APPROVAL SHEET

MULTILAYER CERAMIC CAPACITORS

General Purpose Series (4V to 100V)

0201 to 1812 Sizes

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

RoHS Compliance

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

1. DESCRIPTION

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

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

2. FEATURES

a. 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).

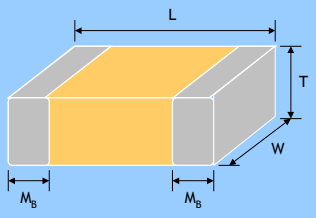
3. APPLICATIONS

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 **F**=Y5V **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% **Z**=-20/+80%	Two significant digits followed by no. of zeros. And R is in place of decimal point. **4R0**=4 VDC **6R3**=6.3 VDC **100**=10 VDC **160**=16 VDC **250**=25 VDC **500**=50 VDC **101**=100 VDC	**C**=Cu/Ni/Sn	**T**=7" reeled **G**=13" reeled

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/-0.10	1.60+0.30/-0.10	1.60+0.30/-0.10	P	R	
	1210 (3225)	3.20±0.30	2.50±0.20	0.95±0.10	C	R	0.75±0.25
				0.85±0.10	T	R	
				1.25±0.10	D	R	
		3.20±0.40	2.50±0.30	1.60±0.20	G	R	
				2.00±0.20	K	R	
				2.50±0.30	M	R	
		3.20±0.60#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_200V ~3kV, 1812_200V~3kV and safety certificated products.
*** For 1206_1000V ~3kV,1808_200V ~3kV, 1812_200V~3kV and safety certificated products.
#1 : For 0603/Cap≧10μF or 0603/Cap≧4.7μF(≦6.3V) or 0603/Cap>1μF(>10V) products.
#2 : For 0201/Cap≧0.68μF products.
#3 : For 0201/Cap≧1μF products.
#4 : For 1210_100V: Cap > 1μF, 250V: Cap >0. 47μF, 400V~630V: Cap >0.22μF.

6. GENERAL ELECTRICAL DATA

Dielectric	NP0	X7R	Y5V	X5R	X6S	X7S
Size	0201, 0402, 0603, 0805, 1206, 1210, 1812					
Capacitance range*	0.1pF to 0.1μF	100pF to 47μF	0.01μF to 100μF	100pF to 220μF	0.1μF to 100μF	1μF to 100μF
Capacitance tolerance**	Cap≤5pF[#1]: A (±0.05pF), B (±0.1pF), C (±0.25pF) 5pF<Cap<10pF: C (±0.25pF), D (±0.5pF) Cap≥10pF: F (±1%), G (±2%), J (±5%), K (±10%)	J (±5%), K (±10%), M (±20%)	M (±20%), Z (-20/+80%)	K (±10%), M (±20%)	K (±10%), M (±20%)	K (±10%), M (±20%)
Rated voltage (WVDC)	10V, 16V, 25V, 50V,100V	6.3V, 10V, 16V, 25V, 50V, 100V				
DF(Tan δ)*	Cap<30pF: Q≥400+20C Cap≥30pF: Q≥1000	Note 1				
Operating temperature	-55 to +125°C		-25 to +85°C	-55 to +85°C	-55 to +105°C	-55 to +125°C
Capacitance characteristic	±30ppm	±15%	+30/-80%	±15%	±22%	±22%
Termination	Ni/Sn (lead-free termination)					

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

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

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

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

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

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

Note 1:

X7R/X5R/X6S/X7S

Rated vol.	D.F.≦	Exception of D.F. ≦	
≧100V	≦2.5%	≦3%	1206≧0.47μF
		≦5%	0805＞0.1μF;0603≧0.068μF;1206>1μF;1210≧2.2μF;TT se
		≦10%	0805＞0.22μF;1210≧3.3μF
50V	≦2.5%	≦3%	0201(50V); 0603≧0.047μF; 0805≧0.18μF;1206≧0.47μF
		≦5%	0201≧0.01uF; 1210≧4.7μF
		≦10%	0402≧0.012μF;0603>0.1μF; 0805≧1μF;1206≧2.2μF; 1210≧10μF; TT series
35V	≦3.5%	≦10%	0603≧1μF;0805≥2.2μF;1206≧2.2μF;1210≧10μF
25V	≦3.5%	≦5%	0201≧0.01μF;0805≧1μF; 1210≧10μF
		≦7%	0603≧0.33μF; 1206≧4.7μF
		≦10%	0201≧0.1μF;0402≧0.10μF;0603≧0.47μF; 0805≧2.2μF; 1206≧6.8μF ; 1210≧22μF ; TT series
		≦12.5%	0402≧0.47μF
16V	≦3.5%	≦5%	0201≧0.01μF;0402≧0.033μF;0603≧0.15μF; 0805≧0.68μF;1206≧2.2μF;1210≧4.7μF
		≦10%	0201≧0.1uF(0201/X7R≧0.022μF); 0402≧ 0.22uF; 0603≧ 1206≧4.7μF; 1210≧22μF; TT series
10V	≦5%	≦10%	0201≧0.012μF;0402≧0.33μF(0402/X7R≧0.22μF); TT series 0603≧0.33μF; 0805≧2.2μF;1206≧2.2μF;1210≧22μF:01R5
		≦15%	0201≧0.1μF; 0402≧1μF
6.3V	≦10%	≦15%	0201≧0.1μF;0402≧1μF;0603≧10μF; 0805≧4.7μF; 1206≧47μF :1210≧100μF; TT series
		≦20%	0402≧2.2μF
4V	≦15%	---	---

Y5V

Rated vol.	D.F. ≦	Exception of D.F.≦	
≧50V	≦5%	≦7%	0603≧0.1μF; 0805≧0.47μF; 1206≧4.7μF; TT series
		≦12.5%	1210≧6.8μF
35V	≦7%	---	---
25V	≦5%	≦7%	0402≧0.047μF;0603≧0.1μF; 0805≧0.33μF; 1206≧1μF; 1210≧4.7μF
		≦9%	0402≧0.068μF;0603≧0.47μF; 1206≧4.7μF; 1210≧22μF; TT series
16V (C<1.0μF)	≦7%	≦9%	0402≧0.068μF; 0603≧0.68μF
		≦12.5%	0402≧0.22μF
16V (C≧1.0μF)	≦9%	≦12.5%	0603≧2.2μF; 0805≧3.3μF;1206≧10μF; 1210≧22μF; 1812≧47μF; TT series
10V	≦12.5%	≦20%	0402≧0.47μF
6.3V	≦20%	---	---

7. CAPACITANCE RANGE

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

8. PACKAGING STYLE AND QUANTITY

Size	Thickness (mm)/Symbol		Paper tape		Plastic tape	
			7" reel	13" reel	7" reel	13" reel
0201 (0603)	0.30±0.03	L	15,000	70,000	-	-
	0.30±0.05	L	15,000	-	-	-
	0.30±0.09	L	15,000	-	-	-
0402 (1005)	0.50±0.05	N	10,000	50,000	-	-
	0.50+0.02/-0.05	Q	10,000	50,000	-	-
	0.50±0.20	E	10,000	-	-	-
0603 (1608)	0.50±0.10	H	4,000	-	-	-
	0.80±0.07	S	4,000	15,000	-	-
	0.80+0.15/-0.10	X	4,000	15,000	-	-
0805 (2012)	0.50±0.10	H	4,000	15,000	-	-
	0.60±0.10	A	4,000	15,000	-	-
	0.80±0.10	B	4,000	15,000	-	-
	0.85±0.10	T	4,000	15,000	-	-
	1.25±0.10	D	-	-	3,000	10,000
	1.25±0.20	I	-	-	3,000	10,000
1206 (3216)	0.80±0.10	B	4,000	15,000	-	-
	0.85±0.10	T	4,000	15,000	-	-
	0.95±0.10	C	-	-	3,000	10,000
	1.15±0.15	J	-	-	3,000	10,000
	1.25±0.10	D	-	-	3,000	10,000
	1.60±0.20	G	-	-	2,000	10,000
	1.60+0.30/-0.10	P	-	-	2,000	9,000
1210 (3225)	0.85±0.10	T	-	-	3,000	10,000
	0.95±0.10	C	-	-	3,000	10,000
	1.25±0.10	D	-	-	3,000	10,000
	1.60±0.20	G	-	-	2,000	-
	2.00±0.20	K	-	-	1,000	6,000
	2.50±0.30	M	-	-	1,000	6,000
1808 (4520)	1.25±0.10	D	-	-	2,000	10,000
	1.10±0.15	F	-	-	2,000	10,000
	1.60±0.20	G	-	-	2,000	8,000
	2.00±0.20	K	-	-	1,000	6,000
1812 (4532)	1.25±0.10	D	-	-	1,000	5,000
	1.60±0.20	G	-	-	1,000	-
	2.00±0.20	K	-	-	1,000	-
	2.50±0.30	M	-	-	500	3,000
	2.80±0.30	U	-	-	500	-

Unit: pieces

9. RELIABILITY TEST CONDITIONS AND REQUIREMENTS

<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>Class I: (NP0)
≦1000pF, 1.0±0.2Vrms，1MHz±10%
＞1000pF, 1.0±0.2Vrms，1KHz±10%
Class II: (X7R, X7E, X6S, X5R,X7S,Y5V)
C≦10μF, 1.0±0.2Vrms，1KHz±10% **
C＞10μF, 0.5±0.2Vrms，120Hz±20%</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>** Test condition: 0.5±0.2Vrms，1KHz±10%
X7R:
0805=106(6.3V), 0603/475(6.3V)
X5R:
01R5≧103, 0201≧224 (6.3V,10V,16V)#1,
0402≧475 (6.3V,16V), 0402≧225(10V),
0603=106 (6.3V,10V),
TT18X≧475(10V) , TT15X series
X6S:
0201≧104 (6.3V,10V), 0402≧225 (6.3V),
0402/475 (10V), 0603/106 (6.3V),
X7S:
0402/225(6.3V)

#1 Excluding
X5R/0201/105(6.3V);225(10V),
(1.0±0.2Vrms，1KHz±10%)

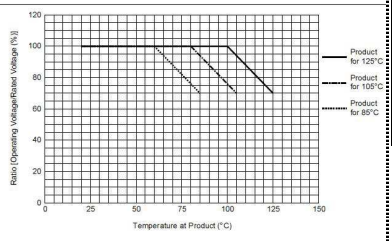
*Before initial measurement (Class II only):
To apply de-aging at 150°C for 1hr then set for 24±2 hrs at room temp.</td><td>NP0: Cap≥30pF, Q≥1000; Cap<30pF,Q≥400+20C
X7R,X5R,X6S,X7S:
<table>
<tr><th>Rated vol.</th><th>D.F.≦</th><th colspan="2">Exception of D.F. ≦</th></tr>
<tr><td rowspan="3">≧100V</td><td rowspan="3">≦2.5%</td><td>≦3%</td><td>1206≧0.47μF</td></tr>
<tr><td>≦5%</td><td>0805＞0.1μF;0603≧0.068μF;1206>1μF;1210≧2.2μF;TT se</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≧4.7μF</td></tr>
<tr><td>≦10%</td><td>0402≧0.012μF;0603>0.1μF; 0805≧1μF;1206≧2.2μF;
1210≧10μF; TT series</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; 1206≧4.7μF</td></tr>
<tr><td>≦10%</td><td>0201≧0.1μF;0402≧0.10μF;0603≧0.47μF; 0805≧2.2μF;
1206≧6.8μF ; 1210≧22μF ; TT series</td></tr>
<tr><td>≦12.5%</td><td>0402≧0.47μF</td></tr>
<tr><td 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≧0.1uF(0201/X7R≧0.022μF); 0402≧ 0.22uF;
0603≧0.68μF;0805≧2.2μF;1206≧4.7μF; 1210≧22μF; TT</td></tr>
<tr><td>10V</td><td>≦5%</td><td>≦10%</td><td>0201≧0.012μF;0402≧0.33μF(0402/X7R≧0.22μF); TT series
0603≧0.33μF; 0805≧2.2μF;1206≧2.2μF;1210≧22μF:01R5</td></tr>
<tr><td rowspan="2">6.3V</td><td rowspan="2">≦10%</td><td>≦15%</td><td>0201≧0.1μF; 0402≧1μF</td></tr>
<tr><td>≦15%</td><td>0201≧0.1μF;0402≧1μF;0603≧10μF; 0805≧4.7μF;
1206≧47μF :1210≧100μF; TT series</td></tr>
<tr><td>4V</td><td>≦15%</td><td>≦20%</td><td>0402≧2.2μF</td></tr>
<tr><td></td><td></td><td>---</td><td>---</td></tr>
</table>
Y5V:
<table>
<tr><th>Rated vol.</th><th>D.F. ≦</th><th colspan="2">Exception of D.F.≦</th></tr>
<tr><td rowspan="2">≧50V</td><td rowspan="2">≦5%</td><td>≦7%</td><td>0603≧0.1μF; 0805≧0.47μF; 1206≧4.7μF; TT series</td></tr>
<tr><td>≦12.5%</td><td>1210≧6.8μF</td></tr>
<tr><td>35V</td><td>≦7%</td><td>---</td><td>---</td></tr>
<tr><td rowspan="2">25V</td><td rowspan="2">≦5%</td><td>≦7%</td><td>0402≧0.047μF;0603≧0.1μF; 0805≧0.33μF;
1206≧1μF; 1210≧4.7μF</td></tr>
<tr><td>≦9%</td><td>0402≧0.068μF;0603≧0.47μF; 1206≧4.7μF;
1210≧22μF; TT series</td></tr>
<tr><td rowspan="2">16V (C<1.0μF)</td><td rowspan="2">≦7%</td><td>≦9%</td><td>0402≧0.068μF; 0603≧0.68μF</td></tr>
<tr><td>≦12.5%</td><td>0402≧0.22μF</td></tr>
<tr><td>16V (C≧1.0μF)</td><td>≦9%</td><td>≦12.5%</td><td>0603≧2.2μF; 0805≧3.3μF;1206≧10μF;
1210≧22μF; 1812≧47μF; TT series</td></tr>
<tr><td>10V</td><td>≦12.5%</td><td>≦20%</td><td>0402≧0.47μF</td></tr>
<tr><td>6.3V</td><td>≦20%</td><td>---</td><td>---</td></tr>
</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>
<tr><td>5.</td><td>Insulation Resistance</td><td>To apply rated voltage for MAX. 120sec.

*Before initial measurement (Class II only):
To apply de-aging at 150°C for 1hr then set for 24±2 hrs at room temp.</td><td>10GΩ or RxC≧500Ω-F whichever is smaller.
Class II (X7R, X7E, X5R,X6S,X7S,Y5V:)
<table>
<tr><th>Rated voltage</th><th>Insulation Resistance</th></tr>
<tr><td>100V: All X7R</td><td rowspan="6">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 ; TT series; Size≥1812</td><td></td></tr>
<tr><td>Rated voltage</td><td>Insulation Resistance</td></tr>
<tr><td>All X6S items, All X7S items</td><td rowspan="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; TT21>4.7μF</td></tr>
<tr><td>6.3V: 0201≥0.1μF; 0603>4.7μF; 0805≥47μF;1206≥10μF; TT15>1.0μF</td></tr>
<tr><td>4V:0603≥22μF; 0805≥47μF; 1206≥100μF</td></tr>
</table></td></tr>
</table>

<table>
<tr><th>No.</th><th>Item</th><th>Test Condition</th><th>Requirements</th></tr>
<tr><td>6.</td><td>Temperature Coefficient</td><td>With no electrical load.
<table>
<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>
*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><td>01005</td><td>0201</td></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>0402</td><td>0603</td></tr>
<tr><td>Cap<1μF: 1V</td><td>Cap≤1μF: 1V</td></tr>
<tr><td>Cap=1μF: 0.5V</td><td>1μF<Cap≤4.7μF: 0.5V</td></tr>
<tr><td>1μF<Cap<10μF: 0.2V</td><td>Cap>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<10μF: 1V</td><td>Cap≤10μF: 1V</td></tr>
<tr><td>Cap=10μF: 0.5V</td><td>10μF<Cap≤100μF: 0.5V</td></tr>
<tr><td>Cap>10μF: 0.2V</td><td>Cap>100μF: 0.2V</td></tr>
</table></td><td>
<table>
<tr><td>T.C.</td><td>Capacitance Change</td></tr>
<tr><td>NPO</td><td>Within ±30ppm/°C</td></tr>
<tr><td>X7R</td><td>Within ±15%</td></tr>
<tr><td>X7S</td><td>Within ±22%</td></tr>
<tr><td>X5R</td><td>Within ±15%</td></tr>
<tr><td>X6S</td><td>Within ±22%</td></tr>
<tr><td>Y5V</td><td>Within +30%/-80%</td></tr>
</table></td></tr>
<tr><td>7.</td><td>Adhesive Strength of Termination</td><td>* Pressurizing force：
1N (0201) and 5N (≤0603) and 10N (>0603)
* Test time: 10±1 sec.</td><td>* No remarkable damage or removal of the terminations.</td></tr>
<tr><td>8.</td><td>Vibration Resistance</td><td>* 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.</td><td> No remarkable damage.
* Cap change and Q/D.F.: To meet initial spec.</td></tr>
<tr><td>9.</td><td>Solderability</td><td>* Solder temperature: 235±5°C
* Dipping time: 2±0.5 sec.</td><td>95% min. coverage of all metalized area.</td></tr>
<tr><td>10.</td><td>Bending Test</td><td>* 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.</td><td>* No remarkable damage.
* Cap change：
NP0: within ±5% or 0.5pF whichever is larger
X7R, X5R, X6S, X7S: within ±12.5%
Y5V: within ±30%
(This capacitance change means the change of capacitance under specified flexure of substrate from the capacitance measured before the test.)</td></tr>
<tr><td>11.</td><td>Resistance to Soldering Heat</td><td>* 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.</td><td> No remarkable damage.
* Cap change:
NP0: within ±2.5% or 0.25pF whichever is larger
X7R, X5R, X6S, X7S: within ±7.5%
Y5V: within ±20%
* Q/D.F., I.R. and dielectric strength: To meet initial requirements.
* 25% max. leaching on each edge.</td></tr>
<tr><td>12.</td><td>Temperature Cycle</td><td>* Conduct the five cycles according to the temperatures and time.
<table>
<tr><td>Step</td><td>Temp. (°C)</td><td>Time (min.)</td></tr>
<tr><td>1</td><td>Min. operating temp. +0/-3</td><td>30±3</td></tr>
<tr><td>2</td><td>Room temp.</td><td>2~3</td></tr>
<tr><td>3</td><td>Max. operating temp. +3/-0</td><td>30±3</td></tr>
<tr><td>4</td><td>Room temp.</td><td>2~3</td></tr>
</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.
* 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: within ±2.5% or 0.25pF whichever is larger
X7R, X5R, X6S, X7S: within ±7.5%
Y5V: within ±20%
* Q/D.F., I.R. and dielectric strength: To meet initial requirements.</td></tr>
</table>

<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 room 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%;
TT series & C≥ 1uF,within ±25%
**10V: 0603≧4.7μF;0402≧1μF;0201≧0.1μF, within ±25%;
Y5V: ≥10V, within ±30%; ≦6.3V, within +30/-40%
* Q/D.F. value:
NP0: More than 30pF Q≥350, 10pF≤C≤30pF, Q≥275+2.5C
Less than 10pF Q≥200+10C
X7R, X5R, X6S, X7S:
<table>
<tr><th>Rated v</th><th>D.F.≦</th><th>Exception of D.F.≦</th><th></th></tr>
<tr><td rowspan="3">≧100V</td><td rowspan="3">≦3%</td><td>≦6%</td><td>1206≧0.47μF</td></tr>
<tr><td>≦7.5%</td><td>0805＞0.1μF, 0603≧0.068μF, 1206>1μF;1210≧2.2μF;TT se</td></tr>
<tr><td>≦20%</td><td>0805＞0.22μF;1210≧3.3μF</td></tr>
<tr><td rowspan="3">≧50V</td><td rowspan="3">≦3%</td><td>≦6%</td><td>0201(50V);0603≧0.047μF; 0805≧0.18μF; 1206≧0.47μF</td></tr>
<tr><td>≦10%</td><td>0201≧0.01uF;1210≧4.7μF</td></tr>
<tr><td>≦20%</td><td>0402≧0.012μF; 0603>0.1μF; 0805≧1μF; 1206≧2.2μF;
1210≧10μF; TT series</td></tr>
<tr><td>35V</td><td>≦5%</td><td>≦20%</td><td>0603≧1μF;0805≥2.2μF;1206≧2.2μF;1210≧10μF</td></tr>
<tr><td rowspan="3">25V</td><td rowspan="3">≦5%</td><td>≦10%</td><td>0201≧0.01μF;0805≧1μF; 1210≧10μF</td></tr>
<tr><td>≦14%</td><td>0603≧0.33μF;1206≧4.7μF</td></tr>
<tr><td>≦15%</td><td>0201≧0.1μF;0402≧0.10μF;0603≧0.47μF;0805≧2.2μF;
1206≧6.8μF;1210≧22μF; TT series</td></tr>
<tr><td rowspan="2">16V</td><td rowspan="2">≦5%</td><td>≦20%</td><td>0402≧0.47μF</td></tr>
<tr><td>≦10%</td><td>0603≧0.15μF;0805≧0.68μF;1206≧2.2μF;1210≧4.7μF</td></tr>
<tr><td rowspan="2">10V</td><td rowspan="2">≦7.5%</td><td>≦15%</td><td>0201≧0.01μF(0201/X7R≧0.022μF);0402≧0.033μF;
0603≧0.68μF;0805≧2.2μF;1206≧4.7μF; 1210≧22μF; TT s</td></tr>
<tr><td>≦15%</td><td>0201≧0.012μF; 0402≧0.33μF(0402/X7R≧0.22μF);
0603≧0.33μF;0805≧2.2μF;1206≧2.2μF; 1210≧22μF</td></tr>
<tr><td rowspan="2">6.3V</td><td rowspan="2">≦15%</td><td>≦20%</td><td>0201≧0.1μF ;0402≧1μF; TT series; 01R5</td></tr>
<tr><td>≦30%</td><td>0201≧0.1μF;0402≧1μF;0603≧10μF;
0805≧4.7μF;1206≧47μF;1210≧100μF;TT series</td></tr>
<tr><td>4V</td><td>≦20%</td><td>---</td><td>---</td></tr>
</table>
Y5V:
<table>
<tr><th>Rated vol.</th><th>D.F.≦</th><th>Exception of D.F.≦</th><th></th></tr>
<tr><td rowspan="2">≧50V</td><td rowspan="2">≦7.5%</td><td>≦10%</td><td>0603≧0.1μF; 0805≧0.47μF;
1206≧4.7μF</td></tr>
<tr><td>≦20%</td><td>1210≧6.8μF</td></tr>
<tr><td>35V</td><td>≦10%</td><td>---</td><td>---</td></tr>
<tr><td rowspan="2">25V</td><td rowspan="2">≦7.5%</td><td>≦10%</td><td>0402≧0.047μF;0603≧0.1μF;
0805≧0.33μF;1206≧1μF; 1210≧4.7μF</td></tr>
<tr><td>≦15%</td><td>0402≧0.068μF;0603≧0.47μF;
1206≧4.7μF; 1210≧22μF</td></tr>
<tr><td rowspan="2">16V
(C<1.0μF)</td><td rowspan="2">≦10%</td><td>≦12.5%</td><td>0402≧0.068μF; 0603≧0.68μF</td></tr>
<tr><td>≦20%</td><td>0402≧0.22μF</td></tr>
<tr><td>16V
(C≧1.0μF)</td><td>≦12.5%</td><td>≦20%</td><td>0603≧2.2μF; 0805≧3.3μF;
1206≧10μF;1210≧22μF; 1812≧47μF;</td></tr>
<tr><td>10V</td><td>≦20%</td><td>≦30%</td><td>0402≧0.47μF</td></tr>
<tr><td>6.3V</td><td>≦30%</td><td>---</td><td>---</td></tr>
</table>
*I.R.: ≥10V, 1GΩ or 50 Ω-F whichever is smaller.
Class II (X7R, X5R, X6S, X7S, Y5V)
<table>
<tr><th>Rated voltage</th><th>Insulation Resistance</th></tr>
<tr><td>100V: All X7R;1210≥3.3μF</td><td rowspan="7">1GΩ or RxC≧10 Ω-F whichever is smaller.</td></tr>
<tr><td>50V: 0402>0.01μF;0603≥1μF;0805≥1μF;1206≥4.7μF;1210≥4.7μF</td></tr>
<tr><td>35V:0603≥1μF;0805≥2.2μF; 1206≧2.2μF;1210≧10μF</td></tr>
<tr><td>25V:0201≧0.1uF; 0402≥0.22μF; 0603≥2.2μF;0805≥2.2μF;
1206≥10μF;1210≥10μF</td></tr>
<tr><td>16V: 0201≧0.1uF;0402≥0.22μF;0603≥1μF;0805≥2.2μF;
1206≥10μF;1210≥47μF</td></tr>
<tr><td>10V:0201≥47nF;0402≥0.47μF;0603≥0.47μF;0805≥2.2μF;
1206≥4.7μF;1210≥47μF</td></tr>
<tr><td>6.3V ; 4V ; TT series ; All X6S/X7S items; Size≥1812</td></tr>
</table></td></tr>
</table>

<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%;
TT series & C≥ 1uF,within ±25%
**10V: 0603≧4.7μF;0402≧1μF;0201≧0.1μF, within ±25%;
Y5V: ≥10V, within ±30%; ≦6.3V, within +30/-40%
Q/D.F. value:
NP0: C≥30pF,Q≥200;C<30pF, Q≥100+10/3C
X7R, X5R, X6S, X7S:
<table>
<tr><th>Rated v</th><th>D.F.≦</th><th>Exception of D.F.≦</th><th></th></tr>
<tr><td rowspan="3">≧100V</td><td rowspan="3">≦3%</td><td>≦6%</td><td>1206≧0.47μF</td></tr>
<tr><td>≦7.5%</td><td>0805＞0.1μF, 0603≧0.068μF, 1206>1μF;1210≧2.2μF;TT ser</td></tr>
<tr><td>≦20%</td><td>0805＞0.22μF;1210≧3.3μF</td></tr>
<tr><td rowspan="3">≧50V</td><td rowspan="3">≦3%</td><td>≦6%</td><td>0201(50V);0603≧0.047μF; 0805≧0.18μF; 1206≧0.47μF</td></tr>
<tr><td>≦10%</td><td>0201≧0.01uF;1210≧4.7μF</td></tr>
<tr><td>≦20%</td><td>0402≧0.012μF; 0603>0.1μF; 0805≧1μF; 1206≧2.2μF;
1210≧10μF; TT series</td></tr>
<tr><td>35V</td><td>≦5%</td><td>≦20%</td><td>0603≧1μF;0805≥2.2μF;1206≧2.2μF;1210≧10μF</td></tr>
<tr><td rowspan="4">25V</td><td rowspan="4">≦5%</td><td>≦10%</td><td>0201≧0.01μF;0805≧1μF; 1210≧10μF</td></tr>
<tr><td>≦14%</td><td>0603≧0.33μF;1206≧4.7μF</td></tr>
<tr><td>≦15%</td><td>0201≧0.1μF;0402≧0.10μF;0603≧0.47μF;0805≧2.2μF;
1206≧6.8μF;1210≧22μF; TT series</td></tr>
<tr><td>≦20%</td><td>0402≧0.47μF</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≧0.68μF;0805≧2.2μF;1206≧4.7μF; 1210≧22μF; TT s</td></tr>
<tr><td rowspan="3">10V</td><td rowspan="3">≦7.5%</td><td>≦15%</td><td>0201≧0.012μF; 0402≧0.33μF(0402/X7R≧0.22μF);
0603≧0.33μF;0805≧2.2μF;1206≧2.2μF; 1210≧22μF</td></tr>
<tr><td>≦20%</td><td>0201≧0.1μF ;0402≧1μF; TT series; 01R5</td></tr>
<tr><td>≦30%</td><td>0201≧0.1μF;0402≧1μF;0603≧10μF;
0805≧4.7μF;1206≧47μF;1210≧100μF;TT series</td></tr>
<tr><td>6.3V</td><td>≦15%</td><td></td><td></td></tr>
<tr><td>4V</td><td>≦20%</td><td>---</td><td>---</td></tr>
</table>
Y5V:
<table>
<tr><th>Rated vol.</th><th>D.F.≦</th><th>Exception of D.F.≦</th><th></th></tr>
<tr><td rowspan="2">≧50V</td><td rowspan="2">≦7.5%</td><td>≦10%</td><td>0603≧0.1μF; 0805≧0.47μF;1206≧4.7μF</td></tr>
<tr><td>≦20%</td><td>1210≧6.8μF</td></tr>
<tr><td>35V</td><td>≦10%</td><td>---</td><td>---</td></tr>
<tr><td rowspan="2">25V</td><td rowspan="2">≦7.5%</td><td>≦10%</td><td>0402≧0.047μF;0603≧0.1μF;
0805≧0.33μF;1206≧1μF; 1210≧4.7μF</td></tr>
<tr><td>≦15%</td><td>0402≧0.068μF;0603≧0.47μF;
1206≧4.7μF; 1210≧22μF</td></tr>
<tr><td rowspan="2">16V
(C<1.0μF)</td><td rowspan="2">≦10%</td><td>≦12.5%</td><td>0402≧0.068μF; 0603≧0.68μF</td></tr>
<tr><td>≦20%</td><td>0402≧0.22μF</td></tr>
<tr><td>16V
(C≧1.0μF)</td><td>≦12.5%</td><td>≦20%</td><td>0603≧2.2μF; 0805≧3.3μF;
1206≧10μF;1210≧22μF; 1812≧47μF;</td></tr>
<tr><td>10V</td><td>≦20%</td><td>≦30%</td><td>0402≧0.47μF</td></tr>
<tr><td>6.3V</td><td>≦30%</td><td>---</td><td>---</td></tr>
</table>
*I.R.: ≥10V, 500MΩ or 25 Ω-F whichever is smaller.
Class II (X7R, X5R, X6S, X7S, Y5V)
<table>
<tr><th>Rated voltage</th><th>Insulation Resistance</th></tr>
<tr><td>100V: All X7R;1210≥3.3μF</td><td rowspan="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 ; TT series ; All X6S/X7S items; Size≥1812</td><td></td></tr>
</table></td></tr>
</table>

<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, Y5V: 85±3°C
*To apply voltage:
(1) ≦6.3V or C≧10μF or TT series: 150% of rated voltage.
(2) 10V≦Ur<500V: 200% of rated voltage.
(3) 500V: 150% of rated voltage.
(4) Ur≧630V: 120% of rated voltage.
(5) 100% of rated voltage for below range.
<table>
<tr><th>Size</th><th>Dielectric</th><th>Rated voltage</th><th>Capacitance range</th></tr>
<tr><td>0201</td><td>X5R/X7R/X6S</td><td>≦10V</td><td>C≧0.1μF</td></tr>
<tr><td></td><td></td><td>≧16V</td><td>C>0.1μF</td></tr>
<tr><td>0402</td><td>X5R/X7R/ X6S/X7S/Y5V</td><td>6.3V,10V 16V,25V</td><td>C≧1.0μF</td></tr>
<tr><td rowspan="3">0603</td><td rowspan="3">X5R/X7R/ X6S/X7S</td><td>4V</td><td>C≧22μF</td></tr>
<tr><td>6.3V,10V</td><td>C≧4.7μF</td></tr>
<tr><td>25V,35V</td><td>C≧1.0μF</td></tr>
<tr><td rowspan="3">0805</td><td rowspan="3">X5R/X7R/ X6S/X7S</td><td>4V</td><td>C≧47μF</td></tr>
<tr><td>6.3V</td><td>C≧22μF</td></tr>
<tr><td>10V~50V</td><td>C≧10μF</td></tr>
<tr><td rowspan="2">1206</td><td>X5R/X7R/X6S</td><td>≦6.3V</td><td>C≧47μF</td></tr>
<tr><td>NP0</td><td>3000V</td><td>C≧1.5pF</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>TT18</td><td>Y5V</td><td>6.3V,10V</td><td>C≧2.2μF</td></tr>
<tr><td rowspan="2">TT21</td><td>Y5V</td><td>6.3V</td><td>C≧10μF</td></tr>
<tr><td>X5R/X7R/X6S</td><td>≦10V</td><td>C≧10μF</td></tr>
<tr><td>TT31</td><td>Y5V</td><td>6.3V</td><td>C≧22μF</td></tr>
</table>
**1WV items must follow de-rating conditions
(6) 150% of rated voltage for below range.
<table>
<tr><th>Size</th><th>Dielectric</th><th>Rated voltage</th><th>Capacitance</th></tr>
<tr><td>0201</td><td>X5R/X7R/X6</td><td>16V/25V</td><td>C≧0.1μF</td></tr>
<tr><td></td><td>X7R</td><td>16V</td><td>C≧0.022μF</td></tr>
<tr><td rowspan="3">0402</td><td rowspan="2">X5R/X7R/X6 S</td><td>50V</td><td>C≧0.1μF</td></tr>
<tr><td>10~25V</td><td>C≧0.22μF</td></tr>
<tr><td>Y5V</td><td>16V</td><td>C≧0.47μF</td></tr>
<tr><td rowspan="3">0603</td><td>X7R</td><td>50V</td><td>C>0.1μF</td></tr>
<tr><td>X5R/X7R/ X6S/X7S</td><td>10V,16V, 50V</td><td>C≧1.0μF</td></tr>
<tr><td>Y5V</td><td>16V</td><td>C≧2.2μF</td></tr>
<tr><td rowspan="4">0805</td><td>X5R/X7R/ X6S/X7S</td><td>10~50V</td><td>C≧4.7μF</td></tr>
<tr><td rowspan="2">X5R/X7R/X7 S</td><td>50V</td><td>C≧2.2μF</td></tr>
<tr><td>100V</td><td>C≧0.47μF</td></tr>
<tr><td>Y5V</td><td>16V</td><td>C≧4.7μF</td></tr>
<tr><td>1206</td><td>X5R/X7R/X6</td><td>100V</td><td>C>1.0μF</td></tr>
<tr><td>1210</td><td>X5R/X7R/X6</td><td>50V~100V</td><td>C≧2.2μF</td></tr>
<tr><td>1825 2220 2225</td><td>X7R</td><td>100V~250V</td><td>C≧1.0μF</td></tr>
</table>
*Test time: 1000+24/-0 hrs.
*Before initial measurement (Class II only): To apply de-aging at 150°C for 1hr then set for 24±2 hrs at room temp.
* Cap. / DF(Q) / I.R. Measurement to be made after de-aging at 150°C for 1hr then set for 24±2 hrs at room temp.
** De-rating conditions:


</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%;
TT series & C≥ 1uF,within ±25%
**10V: 0603≧4.7μF;0402≧1μF;0201≧0.1μF, within ±25%;
Y5V: ≥10V, within ±30%; ≦6.3V, within +30/-40%
Q/D.F. value:
NP0: More than 30pF, Q≥350
10pF≤C<30pF, Q≥275+2.5C
Less than 10pF, Q≥200+10C
X7R, X5R, X6S, X7S:
<table>
<tr><th>Rated v</th><th>D.F.≦</th><th>Exception of D.F.≦</th><th></th></tr>
<tr><td rowspan="3">≧100V</td><td rowspan="3">≦3%</td><td>≦6%</td><td>1206≧0.47μF</td></tr>
<tr><td>≦7.5%</td><td>0805＞0.1μF, 0603≧0.068μF, 1206>1μF;1210≧2.2μF;TT ser</td></tr>
<tr><td>≦20%</td><td>0805＞0.22μF;1210≧3.3μF</td></tr>
<tr><td rowspan="3">≧50V</td><td rowspan="3">≦3%</td><td>≦6%</td><td>0201(50V);0603≧0.047μF; 0805≧0.18μF; 1206≧0.47μF</td></tr>
<tr><td>≦10%</td><td>0201≧0.01uF;1210≧4.7μF</td></tr>
<tr><td>≦20%</td><td>0402≧0.012μF; 0603>0.1μF; 0805≧1μF; 1206≧2.2μF; 1210≧10μF; TT series</td></tr>
<tr><td>35V</td><td>≦5%</td><td>≦20%</td><td>0603≧1μF;0805≧2.2μF;1206≧2.2μF;1210≧10μF</td></tr>
<tr><td rowspan="4">25V</td><td rowspan="4">≦5%</td><td>≦10%</td><td>0201≧0.01μF;0805≧1μF; 1210≧10μF</td></tr>
<tr><td>≦14%</td><td>0603≧0.33μF;1206≧4.7μF</td></tr>
<tr><td>≦15%</td><td>0201≧0.1μF;0402≧0.10μF;0603≧0.47μF;0805≧2.2μF; 1206≧6.8μF;1210≧22μF; TT series</td></tr>
<tr><td>≦20%</td><td>0402≧0.47μF</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≧0.68μF;0805≧2.2μF;1206≧4.7μF; 1210≧22μF; TT s</td></tr>
<tr><td>10V</td><td>≦7.5%</td><td>≦15%</td><td>0201≧0.012μF; 0402≧0.33μF(0402/X7R≧0.22μF); 0603≧0.33μF;0805≧2.2μF;1206≧2.2μF; 1210≧22μF</td></tr>
<tr><td></td><td></td><td>≦20%</td><td>0201≧0.1μF ;0402≧1μF; TT series; 01R5</td></tr>
<tr><td>6.3V</td><td>≦15%</td><td>≦30%</td><td>0201≧0.1μF;0402≧1μF;0603≧10μF; 0805≧4.7μF;1206≧47μF;1210≧100μF;TT series</td></tr>
<tr><td>4V</td><td>≦20%</td><td>---</td><td>---</td></tr>
</table>
Y5V:
<table>
<tr><th>Rated vol.</th><th>D.F.≦</th><th colspan="2">Exception of D.F.≦</th></tr>
<tr><td rowspan="2">≧50V</td><td rowspan="2">≦7.5%</td><td>≦10%</td><td>0603≧0.1μF; 0805≧0.47μF;1206≧4.7μF</td></tr>
<tr><td>≦20%</td><td>1210≧6.8μF</td></tr>
<tr><td>35V</td><td>≦10%</td><td>---</td><td>---</td></tr>
<tr><td rowspan="2">25V</td><td rowspan="2">≦7.5%</td><td>≦10%</td><td>0402≧0.047μF;0603≧0.1μF; 0805≧0.33μF;1206≧1μF; 1210≧4.7μF</td></tr>
<tr><td>≦15%</td><td>0402≧0.068μF;0603≧0.47μF; 1206≧4.7μF; 1210≧22μF</td></tr>
<tr><td rowspan="2">16V (C<1.0μF)</td><td rowspan="2">≦10%</td><td>≦12.5%</td><td>0402≧0.068μF; 0603≧0.68μF</td></tr>
<tr><td>≦20%</td><td>0402≧0.22μF</td></tr>
<tr><td>16V (C≧1.0μF)</td><td>≦12.5%</td><td>≦20%</td><td>0603≧2.2μF; 0805≧3.3μF; 1206≧10μF;1210≧22μF; 1812≧47μF;</td></tr>
<tr><td>10V</td><td>≦20%</td><td>≦30%</td><td>0402≧0.47μF</td></tr>
<tr><td>6.3V</td><td>≦30%</td><td>---</td><td>---</td></tr>
</table>
*I.R.: ≥10V, 1GΩ or 50 Ω-F whichever is smaller.
Class II (X7R, X5R, X6S, X7S, Y5V)
<table>
<tr><th>Rated voltage</th><th>Insulation Resistance</th></tr>
<tr><td>100V: All X7R;1210≥3.3μF</td><td rowspan="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>6.3V ; 4V ; TT series ; All X6S/X7S items; Size≥1812</td><td></td></tr>
</table>
</td></tr>
</table>

APPENDIXES

◙ Tape & reel dimensions

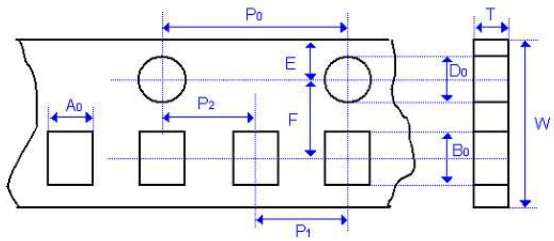


Fig. 2 The dimension of paper tape

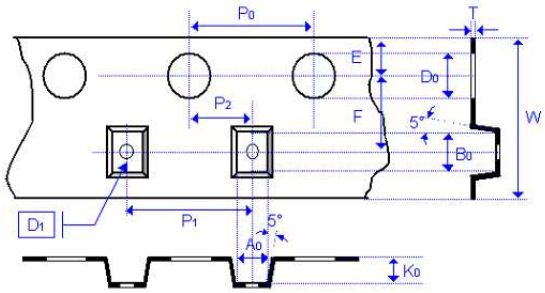


Fig. 3 The dimension of plastic tape

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	0.39 +/-0.07	0.70 +/-0.2	1.05 +/-0.30	1.50 +/-0.20	1.50 +/-0.20	< 1.80	1.90 +/-0.50	< 2.00	<2.30	< 3.05	< 3.05	< 3.20	< 2.50	< 3.90	< 3.90
B_0	0.69 +/-0.07	1.20 +/-0.2	1.80 +/-0.30	2.30 +/-0.20	2.30 +/-0.20	< 2.70	3.50 +/-0.50	< 3.70	< 4.00	< 3.80	< 3.80	<3.95	< 5.30	< 5.30	< 5.30
T	≦0.50	≦0.80	≦1.20	≦1.15	≦1.30	0.23 +/-0.1	≦1.30	0.23 +/-0.1	0.23 +/-0.1	0.23 +/-0.1	0.23 +/-0.1	0.23 +/-0.1	0.25 +/-0.1	0.25 +/-0.1	0.25 +/-0.1
K_0	-	-	-	-	-	< 2.50	-	< 2.50	< 2.50	< 1.50	< 2.50	< 3.20	< 2.50	< 2.50	< 3.50
W	8.00 +/-0.10	8.00 +/-0.10	8.00 +/-0.10	8.00 +/-0.10	8.00 +/-0.10	8.00 +/-0.20	8.00 +/-0.10	8.00 +/-0.20	8.00 +/-0.20	8.00 +/-0.20	8.00 +/-0.20	8.00 +/-0.20	12.00 +/-0.20	12.00 +/-0.20	12.00 +/-0.20
P_0	4.00 +/-0.10	4.00 +/-0.10	4.00 +/-0.10	4.00 +/-0.10	4.00 +/-0.10	4.00 +/-0.10	4.00 +/-0.10	4.00 +/-0.10	4.00 +/-0.10	4.00 +/-0.10	4.00 +/-0.10	4.00 +/-0.10	4.00 +/-0.10	4.00 +/-0.10	4.00 +/-0.10
$10xP_0$	40.00 +/-0.10	40.00 +/-0.10	40.00 +/-0.20	40.00 +/-0.20	40.00 +/-0.20	40.00 +/-0.20	40.00 +/-0.20	40.00 +/-0.20	40.00 +/-0.20	40.00 +/-0.20	40.00 +/-0.20	40.00 +/-0.20	40.00 +/-0.20	40.00 +/-0.20	40.00 +/-0.20
P_1	2.00 +/-0.05	2.00 +/-0.05	4.00 +/-0.10	4.00 +/-0.10	4.00 +/-0.10	4.00 +/-0.10	4.00 +/-0.10	4.00 +/-0.10	4.00 +/-0.10	4.00 +/-0.10	4.00 +/-0.10	4.00 +/-0.10	4.00 +/-0.10	8.00 +/-0.10	8.00 +/-0.10
P_2	2.00 +/-0.05	2.00 +/-0.05	2.00 +/-0.05	2.00 +/-0.05	2.00 +/-0.05	2.00 +/-0.05	2.00 +/-0.05	2.00 +/-0.05	2.00 +/-0.05	2.00 +/-0.05	2.00 +/-0.05	2.00 +/-0.05	2.00 +/-0.10	2.00 +/-0.10	2.00 +/-0.10
D_0	1.55 +/-0.05	1.55 +/-0.05	1.55 +/-0.05	1.55 +/-0.05	1.55 +/-0.05	1.50 +0.1/-0	1.55 +/-0.05	1.50 +0.1/-0	1.50 +0.1/-0	1.50 +0.1/-0	1.50 +0.1/-0	1.50 +0.1/-0	1.50 +0.1/-0	1.50 +0.1/-0	1.50 +0.1/-0
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	1.50 +/-0.10	1.50 +/-0.10	1.50 +/-0.10
E	1.75 +/-0.05	1.75 +/-0.05	1.75 +/-0.05	1.75 +/-0.05	1.75 +/-0.05	1.75 +/-0.10	1.75 +/-0.05	1.75 +/-0.10	1.75 +/-0.10	1.75 +/-0.10	1.75 +/-0.10	1.75 +/-0.10	1.75 +/-0.10	1.75 +/-0.10	1.75 +/-0.10
F	3.50 +/-0.05	3.50 +/-0.05	3.50 +/-0.05	3.50 +/-0.05	3.50 +/-0.05	3.50 +/-0.05	3.50 +/-0.05	3.50 +/-0.05	3.50 +/-0.05	3.50 +/-0.05	3.50 +/-0.05	3.50 +/-0.05	5.50 +/-0.10	5.50 +/-0.10	5.50 +/-0.10

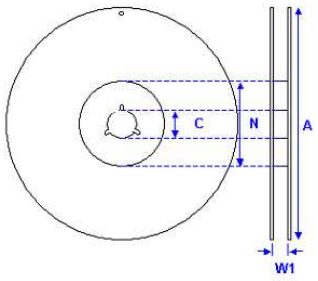
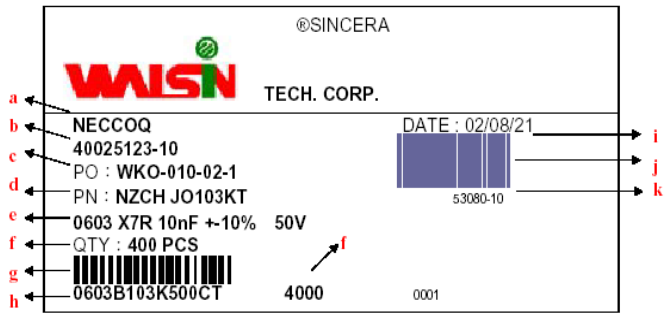


Fig. 4 The dimension of reel

Size	0201, 0402, 0603, 0805, 1206, 1210			1812
Reel size	7”	10”	13”	7”
C	13.0+0.5/-0.2	13.0+0.5/-0.2	13.0+0.5/-0.2	13.0+0.5/-0.2
W_1	8.4+1.5/-0	8.4+1.5/-0	8.4+1.5/-0	12.4+2.0/-0
A	178.0±1.0	250.0±1.0	330.0±1.0	178.0±1.0
N	60.0+1.0/-0	100.0±1.0	100±1.0	60.0+1.0/-0

◙ Description of customer label



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

◙ Constructions

No.	Name		NPO, X7R, X5R, X6S, X7S, Y5V
①	Ceramic material		$BaTiO_3$ based
②	Inner electrode		Ni
③	Termination	Inner layer	Cu
④		Middle layer	Ni
⑤		Outer layer	Sn

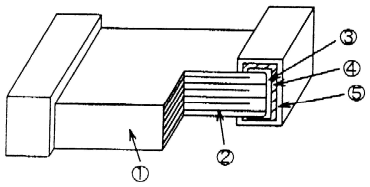


Fig. 5 The construction of MLCC

◙ Storage and handling conditions

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

(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.

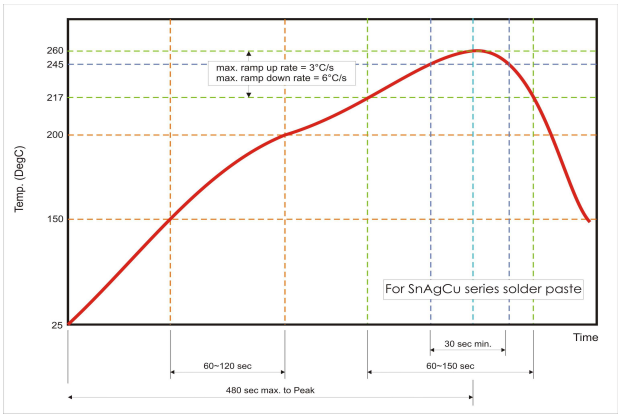


Fig. 6 Recommended reflow soldering profile for SMT process with SnAgCu series solder paste.

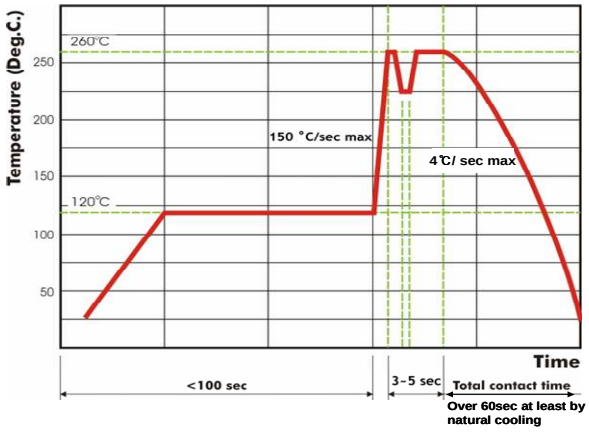


Fig. 7 Recommended wave soldering profile for SMT process with SnAgCu series solder.

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