

# 产品规格确认书

## Specification Approval Sheet

型 号: 18650-12V-3900mAh

| 制 定<br>( <i>Prepared</i> ) | 审核<br>( <i>Check</i> ) | 批准<br>( <i>Approved</i> ) |
|----------------------------|------------------------|---------------------------|
| 禰林 2023-8-2                | 陈进                     | 张山                        |

客户确认(The customer to confirm) :

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## 1.Scope

This document describes the Product Specification of the Sodium-ion rechargeable battery cell supplied by Guangdong Aokly Group Co., LTD.

### 适用范围

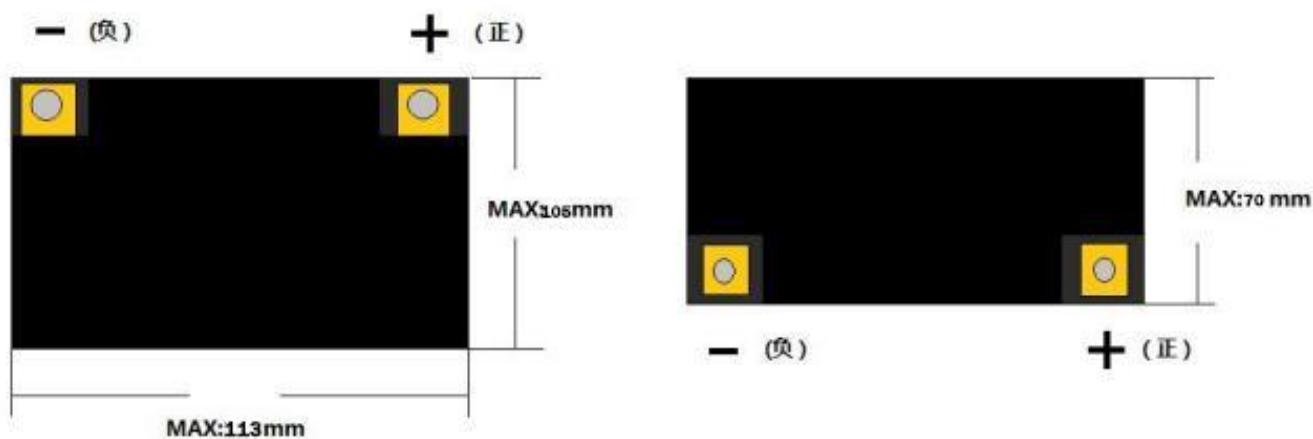
本规格说明书描述了广东奥克莱集团有限公司生产的可充电钠离子电池的产品性能指标

## 2.Model:18650 型号：18650 12V 3900mAh

Na-ion battery 18650 电池

## 3.Dimensions of battery pack

外形尺寸图（未按比例）



重量：772g

4. Specifications of battery pack: 电池规格

| No.  | Item                                               | Specifications                                           | Comments                                                                                                                                                                                                                                                                                                                   |
|------|----------------------------------------------------|----------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 4.1  | Capacity (容量)                                      | 3750mAh (Minimum capacity)<br>3900mAh (Typical capacity) | 0.2C                                                                                                                                                                                                                                                                                                                       |
| 4.2  | Impedance (内阻)                                     | $\leq 80\text{m}\Omega$                                  |                                                                                                                                                                                                                                                                                                                            |
| 4.3  | Nominal Voltage<br>标称电压                            | 12V                                                      |                                                                                                                                                                                                                                                                                                                            |
| 4.4  | Dimensions (mm) (尺寸)                               | 见上图(mm)                                                  |                                                                                                                                                                                                                                                                                                                            |
| 4.5  | Charging Mode(充电方式)                                | CC/CV 恒流/恒压方式                                            |                                                                                                                                                                                                                                                                                                                            |
| 4.6  | Charge voltage<br>(充电电压)                           | $16 \pm 0.05\text{V}$                                    |                                                                                                                                                                                                                                                                                                                            |
| 4.7  | Standard charging current<br>(标准充电电流)              | 1.95A (0.5C)                                             |                                                                                                                                                                                                                                                                                                                            |
| 4.8  | Maximum charge current<br>(最大充电电流)                 | 11.7A (3C)                                               | End of charge voltage<br>15.8V 充电截止电压<br>15.8V                                                                                                                                                                                                                                                                             |
| 4.9  | Min. discharge voltage<br>(最小放电电压)                 | 8V                                                       |                                                                                                                                                                                                                                                                                                                            |
| 4.10 | Standard discharge current<br>标准放电电流               | 1.95A                                                    | 0.5C                                                                                                                                                                                                                                                                                                                       |
| 4.11 | Maximum continuous discharge current<br>(最大持续放电电流) | 39A                                                      | 10C                                                                                                                                                                                                                                                                                                                        |
| 4.12 | Instantaneous Max. discharge current<br>瞬时最大放电电流   | 78A                                                      | 20C ( $\leq 0.5\text{s}$ )                                                                                                                                                                                                                                                                                                 |
| 4.13 | Charge temperature<br>(充电温度)                       | $0^{\circ}\text{C} \sim +45^{\circ}\text{C}$             | $0^{\circ}\text{C} \sim 10^{\circ}\text{C} \leq 0.2\text{C}$<br>$10^{\circ}\text{C} \sim 20^{\circ}\text{C} \leq 0.5\text{C}$<br>$20^{\circ}\text{C} \sim 25^{\circ}\text{C} \leq 1\text{C}$<br>$25^{\circ}\text{C} \sim 35^{\circ}\text{C} \leq 3\text{C}$<br>$35^{\circ}\text{C} \sim 45^{\circ}\text{C} \leq 1\text{C}$ |

|      |                                 |                                                              |  |                                                           |
|------|---------------------------------|--------------------------------------------------------------|--|-----------------------------------------------------------|
|      |                                 |                                                              |  |                                                           |
| 4.14 | Discharge temperature<br>(放电温度) | -40℃ ~ +80℃                                                  |  | -40℃~0℃ ≤1C<br>0℃~20℃ ≤3C<br>20℃~45℃ ≤10C<br>45℃~ 80℃ ≤1C |
| 4.15 | Storage temperature<br>(储存温度)   | ≤ 1 个月 one month - 10~+ 45℃<br>≤3 个月 three months - 10~+ 35℃ |  |                                                           |
| 4.16 | Storage humidity<br>(储存湿度)      | 65%±20%RH                                                    |  |                                                           |

5.Specifications of cell ： 电芯规格

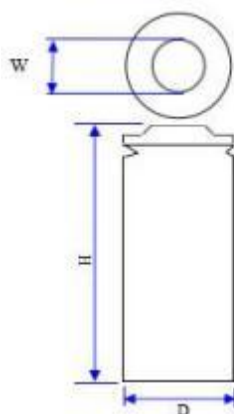
5.1、Technical specifications 技术规格

| No. | Items/项 目                         | Specification/ 规格 | Remarks/ 备注                                                     |
|-----|-----------------------------------|-------------------|-----------------------------------------------------------------|
| 1   | Nominal Capacity<br>标称容量          | 1300mAh           | Discharge :0.2C<br>Cut-off voltage :2.0V<br>0.2C 放 电 至 2.0V 截 止 |
| 2   | Nominal Voltage<br>标称电压           | 3.0V              |                                                                 |
| 3   | Shipment Voltage<br>出厂电压          | ≥3.0V             |                                                                 |
| 4   | Internal Impedance<br>内阻          | ≤20m              | AC 1KHz after standard charge<br>标 准 充 电 后 AC1 KHz 测 试          |
| 5   | Charge cut-off voltage<br>充电截止电压  | 4.0V              |                                                                 |
| 6   | Standard charge current<br>标准充电电流 | 650mA             | 0.5C                                                            |
| 7   | Max. charge current<br>最大充电电流     | 3900mA            | End of charge voltage 3.95V<br>充 电 截 止 电 压 3.95V                |
|     |                                   | 2600mA            | End of charge voltage 4.0V<br>充 电 截 止 电 压 4.0V                  |

|    |                                                  |           |                             |
|----|--------------------------------------------------|-----------|-----------------------------|
| 8  | Standard discharge current<br>标准放电电流             | 650mA     | 0.5C                        |
| 9  | Max. discharge current<br>最大放电电流                 | 13000mA   | 10C                         |
| 10 | Instantaneous Max. discharge current<br>瞬时最大放电电流 | 26000mA   | 20C (≤0.5s)                 |
| 11 | Discharge cut-off voltage<br>放电截止电压              | 2.0V      |                             |
| 12 | Operating Temperature<br>工作温度                    | -10~0℃    | ≤0.1C<br>(不建议充电)            |
|    |                                                  | 0~10℃     | ≤0.2C                       |
|    |                                                  | 10~20℃    | ≤0.5C                       |
|    |                                                  | 20~25℃    | ≤1C                         |
|    |                                                  | 25~35℃    | ≤3C                         |
|    |                                                  | 35~45℃    | ≤1C                         |
|    |                                                  | -40℃~0℃   | ≤1C                         |
|    |                                                  | 0~20℃     | ≤3C                         |
|    |                                                  | 20~45℃    | ≤10C                        |
|    |                                                  | 45~80℃    | ≤1C                         |
| 13 | Storage Temperature<br>贮存温度                      | -10℃~+40℃ | Less than 1 month<br>小于一个月  |
|    |                                                  | -10℃~+35℃ | Less than 6 months<br>小于六个月 |

5.2 电池外形结构及尺寸 Appearance structure and Size of The Battery

|                 |              |
|-----------------|--------------|
| 项目/Items        | 尺寸/Sizes(mm) |
| 直径/Diameter (Φ) | 18.25±0.05   |
| 高度/Height(L)    | 65.20±0.05   |



## 6. Battery Cell Performance Criteria 电池性能检查及测试

### 6.1 Standard Charge Method 标准充电方法

Under the temperature of  $25 \pm 2^\circ\text{C}$ , charge the cell with the current of  $0.5C$  until the voltage reaches up to  $4.0V$ , then charge with constant voltage, and stop charging until the current  $\leq 0.05C$ .

在  $25 \pm 2^\circ\text{C}$  条件下，电芯用  $0.5C$  的电流充电，当电芯电压达到  $4.0V$  时转为恒压充电，直到充电电流小于 或等于  $0.05C$  时停止充电。

### 6.2 Standard Discharge Method 标准放电方法

Under the temperature of  $25 \pm 2^\circ\text{C}$ , discharge the cell with the current of  $0.5C$  until the voltage is  $2.0V$ , the capacity marked as  $C_{min}$ .

在  $25 \pm 2^\circ\text{C}$  条件下，电芯以  $0.5C$  的电流放电至  $2.0V$  时停止，容量记为  $C_{min}$ 。

### 6.3 Electrical Performance 电性能

| No. | Items/项目                  | Conditions /测试条件                                                                                                                                                                                                                       | Criteria/标准                                                                         |
|-----|---------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|
| 1   | 0.2C Discharge<br>0.2C 放电 | Charge the cell with standard charge mode, rest for 0.5h, then discharge with 0.2C until the voltage is 2.0V. Test can repeat 3 times until meets the requirements.<br>将电芯按标准充电模式充好电后，开路搁置 0.5h,再以 0.2C 放电至 2.0V,测试可重复三次，有一次符合要求时即可停止。 | 0.2C Discharge<br>Capacity $\geq 1300\text{mAh}$<br>0.2C 放电容量 $\geq 1300\text{mAh}$ |

|                                                                                 |                                                                  |        |               |
|---------------------------------------------------------------------------------|------------------------------------------------------------------|--------|---------------|
|  | <div>广东奥克莱集团有限公司</div> <div>Guangdong Aokly Group Co., LTD</div> | DOC NO | ZNTC-EN-2-009 |
|                                                                                 |                                                                  | REV.   | A0            |
|                                                                                 |                                                                  | PAGE:  | 第 8 页 共 12 页  |

|   |                                                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |                                                                                                                             |
|---|-------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------|
| 2 | <div>Cycle Life</div> <div>循环寿命</div>                 | <p>Under the temperature of <math>25\pm2^{\circ}\text{C}</math>, charge the cell with 1.0C, when the voltage reaches up to 4.0V charge with constant voltage until the current<math>\leq</math>0.05C, then stop charging, rest for 0.5h, then discharge with 1.0C to 2.0V.Cycle with the above mode, the test shall be terminated when Discharging Capacity &lt;70% of Initial Capacity in three consecutive cycles</p> <p>在 <math>25\pm2^{\circ}\text{C}</math>条件下电芯按 1.0C 充电，当电压达到 4.0V 时改 为恒压充电，直到充电 电流 <math>\leq</math>0.05C 时停止充电，静置 0.5h 后，1.0C 放电至 2.0V 的方式进行循环，当连续三次放 电容量 &lt;初始容量 70%时寿命终止。</p> | <div><math>\geq</math>3000Cycles</div> <div><math>\geq</math>3000 周</div>                                                   |
| 3 | <div>Rate Discharge</div> <div>倍率放电</div>             | <p>Charge the cell with standard charge mode, rest for 0.5h, then discharge with 3C until the voltage is 2.0V.</p> <p>将 电芯按标准充 电模式充好 电后，开路搁置 0.5h,再以 3C 放 电至 2.0V。</p>                                                                                                                                                                                                                                                                                                                                                                                                                                    | <div>3C Discharge Capacity</div> <div><math>\geq</math>90%Cmig</div> <div>3C 放电容量<math>\geq</math></div> <div>90%Cmin</div> |
| 4 | <div>High Temperature Discharge</div> <div>高温放电</div> | <p>Under the temperature of <math>25\pm2^{\circ}\text{C}</math>, after charging the cell with standard charge mode, then put the cell into the constant temperature and humidity oven with <math>55\pm2^{\circ}\text{C}</math> for 2h, then discharge with 0.5C to 2.0V.</p> <p>在 <math>25\pm2^{\circ}\text{C}</math>条件下，电芯按标准充电结束后，将电芯放入 <math>55\pm2^{\circ}\text{C}</math>的恒温恒湿箱 中恒温 2h 后，然后以 0.5C 电流放电至 2.0V。</p>                                                                                                                                                                                     | <div>55℃ Discharge Capacity<math>\geq</math>95%Cmin</div> <div>n 55℃放电容量<math>\geq</math></div> <div>95%Cmin</div>          |
| 5 | <div>Low Temperature Discharge</div> <div>低温放电</div>  | <p>Under the temperature of <math>25\pm2^{\circ}\text{C}</math>,after charging the cell with standard charge mode, then put the cell into the constant temperature and humidity oven with <math>-20\pm2^{\circ}\text{C}</math> for 8h, then discharge with 0.5C to 2.0V.</p> <p>在 <math>25\pm2^{\circ}\text{C}</math>条件下，电芯按标准充电结束后，将电芯放入 <math>-20\pm2^{\circ}\text{C}</math>的恒温恒湿箱 中恒温 8h,然后以 0.5C 电流放电至2.0V</p>                                                                                                                                                                                        | <div>20℃ Discharge Capacity <math>\geq</math>85%Cmin</div> <div>-20℃放电容量<math>\geq</math></div> <div>85%Cmin</div>          |

|                                                                                                                            |                                          |                                                                                                                                                                                                                                                                                                      |                                                                                                   |        |               |
|----------------------------------------------------------------------------------------------------------------------------|------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------|--------|---------------|
| <div><div>奥克莱集团<br/>AOKLY GROUP</div></div> |                                          | 广东奥克莱集团有限公司<br>Guangdong Aokly Group Co., LTD                                                                                                                                                                                                                                                        |                                                                                                   | DOC NO | ZNTC-EN-2-009 |
|                                                                                                                            |                                          |                                                                                                                                                                                                                                                                                                      |                                                                                                   | REV.   | A0            |
|                                                                                                                            |                                          |                                                                                                                                                                                                                                                                                                      |                                                                                                   | PAGE:  | 第 9 页 共 12 页  |
| 6                                                                                                                          | Ultra-low Temperature Discharge<br>超低温放电 | Under the temperature of 25±2℃,after charging the cell with standard charge mode, then put the cell into the constant temperature and humidity oven with -40 ±2 ℃ for 8h, then discharge with 0.5C to 2.0V.<br>在 25 ±2 ℃条件下，电芯按标准充电结束后，将电芯放入 -40 ±2℃ 的恒温恒湿箱中恒温 8h, 然后以 0.5C 电流放电至 2.0V。              | -40℃ Discharge<br>Capacity ≥55%Cmin<br>-40℃放电容量≥55%Cmin                                           |        |               |
| 7                                                                                                                          | Storage Characteristics<br>荷电保持能力        | Charge the cell with standard charge mode, then rest under the temperature of 25±2℃ for 28d and then discharge with 0.5C to 2.0V.Charge the cell at 25±2℃ with standard mode, and then discharge with 0.5C to 2.0V.<br>电芯按标准充电后，将电芯开路放置在 25±2℃条件下 28 天后，以 0.5C 放电至 2.0V。然后电芯按标准充电后，再以 0.5C 放电到 2.0V。 | Retention Capacity<br>≥90%Cmin<br>剩余容量>90%Cmi<br>Recovered Capacity<br>>95%Cmin<br>恢复容量>95%Cmir   |        |               |
| 8                                                                                                                          | High Temperature Storage<br>高温存储         | Charge the cell with standard charge mode, then rest under the temperature of 60±2℃ for 7d then discharge with 0.5C to 2.0V<br>电芯按标准充电后，将电芯开路放置在 60 ±2 ℃条件下 7 天后，以 0.5C 放电至 2.0V。                                                                                                                    | Retention Capacity<br>≥85%Cmin<br>剩 余 容 量 ≥85%Cmt<br>Recovered Capacity<br>≥90%Cmi<br>恢复容量≥90%Cmi |        |               |
| 6.4 安全性能 Safety Characteristics                                                                                            |                                          |                                                                                                                                                                                                                                                                                                      |                                                                                                   |        |               |
| No.                                                                                                                        | Item/项目                                  | Test Conditions/测试条件                                                                                                                                                                                                                                                                                 | Criteria/标准                                                                                       |        |               |

|   |                                               |                                                                                                                                                                                                                                                                                                                                                                                                                |                                                     |
|---|-----------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------|
| 1 | Over charge<br>过充                             | At 25±2℃,charging cell with constant current 1C to voltage 6.0V or stop charging after the time reaches 2h. Then observe the appearance of the cell<br>在 25 ± 2℃ 状态下，电芯用 1C 电流充电至 6.0V, 或者充电时间达到 2h, 然后观察电芯的变化                                                                                                                                                                                                 | No fire, no explosion<br>不起火，不爆炸                    |
| 2 | Over discharge<br>过放                          | At 25 ± 2℃,According to the requirements of standard discharge, the cell will be discharge to cut-off voltage.Then discharge cell to 0V with 0.2C.<br>在 25 ± 2℃ 状态下，按标准放电的要求放电至终止电压后 再以 0 . 2C 电流放电至 0V。                                                                                                                                                                                                       | No fire,no explosion<br>不起火，不爆炸                     |
| 3 | External<br>Short-circuit<br>外部短路             | At 25±2℃,After standard charging, connect cell'anode and cathode by wire which impedance less than 5m2, keep 1h<br>在 25±2℃状态下，标准充电后，将电芯的正负极用一根小于 5mQ 的导线连接，放置 1 小时                                                                                                                                                                                                                                             | No fire, no explosion<br>不起火，不爆炸                    |
| 4 | Drop Test<br>跌落                               | Under the temperature of 25±2℃,after full-charging the cel with 0.5C,then drop it freely from 1.5 meter height onto the concrete slab. Each face of the single cell dropped twice, a total of four drop tests were carried out<br>在 25 ± 2℃ 条件下，电芯按 0.5C 充满电后，将电芯从 1.5 米 高度自由跌落至混凝土板上。单体电池两个端面各跌落两 次，共计进行四次跌落试验。                                                                                               | No fire,no explosion<br>不起火，不爆炸                     |
| 5 | High and low<br>temperature<br>shock<br>高低温冲击 | Under the temperature of 25±2℃,after full-charging the cell with 0.5C, put it into-40℃ for 1 h,and then place it for 1h at 85℃ for another 1h. The test is completed after 32 cycles After the test, take out the sample, and then put it aside for 6 h under the condition of 25 ± 2℃<br>在 25 ± 2℃ 条件下，电芯按 0.5C 充满电后，放入温度 -40℃ 的低温环境中搁置 1h, 再在 85℃ 条件下搁置 1h, 如此循环 32 次结束试验。试验结束后将样品取出，再在 25 ± 2℃ 的条 件下搁置 6 h。 | No fire or explosion,<br>no leakage.<br>不起火，不爆炸，无漏液 |

|   |         |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                           |
|---|---------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------|
| 6 | Hot box | Under the temperature of $25\pm2^{\circ}\text{C}$ , after full-charging the cell                                                                                                                                                                                                                                                                                                                                                                                                                               | No fire or explosion      |
|   | 热箱      | with 0.5C, place the cell in the oven, and raise the temperature at the speed of $3^{\circ}\text{C}\sim7^{\circ}\text{C}/\text{min}$ , and start timing when the temperature rises to $130^{\circ}\text{C}$ , and keep the temperature within the range of $(130\pm2)^{\circ}\text{C}$ for 1h.<br><br>在 $25\pm2^{\circ}\text{C}$ 条件下，电芯按 0.5C 充满电后，将电芯放置在烤箱中，并以 $3^{\circ}\text{C}\sim7^{\circ}\text{C}/\text{min}$ 的速度升温，温度升至 $130^{\circ}\text{C}$<br><br>开始计时，并保持温度一直处于 $(130\pm2)^{\circ}\text{C}$ 范围内 1h。 | no leakage<br>不起火，不爆炸，无漏液 |

※ Above testing of safe characteristic must be with protective equipment. (安全性能测试应在有保护措施下进行)

6.5 标准测试条件 Standard Testing Conditions and Requirements

6.5.1 标准测试条件和要求 Standard Testing Conditions and Requirements

本规格书中所有测试均在温度  $23\pm2^{\circ}\text{C}$ 、湿度  $65\pm20\%\text{RH}$  下进行，测试项目有特殊要求除外。  
All the tests are at a temperature of  $23\pm2^{\circ}\text{C}$  , humidity is  $65\pm20\%$  , test items except for special requirements.

6.5.2 测量设备及仪表 Measurement Equipment and Instrumentation

6.5.2.1 尺寸测量 Measurement Tool

用精度为 0.01mm 的卡尺或更高精度的工具测量尺寸，量程范围 0~ 100mm。  
With a precision of 0.01 mm caliper or higher precision instruments for measuring size, range 0~ 100mm.

6.5.2.2 电压测量 Measurement Voltage

用精度为 0.001V 的电压表测量电压，量程范围 0~20V。  
With a precision of 0.001V voltage meter measuring voltage, range 0~20V.

6.5.2.3 电流测量 Measurement Current

用精度为当前电流 $\pm 0.2\%$ 的电流表测量电流，量程范围 0~20A。  
With a precision of  $\pm 0.2\%$  current Ammeter to measure the current, range 0~20A.

6.5.2.4 内阻测量 Measurement Impedance

用一个 1KHz 的正弦交变电流内阻仪测量内阻。  
The impedance is measured with 1 KHz sinusoidal alternating current resistance instrument.

8. Storage and Others

贮存及其它事项

a) Long Time Storage

If the Cell is stored for a long time, the cell's storage should be 12~12.8V and the cell is to be stored in a condition as No.4.15、4.16。

长期贮存的电池（超过 3 个月）须置于干燥、凉爽处。贮存电压为 12~12.8V 且贮存环境要求如 4.15、4.16,（每隔三个月做充放电一次）。

b) Others

Any matters that this specification does not cover should be conferred between the customer

其它事项

9. Bill of materials

主要材料清单

| 序号 | 物料名称 | 规格型号                                             | 单位  | 数量 | 备注 |
|----|------|--------------------------------------------------|-----|----|----|
| 1  | 电芯   | 3.0V/18650/1300mAh                               | PCS | 12 |    |
| 2  | 电子线  | 一端 T90-10/8 端子 8 号特软硅胶线 红、黑线长 90mm 含剥线 5mm, 浸锡   | SET | 1  |    |
| 3  | 电子线  | PH2.0-5Y 胶壳 20AWG 特软 黑蓝白黄红, 线长 105mm 含剥线 3mm, 浸锡 | SET | 1  |    |
| 4  | PCBA | 专用板                                              | PCS | 1  |    |
| 5  | 胶壳   | 专用                                               | SET | 1  |    |

任何本说明书中未提及的事项，须经双方协商确定