



Specification of Li-ion Rechargeable Battery

Model No.: BAKTH-423040AH-MINI

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1. Scope

This specification describes the definition, technical requirement, testing method, warning and caution of the Lithium ion rechargeable battery. The specification only applies to SHENZHEN BAK's Li-ion battery.

2. Product Model

2.1 Battery type: Lithium ion rechargeable battery pack

2.2 Model No.: BAKTH-423040AH-MINI

3. Basic Specification

3.1	Nominal voltage	3.7V
3.2	Capacity	550mAh (0.2C discharged from 4.2V to 2.75V)
3.3	Charge voltage	4.20±0.05V
3.4	Standard charge current	0.2C(110mA, 0~+45℃)
3.5	Max charge current	1C(550mA, 5~+35℃)
3.6	Charge conditions	CC / CV
3.7	Continuous discharge current	0.2C (110mA)
3.8		1C (550mA)
3.9	Max continuous discharge current	1C (550mA)
3.10	Discharge cut-off voltage	2.75V±0.05V
3.11	Internal Impedance	≤180mho (after charged)
3.12	Working temperature	Charge: 0 ~ +45℃
3.13		Discharge: -20 ~ +60℃
3.14	Storage temperature	-10 ~ +45℃<recommend -0~35℃>
3.15	Relative humidity	65±20%
3.16	Weight	Approx 27g <for battery pack>
3.17	Battery pack dimension	Approx:4.6±0.3*32.5±0.5*40±0.5<mm>
	Weight	Approx 19g <for single cell>

4. Visual Inspection

There shall be no such defects as remarkable scratches, cracks, bolts, cup cancers, deformations, swelling, leakage.

5. Detailed Specification

5.1Electrical specification

Items	Test conditions	Results
5.1.1 Full charge <standard charge>	Under $20\pm5^{\circ}\text{C}$, $65\pm5\%\text{RH}$, it can be charged to 4.2V with constant current of $0.2\text{ C}_5\text{mA}$, and then, charged continuously with constant voltage of 4.2V until the charged current is less than $0.02\text{ C}_5\text{mA}$.	Remark: it is standard charge method
5.1.2 Rated capacity	Under $20\pm5^{\circ}\text{C}$, charge the cell according to above charging method, then, keep it for 0.5-1hrs. Discharge the cell with constant current $0.2\text{ C}_5\text{mA}$ to 2.75V, the discharging time is not less than 5 hours.	$\geq 550\text{mAh}$
5.1.3 Cycle life	Discharge the cell with constant current $0.2\text{ C}_5\text{mA}$ to 2.75V firstly, then, charged it for 2.5hrs by quick charging, keep it for 30mins. Discharge it with current $1\text{ C}_5\text{mA}$ to 2.75V, this is one cycle. To do the cycle test for 300 ^t times.	Capacity \geq at least 80% of the rated capacity
5.1.4 Internal impedance	At 1kHz AC with fully charge state	Initial battery pack $\leq 180\text{m}\Omega$
5.1.5 Temperature performance	Hi-temperature: At $20\pm5^{\circ}\text{C}$, charge the cell according to standard charge, then, keep it in the oven of $55\pm2^{\circ}\text{C}$ for 2hrs. Discharge the cell with constant current of $0.5\text{ C}_5\text{mA}$ to 2.75V, the discharging time should be not less than 51 minutes.	
	Low temperature: At $20\pm5^{\circ}\text{C}$, charge the cell according to standard charge, then, keep it in the oven of $-20\pm2^{\circ}\text{C}$ for 16~24 hrs. Discharge the cell with constant current $0.2\text{ C}_5\text{mA}$, the discharge time should be not less than 3hrs.	
	Constant temperature & humidity: At $20\pm5^{\circ}\text{C}$, charge the cell according to standard charge, then, keep it in $40\pm2^{\circ}\text{C}$ & $90\sim95\%\text{RH}$ for 48hrs, after this, keep the cell in $20\pm5^{\circ}\text{C}$ for 2hrs. Discharge the cell with constant current of $0.5\text{ C}_5\text{mA}$ to 2.75V, the discharge time should be not less than 36mins.	
5.1.6 Storage	Storage for 28 days at 25°C .	Capacity $\geq 80\%$
	Storage for 7 days at 60°C .	Capacity $\geq 85\%$
5.1.7 Open circuit voltage	As of shipment	3.7 – 4.0V

6.1 Mechanical specification

Items	Test conditions
6.2.1 Vibration test	At 20±5°C & normal atmospheric pressure, charge the cell according to standard charge. Then, vibrated it 10 times in each direction of X, Y, Z with changing frequency of 10~55HZ and amplitude of 0.35mm, the rate of scan frequency is from 10~55HZ per min. After above test, to keep the battery at 20±5°C for 30mins, the battery cannot be break, scratch, distortion, contamination and leakage, and the Voltage is not less than 3.6V.
6.2.2 Free fall testing	At 20±5°C, charge the cell by standard charging, then drop it freely for six times in each direction of X, Y, Z from the height of 1000mm onto the hard board with the thickness of 20mm. After above testing, to keep the cell at (20±5)°C for 1-2hrs, the cell cannot be break, scratch, distortion, contamination and leakage. Discharge the cell to 2.75V with constant current 0.2 C ₅ mA, it should be discharged and the discharge time should be not less than 51 minutes.

6.3Secure Specification

Items	Test conditions
6.3.1 Impact Testing	At 20±5°C, full charge the cell by standard charge, then, place the cell on the impact flat, a 10kgs weight dropped from 1m height onto cell, distortion is allowed. After above testing, to keep the battery at 20±5°C for 1-2hrs, the cell should be not exploded or catch fire.
6.3.2 Heat impact testing	Put the cell into a air oven, the temperature in the oven should rise at the rate of speed of (5±2°C)/min to be 130°C±2°C, keeping the temperature for 30 min, the cell should be not explosion, fire or fume.
6.3.3 Short-circuit test	At 20±5°C, full charged the cell by standard charge firstly, short-circuited it by max resistance of 50mΩ by connecting the positive and negative terminals of cell with copper wire, Monitor its temperature while testing, finish the test when the cell case temperature was 10°C lower than the peak temperature. The cell should be not explosion, fire.
6.3.4 Over-charged test	Connect the cell with a CC/CV power, then, charge the cell to 4.6V with constant 3A current, and last for 2hrs. The cell shall be not explode and fire.
6.3.5 Over-discharged test	At 20±5°C, charged the cell by standard charge firstly, then, discharge it with constant current 0.2 C ₅ mA to 2.75V. Connected with external load of 30Ω for 24hrs. The cell shall be not explode or fire.

7. Test Conditions

Temperature : 25±2°C

Relative humidity : 65±20%

8. PCM specifications

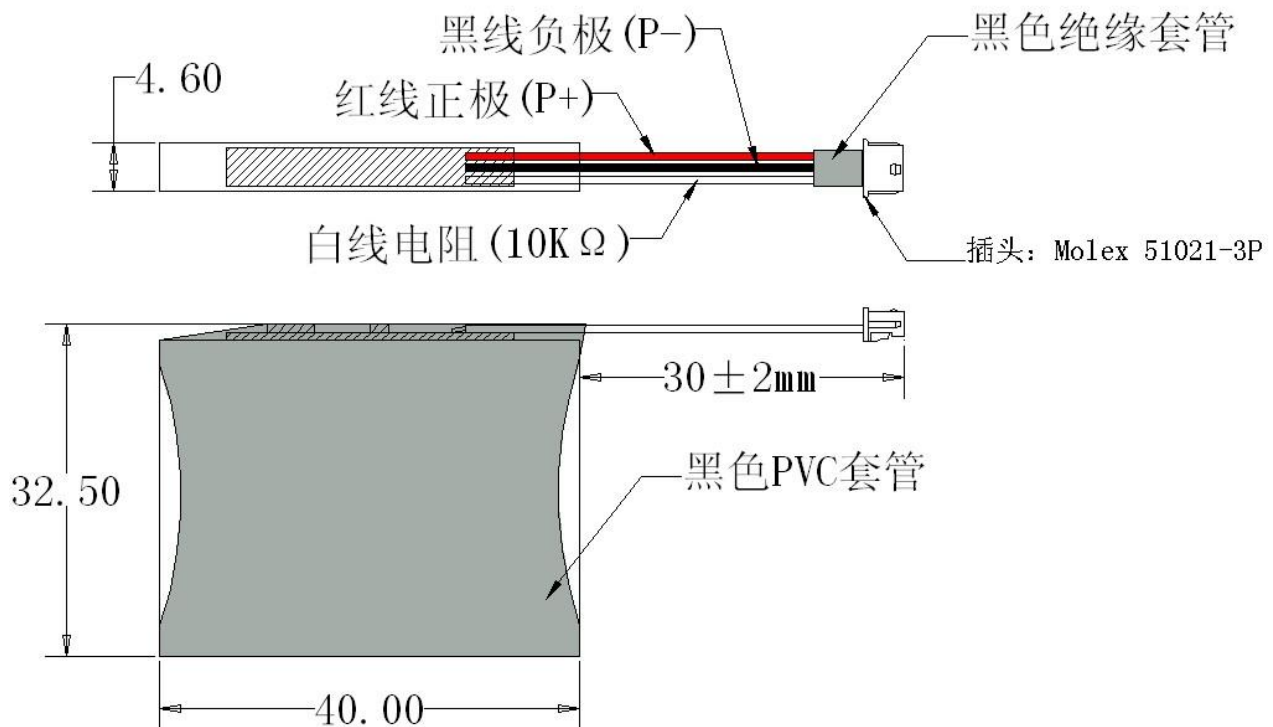
For safety reasons, BAK Lithium-ion cells shall be used with PCM specified as followings :

Main Technical Parameter:

No.	Items	requirements
1	Over- Charge cut-off voltage	$4.30V \pm 0.05V$
2	Over-discharge cut-off voltage	$2.4V \pm 0.1V$
3	Over current test voltage	$0.15 \pm 0.03V$

For details working principle of PCM, please see attached specification below.

9. Drawing for battery pack



11. Warranty

The period of validity of the cell is 12 months.

12. Warnings

12.1 Warning:

To prevent the possibility of the battery from leaking, heating and explosion. Please observe the following precautions:

- Don't immerse the battery in water and seawater. Please put it in cool and dry environment if no using.
- Do not use and leave the battery near a heat source as fire or heater.
- Being charged, using the battery charger specifically for that purpose.
- Don't reverse the positive and negative terminals.
- Don't connect the battery to an electrical outlet directly.
- Don't discard the battery in fire or heater.
- Don't connect the positive and negative terminal directly with metal objects such as wire.
- Do not transport and store the battery together with metal objects such as necklaces, hairpins.
- Do not strike, throw or trample the battery.
- Do not directly solder the battery and pierce the battery with a nail or other sharp object.

12.2 Caution:

- Do not use or leave the battery at very high temperature conditions (for example, strong direct sunlight or a vehicle in extremely hot conditions). Otherwise, it can overheat or fire or its performance will be degenerate and its service life will be decreased.
- Do not use it in a location where is electrostatic and magnetic greatly, otherwise, the safety devices may be damaged, causing hidden trouble of safety
- If the battery leaks, and the electrolyte get into the eyes. Do not wipe eyes, instead, rinse the eyes with clean running water, and immediately seek medical attention. Otherwise, eyes injury can result.
- If the battery gives off an odor, generates heat, becomes discolored or deformed, or in any way appear abnormal during use, recharging or storage, immediately remove it from the device or battery charge and stop using it.
- In case the battery terminals are dirt, clean the terminals with a dry cloth before use. Otherwise power failure or charge failure may occur due to the poor connection with the instrument.
- Be aware discharged batteries may cause fire; tape the terminals to insulate them.

SPECIFICATION FOR PCM USING FOR BAKTH-423040AH-MINI

PCM Function Indication & working principle

● Function Indication:

1). Connect the cell with PCM

When the battery is under the condition of between over-charge and over-discharge, its output voltage of the “P⁺” and “P⁻” is the battery's voltage.

2.) Battery over-charge protection function

Connect the “P⁺” and “P⁻” with a charger and charge the battery pack, when the battery pack's voltage is up to the over-charge voltage ($4.30V \pm 0.05V$), the protect board comes to work and cut off the circuit for protection.

3). Battery over-discharge protection function

Connect the “P⁺” and “P⁻” with a load and discharge the battery pack, when the voltage is up to the over-discharge voltage ($2.4V \pm 0.1V$), the protect board comes to work and cut off the circuit for protection.

4). Short-circuit protection function

when p+ and P- are short-circuit, protection board will be suddenly action to cut off the circuit channel to achieve short-circuit protection.

● Electric performance

Test items:

1.) Visual Inspection: it is good.

2.) Fiberboard thickness: 0.6mm

3) Electronic components

a. Control IC: R5402 N110KD

b. MOSFET: AO8822

4) “SMT” welding technical

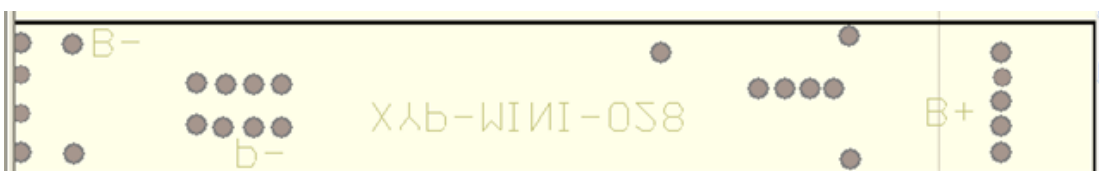
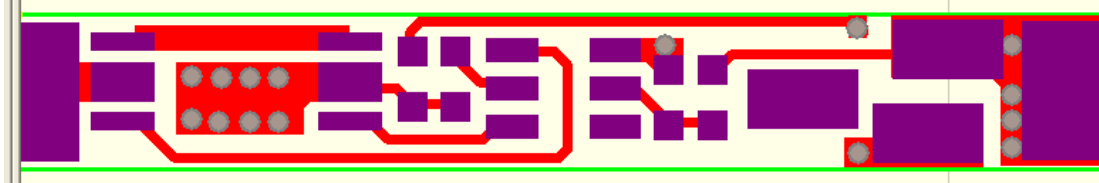
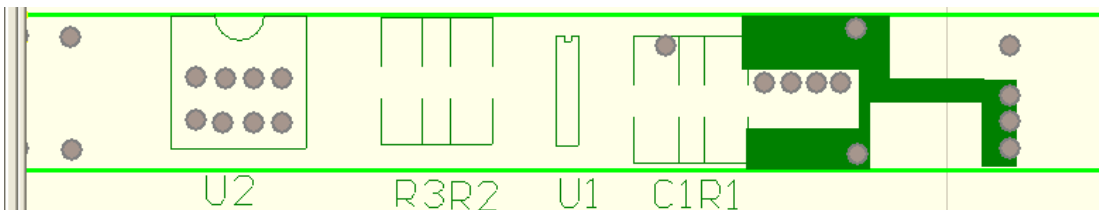
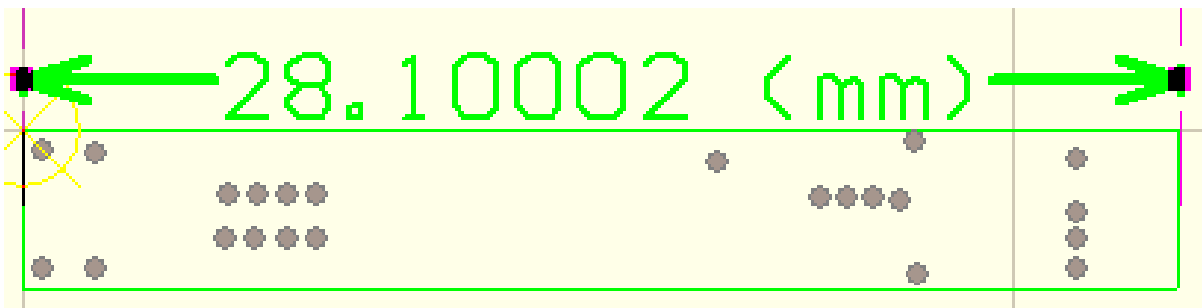
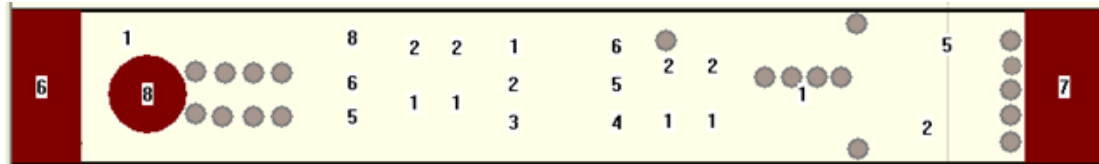
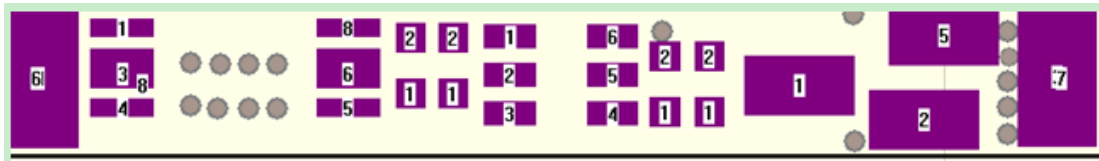
5) BOM list:

No.	Part No.	Name	Specification and model	Specification	QTY
1	PCB	Borad	XYP-MINI-028	28.1*3.8*0.6mm	1PC
2	U2	MOS	8205A	TSSOP-8	1PC
3	U1	IC	DW01+	SOT-23-6	1PC
4	R1	Resistor	SMD 100Ω±5%	0603	1PC
5	R2	Resistor	SMD 1KΩ±5%	0603	1PC
6	R3	Resistor	SMD 10KΩ±5%	0603	1PC
7	C1	capacitance	0.1μF +80%-20% 1/16W	0603	1PC

6.) Performance test Parameter

DW01+		Ta=25°C	
Parameter	Value		
	Min	Type	Max
Overcharge Testing Voltage	4.25V	4.30v	4.35V
Overcharge renew voltage	4.05V	4.10V	4.15V
Overdischarge protect Voltage		80ms	200s
Overdischarge testing Voltage	2.3V	2.40V	2.5V
Overdischarge renew voltage	2.9V	3.00V	3.1V
Overdischarge protect prolong time		20ms	60ms
Overcurrent testing Voltage	0.12V	0.15V	0.18V
Over current prolong time		10ms	20ms
Short testing Voltage	1.25V	1.35V	1.45V
Short protect prolong time		5μs	50μs
Resistance			60 mΩ

● PCB BOARD ATTACHED DRAWING



- PCM working principle drawing:

