



# Product User Manual

<http://www.calb.cn/> | <http://en.calb.cn/>

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China Aviation Lithium Battery Co., Ltd.

# Company Profile



China Aviation Lithium Battery Co., Ltd (CALB) is a high-tech company invested by Aviation Industry Corporation Of China and its affiliated companies, held by CAC(Sichuan Chengfei Integration Technology Co., Ltd) with advanced management technology and specialized in producing Li-ion battery, battery management systems (BMS) and module, so on.

CALB is headquartered in Luoyang, China, covering 94.7 acre, with ¥800 million yuan registered capitals and more than 1,600 employees worldwide( including 13 Ph.D, over 240 masters, and about 300 undergraduates). Our company is devoted to the R&D and manufacturing ability of lithium ion batteries continually, promoting itself to be "Golden Supplier of Lithium-ion Battery". CALB have been funded by four Chinese 863 major projects. The list are the following: "Development of large LiFePO<sub>4</sub> power battery and power pack", "Development of lithium ion battery and pack with high density plastic shell", "Development of highly-safe functional monomers in power battery", "Demonstration of the key technology of long life-time lithium manganese oxide energy storage battery".

The main application fields of CALB lithium battery include electric vehicles, rail transportation, energy storage station, telecommunication stations, mining equipment and military application. CALB have been authorized 181 of various patent, and also passed GB/T19001-2008/ISO9001:2008, GJB9001B-2009 Quality System approval. CALB has got confidentiality accreditation for weapons and equipment research and production, license certification for weapons and equipment research and production, and certifications to enter into international markets including CE, RoHS, and UN38.3 transportation certification. CALB and products have high reputation and influence in home and abroad markets.

Developing green energy is our common history mission. Under the strong support of leaders at all levels and partners, CALB will take the idea of AVIC — "Aviation to serve the country, strengthen the army and enrich the common", and follow the business model of "brand marketing, cooperative R & D, lean manufacturing, consortia purchasing and joint development", making more contribution to the energy saving and emission reduction in the world.

This manual is intended to guide customers to the cell and battery module installation in general use, for more detailed information, please refer to the relevant technical agreements, technical solutions, or contact customer service department.

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Caution



I. A BMS (battery management system or battery protection system) must be used under any circumstance when using or storing battery, to ensure the batteries are used under normal conditions (including normal voltage range, the normal current range, normal temperature range, normal humidity range, the normal pressure range, etc., about the normal defined criteria, please contact CALB service department or retail outlets personnel). If the batteries are used without a battery management system (battery protection system), batteries' will be easily damaged, which will even lead to unpredictable accidents.  
(Note that normal conditions for the battery charging, battery discharging and battery storage are not the same)



II. Reverse charging and discharging the battery is prohibited under any conditions (with regard to the definition of reverse charging and discharging, please contact CALB service department or retail outlets related personnel). Positive and negative terminals of the battery can not be connected directly under any condition.



III. During use, batteries should be away from heat, sources of ignition. Do not drop the battery, knock the battery, strike the battery or other physical damage to the battery.



IV. This battery can only be charged with matched lithium battery charger.

# 1. Basic Introduction

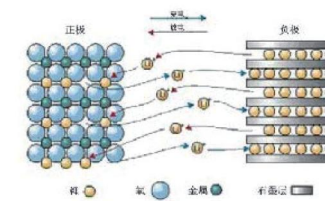
## 1.1 Product Introduction

The lithium-ion batteries produced by CALB have the advantages of high energy density, long life cycle, high power density, high security, even good performance under low temperature. Based on the different case material, the CALB battery can be sorted to molded battery, metal shell batteries, soft pack batteries. They can be applied in: electric vehicles, large-scale energy storage power station systems, small distributed energy storage systems, mineral power supply, communication station, and rail transportation, etc. The company pays high attention to building the ability of scientific research with the idea of "leading technology, reliable quality, customer satisfaction." Our innovative R&D team has been keeping innovation and making a number of achievements in scientific research, dedicating to the development of a new generation of lithium-ion battery with higher security, higher energy density, and better consistency.

## 1.2 The working principle of Lithium-ion batteries

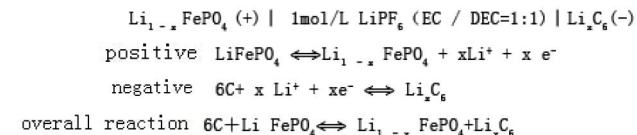
Generally, the cathode material of the lithium-ion battery will choose lithium transition metal oxide with a higher redox potential, commonly lithium cobalt oxide, lithium manganese oxide, lithium iron phosphate and layered mixed cobalt/nickel/manganese oxides. Lithium intercalation material with near lithium potential will be selected as negative electrode material, commonly the hard carbon, graphite, materials.

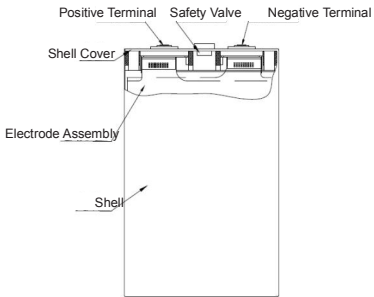
The principle of charging and discharging of lithium-ion batteries is shown in the diagram, the lithium ions shuttle between the positive and negative back and forth during charging and discharging process, so the lithium-ion batteries are also known as "rocking chair" battery.



Lithium ion battery charge and discharge diagram

The charge and discharge mechanism of lithium-ion battery can be described as the following chemical formula (take lithium iron phosphate for example).





### 1.3 The structure of battery

Battery is made up by the electrode assembly, the positive terminal and negative terminal, safety valve, the shell cover and the shell. Electrode group consists of positive and negative electrode terminal and separator (separator plays a barrier between the positive and negative electrode). The shell interior is filled with the electrolyte. Safety valve on the shell cover can release the battery internal pressure and prevent explosion.

## 2. Product installation instructions

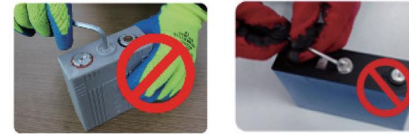
### 2.1 Battery Requirements

- 1) Please read this instruction and other instructions carefully before using the battery.
- 2) Unless otherwise specified, the charging and discharging parameters of CALB lithium iron phosphate batteries series are described as follows:
  - Cut-off charging voltage for single battery: 3.65V (Switch off voltage for single battery charging: 3.8V. Once the cell voltage rises to 3.8V, the charging current should be immediately cut off);
  - Cut-off charging voltage for N batteries in series:  $N \times 3.65V$  (when the cell voltage rises to 3.65V, the charger should be able to automatically change to constant voltage charging mode);
  - The float status: cutoff charging voltage for single battery is set to 3.4V, cut-off voltage for N batteries charging in series is  $N \times 3.4V$ , with a maximum voltage of 3.4V cut-off;
  - Alarming discharging voltage for single battery: 2.8V (during the discharging process, when the cell voltage drops to 2.8V, BMS will alarm, we recommend stopping discharging now);
  - Cut-off discharging voltage for single battery: 2.5V (under  $-20^{\circ}\text{C}$  condition, the cutoff voltage for battery discharging is 2.0V);
- 3) CALB lithium-ion battery products shall be equipped with a special lithium battery management system and lithium battery charger with mode of constant current and voltage limiting. For a few small-capacity batteries are used in series, you can also use lithium batteries protection board of reliable performance;
- 4) In any case, terminal voltage of single cells must be monitored in real-time. Battery packs in series charging or discharging testing without management system or protective board is forbidden, avoiding battery overcharge or over-discharge.
- 5) BMS used shall have function of insulation resistance detection, when the battery and BMS installation is complete, all protection parameters would be the first to set. Be sure to confirm the battery power when setting the initial value of SOC;
- 6) Communication protocol must be determined between the BMS and charger and motor controller. Make sure of the signal butt between BMS and charger and motor controller to ensure that the charger and motor controller is monitored in real-time by BMS during charging or discharging, avoiding over-charging or over-discharging.
- 7) Except in special circumstances, fresh battery from factory is only 30% charged. Before BMS and charger is commissioned, batteries are prohibited for long time use to avoid overcharging or over-discharging ;During battery use, we recommend charging and discharging range between 10-90% DOD (according to the principle of low depth of charge and discharge);
- 8) Screwing the battery terminal is forbidden without permission.
- 9) Damaging the battery safety valve is forbidden without permission.



Screwing the battery terminal is forbidden without permission.

- 9) Damaging the battery safety valve is forbidden without permission.



Damaging the battery safety valve is forbidden without permission.

### 2.2 Power System Requirements

- 1) High-voltage main circuit and low voltage electrical circuit for battery pack shall be properly isolated. Use reliable DC air circuit breakers and fast DC fuses to make sure the safety under high-voltage.
- 2) Do not separate the lead power cord from the battery of the pack to charge a low voltage electronics in car individually.
- 3) The cabinet holding the system must be equipped with lightning protection and anti-tampering measures.
- 4) When splitting the system, battery system power should be disconnected to make sure the system can against electric shock. When the system is assembled, it must be ensure that joints between the power supply modules are connected correctly and firmly.

### 2.3 Power Module layout requirements

- 1) Be cautious when integrating the battery into power system. Not only should you take full consideration of ventilation inside the power module, but also take effective dust proof, waterproof, anti-snow, and anti-impact measures;
- 2) Take full consideration of the convenience of repair and maintenance when laying out the batteries.
- 3) Integrate battery modules into group according to the maximum possible number of cells that a individual BMS sub-module can manage ably.
- 4) Ensure high-pressure cables and wiring harnesses short and smooth when laying out the batteries and battery modules.
- 5) Because the drive motors and motor controllers are strong heating element, batteries should be layout away from them. When batteries are near the motor, proper insulation measures shall be taken ;
- 6) When many batteries are laid out intensively, avoid the situation that adjacent terminal voltage of the battery packs is higher than safe voltage to prevent dangerous electric shock during construction and maintenance.
- 7) If the system is lay out in a compute room, fireproof materials should be equipped on the walls, ceilings and walls, firefighting equipment should be equipped. There should be no flammable, explosive, corrosive gases or article around the site.

### 2.4 Power Module Installation Requirements

Power module or battery shall be operated in accordance with relevant instructions;

- 1) After clamping, each battery group should be fixed into the power module properly with the terminals upward clamped .Placing the battery on its side is not recommended , installing the battery upside down is prohibited ;
- 2) When clipping the power modules into group, make sure all flat washers, spring washers and nuts in readiness and tight.





Battery terminal pole sanding



Bus bar sanding

- 3) For the automotive module or portable module application, appropriate measures of shock absorbing shall be taken.
- 4) Leave enough adequate space above the battery module inner the battery box ,to connect the battery management system harness line, also for better heat dissipation.
- 5) When batteries are integrated into group, insulated protective measures shall be taken;
- 6) When the communication system is installed, it should be checked whether the feeder line connected to the grid is flow in advance, including each node, the socket connection, in order to avoid the open or short circuit faults.

## 2.5 Battery Connection Requirements

Electrical connection should comply with the relevant national electrical installation practices.

- 1) Be careful when connecting the batteries, do pay attention to safety of high voltage to avoid battery short circuit;
- 2) Quick connectors shall be set between battery modules, higher protection level of power cord, plug and socket connectors and charging plugs and sockets shall be chose.
- 3) When connecting the battery management system with batteries, copper and aluminum terminal surface of the battery shall be sanded (180 to 240 mesh is recommended for sanding, nickel terminal pole is prohibited to sand) to remove the oxide layer, thus reducing the contact resistance. If the copper bus bar surface is not processed, the contact surface of bus bar and connectors should be polished.
- 4) Battery pole bolts must be tightened so as to avoid increasing contact resistance caused by poor contact. As the positive pole of battery is made by aluminum material, avoid excessive force when tightening the pole bolt to avoid screw thread slipping. For tightening torque, please refer to content 2.6;
- 5) Make sure the welding and crimping of BMS acquisition line for voltage terminals, and connection of wiring harness reliable, avoid affecting voltage signal sampling accuracy due to poor contact. Insulating bush covering the terminals should not be too long so as to wrap the terminals.
- 6) The voltage acquisition line length should be appropriate. If the voltage acquisition line is too long, voltage on it will drop excessively, which can bring large error for voltage measurement.

## 2.6 Operation tools



Insulating gloves

- 1) During the process of battery connection, insulating gloves must be worn.
- 2) The socket wrench, fixed wrench and screwdriver and other tools used for operation must be gone through rigorously insulating treatment. The operators are prohibited to carry metal items such as key chains, watches, necklaces and so on;
- 3) When the terminal voltage of the connected grouping products is greater than 24V, insulating gloves which can withstand voltage higher than the voltage of the entire group of connected systems shall be worn.
- 4) When tightening the bolts, it is recommend using adjustable torque wrench in 5-30N·m range, the recommended tightening torque values corresponding to specified bolts is shown in the following table.



Tools insulating treatment

No.	Terminal bolt specification	recommended tightening torque (N·m)
1	M5	10
2	M6	12
3	M8	14
4	M14	24

Note: Data shown on the table are manual measurement experience; If you purchase by yourselves, we recommend bolt material A2-70; Tightening torque can be referred to the recommended values corresponding to the thread diameter above.

## 2.7 Power system maintenance period and measures

- 1) In a routine systematic check and detailed record on the power system usage, as well as the work of BMS and charger, detect hidden dangers and solve problems in time.
- 2) Regularly check the connecting bolts fuses, contactors and fuses, as well as the degree of tightening for all the bolts connecting the battery poles.
- 3) Regular inspect the connection reliability of all power connectors and electrical connectors, and check the insulation of the electric circuit and connection of cables and busbars.
- 4) Check the battery voltage and current differences between BMS detected and data actually measured, and check BMS signal acquisition accuracy and check whether the SOC calculation precision calibration is required;
- 5) Check the consistency of the whole set of batteries. If static or dynamic voltage difference of the battery is too large, please operate as troubleshooting steps.

## 2.8 Common troubleshooting methods for power system

No.	Common Fault	Failure Cause	Approach
1	Abnormal voltage	Voltage acquisition failure (BMS software problems, poor socket contact, acquisition line connection error, loose connections of battery terminals, etc.)	1. Investigating the fault and eliminated; 2. If the fault does not exist, it may be the batteries fault.
		Battery fault (State of charge is inconsistent, internal reasons)	repair or replace
2	Abnormal temperature	Temperature acquisition abnormal (acquisition device damage, bad connectors, pole connections loose)	Investigation of the cause of the fault and eliminate
		Thermal management system abnormal (fan or heating device does not start, duct blockage, etc.)	Check the thermal management system
		Battery itself reason (terminal severe oxidation, internal reasons)	repair or replace
3	Battery bulging	Abuse like over charge, over discharge; environmental reasons like high temperature, high humidity, ultra low pressure	Troubleshooting and contact after sales
4	Battery leakage	upside down and other external cause	Troubleshooting and contact after sales
5	Terminal slipperly	tightening torque is too large, tightening operation not standard	Troubleshooting and replace

Note: 1. The examination and treatment for the power system should be based on system technology agreement;  
2. The examination for the power system requires trained personnel, and pay attention to the safety protection against high voltage and devices wounding during examination ;  
3 .If they can not determine the cause of failure, contact our after-sales personnel promptly.

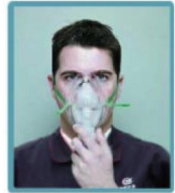
## 3. Emergency treatment

*There are lithium salt compounds, organic solvents, etc. inside the lithium-ion batteries. When abusing or in extreme environments, dangerous situations including leakage, smoking, overheating, and the safety valve opening (with black substance spraying), fire may occur. To protect personnel's safety and reduce economic losses, you should take urgent protective measures in the event of danger, please read and observe the following protective recommendations carefully:*

### 3.1 Personal contact

If there is electrolyte leakage or smoke found, take aid measures:

- 1) Skin contact with the electrolyte: Removing attached clothing, washing with water carefully. Go for medical treatment in severe cases.



- 2) Eye contact with electrolyte: Flush immediately with plenty of water for at least 15 minutes, lifting the upper eyelid during flushing. Go for medical treatment in severe cases.

- 3) Inhalation of smoke: when there is smoke, use protective measures (such as covering nose and mouth with a wet towel or wear a professional gas mask) to prevent inhalation of fumes. As smoke and other harmful gases may cause damage to the respiratory system, give oxygen if necessary. Go for medical treatment in severe cases.



### 3.2 Emergency treatment

- 1) When a conductor is simultaneously exposed to positive and negative terminals of the battery and introduce an external short circuit, disconnect the system and the load circuit in the shortest possible time.
- 2) Occasion like a destructive impact may cause the battery to release the internal energy in an instant, resulting in safety valve pressure relief and smoke, etc. At this time, extinguishing measures should taken to isolate from the air, such as masking sand, carbon dioxide or dry powder extinguishers or others and disconnection the loop at the same time.

## IV. Transportation requirements

- 1) During the transportation process, batteries should not be sun exposure and rained. The recommend state of charge during transport is about 30%. Batteries should be stacked neatly, orderly, compactly and reasonably, safely and reliably. Always keep the battery poles upward to prevent damage caused by shaking during transport ;
- 2) During the loading and unloading process of the battery, pay attention to move and put down lightly, throwing, rolling, crush, mixing with other dangerous goods are prohibited ;
- 3) Minimize the number of transit transport; machinery operation should be used during shipping and handling to avoid the rough handling operations. During the process of transport and use, overly strong impact and extrusion by external should be avoided, to prevent battery casing broken or internal structure damage.
- 4) Recommend transportation environment is no higher than 60 °C., humidity less than 90%.

## IV. Basic requirements for battery storage and maintenance

- 1) When customers receive the product, number of products, product specification must be checked. If the quantity or model is not accurate or there are anomalies such as swelling, leaking, damaged housing and voltage anomalies, please contact sales department to address in 15 working days after the receipt of product. Beyond this time limit, products will be successfully received by default;
- 2) If batteries are not in use for a time, they are recommended to store in dry, clean and ventilated warehouse under the temperature of -20°C to 40°C, as shown in the figure 16. When the batteries are not use for a long time, pack and store the battery at 30% state of charge;
- 3) Special battery drop zone shall be provided in the warehouse, on-flammable and explosive materials can be stored in this area, batteries should be away from heat;
- 4) In general, stock battery should be stored in containers, batteries directly laid on the ground should be equipped with a layer of insulating mulch under the battery, and a dust cover on them, while making warning signs;
- 5) Stock Battery should not be placed upside down, and be prevented from mechanical shock or stress, non-battery exposure and rain;
- 6) Develop a tracking record of voltage, resistance for inventory batteries, check the stock battery voltage, resistance every three months and make detailed records;
- 7) Conduct a full charge discharge test inventory every six months for inventory batteries at a charge and discharge rate of 0.3C, and make detailed records.

## IIIV. Customer Services

As a professional designing and manufacturing lithium batteries company, CALB is devoted to build itself "Global Golden Lithium Battery Manufacturer" with advanced technology, reliable quality and customer-satisfaction. While we provide high-quality products to our dear customers, we present our CALB characteristic after-sales service system as core competitiveness. Our service brand is: "Customer satisfaction - Service never stop."

Goal: customer satisfaction, scheme satisfaction, progress satisfaction, quality satisfaction, cost performance satisfaction, and service satisfaction.

Services: technical advice, program solution, products delivery, free training, on-site services, remote guidance, regular inspection, regular visits, and file creation.

Service concept:

### ● Fast response

Free support on phone, free service Tel: 800-919-2699 (please use fixed telephone to dial).

International Service Tel: 86-0379-60697962, international service mailbox: zhangtao@calb.cn, qiaojingfeng@calb.cn, CALB will arrange professional customer service engineers to answer customer problems they encounter every day, thereby ensuring to provide convenient, fast, high-quality professional services.

Emergency Response (Domestic): When there is a emergency failure on equipment, telephone support still cannot resolve the problems and recovery services, we provide an annual 365 \* 24 hours of on-site emergency support. (in mainland China only)

On-site troubleshooting principles: prior to restore the normal function of the device.

### ● Professionalization

Professional service team: We have a professional service team, every customer service engineer are carefully selected from production or application departments. They have a wealth of knowledge and application experience in battery, and can ensure that the equipment can be used well and safe in time.

Professional maintenance of equipment: We have a dedicated service cart, and complete tool configuration, with functions of self-generating, battery formation, charge and discharge maintenance, data analysis, that can complete the maintenance tasks around the clock. (in mainland China only)

### ● Standardization

Standard Service Process: The company has established a thorough service system, which includes standard procedure for technical support, system maintenance, information feedback. All services are based, recorded, queryable and with assessment, so help customers to solve problems whole-heartedly.

Service commitment

### ● Lifetime Service Guarantee

Once customers buy our products, you can get a life-time maintenance for the batteries from CALB. Product warranty period is subject to contract. Service is free during the warranty period. Beyond the warranty, maintenance fee (labor costs, material costs, etc) will be charged.

For human error (Customers do not follow the instructions of normal use and maintenance, etc. due to transportation, natural irresistible incident), service is beyond the scope of free services, but Customer Service Department from CALB will promptly arrange for engineers to provide customer service after receiving the notice.

### ● Service within warranty Period

#### 1) Product Delivery

When delivering products to domestic customers, the company will send experienced customer service engineers to the site to help customers to complete the product installation and commissioning. They will ensure that the customer's equipment can promptly put into use according to the installation confirmation procedure.

When delivering products to foreign customers, we prepare a detailed guidance documents.

#### 2) Service Response (Domestic)

After receiving a customer service telephone, our engineers will reach customers designated locations within the shortest possible time. (in mainland China only)

Time requirements: For customers in China mainland, CALB will response in two hours within the city, in 24 hours within the province, three working days or within 30 minutes to give customers a clear answer and reach to the customers within the appointed time outside the province. For international customers, CALB will response in 24 hours.

#### 3) Technical Support

Our company is committed to provide customers 365 days a year, 24 hours a day, comprehensive technical support and spare parts supply.

#### 4) Regular inspection

CALB arranges twice national routing inspection a year, including: single cell performance testing, system insulation resistance testing, line testing. Initiative to contact customers once every quarter to know the usage situations, ensuring customers get the full value of the product. (in mainland China only)

#### 5) Free Training

CALB provides products maintenance and training for customers and end-customers for free, and provide training for customer service staff to ensure that trained personnel to reach at least the following levels: master product operating principles, method of application, emergency and routine maintenance and other common skills. CALB provides training for customer training personnel: equipment main performance parameters, failure analysis and troubleshooting; equipment on-site operation and maintenance; equipment installation, operation, maintenance and others.

### ● Service beyond warranty

Service standards beyond the warranty is the same as that in warranty period on product use, maintenance, maintenance, repair, and other applications for customers or their end customers.

If the customers require a renewal, CALB can provide service as renewal, the relevant cost can refer to the contract. Service standards during the warranty renewal is the same as that in warranty period, but can also be single service, the charge way is: on-site labor costs + equipment maintenance fee(or equipment replacement costs), CALB provides the best price for customer service.

## VI. Disclaimer

All batteries delivery must be confirmed to complete the product installation process, CALB has fulfilled the warranty responsibility for batteries complete the confirmation installation process.

CALB does not take the responsibility for losses or accident resulting from improper use, or facts identified as the following:

- 1) Not use reliable BMS or protective plate when doing charging or discharging test, resulting in overcharge or over-discharge for part or the whole battery group;
- 2) Batteries are charged reversely due to the wrong connection, resulting in part or the whole battery group retirement in advance.
- 3) Not control the battery group charging effectively, resulting in part or the whole battery group over-charging.
- 4) Not control the battery group discharging effectively, resulting in part or the whole battery group over-discharging.
- 5) Improper selection of circuit cable, connectors, terminals and other electrical component, resulting fire due to line overheating and spontaneous combustion.
- 6) There is no appropriate high-voltage safety protection devices in the main power circuit, resulting in the battery pack short-circuit or car equipment damage due to the circuit aging, damage, and etc.
- 7) Adopt connection method that influences battery group electrical charge balance (such as leading a separate power cord from a individual cell to supply power to low-voltage electrical power in the car), resulting the individual cells over-discharge;
- 8) The cable terminals of the main power circuit are not well connected to bus bar and battery terminals, resulting in attenuation of battery life, and even accident for loose connecting bolts and exothermic joints.
- 9) Infrequent check on the battery condition and maintenance, resulting in accidents for not discovering and excluding hidden danger in time.

Annex 1: The main battery model parameters table

		CAM72	CAM80	SE60	SE180	SE200	CA40	CA100	CA180	CA400
Nominal capacity		72Ah	80Ah	60Ah	180Ah	200Ah	40Ah	100Ah	180Ah	400Ah
Internal resistance		≦ 1 mΩ	≦ 0.6mΩ	≦ 0.8mΩ	≧ 0.5mΩ		≦ 0.9mΩ	≦ 0.6mΩ	≦ 0.5mΩ	≦ 0.4mΩ
Diameters (mm)	length	135±1	173±1	142±1	182±1	182±1	116±1	142±1	180±1	450±2
	width	290+2	48±1.5	50±1	71±1	71±1.5	46±1	67±1	71±1.5	71±1.5
	height	222±1	133±1	218±2	279±2	279±2	180.5±2	215.5±2	279±2	281±2
weight(about)		1.9Kg	2.2Kg	2.3Kg	5.6Kg	5.7Kg	1.45Kg	3.3Kg	5.6Kg	13.8Kg
Type of shell		metal			plastic					
Nominal voltage		3.2V								
Charge	Maximum charging current	1C								
Maximum charging voltage	Maximum charging voltage	3.65V								
Discharge	Maximum discharging current	2C		1C			2C			
	Termination voltage	2.5V								
Charging time	Standard Charge	4h								
	Fast Charge	1h								
SOC Recommended		10%~90%								
Temperature	Charge	0°C ~ 45°C								
	Discharge	-20°C ~ 55°C								
Storage temperature	short term (within one month)	-20°C ~ 45°C								
	Long-term (within a year)	-20°C~ 25°C								
Storage humidity range		<70%								

Note: There may be difference between the real product performance and this version due to the design changes, all the parameters are subject to our business contact confirmation.