Surface Mount Multilayer Ceramic Chip Capacitors for Commodity Solutions

Below tables are test procedures and requirements unless specified in detail datasheet

VJ....W1BC TEST PROCEDURES AND REQUIREMENTS

TEST	PROCEDURE	REQUIREMENTS			
1) Visual and mechanical		• No remarkable defect. • Dimensions should confirm to individual specification sheet.			
2) Capacitance	Class I: NP0 Cap. ≤ 1000 pF; 1.0 ± 0.2 V_{rms}; 1 MHz ± 10 % Cap. > 1000 pF; 1.0 ± 0.2 V_{rms}; 1 kHz ± 10 % Class II: X7R, X5R, Y5V Cap. ≤ 10 µF; 1.0 ± 0.2 V_{rms}; 1 kHz ± 10 % Cap. > 10 µF; 0.5 ± 0.2 V_{rms}; 120 Hz ± 20 %	• Shall not exceed the limits given in the detailed specification.			
3) Q/DF (Dissipation Factor)		NP0: Cap. ≥ 30 pF: Q ≥ 1000 Cap. < 30 pF: Q ≥ 400 + 20 °C			
		X7R, X5R:			
		Rated Vol.	D. F.	Exception of D. F.	
		≥ 50 V	≤ 2.5 %	≤ 3 %	0603 ≥ 0.047 µF, 0805 ≥ 0.18 µF; 1206 ≥ 0.47 µF
		25 V	≤ 3.5 %	≤ 5 %	0805 ≥ 1µF, 1210 ≥ 10 µF
				≤ 7 %	0402 ≥ 0.10 µF; 0603 ≥ 0.33 µF; 0805 ≥ 2.2 µF; 1206 ≥ 4.7 µF;
				≤ 10 %	0603 ≥ 0.68 µF; 0805 ≥ 4.7 µF; 1206 ≥ 6.8 µF;
		16 V	≤ 3.5 %	≤ 5 %	0201 ≥ 0.0047 µF; 0402 ≥ 0.033 µF; 0603 ≥ 0.15 µF; 0805 ≥ 0.68 µF; 1206 ≥ 2.2 µF 1210 ≥ 4.7 µF
				≤ 10 %	0603 ≥ 0.68 µF; 0805 ≥ 2.2 µF; 1206 ≥ 6.8 µF; 1210 ≥ 22 µF
		10 V	≤ 5.0 %	≤ 10 %	0603 ≥ 1 µF; 0805 ≥ 2.2 µF; 1206 ≥ 6.8 µF; 1210 ≥ 22 µF
		6.3 V	≤ 10 %	≤ 15 %	0603 > 10 µF; 0805 ≥ 10 µF; 1210 > 100 µF
		Y5 V:			
		Rated Vol.	D. F.	Exception of D. F.	
		≥ 50 V	≤ 5.0 %	≤ 7 %	0603 > 0.1 µF; 0805 > 0.47 µF
		25 V	≤ 5.0 %	≤ 7 %	0603 > 0.1µF, 0805 ≥ 0.33 µF, 1206 ≥ 1µF 0402 > 0.047 µF; 1210 µF ≥ 4.7 µF
				≤ 9 %	0402 ≥ 0.068 µF 0603 ≥ 0.47 µF, 1206 ≥ 0.47 µF
		16 V (C < 1.0 µF)	≤ 7.0 %	≤ 9 %	0402 ≥ 0.068 µF; 0603 ≥ 0.068 µF;
		16 V (C ≥ 1 µF)	≤ 9.0 %	≤ 12.5 %	0805 ≥ 4.7 µF; 1206 ≥ 10 µF; 1210 ≥ 22 µF; 1812 ≥ 47µF
		≤ 10 V	≤ 12.5 %	-	-
		≤ 6.3 V	≤ 20 %	-	-

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TEST	PROCEDURE		REQUIREMENTS	
4) Dielectric strength	• To apply voltage (≤ 50 V) 250 %. • Duration: 1 to 5 s • Charge and discharge current less than 50 mA		• No evidence of damage or flash-over during test	
	• To apply voltage: 100 V 200 V ~ 300 V 500 V ~ 999 V 1000 V~3000 V • Cut-off, set at 10 mA • TEST = 15 s • RAMP = 0	≥ 3 times V DC ≥ 2 times V DC ≥ 1.5 times V DC ≥ 1.2 times V DC		
5) Insulation resistance	To apply rated voltage for max. 120 s		≥ 10 GΩ or R x C ≥ 500Ω F whichever is smaller ≥ 100 ΩF for X5R; X7R; Y5V all 6.3 V and 10 V: 0603 > 0.47 µF; 0805 > 2.2 µF > 4.7 µF; 1206 > 4.7 µF	
	Rated voltage: 100 ~ 500 V	To apply rated voltage for 60	≥ 10 GΩ or R x C > 100 ΩF whichever is smaller	
	Rated voltage: > 500 V	To apply 500 V for 60 s	≥ 10 GΩ	
6) Temperature coefficient	With no electrical load:			
	T. C.	Operating Temp.	T. C.	Capacitance change
	NP0 (C0G)	- 55 ~ 125 °C at 25	NP0 (C0G)	Within ± 30 ppm/°C
	X7R	- 55 ~ 125 °C at 25	X7R	Within ± 15 %
	X5R	- 55 ~ 85 °C at 25	X5R	Within ± 15 %
	Y5V	- 25 ~ 85 °C at 20	Y5V	Within + 30 %/- 80 %
7) Adhesive strength of termination	• Pressurizing force: 0201: 2N 0402 and 0603: 5 N > 0603: 10 N • Test time 10 ± 1 s		• No remarkable damage or removal of the terminations	
8) Vibration resistance	• Vibration frequency: 10 to 55 Hz/min • Total amplitude: 1.5 mm • Test time: 6 h (2 h each in 3 mutually perpendicular directions)		• No remarkable damage. • Capacitance change and Q/D.F.: to meet initial specification	
9) Solderability	• Solder temperature: 235 ± 5 °C • Dipping time: 2 ± 0.5 s		95 % minimum coverage of all metallized area	
10) Bending test	• The middle part of the substrate shall be pressurized by means of the pressurizing rod at a rate of about 1 mm per s until the deflection becomes 1 mm and then the pressure shall be maintained for 5 ±1s • Measurement to be made after keeping at room temperature for 24 ± 2 h		• No remarkable damage • Capacitance change: NP0: within ± 5.0 % or ± 0.5 pF 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)	
11) Resistance to soldering heat	• Solder temperature: 270 ± 5 °C. • Dipping time: 10 ± 1 second • Preheating: 120 to 150 °C for 1 minute before immerse the capacitor in a eutectic solder • Before initial measurement (Class II only): Perform 150 + 0/ - 10 °C for 1 h and then set for 48 ± 4 h at room temperature • Measurement to be made after keeping at room temperature for 24 ± 2 h (Class I) or 48 ± 4 h (Class II)		• No remarkable damage • Capacitance change: NP0: within ± 2.5 % or ± 0.25 pF whichever is larger X7R, X5R: within ± 7.5 % Y5V: within ± 20 % • Q/D.F., I.R. and dielectric strength: To meet initial requirements • 25 % maximum leaching on each edge	

VJ....W1BC TEST PROCEDURES AND REQUIREMENTS

<table>
<tr><th>TEST</th><th>PROCEDURE</th><th>REQUIREMENTS</th></tr>
<tr><td>12) Temperature cycle</td><td>• Conduct the 5 cycles according to the temperature and time
<table>
<tr><th>Step</th><th>Temperature (°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 temperature</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 temperature</td><td>2 ~ 3</td></tr>
</table>
• Before initial measurement (Class II only): Perform 150 + 0/- 10 °C for 1 h and then set for 48 ± 4 h at room temperature.
• Measurement to be made after keeping at room temperature for 24 ± 2 h (Class I) or 48 ± 4 h (Class II)</td><td>• No remarkable damage
• Capacitance change:
NP0: within ± 2.5 % or ± 0.25 pF whichever is larger
X7R, X5R: within ± 7.5 %
Y5V: within ± 20 %
• Q/D.F., I.R. and dielectric strength: to meet initial requirements</td></tr>
<tr><td>13) Humidity (steady state)</td><td>• Test temperature: 40 ± 2 °C
• Humidity: 90 ~ 95 % RH
• Test time: 500 + 24/- 0 h
• Measurement to be made after keeping at room temperature for 24 ± 2 h (Class I) or 48 ± 4 h (Class II).</td><td>• No remarkable damage
• Capacitance change:
NP0: within ± 5.0 % or ± 0.5 pF whichever is larger.
X7R, X5R: ≥ 10 V, within ± 12.5 %; 6.3 V, within ± 25 %;
Y5V: within ± 30 %
• Q/D.F. value: NP0: Cap. ≥ 30 pF: Q ≥ 350 ;
10pF ≤ Cap. < 30 pF: Q ≥ 275 + 2.5C; Cap. < 10pF: Q ≥ 20 0 + 10 C
X7R, X5R:
<table>
<tr><td>Rated Vol.</td><td>D. F.</td><td>Exception of D. F.</td><td></td></tr>
<tr><td>≥ 50 V</td><td>≤ 3.0 %</td><td>≤ 6 %</td><td>0603 ≥ 0.047 µF, 0805 ≥ 0.18 µF, 1206 ≥ 0.47 µF</td></tr>
<tr><td rowspan="2">25 V</td><td rowspan="2">≤ 5.0 %</td><td>≤ 10 %</td><td>0805 ≥ 1 µF, 1210 ≥ 10 µF</td></tr>
<tr><td>≤ 14 %</td><td>0603 ≥ 0.33 µF
1206 ≥ 10 µF</td></tr>
<tr><td></td><td></td><td>≤ 7.0 %</td><td>0402 ≥ 10 µF; 1206 ≤ 4.7 µF</td></tr>
<tr><td rowspan="2">16 V</td><td rowspan="2">≤ 5.0 %</td><td>≤ 10 %</td><td>0402 ≥ 0.033 µF, 0603 ≥ 0.15 µF, 0805 ≥ 0.68 µF; 0805 ≥ 2.2 µF, 1210 ≥ 4.7 µF;</td></tr>
<tr><td>≤ 15 %</td><td>1210 ≥ 22 µF</td></tr>
<tr><td>10 V</td><td>≤ 7.5 %</td><td>≤ 15 %</td><td>0402 ≥ 0.056 µF, 0603 ≥ 0.33 µF, 0805 ≥ 2.2 µF, 1206 ≥ 2.2 µF; 1210 ≥ 22 µF</td></tr>
<tr><td>6.3 V</td><td>≤ 15 %</td><td>≤ 30 %</td><td>0603 ≥ 10 µF; 0805 ≥ 10 µF
1210 ≥ 100 µF</td></tr>
<tr><td colspan="4">Y5 V:</td></tr>
<tr><td>Rated Vol.</td><td>D. F.</td><td>Exception of D. F.</td><td></td></tr>
<tr><td>≥ 50 V</td><td>≤ 7.5 %</td><td>-</td><td>-</td></tr>
<tr><td rowspan="2">25 V</td><td rowspan="2">≤ 7.5 %</td><td>≤ 10 %</td><td>0402 ≥ 0.047 µF; 0603 ≥ 0.1 µF
0805 ≥ 0.33 µF, 1206 ≥ 1 µF
1210 ≥ 4.7 µF</td></tr>
<tr><td>≤ 12.5 %</td><td>0402 ≥ 0.068 µF; 0603 ≥ 0.47 µF</td></tr>
<tr><td>16 V (C < 1.0 µF)</td><td>≤ 10 %</td><td>≤ 12.5 %</td><td>0402 ≥ 0.068 µF; 0603 ≥ 0.68 µF</td></tr>
<tr><td>16 V (C ≥ 1.0 µF)</td><td>≤ 12.5 %</td><td>≤ 20 %</td><td>0805 ≥ 4.7 µF; 1206 ≥ 10 µF; 1210 ≥ 22 µF
1812 > 47 µF</td></tr>
<tr><td>10 V</td><td>≤ 15 %</td><td>-</td><td>-</td></tr>
<tr><td>≤ 6.3 V</td><td>≤ 30 %</td><td>-</td><td>-</td></tr>
<tr><td colspan="4">• I.R.: ≥ 10 V: 1 GΩ or R x C ≥ 50 ΩF whichever is smaller
6.3 V: R x C ≥ 10 ΩF</td></tr>
</table></td></tr>
</table>

VJ....W1BC TEST PROCEDURES AND REQUIREMENTS

<table>
<tr><th>TEST</th><th>PROCEDURE</th><th colspan="4">REQUIREMENTS</th></tr>
<tr><td rowspan="20">14) Humidity load
(damp heat)</td><td rowspan="20">• Test temperature: 40 ± 2 °C
• Humidity: 90 ~ 95 % RH
• Test time: 500 + 24/- 0 hours.
• To apply voltage: rated voltage (Max 500 V)
• Measurement to be made after keeping at room temperature for 24 ± 2 hours (Class I) or 48 ± 4 hours (Class II)</td><td colspan="4">• No remarkable damage
• Capacitance change:
NP0: within ± 7.5 % or ± 0.75 pF whichever is larger.
X7R, X5R: ≥ 10V, within ± 12.5 %; 6.3V, with ± 25 %
Y5V: ≥ 10 V, within ± 30 %; 6.3V, within + 30 to - 40 %
• Q/D.F. value: NP0:
Cap ≥ 30 pF: Q ≥ 200;
Cap < 30 pF: Q ≥ 100 + 10/3C
X7R, X5R:</td></tr>
<tr><td>Rated Vol.</td><td>D. F.</td><td colspan="2">Exception of D. F.</td></tr>
<tr><td>≥ 50 V</td><td>≤ 3.0 %</td><td>≤ 6 %</td><td>0603 ≥ 0.047 µF, 0805 ≥ 0.18 µF,
1206 ≥ 0.47 µF</td></tr>
<tr><td rowspan="3">25 V</td><td rowspan="3">≤ 5.0 %</td><td>≤ 7.0 %</td><td>0402 ≥ 0.10 µF;
1206 ≥ 4.7 µF</td></tr>
<tr><td>≤ 10 %</td><td>0805 ≥ 1 µF, 1210 ≥ 10 µF</td></tr>
<tr><td>≤ 14 %</td><td>0603 ≥ 0.33 µF</td></tr>
<tr><td>16 V</td><td>≤ 5.0 %</td><td>≤ 10 %</td><td>0402 ≥ 0.047 µF, 0603 ≥ 0.15 µF,
0805 ≥ 0.68 µF, 1206 ≥ 2.2 µF</td></tr>
<tr><td></td><td></td><td>≤ 15 %</td><td>1210 ≥ 22 µF</td></tr>
<tr><td>10 V</td><td>≤ 7.5 %</td><td>≤ 15 %</td><td>0402 ≥ 0.056 µF, 0603 ≥ 0.33 µF,
0805 ≥ 2.2 µF, 1206 ≥ 2.2 µF,
1210 ≥ 22 µF</td></tr>
<tr><td>6.3 V</td><td>≤ 15 %</td><td>≤ 30 %</td><td>0603 ≥ 10 µF; 0805 ≥ 10 µF;
1210 ≥ 100 µF</td></tr>
<tr><td colspan="4">Y5 V:</td></tr>
<tr><td>Rated Vol.</td><td>D. F.</td><td colspan="2">Exception of D. F.</td></tr>
<tr><td>≥ 50 V</td><td>≤ 7.5 %</td><td>-</td><td>-</td></tr>
<tr><td rowspan="2">25 V</td><td rowspan="2">≤ 7.5 %</td><td>≤ 10 %</td><td>0603 ≥ 0.1 µF, 0805 ≥ 0.33 µF,
1206 ≥ 1.0 µF, 1210 ≥ 4.7 µF</td></tr>
<tr><td>≤ 12.5 %</td><td>0402 ≥ 0.068 µF
0603 ≥ 0.47 µF</td></tr>
<tr><td>16 V
(C < 1.0 µF)</td><td>≤ 10 %</td><td>≤ 12.5 %</td><td>0402 ≥ 0.068 µF; 0603 ≥ 0.68 µF</td></tr>
<tr><td>16 V
(C ≥ 1 µF)</td><td>≤ 12.5 %</td><td>≤ 20 %</td><td>0805 ≥ 4.7 µF; 1206 ≥ 10 µF;
1210 ≥ 22 µF; 1812 ≥ 47 µF</td></tr>
<tr><td>10 V</td><td>≤ 15 %</td><td>-</td><td>-</td></tr>
<tr><td>6.3 V</td><td>≤ 30 %</td><td>-</td><td>-</td></tr>
<tr><td colspan="4">• I.R.: 10 V: 500 MΩ or R x C ≥ 25 ΩF whichever is smaller
6.3 V: R x C ≥ 5 ΩF</td></tr>
</table>

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TEST	PROCEDURE	REQUIREMENTS			
15) High temperature load (endurance)	• Test temperature: NP0, X7R: 125 ± 3 °C X5R, Y5V: 85 ± 3 °C • To apply voltage: 200 % of rated voltage • Test time: 1000 + 24/- 0 h • Measurement to be made after keeping at room temperature for 48 ± 4 h	• No remarkable damage • Capacitance change: NP0: within ± 3.0 % or ± 0.3 pF whichever is larger. X7R, X5R: ≥ 10 V, within ± 12.5 %; 6.3V, with ± 25 % Y5V: ≥ 10 V, within ± 30 %; 6.3 V, within + 30 to - 40 % • Q/D.F. value: NP0: Cap .≥ 30 pF: Q ≥ 350; 10 pF ≤ Cap. < 30 pF: Q ≥ 275 + 2.5C; Cap. < 10 pF: Q ≥ 200 + 10C X7R, X5R:			
		Rated Vol.	D. F.	Exception of D. F.	
		≥ 50 V	≤ 3.0 %	≤ 6 %	0603 ≥ 0.047 µF, 0805 ≥ 0.18 µF, 1206 ≥ 0.47 µF
		25 V	≤ 5.0 %	≤ 7 %	0402 ≥ 0.10 µF;1206 ≥ 4.7 µF
				≤ 10 %	0805 ≥ 1 µF, 1210 ≥ 10 µF
				≤ 14 %	0603 ≥ 0.33 µF
		16 V	≤ 5.0 %	≤ 10 %	0402 ≥ 0.033 µF, 0603 ≥ 0.15 µF, 0805 ≥ 0.68 µF, 1206 ≥ 2.2 µF
				≤ 15 %	1210 ≥ 22 µF
		10 V	≤ 7.5 %	≤ 15 %	0402 ≥ 0.056 µF, 0603 ≥ 0.33 µF, 0805 ≥ 2.2 µF, 1206 ≥ 2.2 µF; 1210 ≥ 22 µF
		6.3 V	≤ 15 %	≤ 30 %	0603 ≥ 10 µF, 0805 ≥ 10 µF, 1210 ≥ 100 µF
		Y5V:			
		Rated Vol.	D. F.	Exception of D. F.	
		≥ 50 V	≤ 7.5 %	-	–
		25 V	≤ 7.5 %	≤ 10 %	0603 ≥ 0.1 µF, 0805 ≥ 0.33 µF, 1206 ≥ 1 µF; 1210 ≥ 4.7 µF
				≤ 12.5 %	0402 ≥ 0.068 µF 0603 ≥ 0.047µF
		16 V (C < 1.0 µF)	≤ 10 %	≤ 12.5 %	0402 ≥ 0.068 µF; 0603 ≥ 0.68 µF
		16 V (C ≥ 1.0 µF)	≤ 12.5 %	-	0805 ≥ 4.7 µF, 1206 ≥ 10 µF; 1210 ≥ 22 µF; 1812 ≥ 47 µF
		10 V	≤ 15 %	-	-
		6.3 V	≤ 30 %	-	-
		• I. R.: ≥ 10 V : 1 GΩ or R x C ≥ 50 ΩF whichever is smaller 6.3 V: R x C ≥ 10 ΩF			