



# Rechargeable Lithium-ion Battery Specification Approval

DOC NO.: ZJ-PS-03767

REV. : A07

SHEET : 1 OF 19

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For any details and enquiry, please contact VDL ; Tel:0755-29961201,Fax:0755-29961203

## VDL SPECIFICATION APPROVAL SHEET

### VDL 产品承认书

Customer Name 客户代码: 0473

Customer Product Model 客户产品型号:

Product Model 产品型号: 432932

Product Capacity 产品容量: 490mAh/3.8V

Product Code 产品编码:

Assembly Plant Code 组装厂编码:

Terminal Code 终端编码:

| Prepared by 制作 | Checked by 审核 | Approved by 批准 |
|----------------|---------------|----------------|
| 熊鑫             | 田芳/刘江伟/陈海异    | 刘圣军            |

| Approved by<br>customer<br>客户承认<br>(Stamp)<br>(盖章) | Tested by 测试 | Checked by 审核 | Approved by 批准 |
|----------------------------------------------------|--------------|---------------|----------------|
|                                                    |              |               |                |

#### 重庆市紫建电子股份有限公司

Chongqing VDL Electronics Co., LTD.

地址：重庆市开州区赵家街道浦里工业新区 1-4 号楼 邮编:405401

Add : Building 1-4, Puli Industrial New Area, Zhaojia Street, Kaizhou District, Chongqing, China

电话(Tel):023-5297 7888 传真(Fax):023-5297 5969

#### 深圳市维都利电子有限公司

Shenzhen VDL Electronics Co., LTD.

销售中心地址：深圳市宝安区卓越时代广场 C2903 邮编:518100

Add : C2903, Times Square Excellence, Bao'an District, Shenzhen , China. Post: 518100

销售中心电话(Tel):0755-2996 1201 ( 10 线 ) 传真(Fax):0755-2996 1203

网址(Web) : [www.gdvdl.com](http://www.gdvdl.com) 邮箱(E-mail) : [vd1@gdvdl.com](mailto:vd1@gdvdl.com) : 2355313400**VDL® 业界领先的聚合物锂电池制造商**



Rechargeable Lithium-ion  
Battery Specification Approval

DOC NO.: ZJ-PS-03767  
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Revision History  
版本履历表

| Revision<br>版本 | Description<br>内容描述                                                                                                             | Modify<br>修改人 | Approval<br>审批人 | Date<br>日期 |
|----------------|---------------------------------------------------------------------------------------------------------------------------------|---------------|-----------------|------------|
| A01            | First Issue 新版发行                                                                                                                | 熊鑫            | 刘圣军             | 2023-12-27 |
| A02            | 客户有 IEC62133 与 IEC62368 认证需求<br>1. 保护板方案由 XBR5152JS+PTC+10K NTC 更改为 XBGL6156JS+10K NTC<br>2. 电池全包高温胶<br>3. 电池内阻由 250mΩ更改为 220mΩ | 余江涛           | 刘圣军             | 2024-02-27 |
| A03            | 1.保护板方案由 XBGL6156JS+10K NTC 更改为 XBD58615JS+PTC+10K NTC<br>2.电池内阻由 220mΩ更改为 250mΩ                                                | 余江涛           | 刘圣军             | 2024-03-01 |
| A04            | 1.NTC 由 10K±1% B=3435 , 变更为 10K±1% B=3380 (NCP15XH103F03RC)<br>2.去除电子线,改为端子线 50801H00-3P,UL10064-28#                            | 余江涛           | 刘圣军             | 2024-03-28 |
| A05            | 客户需求端子线加胶固定线序                                                                                                                   | 余江涛           | 刘圣军             | 2024-05-05 |
| A06            | 增加保护板 layout                                                                                                                    | 余江涛           | 刘圣军             | 2024-05-24 |
| A07            | 1.增加电池重量约 8.76g<br>2.增加电子标签 ,<br>3.增加材料 UL 号<br>4.电池正面增加 CE 喷码 ,背面增加 3C 与 KC 喷码 ,规格书增加相关信息                                      | 余江涛           | 刘圣军             | 2024-05-28 |
|                |                                                                                                                                 |               |                 |            |

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## 1. Scope 概述

The specification shall be applied to Rechargeable Li-ion Battery pack manufactured by **VDL Electronics Co., LTD**. It is the basis for product design, production and inspection. Its purpose is to let the customer know the quality standard and the instruction.

本产品承认书描述重庆市紫建电子股份有限公司设计制造的可充式锂离子电池组，它是产品设计、生产和检验的依据。其作用是让客户了解产品的质量标准和正确使用方法。

## Reference standard 参考标准：

GB/T 31241-2022 《便携式电子产品用锂离子电池和电池组 安全技术规范》

IEC/EN61960 欧盟便携式二次电芯和电池的性能标准

UL1642 美国锂电池安全标准

## 2.Product basic information 产品基本信息：

| No. | Items 项目                                  | Parameter 参数                                  |
|-----|-------------------------------------------|-----------------------------------------------|
| 1   | Battery model 电池型号                        | 432932                                        |
| 2   | Design scheme 保护电路设计方案                    | XBD58615JS+PTC+10K NTC                        |
| 3   | Minimal capacity 最小容量                     | 490mAh ( 0.2C Standard discharge 0.2C标准放电 )   |
| 4   | Rated Capacity 额定容量                       | 490mAh                                        |
| 5   | Typical capacity 典型容量                     | 510mAh ( 0.2C Standard discharge 0.2C标准放电 )   |
| 6   | Nominal voltage 标称电压                      | 3.8V                                          |
| 7   | Shipment voltage 出货电压                     | 3.80~3.95V                                    |
| 8   | Charge ending voltage 充电限制电压              | 4.35V                                         |
| 9   | Charge upper limit voltage 充电上限电压         | 4.35V                                         |
| 10  | Discharge ending voltage 放电终止电压           | 3.0V                                          |
| 11  | Discharge Cut-off Voltage 放电截止电压          | 2.7V                                          |
| 12  | Over current protection 过电流保护             | 1.05-1.95A                                    |
| 13  | Short circuit protection 短路保护功能           | 有 Yes                                         |
| 14  | AC Impedance 内阻                           | ≤250mΩ (详见9.4项 / Detail in 9.4)               |
| 15  | Battery Weight 电池组重量                      | About 约：8.76g                                 |
| 16  | Recommended discharging current<br>推荐放电电流 | 0.2C(详见9.1.2项 / Detail in 9.1.2)              |
| 17  | Max discharge current 最大放电电流              | 1.5C ( 连续放电模式 For continuous discharge mode ) |
| 18  | Recommended charging current<br>推荐充电电流    | 0.5C(详见9.1.1项 / Detail in 9.1.1)              |
| 19  | Max charge current 最大充电电流                 | 1.1C ( 连续充电模式 For continuous charge mode )    |



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|    |                                                         |                               |
|----|---------------------------------------------------------|-------------------------------|
| 20 | Upper limited charging temperature<br>上限充电温度            | 50°C(详见7.1项 / Detail in 7.1)  |
| 21 | Lower limited charging temperature<br>下限充电温度            | 0°C(详见7.1项 / Detail in 7.1)   |
| 22 | Upper limited discharging temperature<br>上限放电温度         | 60°C(详见7.2项 / Detail in 7.2)  |
| 23 | Lower limited discharging temperature<br>下限放电温度         | -20°C(详见7.2项 / Detail in 7.2) |
| 24 | Over voltage charge protection voltage<br>过压充电保护电压      | (4.425±0.025)V                |
| 25 | Over current charging protects the<br>current过流充电保护电流   | 1.05-1.95A                    |
| 26 | Under voltage discharge protection<br>voltage欠压放电保护电压   | (2.8±0.1)V                    |
| 27 | Over current discharge protects the<br>current 过流放电保护电流 | 1.05-1.95A                    |

## 3 . Battery protection characteristics 电池保护特性(Ta=25°C)

| No. | Items 项 目                                            | Parameter 参 数  | condition 条件                                                                                                                                                                                    |
|-----|------------------------------------------------------|----------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1   | Overcharge protection detection voltage 过充保护检测电压     | (4.425±0.025)V | Battery voltage is greater than the protection voltage, and the delay time to reach, then the state of the battery into overcharge protection.<br>电池电压大于过充保护电压,且延时时间达到,则电池进入过充电保护状态。            |
| 2   | Overcharge release voltage 过充保护恢复电压                  | (4.25±0.05)V   |                                                                                                                                                                                                 |
| 3   | Overcharge protection delay time 过充保护延迟时间            | 70-250 ms      |                                                                                                                                                                                                 |
| 4   | Overdischarge protection detection voltage 过放保护检测电压  | (2.8±0.1)V     | Battery voltage is less than the protection voltage, and the delaytime to reach, then the state of the battery into overdischarge protection.<br>电池电压小于过放保护电压,且延时时间达到,则电池进入过放电保护状态。             |
| 5   | Overdischarge release voltage 过放保护恢复电压               | 3.0±0.1V       |                                                                                                                                                                                                 |
| 6   | Over discharge protection delaytime 过放保护延迟时间         | 15-65ms        |                                                                                                                                                                                                 |
| 7   | Overcurrent discharge protection current 放电过流保护电流    | 1.05-1.95A     | Battery discharge current is greater than the protection current, and the delay time to reach, then the state of the battery into overcurrent protection<br>电池放电电流大于过流保护,且延时时间达到,则电池进入放电过流保护状态。 |
| 8   | Overcurrent protection delay time 放电过流保护延时时间         | 5-20 ms        |                                                                                                                                                                                                 |
| 9   | Current consumption (Operation) of PCM 保护板的正常状态下静态电流 | ≤1.5μA         | VDD= 3.9V                                                                                                                                                                                       |
| 10  | Load resistance of PCM 保护板的空载内阻                      | 25-100mΩ       | VDD= 3.9V                                                                                                                                                                                       |
| 11  | 0V charge function 0V充电功能                            | Available允许    | 当Cell过放到0V时,正极表面会有析铜现象,再次充放电,会对电池的可靠性和寿命有一定的影响                                                                                                                                                  |
| 12  | Charge overcurrent protection current 充电过流保护电流       | 1.05-1.95A     | If shall stop charging for an excessive charge current at Over Current Protection current lasts for delay time 电池充电电流大于充电过流保护电流,且延时时间达到,则电池进入充电过流保护状态。                                          |
| 13  | Charge overcurrent delay time 充电过流延迟时间               | 5-20 ms        |                                                                                                                                                                                                 |
| 14  | Load Short-Circuiting Detection Delay Time 短路延时      | 50-550us       |                                                                                                                                                                                                 |

## 4 . Condition adapting characteristics 环境适应性 ( n=1 )

| No. | Items 项目                             | Test Method 测试方法                                                                                                                                                                                                                                                                                                                                                     | Criteria 标准                                                                                |
|-----|--------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------|
| 1   | High/low Temperature<br>高/低温性能       | After the cell fully charged at $23^{\circ}\text{C} \pm 2^{\circ}\text{C}$ , measure the discharging capacity with discharging current 0.2C till 3.0 (V) cut off voltage at different temperature. (as compared with initial capacity )<br>在 $23^{\circ}\text{C} \pm 2^{\circ}\text{C}$ 条件下满充电后 ,测量电池在不同温度下用 0.2 C <sub>5</sub> A 电流放电至 3.0 (V)所放出的容量 ( 与初始容量作为比较 )。 | 在-10℃时 ≥70%<br>At -10℃: ≥70%<br>在 55℃时 ≥95%<br>At 55℃:≥95%                                 |
| 2   | Invariableness humid and hot<br>恒定湿热 | After putting the cell in the invariableness humid and hot box of $40^{\circ}\text{C} \pm 2^{\circ}\text{C}$ and relative humidity of 90 ~ 95% for 48 hours. Discharge the cell to 3.0*n(V) cut-off voltage at 0.2C current.<br>将电池放入 $40^{\circ}\text{C} \pm 2^{\circ}\text{C}$ 及相对湿度为 90 ~ 95% 的恒温恒湿箱中 48 小时后, 再以 0.2C 电流放电至 3.0*n(V)。                             | No leakage, no fire, no explosion. The discharging time ≥3h.<br>无泄漏, 无起火, 无爆炸。<br>放电时间≥3h。 |
| 3   | Vibration<br>振动                      | The fully charged cell is vibrated from 90 to 100 minutes at three mutually perpendicular planes with excursion of 0.8mm, and change the frequency from 10 to 55 HZ with 1Hz/min speed.<br>满充电后的电池在三个相互垂直的方向按振幅 0.8mm 的谐振形式进行振动, 频率在 10-55HZ 以 1Hz/min 的速率变化, 往复振动 90 至 100min.                                                                                      | No leakage, no fire, no explosion.<br>电池无漏液,无冒烟, 无起火, 无爆炸                                  |
| 4   | Free fall<br>自由跌落                    | The cell free falls from a height of 1m into the cement floor from X,Y,Z front and opposite direction of each direction. Then discharge the cell to 3.0*n(V) cut-off voltage with 1.0C current.<br>电池将从 1 米高处自由跌落到水泥地板上, 从 X、Y、Z 正反方向每个方向自由跌落一次,再以 1.0C 放电至 3.0 (V)                                                                                                  | No leakage, no fire, no explosion.<br>电池无漏液,无冒烟, 无起火, 无爆炸                                  |

## 5 . Safety performance 安全性能 ( n=1 )

| No. | Items 项目                 | Test Method 测试方法                                                                                                                                                                                                                                                                                                                                                                           | Criteria 标准                                                                                                     |
|-----|--------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------|
| 1   | Forced discharge<br>强制放电 | Discharge the cell to the cut-off voltage with 0.2C current and then reverse charge the cell for more than 90 mins with 1C current. 电池先以 0.2C 放电至终止电压，再以 1C 电流，对电池进行反向充电，90min 以上                                                                                                                                                                                                          | No fire, no explosion<br>无起火，无爆炸                                                                                |
| 2   | Overcharge<br>过充电        | After discharged with 0.2C to the cut-off voltage, charge the cell with 3.0C/4.6V for 7.0hrs.<br>0.2C 放电至截止电压后，电池用 3C /4.6V 恒流恒压充电 7.0h                                                                                                                                                                                                                                                    | No explosion, no fire<br>无起火、无爆炸                                                                                |
| 3   | Low pressure<br>低气压      | Put the fully charged cell in a vacuum chamber at ambient temperature 20~25°C for 6 hrs. The vacuum environment pressure is set to be less than 11.6kPa, simulating an altitude of 15240m.<br>电池放在一个模拟真空的空间放置 6 小时，环境温度为 20~25°C，真空环境压力≤11.6kpa，模拟 15240m 高空低压环境                                                                                                                           | No leakage, no fire, no explosion<br>无泄漏，不起火，不爆炸                                                                |
| 4   | Short test<br>短路测试       | Short circuit the fully charged cell by connecting the positive and negative terminals with resistance load 80±20 mΩ at room temperature 20~25°C. The cell remains on test for 24 hrs or until the surface temperature declines by 20 % of the maximum temperature rise, whichever is the sooner.<br>在室温 20~25°C 下，把充满电电池的正负极用 80±20 mΩ 的负载连接起来，使电池外部短路。结束条件：测试时间 24 小时或者表面温度下降到最高温度的 20%。 | No fire, no explosion.<br>The temperature of the cell surface not exceeds 150°C.<br>无起火，无爆炸<br>电池表面温度不超过 150°C。 |

|   |                    |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                                                  |
|---|--------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------|
| 5 | Soak test<br>浸泡测试  | Put the fully charged cell into pure water, soaked for 24 hours.<br>把满充电的电池放进清水中浸泡 24 小时                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | No broken, no fire<br>无破裂，无起火                    |
| 6 | Crush test<br>挤压测试 | A fully charged cell is to be crushed between two flat surfaces. The force for the crushing is to be applied by a hydraulic ram or similar force mechanism. The flat surfaces are to be brought in contact with the cell and the crushing is to be continued until an applied force of $13 \pm 1\text{kN}$ is reached. Once the maximum force has been obtained it is to be released.<br>满充电电池，放置在两块平面金属板间，持续施压 $13 \pm 1\text{kN}$ 的压力，直到液压油缸施加的压力达到 $13\text{kN}$ ( $17.2\text{Mpa}$ ) 时停止。                                                                                                                                                                                                                                                                                                                  | No fire, no explosion<br>无起火，无爆炸                 |
| 7 | Shock test<br>撞击测试 | The cell is to be secured to the testing machine by means of a rigid mount which supports all mounting surfaces of the cell. Each cell shall be subjected to a total of three shocks of equal magnitude. The shocks are to be applied in each of three mutually perpendicular directions unless it has only two axes of symmetry in which case only two directions shall be tested. Each shock is to be applied in a direction normal to the face of the cell. For each shock the cell is to be accelerated in such a manner that during the initial 3ms the minimum average acceleration is 75 g (where g is the local acceleration due to gravity). The peak acceleration shall be between 125 and 175 g.<br>在环境温度下，将电池分别按三个轴向固定在测试台面上，每个面经受等量的冲击，每一次冲击前 3ms 内平均加速度最少达到 75g( g 为重力加速度 ) ,峰值加速度达 125g 至 175g。 | No leakage, no fire, no explosion<br>无泄漏，不起火，不爆炸 |

**6. Testing requirements 测试要求****6.1 Battery test environment 电池试验环境**（无特别注明时，试验环境应符合此项要求）

Temperature 温度：25°C±3°C

Relative humidity 相对湿度：45 ~ 85% RH

Atmospheric pressure 大气压力：86 ~ 106 kPa

**6.2 Measuring instrumentation requirements 测量仪表要求**

Voltage instrumentation requirements: Measuring the voltage meter accuracy no less than 0.5 magnitude

电压仪表要求：测量电压的仪表的精确度不低于 0.5 级

Current instrumentation requirements: Measuring the current meter accuracy no less than 0.5 magnitude

电流仪表要求：测量电流的仪表精确度不低于 0.5 级

Time instrumentation requirements: Measuring the time meter accuracy no less than 0.1%

时间仪表要求：测量时间的仪表精确度不低于 0.1%

Temperature instrumentation requirements: Measuring the temperature meter accuracy no less than 0.5 °C

温度仪表要求：测量温度的仪表准确度不低于 0.5°C

Impedance instrumentation requirements: Measuring impedance should by sinusoidal alternating (1 KHZ) test

内阻仪表要求：测量内阻应由正弦交变(1KHZ)进行测试

**7 . Operation temperature and humidity range 运行温湿度范围****7.1 Charging temperature and the Current requirements 充电环境温度及电流要求:**

| Temperature<br>温度 | Max charge current<br>允许最大充电电流 | Maximum relative humidity<br>最大相对湿度 |
|-------------------|--------------------------------|-------------------------------------|
| 0°C≤T≤15°C        | 0.22C(截止电压4.35V)               | 90%                                 |
| 15°C < T≤45°C     | 1.1C(截止电压4.35V)                | 90%                                 |
| 45°C < T≤50°C     | 0.22C(截止电压4.2V)                | 90%                                 |

**7.2 Discharge temperature 放电环境温度:**

-20°C ~ +60°C , Maximum relative humidity : 90%

-20°C ~ +60°C , 最大相对湿度：90%

**8 . Storage temperature and humidity range(At 50% SOC)存储温湿度范围(在 50% SOC 条件下)**

## 8.1 Environmental conditions 存放条件；；

Unless otherwise specified, Cells shall to be tested within one month after shipment and not be cycled (charge/discharge) over one time before the test. All tests shall be performed at  $23\pm 2^{\circ}\text{C}$  and humidity of  $65\pm 20\%$  RH.

The lithium iron cell impedance would increase in whole storage process, while the capacity would decrease, cell would be charged in 9.1.1 and discharged in 9.1.2

除非另有规定，电池应在装运后一个月进行测试，且在测试前一段时间内不得循环(充放电)。所有试验均在  $23\pm 2^{\circ}\text{C}$ 、 $65\pm 20\%$  RH 湿度下进行。锂电池在整个存储过程中阻抗会增大，容量会减小，电池在 9.1.1 条件下进行充电，在 9.1.2 条件下进行放电。

|                                        |             |        |             |         |             |        |
|----------------------------------------|-------------|--------|-------------|---------|-------------|--------|
| Storage Temperature                    | 23°C        | 23°C   | 23°C        | 23°C    | 60°C        | 60°C   |
| Storage Duration                       | 1 Year      | 1 Year | 90 Days     | 90 Days | 1 Week      | 1 Week |
| Storage Charge State                   | As received | 100%   | As received | 100%    | As received | 100%   |
| Recovered Capacity                     | 90%         | 80%    | 95%         | 90%     | 85%         | 80%    |
| Recovered Impedance @100% Charge State | 150%        | 150%   | 120%        | 150%    | 150%        | 160%   |

## 9 . Electrical Characteristics 电气特性

## 9.1 Battery standard charge/discharge 电池组标准充/放电

## 9.1.1 standard charge 标准充电

At  $25^{\circ}\text{C}\pm 3^{\circ}\text{C}$  conditions, CC 0.5C/CV 4.35V, when charging current drops to 0.02C charging is terminated, The charging time limited 4hrs.

在  $25^{\circ}\text{C}\pm 3^{\circ}\text{C}$  条件下，以 0.5C 恒电流，4.35V 恒电压充电至电流降到 0.02C 截止，限时 4 小时。

## 9.1.2 Standard Discharge 标准放电

Standard discharge current 0.2C for continuous discharge, when the voltage drops to discharge cut-off voltage 3.0V discharge is terminated, shall be full discharged.

以标准放电电流 0.2C 进行持续放电，当电压降至放电截止电压 3.0V 时放电被终止，即为放空。

## 9.2 Maximum charge current 最大充电电流

At  $25^{\circ}\text{C}\pm 3^{\circ}\text{C}$  conditions, CC 1.11C/CV 4.35V, when charging current drops to 0.02C charging is terminated, The charging time limited 2h.

在  $25^{\circ}\text{C}\pm 3^{\circ}\text{C}$  条件下，以 1.11C 恒电流，4.35V 恒压，充电至电流降到 0.02C 截止，限时 2 小时。

## 9.3 Maximum discharge current 最大放电电流

At  $23^{\circ}\text{C}\pm 2^{\circ}\text{C}$  condition, discharge the cell with 1.5C.

在  $23^{\circ}\text{C}\pm 2^{\circ}\text{C}$  条件下，以 1.5C 对电池进行放电。

## 9.4 Initial impedance 初始内阻

At  $25^{\circ}\text{C}\pm 3^{\circ}\text{C}$  ambient temperature, after standard charged battery pack, AC impedance tester (1KHz) measuring the initial impedance should be  $\leq 250\text{m}\Omega$ .

在  $25^{\circ}\text{C}\pm 3^{\circ}\text{C}$  环境温度下，经过标准充电的电池，使用交流阻抗测试仪 (1KHz) 测量初始内阻应  $\leq 250\text{m}\Omega$ .



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### 9.5 Initial capacity 初始容量

The initial capacity is for standard charge to full, in 1 hour, the capacity measured at  $25^{\circ}\text{C} \pm 3^{\circ}\text{C}$  conditions with discharge current of 0.2C till 3.0V cut-off voltage.

The initial capacity  $\geq 490\text{mAh}$ .

电池初始容量为电池以标准充电方式满充，1 小时内，在  $25^{\circ}\text{C} \pm 3^{\circ}\text{C}$  条件下以 0.2C 电流放电至 3.0V 截止所放出的容量，初始容量  $\geq 490\text{mAh}$ .

### 9.6 Retention Capability 荷电保持能力

After full charging, storing the battery 28 days with  $20 \pm 5^{\circ}\text{C}$  condition, and then discharge with discharge current of 0.2C till 3.0V cut-off voltage, discharge time should be  $\geq 255\text{min}$

电池满充电后，在  $20 \pm 5^{\circ}\text{C}$  的环境条件下存放 28 天，然后以 0.2C 电流连续放电至 3.0V 终止电压，放电时间  $\geq 255\text{min}$

### 9.7 Cycle life 循环寿命

Battery cycle life is tested at  $25^{\circ}\text{C} \pm 3^{\circ}\text{C}$ . For each cycle test, battery is charged using 0.5C constant current until battery voltage meet 4.35V. Then, battery is charged by constant voltage until battery charging current drop to 0.05C. After that, battery is discharged by 0.5C constant current until battery voltage drop to 3.0V. Repeat until each 50<sup>th</sup> cycle.

At each 50 cycle, battery capacity will be tested. The test condition is that the battery is charged using 0.2C constant current until the battery voltage meet 4.35V. Then, battery is charged by constant voltage until the charging current drop to 0.02C. After that, battery is discharged by 0.2C constant current until battery voltage drop to 3.0V.

If the discharge time is more than or equal to 4hours (80% of initial battery capacity), battery need to repeat above 50cycles charge/discharge test. If not, cycle life test is completed.

Cycle life should be 500cycles or above. the thickness after swelling will be less than 108%.

电池在温度  $25^{\circ}\text{C} \pm 3^{\circ}\text{C}$  条件下循环测试，以 0.5C 恒流充电到电压 4.35V，然后恒压充电到截止电流 0.05C。再以 0.5C 恒流放电到 3.0V，为 1 个循环周期。这样重复 50 次。

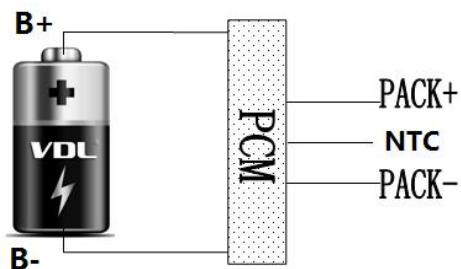
每 50 次做一次容量检测。以 0.2C 恒流充电到 4.35V 然后恒压充电到截止电流 0.02C。再以 0.2C 恒流放电到 3.0V。如果放电时间大于等于 4 小时（80%初始容量），电池必须再重复 50 次充放电测试。否则，循环寿命测试结束。循环寿命应该大于等于 500 次。膨胀后厚度  $\leq 108\%$ 。

### 9.8 Agency approvals 承认机构

VDL battery safety performance is designed according to UL1642 standard and CE Directive requirement, the product's safety performance is conforming to UL1642 standard and CE Directive requirement.

VDL 电池的安全性能是根据 UL1642 标准和 CE 指令要求制定.产品的安全特性与 UL1642 标准和 CE 指令的要求是一致的.

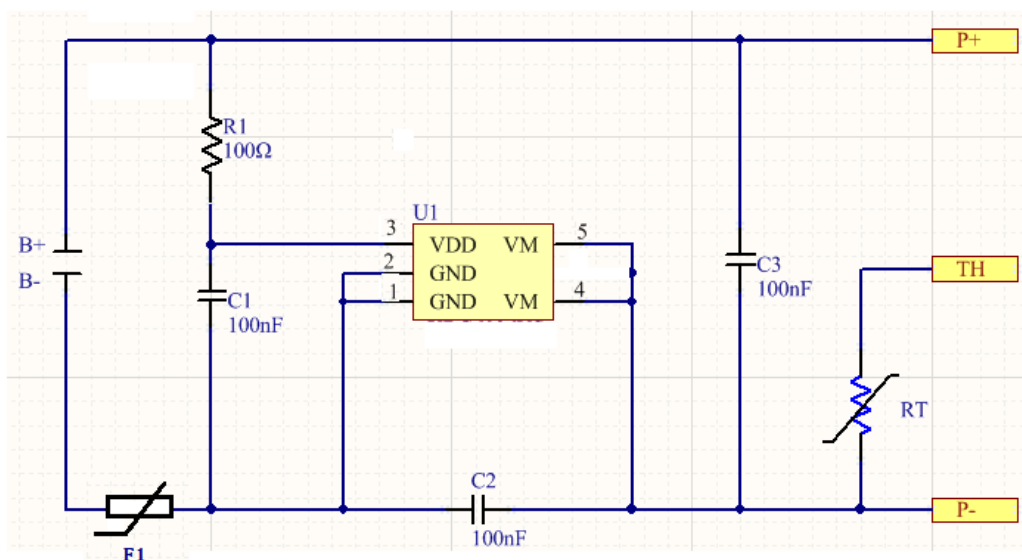
### 10 . Battery structure diagram 电池架构图(Sketch map 示意图)



### 11 . PCB Layout PCB 布线图

|                |  |
|----------------|--|
| Top Layer      |  |
| Top Solder     |  |
| Top Overlay    |  |
| Bottom Layer   |  |
| Bottom Solder  |  |
| Bottom Overlay |  |

### 12 . Schematic circuit diagram 电路原理图

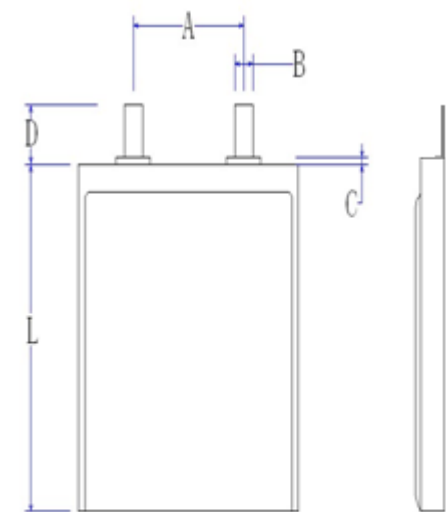


## 13.Cell 电芯

## 13.1 Cell Performance parameters 电芯性能参数

| 编号 | 项目                     | 规格                      | 备注                                                                               |
|----|------------------------|-------------------------|----------------------------------------------------------------------------------|
| 1  | Initial impedance 初始内阻 | $\leq 95\text{m}\Omega$ | 1kHz AC Impedance<br>交流阻抗 AC 1kHz                                                |
| 2  | Nominal voltage 标称电压   | 3.8V                    | /                                                                                |
| 3  | Dimensions<br>外形尺寸     | T                       | 4.35 mm Max<br>Thickness 厚度(受 300gf 力测量)                                         |
|    |                        | W                       | 29.5 mm Max<br>Width 宽度(受 300gf 力测量)                                             |
|    |                        | L                       | 32.0 mm Max<br>Cell length(not include Tab sealant)<br>电芯长度(不含极耳胶) (受 300gf 力测量) |
|    |                        | A                       | $18.0\pm 2.0\text{ mm}$<br>Tab center distance极耳中心距                              |
|    |                        | B                       | $3.0\pm 0.2\text{ mm}$<br>Tab width 极耳宽度                                         |
|    |                        | C                       | 0.5~2.0 mm<br>Tab exposed size<br>极耳胶外露尺寸                                        |

## 13.2 Cell outline drawing 电芯外形尺寸(Not In Scale 未按比例)



## 13.3 Spray Content 电池喷码：

## 正面喷码：

- VDL 432932 3.8V  
490mAh 1.87Wh  
+YMDDLXXX



二维码内容：YMDDLXXX

Remark: YMDD 为生产日期, Y 取 1~9 代表 2021~2029 年, A~X 代表 2030~2053 年(字母 I 和 O 不使用); M 取 1~9 代表 1~9 月、A~C 代表 10~12 月; DD 取 01~31 代表 01~31 日, LLL(批次), 00001(流水码)

例: 390100100001 代表 23 年 9 月 1 日 001 批次的第 1 个电池

喷码二维码内容与第三行“YMDDLXXX”明码内容一致  
尺寸:  $4.5*4.5\pm 0.5\text{mm}$ , 喷码位置: 大致居中即可

VDL 代表生产厂: 重庆市紫建电子股份有限公司

## 背面喷码：

VDL 432932 4.35V

可充式锂离子电池组

红线+ 标称电压 3.8V

黑线- 490mAh

1.87Wh YYMMDD

XXXXXXXX-XXXXXX



VDL 代表生产厂：重庆市紫建电子股份有限公司

YYMMDD 为日期码，代表成品生产日期：

YY 代表生产年份，取年份尾数两位；

MM 代表生产年份；

DD 代表生产日；

喷码位置：电池背面大致居中即可，从靠近极耳一侧开始喷印；

XXXXXXXX-XXXXXX 为 KC 认证号，认证完成后更新；

3C 标识认证前预留位置，认证完成后加印

注：多次喷码，行距不一致为正常现象。

## 13.4 Label 电子标签（电池本体不贴标签）

The following lithium-ion battery labels should be included in the package of the product or in the instructions for use: (Certified LOGOs must be shown in the manner required by the certification)

以下锂电池标识内容须在产品的外包装上或使用说明书中体现:(各种认证的 LOGO 须按认证要求的方式体现)

可充式锂离子电池组/Rechargeable Li-ion Battery  
红线/Red Wire(+) 黑线/Black Wire(-)  
型号/Model: 432932 1ICP5/30/32  
额定容量/Rated Capacity: 490mAh  
额定能量/Nominal Energy: 1.87Wh  
典型容量/Typical Capacity: 510mAh  
标称电压/Nominal Voltage: 3.8V  
充电限制电压/Limited Charge Voltage: 4.35V  
生产厂：重庆市紫建电子股份有限公司  
Chongqing VDL Electronics Co., Ltd.  
中国制造/Made in China 日期/Date: YYMMDD

警告/Caution:  
•禁止拆解、撞击、挤压或投入火中;  
•若出现严重鼓胀,请勿继续使用;  
•请勿置于高温环境中;  
•电池浸水后禁止使用;  
•不要使用本设备专用充电器以外的充电器;  
•按照说明书处理废旧电池;  
•摄入后2小时内可能发生严重烧伤;  
•如果摄入电芯或电池,应立即寻求医疗援助;  
•如果吞咽了电池,应迅速送医院处理,吞咽有可能导致烧伤、软组织穿孔和死亡;  
•不允许儿童在没有成人监督的情况下更换电池,将可被吞咽的小电芯和电池放在儿童取不到的地方;  
•Do not disassemble, impact, squeeze or throw into fire;  
•Do not continue to use if severe swelling;  
•Do not place in a high temperature environment;  
•Do not use after the battery is flooded;  
•Do not use any charger other than that specifically provided for use with the equipment;  
•Dispose of used batteries according to the instructions;  
•In case of ingestion of a cell or battery, seek medical assistance promptly;  
•Swallowing may lead to burns, perforation of soft tissue, and death;  
•Severe burns can occur within 2 h of ingestion;  
•Keep small cells and batteries which are considered swallowable out of the reach of children.

Li-ion 00 XXXX株式会社

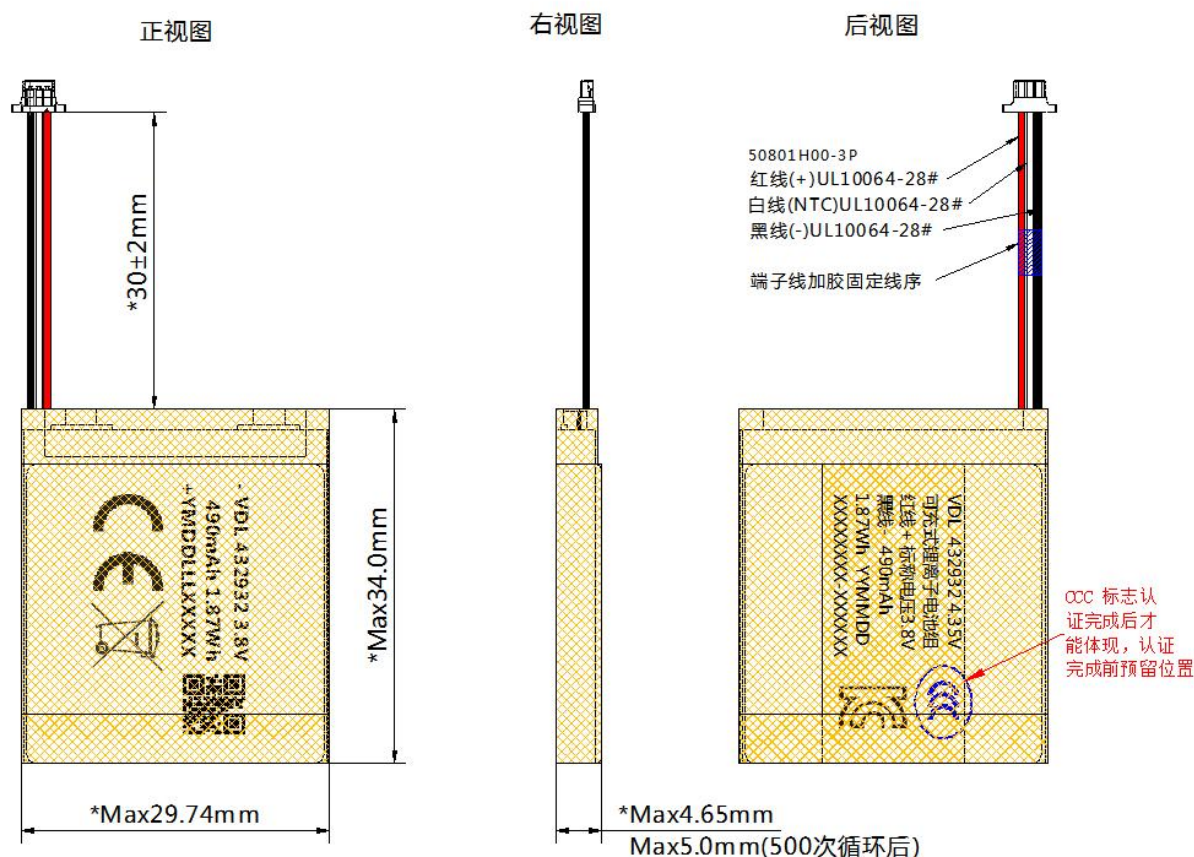
XXXXXXXX-XXXXXX  
A/S: XX-X-XXX-XXXX

YYMMDD: YY:代表生产年份，取年份尾数两位；MM:代表生产月份；DD:代表生产日。

蓝色 LOGO 认证前预留位置，认证完成后才可加印

## 14 . Battery Outline Drawing 电池组外形尺寸 ( Units 单位: mm )

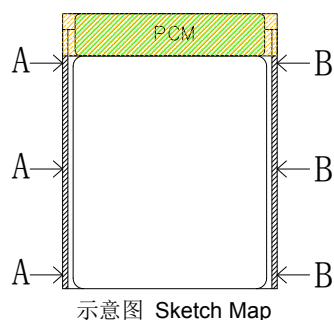
## 14.1 Battery Outline Drawing 电池组外形尺寸 (Not In Scale 未按比例)



## 14.35 Battery size parameters 电池组尺寸参数

| Wiring method 出线方式 | Positive pole lead 正极出线                                                                                                                                                                                                                                                                                                                                                                                              |
|--------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Remark 备注          | <ol style="list-style-type: none"><li>1、Laser welding or energy storage welding of protective circuit , 保护板激光焊或储能焊 ;</li><li>2、Protect circuit components facing outside , 保护电路元器件朝外 ;</li><li>3、The thickness of the finished product is measured by the force of 600gf, and the width and length of the finished product are measured by the force of 300gf. 成品厚度受 600gf 的力测量 , 宽度、长度尺寸 , 需受 300gf 的力测量。</li></ol> |

## 15 . Reminder 关于电池折边面注意事项的温馨提示



## 温馨提示客户:

电池折边面 (图示A&B指示填充区域) 严禁与导体接触; 电池包边若已绝缘, 此点可忽略。

## Caution:

The folded edge surface of the battery (the filling area indicated by A & B in the figure) is strictly prohibited from contacting with the conductor; If the battery edge is insulated, this point can be ignored.

## 16. BOM 1(Bill of materials)电池物料清单

| NO.(项次) | Material Name (零件名称) | Specification(规格型号)                                            | Qty (用量) |
|---------|----------------------|----------------------------------------------------------------|----------|
| 1       | Cell 电芯              | 432932/490mAh                                                  | 1        |
| 2       | Protection board 保护板 | XBD58615JS+PTC+10K NTC                                         | 1        |
| 3       | Plug cord 端子线        | 50801H00-3P ( UL E338796 ) ,<br>红白黑 UL10064-28# ( UL E529724 ) | 1        |
| 4       | Kapton tape 茶色高温胶    | T=0.05mm ( 防火等级 V-0 ; UL E251243 )                             | 若干       |

## PCM BOM 2

| Material Name<br>(零件名称) | Specification<br>(规格型号)          | Position<br>(零件位置) | Qty<br>(用量) |
|-------------------------|----------------------------------|--------------------|-------------|
| PCBA                    | TBD                              | /                  | 1           |
| PCB                     | TBD                              | /                  | 1           |
| IC                      | XBD58615JS                       | U1                 | 1           |
| 贴片电阻<br>Chip resistor   | 100Ω±5%                          | R1                 | 1           |
| NTC                     | 10K±1% B=3380<br>NCP15XH103F03RC | RT                 | 1           |
| 贴片电容<br>Chip capacitors | 0.1μF/-20%~+80%/16V              | C1C2C3             | 3           |
| PTC                     | SMD1206P200SLR ( UL E201431 )    | F1                 | 1           |
| 镍片                      | TBD                              | B+, B-             | 2           |

Note : The battery of materials should be consistent with the requirements of the RoHS&amp; REACH.

注：电池组所使用的材料应符合RoHS&amp; REACH的要求.

**17 . Battery Precautions and Safety Instructions 电池组使用注意事项及安全说明**

Please be sure to comply with the specifications and the following precautions to use with batteries. For any accident caused by operation not following the specifications, VDL Electronics Co., Ltd will not take any responsibility

请您务必遵守本规格书和以下使用注意事项使用电池，对于没有按照规格书进行操作所造成的任何意外事故，重庆市紫建电子股份有限公司将不承担任何责任。

- ◆ Warranty period is 12 months after shipment date.  
从出厂代码日起 12 个月内保修。
- ◆ When the battery is stored for 3 months, it should be charged with 0.5C current to 50% SOC.  
电池每放置三个月,请预先以 0.5C 充电 1 次,即让电池具备 50%以上的电量。
- ◆ Before using the battery, carefully read the instruction manual and battery labels on the surface.  
使用电池前，请仔细阅读使用说明书和电池表面标识。
- ◆ Please use the original battery charger. The battery should be placed in a dry and ventilated place.  
电池需使用原装充电器充电，并应放置在干燥通风场所。
- ◆ If the battery is not used for a long time, please charge the battery to 50% SOC status. Remove the battery from the device and place it separately, to avoid the short-circuit and damage caused by contacting metal.  
如长期不使用时，请将电池充电至半满电荷状态，把电池从设备中拆除并分开放置，避免金属接触电池，造成短路或损坏现象。
- ◆ When using or during storage, if the battery is hot, with leakage, odor, distortion or other anomalies, please stop using it immediately and stay away from the battery.  
在使用或储存期间，如发现电池有出现高温发热、漏液、散发异味、变形及其它异常现象时，请立即停止使用并远离电池。
- ◆ Do not short-circuit the battery positive and negative terminals. Do not damp the battery to avoid any danger.  
切勿将电池正负极短路，并注意不可让电池受潮，以免发生危险。
- ◆ Please keep the battery away from heat, high voltage place. Please do not beat or hit the battery.  
使用过程中，应远离热源、高压场所，并勿摔打、撞击电池。
- ◆ Remove the battery immediately from the device when the battery life ends. Please dispose the waste battery properly. Do not put it into fire or water.  
电池寿命终止应立刻从设备中取出,废弃电池请安全妥善处理，切勿投入火中或水中。
- ◆ Do not allow children to replace batteries without adult supervision, Keep small cells and batteries which are considered swallowable out of the reach of children.  
不允许儿童在没有成人监督的情况下更换电池，将可被吞咽的小电芯和电池放在儿童取不到的地方。
- ◆ Swallowing may lead to burns, perforation of soft tissue, and death. Severe burns can occur within 2h of ingestion. In case of ingestion of a cell or battery, seek medical assistance promptly.  
如果吞咽了电池，应迅速送医院处理，吞咽有可能导致烧伤、软组织穿孔和死亡，摄入后 2 小时内可能发生严重烧伤。
- ◆ In case of ingestion of a cell or battery, seek medical assistance promptly.  
如果摄入电芯或电池，应立即寻求医疗援助。



# Rechargeable Lithium-ion Battery Specification Approval

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## 18 . Customer Inquiry

### 客户要求

Model 型号 : 432932/490mAh

1.If the customer approves the specification and samples, please sign the specification back to VDL within 1 week. It is invalid when expires.

如果客户认可本承认书和样品，请于 7 天内回签本承认书给重庆市紫建电子股份有限公司，过期视为无效。

2. If the customer requires more explanation or the operating conditions are different from the specification content, please write down your information and contact VDL Electronics Co., Ltd in advance. VDL Electronics Co., Ltd could design and build products according to your special request.

如果客户需要其他方面的说明或工作条件与规格书内容不一致,请客户提前和重庆市紫建电子股份有限公司联系. 重庆市紫建电子股份有限公司将按照贵公司特殊要求设计和开发产品.特殊要求标准:

| 项 目<br>序号 | Special Request<br>特殊要求 | Criteria<br>标准 |
|-----------|-------------------------|----------------|
| 1         |                         |                |
| 2         |                         |                |
| 3         |                         |                |
| 4         |                         |                |
| 5         |                         |                |
| 6         |                         |                |

Company Name : Signature : Date:

公司名称:

签名:

日期: