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UN38.3 Test Report

UN38.3 检测报告

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Add. of Client **委托方地址**	4, 5/f, #8, gaoqi Nan Shi'er Road (Aide Airport Industrial Park), Xiamen, Fujian. 厦门高崎南十二路 8 号四，五楼（艾德航空工业园）
Name of Sample **样品名称**	Li-ion Polymer Battery Pack 锂离子聚合物电池组
Model **型号**	X000-001
Testing Laboratory **测试机构**	Shenzhen TCT Testing Technology Co., Ltd. 深圳市通测检测技术有限公司 1B/F., Building 1, Yibaolai Industrial Park, Qiaotou, Fuyong, Baoan District, Shenzhen, Guangdong, China 中国广东省深圳市宝安区福永桥头亿宝来工业城 1 栋 1 层 B
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Test Conclusion 测试结论: **The test results are qualified. 测试结果为合格。**	

Tested by 主检人: Summer Yang 杨淼 **Approved by 批准人:** Tomsin 汤晓森

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Ⅰ、Sample Description 样品描述

Name of Sample 样品名称	Li-ion Polymer Battery Pack 锂离子聚合物电池组		**Model 型号**	X000-001	
Manufacturer 制造商	ShenZhen M-Batt Electronics CO., LTD 深圳电丰电子有限公司				
Address 地址	2/F, No.2 Building, BuChong Industry Park, Shajin Town, Bao'an District, Shenzhen 深圳市宝安区沙井街道步涌同富裕工业区大田小区 2 栋 2 楼				
Trade Mark 商标	----	**Shape 形状**	Prismatic 棱柱形	**Size 尺寸 (L×W×T)**	(53.4×53.3×15.5)mm
Nominal Voltage 标称电压	3.7V	**Rated Capacity 额定容量**	1700mAh 6.29Wh	**Limited Charge Voltage 充电限制电压**	4.2V
Standard Charge Current 标准充电电流	340mA	**Maximum Charge Current 最大充电电流**	850mA	**End Charge Current 结束充电电流**	34mA
Discharge Cut-off Voltage 放电截止电压	3.0V	**Standard Discharge Current 标准放电电流**	340mA	**Maximum Discharge Current 最大放电电流**	1700mA
Cell Model 电芯型号	724049	**Cell Nominal Voltage 电芯标称电压**	3.7V	**Cell Rated Capacity 电芯额定容量**	1700mAh
Cells Number 电芯数量	1PCS	**Start Testing Date 开始测试日期**	2019-01-04	**Completing Date 完成日期**	2019-01-16

Ⅱ、Standard 标准

Recommendations on the Transport of Dangerous Goods, Manual of Test and Criteria (ST/SG/AC.10/11/Rev.6) Sixth revised edition.

联合国《关于危险货物运输的建议书》第六修订版。

Ⅲ、Test Item 测试项目

T.1. ☒Altitude simulation 高度模拟
T.2. ☒Thermal test 温度试验
T.3. ☒Vibration 振动
T.4. ☒Shock 冲击
T.5. ☒External short circuit 外部短路
T.6. ☐Impact / ☒Crush 重物冲击/挤压
T.7. ☒Overcharge 过充电
T.8. ☒Forced discharge 强制放电

Ⅳ、Test Method and Requirement 测试方法和要求

Tests T.1 to T.5 shall be conducted in sequence on the same cell or battery. Tests T.6 and T.8 shall be conducted using not otherwise tested cells. Test T.7 may be conducted using undamaged batteries previously used in tests T.1 to T.5 for purposes of testing on cycled batteries.

用相同的电芯或电池按照顺序进行试验 T.1 至 T.5。试验 T.6 和 T.8 用没有进行其他试验的电芯。为了测试循环后的电池，试验 T.7 可用试验 T.1 至 T.5 后没有损坏的电池。

Batteries of 1#~14# are full charged after one cycle;

Batteries of 15#~18# are full charged after fifty cycles;

Cells of 19#~23# are 50% charged after one cycle;

Cells of 24#~33# are full discharged after one cycle;

Cells of 34#~43# are full discharged after fifty cycles;

Test environment condition: ambient temperature: 20 ± 5 °C.

电池 1#~14#为一次循环满电状态；

电池 15#~18#为五十次循环满电状态；

电芯 19#~23#为一次循环后 50%充电状态；

电芯 24#~33#为一次循环完全放电状态；

电芯 34#~43#为五十次循环完全放电状态；

试验环境条件：环境温度：20 ± 5 °C。

Table 38.3.1: Mass loss limit

表 38.3.1: 质量损失限值

Mass M of cell or battery 电芯或电池的质量	Mass loss limit 质量损失限值
M ＜ 1 g	0.5%
1 g ≤ M ≤75 g	0.2%
M ＞ 75 g	0.1%

In order to quantify the mass loss, the following procedure is provided:

$$\text{Mass loss (\%)} = (M_1 - M_2)/M_1 \times 100$$

质量损失的量化值，可用以下公式计算：

$$\text{质量损失(\%)} = (M_1 - M_2)/M_1 \times 100$$

Where M_1 is the mass before the test and M_2 is the mass after the test. When mass loss does not exceed the values in Table 38.3.1, it shall be considered as "no mass loss".

式中：M_1 是试验前的质量，M_2 是试验后的质量。如果质量损失不超过表 38.3.1 所列的数值，应视为“无质量损失”。

Leakage means the visible escape of electrolyte or other material from a cell or battery or the loss of material (except battery casing, handling devices or labels) from a cell or battery such that the loss of mass exceeds the values in Table 38.3.1.

渗漏是指可以看到的电解液或者其他物质从电芯或电池中漏出，电芯或电池中的物质损失（不包括电池外壳、搬运装置、或标签），质量损失超过表 38.3.1 所列的数值。

Venting means the release of excessive internal pressure from a cell or battery in a manner intended by design to preclude rupture or disassembly.

泄气是指按设计方式释放电芯或电池内部过高的压力，防止其破裂或解体。

Disassembly means a vent or rupture where solid matter from any part of a cell or battery penetrates a wire mesh screen (annealed aluminium wire with a diameter of 0.25 mm and grid density of 6 to 7 wires per cm) placed 25 cm away from the cell or battery.

解体是指排气或破裂使电芯或电池任何部分的固体物质穿过放在离电芯或电池 25 cm 处的丝网筛（直径 0.25 mm 的软铝丝，网格密度每厘米 6 至 7 条铝丝）。

Rupture means the mechanical failure of a cell container or battery case induced by an internal or external cause, resulting in exposure or spillage but not ejection of solid materials.

破裂是指内部或外部原因引起的电芯容器或电池外壳机械损坏，造成内置物暴露或溢出，但无固体喷射。

Fire means that flames are emitted from the test cell or battery.

起火是指试验电芯或电池有火焰冒出。

T.1. Altitude simulation 高度模拟

Test procedure 测试程序

Test cells and batteries shall be stored at a pressure of 11.6 kPa or less for at least six hours at ambient temperature (20 ± 5 °C).

试验电芯和电池被放置在压力等于或低于 11.6 kPa 和环境温度(20 ± 5 °C)下存放至少 6 h。

Requirement 要求

Cells and batteries meet this requirement if there is no leakage, no venting, no disassembly, no rupture and no fire and if the open circuit voltage of each test cell or battery after testing is not less than 90% of its voltage immediately prior to this procedure. The requirement relating to voltage is not applicable to test cells and batteries at fully discharged states.

电芯和电池须无渗漏、无泄气、无解体、无破裂和无起火，并且每个试验电芯和电池在试验后的开路电压不小于其在进行这一试验前电压的 90%。有关电压要求不适用于测试完全放电状态的电芯和电池。

T.2. Thermal test 温度试验

Test procedure 测试程序

Test Cells and batteries are to be stored for at least six hours at a test temperature equal to 72 ± 2 °C, followed by storage for at least six hours at a test temperature equal to – 40 ± 2 °C. The maximum time interval between test temperature extremes is 30 minutes. This procedure is to be repeated until 10 total cycles are complete, after which all test cells and batteries are to be stored for 24 hours at ambient temperature (20 ± 5 °C). For large cells and batteries the duration of exposure to the test temperature extremes should be at least 12 hours.

试验电芯和电池放置在试验温度等于 72 ± 2 °C 的条件下存放至少 6 h，接着再在试验温度等于- 40 ± 2 °C 的条件下存放至少 6 h。两个极端试验温度之间的最大时间间隔为 30 min。此程序重复进行，共完成 10 次，接着将所有试验电池在环境温度(20 ± 5 °C)下存放 24 h。对于大型电芯和电池，暴露于极端试验温度的时间应至少为 12 h。

Requirement 要求

Cells and batteries meet this requirement if there is no leakage, no venting, no disassembly, no rupture and no fire and if the open circuit voltage of each test cell or battery after testing is not less than 90% of its voltage immediately prior to this procedure. The requirement relating to voltage is not applicable to test cells and batteries at fully discharged states.

电芯和电池须无渗漏、无泄气、无解体、无破裂和无起火，并且每个试验电芯和电池在试验后的开路电压不小于其在进行这一试验前电压的 90%。有关电压要求不适用于测试完全放电状态的电芯和电池。

T.3. Vibration 振动

Test procedure 测试程序

Cells and batteries are firmly secured to the platform of the vibration machine without distorting the cells in such a manner as to faithfully transmit the vibration. The vibration shall be a sinusoidal waveform with a logarithmic sweep between 7 Hz and 200 Hz and back to 7 Hz traversed in 15 minutes. This cycle shall be repeated 12 times for a total of 3 hours for each of three mutually perpendicular mounting positions of the cell. One of the directions of vibration must be perpendicular to the terminal face.

The logarithmic frequency sweep shall differ for cells and batteries with a gross mass of not more than 12 kg (cells and small batteries), and for batteries with a gross mass of more than 12 kg (large batteries).

For cells and small batteries: from 7 Hz a peak acceleration of 1 g_n is maintained until 18 Hz is reached. The amplitude is then maintained at 0.8 mm (1.6 mm total excursion) and the frequency increased until a peak acceleration of 8 g_n occurs (approximately 50 Hz). A peak acceleration of 8 g_n is then maintained until the frequency is increased to 200 Hz.

For large batteries: from 7 Hz to a peak acceleration of 1 g_n is maintained until 18 Hz is reached. The amplitude is then maintained at 0.8 mm (1.6 mm total excursion) and the frequency increased until a peak acceleration of 2 g_n occurs (approximately 25 Hz). A peak acceleration of 2 g_n is then maintained until the frequency is increased to 200 Hz.

电芯和电池紧固于振动台台面，但不得造成电池变形，并能准确可靠地传播振动。振动应是正弦波形，对数扫描频率在 7 Hz 和 200 Hz 之间，再回到 7 Hz，1 次循环时间为 15 min。这一振动过程须对三个互相垂直的电池安装方位的每一方向重复进行 12 次，总共为时 3 h。其中一个振动方向必须与端面垂直。

做对数频率扫描对总质量不超过 12 kg 的电芯和电池（电芯和小型电池），和对超过 12 kg 的电池（大型电池）有所不同。

对电芯和小型电池：从 7 Hz 开始，保持 1 g_n 的最大加速度，直到频率达到 18 Hz。然后将振幅保持在 0.8 mm（总位移 1.6 mm），并增加频率直到峰值加速度达到 8 g_n（频率约为 50 Hz）。将峰值加速度保持在 8 g_n 直到频率增加到 200 Hz。

对于大型电池：从 7 Hz 开始，保持 1 g_n 的最大加速度，直到频率达到 18 Hz。然后将振幅保持在 0.8 mm（总位移 1.6 mm），并增加频率直到峰值加速度达到 2 g_n（频率约为 25 Hz）。将峰值加速度保持在 2 g_n 直到频率增加到 200 Hz。

Requirement 要求

Cells and batteries meet this requirement if there is no leakage, no venting, no disassembly, no rupture and no fire during the test and after the test and if the open circuit voltage of each test cell or battery after testing is not less than 90% of its voltage immediately prior to this procedure. The requirement relating to voltage is not applicable to test cells and batteries at fully discharged states.

电芯和电池须无渗漏、无泄气、无解体、无破裂和无起火，并且每个试验电芯和电池在试验后的开路电压不小于其在进行这一试验前电压的 90%。有关电压要求不适用于测试完全放电状态的电芯和电池。

T.4. Shock 冲击

Test procedure 测试程序

Test cells and batteries shall be secured to the testing machine by means of a rigid mount which will support all mounting surfaces of each test battery.

Each cell shall be subjected to a half-sine shock of peak acceleration of 150 g_n and pulse duration of 6 milliseconds. Alternatively, large cells may be subjected to a half-sine shock of peak acceleration of 50 g_n and pulse duration of 11 milliseconds.

Each battery shall be subjected to a half-sine shock of peak acceleration depending on the mass of the battery. The pulse duration shall be 6 milliseconds for small batteries and 11 milliseconds for large batteries. The formulas below are provided to calculate the appropriate minimum peak accelerations.

Each cell or battery shall be subjected to three shocks in the positive direction and to three shocks in the negative direction in each of three mutually perpendicular mounting positions of the cell or battery for a total of 18 shocks.

试验电芯和电池用刚性支架紧固在试验装置上，支架支撑着每个试验电池的所有安装面。

每个电芯需经受峰值加速度 150 g_n 和脉冲持续时间 6 ms 的半正弦波冲击。另外大电芯需要经受峰值加速度 50 g_n 和脉冲持续时间 11 ms 的半正弦波冲击。

每个电池接受半正弦波冲击峰值加速度取决于电池的质量，小型电池脉冲持续时间应为 6 ms，大型电池脉冲持续时间为 11 ms 的半正弦波冲击，下面提供的公式来计算适当的最小峰值加速度。

每个电芯或电池需在三个互相垂直的电池安装方位的正方向经受三次冲击，接着在反方向经受三次冲击，总共经受 18 次冲击。

Requirement 要求

Cells and batteries meet this requirement if there is no leakage, no venting, no disassembly, no rupture and no fire and if the open circuit voltage of each test cell or battery after testing is not less than 90% of its voltage immediately prior to this procedure. The requirement relating to voltage is not applicable to test cells and batteries at fully discharged states.

电芯和电池须无渗漏、无泄气、无解体、无破裂和无起火，并且每个试验电芯和电池在试验后的开路电压不小于其在进行这一试验前电压的 90%。有关电压要求不适用于测试完全放电状态的电芯和电池。

Battery	Minimum peak acceleration	Pulse duration
Small batteries	150 g_n or result of formula Acceleration(g_n) = $\sqrt{\left(\frac{100850}{mass*}\right)}$ whichever is smaller	6 ms
Large batteries	50 g_n or result of formula Acceleration(g_n) = $\sqrt{\left(\frac{30000}{mass*}\right)}$ whichever is smaller	11 ms

* Mass is expressed in kilograms.

*质量用千克表示

T.5. External short circuit 外部短路

Test procedure 测试程序

The cell or battery to be tested shall be shall be heated for a period of time necessary to reach a homogeneous stabilized temperature of 57 ± 4 °C, measured on the external case. This period of time depends on the size and design of the cell or battery and should be assessed and documented. If this assessment is not feasible, the exposure time shall be at least 6 hours for small cells and small batteries, and 12 hours for large cells and large batteries. Then the cell or battery at 57 ± 4 °C shall be subjected to one short circuit condition with a total external resistance of less than 0.1 ohm.

This short circuit condition is continued for at least one hour after the cell or battery external case temperature has returned to 57 ± 4 °C, or in the case of the large batteries, has decreased by half of the maximum temperature increase observed during the test and remains below that value.

The short circuit and cooling down phases shall be conducted at least at ambient temperature.

测试的电芯或电池外壳温度达到恒温 57 ± 4 °C 后，再进行外部短路。短路的时间取决于电芯或电池的尺寸和设计，并需被评估和记录。如果这个评估无法进行，那么小电芯和小电池短路时间至少 6 h，大电芯和大电池短路时间至少 12 h。然后电芯或电池在 57 ± 4 °C 环境下经受一个阻值小于 0.1 Ω 的外部电路短路。电芯或电池温度到 57 ± 4 °C 之后，短路时间需持续 1 h，大型电池短路温度下降到最大温升的一半或低于 57 ± 4 °C。

短路和降温阶段至少应在环境温度下进行。

Requirement 要求

Cells and batteries meet this requirement if their external temperature does not exceed 170 °C and there is no disassembly, no rupture and no fire during the test and within six hours after the test.

电芯和电池外壳温度不超过 170 °C，并且在试验过程中及试验后 6 h 内无解体、无破裂、无起火。

T.6. Impact / Crush 重物冲击/挤压

Test procedure – Impact (applicable to cylindrical cells not less than 18.0 mm in diameter)

测试程序 – 重物冲击（适用于直径大于等于 18.0 mm 的圆柱形电池）

The test sample cell or component cell is to be placed on a flat smooth surface. A 15.8 mm ± 0.1mm diameter, at least 6 cm long, or the longest dimension of the cell, whichever is greater, Type 316 stainless steel bar is to be placed across the centre of the sample. A 9.1 kg ± 0.1 kg mass is to be dropped from a height of 61 ± 2.5 cm at the intersection of the bar and sample in a controlled manner using a near frictionless, vertical sliding track or channel with minimal drag on the falling mass. The vertical track or Channel used to guide the falling mass shall be oriented 90 degrees from the horizontal supporting surface.

The test sample is to be impacted with its longitudinal axis parallel to the flat surface and perpendicular to the longitudinal axis of the 15.8 mm ± 0.1mm diameter curved surface lying across the centre of the test sample. Each sample is to be subjected to only a single impact.

测试电芯或元件电芯样品放在平坦光滑表面上。一根 316 型不锈钢棒横放在测试样品中心，钢棒直径 15.8 mm ± 0.1 mm，长度至少 6 cm，或电芯最长尺寸，取二者之长者。将一块 9.1 kg ± 0.1 kg 的重锤从 61 ± 2.5 cm 高度跌落到钢棒和测试样品交叉处，使用一个几乎没有摩擦的，对落体重锤阻力最小的垂直轨道或管道加以控制。垂直轨道或管道用于引导落锤与水平表面成 90° 落下。

受撞击的测试样品，纵轴应与平坦表面平行，并与横放在测试样品中心直径为 15.8 ± 0.1 mm 弯曲表面的纵轴垂直。每一个测试样品只经受一次撞击。

Test procedure – Crush (applicable to prismatic, pouch, coin/button cells and cylindrical cells less than 18.0 mm in diameter)

测试程序 – 挤压（适用于棱形、袋状、硬币/纽扣电芯和圆柱形电芯直径小于 18.0 mm）

A cell or component cell is to be crushed between two flat surfaces. The crushing is to be gradual with a speed of approximately 1.5 cm/s at the first point of contact. The crushing is to be continued until the first of the three options below is reached.

(a) The applied force reaches 13 kN ± 0.78 kN;

(b) The voltage of the cell drops by at least 100 mV; or

(c) The cell is deformed by 50% or more of its original thickness.

Once the maximum pressure has been obtained, the voltage drops by 100 mV or more, or the cell is deformed by at least 50% of its original thickness, the pressure shall be released.

A prismatic or pouch cell shall be crushed by applying the force to the widest side. A button/coin cell shall be crushed by applying the force on its flat surfaces. For cylindrical cells, the crush force shall be applied perpendicular to the longitudinal axis.

Each test cell or component cell is to be subjected to one crush only. The test sample shall be observed for a further 6 h. The test shall be conducted using test cells or component cells that have not previously been subjected to other tests.

将电芯或元件电芯放在两个平面之间挤压，挤压力度逐渐加大，在第一个接触点上的速度大约为 1.5 cm/s。挤压持续进行，直到出现以下三种情况之一：

(a)施加的力量达到 13 kN ± 0.78 kN；

(b)电芯的电压下降至少 100 mV；或

(c)电芯形变达原始厚度的 50%或更多。

一旦达到最大压力、电压下降 100 mV 或更多，或电芯形变至少达原厚度的 50%，即可解除压力。

棱柱形或袋状电芯须从最宽的面施压。纽扣/硬币形电芯须从平坦表面施压。圆柱形电芯须从与纵轴垂直的方向施压。

每个试验电芯或元件电芯只做一次挤压试验。试验样品须继续观察 6 h。试验须使用之前未做过其他试验的电芯进行。

Requirement 要求

Cells and component cells meet this requirement if their external temperature does not exceed 170 °C and there is no disassembly and no fire during the test and within six hours after this test.

电芯和元件电芯外壳温度不超过 170 °C，并且在试验过程中及试验后 6 h 内无解体、无起火。

T.7. Overcharge 过充电

Test procedure 测试程序

The charge current shall be twice the manufacturer's recommended maximum continuous charge current. The minimum voltage of the test shall be as follows:

(a) When the manufacturer's recommended charge voltage is not more than 18 V, the minimum voltage of the test shall be the lesser of two times the maximum charge voltage of the battery or 22 V.

(b) When the manufacturer's recommended charge voltage is more than 18 V, the minimum voltage of the test shall be 1.2 times the maximum charge voltage.

Tests are to be conducted at ambient temperature. The duration of the test shall be 24 hours.

充电电流为制造商建议的最大持续充电电流的两倍。试验的最小电压如下：

(a) 制造商建议的充电电压不大于 18 V 时，试验的最小电压应是电池最大充电电压的两倍或 22 V 两者中的较小者。

(b) 当制造商建议的充电电压超过 18 V，试验的最小电压应是最大充电电压的 1.2 倍。

试验应在环境温度下进行。进行试验的时间应为 24 h。

Requirement 要求

Rechargeable batteries meet this requirement if there is no disassembly and no fire during the test and within seven days after the test.

可充电电池在试验过程中和试验后 7 天内无解体、无起火。

T.8. Forced discharge 强制放电

Test procedure 测试程序

Each cell shall be forced discharged at ambient temperature by connecting it in series with a 12 V D.C. power supply at an initial current equal to the maximum discharge current specified by the manufacturer.

The specified discharge current is to be obtained by connecting a resistive load of the appropriate size and rating in series with the test cell. Each cell is forced discharged for a time interval (in hours) equal to its rated capacity divided by the initial test current (in ampere).

每个电芯在环境温度下与 12 V 直流电电源串联在起始电流等于制造商规定的最大放电电流的条件下强制放电。

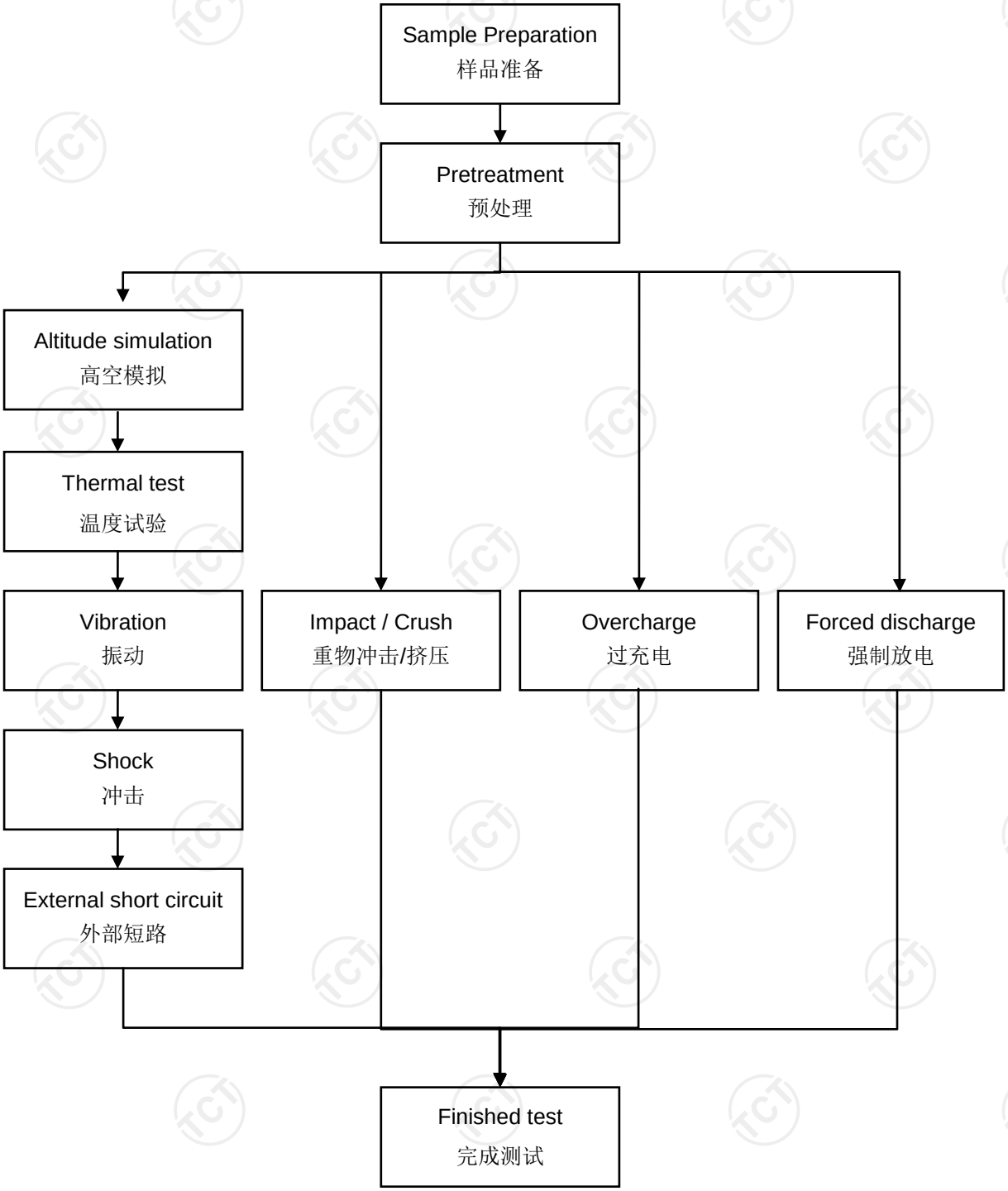
电芯与一个适当大小的电阻负载串联以调节到规定大小的放电电流。每个电芯的放电时间（单位为 h）等于电芯的额定容量除以试验初始放电电流（单位 A）。

Requirement 要求

Primary or rechargeable cells meet this requirement if there is no disassembly and no fire during the test and within seven days after the test.

不可充电或可充电的电芯在试验过程中和试验后 7 天内无解体、无起火。

Ⅴ、Test procedure 测试流程



Ⅵ、Main Test Apparatus 主要测试仪器

Serial No. 设备编号	Name of Equipment 设备名称	Model 型号	Calibration Date /Due Date 校准日期/到期日
TC-B01	Low Altitude Simulation Tester 低压高空模拟试验箱	GX-3020-Z	2018. 04. 20 2019. 04. 19
TC-B04	Vertical Shock Test Instrument 垂直冲击试验台	SY10-2	2018. 04. 20 2019. 04. 19
TC-B05	Vibration test instrument 振动试验台	ES-3-150	2018. 04. 20 2019. 04. 19
TC-B07	Battery Test System 电池测试系统	CTS 20V/10A	2018. 04. 20 2019. 04. 19
TC-B11	Crush Test Instrument 温控型电池挤压试验机	BE-6045T	2018. 04. 20 2019. 04. 19
TC-B13	Battery Short Circuit Tester 电池短路试验机	GX-6055-B	2018. 04. 20 2019. 04. 19
TC-B14	Electronic Balance 电子天平	PTT-A+300	2018. 04. 20 2019. 04. 19
TC-B15	Data Collector 数据采集器	34970A	2018. 04. 20 2019. 04. 19
TC-B18	DC POWER 直流源	P2TSW 80-27	2018. 04. 20 2019. 04. 19
TC-B21	Battery Impact Tester 电池冲击试验机	BE-5066	2018. 04. 20 2019. 04. 19
TC-B25	Digital Multimeter 数字万用表	15B	2018. 09. 11 2019. 09. 10
TC-B10	Programmable high & low temperature test chamber 可程式高低温试验机	BE-TH-150M8-4	2018. 09. 11 2019. 09. 10

Ⅶ、Test Data 测试数据

T.1. Altitude simulation 高度模拟

Test sample status 测试样品状态	No. 编号	Pre-test 试验前		After test 试验后		Mass loss 质量损失 (%)	Change ratio 电压比(%)	Status 结果
		Mass 质量 (g)	Voltage 电压 (V)	Mass 质量 (g)	Voltage 电压 (V)			
Full charged after one cycle 一次循环后满电状态	1#	39.727	4.18	39.727	4.18	0.00	100.0	Pass 合格
	2#	39.636	4.18	39.634	4.18	0.01	100.0	Pass 合格
	3#	39.563	4.19	39.563	4.18	0.00	99.8	Pass 合格
	4#	39.582	4.19	39.582	4.19	0.00	100.0	Pass 合格
	5#	39.641	4.18	39.636	4.18	0.01	100.0	Pass 合格
	6#	39.461	4.18	39.461	4.18	0.00	100.0	Pass 合格
	7#	39.618	4.19	39.618	4.19	0.00	100.0	Pass 合格
	8#	39.384	4.18	39.384	4.18	0.00	100.0	Pass 合格
	9#	39.592	4.19	39.587	4.18	0.01	99.8	Pass 合格
	10#	39.631	4.18	39.631	4.18	0.00	100.0	Pass 合格

Notes 注释: Ambient temperature 环境温度: 23.6 °C。

After the test, there is no leakage, no venting, no disassembly, no rupture and no fire. And change ratio is not less than 90 %. 测试后，样品无渗漏、无泄气、无解体、无破裂和无起火。电压比不小于 90 %。

T.2. Thermal test 温度试验

Test sample status 测试样品状态	No. 编号	Pre-test 试验前		After test 试验后		Mass loss 质量损失 (%)	Change ratio 电压比(%)	Status 结果
		Mass 质量 (g)	Voltage 电压 (V)	Mass 质量 (g)	Voltage 电压 (V)			
Full charged after one cycle 一次循环后满电状态	1#	39.727	4.18	39.715	4.15	0.03	99.3	Pass 合格
	2#	39.634	4.18	39.620	4.14	0.04	99.0	Pass 合格
	3#	39.563	4.18	39.543	4.14	0.05	99.0	Pass 合格
	4#	39.582	4.19	39.564	4.15	0.05	99.0	Pass 合格
	5#	39.636	4.18	39.622	4.15	0.04	99.3	Pass 合格
	6#	39.461	4.18	39.450	4.15	0.03	99.3	Pass 合格
	7#	39.618	4.19	39.602	4.15	0.04	99.0	Pass 合格
	8#	39.384	4.18	39.369	4.14	0.04	99.0	Pass 合格
	9#	39.587	4.18	39.571	4.15	0.04	99.3	Pass 合格
	10#	39.631	4.18	39.611	4.14	0.05	99.0	Pass 合格

Notes 注释: Ambient temperature 环境温度: 23.3 °C。

After the test, there is no leakage, no venting, no disassembly, no rupture and no fire. And change ratio is not less than 90 %. 测试后，样品无渗漏、无泄气、无解体、无破裂和无起火。电压比不小于 90 %。

T.3. Vibration 振动

Test sample status 测试样品状态	No. 编号	Pre-test 试验前		After test 试验后		Mass loss 质量损失 (%)	Change ratio 电压比(%)	Status 结果
		Mass 质量 (g)	Voltage 电压 (V)	Mass 质量 (g)	Voltage 电压 (V)			
Full charged after one cycle 一次循环后满电状态	1#	39.715	4.15	39.715	4.15	0.00	100.0	Pass 合格
	2#	39.620	4.14	39.620	4.13	0.00	99.8	Pass 合格
	3#	39.543	4.14	39.541	4.14	0.01	100.0	Pass 合格
	4#	39.564	4.15	39.564	4.15	0.00	100.0	Pass 合格
	5#	39.622	4.15	39.622	4.14	0.00	99.8	Pass 合格
	6#	39.450	4.15	39.450	4.15	0.00	100.0	Pass 合格
	7#	39.602	4.15	39.602	4.15	0.00	100.0	Pass 合格
	8#	39.369	4.14	39.367	4.14	0.01	100.0	Pass 合格
	9#	39.571	4.15	39.571	4.14	0.00	99.8	Pass 合格
	10#	39.611	4.14	39.609	4.14	0.01	100.0	Pass 合格

Notes 注释: Ambient temperature 环境温度: 23.5 °C。

After the test, there is no leakage, no venting, no disassembly, no rupture and no fire. And change ratio is not less than 90 %. 测试后，样品无渗漏、无泄气、无解体、无破裂和无起火。电压比不小于 90 %。

T.4. Shock 冲击

Test sample status 测试样品状态	No. 编号	Pre-test 试验前		After test 试验后		Mass loss 质量损失 (%)	Change ratio 电压比(%)	Status 结果
		Mass 质量 (g)	Voltage 电压 (V)	Mass 质量 (g)	Voltage 电压 (V)			
Full charged after one cycle 一次循环后满电状态	1#	39.715	4.15	39.713	4.15	0.01	100.0	Pass 合格
	2#	39.620	4.13	39.620	4.13	0.00	100.0	Pass 合格
	3#	39.541	4.14	39.541	4.14	0.00	100.0	Pass 合格
	4#	39.564	4.15	39.564	4.14	0.00	99.8	Pass 合格
	5#	39.622	4.14	39.622	4.14	0.00	100.0	Pass 合格
	6#	39.450	4.15	39.448	4.15	0.01	100.0	Pass 合格
	7#	39.602	4.15	39.600	4.14	0.01	99.8	Pass 合格
	8#	39.367	4.14	39.367	4.14	0.00	100.0	Pass 合格
	9#	39.571	4.14	39.571	4.14	0.00	100.0	Pass 合格
	10#	39.609	4.14	39.609	4.13	0.00	99.8	Pass 合格

Notes 注释: Ambient temperature 环境温度: 23.6 °C。

After the test, there is no leakage, no venting, no disassembly, no rupture and no fire. And change ratio is not less than 90 %. 测试后，样品无渗漏、无泄气、无解体、无破裂和无起火。电压比不小于 90 %。

T.5. External short circuit 外部短路

Test sample status 测试样品状态	No. 编号	Maximum external temperature (°C) 表面最高温度(°C)	Status 结果
Full charged after one cycle 一次循环后满电状态	1#	57.4	Pass 合格
	2#	57.6	Pass 合格
	3#	57.5	Pass 合格
	4#	57.4	Pass 合格
	5#	57.5	Pass 合格
	6#	57.5	Pass 合格
	7#	57.6	Pass 合格
	8#	57.4	Pass 合格
	9#	57.3	Pass 合格
	10#	57.4	Pass 合格
Notes 注释: Ambient temperature 环境温度: 23.4 °C。 Test sample external temperature does not exceed 170 °C and there is no disassembly, no rupture and no fire during the test and within six hours after the test. 测试样品表面温度不超过 170 °C，测试中与测试后 6 小时内无解体、无破裂、无起火。			

T.6. Crush 挤压

Test sample status 测试样品状态	No. 编号	Maximum external temperature (°C) 表面最高温度(°C)	Status 结果
50% charged after one cycle 一次循环后 50%充电状态	19#	23.6	Pass 合格
	20#	23.5	Pass 合格
	21#	23.6	Pass 合格
	22#	23.7	Pass 合格
	23#	23.8	Pass 合格
Notes 注释: Ambient temperature 环境温度: 23.5 °C。 Test sample external temperature does not exceed 170 °C and there is no disassembly, no rupture and no fire during the test and within six hours after the test. 测试样品表面温度不超过 170 °C，测试中与测试后 6 小时内无解体、无破裂、无起火。			

T.7. Overcharge 过充电

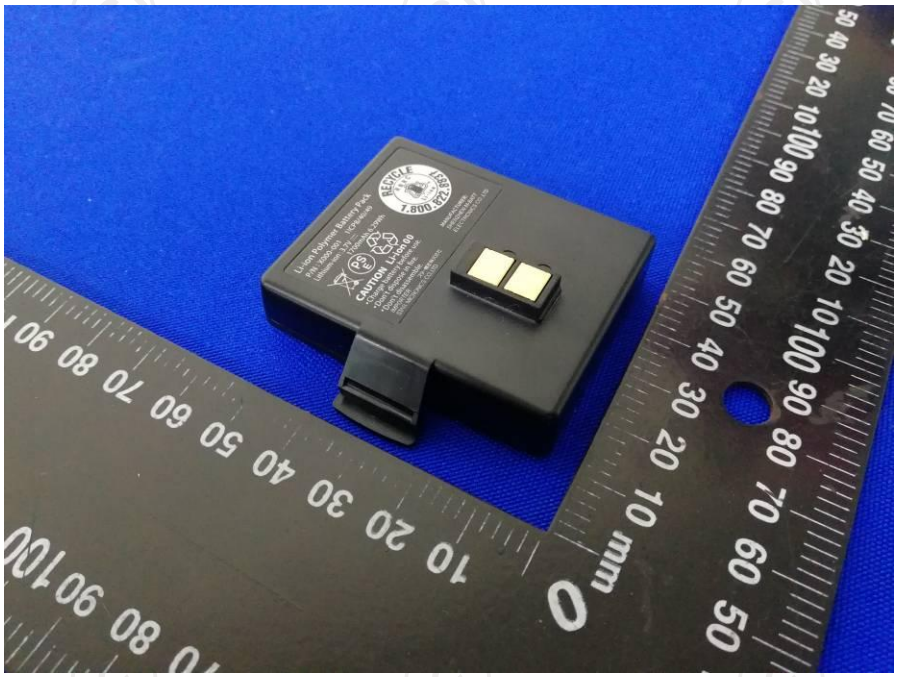
Test sample status 测试样品状态	No. 编号	Status 结果
Full charged after one cycle 一次循环后满电状态	11#	Pass 合格
	12#	Pass 合格
	13#	Pass 合格
	14#	Pass 合格

Full charged after fifty cycles 50 次循环后满电状态	15#	Pass 合格
	16#	Pass 合格
	17#	Pass 合格
	18#	Pass 合格
Notes 注释: Ambient temperature 环境温度: 23.6 °C。 There is no disassembly and no fire during the test and within seven days after the test. 样品在测试中和测试后 7 天内无解体、无起火。		

T.8. Forced discharge 强制放电

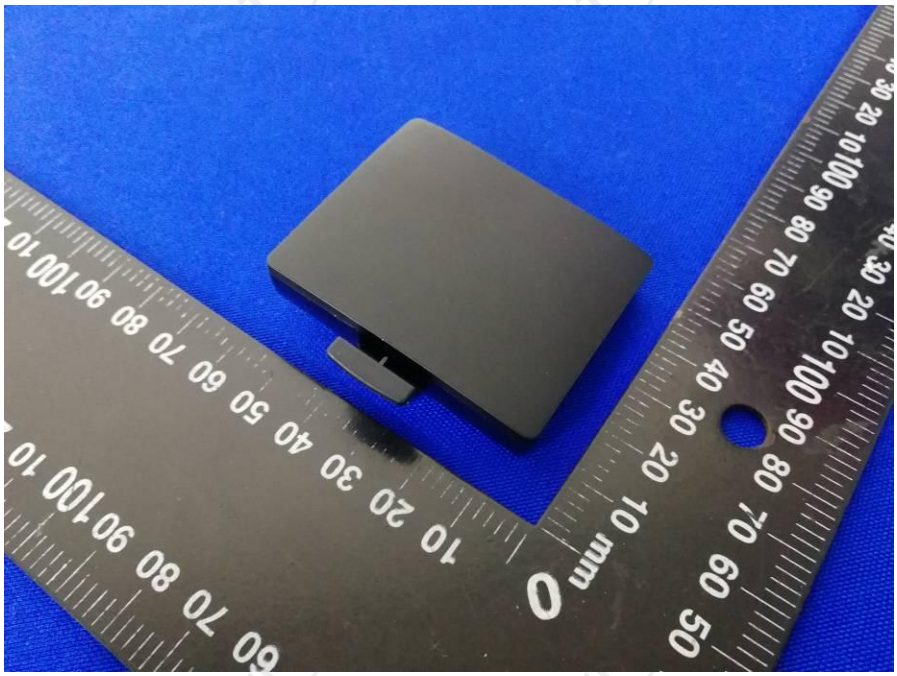
Test sample status 测试样品状态	No. 编号	Status 结果
Full discharged after one cycle 一次循环完全放电状态	24#	Pass 合格
	25#	Pass 合格
	26#	Pass 合格
	27#	Pass 合格
	28#	Pass 合格
	29#	Pass 合格
	30#	Pass 合格
	31#	Pass 合格
	32#	Pass 合格
	33#	Pass 合格
Full discharged after fifty cycles 50 个循环完全放电状态	34#	Pass 合格
	35#	Pass 合格
	36#	Pass 合格
	37#	Pass 合格
	38#	Pass 合格
	39#	Pass 合格
	40#	Pass 合格
	41#	Pass 合格
	42#	Pass 合格
	43#	Pass 合格
Notes 注释: Ambient temperature 环境温度: 23.4 °C。 There is no disassembly and no fire during the test and within seven days after the test. 样品在测试中和测试后 7 天内无解体、无起火。		

Ⅷ、Picture of the sample 样品图片



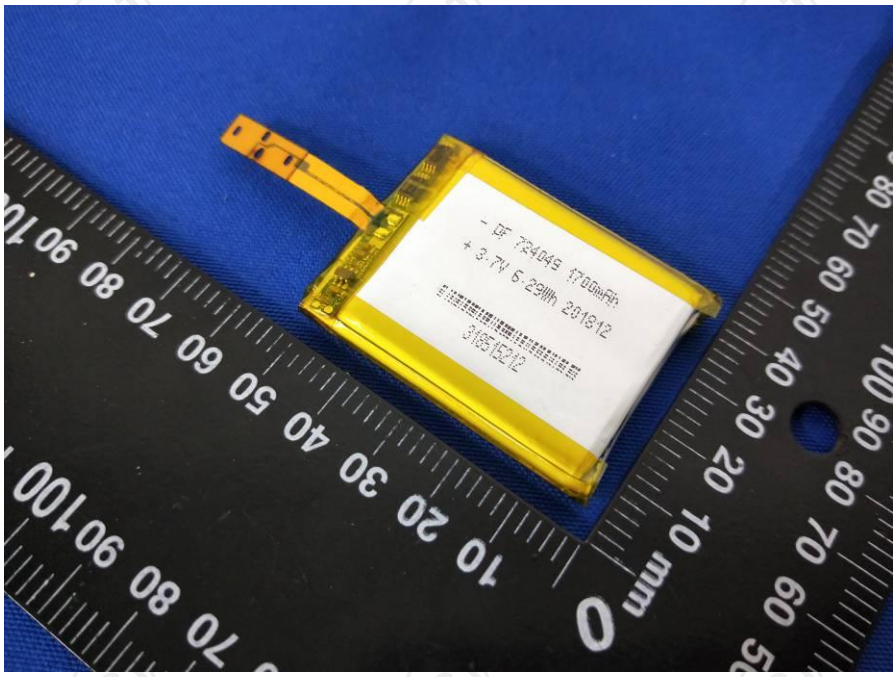
Picture 1. Battery view

图片 1. 电池视图



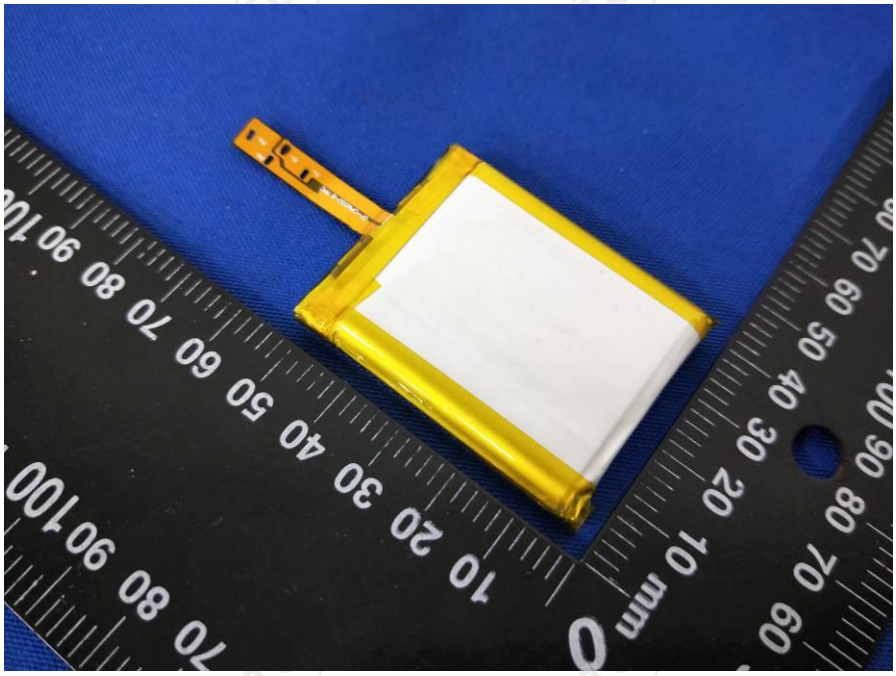
Picture 2. Battery view

图片 2. 电池视图



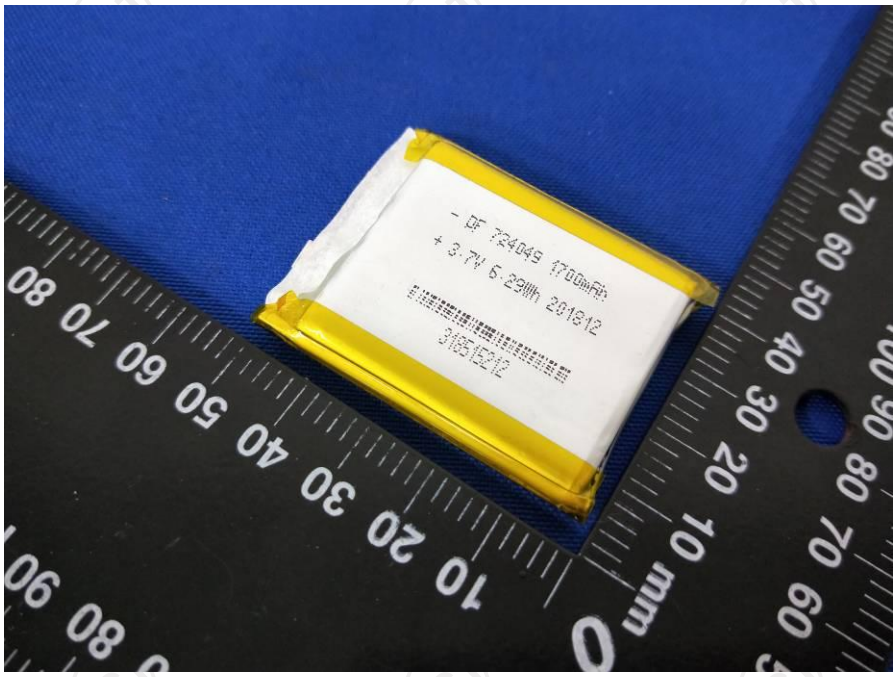
Picture 3. Cell view

图片 3. 电芯视图



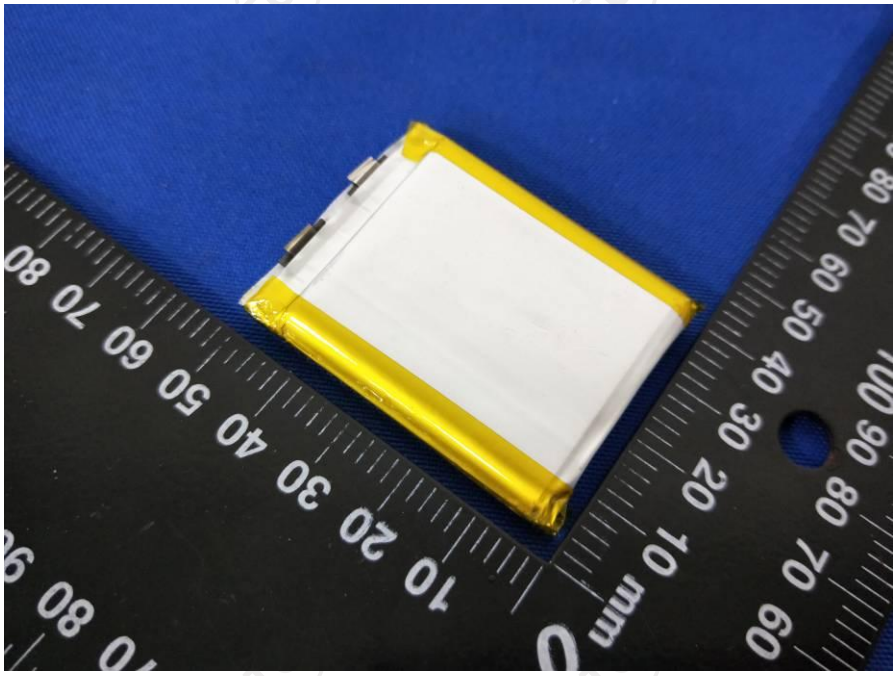
Picture 4. Cell view

图片 4. 电芯视图



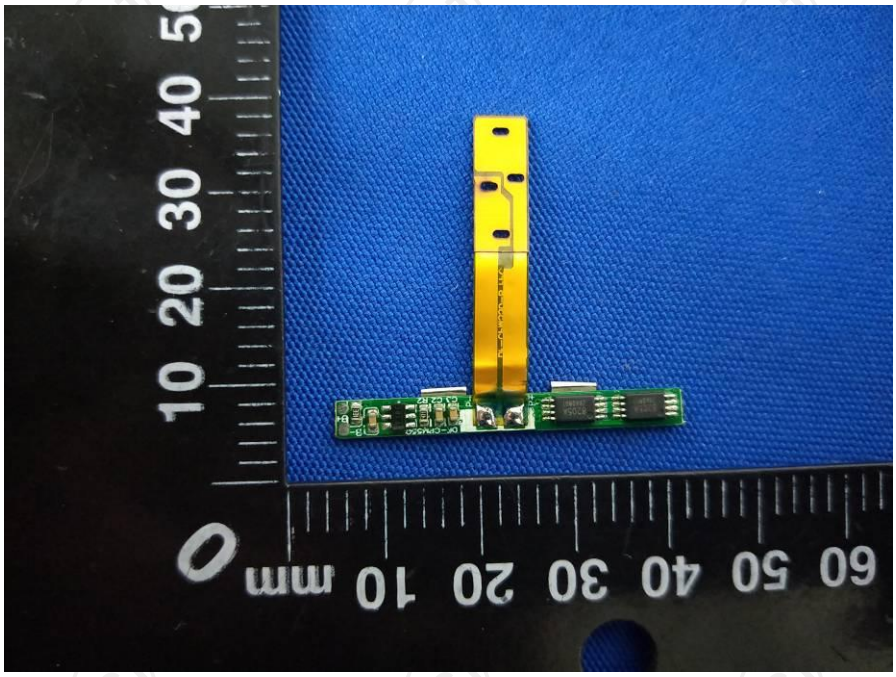
Picture 5. Cell view

图片 5. 电芯视图



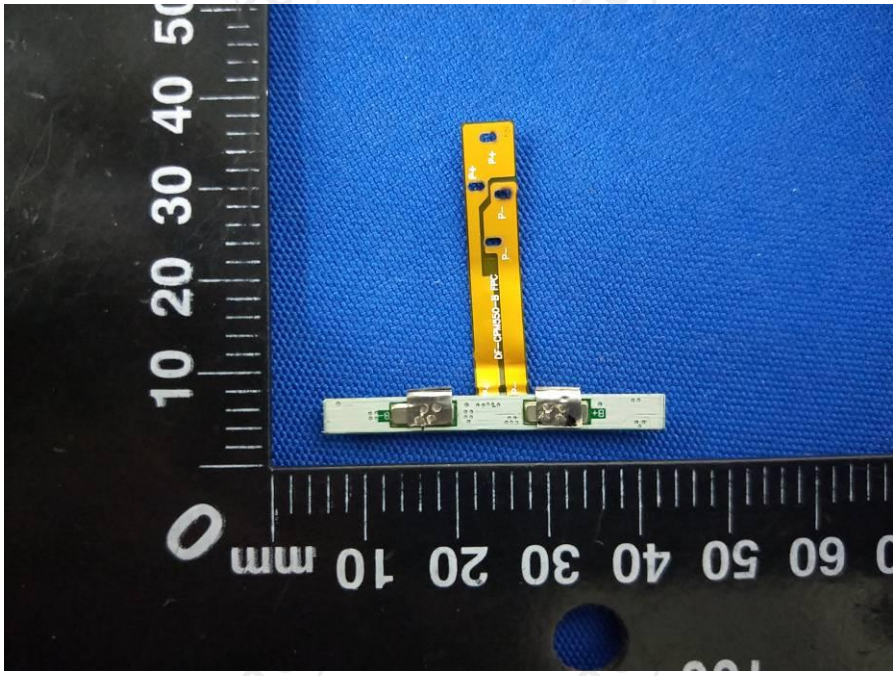
Picture 6. Cell view

图片 6. 电芯视图



Picture 7. Protection board view

图片 7. 保护板视图



Picture 8. Protection board view

图片 8. 保护板视图

********End of Report 报告结束********

Important Notice

注意事项

1. The test report is invalid without the official stamp of TCT.
   本报告书无 TCT 盖章无效。
2. Nobody is allowed to photocopy or partly photocopy this test report without written permission of TCT.
   未经 TCT 书面同意，不得复制或部分地复制本报告书。
3. The test report is invalid without the signatures of Ratifier, Reviewer and Testing engineer.
   本报告书无批准人、审核人、及主检人签名无效。
4. The report is invalid when anything of following happens – illegal transfer, reproduce, embezzlement, imposture, modification or tampering in any media form.
   私自转让、复制、盗用、冒用、涂改、或以任何媒体形式篡改的报告书无效。
5. Objections to the test report must be submitted to TCT within 15 days.
   对报告书若有异议，应于收到报告之日起 15 天内向本公司提出。
6. The test report is valid for the tested samples only.
   本报告仅对本次测试样品有效。
7. The Chinese contents in this report are only for reference.
   本报告中的中文内容仅供参考。
8. This report belongs to quote for the record, the reference test report TCT190103B034.
   此报告为报备案件，参考测试报告 TCT190103B034。