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Date : 2025/11/11

APPROVAL SHEET

Product Name : X7T Material Multilayer Ceramic Chip Capacitors

Part No. : X7T Series

Description : Size 1206/1210/1812/2220, X7T, 250Vdc~630Vdc

PREPARED BY	APPROVED BY

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SPECIFICATION

FOR

Product Name : X7T Material Multilayer Ceramic Chip Capacitors

Part No. : X7T Series

Description : Size 1206/1210/1812/2220, X7T, 250Vdc~630Vdc

SPEC. No. : X7T-000-001-08

DATE : 2025/11/11

DRAWN BY	CHECEKED BY	APPROVED BY
<i>Jane Hsiao</i>	<i>Yvens Chou</i>	<i>Hank chiang</i>



1. INTRODUCTION

X7T Series green type capacitors are manufactured by using green materials without lead and cadmium. These capacitors feature series connection of multi-layer capacitor units in a MLCC to realize high voltage performance. Reliable performances are built-in through exact formulation of dielectric powders, preparation of conductive paste, advanced automatic manufacturing, and strict quality control to assure excellent control in dielectric thickness, electrode integrity, and electrode-to-termination continuity.

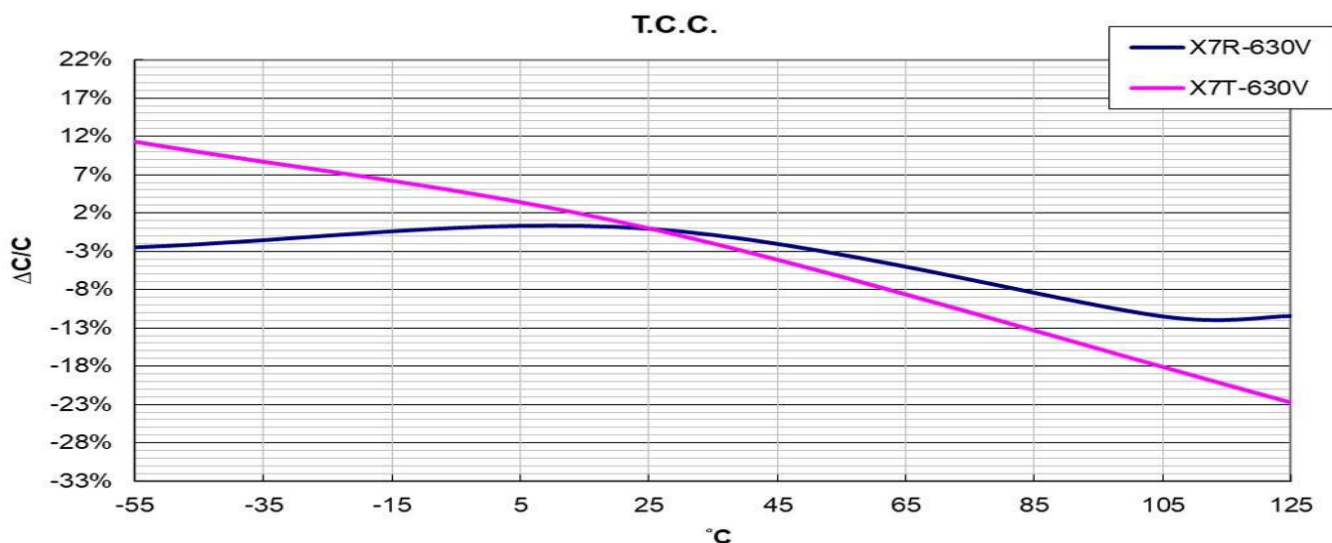
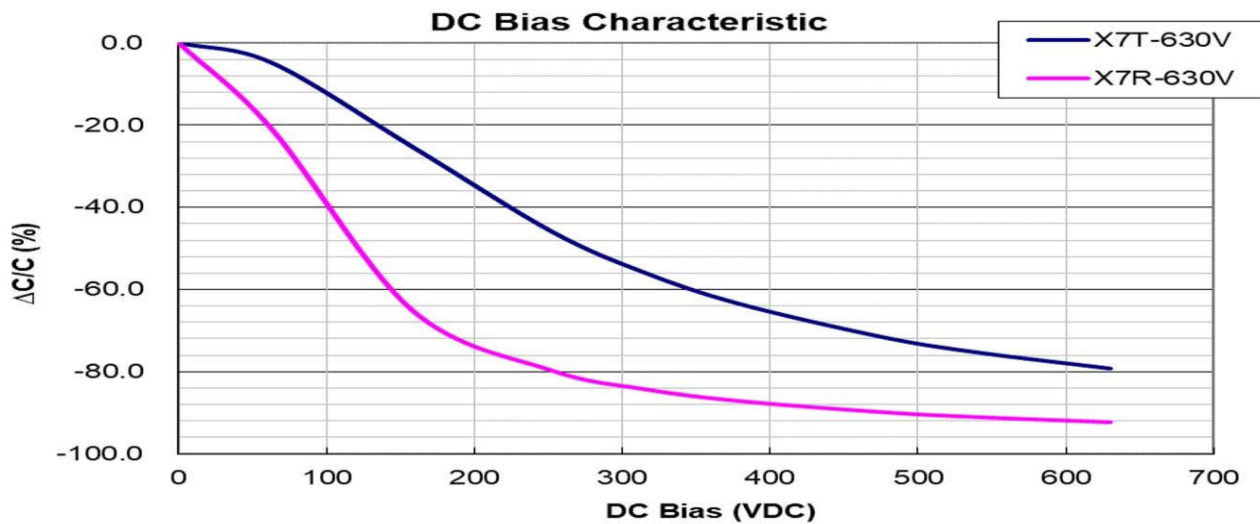
2. FEATURES

- a. Excellent DC-bias characteristics.
- b. Better Ripple-resistance.
- c. Noise improvement.
- d. Medium voltage in a given case size.
- e. High reliability and stability.
- f. RoHS compliant.

3. APPLICATIONS

- a. DC to DC converter.
- b. High voltage coupling/DC blocking.
- c. Back-lighting inverters.
- d. Snubbers in high frequency power converters.
- e. For Power Factor Correction Circuits of Power Supplies, EMI Suppression and Smoothing Circuits

4. DC Bias&TCC Characteristic



5. HOW TO ORDER

FM	32	I	334	K	251	E	G	G
PDC Family	Size	Dielectric	Capacitance	Tolerance	Rated Voltage	Packaging	Thickness	Control Code
Table 1	Table 2	Table 3	Table 4	Table 5	Table 6	Table 7	Table 8	Table 9

Table 1	PDC Family
Code	Description
FM	100V≤Rated Voltage≤630V series
FS	High Capacitance Capacitor ≥1μF(105)
FP	Anti-Bend General Purpose Product

Table 6		Rated Voltage			
Code	Description	Code	Description	Code	Description
101	100Vdc	251	250Vdc	501	500Vdc
201	200Vdc	401	400Vdc	631	630Vdc

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	812 (4532)	56	2225 (5763)
31	1206 (3216)	46	1825 (4563)		

Table 3		Dielectric Material Characteristics	
Code	Description	Code	Description
T	X7T		

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%		

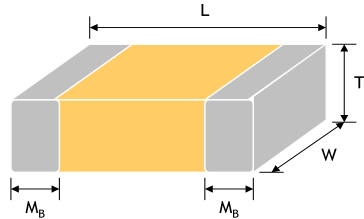
Table 7		Packaging Type	
Code	Description	Code	Description
B	Bulk	T	Tray package
E	Tape and 7" Reel, Embossed Tape	P	Tape and 7" Reel, Paper Tape
K	Tape and 10" Reel, Embossed Tape	D	Tape and 10" Reel, Paper Tape
L	Tape and 13" Reel, Embossed Tape	G	Tape and 13" Reel, Paper Tape

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)



6. EXTERNAL DIMENSIONS

Size Inch (mm)	L (mm)	W (mm)	Code / T (mm)	M _B (mm)	
1206(3216)	3.30±0.30	1.60±0.20 1.60 +0.30/ -0.10 [#]	See No.4 Reference Table 8	0.60±0.20	
1210(3225)	3.20±0.30	2.50±0.30		0.75±0.35	
1812(4532)	4.50±0.40	3.20±0.30		0.75±0.35	
2220(5750)	5.70±0.40	5.00±0.40		0.85±0.35	
					Fig. 5.1 The outline of MLCC

[#] For 1206 size P thickness products

7. GENERAL ELECTRICAL DATA

Dielectric	X7T
Size	1206, 1210, 1812, 2220
Rated voltage (WVDC)	250V, 450V, 630V
Capacitance range	10nF ~ 2.2μF
Capacitance tolerance	Reference to Table5
Tan δ	≤2.5%
Capacitance & Tan δ Test condition	Measured at the condition of 30~70% related humidity
	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
	1.0±0.2Vrms, 1.0KHz±10%, at 25°C ambient temperature
Insulation resistance at U _r	≥10GΩ or RxC≥100Ω-F, whichever is smaller
Operating temperature	-55 to +125°C
Capacitance characteristic	+22% ~ -33%
Termination	Cu/Ni/Sn (lead-free termination)



8. CAPACITANCE RANGE

8-1. X7T

Dimension		1206			1210			1812			2220		
Cap(pF)	code	250V	450V	630V	250V	450V	630V	250V	450V	630V	250V	450V	630V
10000	103		M	M									
12000	123		M	C									
15000	153		M	C									
18000	183		M	C									
22000	223		M	C			M						
27000	273		C	E			C						
33000	333		C	E			C						
39000	393		C	E			C						
47000	473	M	E	P			C						
56000	563	M	E	P			E						
68000	683	M	E			C	E			C			
82000	823	C	P			C	E			C			
100000	104	C	P		M	E	E			E			F
120000	124	E			M	E	F			E			F
150000	154	E			C	F	F		E	E			F
180000	184	E			C	F			E	F			F
220000	224	P			E	F		C	E	F		F	F
270000	274				E			C	F	G		F	F
330000	334				F			C	F			F	F
390000	394							E	G			F	G
470000	474							E	G		F	F	G
560000	564							E			F	F	G
680000	684							E			F	F	
820000	824							F			F	G	
1000000	105							G			F	G	
1500000	155										F		
2200000	225										G		



9. 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	* Class II : (X7T) 1.0±0.2Vrms, 1KHz±10%.	* Shall not exceed the limits given in the detailed spec.															
3.	Q/ D.F. (Tangent of loss angle)		<table><tr><td>Dielectric</td><td>Rated Vol.(V)</td><td>Q/D.F.</td></tr><tr><td>Class II (X7T)</td><td>≥50</td><td>D.F.≤2.5%</td></tr></table>	Dielectric	Rated Vol.(V)	Q/D.F.	Class II (X7T)	≥50	D.F.≤2.5%									
Dielectric	Rated Vol.(V)		Q/D.F.															
Class II (X7T)	≥50	D.F.≤2.5%																
4.	Temperature Coefficient (Temperature characteristic of capacitance)	<table><tr><td>T.C.</td><td>Operating Temp.</td></tr><tr><td>X7T</td><td>-55~125°C at 25°C</td></tr></table>	T.C.	Operating Temp.	X7T	-55~125°C at 25°C												
T.C.	Operating Temp.																	
X7T	-55~125°C at 25°C																	
5.	Insulation Resistance	<table><tr><td>Rated Vol.(V)</td><td>Apply Voltage</td><td>Test Condition</td></tr><tr><td>≤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	Test Condition	≤500	1 times of U _R	60 sec.	>500	500Vdc	60 sec.	<table><tr><td>Dielectric</td><td>Requirements</td></tr><tr><td>Class II</td><td>≥10GΩ or RxC≥100Ω-F, whichever is smaller</td></tr></table>	Dielectric	Requirements	Class II	≥10GΩ or RxC≥100Ω-F, whichever is smaller		
Rated Vol.(V)	Apply Voltage	Test Condition																
≤500	1 times of U _R	60 sec.																
>500	500Vdc	60 sec.																
Dielectric	Requirements																	
Class II	≥10GΩ or RxC≥100Ω-F, whichever is smaller																	
6.	Solderability	* Solder temperature : 235±5°C for (1210). * Solder temperature : 245±5°C for (1812~2220). * Dipping time : 2±0.5 sec.	* 75% min. coverage of all metalized area.															
7.	Dielectric Strength (Voltage proof)	<table><tr><td>Rated Vol.(V)</td><td>Condition</td></tr><tr><td>250</td><td>1.5 times of U_R</td></tr><tr><td>450</td><td>1.5 times of U_R</td></tr><tr><td>≥630</td><td>1.2 times of U_R</td></tr></table> * Duration : 1 to 5 sec. * Charge and discharge current less than 50mA.	Rated Vol.(V)	Condition	250	1.5 times of U _R	450	1.5 times of U _R	≥630	1.2 times of U _R	* No evidence of damage or flashover during test.							
Rated Vol.(V)	Condition																	
250	1.5 times of U _R																	
450	1.5 times of U _R																	
≥630	1.2 times of U _R																	
8.	Resistance to Soldering Heat	* Solder temperature : 260±5°C. * Dipping time : 10±1 sec. * Preheating : 120 to 150°C for 1 minute before immerse the capacitor in a eutectic solder. * Before initial measurement (Class II only) : 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 48±4 hrs (Class II).	* No remarkable damage. * Cap. Change : X7T : Within ±7.5%. * Q/D.F. & I.R. : To meet the initial requirement. * 25% max. leaching on each edge.															
9.	Temperature Cycle (Rapid change of temperature)	* Conduct the five cycles according to the temperatures and time. <table><tr><td>Step</td><td>Temp.(°C)</td><td>Time(min.)</td></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> * 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 48±4 hrs (Class II).	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 : X7T : Within ±7.5%. * Q/D.F. : X7T : 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																

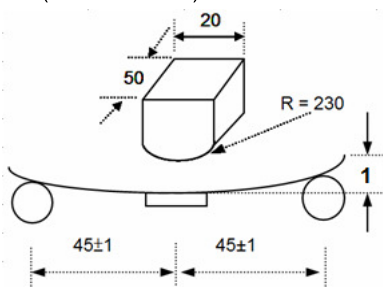
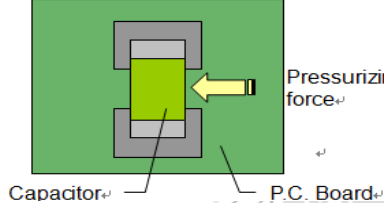


9. RELIABILITY TEST CONDITIONS AND REQUIREMENTS

No.	Item	Test Condition	Requirements
10.	Humidity (Damp Heat) Steady State	* Test temp. : $40\pm 2^{\circ}\text{C}$. * Humidity : 90~95%RH. * Test time : 500 +24/-0 hrs. * Measurement to be made after keeping at room temp. for 48±4 hrs (Class II).	* No remarkable damage. * Cap. change : X7T : Within $\pm 12.5\%$. * Q/D.F. : X7T : D.F. $\leq 200\%$ of initial requirement. * I.R. (Class II) : $\geq 1\text{G}\Omega$ or $\text{RxC} \geq 10\Omega\text{-F}$, whichever is smaller.
11.	Humidity (Damp Heat) Load	* Test temp. : $40\pm 2^{\circ}\text{C}$. * Humidity : 90~95% RH. * Test time : 500 +24/-0hrs. * To apply voltage : Rated voltage (Max. 500Vdc). * Measurement to be made after keeping at room temp. for 48±4 hrs (Class II).	* No remarkable damage. * Cap. change : X7T : Within $\pm 12.5\%$. * Q/D.F. : X7T : D.F. $\leq 200\%$ of initial requirement. * I.R. : $\geq 500\text{M}\Omega$ or $\text{RxC} \geq 25\Omega\text{-F}$, whichever is smaller.
12.	High Temperature Load (Endurance)	* Test temp. : X7T : $125\pm 3^{\circ}\text{C}$. 250 150% of rated voltage = 375V 450 120% of rated voltage = 540V 630 100% of rated voltage = 630V * Test time : 1000 +24/-0 hrs. * Measurement to be made after keeping at room temp. for 48±4 hrs (Class II).	* No remarkable damage. * Cap. change : X7T : Within $\pm 12.5\%$. * Q/D.F. : X7T : D.F. $\leq 200\%$ of initial requirement. * I.R. : $\geq 1\text{G}\Omega$ or $\text{RxC} \geq 10\Omega\text{-F}$, whichever is smaller.



9. RELIABILITY TEST CONDITIONS AND REQUIREMENTS

No.	Item	Test Condition	Requirements				
13	Resistance to Flexure of Substrate (Substrate 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. 5mm for product size < 1808, 3mm for product size ≥ 1808.(FOR Anti-Bend)  Unit : mm	* No remarkable damage. <table><tr><th>Dielectric</th><th>Cap. Change</th></tr><tr><td>Class II (X7T)</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	Class II (X7T)	Within ±12.5%
Dielectric	Cap. Change						
Class II (X7T)	Within ±12.5%						
14.	Adhesive Strength of Termination (Robustness 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.  Pressurizing force Capacitor P.C. Board	* No remarkable damage or removal of the terminations.				
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) * 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 the initial spec.				



10. PACKAGE DIMENSION AND QUANTITY

Size	Thickness (mm)	Paper tape		Plastic tape	
		7" reel	13" reel	7" reel	13" reel
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
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	-
2220(5750)	1.60±0.20	-	-	1k	-
	2.00±0.20	-	-	1k	-
	2.50±0.30	-	-	0.5k	-
	2.80±0.30	-	-	0.5k	-
	3.10±0.30	-	-	-	1k

Unit : pcs

8.1. PAPER TAPE DIMENSIONS

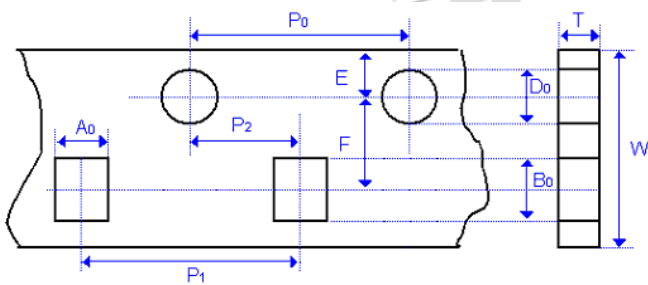


Fig. 10.1 The dimension of paper tape

8.2. EMBOSSED TAPE DIMENSIONS

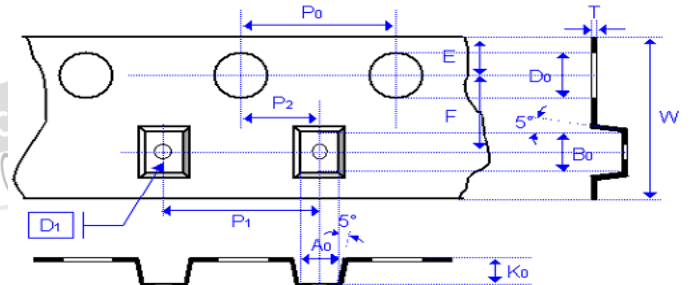


Fig. 10.2 The dimension of plastic tape

Size	1206			1210		1812	
Chip Thickness	0.80±0.10	0.95±0.10 1.25±0.10	1.60±0.20 1.60+0.3/-0.1	0.95±0.10 1.25±0.10 1.60±0.20	2.50±0.30 2.80±0.30	1.25±0.10 1.60±0.20 2.00±0.20	2.50±0.30 2.80±0.30
A0	2.00±0.10	<2.00	<2.00	<3.05	<3.20	<3.90	<3.90
B0	3.50±0.10	<3.60	<3.70	<3.80	<4.00	<5.30	<5.30
T	0.95±0.05	0.23±0.05	0.23±0.05	0.23±0.05	0.23±0.05	0.25±0.05	0.25±0.05
K0	-	<2.50	<2.50	<2.50	<3.50	<2.50	<3.00
W	8.00±0.10	8.00±0.10	8.00±0.10	8.00±0.10	8.00±0.10	12.00±0.20	12.00±0.20
P0	4.00±0.10	4.00±0.10	4.00±0.10	4.00±0.10	4.00±0.10	4.00±0.10	4.00±0.10
10xP0	40.00±0.20	40.00±0.20	40.00±0.20	40.00±0.20	40.00±0.20	40.00±0.20	40.00±0.20
P1	4.00±0.10	4.00±0.10	4.00±0.10	4.00±0.10	4.00±0.10	8.00±0.10	8.00±0.10
P2	2.00±0.05	2.00±0.05	2.00±0.05	2.00±0.05	2.00±0.05	2.00±0.05	2.00±0.05
D0	1.55±0.05	1.50 +0.10/-0	1.50 +0.10/-0	1.50 +0.10/-0	1.50 +0.10/-0	1.50 +0.10/-0	1.50 +0.10/-0
D1	-	1.00±0.10	1.00±0.10	1.50±0.10	1.00±0.10	1.50±0.10	1.50±0.10
E	1.75±0.10	1.75±0.10	1.75±0.10	1.75±0.10	1.75±0.10	1.75±0.10	1.75±0.10
F	3.50±0.05	3.50±0.05	3.50±0.05	3.50±0.05	3.50±0.05	5.50±0.05	5.50±0.05
Unit :	mm	mm	mm	mm	mm	mm	mm



10. PACKAGE DIMENSION AND QUANTITY

Size	2220	
Chip Thickness	1.40±0.15 1.60±0.20 2.00±0.20	2.50±0.30 2.80±0.30
A ₀	<5.80	<6.80
B ₀	<6.50	<6.50
T	0.30±0.10	0.30±0.10
K ₀	<2.50	<3.10
W	12.00±0.20	12.00±0.20
P ₀	4.00±0.10	4.00±0.10
10xP ₀	40.00±0.20	40.00±0.20
P ₁	8.00±0.10	8.00±0.10
P ₂	2.00±0.05	2.00±0.05
D ₀	1.50 +0.10/-0	1.50 +0.10/-0
D ₁	1.50±0.10	1.50±0.10
E	1.75±0.10	1.75±0.10
F	5.50±0.05	5.50±0.05
Unit :	mm	mm

10.2. REEL DIMENSIONS

Size	1210		1812, 2220
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
W	14.4max	14.4max	shall accommodate tape width without interference
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

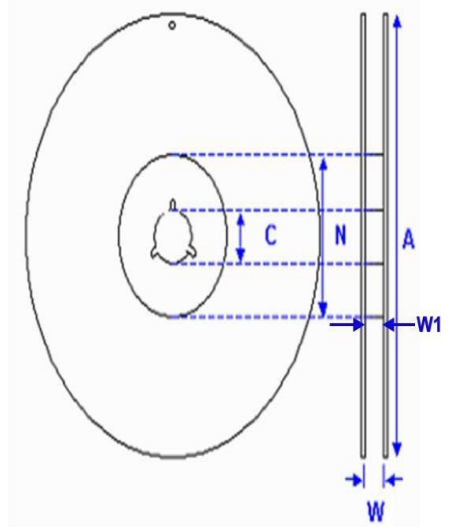


Fig. 10.2 The dimension of reel



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.

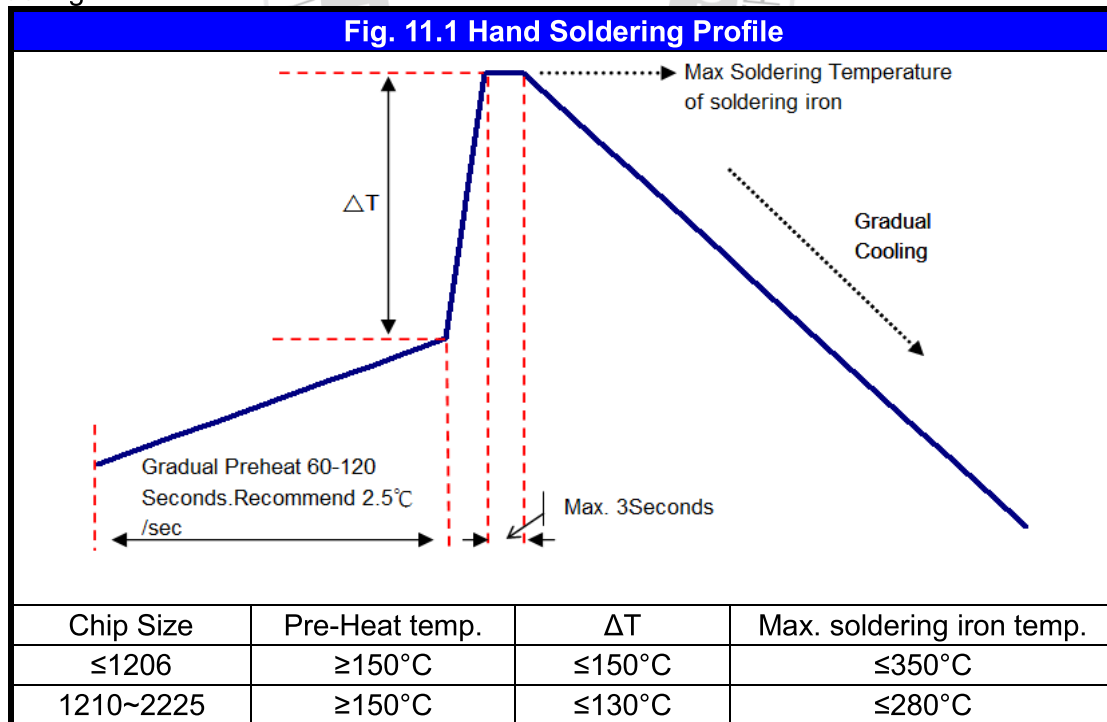
PREHEAT

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.) 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.

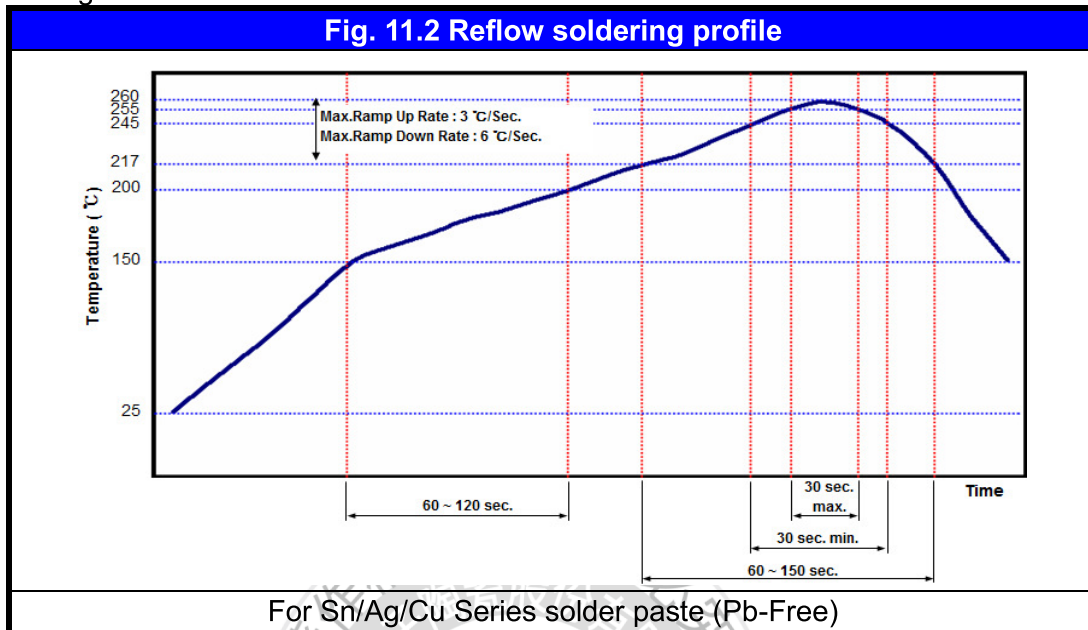
* The Capacitors shall be cooled gradually at room temperature after soldering.

* Forced air cooling is not allowed.

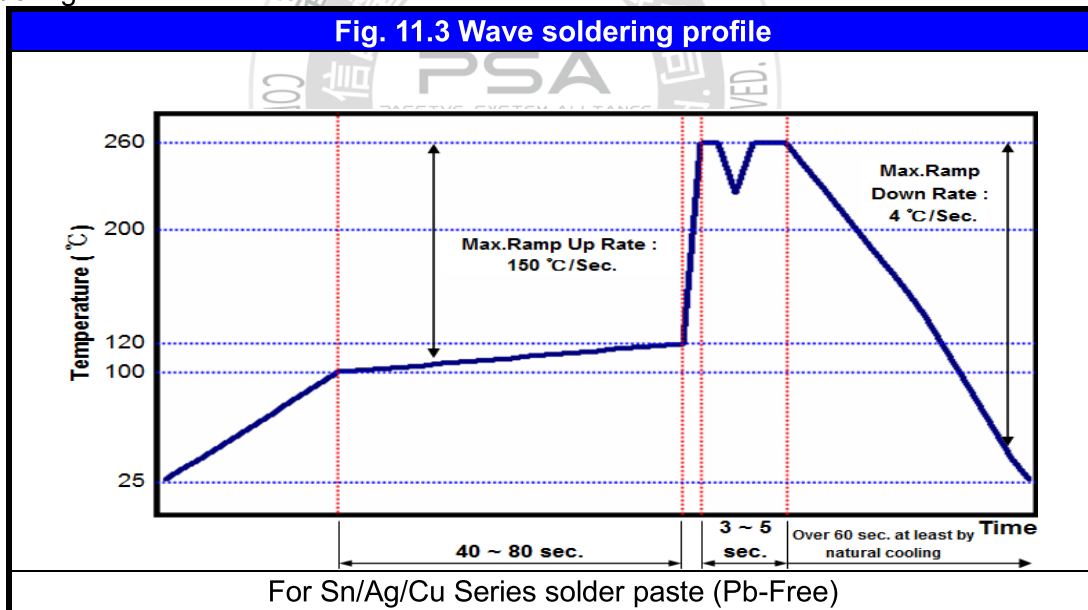


11. APPLICATION NOTES

b.) Reflow soldering :



c.) Wave soldering :



Soldering conditions :

Class II :

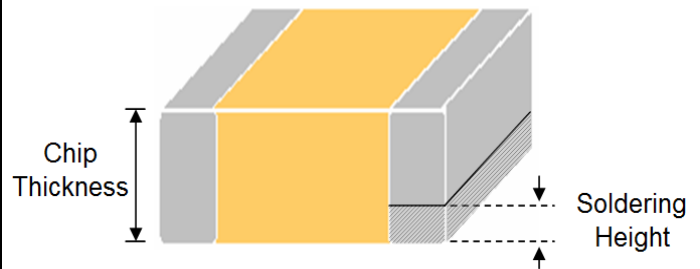
Size Inch (mm)	Temper. Cher.	Capacitance	Condition	
			Wave	Reflow
≤0402 (1005)	Class II	All	X	O
0603 (1608)	Class II	Cap. <2.2μF	O	O
		Cap. ≥2.2μF	X	O
0805 (2012)	Class II	Thickness ≤ 0.95mm	O	O
		Thickness > 0.95mm	X	O
1206 (3216)	Class II	Thickness ≤ 0.95mm	O	O
		Thickness > 0.95mm	X	O
≥1210 (3225)	Class II	All	X	O
Coating Products	All	All	X	O



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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.

