

Customer 客户: \_\_\_\_\_

# Lithium-ion Battery Specification Approval Sheet 锂离子电池规格确认书

Model 型号: 锂三元圆柱电池组: Li-21700-7S4P-25.9V 20Ah-PCM-带外壳-老化-CAN 协议

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## Customer signature 客户签署

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Please sign back specification before bulk order 批量订单前请回签规格书	

Shenzhen Ryder Electronics Co., Ltd.

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## 1 Scope 范围

本规格书描述本公司设计开发的电池，它是产品设计、生产和检验的依据。其作用是让顾客了解产品的质量及正确使用使用方法。

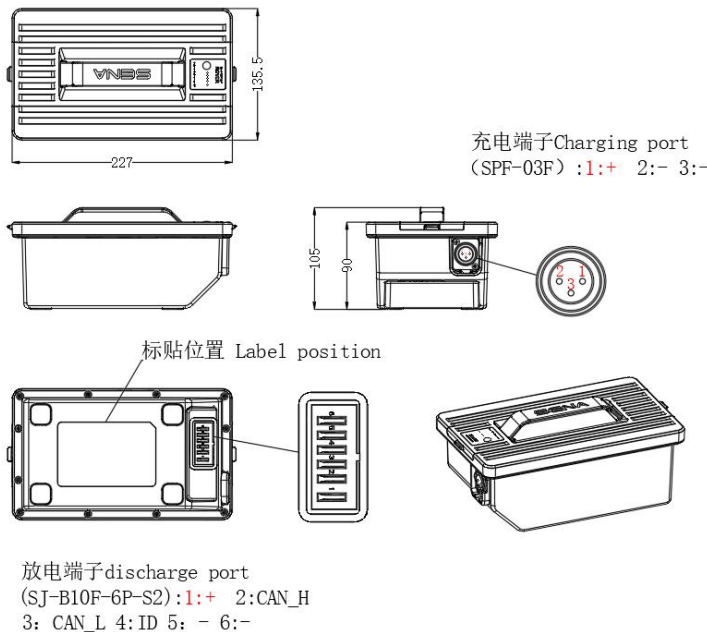
This specification describes the design and development of the company's battery; it is the product of design, production and inspection basis. Its role is to understand the quality of the product and using the correct method for customers.

本规范适用于由深圳瑞鼎电子有限公司制造的锂离子电池产品。This specification shall be applied to Li-ion battery manufactured by Shenzhen Ryder electronics Co., Ltd.

## 2 Product Configuration 产品配置

No.	Item 项目	Criteria 标准	Remark 备注
1	电芯 Lithium-ion Battery Cell	INR21700-50GB	三星
2	PCM	RYD-07S-040 Rev1.1	
3	Connector		

## 3 Product Dimension 产品尺寸

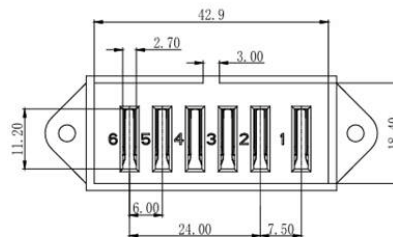


2. Update modifications

2-1 Battery voltmeter PCB modification => Refer to attached drawing

2-2 Battery pinmap change (CAN communication added)

No1 ----- BATT\_P & Charger\_P (Shared use of Battery and Charger 'P')  
 No2 ----- CAN\_H  
 No3 ----- CAN\_L  
 No4 ----- Charger Detect  
 No5, 6 ----- BATT\_N & Charger\_N (Shared use of Battery and Charger 'N')



NO	电池类型 Battery type	电池尺寸 (mm) Dimensions D*H (max)	导线长度 (mm) Lead exposure L	端子头方向 Terminal head direction	浸锡长度 Immersion tin size
1	锂离子圆柱 Li-ion Cylindrical	227*135.5*90 ± 1mm 不含提手	/	/	/

#### 4 Product Specification 产品规格

		测试方法 Testing method	备注 Remark
1	充电截止电压 Charge cut-off voltage	29.4V	
2	充电器电压 Charger voltage	29.05V	
3	放电终止电压 Discharge cut-off voltage	19.6V	
4	标准充电模式 Standard charge	在环境温度-20℃到60℃条件下，以0.2C电流恒流充电至29.05V，转29.05恒压充电，直到充电电流≤0.02C。Under the condition of the ambient temperature of -20℃到60℃，Charge the battery at constant current of 0.2C to reach 29.05V. Then charge the battery at constant 29.05V voltage until the charging current decreasing to 0.02C.	
5	标准放电模式 Standard discharge	以标准充电模式满充后，搁置2小时，以0.2C电流恒流放电至19.6V。 After the standard charging, rest for 2 hour then discharge to 19.6V@0.2C.	
6	出货电压 Shipments voltage	24.5-25.55V	SOC≤30 %
7	最大充电电流 Maximum Charge Current	≤3A	
8	最大持续工作电流 Maximum continuous working current	≤30A	电芯表面温度超过70℃断开 Disconnect when the surface temperature of the battery cell exceeds 70 °C
9	容量 Rated capacity	标称容量Typical capacity: 20Ah 最小容量Minimum capacity: 18.62Ah	标准充电然后标准放电 standard discharge after standard charge
10	工作温度 Operation temperature range	充电: 5~45℃	湿度: 60±25% 60±25%R.H
		放电: -20~60℃	
11	储存温度 Storage temperature	小于1个月: -20~60℃ ≤1 month: -20~60℃	湿度: 60±25% 长时间储存最佳温度: 10~23℃ 60±25%R.H Best 10~23℃ for long-time storage
		小于3个月: -20~45℃ ≤3 months: -20~45℃	
		小于1年: -20~23℃ ≤1 year: -20~23℃	

12	内阻 Impedance	<50mΩ	
13	重量 Weight	Approx: 2.75kg±0.5g	

## 5 Product Electric Performance Test 产品电性能测试

No.	项目 Items	测试方法 Test Conditions	达到要求 Requirements
1	电芯荷电保持能力 Cell Capability of keeping electricity	以标准模式充电后，在环境温度 20℃±5℃的条件下，将电池开路搁置 28d，再以 0.2C 电流进行放电至 2.5V。 Fully charging, store them at (20±5)°C for 28 days, then discharge to 2.5V @0.2C.(the residual capacity is above 85% of nominal capacity)	放电时间≥4.25h Discharging time≥4.25h
2	常温循环寿命 Cycle Life @25℃	以 0.2C 电流恒流放电至 19.6V，再以 0.2C 电流恒流充电至 29.05V，然后恒压 29.05V 充至电流≤0.02C，静止 10min，以 0.2C 电流恒流放电至 19.6V，放电结束后，静止 10min，再进行下一充放循环，直至连续三次放电容量小于 80% 的 0.2C 的首次放电容量。 Discharge to 19.6V @0.2C, then Charge the battery @0.2C to reach 29.05V. Then charge the battery at constant 29.05V voltage until the charging current decreasing to 0.02C. Rest for 10 min. discharge to 19.6V@ 0.2C and rest for 10 min. Continue the charge/discharge cycles until discharge capacity lower than 80% of rated capacity.	循环次数≥300 次 Cycles life ≥300
3	电芯储能性能 Cell energy storage performance	以标准模式充电给电池充入 20%~50% 的容量，然后在环境温度 20℃±5℃，相对湿度 45%~85% 的环境中贮存。贮存 12 个月后满充以 0.2C 电流放电至终止电压 2.5V。 进行贮存试验的电池应选自生产日期到试验日期不足 3 个月的电池。 Charge the battery to 20%~50% of its rated capacity using standard charging mode, then keep it in an 20℃±5℃, humidity 45%~85% room for 12 months, fully charge and discharge it @0.2C until voltage down to 2.5V. (The testing sample should be within 3 months dated from production date)	放电时间≥4h Discharge time≥4h

## 6 Mechanical Performance 机械特性

		测试方法 Testing method	达到要求 Requirements

1	振动实验 Vibration Test	<p>电池标准充电后固定在振动台上，以 X, Y, Z 三个方向从 10Hz~55Hz 循环振动各 30min，扫描速率为 1oct/min；振动频率：10Hz~30Hz；移位振幅/单振幅：0.38mm；振动频率：30Hz~55Hz；移位振幅/单振幅：0.19mm。</p> <p>After standard charging, put battery on the vibration table. 30 min experiment from X, Y, Z axis. Scan rate: 1oct/min; Frequency 10-30Hz, Swing 0.38mm; Frequency 30-55Hz, Swing 0.19mm.</p>	<p>电性能及外观不受影响</p> <p>No influence to batteries' electrical performance and appearance.</p>
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## 7 PCM Specification 保护板规格

### 7.1 PCM 参数

Contents 内容	Min	Type	Max	Tolerance	Unit
<b>Absolute Maximum Rating 绝对最大设定值</b>					
Input charging voltage 输入充电电压	28.7	29.05	29.4	-	V
Continuous charging current 持续充电电流	≤ 3.0				A
Output discharging voltage 输出放电电压	19.6	25.41	29.4		V
Continuous output discharging current 持续输出放电电流	≤ 30.0				A
<b>Ambient Condition 使用环境要求</b>					
Operating temperature 工作温度	-20	-	60	-	°C
Humidity (No Water-Drop) 湿度（无水汽凝结成水珠）	0%	-	90%	-	RH
Atmospheric pressure 大气压强	86	-	106	-	KPa
<b>Storage Condition 存储环境要求</b>					
Storage temperature 存储温度	-5		30		°C
Humidity (No Water-Drop) 湿度（无水汽凝结成水珠）	40%		60%		RH
Atmospheric pressure 大气压强	86		106		KPa
<b>Protection Parameters (for Single Cell). 保护参数（单节电性）</b>					
<b>Over-Charge voltage protection 过充保护</b>					
Over-Charge voltage protection 1 过充保护电压1	4180	4220	4260	±40	mV
Over-Charge voltage protection 2 过充保护电压2 (硬件保护)	4215	4255	4295	±40	mV
Over-Charge voltage protection 3 过充保护电压3 (硬件保护，保险丝熔断)	4310	4350	4390	±40	mV

Over-Charge voltage protection 1/2 release 过充保护1/2恢复电压	4060	4100	4140	±40	mV
Over-Charge voltage protection 3 release 过充保护3恢复电压	4010	4050	4090	±40	mV
Over-Charge voltage protection 1 delay time 过充保护1延迟时间	500	1000	2000	-	mS
Over-Charge voltage protection 2 delay time 过充保护2延迟时间	700	1000	1300	±300	mS
Over-Charge voltage protection 3 delay time 过充保护3延迟时间	2500	4000	5500	±1500	mS
Over-Charge voltage protection 1/2 release delay time 过充保护1/2恢复延迟时间	500	1000	2000	-	mS
Over-Charge voltage protection 3 release delay time 过充保护3恢复延迟时间	2	4	6	-	mS
<b>Cell Voltage Imbalance charge protection 不平衡禁止充电</b>					
Cell Voltage Imbalance charge protection 不平衡禁止充电	Cell Voltage Imbalance≥0.4V & Cellvoltage (Max)≥3.6V & 30Second additional delay. 电芯电压差≥0.4V且电芯最高电压≥3.6V, 延时30秒。				
<b>Over-Discharge voltage protection 过放保护</b>					
Over-Discharge voltage protection 1 过放保护电压1	2700	2800	2900	±100	mV
Over-Discharge voltage protection 2 过放保护电压2 (硬件保护)	2500	2600	2700	±100	mV
Over-Discharge voltage protection release 过放恢复电压	3100	3200	3300	±100	mV
Over-Discharge voltage protection 1 delay time 过放保护1延迟时间	500	1000	2000	-	mS
Over-Discharge voltage protection 2 delay time 过放保护2延迟时间	700	1000	2000	-	mS
Over-Discharge voltage protection 1/2 release delay time 过放保护1/2恢复延迟时间	2000	3000	4000	-	mS
Into Shutdown mode 进入掉电模式	2700	2800	2900	±100	mV
Into Shutdown mode delay time 进入掉电模式延迟时间	-	30	-	±5	Minutes
<b>Battery pack Over-Discharge voltage protection 总电压过放保护</b>					
Battery pack Over- Discharge voltage protection 总电压过放保护	19.4	19.6	19.8	±0.2	V
Battery pack Over-Discharge voltage protection release 总电压过放恢复	22.2	22.4	22.6	±0.2	V
Battery pack Over-Discharge voltage protection delay time 总电压过放保护延迟时间	500	1000	2000	-	mS
Battery pack Over-Charge voltage protection release delay time 总电压过放恢复延迟时间	2000	3000	4000	-	mS
<b>Charge / Discharge Over-Current / Short circuit protection 充电 / 放电过流 / 放电短路保护</b>					
Over-Current charge protection 1 充电过流保护1	9.6	10.0	10.4	±0.4	A
Over-Current charge protection 1 delay time 充电过流保护延迟时间	1500	3000	4500	±1500	mS
Over-Current charge protection 2 充电过流保护2(硬件保护)	19.2	20.2	21.2	±1.0	A
Over-Current charge protection 2 delay time 充电过流保护2延迟时间	500	1000	1500	±500	mS
Over-Current charge protection 1/2 release 充电过流保护释放	Remove the charger and 1 Sec additional delay 移除充电器延时1秒恢复				
Over-Current discharge protection 1 放电过流保护1	33.0	35	37.0	±2.0	A

Over-Current discharge protection 2 放电过流保护2	38	40	42	±2.0	A
Over-Current discharge protection 3 放电过流保护3 (硬件保护)	66.3	73.3	80.3	±7.0	A
Over-Current protection 1 delay time 放电过流保护1延迟	7	10	15	-	Sec
Over-Current protection 2 delay time 放电过流保护2延迟	500	1000	2000	-	mS
Over-Current protection 3 delay time 放电过流保护3延迟	70	100	130	±30	mS
Over-Current discharge protection1/2/3 release 放电过流保护释放	Remove the load and 15 Sec additional delay 移除负载后延时15秒恢复				
Short circuit discharge protection 放电短路保护	131.7	146.7	161.7	±15.0	A
Short circuit protection delay time 放电短路保护延迟	416	480	544	±64	uS
Short circuit protection release 放电短路保护释放	Remove the load and 15 Sec additional delay 移除负载后延时15秒恢复				
<b>Temperature protection 温度保护</b>					
Charge over temperature protection 充电过温保护	46	50	54	±4	°C
Charge over temperature protection release 充电过温恢复	41	45	49	±4	°C
Charge low temperature protection 充电低温保护	-4	0	4	±4	°C
Charge low temperature protection release 充电低温恢复	-1	3	7	±4	°C
Discharging over temperature protection 放电过温保护	66	70	74	±4	°C
Discharging over temperature protection release 放电过温恢复	56	60	64	±4	°C
Discharging low temperature protection 放电低温保护	-24	-20	-16	±4	°C
Discharging low temperature protection release 放电低温恢复	-19	-15	-11	±4	°C
Mosfet over temperature protection Mosfet过温保护	85	90	95	±5	°C
Mosfet over temperature protection release Mosfet过温保护恢复	55	60	65	±5	°C
Cell & Mosfet temperature protection delay time 温度保护延迟	2	3	6	-	Sec
Cell & Mosfet temperature protection release delay time 温度保护恢复延迟	2	3	6	-	Sec
<b>Cell balance 电芯平衡</b>					
Balance start voltage (Charging mode) 平衡启动电压(充电状态)	4000mV			±40	mV
Balance start voltage (Idle mode) 平衡启动电压(空闲状态)	4000mV			±40	mV
Balance start difference voltage between cells 平衡启动压差	≥50				mV
Balance cut-off voltage Δcell voltage 平衡关断电压	≤30				mV
Balance current 平衡电流(Vcell = 4200mV)	32	42	52		mA
Balance condition 平衡条件	Balance on charging mode or idle mode 充电/静置模式下开启均衡				

<b>Current consumption 电流消耗</b>					
Normal mode 正常模式	-	6.0	8.0	-	mA
Sleep mode 睡眠模式	-	300	500	-	uA
Shut down mode (Vcell ≤ 2.8V) 掉电模式	-	15	50	-	uA
Idle mode from Normal mode 正常模式进入睡眠模式	No charge/discharge, no communication, no battery failure, delay 2 minutes 无充/放电、无通讯、电池无故障, 延迟2Minutes				
Into Shut down mode 进入掉电模式	Cell voltage <2800mV (30 minutes delay) or Cell voltage <3200mV (24 hours delay)任意节电芯电压 < 2800mV (延迟30分钟) 或任意节电芯电压 < 3200mV (延迟24小时)				
<b>Wake up way(Shut down mode) 掉电模式唤醒方式</b>					
Wake up (Shut down mode) 掉电模式唤醒	Charger 充电				
<b>Internal resistance PCB内阻</b>					
main circuit internal resistance of the protection board (B+ vs P+) BMS放电主回路内阻	≤20mΩ				
<b>Communication 通讯</b>					
Communication 通讯	CAN, 250K bit/s				
<b>Other 其它</b>					
ESD protection class ESD防护等级	Contact Discharge ±4KV 接触放电±4KV Air Discharge ±8KV 空气放电±8KV				
BMS Charge/discharge port type BMS充/放电端口类型	Charging port and discharge port are same 充/放电同口				
Discharge control switch 放电开关	Not Supported 不支持				
Charge cannot discharge 充电不能放电	Not Supported 不支持				
Charger input over voltage protection 充电器输入过压保护	Not Supported 不支持				
Charging Permission Protection 低压禁止充电保护 (不能充放电)	Support (Cell voltage below 1.5V, can not be charged) 支持(当任意一节电芯电压≤1.5V, 不能充电)				
Open Wire Detection 断线保护 (不能充放电)	Support 支持				
ID Resistance ID电阻	Without 无				
ESD protection class ESD防护等级	1. Contact Discharge ±4KV 2. Air Discharge ±8KV				
Battery pack parallel or series connection 电池组并联或串联使用	Not Supported 不支持				
Temperature sensor 温度传感器	R = 10K±1% @25℃ B = 3435K±1% @25/85℃				
Charge Fuse 充电保险丝	Without 无				
Discharge Fuse 放电保险丝	45A×1PCS				
<b>Remark 备注</b>	<b>1.</b> To improve battery storage time, the charging and discharging current is ≤ 200mA, and there is no communication. If any battery cell is less than 3.2V and lasts for more than 24 hours, the battery will enter the Shut Down mode and can only be activated after charging.为提高电池仓存时间, 充放				

电电流 $\leq 200\text{mA}$ ，且无通讯。任一节电芯 $\leq 3.2\text{V}$ ，持续时间超过24小时，电池进入Shut Down模式，需要充电才能激活。

**2.**If the voltage difference between any two cells is more than 0.4V and the duration is more than 1 minutes, the battery shall not be charged. 任意两节电芯电压差 $\geq 0.4\text{V}$ ，且持续时间超过1分钟，电池禁止充电。

**3.**If the voltage difference between any two cells is more than 0.4V and the duration exceeds 1 minutes, the battery shall not be balanced. 任意两节电芯电芯电压差 $\geq 0.4\text{V}$ ，且持续时间超过1分钟，电池禁止均衡。

**4.**If the voltage of any cell is less than 1.5V and the duration exceeds 1 minutes, charging is prohibited. 任意一节电芯电压 $\leq 1.5\text{V}$ ，且持续时间超过1分钟，禁止充电。

**5.**If the total voltage of the battery pack is less than 10.5V and the duration exceeds 1 minutes, charging is prohibited. 电池组总电压 $\leq 10.5\text{V}$ ，且持续时间超过1分钟，禁止充电。

**6.**Normal charging for 30 minutes, minimum cell voltage  $\leq 3.0\text{V}$ , charging is prohibited. 正常充电30分钟，最低电芯电压 $\leq 3.0\text{V}$ ，禁止充电。

**7.**Since the IC does not support 0V charging, the battery cannot be charged when any cell voltage is less than 1.5V, and regular maintenance is required if not used for a long time.由于 IC 不支持 0V 充电，任意节电芯电压 $\leq 1.5\text{V}$ 时，电池不能充电，需要定期维护，避免长期搁置不使用。

## 8 Storage and Transportation 储存和运输

### 8.1 Storage 储存

8.1.1 The Li-ion battery pack should be stored in a cool, dry and well ventilated area avoiding exposure to heat and high temperatures. Do not place the battery in direct sunlight or heat.

锂离子电池需保存在阴凉，干燥，通风的环境中，避免接触火源与热源。

8.1.2 The battery should be stored in accordance with the manufacturer's specifications. Ideally, a temperature of  $23\pm 5^\circ\text{C}$  and humidity of  $60\pm 15\%$  is recommended.

电池需按规格书规定温度范围进行储存，最佳储存温度为  $23\pm 5^\circ\text{C}$ ，最佳湿度为  $60\pm 15\%$ 。

8.1.3 The battery should be stored within the recommended room temperatures with a charge of 20%-40% of rated capacity.

In order to avoid over-discharge, we suggest charging and discharging the batteries every three (3) months, then charge to 20%-40% of rated capacity.

电池应当在室温下存放，应充到 20%至 40%的电量。为防止电池过放，建议每 3 个月按标准充放电方式进行一次充放电，然后按标准充电方式进行充电至 20%~40%的电量。

### 8.2 Transportation 运输

8.2.1 Do not mix the battery products with other cargos.

请勿与其他货物混合。

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

请勿将电池浸入水中或使其受潮。

8.2.3 Do not stack battery cartons over 7 high or stack upside down.

请勿叠放超过 7 层或倒置。

8.2.4 The highest temperature in transportation is lower than  $65^\circ\text{C}$ .

最高运输温度不超过  $65^\circ\text{C}$ 。

## 9 Warning 注意事项

- 9.1 为确保安全，电池应安装安全装置，在静电强于制造时所要求的静电时请勿使用，否则，安全装置会失效，导致电池过热、破裂、爆炸及着火。  
Use proper Electrostatic Discharge (ESD) handling methods to avoid damaging the battery. Exposure to ESD may damage the battery protection devices which may lead to overheating, rupture, explosion and fire.
- 9.2 请在下列条件下正常使用，否则会过热、着火、性能降低及缩短寿命。  
In the normal use of the following conditions, otherwise they will overheat and catch fire, performance and shorten the life.  
环境条件 Ambient condition: (T 温度 temperature)  
充电 charging: 0~+45°C  
放电 discharging: -20~+60°C
- 9.3 为避免人员受伤或财产损坏，电池应由合适的人员使用。电池应远离婴幼儿和宠物。  
Batteries should be handled by qualified personnel only to avoid injuries or property damage. Keep the battery away from children and pets.
- 9.4 若电池泄露，电解质粘于皮肤或衣服上，请用水冲洗掉或用流水洗衣服，否则将会腐蚀皮肤。  
Avoid contact with leaking batteries as electrolytes may cause burns to skin and damage to clothing. In the event electrolytes make contact, wash effected areas with water and seek medical attention if necessary.
- 9.5 为了不装错或损耗电池，请认真阅读使用说明书，并按照指导进行安装与拆卸(从装置上)。  
In order to avoid damage to the battery and devices, carefully read and understand the operating instructions for proper installation, use and removal of the battery in the device.
- 9.6 若电池不长期使用，请把电池拿出并放于干燥的地方，否则电器将会被腐蚀电池降低性能和减少寿命。  
If the battery is not intended to be used for an extended period of time, remove the battery and store it in a cool dry place per the manufacturer's specifications. This will prevent damage to the appliance while preserving the battery life and performance.
- 9.7 为防止损坏电池或设备，应保持电池接头触点清洁，没有任何污染物。请使用合适的清洁产品清洁电池表面和触点，如干布。  
Ensure the battery connector contacts are clean and free of any contaminants to prevent damage to the battery and device. Use only approved cleaning products, such as a dry cloth, to clean surface and contacts.
- 9.8 远离儿童，不要让儿童在没有成人监督的情况下更换电池。  
Keep out of the reach of children, Do not allow children to replace batteries without adult supervision.

## 10 保质期 Quality Guarantee Period

保修期自出厂之日起使用寿命 300 次或 1 年。如因使用不当造成损坏，不是由产品质量问题造成的，即使在保修期内，生产厂家也不提供免费服务。

The warranty period is 300 times or 1 year from the date of delivery. If the damage caused by improper use is not caused by product quality problems, the manufacturer will not provide free services even within the warranty period.

## 11 Product responsibility 产品责任

您必须严格遵守我司规格书和文件后面的注释使用电池，由于误用会引起电池过热，发生火灾或爆炸。对于没有按照规格书进行操作所造成的任何以外事故，我司不承担任何责任。

You must strictly adhere to our specifications and documentation comment later, due to the misuse of batteries can cause the battery to overheat, fire or explosion. For the specification for any accidental, I Secretary does not bear any responsibility.

如果规格书、原材料、生产过程或生产控制系统发生改变，改变的信息将会随质量和可靠性数据以书面形式通知消费者。

If the specification, raw materials, production processes or production control system is changed, the change of information will vary depending on the quality and reliability data to inform consumers in writing.

## 12 Others 其他

因为电池是利用化学反应，电池的性能会随时间恶化，即使存放很长一段时间没有被使用。此外，如果使用条件如充电，放电，温度，等不在指定的范围内的电池的寿命可能会缩短或设备中的电池使用的电解质渗漏损坏的可能。如果电池无法保持长时间的充电，即使充电正确，这可能表明是时候更换电池。

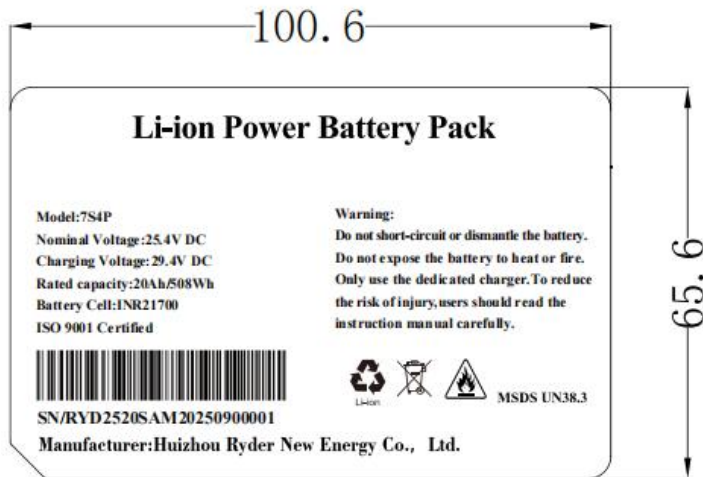
Because batteries utilize a chemical reaction, battery performance will deteriorate over time even if stored for a long period of time without being used. In addition, if the various usage conditions such as charge, discharge, ambient temperature, etc. are not maintained within the specified ranges the 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.

### 13 Note 备注

其他项目不包括在本规范应经双方同意。

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

### 14 Label 标贴



### 15 Packaging drawings 包装图纸