

General Purpose Multilayer Ceramic Chip Capacitors

1. INTRODUCTION

General Purpose Multilayer capacitors supplied in bulk or tape & reel package are ideally suitable for thick-film hybrid circuits and automatic surface mounting on any printed circuit boards.

The nickel-barrier terminations are consisted of a nickel barrier layer over the silver metallization and then finished by electroplated solder layer to ensure the terminations have good solder ability. The nickel barrier layer in terminations prevents the dissolution of termination when extended immersion in molten solder at elevated solder temperature.

2. FEATURES

- a. A wide selection of sizes in available (0402 to 2225)
- b. High capacitance in given case size
- c. Capacitor with lead-free termination (pure Tin).

3. APPLICATIONS

- a. For general digital circuit
- b. For power supply bypass capacitors.
- c. For consumer electronics.
- d. For telecommunication.
- e. DC to DC converter

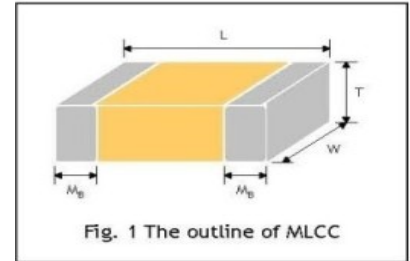
4.HOW TO ORDER

COG	1206	100	J	1H	N	R
<u>DIELECTRIC</u>	<u>SIZE</u>	<u>CAPACITANCE</u>	<u>TOLERANCE</u>	<u>RATED</u>	<u>TERMINATION</u>	<u>PACKING CODE</u>
NPO=COG	0402	1PF = 1R0	B=±0.1pF	<u>VOLTAGE</u>	<u>CODE</u>	B=BULK
X7R = BX	0603	1.5PF = 1R5	C=±0.25pF	1A=6.3V	N=NICKEL	R=TAPED ON REEL
X5R = X5R	0805	2.2PF =2R2	D=±0.5pF	1B=10V	BARRIER	
Y5V = Y5V	1206	100PF=101	F=±1%	1C=16V		
	1210	120PF=121	G=±2%	1E=25V		
	1808	10nF=103	J=±5%	1H=50V		
	1812	100nF= 104	K=±10%			
	2220		M=±20%			
	2225		Z=-20~+80%			

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5. EXTERNAL DIMENSIONS

Size	L (mm)	W (mm)	Tmax (mm)	M _b min (mm)
0402 (1005)	1.00±0.05	0.50±0.05	0.55	0.15
0603 (1608)	1.60±0.15	0.80±0.15	0.95	0.20
0805 (2012)	2.00±0.20	1.25±0.20	1.45	0.30
1206 (3216)	3.20±0.20	1.60±0.20	1.80	0.30
	3.20+0.3/-0.1	1.60+0.3/0.1	1.90	
1210 (3225)	3.20±0.40	2.50±0.30	2.80	0.30
1812 (4532)	4.50±0.40	3.20±0.30	2.80	0.26
1825 (4563)	4.50±0.40	6.30±0.40	3.00	0.30
2220 (5750)	5.70±0.40	5.00±0.40	3.00	0.30
2225 (5763)	5.70±0.40	6.30±0.40	3.00	0.30



6. GENERAL ELECTRICAL DATA

Dielectric	COG (NPO)	X7R	Y5V	X5R
Size	0402,0603,0805,1206,1210,1812	0402,0603,0805,1206,1210,1812,2220,2225	0402,0603,0805,1206,1210,1812	0402,0603
Capacitance	0.1pF to 39nF	100pF to 10uF	10nF to 100uF	27nF to 100uF
Capacitance tolerance	Cap <5pF: B(±0.1pF), C(±0.25pF), D(±0.5pF) Cap >10pF: F(±1%), G(±2%), J(±5%), K(±10%)	J(±5%), K(±10%), M(±20%)	M(±20%), Z(20/+80%)	J(±5%), K(±10%), M(±20%)
Rated voltage (WVDC)	16V, 25V, 50V	10V, 16V, 25V, 50V	10V, 16V, 25V, 50V	6.3V, 10V, 16V, 25V
Tanδ	Cap <30pF: Q ≥ 400+20C Cap >30pF: Q ≥ 1000	Note 1		
Insulation resistance at Ur	≥10 G Ω	≥10 G Ω or RxC ≥ 100Ω xF whichever is less or RxC ≥ 500Ω xF		
Operating temperature	-55 to 125°C		-25 to 85°C	-55 to 85°C
Capacitance characteristic	±30ppm	±15%	±30/-80%	±15%
Termination	Cu(or Ag)/Ni/Sn (lead-free termination)_			

- Measured at the condition of 30~70% related humidity.
COG(NPO): Apply 1.0±0.2Vms, 1.0Mhz ±10% for Cap ≤ 1000pF and 1.0±0.2Vms, 1.0kHz ± 10 for Cap > 1000pF, 25°C at ambient temp.
X7R : Apply 1.0±0.2Vms, 1.0Mhz ±10%, at 25°C ambient temperature.
Y5V : Apply 1.0±0.2Vms, 1.0Mhz ±10%, at 20°C ambient temperature.

Measured at 1.0 ±0.2rms, 1.0Khz ±10% for C <10uF; 0.5 ±0.2rms, 120Hz±20% for C >10uF, 30~70% related humidity; 25°C ambient temperature for X7R, X5R and at 20°C
Preconditioning for Class II MLCC: Perform a heat treatment at 150 ±10°C for 1 hour, then leave in ambient condition for 24 ±2 hours before measurement..

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6. GENERAL ELECTRICAL DATA

⊙ X7R/X5R

Rated Vol.	D.F.	Exception of D.F.	
≥50V	≤2.5%	≤3.0%	0603≥0.047uF;0805≥0.18uF; 1206≥0.47uF
25V	≤3.5%	≤5.0%	0805≥1uF;1206≥10uF
		≤7.0%	0603≥0.33uF;1206≥4.7uF
		≤10%	0402≥0.10uF; 0603≥0.47uF 0805≥2.2uF; 1206≥6.8uF
16V	≤3.5%	≤5.0%	0402≥0.033uF; 0603≥0.15uF 0805≥0.68uF; 1206≥2.2uF; 1210>4.7uF
		≤10%	0603≥0.68uF; 0805≥2.2uF; 1206>4.7uF;1210>22uF
10V	≤5.0%	≤10%	0402≥0.33uF;0603≥0.33uF; 0805≥2.2uF;1206≥2.2uF; 1210>22uF
		≤15%	0402≥1uF
6.3V	≤10%	≤15%	0603≥10uF;0805≥4.7uF; 1210≥100uF
		≤20%	0402≥2.2uF

⊙ Y5V

Rated Vol.	D.F.	Exception of D.F.	
≥50V	≤5%	7.0%	0603≥0.1uF;0805≥0.47uF; 1206≥0.47uF
35	≤7%	----	----
25V	≤5%	≤7.0%	0402≥0.047uF;0603 ≥0.1uF 0805≥0.33uF;1206≥1uF; 1210>4.7uF
		≤9.0%	0402≥0.068uF; 0603≥0.47uF 1206>4.7uF;1210>22uF
16V(C<1uF)	≤7%	≤9.0%	0402≥0.068uF; 0603≥0.47uF
		≤12.5%	0402≥0.22uF
16V(C≥1uF)	≤9%	≤12.5%	0805≥3.3uF; 1206≥10uF 1210>22uF; 1812>47uF
10V	≤12.5%	---	---
6.3V	≤20%	---	---

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7. CAPACITANCE RANGE (NPO Dielectric)

7-1.0402, 0603, 0805 Sizes

DIELECTRIC SIZE (VDC)	NPO											
	0402				0603				0805			
	10V	16V	25V	50V	10V	16V	25V	50V	10V	16V	25V	50V
0.1pF (0R1)												
0.2pF (0R2)												
0.3pF (0R3)												
0.4pF (0R4)												
0.5pF (0R5)												
0.6pF (0R6)												
0.7pF (0R7)												
0.8pF (0R8)												
0.9pF (0R9)												
1pF (1R0)												
1.2pF (1R2)												
1.5pF (1R5)												
1.8pF (1R8)												
2.2pF (2R2)												
2.7pF (2R7)												
3.3pF (3R3)												
3.9pF (3R9)												
4.7pF (4R7)												
5.6pF (5R6)												
6.8pF (6R8)												
8.2pF (8R2)												
10pF (100)												
12pF (120)												
15pF (150)												
18pF (180)												
22pF (220)												
27pF (270)												
33pF (330)												
39pF (390)												
47pF (470)												
56pF (560)												
68pF (680)												
82pF (820)												
100pF (101)												
120pF (121)												
150pF (151)												
180pF (181)												
220pF (221)												
270pF (271)												
330pF (331)												
390pF (391)												
470pF (471)												
560pF (561)												
680pF (681)												
820pF (821)												
1nF (102)												
1.2nF (122)												
1.5nF (152)												
1.8nF (182)												
2.2nF (222)												
2.7nF (272)												
3.3nF (332)												
3.9nF (392)												
4.7nF (472)												
5.6nF (562)												
6.8nF (682)												
8.2nF (822)												
10nF (103)												

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7-2. 1206, 1812, 1812 Sizes

DIELECTRIC SIZE (VDC)	NPO											
	1206				1210				1812			
	10V	16V	25V	50V	10V	16V	25V	50V	10V	16V	25V	50V
1pF (1R0)												
1.2pF (1R2)												
1.5pF (1R5)												
1.8pF (1R8)												
2.2pF (2R2)												
2.7pF (2R7)												
3.3pF (3R3)												
3.9pF (3R9)												
4.7pF (4R7)												
5.6pF (5R6)												
6.8pF (6R8)												
8.2pF (8R2)												
10pF (100)												
12pF (120)												
15pF (150)												
18pF (180)												
22pF (220)												
27pF (270)												
33pF (330)												
39pF (390)												
47pF (470)												
56pF (560)												
68pF (680)												
82pF (820)												
100pF (101)												
120pF (121)												
150pF (151)												
180pF (181)												
220pF (221)												
270pF (271)												
330pF (331)												
390pF (391)												
470pF (471)												
560pF (561)												
680pF (681)												
820pF (821)												
1nF (102)												
1.2nF (122)												
1.5nF (152)												
1.8nF (182)												
2.2nF (222)												
2.7nF (272)												
3.3nF (332)												
3.9nF (392)												
4.7nF (472)												
5.6nF (562)												
6.8nF (682)												
8.2nF (822)												
10nF (103)												
1.2nF (123)												
1.5nF (153)												
1.8nF (183)												
2.2nF (223)												
2.7nF (273)												
3.3nF (333)												
3.9nF (393)												

General Purpose Multilayer Ceramic Chip Capacitors

8. CAPACITANCE RANGE (X7R Dielectric)

8-1 0402, 0603, 0805, 1206 sizes

DIELECTRIC SIZE (VDC)	X7R																			
	0402				0603				0805				1206							
	10V	16V	25V	50V	6.3V	10V	16V	25V	50V	6.3V	10V	16V	25V	50V	6.3V	10V	16V	25V	50V	
100pF (101)																				
120pF (121)																				
150pF (151)																				
180pF (181)																				
220pF (221)																				
270pF (271)																				
330pF (331)																				
390pF (391)																				
470pF (471)																				
560pF (561)																				
680pF (681)																				
820pF (821)																				
1nF (102)																				
1.2nF (122)																				
1.5nF (152)																				
1.8nF (182)																				
2.2nF (222)																				
2.7nF (272)																				
3.3nF (332)																				
3.9nF (392)																				
4.7nF (472)																				
5.6nF (562)																				
6.8nF (682)																				
8.2nF (822)																				
10nF (103)																				
1.2nF (123)																				
1.5nF (153)																				
1.8nF (183)																				
2.2nF (223)																				
2.7nF (273)																				
3.3nF (333)																				
3.9nF (393)																				
4.7nF (473)																				
5.6nF (563)																				
6.8nF (683)																				
8.2nF (823)																				
0.1uF (104)																				
0.12uF (124)																				
0.15uF (154)																				
0.18uF (184)																				
0.22uF (224)																				
0.27uF (274)																				
0.33uF (334)																				
0.39uF (394)																				
0.47uF (474)																				
0.56uF (564)																				
0.68uF (684)																				
0.82uF (824)																				
1.0uF (105)																				
1.5uF (155)																				
2.2uF (225)																				
3.3uF (335)																				
4.7uF (475)																				
10uF (106)																				

General Purpose Multilayer Ceramic Chip Capacitors

8-2. 1210, 1812, 1825, 2220, 2225 Sizes

DIELECTRIC SIZE (VDC)	X7R											
	1210					1812				1825	2220	2225
	6.3V	10V	16V	25V	50V	10V	16V	25V	50V	50V	50V	50V
1nF (102)												
1.2nF (122)												
1.5nF (152)												
1.8nF (182)												
2.2nF (222)												
2.7nF (272)												
3.3nF (332)												
3.9nF (392)												
4.7nF (472)												
5.6nF (562)												
6.8nF (682)												
8.2nF (822)												
10nF (103)												
1.2nF (123)												
1.5nF (153)												
1.8nF (183)												
2.2nF (223)												
2.7nF (273)												
3.3nF (333)												
3.9nF (393)												
4.7nF (473)												
5.6nF (563)												
6.8nF (683)												
8.2nF (823)												
0.1uF (104)												
0.12uF(124)												
0.15uF(154)												
0.18uF(184)												
0.22uF(224)												
0.27uF(274)												
0.33uF(334)												
0.39uF(394)												
0.47uF(474)												
0.56uF(564)												
0.68uF(684)												
0.82uF(824)												
1.0uF(105)												
2.2uF(225)												
4.7uF(475)												
10uF(106)												
22uF(226)												
47uF(476)												

General Purpose Multilayer Ceramic Chip Capacitors

8-3. CAPACITANCE RANGE (X5R Dielectric)

0402, 0603, 0805, 1206, 1210, 1812 Series

DIELECTRIC SIZE (VDC)	X5R																				
	0402				0603				0805				1206				1210				1812
	6.3V	10V	16V	25V	6.3V	10V	16V	25V	6.3V	10V	16V	25V	6.3V	10V	16V	25V	6.3V	10V	16V	25V	6.3V
2.2nF (223)																					
2.7nF (273)																					
3.3nF (333)																					
3.9nF (393)																					
4.7nF (473)																					
5.6nF (563)																					
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8.2nF (823)																					
0.1uF (104)																					
0.12uF(124)																					
0.22uF(224)																					
0.27uF(274)																					
0.33uF(334)																					
0.39uF(394)																					
0.47uF(474)																					
0.68uF(684)																					
0.82uF(824)																					
1.0uF(105)																					
1.5uF(155)																					
2.2uF(225)																					
3.3uF(335)																					
4.7uF(475)																					
6.8uF(685)																					
10uF(106)																					
22uF(226)																					
47uF(476)																					
100uF(107)																					

General Purpose Multilayer Ceramic Chip Capacitors

9. CAPACITANCE RANGE (Y5V Dielectric)

9-2 0402, 0603, 0805, 1206, 1210, 1812 Series

DIELECTRIC SIZE (VDC)	Y5V																													
	0402					0603					0805					1206					1210					1812				
	6.3V	10V	16V	25V	50V	6.3V	10V	16V	25V	50V	6.3V	10V	16V	25V	50V	6.3V	10V	16V	25V	50V	6.3V	10V	16V	25V	50V	10V	16V	25V	50V	
10nF (103)																														
1.5nF (153)																														
2.2nF (223)																														
3.3nF (333)																														
4.7nF (473)																														
6.8nF (683)																														
0.1uF (104)																														
0.15uF(154)																														
0.22uF(224)																														
0.33uF(334)																														
0.47uF(474)																														
0.68uF(684)																														
1.0uF(105)																														
1.5uF(155)																														
2.2uF(225)																														
3.3uF(335)																														
4.7uF(475)																														
6.8uF(685)																														
10uF(106)																														
22uF(226)																														
47uF(476)																														
100uF(107)																														

10. PACKAGE DIMENSION AND QUANTITY

Size	Thickness (mm)	Paper tape		Plastic tape	
		7" reel	13" reel	7" reel	13" reel
0402 (1005)	0.50±0.05	10k	50K	-	-
	0.80±0.07	4k	15k	-	-
0603 (1608)	0.80±0.10	4k	15k	-	-
	0.60±0.10	4k	15k	-	-
0805 (2012)	0.80±0.10	4k	15k	-	-
	1.25±0.10	-	-	3k	10k
	1.25±0.20	-	-	3k	-
1206 (3216)	0.80±0.10	4k	15k	-	-
	0.95±0.10	-	-	3k	10k
	1.25±0.10	-	-	3k	10k
	1.60±0.20	-	-	2k	-
1210 (3225)	0.95±0.10	-	-	3k	10k
	1.25±0.10	-	-	3k	10k
	1.60±0.20	-	-	2k	-
	2.50±0.30	-	-	1k	-
1808 (4520)	1.25±0.10	-	-	2k	-
	1.60±0.20	-	-	2k	-
	2.00±0.20	-	-	1k	-
1812 (4532)	1.25±0.10	-	-	1k	-
	1.60±0.20	-	-	1k	-
	2.00±0.20	-	-	1k	-
	2.50±0.30	-	-	0.5k	-
1825 (4563)	2.00±0.20	-	-	1k	-
	2.50±0.30	-	-	0.5k	-
2220 (5750)	2.00±0.20	-	-	1k	-
	2.50±0.30	-	-	0.5k	-
2225 (5763)	2.00±0.20	-	-	1k	-
	2.50±0.30	-	-	0.5k	-

Unit: pieces

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11. APPLICATION NOTES

STORAGE

To prevent the damage of solderability of terminations, the following storage conditions are recommended.

Indoors under 5~40°C and 20% ~ 70% RH.

No harmful gases containing sulfuric acid, ammonia, hydrogen sulfide or chlorine.

Packaging should not be opened until the capacitors are required for use. If opened, the pack should be re-sealed as soon as is practicable. Taped product should be stored out of direct sunlight, which might promote deterioration in tape or adhesion performance. The capacitors should be used within 6 months and checked the solderability before use.

HANDLING

Chip capacitors are dense, hard, brittle, and abrasive materials, They are liable to suffer mechanical damage, in the form of cracks or chips. Chip Capacitors should be handled with care to avoid contamination or damage. To use vacuum or plastic tweezers to pick up or plastic tweezers is recommended for manual placement. Tape and reeled packages are suitable for automatic pick and placement machine.

PREHEAT

In order to minimize the risk of thermal shock during soldering. A carefully controlled preheat is required. The rate of preheat should not exceed 4°C per second and the final preheat temperature should be within 100°C of the soldering temperature for small chips such as 0603, 0805 and 1206, within 50°C of the soldering temperature for bigger chips such as 1210, 1808,1812,1825,2220 and 2225, etc.

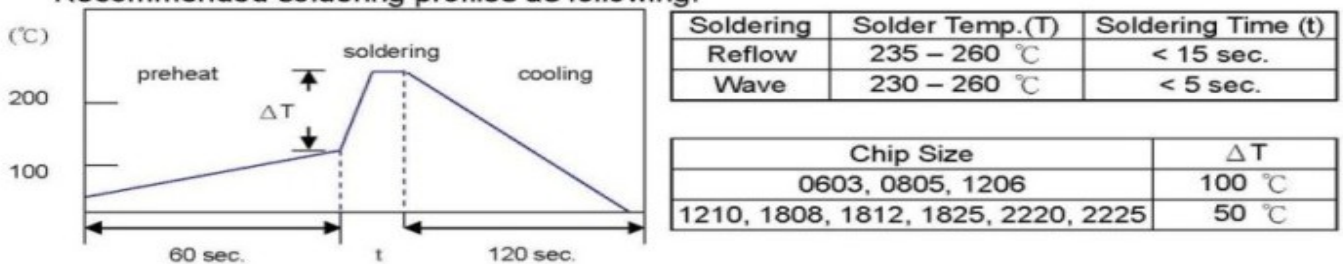
SOLDERING

Use mildly activated rosin RA and RMA fluxes do not use activated flux. The amount of solder in each solder joint should be controlled to prevent the damage of chip capacitors caused by the stress between solder, chips and substrate.

Hand soldering with temperature-controlled iron not exceeding 30 watts and diameter of tip less than 1.2mm is recommended, tip of iron should not contact the ceramic body directly and the temperature of iron should be set to not more than 260°C.

For bigger chips such as 1210, 1808,1812,2220 and 2225, etc. wave soldering and hand soldering are not recommended.

Recommended soldering profiles as following:



COOLING

After soldering, cool the chips and the substrate gradually to room temperature, Natural cooling in air is recommended to minimize stress in the solder joint. A cooling rate not exceeding 4°C per second should be used when forced cooling is necessary.

CLEANING

All flux residues must be removed by using suitable electronic-grade vapor-cleaning solvents to eliminate contamination that could cause electrolytic surface corrosion. Good results can be obtained by using ultrasonic cleaning of the solvent. The choice of the proper system is depends upon many factors such as component mix, flux, and solder paste and assembly method. The ability of the cleaning system to remove flux residues and contamination from under the chips is very important.

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7. RELIABILITY TEST CONDITIONS AND REQUIREMENTS

NO	Item	Test Condition	Requirements																																																																						
1.	Visual and Mechanical	---	*No remarkable defect. *Dimensions to conform to individual specification sheet.																																																																						
2.	Capacitance	Class I:NPO Cap \leq 1000pF, 1.0 \pm 0.2Vrms, 1MHz \pm 10% Cap $>$ 1000pF, 1.0 \pm 0.2Vrms, 1MHz \pm 10%	*Shall not exceed the limits given in the detailed spec.																																																																						
3.	Q/D.F. (Dissipation Factor)	Cap \leq 10 μ F, 1.0 \pm 0.2Vrms, 1KHz \pm 10% Cap $>$ 10 μ F, 0.5 \pm 0.2Vrms, 120Hz \pm 20%	*NPO: Cap \geq 30pF, Q \geq 1000; Cap $<$ 30pF, Q \geq 400+20C X7R, X5R: <table border="1" data-bbox="863 562 1513 1301"> <thead> <tr> <th>Rated vol.</th> <th>D.F.</th> <th colspan="2">Exception of D.F.</th> </tr> </thead> <tbody> <tr> <td>\geq 50V</td> <td>\leq 2.5%</td> <td>\leq 3%</td> <td>0603 \geq 0.047μF; 0805 \geq 0.18 μF, 1206 \geq 0.47μF</td> </tr> <tr> <td rowspan="3">25V</td> <td rowspan="3">\leq 3.5%</td> <td>\leq 5%</td> <td>0805 \geq 1 μF, 1210 \geq 10μF</td> </tr> <tr> <td>\leq 7%</td> <td>0603 \geq 0.33μF; 1206 \geq 4.7μF</td> </tr> <tr> <td>\leq 10%</td> <td>0402 \geq 0.1μF; 0603 \geq 0.47μF 0805 \geq 2.2 μF; 1206 \geq 6.8μF</td> </tr> <tr> <td rowspan="2">16V</td> <td rowspan="2">\leq 3.5%</td> <td>\leq 5%</td> <td>0402 \geq 0.033μF; 0603 \geq 0.15μF 0805 \geq 0.68μF; 1206 \geq 6.8μF 1210 \geq 4.7μF</td> </tr> <tr> <td>\leq 10%</td> <td>0603 \geq 0.68μF; 0805 \geq 2.2μF; 1206 \geq 4.7μF; 1210 \geq 22μF</td> </tr> <tr> <td rowspan="2">10V</td> <td rowspan="2">\leq 5.0%</td> <td>\leq 10%</td> <td>0402 \geq 0.033μF ; 0603 \geq 0.33μF 0805 \geq 2.2μF; 1206 \geq 2.2μF 1210 \geq 22μF</td> </tr> <tr> <td>\leq 15%</td> <td>0402 \geq 1μF</td> </tr> <tr> <td rowspan="2">6.3V</td> <td rowspan="2">\leq 10%</td> <td>\leq 15%</td> <td>0603 \geq 10μF; 0805 \geq 4.7μF; 1210 \geq 100μF</td> </tr> <tr> <td>\leq 20%</td> <td>0402 \geq 2.2μF</td> </tr> </tbody> </table> Y5V: <table border="1" data-bbox="863 1346 1513 1944"> <thead> <tr> <th>Rated vol.</th> <th>D.F.</th> <th colspan="2">Exception of D.F.</th> </tr> </thead> <tbody> <tr> <td>\geq 50V</td> <td>\leq 5.0%</td> <td>\leq 7%</td> <td>0603 \geq 0.1μF; 0805 \geq 0.47μF</td> </tr> <tr> <td>35V</td> <td>\leq 7%</td> <td>---</td> <td>---</td> </tr> <tr> <td rowspan="2">25V</td> <td rowspan="2">\leq 5.0%</td> <td>\leq 7%</td> <td>04020 \geq .047μF; 0603 \geq 0.1μF 0805 \geq 0.33μF; 1206 \geq 1μF 1210 \geq 4.7μF</td> </tr> <tr> <td>\leq 9%</td> <td>0402 \geq 0.068μF; 0603 \geq 0.47μF 1206 \geq 4.7μF; 1210 \geq 22μF</td> </tr> <tr> <td rowspan="2">16V (C$<$1.0μF)</td> <td rowspan="2">\leq 7.0%</td> <td>\leq 9%</td> <td>0402 \geq 0.068μF; 0603 \geq 0.68μF</td> </tr> <tr> <td>\leq 12.5%</td> <td>0402 \geq 0.22μF</td> </tr> <tr> <td>16V (C\geq1.0μF)</td> <td>\leq 9.0%</td> <td>\leq 12.5%</td> <td>0805 \geq 3.3μF; 1206 \geq 10μF 1210 \geq 22μF; 1812 \geq 47μF</td> </tr> <tr> <td>10V</td> <td>\leq 12.5%</td> <td>---</td> <td>---</td> </tr> <tr> <td>6.3V</td> <td>\leq 20%</td> <td>---</td> <td>---</td> </tr> </tbody> </table>	Rated vol.	D.F.	Exception of D.F.		\geq 50V	\leq 2.5%	\leq 3%	0603 \geq 0.047 μ F; 0805 \geq 0.18 μ F, 1206 \geq 0.47 μ F	25V	\leq 3.5%	\leq 5%	0805 \geq 1 μ F, 1210 \geq 10 μ F	\leq 7%	0603 \geq 0.33 μ F; 1206 \geq 4.7 μ F	\leq 10%	0402 \geq 0.1 μ F; 0603 \geq 0.47 μ F 0805 \geq 2.2 μ F; 1206 \geq 6.8 μ F	16V	\leq 3.5%	\leq 5%	0402 \geq 0.033 μ F; 0603 \geq 0.15 μ F 0805 \geq 0.68 μ F; 1206 \geq 6.8 μ F 1210 \geq 4.7 μ F	\leq 10%	0603 \geq 0.68 μ F; 0805 \geq 2.2 μ F; 1206 \geq 4.7 μ F; 1210 \geq 22 μ F	10V	\leq 5.0%	\leq 10%	0402 \geq 0.033 μ F ; 0603 \geq 0.33 μ F 0805 \geq 2.2 μ F; 1206 \geq 2.2 μ F 1210 \geq 22 μ F	\leq 15%	0402 \geq 1 μ F	6.3V	\leq 10%	\leq 15%	0603 \geq 10 μ F; 0805 \geq 4.7 μ F; 1210 \geq 100 μ F	\leq 20%	0402 \geq 2.2 μ F	Rated vol.	D.F.	Exception of D.F.		\geq 50V	\leq 5.0%	\leq 7%	0603 \geq 0.1 μ F; 0805 \geq 0.47 μ F	35V	\leq 7%	---	---	25V	\leq 5.0%	\leq 7%	04020 \geq .047 μ F; 0603 \geq 0.1 μ F 0805 \geq 0.33 μ F; 1206 \geq 1 μ F 1210 \geq 4.7 μ F	\leq 9%	0402 \geq 0.068 μ F; 0603 \geq 0.47 μ F 1206 \geq 4.7 μ F; 1210 \geq 22 μ F	16V (C $<$ 1.0 μ F)	\leq 7.0%	\leq 9%	0402 \geq 0.068 μ F; 0603 \geq 0.68 μ F	\leq 12.5%	0402 \geq 0.22 μ F	16V (C \geq 1.0 μ F)	\leq 9.0%	\leq 12.5%	0805 \geq 3.3 μ F; 1206 \geq 10 μ F 1210 \geq 22 μ F; 1812 \geq 47 μ F	10V	\leq 12.5%	---	---	6.3V	\leq 20%	---	---
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5.	Dielectric Strength	<p>*To apply voltage ($\leq 50V$)250% $\leq 100V=2.5$ times of U_R $> 100V=2.0$ times of U_R *Duration: 1 to 5 sec. *Charge and discharge current less than 50mA.</p>	*No evidence of damage or flash over during test.																								
6.	Insulation Resistance	*To apply voltage for max. 120 sec.	<p>*NPO:$>100G\Omega$ or $RxC>1000\Omega-F$ whichever is smaller. *X7R, X5R, Y5V: $>10G\Omega$ or $RxC>100\Omega-F$ whichever is smaller. *Class II (X5R, X7R, Y5V)</p> <table border="1"> <thead> <tr> <th>Rated Voltage</th> <th>Insulation Resistance</th> </tr> </thead> <tbody> <tr> <td>16V:0402 $\geq 0.22\mu F$</td> <td rowspan="4">$\geq 100\Omega-F$</td> </tr> <tr> <td>10V:0603 $\geq 0.47\mu F$; 0805 $\geq 2.2\mu F$</td> </tr> <tr> <td>1206 $\geq 6.8\mu F$</td> </tr> <tr> <td>6.3V</td> </tr> </tbody> </table>	Rated Voltage	Insulation Resistance	16V:0402 $\geq 0.22\mu F$	$\geq 100\Omega-F$	10V:0603 $\geq 0.47\mu F$; 0805 $\geq 2.2\mu F$	1206 $\geq 6.8\mu F$	6.3V																	
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7.	Adhesive Strength of Termination	<p>*Pressurizing force; 0201:2N 0402 & 0603: 5N >0603:10N *Test time:10±1 sec.</p>	*No remarkable damage or removal of the terminations.																								
8.	Solderability	<p>*Solder temperature: 235±5°C *Dipping time: 5±05 sec.</p>	*75% min. coverage of all metalized area.																								
9.	Bending Test	*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.	<p>*No remarkable damage. *Cap change : NPO: within ±10% 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.)</p>																								
10.	Resistance to Soldering Heat	<p>*Solder temperature: 260±5°C *Dipping time: 10±1 sec. *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 hr and then set for 48±4 hrs. (Class II only) at room temp. *Measurement to be made after keeping at room temp. for 24±2hrs (Class I) or 48±4 hrs (Class II only).</p>	<p>*No remarkable damage. *Cap change : NPO: within ±2.5% or ±0.25pF whichever is larger. X7R,X5R: within ±7.5% Y5V: within ±20% *25% max. leaching on each edge.</p>																								

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11.	Temperature Cycle	<p>*Conduct the five cycles according to the temperatures and time.</p> <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> <p>*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).</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	<p>*NO remarkable damage.</p> <p>*Cap change :</p> <p>NPO: within ±25% or ±0.25pF whichever is larger.</p> <p>X7R,X5R: within ±15%</p> <p>Y5V:within ±20%</p> <p>*Q/D.F. ≤1.5xinitial requirement</p> <p>*I.R. ≥0.25xinitial requirements</p>																	
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12.	Humidity (Damp Heat) Steady State	<p>*Test temp.: 40±2C</p> <p>*Humidity: 90~95% RH</p> <p>*Test time: 500+24/+0hrs.</p> <p>*Measurement to be made after keeping at room temp. for 24±2 hrs (Class I) or 48±4hrs (Class II)</p>	<p>*No remarkable damage.</p> <p>Cap change:NPO: within 5% or ±0.5pF whichever is larger. X7R,X5R: ≥ 10V, within ±15%;63V, within ±25%</p> <p>*Q/D.F. value: NPO:Cap≥30pF, Q≥350;10pF≤Cap<30pF,Q≥; 275+2.5C Cap<10pF, Q≥200+10C</p> <p>⊙X7R, X5R</p> <table border="1"> <thead> <tr> <th>Rated vol.</th> <th>D.F.</th> <th colspan="2">Exception of D.F.</th> </tr> </thead> <tbody> <tr> <td>≥50V</td> <td>≤3%</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%</td> <td>≤10%</td> <td>0805 ≥1μ F,1210 ≥10μF</td> </tr> <tr> <td>≤14%</td> <td>0603 ≥0.33uF; 0805 ≥2.2μF 1206 ≥4.7uF</td> </tr> <tr> <td>≤15%</td> <td>0402 ≥0.1μF; 0603 ≥0.47μF 0805 ≥4.7μ F;1206 ≥6.8μF</td> </tr> <tr> <td rowspan="2">16V</td> <td rowspan="2">≤5%</td> <td>≤10%</td> <td>0603 ≥0.15μF;0805 ≥0.68μF 0805 ≥0.68μF;1206 ≥6.8μF 1206 ≥2.2μF;1210 ≥4.7μF</td> </tr> <tr> <td>≤15%</td> <td>0402 ≥0.033μF;0603 ≥0.68μF 0805 ≥2.2μF;1206 ≥6.8μF; 1210 ≥22μF</td> </tr> <tr> <td rowspan="2">10V</td> <td rowspan="2">≤7.5%</td> <td>≤15%</td> <td>0402 ≥0.033μF ;0603 ≥0.33μF 0805 ≥2.2μF;1206 ≥2.2μF; 1210 ≥22μF;</td> </tr> <tr> <td>≤20%</td> <td>0402 ≥1μF</td> </tr> <tr> <td>6.3V</td> <td>≤30%</td> <td>≤30%</td> <td>0402 ≥2.2μF ;0603 ≥10μF 0805 ≥10μF;1210 ≥100μF;</td> </tr> </tbody> </table>	Rated vol.	D.F.	Exception of D.F.		≥50V	≤3%	≤6%	0603 ≥0.047μF;0805 ≥0.18μF 1206 ≥0.47μF	25V	≤5%	≤10%	0805 ≥1μ F,1210 ≥10μF	≤14%	0603 ≥0.33uF; 0805 ≥2.2μF 1206 ≥4.7uF	≤15%	0402 ≥0.1μF; 0603 ≥0.47μF 0805 ≥4.7μ F;1206 ≥6.8μF	16V	≤5%	≤10%	0603 ≥0.15μF;0805 ≥0.68μF 0805 ≥0.68μF;1206 ≥6.8μF 1206 ≥2.2μF;1210 ≥4.7μF	≤15%	0402 ≥0.033μF;0603 ≥0.68μF 0805 ≥2.2μF;1206 ≥6.8μF; 1210 ≥22μF	10V	≤7.5%	≤15%	0402 ≥0.033μF ;0603 ≥0.33μF 0805 ≥2.2μF;1206 ≥2.2μF; 1210 ≥22μF;	≤20%	0402 ≥1μF	6.3V	≤30%	≤30%	0402 ≥2.2μF ;0603 ≥10μF 0805 ≥10μF;1210 ≥100μF;
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General Purpose Multilayer Ceramic Chip Capacitors

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12.	Humidity (Damp Heat) Steady State		<p>⊙ Y5V</p> <table border="1" data-bbox="863 416 1481 1039"> <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>≤ 10%</td> <td>0603 ≥ 0.1μF; 0805 ≥ 0.47μF</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>04020 ≥ .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 < 1.0μ F)</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 rowspan="2">16V (C ≥ 1.0μ F)</td> <td rowspan="2">≤ 12.5%</td> <td rowspan="2">≤ 20%</td> <td>0805 ≥ 3.3μF; 1206 ≥ 10μF 1210 ≥ 22μF; 1812 ≥ 47μF</td> </tr> <tr> <td>---</td> <td>---</td> </tr> <tr> <td>10V</td> <td>≤ 20%</td> <td>---</td> <td>---</td> </tr> <tr> <td>6.3V</td> <td>≤ 30%</td> <td>---</td> <td>---</td> </tr> </tbody> </table> <p>*Q/D.F. value: Y5V: ≥ 10V, Within ±30%; 6.3V, ,within +30/-40%</p> <p>* I.R.: ≥ 10V, ≥ 1GΩ or RxC ≥ 50Ω-Fwhichever is smaller. 6.3V, RxC ≥ 10GΩ</p>	Rated vol.	D.F.	Exception of D.F.		≥ 50V	≤ 7.5%	≤ 10%	0603 ≥ 0.1μF; 0805 ≥ 0.47μF	35V	≤ 10%	---	---	25V	≤ 7.5%	≤ 10%	04020 ≥ .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 < 1.0μ F)	≤ 10%	≤ 12.5%	0402 ≥ 0.068μF; 0603 ≥ 0.68μF	≤ 20%	0402 ≥ 0.22μF	16V (C ≥ 1.0μ F)	≤ 12.5%	≤ 20%	0805 ≥ 3.3μF; 1206 ≥ 10μF 1210 ≥ 22μF; 1812 ≥ 47μF	---	---	10V	≤ 20%	---	---	6.3V	≤ 30%	---	---
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