq 2.2\mu\text{F}$ ; 1210 $\geq 4.7\mu\text{F}$																																																																																																																																																																																																
		$\leq 10\%$	0201 $\geq 0.1\mu\text{F}$ ; 0402 $\geq 0.22\mu\text{F}$ ; 0603 $> 0.47\mu\text{F}$ ; 0805 $\geq 2.2\mu\text{F}$ ; 1206 $\geq 4.7\mu\text{F}$ ; 1210 $\geq 22\mu\text{F}$																																																																																																																																																																																																
10V	$\leq 5\%$	$\leq 10\%$	0201 $\geq 0.012\mu\text{F}$ ; 0402 $\geq 0.22\mu\text{F}$ ; 0603 $\geq 0.33\mu\text{F}$ ; 0805 $\geq 2.2\mu\text{F}$ ; 1206 $\geq 2.2\mu\text{F}$ ; 1210 $\geq 22\mu\text{F}$ ; 01R5/X5R																																																																																																																																																																																																
		$\leq 12.5\%$	0805 $\geq 10\mu\text{F}$																																																																																																																																																																																																
6.3V	$\leq 10\%$	$\leq 15\%$	0201 $\geq 0.1\mu\text{F}$ ; 0402 $\geq 1\mu\text{F}$ ; 0603 $\geq 10\mu\text{F}$ ; 0805 $\geq 4.7\mu\text{F}$ ; 1206 $\geq 47\mu\text{F}$ ; 1210 $\geq 100\mu\text{F}$																																																																																																																																																																																																
		$\leq 20\%$	0402 $\geq 2.2\mu\text{F}$																																																																																																																																																																																																
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Rated vol.	D.F. $\leq$	Exception of D.F. $\leq$																																																																																																																																																																																																	
$\geq 50\text{V}$	$\leq 5\%$	$\leq 7\%$	0603 $\geq 0.1\mu\text{F}$ ; 0805 $\geq 0.47\mu\text{F}$ ; 1206 $\geq 4.7\mu\text{F}$																																																																																																																																																																																																
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25V	$\leq 5\%$	$\leq 7\%$	0402 $\geq 0.047\mu\text{F}$ ; 0603 $\geq 0.1\mu\text{F}$ ; 0805 $\geq 0.33\mu\text{F}$ ; 1206 $\geq 1\mu\text{F}$ ; 1210 $\geq 4.7\mu\text{F}$																																																																																																																																																																																																
		$\leq 9\%$	0402 $\geq 0.068\mu\text{F}$ ; 0603 $\geq 0.47\mu\text{F}$ ; 1206 $\geq 4.7\mu\text{F}$ ; 1210 $\geq 22\mu\text{F}$																																																																																																																																																																																																
16V	$\leq 7\%$	$\leq 9\%$	0402 $\geq 0.068\mu\text{F}$ ; 0603 $\geq 0.68\mu\text{F}$																																																																																																																																																																																																
(C $<$ 1.0 $\mu\text{F}$ )	$\leq 7\%$	$\leq 12.5\%$	0402 $\geq 0.22\mu\text{F}$																																																																																																																																																																																																
16V	$\leq 9\%$	$\leq 12.5\%$	0603 $\geq 2.2\mu\text{F}$ ; 0805 $\geq 3.3\mu\text{F}$ ; 1206 $\geq 10\mu\text{F}$																																																																																																																																																																																																
(C $\geq$ 1.0 $\mu\text{F}$ )	$\leq 9\%$	$\leq 20\%$	1210 $\geq 22\mu\text{F}$ ; 1812 $\geq 47\mu\text{F}$																																																																																																																																																																																																
10V	$\leq 12.5\%$	$\leq 20\%$	0402 $\geq 0.47\mu\text{F}$																																																																																																																																																																																																
6.3V	$\leq 20\%$	---	---																																																																																																																																																																																																

Multilayer Ceramic Capacitors

No.	Item	Test Condition		Requirements			
Q/ D.F. (Dissipation Factor)		X6S:		X6S:			
		Rated vol.	D.F. $\leq$	Exception of D.F. $\leq$			
				$\leq 3\%$	1206 $\geq 0.47\mu F$		
				$\leq 5\%$	0603 $\geq 0.068\mu F$ ; 0805 $> 0.1\mu F$ ; 1206 $\geq 1\mu F$ ; 1210 $\geq 2.2\mu F$		
				$\leq 10\%$	0805 $> 0.22\mu F$ ; 1210 $\geq 3.3\mu F$		
				$\leq 3\%$	0201(50V); 0603 $\geq 0.047\mu F$ ; 0805 $\geq 0.18\mu F$ ; 1206 $\geq 0.47\mu F$		
				$\leq 5\%$	0201 $\geq 0.01\mu F$ ; 1210 $\geq 3.3\mu F$		
				$\leq 10\%$	0402 $\geq 0.012\mu F$ ; 0603 $> 0.1\mu F$ ; 0805 $\geq 1\mu F$ ; 1206 $\geq 2.2\mu F$ ; 1210 $\geq 10\mu F$		
				$\leq 3.5\%$	0603 $\geq 1\mu F$ ; 0805 $\geq 2.2\mu F$ ; 1206 $\geq 2.2\mu F$ ; 1210 $\geq 10\mu F$		
				$\leq 5\%$	0201 $\geq 0.01\mu F$ ; 0805 $\geq 1\mu F$ ; 1210 $\geq 10\mu F$		
				$\leq 7\%$	0603 $\geq 0.33\mu F$		
				$\leq 10\%$	0201 $\geq 0.1\mu F$ ; 0402 $\geq 0.10\mu F$ ; 0603 $\geq 0.47\mu F$ ; 0805 $\geq 2.2\mu F$ ; 1206 $\geq 4.7\mu F$ ; 1210 $\geq 22\mu F$		
				$\leq 12.5\%$	0402 $\geq 0.47\mu F$		
				$\leq 3.5\%$	0201 $\geq 0.01\mu F$ ; 0402 $\geq 0.033\mu F$ ; 0603 $\geq 0.15\mu F$ ; 0805 $\geq 0.68\mu F$ ; 1206 $\geq 2.2\mu F$ ; 1210 $\geq 4.7\mu F$		
				$\leq 5\%$	0201 $\geq 0.1\mu F$ ; 0402 $\geq 0.22\mu F$ ;		
				$\leq 10\%$	0603 $\geq 0.47\mu F$ ; 0805 $\geq 2.2\mu F$ ; 1206 $\geq 4.7\mu F$ ; 1210 $\geq 22\mu F$		
				$\leq 12.5\%$	0402 $\geq 1\mu F$		
				$\leq 5\%$	0201 $\geq 0.012\mu F$ ; 0402 $\geq 0.22\mu F$ ;		
				$\leq 10\%$	0603 $\geq 0.33\mu F$ ; 0805 $\geq 2.2\mu F$ ; 1206 $\geq 2.2\mu F$ ; 1210 $\geq 22\mu F$		
				$\leq 15\%$	0201 $\geq 0.1\mu F$ ; 0402 $\geq 0.47\mu F$ ; 0603 $\geq 10\mu F$ ; 0805 $\geq 4.7\mu F$ ; 1206 $\geq 47\mu F$ ; 1210 $\geq 100\mu F$		
				$\leq 20\%$	0402 $\geq 2.2\mu F$		
				$\leq 15\%$	---		
				$\leq 15\%$	---		
4. Dielectric Strength		X7S:		X7S:			
		Rated vol.	D.F. $\leq$	Exception of D.F. $\leq$			
				$\leq 3\%$	1206 $\geq 0.47\mu F$		
				$\leq 5\%$	0603 $\geq 0.068\mu F$ ; 0805 $> 0.1\mu F$ ; 1206 $\geq 1\mu F$ ; 1210 $\geq 2.2\mu F$		
				$\leq 10\%$	0805 $> 0.22\mu F$ ; 1210 $\geq 3.3\mu F$		
				$\leq 3\%$	0201(50V); 0603 $\geq 0.047\mu F$ ; 0805 $\geq 0.18\mu F$ ; 1206 $\geq 0.47\mu F$		
				$\leq 5\%$	0201 $\geq 0.01\mu F$ ; 1210 $\geq 3.3\mu F$		
				$\leq 10\%$	0402 $\geq 0.012\mu F$ ; 0603 $> 0.1\mu F$ ; 0805 $\geq 1\mu F$ ; 1206 $\geq 2.2\mu F$ ; 1210 $\geq 10\mu F$		
				$\leq 3.5\%$	0603 $\geq 1\mu F$ ; 0805 $\geq 2.2\mu F$ ; 1206 $\geq 2.2\mu F$ ; 1210 $\geq 10\mu F$		
				$\leq 5\%$	0201 $\geq 0.01\mu F$ ; 0805 $\geq 1\mu F$ ; 1210 $\geq 10\mu F$		
				$\leq 7\%$	0603 $\geq 0.33\mu F$		
				$\leq 10\%$	0201 $\geq 0.1\mu F$ ; 0402 $\geq 0.10\mu F$ ; 0603 $\geq 0.47\mu F$ ; 0805 $\geq 2.2\mu F$ ; 1206 $\geq 4.7\mu F$ ; 1210 $\geq 22\mu F$		
				$\leq 12.5\%$	0402 $\geq 0.47\mu F$		
				$\leq 3.5\%$	0201 $\geq 0.01\mu F$ ; 0402 $\geq 0.033\mu F$ ; 0603 $\geq 0.15\mu F$ ; 0805 $\geq 0.68\mu F$ ; 1206 $\geq 2.2\mu F$ ; 1210 $\geq 4.7\mu F$		
				$\leq 5\%$	0201 $\geq 0.1\mu F$ ; 0402 $\geq 0.22\mu F$ ;		
				$\leq 10\%$	0603 $\geq 0.47\mu F$ ; 0805 $\geq 2.2\mu F$ ; 1206 $\geq 4.7\mu F$ ; 1210 $\geq 22\mu F$		
				$\leq 15\%$	0201 $\geq 0.1\mu F$ ; 0402 $\geq 1\mu F$		
				$\leq 10\%$	0201 $\geq 0.012\mu F$ ; 0402 $\geq 0.22\mu F$ ;		
				$\leq 15\%$	0603 $\geq 0.33\mu F$ ; 0805 $\geq 2.2\mu F$ ; 1206 $\geq 2.2\mu F$ ; 1210 $\geq 100\mu F$		
				$\leq 20\%$	0402 $\geq 2.2\mu F$		
				$\leq 15\%$	---		
				$\leq 15\%$	---		
* To apply voltage ( $\leq 100V$ ) 250%.		* No evidence of damage or flash over during test.					
* Duration: 1 to 5 sec.							
* Charge and discharge current less than 50mA.							

Multilayer Ceramic Capacitors

No.	Item	Test Condition	Requirements																																											
5.	Insulation Resistance	To apply rated voltage for MAX. 120sec.	<p>10GΩ or <math>R_{XC} \geq 500\Omega \cdot F</math> whichever is smaller.</p> <p>Class II (X7R, X7E, X5R, X6S, X7S, Y5V):</p> <table border="1"> <tr><td>Rated voltage</td><td>Insulation Resistance</td></tr> <tr><td>100V: All X7R</td><td rowspan="6">10GΩ or <math>R_{XC} \geq 100 \Omega \cdot F</math> 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 ; Size≥1812</td><td>Insulation Resistance</td></tr> <tr><td>Rated voltage</td><td rowspan="6"><math>R_{XC} \geq 50 \Omega \cdot F</math>.</td></tr> <tr><td>All X6S items, All X7S items</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><td>Insulation Resistance</td></tr> <tr><td>10V: 0201&gt;0.1μF; 0402≥1μF; 0603≥10μF; 0805≥47μF</td><td rowspan="6"><math>R_{XC} \geq 50 \Omega \cdot F</math>.</td></tr> <tr><td>6.3V: 0201≥0.1μF; 0402≥1μF; 0603&gt;4.7μF; 0805≥47μF; 1206≥10μF</td></tr> <tr><td>4V: 0603≥22μF; 0805≥47μF; 1206≥100μF</td></tr> </table>	Rated voltage	Insulation Resistance	100V: All X7R	10GΩ or $R_{XC} \geq 100 \Omega \cdot F$ whichever is smaller.	50V: 0402>0.01μF; 0603≥1μF; 0805≥1μF; 1206≥4.7μF; 1210≥4.7μF	35V: 0805≥2.2μF; 1206≥2.2μF; 1210≥10μF	25V: 0402≥1μF; 0603≥2.2μF; 0805≥2.2μF; 1206≥10μF; 1210≥10μF	16V: 0201≥0.1μF; 0402≥0.22μF; 0603≥1μF; 0805≥2.2μF; 1206≥10μF; 1210≥47μF	10V: 0201≥47nF; 0402≥0.47μF; 0603≥0.47μF; 0805≥2.2μF; 1206≥4.7μF; 1210≥47μF	6.3V ; 4V ; Size≥1812	Insulation Resistance	Rated voltage	$R_{XC} \geq 50 \Omega \cdot F$ .	All X6S items, All X7S items	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	Insulation Resistance	10V: 0201>0.1μF; 0402≥1μF; 0603≥10μF; 0805≥47μF	$R_{XC} \geq 50 \Omega \cdot F$ .	6.3V: 0201≥0.1μF; 0402≥1μF; 0603>4.7μF; 0805≥47μF; 1206≥10μF	4V: 0603≥22μF; 0805≥47μF; 1206≥100μF																			
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6.		Temperature Coefficient	<p>With no electrical load.</p> <table border="1"> <tr><td>T.C.</td><td>Operating Temp</td></tr> <tr><td>NPO</td><td>-55~125°C at 25°C</td></tr> <tr><td>X7R</td><td>-55~125°C at 25°C</td></tr> <tr><td>X7S</td><td>-55 ~ 125°C at 25°C</td></tr> <tr><td>X5R</td><td>-55~ 85°C at 25°C</td></tr> <tr><td>X6S</td><td>-55~105°C at 25°C</td></tr> <tr><td>Y5V</td><td>-25~ 85°C at 20°C</td></tr> </table> <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"> <tr><td>01005</td><td>0201</td></tr> <tr><td>Cap≤0.01μF: 0.5V</td><td>Cap&lt;0.1μF: 1V</td></tr> <tr><td>Cap&gt;0.01μF: 0.2V</td><td>0.1μF≤Cap&lt;1μF: 0.2V</td></tr> <tr><td></td><td>Cap≥1μF: 0.1V</td></tr> <tr><td></td><td>* 0201X104/16V: 0.5V 0201X224/10V: 0.5V</td></tr> <tr><td>0402</td><td>0603</td></tr> <tr><td>Cap&lt;1μF: 1V</td><td>Cap&lt;1μF: 1V</td></tr> <tr><td>Cap=1μF: 0.5V** 0402B474-10V: 0.5V 0402X475M6R3: 0.5V</td><td>1μF≤Cap≤4.7μF: 0.5V</td></tr> <tr><td>1μF&lt;Cap&lt;10μF: 0.2V **0402B105M6R3V: 0.2V</td><td>Cap&gt;4.7μF: 0.2V</td></tr> <tr><td>Cap≥10μF: 0.1V</td><td></td></tr> <tr><td>0805</td><td>1206/1210</td></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> </table>	T.C.	Operating Temp	NPO	-55~125°C at 25°C	X7R	-55~125°C at 25°C	X7S	-55 ~ 125°C at 25°C	X5R	-55~ 85°C at 25°C	X6S	-55~105°C at 25°C	Y5V	-25~ 85°C at 20°C	01005	0201	Cap≤0.01μF: 0.5V	Cap<0.1μF: 1V	Cap>0.01μF: 0.2V	0.1μF≤Cap<1μF: 0.2V		Cap≥1μF: 0.1V		* 0201X104/16V: 0.5V 0201X224/10V: 0.5V	0402	0603	Cap<1μF: 1V	Cap<1μF: 1V	Cap=1μF: 0.5V** 0402B474-10V: 0.5V 0402X475M6R3: 0.5V	1μF≤Cap≤4.7μF: 0.5V	1μF<Cap<10μF: 0.2V **0402B105M6R3V: 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	
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Multilayer Ceramic Capacitors

No.	Item	Test Condition	Requirements															
7.	Adhesive Strength of Termination	<ul style="list-style-type: none"> <li>* Pressurizing force : 2N (0201) and 5N (<math>\leq</math>0603) and 10N (<math>&gt;</math>0603)</li> <li>* Test time: 10<math>\pm</math>1 sec.</li> </ul>	* No remarkable damage or removal of the terminations.															
8.	Vibration Resistance	<ul style="list-style-type: none"> <li>* Vibration frequency: 10-55 Hz/min.</li> <li>* Total amplitude: 1.5mm</li> <li>* Test time: 6 hrs. (Two hrs each in three mutually perpendicular directions.)</li> <li>* Before initial measurement (Class II only): To apply de-aging at 150°C for 1hr then set for 24<math>\pm</math>2 hrs at room temp.</li> <li>* Cap./DF(Q) Measurement to be made after de-aging at 150°C for 1hr then set for 24<math>\pm</math>2 hrs at room temp.</li> </ul>	<ul style="list-style-type: none"> <li>* No remarkable damage.</li> <li>* Cap change and Q/D.F.: To meet initial spec.</li> </ul>															
9.	Solderability	<ul style="list-style-type: none"> <li>* Solder temperature: 235<math>\pm</math>5°C</li> <li>* Dipping time: 2<math>\pm</math>0.5 sec.</li> </ul>	95% min. coverage of all metallized area.															
10.	Bending Test	<ul style="list-style-type: none"> <li>* 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<math>\pm</math>1 sec.</li> <li>* Before initial measurement (Class II only): To apply de-aging at 150°C for 1hr then set for 24<math>\pm</math>2 hrs at room temp.</li> <li>* Measurement to be made after keeping at room temp. for 24<math>\pm</math>2 hrs.</li> </ul>	<ul style="list-style-type: none"> <li>* No remarkable damage.</li> <li>* Cap change : NP0: within <math>\pm</math>5% or 0.5pF whichever is larger X7R, X5R, X6S, X7S: within <math>\pm</math>12.5% Y5V: within <math>\pm</math>30% (This capacitance change means the change of capacitance under specified flexure of substrate from the capacitance measured before the test.)</li> </ul>															
11.	Resistance to Soldering Heat	<ul style="list-style-type: none"> <li>* Solder temperature: 260<math>\pm</math>5°C</li> <li>* Dipping time: 10<math>\pm</math>1 sec</li> <li>* Preheating: 120 to 150°C for 1 minute before immerse the capacitor in a eutectic solder.</li> <li>* Before initial measurement (Class II only): To apply de-aging at 150°C for 1hr then set for 24<math>\pm</math>2 hrs at room temp.</li> <li>* Cap. / DF(Q) / I.R. Measurement to be made after de-aging at 150°C for 1hr then set for 24<math>\pm</math>2 hrs at room temp.</li> </ul>	<ul style="list-style-type: none"> <li>* No remarkable damage.</li> <li>* Cap change: NP0: within <math>\pm</math>2.5% or 0.25pF whichever is larger X7R, X5R, X6S, X7S: within <math>\pm</math>7.5% Y5V: within <math>\pm</math>20%</li> <li>* Q/D.F., I.R. and dielectric strength: To meet initial requirements.</li> <li>* 25% max. leaching on each edge.</li> </ul>															
12.	Temperature Cycle	<ul style="list-style-type: none"> <li>* Conduct the five cycles according to the temperatures and time.</li> </ul> <table border="1" style="margin-left: 100px;"> <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<math>\pm</math>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<math>\pm</math>3</td> </tr> <tr> <td>4</td> <td>Room temp.</td> <td>2-3</td> </tr> </tbody> </table> <ul style="list-style-type: none"> <li>* Before initial measurement (Class II only): To apply de-aging at 150°C for 1hr then set for 24<math>\pm</math>2 hrs at room temp.</li> <li>* Cap. / DF(Q) / I.R. Measurement to be made after de-aging at 150°C for 1hr then set for 24<math>\pm</math>2 hrs at room temp.</li> </ul>	Step	Temp. (°C)	Time (min.)	1	Min. operating temp. +0/-3	30 $\pm$ 3	2	Room temp.	2-3	3	Max. operating temp. +3/-0	30 $\pm$ 3	4	Room temp.	2-3	<ul style="list-style-type: none"> <li>* No remarkable damage.</li> <li>* Cap change : NP0: within <math>\pm</math>2.5% or 0.25pF whichever is larger X7R, X5R, X6S, X7S: within <math>\pm</math>7.5% Y5V: within <math>\pm</math>20%</li> <li>* Q/D.F., I.R. and dielectric strength: To meet initial requirements.</li> </ul>
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4	Room temp.	2-3																

Multilayer Ceramic Capacitors

No.	Item	Test Condition	Requirements																																																																																											
13.	Humidity (Damp Heat) Steady State	<p>*Test temp.: 40±2°C *Humidity: 90~95%RH *Test time: 500+24+0hrs.</p> <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.</p> <p>* 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 ±5% or 0.5pF whichever is larger X7R, X5R, X6S, X7S: ≥10V**, within ±12.5%; ≤6.3V within ±25%; **10V: 0603≥4.7μF; 0402≥1μF; 0201≥0.1μF, within ±25%; Y5V: ≥10V, within ±30%; ≤6.3V, within +30/-40%</p> <p>* Q/D.F. value: NPO: More than 30pF Q≥350, 10pF≤C≤30pF, Q≥275+2.5C Less than 10pF Q≥200+10C</p> <p>X7R, X5R, X6S, X7S:</p> <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>≤6%</td> <td>1206≥0.47μF</td> </tr> <tr> <td>≤7.5%</td> <td>0603≥0.068μF; 0805&gt;0.1μF; 1206≥1μF; 1210≥2.2μF</td> </tr> <tr> <td>≤20%</td> <td>0805&gt;0.22μF; 1210≥3.3μF</td> </tr> <tr> <td rowspan="3">50V</td> <td>≤6%</td> <td>0201(50V); 0603≥0.047μF; 0805≥0.18μF; 1206≥0.47μF</td> </tr> <tr> <td>≤10%</td> <td>0201≥0.01μF; 1210≥3.3μF</td> </tr> <tr> <td>≤20%</td> <td>0402≥0.012μF; 0603&gt;0.1μF; 0805≥1μF(0805/X7R&gt;0.47μF); 1206≥2.2μF; 1210≥10μF</td> </tr> <tr> <td rowspan="3">35V</td> <td>≤5%</td> <td>0603≥1μF; 0805≥2.2μF; 1206≥2.2μF; 1210≥10μF</td> </tr> <tr> <td>≤10%</td> <td>0201≥0.01μF; 0805≥1μF; 1210≥10μF</td> </tr> <tr> <td>≤14%</td> <td>0603≥0.33μF</td> </tr> <tr> <td rowspan="3">25V</td> <td>≤5%</td> <td>0201≥0.1μF; 0402≥0.10μF&amp;(0402/X7R≥0.056μF); 0603≥0.47μF; 0805≥2.2μF; 1206≥4.7μF; 1210≥22μF(1210/X5R≥10μF)</td> </tr> <tr> <td>≤15%</td> <td>0402≥0.47μF</td> </tr> <tr> <td>≤20%</td> <td>0603≥0.15μF; 0805≥0.68μF; 1206≥2.2μF; 1210≥4.7μF</td> </tr> <tr> <td rowspan="3">16V</td> <td>≤5%</td> <td>0201≥0.01μF(0201/X7R≥0.022μF); 0402≥0.033μF; 0603&gt;0.47μF; 0805≥2.2μF; 1206≥4.7μF; 1210≥22μF</td> </tr> <tr> <td>≤10%</td> <td>0201≥0.012μF; 0402≥0.22μF;</td> </tr> <tr> <td>≤15%</td> <td>0201≥0.012μF; 0402≥0.22μF; 0603≥0.33μF; 0805≥2.2μF; 1206≥4.7μF; 1210≥22μF</td> </tr> <tr> <td rowspan="3">10V</td> <td>≤7.5%</td> <td>0201≥0.1μF(0201/X5R&gt;0.1μF); 0402≥1μF; (0603/X5R≥10μF); 01R5/X5R</td> </tr> <tr> <td>≤10%</td> <td>0201≥0.01μF(0201/X5R&gt;0.1μF); 0402≥1μF; (0603/X5R≥10μF); 01R5/X5R</td> </tr> <tr> <td>≤20%</td> <td>0201≥0.1μF(0201/X5R&gt;0.1μF); 0402≥1μF(0402/X6S≥0.47μF); 0603≥10μF; 0805≥4.7μF; 1206≥47μF; 1210≥100μF</td> </tr> <tr> <td>4V</td> <td>≤20%</td> <td>---</td> </tr> <tr> <td></td> <td>Y5V:</td> <td></td> </tr> <tr> <td></td> <td></td> <td></td> <td> <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="2">≥ 50V</td> <td>≤ 7.5%</td> <td>≤ 10% 0603≥0.1μF; 0805≥0.47μF; 1206≥4.7μF ≤ 20% 1210≥6.8μF</td> </tr> <tr> <td>≤ 10%</td> <td>---</td> </tr> <tr> <td rowspan="3">35V</td> <td>≤ 7.5%</td> <td>≤ 10% 0402≥0.047μF; 0603≥0.1μF; 0805≥0.33μF; 1206≥1μF; 1210≥4.7μF ≤ 15% 0402≥0.068μF; 0603≥0.47μF; 1206≥4.7μF; 1210≥22μF</td> </tr> <tr> <td>≤ 10%</td> <td>0402≥0.068μF; 0603≥0.68μF</td> </tr> <tr> <td>≤ 20%</td> <td>0402≥0.22μF</td> </tr> <tr> <td rowspan="2">25V</td> <td>≤ 10%</td> <td>0603≥2.2μF; 0805≥3.3μF; 1206≥10μF; 1210≥22μF; 1812≥47μF</td> </tr> <tr> <td>≤ 15%</td> <td>0402≥0.068μF; 0603≥0.47μF; 1206≥4.7μF; 1210≥22μF</td> </tr> <tr> <td rowspan="2">16V</td> <td>≤ 10%</td> <td>0402≥0.068μF; 0603≥0.68μF</td> </tr> <tr> <td>≤ 20%</td> <td>0402≥0.22μF</td> </tr> <tr> <td rowspan="2">16V (C≥1.0μF)</td> <td>≤ 12.5%</td> <td>0603≥2.2μF; 0805≥3.3μF; 1206≥10μF; 1210≥22μF; 1812≥47μF</td> </tr> <tr> <td>≤ 20%</td> <td>0402≥0.47μF</td> </tr> <tr> <td>10V</td> <td>≤ 20%</td> <td>0402≥0.47μF</td> </tr> <tr> <td>6.3V</td> <td>≤ 30%</td> <td>---</td> </tr> </tbody> </table> </td> </tr> </tbody> </table>	Rated vol.	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\*I.R.: ≥10V, 1GΩ or 50 Ω-F whichever is smaller.

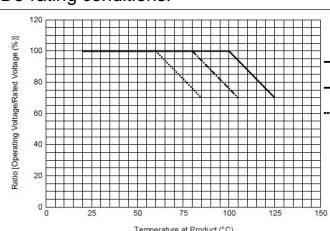
Class II (X7R, X5R, X6S, X7S, Y5V)

Rated voltage	Insulation Resistance
100V: All X7R; 1210≥3.3μF	
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	
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16V: 0201≥0.1μF; 0402≥0.22μF; 0603≥1μF; 0805≥2.2μF; 1206≥10μF; 1210≥47μF	
10V: 0201≥47nF; 0402≥0.47μF; 0603≥0.47μF; 0805≥2.2μF; 1206≥4.7μF; 1210≥47μF	
6.3V ; 4V ; All X6S/X7S items; Size≥1812	

No	Item	Test Condition	Requirements																																																																																																			
14	Humidity (Damp Heat) Load	<p>*Test temp. : <math>40 \pm 2^\circ\text{C}</math></p> <p>*Humidity : 90~95%RH</p> <p>Test time : 500+24/0 hrs.</p> <p>*To apply voltage :</p> <p>    Rated voltage (MAX. 500V)</p> <p>*Before initial measurement (Class II only): To apply de-aging at <math>150^\circ\text{C}</math> for 1hr then set for <math>24 \pm 2</math> hrs at room temp.</p> <p>* Cap. / DF(Q) / I.R. Measurement to be made after de-aging at <math>150^\circ\text{C}</math> for 1hr then set for <math>24 \pm 2</math> hrs at room temp.</p>	<p>* No remarkable damage.</p> <p>Cap change:</p> <p>    NPO: <math>\pm 7.5\%</math> or <math>0.75\mu\text{F}</math> whichever is larger.</p> <p>    X7R, X5R, X6S, X7S: <math>\geq 10\text{V}^{**}</math>, within <math>\pm 12.5\%</math>; <math>\leq 6.3\text{V}</math> within <math>\pm 25\%</math>;</p> <p>        **10V: 0603 <math>\geq 4.7\mu\text{F}</math>; 0402 <math>\geq 1\mu\text{F}</math>; 0201 <math>\geq 0.1\mu\text{F}</math>, within <math>\pm 25\%</math>;</p> <p>    Y5V: <math>\geq 10\text{V}</math>, within <math>\pm 30\%</math>; <math>\leq 6.3\text{V}</math>, within <math>+30/-40\%</math></p> <p>Q/D.F. value:</p> <p>    NP0: <math>C \geq 30\text{pF}</math>, <math>Q \geq 200</math>; <math>C &lt; 30\text{pF}</math>, <math>Q \geq 100 + 10/3\text{C}</math></p> <p>    X7R, X5R, X6S, X7S:</p> <table border="1"> <thead> <tr> <th>Rated vol.</th> <th>D.F. <math>\leq</math></th> <th>Exception of D.F. <math>\leq</math></th> </tr> </thead> <tbody> <tr> <td rowspan="3"><math>\geq 100\text{V}</math></td> <td><math>\leq 6\%</math></td> <td>1206 <math>\geq 0.47\mu\text{F}</math></td> </tr> <tr> <td><math>\leq 7.5\%</math></td> <td>0603 <math>\geq 0.068\mu\text{F}</math>; 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	$\leq 20\%$	0402 $\geq 0.012\mu\text{F}$ ; 0603 $\geq 0.1\mu\text{F}$ ; 0805 $\geq 1\mu\text{F}$ (0805/X7R $\geq 0.47\mu\text{F}$ ); 1206 $\geq 2.2\mu\text{F}$ ; 1210 $\geq 10\mu\text{F}$ ;																																																																																																				
$35\text{V}$	$\leq 20\%$	0603 $\geq 1\mu\text{F}$ ; 0805 $\geq 2.2\mu\text{F}$ ; 1206 $\geq 2.2\mu\text{F}$ ; 1210 $\geq 10\mu\text{F}$																																																																																																				
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	$\leq 14\%$	0603 $\geq 0.33\mu\text{F}$																																																																																																				
$25\text{V}$	$\leq 15\%$	0201 $\geq 0.1\mu\text{F}$ ; 0402 $\geq 0.10\mu\text{F}$ (0402/X7R $\geq 0.056\mu\text{F}$ ); 0603 $\geq 0.47\mu\text{F}$ ; 0805 $\geq 2.2\mu\text{F}$ ; 1206 $\geq 4.7\mu\text{F}$ ; 1210 $\geq 22\mu\text{F}$ (1210/X5R $\geq 10\mu\text{F}^*$ )																																																																																																				
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	$\leq 10\%$	0603 $\geq 0.15\mu\text{F}$ ; 0805 $\geq 0.68\mu\text{F}$ ; 1206 $\geq 2.2\mu\text{F}$ ; 1210 $\geq 4.7\mu\text{F}$																																																																																																				
$16\text{V}$	$\leq 5\%$	0201 $\geq 0.01\mu\text{F}$ (0201/X7R $\geq 0.022\mu\text{F}$ ); 0402 $\geq 0.033\mu\text{F}$ ; 0603 $\geq 0.47\mu\text{F}$ ; 0805 $\geq 2.2\mu\text{F}$ ; 1206 $\geq 4.7\mu\text{F}$ ; 1210 $\geq 22\mu\text{F}$																																																																																																				
$10\text{V}$	$\leq 7.5\%$	0201 $\geq 0.012\mu\text{F}$ ; 0402 $\geq 0.22\mu\text{F}$ ; 0603 $\geq 0.33\mu\text{F}$ ; 0805 $\geq 2.2\mu\text{F}$ ; 1206 $\geq 2.2\mu\text{F}$ ; 1210 $\geq 22\mu\text{F}$																																																																																																				
$6.3\text{V}$	$\leq 15\%$	0201 $\geq 0.1\mu\text{F}$ ; 0402 $\geq 1\mu\text{F}$ (0402/X6S $\geq 0.47\mu\text{F}$ ); 0603 $\geq 10\mu\text{F}$ ; 0805 $\geq 4.7\mu\text{F}$ ; 1206 $\geq 47\mu\text{F}$ ; 1210 $\geq 100\mu\text{F}$																																																																																																				
$4\text{V}$	$\leq 20\%$	---																																																																																																				
Y5V:																																																																																																						
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## Multilayer Ceramic Capacitors

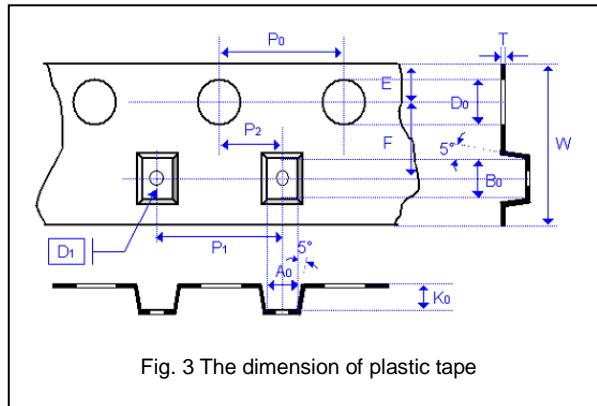
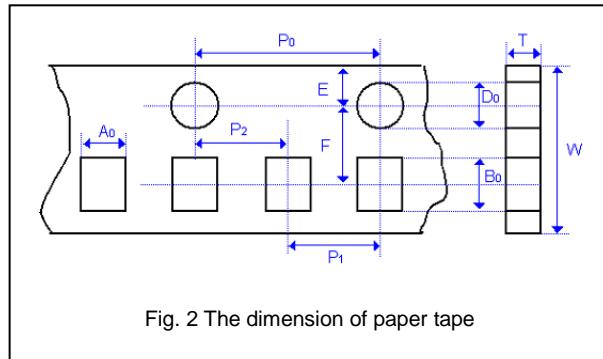
No	Item	Test Condition				Requirements																																																																																				
15.	High Temperature Load (Endurance)	Test temp. : NPO, X7R/X7E/X7S: 125±3°C X6S: 105±3°C X5R, Y5V: 85±3°C Test time: 1000+24/-0 hrs. To apply voltage: (1) $6.3V \leq U_r \leq 10V$ or $C \geq 10\mu F$ : 150% of rated voltage. (2) $10V \leq U_r < 500V$ : 200% of rated voltage. (3) 500V: 150% of rated voltage. (4) $U_r \geq 630V$ : 120% of rated voltage. (5) 100% of rated voltage for below range.				No remarkable damage. Cap change: NPO: ±3.0% or ±0.3pF whichever is larger X7R, X5R, X6S, X7S: ≥10V**, within ±12.5%; ≤ 6.3V within ±25%; **10V: 0603≥4.7μF; 0402≥1μF; 0201≥0.1μF, within ±25% Y5V: ≥10V, within ±30%; ≤ 6.3V, within +30/-40% Q/D.F. value: NPO: More than 30pF, Q≥350 10pF≤C<30pF, Q≥275+2.5C Less than 10pF, Q≥200+10C																																																																																				
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1210	X5R/X7R/X6S	16V	$C \geq 47\mu F$																																																																																							
1210	X7R	100V	$C \geq 3.3\mu F$																																																																																							
TT15	X5R	6.3V	$C > 1.0\mu F$																																																																																							
TT18	Y5V	6.3V,10V	$C \geq 2.2\mu F$																																																																																							
TT21	Y5V	6.3V	$C \geq 10\mu F$																																																																																							
TT31	X5R/X7R/X6S	≤10V	$C \geq 10\mu F$																																																																																							
TT31	Y5V	6.3V	$C \geq 22\mu F$																																																																																							
		**1WV items must follow de-rating conditions. (6) 150% of rated voltage for below range.				Y5V: Rated vol. D.F.≤ Exception of D.F.≤																																																																																				
		<table border="1"> <thead> <tr> <th>Size</th><th>Dielectric</th><th>Rated voltage</th><th>Capacitance</th></tr> </thead> <tbody> <tr> <td rowspan="2">0201</td><td rowspan="2">X5R/X6S</td><td>16V,25V</td><td><math>C=0.1\mu F</math></td></tr> <tr><td>X7R</td><td>16V</td><td><math>C \geq 0.022\mu F</math></td></tr> <tr> <td rowspan="4">0402</td><td rowspan="2">X7R/X5R/X6S</td><td>50V</td><td><math>C&gt;0.01\mu F</math></td></tr> <tr><td>10-25V</td><td><math>C \geq 0.22\mu F</math></td></tr> <tr><td rowspan="2">Y5V</td><td>16V</td><td><math>C \geq 0.47\mu F</math></td></tr> <tr><td>X7S</td><td>50V~100V</td><td><math>C&gt;0.22\mu F</math></td></tr> <tr> <td rowspan="6">0603</td><td rowspan="2">X7R</td><td>50V</td><td><math>C&gt;0.1\mu F</math></td></tr> <tr><td>25V</td><td><math>C=1.0\mu F</math></td></tr> <tr><td>X5R</td><td>50V</td><td><math>C \geq 1.0\mu F</math></td></tr> <tr><td>X5R/X7R/X6S/X7S</td><td>10V,16V</td><td><math>C \geq 1.0\mu F</math></td></tr> <tr><td rowspan="2">Y5V</td><td>16V</td><td><math>C \geq 2.2\mu F</math></td></tr> <tr><td>X5R/X7R/X6S/X7S</td><td>100V</td><td><math>C \geq 0.47\mu F</math></td></tr> <tr> <td rowspan="6">0805</td><td rowspan="2">X5R/X7R/X6S/X7S</td><td>50V</td><td><math>C \geq 0.68\mu F</math></td></tr> <tr><td>35V</td><td><math>C \geq 2.2\mu F</math></td></tr> <tr><td rowspan="2">Y5V</td><td>10-25V</td><td><math>C \geq 4.7\mu F</math></td></tr> <tr><td>16V</td><td><math>C \geq 4.7\mu F</math></td></tr> <tr><td>X7R</td><td>100V</td><td><math>C \geq 1.0\mu F</math></td></tr> <tr><td>50V</td><td><math>C=4.7\mu F</math></td></tr> <tr> <td rowspan="4">1206</td><td>X5R/X6S/X7S</td><td>100V</td><td><math>C &gt; 1.0\mu F</math></td></tr> <tr><td>50V</td><td><math>C=4.7\mu F</math></td></tr> <tr><td>X5R/X7R/X6S/X7S</td><td>50V</td><td><math>C \geq 4.7\mu F</math></td></tr> <tr><td>X7R</td><td>50V</td><td><math>C \geq 1.0\mu F</math></td></tr> <tr> <td>1210</td><td>X5R/X7R/X6S/X7S</td><td>50V~100V</td><td><math>C \geq 2.2\mu F</math></td></tr> <tr> <td>1825</td><td>X7R</td><td>100V~250V</td><td><math>C \geq 1.0\mu F</math></td></tr> <tr> <td>2220</td><td></td><td></td><td></td></tr> <tr> <td>2225</td><td></td><td></td><td></td></tr> </tbody> </table>				Size	Dielectric	Rated voltage	Capacitance	0201	X5R/X6S	16V,25V	$C=0.1\mu F$	X7R	16V	$C \geq 0.022\mu F$	0402	X7R/X5R/X6S	50V	$C>0.01\mu F$	10-25V	$C \geq 0.22\mu F$	Y5V	16V	$C \geq 0.47\mu F$	X7S	50V~100V	$C>0.22\mu F$	0603	X7R	50V	$C>0.1\mu F$	25V	$C=1.0\mu F$	X5R	50V	$C \geq 1.0\mu F$	X5R/X7R/X6S/X7S	10V,16V	$C \geq 1.0\mu F$	Y5V	16V	$C \geq 2.2\mu F$	X5R/X7R/X6S/X7S	100V	$C \geq 0.47\mu F$	0805	X5R/X7R/X6S/X7S	50V	$C \geq 0.68\mu F$	35V	$C \geq 2.2\mu F$	Y5V	10-25V	$C \geq 4.7\mu F$	16V	$C \geq 4.7\mu F$	X7R	100V	$C \geq 1.0\mu F$	50V	$C=4.7\mu F$	1206	X5R/X6S/X7S	100V	$C > 1.0\mu F$	50V	$C=4.7\mu F$	X5R/X7R/X6S/X7S	50V	$C \geq 4.7\mu F$	X7R	50V	$C \geq 1.0\mu F$	1210	X5R/X7R/X6S/X7S	50V~100V	$C \geq 2.2\mu F$	1825	X7R	100V~250V	$C \geq 1.0\mu F$	2220				2225			
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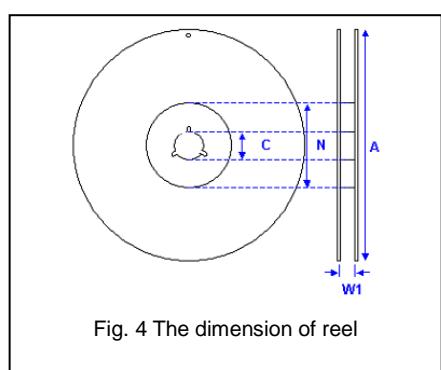
Multilayer Ceramic Capacitors

**APPENDIXES**

□ Tape & reel dimensions



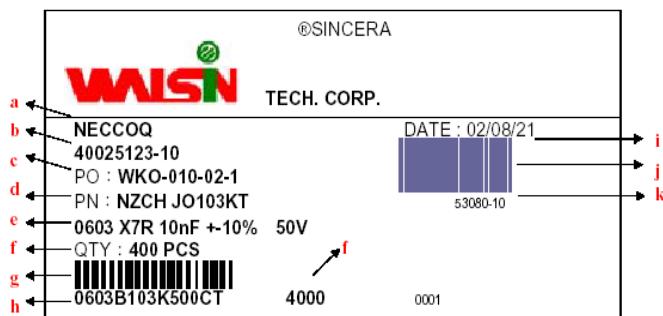
Size	0201	0402	0603	0805			1206			1210			1808			1812		
Thickness	L	N,E	S,H,X	A,H	B,T	D,I	B,T	C,J,D	G,P	T	C,D	G,K	M	D,F	G,K	D,F	G,K	M,U
<b>A<sub>0</sub></b>	0.40 +/-0.10	0.70 +/-0.20	1.05 +/-0.30	1.50 +/-0.20	1.50 +/-0.20	<1.80	1.90 +/-0.50	<2.00	<2.30	<3.05	<3.05	<3.05	<3.20	<2.50	<2.50	<3.90	<3.90	<3.90
<b>B<sub>0</sub></b>	0.70 +/-0.10	1.20 +/-0.20	1.80 +/-0.30	2.30 +/-0.20	2.30 +/-0.20	<2.70	3.50 +/-0.50	<3.70	<4.00	<3.80	<3.80	<3.80	<4.00	<5.30	<5.30	<5.30	<5.30	<5.30
<b>T</b>	≤0.55	≤0.80	≤1.20	≤1.15	≤1.20	0.23 +/-0.1	≤1.20	0.23 +/-0.1	0.23 +/-0.1	0.23 +/-0.1	0.23 +/-0.1	0.23 +/-0.1	0.25 +/-0.1	0.25 +/-0.1	0.25 +/-0.1	0.25 +/-0.1	0.25 +/-0.1	
<b>K<sub>0</sub></b>	-	-	-	-	-	<2.00	-	<2.00	<2.50	<1.50	<2.00	<2.50	<3.20	<2.00	<2.50	<2.00	<2.50	<3.50
<b>W</b>	8.00 +/-0.30	12.00 +/-0.30	12.00 +/-0.30	12.00 +/-0.30	12.00 +/-0.30	12.00 +/-0.30												
<b>P<sub>0</sub></b>	4.00 +/-0.10																	
<b>10xP<sub>0</sub></b>	40.00 +/-0.10	40.00 +/-0.10	40.00 +/-0.20															
<b>P<sub>1</sub></b>	2.00 +/-0.05	2.00 +/-0.05	4.00 +/-0.10															
<b>P<sub>2</sub></b>	2.00 +/-0.05	2.00 +/-0.10	2.00 +/-0.10	2.00 +/-0.10	2.00 +/-0.10	2.00 +/-0.10												
<b>D<sub>0</sub></b>	1.50 +0.1/-0																	
<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 +0.1/-0	1.50 +0.1/-0	1.50 +0.1/-0	1.50 +0.1/-0	1.50 +0.1/-0	
<b>E</b>	1.75 +/-0.10																	
<b>F</b>	3.50 +/-0.05	5.50 +/-0.10	5.50 +/-0.10	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	13.0±0.5	13.0±0.5	13.0±0.5
<b>W<sub>1</sub></b>	10.0±1.5	10.0±1.5	10.0±1.5	12.4±2.0/-0
<b>A</b>	178.0±2.0	250.0±2.0	330.0±2.0	178.0±2.0
<b>N</b>	60.0±1.0/-0	50 min	50 min	60.0±1.0/-0

Multilayer Ceramic Capacitors

Example of customer label



\*Customized label is available upon request

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

Constructions

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

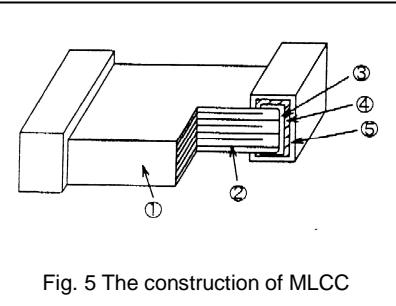


Fig. 5 The construction of MLCC

Storage and handling conditions

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

Cautions:

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

Multilayer Ceramic Capacitors

□ Recommended soldering conditions

The lead-free termination MLCCs are not only to be used on SMT against lead-free solder paste, but also suitable against lead-containing solder paste. If the optimized solder joint is requested, increasing soldering time, temperature and concentration of N<sub>2</sub> within oven are recommended.

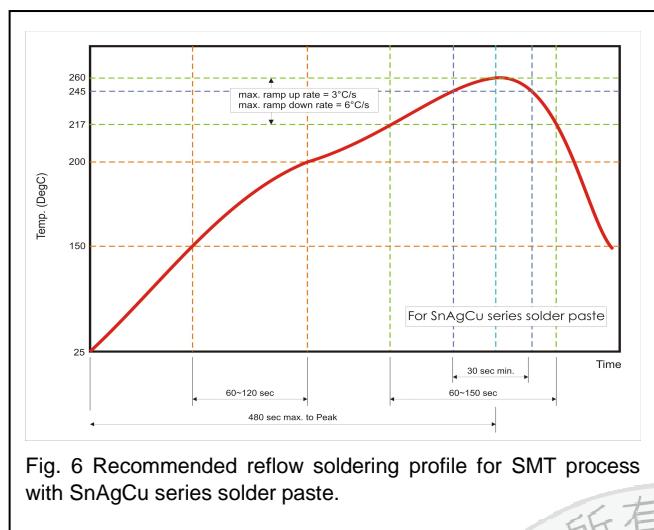


Fig. 6 Recommended reflow soldering profile for SMT process with SnAgCu series solder paste.

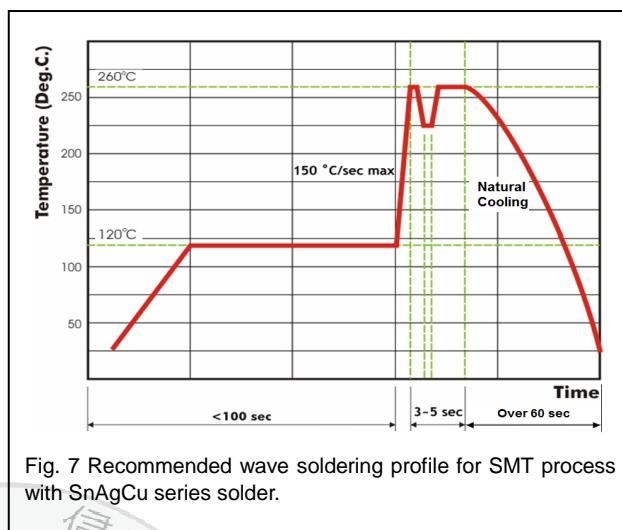


Fig. 7 Recommended wave soldering profile for SMT process with SnAgCu series solder.



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[1206X155J160CT](#) [1206X225J160CT](#) [1206X335J160CT](#) [1206X475J160CT](#) [0805X105M160CT](#) [0805X225J160CT](#)  
[1206B124M160CT](#) [0603X225M160CT](#) [0603X274M160CT](#) [0603X334J160CT](#) [0603X474J160CT](#) [0603X475M160CT](#)  
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[0201B392M160CT](#) [0201B561M160CT](#)

## Walsin:

[0402N1R2C500LT](#) [0402N1R5C500LT](#) [0402N3R3C500LT](#) [0402N4R7C500LT](#) [0402N5R6C500LT](#)  
[0603N1R0C500LT](#) [0402B471K500CT](#) [0402B102K500CT](#) [0402B152K500CT](#) [0402B222K500CT](#) [0402B392K500CT](#)  
[0402B103K500CT](#) [0402B103K250CT](#) [0402B103K160CT](#) [0402B123K160CT](#) [0603B103K500CT](#) [0402X104K160CT](#)  
[0402N101J500CT](#) [0402N150J500CT](#) [0402N330J500CT](#) [0402N2R2C500LT](#) [0402X106M6R3CT](#) [0402N5R6C500CT](#)  
[0603N1R0C500CT](#) [0402N100J500CT](#) [0603N150F500CT](#) [0402N220G500CT](#) [0603N120J500CT](#) [0402N2R2C500CT](#)  
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[0603N560F500CT](#) [0402B472J500CT](#) [0402B562K250CT](#) [0603B681K101CT](#) [0603B561K500CT](#) [1206B224K101CT](#)  
[1206B102K500CT](#) [0603N220J101CT](#) [0603N222J500CT](#) [0603N270J500CT](#) [0603N300J500CT](#)