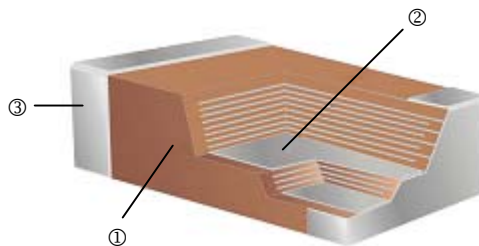


# Multilayer Ceramic Capacitor – MC Series

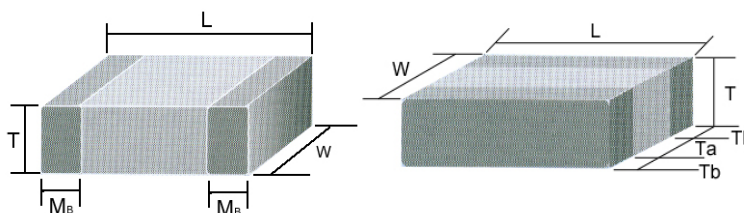
## Construction



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

## 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
		2.00±0.20	1.25±0.20	1.25±0.20	I		-	3K
06	1206	3.20±0.15	1.60±0.15	0.80±0.10	B	0.60±0.20	4K	-
				0.95±0.10	C		-	3K
				1.25±0.10	D		-	3K
				1.15±0.15	J		-	3K
				1.60±0.20	G		-	2K
		3.20+0.3 / -0.1	1.60+0.3 / -0.1	1.60+0.3 / -0.1	P		-	2K
10	1210	3.20±0.30	2.50±0.20	0.95±0.10	C	0.75±0.25	-	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
08	1808	4.50+0.5 / -0.3	2.03±0.25	1.25±0.10	D	0.50±0.25	-	2K
				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
			3.20±0.40	2.50±0.30	M		-	0.5K
12*	1812	4.5+0.5 / -0.3	3.20±0.30	1.25±0.10	D	0.50±0.25	-	1K
				1.60±0.20	G		-	1K
				2.00±0.20	K		-	1K

■ 12\* for Middle and High Voltage

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	A: $\pm 0.05\text{pF}$ ( $\text{Cap} \leq 5\text{pF}$ ) 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 350: 35V 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 $\mu\text{F}$

## High Q and Low ESR Capacitors for MCHL Series

### Capacitance & Voltage

Dielectric		NPO				
EIA	Size	0402		0603		
Code	VDCW	16V	50V	16V	50V	100V
0R5	0.5pF		N		S	S
0R6	0.6pF		N		S	S
0R7	0.7		N		S	S
0R8	0.8		N		S	S
0R9	0.9		N		S	S
1R0	1.0		N		S	S
1R2	1.2		N		S	S
1R5	1.5		N		S	S
1R8	1.8		N		S	S
2R2	2.2		N		S	S
2R7	2.7		N		S	S
3R3	3.3		N		S	S
3R9	3.9		N		S	S
4R7	4.7		N		S	S
5R6	5.6		N		S	S
6R8	6.8		N		S	S
8R2	8.2		N		S	S
100	10		N		S	S
120	12		N		S	S
150	15		N		S	S
180	18		N		S	S
220	22		N		S	S
270	27		N		S	S
330	33		N		S	S
390	39		N		S	S
470	47		N		S	S
560	56		N		S	S
680	68		N		S	S
820	82		N		S	S
101	100		N		S	S
121	120		N		S	S
151	150		N		S	S
181	180		N		S	S
221	220		N		S	S
271	270	N			S	S
331	330	N			S	S
391	390	N			S	S
471	470	N			S	S
561	560				S	
681	680				S	
821	820				S	
102	1000				S	
122	1200			S		
152	1500			S		
182	1800			S		
222	2200			S		
272	2700			S		
332	3300			S		

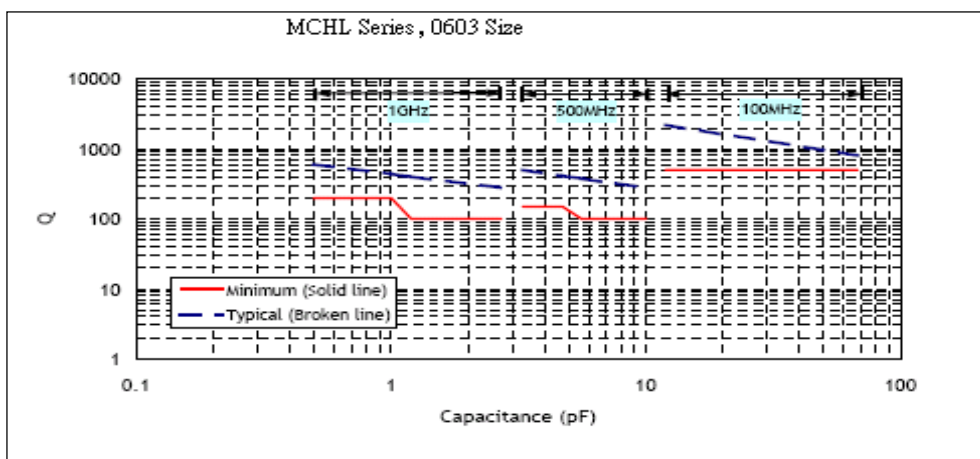
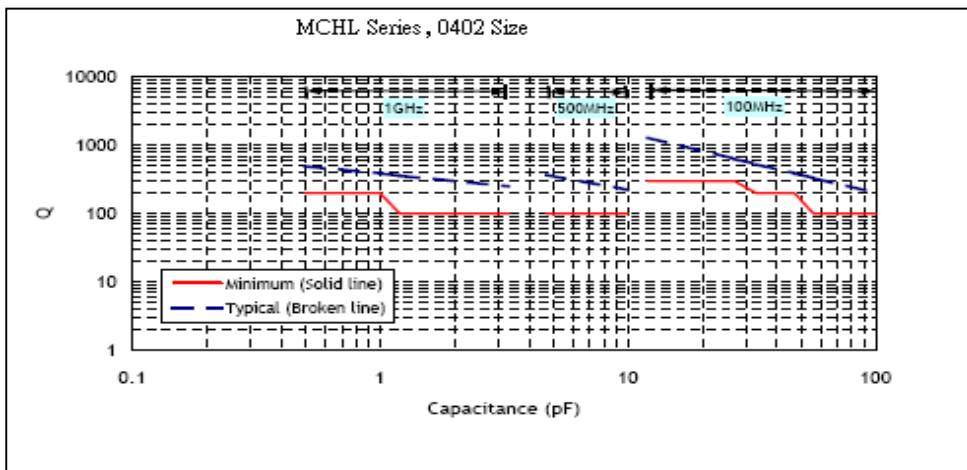
■ The letter in cell is expressed the symbol of product thickness

Electrical Data

Dielectric Size	NPO 0402, 0603
Capacitance*	0402: 0.5pF ~ 470pF 0603: 0.5pF ~ 3300pF
Capacitance tolerance	Cap $\leq$ 5pF: B( $\pm$ 0.1pF), C( $\pm$ 0.25pF) 5pF<Cap<10pF: C( $\pm$ 0.25pF), D( $\pm$ 0.50pF) Cap $\geq$ 10pF: J( $\pm$ 5%)
Rated voltage (VDCW)	16V, 50V, 100V
Q *	Cap<30pF: Q $\geq$ 400 +20C Cap $\geq$ 30pF: Q $\geq$ 1000
Insulation resistance at Ur	$\geq$ 10G $\Omega$
Operating temperature	-55 to +125 $^{\circ}$ C
Capacitance change	$\pm$ 30 ppm
ESR	Cap<2.2pF: $\leq$ 1000m $\Omega$ @900 $\pm$ 100MHz 2.2pF $\leq$ Cap $\leq$ 470pF: $\leq$ 500m $\Omega$ @900 $\pm$ 100MHz Cap>470pF: $\leq$ 500m $\Omega$ @60 $\pm$ 10MHz
Termination	Ni/Sn (lead-free termination)

- \*\*Measured at the conditions of 25 $^{\circ}$ C ambient temperature and 30~70% related humidity
- Apply 1.0 $\pm$ 0.2Vrms, 1.0MHz $\pm$ 10% for Cap $\leq$ 1000pF; 1.0KHz $\pm$ 10% for Cap>1000pF

Electrical characteristics



## 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 $\leq$ 1000pF 1.0 $\pm$ 0.2Vrms, 1MHz $\pm$ 10% Cap $\leq$ 1000pF 1.0 $\pm$ 0.2Vrms, 1KHz $\pm$ 10%																																																																						
Dissipation Factor (D.F.) or Quality factor (Q=1/D.F.)	<p>NPO: Cap<math>\geq</math>30pF, Q<math>\geq</math>1000; Cap<math>&lt;</math>30pF, Q<math>\geq</math>400+20C MCRF Series: Q<math>\geq</math>2500 X7R, X5R:</p> <table border="1"> <thead> <tr> <th>Rated vol.</th> <th>D.F.<math>\leq</math></th> <th colspan="2">Exception of D.F. <math>\leq</math></th> </tr> </thead> <tbody> <tr> <td><math>\geq</math>50V</td> <td>2.5%</td> <td>3%</td> <td>0201(50V); 0603<math>\geq</math>0.047<math>\mu</math>F 0805<math>\geq</math>0.18<math>\mu</math>F; 1206<math>\geq</math>0.47<math>\mu</math>F</td> </tr> <tr> <td rowspan="3">25V</td> <td rowspan="3">3.5%</td> <td>5%</td> <td>0805<math>\geq</math>1<math>\mu</math>F; 1210<math>\geq</math>10<math>\mu</math>F</td> </tr> <tr> <td>7%</td> <td>0603<math>\geq</math>0.33<math>\mu</math>F; 1206<math>\geq</math>4.7<math>\mu</math>F</td> </tr> <tr> <td>10%</td> <td>0402<math>\geq</math>0.10<math>\mu</math>F; 0603<math>\geq</math>0.47<math>\mu</math>F 0805<math>\geq</math>2.2<math>\mu</math>F; 1206<math>\geq</math>6.8<math>\mu</math>F</td> </tr> <tr> <td rowspan="2">16V</td> <td rowspan="2">3.5%</td> <td>5%</td> <td>0402<math>\geq</math>0.033<math>\mu</math>F; 0603<math>\geq</math>0.15<math>\mu</math>F 0805<math>\geq</math>0.68<math>\mu</math>F; 1206<math>\geq</math>2.2<math>\mu</math>F 1210<math>\geq</math>4.7<math>\mu</math>F</td> </tr> <tr> <td>10%</td> <td>0603<math>\geq</math>0.68<math>\mu</math>F; 0805<math>\geq</math>2.2<math>\mu</math>F 1206<math>\geq</math>4.7<math>\mu</math>F; 1210<math>\geq</math>22<math>\mu</math>F</td> </tr> <tr> <td rowspan="2">10V</td> <td rowspan="2">5%</td> <td>10%</td> <td>0402<math>\geq</math>0.33<math>\mu</math>F; 0603<math>\geq</math>0.33<math>\mu</math>F 0805<math>\geq</math>2.2<math>\mu</math>F; 1206<math>\geq</math>2.2<math>\mu</math>F 1210<math>\geq</math>22<math>\mu</math>F</td> </tr> <tr> <td>15%</td> <td>0201<math>\geq</math>0.1<math>\mu</math>F; 0402<math>\geq</math>1<math>\mu</math>F</td> </tr> <tr> <td rowspan="2">6.3V</td> <td rowspan="2">10%</td> <td>15%</td> <td>0603<math>\geq</math>10<math>\mu</math>F; 0805<math>\geq</math>4.7<math>\mu</math>F 1210<math>\geq</math>100<math>\mu</math>F</td> </tr> <tr> <td>20%</td> <td>0402<math>\geq</math>2.2<math>\mu</math>F</td> </tr> </tbody> </table> <p>Y5V:</p> <table border="1"> <thead> <tr> <th>Rated vol.</th> <th>D.F.<math>\leq</math></th> <th colspan="2">Exception of D.F. <math>\leq</math></th> </tr> </thead> <tbody> <tr> <td><math>\geq</math>50V</td> <td>5%</td> <td>7%</td> <td>0603<math>\geq</math>0.1<math>\mu</math>F; 0805<math>\geq</math>0.47<math>\mu</math>F 1206<math>\geq</math>4.7<math>\mu</math>F</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<math>\geq</math>0.047<math>\mu</math>F; 0603<math>\geq</math>0.1<math>\mu</math>F 0805<math>\geq</math>0.33<math>\mu</math>F; 1206<math>\geq</math>1<math>\mu</math>F 1210<math>\geq</math>0.47<math>\mu</math>F</td> </tr> <tr> <td>9%</td> <td>0402<math>\geq</math>0.068<math>\mu</math>F; 0603<math>\geq</math>0.47<math>\mu</math>F 1206<math>\geq</math>4.7<math>\mu</math>F; 1210<math>\geq</math>22<math>\mu</math>F</td> </tr> <tr> <td rowspan="2">16V (C<math>&lt;</math>1.0<math>\mu</math>F)</td> <td rowspan="2">7%</td> <td>9%</td> <td>0402<math>\geq</math>0.068<math>\mu</math>F; 0603<math>\geq</math>0.68<math>\mu</math>F</td> </tr> <tr> <td>12.5%</td> <td>0402<math>\geq</math>0.22<math>\mu</math>F</td> </tr> <tr> <td>16V (C<math>\geq</math>1.0<math>\mu</math>F)</td> <td>9%</td> <td>12.5%</td> <td>0603<math>\geq</math>2.2<math>\mu</math>F; 0805<math>\geq</math>3.3<math>\mu</math>F 1206<math>\geq</math>10<math>\mu</math>F; 1210<math>\geq</math>22<math>\mu</math>F 1812<math>\geq</math>47<math>\mu</math>F</td> </tr> <tr> <td>10V</td> <td>12.5%</td> <td>20%</td> <td>0402<math>\geq</math>0.47<math>\mu</math>F</td> </tr> <tr> <td>6.3V</td> <td>20%</td> <td>-</td> <td>-</td> </tr> </tbody> </table>	Rated vol.	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Dielectric Strength	No evidence of damage or flash over during test	<p>To apply voltage(<math>\leq</math>100V) 250% Duration: 1 to 5sec Charge and discharge current less than 50mA</p> <p>To apply voltage: 200V~300V <math>\geq</math> 2 time VDC 500V~999V <math>\geq</math> 1.5 time VDC 1000V~3000V <math>\geq</math> 1.2 time VDC Cut-off, set at 10mA RAMP=0</p>																																																																						

Item	Requirement	Test Method																				
Insulation Resistance	10GΩ or R×C≥500Ω-F Whichever is smaller X7R, X5R, Y5V: <table border="1"> <tr> <td>Rated Voltage</td> <td>Insulation Resistance</td> </tr> <tr> <td>100V: X7R</td> <td rowspan="4">R×C ≥ 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> </table>	Rated Voltage	Insulation Resistance	100V: X7R	R×C ≥ 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													
	Rated Voltage	Insulation Resistance																				
	100V: X7R	R×C ≥ 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																						
≥10GΩ or R×C≥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"> <tr> <td>T.C.</td> <td>Capacitance Change</td> </tr> <tr> <td>NPO</td> <td>0±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> </table>	T.C.	Capacitance Change	NPO	0±30 (ppm/°C)	X7R	±15%	X5R	±15%	Y5V	+30%~-80%	<table border="1"> <tr> <td>T.C.</td> <td>Operating Temp</td> </tr> <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> </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
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Y5V	-25 ~ 85°C at 20°C																					
Adhesive Strength of Termination	No remarkable damage or removal of the terminations	Pressurizing force: 5N(≤0603) and 10N(>0603) 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)																				
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"> <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(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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3	Max. operating temp.+3/-0	30±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" data-bbox="363 526 995 1059"> <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>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" data-bbox="363 1093 995 1592"> <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" data-bbox="363 1691 1002 1939"> <thead> <tr> <th>Rated voltage</th> <th>Insulation Resistance</th> </tr> </thead> <tbody> <tr> <td>100V:X7R</td> <td rowspan="5">RxC ≥ 10Ω-F</td> </tr> <tr> <td>16V:0402 ≥ 0.22uF</td> </tr> <tr> <td>10V:0201 ≥ 47nF; 0402 ≥ 47uF 0603 ≥ 0.47uF; 0805 ≥ 2.2uF 1206 ≥ 2.2uF; 1210 ≥ 47uF</td> </tr> <tr> <td>6.3V</td> </tr> </tbody> </table>	Rated vol.	D.F. ≤	Exception of D.F. ≤		≥ 50V	3.0%	6%	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	RxC ≥ 10Ω-F	16V:0402 ≥ 0.22uF	10V:0201 ≥ 47nF; 0402 ≥ 47uF 0603 ≥ 0.47uF; 0805 ≥ 2.2uF 1206 ≥ 2.2uF; 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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Item	Requirement	Test Method			
Humidity load	No remarkable damage. Cap change: NPO: $\pm 7.5\%$ or $0.75\text{pF}$ whichever is larger X5R, X5R: $\geq 10\text{V}$ , within $\pm 12.5\%$ ; $6.3\text{V}$ , within $\pm 25\%$ Y5V: $\geq 10\text{V}$ , within $\pm 30\%$ ; $6.3\text{V}$ , within $+30/-40\%$ Q/D.F. value: NPO: $C \geq 30\text{pF}, Q \geq 200$ ; $C < 30\text{pF}, Q \geq 100+10/3C$	Test temp: $40 \pm 2^\circ\text{C}$ Humidity: $90\sim 95\%RH$ Test time: $500+24/-0$ hrs To apply voltage: Rated voltage Measurement to be made after keeping at room temp for $24 \pm 2$ hrs.(Class I) or $48 \pm 4$ hrs.(Class II)			
	X7R, X5R:				
	Rated vol.		D.F. $\leq$	Exception of D.F. $\leq$	
	$\geq 50\text{V}$		3.0%	6% 0603 $\geq 0.047\mu\text{F}$ ; 0805 $\geq 0.18\mu\text{F}$ 1206 $\geq 0.47\mu\text{F}$	
	25V		5.0%	10%	0805 $\geq 1\mu\text{F}$ ; 1210 $\geq 10\mu\text{F}$
				14%	0603 $\geq 0.33\mu\text{F}$ ; 1206 $\geq 4.7\mu\text{F}$
				15%	0402 $\geq 0.10\mu\text{F}$ ; 0603 $\geq 0.47\mu\text{F}$ 0805 $\geq 2.2\mu\text{F}$ ; 1206 $\geq 6.8\mu\text{F}$
	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 $\geq 100\mu\text{F}$	
	Y5V:				
	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%	-			
I.R.: $\geq 10\text{V}$ $500\text{M}\Omega$ or $25\Omega\text{-F}$ (Whichever is smaller) Class II (X7R, X5R, Y5V)					
Rated voltage	Insulation Resistance				
100V: X7R	RxC $\geq 5\Omega\text{-F}$				
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)	<p>No remarkable damage            Cap change:            NPO: <math>\pm 3\%</math> or <math>\pm 0.3F</math> whichever is larger            X7R, X5R: <math>\geq 10V</math>, within <math>\pm 12.5\%</math>; 6.3V, within <math>+30/-40\%</math>            Q/D.F. value:            NPO: more than 30pF, <math>Q \geq 350</math>  <math>10pF \leq C &lt; 30pF</math>, <math>Q \geq 275 + 2.5C</math>            Less than 10pF, <math>Q \geq 200 + 10C</math>            X7R, X5R:</p> <table border="1" data-bbox="336 454 954 987"> <thead> <tr> <th>Rated vol.</th> <th>D.F. <math>\leq</math></th> <th colspan="2">Exception of D.F. <math>\leq</math></th> </tr> </thead> <tbody> <tr> <td><math>\geq 50V</math></td> <td>3.0%</td> <td>6%</td> <td>0603 <math>\geq 0.047\mu F</math>; 0805 <math>\geq 0.18\mu F</math> 1206 <math>\geq 0.47\mu F</math></td> </tr> <tr> <td rowspan="3">25V</td> <td rowspan="3">5.0%</td> <td>10%</td> <td>0805 <math>\geq 1\mu F</math>; 1210 <math>\geq 10\mu F</math></td> </tr> <tr> <td>14%</td> <td>0603 <math>\geq 0.33\mu F</math></td> </tr> <tr> <td>15%</td> <td>0402 <math>\geq 0.10\mu F</math>; 0603 <math>\geq 0.47\mu F</math> 0805 <math>\geq 2.2\mu F</math>; 1206 <math>\geq 6.8\mu F</math></td> </tr> <tr> <td rowspan="2">16V</td> <td rowspan="2">5%</td> <td>10%</td> <td>0603 <math>\geq 0.15\mu F</math>; 0805 <math>\geq 0.68\mu F</math> 1206 <math>\geq 2.2\mu F</math>; 1210 <math>\geq 4.7\mu F</math></td> </tr> <tr> <td>15%</td> <td>0402 <math>\geq 0.033\mu F</math>; 0603 <math>\geq 0.68\mu F</math> 0805 <math>\geq 2.2\mu F</math>; 1206 <math>\geq 4.7\mu F</math> 1210 <math>\geq 22\mu F</math></td> </tr> <tr> <td rowspan="2">10V</td> <td rowspan="2">7.5%</td> <td>15%</td> <td>0402 <math>\geq 0.33\mu F</math>; 0603 <math>\geq 0.33\mu F</math> 0805 <math>\geq 2.2\mu F</math>; 1206 <math>\geq 2.2\mu F</math> 1210 <math>\geq 22\mu F</math></td> </tr> <tr> <td>20%</td> <td>0201 <math>\geq 0.1\mu F</math>; 0402 <math>\geq 1\mu F</math></td> </tr> <tr> <td>6.3V</td> <td>15%</td> <td>30%</td> <td>0402 <math>\geq 2.2\mu F</math>; 0603 <math>\geq 10\mu F</math> 0805 <math>\geq 4.7\mu F</math>; 1210 <math>\geq 100\mu F</math></td> </tr> </tbody> </table> <p>Y5V:</p> <table border="1" data-bbox="336 1048 954 1496"> <thead> <tr> <th>Rated vol.</th> <th>D.F. <math>\leq</math></th> <th colspan="2">Exception of D.F. <math>\leq</math></th> </tr> </thead> <tbody> <tr> <td><math>\geq 50V</math></td> <td>7.5%</td> <td>10%</td> <td>0603 <math>\geq 0.1\mu F</math>; 0805 <math>\geq 0.47\mu F</math> 1206 <math>\geq 4.7\mu F</math></td> </tr> <tr> <td>35V</td> <td>10%</td> <td>—</td> <td>—</td> </tr> <tr> <td>25V</td> <td>7.5%</td> <td>10%</td> <td>0402 <math>\geq 0.047\mu F</math>; 0603 <math>\geq 0.1\mu F</math> 0805 <math>\geq 0.33\mu F</math>; 1206 <math>\geq 1\mu F</math> 1210 <math>\geq 4.7\mu F</math></td> </tr> <tr> <td rowspan="2">16V (C &lt; 1.0<math>\mu F</math>)</td> <td rowspan="2">10%</td> <td>12.5%</td> <td>0402 <math>\geq 0.068\mu F</math>; 0603 <math>\geq 0.68\mu F</math></td> </tr> <tr> <td>20%</td> <td>0402 <math>\geq 0.22\mu F</math></td> </tr> <tr> <td>16V (C <math>\geq 1.0\mu F</math>)</td> <td>12.5%</td> <td>20%</td> <td>0603 <math>\geq 2.2\mu F</math>; 0805 <math>\geq 3.3\mu F</math> 1206 <math>\geq 10\mu F</math>; 1210 <math>\geq 22\mu F</math> 1812 <math>\geq 47\mu F</math></td> </tr> <tr> <td>10V</td> <td>15%</td> <td>30%</td> <td>0402 <math>\geq 0.47\mu F</math></td> </tr> <tr> <td>6.3V</td> <td>30%</td> <td>-</td> <td>-</td> </tr> </tbody> </table> <p>I.R.: <math>\geq 10V</math> 1G<math>\Omega</math> or 50<math>\Omega</math>-F whichever is smaller            Class II (X7R, X5R, Y5V)</p> <table border="1" data-bbox="336 1592 954 1816"> <thead> <tr> <th>Rated voltage</th> <th>Insulation Resistance</th> </tr> </thead> <tbody> <tr> <td>100V: X7R</td> <td rowspan="5">RxC <math>\geq 10\Omega</math>-F</td> </tr> <tr> <td>16V: 0402 <math>\geq 0.22\mu F</math></td> </tr> <tr> <td>10V: 0201 <math>\geq 47nF</math>; 0402 <math>\geq 0.47\mu F</math> 0603 <math>\geq 0.47\mu F</math>; 0805 <math>\geq 2.2\mu F</math> 1206 <math>\geq 4.7\mu F</math>; 1210 <math>\geq 47\mu F</math></td> </tr> <tr> <td>6.3V</td> </tr> </tbody> </table>	Rated vol.	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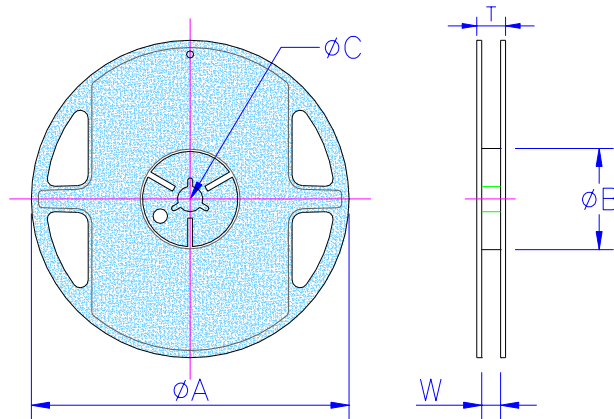
# ■ Packaging

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 +0.05 / -0.10	X	4K	-
0805	0.60±0.10	A	4K	-
	0.80±0.10	B	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
	1.60±0.20	G	-	1K
	2.00±0.20	K	-	1K
	2.50±0.30	M	-	0.5K
0612	0.80±0.10	B	4K	-

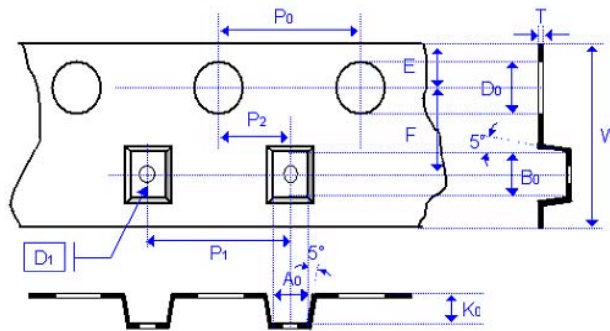
## Tape and Reel



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")

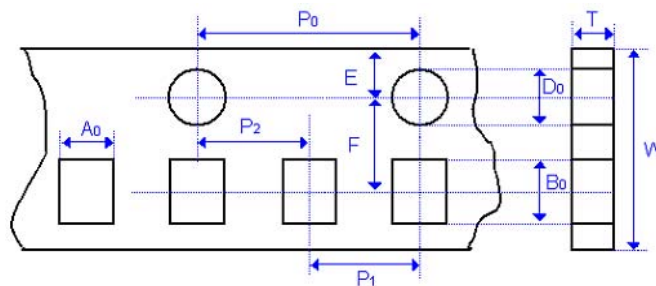
Plastic Tape Size Specification



Unit: mm

Type	0805		1206					1210					1808		1812		
	D	I	C	J	M	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
	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