

Product Specification

Customer's Name:

客户名称:

Spec.No : MLP604060 1500mAh 3.7V

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Date: 2018-05-12

Li-ion Polymer Battery Product Specification 可充电锂离子电池 产品规格书

Model: MLP604060 1500mAh 3.7V

型 号: MLP604060 1500mAh 3.7V

Type: Li-ion Polymer

类型: 聚合物锂离子电池

Approval	Checked	Draft
Kevin	Bruce	David
Customer Approval		

History of specification
规格书修订记录

Date	Contents	Remarks
2018-05-12	First issue	A0

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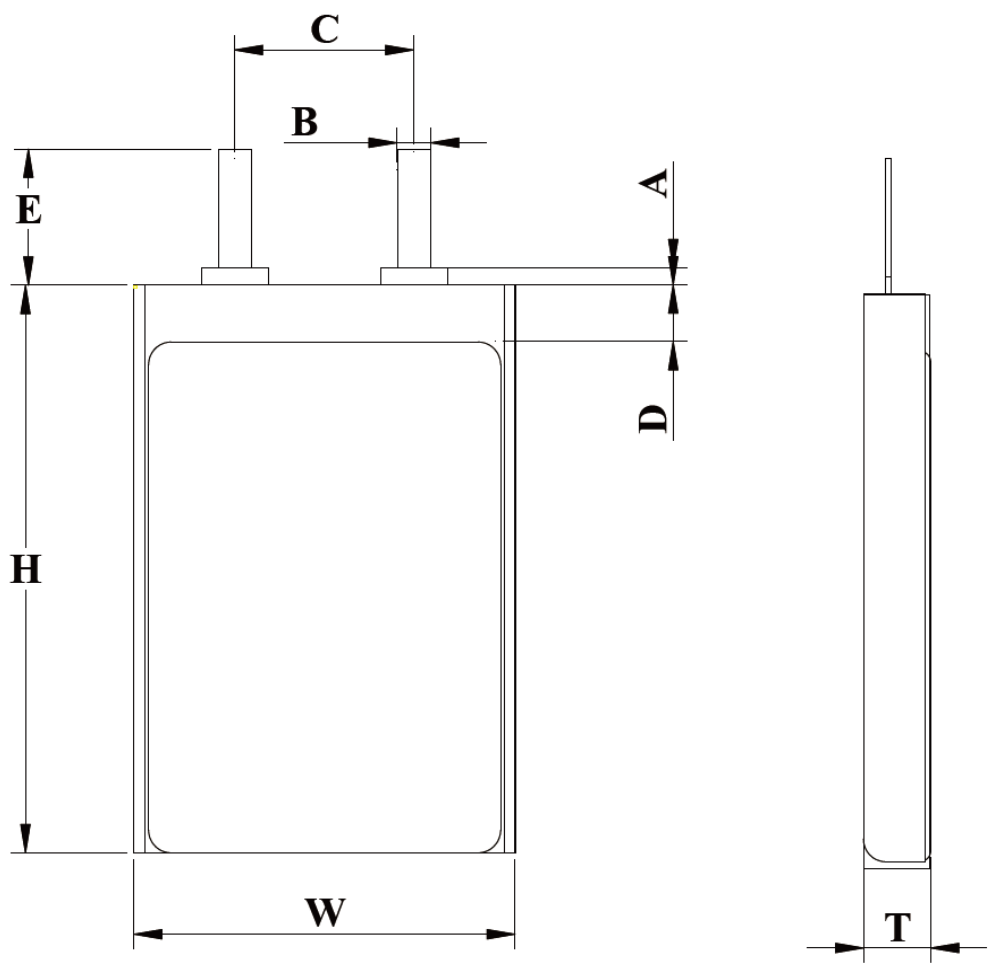
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1. Scope/适用范围

2. Cell Specification/电芯产品规格

No.	Item 项目	Specification 性能	
1	Rated Capacity 额定容量	1500mAh ,0.2 C discharging	
2	Minimum Capacity 最小容量	1500mAh ,0.2 C discharging	
3	Normal Voltage 标称电压	3.70V	
4	O.C.V 出厂电压	3.80-4.2V	
5	Charge Ending Voltage 充电截止电压	4.20±0.03V	
6	Discharge Ending Voltage 放电截止电压	3.0V	
7	Standard charging method 标准充电方式	0.5C constant current charge to 4.2V, then constant voltage 4.2V charge till charged current declines to $\leq 0.01C$, 0°C ~ 45°C	
8	Charge current 充电电流	Standard charge:0.5C	
		Rapid charge:1.0C	
9	charging Time 充电时间	Standard charge:5.5~6.5 h	
		Rapid charge:1.5~2.5 h	
10	Max. Charging Current 最大充电电流	1.0C (5°C ~ +45°C)	
11	Standard discharging Current 标准放电电流	0.5C constant current discharge to 3.0V. 10°C ~ +60°C	
12	Max. Discharging Current 最大放电电流	1.0C (10°C ~ +60°C)	
13	Operating environment 工作环境	Charging: 0°C-45°C, 65%±25%RH Discharging: 10°C-60°C, 65%±25%RH	
14	Cell Impedance 单电芯内阻	<60mohm, (4.2V AC 1KHz measured)	
15	Dimension of Single Cell 单电芯尺寸	Thickness	Max6.0mm
		Width	Max40.0mm
		Height	Max60.0mm

3. Picture of single cell 单体电芯图

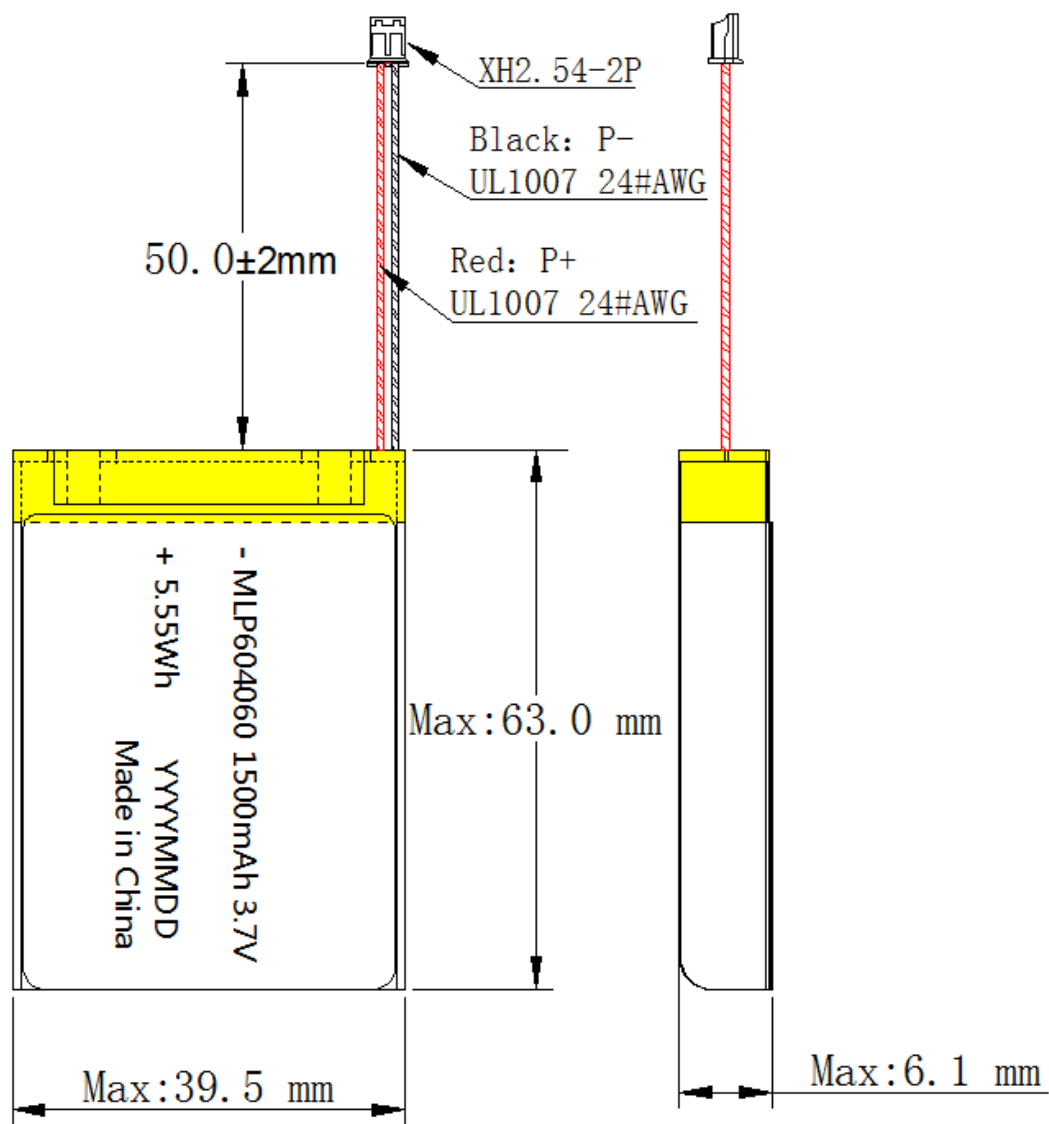


Items	Description	Dimension and Spec
T	电芯厚度	Max:6.0mm
W	电芯宽度	Max:39.5mm
H	电芯长度	Max:60.0mm
C	Tab 间距	19.4±2.0mm
B	Tab 宽度	5.0±0.1mm
D	顶封宽度	4.0±0.5mm
A	极耳胶外露	Max:2.0mm
E	极耳长度	8.0±1.5mm

Fig. (1) The Dimension of Single Cell

图(1) 单体电池尺寸图

4. Picture of assembled battery 组合电池图



厚度 T	宽度 W	长度 L	线径Ø	线型	插头型号
Max:6.1	Max:39.5	Max:63.0	0.9	UL1007/24#	XH2. 54-2P
备注: UNIT 单位: MM					

Fig. (2) The Dimension of Assembled Battery

图 (2) 组合电池外形尺寸图

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5. 产品规格及电气参数Product Specification and Electrical Parameters

序号	Item 项目	Specification 性能	
1	Assembled Mode 组合方式	1P	
2	Normal Capacity 标称容量	$\geq 1500\text{mAh}$, 0.2 C discharging	
3	Normal Voltage 标称电压	3.7V	
4	Impedance 成品内阻	$< 123\text{mohm}$, (100% charge AC 1KHz measured)	
5	Assembly Dimension 装配尺寸	Thickness	Max 6.1mm
		Width	Max 39.5mm
		Height	Max 63.0mm

4. Battery/Cell performance test Criteria/电池性能标准

4.1 Appearance inspection by visual/外观目测

There shall be no such defect as rust, leakage, which may adversely affect commercial value of battery.

电池外观应没有锈渍、污渍、漏液等影响商业价值的缺陷存在。

4.2 Environment Performance 环境性能

Unless otherwise specified, all test stated in this product specification are conduct at below test condition

所有测试应按以下环境条件进行，除非特殊指定外。

No	Items/项目	Test Method and Condition/测试方法及条件	Criteria/标准
1	Discharge at high temperature 高温放电	After stand charging, rest the cells 4h at $60\pm 2^{\circ}\text{C}$, then discharging at 1C to voltage 3.0V, recording the discharging time. 标准充电后，在 $60\pm 2^{\circ}\text{C}$ 条件下贮存 2 小时，然后用 1C 放电至 3.0V，所记录放电时间。	$\geq 54\text{min}$
2	Discharging at low temperature 低温放电	After stand charging, rest the cells for 16h at $-20\pm 2^{\circ}\text{C}$, then discharging at 0.2C to voltage 3.0V, recording the discharging time. 标准充电后，在 $-20\pm 2^{\circ}\text{C}$ 条件下贮存 16 小时，然后用 0.2C 放电至 3.0V，所记录放电时间。	$\geq 210\text{min}$

4.3 Cell Electrical characteristics/电气特性

No	Items/项目	Test Method and Condition/测试方法及条件	Criteria/标准	
1	Rated Capacity at 0.2C (Min.) 0.2C 最小额定容量	After standard charge, the capacity shall be measured on 0.2C discharge till the voltage discharge to 3.0V, 标准充电后，放电至 3.0V 截止，测量 0.2C 放电容量	$\geq 1500\text{mAh}$	$\geq 100\%$

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2	Cycle Life 循环寿命	Charging and discharging battery as blew conditions 0.2C standard charge to 4.2V end-off 0.2C standard discharge to 3.0V cut-off Continuous charge and discharge for 300 cycles ,the capacity will be measure after the 300 th cycle 充放电按以下条件: 0.2C 标准充电至 4.2V, 0.2C 标准放电至 3.0V, 连续充放电循环 300 周, 在第 300 周结束后测量容量	≥80% of initial capacity
3	Capacity retention 容量保持	The battery to be charge in accordance with standard charge condition at 20~25 °C ,then storage the battery at an ambient temperature 20~25°C for 28 days. Measure the capacity after 30 days with 0.2C at 20~25°C as retention capacity 将电池在 20~25°C 标准充电后储存在 20~25°C 的环境中 28 天 28 天后, 测试电池在 20~25°C 环境下 0.2C 放电容量作为保持容量	Retention capacity 容量保持 ≥85%

4.4 Mechanical characteristics/机械特性

No	Items/项目	Test Method and Condition/测试方法及条件	Criteria/标准
1	Free fall test 自由跌落测试	The battery to be fully charged in accordance with standard charge condition, then drop the battery three times from a height of 1,0 m onto a concrete floor. The batteries are dropped so as to obtain impacts in random orientations. 电池按照标准充电条件充满电, 然后从1m高度跌落电池到一个水泥地面, 随机跌落三次。	No Fire, 不起火, 不爆炸
2	Vibration test 振动测试	After standard charging, fixed the cell 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 cell shall be vibrated for 30 minutes per axis of XYZ axes. 将标准充电后的电芯固定在振动台上, 沿 X、Y、Z 三个方向各振动 30 分钟, 振幅 1.6mm, 振动频率为 10Hz~55Hz, 每分钟变化 1Hz。	No explosion, No leakage, No fire 无泄漏,不起火, 不爆炸

4.5Safety performance/安全性能

No	Items/项目	Test Method and Condition/测试方法及条件	Criteria/标准
1	Thermal exposure test 高温热冲击测试	Each fully charged cell, stabilized at room temperature, is placed in a circulating air-convection oven. The oven temperature is raised at a rate of 5 °C/min ± 2 °C/min to a temperature of 130 °C ± 2 °C. The cell remains at this temperature for 10 min before the test is discontinued. 充满电的电池温度稳定到常温后, 放置入循环空气烘箱里, 从常温以5 °C/分± 2 °C/分的速率升至130°C后, 在130°C放置10分钟	No explosion, No fire 无起火,无爆炸

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2	Short test 短路测试(20℃)	The fully charged battery is to be short-circuited by connecting the positive and negative terminals of the battery with resistance load not exceed 100mΩ. Tests are to be conducted at room temperature 20~25℃. 在室温 20~25℃把充满电的电池的正负极用不超过 100mΩ的负载连接起来，连接起来使电池外部短路	No explosion, No fire The Temperature of the Battery surface not exceeded than 150℃ 无起火,无爆炸 电池表面温度不超过 150℃
3.	Short test 短路测试(60℃)	The fully charged battery is to be short-circuited by connecting the positive and negative terminals of the battery with resistance load not exceed 100mΩ. Tests are to be conducted at room temperature about 60-65℃ 在室温约为 60-65℃把充满电的电池的正负极用不超过 100mΩ的负载连接起来，连接起来使电池外部短路	No explosion, No fire The Temperature of the Battery surface not exceeded than 150℃ 无起火,无爆炸 电池表面温度不超过 150℃
4	Forced discharge test 过放电测试	At 23±5℃, According to the requirements of standard charge, the cells will be discharge to cut-off voltage, then connect with external load of 30 ohm for 24 hours. 在 23±5℃状态下，按标准放电的要求放电至终止电压后,外接 30Ω负载放电 24 小时.	No explosion, No fire 无起火,无爆炸
5	Over charge test 过充电测试	After standard charge, continue to charge with a constant voltage 5.0V per a cell, holding 8h. 电芯标准充满电后，以 5.0V 的恒定电压继续充电，保持 8 小时	No explosion, No fire, 无爆炸，无起火

6. 护板参数 PCM data

Item 项目	Symbol 符号	Content 详细内容	Criterion 标准
Over charge Protection 过充保护	VDET1	Over charge detection voltage 过充电检测电压	4.28±0.025V
	tVDET1	Over charge detection delay time 过充电检测延迟时间	1.2s
	VREL1	Over charge release voltage 过充电解除电压	4.08±0.025V
Over discharge protection 过放保护	VDET2	Over discharge detection voltage 过放电检测电压	2.4±0.025V
	tVDET2	Over discharge detection delay time 过放电检测延迟时间	144ms
Over current protection 过流保护	VDET3	Over current detection voltage 过电流检测电压	0.05~0.32V
	IDP	Over current detection current 过电流保护电流	3.0A~4.0A
	tVDET3	Over current Detection delay time 过电流检测延迟时间	9ms
		Release condition 保护解除条件	Cut load 断开负载
Short protection 短路保护		Detection condition 保护条件	Exterior short circuit 外部电路短路
	TSHORT	Detection delay time 检测延迟时间	≤320us
		Release condition 保护解除条件	Cut short circuit 断开短路电路

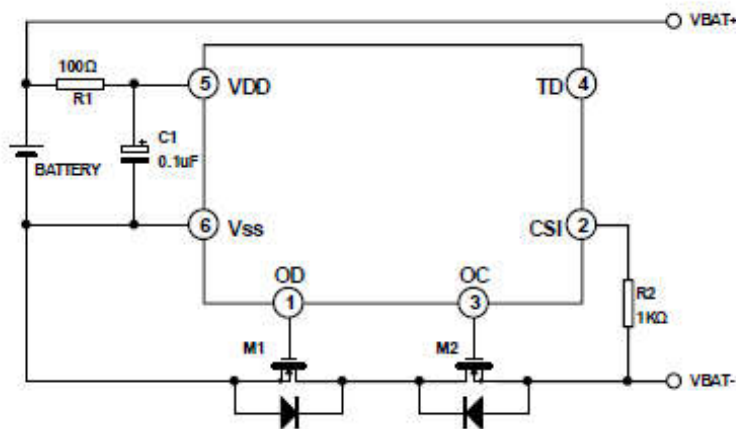
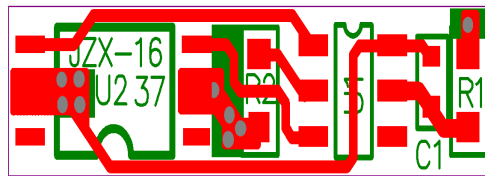
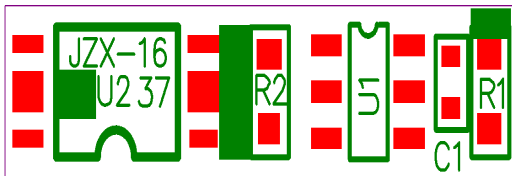
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Interior resistance 内阻	RDS	Main loop electrify resistance 主回路通态内阻	VC=4.2V; $RDS \leq 60m\Omega$
Current consumption 消耗电流	IDD	Current consume in normal operation 工作时电路内部消耗	3.0 μA Type 5.0 μA Max
Current consumption 消耗电流	IDD	Current consume in normal operation 休眠时电路内部消耗	0.1 μA Max
0V 充电		是否可以向 0V 电池充电功能	YES
短路恢复		是否有短路自动恢复功能	YES
休眠功能		是否有休眠功能(有休眠功能的解除条件为充电激活)	NO

7. 清单 BOM:

NO.	Location 元件编号	Part name 元件名称	Specification 元件规格	Pack type 封装式	Q' ty 数量
1	U1	Battery protection IC	DW01 RoHS	SOT-23-6	1
2	U2	Silicon MOSFET	8205A RoHS	TSSOP-6	1
3	R1	Resistance	SMD 470 $\Omega \pm 5\%$ RoHS	0603	1
4	R2	Resistance	SMD 2K $\Omega \pm 5\%$ RoHS	0603	1
5	C1	Capacitance	SMD 0.1 μF RoHS	0402	1
6	PCB	Print circuit board	16*3.7*0.6 RoHS 绿油	JZX	1

8. PCB Layout PCB 布线图



Appendix 附录

Handling Precautions and Guideline For LIP (Li-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

Note (1) : 声明一

The customer is requested to contact _____ in advance, if and when the customer needs other applications or operating conditions than those described in this document. Additional experimentation may be required to verify performance and safety under such conditions.

客户若需要将电芯用于超出本规格书规定以外的设备，或在本规格书规定以外的使用条件下使用电芯，应事先联系，因为需要进行特定的实验测试以核实电芯在该使用条件下的性能及安全性。

Note (2) : 声明二

对于在超出本规格书规定以外的条件下使用电芯而造成的任何意外事故。

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 4.25V**, which is the absolute maximum voltage, must be strictly prohibited. The charger shall be designed to comply with this condition.

充电电压不得超过本规格书刊号中规定的额定电压（4.2V/Cell）。**4.25V 为充电电压最高极限**，充电器的设计应满足此条件。

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.

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 $-20^{\circ}\text{C}\sim 60^{\circ}\text{C}$ range specified in the Product Specification.

电池必须在 $-20^{\circ}\text{C}\sim 60^{\circ}\text{C}$ 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 3.7V and 3.9V.

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 3.7V 至 3.9V 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。

The charger shall be equipped with a device to prevent further discharging exceeding a cut-off voyage specified in the Product Specification. Also the charger shall be equipped with a device to control the recharging procedures as follows: The cell battery pack shall start with a low current (0.01C) for 15 - 30 minutes, i.e. pre-charging, before rapid charging starts. The rapid charging shall be started after the (individual) cell voltage has been reached above 3.0V within 15 - 30 minutes that can be determined with the use of an appropriate timer for pre-charging. In case the (individual) cell voltage does not rise to 3.0V within the pre-charging time, then the charger shall have functions to stop further charging and display the cell/pack is at abnormal state.

充电器应有装置来防止电池放电至低于本规格书规定的截止电压。此外，充电器还应有装置以防止重复充电，步骤如下：电池在快速充电之前，应先以一小电流（0.01C）预充电 15~30 分钟，以使电池的电压达到 3.0V 上，再进行快速充电。可用一计时器来实现该预充电步骤。如果在预充电规定时间内，电池的电压仍未升到 3.0V 以上，充电器应能够停止下一步快速充电，并显示该电芯/电池正处于非正常状态。

4. Storage 贮存

The cell shall be storied within $-5^{\circ}\text{C} \sim 45^{\circ}\text{C}$ range environmental condition.

电芯储存温度必须在 $-5^{\circ}\text{C} \sim 45^{\circ}\text{C}$ 的范围内。

If the cell has to be storied for a long time (Over 3 months), the environmental condition should be:

Temperature: $23 \pm 5^{\circ}\text{C}$

Humidity: $65 \pm 20\% \text{RH}$

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

The voltage for a long time storage shall be $3.7\text{V} \sim 3.9\text{V}$ range.

贮存电压为 $3.7\text{V} \sim 3.9\text{V}$ 。

5. Handling Instructions 电池的注意事项

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。

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Danger!

危 险!

- Do not immerse the battery in water or allow it to get wet.
- 勿将电池投入水中或将其弄湿!
- Do not use or store the battery near sources of heat such as a fire or heater.
- 禁止在火源或极热条件下给电池充电! 勿在热源(如火或加热器)附近使用或贮存电池! 如果电池泄漏或发出异味, 应立即将其从接近明火处移开;
- Do not reverse the positive(+) and negative(-) terminals.
- 勿将正负极接反!
- Do not connect the battery directly to wall outlets or car cigarette-lighter sockets.
- 勿将电池直接连接到墙上插座或车载点烟式插座上!
- Do not put the battery into a fire or apply direct heat to it.
- 勿将电池投入火中或给电池加热!
- Do not short-circuit the battery by connecting wires or other metal objects to the positive(+) and negative(-) terminals.
- 禁止用导线或其它金属物体将电池正负极短路, 禁止将电池与项链、发夹或其它金属物体一起运输或贮存!
- Do not pierce the battery casing with a nail or other sharp object, break it open with a hammer, or step on it.
- 禁止用钉子或其它尖锐物体刺穿电池壳体, 禁止锤击或脚踏电池!
- Do not strike, throw or subject the battery to sever physical shock.
- 禁止撞击、投掷或者使电池受到机械震动
- Do not directly solder the battery terminals.
- 禁止直接焊接电池端子!
- Do not attempt to disassemble or modify the battery in any way.
- 禁止以任何方式分解电池!
- Do not place the battery in a microwave oven or pressurized container.
- 禁止将电池置入微波炉或压力容器中!
- Do not use the battery in combination with primary batteries(such as dry-cell batteries) or batteries of different capacity, type or brand.
- 禁止与一次电池(如干电池)或不同容量、型号、品种电池组合使用!
- Do not use 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.
- 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!

Caution!

注 意!

Do not 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.

不要使用处于极热环境中的电池，如阳光直射或热天的车内。否则，电池会过热，可能着火（点燃），这样就会影响电池的性能、缩短电池的使用寿命。

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.

如果电池漏液后电解液进入眼睛，不要擦，应用水冲洗，立即寻求医疗救助。如不及时处理，眼睛将会受到伤害。

Use the battery only under the following environmental conditions. Failure to do so can result in reduced performance or a shorten service life. Recharging the battery outside of these temperatures can cause the battery to overheat, explode or catch fire.

只能在下述条件下使用电池，否则将会降低电池的性能或缩短电池的使用寿命。

Operating environment:

工作环境

When charging the battery: 0°C ~ 45°C

充电: 0°C ~ 45°C

When discharging the battery: -20°C ~ 60°C

放电: -20°C ~ 60°C

When stored up to 30 days: -5°C ~ +45°C

储存 30 天: -5°C ~ +45°C

When stored up to 90 days: -5°C ~ +35°C

储存 90 天: -5°C ~ +35°C

When stored up to 180 days: 0°C ~ +35°C

储存 180 天: 0°C ~ +35°C

6. Amendment of this Specification 产品规格书的修订

This specification is subject to change with prior notice.