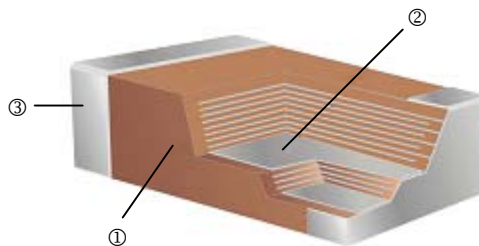


# Multilayer Ceramic Capacitor – MC Series

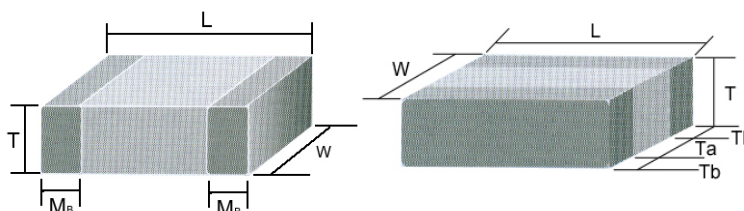
## Construction



①	Ceramic Material	③	Termination:
②	Inner Electrodes		NPO: Ag/Ni/Sn dielectric X7R, Y5V, X5R: Cu/Ni/Sn dielectric

## Features

- Wide capacitance range, extremely compact size
- Low inductance of capacitor for high frequency application
- Excellent solderability and resistance to soldering heat, suitable for flow and reflow soldering
- Adaptable to high-speed surface mount assembly
- Conform to EIAJ-RC3402, and also compatible with EIA-RS198 and IEC PUB. 384-10



## Dimensions

MC / MCHL / MCRF Type

Unit: mm

Type	Size (Inch)	L	W	T / Symbol		Mb	Packaging (7" Reel)	
							Paper tape	Plastic tape
01	0201	0.6±0.03	0.3±0.03	0.3±0.03	L	0.15±0.05	15K	-
02	0402	1.00±0.05	0.50±0.05	0.50±0.05	N	0.25 +0.05 / -0.10	10K	-
03	0603	1.60±0.10	0.80±0.10	0.80±0.07	S	0.40±0.15	4K	-
		1.60 +0.15 / -0.10	0.80 +0.15 / -0.10	0.80 +0.05 / -0.10	X		4K	
05	0805	2.00±0.15	1.25±0.10	0.60±0.10	A	0.50±0.20	4K	-
				0.80±0.10	B		4K	-
		1.25±0.10	D	-	3K			
		0.85±0.10	T	4K	-			
06	1206	2.00±0.20	1.25±0.20	1.25±0.20	I	0.60±0.20	-	3K
				0.80±0.10	B		4K	-
		0.95±0.10	C	-	3K			
		1.25±0.10	D	-	3K			
10	1210	3.20±0.15	1.60±0.15	1.15±0.15	J	0.75±0.25	-	3K
				1.60±0.20	G		-	3K
		3.20±0.20	1.60±0.20	1.60±0.20	P		-	2K
08	1808	3.20±0.3 / -0.1	1.60±0.3 / -0.1	1.60±0.3 / -0.1	P	0.75±0.25	-	2K
				0.95±0.10	C		-	3K
		1.25±0.10	D	-	3K			
		1.60±0.20	G	-	2K			
12	1812	3.20±0.30	2.50±0.20	2.00±0.20	K	0.75±0.25	-	1K
				2.50±0.30	M		-	1K
		3.20±0.40	2.50±0.30	1.25±0.10	D		-	2K
08	1808	4.50±0.40	2.03±0.25	2.00±0.20	K	0.75±0.25	-	1K
				1.25±0.10	D		-	2K
		4.50±0.40	2.03±0.25	2.00±0.20	K		-	1K
12	1812	4.50±0.40	3.20±0.30	1.25±0.10	D	0.75±0.25	-	1K
				2.00±0.20	K		-	1K
		4.50±0.40	3.20±0.30	2.50±0.30	M		-	0.5K

Low Inductance Capacitors for MCLI Type

Unit: mm

Type	Size (Inch)	L	W	T / Symbol		Ta min.	Tb min.	Packaging (7" Reel)	
								Paper tape	Plastic tape
MCLI43	0612	3.20±0.15	1.60±0.15	0.80±0.10	B	0.5	0.13	4K	-

## Part Numbering

MC	03	J	T	N	250	3R9
Product Type	Dimensions (LxW)	Capacitance Tolerance	Packaging	Dielectric	Voltage (VDCW)	Capacitance
MC : General; Ultra-small Middle and High Voltage MCHL: High Q and Low ESR MCRF: Ultra High Q and Low ESR (RF) MCLI: Low Inductance	01: 0201 02: 0402 03: 0603 05: 0805 06: 1206 10: 1210 08: 1808 12: 1812 43: 0612	B: $\pm 0.1\text{pF}$ ( $\text{Cap} \leq 5\text{pF}$ ) C: $\pm 0.25\text{pF}$ ( $\text{Cap} \leq 5\text{pF}$ ) D: $\pm 0.5\text{pF}$ ( $5\text{pF} < \text{Cap} < 10\text{pF}$ ) F: $\pm 1\%$ G: $\pm 2\%$ J: $\pm 5\%$ K: $\pm 10\%$ M: $\pm 20\%$ Z: $+80/-20\%$	T: Taping Reel	N: NPO (COG) B: X7R F: Y5V X: X5R	6V3: 6.3V 250: 25V 500: 50V 101: 100V 102: 1000V 202: 2000V 302: 3000V	3R9: 3.9pF 150: 15pF 181: 180pF 225: 2.2 $\mu\text{F}$ 476: 47 $\mu\text{F}$ 107: 100 $\mu\text{F}$

## Ultra-small 0201 Capacitors

### Capacitance & Voltage

EIA	Size	0201		
Dielectric		NPO		
Code	VDCW	16V	25V	50V
0R3	0.3pF		L <sup>^</sup>	L <sup>^</sup>
0R4	0.4		L <sup>^</sup>	L <sup>^</sup>
0R5	0.5		L <sup>^</sup>	L <sup>^</sup>
1R0	1.0		L <sup>^</sup>	L <sup>^</sup>
1R2	1.2		L <sup>^</sup>	L <sup>^</sup>
1R5	1.5		L <sup>^</sup>	L <sup>^</sup>
1R8	1.8		L <sup>^</sup>	L <sup>^</sup>
2R2	2.2		L <sup>^</sup>	L <sup>^</sup>
2R7	2.7		L <sup>^</sup>	L <sup>^</sup>
3R3	3.3		L <sup>^</sup>	L <sup>^</sup>
3R9	3.9		L <sup>^</sup>	L <sup>^</sup>
4R0	4.0		L <sup>^</sup>	L <sup>^</sup>
4R7	4.7		L <sup>^</sup>	L <sup>^</sup>
5R6	5.6		L <sup>^</sup>	L <sup>^</sup>
6R8	6.8		L <sup>^</sup>	L <sup>^</sup>
8R2	8.2		L <sup>^</sup>	L <sup>^</sup>
100	10		L <sup>^</sup>	L <sup>^</sup>
120	12		L <sup>^</sup>	L <sup>^</sup>
150	15		L <sup>^</sup>	L <sup>^</sup>
180	18		L <sup>^</sup>	L <sup>^</sup>
220	22		L <sup>^</sup>	L <sup>^</sup>
270	27		L <sup>^</sup>	L <sup>^</sup>
330	33		L <sup>^</sup>	L <sup>^</sup>
390	39		L <sup>^</sup>	L <sup>^</sup>
470	47		L <sup>^</sup>	L <sup>^</sup>
560	56	L <sup>^</sup>	L <sup>^</sup>	
680	68	L <sup>^</sup>	L <sup>^</sup>	
820	82	L <sup>^</sup>	L <sup>^</sup>	
101	100	L <sup>^</sup>	L <sup>^</sup>	

EIA	Size	0201									
Dielectric		X7R					X5R				
Code	VDCW	6.3V	10V	16V	25V	50V	6.3V	10V	16V	25V	50V
101	100pF			L	L	L			L	L	L
121	120			L	L	L			L	L	L
151	150			L	L	L			L	L	L
181	180			L	L	L			L	L	L
221	220			L	L	L			L	L	L
271	270			L	L	L			L	L	L
331	330			L	L	L			L	L	L
391	390			L	L	L			L	L	L
471	470			L	L	L			L	L	L
561	560			L	L	L			L	L	L
681	680			L	L	L			L	L	L
821	820			L	L	L			L	L	L
102	1000	L	L	L	L	L			L	L	L
152	1500	L	L	L	L	L			L	L	L
222	2200	L	L	L	L	L			L	L	L
272	2700	L	L	L	L	L			L	L	L
332	3300	L	L	L	L	L			L	L	L
472	4700	L	L	L	L	L			L	L	L
682	6800	L	L	L	L	L			L	L	L
103	0.010μF	L	L				L	L			
153	0.015						L				
223	0.022						L				
333	0.033						L				
473	0.047						L				
683	0.068						L				
104	0.100						L				

- The letter in cell is expressed the symbol of product thickness
- The "A" mark is expressed product with Ag/Ni/Sn terminations

### Electrical Data

Size	0201		
Dielectric	NPO	X7R	X5R
Capacitance*	0.3pF~100pF	100pF~10nF	100pF~0.1μF
Capacitance tolerance	Cap ≤ 5pF: C (±0.25pF) 5pF < Cap < 10pF: D (±0.50pF) Cap ≥ 10pF: J (±5%)	J (±5%) K (±10%)	K (±10%) M (±20%)
Rated voltage (VDCW)	16V, 25V, 50V	6.3V, 10V, 16V, 25V, 50V	6.3V, 10V, 16V, 25V, 50V
Tan δ/Q*	Cap < 30pF: Q ≥ 400 + 20C Cap ≥ 30pF: Q ≥ 1000	Ur=50V: ≤ 3.0% Ur=16V, 25V: ≤ 3.5% Ur=10V: ≤ 5.0% Ur=6.3V: ≤ 10%	Ur=50V: ≤ 3.0% Ur=16V, 25V: ≤ 3.5% Ur=10V: ≤ 5.0% Ur=6.3V: ≤ 10%
Insulation resistance at Ur	≥ 10GΩ	≥ 10GΩ or R×C ≥ 500Ω×F Whichever is less	
Operating temperature	-55 to +125°C		-55 to +85°C
Capacitance change	±30 ppm	±15%	
Termination	Ni/Sn (lead-free termination)		

- \*\*Measured at 30~70% related humidity
- NPO: Apply 1.0±0.2Vrms, 1.0MHz±10% at the condition of 25°C ambient temperature
- X7R, X5R: Apply 1.0±0.2Vrms, 1.0KHz±10% at the condition of 25°C ambient temperature

## Environmental Characteristics

Item	Requirement	Test Method																																																																								
External Appearance	No defects which may affect performance	Visual inspection & Dimension measurement																																																																								
Capacitance(Cap.)	Within the specified tolerance that refers on page2	NPO: (Class I) Cap≤1000pF 1.0±0.2Vrms, 1MHz±10% Cap≤1000pF 1.0±0.2Vrms, 1KHz±10%																																																																								
Dissipation Factor (D.F.) or Quality factor (Q=1/D.F.)	<p>NPO: Cap≥30pF, Q≥1000; Cap&lt;30pF, Q≥400+20C</p> <p>X7R, X5R:</p> <table border="1"> <thead> <tr> <th>Rated vol.</th> <th>D.F.≤</th> <th colspan="2">Exception of D.F. ≤</th> </tr> </thead> <tbody> <tr> <td>≥50V</td> <td>2.5%</td> <td>3%</td> <td>0201(50V); 0603 ≥ 0.047μF 0805 ≥ 0.18μF; 1206 ≥ 0.47μF</td> </tr> <tr> <td rowspan="3">25V</td> <td rowspan="3">3.5%</td> <td>5%</td> <td>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; 1206 ≥ 6.8μF</td> </tr> <tr> <td rowspan="2">16V</td> <td rowspan="2">3.5%</td> <td>5%</td> <td>0402 ≥ 0.033μF; 0603 ≥ 0.15μF 0805 ≥ 0.68μF; 1206 ≥ 2.2μF 1210 ≥ 4.7μF</td> </tr> <tr> <td>10%</td> <td>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>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 rowspan="2">6.3V</td> <td rowspan="2">10%</td> <td>15%</td> <td>0603 ≥ 10μF; 0805 ≥ 4.7μF 1210 ≥ 100μF</td> </tr> <tr> <td>20%</td> <td>0402 ≥ 2.2μF</td> </tr> </tbody> </table> <p>Y5V:</p> <table border="1"> <thead> <tr> <th>Rated vol.</th> <th>D.F.≤</th> <th colspan="2">Exception of D.F. ≤</th> </tr> </thead> <tbody> <tr> <td>≥50V</td> <td>5%</td> <td>7%</td> <td>0603 ≥ 0.1μF; 0805 ≥ 0.47μF 1206 ≥ 4.7μF</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 ≥ 0.47μF</td> </tr> <tr> <td>9%</td> <td>0402 ≥ 0.068μF; 0603 ≥ 0.47μF 1206 ≥ 4.7μF; 1210 ≥ 22μF</td> </tr> <tr> <td rowspan="2">16V (C &lt; 1.0μF)</td> <td rowspan="2">7%</td> <td>9%</td> <td>0402 ≥ 0.068μF; 0603 ≥ 0.68μF</td> </tr> <tr> <td>12.5%</td> <td>0402 ≥ 0.22μF</td> </tr> <tr> <td rowspan="2">16V (C ≥ 1.0μF)</td> <td rowspan="2">9%</td> <td>12.5%</td> <td>0603 ≥ 2.2μF; 0805 ≥ 3.3μF 1206 ≥ 10μF; 1210 ≥ 22μF 1812 ≥ 47μF</td> </tr> <tr> <td>20%</td> <td>0402 ≥ 0.47μF</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> </tbody> </table>	Rated vol.	D.F.≤	Exception of D.F. ≤		≥50V	2.5%	3%	0201(50V); 0603 ≥ 0.047μF 0805 ≥ 0.18μF; 1206 ≥ 0.47μF	25V	3.5%	5%	0805 ≥ 1μF; 1210 ≥ 10μF	7%	0603 ≥ 0.33μF; 1206 ≥ 4.7μF	10%	0402 ≥ 0.10μF; 0603 ≥ 0.47μF 0805 ≥ 2.2μF; 1206 ≥ 6.8μF	16V	3.5%	5%	0402 ≥ 0.033μF; 0603 ≥ 0.15μF 0805 ≥ 0.68μF; 1206 ≥ 2.2μF 1210 ≥ 4.7μF	10%	0603 ≥ 0.68μF; 0805 ≥ 2.2μF 1206 ≥ 4.7μF; 1210 ≥ 22μF	10V	5%	10%	0402 ≥ 0.33μF; 0603 ≥ 0.33μF 0805 ≥ 2.2μF; 1206 ≥ 2.2μF 1210 ≥ 22μF	15%	0201 ≥ 0.1μF; 0402 ≥ 1μF	6.3V	10%	15%	0603 ≥ 10μF; 0805 ≥ 4.7μF 1210 ≥ 100μF	20%	0402 ≥ 2.2μF	Rated vol.	D.F.≤	Exception of D.F. ≤		≥50V	5%	7%	0603 ≥ 0.1μF; 0805 ≥ 0.47μF 1206 ≥ 4.7μF	35V	7%	-	-	25V	5%	7%	0402 ≥ 0.047μF; 0603 ≥ 0.1μF 0805 ≥ 0.33μF; 1206 ≥ 1μF 1210 ≥ 0.47μF	9%	0402 ≥ 0.068μF; 0603 ≥ 0.47μF 1206 ≥ 4.7μF; 1210 ≥ 22μF	16V (C < 1.0μF)	7%	9%	0402 ≥ 0.068μF; 0603 ≥ 0.68μF	12.5%	0402 ≥ 0.22μF	16V (C ≥ 1.0μF)	9%	12.5%	0603 ≥ 2.2μF; 0805 ≥ 3.3μF 1206 ≥ 10μF; 1210 ≥ 22μF 1812 ≥ 47μF	20%	0402 ≥ 0.47μF	10V	12.5%	20%	0402 ≥ 0.47μF	6.3V	20%	-	-	<p>X7R, X5R, Y5V: (Class II) Cap≤10uF 1.0±0.2Vrms, 1KHz±10% Cap&gt;10uF 0.5±0.2Vrms, 120Hz±10%</p>
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Dielectric Strength	No evidence of damage or flash over during test	<p>To apply voltage(≤100V) 250% Duration: 1 to 5sec Charge and discharge current less than 50mA</p> <p>To apply voltage: 200V~300V ≥ 2 time VDC 500V~999V ≥ 1.5 time VDC 1000V~3000V ≥ 1.2 time VDC Cut-off, set at 10mA TEST=15 sec. RAMP=0</p>																																																																								

Item	Requirement	Test Method																				
Insulation Resistance	10GΩ or RxC ≥ 500Ω-F Whichever is smaller X7R, X5R, Y5V: <table border="1" data-bbox="392 264 1007 506"> <thead> <tr> <th>Rated Voltage</th> <th>Insulation Resistance</th> </tr> </thead> <tbody> <tr> <td>100V: X7R</td> <td rowspan="4">RxC ≥ 100Ω-F</td> </tr> <tr> <td>16V: 0402 ≥ 0.22uF</td> </tr> <tr> <td>10V: 0201 ≥ 47nF; 0402 ≥ 0.47uF; 0603 ≥ 0.47uF 0805 ≥ 2.2uF; 1206 ≥ 4.7uF; 1210 ≥ 47uF</td> </tr> <tr> <td>6.3V</td> </tr> </tbody> </table>	Rated Voltage	Insulation Resistance	100V: X7R	RxC ≥ 100Ω-F	16V: 0402 ≥ 0.22uF	10V: 0201 ≥ 47nF; 0402 ≥ 0.47uF; 0603 ≥ 0.47uF 0805 ≥ 2.2uF; 1206 ≥ 4.7uF; 1210 ≥ 47uF	6.3V	To apply rated voltage for max. 120sec													
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≥10GΩ or 100Ω-F whichever is smaller Rated voltage: 200V~630V	To apply rated voltage(500V max.) for 60sec.																					
≥10GΩ Rated voltage: >630V	To apply 500V for 60sec.																					
Temperature Characteristic of Capacitance	<table border="1" data-bbox="392 701 943 869"> <thead> <tr> <th>T.C.</th> <th>Capacitance Change</th> </tr> </thead> <tbody> <tr> <td>NPO</td> <td>±30 (ppm/°C)</td> </tr> <tr> <td>X7R</td> <td>±15%</td> </tr> <tr> <td>X5R</td> <td>±15%</td> </tr> <tr> <td>Y5V</td> <td>+30%~-80%</td> </tr> </tbody> </table>	T.C.	Capacitance Change	NPO	±30 (ppm/°C)	X7R	±15%	X5R	±15%	Y5V	+30%~-80%	With no electrical load. <table border="1" data-bbox="1038 701 1477 869"> <thead> <tr> <th>T.C.</th> <th>Operating Temp</th> </tr> </thead> <tbody> <tr> <td>NPO</td> <td>-55 ~ 125°C at 25°C</td> </tr> <tr> <td>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> </tbody> </table>	T.C.	Operating Temp	NPO	-55 ~ 125°C at 25°C	X7R	-55 ~ 125°C at 25°C	X5R	-55 ~ 85°C at 25°C	Y5V	-25 ~ 85°C at 20°C
T.C.	Capacitance Change																					
NPO	±30 (ppm/°C)																					
X7R	±15%																					
X5R	±15%																					
Y5V	+30%~-80%																					
T.C.	Operating Temp																					
NPO	-55 ~ 125°C at 25°C																					
X7R	-55 ~ 125°C at 25°C																					
X5R	-55 ~ 85°C at 25°C																					
Y5V	-25 ~ 85°C at 20°C																					
Adhesive Strength of Termination	No remarkable damage or removal of the terminations	Pressurizing force: 0201:2N 0402&0603:5N >0603:10N Test time: 10±1 sec																				
Vibration Resistance	No remarkable damage Cap change and Q/D.F.: To meet initial spec	Vibration frequency: 10~55Hz/min Total amplitude: 1.5mm Test time: 6hrs.(tow hrs each in three mutually Perpendicular directions.)																				
Solderability	95% min. coverage of all metalized area.	Solder temperature: 235±5°C Dipping time: 2±0.5 sec.																				
Bending Test	No remarkable damage Cap change: NPO: within±5% or 0.5pF whichever is larger X7R, 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.)	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 1mm and then the pressure shall be maintained for 5±1sec. Measurement to be made after keeping at room temp. for 24±2hrs(Class I) or 48±4hrs(Class II) (Thickness>1.0mm, Thickness≤1.0mm)																				
Resistance to Soldering Heat	No remarkable damage Cap change: NPO: within±2.5% or 0.25pF whichever is larger X7R, 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.	Solder temperature: 270±5°C Dipping time: 10±1sec Preheating: 120 to 150°C for 1minute before immerse the capacitor in a eutectic solder. Before initial measurement(Class II only): Perform 150+0/-10°C for 1hr and then set for 48±4hrs at room temp. Measurement to be made after keep at room temp. for 24±2 hrs.(Class I) or 48±4 hrs.(Class II).																				
Temperature Cycle	No remarkable damage. Cap change: NPO: within±2.5% or 0.25pF whichever is larger X7R, X5R: within±7.5% Y5V: within±20% Q/D.F., I.R. and dielectric strength: To meet initial requirements.	Conduct the five cycles according to the temperature and time. <table border="1" data-bbox="1038 1760 1519 1921"> <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> Before initial measurement(Cass II only): Perform 150+0/-10°C for 1hr and then set for 48±4 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					
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Item	Requirement	Test Method																																																																											
Humidity (steady state)	<p>No remarkable damage. Cap change: NPO: within±5% or 0.5pF whichever is large X7R, X5R:≥10V, within±12.5%;6.3V, within±25% Y5V:≥10V, within±30%;6.3V, within+30/-40% 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:</p> <table border="1"> <thead> <tr> <th>Rated vol.</th> <th>D.F. ≤</th> <th colspan="2">Exception of D.F. ≤</th> </tr> </thead> <tbody> <tr> <td>≥ 50V</td> <td>3.0%</td> <td>6%</td> <td>0201(50V); 0603 ≥ 0.047μF 0805 ≥ 0.18μF ; 1206 ≥ 0.47μF</td> </tr> <tr> <td rowspan="3">25V</td> <td rowspan="3">5.0%</td> <td>10%</td> <td>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 ≥ 0.1μF; 0603 ≥ 0.47μF 0805 ≥ 2.2μF; 1206 ≥ 6.8μF</td> </tr> <tr> <td rowspan="2">16V</td> <td rowspan="2">5%</td> <td>10%</td> <td>0603 ≥ 0.15μF; 0603 ≥ 0.68μF 1206 ≥ 2.2μF; 1210 ≥ 4.7μF</td> </tr> <tr> <td>15%</td> <td>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>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>0402 ≥ 2.2μF; 0603 ≥ 10μF 0805 ≥ 4.7μF; 1210 ≥ 100μF</td> </tr> </tbody> </table> <p>Y5V:</p> <table border="1"> <thead> <tr> <th>Rated vol.</th> <th>D.F. ≤</th> <th colspan="2">Exception of D.F. ≤</th> </tr> </thead> <tbody> <tr> <td>≥ 50 V</td> <td>7.5%</td> <td>10%</td> <td>0603 ≥ 0.1μF; 0805 ≥ 0.47μF 1206 ≥ 4.7μF</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</td> </tr> <tr> <td rowspan="2">16V (C&lt;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 ≥ .0μF)</td> <td>12.5%</td> <td>20%</td> <td>0603 ≥ 2.2μF; 0805 ≥ 3.3μF 1206 ≥ 10μF; 1210 ≥ 22μF 1812 ≥ 47μF</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> </tbody> </table> <p>I.R.: ≥10V 1GΩ or 50Ω-F whichever is smaller. Class II (X7R, X5R, Y5V)</p> <table border="1"> <thead> <tr> <th>Rated voltage</th> <th>Insulation Resistance</th> </tr> </thead> <tbody> <tr> <td>100V:X7R</td> <td rowspan="5">Rx C ≥ 10Ω-F</td> </tr> <tr> <td>16V:0402 ≥ 0.22uF</td> </tr> <tr> <td>10V: 0201 ≥ 47nF; 0402 ≥ 0.47uF 0603 ≥ 0.47uF; 0805 ≥ 2.2uF 1206 ≥ 0.47uF; 1210 ≥ 47uF</td> </tr> <tr> <td>6.3V</td> </tr> </tbody> </table>	Rated vol.	D.F. ≤	Exception of D.F. ≤		≥ 50V	3.0%	6%	0201(50V); 0603 ≥ 0.047μF 0805 ≥ 0.18μF ; 1206 ≥ 0.47μF	25V	5.0%	10%	0805 ≥ 1μF; 1210 ≥ 10μF	14%	0603 ≥ 0.33μF; 1206 ≥ 4.7μF	15%	0402 ≥ 0.1μF; 0603 ≥ 0.47μF 0805 ≥ 2.2μF; 1206 ≥ 6.8μF	16V	5%	10%	0603 ≥ 0.15μF; 0603 ≥ 0.68μF 1206 ≥ 2.2μF; 1210 ≥ 4.7μF	15%	0402 ≥ 0.033μF; 0603 ≥ 0.68μF 0805 ≥ 2.2μF; 1206 ≥ 4.7μF 1210 ≥ 22μF	10V	7.5%	15%	0402 ≥ 0.33μF; 0603 ≥ 0.33μF 0805 ≥ 2.2μF; 1206 ≥ 2.2μF 1210 ≥ 22μF	20%	0201 ≥ 0.1μF; 0402 ≥ 1μF	6.3V	15%	30%	0402 ≥ 2.2μF; 0603 ≥ 10μF 0805 ≥ 4.7μF; 1210 ≥ 100μF	Rated vol.	D.F. ≤	Exception of D.F. ≤		≥ 50 V	7.5%	10%	0603 ≥ 0.1μF; 0805 ≥ 0.47μF 1206 ≥ 4.7μF	35V	10%	—	—	25V	7.5%	10%	0402 ≥ 0.047μF; 0603 ≥ 0.1μF 0805 ≥ 0.33μF; 1206 ≥ 1μF 1210 ≥ 4.7μF	15%	0402 ≥ 0.068μF; 0603 ≥ 0.47μF 1206 ≥ 4.7μF; 1210 ≥ 22μF	16V (C<1.0μF)	10%	12.5%	0402 ≥ 0.068μF; 0603 ≥ 0.68μF	20%	0402 ≥ 0.22μF	16V (C ≥ .0μF)	12.5%	20%	0603 ≥ 2.2μF; 0805 ≥ 3.3μF 1206 ≥ 10μF; 1210 ≥ 22μF 1812 ≥ 47μF	10V	20%	30%	0402 ≥ 0.47μF	6.3V	30%	-	-	Rated voltage	Insulation Resistance	100V:X7R	Rx C ≥ 10Ω-F	16V:0402 ≥ 0.22uF	10V: 0201 ≥ 47nF; 0402 ≥ 0.47uF 0603 ≥ 0.47uF; 0805 ≥ 2.2uF 1206 ≥ 0.47uF; 1210 ≥ 47uF	6.3V	<p>Test temp: 40±2°C Humidity: 90~95% RH Test time: 500+24/-0hrs Measurement to be made after keeping at room temp. for 24±2hrs.(Class I) or 48±4 hrs. (Class II).</p>
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16V	5%	10%	0603 $\geq 0.15\mu\text{F}$ ; 0805 $\geq 0.68\mu\text{F}$ 1206 $\geq 2.2\mu\text{F}$ ; 1210 $\geq 4.7\mu\text{F}$																																																																										
		15%	0402 $\geq 0.033\mu\text{F}$ ; 0603 $\geq 0.68\mu\text{F}$ 0805 $\geq 2.2\mu\text{F}$ ; 1206 $\geq 4.7\mu\text{F}$ 1210 $\geq 22\mu\text{F}$																																																																										
10V	7.5%	15%	0402 $\geq 0.22\mu\text{F}$ ; 0603 $\geq 0.33\mu\text{F}$ 0805 $\geq 2.2\mu\text{F}$ ; 1206 $\geq 2.2\mu\text{F}$ 1210 $\geq 22\mu\text{F}$																																																																										
		20%	0201 $\geq 0.1\mu\text{F}$ ; 0402 $\geq 1\mu\text{F}$																																																																										
6.3V	15%	30%	0402 $\geq 2.2\mu\text{F}$ ; 0603 $\geq 10\mu\text{F}$ 0805 $\geq 4.7\mu\text{F}$ ; 1210 $\geq 100\mu\text{F}$																																																																										
Rated vol.	D.F. $\leq$	Exception of D.F. $\leq$																																																																											
$\geq 50\text{V}$	7.5%	10%	0603 $\geq 0.1\mu\text{F}$ ; 0805 $\geq 0.47\mu\text{F}$ 1206 $\geq 4.7\mu\text{F}$																																																																										
35V	10%	-	-																																																																										
25V	7.5%	10%	0402 $\geq 0.047\mu\text{F}$ ; 0603 $\geq 0.1\mu\text{F}$ 0805 $\geq 0.033\mu\text{F}$ ; 1206 $\geq 1\mu\text{F}$ 1210 $\geq 4.7\mu\text{F}$																																																																										
		15%	0402 $\geq 0.068\mu\text{F}$ ; 0603 $\geq 0.1\mu\text{F}$ 1206 $\geq 4.7\mu\text{F}$ ; 1210 $\geq 22\mu\text{F}$																																																																										
16V ( $C < 1.0\mu\text{F}$ )	10%	12.5%	0402 $\geq 0.068\mu\text{F}$ ; 0603 $\geq 0.68\mu\text{F}$																																																																										
		20%	0402 $\geq 0.22\mu\text{F}$																																																																										
16V ( $C \geq 1.0\mu\text{F}$ )	12.5%	20%	0603 $\geq 2.2\mu\text{F}$ ; 0805 $\geq 3.3\mu\text{F}$ 1206 $\geq 10\mu\text{F}$ ; 1210 $\geq 22\mu\text{F}$ 1812 $\geq 47\mu\text{F}$																																																																										
10V	20%	30%	0402 $\geq 0.47\mu\text{F}$																																																																										
6.3V	30%	-	-																																																																										
Rated voltage	Insulation Resistance																																																																												
100V: X7R	RxC $\geq 5\Omega$ -F																																																																												
16V: 0402 $\geq 0.22\mu\text{F}$																																																																													
10V: 0201 $\geq 47\text{nF}$ ; 0402 $\geq 0.47\mu\text{F}$ 0603 $\geq 0.47\mu\text{F}$ ; 0805 $\geq 2.2\mu\text{F}$ 1206 $\geq 4.7\mu\text{F}$ ; 1210 $\geq 47\mu\text{F}$																																																																													
6.3V																																																																													

Item	Requirement	Test Method																																				
High Temperature Load (Endurance)	No remarkable damage Cap change: NPO: $\pm 3\%$ or $\pm 0.3F$ whichever is larger X7R, X5R: $\geq 10V$ , within $\pm 12.5\%$ ; 6.3V, within $+30/-40\%$ Q/D.F. value: NPO: more than 30pF, $Q \geq 350$ $10pF \leq C < 30pF$ , $Q \geq 275+2.5C$ Less than 10pF, $Q \geq 200+10C$ X7R, X5R:	Test temp: NPO, X7R: $125 \pm 3^\circ C$ X5R, Y5V: $85 \pm 3^\circ C$ To apply voltage: (1.1) 100% of rated voltage for below range <table border="1"> <thead> <tr> <th>Size</th> <th>Dielectric</th> <th>Rated voltage</th> <th>Capacitance range</th> </tr> </thead> <tbody> <tr> <td>0201</td> <td>X5R</td> <td>6.3V, 10V</td> <td><math>C \geq 0.1\mu F</math></td> </tr> <tr> <td>0402</td> <td>X5R, Y5V</td> <td>6.3V, 10V</td> <td><math>C \geq 1.0\mu F</math></td> </tr> <tr> <td>0603</td> <td>X5R</td> <td>6.3V, 10V</td> <td><math>C \geq 4.7\mu F</math></td> </tr> <tr> <td>0805</td> <td>X5R</td> <td>6.3V</td> <td><math>C \geq 22\mu F</math></td> </tr> </tbody> </table> (1.2) 6.3V or $C \geq 10\mu F$ : 150% of rated voltage (2) $10V \leq U_r < 500V$ : 200% of rated voltage 150% of rated voltage for below range <table border="1"> <thead> <tr> <th>Size</th> <th>Dielectric</th> <th>Rated voltage</th> <th>Capacitance range</th> </tr> </thead> <tbody> <tr> <td>0603</td> <td>X5R</td> <td>10V, 16V</td> <td><math>C \geq 1.0\mu F</math></td> </tr> <tr> <td>0805</td> <td>X5R</td> <td>10V</td> <td><math>C \geq 4.7\mu F</math> <math>T = 0.85 \pm 0.1mm</math></td> </tr> <tr> <td>1206</td> <td>X5R</td> <td>10V</td> <td><math>C \geq 4.7\mu F</math> &amp; <math>T = 0.85 \pm 0.1mm</math></td> </tr> </tbody> </table> (3) 500V: 150% of rated voltage (4) $U_r \geq 630V$ : 120% of rated voltage  Test time: 1000+24/-0hrs Measurement to be made after keeping at room temp. for 24 $\pm$ 2hrs.(Class I) or 48 $\pm$ 4hrs.(Class II).	Size	Dielectric	Rated voltage	Capacitance range	0201	X5R	6.3V, 10V	$C \geq 0.1\mu F$	0402	X5R, Y5V	6.3V, 10V	$C \geq 1.0\mu F$	0603	X5R	6.3V, 10V	$C \geq 4.7\mu F$	0805	X5R	6.3V	$C \geq 22\mu F$	Size	Dielectric	Rated voltage	Capacitance range	0603	X5R	10V, 16V	$C \geq 1.0\mu F$	0805	X5R	10V	$C \geq 4.7\mu F$ $T = 0.85 \pm 0.1mm$	1206	X5R	10V	$C \geq 4.7\mu F$ & $T = 0.85 \pm 0.1mm$
	Size		Dielectric	Rated voltage	Capacitance range																																	
	0201		X5R	6.3V, 10V	$C \geq 0.1\mu F$																																	
	0402		X5R, Y5V	6.3V, 10V	$C \geq 1.0\mu F$																																	
	0603		X5R	6.3V, 10V	$C \geq 4.7\mu F$																																	
	0805		X5R	6.3V	$C \geq 22\mu F$																																	
	Size		Dielectric	Rated voltage	Capacitance range																																	
	0603		X5R	10V, 16V	$C \geq 1.0\mu F$																																	
	0805		X5R	10V	$C \geq 4.7\mu F$ $T = 0.85 \pm 0.1mm$																																	
	1206		X5R	10V	$C \geq 4.7\mu F$ & $T = 0.85 \pm 0.1mm$																																	
	Rated vol.		D.F. $\leq$	Exception of D.F. $\leq$																																		
	$\geq 50V$		3.0%	6% 0201(50V); 0603 $\geq 0.047\mu F$ 0805 $\geq 0.18\mu F$ ; 1206 $\geq 0.47\mu F$																																		
	25V		5.0%	10% 0805 $\geq 1\mu F$ ; 1210 $\geq 10\mu F$																																		
				14% 0603 $\geq 0.33\mu F$ ; 1206 $\geq 4.7\mu F$																																		
				15% 0402 $\geq 0.10\mu F$ ; 0603 $\geq 0.47\mu F$ 0805 $\geq 2.2\mu F$ ; 1206 $\geq 6.8\mu F$																																		
16V	5%	10% 0603 $\geq 0.15\mu F$ ; 0805 $\geq 0.68\mu F$ 1206 $\geq 2.2\mu F$ ; 1210 $\geq 4.7\mu F$																																				
		15% 0402 $\geq 0.033\mu F$ ; 0603 $\geq 0.68\mu F$ 0805 $\geq 2.2\mu F$ ; 1206 $\geq 4.7\mu F$ 1210 $\geq 22\mu F$																																				
10V	7.5%	15% 0402 $\geq 0.33\mu F$ ; 0603 $\geq 0.33\mu F$ 0805 $\geq 2.2\mu F$ ; 1206 $\geq 2.2\mu F$ 1210 $\geq 22\mu F$																																				
		20% 0201 $\geq 0.1\mu F$ ; 0402 $\geq 1\mu F$																																				
6.3V	15%	30% 0402 $\geq 2.2\mu F$ ; 0603 $\geq 10\mu F$ 0805 $\geq 4.7\mu F$ ; 1210 $\geq 100\mu F$																																				
Y5V:	Rated vol.	D.F. $\leq$	Exception of D.F. $\leq$																																			
$\geq 50V$	7.5%	10%	0603 $\geq 0.1\mu F$ ; 0805 $\geq 0.47\mu F$ 1206 $\geq 4.7\mu F$																																			
35V	10%	-	-																																			
25V	7.5%	10%	0402 $\geq 0.047\mu F$ ; 0603 $\geq 0.1\mu F$ 0805 $\geq 0.33\mu F$ ; 1206 $\geq 1\mu F$ 1210 $\geq 4.7\mu F$																																			
		15%	0402 $\geq 0.068\mu F$ ; 0603 $\geq 0.47\mu F$ 1206 $\geq 4.7\mu F$ ; 1210 $\geq 22\mu F$																																			
16V ( $C < 1.0\mu F$ )	10%	12.5%	0402 $\geq 0.068\mu F$ ; 0603 $\geq 0.68\mu F$																																			
		20%	0402 $\geq 0.22\mu F$																																			
16V ( $C \geq 1.0\mu F$ )	12.5%	20%	0603 $\geq 2.2\mu F$ ; 0805 $\geq 3.3\mu F$ 1206 $\geq 10\mu F$ ; 1210 $\geq 22\mu F$ 1812 $\geq 47\mu F$																																			
10V	20%	30%	0402 $\geq 0.47\mu F$																																			
6.3V	30%	-	-																																			
I.R.: $\geq 10V$ 1G $\Omega$ or 50 $\Omega$ -F whichever is smaller Class II (X7R, X5R, Y5V)	Rated voltage	Insulation Resistance																																				
100V: X7R	Rx $C \geq 10\Omega$ -F																																					
16V: 0402 $\geq 0.22\mu F$																																						
10V: 0201 $\geq 47nF$ ; 0402 $\geq 0.47\mu F$ 0603 $\geq 0.47\mu F$ ; 0805 $\geq 2.2\mu F$ 1206 $\geq 4.7\mu F$ ; 1210 $\geq 47\mu F$																																						
6.3V																																						



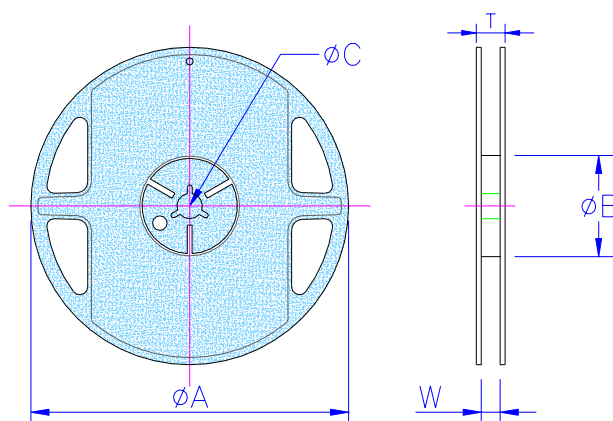
## ■ Packaging

Packaging Quantity

Unit: mm

Type	Thickness / Symbol		Packaging (7" Reel)	
			Paper tape	Plastic tape
0201	0.30±0.03	L	15K	-
0402	0.50±0.05	N	10K	-
0603	0.80±0.07	S	4K	-
	0.80 +0.15 / -0.10	X	4K	-
0805	0.60±0.10	A	4K	-
	0.80±0.10	B	4K	-
	0.85±0.10	T	4K	-
	1.25±0.10	D	-	3K
	1.25±0.20	I	-	3K
1206	0.80±0.10	B	4K	-
	0.95±0.10	C	-	3K
	1.15±0.15	J	-	3K
	1.25±0.10	D	-	3K
	1.60±0.20	G	-	2K
	1.60 +0.30 / -0.10	P	-	2K
1210	0.95±0.10	C	-	3K
	1.25±0.10	D	-	3K
	1.60±0.20	G	-	2K
	2.00±0.20	K	-	1K
	2.50±0.30	M	-	1K
1808	1.25±0.10	D	-	2K
	2.00±0.20	K	-	1K
1812	1.25±0.10	D	-	1K
	2.00±0.20	K	-	1K
	2.50±0.30	M	-	0.5K
0612	0.80±0.10	B	4K	-

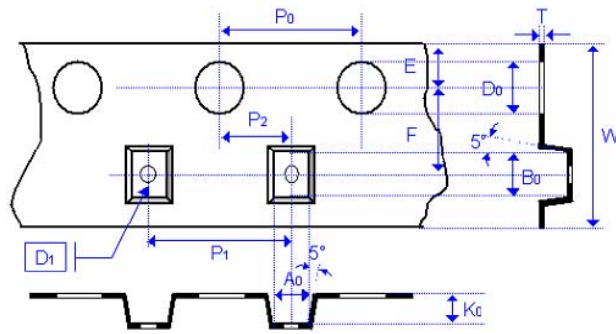
### Tape and Reel



Unit: mm

Type	Chip Size							
	0201	0402	0603	0805	1206/0612	1210	1808	1812
$\phi C$	13.0±1.0	13.0±1.0	13.0±1.0	13.0±1.0	13.0±1.0	13.0±1.0	13.0±1.0	13.0±1.0
$W$	9.0±1.0	9.0±1.0	9.0±1.0	9.0±1.0	9.0±1.0	9.0±1.0	13.5±1.0	13.5±1.0
$\phi A$	178±1.0(7")	178±1.0(7")	178±1.0(7")	178±1.0(7")	178±1.0(7")	178±1.0(7")	178±1.0(7")	178±1.0(7")
$\phi B$	60.5±1.0(7")	60.5±1.0(7")	60.5±1.0(7")	60.5±1.0(7")	60.5±1.0(7")	60.5±1.0(7")	80.0±1.0(7")	80.0±1.0(7")

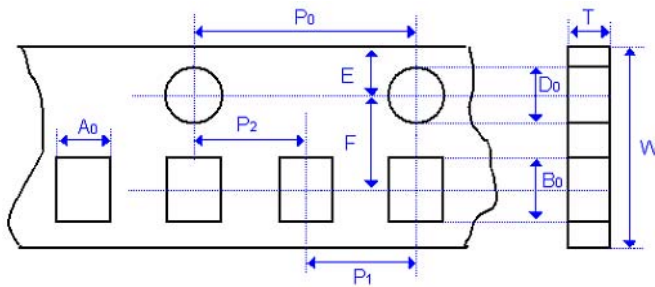
Plastic Tape Size Specification



Unit: mm

Type	0805		1206					1210					1808		1812		
Thickness	D	I	C	J	D	G	P	C	D	G	K	M	D	K	D	K	M
A <sub>0</sub>	<1.57		<1.85		<1.95		<2.97		<2.97		<2.35		<3.81				
B <sub>0</sub>	<2.40		<3.46		<3.67		<3.73		<3.73		<4.98	<5.00	<5.30				
T	0.23±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 <sub>0</sub>	<2.50		<2.50		<2.50		<2.50		<3.00		<2.50		<2.50	<3.00			
W	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				
P <sub>0</sub>	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 <sub>1</sub>	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				
P <sub>2</sub>	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 <sub>0</sub>	1.50±0.05		1.50±0.05		1.50±0.05		1.50±0.05		1.50±0.05		1.50±0.05		1.50±0.05				
D <sub>1</sub>	1.00±0.10		1.00±0.10		1.00±0.10		1.00±0.10		1.00±0.10		1.00±0.10		1.00±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		3.50±0.05		3.50±0.05		3.50±0.05		3.50±0.05		5.50±0.05				

Paper Tape Size Specification



Unit: mm

Type	0201	0402	0603		0805		1206/0612
Thickness	L	N	S	X	A	B	B
A <sub>0</sub>	0.45±0.05	0.62±0.05	1.02±0.05		1.50±0.10	1.50±0.10	2.00±0.10
B <sub>0</sub>	0.75±0.05	1.12±0.05	1.82±0.05		2.30±0.10	2.30±0.10	3.50±0.10
T	0.60±0.05	0.60±0.05	0.95±0.05		0.75±0.05	0.95±0.05	0.95±0.05
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 <sub>0</sub>	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 <sub>1</sub>	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 <sub>2</sub>	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 <sub>0</sub>	1.55±0.05	1.55±0.05	1.55±0.05		1.55±0.05	1.55±0.05	1.50±0.05
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