

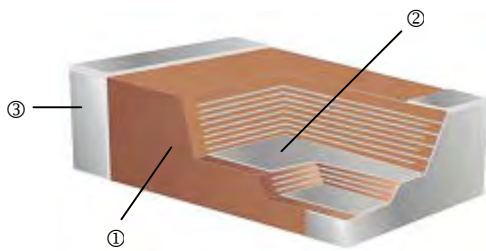
## Multilayer Ceramic Chip Capacitor

### Features

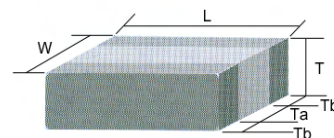
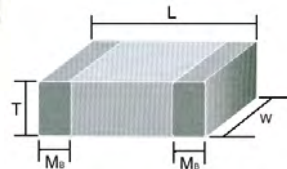
- Wide capacitance range, extremely compact size
- Low inductance of capacitor for high frequency application
- Excellent solderability and resistance to soldering heat, suitable for flow and reflow soldering
- Adaptable to high-speed surface mount assembly
- Conform to EIAJ-RC3402, and also compatible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



### Construction



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



Unit: mm

### Dimensions

MC / MCHL / MCRF Type

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±0.10	S	0.40±0.15	4K	-	
		1.60 +0.15 / -0.10	0.80 +0.15 / -0.10	0.80 +0.15 / -0.10	X		4K		
05	0805	2.00±0.15	1.25±0.20	0.60±0.15	A	0.50±0.20	4K	-	
				0.80±0.10	B		4K	-	
				1.25±0.10	D		-	3K	
		0.85±0.10		T	4K		-		
		2.00±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 (0.50±0.20)***	4K	-	
				0.95±0.10	C		-	3K	
				1.25±0.10	D		-	3K	
		1.15±0.15		J	-		3K		
		3.20±0.20		1.60±0.20	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	
		3.20±0.40		2.50±0.30	1.60±0.20		G	-	2K
					2.00±0.20		K	-	1K
					2.50±0.30		M	-	1K
08	1808	4.50±0.40	2.03±0.25	1.25±0.10	D	0.75±0.25 (0.50±0.20)***	-	2K	
		(4.5+0.5/-0.3)**		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 (0.50±0.20)***	-	1K	
		(4.5+0.5/-0.3)**		2.00±0.20	K		-	1K	
			3.20±0.40	2.50±0.30	M		-	0.5K	

\*\* For 1808/1812: 200~3KV, \*\*\*For 1206:1KV~3KV; 1808/1812: 200~3KV

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	-

**Multilayer Ceramic Chip Capacitor**

**■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 $\mu\text{F}$

**Multilayer Ceramic Chip Capacitor**

**Ultra High Q & Low ESR Capacitors for MCRF Series**

Capacitance & Voltage

Dielectric		NPO										
EIA	Size	0201			0402		0603			0805		
Code	VDCW	6.3V	10V	25V	50V	100V	50V	100V	250V	50V	100V	250V
0R1	0.1pF	L	L	L	N	N						
0R2	0.2	L	L	L	N	N						
0R3	0.3	L	L	L	N	N	S	S	S	T	T	T
0R4	0.4	L	L	L	N	N	S	S	S	T	T	T
0R5	0.5	L	L	L	N	N	S	S	S	T	T	T
0R6	0.6	L	L	L	N	N	S	S	S	T	T	T
0R7	0.7	L	L	L	N	N	S	S	S	T	T	T
0R8	0.8	L	L	L	N	N	S	S	S	T	T	T
0R9	0.9	L	L	L	N	N	S	S	S	T	T	T
1R0	1.0	L	L	L	N	N	S	S	S	T	T	T
1R2	1.2	L	L	L	N	N	S	S	S	T	T	T
1R5	1.5	L	L	L	N	N	S	S	S	T	T	T
1R8	1.8	L	L	L	N	N	S	S	S	T	T	T
2R2	2.2	L	L	L	N	N	S	S	S	T	T	T
2R7	2.7	L	L	L	N	N	S	S	S	T	T	T
3R3	3.3	L	L	L	N	N	S	S	S	T	T	T
3R9	3.9	L	L	L	N	N	S	S	S	T	T	T
4R7	4.7	L	L	L	N	N	S	S	S	T	T	T
5R6	5.6	L	L	L	N	N	S	S	S	T	T	T
6R8	6.8	L	L	L	N	N	S	S	S	T	T	T
8R2	8.2	L	L	L	N	N	S	S	S	T	T	T
100	10	L	L	L	N	N	S	S	S	T	T	T
120	12	L	L	L	N		S	S	S	T	T	T
150	15	L	L	L	N		S	S	S	T	T	T
180	18	L	L	L	N		S	S	S	T	T	T
220	22	L	L	L	N		S	S	S	T	T	T
330	33	L	L	L			S	S	S	T	T	T
390	39						S	S	S	T	T	T
470	47						S	S	S	T	T	T
560	56									T	T	T
680	68									T	T	T
820	82									T	T	T
101	100									T	T	T

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

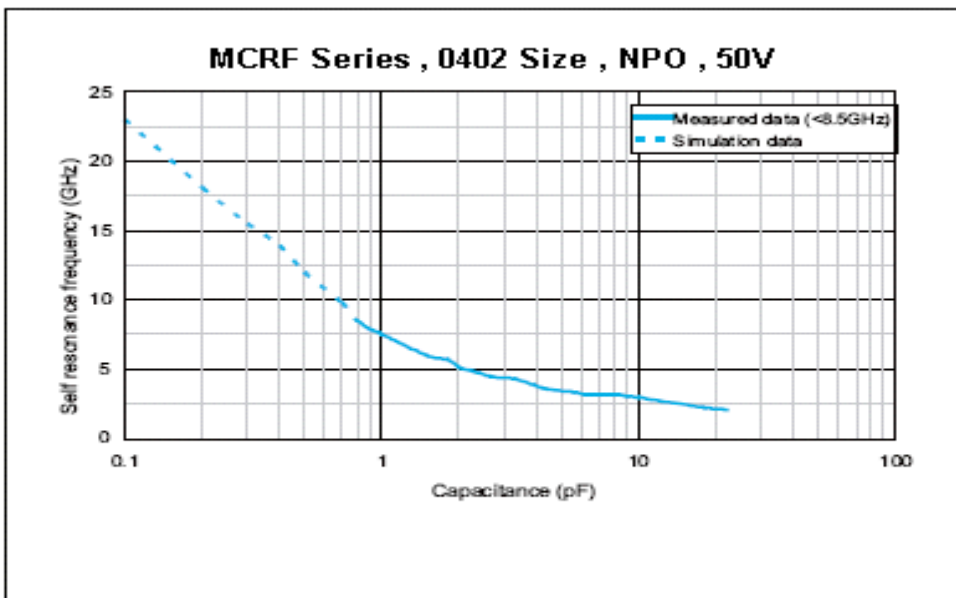
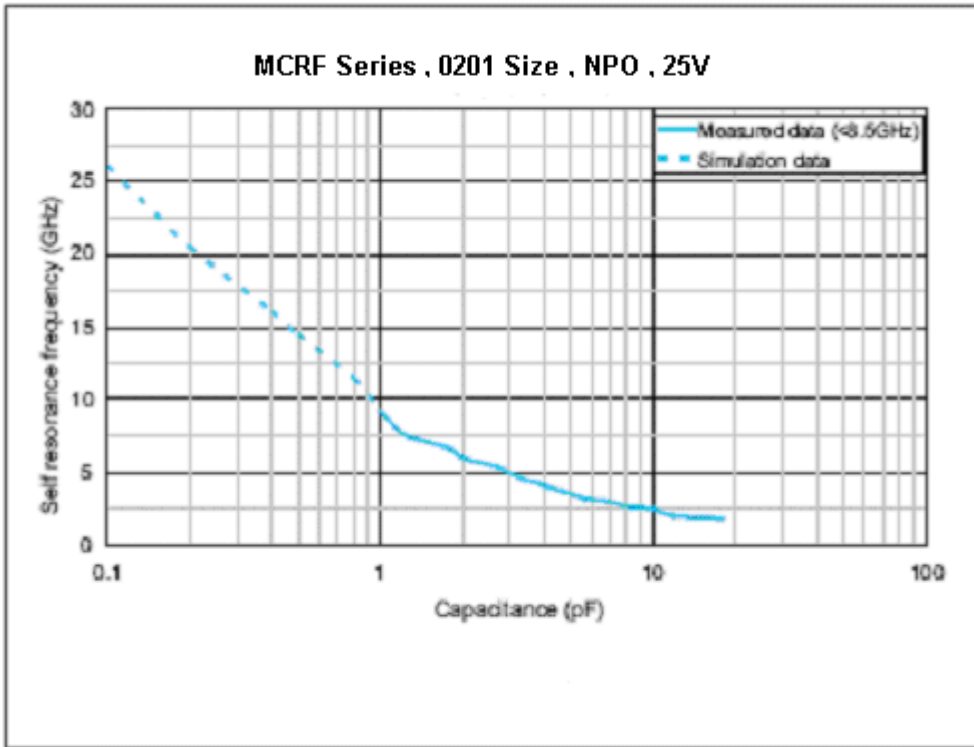
Electrical Data

Dielectric Size	NPO
	0201, 0402, 0603, 0805
Capacitance*	0201: 0.1pF ~ 33pF, 0402: 0.1pF ~ 22pF 0603: 0.3pF ~ 47pF, 0805: 0.3pF ~ 100pF
Capacitance tolerance**	Cap ≤ 5pF: A(±0.05pF), B(±0.1pF), C(±0.25pF) 5pF < Cap < 10pF: B(±0.1pF), C(±0.25pF), D(±0.5pF) Cap ≥ 10pF: F(±1%), G(±2%), J(±5%)
Rated voltage (VDCW)	6.3V, 10V, 25V, 50V, 100V, 250V
Q *	Cap ≥ 30pF: Q ≥ 1000, Cap < 30pF: Q ≥ 400+20C;
Insulation resistance at Ur	≥ 10GΩ
Operating temperature	-55 to +125°C
Capacitance	±30 ppm
Termination	Ni/Sn (lead-free termination)

■ \*\*Measured at the conditions of 25°C ambient temperature and 30~70% related humidity

■ Apply 1.0±0.2Vrms, 1.0MHz±10% for Cap ≤ 1000pF; 1.0KHz±10% for Cap > 1000pF

Electrical characteristics



**Multilayer Ceramic Chip Capacitor**

**■ 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 <sub>≤</sub> 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<sub>≥</sub> 30pF, Q<sub>≥</sub> 1000; Cap&lt;30pF, Q<sub>≥</sub> 400+20C 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 rowspan="3">≥ 50V</td> <td rowspan="3">2.5%</td> <td>3%</td> <td>0201(50V); 0603<sub>≥</sub>0.047μF 0805<sub>≥</sub>0.18μF; 1206<sub>≥</sub>0.47μF</td> </tr> <tr> <td>5%</td> <td>1210<sub>≥</sub>4.7μF</td> </tr> <tr> <td>7%</td> <td>0603<sub>≥</sub>1μF; 0805<sub>≥</sub>1μF 1206<sub>≥</sub>2.2μF; 1210<sub>≥</sub>10μF</td> </tr> <tr> <td rowspan="3">25V</td> <td rowspan="3">3.5%</td> <td>5%</td> <td>0201<sub>≥</sub>0.01μF; 0805<sub>≥</sub>1μF 1210<sub>≥</sub>10μF</td> </tr> <tr> <td>7%</td> <td>0603<sub>≥</sub>0.33μF; 1206<sub>≥</sub>4.7μF</td> </tr> <tr> <td>10%</td> <td>0402<sub>≥</sub>0.10μF; 0603<sub>≥</sub>0.47μF 0805<sub>≥</sub>2.2μF; 1206<sub>≥</sub>6.8μF 1210<sub>≥</sub>22μF</td> </tr> <tr> <td rowspan="2">16V</td> <td rowspan="2">3.5%</td> <td>5%</td> <td>0201<sub>≥</sub>0.01μF; 0402<sub>≥</sub>0.033μF 0603<sub>≥</sub>0.15μF; 0805<sub>≥</sub>0.68μF 1206<sub>≥</sub>2.2μF; 1210<sub>≥</sub>4.7μF</td> </tr> <tr> <td>10%</td> <td>0402<sub>≥</sub>0.22μF; 0603<sub>≥</sub>0.68μF 0805<sub>≥</sub>2.2μF; 1206<sub>≥</sub>4.7μF 1210<sub>≥</sub>22μF</td> </tr> <tr> <td rowspan="2">10V</td> <td rowspan="2">5%</td> <td>10%</td> <td>0201<sub>≥</sub>0.012μF; 0402<sub>≥</sub>0.33μF 0603<sub>≥</sub>0.33μF; 0805<sub>≥</sub>2.2μF 1206<sub>≥</sub>2.2μF; 1210<sub>≥</sub>22μF</td> </tr> <tr> <td>15%</td> <td>0201<sub>≥</sub>0.1μF; 0402<sub>≥</sub>1μF</td> </tr> <tr> <td rowspan="2">6.3V</td> <td rowspan="2">10%</td> <td>15%</td> <td>0201<sub>≥</sub>0.01μF; 0402<sub>≥</sub>1μF 0603<sub>≥</sub>10μF; 0805<sub>≥</sub>4.7μF 1206<sub>≥</sub>47μF; 1210<sub>≥</sub>100μF</td> </tr> <tr> <td>20%</td> <td>0402<sub>≥</sub>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<sub>≥</sub>0.1μF; 0805<sub>≥</sub>0.47μF 1206<sub>≥</sub>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<sub>≥</sub>0.047μF; 0603<sub>≥</sub>0.1μF 0805<sub>≥</sub>0.33μF; 1206<sub>≥</sub>1μF 1210<sub>≥</sub>4.7μF</td> </tr> <tr> <td>9%</td> <td>0402<sub>≥</sub>0.068μF; 0603<sub>≥</sub>0.47μF 1206<sub>≥</sub>4.7μF; 1210<sub>≥</sub>22μF</td> </tr> <tr> <td rowspan="2">16V (C &lt; 1.0μF)</td> <td rowspan="2">7%</td> <td>9%</td> <td>0402<sub>≥</sub>0.068μF; 0603<sub>≥</sub>0.68μF</td> </tr> <tr> <td>12.5%</td> <td>0402<sub>≥</sub>0.22μF</td> </tr> <tr> <td>16V (C ≥ 1.0μF)</td> <td>9%</td> <td>12.5%</td> <td>0603<sub>≥</sub>2.2μF; 0805<sub>≥</sub>3.3μF 1206<sub>≥</sub>10μF; 1210<sub>≥</sub>22μF 1812<sub>≥</sub>47μF</td> </tr> <tr> <td>10V</td> <td>12.5%</td> <td>20%</td> <td>0402<sub>≥</sub>0.47μF</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(≤ 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>																																																																										

**Multilayer Ceramic Chip Capacitor**

Item	Requirement	Test Method																				
Insulation Resistance	10GΩ or R×C≥ 500Ω·F Whichever is smaller X7R, X5R, Y5V:	To apply rated voltage for max. 120sec																				
	<table border="1"> <tr> <td>Rated Voltage</td> <td>Insulation Resistance</td> </tr> <tr> <td>100V: X7R</td> <td rowspan="5">R×C ≥ 100Ω·F</td> </tr> <tr> <td>50V: 0603≥1uF;0805≥1uF;1206≥2.2uF 1210≥4.7uF</td> </tr> <tr> <td>25V: 0402≥1uF;0603≥2.2uF;0805≥2.2uF 1206≥10uF;1210≥10uF</td> </tr> <tr> <td>16V: 0402≥ 0.22uF;0603≥1uF;0805≥2.2uF 1206≥10uF;1210≥47uF</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> <td></td> </tr> </table>		Rated Voltage	Insulation Resistance	100V: X7R	R×C ≥ 100Ω·F	50V: 0603≥1uF;0805≥1uF;1206≥2.2uF 1210≥4.7uF	25V: 0402≥1uF;0603≥2.2uF;0805≥2.2uF 1206≥10uF;1210≥10uF	16V: 0402≥ 0.22uF;0603≥1uF;0805≥2.2uF 1206≥10uF;1210≥47uF	10V: 0201≥47nF;0402≥0.47uF;0603≥0.47uF 0805≥2.2uF;1206≥4.7uF;1210≥47uF	6.3V											
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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"> <tr> <td>T.C.</td> <td>Capacitance Change</td> </tr> <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> </table>	T.C.	Capacitance Change	NPO	±30 (ppm/°C)	X7R	±15%	X5R	±15%	Y5V	+30%~-80%	<p>With no electrical load.</p> <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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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.(two 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: 260±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 24±4hrs at room temp. Measurement to be made after keep at room temp. for 24±2 hrs.																				
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> <p>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).</p>	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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**Multilayer Ceramic Chip Capacitor**

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 rowspan="3">≥ 50V</td> <td rowspan="3">3.0%</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 rowspan="3">25V</td> <td rowspan="3">5.0%</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 ≥ 0.1μF;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;0603 ≥ 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 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>50V:0603 ≥ 1uF;0805 ≥ 1uF;1206 ≥ 2.2uF 1210 ≥ 4.7uF</td> </tr> <tr> <td>25V:0402 ≥ 1uF;0603 ≥ 2.2uF 0805 ≥ 2.2uF; 1206 ≥ 10uF;1210 ≥ 10uF</td> </tr> <tr> <td>16V:0402 ≥ 0.22uF;0603 ≥ 1uF;0805 ≥ 2.2uF 1206 ≥ 10uF;1210 ≥ 47uF</td> </tr> <tr> <td>10V: 0201 ≥ 47nF;0402 ≥ 0.47uF;0603 ≥ 0.47uF 0805 ≥ 2.2uF;1206 ≥ 4.7uF;1210 ≥ 47uF</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	10%	1210 ≥ 4.7μF	20%	0603 ≥ 1μF;0805 ≥ 1μF 1206 ≥ 2.2μF;1210 ≥ 10μF	25V	5.0%	10%	0201 ≥ 0.01μF;0805 ≥ 1μF 1210 ≥ 10μF	14%	0603 ≥ 0.33μF;1206 ≥ 4.7μF	15%	0402 ≥ 0.1μF;0603 ≥ 0.47μF 0805 ≥ 2.2μF;1206 ≥ 6.8μF 1210 ≥ 22μF	16V	5%	10%	0603 ≥ 0.15μF;0603 ≥ 0.68μF 1206 ≥ 2.2μF;1210 ≥ 4.7μF	15%	0201 ≥ 0.01μF;0402 ≥ 0.033μF 0603 ≥ 0.68μF;0805 ≥ 2.2μF 1206 ≥ 4.7μF;1210 ≥ 22μF	10V	7.5%	15%	0201 ≥ 0.012μF;0402 ≥ 0.33μF 0603 ≥ 0.33μF;0805 ≥ 2.2μF 1206 ≥ 2.2μF;1210 ≥ 22μF	20%	0201 ≥ 0.1μF;0402 ≥ 1μF	6.3V	15%	30%	0201 ≥ 0.1μF;0402 ≥ 1μF 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	50V:0603 ≥ 1uF;0805 ≥ 1uF;1206 ≥ 2.2uF 1210 ≥ 4.7uF	25V:0402 ≥ 1uF;0603 ≥ 2.2uF 0805 ≥ 2.2uF; 1206 ≥ 10uF;1210 ≥ 10uF	16V:0402 ≥ 0.22uF;0603 ≥ 1uF;0805 ≥ 2.2uF 1206 ≥ 10uF;1210 ≥ 47uF	10V: 0201 ≥ 47nF;0402 ≥ 0.47uF;0603 ≥ 0.47uF 0805 ≥ 2.2uF;1206 ≥ 4.7uF;1210 ≥ 47uF	<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.</p>
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**Multilayer Ceramic Chip Capacitor**

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**Multilayer Ceramic Chip Capacitor**

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 $+30/-40\%$ 10V: 0603 $\geq 4.7\mu F$ ; 0402 $\geq 1\mu F$ ; 0201 $\geq 0.1\mu F$ , within $\pm 25\%$ 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: $85 \pm 3^\circ C$ Test Time: 1000+25/-0 hrs To apply voltage: (1.1) 100% of rated voltage for below range.																																																															
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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 $\geq 47\mu F$																																																														
		30%	0402 $\geq 0.47\mu F$																																																														
10V	20%	-	-																																																														
6.3V	30%	-	-																																																														
	I.R.: $\geq 10V$ 1G $\Omega$ or 50 $\Omega$ -F whichever is smaller Class II (X7R, X5R, Y5V)																																																																
	<table border="1"> <thead> <tr> <th>Rated voltage</th> <th>Insulation Resistance</th> </tr> </thead> <tbody> <tr> <td>100V: X7R</td> <td rowspan="5">RxC <math>\geq</math> 10<math>\Omega</math>-F</td> </tr> <tr> <td>50V: 0603 <math>\geq 1\mu F</math>; 0805 <math>\geq 1\mu F</math>; 1206 <math>\geq 2.2\mu F</math> 1210 <math>\geq 4.7\mu F</math></td> </tr> <tr> <td>25V: 0402 <math>\geq 1\mu F</math>; 0603 <math>\geq 2.2\mu F</math> 0805 <math>\geq 2.2\mu F</math>; 1206 <math>\geq 10\mu F</math>; 1210 <math>\geq 10\mu F</math></td> </tr> <tr> <td>16V: 0402 <math>\geq 0.22\mu F</math>; 0603 <math>\geq 1\mu F</math>; 0805 <math>\geq 2.2\mu F</math> 1206 <math>\geq 10\mu F</math>; 1210 <math>\geq 47\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> </tbody> </table>	Rated voltage	Insulation Resistance	100V: X7R	RxC $\geq$ 10 $\Omega$ -F	50V: 0603 $\geq 1\mu F$ ; 0805 $\geq 1\mu F$ ; 1206 $\geq 2.2\mu F$ 1210 $\geq 4.7\mu F$	25V: 0402 $\geq 1\mu F$ ; 0603 $\geq 2.2\mu F$ 0805 $\geq 2.2\mu F$ ; 1206 $\geq 10\mu F$ ; 1210 $\geq 10\mu F$	16V: 0402 $\geq 0.22\mu F$ ; 0603 $\geq 1\mu F$ ; 0805 $\geq 2.2\mu F$ 1206 $\geq 10\mu F$ ; 1210 $\geq 47\mu F$	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 $\geq 47\mu F$																																																								
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**Multilayer Ceramic Chip Capacitor**

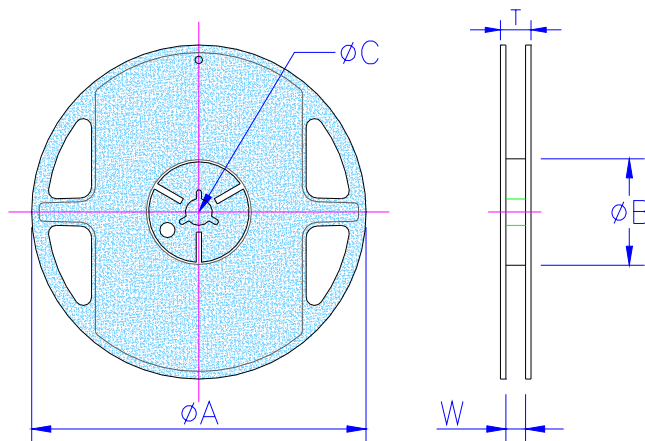
**■Packaging**

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±0.10	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

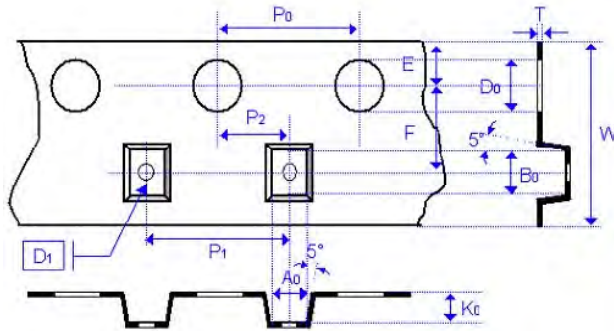


Unit: mm

Type	Chip Size							
	0201	0402	0603	0805	1206/0612	1210	1808	1812
ΦC	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
ΦA	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")
ΦB	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")

**Multilayer Ceramic Chip Capacitor**

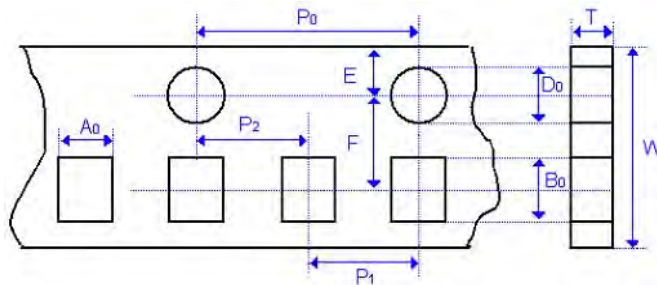
Plastic Tape Size Specification



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		<3.81						
B <sub>0</sub>	<2.40		<3.46			<3.67				<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		0.25±0.05		0.25±0.05				
K <sub>0</sub>	<2.50		<2.50			<2.50				<2.50		<3.00		<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				
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