



Specification of Lithium ion Battery

锂离子电池规格书

REviews NO. 评审单号	TPW-PS-20240322-001
Battery Model 电池型号	HCC21700-4S1P-L03
Product Specification 产品规格	14.4V 5Ah 72Wh
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况发成	单超杰	黄洪波

Customer Approval 客户确认	Signature/Date 签字/日期	
	Company Stamp 公司印章	



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History of Specification

规格书修订履历表

修订编号 Revision	修订内容 Description	版本 Version	日期 Date	准核 Ratify
1	新发行 Initial Release	A/0	2024.04.26	黄洪波



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.

如果有什么疑问请与拓普威联系

2. Product 产品

2.1 Battery Type 电池型号：HCC21700-4S1P-L03

2.2 Cell Type 电芯型号：三星 21700 50S

2.3 Product Specification 产品规格：14.4V 5Ah 72Wh

3. Key parameters 基本参数

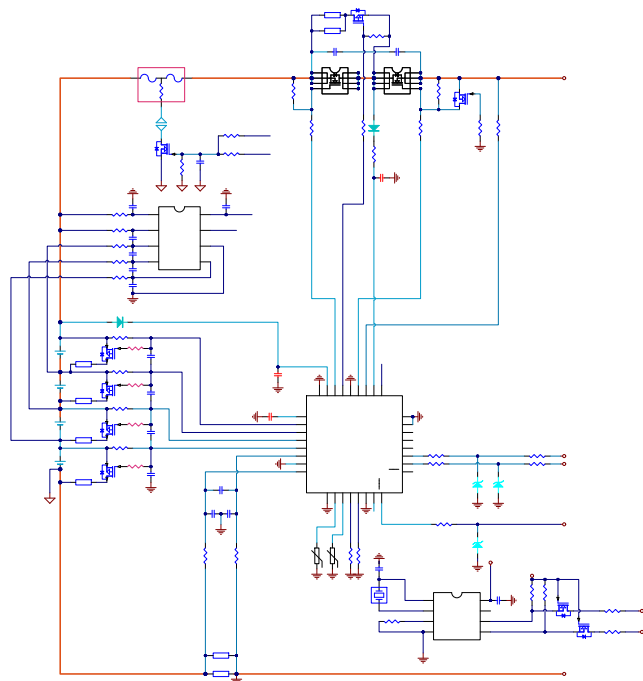
NO. 序号	Item 项目	Parameters 参数	Remark 备注
1	Nominal Capacity 标称容量	5Ah	0.2 CsA 放电, 10.6V 截止
2	Min Capacity 最小容量	4.9Ah	
3	Nominal Voltage 标称电压	14.4V	/
4	Voltage of Shipment 出货电压	≥14V	(待定)
5	Standard Charge Method 标准充电方式	0.2C, CC-CV charge to Charge Limit Voltage, cut-off at 0.02C 0.2C, 恒流恒压充电至充电限制电压, 以 0.02C 截止。	25±2℃
6	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。	25±2℃
7	Max. Charge Current 最大充电电流	6A	15-40℃
8	Max. Discharge Current 最大放电电流	15A	15-60℃
9	Over-Current Discharge Protection 放电保护电流	25A	延时 31ms
10	Charging voltage 充电电压	16.8V	
11	Over discharge detection voltage 过放电保护电压	2.5±0.05V	单节
12	Over discharge release voltage 过放电恢复电压	3.0±0.05V	单节
13	Overcharge detection voltage 过充电保护电压	4.25V±0.05V	单节
14	Overcharge release voltage 过充电恢复电压	4.15±0.05V	单节
15	Internal Impedance 内阻	≤180mΩ	AC Impedance 1kHz 交流阻抗值 1kHz



16	Weight 重量	≈400g	About 大约
17	Short Circuit protection 短路保护	延时 300uS	Disconnect the short-circuit load 断开短路负载或充电恢复
18	Work consumes current 工作消耗电流	600uA Max	
19	Means of communication 通讯方式	SMBUS	
20	Operating Temperature and Humidity Range 工作环境	Charge Temperature: 0℃~40℃ 充电温度: 0℃~40℃ Relative Humidity: 45-85%RH 相对湿度: 45-85%RH	Charge 充电
		Discharge Temperature: -20℃~60℃ 放电温度: -20℃~60℃ Relative Humidity: 45-85%RH 相对湿度: 45-85%RH	Discharge 放电
21	Storage(50%SOC) 贮存(半电)	Less than 1 month 小于 1 个月	+45℃~+60℃, 90%RH Max
		Less than 3 months 小于 3 个月	+30℃~+45℃, 85%RH Max
		Less than 12 months 小于 12 个月	-20℃~+30℃, 85%RH Max

4. PCM Specification and characteristic 保护板规格与特性

4.1 PCM Working Schematic diagram 保护板工作原理框图





4.2 PCM Characteristic 保护板性能

Item 项目	Syol 符号	Content 内容	Criterion 标准
Over charge protection 过充保护	V_{DET1}	Over charge detection voltage 过充保护电压	$4.25V \pm 0.05V$
	tV_{DET1}	Over charge detection delay time 过充保护延迟时间	2000ms
	V_{REL1}	Over charge release voltage 过充恢复电压	$4.15 \pm 0.00V$
Over discharge protection 过放保护	V_{DET2}	Over discharge detection voltage 过放保护电压	$2.5 \pm 0.05V$
	tV_{DET2}	Over discharge detection delay time 过放保护延迟时间	2000ms
	V_{REL2}	Over discharge release voltage 过放恢复电压	$3.0 \pm 0.05V$
Over current protection 过流保护	I_{DP}	Over current detection current 过流保护电流	25A
	tV_{DET3}	Detection delay time 延迟时间	31ms
	/	Release condition 恢复条件	Cut load 断开负载

5.Cell size structure (in mm)电池尺寸结构（单位 mm）



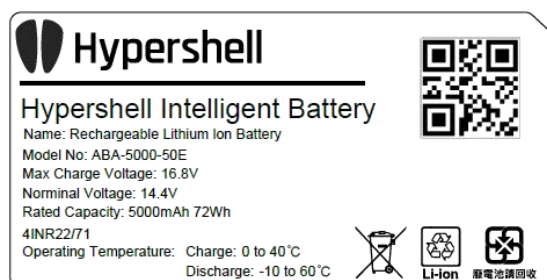
5.1 BOM (Bill of materials) 电池物料清单

NO.	Material Name 零件名称	Specification 规格型号	Qty 用量
1	Cell 电芯	三星21700 50S	4
2	Protection Board (PCM) 保护板	HCC21700-4S1P-L03 保护板, PCB 规格 140*20.8*1mm, BQ40Z50 方案, I2C 通讯	1
3	The shell 外壳	HCC21700-4S1P-L03专用套料, 含下壳、上 盖、支架及配件, 客供	1



5.2 标贴

常温标贴

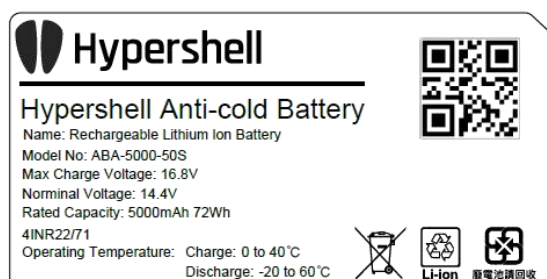


WARNING

1. Only use Hypershell approved chargers.
2. Never disassemble, punctures, shock, crash, short or incineration.

Authorized by HYPERSHELL CO.,LTD
Room 306, Bldg #3 Xingchuang Plaza, No. 5005 Shenjiang Road,
Pudong New District, Shanghai
Made in China
Manufacturer: Hypershell Co., Ltd.

低温标贴



WARNING

1. Only use Hypershell approved chargers.
2. Never disassemble, punctures, shock, crash, short or incineration.

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Manufacturer: Hypershell Co., Ltd.

6.Packing Instruction 包装说明



7. Reliability Test 可靠性测试

Cycle Life 循环寿命	The battery shall be constantly charged at 0.5C₅A in the temperature of (25±2℃). When the battery terminal voltage reaches the charging cut-off voltage, it shall be charged to constant voltage charging. It shall not stop charging until its current is no more than 0.02C₅A .Put it aside for 0.2h Then discharge at the current of 0.5C₅A to the cut-off voltage. When the discharging is finished, the battery shall be put aside for 0.2h and has the next charge and discharge recycle. The above recycle test shall be continued unless there are three continuous discharging time less than 48 minutes, which is taken as the end of the life. 电池循环寿命试验应在 25℃±2℃，以 0.5C₅A 充电，当电池端电压达到充电截止电压时，改为恒压充电，直到充电电流小于或等于 0.02C₅A，停止充电搁置 0.2h，然后以 0.5C₅A 电流放电至截止电压，放电结束后，搁置 0.2h，再进行下一个循环，直至连续三次放电容量小于初始的 80%，则认为寿命终止。	Capacity retention rate after 300cycles should be more than 80% 300 个循环后，容量保持率在 80%以上。
High/low Temperature 高/低温性能	After the battery full charging at 25±2℃,Measure the capacity of the battery discharged at different temperatures from the current of 0.5C₅A to the cut-off voltage.(as compared with initial capacity) 在 25±2℃条件下满充电后，测量电池在不同温度下用 0.5C₅A 电流放电至截止电压所放出的容量（与初始容量作为比较）	At -10℃Cis ≥60% 在-10℃时≥60% At 0℃Cis ≥70% 在 0℃时≥70% At 55℃Cis ≥ 95% 在 55℃时≥ 95%
Electrical load maintenance Ability 荷电保持能力	When the battery has completed standard charged, it shall be disconnected and put aside for 28 Days at(25±2)℃,then discharged at 0.5C₅A. 完全充电后,在 25±2℃条件下，将电开路搁置 28 天，再 0.5C₅A 放电	Discharging shall not be less than 1.8hours 放电时间不少于 1.8 小时
Storage Performance 存储性能	Before storage, charge the battery to 40% to 50% capacity use standard charge, After that, store the battery at the ambient temperature of 25℃±2℃ and relative humidity of 45% to 75% for 12 months and fully charge after standard charge, and discharge at 0.5C to the cut-off voltage. The charge and discharge test may be cycled for 5 times. 电池储存前按标准充电方式给电池充入 40%~45%的容量，然后在环境温度 25℃±2℃，相对湿度 45%~75%的环境中储存 12 个月。然后以标准充电方式充至满电，在 25℃±2℃的温度环境下以 0.5C 放电至终止电压。充放电试验可以循环 5 次。	The discharging time should not be less than 96min. 放电时间不低于 96min.
Constant Humidity & Heat Requirement 恒定湿热性能	As the battery has completed fast charging with constant current,it shall be put into the(40±2)℃,90%-95%RH thermos humidistat for 48h; then taken out at (25±2)℃for 2h. Check its appearance with eyes. Obtain its discharging time after it is discharged at 0.5C₅A to its cut-off voltage. 完全充电后，在 40±2℃，相对湿度为 90%-95%的恒温恒湿条件下搁置 48h 后，再取出放在 25±2℃条件下搁置 2h 再以 0.5C₅A 放电。	The battery appearance shall have no distortion, no explosion, no fire, no smoke and no leak-out 电池外观应无明显变形、锈蚀、冒烟或爆炸



Vibration 振动	The full charging battery vibrate from 90 to 100 minutes at three mutually perpendicular planes with excursion of 0.8mm, and change the frequency from 10 to 55Hz with 1 Hz/min seed. 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 以及 1Hz/min 的速率变化, 往复振动 90 至 100min。	The battery appearance has no distortion, no explosion, no fire, no smoke and no leak-out. 电池外观应无明显变形、锈蚀、冒烟或爆炸
Free Drop 自由跌落	The battery fall from a height of 1m free fall into the cement floor X,Y,Z positive and negative direction of each direction free fall time. 电池将从 1 米高处自由跌落到水泥地板上, 从 X, Y, Z 正负方向每个方向自由跌落一次。	The battery appearance has no distortion, no explosion, no fire, no smoke and no leak-out. 电池应不漏液, 不冒烟, 不爆炸
Overcharge Protection 过充电保护性能	When the battery is fully charged, go on loading for 8h with a twice rating voltage, 2.0C₅A output current, it starts the over charge protection function. 电池完全充电结束后, 用恒流恒压源给电池加载 8h, 恒流恒源设定为 2 倍标称电压, 电流设定为 2C₅A。	The battery appearance has no distortion, no explosion, no fire, no smoke and no leak-out. 电池应不爆炸, 不起火, 不冒烟或漏液。
Over discharge Protection 过放电保护性能	The battery is discharged at 0.2 C₅A in the constant current till it reaches over discharge protection voltage at (20±5) °C, connected with a 30Ω lead and discharged for 24h 电池在环境温度 25±2°C 的条件下, 以 0.2C₅A 放电至终止电压后, 外接 30Ω 负载电阻放电 24h。	The battery appearance has no distortion, no explosion, no fire, no smoke and no leak-out. 电池应不爆炸, 不起火, 不冒烟或漏液。
Shot-circuit Protection 短路保护性能	After standard charging, and then short-circuit the battery for 1 hour by connecting the positive and negative terminals with a resistor of 80±20mΩ. After the test, the battery should meet the criteria. 电池按标准充电模式充电后, 将正负极用 80mΩ±20 mΩ 电阻器短路 1h 后, 电池应符合判定标准;	No leak, no venting, no rupture, no fire and no explosion. 电池应不泄漏、不泄气、不破裂、不起火和不爆炸。

8. Test methods and definitions 测试方法和定义

8.1 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: 25±2°C

温度: 25±2°C

Relative humidity: 45% ~ 75%

相对湿度: 45%~75%

Atmospheric pressure: 86kpa ~ 106kpa

大气压力: 86kPa~106kPa

8.2 Test instruments requirements 测量仪表与设备要求

The precision of voltage measuring instrument should not be lower than ±0.5%.

测量电压的仪表准确度应不低于±0.5%。



The precision of current measuring instrument should not be lower than $\pm 0.5\%$

测量电流的仪表准确度应不低于 $\pm 0.5\%$ 。

The precision of time measuring instrument should not be lower than $\pm 0.1\%$

测量时间用的仪表准确度应不低于 $\pm 0.1\%$ 。

The precision of temperature measuring instrument should not be lower than $\pm 0.5^\circ\text{C}$

测量温度的仪表准确度应不低于 $\pm 0.5^\circ\text{C}$ 。

The current of the constant current power supply can be adjusted; the relative variation of its current should be in the range of $\pm 1\%$ at constant charge or discharge

恒流源的电流可调，在恒流充电或放电过程中，其电流的相对变化应在 $\pm 1\%$ 范围内。

The voltage of the constant current power supply can be adjusted; the relative variation of its voltage should be in the range of $\pm 1\%$ at constant charge

恒压源的电压可调，在恒压充电过程中，其电压变化应在 $\pm 1\%$ 范围内。

The precision of weight measuring instrument should not be lower than 1% .

测量重量用的仪器准确度应不低于 1% 。

9. CAUTIONS IN USE 使用警告

9.1 Read and observe the following warnings and precautions to ensure correct and safe use of Li-ion batteries. Shenzhen Topway New Energy Co., LTD not responsible for any problems arising from the violation of the following precautions

认真阅读下面的注意事项，确保正确使用锂离子电池。深圳市拓普威新能源有限公司对违反下述注意事项而产生的任何问题不予负责。

9.1 Danger 危险

9.1.1 Do not immerse the battery in water or allow it to get wet.

勿将电池投入水中或将其弄湿！

9.1.2 Do not use or store the battery near sources of heat such as a fire or heater.

禁止在火源或极热条件下给电池充电！勿在热源（如火或加热器）附近使用或贮存电池！如果电池泄漏或发出异味，应立即将其从接近明火处移开；

9.1.3 Do not use any chargers other than those recommended.

请使用专用充电器！

9.1.4 Do not reverse the positive (+) and negative (-) terminals.

勿将正负极接反！

9.1.5 Do not connect the battery directly to wall outlets or car cigarette-lighter sockets.

勿将电池直接连接到墙上插座或车载点烟式插座上！

9.1.6 Do not put the battery into a fire or apply direct heat to it.

勿将电池投入火中或给电池加热！

9.1.7 Do not short-circuit the battery by connecting wires or other metal objects to the positive (+) and negative (-) terminals.

禁止用导线或其它金属物体将电池正负极短路，禁止将电池与项链、发夹或其它金属物体一起运输或贮存！



9.1.8 Do not pierce the battery casing with a nail or other sharp object, break it open with a hammer, or step on it.

禁止用钉子或其它尖锐物体刺穿电池壳体，禁止锤击或脚踏电池！

9.1.9 Do not strike, throw or subject the battery to sever physical shock.

禁止撞击、投掷或者使电池受到机械震动！

9.1.10 Do not directly solder the battery terminals.

禁止直接焊接电池端子！

9.1.11 Do not attempt to disassemble or modify the battery in any way.

禁止以任何方式分解电池！

9.1.12 Do not place the battery in a microwave oven or pressurized container.

禁止将电池置入微波炉或压力容器中！

9.1.13 Do not use the battery in combination with primary batteries (such as dry-battery batteries) or batteries of different capacity, type or brand.

禁止与一次电池（如干电池）或不同容量、型号、品种电池组合使用！

9.1.14 Do not use the battery if it gives off an odor, generates heat, becomes discolored or deformed, or appears abnormal in any way. If the battery is in use or being recharged, remove it from the device or charger immediately and discontinue use.

如果电池发出异味、发热、变形、变色或出现其它任何异常现象时不得使用；如果电池正在使用或充电，应立即从用电器中或充电器上取出并停止使用！

9.2 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

9.3 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。

10. Battery Operation Instruction 电池操作说明

10.1 Charging 充电

10.1.1 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

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

充电电压：不能超过规格书规定的最高的限制电压

10.1.3 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



10.1.4 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。

10.2. Discharging 放电

10.2.1 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。

10.2.2 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

10.2.3 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。

10.3 Transportation and storage 运输和贮存电池

10.3.1 Transportation 运输

The battery should be packaged into boxes for transportation. Excess vibration, shock, crush, direct sunlight and drenching should be avoided in transit. The battery must not ship together with things that are flammable, explosive or corrosive on the same vehicle. The battery can be transported on trucks, trains, ships, aircrafts or other transportation vehicles.

电池应包装成箱进行运输，在运输过程中应防止剧烈振动、冲击或挤压，防止日晒雨淋，严禁与易燃、易爆、易腐蚀的物品同车装运，可使用汽车、火车、轮船、飞机等交通工具进行运输。

10.3.2 Storage 贮存

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. Other wise, 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、膨胀现象。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。



The battery should be kept in their original package and stored in a warehouse with ambient temperature in the range between -5°C and $+35^{\circ}\text{C}$, and relative humidity no more than 75%. The battery should be kept indoors in a place that is clean, dry, ventilated and equipped with measures against moisture, dust, vibration and corrosion, and kept from contact with corrosive substance and sources of ignition and heating.

电池贮存应保持原有包装, 存放产品仓库环境温度为 $-5^{\circ}\text{C} \sim +35^{\circ}\text{C}$, 相对湿度不大于 75% 的清洁、干燥、通风并设有防潮、防尘、防震、防腐蚀措施的室内, 避免与腐蚀性物质接触, 应远离火源及热源。

11. Period of Warranty 保质期

Period of warranty: 12 months after shipment;

产品保质期: 自交货期开始算起后的 12 个月;

Range of warranty: Operating within the specified current, voltage ranges and working temperature range, the battery performs normally without swelling, 0V and electrolyte-leaking. Battery damage caused by misuse or incorrect storage cannot apply the Warranty. If the life cycle meets the requirement of the Specification, the battery is invalid in advance.

保质范围: 在规格书规定的充放电电压范围、电流范围、工作温度等正常使用及存放条件下电池可进行充放电, 无气鼓、零电压、漏液等不良现象。不当使用或存放造成电池不良不在保质范围内。当循环寿命达到规格书中要求后, 电池提前过保质期。

12. 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。

13. Note: 备注

The aforementioned could be used as agreed framework by both parties for battery performance and inspection specifications. It should be implemented if there is no new written agreement or change notice. 以上所述, 可以作为供需双方对电池产品性能和检验规则的约定框架。如果没有新的书面约定或更改通知, 即可按此执行。