APPROVAL SHEET

MULTILAYER CERAMIC CAPACITORS

Automotive Capacitors Series (MG)

0201 to 1812 Sizes

NP0, X7R, X5R, Dielectrics,

6.3V to 1000V

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 MG series MLCC is made by NP0, X7R & X5R dielectrics and which provides product with high electrical precision, stability and reliability. Besides, MG series MLCC is tighten controlling in quality in line to assure quality performance in automotive applications.

2. FEATURES

a. A wide selection of sizes is available (0402 to 1812).
b. High capacitance in given case size.
c. Capacitor with lead-free termination (pure Tin).

3. APPLICATIONS

a. For Navigation & Information equipments.
b. For entertainment equipments
c. For comfortable equipments.

4. HOW TO ORDER

MG	31	B	104	K	500	C	T
Series	**Size**	**Dielectric**	**Capacitance**	**Tolerance**	**Rated voltage**	**Termination**	**Packaging style**
MG= Automotive (without AEC-Q200 certification)	**03**=0201 (0603) **15**=0402 (1005) **18**=0603 (1608) **21**=0805 (2012) **31**=1206 (3216) **32**=1210 (3225) **43**=1812 (4532)	**N**=NP0 (C0G) **B**=X7R **X**=X5R	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	**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. **6R3**=6.3 VDC **100**=10 VDC **160**=16 VDC **250**=25 VDC **500**=50 VDC **101**=100 VDC **201**=200 VDC **251**=250 VDC **501**=500 VDC **631**=630 VDC **102**=1000 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)
	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
				0.50+0.02/-0.05	Q	R	+0.05/-0.10
		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 1808/1812/1825_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≧4.7μFor 0603(>10V)/Cap>1μF products.
#2: For 0201/ 0.1uF < Cap < 0.68uF products.
#3: For 0201/Cap≧0.68μF products.
#4: For 1210(100V)/Cap>1μF or 1210(250V)/Cap>0.47μF or 1210(400V~630V)/Cap>0.22μF.

6. GENERAL ELECTRICAL DATA

Dielectric	NP0	X7R	X5R
Size	0201, 0402, 0603, 0805, 1206, 1210, 1812		
Capacitance range*	0.1pF to 0.033μF	100pF to 2.2μF	0.068μF to 10μF
Capacitance tolerance**	Cap≤5pF: B (±0.1pF), C (±0.25pF) 5pF<Cap<10pF: C (±0.25pF), D (±0.5pF) Cap≥10pF: F (±1%), G (±2%), J (±5%)	J (±5%), K (±10%), M (±20%)	
Rated voltage (WVDC)	10V, 16V, 25V, 50V, 100V, 200V, 250V, 500V, 630V, 1000V		6.3V, 10V, 16V, 25V
Tan δ*	Cap<30pF: Q≥400+20C Cap≥30pF: Q≥1000	Note 1	
Operating temperature	-55 to +125℃		-55 to +85℃
Capacitance characteristic	±30ppm/℃	±15%	
Termination	Ni/Sn (lead-free termination)		

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

NP0: Apply 1.0±0.2Vrms, 1.0MHz±10% for Cap≤1000pF and 1.0±0.2Vrms, 1.0kHz±10% for Cap>1000pF, 25℃ at ambient temperature Measured at 1.0±0.2Vrms, 1.0kHz±10% for C≤10μF; 0.5±0.2Vrms, 120Hz±20% for C>10μF, 30~70% related humidity, 25℃ ambient temperature for X7R, X5R.

** Preconditioning for Class II MLCC: Perform a heat treatment at 150±10℃ for 1 hour, then leave in a mbient condition for 24±2 hours before measurement.

X7R/X5R

Rated vol.	D.F.≦	Exception of D.F. ≦	
≧100V	≦2.5%	≦3%	1206≧0.47μF
		≦5%	0603≧0.068μF;0805＞0.1μF;1206≧1μF;1210≧2.2μF
		≦10%	0805＞0.22μF;1210≧3.3μF
50V	≦2.5%	≦3%	0201(50V);0603≧0.047μF;0805≧0.18μF;1206≧0.47μF
		≦5%	0201≧0.01uF;1210≧3.3μF
		≦10%	0402≧0.012μF;0603>0.1μF;0805/X5R≧1μF; 0805/X7R>0.47μF;1206≧2.2μF;1210≧10μF
35V	≦3.5%	≦10%	0603≧1μF;0805≥2.2μF;1206≧2.2μF;1210≧10μF
25V	≦3.5%	≦5%	0201≧0.01μF;0805≧1μF;1210/X7R≧10μF
		≦7%	0603≧0.33μF
		≦10%	0201≧0.1μF;0402/X5R≧0.10μF;0402/X7R≧0.056μF; 0603≧0.47μF; 0805≧2.2μF;1206≧4.7μF; 1210/X7R≧22μF;1210/X5R≧10μF
		≦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/X5R≧0.1uF;0201/X7R≧0.022μF;0402≧0.22uF; 0603>0.47μF;0805≧2.2μF;1206≧4.7μF;1210≧22μF
10V	≦5%	≦10%	0201≧0.012μF;0402≧0.22μF;0603≧0.33μF; 0805≧2.2μF;1206≧2.2μF;1210≧22μF
		≦15%	0201/X7R≧0.1μF;0201/X5R>0.1μF;0402≧1μF
6.3V	≦10%	≦15%	0201/X7R≧0.1μF;0201/X5R>0.1μF;0402≧1μF; 0603≧10μF;0805≧4.7μF;1206≧47μF;1210≧100μF
		≦20%	0402≧2.2μF
4V	≦15%	---	---

7. CAPACITANCE RANGE (NP0 Dielectric)

NP0 Dielectric 0201, 0402, 0603 Sizes

DIELECTRIC		NP0																
SIZE		0201					0402					0603						
RATED VOLTAGE		10	16	25	50	100	10	16	25	50	100	10	16	25	50	100	200	250
Capacitance	0.1pF (0R1)	L	L	L	L	L	N	N	N	N	N							
	0.2pF (0R2)	L	L	L	L	L	N	N	N	N	N							
	0.3pF (0R3)	L	L	L	L	L	N	N	N	N	N							
	0.4pF (0R4)	L	L	L	L	L	N	N	N	N	N							
	0.5pF (0R5)	L	L	L	L	L	N	N	N	N	N	S	S	S	S	S	S	S
	0.6pF (0R6)	L	L	L	L	L	N	N	N	N	N	S	S	S	S	S	S	S
	0.7pF (0R7)	L	L	L	L	L	N	N	N	N	N	S	S	S	S	S	S	S
	0.8pF (0R8)	L	L	L	L	L	N	N	N	N	N	S	S	S	S	S	S	S
	0.9pF (0R9)	L	L	L	L	L	N	N	N	N	N	S	S	S	S	S	S	S
	1.0pF (1R0)	L	L	L	L	L	N	N	N	N	N	S	S	S	S	S	S	S
	1.2pF (1R2)	L	L	L	L	L	N	N	N	N	N	S	S	S	S	S	S	S
	1.5pF (1R5)	L	L	L	L	L	N	N	N	N	N	S	S	S	S	S	S	S
	1.8pF (1R8)	L	L	L	L	L	N	N	N	N	N	S	S	S	S	S	S	S
	2.0pF (2R0)	L	L	L	L	L	N	N	N	N	N	S	S	S	S	S	S	S
	2.2pF (2R2)	L	L	L	L	L	N	N	N	N	N	S	S	S	S	S	S	S
	2.7pF (2R7)	L	L	L	L	L	N	N	N	N	N	S	S	S	S	S	S	S
	3.0pF (3R0)	L	L	L	L	L	N	N	N	N	N	S	S	S	S	S	S	S
	3.3pF (3R3)	L	L	L	L	L	N	N	N	N	N	S	S	S	S	S	S	S
	3.9pF (3R9)	L	L	L	L	L	N	N	N	N	N	S	S	S	S	S	S	S
	4.0pF (4R0)	L	L	L	L	L	N	N	N	N	N	S	S	S	S	S	S	S
	4.7pF (4R7)	L	L	L	L	L	N	N	N	N	N	S	S	S	S	S	S	S
	5.0pF (5R0)	L	L	L	L	L	N	N	N	N	N	S	S	S	S	S	S	S
	5.6pF (5R6)	L	L	L	L	L	N	N	N	N	N	S	S	S	S	S	S	S
	6.0pF (6R0)	L	L	L	L	L	N	N	N	N	N	S	S	S	S	S	S	S
	6.8pF (6R8)	L	L	L	L	L	N	N	N	N	N	S	S	S	S	S	S	S
	7.0pF (7R0)	L	L	L	L	L	N	N	N	N	N	S	S	S	S	S	S	S
	8.0pF (8R0)	L	L	L	L	L	N	N	N	N	N	S	S	S	S	S	S	S
	8.2pF (8R2)	L	L	L	L	L	N	N	N	N	N	S	S	S	S	S	S	S
	9.0pF (9R0)	L	L	L	L	L	N	N	N	N	N	S	S	S	S	S	S	S
	10pF (100)	L	L	L	L	L	N	N	N	N	N	S	S	S	S	S	S	S
	12pF (120)	L	L	L	L	L	N	N	N	N	N	S	S	S	S	S	S	S
	15pF (150)	L	L	L	L	L	N	N	N	N	N	S	S	S	S	S	S	S
	18pF (180)	L	L	L	L	L	N	N	N	N	N	S	S	S	S	S	S	S
	22pF (220)	L	L	L	L	L	N	N	N	N	N	S	S	S	S	S	S	S
	27pF (270)	L	L	L	L	L	N	N	N	N	N	S	S	S	S	S	S	S
	33pF (330)	L	L	L	L	L	N	N	N	N	N	S	S	S	S	S	S	S
	39pF (390)	L	L	L	L	L	N	N	N	N	N	S	S	S	S	S	S	S
	47pF (470)	L	L	L	L	L	N	N	N	N	N	S	S	S	S	S	S	S
	56pF (560)	L	L	L	L	L	N	N	N	N	N	S	S	S	S	S	S	S
	68pF (680)	L	L	L	L		N	N	N	N	N	S	S	S	S	S	S	S
	82pF (820)	L	L	L	L		N	N	N	N	N	S	S	S	S	S	S	S
	100pF (101)	L	L	L	L		N	N	N	N	N	S	S	S	S	S	S	S
	120pF (121)						N	N	N	N	N	S	S	S	S	S	S	S
	150pF (151)						N	N	N	N	N	S	S	S	S	S	S	S
	180pF (181)						N	N	N	N	N	S	S	S	S	S	S	S
	220pF (221)						N	N	N	N	N	S	S	S	S	S	S	S
	270pF (271)						N	N	N	N		S	S	S	S	S	X	X
	330pF (331)						N	N	N	N		S	S	S	S	S	X	X
	390pF (391)						N	N	N	N		S	S	S	S	S	X	X
	470pF (471)						N	N	N	N		S	S	S	S	S	X	X
	560pF (561)						N	N	N	N		S	S	S	S	S		
	680pF (681)						N	N	N	N		S	S	S	S	S		
	820pF (821)						N	N	N	N		S	S	S	S	S		
	1,000pF (102)						N	N	N	N		S	S	S	S	S		
	1,200pF (122)											X	X	X	X			
	1,500pF (152)											X	X	X	X			
	1,800pF (182)											X	X	X	X			
	2,200pF (222)											X	X	X	X			
	2,700pF (272)											X	X	X	X			
	3,300pF (332)											X	X	X	X			
	3,900pF (392)																	
	4,700pF (472)																	
	5,600pF (562)																	
	6,800pF (682)																	
	8,200pF (822)																	
	0.01μF (103)																	

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.

NP0 Dielectric 0805 Size (Continued)

DIELECTRIC		NP0								
SIZE		0805								
RATED VOLTAGE		10	16	25	50	100	200	250	500	630
Capacitance	0.5pF (0R5)	A	A	A	A	A	A	A	A	A
	0.6pF (0R6)	A	A	A	A	A	A	A	A	A
	0.7pF (0R7)	A	A	A	A	A	A	A	A	A
	0.8pF (0R8)	A	A	A	A	A	A	A	A	A
	0.9pF (0R9)	A	A	A	A	A	A	A	A	A
	1.0pF (1R0)	A	A	A	A	A	A	A	A	A
	1.2pF (1R2)	A	A	A	A	A	A	A	A	A
	1.5pF (1R5)	A	A	A	A	A	A	A	A	A
	1.8pF (1R8)	A	A	A	A	A	A	A	A	A
	2.2pF (2R2)	A	A	A	A	A	A	A	A	A
	2.7pF (2R7)	A	A	A	A	A	A	A	A	A
	3.3pF (3R3)	A	A	A	A	A	A	A	A	A
	3.9pF (3R9)	A	A	A	A	A	A	A	A	A
	4.7pF (4R7)	A	A	A	A	A	A	A	A	A
	5.6pF (5R6)	A	A	A	A	A	A	A	A	A
	6.8pF (6R8)	A	A	A	A	A	A	A	A	A
	8.2pF (8R2)	A	A	A	A	A	A	A	A	A
	10pF (100)	A	A	A	A	A	A	A	A	A
	12pF (120)	A	A	A	A	A	A	A	A	A
	15pF (150)	A	A	A	A	A	A	A	A	A
	18pF (180)	A	A	A	A	A	A	A	A	A
	22pF (220)	A	A	A	A	A	A	A	A	A
	27pF (270)	A	A	A	A	A	A	A	A	A
	33pF (330)	A	A	A	A	A	A	A	A	A
	39pF (390)	A	A	A	A	A	A	A	A	A
	47pF (470)	A	A	A	A	A	A	A	A	A
	56pF (560)	A	A	A	A	A	A	A	A	A
	68pF (680)	A	A	A	A	A	A	A	A	A
	82pF (820)	A	A	A	A	A	A	A	B	B
	100pF (101)	A	A	A	A	A	B	B	B	B
	120pF (121)	A	A	A	A	A	B	B	D	D
	150pF (151)	A	A	A	A	A	D	D	D	D
	180pF (181)	A	A	A	A	A	D	D	D	D
	220pF (221)	A	A	A	A	A	D	D	D	D
	270pF (271)	A	A	A	A	A	D	D	D	D
	330pF (331)	A	A	A	A	A	D	D	D	D
	390pF (391)	B	B	B	B	B	D	D	D	D
	470pF (471)	B	B	B	B	B	D	D		
	560pF (561)	B	B	B	B	B	D	D		
	680pF (681)	B	B	B	B	B	D	D		
	820pF (821)	B	B	B	B	B	D	D		
	1,000pF (102)	B	B	B	B	B	D	D		
	1,200pF (122)	B	B	B	B	B	D	D		
	1,500pF (152)	B	B	B	B	B	D	D		
	1,800pF (182)	B	B	B	B	B	D	D		
	2,200pF (222)	B	B	B	B	B	D	D		
	2,700pF (272)	D	D	D	D	D				
	3,300pF (332)	D	D	D	D	D				
	3,900pF (392)	D	D	D	D	D				
	4,700pF (472)	D	D	D	D	D				
	5,600pF (562)	D	D	D	D	D				
	6,800pF (682)	D	D	D	D	D				
	8,200pF (822)	D	D	D	D					
	0.01µF (103)	D	D	D	D					

NP0 Dielectric 1206 Size (Continued)

DIELECTRIC		NP0									
SIZE		1206									
RATED VOLTAGE		10	16	25	50	100	200	250	500	630	1000
Capacitance	1.0pF (1R0)										
	1.2pF (1R2)	B	B	B	B	B	B	B	B	B	
	1.5pF (1R5)	B	B	B	B	B	B	B	B	B	B
	1.8pF (1R8)	B	B	B	B	B	B	B	B	B	B
	2.2pF (2R2)	B	B	B	B	B	B	B	B	B	B
	2.7pF (2R7)	B	B	B	B	B	B	B	B	B	B
	3.3pF (3R3)	B	B	B	B	B	B	B	B	B	B
	3.9pF (3R9)	B	B	B	B	B	B	B	B	B	B
	4.7pF (4R7)	B	B	B	B	B	B	B	B	B	B
	5.6pF (5R6)	B	B	B	B	B	B	B	B	B	B
	6.8pF (6R8)	B	B	B	B	B	B	B	B	B	B
	8.2pF (8R2)	B	B	B	B	B	B	B	B	B	B
	10pF (100)	B	B	B	B	B	B	B	B	B	B
	12pF (120)	B	B	B	B	B	B	B	B	B	B
	15pF (150)	B	B	B	B	B	B	B	B	B	B
	18pF (180)	B	B	B	B	B	B	B	B	B	B
	22pF (220)	B	B	B	B	B	B	B	B	B	D
	27pF (270)	B	B	B	B	B	B	B	B	B	D
	33pF (330)	B	B	B	B	B	B	B	B	B	D
	39pF (390)	B	B	B	B	B	B	B	B	B	D
	47pF (470)	B	B	B	B	B	B	B	B	B	D
	56pF (560)	B	B	B	B	B	B	B	B	B	D
	68pF (680)	B	B	B	B	B	B	B	B	B	D
	82pF (820)	B	B	B	B	B	B	B	B	B	D
	100pF (101)	B	B	B	B	B	B	B	B	B	D
	120pF (121)	B	B	B	B	B	B	B	B	B	D
	150pF (151)	B	B	B	B	B	B	B	B	B	D
	180pF (181)	B	B	B	B	B	B	B	B	B	G
	220pF (221)	B	B	B	B	B	B	B	B	B	G
	270pF (271)	B	B	B	B	B	B	C	C	C	G
	330pF (331)	B	B	B	B	B	B	C	C	C	G
	390pF (391)	B	B	B	B	B	B	C	C	C	G
	470pF (471)	B	B	B	B	B	C	C	C	C	G
	560pF (561)	B	B	B	B	B	C	D	D	D	G
	680pF (681)	B	B	B	B	B	C	D	D	D	G
	820pF (821)	B	B	B	B	B	C	G	G	G	G
	1,000pF (102)	B	B	B	B	B	C	G	G	G	G
	1,200pF (122)	B	B	B	B	B	C	G	G	G	
	1,500pF (152)	B	B	B	B	B	D	G	G	G	
	1,800pF (182)	B	B	B	B	B	D	G	G	G	
	2,200pF (222)	B	B	B	B	B	D	G	G	G	
	2,700pF (272)	B	B	B	B	B	D	G			
	3,300pF (332)	B	B	B	B	B	D	G			
	3,900pF (392)	B	B	B	B	B	D	G			
	4,700pF (472)	B	B	B	B	B	D	G			
	5,600pF (562)	B	B	B	B	B					
	6,800pF (682)	C	C	C	C	C					
	8,200pF (822)	D	D	D	D	D					
	0.01µF (103)	D	D	D	D	D					

NP0 Dielectric 1210 Size (Continued)

DIELECTRIC		NP0									
SIZE		1210									
RATED VOLTAGE		10	16	25	50	100	200	250	500	630	1000
Capacitance	10pF (100)	C	C	C	C	C	C	C	C	C	C
	12pF (120)	C	C	C	C	C	C	C	C	C	C
	15pF (150)	C	C	C	C	C	C	C	C	C	C
	18pF (180)	C	C	C	C	C	C	C	C	C	C
	22pF (220)	C	C	C	C	C	C	C	C	C	C
	27pF (270)	C	C	C	C	C	C	C	C	C	C
	33pF (330)	C	C	C	C	C	C	C	C	C	C
	39pF (390)	C	C	C	C	C	C	C	C	C	C
	47pF (470)	C	C	C	C	C	C	C	C	C	C
	56pF (560)	C	C	C	C	C	C	C	C	C	C
	68pF (680)	C	C	C	C	C	C	C	C	C	C
	82pF (820)	C	C	C	C	C	C	C	C	C	C
	100pF (101)	C	C	C	C	C	C	C	C	C	D
	120pF (121)	C	C	C	C	C	C	C	C	C	D
	150pF (151)	C	C	C	C	C	C	C	C	C	D
	180pF (181)	C	C	C	C	C	C	C	C	C	D
	220pF (221)	C	C	C	C	C	C	C	C	C	G
	270pF (271)	C	C	C	C	C	C	C	C	C	G
	330pF (331)	C	C	C	C	C	C	C	C	C	G
	390pF (391)	C	C	C	C	C	C	C	C	C	G
	470pF (471)	C	C	C	C	C	C	C	C	C	G
	560pF (561)	C	C	C	C	C	C	C	C	C	G
	680pF (681)	C	C	C	C	C	C	C	C	C	G
	820pF (821)	C	C	C	C	C	C	C	C	C	G
	1,000pF (102)	C	C	C	C	C	D	D	D	D	G
	1,200pF (122)	C	C	C	C	C	D	D	D	D	
	1,500pF (152)	C	C	C	C	C	D	D	D	D	
	1,800pF (182)	C	C	C	C	C	D	D	D	D	
	2,200pF (222)	C	C	C	C	C	D	D	D	D	
	2,700pF (272)	C	C	C	C	C	D	D	D	D	
	3,300pF (332)	C	C	C	C	C	D	D	D	D	
	3,900pF (392)	C	C	C	C	C	D	D	D	D	
	4,700pF (472)	C	C	C	C	C	G	G			
	5,600pF (562)	C	C	C	C	C	G	G			
	6,800pF (682)	C	C	C	C	C	G	G			
	8,200pF (822)	C	C	C	C	C	G	G			
	0.010μF (103)	C	C	C	C	C	G	G			
	0.012μF (123)	D	D	D	D	D					
	0.015μF (153)	D	D	D	D	D					
	0.018μF (183)	K	K	K	K	K					
	0.022μF (223)	K	K	K	K	K					
	0.027μF (273)	K	K	K	K	K					
	0.033μF (333)	K	K	K	K	K					
	0.039μF (393)	K	K	K	K	K					
	0.047μF (473)	K	K	K	K	K					

NP0 Dielectric 1812 Size (Continued)

DIELECTRIC		NP0				
SIZE		1812				
RATED VOLTAGE (VDC)		10	16	25	50	100
Capacitance	10pF (100)					D
	12pF (120)					D
	15pF (150)					D
	18pF (180)					D
	22pF (220)					D
	27pF (270)					D
	33pF (330)					D
	39pF (390)					D
	47pF (470)					D
	56pF (560)					D
	68pF (680)					D
	82pF (820)					D
	100pF (101)					D
	120pF (121)					D
	150pF (151)					D
	180pF (181)					D
	220pF (221)					D
	270pF (271)					D
	330pF (331)					D
	390pF (391)					D
	470pF (471)					D
	560pF (561)					D
	680pF (681)					D
	820pF (821)					D
	1,000pF (102)	D	D	D	D	D
	1,200pF (122)	D	D	D	D	D
	1,500pF (152)	D	D	D	D	D
	1,800pF (182)	D	D	D	D	D
	2,200pF (222)	D	D	D	D	D
	2,700pF (272)	D	D	D	D	D
	3,300pF (332)	D	D	D	D	D
	3,900pF (392)	D	D	D	D	D
	4,700pF (472)	D	D	D	D	D
	5,600pF (562)	D	D	D	D	D
	6,800pF (682)	D	D	D	D	D
	8,200pF (822)	D	D	D	D	D
	0.010μF (103)	D	D	D	D	D
	0.012μF (123)	D	D	D	D	D
	0.015μF (153)	D	D	D	D	D
	0.018μF (183)	D	D	D	D	D
	0.022μF (223)	D	D	D	D	D
	0.027μF (273)	D	D	D	D	D
	0.033μF (333)	D	D	D	D	D
	0.039μF (393)					

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.

8. CAPACITANCE RANGE (X7R Dielectric)

X7R Dielectric 0201, 0402, 0603 Sizes

DIELECTRIC		X7R												
SIZE		0201				0402				0603				
RATED VOLTAGE		10	16	25	50	10	16	25	50	10	16	25	50	100
Capacitance	100pF (101)	L	L	L	L	N	N	N	N	S	S	S	S	S
	120pF (121)	L	L	L	L	N	N	N	N	S	S	S	S	S
	150pF (151)	L	L	L	L	N	N	N	N	S	S	S	S	S
	180pF (181)	L	L	L	L	N	N	N	N	S	S	S	S	S
	220pF (221)	L	L	L	L	N	N	N	N	S	S	S	S	S
	270pF (271)	L	L	L	L	N	N	N	N	S	S	S	S	S
	330pF (331)	L	L	L	L	N	N	N	N	S	S	S	S	S
	390pF (391)	L	L	L	L	N	N	N	N	S	S	S	S	S
	470pF (471)	L	L	L	L	N	N	N	N	S	S	S	S	S
	560pF (561)	L	L	L	L	N	N	N	N	S	S	S	S	S
	680pF (681)	L	L	L	L	N	N	N	N	S	S	S	S	S
	820pF (821)	L	L	L	L	N	N	N	N	S	S	S	S	S
	1,000pF (102)	L	L	L	L	N	N	N	N	S	S	S	S	S
	1,200pF (122)	L	L	L		N	N	N	N	S	S	S	S	S
	1,500pF (152)	L	L	L		N	N	N	N	S	S	S	S	S
	1,800pF (182)	L	L	L		N	N	N	N	S	S	S	S	S
	2,200pF (222)	L	L	L		N	N	N	N	S	S	S	S	S
	2,700pF (272)	L	L	L		N	N	N	N	S	S	S	S	S
	3,300pF (332)	L	L	L		N	N	N	N	S	S	S	S	S
	3,900pF (392)	L	L	L		N	N	N	N	S	S	S	S	S
	4,700pF (472)	L	L	L		N	N	N	N	S	S	S	S	S
	5,600pF (562)	L	L	L		N	N	N	N	S	S	S	S	S
	6,800pF (682)	L				N	N	N	N	S	S	S	S	S
	8,200pF (822)	L				N	N	N	N	S	S	S	S	S
	0.010μF (103)	L				N	N	N	N	S	S	S	S	S
	0.012μF (123)					N	N	N		S	S	S	S	X
	0.015μF (153)					N	N	N		S	S	S	S	X
	0.018μF (183)					N	N	N		S	S	S	S	X
	0.022μF (223)					N	N	N		S	S	S	S	X
	0.027μF (273)					N	N	N		S	S	S	S	
	0.033μF (333)					N	N	N		S	S	S	X	
	0.039μF (393)					N	N	N		S	S	S	X	
	0.047μF (473)					N	N	N		S	S	S	X	
	0.056μF (563)					N	N			S	S	S	X	
	0.068μF (683)					N	N			S	S	S	X	
	0.082μF (823)					N	N			S	S	S	X	
	0.10μF (104)					N	N			S	S	S	X	
	0.12μF (124)									S	S	X		
	0.15μF (154)									S	S	X		
	0.18μF (184)									S	S	X		
	0.22μF (224)									S	S	X		
	0.27μF (274)									X	X	X		
	0.33μF (334)									X	X	X		
	0.39μF (394)									X	X	X		
	0.47μF (474)									X	X	X		

X7R Dielectric 0805, 1206 Size

DIELECTRIC		X7R																	
SIZE		0805									1206								
RATED VOLTAGE (VDC)		10	16	25	50	100	200	250	500	630	10	16	25	50	100	200	250	500	630
Capacitance	100pF (101)	B	B	B	B	B	B	B	B	B						D	D	D	D
	120pF (121)	B	B	B	B	B	B	B	B	B						D	D	D	D
	150pF (151)	B	B	B	B	B	B	B	B	B	B	B	B	B	B	D	D	D	D
	180pF (181)	B	B	B	B	B	B	B	B	B	B	B	B	B	B	D	D	D	D
	220pF (221)	B	B	B	B	B	B	B	B	B	B	B	B	B	B	D	D	D	D
	270pF (271)	B	B	B	B	B	B	B	B	B	B	B	B	B	B	D	D	D	D
	330pF (331)	B	B	B	B	B	B	B	B	B	B	B	B	B	B	D	D	D	D
	390pF (391)	B	B	B	B	B	B	B	B	B	B	B	B	B	B	D	D	D	D
	470pF (471)	B	B	B	B	B	B	B	B	B	B	B	B	B	B	D	D	D	D
	560pF (561)	B	B	B	B	B	B	B	B	B	B	B	B	B	B	D	D	D	D
	680pF (681)	B	B	B	B	B	B	B	B	B	B	B	B	B	B	D	D	D	D
	820pF (821)	B	B	B	B	B	B	B	B	B	B	B	B	B	B	D	D	D	D
	1,000pF (102)	B	B	B	B	B	B	B	B	B	B	B	B	B	B	D	D	D	D
	1,200pF (122)	B	B	B	B	B	B	B	B	B	B	B	B	B	B	D	D	D	D
	1,500pF (152)	B	B	B	B	B	B	B	B	B	B	B	B	B	B	D	D	D	D
	1,800pF (182)	B	B	B	B	B	B	B	B	B	B	B	B	B	B	D	D	D	D
	2,200pF (222)	B	B	B	B	B	B	B	B	B	B	B	B	B	B	D	D	D	D
	2,700pF (272)	B	B	B	B	B	B	B	B	B	B	B	B	B	B	D	D	D	D
	3,300pF (332)	B	B	B	B	B	B	B	B	B	B	B	B	B	B	D	D	D	D
	3,900pF (392)	B	B	B	B	B	B	B	B	B	B	B	B	B	B	D	D	D	D
	4,700pF (472)	B	B	B	B	B	B	B	D	D	B	B	B	B	B	D	D	D	D
	5,600pF (562)	B	B	B	B	B	B	B	D	D	B	B	B	B	B	D	D	D	D
	6,800pF (682)	B	B	B	B	B	B	B	D	D	B	B	B	B	B	D	D	D	D
	8,200pF (822)	B	B	B	B	B	B	B	D	D	B	B	B	B	B	D	D	D	D
	0.010μF (103)	B	B	B	B	B	D	D	D	D	B	B	B	B	B	D	D	D	D
	0.012μF (123)	B	B	B	B	B	D	D			B	B	B	B	B	D	D		
	0.015μF (153)	B	B	B	B	B	D	D			B	B	B	B	B	D	D		
	0.018μF (183)	B	B	B	B	B	D	D			B	B	B	B	B	D	D		
	0.022μF (223)	B	B	B	B	B	D	D			B	B	B	B	B	D	D		
	0.027μF (273)	B	B	B	B	D					B	B	B	B	B	D	D		
	0.033μF (333)	B	B	B	B	D					B	B	B	B	B	G	G		
	0.039μF (393)	B	B	B	B	D					B	B	B	B	B	G	G		
	0.047μF (473)	B	B	B	B	D					B	B	B	B	B	G	G		
	0.056μF (563)	B	B	B	B	D					B	B	B	B	B	G	G		
	0.068μF (683)	B	B	B	B	D					B	B	B	B	B	G	G		
	0.082μF (823)	B	B	B	B	D					B	B	B	B	D	G	G		
	0.10μF (104)	B	B	B	B	D					B	B	B	B	D	G	G		
	0.12μF (124)	B	B	B	D						B	B	B	B	D				
	0.15μF (154)	D	D	D	D						C	C	C	C	G				
	0.18μF (184)	D	D	D	D						C	C	C	C	G				
	0.22μF (224)	D	D	D	D						C	C	C	C	G				
	0.27μF (274)	D	D	D							C	C	C	D					
	0.33μF (334)	D	D	D							C	C	C	D					
	0.39μF (394)	D	D	D							C	C	J	P					
	0.47μF (474)	D	D	D							J	J	J	P					
	0.56μF (564)	D	D	D							J	J	J	P					
	0.68μF (684)	D	D	D							J	J	J	P					
	0.82μF (824)	D	D	D							J	J	J	P					
	1.0μF (105)	D	D	D							J	J	J	P					
	1.5μF (155)										J	J	P						
	2.2μF (225)										J	J	P						
	4.7μF (475)																		
	10μF (106)																		

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.

X7R Dielectric 1210, 1812 Size

DIELECTRIC		X7R															
SIZE		1210									1812						
RATED VOLTAGE (VDC)		10	16	25	50	100	200	250	500	1000	10	16	25	50	100	200	250
Capacitance	100pF (101)							D	D	D							
	120pF (121)							D	D	D							
	150pF (151)							D	D	D							
	180pF (181)							D	D	D							
	220pF (221)							D	D	D							
	270pF (271)							D	D	D							
	330pF (331)							D	D	D							
	390pF (391)							D	D	D							
	470pF (471)							D	D	D							
	560pF (561)							D	D	D							
	680pF (681)							C	D	D							
	820pF (821)							C	D	D							
	1,000pF (102)	C	C	C	C	C	C	C	D	D	D	D	D	D	D	D	D
	1,200pF (122)	C	C	C	C	C	C	C	D	D	D	D	D	D	D	D	D
	1,500pF (152)	C	C	C	C	C	C	C	D	D	D	D	D	D	D	D	D
	1,800pF (182)	C	C	C	C	C	C	C	D	D	D	D	D	D	D	D	D
	2,200pF (222)	C	C	C	C	C	C	C	D	D	D	D	D	D	D	D	D
	2,700pF (272)	C	C	C	C	C	C	C	D	D	D	D	D	D	D	D	D
	3,300pF (332)	C	C	C	C	C	C	C	D	D	D	D	D	D	D	D	D
	3,900pF (392)	C	C	C	C	C	C	C	D	G	D	D	D	D	D	D	D
	4,700pF (472)	C	C	C	C	C	C	C	D	G	D	D	D	D	D	D	D
	5,600pF (562)	C	C	C	C	C	C	C	D	G	D	D	D	D	D	D	D
	6,800pF (682)	C	C	C	C	C	C	C	D	G	D	D	D	D	D	D	D
	8,200pF (822)	C	C	C	C	C	C	C	D	G	D	D	D	D	D	D	D
	0.010μF (103)	C	C	C	C	C	C	C	D	G	D	D	D	D	D	D	D
	0.012μF (123)	C	C	C	C	C	C	C	D		D	D	D	D	D	D	D
	0.015μF (153)	C	C	C	C	C	C	C	D		D	D	D	D	D	D	D
	0.018μF (183)	C	C	C	C	C	C	C	D		D	D	D	D	D	D	D
	0.022μF (223)	C	C	C	C	C	C	C	D		D	D	D	D	D	D	D
	0.027μF (273)	C	C	C	C	C	C	C			D	D	D	D	D	D	D
	0.033μF (333)	C	C	C	C	C	C	C			D	D	D	D	D	D	D
	0.039μF (393)	C	C	C	C	C	C	C			D	D	D	D	D	D	D
	0.047μF (473)	C	C	C	C	C	D	D			D	D	D	D	D	D	D
	0.056μF (563)	C	C	C	C	C	D	D			D	D	D	D	D	D	D
	0.068μF (683)	C	C	C	C	C	G	G			D	D	D	D	D	D	D
	0.082μF (823)	C	C	C	C	C	G	G			D	D	D	D	D	D	D
	0.10μF (104)	C	C	C	C	C	G	G			D	D	D	D	D	D	D
	0.12μF (124)	C	C	C	C	C	G	G			D	D	D	D	D	D	D
	0.15μF (154)	D	D	D	D	D	M	M			D	D	D	D	D	K	K
	0.18μF (184)	D	D	D	D	D	M	M			D	D	D	D	D	K	K
	0.22μF (224)	D	D	D	D	D	M	M			D	D	D	D	D	K	K
	0.27μF (274)	D	D	D	D	G	M	M			D	D	D	D	D	K	K
	0.33μF (334)	D	D	D	D	G	M	M			D	D	D	D	D	K	K
	0.39μF (394)	D	D	D	D	M	M	M			D	D	D	D	D	K	K
	0.47μF (474)	D	D	D	D	M	M	M			D	D	D	D	K	K	K
	0.56μF (564)	D	D	D	D	M					D	D	D	D	K		
	0.68μF (684)	D	D	D	D	K					D	D	D	K	K		
	0.82μF (824)	D	D	D	D	K					D	D	D	K	K		
	1.00μF (105)	D	D	D	D	K					D	D	D	K	K		
	1.50μF (155)	K	K	G											K		
	2.20μF (225)	K	K	G											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.

9. CAPACITANCE RANGE (X5R Dielectric)

DIELECTRIC		X5R																	
SIZE		0402				0603				0805				1206				1210	
RATED VOLTAGE(VDC)		6.3	10	16	25	6.3	10	16	25	6.3	10	16	25	6.3	10	16	25	10	16
Capacitance	0.022μF (223)																		
	0.033μF (333)																		
	0.047μF (473)																		
	0.068μF (683)		N																
	0.10μF (104)		N	N															
	0.15μF (154)		N	N															
	0.22μF (224)	N	N	N															
	0.33μF (334)	N	N				X	X	X										
	0.47μF (474)	N					X	X	X										
	0.68μF (684)	N					X	X	X										
	1.0μF (105)					X	X	X	X										
	1.5μF (155)									I	I				J	J	P	K	K
	2.2μF (225)									I	I	I	I		J	J	P	K	K
	3.3μF (335)											I	I	P	P	P	P	K	K
	4.7μF (475)											I	I	P	P	P	P	K	K
	6.8μF (685)													P					
	10μF (106)													P					
	22μF (226)																		

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

10. 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	15k	70k	-	-
0402 (1005)	0.50±0.05	N	10k	50k	-	-
0603 (1608)	0.80±0.07	S	4k	15k	-	-
	0.80+0.15/-0.10	X	4k	15k	-	-
0805 (2012)	0.60±0.10	A	4k	15k	-	-
	0.80±0.10	B	4k	15k	-	-
	1.25±0.10	D	-	-	3k	10k
	1.25±0.20	I	-	-	3k	10k
1206 (3216)	0.80±0.10	B	4k	15k	-	-
	0.95±0.10	C	-	-	3k	10k
	1.15±0.15	J	-	-	3k	10k
	1.25±0.10	D	-	-	3k	10k
	1.60±0.20	G	-	-	2k	10k
	1.60+0.30/-0.10	P	-	-	2k	9k
1210 (3225)	0.95±0.10	C	-	-	3k	10k
	1.25±0.10	D	-	-	3k	10k
	1.60±0.20	G	-	-	2k	-
	2.00±0.20	K	-	-	1k	6k
	2.50±0.30	M	-	-	1k	6k
1812 (4532)	1.25±0.10	D	-	-	1k	5k
	2.00±0.20	K	-	-	1k	-
	2.50±0.30	M	-	-	0.5k	3k

Unit: pieces

11. 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%

** Test condition: 0.5±0.2Vrms，1KHz±10%</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>X7R:
0805=106(6.3V), 0603/475(6.3V)
X5R:
0201≧224 (6.3V,10V,16V)#1,
0402≧475 (6.3V,16V), 0402≧225(10V),
0603=106 (6.3V),
X6S:
0201/474(4V),0201≧104 (6.3V,10V#1),
0402≧225 (6.3V),
0402/475 (10V), 0603/106 (6.3V),
X7S:
0402/225(6.3V)

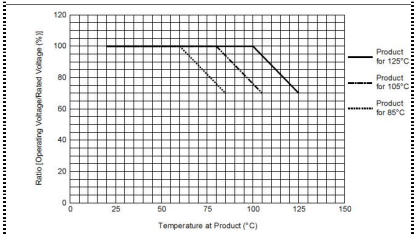
#1 Excluding
X5R/0201/105(6.3V);225(10V),
X6S/0201/104(10V)
(1.0±0.2Vrms，1KHz±10%)

*Before initial measurement (Class II only):
To apply de-aging at 150℃ 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>Exception of D.F. ≦</th><th></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/X5R≧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/X7R≧10μF</td></tr>
<tr><td>≦7%</td><td>0603≧0.33μF</td></tr>
<tr><td>≦10%</td><td>0201≧0.1μF;0402/X5R≧0.10μF;0402/X7R≧0.056μF;
0603≧0.47μF; 0805≧2.2μF;1206≧4.7μF;
1210/X7R≧22μF;1210/X5R≧10μF</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/X5R≧0.1uF;0201/X7R≧0.022μF;0402≧0.22uF;
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≧0.22μF;0603≧0.33μF;
0805≧2.2μF;1206≧2.2μF;1210≧22μF</td></tr>
<tr><td>≦15%</td><td>0201/X7R≧0.1μF;0201/X5R>0.1μF;0402≧1μF</td></tr>
<tr><td rowspan="2">6.3V</td><td rowspan="2">≦10%</td><td>≦15%</td><td>0201/X7R≧0.1μF;0201/X5R>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>
<tr><td>4.</td><td>Dielectric Strength</td><td>* To apply voltage (≤100V) 250%.
200V~300V ≥2 times VDC
400V~450V ≥1.2 times VDC
500V~999V ≥1.5 times VDC
1000V~3000V ≥1.2 times VDC
* 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>Rated voltage: ≤100V
To apply rated voltage for MAX. 120sec.</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="8">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>
<tr><td colspan="2"></td></tr>
<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>
<table>
<tr><td>Rated voltage: 200~630V</td><td>To apply rated voltage (500V max.) for 60 sec.</td></tr>
<tr><td>Rated voltage: ≥630V</td><td>To apply 500V for 60 sec.</td></tr>
</table>
≥10GΩ or RxC≥100Ω-F whichever is smaller</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><th>T.C.</th><th>Operating Temp</th></tr>
<tr><td>NPO</td><td>-55~125℃ at 25℃</td></tr>
<tr><td>X7R</td><td>-55~125℃ at 25℃</td></tr>
<tr><td>X7S</td><td>-55 ~ 125℃ at 25℃</td></tr>
<tr><td>X5R</td><td>-55~ 85℃ at 25℃</td></tr>
<tr><td>X6S</td><td>-55~105℃ at 25℃</td></tr>
<tr><td>Y5V</td><td>-25~ 85℃ at 20℃</td></tr>
</table>
*Before initial measurement (Class II only):
To apply de-aging at 150℃ for 1hr then set for 24± 2 hrs at room temp.
* Measurement voltage for Class II:
<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></td><td>*0201X104/16V: 0.5V</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</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><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</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><th>T.C.</th><th>Capacitance Change</th></tr>
<tr><td>NPO</td><td>Within ±30ppm/℃</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：
2N (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℃ for 1hr then set for 24± 2 hrs at room temp.
Cap./DF(Q) Measurement to be made after de-aging at 150℃ 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℃
* 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℃ 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℃
* Dipping time: 10±1 sec
* Preheating: 120 to 150℃ for 1 minute before imme rse the capacitor in a eutectic solder.
*Before initial measurement (Class II only): To apply de-aging at 150℃ 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℃ 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><th>Step</th><th>Temp. (℃)</th><th>Time (min.)</th></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℃ 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℃ 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℃
*Humidity: 90~95%RH
*Test time: 500+24/-0hrs.
*Before initial measurement (Class II only): To apply de-aging at 150℃ 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℃ 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 vol.</th><th>D.F.≦</th><th colspan="2">Exception of D.F.≦</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>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="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≧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;0805≧1μF;1210≧10μF</td></tr>
<tr><td>≦14%</td><td>0603≧0.33μF</td></tr>
<tr><td>≦15%</td><td>0201≧0.1μF;0402≧0.10μF&(0402/X7R≧0.056μF);0603≧0.47μF
0805≧2.2μF;1206≧4.7μF;1210≧22μF(1210/X5R≧10μF)</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>0.47μF;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;
0603≧0.33μF;0805≧2.2μF;1206≧2.2μF;1210≧22μF</td></tr>
<tr><td>≦20%</td><td>0201≧0.1μF(0201/X5R>0.1μF);0402≧1μF</td></tr>
<tr><td>6.3V</td><td>≦15%</td><td>≦30%</td><td>0201≧0.1μF(0201/X5R>0.1μF);0402≧1μF;
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, 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 colspan="2">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℃
*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℃ 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℃ 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 vol.</th><th>D.F.≦</th><th colspan="2">Exception of D.F.≦</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>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="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≧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;0805≧1μF;1210≧10μF</td></tr>
<tr><td>≦14%</td><td>0603≧0.33μF</td></tr>
<tr><td>≦15%</td><td>0201≧0.1μF;0402≧0.10μF&(0402/X7R≧0.056μF);0603≧0.47μF;
0805≧2.2μF;1206≧4.7μF;1210≧22μF(1210/X5R≧10μF)</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>0.47μF;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;
0603≧0.33μF;0805≧2.2μF;1206≧2.2μF;1210≧22μF</td></tr>
<tr><td>≦20%</td><td>0201≧0.1μF(0201/X5R>0.1μF);0402≧1μF</td></tr>
<tr><td>6.3V</td><td>≦15%</td><td>≦30%</td><td>0201≧0.1μF(0201/X5R>0.1μF);0402≧1μF;
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, Y5V)
<table>
<tr><th>Rated voltage</th><th>Insulation Resistance</th></tr>
<tr><td>100V: All X7R;1210≥3.3μF</td><td rowspan="7">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></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℃
X6S: 105±3℃
X5R, Y5V: 85±3℃
*Test time: 1000+24/-0 hrs.
*To apply voltage:
(1) ≤ 6.3V or C ≥10μF : 150% of rated voltage.
(2) 10V ≤ Ur < 500V: 200% of rated voltage.
(3) 500V: 150% of rated voltage.
(4) Ur ≥ 630V: 120% of rated voltage.
(5) 100% of rated voltage for below range.
<table>
<tr><th>Size</th><th>Dielectric</th><th>Rated voltage</th><th>Capacitance</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 rowspan="5">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 rowspan="2">X6S</td><td>6.3V,10V</td><td>C >1.0μF</td></tr>
<tr><td>16V,25V</td><td>C≧1.0μF</td></tr>
<tr><td>X7R/X7S/Y5V</td><td>6.3V,10V</td><td>C≧1.0μF</td></tr>
<tr><td rowspan="4">0603</td><td rowspan="2">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>X5R/X6S/X7S</td><td>25V</td><td>C≧1.0μF</td></tr>
<tr><td>X7R</td><td>35V</td><td>C≧1.0μF</td></tr>
<tr><td rowspan="5">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>X7R/X6S/X7S</td><td rowspan="2">16V,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>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/X6S</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">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>Y5V</td><td>16V</td><td>C≧0.47μF</td></tr>
<tr><td rowspan="6">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>Y5V</td><td>16V</td><td>C≧2.2μF</td></tr>
<tr><td rowspan="5">0805</td><td rowspan="5">X5R/X7R/
X6S/X7S</td><td>100V</td><td>C≧0.47μF</td></tr>
<tr><td>50V</td><td>C≧1.0μF</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>Y5V</td><td>16V</td><td>C≧4.7μF</td></tr>
<tr><td rowspan="4">1206</td><td rowspan="2">X7R</td><td>100V</td><td>C≧1.0μF</td></tr>
<tr><td>50V</td><td>C=4.7μF</td></tr>
<tr><td rowspan="2">X5R/X6S/
X7S</td><td>100V</td><td>C>1.0μF</td></tr>
<tr><td>50V</td><td>C=4.7μF</td></tr>
<tr><td>1210</td><td>X5R/X7R/
X6S/X7S</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>
* Before initial measurement (Class II only): To apply de-aging at 150℃ 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℃ 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 vol.</th><th>D.F.≦</th><th colspan="2">Exception of D.F.≦</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>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="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≧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;0805≧1μF;1210≧10μF</td></tr>
<tr><td>≦14%</td><td>0603≧0.33μF</td></tr>
<tr><td>≦15%</td><td>0201≧0.1μF;0402≧0.10μF&(0402/X7R≧0.056μF);0603≧0.47μF;
0805≧2.2μF;1206≧4.7μF;1210≧22μF(1210/X5R≧10μF)</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>0.47μF;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;
0603≧0.33μF;0805≧2.2μF;1206≧2.2μF;1210≧22μF</td></tr>
<tr><td>≦20%</td><td>0201≧0.1μF(0201/X5R>0.1μF);0402≧1μF</td></tr>
<tr><td>6.3V</td><td>≦15%</td><td>≦30%</td><td>0201≧0.1μF(0201/X5R>0.1μF);0402≧1μF;
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, 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

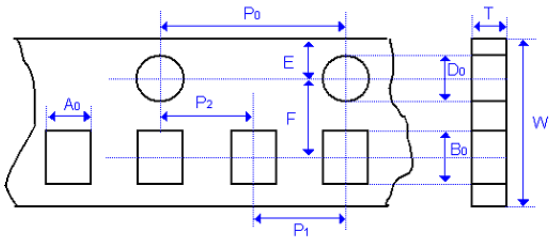


Fig. 2 The dimension of paper tape

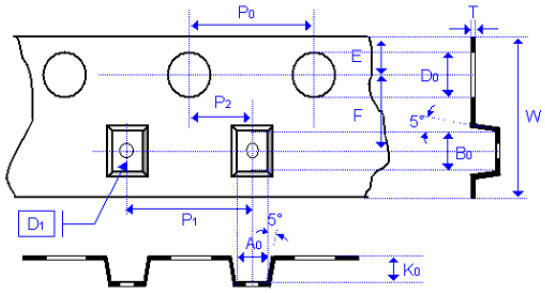


Fig. 3 The dimension of plastic tape

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	0.40 +/-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	< 3.20	< 2.50	< 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	<4.00	< 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	0.25 +/-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 +/-0.30	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
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	1.50 +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	1.50 +/-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
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

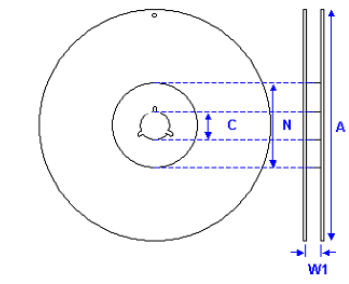
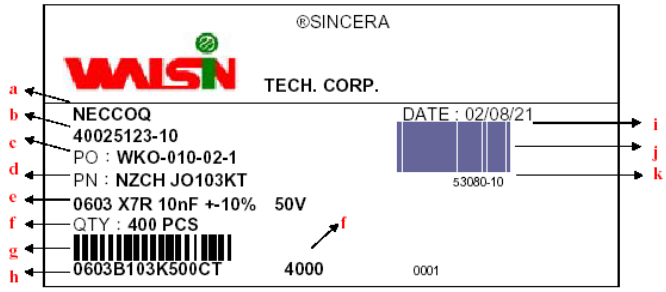


Fig. 4 The dimension of reel

Size	0201, 0402, 0603, 0805, 1206, 1210			1808, 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

◙ 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		NP0,	X7R
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 (Matt)	

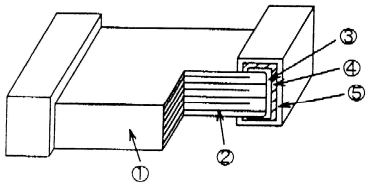


Fig. 5 The construction of MLCC

◙ 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.

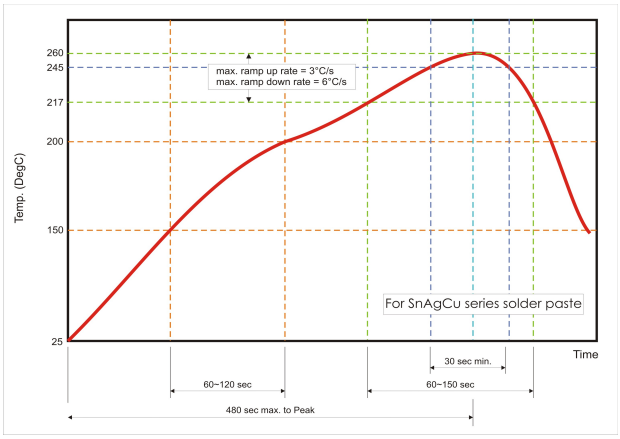


Fig. 5 Recommended reflow soldering profile for SMT process with SnAgCu series solder paste.

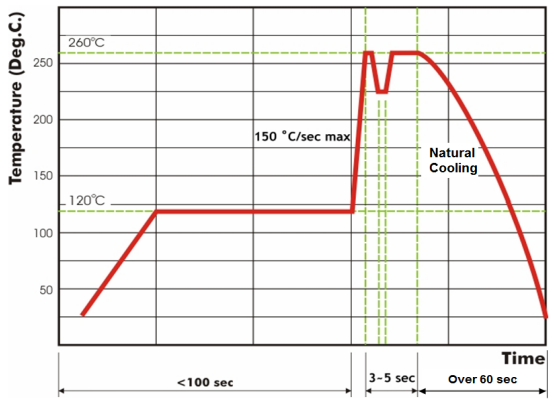


Fig. 6 Recommended wave soldering profile for SMT process with SnAgCu series solder.