Specification of Li-ion Rechargeable Battery

Model No.: 18650-1S4P

Specification Approval sheet

1. Scope

This specification describes the type and dimension, performance, technical characteristics, warning and caution of the lithium ion rechargeable battery. The specification only applies to Lithium batteries supplied by Akyga.

2. Product basic information

Below data shall be based on the testing for fresh battery unless otherwise specified

No.	Items	Specification	
1	Normal Voltage	3.6V	
2	Nominal Capacity	1000mAh	Standard charge & discharge
3	Minimum Capacity	9800mAh	
4	Max Charge Voltage	4.2V / Standard Charging Method CC/CV)	
5	Discharge cut-off voltage	2.8V (limited by PCB)	
6	Standard Charge	0.15C 4.2V .01C / CC charge to 4.2V, then CV to 0.01C cut off)	25±2℃
7	Standard Discharge	0.15C (CC Discharge to 2.8V /	25±2℃
8	Max. Charge Current /	1.8A 45℃≥T≥25℃	
9	Max. Discharge Current /	1.8A	
10	Humidity range	65%±15% RH (non-condensing	
11	Impedance	≤150mΩ (AC Impedance, 1000 Hz)	
12	Battery Weight	Approx: 190g	
13	Battery Dimension	L( ): 69mm Max W( ): 39mm Max T( ): 37.5mm Max	
14	As of shipment Voltage	3.55~3.7V (or according to customer's required/	
16	St dition	45～60℃, 60% RH: 1month（1 个月） 25～45℃, 60% RH: 3month（3 个月）	

		-20～25℃, 60% RH: 12month（12 个月） Storage in a 50% charged state; (Do NOT storage at fully charged state; Over long storage periods batteries should be cycled every 90 days, The method is to do a charge-discharge cycle with standard method. (Under normal storage conditions, long time storage can lead to decrease of capacity and cycle life, it will be caused more decreasing of the capacity and the cycle life if the storage condition out of the normal condition.) 50%
17	Shipment Requirement	To prevent violent vibration, impact or crush during transportation, avoid direct exposure under the sun or the rain.

3. Visual inspection

The surface is clear and no scratch, no mechanical abrasion, deformations.

4. Electrical characteristics (for cell)

4.1 Definition

Standard charge method

At 25±2℃ The battery shall be charged to 4.20V with a constant current of 0.5C and then continually charged at constant voltage of 4.20V; the charging process should be cut off till the charging current is less than 0.01C.

Standard discharge method

At 25±2℃, after fully charged by standard charging method, discharged the battery to 2.75 V under 0.2C constant current.

4.2 Requirement of the testing equipment

a. The dimension measurement shall be implemented by instruments with equal or more precision seal of 0.01mm.

b. Standard class specified in the national standard or more sensitive class having inner impedance more than10k Ω/v.

c. Impedance shall be measured by a sinusoidal alternating current method(1kHz LCR meter).

d. The current measurement shall be implemented by instrument with equal to more precision scale of ± 0.1% and the constant voltage precision should be implemented with ± 0.5%; and the timing precision should be not below ±0.1%.

e. The temperature measurement shall be implemented by instrument with equal or more precision seal of ±0.5℃.

4.3 Electrical characteristics

Test batteries within one month after shipment from our factory and the batteries shall not be cycled over 3 times before the tests; All the tests in this specification shall be conducted in an ambient temperature of 25±2℃ under a humidity of 25% to 85% unless otherwise specified.

Items	Conditions	Criteria
0.2C Capacity	1.(For cell)The test shall be conducted in an ambient temperature of 23±2℃. Discharge at 0.2C down to 2.75V, rest 30 minutes； and then charge at 0.2C/4.2V CC/CV mode cut-off current 0.02C. Rest 30 minutes, and then discharge at 0.2C to 2.75V. 2. (For battery pack)The test shall be conducted in an ambient temperature of 23±2℃. Discharge at 0.2C down to 2.8V, rest 30 minutes； and then	1.The discharge time should ≥300mins 2.The discharge time for battery pack should ≥290mins

	charge at 0.2C/4.2V CC/CV mode cut-off current 0.02C. Rest 30 minutes, and then discharge at 0.2C to 2.8V.	
Storage Characteristic	Test condition: Charge: Standard charge method stored at 25℃ for 30 days Discharge: Standard discharge method	residual capacity after 30 days storage≥95% recover capacity after 30 days storage≥97%
Cycle Life (for cell/)	Test condition： Temperature : 25±2℃ Charge: CC/CV 0.5C（1250mA）4.2V Cut off current: 0.05C（125mA） Discharge: CC 1C（2500mA）; End-of-discharge Voltage: 2.8V	discharge capacity of 300th cycle≥80%

5. Safety performance (for cell)

Items	Conditions	Criteria
Overcharge test	After fully charged according to the standard charge method, the cell is charged at 1 C till the ending conditions: the cell voltage reaches 1.5 times of the cut-off voltage of standard charge or the 1 C charge time reaches 60 min. The cell is observed for 60 min afterwards.	The battery must has no explosion, no fire
Over discharge test	After fully charged according to the standard charge method, the cell is discharged at 1C for 90 min and then observed for 1h.	The battery must has no explosion, no fire
130 ℃ hot oven test	After fully charged according to the standard charge method, the cell is put in a oven at a heating speed of 5 ℃ per minute until the temperatures of both the cell and the oven reach 130 ℃. The cell shall be maintained at 130 ℃ for 30 min or until a fire or explosion is obtained.	The battery must has no explosion, no fire.
Crush test	After standard charge, cell is crushed between two flat surfaces until an applied force of 13kN±1kN is reached.	The battery has no explosion, no fire.
Short circuit test	After fully charged according to the standard charge method, the cell is short-circuited by connecting the positive and negative terminals with a copper wire for 10 min. The wire resistance shall be less than 5mΩ. The cell is observed for 1 h after test.	The battery has no explosion, no fire.
Note	Unless otherwise specified, above tests above shall be conducted in ventilated environment at 25 ± 2 ℃ and under protective equipment.	

6. Environmental performance

Items	Conditions	Criteria
Vibration Test	Fully charged the battery at 0.2C, fix it on the vibration table. Adjust the instrument as follows. There are 3 directions: X, Y, Z. In each direction, the battery should be vibrated for 30min from 10Hz to 55Hz. Frequency sweeping rate:1Hz/min; Vibrating frequency:10Hz～30 Hz; Movement amplitude(mono-amplitude):0.38mm; Vibrating frequency:30Hz～55 Hz; Movement amplitude(mono-amplitude):0.19mm.	The battery has no distortion, no leakage, no smoking and no explosion.
Drop Testing	Procedure: After fully charged, the battery is dropped from a high 1.0m away free onto concrete land once of each side，total sex times.	The battery has no leakage, no smoking, no fire no explosion.
Note	Unless otherwise specified, above tests above shall be conducted in ventilated environment at	

7. The Main Materials List of Battery

N0.	Material	Specification	Remark
1	Cell	18650 3.6V 2450~2500mAh*4PCS	
2	PCM	DB1-006	
3	Connector	Molex 51021-0300 UL1571-26AWG	

8. Electric protect features (25℃)

Item	Content	Criterion	Remarks
Application	Battery Type	Li-ion	
	Battery Cell	1	
Charge Parameters	Input charging voltage	4.200V±0.050V	
	Input charging current	Max2A	
Discharge Parameters	Continuous discharge current	Max2A	
Item	Content	Criterion	Remarks
Over charge protect	Over charge detection voltage(Cell)	4.250V±0.050V	
	Protect delay time	700ms—1200ms	
	Over charge release voltage(Cell)	4.050V±0.050V	
Over discharge protect	Over discharge detection voltage(Cell)	2.800V±0.100V	
	Protect delay time	26ms-120ms	
	Over discharge release voltage(Cell)	3.000V±0.100V	
Over Current protect	Overcurrent Discharge	2A-6A	
	Protect delay time	5ms—20ms	
	Protect relieve condition	Cut load	
	Overcurrent charge	-	
	Protect delay time	-	

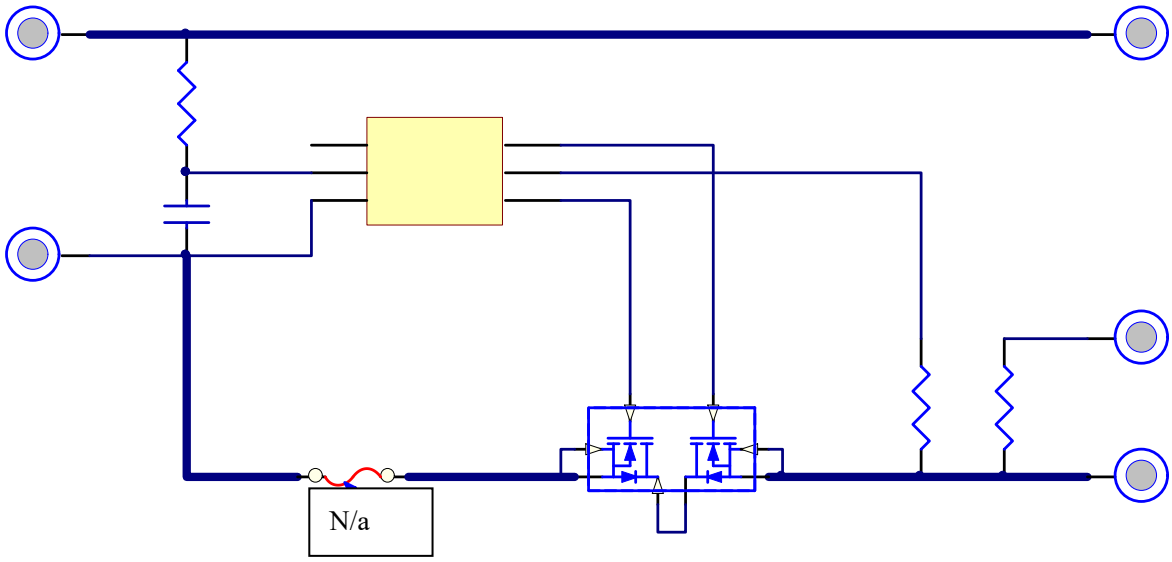
Short Protection	Detection delay time	230-530us	
	Recovery condition	Cut short circuit . Cut load	
Dimension(L*W*T)	33.5*4.7*0.6mm		

NO	Items		condition	Remarks
1	Impedance		≤80mΩ	
2	Current consumption	Operation mod	≤6uA	

9. PCB parts list BOM

1	33.5*4.7*0.6mm	1	PCS	PCB
2	0402-330R ±5% 1/16W-	1	PCS	R1
3	0402-1K ±5% 1/16W-	1	PCS	R2
4	0402-10NF-25V-X7R ±10%	1	PCS	C1
5	MOS: CJS8810 20V7A TSSOP-8	1	PCS	U2
6	IC: R5478N218CD SOT-23-6 4.250V/2.800V	1	PCS	U1
7		1	PCS	P1
8	0402 10K NTC±1% B=3435K (10K/)	1	PCS	R3
9	3*3*0.3mm	2	PCS	B-, B+

10. Schematic circuit diagram



12. Warranty

The Warranty period of battery is 12 months since delivery date.

However, even though the problem occurs within this period, Akyga won't replace a new one for free as long as the problem is not due to the failure of Akyga manufacturing process or is due to customer's abuse or misuse.

13. Battery precautions and safety instructions

Lithium-Ion rechargeable batteries subject to abusive conditions can cause damage to the cell and/or personal injury. Please read and observe the standard cell precautions below before using utilization.

Note 1. The customer is required to contact Akyga in advance, if and when the customer needs other
applications or operating conditions than those described in this document.

Note 2. will take no responsibility for any accident when the cell is used under other conditions than those described in this Document.

Note3. When the batteries are not be used for a long time, please store them safely so that they will stay in a half-charged state. Please wrap the batteries with non-conductive materials in order that metallic materials will not contact the batteries directly, which may result in damage to the batteries. Keep the batteries in a cool and dry place.

Warning

Danger warning (it should be described in manual or instruction for users, indicated especially) to prevent the possibility of the battery from leaking, heating, explosion. Please observe the following precautions:

- Don’t immerse the battery in water and seawater, damping of the battery is prohibited. Please put it in cool and dry environment if no using.
- Don’t use and leave the cell near a heat source such as fire or heater.
- Do not use or leave the cell under the blazing sun (or in heated car by sunshine).
- Avoid to charge battery near a fire source or in direct sunlight
- Being charged, using the battery charger specifically for that purpose.
- Don’t reverse the positive and negative terminals
- Do not disassemble or modify the battery.
- Do not use the cell with conspicuous damage or deformation..
- Don’t connect the battery to an electrical outlet directly.
- Don’t discard the battery in fire or heater.
- Do not short circuit, over-charge or over-discharge the battery.
- Don’t transport and store the battery together with metal objects such as necklaces, hairpins.
- Do not use lithium ion battery and others different lithium battery model in mixture.
- Keep the battery away from babies.
- Don’t strike, throw or trample the battery.
- Prohibition of use of damaged battery.
- Battery pack designing and packing Prohibition injury batteries.

- The battery replacement shall be done only by either cells supplier or device supplier and never be done by the user.

- Be aware discharged batteries may cause fire; tape the terminals to insulate them..

- 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.

- Do not directly solder the battery and pierce the battery with a nail or other sharp object.

- When disposing of secondary cells, keep cells of different electrochemical systems separate from each other.

Caution

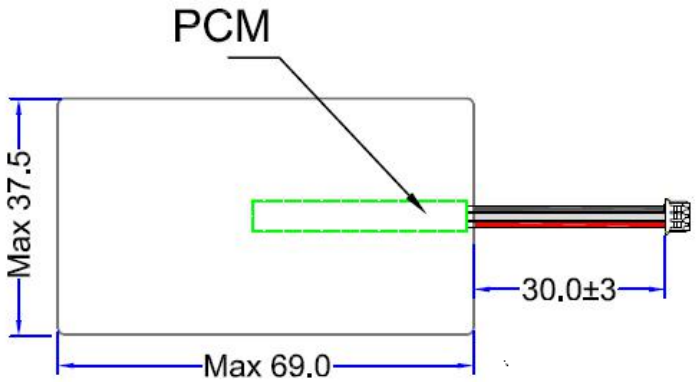
- Do not use or leave the battery at very high temperature conditions (for example, strong direct sunlight or a vehicle in extremely hot conditions). Otherwise, it can overheat or fire or its performance will be degenerate and its service life will be decreased.

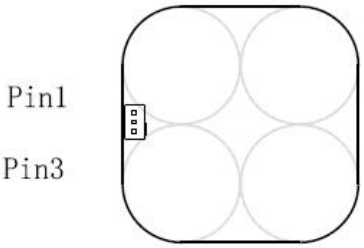
- If the battery leaks and the electrolyte get into the eyes, don’t wipe eyes, instead, thoroughly rinse the eyes with clean running water for at least 15 minutes, and immediately seek medical attention. Otherwise, eyes injury can result.

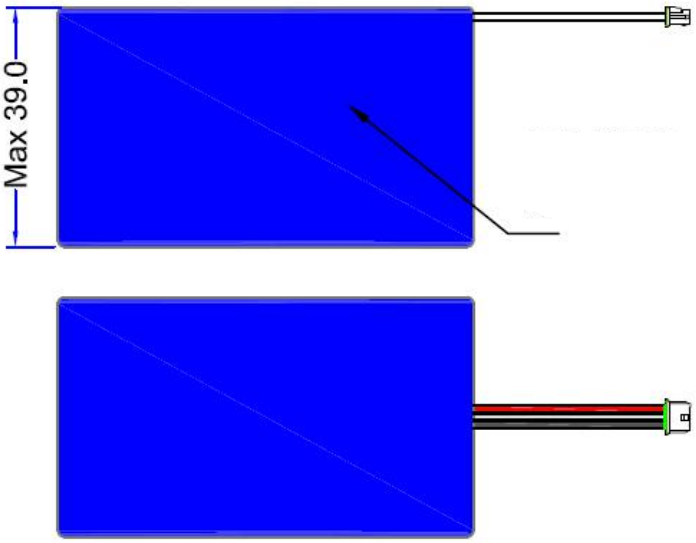
- If the battery gives off an odor, generates heat, becomes discolored or deformed, or in any way appear abnormal during usage, recharging or storage, immediately remove it from the device or battery charger and stop using it.

- 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.

14. Battery outline drawing **(Unite:mm)**







MOLEX 51021-0300 Wire:UL1571-26#		
Pin1	Black	P−
Pin2	White	NTC:10K ±1%
Pin3	Red	P+

15. Battery label

16. Package