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Messrs. : 一般共用

Date : __

APPROVAL SHEET

Product Name : Anti-Bend General Purpose Multilayer Ceramic Chip Capacitors

Part No. : FP Series

Description : Anti-Bend, Size 0402~2225, C0G/X7R, 25~4000V

PREPARED BY	APPROVED BY

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SPECIFICATION

FOR

Product Name : Anti-Bend General Purpose Multilayer Ceramic Chip Capacitors
Part No. : FP Series
Description : Anti-Bend, Size 0402~2225, C0G/X7R, 25~4000V

SPEC. No. : <u>FP-000-001-07</u>
DATE :

DRAWN BY	CHECEKED BY	APPROVED BY
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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.

FP series use a special material between nickel-barrier and ceramic body. It provides excellent performance to against bending stress occurred during process and provide more security for PCB process.

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

- High performance to withstanding 5mm of substrate bending test guarantee.
- A wide selection of sizes is available.
- High capacitance in given case size.
- Capacitor with lead-free termination (pure Tin).
- Reduction in PCB bend failure.
- High reliability and stability.
- RoHS & 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>FP</u>	<u>32</u>	<u>X</u>	<u>225</u>	<u>K</u>	<u>101</u>	<u>E</u>	<u>G</u>	<u>G</u>
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	Code	Description
FP	Anti-Bend General Purpose Product		

Table 2		General Purpose			
Code	Description	Code	Description	Code	Description
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)
31	1206 (3216)	46	1825 (4563)		

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	$102=10 \times 10^2=1000\text{pF}$
0R5	0.5pF	104	$104=10 \times 10^4=100\text{nF}$
100	$100=10 \times 10^0=10\text{pF}$	106	$106=10 \times 10^6=10\mu\text{F}$

Table 5		Tolerance			
Code	Description	Code	Description	Code	Description
A	$\pm 0.05 \text{ pF}$	H	$\pm 3 \%$	N	$-5\% \sim +10\%$
B	$\pm 0.10 \text{ pF}$	I	$-10\% \sim 0\%$	P	$\pm 0.02 \text{ pF}$
C	$\pm 0.25 \text{ pF}$	J	$\pm 5 \%$	Q	$\pm 0.03 \text{ pF}$
D	$\pm 0.50 \text{ pF}$	K	$\pm 10 \%$	Z	$-20\% \sim +80\%$
F	$\pm 1 \%$	L	$0\% \sim +10\%$	X	$+10\% \sim +20\%$
G	$\pm 2 \%$	M	$\pm 20 \%$		

Table 6		Rated Voltage			
Code	Description	Code	Description	Code	Description
6R3	6.3VDC	201	200VDC	152	1500VDC
100	10VDC	251	250VDC	202	2000VDC
160	16VDC	401	400VDC	302	3000VDC
250	25VDC	501	500VDC	402	4000VDC
500	50VDC	631	630VDC	502	5000VDC
101	100VDC	102	1000VDC	602	6000VDC

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

Table 9		Special Control Code	
Code	Description	Code	Description
G	RoHS Compliant	H	High reliability

5. EXTERNAL DIMENSIONS

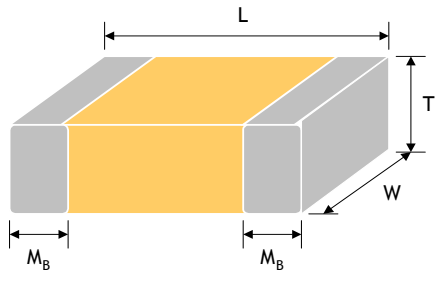
Size Inch (mm)	L (mm)	W (mm)	Code / T (mm)	M _B (mm)	
0402(1005)	1.00±0.10	0.50±0.10	See No.4 Reference Table 8	0.25 +0.05/-0.10	
0603(1608)	1.60±0.20	0.80±0.15		0.40±0.15	
0805(2012)	2.10±0.20	1.25±0.20		0.50±0.20	
1206(3216)	3.30±0.30	1.60±0.20		0.60±0.20	
1210(3225)	3.30±0.40	2.50±0.30		0.75±0.35	
1808(4520)	4.60±0.50	2.00±0.20		0.75±0.35	
1812(4532)	4.60±0.50	3.20±0.30		0.75±0.35	
1825(4563)	4.60±0.50	6.30±0.40		0.75±0.35	
2220(5750)	5.70±0.50	5.00±0.40		0.85±0.35	
2225(5763)	5.70±0.50	6.30±0.40		0.85±0.35	

Fig. 5.1 The outline of MLCC

6. GENERAL ELECTRICAL DATA

Dielectric	COG		X7R	
Size	0402, 0603, 0805, 1206, 1210, 1808, 1812, 1825, 2220, 2225		0402, 0603, 0805, 1206, 1210, 1808, 1812, 1825, 2220, 2225	
Rated voltage (WVDC)	10V, 16V, 25V, 50V, 100V, 200V, 250V, 500V, 630V, 1KV, 1.5KV, 2KV, 3KV, 4KV		6.3V, 10V, 16V, 25V, 50V, 100V, 200V, 250V, 500V, 630V, 1KV, 1.5KV, 2KV, 3KV, 4KV	
Capacitance range	0.1pF ~ 330nF		100pF ~ 22μF	
Capacitance tolerance	Reference to Table 5		Reference to Table 5	
Tan δ	Cap. Range	Q Spec.	Reference to 8. RELIABILITY TEST CONDITIONS AND REQUIREMENTS	
	Cap.<30pF	Q≥400+20C		
	Cap≥30pF	Q≥1000		
Capacitance & Tan δ Test condition	For 25°C at 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	
	Cap. Range	Test Condition	Cap. Range	Test Condition
	Cap.≤1000pF	1.0±0.2Vrms, 1.0MHz±10%	Cap.≤10μF	1.0±0.2Vrms, 1.0KHz±10%
	Cap.>1000pF	1.0±0.2Vrms, 1.0KHz±10%	Cap.>10μF	0.5±0.2Vrms, 120Hz±20%
Insulation resistance	≥100GΩ or RxC≥500Ω-F, whichever is smaller		≥10GΩ or RxC≥100Ω-F, whichever is smaller	
Operating temperature	-55°C to +125°C			
Temperature coefficient	±30ppm/°C		±15%	
Termination	Cu/Ag polymer/Ni/Sn(lead-free termination)			

7. CAPACITANCE RANGE

7-1. C0G

DIELECTRIC & Series		C0G																						
Cap (pF)	EIA Size	0402					0603					0805												
		10V	16V	25V	50V	100V	10V	16V	25V	50V	100V	200V	250V	10V	16V	25V	50V	100V	200V	250V	500V	630V	1000V	
0.1	0R1	K	K	K	K																			
0.2	0R2	K	K	K	K																			
0.3	0R3	K	K	K	K		S	S	S	S														
0.4	0R4	K	K	K	K		S	S	S	S														
0.5	0R5	K	K	K	K	K	S	S	S	S	S	S	S	A	A	A	A	A	A	A	A	A	A	C
1.0	1R0	K	K	K	K	K	S	S	S	S	S	S	S	A	A	A	A	A	A	A	A	A	A	C
1.2	1R2	K	K	K	K	K	S	S	S	S	S	S	S	A	A	A	A	A	A	A	A	A	A	C
1.5	1R5	K	K	K	K	K	S	S	S	S	S	S	S	A	A	A	A	A	A	A	A	A	A	C
1.8	1R8	K	K	K	K	K	S	S	S	S	S	S	S	A	A	A	A	A	A	A	A	A	A	C
2	2R0	K	K	K	K	K	S	S	S	S	S	S	S	A	A	A	A	A	A	A	A	A	A	C
2.2	2R2	K	K	K	K	K	S	S	S	S	S	S	S	A	A	A	A	A	A	A	A	A	A	C
2.7	2R7	K	K	K	K	K	S	S	S	S	S	S	S	A	A	A	A	A	A	A	A	A	A	C
3.3	3R3	K	K	K	K	K	S	S	S	S	S	S	S	A	A	A	A	A	A	A	A	A	A	C
3.9	3R9	K	K	K	K	K	S	S	S	S	S	S	S	A	A	A	A	A	A	A	A	A	A	C
4.7	4R7	K	K	K	K	K	S	S	S	S	S	S	S	A	A	A	A	A	A	A	A	A	A	C
5.0	5R0	K	K	K	K	K	S	S	S	S	S	S	S	A	A	A	A	A	A	A	A	A	A	C
5.6	5R6	K	K	K	K	K	S	S	S	S	S	S	S	A	A	A	A	A	A	A	A	A	A	C
6.8	6R8	K	K	K	K	K	S	S	S	S	S	S	S	A	A	A	A	A	A	A	A	A	A	C
8.2	8R2	K	K	K	K	K	S	S	S	S	S	S	S	A	A	A	A	A	A	A	A	A	A	C
10	100	K	K	K	K	K	S	S	S	S	S	S	S	A	A	A	A	A	A	A	A	A	A	C
12	120	K	K	K	K	K	S	S	S	S	S	S	S	A	A	A	A	A	A	A	A	A	A	C
15	150	K	K	K	K	K	S	S	S	S	S	S	S	A	A	A	A	A	A	A	A	A	A	C
18	180	K	K	K	K	K	S	S	S	S	S	S	S	A	A	A	A	A	A	A	A	A	A	C
22	220	K	K	K	K	K	S	S	S	S	S	S	S	A	A	A	A	A	A	A	A	A	A	C
27	270	K	K	K	K	K	S	S	S	S	S	S	S	A	A	A	A	A	A	A	A	A	A	C
33	330	K	K	K	K	K	S	S	S	S	S	S	S	A	A	A	A	A	A	A	A	A	A	C
39	390	K	K	K	K	K	S	S	S	S	S	S	S	A	A	A	A	A	A	A	A	A	A	C
47	470	K	K	K	K	K	S	S	S	S	S	S	S	A	A	A	A	A	A	A	A	A	A	C
56	560	K	K	K	K	K	S	S	S	S	S	S	S	A	A	A	A	A	A	A	A	A	A	C
68	680	K	K	K	K	K	S	S	S	S	S	S	S	A	A	A	A	A	A	A	A	A	A	C
82	820	K	K	K	K	K	S	S	S	S	S	S	S	A	A	A	A	A	A	A	A	X	X	C
100	101	K	K	K	K	K	S	S	S	S	S	S	S	A	A	A	A	A	A	X	X	X	X	C
120	121	K	K	K	K	K	S	S	S	S	S	S	S	A	A	A	A	A	A	X	X	C	C	C
150	151	K	K	K	K	K	S	S	S	S	S	S	S	A	A	A	A	A	X	X	C	C	C	C
180	181	K	K	K	K	K	S	S	S	S	S	S	S	A	A	A	A	A	X	C	C	C	C	C
220	221	K	K	K	K	K	S	S	S	S	S	S	S	A	A	A	A	A	C	C	C	C	C	C
270	271	K	K	K	K		S	S	S	S	S	B	B	A	A	A	A	A	C	C	C	C	C	C
330	331	K	K	K	K		S	S	S	S	S	B	B	A	A	A	A	A	C	C	C	C	C	C
390	391	K	K	K	K		S	S	S	S	S	B	B	X	X	X	X	X	C	C	C	C	C	C
470	471	K	K	K	K		S	S	S	S	S	B	B	X	X	X	X	X	C	C	I	I		
560	561	K	K	K	K		S	S	S	S	S	B	B	X	X	X	X	X	C	C	I	I		
680	681	K	K	K	K		S	S	S	S	S	B	B	X	X	X	X	X	C	C	I	I		
820	821	K	K	K	K		S	B	S	S	S	B	B	X	X	X	X	X	C	C	I	I		
1000	102	K	K	K	K		S	B	S	S	S			X	X	X	X	X	C	C	I	I		
1200	122						B	B	B	B				X	X	X	X	X	C	C	I	I		
1500	152						B	B	B	B				X	X	X	X	X	C	C	I	I		
1800	182						B	B	B	B				X	X	X	X	X	C	C	I	I		
2200	222						B	B	B	B				X	X	X	X	X	C	C	I	I		
2700	272						B		B	B				C	C	C	C	C	C	C				
3300	332						B		B	B				C	C	C	C	C	C	C				
3900	392													C	C	C	C	C						
4700	472													C	C	C	C	C						
5600	562													C	C	C	C	C						
6800	682													C	C	C	C	C						
8200	822													C	C	C	C							
10000	103													C	C	C	C							

7. CAPACITANCE RANGE(Con.)

7-1. C0G

DIELECTRIC & Series		C0G																							
Cap (pF)	EIA Size	1206										1210													
	Rated	10V	16V	25V	50V	100V	200V	250V	500V	630V	1000V	1500V	2000V	10V	16V	25V	50V	100V	200V	250V	500V	630V	1000V	1500V	2000V
1.0	1R0				X																				
1.2	1R2	X	X	X	X	X			X																
1.5	1R5	X	X	X	X	X	X	X	X	X	X	X	X												
1.8	1R8	X	X	X	X	X	X	X	X	X	X	X	X												
2	2R0	X	X	X	X	X	X	X	X	X	X	X	X												
2.2	2R2	X	X	X	X	X	X	X	X	X	X	X	X												
2.7	2R7	X	X	X	X	X	X	X	X	X	X	X	X												
3.3	3R3	X	X	X	X	X	X	X	X	X	X	X	X												
3.9	3R9	X	X	X	X	X	X	X	X	X	X	X	X												
4.7	4R7	X	X	X	X	X	X	X	X	X	X	X	X												
5.0	5R0	X	X	X	X	X	X	X	X	X	X	X	X												
5.6	5R6	X	X	X	X	X	X	X	X	X	X	X	X												
6.8	6R8	X	X	X	X	X	X	X	X	X	X	X	X												
8.2	8R2	X	X	X	X	X	X	X	X	X	X	X	X												
10	100	X	X	X	X	X	X	X	X	X	X	X	X	M	M	M	M	M	M	M	M	M	M	M	M
12	120	X	X	X	X	X	X	X	X	X	X	X	X	M	M	M	M	M	M	M	M	M	M	M	M
15	150	X	X	X	X	X	X	X	X	X	X	X	X	M	M	M	M	M	M	M	M	M	M	M	M
18	180	X	X	X	X	X	X	X	X	X	X	X	X	M	M	M	M	M	M	M	M	M	M	M	M
22	220	X	X	X	X	X	X	X	X	X	X	X	X	M	M	M	M	M	M	M	M	M	M	M	M
27	270	X	X	X	X	X	X	X	X	X	X	X	X	M	M	M	M	M	M	M	M	M	M	M	M
33	330	X	X	X	X	X	X	X	X	X	X	X	M	M	M	M	M	M	M	M	M	M	M	M	M
39	390	X	X	X	X	X	X	X	X	X	X	M	M	M	M	M	M	M	M	M	M	M	M	M	M
47	470	X	X	X	X	X	X	X	X	X	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M
56	560	X	X	X	X	X	X	X	X	X	C	C	M	M	M	M	M	M	M	M	M	M	M	C	C
68	680	X	X	X	X	X	X	X	X	X	C	C	M	M	M	M	M	M	M	M	M	M	M	C	C
82	820	X	X	X	X	X	X	X	X	X	C	C	M	M	M	M	M	M	M	M	M	M	M	C	C
100	101	X	X	X	X	X	X	X	X	X	C	C	M	M	M	M	M	M	M	M	M	M	C	C	C
120	121	X	X	X	X	X	X	X	X	X	C	E	E	M	M	M	M	M	M	M	M	M	C	C	C
150	151	X	X	X	X	X	X	X	X	X	C	E	E	M	M	M	M	M	M	M	M	M	C	E	E
180	181	X	X	X	X	X	X	X	X	X	E	E	E	M	M	M	M	M	M	M	M	M	C	E	E
220	221	X	X	X	X	X	X	X	X	X	E	E	E	M	M	M	M	M	M	M	M	M	E	E	E
270	271	X	X	X	X	X	X	M	M	M	E	P	P	M	M	M	M	M	M	M	M	M	E	E	E
330	331	X	X	X	X	X	X	M	M	M	E	P	P	M	M	M	M	M	M	M	M	M	E	E	E
390	391	X	X	X	X	X	X	M	M	M	E	P	P	M	M	M	M	M	M	M	M	M	E	E	E
470	471	X	X	X	X	X	M	M	M	M	E	P	P	M	M	M	M	M	M	M	M	M	E	E	E
560	561	X	X	X	X	X	M	C	C	C	E			M	M	M	M	M	M	M	M	M	E	E	E
680	681	X	X	X	X	X	M	C	C	C	E			M	M	M	M	M	M	M	M	M	E		
820	821	X	X	X	X	X	M	E	E	E	E			M	M	M	M	M	M	M	M	M	E		
1000	102	X	X	X	X	X	M	E	E	E	E			M	M	M	M	M	C	C	C	C	E		
1200	122	X	X	X	X	X	M	E	E	E	E			M	M	M	M	M	C	C	C	C			
1500	152	X	X	X	X	X	C	E	E	E				M	M	M	M	M	C	C	C	C			
1800	182	X	X	X	X	X	C	E	E	E				M	M	M	M	M	C	C	C	C			
2200	222	X	X	X	X	X	C	E	E	E				M	M	M	M	M	C	C	C	C			
2700	272	X	X	X	X	X	C	E	E	E				M	M	M	M	M	C	C	C	C			
3300	332	X	X	X	X	X	C	E	E	E				M	M	M	M	M	C	C	C	C			
3900	392	X	X	X	X	X	C	E	E	E				M	M	M	M	M	C	C	C	C			
4700	472	X	X	X	X	X	C	E	E	E				M	M	M	M	M	E	E	C				
5600	562	X	X	X	X	X	E	E	E	E				M	M	M	M	M	E	E	C				
6800	682	M	M	M	M	M	E	E	E	E				M	M	M	M	M	E	E	E				
8200	822	C	C	C	C	C	E	E						M	M	M	M	M	E	E	E				
10000	103	C	C	C	C	C	E	E						M	M	M	M	M	E	E	F				
12000	123	P	P	P	P	P								C	C	C	C	C	F	F	F				
15000	153	P	P	P	P	P								C	C	C	C	G	G	G					
18000	183	P	P	P	P	P										F	F	G	G	G	G				
22000	223	P	P	P	P	P										F	F	G	G	G					
27000	273	P	P	P	P											G	G	G	G	G					
33000	333	P	P	P	P											G	G	G	G						
39000	393	P	P	P	P											G	G	G							
47000	473															G	G	G							
56000	563															G	G								
68000	683															G	G								

7. CAPACITANCE RANGE(Con.)

7-1. C0G

DIELECTRIC & Series		C0G										
Cap (pF)	EIA Size	1808										
	Rated	25V	50V	100V	200V	250V	500V	630V	1000V	1500V	2000V	3000V
2.2	2R2	C	C	C	C	C	C	C	C	C	C	C
2.7	2R7	C	C	C	C	C	C	C	C	C	C	C
3.3	3R3	C	C	C	C	C	C	C	C	C	C	C
3.9	3R9	C	C	C	C	C	C	C	C	C	C	C
4.7	4R7	C	C	C	C	C	C	C	C	C	C	C
5.0	5R0	C	C	C	C	C	C	C	C	C	C	C
5.6	5R6	C	C	C	C	C	C	C	C	C	C	C
6.8	6R8	C	C	C	C	C	C	C	C	C	C	C
8.2	8R2	C	C	C	C	C	C	C	C	C	C	C
10	100	C	C	C	C	C	C	C	C	C	C	C
12	120	C	C	C	C	C	C	C	C	C	C	C
15	150	C	C	C	C	C	C	C	C	C	C	C
18	180	C	C	C	C	C	C	C	C	C	C	C
22	220	C	C	C	C	C	C	C	C	C	C	C
27	270	C	C	C	C	C	C	C	C	C	C	C
33	330	C	C	C	C	C	C	C	C	C	C	C
39	390	C	C	C	C	C	C	C	C	C	C	C
47	470	C	C	C	C	C	C	C	C	C	C	C
56	560	C	C	C	C	C	C	C	C	C	C	C
68	680	C	C	C	C	C	C	C	C	C	C	C
82	820	C	C	C	C	C	C	C	C	C	C	C
100	101	C	C	C	C	C	C	C	C	C	C	F
120	121	C	C	C	C	C	C	C	C	C	C	F
150	151	C	C	C	C	C	C	C	C	F	F	F
180	181	C	C	C	C	C	C	C	C	F	F	F
220	221	C	C	C	C	C	C	C	C	F	F	F
270	271	C	C	C	C	C	F	F	F	F	F	F
330	331	C	C	C	C	C	F	F	F	F	F	F
390	391	C	C	C	C	C	F	F	F	F	F	F
470	471	C	C	C	C	C	F	F	F	F	F	F
560	561	C	C	C	C	C	F	F	F	F	F	F
680	681	C	C	C	C	C	F	F	F	F	F	
820	821	C	C	C	C	C	F	F	F	F	F	
1000	102	C	C	C	C	C	F	F	F	F	F	
1200	122	C	C	C	C	C	F	F	F	F	F	
1500	152	C	C	C	C	C	F	F	F	F	F	
1800	182	C	C	C	C	C	F	F	F	F	F	
2200	222	C	C	C	C	C	F	F	F			
2700	272	C	C	C	C	C	F	F	F			
3300	332	C	C	C	C	C	F	F	F			
3900	392	C	C	C	C	C	F	F				
4700	472	C	C	C	C	C	F	F				
5600	562	C	C	C	E	E	F	F				
6800	682	C	C	C	E	E	F	F				
8200	822	C	C	E	F	F	F	F				
10000	103	C	C	E	F	F	F	F				
12000	123	E	E	F	F	F	F					
15000	153	E	E	F	F	F						
18000	183	F	F	F	F	F						
22000	223	F	F	F								
27000	273	F	F	F								
33000	333	F	F									
39000	393	F	F									

7. CAPACITANCE RANGE(Con.)

7-1. C0G

DIELECTRIC & Series		C0G																											
Cap (pF)	EIA Size Rated	1812														1825													
		10V	16V	25V	50V	100V	200V	250V	500V	630V	1000V	1500V	2000V	3000V	25V	50V	100V	200V	250V	500V	630V	1000V	1500V	2000V	3000V				
10	100	C	C	C	C	C	C	C	C	C	C	C	C	C	C	E	E	E	E	E	E	E	E	E	E	E	E	E	
12	120	C	C	C	C	C	C	C	C	C	C	C	C	C	C	E	E	E	E	E	E	E	E	E	E	E	E	E	E
15	150	C	C	C	C	C	C	C	C	C	C	C	C	C	C	E	E	E	E	E	E	E	E	E	E	E	E	E	E
18	180	C	C	C	C	C	C	C	C	C	C	C	C	C	C	E	E	E	E	E	E	E	E	E	E	E	E	E	E
22	220	C	C	C	C	C	C	C	C	C	C	C	C	C	C	E	E	E	E	E	E	E	E	E	E	E	E	E	E
27	270	C	C	C	C	C	C	C	C	C	C	C	C	C	C	E	E	E	E	E	E	E	E	E	E	E	E	E	E
33	330	C	C	C	C	C	C	C	C	C	C	C	C	C	C	E	E	E	E	E	E	E	E	E	E	E	E	E	E
39	390	C	C	C	C	C	C	C	C	C	C	C	C	C	C	E	E	E	E	E	E	E	E	E	E	E	E	E	E
47	470	C	C	C	C	C	C	C	C	C	C	C	C	C	C	E	E	E	E	E	E	E	E	E	E	E	E	E	E
56	560	C	C	C	C	C	C	C	C	C	C	C	C	C	C	E	E	E	E	E	E	E	E	E	E	E	E	E	E
68	680	C	C	C	C	C	C	C	C	C	C	C	C	C	C	E	E	E	E	E	E	E	E	E	E	E	E	E	E
82	820	C	C	C	C	C	C	C	C	C	C	C	C	C	C	E	E	E	E	E	E	E	E	E	E	E	E	E	E
100	101	C	C	C	C	C	C	C	C	C	C	C	C	C	C	E	E	E	E	E	E	E	E	E	E	E	E	E	E
120	121	C	C	C	C	C	C	C	C	C	C	C	C	C	C	E	E	E	E	E	E	E	E	E	E	E	E	E	E
150	151	C	C	C	C	C	C	C	C	C	C	C	C	C	C	E	E	E	E	E	E	E	E	E	E	E	E	E	E
180	181	C	C	C	C	C	C	C	C	C	C	C	C	C	C	E	E	E	E	E	E	E	E	E	E	E	E	E	E
220	221	C	C	C	C	C	C	C	C	C	C	C	C	C	C	E	E	E	E	E	E	E	E	E	E	E	E	E	E
270	271	C	C	C	C	C	C	C	C	C	C	C	C	C	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E
330	331	C	C	C	C	C	C	C	C	C	C	C	C	C	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E
390	391	C	C	C	C	C	C	C	C	C	C	C	C	C	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E
470	471	C	C	C	C	C	C	C	C	C	C	C	C	C	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E
560	561	C	C	C	C	C	C	C	C	C	C	C	C	C	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E
680	681	C	C	C	C	C	C	C	C	C	C	C	C	C	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E
820	821	C	C	C	C	C	C	C	C	C	C	C	C	C	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E
1000	102	C	C	C	C	C	C	C	C	C	C	C	C	C	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E
1200	122	C	C	C	C	C	C	C	C	C	C	C	C	C	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E
1500	152	C	C	C	C	C	C	C	C	C	C	C	C	C	E	E	E	E	E	E	E	E	E	E	E	E	E	E	F
1800	182	C	C	C	C	C	C	C	C	C	C	C	C	C	E	F	F		E	E	E	E	E	E	E	E	E	E	F
2200	222	C	C	C	C	C	C	C	C	C	C	C	C	C	E	F	F		E	E	E	E	E	E	E	E	E	E	G
2700	272	C	C	C	C	C	C	C	C	C	C	C	C	C	F	G	G		E	E	E	E	E	E	E	E	E	E	G
3300	332	C	C	C	C	C	C	C	C	C	C	C	C	C	F	G	G		E	E	E	E	E	E	E	E	E	E	
3900	392	C	C	C	C	C	C	C	C	C	C	C	C	C	G				E	E	E	E	E	E	E	E	E	E	
4700	472	C	C	C	C	C	C	C	C	C	C	C	C	C	G				E	E	E	E	E	E	E	E	E	F	F
5600	562	C	C	C	C	C	C	C	C	C	C	C	C	C	G				E	E	E	E	E	E	E	E	F	F	F
6800	682	C	C	C	C	C	C	C	C	C	C	C	C	C					E	E	E	E	E	E	E	E	F	G	G
8200	822	C	C	C	C	C	C	C	C	C	C	C	C	C					E	E	E	E	E	E	E	E	G	G	G
10000	103	C	C	C	C	C	C	C	C	C	C	C	C	C					E	E	E	E	E	E	E	E	G		
12000	123	C	C	C	C	C	C	C	C	C	C	C	C	C					E	E	E	E	E	E	E	E	G		
15000	153	C	C	C	C	C	C	C	C	C	C	C	C	C					E	E	E	E	E	E	E	E			
18000	183	C	C	C	C	C	C	E	F	F	F	F	F					E	E	E	E	E	E	E	E				
22000	223	C	C	C	C	C	C	E	F	F	F	F	F					E	E	E	E	E	E	E	E				
27000	273	C	C	C	C	E	F	G	G	G	G	G	G					E	E	E	E	E	E	F	F				
33000	333	C	C	E	E	F	G	G	G	G	G	G						E	E	E	E	E	E	F	F				
39000	393			F	F	G	G	G	G	G								E	E	E	F	F	G	G					
47000	473			F	F	G	G	G	G									E	E	E	F	F	G	G					
56000	563			F	G	G	G	G										E	E	F	G	G	G	G					
68000	683			F	G	G												E	E	F	G	G	G	G					
82000	823			F	G	G												F	F	G	G	G	G						
100000	104			F	G	G												G	G	G	G	G							
120000	124			F	G													G	G	G									
150000	154			F	G													G	G										

7. CAPACITANCE RANGE(Con.)

7-1. C0G

DIELECTRIC & Series		C0G																								
Cap (pF)	EIA Size	2220												2225												
		25V	50V	100V	200V	250V	500V	630V	1000V	1500V	2000V	3000V	4000V	25V	50V	100V	200V	250V	500V	630V	1000V	1500V	2000V	3000V	4000V	
10	100	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	
12	120	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E
15	150	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E
18	180	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E
22	220	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E
27	270	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E
33	330	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E
39	390	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E
47	470	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E
56	560	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E
68	680	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E
82	820	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E
100	101	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E
120	121	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E
150	151	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E
180	181	E	E	E	E	E	E	E	E	E	E	E	E	F	E	E	E	E	E	E	E	E	E	E	E	F
220	221	E	E	E	E	E	E	E	E	E	E	E	E	F	E	E	E	E	E	E	E	E	E	E	E	F
270	271	E	E	E	E	E	E	E	E	E	E	E	E	G	E	E	E	E	E	E	E	E	E	E	E	G
330	331	E	E	E	E	E	E	E	E	E	E	E	E	G	E	E	E	E	E	E	E	E	E	E	E	E
390	391	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E
470	471	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E
560	561	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E
680	681	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E
820	821	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E
1000	102	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E
1200	122	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E
1500	152	E	E	E	E	E	E	E	E	E	E	E	F	E	E	E	E	E	E	E	E	E	E	E	E	E
1800	182	E	E	E	E	E	E	E	E	E	E	E	G	E	E	E	E	E	E	E	E	E	E	E	E	F
2200	222	E	E	E	E	E	E	E	E	E	E	E	G	E	E	E	E	E	E	E	E	E	E	E	E	F
2700	272	E	E	E	E	E	E	E	E	E	E	E	G	E	E	E	E	E	E	E	E	E	E	E	E	G
3300	332	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	G
3900	392	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E
4700	472	E	E	E	E	E	E	E	E	F	F	F	E	E	E	E	E	E	E	E	E	E	E	E	E	E
5600	562	E	E	E	E	E	E	E	F	F	F	F	E	E	E	E	E	E	E	E	E	F	F	F	F	E
6800	682	E	E	E	E	E	E	E	F	G	G	G	E	E	E	E	E	E	E	E	E	F	F	F	F	E
8200	822	E	E	E	E	E	E	E	G	G	G	G	E	E	E	E	E	E	E	E	F	G	G	G	G	E
10000	103	E	E	E	E	E	E	E	G	E	E	E	E	E	E	E	E	E	E	E	G	G	G	G	E	E
12000	123	E	E	E	E	E	E	E	G	E	E	E	E	E	E	E	E	E	E	E	G	E	E	E	E	E
15000	153	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E
18000	183	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E
22000	223	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E
27000	273	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E
33000	333	E	E	E	F	F	F	F	F	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E
39000	393	E	E	E	F	F	F	F	F	E	E	E	F	F	F	F	F	F	F	F	E	E	E	E	E	E
47000	473	E	E	E	G	G	G	G	G	E	E	E	F	F	F	F	F	F	F	E	E	E	E	E	E	E
56000	563	E	E	F	G	G	G	G	G	E	E	E	G	G	G	G	G	G	G	E	E	E	E	E	E	E
68000	683	E	E	F	G	G	G	G	E	E	E	F	G	G	G	G	G	G	G	E	E	E	E	E	E	E
82000	823	F	F	G	G	G	E	E	E	E	E	F	F	F	G	G	G	G	G	E	E	E	E	E	E	E
100000	104	G	G	G	G	G	E	E	E	E	E	F	F	F	G	G	G	G	G	E	E	E	E	E	E	E
120000	124	G	G	G	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E
150000	154	G	G	G	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E
180000	184	G	G	G	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E
220000	224	G	G	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E
270000	274	G	G	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E
330000	334	G	G	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E

7. CAPACITANCE RANGE(Con.)

7-2. X7R

DIELECTRIC & Series		X7R																								
Cap (pF)	EIA Size	0402					0603					0805														
	Rated	6.3V	10V	16V	25V	50V	100V	6.3V	10V	16V	25V	50V	100V	200V	250V	6.3V	10V	16V	25V	50V	100V	200V	250V	500V	630V	1000V
100	101		K	K	K	K	K	S	S	S	S	S	S	B	B	C	C	C	C	C	C	C	C	X	X	X
120	121		K	K	K	K	K	S	S	S	S	S	S	B	B	C	C	C	C	C	C	C	C	X	X	X
150	151		K	K	K	K	K	S	S	S	S	S	S	B	B	C	C	C	C	C	C	C	C	X	X	X
180	181		K	K	K	K	K	S	S	S	S	S	S	B	B	C	C	C	C	C	C	C	C	X	X	X
220	221		K	K	K	K	K	S	S	S	S	S	S	B	B	C	C	C	C	C	C	C	C	X	X	X
270	271		K	K	K	K	K	S	S	S	S	S	S	B	B	C	C	C	C	C	C	C	C	X	X	X
330	331		K	K	K	K	K	S	S	S	S	S	S	B	B	C	C	C	C	C	C	C	C	X	X	X
390	391		K	K	K	K	K	S	S	S	S	S	S	B	B	C	C	C	C	C	C	C	C	X	X	X
470	471		K	K	K	K	K	S	S	S	S	S	S	B	B	C	C	C	C	C	C	C	C	X	X	X
560	561		K	K	K	K	K	S	S	S	S	S	S	B	B	C	C	C	C	C	C	C	C	X	X	X
680	681		K	K	K	K	K	S	S	S	S	S	S	B	B	C	C	C	C	C	C	C	C	X	X	X
820	821		K	K	K	K	K	S	S	S	S	S	S	B	B	C	C	C	C	C	C	C	C	X	X	X
1000	102		K	K	K	K	K	S	S	S	S	S	S	B	B	C	C	C	C	C	C	C	C	X	X	X
1200	122		K	K	K	K	K	S	S	S	S	S	S	B	B	C	C	C	C	C	C	C	C	X	X	X
1500	152		K	K	K	K	K	S	S	S	S	S	S	B	B	C	C	C	C	C	C	C	C	X	X	C
1800	182		K	K	K	K	K	S	S	S	S	S	S	B	B	C	C	C	C	C	C	C	C	X	X	C
2200	222		K	K	K	K	K	S	S	S	S	S	S	B	B	C	C	C	C	C	C	C	C	X	X	C
2700	272		K	K	K	K	K	S	S	S	S	S	S	B	B	C	C	C	C	C	C	C	C	X	X	C
3300	332		K	K	K	K	K	S	S	S	S	S	S	B	B	C	C	C	C	C	C	C	C	X	X	C
3900	392		K	K	K	K	K	S	S	S	S	S	S	B	B	C	C	C	C	C	C	C	C	X	X	C
4700	472		K	K	K	K	K	S	S	S	S	S	S	B	B	C	C	C	C	C	C	C	C	C	C	C
5600	562		K	K	K	K		S	S	S	S	S	S	B	B	C	C	C	C	C	C	C	C	C	C	C
6800	682		K	K	K	K		S	S	S	S	S	S	B	B	C	C	C	C	C	C	C	C	C	C	C
8200	822		K	K	K	K		S	S	S	S	S	S	B	B	C	C	C	C	C	C	C	C	C	C	C
10000	103		K	K	K	K		S	S	S	S	S	S	B	B	C	C	C	C	C	C	C	C	C	C	C
12000	123		K	K	K			S	S	S	S	S	B	B	B	C	C	C	C	C	C	C	C	C	C	C
15000	153		K	K	K			S	S	S	S	S	B	B	B	C	C	C	C	C	C	C	C	C	C	C
18000	183		K	K	K			S	S	S	S	S	B			C	C	C	C	C	C	C	C	C	C	C
22000	223		K	K	K			S	S	S	S	S	B			C	C	C	C	C	C	C	C	C	C	C
27000	273		K	K	K			S	S	S	S	S	B			C	C	C	C	C	C	C	C	C	C	C
33000	333		K	K	K			S	S	S	S	B	B			C	C	C	C	C	C	C	C			
39000	393		K	K	K			S	S	S	S	B	B			C	C	C	C	C	C	C	C			
47000	473		K	K	K			S	S	S	S	B	B			C	C	C	C	C	C	C	C			
56000	563		K	K				S	S	S	S	B	B			C	C	C	C	C	C	C	C			
68000	683		K	K				S	S	S	S	B	B			C	C	C	C	C	C	C	C			
82000	823		K	K				S	S	S	S	B	B			C	C	C	C	C	C	C	C			
100000	104	K	K	K				S	S	S	S	B	B			C	C	C	C	C	C	C				
120000	124							S	S	S	B					C	C	C	C	C	I					
150000	154							S	S	S	B					C	C	C	C	C	I					
180000	184							S	S	S	B					C	C	C	C	C	I					
220000	224							S	S	S	B					C	C	C	C	C	I					
270000	274						B	B	B	B						I	I	I	I							
330000	334						B	B	B	B						I	I	I	I							
390000	394						B	B	B	B						I	I	I	I							
470000	474						B	B	B	B						I	I	I	I		I					
560000	564							B	B							I	I	I								
680000	684						B	B	B							I	I	I								
820000	824							B	B							I	I	I								
1000000	105						B	B	B							I	I	I	I							
1200000	125																									
1500000	155																I	I	I							
1800000	185																									
2200000	225																I	I	I	I						
2700000	275																									
3300000	335																									
3900000	395																									
4700000	475																	I								

7. CAPACITANCE RANGE(Con.)

7-2. X7R

DIELECTRIC & Series		X7R																										
Cap (pF)	EIA Size	1206												1210														
		6.3V	10V	16V	25V	50V	100V	200V	250V	500V	630V	1000V	1500V	2000V	10V	16V	25V	50V	100V	200V	250V	400V	500V	630V	1000V	1500V	2000V	
100	101							C	C	C	C	C	C															
120	121							C	C	C	C	C	C															
150	151		C	C	C	C	C	C	C	C	C	C	C															
180	181		C	C	C	C	C	C	C	C	C	C	C															
220	221		C	C	C	C	C	C	C	C	C	C	C								M	M	M	M	M	M	M	M
270	271		C	C	C	C	C	C	C	C	C	C	C								M	M	M	M	M	M	M	M
330	331		C	C	C	C	C	C	C	C	C	C	C								M	M	M	M	M	M	M	M
390	391		C	C	C	C	C	C	C	C	C	C	C								M	M	M	M	M	M	M	M
470	471		C	C	C	C	C	C	C	C	C	C	C								M	M	M	M	M	M	M	M
560	561		C	C	C	C	C	C	C	C	C	C	C								M	M	M	M	M	M	M	M
680	681		C	C	C	C	C	C	C	C	C	C	C								M	M	M	M	M	M	M	M
820	821		C	C	C	C	C	C	C	C	C	C	C								M	M	M	M	M	M	M	M
1000	102		C	C	C	C	C	C	C	C	C	C	C								M	M	M	M	M	M	M	M
1200	122		C	C	C	C	C	C	C	C	C	C	C	E	E	M	M	M	M	M	M	M	M	M	M	M	M	C
1500	152		C	C	C	C	C	C	C	C	C	C	C	E	E	M	M	M	M	M	M	M	M	M	M	M	M	E
1800	182		C	C	C	C	C	C	C	C	C	C	C	E	E	M	M	M	M	M	M	M	M	M	M	M	M	E
2200	222		C	C	C	C	C	C	C	C	C	C	C	E	E	M	M	M	M	M	M	M	M	M	M	M	M	F
2700	272		C	C	C	C	C	C	C	C	C	C	C	E	E	M	M	M	M	M	M	M	M	M	M	M	M	F
3300	332		C	C	C	C	C	C	C	C	C	C	C	E	E	M	M	M	M	M	M	M	M	M	M	M	M	F
3900	392		C	C	C	C	C	C	C	C	C	C	C	E	E	M	M	M	M	M	M	M	M	M	M	M	M	G
4700	472		C	C	C	C	C	C	C	C	C	C	C	E	E	M	M	M	M	M	M	M	M	M	M	M	M	G
5600	562		C	C	C	C	C	C	C	C	C	C	C	E	E	M	M	M	M	M	M	M	M	M	M	M	M	G
6800	682		C	C	C	C	C	C	C	C	C	C	C	E	E	M	M	M	M	M	M	M	M	M	M	M	M	G
8200	822		C	C	C	C	C	C	C	C	C	C	C			M	M	M	M	M	M	M	M	M	M	M	M	G
10000	103		C	C	C	C	C	C	C	C	C	C	C			M	M	M	M	M	M	M	M	M	M	M	M	C
12000	123		C	C	C	C	C	C	C	C	C	C	C	E		M	M	M	M	M	M	M	M	M	M	M	M	C
15000	153		C	C	C	C	C	C	C	C	C	C	C			M	M	M	M	M	M	M	M	M	M	M	M	E
18000	183		C	C	C	C	C	C	C	C	C	C	C			M	M	M	M	M	M	M	M	M	M	C	C	E
22000	223		C	C	C	C	C	C	C	C	C	C	C	E	E	M	M	M	M	M	M	M	M	M	C	C	E	
27000	273		C	C	C	C	C	C	C	C	C	C	C	E	E	M	M	M	M	M	M	M	M	M	C	C	E	
33000	333		C	C	C	C	C	C	C	C	C	C	C	E	E	M	M	M	M	M	M	M	M	M	E	E	E	
39000	393		C	C	C	C	C	C	C	C	C	C	C	E	E	M	M	M	M	M	M	M	M	M	E	E	F	
47000	473		C	C	C	C	C	C	C	C	C	C	C	E	E	M	M	M	M	M	C	C	M	E	E	E	G	
56000	563		C	C	C	C	C	C	C	C	C	C	C	E	E	M	M	M	M	M	C	C	M	E	E	E	G	
68000	683		C	C	C	C	C	C	C	C	C	C	C	E	E	M	M	M	M	M	E	E	M	F	F	F	G	
82000	823		C	C	C	C	C	C	C	C	C	C	C	E	E	M	M	M	M	M	E	E	M	F	F	F		
100000	104		C	C	C	C	C	C	C	C	C	C	C	E	E	M	M	M	M	M	E	E	M	F	F	F		
120000	124		C	C	C	C	C	C	C	C	C	C	C			M	M	M	M	M	E	E	E	E	G	G		
150000	154		M	M	M	M	E									M	M	M	M	C	E	E	E	E	G	G		
180000	184		M	M	M	M	E									M	M	M	M	C	E	E	E	E				
220000	224		M	M	M	M	E									M	M	M	M	C	E	E	E	E				
270000	274		M	M	M	C	E									M	M	M	M	E	F	F	F					
330000	334		M	M	M	C	E									M	M	M	C	E	F	F	F					
390000	394		M	M	J	P	E									M	M	M	C	E	G	G	G					
470000	474		J	J	J	P	E									M	M	M	C	E	G	G	G					
560000	564		J	J	J	P	P									C	C	C	C	E	G	G						
680000	684		J	J	J	P	P									C	C	C	C	F	G	G						
820000	824		J	J	J	P	P									C	C	C	C	F								
1000000	105		J	J	J	P	P									C	C	C	C	F								
1200000	125																											
1500000	155		J	J	J	P															F	E	G	G				
1800000	185																											
2200000	225		J	J	J	P	P														F	E	G	G				
2700000	275																											
3300000	335			P	P	P															F	E	G	G				
3900000	395																											
4700000	475		P	P	P	P															F	F	F	G				
5600000	565																											
6800000	685																											
8200000	825																											
10000000	106		P	P																	F	F						



7. CAPACITANCE RANGE(Con.)

7-2. X7R

DIELECTRIC & Series		X7R 1808											
Cap (pF)	EIA Size	25V	50V	100V	200V	250V	500V	630V	1000V	1500V	2000V	3000V	4000V
	Rated												
150	151	C	C	C	C	C	C	C	C	C	C	C	F
180	181	C	C	C	C	C	C	C	C	C	C	C	F
220	221	C	C	C	C	C	C	C	C	C	C	C	F
270	271	C	C	C	C	C	C	C	C	C	C	C	F
330	331	C	C	C	C	C	C	C	C	C	C	C	F
390	391	C	C	C	C	C	C	C	C	C	C	C	F
470	471	C	C	C	C	C	C	C	C	C	C	C	F
560	561	C	C	C	C	C	C	C	C	C	C	E	F
680	681	C	C	C	C	C	C	C	C	C	C	E	F
820	821	C	C	C	C	C	C	C	C	C	C	E	F
1000	102	C	C	C	C	C	C	C	C	C	C	F	F
1200	122	C	C	C	C	C	C	C	C	C	C	F	
1500	152	C	C	C	C	C	C	C	C	C	C	F	
1800	182	C	C	C	C	C	C	C	C	C	C	F	
2200	222	C	C	C	C	C	C	C	C	E	E	F	
2700	272	C	C	C	C	C	C	C	C	F	F		
3300	332	C	C	C	C	C	C	C	C	F	F		
3900	392	C	C	C	C	C	C	C	C	F	F		
4700	472	C	C	C	C	C	C	C	C	F	F		
5600	562	C	C	C	C	C	C	C	C	F	F		
6800	682	C	C	C	C	C	C	C	C	F	F		
8200	822	C	C	C	C	C	C	C	C				
10000	103	C	C	C	C	C	C	C	C				
12000	123	E	E	E	E	E	E	E	E				
15000	153	E	E	E	E	E	E	E	E				
18000	183	E	E	E	E	E	F	F	F				
22000	223	E	E	E	E	E	F	F	F				
27000	273	E	E	E	E	E	F	F	F				
33000	333	E	E	E	E	E	F	F	F				
39000	393	E	E	E	E	E	F	F	F				
47000	473	E	E	E	E	E	F	F	F				
56000	563	E	E	E	E	E	F	F	F				
68000	683	E	E	E	E	E	F	F					
82000	823	E	E	E	E	E	F	F					
100000	104	E	E	E	E	E							
120000	124	E	E	E	E	E							
150000	154	E	E	E	E	E							
180000	184	E	E	E	F	F							
220000	224	E	E	E									
270000	274	F	F	F									
330000	334	F	F	F									
390000	394	F	F	F									
470000	474	F	F										
560000	564	F	F										
680000	684	F	F										

7. CAPACITANCE RANGE(Con.)

7-2. X7R

DIELECTRIC & Series		X7R																												
Cap (pF)	EIA Size Rated	1812														1825														
		10V	16V	25V	50V	100V	200V	250V	400V	500V	630V	1000V	1500V	2000V	3000V	4000V	25V	50V	100V	200V	250V	500V	630V	1000V	1500V	2000V	3000V	4000V		
150	151																													
180	181																													
220	221																													
270	271			C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	
330	331			C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	
390	391			C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	
470	471			C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	
560	561			C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	
680	681			C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	
820	821			C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	
1000	102	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	
1200	122	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	
1500	152	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	
1800	182	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	
2200	222	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	
2700	272	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	
3300	332	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	
3900	392	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	
4700	472	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	
5600	562	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	
6800	682	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	
8200	822	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	
10000	103	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	
12000	123	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	
15000	153	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	
18000	183	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	
22000	223	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	
27000	273	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	
33000	333	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	
39000	393	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	
47000	473	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	
56000	563	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	
68000	683	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	
82000	823	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	
100000	104	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	
120000	124	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	
150000	154	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	
180000	184	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	
220000	224	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	
270000	274	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	
330000	334	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	
390000	394	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	
470000	474	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	
560000	564	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	
680000	684	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	
820000	824	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	
1000000	105	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	
1200000	125			C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	
1500000	155			C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	
1800000	185			E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	
2200000	225			E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	
2700000	275			F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F		
3300000	335			F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F		
3900000	395			F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F		
4700000	475			G	G	G	G	G	G	G	G	G	G	G	G	G	G	G	G	G	G	G	G	G	G	G	G	G		
5600000	565			G	G	G	G	G	G	G	G	G	G	G	G	G	G	G	G	G	G	G	G	G	G	G	G	G		
6800000	685			G	G	G	G	G	G	G	G	G	G	G	G	G	G	G	G	G	G	G	G	G	G	G	G	G		
8200000	825			G	G	G	G	G	G	G	G	G	G	G	G	G	G	G	G	G	G	G	G	G	G	G	G	G		
10000000	106			G	G	G	G	G	G	G	G	G	G	G	G	G	G	G	G	G	G	G	G	G	G	G	G	G		

7. CAPACITANCE RANGE(Con.)

7-2. X7R

DIELECTRIC & Series		X7R 2220												
Cap (pF)	EIA Size Rated	25V	50V	100V	200V	250V	400V	500V	630V	1000V	1500V	2000V	3000V	4000V
270	271													F
330	331													F
390	391													F
470	471													F
560	561													F
680	681													F
820	821													F
1000	102	F	F	F	F	F	F	F	F	F	F	F	F	F
1200	122	F	F	F	F	F	F	F	F	F	F	F	F	G
1500	152	F	F	F	F	F	F	F	F	F	F	F	F	G
1800	182	F	F	F	F	F	F	F	F	F	F	F	F	G
2200	222	F	F	F	F	F	F	F	F	F	F	F	F	
2700	272	F	F	F	F	F	F	F	F	F	F	F	F	
3300	332	F	F	F	F	F	F	F	F	F	F	F	F	
3900	392	F	F	F	F	F	F	F	F	F	F	F	F	
4700	472	F	F	F	F	F	F	F	F	F	F	F	F	
5600	562	F	F	F	F	F	F	F	F	F	F	F	F	
6800	682	F	F	F	F	F	F	F	F	F	F	F	F	G
8200	822	F	F	F	F	F	F	F	F	F	G	G	G	
10000	103	F	F	F	F	F	F	F	F	F	G	G	G	
12000	123	F	F	F	F	F	F	F	F	F	G	G	H	
15000	153	F	F	F	F	F	F	F	F	F	G	G	H	
18000	183	F	F	F	F	F	F	F	F	F	H	H	H	
22000	223	F	F	F	F	F	F	F	F	F	H	H		
27000	273	F	F	F	F	F	F	F	F	F	H	H		
33000	333	F	F	F	F	F	F	F	F	F	H	H		
39000	393	F	F	F	F	F	F	F	F	F	H	H		
47000	473	F	F	F	F	F	F	F	F	F	H	H		
56000	563	F	F	F	F	F	F	F	F	F	H	H		
68000	683	F	F	F	F	F	F	F	F	F				
82000	823	F	F	F	F	F	F	F	F	F				
100000	104	F	F	F	F	F	F	F	F	G				
120000	124	F	F	F	F	F	F	F	F	G				
150000	154	F	F	F	F	F	F	F	F	H				
180000	184	F	F	F	F	F	F	F	F	H				
220000	224	F	F	F	F	F	F	F	F	H				
270000	274	F	F	F	F	F	F	F	F	H				
330000	334	F	F	F	F	F	F	F	F	H				
390000	394	F	F	F	F	F	F	F	F	H				
470000	474	F	F	F	F	F	F	F	F					
560000	564	F	F	F	F	F	G	G	G					
680000	684	F	F	F	F	F	G	G	G					
820000	824	F	F	F	F	F	H	H	H					
1000000	105	F	F	F	F	F	H	H	H					
1200000	125	F	F	F	G	G								
1500000	155	F	F	F	G	G								
1800000	185	F	F	F	G	G								
2200000	225	F	F	F	G	G								
2700000	275	F	F	F	H	H								
3300000	335	F	F	F										
3900000	395	F	F	F										
4700000	475	F	F	F										
5600000	565	F	F	F										
6800000	685	F	F	F										
8200000	825	G	G	G										
10000000	106	G	G	G										
12000000	126	H	H											
15000000	156	H	H											
18000000	186	H	H											
22000000	226	H	H											

7. CAPACITANCE RANGE(Con.)

7-2. X7R

DIELECTRIC & Series		X7R											
Cap (pF)	EIA Size	2225											
	Rated	25V	50V	100V	200V	250V	500V	630V	1000V	1500V	2000V	3000V	4000V
270	271												F
330	331												F
390	391												F
470	471												F
560	561												F
680	681												F
820	821												F
1000	102	F	F	F	F	F	F	F	F	F	F	F	F
1200	122	F	F	F	F	F	F	F	F	F	F	F	G
1500	152	F	F	F	F	F	F	F	F	F	F	F	G
1800	182	F	F	F	F	F	F	F	F	F	F	F	G
2200	222	F	F	F	F	F	F	F	F	F	F	F	
2700	272	F	F	F	F	F	F	F	F	F	F	F	
3300	332	F	F	F	F	F	F	F	F	F	F	F	
3900	392	F	F	F	F	F	F	F	F	F	F	F	
4700	472	F	F	F	F	F	F	F	F	F	F	F	
5600	562	F	F	F	F	F	F	F	F	F	F	G	
6800	682	F	F	F	F	F	F	F	F	F	F	G	
8200	822	F	F	F	F	F	F	F	F	F	F	G	
10000	103	F	F	F	F	F	F	F	F	F	F	G	
12000	123	F	F	F	F	F	F	F	F	G	G	G	
15000	153	F	F	F	F	F	F	F	F	G	G	G	
18000	183	F	F	F	F	F	F	F	F	G	G	H	
22000	223	F	F	F	F	F	F	F	F	G	G		
27000	273	F	F	F	F	F	F	F	F	G	G		
33000	333	F	F	F	F	F	F	F	F	G	G	G	
39000	393	F	F	F	F	F	F	F	F	G	H		
47000	473	F	F	F	F	F	F	F	F	G	H		
56000	563	F	F	F	F	F	F	F	F	G	H		
68000	683	F	F	F	F	F	F	F	F	G			
82000	823	F	F	F	F	F	F	F	F	G			
100000	104	F	F	F	F	F	F	F	F	G	G		
120000	124	F	F	F	F	F	F	F	H				
150000	154	F	F	F	F	F	F	F	H				
180000	184	F	F	F	F	F	F	F	H				
220000	224	F	F	F	F	F	F	F	H				
270000	274	F	F	F	F	F	F	F	H				
330000	334	F	F	F	F	F	F	F	H				
390000	394	F	F	F	F	F	F	F	H				
470000	474	F	F	F	F	F	F	F					
560000	564	F	F	F	F	F	F	F					
680000	684	F	F	F	F	F	F	F					
820000	824	F	F	F	F	F	G	G					
1000000	105	F	F	F	F	F	G	G					
1200000	125	F	F	F	G	G	H	H					
1500000	155	F	F	F	G	G	H	H					
1800000	185	F	F	F	G	G							
2200000	225	F	F	F	G	G							
2700000	275	F	F	F	G	G							
3300000	335	F	F	F	H	H							
3900000	395	F	F	F	H	H							
4700000	475	F	F	F									
5600000	565	F	F	F									
6800000	685	F	F	F									
8200000	825	G	G	G									
10000000	106	G	G	G									
12000000	126	H	H										
15000000	156	H	H										
18000000	186	H	H										
22000000	226	H	H										

8. 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		* Shall not exceed the limits given in the detailed spec.																																																																		
3.	Q/D.F. (Dissipation Factor)	<p>* Class I : Cap.≤1000pF, 1.0±0.2Vrms, 1MHz±10%. Cap.>1000pF, 1.0±0.2Vrms, 1KHz±10%.</p> <p>* Class II : Cap.≤10μF, 1.0±0.2Vrms, 1KHz±10%. Cap.>10μF, 0.5±0.2Vrms, 120Hz±20%.</p> <p>* Exception of Class II : (0.5±0.2Vrms, 1KHz±10%) 0805=106(6.3V&10V), 0603=475(6.3V).</p>	<table border="1"> <thead> <tr> <th>Dielectric</th> <th>Rated Vol.(V)</th> <th>Q/D.F.</th> <th>Remark</th> </tr> </thead> <tbody> <tr> <td rowspan="2">Class I</td> <td rowspan="2">All</td> <td>Q≥1000</td> <td>Cap.≥30pF</td> </tr> <tr> <td>Q≥400+20C</td> <td>Cap.<30pF</td> </tr> </tbody> </table> <p>Class II :</p> <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">≥100V</td> <td rowspan="3">≤2.5%</td> <td>≤3%</td> <td>1206≥0.47μF</td> </tr> <tr> <td>≤5%</td> <td>0805>0.1μF, 0603≥0.068μF, 1206>1μF, 1210≥2.2μF</td> </tr> <tr> <td>≤10%</td> <td>0805>0.22μF, 1210≥3.3μF</td> </tr> <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="3">25V</td> <td rowspan="3">≤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 rowspan="3">16V</td> <td rowspan="3">≤3.5%</td> <td>≤12.5%</td> <td>0402≥0.47μF</td> </tr> <tr> <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≥0.1μF(0201/X7R≥0.022μF), 0402≥0.22μF, 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> </tbody> </table>	Dielectric	Rated Vol.(V)	Q/D.F.	Remark	Class I	All	Q≥1000	Cap.≥30pF	Q≥400+20C	Cap.<30pF	Rated	D.F.≤	Exception of D.F.≤		≥100V	≤2.5%	≤3%	1206≥0.47μF	≤5%	0805>0.1μF, 0603≥0.068μF, 1206>1μF, 1210≥2.2μF	≤10%	0805>0.22μF, 1210≥3.3μF	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	16V	≤3.5%	≤12.5%	0402≥0.47μF	≤5%	0201≥0.01μF, 0402≥0.033μF, 0603≥0.15μF, 0805≥0.68μF, 1206≥2.2μF, 1210≥4.7μF	≤10%	0201≥0.1μF(0201/X7R≥0.022μF), 0402≥0.22μF, 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%	---	---
			Dielectric	Rated Vol.(V)	Q/D.F.	Remark																																																															
Class I	All	Q≥1000	Cap.≥30pF																																																																		
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Rated	D.F.≤	Exception of D.F.≤																																																																			
≥100V	≤2.5%	≤3%	1206≥0.47μF																																																																		
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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																																																																		
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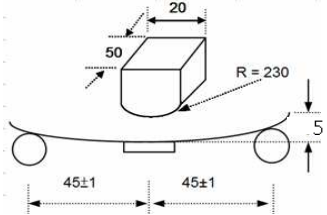
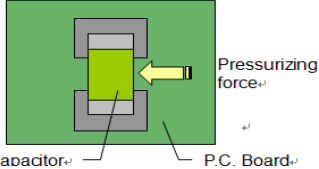
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* Charge and discharge current less than 50mA.																					
6.	Insulation Resistance	<table border="1"> <thead> <tr> <th>Rated Vol.(V)</th> <th>Apply Voltage</th> <th>Charge Time</th> </tr> </thead> <tbody> <tr> <td>≤100</td> <td>1 times of U_R</td> <td>Max. 120 sec.</td> </tr> <tr> <td>100<V≤500</td> <td>1 times of U_R</td> <td>60 sec.</td> </tr> <tr> <td>>500</td> <td>500VDC</td> <td>60 sec.</td> </tr> </tbody> </table>	Rated Vol.(V)	Apply Voltage	Charge Time	≤100	1 times of U _R	Max. 120 sec.	100<V≤500	1 times of U _R	60 sec.	>500	500VDC	60 sec.	<table border="1"> <thead> <tr> <th>Dielectric</th> <th>Capacitance Change</th> </tr> </thead> <tbody> <tr> <td>Class I</td> <td>≥100GΩ or RxC≥500Ω-F, whichever is smaller</td> </tr> <tr> <td>Class II</td> <td>≥10GΩ or RxC≥100Ω-F, whichever is smaller</td> </tr> </tbody> </table>	Dielectric	Capacitance Change	Class I	≥100GΩ or RxC≥500Ω-F, whichever is smaller	Class II	≥10GΩ or RxC≥100Ω-F, whichever is smaller
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7.	Solderability	<p>* Solder temperature : 235±5°C for (0603~1210). * Solder temperature : 245±5°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±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 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>	<p>* No remarkable damage. * Cap. change : C0G : Within ±2.5% or ±0.25pF, whichever is larger. X7R : Within ±7.5%. * D.F. / I.R. & Dielectric strength : To meet initial requirement. * 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.(°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. * Cap. change : C0G : Within ±2.5% or ±0.25pF, whichever is larger. X7R : Within ±7.5%. * Q/D.F. : C0G : Q≥100% of initial requirements. X7R : D.F.≤150% of initial requirements. * I.R. & Dielectric strength : To meet initial requirements.</p>			
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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 24±2 hrs (Class I) or 48±4 hrs (Class II).</p>	<p>* No remarkable damage. * Cap. change : C0G : Within ±5% or ±0.5pF, whichever is larger. X7R : Within ±12.5% for ≥10V**, within ±25% for ≤6.3V. **10V : 0603≥4.7μF, 0402≥1μF, 0201≥0.1μF, within ±25%. * Q/D.F. value : C0G : Q≥350 for Cap.>30pF, Q≥275+2.5C for 10pF≤Cap.≤30pF, Q≥200+10C for Cap.<10pF. X7R : D.F.≤200% of initial requirements. * I.R. : ≥10V, ≥1GΩ or RxC≥50Ω-F, whichever is smaller. 6.3V, RxC≥10Ω-F.</p>																		

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11.	Humidity (Damp Heat) Load	<p>* Reflow solder the capacitors on a P.C. Board before test.</p> <p>* Test temp. : 40±2°C (85±3°C for control code H).</p> <p>* Humidity : 90~95% RH (85±5% for control code H).</p> <p>* Test time : 500 +24/-0hrs.</p> <p>* To apply voltage : Rated voltage (500Vdc max. for general purpose and 100Vdc max. for control code H)</p> <p>* Measurement to be made after keeping at room temp. for 24±2 hrs (Class I) or 48±4 hrs (Class II).</p>	<p>* No remarkable damage.</p> <p>* Cap. change : C0G : Within ±7.5% or ±0.75pF, whichever is larger. X7R : Within ±12.5% for ≥10V**, within ±25% for ≤6.3V. **10V : 0603≥4.7μF, 0402≥1μF, 0201≥0.1μF, within ±25%.</p> <p>* Q/D.F. value : C0G : Q≥350 for Cap.>30pF, Q≥275+2.5C for 10pF≤Cap.≤30pF, Q≥200+10C for Cap.<10pF. X7R : D.F.≤200% of initial requirements.</p> <p>* I.R. : ≥10V, ≥1GΩ or RxC≥50Ω-F, whichever is smaller. 6.3V, RxC≥10Ω-F.</p>																																																																																						
12.	High Temperature Load (Endurance)	<p>* Test temp. : 125±3°C.</p> <table border="1"> <thead> <tr> <th>Rated Vol.(V)</th> <th>Apply Voltage</th> </tr> </thead> <tbody> <tr> <td>≤250</td> <td>2.0 times of U_R</td> </tr> <tr> <td>250<V≤500</td> <td>1.5 times of U_R</td> </tr> <tr> <td>630≤V≤1000</td> <td>1.2 times of U_R</td> </tr> <tr> <td>1000<V≤5000V</td> <td>1.1 times of U_R</td> </tr> <tr> <td>>5000</td> <td>1.0 times of U_R</td> </tr> </tbody> </table> <p>* Exception item (X7R only) : 100% of rated voltage for below range :</p> <table border="1"> <thead> <tr> <th>Size</th> <th>Rated Voltage</th> <th>Capacitance range</th> </tr> </thead> <tbody> <tr> <td rowspan="2">0201</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>6.3V, 10V, 16V, 25V</td> <td>C≥1.0μF</td> </tr> <tr> <td rowspan="3">0603</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>4V</td> <td>C≥47μF</td> </tr> <tr> <td>6.3V</td> <td>C≥22μF</td> </tr> <tr> <td rowspan="2">1206</td> <td>10V~50V</td> <td>C≥10μF</td> </tr> <tr> <td>≤6.3V</td> <td>C≥47μF</td> </tr> <tr> <td rowspan="2">1210</td> <td>16V</td> <td>C≥47μF</td> </tr> <tr> <td>100V</td> <td>C≥3.3μF</td> </tr> </tbody> </table> <p>150% of rated voltage for below range :</p> <table border="1"> <thead> <tr> <th>Size</th> <th>Rated Voltage</th> <th>Capacitance range</th> </tr> </thead> <tbody> <tr> <td rowspan="2">0201</td> <td>16V/25V</td> <td>C≥0.1μF</td> </tr> <tr> <td>16V</td> <td>C≥0.022μF</td> </tr> <tr> <td rowspan="2">0402</td> <td>50V</td> <td>C≥0.1μF</td> </tr> <tr> <td>10~25V</td> <td>C≥0.22μF</td> </tr> <tr> <td rowspan="2">0603</td> <td>50V</td> <td>C>0.1μF</td> </tr> <tr> <td>10V,16V, 50V</td> <td>C≥1.0μF</td> </tr> <tr> <td rowspan="3">0805</td> <td>10~50V</td> <td>C≥4.7μF</td> </tr> <tr> <td>50V</td> <td>C≥2.2μF</td> </tr> <tr> <td>100V</td> <td>C≥0.12μF</td> </tr> <tr> <td>1206</td> <td>50V~100V</td> <td>C>1.0μF</td> </tr> <tr> <td rowspan="2">1210</td> <td>50V~100V</td> <td>C≥1.0μF</td> </tr> <tr> <td>200V~250V</td> <td>C≥0.22μF</td> </tr> <tr> <td rowspan="2">1812</td> <td>100V</td> <td>C≥1.0μF</td> </tr> <tr> <td>200V~250V</td> <td>C≥0.47μF</td> </tr> <tr> <td>1825</td> <td>100V~250V</td> <td>C≥1.0μF</td> </tr> </tbody> </table> <p>* Test time : 1000 +24/-0 hrs.</p> <p>* Measurement to be made after keeping at room temp. for 24±2 hrs (Class I) or 48±4 hrs (Class II).</p>	Rated Vol.(V)	Apply Voltage	≤250	2.0 times of U _R	250<V≤500	1.5 times of U _R	630≤V≤1000	1.2 times of U _R	1000<V≤5000V	1.1 times of U _R	>5000	1.0 times of U _R	Size	Rated Voltage	Capacitance range	0201	≤10V	C≥0.1μF	≥16V	C>0.1μF	0402	6.3V, 10V, 16V, 25V	C≥1.0μF	0603	4V	C≥22μF	6.3V,10V	C≥4.7μF	25V, 35V	C≥1.0μF	0805	4V	C≥47μF	6.3V	C≥22μF	1206	10V~50V	C≥10μF	≤6.3V	C≥47μF	1210	16V	C≥47μF	100V	C≥3.3μF	Size	Rated Voltage	Capacitance range	0201	16V/25V	C≥0.1μF	16V	C≥0.022μF	0402	50V	C≥0.1μF	10~25V	C≥0.22μF	0603	50V	C>0.1μF	10V,16V, 50V	C≥1.0μF	0805	10~50V	C≥4.7μF	50V	C≥2.2μF	100V	C≥0.12μF	1206	50V~100V	C>1.0μF	1210	50V~100V	C≥1.0μF	200V~250V	C≥0.22μF	1812	100V	C≥1.0μF	200V~250V	C≥0.47μF	1825	100V~250V	C≥1.0μF	<p>* No remarkable damage.</p> <p>* Cap. change : C0G : Within ±3.0% or ±0.30pF, whichever is larger. X7R : Within ±12.5% for ≥10V**, within ±25% for ≤6.3V. **10V : 0603≥4.7μF, 0402≥1μF, 0201≥0.1μF, within ±25%.</p> <p>* Q/D.F. value : C0G : Q≥350 for Cap.>30pF, Q≥275+2.5C for 10pF≤Cap.≤30pF, Q≥200+10C for Cap.<10pF. X7R : D.F.≤200% of initial requirements.</p> <p>* I.R. : ≥10V, ≥1GΩ or RxC≥50Ω-F, whichever is smaller. 6.3V, RxC≥10Ω-F.</p>
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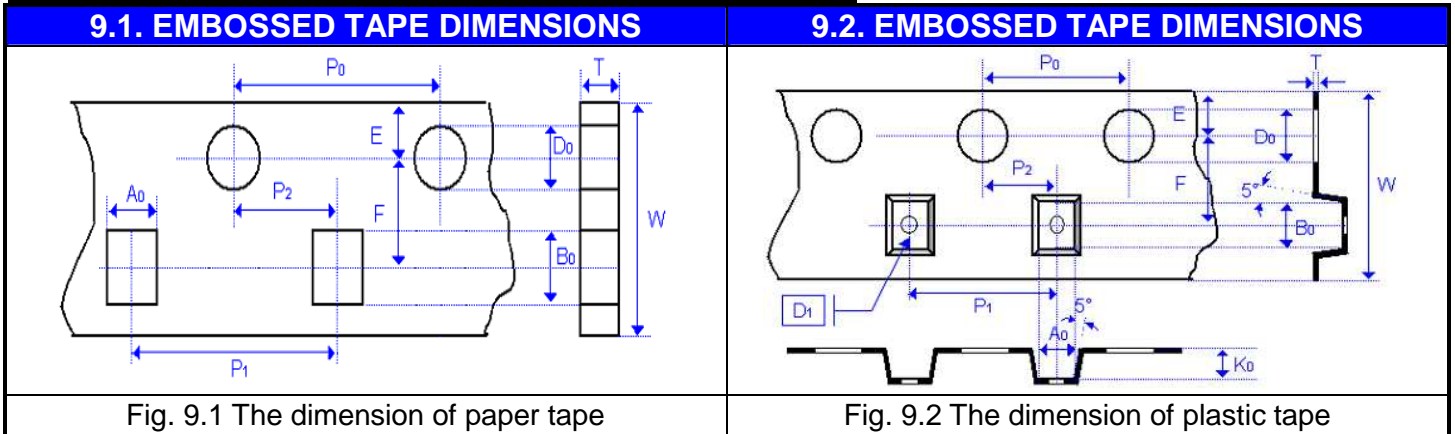
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13.	Resistance to Flexure of Substrate	<p>* The middle part of substrate shall be pressurized by means of the pressurizing rod at a rate of about 1mm per second until the deflection becomes 5mm.</p>  <p style="text-align: right;">Unit : mm</p>	<table border="1"> <tr> <td>Dielectric</td> <td>Class I</td> <td>Class II</td> </tr> <tr> <td>External Appearance</td> <td colspan="2">No remarkable damage</td> </tr> <tr> <td>Cap. Change</td> <td>Within ±3.0% or ±0.3pF, whichever is larger</td> <td>Within ±12.5%</td> </tr> </table> <p>(This capacitance change means the change of capacitance under specified flexure of substrate from the capacitance measured before the test)</p>	Dielectric	Class I	Class II	External Appearance	No remarkable damage		Cap. Change	Within ±3.0% or ±0.3pF, whichever is larger	Within ±12.5%
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Cap. Change	Within ±3.0% or ±0.3pF, whichever is larger	Within ±12.5%										
14.	Adhesive Strength of Termination	<p>* Capacitors mounted on a substrate. A force of 5N(≤ 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>* No remarkable damage or removal of the terminations.</p>									
15.	Vibration	<p>* Reflow solder the capacitors on P.C Board before test. * Vibration frequency : 10~55 Hz/min. * Total amplitude : 1.5mm. * Repeat the conditions for 2 hours each in 3 perpendicular directions.</p>	<p>* No remarkable defect. * Cap. change and Q/D.F. : To meet initial spec.</p>									

9. 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	-	-
	0.50 +0.02/-0.05	10k	50k	-	-
	0.50±0.20	10k	-	-	-
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)	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



Size	0402	0603	0603	0805	0805	1206	1206	1206
Chip Thickness	0.50±0.10	0.80±0.07	0.80 +0.15/-0.10	0.80±0.10	1.25±0.10 1.25±0.20	0.80±0.10	0.95±0.10 1.25±0.10	1.60±0.20 1.60 +0.3/-0/1
A0	0.70±0.2	1.00 +0.05/-0.10	1.02 +0.05/-0.10	1.50±0.10	<1.65	2.00±0.10	<2.00	<2.00
B0	1.20±0.2	1.80±0.10	1.80±0.10	2.30±0.10	<2.40	3.50±0.10	<3.60	<3.70
T	≤0.80	0.95±0.05	0.97±0.05	0.95±0.05	0.23±0.05	0.95±0.05	0.23±0.05	0.23±0.05
K0	-	-	-	-	<2.50	-	<2.50	<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	8.00±0.10	8.00±0.10
P0	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	4.00±0.10
10xP0	40.00±0.10	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
P1	2.00±0.05	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
P2	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	2.00±0.05
D0	1.55±0.05	1.55±0.05	1.55±0.05	1.55±0.05	1.50 +0.10/-0	1.55±0.05	1.50 +0.10/-0	1.50 +0.10/-0
D1	-	-	-	-	1.00±0.10	-	1.00±0.10	1.00±0.10
E	1.75±0.05	1.75±0.05	1.75±0.05	1.75±0.05	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	3.50±0.05	3.50±0.05	3.50±0.05
Unit :	mm	mm	mm	mm	mm	mm	mm	mm

Size	1210		1808		1812		
Chip Thickness	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
A0	<3.05	<3.10	<2.50	<2.50	<3.90	<3.90	<3.90
B0	<3.80	<4.00	<5.30	<5.30	<5.30	<5.30	<5.30
T	0.23±0.05	0.23±0.05	0.25±0.05	0.25±0.05	0.25±0.05	0.25±0.05	0.25±0.05
K0	<2.50	<3.50	<2.50	<2.50	<2.50	<2.50	<3.00
W	8.00±0.10	8.00±0.10	12.0±0.20	12.0±0.20	12.0±0.20	12.0±0.20	12.0±0.20
P0	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
10xP0	40.00±0.20	40.0±0.10	40.0±0.20	40.0±0.20	40.00±0.20	40.00±0.20	40.00±0.20
P1	4.00±0.10	4.00±0.10	4.00±0.10	4.00±0.10	8.00±0.10	8.00±0.10	8.00±0.10
P2	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
D0	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	1.50 +0.10/-0
D1	1.00±0.10	1.00±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	1.75±0.1
F	3.50±0.05	3.50±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	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	12.0±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

9.3. REEL DIMENSIONS

Size	0402, 0603, 0805 1206, 1210			1808, 1812, 1825 2220, 2225
	7"	7"	13"	7"
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

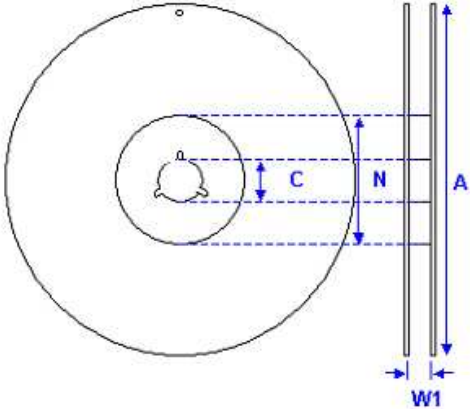


Fig. 9.3 The dimension of reel

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

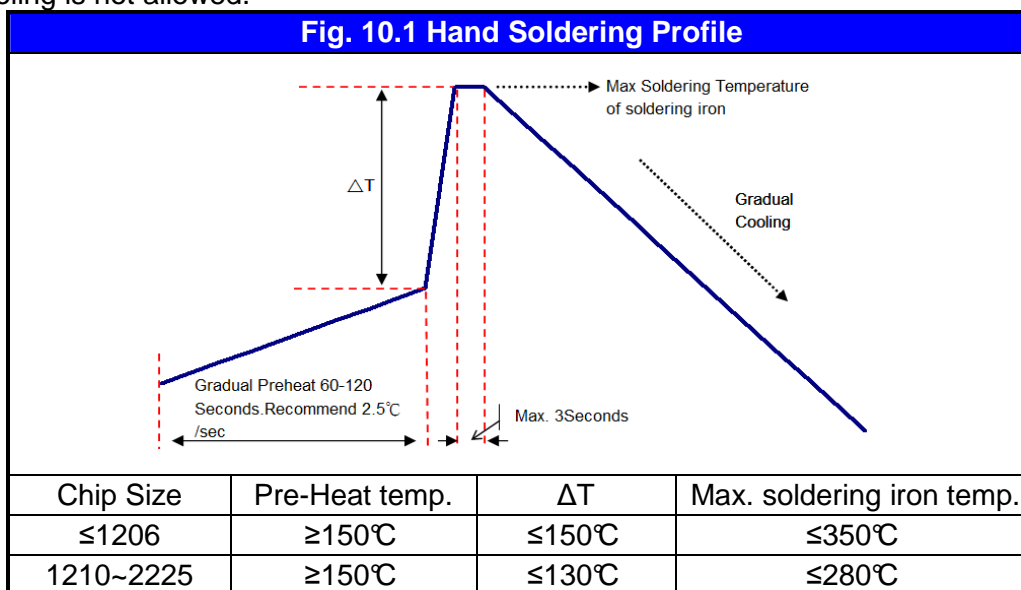
Use middy activated rosin RA and RMA fluxes do not use activated flux. The amount of solder in each solder joint should be controlled to prevent the damage of chip capacitors caused by the stress between solder, chips, and substrate.

a.) Hand soldering :

FP series or Soft termination series do not recommend using hand soldering, due to the direct contact of soldering iron might carry a huge temperature deviation to the device and damage the device.

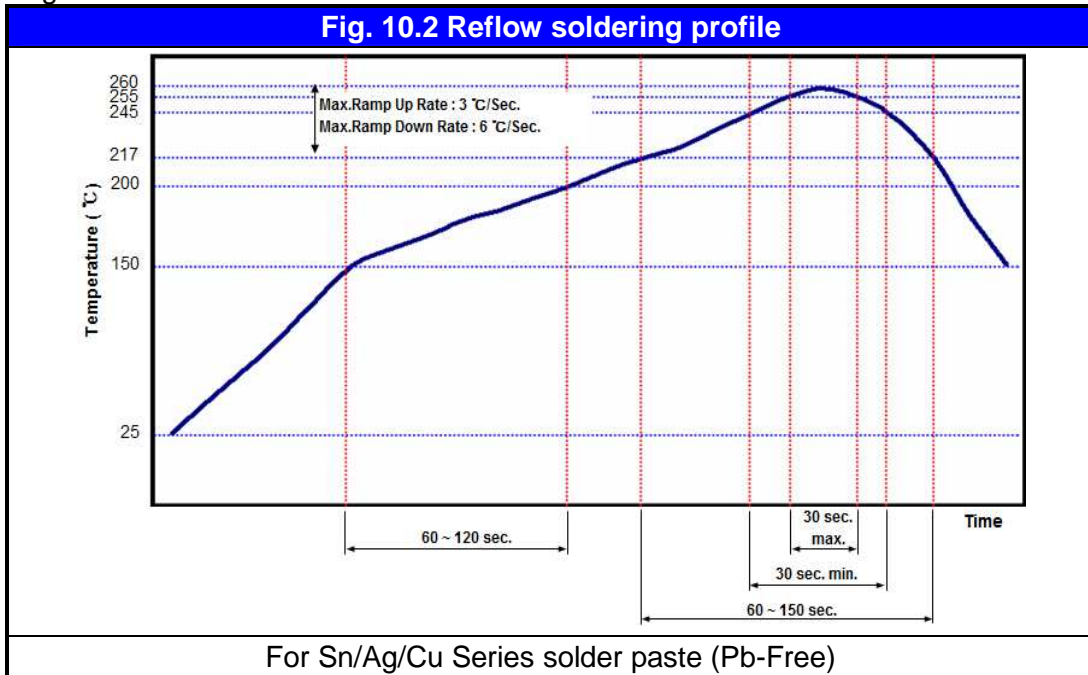
If hand soldering is an unavoidable process, please follow recommend as below :

- * 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 termination of chip capacitor directly.
- * The Capacitors shall be cooled gradually at room temperature after soldering.
- * Forced air cooling is not allowed.

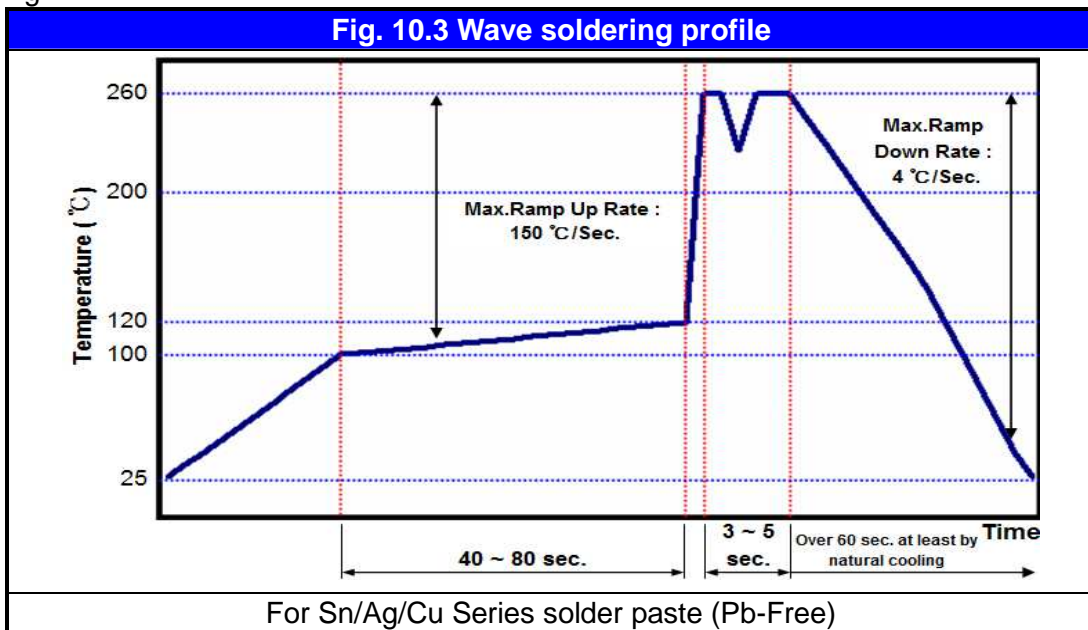


10. APPLICATION NOTES

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	Not recommended	O
0805(2012)	Class I - C0G	All	Not recommended	O
1206(3216)	Class I - C0G	All	Not recommended	O
≥1210(3225)	Class I - C0G	All	X	O

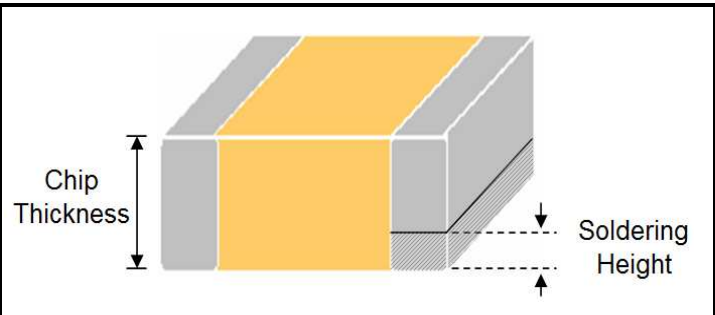
10. APPLICATION NOTES

Soldering conditions :

Class II :

Size Inch (mm)	Temper. Cher.	Capacitance	Condition	
			Wave	Reflow
≤0402(1005)	Class II - X7R	All	X	O
0603(1608)	Class II - X7R	Cap. <2.2μF	Not recommended	O
		Cap. ≥2.2μF	X	O
0805(2012)	Class II - X7R	Cap. <4.7μF	Not recommended	O
		Cap. ≥4.7μF	X	O
1206(3216)	Class II - X7R	Cap. <4.7μF	Not recommended	O
		Cap. ≥4.7μF	X	O
≥1210(3225)	Class II - X7R	All	X	O

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 on a substrate. A vertical double-headed arrow on the left indicates the 'Chip Thickness'. A horizontal dashed line with a vertical arrow pointing down from the top surface of the chip indicates the 'Soldering Height'.</p>
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COOLING

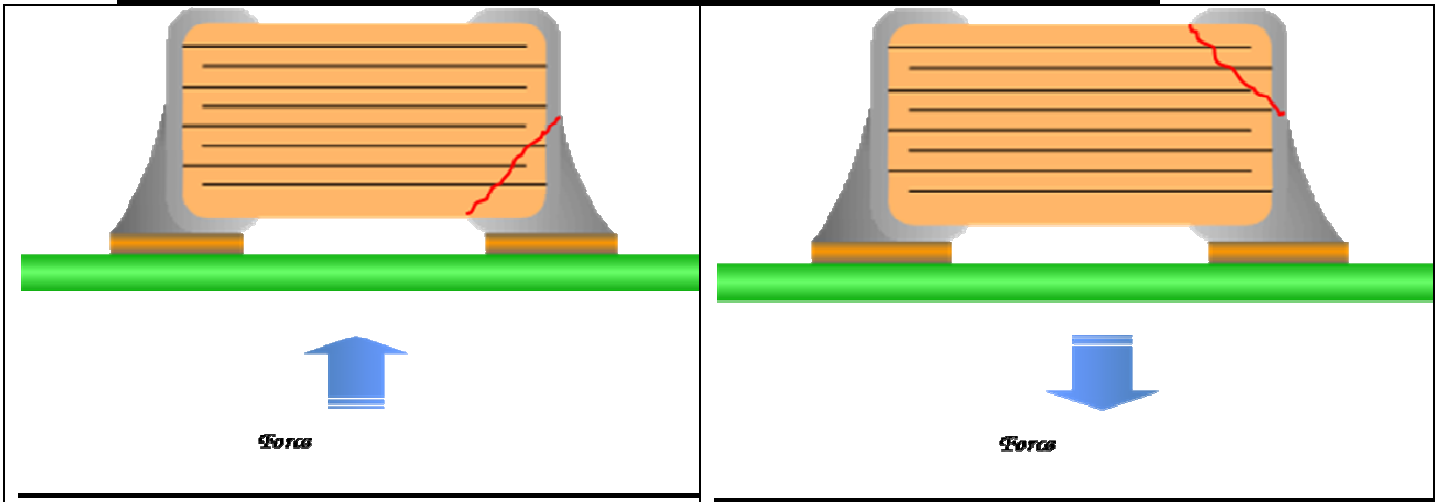
After soldering, cool the chips and the substrate gradually to room temperature. Natural cooling in air is recommended to minimize stress in the solder joint.

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.

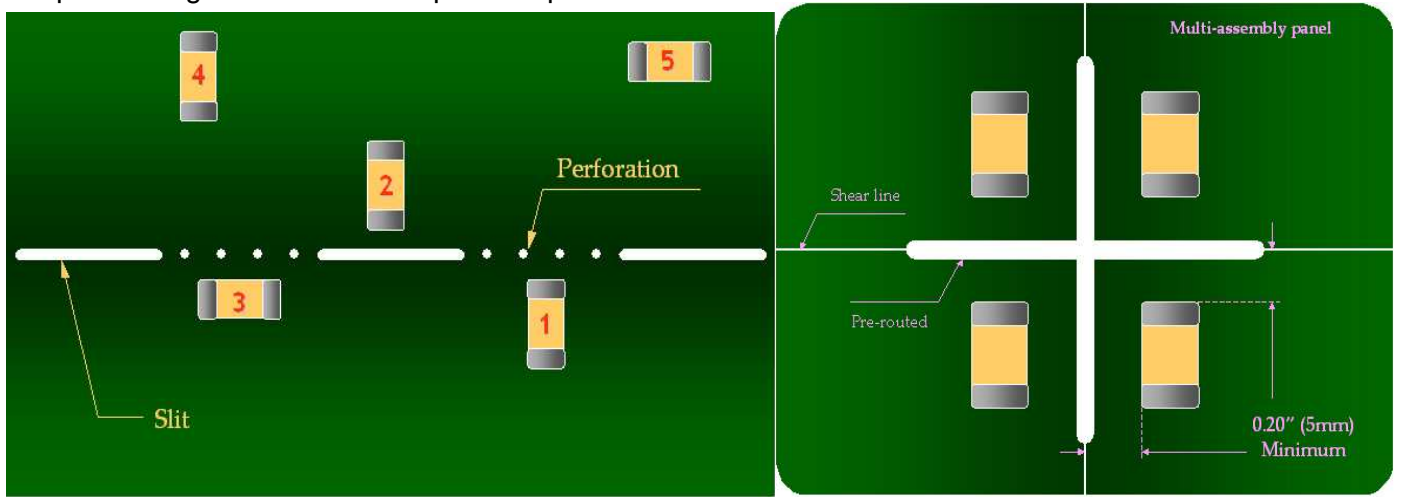
11. Typical Bending Cracks of MLCC

MLCC ceramic body is consisted of rigidity material. It will be suffered compressive and tensional stress when the carried board is bended. If the suffered stress is over ceramic body strength, the bending crack is occurred. **Therefore, the bending crack will be only occurred after soldering process.**



12. The stress v.s. position on PCB during bending

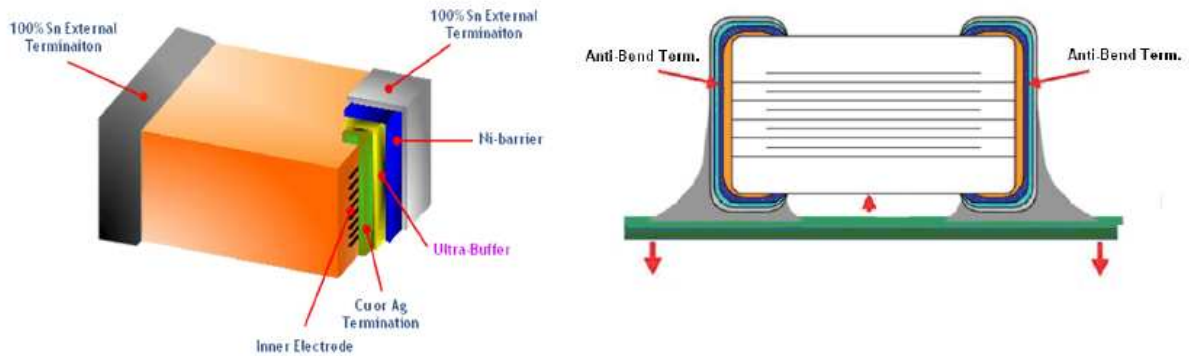
Chip mounting close to board separation point



Magnitude of stress $1 > 2 \approx 3 > 4 > 5$

13. Structure

PDC FP series is added a special termination material (Ultra-Buffer or Anti-Bend) between ceramic body and Ni-barrier that can absorb mechanical stress to prevent bending crack occurred.



14. Illustration of Bending Test

