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富力能源有限公司  
FULLEST ENERGY CO., LTD.

Specification Approval Sheet  
锂离子电池规格承认书

型号: FE503759  
Model: FE503759  
类型: 聚合物锂离子  
Type: Li-ion Polymer

制定人 Prepared by	审核人 Checked by	批准人 Approved by
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客户承认 Customer Approval	公司名: <i>Company Name:</i>	
	客户签名: <i>Customers Signature:</i>	
	客户编号: <i>Customers No.:</i>	

规格书修订记录  
History of specification

Date	Contents	Remarks
	Second issue	

2017.1.14已经做修改

电芯加保护板分为精工保护板和普通保护板，精工保护板截止电压3.0V，普通保护板截止电压2.5V

# Contents

## 目录

1. 适用范围 Scope	4
2. 电池组成 Battery configuration	4
3. 主要技术参数 Specification	4
4. 电池尺寸 Battery Drawing	5
5. 电池性能检查及测试 Battery Performance Criteria	5
5.1 外观 Appearance	5
5.2 标准的测试条件 standard Test Condition	5
5.3 电性能测试 Electrical Performance	6
5.4 机械性能 Mechanical Performance	6
5.5 安全性能 Safety Performance	7
5.6 高温储存性能 HT Storage Performance	7
6. 贮存及其它事项 Storage and Others	7
6.1 长期贮存 Long Time Storage	7
6.2 其它事项 Others	7
Appendix 附录	
1. 充电 Charging	8
1.1 充电电流 Charging current	8
1.2 充电电压 Charging voltage	8
1.3 充电温度 Charging temperature	8
1.4 禁止反向充电 Prohibition of reverse charging	9
2. 放电 Discharging	9
2.1 放电电流 Discharging current	9
2.2 放电温度 Discharging temperature	9
2.3 过放电 Over-discharging	9
3. 保护电路模块 Protection Circuit Module	9
3.1 过充保护电压 overcharging prohibition	10
3.2 过放电保护 over-discharging prohibition:	10
4. 贮存 Storage	10
5. 电池的注意事项 Handling Instructions	11

## 1. 适用范围 Scope

仅适用于富力能源有限公司生产的可充电锂离子电池或电池组, 包括锂离子电池电芯和保护组件。

This document describes the product specification of lithium ion polymer battery or module which includes cell and protection devices supplied by Fullest Energy co., Ltd.

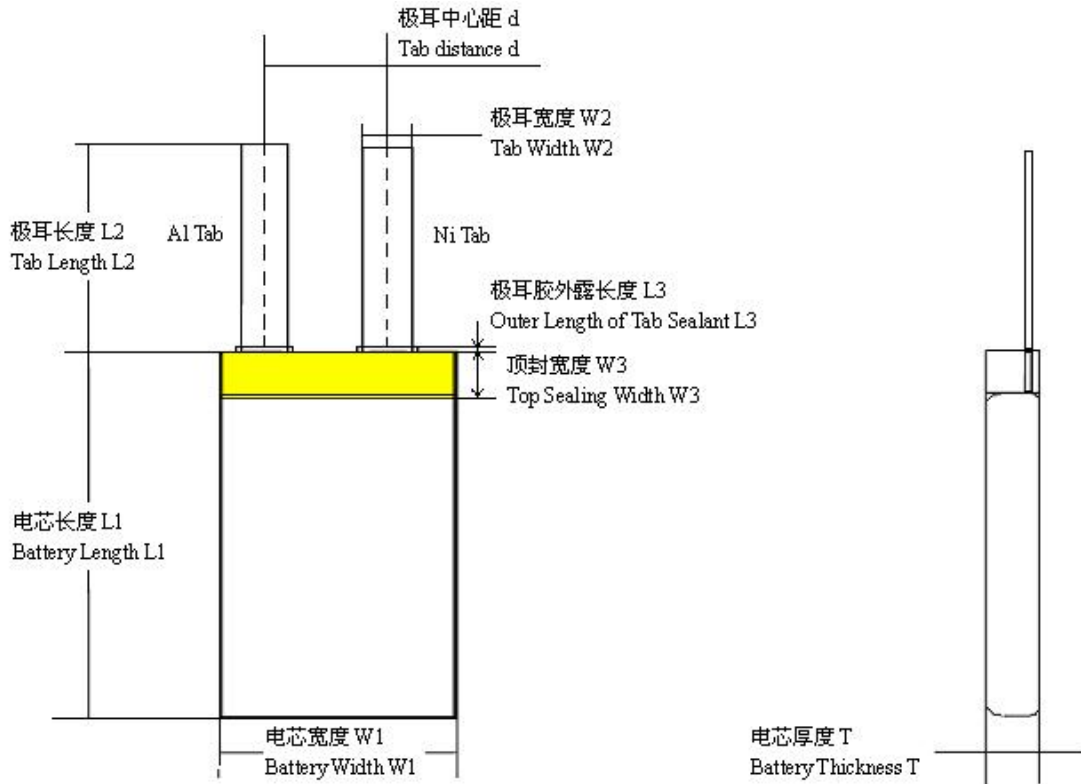
## 2. 电池组成 Battery Constitution

序号 No.	名称 Name	型号 Model	备注 Remark
1	1支锂离子电芯 One piece cell	富力聚合物电池503759 FE503759	富力聚合物电池 FE Polymer Lithium Ion Battery

## 3. 主要技术参数 Specification

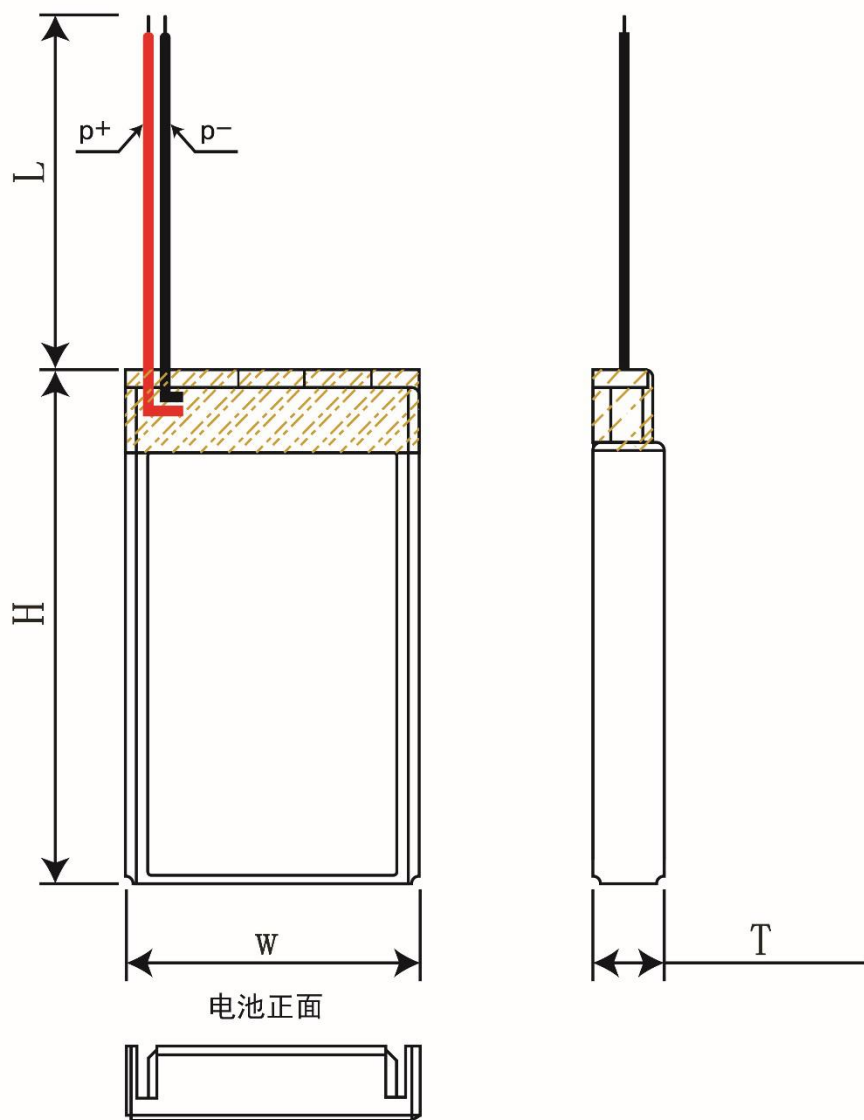
NO	Items	Criteria	Remarks
2.1	Typical Capacity 典型容量	<u>1200mA</u>	0.2charge and discharge for cut- off voltage 0.2C 充放电至终止电压
2.1	Minimum Capacity 最小容量	<u>1200mA</u>	
2.2	Nominal Voltage 标称电压	3.7 V	
2.3	Internal Impedance 内阻	电芯 Cell: $\leq 100m\Omega$	AC1KHz after standard charge 标准 充电后AC 1KHz 测试
		电池 Battery: $\leq 100m\Omega$	
2.4	Charge cut-off voltage 充电截止电压 (V)	4.25V	
2.5	Standard charge current 标准充电电流	600 mA	0.5C
2.6	Max. charge current 最大充电电流	1200 mA	1C
2.7	Standard dis-charge current 标准放电电流	600 mA	0.5C
2.8	Max. discharge current 最大放电电流	1200 mA	1C
2.9	Discharge cut-off voltage 放电截止电压	2.5V $\pm$ 0.1V	
2.10	Operating Temperature 工作温度	0~+45°C	Charging 充电
		-10°C~+60°C	Discharging 放电
2.11	Storage Temperature 贮存温度	-20°C / +45°C	Less than 1 month 小于一个月
		-20°C / +35°C	Less than 6 months 小于六个月

## 4. 电池尺寸 Battery Drawing



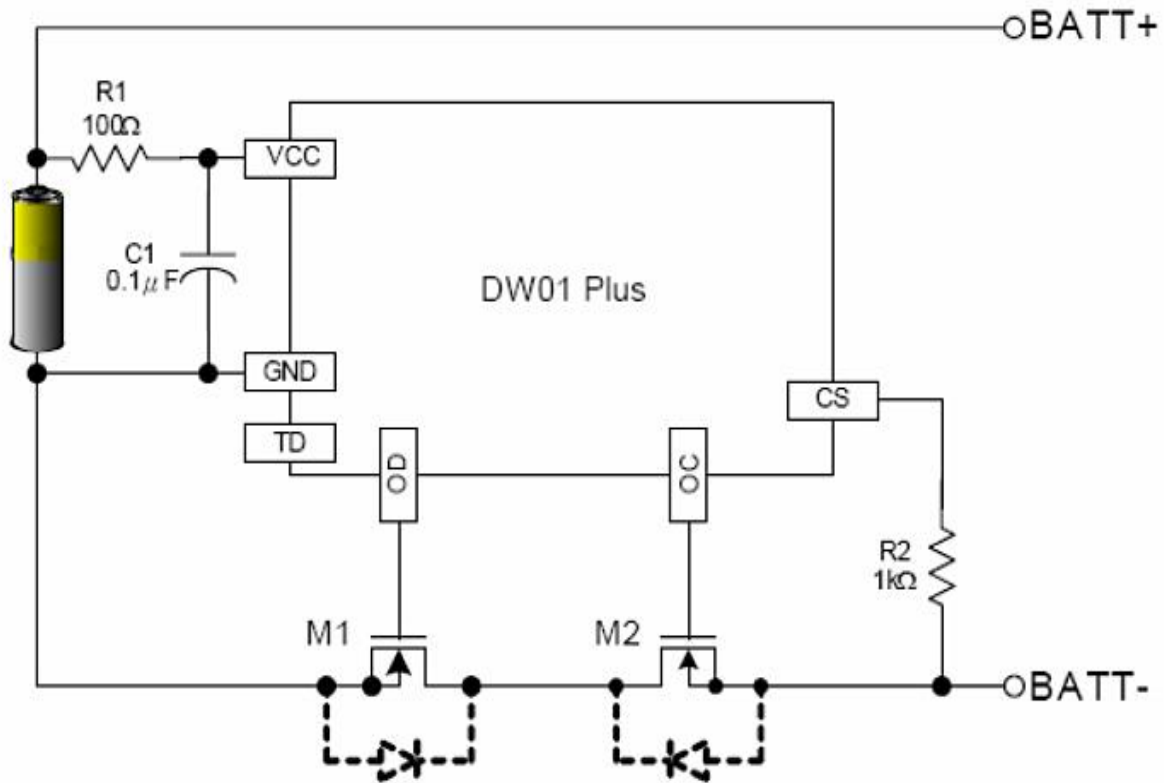
项目	标准	项目	标准
目	Criteria	Ite	Criteria
电芯长度 L1	最大 59.5 毫米 59 ± 0.5 mm Max.	极耳宽度 W2	5 毫米 5 mm
极耳长度 L2 Tab Length L2	6.0 ± 1.0 毫米 6.0 ± 1.0 mm	顶封宽度 W3	2.4 ~ 3.8 毫米 2.4 ~ 3.8 mm
极耳胶外露长度 L3 Outer Length of Tab Sealant L3	0.2 ~ 2.0 毫米 0.2 ~ 2.0 mm	电芯厚度 T	最大 5.1 毫米 5.1 mm Max.
电芯宽度 W1 Battery Width W1	最大 37.2 毫米 37 ± 0.2 mm Max.	极耳中心距 d	18 ± 1.5 毫米 18 ± 1.5 mm

## 5. 电池成品图 Finished Battery Drawing



电池厚度: T	5.0±0.2mm	出线长度: L	50±3mm
电池宽度: W	37±0.2mm		
电池长度: H	61±0.5mm		

## 6. 线路板原理图 Application Circuit



## 7. 电池性能 Battery Performance

### 7.1 外观 Visual Inspection

电池外表面应保持干净、清洁，不能出现划痕、凹点、脏污、漏液、变形等不良现象。

There shall be no such defects as scratch, flaw, crack, and leakage, which may adversely affect commercial value of the battery.

### 7.2 标准测试条件 Standard Testing Condition

除非另有说明,涉及本规格书的所有测试项目均应在温度  $25 \pm 3^\circ\text{C}$ ,相对湿度 45% - 85%RH 条件下进行。

Unless otherwise specified, all tests stated in this product specification are conducted at below condition: Temperature:  $25 \pm 3^\circ\text{C}$

Humidity: 45% - 85% RH

### 7.3电性能 Electric Performance

序号 No.	项目 Item	测试条件 Test Method and	标准 Criteri
1	标准充电模式 Standard Charge	0.5C 恒流充电至 4.25V, 然后恒压充电至 0.05C Charge to 4.35V at constant current 0.5C, then constant voltage charge to taper current 0.05C	总充电时间不超过 5.0 小时, 其中在 25±3°C环境下充电; Constant voltage 4.25V for 5.0hours in all at25±2°C
2	最小容量 Minimum Capacity	在标准充电模式和标准放电模式下测量的电池容量 Measure the capacity through standard charge model and standard discharge model	≥1200毫安 ≥1200mAh
3	循环 Cycle Life	(1) 充电过程: 标准充电模式; (2) 放电过程: 标准放电模式。 重复以上步骤 300 次。 Charge: Standard charge model Discharge: Standard discharge	300 次循环后放电容量大于等于第一次放电容量的 80% Residual capacity ≥ 80% after 300 cycles vs. Discharge capacity of first cycle
4	内阻 Impedance	电芯 50%容量时, 1KHz 下的交流阻抗 Internal resistance measured at 1KHz AC impedance at 50% capacity	≤100 毫欧 ≤100mohm
5	电池电压 Battery Voltage	用万用表测试开路电压 Measure OCV by multimeter	3.75 - 3.95 伏 3.75 - 3.95V
6	电池温度性能 Temperature Performance of Battery	充电过程: 标准充电模式 放电过程: 分别在-20°C,-10°C, 0°C 和 60°C 温度下以 0.2C 恒流放电至 3.0V Charge: Standard charge model Discharge: Discharge to 3.0V at 0.2C constant current at -20°C, -10°C, 0°C and 60°C respectively	-20°C 下, 容量≥40% -10°C 下, 容量≥75% 0°C 下, 容量≥80% 60°C 下, 容量≥95% -20°C, capacity ≥ 40% -10°C, capacity ≥ 75% 0°C, capacity ≥ 80% 60°C, Capacity ≥ 95%
7	荷电保持能力	贮存电压为 3.75~3.95V, 环境为 23°C±5°C的条件下, 将电池开路贮存 1 年, 贮存期间, 1 个月后取 4PCS, 六个月后取 4PCS, 一年后取 4PCS 分别测量一次电压和内阻, 并记录; 并将取出的电池以 0.5C 电流进行放电至终止电压, 记录放电容量, 取下的电池不再用作贮存测试。	第 30 天: 电压 >95% 内阻<120% 容量保持率>95% 6 个月: 电压>94% 内阻<130% 容量保持率>88% 12 个月: 电压 >90% 内阻<135% 容量保持率>80%



## 7.4机械性能测试 Mechanical Performance Testing

序号 No.	项目 Item	测试条件 Test Method and Condition	判断标准 Criteria
1	振动测试 Vibration Test	<p>充满电电池按 X、Y、Z 三个方向，每个方向上从 10HZ~55HZ 的频率循环扫描振动 90min 振动频率 10HZ~50HZ 位移幅值（单振幅 0.8mm）。</p> <p>After standard charging, fixed the capacitor to vibration table and subjected to vibration cycling that the frequency is to be varied at the rate of 1Hz per minute between 10Hz and 55Hz, the excursion of the vibration is 1.6mm. The capacitor shall be vibrated for 30 minutes per axis of XYZ axes.</p>	<p>不起火,不爆炸,不冒烟 或漏液</p> <p>No fire, no explode, no smoke or no leakage</p>
2	跌落测试 Drop Test	<p>电池完全充电后从 1300mm 高度由 X, Y, Z 正负 6 个方向 自由跌落到置于水泥地面上 18mm-20mm 的厚木板上, 每个 方向跌落 1 次,最后用 1C 进行充放循环 3 次。</p> <p>Battery is dropped from a height of 1.3 meters 6 times at six angles (X, Y, Z plus positive, negative) to concrete ground, then cycle three times at 1C current.</p>	<p>不起火,不爆炸,不冒烟 或漏液</p> <p>No fire, no explode, no smoke or no leakage</p>

## 7.5安全性能测试 Safety Performance Testing

序号 No.	项目 Items	测试条件 Testing	标准 Criteria
1	过充电测试 Overcharge testing	<p>充满电的电池外接 3C/4.6V 的电源给电池持续加载 2 小时</p> <p>3C/4.6V DC power supply charge 2hrs after fully charge</p>	<p>不起火,不爆炸,不冒烟或漏液 No fire, no explode, no smoke or no leakage</p>
2	短路测试 Short-circuit testing	<p>充满电电池用小于 0.1Ω 电阻短路 1 h</p> <p>Short circuit 0.1hr through less than 0.1Ω resistor after fully charge</p>	<p>不起火,不爆炸,不冒烟或漏液</p> <p>No fire, no explode, no smoke or no leakage</p>
3	重物冲击 Impact testing	<p>将电池放在冲击台上, 将 10kg 重锤自 1m 高度自由落下, 冲击电芯</p> <p>Cell is placed on the impact plat. A 10kg weight is dropped from the height of 1m onto the cell</p>	<p>不起火,不爆炸, 允许电芯变形</p> <p>No fire, no explode, but distortion is allowed</p>

4	过放电测试 Overdischarge testing	将电池放电至终止电压后,以 30Ω 负载给电池持续加载 28 小时 Discharge 28hrs through 30Ω resistor after fully charge	不起火,不爆炸,不冒烟或漏液 No fire, no explode, no smoke or no leakage
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## 7.6 高温储存性能测试 HT Storage Performance Testing

序号 No.	项目 Item	测试条件 Testing	标准 Criteria
1	60°C/7 天 60°C/7 days	充满电电池在 60±2°C 高温箱中搁置 7 天,再放电至终止电压 Storage 7 days at 60±2°C oven after fully charge, then discharge to 3.0V at RT	不起火,不爆炸,不冒烟或漏液 No fire, no explode, no smoke or no leakage 容量衰减 < 10%, 内阻增加 < 30% Cap loss < 10%, imp increase < 30%

## 8. 贮存及其它事项 Storage and Others

### 8.1 长期贮存 Long Time Storage

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 3.75 ~ 3.95V.

If stored for a long time(exceed three months), the cell should be stored in drying and cooling place. The cell's storage voltage should be 3.75~3.95V

### 8.2 其它事项 Others

任何本说明书中未提及的事项，须经双方协商确定

Any matters which this specification does not cover should be conferred between the customer and FULLEST ENERGY.

# Appendix

## 附录

### Handling Precautions and Guideline

### For LIP (Lithium-Ion Polymer) Rechargeable Batteries

### 聚合物锂离子充电电池操作指示及注意事项

#### Preface 前言

This document of 'Handling Precautions and Guideline LIP Rechargeable Batteries' shall be applied to the battery cells manufactured by WON.

本档“聚合物锂离子充电电芯操作指示及注意事项”仅适用于深圳万造科技有限公司生产电芯。

#### 1 Charging 充电

##### 1.1 Charging current 充电电流

Charging current should be less than maximum charge current specified in the Product Specification. Charging with higher current than recommended value may cause damage to cell electrical, mechanical, and safety performance and could lead to heat generation or leakage.

充电电流不得超过本规格书中规定的最大充电电流。使用高于推荐值电流充电将可能引起电芯的充放电性能、机械性能和安全性能的问题，并可能会导致发热或泄漏。

##### 1.2 Charging voltage 充电电压

Charging shall be done by voltage less than that specified in the Product Specification (4.2V/cell). Charging beyond 4.30V, which is the absolute maximum voltage, must be strictly prohibited. The charger shall be designed to comply with this condition. It is very dangerous that charging with higher voltage than maximum voltage may cause damage to the cell electrical, mechanical safety performance and could lead to heat generation or leakage.

充电电压不得超过本规格书刊号中规定的额定电压 (4.2V/电芯)。4.30V 为充电电压最高极限，充电器的设计应满足此条件。电池电压高于额定电压值时，将可能引起电芯的充放电性能、机械性能和安全性能的问题，可能会导致发热或泄漏。

##### 1.3 Charging temperature 充电温度

The cell shall be charged within 0°C~45 °C range in the Product Specification.

电池必须在 0°C~45 °C 的环境温度范围内进行充电。

##### 1.4 Prohibition of reverse charging 禁止反向充电

Reverse charging is prohibited. The cell shall be connected correctly. The polarity has to be confirmed before wiring. In case of the cell is connected improperly, the cell cannot be charged. Simultaneously, the reverse charging may cause damaging to the cell which may lead to degradation

of cell performance and damage the cell safety, and could cause heat generation or leakage.

正确连接电池的正负极，严禁反向充电。若电池正负极接反，将无法对电芯进行充电。同时，反向充电会降低电芯的充放电性能、安全性，并会导致发热、泄漏。

## 2 Discharging 放电

### 2.1 Discharging current 放电电流

The cell shall be discharged at less than the maximum discharge current specified in the Product Specification. High discharging current may reduce the discharging capacity significantly or cause over-heat.

放电电流不得超过本规格书规定的最大放电电流，大电流放电会导致电芯容量剧减并导致过热。

### 2.2 Discharging temperature 放电温度

The cell shall be discharged within  $-10^{\circ}\text{C}\sim 60^{\circ}\text{C}$  range specified in the Product Specification.

电池必须在  $-10^{\circ}\text{C}\sim 60^{\circ}\text{C}$  的环境温度范围内进行放电。

### 2.3 Over-discharging 过放电

It should be noted that the cell would be at an over-discharged state by its self-discharge characteristics in case the cell is not used for long time. In order to prevent over-discharging, the cell shall be charged periodically to maintain between 3.75V and 3.95V.

需要注意的是，在电池长期未使用期间，它可能会用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，电池应定期充电，将其电压维持在 3.75V 至 3.95V 之间。

Over-discharging may causes loss of cell performance, characteristics, or battery functions. 过放电会导致电芯性能、电池功能的丧失。

## 3. Protection Circuit Module 保护电路模块

The cell/battery pack shall be with a PCM that can protect cell/battery pack properly. PCM shall have functions of (1) overcharging prevention ,(2) over-discharging prevention, (3) over current prevention to maintain safety and Prevent significant deterioration of cell performance. The over current can occur by external short circuit

电芯/电池包装应配有 PCM 以正确保护电芯/电池。PCM 应具有以下功能以保证安全并防止损坏电池性能：

(1) 过充保护功能；(2) 过放保护功能；(3) 过流保护

### 3.1 overcharging prohibition: 过充保护电压

Overcharging prohibition function shall stop charging if any one of the cells of the battery pack reaches  $4.25\pm 0.025\text{V}$

当电池中任一电芯的电压达到  $4.25 \pm 0.025V$  时，过充电保护功能应立即启动并停止充电。

### 3.2 over-discharging prohibition: 过放电保护

Over-discharging prevention function shall work to avoid further drop in cell voltage of  $2.5V \pm 0.1V$  Or less per cell in any cell of the battery pack. It is recommended that the dissipation current of PCM Shall be minimized to  $0.5\mu A$  or less with the over-discharging prevention. The protection function shall monitor each bank of the battery pack and control the current all the time .

当电池中任一电芯的电压降至  $2.5 \pm 0.1V$  以下时，过放保护功能应起保护作用以避免电芯的深度放电。

推荐 PCM 的静态电流小于  $0.5\mu A$ ，并具有过放保护功能。该保护功能应实时监控所有电池。

### 4. Storage 贮存

If the cell has to be storied for a long time (Over 3 months), the environmental condition should be: Temperature:  $23 \pm 5^\circ C$  Humidity:  $65 \pm 20\%RH$

长期存储电池（超过 3 个月）须置于温度为  $23 \pm 5^\circ C$ 、湿度为  $65 \pm 20\%RH$  的环境中。

The voltage for a long time storage shall be  $3.75V \sim 3.95V$  range.

贮存电压为  $3.75V \sim 3.95V$  。

### 5. 电池的注意事项 Handling Instructions

Read and observe the following warnings and precautions to ensure correct and safe use of Li- ion batteries.

认真阅读下面的注意事项，确保正确使用聚合物锂离子电池。WONZER 对违反下述注意事项而产生的任何问题不予负责。

#### **Danger!**

危险!

#### 安全警示及使用说明 Caution and Guideline

使用前应先阅读产品规格书以及安全警示，确保正确使用电池并确保电池使用过程中的安全。

Before using battery, please read specification and safety caution, insure proper application and safety.

#### 安全警示 Caution

下面的操作可能导致电池泄漏，发热甚至燃烧：

Failing in following items can cause leakage, heat even fire:

禁止反向充电！

Prohibition of reverse charge of battery.

禁止过充电！

Prohibition of overcharge of battery.

禁止过放电!

Prohibition of over-discharge of battery.

禁止正负极短路!

Prohibition of short circuit of positive and negative of battery.

请使用指定的充电器充电!

Please charge by specified charger.

请不要撞击, 敲打, 钉刺或拆卸电池!

Don't knock, beat, nail or disassemble battery.

请保持电芯远离热源, 禁止将电芯扔入火中!

Please keep away from fire or other heating sources and prohibition of dumping of battery into fire.

### 使用说明 **Guideline**

如果电解液接触到皮肤或眼睛,请立刻用清水冲洗接触的区域并寻求医生的建议!

If electrolyte comes into contact with the skin or eyes where shall flush the electrolyte immediately with fresh water and physicians' advice is to be sought.

请不要在规定的范围外使用或储存电池, 否则将削弱电池的性能, 缩短电池的寿命, 甚至导致电池发热, 起火或爆炸!

Don't use or storage battery under the circumstance beyond specified, unless will weaken battery performance and shorten battery life-span, even will cause heating, fire or explosion.

使用前请确保电池在质量保证期内。

Please insure battery in quality guarantee duration before using.

如果电池太脏, 使用前请清扫它们, 否则可能导致其不正常工作。

If batteries are too dirty, please clean them before using. Unless will cause abnormal work of battery.