

Data Sheet

Customer: _____

Product: Anti-Bend Multilayer Ceramic Chip Capacitors - ST series

Size : 0402/0603/0805/1206/1210/1808/1812/1825/2220/2225

Issued Date: 28-Jul.-2024

Edition: Ver. 5

Record of change

Date	Ver.	Description	Page
17-Feb.-2016	1		
18-Oct.-2018	2	Add items	
11-Sep.-2019	3	Add items	
08-May-2023	4	Add Cap. Range/Rated Voltage/Test Conditions	1~26
28-Jun.-2024	5	Revise Rated voltage	1

HITANO ENTERPRISE CORP.

7F-7, No. 3, Wu Chuan 1st Road, New Taipei Industrial Park,
New Taipei City, TAIWAN, R.O.C.

Tel: +886 2 2299 1331 (Rep.)

Fax: +886 2 2298 2466, 2298 2969

Prepared by	Checked by	Approved by	Accepted by (customer)
28-Jun.-2024	28-Jun.-2024	28-Jun.-2024	
Randy Yu	Michelle Lin	Arthur Su	

1. INTRODUCTION

HITANO Multilayer Ceramic Chip Capacitors supplied in bulk or tape & reel package are ideally suitable for thick-film hybrid circuits and automatic surface mounting on any printed circuit boards.

ST series use a special material between nickel-barrier and ceramic body. It provides excellent performance to against bending stress occurred during process and provide more security for PCB process.

The nickel-barrier terminations are consisted of a nickel barrier layer over the silver metallization and then finished by electroplated solder layer to ensure the terminations have good solderability. The nickel barrier layer in terminations prevents the dissolution of termination when extended immersion in molten solder at elevated solder temperature.

2. FEATURES

- High performance to withstanding 3~5mm of substrate bending test guarantee.
- A wide selection of sizes is available.
- High capacitance in given case size.
- Capacitor with lead-free termination (pure Tin).
- Reduction in PCB bend failure.
- High reliability and stability.
- RoHS & HALOGEN FREE.

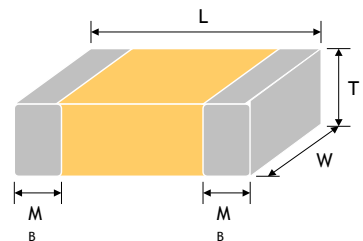
3. APPLICATIONS

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

4. Part Numbering

ST	0603	N	100	G	500	N	T
<u>Series</u>	<u>Size</u>	<u>Dielectric</u>	<u>Capacitance</u>	<u>Tolerance</u>	<u>Rated voltage</u>	<u>Termination</u>	<u>Packaging</u>
	Inch (mm)	N:C0G(NPO)	Two significant digits followed by no. of zeros and R is in place of decimal point. eg.:	B=±0.1pF	Two significant digits followed by no. of zeros. And R is in place of decimal point.	N=Cu/Ni/Sn	B = Bulk in Tray
	0402 (1005)			C=±0.25pF	063= 6.3 VDC		05 = 500/Reel
	0603 (1608)	B: X7R		D=±0.5pF	100= 10 VDC		1= 1K/Reel
	0805 (2012)			F=±1%	160= 16 VDC		2= 2K/Reel
	1206 (3216)		R47=0.47pF	G=±2%	250= 25 VDC		3= 3K/Reel
	1210 (3225)		0R5=0.5pF	J=±5%	500= 50 VDC		T= 4K/Reel
	1808 (4520)			K=±10%	101= 100 VDC		U= 10K/ Reel
	1812 (4532)		100=10x10 ⁰ =10pF	M=±20%	201= 200 VDC		V= 15K/ Reel
	1825 (4563)		102=10x10 ² = 1000pF		251= 250 VDC		
	2220 (5750)		104=10x10 ⁴ = 100nF		401= 400 VDC		
	2225 (5763)		106=10x10 ⁶ = 10μF		501= 500 VDC		
					631= 630 VDC		
					102= 1000 VDC		
					152= 1500 VDC		
					202= 2000 VDC		
					302= 3000 VDC		
					402= 4000 VDC		
					502= 5000 VDC		

5. EXTERNAL DIMENSIONS

Size Inch (mm)	L (mm)	W (mm)	Code / T (mm)	M _B (mm)	
0402(1005)	1.00±0.20	0.50±0.20	Refer to cap. range table	0.25 +0.05/-0.10	
0603(1608)	1.60±0.20	0.80±0.20		0.40±0.15	
0805(2012)	2.10±0.20	1.25±0.20		0.50±0.20	
1206(3216)	3.30±0.30	1.60±0.20 1.60 +0.30/-0.10 [#]		0.60±0.20	
1210(3225)	3.30±0.40	2.50±0.30		0.75±0.35	
1808(4520)	4.60±0.50	2.00±0.25		0.75±0.35	
1812(4532)	4.60±0.50	3.20±0.30		0.75±0.35	
1825(4563)	4.60±0.50	6.30±0.40		0.75±0.35	
2220(5750)	5.70±0.50	5.00±0.40		0.85±0.35	
2225(5763)	5.70±0.50	6.30±0.40		0.85±0.35	
					Fig. 5.1 The outline of MLCC

[#] For 1206 size P thickness products.

6. GENERAL ELECTRICAL DATA

Dielectric	C0G(NPO)	X7R						
Size	0402, 0603, 0805, 1206, 1210, 1808, 1812, 1825, 2220, 2225	0402, 0603, 0805, 1206, 1210, 1808, 1812, 1825, 2220, 2225						
Rated voltage (WVDC)	10V, 16V, 25V, 50V, 100V, 200V, 250V, 500V, 630V, 1KV, 1.5KV, 2KV, 3KV, 4KV	6.3V, 10V, 16V, 25V, 50V, 100V, 200V, 250V, 500V, 630V, 1KV, 1.5KV, 2KV, 3KV, 4KV, 5KV						
Capacitance range	0.1pF ~ 330nF	100pF ~ 47μF						
Capacitance tolerance	B=±0.1pF,C=±0.25pF,D=±0.5pF,F=±1%,G=±2%,J=±5%,K=±10%,M=±20%							
Tan δ	<table><tr><td>Cap. Range</td><td>Q Spec.</td></tr><tr><td>Cap.<30pF</td><td>Q≥400+20C</td></tr><tr><td>Cap.≥30pF</td><td>Q≥1000</td></tr></table>	Cap. Range	Q Spec.	Cap.<30pF	Q≥400+20C	Cap.≥30pF	Q≥1000	Reference to 8. RELIABILITY TEST CONDITIONS AND REQUIREMENTS
Cap. Range	Q Spec.							
Cap.<30pF	Q≥400+20C							
Cap.≥30pF	Q≥1000							
Capacitance & Tan δ Test condition	For 25°C at ambient temperature <table><tr><td>Cap. Range</td><td>Test Condition</td></tr><tr><td>Cap.≤1000pF</td><td>1.0±0.2Vrms, 1.0MHZ±10%</td></tr><tr><td>Cap.>1000pF</td><td>1.0±0.2Vrms, 1.0KHZ±10%</td></tr></table>	Cap. Range	Test Condition	Cap.≤1000pF	1.0±0.2Vrms, 1.0MHZ±10%	Cap.>1000pF	1.0±0.2Vrms, 1.0KHZ±10%	
Cap. Range	Test Condition							
Cap.≤1000pF	1.0±0.2Vrms, 1.0MHZ±10%							
Cap.>1000pF	1.0±0.2Vrms, 1.0KHZ±10%							
Insulation resistance	≥10GΩ or RxC≥500Ω-F, whichever is smaller	≥10GΩ or RxC≥100Ω-F, whichever is smaller						
Operating temperature	-55°C to +125°C	-55°C to +125°C						
Temperature coefficient	±30ppm/°C	±15%						
Termination	Cu/Ag polymer/Ni/Sn(lead-free termination)	Cu/Ag polymer/Ni/Sn(lead-free termination)						

7. CAPACITANCE RANGE

7-1. C0G

Dimension		0402					0603							0805									
Cap.(pF)	Code	10V	16V	25V	50V	100V	10V	16V	25V	50V	100V	200V	250V	10V	16V	25V	50V	100V	200V	250V	500V	630V	1000V
0.1	0R1	K	K	K	K																		
0.2	0R2	K	K	K	K																		
0.3	0R3	K	K	K	K		S	S	S	S													
0.4	0R4	K	K	K	K		S	S	S	S													
0.5	0R5	K	K	K	K	K	S	S	S	S	S	S	S	A	A	A	A	A	A	A	A	A	C
0.6	0R6	K	K	K	K	K	S	S	S	S	S	S	S	A	A	A	A	A	A	A	A	A	C
0.7	0R7	K	K	K	K	K	S	S	S	S	S	S	S	A	A	A	A	A	A	A	A	A	C
0.8	0R8	K	K	K	K	K	S	S	S	S	S	S	S	A	A	A	A	A	A	A	A	A	C
0.9	0R9	K	K	K	K	K	S	S	S	S	S	S	S	A	A	A	A	A	A	A	A	A	C
1.0	1R0	K	K	K	K	K	S	S	S	S	S	S	S	A	A	A	A	A	A	A	A	A	C
1.2	1R2	K	K	K	K	K	S	S	S	S	S	S	S	A	A	A	A	A	A	A	A	A	C
1.5	1R5	K	K	K	K	K	S	S	S	S	S	S	S	A	A	A	A	A	A	A	A	A	C
1.8	1R8	K	K	K	K	K	S	S	S	S	S	S	S	A	A	A	A	A	A	A	A	A	C
2.2	2R2	K	K	K	K	K	S	S	S	S	S	S	S	A	A	A	A	A	A	A	A	A	C
2.7	2R7	K	K	K	K	K	S	S	S	S	S	S	S	A	A	A	A	A	A	A	A	A	C
3.3	3R3	K	K	K	K	K	S	S	S	S	S	S	S	A	A	A	A	A	A	A	A	A	C
3.9	3R9	K	K	K	K	K	S	S	S	S	S	S	S	A	A	A	A	A	A	A	A	A	C
4.7	4R7	K	K	K	K	K	S	S	S	S	S	S	S	A	A	A	A	A	A	A	A	A	C
5.0	5R0	K	K	K	K	K	S	S	S	S	S	S	S	A	A	A	A	A	A	A	A	A	C
5.6	5R6	K	K	K	K	K	S	S	S	S	S	S	S	A	A	A	A	A	A	A	A	A	C
6.8	6R8	K	K	K	K	K	S	S	S	S	S	S	S	A	A	A	A	A	A	A	A	A	C
8.2	8R2	K	K	K	K	K	S	S	S	S	S	S	S	A	A	A	A	A	A	A	A	A	C
10	100	K	K	K	K	K	S	S	S	S	S	S	S	A	A	A	A	A	A	A	A	A	C
12	120	K	K	K	K	K	S	S	S	S	S	S	S	A	A	A	A	A	A	A	A	A	C
15	150	K	K	K	K	K	S	S	S	S	S	S	S	A	A	A	A	A	A	A	A	A	C
18	180	K	K	K	K	K	S	S	S	S	S	S	S	A	A	A	A	A	A	A	A	A	C
22	220	K	K	K	K	K	S	S	S	S	S	S	S	A	A	A	A	A	A	A	A	A	C
27	270	K	K	K	K	K	S	S	S	S	S	S	S	A	A	A	A	A	A	A	A	A	C
33	330	K	K	K	K	K	S	S	S	S	S	S	S	A	A	A	A	A	A	A	A	A	C
39	390	K	K	K	K	K	S	S	S	S	S	S	S	A	A	A	A	A	A	A	A	A	C
47	470	K	K	K	K	K	S	S	S	S	S	S	S	A	A	A	A	A	A	A	A	A	C
56	560	K	K	K	K	K	S	S	S	S	S	S	S	A	A	A	A	A	A	A	A	A	C
68	680	K	K	K	K	K	S	S	S	S	S	S	S	A	A	A	A	A	A	A	A	A	C
82	820	K	K	K	K	K	S	S	S	S	S	S	S	A	A	A	A	A	A	A	X	X	C
100	101	K	K	K	K	K	S	S	S	S	S	S	S	A	A	A	A	A	A	X	X	X	C
120	121	K	K	K	K	K	S	S	S	S	S	S	S	A	A	A	A	A	A	X	C	C	C
150	151	K	K	K	K	K	S	S	S	S	S	S	S	A	A	A	A	A	X	C	C	C	C
180	181	K	K	K	K	K	S	S	S	S	S	S	S	A	A	A	A	A	X	C	C	C	C
220	221	K	K	K	K	K	S	S	S	S	S	S	S	A	A	A	A	A	C	C	C	C	C
270	271	K	K	K	K		S	S	S	S	S	B	B	A	A	A	A	A	C	C	C	C	C
330	331	K	K	K	K		S	S	S	S	S	B	B	A	A	A	A	A	C	C	C	C	C
390	391	K	K	K	K		S	S	S	S	S	B	B	X	X	X	X	X	C	C	C	C	C
470	471	K	K	K	K		S	S	S	S	S	B	B	X	X	X	X	X	C	C	I	I	
560	561	K	K	K	K		S	S	S	S	S			X	X	X	X	X	C	C	I	I	
680	681	K	K	K	K		S	S	S	S	S			X	X	X	X	X	C	C	I	I	
820	821	K	K	K	K		S	S	S	S	S			X	X	X	X	X	C	C	I	I	
1000	102	K	K	K	K		S	S	S	S	S			X	X	X	X	X	C	C	I	I	
1200	122						B	B	B	B				X	X	X	X	X	C	C			
1500	152						B	B	B	B				X	X	X	X	X	C	C			
1800	182						B	B	B	B				X	X	X	X	X	C	C			
2200	222						B	B	B	B				X	X	X	X	X	C	C			
2700	272						B	B	B	B				C	C	C	C	C	C	C			
3300	332						B	B	B	B				C	C	C	C	C					
3900	392													C	C	C	C	C					
4700	472													C	C	C	C	C					
5600	562													C	C	C	C	C					
6800	682													C	C	C	C	C					
8200	822													C	C	C	C						
10000	103													C	C	C	C						

7. CAPACITANCE RANGE(Con.)

7-1. C0G

Dimension		1206										1210											
Cap.(pF)	Code	10V 16V 25V	50V	100V	200V	250V	500V	630V	1000V	1500V	2000V	10V 16V 25V	50V	100V	200V	250V	500V	630V	1000V	1500V	2000V	3000V	
1.0	1R0		X																				
1.2	1R2	X	X	X			X																
1.5	1R5	X	X	X	X	X	X	X	X	X	X												
1.8	1R8	X	X	X	X	X	X	X	X	X	X												
2.2	2R2	X	X	X	X	X	X	X	X	X	X												
2.7	2R7	X	X	X	X	X	X	X	X	X	X												
3.3	3R3	X	X	X	X	X	X	X	X	X	X												
3.9	3R9	X	X	X	X	X	X	X	X	X	X												
4.7	4R7	X	X	X	X	X	X	X	X	X	X												
5.0	5R0	X	X	X	X	X	X	X	X	X	X												
5.6	5R6	X	X	X	X	X	X	X	X	X	X												
6.8	6R8	X	X	X	X	X	X	X	X	X	X												
8.2	8R2	X	X	X	X	X	X	X	X	X	X												
10	100	X	X	X	X	X	X	X	X	X	X	M	M	M	M	M	M	M	M	M	M	F	
12	120	X	X	X	X	X	X	X	X	X	X	M	M	M	M	M	M	M	M	M	M	F	
15	150	X	X	X	X	X	X	X	X	X	X	M	M	M	M	M	M	M	M	M	M	F	
18	180	X	X	X	X	X	X	X	X	X	X	M	M	M	M	M	M	M	M	M	M	F	
22	220	X	X	X	X	X	X	X	X	X	X	M	M	M	M	M	M	M	M	M	M	F	
27	270	X	X	X	X	X	X	X	X	X	X	M	M	M	M	M	M	M	M	M	M	F	
33	330	X	X	X	X	X	X	X	X	M	M	M	M	M	M	M	M	M	M	M	M	F	
39	390	X	X	X	X	X	X	X	X	M	M	M	M	M	M	M	M	M	M	M	M	F	
47	470	X	X	X	X	X	X	X	M	M	M	M	M	M	M	M	M	M	M	M	M	F	
56	560	X	X	X	X	X	X	X	M	C	C	M	M	M	M	M	M	M	M	C	C	F	
68	680	X	X	X	X	X	X	X	M	C	C	M	M	M	M	M	M	M	M	C	C	F	
82	820	X	X	X	X	X	X	X	C	C	C	M	M	M	M	M	M	M	M	C	C	F	
100	101	X	X	X	X	X	X	X	C	C	C	M	M	M	M	M	M	M	C	C	C	F	
120	121	X	X	X	X	X	X	X	C	E	E	M	M	M	M	M	M	M	C	C	C	F	
150	151	X	X	X	X	X	X	X	C	E	E	M	M	M	M	M	M	M	C	E	E	F	
180	181	X	X	X	X	X	X	X	E	E	E	M	M	M	M	M	M	M	C	E	E	F	
220	221	X	X	X	X	X	X	X	E	E	E	M	M	M	M	M	M	M	E	E	E	F	
270	271	X	X	X	X	M	M	M	E	P	P	M	M	M	M	M	M	M	E	F	F	G	
330	331	X	X	X	X	M	M	M	E	P	P	M	M	M	M	M	M	M	E	F	F		
390	391	X	X	X	X	M	M	M	E	P	P	M	M	M	M	M	M	M	E	G	G		
470	471	X	X	X	M	M	M	M	E	E	E	M	M	M	M	M	M	M	E	G	G		
560	561	X	X	X	M	C	C	C	E			M	M	M	M	M	M	M	E	G	G		
680	681	X	X	X	M	C	C	C	E			M	M	M	M	M	M	M	E	G	G		
820	821	X	X	X	M	E	E	E	E			M	M	M	M	M	M	M	E	G	G		
1000	102	X	X	X	M	E	E	E	E			M	M	M	C	C	C	C	E	G	G		
1200	122	X	X	X	M	E	E	E				M	M	M	C	C	C	C	E	F	F		
1500	152	X	X	X	C	E	E	E				M	M	M	C	C	C	C	F	G	G		
1800	182	X	X	X	C	E	E	E				M	M	M	C	C	C	C	G	G	G		
2200	222	X	X	X	C	E	E	E				M	M	M	C	C	C	C	G				
2700	272	X	X	X	C	E	E	E				M	M	M	C	C	C	C	G				
3300	332	X	X	X	C	E	E	E				M	M	M	C	C	C	C	G				
3900	392	X	X	X	E	E	E	E				M	M	M	C	C	C	C	G				
4700	472	X	X	X	E	E	E	E				M	M	M	E	E	E	E	G				
5600	562	X	X	X	E	E	E	E				M	M	C	E	E	E	E	G				
6800	682	M	M	M	E	E	E	C/E				M	M	C	E	E	E	E	G				
8200	822	C	C	C	E	E	E	E				M	M	C	E	E	E	E	G				
10000	103	C	C	C	E	E	E	E				M	M	E	F	F	F	F	G				
12000	123	P	P	P								C	C	E	F	F	F	F					
15000	153	P	P	P								C	C	F	F	F	F	F					
18000	183	P	P	P								F	F	F	F	F	F	F					
22000	223	P	P	P								F	F	F	F	F	F	F					
27000	273	P	P									F/G	F/G	F	F	F	G	G					
33000	333	P	P									F/G	F/G	F	F	F	G	G					
39000	393	P	P									F/G	F/G	F	F	F							
47000	473											F	F	F	F	F							
56000	563																						
68000	683																						

7. CAPACITANCE RANGE(Con.)

7-1. C0G

Dimension		1808											1812												
Cap.(pF)	Code	25V 50V	100V	200V	250V	500V	630V	1000V	1500V	2000V	3000V	4000V	10V 16V	25V	50V	100V	200V	250V	500V	630V	1000V	1500V	2000V	3000V	4000V
1.0	1R0																								
1.2	1R2																								
1.5	1R5																								
1.8	1R8																								
2.2	2R2	C	C	C	C	C	C	C	C	C	C	C													
2.7	2R7	C	C	C	C	C	C	C	C	C	C	C													
3.3	3R3	C	C	C	C	C	C	C	C	C	C	C													
3.9	3R9	C	C	C	C	C	C	C	C	C	C	C													
4.7	4R7	C	C	C	C	C	C	C	C	C	C	C													
5.0	5R0	C	C	C	C	C	C	C	C	C	C	C													
5.6	5R6	C	C	C	C	C	C	C	C	C	C	C													
6.8	6R8	C	C	C	C	C	C	C	C	C	C	C													
8.2	8R2	C	C	C	C	C	C	C	C	C	C	C													
10	100	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C
12	120	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C
15	150	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C
18	180	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C
22	220	C	C	C	C	C	C	C	C	C	C	C	E	C	C	C	C	C	C	C	C	C	C	C	C
27	270	C	C	C	C	C	C	C	C	C	C	C	E	C	C	C	C	C	C	C	C	C	C	C	C
33	330	C	C	C	C	C	C	C	C	C	C	C	F	C	C	C	C	C	C	C	C	C	C	C	C*
39	390	C	C	C	C	C	C	C	C	C	C	C	F	C	C	C	C	C	C	C	C	C	C	C	C*
47	470	C	C	C	C	C	C	C	C	C	C	C		C	C	C	C	C	C	C	C	C	C	C	E*
56	560	C	C	C	C	C	C	C	C	C	C	C		C	C	C	C	C	C	C	C	C	C	C	E*
68	680	C	C	C	C	C	C	C	C	C	C	C		C	C	C	C	C	C	C	C	C	C	C	F*
82	820	C	C	C	C	C	C	C	C	C	C	C		C	C	C	C	C	C	C	C	C	C	C	F*
100	101	C	C	C	C	C	C	C	C	C	C	F		C	C	C	C	C	C	C	C	C	C	C	F*
120	121	C	C	C	C	C	C	C	C	C	C	F		C	C	C	C	C	C	C	C	C	C	C	G*
150	151	C	C	C	C	C	C	C	C	F	F	F		C	C	C	C	C	C	C	C	C	C	C	
180	181	C	C	C	C	C	C	C	F	F	F	F		C	C	C	C	C	C	C	C	C	C	C	F
220	221	C	C	C	C	C	C	C	F	F	F	F		C	C	C	C	C	C	C	C	C	C	C	F
270	271	C	C	C	C	C	C	F	F	F	F	F		C	C	C	C	C	C	C	C	F	F	F	
330	331	C	C	C	C	C	C	F	F	F	F	F		C	C	C	C	C	C	C	C	F	F	F	
390	391	C	C	C	C	C	C	F	F	F	F	F		C	C	C	C	C	C	C	C	F	F	F	
470	471	C	C	C	C	C	C	F	F	F	F	F		C	C	C	C	C	C	C	C	F	F	F	
560	561	C	C	C	C	C	C	F	F	F	F	F		C	C	C	C	C	C	C	C	F	F	F	
680	681	C	C	C	C	C	C	F	F	F	F	F		C	C	C	C	C	C	C	C	F	F	F	
820	821	C	C	C	C	C	C	F	F	F	F	F		C	C	C	C	C	C	C	C	F	F	G	
1000	102	C	C	C	C	C	C	F	F	F	F	F		C	C	C	C	C	C	C	C	F	F	G	
1200	122	C	C	C	C	C	C	F	F	F	F	F		C	C	C	C	C	C	C	C	F	F	R	
1500	152	C	C	C	C	C	C	F	F	F	F	F		C	C	C	C	C	C	C	C	F	F		
1800	182	C	C	C	C	C	C	F	F	F	F	F		C	C	C	C	C	C	C	F	F	F		
2200	222	C	C	C	C	C	C	F						C	C	C	C	C	C	C	E	F	F		
2700	272	C	C	C	C	C	C							C	C	C	C	C	C	C	F	G	G		
3300	332	C	C	C	C	C	C							C	C	C	C	C	C	C	F	G	G		
3900	392	C	C	C	C									C	C	C	C	C	C	C	G				
4700	472	C	C	C	C									C	C	C	C	C	C	C	F/G				
5600	562	C	C	E	E									C	C	C	C	C	C	C	G				
6800	682	C	C	E	E									C	C	C	C	C	C	C					
8200	822	C	E	F	F									C	C	C	C	C	C	C					
10000	103	C	E	F	F									C	C	C	C	C	C	C					
12000	123	E												C	C	C	C	E	E	E	E				
15000	153	E												C	C	C	C	E	E	E	E				
18000	183	F												C	C	C	E	F	F	F	F				
22000	223	F												C	C	C	E	F	F	F	F				
27000	273													C	E	E	F	G	G						
33000	333													C	E	E	F								
39000	393														F	F	G								
47000	473														F	F	G								
56000	563														G	G									
68000	683														G	G									
82000	823														G	G									
100000	104														G	G									
120000	124																								
150000	154																								

7. CAPACITANCE RANGE(Con.)

7-1. C0G

Dimension		1825										2220										
Cap.(pF)	Code	25V 50V	100V	200V	250V	500V	630V	1000V	1500V	2000V	3000V	25V 50V	100V	200V	250V	500V	630V	1000V	1500V	2000V	3000V	4000V
10	100	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F		F	F	
12	120	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F		F	F	
15	150	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	
18	180	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	
22	220	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	
27	270	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F
33	330	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F
39	390	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F
47	470	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F
56	560	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F
68	680	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F
82	820	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F
100	101	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F
120	121	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F
150	151	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F
180	181	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F
220	221	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F
270	271	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	G
330	331	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	G
390	391	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	
470	471	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	
560	561	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	
680	681	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	
820	821	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	
1000	102	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	
1200	122	F	F	F	F	F	F	F	F			F	F	F	F	F	F	F	F	F	F	
1500	152	F	F	F	F	F	F	F	F			F	F	F	F	F	F	F	F	F	F	
1800	182	F	F	F	F	F	F	F	F			F	F	F	F	F	F	F	F	F		
2200	222	F	F	F	F	F	F	F	F			F	F	F	F	F	F	F	F	F		
2700	272	F	F	F	F	F	F	F	F			F	F	F	F	F	F	F	F	F		
3300	332	F	F	F	F	F	F	F	F			F	F	F	F	F	F	F	F	F		
3900	392	F	F	F	F	F	F	F	F			F	F	F	F	F	F	F	F	F		
4700	472	F	F	F	F	F	F	F	F			F	F	F	F	F	F	F	F	F		
5600	562	F	F	F	F	F	F	F				F	F	F	F	F	F	F				
6800	682	F	F	F	F	F	F	F				F	F	F	F	F	F	F				
8200	822	F	F	F	F	F	F	G				F	F	F	F	F	F	G				
10000	103	F	F	F	F	F	F	G				F	F	F	F	F	F	G				
12000	123	F	F	F	F	F	F					F	F	F	F	F	F					
15000	153	F	F	F	F	F	F					F	F	F	F	F	F					
18000	183	F	F	F	F	F	F					F	F	F	F	F	F					
22000	223	F	F	F	F	F	F					F	F	F	F	F	F					
27000	273	F	F	F	F	F	F					F	F	F	F	F	F					
33000	333	F	F	F	F	F	F					F	F	F	F	F	E/F					
39000	393	F	E	F	F	G	G					F	F	F	F	F	E/F					
47000	473	F	E	F	F							F	F	G	G	G	E/F					
56000	563	F	F	G	G							F	F	G	G		F					
68000	683	F	F	G	G							F	F	G	G		F					
82000	823	F	G									F	G				F					
100000	104	G	G									G	G				G					
120000	124																					
150000	154																					
180000	184																					
220000	224																					
270000	274																					
330000	334																					

7. CAPACITANCE RANGE(Con.)

7-1. C0G

Dimension		2225										
Cap.(pF)	Code	25V 50V	100V	200V	250V	500V	630V	1000V	1500V	2000V	3000V	4000V
10	100	F	F	F	F	F	F	F	F	F	F	
12	120	F	F	F	F	F	F	F	F	F	F	
15	150	F	F	F	F	F	F	F	F	F	F	
18	180	F	F	F	F	F	F	F	F	F	F	
22	220	F	F	F	F	F	F	F	F	F	F	
27	270	F	F	F	F	F	F	F	F	F	F	F
33	330	F	F	F	F	F	F	F	F	F	F	F
39	390	F	F	F	F	F	F	F	F	F	F	F
47	470	F	F	F	F	F	F	F	F	F	F	F
56	560	F	F	F	F	F	F	F	F	F	F	F
68	680	F	F	F	F	F	F	F	F	F	F	F
82	820	F	F	F	F	F	F	F	F	F	F	F
100	101	F	F	F	F	F	F	F	F	F	F	F
120	121	F	F	F	F	F	F	F	F	F	F	
150	151	F	F	F	F	F	F	F	F	F	F	
180	181	F	F	F	F	F	F	F	F	F	F	
220	221	F	F	F	F	F	F	F	F	F	F	
270	271	F	F	F	F	F	F	F	F	F	F	
330	331	F	F	F	F	F	F	F	F	F	F	
390	391	F	F	F	F	F	F	F	F	F	F	
470	471	F	F	F	F	F	F	F	F	F	F	
560	561	F	F	F	F	F	F	F	F	F	F	
680	681	F	F	F	F	F	F	F	F	F	F	
820	821	F	F	F	F	F	F	F	F	F	F	
1000	102	F	F	F	F	F	F	F	F	F	F	
1200	122	F	F	F	F	F	F	F	F	F	F	
1500	152	F	F	F	F	F	F	F	F	F	F	
1800	182	F	F	F	F	F	F	F	F	F	F	
2200	222	F	F	F	F	F	F	F	F	F	F	
2700	272	F	F	F	F	F	F	F	F	F	G	
3300	332	F	F	F	F	F	F	F	F	F	G	
3900	392	F	F	F	F	F	F	F	F	F		
4700	472	F	F	F	F	F	F	F	F	F		
5600	562	F	F	F	F	F	F	F	F	F		
6800	682	F	F	F	F	F	F	F	F	F		
8200	822	F	F	F	F	F	F	F	G	G		
10000	103	F	F	F	F	F	F	G	G	G		
12000	123	F	F	F	F	F	F					
15000	153	F	F	F	F	F	F					
18000	183	F	F	F	F	F	F					
22000	223	F	F	F	F	F	F					
27000	273	F	F	F	F	F	F					
33000	333	F	F	F	F	F	F					
39000	393	F	F	F	F	F	F					
47000	473	F	F	F	F	F	F					
56000	563	F	F	G	G	G	G					
68000	683	F	F	G	G	G	G					
82000	823	F	F	G	G	G						
100000	104	F	G	G	G							
120000	124											
150000	154											
180000	184											
220000	224											
270000	274											
330000	334											

7. CAPACITANCE RANGE(Con.)

7-2. X7R

Dimension		0402						0603								0805											
Cap.(pF)	Code	6.3V	10V	16V	25V	50V	100V	6.3V	10V	16V	25V	50V	100V	200V	250V	6.3V	10V	16V	25V	50V	100V	200V	250V	500V	630V	1000V	
100	101		K	K	K	K	K		S	S	S	S	S	B	B		C	C	C	C	C	C	C	C	X	X	X
120	121		K	K	K	K	K		S	S	S	S	S	B	B		C	C	C	C	C	C	C	C	X	X	X
150	151		K	K	K	K	K		S	S	S	S	S	B	B		C	C	C	C	C	C	C	C	X	X	X
180	181		K	K	K	K	K		S	S	S	S	S	B	B		C	C	C	C	C	C	C	C	X	X	X
220	221		K	K	K	K	K		S	S	S	S	S	B	B		C	C	C	C	C	C	C	C	X	X	X
270	271		K	K	K	K	K		S	S	S	S	S	B	B		C	C	C	C	C	C	C	C	X	X	X
330	331		K	K	K	K	K		S	S	S	S	S	B	B		C	C	C	C	C	C	C	C	X	X	X
390	391		K	K	K	K	K		S	S	S	S	S	B	B		C	C	C	C	C	C	C	C	X	X	X
470	471		K	K	K	K	K		S	S	S	S	S	B	B		C	C	C	C	C	C	C	C	X	X	X
560	561		K	K	K	K	K		S	S	S	S	S	B	B		C	C	C	C	C	C	C	C	X	X	X
680	681		K	K	K	K	K		S	S	S	S	S	B	B		C	C	C	C	C	C	C	C	X	X	X
820	821		K	K	K	K	K		S	S	S	S	S	B	B		C	C	C	C	C	C	C	C	X	X	X
1000	102		K	K	K	K	K		S	S	S	S	S	B	B		C	C	C	C	C	C	C	C	X	X	X
1200	122		K	K	K	K	K		S	S	S	S	S	B	B		C	C	C	C	C	C	C	C	X	X	X
1500	152		K	K	K	K	K		S	S	S	S	S	B	B		C	C	C	C	C	C	C	C	X	X	C
1800	182		K	K	K	K	K		S	S	S	S	S	B	B		C	C	C	C	C	C	C	C	X	X	C
2200	222		K	K	K	K	K		S	S	S	S	S	B	B		C	C	C	C	C	C	C	C	X	X	C
2700	272		K	K	K	K	K		S	S	S	S	S	B	B		C	C	C	C	C	C	C	C	X	X	
3300	332		K	K	K	K	K		S	S	S	S	S	B	B		C	C	C	C	C	C	C	C	X	X	
3900	392		K	K	K	K	K		S	S	S	S	S	B	B		C	C	C	C	C	C	C	C	X	X	
4700	472		K	K	K	K	K		S	S	S	S	S	B	B		C	C	C	C	C	C	C	C	C	C	
5600	562		K	K	K	K			S	S	S	S	S	B	B		C	C	C	C	C	C	C	C	C	C	
6800	682		K	K	K	K			S	S	S	S	S	B	B		C	C	C	C	C	C	C	C	C	C	
8200	822		K	K	K	K			S	S	S	S	S	B	B		C	C	C	C	C	C	C	C	C	C	
10000	103		K	K	K	K			S	S	S	S	S	B	B		C	C	C	C	C	C	C	C	C	C	
12000	123		K	K	K				S	S	S	S	B				C	C	C	C	C	C	C	C	C	C	
15000	153		K	K	K				S	S	S	S	B				C	C	C	C	C	C	C	C	C	C	
18000	183		K	K	K				S	S	S	S	B				C	C	C	C	C	C	C	C	C	C	
22000	223		K	K	K				S	S	S	S	B				C	C	C	C	C	C	C	C	C	C	
27000	273		K	K	K				S	S	S	S	B				C	C	C	C	C	C	C	C	C	C	
33000	333		K	K	K				S	S	S	B	B				C	C	C	C	C	C	C	C	C		
39000	393		K	K	K				S	S	S	B	B				C	C	C	C	C	C	C	C			
47000	473		K	K	K				S	S	S	B	B				C	C	C	C	C	C	C	C			
56000	563		K	K					S	S	S	B	B				C	C	C	C	C	C	C	C			
68000	683		K	K					S	S	S	B	B				C	C	C	C	C	C	C	C			
82000	823		K	K					S	S	S	B	B				C	C	C	C	C	C	C				
100000	104	K	K	K					S	S	S	B	B				C	C	C	C	C	C					
120000	124								S	S	B						C	C	C	C	I						
150000	154								S	S	B						C	C	C	C	I						
180000	184								S	S	B						C	C	C	C	I						
220000	224								S	S	B	B					C	C	C	C	I						
270000	274							B	B	B	B						I	I	I	I							
330000	334								B	B	B						I	I	I	I							
390000	394								B	B	B						I	I	I	I							
470000	474							B	B	B	B						I	I	I	I	I						
560000	564								B	B							I	I	I								
680000	684							B	B	B							I	I	I								
820000	824								B	B							I	I	I								
1000000	105							B	B	B	B						I	I	I	I							
1200000	125																										
1500000	155																I	I	I								
2200000	225																I	I	I	I							
4700000	475																I	I	I	I							
10000000	106																I	I									

7. CAPACITANCE RANGE(Con.)

7-2. X7R

Dimension		1206														1210													
Cap.(pF)	Code	6.3V	10V	16V	25V	50V	100V	200V	250V	500V	630V	1000V	1500V	2000V	10V	16V	25V	50V	100V	200V	250V	500V	630V	1000V	1500V	2000V			
100	101							C	C	C	C	C	C	C															
120	121							C	C	C	C	C	C	C															
150	151		C	C	C	C	C	C	C	C	C	C	C	C															
180	181		C	C	C	C	C	C	C	C	C	C	C	C															
220	221		C	C	C	C	C	C	C	C	C	C	C	C			M	M	M	M	M	M	M	M	M	M			
270	271		C	C	C	C	C	C	C	C	C	C	C	C			M	M	M	M	M	M	M	M	M	M			
330	331		C	C	C	C	C	C	C	C	C	C	C	C			M	M	M	M	M	M	M	M	M	M			
390	391		C	C	C	C	C	C	C	C	C	C	C	C			M	M	M	M	M	M	M	M	M	M			
470	471		C	C	C	C	C	C	C	C	C	C	C	C			M	M	M	M	M	M	M	M	M	M			
560	561		C	C	C	C	C	C	C	C	C	C	C	C			M	M	M	M	M	M	M	M	M	M			
680	681		C	C	C	C	C	C	C	C	C	C	C	C			M	M	M	M	M	M	M	M	M	M			
820	821		C	C	C	C	C	C	C	C	C	C	C	C			M	M	M	M	M	M	M	M	M	M			
1000	102		C	C	C	C	C	C	C	C	C	C	C	X/C	M	M	M	M	M	M	M	M	M	M	C	C			
1200	122		C	C	C	C	C	C	C	C	C	C	E	E	M	M	M	M	M	M	M	M	M	M	E	E			
1500	152		C	C	C	C	C	C	C	C	C	C	E	E	M	M	M	M	M	M	M	M	M	M	E	E			
1800	182		C	C	C	C	C	C	C	C	C	C	E	E	M	M	M	M	M	M	M	M	M	M	E	E			
2200	222		C	C	C	C	C	C	C	C	C	C	E	E	M	M	M	M	M	M	M	M	M	M	F	F			
2700	272		C	C	C	C	C	C	C	C	C	C	E	E	M	M	M	M	M	M	M	M	M	M	F	G			
3300	332		C	C	C	C	C	C	C	C	C	C	E	E	M	M	M	M	M	M	M	M	M	M	F	G			
3900	392		C	C	C	C	C	C	C	C	C	C	E		M	M	M	M	M	M	M	M	M	M	G	G			
4700	472		C	C	C	C	C	C	C	C	C	C	E		M	M	M	M	M	M	M	M	M	M	F/G	F/G			
5600	562		C	C	C	C	C	C	C	C	C	C	E		M	M	M	M	M	M	M	M	M	M	G	G*			
6800	682		C	C	C	C	C	C	C	C	C	C	E		M	M	M	M	M	M	M	M	M	M	G	G*			
8200	822		C	C	C	C	C	C	C	C	C	C	E		M	M	M	M	M	M	M	M	M	M	G	G*			
10000	103		C	C	C	C	C	C	C	C	C	C	E		M	M	M	M	M	M	M	M	M	C	G	G*			
12000	123		C	C	C	C	C	C	C	C	C	C	E		M	M	M	M	M	M	M	M	M	C	G				
15000	153		C	C	C	C	C	C	C	C	C	C	E		M	M	M	M	M	M	M	M	M	E	G				
18000	183		C	C	C	C	C	C	C	C	C				M	M	M	M	M	M	M	C	C	E	G				
22000	223		C	C	C	C	C	C	C	C	E	E			M	M	M	M	M	M	M	C	C	E	G				
27000	273		C	C	C	C	C	C	C	E	E				M	M	M	M	M	M	M	C	C	E	G				
33000	333		C	C	C	C	C	E	E	E	E				M	M	M	M	M	M	M	E	E	E	G				
39000	393		C	C	C	C	C	E	E	E	E				M	M	M	M	M	M	M	E	E	F					
47000	473		C	C	C	C	C	E	E	E	E				M	M	M	M	M	C	C	E	E	G					
56000	563		C	C	C	C	C	E	E	E	E				M	M	M	M	M	C	C	E	E						
68000	683		C	C	C	C	C	E	E						M	M	M	M	M	E	E	F	F						
82000	823		C	C	C	C	C	E	E						M	M	M	M	M	E	E	F	F						
100000	104		C	C	C	C	C	E	E						M	M	M	M	M	E	E	F	F						
120000	124		C	C	C	C	C								M	M	M	M	M	E	E	G	G						
150000	154		M	M	M	M	E								M	M	M	M	C	E	E	G	G						
180000	184		M	M	M	M	E								M	M	M	M	C	E	E								
220000	224		M	M	M	M	E	E	E						M	M	M	M	C	C/E	C/E								
270000	274		M	M	M	C	E								M	M	M	M	E	F	F								
330000	334		M	M	M	C	E								M	M	M	C	E	F	F								
390000	394		M	M	J	P	E								M	M	M	C	G	G	G								
470000	474		J	J	J	P	E								M	M	M	C	G	G	G								
560000	564		J	J	J	P	P								C	C	C	C	G	G	G								
680000	684		J	J	J	P	P								C	C	C	C	F	G	G								
820000	824		J	J	J	P	P								C	C	C	C	F										
1000000	105		J	J	J	P	P								C	C	C	C	F										
1200000	125				P	P	E/P																						
1500000	155	J	J	J	P	P	E/P									F	E	G	G										
1800000	185				P	P	P																						
2200000	225	J	J	J	E/P	P	P									F	E	G	G										
2700000	275				P	P																							
3300000	335		P	P	P	P										F	E	G	G										
3900000	395				P	P																							
4700000	475	P	P	P	P	P									F	F	F	G	G										
5600000	565		P	P	P										G	G	G	G											
6800000	685		P	P	P										G	G	G	G											
8200000	825		P	P	P										G	G	G	G											
10000000	106	P	P	P	P										F	F	G	G											
12000000	126														G	G	G												
15000000	156														G	G	G												
18000000	186														G	G	G												
22000000	226		P												G	G	G												

* Surface coating only.

7. CAPACITANCE RANGE(Con.)

7-2. X7R

Dimension		1808							1812												
Cap.(pF)	Code	500V	630V	1000V	1500V	2000V	3000V	4000V	10V 16V 25V	50V	100V	200V	250V	400V	500V	630V	1000V	1500V	2000V	3000V	4000V
100	101																				
120	121																				
150	151	C	C	C	C	C	C	F*													
180	181	C	C	C	C	C	C	F*													
220	221	C	C	C	C	C	C	F*													
270	271	C	C	C	C	C	C	F*	C	C	C	C	C	C	C	C	C	C	C	C	F*
330	331	C	C	C	C	C	C	F*	C	C	C	C	C	C	C	C	C	C	C	C	F*
390	391	C	C	C	C	C	C	F*	C	C	C	C	C	C	C	C	C	C	C	C	F*
470	471	C	C	C	C	C	C	F*	C	C	C	C	C	C	C	C	C	C	C	C	F*
560	561	C	C	C	C	C	E	F*	C	C	C	C	C	C	C	C	C	C	C	C	F*
680	681	C	C	C	C	C	E	F*	C	C	C	C	C	C	C	C	C	C	C	C	F*
820	821	C	C	C	C	C	E	F*	C	C	C	C	C	C	C	C	C	C	C	C	F*
1000	102	C	C	C	C	C	F	F*	C	C	C	C	C	C	C	C	C	C	C	E	F*
1200	122	C	C	C	C	C	F		C	C	C	C	C	C	C	C	C	C	C	F	G*
1500	152	C	C	C	C	C	F		C	C	C	C	C	C	C	C	C	C	C	F	G*
1800	182	C	C	C	C	C	F		C	C	C	C	C	C	C	C	C	C	C	G	G*
2200	222	C	C	C	C	E	F		C	C	C	C	C	C	C	C	C	C	C	G	
2700	272	C	C	C	F	F	F		C	C	C	C	C	C	C	C	C	C	C	G*	
3300	332	C	C	C	F	F	F		C	C	C	C	C	C	C	C	C	E	E	G*	
3900	392	C	C	C	F	F	F*		C	C	C	C	C	C	C	C	C	F	F	G*	
4700	472	C	C	C	F	F	F*		C	C	C	C	C	C	C	C	C	F	F	G*	
5600	562	C	C	C	F	F	F*		C	C	C	C	C	C	C	C	C	G	G		
6800	682	C	C	C	F	F	F*		C	C	C	C	C	C	C	C	C	G	G		
8200	822	C	C	C	F*	F*	F*		C	C	C	C	C	C	C	C	C	G	G		
10000	103	C	C	C	F*	F*	F*		C	C	C	C	C	C	C	C	C	E/F/G	E/F/G		
12000	123	E	E	E					C	C	C	C	C	C	C	C	C	E/F/G	G		
15000	153	E	E	E					C	C	C	C	C	C	C	C	C	E/F/G	G		
18000	183	F	F	F					C	C	C	C	C	C	C	C	E	E/F/G	G		
22000	223	F	F	F					C	C	C	C	C	C	C	C	E	F/G	G		
27000	273	F	F	F					C	C	C	C	C	C	C	C	F				
33000	333	F	F	F					C	C	C	C	C	C	C	C	F				
39000	393	F	F	F					C	C	C	C	C	C	C	C	G				
47000	473	F	F	F					C	C	C	C	C	C	C	C	F/G				
56000	563	F	F	F					C	C	C	C	C	C	E	E	G				
68000	683	F	F						C	C	C	C	C	C	E	E	G				
82000	823	F	F						C	C	C	C	C	C	E	E	G				
100000	104								C	C	C	C	C	C	E	E	G				
120000	124								C	C	C	C	C	C	F	F					
150000	154								C	C	C	C	C	C	F	F					
180000	184								C	C	C	C	C	C	G	G					
220000	224								C	C	C	C	C	C	G	G					
270000	274								C	C	C	E	E	E	G						
330000	334								C	C	C	E	E	E	G						
390000	394								C	C	C	F	F	F	G						
470000	474								C	C	C	F	F	F	G						
560000	564								C	C	C	G	G								
680000	684								C	C	C	G	G								
820000	824								C	C	C	G	G								
1000000	105								C	C	C	G	G								
1200000	125								C	C	C										
1500000	155								C	C	C										
1800000	185								E	E	E										
2200000	225								E	E	E										
2700000	275								F	F	F										
3300000	335								F	F	F										
3900000	395								F	F	F										
4700000	475								G	G	G										
5600000	565								G	G											
6800000	685								G	G											
8200000	825								G	G											
10000000	106								G	G											
12000000	126								G												
15000000	156								G												
18000000	186								G												
22000000	226																				

* Surface coating only.

7. CAPACITANCE RANGE(Con.)

7-2. X7R

Dimension		1825											2220											
Cap.(pF)	Code	25V 50V	100V	200V	250V	500V	630V	1000V	1500V	2000V	3000V	4000V	25V 50V	100V	200V	250V	400V	500V	630V	1000V	1500V	2000V	3000V	4000V
100	101																							
120	121																							
150	151																							
180	181																							
220	221																							
270	271											F*												F*
330	331											F*												F*
390	391											F*												F*
470	471											F*												F*
560	561											F*												F*
680	681											F*												F*
820	821											F*												F*
1000	102	F	F	F	F	F	F	F	F	F	F	F*	F	F	F	F	F	F	F	F	F	F	F	F*
1200	122	F	F	F	F	F	F	F	F	F	F	G*	F	F	F	F	F	F	F	F	F	F	F	G*
1500	152	F	F	F	F	F	F	F	F	F	F	G*	F	F	F	F	F	F	F	F	F	F	F	G*
1800	182	F	F	F	F	F	F	F	F	F	F	G*	F	F	F	F	F	F	F	F	F	F	F	G*
2200	222	F	F	F	F	F	F	F	F	F	F*		F	F	F	F	F	F	F	F	F	F	F	F*
2700	272	F	F	F	F	F	F	F	F	F	F*		F	F	F	F	F	F	F	F	F	F	F	F*
3300	332	F	F	F	F	F	F	F	F	F	F*		F	F	F	F	F	F	F	F	F	F	F	F*
3900	392	F	F	F	F	F	F	F	F	F	F*		F	F	F	F	F	F	F	F	F	F	F	F*
4700	472	F	F	F	F	F	F	F	F	F	F*		F	F	F	F	F	F	F	F	F	F	F	F*
5600	562	F	F	F	F	F	F	F	F	F	G*		F	F	F	F	F	F	F	F	F	F	F	F*
6800	682	F	F	F	F	F	F	F	F	F	G*		F	F	F	F	F	F	F	F	F	F	F	G*
8200	822	F	F	F	F	F	F	F	F	F	G*		F	F	F	F	F	F	F	F	G	G	G	G*
10000	103	F	F	F	F	F	F	F	F	F	G*		F	F	F	F	F	F	F	F	F/G	F/G	G*	
12000	123	F	F	F	F	F	F	F	G	G	H*		F	F	F	F	F	F	F	F	G	G	H*	
15000	153	F	F	F	F	F	F	F	G	G	H*		F	F	F	F	F	F	F	F	G	G	H*	
18000	183	F	F	F	F	F	F	F	G	G	H*		F	F	F	F	F	F	F	F	H	H	H*	
22000	223	F	F	F	F	F	F	F	G	G			F	F	F	F	F	F	F	F	H	H		
27000	273	F	F	F	F	F	F	F	H	H			F	F	F	F	F	F	F	F	H	H		
33000	333	F	F	F	F	F	F	F	H	H			F	F	F	F	F	F	F	F	H	H		
39000	393	F	F	F	F	F	F	F	H	H			F	F	F	F	F	F	F	F	H	H		
47000	473	F	F	F	F	F	F	F	H	H			F	F	F	F	F	F	F	F	H	H		
56000	563	F	F	F	F	F	F	F	H				F	F	F	F	F	F	F	F	H	H		
68000	683	F	F	F	F	F	F	F					F	F	F	F	F	F	F	F				
82000	823	F	F	F	F	F	F	F					F	F	F	F	F	F	F	F				
100000	104	F	F	F	F	F	F	G					F	F	F	F	F	F	F	G				
120000	124	F	F	F	F	F	F						F	F	F	F	F	F	F	G				
150000	154	F	F	F	F	F	F						F	F	F	F	F	F	F	H				
180000	184	F	F	F	F	F	F						F	F	F	F	F	F	F	H				
220000	224	F	F	F	F	F	F						F	F	F	F	F	F	F	H				
270000	274	F	F	F	F	F	F						F	F	F	F	F	F	F					
330000	334	F	F	F	F	F	F						F	F	F	F	F	F	F					
390000	394	F	F	F	F	F	F						F	F	F	F	F	F	F					
470000	474	F	F	F	F	F	F						F	F	F	F	F	F	F					
560000	564	F	F	F	F	G	G						F	F	F	F	G	G	G					
680000	684	F	F	F	F								F	F	F	F	G	G	G					
820000	824	F	F	F	F								F	F	F	F	H	H	H					
1000000	105	F	F	F	F								F	F	F	F	H	H	H					
1200000	125	F	F	G									F	F	G	G								
1500000	155	F	F	G									F	F	G	G								
1800000	185	F	F	G									F	F	G	G								
2200000	225	F	F	G									F	F	G	G								
2700000	275	F	F										F	F										
3300000	335	F	F										F	F										
3900000	395	F	F										F	F										
4700000	475	F	F										F	F										
5600000	565	F	F										F	F										
6800000	685	F	F										F	F										
8200000	825	G	G										G	G										
10000000	106	G	G										G	G										
12000000	126												H	F/G										
15000000	156												H	G										
18000000	186												H	H										
22000000	226												H	R										
27000000	276												H											
33000000	336												H											
39000000	396												H											
47000000	476												R											

* Surface coating only.

7. CAPACITANCE RANGE(Con.)

7-2. X7R

Dimension		2225												
Cap.(pF)	Code	25V	50V	100V	200V	250V	500V	630V	1000V	1500V	2000V	3000V	4000V	5000V
100	101													
120	121													
150	151													
180	181													
220	221													
270	271												F*	F*
330	331												F*	F*
390	391												F*	F*
470	471												F*	F*
560	561												F*	F*
680	681												F*	F*
820	821												F*	F*
1000	102	F	F	F	F	F	F	F	F	F	F	F*	F*	F*
1200	122	F	F	F	F	F	F	F	F	F	F	F*	G*	F*
1500	152	F	F	F	F	F	F	F	F	F	F	F*	G*	F*
1800	182	F	F	F	F	F	F	F	F	F	F	F*	G*	F*
2200	222	F	F	F	F	F	F	F	F	F	F	F*		F*
2700	272	F	F	F	F	F	F	F	F	F	F	F*		F*
3300	332	F	F	F	F	F	F	F	F	F	F	F*		F*
3900	392	F	F	F	F	F	F	F	F	F	F	F*		F*
4700	472	F	F	F	F	F	F	F	F	F	F	F*		F/G*
5600	562	F	F	F	F	F	F	F	F	F	F	G*		
6800	682	F	F	F	F	F	F	F	F	F	F	G*		
8200	822	F	F	F	F	F	F	F	F	F	F	G*		
10000	103	F	F	F	F	F	F	F	F	F	F	G*		
12000	123	F	F	F	F	F	F	F	F	G	G	G*		
15000	153	F	F	F	F	F	F	F	F	G	G	G*		
18000	183	F	F	F	F	F	F	F	F	G	G	H*		
22000	223	F	F	F	F	F	F	F	F	F/G	F/G	F*		
27000	273	F	F	F	F	F	F	F	F	G	G			
33000	333	F	F	F	F	F	F	F	F	G	G			
39000	393	F	F	F	F	F	F	F	F	G	H			
47000	473	F	F	F	F	F	F	F	F	G	H			
56000	563	F	F	F	F	F	F	F	F	G	H			
68000	683	F	F	F	F	F	F	F	F	G				
82000	823	F	F	F	F	F	F	F	F	G				
100000	104	F	F	F	F	F	F	F	G	G				
120000	124	F	F	F	F	F	F	F	H					
150000	154	F	F	F	F	F	F	F	H					
180000	184	F	F	F	F	F	F	F	H					
220000	224	F	F	F	F	F	F	F	H					
270000	274	F	F	F	F	F	F	F	F/G/H					
330000	334	F	F	F	F	F	F	F	F/G/H					
390000	394	F	F	F	F	F	F	F						
470000	474	F	F	F	F	F	F	F						
560000	564	F	F	F	F	F	F	F						
680000	684	F	F	F	F	F	F							
820000	824	F	F	F	F	F								
1000000	105	F	F	F	F	F								
1200000	125	F	F	F	G	G								
1500000	155	F	F	F	G	G								
1800000	185	F	F	F	G	G								
2200000	225	F	F	F	G	G								
2700000	275	F	F	F	G	G								
3300000	335	F	F	F										
3900000	395	F	F	F										
4700000	475	F	F	F										
5600000	565	F	F	F										
6800000	685	F	F	F										
8200000	825	G	G	G										
10000000	106	G	G	G										
12000000	126	F/G												
15000000	156	F/G												
18000000	186													
22000000	226													

* Surface coating only.

8. RELIABILITY TEST CONDITIONS AND REQUIREMENTS

No.	Item	Test Condition	Requirements																																																																																				
1.	Visual and Dimensions	---	* No remarkable defect. * Dimensions to confirm to individual specification sheet.																																																																																				
2.	Capacitance	* Class I : Cap.≤1000pF, 1.0±0.2Vrms, 1MHz±10%. Cap.>1000pF, 1.0±0.2Vrms, 1KHz±10%. * Class II : Cap.≤10μF, 1.0±0.2Vrms, 1KHz±10%**. Cap.>10μF, 0.5±0.2Vrms, 120Hz±20%. ** Test condition: 0.5±0.2Vrms · 1KHz±10% X7R: 0805=106(6.3V), 0603/475(6.3V) X5R: 0201≥224 (6.3V,10V,16V)#1, 0402≥475 (6.3V,16V), 0402≥225(10V), 0603=106 (6.3V) TT18X≥475(10V) , TT15X series X6S: 0201/474(4V),0201≥104 (6.3V,10V#1), 0402≥225 (6.3V), 0402/475 (10V), 0603/106 (6.3V), X7S: 0402/225(6.3V) #1 Excluding X5R/0201/105(6.3V);225(10V), X6S/0201/104(10V) (1.0±0.2Vrms · 1KHz±10%) *Before initial measurement (Class II only) : To apply de-aging at 150°C for 1hr then set for 24±2 hrs at room temp.	* Shall not exceed the limits given in the detailed spec. * Class I : <table><tr><th>Dielectric</th><th>Rated Vol.(V)</th><th>Q/D.F.</th><th>Remark</th></tr><tr><td rowspan="2">Class I</td><td rowspan="2">All</td><td>Q≥1000</td><td>Cap.≥30pF</td></tr><tr><td>Q≥400+20C</td><td>Cap.<30pF</td></tr></table> * Class II : <table><tr><th>Rated</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>≤3.5%</td><td colspan="2">0603≥0.047μF, 0805=0.1μF, 1206≥0.47μF, 1812≥4.7μF, 1825≥4.7μF, 2220≥4.7μF, 2225≥4.7μF</td></tr><tr><td>≤5%</td><td colspan="2">0603≥0.068μF, 0805>0.1μF, 1206>1μF, 1210≥2.2μF</td></tr><tr><td>≤10%</td><td colspan="2">0805>0.22μF, 1210≥3.3μF</td></tr><tr><td rowspan="3">50V</td><td rowspan="3">≤2.5%</td><td>≤3.5%</td><td colspan="2">0201(50V), 0603≥0.047μF, 0805≥0.1μF, 1206≥0.47μF, 1210≥2.2μF, 1812≥4.7μF, 1825≥4.7μF, 2220≥4.7μF, 2225≥4.7μF</td></tr><tr><td>≤5%</td><td colspan="2">0201≥0.01uF, 1210≥4.7μF</td></tr><tr><td>≤10%</td><td colspan="2">0402≥0.1μF, 0603>0.1μF, 0805≥1μF, 1206≥2.2μF, 1210≥10μF</td></tr><tr><td>35V</td><td>≤3.5%</td><td>≤10%</td><td colspan="2">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 colspan="2">0201≥0.01μF, 0805≥1μF, 1210≥10μF</td></tr><tr><td>≤7%</td><td colspan="2">0603≥0.33μF, 1206≥4.7μF</td></tr><tr><td>≤10%</td><td colspan="2">0201≥0.1μF, 0402≥0.10μF, 0603≥0.47μF, 0805≥2.2μF, 1206≥6.8μF, 1210≥22μF</td></tr><tr><td>≤12.5%</td><td colspan="2">0402≥0.47μF</td></tr><tr><td rowspan="2">16V</td><td rowspan="2">≤3.5%</td><td>≤5%</td><td colspan="2">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 colspan="2">0201≥0.1uF(0201/X7R≥0.022μF), 0402≥0.22uF, 0603≥0.68μF, 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 colspan="2">0201≥0.012μF, 0402≥0.33μF(0402/X7R≥0.22μF), 0603≥0.33μF, 0805≥2.2μF, 1206≥2.2μF, 1210≥22μF</td></tr><tr><td>≤15%</td><td colspan="2">0201≥0.1μF, 0402≥1μF</td></tr><tr><td rowspan="2">6.3V</td><td rowspan="2">≤10%</td><td>≤15%</td><td colspan="2">0201≥0.1μF, 0402≥1μF, 0603≥10μF, 0805≥4.7μF, 1206≥47μF, 1210≥100μF</td></tr><tr><td>≤20%</td><td colspan="2">0402≥2.2μF</td></tr><tr><td>4V</td><td>≤15%</td><td>---</td><td colspan="2">---</td></tr></table>	Dielectric	Rated Vol.(V)	Q/D.F.	Remark	Class I	All	Q≥1000	Cap.≥30pF	Q≥400+20C	Cap.<30pF	Rated	D.F.≤	Exception of D.F.≤		≥100V	≤2.5%	≤3.5%	0603≥0.047μF, 0805=0.1μF, 1206≥0.47μF, 1812≥4.7μF, 1825≥4.7μF, 2220≥4.7μF, 2225≥4.7μF		≤5%	0603≥0.068μF, 0805>0.1μF, 1206>1μF, 1210≥2.2μF		≤10%	0805>0.22μF, 1210≥3.3μF		50V	≤2.5%	≤3.5%	0201(50V), 0603≥0.047μF, 0805≥0.1μF, 1206≥0.47μF, 1210≥2.2μF, 1812≥4.7μF, 1825≥4.7μF, 2220≥4.7μF, 2225≥4.7μF		≤5%	0201≥0.01uF, 1210≥4.7μF		≤10%	0402≥0.1μF, 0603>0.1μF, 0805≥1μF, 1206≥2.2μF, 1210≥10μF		35V	≤3.5%	≤10%	0603≥1μF, 0805≥2.2μF, 1206≥2.2μF, 1210≥10μF		25V	≤3.5%	≤5%	0201≥0.01μF, 0805≥1μF, 1210≥10μF		≤7%	0603≥0.33μF, 1206≥4.7μF		≤10%	0201≥0.1μF, 0402≥0.10μF, 0603≥0.47μF, 0805≥2.2μF, 1206≥6.8μF, 1210≥22μF		≤12.5%	0402≥0.47μF		16V	≤3.5%	≤5%	0201≥0.01μF, 0402≥0.033μF, 0603≥0.15μF, 0805≥0.68μF, 1206≥2.2μF, 1210≥4.7μF		≤10%	0201≥0.1uF(0201/X7R≥0.022μF), 0402≥0.22uF, 0603≥0.68μF, 0805≥2.2μF, 1206≥4.7μF, 1210≥22μF		10V	≤5%	≤10%	0201≥0.012μF, 0402≥0.33μF(0402/X7R≥0.22μF), 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		≤20%	0402≥2.2μF		4V	≤15%	---	---	
Dielectric	Rated Vol.(V)	Q/D.F.	Remark																																																																																				
Class I	All	Q≥1000	Cap.≥30pF																																																																																				
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16V	≤3.5%	≤5%	0201≥0.01μF, 0402≥0.033μF, 0603≥0.15μF, 0805≥0.68μF, 1206≥2.2μF, 1210≥4.7μF																																																																																				
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4V	≤15%	---	---																																																																																				
3.	Q/D.F. (Dissipation Factor)																																																																																						
4.	Temperature Coefficient	* With no electrical load. <table><tr><th>T.C.</th><th>Operating Temp.</th></tr><tr><td>C0G</td><td>-55~125°C at 25°C</td></tr><tr><td>X7R</td><td>-55~125°C at 25°C</td></tr></table> * Measurement voltage for Class II : <table><tr><th>Size</th><th>Cap. Range</th><th>Condition</th></tr><tr><td rowspan="3">0201</td><td>Cap.<0.1μF</td><td>1V</td></tr><tr><td>0.1μF≤Cap.<1μF</td><td>0.2V</td></tr><tr><td>Cap.≥1μF</td><td>0.1V</td></tr><tr><td rowspan="4">0402</td><td>Cap.<0.1μF</td><td>1V</td></tr><tr><td>Cap.=1μF</td><td>0.5V</td></tr><tr><td>1μF<Cap.<10μF</td><td>0.2V</td></tr><tr><td>Cap.≥10μF</td><td>0.1V</td></tr><tr><td rowspan="3">0603</td><td>Cap.≤1μF</td><td>1V</td></tr><tr><td>1μF<Cap.≤4.7μF</td><td>0.5V</td></tr><tr><td>Cap.>4.7μF</td><td>0.2V</td></tr><tr><td rowspan="3">0805</td><td>Cap.<10μF</td><td>1V</td></tr><tr><td>Cap.=10μF</td><td>0.5V</td></tr><tr><td>Cap.>10μF</td><td>0.2V</td></tr><tr><td rowspan="3">1206/1210</td><td>Cap.≤10μF</td><td>1V</td></tr><tr><td>10μF<Cap.≤100μF</td><td>0.5V</td></tr><tr><td>Cap.>100μF</td><td>0.2V</td></tr></table>	T.C.	Operating Temp.	C0G	-55~125°C at 25°C	X7R	-55~125°C at 25°C	Size	Cap. Range	Condition	0201	Cap.<0.1μF	1V	0.1μF≤Cap.<1μF	0.2V	Cap.≥1μF	0.1V	0402	Cap.<0.1μF	1V	Cap.=1μF	0.5V	1μF<Cap.<10μF	0.2V	Cap.≥10μF	0.1V	0603	Cap.≤1μF	1V	1μF<Cap.≤4.7μF	0.5V	Cap.>4.7μF	0.2V	0805	Cap.<10μF	1V	Cap.=10μF	0.5V	Cap.>10μF	0.2V	1206/1210	Cap.≤10μF	1V	10μF<Cap.≤100μF	0.5V	Cap.>100μF	0.2V	<table><tr><th>T.C.</th><th>Capacitance Change</th></tr><tr><td>C0G</td><td>Within ±30ppm/°C</td></tr><tr><td>X7R</td><td>Within ±15%</td></tr></table>	T.C.	Capacitance Change	C0G	Within ±30ppm/°C	X7R	Within ±15%																																
		T.C.	Operating Temp.																																																																																				
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T.C.	Capacitance Change																																																																																						
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X7R	Within ±15%																																																																																						

8. RELIABILITY TEST CONDITIONS AND REQUIREMENTS

No.																														
5.	Insulation Resistance		<table><tr><td>Dielectric</td><td>Capacitance Change</td></tr><tr><td>Class I</td><td>≥10GΩ or RxC≥500Ω-F, whichever is smaller</td></tr><tr><td>Class II</td><td>≥10GΩ or RxC≥100Ω-F, whichever is smaller</td></tr></table> * Except (Class II) : <table><tr><td>Rated voltage (X7R)</td><td>I.R.</td></tr><tr><td>≥100V : All X7R</td><td rowspan="10">≥10GΩ or RxC≥100Ω-F, whichever is smaller</td></tr><tr><td>50V : 0402>0.01μF, 0603≥1μF, 0805≥1μF, 1206≥4.7μF, 1210≥4.7μF, 1812≥10μF, 2220≥22μF</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</td></tr><tr><td>Rated voltage (X7R)</td><td>I.R.</td></tr><tr><td>100V : 1210≥3.3μF</td><td rowspan="6">RxC≥50Ω-F</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, 0603>4.7μF, 0805≥47μF, 1206≥10μF</td></tr><tr><td>4V : 0603≥22μF, 0805≥47μF, 1206≥100μF</td></tr></table>	Dielectric	Capacitance Change	Class I	≥10GΩ or RxC≥500Ω-F, whichever is smaller	Class II	≥10GΩ or RxC≥100Ω-F, whichever is smaller	Rated voltage (X7R)	I.R.	≥100V : All X7R	≥10GΩ or RxC≥100Ω-F, whichever is smaller	50V : 0402>0.01μF, 0603≥1μF, 0805≥1μF, 1206≥4.7μF, 1210≥4.7μF, 1812≥10μF, 2220≥22μF	35V : 0805≥2.2μF, 1206≥2.2μF, 1210≥10μF	25V : 0402≥1μF, 0603≥2.2μF, 0805≥2.2μF, 1206≥10μF, 1210≥10μF	16V : 0201≥0.1μF, 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	Rated voltage (X7R)	I.R.	100V : 1210≥3.3μF	RxC≥50Ω-F	50V : 0402≥0.1μF, 0603≥2.2μF, 0805≥10μF, 1206≥10μF	35V : 0603≥1μF	25V : 0201≥0.1μF, 0402≥2.2μF, 0603≥10μF, 0805≥10μF, 1206≥22μF	16V : 0603≥10μF, 0402≥1μF, 0201≥0.22μF	10V : 0201>0.1μF, 0402≥1μF, 0603≥10μF, 0805≥47μF	6.3V : 0201≥0.1μF, 0603>4.7μF, 0805≥47μF, 1206≥10μF	4V : 0603≥22μF, 0805≥47μF, 1206≥100μF
		Dielectric	Capacitance Change																											
		Class I	≥10GΩ or RxC≥500Ω-F, whichever is smaller																											
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		Rated voltage (X7R)	I.R.																											
		≥100V : All X7R	≥10GΩ or RxC≥100Ω-F, whichever is smaller																											
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		16V : 0201≥0.1μF, 0402≥0.22μF, 0603≥1μF, 0805≥2.2μF, 1206≥10μF, 1210≥47μF																												
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Rated voltage (X7R)	I.R.																													
100V : 1210≥3.3μF	RxC≥50Ω-F																													
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16V : 0603≥10μF, 0402≥1μF, 0201≥0.22μF																														
10V : 0201>0.1μF, 0402≥1μF, 0603≥10μF, 0805≥47μF																														
6.3V : 0201≥0.1μF, 0603>4.7μF, 0805≥47μF, 1206≥10μF																														
4V : 0603≥22μF, 0805≥47μF, 1206≥100μF																														
6.	Dielectric Strength	<table><tr><td>Rated Voltage</td><td>Condition</td></tr><tr><td>≤100</td><td>2.5 times of UR</td></tr><tr><td>100<V≤250</td><td>2.0 times of UR</td></tr><tr><td>250<V≤500</td><td>1.5 times of UR</td></tr><tr><td>630≤V≤3000V</td><td>1.2 times of UR</td></tr><tr><td>3000<V<5000V</td><td>1.1 times of UR</td></tr><tr><td>≥5000V</td><td>1.0 times of UR</td></tr></table> * Duration : 1 to 5 sec. Voltage ramp up rate ≤500Vdc/sec. * Charge and discharge current less than 50mA. * Test in insulating fluid for rated voltage ≥1KV products.	Rated Voltage	Condition	≤100	2.5 times of UR	100<V≤250	2.0 times of UR	250<V≤500	1.5 times of UR	630≤V≤3000V	1.2 times of UR	3000<V<5000V	1.1 times of UR	≥5000V	1.0 times of UR	* No evidence of damage or flash over during test.													
		Rated Voltage	Condition																											
		≤100	2.5 times of UR																											
		100<V≤250	2.0 times of UR																											
		250<V≤500	1.5 times of UR																											
		630≤V≤3000V	1.2 times of UR																											
		3000<V<5000V	1.1 times of UR																											
		≥5000V	1.0 times of UR																											
		7.	Solderability	* Solder temperature : 235±5°C for (0402~1210). * Solder temperature : 245±5°C for (1808~2225). * Dipping time : 2±0.5 sec.	* 75% min. coverage of all metalized area.																									
				8.	Resistance to Soldering Heat	* Solder temperature : 260±5°C. * Dipping time : 10±1 sec. * Preheating : 120 to 150°C for 1 minute before immerse the capacitor in a eutectic solder. * Before initial measurement (Class II only) : To apply de-aging at 150°C for 1hr then set for 24±2 hrs at room temp. * Measurement to be made after keeping at room temp. for 24±2 hrs (Class I) or 48±4 hrs (Class II).	* No remarkable damage. * Cap. change : C0G : Within ±2.5% or ±0.25pF, whichever is larger. X7R : Within ±7.5%. * D.F./Q, I.R : To meet initial requirements. * 25% max. leaching on each edge.																							
9.	Temperature Cycle					* Conduct the five cycles according to the temperatures and time. <table><tr><td>Step</td><td>Temp.(°C)</td><td>Time(min.)</td></tr><tr><td>1</td><td>Min. operating temp. +0/-3</td><td>30±3</td></tr><tr><td>2</td><td>Room temp.</td><td>2~3</td></tr><tr><td>3</td><td>Max. operating temp. +3/-0</td><td>30±3</td></tr><tr><td>4</td><td>Room temp.</td><td>2~3</td></tr></table> * Before initial measurement (Class II only) : To apply de-aging at 150°C for 1hr then set for 24±2 hrs at room temp. * Measurement to be made after keeping at room temp. for 24±2 hrs (Class I) or 48±4 hrs (Class II).	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 : C0G : Within ±2.5% or ±0.25pF, whichever is larger. X7R : Within ±7.5%. * D.F./Q : C0G : Q≥100% of initial requirements. X7R : D.F.≤150% of initial requirement. * I.R. : ≥100% of initial requirement.								
						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																						

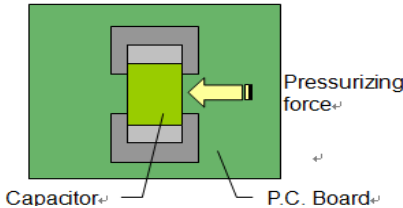
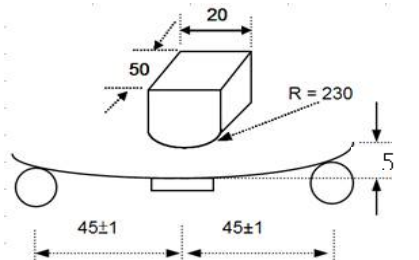
8. RELIABILITY TEST CONDITIONS AND REQUIREMENTS

No.	Item	Test Condition	Requirements										
10.	Humidity (Damp Heat) Steady State	* 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. * Measurement to be made after keeping at room temp. for 24±2 hrs (Class I) or 48±4 hrs (Class II).	* No remarkable damage. * Cap. change : C0G : Within ±5.0% or ±0.5pF, whichever is larger. X7R : Within ±12.5% for ≥10V**, within ±25% for 6.3V. **10V : Within ±25% for 0603≥4.7μF, 0402≥1μF. * D.F./Q : C0G : Q≥350 for Cap.>30pF, Q≥275+2.5C for 10pF≤Cap.≤30pF, Q≥200+10C for Cap.<10pF. X7R : D.F.≤200% of initial requirement. * I.R. : ≥10V, ≥1GΩ or R×C≥50Ω-F, whichever is smaller. Except : <table><tr><th>Rated voltage</th><th>I.R.</th></tr><tr><td>100V : All X7R; 1210≥3.3μF</td><td rowspan="7">≥1GΩ or RxC≥10Ω-F, whichever is smaller</td></tr><tr><td>50V : 0402>0.01μF, 0603≥1μF, 0805≥1μF, 1206≥4.7μF, 1210≥4.7μF</td></tr><tr><td>35V : 0603≥1μF, 0805≥2.2μF, 1206≥2.2μF, 1210≥10μF</td></tr><tr><td>25V : 0201≥0.1uF, 0402≥0.22μF, 0603≥2.2μF, 0805≥2.2μF, 1206≥10μF, 1210≥10μF</td></tr><tr><td>16V : 0201≥0.1uF, 0402≥0.22μF, 0603≥1μF, 0805≥2.2μF, 1206≥10μF, 1210≥47μF</td></tr><tr><td>10V : 0201≥47nF, 0402≥0.47μF, 0603≥0.47μF, 0805≥2.2μF, 1206≥4.7μF, 1210≥47μF</td></tr><tr><td>6.3V; 4V; Size≥1812</td></tr></table>	Rated voltage	I.R.	100V : All X7R; 1210≥3.3μF	≥1GΩ or RxC≥10Ω-F, whichever is smaller	50V : 0402>0.01μF, 0603≥1μF, 0805≥1μF, 1206≥4.7μF, 1210≥4.7μF	35V : 0603≥1μF, 0805≥2.2μF, 1206≥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; Size≥1812
Rated voltage	I.R.												
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6.3V; 4V; Size≥1812													
11.	Humidity (Damp Heat) Load	* Reflow solder the capacitors on a P.C. Board before test. * Test temp. : 40±2°C (85±3°C for control code H). * Humidity : 90~95% RH (85±5% for control code H). * Test time : 500 +24/-0hrs. * To apply voltage : Rated voltage (500Vdc max. for general purpose and 100Vdc max. for control code H) * Measurement to be made after keeping at room temp. for 24±2 hrs (Class I) or 48±4 hrs (Class II).	* No remarkable damage. * Cap. change : C0G : Within ±7.5% or ±0.75pF, whichever is larger. X7R : Within ±12.5% for ≥10V**, within ±25% for 6.3V. **10V : Within ±25% for 0603≥4.7μF, 0402≥1μF. * D.F./Q : C0G : Q≥350 for Cap.>30pF, Q≥275+2.5C for 10pF≤Cap.≤30pF, Q≥200+10C for Cap.<10pF. X7R : ≤200% of initial requirement. * I.R. : ≥10V, ≥500MΩ or RxC≥25Ω-F, whichever is smaller. Except : <table><tr><th>Rated voltage</th><th>I.R.</th></tr><tr><td>≥100V : All X7R; 1210≥3.3μF</td><td rowspan="7">≥500MΩ or RxC≥5Ω-F, whichever is smaller</td></tr><tr><td>50V : 0402>0.01μF, 0603≥1μF, 0805≥1μF, 1206≥4.7μF, 1210≥4.7μF</td></tr><tr><td>35V : 0603≥1μF, 0805≥2.2μF, 1206≥2.2μF, 1210≥10μF</td></tr><tr><td>25V : 0201≥0.1uF, 0402≥0.22μF, 0603≥2.2μF, 0805≥2.2μF, 1206≥10μF, 1210≥10μF</td></tr><tr><td>16V : 0201≥0.1uF, 0402≥0.22μF, 0603≥1μF, 0805≥2.2μF, 1206≥10μF, 1210≥47μF</td></tr><tr><td>10V : 0201≥47nF, 0402≥0.47μF, 0603≥0.47μF, 0805≥2.2μF, 1206≥4.7μF, 1210≥47μF</td></tr><tr><td>6.3V; 4V; Size≥1812</td></tr></table>	Rated voltage	I.R.	≥100V : All X7R; 1210≥3.3μF	≥500MΩ or RxC≥5Ω-F, whichever is smaller	50V : 0402>0.01μF, 0603≥1μF, 0805≥1μF, 1206≥4.7μF, 1210≥4.7μF	35V : 0603≥1μF, 0805≥2.2μF, 1206≥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; Size≥1812
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8. RELIABILITY TEST CONDITIONS AND REQUIREMENTS

No.																																																																																																																									
12.	High Temperature Load (Endurance)	* Test temp. : 125±3°C. * To apply voltage : (1) ≤6.3V or Cap.≥10μF : 150% of rated voltage. (2) 10V≤Ur≤100V : 200% of rated voltage. (3) 200V≤Ur≤500V : 150% of rated voltage. (4) 630V : 120% of rated voltage. (5) Ur≥1000V : 100% of rated voltage. (6) 100% of rated voltage for below range : <table><tr><th>Size</th><th>Dielectric</th><th>Rated</th><th>Capacitance</th></tr><tr><td rowspan="2">0201</td><td rowspan="2">X7R</td><td>≤10V</td><td>C≥0.1μF</td></tr><tr><td>≥16V</td><td>C>0.1μF</td></tr><tr><td>0402</td><td>X7R</td><td>6.3V, 10V, 16V, 25V</td><td>C≥1.0μF</td></tr><tr><td rowspan="3">0603</td><td rowspan="3">X7R</td><td>4V</td><td>C≥22μF</td></tr><tr><td>6.3V,10V</td><td>C≥4.7μF</td></tr><tr><td>25V, 35V</td><td>C≥1.0μF</td></tr><tr><td rowspan="3">0805</td><td rowspan="3">X7R</td><td>4V</td><td>C≥47μF</td></tr><tr><td>6.3V</td><td>C≥22μF</td></tr><tr><td>10V~50V</td><td>C≥10μF</td></tr><tr><td rowspan="2">1206</td><td rowspan="2">X7R</td><td>≤6.3V</td><td>C≥47μF</td></tr><tr><td>100V</td><td>C≥2.2μF</td></tr><tr><td rowspan="2">1210</td><td>X7R</td><td>16V</td><td>C≥47μF</td></tr><tr><td>X7R</td><td>≥100V</td><td>C≥3.3μF</td></tr><tr><td>2220</td><td>X7R</td><td>100V</td><td>C≥22μF</td></tr></table> (7) 150% of rated voltage for below range : <table><tr><th>Size</th><th>Dielectric</th><th>Rated Voltage</th><th>Capacitance</th></tr><tr><td>0201</td><td>X7R</td><td>16V</td><td>C≥0.022μF</td></tr><tr><td rowspan="2">0402</td><td rowspan="2">X7R</td><td>50V</td><td>C≥0.1μF</td></tr><tr><td>10~25V</td><td>C≥0.22μF</td></tr><tr><td rowspan="2">0603</td><td>X7R</td><td>≥50V</td><td>C≥0.082μF</td></tr><tr><td>X7R</td><td>10V,16V, 50V</td><td>C≥1.0μF</td></tr><tr><td rowspan="3">0805</td><td rowspan="3">X7R</td><td>10~50V</td><td>C≥4.7μF</td></tr><tr><td>50V</td><td>C≥0.47μF</td></tr><tr><td>≥100V</td><td>C≥0.12μF</td></tr><tr><td>1206</td><td>X7R</td><td>≥50V</td><td>C≥1.0μF</td></tr><tr><td rowspan="2">1210</td><td>X7R</td><td>≤100V</td><td>C≥1.0μF</td></tr><tr><td>X7R</td><td>>100V</td><td>C≥0.22μF</td></tr><tr><td rowspan="2">1812</td><td rowspan="2">X7R</td><td>≤50V</td><td>C≥4.7μF</td></tr><tr><td>100V</td><td>C≥1.0μF</td></tr><tr><td>1825</td><td rowspan="3">X7R</td><td rowspan="3">≥100V</td><td rowspan="3">C≥1.0μF</td></tr><tr><td>2220</td></tr><tr><td>2225</td></tr></table> (8) 120% of rated voltage for below range : <table><tr><th>Size</th><th>Dielectric</th><th>Rated Voltage</th><th>Capacitance</th></tr><tr><td>2220</td><td>X7R</td><td>≥100V</td><td>C≥15μF</td></tr></table> * Test time : 1000 +24/-0 hrs. * Before initial measurement (Class II only) : To apply de-aging at 150°C for 1hr then set for 24±2 hrs at room temp. * Measurement to be made after keeping at room temp. for 48±4 hrs (Class II). ** De-rating conditions : Ratio (Operating Voltage/Rated Voltage (%) Temperature at Product (°C) Product for 125°C Product for 105°C Product for 85°C	Size	Dielectric	Rated	Capacitance	0201	X7R	≤10V	C≥0.1μF	≥16V	C>0.1μF	0402	X7R	6.3V, 10V, 16V, 25V	C≥1.0μF	0603	X7R	4V	C≥22μF	6.3V,10V	C≥4.7μF	25V, 35V	C≥1.0μF	0805	X7R	4V	C≥47μF	6.3V	C≥22μF	10V~50V	C≥10μF	1206	X7R	≤6.3V	C≥47μF	100V	C≥2.2μF	1210	X7R	16V	C≥47μF	X7R	≥100V	C≥3.3μF	2220	X7R	100V	C≥22μF	Size	Dielectric	Rated Voltage	Capacitance	0201	X7R	16V	C≥0.022μF	0402	X7R	50V	C≥0.1μF	10~25V	C≥0.22μF	0603	X7R	≥50V	C≥0.082μF	X7R	10V,16V, 50V	C≥1.0μF	0805	X7R	10~50V	C≥4.7μF	50V	C≥0.47μF	≥100V	C≥0.12μF	1206	X7R	≥50V	C≥1.0μF	1210	X7R	≤100V	C≥1.0μF	X7R	>100V	C≥0.22μF	1812	X7R	≤50V	C≥4.7μF	100V	C≥1.0μF	1825	X7R	≥100V	C≥1.0μF	2220	2225	Size	Dielectric	Rated Voltage	Capacitance	2220	X7R	≥100V	C≥15μF	* No remarkable damage. * Cap. change : C0G : Within ±5.0% or ±0.5pF, whichever is larger. X7R : Within ±12.5% for ≥10V**, within ±25% for 6.3V. **10V : Within ±25% for 0603≥4.7μF, 0402≥1μF. * D.F./Q : C0G : Q≥350 for Cap.>30pF, Q≥275+2.5C for 10pF≤Cap.≤30pF, Q≥200+10C for Cap.<10pF. X7R : D.F.≤200% of initial requirement. * I.R. : ≥10V, ≥1GΩ or R×C≥50Ω-F, whichever is smaller. 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8. RELIABILITY TEST CONDITIONS AND REQUIREMENTS

No.	Item	Test Condition	Requirements						
13.	Adhesive Strength of Termination	* Capacitors mounted on a substrate. A force of 5N($\leq$0603) or 10N($>$0603) applied perpendicular to the place of substrate and parallel the line joining the center of terminations for 10$\pm$1 second.  Capacitor P.C. Board	* No remarkable damage or removal of the terminations.						
14.	Bending Test	* The middle part of substrate shall be pressurized by means of the pressurizing rod at a rate of about 1mm per second until the deflection becomes 5mm for product size < 1808, 3mm for product size $\geq$ 1808.  Unit : mm	* No remarkable damage. <table><tr><th>Dielectric</th><th>Cap. Change</th></tr><tr><td>Class I (C0G)</td><td>Within $\pm$5.0% or $\pm$0.5pF, whichever is larger</td></tr><tr><td>Class II (X7R)</td><td>Within $\pm$12.5%</td></tr></table> (This capacitance change means the change of capacitance under specified flexure of substrate from the capacitance measured before the test)	Dielectric	Cap. Change	Class I (C0G)	Within $\pm$ 5.0% or $\pm$ 0.5pF, whichever is larger	Class II (X7R)	Within $\pm$ 12.5%
Dielectric	Cap. Change								
Class I (C0G)	Within $\pm$ 5.0% or $\pm$ 0.5pF, whichever is larger								
Class II (X7R)	Within $\pm$ 12.5%								
15.	Vibration Resistance	* Vibration frequency : 10~55 Hz/min. * Total amplitude : 1.5mm. * Test time : 6 hrs. (Two hrs each in three mutually perpendicular directions) * Before initial measurement (Class II only) : To apply de-aging at 150°C for 1hr then set for 24$\pm$2 hrs at room temp. * Measurement to be made after keeping at room temp. for 24$\pm$2 hrs (Class I) or 48$\pm$4 hrs (Class II).	* No remarkable damage. * Cap. change and D.F./Q : To meet initial spec.						

9. PACKAGE DIMENSION AND QUANTITY

Size	Thickness Code	Thickness (mm)	Paper tape		Plastic tape	
			7" reel	13" reel	7" reel	13" reel
0402(1005)	K	0.50±0.20	10k	-	-	-
0603(1608)	S	0.80±0.07	4k	15k	-	-
	B	0.80 +0.15/-0.10	4k	15k	-	-
0805(2012)	A	0.60±0.10	4k	15k	-	-
	X	0.80±0.10	4k	15k	-	-
	C	1.25±0.10	-	-	3k	10k
	I	1.25±0.20	-	-	3k	10k
1206(3216)	X	0.80±0.10	4k	15k	-	-
	M	0.95±0.10	-	-	3k	10k
	J	1.15±0.15	-	-	3k	10k
	C	1.25±0.10	-	-	3k	10k
	E	1.60±0.20	-	-	2k	10k
	P	1.60 +0.30/-0.10	-	-	2k	9k
1210(3225)	M	0.95±0.10	-	-	3k	10k
	C	1.25±0.10	-	-	3k	10k
	E	1.60±0.20	-	-	2k	-
	F	2.00±0.20	-	-	1k	6k
	G	2.50±0.30	-	-	1k	6k
1808(4520)	C	1.25±0.10	-	-	2k	10k
	E	1.60±0.20	-	-	2k	8k
	F	2.00±0.20	-	-	1k	6k
1812(4532)	C	1.25±0.10	-	-	1k	5k
	E	1.60±0.20	-	-	1k	-
	F	2.00±0.20	-	-	1k	-
	G	2.50±0.30	-	-	0.5k	3k
	R	3.10±0.30	-	-	0.5k	-
1825(4563)	F	2.00±0.20	-	-	1k	-
	G	2.50±0.30	-	-	0.5k	-
	H	2.80±0.30	-	-	0.5k	-
2220(5750)	E	1.60±0.20	-	-	1k	-
	F	2.00±0.20	-	-	1k	-
	G	2.50±0.30	-	-	0.5k	-
	H	2.80±0.30	-	-	0.5k	-
	R	3.10±0.30	-	-	-	1k
2225(5763)	F	2.00±0.20	-	-	1k	-
	G	2.50±0.30	-	-	0.5k	-
	H	2.80±0.30	-	-	0.5k	-

Unit : pcs

9. PACKAGE DIMENSION AND QUANTITY

9.1. EMBOSSED TAPE DIMENSIONS

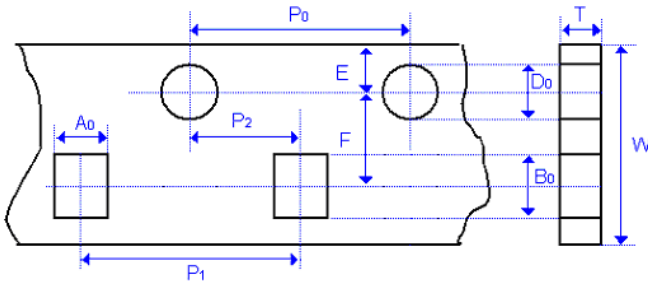


Fig. 9.1 The dimension of paper tape

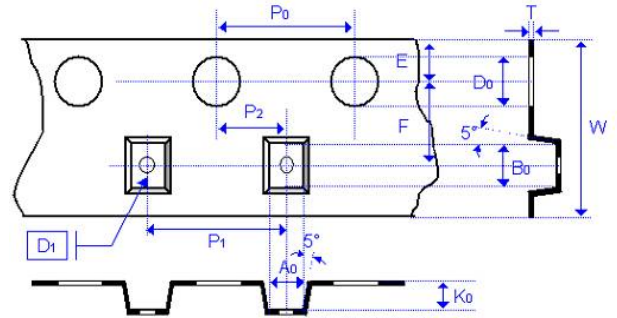


Fig. 9.2 The dimension of plastic tape

Size	0402		0603		0805	
Chip Thickness	0.50±0.05	0.50±0.10	0.80±0.07	0.80 +0.15/-0.1	0.80±0.10	1.25±0.10 1.25±0.20
A ₀	0.70±0.20	0.70±0.20	1.00 +0.05/-0.1	1.02 +0.05/-0.1	1.50±0.10	<1.65
B ₀	1.20±0.20	1.20±0.20	1.80±0.10	1.80±0.10	2.30±0.10	<2.40
T	≤0.80	≤0.80	0.95±0.05	0.97±0.05	0.95±0.05	0.23±0.05
K ₀	-	-	-	-	-	<2.50
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
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
10xP ₀	40.00±0.10	40.00±0.10	40.00±0.20	40.00±0.20	40.00±0.20	40.00±0.20
P ₁	2.00±0.05	2.00±0.05	4.00±0.10	4.00±0.10	4.00±0.10	4.00±0.10
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
D ₀	1.55±0.05	1.55±0.05	1.55±0.05	1.55±0.05	1.55±0.05	1.50 +0.10/-0
D ₁	-	-	-	-	-	1.00±0.10
E	1.75±0.05	1.75±0.05	1.75±0.05	1.75±0.05	1.75±0.05	1.75±0.10
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
Unit :	mm	mm	mm	mm	mm	mm

Size	1206			1210		1808	
Chip Thickness	0.80±0.10	0.95±0.10 1.25±0.10	1.60±0.20 1.60+0.3/-0/1	0.95±0.10 1.25±0.10 1.60±0.20	2.50±0.30	1.25±0.10 1.60±0.20	2.00±0.20
A ₀	2.00±0.10	<2.00	<2.50	<3.05	<3.20	<2.50	<2.50
B ₀	3.50±0.50	<3.70	<4.00	<3.80	<4.00	<5.30	<5.30
T	0.95±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
K ₀	-	<2.50	<2.50	<2.50	<3.50	<2.50	<2.50
W	8.00±0.10	8.00±0.10	12.00±0.20	8.00±0.10	8.00±0.10	12.00±0.20	12.00±0.20
P ₀	4.00±0.10	4.00±0.10	4.00±0.10	4.00±0.10	4.00±0.10	4.00±0.10	4.00±0.10
10xP ₀	40.00±0.20	40.00±0.20	40.0±0.20	40.00±0.20	40.00±0.20	40.0±0.20	40.0±0.20
P ₁	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
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
D ₀	1.55±0.05	1.50 +0.10/-0	1.50±0.10/-0	1.50 +0.10/-0	1.50 +0.10/-0	1.50±0.10/-0	1.50+0.10/-0
D ₁	-	1.00±0.10	1.50±0.10	1.00±0.10	1.00±0.10	1.50±0.10	1.50±0.10
E	1.75±0.10	1.75±0.10	1.75±0.10	1.75±0.10	1.75±0.10	1.75±0.10	1.75±0.10
F	3.50±0.05	3.50±0.05	5.50±0.05	3.50±0.05	3.50±0.05	5.50±0.05	5.50±0.05
Unit :	mm	mm	mm	mm	mm	mm	mm

9. PACKAGE DIMENSION AND QUANTITY

Size	1812		1825		2220		
Chip Thickness	1.25±0.10 1.60±0.20 2.00±0.20	2.50±0.30 2.80±0.30	1.60±0.20 2.00±0.20	2.50±0.30 2.80±0.30	1.40±0.15 1.60±0.20 2.00±0.20	2.50±0.30 2.80±0.30	3.10±0.30
A₀	<3.90	<3.90	<6.80	<6.80	<5.80	<6.80	<5.60
B₀	<5.30	<5.30	<5.30	<5.30	<6.50	<6.50	<6.50
T	0.25±0.05	0.25±0.05	0.30±0.10	0.30±0.10	0.30±0.10	0.30±0.10	0.30±0.10
K₀	<2.50	<3.00	<2.50	<3.10	<2.50	<3.10	<4.20
W	12.00±0.20	12.00±0.20	12.00±0.20	12.00±0.20	12.00±0.20	12.00±0.20	12.00±0.20
P₀	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
10xP₀	40.00±0.20	40.00±0.20	40.00±0.20	40.00±0.20	40.00±0.20	40.00±0.20	40.00±0.20
P₁	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
P₂	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
D₀	1.50 +0.10/-0	1.50 +0.10/-0	1.50 +0.10/-0	1.50 +0.10/-0	1.50 +0.10/-0	1.50 +0.10/-0	1.50 +0.10/-0
D₁	1.50±0.10	1.50±0.10	1.50±0.10	1.50±0.10	1.50±0.10	1.50±0.10	1.50±0.10
E	1.75±0.10	1.75±0.10	1.75±0.10	1.75±0.10	1.75±0.10	1.75±0.10	1.75±0.10
F	5.50±0.05	5.50±0.05	5.50±0.05	5.50±0.05	5.50±0.05	5.50±0.05	5.50±0.05
Unit :	mm	mm	mm	mm	mm	mm	mm

Size	2225	
Chip Thickness	1.60±0.20 2.00±0.20	2.50±0.30 2.80±0.30
A₀	<6.80	<6.80
B₀	<6.50	<6.50
T	0.30±0.10	0.30±0.10
K₀	<2.50	<3.10
W	12.00±0.20	12.00±0.20
P₀	4.00±0.10	4.00±0.10
10xP₀	40.00±0.20	40.00±0.20
P₁	8.00±0.10	8.00±0.10
P₂	2.00±0.05	2.00±0.05
D₀	1.50 +0.10/-0	1.50 +0.10/-0
D₁	1.50±0.10	1.50±0.10
E	1.75±0.10	1.75±0.10
F	5.50±0.05	5.50±0.05
Unit :	mm	mm

9. PACKAGE DIMENSION AND QUANTITY

9.2. REEL DIMENSIONS

Size	0201, 0402, 0603, 0805, 1206, 1210		1808, 1812, 1825, 2220, 2225	2220, 2225
Reel size	7"	13"	7"	13"
C	13.0 +0.5/-0.2	13.0 +0.7/-0.3	13.0 +0.5/-0.2	13.5 ±0.5
W ₁	8.4+1.5	8.4+1.5	12.4 +2.0/-0	12.4 +2.0/-0
W	14.4max	14.4max	shall accommodate tape width without interference	
A	178.0 ±0.10	330.0 ±1.0	178.0 ±0.10	330.0 ±1.0
N	60.0 +1.0/-0	100 ±1.0	60.0 +1.0/-0	100 ±1.0

The diagram illustrates the dimensions of a reel. It shows a top view of a circular reel with a central hub. The dimensions are labeled as follows: A is the total height of the reel, N is the height of the central hub, C is the height of the tape, W is the width of the reel, and W1 is the width of the tape. The dimensions are shown with arrows indicating the measurement direction.

Fig. 9.3 The dimension of reel

10. APPLICATION NOTES

STORAGE

To prevent the damage of solderability of terminations, the following storage conditions are recommended :

Indoors under 5 ~ 40°C and 20% ~ 70% RH.

No harmful gases containing sulfuric acid, ammonia, hydrogen sulfide or chlorine.

Packaging should not be opened until the capacitors are required for use. If opened, the pack should be re-sealed as soon as is practicable. Taped product should be stored out of direct sunlight, which might promote deterioration in tape or adhesion performance. The product is recommended to be used within 12 months after shipment and checked the solderability before use.

HANDLING

Chip capacitors are dense, hard, brittle, and abrasive materials. They are liable to suffer mechanical damage, in the form of cracks or chips. Chip Capacitors should be handled with care to avoid contamination or damage. To use vacuum or plastic tweezers to pick up or plastic tweezers is recommended for manual placement. Tape and reeled packages are suitable for automatic pick and placement machine.

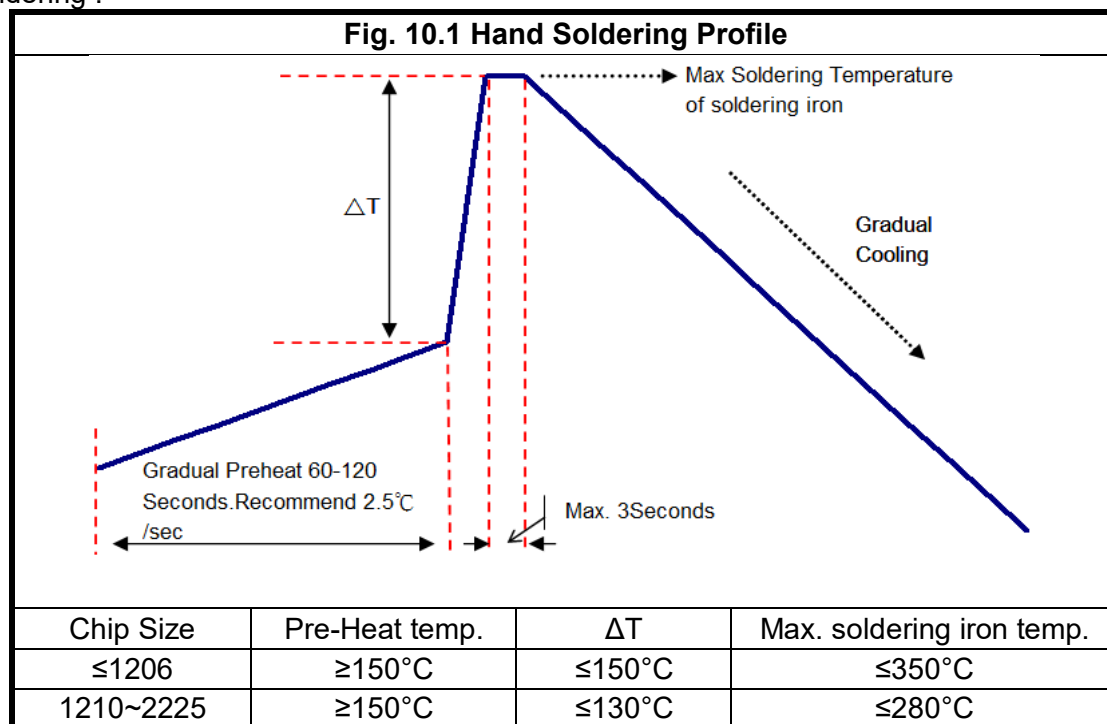
PREHEAT

In order to minimize the risk of thermal shock during soldering, a carefully controlled preheat is required. The rate of preheat should not exceed 3°C per second.

SOLDERING

Use mildly activated rosin fluxes do not use activated flux. The amount of solder in each solder joint should be controlled to prevent the damage of chip capacitors caused by the stress between solder, chips, and substrate.

a.) Hand soldering :



* Soldering iron tip diameter ≤1.0 mm and wattage max. 20W.

* The Capacitors shall be pre-heated and that the temperature gradient between the devices and the tip of the soldering iron.

* The required amount of solder shall be melted on the soldering tip.

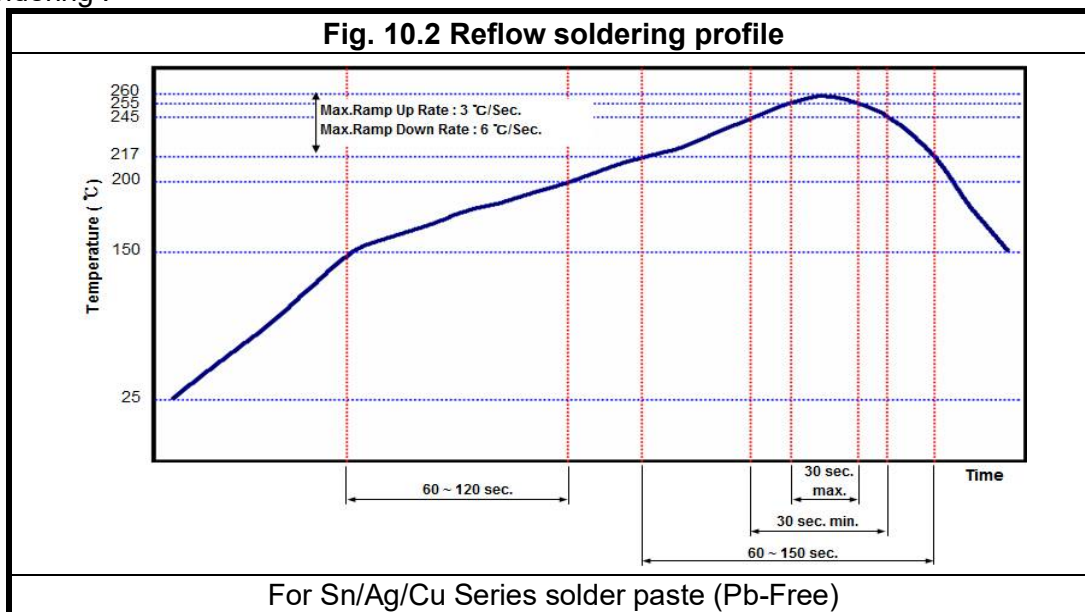
* The tip of iron should not contact the ceramic body directly.

* The Capacitors shall be cooled gradually at room temperature after soldering.

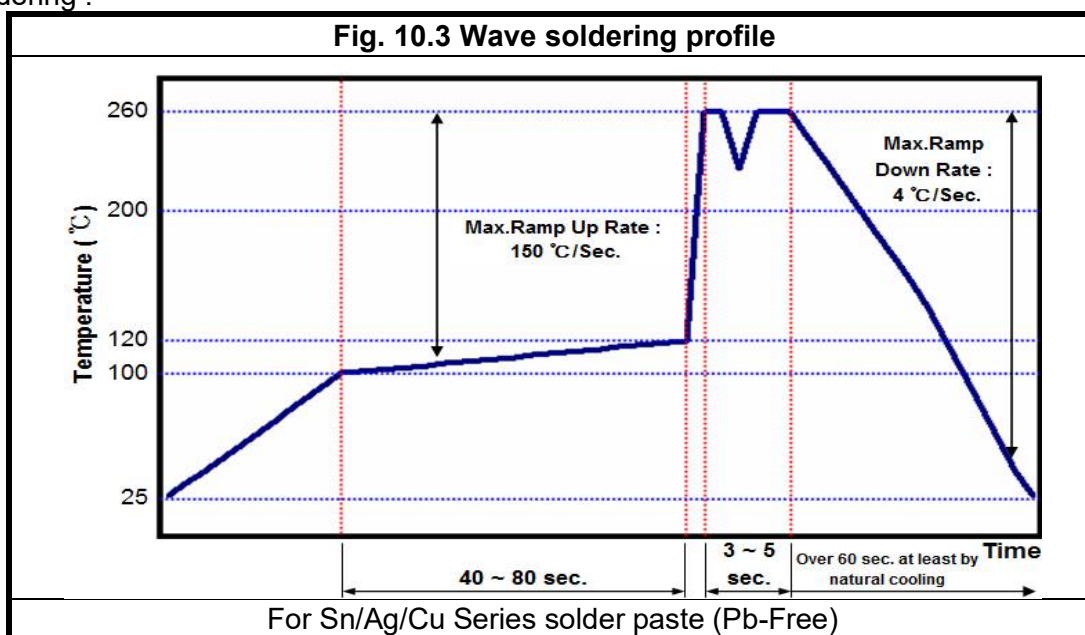
* Forced air cooling is not allowed.

10. APPLICATION NOTES

b.) Reflow soldering :



c.) Wave soldering :



Soldering conditions :

Class I :

Size Inch (mm)	Temper. Cher.	Capacitance	Condition	
			Wave	Reflow
≤0402 (1005)	Class I	All	X	O
0603 (1608)	Class I	All	O	O
0805 (2012)	Class I	All	O	O
1206 (3216)	Class I	All	O	O
		Thickness >0.95mm	X	O
≥1210 (3225)	Class I	All	X	O
Coating Products	All	All	X	O

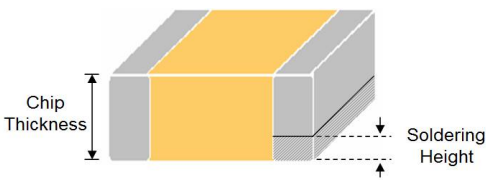
10. APPLICATION NOTES

Soldering conditions :

Class II :

Size Inch (mm)	Temper. Cher.	Capacitance	Condition	
			Wave	Reflow
≤0402 (1005)	Class II	All	X	O
0603 (1608)	Class II	Cap. <2.2μF	O	O
		Cap. ≥2.2μF	X	O
0805 (2012)	Class II	Thickness ≤ 0.95mm	O	O
		Thickness > 0.95mm	X	O
1206 (3216)	Class II	Thickness ≤ 0.95mm	O	O
		Thickness > 0.95mm	X	O
≥1210 (3225)	Class II	All	X	O
Coating Products	All	All	X	O

Soldering height :

The solder climbing minimum height is suggesting to 25% of chip thickness or 500um whichever is less. (Reference from IPC-610E)	
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COOLING

After soldering, cool the chips and the substrate gradually to room temperature. Natural cooling in air is recommended to minimize stress in the solder joint.

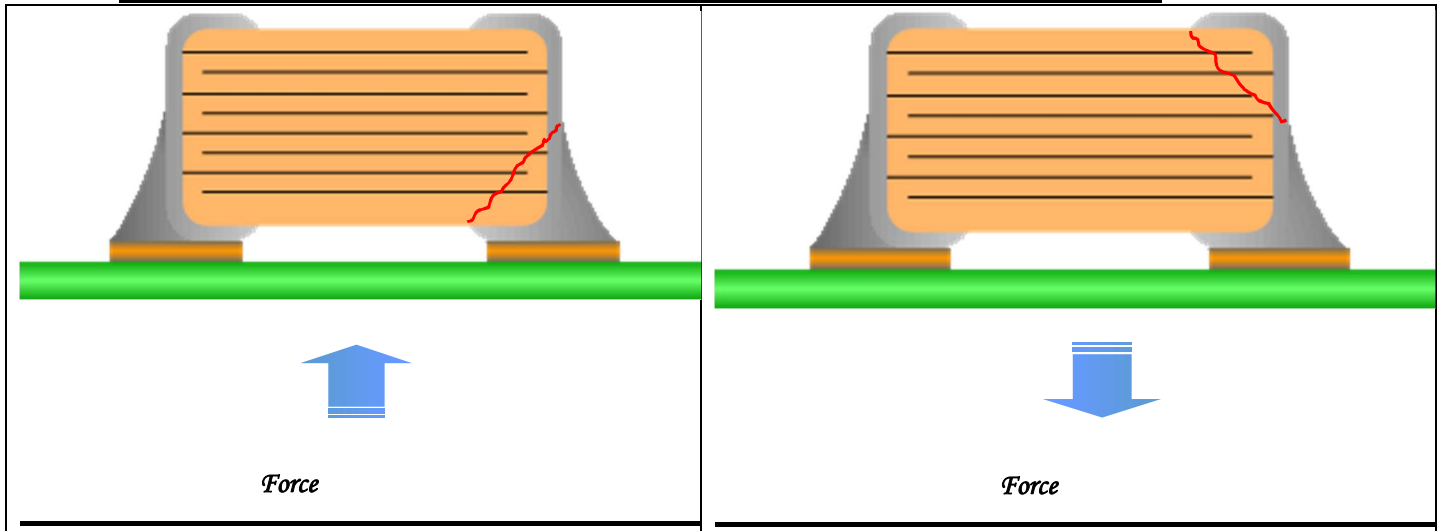
CLEANING

All flux residues must be removed by using suitable electronic-grade vapor-cleaning solvents to eliminate contamination that could cause electrolytic surface corrosion. Good results can be obtained by using ultrasonic cleaning of the solvent. The choice of the proper system is depends upon many factors such as component mix, flux, and solder paste and assembly method. The ability of the cleaning system to remove flux residues and contamination from under the chips is very important.

Surface coating products are not suitable cleaning/washing by solvent

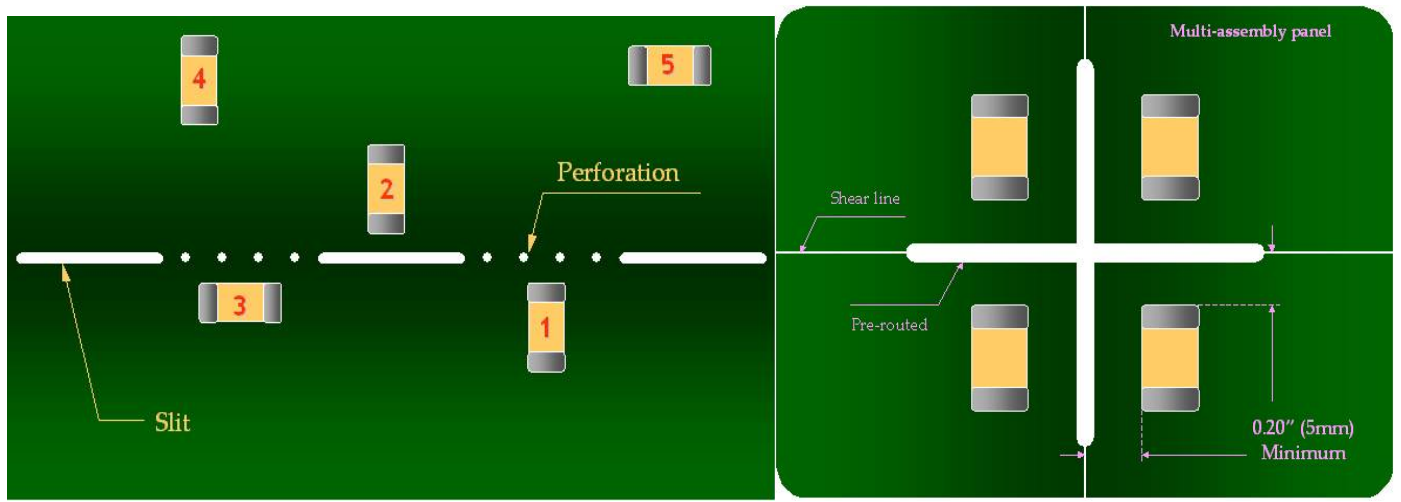
11. Typical Bending Cracks of MLCC

MLCC ceramic body is consisted of rigidity material. It will be suffered compressive and tensional stress when the carried board is bended. If the suffered stress is over ceramic body strength, the bending crack is occurred. **Therefore, the bending crack will be only occurred after soldering process.**



12. The stress v.s. position on PCB during bending

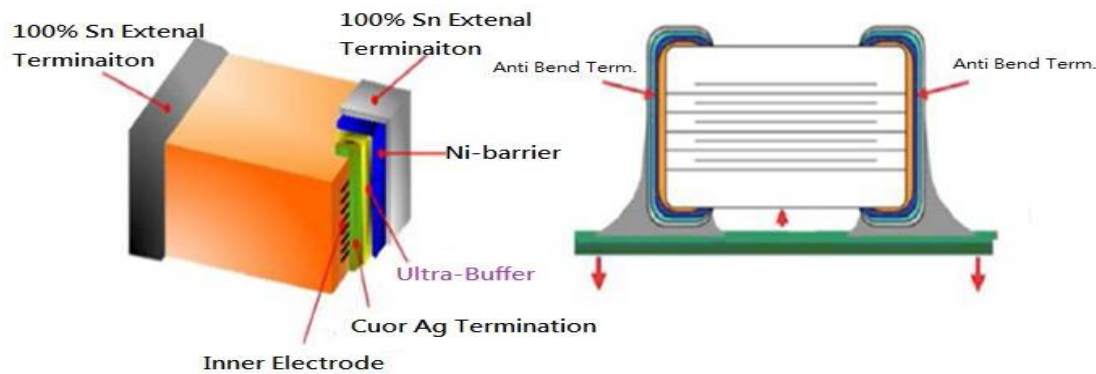
Chip mounting close to board separation point



Magnitude of stress $1 > 2 \approx 3 > 4 > 5$

13. Structure

Soft termination series is added a special termination material(Ultra-Buffer or Anti-Bend)between ceramic body and Ni-barrier that can absorb mechanical stress to prevent bending crack occurred



14. Illustration of Bending Test

