

## Specification

Series 系列: Li-Polymer

Model No.型号 : 502535

Capacity 容量: 440mAh

Version 版本: 01

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Customer	Company Name:	
Approval	Company Stamp:	

## 1. SCOPE 使用范围

This specification is applied to the reference battery in this specification and manufactured by ShenZhen CLN Electronics Co.,Ltd

本说明书适用于本书中所提及的深圳市佳力能电子有限公司生产的锂聚合物电池。

## 2. Product Specification 电芯规格书

No.	Item	Rated Performance		Remark
		Typical 平均容量	440mAh	
1	Rated Capacity 额定容量	Minimum 最小容量	420mAh	Standard discharge 0.2C(88mA) after Standard charge 标准充电后以 0.2C88mA 放电
2	Cell Model No. 电芯型号	502535		
3	Nominal Voltage 标称电压	3.7V		
4	End Voltage of Discharge 放电截止电压	3.0V		
5	Standard Charge Voltage 标准充电电压	4.2 ± 0.02V		
6	Initial Impedance 初始内阻	≤ 300mΩ		Internal resistance measured at 1KHz after 50% charge 半充电状态下 1KHz 交流频率测试
7	Standard Charge 标准充电	Constant Current 0.5C Constant Voltage 4.2V 0.05C Cut-off 0.5C 恒流充电到 4.2V, 再恒压充电到电流到 0.05C 截止		Charging time: approx. 4h 充电时间: 大约 4h
8	Standard Discharge 标准放电	Constant Current 0.2C, End voltage 3.0V 0.2C 恒流放电到 3.0V 电压截止		
9	Fast charge 快速充电	Constant Current 1.0C Constant Voltage 4.2V, 0.05C Cut-off 1.0C 恒流充电到 4.2V, 再恒压充电到电流到 0.05C 截止		Charging time: approx. 2h 充电时间: 大约
10	Fast discharge 快速放电	Constant Current 1.0C, End voltage 3.0V 1.0C 恒流放电到 3.0V 电压截止		

11	Max. Continuous Charge Current 最大连续充电电流	1.0CmA	
12	Max. Continuous Discharge Current 最大连续放电电流	2.0CmA	
13	Operation Temperature Range 操作温度	Charge 充电: 0~45℃	60±25%R.H.
		Discharge 放电: -20~60℃	
14	Storable Temperature Range 储存温度	1year 一年 -20~25℃	60±25%R.H.
		3months 三个月 -20~40℃	
		1week 一周 -20~60℃	
15	Weight 重量	Approx 约:12g	Battery pack 电池包
16	Dimension 尺寸	Height 高: Max.35.5mm	Battery pack 电池包
		Width 宽: Max.25.5mm	
		Thickness 厚:Max.5.2mm	

### 3. Performance And Test Conditions

#### 3.1 Standard Test Conditions 标准测试条件

Test should be conducted with new batteries within one week after shipment from our factory and the batteries shall not be cycled more than five times before the test. Unless otherwise defined, test and measurement shall be done under temperature of 20±5℃ and relative humidity of 45~85%. If it is judged that the test results are not affected by such conditions, the tests may be conducted at temperature 15~30℃ and humidity 25~85%RH.

测试必须使用出厂时间不超过一个星期的新电池，且未进行过五次以上的充放电循环。除非特别说明，否则测试会在温度 20±5℃，相对湿度 45~85%的条件下进行。如果经鉴定测试结果不受上述条件影响，测试也可以在温度 15~30℃，相对湿度 25~85%RH 的条件下进行

#### 3.2 Measuring Instrument or Apparatus 测试仪器及设备

##### 3.2.1 Dimension Measuring Instrument 尺寸测试仪器

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

尺寸测量器具的精度等级应不小于 0.01 mm precision scale of 0.01mm.

##### 3.2.2 Voltmeter 伏特计

Standard class specified in the national standard or more sensitive class having inner impedance more than 10kΩ/V

按照国家标准指定规格等级或采用灵敏度更高的，测量电压时内阻不应小于 10k Ω/V

##### 3.2.3 Ammeter 安培仪

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

按照国家标准指定规格等级或采用灵敏度更高的，包括电流表及电线在内的总外阻应小于 0.01 Ω

##### 3.2.4 Impedance Meter 内阻仪

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

内阻测试仪测量原理应为交流阻抗法（1kHz LCR）

#### 3.3 Standard Charge\Discharge(For bare battery)标准充放电（适用裸电芯）

##### 3.3.1 Standard Charge : Test procedure and its criteria are referred as follows:

标准充电：测试过程及标准如下

0.5C = 220mA

Charging shall consist of charging at a 0.5C constant current rate until the battery reaches 4.2V. The battery shall then be charged at constant voltage of 4.2V while tapering the charge current. Charging shall be terminated when the charging current has tapered to 0.05 C. Charge time: Approx 4.0h, the battery shall demonstrate no permanent degradation when charged between 0 °C and 45 °C.

电池先 0.5C 恒流充至 4.2V，当充电电流逐渐减小时再以 4.2V 恒压充至电流减小到 0.05 C，充电时间大约为 4 个小时。在 0°C-45°C 内充电电池应没有永久损害。

### 3.3.2 Standard Discharge 标准放电

0.2C = 88mA

Batterys shall be discharged at a constant current of 0.2C to 3.0V @ 20° ± 5C

电池以 0.2 C 恒流放电至 3.0V @ 20° ± 5C

### 3.3.3 If no otherwise specified, the rest time between charging and discharging around to 30min.

如果没有特别说明，电池充放电时间间隔为 30 分钟

### 3.4 Appearance 外观

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

电池外观应没有划伤、破裂、污渍、生锈、漏液等影响市场价值的缺陷存在。

### 3.5 Initial Performance Test 初始性能测试

Item 项目	Measuring Procedure 测试流程	Requirements 要求
Open-Circuit Voltage 开路电压	The open-circuit voltage shall be measured within 24 hours after standard charge. 标准充电后 24 小时内测量开路电压	≥4.08V
AC Impedance 初始交流电阻	The Impedance shall be measured in an alternating current method (1kHz LCR meter) after standard charge at 20±5°C. 半充电状态下，测量其 AC 1KHz 下的交流阻抗	≤300mΩ
Nominal Capacity 额定容量	The capacity on 0.2C discharge shall be measured after standard charge at 20±5°C. 20±5°C.标准充电后，测量 0.2C 放电容量	Discharge Capacity ≥440mAh

### 3.6 Temperature Dependence of Capacity 不同温度容量

Batterys shall be charged per 3.3.1. And discharged @0.2C to 3.0 volts. Except to be discharged at temperatures per Table 3. Batterys shall be stored for 3 hours at the test temperature prior to discharging and then shall be discharged at the test temperature. The capacity of a battery at each temperature shall be compared to the capacity achieved at 23 °C and the percentage shall be calculated. Each battery shall meet or exceed the requirements as below table

电池按 3.3.1 规定充电。按表 3 的温度中放电，电池必须先在该试验温度中放置 3 个小时。在度中的放电容量应不小于表 3 的要求

Discharge Temperature 放电温度	-10°C	0°C	23°C	60°C

Discharge Capacity (0.2 C) 放电容量 (0.2 C)	50%	80%	100%	95%
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### 3.7 Cycle Life and Leakage-Proof 循环寿命及漏液试验

No.	Item	Criteria	Test Conditions
1	Cycle Life 循环寿命 (0.5C)	Higher than 70% of the Initial Capacities of the Batterys 高于初始容量的 70%	Carry out 400cycle charging/ Discharging in the below condition. 循环 400 次, 充放电按以下条件: ◆Charge 充电:CC/CV,0.5C, 4.2V, 0.05C cut off ◆Discharge 放电:0.5C up to 3.0V ◆Rest Time 搁置:30min. ◆Temperature 温度:20±5℃
2	Leakage-Proof 漏液试验	No leakage 无泄漏 (visual inspection 目测)	After full charge, store at 60±3℃ 60±10%RH for 1 month. 标准充电条件下充满电后在温度 60±3℃, 湿度 60±10%RH 下储存一个月

## 4. Mechanical Characteristics and Safety Test 机械特性及安全测试

### Mechanical Characteristics 机械特性

Items	Test Condition and Method	Criteria
Vibration Test 振动测试	After standard charging. Fixed the battery 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 for 30minutes per axis of XYZ axis. 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 leakage No fire No explosion 不泄漏, 不起火, 不爆炸
Drop Test 跌落测试	The battery is to be dropped from a height of 1 meter twice onto concrete ground. 将标准充电后的电芯从 1 米高度跌落至混凝土地面 2 次	No leakage No fire No explosion 不泄漏, 不起火, 不爆炸

### Safety Test 安全测试

ITEM	BATTERY CONDITION	TEST METHOD 测试方法	RESULTS
Crush 挤压	Fresh, Full charged 满充电池	Crush between two flat plates. Applied force is about 13kN(1.72Mpa) for 30min. 电池放置在两块平面金属板间, 施加 13KN (1.72Mpa) 的作用力, 且持续保持 30 分钟	No leakage, No f No explosion 不泄漏, 不起火 不爆炸

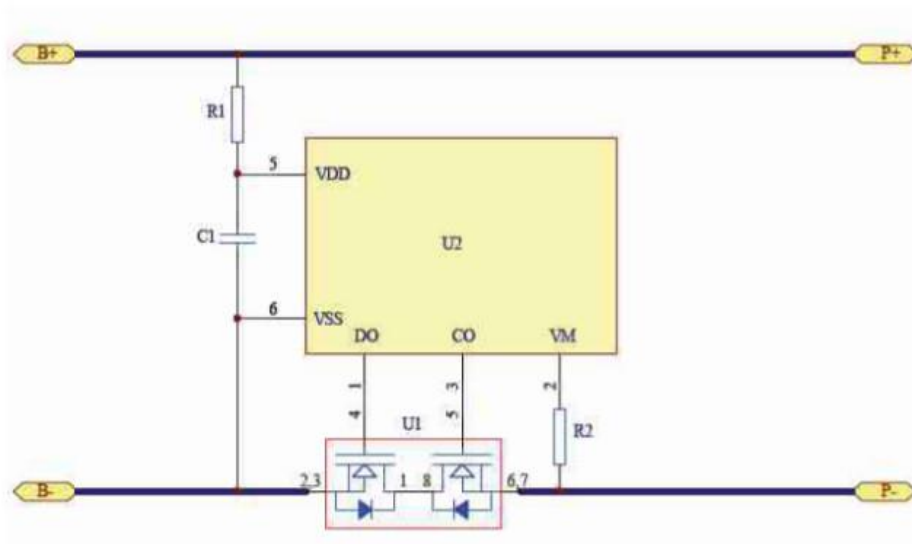
Short-Circuit 20°C 常温短路	Fresh, Full charged 满充电池	Each test sample battery, in turn, is to be short-circuited by connecting the (+) and (-) terminals of the battery with a Cu wire having a maximum resistance load of 0.1Ω. Tests are to be conducted at room temperature(20±2°C ). 在常温下约 20±2°C 依次把每个样品电池的正负极用铜线连接起来使电池外部短路--线路总电阻不超过 0.1 Ω	No leakage, No fire No explosion 不泄漏, 不起火 不爆炸
Short-Circuit 60°C 高温短路	Fresh, Full charged 满充电池	Each test sample battery, in turn, is to be short-circuited by connecting the (+) and (-) terminals of the battery with a Cu wire having a maximum resistance load of 0.1Ω. Tests are to be conducted at temperature(60±2°C ). 在常温下约 60±2°C 依次把每个样品电池的正负极用铜线连接起来使电池外部短路--线路总电阻不超过 0.1 Ω	No leakage, No fire No explosion 不泄漏, 不起火 不爆炸
Impact 冲击	Fresh, Full charged 满充电池	A 56mm diameter bar is inlayed into the bottom of a 10kg weight. And the weight is to be dropped from a height of 1m onto a sample battery and then the bar will be across the center of the sample. 用一条直径为 56mm 的圆棒放置在电池中央, 将一 10Kg 的重锤从 1m 的高度垂直落下在电池的中心位置	No leakage, No fire No explosion 不泄漏, 不起火 不爆炸
Forced Discharge 强制过放	Fresh, Full charged 满充电池	Discharge at a current of 1CmA for 2.5h. 以 1C 的电流放电 2.5 小时	No leakage, No fire No explosion 不泄漏, 不起火 不爆炸

## 5. Protection Circuit Board 保护线路板

### 5.1 基本参数规格

Name	最小	典型	最大	单位
Over Charge Detect Voltage 过充保护电压	4.25	4.30	4.35	V
Over Discharge Detect Voltage 过放保护电压	2.85	3.0	3.1	V
Excess Current 过电流	2.0	--	6.0	A
Supply Current 工作静耗			10	μ A
Internal Resistance in normal operation 内阻			70	mΩ

## 5.2 原理图



## 5.4 保护板物料清单

规格	名称	数量	备注
2110CB 或同等规格	Control IC	1	U2
8205 或同等规格	MOSFET	1	U1
100Ω (0603/0402)	Resistor	1	R1
1KΩ (0603/0402)	Resistor	1	R2
0.1μF (0603/0402)	Capacitor	1	C1

\*Possibly be substituted by other model IC

\*Lead-Free

## 6. Handling of Batterys 电池操作手册

### 6.1 Consideration of strength of film package 包装薄膜注意事项

1)Aluminium laminated film Easily damaged by sharp edge parts such as pins and needles, comparing with metal- can-cased LIB.

铝箔软包装相对于金属壳的方形电池，铝箔软包装比较容易被锐利部件刺损，如针尖、镍带

2).Sealed edge May be damaged by heat above 100°C.

封边被加热到 100°C 以上以及弯折封边都容易使封边受损.

### 6.2 Prohibition short circuit 禁止电池短路

Never make short circuit battery. It generates very high current which causes heating of the bat may cause electrolyte leakage, gassing or explosion that are very dangerous. The LIP tabs may short-circuited by putting them on conductive surface.(Such outer short circuit may lead to heat g

and damage of the battery.) An appropriate circuitry with PCM shall be employed to protect accidental short circuit of the battery pack.

避免电池短路。短路会产生很高的电流而使电池发热以及电解液泄漏，产生有毒气体或燃烧是非常危险的。极片连接在导电物体表面很容易短路，外部短路会导致发热及损害电池。选用一个适当的保护电路可以在意外短路时保护电池。

#### 6.3 Mechanical shock 机械冲击

LIP batteries have less mechanical endurance than metal-can-cased LIB. Falling, hitting, bending, etc. may cause degradation of LIP characteristics.

聚合物电池比金属壳方形电池的机械耐久性更小。

跌落、碰撞、弯曲等等都可能会降低聚合物电池的性能。

#### 6.4 Handling of tabs 极片操作注意事项

The LIP tabs are not exceedingly sturdy, especially the aluminium tabs for the terminal. Do not put much force on LIP tabs. (Aluminium tab may easily be torn off by shear force.) Do not bend tabs .

极片的机械强度并非异常坚固，特别是铝片。没有必要时禁止弯折极片

### 7. Notice for Designing Battery Pack 电池外壳设计注意事项

#### 7.1 Pack toughness 外壳坚韧度

Battery pack should have sufficient strength and the LIP battery inside should be protected from mechanical shocks.

电池外壳应该有足够的机械强度使聚合物电池免受机械撞击

#### 7.2 Battery fixing 电池固定

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

电池最大面积的一面应该固定在外壳上，安装后电池不能有松动。

#### 7.3 Inside design 内部设计

No sharp edge components should be inside the pack containing the LIP battery.

外壳内安装电池的部位不应有锋锐边

#### 7.4 Tab connection 极片连接

Ultrasonic welding is recommended for LIP tab connection method. Battery pack should be designed that shear force are not applied to the LIP tabs.

建议使用超声波或点焊焊接方法；外壳设计应使极片不受外力

#### 7.5 For mishaps 针对意外事件

Battery pack should be designed not to generate heat even when leakage occurs due to mishaps.

发生意外时外壳设计应考虑即使在电池出现漏液时也不会发热。

1) Isolate PCM (Protection Circuit Module) from leaked electrolyte as perfectly as possible.

尽量把保护电路与渗漏的电解液隔离开

2) Avoid narrow spacing between bare circuit patterns with different voltage. (Including around co

在不同的电压情况下避免出现小间距的裸露电路——包括插头周围

3) LIP battery should not have liquid from electrolyte, but in case If leaked electrolyte touches b



patterns, higher potential terminal material may dissolve and precipitate at the lower potential terminal, and may cause short circuit. The design of the PCM must have this covered.

聚合物电池不应该有来自电解液的液体，但是一旦发生电解液渗漏触及裸露电路，高电势端子材料可能会溶解然后沉淀到低电势端子，可能会造成短路。保护板的设计必须含有覆盖保护层

## 8. Notice for Assembling Battery Pack 电池装配注意事项

8.1 在电池装配过程中不允许撞击、高温或接触尖锐部分

## 9. Others 其他

9.1 Battery connection 电池连接

1) Direct soldering of wire leads or devices to the battery is strictly prohibited.

严禁直接焊接引线或设备到电池上

2) Lead tabs with pre-soldered wiring shall be spot welded to the batteries. Direct soldering may cause damage of components, such as separator and insulator, by heat generation.

极片在焊接引线之前应该先点焊到电池上，直接与电池热焊接，产生的热量会使电池的隔离体及绝缘体受损。

9.2 Prevention of short circuit within a battery pack 电池内部的短路预防

Enough insulation layers between wiring and the batteries shall be used to maintain extra safety protection.

The battery pack shall be structured with no short circuit within the battery pack, which may cause generation of smoke or firing.

在电池和引线之间应该有足够的绝缘层用于安全保护。电池的包装构成应没有导致起烟起火的短路情况

9.3 Prohibition of disassembly 禁止拆卸

1) Never disassemble the batteries the disassembling may generate internal short circuit in the battery, which may cause gassing, fining, explosion, or other problems.

不要拆卸电池，拆卸电池会发生电池内部短路，会引起起火、有害气体或者其它问题

2) Electrolyte is harmful LIP battery should not have liquid from electrolyte flowing, but in case the electrolyte come into contact with the skin, or eyes, physicians shall flush the electrolyte immediately with fresh water and medical advice is to be sought.

电解液是有毒的，万一电解液沾到皮肤、进入眼睛，应立即用清水冲洗以及求助医生

9.4 Prohibition of dumping of batteries into fire 不要把电池倾倒在火中

Never incinerate nor dispose the batteries in fire. These may cause explosion of the batteries, which is very dangerous and is prohibited.

不要焚毁电池，否则会致电池爆炸，这个很危险，必须禁止

9.5 Prohibition of batteries immersion into liquid such as water 禁止浸泡电池

The batteries shall never be soaked with liquids such as water, seawater, drinks such as soft drink, coffee or others.

请不要把电池浸泡在液体当中，像清水、海水，及非酒精饮料、果汁、咖啡或者其它的饮

9.6 Battery batteries replacement 更换电池

The battery replacement shall be done only by either batteries supplier or device supplier and neve

by the user.

更换电池应由电池生产商或设备供应商完成，用户不要自行更换

#### 9.7 Prohibition of use of damaged batteries 禁止使用损坏的电池

The batteries might be damaged during shipping by shock. If any abnormal features of the batteries are found such as damages in a plastic envelop of the battery, deformation of the battery package, smelling of an electrolyte, an electrolyte leakage and others, the batteries shall never be used any more.

The Batterys with a smell of the electrolyte or a leakage shall be placed away from fire to avoid firing or explosion.

电池可能在出货途中碰撞而受损。如果发现电池有异常，例如包装损坏、电池包裹变形，有电解液的味道、发现漏液等等，不要再使用这些电池。

电池如果有电解液的味道或者出现漏液，电池放置应该远离火源避免起火燃烧。

#### 10. Period of Warranty 保质期

The period of warranty is one year from the date of shipment. S.C Power guarantees to give a replacement in case of batteries with defects proven due to manufacturing process instead of the customers abuse and misuse.

电池的保质期从出货之日算起为一年。如果证明电池的缺陷是在制造过程中形成的而不是由于用户滥用及错误使用造成，本公司负责退换电池。

#### 11. Storing the Batteries 电池存放

The batteries should be stored at room temperature, charged to about 30% to 50% of capacity.

We recommend that batteries be charged about once per year to prevent over discharge.

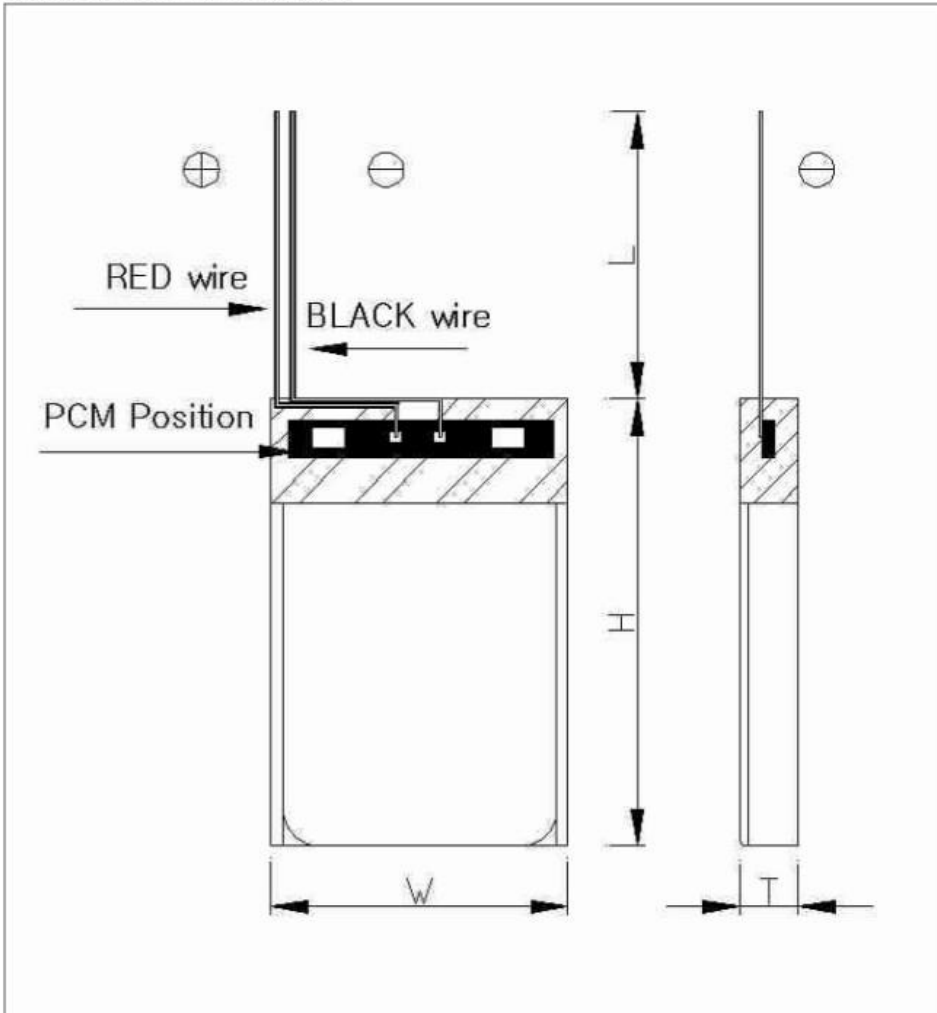
电池应当在室温下存放，应充到 30%至 50%的电量。如长时间储存，建议每半年充一次电以防止电池过放电

#### 12. Other The Chemical Reaction 其他化学反应

Because batteries utilize a chemical reaction, battery performance will deteriorate over time even if stored for a long period of time without being used. In addition, if the various usage conditions such as charge, discharge, ambient temperature, etc. are not maintained within the specified ranges the life expectancy of the battery may be shortened or the device in which the battery is used may be damaged by electrolyte leakage. If the batteries cannot maintain a charge for long periods of time, even when they are charged correctly, this may indicate it is time to change the battery.

由于电池是利用化学反应的原理，所以随时间的增加电池性能会降低，即使是存放很长一段时间而不使用。如果使用条件如充电、放电及周围环境温度等情形不在指定的使用范围内，会使缩短电池的使用寿命或者会产生漏液导致设备损坏。如果电池长周期不能充电，即使充电方法正确，也需要更换电池了！

13. Battery Pack Dimension 电池尺寸



Unit	mm		L	50±2 mm	
Wire	UL 1007#26	HOUSING	--	PCB	3817
H	35.5max.	W	25.5max.	T	5.2max.
Drawer	Checked	Approved	Date		
佳力能		502535CLN			
		CLN ID			