SMD Multilayer Ceramic Capacitors

RoHS Compliant

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.

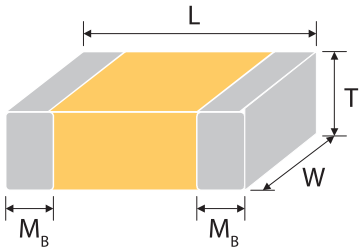
This MLCC is made by NP0, X7R, X6S and X5R dielectric material and which provides product with high electrical precision, stability and reliability.

Features

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

Applications

- For general digital circuit.
- For power supply bypass capacitors.
- For consumer electronics.
- For telecommunication.



The outline of MLCC

External Dimensions

Size Inch (mm)	L (mm)	W (mm)	T (mm)/Symbol		Soldering Method *	M_B min (mm)
0402 (1005)	1 ±0.05	0.5 ±0.05	0.5 ±0.05	N	R	0.25 +0.05/-0.1
			0.5 +0.02/-0.05	Q	R	
	1 ±0.2	0.5 ±0.20	0.5 ±0.2	E	R	
0603 (1608)	1.6 ±0.1	0.8 ±0.1	0.8 ±0.07	S	R / W	0.4 ±0.15
	1.6+0.15/-0.1	0.8 +0.15/-0.1	0.5 ±0.1	H	R / W	
			0.8 +0.15/-0.1	X	R / W	
	1.6 ±0.2[#1]	0.8 ±0.2[#1]	0.8 ±0.2[#1]		R / W	
0805 (2012)	2 ±0.15	1.25 ±0.1	0.5 ±0.1	H	R / W	0.5 ±0.2
			0.6 ±0.1	A	R / W	
			0.8 ±0.1	B	R / W	
			1.25 ±0.1	D	R	
	2 ±0.20	1.25 ±0.2	0.85 ±0.1	T	R / W	
			1.25 ±0.2	I	R	

Size Inch (mm)	L (mm)	W (mm)	T (mm)/Symbol		Soldering Method *	M_B min (mm)
1206 (3216)	3.2 ±0.15	1.6 ±0.15	0.80±0.10	B	R / W	0.6 ±0.2 (0.5 ±0.25)***
			0.95±0.10	C	R	
			1.25±0.10	D	R	
			1.15±0.15	J	R	
	3.2 ±0.2	1.6 ±0.2	19	G	R	
			0.85 ±0.1	T	R / W	
	3.2 +0.3/-0.1 3.3 +0.3/-0.1#5	1.6 +0.3/-0.1	1.6 +0.3/-0.1	P	R	
1210 (3225)	3.2 ±0.3	2.5 ±0.2	0.95 ±0.1	C	R	0.75 ±0.25
			0.85 ±0.1	T	R	
			1.25 ±0.1	D	R	
	3.2 ±0.4	2.5 ±0.3	1.6 ±0.2	G	R	
			2 ±0.2	K	R	
			2.5 ±0.3	M	R	
	3.2 ±0.6#4	2.50±0.50#4	2.5 ±0.5#4			
1812 (4532)	4.5 ±0.4 (4.5+0.5/-0.3)**	3.2 ±0.3	1.25 ±0.1	D	R	0.75 ±0.25 (0.5 ±0.25)***
			1.6 ±0.2	J	R	
			2 ±0.20	K	R	
		3.2 ±0.4	2.5 ±0.3	M	R	
			2.8 ±0.3	U	R	

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

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

*** For 1206_≥1000V, 1808/1812_200V~4000V and safety certificated products.

#1: For 0603/Cap≥10μF or 0603(≤6.3V)/Cap≥4.7μF or 0603(>10V)/Cap>1μF products, Excluding 0603X225(16V&25V),0603S225(6.3V&16V),0603X475(6.3V&16V),0603S475(4V&6.3V).

#2: For 0201/ 0.1uF < Cap < 0.68uF products, Excluding 0201X334~474(≤6.3V) & 0201X224(≤10V).

#3: For 0201/Cap≥0.68μF products, Excluding 0201X105*6R3=>(L:0.6±0.05,W:0.3±0.05,T:0.3±0.05).

#4: For 1210(200V&250V)/Cap>0.47μF products.

#5: For 1206(100V)/Cap≥1.2μF products.

General Electrical Data:

Dielectric	NP0	X7R	X5R
Size	0402, 0603, 0805, 1206, 1210, 1812		
Capacitance range*	0.1pF to 0.1μF	100pF to 47μF	100pF to 220μF
Capacitance tolerance**	Cap≤5pF#1: A(±0.05pF),B(±0.1pF), C (±0.25pF) 5pF<Cap<10pF: C(±0.25pF),D(±0.5pF) Cap≥10pF: F (±1%), G (±2%), J (±5%), K (±10%)	J (±5%), K (±10%), M (±20%)	K (±10%), M (±20%)
Rated voltage (WVDC)	10V, 16V, 25V, 50V,100V	4V, 6.3V, 10V, 16V, 25V, 50V, 100V	

Dielectric	NP0	X7R	X5R
Operating temperature	-55 to +125°C		-55 to +85°C
Capacitance characteristic	±30ppm	±15%	
Termination	Ni/Sn (lead-free termination)		

#1: NP0, 0.1pF product only provide B tolerance; 0603N0R3/0R4 provide B&C tolerance.
* Measured at the condition of 30~70% related humidity.
NP0: Apply 1.0±0.2Vrms, 1.0MHz±10% for Cap≤1000pF and 1.0±0.2Vrms, 1.0kHz±10% for Cap>1000pF, 25°C at ambient temperature
X7R/X6S/X5R/X7S: Please refer to page 13 “Reliability test conditions and requirements” for detail.
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 i n ambient condition for 24±2 hours before measurement.

Capacitance Range

Dielectric	NPO														
Size	0402					0603					0805				
Rated Voltage (V DC)	10	16	25	50	100	10	16	25	50	100	10	16	25	50	100
0.1pF (0R1)	N	N	N	N											
0.2pF (0R2)	N	N	N	N											
0.3pF (0R3)	N	N	N	N		S	S	S	S						
0.4pF (0R4)	N	N	N	N		S	S	S	S						
0.5pF (0R5)	N	N	N	N	N	S	S	S	S	S	A	A	A	A	A
0.6pF (0R6)	N	N	N	N	N	S	S	S	S	S	A	A	A	A	A
0.7pF (0R7)	N	N	N	N	N	S	S	S	S	S	A	A	A	A	A
0.8pF (0R8)	N	N	N	N	N	S	S	S	S	S	A	A	A	A	A
0.9pF (0R9)	N	N	N	N	N	S	S	S	S	S	A	A	A	A	A
1.0pF (1R0)	N	N	N	N	N	S	S	S	S	S	A	A	A	A	A
1.2pF (1R2)	N	N	N	N	N	S	S	S	S	S	A	A	A	A	A
1.5pF (1R5)	N	N	N	N	N	S	S	S	S	S	A	A	A	A	A
1.8pF (1R8)	N	N	N	N	N	S	S	S	S	S	A	A	A	A	A
2.0pF (2R0)	N	N	N	N	N	S	S	S	S	S	A	A	A	A	A
2.2pF (2R2)	N	N	N	N	N	S	S	S	S	S	A	A	A	A	A
2.7pF (2R7)	N	N	N	N	N	S	S	S	S	S	A	A	A	A	A
3.0pF (3R0)	N	N	N	N	N	S	S	S	S	S	A	A	A	A	A
3.3pF (3R3)	N	N	N	N	N	S	S	S	S	S	A	A	A	A	A
3.9pF (3R9)	N	N	N	N	N	S	S	S	S	S	A	A	A	A	A

Dielectric	NPO														
Size	0402					0603					0805				
Rated Voltage (V DC)	10	16	25	50	100	10	16	25	50	100	10	16	25	50	100
4.0pF (4R0)	N	N	N	N	N	S	S	S	S	S	A	A	A	A	A
4.7pF (4R7)	N	N	N	N	N	S	S	S	S	S	A	A	A	A	A
5.0pF (5R0)	N	N	N	N	N	S	S	S	S	S	A	A	A	A	A
5.6pF (5R6)	N	N	N	N	N	S	S	S	S	S	A	A	A	A	A
6.0pF (6R0)	N	N	N	N	N	S	S	S	S	S	A	A	A	A	A
6.8pF (6R8)	N	N	N	N	N	S	S	S	S	S	A	A	A	A	A
7.0pF (7R0)	N	N	N	N	N	S	S	S	S	S	A	A	A	A	A
8.0pF (8R0)	N	N	N	N	N	S	S	S	S	S	A	A	A	A	A
8.2pF (8R2)	N	N	N	N	N	S	S	S	S	S	A	A	A	A	A
9.0pF (9R0)	N	N	N	N	N	S	S	S	S	S	A	A	A	A	A
10pF (100)	N	N	N	N	N	S	S	S	S	S	A	A	A	A	A
12pF (120)	N	N	N	N	N	S	S	S	S	S	A	A	A	A	A
15pF (150)	N	N	N	N	N	S	S	S	S	S	A	A	A	A	A
18pF (180)	N	N	N	N	N	S	S	S	S	S	A	A	A	A	A
22pF (220)	N	N	N	N	N	S	S	S	S	S	A	A	A	A	A
27pF (270)	N	N	N	N	N	S	S	S	S	S	A	A	A	A	A
33pF (330)	N	N	N	N	N	S	S	S	S	S	A	A	A	A	A
39pF (390)	N	N	N	N	N	S	S	S	S	S	A	A	A	A	A
47pF (470)	N	N	N	N	N	S	S	S	S	S	A	A	A	A	A
56pF (560)	N	N	N	N	N	S	S	S	S	S	A	A	A	A	A
68pF (680)	N	N	N	N	N	S	S	S	S	S	A	A	A	A	A
82pF (820)	N	N	N	N	N	S	S	S	S	S	A	A	A	A	A
100pF (101)	N	N	N	N	N	S	S	S	S	S	A	A	A	A	A
120pF (121)	N	N	N	N	N	S	S	S	S	S	A	A	A	A	A
150pF (151)	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)	N	N	N	N		S	S	S	S	S	A	A	A	A	A
330pF (331)	N	N	N	N		S	S	S	S	S	A	A	A	A	A
390pF (391)	N	N	N	N		S	S	S	S	S	B	B	B	B	B
470pF (471)	N	N	N	N		S	S	S	S	S	B	B	B	B	B
560pF (561)	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

Dielectric	NPO														
Size	0402					0603					0805				
Rated Voltage (V DC)	10	16	25	50	100	10	16	25	50	100	10	16	25	50	100
1,500pF (152)						X	X	X	X	X	B	B	B	B	B
1,800pF (182)						X	X	X	X	X	B	B	B	B	B
2,200pF (222)						X	X	X	X	X	B	B	B	B	B
2,700pF (272)						X	X	X	X	X	D	D	D	D	D
3,300pF (332)						X	X	X	X	X	D	D	D	D	D
3,900pF (392)						X	X	X	X	X	D	D	D	D	D
4,700pF (472)						X	X	X	X	X	D	D	D	D	D
5,600pF (562)						X	X	X	X	X	D	D	D	D	D
6,800pF (682)						X	X	X	X	X	D	D	D	D	D
8,200pF (822)						X	X	X	X	X	D	D	D	D	D
0.010uF (103)						X	X	X	X	X	D	D	D	D	D
0.012uF (123)											D	D	D	D	D
0.015uF (153)											D	D	D	D	D
0.018uF (183)											D	D	D	D	D
0.022uF (223)											D	D	D	D	D

1. The letter in cell is expressed the symbol of product thickness.
2. The letter in cell with " * " mark is expressed capacitance tolerance "J" (±5%) only.

NP0 Dielectric 1206 Size

Dielectric		NP0													
Size		1206					1210								
Rated Voltage (V DC)		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

Dielectric		NP0													
Size		1206					1210								
Rated Voltage (V DC)		10	16	25	50	100	10	16	25	50	100	16	25	50	100
Capacitance	1,000pF (102)	B	B	B	B	B	C	C	C	C	C	D	D	D	D
	1,200pF (122)	B	B	B	B	B	C	C	C	C	C	D	D	D	D
	1,500pF (152)	B	B	B	B	B	C	C	C	C	C	D	D	D	D
	1,800pF (182)	B	B	B	B	B	C	C	C	C	C	D	D	D	D
	2,200pF (222)	B	B	B	B	B	C	C	C	C	C	D	D	D	D
	2,700pF (272)	B	B	B	B	B	C	C	C	C	C	D	D	D	D
	3,300pF (332)	B	B	B	B	B	C	C	C	C	C	D	D	D	D
	3,900pF (392)	B	B	B	B	B	C	C	C	C	C	D	D	D	D
	4,700pF (472)	B	B	B	B	B	C	C	C	C	C	D	D	D	D
	5,600pF (562)	B	B	B	B	B	C	C	C	C	C	D	D	D	D
	6,800pF (682)	C	C	C	C	C	C	C	C	C	C	D	D	D	D
	8,200pF (822)	D	D	D	D	D	C	C	C	C	C	D	D	D	D
	0.010µF (103)	D	D	D	D	D	C	C	C	C	C	D	D	D	D
	0.012µF (123)	P	P	P	P	P	D	D	D	D	D	D	D	D	D
	0.015µF (153)	P	P	P	P	P	D	D	D	D	D	D	D	D	D
	0.018µF (183)	P	P	P	P	P	K	K	K	K	K	D	D	D	D
	0.022µF (223)	P	P	P	P	P	K	K	K	K	K	D	D	D	D
	0.027µF (273)	P	P	P	P		K	K	K	K	K	D	D	D	D
	0.033µF (333)	P	P	P	P		K	K	K	K	K	D	D	D	D
	0.039µF (393)	P	P	P	P		K	K	K	K	K	D	D	D	D
	0.047µF (473)	P	P	P	P		K	K	K	K	K	D	D	D	D
	0.056µF (563)	P	P	P	P							M	M	M	M
	0.068µF (683)	P	P	P	P							M	M	M	M
	0.082µF (823)	P	P	P	P							M	M	M	M
	0.1µF (104)	P	P	P	P							M	M	M	M

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

X7R Dielectric 0402, 0603, 0805 Sizes

Dielectric																			
SIZE		0402					0603						0805						
Rated Voltage (VDC)		10	16	25	50	100	6.3	10	16	25	50	100	6.3	10	16	25	35	50	100
Capacitance	100pF (101)	N	N	N	N	N		S	S	S	S	S		B	B	B		B	B
	120pF (121)	N	N	N	N	N		S	S	S	S	S		B	B	B		B	B
	150pF (151)	N	N	N	N	N		S	S	S	S	S		B	B	B		B	B
	180pF (181)	N	N	N	N	N		S	S	S	S	S		B	B	B		B	B
	220pF (221)	N	N	N	N	N		S	S	S	S	S		B	B	B		B	B
	270pF (271)	N	N	N	N	N		S	S	S	S	S		B	B	B		B	B
	330pF (331)	N	N	N	N	N		S	S	S	S	S		B	B	B		B	B
	390pF (391)	N	N	N	N	N		S	S	S	S	S		B	B	B		B	B
	470pF (471)	N	N	N	N	N		S	S	S	S	S		B	B	B		B	B
	560pF (561)	N	N	N	N	N		S	S	S	S	S		B	B	B		B	B
	680pF (681)	N	N	N	N	N		S	S	S	S	S		B	B	B		B	B
	820pF (821)	N	N	N	N	N		S	S	S	S	S		B	B	B		B	B
	1,000pF (102)	N	N	N	N	N		S	S	S	S	S		B	B	B		B	B
	1,200pF (122)	N	N	N	N	N		S	S	S	S	S		B	B	B		B	B
	1,500pF (152)	N	N	N	N	N		S	S	S	S	S		B	B	B		B	B
	1,800pF (182)	N	N	N	N	N		S	S	S	S	S		B	B	B		B	B
	2,200pF (222)	N	N	N	N	N		S	S	S	S	S		B	B	B		B	B
	2,700pF (272)	N	N	N	N	N		S	S	S	S	S		B	B	B		B	B
	3,300pF (332)	N	N	N	N	N		S	S	S	S	S		B	B	B		B	B
	3,900pF (392)	N	N	N	N	N		S	S	S	S	S		B	B	B		B	B
	4,700pF (472)	N	N	N	N	N		S	S	S	S	S		B	B	B		B	B
	5,600pF (562)	N	N	N	N			S	S	S	S	S		B	B	B		B	B
	6,800pF (682)	N	N	N	N			S	S	S	S	S		B	B	B		B	B
	8,200pF (822)	N	N	N	N			S	S	S	S	S		B	B	B		B	B
	0.010µF (103)	N	N	N	N			S	S	S	S	S		B	B	B		B	B
	0.012µF (123)	N	N	N	N			S	S	S	S	X		B	B	B		B	B
	0.015µF (153)	N	N	N	N			S	S	S	S	X		B	B	B		B	B
	0.018µF (183)	N	N	N	N			S	S	S	S	X		B	B	B		B	B
	0.022µF (223)	N	N	N	N			S	S	S	S	X		B	B	B		B	B
	0.027µF (273)	N	N	N	N			S	S	S	S	X		B	B	B		B	D
	0.033µF (333)	N	N	N	N			S	S	S	X	X		B	B	B		B	D
	0.039µF (393)	N	N	N	N			S	S	S	X	X		B	B	B		B	D
	0.047µF (473)	N	N	N	N			S	S	S	X	X		B	B	B		B	D
	0.056µF (563)	N	N	N	E			S	S	S	X	X		B	B	B		B	D
	0.068µF (683)	N	N	N	E			S	S	S	X	X		B	B	B		B	D
	0.082µF (823)	N	N	N	E			S	S	S	X	X		B	B	B		B	D

Dielectric																			
SIZE		0402					0603						0805						
Rated Voltage (VDC)		10	16	25	50	100	6.3	10	16	25	50	100	6.3	10	16	25	35	50	100
Capacitance	0.10μF (104)	N	N	N	N	E		S	S	S	X	X		B	B	B		B	D
	0.12μF (124)							S	S	X				B	B	B		B	I
	0.15μF (154)		N					S	S	X	X			D	D	D		D	I
	0.18μF (184)							S	S	X				D	D	D		D	I
	0.22μF (224)	N	N	N	N			S	S	X	X			D	D	D		D	I
	0.27μF (274)						X	X	X	X				D	D	D		I	I
	0.33μF (334)	N	N				X	X	X	X	X			D	D	D		I	I
	0.39μF (394)						X	X	X	X				D	D	D		I	I
	0.47μF (474)	N	N				X	X	X	X	X			D	D	D		I	I
	0.56μF (564)						X	X	X					D	D	D			
	0.68μF (684)						X	X	X					D	D	D		I	
	0.82μF (824)						X	X	X					D	D	D			
	1.0μF (105)	N					X	X	X	X	X			D	D	D	I	I	
	1.5μF (155)													I	I	I			
	2.2μF (225)						X	X	X				I	I	I	I	I	I	
	3.3μF (335)																		
	4.7μF (475)						X						I	I	I	I			
	6.8μF (685)																		
	10μF (106)												I	I	I*				
	22μF (226)																		

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

X7R Dielectric 1206 Size

Dielectric		X7R															
Size		1206						1210					1812				
Rated Voltage (VDC)		10	16	25	35	50	100	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

Dielectric		X7R															
Size		1206						1210					1812				
Rated Voltage (VDC)		10	16	25	35	50	100	10	16	25	50	100	10	16	25	50	100
Capacitance	0.10µF (104)	B	B	B		B	C	C	C	C	C	C	D	D	D	D	D
	0.12µF (124)	B	B	B		B	D	C	C	C	C	C	D	D	D	D	D
	0.15µF (154)	C	C	C		C	G	C	C	C	C	C	D	D	D	D	D
	0.18µF (184)	C	C	C		C	G	C	C	C	C	C	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	P					G	G	M	M			D	K	K
	2.2µF (225)	J	J	P		P	P		G	G	M	M			G	M	M
	3.3µF (335)	P	P	P					G	G	M				K	K	
	4.7µF (475)	P	P	P		P		K	K	K	M	M			M	M	
	6.8µF (685)														M	M	
	10µF (106)	P	P	P	P			K	K	K	M				M	M	
	22µF (226)	P	P*					M	M	M							
	47µF (476)							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.

X5R Dielectric 0402, 0603, 0805, 1206, 1210 Sizes

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

Dielectric		X5R																		
Size		0805						1206						1210						
Rated Voltage (VDC)		4	6.3	10	16	25	50	4	6.3	10	16	25	50	4	6.3	10	16	25	35	50
Capacitance	1.0μF (105)			D	D	D	I						P							
	1.5μF (155)		I	I	I	I				J	J	P	P			K	K			
	2.2μF (225)		I	I	I	I	I			J	J	P	P			K	K			
	3.3μF (335)		I	I	I	I				P	P	P	P							
	4.7μF (475)		I	I	I	I	I		P	P	P	P	P			K	K	K		
	6.8uF (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*	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.

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 rowspan="2">*Test temp.: Room Temperature.
*Class I: (NP0)
≤1000pF, 1 ±0.2Vrms, 1MHz±10%
>1000pF, 1 ±0.2Vrms, 1KHz±10%
Class II: (X7R, X7E, X6S, X5R,X7S,Y5V)
C≤10μF, 1 ±0.2Vrms, 1KHz±10% **
C>10μF, 0.5±0.2Vrms, 120Hz±20%

0603/475(6.3V)
X5R#1:
0201≥224 (6.3V,10V,16V),
0402≥475 (6.3V,16V),
0402≥225(10V),
0603=106 (6.3V)
TT18X≥475(10V) , TT15X series
X6S:
0201/474(4V),0201>104 (6.3V,10V),
0402≥225 (6.3V),
0402/475 (10V), 0603/106 (6.3V),
X7S:
0402/225(6.3V)
#1 Excluding X5R/0201/105(6.3V);225(10V);224(16V),
0402X475M6R3, 0402X106M100 (1.0±0.2Vrms, 1KHz±10%)
*Before initial measurement (Class II only):
To apply de-aging at 150°C for 1hr then set
for 24±2 hrs at room temp.</td><td>* Shall not exceed the limits given in the detailed spec.</td></tr>
<tr><td>3</td><td>Q/ D.F. (Dissipation Factor)</td><td>NP0: Cap≥30pF, Q≥1000; Cap<30pF,Q≥400+20C
X7R:
<table>
<tr><th>Rated vol.</th><th>D.F.≤</th><th colspan="2">Exception of D.F.≤</th></tr>
<tr><td rowspan="4">≥ 100V</td><td rowspan="4">≤2.5%</td><td>≤3%</td><td>1206≥0.47μF</td></tr>
<tr><td>≤3.5%</td><td>1812≥4.7μF;1825≥4.7μF; 2220≥4.7μF; 2225≥4.7μF</td></tr>
<tr><td>≤5%</td><td>0603≥0.068μF; 0805>0.1μF; 1206≥1μF; 1210≥2.2μF;</td></tr>
<tr><td>≤10%</td><td>0805≥0.22μF; 1210≥3.3μF</td></tr>
<tr><td rowspan="4">50V</td><td rowspan="4">≤2.5%</td><td>≤3%</td><td>0201(50V);0603≥0.047μF;0805≥0.18μF;1206≥0.47μF</td></tr>
<tr><td>≤3.5%</td><td>1812≥4.7μF;1825≥4.7μF; 2220≥4.7μF; 2225≥4.7μF</td></tr>
<tr><td>≤5%</td><td>0201≥0.01uF;1210≥3.3μF</td></tr>
<tr><td>≤10%</td><td>0402≥0.012μF;0603>0.1μF; 0805/X7R>0.47μF;
1206≥2.2μF;1210≥10μF</td></tr>
<tr><td>35V</td><td>≤3.5%</td><td>≤10%</td><td>0603≥1μF;0805≥2.2μF;1206≥2.2μF;1210≥10μF</td></tr>
<tr><td rowspan="4">25V</td><td rowspan="4">≤3.5%</td><td>≤5%</td><td>0201≥0.01μF;0805≥1μF;1210≥10μF</td></tr>
<tr><td>≤7%</td><td>0603≥0.33μF</td></tr>
<tr><td>≤10%</td><td>0201≥0.1μF; 0402≥0.056μF;0603≥0.47μF;
0805≥2.2μF;1206≥4.7μF;1210≥22μF</td></tr>
<tr><td>≤12.5%</td><td>0402≥0.33μF</td></tr>
<tr><td rowspan="2">16V</td><td rowspan="2">≤3.5%</td><td>≤5%</td><td>0201≥0.01μF; 0402≥0.033μF; 0603≥0.15μF;
0805≥0.68μF; 1206≥2.2μF; 1210≥4.7μF</td></tr>
<tr><td>≤10%</td><td>0201/X7R≥0.022μF; 0402≥0.15uF;
0603>0.47μF; 0805≥2.2μF; 1206≥4.7μF; 1210≥22μF</td></tr>
<tr><td rowspan="2">10V</td><td rowspan="2">≤5%</td><td>≤10%</td><td>0201≥0.1μF; 0402≥1μF; 0603≥10μF;
0805≥4.7μF; 1206≥47μF; 1210≥100μF</td></tr>
<tr><td>≤15%</td><td>0201≥0.1μF;0402≥1μF</td></tr>
<tr><td rowspan="2">6.3V</td><td rowspan="2">≤10%</td><td>≤15%</td><td>0201≥0.1μF;0402≥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>
* I.R.: 10GΩ or RxC500Ω-F whichever is smaller.
Class II (X7R)</td></tr>
</table>

X5R:

<table>
<tr><th>No</th><th>Item</th><th>Test Condition</th><th>Requirements</th></tr>
<tr><td>3</td><td>Q/ D.F. (Dissipation Factor)</td><td>*Test temp.: Room Temperature.
*Class I: (NP0)
≤1000pF, 1 ±0.2Vrms, 1MHz±10%
>1000pF, 1 ±0.2Vrms, 1KHz±10%
Class II: (X7R, X7E, X6S, X5R,X7S,Y5V)
C≤10μF, 1 ±0.2Vrms, 1KHz±10% **
C>10μF, 0.5±0.2Vrms, 120Hz±20%

0603/475(6.3V)
X5R#1:
0201≥224 (6.3V,10V,16V),
0402≥475 (6.3V,16V),
0402≥225(10V),
0603=106 (6.3V)
TT18X≥475(10V) , TT15X series
X6S:
0201/474(4V),0201>104 (6.3V,10V),
0402≥225 (6.3V),
0402/475 (10V), 0603/106 (6.3V),
X7S:
0402/225(6.3V)
#1 Excluding X5R/0201/105(6.3V);225(10V);224(16V),
0402X475M6R3, 0402X106M100 (1.0±0.2Vrms, 1KHz±10%)
*Before initial measurement (Class II only):
To apply de-aging at 150°C for 1hr then set
for 24±2 hrs at room temp.</td><td>* Shall not exceed the limits given in the detailed spec.
NP0: Cap≥30pF, Q≥1000; Cap<30pF,Q≥400+20C
X7R:
<table>
<tr><th>Rated vol.</th><th>D.F.≤</th><th colspan="2">Exception of D.F.≤</th></tr>
<tr><td rowspan="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="4">50V</td><td rowspan="4">≤2.5%</td><td>≤3%</td><td>0201(50V);0603≥0.047μF;0805≥0.18μF;1206≥0.47μF</td></tr>
<tr><td>≤5%</td><td>0201≥0.01uF;1210≥3.3μF</td></tr>
<tr><td>≤10%</td><td>0402≥0.012μF;0603>0.1μF; 0805/X7R>0.47μF;
1206≥2.2μF;1210≥10μF</td></tr>
<tr><td>≤12.5%</td><td>1206=10μF</td></tr>
<tr><td>35V</td><td>≤3.5%</td><td>≤10%</td><td>0603≥1μF;0805≥2.2μF;1206≥2.2μF;1210≥10μF</td></tr>
<tr><td rowspan="4">25V</td><td rowspan="4">≤3.5%</td><td>≤5%</td><td>0201=0.01μF; 0805≥1μF</td></tr>
<tr><td>≤7%</td><td>0603≥0.33μF</td></tr>
<tr><td>≤10%</td><td>0201>0.01μF; 0402≥0.10μF; 0603≥0.47μF;
0805≥2.2μF; 1206≥4.7μF; 1210≥10μF</td></tr>
<tr><td>≤12.5%</td><td>402≥0.33μF;0805=10μF</td></tr>
<tr><td rowspan="3">16V</td><td rowspan="3">≤3.5%</td><td>≤5%</td><td>0201=0.01μF; 0402≥0.033μF; 0603≥0.15μF;
0805≥0.68μF; 1206≥2.2μF; 1210≥4.7μF</td></tr>
<tr><td>≤10%</td><td>0201>0.01uF; 0402≥ 0.22uF;
0603>0.47μF; 0805≥2.2μF; 1206≥4.7μF; 1210≥22μF</td></tr>
<tr><td>≤12.5%</td><td>0402≥1μF;0805=10μF</td></tr>
<tr><td rowspan="3">10V</td><td rowspan="3">≤5%</td><td>≤10%</td><td>0201≥0.012μF; 0402≥0.22μF;
0603≥0.33μF; 0805≥2.2μF; 1206≥2.2μF; 1210≥22μF;
01R5/X5R</td></tr>
<tr><td>≤12.5%</td><td>0805=10μF</td></tr>
<tr><td>≤15%</td><td>0201≥0.1μF;0402≥1μF 0603≥10μF</td></tr>
<tr><td rowspan="2">6.3V</td><td rowspan="2">≤10%</td><td>≤15%</td><td>0201≥0.1μF;0402≥1μF;0603≥10μF;
0805≥4.7μF;1206≥47μF;1210≥100μF</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>
* I.R.: 10GΩ or RxC500Ω-F whichever is smaller.
Class II (X7R)</td></tr>
</table>

<table>
<tr><th>No</th><th>Item</th><th>Test Condition</th><th>Requirements</th></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>*Test temp.: Room Temperature.
*To apply rated voltage for MAX. 120sec.</td><td>10G 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="7">10GΩ or RxC≥100 Ω-F whichever is smaller</td></tr>
<tr><td>50V:0402>0.01μF;0603≥1μF;0805≥1μF;1206≥4.7μF;1210≥4.7μF</td></tr>
<tr><td>35V:0805≥2.2μF;1206≥2.2μF;1210≥10μF</td></tr>
<tr><td>25V:0402≥1μF;0603≥2.2μF;0805≥2.2μF;1206≥10μF;1210≥10μF</td></tr>
<tr><td>16V: 0201≥0.1μF,0402≥0.22μF;0603≥1μF;
0805≥2.2μF;1206≥10μF;1210≥47μF</td></tr>
<tr><td>10V:0201≥47nF;0402≥0.47μF;0603≥0.47μF;0805≥2.2μF;
1206≥4.7μF;1210≥47μF</td></tr>
<tr><td>6.3V ; 4V ; Size≥1812</td></tr>
</table>
<table>
<tr><th>Rated voltage</th><th>Insulation Resistance</th></tr>
<tr><td>All X6S items, All X7S items</td><td rowspan="9">RxC≥50 Ω-F.</td></tr>
<tr><td>100V: 1210≥3.3μF</td></tr>
<tr><td>50V: 0402≥0.1μF; 0603≥2.2μF; 0805≥10μF;1206≥10μF</td></tr>
<tr><td>35V: 0603≥1μF;</td></tr>
<tr><td>25V: 0201≥0.1μF; 0402≥2.2μF;0603≥10μF; 0805≥10μF;1206≥22μF</td></tr>
<tr><td>16V: 0603≥10μF; 0402≥1μF; 0201≥0.22μF</td></tr>
<tr><td>10V: 0201>0.1μF; 0402≥1μF; 0603≥10μF; 0805≥47μF</td></tr>
<tr><td>6.3V:0201≥0.1μF; 0402≥1μF; 0603>4.7μF; 0805≥47μF; 1206≥10μF</td></tr>
<tr><td>4V: 0603≥22μF; 0805≥47μF; 1206≥100μF</td></tr>
</table></td></tr>
</table>

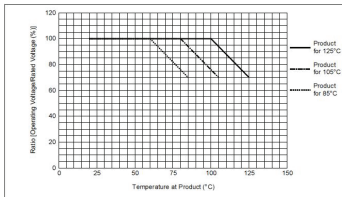
<table>
<tr><th>No</th><th>Item</th><th>Test Condition</th><th>Requirements</th></tr>
<tr><td>6.</td><td>Temperature Coefficient</td><td colspan="2">With no electrical load.
<table>
<tr><th>T.C.</th><th>Operating Temp</th><th>T.C.</th><th>Capacitance Change</th></tr>
<tr><td>NPO</td><td>55~125°C at 25°C</td><td>NPO</td><td>Within ±30ppm/°C</td></tr>
<tr><td>X7R</td><td>-55~125°C at 25°C</td><td>X7R</td><td>Within ±15%</td></tr>
<tr><td>X5R</td><td>-55~ 85°C at 25°C</td><td>X5R</td><td>Within ±15%</td></tr>
</table>
*Before initial measurement (Class II only):
To apply de-aging at 150°C for 1hr then set for 24±2 hrs at room temp.
* Measurement voltage for Class II:
<table>
<tr><th>0402</th><th>0603</th></tr>
<tr><td>Cap<1μF: 1V</td><td>Cap<1μF: 1V</td></tr>
<tr><td>Cap=1μF: 0.5V**
0402B224-16V: 0.5V
0402B334/474-6.3V&10V: 0.5V
0402S334/474-6.3V: 0.5V
0402X225/475-6.3V: 0.5V</td><td>1μF≤Cap≤4.7μF: 0.5V
0603X106-10V: 0.5V</td></tr>
<tr><td>1μF<Cap<10μF: 0.2V
**0402B105M6R3V: 0.2V</td><td>Cap>4.7μF: 0.2V</td></tr>
<tr><td>Cap≥10μF: 0.1V</td><td></td></tr>
<tr><th>0805</th><th>1206/1210</th></tr>
<tr><td>Cap<10μF: 1V</td><td>Cap≤10μF: 1V</td></tr>
<tr><td>Cap=10μF: 0.5V
0805B475/6.3V~25V: 0.5V</td><td>10μF<Cap≤100μF: 0.5V</td></tr>
<tr><td>Cap>10μF: 0.2V</td><td>Cap>100μF: 0.2V
1206X107-6.3V: 0.2V
1210S107-6.3V: 0.2V</td></tr>
</table></td></tr>
<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°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>
</table>

<table>
<tr><th>No</th><th>Item</th><th>Test Condition</th><th>Requirements</th></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%
(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%
* 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. (°C)</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°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%
* 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%;
**10V: 0603≥4.7μF;0402≥1μF;0201≥0.1μF, within ±25%;
* Q/D.F. value:
NP0: More than 30pF Q≥350, 10pF≤C≤30pF, Q≥275+2.5C
Less than 10pF Q200+10C X7R, X5R, X6S, X7S:
<table>
<tr><th>Rated vol.</th><th>D.F.≤</th><th colspan="2">Exception of D.F.≤</th></tr>
<tr><td rowspan="4">≥ 100V</td><td rowspan="4">≤3%</td><td>≤6%</td><td>1206≥0.47μF</td></tr>
<tr><td>≤7%</td><td>1812≥4.7μF;1825≥4.7μF; 2220≥4.7μF; 2225≥4.7μF</td></tr>
<tr><td>≤7.5%</td><td>0603≥0.068μF;0805>0.1μF;1206≥1μF;1210≥2.2μF</td></tr>
<tr><td>≤20%</td><td>0805>0.22μF;1210≥3.3μF</td></tr>
<tr><td rowspan="4">50V</td><td rowspan="4">≤3%</td><td>≤6%</td><td>0201(50V);0603≥0.047μF;0805≥0.18μF;1206≥0.47μF</td></tr>
<tr><td>≤7%</td><td>1812≥4.7μF;1825≥4.7μF; 2220≥4.7μF; 2225≥4.7μF</td></tr>
<tr><td>≤10%</td><td>0201≥0.01uF;1210≥3.3μF</td></tr>
<tr><td>≤20%</td><td>0402≥0.012μF;0603>0.1μF; 0805/X7R>0.47μF;
1206≥2.2μF;1210≥10μF</td></tr>
<tr><td>35V</td><td>≤5%</td><td>≤20%</td><td>0603≥1μF;0805≥2.2μF;1206≥2.2μF;1210≥10μF</td></tr>
<tr><td rowspan="4">25V</td><td rowspan="4">≤5%</td><td>≤10%</td><td>0201≥0.01μF(0201/X5R=0.01μF);0805≥1μF;1210≥10μF*</td></tr>
<tr><td>≤14%</td><td>0603≥0.33μF</td></tr>
<tr><td>≤15%</td><td>0201≥0.1μF(0201/X5R>0.01μF); 0603≥0.47μF;TTseries
0402≥0.10μF(0402/X7R≥0.056μF);0805≥2.2μF;
1206≥4.7μF;1210≥22μF(1210/X5R≥10μF)*;</td></tr>
<tr><td>≤20%</td><td>0402≥0.33μF</td></tr>
<tr><td rowspan="2">16V</td><td rowspan="2">≤5%</td><td>≤10%</td><td>0603≥0.15μF;0805≥0.68μF;1206≥2.2μF;1210≥4.7μF</td></tr>
<tr><td>≤15%</td><td>0201≥0.012μF;04028≥0.22μF (0402/X7R80.15μF);
0603≥0.33μF;0805≥2.2μF;1206≥2.2μF;1210≥22μF</td></tr>
<tr><td rowspan="2">10V</td><td rowspan="2">≤7.5%</td><td>≤15%</td><td>0201≥0.012μF;0402V0.22μF (0402/X7R≥0.15μF);
0603≥0.33μF;0805V2.2μF;1206≥2.2μF;1210≥22μF</td></tr>
<tr><td>≤20%</td><td>0201≥0.1μF;0402≥1μF;0603/X5R≥10μF;01R5/X5R</td></tr>
<tr><td>6.3V</td><td>≤15%</td><td>≤30%</td><td>0201≥0.1μF;0402≥1μF(0402/X6S≥0.47μF);
0603≥10μF;0805≥4.7μF;1206≥47μF;1210≥100μF</td></tr>
<tr><td>4V</td><td>≤20%</td><td>---</td><td>---</td></tr>
</table>
*I.R.: ≥10V, 1GΩ or 50Ω-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;12064.7μF;1210≥4.7μF</td></tr>
<tr><td>35V:0603≥1μF;0805≥2.2μF; 1206≥2.2μF;1210≥10μF</td></tr>
<tr><td>25V:0201≥0.1uF; 0402≥0.22μF; 0603≥2.2μF;0805≥2.2μF;
1206≥10μF;1210≥10μF</td></tr>
<tr><td>16V: 0201≥0.1uF;0402≥0.22μF;0603≥1μF;0805≥2.2μF;
1206≥10μF;1210≥47μF</td></tr>
<tr><td>10V:0201≥47nF;0402≥0.47μF;0603≥0.47μF;0805≥2.2μF;
1206≥4.7μF;1210≥47μF</td></tr>
<tr><td>6.3V ; 4V ; All X6S/X7S items; Size≥1812</td></tr>
</table>
</td></tr>
</table>

<table>
<tr><th>No</th><th>Item</th><th>Test Condition</th><th>Requirements</th></tr>
<tr><td>14.</td><td>Humidity
(Damp Heat)
Load</td><td>*Test temp.: 40±2°C
*Humidity: 90~95%RH
*Test time: 500+24/-0 hrs.
*To apply voltage:
Rated voltage (MAX. 500V)
*Before initial measurement (Class II only): To apply
de-aging at 150°C for 1hr then set for 24±2 hrs at room temp.
* Cap. / DF(Q) / I.R.
Measurement to be made after de-aging at 150°C for 1hr then set for 24±2 hrs at room temp.</td><td>* No remarkable damage.
* Cap change:
NP0: ±7.5% or 0.75pF whichever is larger.
X7R, X5R, X6S, X7S: ≥10V**,within ±12.5%; ≤6.3V within ±25%;
**10V: 0603≥4.7μF;0402≥1μF;0201≥0.1μF, within ±25%;
* Q/D.F. value:
NP0: C≥30pF,Q≥200;C<30pF, Q≥100+10/3C
X7R, X5R, X6S, X7S:
<table>
<tr><th>Rated vol.</th><th>D.F.≤</th><th colspan="2">Exception of D.F.≤</th></tr>
<tr><td rowspan="4">≥ 100V</td><td rowspan="4">≤3%</td><td>≤6%</td><td>1206≥0.47μF</td></tr>
<tr><td>≤7%</td><td>1812≥4.7μF;1825≥4.7μF; 2220≥4.7μF; 2225≥4.7μF</td></tr>
<tr><td>≤7.5%</td><td>0603≥0.068μF;0805>0.1μF;1206≥1μF;1210≥2.2μF</td></tr>
<tr><td>≤20%</td><td>0805>0.22μF;1210≥3.3μF</td></tr>
<tr><td rowspan="4">50V</td><td rowspan="4">≤3%</td><td>≤6%</td><td>0201(50V);0603≥0.047μF;0805≥0.18μF;1206≥0.47μF</td></tr>
<tr><td>≤7%</td><td>1812≥4.7μF;1825≥4.7μF; 2220≥4.7μF; 2225≥4.7μF</td></tr>
<tr><td>≤10%</td><td>0201≥0.01uF;1210≥3.3μF</td></tr>
<tr><td>≤20%</td><td>0402≥0.012μF;0603>0.1μF; 0805/X7R>0.47μF;
1206≥2.2μF;1210≥10μF</td></tr>
<tr><td>35V</td><td>≤5%</td><td>≤20%</td><td>0603≥1μF;0805≥2.2μF;1206≥2.2μF;1210≥10μF</td></tr>
<tr><td rowspan="4">25V</td><td rowspan="4">≤5%</td><td>≤10%</td><td>0201≥0.01μF(0201/
X5R=0.01μF);0805≥1μF;1210≥10μF*</td></tr>
<tr><td>≤14%</td><td>0603≥0.33μF</td></tr>
<tr><td>≤15%</td><td>0201≥0.1μF(0201/X5R>0.01μF);
0603≥0.47μF;TTseries
0402≥0.10μF(0402/X7R≥0.056μF);0805≥2.2μF;
1206≥4.7μF;1210≥22μF(1210/X5R≥10μF)*;</td></tr>
<tr><td>≤20%</td><td>0402≥0.33μF</td></tr>
<tr><td rowspan="2">16V</td><td rowspan="2">≤5%</td><td>≤10%</td><td>0603≥0.15μF;0805≥0.68μF;1206≥2.2μF;1210≥4.7μF</td></tr>
<tr><td>≤15%</td><td>0201≥0.012μF;04028≥0.22μF (0402/X7R80.15μF);
0603≥0.33μF;0805≥2.2μF;1206≥2.2μF;1210≥22μF</td></tr>
<tr><td rowspan="2">10V</td><td rowspan="2">≤7.5%</td><td>≤15%</td><td>0201≥0.012μF;0402V0.22μF (0402/X7R≥0.15μF);
0603≥0.33μF;0805V2.2μF;1206≥2.2μF;1210≥22μF</td></tr>
<tr><td>≤20%</td><td>0201≥0.1μF;0402≥1μF;0603/X5R≥10μF;01R5/X5R</td></tr>
<tr><td>6.3V</td><td>≤15%</td><td>≤30%</td><td>0201≥0.1μF;0402≥1μF(0402/X6S≥0.47μF);
0603≥10μF;0805≥4.7μF;1206≥47μF;1210≥100μF</td></tr>
<tr><td>4V</td><td>≤20%</td><td>---</td><td>---</td></tr>
</table>
*I.R.: ≥10V, 500MΩ or 25Ω-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">500MΩor RxC≥5Ω-F whichever is smaller.</td></tr>
<tr><td>50V: 0402>0.01μF;0603≥1μF;0805≥1μF;12064.7μF;1210≥4.7μF</td></tr>
<tr><td>35V:0603≥1μF;0805≥2.2μF; 1206≥2.2μF;1210≥10μF</td></tr>
<tr><td>25V:0201≥0.1uF; 0402≥0.22μF; 0603≥2.2μF;0805≥2.2μF;
1206≥10μF;1210≥10μF</td></tr>
<tr><td>16V: 0201≥0.1uF;0402≥0.22μF;0603≥1μF;0805≥2.2μF;
1206≥10μF;1210≥47μF</td></tr>
<tr><td>10V:0201≥47nF;0402≥0.47μF;0603≥0.47μF;0805≥2.2μF;
1206≥4.7μF;1210≥47μF</td></tr>
<tr><td>6.3V ; 4V ; All X6S/X7S items; Size≥1812</td></tr>
</table></td></tr>
</table>

<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
*Test time: 1000+24/-0 hrs.
*To apply voltage:
(1) 100% of rated voltage for below range.
<table>
<tr><th>Size</th><th>Dielectric</th><th>Rated voltage</th><th>Capacitance</th></tr>
<tr><td rowspan="3">0402</td><td rowspan="3">X5R</td><td>≥16V</td><td rowspan="3">C >1.0μF</td></tr>
<tr><td>≤16V</td></tr>
<tr><td>25V,50V</td></tr>
<tr><td>X7R/X7S/ Y5V</td><td>6.3V,10V</td><td>C≥1.0μF</td></tr>
<tr><td rowspan="3">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/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>TT21</td><td>X5R/X7R/ X6S</td><td>≤10V</td><td>C >10μF</td></tr>
</table>
**1WV items must follow de-rating conditions.
(2) 150% of rated voltage for below range.
</td><td>
* No remarkable damage.
Cap change:
NP0: ±3.0% or ±0.3pF whichever is larger
X7R, X5R, X6S, X7S: ≥10V**,within ±12.5%; ≤6.3V within ±25%;
**10V: 0603≥4.7μF;0402≥1μF;0201≥0.1μF, within ±25%
Q/D.F. value:
NP0: More than 30pF, Q≥350
10pF≤C<30pF, Q≥275+2.5C
Less than 10pF, Q≥200+10C
X7R, X5R, X6S, X7S:
*I.R.: 10V, 1GΩ or 50Ω-F whichever is smaller.
Class II (X7R, X5R, X6S, X7S, Y5V)
<table>
<tr><th>Rated vol.</th><th>D.F.≤</th><th colspan="2">Exception of D.F.≤</th></tr>
<tr><td rowspan="4">≥ 100V</td><td rowspan="4">≤3%</td><td>≤6%</td><td>1206≥0.47μF</td></tr>
<tr><td>≤7%</td><td>1812≥4.7μF;1825≥4.7μF; 2220≥4.7μF; 2225≥4.7μF</td></tr>
<tr><td>≤7.5%</td><td>0603≥0.068μF;0805>0.1μF;1206≥1μF;1210≥2.2μF</td></tr>
<tr><td>≤20%</td><td>0805>0.22μF;1210≥3.3μF</td></tr>
<tr><td rowspan="4">50V</td><td rowspan="4">≤3%</td><td>≤6%</td><td>0201(50V);0603≥0.047μF;0805≥0.18μF;1206≥0.47μF</td></tr>
<tr><td>≤7%</td><td>1812≥4.7μF;1825≥4.7μF; 2220≥4.7μF; 2225≥4.7μF</td></tr>
<tr><td>≤10%</td><td>0201≥0.01uF;1210≥3.3μF</td></tr>
<tr><td>≤20%</td><td>0402≥0.012μF;0603>0.1μF; 0805/X7R>0.47μF;
1206≥2.2μF;1210≥10μF</td></tr>
<tr><td>35V</td><td>≤5%</td><td>≤20%</td><td>0603≥1μF;0805≥2.2μF;1206≥2.2μF;1210≥10μF</td></tr>
<tr><td rowspan="5">25V</td><td rowspan="5">≤5%</td><td>≤10%</td><td>0201≥0.01μF(0201/X5R=0.01μF);0805≥1μF;1210≥10μF*</td></tr>
<tr><td>≤14%</td><td>0603≥0.33μF</td></tr>
<tr><td>≤15%</td><td>0201≥0.1μF(0201/X5R>0.01μF); 0603≥0.47μF;TTseries
0402≥0.10μF(0402/X7R≥0.056μF);0805≥2.2μF;
1206≥4.7μF;1210≥22μF(1210/X5R≥10μF)*;</td></tr>
<tr><td>≤20%</td><td>0402≥0.33μF</td></tr>
<tr><td 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≥0.012μF;04028≥0.22μF (0402/X7R80.15μF);
0603≥0.33μF;0805≥2.2μF;1206≥2.2μF;1210≥22μF</td></tr>
<tr><td rowspan="3">10V</td><td rowspan="3">≤7.5%</td><td>≤15%</td><td>0201≥0.012μF;0402V0.22μF (0402/X7R≥0.15μF);
0603≥0.33μF;0805V2.2μF;1206≥2.2μF;1210≥22μF</td></tr>
<tr><td>≤20%</td><td>0201≥0.1μF;0402≥1μF;0603/X5R≥10μF;01R5/X5R</td></tr>
<tr><td>6.3V</td><td>≤15%</td><td>≤30%</td><td>0201≥0.1μF;0402≥1μF(0402/X6S≥0.47μF);
0603≥10μF;0805≥4.7μF;1206≥47μF;1210≥100μF</td></tr>
<tr><td>4V</td><td>≤20%</td><td>---</td><td>---</td></tr>
</table>
<table>
<tr><th>Rated voltage</th><th>Insulation Resistance</th></tr>
<tr><td>100V: All X7R;1210≥3.3μF</td><td rowspan="7">1GΩor RxC≥10Ω-F whichever is smaller.</td></tr>
<tr><td>50V: 0402>0.01μF;0603≥1μF;0805≥1μF;12064.7μF;1210≥4.7μF</td></tr>
<tr><td>35V:0603≥1μF;0805≥2.2μF; 1206≥2.2μF;1210≥10μF</td></tr>
<tr><td>25V:0201≥0.1uF; 0402≥0.22μF; 0603≥2.2μF;0805≥2.2μF;
1206≥10μF;1210≥10μF</td></tr>
<tr><td>16V: 0201≥0.1uF;0402≥0.22μF;0603≥1μF;0805≥2.2μF;
1206≥10μF;1210≥47μF</td></tr>
<tr><td>10V:0201≥47nF;0402≥0.47μF;0603≥0.47μF;0805≥2.2μF;
1206≥4.7μF;1210≥47μF</td></tr>
<tr><td>6.3V ; 4V ; All X6S/X7S items; Size≥1812</td></tr>
</table>
</td></tr>
</table>

<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>
<table>
<tr><th>Size</th><th>Dielectric</th><th>Rated voltage</th><th>Capacitance</th></tr>
<tr><td rowspan="2">0402</td><td rowspan="2">X7R/X5R/ X6S</td><td>50V</td><td>C>0.01μF</td></tr>
<tr><td>10~25V</td><td>C≥0.22μF</td></tr>
<tr><td rowspan="5">0603</td><td 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="4">0805</td><td rowspan="4">X5R/X7R/ X6S/X7S</td><td>100V</td><td>C≥0.47μF</td></tr>
<tr><td>50V</td><td>C≥0.68μF</td></tr>
<tr><td>35V</td><td>C≥2.2μF</td></tr>
<tr><td>10~25V</td><td>C≥4.7μF</td></tr>
<tr><td rowspan="4">1206</td><td rowspan="2">X7R</td><td>100V</td><td>C≥1.0μF</td></tr>
<tr><td>50V</td><td>C≥2.2μF</td></tr>
<tr><td 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>
</table>
(3) 6.3V or C 10μF :150% of rated voltage.
(4) 10V Ur < 500V: 200% of rated voltage.
(5) 500V: 150% of rated voltage.
(6) Ur 630V: 120% of rated voltage
* Before initial measurement (Class II only): To apply de-aging at 150°C for 1hr then set for 24±2 hrs at room temp.
* Cap. / DF(Q) / I.R. Measurement to be made after de-aging at 150°C for 1hr then set for 24±2 hrs at room temp.
** De-rating conditions:
</td>
<td>


The general MLCC products are designed for use in devices with a typical lifetime around 10 years.
The general MLCC products are designed so that the useful lifetime can be extended longer than 10 years under the following conditions: (80% of the rated voltage or less, Maximum operating temperature -20 degree C or less)
Extended useful lifetime, under specific operating conditions, can be estimated from
the chart.

The useful lifetime is the time when cumulative failure rate becomes 1%.
Please note that the useful lifetime data is for reference only and not guaranteed.

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

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

APPENDIXES

Tape & reel dimensions

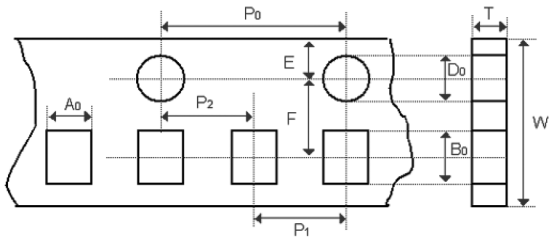


Fig. 2 The dimension of paper tape

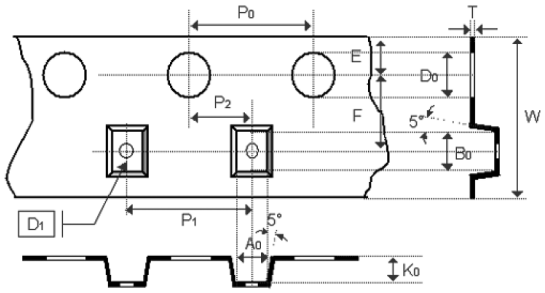


Fig. 3 The dimension of plastic tape

Size	0402	0603	0805			1206			1210				18812		
Thickness	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	M,U
A0	0.7 +/-0.2	1.05 +/-0.3	1.5 +/-0.2	1.5 +/-0.2	< 1.8	1.9 +/-0.5	< 2	<2.3	< 3.05	< 3.05	< 3.05	< 3.2	< 3.9	< 3.9	< 3.9
B0	1.2 +/-0.2	1.8 +/-0.3	2.3 +/-0.2	2.3 +/-0.2	< 2.7	3.5 +/-0.5	< 3.7	< 4	< 3.8	< 3.8	< 3.8	<4	< 5.3	< 5.3	< 5.3
T	≤0.8	≤1.2	≤1.15	≤1.2	0.23 +/-0.1	≤1.2	0.23 +/-0.1	0.23 +/-0.1	0.23 +/-0.1	0.23 +/-0.1	0.23 +/-0.1	0.23 +/-0.1	0.25 +/-0.1	0.25 +/-0.1	0.25 +/-0.1
K0	-	-	-	-	< 2	-	< 2	< 2.5	< 1.5	< 2	< 2.5	< 3.2	< 2	< 2.5	< 3.5
W	8 +/-0.3	8 +/-0.3	8 +/-0.3	8 +/-0.3	8 +/-0.3	8 +/-0.3	8 +/-0.3	8 +/-0.3	8 +/-0.3	8 +/-0.3	8 +/-0.3	8 +/-0.3	12 +/-0.3	12 +/-0.3	12 +/-0.3
P0	4 +/-0.1	4 +/-0.1	4 +/-0.1	4 +/-0.1	4 +/-0.1	4 +/-0.1	4 +/-0.1	4 +/-0.1	4 +/-0.1	4 +/-0.1	4 +/-0.1	4 +/-0.1	4 +/-0.1	4 +/-0.1	4 +/-0.1
10xP0	40 +/-0.1	40 +/-0.2	40 +/-0.2	40 +/-0.2	40 +/-0.2	40 +/-0.2	40 +/-0.2	40 +/-0.2	40 +/-0.2	40 +/-0.2	40 +/-0.2	40 +/-0.2	40 +/-0.2	40 +/-0.2	40 +/-0.2
P1	2 +/-0.05	4 +/-0.1	4 +/-0.1	4 +/-0.1	4 +/-0.1	4 +/-0.1	4 +/-0.1	4 +/-0.1	4 +/-0.1	4 +/-0.1	4 +/-0.1	4 +/-0.1	8 +/-0.1	8 +/-0.1	8 +/-0.1
P2	2 +/-0.05	2 +/-0.05	2 +/-0.05	2 +/-0.05	2 +/-0.05	2 +/-0.05	2 +/-0.05	2 +/-0.05	2 +/-0.05	2 +/-0.05	2 +/-0.05	2 +/-0.05	2 +/-0.1	2 +/-0.1	2 +/-0.1
D0	1.5 +0.1/-0	1.5 +0.1/-0	1.5 +0.1/-0	1.5 +0.1/-0	1.5 +0.1/-0	1.5 +0.1/-0	1.5 +0.1/-0	1.5 +0.1/-0	1.5 +0.1/-0	1.5 +0.1/-0	1.5 +0.1/-0	1.5 +0.1/-0	1.5 +0.1/-0	1.5 +0.1/-0	1.5 +0.1/-0
D1	-	-	-	-	1 +/-0.10	-	1 +/-0.1	1 +/-0.1	1 +/-0.1	1 +/-0.1	1 +/-0.1	1 +/-0.1	1.5 +/-0.1	1.5 +/-0.1	1.5 +/-0.1
E	1.75 +/-0.1	1.75 +/-0.1	1.75 +/-0.1	1.75 +/-0.1	1.75 +/-0.1	1.75 +/-0.1	1.75 +/-0.1	1.75 +/-0.1	1.75 +/-0.1	1.75 +/-0.1	1.75 +/-0.1	1.75 +/-0.1	1.75 +/-0.1	1.75 +/-0.1	1.75 +/-0.1
F	3.5 +/-0.05	3.5 +/-0.05	3.5 +/-0.05	3.5 +/-0.05	3.5 +/-0.05	3.5 +/-0.05	3.5 +/-0.05	3.5 +/-0.05	3.5 +/-0.05	3.5 +/-0.05	3.5 +/-0.05	3.5 +/-0.05	5.5 +/-0.1	5.5 +/-0.1	5.5 +/-0.1

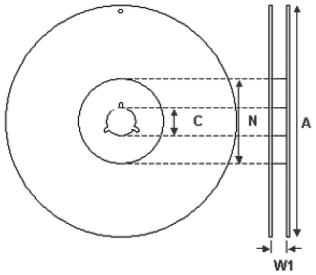
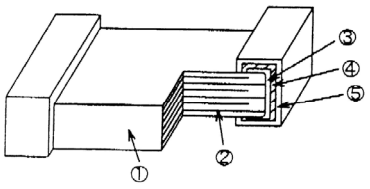


Fig. 4 The dimension of reel

Size	0402, 0603, 0805 1206, 1210			1812
Reel size	7”	10”	13”	7”
C	13 ±0.5	13 ±0.5	13 ±0.5	13 ±0.5
W_1	10 ±1.5	10 ±1.5	10 ±1.5	12.4 +2/-0
A	178 ±2	250 ±2	330 ±2	178 ±2
N	60 +1/-0	50 min	50 min	60+1/-0

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	



The construction of MLCC

Application Notes

Storage and handling conditions

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

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

Cautions:

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

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

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

Recommended soldering conditions

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

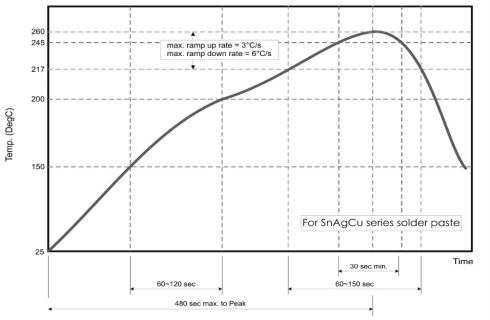


Fig. 6 Recommended reflow soldering profile for SMT process with SnAgCu series solder paste.

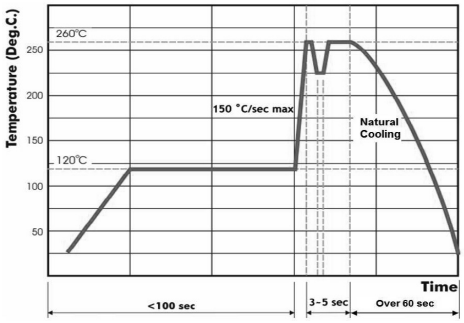


Fig. 7 Recommended wave soldering profile for SMT process with SnAgCu series solder.

Part Number Table

Description	Part Number
SMD Multilayer Ceramic Capacitors, 0402, X7R, 1nF, 5%, 16V	MC0402B102J160CT
SMD Multilayer Ceramic Capacitors, 0402, X7R, 15nF, 10%, 50V	MC0402B153K500CT
SMD Multilayer Ceramic Capacitors, 0402, X7R, 22nF, 5%, 25V	MC0402B223J250CT
SMD Multilayer Ceramic Capacitors, 0402, X7R, 470nF, 10%, 10V	MC0402B474K100CT
SMD Multilayer Ceramic Capacitors, 0402, NPO, 10pF, 10%, 50V	MC0402N100K500CT
SMD Multilayer Ceramic Capacitors, 0402, NPO, 100pF, 5%, 100V	MC0402N101J101CT
SMD Multilayer Ceramic Capacitors, 0402, NPO, 1nF, 5%, 25V	MC0402N102J250CT
SMD Multilayer Ceramic Capacitors, 0402, NPO, 12pF, 5%, 25V	MC0402N120J250CT
SMD Multilayer Ceramic Capacitors, 0402, NPO, 22pF, 1%, 50V	MC0402N220F500CT
SMD Multilayer Ceramic Capacitors, 0402, X5R, 1uF, 20%, 16V	MC0402X105M160CT
SMD Multilayer Ceramic Capacitors, 0603, X7R, 270nF, 10%, 16V	MC0603B274K160CT
SMD Multilayer Ceramic Capacitors, 0603, X7R, 47nF, 5%, 50V	MC0603B473J500CT
SMD Multilayer Ceramic Capacitors, 0603, NPO, 10pF, 0.25pF, 50V	MC0603N100C500CT
SMD Multilayer Ceramic Capacitors, 0603, NPO, 10pF, 1%, 100V	MC0603N100F101CT
SMD Multilayer Ceramic Capacitors, 0603, NPO, 10pF, 10%, 50V	MC0603N100K500CT
SMD Multilayer Ceramic Capacitors, 0603, NPO, 100pF, 5%, 25V	MC0603N101J250CT
SMD Multilayer Ceramic Capacitors, 0603, NPO, 1nF, 5%, 100V	MC0603N102J101CT
SMD Multilayer Ceramic Capacitors, 0603, NPO, 16pF, 5%, 50V	MC0603N160J500CT
SMD Multilayer Ceramic Capacitors, 0603, NPO, 22pF, 10%, 25V	MC0603N220K250CT
SMD Multilayer Ceramic Capacitors, 0603, NPO, 2700pF, 5%, 50V	MC0603N272J500CT
SMD Multilayer Ceramic Capacitors, 0603, NPO, 3300pF, 1%, 50V	MC0603N332F500CT
SMD Multilayer Ceramic Capacitors, 0603, NPO, 36pF, 5%, 50V	MC0603N360J500CT
SMD Multilayer Ceramic Capacitors, 0603, NPO, 470pF, 5%, 100V	MC0603N471J101CT
SMD Multilayer Ceramic Capacitors, 0603, NPO, 4700pF, 1%, 50V	MC0603N472F500CT
SMD Multilayer Ceramic Capacitors, 0603, NPO, 4700pF, 5%, 25V	MC0603N472J250CT
SMD Multilayer Ceramic Capacitors, 0603, NPO, 510pF, 5%, 50V	MC0603N511J500CT
SMD Multilayer Ceramic Capacitors, 0603, NPO, 5.6pF, 0.25pF, 50V	MC0603N5R6C500CT
SMD Multilayer Ceramic Capacitors, 0603, NPO, 62pF, 5%, 50V	MC0603N620J500CT

Description	Part Number
SMD Multilayer Ceramic Capacitors, 0603, NPO, 6800pF, 5%, 50V	MC0603N682J500CT
SMD Multilayer Ceramic Capacitors, 0603, X5R, 100nF, 10%, 25V	MC0603X104K250CT
SMD Multilayer Ceramic Capacitors, 0805, X7R, 1nF, 10%, 1KV	MC0805B102K102CT
SMD Multilayer Ceramic Capacitors, 0805, X7R, 10nF, 10%, 500V	MC0805B103K501CT
SMD Multilayer Ceramic Capacitors, 0805, X7R, 1uF, 5%, 10V	MC0805B105J100CT
SMD Multilayer Ceramic Capacitors, 0805, X7R, 1uF, 5%, 16V	MC0805B105J160CT
SMD Multilayer Ceramic Capacitors, 0805, X7R, 1uF, 5%, 25V	MC0805B105J250CT
SMD Multilayer Ceramic Capacitors, 0805, X7R, 10uF, 20%, 10V	MC0805B106M100CT
SMD Multilayer Ceramic Capacitors, 0805, X7R, 220nF, 5%, 100V	MC0805B224J101CT
SMD Multilayer Ceramic Capacitors, 0805, X7R, 220nF, 10%, 100V	MC0805B224K101CT
SMD Multilayer Ceramic Capacitors, 0805, X7R, 680nF, 10%, 50V	MC0805B684K500CT
SMD Multilayer Ceramic Capacitors, 0805, NPO, 10nF, 1%, 50V	MC0805N103F500CT
SMD Multilayer Ceramic Capacitors, 0805, NPO, 10nF, 5%, 50V	MC0805N103J500CT
SMD Multilayer Ceramic Capacitors, 0805, NPO, 22nF, 1%, 50V	MC0805N223F500CT
SMD Multilayer Ceramic Capacitors, 0805, NPO, 22nF, 5%, 50V	MC0805N223J500CT
SMD Multilayer Ceramic Capacitors, 0805, X5R, 1uF, 20%, 50V	MC0805X105M500CT
SMD Multilayer Ceramic Capacitors, 1206, X7R, 1nF, 20%, 50V	MC1206B102M500CT
SMD Multilayer Ceramic Capacitors, 1206, X7R, 10nF, 20%, 50V	MC1206B103M500CT
SMD Multilayer Ceramic Capacitors, 1206, X7R, 1uF, 20%, 50V	MC1206B105M500CT
SMD Multilayer Ceramic Capacitors, 1206, X7R, 22uF, 10%, 10V	MC1206B226K100CT
SMD Multilayer Ceramic Capacitors, 1206, X7R, 47nF, 10%, 500V	MC1206B473K501CT
SMD Multilayer Ceramic Capacitors, 1206, NPO, 1500pF, 5%, 50V	MC1206N152J500CT
SMD Multilayer Ceramic Capacitors, 1206, X5R, 4.7uF, 10%, 50V	MC1206X475K500CT
SMD Multilayer Ceramic Capacitors, 1210, X7R, 1nF, 10%, 2KV	MC1210B102K202CT
SMD Multilayer Ceramic Capacitors, 1210, X7R, 10nF, 5%, 1KV	MC1210B103J102CT
SMD Multilayer Ceramic Capacitors, 1210, X7R, 10uF, 10%, 50V	MC1210B106K500CT
SMD Multilayer Ceramic Capacitors, 1210, X7R, 2.2uF, 10%, 50V	MC1210B225K500CT
SMD Multilayer Ceramic Capacitors, 1210, X7R, 22uF, 10%, 25V	MC1210B226K250CT
SMD Multilayer Ceramic Capacitors, 1210, X7R, 22uF, 20%, 25V	MC1210B226M250CT
SMD Multilayer Ceramic Capacitors, 1210, X7R, 3.3uF, 10%, 50V	MC1210B335K500CT
SMD Multilayer Ceramic Capacitors, 1210, X7R, 4700pF, 10%, 2KV	MC1210B472K202CT
SMD Multilayer Ceramic Capacitors, 1210, X5R, 10uF, 20%, 50V	MC1210X106M500CT
SMD Multilayer Ceramic Capacitors, 1210, X5R, 100uF, 20%, 16V	MC1210X107M160CT
SMD Multilayer Ceramic Capacitors, 1812, X7R, 10nF, 10%, 2KV	MC1812B103K202CT
SMD Multilayer Ceramic Capacitors, 1812, X7R, 1uF, 10%, 50V	MC1812B105K500CT

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