深圳市拓普威新能源有限公司 Shenzhen Topway New Energy Co.，Ltd
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APPROVAL SHEET
产品承认书

Customer 客户名称：

Part No 产品型号： TPW18650CR2S1P

Description 产品描述： 7.4V 2200mAh

Application 应用机型：

SIGNATURE 制作方签名		
MADE BY 制作：	王明英	DATE 日期： 2023/9/18
APPROVED BY 批准：	黄陈根	DATE 日期： 2023/9/18

CUSTOMER APPROVAL 客户确认		
CONFIGURATION 结构确认：		DATE 日期：
FUNCTION 性能确认：		DATE 日期：
APPROVED BY 批 准：		DATE 日期：

NO. 编号	TPW18650CR2S1P		
DESCRIPTION 描述	7.4V 2200mAh Li-ion Rechargeable Battery 7.4V 2200mAh 可充电锂离子电池		
DATE 日期	2023/9/18	Version 版别	A/0

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Amendment Record

修正记录

Revision 修订编号	Description 修订内容	Version 版别	Date 日期	Approval 审核
1	新发行 Initial Release	A/0	2023/9/18	黄洪波

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1. Scope 适用范围

1.1 This product specification applies to the lithium ion battery of Shenzhen Topway New Energy Co.,Ltd
本产品规格书适用于深圳市拓普威新能源有限公司生产的锂离子成品电池

1.2 The products are based on standards: PRC national standards GB/T 31241
本产品基于国标 GB/T 31241

1.3 Please contact Topway coordination with the settlement if you have any questions.
如果有什么问题请与拓普威联系

2. Type 电池型号

2.1 Battery Type 电池型号：TPW186502S1P .

2.1 The products of all materials are in compliance with ROHS requirements. 产品所有物料均符合 ROHS 要求。

3. General Performance 常规性能

Item 项目	Specifications 性能	Remark 备注
3.01 Nominal Capacity 标称容量	2200mAh	**Standard Charge** & **Standard Discharge** / 标准充放电
3.02 Min Capacity 最小容量	2100mAh	
3.03 Nominal Voltage 标称电压	7.4V	/
3.04 Discharge Cut-off Voltage 放电截止电压	5.6±0.1V	/
3.05 Charge Limit Voltage 充电限制电压	8.4V	/
3.06 Standard Charge Method 标准充电方式	0.2C, CC-CV charge to **Charge Limit Voltage**, cut-off at 0.02C 0.2C, 恒流恒压充电至**充电限制电压**，以 0.02C 截止。	23±2℃
3.07 Standard Discharge Method 标准放电方式	0.2C CC Discharge to **Discharge Cut-off Voltage**. 0.2C 恒流放电至**放电截止电压**。	23±2℃
3.08 Max. Continuous Charge	0.5C	15-45℃

Current 最大充电电流		
3.09 Max. Continuous Discharge Current 最大放电电流	1.0C	15-60℃
3.10 Operating Temperature and Humidity Range 工作环境	Charge Temperature: 0℃~45℃ 充电温度：0℃~45℃ Relative Humidity: 45-85%RH 相对湿度：45-85%RH	0℃~15℃: Charge Current Max. 0.2C 最大充电电流 0.2C 15℃~45℃: Charge Current Max.0.5C 最大充电电流 0.5C
	Discharge Temperature: -20℃~60℃ 放电温度：-20℃~60℃ Relative Humidity: 45-85%RH 相对湿度：45-85%RH	/
3.11 Internal Impedance 内阻	≦120mΩ	AC Impedance 1kHz 交流阻抗值 1kHz
3.12 Weight 重量	90g	About 大约
3.13 Storage Environment 存储环境	Less than 1 month 小于 1 个月	-10℃ ~ +45℃, 90％RH Max
	Less than 12 months 小于 12 个月	-10℃ ~ +35℃, 85％RH Max
	Long Time Storage 长期存储	The capacity for a long-time storage shall be 60~70% range. 长期存储容量为 60%~70% 60%±20% RH
3.14 Voltage of Shipment 出货电压	≥7.2V	/

4. Electrochemical Characteristic 电化学性能

4.1	At 25±3℃ conditions, with discharge current of 0.2C	Capacity retention rate after300

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Cycle Life 循环性能	till 6.0V; Again with 0.2C constant current charging to 8.4V, then with constant voltage 8.4V charge until the charge current drops to 0.02 C, rest 30 min, with discharge current of 0.2C till 6.0V, rest 30 min, after 300 cycles, the capacity with 0.2C discharge current should be≥85% 在 25±3℃条件下以 0.2C 电流恒流放电至 6.0V，再以 0.2C 电流恒流充电至 8.4V，然后恒压 8.4V 充电至 电流小于 0.02C，搁置 30min，以 0.2C 电流恒流放电至 6.0V，放电结束后，搁置 30min，重复循环 300 次后，0.2C 电流放电容量应≥85%	cycles should be more than 85% 300 个循环后，容量保持率在 85%以上

5. Environment Characteristic 环境适应性能

5.1 Constant Temperature and Humidity Test 恒定湿热性能	After **Standard Charge**, the test conditions are as follows: Temperature: 40±5°C Relative humidity: 90~95% Placement time: 48 hours Take out the batteries and set the batteries aside at room temperature for 2 hours, then discharge them to the **Discharge Cut-off Voltage** at 0.2C. **标准充电**后，测试条件如下： 温度：40±5℃ 相对湿度：90~95% 放置时间：48 小时 取出电池在室温下放置 2 小时，然后以 0.2C 放电至**放电截止电压**。	No explosion No fire No leakage Residual capacity ≥ 60% **Nominal Capacity** 不起火、不爆炸、不泄漏。残余容量不低于标称容量的 60%
5.2 Vibration Test 振动	**标准充电**结束后固定在振动台上，采用正弦波进行振动，并以对数扫频方式在 15 分钟内从 7Hz 扫频到 200Hz 并返回到 7Hz。振动沿样品互相垂直的三个方向（其中一个方向必须与样品正负极所在平面垂直）进行，每个方向按上述对数扫频方式重复 12 次，振动 3 小时。对数扫频方式如下：7Hz～18Hz 保持 1g 的峰值加速度。将振幅保持在 0.8mm（位移为 1.6mm）直至峰值加速度达到 8g（频率约为 50HZ）。保持 8g 的峰值加速度直到频率增长到 200Hz。 After **Standard Charge**, the batteries are fixed on a vibration table	No explosion, no fire no leakage 不起火、不爆炸、

	and subjected to sinusoidal vibration. The vibration frequency is swept logarithmically from 7Hz to 200Hz and then back to 7Hz within 15 mins. The vibration is carried out along 3 directions perpendicular to each other, one of which must be perpendicular to the plane of the positive and negative electrodes. Each direction is repeated 12 times using the logarithmic sweep method described above, and the vibration lasts for 3 hours. The logarithmic sweep method is as follows: maintain a peak acceleration of 1g between 7Hz and 18Hz. Keep the amplitude at 0.8mm (displacement is 1.6mm) until the peak acceleration reaches 8g (frequency is about 50Hz). Maintain a peak acceleration of 8g until the frequency increases to 200Hz.	

6. Safety Test 安全测试

Test Item 测试项目	**Test Method 测试方法**	**Criteria 检验标准**
6.1 Heating Test 热冲击	Acell after standard charging, is to be put into an hot box. The temperature of the oven is to be raised at a rate of 5 ±2°C per minute to a temperature of 130 ±2°C and remain for 30 minutes. 按标准充电后放置于热箱中，温度以(5±2℃)/min 的速率升温至 130±2℃保温 30min。	No explosion No fire Temperature≤150℃ 不起火、不爆炸、温度
6.2 Overcharging test 过充测试	After the battery is fully charged, use constant current constant voltage source to continue to load the battery 8h, constant current constant voltage source voltage is set to 2 times the nominal voltage, the current is set to 2.0C external current 电池满充电后，用恒流恒压源持续给电池加载 8h， 恒流恒压源电压设定为 2 倍标称电压，电流设定为 2.0C 的外接电流.	Criteria： No fire, No explosion 标准：不起火，不爆炸
6.3 Over discharge test 过放测试	The batteries are discharged according to the **Standard Discharge** requirements, and discharged for 24 hours with an external 30Ω load. 按**标准放电**的要求放电至**放电截止电压**后，外接 30Ω负载放电 24 小时..	Criteria： No fire, No explosion 标准：不起火，不爆炸
6.4 Short-circuit Test	Acell after standard charging, is to be short-circuited by connecting the positive and negative terminals of the cell with a	No explosion No fire

短路	circuit load having a resistance load of 80 ±20mΩ. When the cell temperature falls 20% lower than the peak or last 24h, stop testing. 标准充电后，使用内阻为 80±20mΩ的导线短路正负极, 当电芯温度下降到比峰值低约 20%或者持续短路 24 小时，结束试验。	不起火、不爆炸

7. Testing Conditions 测试条件

Unless otherwise specified, all tests stated in this product specifications

Should be conducted under the following atmosphere conditions:

除非另有规定，本规格书中各项试验应在标准大气条件下进行：

Temperature:21℃～25℃

温度：21℃～25℃

Relative humidity:45％～75%

相对湿度：45%～75%

Atmospheric pressure: 86kpa～106kpa

大气压力：86kPa～106kPa

8. CAUTIONS IN USE 使用警告

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

为了使电池安全的使用及处理请在使用前认真的阅读操作说明

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

  不能把电池曝晒或丢在火中

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

  电池充电时不能把正负极性装反

- Avoid short-circuiting battery

  避免短路电池

- Avoid excessive physical shock or vibration.

  避免过分的物理震动和冲击电池

- Do not disassemble or deform the battery.

  不能拆解或使电池变形

- Do not immerse in water.

  不能将电池浸入水中

- Do not use the battery mixed with other manufacturer, type, or model.

  不能将其它不同厂家，类型，型号的电池混合使用

- Keep out of the reach of children.

  禁止小孩接触电池

8.2 Charge and discharge 充放电

- Battery must be charged in appropriate charger.

  电池必须在合适的条件下充电

- Never use a modified or damaged charger.

  决不能用故障的充电器给电池充电

- Do not leave battery in charger over 24 hours.

  电池持续充电不能超过 24h

8.3 Storage 贮存

- Store the battery in a cool, dry and well-ventilated area.

  电池贮藏在通风干燥的环境中

8.4 Disposal 处理

- Regulations vary from country to country; Battery should be handled in accordance with local regulations.

  不同国家法规的不同，处理时根据当地的法规。

9. Battery Operation Instruction 电池操作说明

9.1 Charging 充电

9.1.1 Charging current: The maximum charging current specified in the specification must not be exceeded

充电电流：不能超过规格书规定的最大的充电电流

9.1.2 Charging voltage: The maximum limit voltage specified in the specification must not be exceeded

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充电电压：不能超过规格书规定的最高的限制电压

9.1.3 Charge temperature: Battery charging temperature must be in accordance with the temperature range in the specification

充电温度：电池充电温度必须按照规格书的温度范围执行

9.1.4 The battery must be charged at constant current and then at constant voltage. If the positive and negative terminals are reversed, the battery will be damaged and there is a risk of explosion.

先恒流后恒压方式充电，禁止颠倒的方式充电。如果电池正负极颠倒充电会损坏电池并有爆炸的危险。

9.2. Discharging 放电

9.2.1 Discharging current: The battery discharge current must not exceed the maximum discharge current specified in the specification. Excessive current discharge will cause the battery to heat up and decay in capacity.

放电电流：电池放电电流不能超过规格书规定的最大放电电流，过大的电流放电会让电池发热和容量衰减。

9.2.2 Discharge temperature: Battery discharge temperature must be in accordance with the temperature range in the specification

放电温度：电池放电温度必须按照规格书的温度范围执行

9.2.3 Over-discharges: Short-term overcharging and discharging do not affect the use of the battery, but prolonged over-discharging will cause the battery to fail and lose energy, making it permanently unusable.

过放电：短时间的过充过放不影响电池的使用，但是长时间的过放电会使电池的功能失效、能量消失，则电池永久性不能使用。

9.2.4 Storing batteries 贮存电池

The batteries must be stored within the environmental range specified in the specification. If the batteries are stored for more than 3 months, it is required to perform 1-3 cycles to activate the chemical substances inside the batteries. Otherwise, the chemical substances inside the batteries will gradually become stagnant, resulting in a decrease in capacity and a shortened service life. Over-discharging of the batteries may cause leakage and swelling. Additionally, due to self-discharge, batteries that are not used or activated for a long time may not be able to recharge and be used again once their energy is depleted.

电池必须贮存在规格书规定的环境范围内，如果电池贮存超过三个月，要求给电池做 1-3 次循环，以激活电池内的化学物质，否则电池内化学物质逐渐僵滞而导致容量的降低和使用寿命的缩短。电池过放可能产生漏液,鼓胀现象。另外电池存在静耗，长时间不使用也不激活，一旦电量耗尽，电池可能无法充电并再次被使用。

10. Period of Warranty 保质期

The warranty period of the battery is one year from the date of shipment. If it is proven that the defect was formed during the manufacturing process and is not due to abuse or misuse by the user, we are responsible for returning the battery or negotiating an alternative solution with the customer.

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或与客户协商其它方案。

11. Other Chemical Reaction 其它化学反应

As batteries utilize chemical reactions, their performance can deteriorate over time even when stored unused for long periods of time. If various conditions of use, such as charging, discharging and ambient temperatures are not maintained within the specified range, the expected life of the battery may be shortened or the equipment using the battery may be damaged by electrolyte leakage. If a battery fails to hold a charge for an extended period of time, even when properly charged, this may indicate that it is time to replace the battery.

由于电池利用化学反应，即使长期储存不使用，电池的性能也会随着时间的推移而退化。如果各种使用条件，如充电、放电和环境温度没有保持在规定的范围内，电池的预期寿命可能会缩短，或者使用电池的设备可能因电解质泄漏而损坏。如果一个电池在很长一段时间内不能保持充电状态，即使是在正确充电的情况下，这可能表明是时候更换电池了。

12. Note: 备注

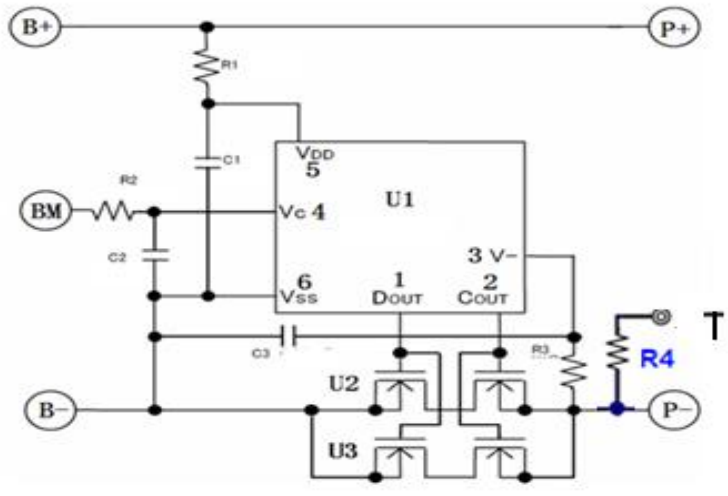
Any other items which are not covered in this specification shall be agreed by both parties.

本说明书未包括事项应由双方协议确定。

13: PCM Characteristic 保护板性能

项目		符号	检验方法及设备	检验标准			单位
				最小值	典型值	最大值	
过充保护	过充电检测电压	V_{DET1}	锂电保护板测试仪	4.245	4.280	4.300	V
	过充电检测延迟时间	tV_{DET1}	锂电保护板测试仪	800	1000	1200	ms
	过充电解除电压	V_{REL1}	锂电保护板测试仪	4.045	4.075	4.105	V
过放保护	过放电检测电压	V_{DET2}	锂电保护板测试仪	2.8	2.9	3.0	V
	过放电检测延迟时间	tV_{DET2}	锂电保护板测试仪	76.8	96.0	115.2	ms
	过放电解除电压	V_{REL2}	锂电保护板测试仪	2.90	3.00	3.10	V
过流保护	过电流检测电压	V_{DET3}	锂电保护板测试仪	0.140	0.150	0.185	V
	过电流保护电流	I_{DP}	锂电保护板测试仪	6.0	5.0	13.0	A
	检测延迟时间	tV_{DET3}	锂电保护板测试仪	9.6	12.0	14.4	ms

附图 1: PCM Working Principle 保护板工作原理图



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PCM BOM LIST 保护板元件清单

序号	元件编号	元件名称	元件规格	封装形式	数量	厂商/备注
1	U1	IC	HY2120-CB	SOT-23-6	1	/
2	U2	MOSFET	8205A	TSSOP-8	2	/
3	R1、R2	电阻	SMD 330Ω±5%	0603	2	/
4	R3	电阻	SMD 2KΩ±5%	0603	1	/
5	C1、C2	电容	SMD 0.1μF±20%	0603	2	/
6	R4、	电阻	SMD 10K±1%	0603	1	/
	C3	电容	/	/	空置	/

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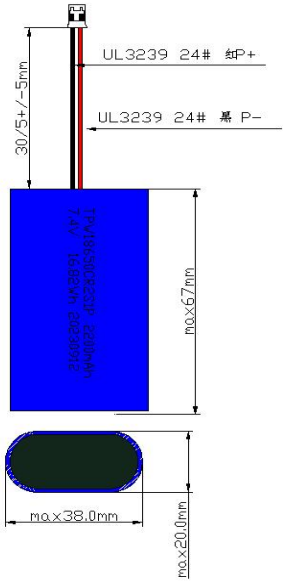
附图 2: Battery Drawing 电池图

The picture is not drawn precisely to the actual scale. Unit: mm
图片未按实际比例精确绘制。单位：毫米



BOM (Bill of materials) 电池物料清单

NO.	Material Name 零件名称	Specification 规格型号	Qty 用量	Remark 备注
1	Cell 电芯	18650/2200mAh/3.7V	2	RoHS
2	Protection Board (PCM) 保护板	18650 2S1P Dedicated 18650 2S1P专用板	1	RoHS
3	Wires 引线	Red Wire 红线 UL3239-24# P+	1	RoHS
		Black Wire 黑线 UL3239-24# P-	1	RoHS
				/
4	Connector 端子	PH-2.0反向 黑，红	1	RoHS

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