FEATURES

- Peak Impulse Surge: 5,000 VDC
- Dielectric withstand strength: 1,500VAC

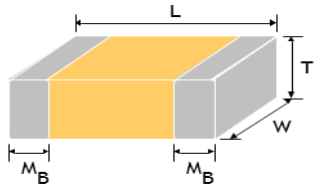
PART NUMBER DESCRIPTION

1808	S	302	N	100	J	C	E
Size	Series	Rated Voltage	Dielectric	Capacitance	Tolerance	Termination	Packaging
1808 (4520) 1812 (4532) 2211 (5728) 2220 (5750)	S: X1/Y2 Safety	302: 3,000V	N: NP0 X: X7R	100: 10pF 101: 100pF	J: ±5% K: ±10%	C: Cu/Ni/Sn	E: 7" Plastic Tape Q: 13" Plastic Tape Z or blank: Bulk

GENERAL ELECTRICAL DATA

Dielectric	NP0, X7R
Size	1808, 1812, 2211, 2220
Capacitance Range	100pF to 4,700pF
Capacitance tolerance	J (±5%), K (±10%)
Rated voltage (WVAC)	250V_{RMS}
Q	NP0: Cap<30pF,Q≥400+20C Cap≥30pF, Q≥1000 X7R: DF ≤ 2.5%
Insulation resistance (25°C)	≥10GΩ
Dielectric withstand strength	1,500VAC
Peak impulse voltage	5,000V
Operating temperature	-55°C to +125°C
Temperature coefficient of capacitance	NP0: ±30ppm X7R: ±15%
Termination	Ni/Sn (lead-free termination)
Certified Number	TUV: R50195920, UL: R250427, R182369
Test Standard	EN 60384-14, UL 60950:2000, UL 60384-14

EXTERNAL DIMENSIONS

Outline	Case Size EIA (mm)	L (mm)	W (mm)	T (mm)	Soldering Method	M_B (mm)
	1808 (4520)	4.50 +0.5/-0.3	2.03 ±0.25	1.40 ±0.15	R	0.26
				1.60 ±0.20		
				2.00 ±0.20		
	1812 (4532)	4.50 +0.5/-0.3	3.20 ±0.30	1.60 ±0.20	R	0.26
				2.00 ±0.20		
				2.50 ±0.30		
	2220 (5750)	5.70 ±0.40	5.00 ±0.40	2.00 ±0.20	R/W	0.30
				2.50 ±0.30		
	2211 (5728)	5.70 ±0.40	2.80 ±0.30	1.60 ±0.20	R / W	0.30
				2.00 ±0.20		
				2.50 ±0.30		

THICKNESS CODES/PACKAGING QUANTITY

Case Size	Size Code	Max Thickness (mm)	Length (mm)	Width (mm)	Thickness (mm)	Paper Tape		Embossed Plastic Tape	
						7" Reel	13" Reel	7" Reel	13" Reel
1808	GE	1.55	4.50 +0.5/-0.3	2.03 ±0.25	1.40 ±0.15	-	-	2,000	-
	GF	1.80			1.60 ±0.20	-	-	1,000	
	GH	2.20			2.00 ±0.20	-	-	1,000	
1812	HB	1.80	4.5 +0.5/-0.3	3.20 ±0.30	1.60 ±0.20	-	-	1,000	-
	HC	2.20			2.00 ±0.20	-	-	1,000	-
	HD	2.80			2.50 ±0.30	-	-	500	-
2220	JA	2.20	1.40 +0.33/-0.25	5.00 ±0.40	2.00 ±0.20	-	-	1,000	-
	JB	2.80			2.50 ±0.30	-	-	500	
2211	LA	1.80	1.6 ±0.1	2.80 ±0.30	1.60 ±0.20	-	-	1,000	-
	LB	2.20			2.00 ±0.20	-	-	1,000	-
	LC	2.80			2.50 ±0.30	-	-	500	-

NP0 Dielectric

		Tolerance	1808	1812	2211
			3,000 Rated (VDC) 5,000 Peak Impulse Surge	3,000 Rated (VDC) 5,000 Peak Impulse Surge	3,000 Rated (VDC) 5,000 Peak Impulse Surge
4R0	4.0 pF	J	GE		LB
5R0	5.0 pF		GE		LB
100	10 pF		GE	HB	LB
120	12 pF		GE	HB	LB
150	15 pF		GE	HB	LB
180	180 pF		GE	HB	LB
220	220 pF		GE	HB	LB
270	270 pF		GE	HB	LB
330	330 pF		GE	HB	LB
390	390 pF		GF	HB	LB
470	470 pF		GF	HB	LB
560	560 pF		GF	HB	LB
680	680 pF	K	GF	HB	LB
820	820 pF		GF	HB	LB
101	100 pF		GH	HB	LB
121	120 pF		GH	HB	LC
151	150 pF		GH	HB	LC
181	180 pF			HB	LC
221	220 pF			HC	LC
271	270 pF			HC	LC
331	330 pF			HC	LC
391	390 pF			HC	LC
471	470 pF			HC	LC
561	560 pF				LC
681	680 pF				LC

X7R Dielectric

		Tolerance	1808	1812	2211	2220
			3,000 Rated (VDC) 5,000 Peak Impulse Surge	3,000 Rated (VDC) 5,000 Peak Impulse Surge	3,000 Rated (VDC) 5,000 Peak Impulse Surge	3,000 Rated (VDC) 5,000 Peak Impulse Surge
101	100 pF	J	GF			
121	120 pF		GF			
151	150 pF		GF	HB	LA	
181	180 pF		GF	HB	LA	JA
221	220 pF		GF	HB	LA	JA
271	270 pF		GH	HB	LA	JA
331	330 pF		GH	HB	LA	JA
391	390 pF		GH	HB	LA	JA
471	470 pF	K	GH	HB	LB	JA
561	560 pF		GH	HB	LB	JA
681	680 pF		GH	HC	LB	JA
821	820 pF		GH	HC	LB	JA
102	1000 pF		GH	HD	LC	JA
122	1200 pF				LC	JB
152	1500 pF				LC	JB
182	1800 pF				LC	JB
222	2200 pF				LC	JB
332	3300 pF					JB
472	4700 pF					JB

<table>
<tr><th></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 conform to individual specification sheet</td></tr>
<tr><td>2</td><td>Capacitance</td><td rowspan="2"></td><td>* Shall not exceed the limits given in the detailed spec</td></tr>
<tr><td>3</td><td>Q/ DF (Dissipation Factor)</td><td>NP0: Cap≥30pF, Q≥1000, Cap<30pF,Q≥400+20C
X7R, X5R:
<table>
<tr><th>Rated voltage (DCV)</th><th>D.F. ≤</th><th colspan="2">Exception of D.F. ≤</th></tr>
<tr><td rowspan="3">≥ 50V</td><td rowspan="3">≤ 2.5%</td><td>≤3%</td><td>0201(50V), 0603 ≥ 0.047μF,
0805 ≥ 0.18μF, 1206 ≥ 0.47μF</td></tr>
<tr><td>≤5%</td><td>1210 ≥ 4.7μF</td></tr>
<tr><td>≤10%</td><td>0603≥1μF, 0805≥1μF,1206≥2.2μF, 1210≥10μF</td></tr>
<tr><td>35V</td><td>≤3.5%</td><td>≤10%</td><td>0805≥2.2μF, 1210≥10μF</td></tr>
<tr><td rowspan="3">25V</td><td rowspan="3">≤3.5%</td><td>≤5%</td><td>0201≥0.01μF,0805≥1μF, 1210≥10μF</td></tr>
<tr><td>≤7%</td><td>0603≥0.33μF, 1206≥4.7μF</td></tr>
<tr><td>≤10%</td><td>0402≥0.10μF,0603≥0.47μF, 0805≥2.2μF,</td></tr>
<tr><td rowspan="2">16V</td><td rowspan="2">≤3.5%</td><td>≤5%</td><td>0201≥0.01μF,0402≥0.033μF, 0603≥0.15μF,
0805≥0.68μF, 1206≥2.2μF,1210≥4.7μF</td></tr>
<tr><td>≤10%</td><td>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>0201≥0.012μF,0402≥0.33μF,0603≥0.33μF,0805
≥2.2μF, 1206≥2.2μF,1210≥22μF</td></tr>
<tr><td>≤15%</td><td>0201≥0.1μF, 0402≥1μF</td></tr>
<tr><td>6.3V</td><td>≤10%</td><td>≤15%</td><td>0201≥0.1μF,0402≥1μF,0603≥10μF,
0805≥4.7μF, 1206≥47μF :1210≥100μF</td></tr>
<tr><td></td><td></td><td>≤20%</td><td>0402≥2.2μF</td></tr>
<tr><td>4V</td><td>≤15%</td><td>---</td><td>---</td></tr>
</table>
Y5V:
<table>
<tr><th>Rated voltage</th><th>D.F. ≤</th><th colspan="2">Exception of D.F.≤</th></tr>
<tr><td>≥50V</td><td>≤5%</td><td>≤7%</td><td>0603≥0.1μF, 0805≥0.47μF, 1206≥4.7μF,
Cap≥1μF</td></tr>
<tr><td>35V</td><td>≤7%</td><td>---</td><td>---</td></tr>
<tr><td rowspan="2">25V</td><td rowspan="2">≤5%</td><td>≤7%</td><td>0402≥0.047μF,0603≥0.1μF,
0805≥0.33μF,1206≥1μF, 1210≥4.7μF</td></tr>
<tr><td>≤9%</td><td>0402≥0.068μF,0603≥0.47μF, 1206≥4.7μF,
1210≥22μF, Cap≥1μF</td></tr>
<tr><td>16V
(C<1.0μF)</td><td>≤7%</td><td>≤9%
≤12.5%</td><td>0402≥0.068μF, 0603≥0.68μF
0402≥0.22μF</td></tr>
<tr><td>16V
(C≥1.0μF)</td><td>≤9%</td><td>≤12.5%</td><td>0603≥2.2μF, 0805≥3.3μF,1206≥10μF,
1210≥22μF, 1812≥47μF, Cap≥1μF</td></tr>
<tr><td>10V</td><td>≤12.5%</td><td>≤20%</td><td>0402≥0.47μF</td></tr>
<tr><td>6.3V</td><td>≤20%</td><td>---</td><td>---</td></tr>
</table></td></tr>
<tr><td>4</td><td>Dielectric Strength</td><td>*To apply voltage(≤100V) 250%.
*Duration: 1 to 5 sec.
*Charge & discharge current less than 50mA.

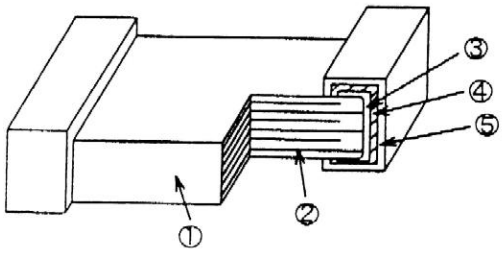
*To apply voltage:
200V ~300V & LD series ≥2 times VDC
500V ~ 999V ≥1.5 times VDC
1000V ~ 3000V ≥1.2 times VDC
*Cut-off, set at 10mA
*TEST= 15 sec. *RAMP=0</td><td>*No evidence of damage or flash over during test.</td></tr>
<tr><td>5</td><td>Insulation Resistance</td><td>To apply rated voltage for max. 120 sec.

Rated Voltage: 200V ~ 630V — To apply rated voltage (500V max.) for 60 sec.
>630V — To apply 500V for 60sec.</td><td>10GΩ or RxC≥500Ω-F whichever is lower.
Class II (X7R, X7E, X5R, Y5V):
<table>
<tr><th>Rated voltage</th><th>Insulation Resistance</th></tr>
<tr><td>100V: X7R</td><td rowspan="7">10GΩ or RxC≥100 Ω-F
whichever is lower.</td></tr>
<tr><td>50V:0603≥1μF,0805≥1μF, 1206≥2.2μF, 1210≥4.7μF</td></tr>
<tr><td>35V:0805≥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: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,</td></tr>
</table>
>10GΩ or 100Ω-F whichever is lower.
>10GΩ</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>NPO (C0G)
NPO (C0H)
NPO (C0J)
X7R</td><td>-55~125°C at 25°C</td></tr>
<tr><td>X5R</td><td>-55~ 85°C at 25°C</td></tr>
<tr><td>Y5V</td><td>-25~ 85°C at 20°C</td></tr>
</table></td><td>
<table>
<tr><th>T.C.</th><th>Capacitance Change</th></tr>
<tr><td>NPO (C0G)</td><td>Within ±30ppm/°C</td></tr>
<tr><td>NPO (C0H)</td><td>Within ±60ppm/°C</td></tr>
<tr><td>NPO (C0J)</td><td>Within ±120ppm/°C</td></tr>
<tr><td>X7R</td><td>Within ±15%</td></tr>
<tr><td>X5R</td><td>Within ±15%</td></tr>
<tr><td>Y5V</td><td>Within +30%/-80%</td></tr>
</table></td></tr>
<tr><td>7</td><td>Adhesive Strength of Termination</td><td>*Pressurizing force：
0201: 2N
0402 & 0603: 5N
>0603: 10N
Test time：10 ±1 sec</td><td> No remarkable damage or removal of the terminations.</td></tr>
</table>

<table>
<tr><th></th><th>Item</th><th>Test Condition</th><th>Requirements</th></tr>
<tr><td>8</td><td>Vibration Resistance</td><td>* Vibration frequency: 10~55 Hz/min.
* Total amplitude: 1.5mm
* Test time: 6 hours
(Two hrs each in three mutually perpendicular directions)
* Measurement to be made after keeping at room temp. for 24±2 hours</td><td>* No remarkable damage.
* Cap change and Q/D.F.: To meet initial spec.</td></tr>
<tr><td>9</td><td>Solderability</td><td>* Solder temperature: 235±5°C
* Dipping time: 2±0.5 sec.</td><td>95% min. coverage of all metalized area.</td></tr>
<tr><td>10</td><td>Bending Test</td><td>*The middle part of substrate shall be pressurized by means of the pressurizing rod at a rate of approximately 1 mm per second until the deflection becomes 1 mm and then the pressure shall be maintained for 5±1 sec.
Measurement to be made after keeping at room temp. for 24±2 hrs.</td><td> No remarkable damage.
* Capacitance change ：
NP0: within ±5% or 0.5pF whichever is larger
X7R, X7E, X5R: 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.)</td></tr>
<tr><td>11</td><td>Resistance to Soldering Heat</td><td>* Solder temperature: 260±5°C
* Dipping time: 10±1 sec
* Preheating: 120 to 150°C for 1 minute before immersing the capacitor in an eutectic solder.
* Before initial measurement (Class II only): Perform 150+0/-10°C for 1 hr and then set for 24±2 hrs at room temp.
* Measurement to be made after keeping at room temp. for 24±2 hrs.</td><td>* No remarkable damage.
* Capacitance change:
NP0: within ±2.5% or 0.25pF whichever is larger
X7R, X7E, X5R: within ±7.5%
Y5V: within ±20%
* Q/D.F., I.R. and dielectric strength: To meet initial requirements.
* 25% max. leaching on each edge.</td></tr>
<tr><td>12</td><td>Temperature Cycle</td><td>* Conduct the five cycles according to the temperatures and time.
<table>
<tr><th>Step</th><th>Temp. (°C)</th><th>Time (min.)</th></tr>
<tr><td>1</td><td>Min. operating temp. +0/-3</td><td>30±3</td></tr>
<tr><td>2</td><td>Room temp.</td><td>2~3</td></tr>
<tr><td>3</td><td>Max. operating temp. +3/-0</td><td>30±3</td></tr>
<tr><td>4</td><td>Room temp.</td><td>2~3</td></tr>
</table>
* Before initial measurement (Class II only): Perform 150+0/-10°C for 1 hr and then set for 24±2 hrs at room temp.
* Measurement to be made after keeping at room temp. for 24±2 hrs.</td><td>* No remarkable damage.
* Capacitance change
NP0: within ±2.5% or 0.25pF whichever is larger
X7R, X7E, X5R: within ±7.5%
Y5V: within ±20%
* Q/D.F., I.R. and dielectric strength: To meet initial requirements.</td></tr>
<tr><td>13</td><td>Humidity (Damp Heat) Steady State</td><td>* Test temp.: 40±2°C
* Humidity: 90~95% RH
* Test time: 500+24/-0hrs.
* Before initial measurement (Class II only): Perform 150 +0/-10°C for 1 hr and then set for 24±2 hrs. at room temp.
* Measurement to be made after keeping at room temp. for 24±2 hrs.</td><td>* No remarkable damage.
* Cap change: NP0: within ±5% or 0.5pF whichever is larger
X7R, X7E, X5R: ≥10V**,within ±12.5%;6.3V within ±25%;TT series,within ±25%
**10V:0603≥4.7μF;0402≥1μF;0201≥0.1μF, within ±25%;
Y5V: ≥10V, within ±30%; 6.3V, within +30/-40%
* Q/D.F. value:
NP0: More than 30pF Q≥350, 10pF≤C≤30pF, Q≥275+2.5C,Less than 10pF Q≥200+10C
X7R, X5R:
<table>
<tr><th>Rated vol.</th><th>D.F.≤</th><th colspan="2">Exception of D.F.≤</th></tr>
<tr><td rowspan="3">≥50V</td><td rowspan="3">≤3%</td><td>≤6%</td><td>0201(50V); 0603≥0.047μF; 0805≥0.18μF; 1206≥0.47μF</td></tr>
<tr><td>≤10%</td><td>1210≥4.7μF</td></tr>
<tr><td>≤20%</td><td>0603≥1μF; 0805≥1μF; 1206≥2.2μF; 1210≥10μF</td></tr>
<tr><td>35V</td><td>≤5%</td><td>≤20%</td><td>0805≥2.2μF;1210≥10μF</td></tr>
<tr><td rowspan="3">25V</td><td rowspan="3">≤5%</td><td>≤10%</td><td>0201≥0.01μF;0805≥1μF; 1210≥10μF</td></tr>
<tr><td>≤14%</td><td>0603≥0.33μF;1206≥4.7μF</td></tr>
<tr><td>≤15%</td><td>6≥6.8μF1210≥22μF</td></tr>
<tr><td rowspan="2">16V</td><td rowspan="2">≤5%</td><td>≤10%</td><td>0603≥0.15μF;0805≥0.68μF;1206≥2.2μF;1210≥4.7μF</td></tr>
<tr><td>≤15%</td><td>0201≥0.01μF;0402≥0.033μF;0603≥0.68μF;0805≥2.2μF; 1206≥4.7μF; 1210≥22μF</td></tr>
<tr><td rowspan="2">10V</td><td rowspan="2">≤7.5%</td><td>≤15%</td><td>0201≥0.012μF; 0402≥0.33μF; 0603≥0.33μF;0805≥2.2μF; 1206≥2.2μF;</td></tr>
<tr><td>≤20%</td><td>0201≥0.1μF ;0402≥1μF</td></tr>
<tr><td>6.3V</td><td>≤15%</td><td>≤30%</td><td>0201≥0.1μF;0402≥1μF;0603≥10μF; 0805≥4.7μF;</td></tr>
<tr><td>4V</td><td>≤20%</td><td>---</td><td>---</td></tr>
</table>
Y5V:
<table>
<tr><th>Rated vol.</th><th>D.F.≤</th><th colspan="2">Exception of D.F.≤</th></tr>
<tr><td>≥50V</td><td>≤7.5%</td><td>≤10%</td><td>0603≥0.1μF; 0805≥0.47μF; 1206≥4.7μF; Cap≥1μF</td></tr>
<tr><td>35V</td><td>≤10%</td><td>---</td><td>---</td></tr>
<tr><td rowspan="4">25V</td><td rowspan="4">≤7.5%</td><td rowspan="2">≤10%</td><td>0402≥0.047μF;0603≥0.1μF;0805≥0.33μF;</td></tr>
<tr><td>1206≥1μF; 1210≥4.7μF</td></tr>
<tr><td rowspan="2">≤15%</td><td>0402≥0.068μF;0603≥0.47μF;1206≥4.7μF;</td></tr>
<tr><td>1210≥22μF; Cap≥1μF</td></tr>
<tr><td>16V
(C<1.0μF)</td><td>≤10%</td><td>≤12.5%</td><td>0402≥0.068μF; 0603≥0.68μF</td></tr>
<tr><td></td><td></td><td>≤20%</td><td>0402≥0.22μF</td></tr>
<tr><td>16V
(C≥1.0μF)</td><td>≤12.5%</td><td>≤20%</td><td>0603≥2.2μF;0805≥3.3μF;1206≥10μF;1210≥22μF;
1812≥47μF; Cap≥1μF</td></tr>
<tr><td>10V</td><td>≤20%</td><td>≤30%</td><td>0402≥0.47μF</td></tr>
<tr><td>6.3V</td><td>≤30%</td><td>---</td><td>---</td></tr>
</table>
*I.R.: ≥10V, 1GΩ or 50 Ω-F whichever is lower.
Class II (X7R, X7E, X5R, Y5V)
<table>
<tr><th>Rated voltage</th><th>Insulation Resistance</th></tr>
<tr><td>100V: X7R
50V:0603≥1μF;0805≥1μF; 206≥2.2μF;1210≥4.7μF
25V:0402≥1μF;0603≥2.2μF;0805≥2.2μF;1206≥10μF;1210≥10μF
16V: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</td><td>1GΩ or RxC≥10 Ω-F whichever is lower.</td></tr>
</table></td></tr>
</table>

<table>
<tr><th></th><th>Item</th><th>Test Condition</th><th>Requirements</th></tr>
<tr><td>14</td><td>Humidity (Damp Heat) Load</td><td>* Test temp.: 40±2°C
* Humidity: 90~95%RH
* Test time: 500+24/-0 hrs.
* Voltage :
Rated voltage.(Max.500V)
* Before initial measurement (Class II only): To apply test voltage for 1hr at 40°C and then set for 24±2 hrs at room temp.* Measurement to be made after keeping at room temp. for 24±2 hrs.</td><td>* No remarkable damage.
Cap change:
NP0: ±7.5% or 0.75pF whichever is larger.
X7R, X7E, X5R: ≥10V**,within ±12.5%;6.3V within ±25%;
**10V:0603≥4.7μF;0402≥1μF;0201≥0.1μF, within ±25%;
Y5V: ≥10V, within ±30%; 6.3V, within +30/-40%
Q/D.F. value:
NP0: C≥30pF,Q≥200;C<30pF, Q≥100+10/3C
X7R, X5R:
<table><tr><th>Rated voltage</th><th>D.F.≤</th><th colspan="2">Exception of D.F. ≤</th></tr><tr><td rowspan="3">≥50V</td><td rowspan="3">≤3%</td><td>≤6%</td><td>0201(50V);0603≥0.047μF; 0805≥0.18μF; 1206≥0.47μF</td></tr><tr><td>≤10%</td><td>1210≥4.7μF</td></tr><tr><td>≤20%</td><td>0603≥1μF; 0805≥1μF; 1206≥2.2μF; 1210≥10μF</td></tr><tr><td>35V</td><td>≤5%</td><td>≤20%</td><td>0805≥2.2μF;1210≥10μF</td></tr><tr><td rowspan="3">25V</td><td rowspan="3">≤5%</td><td>≤10%</td><td>0201≥0.01μF;0805≥1μF; 1210≥10μF</td></tr><tr><td>≤14%</td><td>0603≥0.33μF;1206≥4.7μF</td></tr><tr><td>≤15%</td><td>0402≥0.10μF;0603≥0.47μF;0805≥2.2μF; 1206≥6.8μF;1210≥22μF</td></tr><tr><td rowspan="2">16V</td><td rowspan="2">≤5%</td><td>≤10%</td><td>0603≥0.15μF;0805≥0.68μF;1206≥2.2μF;1210≥4.7μF</td></tr><tr><td>≤15%</td><td>0201≥0.01μF;0402≥0.033μF;0603≥0.68μF;0805≥2.2μF; 1206≥4.7μF; 1210≥22μF</td></tr><tr><td rowspan="2">10V</td><td rowspan="2">≤7.5%</td><td>≤15%</td><td>0201≥0.012μF;0402≥0.33μF; 0603≥0.33μF;0805≥2.2μF; 1206≥2.2μF; 1210≥22μF</td></tr><tr><td>≤20%</td><td>0201≥0.1μF ;0402≥1μF</td></tr><tr><td>6.3V</td><td>≤15%</td><td>≤30%</td><td>0201≥0.1μF;0402≥1μF;0603≥10μF; 0805≥4.7μF;1206≥47μF;1210≥100μF</td></tr><tr><td>4V</td><td>≤20%</td><td>---</td><td>---</td></tr></table>X7R/X7E, LD series : DF≤3%
Y5V:
<table><tr><th>Rated voltage</th><th>D.F.≤</th><th colspan="2">Exception of D.F.≤</th></tr><tr><td>≥50V</td><td>≤7.5%</td><td>≤10%</td><td>0603≥0.1μF; 0805≥0.47μF;1206≥4.7μF; Cap≥1μF</td></tr><tr><td>35V</td><td>≤10%</td><td>---</td><td>---</td></tr><tr><td rowspan="2">25V</td><td rowspan="2">≤7.5%</td><td>≤10%</td><td>0402≥0.047μF;0603≥0.1μF;0805≥0.33μF;1206≥1μF; 1210≥4.7μF</td></tr><tr><td>≤15%</td><td>0402≥0.068μF;0603≥0.47μF;1206≥4.7μF;1210≥22μF; Cap≥1μF</td></tr><tr><td rowspan="2">16V (C<1.0μF)</td><td rowspan="2">≤10%</td><td>≤12.5%</td><td>0402≥0.068μF; 0603≥0.68μF</td></tr><tr><td>≤20%</td><td>0402≥0.22μF</td></tr><tr><td>16V (C≥1.0μF)</td><td>≤12.5%</td><td>≤20%</td><td>0603≥2.2μF;0805≥3.3μF;1206≥10μF;1210≥22μF;1812≥47μF; Cap≥1μF</td></tr><tr><td>10V</td><td>≤20%</td><td>≤30%</td><td>0402≥0.47μF</td></tr><tr><td>6.3V</td><td>≤30%</td><td>---</td><td>---</td></tr></table>*I.R.: ≥10V, 500MΩ or 25 Ω-F whichever is lower. Class II (X7R, X7E, X5R, Y5V)
<table><tr><th>Rated voltage</th><th>Insulation Resistance</th></tr><tr><td>100V: X7R</td><td rowspan="6">500MΩ or RxC≥5 Ω-F whichever is lower.</td></tr><tr><td>50V:0603≥1μF;0805≥1μF; 1206≥2.2μF;1210≥4.7μF</td></tr><tr><td>25V:0402≥1μF;0603≥2.2μF;0805≥2.2μF;1206≥10μF;1210≥10μF</td></tr><tr><td>16V: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></table></td></tr>
<tr><td>15</td><td>High Temperature Load (Endurance)</td><td>*Test temp. :
NP0, X7R/X7E: 125±3°C
X5R, Y5V: 85±3°C
*Test time: 1000+24/-0 hrs.
*To apply voltage:
(1) 6.3V or C≥10μF 150% of rated voltage:
(2) 10V≤Ur<500V: 200% of rated voltage.
(3) 500V: 150% of rated voltage.
(4) Ur≥630V: 120% of rated voltage.(5) 100% of rated voltage for below range:
<table><tr><th>Size</th><th>Dielectric</th><th>Rated voltage</th></tr><tr><td>0201</td><td>X5R/X7R</td><td>6.3V,10V</td></tr><tr><td>0402</td><td>X5R/X7R</td><td>6.3V,10V</td></tr><tr><td>0603</td><td>X5R/X7R</td><td>6.3V,10V</td></tr><tr><td>0805</td><td>X5R/X7R</td><td>6.3V</td></tr><tr><td>1206</td><td>X5R/X7R
NP0</td><td>6.3V
3000V</td></tr></table>(6)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>0402</td><td>X5R/X7R
Y5V</td><td>10V,16V,25V
16V</td><td>C≥0.22μF
C≥0.47μF</td></tr><tr><td>0603</td><td>X5R/X7R
Y5V</td><td>10V,16V
16V</td><td>C≥1.0μF
C≥2.2μF</td></tr><tr><td>0805</td><td>X5R/X7R
Y5V</td><td>10V
16V</td><td>C≥4.7μF
C≥4.7μF</td></tr></table>*Before initial measurement (Class II only):
To apply test voltage for 1hr at test temp. and then set for 24±2 hrs at room temp.
Measurement to be made after keeping at room temp. for 24±2 hrs.</td><td> No remarkable damage.
Cap change:
NP0: ±3.0% or ±0.3pF whichever is larger
X7R, X7E, X5R: ≥10V**,within ±12.5%;6.3V within ±25%; **10V:0603≥4.7μF;0402≥1μF;0201≥0.1μF, within ±25%;
Y5V: ≥10V, within ±30%; 6.3V, within +30/-40%
Q/D.F. value:
NP0: More than 30pF, Q≥350; 10pF≤C<30pF, Q≥275+2.5C; Less than 10pF, Q≥200+10C
X7R, X5R:
<table><tr><th>Rated voltage</th><th>D.F.≤</th><th colspan="2">Exception of D.F.≤</th></tr><tr><td rowspan="3">≥50V</td><td rowspan="3">≤3%</td><td>≤6%</td><td>0201(50V);0603≥0.047μF; 0805≥0.18μF; 1206≥0.47μF</td></tr><tr><td>≤10%</td><td>1210≥4.7μF</td></tr><tr><td>≤20%</td><td>0603≥1μF; 0805≥1μF; 1206≥2.2μF; 1210≥10μF</td></tr><tr><td>35V</td><td>≤5%</td><td>≤20%</td><td>0805≥2.2μF;1210≥10μF</td></tr><tr><td rowspan="3">25V</td><td rowspan="3">≤5%</td><td>≤10%</td><td>0201≥0.01μF;0805≥1μF; 1210≥10μF</td></tr><tr><td>≤14%</td><td>0603≥0.33μF;1206≥4.7μF</td></tr><tr><td>≤15%</td><td>0402≥0.10μF;0603≥0.47μF;0805≥2.2μF; 1206≥6.8μF;1210≥22μF</td></tr><tr><td rowspan="2">16V</td><td rowspan="2">≤5%</td><td>≤10%</td><td>0603≥0.15μF;0805≥0.68μF; 1206≥2.2μF;1210≥4.7μF</td></tr><tr><td>≤15%</td><td>0201≥0.01μF;0402≥0.033μF; 0603≥0.68μF;0805≥2.2μF; 1206≥4.7μF; 1210≥22μF</td></tr><tr><td rowspan="2">10V</td><td rowspan="2">≤7.5%</td><td>≤15%</td><td>0201≥0.012μF;0402≥0.33μF; 0603≥0.33μF;0805≥2.2μF; 1206≥2.2μF; 1210≥22μF</td></tr><tr><td>≤20%</td><td>0201≥0.1μF ;0402≥1μF</td></tr><tr><td>6.3V</td><td>≤15%</td><td>≤30%</td><td>0201≥0.1μF;0402≥1μF; 0603≥10μF;0805≥4.7μF; 1206≥47μF; 1210≥100μF</td></tr><tr><td>4V</td><td>≤20%</td><td>--</td><td>--</td></tr></table>X7R: DF≤3%
Y5V:
<table><tr><th>Rated voltage</th><th>D.F.≤</th><th colspan="2">Exception of D.F.≤</th></tr><tr><td>≥50V</td><td>≤7.5%</td><td>≤10%</td><td>0603≥0.1μF; 0805≥0.47μF;1206≥4.7μF;Cap≥1μF</td></tr><tr><td rowspan="2">25V</td><td rowspan="2">≤7.5%</td><td>≤10%</td><td>0402≥0.047μF;0603≥0.1μF; 0805≥0.33μF;1206≥1μF; 1210≥4.7μF</td></tr><tr><td>≤15%</td><td>0402≥0.068μF;0603≥0.47μF; 1206≥4.7μF;1210≥22μF;Cap≥1μF</td></tr><tr><td rowspan="2">16V (C<1.0μF)</td><td rowspan="2">≤10%</td><td>≤12.5%</td><td>0402≥0.068μF; 0603≥0.68μF</td></tr><tr><td>≤20%</td><td>0402≥0.22μF</td></tr><tr><td>16V (C≥1.0μF)</td><td>≤12.5%</td><td>≤20%</td><td>0603≥2.2μF;0805≥3.3μF;1206≥10μF; 1210≥22μF;1812≥47μF;Cap≥1μF</td></tr><tr><td>10V</td><td>≤20%</td><td>≤30%</td><td>0402≥0.47μF</td></tr><tr><td>6.3V</td><td>≤30%</td><td>---</td><td>---</td></tr></table>*I.R.: ≥10V, 1GΩ or 50 Ω-F whichever is lower.
Class II (X7R, X7E, X5R, Y5V):
<table><tr><th>Rated voltage</th><th>Insulation Resistance</th></tr><tr><td>100V: X7R</td><td rowspan="7">1GΩ or RxC≥10 Ω-F whichever is lower.</td></tr><tr><td>50V:0603≥1μF;0805≥1μF; 1206≥2.2μF;1210≥4.7μF</td></tr><tr><td>25V:0402≥1μF;0603≥2.2μF; 0805≥2.2μF;1206≥10μF;1210≥10μF</td></tr><tr><td>16V: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></table></td></tr>
</table>

	Name		NP0/X7R	NPO/X7R/X5R/Y5V
1	Ceramic material		$BaTiO_3$ based	
2	Inner electrode		Ni	
3	Termination	Inner layer	Cu	
4		Middle layer	Ni	
5		Outer layer	Sn	



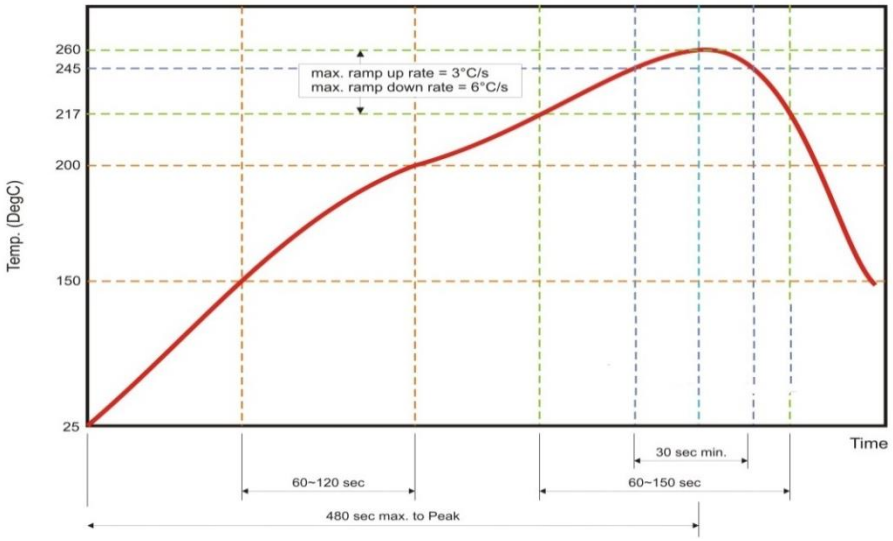
Storage and handling

(1) Products should be stored at 5 to 40°C ambient temperature and 20 to 70%. relative humidity.
(2) It is recommended that the product be used within one year from shipment. After one year from shipment, solderability should be checked.

Cautions

a. Corrosive gas reacts with the terminal electrodes of capacitors. Do not store capacitors in the proximity of corrosive gas (e.g., hydrogen sulfide, sulfur dioxide, chlorine, ammonia gas etc.) otherwise there can be solderability issues.
b. In a corrosive atmosphere, solderability might be degraded, and/or silver migration may occur which can cause lower reliability.
c. Dewing caused by rapid humidity changes and/or photochemical changes of the terminal electrode (caused by direct sunlight contact) can affect the solderability and electrical performance. Do not store capacitors under direct sunlight or in dewing conditions.

Recommended **reflow** profile for SnAgCu solder paste:



Recommended **wave** profile for SnAgCu solder paste: