

1. Scope (适用范围)

This specification is applied to the reference battery in this Specification

2. Product Specification (产品技术规格)

No. (序号)	Item (项目)	General Parameter (常规参数)	Remark (备注)
1	Nominal capacity (标称容量)	1500mAh	Standard discharge (0.5C ₅ A after Standard charge) (0.5C ₅ A 标准充电后 0.5C ₅ A 标准放电)
	Typical capacity (典型容量)	1560mAh	
2	Nominal Voltage (正常电压)	3.10V	Mean Operation Voltage (工作电压)
3	Voltage at end of Discharge (放电终止电压)	1.50V	Discharge Cut-off Voltage (放电截止电压)
4	Charging Voltage (充电电压)	4.00V	Charge Cut-off Voltage (充电截止电压)
5	Internal Impedance (内阻)	≤18mΩ	Internal resistance measured at AC 1KHZ after 50% charge. The measure must uses the new batteries that within one week after shipment and cycles less than 5 times (半电态下用交流法测量内阻; 使用出货后不到一个星期及循环次数少于 5 次的新电池测量)
6	Standard charge (标准充电)	0.5C ₅ A CC(constant current)charge to 4.0V,then CV(constant voltage 4.0V)charge till charge currnt decline to ≤0.02C 0.5C ₅ A CC(恒流)充电至 4.0V,再 CV(恒压) 4.0V 充电直至充电电流≤0.02C	Charge time : Approx 3h (充电时间: 大约 3 小时)
7	Standard discharge (标准放电)	Constant current 0.5C ₅ A end voltage 1.50V (持续电流: 0.5C ₅ A 截止电压: 1.50V)	Discharge time : Approx 2.5h (放电时间: 大约 2.5 小时)
8	Fast charge (快速充电)	Constant Current 1.0C ₅ A Constant Voltage 4.0V 0.02 C ₅ A cut-off (持续电流: 1.0C ₅ A 持续电压: 4.0V 截止电流: 0.02C ₅ A)	Charge time : Approx 1.5h (充电时间: 大约 1.5 小时); 快速充电会造成电池容量衰减, 不建议客户使用快速充电

No. (序号)	Item (项目)	General Parameter (常规参数)	Remark (备注)
9	Maximum constant Discharge Current (最大持续放电电流)	3.0C ₅ A	constant (持续)
	Maximum Discharge Current (最大放电电流)	5.0C ₅ A	Instant (瞬间)
10	Operation Temperature Range (工作温度范围)	Charge (充电) : -10~45°C	60±25%R.H. Bare Cell (单体电池储存湿度范围)
		Discharge (放电) : -30~60°C	
11	Storage Temperature Range (储存温度范围)	Less than 1 year: -10~25°C (小于一年: -10~25°C)	25-85%R.H. at the shipment state (出货状态时的湿度范围)
		Less than 3 months: -10~40°C (小于3个月: -10~40°C)	
12	Weight (重量)	38.0±1.0g	cell (单支电池)
13	Cell Dimension (单体电池尺寸)	High/高度(Max): 65.3±0.1mm	Initial Dimension (初始尺寸)
		Diameter/直径 (Max):18.3±0.1mm	
Discharge Capacity Rate (放电倍率)			
Charge Current 充电电流		Discharge Rate (放电倍率)	
0.5 C ₅ A		1.0C ₅ A	3.0C ₅ A
		98.0%~100.0%	95.0~97.0%

3. Performance And Test Conditions (电池性能及测试条件)

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 cells shall not be cycled more than five times before the test. Unless otherwise specified, test and measurement shall be done under temperature of $25\pm 3^{\circ}\text{C}$ 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 $20\sim 30^{\circ}\text{C}$ and humidity 25~85%RH. Atmosphere pressure : 86KPa~106 kPa

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 $25\pm 3^{\circ}\text{C}$ ，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 $20\sim 30^{\circ}\text{C}$ ，相对湿度 25~85%RH 的条件下进行。大气压：86KPa~106 kPa

3.2 Measuring Instrument or Apparatus (测量器具及设备)

3.2.1 Dimension Measuring Instrument (尺寸测量器具)

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。

3.2.2 Voltmeter (伏特计)

Standard class specified in the national standard or more sensitive class having inner impedance more than $10\text{k}\Omega/\text{V}$

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 $10\text{K}\Omega/\text{V}$ 。

3.2.3 Ammeter (安培计)

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 0.01Ω 。

3.2.4 Impedance Meter (电阻计)

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 (标准充放电)

3.3.1 Standard Charge : $0.5C_5\text{A}$

标准充电: $0.5C_5\text{A}$

Charging shall consist of charging at a $0.5C_5\text{A}$ constant current rate until the cell reaches 4.0V. The cell shall then be charged at constant voltage of 4.0volts while tapering the charge current. Charging shall be terminated when the charging current has tapered to $0.02 C_5\text{A}$. Charge time : Approx 3h, The cell shall demonstrate no permanent degradation when charged between -10°C and 45°C .

电池先以 $0.5C_5\text{A}$ 恒流充电至 4.0V，再以 4.0V 恒压充电至电流减小到 $0.02 C_5\text{A}$ ，充电时间大约为 3 个小时。在 $-10^{\circ}\text{C}\sim 45^{\circ}\text{C}$ 内充电电池应没有永久损害。

3.3.2 Standard Discharge (标准放电)

标准放电: $0.5C_5\text{A}$

Cells shall be discharged at a constant current of $0.5C_5\text{A}$ to 1.50 volts @ $25\pm 3^{\circ}\text{C}$.

电池以 $0.5C_5\text{A}$ 恒流放电至 1.50V @ $25\pm 3^{\circ}\text{C}$ 。

3.3.3 If no otherwise specified, the rest time between Chare and Discharge amount to 5min.

如果没有特别说明，电池充放电间隔时间为 5 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)	Test Method and Condition (测试方法及条件)	Requirements (要求)
(1) Cell Voltage (电池电压)	Delivery voltage 出货电压	$\geq 3.60V$
(2) Open-Circuit Voltage (开路电压)	The open-circuit voltage shall be measured within 24 hours after standard charge. (标准充满电后 24 小时内测量开路电压)	$\geq 3.85V$
(3) Internal impedance (初始内阻)	Internal resistance measured at AC 1KHz after 50% charge. (半充电状态, 测量其 AC 1KHz 下的交流阻抗)	$\leq 18m\Omega$
(4) Minimal Rated Capacity (最小额定容量)	The capacity on 0.5C ₅ A discharge till the voltage tapered to 1.50V shall be measured after rested for 30min then finish standard charge. (标准充电后, 搁置 30min, 测量 0.5C ₅ A 放电至 1.50V 截止电压所放出的容量)	Discharge Capacity (放电容量) $\geq 1500mAh$

3.6 Electrical performance (电性能)

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

Cells shall meet the discharge capacity requirements listed in the below table under respective discharge temperatures. Low-temperature discharge current of 0.5 C₅A, high temperature discharge current of 0.5C₅A, (1.50V cut-off) after standard charge at 25±3°C.

电池在 25±3°C 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 小时, 低温放电电流为 0.5C₅A, 高温放电电流为 0.5C₅A, 做完一个温度实验后, 电池在室温下放置 2h。

Discharge Temperature 放电温度	-30°C	25°C	55°C
Discharge Capacity 放电容量	85%	100%	95%

3.6 electrical performance (电性能)

No. (序号)	Item (项目)	Criteria (标准)	Test Conditions (测试条件)
1	Cycle Life 循环寿命	Higher than 80% of the Initial Capacities of the Cells (≥初始容量的 80%)	Carry out 4000 cycle Charging/Discharging in the below condition. ◆ Charge: Standard Charge, per 3.3.1 ◆ Discharge: 0.5C ₅ A to 1.50V ◆ Rest Time between charge/discharge: 5min. ◆ Temperature: 25±3°C 循环 4000 次 充放电按以下条件: ◆ 充电: 标准充电, 按 3.3.1 规定 ◆ 放电: 0.5C ₅ A 放至 1.50V ◆ 搁置: 5min. ◆ 温度: 25±3°C
2	Shelf Life 荷电保持能力	The capacity on 1C ₅ A discharge shall be measured after standard charge and then storage at 25±3°C for 28 days. 标准充电后电池在 25±3°C 的环境中贮存 28 天, 测试 0.5C ₅ A 放电容量 (保持容量)	Remaining Capacity ≥85% 容量保持 ≥85%
		After above measured Remaining capacity, the capacity on standard discharge shall be measured after standard charge. 0.5C ₅ A 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%
3	Leakage-Proof 漏液试验	No leakage (visual inspection) (没有漏液/目测)	After full charge with standard charge, store at 60±3°C, 60±10%RH for 1 month. 标准充电条件下充满电后在温度 60±3°C, 湿度 60±10%RH 下储存一个月

4. Mechanical characteristics and Safety Test (安全测试及机械特性)

No. (序号)	Items (项目)	Test Method and Condition (测试方法及条件)	Criteria (标准)
1	Vibration Test 振动测试	<p>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.</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 30 分钟，振幅 1.6mm，振动频率为 10Hz~55Hz，每分钟变化 1Hz。</p>	<p>No leakage 无泄漏 No fire 不起火</p>
2	Drop Test 跌落测试	<p>Drop the battery in the shipment condition(full-charge)from 1m height onto 18~20 mm or thicker concrete with p-tile on it 1 times each of obverse and inverse directions at 25±3°C</p> <p>电池振动试验结束后按下列条件进行自由跌落试验： 跌落高度：1.0m； 承接物：18~20mm 厚硬木板； 跌落方向：沿水平方向正反面各跌落一次。</p>	<p>No fire, no explosion, no smoking, no explosion, 电池无漏液、冒烟 或爆炸</p>
3	Thermal abuse 加热	<p>Each fully charged cell, stabilized at room temperature is placed in a gravity or circulating air-convection oven. The oven temperature is raised at a rate of 5 °C/min ± 2 °C/min to a temperature of 130°C ± 2°C. The cell remains at this temperature for 10 min before the test is discontinued.</p> <p>将充满电的电池放置在空气循环烘箱中，烘箱温度以 5 °C/min ± 2 °C/min 升高到 130°C ± 2°C，在此温度下保留 10min。</p>	<p>No explosion, No fire (无起火、无爆炸)</p>

Item (项目)	Battery Condition (电池要求)	Test Method (测试方法)	Requirements (要求)
Short Circuit (短路试验)	Fresh, Fully charged (充满电的新电池)	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 0.1Ω)	No explosion, No fire The Temperature of the surface of the Cells are lower than 150°C (无起火、无爆炸 电池表面温度低于 150°C)
Impact (重物冲击)	Fresh, Fully charged (充满电的新电池)	A 15.8mm diameter bar is inlayed into the bottom of a 9.1kg weight. And the weight is to be dropped from a height of 610mm onto a sample battery and then the bar will be across the center of the sample. (用一条直径为 15.8mm 的圆棒放置在电池中央, 将一 9.1Kg 的重锤从 610mm 的高度垂直落下在电池的中心位置)	No explosion, No fire (无起火、无爆炸)
Forced Discharge (过放试验)	Fresh, Fully charged (充满电的新电池)	Discharge at a current of 1.0 C ₅ A for 1.5h. (以 1.0C ₅ A 的电流放电 1.5 小时)	No explosion, No fire (无起火、无爆炸)
Abnormal Charging Test 过充电测试	Fresh, Fully charged (充满电的新电池)	After standard charge, charge at a current of 1.0 C ₅ A for 1h. 标准充电后, 以 1.0C ₅ A 的电流继续充电 1 小时	No explosion, No fire (无起火、无爆炸)

5. Handling of Cells (电池操作注意事项)

5.1 Prohibition short circuit (禁止电池短路)

Never make short circuit cell. It generates very high current which causes heating of the cells and may cause electrolyte leakage, gassing or explosion that are very dangerous.

The poles may be easily short-circuited by putting them on conductive surface.

Such outer short circuit may lead to heat generation and damage of the cell.

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，产生有毒气体或爆炸是非常危险的。电极端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。

5.2 Mechanical shock (机械撞击)

Falling, hitting, bending, etc. may cause degradation of battery characteristics.

跌落、碰撞、弯曲等等都可能会降低电池的性能。

6. Notice for Designing Battery Pack (电池外壳设计注意事项)

6.1 Pack toughness (外壳坚韧度)

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

电池外壳应该有足够的机械强度使电池免受机械撞击。

6.2 Cell fixing (电池的固定)

No cell 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。

6.3 Inside design (外壳内部设计)

No sharp edge components should be insides the pack containing the cell.

外壳内安装电池的部位不应有锋锐边。

6.4 Pole connection (电极端连接)

Ultrasonic welding or spot welding is recommended for pole connection method.

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 350°C;
- 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. 90°C.

建议使用超声波或点焊焊接方法。

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：

- 焊接烙铁的温度必须可控且可防静电；
- 焊接时烙铁的温度不能超过 350°C；
- 焊锡时间不能超过 3 秒钟；
- 焊锡次数不能超过 5 次，待电极端冷却后才能进行下一次焊锡；
- 严禁直接加热电芯，高于 90°C 度会损害电芯。

6.5 For mishaps (针对意外事件)

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

- 1) Isolate PCM (Protection Circuit Module) from leaked electrolyte as perfectly as possible.
- 2) Avoid narrow spacing between bare circuit patterns with different voltage.
(Including around connector)
- 3) Battery should not have liquid from electrolyte, but in case If leaked electrolyte touch bare circuit 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.

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、尽量把保护电路与渗漏的电解液隔离开。
- 2、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、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。

7. Notice for Assembling Battery Pack (电池装配注意事项)

Shocks, high temperature, or contacts of sharp edge components should not be allowed in battery pack assembling process.

在电池装配过程中不允许撞击、高温或接触尖锐部分。

8. Others (其它)

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

Enough insulation layers between wiring and the cells 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。

8.2 Prohibition of disassembly (禁止拆卸)

1) Never disassemble the cells

The disassembling may generate internal short circuit in the cell, which may cause gassing, firing, explosion, or other problems.

2) Electrolyte is harmful

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.

1、不要拆卸电池。

拆卸电池会发生电池内部短路，会引起起火、爆炸、有害气体或者其它问题。

2、电解液是有害的

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。

8.3 Prohibition of dumping of cells into fire (不要把电池倾倒入火中)

Never incinerate nor dispose the cells in fire. These may cause explosion of the cells, 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。

8.4 Prohibition of cells immersion into liquid such as water (禁止浸泡电池)

The cells shall never be soaked with liquids such as water, seawater, drinks such as soft drinks, juices, 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、咖啡或者其它的饮料。

8.5 Battery cells replacement (更换电池)

The battery replacement shall be done only by either cells supplier or device supplier and never be done 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。

8.6 Prohibition of use of damaged cells (禁止使用损坏的电池)

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

The Cells 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及爆炸。

9. Period of Warranty (保质期)

The period of warranty is a year from the date of shipment. guarantees to give a replacement in case of cells with defects proven due to manufacturing process instead of the customer 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。

10. Storing the Batteries (电池的存放)

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 three months to prevent over discharge.

电池应当在室温下存放，应充到 50%至 60%的电量。如长时间储存，建议每三个月充一次电以防止电池过放电。

11. Other The Chemical Reaction (其它的化学反应)

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.

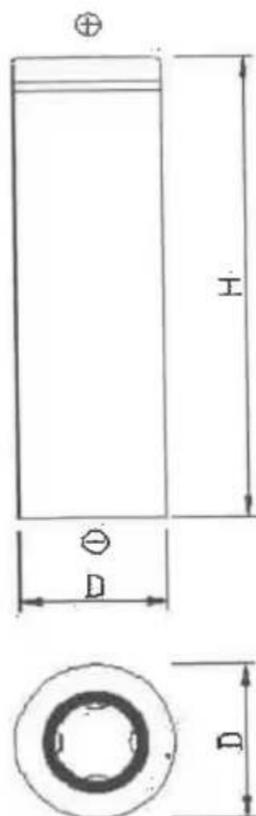
由于电池是利用化学反应的原理，所以随时间的增加电池的性能会降低，即使是存放很长一段时间而不使用。如果使用条件如充电、放电及周围环境温度等情形不在指定的使用范围内，会使缩短电池的使用寿命，或者会产生漏液导致设备损坏。如果电池长周期不能充电，即使充电方法正确，这样需要更换电池了。

12.Note: (注释)

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

本说明书未包括事项应由双方协议确定。

13. Dimension (尺寸)



尺寸	D	18.3±0.1	H	65.3±0.1	单位	mm
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