

Guangzhou Great Power Energy & Technology Co., Ltd.

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Rev. No. 1.0

Cylindrical Li-ion Battery Pack Product Specification

Model : 18650 3.7v 3000mAh

Prepared by : Lily Wu
Checked by : XhouFon Wang
Approve by : Xiao Linping

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1.4 General Performance

Definition of Standard charging method : At 20±5℃, charging the cell initially with constant current 0.2C₅A till voltage 4.2V, then with constant voltage 4.2 till current declines to 0.05C₅A.

Item	Test Methods	Performance
4.1 0.2C Capacity	After standard charging, laying the battery 0.5h, then discharging at 0.2C ₅ A to voltage 2.75V, recording the discharging time.	≥300min
4.2 1C Capacity	After standard charging, laying the battery 0.5h, then discharging at 1C ₅ A to voltage 2.75V, recording the discharging time.	≥54min
4.3 Cycle Life	Constant current 0.5C ₅ A charge to 4.2V, then constant voltage charge to current declines to 0.05C ₅ A, stay 5min ; constant current 0.5C ₅ A discharge to 2.75V ; stay 5min. Repeat above steps till continuously discharging time less than 36min.	≥500times
4.4 Capability of keeping electricity	20±5℃. After standard charging, laying the battery 28days, discharging at 0.2C ₅ A to voltage 2.75V, recording the discharging time.	≥240min

1.5 Environment Performance

Item	Test Methods	Performance
5.1 High temperature	After standard charging, laying the battery 4h at 60℃, then discharging at 0.2C ₅ A to voltage 2.75V, recording the discharging time.	≥270min
5.2 Low temperature	After standard charging, laying the battery 4h at -10℃, then discharging at 0.2C ₅ A to voltage 2.75V, recording the discharging time.	≥210min
5.3 Constant humidity and temperature	After standard charging, laying the battery 48h at 40 ± 2℃, RH 93± 2%. Recording 0.2C ₅ A discharging time.	No distortion No electrolytes leakage ≥270 min
5.4 Temperature shock	After standard charging, battery stored at -20℃ for 2 hours, then stored at 50℃ for 2 hours. Repeat 10 times.	No electrolytes leakage

1.6 Mechanical Performance

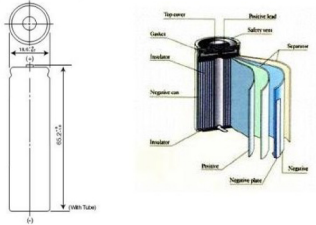
Item	Test Methods	Performance
6.1 Vibration	After standard charging, put battery on the vibration table. 30 min experiment from X,Y, Z axis. Scan rate: 1 oct/min. Frequency 10-30Hz, Swing 0.38mm; Frequency 30-55Hz, Swing 0.19mm.	No influence to batteries' electrical performance and appearance.
6.2 Collision	After vibration test, batteries were laying on the vibration table about X, Y, Z axis. Max frequency acceleration: 100ms ⁻² ; collision times per minutes: 40-80; frequency keeping time 16ms; all collision times 1000± 10.	No influence to batteries' electrical performance and appearance.
6.3 Drop	Random drop the battery from 10m height onto concrete one times.	No explosion or fire

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1.1 Li-Ion Battery Pack Data Sheet

Type	Li-ion Battery Pack		
Model	ICR18650 3.7V 3000mAh		
Normal Voltage	3.7V		
Weight	85 g (ref)		
C5mAh	3000mAh		
Charge voltage	4.20 ± 0.05V		
Minimum discharge end voltage	2.75V		
Maximum charge voltage	4.2V		
Standard continuous charge current	0.2C5mA		
Maximum continuous charge current	2200mA		
Maximum continuous discharge current	3200mA		
Capacity (20°C 150C, 0.2Cs to 3.0V)			
Nominal capacity	3000mAh		
Minimum capacity	3000mAh		
Internal impedance (200C ±50C AC Impedance 1 KHz)	≤260mΩ		
Charge and discharge conditions (20°C)			
Standard charge	Constant current and constant voltage (CC/CV)		
Current=0.2C5mA	Voltage=4.20V	End Current=0.01C5mA	
Fast charge	Constant current and constant voltage (CC/CV)		
Current=1500mA	Voltage=4.20V	End Current=0.01C5mA	
Standard discharge	Constant current (CC)		
Current=0.2C5mA	End Voltage=3.0V		
Operation conditions (recommended)			
Standard charge	0 ~ 45°C		
Discharge	20°C ~ 60°C		
Storage humidity			
Relative humidity	45~75		
Temperature range for Storage (Percentage of recoverable capacity 80%)			
1 month	-20 ~ +60°C		
3 months	-20 ~ +45°C		
1 year	-20 ~ +20°C		
Standard Test Conditions (Except additional quest)			
Temperature	-20°C ~ 50°C		
Relative humidity	65 ± 20%		

1.2 Li-Ion Battery Pack Drawing



1.3 Specification

Item	Specifications	Remark
Nominal Capacity	3000mAh ±5%	0.2C ₅ A discharge , 25℃
Nominal Voltage	3.7V	Average Voltage at 0.2C ₅ A discharge
Standard Charge Current	0.2 C ₅ A	Working temperature : 0~40℃
Max Charge Current	1C ₅ A	Working temperature : 0~40℃
Charge cut-off Voltage	4.2V	CC/CV
Standard Discharge Current	0.5C ₅ A	Working temperature : 25℃
Discharge cut-off Voltage	2.75V	
Cell Voltage	3.7-3.9V	When leave factory
Impedance	≤35mΩ	AC 1KHz after 50% charge,25℃
Weight	Approx.85.0g	
Storage temperature	≤1month	-10~45℃
	≤3month	0~30℃
	≤6month	20± 5℃
Storage humidity	65± 20% RH	Best 20± 5℃ for long-time storage

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2. Safety Test

Test conditions : The following tests must be measured at flowing air and safety protection conditions. All batteries must standard charge and lay 24h.

Item	Test Methods	Performance
7.1 Over charge	At 20±5℃, charging batteries with constant current 3C ₅ A to voltage 5V, then with constant voltage 5V till current decline to 0. Stop test till batteries' temperature 10℃ lower than max temperature.	No explosion or fire
7.2 Over discharge	At 20 ± 5℃ , discharge battery with 0.2C ₅ A continuously 12.5h.	No explosion or fire
7.3 Short-circuit	At 20±5℃, connect batteries' anode and cathode by wire which impedance less than 50mΩ, keep 6h.	No explosion or fire
7.4 Extrusion	At 20±5℃, put the battery in two parallel steel broad, add pressure 13 kN.	No explosion or fire
7.5 Thermal shock	Put the battery in the oven. The temperature of the oven is to be raised at 5±1℃ per minute to a temperature of 130 ± 2℃ and remains 60 minutes.	No explosion or fire

3. Cautions

3.1 Cautions of batteries' operation

The batteries must be careful of proceed the operation for it's soft package.
To assure product safety, describe the following precautions in the instruction manual of the equipment.

Danger

Do not heat or throw battery into a fire.
Do not use, leave battery close to fire or inside of a car where temperature may be above 60 0C. Also do not chargedischarge in such conditions.
Hairpins, coins, or screws. Do not store batteries with such objects.
Do not short circuit the(+)and(-) terminals with other metals.
Do not place battery in a device with the(+) and(-) in the wrong way around.
Do not hit with a hammer, step on or throw or drop to cause strong shock.
Do not disassemble or modify the battery.
Do not solder a battery directly.
Do not use a battery with serious scar or deformation.

Warning

Do not use battery with dry cells and other primary batteries, or batteries of a different package, type, or brand.
Stop charging the battery if charging is not completed within the specified time.
During use, charge, or storage.
Keep away from fire immediately when leakage or foul odor is detected.
If liquid leaks onto your skin or clothes, wash well with fresh water immediately.
If liquid leaking from the battery gets into your eyes, do not rub your eyes. Wash them well with clean water and go to see a doctor immediately.

Caution

Store batteries out of reach of children so that they are not accidentally swallowed.
Batteries have life cycles. If the time that the battery powers equipment becomes much shorter than usual, the battery life is at an end. Replace the battery with a new same one.

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Remove a battery whose life cycle has expired from equipment immediately.

When the battery is thrown away, be sure it is non-conducting by applying vinyl tape to the(+)

And terminals.

When not using battery for an extended period, remove it from the equipment and store in a place with low humidity and low temperature.

While the battery pack is charged, used and stored, keep it away from objects or materials with static electric charges.

The battery can be used within the following temperature ranges. Do not exceed these ranges.

3.2Standard Test Environment for polymer lithium-ion batteries

Environment temperature: 20± 5℃ Humidity: 45-85%

3.3Cautions of charge & discharge

3.4 charge

Charging current should be lower than values that recommend below. Higher current and voltage charging may cause damage to cell electrical, mechanical, safety performance and could lead heat generation or leakage.

- (1) Batteries charger should charging with constant current and constant voltage mode;
- (2) Charging current should be lower than (or equal to) 1C₅A;
- (3) Temperature 0~40℃ is preferred when charging;
- (4) Charging voltage must be lower than 4.25V.

3.5. discharge

- (1) Discharging current must be lower than (or equal to) 2C₅A;
- (2) Temperature 0~60℃ is preferred when discharging;
- (3) Discharging voltage must not be lower than 2.75V.

3.6. over-discharge

It should be noted that the cell would be at an over-discharge state by its self-discharge. In order to prevent over-discharge, the cell shall be charged periodically to keeping voltage between 3.7-3.9V. Over-discharge may cause loss of cell performance. It should be noted that the cell would not discharge till voltage lower than 2.75V.

4Storage of polymer lithium-ion batteries

The environment of long-time storage:

Temperature: 20± 5℃
Humidity: 45-85%
Batteries were 40~60% charged.

In case of over-discharge, batteries should be charged for one time every 3 months while storing. Batteries should be discharged and charged after being stored more than a year in order to activate it and restore energy. Please charge the battery with constant current 0.5C₅A for 1 hour so that it has some storage of charge for properly using.

Charge and discharge afresh to active and renew battery energy after storage above 1 year.

5Transportation of polymer lithium-ion batteries

The batteries should transportation with 10~50% charged states.

6.Others

Please note cautions below to prevent cells' leakage, heat generation and explosion.

Prohibition of disassembly cells;

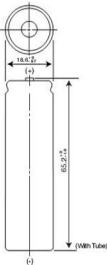
Prohibition of cells immersion into liquid such as water or seawater;

Prohibition of dumping cells into fire;

Prohibition of using damaged cells. The cells with a smell of electrolyte or leakage must be placed away from fire to avoid firing.

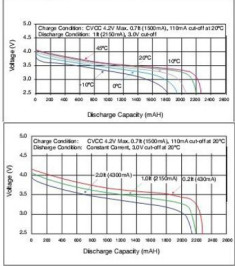
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7. Single cells specifications



Type description	APL-18650-3000mAh
System	Li-ion
Nominal Voltage	3.7V(average)
Typical Capacity(mAh)	3000(at c/5 from 4.2v to 2.75v at 20 °C)
Nominal Capacity(mAh)	3000(at c/5 from 4.2v to 2.75v at 20 °C)
Dimensions (mm)	
Diameter(d)	18.40 Max.
Height (h)	65.0
Weight, approx.(g)	46.0
Charging Method	Constant Current + Constant Voltage
Charge Voltage(V)	4.20(±50mv)
Initial Charge Current(mA)	standard Charge:1200
Charging Cut-off (a)or(b)	Rapid charge: 2250mAh
a)by time(h)	Stand Charge:3
b)by min.current(mA)	Rapid Charge: 2.5
Discharge Cut-off Voltage (v)	C/50
Max.continuous discharge current(mA)	2.75
Operating Temperature (°C)	2600
Storage Temperature(°C)	Charge 0-45 °C
Capacity Recovery Rate(%)	Discharge -20-60 °C
	1 Year at -20 to 20 °C >80
	3 Months at -20 to 45 °C >80
	1 Months at -20 to 60 °C >80

Discharge Characteristics

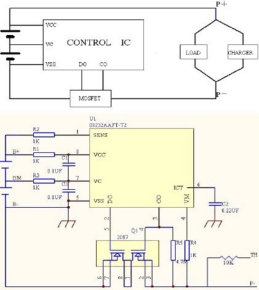


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Impedance Initial(mΩ) <100@1kHz
Life Expectancy C/2, 20 °C (cycles) >380

After storage at initial cell voltage of 3.7 to 3.9v /cell, capacity C/5 measured at 20 °C

Test circuit diagram



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8. Notice of Designing Battery Pack

- 8.1 Pack design
Battery pack should have sufficient strength and battery should be protected from mechanical shock. No sharp edge components should be inside the pack contains the battery.
- 8.2 PCM design
The overcharge threshold voltage should not be exceeding 4.25V.
The over-discharge threshold voltage should not be lower than 2.3V.
The PCM should have short protection function built inside.
- 8.3 Tab connection
Ultrasonic welding or spot welding is recommended to connect battery with PCM or other parts.
If apply manual solder method to connect tab with PCM, the notice below is very important to ensure battery performance.
(1) The electric iron should be temperature controlled and ESD safe.
(2) Soldering temperature should not exceed 350°C
(3) Soldering time should not be longer than 3s, keep battery tab cold down before next soldering.
(4) Soldering times should not exceed 5 times.
(5) Directly heat cell body is strictly prohibited, battery may be damaged by heat above approx. 100°C.
- 8.4 Cell fixing
The battery should be fixed to the battery pack by its large surface area. No cell movement in the battery pack should be allowed.
- 8.5 Cells replacement
The cell replacement should be done by professional people.
Prohibit short-circuit between cells' Al package and exterior component.