

Specification For Approval

客户承认书

Customer(客户名称): _____

Battery model name (电池型号) QL401015

Customer model number (客户料号): _____

Revision (版本): A0

Date (日期): 2022-06-24

Customer approval(客户承认)
Comment (备注):
Customer's signature/ Date(客户签名/日期): _____

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1.Scope

This document describes the Product Specification of the Lithium-Polymer (LIP) rechargeable battery cell supplied by QIANLANG Corporation Limited).

适用范围

本规格说明书描述了深圳市乾朗新能源科技有限公司（以下简称乾朗新能源）生产的可充电聚合物锂离子电池的产品性能指标

2.Model: QL 401015

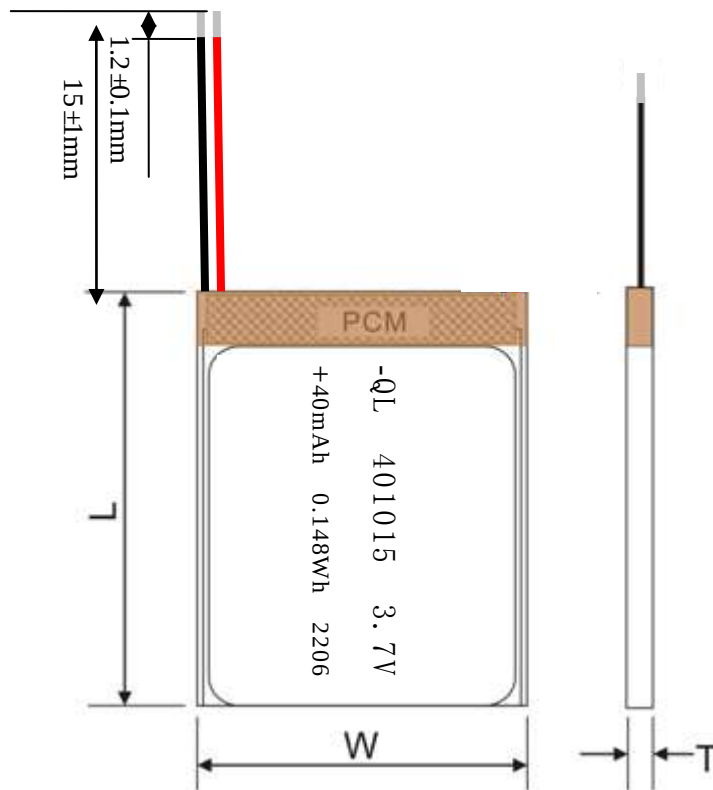
型 号: QL 401015

PCM—保护板

3.Dimensions of battery pack

电池成品尺寸 T: $\leq 4\text{mm}$ * W: $\leq 10\text{mm}$ * L $\leq 15\text{mm}$

Ltems 项目	Description 类型	Dimension and Spec 尺寸和规格
T	Thickness 厚度（不含胶纸）	4.0mm Max
W	Width 宽度（双这边）	10.0mm Max
L	Length(Withour sealant) 电芯长度 (不含极耳胶)	15.0mm MaX
B	Distance between center of 2 tabs 极耳 中心距	$2.5 \pm 2.0\text{mm}$
C	Tab width 极耳宽度	$2 \pm 0.1\text{mm}$
D	Top sealing Width 顶封宽度	$6.7 \pm 0.5\text{mm}$
E	Sealant Length 极耳胶尺寸	0.5-2.0mm
A	Tab Length 极耳长度	$8.0 \pm 1.0\text{mm}$



- Connecting Wires
接线方式
- Red: connect to “+”
红色接正极
- Black : connect to ground “ — ”
黑色接负极

4. Battery configuration 电池组成

4. Specifications of battery pack

NO	Item	criteria	Remarks
	电芯型号 Semi-manufactured cell	QL401015	
2	保护板 (PCM)	DW01+8205A	普通板
3	线材/接头 (Wire/connector)	左出线 外漏 15±1mm 1571# 线径 0.38mm	

电池组规格

No.	Item	Specifications	Comments
4.0	组装方式	单节	
4.1	Capacity (容量)	40mAh	
4.2	Impedance (内阻)	$\leq 350\text{m}\Omega$ (加板后) 常温 25℃	
4.3	Dimensions (mm) (尺寸)	≤ 4 (T) * ≤ 10.0 (W) * ≤ 15.0 (L) (mm)	
4.4	Weight (g) (重量)	约 1.05g	
4.5	Overcharge protection voltage (过充保护电压)	4.25V	
4.6	Max. charge current (最大充电电流)	1C	
4.7	Over discharge protection voltage (过放保护电压)	2.5V	
4.8	Max discharge current (最大放电电流)	1.0C	
4.9	Charge temperature (充电温度)	0℃ ~ +55℃	
4.10	Discharge temperature (放电温度)	-20℃ ~ + 55℃	
4.11	Storage temperature (储存温度)	-5℃ ~ 35℃ 推荐 (25±5℃) 贮存时应充电至容量的 40%~50%	
4.12	Storage humidity (储存湿度)	$\leq 75\%$	
4.13	成品尺寸 (加板后) Finished product size (after adding board)	3.9*9.6*14.5±0.5mm	

5. Specifications of cell

电芯规格

NO.	Items	Specifications	
1	Charge voltage 充电电压	4.2V	
2	Nominal voltage 标称电压	3.7V	
3	Nominal capacity 标称容量	40mAh 0.2C Discharge (0.2C 放电)	
	Typical capacity 典型容量	40mAh@0.2C Discharge	
4	Charge current 充电电流	Standard Charging: 0.2C 标准充电: 0.2C Rapid charge: 1.0C 快速充电: 1.0C	
5	Standard Charging method 标准充电方法	0.2C CC (constant current) charge to 4.2V, then CV (constant voltage 4.2V) charge till charge current decline to $\leq 0.02C$ 0.2C CC (恒流) 充电至 4.2V, 再 CV (恒压 4.2V) 充电直至充电电流 $\leq 0.02C$	
6	Charging time 充电时间	Standard Charging: 5.0-6.0 hours (Ref.) 标准充电: 5.0-6.0 小时 (参考值) Rapid charge: 1.0-2.0 hours (Ref.) 快速充电: 1.0-2.0 小时 (参考值)	
7	Max.charge current 最大充电电流	1.0C	
	Max.discharge current 最大放电电流	1.0C	
9	Discharge cut-off voltage 放电截止电压	2.5V	
10	Discharge temperature 放电温度	-20~+55℃	
11	Temperature range for storage 储存温度范围	less than 1 month 一个月以内	-20~+55℃
		less than 3 month 三个月以内	-20~+40℃
		less than 1 year 一年以内	0~+25℃
12	Cell Weight 电芯重量	Approx: 1.05g 约: 1.05g	
13	Cell Dimension 电芯尺寸	Length 长度: 15mm Max (not including tabs) Width 宽度: 10mm Max Thickness 厚度: 4.0mm Max	

6. Battery Cell Performance Criteria

电芯性能检查及测试

6.1 Electrical characteristics 充放电性能

O.	Items	Test Method and Condition	Criteria
1	Standard Charge 标准充电	Charging the cell initially with constant current at 0.2C and then with constant voltage at 4.2V till charge current declines to 0.02C 先用 0.2C 恒流充电至 4.2V，再恒压 4.2V 充电直至充电电流 $\leq 0.02C$	
2	Rated Capacity 初始容量	The capacity means the discharge capacity of the cell, which is measured with discharge current of 0.2C with 2.75V cut-off voltage after standard charge. 该容量是指标准充电后，0.2C 放电至 2.75V 截止电压所放出的容量。	$\geq 40\text{mAh}$
3	Cycle Life 循环寿命	Test condition: Charge: 0.2C to 4.2V Discharge: 0.2C to 2.5V 80% or more of 1 st cycle capacity at 0.2C discharge of Operation 测试条件: 充电: 0.2C 充电到 4.2V 放电: 0.2C 放电到 2.5V 当放电容量降至初始容量的 85% 时，所完成的循环次数定义为该电池的循环寿命	≥ 500 周
4	Self-discharge 自放电	After the standard charging, storied the cells under the condition as No.6.4 for 28 days, then measured the capacity with 0.2C till 3.0V 标准充电后，在 No.6.4 条件下贮存 28 天，再以 0.2C 放电至 3.0V 所放出的容量。	Residual capacity > 85% 余容量 > 85%
5	Initial impedance of cell 电芯初始内阻	(At 25°C) Internal resistance measured at AC 1KHz after 50% charge (25°C) 半充状态下，测量其 AC 1KHz 下的交流阻抗	$\leq 350\text{m}\Omega$
6	Temperature Characteristics 温度特性	1. According to item 4.1.1, at 25 $\pm$ 5°C. 2. Capacity comparison at each temperature, measured with constant discharge current 0.2C with 3.0V cut-off. Percentage as an index of the capacity compared with 100% at 25°C 1. 在 25 $\pm$ 5°C 条件下，用 4.1.1 方法将电池充电。 2. 在不同温度条件下，用 0.2C 的电流恒流放电至截止电压 3.0V。以 25°C 时放电容量为基准计算百分比。	-20°C: $\geq 50\%$ 25°C: 100% 60°C: $\geq 85\%$

6.2 Mechanical characteristics

机械特性

NO.	Items	Test Method and Condition	Criteria
1	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. 将标准充电后的电池固定在振动台上，沿 X、Y、Z 三个方向各振动 30 分钟，振幅 1.6 mm，振动频率为 10Hz~55Hz，每分钟变化为 1Hz。	No leakage 无泄漏 No fire 不起火
2	Drop Test 跌落测试	The cell is to be dropped from a height of meter twice onto concrete ground. 将标准充电后的电池从 1 米高度跌落至混凝土地面 2 次	No fire, no leakage. 无起火、无泄漏

6.3 Visual inspection

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

外观检查

不允许有任何影响电池性能的外观缺陷，诸如裂纹、裂缝、泄漏等。

6.4 Standard environmental test condition

Unless otherwise specified, all tests stated in this Product Specification are conducted at below condition:

Temperature: $25.0 \pm 5.0^{\circ}\text{C}$

Humidity: $\leq 75.0\% \text{RH}$

标准测试环境

除非特别说明，本标准书中所有测试均在以下环境条件下进行：

温度： $25.0 \pm 5.0^{\circ}\text{C}$

湿度： $\leq 75.0\% \text{RH}$

7. PCM parameter PCM 参数

7.1 PCM 参数

序号	项目		符号	检验方法及设备	检验标准			单位
					最小值	典型值	最大值	
4.1	过充保护	过充电检测电压	V_{DET1}	锂电保护板测试仪	4.275	4.3	4.325	V
		过充电检测延迟时间	tV_{DET1}	锂电保护板测试仪		200		ms
		过充电解除电压	V_{REL1}	锂电保护板测试仪	4.05	4.1	4.15	V
4.2	过放保护	过放电检测电压	V_{DET2}	锂电保护板测试仪	2.3	2.4	2.5	V
		过放电检测延迟时间	tV_{DET2}	锂电保护板测试仪		144		ms
		过放电解除电压	V_{REL2}	锂电保护板测试仪	2.8	2.9	3.0	V
4.3	过流保护	过电流检测电压	V_{DET3}	锂电保护板测试仪	0.13	0.15	0.17	V
		过电流保护电流	I_{DP}	锂电保护板测试仪	2.0	3.0	4.0	A
		检测延迟时间	tV_{DET3}	锂电保护板测试仪		9		ms
4.4	短路保护	检测延迟时间	T_{SHORT}	锂电保护板测试仪		320		μS
		保护解除条件		万用表	断开外部短路负载或充电恢复			
4.5	内阻	主回路通态电阻	R_{DS}	锂电保护板测试仪	30	40	65	m Ω
4.6	消耗电流	通常工作时消耗电流	I_{DD}	锂电保护板测试仪	1.0	3.5	7.0	μA
4.7	静态电流	休眠时消耗电流	I_{PWN}	锂电保护板测试仪			0.1	μA
4.8	识别电阻	T 端电阻值	R_S	万用表				K Ω
4.9	NTC 电阻	S 端电阻值	R_T	万用表				K Ω
4.10	码片	码片数据类型	ROM	锂电保护板测试仪 或读码器				

注：以上测试环境均为25℃所测出的值,非常温下可能有所不同,该电路的工作温度范围为-40--85℃,具体测试条件及测试电路请参照保护IC之规格书。

7.2 PCB component list

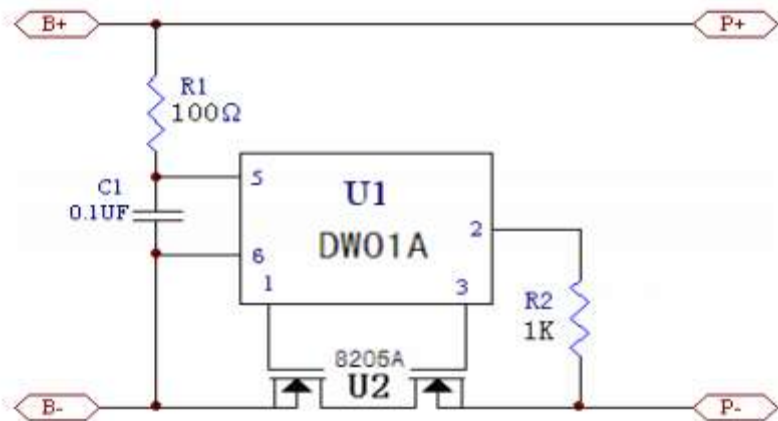
保护板主要元件清单

序号	物料名称	物料代号	物料规格	用量	厂商/备注
1	保护 IC	U1	DW01/SOT23-6	1	德普威
2	MOSFET	U2	8205A/SOT23-6	1	德普威
3	贴片电阻	R1	100 Ω $\pm$ 5%/0603	1	华新科
4	贴片电阻	R2	1K Ω $\pm$ 5%/0603	1	华新科
6	贴片电容	C1	0.1 μ F -20%/+80%25V/0402	1	华新科
7	镍片	B+/B-	5.0*3.0*0.3	2	XBL
8	底板尺寸		6*3.5*0.6mm	1	佳万通达

备注：板长公差 $\pm$ 0.1mm 板宽公差 $\pm$ 0.1

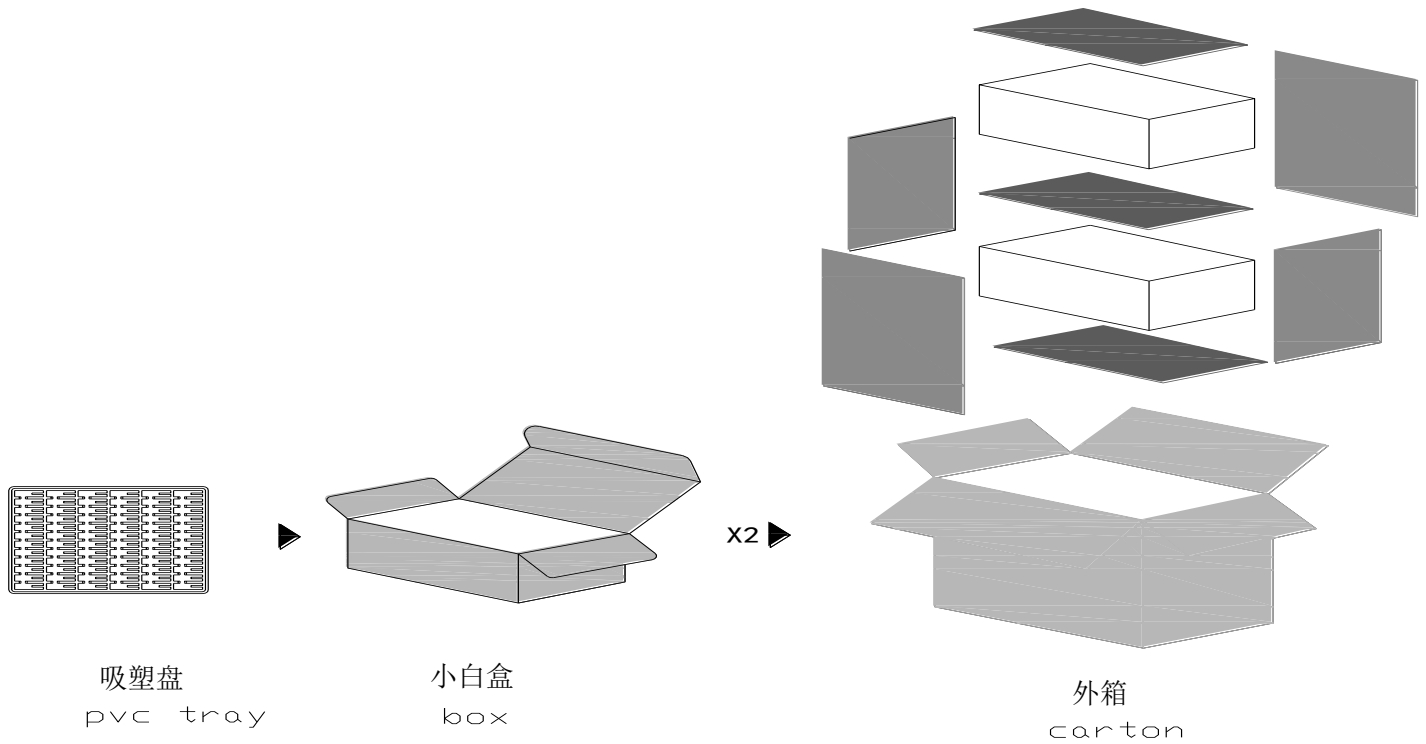
7.3 Application Schematic

应用原理图



8. Packaging、Storage and Transportation 包装、储存及运输

8.1 Packaging model



8.2 Storage 储存:

8.2.1 The Li-ion battery pack should be stored in a cool, dry and well-ventilated area, and should be far from the fire and the high temperature.

锂电池需保存在阴凉，干燥，通风的环境中，避免接触火源与热源。

8.2.2 The battery should store in the product specification book stipulation temperature range, the best storage temp. is 0 to 25°C. The best humidity is 60±25%.

电池需按规格书规定温度范围进行储存，最佳储存温度为 0 到 25°C，最佳湿度为 60±25%。

8.2.3 The battery should be stored within room temperature, and charged to 40%~60% electric quantity. In order to avoid over-discharge, we suggest charge the batteries every three months. If stored over one year, we suggest activate the battery as per standard charge-discharge method.

电池应当在室温下存放，应充到 40%至 60%的电量。为防止电池过放，建议每 3 个月按标准充电方式进行一次充电，如储存时间超过一年，建议每年按标准充放电方式进行一次充、放电循环以激活电池。

8.3 Transportation 运输:

8.3.1 Do not mix the battery products with other cargos.

请勿与其他货物混合。

8.3.2 Do not immerse the battery products in water or allow it to get wet.

请勿将电池浸入水中或使其受潮。

8.3.3 Do not over 7 layers staking and upside-down.

请勿叠放超过 7 层或倒置。

8.3.4 The highest temperature in transportation is lower than 65°C.

最高运输温度不超过 65°C。

9. Use Attentions 使用注意事项:

To ensure proper use of the battery please read the manual carefully before using it.

为确保电池正确使用，请在使用之前阅读使用说明书。

9.1 Warnings 警告:

9.1.1 Do not expose to, dispose of the battery in fire.

不可将电池置于火中。

9.1.2 Do not put the battery in a charger or equipment with wrong terminals connected.

不可将电池充电器正负极反接。

9.1.3 Avoid shorting the battery.

不可将电池短路(P+、P-)。

9.1.4 Avoid excessive physical shock or vibration.

避免电池过度冲击和震荡。

9.1.5 Do not disassemble or deform the battery.

不可拆解或扭曲电池。

9.1.6 Do not immerse in water.

不可浸入水中。

9.1.7 Do not use the battery mixed with other different type or model batteries.

不可将该电池与其他种类和型号的电池混用。

9.1.8 Keep out of the reach of children.

请置于儿童接触不到的地方。

9.2 Charge 充电:

9.2.1 Battery must be charged in appropriate charger only.

请使用合适的充电器对电池充电。

9.2.2 Never use a modified or damaged charger.

请勿用返修或损坏过的充电器充电。

9.2.3 Do not leave battery in charger over 24 hours.

请勿对电池充电 24H 以上。

9.2.4 Charging current: Can not surpass the biggest charging current which in this specification book stipulated.

不可使用超出本规格书最大充电电流对电池进行充电。

9.2.5 Charging voltage: Does not have to surpass the highest amount which in this specification book stipulated to decide the voltage.

充电电压：请不要超出本规格书所规定最高充电电压。

9.2.6 Charge temperature: The battery must carry on the charge in the ambient temperature scope which this specification book stipulated.

充电温度：电池需在指定温度范围内进行充放电。

9.2.7 Uses constant current and constant voltage way charge. PLS connect the positive and negative terminals in right way, or the battery may be damaged.

请使用恒流恒压方式进行充电。请勿反接正负极，以免损坏电池。

9.2.8 The battery must be stored after charged, and should be charged and discharged once every 3 months.

电池必须带电储存，并且每三个月进行充放电一次。

9.3 Discharge 放电:

9.3.1 The discharging current should not surpass the biggest discharging current this specification book stipulation, The large discharge current can cause heat and lower capacity.

放电电流不可超过规格书最大额定放电电流。大电流会导致电池发热和容量降低。

9.3.2 Discharge temperature: The battery discharge must carry on in the ambient temperature scope which this specification book stipulated.

放电温度：电池必须在规格书规定温度范围内放电。

9.3.3 Over-discharge: After short time over discharge, then charge immediately won't damage the battery. But the battery will be damaged for being long time over discharged. During long-term storage, the battery may be within over-discharging condition for self discharge. To prevent the occurrence of over discharging, the battery should maintain the certain capacity when storage.

过放电：电池瞬间过放后立即充电不会损坏电池。但是如果长时间过放，电池将会被损坏。在长期储存中，可能由于电池自放电而导致电池处于过放状态。因此为避免电池过放，必须带电储存。

9.4 Handling of Cells 电池操作注意事项

1 Soft Al foil (铝箔软包装)

- Don't strike battery with any sharp edge parts 勿用尖锐处撞击电池。
- Trim your nail or wear glove before taking battery 剪掉指甲，或者戴手套。
- Clean worktable to make sure no any sharp particle 清理工作台，避免尖锐零部件。

2 Sealed edge may be damaged by heat above 100 ℃, bend or fold sealed edge.

封边被加热到 100 ℃ 以上以及弯折封边都容易使封边受损。

3 Handling of Tabs (极耳操作注意事项)

The battery tabs are not so stubborn especially for aluminous tab.

Do not bend tabs unnecessarily.

极耳的机械强度并非异常坚固，特别是铝极耳。没有必要时禁止弯折极耳。

4 Tab Connection (极耳连接)

Ultrasonic welding or spot welding is recommended for LIP tab connection method.

Battery pack should be designed that shear force are not applied to the LIP tabs.

If apply manual solder method to connect tab with PCM, below notice is very important to ensure battery performance:

- The solder iron should be temperature controlled and ESD safe;
- Soldering temperature should not exceed 370 ℃;
- Soldering time should not be longer than 3s;
- Soldering times should not exceed 5 times, Keep battery tab cold down before next time soldering;
- Directly heat cell body is strictly prohibited, Battery may be damaged by heat above approx. 100 ℃

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。

如果使用人工焊接保护板，下面的注意事项对于确保电池性能非常重要：

- 焊接铬铁的温度必须可控且可防静电；
- 焊接时铬铁的温度不能超过 370℃；
- 焊锡时间不能超过 3 秒钟；
- 焊锡次数不能超过 5 次，待极片冷却后才能进行下一次焊锡；
- 严禁直接加热电芯，高于 100℃度会损害电芯。

9.5 Disposal 处理措施:

Regulations vary for different countries. Dispose of in accordance with local regulations.

不同国家有不同规定。请按当地规定进行处理。

9.6 Note:

Any other items which are not covered in this specification shall be agreed by both parties.

规格书所未包含的其它条款由双方协议解决。