



信昌電子陶瓷股份有限公司



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Messrs. : 一般共用

Date : 2024/11/08

APPROVAL SHEET

Product Name : Stacked Capacitors

Part No. : FE Series

Description : Size 1210~2225, C0G/X7R, 50~1500Vdc

PREPARED BY	APPROVED BY

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SPECIFICATION

FOR

Product Name : Stacked Capacitors

Part No. : FE Series

Description : Size 1210~2225, C0G/X7R, 50~1500Vdc

SPEC. No. : FE-000-001-14

DATE : 2024/11/08

DRAWN BY	CHECEKED BY	APPROVED BY
Jane Hsiao	Yvens Chou	Jason Lin



1. INTRODUCTION

FE Series green type capacitors are manufactured by using green materials without lead and cadmium. These capacitors to achieve a unique structure of high reliability. The use of metal lead frame, can absorb the heat and mechanical stress. ESR (equivalent series resistance), ESL (equivalent series inductance) is small, the most suitable for high frequency operation of the rectifier power supply.

2. FEATURES

- High reliability and stability.
- Higher mechanical endurance.
- Anti thermal stress and mechanical stress.
- Improved vibration performance.
- More capacitance without changing footprint.
- RoHS & HALOGEN Compliant.

3. APPLICATIONS

- DC to DC converter.
- High voltage coupling/DC blocking.
- Back-lighting inverters.
- Snubbers in high frequency power converters.
- Power supplies.
- Surge protection.
- Filtering, smoothing, and decoupling application.

4. HOW TO ORDER

<u>FE</u>	<u>2H</u>	<u>X</u>	<u>106</u>	<u>K</u>	<u>500</u>	<u>L</u>	<u>G</u>	<u>L</u>	<u>M</u>
PDC Family	Size	Dielectric	Capacitance	Tolerance	Rated Voltage	Packaging	Thickness	Control Code	Special Code
Table 1	Table 2	Table 3	Table 4	Table 5	Table 6	Table 7	Table 8	Table 9	Table 10

Table 1	PDC Family
Code	Description
FE	Stacked Capacitors Series

Table 2		Stack chip quantity and chip size			
The first digit : # of chips in stack					
Second digit code : chip size (below)					
Code	Description	Code	Description	Code	Description
A	1210 (3225)	G	1825 (4563)	I	2225 (5763)
C	1812 (4532)	H	2220 (5750)		

Table 3		Dielectric Material Characteristics	
Code	Description	Code	Description
N	C0G	X	X7R

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

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

Table 6		Rated Voltage			
Code	Description	Code	Description	Code	Description
500	50Vdc	251	250Vdc		
101	100Vdc	501	500Vdc		
201	200Vdc	631	630Vdc		

Table 7		Packaging Type	
Code	Description	Code	Description
B	Bulk	T	Tray package
L	Tape and 13" Reel, Embossed Tape		

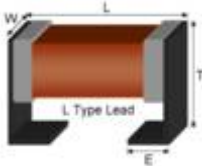
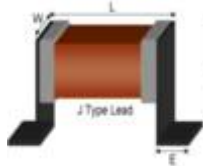
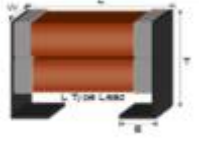
Table 8		Thickness Description			
Code	Description	Code	Description	Code	Description
A	3.00±0.35 mm	J	7.80±0.35 mm	S	12.60±0.35 mm
B	3.60±0.35 mm	K	8.40±0.35 mm	T	13.20±0.35 mm
C	4.20±0.35 mm	L	9.00±0.35 mm	U	1.70±0.25 mm
D	4.80±0.35 mm	M	9.60±0.35 mm	V	2.10±0.25 mm
E	5.40±0.35 mm	N	10.20±0.35 mm	W	2.50±0.25 mm
F	6.00±0.35 mm	P	10.80±0.35 mm		
G	6.60±0.35 mm	Q	11.40±0.35 mm		
H	7.20±0.35 mm	R	12.00±0.35 mm		

Table 9	Control Code		
Code	Description	Code	Description
L	L type lead	K	K type lead
J	J type lead	B	B type lead
S	Straight type lead	F	Straight type lead

Table 10	Special Code		
Blank	General purpose	M	Automotive



5. EXTERNAL DIMENSIONS

Size Inch (mm)	L (mm)	W (mm)	Code / T (mm)	E (mm)	 	
1210 (3225)	3.50±0.40	2.50±0.40	Reference Table 8	1.10±0.15		
1812 (4532)	4.80±0.40	3.20±0.40		1.40±0.15		
1825 (4563)	4.80±0.40	6.30±0.50		1.70±0.15		
2220 (5750)	6.00±0.50	5.00±0.50		1.70±0.15		
2225 (5763)	6.00±0.50	6.30±0.50		1.70±0.15	Fig. 5.1 The outline of Stacked Capacitors	

6. GENERAL ELECTRICAL DATA

Dielectric	COG		X7R	
Size	1210, 1812, 1825, 2220, 2225		1210, 1812, 1825, 2220, 2225	
Rated voltage (WVDC)	50V, 100V, 200V, 250V, 500V, 630V, 1000V, 1500V		50V, 100V, 200V, 250V, 500V, 630V, 1000V, 1500V	
Capacitance range	220nF Max.		47μF Max.	
Capacitance tolerance	Reference to Table 5		Reference to Table 5	
Tan δ	Cap. Range	Q Spec.	Cap. Range	D.F. Spec.
	Cap. <30pF	Q≥400+20C	1210≥2.2μF	≤5.0%
	Cap. ≥30pF	Q≥1000	1812~2225≥4.7μF	≤5.0%
			Other	≤2.5%
Capacitance & Tan δ Test condition	Measured at the condition of 30~70% related humidity		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 (25°C) 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 at Ur	≥10GΩ or Rx≥500Ω-F, whichever is smaller		≥10GΩ or Rx≥100Ω-F, whichever is smaller	
Operating temperature	-55 to +125°C		-55 to +125°C	
Capacitance characteristic	±30ppm / °C		±15%	
Termination	L / J / Straight type lead		L / J / Straight type lead	

**7. CAPACITANCE RANGE (Max.)****7-1. C0G**

Dimension	Code	Rated Voltage							
		50V	100V	200V	250V	500V	630V	1000V	1500V
1210	1A	393	223	473	473	333	333	223	182
	2A	823(M)	473(M)	104(M)	104(M)	683(M)	683(M)	473(M)	392(M)
1812	1C	104	473	273	273	223	223	123	332
	2C	224(M)	104(M)	563(M)	563(M)	473(M)	473(M)	223(M)	682(M)
1825	1G	104	104	683	683	683	683	103	472
	2G	224(M)	224(M)	134(M)	134(M)	134(M)	134(M)	223(M)	103(M)
2220	1H	104	104	683	683	104	104	333	472
	2H	224(M)	224(M)	134(M)	134(M)	224(M)	224(M)	683(M)	104(M)
2225	1I	104	104	104	104	823	683	103	103
	2I	224(M)	224(M)	224(M)	224(M)	184(M)	134(M)	223(M)	223(M)

7-2. X7R

Dimension	Code	Rated Voltage							
		50V	100V	200V	250V	500V	630V	1000	1500
1210	1A	106	475	684	684	154	154	473	333
	2A	226(M)	106(M)	135(M)	135(M)	334(M)	334(M)	104(M)	683(M)
1812	1C	106	475	105	105	474	224	104	223
	2C	226(M)	106(M)	225(M)	225(M)	105(M)	474(M)	224(M)	473(M)
1825	1G	106	106	225	105	564	564	104	563
	2G	226(M)	226(M)	475(M)	225(M)	125(M)	125(M)	224(M)	124(M)
2220	1H	226	226	225	225	474	474	334	563
	2H	476(M)	476(M)	475(M)	475(M)	105(M)	105(M)	684(M)	124(M)
2225	1I	106	106	275	275	564	564	334	104
	2I	226(M)	226(M)	565(M)	565(M)	125(M)	125(M)	684(M)	224(M)

(M) means M tolerance only.

7-3. Customizable, Please contact the liaison.



7. CAPACITANCE RANGE

7-1. C0G

Cap(pF)	EIA Size		1210															
	Voltage	Stacked	50V	50V	100V	100V	200V	200V	250V	250V	500V	500V	630V	630V	1000V	1000V	1500V	1500V
			1A	2A	1A	2A	1A	2A	1A	2A	1A	2A	1A	2A	1A	2A	1A	2A
1000	102																	
1200	122																	
1500	152																	
1800	182																	
2200	222																	
2700	272																	
3300	332																	
3900	392																	
4700	472																	
5600	562																	
6800	682																	
8200	822																	
10000	103																	
12000	123																	
15000	153																	
18000	183																	
22000	223																	
27000	273																	
33000	333																	
39000	393																	
47000	473																	
56000	563																	
68000	683																	
82000	823																	
100000	104																	

Cap(pF)	EIA Size		1812															
	Voltage	Stacked	50V		100V		200V		250V		500V		630V		1000V		1500V	
			1C	2C	1C	2C	1C	2C	1C	2C	1C	2C	1C	2C	1C	2C	1C	2C
1000	102																	
1200	122																	
1500	152																	
1000	102																	
1200	122																	
1500	152																	
1800	182																	
2200	222																	
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27000	273																	
33000	333																	
39000	393																	
47000	473																	
56000	563																	
68000	683																	
82000	823																	
100000	104																	
120000	124																	
150000	154																	
180000	184																	
220000	224																	

1. The code in the table indicates the thickness. 2. Capacitance M tolerance only.



7. CAPACITANCE RANGE

7-1. C0G

Cap(pF)	EIA Size	1825															
		50V		100V		200V		250V		500V		630V		1000V		1500V	
		1G	2G	1G	2G	1G	2G	1G	2G	1G	2G	1G	2G	1G	2G	1G	2G
1000	102																
1200	122																
1500	152																
1800	182																
2200	222																
2700	272																
3300	332																
3900	392																
4700	472																
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6800	682																
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15000	153																
18000	183																
22000	223																
27000	273																
33000	333																
39000	393																
47000	473																
56000	563																
68000	683																
82000	823																
100000	104																
120000	124																
130000	134																
150000	154																
180000	184																
220000	224																
270000	274																
330000	334																
390000	394																
470000	474																
560000	564																
680000	684																
820000	824																
1000000	105																

1. The code in the table indicates the thickness. 2. “*” Capacitance M tolerance only.



7. CAPACITANCE RANGE

7-1. C0G

Cap(pF)	EIA Size	2220															
		50V		100V		200V		250V		500V		630V		1000V		1500V	
		1H	2H	1H	2H	1H	2H	1H	2H	1H	2H	1H	2H	1H	2H	1H	2H
1000	102																
1200	122																
1500	152																
1800	182																
2200	222																
2700	272																
3300	332																
3900	392																
4700	472																
5600	562																
6800	682																
8200	822																
10000	103																
12000	123																
15000	153																
18000	183																
22000	223																
27000	273																
33000	333																
39000	393																
47000	473																
56000	563																
68000	683																
82000	823																
100000	104																
120000	124																
130000	134																
150000	154																
180000	184																
220000	224																
270000	274																
330000	334																
390000	394																
470000	474																
560000	564																
680000	684																
820000	824																
1000000	105																

1. The code in the table indicates the thickness. 2. “*” Capacitance M tolerance only.



7. CAPACITANCE RANGE

7-1. C0G

Cap(pF)	EIA Size		2225															
	Voltage		50V		100V		200V		250V		500V		630V		1000V		1500V	
	Stacked		1I	2I	1I	2I	1I	2I	1I	2I	1I	2I	1I	2I	1I	2I	1I	2I
1000	102																	
1200	122																	
1500	152																	
1800	182																	
2200	222																	
2700	272																	
3300	332																	
3900	392																	
4700	472																	
5600	562																	
6800	682																	
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39000	393																	
47000	473																	
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68000	683																	
82000	823																	
100000	104																	
120000	124																	
150000	154																	
180000	184																	
220000	224																	
270000	274																	
330000	334																	
390000	394																	
470000	474																	
560000	564																	
680000	684																	
820000	824																	
1000000	105																	

1. The code in the table indicates the thickness. 2. “*” Capacitance M tolerance only.



7. CAPACITANCE RANGE

7-2. X7R

Cap(pF)	EIA Size	1210															
		50V		100V		200V		250V		500V		630V		1000V		1500V	
		1A	2A	1A	2A	1A	2A	1A	2A	1A	2A	1A	2A	1A	2A	1A	2A
10000	103																
12000	123																
15000	153																
18000	183																
22000	223																
27000	273																
33000	333																
39000	393																
47000	473																
56000	563																
68000	683																
82000	823																
100000	104																
120000	124																
150000	154																
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1000000	105																
1200000	125																
1300000	135																
1500000	155																
1800000	185																
2200000	225																
2700000	275																
3300000	335																
3900000	395																
4700000	475																
5600000	565																
6800000	685																
8200000	825																
10000000	106																
12000000	126																
15000000	156																
18000000	186																
22000000	226																

1. The code in the table indicates the thickness.



7. CAPACITANCE RANGE

7-2. X7R

Cap(pF)	EIA Size	1812															
		50V		100V		200V		250V		500V		630V		1000V		1500V	
		1C	2C	1C	2C	1C	2C	1C	2C	1C	2C	1C	2C	1C	2C	1C	2C
10000	103																
12000	123																
15000	153																
18000	183																
22000	223																
27000	273																
33000	333																
39000	393																
47000	473																
56000	563																
68000	683																
82000	823																
100000	104																
120000	124																
150000	154																
180000	184																
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330000	334																
390000	394																
470000	474																
560000	564																
680000	684																
820000	824																
1000000	105																
1200000	125																
1500000	155																
1800000	185																
2200000	225																
2700000	275																
3300000	335																
3900000	395																
4700000	475																
5600000	565																
6800000	685																
8200000	825																
10000000	106																
12000000	126																
15000000	156																
18000000	186																
22000000	226																
27000000	276																
33000000	336																
39000000	396																
47000000	476																

1. The code in the table indicates the thickness. 2. “*” Capacitance M tolerance only.



7. CAPACITANCE RANGE

7-2. X7R

Cap(pF)	EIA Size	1825															
		50V		100V		200V		250V		500V		630V		1000V		1500V	
		1G	2G	1G	2G	1G	2G	1G	2G	1G	2G	1G	2G	1G	2G	1G	2G
10000	103																
12000	123																
15000	153																
18000	183																
22000	223																
27000	273																
33000	333																
39000	393																
47000	473																
56000	563																
68000	683																
82000	823																
100000	104																
120000	124																
150000	154																
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270000	274																
330000	334																
390000	394																
470000	474																
560000	564																
680000	684																
820000	824																
1000000	105																
1200000	125																
1500000	155																
1800000	185																
2200000	225																
2700000	275																
3300000	335																
3900000	395																
4700000	475																
5600000	565																
6800000	685																
8200000	825																
10000000	106																
12000000	126																
15000000	156																
18000000	186																
22000000	226																
27000000	276																
33000000	336																
39000000	396																
47000000	476																

1. The code in the table indicates the thickness. 2. "*" Capacitance M tolerance only.



7. CAPACITANCE RANGE

7-2. X7R

Cap(pF)	EIA Size	2220															
		50V		100V		200V		250V		500V		630V		1000V		1500V	
		1H	2H	1H	2H	1H	2H	1H	2H	1H	2H	1H	2H	1H	2H	1H	2H
10000	103																
12000	123																
15000	153																
18000	183																
22000	223																
27000	273																
33000	333																
39000	393																
47000	473																
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100000	104																
120000	124																
150000	154																
180000	184																
220000	224																
270000	274																
330000	334																
390000	394																
470000	474																
560000	564																
680000	684																
820000	824																
1000000	105																
1200000	125																
1500000	155																
1800000	185																
2200000	225																
2700000	275																
3300000	335																
3900000	395																
4700000	475																
5600000	565																
6800000	685																
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22000000	226																
27000000	276																
33000000	336																
39000000	396																
47000000	476																

1. The code in the table indicates the thickness. 2. "*" Capacitance M tolerance only.



7. CAPACITANCE RANGE

7-2. X7R

Cap(pF)	EIA Size	2225															
		50V		100V		200V		250V		500V		630V		1000V		1500V	
		1l	2l	1l	2l	1l	2l	1l	2l	1l	2l	1l	2l	1l	2l	1l	2l
10000	103																
12000	123																
15000	153																
18000	183																
22000	223																
27000	273																
33000	333																
39000	393																
47000	473																
56000	563																
68000	683																
82000	823																
100000	104																
120000	124																
150000	154																
180000	184																
220000	224																
270000	274																
330000	334																
390000	394																
470000	474																
560000	564																
680000	684																
820000	824																
1000000	105																
1200000	125																
1300000	135																
1500000	155																
1800000	185																
2200000	225																
2700000	275																
3300000	335																
3900000	395																
4700000	475																
5600000	565																
6800000	685																
8200000	825																
10000000	106																
12000000	126																
15000000	156																
18000000	186																
22000000	226																
27000000	276																
33000000	336																
39000000	396																
47000000	476																

1. The code in the table indicates the thickness. 2. “*” Capacitance M tolerance 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%.	<table><tr><th>Dielectric</th><th>Cap. Range</th><th>Q/D.F.</th></tr><tr><td rowspan="2">Class I (C0G)</td><td>Cap.≥30pF</td><td>Q≥1000</td></tr><tr><td>Cap.<30pF</td><td>Q≥400+20C</td></tr><tr><td rowspan="2">Class II (X7R)</td><td>1210≥2.2μF & 1812~2220≥4.7μF</td><td>D.F.≤5.0%</td></tr><tr><td>Other</td><td>D.F.≤2.5%</td></tr></table>	Dielectric	Cap. Range	Q/D.F.	Class I (C0G)	Cap.≥30pF	Q≥1000	Cap.<30pF	Q≥400+20C	Class II (X7R)	1210≥2.2μF & 1812~2220≥4.7μF	D.F.≤5.0%	Other	D.F.≤2.5%					
		Dielectric	Cap. Range	Q/D.F.																	
		Class I (C0G)	Cap.≥30pF	Q≥1000																	
Cap.<30pF	Q≥400+20C																				
Class II (X7R)	1210≥2.2μF & 1812~2220≥4.7μF	D.F.≤5.0%																			
	Other	D.F.≤2.5%																			
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>	T.C.	Operating Temp.	C0G	-55~125°C at 25°C	X7R	-55~125°C at 25°C	<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.																		
C0G	-55~125°C at 25°C																				
X7R	-55~125°C at 25°C																				
T.C.	Capacitance Change																				
C0G	Within ±30ppm/°C																				
X7R	Within ±15%																				
5.	Insulation Resistance	<table><tr><th>Rated Vol. (V)</th><th>Apply Voltage</th><th>Test Time</th></tr><tr><td>≤100</td><td>1 times of UR</td><td>Max. 120 sec.</td></tr><tr><td>100<V≤500</td><td>1 times of UR</td><td>60 sec.</td></tr><tr><td>>500</td><td>500Vdc</td><td>60 sec.</td></tr></table>	Rated Vol. (V)	Apply Voltage	Test Time	≤100	1 times of UR	Max. 120 sec.	100<V≤500	1 times of UR	60 sec.	>500	500Vdc	60 sec.	<table><tr><th>Dielectric</th><th>Requirements</th></tr><tr><td>Class I</td><td>≥10GΩ 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></table>	Dielectric	Requirements	Class I	≥10GΩ or RxC≥500Ω-F, whichever is smaller	Class II	≥10GΩ or RxC≥100Ω-F, whichever is smaller
		Rated Vol. (V)	Apply Voltage	Test Time																	
		≤100	1 times of UR	Max. 120 sec.																	
100<V≤500	1 times of UR	60 sec.																			
>500	500Vdc	60 sec.																			
Dielectric	Requirements																				
Class I	≥10GΩ or RxC≥500Ω-F, whichever is smaller																				
Class II	≥10GΩ or RxC≥100Ω-F, whichever is smaller																				
6.	Dielectric Strength	<table><tr><th>Rated Voltage</th><th>Condition</th></tr><tr><td>≤100</td><td>2.5 times of UR</td></tr><tr><td>100<V≤250</td><td>2.0 times of UR</td></tr><tr><td>250<V≤500</td><td>1.5 times of UR</td></tr><tr><td>630≤V≤3000V</td><td>1.2 times of UR</td></tr></table>	Rated Voltage	Condition	≤100	2.5 times of UR	100<V≤250	2.0 times of UR	250<V≤500	1.5 times of UR	630≤V≤3000V	1.2 times of UR	* No evidence of damage or flash over during test.								
		Rated Voltage	Condition																		
		≤100	2.5 times of UR																		
100<V≤250	2.0 times of UR																				
250<V≤500	1.5 times of UR																				
630≤V≤3000V	1.2 times of UR																				
7.	Temperature Cycle	* Conduct the 100 cycles according to the temperatures and time.																			
		<table><tr><th>Step</th><th>Temp.(°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>2~3</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></table>	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	* 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 requirement. X7R : D.F.≤150% of initial requirement. * I.R. : To meet the initial requirement.			
		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																			
8.	Humidity (Damp Heat) Steady State	* Test temp. : 40±2°C.	* No remarkable damage.																		
		* Humidity : 90~95%RH.	* Cap. change : C0G Within ±5.0% or ±0.5pF, whichever is larger. X7R Within ±12.5%.																		
		* Test time : 500 +24/-0hrs.	* Q/D.F. : C0G : Q≥350. X7R : D.F.≤200% of initial requirement.																		
		* Before initial measurement (Class II only) : To apply de-aging at 150°C for 1hr then set for 24±2 hrs at room temp.	* I.R. (Class I):. : ≥1GΩ or RxC≥50Ω-F, whichever is smaller.																		
		* Measurement to be made after keeping at room temp. for 24±2 hrs (Class I) or 48±4 hrs (Class II).	* I.R. (Class II): ≥1GΩ or RxC≥10Ω-F, whichever is smaller.																		

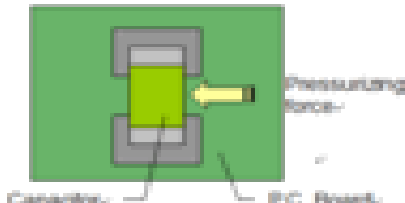
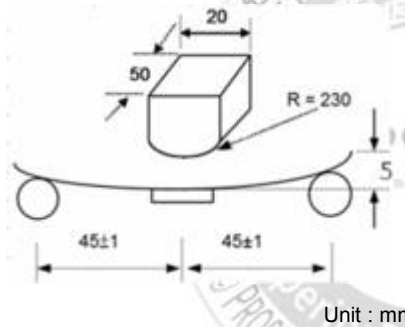


8. RELIABILITY TEST CONDITIONS AND REQUIREMENTS

No.	Item	Test Condition	Requirements																																																	
9.	Humidity (Damp Heat) Load	* Test temp. : 40±2°C. * Humidity : 90~95%RH. * Test time : 500 +24/-0hrs. * To apply voltage : Rated voltage (500V max.). * 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 ±7.5% or ±0.75pF, whichever is larger. X7R Within ±12.5%. * Q/D.F. : C0G : Q≥200. X7R : D.F.≤200% of initial requirement. * I.R. : ≥500MΩ or RxC≥25Ω-F, whichever is smaller.																																																	
10.	High Temperature Load (Endurance)	* Test temp. : 125±3°C. * To apply voltage : <table border="1"><thead><tr><th>Dielectric</th><th>Rated Vol.(V)</th><th>Apply Voltage</th></tr></thead><tbody><tr><td rowspan="4">C0G/X7R</td><td>≤100</td><td>2.0 times of UR</td></tr><tr><td>200≤V≤ 500</td><td>1.5 times of UR</td></tr><tr><td>=630</td><td>1.2 times of UR</td></tr><tr><td>>1000</td><td>1.0 times of UR</td></tr></tbody></table> * Exception items (X7R only) : (1) 150% of rated voltage for below range : <table border="1"><thead><tr><th>Rated Vol.(V)</th><th>Size</th><th>Cap. Range</th></tr></thead><tbody><tr><td>ALL</td><td>ALL</td><td>Cap.≥106</td></tr><tr><td rowspan="5">50V & 100V</td><td>1210</td><td rowspan="5">Cap.≥105</td></tr><tr><td>1812</td></tr><tr><td>1825</td></tr><tr><td>2220</td></tr><tr><td>2225</td></tr></tbody></table> (2) 120% of rated voltage for below range : <table border="1"><thead><tr><th>Size</th><th>Dielectric</th><th>Rated Voltage</th><th>Capacitance</th></tr></thead><tbody><tr><td>2220</td><td>X7R</td><td>≥100V</td><td>Cap.≥15μF</td></tr></tbody></table> (3) 100% of rated voltage for below range : <table border="1"><thead><tr><th>Size</th><th>Dielectric</th><th>Rated Voltage</th><th>Capacitance</th></tr></thead><tbody><tr><td>1206</td><td>X7R</td><td>≥100V</td><td>Cap.≥2.2μF</td></tr><tr><td>1210</td><td>X7R</td><td>≥100V</td><td>Cap.≥3.3μF</td></tr><tr><td>2220</td><td>X7R</td><td>≥100V</td><td>Cap.≥22μF</td></tr></tbody></table> * Test time : 1000 +24/-0 hrs. * Before initial measurement (Class II only) : To apply de-aging at 150°C for 1hr then set for 24±2 hrs at room temp. * Measurement to be made after keeping at room temp. for 24±2 hrs (Class I) or 48±4 hrs (Class II).	Dielectric	Rated Vol.(V)	Apply Voltage	C0G/X7R	≤100	2.0 times of UR	200≤V≤ 500	1.5 times of UR	=630	1.2 times of UR	>1000	1.0 times of UR	Rated Vol.(V)	Size	Cap. Range	ALL	ALL	Cap.≥106	50V & 100V	1210	Cap.≥105	1812	1825	2220	2225	Size	Dielectric	Rated Voltage	Capacitance	2220	X7R	≥100V	Cap.≥15μF	Size	Dielectric	Rated Voltage	Capacitance	1206	X7R	≥100V	Cap.≥2.2μF	1210	X7R	≥100V	Cap.≥3.3μF	2220	X7R	≥100V	Cap.≥22μF	* No remarkable damage. * Cap. change : C0G Within ±3.0% or ±0.3pF, whichever is larger. X7R Within ±12.5%. * Q/D.F. : C0G : Q≥350. X7R : D.F.≤200% of initial requirement. * I.R. (Class I) : ≥1GΩ or RxC≥50Ω-F, whichever is smaller. * I.R. (Class II) : ≥1GΩ or RxC≥10Ω-F, whichever is smaller.
Dielectric	Rated Vol.(V)	Apply Voltage																																																		
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ALL	ALL	Cap.≥106																																																		
50V & 100V	1210	Cap.≥105																																																		
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Size	Dielectric	Rated Voltage	Capacitance																																																	
2220	X7R	≥100V	Cap.≥15μF																																																	
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1206	X7R	≥100V	Cap.≥2.2μF																																																	
1210	X7R	≥100V	Cap.≥3.3μF																																																	
2220	X7R	≥100V	Cap.≥22μF																																																	



8. RELIABILITY TEST CONDITIONS AND REQUIREMENTS

No.	Item	Test Condition	Requirements						
11.	Adhesive Strength of Termination	* Capacitors mounted on a substrate. A force of 10N applied perpendicular to the place of substrate and parallel the line joining the center of terminations for 10±1 second.  Capacitor P.C. Board Pressing force	* No remarkable damage or removal of the terminations.						
12.	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 5mm and then the pressure shall be maintained for 5±1 sec.  Unit : mm	* No remarkable damage. <table><tr><th>Dielectric</th><th>Cap. Change</th></tr><tr><td>C0G</td><td>Within ±3.0% or ±2.0pF, whichever is larger</td></tr><tr><td>X7R</td><td>Within ±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	C0G	Within ±3.0% or ±2.0pF, whichever is larger	X7R	Within ±12.5%
Dielectric	Cap. Change								
C0G	Within ±3.0% or ±2.0pF, whichever is larger								
X7R	Within ±12.5%								
13.	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±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 and D.F. : To meet initial spec.						
14	Resistance to Soldering Heat	* Reflow soldering : Peak 260±5°C. * 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).	* No remarkable damage. * Cap. Change : C0G : Within ±2.5% or ±0.25pF, whichever is larger. X7R : Within ±7.5%. * Q/D.F. & I.R. : To meet the initial requirement.						



9. PACKAGE DIMENSION AND QUANTITY

9.1. PACKAGE QUANTITY

PDC Family & Size	Thickness (mm)	Plastic tape
		13" reel
FE1A	ALL	1.5k
FE2A	ALL	1.0k
FE1C	ALL	1.5k
FE2C	ALL	0.5k
FE1H	ALL	1k
FE2H	ALL	0.5k
For other chip size, please contact the liaison		

9.2. EMBOSSED TAPE DIMENSIONS

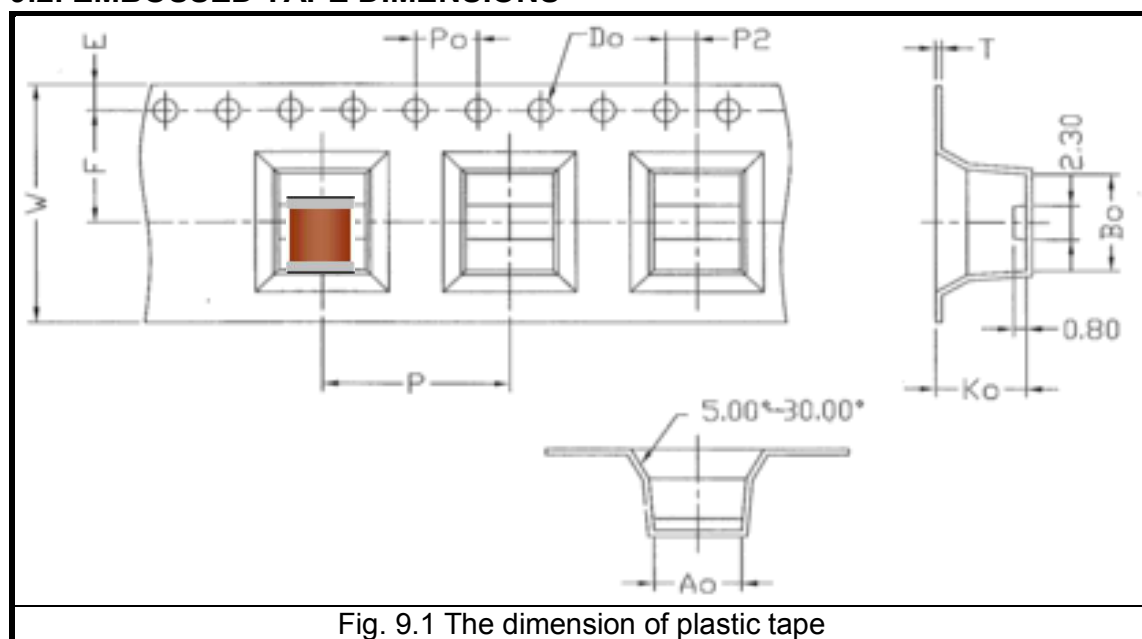


Fig. 9.1 The dimension of plastic tape

Size	FE1A	FE2A	FE1C	FE2C	FE1H	FE2H
Chip Thickness	3.00±0.35	3.60±0.35	3.60±0.35	6.00±0.35 6.60±0.35	4.20±0.35	6.00±0.35 6.60±0.35
W	12.00±0.30	12.00±0.30	16.00±0.30	16.00±0.30	16.00±0.30	16.00±0.30
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±0.10	5.50±0.10	7.50±0.10	7.50±0.10	7.50±0.10	7.50±0.10
P	8.00±0.10	8.00±0.10	8.00±0.10	12.00±0.10	12.00±0.10	12.00±0.10
P ₀	4.00±0.10	4.00±0.10	4.00±0.10	4.00±0.10	4.00±0.10	4.00±0.10
10xP ₀	40.00±0.20	40.00±0.20	40.00±0.20	40.00±0.20	40.00±0.20	40.00±0.20
P ₂	2.00±0.10	2.00±0.10	2.00±0.10	2.00±0.10	2.00±0.10	2.00±0.10
D ₀	Ø1.50 +0.10/-0	Ø1.50 +0.10/-0	Ø1.50 +0.10/-0	Ø1.50 +0.10/-0	Ø1.50 +0.10/-0	Ø1.50 +0.10/-0
T	0.40±0.05	0.40±0.05	0.40±0.05	0.40±0.05	0.40±0.05	0.50±0.05
A ₀	3.00±0.10	3.00±0.10	3.52±0.10	5.70±0.10	5.70±0.10	5.60±0.10
B ₀	3.82±0.10	4.00±0.10	5.08±0.10	6.60±0.10	6.45±0.10	6.60±0.10
K ₀	3.40±0.10	6.40±0.10	4.00±0.10	7.00±0.10	5.00±0.10	7.00±0.10
Unit :	mm	mm	mm	mm	mm	mm

* For other chip size, please contact the liaison.



9. PACKAGE DIMENSION AND QUANTITY

9.3. REEL DIMENSIONS

Reel size	13"	
A	330.0±0.50mm	
B	2.00±0.50mm	
C	13.00+0.50/-0.20mm	
T	2.00+0.50/-0.20 mm	

Fig. 9.2 The dimension of reel

10. FOOTPRINT DIMENSIONS

Size	1210	1812	1825	2220	2225	
D1	4.90	6.80	6.80	8.40	8.40	
D2	1.40	1.60	1.60	2.20	2.20	
D3	2.10	3.60	3.60	4.00	4.00	
D4	1.40	1.60	1.60	2.20	2.20	
D5	2.80	3.80	6.80	5.50	6.80	

Dimensions in millimeters



11. APPLICATION NOTES

STORAGE

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

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

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

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

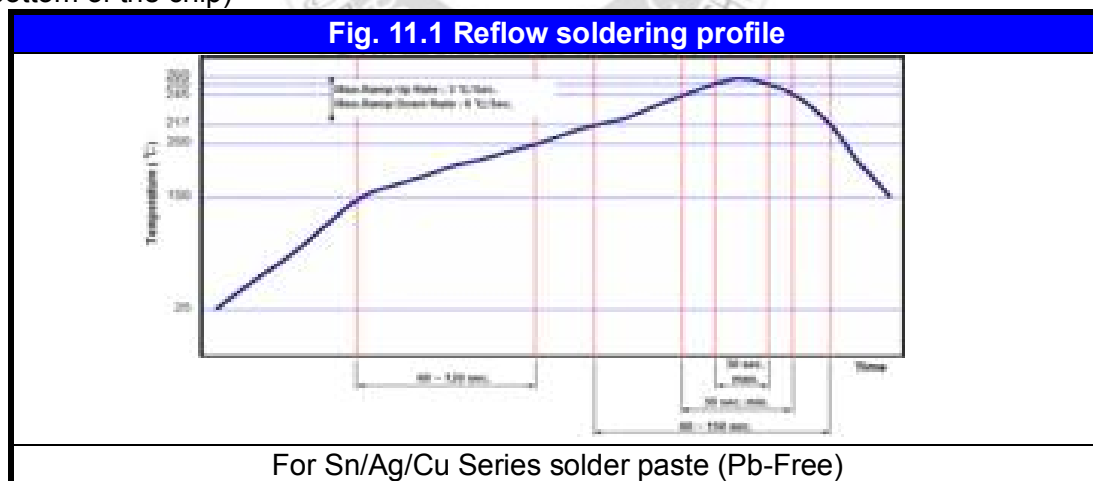
PREHEAT

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 mildly activated rosin 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.) Reflow soldering : (Please make sure that solder is smoothly applied higher than 0.3mm and lower than the level of the bottom of the chip)



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.