Customer's Name：

受领公司名称：矽递科技

Spec.No ：
File. No：
Ver： A/0
Date： 2015-07-27

TCL Hyperpower Batteries Inc

惠州 TCL 金能电池有限公司

Specification For Approval

客户承认书

Model: **PR-115957G**

型 号：**PR-115957G**

Type: Li-ion polymer

类型: 聚合物锂离子

Approval	Checked	Draft	
Li Wang	**Shuqing Gao**	**Xiang Li**	**Xiaoyu Tian**
Customer Approval			

http://www.tclbattery.com

Address ： No.3,Hechang Dongliu Rd. Huitai Industrial Zone,Huicheng District,Huizhou City,Guangdong Province,China;

TEL：+86-752-2367926 FAX：+86-752-2365600 Postcode：516006

地址：广东省惠州市惠城区惠台工业区和畅东六路 3 号

电话：（0752）2367926 传真：2365600 邮编：516006

History of specification

规格书修订记录

Ver	Date	Remarks
A/0	2015-07-27	

Contents 目录

1. Scope 适用范围

The specification shall be applied to Li-ion polymer rechargeable battery pack of PR-115957G, Which is manufactured by TCL Hyperpower Batteries.
本规格书适用于惠州 TCL 金能电池有限公司生产的 PR-115957G 聚合物锂离子可充电电池.

2. Specification 主要技术参数

NO	Items	Criteria	Remarks
2.1	Typical Capacity 典型容量	5100mAh	0.2C charge and discharge for cut-off voltage3.0V 0.2C 充放电至终止电压 3.0V
	Minimum Capacity 最小容量	5000mAh	
2.2	Nominal Voltage 标称电压	3.8V	
2.3	Internal Impedance 内阻	Cell: ≤45mΩ	AC 1KHz after standard charge 标准充电后 AC 1KHz 测试
		Battery: ≤200mΩ	
2.4	Charge voltage 充电电压（V）	4.35V	
2.5	Max. Charge Voltage 充电最高电压	4.38V	
2.6	Standard charge current 标准充电电流	1000mA	
2.7	Max. charge current 最大充电电流	2500mA	
2.8	Standard dis-charge current 标准放电电流	1000mA	
2.9	Max. discharge current 最大放电电流	3000mA	
2.10	Shippingvoltage 出货电压	3.8V	
2.11	Operating Temperature 工作温度	0℃~+45℃	Charging 充电
		-10℃~+60℃	Discharging 放电
2.12	Storage Temperature 贮存温度	-20℃～+45℃	Lessthan1month 小于一个月
		-20℃～+35℃	Lessthan6months 小于六个月

3. Battery configuration 电池组成

NO	Item	Criteria	Remarks
3.1	Semi-manufactured cell	PR-115957G	TCL
3.2	PCM	待定	TCL
3.3	Connector	JST PHR-2	/
3.4	wire	UL3302 24AWG	/

4.Battery Performance Criteria 电池性能检查及测试

4.1 Appearance 外观

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

电池外表面清洁，无电解液泄漏，无明显的划痕及机械损伤，无明显变形，无影响电池价值的其它外观缺陷。

4.2 Measurement Apparatus 测试设备要求

(1) Dimension Measuring Instrument 尺寸测量设备

The dimension measurement shall be implemented by instruments with equal or more precision scale of 0.01mm.

测量尺寸的仪器的精度应不小于 0.01mm

(2)Voltmeter 电压表

Standard class specified in the national standard or more sensitive class having inner impedance not less than 10 KΩ/V.

国家标准或更灵敏等级,内阻不小于 10 KΩ/V.

(3) Ammeter 电流表

Standard class specified in the national standard or more sensitive class. Total external resistance including ammeter and wire is less than 0.01Ω.

国家标准或更灵敏等级，外部总体内阻包括电流表和导线应小于 0.01Ω.

(4) Impedance Meter 内阻测试仪

Impedance shall be measured by a sinusoidal alternating current method(AC 1kHz LCR meter).

内阻测试仪测试方法为交流阻抗法(AC 1kHz LCR).

4.3 standard Test Condition 标准的测试条件

Test should be conducted with new batteries within one month after shipment from our factory and the cells shall not be cycled more than five times before the test. Unless otherwise defined, test and measurement shall be done under temperature of 25±3℃ and relative humidity of 45~85%.

测试电池必须是本公司出厂时间不超过一个月的新电池，且电池未进行过五次以上充放电循环。除非其它特殊要求，本产品规格书规定的测试的环境条件为：温度 25±3℃，相对湿度 45%~85%。

4.4 Standard Charge 标准充电

0.2CmA=1000mA

Full charge condition: Constant current 0.2CmA,Constant voltage 4.35V to 0.01CmA for 6.0hours in all at 25±3℃.

25±3℃环境下充电，0.2CmA 4.35V(CC-CV) 截止电流为 0.01CmA，总充电时间不超过 6.0 小时。

4.5 Electrical Performance 电性能测试

4.5.1 Temperature Dependence of Capacity (Discharge) 放电温度特性

Cells shall meet the discharge capacity requirements listed in the below table under respective discharge temperatures. After standard charge, the battery is to be cooled or heated to a respective discharge temperature in 30 minutes. 2.5 hours rest period later, 0.2CmA discharge to a cut-off voltage of 3.0V. When after one temperature test, remain the battery at 25±3℃ for 2 hours, then followed by a standard charge.

电池应该满足不同放电温度下的放电容量要求。电池在 25±3℃标准充电，然后在 30 分钟内冷却或加热到测试温度。放电前电池在此温度下保持 2.5 小时，放电电流为 0.2CmA（截止电压 3.0V），做完一个温度实验后，电池在室温下放置 2h，然后进行充电（25±3℃），要求如下：

Discharge Temperature 放电温度	-20℃	25℃	60℃
Discharge Capacity 放电容量	60%	100%	95%

4.5.2 Cycle Life 循环性能

30min rest period after standard charge, 1.0CmA discharge to a cut-off voltage of 3.0V, 30min rest period, the capacity shall be measured after 500 cycles of standard charge and discharge at 25±3℃.

Capacity ≥80%

标准充电后，搁置 30min，1.0CmA 放电至 3.0V，搁置 30min，，重复上述步骤进行循环，直至电池循环 500 次 测试温度 25±3℃（影响电池循环性能的重要参数），要求如下：

容量≥80%

4.5.3 Shelf Life 荷电保持能力

Item 项　目		Measuring Procedure 测试方法	Requirements 要　求
Storage Characteristics 1 常温贮存	1	The capacity on 0.2CmA discharge shall be measured after standard charge and then storage at 25±3℃ for 30 days. 标准充电后电池在 25±3℃的环境中贮存 30 天，测试 0.2CmA 放电容量（保持容量）	Remaining Capacity ≥85% 容量保持≥85%
	2	After above measured Remaining capacity, the capacity on standard discharge shall be measured after standard charge. 0.2CmA 循环 3 次，测试恢复容量（3 周循环的最大放电容量）	Recovery capacity ≥90% 容量恢复≥90%
Storage Characteristics 2 高温贮存	1	The capacity on 0.2CmA discharge shall be measured after standard charge and then storage at 60±2℃ for 7 days. 标准充电后电池在 60±2℃的环境中贮存 7 天，测试 0.2CmA 放电容量（保持容量）	Remaining Capacity ≥60% 容量保持≥60%

	2	After above measured Remaining capacity, the capacity on standard discharge shall be measured after standard charge. 0.2CmA 循环 3 次，测试恢复容量（3 周循环的最大放电容量）	Recovery capacity ≥80% 容量恢复≥80%

4.6 Mechanical Performance 机械性能

Item	Measuring Procedure	Requirements
Vibration test 振动测试	After standard charge, the battery is to be tested as following conditions: Amplitude:0.8mm Frequency:10~55Hz(sweep:1Hz/min) Direction: X/Y/Z axis for 90~100min. The battery is to be tested in three mutually perpendicular to each axis. 标准充电后，电池在以下条件下测试: 振幅: 0.8mm 振动频率: 10~55Hz(扫频:1Hz/min) 方向: X、Y、Z 三个互相垂直方向往复振动 90~100min.	No fire, no explosion, no smoking is obtained. 电池不起火,不爆炸，不冒烟
Drop Test 跌落测试	Under the temperature of 25±3℃, let the battery drop to the cement floor in free-falling from the height of 1 M, each surface of battery is falling one time, 6 times totally. 在 25±3℃的环境条件下，将电池按 1m 的跌落高度自由落体跌落于水泥地板上,电池每个面各跌落 1 次，共 6 次	No fire, no explosion, no smoking is obtained. 电池不起火,不爆炸，不冒烟

4.7Safety Performance 安全性能

Item	Condition	Criteria
Overcharge Test 过充电测试	After standard charge (Section 4.4),the battery shall be charged at 1.5C/4.6V for 8.0hrs. 标准充电后，电池用 1.5C/4.6V 恒流恒压充电 8 小时.	No fire, no explosion, no smoking is obtained. 电池不起火,不爆炸，不冒烟
Short circuiting Test 短路测试	After standard charge (Section 4.4),the battery shall be subjected to a short-circuit condition with a wire of resistance less than 100mΩ for 1 hour. 标准充电后，将接有热电偶的电池置于通风橱中，短路其正、负极，线路总电阻不大于 100mΩ，测试 1 小时	No fire, no explosion, no smoking is obtained. 电池不起火,不爆炸，不冒烟
Over discharge Test 过放电测试	After discharged to the cut-off voltage , the battery shall be subjected to a short-circuit condition with a load of resistance less than 30Ω for 24hour . 放电至截止电压后，外接小于 30Ω 的负载电阻放电 24 小时	No fire, no explosion, no smoking is obtained. 电池不起火,不爆炸，不冒烟
Heating Test2 热冲击	A battery is to be heated in a gravity convection or circulating air oven. The temperature of the oven is to be	No explosion, no fire. 电池不起火,不爆炸

	raised at a rate of 5±2℃/min to a temperature of 130±2℃ at which temperature the oven is to remain for 30 minutes before the test is discontinued. 电池放于热箱中，温度以（5±2℃）/min 的速率升至 130±2℃并保温 30min.	

4.7 Rest Period 搁置时间

Unless otherwise defined, 30min,rest period after charge,30min,rest period after discharge.
如无特殊要求，电池充放电间隔为 30min。

5. Storage and Others 贮存及其它事项

5.1 Long Time Storage 长期贮存

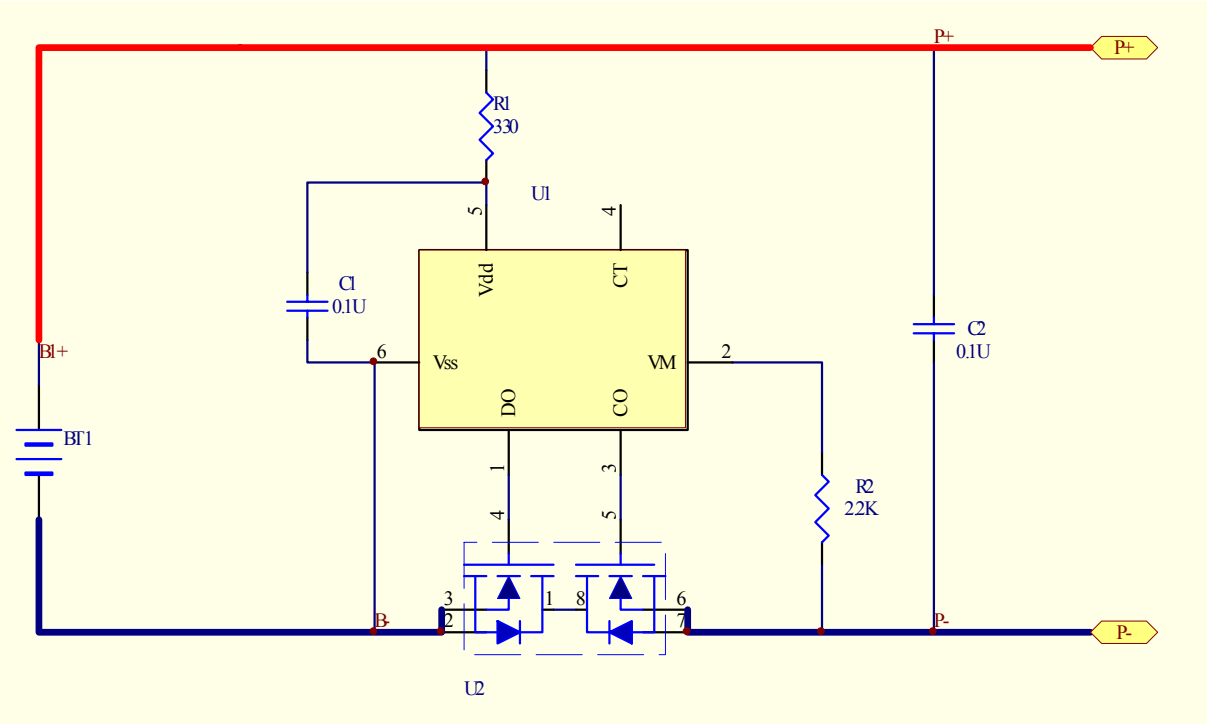
If stored for a long time(exceed three months), the cell should be stored in drying and cooling place. The cell's storage voltage should be 3.8~3.9V and the cell is to be stored in a condition as No. 4.
长期贮存的电池（超过 3 个月）须置于干燥、凉爽处。贮存电压为 3.8~3.9V 且贮存环境要求如附录 第 4 条.

5.2 Others 其它事项

Any matters that this specification does not cover should be conferred between the customer and TCL.
任何本说明书中未提及的事项，须经双方协商确定

6.Protection Circuit 保护电路

6.1 Circuit Diagram 电路原理图



6.2 PCM BOM

Item	Reference	Description	Type	Qty
1	U1	Protection IC	MM3280JB5	1
2	U2	Power Mosfet	HD8205A	1
3	R1	Resistor	330Ω±5%	1
4	R2	Resistor	2.2KΩ±5%	1
5	C1、C2	Capacitor	0.1uF±20%	2
6		pcb		1

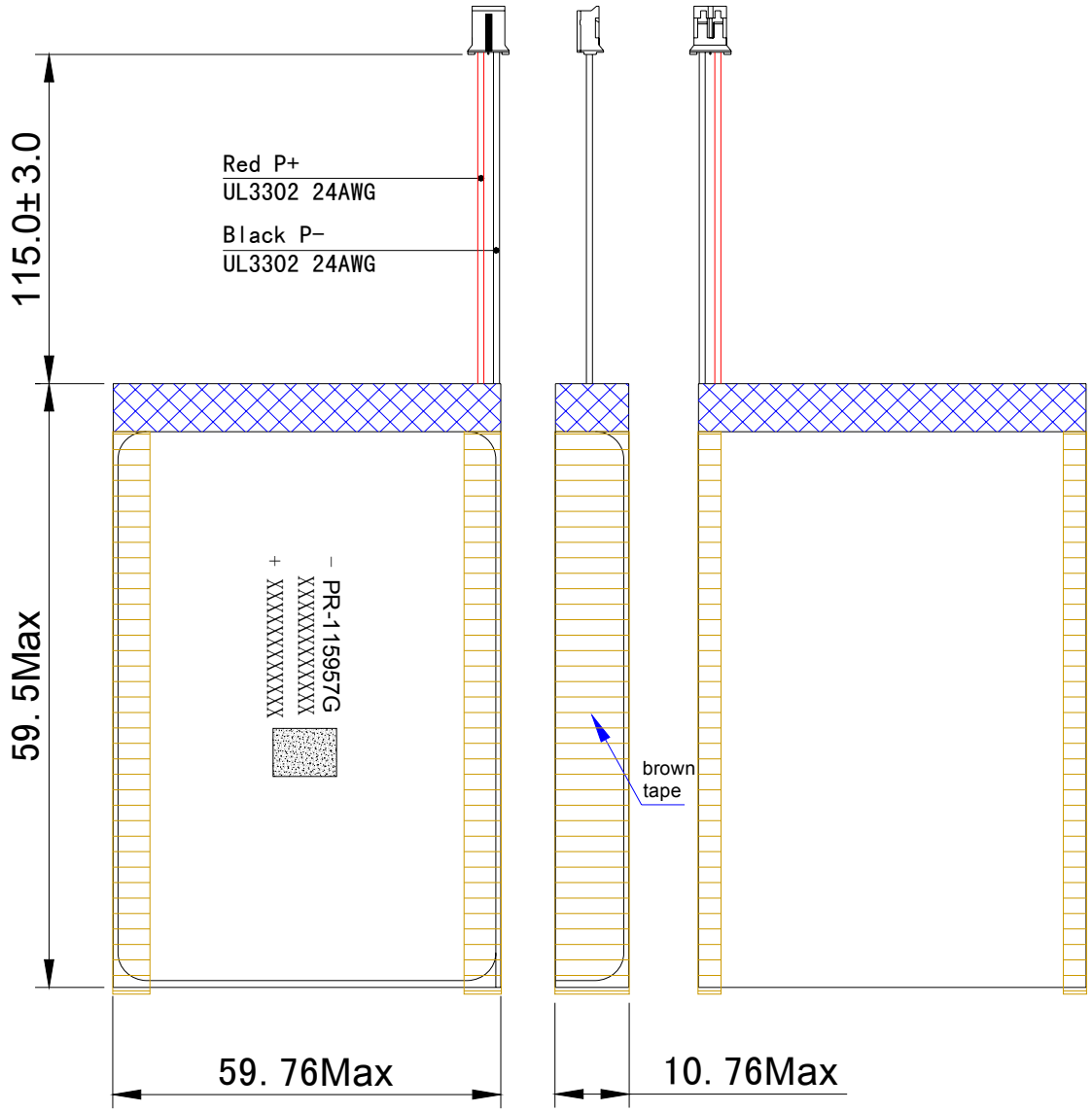
6.3 PCM parameter PCM 参数

NO	Item	Criteria
1	Over-charge Protection Voltage 过充电保护电压	4.400±0.020V
2	Over-discharge protection Voltage 过放保护电压	2.8±0.035V
3	Over-current protection Voltage 过流保护电流	3-6A
4	Operation Station Current 工作自耗电	6.0uA MAX
5	Storage Wasting Current 休眠状态自耗电	0.3uA MAX

7. Assembly Drawing 装配图纸

Rev.	Revision note	Date	Signature	Checked

Connector:JST PHR-2
Metal pin is downard, Pitch=1.25mm;
wire:UL3302 24AWG
Left is red, right is black.



After 300 cycles,the Max.thickness is 11.66mm

TCL HYPERPOWER BATTERIES INC.				
DRAW: Tianxy	DATE: 2015-07-27	SCALE:	TITLE	PR-115957G
CHECK:	MATERIAL:	VER:A/0		
APPROVAL:	FINISHED:		unit:mm	doc. number:

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 TCL Hyperpower Batteries Inc.

本文档“聚合物锂离子充电电芯操作指示及注意事项”仅适用于惠州 TCL 金能电池有限公司生产电池。

Note (1) ：声明一

The customer is requested to contact TCL Hyperpower Batteries Inc. 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.

客户若需要将电池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池，应事先联系惠州 TCL 金能电池有限公司，因为需要进行特定的实验测试以核实电池在该使用条件下的性能及安全性。

Note (2) ：声明二

TCL Hyper-power Batteries Inc. will take no responsibility for any accident when the cell is used under other conditions than those described in this Document.

对于在超出本规格书规定以外的条件下使用电池而造成的任何意外事故，惠州 TCL 金能电池有限公司概不负责。

Note (3)：声明三

TCL Hyper-power Batteries Inc. will inform, in a written form, the customer of improvement(s) regarding proper use and handling of the cell, if it is deemed necessary.

如有必要，惠州 TCL 金能电池有限公司会以书面形式告知客户有关正确操作使用电池的改进措施。

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池的充放电性能、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 (4.35V/cell). Charging beyond 4.38V, 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规定的额定电压（4.35V/电芯）。4.38V 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 range in the Product Specification.
电池必须在本规格书规定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 range specified in the Product Specification.
电池必须在本规格书规定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 3.8V 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 3.8V 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 voltage specified in the Product Specification. Also the charger shall be equipped with a device to control the recharging

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，

3.Portection 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 4.400±0. 020V

当电池中任一电芯的电压达到 4.400±0. 020V 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 2.8±0.035V Or less per cell in any cell of the battery pack. It is recommended that the dissipation current of PCM Shall be minimized to 6.0uA 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 2.8±0.035V 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 6.0uA，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

The cell shall be stored within range environmental condition of specification

电池贮存必须是在本规格书规定的环境条件范围内贮存。

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。TCL 对违反下述注意事项而产生的任何问题不予负责。

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 use any chargers other than those recommended by TCL.
— 请使用专用充电器！
— 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 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！

— Do not short-circuit the battery by connecting the negative(-) terminal to the packing foil in battery assembling.

— 电池装配中，严禁负极与包装膜短路。

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 specification of cell. Failure to do so can result in reduced performance or a shorten service life.

只能在电芯规定的条件下使用电池，否则将会降低电池的性能或缩短电池的使用寿命。

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

This specification is subject to change with prior notice.

- 本公司有权对本产品规格书进行修订，在对产品规格书修订后惠州 TCL 金能电池有限公司将会通知客户。