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Date:

APPROVAL SHEET

Product Name : General Purpose Multilayer Ceramic Chip Capacitors

Part No. : MA Series

Description : Size 0201~2225, C0G(NPO)/X7R/X5R/Y5V, $U_R \leq 50V$,

PREPARED BY	APPROVED BY

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SPECIFICATION FOR
GENERAL PURPOSE MULTILAYER CERAMIC CHIP CAPACITORS

Part No. : MA Series

Description : Size 0201~2225, C0G(NPO)/X7R/X5R/Y5V, $U_R \leq 50V$,

<u>DRAWN BY</u>	<u>CHECKED BY</u>	<u>APPROVED BY</u>
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1. INTRODUCTION

POSPERITY Multilayer Ceramic Chip 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 solderability. The nickel barrier layer in terminations prevents the dissolution of termination when extended immersion in molten solder at elevated solder temperature.

2. FEATURES

- A wide selection of sizes is available (0201 to 2225).
- High capacitance in given case size.
- Capacitor with lead-free termination (pure Tin).
- RoHS compliant
- HALOGEN compliant

3. APPLICATIONS

- For general digital circuit.
- For power supply bypass capacitors.
- For consumer electronics.
- For telecommunication.
- DC to DC converter

4. HOW TO ORDER

<u>MA</u>	<u>1206</u>	<u>XR</u>	—	<u>104</u>	<u>K</u>	—	<u>500</u>	<u>PR</u>	<u>G</u>
<u>PDCF</u> Family	<u>Size</u>	<u>Dielectric</u>		<u>Capacitance</u>	<u>Tolerance</u>		<u>Rated voltage</u>	<u>Packaging</u>	<u>Control Code</u>
	Inch (mm) 0201 (0603) 0402 (1005) 0603 (1608) 0805 (2012) 1206 (3216) 1210 (3225) 1808 (4520) 1812 (4532) 1825 (4563) 2220 (5750) 2225 (5763)	CG: C0G(NPO) XR: X7R or X5R YV: Y5V		Two significant digits followed by no. of zeros. And R is in place of decimal point. eg.: R47=0.47pF 0R5=0.5pF 1R0=1.0pF 100=10x10 ⁰ =10pF	B =±0.1pF C =±0.25pF D =±0.5pF F =±1% 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. 6R3 = 6.3 VDC 100 =10 VDC 160 =16 VDC 250 =25 VDC 500 =50 VDC	ER: Tape and Reel, Embossed Tape PR: Tape and Reel, Paper Tape No Code: Bulk	G: RoHS compliant

5. EXTERNAL DIMENSIONS

Size Inch (mm)	L (mm)	W (mm)	Thickness		M _B (mm)
			mm	Symbol	
0402 (1005)	1.00±0.10	0.50±0.10	0.50±0.05	N	0.25 +0.05/-0.10
0603 (1608)	1.60±0.15	0.80±0.15	0.80±0.07	S	0.40±0.15
			0.80 +0.15/-0.10	X	
0805 (2012)	2.00±0.20	1.25±0.20	0.60±0.10	A	0.50±0.20
			0.80±0.10	B	
			1.25±0.10	D	
1206 (3216)	3.20±0.20	1.60±0.20	0.80±0.10	B	0.60±0.20
			0.85±0.10	T	
			0.95±0.10	C	
			1.25±0.10	D	
			1.60±0.20	G	
			1.60+0.30/-0.10	P, #	
1210 (3225)	3.20±0.30	2.50±0.30	0.95±0.10	C	0.75±0.35
			1.25±0.10	D	
			1.60±0.20	G	
			2.00±0.20	K	
			2.50±0.30	M	
1808 (4520)	4.50±0.40	2.00±0.25	1.60±0.20	G	0.75±0.35
1812 (4532)	4.50±0.40	3.20±0.30	1.25±0.10	D	0.75±0.35
			1.60±0.20	G	
			2.00±0.20	K	
			2.50±0.30	M	
1825 (4563)	4.50±0.40	6.30±0.40	2.00±0.20	K	0.75±0.35
2220 (5750)	5.70±0.40	5.00±0.40	2.00±0.20	K	0.85±0.35
			2.50±0.30	M	
2225 (5763)	5.70±0.40	6.30±0.40	2.00±0.20	K	0.85±0.35
			2.50±0.30	M	

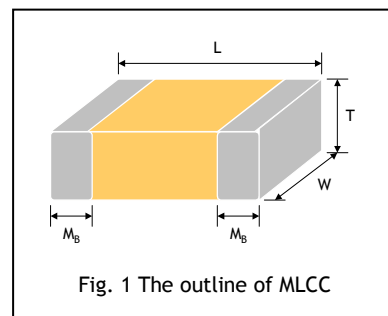


Fig. 1 The outline of MLCC

6. GENERAL ELECTRICAL DATA

Dielectric	C0G	X7R	X5R	Y5V
Size	0201, 0402, 0603, 0805, 1206, 1210, 1808, 1812, 1825, 2220, 2225	0201, 0402, 0603, 0805, 1206, 1210, 1808, 1812, 1825, 2220, 2225	0201, 0402, 0603	0201, 0402, 0603, 0805, 1206, 1210, 1812
Rated voltage (WVDC)	10V, 16V, 25V, 50V	6.3V, 10V, 16V, 25V, 50V	4V, 6.3V, 10V, 16V, 25V, 50V	6.3V, 10V, 16V, 25V, 50V
Capacitance range*	0R1 to 390nF	100pF to 820nF	100pF to 820nF	10nF to 680nF
Capacitance tolerance	J($\pm 5\%$), K($\pm 10\%$)	J($\pm 5\%$), K($\pm 10\%$), M($\pm 20\%$)		Z(-20/+80%)
Tan δ	Cap.<30pF : Q $\geq 400+20C$ Cap. $\geq 30pF$: Q ≥ 1000	Note 1		
Operating temperature	-55 to +125°C		-55 to +85°C	-25 to +85°C
Capacitance characteristic	$\pm 30ppm/^\circ C$	$\pm 15\%$		+30/-80%
Termination	Cu or Ag/Ni/Sn or Au (lead-free termination)			

* Measured at the condition of 30~70% related humidity.

C0G : Apply 1.0 \pm 0.2Vrms, 1.0MHz \pm 10% for Cap. \leq 1000pF and 1.0 \pm 0.2Vrms, 1.0KHz \pm 10% for Cap. $>$ 1000pF, 25°C at ambient temperature.

X7R : Apply 1.0 \pm 0.2Vrms, 1.0KHz \pm 10%, at 25°C ambient temperature.

Y5V : Apply 1.0 \pm 0.2Vrms, 1.0KHz \pm 10%, at 20°C ambient temperature.

** Preconditioning for Class II MLCC : Perform a heat treatment at 150 \pm 10°C for 1 hour, then leave in ambient condition for 24 \pm 2 hours before measurement.

Note 1 : X7R/X5R

Rated	D.F. \leq	Exception of D.F. \leq	
50V	$\leq 2.5\%$	$\leq 3\%$	0201(50V), 0603 $\geq 0.047\mu F$, 0805 $\geq 0.18\mu F$, 1206 $\geq 0.47\mu F$
		$\leq 5\%$	0201 $\geq 0.01\mu F$, 1210 $\geq 4.7\mu F$
		$\leq 10\%$	0402 $\geq 0.1\mu F$, 0603 $\geq 0.1\mu F$, 0805 $\geq 1\mu F$, 1206 $\geq 2.2\mu F$, 1210 $\geq 10\mu F$
35V	$\leq 3.5\%$	$\leq 10\%$	0603 $\geq 1\mu F$, 0805 $\geq 2.2\mu F$, 1206 $\geq 2.2\mu F$, 1210 $\geq 10\mu F$
		$\leq 5\%$	0201 $\geq 0.01\mu F$, 0805 $\geq 1\mu F$, 1210 $\geq 10\mu F$
25V	$\leq 3.5\%$	$\leq 7\%$	0603 $\geq 0.33\mu F$, 1206 $\geq 4.7\mu F$
		$\leq 10\%$	0201 $\geq 0.1\mu F$, 0402 $\geq 0.10\mu F$, 0603 $\geq 0.47\mu F$, 0805 $\geq 2.2\mu F$, 1206 $\geq 6.8\mu F$, 1210 $\geq 22\mu F$
		$\leq 12.5\%$	0402 $\geq 0.47\mu F$
		$\leq 5\%$	0201 $\geq 0.01\mu F$, 0402 $\geq 0.033\mu F$, 0603 $\geq 0.15\mu F$, 0805 $\geq 0.68\mu F$, 1206 $\geq 2.2\mu F$, 1210 $\geq 4.7\mu F$
16V	$\leq 3.5\%$	$\leq 10\%$	0201 $\geq 0.1\mu F$ (0201/X7R $\geq 0.022\mu F$), 0402 $\geq 0.22\mu F$, 0603 $\geq 0.68\mu F$, 0805 $\geq 2.2\mu F$, 1206 $\geq 4.7\mu F$, 1210 $\geq 22\mu F$
		$\leq 15\%$	0201 $\geq 0.1\mu F$, 0402 $\geq 1\mu F$
10V	$\leq 5\%$	$\leq 10\%$	0201 $\geq 0.012\mu F$, 0402 $\geq 0.33\mu F$ (0402/X7R $\geq 0.22\mu F$), 0603 $\geq 0.33\mu F$, 0805 $\geq 2.2\mu F$, 1206 $\geq 2.2\mu F$, 1210 $\geq 22\mu F$
		$\leq 15\%$	0201 $\geq 0.1\mu F$, 0402 $\geq 1\mu F$
6.3V	$\leq 10\%$	$\leq 15\%$	0201 $\geq 0.1\mu F$, 0402 $\geq 1\mu F$, 0603 $\geq 10\mu F$, 0805 $\geq 4.7\mu F$, 1206 $\geq 47\mu F$, 1210 $\geq 100\mu F$
		$\leq 20\%$	0402 $\geq 2.2\mu F$
4V	$\leq 15\%$	---	---

Y5V

Rated	D.F. \leq	Exception of D.F. \leq	
$\geq 50V$	$\leq 5\%$	$\leq 7\%$	0603 $\geq 0.1\mu F$, 0805 $\geq 0.47\mu F$, 1206 $\geq 4.7\mu F$
		$\leq 12.5\%$	1210 $\geq 6.8\mu F$
35V	$\leq 7\%$	---	---
25V	$\leq 5\%$	$\leq 7\%$	0402 $\geq 0.047\mu F$, 0603 $\geq 0.1\mu F$, 0805 $\geq 0.33\mu F$, 1206 $\geq 1\mu F$, 1210 $\geq 4.7\mu F$
		$\leq 9\%$	0402 $\geq 0.068\mu F$, 0603 $\geq 0.47\mu F$, 1206 $\geq 4.7\mu F$, 1210 $\geq 22\mu F$
16V (C<1.0 μF)	$\leq 7\%$	$\leq 9\%$	0402 $\geq 0.068\mu F$, 0603 $\geq 0.68\mu F$
16V (C $\geq 1.0\mu F$)	$\leq 9\%$	$\leq 12.5\%$	0603 $\geq 2.2\mu F$, 0805 $\geq 3.3\mu F$, 1206 $\geq 10\mu F$, 1210 $\geq 22\mu F$, 1812 $\geq 47\mu F$
10V	$\leq 12.5\%$	$\leq 20\%$	0402 $\geq 0.47\mu F$
6.3V	$\leq 20\%$	---	---

7.CAPACITANCE RANGE (C0G/NPO Dielectric)

Cap(pF)	EIA Size Code	0201				0402				0603				0805				1206		
		10V	16V	25V	50V	10V	16V	25V	50V	10V	16V	25V	50V	10V	16V	25V	50V	10V	16V	25V
0.1	0R1																			
0.2	0R2																			
0.3	0R3																			
0.4	0R4																			
0.5	0R5																			
1.0	1R0																			
1.2	1R2																			
1.5	1R5																			
1.8	1R8																			
2.2	2R2																			
2.7	2R7																			
3.3	3R3																			
3.9	3R9																			
4.7	4R7																			
5.6	5R6																			
6.8	6R8																			
8.2	8R2																			
10	100																			
12	120																			
15	150																			
18	180																			
22	220																			
27	270																			
33	330																			
39	390																			
47	470																			
56	560																			
68	680																			
82	820																			
100	101																			
120	121																			
150	151																			
180	181																			
220	221																			
270	271																			
330	331																			
390	391																			
470	471																			
560	561																			
680	681																			
820	821																			
1000	102																			
1200	122																			
1500	152																			
1800	182																			
2200	222																			
2700	272																			
3300	332																			
3900	392																			
4700	472																			
5600	562																			
6800	682																			
8200	822																			
10000	103																			
12000	123																			
15000	153																			
18000	183																			
22000	223																			
27000	273																			
33000	333																			
39000	393																			
47000	473																			
56000	563																			
68000	683																			
82000	823																			
100000	104																			



7.CAPACITANCE RANGE (C0G/NPO Dielectric)

Cap(pF)	EIA Size Code	1210				1808		1812				1825		2220		2225	
		10V	16V	25V	50V	25V	50V	10V	16V	25V	50V	25V	50V	25V	50V	25V	50V
2.2	2R2																
2.7	2R7																
3.3	3R3																
3.9	3R9																
4.7	4R7																
5.6	5R6																
6.8	6R8																
8.2	8R2																
10	100																
12	120																
15	150																
18	180																
22	220																
27	270																
33	330																
39	390																
47	470																
56	560																
68	680																
82	820																
100	101																
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150	151																
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220	221																
270	271																
330	331																
390	391																
470	471																
560	561																
680	681																
820	821																
1000	102																
1200	122																
1500	152																
1800	182																
2200	222																
2700	272																
3300	332																
3900	392																
4700	472																
5600	562																
6800	682																
8200	822																
10000	103																
12000	123																
15000	153																
18000	183																
22000	223																
27000	273																
33000	333																
39000	393																
47000	473																
56000	563																
68000	683																
82000	823																
100000	104																
120000	124																
150000	154																
180000	184																
220000	224																
270000	274																
330000	334																
390000	394																

8. CAPACITANCE RANGE (X7R Dielectric)

Cap(pF)	EIA Size Code	0201					0402					0603					0805				
		6.3V	10V	16V	25V	50V	6.3V	10V	16V	25V	50V	6.3V	10V	16V	25V	50V	6.3V	10V	16V	25V	
100	101																				
120	121																				
150	151																				
180	181																				
220	221																				
270	271																				
330	331																				
390	391																				
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180000	184																				
220000	224																				
270000	274																				
330000	334																				
390000	394																				
470000	474																				
560000	564																				
680000	684																				
820000	824																				

8. CAPACITANCE RANGE (X7R Dielectric)

Cap(pF)	EIA Size	1206					1210					1808		1812				1825		2220	2225	
		6.3V	10V	16V	25V	50V	6.3V	10V	16V	25V	50V	25V	50V	10V	16V	25V	50V	25V	50V	25V		
100	101																					
120	121																					
150	151																					
180	181																					
220	221																					
270	271																					
330	331																					
390	391																					
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180000	184																					
220000	224																					
270000	274																					
330000	334																					
390000	394																					
470000	474																					
560000	564																					
680000	684																					
820000	824																					



9. CAPACITANCE RANGE (X5R Dielectric)

Cap(pF)	EIA Size	0201						0402						0603					
		4V	6.3V	10V	16V	25V	50V	4V	6.3V	10V	16V	25V	50V	4V	6.3V	10V	16V	25V	50V
100	101																		
120	121																		
150	151																		
180	181																		
220	221																		
270	271																		
330	331																		
390	391																		
470	471																		
560	561																		
680	681																		
820	821																		
1000	102																		
1500	152																		
2200	222																		
2700	272																		
3300	332																		
4700	472																		
6800	682																		
10000	103																		
15000	153																		
22000	223																		
27000	273																		
33000	333																		
39000	393																		
47000	473																		
56000	563																		
68000	683																		
82000	823																		
100000	104																		
150000	154																		
220000	224																		
270000	274																		
330000	334																		
390000	394																		
470000	474																		
680000	684																		
820000	824																		

10.CAPACITANCE RANGE (Y5V Dielectric)

Cap(pF)	EIA Size	0201	0402					0603					0805			
	Code	6.3V	6.3V	10V	16V	25V	50V	6.3V	10V	16V	25V	50V	10V	16V	25V	50V
10000	103															
15000	153															
22000	223															
33000	333															
47000	473															
68000	683															
100000	104															
150000	154															
220000	224															
330000	334															
470000	474															
680000	684															

Cap(pF)	EIA Size	1206				1210				1812			
	Code	10V	16V	25V	50V	10V	16V	25V	50V	10V	16V	25V	50V
10000	103												
15000	153												
22000	223												
33000	333												
47000	473												
68000	683												
100000	104												
150000	154												
220000	224												
330000	334												
470000	474												
680000	684												

11. PACKAGE DIMENSION AND QUANTITY

Size	Thickness (mm)	Paper tape		Plastic tape	
		7" reel	13" reel	7" reel	13" reel
0201 (0603)	0.30±0.05	15k	70K	-	-
0402 (1005)	0.50±0.05	10k	50K		
0603 (1608)	0.80±0.07	4k	15k	-	-
	0.80±0.15/-0.10	4k	15k		
0805 (2012)	0.60±0.10	4k	15k	-	-
	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	-

11. PACKAGE DIMENSION AND QUANTITY

9.1. EMBOSSED TAPE DIMENSIONS

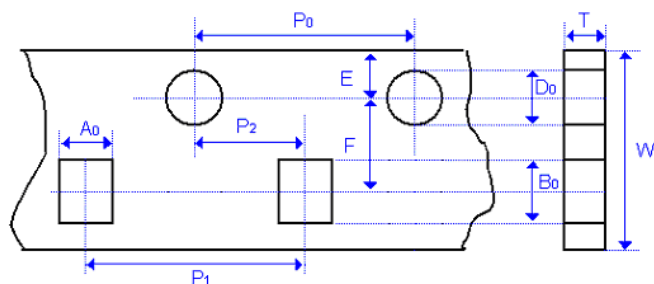


Fig. 9.1 The dimension of paper tape

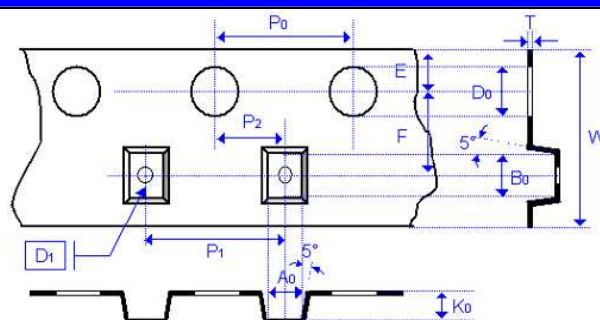


Fig. 9.2 The dimension of plastic tape

Size	0201	0402	0603		0805	
Chip Thickness	0.30±0.03	0.50±0.05 0.50±0.10	0.80±0.07	0.80 +0.15/-0.1	0.80±0.10	1.25±0.10 1.25±0.20
A ₀	0.39±0.07	0.70±0.2	1.00 +0.05/-0.1	1.02 +0.05/-0.1	1.50±0.10	<1.65
B ₀	0.69±0.07	1.20±0.2	1.80±0.10	1.80±0.10	2.30±0.10	<2.40
T	≤0.50	≤0.80	0.95±0.05	0.97±0.05	0.95±0.05	0.23±0.05
K ₀	-	-	-	-	-	<2.50
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 ₀	4.00±0.10	4.00±0.10	4.00±0.10	4.00±0.10	4.00±0.10	4.00±0.10
10xP ₀	40.00±0.10	40.00±0.10	40.00±0.2	40.00±0.2	40.00±0.2	40.00±0.20
P ₁	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 ₂	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 ₀	1.55±0.05	1.55±0.05	1.55±0.05	1.55±0.05	1.55±0.05	1.50 +0.10/-0
D ₁	-	-	-	-	-	1.00±0.10
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
Unit :	mm	mm	mm	mm	mm	mm

Size	1206			1210		1812	
Chip Thickness	0.80±0.10	0.95±0.10 1.25±0.10	1.60±0.20 1.60+0.3/-0/1	0.95±0.10 1.25±0.10 1.60±0.20	2.50±0.30	1.25±0.10 1.60±0.20 2.00±0.20	2.50±0.30
A ₀	2.00±0.10	<2.00	<2.00	<3.05	<3.10	<3.90	<3.90
B ₀	3.50±0.10	<3.60	<3.70	<3.80	<4.00	<5.30	<5.30
T	0.95±0.05	0.23±0.05	0.23±0.05	0.23±0.05	0.23±0.05	0.25±0.05	0.25±0.05
K ₀	-	<2.50	<2.50	<2.50	<3.50	<2.50	<3.00
W	8.00±0.10	8.00±0.10	8.00±0.10	8.00±0.10	8.00±0.10	12.0±0.20	12.0±0.20
P ₀	4.00±0.10	4.00±0.10	4.00±0.10	4.00±0.100	4.00±0.10	4.00±0.10	4.00±0.10
10xP ₀	40.00±0.20	40.00±0.20	40.00±0.20	40.00±0.20	40.0±0.10	40.00±0.20	40.00±0.20
P ₁	4.00±0.10	4.00±0.10	4.00±0.10	4.00±0.10	4.00±0.10	8.00±0.10	8.00±0.10
P ₂	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 ₀	1.55±0.05	1.50 +0.10/-0	1.50 +0.10/-0	1.50 +0.10/-0	1.50 +0.10/-0	1.50 +0.10/-0	1.50 +0.10/-0
D ₁	-	1.00±0.10	1.00±0.10	1.00±0.10	1.00±0.10	1.50±0.10	1.50±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±0.1
F	3.50±0.05	3.50±0.05	3.50±0.05	3.50±0.05	3.50±0.05	5.50±0.05	5.50±0.05
Unit :	mm	mm	mm	mm	mm	mm	mm

11. PACKAGE DIMENSION AND QUANTITY

Size	1825		2220		2225	
Chip Thickness	1.60±0.20 2.00±0.20	2.50±0.30	1.40±0.15 1.60±0.20 2.00±0.20	2.50±0.30	1.60±0.20 2.00±0.20	2.50±0.30
A ₀	<6.80	<6.80	<5.80	<5.80	<6.80	<6.80
B ₀	<5.30	<5.30	<6.50	<6.50	<6.50	<6.50
T	0.30±0.10	0.30±0.10	0.30±0.10	0.30±0.10	0.30±0.10	0.30±0.10
K ₀	<2.50	<3.10	<2.50	<3.10	<2.50	<3.10
W	12.0±0.20	12.0±0.20	12.0±0.20	12.0±0.20	12.0±0.20	12.0±0.20
P ₀	4.00±0.10	4.00±0.10	4.00±0.10	4.00±0.10	4.00±0.10	4.00±0.10
10xP ₀	40.00±0.20	40.00±0.20	40.00±0.20	40.00±0.20	40.00±0.20	40.00±0.20
P ₁	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 ₂	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 ₀	1.50 +0.10/-0	1.50 +0.10/-0	1.50 +0.10/-0	1.50 +0.10/-0	1.50 +0.10/-0	1.50 +0.10/-0
D ₁	1.50±0.10	1.50±0.10	1.50±0.10	1.50±0.10	1.50±0.10	1.50±0.10
E	1.75±0.1	1.75±0.10	1.75±0.1	1.75±0.10	1.75±0.10	1.75±0.10
F	5.50±0.05	5.50±0.05	5.50±0.05	5.50±0.05	5.50±0.05	5.50±0.05
Unit :	mm	mm	mm	mm	mm	mm

11.2. REEL DIMENSIONS

Size	0201, 0402, 0603 0805, 1206, 1210			1808, 1812, 1825 2220, 2225
Reel size	7"	7"	13"	7"
C	13.0 +0.5/-0.2	13.0 +0.5/-0.2	13.0 +0.5/-0.2	13.0 +0.5/-0.2
W ₁	8.4 +1.5/-0	12.4 +2.0/-0	8.4 +1.5/-0	8.4 +1.5/-0
A	178.0 ±0.10	178.0 ±0.10	330.0 ±1.0	178.0 ±0.10
N	60.0 +1.0/-0	80.0 ±1.0	100 ±1.0	60.0 +1.0/-0

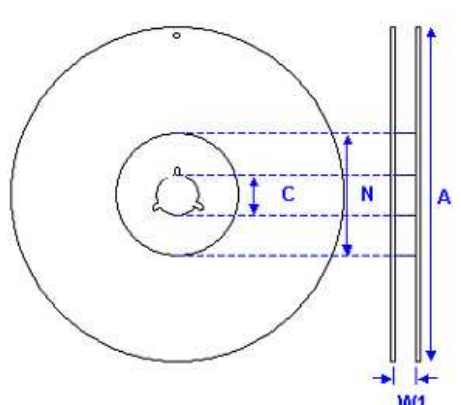


Fig. 9.3 The dimension of reel

12.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 product is recommended to be used within 12 months after shipment 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.

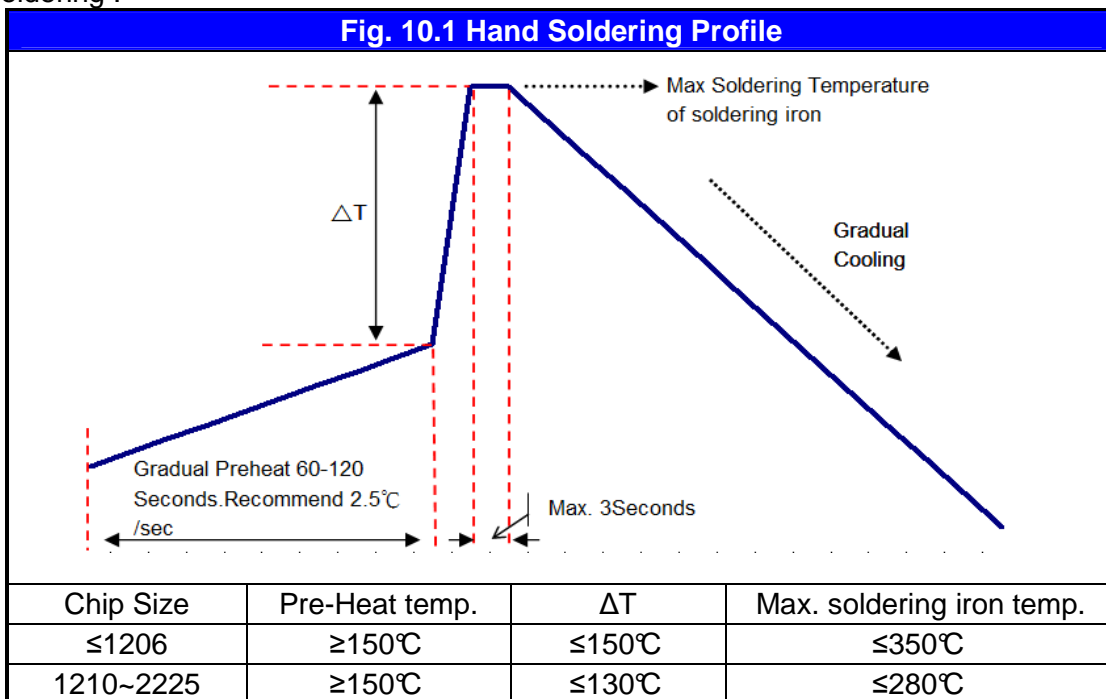
PREHEAT

In order to minimize the risk of thermal shock during soldering, a carefully controlled preheat is required. The rate of preheat should not exceed 3°C per second.

SOLDERING

Use middy 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.

a.) Hand soldering :



* Soldering iron tip diameter ≤ 1.0 mm and wattage max. 20W.

* The Capacitors shall be pre-heated and that the temperature gradient between the devices and the tip of the soldering iron.

* The required amount of solder shall be melted on the soldering tip.

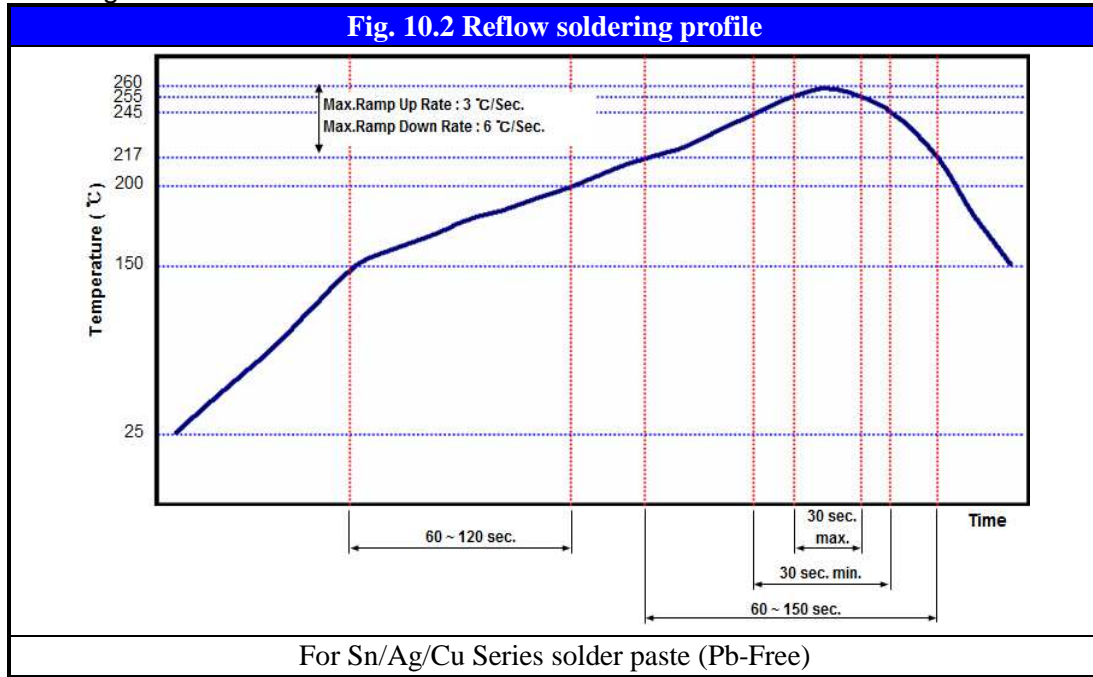
* The tip of iron should not contact the ceramic body directly.

* The Capacitors shall be cooled gradually at room temperature after soldering.

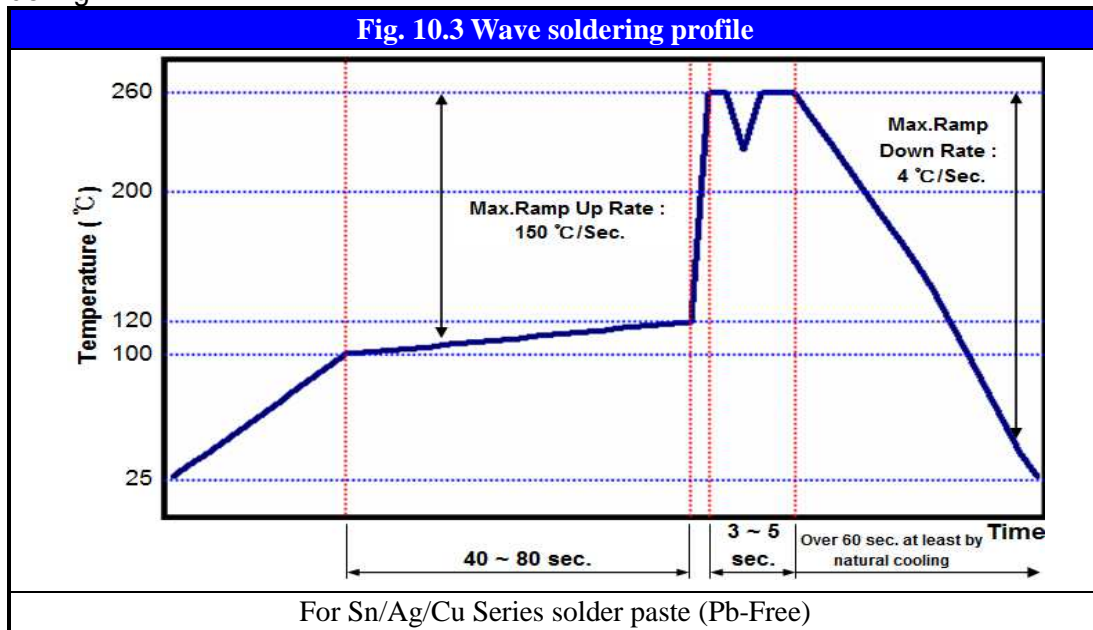
* Forced air cooling is not allowed.

12. APPLICATION NOTES

b.) Reflow soldering :



c.) Wave soldering :



Soldering conditions :

Class I :

Size Inch (mm)	Temper. Cher.	Capacitance	Condition	
			Wave	Reflow
≤0402(1005)	Class I - C0G	All	X	O
0603(1608)	Class I - C0G	All	O	O
0805(2012)	Class I - C0G	All	O	O
1206(3216)	Class I - C0G	All	O	O
≥1210(3225)	Class I - C0G	All	X	O

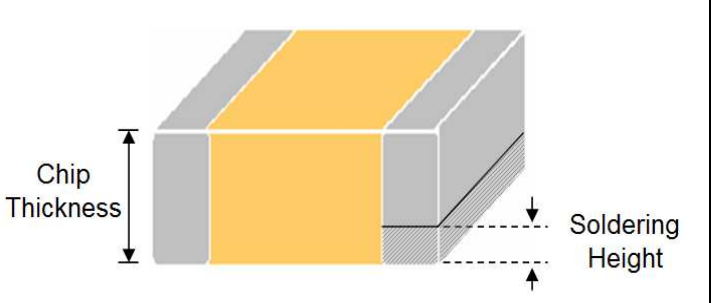
12.APPLICATION NOTES

Soldering conditions:

ClassII:

Size Inch (mm)	Temper. Cher.	Capacitance	Condition	
			Wave	Reflow
0402 (1005)	ClassII - X7R	All	X	○
0603 (1608)	ClassII - X7R	Cap. < 2.2 μ F	○	○
		Cap. \geq 2.2 μ F	X	○
0805 (2012)	ClassII - X7R	Cap. < 4.7 μ F	○	○
		Cap. \geq 4.7 μ F	X	○
1206 (3216)	ClassII - X7R	Cap. < 4.7 μ F	○	○
		Cap. \geq 4.7 μ F	X	○
\geq 1210 (3225)	ClassII - X7R	All	X	○

Soldering height :

<p>The solder climbing minimum height is suggesting to 25% of chip thickness or 500um whichever is less. (Reference from IPC-610E)</p>	 <p>The diagram illustrates a cross-section of a chip (yellow) on a substrate (grey). A layer of solder (orange) is applied to the bottom surface of the chip. A vertical double-headed arrow on the left indicates the 'Chip Thickness'. A vertical double-headed arrow on the right indicates the 'Soldering Height', which is the height of the solder layer on the substrate. Dashed lines show the solder layer extending under the chip.</p>
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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.

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.

13. RELIABILITY TEST CONDITIONS AND REQUIREMENTS

No.	Item	Test Condition	Requirements																																																																																								
1.	Visual and Dimensions	---	* No remarkable defect. * Dimensions to confirm to individual specification sheet.																																																																																								
2.	Capacitance		* Shall not exceed the limits given in the detailed spec. * C0G : Cap.≥30pF, Q≥1000; Cap.<30pF, Q≥400+20C. * X7R, X5R																																																																																								
3.	Q/D.F. (Dissipation Factor)	* Class I : (C0G) Cap.≤1000pF, 1.0±0.2Vrms, 1MHz±10%. Cap.>1000pF, 1.0±0.2Vrms, 1KHz±10%. * Class II : (X7R, X5R, Y5V) Cap.≤10μF, 1.0±0.2Vrms, 1KHz±10%**. Cap.>10μF, 0.5±0.2Vrms, 120Hz±20%. ** Test condition : 0.5±0.2Vrms, 1KHz±10%. X7R : 0805=106(6.3V&10V), 0603=475(6.3V). X6S : 0201≥104(6.3V&10V), 0402≥225(6.3V), 0402/475(10V), 0603/106(6.3V). X5R : 01R5≥103, 0201≥224(6.3V, 10V, 16V)#1, 0402≥475(6.3V, 16V), 0402≥225(10V), 0603=106(6.3V, 10V).	<table border="1"> <thead> <tr> <th>Rated</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≥0.047μF, 0805≥0.18μF, 1206≥0.47μF</td> </tr> <tr> <td>≤5%</td> <td>0201≥0.01μF, 1210≥4.7μF</td> </tr> <tr> <td>≤10%</td> <td>0402≥0.1μF, 0603≥0.1μF, 0805≥1μF, 1206≥2.2μF, 1210≥10μF</td> </tr> <tr> <td>35V</td> <td>≤3.5%</td> <td>≤10%</td> <td>0603≥1μF, 0805≥2.2μF, 1206≥2.2μF, 1210≥10μF</td> </tr> <tr> <td rowspan="4">25V</td> <td rowspan="4">≤3.5%</td> <td>≤5%</td> <td>0201≥0.01μF, 0805≥1μF, 1210≥10μF</td> </tr> <tr> <td>≤7%</td> <td>0603≥0.33μF, 1206≥4.7μF</td> </tr> <tr> <td>≤10%</td> <td>0201≥0.1μF, 0402≥0.10μF, 0603≥0.47μF, 0805≥2.2μF, 1206≥6.8μF, 1210≥22μF</td> </tr> <tr> <td>≤12.5%</td> <td>0402≥0.47μF</td> </tr> <tr> <td>16V</td> <td>≤3.5%</td> <td>≤5%</td> <td>0201≥0.01μF, 0402≥0.033μF, 0603≥0.15μF, 0805≥0.68μF, 1206≥2.2μF, 1210≥4.7μF</td> </tr> <tr> <td rowspan="2">10V</td> <td rowspan="2">≤5%</td> <td>≤10%</td> <td>0201≥0.1μF(0201/X7R≥0.022μF), 0402≥0.22μF, 0603≥0.68μF, 0805≥2.2μF, 1206≥4.7μF, 1210≥22μF</td> </tr> <tr> <td>≤15%</td> <td>0201≥0.1μF, 0402≥1μF</td> </tr> <tr> <td>6.3V</td> <td>≤10%</td> <td>≤15%</td> <td>0201≥0.1μF, 0402≥1μF, 0603≥10μF, 0805≥4.7μF, 1206≥47μF, 1210≥100μF</td> </tr> <tr> <td>4V</td> <td>≤15%</td> <td>---</td> <td>---</td> </tr> </tbody> </table>	Rated	D.F.≤	Exception of D.F.≤		50V	≤2.5%	≤3%	0201(50V), 0603≥0.047μF, 0805≥0.18μF, 1206≥0.47μF	≤5%	0201≥0.01μF, 1210≥4.7μF	≤10%	0402≥0.1μF, 0603≥0.1μF, 0805≥1μF, 1206≥2.2μF, 1210≥10μF	35V	≤3.5%	≤10%	0603≥1μF, 0805≥2.2μF, 1206≥2.2μF, 1210≥10μF	25V	≤3.5%	≤5%	0201≥0.01μF, 0805≥1μF, 1210≥10μF	≤7%	0603≥0.33μF, 1206≥4.7μF	≤10%	0201≥0.1μF, 0402≥0.10μF, 0603≥0.47μF, 0805≥2.2μF, 1206≥6.8μF, 1210≥22μF	≤12.5%	0402≥0.47μF	16V	≤3.5%	≤5%	0201≥0.01μF, 0402≥0.033μF, 0603≥0.15μF, 0805≥0.68μF, 1206≥2.2μF, 1210≥4.7μF	10V	≤5%	≤10%	0201≥0.1μF(0201/X7R≥0.022μF), 0402≥0.22μF, 0603≥0.68μF, 0805≥2.2μF, 1206≥4.7μF, 1210≥22μF	≤15%	0201≥0.1μF, 0402≥1μF	6.3V	≤10%	≤15%	0201≥0.1μF, 0402≥1μF, 0603≥10μF, 0805≥4.7μF, 1206≥47μF, 1210≥100μF	4V	≤15%	---	---																																												
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13. RELIABILITY TEST CONDITIONS AND REQUIREMENTS

No.	Item	Test Condition	Requirements															
5.	Insulation Resistance	* To apply rated voltage for Max. 120sec.	<p>* $\geq 10G\Omega$ or $RxC \geq 500\Omega-F$, whichever is smaller. * Class II (X7R, X5R, Y5V) :</p> <table border="1"> <thead> <tr> <th>Rated voltage</th> <th>I.R.</th> </tr> </thead> <tbody> <tr> <td>50V : 0402$\geq 0.01\mu F$, 0603$\geq 1\mu F$, 0805$\geq 1\mu F$, 1206$\geq 4.7\mu F$, 1210$\geq 4.7\mu F$</td> <td rowspan="6">$\geq 10G\Omega$ or $RxC \geq 100\Omega-F$, whichever is smaller</td> </tr> <tr> <td>35V : 0805$\geq 2.2\mu F$, 1206$\geq 2.2\mu F$, 1210$\geq 10\mu F$</td> </tr> <tr> <td>25V : 0402$\geq 1\mu F$, 0603$\geq 2.2\mu F$, 0805$\geq 2.2\mu F$, 1206$\geq 10\mu F$, 1210$\geq 10\mu F$</td> </tr> <tr> <td>16V : 0201$\geq 0.1\mu F$, 0402$\geq 0.22\mu F$, 0603$\geq 1\mu F$, 0805$\geq 2.2\mu F$, 1206$\geq 10\mu F$, 1210$\geq 47\mu F$</td> </tr> <tr> <td>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$\geq 47\mu F$</td> </tr> <tr> <td>6.3V, 4V</td> </tr> </tbody> </table>	Rated voltage	I.R.	50V : 0402 $\geq 0.01\mu F$, 0603 $\geq 1\mu F$, 0805 $\geq 1\mu F$, 1206 $\geq 4.7\mu F$, 1210 $\geq 4.7\mu F$	$\geq 10G\Omega$ or $RxC \geq 100\Omega-F$, whichever is smaller	35V : 0805 $\geq 2.2\mu F$, 1206 $\geq 2.2\mu F$, 1210 $\geq 10\mu F$	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 : 0201 $\geq 0.1\mu F$, 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 $\geq 47\mu F$	6.3V, 4V						
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6.	Dielectric Strength	<p>* To apply 250% of rated voltage. * Duration : 1 to 5 sec. * Charge and discharge current less than 50mA.</p>	* No evidence of damage or flash over during test.															
7.	Solderability	<p>* Solder temperature : $235 \pm 5^\circ C$ for (0201~1210). * Solder temperature : $245 \pm 5^\circ C$ for (1808~2225). * Dipping time : 2 ± 0.5 sec.</p>	* 75% min. coverage of all metalized area.															
8.	Resistance to Soldering Heat	<p>* Solder temperature : $260 \pm 5^\circ C$. * Dipping time : 10 ± 1 sec. * Preheating : 120 to $150^\circ C$ for 1 minute before immerse the capacitor in a eutectic solder. * Before initial measurement (Class II only) : To apply de-aging at $150^\circ C$ for 1hr then set for 24 ± 2 hrs at room temp. * Cap. / D.F. / I.R. Measurement to be made after de-aging at $150^\circ C$ for 1hr then set for 24 ± 2 hrs at room temp.</p>	<p>* No remarkable damage. * Cap. change : C0G : Within $\pm 2.5\%$ or $\pm 0.25pF$, whichever is larger. X7R, X5R : Within $\pm 7.5\%$. Y5V : Within $\pm 20\%$. * D.F.(Q)/I.R. : To meet initial requirements. * 25% max. leaching on each edge.</p>															
9.	Temperature Cycle	<p>* Conduct the five cycles according to the temperatures and time.</p> <table border="1"> <thead> <tr> <th>Step</th> <th>Temp.($^\circ C$)</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) : To apply de-aging at $150^\circ C$ for 1hr then set for 24 ± 2 hrs at room temp. * Cap./D.F./I.R. measurement to made after de-aging at $150^\circ C$ for 1hr then set for 24 ± 2 hrs at room temp .</p>	Step	Temp.($^\circ C$)	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. * Cap. change : C0G : Within $\pm 2.5\%$ or $\pm 0.25pF$, whichever is larger. X7R, X5R : Within $\pm 7.5\%$. Y5V : Within $\pm 20\%$. * D.F.(Q) : To meet initial requirement. * I.R. : $\geq 25\%$ of initial requirement.</p>
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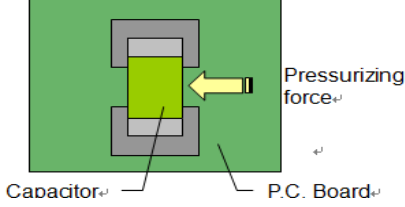
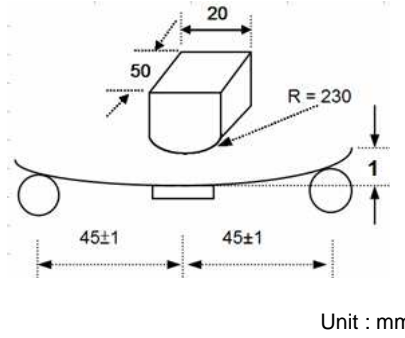
13.RELIABILITY TEST CONDITIONS AND REQUIREMENTS(Con.)

No.	Item	Test Condition	Requirements									
10.	Humidity (Damp Heat) Steady State	<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 48±4 hrs (Class II).</p>	<p>* No remarkable damage. * Cap. change : COG : Within ±5.0% or ±0.5pF, whichever is larger. X7R, X5R : Within ±12.5% for ≥10V**, within ±25% for 6.3V. **10V : Within ±25% for 0603≥4.7μF, 0402≥1μF, 0201≥0.1μF. Y5V : Within ±30% for ≥10V, within +30/-40% for 6.3V. * Q for COG : Cap.>30pF, Q≥350. 10pF≤Cap.≤30pF, Q≥275+2.5C. Cap.<10pF, Q≥200+10C. * D.F.(Class II) : ≤200% of initial requirement. * I.R. : ≥10V, ≥1GΩ or RxC≥50Ω-F, whichever is smaller. Class II (X7R, X5R, Y5V)</p> <table border="1"> <thead> <tr> <th>Rated voltage</th> <th>I.R.</th> </tr> </thead> <tbody> <tr> <td>50V : 0402>0.01μF, 0603≥1μF, 0805≥1μF, 1206≥4.7μF, 1210≥4.7μF</td> <td rowspan="6">≥1GΩ or RxC≥10Ω-F, whichever is smaller</td> </tr> <tr> <td>35V : 0603≥1μF, 0805≥2.2μF, 1206≥2.2μF, 1210≥10μF</td> </tr> <tr> <td>25V : 0201≥0.1μF, 0402≥0.22μF, 0603≥2.2μF, 0805≥2.2μF, 1206≥10μF, 1210≥10μF</td> </tr> <tr> <td>16V : 0201≥0.1μF, 0402≥0.22μF, 0603≥1μF, 0805≥2.2μF, 1206≥10μF, 1210≥47μF</td> </tr> <tr> <td>10V : 0201≥47nF, 0402≥0.47μF, 0603≥0.47μF, 0805≥2.2μF, 1206≥4.7μF, 1210≥47μF</td> </tr> <tr> <td>6.3V, 4V</td> </tr> </tbody> </table>	Rated voltage	I.R.	50V : 0402>0.01μF, 0603≥1μF, 0805≥1μF, 1206≥4.7μF, 1210≥4.7μF	≥1GΩ or RxC≥10Ω-F, whichever is smaller	35V : 0603≥1μF, 0805≥2.2μF, 1206≥2.2μF, 1210≥10μF	25V : 0201≥0.1μF, 0402≥0.22μF, 0603≥2.2μF, 0805≥2.2μF, 1206≥10μF, 1210≥10μF	16V : 0201≥0.1μF, 0402≥0.22μF, 0603≥1μF, 0805≥2.2μF, 1206≥10μF, 1210≥47μF	10V : 0201≥47nF, 0402≥0.47μF, 0603≥0.47μF, 0805≥2.2μF, 1206≥4.7μF, 1210≥47μF	6.3V, 4V
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11.	Humidity (Damp Heat) Load	<p>* Test temp. : 40±2°C. * Humidity : 90~95%RH. * Test time : 500 +24/-0hrs. * To apply voltage : Rated voltage (500V max.). * Measurement to be made after keeping at room temp. for 48±4 hrs (Class II).</p>	<p>* No remarkable damage. * Cap. change : COG : Within ±7.5% or ±0.75pF, whichever is larger. X7R, X5R : Within ±12.5% for ≥10V**, within ±25% for 6.3V. **10V : Within ±25% for 0603≥4.7μF, 0402≥1μF, 0201≥0.1μF. Y5V : Within ±30% for ≥10V, within +30/-40% for 6.3V. * Q for COG : Cap.≥30pF, Q≥200; Cap.<30pF, Q≥100+10/3C. * D.F.(Class II) : ≤200% of initial requirement. * I.R. : ≥10V, ≥500MΩ or RxC≥25Ω-F, whichever is smaller. Class II (X7R, X5R, Y5V)</p> <table border="1"> <thead> <tr> <th>Rated voltage</th> <th>I.R.</th> </tr> </thead> <tbody> <tr> <td>50V : 0402>0.01μF, 0603≥1μF, 0805≥1μF, 1206≥4.7μF, 1210≥4.7μF</td> <td rowspan="6">≥500MΩ or RxC≥5Ω-F, whichever is smaller</td> </tr> <tr> <td>35V : 0603≥1μF, 0805≥2.2μF, 1206≥2.2μF, 1210≥10μF</td> </tr> <tr> <td>25V : 0201≥0.1μF, 0402≥0.22μF, 0603≥2.2μF, 0805≥2.2μF, 1206≥10μF, 1210≥10μF</td> </tr> <tr> <td>16V : 0201≥0.1μF, 0402≥0.22μF, 0603≥1μF, 0805≥2.2μF, 1206≥10μF, 1210≥47μF</td> </tr> <tr> <td>10V : 0201≥47nF, 0402≥0.47μF, 0603≥0.47μF, 0805≥2.2μF, 1206≥4.7μF, 1210≥47μF</td> </tr> <tr> <td>6.3V, 4V</td> </tr> </tbody> </table>	Rated voltage	I.R.	50V : 0402>0.01μF, 0603≥1μF, 0805≥1μF, 1206≥4.7μF, 1210≥4.7μF	≥500MΩ or RxC≥5Ω-F, whichever is smaller	35V : 0603≥1μF, 0805≥2.2μF, 1206≥2.2μF, 1210≥10μF	25V : 0201≥0.1μF, 0402≥0.22μF, 0603≥2.2μF, 0805≥2.2μF, 1206≥10μF, 1210≥10μF	16V : 0201≥0.1μF, 0402≥0.22μF, 0603≥1μF, 0805≥2.2μF, 1206≥10μF, 1210≥47μF	10V : 0201≥47nF, 0402≥0.47μF, 0603≥0.47μF, 0805≥2.2μF, 1206≥4.7μF, 1210≥47μF	6.3V, 4V
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13.RELIABILITY TEST CONDITIONS AND REQUIREMENTS(Con.)

No.	Item	Test Condition	Requirements																																																																																																			
12.	High Temperature Load (Endurance)	<p>* Test temp. : C0G, X7R : 125±3°C. X5R, Y5V : 85±3°C.</p> <p>* To apply voltage : (1) ≤6.3V or Cap.≥10μF : 150% of rated voltage. (2) 10V≤Ur≤50V : 200% of rated voltage. (3) 100% of rated voltage for below range :</p> <table border="1"> <thead> <tr> <th>Size</th> <th>Dielectric</th> <th>Rated</th> <th>Capacitance range</th> </tr> </thead> <tbody> <tr> <td rowspan="2">0201</td> <td rowspan="2">X5R/X7R</td> <td>≤10V</td> <td>C≥0.1μF</td> </tr> <tr> <td>≥16V</td> <td>C>0.1μF</td> </tr> <tr> <td>0402</td> <td>X5R/X7R/Y5V</td> <td>6.3V, 10V, 16V,</td> <td>C≥1.0μF</td> </tr> <tr> <td rowspan="3">0603</td> <td rowspan="3">X5R/X7R</td> <td>4V</td> <td>C≥22μF</td> </tr> <tr> <td>6.3V,10V</td> <td>C≥4.7μF</td> </tr> <tr> <td>25V, 35V</td> <td>C≥1.0μF</td> </tr> <tr> <td rowspan="2">0805</td> <td rowspan="2">X5R/X7R</td> <td>4V</td> <td>C≥47μF</td> </tr> <tr> <td>6.3V</td> <td>C≥22μF</td> </tr> <tr> <td></td> <td></td> <td>10V-50V</td> <td>C≥10μF</td> </tr> <tr> <td>1206</td> <td>X5R/X7R</td> <td>≤6.3V</td> <td>C≥47μF</td> </tr> <tr> <td>1210</td> <td>X5R/X7R</td> <td>16V</td> <td>C≥47μF</td> </tr> </tbody> </table> <p>(4) 150% of rated voltage for below range :</p> <table border="1"> <thead> <tr> <th>Size</th> <th>Dielectric</th> <th>Rated Voltage</th> <th>Capacitance</th> </tr> </thead> <tbody> <tr> <td rowspan="2">0201</td> <td>X5R/X7R</td> <td>16V/25V</td> <td>C≥0.1μF</td> </tr> <tr> <td>X7R</td> <td>16V</td> <td>C≥0.022μF</td> </tr> <tr> <td rowspan="2">0402</td> <td rowspan="2">X5R/X7R</td> <td>50V</td> <td>C≥0.1μF</td> </tr> <tr> <td>10-25V</td> <td>C≥0.22μF</td> </tr> <tr> <td></td> <td>Y5V</td> <td>16V</td> <td>C≥0.47μF</td> </tr> <tr> <td rowspan="2">0603</td> <td>X7R</td> <td>50V</td> <td>C>0.1μF</td> </tr> <tr> <td>X5R/X7R</td> <td>10V,16V, 50V</td> <td>C≥1.0μF</td> </tr> <tr> <td></td> <td>Y5V</td> <td>16V</td> <td>C≥2.2μF</td> </tr> <tr> <td rowspan="3">0805</td> <td>X5R/X7R</td> <td>10-50V</td> <td>C≥4.7μF</td> </tr> <tr> <td>X5R/X7R</td> <td>50V</td> <td>C≥2.2μF</td> </tr> <tr> <td>Y5V</td> <td>16V</td> <td>C≥4.7μF</td> </tr> <tr> <td>1206</td> <td>X5R/X7R</td> <td>50V</td> <td>C>1.0μF</td> </tr> <tr> <td>1210</td> <td>X5R/X7R</td> <td>50V</td> <td>C≥1.0μF</td> </tr> </tbody> </table> <p>* Test time : 1000 +24/-0 hrs. * Before initial measurement (Class II only) : To apply de-aging at 150°C for 1hr then set for 24±2 hrs at room temp. * Cap./D.F./I.R. measurement to be made after de-aging at 150°C for 1hr then set for 24±2 hrs at room temp. ** De-rating conditions :</p>	Size	Dielectric	Rated	Capacitance range	0201	X5R/X7R	≤10V	C≥0.1μF	≥16V	C>0.1μF	0402	X5R/X7R/Y5V	6.3V, 10V, 16V,	C≥1.0μF	0603	X5R/X7R	4V	C≥22μF	6.3V,10V	C≥4.7μF	25V, 35V	C≥1.0μF	0805	X5R/X7R	4V	C≥47μF	6.3V	C≥22μF			10V-50V	C≥10μF	1206	X5R/X7R	≤6.3V	C≥47μF	1210	X5R/X7R	16V	C≥47μF	Size	Dielectric	Rated Voltage	Capacitance	0201	X5R/X7R	16V/25V	C≥0.1μF	X7R	16V	C≥0.022μF	0402	X5R/X7R	50V	C≥0.1μF	10-25V	C≥0.22μF		Y5V	16V	C≥0.47μF	0603	X7R	50V	C>0.1μF	X5R/X7R	10V,16V, 50V	C≥1.0μF		Y5V	16V	C≥2.2μF	0805	X5R/X7R	10-50V	C≥4.7μF	X5R/X7R	50V	C≥2.2μF	Y5V	16V	C≥4.7μF	1206	X5R/X7R	50V	C>1.0μF	1210	X5R/X7R	50V	C≥1.0μF	<p>* No remarkable damage.</p> <p>* Cap. change : C0G : Within ±3.0% or ±0.3pF, whichever is larger. X7R, X5R : Within ±12.5% for ≥10V**, within ±25% for ≤6.3V. **10V : Within ±25% for 0603≥4.7μF, 0402≥1μF, 0201≥0.1μF. Y5V : Within ±30% for ≥10V, within +30/-40% for ≤6.3V.</p> <p>* Q for C0G : Cap.>30pF, Q≥350. 10pF≤Cap.≤30pF, Q≥275+2.5C. Cap.<10pF, Q≥200+10C.</p> <p>* D.F.(Class II) : ≤200% of initial requirement. * I.R. : ≥10V, ≥1GΩ or RxC≥50Ω-F, whichever is smaller. Class II (X7R, X5R, Y5V)</p> <table border="1"> <thead> <tr> <th>Rated voltage</th> <th>I.R.</th> </tr> </thead> <tbody> <tr> <td>50V : 0402>0.01μF, 0603≥1μF, 0805≥1μF, 1206≥4.7μF, 1210≥4.7μF</td> <td rowspan="6">≥1GΩ or RxC≥10Ω-F, whichever is smaller</td> </tr> <tr> <td>35V : 0603≥1μF, 0805≥2.2μF, 1206≥2.2μF, 1210≥10μF</td> </tr> <tr> <td>25V : 0201≥0.1μF, 0402≥0.22μF, 0603≥2.2μF, 0805≥2.2μF, 1206≥10μF, 1210≥10μF</td> </tr> <tr> <td>16V : 0201≥0.1μF, 0402≥0.22μF, 0603≥1μF, 0805≥2.2μF, 1206≥10μF, 1210≥47μF</td> </tr> <tr> <td>10V : 0201≥47nF, 0402≥0.47μF, 0603≥0.47μF, 0805≥2.2μF, 1206≥4.7μF, 1210≥47μF</td> </tr> <tr> <td>6.3V, 4V</td> </tr> </tbody> </table>	Rated voltage	I.R.	50V : 0402>0.01μF, 0603≥1μF, 0805≥1μF, 1206≥4.7μF, 1210≥4.7μF	≥1GΩ or RxC≥10Ω-F, whichever is smaller	35V : 0603≥1μF, 0805≥2.2μF, 1206≥2.2μF, 1210≥10μF	25V : 0201≥0.1μF, 0402≥0.22μF, 0603≥2.2μF, 0805≥2.2μF, 1206≥10μF, 1210≥10μF	16V : 0201≥0.1μF, 0402≥0.22μF, 0603≥1μF, 0805≥2.2μF, 1206≥10μF, 1210≥47μF	10V : 0201≥47nF, 0402≥0.47μF, 0603≥0.47μF, 0805≥2.2μF, 1206≥4.7μF, 1210≥47μF	6.3V, 4V
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13.RELIABILITY TEST CONDITIONS AND REQUIREMENTS(Con.)

No.	Item	Test Condition	Requirements								
13.	Adhesive Strength of Termination	<p>* Capacitors mounted on a substrate. A force of 2N(0201) or 5N(0402~0603) or 10N(>0603) applied perpendicular to the place of substrate and parallel the line joining the center of terminations for 10±1 second.</p>  <p>Capacitor P.C. Board Pressurizing force</p>	<p>* No remarkable damage or removal of the terminations.</p>								
14.	Bending Test	<p>* 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.</p>  <p>Unit : mm</p>	<p>* No remarkable damage.</p> <table border="1"> <thead> <tr> <th>Dielectric</th> <th>Cap. Change</th> </tr> </thead> <tbody> <tr> <td>Class I (C0G)</td> <td>Within ±5.0% or ±0.5pF, whichever is larger</td> </tr> <tr> <td>Class II (X7R, X5R)</td> <td>Within ±12.5%</td> </tr> <tr> <td>Class II (Y5V)</td> <td>Within ±30%</td> </tr> </tbody> </table> <p>(This capacitance change means the change of capacitance under specified flexure of substrate from the capacitance measured before the test)</p>	Dielectric	Cap. Change	Class I (C0G)	Within ±5.0% or ±0.5pF, whichever is larger	Class II (X7R, X5R)	Within ±12.5%	Class II (Y5V)	Within ±30%
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15.	Vibration Resistance	<p>* Vibration frequency : 10~55 Hz/min. * Total amplitude : 1.5mm. * Test time : 6 hrs. (Two hrs each in three mutually perpendicular directions)</p>	<p>* No remarkable damage. * Cap. change and D.F. : To meet initial spec.</p>								