Surface-Mount Safety Capacitors
SMD-X1Y1 Series

1、 Characteristics

- The product height is 2.5mm, significantly reduced compared to traditional lead-type capacitor；
- The product is tape-packaged and suitable for SMT (Surface Mount Technology) automatic insertion soldering;
- SMD ceramic capacitors enable comprehensive surface mounting and miniaturization of end products;
- The product is coated using flame-retardant epoxy resin (compliant with UL 94V-0 flame retardant rating).

2、 Application

- Filtering in AC circuits, primary and secondary coupling in switch-mode power supplies and AC converters;
- The D-A isolation and noise reduction of the transformerless DDA modem;

Part numbering on request.

4、 Technical Information

Capacitor Type	Y1 Class
Climatic Category	40/125/21 B
Operating Temperature Range	-40℃～125℃
Rated Voltage	500VAC
Capacitance Range	3300pF～4700pF
Dissipation Factor	D.F.≤2.5%
Withstanding Voltage	4000Vac (r.m.s.)/60sec.
Insulation Resistance	＞10000MΩ(Charging for 60±5 seconds under 500VDC)

5、 Product imprinting

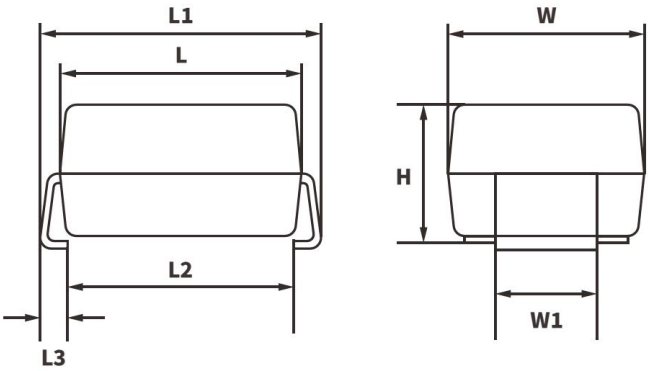
Example			
	1	STE	SongTian Logo
	2	SMD	Product Model：SMD
	3	Y5V	Temperature Characteristics：Y5V
	4	472	Capacitance：4700pF
	5	M	Capacitance Tolerance：M（±20%）
	6	X1Y1	Capacitor Type
	7	760～ 500～	Rated Voltage：760VAC 500VAC

6、 Safety Certificate

Approval	Organization	Safety Standards	Certificate No.	Rated Voltage
China	CQC	IEC60384-14:2013/ AMD1:2016	CQC24001446247	X1:760VAC、500VAC、400VAC Y1:500VAC、400VAC、250VAC
EU	ENEC	DIN EN IEC60384-14:2024; ENIEC60384-14:2023	40058861	
Germany	VDE	DIN EN IEC60384-14:2024; ENIEC60384-14:2023	40058861	
USA / Canada	UL/cUL	UL60384-14	E530201	
International Electrotechnical Commission	IEC-CB	IEC60384-14:2023	DE1-68874/B1/M2	

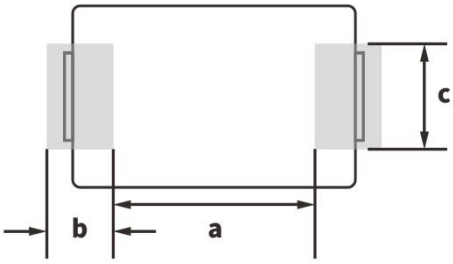
7、 Physical Dimensions (for 4522)

■ Product Dimension



Product Dimension	L±0.3	W±0.3	H±0.3	L1±0.3	L2±0.3	L3±0.3	W1±0.3
500VAC	11.4	5.4	2.5	11.8	10.4	0.6	2.5

■ Pad Dimension



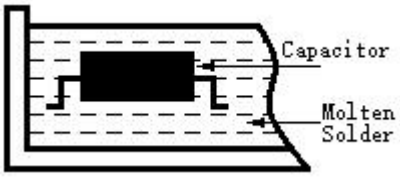
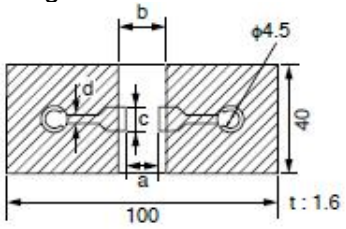
Dimension	a±0.3	b±0.3	c±0.3
11.4×5.4	9.0	1.7	3.6

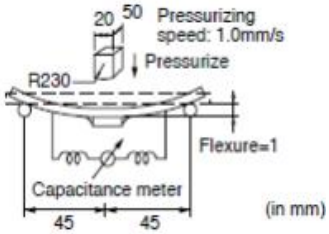
8、 Specification List

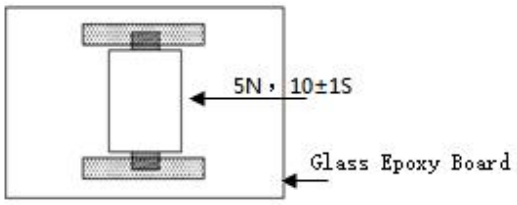
Temperature Characteristics	Nominal Capacitance（pF）	STE Part Number
Y5V	3300	SMDY14522Y5V332MQ
Y5V	4700	SMDY14522Y5V472MQ

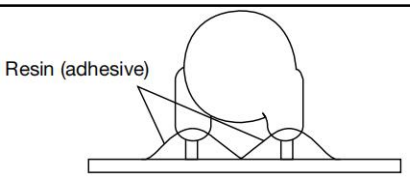
9、 Basic Characteristics and Reliability Experiments

<table>
<tr><th>No.</th><th>Item</th><th>Standard</th><th>Test Method</th></tr>
<tr><td>1</td><td>Appearance and Dimensions</td><td>No obvious defects in appearance and dimensions within the standard range.</td><td>Capacitor must be visually inspected for any obvious defects
Measure the dimensions using a vernier caliper</td></tr>
<tr><td>2</td><td>Marking</td><td>Clear and easily recognizable</td><td>Visual inspection</td></tr>
<tr><td>3</td><td>Capacitance</td><td>Within the tolerance range</td><td rowspan="2">S(SL): The dissipation factor must be measured at 25℃, using a frequency of 1±0.1MHz and a voltage of 1.0V.
B(Y5P), E(Y5U)，F(Y5V) : The capacitance and dissipation factor must be measured at 25℃, using a frequency of 1±0.1KHz and a voltage of 1.0V.</td></tr>
<tr><td>4</td><td>Dissipation Factor</td><td>D.F.≤2.5%</td></tr>
<tr><td>5</td><td>Insulation Resistance</td><td>>10000MΩ</td><td>The insulation resistance must be tested after charging at 500VDC for 60±5 seconds.</td></tr>
<tr><td>6</td><td>Dielectric Strength (Between terminals)</td><td>No breakdown or arcing</td><td>The capacitor withstands the test voltage from Table 1 for 60 seconds between the two leads without damage.
<Table 1>
<table><tr><td>Type</td><td>Test Voltage</td></tr><tr><td>X1Y1</td><td>AC4000V (r.m.s.)</td></tr></table>Recommended voltage rise time>0.3s.</td></tr>
<tr><td>7</td><td>Solderability</td><td>The lead surface requires solder coverage on over 95% of the area.</td><td>245±3℃, 3±0.3s.
Solder composition:Sn96.5Ag3.0Cu0.5</td></tr>
</table>

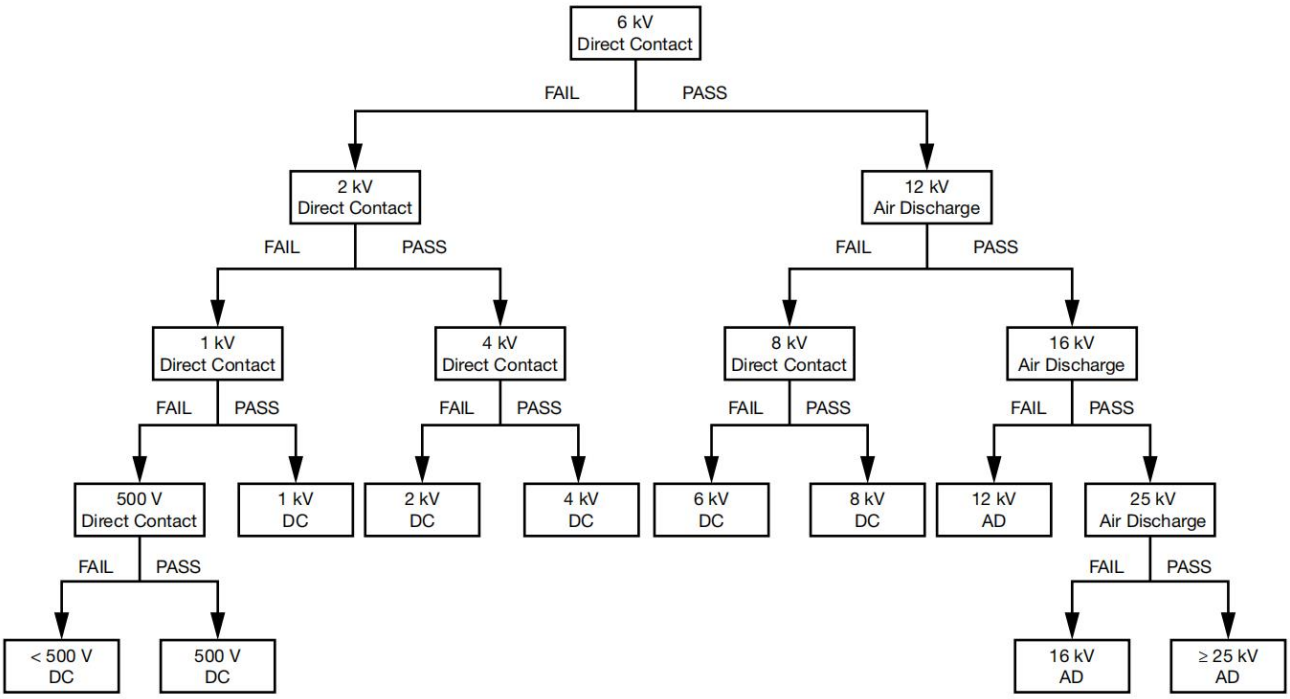
<table>
<tr><th>No.</th><th colspan="2">Item</th><th>Standard</th><th>Test Method</th></tr>
<tr><td rowspan="3">8</td><td rowspan="3">Solder Heat Resistance</td><td>Appearance</td><td>No visual damage</td><td rowspan="3">Pre-treatment: The product is placed at 150 +0/-10℃ for 60±5 minutes, followed by a 24±2 hours placement at room temperature. (applicable for B/E/F material).
After the above pretreatment, the capacitor is immersed in molten solder at 260℃ ±5℃ for 10±1 seconds, and then allowed to stand at room temperature for 24±2 hours before testing.

</td></tr>
<tr><td>Capacitance Change Rate</td><td>Within ±10%</td></tr>
<tr><td>Withstanding Voltage</td><td>4KVAC/60S Pass</td></tr>
<tr><td rowspan="3">9</td><td rowspan="3">Vibration</td><td>Appearance</td><td>No visual damage</td><td rowspan="3">Solder the capacitor to the test fixture and subject it to vibrations at 10Hz-55Hz-10Hz with a total amplitude of 1.5mm, repeating the vibration cycle within 1 minute. Unless otherwise specified, check for mechanical damage after operating in mutually perpendicular directions for a total of 6 hours (2 hours each direction)</td></tr>
<tr><td>Capacitance</td><td>Within tolerance range</td></tr>
<tr><td>Dissipation Factor</td><td>S(SL):D.F.≤0.4%
B(Y5P)/E(Y5U)/F(Y5V):
D.F.≤2.5%</td></tr>
<tr><td>10</td><td colspan="2">Plate flexural test</td><td>no significant abnormalities


<table>
<tr><td colspan="4">Dimension（mm）</td></tr>
<tr><td>a</td><td>b</td><td>c</td><td>d</td></tr>
<tr><td>9.6</td><td>11.7</td><td>2.7</td><td>1.0</td></tr>
</table></td><td>Weld the capacitor to the test fixture as shown in the diagram and apply the specified test force. Use reflow soldering with care to prevent heat-related damage to the capacitor.


<table>
<tr><td>Bending Troke</td><td>2.0mm</td></tr>
<tr><td>Pressing Speed</td><td>1.0mm/s</td></tr>
<tr><td>Exit Speed</td><td>5.0mm/s</td></tr>
<tr><td>Duration</td><td>20.0s</td></tr>
</table></td></tr>
<tr><td>11</td><td colspan="2">Welding Strength (Cutting testing)</td><td>No pin misalignment or other adverse events</td><td>Weld the capacitor onto the test fixture as shown in the diagram, apply a 5N pushing force in the direction of the arrow. Solder the capacitor using reflow soldering and handle with care to avoid damage from heat shocks.

</td></tr>
<tr><td rowspan="4">12</td><td rowspan="4">Steady-State Humidity-Heat</td><td>Appearance</td><td>No visual damage</td><td rowspan="4">Capacitor kept at 40±2°C, 90-95% RH for 500±12 hours. Post-test: Store capacitor at room temperature for 1-2 hours.</td></tr>
<tr><td>Capacitance Change Rate</td><td>S(SL)/B(Y5P)/ E(Y5U)/F(Y5V):
≤±15%</td></tr>
<tr><td>Insulation Resistance</td><td>>5000MΩ</td></tr>
<tr><td>Withstanding Voltage</td><td>4KVAC/60S Pass</td></tr>
</table>

No.	Item		Standard	Test Method
13	High Humidity and High Temperature (85°C/85% RH)	Appearance	No visible damage	Temperature: 85 ± 2℃; Humidity: 85±2%; Test period: 1000 hours Voltage：U_R
		Capacitance Change	S(SL)/B(Y5P)/ E(Y5U) /F(Y5V)：≤±15%	
		I.R.	>5000MΩ	
		Withstanding Voltage	4KVAC/60S Pass	
14	Durability	Appearance	No visual damage	 Solder the capacitor properly, attach onto test board with epoxy (adhesive). In 3 directions perpendicularly intersecting each other (total 18 times). Peak value 100g's Half sine Waveform Normal duration (D): 6ms Acceleration: 100g
		Capacitance Change Rate	Within ±10%	
		Dissipation Factor	B(Y5P)/E(Y5U)/F(Y5V): D.F.≤2.5%	
		Withstanding Voltage	4KVAC/60S Pass	
15	Resistance to solvents	Appearance	No visible damage Marking is clearly visible	Solvent 1: 1/4 volume of isopropanol and 3/4 volume of 80% kerosene and 20% ethylbenzene mixture Solvent 3: A terpene solder remover composed of at least 90% d-limonene and 10% surfactant Solvent 4: 42% volume water, 29% volume propylene glycol methyl ether 29% volume monoethanolamine. Additional: OKEMCLEAN washing chemicals or 6% Oakite cleaner or equivalent 1. Dip the varistor into (solvent 1 + solvent 3) + 0.5/-0min, solvent temperature 25±5 °C, 3 times; 2. Dip the varistor into (solvent 4 + additional) + 0.5/-0min, solvent temperature 63-70 °C, 3 times; 3. Use normal hand force to brush 10 times 4. Rinse with 25°C water, air dry. 5.Then use a 3x magnifying glass to observe whether the marking is clear, and a 10x magnifying glass to observe whether the varistor body is damaged.
16	ESD	Appearance	No visible damage Marking is clearly visible	Details as below ESD test method
		Capacitance Rate of Change	±10%；	
		D.F.	D.F.≤5%	
		I.R.	>10000MΩ	

ESD Test Method



Remark:

Sample quantity: 15pcs/group

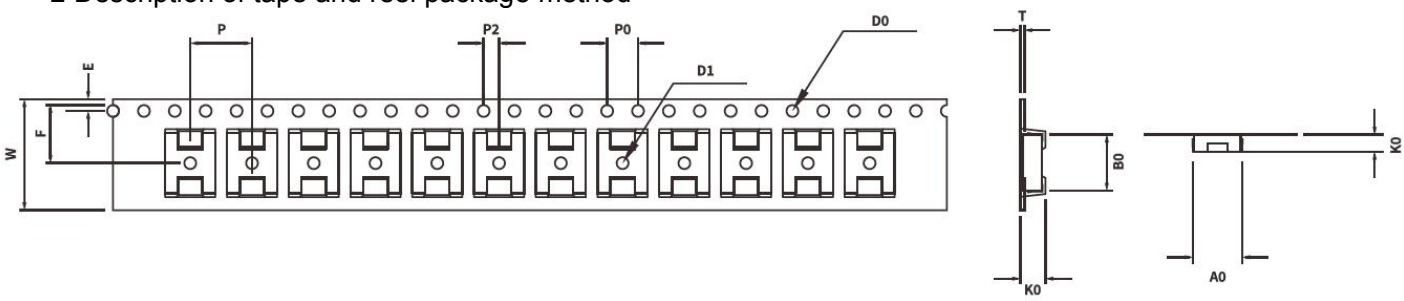
Test environment: 22℃±5℃，30%-60%RH

CD means “direct contact to discharge”,+/- each one time

AD means “ air discharge”,discharge distance≥15mm, Moving speed: 5mm/s, +/- each one time

10、 Packing Instructions (for 4522)

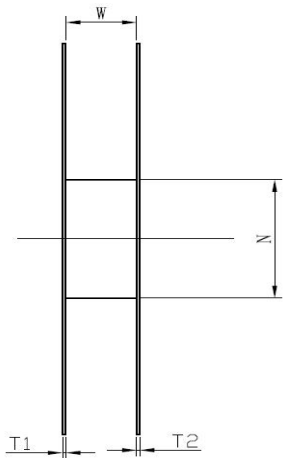
■ Description of tape and reel package method

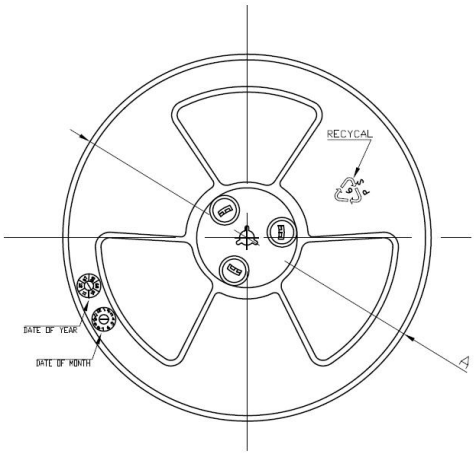


unit：mm

A0	B0	K0	P0	P	P2	T
5.61±0.15	12.40±0.15	3.20±0.1	4.0±0.1	8.0±0.1	2.0±0.15	0.3±0.10
W	E	F	D0	D1	Components/Reel	
24.0±0.3	1.75±0.1	11.5±0.1	1.5+0.15/-0	1.5+0.15/-0	4000pcs	

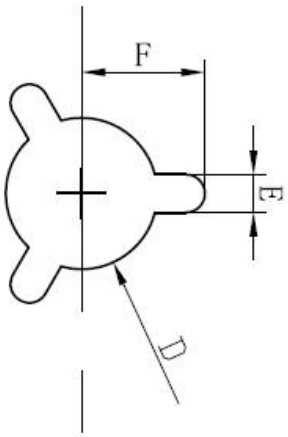
■ 15-inch reel size



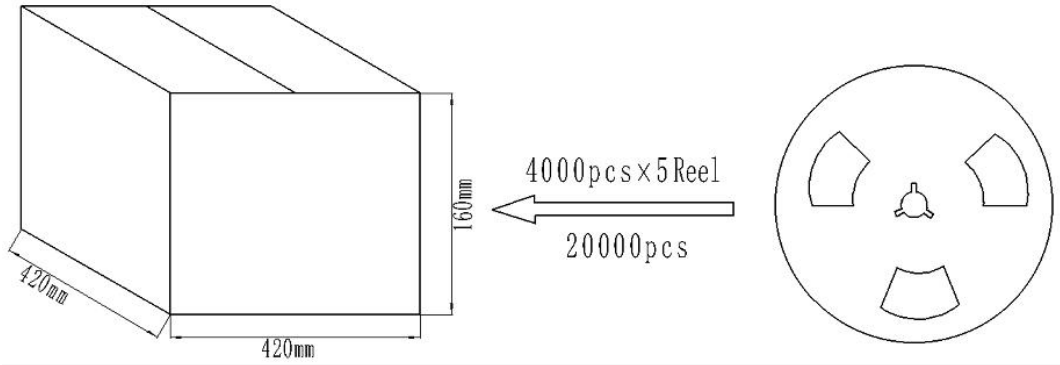


Unit：mm

SPEC	24
E±0.5	2.3
F±0.5	10.75
W±0.2	24.4
T1±0.3	2.2
T2±0.3	2.2
A+0/-2	φ380
N±3.0	φ100
D±0.3	13.3

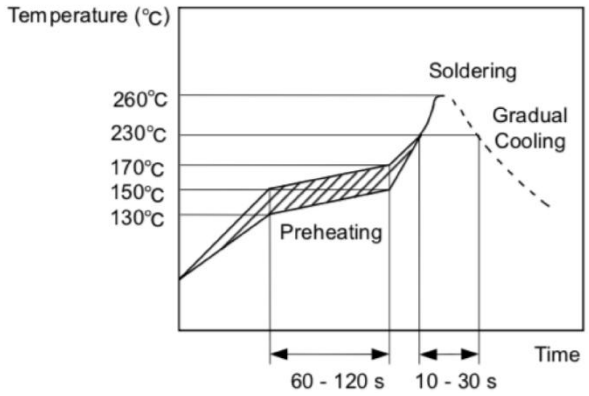


■ Packing Carton

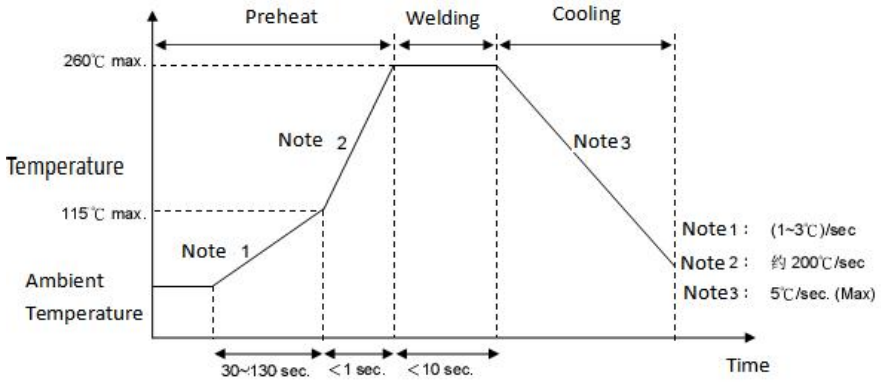


11、 Soldering Instruction

■ Reflow Soldering Curve



■ Wave Soldering Curve



■ Soldering Conditions

Item	Condition
Soldering Iron Tip Temperature	400℃(max.)
Soldering Time	3.5 sec(max.)
Soldering Iron Power	50W(max.)

12、 Storage Environment

- The insulation coating of the capacitor cannot form a perfect seal; therefore, avoid using or storing the capacitor in corrosive environments, especially where chloride gas, sulfide gas, acids, alkalis, salts, or similar substances are present, and minimize exposure to moisture. Verify that cleaning, soldering, or forming processes do not affect the product quality before these processes are performed.
- This is an MSL3 product. Hence,to prevent moisture absorption,the capacitor is packaged in a moisture-proof sealed bag.
- The capacitor should be stored and used within the following conditions for up to 6 months after delivery:

  Temperature: Below 30°C

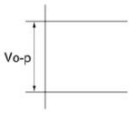
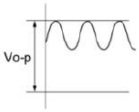
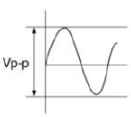
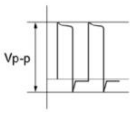
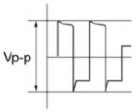
  Humidity: 60%RH max
- After opening the moisture-proof packaging, solder the capacitor within 168 hours. Post-opening, store the capacitor in a moisture-proof bag with desiccant, along with the information card, and maintain the aforementioned conditions.
- If the storage period exceeds 6 months or the sealed bag is opened, perform baking (60°C, 168 hours) before soldering.

13、 Usage Precaution


Warning

- Operating Voltage:

  Ensure that the applied voltage (Vp-p or Vo-p with DC bias) stays within the rated voltage range when using DC-rated capacitors in AC or ripple current circuits. Temporary abnormal voltages may occur during start-up or shutdown due to resonance or switching. Use capacitors within the rated voltage range to accommodate such conditions.

Voltage	VDC	VDC+VAC	VAC	Pulse Voltage (1)	Pulse Voltage (2)
Position Measurement					

- Operating Temperature and Self-Heating (Applicable to B/E Characteristics)

  The capacitor's surface temperature should be kept below the upper limit of its rated operating temperature range. Consider the self-heating of the capacitor, which may occur in high-frequency

currents, pulse currents, etc. External voltage should not allow the temperature rise due to self-heating to exceed a range of 20°C around 25°C. Use a φ0.1mm low heat capacity (K) thermocouple for measurements, and ensure that the capacitor is not influenced by heat dissipation from other components or fluctuations in ambient temperature. Overheating may lead to a decrease in capacitor characteristics and reliability.

(Do not conduct measurements when the cooling fan is running, as it may affect the accuracy of the measurement).

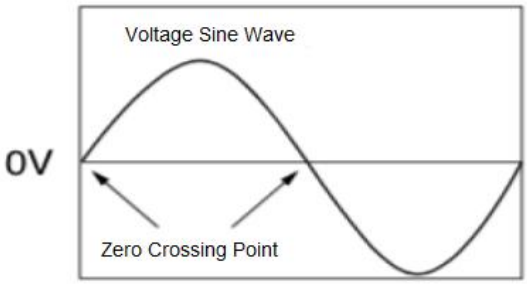
■ Test Conditions for Withstand Voltage

Test Equipment:

The AC withstand voltage test equipment should be capable of generating a sine wave similar to 50/60Hz. Applying deformed sine waves or overload voltages exceeding the specified voltage may result in failure.

Voltage Application Method:

When applying the withstand voltage, the leads or terminals of the capacitor should be securely connected to the output terminals of the withstand voltage test equipment. Gradually increase the voltage from near zero to the test voltage. If the test voltage is not gradually increased from near zero but directly applied to the capacitor, it should include *zero crossing during application. At the end of the test, the test voltage should be reduced to near zero before removing the capacitor leads or terminals from the output terminals of the withstand voltage test equipment. If the test voltage is not gradually increased from near zero but directly applied to the capacitor, surges may occur, leading to failure.



*Zero crossing refers to the position where the sine wave voltage passes through 0V. See the figure on the right.

■ Repeated withstand voltage tests conducted by users may damage the capacitor, so capacitors tested after the test should not be used as qualified products again.

■ Fail-Safe Design

If the capacitor is damaged, it can lead to a short circuit fault. Be sure to provide appropriate automatic fault protection functions, such as fuses, on the product to prevent electric shock, fire, or smoke.

■ Vibration and Shock

During use, avoid excessive shocks or vibrations that may expose the capacitor or pins, and prevent any crushing, bending, or external impact.

■ Bonding, Molding, or Coating

Before bonding, molding, or coating this product, verify through testing the performance of bonding, molding, or coating the product in the designated equipment to ensure that these processes do not affect the quality of the capacitor.

If there are drying/adhesive hardening conditions and the molding resin contains organic solvents (ethyl acetate, methyl ethyl ketone, toluene, etc.), SMD is not suitable. Organic solvents may cause damage to the resin on the outer layer of the capacitor, resulting in cases of damage or short circuits.

During temperature cycling, changes in the thickness of adhesives, molding resins, or coatings may lead to cracking of the outer shell resin and/or cracking of ceramic components.

■ Capacitors mounted on PCBs require the PCB pads to align with the capacitor pins for proper soldering. Otherwise, poor soldering between the capacitor and PCB may occur, leading to deformation of the capacitor pins or damage to the body, resulting in capacitor damage. Capacitors soldered to PCBs should not be forcibly moved or have the body tilted.

■ Consult our technical personnel in advance when performing resin molding on capacitors.

■ Restricted Applications

Contact us before using our products in the following applications that require exceptionally high reliability to prevent defects that could directly cause harm to third parties' life, body, or property.

Aircraft Equipment

Aerospace Equipment

Submersible Equipment

Power Plant Control Equipment

Medical Equipment

Transportation Equipment

Traffic Signal Equipment

Disaster Prevention/Crime Prevention Equipment

Data Processing Equipment affecting the public

Applications with similar complexity and/or reliability requirements.