● 目録 LIST OF PRODUCTS

類別 Class	結構類型 Structure Type	特性系列 Feature Series	工作温度範圍 Operating Temperature Range	額定電壓 Rated Voltage	容量範圍 Capacitance Range	循環壽命 Cycle Life	頁次 Page
扣式超級電容器 Coin Type Supercapacitor	C	常規型/高温型 Normal/ High Temperature Type	-25℃～+70/85℃	5.5V	0.1F~1.5F	≥500,000Cycles	463
	H	常規型/高温型 Normal/ High Temperature Type	-25℃～+70/85℃	5.5V	0.1F~4.0F	≥500,000Cycles	464
	V	常規型/高温型 Normal/ High Temperature Type	-25℃～+70/85℃	5.5V	0.1F~4.0F	≥500,000Cycles	464
卷繞式超級電容器 Winding Type Supercapacitor	單體 Cells	常規型 Normal Type	-40℃～+70℃	2.7V	0.47F~3000F	≥500,000Cycles	465
	單體 Cells	低內阻 Low ESR Type	-40℃～+70℃	2.7V	0.47F~400F	≥500,000Cycles	466
	單體 Cells	高壓型 High Voltage Type	-40℃～+70℃	3.0V	0.47F~3000F	≥500,000Cycles	467
	單體 Cells	高温型 High Temperature Type	-40℃～+85℃	2.7V	0.47F~50F	≥500,000Cycles	468
	模組 modules	常規型 Normal Type	-40℃～+70℃	5.5V	0.22F~25F	≥500,000Cycles	469
	模組 modules	高温型 High Temperature Type	-40℃～+85℃	5.5V	0.22F~25F	≥500,000Cycles	470
	模組 modules	定制型 Customized	-40℃～+70/85℃	5.5V~160V	0.1F~160F	≥500,,000Cycles	471
鋰離子電容器 LIC	單體 Cells	常規型 Normal Type	-20℃～+70℃	3.8V	10F~220F	≥200,000Cycles	472
極片 Eletrode							473

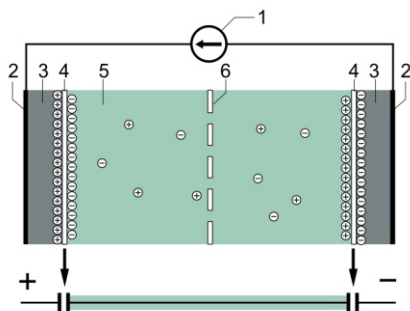本説明書中所列參數如有更新，我司可能無法另行通知，産品詳細信息請參見我司規格書，産品參數以規格書爲准。

If the parameters listed in this manual are updated, our company may not be able to give further notice. Please refer to our specifications for product details. The product parameters are subject to the specifications.

• 超級電容器簡介

　　超級電容器又稱爲電化學雙電層電容器（EDLC），是擁有高能量密度的電化學電容器，比傳統的電解電容容量高上數百倍至千倍不等。超級電容器是一種介于傳統電容器和充電電池之間的新型綠色儲能裝置。

• 超級電容器原理

　　插入電解質溶液中的金屬電極表面與液面兩側會出現符號相反的過剩電荷，從而使相間産生電位差。那麽，如果在電解液中同時插入兩個電極，并在其間施加一個小于電解質溶液分解電壓的電壓，這時電解液中的正、負離子在電場的作用下會迅速向兩極運動，并分別在兩上電極的表面形成緊密的電荷層，即雙電層，它所形成的雙電層和傳統電容器中的電介質在電場作用下産生的極化電荷相似，從而産生電容效應，緊密的雙電層近似于平板電容器，但是，由于緊密的電荷層間距比普通電容器電荷層間的距離更小得多，因而具有比普通電容器更大的容量。雙電層電容器沒有傳統的電介質，而是使用絕緣體隔開。這個絕緣層可以讓電解液中的正負離子通過。該電解液本身不能傳導電子。所以當充電結束後，電容器內部不會發生漏電（電子不會從一極流向另外一極）。當放電的時候，電極上的電子通過外部電路從一極流向另外一極。結果是電極與電解液中的離子吸附顯著降低。從而使電解液中的正負離子重新均勻分布開來。
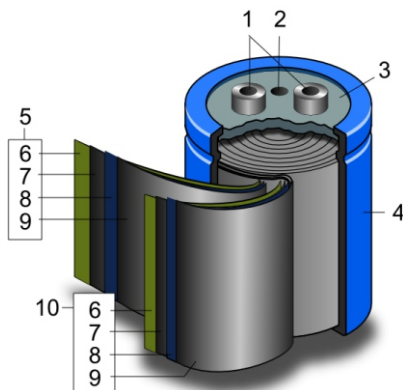
• Supercapacitor Overview

Supercapacitors, also known as electrochemical double-layer capacitors (EDLC), are electrochemical capacitors with high energy density, which are several hundred to thousand times higher than conventional electrolytic capacitors. The supercapacitor is a new type of green energy storage device between the conventional capacitor and the rechargeable battery.

• Principle of Supercapacitor

When a metal electrode is inserted in the electrolyte, excess charge with opposite signs will be present at the metal/solution interfaces because of the potential difference between the two phases. If two electrodes are inserted in the electrolyte at the same time and a voltage lower than the decomposition potential of the electrolyte is applied, the anions and cations in the electrolyte will rapidly migrate to the electrodes under the electric field. Close charge layers will be formed at the two opposite surfaces of the electrodes, i.e., the electric double layer, which is similar to the polarized charge induced by the electric field in a conventional capacitor, therefore exhibiting a capacitive effect. Such that a close electric double layer is similar to the parallel plane capacitor. Since the close charge layer spacing is much narrower than the distance between ordinary capacitor charge layers, it has a larger capacitance than an ordinary capacitor. There is no traditional dielectrics in the double layer capacitors. Instead, they are separated by insulators. Anions and cations in the electrolyte can pass through the insulating layer, while electron can not be conducted in the electrolyte itself. Therefore, no leakage occurs within the capacitor when charging is completed (electrons do not flow from one electrode to the other). When discharging, the electrons on one electrode flow to the other via an external circuit. As a result, ion adsorption in the electrode and the electrolyte is significantly reduced. In this way, the positive and negative ions in the electrolyte are homogeneously redistributed.

超級電容器的典型結構：（1）電源，（2）集流體，（3）極化電極，（4）亥姆霍茲雙電層，（5）帶有陰陽離子的電解液，（6）隔離層
Typical construction of a supercapacitor: (1) power source, (2) collector, (3) polarized electrode, (4) Helmholtz double layer, (5) electrolyte having anions and cations, (6) separator

• 卷繞型超級電容器結構

• Structure of Wound Supercapacitor

卷繞型超級電容的結構示意圖：（1）引出端，（2）安全排氣孔，（3）密封片，（4）鋁殼，（5）正極，（6）隔離膜，（7）碳電極，（8）集流體，（9）碳電極，（10）負極
Schematic construction of a wound supercapacitor: (1) terminals, (2) safety vent, (3) sealing disc, (4) aluminum can, (5) positive pole, (6) separator, (7) carbon electrode, (8) collector, (9) carbon electrode, (10) negative pole

● 產品特點

內阻低，功率密度高；

自放電率小，72小時自放電<20%；

優异的循環壽命，庫侖效率達95%以上；

工作溫度範圍寬；
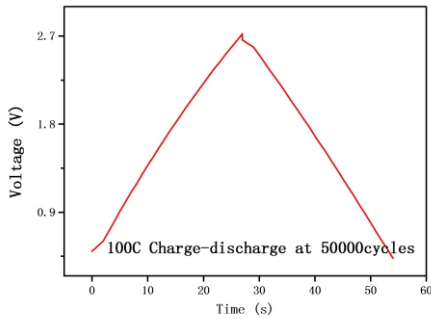
綠色環保，滿足RoHs和REACH要求。

● Product Features

Low equivalent internal resistance, with high power density;
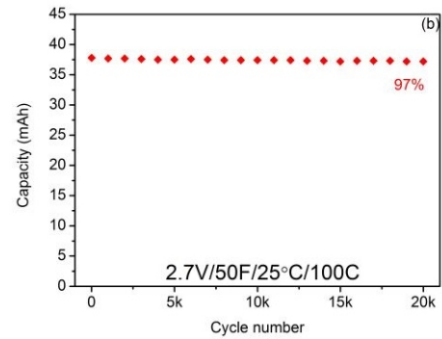
Low self-discharge rate, <20% within 72h;

Wonderful cycle life, with coulombic efficiency up to 95%;

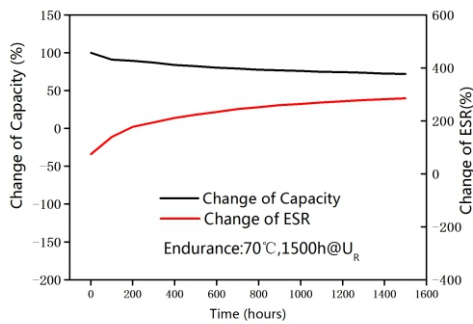Wide operating temperature range;

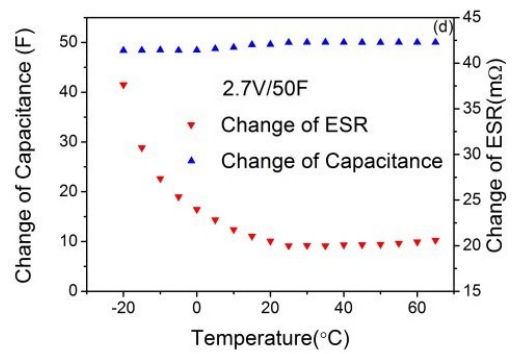Green and environmentally friendly, complying with RoHs and REACH requirements.

恒流充放電曲綫
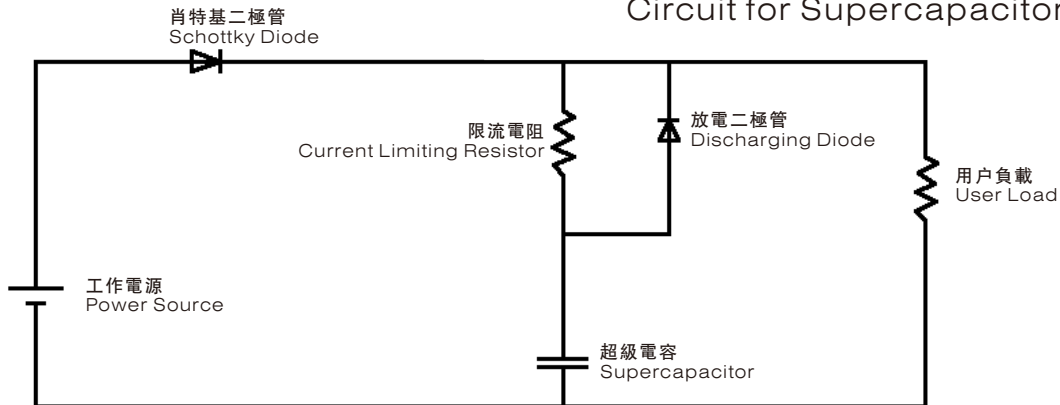Constant-current charging & discharging

循環壽命曲綫
Cycling life

疲勞特性曲綫
Fatigue characteristics

温度特性曲綫
Temperature characteristics

• 超級電容器基本充放電電路

• Basic Charging & Discharging Circuit for Supercapacitor

肖特基二極管
Schottky Diode

限流電阻
Current Limiting Resistor

放電二極管
Discharging Diode

用户負載
User Load

工作電源
Power Source

超級電容
Supercapacitor

　　限流電阻的大小主要取決于用戶電源系統的功率；如果用戶電源系統的功率比較大，那么限流電阻可以取小一點，如果電源功率比較小，那么電阻取大一些，同時注意電阻的功率，正常功率必須在1W以上。比如電源最大工作電流爲1A，電壓5V，那么限流電阻取5歐左右，功率爲5W。此充電電路只限于內阻很小的超級電容，比如柱式超級電容，對于內阻比較大的超級電容，則無須限流電阻，比如扣式超級電容。放電二極管可以選取正向導通壓降比較小的齊納二極管，同時保證一定的功率。

The value of the current limiting resistor depends on the power of the user's power system. If the power of the user's power system is relatively large, then the current limiting resistor can be smaller. If the power is relatively small, then the resistance is larger and the power of the resistor is taken into account. The normal power must be above 1W. For example, the maximum operating current of the power supply is 1A and the voltage is 5V. Then, the current limiting resistor is about 5 ohms and the power is 5W. The charging circuit is limited to supercapacitors with very small internal resistance, such as pillar-type supercapacitors. For supercapacitors with relatively large internal resistance, there is no need for current limiting resistors, such as button-type supercapacitors. The discharge diode can select a Zener diode with a relatively low forward voltage drop, while ensuring a certain power.

• 超級電容器的選型

• Selection of Supercapacitor

　　超級電容器的兩個主要應用：高功率脈衝應用和瞬時功率保持。高功率脈衝應用的特征：瞬時流向負載大電流；瞬時功率保持應用的特征：要求持續向負載提供功率，持續時間一般爲幾秒或幾分鐘。瞬時功率保持的一個典型應用：斷電時磁盤驅動頭的復位或者GPRS聯網時大電流脈衝補償。不同的應用對超電容的參數要求也是不同的。高功率脈衝應用是利用超電容較小的內阻(R)，而瞬時功率保持是利用超級電容較大的容量(C)。

The two main applications of supercapacitors are: high power pulse applications and instantaneous power retention. The characteristics of high-power pulse applications are: instantaneous flow into the load with high current; characteristics of the instantaneous power retention application: the requirement to continuously provide power to the load, the duration is generally a few seconds or minutes. A typical application of instantaneous power retention: reset of the disk drive head during power off or high current pulse compensation during GPRS networking. Different applications have different parameter requirements for supercapacitors. High-power pulse applications utilize ultra-capacitor small internal resistance (R), while instantaneous power retention utilizes a large capacity (C) of the supercapacitor.

• 超級電容器的選型（ 續 ）

下面提供了兩種計算公式和應用實例：

C(F)： 超電容的標稱容量；

R(Ohms)： 超電容的標稱內阻；

ESR(Ohms)：1KZ下等效串聯電阻；

Vwork (V)： 在電路中的正常工作電壓

Vmin (V)： 要求器件工作的最小電壓；

t(s)： 在電路中要求的保持時間或脈衝應用中的脈衝持續時間；

Vdrop (V)： 在放電或大電流脈衝結束時，總的電壓降，其值等于Vwork-Vmin;

I(A)： 負載電流。

瞬時功率保持應用

超電容容量的近似計算公式，該公式根據，保持所需能量=超電容減少能量。

保持期間所需能量=1/2I(Vwork+ Vmin)t；

超級電容減少能量=1/2C(Vwork2 -Vmin2)，

可得其容量(忽略由IR引起的壓降)C=I t (Vwork+ Vmin) /(Vwork2 -Vmin2)

經過公式變換，計算公式簡化爲：C=I*t/Vdrop

實例：

假設磁帶驅動的工作電壓5V，安全工作電壓3V。如果直流馬達要求0.5A保持2秒（ 可以安全工作 ），那么,根據上公式可得其容量至少爲0.5 F。

因爲5V的電壓超過了單體電容器的標稱工作電壓。因而，可以將兩只電容器串聯。如果兩只相同的電容器串聯，那么每只分壓即爲其標稱電壓2.5V。

如果我們選擇標稱容量是1F的電容器，兩只串聯后的容量爲0.5F。考慮到電容器一般有-20%的容量偏差，這種選擇不能提供足夠的余量。可以選擇標稱容量是1.5F的電容器，能提供1.5F/2=0.75F。考慮-20%的容量偏差，最小值1.2F/2=0.6F。這種超級電容器提供了充足的安全余量。大電流脈衝后，磁帶驅動轉入小電流工作模式，用超電容剩余的能量。

•Selection of Supercapacitor (cont.)

The following provides two calculation formulas and application examples:

C(F): Nominal capacity of the supercapacitor;

R(Ohms): Nominal internal resistance of the supercapacitor;

ESR (Ohms): Equivalent series resistance at 1 KZ;

Vwork (V): Normal operating voltage in the circuit

Vmin (V): Minimum voltage required to operate the device;

t(s): Hold time required in the circuit or the pulse duration in the pulse application;

Vdrop (V): The total voltage drop at the end of the discharge or high current pulse, whose value is equal to Vwork-Vmin;

I(A): load current.

Instantaneous power retention application

The approximate calculation formula for the capacity of the supercapacitor is based on the principle of maintaining the required energy = supercapacitor to reduce energy.

The required energy during the holding period = 1/2I(Vwork+Vmin)t;

Super capacitor reduces energy = 1/2C (Vwork2 - Vmin2),

Available capacity (ignoring pressure drop due to IR) C = I t (Vwork + Vmin) / (Vwork2 -Vmin2)

After formula transformation, the formula is simplified as: C=I*t/Vdrop

Example:

Assume that the tape drive operates at 5V and the safe operating voltage is 3V. If the DC motor requires 0.5A for 2 seconds (can work safely), then according to the above formula can get at least 0.5F.

Because 5V voltage exceeds the nominal operating voltage of the monolithic capacitor. Thus, two capacitors can be connected in series. If two identical capacitors are connected in series, then each partial voltage is the nominal voltage of 2.5V.

If we choose a capacitor with a nominal capacity of 1F, the two connected series have a capacity of 0.5F. Considering that the capacitors generally have a -20% capacity deviation, this option does not provide enough margin. A capacitor with a nominal capacity of 1.5F can be selected and can provide 1.5F/2=0.75F. Consider a -20% capacity deviation with a minimum of 1.2F/2=0.6F. This super capacitor offers ample safety margin. After a large current pulse, the tape drive goes into a low-current mode of operation, using the excess energy of the supercapacitor.

• 超級電容器的選型（續）

脉衝功率應用

脉衝功率應用的特征：和瞬時大電流相對的較小的持續電流。脉衝功率應用的持續時間從1ms到幾秒。

設計分析假定脉衝期間超級電容是唯一的能量提供者。在該實例中總的壓降由兩部分組成：由電容器內阻引起的瞬時電壓降和電容器在脉衝結束時壓降。關系如下：

Vdrop=I(R+t/C)

上式表明電容器必須有較低的R和較高的C，總的壓降Vdrop才會比較小。

對于多數脉衝功率應用，R的值比C更重要。以2.5V1.5F爲例。它的內阻 **R** 可以用直流ESR估計，標稱是0.075Ohms(DC ESR＝AC ESR*1.5＝0.060Ohms*1.5＝0.090Ohms)。額定容量是1.5F。對于一個0.001s的脉衝，t/C小于0.001Ohms。即便是0.01s的脉衝t/C也小于0.0067Ohms，顯然R（0.090Ohms）決定了上式的Vdrop輸出。

實例：

GSM/GPRS無綫調制解調器需要一每間隔4.6ms達2A的電流，該電流持續0.6ms。這種調制解調器現用在筆記本電腦的PCMCIA卡上。筆記本電腦電源最大可以提供1A的電流。許多功率放大器（PA）要求3.0V的最小電壓。對于筆記本電腦輸出3.0V的電壓是可能的。到功率放大器的電壓必須先升到3.6V。在3.6V的工作電壓下（最小3.0V），允許的壓降是0.6V。

選擇超級電容器（ C：0.15F,AC ESR：0.200Ohms,DC ESR：0.250Ohms）。對于2A脉衝，電池提供大約1A，超電容提供剩余的1A。根據上面的公式，由內阻引起的壓降：1A×0.25Ohms＝0.25V。I(t/C)＝0.04V它和由內阻引起的壓降相比是小的。

結論：

不管是功率保持還是功率脉衝應用都可以用上公式計算。當電路的工作電壓超過超電容的工作電壓時，可以用相同的電容器串聯。電容串聯應該保持平衡以確保電壓平均分配。

• Selection of Supercapacitor (cont.)

Pulse power application

Pulsed power applications are characterized by a small continuous current as opposed to an instantaneous large current. Pulse power applications last from 1ms to several seconds.

The design analysis assumes that the super capacitor is the only energy provider during the pulse. The total voltage drop in this example consists of two parts: the instantaneous voltage drop caused by the internal resistance of the capacitor and the voltage drop at the end of the pulse of the capacitor. The relationship is as follows:

Vdrop=I(R+t/C)

The above formula shows that the capacitor must have a lower R and a higher C, and the total voltage drop Vdrop will be smaller.

For most pulsed power applications, the value of R is more important than C. Take 2.5V 1.5F as an example. Its internal resistance R can be estimated by DC ESR, nominally 0.075 Ohms (DC ESR＝AC ESR*1.5＝0.060Ohms*1.5＝0.090Ohms). The rated capacity is 1.5F. For a 0.001s pulse, t/C is less than 0.001 Ohms. Even if the 0.01s pulse t/C is less than 0.0067 Ohms, it is clear that R (0.090 Ohms) determines the Vdrop output of the above equation.

Example:

The GSM/GPRS radio modem requires a current of 2A per interval of 4.6ms. This current lasts 0.6 ms. This modem is now used on PCMCIA cards in laptops. Laptop power can provide up to 1A of current. Many power amplifiers (PAs) require a minimum voltage of 3.0V. It is possible for the laptop to output a voltage of 3.0V. The voltage to the power amplifier must first rise to 3.6V. At an operating voltage of 3.6V (minimum 3.0V), the permissible voltage drop is 0.6V.

Supercapacitors were selected (C: 0.15F, AC ESR: 0.200 Ohms, DC ESR: 0.250 Ohms). For a 2A pulse, the battery provides approximately 1A and the supercapacitor provides the remaining 1A. According to the above formula, the pressure drop caused by the internal resistance: 1A × 0.25Ohms＝0.25V. I(t/C)＝0.04 V It is small compared to the pressure drop caused by the internal resistance.

Conclusion:

Both power retention and power pulse applications can be calculated using the above formula. When the operating voltage of the circuit exceeds the operating voltage of the supercapacitor, the same capacitor can be used in series. Capacitor series should be balanced to ensure even voltage distribution.

• 超級電容器的使用及注意事項

1、超級電容器的壽命主要受工作電壓和溫度的聯合影響。如果長期置于高溫、高電壓下，其結果將會導致壽命縮短，極端情況下，電壓引起的產品失效將導致單體漏液或氣體泄漏。

2、如果在一方向上長期充電后再進行反向充電，超級電容的壽命將會大大的縮短，因此保持極性十分重要。

3、高于額定溫度上限使用將導致單體的使用特性和壽命嚴重惡化。惡化程度與超過上限溫度多高和持續時間多長成正比。典型影響包括容量快速下降，ESR上升，電解液分解內部產生大量氣體，最終導致單體漏液或氣體泄漏。。

4、單個超級電容器單體的電壓有限，必須串聯超級電容器以達到要求的電壓。由于每個超級電容器在電容和阻抗上有輕微的公差，必須均衡或防止單個超級電容器超過額定電壓。。

5、不要在以下環境中貯存超級電容器：

　a、高溫/高濕環境。
　b、陽光直射，粉塵環境。
　c、直接與水、鹽水、油或其它化學品接觸。
　d、直接與腐蝕性材料、酸、堿金屬或有毒氣體接觸。

　e、衝擊或振動環境。

• Usage and Cautions

1、The life of supercapacitor mainly depends on work voltage & temperature. If put supercapacitor in high temperature & high voltage environment, it will shorten the lifetime of supercapacitor. In the extreme case, it will lead to cell leakage or gas leakage when product failure caused by boltage.

2、It is important to keep right polarity, because it will greatly shorten the life of supercapacitors when charge it in one polarity and then reverse charge.

3、It will greatly damage supercapacitor function performance & lifetime when the temperature exceeds rated temperature. The damage intensity for supercapacitor is proportional to how much it exceeds the rated temperatures and the duration times. Typical effects include rapid decline in capacitance, ESR increase and gas generated from decomposition of the electrolyte, finally lead to supercapacitor leakage or gas leakage.

4、Single supercapacitor voltage is too low for most application, so it needs connect in series to get the needed voltages. Since each single supercapacitor with slight tolerance on capacitance & resistance, the connected supercapacitor shall have equivalent or prevent a single supercapacitor exceeds the rated voltage.

5、Do not store supercapacitor in any of the following environments:
a、High temperature/high humidity environments.
b、Direct sunlight, dust environment.
c、Direct contact with the water, salt, oil or other chemicals.
d、Direct contact with corrosive materials, acids, alkalis or toxic gases.
e、Shock or vibration environments.

• 緊急情況處理

漏液情況處理：

1、皮膚接觸：用肥皂水和清水徹底衝洗皮膚。

2、眼睛接觸：用流動清水或生理鹽水衝洗，就醫。

3、吸取：立即用水漱口，就醫。

　　如果發現超級電容器過熱或是聞到氣味，應立即斷開與超級電容器連接的電源和負載，讓其降溫，然後進行正確處理，不可讓臉或手接觸過熱的超級電容器。

• Emergency Treatments

Leakage case:

1、Skin contact: Use soap and water thoroughly wash skin.

2、Eye contact: Flush with flowing water or saline, and ask for medical treatment.

3、Draw: Immediately wash with water and ask for medical treatment.
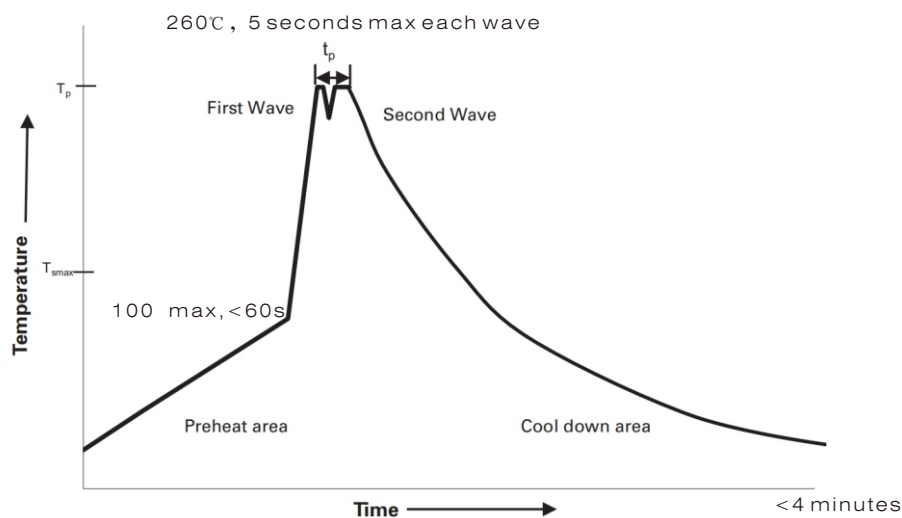
　　Disconnect the power supply & load connected with supercapacitor, once supercapacitor overheat or smells. Lower its temperature, avoid direct face or hands for overheat superacapacitors.

• 波峰焊推薦温度曲綫

1、短時間内按照以下焊接條件，開展低温焊接工作。

2、PCB只應從底部進行預熱，預熱時間不超過60秒，對於厚度等于或大于0.8 mm的PCB，電路板的頂部温度應在100℃以下。

3、有關更多焊接的條件請咨詢我們。

• Wave-Soldering Curve
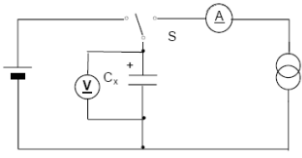
1、The products should be soldered under the following conditions.

2、The PCB should be preheated only from the bottom and for less than 60 seconds, with temperature at, or below, 100℃ on the top side of the board for PCBs equal to or greater than 0.8 mm thick.

3、For more information on soldering, please contact us.

260℃，5 seconds max each wave

● 測試方法 Measuring Methods

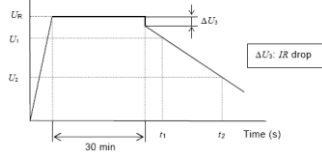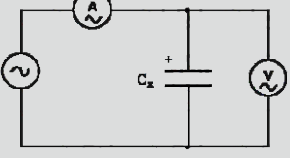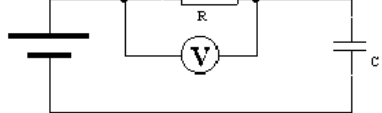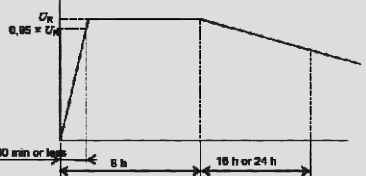| 項目Item	測試方法Measuring Methods
容量 Capacitance	恒流放電法測量： 1、恒流/恒壓源的直流電壓設定爲額定電壓U_R； 2、設定規定的恒電流放電裝置的恒定電流值； 3、將開關S切換到直流電源，在恒流/恒壓源達到額定電壓后恒壓充電30min； 4、充電結束后將開關S變換到恒流放電裝置，以恒定電流進行放電； 5、測量電容器兩端電壓從U_1到U_2的時間t_1和t_2，如圖所示，根據下列等式計算電容量值： Measured in constant current discharging method: 1、Set the DC voltage of the power source to the rated voltage U_R; 2、Set the constant current of the discharge equipment; 3、Connect the DUT to the power source through the switch S, charge DUT to constant voltage for 30min; 4、Connect the DUT to the discharge equipment through the switch S, discharge DUT at constant current; 5、Measure the period when the voltage of DUT change from U_1 to U_2, calculate the capacitance as: $$C = \frac{I \times (t_2 - t_1)}{U_1 - U_2}$$
内阻 Resistance	采用交流阻抗法測量，如下圖所示： Measured through AC impedance method, as illustrated in the following schematic: $$R_a = \frac{U}{I}$$ R_a：交流内阻 AC resistance; U：交流電壓有效值 AC voltage (Vrms); I：交流電流有效值AC current (Irms):
漏電流 Leakage current	1、放電：該測量開始前，電容器應進行充分放電。放電過程持續1h到24h。 2、漏電流的測量應應額定溫度和額定電壓(UR)，經過最大30min充電時間后達到95%充電電壓，充電時間從30min, 1h, 2h, 4h, 8h, 12h, 24h, 48h, 72h中選擇并在相應標準中規定。 3、應使用穩定的電源如直流穩壓電源。 4、通過1000Ω以下的保護電阻給電容器施加電壓。 1、Discharge: before the measurement begins, the capacitor should be fully discharged.The discharge process lasts from 1h to 24h.2、Leakage current shall be measured at rated temperature and rated voltage (UR).The charging voltage reached 95% after the maximum 30min charging time. The charging time was selected from 30min ,1h , 2h , 4h , 8h , 12h , 24h , 48h , 72h and shall be specified in the detail specification.3、Stable power supply, such as dc stabilized power supply, should be used.4、Through the protection under 1000 Ω resistance to capacitor voltage.
自放電 Self discharge	測量開始前，電容器應進行充分放電，放電過程持續1h到24h，在電容器兩端直接施加額定電壓U，不使用保護電阻，充電時間爲8h，包括電壓達到施加電壓95%的最大30min充電時間，將電容器兩端從電壓源斷開。電容器應置于標準常溫常壓條件下放置24h。直流電壓表的内阻應大于1MΩ。 Before measurement, the DUT should be discharged sufficiently for 1h to 24h. After charging the DUT for 8h (including 30min max. for the voltage reaches 95% of the applied value) applying rated voltage directly to the two terminals without a protective resistor, disconnect the DUT from the power source. Recover under standard conditions (room temperature and atmospheric pressure) for 24h. The resistance of the DC voltmeter should be > 1MΩ.

产品可靠性测试 Product Reliability

项目 Item		合格標准 Acceptable Quality Level	測試條件 Test Conditons
循環壽命 Cycle Life Characteristics	容量變化 Capacitance	≤初始值的30% ≤30% of initial value	在25℃下，用恒定電流使電容器在額定電壓和半額定電壓間循環充放電50萬次 Capacitors cycles 500000 times between rated voltage and half rated voltage under constant current at 25℃
	內阻 Internal Resistance	≤初始值的2倍 ≤2 times of initial value	
	外觀變化 Appearance	無顯著變化 No remarkable chane	
高溫負荷壽命 High Temperature Load Life	容量變化 Capacitance	≤初始值的30% ≤30% of initial value	溫度Temperature：Tmax±2℃ 電壓Voltage：U$_R$ 測試時長Duration of testing：1000h
	內阻 Internal Resistance	≤規定值的4倍 ≤4 times of specified value	
	外觀變化 Appearance	無顯著變化 No remarkable chane	
溫度特性 Temperature Characteristics	容量變化 Capacitance	≤初始值的30% ≤30% of initial value	存儲時長Duration of storage：16h 溫度Temperature：-40℃、25℃、70/85℃
	內阻 Internal Resistance	≤初始值的2倍 ≤2 times of initial value	
	外觀變化 Appearance	無顯著變化 No remarkable chane	
抗振性 Vibration Resistance	容量變化 Capacitance	≤初始值的30% ≤30% of initial value	振幅Amplitude：1.5mm 頻率Frequency：10~55Hz 方向Direction：X,Y,Z(2h) 測試時長Duration of testing：6h
	內阻 Internal Resistance	≤初始值的2倍 ≤2 times of initial value	
	外觀變化 Appearance	無顯著變化 No remarkable chane	
濕熱特性 Damp Heat	容量變化 Capacitance	≤初始值的30% ≤30% of initial value	電壓Voltage：額定電壓U$_R$ 相對濕度Relative humidity：90~95% 測試時長Duration of testing：240h 溫度Temperature：40±2℃
	內阻 Internal Resistance	≤初始值的2倍 ≤2 times of initial value	
	外觀變化 Appearance	無顯著變化 No remarkable chane	

訂貨方式 How to Order

單體 Cells

FH 2R7 L 505 M N 0824 - 00
① ② ③ ④ ⑤ ⑥ ⑦ ⑧

① 品牌代碼 Brand	② 額定電壓 Rated voltage		③ 結構 Structure		④ 額定容量 Rated Capacitance		⑤ 容量誤差 Capacitance Tolerance		⑥ 特性 Features		⑦ 單體尺寸 φD×L/mm Dimensions		⑧ 預留(省略) Reserve (omit)
	2R7	2.7V	L	引針式 Radial Type	104	0.1F	X	−10%~+30%	N	常規 Normal	0612	6.3×12.5	
	3R0	3.0V			224	0.22F	V	−10%~+10%			0813	8×13	
	3R6	3.6V	S	蓋板式 Cover plate type	334	0.33F	M	±20%	H	高溫 High Temperature	0816	8×16	
	3R8	3.8V			474	0.47F	T	−20%~+80%			0820	8×20	
	5R0	5.0V	W	螺柱式 Stud type	105	1.0F			L	低內阻 Low ESR	0824	8×24	
	5R5	5.5V			205	2.0F					1020	10×20	
	6R0	6.0V	K	螺紋式 Screw type	335	3.3F			V	高電壓 High Voltage	1025	10×25	
	10R8	10.8V			505	5.0F					1225	12.5×25	
	13R5	13.5V	C	扣式 Coin type	106	10F					1625	16×25	
	48R0	48V			156	15F					1842	18×42	
			H	扣式 Coin type	256	25F							
					506	50F							
			V	扣式 Coin type	107	100F							
					157	150F							
			Z	組合式 Combined type	407	400F							
					308	3000F							
			M	鋰離子電容 LIC									

模組 Modules

代碼 code	P	F	Y
封裝類型 Package type	PET套管 PET Sleeve	方形塑料殼灌封 Square plastic shell potting type	圓角塑料殼灌封 Fillet plastic shell potting type

代碼 code	A	B	C	Y
引出方式 Lead out mode	兩側引針 Both sides lead out	中間橫向引針 Middle lateral lead out	中間縱向引針 Middle longitudinal lead out	引綫引出 Wire lead out

一、扣式超級電容 Coin Type Supercapacitor

■ 特性表 SPECITICATIONS

參數 Parameters	主要特性 Performance Characteristics	備注 Notes
標稱容量範圍 Nominal Capacitance Range	0.1F~4.0F	IEC62391-1-2015
容量允許偏差 Capacitance Tolerance	-20%~+80%	@25℃
額定電壓 Rated Voltage	5.5V	DC
浪涌電壓 Surge Voltage	6.0V	DC
工作溫度範圍 Operating Temperature Range	-25℃ ~ +70/85℃	
循環壽命 Cycle Life	≥500,000 Cycles	@25℃

● C型標准產品規定值及尺寸
Specifications and Outline Dimensions of Standard C Type Product

型號 Part Number	額定電壓 U$_R$（V）	額定容量 Rated Cap.（F）	最大交流阻抗 Max ESR AC（Ω） @1KHZ，100mA	漏電流 Leakage Current (@25℃,24h,mA)	儲存能量 mWh	產品尺寸 Size / mm D×h
FH5R5C104T	5.5	0.1	60	0.006	0.42	13.2×7.0
FH5R5C334T	5.5	0.33	40	0.007	1.39	13.2×7.0
FH5R5C474T	5.5	0.47	40	0.010	1.97	13.2×7.0
FH5R5C105T	5.5	1.0	15	0.012	4.20	21.0×7.5
FH5R5C155T	5.5	1.5	10	0.012	6.30	21.0×7.5

● C型外形圖及尺寸 C Type Outline Dimensions (mm)