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USER MANUAL

Super Capacitors

(Coin Series)

Do not apply external forces to the product or port, such as twisting, bending, pushing, or knocking.This can cause the product or port to fall off, causing a circuit breaker, short circuit, or liquid leak.
Do not overheat the capacitor when heating in the binder curing furnace. For details, see Precautions for Using Double layer capacitors.

1.The structure and principles of EDLC

Figure 1 illustrates a cross-sectional view of a coin-type cell EDLC.
The internal electrodes of the battery are made from activated carbon. Subsequently, an electrolyte is impregnated onto the electrodes. This separator exhibits high insulating properties for ions and can penetrate between the electrodes, preventing short circuits. The seal between the top cover and the bottom casing is achieved by adding filler material.EDLC is formed at the electrolyte interface, creating an extremely thin ionic layer at the electrodes (as shown in Figure 2). Charging can be achieved by applying voltage (as depicted in Figure 3).

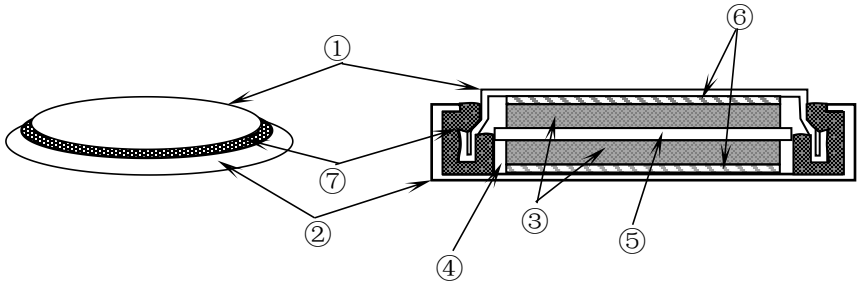


图 1

No.	①	②	③	④	⑤	⑥	⑦
Components	Operculum (stainless steel)	bottom cap (stainless steel)	electrode	electrolyte	electrolytic paper	conducting strip	seal ring (PP)

The EDLC acts as an insulator and does not allow the flow of current when an external DC voltage is applied.However, as the voltage increases and reaches the breakdown point, current will begin to flow. The magnitude of this voltage is referred to as the "breakdown voltage."Further increasing this voltage will result in the decomposition of the electrolyte and additional current flow. The voltage withstand capability of a double-layer capacitor is determined by the breakdown voltage. The composition of the breakdown voltage is determined by the electrolyte and electrode materials of the double-layer capacitor.
EDLC use activated carbon electrodes (solid) and organic electrolytes (liquid). The EDLC formed at the interface between the electrode and electrolyte is extremely thin, resembling a single molecule. Activated carbon used for electrodes has an exceptionally large surface area, which results in a very high capacitance.

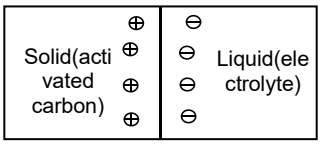


图 2

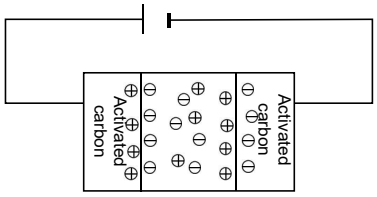


图 3

2.The polarity and operating voltage of EDLC

1.SEDLC have polarity, and it's important not to apply reverse voltage or alternating current voltage to them. Prolonged exposure to reverse voltage can not only shorten their lifespan but also potentially lead to leakage and other serious damage.
2.The rated voltage of a EDLC is the highest voltage it can safely handle during normal operation. Therefore, it's essential not to apply a voltage higher than the rated voltage to both ends of the EDLC. Operating at high voltage not only shortens its lifespan but also can lead to fatal failures such as increased gas generation, leakage, and rupture due to electrochemical reactions.

3. Circuits through which ripple currents pass

1.The internal resistance of EDLC is higher than that of electrolytic capacitors. EDLC may generate heat due to ripple currents.When using a capacitor in a circuit through which ripple currents pass, monitor the allowable temperature range.

2.Please use the EDLC below its maximum rated voltage, taking into account voltage variations caused by ripple currents.
3.EDLC typically have higher internal resistance and are not well-suited for ripple absorption. Please consider using products with lower internal resistance that are designed for this purpose.

4.The influence of ambient temperature on EDLC

1.Capacitor life is affected by usage temperatures. Capacitor life is approximately doubled when the temperature is decreased by 10℃. Therefore, lower the usage temperature as much as possible. Using capacitors beyond the guaranteed range may cause rapid deterioration of their characteristics and cause them to break down.
2.The usage temperature of EDLC should not only consider the ambient temperature around the device but also take into account the internal temperature, as well as the heat generated by internal components such as power transistors and resistors. It's important to account for the self-heating temperature caused by ripple currents. Additionally, avoid installing heat-generating components on the backside of the EDLC.

5.Life calculation

The life of the EDLC is affected by the operating voltage and operating temperature, which conforms to the following equation:

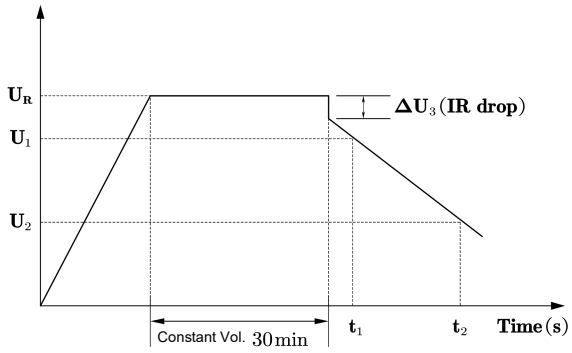
$$\mathbf{L = L_0 \times 3.25^{\frac{T_0 - T}{10}} \times 1.52^{\frac{V_0 - V}{0.1}}}$$

L : is the theoretical lifetime at T temperature;
L_0 : is the working life of the highest rated working temperature;
T : is the actual working temperature;
T_0 : is the highest rated working temperature;
V : is the actual working voltage;
V_0 : is the highest rated working voltage.

6.Capacity Computing

$$C = \frac{I \times (t_2 - t_1)}{U_1 - U_2}$$

C : Capacity(F)
I : Discharge current
t_1 : The time from the start of Discharge until the voltage reaches U1(s)
t_2 : Time from discharge to voltage U2 (s)
U_1 : Initial voltage(V)
U_2 : Termination voltage(V)



7.The voltage drop when used as a backup power supply

When the main power source is turned off, EDLC switch from power failure detection mode to backup power operation mode. During this transition, the instantaneous startup current and the internal resistance of the capacitors can cause a drop in open-circuit voltage. It's important to refer to the impedance and usage current values listed in the relevant product specifications provided by the manufacturer.

8.In series

To ensure the voltage balance when the EDLC is connected in series, the resistor and the EDLC can be considered in parallel to play the role of leakage voltage division.

9.Precautions for Soldering

When soldering supercapacitor products onto a printed circuit board, it is crucial to avoid subjecting the supercapacitors to excessive heat stress. Overheating can not only degrade their electrical characteristics but can also lead to critical failures beyond just cosmetic damage, such as poor airtightness and increased internal pressure causing leakage or short circuits. Please adhere to the following guidelines:

1.Use a soldering iron to weld：

During the soldering process, please avoid direct contact between the soldering iron and the product body. Maintain the soldering iron temperature below 350℃ and complete the soldering within 4 seconds. If performing continuous soldering operations, allow a 15-second interval for every 3 consecutive soldering operations.

2.Wave Soldering：

a.Do not touch the solder tank during Soldering；

b.When Soldering, please control the temperature of the main body of the product within 100℃ for 60 seconds, and the peak temperature within 105℃.The standard conditions are shown below.In addition, even within the specified temperature range, the product temperature may also rise more than expected due to the size of the circuit board and the relationship between the surrounding parts, so it is recommended to confirm the main temperature of the supercapacitor product during Soldering.

c.Other heat stress

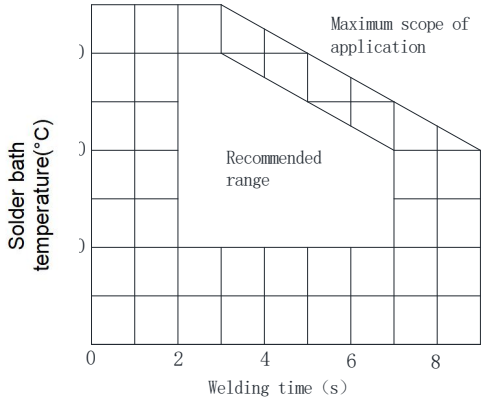
When using a curing oven to bake the circuit board for resin fixation, please ensure that the product surface temperature remains below 100℃ for no more than 60 seconds (with a maximum of 105℃). Additionally, during this process, keep the residual voltage of the product below 0.3 V.

d. Cleaning/Washing

Avoid cleaning circuit boards, but if you must clean them, use electrostatic or ultrasonic immersion in a standard circuit with a circuit board cleaning solution for no more than 5 minutes at a maximum temperature of +60 °C. Then rinse and dry the board thoroughly. In general, treat supercapacitors the same way you treat aluminum electrolytic capacitors.

e.Others

To enhance solderability, there may be a tin-plated layer on the leads and soldering pads. Therefore, abrasive actions like filing can potentially damage the tin-plated layer and reduce solderability. Applying excessive force to the leads or soldering pads may lead to breakage or misalignment, resulting in a degradation of characteristics.



Pre-heating temperature：110°C or under（on the surface of circuit board）
100°C or under（on the surface of capacitor）
Pre-heating time：60s or under
Board thickness：0.8 mm or more

10. Emergency procedures

If the capacitors generate heat, then smoke may come out of the exterior resin. Under these conditions turn off the equipment immediately and stop using it.
Do not place your face or hands close to the capacitor, burns may be caused.

11.Storage&Maintenance

Please avoid storing supercapacitors in high-temperature and high-humidity environments. It is recommended to store them in a well-packaged state in an environment at room temperature of 25 ± 10℃ with a relative humidity below 80%. It's advisable not to exceed a storage period of 24 months. Avoid storing capacitors under the following conditions.

(1) Exposed to water, high temperatures or humidity, or when condensation can occurs.
(2) Exposed to oil or in environments filled with gaseous oil contents.
(3) Exposed to salt water or environments filled with saline substances.
(4) In environments filled with harmful gases (hydrogen disulfide, sulfurous acid, nitrous acid, chlorine, bromine, bromomethane, etc.)
(5) Exposed to direct sunlight, ozone, ultraviolet or radial rays.
(6) Exposed to vibrations or mechanical impact.

13. Discarding

Dispose of capacitors as industrial waste. They are comprised of various metals and resin.