Lithium Iron Phosphate Battery

DATA SHEET

Battery Model:

LIP18650

Prepared	Authorized	Approved
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Manufacturer: EEMB Co., Ltd.
Website: http://www.eemb.com

SCOPE

This Specification describes the requirements of the lithium ion phosphate battery supplied by EEMB Co.,Ltd..

1. Basic Specification

Table 1

No.	Item	General Parameter	Remark
1	Nominal Capacity	1400mAh	Standard discharge （ 0.2C_5A) after Standard charge
	Minimum Capacity	1380mAh	
2	Nominal Voltage	3.2V	Mean Operation Voltage
3	Voltage at end of Discharge	2.0V	Discharge Cut-off Voltage
4	Charging Voltage	3.65V	
5	Standard charge	Constant Current 0.2C_5A Constant Voltage 3.65V 0.01 C_5A cut-off	
6	Standard discharge	Constant current 0.2C_5A end voltage 2.0V	
7	Fast charge	Constant Current 1C_5A Constant Voltage 3.65V 0.01 C_5A cut-off	Charge time：Approx 2.5h
8	Maximum Continuous Charge Current	1.0 C_5A （1400mA）	
9	Maximum Continuous Discharge Current	1.0 C_5A （1400mA）	Maximum Pulse Discharge Current: 3.0 C_5A
10	Operation Temperature Range	Charge: 0~45℃	60±25%R.H. Bare Cell **Remark:** working efficiency is around 40%-50% at -20℃
		Discharge: -20~60℃	
11	Storage Temperature Range	Less than 1 year: -20~25℃	60±25%R.H. at the shipment state
		less than 3 months: -20~40℃	
12	Pack Dimension	Height: 60.5±0.3 mm	Initial Dimension
		Diameter: 18.1±0.3mm	
13	Weight	Approx：40g	FYI

2. Performance and Test Conditions

2.1 Standard Test Conditions

Test should be conducted with new batteries within one week after shipment from our factory and the cells shall not be cycled more than five times before the test. Unless otherwise specified, test and measurement shall be done under temperature of 20±5℃ and relative humidity of 45~85%. If it is judged that the test results are not affected by such conditions, the tests may be conducted at temperature 15~30℃ and humidity 25~85%RH.

2.2 Measuring Instrument or Apparatus

2.2.1 Dimension Measuring Instrument

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

2.2.2 Voltmeter

Standard class specified in the national standard or more sensitive class having inner impedance more than 10kΩ/V

2.2.3 Ammeter

Standard class specified in the national standard or more sensitive class. Total external resistance including ammeter and wire is less than 0.01Ω.

2.2.4 Impedance Meter

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

2.3 Standard Charge\Discharge

2.3.1 Standard Charge ： Test procedure and its criteria are referred as follows:

$0.2C_5A$ =280mA

Charging shall consist of charging at a $0.5C_5A$ constant current rate until the cell reaches 3.65V. The cell shall then be charged at constant voltage of 3.65 volts while tapering the charge current. Charging shall be terminated when the charging current has tapered to 0.02 C_5A. Charge time: Approx 6.0h. The cell shall demonstrate no permanent degradation when charged between 0 ºC and 45 ºC.

2.3.2 Standard Discharge

$0.2C_5A$ =280mA

Cells shall be discharged at a constant current of 0.2 C_5A to 2.0 volts @ 20º ± 5C

2.3.3 If no otherwise specified, the rest time between Chare and Discharge amount to 30min.

2.4 Appearance

There shall be no such defect as flaw, crack, rust, leakage, which may adversely affect commercial value of battery.

2.5 Initial Performance Test

Table 2

Item	Test Method and Condition	Requirements
(1) Open-Circuit Voltage	The open-circuit voltage shall be measured within 24 hours after standard charge.	≥3.4V
(2) Internal impedance	Internal resistance measured at AC 1KHz after 50% charge.	≤60 mΩ
(3) Minimal Rated Capacity	The capacity on 0.2C_5A discharge till the voltage tapered to 2.0V shall be measured after rested for 30min then finish standard charge.	Discharge Capacity

2.6 Temperature Dependence of discharge capacity

Cells shall be charged per 2.3.1 and discharged @0.2 C5A to 2 volts. Except to be discharged at temperatures per Table 3. Cells shall be stored for 3 hours at the test temperature prior to discharging and then shall be discharged at the test temperature. The capacity of a cell at each temperature shall be compared to the capacity achieved at 23 ºC and the percentage shall be calculated. Each cell shall meet or exceed the requirements of Table 3.

Discharge Temperature	-10℃	0℃	23℃	60℃
Discharge Capacity （0.2 C_5A）	50%	80%	100%	95%

2.7 Cycle Life and Leakage-Proof

Table 4

No.	Item	Criteria	Test Conditions
1	Cycle Life 0.5 C_5A	Higher than 80% of the Initial Capacities of the Cells	Carry out 1000 cycle Charging/Discharging in the below condition. ◆Charge: Standard Charge, ◆Discharge: 0.5 C_5A to 2.0V ◆Rest Time between charge/discharge: 30min. ◆Temperature:20±5℃
2	Leakage-Proof	No leakage (visual inspection)	After full charge with standard charge, store at 60±3℃, 60±10%RH for 1 month.

3. Mechanical Characteristics and Safety Test

Table 5 (Mechanical characteristics)

No.	Items	Test Method and Condition	Criteria
1	Vibration Test	After standard charging, fixed the cell to vibration table and subjected to vibration cycling that the frequency is to be varied at the rate of 1Hz per minute between 10Hz an 55Hz, the excursion of the vibration is 1.6mm. The cell shall be vibrated for 30 minutes per axis of XYZ axes.	No leakage No fire
2	Drop Test	The cell is to be dropped from a height of 1 meter twice onto concrete ground.	No explosion, No fire, no leakage.

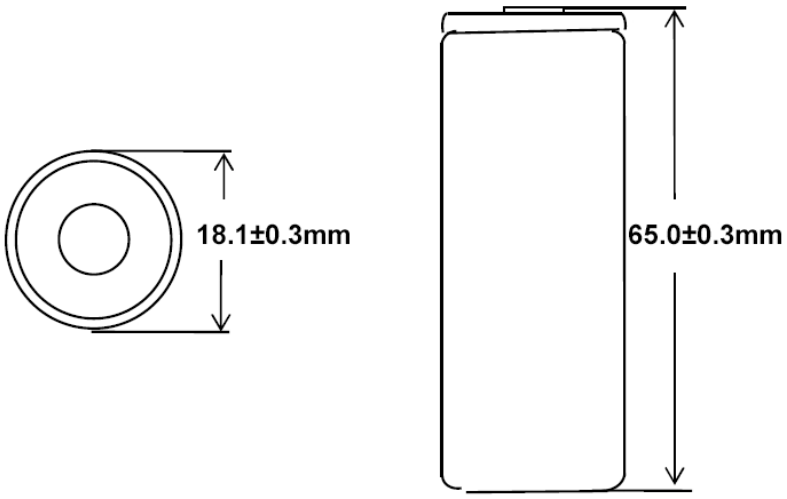
Table 6

(Safety Test)

Item	Battery Condition	Test Method	Requirements
Crush	Fresh, Fully charged	Crush between two flat plates. Applied force is about 13kN(1.72Mpa) for 30min.	No explosion, No fire
Short Circuit（20℃）	Fresh, Fully charged	Each test sample battery, in turn, is to be short-circuited by connecting the (+) and (-) terminals of the battery with a Cu wire having a maximum resistance load of 0.1Ω.Tests are to be conducted at room temperature(20±2℃).	No explosion, No fire The Temperature of the surface of the Cells are lower than 150℃
Short Circuit（60℃）	Fresh, Fully charged	Each test sample battery, in turn, is to be short-circuited by connecting the (+) and (-) terminals of the battery with a Cu wire having a maximum resistance load of 0.1Ω.Tests are to be conducted at temperature(60±2℃).	No explosion, No fire The Temperature of the surface of the Cells are lower than 150℃
Impact	Fresh, Fully charged	A 56mm diameter bar is inlayed into the bottom of a 10kg weight. And the weight is to be dropped from a height of 1m onto a sample battery and then the bar will be across the center of the sample.	No explosion, No fire

Forced Discharge	Fresh, Fully charged	Discharge at a current of 1 C_5A for 2.5h.	No explosion, No fire

4. Initial Dimension (unit：mm)



5. Protection

When Li-ion rechargeable battery is used over the permitted voltage or current, electrolyte may disassemble, and this case will affect safety performance of Li-ion rechargeable battery. So protection circuit module were used in order to prevent overcharge, over discharge and over current.

WARNINGS!

1) Do not immerse the battery in water or seawater, and keep the battery in a cool dry surrounding if it stands by.
2) Do not use or leave the battery near a heat source as fire or heater
3) When recharging, use the battery charger specifically for that purpose
4) Do not reverse the position (+) and negative (-) terminals
5) Do not connect the battery to an electrical outlet
6) Do not discard the battery in fire or heat it
7) Do not short-circuit the battery by directly connecting the positive (+) and negative (-) terminal with metal objects such as wire.
8) Do not transport or store the battery together with metal objects such as necklaces, hairpins etc.
9) Do not strike or throw the battery
10) Do not directly solder the battery and pierce the battery with a nail or other sharp object.

CAUTIONS!

1) Do not use or leave the battery at very high temperature (for example, at strong direct sunlight or in a vehicle in extremely hot weather). Otherwise, it can overheat or fire or its performance will be degenerate and its service life will be decreased.
2) Do not use it in a location where static electricity is great, otherwise, the safety devices may be damaged, causing hidden trouble of safety.
3) If the battery leaks, and the electrolyte get into the eyes. Do not rub eyes, instead, rinse the eyes with clean running water, and immediately seek medical attention. Otherwise, it may injure eyes or cause a loss of sight.
4) 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 charger and stop using it.
5) 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.
6) Be aware discarded batteries may cause fire, tape the battery terminals to insulate them.

Special notice!

Keep the cells in 50% charged state during long period storage. We recommend to charge the battery up to 50% of the total capacity every 3 months after receipt of the battery and maintain the voltage 3.2~3.4V. And store the battery in cool and dry place.