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Date : 2021/06/11

APPROVAL SHEET

Product Name : High Reliability Multilayer Ceramic Chip Capacitors

Part No. : FR Series

Description : Size 0805~2225, C0G/X7R, 25Vdc to 4000Vdc

PREPARED BY	APPROVED BY

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SPECIFICATION

FOR

Product Name : High Reliability Multilayer Ceramic Chip Capacitors

Part No. : FR Series

Description : Size 0603~2225, C0G/X7R, 25Vdc to 4000Vdc

SPEC. No. : FR-000-001-10

DATE : 2021/06/11

DRAWN BY	CHECEKED BY	APPROVED BY
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1. INTRODUCTION

MLCC consists of a conducting material and electrodes. To manufacture a chip-type SMT and achieve miniaturization, high density and high efficiency, ceramic condensers are used.

PDC high capacitance MLCC offers low ESR and excellent frequency characteristics to be suited for coupling and decoupling applications in circuit. The high dielectric constant materials X7R are used for this series product.

2. FEATURES

- Realize high capacitance in small size.
- Capacitor with lead-free termination (pure Tin).
- RoHS & HALOGEN compliant.
- Surface mount suited for wave and reflow soldering.
- High reliability and no polarity.
- Excellent in high frequency characteristic.

3. APPLICATIONS

- Digital circuit coupling or decoupling applications.
- For high frequency and high-density type power suppliers.
- For bypassing.
- Ideal for smoothing circuits.
- DC to DC converter.

4. HOW TO ORDER

<u>FR</u>	<u>31</u>	<u>X</u>	<u>471</u>	<u>K</u>	<u>251</u>	<u>P</u>	<u>X</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
FR	High Quality Equipment Capacitor

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

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 ± 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
Q	Surface Coating (size 1206~2225)

5. EXTERNAL DIMENSIONS

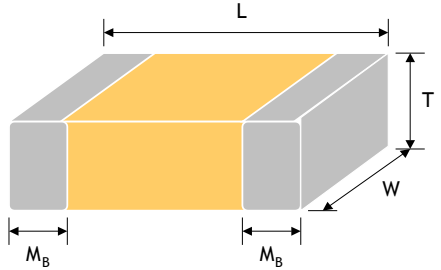
Size Inch (mm)	L (mm)	W (mm)	Code / T (mm)	M _B (mm)	
0805(2012)	2.00±0.20 2.10±0.20*	1.25±0.20	See No.4 Reference Table 8	0.50±0.20	
1206(3216)	3.20±0.20 3.30±0.30*	1.60±0.20		0.60±0.20	
1210(3225)	3.20±0.30 3.30±0.40*	2.50±0.30		0.75±0.35	
1808(4520)	4.50±0.40 4.50 +0.50/-0.30*	2.00±0.25		0.75±0.35	
1812(4532)	4.50±0.40 4.50 +0.50/-0.30*	3.20±0.30 3.20±0.40*		0.75±0.35	
1825(4563)	4.50±0.40 4.50 +0.50/-0.30*	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

“*” Means rated voltage≥1000Vdc

6. GENERAL ELECTRICAL DATA

Dielectric	C0G		X7R						
Size	0805, 1206, 1210, 1808, 1812, 1825, 2220, 2225								
Rated voltage (WVDC)	25V, 50V, 100V, 200V, 250V, 500V, 630V, 1000V, 1500V, 2000V, 3000V, 4000V								
Capacitance range*	0.5pF ~ 120nF		100pF ~ 22μF						
Capacitance tolerance	Reference to Table 5		Reference to Table 5						
Tan δ	<table><tr><td>Cap. Rang</td><td>Q Spec.</td></tr><tr><td>Cap.<30pF</td><td>Q≥400+20C</td></tr><tr><td>Cap.≥30pF</td><td>Q≥1000</td></tr></table>		Cap. Rang	Q Spec.	Cap.<30pF	Q≥400+20C	Cap.≥30pF	Q≥1000	≤2.5%~≤10%
	Cap. Rang	Q Spec.							
	Cap.<30pF	Q≥400+20C							
	Cap.≥30pF	Q≥1000							
Capacitance & Tan δ Test condition	Measured at the condition of 30~70% related humidity								
	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						
	<table><tr><td>Cap. Rang</td><td>Test Condition</td></tr><tr><td>Cap.≤1000pF</td><td>1.0±0.2Vrms, 1.0MHz±10%</td></tr><tr><td>Cap.>1000pF</td><td>1.0±0.2Vrms, 1.0kHz±10%</td></tr></table>		Cap. Rang	Test Condition	Cap.≤1000pF	1.0±0.2Vrms, 1.0MHz±10%	Cap.>1000pF	1.0±0.2Vrms, 1.0kHz±10%	1.0±0.2Vrms, 1.0KHz±10% for Cap.≤10μF and 0.5±0.2Vrms, 120Hz±20% for Cap.>10μF, at 25°C ambient temperature
	Cap. Rang	Test Condition							
	Cap.≤1000pF	1.0±0.2Vrms, 1.0MHz±10%							
Cap.>1000pF	1.0±0.2Vrms, 1.0kHz±10%								
Insulation resistance at Ur	≥100GΩ or RxC≥500Ω-F, whichever is smaller		≥10GΩ or RxC≥100Ω-F, whichever is smaller						
Operating temperature	-55°C to +125°C								
Capacitance characteristic	±30ppm/°C		±15%						
Termination	Cu/Ni/Sn (lead-free termination)								

7. CAPACITANCE RANGE

7-1. C0G

Dimension		0805							
Cap.(pF)	Code	25V	50V	100V	200V	250V	500V	630V	1000V
0.5	0R5	A	A	A	A	A	A	A	
0.6	0R6	A	A	A	A	A	A	A	
0.7	0R7	A	A	A	A	A	A	A	
0.8	0R8	A	A	A	A	A	A	A	
0.9	0R9	A	A	A	A	A	A	A	
1.0	1R0	A	A	A	A	A	A	A	
1.2	1R2	A	A	A	A	A	A	A	
1.5	1R5	A	A	A	A	A	A	A	X
1.8	1R8	A	A	A	A	A	A	A	X
2.2	2R2	A	A	A	A	A	A	A	X
2.7	2R7	A	A	A	A	A	A	A	X
3.3	3R3	A	A	A	A	A	A	A	X
3.9	3R9	A	A	A	A	A	A	A	X
4.7	4R7	A	A	A	A	A	A	A	X
5.0	5R0	A	A	A	A	A	A	A	X
5.6	5R6	A	A	A	A	A	A	A	X
6.8	6R8	A	A	A	A	A	A	A	X
8.2	8R2	A	A	A	A	A	A	A	X
10	100	A	A	A	A	A	A	A	X
12	120	A	A	A	A	A	A	A	X
15	150	A	A	A	A	A	A	A	X
18	180	A	A	A	A	A	A	A	X
22	220	A	A	A	A	A	A	A	X
27	270	A	A	A	A	A	A	A	X
33	330	A	A	A	A	A	A	A	X
39	390	A	A	A	A	A	A	A	X
47	470	A	A	A	A	A	A	A	X
56	560	A	A	A	A	A	A	A	X
68	680	A	A	A	A	A	A	A	X
82	820	A	A	A	A	A	A	A	X
100	101	A	A	A	A	A	A	A	X
120	121	A	A	A	A	A	A	A	X
150	151	A	A	A	A	A	A	A	X
180	181	A	A	A	A	A	A	A	C
220	221	A	A	A	A	A	A	A	C
270	271	A	A	A	A	A	A	A	
330	331	A	A	A	A	A	A	A	
390	391	A	A	A	A	A	A	A	
470	471	A	A	A	X	X	X	X	
560	561	A	A	A	X	X	X	X	
680	681	A	A	A	X	X	X	X	
820	821	A	A	A	M	M	M	M	
1000	102	X	X	X	M	M	M	M	
1200	122	X	X	X	C	C			
1500	152	X	X	X	C	C			
1800	182	M	M	M	C	C			
2200	222	M	M	C	C	C			
2700	272	C	C	C	C	C			
3300	332	C	C	C					
3900	392	C	C	C					
4700	472	C	C	C					
5600	562	C	C						
6800	682								
8200	822								
10000	103								

7. CAPACITANCE RANGE**7-1. C0G**

Dimension		1206											1210										
Cap.(pF)	Code	25V	50V	100V	200V	250V	500V	630V	1000V	1500V	2000V	3000V	25V	50V	100V	200V	250V	500V	630V	1000V	1500V	2000V	3000V
1.2	1R2	X	X	X																			
1.5	1R5	X	X	X	X	X	X	X	X	X	X												
1.8	1R8	X	X	X	X	X	X	X	X	X	X												
2.2	2R2	X	X	X	X	X	X	X	X	X	X												
2.7	2R7	X	X	X	X	X	X	X	X	X	X												
3.3	3R3	X	X	X	X	X	X	X	X	X	X												
3.9	3R9	X	X	X	X	X	X	X	X	X	X												
4.7	4R7	X	X	X	X	X	X	X	X	X	X												
5.0	5R0	X	X	X	X	X	X	X	X	X	X												
5.6	5R6	X	X	X	X	X	X	X	X	X	X												
6.8	6R8	X	X	X	X	X	X	X	X	X	X												
8.2	8R2	X	X	X	X	X	X	X	X	X	X												
10	100	X	X	X	X	X	X	X	X	X	X	E	M	M	M	M	M	M	M	M	M	M	F
12	120	X	X	X	X	X	X	X	X	X	X	E	M	M	M	M	M	M	M	M	M	M	F
15	150	X	X	X	X	X	X	X	X	X	X	E	M	M	M	M	M	M	M	M	M	M	F
18	180	X	X	X	X	X	X	X	X	X	X	E	M	M	M	M	M	M	M	M	M	M	F
22	220	X	X	X	X	X	X	X	X	X	X	E	M	M	M	M	M	M	M	M	M	M	F
27	270	X	X	X	X	X	X	X	X	X	X	E	M	M	M	M	M	M	M	M	M	M	F
33	330	X	X	X	X	X	X	X	X	X	X	E	M	M	M	M	M	M	M	M	M	M	F
39	390	X	X	X	X	X	X	X	X	X	X	E	M	M	M	M	M	M	M	M	M	M	F
47	470	X	X	X	X	X	X	X	X	X	X	E	M	M	M	M	M	M	M	M	M	M	F
56	560	X	X	X	X	X	X	X	X	X	X	E	M	M	M	M	M	M	M	M	M	M	F
68	680	X	X	X	X	X	X	X	X	X	X	E	M	M	M	M	M	M	M	M	M	M	F
82	820	X	X	X	X	X	X	X	X	X	X	E	M	M	M	M	M	M	M	M	M	M	F
100	101	X	X	X	X	X	X	X	X	X	X	E	M	M	M	M	M	M	M	M	M	M	F
120	121	X	X	X	X	X	X	X	X	X	X	E	M	M	M	M	M	M	M	M	M	M	F
150	151	X	X	X	X	X	X	X	M	M	M		M	M	M	M	M	M	M	M	M	M	F
180	181	X	X	X	X	X	X	M	M	M	M		M	M	M	M	M	M	M	M	M	M	F
220	221	X	X	X	X	X	X	X	M	C	C		M	M	M	M	M	M	M	M	M	M	F
270	271	X	X	X	X	X	X	X	M	C	C		M	M	M	M	M	M	M	M	M	M	G
330	331	X	X	X	X	X	X	X	C	E	E		M	M	M	M	M	M	M	M	M	M	
390	391	X	X	X	X	X	X	X	C	E	E		M	M	M	M	M	M	M	M	M	M	
470	471	X	X	X	X	X	X	X	C				M	M	M	M	M	M	M	M	C	C	
560	561	X	X	X	X	X	X	X	E				M	M	M	M	M	M	M	C	C	C	
680	681	X	X	X	X	X	X	X	E				M	M	M	M	M	M	M	C	E	E	
820	821	X	X	X	X	X	X	X	E				M	M	M	M	M	M	M	E	E	E	
1000	102	X	X	X	X	X	X	X	E				M	M	M	C	C	C	C	E	F	F	
1200	122	X	X	X	X	X	X	X					M	M	M	C	C	C	C	E	F	F	
1500	152	X	X	X	M	M	M	M					M	M	M	C	C	C	C	F	G	G	
1800	182	X	X	X	M	M	M	M					M	M	M	C	C	C	C	G	G	G	
2200	222	X	X	M	C	C	C	C					M	M	M	C	C	C	C	G			
2700	272	X	X	M	C	C	C	C					M	M	M	C	C	C	C				
3300	332	M	M	C	C	C	C	C					M	M	M	C	C	C	C				
3900	392	M	M	C	E	E	E	E					M	M	M	C	C	C	C				
4700	472	C	C	C	E	E	E	E					M	M	M	C	C	C	C				
5600	562	C	C	E	E	E	E						M	M	M	C	C	C	C				
6800	682	M/C	M/C	E	E	E	E						C	C	C	E	E	E	E				
8200	822	E	E	E	E	E							C	C	C	E	E	E	E				
10000	103	E	E	E	E	E							C	C	C	F	F	F	F				
12000	123	E	E										E	E	E								
15000	153	E	E										E	E	F								
18000	183	E	E										F	F	G								
22000	223												F	F	G								
27000	273												G	G									
33000	333												G	G									
39000	393												G	G									
47000	473																						
56000	563																						
68000	683																						

7. CAPACITANCE RANGE

7-1. C0G

Dimension		1808												
Cap.(pF)	Code	25V	50V	100V	200V	250V	500V	630V	1000V	1500V	2000V	3000V	4000V	
2.2	2R2	C	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	C	
3.3	3R3	C	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	C	
4.7	4R7	C	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	C	
5.6	5R6	C	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	C	
8.2	8R2	C	C	C	C	C	C	C	C	C	C	C	C	
10	100	C	C	C	C	C	C	C	C	C	C	C	C	
12	120	C	C	C	C	C	C	C	C	C	C	C	C	
15	150	C	C	C	C	C	C	C	C	C	C	C	C	
18	180	C	C	C	C	C	C	C	C	C	C	C	C	
22	220	C	C	C	C	C	C	C	C	C	C	C	E	
27	270	C	C	C	C	C	C	C	C	C	C	C	E	
33	330	C	C	C	C	C	C	C	C	C	C	C	E*	
39	390	C	C	C	C	C	C	C	C	C	C	C	F*	
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	C		
120	121	C	C	C	C	C	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	E		
270	271	C	C	C	C	C	C	C	C	C	C	E		
330	331	C	C	C	C	C	C	C	C	C	C	F		
390	391	C	C	C	C	C	C	C	C	C	C	F		
470	471	C	C	C	C	C	C	C	C	C	C	F		
560	561	C	C	C	C	C	C	C	C	C	C			
680	681	C	C	C	C	C	C	C	C	C	C			
820	821	C	C	C	C	C	C	C	C	C	C			
1000	102	C	C	C	C	C	C	C	C	E	E			
1200	122	C	C	C	C	C	C	C	E	E	E			
1500	152	C	C	C	C	C	C	C	E	F	F			
1800	182	C	C	C	C	C	C	C	F	F	F			
2200	222	C	C	C	C	C	C	C	F					
2700	272	C	C	C	C	C	C	C						
3300	332	C	C	C	C	C	C	C						
3900	392	C	C	C	C	C	C	C						
4700	472	C	C	C	C	C	C	C						
5600	562	C	C	C	E	E	E	E						
6800	682	C	C	C	E	E								
8200	822	C	C	E	F	F								
10000	103	C	C	E	F	F								
12000	123	E	E	F										
15000	153	E	E											
18000	183	F	F											
22000	223	F	F											
27000	273													
33000	333													
39000	393													
47000	473													
56000	563													
68000	683													
82000	823													
100000	104													
120000	124													
150000	154													

7. CAPACITANCE RANGE(Con.)

7-1. C0G

Dimension		1812											
Cap.(pF)	Code	25V	50V	100V	200V	250V	500V	630V	1000V	1500V	2000V	3000V	4000V
2.2	2R2												
2.7	2R7												
3.3	3R3												
3.9	3R9												
4.7	4R7												
5.0	5R0												
5.6	5R6												
6.8	6R8												
8.2	8R2												
10	100	C	C	C	C	C	C	C	C	C	C	C	C
12	120	C	C	C	C	C	C	C	C	C	C	C	C
15	150	C	C	C	C	C	C	C	C	C	C	C	C
18	180	C	C	C	C	C	C	C	C	C	C	C	C
22	220	C	C	C	C	C	C	C	C	C	C	C	C
27	270	C	C	C	C	C	C	C	C	C	C	C	C
33	330	C	C	C	C	C	C	C	C	C	C	C	C*
39	390	C	C	C	C	C	C	C	C	C	C	C	C*
47	470	C	C	C	C	C	C	C	C	C	C	C	E*
56	560	C	C	C	C	C	C	C	C	C	C	C	E*
68	680	C	C	C	C	C	C	C	C	C	C	C	F*
82	820	C	C	C	C	C	C	C	C	C	C	C	F*
100	101	C	C	C	C	C	C	C	C	C	C	C	F*
120	121	C	C	C	C	C	C	C	C	C	C	C	G*
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	
270	271	C	C	C	C	C	C	C	C	C	C	C	
330	331	C	C	C	C	C	C	C	C	C	C	C	
390	391	C	C	C	C	C	C	C	C	C	C	C	
470	471	C	C	C	C	C	C	C	C	C	C	F	
560	561	C	C	C	C	C	C	C	C	C	C	F	
680	681	C	C	C	C	C	C	C	C	C	C	F	
820	821	C	C	C	C	C	C	C	C	C	C	G	
1000	102	C	C	C	C	C	C	C	C	C	C	G	
1200	122	C	C	C	C	C	C	C	C	F	F		
1500	152	C	C	C	C	C	C	C	C	F	F		
1800	182	C	C	C	C	C	C	C	E	F	F		
2200	222	C	C	C	C	C	C	C	E	F	F		
2700	272	C	C	C	C	C	C	C	F	G	G		
3300	332	C	C	C	C	C	C	C	G	F	G		
3900	392	C	C	C	C	C	C	C	G				
4700	472	C	C	C	C	C	C	C	G				
5600	562	C	C	C	C	C	C	C	G				
6800	682	C	C	C	C	C	C	C					
8200	822	C	C	C	C	C	C	C					
10000	103	C	C	C	C	C	C	C					
12000	123	C	C	C	E	E	E	E					
15000	153	C	C	C	E	E	E	E					
18000	183	C	C	E	F	F	F	F					
22000	223	C	C	E	F	F	F	F					
27000	273	E	C	F	G	G							
33000	333	E	C	F									
39000	393	F	F	G									
47000	473	F	F	G									
56000	563	G	G										
68000	683	G	G										
82000	823	G	G										
100000	104	G	G										
120000	124												
150000	154												

* Surface coating only.

7. CAPACITANCE RANGE(Con.)

7-1. C0G

Dimension		1825											2220											
Cap.(pF)	Code	25V	50V	100V	200V	250V	500V	630V	1000V	1500V	2000V	3000V	25V	50V	100V	200V	250V	500V	630V	1000V	1500V	2000V	3000V	4000V
10	100	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	
12	120	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	
15	150	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	
18	180	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	
22	220	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	
27	270	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	
33	330	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	
39	390	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	
47	470	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	
56	560	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	
68	680	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	
82	820	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	
100	101	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	
120	121	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	
150	151	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	
180	181	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	
220	221	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	
270	271	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	G
330	331	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	G
390	391	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	
470	471	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	
560	561	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	
680	681	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	
820	821	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	
1000	102	F	F	F	F	F	F	F	F	F	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	F	F	F	F	F	F	F	F	F	F	
1500	152	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	
1800	182	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	
2200	222	F	F	F	F	F	F	F	F	F	F	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	F	F	F	F	F	F	F	F	F	
3300	332	F	F	F	F	F	F	F	F	F	F		F	F	F	F	F	F	F	F	F	F	F	
3900	392	F	F	F	F	F	F	F	G	F	F		F	F	F	F	F	F	F	F	F	F	F	
4700	472	F	F	F	F	F	F	F	G	F	F		F	F	F	F	F	F	F	F	F	F	F	
5600	562	F	F	F	F	F	F	F	G				F	F	F	F	F	F	F	F				
6800	682	F	F	F	F	F	F	F	G				F	F	F	F	F	F	F	F				
8200	822	F	F	F	F	F	F	F	G				F	F	F	F	F	F	F	G				
10000	103	F	F	F	F	F	F	F	G				F	F	F	F	F	F	F	G				
12000	123	F	F	F	F	F	F	F					F	F	F	F	F	F	F					
15000	153	F	F	F	F	F	F	F					F	F	F	F	F	F	F					
18000	183	F	F	F	F	F	F	F					F	F	F	F	F	F	F					
22000	223	F	F	F	F	F	F	F					F	F	F	F	F	F	F					
27000	273	F	F	F	F	F	F	F					F	F	F	F	F	F	F					
33000	333	F	F	F	F	F	F	F					F	F	F	F	F	F						
39000	393	F	F	F	F	F	G	G					F	F	F	F	F	F						
47000	473	F	F	F	F	F							F	F	F	G	G	G						
56000	563	F	F	F	G	G							F	F	F	G	G							
68000	683	F	F	F	G	G							F	F	F	G	G							
82000	823	F	F	G									F	F	G									
100000	104	G	G	G									G	G	G									
120000	124																							
150000	154																							
180000	184																							
220000	224																							
270000	274																							

7. CAPACITANCE RANGE(Con.)

7-1. C0G

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

7. CAPACITANCE RANGE

7-2. X7R

Dimension		0805							
Cap.(pF)	Code	25V	50V	100V	200V	250V	500V	630V	1000V
100	101	X	X	X	X	X	X	X	X
120	121	X	X	X	X	X	X	X	X
150	151	X	X	X	X	X	X	X	X
180	181	X	X	X	X	X	X	X	X
220	221	X	X	X	X	X	X	X	X
270	271	X	X	X	X	X	X	X	X
330	331	X	X	X	X	X	X	X	X
390	391	X	X	X	X	X	X	X	X
470	471	X	X	X	X	X	X	X	X
560	561	X	X	X	X	X	X	X	X
680	681	X	X	X	X	X	X	X	X
820	821	X	X	X	X	X	X	X	X
1000	102	X	X	X	X	X	X	X	X
1200	122	X	X	X	X	X	X	X	
1500	152	X	X	X	X	X	X	X	
1800	182	X	X	X	X	X	X	X	
2200	222	X	X	X	X	X	X	X	
2700	272	X	X	X	X	X	X	X	
3300	332	X	X	X	X	X	X	X	
3900	392	X	X	X	X	X	X	X	
4700	472	X	X	X	X	X	C	C	
5600	562	X	X	X	X	X	C	C	
6800	682	X	X	X	X	X	C	C	
8200	822	X	X	X	C	C	C	C	
10000	103	X	X	X	C	C	C	C	
12000	123	X	X	X	C	C	C	C	
15000	153	X	X	X	C	C	C	C	
18000	183	X	X	X	C	C	C	C	
22000	223	X	X	X	C	C	C	C	
27000	273	X	X	C	C	C			
33000	333	X	X	C	C	C			
39000	393	X	X	C					
47000	473	X	X	C					
56000	563	X	X	C					
68000	683	X	X	C					
82000	823	X	X	C					
100000	104	X	X	C					
120000	124	X	C	C					
150000	154	C	C	C					
180000	184	C	C	C					
220000	224	C	C	C					
270000	274	C	C/I	C					
330000	334	C	C/I	C					
390000	394	C	C/I	C					
470000	474	C	C/I	C/I					
560000	564	C	C/I						
680000	684	C	C/I						
820000	824	C	C/I						
1000000	105	C/I	C/I						

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7. CAPACITANCE RANGE

7-2. X7R

Dimension		1206											1210									
Cap.(pF)	Code	25V	50V	100V	200V	250V	500V	630V	1000V	1500V	2000V	2500V	25V	50V	100V	200V	250V	500V	630V	1000V	1500V	2000V
100	101	X	X	X	X	X	X	X	X	X	X											
120	121	X	X	X	X	X	X	X	X	X	X											
150	151	X	X	X	X	X	X	X	X	X	X											
180	181	X	X	X	X	X	X	X	X	X	X											
220	221	X	X	X	X	X	X	X	X	X	X		M	M	M	M	M	M	M	M	M	M
270	271	X	X	X	X	X	X	X	X	X	X		M	M	M	M	M	M	M	M	M	M
330	331	X	X	X	X	X	X	X	X	X	X		M	M	M	M	M	M	M	M	M	M
390	391	X	X	X	X	X	X	X	X	X	X		M	M	M	M	M	M	M	M	M	M
470	471	X	X	X	X	X	X	X	X	X	X		M	M	M	M	M	M	M	M	M	M
560	561	X	X	X	X	X	X	X	X	X	X		M	M	M	M	M	M	M	M	M	M
680	681	X	X	X	X	X	X	X	X	M	M	C*	M	M	M	M	M	M	M	M	M	M
820	821	X	X	X	X	X	X	X	X	M	M	C*	M	M	M	M	M	M	M	M	M	M
1000	102	X	X	X	X	X	X	X	X	C	C	E*	M	M	M	M	M	M	M	M	C	C
1200	122	X	X	X	X	X	X	X	X	E	E	E*	M	M	M	M	M	M	M	M	E	E
1500	152	X	X	X	X	X	X	X	X	E	E	E*	M	M	M	M	M	M	M	M	E	E
1800	182	X	X	X	X	X	X	X	X	E	E	E*	M	M	M	M	M	M	M	M	E	E
2200	222	X	X	X	X	X	X	X	X	E	E	E*	M	M	M	M	M	M	M	M	F	F
2700	272	X	X	X	X	X	X	X	X	E	E	E*	M	M	M	M	M	M	M	M	F	G
3300	332	X	X	X	X	X	X	X	X	E	E	E*	M	M	M	M	M	M	M	M	F	G
3900	392	X	X	X	X	X	X	X	X	E	E	E*	M	M	M	M	M	M	M	M	G	G
4700	472	X	X	X	X	X	X	X	X	E	E	E*	M	M	M	M	M	M	M	M	F/G	F/G
5600	562	X	X	X	X	X	X	X	X				M	M	M	M	M	M	M	M	G	G*
6800	682	X	X	X	X	X	X	X	M				M	M	M	M	M	M	M	M	G	G*
8200	822	X	X	X	X	X	X	X	M				M	M	M	M	M	M	M	M	G	G*
10000	103	X	X	X	X	X	M	M	M				M	M	M	M	M	M	M	C	G	G*
12000	123	X	X	X	X	X	C	C	C				M	M	M	M	M	M	M	C	G	
15000	153	X	X	X	X	X	C	C	C	E			M	M	M	M	M	M	M	E	G	
18000	183	X	X	X	X	X	C	C	E				M	M	M	M	M	C	C	E	G	
22000	223	X	X	X	X	X	E	E	E				M	M	M	M	M	C	C	E	G	
27000	273	X	X	X	X	X	E	E					M	M	M	M	M	C	C	E	G	
33000	333	X	X	X	X	X	E	E					M	M	M	M	M	E	E	E	G	
39000	393	X	X	X	X	X	E	E					M	M	M	M	M	E	E	E	F	
47000	473	X	X	X	M	M	E	E					M	M	M	M	M	E	E	E	G	
56000	563	X	X	X	C	C							M	M	M	M	M	E	E			
68000	683	X	X	X	E	E							M	M	M	M	M	F	F			
82000	823	X	X	X	C	C							M	M	M	M	M	F	F			
100000	104	X	X	X	E	E							M	M	M	M	M	F	F			
120000	124	X	X	X									M	M	M	E	E	G	G			
150000	154	X	X	X									M	M	M	E	E					
180000	184	X	X	M									M	M	M	E	E					
220000	224	X	X	M									M	M	M	E	E					
270000	274	X	X	C									M	M	M	F	F					
330000	334	X	X	E									M	M	M	F	F					
390000	394	J	P	E									M	M	C	G	G					
470000	474	J/C	C	E									M	M	C	G	G					
560000	564	C	P	P									M	M	E	G	G					
680000	684	C	C	P									M	M	E	G	G					
820000	824	E	E	P									C	C	P							
1000000	105	J/P	P	P									C	C	P							
1200000	125	P	P										P	P	F							
1500000	155	P	P										E	G	G							
1800000	185	P	P										F	F	F							
2200000	225	P	P										G	G	G							
2700000	275												G	G	G							
3300000	335												G	G	G							
3900000	395												G	G								
4700000	475												G	G								

* Surface coating only.

7. CAPACITANCE RANGE(Con.)

7-2. X7R

Dimension		1808												1812											
Cap.(pF)	Cod e	25V	50V	100V	200V	250V	500V	630V	1000V	1500V	2000V	3000V	4000V	25V	50V	100V	200V	250V	500V	630V	1000V	1500V	2000V	3000V	4000V
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*	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*	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*	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*	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*	C	C	C	C	C	C	C	C	C	C	C	F*
680	681	C	C	C	C	C	C	C	C	C	C	E	F*	C	C	C	C	C	C	C	C	C	C	C	F*
820	821	C	C	C	C	C	C	C	C	C	C	E	F*	C	C	C	C	C	C	C	C	C	C	C	F*
1000	102	C	C	C	C	C	C	C	C	C	C	F	F*	C	C	C	C	C	C	C	C	C	C	E	F*
1200	122	C	C	C	C	C	C	C	C	C	C	F		C	C	C	C	C	C	C	C	C	C	F	G*
1500	152	C	C	C	C	C	C	C	C	C	C	F		C	C	C	C	C	C	C	C	C	C	F	G*
1800	182	C	C	C	C	C	C	C	C	C	C	F		C	C	C	C	C	C	C	C	C	C	G	G*
2200	222	C	C	C	C	C	C	C	C	E	E	F		C	C	C	C	C	C	C	C	C	C	G*	
2700	272	C	C	C	C	C	C	C	C	F	F	F		C	C	C	C	C	C	C	C	C	C	G*	
3300	332	C	C	C	C	C	C	C	C	F	F	F		C	C	C	C	C	C	C	C	E	E	G*	
3900	392	C	C	C	C	C	C	C	C	F	F	F*		C	C	C	C	C	C	C	C	F	F	G*	
4700	472	C	C	C	C	C	C	C	C	F	F	F*		C	C	C	C	C	C	C	F	F	F	G	
5600	562	C	C	C	C	C	C	C	C	F	F			C	C	C	C	C	C	C	G	G			
6800	682	C	C	C	C	C	C	C	C	F	F			C	C	C	C	C	C	C	G	G			
8200	822	C	C	C	C	C	C	C	C	F*	F*			C	C	C	C	C	C	C	G	G			
10000	103	C	C	C	C	C	C	C	C	F*	F*			C	C	C	C	C	C	C	E/F/G	E/F/G			
12000	123	E	E	E	E	E	E	E	E					C	C	C	C	C	C	C					
15000	153	E	E	E	E	E	E	E	E					C	C	C	C	C	C	C					
18000	183	E	E	E	E	E	F	F	F					C	C	C	C	C	C	C	E				
22000	223	E	E	E	E	E	F	F	F					C	C	C	C	C	C	C	E				
27000	273	E	E	E	E	E	F	F	F					C	C	C	C	C	C	C	F				
33000	333	E	E	E	E	E	F	F	F					C	C	C	C	C	C	C	F				
39000	393	E	E	E	E	E	F	F	F					C	C	C	C	C	C	C	G				
47000	473	E	E	E	E	E	F	F	F					C	C	C	C	C	C	C	F/G				
56000	563	E	E	E	E	E	F	F	F					C	C	C	C	C	E	E	G				
68000	683	E	E	E	E	E	F	F						C	C	C	C	C	E	E	G				
82000	823	E	E	E	E	E	F	F						C	C	C	C	C	E	E	G				
100000	104	E	E	E	E	E								C	C	C	C	C	E	E	G				
120000	124	E	E	E										C	C	C	C	C	F	F					
150000	154	E	E	E										C	C	C	C	C	F	F					
180000	184													C	C	C	C	C	G	G					
220000	224													C	C	C	C	C	G	G					
270000	274													C	C	C	E	E	G						
330000	334													C	C	C	E	E	G						
390000	394													C	C	C	F	F	G						
470000	474													C	C	C	F	F	G						
560000	564													C	C	C	G	G							
680000	684													C	C	C	G	G							
820000	824													C	C	C	G	G							
1000000	105													C	C	C	G	G							
1200000	125													C	C	C									
1500000	155													C	C	C									
1800000	185													E	E	E									
2200000	225													E	E	E									
2700000	275													F	F	F									
3300000	335													F	F	F									
3900000	395													F	F	F									
4700000	475													G	G	G									
5600000	565													G	G										
6800000	685													G	G										
8200000	825													G	G										
10000000	106													G	G										

* Surface coating only.

7. CAPACITANCE RANGE

7-2. X7R

Dimension		1825											
Cap.(pF)	Code	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	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	G*
6800	682	F	F	F	F	F	F	F	F	F	F	F	G*
8200	822	F	F	F	F	F	F	F	F	F	F	F	G*
10000	103	F	F	F	F	F	F	F	F	F	F	F	G*
12000	123	F	F	F	F	F	F	F	F	G	G	G	H*
15000	153	F	F	F	F	F	F	F	F	G	G	G	H*
18000	183	F	F	F	F	F	F	F	F	G	G	G	H*
22000	223	F	F	F	F	F	F	F	F	G	G	G	
27000	273	F	F	F	F	F	F	F	F	H	H	H	
33000	333	F	F	F	F	F	F	F	F	H	H	H	
39000	393	F	F	F	F	F	F	F	F	H	H	H	
47000	473	F	F	F	F	F	F	F	F	H	H	H	
56000	563	F	F	F	F	F	F	F	F	H	H	H	
68000	683	F	F	F	F	F	F	F	F				
82000	823	F	F	F	F	F	F	F	F				
100000	104	F	F	F	F	F	F	F	G				
120000	124	F	F	F	F	F	F	F	F				
150000	154	F	F	F	F	F	F	F	F				
180000	184	F	F	F	F	F	F	F	F				
220000	224	F	F	F	F	F	F	F	F				
270000	274	F	F	F	F	F	F	F	F				
330000	334	F	F	F	F	F	F	F	F				
390000	394	F	F	F	F	F	F	F	F				
470000	474	F	F	F	F	F	F	F	F				
560000	564	F	F	F	F	F	G	G					
680000	684	F	F	F	F	F							
820000	824	F	F	F	F	F							
1000000	105	F	F	F	F	F							
1200000	125	F	F	F	G								
1500000	155	F	F	F	G								
1800000	185	F	F	F	G								
2200000	225	F	F	F	G								
2700000	275	F	F	F									
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									

* Surface coating only.

7. CAPACITANCE RANGE(Con.)

7-2. X7R

Dimension		2220												2225											
Cap.(pF)	Code	25V	50V	100V	200V	250V	500V	630V	1000V	1500V	2000V	3000V	4000V	25V	50V	100V	200V	250V	500V	630V	1000V	1500V	2000V	3000V	4000V
100	101																								
120	121																								
150	151																								
180	181																								
220	221																								
270	271																								
330	331												F*												F*
390	391												F*												F*
470	471												F*										E		F*
560	561												F*												F*
680	681												F*												F*
820	821												F*												F*
1000	102	F	F	F	F	F	F	F	F	F	F	F	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	G*	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*	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*	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*	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*	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*	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*	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*	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*	F	F	F	F	F	F	F	F	F	F	F	G*
6800	682	F	F	F	F	F	F	F	F	F	F	F	G*	F	F	F	F	F	F	F	F	F	F	F	G*
8200	822	F	F	F	F	F	F	F	F	F/G	F/G	G*		F	F	F	F	F	F	F	F	F	F	F	G*
10000	103	F	F	F	F	F	F	F	F	G	G	G*		F	F	F	F	F	F	F	F	F	F	F	G*
12000	123	F	F	F	F	F	F	F	F	G	G	H*		F	F	F	F	F	F	F	F	F	G	G	G*
15000	153	F	F	F	F	F	F	F	F	G	G	H*		F	F	F	F	F	F	F	F	G	G	G	G*
18000	183	F	F	F	F	F	F	F	F	H	H	H*		F	F	F	F	F	F	F	F	G	G	G	H*
22000	223	F	F	F	F	F	F	F	F	H	H			F	F	F	F	F	F	F	F	F/G	F/G		
27000	273	F	F	F	F	F	F	F	F	H	H			F	F	F	F	F	F	F	F	G	G		
33000	333	F	F	F	F	F	F	F	F	H	H			F	F	F	F	F	F	F	F	G	G		
39000	393	F	F	F	F	F	F	F	F	H	H			F	F	F	F	F	F	F	F	G	H		
47000	473	F	F	F	F	F	F	F	F	H	H			F	F	F	F	F	F	F	F	G	H		
56000	563	F	F	F	F	F	F	F	F	H	H			F	F	F	F	F	F	F	F	G	H		
68000	683	F	F	F	F	F	F	F	G					F	F	F	F	F	F	F	F	G			
82000	823	F	F	F	F	F	F	F	G					F	F	F	F	F	F	F	F	G			
100000	104	F	F	F	F	F	F	F	G					F	F	F	F	F	F	F	G	G			
120000	124	F	F	F	F	F	F	F	F/G					F	F	F	F	F	F	F	H				
150000	154	F	F	F	F	F	F	F	H					F	F	F	F	F	F	F	H				
180000	184	F	F	F	F	F	F	F	H					F	F	F	F	F	F	F	H				
220000	224	F	F	F	F	F	F	F	H					F	F	F	F	F	F	F	H				
270000	274	F	F	F	F	F	F	F						F	F	F	F	F	F	F					
330000	334	F	F	F	F	F	F	F						F	F	F	F	F	F	F					
390000	394	F	F	F	F	F	F	F						F	F	F	F	F	F	F					
470000	474	F	F	F	F	F	F	F						F	F	F	F	F	F	F					
560000	564	F	F	F	F	F	G	G						F	F	F	F	F	F	F					
680000	684	F	F	F	F	F	G	G						F	F	F	F	F	F	F					
820000	824	F	F	F	F	F								F	F	F	F	F	F	F					
1000000	105	F	F	F	F	F								F	F	F	F	F	F	F					
1200000	125	F	F	F	G	G								F	F	F	G	G	G	G					
1500000	155	F	F	F	G	G								F	F	F	G	G	G	G					
1800000	185	F	F	F	G	G								F	F	F	G	G	G	G					
2200000	225	F	F	F	G	G								F	F	F	G	G	G	G					
2700000	275	F	F	F										F	F	F	G	G	G	G					
3300000	335	F	F	F										F	F	F									
3900000	395	F	F	F										F	F	F									
4700000	475	F	F	F										F	F	G									
5600000	565	F	F	F										F	F	F									
6800000	685	F	F	F										F	F	F									
8200000	825	G	G	G										G	G	G									
10000000	106	G	G	G										G	G	G									
12000000	126	H	H																						
15000000	156	H	H																						
18000000	186	H	H																						
22000000	226	H	H																						

* Surface coating only.

8. RELIABILITY TEST CONDITIONS AND REQUIREMENTS

No.	Item	Test Condition	Requirements																																						
1.	Visual and Dimensions	---	* No remarkable defect. * Dimensions to confirm to individual specification sheet.																																						
2.	Capacitance		* Shall not exceed the limits given in the detailed spec.																																						
3.	Q/D.F. (Dissipation Factor)	* Class I : Cap.≤1000pF, 1.0±0.2Vrms, 1MHz±10%. Cap.>1000pF, 1.0±0.2Vrms, 1KHz±10%. * Class II : 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).	* Class I : <table><tr><th>Dielectric</th><th>Rated Vol.(V)</th><th>Q/D.F.</th><th>Remark</th></tr><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></table> * Class II : <table><tr><th>Rated</th><th>D.F.≤</th><th colspan="2">Exception of D.F.≤</th></tr><tr><td rowspan="3">≥100V</td><td rowspan="3">≤2.5%</td><td>≤3.5%</td><td>0805=0.1μF, 1206≥0.47μF, 1812≥4.7μF, 1825≥4.7μF, 2220≥4.7μF, 2225≥4.7μF</td></tr><tr><td>≤5%</td><td>0805>0.1μF, 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>≤3.5%</td><td>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>1210≥4.7μF</td></tr><tr><td>≤10%</td><td>0805≥1μF, 1206≥2.2μF, 1210≥10μF</td></tr><tr><td rowspan="3">25V</td><td rowspan="3">≤3.5%</td><td>≤5%</td><td>0805≥1μF, 1210≥10μF</td></tr><tr><td>≤7%</td><td>1206≥4.7μF</td></tr><tr><td>≤10%</td><td>0805≥2.2μF, 1206≥6.8μF, 1210≥22μF</td></tr></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%	≤3.5%	0805=0.1μF, 1206≥0.47μF, 1812≥4.7μF, 1825≥4.7μF, 2220≥4.7μF, 2225≥4.7μF	≤5%	0805>0.1μF, 1206>1μF, 1210≥2.2μF	≤10%	0805>0.22μF, 1210≥3.3μF	50V	≤2.5%	≤3.5%	0805≥0.1μF, 1206≥0.47μF, 1210≥2.2μF, 1812≥4.7μF, 1825≥4.7μF, 2220≥4.7μF, 2225≥4.7μF	≤5%	1210≥4.7μF	≤10%	0805≥1μF, 1206≥2.2μF, 1210≥10μF	25V	≤3.5%	≤5%	0805≥1μF, 1210≥10μF	≤7%	1206≥4.7μF	≤10%	0805≥2.2μF, 1206≥6.8μF, 1210≥22μF
		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%	≤3.5%	0805=0.1μF, 1206≥0.47μF, 1812≥4.7μF, 1825≥4.7μF, 2220≥4.7μF, 2225≥4.7μF																																						
		≤5%	0805>0.1μF, 1206>1μF, 1210≥2.2μF																																						
		≤10%	0805>0.22μF, 1210≥3.3μF																																						
50V	≤2.5%	≤3.5%	0805≥0.1μF, 1206≥0.47μF, 1210≥2.2μF, 1812≥4.7μF, 1825≥4.7μF, 2220≥4.7μF, 2225≥4.7μF																																						
		≤5%	1210≥4.7μF																																						
		≤10%	0805≥1μF, 1206≥2.2μF, 1210≥10μF																																						
25V	≤3.5%	≤5%	0805≥1μF, 1210≥10μF																																						
		≤7%	1206≥4.7μF																																						
		≤10%	0805≥2.2μF, 1206≥6.8μF, 1210≥22μF																																						
4.	Temperature Coefficient	* 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></table> * Measurement voltage for Class II : <table><tr><th>Size</th><th>Cap. Range</th><th>Condition</th></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>	T.C.	Operating Temp.	C0G	-55~125°C at 25°C	X7R	-55~125°C at 25°C	Size	Cap. Range	Condition	0805	Cap.<10μF	1V	Cap.=10μF	0.5V	Cap.>10μF	0.2V	1206/1210	Cap.≤10μF	1V	10μF<Cap.≤100μF	0.5V	Cap.>100μF	0.2V	<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></table>	T.C.	Capacitance Change	C0G	Within ±30ppm/°C	X7R	Within ±15%									
T.C.	Operating Temp.																																								
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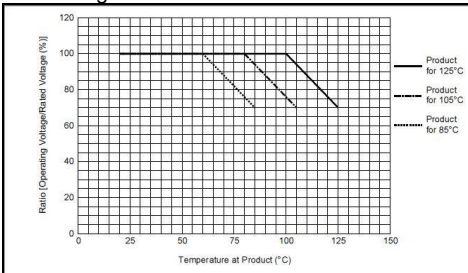
8. RELIABILITY TEST CONDITIONS AND REQUIREMENTS

No.	Item	Test Condition	Requirements																										
5.	Insulation Resistance		<table><tr><th>Dielectric</th><th>Capacitance Change</th></tr><tr><td>Class I</td><td>$\geq 10\text{G}\Omega$ or $\text{RxC}\geq 500\Omega\text{-F}$, whichever is smaller</td></tr><tr><td>Class II</td><td>$\geq 10\text{G}\Omega$ or $\text{RxC}\geq 100\Omega\text{-F}$, whichever is smaller</td></tr></table>	Dielectric	Capacitance Change	Class I	$\geq 10\text{G}\Omega$ or $\text{RxC}\geq 500\Omega\text{-F}$, whichever is smaller	Class II	$\geq 10\text{G}\Omega$ or $\text{RxC}\geq 100\Omega\text{-F}$, whichever is smaller																				
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<table><tr><th>Rated Vol.(V)</th><th>Apply Voltage</th><th>Charge Time</th></tr><tr><td>≤ 100</td><td>1 times of U_R</td><td>Max. 120 sec.</td></tr><tr><td>$200\leq V\leq 500$</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></table>	Rated Vol.(V)	Apply Voltage	Charge Time	≤ 100	1 times of U_R	Max. 120 sec.	$200\leq V\leq 500$	1 times of U_R	60 sec.	>500	500Vdc	60 sec.	* Except (Class II) : <table><tr><th>Rated voltage (X7R)</th><th>I.R.</th></tr><tr><td>$\geq 100\text{V}$: All X7R</td><td>$\geq 10\text{G}\Omega$ or $\text{RxC}\geq 100\Omega\text{-F}$, whichever is smaller</td></tr><tr><td>50V : 0805$\geq 1\mu\text{F}$, 1206$\geq 4.7\mu\text{F}$, 1210$\geq 4.7\mu\text{F}$, 1812$\geq 10\mu\text{F}$, 2220$\geq 22\mu\text{F}$</td><td></td></tr><tr><td>25V : 0805$\geq 2.2\mu\text{F}$, 1206$\geq 10\mu\text{F}$, 1210$\geq 10\mu\text{F}$</td><td></td></tr><tr><th>Rated voltage (X7R)</th><th>I.R.</th></tr><tr><td>100V : 1210$\geq 3.3\mu\text{F}$</td><td></td></tr><tr><td>50V : 0805$\geq 10\mu\text{F}$, 1206$\geq 10\mu\text{F}$</td><td>$\text{RxC}\geq 50\Omega\text{-F}$</td></tr><tr><td>25V : 0805$\geq 10\mu\text{F}$, 1206$\geq 22\mu\text{F}$</td><td></td></tr></table>	Rated voltage (X7R)	I.R.	$\geq 100\text{V}$: All X7R	$\geq 10\text{G}\Omega$ or $\text{RxC}\geq 100\Omega\text{-F}$, whichever is smaller	50V : 0805 $\geq 1\mu\text{F}$, 1206 $\geq 4.7\mu\text{F}$, 1210 $\geq 4.7\mu\text{F}$, 1812 $\geq 10\mu\text{F}$, 2220 $\geq 22\mu\text{F}$		25V : 0805 $\geq 2.2\mu\text{F}$, 1206 $\geq 10\mu\text{F}$, 1210 $\geq 10\mu\text{F}$		Rated voltage (X7R)	I.R.	100V : 1210 $\geq 3.3\mu\text{F}$		50V : 0805 $\geq 10\mu\text{F}$, 1206 $\geq 10\mu\text{F}$	$\text{RxC}\geq 50\Omega\text{-F}$	25V : 0805 $\geq 10\mu\text{F}$, 1206 $\geq 22\mu\text{F}$	
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6.	Dielectric Strength	<table><tr><th>Rated Voltage</th><th>Condition</th></tr><tr><td>≤ 100</td><td>2.5 times of U_R</td></tr><tr><td>$100<V\leq 250$</td><td>2.0 times of U_R</td></tr><tr><td>$250<V\leq 500$</td><td>1.5 times of U_R</td></tr><tr><td>$630\leq V\leq 3000\text{V}$</td><td>1.2 times of U_R</td></tr><tr><td>$3000<V<5000\text{V}$</td><td>1.1 times of U_R</td></tr><tr><td>$\geq 5000\text{V}$</td><td>1.0 times of U_R</td></tr></table>	Rated Voltage	Condition	≤ 100	2.5 times of U_R	$100<V\leq 250$	2.0 times of U_R	$250<V\leq 500$	1.5 times of U_R	$630\leq V\leq 3000\text{V}$	1.2 times of U_R	$3000<V<5000\text{V}$	1.1 times of U_R	$\geq 5000\text{V}$	1.0 times of U_R	* No evidence of damage or flash over during test.												
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	* Duration : 1 to 5 sec. * Charge and discharge current less than 50mA. * Test in insulating fluid for rated voltage $\geq 1\text{KV}$ products.																												
7.	Solderability	* Solder temperature : $235\pm 5^{\circ}\text{C}$ for (0805~1210). * Solder temperature : $245\pm 5^{\circ}\text{C}$ for (1808~2225). * Dipping time : 2 ± 0.5 sec.	* 75% min. coverage of all metalized area.																										
8.	Resistance to Soldering Heat	* Solder temperature : $260\pm 5^{\circ}\text{C}$. * 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 $\pm 2.5\%$ or $\pm 0.25\text{pF}$, whichever is larger. X7R : Within $\pm 7.5\%$. * 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. <table><tr><th>Step</th><th>Temp.($^{\circ}\text{C}$)</th><th>Time(min.)</th></tr><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>$2\sim 3$</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>$2\sim 3$</td></tr></table>	Step	Temp.($^{\circ}\text{C}$)	Time(min.)	1	Min. operating temp. $+0/-3$	30 ± 3	2	Room temp.	$2\sim 3$	3	Max. operating temp. $+3/-0$	30 ± 3	4	Room temp.	$2\sim 3$	* No remarkable damage. * Cap. change : C0G : Within $\pm 2.5\%$ or $\pm 0.25\text{pF}$, whichever is larger. X7R : Within $\pm 7.5\%$. * D.F./Q : C0G : $Q\geq 100\%$ of initial requirements. X7R : D.F.$\leq 150\%$ of initial requirement. * I.R. : $\geq 100\%$ of initial requirement.											
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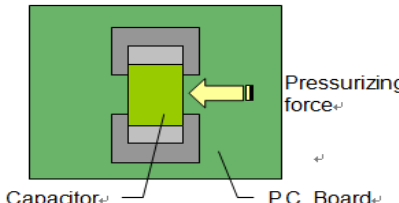
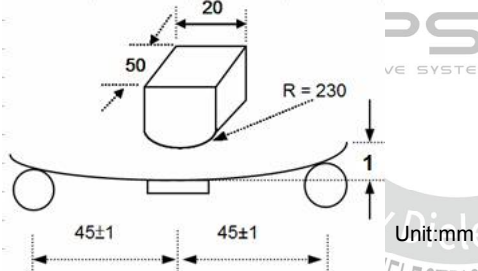
8. RELIABILITY TEST CONDITIONS AND REQUIREMENTS

No.	Item	Test Condition	Requirements						
10.	Humidity (Damp Heat) Steady State	* 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).	* No remarkable damage. * Cap. change : C0G : Within ±5.0% or ±0.5pF, whichever is larger. X7R : Within ±12.5% for ≥10V**, within ±25% for 6.3V. **10V : Within ±25% for 0603≥4.7μF, 0402≥1μF. * D.F./Q : 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 requirement. * I.R. : ≥10V, ≥1GΩ or R×C≥50Ω-F, whichever is smaller. Except : <table><tr><th>Rated voltage</th><th>I.R.</th></tr><tr><td>≥100V : All X7R; 1210≥3.3μF</td><td rowspan="3">≥1GΩ or RxC≥10Ω-F, whichever is smaller</td></tr><tr><td>50V : 0805≥1μF, 1206≥4.7μF, 1210≥4.7μF</td></tr><tr><td>25V : 0805≥2.2μF, 1206≥10μF, 1210≥10μF</td></tr></table>	Rated voltage	I.R.	≥100V : All X7R; 1210≥3.3μF	≥1GΩ or RxC≥10Ω-F, whichever is smaller	50V : 0805≥1μF, 1206≥4.7μF, 1210≥4.7μF	25V : 0805≥2.2μF, 1206≥10μF, 1210≥10μF
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25V : 0805≥2.2μF, 1206≥10μF, 1210≥10μF									
11.	Humidity (Damp Heat) Load	* Test temp. : 85±3°C. * Humidity : 85±5% RH. * Test time : 500 +24/-0 hrs. * To apply voltage : Rated voltage (100Vdc max.). * 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 ±7.5% or ±0.75pF, whichever is larger. X7R : Within ±12.5% for ≥10V**, within ±25% for 6.3V. **10V : Within ±25% for 0603≥4.7μF, 0402≥1μF. * D.F./Q : C0G : Q≥350 for Cap.>30pF, Q≥275+2.5C for 10pF≤Cap.≤30pF, Q≥200+10C for Cap.<10pF. X7R : ≤200% of initial requirement. * I.R. : ≥10V, ≥500MΩ or RxC≥25Ω-F, whichever is smaller. Except : <table><tr><th>Rated voltage</th><th>I.R.</th></tr><tr><td>≥100V : All X7R; 1210≥3.3μF</td><td rowspan="3">≥500MΩ or RxC≥5Ω-F, whichever is smaller</td></tr><tr><td>50V : 0805≥1μF, 1206≥4.7μF, 1210≥4.7μF</td></tr><tr><td>25V : 0805≥2.2μF, 1206≥10μF, 1210≥10μF</td></tr></table>	Rated voltage	I.R.	≥100V : All X7R; 1210≥3.3μF	≥500MΩ or RxC≥5Ω-F, whichever is smaller	50V : 0805≥1μF, 1206≥4.7μF, 1210≥4.7μF	25V : 0805≥2.2μF, 1206≥10μF, 1210≥10μF
Rated voltage	I.R.								
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8. RELIABILITY TEST CONDITIONS AND REQUIREMENTS

No.	Item	Test Condition	Requirements																																																																										
12.	High Temperature Load (Endurance)	* Test temp. : 125±3°C. * To apply voltage : (1) 25≤Ur≤100V : 200% of rated voltage. (2) 200V≤Ur≤500V : 150% of rated voltage. (3) 630V : 120% of rated voltage. (4) Ur≥1000V : 100% of rated voltage. (5) 100% of rated voltage for below range : <table><tr><th>Size</th><th>Dielectric</th><th>Rated</th><th>Capacitance</th></tr><tr><td rowspan="3">0805</td><td rowspan="3">X7R</td><td>4V</td><td>C≥47μF</td></tr><tr><td>6.3V</td><td>C≥22μF</td></tr><tr><td>10V~50V</td><td>C≥10μF</td></tr><tr><td>1206</td><td>X7R</td><td>≤6.3V</td><td>C≥47μF</td></tr><tr><td rowspan="2">1210</td><td>X7R</td><td>16V</td><td>C≥47μF</td></tr><tr><td>X7R</td><td>≥100V</td><td>C≥3.3μF</td></tr></table> (6) 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="3">0805</td><td rowspan="3">X7R</td><td>10~50V</td><td>C≥4.7μF</td></tr><tr><td>50V</td><td>C≥0.47μF</td></tr><tr><td>≥100V</td><td>C≥0.12μF</td></tr><tr><td>1206</td><td>X7R</td><td>≥50V</td><td>C≥1.0μF</td></tr><tr><td rowspan="2">1210</td><td>X7R</td><td>≤100V</td><td>C≥1.0μF</td></tr><tr><td>X7R</td><td>>100V</td><td>C≥0.22μF</td></tr><tr><td>1812</td><td>X7R</td><td>≤50V</td><td>C≥4.7μF</td></tr><tr><td></td><td></td><td>100V</td><td>C≥1.0μF</td></tr><tr><td>1825</td><td rowspan="3">X7R</td><td rowspan="3">≥100V</td><td rowspan="3">C≥1.0μF</td></tr><tr><td>2220</td></tr><tr><td>2225</td></tr></table> (7) 120% of rated voltage for below range : <table><tr><th>Size</th><th>Dielectric</th><th>Rated Voltage</th><th>Capacitance</th></tr><tr><td>2220</td><td>X7R</td><td>≥100V</td><td>C≥15μF</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 48±4 hrs (Class II). ** De-rating conditions : 	Size	Dielectric	Rated	Capacitance	0805	X7R	4V	C≥47μF	6.3V	C≥22μF	10V~50V	C≥10μF	1206	X7R	≤6.3V	C≥47μF	1210	X7R	16V	C≥47μF	X7R	≥100V	C≥3.3μF	Size	Dielectric	Rated Voltage	Capacitance	0805	X7R	10~50V	C≥4.7μF	50V	C≥0.47μF	≥100V	C≥0.12μF	1206	X7R	≥50V	C≥1.0μF	1210	X7R	≤100V	C≥1.0μF	X7R	>100V	C≥0.22μF	1812	X7R	≤50V	C≥4.7μF			100V	C≥1.0μF	1825	X7R	≥100V	C≥1.0μF	2220	2225	Size	Dielectric	Rated Voltage	Capacitance	2220	X7R	≥100V	C≥15μF	* No remarkable damage. * Cap. change : C0G : Within ±5.0% or ±0.5pF, whichever is larger. X7R : Within ±12.5% for ≥10V**, within ±25% for 6.3V. **10V : Within ±25% for 0603≥4.7μF, 0402≥1μF. * D.F./Q : 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 requirement. * I.R. : ≥10V, ≥1GΩ or R×C≥50Ω·F, whichever is smaller. Except : <table><tr><th>Rated voltage</th><th>I.R.</th></tr><tr><td>≥100V : All X7R; 1210≥3.3μF</td><td rowspan="3">≥1GΩ or RxC≥10Ω·F, whichever is smaller</td></tr><tr><td>50V : 0805≥1μF, 1206≥4.7μF, 1210≥4.7μF</td></tr><tr><td>25V : 0805≥2.2μF, 1206≥10μF, 1210≥10μF</td></tr></table>	Rated voltage	I.R.	≥100V : All X7R; 1210≥3.3μF	≥1GΩ or RxC≥10Ω·F, whichever is smaller	50V : 0805≥1μF, 1206≥4.7μF, 1210≥4.7μF	25V : 0805≥2.2μF, 1206≥10μF, 1210≥10μF
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8. RELIABILITY TEST CONDITIONS AND REQUIREMENTS

No.	Item	Test Condition	Requirements						
13.	Adhesive Strength of Termination	* 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$\pm$1 second.  Capacitor P.C. Board	* No remarkable damage or removal of the terminations.						
14.	Bending Test	* 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	* No remarkable damage. <table><tr><th>Dielectric</th><th>Cap. Change</th></tr><tr><td>Class I (C0G)</td><td>Within $\pm 5.0\%$ or $\pm 0.5\text{pF}$, whichever is larger</td></tr><tr><td>Class II (X7R)</td><td>Within $\pm 12.5\%$</td></tr></table> (This capacitance change means the change of capacitance under specified flexure of substrate from the capacitance measured before the test)	Dielectric	Cap. Change	Class I (C0G)	Within $\pm 5.0\%$ or $\pm 0.5\text{pF}$, whichever is larger	Class II (X7R)	Within $\pm 12.5\%$
Dielectric	Cap. Change								
Class I (C0G)	Within $\pm 5.0\%$ or $\pm 0.5\text{pF}$, whichever is larger								
Class II (X7R)	Within $\pm 12.5\%$								
15.	Vibration Resistance	* 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$\pm$2 hrs at room temp. * Measurement to be made after keeping at room temp. for 24$\pm$2 hrs (Class I) or 48$\pm$4 hrs (Class II).	* No remarkable damage. * Cap. change and D.F./Q : To meet initial spec.						

9. PACKAGE DIMENSION AND QUANTITY

Size	Thickness (mm)	Paper tape		Plastic tape	
		7" reel	13" reel	7" reel	13" reel
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

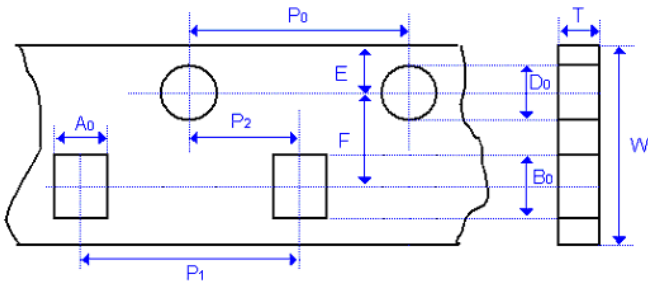


Fig. 9.1 The dimension of paper tape

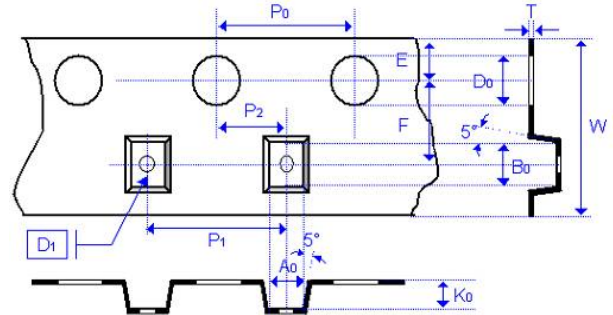


Fig. 9.2 The dimension of plastic tape

Size	0805		1206		
Chip Thickness	0.80±0.10	1.25±0.10 1.25±0.20	0.80±0.10	0.95±0.10 1.25±0.10	1.25±0.10 1.60±0.20
A ₀	1.50±0.10	<1.65	2.00±0.10	<2.00	<2.50
B ₀	2.30±0.10	<2.40	3.50±0.10	<3.60	<5.30
T	0.95±0.05	0.23±0.05	0.95±0.05	0.23±0.05	0.25±0.05
K ₀	-	<2.50	-	<2.50	<2.50
W	8.00±0.10	8.00±0.10	8.00±0.10	8.00±0.10	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
10xP ₀	40.00±0.20	40.00±0.20	40.00±0.20	40.00±0.20	40.0±0.20
P ₁	4.00±0.10	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
D ₀	1.55±0.05	1.50 +0.10/-0	1.55±0.05	1.50 +0.10/-0	1.50±0.10/-0
D ₁	-	1.00±0.10	-	1.00±0.10	1.50±0.10
E	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	5.50±0.05
Unit :	mm	mm	mm	mm	mm

Size	1210		1808		1812	
Chip Thickness	1.25±0.10 1.60±0.20	2.50±0.30	1.25±0.10 1.60±0.20	2.00±0.20	1.25±0.10 1.60±0.20 2.00±0.20	2.50±0.30
A ₀	<2.50	<3.10	<2.50	<2.50	<3.90	<3.90
B ₀	<5.30	<4.00	<5.30	<5.30	<5.30	<5.30
T	0.25±0.05	0.23±0.05	0.25±0.05	0.25±0.05	0.25±0.05	0.25±0.05
K ₀	<2.50	<3.50	<2.50	<2.50	<2.50	<3.00
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	40.0±0.20	40.00±0.20	40.0±0.20	40.0±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	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	1.00±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	3.50±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. 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	<6.80	<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. PACKAGE DIMENSION AND QUANTITY

9.2. REEL DIMENSIONS

Size	0805, 1206, 1210		1808, 1812, 1825, 2220, 2225
Reel size	7"	13"	7"
C	13.0 +0.5/-0.2	13.0 +0.7/-0.3	13.0 +0.5/-0.2
W ₁	8.4 +1.5/-0	8.4 +2.0/-0	12.4 +2.0/-0
A	178.0 ±0.10	330.0 ±1.0	178.0 ±0.10
N	60.0 +1.0/-0	100 ±1.0	60.0 +1.0/-0

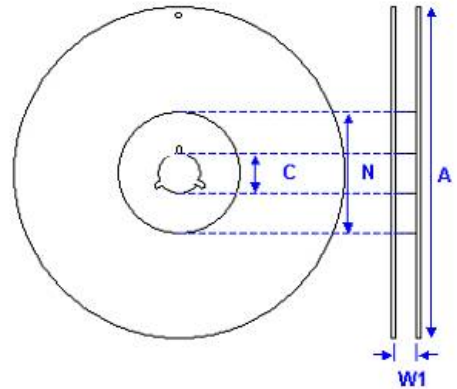


Fig. 9.3 The dimension of reel

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.

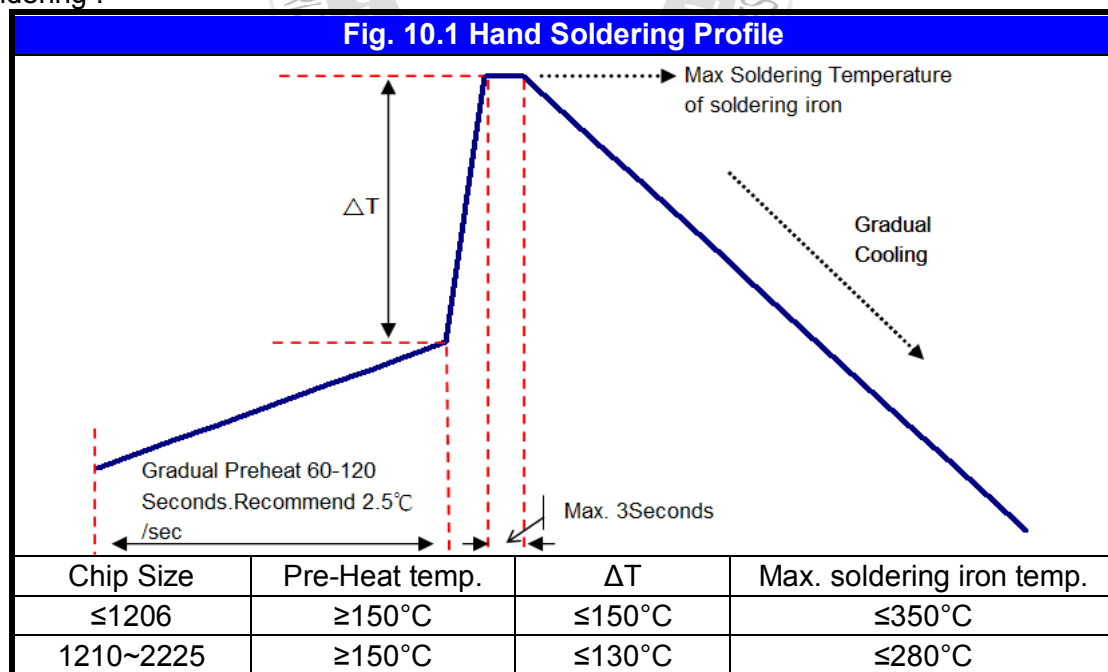
PREHEAT

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 :



* 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.

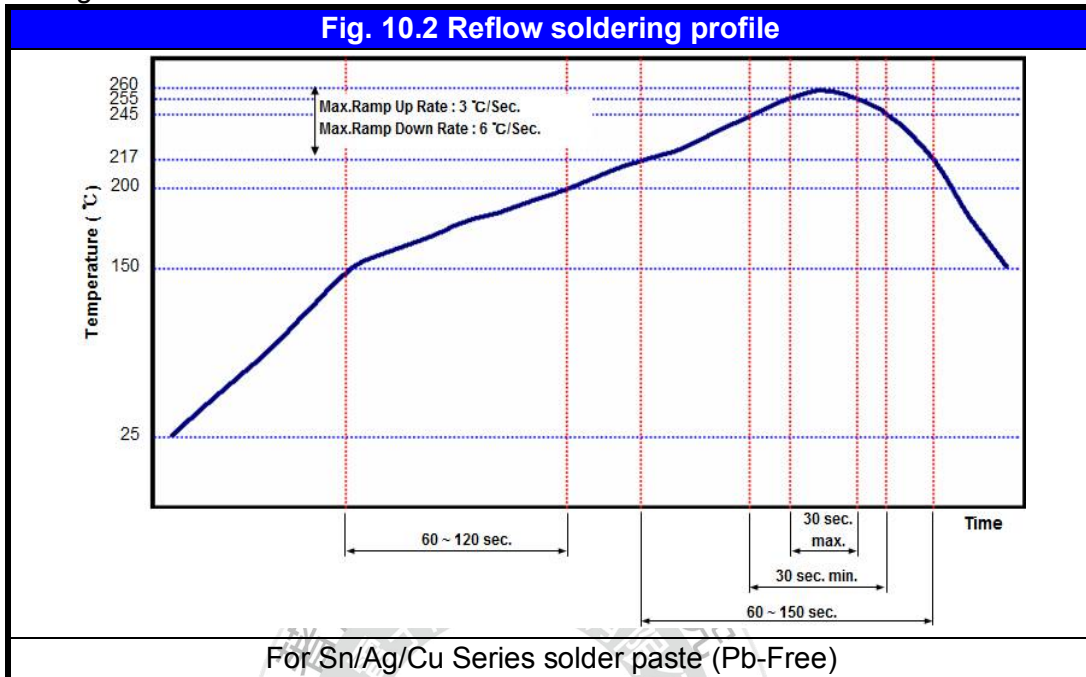
* The tip of iron should not contact the ceramic body directly.

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

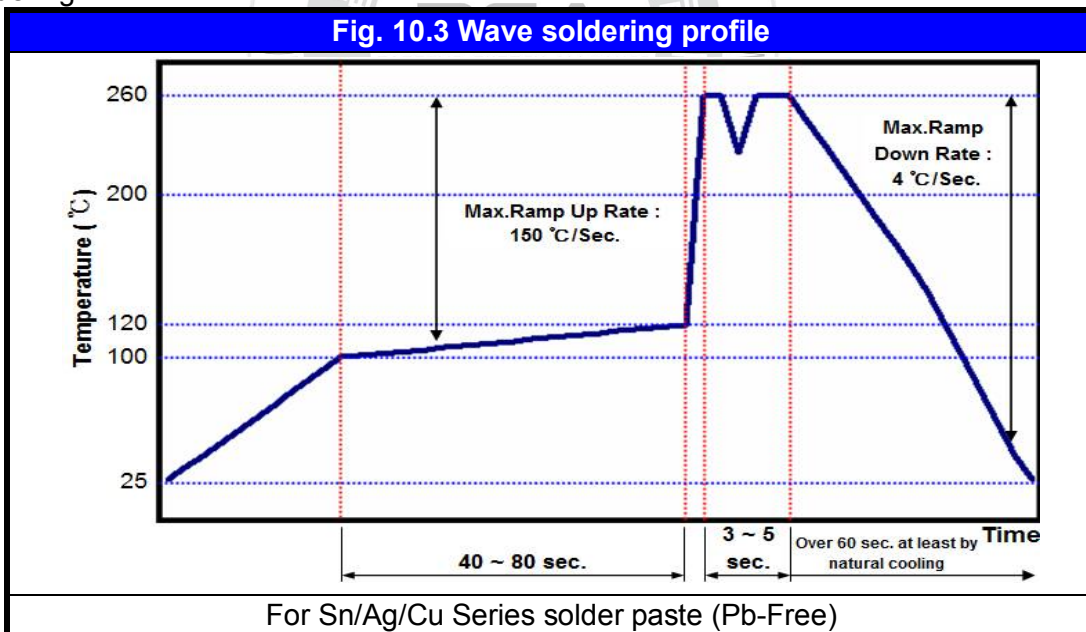
* Forced air cooling is not allowed.

10. APPLICATION NOTES

b.) Reflow soldering :



c.) Wave soldering :



Soldering conditions :

Class I :

Size Inch (mm)	Temper. Char.	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.