

## 1.Scope 适用范围

The specification shall be applied to Li-ion polymer rechargeable battery manufactured by EVERPOWER TECHNOLOGY CO., LTD.

本规格书适用于惠州恒泰科技股份有限公司生产的聚合物锂离子可充电电池。

## 2. Model Name 产品型号：PL762024V-R03

## 3. Specification 主要技术参数

No.	Items	Criteria	Remarks
3.1	Typical Capacity 典型容量	460mAh	Standard capacity measure method: 25°C ±3°C, 0.2C CC(constant current) charge to 4.35V, then CV(constant Voltage 4.35V) charge till charge current decline to 0.02C, then with 0.2C discharge to 3.0V cut off. 容量测试方法：25°C ±3°C，先用0.2C恒流充电至4.35V，再恒压充电直至充电电流为0.02C截止，然后用0.2C放电至3.0V的容量（该容量定义为C5）
	Minimum Capacity 最小容量	450mAh (C5)	
3.2	Energy 能量	1.71Wh	
3.3	Nominal Voltage 标称电压	3.8V	
3.4	Limited charging Voltage 充电限制电压	4.35V	
3.5	End of discharge voltage 放电终止电压	3.0V	
3.6	Upper limited Charging Voltage 充电上限电压	4.40V	
3.7	Discharge cut-off voltage 放电截止电压	2.37V	
3.8	Energy density 能量密度	413Wh/L	
3.9	Open Circuit Voltage 出厂电压	4.05~4.15V	
3.10	Internal Impedance 交流内阻	Battery 成品: ≤250mΩ	AC 1KHz after standard charge 标准充电后 AC 1KHz 测试
3.11	Standard charge current 标准充电电流	90mA	0.2C
3.12	Max. charge current 最大充电电流	450mA	1.0C
3.13	Standard discharge current 标准放电电流	90mA	0.2C
3.14	Max. discharge current 最大放电电流	450mA	1.0C
3.15	Charge Time 充电时间	Approx 4.0h	0.5C

3.16	Weight 重量	7.2±0.5g	Reference only 仅供参考
3.17	Operating Temperature 工作温度	Cell Surface Temperature 电芯表面温度	Current and Voltage 充放电电流和电压
	Charge 充电	<0°C或>60°C	No charging 禁止充电
		0°C~10°C	0.3C Charge 0.3C 充电(MAX)
		10°C~45°C	1.0C Charge 1.0C 充电(MAX)
		45°C~60°C	1.0C Charge 1.0C 充电(MAX)
Discharge 放电	-10°C~60°C	1.0C Discharge Max. 最大 1.0C 放电 (温度越低、放电倍率越大, 放电容量 越小, 具体以实际放电容量为准)	
3.18	Storage Temperature 贮存温度	-10°C~45°C	Less than 1 month 小于 1 个月 (65±20%RH)
		-10°C~35°C	Less than 3 months 小于 3 个月 (65±20%RH)
		25°C±3°C	Over 3 months (When cell storage is required for more than 3 months, the cell should be charged and maintain a voltage of 3.7V to 3.95V) (65±20%RH) 超过 3 个月 (电池存储超过 3 个月需要 给电池充电维持电压在 3.7V 到 3.95V) (65±20%RH)
3.19	K 值标准	电芯-0.05~0.125mV/h(3mV/d) 成品-0.05~0.160mV/h(4mV/d)	

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

### 4.1 Appearance 外观和结构

There shall be no such defect as scratch, bur and other mechanical scratch. The structure and dimensions see attached drawing of the battery.

电池的表面应无明显的划痕毛刺及其其它机械划伤。结构尺寸见电池的外形尺寸图;

### 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 battery shall not be cycled more than five times before the test. Unless otherwise defined, test and measurement shall be done under temperature of 25°C±3°C and relative humidity of 65%±20%, barometric pressure:86kPa ~ 106kPa.If no otherwise specified, the rest time between Charge and Discharge amount to 30mins.

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°C±3°C，相对湿度 65%±20%，大气压：86KPa~106KPa。如果没有特殊的说明，充电和放电之间的静置时间是 30 分钟。

4.4 Standard Charge 标准充电

Standard charging : standard temperature 25°C±3°C Charging cell consist of charging at constant current rate of 0.2C until the cell voltage reach 4.35V. Then cell be charged at constant voltage of 4.35V while tapering the charge current. Terminal charge until the charging current drops to 0.02C.Charging time does not exceed 8 hours.

在 25°C±3°C条件下，电芯用 0.2C 充电，当电芯电压达到 4.35V 时改为恒压充电，直到充电电流小于或等于 0.02C 时，停止充电，充电时间不超过 8 小时。

5. Electrical Performance 电性能测试

5.1 Temperature Dependence of Capacity (Discharge) 不同温度放电特性

After standard charging pretreatment at 25°C±3°C, the battery is placed under the temperature to be measured for 1h, and then discharged to 3.0V with the specified current. After each temperature discharge test, the battery should be placed at room temperature for 1h before the next test. Discharge requirements are as follows:

电池在 25°C±3°C标准充电前处理后，置于待测温度下 1h，然后按指定电流放电至 3.0V。做完每个温度放电实验后，电池都需要在室温下放置 1h 后再进行下一实验。放电要求如下：

Discharge Temperature 放电温度	-10°C (0.2C)	0°C (0.2C)	25°C (0.2C)	60°C (0.2C)
Discharge Capacity 放电容量 (与 C5 相比)	60%	80%	100%	95%

5.2 Cycle Life 循环性能

常温循环：

30min rest after 1.0C charge, then discharge with 1.0C discharge current to 3.0V cut off. The test shall be terminated when Discharging Capacity≤80%C<sub>5</sub> in three consecutive cycles. Standard charge and Discharge at 25°C±3°C.

0.2C 充电后，搁置 30min，0.2C 放电至 3.0V。重复上述步骤进行循环，直至电池放电容量连续 3 次≤ 80%C<sub>5</sub>。测试温度 25°C±3°C（影响电池循环的重要参数），要求如下：

Cycle time≥500 times  
循环次数≥500

## 5.3 Shelf Life 荷电保持能力

Item 项目	Measuring Procedure 内容	Requirements 备注
Storage Characteristics 1 贮存特性 1	1 The Time on 0.2C discharge shall be measured after standard charge and then storage at 25°C±3°C for 28 days. 标准充电后电芯在 25°C±3°C 的环境中贮存 28 天，测试 0.2C 放电容量（保持容量）。	Remaining Capacity ≥85% C <sub>5</sub> 容量保持 ≥85% C <sub>5</sub>
	2 After above measured Remaining capacity, the capacity on standard discharge shall be measured after standard charge. 0.2C 循环 3 次，测试恢复放电容量（3 周循环的最大放电容量）。	Recovery Capacity ≥90% C <sub>5</sub> 容量保持 ≥90% C <sub>5</sub>
Storage Characteristics 2 贮存特性 2	1 The capacity on 0.2C discharge shall be measured after 0.2C charge and then storage at 60°C±2°C for 7 days. 0.2C 充电后电池在 60°C±2°C 的环境中贮存 7 天，测试 0.2C 放电容量（保持容量）。	Remaining Capacity ≥60% C <sub>5</sub> 容量保持 ≥60% C <sub>5</sub>
	2 After above measured Remaining capacity, the capacity on standard discharge shall be measured after standard charge. 0.2C 循环 3 次，测试恢复容量（3 周循环的最大放电容量）。	Recovery capacity ≥80% C <sub>5</sub> 容量恢复 ≥80% C <sub>5</sub>
Storage Characteristics 3 贮存特性 3	3 The production date of experimented battery must within 3 months. After about charging 40%~50% capacity after a period of storage at 20 °C±5°C for one year (365 days). Then 0.2 C discharge three times at 25°C±3°C. The recovery available capacity is ≥85% C <sub>5</sub> . The capacity is determined with the capacity of the by the most of preceding three cycles. 进行该项实验的电池应选生产日期到实验日期 3 个月内的电池，贮存前给电池充入 40%~50% 的容量，然后在 20°C±5°C 路搁置 1 年（365 天）在 25°C±3°C 的环境条件下 0.2 C 循环 3 次，测试恢复容量（3 周循环的最大放电容量）	Recovery capacity ≥85% C <sub>5</sub> 容量恢复 ≥85% C <sub>5</sub>

## 6. Mechanical Performance and Safety Performance 机械特性和安全性能

Item 项目	Measuring Procedure 测试方法	Requirements 要求
Drop Test 自由跌落	<p>After standard charge, Test cells or batteries were dropped from a height of 1m to a concrete surface, Each cell or battery is to be dropped once in the positive and negative directions of three mutually perpendicular mounting positions for a total of 6 times.</p> <p>标准充电充满电后的电芯或电池从 1 米的高度自由跌落到水泥地面上；每个电芯或电池将沿着三个互相垂直轴的正负方向跌落 1 次，总共 6 次。</p>	<p>No fire, No explosion 电芯不起火、不爆炸</p>
Constant Humidity and Temperature Characteristics 恒定湿热	<p>Under the temperature of <math>25^{\circ}\text{C}\pm 3^{\circ}\text{C}</math>, after charging the cell, then put the cell into the constant temperature and humidity oven with <math>40^{\circ}\text{C}\pm 2^{\circ}\text{C}</math> and 90~95% for 48h, the cell should be no obvious deformation, leakage, rust, smoking and explosion. After testing take out the cell then rest for 2h under the temperature of <math>25^{\circ}\text{C}\pm 3^{\circ}\text{C}</math>, discharge with 0.2C to 3.0V.</p> <p>在 <math>25^{\circ}\text{C}\pm 3^{\circ}\text{C}</math> 条件下，电芯充满电后，放入 <math>40^{\circ}\text{C}\pm 2^{\circ}\text{C}</math>，湿度 90~95% 的恒温恒湿箱内 48h，电芯应无明显变形、漏液、生锈、冒烟或爆炸，试验结束后将电芯取出搁置 2h，在 <math>25^{\circ}\text{C}\pm 3^{\circ}\text{C}</math> 条件下，以 0.2C 放电至 3.0V。</p>	<p>Discharge Time <math>\geq 3.0\text{h}</math> 放电时间 <math>\geq 3.0\text{h}</math></p>
High temperature external short-circuit 高温外部短路	<p>After the standard charge, then stored in an ambient temperature of <math>55^{\circ}\text{C}\pm 5^{\circ}\text{C}</math>, the cell is to <math>55^{\circ}\text{C}\pm 5^{\circ}\text{C}</math> and remain for 30 minutes at that temperature, a cell is to be short circuited by connecting the positive and negative terminals of the cell with copper wire having a maximum resistance <math>80\text{m}\Omega\pm 20\text{m}\Omega</math>. Stop the test when the surface temperature of the cell decays to about 20% from the maximum or short time reach 24 hours.</p> <p>电芯经过标准充电后，放置在 <math>55^{\circ}\text{C}\pm 5^{\circ}\text{C}</math> 的环境中，待电芯温度达到 <math>55^{\circ}\text{C}\pm 5^{\circ}\text{C}</math> 后，再放置 30min。然后用康铜线连接电芯正负极端，并确保全部外部电阻为 <math>80\text{m}\Omega\pm 20\text{m}\Omega</math>。实验过程中当电芯表面温度比峰值低约 20%，或者短接时间达到 24 小时后停止测试。</p>	<p>No fire, No explosion The cell surface maximum temperature <math>\leq 150^{\circ}\text{C}</math> 不起火、不爆炸，电芯外部温度不超过 <math>150^{\circ}\text{C}</math>。</p>
Vibration test 振动	<p>After standard charge, fixed the cell to vibration table and subjected vibration cycle 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 shell be vibrated for 15 minutes per axis of X/Y/Z axes.</p> <p>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 15 分钟，振幅 1.6mm，振动频率为 10Hz~55Hz，每分钟变化 1Hz。</p>	<p>No leakage, No fire and No explosion 电芯无漏液、起火或爆炸</p>

<p>Abnormal Charging Test 过充电测试</p>	<p>After standard discharge, the cell is subjected to a charging current by connecting it to a dc-power supply. The beginning current is 3.0C, which is to be obtained by connecting a resistor of specified size and rating in series with the cell; the voltage of the dc-power supply is 4.6V. The test time is 2.5 hours.</p> <p>标准放电后，电芯及滑动变阻器串联于一恒流恒压源，电压调节为 4.6V，通过滑动变阻器调节电流至 3.0C，然后对电芯以 3.0C 充电。测试时间为 2.5h。</p>	<p>No fire, No explosion 不起火、不爆炸</p>
<p>Temperature Cycle 温度循环</p>	<p>Put the full charged cell into the environment box and do the temperature cycle of <math>-40^{\circ}\text{C}\sim+75^{\circ}\text{C}</math> :</p> <p>A. After the temperature rose to <math>75^{\circ}\text{C} \pm 2^{\circ}\text{C}</math> within 30 minutes, the temperature was maintained for 6h;</p> <p>B. After the temperature drops to <math>-40^{\circ}\text{C} \pm 2^{\circ}\text{C}</math> within 30 minutes, the temperature is maintained for 6h;</p> <p>C. Repeat steps A-B for 10 cycles;</p> <p>将满电电芯池放入环境箱，做<math>-40^{\circ}\text{C}\sim+75^{\circ}\text{C}</math>的温度循环：</p> <p>a、30min 内温度升到 <math>75^{\circ}\text{C} \pm 2^{\circ}\text{C}</math>后，保持 6h；</p> <p>b、30min 内温度降到<math>-40^{\circ}\text{C} \pm 2^{\circ}\text{C}</math>后，保持 6h；</p> <p>c、重复 a-b 步骤，共 10 个循环；</p>	<p>No leakage, No fire and No explosion 不漏液、不起火、不爆炸</p>
<p>Over-discharge Protection Characteristics 过放电保护性能</p>	<p>Under the temperature of <math>23^{\circ}\text{C} \pm 2^{\circ}\text{C}</math>, after discharging the battery with 0.2C to 3.0V, then connect the load with <math>30\Omega</math> then discharge for 7h.</p> <p>在 <math>23 \pm 2^{\circ}\text{C}</math> 条件下，电池按 0.2C 放电至 3.0V 后，外接 <math>30\Omega</math> 负载放电 7h。</p>	<p>No leakage, No fire, No smoking, No explosion 不漏液、不起火、不冒烟、爆炸</p>
<p>Short-circuit Protection Characteristics 短路保护性能</p>	<p>Under the temperature of <math>23^{\circ}\text{C} \pm 2^{\circ}\text{C}</math>, after full-charging the battery with 0.2C, then make the battery's anode and cathode short-circuit for 1h (the connecting resistance is <math>80\text{m}\Omega \pm 20\text{m}\Omega</math>), then cut the anode and cathode, After the battery momentary charge by 1C current, the voltage should come back to 3.6V.</p> <p>在 <math>23 \pm 2^{\circ}\text{C}</math> 条件下，电池按 0.2C 充满电后，将电池正负极短路（外接电阻 <math>80\text{m}\Omega \pm 20\text{m}\Omega</math>）持续 1h，再将电池正负极断开，电池以 1C 瞬时充电后电压应不小于 3.6V。</p>	<p>No leakage, No deformation, No smoking, No explosion 电池不漏液、不变形、不冒烟、不爆炸</p>

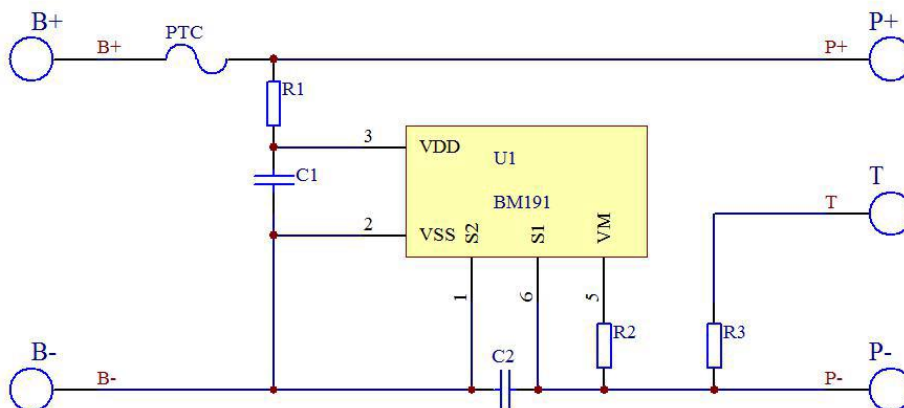
<p>Maximum pressure of battery main body 电池主体最大承受压力</p>	<p>Take a single qualified battery, put it in the center of the test table level test position, set up the test pressure, let the radius 7.6cm test metal disc, reduce the speed of 58mm/s, make the center of the metal test disk just press in the battery core, make the core body uniform force; The whole surface of the single cell can withstand the maximum pressure <math>\leq 100</math> kg and the test time is 1h. 取单只合格电池，放置于测试台中心平整测试位，设置好测试压力，让半径 7.6cm 测试金属圆盘，以 58mm/s 速度下降，使金属测试圆盘中心正好压中电池芯体，使芯体整体均匀受力；单电池整个表面整体可承受最大压力<math>\leq 79</math>kg，测试时间 1h.</p>	
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### 7. Battery configuration 电池组成

NO	Item	Criteria	Remarks
7.1	Cell 电芯	PL762024V	Li-ion polymer
7.2	PCM 保护板	HT-1504-R03	IC:BM191-VBEB-DE NTC:47K $\Omega$ $\pm$ 1% B=4100K PTC: SL190PK
7.3	插头线	HDGC1002H-03P UL3302 AWG28	导线外露:32 $\pm$ 3mm

### 8. Protection Circuit 保护电路

#### 8.1 Circuit Diagram 电路原理图



## 8.2 PCM BOM PCM 物料清单

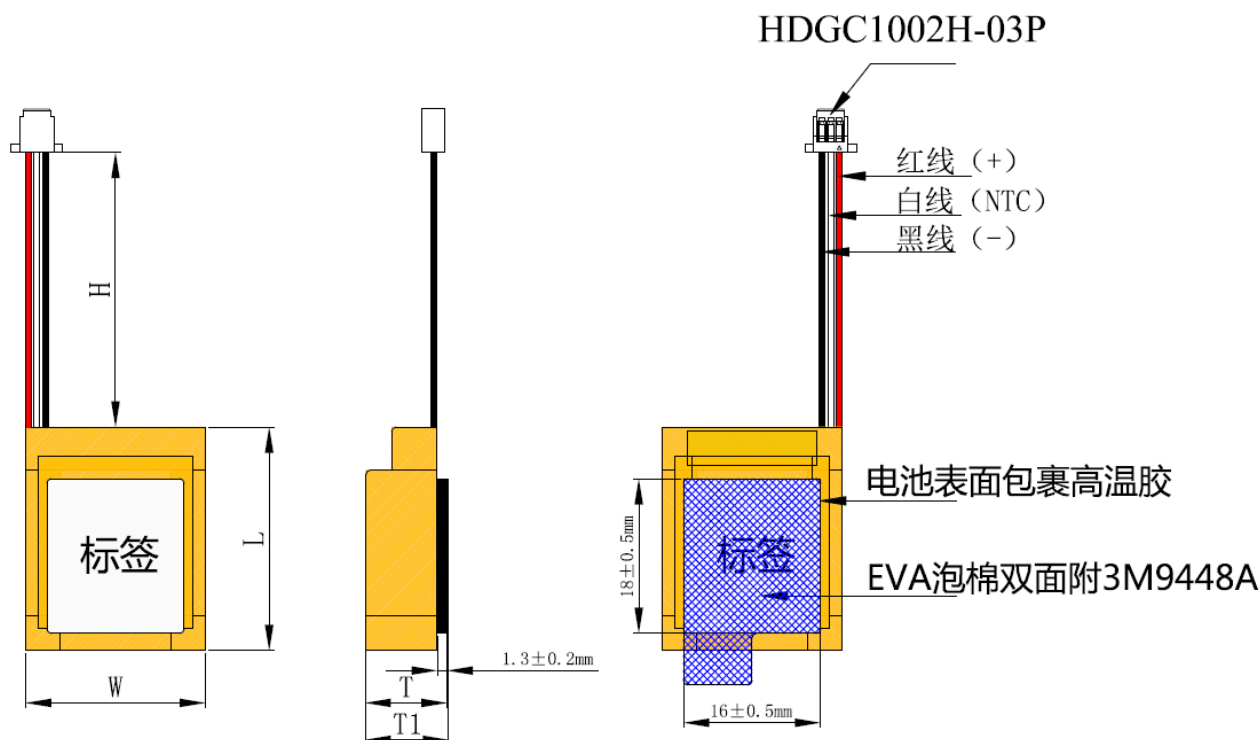
序号	物料名称	规格型号	单位	数量	备注
1	IC	BM191-VBEB-DE	PCS	1	U1
2	PCB板	HT-1504	PCS	1	/
3	电阻	4.7KΩ±5%	PCS	1	R1
4	电阻	2.7KΩ±5%	PCS	1	R2
5	电容	0.1uF±10%	PCS	2	C1、C2
6	NTC	47KΩ±1% B=4100K	PCS	1	R3
7	PTC	SL190PK	PCS	1	PTC

## 8.3 PCM Parameter PCM 参数

NO	Item 项目	Criteria 标准
1	Over-charge Protection Voltage 过充电保护电压	4.425±0.050V
2	Over charge release voltage 过充保护恢复电压	4.225±0.070V
3	Over charge protection delay time 过充保护延迟时间	200ms Max.
4	Over-discharge protection Voltage 过放保护电压	2.470±0.100V
5	Over discharge release voltage 过放保护恢复电压	3.000±0.100V
6	Over discharge protection delay time 过放保护延迟时间	100ms Max
7	Over current protection current 放电过流保护电流	2-6A
8	Over current protection delay time 放电过流保护延迟时间	20ms Max
9	Current consumption in normal operation 工作时消耗电流	4.0uA Max.
10	Inner resistance 内阻	70MΩ(不含 PTC)
11	0V charging function 0V 充电功能	Available



## 9.Assembly Drawing 装配图纸



Length 长度 L(mm) (不含导线)	Wide 宽度 W(mm)	Thickness 厚度 T(含标签 +EVA 泡 棉)(mm)	Thickness 厚度 T1(mm) (含标签+EVA 泡棉+离型纸)	Thickness after 500 cycles 500 周循环厚度 T(mm) (含标签+ EVA 泡棉)	Conductor length 导线长度 H (mm)
26.0max	21.0max	9.9max	10.1max	10.53 max	32±3

实物标签内容:

正面标签:



背面标签:



注:YYYYMMDDXX 表示生产批号,YYYYMMDD 表示年月日,例如 2023 年 9 月 21 日表示为 20230921;  
XX 表示订单序号,01~99。