



杭州天丰电源股份有限公司
Hangzhou Skyrich Power Co.,Ltd.

客户名称 Customer:

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聚合物锂离子电池
产品规格书
Polymer Lithium-ion Battery
Product Specification
(常规电池 General battery)



型 号 Model: 401020

杭州天丰电源股份有限公司
Hangzhou Skyrich power Co.,Ltd.

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1. 适用范围、严正申明:

本产品规格书适用于杭州天丰电源股份有限公司生产的二次聚合物锂离子电池主要性能指标的描述。

用户请务必严格按照规格书中的测试或使用方法进行测试或使用，如对表中的测试项目或测试方法有异议，请与供应方协商解决。

本规格书列举的注意事项请用户在首次使用前务必仔细阅读，在电池使用过程中采取可靠的防护措施。客户如需要在超出本文件规定的环境或条件下使用电池，必须事先与杭州天丰电源股份有限公司联系，取得书面认可。对于未经书面认可的电池超出本文件规定的环境或条件下使用造成的所有意外事故或损失，杭州天丰电源股份有限公司声明拒绝承担任何责任。

对于 2 串以上的电池组合，建议采用平衡充电器充电，以保证电池性能稳定与安全使用。

This product specification describes Tianfeng polymer lithium-ion battery. Please using the test methods that recommend in this specification. If you have any opinions or advices about the test items and methods, please contact us. Please read the cautions recommended in the specifications first, take the credibility measure of the cell's using.

If the cells should be using at the environment that not preferred in this document, please connect with our first and get our authorization. For the reason of stable Performance and better safety, battery pack with more than 2 cells connected in serial way should be charged with a balance charger.

It is claimed that we should have no any responsibility with the contingency and loss due to the cells' wrong usage (not preferred in the product specification).

2. 产品类型、型号和外形尺寸 Product Type, Model and Dimension:

2.1 产品类型 Type: 二次聚合物锂离子电池 Polymer lithium-ion battery

2.2 产品型号 Model: 401020 (转镍) (Cell adding Ni Tabs)

2.3 电芯外形尺寸 Dimension(Max. T*W*L)mm: 4.2×11.3×21.5

3. 产品规格 Specification:

项 目 Item	特 征 值 Parameter	备 注 Remark
标称容量 Nominal Capacity	50mAh±5%	25℃, 0.2C ₅ A 放电容量 0.2C ₅ A discharge, 25℃
标称电压 Nominal Voltage	3.7V	25℃, 0.2C ₅ A 放电平均电压 Average Voltage at 0.2C ₅ A discharge
标准充电电流 Standard Charge Current	0.2C ₅ A	工作温度: 0~45℃ Working temperature: 0~45℃
快速充电电流 Max Charge Current	1.0C ₅ A	工作温度: 0~45℃ Working temperature: 0~45℃
充电截止电压 Charge cut-off Voltage	4.20±0.05V	CC/CV
放电电流 Discharge Current	Cont.0.2C ₅ A~Max:2.0C ₅ A	Working temperature: -20~60℃
放电截止电压 Discharge cut-off Voltage	2.75V	
出厂电压 Cell Voltage	3.76~3.9V	When leave factory
标称内阻 Impedance	≤400mΩ	半充电态, AC 1KHz, 25±5℃ AC 1KHz after 50% charge,25℃
重量 Weight	Approx2g	

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贮存温度 Storage Temperature	≤1 个月 ≤1month	-10~45℃	长期贮存温度: 20±5℃ (推荐) Best 20±5℃ for long-time storage
	≤3 个月 ≤3month	0~30℃	
	≤6 个月 ≤6month	0~25℃	
贮存湿度 Storage humidity		65±20% RH	

4. 常规性能 General Performance:

标准充电定义: 在环境温度 20±5℃ 条件下, 对电池以 0.2C₅A 恒流充电至 4.2V, 然后以 4.2V 恒压充电至充电电流小于等于 0.05C₅A。

Definition of Standard charging method: At 20±5℃, charging the cell initially with constant current 0.2C₅A till voltage 4.2V, then with constant voltage 4.2V till current declines to 0.05C₅A.

项 目 Item		测试方法 Test Methods	指标 Performance
4.1	0.2C 容量 0.2C Capacity	电池标准充电后搁置 0.5h, 用 0.2C ₅ A 恒流放电至 2.75V, 记录电池放电时间。 After standard charging, laying the battery 0.5h, then discharging at 0.2C ₅ A to voltage 2.75V, recording the discharging time.	≥285min
4.2	1C 容量 1C Capacity	电池标准充电后搁置 0.5h, 用 1C ₅ A 恒流放电至 2.75V, 记录电池放电时间。 After standard charging, laying the battery 0.5h, then discharging at 1C ₅ A to voltage 2.75V, recording the discharging time.	≥54min
4.3	循环寿命 Cycle life	用 1C ₅ A 恒流充电至 4.2V, 4.2V 恒压充电至截止电流 ≤ 0.05C ₅ A, 静置 5min 后, 用 1C ₅ A 恒流放电至 2.75V, 静置 5min。重复上述步骤, 直至连续两次放电时间小于 36min, 记录电池充放电次数。 Constant current 1C ₅ A charge to 4.2V, then constant voltage charge to current declines to 0.05C ₅ A, stay 5min, constant current 1C ₅ A discharge to 2.75V, stay 5min. Repeat above steps till continuously discharging time less than 36min.	≥300 次
4.4	荷电保持能力 Capability of keeping electricity	电池标准充电后在 20±5℃ 条件下搁置 28 天, 用 0.2C ₅ A 恒流放电至 2.75V, 记录电池放电时间。 20±5℃, After standard charging, laying the battery 28days, discharging at 0.2C ₅ A to voltage 2.75V, recording the discharging time.	≥240min

5. 环境适应性能 Environment Performance:

项 目 Item		测试方法 Test Methods	指标 Performance
5.1	高温性能 High temperature	电池标准充电后在 60℃ 环境下搁置 4h, 用 0.2C ₅ A 放电至截止电压 2.75V, 记录电池放电时间。 After standard charging, laying the battery 4h at 60℃, then discharging at 0.2C ₅ A to voltage 2.75V, recording the discharging time.	≥240min

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5.2	低温性能 Low temperature	<p>电池标准充电后在-10℃环境下搁置 4h, 用 0.2C₅A 放电至截止电压 2.5V, 记录电池放电时间。</p> <p>After standard charging, laying the battery 4h at -10℃, then discharging at 0.2C₅A to voltage 2.5V, recording the discharging time.</p>	≥210min
5.3	恒定湿热 Constant humidity and temperature	<p>电池标准充电后在 40±2℃, 相对湿度 93±2% 环境中放置 48h, 用 0.2C₅A 放电至截止电压 2.75V, 记录电池放电时间。</p> <p>After standard charging, laying the battery 48h at 40±2℃, RH 93±2%. Recording 0.2C₅A discharging time</p>	不变形、不漏液、 ≥270min。 No distortion No electrolytes leakage

6. 机械特性 Mechanical Performance:

项 目 Item	测 试 方 法 Test Methods	指 标 Performance	
6.1	机械振动 Vibration	<p>电池标准充电后固定在振动台上, 以 X, Y, Z 三个方向从 10Hz~55Hz 循环振动各 30min, 扫描速率为 1oct/min; 振动频率: 10Hz~30Hz; 移位振幅/单振幅: 0.38mm; 振动频率: 30Hz~55Hz; 移位振幅/单振幅: 0.19mm。</p> <p>After standard charging, put battery on the vibration table. 30 min experiment from X,Y,Z axis. Scan rate: 1 oct/min; Frequency 10-30Hz, Swing 0.38mm; Frequency 30-55Hz, Swing 0.19mm.</p>	电性能及外观 不受影响 No influence to batteries' electrical Performance and appearance.
6.2	机械碰撞 Collision	<p>振动试验后, 电池平均按 X, Y, Z 三个互相垂直轴向固定在台面上。脉冲峰值加速度: 100m/s²; 每分钟碰撞次数: 40~80; 脉冲持续时间 16ms; 碰撞次数 1000±10。After vibration test, batteries were laying on the vibration table about X, Y, Z axis. Max frequency acceleration: 100m/s²; collision times per minutes: 40~80; frequency keeping time 16ms; all collision times 1000±10.</p>	电性能及外观 不受影响 No influence to batteries' electrical Performance and appearance.
6.3	跌落测试 Drop	<p>电池标准充电后从 1.0m 高处自由跌落至木板, 每个面各 1 次。</p> <p>Random drop the battery from 1.0m height onto wood board one times for every face.</p>	不爆炸 不着火 No explosion or fire

7. 安全性能 Safety Test:

实验条件: 下述实验应在有强制排风条件及具有安全措施的环境内进行。实验前所有电池需按标准充电并且搁置 24h。

Test conditions: The following tests must be measured at flowing air and safety protection conditions. All batteries must standard charge and lay 24h.

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项 目 Item	测 试 方 法 Test Methods	指 标 Performance
7.1 过充电 Over charge	在 $20\pm 5^{\circ}\text{C}$ 条件下, 将电池正负极连接于恒流恒压源上, 调节电流至 $3C_5\text{A}$, 电压至 4.6V , 然后对电池以 $3C_5\text{A}$ 恒流充电直到电压为 4.6V , 终止试验。 At $20\pm 5^{\circ}\text{C}$, charging batteries with constant current $3C_5\text{A}$ to voltage 4.6V , then with constant voltage 4.6V .	不爆炸 不着火 No explosion or fire
7.2 强制放电 Over discharge	在 $20\pm 5^{\circ}\text{C}$ 条件下, 电池以 $0.2C_5\text{A}$ 恒流放电 12.5 小时。 At $20\pm 5^{\circ}\text{C}$, discharge battery with $0.2C_5\text{A}$ continuously 12.5h.	不爆炸 不着火 No explosion or fire
7.3 外部短路 Short-circuit	在 $20\pm 5^{\circ}\text{C}$ 条件下, 用电阻值小于 $50\text{m}\Omega$ 的导线将电池的正负极短路, 保持 6h。 At $20\pm 5^{\circ}\text{C}$, connect batteries' anode and cathode by wire which impedance less than $50\text{m}\Omega$, keep 6h.	不爆炸 不着火 No explosion or fire
7.4 挤压 Extrusion	在 $20\pm 5^{\circ}\text{C}$ 条件下, 将电池置于两块铁板之间, 并使电极面与铁板平行, 在铁板上施加 13kN 的压力。 At $20\pm 5^{\circ}\text{C}$, put the battery in two parallel steal broad, add pressure 13kN .	不爆炸 不着火 No explosion or fire
7.5 热冲击 Thermal shock	将电池放入烘箱, 以 $5\pm 1^{\circ}\text{C}/\text{min}$ 的速率升至 130°C , 保持 1h。 Put the battery in the oven. The temperature of the oven is to be raised at $5\pm 1^{\circ}\text{C}$ per minute to a temperature of $130\pm 2^{\circ}\text{C}$ and remains 60 minutes.	不爆炸 不着火 No explosion or fire

8. 注意事项 Cautions:

8.1 电芯使用注意事项 Cautions of batteries' operation:

锂聚合物电芯采用软包装, 为保证电芯的性能不受损害, 使用时必须小心对电芯进行操作。

The batteries must be careful of proceed the operation for it's soft package.

8.1.1 铝塑复合膜外包装 Aluminum packing materials:

铝塑复合膜外包装材料易被尖锐部件刺伤而损坏, 诸如镍片、尖针、引线头等, 使用电芯时应:

The aluminum packing material was easily damaged by the sharp edge part, such as nickel-tabs.

(1) 禁止用尖锐部件碰撞电池 forbid to use the sharp part touching the battery;

(2) 时常清理工作台面, 避免有尖锐部件存在; should cleaning working condition, avoiding the sharp edge part existence;

(3) 禁止用尖利器具刃口接触电芯;

Forbid to pierce the battery with nail and other sharp items;

(4) 禁止将电池与金属物, 如项链、发夹等一起运输或贮存。

The battery was forbidden with metal, such as necklace, hairpin etc in transportation and storage.

8.1.2 顶封边 Sealed edge (极柄端封边):

(1) 顶封边非常容易因外力受到损坏, 破坏封口效果导致电芯失效报废, 禁止弯折顶封边。

Sealing edge is very easily damaged and don't bend it.

(2) 顶封边端面铝塑复合膜外包装材料夹层由纯铝构成, 具有良好的导电性能, 使用时必须采取可靠的绝缘隔离措施, 防止其与外部元器件构成短路损坏电芯或影响主机工作性能。(如果负极和铝塑复合膜短接很有可能造成电芯内腐蚀、胀气)

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The Al interlayer of package has good electric Performance. It's forbidden to connect with exterior component for preventing short-circuits. (Short the anode and the Al interlayer of package will cause t corrosion or swollen of the cell).

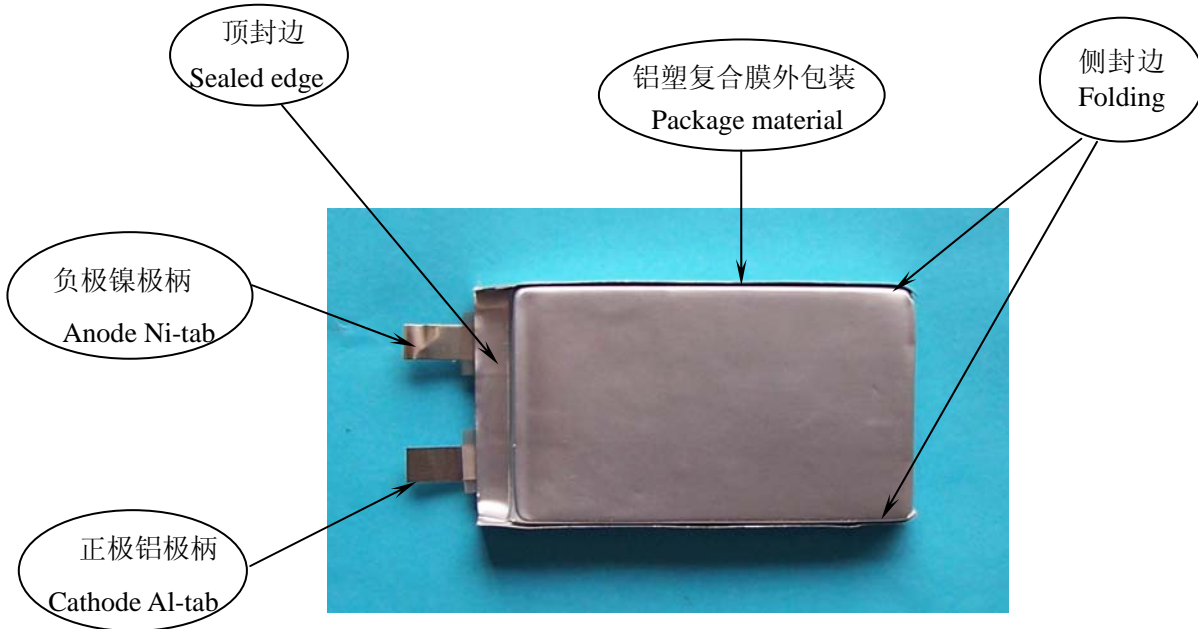


图 1: 锂聚合物电芯外形示意图

Exterior schematic of polymer lithium-ion cells

8.1.3 侧封边 Folding dge:

(1) 侧封边在电芯生产过程中已实施了折边并通过了密封测试，禁止打开或破坏折边。

The folding edge is formed in batteries' processes and passed all hermetic tests, don't open or deform it.

(2) 未采用回折结构的侧封边（单层折边）端面铝塑复合膜外包装材料夹层由纯铝构成，具有良好的导电性能，使用时必须采取可靠的绝缘隔离措施，防止其与外部元器件构成短路损坏电芯或影响主机工作性能。回折结构构成双层折边。（如果负极和铝塑复合膜短接很有可能造成电芯内腐蚀、胀气）

The Al interlayer of package has good electric Performance. It's forbidden to connect with exterior component for preventing short-circuits. (Short the anode and the Al interlayer of package will cause t corrosion or swollen of the cell).



图 2: 锂聚合物电芯单层折边示意图
Single folding edge schematic of PL cells

图 3: 锂聚合物电芯双层折边示意图
Reverse folding edge schematic of PL cells

8.1.4 极柄 Tab:

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电芯正极引出端子采用铝极柄，负极引出端子采用镍极柄。

The cathode is Al tab and the anode is Ni tab.

(1) 极柄的厚度较薄，机械强度并非异常坚固，特别是铝极柄极易因外力折断，禁止弯折极柄。

The batteries' tabs are not so stubborn especially for aluminum tabs. Don't bend tabs.

(2) 电芯生产过程中正、负极柄与铝塑复合膜外包装材间由套圈膜可靠隔离，防止发生短路，严禁修剪套圈膜。

The tab-tapes are used to isolate The anode、cathode tabs from Aluminum packing materials to prevent short-circuit, so prohibit manicuring of the tab-tapes.

8.1.5 机械撞击 Mechanical shock:

(1) 禁止坠落、冲击、弯折电芯；Don't fall, hit, bent the batteries' body.

(2) 禁止用锤子敲击或踩踏电池；Don't knock on by sinker or trample the batteries.

(3) 禁止抛掷电池。Don't sling the batteries.

8.1.6 短路 Short-circuit:

任何时候禁止电芯短路，它会导致电芯严重损坏。

Short-circuit is strictly prohibited. It should damage batteries badly.

(1) 禁止用金属物如电线短路连接电池正、负极；

Don't connect the anode and cathode of the batteries to avoid short-circuit.

(2) 禁止电芯的正极（或负极）与电芯的外包装铝塑复合膜材料中的铝层相短路。

Prohibit short-circuit of the anode (or cathode) and aluminum layer of Aluminum packing materials.

8.2 聚合物锂离子电池测试标准环境 **Standard Test Environment for polymer lithium-ion batteries:**

环境温度：20±5℃，相对湿度：45~85%。

Environment temperature: 20±5℃ Humidity: 45-85%

8.3 聚合物锂离子电池充放电注意事项 **Cautions of charge & discharge:**

8.3.1 充电 Charge:

充电电流及充电电压不得超过以下标准，如超过规定值可能会对电芯的充放电性能、机械性能及安全性造成损坏，并可能导致发热及泄漏。

Charging current should be lower than values that recommend below. Higher current and voltage charging may cause damage to cell electrical, mechanical, safety Performance and could lead heat generation or leakage.

(1) 电池充电器必须能恒流恒压充电；

Batteries charger should charging with constant current and constant voltage mode;

(2) 充电时电芯充电电流必须在 1C_{5A} 以下

Charging current should be lower than (or equal to) 1C_{5A}; ;

(3) 充电时电芯温度范围应在 0~45℃内；

Temperature 0~45℃ is preferred when charging;

(4) 充电时加载在电芯正、负极上的充电电压严禁超过 4.25V。

Charging voltage must be lower than 4.25V.

8.3.2 放电 discharge:

(1) 电芯最大放电电流必须不大于 2C_{5A}；

Discharging current must be lower than (or equal to) 2C_{5A};

(2) 放电时电芯温度范围应在-20~60℃；

Temperature -20~60℃ is preferred when discharging;

(3) 放电时电芯终止电压严禁低于 2.75V。(低温-10℃放电除外)

Discharging voltage must not be lower than 2.75V. (Not including -10℃ discharge)

8.3.3 过放电 Over-discharge:

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需要注意的是，在电芯长期未使用期间，它可能会因其自放电特性而处于某种过放电状态。为防止过放电的发生，电芯应定期充电，将其电压维持在 3.6V~3.9V 之间。

过放电会导致电芯性能、电池功能的丧失，用户应确保电芯放电终止电压高于 2.5V。

It should be noted that the cell would be at an over-discharge state by its self-discharge. In order to prevent over-discharge, the cell shall be charged periodically to keeping voltage between 3.6-3.9V. Over-discharge may cause loss of cell Performance. It should be noted that the cell would not discharge till voltage lower than 2.5V.

8.4 聚合物锂离子电池贮存 **Storage of polymer lithium-ion batteries:**

电芯长期贮存时应维持 40~60% 的荷电状态；

电芯短期贮存（≤3 个月）时环境要求为：储存温度 0~30℃、相对湿度 45~85%。

电芯长期贮存（>3 个月）时必须置于温度为 20±5℃、相对湿度为 65±20%RH 的环境中。

为防止电池过放，电池在贮存期间最好每 3 个月充电一次。长时间储存时，请客户对电池用 0.5C₅A 的电流充电 1h 左右使其带有部分电量储存。

电池存储一年后对电池重新充放电激活以恢复电池能量。

The battery should be stored with 40-60% charge state.

The environment of long-time storage:

Temperature: 20±5℃;

Humidity: 45-85%;

Batteries were 40~60% charged.

The battery had better charge a time per three month during its storage for avoiding over discharge. Please charge the battery with constant current 0.5C₅A for 1 hour once every three month when in storage so that it has some storage of charge for properly using.

Charge and discharge afresh to active and renew battery energy after storage above 1 year.

8.5 聚合物锂离子电池运输 **Transportation of polymer lithium-ion batteries:**

电池应在 10%~50% 的荷电状态下运输。

The batteries should transportation with 10~50% charged states.

8.6 聚合物锂离子电池其它使用说明 **Others:**

为了防止电芯可能发生的泄漏、发热、燃烧、爆炸，请务必注意以下要求：

Please note cautions below to prevent cells' leakage, heat generation and explosion.

(1) 禁止在任何情况下拆卸电芯；

Prohibit disassembling cells;

(2) 禁止将电池浸入水中或海水中，电芯不能受潮；

Prohibit immerse cells into liquid such as water or seawater;

(4) 禁止将电池加热或丢入火中；

Prohibit dumping the battery into fire;

(5) 禁止直接焊接电池；

Prohibit soldering directly the battery.

(6) 禁止在火边或很热的环境中充电；

Prohibit charging the battery near fire or in the hot circumstance.

(7) 禁止将电池放入微波炉或高压容器内；

Prohibit placing the battery in a microwave oven or pressurized container.

(8) 禁止在高温下（如强阳光或很热的汽车中）长期使用或放置电池，否则会引起过热、起火或者功能衰退、寿命减小；

Prohibit use or store the battery where is exposed to extremely hot, such as under window of a car in direct sunlight in a hot day. Otherwise, the battery may be overheated. This can also reduce battery Performance and/or shorten service life.

(9) 万一有电解液泄漏而接触到皮肤或身体其它部位，应立即用清水冲洗；电解液接触到眼睛应立即

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用清水冲洗后就近就医；

If the battery leaks and electrolyte gets in your eyes, do not rub them. Instead, rinse them with clean running water and immediately seek medical attention. If left as is, electrolyte can cause eye injury.

(10) 如果电池发出异味、发热、变形、变色或出现其它任何异常现象时不得使用。如果电池正在使用或充电，应立即从用电器中或充电器上取出并停止使用。出现电解液泄漏或散发电解液气味的电池应远离火源以避免着火或爆炸。

Prohibit using the battery if it gives off an odor, generates heat, becomes discolored or deformed, or appears abnormal in any way. If the battery is in use or being recharged, remove it from the device or charger immediately and discontinue use. If the battery leaks or gives off an odor, move it away from a fire source to avoid fire or explosion.

9. 电芯的组合安装使用 Cell packing and Fixing:

9.1 电池外壳设计注意事项 Notice of Designing Battery Pack:

电池外壳应有足够的机械强度以保护其内部的电芯免受外部机械损伤。电池外壳内的电芯安装部位必须采用光滑过渡结构，避免锋利边角损伤电芯。电芯安装在外壳内时，必须依据 8.1.2、8.1.3 采取有效防护措施，防止铝塑复合膜夹层纯铝与外部元器件接触短路。

Battery pack should have sufficient strength and battery should be protected from mechanical shock. No sharp edge components should be inside the pack contain the battery.

9.2 电芯保护电路模块设计 PCM design

电芯保护电路模块设计时必须保证单只电芯过充限制电压小于 4.25V；

The overcharge threshold voltage should not be exceed 4.25V.

电芯保护电路模块设计时，考虑到控制 IC 的通用性，单只电芯过放限制电压须大于 2.3V；

The over-discharge threshold voltage should not be lower than 2.3V.

电芯保护电路模块设计时必须具备短路保护功能（过流保护）。

The PCM should have short protection function built inside.

9.3 电芯的连接 Cell connection:

推荐采用超声波焊接或点焊技术来连接电芯与保护电路模块或其他组件。

Ultrasonic welding or spot welding is recommended to connect battery with PCM or other parts.

如果使用手工锡焊进行连接，必须注意以下事项，以确保电芯性能不受影响：

If apply manual solder method to connect tab with PCM, the notice below is very important to ensure battery Performance.

(1) 请务必使用恒温防静电电烙铁进行焊接；

The electric iron should be temperature controlled and ESD safe;

(2) 电烙铁的温度不能超过 350℃；

Soldering temperature should not exceed 350℃;

(3) 同一极柄的锡焊加热时间不能超过 3 秒，必须在焊点冷却后再进行二次焊接；

Soldering time should not be longer than 3s, keep battery tab cold down before next soldering;

(4) 同一极柄的锡焊次数不能超过 5 次，禁止直接加热电芯，防止电芯损坏。

Soldering times should not exceed 5 times;

(5) 焊点位置应尽量远离极柄套圈膜，防止破坏极柄和套圈膜间的密封效果。

Soldering spot location should be away from the tab film to ensure the sealing of the tab film.

(6) 焊点应圆滑饱满，与铝塑复合膜接近处无尖点。

The soldering spot should be smooth and there should be no acumination.

9.4 电芯的安装 Cell fixing:

电芯应在外壳内平放安装并可靠定位，安装后不允许电芯在外壳内活动。

The battery should be fixed to the battery pack by its large surface area. No cell movement in the battery pack should be allowed.

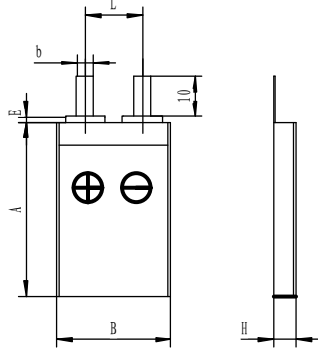
9.5 电芯的更换 Cells replacement:

更换电芯必须由受过专业训练的人员进行。

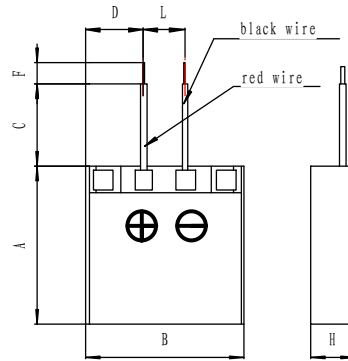
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The cell replacement should be done by professional people.

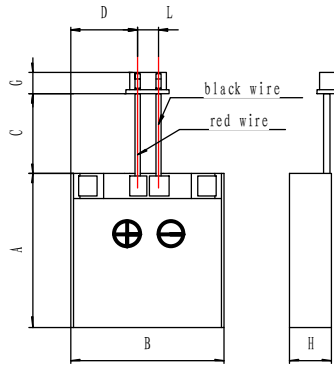
10. 电池外形尺寸示意图 Schematic of Battery:



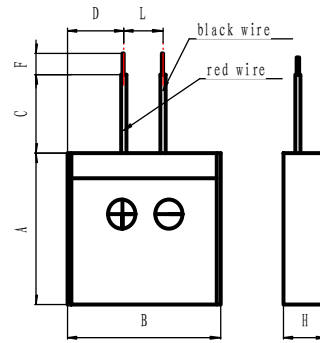
电芯或转铜电芯 Cell or adding Ni tabs



加保护板引线 Cell adding PCM, wire



加保护板/引线插头 Cell adding PCM, plug



加引线电池 Cell adding wire

电芯外形尺寸参数表 **Parameter:**

尺寸代码 Sign	尺寸项目 Item	最大值 MAX (mm)	备注 Remark	尺寸代码 Sign	尺寸项目 Item	最大值 MAX (mm)	备注 Remark
A	长度 Length	21.5		L	正负极间距 Space between Tabs	5±1	
B	宽度 Width	11.3		b	极柄宽度 Tab Width	2	
H	厚度 Thickness	4.2					