■3. 8V 系列锂离子超级电容器 3.8V series lithium-ion supercapacitors

◆特征 Features

*超低自放电，高容量（同体积 EDLC 的 10 倍）；
Ultra-low self-discharge, high capacity (10 times the same volume of EDLC)

*高工作电压（3.8V）；

High operating voltage (3.8V);

*工作温度范围-40℃~+70℃

Operating temperature range-40℃ ~ +70℃

*绿色环保、安全性、可靠性高，免维护

Green environmental protection，high security, reliability and maintenance-free

◆应用 Applications

*物联网终端 GPS 定位、通信电源，NB 通信/脉冲功率电源

Internet of Things terminal GPS positioning and communication power supply，NB IOT/Pulse power supply

*电动工具/ETC 及其它快充电源

Electric Tool/ETC/Quick Charge power

*主电源、备用电源，智能水电气表、汽车电子等

Primary or backup power supply，Intelligent water、electricity and gas meter, automotive electronics, etc.

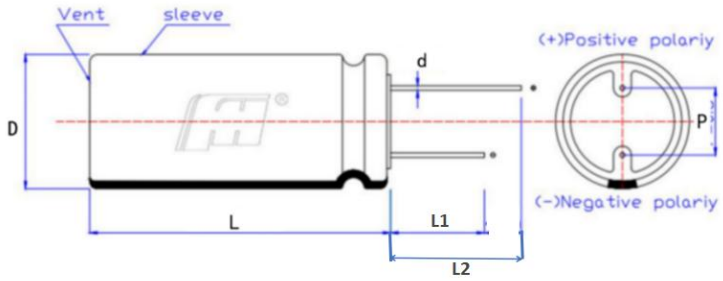
◆型号命名规则 Part Number System

FH	3R8	M	506	T	N	0825	00
品牌代码 Brand FH	额定电压 Rated voltage	结构 Structure	额定容量 Rated Capacitance	容量偏差Permitting capacitance error	特性 Series	单体尺寸φD*L/mm Dimensions	预留（一般省略） Reserve(Omitted in generally)
	2R7 2.7V	L 引针式 Radial Type	104 0.1F	X -10%~+30%	N 常规 Normal	0612 6.3*12.5	客户代码、内部代号等 Customer code or internal code, etc.
	2R8 2.8V	S 盖板式 Cover plate type	224 0.22F	V -10%~+10%	H 高温 High Temperature	0825 8*25	
	3R0 3.0V	W 螺柱式 Stud type	334 0.33F	M ±20%	L 低内阻 Low ESR	1014 10*14	
	3R6 3.6V	K 螺纹式 Screw type	474 0.47F	T -20%~+80%	V 高电压 High Voltage	1020 10*20	
	3R8 3.8V	C V H 纽扣式 Coin type	504 0.5F	S 0~+50%		1220 12.5*20	
	4R2 4.2V	Z 组合式 Combined type	105 1.0F			1625 16*25	
	5R5 5.5V	M 锂离子电容 LIC	155 1.5F			1840 18*40	
	7R5 7.5V		205 2.0F				
	13R5 13.5V		305 3.0F				
	25R0 25V		505 5.0F				
	48R0 48V		705 7.0F				
			106 10F				
			206 20F				
			256 25F				
			306 35F				
			506 50F				
			127 120F				
			757 750F				
			308 3000F				

备注：上述型号仅为示例，帮助您了解我们的产品命名规则，具体产品名称及参数在产品列表中给出。

Note: the above models are only examples to help you understand our product naming rules. Specific product names and parameters are given in the product list.

◆标准产品外形尺寸图 shape of standard product



实际尺寸及公差以参数表为准。

The actual size and tolerance shall be subject to the parameter table.

◆产品尺寸和规格 Product Dimensions and specification

型号 Part Number	额定电压 Rated Voltage（V）	额定电容 Rated Capacitance（F）	最大交流阻抗 MAX ESRAC（mΩ）@1KHz	最大放电电流 Max. discharge current （A）	脉冲电流 Plus Current（＜1s，A）	产品尺寸 Size/ mm					
						D ±1.5	L ±1.5	d ±0.1	P ±0.5	L1 ±1.5	L2 ±1.5
FH3R8M106T-N0613	3.8	10	1500	0.05	0.5	6	13	0.6	2.5	20.5	25.5
FH3R8M206T-N0813	3.8	20	500	0.1	0.8	8	13	0.6	3.5	22.5	28.5
FH3R8M306T-N0820	3.8	30	250	0.2	2.0	8	20	0.6	3.5	21.0	27.0
FH3R8M406T-N0820	3.8	40	200	0.2	2.0	8	20	0.6	3.5	21.0	27.0
FH3R8M506T-N0825	3.8	50	250	0.3	2.5	8	25	0.6	3.5	20.0	26.0
FH3R8M706T-N0825	3.8	70	250	0.5	2.5	8	25	0.6	3.5	20.0	26.0
FH3R8M306T-N1013	3.8	30	250	0.15	2.0	10	13.5	0.6	5.0	23.0	28.5
FH3R8M406T-N1013	3.8	40	200	0.15	2.0	10	13.5	0.6	5.0	23.0	28.5
FH3R8M506T-N1016	3.8	50	175	0.15	3.0	10	16	0.6	5.0	21.0	27.0
FH3R8M806T-N1020	3.8	80	150	0.25	3.5	10	20	0.6	5.0	21.0	27.0
FH3R8M127T-N1030	3.8	120	100	0.5	6.0	10	30	0.6	5.0	20.5	26.5
FH3R8M706T-N1313	3.8	70	175	0.25	2.5	12.5	13	0.6	5.0	23.0	29.0
FH3R8M127T-N1320	3.8	120	100	0.5	5.0	12.5	20	0.6	5.0	20.5	26.5
FH3R8M207T-N1330	3.8	200	80	0.7	7.0	12.5	30	0.6	5.0	20.5	26.5
FH3R8M257T-N1335	3.8	250	50	0.8	9.0	12.5	35	0.6	5.0	20.5	27.0
FH3R8M307T-N1340	3.8	300	50	1.0	10	12.5	40	0.6	5.0	20.0	26.5
FH3R8M257T-N1620	3.8	250	50	1.0	7.0	16	22	0.8	7.5	22.5	25.5
FH3R8M507T-N1640	3.8	500	40	2.0	16	16	41	0.8	7.5	24.0	28.5
FH3R8M757T-N1840	3.8	750	35	3.0	16	18	41	0.8	7.5	25.0	27.5
FH3R8M108T-N1840	3.8	1000	35	6.0	20	18	41	0.8	7.5	25.0	27.5

备注：测试电流 I(mA)=5xCRx(UR-Umin)/3.6。

Note: Test current I(mA)=5xCRx (UR-Umin)/3.6

◆产品典型性能 Typical product performance

项目 project	明细 Detail	备注 Notes
工作温度范围 Category temperature range	－40℃~＋70℃	
最低电压 Minimum Voltage	2.5V	
容量偏差 Capacitance Tolerance	－20%~＋80%	
最佳存储环境 Optimum storage condition	+10℃~50℃，≤65%RH	
循环寿命 Cycle Life	≥100000 次 容量变化ΔC 小于等于初始值的 30%； Capacitiy Change ≤30% of the initial value. 内阻小于规定值 4 倍。 ESR is less than 4 times of the specified value.	在 25℃下，用 10C 恒定电流使电容器在 3.1V~3.7V 间循环充放电 10 万次。 Capacitors charge/discharge 100000 times between 3.1V and 3.7V under 10C constant current at 25℃
高温特性 High Temperature Characteristics	容量变化ΔC 小于等于 25℃时的 30%； Capacitiy Change ≤30% of the value at 25℃. 内阻值小于 25℃时的 2 倍。 ESR is less than 2 times of the value at 25℃.	Tmax±2℃,16h
低温特性 Low Temperature Characteristics	容量变化ΔC 小于等于 25℃时的 50%； Capacitiy Change ≤50% of the value at 25℃. 内阻小于规定值 20 倍。 ESR is less than 20 times of the specified value.	Tmin±2℃,2h
高温负荷寿命 High Temperature Load Life	容量变化ΔC 小于等于初始值的 30%； Capacitiy Change ≤30% of the initial value. 内阻小于规定值 4 倍。 ESR is less than 4 times of the specified value. 外观无明显变化。 Appearance no remarkable defects.	1000h，65±2℃@UR
高温储存寿命 High Temperature Storage	容量变化ΔC 小于等于初始值的 30%； Capacitiy Change ≤30% of the initial value. 内阻小于规定值 2 倍。 ESR is less than 2 times of the specified value.	1000h，Tmax±2℃，3.6V，No charging
湿热特性 Humidity Characteristics	容量变化ΔC 小于等于初始值的 30%； Capacitiy Change ≤30% of the initial value. 内阻小于规定值 2 倍。 ESR is less than 2 times of the specified value.	240h，40℃，90±2% RH

◆包装规格 Packing Specification

产品尺寸 Product size(D*L)	塑料托盘 Plastic tray pcs/托	内盒 District
6*13	75	1500
8*13	50	800
8*20	50	800
8*25	60	960
10*13	50	700
10*16	50	700
10*20	50	700
10*30	40	520
13*13	60	600
13*20	60	600
13*30	40	440
13*35	40	440
13*40	40	440
16*20	60	600
16*40	40	320
18*40	40	280

备注：当包装数量小于外箱可容纳的产品数量时，将根据数量采用合适的包装外箱。

Note: when the packing quantity is less than the product quantity that can be contained in the outer box, the appropriate packing box will be adopted according to the quantity.

包装规格可按需求更改，下单前请与我司联系确定。

Packaging specifications can be changed as needed, please contact us before you place your order.

◆测试方法 Measuring Method

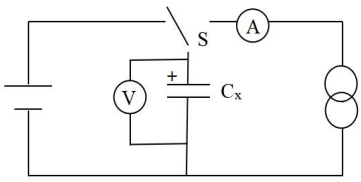
<table>
<tr>
<td>容量
Capacitance</td>
<td>
恒流放电法测量 Measurement by Permanent electrotransport
1、采用如图1.1电路图进行测量：
Use the circuit diagram in Figure 1.1 to measure:
2、恒流/恒压源的直流电压设定为额定电压（U_R）。
DC voltage of constant current/constant voltage source is set as rated voltage (U_R).
3、设定规定的恒流放电装置的恒定电流值I。
Set the constant current value I of the constant current discharge device.
4、将开关S切换到直流电源，室温下(25±2℃)，在恒流/恒压源达到额定电压后恒压充电30min。
Switch the switch S to the DC power supply, and at room temperature (25±2℃), charge the battery with constant voltage for 30min after the constant current/constant voltage source reaches the rated voltage.
5、充电30min结束后，将开关S变换到恒流放电装置，以恒定电流I进行放电至工作电压下限U_2，并记录开始放电的电压U_1。
After charging for 30 min, switch S to a constant current discharge device, discharge with constant current I to the lower limit of working voltage U_2, and record the voltage U_1 at which the discharge begins.
6、记录电容器两端电压从U_1到U_2的时间t_1和t_2，如图1.2所示，根据等式(1)计算电容量值：
$C=I(t_2-t_1)/(U_1-U_2)$ (1)
Record the times t_1 and t_2 for the voltage across the capacitor from U1 to U_2, as shown in Figure 1.2, and calculate the capacitance value according to the equation (1):


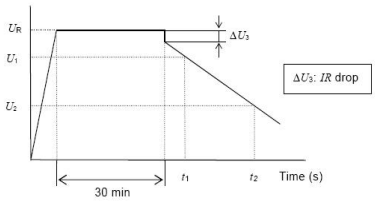
图 1.1


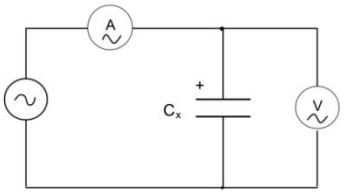
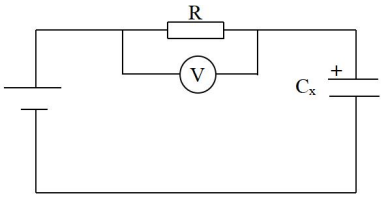
图 1.2
</td>
</tr>
<tr>
<td>交流内阻
AC impedance</td>
<td>
交流阻抗法测量 AC impedance measurements
1、采用如图2所示的电路进行测量：
The measurement is performed using the circuit shown in Figure 2:


图 2
2、测试前必须将电容器以额定电流放电至工作电压下限。
The capacitor must be discharged to the lower limit of the working voltage with rated current before the test.
3、室温(25±2℃)下，在电容器两端加上固定频率 1kHz 的交流电流，等效交流电流为 I，可由交流电流表读取，当交流电的频率较高时，理想电容器 C_x 可视为短路状态，同时产生一个压降 U，可由交流电压表读得。根据公式（2）计算得到电容器单体的交流内阻 R_a。
$R_a=U/I$ (2)
At room temperature (25±2℃), a fixed frequency 1kHz AC current is applied to both ends of the capacitor, and the equivalent AC current is I, which can be read by the AC ammeter. When the frequency of the AC current is high, the ideal capacitor Cx can be regarded as a short-circuit state, and a voltage drop U is generated at the same time. It can be read by an AC voltmeter. Calculate the AC internal resistance R_a of the capacitor unit according toequation (2).
</td>
</tr>
</table>

	其中 where： Ra 交流内阻 AC impedance（Ω）； U 交流电压有效值 Effective value of U ac voltage（V）； I 交流电流有效值 Effective value of I ac current（A）。
漏电流 Leakage Current	漏电流测量 Leakage current measurement 1、采用如图3所示的电路进行测量： The measurement is performed using the circuit shown in Figure 3:  图 3 2、测试前必须将电容器以额定电流放电至工作电压下限。 Before the test, the capacitor must be discharged to the lower limit of the working voltage with a constant current. 3、室温(25±2℃)下，电容器单体以恒定电流I充电到额定电压U_R。 At room temperature (25±2℃), the capacitor is charged to the rated voltage U_R with a constant current; 4、再将电容器单体在额定电压下恒压充电72h，充电结束后的电流即为产品的漏电流。 Then charge the capacitor at a constant voltage for 72 hours at the rated voltage, and the current after charging is the leakage current of the product. 备注 Note: 应使用稳定的电源如直流稳压电源。 Stable power supply, such as dc stabilized power supply, should be used. 通过1000Ω以下的保护电阻给电容器施加电压。 through the protection under 1000 Ω resistance to capacitor voltage.
自放电 Self discharge	自放电测量 Self-discharge measurement 1、测试前必须将电容器以额定电流放电至工作电压下限。 Before the test, the capacitor must be discharged to the lower limit of the working voltage with a constant current. 2、室温(25±2℃)下，将电容器单体以恒定电流I充电到95%U_R，施加的恒定电流应保证电压达到95%U_R的最大充电时间为30min。 At room temperature (25±2℃), charge the capacitor to 95%U_R with a constant current I, and the applied constant current should ensure that the maximum charging time until the voltage reaches 95%U_R is 30min. 3、再将电容器单体以恒定电流I充电至U_R，并在额定电压下恒压充电，如图4所示，2、3步骤的充电总时间为8h。 Charge the capacitor to U_R with a constant current I, and charge it with a constant voltage at the rated voltage. As shown in Figure 4, the total charging time of steps 2 and 3 is 8h. 4、将电容器两端从电压源断开，在室温下开路静置168h后，测试电容器电压。 Disconnect both ends of the capacitor from the voltage source, and test the voltage of the capacitor after 168 hours in the open circuit at room temperature.

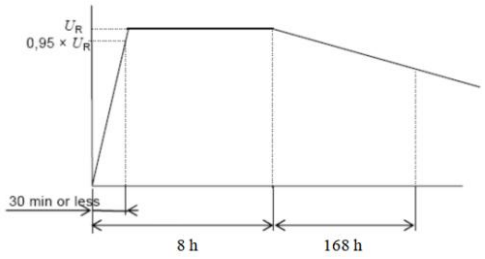


图 4

◆注意事项和使用指导 Handling Precautions and Guidelines

当您的产品需要使用电容器时，请直接联系咨询技术规格、安装注意事项和使用要求，以评估使用的可行性和保证使用的安全性。

When your product needs to use capacitors, please contact directly to consult technical specifications, installation precautions and use requirements to evaluate the feasibility of use and ensure the safety of use.

1、注意事项 Precautions

(1) 漏液情况处理 Handling of leakage situation

皮肤接触：用肥皂水和清水彻底冲洗皮肤；

Skin contact: rinse skin thoroughly with soap and water;

眼睛接触：用流动清水或生理盐水冲洗，就医；

Eye contact: flush with flowing water or normal saline and seek medical advice;

吸取：立即用水漱口，就医；

Absorb: immediately rinse with water and seek medical advice;

如果发现电容器过热或是闻到气味，应立即断开与电容器连接的电源和负载，让其降温，然后进行正确处理，不可让脸或手接触过热的电容器。

If the capacitor is found to be overheating or smelling, the power supply and load connected to the capacitor should be disconnected immediately to cool it, and the capacitor should be treated properly so that no face or hand contact with the capacitor is allowed.

(2) 禁止反向充电 Prohibition of reversing the positive(+) and negative(-) terminals

与超级电容器不同的是，锂离子电容器与电解电容器或电池一样具有极性，在使用时不小心短期反向使用，会造成锂离子电容器的实质性破坏，可能导致产气、泄漏、爆炸或其他问题。

Unlike supercapacitors, lithium-ion capacitors have the same polarity as electrolytic capacitors or batteries. Careless short-term reverse use during use will cause substantial damage to lithium-ion capacitors, which may lead to gas production, leakage, explosion or other question.

(3) 禁止拆卸 Prohibition of disassembly

拆卸电容会导致内部短路，可能导致产气，泄漏，爆炸，或其他问题。

Removing the capacitor can cause an internal short circuit, which can lead to gas production, leaks, explosions, or other problems.

(4)禁止将电容放入火中 Prohibition of putting capacitors into fire

会导致电容爆炸，这是非常危险的，是被禁止的。

It will cause the capacitor to explode, which is very dangerous and is prohibited.

(5)禁止将电容浸入液体 Prohibition of cells immersion into liquid

电容不能用任何液体浸泡。

Capacitors cannot be immersed in any liquid.

(6)禁止使用损坏的电容 Prohibition of using damaged capacitors

运送过程中，电容可能因运输问题而被损坏。若发现电容有任何异常情况，如包装破损、电解液泄漏、形状扭曲，请勿使用该电容。有电解液味道或泄漏的电容应放置在远离火的地方，以避免起火或爆炸。

During shipping, capacitors may be damaged due to shipping issues. Do not use the capacitor if you find any abnormality in the capacitor, such as damaged packaging, leakage of electrolyte, or distorted shape. Capacitors that smell or leak should be placed away

from fire to avoid fire or explosion.

(7)禁止短路 Prohibition short circuit

会导致产气，泄漏，爆炸，或其他问题。

May cause gas production, leakage, explosion, or other problems.

(8)运输及储存 Transport and storage

产品运输过程应防止产品受潮，储存温度应为-30℃~50℃、相对湿度小于 60%，最大湿度不可超过 85%，否则会导致电容受潮性能劣化或生锈。

Should prevent products be affected with damp be affected with damp in product transportation, storage temperature should be -30℃to 50℃, relative humidity less than 60%, the maximum humidity no more than 85%, otherwise it will cause capacitance performance degradation of be affected with damp be affected with damp or rust.

(9)禁止随意丢弃 Prohibition of throwing away randomly

不要随意丢弃。遵循法令或地方公共团体等指定的条例，将废弃品交给工业废弃物处理商。

Don't throw it away randomly. Follow the laws and regulations or local public organizations and other designated regulations, and hand over the waste to the industrial waste disposal company.

2、使用指导 Handling Guidelines

(1)确认极性 Checking polarity

使用前应确认电容器的极性。如果在反极性下工作，电容不仅会缩短使用寿命，甚至还会造成严重的损坏，如气胀、电解液泄漏等。

The polarity of the capacitor should be confirmed before use. If operated in reverse polarity, the capacitor will not only shorten the service life, but even cause serious damage, such as gas swelling, electrolyte leakage, etc.

(2)焊接 Soldering

建议产品的焊接条件为流动焊接，热冲击会影响电容的电性能，甚至会导致电容的鼓气、漏液以及开裂。

The welding condition of the proposed product is flow welding, heat shock will decrease electric performance of capacitor, even cause swelling, leakage or crack.

手工焊的温度建议低于 350℃，焊接持续时间少于 4s。

Manual soldering temperature should not exceed 350℃, soldering time should not exceed 4s.

使用波峰焊前，请考虑是否发生短路，若一定不会发生短路，则可以使用。

Before using wave soldering, please consider whether there is a short circuit. If there is no short circuit, it can be used.

(3)安装 Installation

电容器用于双面电路板上时，要注意连接处不可经过电容器可触及的地方，否则会导致产品短路过压及电容器损坏。安装过程及安装后，不可强行扭动或倾斜电容器，不得用力拉拽引线，应先断针及折弯后焊接。

When a capacitor is used on a double-sided circuit board, be careful not to place the connection where the capacitor can be touched, otherwise it will lead to short circuit and overvoltage of the product and damage to the capacitor. During the installation process and after installation, do not twist or tilt the capacitor forcibly, and do not pull the lead wires forcibly. The pins should be broken and bent before soldering.

电容器对应印刷电路板位置不宜放置其他器件和布线。

Other devices and wiring should not be placed in the position of the capacitor corresponding to the printed circuit board.

(4)环境 Environment

环境温度的升高和降低都会使电容器的容量、内阻、漏电流等性能变化，故使用温度不宜超过额定温度的上限或下限。

The increase and decrease of the ambient temperature will change the capacity, internal resistance, leakage current and other properties of the capacitor, so the operating temperature should not exceed the upper or lower limit of the rated temperature.

电容器不应与周边的发热元件直接接触，必须有散热空间。

The capacitor should not be in direct contact with the surrounding heating elements, and there must be space for heat dissipation.

(5)不适用场景 Not applicable scenarios

锂离子电容器不适用于交流电路、滤波电路和高频率充放电电路中。

Lithium-ion capacitors are not suitable for AC circuits, filter circuits and high-frequency charge and discharge circuits.

由于电容器的内阻大于普通电容器，在交流电路或高频率充放电过程中，电容内部发热，容量迅速衰减，内阻增加，在某些情况下会导致电容器性能失效，故锂离子电容器一般只用于直流电路。

Since the internal resistance of capacitors is larger than that of ordinary capacitors, in the process of AC circuit or high-frequency charging and discharging, the internal heating of the capacitors, the capacity decays rapidly, and the internal resistance increases, which will lead to the failure of capacitor performance in some cases. Therefore, lithium-ion capacitors are generally only used in DC circuits.

(6)电压 Voltage

锂离子电容器应在规定电压区间内使用，工作电压不应超过电池额定最高工作电压。否则电容器的使用寿命会缩短，甚至产生气胀、漏液或开裂。

Lithium-ion capacitors should be used within the specified voltage range, and the working voltage should not exceed the maximum rated working voltage of the battery. Otherwise, the service life of the capacitor will be shortened, and even gas swelling, liquid leakage or cracking will occur.

(7)充电方式 Charging method

电容器可采用限流、恒流、恒功率、恒电压等多种充电方式，充电时可能会拉低充电电源电压，直到电容器充满维持电压平衡。

Capacitors can be charged in various ways such as current limiting, constant current, constant power, and constant voltage. During charging, the charging power supply voltage may be pulled down until the capacitor is fully charged to maintain voltage balance.

使用时，电流设置请勿超过额定充放电电流，可能会造成电容器损坏。

When using, the current setting should not exceed the rated charge and discharge current, which may cause damage to the capacitor.

(8)IR 降 IR drop

在充放电过程中，电容器的内阻引起的 IR 降，会损失电容器的充放电效率，故电容器内阻大小在一定程度上决定了电容器品质的优劣。

In the process of charging and discharging, the IR drop caused by the internal resistance of the capacitor will lose the charging and discharging efficiency of the capacitor, so the internal resistance of the capacitor determines the quality of the capacitor to a certain extent.

当主电源关闭，电容会从电源失效检测模式转变为后备电源工作模式，此时由于瞬间启动电流和电容内阻会导致开路电压下降。

When the main power is turned off, the capacitor will change from the power failure detection mode to the backup power operation mode. At this time, the open circuit voltage will drop due to the instantaneous start-up current and the internal resistance of the capacitor.

(9)短路判断 Short circuit judgment

短路电容不能进行充放电。

Short-circuit capacitors cannot be charged or discharged.

在电容正负极间施加直流电压，电容电压不升高，可判定短路。

If a DC voltage is applied between the positive and negative electrodes of the capacitor, the voltage of the capacitor does not rise, and a short circuit can be determined.

用万用表判定时，电容在为充电时，以欧姆档测量（短路挡）指示为短路状态，是正常现象，不能确定电容即为短路，应观察阻值是否增加，如增加即为非短路。

When judging with a multimeter, when the capacitor is charging, it is indicated as a short circuit by the ohm gear measurement (short-circuit gear).

(10)串联操作 Series operation

相同电容器串联使用时，总电压=串联个数×单体耐压；总容量=单体容量÷串联个数；总能量=串联个数×单体容量，总内阻=串联个数×单体内阻。

When the same capacitor is used in series, the total voltage=series number * monomer withstand voltage; Total capacity = unit capacity Total energy = series number x monomer capacity, total internal resistance=series number x monomer resistance.

三个及以上串联存在单体间的电压均衡问题，需要考虑采用均衡电路，用于保证长期使用过程中电容不能过电压使用，从而引起电容器寿命衰减及损坏，不同规格超级电容器不可进行串联使用。

There is a problem of voltage balancing between three or more monomers in series, so it is necessary to consider adopting equalizing circuit to ensure that the capacitance cannot be used over voltage during long-term use, thus causing capacitor life attenuation and damage. Capacitors of different specifications cannot be used in series.

(11)并联操作 parallel operation

电容器进行并联使用时，可以不同容值的并联，采用相同电压充电，但要注意各个电容之间的电流平衡问题以及相互隔离，避免由于放电后电势差产生的相互反向充电。

When the capacitors are used in parallel, they can be connected in parallel with different capacitance values and charged by the same voltage. However, it is necessary to pay attention to the current balance between the capacitors and to isolate each other, so as to avoid reverse charging due to the potential difference after discharge.

◆关于废弃 About discarding

不要随意丢弃，遵循法令或地方公共团体等指定的条例，将废弃品交给工业废弃物处理商。

Don't throw it away randomly. Follow the laws and regulations or local public organizations and other designated regulations, and hand over the waste to the industrial waste disposal company.

◆修改履历 AMENDMENT RECORDS

版本 Ver.No.	内容 Description	日期 Date	修改 Revised	审核 Checked
V2.0	合并新增所有内容 Add all new content	2022/11/1	佘涛江 Taojiang Shi	蓝海玲 Hailin Lan
V3.0	1.新增规格 New specifications： FH3R8M257T-N1335 FH3R8M307T-N1340 FH3R8M757T-N1840 2.修改内容： FH3R8M507T-N1640 和 FH3R8M108T-N1840 的“L”由 40 改为 41 2.revise content： The "L" of FH3R8M507T-N1640 and FH3R8M108T-N1840 is changed from 40 to 41 3.修改包装数量； 3.Modify the number of packages； 4.增加导针长度 L1、L2。 4.Increase the length of guide needle L1 and L2.	2023/8/1	黄桂远 Guiyuan Huang	蓝海玲 Hailin Lan
V3.1	1.修改包装数量； 1.Modify the number of packages； 2.产品尺寸：FH3R8M306T-N1013 和 FH3R8M406T-N1013 的“L”由 13 改为 13.5 2.Product size: The "L" of FH3R8M306T-N1013 and FH3R8M406T-N1013 is changed from 13 to 13.5 3.新增规格 New specifications： FH3R8M506T-N1016 FH3R8M207T-N1330 4.高温负荷寿命测试由“55℃”更改为“65℃”。 4.The high temperature load life test is changed from "55℃" to "65℃".	2024/3/19	黄桂远 Guiyuan Huang	蓝海玲 Hailin Lan
V4.0	1.修改包装数量； 1.Modify the number of packages； 2.产品尺寸：FH3R8M257T-N1620 的“L”由 21 改为 22。 2. Product size: The "L" of FH3R8M257T-N1620 is changed from 21 to 22.	2025/3/24	黄舒婷 Shuting Huang	袁建才 Jiancai Yuan

注：上述所提供之内容为产品规格说明。在产品未变更时，风华保有修改此内容不另行通知之所有权利，任何产品变更将会以ＰＣＮ通知客户。

■4. 2V 系列锂离子超级电容器 4.2V series lithium-ion supercapacitors

◆特征 Features

*超低自放电，高容量（同体积 EDLC 的 10 倍）；
Ultra-low self-discharge, high capacity (10 times the same volume of EDLC)

*高工作电压（4.2V）；

High operating voltage (4.2V);

*工作温度范围-40℃~+65℃

Operating temperature range-40℃ ~ +65℃

*绿色环保、安全性、可靠性高，免维护

Green environmental protection，high security, reliability and maintenance-free

◆应用 Applications

*物联网终端 GPS 定位、通信电源，NB 通信/脉冲功率电源

Internet of Things terminal GPS positioning and communication power supply，NB IOT/Pulse power supply

*电动工具/ETC 及其它快充电源

Electric Tool/ETC/Quick Charge power

*主电源、备用电源，智能水电气表、汽车电子等

Primary or backup power supply，Intelligent water、electricity and gas meter, automotive electronics, etc.

◆型号命名规则 Part Number System

FH	4R2	M	906	T	N	0825	00

FH — 品牌代码 Brand

4R2 — 额定电压 Rated voltage

2R7	2.7V
2R8	2.8V
3R0	3.0V
3R6	3.6V
3R8	3.8V
4R2	4.2V
5R5	5.5V
7R5	7.5V
13R5	13.5V
25R0	25V
48R0	48V

M — 结构 Structure

L	引针式 Radial Type
S	盖板式 Cover plate type
W	螺柱式 Stud type
K	螺纹式 Screw type
C	纽扣式 Coin type
V	
H	
Z	组合式 Combined type
M	锂离子电容 LIC

906 — 额定容量 Rated Capacitance

104	0.1F
224	0.22F
334	0.33F
474	0.47F
504	0.5F
105	1.0F
155	1.5F
205	2.0F
305	3.0F
505	5.0F
705	7.0F
106	10F
206	20F
256	25F
306	35F
506	50F
127	120F
757	750F
308	3000F

T — 容量偏差Permitting capacitance error

X	-10%~+30%
V	-10%~+10%
M	±20%
T	-20%~+80%
S	0~+50%

N — 特性 Series

N	常规 Normal
H	高温 High Temperature
L	低内阻 Low ESR
V	高电压 High Voltage

0825 — 单体尺寸φD*L/mm Dimensions

0612	6.3*12.5
0825	8*25
1014	10*14
1020	10*20
1220	12.5*20
1625	16*25
1840	18*40

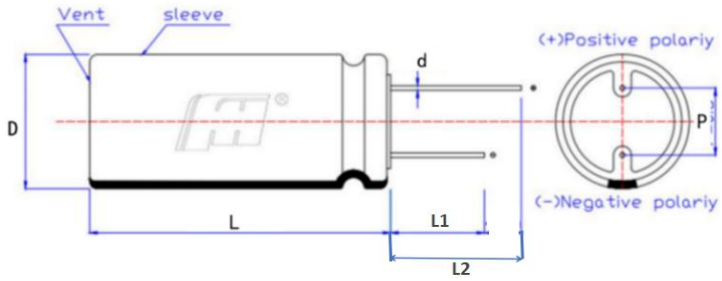
00 — 预留（一般省略）Reserve(Omitted in generally)

客户代码、内部代号等 Customer code or internal code, etc.

备注：上述型号仅为示例，帮助您了解我们的产品命名规则，具体产品名称及参数在产品列表中给出。

Note: the above models are only examples to help you understand our product naming rules. Specific product names and parameters are given in the product list.

◆标准产品外形尺寸图 shape of standard product



实际尺寸及公差以参数表为准。

The actual size and tolerance shall be subject to the parameter table.

◆产品尺寸和规格 Product Dimensions and specification

型号 Part Number	额定电压 Rated Voltage（V）	额定电容 Rated Capacitance（F）	最大交流阻抗 MAX ESRAC（mΩ）@1KHz	最大放电电流 Max. discharge current （A）	脉冲电流 Plus Current（＜1s，A）	产品尺寸 Size/ mm					
						D ±1.5	L ±1.5	d ±0.1	P ±0.5	L1 ±1.5	L2 ±1.5
FH4R2M906T-N0825	4.2	90	250	0.5	2.5	8	25	0.6	3.5	20.0	26.0
FH4R2M197T-N1030	4.2	190	100	0.9	5.0	10	30	0.6	5.0	20.5	26.5
FH4R2M257T-N1320	4.2	250	100	1.2	6.0	12.5	20	0.6	5.0	20.5	26.5
FH4R2M307T-N1330	4.2	300	90	2.0	10	12.5	30	0.6	5.0	20.5	26.5
FH4R2M557T-N1340	4.2	550	80	3.0	15	12.5	40	0.6	5.0	20.0	26.5
FH4R2M407T-N1620	4.2	400	80	2.0	10	16	22	0.8	7.5	22.5	25.5
FH4R2M807T-N1640	4.2	800	60	4.0	15	16	41	0.8	7.5	24.0	28.5
FH4R2M108T-N1840	4.2	1000	35	6.0	20	18	41	0.8	7.5	25.0	27.5
FH4R2M138T-N1840	4.2	1300	35	6.0	20	18	41	0.8	7.5	25.0	27.5

备注：测试电流 I(mA)=5xCRx(UR-Umin)/3.6。

Note: Test current I(mA)=5xCRx (UR-Umin)/3.6

◆产品典型性能 Typical product performance

项目 project	明细 Detail	备注 Notes
工作温度范围 Category temperature range	－40℃~＋65℃	
最低电压 Minimum Voltage	2.5V	
容量偏差 Capacitance Tolerance	－20%~＋80%	
最佳存储环境 Optimum storage condition	+10℃~50℃，≤65%RH	
循环寿命	≥100000 次	在 25℃下 ，用 5C 恒定电流使电容器

Cycle Life	容量变化ΔC 小于等于初始值的 30%； Capacitiy Change ≤30% of the initial value. 内阻小于规定值 4 倍。 ESR is less than 4 times of the specified value.	在 3.0V~4.0V 间循环充放电 10 万次。 Capacitors charge/discharge 100000 times between 3.0V and 4.0V under 5C constant current at 25℃.
高温特性 High Temperature Characteristics	容量变化ΔC 小于等于 25℃时的 30%； Capacitiy Change ≤30% of the value at 25℃. 内阻值小于 25℃时的 2 倍。 ESR is less than 2 times of the value at 25℃.	Tmax±2℃,16h
低温特性 Low Temperature Characteristics	容量变化ΔC 小于等于 25℃时的 50%； Capacitiy Change ≤50% of the value at 25℃. 内阻小于规定值 20 倍。 ESR is less than 20 times of the specified value.	Tmin±2℃,2h
高温负荷寿命 High Temperature Load Life	容量变化ΔC 小于等于初始值的 30%； Capacitiy Change ≤30% of the initial value. 内阻小于规定值 4 倍。 ESR is less than 4 times of the specified value. 外观无明显变化。 Appearance no remarkable defects.	1000h，55±2℃@UR
高温储存寿命 High Temperature Storage	容量变化ΔC 小于等于初始值的 30%； Capacitiy Change ≤30% of the initial value. 内阻小于规定值 2 倍。 ESR is less than 2 times of the specified value.	1000h，Tmax±2℃，4.0V，No charging
湿热特性 Humidity Characteristics	容量变化ΔC 小于等于初始值的 30%； Capacitiy Change ≤30% of the initial value. 内阻小于规定值 2 倍。 ESR is less than 2 times of the specified value.	240h，40℃，90±2% RH

◆包装规格 Packing Specification

产品尺寸 Product size(D*L)	塑料托盘 Plastic tray pcs/托	内盒 District
8*25	60	960
10*30	40	520
13*20	60	600
13*30	40	440
13*40	40	440
16*20	60	600
16*40	40	320
18*40	40	280

备注：当包装数量小于外箱可容纳的产品数量时，将根据数量采用合适的包装外箱。

Note: when the packing quantity is less than the product quantity that can be contained in the outer box, the appropriate packing box will be adopted according to the quantity.

包装规格可按需求更改，下单前请与我司联系确定。

Packaging specifications can be changed as needed, please contact us before you place your order.

◆测试方法 Measuring Method

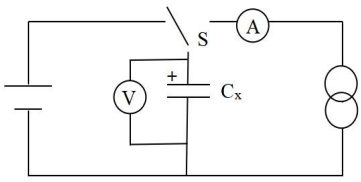
<table>
<tr>
<td>容量
Capacitance</td>
<td>
恒流放电法测量 Measurement by Permanent electrotransport
1、采用如图1.1电路图进行测量：
Use the circuit diagram in Figure 1.1 to measure:
2、恒流/恒压源的直流电压设定为额定电压（U_R）。
DC voltage of constant current/constant voltage source is set as rated voltage (U_R).
3、设定规定的恒流放电装置的恒定电流值I。
Set the constant current value I of the constant current discharge device.
4、将开关S切换到直流电源，室温下(25±2℃)，在恒流/恒压源达到额定电压后恒压充电30min。
Switch the switch S to the DC power supply, and at room temperature (25±2℃), charge the battery with constant voltage for 30min after the constant current/constant voltage source reaches the rated voltage.
5、充电30min结束后，将开关S变换到恒流放电装置，以恒定电流I进行放电至工作电压下限U_2，并记录开始放电的电压U_1。
After charging for 30 min, switch S to a constant current discharge device, discharge with constant current I to the lower limit of working voltage U_2, and record the voltage U_1 at which the discharge begins.
6、记录电容器两端电压从U_1到U_2的时间t_1和t_2，如图1.2所示，根据等式(1)计算电容量值：
$C=I(t_2-t_1)/(U_1-U_2)$ (1)
Record the times t_1 and t_2 for the voltage across the capacitor from U1 to U_2, as shown in Figure 1.2, and calculate the capacitance value according to the equation (1):


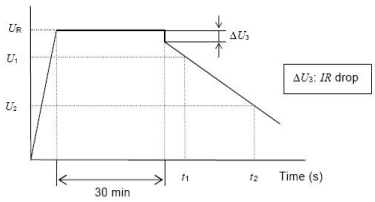
图 1.1


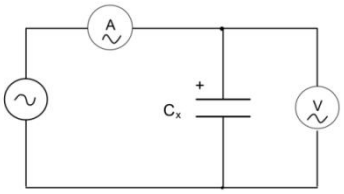
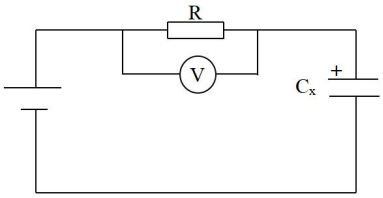
图 1.2
</td>
</tr>
<tr>
<td>交流内阻
AC impedance</td>
<td>
交流阻抗法测量 AC impedance measurements
1、采用如图2所示的电路进行测量：
The measurement is performed using the circuit shown in Figure 2:


图 2
2、测试前必须将电容器以额定电流放电至工作电压下限。
The capacitor must be discharged to the lower limit of the working voltage with rated current before the test.
3、室温(25±2℃)下，在电容器两端加上固定频率 1kHz 的交流电流，等效交流电流为 I，可由交流电流表读取，当交流电的频率较高时，理想电容器 C_x 可视为短路状态，同时产生一个压降 U，可由交流电压表读得。根据公式（2）计算得到电容器单体的交流内阻 R_a。
$R_a=U/I$ (2)
At room temperature (25±2℃), a fixed frequency 1kHz AC current is applied to both ends of the capacitor, and the equivalent AC current is I, which can be read by the AC ammeter. When the frequency of the AC current is high, the ideal capacitor Cx can be regarded as a short-circuit state, and a voltage drop U is generated at the same time. It can be read by an AC voltmeter. Calculate the AC internal resistance R_a of the capacitor unit according toequation (2).
</td>
</tr>
</table>

	其中 where： Ra 交流内阻 AC impedance（Ω）； U 交流电压有效值 Effective value of U ac voltage（V）； I 交流电流有效值 Effective value of I ac current（A）。
漏电流 Leakage Current	漏电流测量 Leakage current measurement 1、采用如图3所示的电路进行测量： The measurement is performed using the circuit shown in Figure 3:  图 3 2、测试前必须将电容器以额定电流放电至工作电压下限。 Before the test, the capacitor must be discharged to the lower limit of the working voltage with a constant current. 3、室温(25±2℃)下，电容器单体以恒定电流I充电到额定电压U_R。 At room temperature (25±2℃), the capacitor is charged to the rated voltage U_R with a constant current; 4、再将电容器单体在额定电压下恒压充电72h，充电结束后的电流即为产品的漏电流。 Then charge the capacitor at a constant voltage for 72 hours at the rated voltage, and the current after charging is the leakage current of the product. 备注 Note: 应使用稳定的电源如直流稳压电源。 Stable power supply, such as dc stabilized power supply, should be used. 通过1000Ω以下的保护电阻给电容器施加电压。 through the protection under 1000 Ω resistance to capacitor voltage.
自放电 Self discharge	自放电测量 Self-discharge measurement 1、测试前必须将电容器以额定电流放电至工作电压下限。 Before the test, the capacitor must be discharged to the lower limit of the working voltage with a constant current. 2、室温(25±2℃)下，将电容器单体以恒定电流I充电到95%U_R，施加的恒定电流应保证电压达到95%U_R的最大充电时间为30min。 At room temperature (25±2℃), charge the capacitor to 95%U_R with a constant current I, and the applied constant current should ensure that the maximum charging time until the voltage reaches 95%U_R is 30min. 3、再将电容器单体以恒定电流I充电至U_R，并在额定电压下恒压充电，如图4所示，2、3步骤的充电总时间为8h。 Charge the capacitor to U_R with a constant current I, and charge it with a constant voltage at the rated voltage. As shown in Figure 4, the total charging time of steps 2 and 3 is 8h. 4、将电容器两端从电压源断开，在室温下开路静置168h后，测试电容器电压。 Disconnect both ends of the capacitor from the voltage source, and test the voltage of the capacitor after 168 hours in the open circuit at room temperature.

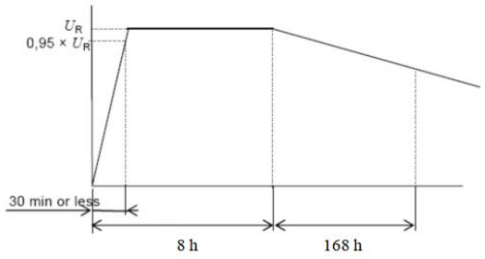


图 4

◆注意事项和使用指导 Handling Precautions and Guidelines

当您的产品需要使用电容器时，请直接联系咨询技术规格、安装注意事项和使用要求，以评估使用的可行性和保证使用的安全性。

When your product needs to use capacitors, please contact directly to consult technical specifications, installation precautions and use requirements to evaluate the feasibility of use and ensure the safety of use.

1、注意事项 Precautions

(1) 漏液情况处理 Handling of leakage situation

皮肤接触：用肥皂水和清水彻底冲洗皮肤；

Skin contact: rinse skin thoroughly with soap and water;

眼睛接触：用流动清水或生理盐水冲洗，就医；

Eye contact: flush with flowing water or normal saline and seek medical advice;

吸取：立即用水漱口，就医；

Absorb: immediately rinse with water and seek medical advice;

如果发现电容器过热或是闻到气味，应立即断开与电容器连接的电源和负载，让其降温，然后进行正确处理，不可让脸或手接触过热的电容器。

If the capacitor is found to be overheating or smelling, the power supply and load connected to the capacitor should be disconnected immediately to cool it, and the capacitor should be treated properly so that no face or hand contact with the capacitor is allowed.

(2) 禁止反向充电 Prohibition of reversing the positive(+) and negative(-) terminals

与超级电容器不同的是，锂离子电容器与电解电容器或电池一样具有极性，在使用时不小心短期反向使用，会造成锂离子电容器的实质性破坏，可能导致产气、泄漏、爆炸或其他问题。

Unlike supercapacitors, lithium-ion capacitors have the same polarity as electrolytic capacitors or batteries. Careless short-term reverse use during use will cause substantial damage to lithium-ion capacitors, which may lead to gas production, leakage, explosion or other question.

(3) 禁止拆卸 Prohibition of disassembly

拆卸电容会导致内部短路，可能导致产气，泄漏，爆炸，或其他问题。

Removing the capacitor can cause an internal short circuit, which can lead to gas production, leaks, explosions, or other problems.

(4)禁止将电容放入火中 Prohibition of putting capacitors into fire

会导致电容爆炸，这是非常危险的，是被禁止的。

It will cause the capacitor to explode, which is very dangerous and is prohibited.

(5)禁止将电容浸入液体 Prohibition of cells immersion into liquid

电容不能用任何液体浸泡。

Capacitors cannot be immersed in any liquid.

(6)禁止使用损坏的电容 Prohibition of using damaged capacitors

运送过程中，电容可能因运输问题而被损坏。若发现电容有任何异常情况，如包装破损、电解液泄漏、形状扭曲，请勿使用该电容。有电解液味道或泄漏的电容应放置在远离火的地方，以避免起火或爆炸。

During shipping, capacitors may be damaged due to shipping issues. Do not use the capacitor if you find any abnormality in the

capacitor, such as damaged packaging, leakage of electrolyte, or distorted shape. Capacitors that smell or leak should be placed away from fire to avoid fire or explosion.

(7)禁止短路 Prohibition short circuit

会导致产气，泄漏，爆炸，或其他问题。

May cause gas production, leakage, explosion, or other problems.

(8)运输及储存 Transport and storage

产品运输过程应防止产品受潮，储存温度应为-30℃~50℃、相对湿度小于 60%，最大湿度不可超过 85%，否则会导致电容受潮性能劣化或生锈。

Should prevent products be affected with damp be affected with damp in product transportation, storage temperature should be -30℃to 50℃, relative humidity less than 60%, the maximum humidity no more than 85%, otherwise it will cause capacitance performance degradation of be affected with damp be affected with damp or rust.

(9)禁止随意丢弃 Prohibition of throwing away randomly

不要随意丢弃。遵循法令或地方公共团体等指定的条例，将废弃品交给工业废弃物处理商。

Don't throw it away randomly. Follow the laws and regulations or local public organizations and other designated regulations, and hand over the waste to the industrial waste disposal company.

2、使用指导 Handling Guidelines

(1)确认极性 Checking polarity

使用前应确认电容器的极性。如果在反极性下工作，电容不仅会缩短使用寿命，甚至还会造成严重的损坏，如气胀、电解液泄漏等。

The polarity of the capacitor should be confirmed before use. If operated in reverse polarity, the capacitor will not only shorten the service life, but even cause serious damage, such as gas swelling, electrolyte leakage, etc.

(2)焊接 Soldering

建议产品的焊接条件为流动焊接，热冲击会影响电容的电性能，甚至会导致电容的鼓气、漏液以及开裂。

The welding condition of the proposed product is flow welding, heat shock will decrease electric performance of capacitor, even cause swelling, leakage or crack.

手工焊的温度建议低于 350℃，焊接持续时间少于 4s。

Manual soldering temperature should not exceed 350℃, soldering time should not exceed 4s.

使用波峰焊前，请考虑是否发生短路，若一定不会发生短路，则可以使用。

Before using wave soldering, please consider whether there is a short circuit. If there is no short circuit, it can be used.

(3)安装 Installation

电容器用于双面电路板上时，要注意连接处不可经过电容器可触及的地方，否则会导致产品短路过压及电容器损坏。安装过程及安装后，不可强行扭动或倾斜电容器，不得用力拉拽引线，应先断针及折弯后焊接。

When a capacitor is used on a double-sided circuit board, be careful not to place the connection where the capacitor can be touched, otherwise it will lead to short circuit and overvoltage of the product and damage to the capacitor. During the installation process and after installation, do not twist or tilt the capacitor forcibly, and do not pull the lead wires forcibly. The pins should be broken and bent before soldering.

电容器对应印刷电路板位置不宜放置其他器件和布线。

Other devices and wiring should not be placed in the position of the capacitor corresponding to the printed circuit board.

(4)环境 Environment

环境温度的升高和降低都会使电容器的容量、内阻、漏电流等性能变化，故使用温度不宜超过额定温度的上限或下限。

The increase and decrease of the ambient temperature will change the capacity, internal resistance, leakage current and other properties of the capacitor, so the operating temperature should not exceed the upper or lower limit of the rated temperature.

电容器不应与周边的发热元件直接接触，必须有散热空间。

The capacitor should not be in direct contact with the surrounding heating elements, and there must be space for heat dissipation.

(5)不适用场景 Not applicable scenarios

锂离子电容器不适用于交流电路、滤波电路和高频率充放电电路中。

Lithium-ion capacitors are not suitable for AC circuits, filter circuits and high-frequency charge and discharge circuits.

由于电容器的内阻大于普通电容器，在交流电路或高频率充放电过程中，电容内部发热，容量迅速衰减，内阻增加，在某些情况下会导致电容器性能失效，故锂离子电容器一般只用于直流电路。

Since the internal resistance of capacitors is larger than that of ordinary capacitors, in the process of AC circuit or high-frequency charging and discharging, the internal heating of the capacitors, the capacity decays rapidly, and the internal resistance increases, which will lead to the failure of capacitor performance in some cases. Therefore, lithium-ion capacitors are generally only used in DC circuits.

(6)电压 Voltage

锂离子电容器应在规定电压区间内使用，工作电压不应超过电池额定最高工作电压。否则电容器的使用寿命会缩短，甚至产生气胀、漏液或开裂。

Lithium-ion capacitors should be used within the specified voltage range, and the working voltage should not exceed the maximum rated working voltage of the battery. Otherwise, the service life of the capacitor will be shortened, and even gas swelling, liquid leakage or cracking will occur.

(7)充电方式 Charging method

电容器可采用限流、恒流、恒功率、恒电压等多种充电方式，充电时可能会拉低充电电源电压，直到电容器充满维持电压平衡。

Capacitors can be charged in various ways such as current limiting, constant current, constant power, and constant voltage. During charging, the charging power supply voltage may be pulled down until the capacitor is fully charged to maintain voltage balance.

使用时，电流设置请勿超过额定充放电电流，可能会造成电容器损坏。

When using, the current setting should not exceed the rated charge and discharge current, which may cause damage to the capacitor.

(8)IR 降 IR drop

在充放电过程中，电容器的内阻引起的 IR 降，会损失电容器的充放电效率，故电容器内阻大小在一定程度上决定了电容器品质的优劣。

In the process of charging and discharging, the IR drop caused by the internal resistance of the capacitor will lose the charging and discharging efficiency of the capacitor, so the internal resistance of the capacitor determines the quality of the capacitor to a certain extent.

当主电源关闭，电容会从电源失效检测模式转变为后备电源工作模式，此时由于瞬间启动电流和电容内阻会导致开路电压下降。

When the main power is turned off, the capacitor will change from the power failure detection mode to the backup power operation mode. At this time, the open circuit voltage will drop due to the instantaneous start-up current and the internal resistance of the capacitor.

(9)短路判断 Short circuit judgment

短路电容不能进行充放电。

Short-circuit capacitors cannot be charged or discharged.

在电容正负极间施加直流电压，电容电压不升高，可判定短路。

If a DC voltage is applied between the positive and negative electrodes of the capacitor, the voltage of the capacitor does not rise, and a short circuit can be determined.

用万用表判定时，电容在为充电时，以欧姆档测量（短路挡）指示为短路状态，是正常现象，不能确定电容即为短路，应观察阻值是否增加，如增加即为非短路。

When judging with a multimeter, when the capacitor is charging, it is indicated as a short circuit by the ohm gear measurement (short-circuit gear).

(10)串联操作 Series operation

相同电容器串联使用时，总电压=串联个数×单体耐压；总容量=单体容量÷串联个数；总能量=串联个数×单体容量，总内阻=串联个数×单体内阻。

When the same capacitor is used in series, the total voltage=series number * monomer withstand voltage; Total capacity = unit capacity Total energy = series number x monomer capacity, total internal resistance=series number x monomer resistance.

三个及以上串联存在单体间的电压均衡问题，需要考虑采用均衡电路，用于保证长期使用过程中电容不能过电压使用，从而引起电容器寿命衰减及损坏，不同规格超级电容器不可进行串联使用。

There is a problem of voltage balancing between three or more monomers in series, so it is necessary to consider adopting equalizing circuit to ensure that the capacitance cannot be used over voltage during long-term use, thus causing capacitor life attenuation and damage. Capacitors of different specifications cannot be used in series.

(11)并联操作 parallel operation

电容器进行并联使用时，可以不同容值的并联，采用相同电压充电，但要注意各个电容之间的电流平衡问题以及相互隔离，避免由于放电后电势差产生的相互反向充电。

When the capacitors are used in parallel, they can be connected in parallel with different capacitance values and charged by the same voltage. However, it is necessary to pay attention to the current balance between the capacitors and to isolate each other, so as to avoid reverse charging due to the potential difference after discharge.

◆关于废弃 About discarding

不要随意丢弃，遵循法令或地方公共团体等指定的条例，将废弃品交给工业废弃物处理商。

Don't throw it away randomly. Follow the laws and regulations or local public organizations and other designated regulations, and hand over the waste to the industrial waste disposal company.

◆修改履历 AMENDMENT RECORDS

版本 Ver.No.	内容 Description	日期 Date	修改 Revised	审核 Checked
V2.0	合并新增所有内容 Add all new content	2022/11/1	佘涛江 Taojiang Shi	蓝海玲 Hailin Lan
V3.0	增加导针长度 L1、L2 Increase the length of guide needle L1 and L2	2023/8/1	黄桂远 Guiyuan Huang	蓝海玲 Hailin Lan
V3.1	修改包装数量 Modify the number of packages	2024/3/19	黄桂远 Guiyuan Huang	蓝海玲 Hailin Lan
V4.0	1.修改包装数量； 1.Modify the number of packages； 2.产品尺寸：FH4R2M407T-N1620 的“L”由 21 改为 22。 2. Product size: The "L" of FH4R2M407T-N1620 is changed from 21 to 22.	2025/3/24	黄舒婷 Shuting Huang	袁建才 Jiancai Yuan