Specification Approval Sheet

Model : ICR18650-32-2S-PTLC

Type : Li-ion battery

Specification : 7.2V/3200mAh

signed by client	
Confirmed	
Checked	
Approved	

signed by manufacturer	
Prepared:	Alex Wang
Checked:	Howell Zhu
Approved:	Xueming Zhao

1. Application Scope

This product specification defines the requirements of the rechargeable Lithium Ion Battery supplied to the customer by AkkuTronics.

2. Model

ICR18650-32, 3.6V3200mAh

3. Basic Technical Parameters

NO.	Item		Standard	Note
1	Standard Capacity		3200mAh	discharge with 620mA (0.2C) to 2.5V
2	Minimum Capacity		3000mAh	
3	Standard Voltage		3.6 V	
4	Alternating Internal Resistance		≤40mΩ	
5	Standard Charge	Constant current	0.5C (1600mA)	
		Constant voltage	4.2V	
		Cut-off Current	32mA	0.01C
6	Max. Charge Voltage		4.2V	
7	Rapid Charge Current		1C (3200mA)	
8	Standard Discharge	Constant current	0.2C (640mA)	
		Cut-off voltage	2.5V	
9	Max. Discharge Current		2C (6400mA)	For continuous discharge, not for cycle life
10	Weight		45.0 ± 2.0 g	
11	Max. Dimension		Diameter (φ): 18.6mm Height (H): 65.2mm	
12	Charge Temperature		0℃ <T ≤ 45℃	
13	Discharge Temperature		-30℃ <T ≤ 60℃	
14	Storage Temperature		Within one month: -30~ 60℃	
			Within six months: -30 ~ 45℃	
			Within one year: -30~ 25℃	

4. Standard Conditions for Test

All the tests need to be done within one month after the delivery date under the following conditions:

Ambient Temperature:25±2℃; Relative Humidity:≤75%

1	Standard Charge	Charge with constant current 1600mA and Constant Voltage (CC/CV)

		4.20V, cut-off at the current of 32mA.
2	Standard Discharge	Discharge with constant current 640mA and cut-off at the voltage of 2.5V.

5. Characteristics

5.1 Electrical Characteristics

NO.	Item	Test Method	Standard	
1	Nominal Voltage	The average value of working voltage during discharge with the current of 0.2C after charged under the condition of 4.1.	3.6V	
2	Discharge Capacity	Discharge with the current of 0.2C and cut-off at 2.5V after charged under the condition of 4.1	≥3000mAh	
3	Cycle Life	At the ambient temperature of 25±2℃, charge with constant current 0.5C and constant voltage (CC/CV) 4.20V, cut-off at current 32mA. Rest 10 minutes. Discharge with 1C and cut-off at 2.5V. Rest 20 minutes. This is a cycle life. If discharge capacity is lower than 80% of the first cycle twice in series, cycle life test is over.	≥500 Cycles (80%) With 0.5C/1C	
4	Temperature Dependency of Capacity	Cells shall be charged per 4.1.at 25℃±2℃ and discharged at following discharge currents and temperatures: 0.2C @ -20℃ 0.2C @ 25℃ 0.5C @ 60℃.	-20℃	≥70%
			25℃	≥100%
			50℃	≥95%
5	Capacity Retention at Room temperatures	Charge the cell under the condition of 4.1. Store 28 days at the ambient temperature of 25±2℃. Discharge with 0.2C to 2.5V and calculate capacity retention (compare to the standard capacity in 4.2). Charge the cell under the condition of 4.1 and discharge with 0.2C to 2.5V. Calculate capacity recovery (compare to the standard capacity in 4.2).	Retention ratio≥90% Recovery ratio≥95%	
6	Capacity Retention at High temperatures	Charge the cell under the condition of 4.1. Store 28 days at the ambient temperature of 45±2℃. Discharge with 0.2C to 2.5V and calculation capacity retention (compare to the standard capacity in 4.2). Charge the	Retention ratio≥90% Recovery ratio≥95%	

		cell under the condition of 4.1 and discharge with 0.2C to 2.5V. Calculate capacity recovery (compare to the standard capacity in 4.2).	

5.2 **Electrical tests**

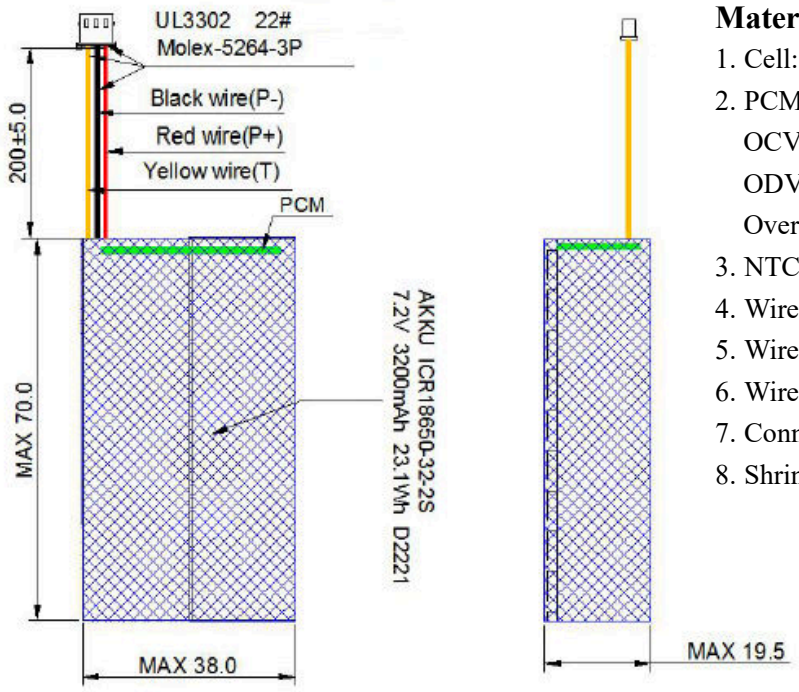
NO.	Item	Test Method	Standard
1	Short Circuit	After fully charged under the condition of 4.1, cell is to be short-circuited by connecting positive and negative terminals with a circuit load having a resistance of 50mΩ, test for 1 hour.	No fire, no explosion, no leakage.
2	Over charge	After fully charged under the condition of 4.1, the cell is charged by 10V 3200mA for 2.5 hours.	No fire, No explosion.
3	Forced-Discharge	After fully discharged under the condition of 4.2, the cell is subjected a forced discharge with 50Ω for 24 hours.	No fire, No explosion, no leakage.

5.3 **Mechanical tests**

NO.	Item	Test Method	Standard
1	Vibration	After fully charged under the condition of 4.1, cells are firmly secured to the platform of the vibration machine. The vibration shall be a sinusoidal waveform with frequency 16.7 Hz for 1 hour. The amplitude is maintained at 1mm, mounting positions of the cell is arbitrary. After vibration test, the cell shall be fully charged and discharged under the condition of 4.1 and 4.2.	No fire, no explosion and no leakage. Can be charged and discharged.
2	Drop	After fully charged under the condition of 4.1, the cells should be dropped from a height of 1m onto a flat concrete floor. Each cell should be dropped four times. The positive and negative electrode side should be dropped once respectively, and the cylindrical surface be dropped twice.	No fire, No explosion, no leakage.
3	Crush	After fully charged under the condition of 4.1, cell should be placed between two flat surfaces of the crushing apparatus, with its longitudinal axis parallel to the flat surfaces. The flat surfaces are to be brought in contact with the cell and the crushing is to be continued until the applied force 13KN±0.78KN is	No fire, No explosion.

		reached. Once the maximum force has been obtained it is released. Each cell should be tested just once.	
4	Thermal abuse	After fully charged under the condition of 4.1, cells are placed in a gravity or circulating air convection oven, in an ambient temperature of 20±5 ℃. Then the oven temperature is raised at a rate of 5±2 ℃/min to the test temperature 130±2 ℃. Cells should be remained at 130±2 ℃ for 30 minutes before the test ends.	No fire, No explosion.

6. Battery pack specification (unit: mm)



Material

1. Cell: 18650 3200mAh (see 3. Basic Technical Parameters)
2. PCM:
   OCV: 4.30±0.02V
   ODV: 2.4±0.05V
   Over current protection: 13±3.5A
3. NTC: R=10KΩ ±1% B=3435±1%
4. Wire Yellow NTC UL3302 AWG22
5. Wire Black Negative UL3302 AWG22
6. Wire Red Positive UL3302 AWG22
7. Connector: Molex 5264-3P
8. Shrink blue PVC

7. Caution

Please read this specification carefully before testing or using the cell since improper handling of a Li-ion cell may lead to loss of efficiency, heating, ignition, electrolyte leakage and explosion.

7.1 Caution in use:

7.1.1 Abnormal operating conditions such as overcharge (voltage > 4.25V), over discharge (voltage<2.5V) and overcurrent charge-discharge (maximum current allowed at current temperature) cannot occur during the operation of the cell. It is strictly prohibited to use the cell in the environment which is easy to generate static electricity and poor sealing (water and dust entering).

7.1.2 More than 0.5C current charging, use in high-temperature/low-temperature environment, use in vibration environment, not match well cells and use in humid environment will reduce the cycle life of the cell.
7.1.3 The battery shall not be used in the environment of high frequency microwave and ultrasonic wave. When the battery is used in multiple S and P module, it is recommended to coat the electromagnetic insulation cover of high-voltage wire to prevent the electromagnetic wave from damaging adjacent devices and human body.
7.1.4 There should be no overlapping or contact between the positive and negative terminal wires of the battery to reduce the risk of short circuit.
7.1.5 The battery shall be designed for charging and discharging in strict accordance with the current specification to ensure the battery's cycle life and safety.
7.1.6 When the battery is assembled module for use, the cells with the same capacity, internal resistance position, same batch and same charged state shall be used. The standard of the battery should be strictly in accordance with the technical agreement. The working process of the battery module, the battery pack inside temperature difference should be less than 5℃.
7.1.7 Do not charge the cell when cell temperature less than 0℃, please standby before charging when cell exposure at under-zero environment. Time standby as follows:

Outside Temperature	-5℃ ≤ T ≤0℃	-10℃ ≤ T ≤-5℃	-15℃ ≤ T ≤-10℃	-20℃ ≤ T ≤-15℃
Time	2h	5h	8h	10h

7.2 Safety Caution

7.2.1 The cell should be placed away from the children.
7.2.2 When testing the cells by charging or discharging, please use professional test equipment specially designed for Li-ion batteries. Do not use ordinary constant current or constant voltage (CC/CV) power supplies. These do not protect the cell from being overcharged and over-discharged and may lead to possible loss of efficiency or danger.
7.2.3 When charging or discharging, or assembling, reversing the positive and negative terminals would lead to overcharge and over-discharge of the cell (s). This could lead to serious loss of efficiency and even explosions.
7.2.4 Do not solder the cell directly. Do not resolve the cell.
7.2.5 Do not put the cell (s) in pockets or bags with metal products, such as necklaces, hairpins, coins, screws, etc. Neither storing them without proper isolation. Do not connect the positive and negative electrodes directly with conductive materials. This could lead to a short-circuit of the cell.
7.2.6 Do not hammer, throw or trample the cell. Do not put the cell into washing machines or high-pressure containers.
7.2.7 Keep the cells away from heat sources, such as fires, heaters, etc. Do not use or store cell (s) at locations where the temperature could exceed 60℃, such as in direct sunlight. This may lead to the generation of excessive heat, ignition and lose of efficiency.
7.2.8 Do not get the cells wet or throw them into water. When not in use, place the cells in a dry environment at low temperatures.
7.2.9 When in use, testing or storing, if the cells become hot, distributing a smell, changing color, deformation or showing any other abnormalities, please stop using or testing immediately. Attempt to isolate the cell and keep it away from other cells.

7.2.10 Should electrolyte get into the eyes, do not rub the eyes. Rinse the eyes with clean water and seek medical attention if problems remain. If electrolyte gets onto the skin or clothing, wash with clean water immediately.

8. Packing

Batteries are at 50% state of charge when packed.

9. Transportation

During transportation, do not subject the cell (s) or the box (es) to violent shaking, bumps, rain or direct sunlight. Keep the cell at 50% state of charge.

10. Long-term Storage

When delivery, cells will be charged to the voltage of 3.45V~3.7V. Long-term storage at more than 80% SOC will lead to capacity loss and cycle life loss, please keep cell in use when cell capacity more the 80%. If Cells are delivered at ≤20% SOC, cells may be capacity empty due to the self-discharge. Do not use or storage the cell when voltage less than 2.5V.

11. The warranty period of this product is 12 months from the date of delivery from the factory.

12. Warranty will be void if the cells are used beyond these specifications.

13. The information in this specification is subject to change without prior notice.