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SPECIFICATION FOR

Low Dissipation MEDIUM / HIGH VOLTAGE MULTILAYER CERAMIC CHIP CAPACITORS

Series : LD Series

Description : Low Dissipation, Size 0805~2225, X7R, 100V to 2KV, RoHS Compliant

DRAWN BY	CHECKED BY	APPROVED BY
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1. INTRODUCTION

LD Series green type capacitors are manufactured by using green materials without lead and cadmium. These capacitors feature series connection of multi-layer capacitor units in a MLCC to realize high voltage performance. Reliable performances are built-in through exact formulation of dielectric powders, preparation of conductive paste, advanced automatic manufacturing, and strict quality control to assure excellent control in dielectric thickness, electrode integrity, and electrode-to-termination continuity.

2. FEATURES

a. Low ESR and Low Tan δ
b. Excellent DC Bias
c. Provide Good Ripple Characteristic.
d. Excellent Temperature Coefficient
e. RoHS & SS-00259 compliant

3. APPLICATIONS

a. Power supply.
b. Strobe trigger circuit for digital cameras.
c. elecommunication (ADSL, Modem, Splitter)
d. Audio circuit
e. Lighting

4.HOW TO ORDER

LD	06	X	223	K	631	E	E	G
Series code	Size	Dielectric	Capacitance	Tolerance	Safety Class	Packaging	Thickness code	Control Code
	Inch (mm) **05**: 0805(2012) **06**: 1206(3216) **10**: 1210(3225) **12**: 1812(4532) **20**: 2220(5750)	**X**: X7R	Two significant digits followed by no. of zeros. And R is in place of decimal point. eg.: R47=0.47pF 0R5=0.5pF 1R0=1.0pF 100=10x10^0 =10pF	**J**=±5% **K**=±10% **M**=±20%	**101**: 100V **201**: 200V **251**: 250V **501**: 500V **631**: 630V **102**: 1000V **202**: 2000V **302**: 3000V	**E**: Tape and Reel, Embossed Tape No Code: Bulk	**C**: 1.25±0.10mm **D**: 1.40±0.15mm **E**: 1.60±0.20 mm **F**: 2.00±0.20 mm **G**: 2.50±0.30 mm	**G**: RoHS compliant

5. EXTERNAL DIMENSIONS

Size Inch (mm)	L (mm)	W (mm)	T (mm)	Remark	M_B min (mm)
0805 (2012)	2.00±0.20	1.25±0.20	0.80±0.10	B	0.30
			1.25±0.10	D	
1206 (3216)	3.20±0.20	1.60±0.20	0.80±0.10	B	0.30
			1.25±0.10	D	
			1.60±0.20	G	
1210 (3225)	3.20±0.40	2.50±0.30	1.40±0.15	F	0.30
			1.60±0.20	G	
1812 (4532)	4.50±0.40	3.20±0.30	1.60±0.20	G	0.26
			2.00±0.20	K	
			2.50±0.30	M	
2220 (5750)	5.70±0.40	5.00±0.40	2.00±0.20	K	0.30
			2.50±0.30	M	
			2.50±0.30	M	

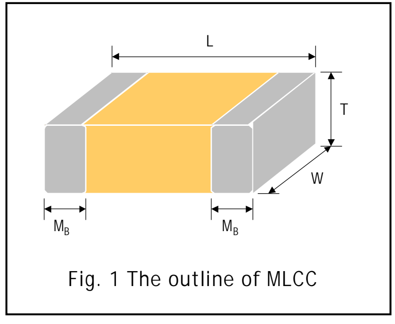


Fig. 1 The outline of MLCC

Reflow soldering only is recommended.

6.GENERAL ELECTRICAL DATA

Dielectric	X7R
Size	0805, 1206, 1210, 1812, 2220
Capacitance range*	470pF ~ 1.2μF
Capacitance tolerance	J (±5%), K (±10%), M(±20%)
Rated voltage (WVDC)	100V, 200V, 250V, 350V, 500V, 630V, 2000V
Tan δ	U_R<200V: 1.4% max. ; U_R≥200V: 1.0% max.
Insulation resistance at U_R**	≥10GΩ or R·C≥500Ω·F whichever is smaller
Operating temperature	-55 to +125°C
Capacitance characteristic	±15%
Termination	Ag / Ni / Sn

* Measured at the condition of 30~70% related humidity.
Apply 1.0±0.2Vrms, 1.0kHz±10%, at 25°C ambient temperature.

**Measured at 500VDC for 60 sec, for U_R>500VDC

7.CAPACITANCE RANGE

7-1. 0805, 1206, 1210, 1812, 2220 Sizes.

DIELECTRIC	X7R															
SIZE	0805			1206					1210				1812		1825	2220	
RATED	200	250	350	100	200	250	500	630	100	200	250	630	100	2000	100	100	250
100pF (101)	B	B	B														
120pF (121)	B	B	B														
150pF (151)	B	B	B	B/D	B/D	B/D	B/D	B/D									
180pF (181)	B	B	B	B/D	B/D	B/D	B/D	B/D									
220pF (221)	B	B	B	B/D	B/D	B/D	B/D	B/D									
270pF	B	B	B	B/D	B/D	B/D	B/D	B/D									
330pF	B	B	B	B/D	B/D	B/D	B/D	B/D									
390pF	B	B	B	B/D	B/D	B/D	B/D	B/D									
470pF	B	B	B	B/D	B/D	B/D	B/D	B/D	G	G	F/G	F	G	G			
560pF	B	B	B	B/D	B/D	B/D	B/D	B/D	G	G	F/G	F	G	G			
680pF	B	B	B	B/D	B/D	B/D	B/D	B/D	G	G	F/G	F	G	G			
820pF	B	B	B	B/D	B/D	B/D	B/D	B/D	G	G	F/G	F	G	G			
1,000pF	B	B	B	B/D	B/D	B/D	B/D	B/D	G	G	F/G	F	G	G	G	K	K
1,200pF	B	B	B	B/D	B/D	B/D	B/D	B/D	G	G	F/G	F	G	G	G	K	K
1,500pF	B	B	B	B/D	B/D	B/D	B/D	B/D	G	G	F/G	F	G	G	G	K	K
1,800pF	B	B	B	B/D	B/D	B/D	B/D	B/D	G	G	F/G	F	G	G	G	K	K
2,200pF	B	B	B	B/D	B/D	B/D	B/D	B/D	G	G	F/G	F	G	G	G	K	K
2,700pF	B	B	B	B/D	B/D	B/D	B/D	B/D	G	G	F/G	F	G	G	G	K	K
3,300pF	B	B	B	B/D	B/D	B/D	D	D	G	G	F/G	F	G	G	G	K	K
3,900pF	B	B	B	B/D	B/D	B/D	D	D	G	G	F/G	F	G	G	G	K	K
4,700pF	B	B	B	B/D	B/D	B/D	D	D	G	G	F/G	F	G	K	G	K	K
5,600pF	B	B	B	B/D	B/D	B/D	D	D	G	G	F/G	F	G		G	K	K
6,800pF	B	B	B	B/D	B/D	B/D	D	D	G	G	F/G	F	G		G	K	K
8,200pF	B	B	B	B/D	B/D	B/D	D	D	G	G	F/G	F	G		G	K	K
0.010μF	B	B	B	B/D	B/D	B/D	D	D	G	G	F/G	F	G		G	K	K
0.012μF	B	B	B	B/D	D	D	D	D	G	G	F/G	F	G		G	K	K
0.015μF	D	D	D	B/D	D	D	D	D	G	G	F/G	F	G		G	K	K
0.018μF	D	D	D	B/D	D	D	G	G	G	G	F/G	F	G		G	K	K
0.022μF	D	D	D	B/D	D	D	G	G	G	G	F/G	F	G		G	K	K
0.027μF				B/D	D	D	G	G	G	G	F/G	F	G		G	K	K
0.033μF				D	D	D	G		G	G	F/G	F	G		G	K	K
0.039μF				D	D	D			G	G	G	G	G		G	K	K
0.047μF				D	D	D			G	G	G	G	G		G	K	K
0.056μF				D	G	G			G	G	G		G		G	K	K
0.068μF				D	G	G			G	G	G		G		G	K	K
0.082μF				D	G	G			G	G	G		G		G	K	K
0.10μF				D	G	G			G	G	G		G		G	K	K
0.12μF				G					G	G	G		G		G	K	K
0.15μF				G					G	G	G		G		G	K	K
0.18μF				G					G				G		G	K	K
0.22μF				G					G				G		G	K	K
0.27μF									G				G		G	K	K
0.33μF									G				G		G	K	K
0.39μF													G		G	K	K
0.47μF													G		G	K	K
0.56μF													G		K	K	K
0.68μF													K		K	K	M
0.82μF													K		K	K	
1.0μF													M		K	K	
1.2μF																M	

8.PACKAGE DIMENSION AND QUANTITY

Size	Thickness (mm)	Paper tape		Plastic tape	
		7” reel	13” reel	7” reel	13” reel
0805 (2012)	0.80±0.10	4k	15k	-	-
	1.25±0.10	-	-	3k	10k
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)	1.40±0.15	-	-	2k	10k
	1.60±0.20	-	-	2k	-
1812 (4532)	1.60±0.20	-	-	1k	-
	2.00±0.20	-	-	1k	-
	2.50±0.30	-	-	0.5k	3k
2220 (5750)	2.00±0.20	-	-	1k	-
	2.50±0.30	-	-	0.5k	-

Unit: pieces

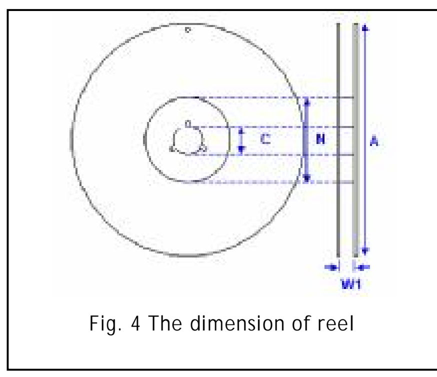


Fig. 4 The dimension of reel

Size	0805, 1206, 1210			1812, 2220
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	60.5±1.0	100.0±1.0	100±1.0	60.5±1.0

8-1. CARDBOARD TAPE DIMESIONS

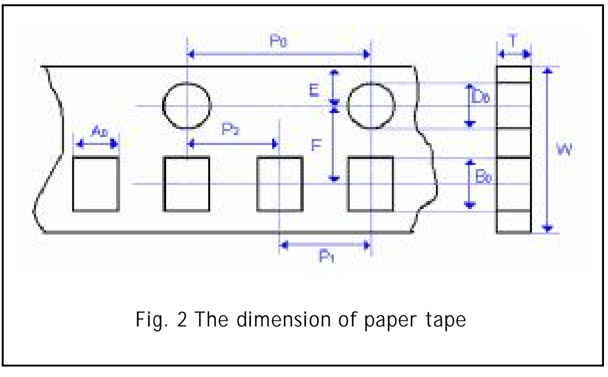


Fig. 2 The dimension of paper tape

8-2. EMBOSSED TAPE DIMENSIONS

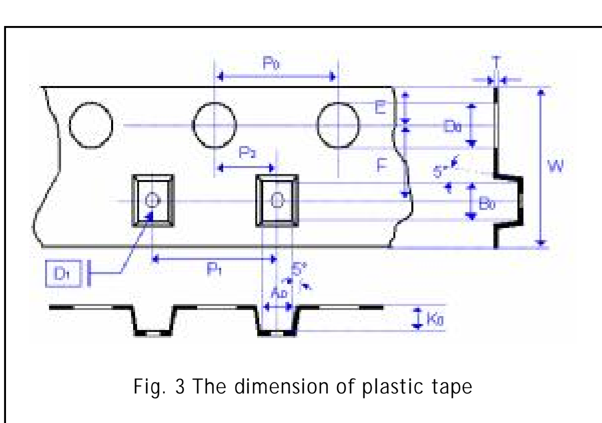


Fig. 3 The dimension of plastic tape

Size	0805		1206			1210	1812		2220	
Chip Thickness	0.80±0.10	1.25±0.10	0.80±0.10	1.25±0.10	1.60±0.20	1.40±0.15 1.60±0.20	1.60±0.20 2.00±0.20	2.50±0.30	2.00±0.20	2.50±0.30
A_0	1.50±0.10	<1.57	2.00±0.10	<1.85	<1.95	<2.97	<3.90	<3.90	<5.50	<5.50
B_0	2.30±0.10	<2.40	3.50±0.10	<3.46	<3.67	<3.73	<5.30	<5.30	<6.50	<6.50
T	0.95±0.05	0.23±0.05	0.95±0.05	0.23±0.05	0.23±0.05	0.23±0.05	0.25±0.05	0.25±0.05	0.30±0.10	0.30±0.10
K_0	-	<2.50	-	<2.50	<2.50	<2.50	<2.50	<3.0	<2.50	<3.10
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	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±0.100	4.00±0.10	4.00±0.10	4.00±0.10	4.00±0.10
$10xP_0$	40.0±0.10	40.0±0.10	40.0±0.10	40.0±0.10	40.0±0.10	40.0±0.10	40.0±0.10	40.0±0.20	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	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	2.00±0.05	2.00±0.05
D_0	1.55±0.05	1.50±0.05	1.50±0.05	1.50±0.05	1.50±0.05	1.50±0.05	1.50+0.10/-0.00	1.50+0.10/-0.00	1.50+0.10/-0.00	1.50+0.10/-0.00
D_1	-	1.00±0.10	-	1.00±0.10	1.00±0.10	1.00±0.10	1.50±0.10	1.50+/-0.10	1.50±0.10	1.50±0.10
E	1.75±0.05	1.75±0.10	1.75±0.10	1.75±0.10	1.75±0.10	1.75±0.10	1.75±0.10	1.75+/-0.1	1.75±0.1	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	5.50±0.05	5.50+/-0.05	5.50±0.05	5.50±0.05

9.APPLICATION NOTES

STORAGE

To prevent the damage of solderability of terminations, the following storage conditions are recommended: Indoors under 5 ~ 40℃ 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℃ per second and the final preheat temperature should be within 100℃ of the soldering temperature for small chips such as 0603, 0805 and 1206, within 50℃ of the soldering temperature for bigger chips such as 1210, 1808, 1812, 2220 and 2225, etc.

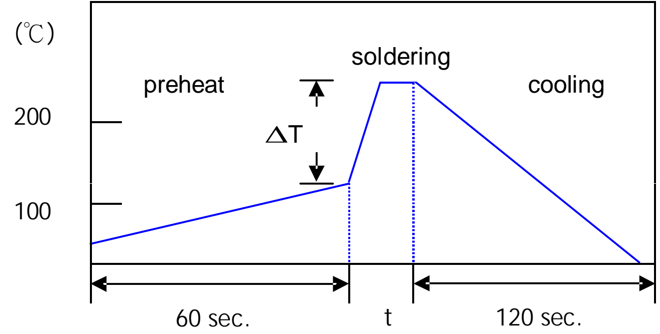
SOLDERING

Use middy 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℃.

For bigger chips such as 1210, 1808, 1812, 2220 and 2225, etc. wave soldering and hand soldering are no recommended.

Recommended soldering profiles as following:



Soldering	Solder Temp.(T)	Soldering Time (t)
Reflow	235 – 250 ℃	< 15 sec.
Wave	230 – 250 ℃	< 5 sec.

Chip Size	ΔT
0603, 0805, 1206	100 ℃
1210, 1808, 1812, 2220, 2225	50 ℃

COOLING

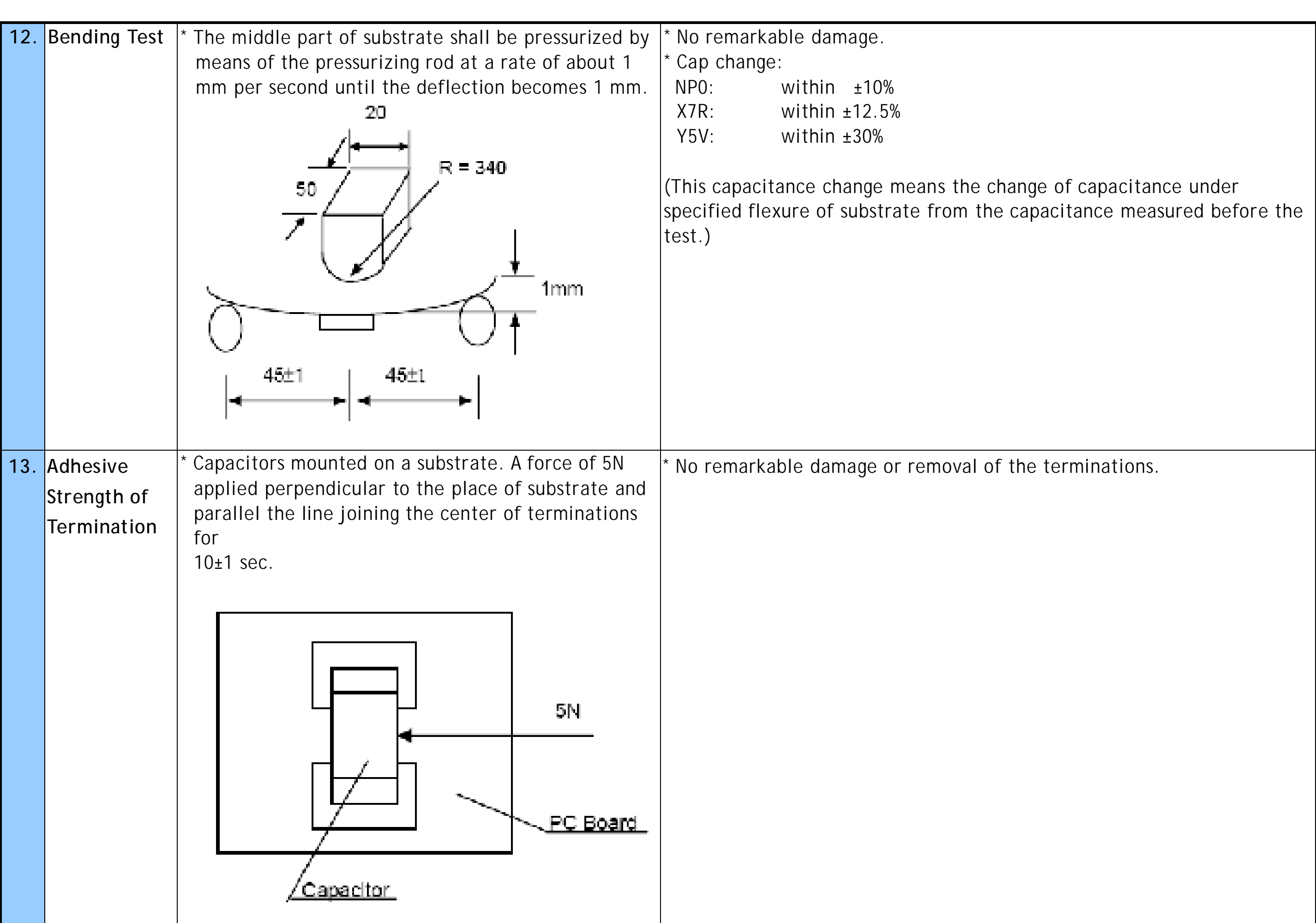
After soldering, cool the chips and the substrate gradually to room temperature. Natural cooling in air is recommended to minimize stress in the solder joint. A cooling rate not exceeding 4℃ per second should be used when forced cooling is necessary.

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.

10.RELIABILITY TEST CONDITIONS AND REQUIREMENTS

<table>
<tr><th>No.</th><th>Item</th><th>Test Condition</th><th>Requirements</th></tr>
<tr><td>1.</td><td>Visual and Mechanical</td><td>---</td><td>* No remarkable defect.
* Dimensions to conform to individual specification sheet.</td></tr>
<tr><td>2.</td><td>Capacitance</td><td rowspan="2">1.0±0.2Vrms, 1kHz±10%</td><td>* Shall not exceed the limits given in the detailed spec.</td></tr>
<tr><td>3.</td><td>D.F. (Dissipation Factor)</td><td>U_R < 200V: D.F ≤ 1.40%
U_R ≥ 200V: D.F ≤ 1.00%</td></tr>
<tr><td>4.</td><td>Dielectric Strength</td><td>* To apply voltage:
U_R= 100V =2.5 times of U_R
U_R =200V/250V =2 times of U_R U_R
=350/500V =1.5 times of U_R
U_R >500V =1.2 times of U_R
* Duration: 1 to 5 sec.</td><td>* No evidence of damage or flashover during test.</td></tr>
<tr><td>5.</td><td>Insulation Resistance</td><td>U_R>100V: To apply voltage at U_R (500V max.) for 60 sec.</td><td>≥10GΩ or R·C≥500Ω-F whichever is smaller.</td></tr>
<tr><td>6.</td><td>Temperature Coefficient</td><td>With no electrical load.<table><tr><th>T.C.</th><th>Operating Temp</th></tr><tr><td>X7R</td><td>-55~125°C at 25°C</td></tr></table></td><td><table><tr><th>T.C.</th><th>Capacitance Change</th></tr><tr><td>X7R</td><td>Within ±15%</td></tr></table></td></tr>
<tr><td>7.</td><td>Solderability</td><td>* Solder temperature: 245±5°C
* Dipping time: 5±0.5 sec.</td><td>75% min. coverage of all metalized area.</td></tr>
<tr><td>8.</td><td>Resistance to Soldering Heat</td><td>* Solder temperature: 260±5°C
* Dipping time: 10±1 sec
* Preheating: 120 to 150°C for 1 minute before immerse the capacitor in a eutectic solder.
* Before initial measurement: Perform 150+0/-10°C fo 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.</td><td>* No remarkable damage.
* Cap change is within ±7.5%
* 25% max. leaching on each edge.</td></tr>
<tr><td>9.</td><td>Temperature Cycle</td><td>* Conduct the five cycles according to the temperatures and time.<table><tr><th>Step</th><th>Temp. (°C)</th><th>Time (min.)</th></tr><tr><td>1</td><td>Min. operating temp. +0/-3</td><td>30±3</td></tr><tr><td>2</td><td>Room temp.</td><td>2~3</td></tr><tr><td>3</td><td>Max. operating temp. +3/-0</td><td>30±3</td></tr><tr><td>4</td><td>Room temp.</td><td>2~3</td></tr></table>* Before initial measurement: Perform 150+0/-10°C fo 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.</td><td>* No remarkable damage.
* Cap change is within ±15%
* Q/D.F. ≤1.5 × Initial requirement
* I.R.≥ 0.25 × initial requirements.</td></tr>
<tr><td>10.</td><td>Humidity (Damp Heat) Steady State</td><td>* 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.</td><td>* No remarkable damage.
* Cap change is within ±15%
* Q/D.F. ≤1.5 × Initial requirement
* I.R.≥ 0.25 × initial requirements.</td></tr>
<tr><td>11.</td><td>High Temperature Load (Endurance)</td><td>* Test temp.:
NP0, X7R: 125±3°C
Y5V: 85±3°C
* To apply voltage:
(1) 100V<U_R≤250V: 200% of rated voltage.
(2) 250<U_R≤500V: 150% of rated voltage.
(3) U_R≥630V: 120% of rated voltage.
* Test time: 1000+24/-0 hrs.
* Measurement to be made after keeping at room temp. for 48±4 hrs.</td><td>* No remarkable damage.
* Cap change is within ±20%
* D.F value ≤7.0%
* I.R.≥ 0.25 × initial requirements.</td></tr>
</table>



12.	Bending Test	* The middle part of substrate shall be pressurized by means of the pressurizing rod at a rate of about 1 mm per second until the deflection becomes 1 mm.	* No remarkable damage. * Cap change: NP0: within ±10% X7R: within ±12.5% Y5V: within ±30% (This capacitance change means the change of capacitance under specified flexure of substrate from the capacitance measured before the test.)
13.	Adhesive Strength of Termination	* 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 sec.	* No remarkable damage or removal of the terminations.