

Messrs.

Date:

APPROVAL SHEET

Product Name : ANTI-BEND General Purpose Multilayer Ceramic Chip Capacitors
Part No. : FP series
Description : ANTI-BEND, Size 0603~2225, NPO(C0G)/X7R, 50~3000V

PREPARED BY	APPROVED BY

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SPECIFICATION FOR

ANTI-BEND GENERAL PURPOSE MULTILAYER CERAMIC CHIP
CAPACITORS

Part No. : FP Series

Description : ANTI-BEND, Size 0603~2225, NPO(C0G)X7R,
50~3000V

<u>DRAWN BY</u>	<u>CHECKED BY</u>	<u>APPROVED BY</u>
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1. INTRODUCTION

PROSPERITY 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.

FP 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 5mm of substrate bending test guarantee.
- A wide selection of sizes is available (0603 to 2225).
- High capacitance in given case size.
- Capacitor with lead-free termination (pure Tin).
- Reduction in PCB bend failure.
- High reliability and stability.
- RoHS & HALOGEN compliant.

3. APPLICATIONS

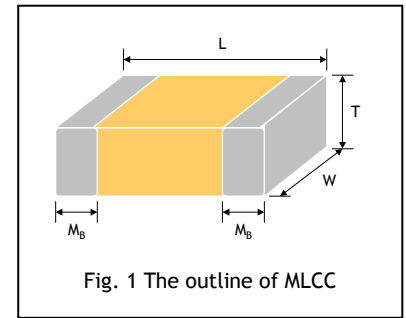
- For general digital circuit.
- For power supply bypass capacitors.
- For consumer electronics.
- For telecommunication.
- DC to DC converter

4.HOW TO ORDER

<u>FP</u>	<u>15</u>	<u>N</u>	<u>100</u>	<u>G</u>	<u>500</u>	<u>P</u>	<u>N</u>	<u>G</u>
<u>PDC</u>	<u>Size</u>	<u>Dielectric</u>	<u>Capacitance</u>	<u>Tolerance</u>	<u>Rated voltage</u>	<u>Packaging</u>	<u>Thickness</u>	<u>Control Code</u>
<u>Family</u>								
	Inch (mm)	N: COG(NPO)	Two significant digits followed by no. of zeros. And R is in place of decimal point.	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.	E : Tape and Reel, Embossed Tape P : Tape and Reel, Paper Tape No Code : Bulk	A : 0.60±0.10mm B : 0.80 ^{+0.15} / _{-0.10} mm C : 1.25±0.20mm D : 1.40±0.20mm E : 1.60±0.20mm F : 2.00±0.20mm G : 2.50±0.30mm H : 2.80±0.30mm I : 1.25±0.20mm J : 1.15±0.15mm M : 0.95±0.10mm N : 0.50±0.05mm P : 1.60 ^{+0.30} / _{-0.10} mm S : 0.80±0.07mm X : 0.80±0.10mm	G : RoHS compliant P : Pb/Sn plating(Tin/lead with min. 5% lead)*
	18 : 0603 (1608) 21 : 0805 (2012) 31 : 1206 (3216) 32 : 1210 (3225) 42 : 1808 (4520) 43 : 1812 (4532) 46 : 1825 (4563) 55 : 2220 (5750) 56 : 2225 (5763)	X: X7R	eg.: R47=0.47pF 0R5=0.5pF 1R0=1.0pF 100=10x10 ⁰ =10pF		500 = 50 VDC 101 = 100 VDC 201 = 200 VDC 251 = 250 VDC 501 = 500 VDC 631 = 630 VDC 102 = 1000 VDC 152 = 1500 VDC 202 = 2000 VDC 302 = 3000 VDC			

5. EXTERNAL DIMENSIONS

Size Inch (mm)	L (mm)	W (mm)	Tmax (mm)	M _B (mm)
0603 (1608)	1.60±0.20	0.80±0.15	0.95	0.40±0.15mm
0805 (2012)	2.10±0.20	1.25±0.20	1.45	0.50±0.20mm
1206 (3216)	3.30±0.40	1.60±0.20	1.80	0.60±0.20mm
1210 (3225)	3.30±0.40	2.50±0.40	2.80	0.75±0.25mm
1808 (4520)	4.50±0.50	2.00±0.20	2.20	0.75±0.35mm
1812 (4532)	4.60±0.50	3.20±0.30	2.80	0.75±0.35mm
1825 (4563)	4.60±0.50	6.30±0.40	2.80	0.75±0.35mm
2220 (5750)	5.70±0.50	5.00±0.40	3.10	0.85±0.35mm
2225 (5763)	5.70±0.50	6.30±0.40	3.10	0.85±0.35mm



6. GENERAL ELECTRICAL DATA

Dielectric	NPO	X7R
Size	1206, 1210, 1808, 1812, 1825, 2220, 2225	0603, 1206, 1210, 1812, 1808, 1825, 2220, 2225
Rated voltage (WVDC)	50V, 100V, 200V, 250V, 500V, 630V, 1.5KV, 1KV, 2KV, 3KV	50V, 100V, 200V, 250V, 500V, 630V, 1KV, 1.5KV, 2KV, 3KV
Capacitance range*	1.5pF ~ 6800pF	100pF ~ 10μF
Capacitance tolerance	Cap≤5pF: B (±0.1pF), C (±0.25pF) 5pF<Cap<10pF: C (±0.25pF), D (±0.5pF) Cap≥10pF: F (±1%), G (±2%), J (±5%), K (±10%)	J (±5%), K (±10%), M (±20%)
Tan δ*	Cap<30pF: Q≥400+20C Cap≥30pF: Q≥1000	50V ≤ 2.5%** 100V ~ 3KV ≤ 2.5%
Insulation resistance at 500Vdc for 60 seconds	≥100GΩ or R·C≥1000 whichever is smaller	≥10GΩ or R·C≥ 500Ω·F whichever is smaller
Operating temperature	-55 to +125°C	
Temperature coefficient	±30ppm / °C	±15%
Termination	Ag (or Cu)/Ni/Sn (lead-free termination)	

* Measured at 1.0±0.2Vrms, 1.0kHz±10% for C≤10μF; 0.5±0.2Vrms, 120Hz±20% for C>10μF, 30~70% related humidity, 25°C ambient temperature.

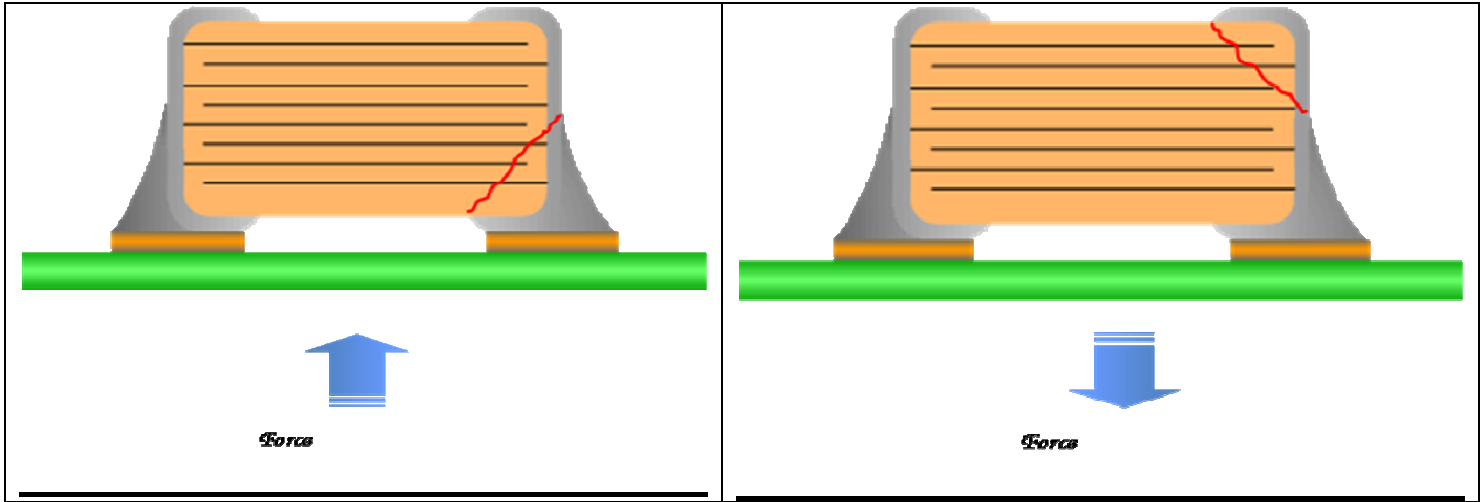
**

X7R:

Rated vol.	D.F.	Exception of D.F.
50V	≤2.5%	≤3% 0603≥0.047μF; 0805≥0.18μF, 1206≥0.47μF

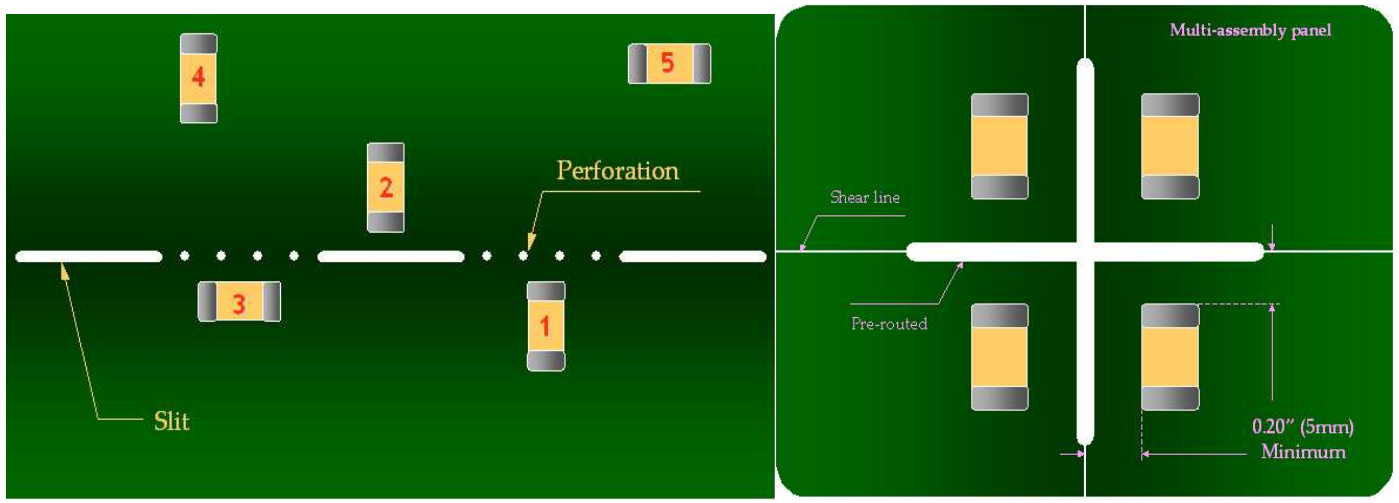
7. Typical Bending Cracks of MLCC

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.**



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

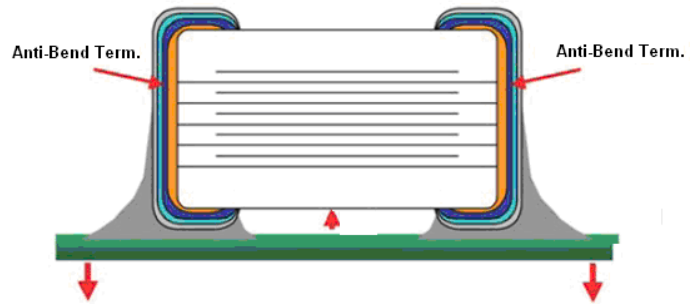
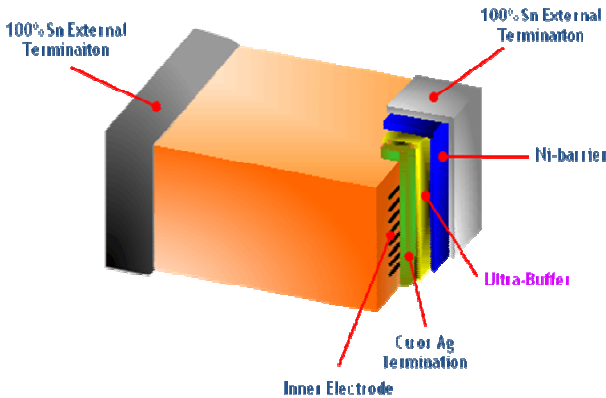
Chip mounting close to board separation point



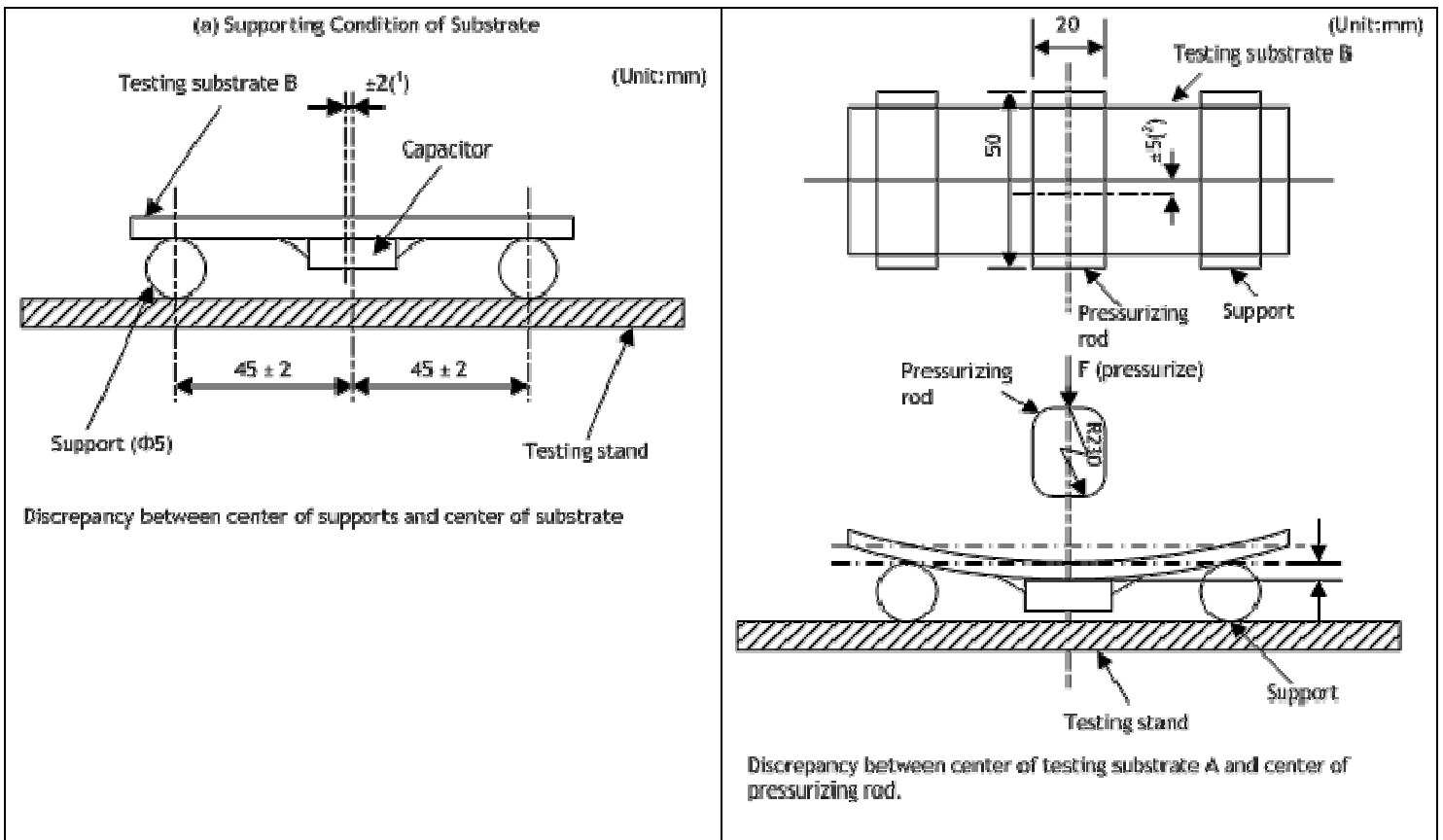
Magnitude of stress $1 > 2 \approx 3 > 4 > 5$

9. Structure

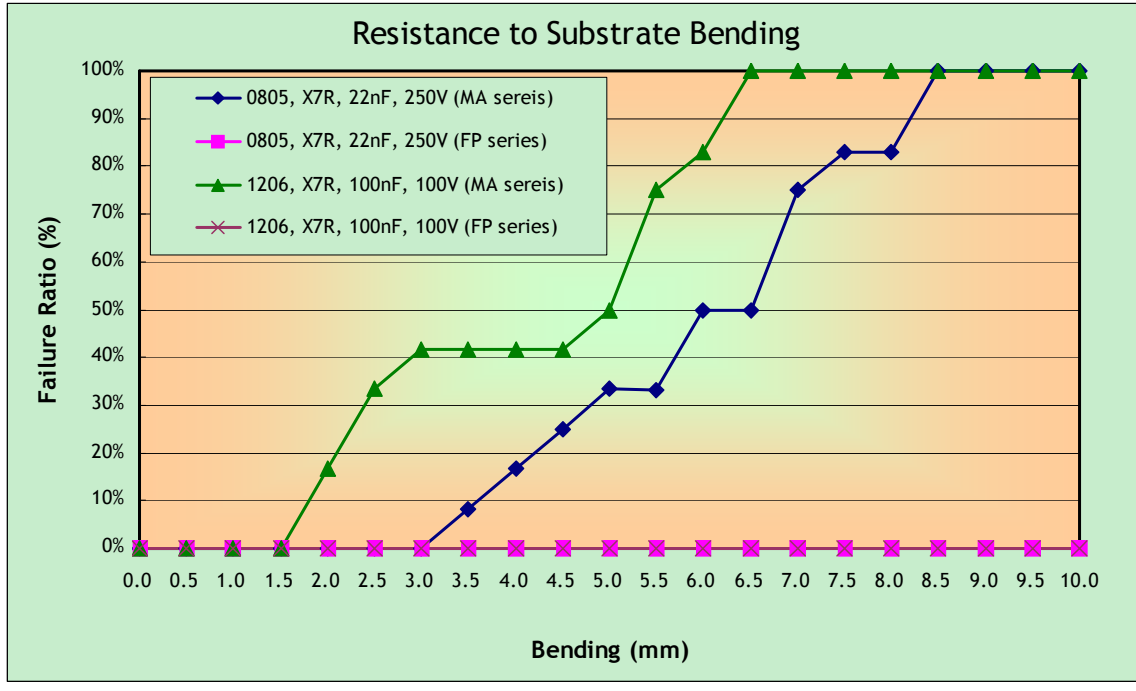
PDC FP series is added a special termination material (Ultra-Buffer or Anti-Bend) between ceramic body and Ni-barrier that can absorb mechanical stress to prevent bending crack occurred.



10. Illustration of Bending Test



11. Comparison of Bending Test Result



PCB TEST RESULT			
Size	Mean Bend MA series(mm)	Mean Bend FP series.(mm)	Improvement with Ultra-buffer
0603	≥ 2	≥ 5	300%
0805	≥ 2	≥ 5	300%
1206	≥ 2	≥ 5	300%
1210	≥ 2	≥ 5	300%
1808	≥ 3	≥ 5	300%
1812	≥ 3	≥ 5	140%
1825	≥ 3	≥ 5	117%
2220	≥ 5	≥ 7	114%
2225	≥ 5	≥ 7	114%

12.CAPACITANCE RANGE

12-1. NPO(C0G)

DIELECTRIC		C0G(NP0)															
SIZE		0603				0805						1206					
RATED VOLTAGE (VDC)		50	100	200	250	50	100	200	250	500	630	50	100	200	250	500	630
Capacitance	0.5pF (0R5)																
	1.0pF (1R0)																
	1.2pF (1R2)																
	1.5pF (1R5)																
	1.8pF (1R8)																
	2.2pF (2R2)																
	2.7pF (2R7)																
	3.3pF (3R3)																
	3.9pF (3R9)																
	4.7pF (4R7)																
	5.6pF (5R6)																
	6.8pF (6R8)																
	8.2pF (8R2)																
	10pF (100)																
	12pF (120)																
	15pF (150)																
	18pF (180)																
	22pF (220)																
	27pF (270)																
	33pF (330)																
	39pF (390)																
	47pF (470)																
	56pF (560)																
	68pF (680)																
	82pF (820)																
	100pF (101)																
	120pF (121)																
	150pF (151)																
	180pF (181)																
	220pF (221)																
	270pF (271)																
	330pF (331)																
	390pF (391)																
	470pF (471)																
560pF (561)																	
680pF (681)																	
820pF (821)																	
1,000pF (102)																	
1,200pF (122)																	
1,500pF (152)																	
1,800pF (182)																	
2,200pF (222)																	
2,700pF (272)																	
3,300pF (332)																	
3,900pF (392)																	
4,700pF (472)																	
5,600pF (562)																	
6,800pF (682)																	
8,200pF (822)																	
0.010μF (103)																	



12.CAPACITANCE RANGE(Con.)

12-1. NPO(C0G)

DIELECTRIC		C0G(NP0)																
		1206				1210												1808
SIZE		1000	1500	2000	3000	50	100	200	250	500	630	1000	1500	2000	3000	50	100	200
RATED VOLTAGE (VDC)		1000	1500	2000	3000	50	100	200	250	500	630	1000	1500	2000	3000	50	100	200
Capacitance	1.5pF (1R5)																	
	1.8pF (1R8)																	
	2.2pF (2R2)																	
	2.7pF (2R7)																	
	3.3pF (3R3)																	
	3.9pF (3R9)																	
	4.7pF (4R7)																	
	5.6pF (5R6)																	
	6.8pF (6R8)																	
	8.2pF (8R2)																	
	10pF (100)																	
	12pF (120)																	
	15pF (150)																	
	18pF (180)																	
	22pF (220)																	
	27pF (270)																	
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4,700pF (472)																		
5,600pF (562)																		
6,800pF (682)																		
8,200pF (822)																		
0.010μF (103)																		
0.012μF (123)																		
0.015μF (153)																		
0.018μF (183)																		



12.CAPACITANCE RANGE(Con.)

12-1. NPO(C0G)

DIELECTRIC		C0G(NP0)																
SIZE		1808								1812								
RATED VOLTAGE (VDC)		250	500	630	1000	1500	2000	3000	50	100	200	250	500	630	1000	1500	2000	3000
Capacitance	2.2pF (2R2)																	
	2.7pF (2R7)																	
	3.3pF (3R3)																	
	3.9pF (3R9)																	
	4.7pF (4R7)																	
	5.6pF (5R6)																	
	6.8pF (6R8)																	
	8.2pF (8R2)																	
	10pF (100)																	
	12pF (120)																	
	15pF (150)																	
	18pF (180)																	
	22pF (220)																	
	27pF (270)																	
	33pF (330)																	
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0.022μF (223)																		
0.027μF (273)																		
0.033μF (333)																		
0.039μF (393)																		



12. CAPACITANCE RANGE (Con.)

12-1. NPO (C0G)

DIELECTRIC		COG(NP0)													
SIZE		1825							2220						
RATED VOLTAGE (VDC)		50	100	200 250	500 630	1000	1500 2000	3000	50	100	200 250	500 630	1000	1500 2000	3000
Capacitance	10pF (100)														
	12pF (120)														
	15pF (150)														
	18pF (180)														
	22pF (220)														
	27pF (270)														
	33pF (330)														
	39pF (390)														
	47pF (470)														
	56pF (560)														
	68pF (680)														
	82pF (820)														
	100pF (101)														
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	6,800pF (682)														
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0.022μF (223)															
0.027μF (273)															
0.033μF (333)															
0.039μF (393)															
0.047μF (473)															
0.056μF (563)															
0.068μF (683)															
0.082μF (823)															
0.10μF (104)															
0.12μF (124)															



12.CAPACITANCE RANGE(Con.)

12-1. NPO(C0G)

DIELECTRIC		C0G(NP0)						
SIZE		2225						
RATED VOLTAGE (VDC)		50	100	200 250	500 630	1000	1500 2000	3000
Capacitance	10pF (100)							
	12pF (120)							
	15pF (150)							
	18pF (180)							
	22pF (220)							
	27pF (270)							
	33pF (330)							
	39pF (390)							
	47pF (470)							
	56pF (560)							
	68pF (680)							
	82pF (820)							
	100pF (101)							
	120pF (121)							
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	4,700pF (472)							
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	6,800pF (682)							
	8,200pF (822)							
	0.010μF (103)							
	0.012μF (123)							
	0.015μF (153)							
	0.018μF (183)							
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0.027μF (273)								
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0.039μF (393)								
0.047μF (473)								
0.056μF (563)								
0.068μF (683)								
0.082μF (823)								
0.10μF (104)								
0.12μF (124)								

12.CAPACITANCE RANGE(Con.)

12-2. X7R

DIELECTRIC		X7R															
SIZE		0603				0805						1206					
RATED VOLTAGE (VDC)		50	100	200	250	50	100	200	250	500	630	50	100	200	250	500	630
Capacitance	100pF (101)																
	120pF (121)																
	150pF (151)																
	180pF (181)																
	220pF (221)																
	270pF (271)																
	330pF (331)																
	390pF (391)																
	470pF (471)																
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0.33μF (334)																	
0.39μF (394)																	
0.47μF (474)																	
0.56μF (564)																	
0.68μF (684)																	
0.82μF (824)																	
1.0μF (105)																	



12.CAPACITANCE RANGE(Con.)

12-2. X7R

DIELECTRIC		X7R																
SIZE		1206		1210						1808								
RATED VOLTAGE (VDC)		1000	1500 2000	50	100	200	250	500 630	1000	1500	2000	50	100	200 250	500 630	1000	1500 2000	3000
Capacitance	100pF (101)																	
	120pF (121)																	
	150pF (151)																	
	180pF (181)																	
	220pF (221)																	
	270pF (271)																	
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	820pF (821)																	
	1,000pF (102)																	
	1,200pF (122)																	
	1,500pF (152)																	
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	4,700pF (472)																	
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	0.022μF (223)																	
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	0.033μF (333)																	
	0.039μF (393)																	
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0.10μF (104)																		
0.12μF (124)																		
0.15μF (154)																		
0.18μF (184)																		
0.22μF (224)																		
0.27μF (274)																		
0.33μF (334)																		
0.39μF (394)																		
0.47μF (474)																		
0.56μF (564)																		
0.68μF (684)																		
0.82μF (824)																		
1.00μF (105)																		
1.20μF (125)																		
1.50μF (155)																		
1.80μF (185)																		
2.20μF (225)																		
2.70μF (275)																		
3.30μF (335)																		



12.CAPACITANCE RANGE(Con.)

12-2. X7R

DIELECTRIC		X7R															
		1812							1825								
SIZE		50	100	200	500	630	1000	1500	3000	50	100	200	500	1000	1500	3000	
RATED VOLTAGE (VDC)				250				2000				250	630		2000		
Capacitance	270pF (271)																
	330pF (331)																
	390pF (391)																
	470pF (471)																
	560pF (561)																
	680pF (681)																
	820pF (821)																
	1,000pF (102)																
	1,200pF (122)																
	1,500pF (152)																
	1,800pF (182)																
	2,200pF (222)																
	2,700pF (272)																
	3,300pF (332)																
	3,900pF (392)																
	4,700pF (472)																
	5,600pF (562)																
	6,800pF (682)																
	8,200pF (822)																
	0.010μF (103)																
	0.012μF (123)																
	0.015μF (153)																
	0.018μF (183)																
	0.022μF (223)																
	0.027μF (273)																
	0.033μF (333)																
	0.039μF (393)																
	0.047μF (473)																
	0.056μF (563)																
	0.068μF (683)																
	0.082μF (823)																
	0.10μF (104)																
	0.12μF (124)																
	0.15μF (154)																
	0.18μF (184)																
	0.22μF (224)																
	0.27μF (274)																
	0.33μF (334)																
	0.39μF (394)																
	0.47μF (474)																
0.56μF (564)																	
0.68μF (684)																	
0.82μF (824)																	
1.00μF (105)																	
1.20μF (125)																	
1.50μF (155)																	
1.80μF (185)																	
2.20μF (225)																	
2.70μF (275)																	
3.30μF (335)																	
3.90μF (395)																	
4.70μF (475)																	
5.60μF (565)																	
6.80μF (685)																	
8.20μF (825)																	
10.0μF (106)																	



12.CAPACITANCE RANGE(Con.)

12-2. X7R

DIELECTRIC		X7R														
		2220							2225							
SIZE		50	100	200 250	500	630	1000	1500 2000	3000	50	100	200 250	500 630	1000	1500 2000	3000
RATED VOLTAGE (VDC)																
Capacitance	1,000pF (102)															
	1,200pF (122)															
	1,500pF (152)															
	1,800pF (182)															
	2,200pF (222)															
	2,700pF (272)															
	3,300pF (332)															
	3,900pF (392)															
	4,700pF (472)															
	5,600pF (562)															
	6,800pF (682)															
	8,200pF (822)															
	0.010μF (103)															
	0.012μF (123)															
	0.015μF (153)															
	0.018μF (183)															
	0.022μF (223)															
	0.027μF (273)															
	0.033μF (333)															
	0.039μF (393)															
	0.047μF (473)															
	0.056μF (563)															
	0.068μF (683)															
	0.082μF (823)															
	0.10μF (104)															
	0.12μF (124)															
	0.15μF (154)															
	0.18μF (184)															
	0.22μF (224)															
	0.27μF (274)															
	0.33μF (334)															
	0.39μF (394)															
	0.47μF (474)															
	0.56μF (564)															
	0.68μF (684)															
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1.80μF (185)																
2.20μF (225)																
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3.90μF (395)																
4.70μF (475)																
5.60μF (565)																
6.80μF (685)																
8.20μF (825)																
10.0μF (106)																



13. PACKAGE DIMENSION AND QUANTITY

Size	Thickness (mm)	Paper tape		Plastic tape	
		7" reel	13" reel	7" reel	13" reel
0603 (1608)	0.80±0.07	4k	15k	-	-
	0.80+0.15/-0.10	4k	15k	-	-
0805 (2012)	0.60±0.10	4k	15k	-	-
	0.80±0.10	4k	15k	-	-
	1.25±0.10	-	-	3k	10k
	1.25±0.20	-	-	3k	-
1206 (3216)	0.80±0.10	4k	15k	-	-
	0.95±0.10	-	-	3k	10k
	1.25±0.10	-	-	3k	10k
	1.60±0.20	-	-	2k	-
1210 (3225)	0.95±0.10	-	-	3k	10k
	1.25±0.10	-	-	3k	10k
	1.60±0.20	-	-	2k	-
	2.50±0.30	-	-	1k	-
1812 (4532)	1.25±0.10	-	-	1k	-
	1.60±0.20	-	-	1k	-
	2.00±0.20	-	-	1k	-
	2.50±0.30	-	-	0.5k	-
1825 (4563)	2.00±0.20	-	-	1k	-
	2.50±0.30	-	-	0.5k	-
	2.80±0.30	-	-	0.5k	-
2220 (5750)	2.00±0.20	-	-	1k	-
	2.50±0.30	-	-	0.5k	-
	2.80±0.30	-	-	0.5k	-
2225 (5763)	2.00±0.20	-	-	1k	-
	2.50±0.30	-	-	0.5k	-
	2.80±0.30	-	-	0.5k	-

Unit: pieces

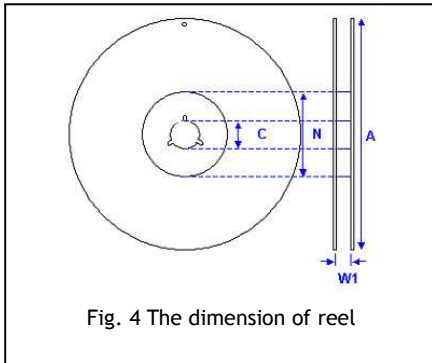


Fig. 4 The dimension of reel

Size	0603, 0805, 1206, 1210			1812, 1825, 2220, 2225
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	80.0±1.0

13-1. CARDBOARD TAPE DIMESIONS

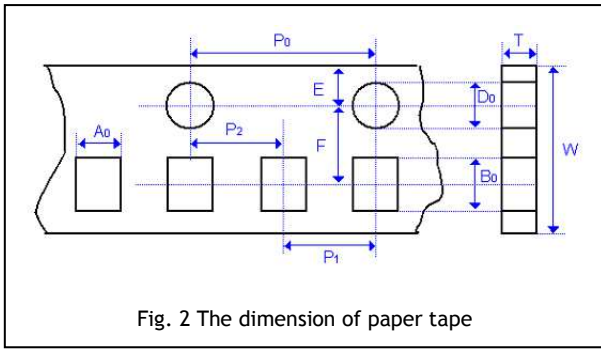


Fig. 2 The dimension of paper tape

13-2. EMBOSSED TAPE DIMENSIONS

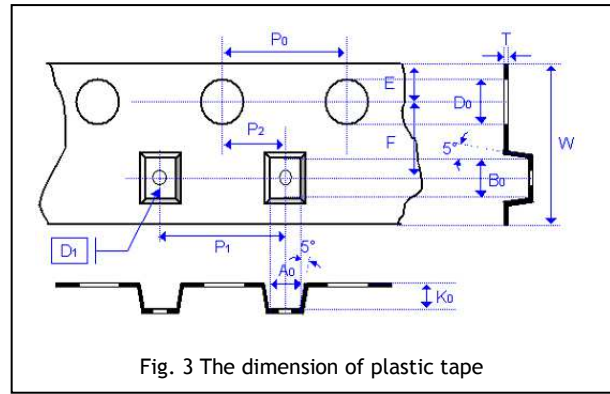


Fig. 3 The dimension of plastic tape

Size	0603		0805		1206			1210	
Chip Thickness	0.80±0.07	0.80+0.15/-0.10	0.80±0.10	1.25±0.10 1.25±0.20	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
A_0	1.00+0.05/-0.10	1.02+0.05/-0.10	1.50±0.10	<1.65	2.00±0.10	<2.00	<2.00	<3.05	<3.10
B_0	1.80±0.10	1.80±0.10	2.30±0.10	<2.40	3.50±0.10	<3.60	<3.70	<3.80	<4.00
T	0.95±0.05	0.97±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
K_0	-	-	-	<2.50	-	<2.50	<2.50	<2.50	<3.50
W	8.00±0.10	8.00±0.10	8.00±0.10	8.00±0.10	8.00±0.10	8.00±0.10	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	4.00±0.10	4.00±0.100	4.00±0.10
$10 \times P_0$	40.00±0.20	40.00±0.20	40.00±0.20	40.00±0.20	40.00±0.20	40.00±0.20	40.00±0.20	40.00±0.20	40.0±0.10
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	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	2.00±0.05	2.00±0.05
D_0	1.55±0.05	1.55±0.05	1.55±0.05	1.50±0.10/-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
D_1	-	-	-	1.00±0.10	-	1.00±0.10	1.00±0.10	1.00±0.10	1.00±0.10
E	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
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

Size	1812		1825		2220		2225	
Chip Thickness	1.25±0.10 1.60±0.20 2.00±0.20	2.50±0.30	1.60±0.20 2.00±0.20	2.50±0.30	1.40±0.15 1.60±0.20 2.00±0.20	2.50±0.30	2.00±0.20	2.50±0.30
A_0	<3.90	<3.90	<6.80	<6.80	<5.80	<5.80	<6.80	<6.80
B_0	<5.30	<5.30	<5.30	<5.30	<6.50	<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	0.30±0.10
K_0	<2.50	<3.00	<2.50	<3.10	<2.50	<3.10	<2.50	<3.10
W	12.0±0.20	12.0±0.20	12.0±0.20	12.0±0.20	12.0±0.20	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
$10 \times P_0$	40.00±0.20	40.00±0.20	40.00±0.20	40.00±0.20	40.00±0.20	40.00±0.20	40.00±0.20	40.00±0.20
P_1	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
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
D_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	1.50+0.10/-0	1.50+0.10/-0
D_1	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	1.50±0.10
E	1.75±0.10	1.75+/-0.1	1.75±0.1	1.75±0.10	1.75±0.1	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	5.50±0.05

14.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 capacitors should be used within 6 months 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 4°C per second and the final preheat temperature should be within 100°C of the soldering temperature for small chips such as 0603, 0805 and 1206, within 50°C of the soldering temperature for bigger chips such as 1210, 1808, 1812, 1825, 2220 and 2225, etc.

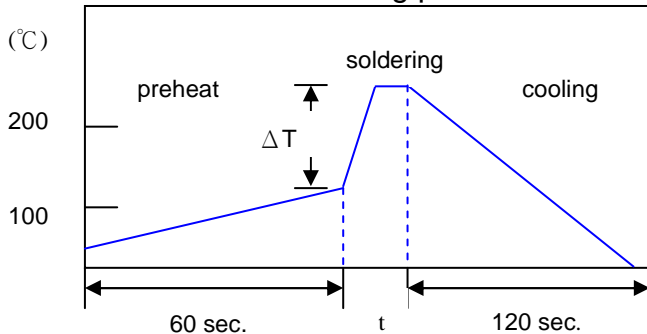
SOLDERING

Use mildly activated rosin RA and RMA 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.

Hand soldering with temperature-controlled iron not exceeding 30 watts and diameter of tip less than 1.2 mm is recommended, tip of iron should not contact the ceramic body directly, and the temperature of iron should be set to not more than 260°C.

For bigger chips such as 1210, 1808, 1812, 1825, 2220 and 2225, etc. wave soldering and hand soldering are not recommended.

Recommended soldering profiles as following:



Soldering	Solder Temp.(T)	Soldering Time (t)
Reflow	235 – 260 °C	< 15 sec.
Wave	230 – 260 °C	< 5 sec.

Chip Size	ΔT
0603, 0805, 1206	100 °C
1210, 1808, 1812, 1825, 2220, 2225	50 °C

COOLING

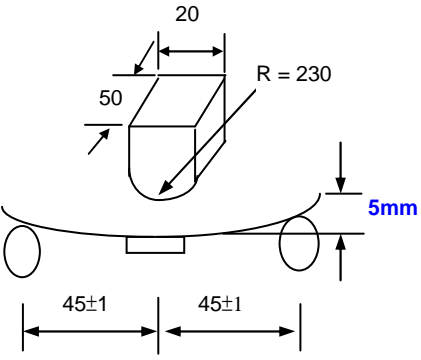
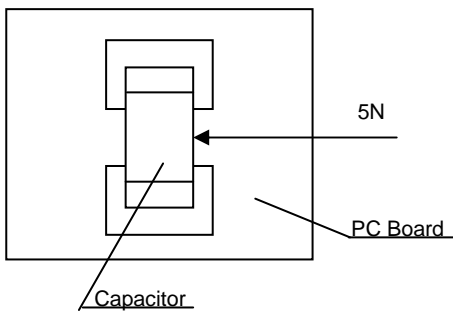
After soldering, cool the chips and the substrate gradually to room temperature. Natural cooling in air is recommended to minimize stress in the solder joint. A cooling rate not exceeding 4°C per second should be used when forced cooling is necessary.

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.

15.RELIABILITY TEST CONDITIONS AND REQUIREMENTS

No.	Item	Test Condition	Requirements															
1.	Visual and Mechanical	---	<ul style="list-style-type: none"> * No remarkable defect. * Dimensions to conform to individual specification sheet. 															
2.	Capacitance	Cap≤10μF, 1.0±0.2Vrms, 1KHz±10%	* Shall not exceed the limits given in the detailed spec.															
3.	Q/ D.F. (Dissipation Factor)	Cap>10μF, 0.5±0.2Vrms, 120Hz±20%	UR=50V, D.F. < 2.5% <table border="1"> <thead> <tr> <th>Rated vol.</th> <th>D.F.</th> <th>Exception of D.F.</th> </tr> </thead> <tbody> <tr> <td>50V</td> <td>≤2.5%</td> <td>≤3% 0603≥0.047μF; 0805≥0.18μF, 1206≥0.47μF</td> </tr> </tbody> </table> UR< 50V, D.F. < 3.5%	Rated vol.	D.F.	Exception of D.F.	50V	≤2.5%	≤3% 0603≥0.047μF; 0805≥0.18μF, 1206≥0.47μF									
Rated vol.	D.F.	Exception of D.F.																
50V	≤2.5%	≤3% 0603≥0.047μF; 0805≥0.18μF, 1206≥0.47μF																
4.	Temperature Coefficient	With no electrical load. <table border="1"> <thead> <tr> <th>T.C.</th> <th>Operating Temp</th> </tr> </thead> <tbody> <tr> <td>X7R</td> <td>-55~125°C at 25°C</td> </tr> </tbody> </table>	T.C.	Operating Temp	X7R	-55~125°C at 25°C	<table border="1"> <thead> <tr> <th>T.C.</th> <th>Capacitance Change</th> </tr> </thead> <tbody> <tr> <td>X7R</td> <td>Within ±15%</td> </tr> </tbody> </table>	T.C.	Capacitance Change	X7R	Within ±15%							
T.C.	Operating Temp																	
X7R	-55~125°C at 25°C																	
T.C.	Capacitance Change																	
X7R	Within ±15%																	
5.	Dielectric Strength	<ul style="list-style-type: none"> * To apply voltage (≤50V) 250%. * Duration: 1 to 5 sec. * Charge and discharge current less than 50mA. 	* No evidence of damage or flash over during test.															
6.	Insulation Resistance	To apply rated voltage for max. 120 sec.	* ≥10GΩ or RxC≥500Ω-F whichever is smaller.															
7.	Solderability	<ul style="list-style-type: none"> * Solder temperature: 235±5°C * Dipping time: 2±0.5 sec. 	75% min. coverage of all metalized area.															
8.	Resistance to Soldering Heat	<ul style="list-style-type: none"> * 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: Perform 150+0/-10°C for 1 hr and then set for 48±4 hrs at room temp. * Measurement to be made after keeping at room temp. for 48±4 hrs. 	<ul style="list-style-type: none"> * No remarkable damage. * Cap change: X7R: within ±15% * 25% max. leaching on each edge. 															
9.	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> <ul style="list-style-type: none"> * Before initial measurement: Perform 150+0/-10°C for 1 hr and then set for 48±4 hrs at room temp. * Measurement to be made after keeping at room temp. for 48±4 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	<ul style="list-style-type: none"> * No remarkable damage. * Cap change : X7R: within ±15% * Q/D.F.≤1.5×initial requirement * I.R.≥ 0.25×initial requirements.
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																
10.	Humidity (Damp Heat) Steady State	<ul style="list-style-type: none"> * Test temp.: 40±2°C * Humidity: 90~95% RH * Test time: 500+24/-0hrs. * Measurement to be made after keeping at room temp. for 48±4 hrs. 	<ul style="list-style-type: none"> * No remarkable damage. * Cap change: X7R : within ±15% * Q/D.F Value: X7R: ≤7.0% * I.R.: ≥1GΩ or RxC≥50Ω-F whichever is smaller. 															

No.	Item	Test Condition	Requirements
11.	High Temperature Load (Endurance)	<ul style="list-style-type: none"> * Test temp.: X7R: 125±3°C * To apply voltage: 200% of rated voltage. * Test time: 1000+24/-0 hrs. * Measurement to be made after keeping at room temp. for 48±4 hrs. 	<ul style="list-style-type: none"> * No remarkable damage. * Cap change: X7R : within ±15% * Q/D.F Value: X7R: ≤7.0% * I.R.: ≥1GΩ or RxC≥50Ω-F whichever is smaller.
12.	Resistance to Flexure of Substrate	<p>* 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.</p> 	<ul style="list-style-type: none"> * No remarkable damage. * Cap change: X7R: within ±10% <p>(This capacitance change means the change of capacitance under specified flexure of substrate from the capacitance measured before the test.)</p>
13.	Adhesive Strength of Termination	<p>* Capacitors mounted on a substrate. A force of 5N applied perpendicular to the place of substrate and parallel the line joining the center of terminations for 10±1 second.</p> 	<ul style="list-style-type: none"> * No remarkable damage or removal of the terminations.