

# Multilayer SMD Ceramic Capacitors **multicomp** PRO

**RoHS  
Compliant**



## Features:

- High reliability and stability.
- Small size and high capacitance
- Safety standard approval by  
EN 60384-14 : 2013  
IEC 60384-14 : 2013  
UL 60384-14 (Ed 2.0)
- Certificate number:  
TUV: R50195920, TUV: R50381780  
UL: E182369
- HALOGEN compliant.

## Description:

SAFETY CERTIFIED CAPACITORS are designed for surge or lightning immunity in modern facsimile and other equipments. The capacitors of series S2 are class X1/Y2 compliant respectively.

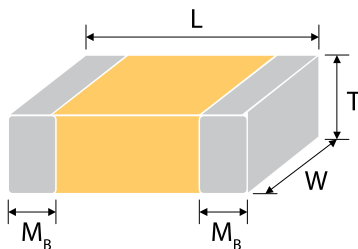
The green type capacitors in S2 and S3 series are manufactured by using environmentally friendly materials without lead or cadmium.

The terminations are composed of plated nickel and pure tin to feature the superior leaching resistance during soldering.

## Applications:

- Modem.
- Facsimile.
- Telephone.
- Other electronic equipment for lightning or surge protection and isolation

## External Dimensions & Structure



The outline of MLCC

### Safety certified Caps.

Size Inch (mm)	L (mm)	W (mm)	T (mm)/Symbol	M <sub>B</sub> min (mm)
2220 (5750)	5.7 ±0.4	5 ±0.4	2.8 ±0.3 (M)	0.6 ±0.3

### Safety certified Caps. with soft termination

Size Inch (mm)	L (mm)	W(mm)	T(mm)	M <sub>B</sub> (mm)
2220 (5750)	5.7 ±0.5	5 ±0.5	2.8 ±0.3 (M)	0.6 ±0.3

# Reflow soldering only is recommended.

## General Electrical Data:

Dielectric	X7R
Size	2220
Capacitance	100pF to 4700pF
Capacitance tolerance	J (±5%), K (±10%), M (±20%)
Rated voltage (WVDC)	250V AC
Q/DF (Tan δ)	DF≤2.5%
Insulation resistance at Ur	≥10GΩ
Peak impulse voltage	5000V ~ 6000V
Operating temperature	-55°C to +125°C
Capacitance characteristic	±15%
Termination	Ni/Sn (lead-free termination)
Certified number	TUV: R50195920, TUV: R50381780, UL: E182369
Test standard	EN 60384-14 : 2013, IEC 60384-14 : 2013, UL 60384-14 (Ed 2.0)

\* X7R: Apply 1.0±0.2Vrms, 1.0kHz±10%, at 25°C ambient temperature.

Newark.com/multicomp-pro  
Farnell.com/multicomp-pro  
sg.element14.com/b/multicomp-pro

**multicomp** PRO

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## Packaging Style And Quantity

Size	Thickness (mm)/Symbol		Paper tape	
			7" reel	13" reel
2220 (5750)	2 ±0.2	K	1K	--
	2.5 ±0.3	M	0.5k	2k

## Capacitance Range

Dielectric		X7R	
Size		2220	
Peak Impulse Voltage		5000	
Rated Voltage (VDC)		TUV IEC60384-14	UL 60384
Capacitance	100pF (101)	--	--
	120pF (121)	--	--
	130pF (131)	--	--
	150pF (151)	--	--
	160pF (161)	K	K
	180pF (181)	K	K
	220pF (221)	K	K
	270pF (271)	K	K
	300pF (301)		K
	330pF (331)	K	K
	390pF (391)	K	K
	470pF (471)	K	K
	560pF (561)	K	K
	680pF (681)	K	K
	720pF (721)	K	K
	820pF (821)	K	K
	1,000pF (102)	K	K
	1,200pF (122)	M	M
	1,500pF (152)	M	M
	1,800pF (182)	M	M
2,200pF (222)	M	M	
2,700pF (272)	M	M	
3,300pF (332)	M	M	
3,900pF (392)	M	M	
4,700pF (472)	M	M	

The letter in cell is expressed the symbol of product thickness.

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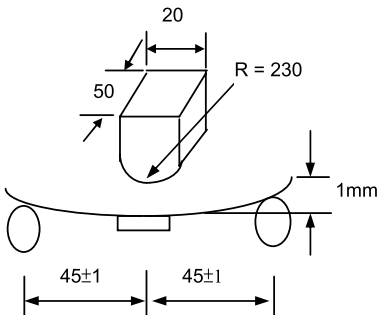
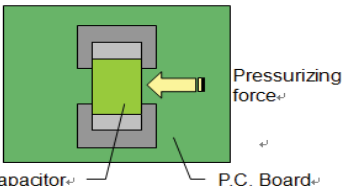
## Reliability Test Conditions And Requirements

No	Item	Standard Method	Test Condition	Requirements												
1	Visual examination and Dimensions	IEC 60384-1 4.1	-	* No remarkable defect. * Dimensions to confirm to individual specification sheet..												
2	Capacitance	IEC 60384-1 4.2.2	* Test temp.: Room Temperature. * Class I : (COG) Cap.1000pF, 1.0±0.2Vrms, 1MHz±10%. Cap.>1000pF, 1.0±0.2Vrms, 1KHz±10%.	* Capacitance is within specified tolerance. * CR means rated capacitance for conform to the E6 series of preferred values given in IEC 60063.												
3	D.F. (Dissipation Factor) Tangent of loss angle	IEC 60384-1 4.2.3	* Class II : (X7R) 1.0±0.2Vrms, 1KHz±10%.	<table border="1"> <thead> <tr> <th>Dielectric</th> <th>Q/D.F.</th> <th>Remark</th> </tr> </thead> <tbody> <tr> <td>Class II (X7R)</td> <td>D.F.≤2.5%</td> <td>--</td> </tr> </tbody> </table>	Dielectric	Q/D.F.	Remark	Class II (X7R)	D.F.≤2.5%	--						
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4	Temperature Coefficient	IEC 60384-21/22 4.6	With no electrical load. <table border="1"> <thead> <tr> <th>T.C.</th> <th>Operating Temp</th> </tr> </thead> <tbody> <tr> <td>X7R</td> <td>-55°C to 125°C at 25°C</td> </tr> </tbody> </table>	T.C.	Operating Temp	X7R	-55°C to 125°C at 25°C	<table border="1"> <thead> <tr> <th>T.C.</th> <th>Capacitance Change</th> </tr> </thead> <tbody> <tr> <td>X7R</td> <td>Within ±15%</td> </tr> </tbody> </table>	T.C.	Capacitance Change	X7R	Within ±15%				
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5	Voltage proof (Dielectric Strength)	IEC 60384-14 4.2.1	* 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.	* No evidence of damage or flash over during test.												
6	Insulation Resistance	IEC 60384-21/22 4.5.3	<table border="1"> <thead> <tr> <th>Rated Vol.(V)</th> <th>Apply Voltage</th> <th>Charge Current</th> <th>Charge Time</th> </tr> </thead> <tbody> <tr> <td>&gt;500</td> <td>500V DC</td> <td>≤50mA</td> <td>60 sec.</td> </tr> </tbody> </table> *Test temp.: Room Temperature.	Rated Vol.(V)	Apply Voltage	Charge Current	Charge Time	>500	500V DC	≤50mA	60 sec.	<table border="1"> <thead> <tr> <th>Dielectric</th> <th>Requirements</th> </tr> </thead> <tbody> <tr> <td>Class II (X7R)</td> <td>≥10G or RxC500-F, whichever is smaller</td> </tr> </tbody> </table>	Dielectric	Requirements	Class II (X7R)	≥10G or RxC500-F, whichever is smaller
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Class II (X7R)	≥10G or RxC500-F, whichever is smaller															
7	Solderability	IEC 60384-21/22 4.1	* Solder temperature: 235±5°C(0201~1210). * Solder temperature: 245±5°C(1808~2225). * Dipping time : 2±0.5 sec.	* 75% min. coverage of all metalized area												
8	Resistance to Soldering Heat	IEC 60384-14 4.4 IEC 60384-21/22 4.9	* 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. * Measurement to be made after keeping at room temperature for 24±2 hrs.	<table border="1"> <thead> <tr> <th>Dielectric</th> <th>I.R.</th> <th>Cap. Change</th> <th>Q/D.F.</th> </tr> </thead> <tbody> <tr> <td>Class II (X7R)</td> <td>≥1GΩ</td> <td>Within ±7.5%</td> <td>≤100% of initial requirement</td> </tr> </tbody> </table>	Dielectric	I.R.	Cap. Change	Q/D.F.	Class II (X7R)	≥1GΩ	Within ±7.5%	≤100% of initial requirement				
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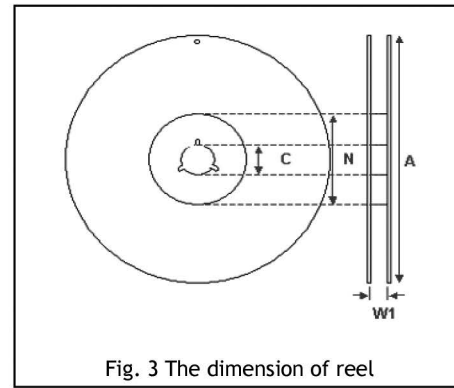
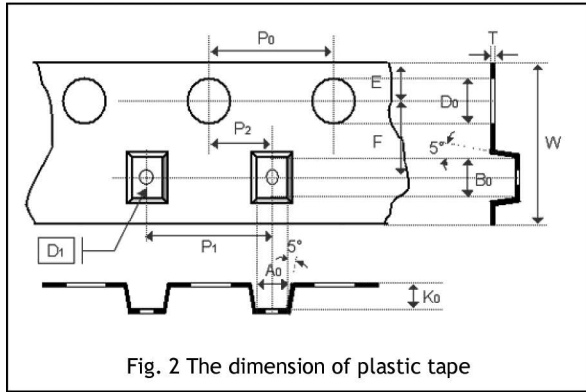
No	Item	Standard Method	Test Condition	Requirements																							
9	Temperature Cycle	IEC 60384-21/22 4.11	<p>* Conduct the five cycles according to the temperatures and time.</p> <table border="1"> <thead> <tr> <th>Step</th> <th>Temp.(°C)</th> <th>Time (min.)</th> </tr> </thead> <tbody> <tr> <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> </tbody> </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	<table border="1"> <thead> <tr> <th>Dielectric</th> <th>I.R.</th> <th>Cap. Change</th> <th>Q/D.F.</th> </tr> </thead> <tbody> <tr> <td>Class II (X7R)</td> <td>To meet initial requirement</td> <td>Within ±7.5%</td> <td>≤1.5(D.F.) × initial requirement</td> </tr> </tbody> </table>	Dielectric	I.R.	Cap. Change	Q/D.F.	Class II (X7R)	To meet initial requirement	Within ±7.5%	≤1.5(D.F.) × initial requirement
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10	Humidity (Damp Heat) Steady State	IEC 60384-14 4.12	<p>* 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 24±2 hrs (Class I) and 48±4 hrs (Class II).</p>	<p>* No remarkable damage.</p> <table border="1"> <thead> <tr> <th>Dielectric</th> <th>I.R.</th> <th>Cap. Change</th> <th>Q/D.F.</th> </tr> </thead> <tbody> <tr> <td>Class II (X7R)</td> <td>≤1G or RxC≥ 25-F, whichever is smaller</td> <td>Within ±15%</td> <td>≤2.0(D.F.) × initial requirement</td> </tr> </tbody> </table>	Dielectric	I.R.	Cap. Change	Q/D.F.	Class II (X7R)	≤1G or RxC≥ 25-F, whichever is smaller	Within ±15%	≤2.0(D.F.) × initial requirement															
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11	Passive Flammability	IEC 60384-14 4.17 IEC 60384-1 4.38	<p>* Volume sample: 21.56 mm<sup>3</sup>            * Flame exposure time: 5 sec Max.            * Category of flammability : C.</p>	<p>* Capacitor didn't burn at all.</p>																							
12	Active Flammability	IEC 60384-21/22 4.18	<p>* 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, place U<sub>i</sub> 2500V for X1Y2 across the capacitor under test. The interval between successive discharges shall be 5 sec.</p>	<p>* The cheese cloth shall not burn with a flame.</p>																							
13.	High Temperature Load (Endurance)	IEC 60384-14 4.14	<p>* Impulse Voltage :            Each individual capacitor shall be subjected to a V<sub>p</sub> = 5.0KV (X1Y2 Class Impulse 5KV) &amp; V<sub>p</sub> = 6.0KV (X1Y2 Class Impulse 6KV) 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).</p>	<p>* Appearance :            No mechanical damage.            * Cap. change :            X7R within ±20%.            * D.F. value :            X7R5.0%.            * I.R.1G.            * Dielectric strength satisfies the specified initial value.</p>																							

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No	Item	Standard Method	Test Condition	Requirements				
14.	Resistance to Flexure of Substrate	IEC 60384-21/22 4.8	<p>* Capacitors mounted on a substrate. The board shall be bent 1mm with a rate of 1mm/sec.</p> 	<p>* No remarkable damage.</p> <table border="1" data-bbox="944 459 1401 533"> <tr> <td>Dielectric</td> <td>Cap. Change</td> </tr> <tr> <td>Class II (X7R)</td> <td>Within ±12.5%</td> </tr> </table> <p>(This capacitance change means the change of capacitance under specified flexure of substrate from the capacitance measured before the test)</p>	Dielectric	Cap. Change	Class II (X7R)	Within ±12.5%
Dielectric	Cap. Change							
Class II (X7R)	Within ±12.5%							
15.	Adhesive Strength of Termination	IEC 60384-21/22 4.15 IEC 60384-1 4.13	<p>* 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.</p> 	<p>* No remarkable damage or removal of the terminations.</p>				
16.	Vibration	IEC 60384-1 4.17	<p>* Reflow solder the capacitors on P. C. Board before test.</p> <p>* Vibration frequency : 10~55 Hz/ min.</p> <p>* Total amplitude : 1.5mm.</p> <p>* Repeat the conditions for 2 hours each in 3 perpendicular directions.</p>	<p>* No remarkable damage.</p> <p>* Cap. change and Q/D.F. : To meet initial spec.</p>				
17.	Impulse Voltage	IEC 60384-14 4.13	<p>* X1 : 4.0KV</p> <p>* Y2 : 5.0KV.</p> <p>* Number of impulse : 24 max.</p>	<p>* There shall be no permanent breakdown or flashover.</p>				

\* "Room condition" Temperature: 15 to 35°C, Relative humidity: 25 to 75%, Atmospheric pressure: 86 to 106kPa.

## Embossed Tape Dimensions



Size	2220	
Chip Thickness	2 ±0.2	2.5 ±0.3
A <sub>0</sub>	<5.8	<5.8
B <sub>0</sub>	<6.5	<6.5
T	0.3 ±0.1	0.3 ±0.1
K <sub>0</sub>	<2.5	<3.5
W	12 ±0.3	12 ±0.3
P <sub>0</sub>	4 ±0.1	4 ±0.1
10xP <sub>0</sub>	4 ±0.2	4 ±0.2
P <sub>1</sub>	8 ±0.1	8 ±0.1
P <sub>2</sub>	2 ±0.1	2 ±0.1
D <sub>0</sub>	1.5 +0.10/-0	1.5 +0.10/-0
D <sub>1</sub>	1.5 ±0.1	1.5 ±0.1
E	1.75 ±0.1	1.75 ±0.1
F	5.5 ±0.1	5.5 ±0.1

Size	2220	
Reel size	7"	13"
C	13 +0.5/-0.2	13 +0.5/-0.2
W <sub>1</sub>	12.4+2.0/-0	12.4+2.0/-0
A	178 ±0.1	330 ±1
N	60 +1/-0	100 ±1

## Application Notes

### Storage and handling conditions

To prevent the damage of solderability of terminations, the following storage conditions are recommended: Indoors under 5 ~ 40°C and 20% ~ 70% RH; MSL Level 1.

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.

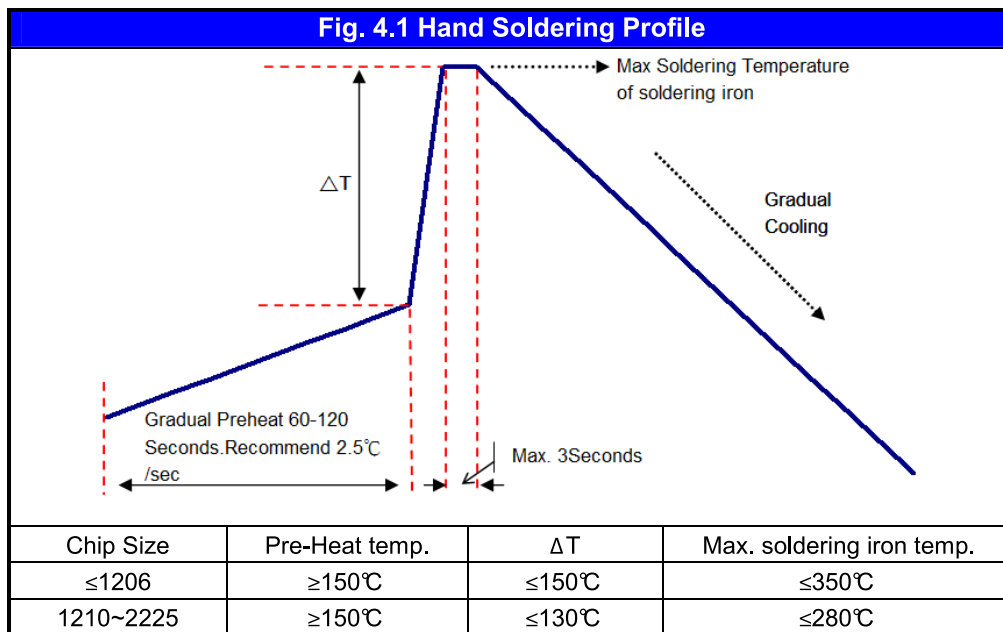
### Preheat

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 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.

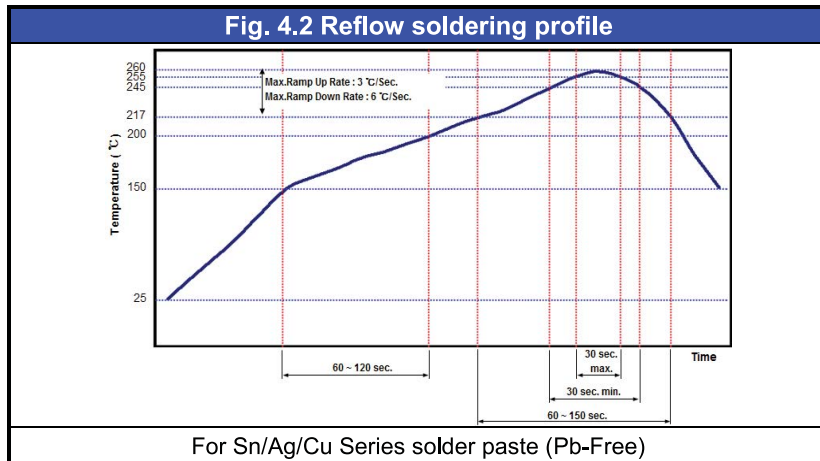
a.) Hand soldering :



- 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.

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- The Capacitors shall be cooled gradually at room temperature after soldering.
  - Forced air cooling is not allowed.
- b.) Reflow soldering :



## 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.

## Part Number Table

Description	Part Number
Capacitor, 2220, 2200pF, X7R, 5000V	MPS255B222K502CT

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