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Messrs. : 一般共用

Date : 2018/08/17

APPROVAL SHEET

Product Name : General Purpose Multilayer Ceramic Chip Capacitors

Part No. : FN Series

Description : Size 0201~2225, C0G/X7R/X5R/Y5V, U_R≤50V

PREPARED BY	APPROVED BY

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SPECIFICATION

FOR

Product Name : General Purpose Multilayer Ceramic Chip Capacitors

Part No. : FN Series

Description : Size 0201~2225, C0G/X7R/X5R/Y5V, U_R≤50V

SPEC. No. : FN-000-001-09
DATE : 2018/08/17

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

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

FN	21	X	471	K	500	P	X	G
PDC Family	Size	Dielectric	Capacitance	Tolerance	Rated Voltage	Packaging	Thickness	Control Code
Table 1	Table 2	Table 3	Table 4	Table 5	Table 6	Table 7	Table 8	Table 9

Table 1 PDC Family

Code	Description
FN	General purpose product ≤50Vdc

Table 2 General Purpose

Code	Description	Code	Description	Code	Description
03	0201 (0603)	31	1206 (3216)	46	1825 (4563)
15	0402 (1005)	32	1210 (3225)	52	2211 (5728)
18	0603 (1608)	42	1808 (4520)	55	2220 (5750)
21	0805 (2012)	43	1812 (4532)	56	2225 (5763)

Table 3 Dielectric Material Characteristics

Code	Description	Code	Description
N	C0G	X	X7R
B	X5R	F	Y5V

Table 4 Capacitance Rule Code

Code	Description	Code	Description
R47	0.47pF	102	102=10x10^2=1000pF
0R5	0.5pF	104	104=10x10^4=100nF
100	100=10x10^0=10pF	106	106=10x10^6=10μF

Table 5 Tolerance

Code	Description	Code	Description	Code	Description
A	±0.05 pF	I	-10% ~ 0%	Q	±0.03 pF
B	±0.10 pF	J	±5 %	Z	-20% ~ +80%
C	±0.25 pF	K	±10 %	X	+10% ~ +20%
D	±0.50 pF	L	0% ~ +10%		
F	±1 %	M	±20 %		
G	±2 %	N	-5% ~ +10%		
H	±3 %	P	±0.02 pF		

Table 6 Rated Voltage

Code	Description	Code	Description	Code	Description
4R0	4.0Vdc	100	10Vdc	250	25Vdc
6R3	6.3Vdc	160	16Vdc	500	50Vdc

Table 7 Packaging Type

Code	Description	Code	Description
B	Bulk	T	Tray package
E	Tape and 7" Reel, Embossed Tape	P	Tape and 7" Reel, Paper Tape
K	Tape and 10" Reel, Embossed Tape	D	Tape and 10" Reel, Paper Tape
L	Tape and 13" Reel, Embossed Tape	G	Tape and 13" Reel, Paper Tape

Table 8 Thickness Description

Code	Description	Code	Description	Code	Description
A	0.60 ± 0.10 mm	I	1.25 ± 0.20 mm	Q	0.50 +0.02/-0.05 mm
B	0.8 + 0.15/-0.10 mm	J	1.15 ± 0.15 mm	R	3.10 ± 0.30 mm
C	1.25 ± 0.10 mm	K	0.50 ± 0.20 mm	S	0.80 ± 0.07 mm
D	1.40 ± 0.15 mm	L	0.30 ± 0.03 mm	T	0.85 ± 0.10 mm
E	1.60 ± 0.20 mm	M	0.95 ± 0.10 mm	U	0.50 ± 0.10 mm
F	2.00 ± 0.20 mm	N	0.50 ± 0.05 mm	V	0.20 ± 0.02 mm
G	2.50 ± 0.30 mm	O	3.50 ± 0.20 mm	X	0.80 ± 0.10 mm
H	2.80 ± 0.30 mm	P	1.60 +0.3/-0.10 mm	Z	0.25 ± 0.03 mm

Table 9 Special Control Code

Code	Description
G	RoHS Compliant
O	Gold plating (Size≥0603)

5. EXTERNAL DIMENSIONS

Size Inch (mm)	L (mm)	W (mm)	Code / T (mm)	M_B (mm)
0201(0603)	0.60±0.03 0.60±0.05 (Cap.≥0.68μF)	0.30±0.03 0.30±0.05 (Cap.≥0.68μF)	See No.4 Reference Table 8	0.15±0.05
0402(1005)	1.00±0.10 1.00±0.20#1	0.50±0.10 0.50±0.20#1		0.25 +0.05/-0.10
0603(1608)	1.60±0.15	0.80±0.15		0.40±0.15
0805(2012)	2.00±0.20	1.25±0.20		0.50±0.20
1206(3216)	3.20±0.20 3.20 +0.30/-0.10#2	1.60±0.20 1.60 +0.30/-0.10#2		0.60±0.20
1210(3225)	3.20±0.30	2.50±0.30		0.75±0.35
1812(4532)	4.50±0.40	3.20±0.30		0.75±0.35
1825(4563)	4.50±0.40	6.30±0.40		0.75±0.35
2220(5750)	5.70±0.40	5.00±0.40		0.85±0.35
2225(5763)	5.70±0.40	6.30±0.40		0.85±0.35

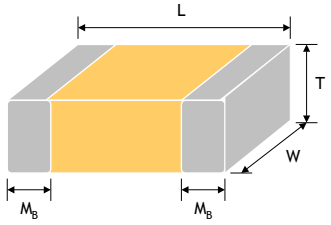


Fig. 5.1 The outline of MLCC

"#1" For 0402 size K thickness products. "#2" For 1206 size P thickness products.

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 100nF	100pF to 820nF	100pF to 820nF	10nF to 680nF
Capacitance tolerance**	J(±5%), K(±10%)	J(±5%), K(±10%), M(±20%)		Z(-20/+80%)
Tan δ*	Cap.<30pF : Q≥400+20C Cap.≥30pF : Q≥1000	Note 1		
Operating temperature	-55 to +125°C		-55 to +85°C	-25 to +85°C
Capacitance characteristic	±30ppm/°C	±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±0.2Vrms, 1.0MHz±10% for Cap.≤1000pF and 1.0±0.2Vrms, 1.0KHz±10% for Cap.>1000pF, 25°C at ambient temperature.
X7R/X5R : Apply 1.0±0.2Vrms, 1.0KHz±10%, at 25°C ambient temperature.
Y5V : Apply 1.0±0.2Vrms, 1.0KHz±10%, at 20°C ambient temperature.

** 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.

Note 1 : X7R/X5R

Rated	D.F.≤	Exception of D.F.≤	
50V	≤2.5%	≤3.5%	0201(50V), 0603≥0.047μF, 0805≥0.1μF, 1206≥0.47μF, 1210≥2.2μF, 1812≥4.7μF, 1825≥4.7μF, 2220≥4.7μF, 2225≥4.7μF
		≤5%	0201≥0.01uF, 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
		≤10%	0201≥0.1uF(0201/X7R≥0.022μF), 0402≥0.22uF, 0603≥0.68μF, 0805≥2.2μF, 1206≥4.7μF, 1210≥22μF
10V	≤5%	≤10%	0201≥0.012μF, 0402≥0.33μF(0402/X7R≥0.22μF), 0603≥0.33μF, 0805≥2.2μF, 1206≥2.2μF, 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
		≤20%	0402≥2.2μF
4V	≤15%	---	---

Y5V

Rated	D.F.≤	Exception of D.F.≤	
50V	≤5%	≤7%	0603≥0.1μF, 0805≥0.47μF, 1206≥4.7μF
		≤12.5%	1210≥6.8μF
35V	≤7%	---	---
25V	≤5%	≤7%	0402≥0.047μF, 0603≥0.1μF, 0805≥0.33μF, 1206≥1μF, 1210≥4.7μF
		≤9%	0402≥0.068μF, 0603≥0.47μF, 1206≥4.7μF, 1210≥22μF
16V (C<1.0μF)	≤7%	≤9%	0402≥0.068μF, 0603≥0.68μF
		≤12.5%	0402≥0.22μF
16V (C≥1.0μF)	≤9%	≤12.5%	0603≥2.2μF, 0805≥3.3μF, 1206≥10μF, 1210≥22μF, 1812≥47μF
10V	≤12.5%	≤20%	0402≥0.47μF
6.3V	≤20%	---	---

7. CAPACITANCE RANGE

7-1. C0G

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

7. CAPACITANCE RANGE(Con.)

7-1. C0G

Cap(pF)	EIA Size	1210				1808		1812				1825		2220		2225	
	Code	10V	16V	25V	50V	25V	50V	10V	16V	25V	50V	25V	50V	25V	50V	25V	50V
2.2	2R2					C	C										
2.7	2R7					C	C										
3.3	3R3					C	C										
3.9	3R9					C	C										
4.7	4R7					C	C										
5.6	5R6					C	C										
6.8	6R8					C	C										
8.2	8R2					C	C										
10	100	M	M	M	M	C	C	C	C	C	C	F	F	F	F	F	F
12	120	M	M	M	M	C	C	C	C	C	C	F	F	F	F	F	F
15	150	M	M	M	M	C	C	C	C	C	C	F	F	F	F	F	F
18	180	M	M	M	M	C	C	C	C	C	C	F	F	F	F	F	F
22	220	M	M	M	M	C	C	C	C	C	C	F	F	F	F	F	F
27	270	M	M	M	M	C	C	C	C	C	C	F	F	F	F	F	F
33	330	M	M	M	M	C	C	C	C	C	C	F	F	F	F	F	F
39	390	M	M	M	M	C	C	C	C	C	C	F	F	F	F	F	F
47	470	M	M	M	M	C	C	C	C	C	C	F	F	F	F	F	F
56	560	M	M	M	M	C	C	C	C	C	C	F	F	F	F	F	F
68	680	M	M	M	M	C	C	C	C	C	C	F	F	F	F	F	F
82	820	M	M	M	M	C	C	C	C	C	C	F	F	F	F	F	F
100	101	M	M	M	M	C	C	C	C	C	C	F	F	F	F	F	F
120	121	M	M	M	M	C	C	C	C	C	C	F	F	F	F	F	F
150	151	M	M	M	M	C	C	C	C	C	C	F	F	F	F	F	F
180	181	M	M	M	M	C	C	C	C	C	C	F	F	F	F	F	F
220	221	M	M	M	M	C	C	C	C	C	C	F	F	F	F	F	F
270	271	M	M	M	M	C	C	C	C	C	C	F	F	F	F	F	F
330	331	M	M	M	M	C	C	C	C	C	C	F	F	F	F	F	F
390	391	M	M	M	M	C	C	C	C	C	C	F	F	F	F	F	F
470	471	M	M	M	M	C	C	C	C	C	C	F	F	F	F	F	F
560	561	M	M	M	M	C	C	C	C	C	C	F	F	F	F	F	F
680	681	M	M	M	M	C	C	C	C	C	C	F	F	F	F	F	F
820	821	M	M	M	M	C	C	C	C	C	C	F	F	F	F	F	F
1000	102	M	M	M	M	C	C	C	C	C	C	F	F	F	F	F	F
1200	122	M	M	M	M	C	C	C	C	C	C	F	F	F	F	F	F
1500	152	M	M	M	M	C	C	C	C	C	C	F	F	F	F	F	F
1800	182	M	M	M	M	C	C	C	C	C	C	F	F	F	F	F	F
2200	222	M	M	M	M	C	C	C	C	C	C	F	F	F	F	F	F
2700	272	M	M	M	M	C	C	C	C	C	C	F	F	F	F	F	F
3300	332	M	M	M	M	C	C	C	C	C	C	F	F	F	F	F	F
3900	392	M	M	M	M	C	C	C	C	C	C	F	F	F	F	F	F
4700	472	M	M	M	M	C	C	C	C	C	C	F	F	F	F	F	F
5600	562	M	M	M	M	C	C	C	C	C	C	F	F	F	F	F	F
6800	682	M	M	C	C	C	C	C	C	C	C	F	F	F	F	F	F
8200	822	M	M	C	C	C	C	C	C	C	C	F	F	F	F	F	F
10000	103	M	M	C	C	C	C	C	C	C	C	F	F	F	F	F	F
12000	123	C	C	E	E	E	E	C	C	C	C	F	F	F	F	F	F
15000	153	C	C	E	E	E	E	C	C	C	C	F	F	F	F	F	F
18000	183	F	F	F	F	F	F	C	C	C	C	F	F	F	F	F	F
22000	223	F	F	F	F	F	F	C	C	C	C	F	F	F	F	F	F
27000	273	F	F	G	G			C	C	E	E	F	F	F	F	F	F
33000	333	F	F	G	G			C	C	E	E	F	F	F	F	F	F
39000	393	F	F	G	G			G	G	G	G	F	F	F	F	F	F
47000	473	F	F	G	G			G	G	G	G	F	F	F	F	F	F
56000	563							G	G	G	G	F	F	F	F	F	F
68000	683							G	G	G	G	F	F	F	F	F	F
82000	823							G	G	G	G	F	F	F	F	F	F
100000	104							G	G	G	G	G	G	G	G	F	F

7. CAPACITANCE RANGE(Con.)

7-2. X7R

Cap(pF)	EIA Size	0201					0402					0603					0805				
	Code	6.3V	10V	16V	25V	50V	6.3V	10V	16V	25V	50V	6.3V	10V	16V	25V	50V	6.3V	10V	16V	25V	50V
100	101			L	L	L		N	N	N	N		S	S	S	S		X	X	X	X
120	121			L	L	L		N	N	N	N		S	S	S	S		X	X	X	X
150	151			L	L	L		N	N	N	N		S	S	S	S		X	X	X	X
180	181			L	L	L		N	N	N	N		S	S	S	S		X	X	X	X
220	221			L	L	L		N	N	N	N		S	S	S	S		X	X	X	X
270	271			L	L	L		N	N	N	N		S	S	S	S		X	X	X	X
330	331			L	L	L		N	N	N	N		S	S	S	S		X	X	X	X
390	391			L	L	L		N	N	N	N		S	S	S	S		X	X	X	X
470	471			L	L	L		N	N	N	N		S	S	S	S		X	X	X	X
560	561			L	L	L		N	N	N	N		S	S	S	S		X	X	X	X
680	681			L	L	L		N	N	N	N		S	S	S	S		X	X	X	X
820	821			L	L	L		N	N	N	N		S	S	S	S		X	X	X	X
1000	102	L	L	L	L	L		N	N	N	N		S	S	S	S		X	X	X	X
1200	122	L	L	L	L			N	N	N	N		S	S	S	S		X	X	X	X
1500	152	L	L	L	L			N	N	N	N		S	S	S	S		X	X	X	X
1800	182	L	L	L	L			N	N	N	N		S	S	S	S		X	X	X	X
2200	222	L	L	L	L			N	N	N	N		S	S	S	S		X	X	X	X
2700	272	L	L	L	L			N	N	N	N		S	S	S	S		X	X	X	X
3300	332	L	L	L	L			N	N	N	N		S	S	S	S		X	X	X	X
3900	392	L	L	L	L			N	N	N	N		S	S	S	S		X	X	X	X
4700	472	L	L	L	L			N	N	N	N		S	S	S	S		X	X	X	X
5600	562	L	L	L	L			N	N	N	N		S	S	S	S		X	X	X	X
6800	682	L	L	L				N	N	N	N		S	S	S	S		X	X	X	X
8200	822	L	L	L				N	N	N	N		S	S	S	S		X	X	X	X
10000	103	L	L	L	L			N	N	N	N		S	S	S	S		X	X	X	X
12000	123							N	N	N	K		S	S	S	S		X	X	X	X
15000	153							N	N	N	K		S	S	S	S		X	X	X	X
18000	183							N	N	N	K		S	S	S	S		X	X	X	X
22000	223		L	L			N	N	N	N	K		S	S	S	S		X	X	X	X
27000	273							N	N	N	K		S	S	S	S		X	X	X	X
33000	333							N	N	N	K		S	S	B	B		X	X	X	X
39000	393							N	N	N	K		S	S	B	B		X	X	X	X
47000	473							N	N	N	K		S	S	B	B		X	X	X	X
56000	563							N	N	N	K		S	S	B	B		X	X	X	X
68000	683							N	N	N	K		S	S	B	B		X	X	X	X
82000	823							N	N	N	K		S	S	B	B		X	X	X	X
100000	104						N	N	N	N	K		S	S	B	B		X	X	X	X
120000	124												S	S	B			X	X	X	C
150000	154												S	S	B			C	C	C	C
180000	184												S	S	B			C	C	C	C
220000	224						N	N	N	N			S	S	B	B		C	C	C	C
270000	274											B	B	B	B		C	C	C	C	I
330000	334												B	B	B	B		C	C	C	I
390000	394												B	B	B			C	C	C	I
470000	474						N	N				B	B	B	B	B		C	C	C	I
560000	564												B	B				C	C	C	I
680000	684											B	B	B				C	C	C	I
820000	824												B	B				C	C	C	I

7. CAPACITANCE RANGE(Con.)

7-2. X7R

Cap(pF)	EIA Size	1206					1210					1812				1825		2220		2225	
	Code	6.3V	10V	16V	25V	50V	6.3V	10V	16V	25V	50V	10V	16V	25V	50V	25V	50V	25V	50V	25V	50V
100	101				X	X															
120	121				X	X															
150	151		X	X	X	X															
180	181		X	X	X	X															
220	221		X	X	X	X				M	M										
270	271		X	X	X	X				M	M			C	C						
330	331		X	X	X	X				M	M			C	C						
390	391		X	X	X	X				M	M			C	C						
470	471		X	X	X	X				M	M			C	C						
560	561		X	X	X	X				M	M			C	C						
680	681		X	X	X	X				M	M			C	C						
820	821		X	X	X	X				M	M			C	C						
1000	102		X	X	X	X		M	M	M	M	C	C	C	C	F	F	F	F	F	F
1200	122		X	X	X	X		M	M	M	M	C	C	C	C	F	F	F	F	F	F
1500	152		X	X	X	X		M	M	M	M	C	C	C	C	F	F	F	F	F	F
1800	182		X	X	X	X		M	M	M	M	C	C	C	C	F	F	F	F	F	F
2200	222		X	X	X	X		M	M	M	M	C	C	C	C	F	F	F	F	F	F
2700	272		X	X	X	X		M	M	M	M	C	C	C	C	F	F	F	F	F	F
3300	332		X	X	X	X		M	M	M	M	C	C	C	C	F	F	F	F	F	F
3900	392		X	X	X	X		M	M	M	M	C	C	C	C	F	F	F	F	F	F
4700	472		X	X	X	X		M	M	M	M	C	C	C	C	F	F	F	F	F	F
5600	562		X	X	X	X		M	M	M	M	C	C	C	C	F	F	F	F	F	F
6800	682		X	X	X	X		M	M	M	M	C	C	C	C	F	F	F	F	F	F
8200	822		X	X	X	X		M	M	M	M	C	C	C	C	F	F	F	F	F	F
10000	103		X	X	X	X		M	M	M	M	C	C	C	C	F	F	F	F	F	F
12000	123		X	X	X	X		M	M	M	M	C	C	C	C	F	F	F	F	F	F
15000	153		X	X	X	X		M	M	M	M	C	C	C	C	F	F	F	F	F	F
18000	183		X	X	X	X		M	M	M	M	C	C	C	C	F	F	F	F	F	F
22000	223		X	X	X	X		M	M	M	M	C	C	C	C	F	F	F	F	F	F
27000	273		X	X	X	X		M	M	M	M	C	C	C	C	F	F	F	F	F	F
33000	333		X	X	X	X		M	M	M	M	C	C	C	C	F	F	F	F	F	F
39000	393		X	X	X	X		M	M	M	M	C	C	C	C	F	F	F	F	F	F
47000	473		X	X	X	X		M	M	M	M	C	C	C	C	F	F	F	F	F	F
56000	563		X	X	X	X		M	M	M	M	C	C	C	C	F	F	F	F	F	F
68000	683		X	X	X	X		M	M	M	M	C	C	C	C	F	F	F	F	F	F
82000	823		X	X	X	X		M	M	M	M	C	C	C	C	F	F	F	F	F	F
100000	104		X	X	X	X		M	M	M	M	C	C	C	C	F	F	F	F	F	F
120000	124		X	X	X	X		M	M	M	M	C	C	C	C	F	F	F	F	F	F
150000	154		M	M	M	M		M	M	M	M	C	C	C	C	F	F	F	F	F	F
180000	184		M	M	M	M		M	M	M	M	C	C	C	C	F	F	F	F	F	F
220000	224		M	M	M	M		M	M	M	M	C	C	C	C	F	F	F	F	F	F
270000	274		M	M	M	C		M	M	M	M	C	C	C	C	F	F	F	F	F	F
330000	334		M	M	M	C		M	M	M	C	C	C	C	C	F	F	F	F	F	F
390000	394		M	M	C	P		M	M	M	C	C	C	C	C	F	F	F	F	F	F
470000	474		J	J	C	P		M	M	M	C	C	C	C	C	F	F	F	F	F	F
560000	564		J	J	C	P		C	C	C	C	C	C	C	C	F	F	F	F	F	F
680000	684		J	J	C	P		C	C	C	C	C	C	C	F	F	F	F	F	F	F
820000	824		J	J	E	P		C	C	C	C	C	C	C	F	F	F	F	F	F	F

7. CAPACITANCE RANGE(Con.)

7-3. X5R

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

7. CAPACITANCE RANGE(Con.)

7-4. Y5V

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			N	N	N	N		S	S	S	S	A	A	A	A
15000	153			N	N	N	N		S	S	S	S	A	A	A	A
22000	223			N	N	N	N		S	S	S	S	A	A	A	A
33000	333			N	N	N	N		S	S	S	S	A	A	A	A
47000	473			N	N	N			S	S	S	S	A	A	A	A
68000	683			N	N	N			S	S	S	S	A	A	A	A
100000	104			N	N	N			S	S	S	S	A	A	A	A
150000	154								S	S	S	S	A	A	A	A
220000	224							S	S	S	S	S	A	A	A	A
330000	334												X	X	X	X
470000	474												X	X	X	C
680000	684												X	X	C	C

Cap(pF)	EIA Size	1206						1210						1812			
	Code	6.3V	10V	16V	25V	35V	50V	6.3V	10V	16V	25V	35V	50V	10V	16V	25V	50V
10000	103		X	X	X		X										
15000	153		X	X	X		X										
22000	223		X	X	X		X										
33000	333		X	X	X		X										
47000	473		X	X	X		X										
68000	683		X	X	X		X										
100000	104		X	X	X		X		M	M	M		M	C	C	C	C
150000	154		X	X	X		X		M	M	M		M	C	C	C	C
220000	224		X	X	X		X		M	M	M		M	C	C	C	C
330000	334		X	X	X		X		M	M	M		M	C	C	C	C
470000	474		X	X	X		X		M	M	M		M	C	C	C	C
680000	684		X	X	X		X		M	M	M		M	C	C	C	C

8. RELIABILITY TEST CONDITIONS AND REQUIREMENTS

<table>
<tr><th>No.</th><th>Item</th><th>Test Condition</th><th>Requirements</th></tr>
<tr><td>1.</td><td>Visual and Dimensions</td><td>---</td><td>* No remarkable defect.
* Dimensions to confirm to individual specification sheet.</td></tr>
<tr><td>2.</td><td>Capacitance</td><td rowspan="2"></td><td>* Shall not exceed the limits given in the detailed spec.</td></tr>
<tr><td>3.</td><td>Q/D.F. (Dissipation Factor)</td><td>* 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).
X5R :
01R5≥103, 0201≥224(6.3V,10V,16V)#1,
0402≥475(6.3V,16V), 0402≥225(10V),
0603=106(6.3V,10V).</td><td>* C0G : Cap.≥30pF, Q≥1000; Cap.<30pF, Q≥400+20C.
*X7R/X5R :
<table>
<tr><th>Rated</th><th>D.F.≤</th><th colspan="2">Exception of D.F.≤</th></tr>
<tr><td rowspan="3">50V</td><td rowspan="3">≤2.5%</td><td>≤3.5%</td><td>0201(50V), 0603≥0.047μF, 0805≥0.1μF, 1206≥0.47μF, 1210≥2.2μF, 1812≥4.7μF, 1825≥4.7μF, 2220≥4.7μF, 2225≥4.7μF</td></tr>
<tr><td>≤5%</td><td>0201≥0.01uF, 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 rowspan="2">16V</td><td rowspan="2">≤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>≤10%</td><td>0201≥0.1uF(0201/X7R≥0.022μF), 0402≥0.22uF, 0603≥0.68μF, 0805≥2.2μF, 1206≥4.7μF, 1210≥22μF</td></tr>
<tr><td rowspan="2">10V</td><td rowspan="2">≤5%</td><td>≤10%</td><td>0201≥0.012μF, 0402≥0.33μF(0402/X7R≥0.22μF), 0603≥0.33μF, 0805≥2.2μF, 1206≥2.2μF, 1210≥22μF</td></tr>
<tr><td>≤15%</td><td>0201≥0.1μF, 0402≥1μF</td></tr>
<tr><td rowspan="2">6.3V</td><td rowspan="2">≤10%</td><td>≤15%</td><td>0201≥0.1μF, 0402≥1μF, 0603≥10μF, 0805≥4.7μF, 1206≥47μF, 1210≥100μF</td></tr>
<tr><td>≤20%</td><td>0402≥2.2μF</td></tr>
<tr><td>4V</td><td>≤15%</td><td>---</td><td>---</td></tr>
</table>
* Y5V
<table>
<tr><th>Rated</th><th>D.F.≤</th><th colspan="2">Exception of D.F.≤</th></tr>
<tr><td rowspan="2">50V</td><td rowspan="2">≤5%</td><td>≤7%</td><td>0603≥0.1μF, 0805≥0.47μF, 1206≥4.7μF</td></tr>
<tr><td>≤12.5%</td><td>1210≥6.8μF</td></tr>
<tr><td>35V</td><td>≤7%</td><td>---</td><td>---</td></tr>
<tr><td rowspan="2">25V</td><td rowspan="2">≤5%</td><td>≤7%</td><td>0402≥0.047μF, 0603≥0.1μF, 0805≥0.33μF, 1206≥1μF, 1210≥4.7μF</td></tr>
<tr><td>≤9%</td><td>0402≥0.068μF, 0603≥0.47μF, 1206≥4.7μF, 1210≥22μF</td></tr>
<tr><td rowspan="2">16V (C<1.0μF)</td><td rowspan="2">≤7%</td><td>≤9%</td><td>0402≥0.068μF, 0603≥0.68μF</td></tr>
<tr><td>≤12.5%</td><td>0402≥0.22μF</td></tr>
<tr><td>16V (C≥1.0μF)</td><td>≤9%</td><td>≤12.5%</td><td>0603≥2.2μF, 0805≥3.3μF, 1206≥10μF, 1210≥22μF, 1812≥47μF</td></tr>
<tr><td>10V</td><td>≤12.5%</td><td>≤20%</td><td>0402≥0.47μF</td></tr>
<tr><td>6.3V</td><td>≤20%</td><td>---</td><td>---</td></tr>
</table></td></tr>
</table>

8. RELIABILITY TEST CONDITIONS AND REQUIREMENTS

<table>
<tr><th>No.</th><th>Item</th><th>Test Condition</th><th>Requirements</th></tr>
<tr><td>4.</td><td>Temperature Coefficient</td><td>
* With no electrical load.
<table>
<tr><th>T.C.</th><th>Operating Temp.</th></tr>
<tr><td>C0G</td><td>-55~125°C at 25°C</td></tr>
<tr><td>X7R</td><td>-55~125°C at 25°C</td></tr>
<tr><td>X5R</td><td>-55~ 85°C at 25°C</td></tr>
<tr><td>Y5V</td><td>-25~ 85°C at 20°C</td></tr>
</table>
* Measurement voltage for Class II :
<table>
<tr><th>Size</th><th>Cap. Range</th><th>Condition</th></tr>
<tr><td rowspan="3">0201</td><td>Cap.<0.1μF</td><td>1V</td></tr>
<tr><td>0.1μF≤Cap.<1μF</td><td>0.2V</td></tr>
<tr><td>Cap.≥1μF</td><td>0.1V</td></tr>
<tr><td rowspan="4">0402</td><td>Cap.<0.1μF</td><td>1V</td></tr>
<tr><td>Cap.=1μF</td><td>0.5V</td></tr>
<tr><td>1μF<Cap.<10μF</td><td>0.2V</td></tr>
<tr><td>Cap.≥10μF</td><td>0.1V</td></tr>
<tr><td rowspan="3">0603</td><td>Cap.≤1μF</td><td>1V</td></tr>
<tr><td>1μF<Cap.≤4.7μF</td><td>0.5V</td></tr>
<tr><td>Cap.>4.7μF</td><td>0.2V</td></tr>
<tr><td rowspan="3">0805</td><td>Cap.<10μF</td><td>1V</td></tr>
<tr><td>Cap.=10μF</td><td>0.5V</td></tr>
<tr><td>Cap.>10μF</td><td>0.2V</td></tr>
<tr><td rowspan="3">1206/1210</td><td>Cap.≤10μF</td><td>1V</td></tr>
<tr><td>10μF<Cap.≤100μF</td><td>0.5V</td></tr>
<tr><td>Cap.>100μF</td><td>0.2V</td></tr>
</table>
</td><td>
<table>
<tr><th>T.C.</th><th>Capacitance Change</th></tr>
<tr><td>C0G</td><td>Within ±30ppm/°C</td></tr>
<tr><td>X7R</td><td>Within ±15%</td></tr>
<tr><td>X5R</td><td>Within ±15%</td></tr>
<tr><td>Y5V</td><td>Within +30%/-80%</td></tr>
</table>
</td></tr>
<tr><td>5.</td><td>Insulation Resistance</td><td>* To apply rated voltage for Max. 120sec.</td><td>
* ≥10GΩ or RxC≥500Ω-F, whichever is smaller.
* Except :
<table>
<tr><th>Rated voltage (X7R/X5R/Y5V)</th><th>I.R.</th></tr>
<tr><td>50V : 0402>0.01μF, 0603≥1μF, 0805≥1μF, 1206≥4.7μF, 1210≥4.7μF, 1812≥10μF, 2220≥22μF</td><td rowspan="6">≥10GΩ or RxC≥100Ω-F , whichever is smaller</td></tr>
<tr><td>35V : 0805≥2.2μF, 1206≥2.2μF, 1210≥10μF</td></tr>
<tr><td>25V : 0402≥1μF, 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>
<tr><th>Rated voltage (X7R/X5R/Y5V)</th><th>I.R.</th></tr>
<tr><td>50V : 0402≥0.1μF, 0603≥2.2μF, 0805≥10μF, 1206≥10μF</td><td rowspan="7">RxC≥50Ω-F</td></tr>
<tr><td>35V : 0603≥1μF</td></tr>
<tr><td>25V : 0201≥0.1μF, 0402≥2.2μF, 0603≥10μF, 0805≥10μF, 1206≥22μF</td></tr>
<tr><td>16V : 0603≥10μF, 0402≥1μF, 0201≥0.22μF</td></tr>
<tr><td>10V : 0201>0.1μF, 0402≥1μF, 0603≥10μF, 0805≥47μF</td></tr>
<tr><td>6.3V : 0201≥0.1μF, 0603>4.7μF, 0805≥47μF, 1206≥10μF</td></tr>
<tr><td>4V : 0603≥22μF, 0805≥47μF, 1206≥100μF</td></tr>
</table>
</td></tr>
</table>

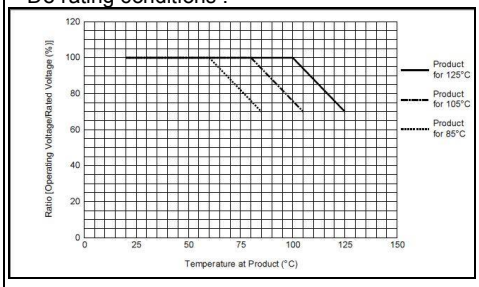
8. RELIABILITY TEST CONDITIONS AND REQUIREMENTS

No.	Item	Test Condition	Requirements
6.	**Dielectric Strength**	* To apply 250% of rated voltage. * Duration : 1 to 5 sec. * Charge and discharge current less than 50mA.	* No evidence of damage or flash over during test.
7.	**Solderability**	* Solder temperature : 235±5°C for (0201~1210). * Solder temperature : 245±5°C for (1808~2225). * Dipping time : 2±0.5 sec.	* 75% min. coverage of all metalized area.
8.	**Resistance to Soldering Heat**	* 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) : To apply de-aging at 150°C for 1hr then set for 24±2 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).	* No remarkable damage. * Cap. change : C0G : Within ±2.5% or ±0.25pF, whichever is larger. X7R, X5R : Within ±7.5%. Y5V : Within ±20%. * D.F.(Q)/I.R. : To meet initial requirements. * 25% max. leaching on each edge.
9.	**Temperature Cycle**	* Conduct the five cycles according to the temperatures and time. 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 * Before initial measurement (Class II only) : To apply de-aging at 150°C for 1hr then set for 24±2 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).	* No remarkable damage. * Cap. change : C0G : Within ±2.5% or ±0.25pF, whichever is larger. X7R, X5R : Within ±7.5%. Y5V : Within ±20%. * Q for C0G : To meet initial requirements. * D.F.(Class II) : ≤150% of initial requirement. * I.R. : To meet initial requirements.

8. RELIABILITY TEST CONDITIONS AND REQUIREMENTS

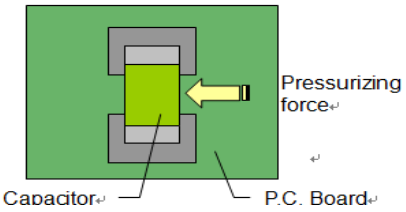
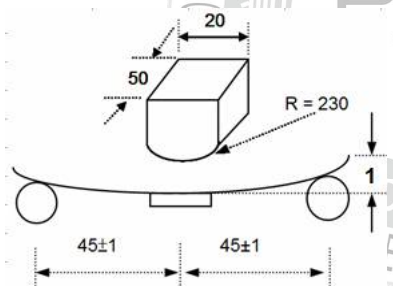
<table>
<tr><th>No.</th><th>Item</th><th>Test Condition</th><th>Requirements</th></tr>
<tr><td>10.</td><td>Humidity (Damp Heat) Steady State</td><td>* Test temp. : 40±2°C.
* Humidity : 90~95% RH.
* Test time : 500 +24/-0hrs.
* Before initial measurement (Class II only) : To apply de-aging at 150°C for 1hr then set for 24±2 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).</td><td>* No remarkable damage.
* Cap. change :
C0G : 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 C0G :
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 R×C≥50Ω-F, whichever is smaller.
Class II (X7R, X5R, Y5V)
<table>
<tr><th>Rated voltage</th><th>I.R.</th></tr>
<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≥0.1uF, 0402≥0.22μF, 0603≥2.2μF, 0805≥2.2μF, 1206≥10μF, 1210≥10μF</td></tr>
<tr><td>16V : 0201≥0.1uF, 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; Size≥1812</td></tr>
</table></td></tr>
<tr><td>11.</td><td>Humidity (Damp Heat) Load</td><td>* Test temp. : 40±2°C.
* Humidity : 90~95%RH.
* Test time : 500 +24/-0hrs.
* To apply voltage : Rated voltage.
* Before initial measurement (Class II only) : To apply de-aging at 150°C for 1hr then set for 24±2 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).</td><td>* No remarkable damage.
* Cap. change :
C0G : 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 C0G : 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)
<table>
<tr><th>Rated voltage</th><th>I.R.</th></tr>
<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≥0.1uF, 0402≥0.22μF, 0603≥2.2μF, 0805≥2.2μF, 1206≥10μF, 1210≥10μF</td></tr>
<tr><td>16V : 0201≥0.1uF, 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; Size≥1812</td></tr>
</table></td></tr>
</table>

8. RELIABILITY TEST CONDITIONS AND REQUIREMENTS

<table>
<tr><th>No.</th><th>Item</th><th>Test Condition</th><th>Requirements</th></tr>
<tr><td>12.</td><td>High Temperature Load (Endurance)</td><td>
* Test temp. :
C0G, X7R : 125±3°C.
X5R, Y5V : 85±3°C.
* To apply voltage :
(1) ≤6.3V : 150% of rated voltage.
(2) 10V≤Ur≤50V : 200% of rated voltage.
(3) 100% of rated voltage for below range :
<table>
<tr><th>Size</th><th>Dielectric</th><th>Rated</th><th>Capacitance range</th></tr>
<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>
</table>
(4) 150% of rated voltage for below range :
<table>
<tr><th>Size</th><th>Dielectric</th><th>Rated Voltage</th><th>Capacitance</th></tr>
<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="3">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>Y5V</td><td>16V</td><td>C≥0.47μF</td></tr>
<tr><td>0603</td><td>X7R</td><td>≥50V</td><td>C≥0.082μF</td></tr>
<tr><td>0805</td><td>X5R/X7R</td><td>50V</td><td>C≥0.47μF</td></tr>
</table>
* 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.
* Measurement to be made after keeping at room temp. for 24±2 hrs (Class I) or 48±4 hrs (Class II).
** De-rating conditions :


</td><td>
* No remarkable damage.
* 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.
* Q for C0G :
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)
<table>
<tr><th>Rated voltage</th><th>I.R.</th></tr>
<tr><td>50V : 0402>0.01μF, 0603≥1μF, 0805≥1μF, 1206≥4.7μF, 1210≥4.7μF</td><td rowspan="5">≥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≥0.1uF, 0402≥0.22μF, 0603≥2.2μF, 0805≥2.2μF, 1206≥10μF, 1210≥10μF</td></tr>
<tr><td>16V : 0201≥0.1uF, 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; Size≥1812</td></tr>
</table>
</td></tr>
</table>

8. RELIABILITY TEST CONDITIONS AND REQUIREMENTS

<table>
<tr><th>No.</th><th>Item</th><th>Test Condition</th><th>Requirements</th></tr>
<tr><td>13.</td><td>Adhesive Strength of Termination</td><td>* 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.
 
</td><td>* No remarkable damage or removal of the terminations.</td></tr>
<tr><td>14.</td><td>Bending Test</td><td>* 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.
 

Unit : mm</td><td>* No remarkable damage.
<table>
<tr><th>Dielectric</th><th>Cap. Change</th></tr>
<tr><td>C0G</td><td>Within ±5.0% or ±0.5pF, whichever is larger</td></tr>
<tr><td>X7R, X5R</td><td>Within ±12.5%</td></tr>
<tr><td>Y5V</td><td>Within ±30%</td></tr>
</table>
(This capacitance change means the change of capacitance under specified flexure of substrate from the capacitance measured before the test)</td></tr>
<tr><td>15.</td><td>Vibration Resistance</td><td>* Vibration frequency : 10~55 Hz/min.
* Total amplitude : 1.5mm.
* Test time : 6 hrs. (Two hrs each in three mutually perpendicular directions)
* Before initial measurement (Class II only) : To apply de-aging at 150°C for 1hr then set for 24±2 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).</td><td>* No remarkable damage.
* Cap. change and D.F. : To meet initial spec.</td></tr>
</table>

9. PACKAGE DIMENSION AND QUANTITY

Size	Thickness (mm)	Paper tape		Plastic tape	
		7" reel	13" reel	7" reel	13" reel
0201(0603)	0.30±0.03	15k	70k	-	-
	0.30±0.05	15k	-	-	-
	0.30±0.09	15k	-	-	-
0402(1005)	0.50±0.05	10k	50k	-	-
	0.50 +0.02/-0.05	10k	50k	-	-
	0.50±0.20	10k	-	-	-
0603(1608)	0.50±0.10	4k	-	-	-
	0.80±0.07	4k	15k	-	-
	0.80 +0.15/-0.10	4k	15k	-	-
0805(2012)	0.50±0.10	4k	15k	-	-
	0.60±0.10	4k	15k	-	-
	0.80±0.10	4k	15k	-	-
	0.85±0.10	4k	15k	-	-
	1.25±0.10	-	-	3k	10k
	1.25±0.20	-	-	3k	10k
1206(3216)	0.80±0.10	4k	15k	-	-
	0.85±0.10	4k	15k	-	-
	0.95±0.10	-	-	3k	10k
	1.15±0.15	-	-	3k	10k
	1.25±0.10	-	-	3k	10k
	1.60±0.20	-	-	2k	10k
	1.60 +0.30/-0.10	-	-	2k	9k
1210(3225)	0.85±0.10	-	-	3k	10k
	0.95±0.10	-	-	3k	10k
	1.25±0.10	-	-	3k	10k
	1.60±0.20	-	-	2k	-
	2.00±0.20	-	-	1k	6k
	2.50±0.30	-	-	1k	6k
1808(4520)	1.25±0.10	-	-	2k	10k
	1.60±0.20	-	-	2k	8k
	2.00±0.20	-	-	1k	6k
1812(4532)	1.25±0.10	-	-	1k	5k
	1.60±0.20	-	-	1k	-
	2.00±0.20	-	-	1k	-
	2.50±0.30	-	-	0.5k	3k
	2.80±0.30	-	-	0.5k	-
1825(4563)	1.60±0.20	-	-	1k	-
	2.00±0.20	-	-	1k	-
	2.50±0.30	-	-	0.5k	-
	2.80±0.30	-	-	0.5k	-
2220(5750)	1.60±0.20	-	-	1k	-
	2.00±0.20	-	-	1k	-
	2.50±0.30	-	-	0.5k	-
	2.80±0.30	-	-	0.5k	-
2225(5763)	1.60±0.20	-	-	1k	-
	2.00±0.20	-	-	1k	-
	2.50±0.30	-	-	0.5k	-
	2.80±0.30	-	-	0.5k	-

Unit : pcs

9. PACKAGE DIMENSION AND QUANTITY

9.1. EMBOSSED TAPE DIMENSIONS

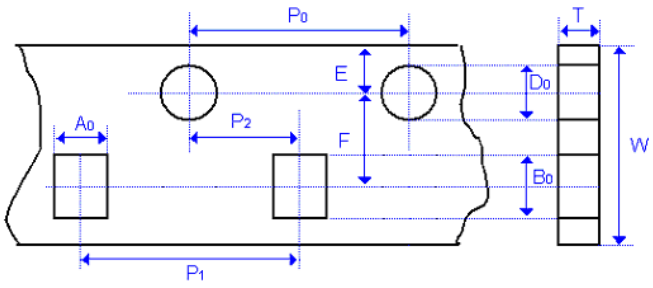


Fig. 9.1 The dimension of paper tape

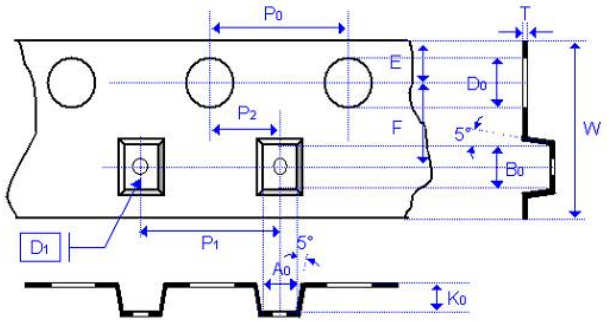


Fig. 9.2 The dimension of plastic tape

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±0.20	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±0.20	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±0.20	40.00±0.20	40.00±0.20	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	12.00±0.20	12.00±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	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	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±0.10
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

9. 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	12.00±0.20	12.00±0.20	12.00±0.20	12.00±0.20	12.00±0.20	12.00±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±0.10	1.75±0.10	1.75±0.10	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

9.2. 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

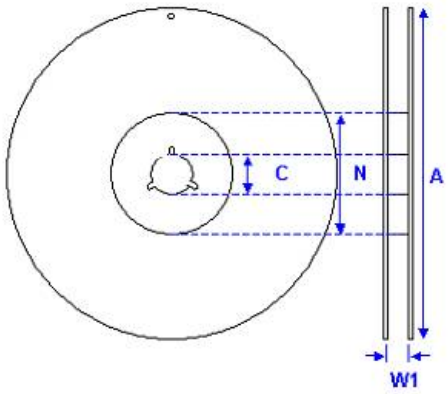


Fig. 9.3 The dimension of reel

10. 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

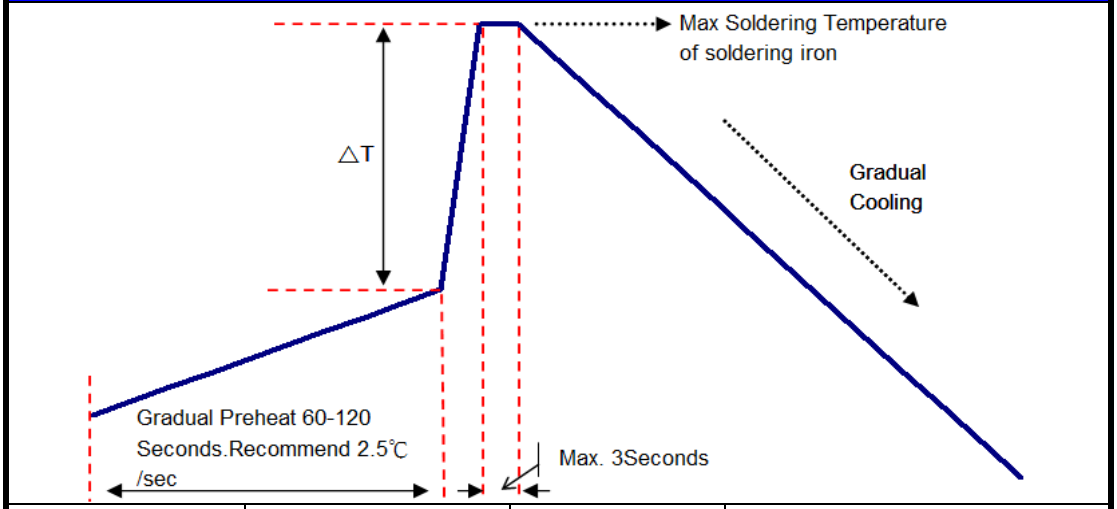
In order to minimize the risk of thermal shock during soldering, a carefully controlled preheat is required. The rate of preheat should not exceed 3°C per second.

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 :

Fig. 10.1 Hand Soldering Profile



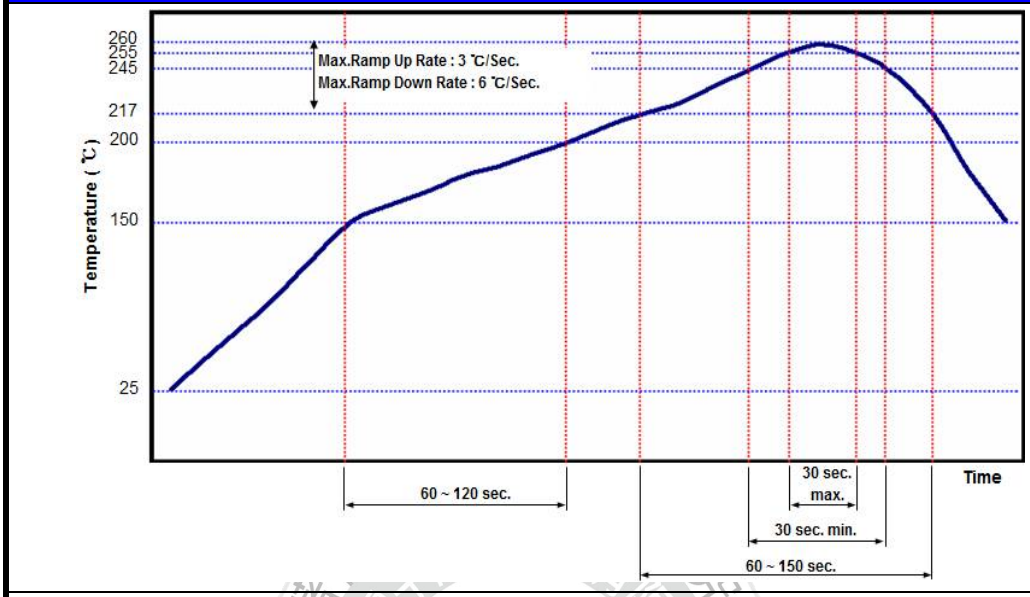
Chip Size	Pre-Heat temp.	ΔT	Max. soldering iron temp.
≤1206	≥150°C	≤150°C	≤350°C
1210~2225	≥150°C	≤130°C	≤280°C

* 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.

10. APPLICATION NOTES

b.) Reflow soldering :

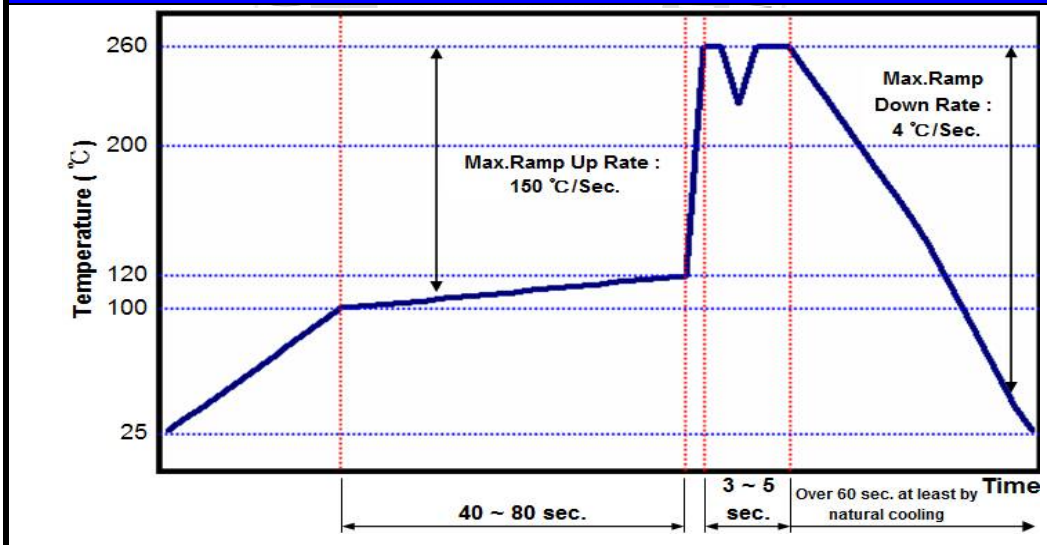
Fig. 10.2 Reflow soldering profile



For Sn/Ag/Cu Series solder paste (Pb-Free)

c.) Wave soldering :

Fig. 10.3 Wave soldering profile



For Sn/Ag/Cu Series solder paste (Pb-Free)

Soldering conditions :

Class I :

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

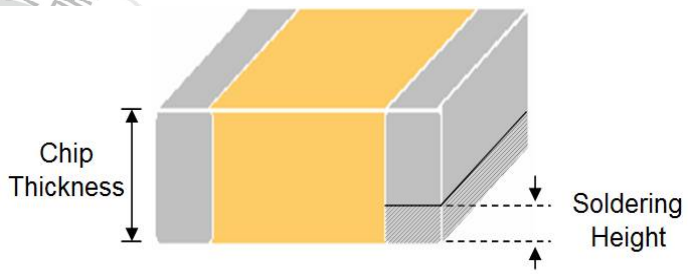
10. APPLICATION NOTES

Soldering conditions :
Class II :

Size Inch (mm)	Temper. Cher.	Capacitance	Condition	
			Wave	Reflow
≤0402 (1005)	All Class II	All	X	O
0603 (1608)	All Class II	Cap. <2.2μF	O	O
		Cap. ≥2.2μF	X	O
0805 (2012)	All Class II	Cap. <4.7μF	O	O
		Cap. ≥4.7μF	X	O
1206 (3216)	All Class II	Cap. <4.7μF	O	O
		Cap. ≥4.7μF	X	O
≥1210 (3225)	All Class II	All	X	O

Soldering height :

The solder climbing minimum height is suggesting to 25% of chip thickness or 500um whichever is less.
(Reference from IPC-610E)



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.

