SPECIFICATION FOR APPROVAL

客户承认书

Product Type 产品类型	Lithium-ion Battery 锂离子电池	
Product Model 产品型号	M502728	
File No. 文件编号	8850272801-520mAh-A2	
Customer model 客户型号	40.72.013800	
Material code 客户物料编码		
Effective Date 生效日期	2023 年 03 月 08 日	
Prepared by 制订	Checked by 审核	Approved by 批准
Customer Name 客户名称	巨欣	
Customer Approval 客户承认		

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History of Revision
修订记录

No. 序号	Revision 版本	Date 日期	Changing Content 变更内容
1	A0	2021-07-27	New Released 首版发行
2	A1	2021-08-11	导线从 28#线改 32#线，黄线加长 2mm
3	A2	2023-03-08	IC 型号由 HY2113-OB1B 改为 VA7072E

Contents

目录

1. Scope 适用范围

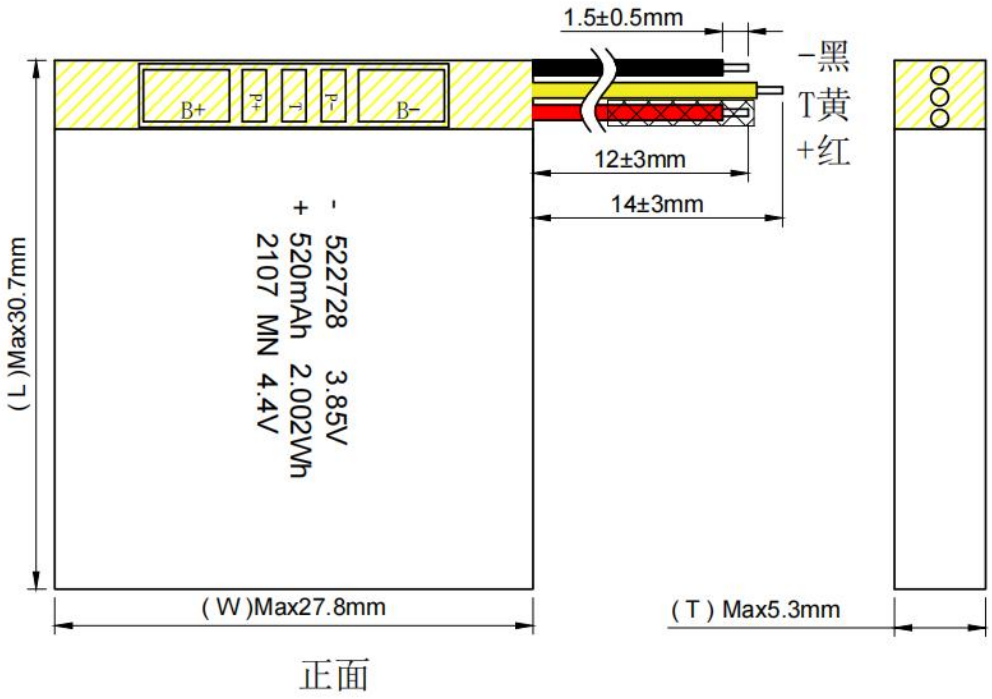
This specification describes the requirements of the lithium-ion polymer rechargeable battery supplied by GUANGDONG MIYEAR TECHNOLOGY CO., LTD.

本文件描述了广东美尼科技有限公司提供的锂离子电池的各项要求。

2. Specification 主要技术参数

No. 序号	Item 项目	Specification 规格	Remark 说明
1	Typical capacity 典型容量	540mAh	After standard charging, discharge at 0.2C and discharge at 4.4V to 3.0V；标准充电后，以 0.2C 放电，电压从 4.4V 放电至 3.0V 截止
	Minimum capacity 最小容量	520mAh	
2	Nominal voltage 标称电压	3.85V	
3	Shipment voltage 出厂电压	3.80~4.1V	
4	Internal impedance 内阻	Battery 电池：≤260mΩ	检测温度 25℃±2
5	Charge cut-off voltage 充电截止电压	4.4V	Charge cut-off current 0.02C 充电截止电流 0.02C
6	Nominal charging current 标准充电电流	0.2C	
7	Max continuous charge current 最大持续充电电流	1.0C	
8	Discharge cut-off voltage 放电截止电压	3.0V	
9	Nominal discharging current 标准放电电流	0.2C	
10	Max continuous discharge current 最大持续放电电流	1.0C	-10~+60℃
11	Work environment 工作环境	0~45℃ 65±20%RH	0.2C charging 0.2C 充电
		15~45℃ 65±20%RH	1.0C charging 1.0C 充电
		-20~+60℃ 65±20%RH	0.2C discharging 0.2C 放电
12	Storage environment 储存环境	-20~+45℃ 65±20%RH	Less than 1 months 少于 1 个月
		-20~+35℃ 65±20%RH	Less than 6 months 小于 6 个月
		0~+28℃ 65±20%RH	Less than 12 months 小于 12 个月
13	Environmental standards 产品环保标准	☑ RoHS ☐ REACH ☐ HF(无卤)	
14	Long time storage: If the cell is stored for a long time, the cell’s storage voltage should be 3.70-3.95V and the cell is to be stored in a condition as above requirement. Also, it is recommended to charge the cell every Four months. 长期储存： 如果电池长期存放，电池的存储电压应为 3.70-3.95V 电池应按上述要求储存。同时，建议每 4 个月给电池充电一次。		

3. Battery size 电池外型尺寸



正面

备注：

1）电芯单折边，正面喷码；

2）保护板包茶色胶绝缘，头部裹茶色胶固定；

3）保护板与电芯之间采用储能焊焊接方式，导线采用锡焊方式；

4）元件面朝内，且出线方向是右侧水平方向出线（负极出线）；

5) 套管绝缘红线。

正面喷码：- 522728 3.85V

+ 520mAh 2.002Wh

XXXX MN 4.4V

XXXX----YYMM（生产日期：年月）

喷码位置：居中喷码，如上图。

成品尺寸 Battery dimension 单位/Unit：mm	长度（L） Length	宽度（W） Width	厚度（T） Thickness	线长（L1）Exposed wire length			线头镀锡 L2 Tin wire length
				红线 Red wire	黄线 Yellow wire	黑线 Black wire	
	30.7max	27.8max	5.3max	12±3	14±3	12±3	1.5±0.5

电池类型 Battery type	锂离子电池 Lithium-ion battery	物料清单 Part lists	编码 NO.	物料名称 Part name	物料规格描述 Part specification description	单位 Unit	用量 Usage
			1	锂离子电芯	522728-520mAh	pcs	1
型号 Model	522728		2	保护板	MN-1837	pcs	1
			3	茶色高温胶	0.05*25mm*66m（绝缘保护板）	卷	
电压 Voltage	3.8V		4	茶色高温胶	0.05*6mm*66m（裹头部）	卷	
			5	红电子线	UL3302-32#	pcs	1
			6	黑电子线	UL3302-32#	pcs	1
			7	黄电子线	UL3302-32#	pcs	1
容量 Capacity	520mAh						

4. Test condition and requirement 测试条件和要求

4.1 Test environment 测试环境

Unless otherwise specified, this specification item test should be performed in the test under the condition of normal atmospheric pressure.

除非另有规定，本规范中个项试验应在试验的标准大气压条件下进行。

- The temperature 温度：20℃~25℃
- Relative humidity 相对湿度：45%~75%
- Atmospheric pressure 大气压力：86K Pa~106K Pa

4.2 Measuring instrument and equipment requirements 测量仪表与设备要求

- Measure the voltage meter accuracy should be not less than 0.5 on the Richter scale, Ω resistance shall be not less than 10 k/V.
  测量电压的仪表准确度应不低于 0.5 级，内阻应不小于 10KΩ/V。
- Measure the current meter accuracy shall be not less than 0.5.
  测量电流的仪表准确度应不低于 0.5 级。
- The instrument accuracy measuring time shall be not less than ± 0.1%.
  测量时间的仪表准确度应不低于±0.1%。
- Measuring temperature meter accuracy shall be not less than plus or minus ± 0.5℃.
  测量温度的仪表准确度应不低于±0.5℃。
- Adjustable constant current source of constant current, in the process of charging or discharging, the current changes shall be within ± 1%.
  恒流源电流恒定可调，在充电或放电过程中，其电流变化应在±1%范围内。
- Constant voltage source voltage is adjustable, and its voltage range is ± 0.5%.
  恒压源的电压可调，其电压变化范围为±0.5%。
- Measuring instrument accuracy is not lower than 0.02 mm size.
  尺寸测量仪的准确度不低于 0.02mm。
- Weighing the quality of the instruments are not less than 0.1 g.
  称量质量的仪器感量不低于 0.1g。

4.3 Standard charging mode 标准充电模式

Standard temperature 23±2℃ charging battery consist of charging at constant current rate of 0.2C until the battery voltage reach 4.4V .then battery be charged at constant voltage of 4.4V while tapering the charge current. Terminal charge until the charging current drops to 0.02C. Anyway, the total charge time for one cycle is not more than 7.5hours.

在 23±2℃条件下，电池用 0.2C 充电，当电池电压达到 4.4V 时改为恒压充电，直到充电电流小于或等于 0.02C 时，停止充电. 每次标准充电时间不能超 7.5 小时。

4.4 Standard discharge mode 标准放电模式

Standard temperature 23±2℃ discharge to the cut-off voltage with 0.2C current.

在 23±2℃环境温度条件下以 0.2C 的电流将电池放电到终止电压。

4.5 Initial capacity 初始容量

The standard charge mode for charging, then the standard discharge mode to discharge, measured for the first time the battery capacity is the initial capacity.

按标准充电模式进行充电，再以标准放电模式进行放电，在此方式下所测得的首次电池容量即为初始容量。

5. Product performance 产品性能

5.1 Product performance 产品常规性能

No. 序号	Item 项目	Testing instruction 测试方法	Requirements 标准
1	Nominal capacity 额定容量	In 23±2℃ ambient temperature, after standard charging, the cell is placed for 5 minutes, and then 0.2C discharged to ending voltage. 在 23±2℃环境温度中，标准充电后，电芯放置 5 分钟，再以 0.2C 放电至终止电压。	≥520mAh
2	1C discharging capacity 1C 放电性能	In 23±2℃ ambient temperature, after standard charging, rest 5minutes, then 1C discharge to ending voltage 在 23±2℃环境温度标准充电后，电芯放置 5 分钟，再以 1C 放电至终止电压。	Discharging capacity is not less than 90% normal capacity. 放电容量应不小于标称容量的 90%。
3	Cycle life 循环寿命	Test condition： Temperature：23±3℃ Charge：0.2C to4.4V Aside: 10 min Discharge：0.2C to 3.0V Aside: 10 min When the discharge capacity reduced to 80% of rated capacity, Stop testing 测试条件： 温度：23±3℃ 充电：0.2C 充电到 4.4V 搁置：10min 放电：0.2C 放电到 3.0V 搁置：10min 当放电容量降至额定容量的 80%时，停止测试	The cycle times is not less than500 循环次数不小于 500 次。 （电池厚度膨胀率≤8%）
4	Charge retention 荷电保持能力	After standard charging, test condition： Temperature: 23±2℃ Storage Time: 28days Then 0.2C discharge to ending voltage. 标准充电后，测试条件如下： 温度：23±2℃ 搁置时间：28 天 再以 0.2C 放电至终止电压。	Discharging capacity is not less than 90% initial capacity. 放电容量应不低于初始容量的 90%。

No. 序号	Item 项目	Testing instruction 测试方法	Requirements 标准
5	Temperature characteristics 温度特性	23±2℃ environment, after the standard charge, a cell is stored in an environment of specific temperature for 2 hours, then discharged to cut-off voltage 3.0V with a constant current of 0.2C. 23±2℃环境下标准充电后，储存在特定温度的环境中 2H，然后 0.2C 恒流放电至截止电压 3.0V。	Capacity rate at -10℃≥60%; -10℃放电容量≥60%； Capacity rate at 0℃≥×70%; 0℃放电容量≥初始容量×70%； Capacity rate at 45℃≥100%. 45℃放电容量≥初始容量×100%。
6	K value K 值	23±2℃ environment, constant current constant voltage charging 0.2 C to 3.92 ± 0.1 cut-off current 0.01 C. 23±2℃环境下，以 0.2C 恒流恒压充电至 3.92±0.1 截止电流 0.01C。	The normal temperature 25 ℃ for 96 h; The high temperature 45 ℃ for 72 h pressure drop 15 mV or less. 常温 25℃搁置 96H； 高温 45℃搁置 72H 压降≤15mV。

5.2 Condition adapting characteristics 环境适应性

No. 序号	Item 项目	Testing Instruction 测试方法	Requirements 标准
1	Static humidity and temperature 恒定湿热性能	After standard charging, test condition: Temperature: 40±5℃ Relative humidity: 90~95%RH Storage time: 96 hours Then return to room temperature for 2 hours, Then 1C discharged to ending voltage. 标准充电后，测试条件如下： 温度：40±5℃ 相对湿度：90~95% 放路时间：96 小时 电芯取出在室温下放置 2 小时，然后以 1C 电流放电至终止电压。	No explosion, no fire, no leakage. Discharging capacity is not less than 85% initial capacity. 不起火、不爆炸、不泄漏。 放电容量不低于初始容量的 85%。
2	Vibration 振动	After standard charging, fixed the cell to vibration table, then subjected to vibration test for 30 minutes per axis of XYZ axes Frequency rate: 1oct/min Vibration frequency: 10Hz-55Hz Excursion (single amplitude): 0.8mm 电芯按标准充电后，固定在振动台上，然后沿 XYZ 每个坐标方向振动 30 分钟 扫频速率：1oct/min 振动频率：10Hz~55Hz 位移幅值(单振幅)：0.8mm	No explosion, no fire, no leakage. 不起火、不爆炸、不泄漏。
3	High-temperature discharge 高温放电	After charging the battery according to standard mode, constant temperature in the 55±2℃ high temperature box for 2h, then ItA current to discharge voltage at 0.2. 将电池按标准模式充电后，放入 55±2℃的高温箱中恒温 2H，然后以 0.2ItA 电流放电至终止电压。	Discharge time should not be less than 5 hours. 放电时间应不低于 5 小时。

4	Low-temperature discharge 低温放电	After charging, the battery according to standard mode into -10±2℃ low temperature box temperature after 4h, discharge to termination voltage with 0.2itA current. 将电池按标准模式充电后，放入-10±2℃的低温箱中恒温 4H 后，以 0.2ItA 电流放电至终止电压。	Discharge time should not be less than 3 hours. 放电时间应不低于 3 小时。
5	Shock test 碰撞	After standard charging, test condition: Acceleration: 100m/s 2Pulse lasting time: <16ms Shock times: 1000±10 times 标准充电后，测试条件如下： 加速度：100m/s 2 脉冲持续时间：<16ms 碰撞次数：1000±10。	No explosion, no fire, no leakage. 不起火、不爆炸、不泄漏。
6	Low pressure 低压测试	Each fully charged cell is placed in a vacuum chamber, in an ambient temperature of 20~25℃. Once the chamber has been sealed, its internal pressure is gradually reduced to a pressure equal to ≤11.6kpa (this simulates an altitude of 15240 m) held at that value for 6 h. 电池放在一个模拟真空的空间放置 6 小时，环境温度为 20~25℃.真空环境压力≤11.6kpa,模拟 15240m 高空低压环境。	No explosion, no fire, no leakage. 不起火、不爆炸、不泄漏。

5.3 Safety performance 安全性能

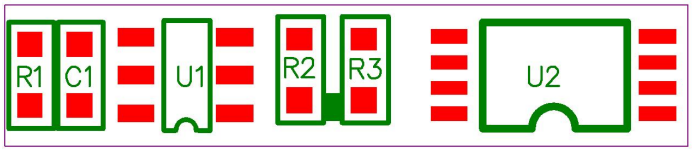
No. 序号	Item 项目	Testing Instruction 测试方法	Requirements 标准
1	Over charge test 过充电性能	Charging battery with constant current to voltage 4.6V, then with constant voltage 4.6V till current decline to 0A. Stop test till battery temperature 10℃ lower than max temperature. 在标准测试环境下，电池用 3C 电流充电至 4.6V，然后恒压 4.6V 让电流下降接近为 0A，监视电池温度变化，当电池温度下降至低于峰值 10℃时，停止实验。	No fire, no smoking, no explosion. 无冒烟、无起火、无爆炸。
2	RT short-circuit test 常温短路测试	Rest for 30miniutes at (25±2)℃ after standard charge, then short-circuit battery by connecting the positive and negative terminals with a circuit load having a resistance load(copper wire) of 80±20mΩ.Test can be terminated when battery surface temperature has returned to +10°C of environment temperature. 电池标准充电后，将电池在(25±2)℃的温度下恒温30min，然后用铜导线（总电阻 80±20mΩ）短接其正负极，当电池表面温度恢复至高于环境温度10℃以内时，结束实验。	No explosion, no fire, the temperature of the surface of the cells are lower than 150℃. 不起火、不爆炸，电芯表面温度不超过 150℃。
3	Short Circuit 短路试验（55℃）	Rest for 30miniutes at (55±2)℃ after standard charge, then short-circuit battery by connecting the positive and negative terminals with a circuit load having a resistance load (copper wire) of 80±20mΩ.Test can be terminated when battery surface temperature has returned to +10°C of environment temperature. 电池标准充电后，将电池在(55±2)℃的温度下恒温30min，然后用铜导线（总电阻 80±20mΩ）短接其正负极，当电池表面温度恢复至高于环境温 10℃以内时，结束实验。	No explosion, no fire, the temperature of the surface of the cells are lower than 150℃. 不起火、不爆炸，电芯表面温度不超过 150℃。

4	Heating test 热冲击	The cell is to be heated in a gravity convection or circulating air oven after standard charge. The temperature of the oven is to be raised at a rate of 5±2℃ per minute to a temperature of 130 ±2°C and remain for 10 minutes. 将标准充电后的电池放入鼓风式烘箱内，以(5±2)℃/min 的速率由室温升温至(130±2)℃，并在此温度下恒温 30min。	No fire, no explosion. 电池不起火、不爆炸。
5	Forced discharge test 强制放电	A discharged cell is subjected to a reverse charge at 1C for 90 min. 将电芯放完电，再用 1C 反接充电 90 分钟。	No fire, no explosion. 无起火、无爆炸。
6	Free fall test 自由跌落	After standard charge, the cell is to be dropped from a height of 1.0 meter onto concrete board for 6 times. 标准充电后的电池从 1.0m 高处自由跌落在到混凝土板上 6 次。	No rupture, no leakage, no fire, no explosion. 不破裂、不漏液、不起火、不爆炸。
7	Crush test 挤压测试	Fully charged the battery in accordance with standard charge condition, the battery is to be crushed between two flat plates. Continuous to applied force on battery of 13kN(17.2Mpa), stopped until a pressure reading of 17.2Mpa is reached on the hydraulic ram. 电池按标准充电条件充满电，放置在两块平面金属板间，持续施加 13KN（17.2Mpa ）的压力，直到液压油缸施加的压力达到 13KN（17.2Mpa）时停止。	No fire, no explosion. 无起火、无爆炸。

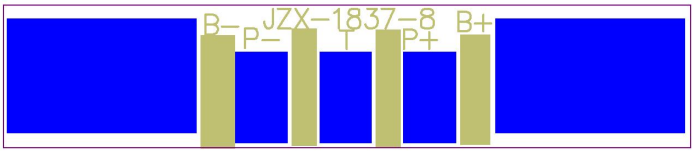
6. Protection circuit 保护电路

6.1 PCB chart　PCB 线路图

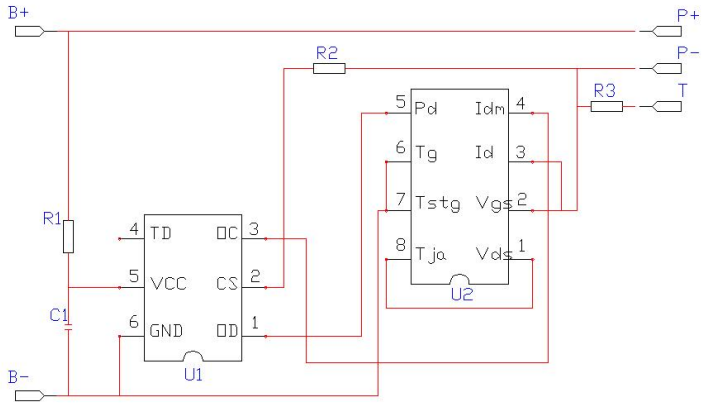
Top layer 顶层图：



Bottom layer 底层图：



6.2 Circuit diagram 电路原理图



6.3 PCM　BOM保护板单元

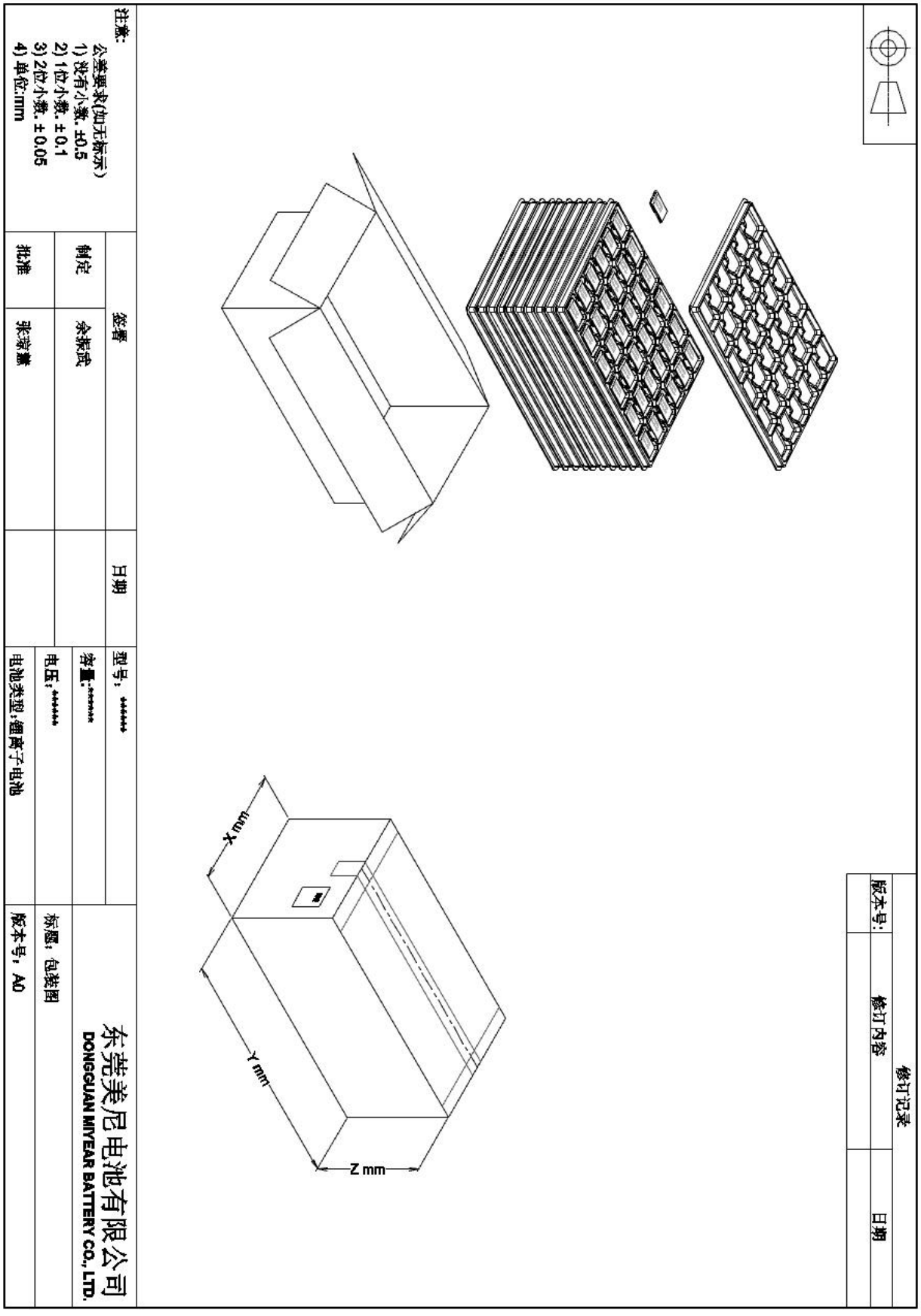
NO.	Location 元件编号	Part name 元件名称	Specification 元件规格	Pack type 封装式	Q'ty 数量	**Remark** 备注
1	U1	Battery protection IC	VA7072E　RoHS	SOT-23-6	1	中感微
2	U2	Silicon MOSFET	8205A　RoHS	TSSOP-8	1	德普微
3	R1	Resistance	SMD 100Ω ±5%　RoHS	0603	1	华新
4	R2	Resistance	SMD 2KΩ ±5%　RoHS	0603	1	华新
5	C1	Capacitance	SMD 0.1μF　RoHS	0603	1	村田(华新国巨)
6	R3	NTC	SMD10KΩ ±5%　RoHS	0603	1	顺络　B=3435
7	B+B-	镍片	5*3*0.3		2	星光
8	PCB	Print circuit board	18mm*3.7mm*0.6mm　FR4 绿油白字　RoHS 长宽厚公差 ± 0.1mm 成品厚度：2.1±0.1mm		1	路通达

环保物质要求：RoHS

6.4 PCM parameter 保护板参数（25℃±3℃）

参数 Parameter	值Value		
	最小Min	标准Type	最大Max
过充检测电压 Overcharge Testing Voltage	4.45V	4.475V	4.5V
过充恢复电压 Overcharge renew voltage	4.225V	4.275V	4.325V
过充保护延迟时间 Overdischarge protect Voltage	840ms	1200ms	1560ms
过放检测电压 Overdischarge testing Voltage	2.425V	2.50V	2.575V
过放恢复电压 Overdischarge renew voltage	2.825V	2.90V	2.975V
过放保护延迟时间Overdischarge protect prolong time	108.5ms	155ms	201.5ms
放电过流保护检测电压 Overcurrent testing Voltage	0.130V	0.150V	0.170V
放电过流保护延迟时间 Over current prolong time	6.58ms	9.4ms	12.22ms
短路保护检测电压 Short testing Voltage	0.4V	0.5V	0.6V
短路保护延迟时间 Short protect prolong time	150us	280us	500us
放电过流over current	2.0A	3.3A	5.0A
耗电Power consumption	/	1.5uA	4.0uA
内阻 Resistance	/	/	60mΩ
0V充电		允许	

7. Packing drawing 包装图



8. Quality assurance 质量保证

- Period of warranty: 12 months after sales.
  质量保证期限：售后 12 个月内。
- MIYEAR company is not responsible for the damage caused by mishandling of the battery which is clearly against the instructions in this specification.
  美尼公司对因没有按本规格书规定操作而导致的意外不负责任。

9. Matters needing attention 电池使用注意事项

Please be sure to take to comply with the specifications and the following precautions to use with batteries, did not follow the specifications for the operation caused any accidents, Miyear company will not accept any responsibility.
请您务必需遵守本规格书和以下使用注意事项使用电池，对于没有按照规格书进行操作所造成的任何意外事故，美尼电子有限公司将不承担任何责任。

! Danger ！危险

- Never heat cell or throw it into fire. 严禁把将电池投进火中或进行加热。
- Never throw cell in liquid such as water, gasoline or drink etc, also do not wet cell. 严禁把电池投入液体中，如水、汽油、饮料等，也不要把电池弄湿。
- Prohibition of use cell close to fire or in a car where temperature may be above 60℃. Also do not charge / discharge in such conditions. 禁止在火源附近或温度超过 60℃的轿车中使用或遗留电池，也不要在这些环境中进行充放电。
- Never put batteries in your pockets or a bag together with metal objects such as necklaces, hairpins, coins, or screws. Do not store or transport batteries with such objects. 禁止把电池同项链、发夹、硬币或螺钉等金属品一起放在兜中或包中，也不要把电池同上述物品一起储存或运输。
- Never short-circuit the (+) and (-) terminals with other metals. 禁止使用金属导体短路电池的正负极。
- Do not place cell in a device with the (+) and (-) in the wrong way around. 在装入设备时注意电池的正负极不要反装。
- Do not pierce cell with a sharp object such as a needle. 禁止使用锐利的物品刺穿电池。
- Do not disassemble the cell. 禁止对电池进行分解。
- Never weld a cell directly. 禁止直接对电池进行焊接。
- Do not use a damaged cell. 禁止使用已经损坏的电池。
- Please carefully read the user's manual prior to use to avoid deteriorated performance, even cell leakage, heat, smoke, fire, explosion due to wrong operations. 在使用之前请详细阅读操作说明书，不适当的操作可能引起电池变热、着火、爆炸、毁坏或电池容量的衰减。

! Warning ！警告

- Do not put cell into a microwave oven, dryer, or high-pressure container. 禁止把电池放加热器皿、洗衣机或高压容器中。
- Never use cell with dry cells and other primary batteries. Also do not use mixed cells/batteries with different package, model, or brand. 禁止把电池同干电池或其它原电池或者新旧电池一起使用，也不要同不同包装、不同型号或不同品牌的电池一起使用。
- Stop charging the cell if charging is not completed within the specified time. 如果在规定的充电时间内充电没有结束，停止充电。
- Stop using the cell if abnormal heat, odor, discoloration, deformation or abnormal condition is

detected during use, charge, or storage. 在使用、充电或储存期间如发现电池有变热、散发气味、变色、变形或其它反常之处停止使用。

- Keep away from fire immediately when leakage or unpleasant smell is detected. 当发现电池漏液或散发出难闻的气味时立即远离。
- If liquid leaks onto your skin or clothes, wash well with fresh water immediately. 如果电解液渗漏到您的皮肤或衣服上，立刻用大量清水冲洗。
- If liquid leaking from the cell gets into your eyes, do not rub your eyes, wash them well with fresh water and go to see a doctor immediately. 如果电解液渗出并进入您的眼睛里，不要揉擦您的眼睛，立刻用清水清洗眼睛并就医。

! Caution ！注意

- Before using the cell, be sure to read the user's manual and cautions on handling thoroughly. 在使用电池之前，应详细阅读操作指南并对使用中的注意事项有足够深刻的理解。
- Charge with specific charger according to product specification. Charge with CC/CV model. Reverse charging is prohibited, for it will deteriorate the cell performance and lead to safety issues such as heat and leakage. 充电时请使用指定的充电器并按照本规格书的要求进行充电。采用恒流恒压方式充电，禁止反向充电。同时，反向充电会降低电芯的充放电性能和安全性，并会导致发热和泄漏。
- Keep batteries out of reach of children to avoid being swallowed. 把电池放到小孩够不到的地方以免吞服。
- If children use the cell, their guardians should explain the proper handling. 小孩使用电池时，监护人应详细解释操作方法。
- Batteries have life cycles. If cell powers equipment much shorter time than usual, please replace the cell with a new one. 电池具有使用寿命，如果使用电池的设备的工作时间比平常少的多，请更换新电池。
- When not using cell for long terms, remove it from the equipment and store in a place with low humidity and low temperature. 当长期不用时，要将电池从设备中取出并放在低温低湿的环境中保存。
- While the cell pack is charged, used and stored, keep it away from places/objects with static electric. 电池应在远离静电的场所进行充电、使用和储存。
- If the terminals of cell become dirty, clean it with dry cloth before using. 如果电池的接线端变脏，在使用之前用干布擦净。
- Cell would be over-discharged by its self-discharge characteristics in case the battery is not used for long time. In order to prevent over-discharging, the battery shall be charged periodically to maintain between 3.7V and 3.9V. Cell is to be stored in a condition as above. 由于自放电存在，电芯长时间不使用时将会过放；为避免电芯过放，应定期给电芯充电以维持电压在 3.7V 到 3.9V 之间。同时电芯应在以上给定的条件下存贮。