

Middle and High Voltage Capacitors

HOW TO ORDER

1808	N	100	G	202	L	T
Size	Dielectric	Capacitance	Tolerance	Rated voltage	Termination	Packaging
Inch (mm) 0603(1608) 0805 (2012) 1206 (3216) 1210 (3225) 1808 (4520) 1812 (4532)	N=NPO (COG) B=X7R F=Y5V	Two significant digits followed by no. of zeros. And R is in place of decimal point. eg.: R47=0.47pF OR5=0.5pF 1R0=1.0pF 100=10x10 ⁰ =10pF	B=±0.1pF C=±0.25pF D=±0.5pF G=±2% J=±5% K=±10% M=±20% Z=-20/+80%	Two significant digits followed by no. of zeros. And R is in place of decimal point. 201=200 VDC 251=250 VDC 501=500 VDC 631=630 VDC 102=1000 VDC 152=1500 VDC 202=2000 VDC 302=3000 VDC	L=Ag/Ni/Sn (for NPO dielectric) C=Cu/Ni/Sn (for X7R*, Y5V dielectric)	B=Bulk T=7" reeled G=13" reeled

* Partial X7R items are with Ag/Ni/Sn terminations, please ref to below product range of X7R dielectric for detail.

PACKAGING DIMENSION AND QUANTITY

Size	Thickness (mm)/Symbol		Paper tape		Plastic tape	
			7" reel	13" reel	7" reel	13" reel
0603 (1608)	0.80±0.07	S	4k	15k	-	-
0805 (2012)	0.60±0.10	A	4k	15k	-	-
	0.80±0.10	B	4k	15k	-	-
	1.25±0.10	D	-	-	3k	10k
1206 (3216)	0.80±0.10	B	4k	15k	-	-
	0.95±0.10	C	-	-	3k	10k
	1.25±0.10	D	-	-	3k	10k
	1.60±0.20	G	-	-	2k	-
1210 (3225)	0.95±0.10	C	-	-	3k	10k
	1.25±0.10	D	-	-	3k	10k
	1.60±0.20	G	-	-	2k	-
	2.50±0.30	M	-	-	1k	-
1808 (4520)	1.25±0.10	D	-	-	2k	-
	2.00±0.20	K	-	-	1k	-
1812 (4532)	1.25±0.10	D	-	-	1k	-
	2.00±0.20	K	-	-	1k	-

Unit: pieces

Middle and High Voltage Capacitors

■ CAPACITANCE RANGE

NPO Dielectric 200V to 630V

Dielectric		NPO																	
Size		0603		0805				1206				1210				1812			
Rated Voltage (VDC)		200	250	200	250	500	630	200	250	500	630	200	250	500	630	200	250	500	630
Capacitance	0.5pF (0R5)			A	A	A	A												
	1.0pF (1R0)			A	A	A	A												
	1.2pF (1R2)			A	A	A	A												
	1.5pF (1R5)			A	A	A	A	B	B	B	B								
	1.8pF (1R8)			A	A	A	A	B	B	B	B								
	2.2pF (2R2)			A	A	A	A	B	B	B	B								
	2.7pF (2R7)			A	A	A	A	B	B	B	B								
	3.3pF (3R3)			A	A	A	A	B	B	B	B								
	3.9pF (3R9)			A	A	A	A	B	B	B	B								
	4.7pF (4R7)			A	A	A	A	B	B	B	B								
	5.6pF (5R6)			A	A	A	A	B	B	B	B								
	6.8pF (6R8)			A	A	A	A	B	B	B	B								
	8.2pF (8R2)			A	A	A	A	B	B	B	B								
	10pF (100)			A	A	A	A	B	B	B	B	C	C	C	C	D	D	D	D
	12pF (120)			A	A	A	A	B	B	B	B	C	C	C	C	D	D	D	D
	15pF (150)			A	A	A	A	B	B	B	B	C	C	C	C	D	D	D	D
	18pF (180)			A	A	A	A	B	B	B	B	C	C	C	C	D	D	D	D
	22pF (220)	S	S	A	A	A	A	B	B	B	B	C	C	C	C	D	D	D	D
	27pF (270)	S	S	A	A	A	A	B	B	B	B	C	C	C	C	D	D	D	D
	33pF (330)	S	S	A	A	A	A	B	B	B	B	C	C	C	C	D	D	D	D
	39pF (390)	S	S	A	A	A	A	B	B	B	B	C	C	C	C	D	D	D	D
	47pF (470)	S	S	A	A	A	A	B	B	B	B	C	C	C	C	D	D	D	D
	56pF (560)	S	S	A	A	A	A	B	B	B	B	C	C	C	C	D	D	D	D
	68pF (680)	S	S	A	A	A	A	B	B	B	B	C	C	C	C	D	D	D	D
	82pF (820)	S	S	A	A	B	B	B	B	B	B	C	C	C	C	D	D	D	D
	100pF (101)	S	S	A	A	B	B	B	B	B	B	C	C	C	C	D	D	D	D
	120pF (121)			A	A	D	D	B	B	B	B	C	C	C	C	D	D	D	D
	150pF (151)			B	B	D	D	B	B	B	B	C	C	C	C	D	D	D	D
	180pF (181)			B	B	D	D	B	B	B	B	C	C	C	C	D	D	D	D
	220pF (221)			D	D	D	D	B	B	B	B	C	C	C	C	D	D	D	D
	270pF (271)			D	D	D	D	B	B	C	C	C	C	C	C	D	D	D	D
	330pF (331)			D	D	D	D	B	B	C	C	C	C	C	C	D	D	D	D
	390pF (391)			D	D	D	D	B	B	C	C	C	C	C	C	D	D	D	D
	470pF (471)			D				C	C	C	C	C	C	C	C	D	D	D	D
	560pF (561)			D				C	C	C	C	C	C	C	C	D	D	D	D
	680pF (681)			D				C	C	C	C	C	C	C	C	D	D	D	D
	820pF (821)			D				C	D	D	D	C	C	C	C	D	D	D	D
	1,000pF (102)							C	G	G	G	C	C	C	C	D	D	D	D
1,200pF (122)							C				D	D	D	D	D	D	D	D	
1,500pF (152)							C				D	D	D	D	D	D	D	D	
1,800pF (182)							D				D	D	D	D	D	D	D	D	
2,200pF (222)							D				D	D			D	D	D	D	
2,700pF (272)											D	D			D	D	D	D	
3,300pF (332)											D				D	D	D	D	
3,900pF (392)											D				D				
4,700pF (472)															D				
5,600pF (562)															D				
6,800pF (682)															D				

1. The letter in cell is expressed the symbol of product thickness.

2. For more information about products with special capacitance or other data, please contact WTC local representative.

Middle and High Voltage Capacitors

NPO Dielectric 1kV to 3kV

Dielectric		NPO									
Size		1206		1210		1808			1812		
Rated Voltage (VDC)		1000	2000	1000	2000	1000	2000	3000	1000	2000	3000
Capacitance	1.5pF (1R5)	B	B								
	1.8pF (1R8)	B	B								
	2.2pF (2R2)	B	B			D	D	D			
	2.7pF (2R7)	B	B			D	D	D			
	3.3pF (3R3)	B	B			D	D	D			
	3.9pF (3R9)	B	B			D	D	D			
	4.7pF (4R7)	B	B			D	D	D			
	5.6pF (5R6)	B	B			D	D	D			
	6.8pF (6R8)	B	B			D	D	D			
	8.2pF (8R2)	B	B			D	D	D			
	10pF (100)	B	B	C	C	D	D	D	D	D	D
	12pF (120)	B	B	C	C	D	D	D	D	D	D
	15pF (150)	B	B	C	C	D	D	D	D	D	D
	18pF (180)	B	B	C	C	D	D	D	D	D	D
	22pF (220)	B	B	C	C	D	D	D	D	D	D
	27pF (270)	B	B	C	C	D	D	D	D	D	D
	33pF (330)	B	B	C	C	D	D	D	D	D	D
	39pF (390)	B	B	C	C	D	D	D	D	D	D
	47pF (470)	B	B	C	C	D	D	D	D	D	D
	56pF (560)	B	B	C	D	D	D	D	D	D	D
	68pF (680)	B	C	C	D	D	D	D	D	D	D
	82pF (820)	B	C	C	D	D	D	D	D	D	D
	100pF (101)	B	C	C	D	D	D	D	D	D	D
	120pF (121)	B	D	C	D	D	D	D	D	D	D
	150pF (151)	C	D	C	D	D	D	D	D	D	D
	180pF (181)	C	G	C	D	D	D	K	D	D	D
	220pF (221)	D	G	C	D	D	D	K	D	D	D
	270pF (271)	D		C		D	D	K	D	D	K
	330pF (331)	G		D		D	D		D	D	K
	390pF (391)	G		D		D	K		D	D	K
470pF (471)	G		D		D	K		D	D	K	
560pF (561)					K	K		D	D		
680pF (681)					K	K		D	K		
820pF (821)					K			D	K		
1,000pF (102)					K			K	K		
1,200pF (122)								K			
1,500pF (152)								K			

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Middle and High Voltage Capacitors

X7R Dielectric 200V to 630V

Dielectric Size		X7R															
		0805				1206				1210				1812			
Rated Voltage (VDC)		200	250	500	630	200	250	500	630	200	250	500	630	200	250	500	630
Capacitance	100pF (101)	B	B	B^	B^												
	120pF (121)	B	B	B^	B^												
	150pF (151)	B	B	B^	B^	B	B	B^	B^								
	180pF (181)	B	B	B^	B^	B	B	B^	B^								
	220pF (221)	B	B	B^	B^	B	B	B^	B^								
	270pF (271)	B	B	B^	B^	B	B	B^	B^								
	330pF (331)	B	B	B^	B^	B	B	B^	B^								
	390pF (391)	B	B	B^	B^	B	B	B^	B^								
	470pF (471)	B	B	B^	B^	B	B	B^	B^								
	560pF (561)	B	B	B^	B^	B	B	B^	B^								
	680pF (681)	B	B	B^	B^	B	B	B^	B^								
	820pF (821)	B	B	B^	B^	B	B	B^	B^								
	1,000pF (102)	B	B	B^	B^	B	B	B^	B^	C	C	C^	C^	D	D	D^	D^
	1,200pF (122)	B	B	B^	B^	B	B	B^	B^	C	C	C^	C^	D	D	D^	D^
	1,500pF (152)	B	B	B^	B^	B	B	B^	B^	C	C	C^	C^	D	D	D^	D^
	1,800pF (182)	B	B	B^	B^	B	B	B^	B^	C	C	C^	C^	D	D	D^	D^
	2,200pF (222)	B	B	B^	B^	B	B	B^	B^	C	C	C^	C^	D	D	D^	D^
	2,700pF (272)	B	B	B^	B^	B	B	B^	B^	C	C	C^	C^	D	D	D^	D^
	3,300pF (332)	B	B			B	B	B^	B^	C	C	C^	C^	D	D	D^	D^
	3,900pF (392)	B	B			B	B	B^	B^	C	C	C^	C^	D	D	D^	D^
	4,700pF (472)	B	B			B	B	B^	B^	C	C	C^	C^	D	D	D^	D^
	5,600pF (562)	D	D			B	B	B^	B^	C	C	C^	C^	D	D	D^	D^
	6,800pF (682)	D	D			B	B	B^	B^	C	C	C^	C^	D	D	D^	D^
	8,200pF (822)	D	D			B	B	C^	C^	C	C	C^	C^	D	D	D^	D^
	0.010μF (103)	D	D			B	B	C^	C^	C	C	C^	C^	D	D	D^	D^
	0.012μF (123)	D	D			B	B	D^	D^	C	C	C^	C^	D	D	D^	D^
	0.015μF (153)	D	D			C	C	D^	D^	C	C	C^	C^	D	D	D^	D^
	0.018μF (183)	D	D			C	C	D^	D^	C	C	C^	C^	D	D	D^	D^
	0.022μF (223)	D	D			C	C	G^	G^	C	C	D^	D^	D	D	D^	D^
	0.027μF (273)					C	C	G^	G^	C	C	G^	G^	D	D	D^	D^
	0.033μF (333)					G	G	G^	G^	C	C	G^	G^	D	D	D^	D^
	0.039μF (393)					G	G			C	C	G^	G^	D	D	D^	D^
	0.047μF (473)					G	G			D	D	G^	G^	D	D	D^	D^
	0.056μF (563)					G	G			D	D	G^	G^	D	D	K^	K^
	0.068μF (683)					G	G			G	G			D	D	K^	K^
	0.082μF (823)					G	G			G	G			D	D	K^	K^
0.10μF (104)					G	G			G	G			D	D	K^	K^	
0.12μF (124)									G	G			D	D			
0.15μF (154)									M	M			K	K			
0.18μF (184)									M	M			K	K			
0.22μF (224)									M	M			K	K			
0.27μF (274)													K	K			
0.33μF (334)													K	K			
0.39μF (394)													K	K			
0.47μF (474)													K	K			

1. The letter in cell is expressed the symbol of product thickness.

2. The letter in cell with "^" mark is expressed product with Ag/Ni/Sn terminations.

3. For more information about products with special capacitance or other data, please contact WTC local representative.

Middle and High Voltage Capacitors

X7R Dielectric 1kV to 3kV

Dielectric		X7R										
Size		1206			1210	1808				1812		
Rated Voltage (VDC)		1000	1500	2000	1000	1000	1500	2000	3000	1000	2000	3000
Capacitance	150pF (151)	B^	B^	B^		D^	D^	D^				
	180pF (181)	B^	B^	B^		D^	D^	D^				
	220pF (221)	B^	B^	B^		D^	D^	D^				
	270pF (271)	B^	B^	B^		D^	D^	D^		D^	D^	
	330pF (331)	B^	B^	B^		D^	D^	D^		D^	D^	
	390pF (391)	B^	B^	C^		D^	D^	D^		D^	D^	
	470pF (471)	B^	B^	C^		D^	D^	D^	K^	D^	D^	
	560pF (561)	B^	C^	C^		D^	D^	D^	K^	D^	D^	
	680pF (681)	B^	C^	C^		D^	D^	D^	K^	D^	D^	K^
	820pF (821)	B^	G^	G^		D^	D^	D^	K^	D^	D^	K^
	1,000pF (102)	B^	G^	G^	C^	D^	D^	K^	K^	D^	D^	K^
	1,200pF (122)	B^	G^		C^	D^	D^	K^		D^	D^	
	1,500pF (152)	C^	G^		C^	D^	D^	K^		D^	D^	
	1,800pF (182)	C^	G^		C^	D^	D^	K^		D^	D^	
	2,200pF (222)	D^	G^		C^	D^	D^	K^		D^	D^	
	2,700pF (272)	G^			C^	D^	D^			D^	D^	
	3,300pF (332)	G^			D^	D^	K^			D^	K^	
	3,900pF (392)	G^				D^				D^	K^	
	4,700pF (472)					D^				D^	K^	
	5,600pF (562)					K^				D^		
6,800pF (682)					K^				D^			
8,200pF (822)					K^				D^			
0.010μF (103)					K^				D^			
0.012μF (123)									K^			
0.015μF (153)									K^			

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2. The letter in cell with " ^ " mark is expressed product with Ag/Ni/Sn terminations.
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Y5V Dielectric 200V to 250V

Dielectric		Y5V							
Size		0805		1206		1210		1812	
Rated Voltage (VDC)		200	250	200	250	200	250	200	250
Capacitance	0.010μF (103)	B	B	B	B	C	C	D	D
	0.015μF (153)	B	B	B	B	C	C	D	D
	0.022μF (223)	B	B	B	B	C	C	D	D
	0.033μF (333)	B	B	B	B	C	C	D	D
	0.047μF (473)	B	B	B	B	C	C	D	D
	0.068μF (683)	B	B	B	B	C	C	D	D
	0.10μF (104)			B	B	C	C	D	D
	0.15μF (154)			C	C	C	C	D	D
	0.22μF (224)							D	D
	0.33μF (334)							D	D
	0.47μF (474)							D	D
	0.68μF (684)							D	D
	1.0μF (105)								

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Appendix I : Reliability Test Conditions and Requirements

NO.	Item	Test Condition	Requirements																																																																
1.	Visual and Mechanical	---	<ul style="list-style-type: none"> * No remarkable defect. * Dimensions to confirm to individual specification sheet. 																																																																
2.	Capacitance	Class I : NPO Cap 1000pF 1.0±0.2Vrms, 1MHz±10%	<ul style="list-style-type: none"> * Shall not exceed the limits given in the detailed spec. <p>NPO: Cap 30pF, Q 1000; Cap<30pF, Q 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>50V</td> <td>2.5%</td> <td>3.0%</td> <td>All 0201:0603 0.047µF;0805 0.18µF; 1206 0.47µF</td> </tr> <tr> <td rowspan="2">25V</td> <td rowspan="2">3.5%</td> <td>5.0%</td> <td>0805 1µF, 1210 10µF</td> </tr> <tr> <td>7.0%</td> <td>0603 0.33µF;TT series & Cap 1µF</td> </tr> <tr> <td rowspan="2">16V</td> <td rowspan="2">3.5%</td> <td>5.0%</td> <td>0402 0.033µF;0603 0.15µF; 0805 0.68µF;1206 2.2µF</td> </tr> <tr> <td>10%</td> <td>TT series & Cap 1µF</td> </tr> <tr> <td>10V</td> <td>5.0%</td> <td>10.0%</td> <td>TT series & Cap 1µF;0805 10µF</td> </tr> <tr> <td>6.3V</td> <td>10.0%</td> <td>15.0%</td> <td>0805 22µF;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>50V</td> <td>5.0%</td> <td>---</td> <td>---</td> </tr> <tr> <td rowspan="2">35V</td> <td rowspan="2">7.0%</td> <td>---</td> <td>---</td> </tr> <tr> <td>---</td> <td>---</td> </tr> <tr> <td rowspan="2">25V</td> <td rowspan="2">5.0%</td> <td>7.0%</td> <td>0603 0.1µF; 0805 0.33µF; 1206 1µF; 1210 4.7µF</td> </tr> <tr> <td>9.0%</td> <td>0402 0.068µF</td> </tr> <tr> <td>16V (C<1.0µF)</td> <td>7.0%</td> <td>9.0%</td> <td>0402 0.068µF; 0603 0.68µF</td> </tr> <tr> <td>16V (C 1.0µF)</td> <td>9.0%</td> <td>12.5%</td> <td>0805 4.7µF;1206 10µF;1210 22µF</td> </tr> <tr> <td>10V</td> <td>12.5%</td> <td>---</td> <td>---</td> </tr> <tr> <td>6.3V</td> <td>20.0%</td> <td>---</td> <td>---</td> </tr> </tbody> </table>	Rated vol.	D.F.	Exception of D.F.		50V	2.5%	3.0%	All 0201:0603 0.047µF;0805 0.18µF; 1206 0.47µF	25V	3.5%	5.0%	0805 1µF, 1210 10µF	7.0%	0603 0.33µF;TT series & Cap 1µF	16V	3.5%	5.0%	0402 0.033µF;0603 0.15µF; 0805 0.68µF;1206 2.2µF	10%	TT series & Cap 1µF	10V	5.0%	10.0%	TT series & Cap 1µF;0805 10µF	6.3V	10.0%	15.0%	0805 22µF;1210 100µF	Rated vol.	D.F.	Exception of D.F.		50V	5.0%	---	---	35V	7.0%	---	---	---	---	25V	5.0%	7.0%	0603 0.1µF; 0805 0.33µF; 1206 1µF; 1210 4.7µF	9.0%	0402 0.068µF	16V (C<1.0µF)	7.0%	9.0%	0402 0.068µF; 0603 0.68µF	16V (C 1.0µF)	9.0%	12.5%	0805 4.7µF;1206 10µF;1210 22µF	10V	12.5%	---	---	6.3V	20.0%	---	---
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3.	Q/ D.F. (Dissipation Factor)	Class II : X7R, X5R, Y5V Cap 10µF, 1.0±0.2Vrms, 1KHz±10% Cap>10µF, 0.5±0.2Vrms, 120Hz±20%																																																																	
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4b.	Dielectric Strength (for X1/Y2 & X2/Y3)	<ul style="list-style-type: none"> * To apply 1500 VAC voltage. * Duration: 60 sec. 	<ul style="list-style-type: none"> * No evidence of damage or flash over during test. 																																																																
5.	Insulation Resistance	To apply rated voltage for max. 120 sec.	10G or RxC 500 -F whichever is smaller.																																																																
		Rated voltage: 100 ~ 500V	To apply rated voltage for 60 sec.	10G																																																															
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6.	Temperature Coefficient	With no electrical load.																																																																	
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7.	Adhesive Strength of Termination	<ul style="list-style-type: none"> * Pressurizing force: 0201: 2N 0402 & 0603: 5N >0603: 10N * Test time: 10±1 sec. 	<ul style="list-style-type: none"> * No remarkable damage or removal of the terminations. 																																																																
8.	Vibration Resistance	<ul style="list-style-type: none"> * Vibration frequency: 10~55 Hz/min. * Total amplitude: 1.5mm * Test time: 6 hrs. (Two hrs each in three mutually perpendicular directions.) 	<ul style="list-style-type: none"> * No remarkable damage. * Cap change and Q/D.F.: To meet initial spec. 																																																																

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9.	Solderability	<ul style="list-style-type: none"> * Solder temperature: 235±5°C * Dipping time: 2±0.5 sec. 	95% min. coverage of all metalized area.																																																										
10.	Bending Test	<ul style="list-style-type: none"> * The middle part of substrate shall be pressurized by means of the pressurizing rod at a rate of about 1 mm per second until the deflection becomes 1 mm and then the pressure shall be maintained for 5±1 sec. * Measurement to be made after keeping at room temp. for 24±2 hrs. 	<ul style="list-style-type: none"> * No remarkable damage. * Cap change: NPO: within ±5.0% 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.)																																																										
11.	Resistance to Soldering Heat	<ul style="list-style-type: none"> * Solder temperature: 270±5°C * Dipping time: 10±1 sec * Preheating: 120 to 150°C for 1 minute before immerse the capacitor in an eutectic solder. * Before initial measurement (Class II only): Perform 150+0/-10°C for 1 hr 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). 	<ul style="list-style-type: none"> * 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. 																																																										
12.	Temperature Cycle	<ul style="list-style-type: none"> * Conduct the five cycles according to the temperatures and time. <table border="1"> <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> <ul style="list-style-type: none"> * Before initial measurement (Class II only): Perform 150+0/-10°C for 1 hr 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	<ul style="list-style-type: none"> * 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. 																																											
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13.	Humidity (Steady State)	<ul style="list-style-type: none"> * 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±2 hrs. (Class I) or 48±4 hrs. (Class II). 	<ul style="list-style-type: none"> * No remarkable damage. * Cap change: NPO: within ±5.0% or ±0.5pF whichever is larger. X7R, X5R: 10V, within ±12.5% 6.3V, within ±25% Y5V: within ±30% * Q/D.F. value: NPO: Cap 30pF, Q 350; 10pF Cap<30pF, Q 275+2.5C Cap<10pF; Q 200+10C X7R, X5R: <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>6.0%</td> <td>0603 0.047µF; 0805 0.18µF; 1206 0.47µF</td> </tr> <tr> <td rowspan="2">25V</td> <td rowspan="2">5.0%</td> <td>10.0%</td> <td>0805 1µF; 1210 10µF</td> </tr> <tr> <td>14.0%</td> <td>0603 0.33µF</td> </tr> <tr> <td rowspan="2">16V</td> <td rowspan="2">5.0%</td> <td>10.0%</td> <td>0402 0.033µF; 0603 0.15µF; 0805 0.68µF; 1206 2.2µF</td> </tr> <tr> <td>15.0%</td> <td>0402 0.056µF; 0603 0.33µF; 0805 2.2µF; 1206 2.2µF, TT series & Cap 1µF</td> </tr> <tr> <td>6.3V</td> <td>15.0%</td> <td>30.0%</td> <td>0805 10µF; 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>50V</td> <td>7.5%</td> <td>---</td> <td>---</td> </tr> <tr> <td>35V</td> <td>10.0%</td> <td>---</td> <td>---</td> </tr> <tr> <td rowspan="2">25V</td> <td rowspan="2">7.5%</td> <td>10.0%</td> <td>0603 0.1µF; 0805 0.33µF; 1206 1µF; 1210 4.7µF</td> </tr> <tr> <td>12.5%</td> <td>0402 0.068µF</td> </tr> <tr> <td>16V (C<1.0µF)</td> <td>10.0%</td> <td>12.5%</td> <td>0402 0.068µF; 0603 0.68µF</td> </tr> <tr> <td>16V (C 1.0µF)</td> <td>12.5%</td> <td>---</td> <td>---</td> </tr> <tr> <td>10V</td> <td>15.0%</td> <td>---</td> <td>---</td> </tr> <tr> <td>6.3V</td> <td>30.0%</td> <td>---</td> <td>---</td> </tr> </tbody> </table> <ul style="list-style-type: none"> * I.R.: 10V 1G or 50 -F whichever is smaller. 6.3V, 10 -F 	Rated vol.	D.F.	Exception of D.F.		50V	3.0%	6.0%	0603 0.047µF; 0805 0.18µF; 1206 0.47µF	25V	5.0%	10.0%	0805 1µF; 1210 10µF	14.0%	0603 0.33µF	16V	5.0%	10.0%	0402 0.033µF; 0603 0.15µF; 0805 0.68µF; 1206 2.2µF	15.0%	0402 0.056µF; 0603 0.33µF; 0805 2.2µF; 1206 2.2µF, TT series & Cap 1µF	6.3V	15.0%	30.0%	0805 10µF; 1210 100µF	Rated vol.	D.F.	Exception of D.F.		50V	7.5%	---	---	35V	10.0%	---	---	25V	7.5%	10.0%	0603 0.1µF; 0805 0.33µF; 1206 1µF; 1210 4.7µF	12.5%	0402 0.068µF	16V (C<1.0µF)	10.0%	12.5%	0402 0.068µF; 0603 0.68µF	16V (C 1.0µF)	12.5%	---	---	10V	15.0%	---	---	6.3V	30.0%	---	---
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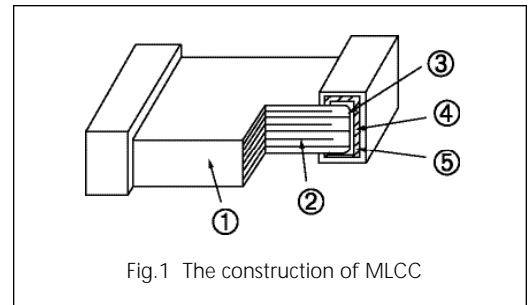
Appendix I : Reliability Test Conditions and Requirements

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14.	Humidity Load (Damp Heat)	<ul style="list-style-type: none"> * Test temp.: 40±2°C * Humidity: 90~95%RH * Test time: 500+24/-0 hrs. * To apply voltage: rated voltage (Max. 500V) * Measurement to be made after keeping at room temp. for 24±2 hrs. (Class I) or 48±4 hrs. (Class II). 	<ul style="list-style-type: none"> * No remarkable damage. * Cap change: NPO: within ±7.5% or ±0.75pF whichever is larger. X7R, X5R: 10V, within ±12.5% 6.3V, with ±25% Y5V: 10V, within ±30% 6.3V, within +30 to -40% * Q/D.F. value: NPO: Cap 30pF, Q 200; Cap<30pF, Q 100+10/3C X7R, X5R: <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>6.0%</td> <td>0603 0.047µF; 0805 0.18µF; 1206 0.47µF</td> </tr> <tr> <td rowspan="2">25V</td> <td rowspan="2">5.0%</td> <td>10.0%</td> <td>0805 1µF, 1210 10µF</td> </tr> <tr> <td>14.0%</td> <td>0603 0.33µF</td> </tr> <tr> <td rowspan="2">16V</td> <td rowspan="2">5.0%</td> <td>10.0%</td> <td>0402 0.033µF; 0603 0.15µF; 0805 0.68µF; 1206 2.2µF</td> </tr> <tr> <td>15.0%</td> <td>0402 0.056µF; 0603 0.33µF; 0805 2.2µF; 1206 2.2µF, TT series & Cap 1µF</td> </tr> <tr> <td>6.3V</td> <td>15.0%</td> <td>30.0%</td> <td>0805 10µF; 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>50V</td> <td>7.5%</td> <td>---</td> <td>---</td> </tr> <tr> <td>35V</td> <td>10.0%</td> <td>---</td> <td>---</td> </tr> <tr> <td rowspan="2">25V</td> <td rowspan="2">7.5%</td> <td>10.0%</td> <td>0603 0.1µF; 0805 0.33µF; 1206 1µF; 1210 4.7µF</td> </tr> <tr> <td>12.5%</td> <td>0402 0.068µF</td> </tr> <tr> <td>16V (C<1.0µF)</td> <td>10.0%</td> <td>12.5%</td> <td>0402 0.068µF; 0603 0.68µF</td> </tr> <tr> <td>16V (C 1.0µF)</td> <td>12.5%</td> <td>---</td> <td>---</td> </tr> <tr> <td>10V</td> <td>15.0%</td> <td>---</td> <td>---</td> </tr> <tr> <td>6.3V</td> <td>30.0%</td> <td>---</td> <td>---</td> </tr> </tbody> </table> <ul style="list-style-type: none"> * I.R.: 10V, 500M or 25 -F whichever is smaller. 6.3V, 5 -F 	Rated vol.	D.F.	Exception of D.F.		50V	3.0%	6.0%	0603 0.047µF; 0805 0.18µF; 1206 0.47µF	25V	5.0%	10.0%	0805 1µF, 1210 10µF	14.0%	0603 0.33µF	16V	5.0%	10.0%	0402 0.033µF; 0603 0.15µF; 0805 0.68µF; 1206 2.2µF	15.0%	0402 0.056µF; 0603 0.33µF; 0805 2.2µF; 1206 2.2µF, TT series & Cap 1µF	6.3V	15.0%	30.0%	0805 10µF; 1210 100µF	Rated vol.	D.F.	Exception of D.F.		50V	7.5%	---	---	35V	10.0%	---	---	25V	7.5%	10.0%	0603 0.1µF; 0805 0.33µF; 1206 1µF; 1210 4.7µF	12.5%	0402 0.068µF	16V (C<1.0µF)	10.0%	12.5%	0402 0.068µF; 0603 0.68µF	16V (C 1.0µF)	12.5%	---	---	10V	15.0%	---	---	6.3V	30.0%	---	---
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15.	High Temperature Load (Endurance)	<ul style="list-style-type: none"> * Test temp.: NPO, X7R: 125±3°C X5R, Y5V: 85±3°C * To apply voltage: (1) 6.3V or C 10µF (for X7R, X5R): 150% of rated voltage. (2) 6.3V<V<500V and C<10µF (for X7R, X5R): 200% of rated voltage. (3) 500V: 150% of rated voltage. (4) V 630V: 120% of rated voltage. (Max. 3600V) * Test time: 1000+24/-0 hrs. * Measurement to be made after keeping at room temp. for 24±2 hrs. (Class I) or 48±4 hrs. (Class II). 	<ul style="list-style-type: none"> * No remarkable damage. * Cap change: NPO: within ±3.0% or ±0.3pF whichever is larger. X7R, X5R: 10V, within ±12.5% 6.3V, with ±25% Y5V: 10V, within ±30% 6.3V, within +30 to -40% * Q/D.F. value: NPO: Cap 30pF, Q 350 10pF Cap<30pF, Q 275+2.5C Cap<10pF, Q 200+10C X7R, X5R: <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>6.0%</td> <td>0603 0.047µF; 0805 0.18µF, 1206 0.47µF</td> </tr> <tr> <td rowspan="2">25V</td> <td rowspan="2">5.0%</td> <td>10.0%</td> <td>0805 1µF, 1210 10µF</td> </tr> <tr> <td>14.0%</td> <td>0603 0.33µF</td> </tr> <tr> <td rowspan="2">16V</td> <td rowspan="2">5.0%</td> <td>10.0%</td> <td>0402 0.033µF; 0603 0.15µF; 0805 0.68µF; 1206 2.2µF</td> </tr> <tr> <td>15.0%</td> <td>0402 0.056µF; 0603 0.33µF; 0805 2.2µF; 1206 2.2µF TT series & Cap 1µF</td> </tr> <tr> <td>6.3V</td> <td>15.0%</td> <td>30.0%</td> <td>0805 10µF; 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>50V</td> <td>7.5%</td> <td>---</td> <td>---</td> </tr> <tr> <td>35V</td> <td>10.0%</td> <td>---</td> <td>---</td> </tr> <tr> <td rowspan="2">25V</td> <td rowspan="2">7.5%</td> <td>10.0%</td> <td>0603 0.1µF; 0805 0.33µF; 1206 1µF; 1210 4.7µF</td> </tr> <tr> <td>12.5%</td> <td>0402 0.068µF</td> </tr> <tr> <td>16V (C<1.0µF)</td> <td>10.0%</td> <td>12.5%</td> <td>0402 0.068µF; 0603 0.68µF</td> </tr> <tr> <td>16V (C 1.0µF)</td> <td>12.5%</td> <td>---</td> <td>---</td> </tr> <tr> <td>10V</td> <td>15.0%</td> <td>---</td> <td>---</td> </tr> <tr> <td>6.3V</td> <td>30.0%</td> <td>---</td> <td>---</td> </tr> </tbody> </table> <ul style="list-style-type: none"> * I.R.: 10V, 1G or 50 -F whichever is smaller. 6.3V, 10 -F 	Rated vol.	D.F.	Exception of D.F.		50V	3.0%	6.0%	0603 0.047µF; 0805 0.18µF, 1206 0.47µF	25V	5.0%	10.0%	0805 1µF, 1210 10µF	14.0%	0603 0.33µF	16V	5.0%	10.0%	0402 0.033µF; 0603 0.15µF; 0805 0.68µF; 1206 2.2µF	15.0%	0402 0.056µF; 0603 0.33µF; 0805 2.2µF; 1206 2.2µF TT series & Cap 1µF	6.3V	15.0%	30.0%	0805 10µF; 1210 100µF	Rated vol.	D.F.	Exception of D.F.		50V	7.5%	---	---	35V	10.0%	---	---	25V	7.5%	10.0%	0603 0.1µF; 0805 0.33µF; 1206 1µF; 1210 4.7µF	12.5%	0402 0.068µF	16V (C<1.0µF)	10.0%	12.5%	0402 0.068µF; 0603 0.68µF	16V (C 1.0µF)	12.5%	---	---	10V	15.0%	---	---	6.3V	30.0%	---	---
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Appendix II : General Information

Construction

No.	Name	NP0/X7R	X7R/X5R/Y5V
①	Ceramic material	BaTiO ₃ based	
②	Inner electrode	AgPd alloy	Ni
③	Termination	Inner layer	Ag
④		Middle layer	Ni
⑤		Outer layer	Sn (Matt)



Storage and handling conditions

- (1) To store products at 5 to 40°C ambient temperature and 20 to 70% related humidity conditions.
- (2) The product is recommended to be used within one year after shipment. Check solderability in case of shelf life extension is needed.

Cautions:

- Don't store products in a corrosive environment such as sulfide, chloride gas, or acid. It may cause oxidization of electrode, which easily be resulted in poor soldering.
- To store products on the shelf and avoid exposure to moisture.
- Don't expose products to excessive shock, vibration, direct sunlight and so on.

Recommended soldering conditions

The lead-free termination MLCCs are not only to be used on SMT against lead-free solder paste, but also suitable against lead-containing solder paste. If the optimized solder joint is requested, increasing soldering time, temperature and concentration of N₂ within oven are recommended.

