MULTILAYER CERAMIC CAPACITORS
晶片電容

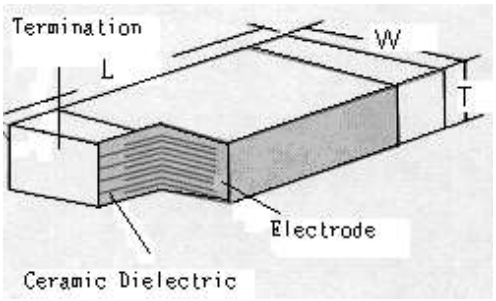
General Type and High-Voltage Type

Tolerance and Capacitance

Capacitance & Tolerance		NPO	X7R	X5R	Y5V
1R0=1.0pF 100=10pF 101=100pF 102=1000pF=1nF	103=10000=10nF 104=100nF 105=1000nF=1uF 106=10000nF=10uF	0R3~104	101~476	100~227	103~107
B:±0.1pF (Cap≦5pF) C:±0.25pF (Cap≦5pF) D=±0.5Pf (5pF≦CAP≦10pF) F=±1%	G=±2% J=±5% K=±10% M=±20% Z=-20%/+80%	B,C,D,F, G,J,K	J,K,M	K,M	M,Z

Dimension Specification

Size in inch (in metric)	Length (mm)	Width (mm)
01R5(0402)	0.40±0.02	0.20±0.02
0201(0603)	0.60±0.03	0.30±0.03
0402(1005)	1.00±0.05	0.50±0.05
0603(1608)	1.60±0.10	0.80±0.10
0805(2012)	2.00±0.15	1.25±0.15
1206(3216)	3.20±0.15	1.60±0.15
1210(3225)	3.20±0.15	2.50±0.15
1808(4520)	4.50±0.25	2.00±0.15
1812(4532)	4.50±0.25	3.20±0.15



Code	Thickness	Size
V	0.20mm±0.02mm	01005
L	0.30mm±0.03mm	0201
N	0.50mm±0.05mm	0402
S	0.80mm±0.07mm	0603
A	0.60mm±0.10mm	0805
B	0.80mm±0.10mm	0805 \ 1206
C	0.95mm±0.10mm	1206 \ 1210
D	1.25mm±0.10mm	0805 \ 1206 \ 1210 \ 1808 \ 1812
E	0.50mm±0.20mm	0402
F	1.40mm±0.15mm	1808
G	1.60mm±0.20mm	1206 \ 1210 \ 1808 \ 1812
H	0.50mm±0.10mm	0603 \ 0805
T	0.85mm±0.10mm	0805 \ 1206
K	2.00mm±0.20mm	1210 \ 1808 \ 1812

Capacitance and Voltage

Normal Product-Capacitance Range (NPO/X7R/X5R/Y5V)

NPO		
Size\Voltage	**50V**	**100V**
0201	0.3PF~120PF	
0402	0.47pF~330pF	
0603	0.47pF ~2.2nF	10pF ~680pF
0805	4.7pF ~10nF	10pF ~2.7nF
1206	10pF ~33nF	10pF~6.8nF
1210	1nF ~33nF	8.2nF~10nF

X7R						
Size\Voltage	**10V**	**16V**	**25V**	**50V**	**100V**	**200\250V**
0201	100P~10nF	100P~1.5nF	100P~1.5nF	100P~1.0nF		
0402	100pF~47nF	100pF~47nF	100pF~22nF	100pF~6.8nF	100P~1.0nF	
0603	100pF~2200nF	100pF~1000nF	100pF~1000nF	100pF~1000nF	100P~100nF	100pF~10nF
0805	100pF~10uF	100pF~10uF	100pF~4.7uF	100pF~2.2uF	100pF~0.47uF	100pF~68nF
1206	220pF~4.7uF	220pF~3.3uF	220pF~2.2uF	220pF~470nF	220pF~100nF	150pF~100nF
1210			1nF~470nF	1nF~220nF	47nF~150nF	1nF~470nF
1812	1nF~1000nF	1nF~1000nF	1nF~1000nF	1nF~1000nF	1nF~2.2uF	1nF~1.0uF

X5R		
Size\Voltage	**6.3V**	**10V**
0402	82nF~10uF	56nF~10uF
0603	330nF~22uF	330nF~22uF
0805	1uF~47uF	1uF~22uF
1206	4.7uF~100uF	1uF~47uF

Y5V				
Size\Voltage	**10V**	**16V**	**25V**	**50V**
0402	10nF~1uF	10nF~0.47uF	10nF~0.01uF	10nF~0.03uF
0603	10nF~4.7uF	10nF~2.2uF	10nF~1.0uF	10nF~0.47uF
0805	10nF~22uF	10nF~10uF	10nF~4.7uF	10nF~0.68Uf
1206	10nF~22uF	10nF~22uF	10nF~10uF	10nF~4.7uF
1210	100nF~47uF	100nF~47uF	100nF~10uF	100nF~4.7uF

High Voltage Products-Capacitance Range (NPO/X7R)

NPO				
Size\Voltage	**500V**	**1KV**	**2KV**	**3KV**
1206	1.5pF~2200pF	1.5pF~1000pF	1.5pF~2200pF	
1808	2.2pF~2200pF	2.2pF~1000pF	2.2pF~680pF	2.2pF~330pF
1812	10pF~3300pF	10pF~1500pF	10pF~1000pF	10pF~470pF

X7R				
Size\Voltage	**500V**	**1KV**	**2KV**	**3KV**
1206	150pF~0.056uF	150pF~0.015uF	150pF~3300pF	
1210	1000PF~0.1uF	1000PF~0.022uF	220PF~1000pF	
1808		270pF~10nF	270pF~2.2nF	270pF~10nF
1812	270PF~0.22uF	270PF~0.015uF	680pF~4.7nF	680pF~3.3nF

High Frequency Products-Capacitance Range (NPO)

NPO			
Size\Voltage	**16V**	**25V**	**50V**
0402	0.47pF~22pF	0.47pF~22pF	0.47pF~22pF

Specification and Test Method

<table>
<tr><th>Test item</th><th>Test Conditions</th><th>Requirements</th></tr>
<tr><td>Visual & Mechanical</td><td></td><td>＊ No remarkable defect.
＊ Dimensions to conform to individual specification sheet.</td></tr>
<tr><td>Capacitance</td><td>Class Ⅰ: (NPO)</td><td>＊ Shall not exceed the limits given in the detailed spec.</td></tr>
<tr><td>Q/D. F. (Dissipation Factor)</td><td>≦1000pF 1.0±0.2Vrms, 1MHZ±10%
＞1000pF 1.0±0.2Vrms, 1KHZ±10%
Class Ⅱ:(X7R, X5R, Y5V)
C≦10uF, 1.0±0.2Vrms, 1KHZ±10%
C＞10uF, 0.5±0.2Vrms, 120HZ±20%</td><td>NPO: More than 30pF:Q≧1000; Less than 30pF: Q≧400+20C
X7R, X5R
<table>
<tr><th>Rated Volt.</th><th>D.F.≦</th><th colspan="2">Exception of D.F≦</th></tr>
<tr><td>≧50V</td><td>2.5%</td><td>3%</td><td>0201(50V),0603≧0.047Uf…</td></tr>
<tr><td>25V</td><td>3.5%</td><td>5%</td><td>0201≧0.01uF,0805≧1uF…</td></tr>
<tr><td>16V</td><td>3.5%</td><td>5%</td><td>0201≧0.01uF ,0402≧0.033uF, 0603≧0.15uF, 0805≧0.68uF…</td></tr>
<tr><td>10V</td><td>5.0%</td><td>10%</td><td>0201≧0.012uF ,0402≧0.33uF, 0603≧0.33uF, 0805≧2.2uF…</td></tr>
<tr><td>6.3V</td><td>10%</td><td>15%</td><td>0201≧0.1uF ,0402≧1uF, 0603≧10uF, 0805≧4.7uF…</td></tr>
</table>
Y5V
<table>
<tr><th>Rated Volt.</th><th>D.F.≦</th><th colspan="2">Exception of D.F≦</th></tr>
<tr><td>≧50V</td><td>5.0%</td><td>7%</td><td>0603≧0.1uF, 0805≧0.47uF…</td></tr>
<tr><td rowspan="2">25V</td><td rowspan="2">5.0%</td><td>7%</td><td>0402≧0.47uF,0603≧0.1uF,0805≧0.33uF, 1206≧1uF, 1210≧4.7uF</td></tr>
<tr><td>9%</td><td>0402≧0.068uF,0603≧0.68uF</td></tr>
<tr><td>16V (C＜1.0uF)</td><td>7.0%</td><td>9%</td><td>0402≧0.068uF,0603≧0.68uF</td></tr>
<tr><td>16V (C≧1.0uF)</td><td>9.0%</td><td>12.5%</td><td>0603≧2.2uF,0805≧3.3uF, 1206≧10uF, 1210≧22uF…</td></tr>
<tr><td>10V</td><td>12.5%</td><td>20%</td><td>0402≧0.47uF</td></tr>
<tr><td>6.3V</td><td>20%</td><td>…</td><td>…</td></tr>
</table></td></tr>
<tr><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 ≧2 times V DC
500V~999V ≧1.5 times V DC
1KV~3KV ≧1.2 times V DC
＊ 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 rowspan="3">Insulation Resistance</td><td colspan="2">To apply rated voltage for max. 120sec.</td><td>10GΩ MIN. or 500Ω-F MIN. , whichever is smaller.</td></tr>
<tr><td>Rated Voltage: 200V~630V</td><td>To apply rated voltage (500V max.)for 60 sec</td><td>＞10GΩ</td></tr>
<tr><td>Rated Voltage: ＞630V</td><td>To apply 500V*60sec</td><td>＞10GΩ</td></tr>
<tr><td>Temperature Coefficient</td><td>With no electrical load.
<table>
<tr><th>T.C</th><th>Operating Temp</th></tr>
<tr><td>NPO</td><td>-55 ~ 125℃ at 25℃</td></tr>
<tr><td>X7R</td><td>-55 ~ 125℃ at 25℃</td></tr>
<tr><td>X5R</td><td>-55 ~ 85℃ at 25℃</td></tr>
<tr><td>Y5V</td><td>-25 ~ 85℃ at 20℃</td></tr>
</table></td><td>
<table>
<tr><th>T.C</th><th>Operating Temp</th></tr>
<tr><td>NPO</td><td>Within ±30ppm/℃</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>Adhesive strength of Termination</td><td>＊ Pressurizing force:
01005:1N,0201: 2N,0402&0603:5N
＞0603:10N
＊ Test time: 10±1 sec</td><td>＊ No remarkable damage or removal of the terminations.</td></tr>
<tr><td>Vibration Resistance</td><td>＊ Vibration frequency: 10~55 Hz/min
＊ Total amplitude: 1.5mm
＊ Test time: 6 hrs.(Two hrs. each in three mutually perpendicular directions)</td><td>＊ No remarkable damage.
＊ Cap change & Q/D.F.: To meet initial spec.</td></tr>
<tr><td>Solderability</td><td>＊ Solder temperature: 235 ±5℃
＊ Dipping time: 2±0.5 sec.</td><td>95%MIN. coverage of all metalized area.</td></tr>
</table>

<table>
<tr><th>Test item</th><th>Test Conditions</th><th>Requirements</th></tr>
<tr><td>Bending Test</td><td>＊ 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 1 mm and then the pressure shall be maintained for 5 ±1 sec. (Appendix 1)
＊ Measurement to be made after keeping at room temp. for 24 ±2 hrs.</td><td>＊ No remarkable damage.
＊ Cap change.
NPO: ±5%MAX. or ±0.5pF whichever is larger.
X7R, X5R: ≦±12.5%
Y5V: ≦±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>Resistance to Soldering Heat</td><td>＊ Solder temperature: 260±5℃
＊ Dipping time: 10±1 sec.
＊ Preheating: 120 to 150℃ for 1 minute before immerse the capacitor in a eutectic solder.
＊ Before initial measurement (Class Ⅱ only): Perform 150+0/-10℃ 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:
NPO: ±2.5% or ±0.25pF whichever is larger.
X7R, X5R: ＜±7.5%
Y5V: ＜±20%
＊ Q/D.F. & I.R. & Dielectric strength: To meet initial requirements.
＊ 25%MAX. leaching on each edge.</td></tr>
<tr><td>Temperature Cycle</td><td>＊ Conduct the five cycles according to the temperatures and time.
<table>
<tr><th>Step</th><th>Temp. (℃)</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℃ 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:
NPO: ±2.5%MAX. or ±0.25pF MAX. , whichever is larger.
X7R, X5R: ＜±7.5%
Y5V: ＜±20%
＊ Q/D.F. & I.R. & Dielectric strength: To meet initial requirements.</td></tr>
<tr><td>Humidity (Damp Heat) Steady State</td><td>＊ Test temp.: 40±2℃
＊ Humidity: 90~95% RH
＊ Test time: 500+24/-0hrs.
＊ Measurement to be made after keeping at room temp. for 24±2 hrs.</td><td>＊ No remarkable damage.
＊ Cap change:
NPO: ±5.0%MAX. or ±0.5pF MAX. , whichever is larger.
X7R, X5R: ＜±12.5%
Y5V: ＜±30%
＊ Q/D.F. value:
NPO: More than 30pF Q≧350; 10pF≦C≦30pF Q≧275+2.5C
Less than 10pF Q≧200+10C
X7R, X5R:
<table>
<tr><th>Rated Volt.</th><th>D.F≦</th><th colspan="2">Exception of D.F≦</th></tr>
<tr><td>≧50V</td><td>3.0%</td><td>6%</td><td>0201(50v),0603≧0.047uF…</td></tr>
<tr><td>25V</td><td>5.0%</td><td>10%</td><td>0201≧0.1uF, 0805≧1uF…</td></tr>
<tr><td>16V</td><td>5.0%</td><td>10%</td><td>0603≧0.15uF, 0805≧0.68uF,1206≧2.2uF, 1210≧4.7uF</td></tr>
<tr><td>10V</td><td>7.5%</td><td>15%</td><td>0201≧0.012uF, 0402≧0.33uF,0603≧0.33uF, 0805≧2.2uF…</td></tr>
<tr><td>6.3V</td><td>15%</td><td>30%</td><td>0201≧0.1uF, 0402≧1uF,0603≧10uF, 0805≧4.7uF…</td></tr>
</table>
Y5V
<table>
<tr><th>Rated Volt.</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≧0.1uF; 0805≧0.47uF; 1206≧4.7uF</td></tr>
<tr><td rowspan="2">25V</td><td rowspan="2">7.5%</td><td>10%</td><td>0402≧0.047uF;0603≧0.1uF; 0805≧0.33uF; 1206≧1uF</td></tr>
<tr><td>1%</td><td>0402≧0.068uF;0603≧0.47uF…</td></tr>
<tr><td>16V (C＜1.0uF)</td><td>10%</td><td>12.5%</td><td>0402≧0.068uF;0603≧0.68uF</td></tr>
<tr><td>16V (C≧1.0uF)</td><td>12.5%</td><td>20%</td><td>0603≧2.2uF; 0805≧3.3uF; 1206≧10uF; 1210≧22uF;1812≧47uF…</td></tr>
<tr><td>10V</td><td>20%</td><td>30%</td><td>0402≧0.47uF</td></tr>
<tr><td>6.3V</td><td>30%</td><td>…</td><td>…</td></tr>
</table>
＊ I.R.: 1GΩ MIN. or 50Ω-F MIN., whichever is smaller.</td></tr>
</table>

<table>
<tr><th>Test item</th><th>Test Conditions</th><th>Requirements</th></tr>
<tr><td>Humidity
(Damp Heat
Load)</td><td>＊ Test temp.: 40±2℃
＊ Humidity: 90~95% RH
＊ Test time: 500+24/-0hrs.
＊ To apply voltage: rated voltage
(MAX. 500V)
＊ Measurement to be made after
keeping at room temp. for 24±2 hrs.</td><td>＊ No remarkable damage.
＊ Cap change:
NPO: ±7.5%MAX. or ±0.75pF MAX. , whichever is larger.
X7R, X5R: ＜±12.5%
Y5V: ＜±30%
＊ Q/D.F. value:
NPO: C≧30pF Q≧200; C＜30pF Q≧100+10/3C
X7R, X5R:
<table>
<tr><td>Rated Volt.</td><td>D.F≦</td><td colspan="2">Exception of D.F≦</td></tr>
<tr><td>≧50V</td><td>3.0%</td><td>6%</td><td>0603≧0.047uF</td></tr>
<tr><td>25V</td><td>5.0%</td><td>10%</td><td>0201≧0.1uF;0805≧1uF</td></tr>
<tr><td>16V</td><td>5.0%</td><td>10%</td><td>0603≧0.15uF, 0805≧0.68uF,
1206≧2.2uF, 1210≧4.7uF</td></tr>
<tr><td>10V</td><td>7.5%</td><td>15%</td><td>0201≧0.012uF, 0402≧33uF,
0603≧0.33uF, 0805≧2.2uF</td></tr>
<tr><td>6.3V</td><td>15%</td><td>30%</td><td>0603≧10uF, 0805≧4.7uF,
1206≧47uF, 1210≧100uF</td></tr>
</table>
Y5V
<table>
<tr><td>Rated Volt.</td><td>D.F.≦</td><td colspan="2">Exception of D.F≦</td></tr>
<tr><td>≧50V</td><td>7.5%</td><td>10%</td><td>0603≧0.1uF; 0805≧0.47uF;
1206≧4.7uF</td></tr>
<tr><td>25V</td><td>7.5%</td><td>10%</td><td>0402≧0.047uF, 0603≧0.1uF,
0805≧0.33uF, 1206≧1.0uF</td></tr>
<tr><td>16V
(C＜1.0uF)</td><td>10%</td><td>12.5%</td><td>0402≧0.068uF;
0603≧0.68uF</td></tr>
<tr><td>16V
(C≧1.0uF)</td><td>12.5%</td><td>20%</td><td>0603≧2.2uF, 0805≧3.3uF, 1206
≧10uF, 1210≧22uF</td></tr>
<tr><td>10V</td><td>20%</td><td>30%</td><td>0402≧0.47uF</td></tr>
<tr><td>6.3V</td><td>30%</td><td>…</td><td>…</td></tr>
</table>
* I.R.: 500MΩ MIN. or 25Ω-F MIN., whichever is smaller.</td></tr>
<tr><td>High
Temperature
Load
(Endurance)</td><td>＊ Test temp.:
NPO, X7R: 125±3℃
X5R, Y5V: 85±3℃
＊ Test time: 1000+24/-0hrs.
＊ Measurement to be made after
keeping at room temp. for 24±2 hrs.</td><td>＊ No remarkable damage.
＊ Cap change:
NPO: ±3.0%MAX. or ±0.3pF MAX. , whichever is larger.
X7R, X5R: ＜±12.5%
Y5V: ＜±30%
＊ Q/D.F. value:
NPO: More than 30pF Q≧350; 10pF≦C＜30pF Q≧275+2.5C
Less than 10pF Q≧200+10C
X7R, X5R:
<table>
<tr><td>Rated Volt.</td><td>D.F≦</td><td colspan="2">Exception of D.F≦</td></tr>
<tr><td>≧50V</td><td>3.0%</td><td>6%</td><td>0201(50V);0603≧0.047uF,
0805≧18uF, 1206≧0.47uF</td></tr>
<tr><td>25V</td><td>5.0%</td><td>10%</td><td>0201≧0.01uF, 0805≧1uF;1210≧
10uF</td></tr>
<tr><td>16V</td><td>5.0%</td><td>10%</td><td>0603≧0.15uF, 0805≧0.68uF, 1206
≧2.2uF, 1210≧4.7uF</td></tr>
<tr><td>10V</td><td>7.5%</td><td>15%</td><td>0201≧0.012uF, 0402≧0.33uF,
0603≧0.33uF, 0805≧2.2uF</td></tr>
<tr><td>6.3V</td><td>15%</td><td>30%</td><td>0201≧0.1uF, 0402≧1uF, 0603≧
10uF, 0805≧4.7uF; 1206≧47uF,
1210≧100uF</td></tr>
</table>
Y5V
<table>
<tr><td>Rated Volt.</td><td>D.F.≦</td><td colspan="2">Exception of D.F≦</td></tr>
<tr><td>≧50V</td><td>7.5%</td><td>10%</td><td>0603≧0.1uF; 0805≧0.47uF;
1206≧4.7uF</td></tr>
<tr><td>25V</td><td>7.5%</td><td>10%</td><td>0402≧0.047uF, 0603≧0.1uF,
0805≧0.33uF, 1206≧1.0uF</td></tr>
<tr><td>16V
(C＜1.0uF)</td><td>10%</td><td>12.5%</td><td>0402≧0.068uF</td></tr>
<tr><td>10V</td><td>20%</td><td>30%</td><td>0402≧0.47uF</td></tr>
<tr><td>6.3V</td><td>15%</td><td></td><td></td></tr>
</table>
*I.R.: 1GΩ MIN. or 50Ω-F MIN., whichever is smaller.</td></tr>
</table>

＊Specification of particular production and up-to-date version is in accordance with relevant datasheet.

Appendix 3 Notice

1.Storage and Handing Conditions:

(1).Products are recommended to be used up within one year. Check solderability in case shelf life extension is needed.

(2).To store products with following condition:

Temperature : 5 to 40℃

Humidity : 20 to 70% relative humidity.

(3).Caution:

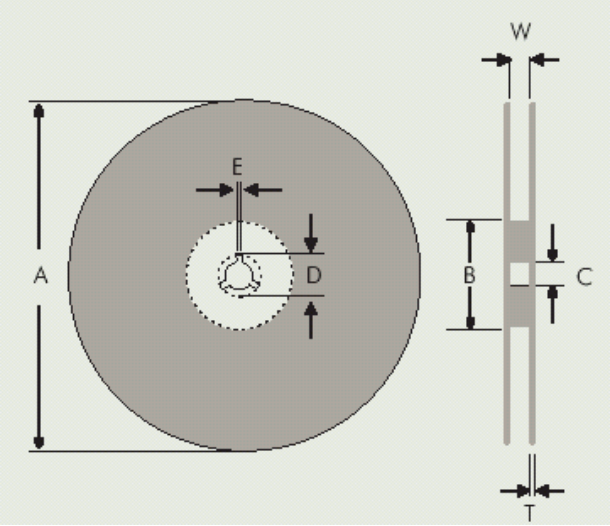
a. Don't store products in a corrosive environment such as sulfide, chloride gas, or acud. It may cause oxidization of electrode, which easily be resulted in poor soldering.

b. To store products on the shelf and avoid exposure to moisture.

c. Don't expose products to excessive shock, vibration, direct sunlight and so on.

2.Recommendation of Soldering Profile:

Chip Capacitor on Tape and Reel

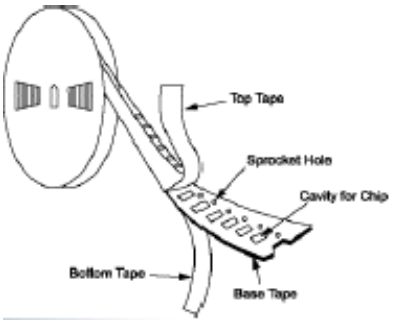


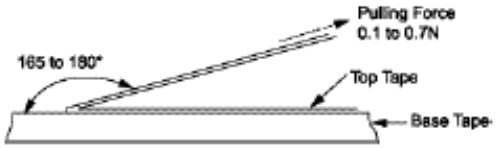
	Tape Size	A (MAX.)	B (MIN.)	C	D(MIN.)	E (MIN.)	W	T (MAX.)
13" Reel	8mm	330±2 (12.992±0.08)	60 (2.362)	13.0±0.5 (0.512±0.02)	20.2 (0.795)	1.5 (0.059)	9±0.5 (0.354±0.02)	2.5 (0.1)
	12mm						13±0.5 (0.512±0.02)	
7" Reel	8mm	178±1 (7.008±0.04)	50 (1.969)	13.0±0.5 (0.512±0.02)	20.2 (0.795)	1.5 (0.059)	9±0.5 (0.354±0.02)	2.5 (0.1)
	12mm						13±0.5 (0.512±0.02)	

STANDARD

Size	7" Reel		13" Reel		Tape Width
	Paper	Plastic	Paper	Plastic	
0201	15,000		70,000		8mm
0402	10,000		50,000		
0603	4,000		15,000		
0805	4,000	3,000	10,000	10,000	
1206	4,000	3,000	10,000	10,000	
1210		3,000			12mm
1808		2,000 3,000			
1812		500 1,000			

Appearance of Taping





∗The component does not protrude beyond either surface of the base tape.

∗No bottom tape adhesion force, chip capacitor is free condition without sticking on bottom and top side tape.

∗In case of turning the base tape over without shock or vibration, the chip capacitor is easily dropped capacitor's weight itself

∗[Peeling off force] 0.1 to 0.7N in the direction shown as above sketch.