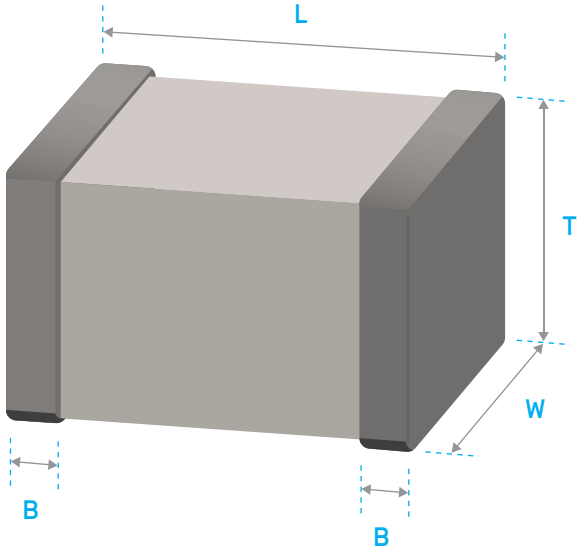
Safety Certified Capacitors



Quantic™ UTC's Safety Certified Capacitors are designed for surge or lightning immunity in modems, facsimiles, and other equipment. The capacitors of SY2 series are class X1/Y2 compliant, and the capacitors of SX2 series are class X2 compliant.

The green type capacitors in SY2/SX2 series are manufactured using environmentally friendly materials without lead or cadmium. The terminations are composed of plated nickel and pure tin, providing superior leaching resistance during soldering.

Features

- High reliability and stability
- Small size and high capacitance
- Safety standard approval by certificate number:
  TUV. R-50551491
  UL. E529341
- RoHS and HALOGEN compliant

Applications

Modem

Facsimile

Telephone

Other electronic equipment for lightning or surge protection and isolation

Quantic™ UTC

Quantic™ UTC is a global capacitor provider manufacturing multilayer ceramic capacitors (MLCCs) and leaded devices for use in defense, aerospace, computer, telecommunications, industrial and various high reliability applications. Our offerings include surface mount (SMT) multi-layer ceramic chips capacitors in both custom and EIA standard sizes; switch mode power supply (SMPS) capacitors in accordance with MIL-PRF-49470 and DSCC/DLA 87106, 88011 drawings and customer source controlled drawings (SCDs); SMT high voltage MLCC; radial leaded high voltage capacitors; SMD large body size MLCC; discoidal capacitors; discoidal arrays; and custom molded case radial parts.

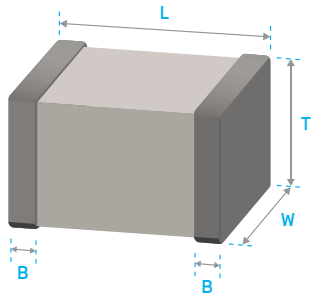
info@quanticutc | **quanticutc.com** | **+1-323-266-6603**

Part Ordering

SY2	W	1812	X7R	101	K	W	T
UTC Family	Impulse Voltage	Size	Dialectric	Capacitance	Tolerance	Termination	Packaging
SY2 = Safety ×1 & Y2 Series **SX2** = Safety ×2 Series	**W** = Impulse 2500V **Z** = Impulse 5000V **Q** = Impulse 6000V	1206 1808 1812 2211 2220	C0G X7R	Two significant digits followed by no. of zeros, and **R** is in place of the decimal point. **Examples:** 0R5 = 0.5pF 1R0 = 1.0pF 100 = 10pF	**A** ±0.05pF **B** ±0.1pF **C** ±0.25pF **D** ±0.5pF **F** ±1% **G** ±2% **J** ±5% **K** ±10% **M** ±20%	**W** = Cu/Ni/Sn	**T** = Tape & Reel

External Dimensions

Size Inch (mm)	L (mm)	W (mm)	Code / T (mm)	B (mm)
1206 (3216)	3.30±0.40	1.60±0.20	*Refer to **Capacitance Range** table below*	0.50±0.25
1808 (4520)	4.50+0.6/-0.3	2.00±0.30		0.50±0.25
1812 (4532)	4.50+0.6/-0.3	3.20±0.40		0.50±0.25
2211 (5728)	5.70±0.50	2.80±0.40		0.60±0.30
2220 (5750)	5.70±0.50	5.00±0.50		0.60±0.30



General Electrical Data

Dielectric	C0G		X7R	
Size	1808, 1812, 2211		1808, 1812, 2211, 2220	1206
Rated Voltage	250Vac			2.5KVdc
Capacitance Range	X1/Y2 Class (Impulse 6KV) : 4pF~100pF X1/Y2 Class (Impulse 5KV) : 3pF~720pF X2 Class : 3pF~1000pF		X1/Y2 Class : 100pF~4700pF X2 Class : 100pF~56000pF	100pF~1000pF
Capacitance Tolerance	Cap. Range	Tolerance Spec.	J (±5%) K (±10%) M (±20%)	
	Cap. <10pF	A (±0.05pF), B (±0.1pF), C (±0.25pF), D (±0.5pF)		
	10pF ≤Cap.	F (±1%), G (±2%), J (±5%) K (±10%), M (±20%)		
Tan δ	0.10% max.		≤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	
	Cap. Range	Test Condition	1.0±0.2Vrms, 1.0KHz±10%, at 25°C ambient temperature	
	Cap. ≤1000pF	1.0±0.2Vrms, 1.0MHz±10%		
	Cap. >1000pF	1.0±0.2Vrms, 1.0KHz±10%		
Insulation Resistance	≥100GΩ or RxC ≥1000Ω-F, whichever is smaller		≥10GΩ or RxC ≥500Ω-F, whichever is smaller	
Operating Temperature	-55°C to +125°C			
Temperature Coefficient	±30ppm /°C		±15%	
Termination	Cu/Ni/Sn (lead-free termination)			

Capacitance Range

Max Capacitance Rating (pF) for

C0G Dielectric & Max Rated Voltage up to **5KV DC** & **250 VAC**

EIA Size	Impulse		Max Height (H)
	5KV	6KV	
1808	3 pF–270 pF	N/A	F
1812	10 pF–470 pF	N/A	F
2211	4 pF–680 pF	4 pF–100 pF	G/H**

Max Capacitance Rating (pF) for

X7R Dielectric & Max Rated Voltage up to **5KV DC** & **250 VAC**

EIA Size	Impulse	Max Height (H)
	5KV (52)	
1808	100pF–1000pF	F*
1812	150pF–1000pF	G*

Max Capacitance Rating (pF) for

C0G Dielectric & Max Rated Voltage up to **2.5KV DC** & **250 VAC**

EIA Size	Impulse	Max Height (H)
	2.5KV	
1808	3pF–1000pF	F
1812	10pF–1000pF	G

Max Capacitance Rating (pF) for

X7R Dielectric & Max Rated Voltage up to **2.5KV DC** & **250 VAC**

EIA Size	Impulse	Max Height (H)
	2.5KV	
1808	150pF–2200pF	F
1812	270pF–5600pF	G
2220	10nF–56nF	H*

Max Capacitance Rating (pF) for

X7R Dielectric & Max Rated Voltage up to **2.5KV DC** & **250 VAC**

EIA Size	Impulse	Max Height (H)
	25KV	
1206	100pF–1000pF	C

C: 0.95±0.10mm

F: 2.00±0.20mm

G: 1.60±0.20mm

H: 2.80±0.30mm

* Conformal Coating

** 6K Impulse Voltage

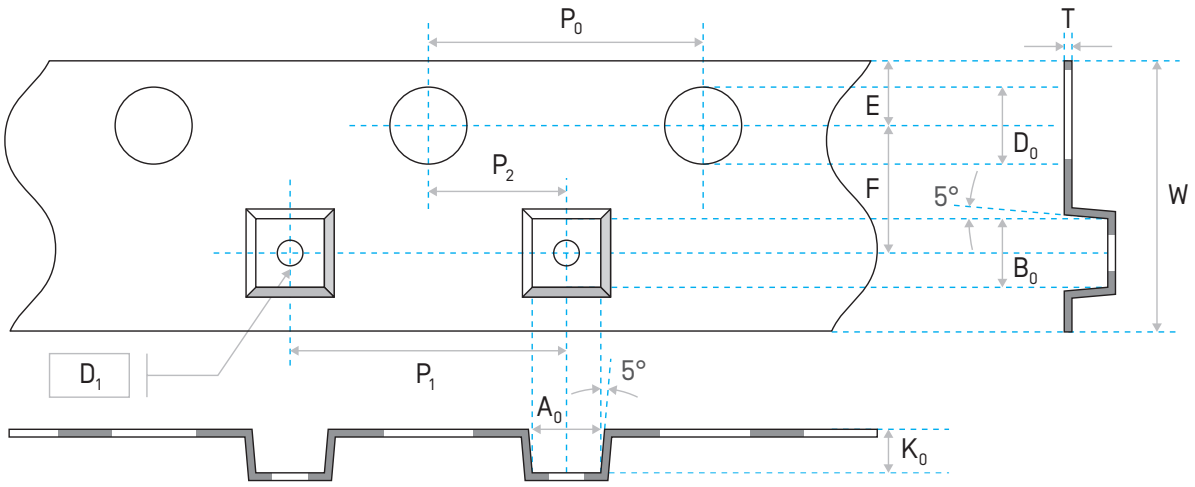
Reliability Test Conditions and Requirements

<table>
<tr><th>Item</th><th>Standard Methods</th><th>Test Condition</th><th>Requirements</th></tr>
<tr><td>1. Visual examination and Dimensions</td><td>IEC 60384-1
4.1</td><td>—</td><td>▪ No remarkable defect
▪ Dimensions to confirm to individual specification sheet</td></tr>
<tr><td>2. Capacitance</td><td>IEC 60384-1
4.2.2</td><td rowspan="2">▪ Class I: [C0G]
Cap. ≤1000pF, 1.0±0.2Vrms, 1MHz±10%
Cap. >1000pF, 1.0±0.2Vrms, 1KHz±10%
▪ Class II: [X7R]
1.0±0.2Vrms, 1KHz±10%</td><td>▪ Capacitance is within specified tolerance
▪ CR means rated capacitance for conform to the E6 series of preferred values given in IEC 60063</td></tr>
<tr><td>3. D.F. [Dissipation Factor]</td><td>IEC 60384-1
4.2.3</td><td><table><tr><th>Dielectric</th><th>D.F.</th></tr><tr><td>Class I [C0G]</td><td>0.1%</td></tr><tr><td>Class II [X7R]</td><td>≤2.5%</td></tr></table></td></tr>
<tr><td>4. Temperature Coefficient</td><td>IEC 60384-21/22
4.6</td><td>▪ 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></td><td><table><tr><th>T.C.</th><th>Capacitance Change</th></tr><tr><td>C0G</td><td>±30ppm/°C</td></tr><tr><td>X7R</td><td>±15%</td></tr></table></td></tr>
<tr><td>5. Voltage proof [Dielectric Strength]</td><td>IEC 60384-14
4.2.1</td><td>▪ To apply voltage:
X Capacitor: 1075Vdc [4.3UR]
Y Capacitor: 1500Vac
▪ Duration: 60 sec
▪ The charge current shall not exceed 0.05A
▪ The voltage shall be raised from the near zero to the test voltage a rate not exceeding 150V[r.m.s.]/sec.
▪ For SX2 series : 1500Vac / 1~5 sec.
▪ For SY2 series: 4000Vdc / 1~5 sec. [Validation by UL]
▪ For SY2 series: 3000Vdc / 1~5 sec. [Internal validation]</td><td>▪ No evidence of damage or flash over during test</td></tr>
<tr><td>6. Insulation Resistance</td><td>IEC 60384-21/22
4.5.3</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 I [C0G]</td><td>≥100GΩ or RxC ≥1000Ω-F, whichever is smaller</td></tr><tr><td>Class II [X7R]</td><td>≥10GΩ or RxC ≥500Ω-F, whichever is smaller</td></tr></table></td></tr>
<tr><td>7. Solderability</td><td>IEC 60384-21/22
4.10</td><td>▪ Solder temperature: 235±5°C [1206]
▪ Solder temperature: 245±5°C [1808~2220]
▪ Dipping time: 2.0±0.5 sec.</td><td>▪ 75% min. coverage of all metalized area</td></tr>
<tr><td>8. Resistance to Soldering Heat</td><td>IEC 60384-14
4.4
IEC 60384-21/22
4.9</td><td>▪ Solder temperature: 260±5°C
▪ Dipping time: 10±1 sec.
▪ Preheating: 120°C–150°C for 1 minute before immersing the capacitor in a eutectic solder
▪ Measurement to be made after keeping at room temperature for 24±2 hrs. [Class I] and 48±4 hrs. [Class II]</td><td>▪ Appearance:
No remarkable damage
▪ Cap. change:
C0G within ±2.5% or ±0.25pF, whichever is larger
X7R within ±7.5%
▪ D.F. value:
C0G to meet initial requirement
X7R to meet initial requirement
▪ I.R. : ≥1GΩ</td></tr>
</table>

Reliability Test Conditions and Requirements

Item	Standard Methods	Test Condition	Requirements
9. Temperature Cycle	IEC 60384-21/22 4.11	▪ Conduct the five cycles according to the temperatures and time **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 ▪ Measurement to be made after keeping at room temperature for 24 ±2 hrs. (Class I) and 48 ±4 hrs. (Class II)	▪ Appearance: No remarkable damage ▪ Cap. change: C0G within ±2.5% or ±0.25pF, whichever is larger X7R within ±7.5% ▪ D.F. value: C0G to meet initial requirement X7R ≤150% of initial requirement ▪ I.R.: To meet initial requirement
10. Humidity (Damp Heat) Steady State	IEC 60384-14 4.12	▪ Test temp.: 40 ±2°C ▪ Humidity: 90~95% RH ▪ Test time: 500 +24/-0hrs. ▪ Applied voltage: 250Vac. (SX2 series without the voltage) ▪ Measurement to be made after keeping at room temp. for 24±2 hrs (Class I) and 48±4 hrs. (Class II)	▪ Appearance: No remarkable damage ▪ Cap. change: C0G within ±3.0% or ±2.0pF, whichever is larger X7R within ±15% ▪ D.F. value: C0G ≤0.25% X7R ≤200% ▪ I.R.: ≥1GΩ or RxC ≥25Ω-F, whichever is smaller
11. Passive Flammability	IEC 60384-14 4.17 IEC 60384-1 4.38	▪ Volume sample: 21.56mm^3 ▪ Flame exposure time: 5 sec. max. ▪ Category of flammability: C	▪ Capacitor didn't burn at all (SX2 series not included)
12. Active Flammability	IEC 60384-14 4.17 IEC 60384-1 4.38	▪ The capacitors applied UR (250Vac). Then each sample shall be subjected to 20 discharges from a tank capacitor, charge to a voltage that, when discharged, places Ui 2500V for X2, Ui 5000V for X1Y2 across the capacitor under test. The interval between successive discharges shall be 5 sec.	▪ The cheese cloth shall not burn with a flame (SX2 series not included)
13. High Temperature Load (Endurance)	IEC 60384-14 4.14	▪ Impulse Voltage: Each individual capacitor shall be subjected to a Vp = 5.0KV (X1Y2 Class Impulse 5KV) or Vp = 2.5KV (X2 Class Impulse 2.5KV) impulse for three times before applied to endurance test ▪ Test temp: 125 ±3°C ▪ Test time: 1000 +48/-0 hrs. ▪ Applied voltage: X capacitor: 1.25UR (312.5Vac) Y capacitor: 1.70UR (425Vac) Once every hour the voltage shall be increased to 1000Vrms for 0.1 sec. ▪ Measurement to be made after keeping at room temp. for 24 ±2 hrs. (Class I) and 48 ±4 hrs. (Class II) **For SX2 series:** ▪ Test temp: 125 ±3°C ▪ To apply voltage: 2.5KVdc ▪ Test time: 1000 +24/-0 hrs. ▪ Measurement to be made after keeping at room temp. for 48 ±4 hrs.	▪ Appearance: No mechanical damage ▪ Cap. change: C0G within ±5.0% or ±0.5pF, whichever is larger X7R within ±20% ▪ D.F. value: C0G ≤0.25% X7R ≤5.0% ▪ I.R.: ≥1GΩ ▪ Dielectric strength satisfies the specified initial value. (SX2 series not include)

Tape Dimensions



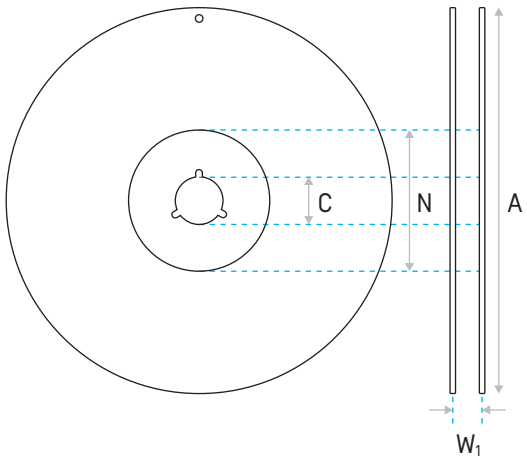
Size	1206	1808		1812		2211		2220	
Chip Thickness	1.25±0.10	1.25±0.10 1.40±0.15 1.60±0.20	2.00±0.20	1.25±0.10 1.40±0.15 1.60±0.20 2.00±0.20	2.50±0.30	1.60±0.20 2.00±0.20	2.50±0.30 2.80±0.30	2.00±0.20	2.50±0.30 2.80±0.30
A_0	<2.00	<2.50	<2.50	<3.90	<3.90	<3.30	<3.30	<5.80	<5.80
B_0	<3.60	<5.30	<5.30	<5.30	<5.30	<6.50	<6.50	<6.50	<6.50
T	0.23±0.05	0.25±0.05	0.25±0.05	0.25±0.05	0.25±0.05	0.30±0.10	0.30±0.10	0.30±0.10	0.30±0.10
K_0	<2.50	<2.50	<2.50	<2.50	<3.00	<2.50	<3.10	<2.50	<3.10
W	8.00±0.10	12.00±0.20	12.00±0.20	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	4.00±0.10	4.00±0.10	4.00±0.10
$10 \times P_0$	40.00±0.20	40.00±0.20	40.00±0.20	40.00±0.20	40.00±0.20	40.00±0.20	40.00±0.20	40.00±0.20	40.00±0.20
P_1	4.00±0.10	4.00±0.10	4.00±0.10	8.00±0.10	8.00±0.10	8.00±0.10	8.00±0.10	8.00±0.10	8.00±0.10
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	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	1.50+0.10/-0	1.50+0.10/-0	1.50+0.10/-0
D_1	1.00±0.10	1.50±0.10	1.50±0.10	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	1.75±0.10	1.75±0.10	1.75±0.10
F	3.50±0.05	5.50±0.05	5.50±0.05	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	mm	mm	mm

Packaging Dimensions & Quantity

Size	Thickness (mm)	Plastic Tape	
		7" Reel	13" Reel
1206 (3216)	1.25 ±0.10	3k	10k
1808 (4520)	1.25 ±0.10	2k	10k
	1.40 ±0.15	2k	10k
	1.60 ±0.20	2k	8k
	2.00 ±0.20	1k	6k
1812 (4532)	1.25 ±0.10	1k	5k
	1.40 ±0.15	1k	4k
	1.60 ±0.20	1k	4k
	2.00 ±0.20	1k	3k
	2.50 ±0.30	0.5k	3k
	2.80 ±0.30	0.5k	
2211 (5728)	1.60 ±0.20	1k	4k
	2.00 ±0.20	1k	3k
	2.50 ±0.30	0.5k	3k
	2.80 ±0.30	0.5k	—
2220 (5750)	2.00 ±0.20	1k	3k
	2.50 ±0.30	0.5k	2k
	2.80 ±0.30	0.5k	2k

Reel Dimensions

Size	1206	1808, 1812, 2211, 2220
Reel size	7"	7"
C	13.0 +0.5/-0.2	13.0 +0.5/-0.2
W_1	8.4 +1.5/-0	12.4 +2.0/-0
W	14.4 max.	shall accommodate tape width without interference
A	178.0 ±0.1	178.0 ±0.1
N	60.0 +1.0/-0	60.0 +1.0/-0



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.

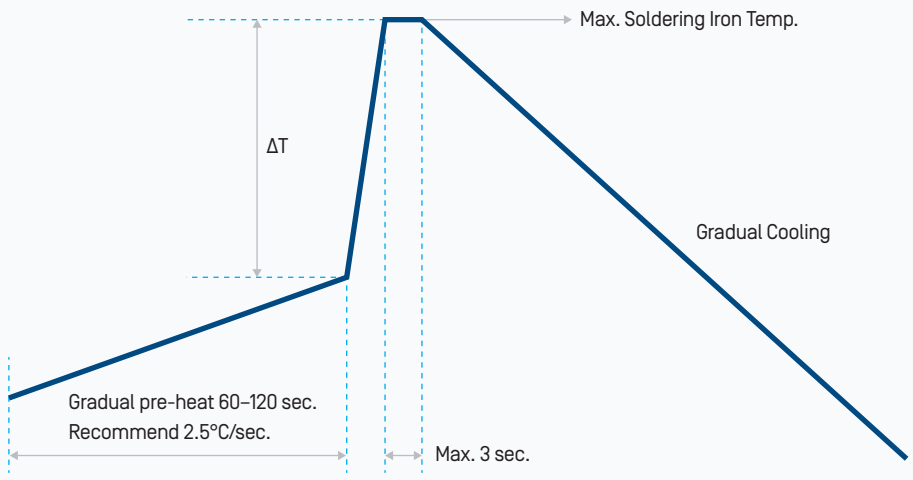
Preheat

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.

Hand Soldering Profile

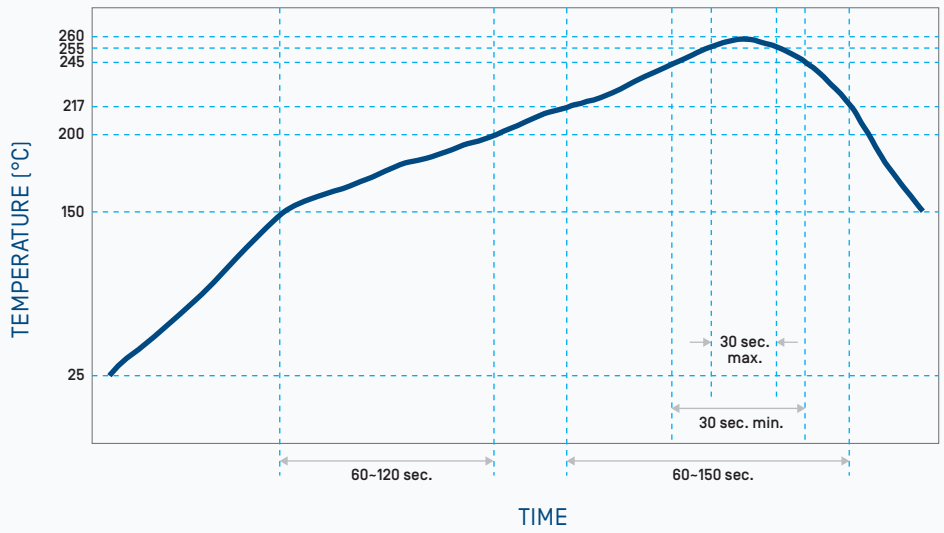


Chip Size	Pre-Heat Temp.	ΔT	Max. Soldering Iron Temp.
≤1206	≥150°C	≤150°C	≤350°C
1210~2225	≥150°C	≤130°C	≤280°C

Hand Soldering

- Soldering iron tip diameter ≤1.0mm and 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.

Reflow Soldering Profile for Sn/Ag/Cu Series Solder Paste (Pb-Free)

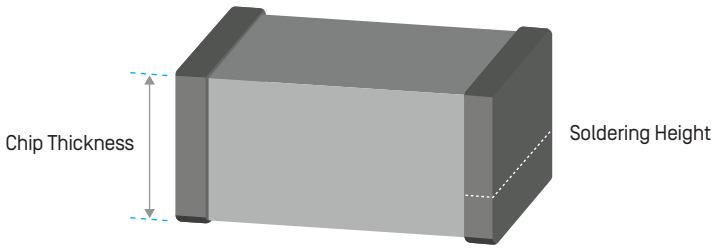


Wave Soldering

Do not apply wave soldering for size >1206 products, the condition for SX2 series products please contact with our sales representative.

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.

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