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Date : 2022/09/30

APPROVAL SHEET

Product Name : High Voltage Multilayer Ceramic Chip Capacitors

Part No. : FA55X104M102EFG

Description : Size 2220, X7R, 100nF, ±20%, 250VAC

PREPARED BY	APPROVED BY

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SPECIFICATION

FOR

Product Name : High Voltage Multilayer Ceramic Chip Capacitors

Part No. : FA55X104M102EFG

Description : Size 2220, X7R, 100nF, ±20%, 250VAC

SPEC. No. : FA-018-002-01	
DATE : 2022/09/30	

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

1. INTRODUCTION

PDC FA Series green type capacitors are manufactured by using environmental friendly material without lead or cadmium. These capacitors feature series connection of multi-layer capacitor units in a MLCC to realize high voltage performance. This special design can distribute voltage gradients throughout the entire capacitor, so as to prevent short circuit failure.
This series is no safety approval.
This series refer to the Electrical Appliance and Material Safety Law of Japan for general purpose.
Do not use these products in any automotive power train or safety equipment including battery chargers for electric vehicles and plugin hybrids

2. FEATURES

a. High reliability and stability.
b. Small size and high capacitance.
c. RoHS compliant.

3. APPLICATIONS

a. Modem.
b. Facsimile.
c. Telephone.
d. Other electronic equipment for lighting or surge protection and isolation.
e. Commercial power supplies.

4. HOW TO ORDER

FA	55	X	104	K	102	E	F	G
PDC Family	Size	Dielectric	Capacitance	Tolerance	Reference Voltage	Packaging	Thickness	Customer 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
FA	AC voltage application product

Table 2 Size

Code	Description	Code	Description	Code	Description
55	2220 (5750)				

Table 3 Dielectric Material Characteristics

Code	Description	Code	Description
N	C0G	X	X7R

Table 4 Capacitance Rule Code

Code	Description	Code	Description
0R5	0.5pF	104	104=10x10^4=100nF

Table 5 Tolerance

Code	Description	Code	Description	Code	Description
D	±0.50 pF	G	±2 %	K	±10 %
F	±1 %	J	±5 %	M	±20 %

Table 6 Reference Voltage

Code	Description	Code	Description	Code	Description
102	250Vac				

Table 7 Packaging Type

Code	Description	Code	Description
B	Bulk	E	Embossed Tape

Table 8 Thickness Description

Code	Description	Code	Description	Code	Description
C	1.25±0.10 mm	E	1.60±0.20 mm	G	2.50±0.30 mm
D	1.40±0.15 mm	F	2.00±0.20 mm	H	2.80±0.30 mm

Table 9 Customer Code

Code	Description	Code	Description
G	RoHS Compliant	Q	Surface Coating

5. EXTERNAL DIMENSIONS

Size Inch (mm)	2220(5750)
L (mm)	5.70±0.50
W (mm)	5.00±0.50
Code / T(mm)	F / 2.00±0.20
M_B min.(mm)	0.60±0.30

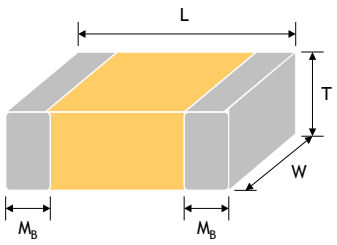


Fig. 5.1 The outline of MLCC

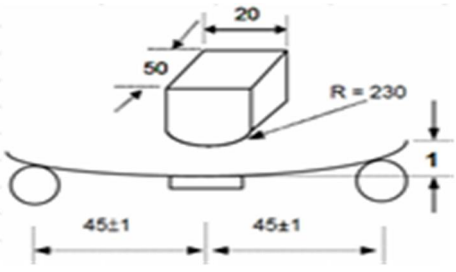
6. GENERAL ELECTRICAL DATA

Dielectric	X7R
Size	2220
Rated voltage	250Vac
Capacitance range	100nF
Capacitance tolerance	M(±20%)
Tan δ	≤2.5%
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
	Apply 1.0±0.2Vrms, 1.0KHz±10%, at 25°C ambient temperature
Insulation resistance	≥10GΩ or RxC≥100Ω-F, whichever is smaller
Operating temperature	-55°C to +125°C
Temperature coefficient	±15%
Termination	Cu/Ni/Sn (lead-free termination)

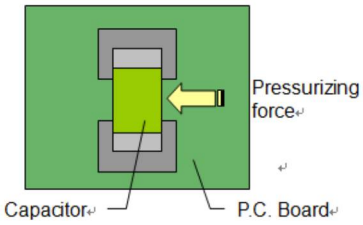
7. RELIABILITY TEST CONDITIONS AND REQUIREMENTS

<table>
<tr><th>No.</th><th>Item</th><th>Test Condition</th><th>Requirements</th></tr>
<tr><td>1.</td><td>Visual examination and Dimensions</td><td>---</td><td>* No remarkable defect.
* Dimensions to confirm to individual specification sheet.</td></tr>
<tr><td>2.</td><td>Capacitance</td><td rowspan="2">* Class II : 1.0±0.2Vrms, 1KHz±10%.</td><td>* Capacitance is within specified tolerance.</td></tr>
<tr><td>3.</td><td>Q/D.F. (Dissipation Factor)</td><td><table><tr><th>Dielectric</th><th>Rated Vol. (V)</th><th>Q/D.F.</th></tr><tr><td>Class II (X7R)</td><td>≥50</td><td>D.F.≤2.5%</td></tr></table></td></tr>
<tr><td>4.</td><td>Temperature Coefficient</td><td>* With no electrical load.<table><tr><th>T.C.</th><th>Operating Temp.</th></tr><tr><td>X7R</td><td>-55~125°C at 25°C</td></tr></table></td><td><table><tr><th>T.C.</th><th>Capacitance Change</th></tr><tr><td>X7R</td><td>±15%</td></tr></table></td></tr>
<tr><td>5.</td><td>Voltage proof (Dielectric Strength)</td><td>* To apply voltage :
10000pF min. : AC575V(r.m.s.).
less than 10000pF : AC1500V(r.m.s.).
* Duration : 60 sec.
* The charge current shall not exceed 0.05A.</td><td>* No evidence of damage or flash over during test.</td></tr>
<tr><td>6.</td><td>Insulation Resistance</td><td><table><tr><th>Rated Vol.(V)</th><th>Apply Voltage</th><th>Charge Current</th><th>Charge Time</th></tr><tr><td>>500</td><td>500Vdc</td><td>≤50mA</td><td>60 sec.</td></tr></table></td><td><table><tr><th>Dielectric</th><th>Requirements</th></tr><tr><td>Class II (X7R)</td><td>≥10GΩ or RxC≥100Ω-F, whichever is smaller</td></tr></table></td></tr>
<tr><td>7.</td><td>Solderability</td><td>* Solder temperature : 245±5°C.
* Dipping time : 2.0±0.5 sec.</td><td>* 75% min. coverage of all metalized area.</td></tr>
<tr><td>8.</td><td>Resistance to Soldering Heat</td><td>* Solder temperature : 260±5°C.
* Dipping time : 10±1 sec.
* Preheating : 120 to 150°C for 1 minute before immerse the capacitor in a eutectic solder.
* Before initial measurement (Class II only) : Perform 150 +0/-10°C for 1 hr and then set for 48±4 hrs at room temp.
* Measurement to be made after keeping at room temperature for 48±4 hrs (Class II).</td><td>* Appearance : No remarkable damage.
* Cap. change : X7R within ±7.5%.
* D.F. : X7R≤100% of initial requirement.
* I.R. : ≥100% of initial requirement.</td></tr>
<tr><td>9.</td><td>Temperature Cycle</td><td>* Conduct the five 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>* Measurement to be made after keeping at room temperature for 48±4 hrs (Class II).</td><td>* Appearance : No remarkable damage.
* Cap. change : X7R within ±7.5%.
* D.F. : X7R≤150% of initial requirement.
* I.R. : ≥100% of initial requirement.</td></tr>
</table>

7. 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. * Measurement to be made after keeping at room temp. for 48±4 hrs (Class II).	* Appearance : No remarkable damage. * Cap. change : X7R within ±15%. * D.F. : X7R≤200% of initial requirement. * I.R. : ≥1GΩ or RxC≥50Ω-F, whichever is smaller.
11.	**Humidity (Damp Heat) Load**	* Test temp. : 40±2°C. * Humidity : 90~95% RH. * Test time : 500 +24/-0hrs. * Applied voltage : 250Vac. * Measurement to be made after keeping at room temp. for 48±4 hrs (Class II).	* Appearance : No remarkable damage. * Cap. change : X7R within ±15%. * D.F. : X7R≤200% of initial requirement. * I.R. : ≥500MΩ or RxC≥25Ω-F, whichever is smaller.
13.	**High Temperature Load (Endurance)**	* Test temp. : 125±3°C. * Test time : 1000 +48/-0 hrs for Cap.≥103. 1500 +48/-0 hrs for Cap.<103. * Applied voltage : 300Vac for Cap.≥103 (Once every hour the voltage shall be increased to 1000Vrms for 0.1 sec.). 500Vac for Cap.<103. * Measurement to be made after keeping at room temp. for 48±4 hrs (Class II).	* Appearance : No mechanical damage. * Cap. change : X7R within ±20%. * D.F. : X7R≤200% of initial requirement. * I.R. : ≥1GΩ.
14.	**Resistance to Flexure of Substrate**	* Capacitors mounted on a substrate. The board shall be bent 1mm with a rate of 1mm/sec.  Unit : mm	* No remarkable damage. * Cap. change : X7R within ±12.5%. (This capacitance change means the change of capacitance under specified flexure of substrate from the capacitance measured before the test)

7. RELIABILITY TEST CONDITIONS AND REQUIREMENTS

No.	Item	Test Condition	Requirements
15.	**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 sec.  	* No remarkable damage or removal of the terminations.
16.	**Vibration**	* Reflow solder the capacitors on P. C. Board before test. * Vibration frequency : 10~55 Hz/min. * Total amplitude : 1.5mm. * Repeat the conditions for 2 hours each in 3 perpendicular directions. * Measurement to be made after keeping at room temp. for 48±4 hrs (Class II).	* No remarkable damage. * Cap. change and Q/D.F. : To meet initial spec.

8. PACKAGE DIMENSION AND QUANTITY

8.1. PACKAGE QUANTITY

Size	Thickness (mm)	Paper tape		Plastic tape	
		7" reel	13" reel	7" reel	13" reel
2220(5750)	2.00±0.20	-	-	1k	

8.2. EMBOSSED TAPE DIMENSIONS

Size	2220
Chip Thickness	2.00±0.20
A_0	<5.80
B_0	<6.50
T	0.30±0.10
K_0	<3.10
W	12.00±0.20
P_0	4.00±0.10
$10xP_0$	40.00±0.20
P_1	8.00±0.10
P_2	2.00±0.05
D_0	1.50+0.10/-0
D_1	1.50±0.10
E	1.75±0.10
F	5.50±0.05
Unit :	mm

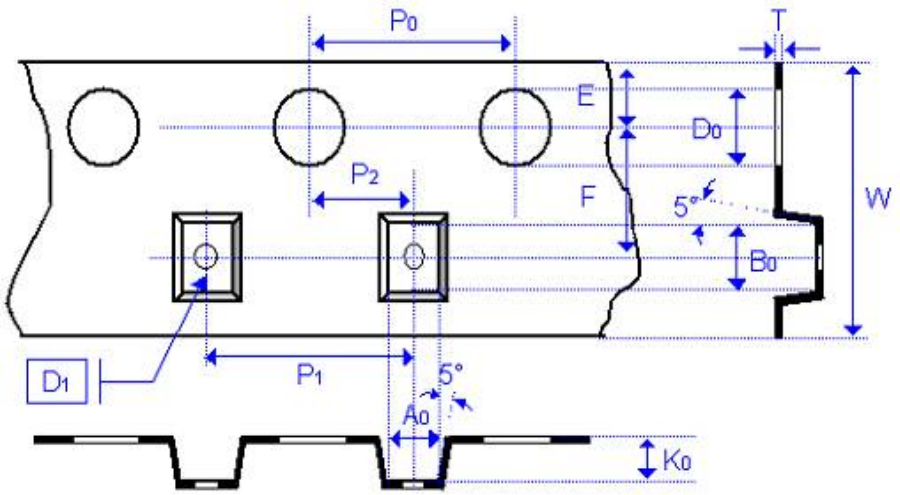


Fig. 8.1 The dimension of plastic tape

8.3. REEL DIMENSIONS

Reel size	7"
C	13.0 +0.5/-0.2
W_1	8.4 +1.5/-0
A	178.0 ±0.10
N	60.0 +1.0/-0

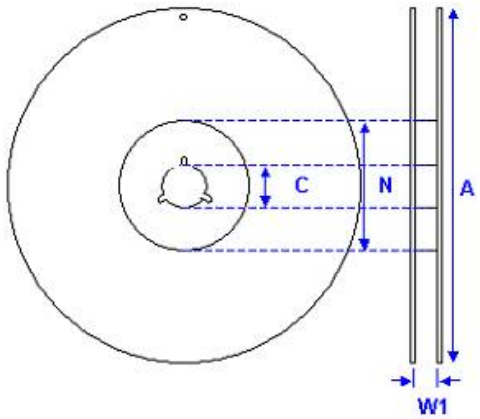


Fig. 8.2 The dimension of reel

9. 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

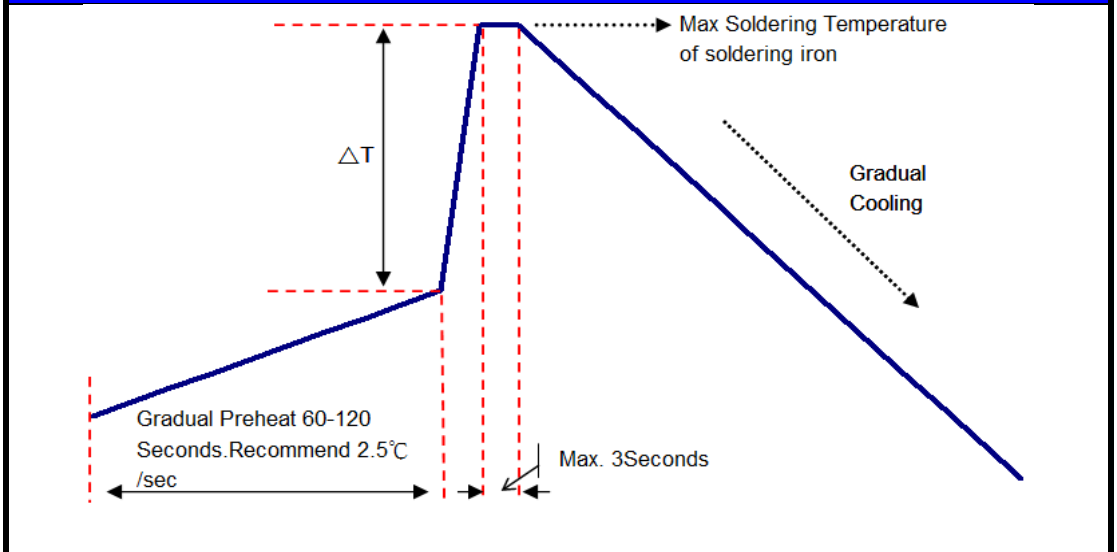
In order to minimize the risk of thermal shock during soldering, a carefully controlled preheat is required. The rate of preheat should not exceed 3°C per second.

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.) Hand soldering :

Fig. 9.1 Hand Soldering Profile



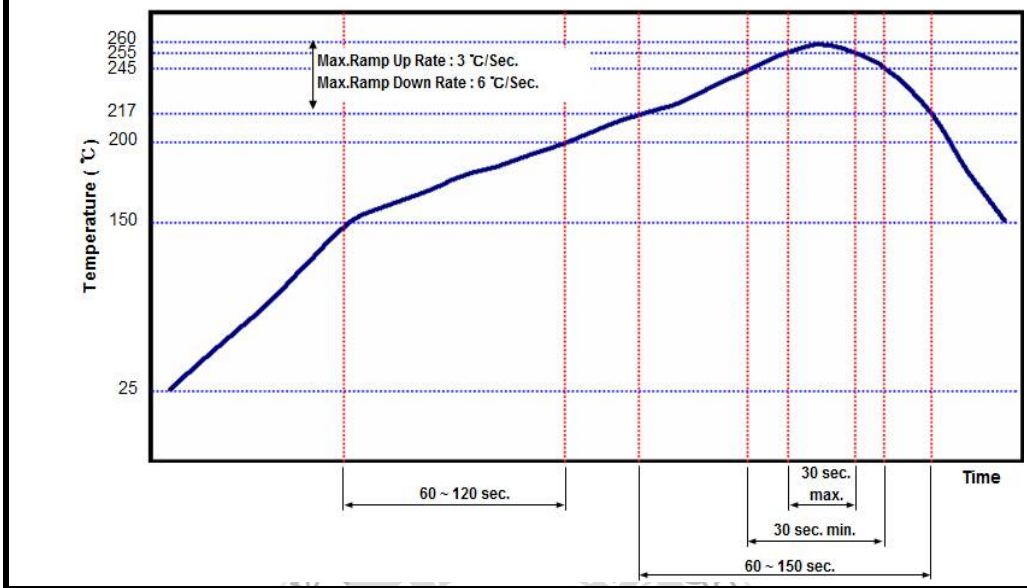
Chip Size	Pre-Heat temp.	ΔT	Max. soldering iron temp.
≤1206	≥150°C	≤150°C	≤350°C
1210~2225	≥150°C	≤130°C	≤280°C

* Soldering iron tip diameter ≤1.0 mm and wattage max. 20W.
* The Capacitors shall be pre-heated and that the temperature gradient between the devices and the tip of the soldering iron.
* The required amount of solder shall be melted on the soldering tip.
* The tip of iron should not contact the ceramic body directly.
* The Capacitors shall be cooled gradually at room temperature after soldering.
* Forced air cooling is not allowed.

9. APPLICATION NOTES

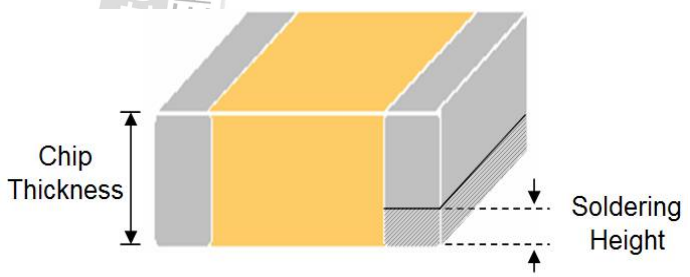
b.) Reflow soldering :

Fig. 9.2 Reflow soldering profile



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

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.