

CT41 MULTILAYER CERAMIC CAPACITORS

General Purpose Series (4V to 100V)

0201 to 1812 Sizes

NP0, X7R, Y5V, X6S & X5R Dielectrics

RoHS Compliance

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.

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

2. FEATURES

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

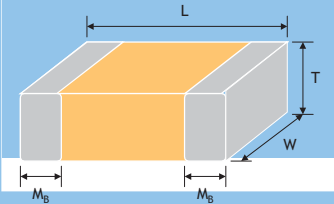
3. APPLICATIONS

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

4. HOW TO ORDER

<u>1206</u>	<u>B</u>	<u>104</u>	<u>K</u>	<u>500</u>	<u>C</u>	<u>R</u>
<u>Size</u>	<u>Dielectric</u>	<u>Capacitance</u>	<u>Tolerance</u>	<u>Rated voltage</u>	<u>Termination</u>	<u>Packaging style</u>
Inch (mm) 0201 (0603) 0402 (1005) 0603 (1608) 0805 (2012) 1206 (3216) 1210 (3225) 1812 (4532)	N =NP0 (C0G) B =X7R F =Y5V X =X5R S =X6S	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% Z =-20/+80%	Two significant digits followed by no. of zeros. And R is in place of decimal point. 4R0 =4 VDC 6R3 =6.3 VDC 100 =10 VDC 160 =16 VDC 250 =25 VDC 500 =50 VDC 101 =100 VDC	C =Cu/Ni/Sn	R = T&R

5. EXTERNAL DIMENSIONS

Outline	Size Inch (mm)	L (mm)	W (mm)	T (mm)/Symbol	Soldering Method *	M _B (mm)
 <p>Fig. 1 The outline of MLCC</p>	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}		0.15+0.1/-0.05
		0.6±0.09 ^{#3}	0.3±0.09 ^{#3}	0.3±0.09 ^{#3}		
	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	
		1.00±0.20	0.50±0.20	0.5±0.20	E R	+0.05/-0.10
	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	
	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	1.60±0.20	1.15±0.15	J R	
1.60±0.20				G R		
0.85±0.10				T R / W		
3.20	1.60	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					
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	3.20±0.40	2.50±0.30	M R		
			2.80±0.30	U R		
(5750)	5.70±0.5	5.0±0.5	2.50±0.30	M R		

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

** For 1808_200V ~3kV, 1812_200V~3kV

*** For 1206_1000V ~3kV, 1808_200V ~3kV, 1812_200V~3kV

#1: For 0603/Cap ≥ 10μF or 0603(>10V)/Cap>1μF products.

#2: For 0201/Cap ≥ 0.68μF products.

#3: For 0201/Cap >1μF products.

6. GENERAL ELECTRICAL DATA

Dielectric	NP0	X7R	Y5V	X5R	X6S
Size	0402, 0603, 0805, 1206, 1210, 1812				
Capacitance range*	0.1pF to 0.1μF	100pF to 47μF	0.01μF to 100μF	100pF to 220μF	0.1μF to 100μF
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%), K (±10%)	J (±5%), K (±10%), M (±20%)	M (±20%), Z (-20/+80%)	K (±10%), M (±20%)	K (±10%), M (±20%)
Rated voltage (WVDC)	10V, 16V, 25V, 50V, 100V	6.3V, 10V, 16V, 25V, 50V, 100V		4V, 6.3V, 10V, 16V, 25V, 50V	
DF(Tan δ)*	Cap<30pF: Q≥400+20C Cap≥30pF: Q≥1000	Note 1			
Operating temperature	-55 to +125°C		-25 to +85°C	-55 to +85°C	-55 to +105°C
Capacitance characteristic	±30ppm	±15%	+30/-80%	±15%	±22%
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°C at ambient temperature

X7R/X6S/X5R: Apply 1.0±0.2Vrms, 1.0kHz±10%, at 25°C ambient temperature.

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, then leave in ambient condition for 24±2 hours before measurement.

Note 1:

X7R/X5R/X6S

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

Y5V

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



7. CAPACITANCE RANGE

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

DIELECTRIC		NP0																	
SIZE		0201			0402				0603					0805					
RATED VOLTAGE (VDC)		16	25	50	10	16	25	50	100	10	16	25	50	100	10	16	25	50	100
Capacitance	0.1pF (0R1)	L	L	L	N	N	N	N											
	0.2pF (0R2)	L	L	L	N	N	N	N											
	0.3pF (0R3)	L	L	L	N	N	N	N											
	0.4pF (0R4)	L	L	L	N	N	N	N											
	0.5pF (0R5)	L	L	L	N	N	N	N	N	S	S	S	S	S	A	A	A	A	A
	0.6pF (0R6)	L	L	L	N	N	N	N	N	S	S	S	S	S	A	A	A	A	A
	0.7pF (0R7)	L	L	L	N	N	N	N	N	S	S	S	S	S	A	A	A	A	A
	0.8pF (0R8)	L	L	L	N	N	N	N	N	S	S	S	S	S	A	A	A	A	A
	0.9pF (0R9)	L	L	L	N	N	N	N	N	S	S	S	S	S	A	A	A	A	A
	1.0pF (1R0)	L	L	L	N	N	N	N	N	S	S	S	S	S	A	A	A	A	A
	1.2pF (1R2)	L	L	L	N	N	N	N	N	S	S	S	S	S	A	A	A	A	A
	1.5pF (1R5)	L	L	L	N	N	N	N	N	S	S	S	S	S	A	A	A	A	A
	1.8pF (1R8)	L	L	L	N	N	N	N	N	S	S	S	S	S	A	A	A	A	A
	2.0pF (2R0)	L	L	L	N	N	N	N	N	S	S	S	S	S	A	A	A	A	A
	2.2pF (2R2)	L	L	L	N	N	N	N	N	S	S	S	S	S	A	A	A	A	A
	2.7pF (2R7)	L	L	L	N	N	N	N	N	S	S	S	S	S	A	A	A	A	A
	3.0pF (3R0)	L	L	L	N	N	N	N	N	S	S	S	S	S	A	A	A	A	A
	3.3pF (3R3)	L	L	L	N	N	N	N	N	S	S	S	S	S	A	A	A	A	A
	3.9pF (3R9)	L	L	L	N	N	N	N	N	S	S	S	S	S	A	A	A	A	A
	4.0pF (4R0)	L	L	L	N	N	N	N	N	S	S	S	S	S	A	A	A	A	A
	4.7pF (4R7)	L	L	L	N	N	N	N	N	S	S	S	S	S	A	A	A	A	A
	5.0pF (5R0)	L	L	L	N	N	N	N	N	S	S	S	S	S	A	A	A	A	A
	5.6pF (5R6)	L	L	L	N	N	N	N	N	S	S	S	S	S	A	A	A	A	A
	6.0pF (6R0)	L	L	L	N	N	N	N	N	S	S	S	S	S	A	A	A	A	A
	6.8pF (6R8)	L	L	L	N	N	N	N	N	S	S	S	S	S	A	A	A	A	A
	7.0pF (7R0)	L	L	L	N	N	N	N	N	S	S	S	S	S	A	A	A	A	A
	8.0pF (8R0)	L	L	L	N	N	N	N	N	S	S	S	S	S	A	A	A	A	A
	8.2pF (8R2)	L	L	L	N	N	N	N	N	S	S	S	S	S	A	A	A	A	A
	9.0pF (9R0)	L	L	L	N	N	N	N	N	S	S	S	S	S	A	A	A	A	A
	10pF (100)	L	L	L	N	N	N	N	N	S	S	S	S	S	A	A	A	A	A
	12pF (120)	L	L	L	N	N	N	N	N	S	S	S	S	S	A	A	A	A	A
	15pF (150)	L	L	L	N	N	N	N	N	S	S	S	S	S	A	A	A	A	A
	18pF (180)	L	L	L	N	N	N	N	N	S	S	S	S	S	A	A	A	A	A
	22pF (220)	L	L	L	N	N	N	N	N	S	S	S	S	S	A	A	A	A	A
	27pF (270)	L	L	L	N	N	N	N	N	S	S	S	S	S	A	A	A	A	A
	33pF (330)	L	L	L	N	N	N	N	N	S	S	S	S	S	A	A	A	A	A
	39pF (390)	L	L	L	N	N	N	N	N	S	S	S	S	S	A	A	A	A	A
	47pF (470)	L	L	L	N	N	N	N	N	S	S	S	S	S	A	A	A	A	A
	56pF (560)	L	L	L	N	N	N	N	N	S	S	S	S	S	A	A	A	A	A
	68pF (680)	L	L	L	N	N	N	N	N	S	S	S	S	S	A	A	A	A	A
	82pF (820)	L	L	L	N	N	N	N	N	S	S	S	S	S	A	A	A	A	A
	100pF (101)	L	L	L	N	N	N	N	N	S	S	S	S	S	A	A	A	A	A
120pF (121)	L	L	L	N	N	N	N	N	S	S	S	S	S	A	A	A	A	A	
150pF (151)				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	N	S	S	S	S	S	A	A	A	A	A	
330pF (331)				N	N	N	N	N	S	S	S	S	S	A	A	A	A	A	
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)									X	X	X	X	X	B	B	B	B	B	
1,500pF (152)									X	X	X	X	X	B	B	B	B	B	
1,800pF (182)									X	X	X	X	X	B	B	B	B	B	
2,200pF (222)									X	X	X	X	X	B	B	B	B	B	
2,700pF (272)									X	X	X	X	X	D	D	D	D	D	
3,300pF (332)									X	X	X	X	X	D	D	D	D	D	
3,900pF (392)									X	X	X	X	X	D	D	D	D	D	
4,700pF (472)									X	X	X	X	X	D	D	D	D	D	
5,600pF (562)									X	X	X	X	X	D	D	D	D	D	
6,800pF (682)									X	X	X	X	X	D	D	D	D	D	
8,200pF (822)									X	X	X	X	X	D	D	D	D	D	
0.010uF (103)									X	X	X	X	X	D	D	D	D	D	
0.012uF (123)														T	T	T	T	T	
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. For more information about products with special capacitance or other data, please contact our sales



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

DIELECTRIC		NP0													
SIZE		1206					1210					1812			
RATED VOLTAGE (VDC)		10	16	25	50	100	10	16	25	50	100	16	50	100	
Capacitance	1.0pF (1R0)														
	1.2pF (1R2)	B	B	B	B	B									
	1.5pF (1R5)	B	B	B	B	B									
	1.8pF (1R8)	B	B	B	B	B									
	2.2pF (2R2)	B	B	B	B	B									
	2.7pF (2R7)	B	B	B	B	B									
	3.3pF (3R3)	B	B	B	B	B									
	3.9pF (3R9)	B	B	B	B	B									
	4.7pF (4R7)	B	B	B	B	B									
	5.6pF (5R6)	B	B	B	B	B									
	6.8pF (6R8)	B	B	B	B	B									
	8.2pF (8R2)	B	B	B	B	B									
	10pF (100)	B	B	B	B	B	C	C	C	C	C	D	D	D	
	12pF (120)	B	B	B	B	B	C	C	C	C	C	D	D	D	
	15pF (150)	B	B	B	B	B	C	C	C	C	C	D	D	D	
	18pF (180)	B	B	B	B	B	C	C	C	C	C	D	D	D	
	22pF (220)	B	B	B	B	B	C	C	C	C	C	D	D	D	
	27pF (270)	B	B	B	B	B	C	C	C	C	C	D	D	D	
	33pF (330)	B	B	B	B	B	C	C	C	C	C	D	D	D	
	39pF (390)	B	B	B	B	B	C	C	C	C	C	D	D	D	
	47pF (470)	B	B	B	B	B	C	C	C	C	C	D	D	D	
	56pF (560)	B	B	B	B	B	C	C	C	C	C	D	D	D	
	68pF (680)	B	B	B	B	B	C	C	C	C	C	D	D	D	
	82pF (820)	B	B	B	B	B	C	C	C	C	C	D	D	D	
	100pF (101)	B	B	B	B	B	C	C	C	C	C	D	D	D	
	120pF (121)	B	B	B	B	B	C	C	C	C	C	D	D	D	
	150pF (151)	B	B	B	B	B	C	C	C	C	C	D	D	D	
	180pF (181)	B	B	B	B	B	C	C	C	C	C	D	D	D	
	220pF (221)	B	B	B	B	B	C	C	C	C	C	D	D	D	
	270pF (271)	B	B	B	B	B	C	C	C	C	C	D	D	D	
	330pF (331)	B	B	B	B	B	C	C	C	C	C	D	D	D	
	390pF (391)	B	B	B	B	B	C	C	C	C	C	D	D	D	
	470pF (471)	B	B	B	B	B	C	C	C	C	C	D	D	D	
	560pF (561)	B	B	B	B	B	C	C	C	C	C	D	D	D	
	680pF (681)	B	B	B	B	B	C	C	C	C	C	D	D	D	
	820pF (821)	B	B	B	B	B	C	C	C	C	C	D	D	D	
	1,000pF (102)	B	B	B	B	B	C	C	C	C	C	D	D	D	
	1,200pF (122)	B	B	B	B	B	C	C	C	C	C	D	D	D	
	1,500pF (152)	B	B	B	B	B	C	C	C	C	C	D	D	D	
	1,800pF (182)	B	B	B	B	B	C	C	C	C	C	D	D	D	
	2,200pF (222)	B	B	B	B	B	C	C	C	C	C	D	D	D	
	2,700pF (272)	B	B	B	B	B	C	C	C	C	C	D	D	D	
3,300pF (332)	B	B	B	B	B	C	C	C	C	C	D	D	D		
3,900pF (392)	B	B	B	B	B	C	C	C	C	C	D	D	D		
4,700pF (472)	B	B	B	B	B	C	C	C	C	C	D	D	D		
5,600pF (562)	B	B	B	B	B	C	C	C	C	C	D	D	D		
6,800pF (682)	C	C	C	C	C	C	C	C	C	C	D	D	D		
8,200pF (822)	D	D	D	D	D	C	C	C	C	C	D	D	D		
0.010μF (103)	D	D	D	D	D	C	C	C	C	C	D	D	D		
0.012μF (123)	T	T	T	T	T	D	D	D	D	D	D	D	D		
0.015μF (153)	T	T	T	T	T	D	D	D	D	D	D	D	D		
0.018μF (183)	T	T	T	T	T						D	D	D		
0.022μF (223)	T	T	T	T	T						D	D	D		
0.027μF (273)	T	T	T	T	T						D	D	D		
0.033μF (333)	T	T	T	T	T						D	D	D		
0.039μF (393)	J	J	J	J	J										
0.047μF (473)	J	J	J	J	J										
0.056μF (563)	J	J	J	J	J										
0.068μF (683)	G	G	G	G	G										
0.082μF (823)	G	G	G	G	G										
0.1μF (104)	G	G	G	G	G										

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2. For more information about products with special capacitance or other data, please contact our sales



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

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

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

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

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

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

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

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

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

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

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



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

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

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

2. For more information about products with special capacitance or other data, please contact our sales

8. PACKAGING STYLE AND QUANTITY

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

Unit: pieces



9. RELIABILITY TEST CONDITIONS AND REQUIREMENTS

No.	Item	Test Condition	Requirements																																																																		
1.	Visual and Mechanical	---	* No remarkable defect. * Dimensions to conform to individual specification sheet.																																																																		
2.	Capacitance	Class I: (NP0)	* Shall not exceed the limits given in the detailed spec.																																																																		
3.	Q/ D.F. (Dissipation Factor)	$\leq 1000\mu\text{F}, 1.0\pm 0.2\text{Vrms} \cdot 1\text{MHz}\pm 10\%$ $> 1000\mu\text{F}, 1.0\pm 0.2\text{Vrms} \cdot 1\text{KHz}\pm 10\%$ Class II: (X7R, X7E, X6S, X5R, Y5V) $C \leq 10\mu\text{F}, 1.0\pm 0.2\text{Vrms} \cdot 1\text{KHz}\pm 10\%$ ** $C > 10\mu\text{F}, 0.5\pm 0.2\text{Vrms} \cdot 120\text{Hz}\pm 20\%$	NP0: Cap $\geq 30\mu\text{F}$, Q ≥ 1000 ; Cap $< 30\mu\text{F}$, Q $\geq 400+20\text{C}$ X7R, X5R, X6S: <table border="1"> <thead> <tr> <th>Rated vol.</th> <th>D.F. \leq</th> <th colspan="2">Exception of D.F. \leq</th> </tr> </thead> <tbody> <tr> <td>$\geq 100\text{V}$</td> <td>$\leq 2.5\%$</td> <td>$\leq 3\%$</td> <td>1206 $\geq 0.47\mu\text{F}$</td> </tr> <tr> <td></td> <td></td> <td>$\leq 5\%$</td> <td>0805 $> 0.1\mu\text{F}$; 0603 $\geq 0.068\mu\text{F}$; 1206 $> 1\mu\text{F}$; TT series</td> </tr> <tr> <td rowspan="2">50V</td> <td rowspan="2">$\leq 2.5\%$</td> <td>$\leq 3\%$</td> <td>0201(50V); 0603 $\geq 0.047\mu\text{F}$; 0805 $\geq 0.18\mu\text{F}$; 1206 $\geq 0.47\mu\text{F}$</td> </tr> <tr> <td>$\leq 5\%$</td> <td>1210 $\geq 4.7\mu\text{F}$</td> </tr> <tr> <td></td> <td></td> <td>$\leq 10\%$</td> <td>0402 $\geq 0.1\mu\text{F}$; 0603 $> 0.1\mu\text{F}$; 0805 $\geq 1\mu\text{F}$; 1206 $\geq 2.2\mu\text{F}$; 1210 $\geq 10\mu\text{F}$; TT series</td> </tr> <tr> <td>35V</td> <td>$\leq 3.5\%$</td> <td>$\leq 10\%$</td> <td>0603 $\geq 1\mu\text{F}$; 0805 $\geq 2.2\mu\text{F}$; 1210 $\geq 10\mu\text{F}$</td> </tr> <tr> <td rowspan="3">25V</td> <td rowspan="3">$\leq 3.5\%$</td> <td>$\leq 5\%$</td> <td>0201 $\geq 0.01\mu\text{F}$; 0805 $\geq 1\mu\text{F}$; 1210 $\geq 10\mu\text{F}$</td> </tr> <tr> <td>$\leq 7\%$</td> <td>0603 $\geq 0.33\mu\text{F}$; 1206 $\geq 4.7\mu\text{F}$</td> </tr> <tr> <td>$\leq 10\%$</td> <td>0402 $\geq 0.10\mu\text{F}$; 0603 $\geq 0.47\mu\text{F}$; 0805 $\geq 2.2\mu\text{F}$; 1206 $\geq 6.8\mu\text{F}$; 1210 $\geq 22\mu\text{F}$; TT series</td> </tr> <tr> <td></td> <td></td> <td>$\leq 12.5\%$</td> <td>0402 $\geq 1\mu\text{F}$</td> </tr> <tr> <td rowspan="2">16V</td> <td rowspan="2">$\leq 3.5\%$</td> <td>$\leq 5\%$</td> <td>0201 $\geq 0.01\mu\text{F}$; 0402 $\geq 0.033\mu\text{F}$; 0603 $\geq 0.15\mu\text{F}$; 0805 $\geq 0.68\mu\text{F}$; 1206 $\geq 2.2\mu\text{F}$; 1210 $\geq 4.7\mu\text{F}$</td> </tr> <tr> <td>$\leq 10\%$</td> <td>0201 $\geq 0.1\mu\text{F}$; 0402 $\geq 0.22\mu\text{F}$; 0603 $\geq 0.68\mu\text{F}$; 0805 $\geq 2.2\mu\text{F}$; 1206 $\geq 4.7\mu\text{F}$; 1210 $\geq 22\mu\text{F}$; TT series</td> </tr> <tr> <td>10V</td> <td>$\leq 5\%$</td> <td>$\leq 10\%$</td> <td>0201 $\geq 0.012\mu\text{F}$; 0402 $\geq 0.33\mu\text{F}$ (0402/X7R $\geq 0.22\mu\text{F}$); TT series</td> </tr> <tr> <td></td> <td></td> <td>$\leq 15\%$</td> <td>0603 $\geq 0.33\mu\text{F}$; 0805 $\geq 2.2\mu\text{F}$; 1206 $\geq 2.2\mu\text{F}$; 1210 $\geq 22\mu\text{F}$</td> </tr> <tr> <td></td> <td></td> <td></td> <td>0201 $\geq 0.1\mu\text{F}$; 0402 $\geq 1\mu\text{F}$</td> </tr> <tr> <td rowspan="2">6.3V</td> <td rowspan="2">$\leq 10\%$</td> <td>$\leq 15\%$</td> <td>0201 $\geq 0.1\mu\text{F}$; 0402 $\geq 1\mu\text{F}$; 0603 $\geq 10\mu\text{F}$; 0805 $\geq 4.7\mu\text{F}$; 1206 $\geq 47\mu\text{F}$; 1210 $\geq 100\mu\text{F}$; TT series</td> </tr> <tr> <td>$\leq 20\%$</td> <td>0402 $\geq 2.2\mu\text{F}$</td> </tr> <tr> <td>4V</td> <td>$\leq 15\%$</td> <td>---</td> <td>---</td> </tr> </tbody> </table>	Rated vol.	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4V	$\leq 15\%$	---	---																																																																		
		** Test condition: $0.5\pm 0.2\text{Vrms} \cdot 1\text{KHz}\pm 10\%$ X7R: 0805=106(6.3V,10V) X5R: 01R5 ≥ 103 , 0201 ≥ 224 (6.3V,10V), 0402 ≥ 475 (6.3V), 0402 ≥ 225 (10V), 0603=106 (6.3V,10V), TT18X ≥ 475 (10V), TT15X series X6S: 0201 ≥ 104 (6.3V), 0402 ≥ 225 (6.3V), 0603 ≥ 106 (6.3V),																																																																			
		Y5V: <table border="1"> <thead> <tr> <th>Rated vol.</th> <th>D.F. \leq</th> <th colspan="2">Exception of D.F. \leq</th> </tr> </thead> <tbody> <tr> <td>$\geq 50\text{V}$</td> <td>5%</td> <td>7%</td> <td>0603 $\geq 0.1\mu\text{F}$; 0805 $\geq 0.47\mu\text{F}$; 1206 $\geq 4.7\mu\text{F}$</td> </tr> <tr> <td>35V</td> <td>7%</td> <td>---</td> <td>---</td> </tr> <tr> <td rowspan="2">25V</td> <td rowspan="2">5%</td> <td>7%</td> <td>0402 $\geq 0.047\mu\text{F}$; 0603 $\geq 0.1\mu\text{F}$; 0805 $\geq 0.33\mu\text{F}$; 1206 $\geq 1\mu\text{F}$; 1210 $\geq 4.7\mu\text{F}$</td> </tr> <tr> <td>9%</td> <td>0402 $\geq 0.068\mu\text{F}$; 0603 $\geq 0.47\mu\text{F}$; 1206 $\geq 4.7\mu\text{F}$; 1210 $\geq 22\mu\text{F}$</td> </tr> <tr> <td>16V (C$< 1.0\mu\text{F}$)</td> <td>7%</td> <td>9%</td> <td>0402 $\geq 0.068\mu\text{F}$; 0603 $\geq 0.68\mu\text{F}$</td> </tr> <tr> <td></td> <td></td> <td>12.5%</td> <td>0402 $\geq 0.22\mu\text{F}$</td> </tr> <tr> <td>16V (C$\geq 1.0\mu\text{F}$)</td> <td>9%</td> <td>12.5%</td> <td>0603 $\geq 2.2\mu\text{F}$; 0805 $\geq 3.3\mu\text{F}$; 1206 $\geq 10\mu\text{F}$; 1210 $\geq 22\mu\text{F}$; 1812 $\geq 47\mu\text{F}$</td> </tr> <tr> <td>10V</td> <td>12.5%</td> <td>20%</td> <td>0402 $\geq 0.47\mu\text{F}$</td> </tr> <tr> <td>6.3V</td> <td>20%</td> <td>---</td> <td>---</td> </tr> </tbody> </table>	Rated vol.	D.F. \leq	Exception of D.F. \leq		$\geq 50\text{V}$	5%	7%	0603 $\geq 0.1\mu\text{F}$; 0805 $\geq 0.47\mu\text{F}$; 1206 $\geq 4.7\mu\text{F}$	35V	7%	---	---	25V	5%	7%	0402 $\geq 0.047\mu\text{F}$; 0603 $\geq 0.1\mu\text{F}$; 0805 $\geq 0.33\mu\text{F}$; 1206 $\geq 1\mu\text{F}$; 1210 $\geq 4.7\mu\text{F}$	9%	0402 $\geq 0.068\mu\text{F}$; 0603 $\geq 0.47\mu\text{F}$; 1206 $\geq 4.7\mu\text{F}$; 1210 $\geq 22\mu\text{F}$	16V (C $< 1.0\mu\text{F}$)	7%	9%	0402 $\geq 0.068\mu\text{F}$; 0603 $\geq 0.68\mu\text{F}$			12.5%	0402 $\geq 0.22\mu\text{F}$	16V (C $\geq 1.0\mu\text{F}$)	9%	12.5%	0603 $\geq 2.2\mu\text{F}$; 0805 $\geq 3.3\mu\text{F}$; 1206 $\geq 10\mu\text{F}$; 1210 $\geq 22\mu\text{F}$; 1812 $\geq 47\mu\text{F}$	10V	12.5%	20%	0402 $\geq 0.47\mu\text{F}$	6.3V	20%	---	---																													
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6.3V	20%	---	---																																																																		
4.	Dielectric Strength	* To apply voltage ($\leq 100\text{V}$) 250%. Duration: 1 to 5 sec. * Charge and discharge current less than 50mA.	* No evidence of damage or flash over during test.																																																																		
5.	Insulation Resistance	To apply rated voltage for max. 120 sec.	10G Ω or RxC $\geq 500\Omega\cdot\text{F}$ whichever is smaller. Class II (X7R, X5R, X6S, Y5V)																																																																		
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6.	Temperature Coefficient	With no electrical load. <table border="1"> <thead> <tr> <th>T.C.</th> <th>Operating Temp</th> </tr> </thead> <tbody> <tr> <td>NPO</td> <td>-55~125°C at 25°C</td> </tr> <tr> <td>X7R</td> <td>-55~125°C at 25°C</td> </tr> <tr> <td>X5R</td> <td>-55~ 85°C at 25°C</td> </tr> <tr> <td>X6S</td> <td>-55~105°C at 25°C</td> </tr> <tr> <td>Y5V</td> <td>-25~ 85°C at 20°C</td> </tr> </tbody> </table>	T.C.	Operating Temp	NPO	-55~125°C at 25°C	X7R	-55~125°C at 25°C	X5R	-55~ 85°C at 25°C	X6S	-55~105°C at 25°C	Y5V	-25~ 85°C at 20°C	<table border="1"> <thead> <tr> <th>T.C.</th> <th>Capacitance Change</th> </tr> </thead> <tbody> <tr> <td>NPO</td> <td>Within ±30ppm/°C</td> </tr> <tr> <td>X7R</td> <td>Within ±15%</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> </tbody> </table>	T.C.	Capacitance Change	NPO	Within ±30ppm/°C	X7R	Within ±15%	X5R	Within ±15%	X6S	Within ±22%	Y5V	Within +30%/-80%
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7.	Adhesive Strength of Termination	* Pressurizing force : 1N (0201) and 5N (≤0603) and 10N (>0603) * Test time: 10±1 sec.	* No remarkable damage or removal of the terminations.																								
8.	Vibration Resistance	* Vibration frequency: 10~55 Hz/min. * Total amplitude: 1.5mm * Test time: 6 hrs. (Two hrs each in three mutually perpendicular directions.) * Measurement to be made after keeping at room temp. for 24±2 hrs.	* No remarkable damage. * Cap change and Q/D.F.: To meet initial spec.																								
9.	Solderability	* Solder temperature: 235±5°C * Dipping time: 2±0.5 sec.	95% min. coverage of all metalized area.																								
10.	Bending Test	* The middle part of substrate shall be pressurized by means of the pressurizing rod at a rate of about 1 mm per second until the deflection becomes 1 mm and then the pressure shall be maintained for 5±1 sec. * Measurement to be made after keeping at room temp. for 24±2 hrs.	* No remarkable damage. * Cap change : NPO: within ±5% or 0.5pF whichever is larger X7R, X5R, X6S: 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.)																								
11.	Resistance to Soldering Heat	* Solder temperature: 260±5°C * Dipping time: 10±1 sec * Preheating: 120 to 150°C for 1 minute before immerse the capacitor in a eutectic solder. * Before initial measurement (Class II only): Perform 150+0/-10°C for 1 hr and then set for 24±2 hrs at room temp. * Measurement to be made after keeping at room temp. for 24±2 hrs.	* No remarkable damage. * Cap change: NPO: within ±2.5% or 0.25pF whichever is larger X7R, X5R, X6S: within ±7.5% Y5V: within ±20% * Q/D.F., I.R. and dielectric strength: To meet initial requirements. * 25% max. leaching on each edge.																								
12.	Temperature Cycle	* Conduct the five cycles according to the temperatures and time. <table border="1"> <thead> <tr> <th>Step</th> <th>Temp. (°C)</th> <th>Time (min.)</th> </tr> </thead> <tbody> <tr> <td>1</td> <td>Min. operating temp. +0/-3</td> <td>30±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> </tbody> </table> * Before initial measurement (Class II only): Perform 150+0/-10°C for 1 hr and then set for 24±2 hrs at room temp. * Measurement to be made after keeping at room temp. for 24±2 hrs.	Step	Temp. (°C)	Time (min.)	1	Min. operating temp. +0/-3	30±3	2	Room temp.	2~3	3	Max. operating temp. +3/-0	30±3	4	Room temp.	2~3	* No remarkable damage. * Cap change : NPO: within ±2.5% or 0.25pF whichever is larger X7R, X5R, X6S: within ±7.5% Y5V: within ±20% * Q/D.F., I.R. and dielectric strength: To meet initial requirements.									
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1	Min. operating temp. +0/-3	30±3																									
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3	Max. operating temp. +3/-0	30±3																									
4	Room temp.	2~3																									

No.	Item	Test Condition	Requirements
13.	Humidity (Damp Heat) Steady State	* Test temp.: 40±2°C	* No remarkable damage.
		* Humidity: 90~95% RH	* Cap change:
		* Test time: 500+24/-0hrs.	NP0: within ±5% or 0.5pF whichever is larger
		*Before initial measurement (Class II only): Perform 150+0/-10°C for 1 hr and then set for 24±2 hrs at room temp.	X7R, X5R, X6S: ≥10V**, within ±12.5%; ≤6.3V within ±25%; TT series & C≥1uF, within ±25%
		* Measurement to be made after keeping at room temp. for 24±2 hrs.	**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:
			Rated vol. D.F. ≤ Exception of D.F. ≤
			≥100V ≤3% ≤6% 1206 ≥0.47μF
			≤7.5% 0805 >0.1μF; 0603 ≥0.068μF; 1206 >1μF; TT series
			≥50V ≤3% ≤6% 0201(50V); 0603 ≥0.047μF; 0805 ≥0.18μF; 1206 ≥0.47μF
			≤10% 1210 ≥4.7μF
			≤20% 0402 ≥0.1μF; 0603 >0.1μF; 0805 ≥1μF; 1206 ≥2.2μF; 1210 ≥10μF; TT series
			35V ≤5% ≤20% 0603 ≥1μF; 0805 ≥2.2μF; 1210 ≥10μF
	≤10% 0201 ≥0.01μF; 0805 ≥1μF; 1210 ≥10μF		
	≤14% 0603 ≥0.33μF; 1206 ≥4.7μF		
	25V ≤5% ≤15% 0402 ≥0.10μF; 0603 ≥0.47μF; 0805 ≥2.2μF; 1206 ≥6.8μF; 1210 ≥22μF; TT series		
	≤20% 0402 ≥1μF		
	16V ≤5% ≤10% 0603 ≥0.15μF; 0805 ≥0.68μF; 1206 ≥2.2μF; 1210 ≥4.7μF		
	≤15% 0201 ≥0.01μF; 0402 ≥0.033μF; 0603 ≥0.68μF; 0805 ≥2.2μF; 1206 ≥4.7μF; 1210 ≥22μF; TT series		
	10V ≤7.5% ≤15% 0201 ≥0.012μF; 0402 ≥0.33μF(0402/X7R ≥0.22μF); 0603 ≥0.33μF; 0805 ≥2.2μF; 1206 ≥2.2μF; 1210 ≥22μF		
	≤20% 0201 ≥0.1μF; 0402 ≥1μF; TT series		
	6.3V ≤15% ≤30% 0201 ≥0.1μF; 0402 ≥1μF; 0603 ≥10μF; 0805 ≥4.7μF; 1206 ≥47μF; 1210 ≥100μF; TT series		
	4V ≤20% --- ---		
	Y5V:		
	Rated vol. D.F. ≤ Exception of D.F. ≤		
	≥50V 7.5% 10% 0603 ≥0.1μF; 0805 ≥0.47μF; 1206 ≥4.7μF		
	35V 10% --- ---		
	25V 7.5% 10% 0402 ≥0.047μF; 0603 ≥0.1μF; 0805 ≥0.33μF; 1206 ≥1μF; 1210 ≥4.7μF		
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	20% 0402 ≥0.22μF		
	16V (C ≥1.0μF) 12.5% 20% 0603 ≥2.2μF; 0805 ≥3.3μF; 1206 ≥10μF; 1210 ≥22μF; 1812 ≥47μF;		
	10V 20% 30% 0402 ≥0.47μF		
	6.3V 30% --- ---		
	*I.R.: ≥10V, 1GΩ or 50 Ω-F whichever is smaller.		
	Class II (X7R, X5R, X6S, Y5V)		
	Rated voltage Insulation Resistance		
	100V: X7R	1GΩ or RxC ≥10 Ω-F whichever is smaller.	
	50V: 0402 ≥0.1μF; 0603 ≥1μF; 0805 ≥1μF; 1206 ≥4.7μF; 1210 ≥4.7μF		
	35V: 0603 ≥1μF; 0805 ≥2.2μF; 1210 ≥10μF		
	25V: 0201 ≥0.1uF; 0402 ≥0.22μF; 0603 ≥2.2μF; 0805 ≥2.2μF; 1206 ≥10μF; 1210 ≥10μF		
	16V: 0201 ≥0.1uF; 0402 ≥0.22μF; 0603 ≥1μF; 0805 ≥2.2μF; 1206 ≥10μF; 1210 ≥47μF		
	10V: 0201 ≥47nF; 0402 ≥0.47μF; 0603 ≥0.47μF; 0805 ≥2.2μF; 1206 ≥4.7μF; 1210 ≥47μF		
	6.3V ; 4V ; TT series ; All X6S items		

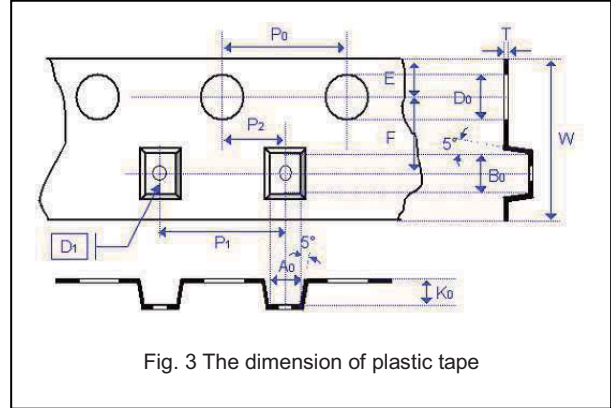
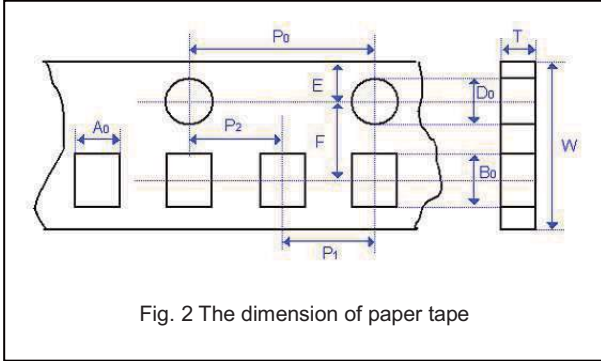


No	Item	Test Condition	Requirements																																		
14	Humidity (Damp Heat) Load	* Test temp.: 40±2°C * Humidity: 90~95%RH * Test time: 500+24/-0 hrs. * To apply voltage : rated voltage. * Before initial measurement (Class II only): To apply test voltage for 1hr at 40°C and then set for 24±2 hrs at room temp. * Measurement to be made after keeping at room temp. for 24±2 hrs.	* No remarkable damage. Cap change: NP0: ±7.5% or 0.75pF whichever is larger. X7R, X5R, X6S: ≥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:																																		
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*I.R.: ≥10V, 500MΩ or 25 Ω-F whichever is smaller. Class II (X7R, X5R, X6S, Y5V)																																					
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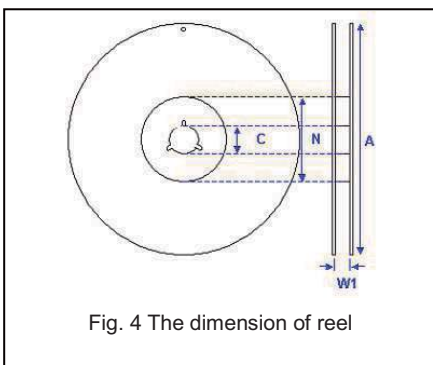
No	Item	Test Condition	Requirements																																																																																															
15.	High Temperature Load (Endurance)	Test temp. : NP0, X7R/X7E: 125±3°C X6S: 105±3°C X5R, Y5V: 85±3°C Test time: 1000+24/-0 hrs. *To apply voltage: (1) ≤ 6.3V or C ≥ 10µF or TT series: 150% of rated voltage. (2) 10V ≤ Ur < 500V: 200% of rated voltage. (3) 500V: 150% of rated voltage. (4) Ur ≥ 630V: 120% of rated voltage. (5) 100% of rated voltage for below range.	* No remarkable damage. Cap change: NP0: ±3.0% or ±0.3pF whichever is larger X7R, X5R, X6S: ≥10V**, within ±12.5%; ≤ 6.3V within ±25%; TT series & C ≥ 1µF, 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:																																																																																															
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APPENDIXES

▣ Tape & reel dimensions



Size	0201			0402			0603			0805			1206			1210			1812		
Thickness	L	N	E	S, X	A, H	B, T	C, D, I	B, T	C, J, D	G, P	C, D	F, G, K	M	D, F, G, K	M	U					
A ₀	0.38±0.05	0.62±0.05	0.70±0.10	1.02±0.05	1.50±0.10	1.50±0.10	<1.57	2.00±0.10	<1.85	<1.95	<2.97	<2.97	<2.97	<3.81	<3.81	<3.90					
B ₀	0.68±0.05	1.12±0.05	1.20±0.10	1.80±0.05	2.30±0.10	2.30±0.10	<2.40	3.50±0.10	<3.46	<3.67	<3.73	<3.73	<3.73	<5.30	<5.30	<5.30					
T	0.42±0.05	0.60±0.05	0.70±0.10	0.95±0.05	0.75±0.05	0.95±0.05	0.23±0.05	0.95±0.05	0.23±0.05	0.23±0.05	0.23±0.05	0.23±0.05	0.23±0.05	0.25±0.05	0.25±0.05	0.25±0.05					
K ₀	-	-	-	-	-	-	<2.50	-	<2.50	<2.50	<2.50	<2.50	<3.00	<2.50	<3.00	<3.50					
W	8.00±0.10	8.00±0.10	8.00±0.10	8.00±0.10	8.00±0.10	8.00±0.10	8.00±0.10	8.00±0.10	8.00±0.10	8.00±0.10	8.00±0.10	8.00±0.10	8.00±0.10	12.0±0.20	12.0±0.20	12.0±0.20					
P ₀	4.00±0.10	4.00±0.10	4.00±0.10	4.00±0.10	4.00±0.10	4.00±0.10	4.00±0.10	4.00±0.10	4.00±0.10	4.00±0.10	4.00±0.10	4.00±0.10	4.00±0.10	4.00±0.10	4.00±0.10	4.00±0.10					
10xP ₀	40.0±0.10	40.0±0.10	40.0±0.10	40.0±0.10	40.0±0.10	40.0±0.10	40.0±0.10	40.0±0.10	40.0±0.10	40.0±0.10	40.0±0.10	40.0±0.10	40.0±0.10	40.0±0.10	40.0±0.10	40.0±0.20					
P ₁	2.00±0.05	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	8.00±0.10	8.00±0.10	8.00±0.10					
P ₂	2.00±0.05	2.00±0.05	2.00±0.05	2.00±0.05	2.00±0.05	2.00±0.05	2.00±0.05	2.00±0.05	2.00±0.05	2.00±0.05	2.00±0.05	2.00±0.05	2.00±0.05	2.00±0.05	2.00±0.05	2.00±0.05					
D ₀	1.55±0.05	1.55±0.05	1.55±0.05	1.55±0.05	1.55±0.05	1.55±0.05	1.50±0.05	1.50±0.05	1.50±0.05	1.50±0.05	1.50±0.05	1.50±0.05	1.50±0.05	1.50±0.05	1.50±0.05	1.50±0.10					
D ₁	-	-	-	-	-	-	1.00±0.10	-	1.00±0.10	1.00±0.10	1.00±0.10	1.00±0.10	1.00±0.10	1.50±0.10	1.50±0.10	1.50±0.10					
E	1.75±0.05	1.75±0.05	1.75±0.05	1.75±0.05	1.75±0.05	1.75±0.05	1.75±0.10	1.75±0.10	1.75±0.10	1.75±0.10	1.75±0.10	1.75±0.10	1.75±0.10	1.75±0.10	1.75±0.10	1.75±0.10					
F	3.50±0.05	3.50±0.05	3.50±0.05	3.50±0.05	3.50±0.05	3.50±0.05	3.50±0.05	3.50±0.05	3.50±0.05	3.50±0.05	3.50±0.05	3.50±0.05	3.50±0.05	5.50±0.05	5.50±0.05	5.50±0.05					



Size	0201, 0402, 0603, 0805, 1206, 1210			1812
Reel size	7"	10"	13"	7"
C	13.0+0.5/-0.2	13.0+0.5/-0.2	13.0+0.5/-0.2	13.0+0.5/-0.2
W ₁	8.4+1.5/-0	8.4+1.5/-0	8.4+1.5/-0	12.4+2.0/-0
A	178.0±0.10	250.0±1.0	330.0±1.0	178.0±0.10
N	60.0+1.0/-0	100.0±1.0	100±1.0	60.0+1.0/-0

▣ Constructions

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

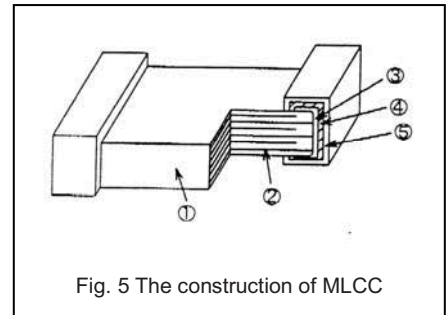


Fig. 5 The construction of MLCC

▣ Storage and handling conditions

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

Cautions:

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

▣ Recommended soldering conditions

The lead-free termination MLCCs are not only to be used on SMT against lead-free solder paste, but also suitable against lead-containing solder paste. If the optimized solder joint is requested, increasing soldering time, temperature and concentration of N₂ within oven are recommended.

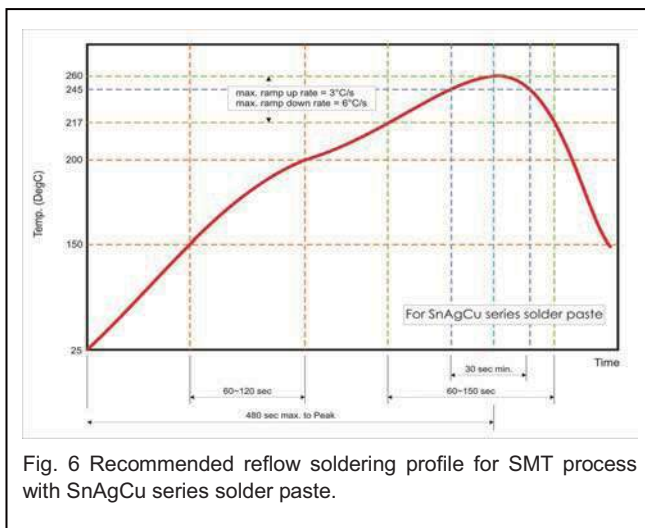


Fig. 6 Recommended reflow soldering profile for SMT process with SnAgCu series solder paste.

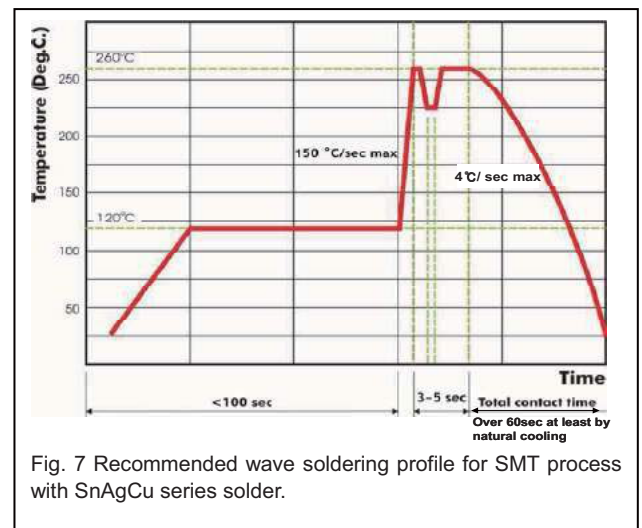


Fig. 7 Recommended wave soldering profile for SMT process with SnAgCu series solder.