APPROVAL SHEET

MULTILAYER CERAMIC CAPACITORS

General Purpose Series (4V to 100V)

0201 to 1812 Sizes

NP0, X7R, X6S, X7S & X5R Dielectrics

Halogen Free & RoHS Compliance

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

1. DESCRIPTION

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

WTC's MLCC is made by NP0, X7R, X6S and X5R 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).

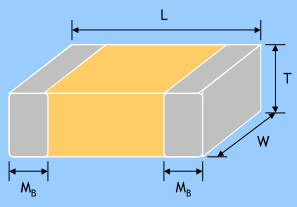
3. APPLICATIONS

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

4. HOW TO ORDER

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

5. EXTERNAL DIMENSIONS

Outline	Size Inch (mm)	L (mm)	W (mm)	T (mm)/Symbol		Soldering Method *	M_B (mm)
 Fig. 1 The outline of MLCC	01R5 (0402)	0.4±0.02	0.2±0.02	0.2±0.02	V	R	0.10±0.03
	0201 (0603)	0.6±0.03	0.3±0.03	0.3±0.03	L	R	0.15±0.05
		0.6±0.05#2	0.3±0.05#2	0.3±0.05#2			
		0.6±0.09#3	0.3±0.09#3	0.3±0.09#3			0.15+0.1/-0.05
	0402 (1005)	1.00±0.05	0.50±0.05	0.50±0.05	N	R	0.25 +0.05/-0.10
				0.50+0.02/-0.05	Q	R	
		1.00±0.20	0.50±0.20	0.5±0.20	E	R	
	0603 (1608)	1.60±0.10	0.80±0.10	0.80±0.07	S	R / W	0.40±0.15
		1.60+0.15/-0.10	0.80+0.15/-0.10	0.50±0.10	H	R / W	
				0.80+0.15/-0.10	X	R / W	
		1.60±0.20#1	0.80±0.20#1	0.8±0.20#1			
	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)***
				0.95±0.10	C	R	
				1.25±0.10	D	R	
		3.20±0.20		1.15±0.15	J	R	
			1.60±0.20	1.60±0.20	G	R	
				0.85±0.10	T	R / W	
		3.20+0.30/-0.1 3.30+0.30/-0.1#5	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	
				1.60±0.20	G	R	
		3.20±0.40	2.50±0.30	2.00±0.20	K	R	
				2.50±0.30	M	R	
		3.20±0.60#4	2.50±0.50#4	2.50±0.50#4			
	1808 (4520)	4.50±0.40 (4.5+0.5/-0.3)**	2.03±0.25	1.25±0.10	D	R	0.75±0.25 (0.5±0.25)***
				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)**	3.20±0.30	1.25±0.10	D	R	0.75±0.25 (0.5±0.25)***
				1.60±0.20	G	R	
				2.00±0.20	K	R	
			3.20±0.40	2.50±0.30	M	R	
				2.80±0.30	U	R	

* R = Reflow soldering process ; W = Wave soldering process.
** For 1808/1812/1825_200V~4000V and safety certificated products.
*** For 1206_≧1000V, 1808/1812_200V~4000V and safety certificated products.
#1: For 0603/Cap≧10μF or 0603(≦6.3V)/Cap≧4.7μF or 0603(>10V)/Cap>1μF products,
Excluding 0603X225(16V&25V),0603S225(6.3V&16V),0603X475(6.3V&16V),0603S475(4V&6.3V).
#2: For 0201/ 0.1uF < Cap < 0.68uF products, Excluding 0201X334~474(≦6.3V) & 0201X224(≦10V).
#3: For 0201/Cap≧0.68μF products, Excluding 0201X105*6R3=>(L:0.6±0.05,W:0.3±0.05,T:0.3±0.05).
#4: For 1210(200V&250V)/Cap>0.47μF products.
#5: For 1206(100V)/Cap≧1.2μF products.

6. GENERAL ELECTRICAL DATA

Dielectric	NP0	X7R	X5R	X6S	X7S
Size	0201, 0402, 0603, 0805, 1206, 1210, 1812				
Capacitance range*	0.1pF to 0.1μF	100pF to 47μF	100pF to 220μF	0.1μF to 100μF	0.1μF to 100μF
Capacitance tolerance**	Cap≤5pF#1: A(±0.05pF),B(±0.1pF), C (±0.25pF) 5pF<Cap<10pF: C(±0.25pF),D(±0.5pF) Cap≥10pF: F (±1%), G (±2%), J (±5%), K (±10%)	J (±5%), K (±10%), M (±20%)	K (±10%), M (±20%)	K (±10%), M (±20%)	K (±10%), M (±20%)
Rated voltage (WVDC)	10V, 16V, 25V, 50V,100V	4V, 6.3V, 10V, 16V, 25V, 50V, 100V			
Operating temperature	-55 to +125°C		-55 to +85°C	-55 to +105°C	-55 to +125°C
Capacitance characteristic	±30ppm	±15%	±15%	±22%	±22%
Termination	Ni/Sn (lead-free termination)				

#1: NP0, 0.1pF product only provide B tolerance; 0603N0R3/0R4 provide B&C tolerance.

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

NP0: Apply 1.0±0.2Vrms, 1.0MHz±10% for Cap≤1000pF and 1.0±0.2Vrms, 1.0kHz±10% for Cap>1000pF, 25°C at ambient temperature

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

** 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.

7. CAPACITANCE RANGE

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

DIELECTRIC		NP0																			
SIZE		0201					0402					0603					0805				
RATED VOLTAGE (VDC)		10	16	25	50	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	N	S	S	S	S	S	A	A	A	A	A
	0.6pF (0R6)	L	L	L	L	L	N	N	N	N	N	S	S	S	S	S	A	A	A	A	A
	0.7pF (0R7)	L	L	L	L	L	N	N	N	N	N	S	S	S	S	S	A	A	A	A	A
	0.8pF (0R8)	L	L	L	L	L	N	N	N	N	N	S	S	S	S	S	A	A	A	A	A
	0.9pF (0R9)	L	L	L	L	L	N	N	N	N	N	S	S	S	S	S	A	A	A	A	A
	1.0pF (1R0)	L	L	L	L	L	N	N	N	N	N	S	S	S	S	S	A	A	A	A	A
	1.2pF (1R2)	L	L	L	L	L	N	N	N	N	N	S	S	S	S	S	A	A	A	A	A
	1.5pF (1R5)	L	L	L	L	L	N	N	N	N	N	S	S	S	S	S	A	A	A	A	A
	1.8pF (1R8)	L	L	L	L	L	N	N	N	N	N	S	S	S	S	S	A	A	A	A	A
	2.0pF (2R0)	L	L	L	L	L	N	N	N	N	N	S	S	S	S	S	A	A	A	A	A
	2.2pF (2R2)	L	L	L	L	L	N	N	N	N	N	S	S	S	S	S	A	A	A	A	A
	2.7pF (2R7)	L	L	L	L	L	N	N	N	N	N	S	S	S	S	S	A	A	A	A	A
	3.0pF (3R0)	L	L	L	L	L	N	N	N	N	N	S	S	S	S	S	A	A	A	A	A
	3.3pF (3R3)	L	L	L	L	L	N	N	N	N	N	S	S	S	S	S	A	A	A	A	A
	3.9pF (3R9)	L	L	L	L	L	N	N	N	N	N	S	S	S	S	S	A	A	A	A	A
	4.0pF (4R0)	L	L	L	L	L	N	N	N	N	N	S	S	S	S	S	A	A	A	A	A
	4.7pF (4R7)	L	L	L	L	L	N	N	N	N	N	S	S	S	S	S	A	A	A	A	A
	5.0pF (5R0)	L	L	L	L	L	N	N	N	N	N	S	S	S	S	S	A	A	A	A	A
	5.6pF (5R6)	L	L	L	L	L	N	N	N	N	N	S	S	S	S	S	A	A	A	A	A
	6.0pF (6R0)	L	L	L	L	L	N	N	N	N	N	S	S	S	S	S	A	A	A	A	A
	6.8pF (6R8)	L	L	L	L	L	N	N	N	N	N	S	S	S	S	S	A	A	A	A	A
	7.0pF (7R0)	L	L	L	L	L	N	N	N	N	N	S	S	S	S	S	A	A	A	A	A
	8.0pF (8R0)	L	L	L	L	L	N	N	N	N	N	S	S	S	S	S	A	A	A	A	A
	8.2pF (8R2)	L	L	L	L	L	N	N	N	N	N	S	S	S	S	S	A	A	A	A	A
	9.0pF (9R0)	L	L	L	L	L	N	N	N	N	N	S	S	S	S	S	A	A	A	A	A
	10pF (100)	L	L	L	L	L	N	N	N	N	N	S	S	S	S	S	A	A	A	A	A
	12pF (120)	L	L	L	L	L	N	N	N	N	N	S	S	S	S	S	A	A	A	A	A
	15pF (150)	L	L	L	L	L	N	N	N	N	N	S	S	S	S	S	A	A	A	A	A
	18pF (180)	L	L	L	L	L	N	N	N	N	N	S	S	S	S	S	A	A	A	A	A
	22pF (220)	L	L	L	L	L	N	N	N	N	N	S	S	S	S	S	A	A	A	A	A
	27pF (270)	L	L	L	L	L	N	N	N	N	N	S	S	S	S	S	A	A	A	A	A
	33pF (330)	L	L	L	L	L	N	N	N	N	N	S	S	S	S	S	A	A	A	A	A
	39pF (390)	L	L	L	L	L	N	N	N	N	N	S	S	S	S	S	A	A	A	A	A
	47pF (470)	L	L	L	L	L	N	N	N	N	N	S	S	S	S	S	A	A	A	A	A
	56pF (560)	L	L	L	L	L	N	N	N	N	N	S	S	S	S	S	A	A	A	A	A
	68pF (680)	L	L	L	L	L	N	N	N	N	N	S	S	S	S	S	A	A	A	A	A
	82pF (820)	L	L	L	L	L	N	N	N	N	N	S	S	S	S	S	A	A	A	A	A
	100pF (101)	L	L	L	L	L	N	N	N	N	N	S	S	S	S	S	A	A	A	A	A
	120pF (121)	L	L	L	L	L	N	N	N	N	N	S	S	S	S	S	A	A	A	A	A
	150pF (151)	L	L	L	L	L	N	N	N	N	N	S	S	S	S	S	A	A	A	A	A
	180pF (181)	L	L	L	L	L	N	N	N	N	N	S	S	S	S	S	A	A	A	A	A
	220pF (221)	L	L	L	L	L	N	N	N	N	N	S	S	S	S	S	A	A	A	A	A
	270pF (271)	L	L	L			N	N	N	N		S	S	S	S	S	A	A	A	A	A
	330pF (331)	L	L	L			N	N	N	N		S	S	S	S	S	A	A	A	A	A
	390pF (391)	L	L	L			N	N	N	N		S	S	S	S	S	B	B	B	B	B
	470pF (471)	L	L	L			N	N	N	N		S	S	S	S	S	B	B	B	B	B
	560pF (561)	L	L	L			N	N	N	N		S	S	S	S	S	B	B	B	B	B
	680pF (681)	L	L	L			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)																D	D	D	D	D
	0.018uF (183)																D	D	D	D	D
	0.022uF (223)																D	D	D	D	D

1. The letter in cell is expressed the symbol of product thickness.
2. The letter in cell with " * " mark is expressed capacitance tolerance "J" (±5%) only.
3. For more information about products with special capacitance or other data, please contact WTC local representative.

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

DIELECTRIC		NP0													
SIZE		1206					1210					1812			
RATED VOLTAGE (VDC)		10	16	25	50	100	10	16	25	50	100	16	25	50	100
Capacitance	1.0pF (1R0)														
	1.2pF (1R2)	B	B	B	B	B									
	1.5pF (1R5)	B	B	B	B	B									
	1.8pF (1R8)	B	B	B	B	B									
	2.2pF (2R2)	B	B	B	B	B									
	2.7pF (2R7)	B	B	B	B	B									
	3.3pF (3R3)	B	B	B	B	B									
	3.9pF (3R9)	B	B	B	B	B									
	4.7pF (4R7)	B	B	B	B	B									
	5.6pF (5R6)	B	B	B	B	B									
	6.8pF (6R8)	B	B	B	B	B									
	8.2pF (8R2)	B	B	B	B	B									
	10pF (100)	B	B	B	B	B	C	C	C	C	C	D	D	D	D
	12pF (120)	B	B	B	B	B	C	C	C	C	C	D	D	D	D
	15pF (150)	B	B	B	B	B	C	C	C	C	C	D	D	D	D
	18pF (180)	B	B	B	B	B	C	C	C	C	C	D	D	D	D
	22pF (220)	B	B	B	B	B	C	C	C	C	C	D	D	D	D
	27pF (270)	B	B	B	B	B	C	C	C	C	C	D	D	D	D
	33pF (330)	B	B	B	B	B	C	C	C	C	C	D	D	D	D
	39pF (390)	B	B	B	B	B	C	C	C	C	C	D	D	D	D
	47pF (470)	B	B	B	B	B	C	C	C	C	C	D	D	D	D
	56pF (560)	B	B	B	B	B	C	C	C	C	C	D	D	D	D
	68pF (680)	B	B	B	B	B	C	C	C	C	C	D	D	D	D
	82pF (820)	B	B	B	B	B	C	C	C	C	C	D	D	D	D
	100pF (101)	B	B	B	B	B	C	C	C	C	C	D	D	D	D
	120pF (121)	B	B	B	B	B	C	C	C	C	C	D	D	D	D
	150pF (151)	B	B	B	B	B	C	C	C	C	C	D	D	D	D
	180pF (181)	B	B	B	B	B	C	C	C	C	C	D	D	D	D
	220pF (221)	B	B	B	B	B	C	C	C	C	C	D	D	D	D
	270pF (271)	B	B	B	B	B	C	C	C	C	C	D	D	D	D
	330pF (331)	B	B	B	B	B	C	C	C	C	C	D	D	D	D
	390pF (391)	B	B	B	B	B	C	C	C	C	C	D	D	D	D
	470pF (471)	B	B	B	B	B	C	C	C	C	C	D	D	D	D
	560pF (561)	B	B	B	B	B	C	C	C	C	C	D	D	D	D
	680pF (681)	B	B	B	B	B	C	C	C	C	C	D	D	D	D
	820pF (821)	B	B	B	B	B	C	C	C	C	C	D	D	D	D
	1,000pF (102)	B	B	B	B	B	C	C	C	C	C	D	D	D	D
	1,200pF (122)	B	B	B	B	B	C	C	C	C	C	D	D	D	D
	1,500pF (152)	B	B	B	B	B	C	C	C	C	C	D	D	D	D
	1,800pF (182)	B	B	B	B	B	C	C	C	C	C	D	D	D	D
	2,200pF (222)	B	B	B	B	B	C	C	C	C	C	D	D	D	D
	2,700pF (272)	B	B	B	B	B	C	C	C	C	C	D	D	D	D
	3,300pF (332)	B	B	B	B	B	C	C	C	C	C	D	D	D	D
	3,900pF (392)	B	B	B	B	B	C	C	C	C	C	D	D	D	D
	4,700pF (472)	B	B	B	B	B	C	C	C	C	C	D	D	D	D
	5,600pF (562)	B	B	B	B	B	C	C	C	C	C	D	D	D	D
	6,800pF (682)	C	C	C	C	C	C	C	C	C	C	D	D	D	D
	8,200pF (822)	D	D	D	D	D	C	C	C	C	C	D	D	D	D
	0.010μF (103)	D	D	D	D	D	C	C	C	C	C	D	D	D	D
	0.012μF (123)	P	P	P	P	P	D	D	D	D	D	D	D	D	D
	0.015μF (153)	P	P	P	P	P	D	D	D	D	D	D	D	D	D
	0.018μF (183)	P	P	P	P	P	K	K	K	K	K	D	D	D	D
	0.022μF (223)	P	P	P	P	P	K	K	K	K	K	D	D	D	D
	0.027μF (273)	P	P	P	P		K	K	K	K	K	D	D	D	D
	0.033μF (333)	P	P	P	P		K	K	K	K	K	D	D	D	D
	0.039μF (393)	P	P	P	P		K	K	K	K	K	M	M	M	M
	0.047μF (473)	P	P	P	P		K	K	K	K	K	M	M	M	M
	0.056μF (563)	P	P	P	P							M	M	M	M
	0.068μF (683)	P	P	P	P							M	M	M	M
	0.082μF (823)	P	P	P	P							M	M	M	M
	0.1μF (104)	P	P	P	P							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	35	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	N		S	S	S	S	S		B	B	B		B	B
	1,200pF (122)	L	L	L	L			N	N	N	N	N		S	S	S	S	S		B	B	B		B	B
	1,500pF (152)	L	L	L	L			N	N	N	N	N		S	S	S	S	S		B	B	B		B	B
	1,800pF (182)	L	L	L	L			N	N	N	N	N		S	S	S	S	S		B	B	B		B	B
	2,200pF (222)	L	L	L	L			N	N	N	N	N		S	S	S	S	S		B	B	B		B	B
	2,700pF (272)	L	L	L	L			N	N	N	N	N		S	S	S	S	S		B	B	B		B	B
	3,300pF (332)	L	L	L	L			N	N	N	N	N		S	S	S	S	S		B	B	B		B	B
	3,900pF (392)	L	L	L	L			N	N	N	N	N		S	S	S	S	S		B	B	B		B	B
	4,700pF (472)	L	L	L	L		N	N	N	N	N	N		S	S	S	S	S		B	B	B		B	B
	5,600pF (562)	L	L	L	L			N	N	N	N			S	S	S	S	S		B	B	B		B	B
	6,800pF (682)	L	L	L				N	N	N	N			S	S	S	S	S		B	B	B		B	B
	8,200pF (822)	L	L	L				N	N	N	N			S	S	S	S	S		B	B	B		B	B
	0.010μF (103)	L	L	L	L		N	N	N	N	N			S	S	S	S	S		B	B	B		B	B
	0.012μF (123)							N	N	N	N			S	S	S	S	X		B	B	B		B	B
	0.015μF (153)							N	N	N	N			S	S	S	S	X		B	B	B		B	B
	0.018μF (183)							N	N	N	N			S	S	S	S	X		B	B	B		B	B
	0.022μF (223)		L	L			N	N	N	N	N			S	S	S	S	X		B	B	B		B	B
	0.027μF (273)							N	N	N	N			S	S	S	S	X		B	B	B		B	D
	0.033μF (333)							N	N	N	N			S	S	S	X	X		B	B	B		B	D
	0.039μF (393)							N	N	N	N			S	S	S	X	X		B	B	B		B	D
	0.047μF (473)							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	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)								N					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				S	S	X	X			D	D	D		D	I
	0.27μF (274)												X	X	X	X				D	D	D		I	I
	0.33μF (334)						N	N					X	X	X	X	X			D	D	D		I	I
	0.39μF (394)												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	I	
	1.5μF (155)																			I	I	I			
	2.2μF (225)												X	X	X				I	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																	
SIZE		1206							1210							1812				
RATED VOLTAGE (VDC)		6.3	10	16	25	35	50	100	6.3	10	16	25	35	50	100	10	16	25	50	100
Capacitance	100pF (101)																			
	120pF (121)																			
	150pF (151)		B	B	B		B	B												
	180pF (181)		B	B	B		B	B												
	220pF (221)		B	B	B		B	B												
	270pF (271)		B	B	B		B	B												
	330pF (331)		B	B	B		B	B												
	390pF (391)		B	B	B		B	B												
	470pF (471)		B	B	B		B	B												
	560pF (561)		B	B	B		B	B												
	680pF (681)		B	B	B		B	B												
	820pF (821)		B	B	B		B	B												
	1,000pF (102)		B	B	B		B	B		C	C	C		C	C	D	D	D	D	D
	1,200pF (122)		B	B	B		B	B		C	C	C		C	C	D	D	D	D	D
	1,500pF (152)		B	B	B		B	B		C	C	C		C	C	D	D	D	D	D
	1,800pF (182)		B	B	B		B	B		C	C	C		C	C	D	D	D	D	D
	2,200pF (222)		B	B	B		B	B		C	C	C		C	C	D	D	D	D	D
	2,700pF (272)		B	B	B		B	B		C	C	C		C	C	D	D	D	D	D
	3,300pF (332)		B	B	B		B	B		C	C	C		C	C	D	D	D	D	D
	3,900pF (392)		B	B	B		B	B		C	C	C		C	C	D	D	D	D	D
	4,700pF (472)		B	B	B		B	B		C	C	C		C	C	D	D	D	D	D
	5,600pF (562)		B	B	B		B	B		C	C	C		C	C	D	D	D	D	D
	6,800pF (682)		B	B	B		B	B		C	C	C		C	C	D	D	D	D	D
	8,200pF (822)		B	B	B		B	B		C	C	C		C	C	D	D	D	D	D
	0.010μF (103)		B	B	B		B	B		C	C	C		C	C	D	D	D	D	D
	0.012μF (123)		B	B	B		B	B		C	C	C		C	C	D	D	D	D	D
	0.015μF (153)		B	B	B		B	B		C	C	C		C	C	D	D	D	D	D
	0.018μF (183)		B	B	B		B	B		C	C	C		C	C	D	D	D	D	D
	0.022μF (223)		B	B	B		B	B		C	C	C		C	C	D	D	D	D	D
	0.027μF (273)		B	B	B		B	B		C	C	C		C	C	D	D	D	D	D
	0.033μF (333)		B	B	B		B	B		C	C	C		C	C	D	D	D	D	D
	0.039μF (393)		B	B	B		B	B		C	C	C		C	C	D	D	D	D	D
	0.047μF (473)		B	B	B		B	B		C	C	C		C	C	D	D	D	D	D
	0.056μF (563)		B	B	B		B	B		C	C	C		C	C	D	D	D	D	D
	0.068μF (683)		B	B	B		B	B		C	C	C		C	C	D	D	D	D	D
	0.082μF (823)		B	B	B		B	D		C	C	C		C	C	D	D	D	D	D
	0.10μF (104)		B	B	B		B	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		P				G	G		M	M			D	K	K
	2.2μF (225)	J	J	J	P		P	P			G	G		M	M			G	M	M
	3.3μF (335)		P	P	P		P				G	G		M				K	K	
	4.7μF (475)	P	P	P	P		P			K	K	K		M	M			M	M	
	6.8μF (685)																	M	M	
	10μF (106)	P	P	P	P	P			K	K	K	K	M	M				M	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. 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									N						
	0.022μF (223)	L	L	L	L							N						
	0.033μF (333)	L	L							N		N						
	0.047μF (473)	L	L	L	L			N	N	N		N						
	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	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	L					N	N	N	N	E		X	X	X	X	X
	0.68μF (684)							N	N					X	X	X	X	
	0.82uF (824)													X	X	X	X	
	1.0μF (105)	L	L*	L*				N	N	N	N	E		X	X	X	X	X
	1.5μF (155)													X	X			
	2.2μF (225)	L*	L*					N	N	E	E			X	X	X	X	X
	3.3μF (335)													X	X			
	4.7μF (475)							E	E	E*				X	X	X	X	
	6.8μF (685)																	
	10μF (106)						E*	E*	E*				X	X	X	X	X	
	22μF (226)						E*	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						P							
	1.5μF (155)		I	I	I	I				J	J	P	P			K	K			
	2.2μF (225)		I	I	I	I	I			J	J	P	P			K	K			
	3.3μF (335)		I	I	I	I				P	P	P	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*	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.

7-4. X6S Dielectric 0201, 0402, 0603, 0805, 1206, 1210 Sizes

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

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

7-5. 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
Capacitance	0.1μF (104)	L												I										
	1.0μF (105)			E																				
	1.5μF (155)																							
	2.2μF (225)		E	E					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)																			M*				

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

8. PACKAGING STYLE AND QUANTITY

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

Unit: pieces

9. RELIABILITY TEST CONDITIONS AND REQUIREMENTS

<table>
<tr><th>No.</th><th>Item</th><th>Test Condition</th><th>Requirements</th></tr>
<tr><td>1.</td><td>Visual and Mechanical</td><td>---</td><td>* No remarkable defect.
* Dimensions to conform to individual specification sheet.</td></tr>
<tr><td>2.</td><td>Capacitance</td><td>*Test temp.: Room Temperature.
*Class I: (NP0)
≦1000pF, 1.0±0.2Vrms，1MHz±10%
＞1000pF, 1.0±0.2Vrms，1KHz±10%
Class II: (X7R, X7E, X6S, X5R, X7S)
C≦10μF, 1.0±0.2Vrms，1KHz±10% **
C＞10μF, 0.5±0.2Vrms，120Hz±20%

** Test condition: 0.5±0.2Vrms，1KHz±10%
X7R:
0603/475(6.3V)
X5R#1:
0201≧224 (6.3V,10V,16V),
0402≧475 (6.3V,16V), 0402≧225(10V),
0603=106 (6.3V)
TT18X≧475(10V) , TT15X series
X6S:
0201/474(4V),0201>104 (6.3V,10V),
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);224(16V),
0402X475M6R3, 0402X106M100
(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.</td><td>* Shall not exceed the limits given in the detailed spec.</td></tr>
<tr><td>3.</td><td>Q/ D.F. (Dissipation Factor)</td><td></td><td>NP0: Cap≥30pF, Q≥1000; Cap<30pF,Q≥400+20C
X7R:
<table>
<tr><th>Rated vol.</th><th>D.F.≦</th><th colspan="2">Exception of D.F. ≦</th></tr>
<tr><td rowspan="4">≧100V</td><td rowspan="4">≦2.5%</td><td>≦3%</td><td>1206≧0.47μF</td></tr>
<tr><td>≦3.5%</td><td>1812≧4.7μF;1825≥4.7μF; 2220≥4.7μF; 2225≥4.7μF</td></tr>
<tr><td>≦5%</td><td>0603≧0.068μF; 0805＞0.1μF; 1206≧1μF; 1210≧2.2μF;</td></tr>
<tr><td>≦10%</td><td>0805＞0.22μF; 1210≧3.3μF</td></tr>
<tr><td rowspan="4">50V</td><td rowspan="4">≦2.5%</td><td>≦3%</td><td>0201(50V); 0603≧0.047μF; 0805≧0.18μF; 1206≧0.47μF</td></tr>
<tr><td>≦3.5%</td><td>1812≧4.7μF;1825≥4.7μF; 2220≥4.7μF; 2225≥4.7μF</td></tr>
<tr><td>≦5%</td><td>0201≧0.01uF; 1210≧3.3μF</td></tr>
<tr><td>≦10%</td><td>0402≧0.012μF; 0603>0.1μF; 0805/X7R>0.47μF;
1206≧2.2μF; 1210≧10μF</td></tr>
<tr><td>35V</td><td>≦3.5%</td><td>≦10%</td><td>0603≧1μF; 0805≥2.2μF; 1206≧2.2μF; 1210≧10μF</td></tr>
<tr><td rowspan="4">25V</td><td rowspan="4">≦3.5%</td><td>≦5%</td><td>0201≧0.01μF; 0805≧1μF; 1210≧10μF</td></tr>
<tr><td>≦7%</td><td>0603≧0.33μF</td></tr>
<tr><td>≦10%</td><td>0201≧0.1μF; 0402≧0.056μF; 0603≧0.47μF;
0805≧2.2μF; 1206≧4.7μF; 1210≧22μF</td></tr>
<tr><td>≦12.5%</td><td>0402≧0.33μF</td></tr>
<tr><td rowspan="2">16V</td><td rowspan="2">≦3.5%</td><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>≦10%</td><td>0201/X7R≧0.022μF; 0402≧0.15uF;
0603>0.47μF; 0805≧2.2μF; 1206≧4.7μF; 1210≧22μF</td></tr>
<tr><td rowspan="2">10V</td><td rowspan="2">≦5%</td><td>≦10%</td><td>0201≧0.012μF; 0402≧0.15μF;
0603≧0.33μF; 0805≧2.2μF; 1206≧2.2μF; 1210≧22μF</td></tr>
<tr><td>≦15%</td><td>0201≧0.1μF; 0402≧1μF</td></tr>
<tr><td rowspan="3">6.3V</td><td rowspan="3">≦10%</td><td>≦15%</td><td>0201≧0.1μF; 0402≧1μF; 0603≧10μF;
0805≧4.7μF; 1206≧47μF; 1210≧100μF</td></tr>
<tr><td>≦20%</td><td>0402≧2.2μF</td></tr>
<tr><td>4V</td><td>≦15%</td><td>---</td><td>---</td></tr>
</table>
X5R:
<table>
<tr><th>Rated vol.</th><th>D.F.≦</th><th colspan="2">Exception of D.F. ≦</th></tr>
<tr><td rowspan="4">≧100V</td><td rowspan="4">≦2.5%</td><td>≦3%</td><td>1206≧0.47μF</td></tr>
<tr><td>≦5%</td><td>0603≧0.068μF; 0805＞0.1μF; 1206≧1μF; 1210≧2.2μF</td></tr>
<tr><td>≦10%</td><td>0805＞0.22μF; 1210≧3.3μF</td></tr>
<tr><td rowspan="4">50V</td><td rowspan="4">≦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≧0.01uF; 1210≧3.3μF</td></tr>
<tr><td>≦10%</td><td>0402≧0.012μF; 0603>0.1μF; 0805≧1μF;1206≧2.2μF; 1210≧10μF</td></tr>
<tr><td>≦12.5%</td><td>1206=10μF</td></tr>
<tr><td>35V</td><td>≦3.5%</td><td>≦10%</td><td>0603≧1μF; 0805≥2.2μF; 1206≧2.2μF; 1210≧10μF</td></tr>
<tr><td rowspan="4">25V</td><td rowspan="4">≦3.5%</td><td>≦5%</td><td>0201=0.01μF; 0805≧1μF</td></tr>
<tr><td>≦7%</td><td>0603≧0.33μF</td></tr>
<tr><td>≦10%</td><td>0201>0.01μF; 0402≧0.10μF; 0603≧0.47μF;
0805≧2.2μF; 1206≧4.7μF; 1210≧10μF</td></tr>
<tr><td>≦12.5%</td><td>0402≧0.33μF;0805=10μF</td></tr>
<tr><td rowspan="3">16V</td><td rowspan="3">≦3.5%</td><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>≦10%</td><td>0201>0.01uF; 0402≧ 0.22uF;
0603>0.47μF; 0805≧2.2μF; 1206≧4.7μF; 1210≧22μF</td></tr>
<tr><td>≦12.5%</td><td>0402≧1μF;0805=10μF</td></tr>
<tr><td rowspan="3">10V</td><td rowspan="3">≦5%</td><td>≦10%</td><td>0201≧0.012μF; 0402≧0.22μF;
0603≧0.33μF; 0805≧2.2μF; 1206≧2.2μF; 1210≧22μF; 01R5/X5R</td></tr>
<tr><td>≦12.5%</td><td>0805=10μF</td></tr>
<tr><td>≦15%</td><td>0201>0.1μF; 0402≧1μF; 0603≧10μF</td></tr>
<tr><td rowspan="3">6.3V</td><td rowspan="3">≦10%</td><td>≦15%</td><td>0201>0.1μF; 0402≧1μF; 0603≧10μF;
0805≧4.7μF; 1206≧47μF; 1210≧100μF</td></tr>
<tr><td>≦20%</td><td>0402≧2.2μF</td></tr>
<tr><td>4V</td><td>≦15%</td><td>---</td><td>---</td></tr>
</table></td></tr>
</table>

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

<table>
<tr><th>No.</th><th>Item</th><th>Test Condition</th><th>Requirements</th></tr>
<tr><td></td><td>Q/ D.F.
(Dissipation
Factor)</td><td></td><td>X6S:
<table>
<tr><th>Rated vol.</th><th>D.F.≦</th><th colspan="2">Exception of D.F. ≦</th></tr>
<tr><td rowspan="3">≧100V</td><td rowspan="3">≦2.5%</td><td>≦3%</td><td>1206≧0.47μF</td></tr>
<tr><td>≦5%</td><td>0603≧0.068μF;0805＞0.1μF;1206≧1μF;1210≧2.2μF</td></tr>
<tr><td>≦10%</td><td>0805＞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≧0.01uF;1210≧3.3μF</td></tr>
<tr><td>≦10%</td><td>0402≧0.012μF;0603>0.1μF; 0805≧1μF;
1206≧2.2μF;1210≧10μF</td></tr>
<tr><td>35V</td><td>≦3.5%</td><td>≦10%</td><td>0603≧1μF;0805≥2.2μF;1206≧2.2μF;1210≧10μF</td></tr>
<tr><td rowspan="4">25V</td><td rowspan="4">≦3.5%</td><td>≦5%</td><td>0201≧0.01μF;0805≧1μF;1210≧10μF</td></tr>
<tr><td>≦7%</td><td>0603≧0.33μF</td></tr>
<tr><td>≦10%</td><td>0201≧0.1μF; 0402≧0.10μF;0603≧0.47μF;
0805≧2.2μF; 1206≧4.7μF;1210≧22μF</td></tr>
<tr><td>≦12.5%</td><td>0402≧0.33μF;0805=10μF</td></tr>
<tr><td rowspan="3">16V</td><td rowspan="3">≦3.5%</td><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>≦10%</td><td>0201≧0.1uF; 0402≧0.22uF;
0603>0.47μF; 0805≧2.2μF;1206≧4.7μF;1210≧22μF</td></tr>
<tr><td>≦12.5%</td><td>0402=1μF;0805=10μF</td></tr>
<tr><td rowspan="3">10V</td><td rowspan="3">≦5%</td><td>≦10%</td><td>0201≧0.012μF;0402≧0.22μF;
0603≧0.33μF; 0805≧2.2μF;1206≧2.2μF;1210≧22μF</td></tr>
<tr><td>≦12.5%</td><td>0805=10μF</td></tr>
<tr><td>≦15%</td><td>0201≧0.1μF; 0402≧1μF</td></tr>
<tr><td rowspan="2">6.3V</td><td rowspan="2">≦10%</td><td>≦15%</td><td>0201≧0.1μF;0402≧0.47μF; 0603≧10μF;
0805≧4.7μF;1206≧47μF; 1210≧100μF</td></tr>
<tr><td>≦20%</td><td>0402≧2.2μF</td></tr>
<tr><td>4V</td><td>≦15%</td><td>---</td><td>---</td></tr>
</table>
X7S:
<table>
<tr><th>Rated vol.</th><th>D.F.≦</th><th colspan="2">Exception of D.F. ≦</th></tr>
<tr><td rowspan="3">≧100V</td><td rowspan="3">≦2.5%</td><td>≦3%</td><td>1206≧0.47μF</td></tr>
<tr><td>≦5%</td><td>0603≧0.068μF;0805＞0.1μF;1206≧1μF;1210≧2.2μF</td></tr>
<tr><td>≦10%</td><td>0805＞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≧0.01uF; 1210≧3.3μF</td></tr>
<tr><td>≦10%</td><td>0402≧0.012μF;0603>0.1μF; 0805≧1μF;
1206≧2.2μF;1210≧10μF</td></tr>
<tr><td>35V</td><td>≦3.5%</td><td>≦10%</td><td>0603≧1μF;0805≥2.2μF;1206≧2.2μF;1210≧10μF</td></tr>
<tr><td rowspan="4">25V</td><td rowspan="4">≦3.5%</td><td>≦5%</td><td>0201≧0.01μF;0805≧1μF;1210≧10μF</td></tr>
<tr><td>≦7%</td><td>0603≧0.33μF</td></tr>
<tr><td>≦10%</td><td>0201≧0.1μF;0402≧0.10μF;0603≧0.47μF;
0805≧2.2μF; 1206≧4.7μF;1210≧22μF</td></tr>
<tr><td>≦12.5%</td><td>0402≧0.33μF</td></tr>
<tr><td rowspan="3">16V</td><td rowspan="3">≦3.5%</td><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>≦10%</td><td>0201≧0.1uF; 0402≧ 0.22uF;
0603>0.47μF;0805≧2.2μF;1206≧4.7μF; 1210≧22μF</td></tr>
<tr><td>≦12.5%</td><td></td></tr>
<tr><td rowspan="3">10V</td><td rowspan="3">≦5%</td><td>≦10%</td><td>0201≧0.012μF;0402≧0.22μF;
0603≧0.33μF; 0805≧2.2μF;1206≧2.2μF;1210≧22μF</td></tr>
<tr><td>≦15%</td><td>0201≧0.1μF; 0402≧1μF</td></tr>
<tr><td>≦12.5%</td><td></td></tr>
<tr><td rowspan="3">6.3V</td><td rowspan="3">≦10%</td><td>≦15%</td><td>0201≧0.1μF;0402≧1μF;0603≧10μF;
0805≧4.7μF; 1206≧47μF; 1210≧100μF</td></tr>
<tr><td>≦20%</td><td>0402≧2.2μF</td></tr>
<tr><td>≦12.5%</td><td></td></tr>
<tr><td>4V</td><td>≦15%</td><td>---</td><td>---</td></tr>
</table></td></tr>
<tr><td>4.</td><td>Dielectric
Strength</td><td>* To apply voltage (≤100V) 250%.
* Duration: 1 to 5 sec.
* Charge and discharge current less than 50mA.</td><td>* No evidence of damage or flash over during test.</td></tr>
</table>

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

<table>
<tr><th>No.</th><th>Item</th><th>Test Condition</th><th>Requirements</th></tr>
<tr><td>5.</td><td>Insulation Resistance</td><td>*Test temp.: Room Temperature.
*To apply rated voltage for MAX. 120sec.</td><td>10GΩ or RxC≧500Ω-F whichever is smaller.
Class II (X7R, X7E, X5R,X6S,X7S)
<table>
<tr><th>Rated voltage</th><th>Insulation Resistance</th></tr>
<tr><td>100V: All X7R</td><td rowspan="7">10GΩ or RxC≧100 Ω-F whichever is smaller.</td></tr>
<tr><td>50V:0402>0.01μF;0603≥1μF;0805≥1μF;1206≥4.7μF;1210≥4.7μF</td></tr>
<tr><td>35V: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></tr>
</table>
<table>
<tr><th>Rated voltage</th><th>Insulation Resistance</th></tr>
<tr><td>All X6S items, All X7S items</td><td rowspan="10">RxC≧50 Ω-F.</td></tr>
<tr><td>100V: 1210≥3.3μF</td></tr>
<tr><td>50V: 0402≥0.1μF; 0603≥2.2μF; 0805≥10μF;1206≥10μF</td></tr>
<tr><td>35V: 0603≥1μF;</td></tr>
<tr><td>25V: 0201≥0.1μF; 0402≥2.2μF;0603≥10μF; 0805≥10μF;1206≥22μF</td></tr>
<tr><td>16V: 0603≥10μF; 0402≥1μF; 0201≥0.22μF</td></tr>
<tr><td>10V: 0201>0.1μF; 0402≥1μF; 0603≥10μF; 0805≥47μF</td></tr>
<tr><td>6.3V:0201≥0.1μF; 0402≥1μF; 0603>4.7μF; 0805≥47μF; 1206≥10μF</td></tr>
<tr><td>4V: 0603≥22μF; 0805≥47μF; 1206≥100μF</td></tr>
</table></td></tr>
<tr><td>6.</td><td>Temperature Coefficient</td><td>With no electrical load.
<table>
<tr><th>T.C.</th><th>Operating Temp</th></tr>
<tr><td>NPO</td><td>-55~125°C at 25°C</td></tr>
<tr><td>X7R</td><td>-55~125°C at 25°C</td></tr>
<tr><td>X7S</td><td>-55 ~ 125°C at 25°C</td></tr>
<tr><td>X5R</td><td>-55~ 85°C at 25°C</td></tr>
<tr><td>X6S</td><td>-55~105°C at 25°C</td></tr>
</table>
*Before initial measurement (Class II only): To apply de-aging at 150°C for 1hr then set for 24±2 hrs at room temp.
* Measurement voltage for Class II:
<table>
<tr><th>T.C.</th><th>Capacitance Change</th></tr>
<tr><td>NPO</td><td>Within ±30ppm/°C</td></tr>
<tr><td>X7R</td><td>Within ±15%</td></tr>
<tr><td>X7S</td><td>Within ±22%</td></tr>
<tr><td>X5R</td><td>Within ±15%</td></tr>
<tr><td>X6S</td><td>Within ±22%</td></tr>
</table>
<table>
<tr><th>01005</th><th>0201</th></tr>
<tr><td>Cap≤0.01μF: 0.5V</td><td>Cap<0.1μF:1V</td></tr>
<tr><td>Cap>0.01μF: 0.2V</td><td>0.1μF≤Cap<1μF: 0.2V*</td></tr>
<tr><td></td><td>Cap≥1μF: 0.1V*</td></tr>
<tr><td>*0201X104/6.3V~25V: 0.5V
0201X224/10V~25V: 0.5V
0201X474/10V: 0.5V</td><td>*0201S104/6.3V~16V: 0.3V
0201S224/6.3V: 0.3V
0201X105/6.3V&10V: 0.3V</td></tr>
<tr><th>0402</th><th>0603</th></tr>
<tr><td>Cap<1μF: 1V</td><td>Cap<1μF: 1V</td></tr>
<tr><td>Cap=1μF: 0.5V**
0402B224-16V: 0.5V
0402B334/474-6.3V&10V: 0.5V
0402S334/474-6.3V: 0.5V
0402X225/475-6.3V: 0.5V</td><td>1μF≤Cap≤4.7μF: 0.5V
0603X106-10V: 0.5V</td></tr>
<tr><td>1μF<Cap<10μF: 0.2V
**0402B105M6R3V: 0.2V</td><td>Cap>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<10μF: 1V</td><td>Cap≤10μF: 1V</td></tr>
<tr><td>Cap=10μF: 0.5V
0805B475/6.3V~25V: 0.5V</td><td>10μF<Cap≤100μF: 0.5V</td></tr>
<tr><td>Cap>10μF: 0.2V</td><td>Cap>100μF: 0.2V
1206X107-6.3V: 0.2V
1210S107-6.3V: 0.2V</td></tr>
</table></td></tr>
</table>

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

No.	Item	Test Condition	Requirements
7.	**Adhesive Strength of Termination**	* Pressurizing force： 2N (0201) and 5N (≤0603) and 10N (>0603) * Test time: 10±1 sec.	* No remarkable damage or removal of the terminations.
8.	**Vibration Resistance**	* Vibration frequency: 10~55 Hz/min. * Total amplitude: 1.5mm * Test time: 6 hrs. (Two hrs each in three mutually perpendicular directions.) *Before initial measurement (Class II only): To apply de-aging at 150°C for 1hr then set for 24±2 hrs at room temp. *Cap./DF(Q) Measurement to be made after de-aging at 150°C for 1hr then set for 24±2 hrs at room temp.	* No remarkable damage. * Cap change and Q/D.F.: To meet initial spec.
9.	**Solderability**	* Solder temperature: 235±5°C * Dipping time: 2±0.5 sec.	* 95% min. coverage of all metalized area.
10.	**Bending Test**	* The middle part of substrate shall be pressurized by means of the pressurizing rod at a rate of about 1 mm per second until the deflection becomes 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.	* No remarkable damage. * Cap change： NP0: within ±5% or 0.5pF whichever is larger X7R, X5R, X6S, X7S: within ±12.5% (This capacitance change means the change of capacitance under specified flexure of substrate from the capacitance measured before the test.)
11.	**Resistance to Soldering Heat**	* Solder temperature: 260±5°C * Dipping time: 10±1 sec * Preheating: 120 to 150°C for 1 minute before immerse the capacitor in a eutectic solder. *Before initial measurement (Class II only): To apply de-aging at 150°C for 1hr then set for 24±2 hrs at room temp. *Cap. / DF(Q) / I.R. Measurement to be made after de-aging at 150°C for 1hr then set for 24±2 hrs at room temp.	* No remarkable damage. * Cap change: NP0: within ±2.5% or 0.25pF whichever is larger X7R, X5R, X6S, X7S: within ±7.5% * Q/D.F., I.R. and dielectric strength: To meet initial requirements. * 25% max. leaching on each edge.
12.	**Temperature Cycle**	* Conduct the five cycles according to the temperatures and time. 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 *Before initial measurement (Class II only): To apply de-aging at 150°C for 1hr then set for 24±2 hrs at room temp. * Cap. / DF(Q) / I.R. Measurement to be made after de-aging at 150°C for 1hr then set for 24±2 hrs at room temp.	* No remarkable damage. * Cap change： NP0: within ±2.5% or 0.25pF whichever is larger X7R, X5R, X6S, X7S: within ±7.5% * Q/D.F., I.R. and dielectric strength: To meet initial requirements.

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

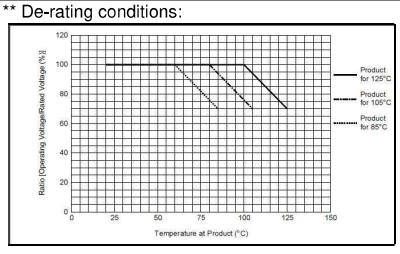
<table>
<tr><th>No.</th><th>Item</th><th>Test Condition</th><th>Requirements</th></tr>
<tr><td>13.</td><td>Humidity (Damp Heat) Steady State</td><td>*Test temp.: 40±2°C
*Humidity: 90~95%RH
*Test time: 500+24/-0hrs.
*Before initial measurement (Class II only): To apply de-aging at 150°C for 1hr then set 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 ro0om temp.</td><td>* 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%;
**10V: 0603≧4.7μF;0402≧1μF;0201≧0.1μF, within ±25%;
* Q/D.F. value:
NP0: More than 30pF Q≥350, 10pF≤C<30pF, Q≥275+2.5C
Less than 10pF Q≥200+10C
X7R, X5R, X6S, X7S:
<table>
<tr><th>Rated vol.</th><th>D.F.≦</th><th colspan="2">Exception of D.F.≦</th></tr>
<tr><td rowspan="4">100V</td><td rowspan="4">≦3%</td><td>≦6%</td><td>1206≧0.47μF</td></tr>
<tr><td>≦7%</td><td>1812≧4.7μF;1825≥4.7μF; 2220≥4.7μF; 2225≥4.7μF</td></tr>
<tr><td>≦7.5%</td><td>0603≧0.068μF;0805＞0.1μF;1206≧1μF;1210≧2.2μF</td></tr>
<tr><td>≦20%</td><td>0805＞0.22μF;1210≧3.3μF</td></tr>
<tr><td rowspan="4">50V</td><td rowspan="4">≦3%</td><td>≦6%</td><td>0201(50V);0603≧0.047μF;0805≧0.18μF;1206≧0.47μF</td></tr>
<tr><td>≦7%</td><td>1812≧4.7μF;1825≥4.7μF; 2220≥4.7μF; 2225≥4.7μF</td></tr>
<tr><td>≦10%</td><td>0201≧0.01uF;1210≧3.3μF</td></tr>
<tr><td>≦20%</td><td>0402≧0.012μF;0603>0.1μF;0805≧1μF(0805/X7R>0.47μF);
1206≧2.2μF;1210≧10μF;</td></tr>
<tr><td>35V</td><td>≦5%</td><td>≦20%</td><td>0603≧1μF;0805≥2.2μF;1206≧2.2μF;1210≧10μF</td></tr>
<tr><td rowspan="4">25V</td><td rowspan="4">≦5%</td><td>≦10%</td><td>0201≧0.01μF(0201/X5R=0.01μF);0805≧1μF;1210≧10μF*</td></tr>
<tr><td>≦14%</td><td>0603≧0.33μF</td></tr>
<tr><td>≦15%</td><td>0201≧0.1μF(0201/X5R>0.01μF); 0603≧0.47μF;TTseries
0402≧0.10μF(0402/X7R≧0.056μF);0805≧2.2μF;
1206≧4.7μF;1210≧22μF(1210/X5R≧10μF)*;</td></tr>
<tr><td>≦20%</td><td>0402≧0.33μF</td></tr>
<tr><td rowspan="2">16V</td><td rowspan="2">≦5%</td><td>≦10%</td><td>0603≧0.15μF;0805≧0.68μF;1206≧2.2μF;1210≧4.7μF</td></tr>
<tr><td>≦15%</td><td>0201≧0.01μF(0201/X7R≧0.022μF);0402≧0.033μF;
0603>0.47μF;0805≧2.2μF;1206≧4.7μF;1210≧22μF</td></tr>
<tr><td rowspan="2">10V</td><td rowspan="2">≦7.5%</td><td>≦15%</td><td>0201≧0.012μF;0402≧0.22μF (0402/X7R≧0.15μF);
0603≧0.33μF;0805≧2.2μF;1206≧2.2μF;1210≧22μF</td></tr>
<tr><td>≦20%</td><td>0201≧0.1μF;0402≧1μF;0603/X5R≧10μF;01R5/X5R</td></tr>
<tr><td>6.3V</td><td>≦15%</td><td>≦30%</td><td>0201≧0.1μF;0402≧1μF(0402/X6S≧0.47μF);
0603≧10μF;0805≧4.7μF;1206≧47μF;1210≧100μF</td></tr>
<tr><td>4V</td><td>≦20%</td><td>---</td><td>---</td></tr>
</table>
*I.R.: ≥10V, 1GΩ or 50 Ω-F whichever is smaller.
Class II (X7R, X5R, X6S, X7S)
<table>
<tr><th>Rated voltage</th><th>Insulation Resistance</th></tr>
<tr><td>100V: All X7R;1210≥3.3μF</td><td rowspan="7">1GΩ or RxC≧10 Ω-F whichever is smaller.</td></tr>
<tr><td>50V: 0402>0.01μF;0603≥1μF;0805≥1μF;1206≥4.7μF;1210≥4.7μF</td></tr>
<tr><td>35V:0603≥1μF;0805≥2.2μF; 1206≧2.2μF;1210≧10μF</td></tr>
<tr><td>25V:0201≧0.1uF; 0402≥0.22μF; 0603≥2.2μF;0805≥2.2μF;
1206≥10μF;1210≥10μF</td></tr>
<tr><td>16V: 0201≧0.1uF;0402≥0.22μF;0603≥1μF;0805≥2.2μF;
1206≥10μF;1210≥47μF</td></tr>
<tr><td>10V:0201≥47nF;0402≥0.47μF;0603≥0.47μF;0805≥2.2μF;
1206≥4.7μF;1210≥47μF</td></tr>
<tr><td>6.3V ; 4V ; All X6S/X7S items; Size≥1812</td></tr>
</table></td></tr>
</table>

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

<table>
<tr><th>No</th><th>Item</th><th>Test Condition</th><th>Requirements</th></tr>
<tr><td>14</td><td>Humidity (Damp Heat) Load</td><td>*Test temp.：40±2°C
*Humidity：90~95%RH
*Test time：500+24/-0 hrs.
*To apply voltage：
Rated voltage (MAX. 500V)
*Before initial measurement (Class II only): To apply de-aging at 150°C for 1hr then set for 24±2 hrs at room temp.
* Cap. / DF(Q) / I.R. Measurement to be made after de-aging at 150°C for 1hr then set for 24±2 hrs at room temp.</td><td>* 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%;
**10V: 0603≧4.7μF;0402≧1μF;0201≧0.1μF, within ±25%;
Q/D.F. value:
NP0: C≥30pF,Q≥200;C<30pF, Q≥100+10/3C
X7R, X5R, X6S, X7S:
<table>
<tr><th>Rated vol.</th><th>D.F.≦</th><th colspan="2">Exception of D.F.≦</th></tr>
<tr><td rowspan="4">100V</td><td rowspan="4">≦3%</td><td>≦6%</td><td>1206≧0.47μF</td></tr>
<tr><td>≦7%</td><td>1812≧4.7μF;1825≥4.7μF; 2220≥4.7μF; 2225≥4.7μF</td></tr>
<tr><td>≦7.5%</td><td>0603≧0.068μF;0805＞0.1μF;1206≧1μF;1210≧2.2μF</td></tr>
<tr><td>≦20%</td><td>0805＞0.22μF;1210≧3.3μF</td></tr>
<tr><td rowspan="4">50V</td><td rowspan="4">≦3%</td><td>≦6%</td><td>0201(50V);0603≧0.047μF;0805≧0.18μF;1206≧0.47μF</td></tr>
<tr><td>≦7%</td><td>1812≧4.7μF;1825≥4.7μF; 2220≥4.7μF; 2225≥4.7μF</td></tr>
<tr><td>≦10%</td><td>0201≧0.01uF;1210≧3.3μF</td></tr>
<tr><td>≦20%</td><td>0402≧0.012μF;0603>0.1μF;0805≧1μF(0805/X7R>0.47μF);
1206≧2.2μF;1210≧10μF;</td></tr>
<tr><td>35V</td><td>≦5%</td><td>≦20%</td><td>0603≧1μF;0805≥2.2μF;1206≧2.2μF;1210≧10μF</td></tr>
<tr><td rowspan="4">25V</td><td rowspan="4">≦5%</td><td>≦10%</td><td>0201≧0.01μF(0201/X5R=0.01μF);0805≧1μF;1210≧10μF*</td></tr>
<tr><td>≦14%</td><td>0603≧0.33μF</td></tr>
<tr><td>≦15%</td><td>0201≧0.1μF(0201/X5R>0.01μF); 0603≧0.47μF;TTseries
0402≧0.10μF(0402/X7R≧0.056μF);0805≧2.2μF;
1206≧4.7μF;1210≧22μF(1210/X5R≧10μF)*;</td></tr>
<tr><td>≦20%</td><td>0402≧0.33μF</td></tr>
<tr><td rowspan="2">16V</td><td rowspan="2">≦5%</td><td>≦10%</td><td>0603≧0.15μF;0805≧0.68μF;1206≧2.2μF;1210≧4.7μF</td></tr>
<tr><td>≦15%</td><td>0201≧0.01μF(0201/X7R≧0.022μF);0402≧0.033μF;
0603>0.47μF;0805≧2.2μF;1206≧4.7μF;1210≧22μF</td></tr>
<tr><td rowspan="3">10V</td><td rowspan="3">≦7.5%</td><td>≦15%</td><td>0201≧0.012μF;0402≧0.22μF (0402/X7R≧0.15μF);
0603≧0.33μF;0805≧2.2μF;1206≧2.2μF;1210≧22μF</td></tr>
<tr><td>≦20%</td><td>0201≧0.1μF;0402≧1μF;0603/X5R≧10μF;01R5/X5R</td></tr>
<tr><td>6.3V</td><td>≦15%</td><td>≦30%</td><td>0201≧0.1μF;0402≧1μF(0402/X6S≧0.47μF);
0603≧10μF;0805≧4.7μF;1206≧47μF;1210≧100μF</td></tr>
<tr><td>4V</td><td>≦20%</td><td>---</td><td>---</td></tr>
</table>
*I.R.: ≥10V, 500MΩ or 25 Ω-F whichever is smaller.
Class II (X7R, X5R, X6S, X7S)
<table>
<tr><th>Rated voltage</th><th>Insulation Resistance</th></tr>
<tr><td>100V: All X7R;1210≥3.3μF</td><td rowspan="6">500MΩ or RxC≧5 Ω-F whichever is smaller.</td></tr>
<tr><td>50V: 0402>0.01μF;0603≥1μF;0805≥1μF;1206≥4.7μF;1210≥4.7μF</td></tr>
<tr><td>35V:0603≥1μF;0805≥2.2μF; 1206≧2.2μF;1210≧10μF</td></tr>
<tr><td>25V:0201≧0.1uF; 0402≥0.22μF; 0603≥2.2μF;0805≥2.2μF;
1206≥10μF;1210≥10μF</td></tr>
<tr><td>16V: 0201≧0.1uF;0402≥0.22μF;0603≥1μF;0805≥2.2μF;
1206≥10μF;1210≥47μF</td></tr>
<tr><td>10V:0201≥47nF;0402≥0.47μF;0603≥0.47μF;0805≥2.2μF;
1206≥4.7μF;1210≥47μF</td></tr>
<tr><td>6.3V ; 4V ; All X6S/X7S items; Size≥1812</td></tr>
</table></td></tr>
</table>

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

<table>
<tr><th>No</th><th>Item</th><th>Test Condition</th><th>Requirements</th></tr>
<tr><td>15.</td><td>High Temperature Load (Endurance)</td><td>
*Test temp. :
NP0, X7R/X7E/X7S: 125±3°C
X6S: 105±3°C
X5R: 85±3°C
*Test time: 1000+24/-0 hrs.
*To apply voltage:
(1) 100% of rated voltage for below range.
<table>
<tr><th>Size</th><th>Dielectric</th><th>Rated voltage</th><th>Capacitance</th></tr>
<tr><td>01R5</td><td>X5R</td><td>=10V</td><td>C=0.1μF</td></tr>
<tr><td rowspan="2">0201</td><td rowspan="2">X5R/X7R/
X6S/X7S</td><td>≦10V</td><td>C≧0.1μF</td></tr>
<tr><td>≧16V</td><td>C >0.1μF</td></tr>
<tr><td rowspan="3">0402</td><td rowspan="2">X5R</td><td>≦16V</td><td>C >1.0μF</td></tr>
<tr><td>25V,50V</td><td>C≧1.0μF</td></tr>
<tr><td>X6S</td><td>6.3V,10V</td><td>C >1.0μF</td></tr>
<tr><td></td><td>X7R/X7S</td><td>16V,25V</td><td>C≧1.0μF</td></tr>
<tr><td rowspan="3">0603</td><td rowspan="2">X5R/X7R/
X6S/X7S</td><td>6.3V,10V</td><td>C≧1.0μF</td></tr>
<tr><td>4V</td><td>C≧22μF</td></tr>
<tr><td>X5R/X6S/X7S</td><td>6.3V,10V</td><td>C≧4.7μF#1</td></tr>
<tr><td></td><td>X7R</td><td>25V</td><td>C≧1.0μF</td></tr>
<tr><td rowspan="4">0805</td><td rowspan="3">X5R/X7R/
X6S/X7S</td><td>35V</td><td>C≧1.0μF</td></tr>
<tr><td>4V</td><td>C≧47μF</td></tr>
<tr><td>6.3V</td><td>C≧22μF</td></tr>
<tr><td rowspan="2">X6S</td><td>10V,50V</td><td>C≧10μF</td></tr>
<tr><td>16V</td><td>C >10μF</td></tr>
<tr><td rowspan="2">1206</td><td>X7R/X7S</td><td rowspan="2">25V</td><td>C≧10μF</td></tr>
<tr><td>X5R</td><td>C≧22μF</td></tr>
<tr><td>1206</td><td>X5R/X7R/X6S</td><td>≦6.3V</td><td>C≧47μF</td></tr>
<tr><td rowspan="2">1210</td><td>X5R/X7R/X6S</td><td>16V</td><td>C≧47μF</td></tr>
<tr><td>X7R</td><td>100V</td><td>C≧3.3μF</td></tr>
<tr><td>TT15</td><td>X5R</td><td>6.3V</td><td>C >1.0μF</td></tr>
<tr><td>TT21</td><td>X5R/X7R/X6S</td><td>≦10V</td><td>C≧10μF</td></tr>
</table>
**1WV items must follow de-rating conditions.
#1. 0603X106(10V)&0603S106(4V&6.3V):150% of rated voltage
(2) 150% of rated voltage for below range.
<table>
<tr><th>Size</th><th>Dielectric</th><th>Rated voltage</th><th>Capacitance</th></tr>
<tr><td rowspan="2">0201</td><td>X5R/X6S</td><td>16V,25V</td><td>C=0.1μF</td></tr>
<tr><td>X7R</td><td>16V</td><td>C≧0.022μF</td></tr>
<tr><td rowspan="2">0402</td><td rowspan="2">X7R/X5R/
X6S</td><td>50V</td><td>C>0.01μF</td></tr>
<tr><td>10~25V</td><td>C≧0.22μF</td></tr>
<tr><td rowspan="5">0603</td><td>X7S</td><td>50V~100V</td><td>C>0.22μF</td></tr>
<tr><td rowspan="2">X7R</td><td>50V</td><td>C>0.1μF</td></tr>
<tr><td>25V</td><td>C=1.0μF</td></tr>
<tr><td>X5R</td><td>50V</td><td>C≧1.0μF</td></tr>
<tr><td>X5R/X7R/
X6S/X7S</td><td>10V,16V</td><td>C≧1.0μF</td></tr>
<tr><td rowspan="4">0805</td><td rowspan="4">X5R/X7R/
X6S/X7S</td><td>100V</td><td>C≧0.47μF</td></tr>
<tr><td>50V</td><td>C≧0.68μF</td></tr>
<tr><td>35V</td><td>C≧2.2μF</td></tr>
<tr><td>10~25V</td><td>C≧4.7μF</td></tr>
<tr><td rowspan="3">1206</td><td rowspan="2">X7R</td><td>100V</td><td>C≧1.0μF</td></tr>
<tr><td>50V</td><td>C≧2.2μF</td></tr>
<tr><td>X5R/X6S/
X7S</td><td>100V</td><td>C>1.0μF</td></tr>
<tr><td>1210</td><td>X5R/X7R/
X6S/X7S</td><td>50V~100V</td><td>C≧2.2μF</td></tr>
<tr><td rowspan="2">1812</td><td rowspan="2">X7R</td><td>≦50V</td><td>C≧4.7μF</td></tr>
<tr><td>100V</td><td>C≧1.0μF</td></tr>
<tr><td>1825
2220
2225</td><td>X7R</td><td>100V~250V</td><td>C≧1.0μF</td></tr>
</table>
(3) ≤ 6.3V or C ≥10μF :150% of rated voltage.
(4) 10V ≤ Ur < 250V: 200% of rated voltage.
(5) 500V: 150% of rated voltage.
(6) Ur ≥ 630V: 120% of rated voltage

* Before initial measurement (Class II only): To apply de-aging at 150°C for 1hr then set for 24±2 hrs at room temp.
* Cap. / DF(Q) / I.R. Measurement to be made after de-aging at 150°C for 1hr then set for 24±2 hrs at room temp.
</td><td>
* No remarkable damage.
Cap change:
NP0: ±3.0% or ±0.3pF whichever is larger
X7R, X5R, X6S, X7S: ≥10V**,within ±12.5%; ≤ 6.3V within ±25%;
**10V: 0603≥4.7μF;0402≥1μF;0201≥0.1μF, within ±25%
Q/D.F. value:
NP0: More than 30pF, Q≥350
10pF≤C<30pF, Q≥275+2.5C
Less than 10pF, Q≥200+10C
X7R, X5R, X6S, X7S:
<table>
<tr><th>Rated vol.</th><th>D.F.≦</th><th colspan="2">Exception of D.F.≦</th></tr>
<tr><td rowspan="4">100V</td><td rowspan="4">≦3%</td><td>≦6%</td><td>1206≧0.47μF</td></tr>
<tr><td>≦7%</td><td>1812≧4.7μF;1825≥4.7μF; 2220≥4.7μF; 2225≥4.7μF</td></tr>
<tr><td>≦7.5%</td><td>0603≧0.068μF;0805＞0.1μF;1206≧1μF;1210≧2.2μF</td></tr>
<tr><td>≦20%</td><td>0805＞0.22μF;1210≧3.3μF</td></tr>
<tr><td rowspan="4">50V</td><td rowspan="4">≦3%</td><td>≦6%</td><td>0201(50V);0603≧0.047μF;0805≧0.18μF;1206≧0.47μF</td></tr>
<tr><td>≦7%</td><td>1812≧4.7μF;1825≥4.7μF; 2220≥4.7μF; 2225≥4.7μF</td></tr>
<tr><td>≦10%</td><td>0201≧0.01uF;1210≧3.3μF</td></tr>
<tr><td>≦20%</td><td>0402≧0.012μF;0603>0.1μF;0805≧1μF(0805/X7R>0.47μF);
1206≧2.2μF;1210≧10μF;</td></tr>
<tr><td>35V</td><td>≦5%</td><td>≦20%</td><td>0603≧1μF;0805≥2.2μF;1206≧2.2μF;1210≧10μF</td></tr>
<tr><td rowspan="5">25V</td><td rowspan="5">≦5%</td><td>≦10%</td><td>0201≧0.01μF(0201/X5R=0.01μF);0805≧1μF;1210≧10μF*</td></tr>
<tr><td>≦14%</td><td>0603≧0.33μF</td></tr>
<tr><td>≦15%</td><td>0201≧0.1μF(0201/X5R>0.01μF); 0603≧0.47μF;TTseries
0402≧0.10μF(0402/X7R≧0.056μF);0805≧2.2μF;
1206≧4.7μF;1210≧22μF(1210/X5R≧10μF)*;</td></tr>
<tr><td>≦20%</td><td>0402≧0.33μF</td></tr>
<tr><td>≦10%</td><td>0603≧0.15μF;0805≧0.68μF;1206≧2.2μF;1210≧4.7μF</td></tr>
<tr><td>16V</td><td>≦5%</td><td>≦15%</td><td>0201≧0.01μF(0201/X7R≧0.022μF);0402≧0.033μF;
0603>0.47μF;0805≧2.2μF;1206≧4.7μF;1210≧22μF</td></tr>
<tr><td rowspan="2">10V</td><td rowspan="2">≦7.5%</td><td>≦15%</td><td>0201≧0.012μF;0402≧0.22μF (0402/X7R≧0.15μF);
0603≧0.33μF;0805≧2.2μF;1206≧2.2μF;1210≧22μF</td></tr>
<tr><td>≦20%</td><td>0201≧0.1μF;0402≧1μF;0603/X5R≧10μF;01R5/X5R</td></tr>
<tr><td>6.3V</td><td>≦15%</td><td>≦30%</td><td>0201≧0.1μF;0402≧1μF(0402/X6S≧0.47μF);
0603≧10μF;0805≧4.7μF;1206≧47μF;1210≧100μF</td></tr>
<tr><td>4V</td><td>≦20%</td><td>---</td><td>---</td></tr>
</table>
*I.R.: ≥10V, 1GΩ or 50 Ω-F whichever is smaller.
Class II (X7R, X5R, X6S, X7S)
<table>
<tr><th>Rated voltage</th><th>Insulation Resistance</th></tr>
<tr><td>100V: All X7R;1210≥3.3μF</td><td rowspan="6">1GΩ or RxC≧ 10 Ω-F whichever is smaller.</td></tr>
<tr><td>50V: 0402>0.01μF;0603≥1μF;0805≥1μF;1206≥4.7μF;1210≥4.7μF</td></tr>
<tr><td>35V:0603≥1μF;0805≥2.2μF; 1206≧2.2μF;1210≧10μF</td></tr>
<tr><td>25V:0201≧0.1uF; 0402≥0.22μF; 0603≥2.2μF;0805≥2.2μF;
1206≥10μF;1210≥10μF</td></tr>
<tr><td>16V: 0201≧0.1uF;0402≥0.22μF;0603≥1μF;0805≥2.2μF;
1206≥10μF;1210≥47μF</td></tr>
<tr><td>10V:0201≥47nF;0402≥0.47μF;0603≥0.47μF;0805≥2.2μF;
1206≥4.7μF;1210≥47μF</td></tr>
<tr><td colspan="2">6.3V ; 4V ; All X6S/X7S items; Size≥1812</td></tr>
</table>
** De-rating conditions:


</td></tr>
</table>

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

APPENDIXES

◙ Tape & reel dimensions

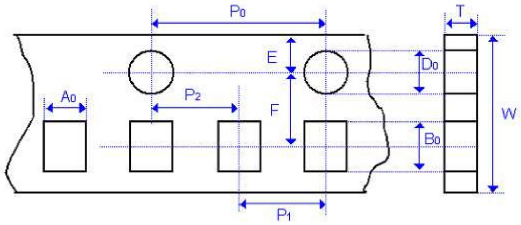


Fig. 2 The dimension of paper tape

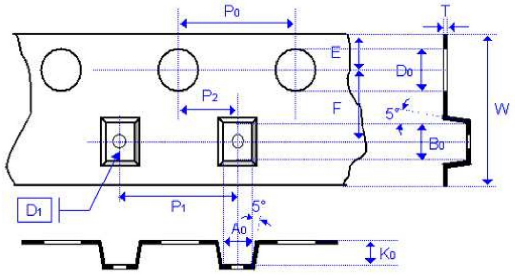


Fig. 3 The dimension of plastic tape

Size	0201	0402	0603	0805			1206			1210				1808		1812		
Thickness	L	N,E	S,H,X	A,H	B,T	D,I	B,T	C,J,D	G,P	T	C,D	G,K	M	D,F	G,K	D,F	G,K	M,U
A_0	0.40 +/-0.10	0.70 +/-0.20	1.05 +/-0.30	1.50 +/-0.20	1.50 +/-0.20	< 1.80	1.90 +/-0.50	< 2.00	<2.30	< 3.05	< 3.05	< 3.05	< 3.20	< 2.50	< 2.50	< 3.90	< 3.90	< 3.90
B_0	0.70 +/-0.10	1.20 +/-0.20	1.80 +/-0.30	2.30 +/-0.20	2.30 +/-0.20	< 2.70	3.50 +/-0.50	< 3.70	< 4.00	< 3.80	< 3.80	< 3.80	<4.00	< 5.30	< 5.30	< 5.30	< 5.30	< 5.30
T	≦0.55	≦0.80	≦1.20	≦1.15	≦1.20	0.23 +/-0.1	≦1.20	0.23 +/-0.1	0.23 +/-0.1	0.23 +/-0.1	0.23 +/-0.1	0.23 +/-0.1	0.23 +/-0.1	0.25 +/-0.1	0.25 +/-0.1	0.25 +/-0.1	0.25 +/-0.1	0.25 +/-0.1
K_0	-	-	-	-	-	< 2.00	-	< 2.00	< 2.50	< 1.50	< 2.00	< 2.50	< 3.20	< 2.00	< 2.50	< 2.00	< 2.50	< 3.50
W	8.00 +/-0.30	8.00 +/-0.30	8.00 +/-0.30	8.00 +/-0.30	8.00 +/-0.30	8.00 +/-0.30	8.00 +/-0.30	8.00 +/-0.30	8.00 +/-0.30	8.00 +/-0.30	8.00 +/-0.30	8.00 +/-0.30	8.00 +/-0.30	12.00 +/-0.30	12.00 +/-0.30	12.00 +/-0.30	12.00 +/-0.30	12.00 +/-0.30
P_0	4.00 +/-0.10	4.00 +/-0.10	4.00 +/-0.10	4.00 +/-0.10	4.00 +/-0.10	4.00 +/-0.10	4.00 +/-0.10	4.00 +/-0.10	4.00 +/-0.10	4.00 +/-0.10	4.00 +/-0.10	4.00 +/-0.10	4.00 +/-0.10	4.00 +/-0.10	4.00 +/-0.10	4.00 +/-0.10	4.00 +/-0.10	4.00 +/-0.10
$10xP_0$	40.00 +/-0.10	40.00 +/-0.10	40.00 +/-0.20	40.00 +/-0.20	40.00 +/-0.20	40.00 +/-0.20	40.00 +/-0.20	40.00 +/-0.20	40.00 +/-0.20	40.00 +/-0.20	40.00 +/-0.20	40.00 +/-0.20	40.00 +/-0.20	40.00 +/-0.20	40.00 +/-0.20	40.00 +/-0.20	40.00 +/-0.20	40.00 +/-0.20
P_1	2.00 +/-0.05	2.00 +/-0.05	4.00 +/-0.10	4.00 +/-0.10	4.00 +/-0.10	4.00 +/-0.10	4.00 +/-0.10	4.00 +/-0.10	4.00 +/-0.10	4.00 +/-0.10	4.00 +/-0.10	4.00 +/-0.10	4.00 +/-0.10	4.00 +/-0.10	4.00 +/-0.10	8.00 +/-0.10	8.00 +/-0.10	8.00 +/-0.10
P_2	2.00 +/-0.05	2.00 +/-0.05	2.00 +/-0.05	2.00 +/-0.05	2.00 +/-0.05	2.00 +/-0.05	2.00 +/-0.05	2.00 +/-0.05	2.00 +/-0.05	2.00 +/-0.05	2.00 +/-0.05	2.00 +/-0.05	2.00 +/-0.05	2.00 +/-0.10	2.00 +/-0.10	2.00 +/-0.10	2.00 +/-0.10	2.00 +/-0.10
D_0	1.50 +0.1/-0	1.50 +0.1/-0	1.50 +0.1/-0	1.50 +0.1/-0	1.50 +0.1/-0	1.50 +0.1/-0	1.50 +0.1/-0	1.50 +0.1/-0	1.50 +0.1/-0	1.50 +0.1/-0	1.50 +0.1/-0	1.50 +0.1/-0	1.50 +0.1/-0	1.50 +0.1/-0	1.50 +0.1/-0	1.50 +0.1/-0	1.50 +0.1/-0	1.50 +0.1/-0
D_1	-	-	-	-	-	1.00 +/-0.10	-	1.00 +/-0.10	1.00 +/-0.10	1.00 +/-0.10	1.00 +/-0.10	1.00 +/-0.10	1.00 +/-0.10	1.50 +/-0.10	1.50 +/-0.10	1.50 +/-0.10	1.50 +/-0.10	1.50 +/-0.10
E	1.75 +/-0.10	1.75 +/-0.10	1.75 +/-0.10	1.75 +/-0.10	1.75 +/-0.10	1.75 +/-0.10	1.75 +/-0.10	1.75 +/-0.10	1.75 +/-0.10	1.75 +/-0.10	1.75 +/-0.10	1.75 +/-0.10	1.75 +/-0.10	1.75 +/-0.10	1.75 +/-0.10	1.75 +/-0.10	1.75 +/-0.10	1.75 +/-0.10
F	3.50 +/-0.05	3.50 +/-0.05	3.50 +/-0.05	3.50 +/-0.05	3.50 +/-0.05	3.50 +/-0.05	3.50 +/-0.05	3.50 +/-0.05	3.50 +/-0.05	3.50 +/-0.05	3.50 +/-0.05	3.50 +/-0.05	3.50 +/-0.05	5.50 +/-0.10	5.50 +/-0.10	5.50 +/-0.10	5.50 +/-0.10	5.50 +/-0.10

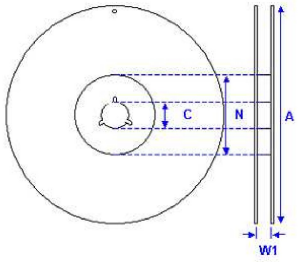
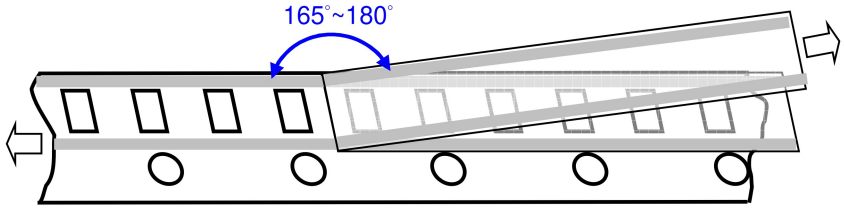


Fig. 4 The dimension of reel

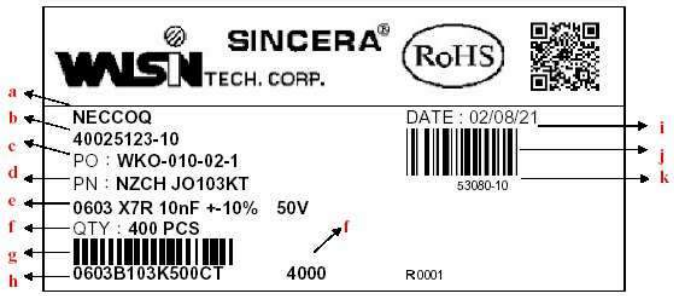
Size	0201, 0402, 0603, 0805, 1206, 1210			1812
Reel size	7”	10”	13”	7”
C	13.0±0.5	13.0±0.5	13.0±0.5	13.0±0.5
W_1	10.0±1.5	10.0±1.5	10.0±1.5	12.4+2.0/-0
A	178.0±2.0	250.0±2.0	330.0±2.0	178.0±2.0
N	60.0+1.0/-0	50 min	50 min	60.0+1.0/-0

◙ Peeling force (EIA-481)

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



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
①	Ceramic material		$CaZrO_3$ based	$BaTiO_3$ based
②	Inner electrode		Ni	
③	Termination	Inner layer	Cu	
④		Middle layer	Ni	
⑤		Outer layer	Sn	

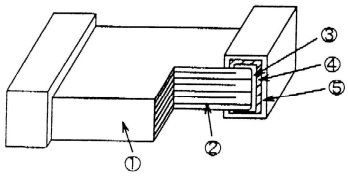


Fig. 5 The construction of MLCC

Storage and handling conditions

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

(2) The product is recommended to be used within one year after shipment. Check solderability in case of shelf life extension is needed.

Cautions:

a. The corrosive gas reacts on the terminal electrodes of capacitors, and results in the poor solderability. Do not store the capacitors in the ambience of corrosive gas (e.g., hydrogen sulfide, sulfur dioxide, chlorine, ammonia gas etc.)

b. In corrosive atmosphere, solderability might be degraded, and silver migration might occur to cause low reliability.

c. Due to the dewing by rapid humidity change, or the photochemical change of the terminal electrode by direct sunlight, the solderability and electrical performance may deteriorate. Do not store capacitors under direct sunlight or dewing condition. To store products on the shelf and avoid exposure to moisture.

◙ Recommended soldering conditions

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

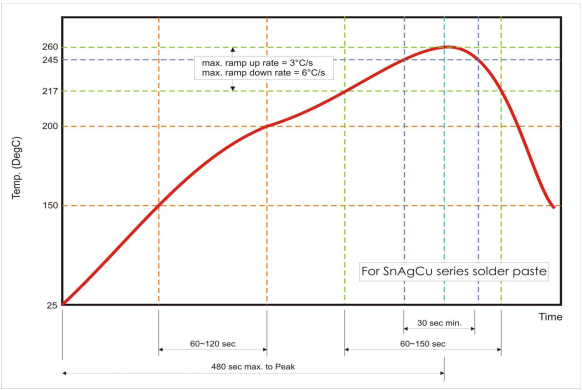


Fig. 6 Recommended reflow soldering profile for SMT process with SnAgCu series solder paste.

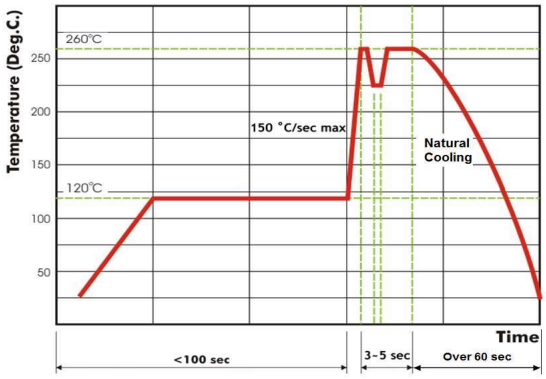


Fig. 7 Recommended wave soldering profile for SMT process with SnAgCu series solder.

Mouser Electronics

Authorized Distributor

Click to View Pricing, Inventory, Delivery & Lifecycle Information:

Kamaya:

0402B105K6R3CT 0603N682J500CT 1206B225K500CT 1206B226K6R3CT 1206N104J500CT 1210B106K500CT 0201N1R8A250CT 0603N392J500CT 0603X225K500CT 2220B106K101CT 2220B106K500CT 0402N3R0B101CT 0603B333K101CT 1210X476M250CT 0201N1R0A250CT 0201X334M6R3CT 0603N102F100CT 0603N822J500CT RT15N0R6A500CT 0402X334M160CT 0402X334M160CG 0201N2R3B500CT 0201N2R6B500CT 0402N5R0A250CT RT15N160F500CT RT15N160G500CT RT15N180F500CT RT15N180G500CT SH18N122J160CT SH18N681J500CT SH31N221J101CT 0402B105M6R3CT

Walsin:

0402N1R2C500LT 0402N1R5C500LT 0402N3R3C500LT 0402N4R7C500LT 0402N5R6C500LT 0603N1R0C500LT 0402B471K500CT 0402B102K500CT 0402B152K500CT 0402B222K500CT 0402B392K500CT 0402B103K500CT 0402B103K250CT 0402B103K160CT 0402B123K160CT 0603B103K500CT 0402X104K160CT 0402N101J500CT 0402N150J500CT 0402N330J500CT 0402N2R2C500LT 0402X106M6R3CT 0402N5R6C500CT 0603N1R0C500CT 0402N100J500CT 0603N150F500CT 0402N220G500CT 0603N120J500CT 0402N2R2C500CT 0402X105K100CT 1206B104K500CT 1206B105K500CT 1206B103K500CT 0805B102K500CT 1206B475K250CT 0603N180J500CT 0603B682K500CT 0603B393K500CT 0603B104K160CT 0402B333K100CT 0402N0R5B500CT 0402N120F500CT 0402B473K500CT 0201X223K6R3CT 0402N271J500CT 0603B202K500CT 0603N511J500CT 0603N680J500CT 0201N180J500CT 0603B104J250CT 0603B333K160CT 0805B333K500CT 0805B333J500CT 1206B223K500CT 0201B101K250CT 0603N390J500CT 0603N5R0C500CT 0603N681J500CT 0402B681K500CT 0402B104J160CT 0603B472K160CT 1206B222K500CT 1210B104K500CT 0201B222K160CT 0402N100J250CT 0603N121J500CT 0603N180J101CT 0603N220J500CT 0402B561K500CT 0603B152K500CT 0603B273K500CT 0603B183J500CT 0603B183K500CT 0603B223K500CT 0603B473J500CT 0402B104K100CT 0402N2R4C500CT 0402N3R3C500CT 0603N751J500CT 0805N222J500CT 0805N682J500CT 0402B391K500CT 0402B822K250CT 0603B392K500CT 1206B472K500CT 0201B472K100CT 0402N3R0B500CT 0603N180F500CT 0603N330F500CT

0603N560F500CT 0402B472J500CT 0402B562K250CT 0603B681K101CT 0603B561K500CT 1206B224K101CT
1206B102K500CT 0603N220J101CT 0603N222J500CT 0603N270J500CT 0603N300J500CT