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# EEMB CO., LTD

## Li-ion Battery

## Specification

<b>Model:</b>	<b>LIR18650</b>
<b>Capacity:</b>	<b>2400mAh</b>

Prepared	Checked	Approved

Customer:

Customer Approval (Customer confirmation) :

Signature	Checked	Approved

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## 1. Scope

This product specification defines the requirements of the rechargeable lithium-ion battery supplied to the customer by EEMB Co., Ltd.

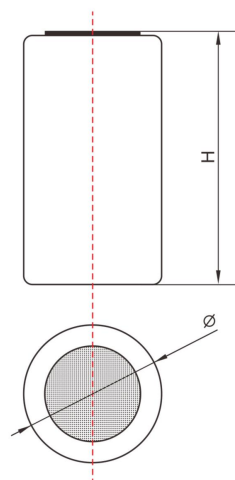
## 2. Battery Cell Basic Characteristics

No.	Item		Characteristics		Remark	
2.1	Model		LIR18650			
2.2	Capacity	Nominal	2400	mAh	0.5C	
		Minimum	2400	mAh	0.5C	
2.3	Nominal Voltage		3.6	V		
2.4	Weight		Approx. 47	g		
2.5	Energy Density		499	Wh/L		
			188	Wh/kg		
2.6	Internal Impedance		≤ 35	mΩ	AC 1KHz(50% charge)	
2.7	Dimension	Diameter	≤ 18.4	mm		
		Height	≤ 65.1	mm		
2.8	Charge	Standard charging Current	1200	mA	0.5C (CC&CV)	
		Voltage	4.200±0.050	V		
		Max Current	1C (T ≥ 10°C)		mA	
			0.5C (10°C > T ≥ 0°C)		mA	
	0.1C (0°C > T ≥ -10°C)		mA			
2.9	Discharge Cut-off Voltage		2.75±0.050	V		
2.10	Maximum Discharge Current		4C (T ≥ 0°C)	mA		
			2C (0°C > T ≥ -20°C)	mA		
2.11	Operation Temperature	Charge	0 ~ 45	°C		
		Discharge	-20 ~ +60	°C		
2.12	Storage Temperature	Less than 3 months	-20 ~ +45	°C		
		Over 1 year	-20 ~ +25	°C		
2.13	Storage Relative Humidity		0~45	%		

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### 3. Battery Cell Shape and Dimensions (Unit: mm)

Item	Specification
Diameter (Φ)	18.4mm
Height (H)	65.1mm



### 4. Appearance

It shall be free from any defects such as remarkable scratches, breaks, cracks, discoloration, leakage, or middle deformation.

### 5. Battery Cell Specification

#### 5.1 Electrical Characteristics

No.	Item	Criteria	Test Instructions
5.1.1	Discharge performance	0.5C <sub>5A</sub> ≥ 100%	In standard atmospheric pressure, ambient temperature of 25±2 °C, relative humidity of 45% ~ 80%, standard charge with 0.5C <sub>5A</sub> , rest for 15min, discharge with different currents to 2.75V. Recycled three times, when once reach standard, namely to meet the standard requirements.
		1 C <sub>5A</sub> ≥ 95%	
		2 C <sub>5A</sub> ≥ 90%	
		3 C <sub>5A</sub> ≥ 90%	
5.1.2	Charge retention	Residual capacity ≥ nominal capacity * 85% Recovery capacity ≥ nominal capacity * 90%	Measure the initial state and initial capacity of the battery, battery charging standards, Open place for 30 days, measuring battery final state; In 0.5C <sub>5A</sub> discharge to 2.75 V, measuring the residual capacity of battery; 0.5 C <sub>5A</sub> /0.5 C <sub>5A</sub> electrical measurement Pool recovery capacity. Recycled three times, when once reach standard, namely to meet the standard requirements.
5.1.3	Cycle Life	Capacity ≥ Nominal capacity * 80%	Measuring battery's initial state and initial capacity. Measuring the final state after cycle 800 times at 0.5C <sub>5A</sub> /1C <sub>5A</sub> .
5.1.4	Storage performance	Discharge time of 0.2 C <sub>5A</sub> : Storage 12 months of battery ≥ 4h	Charge to 3.80 ± 0.02V, before storage, measure the initial condition and initial capacity of the battery, Store for 12 months at room temperature and measure the final condition of battery. Then conduct 0.5C <sub>5A</sub> /0.2C <sub>5A</sub> cycle for 3 times to record the discharge time of the battery.

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## 5.2 Acclimatization Characteristics

No.	Item	Criteria	Test Instructions
5.2.1	Thermal cycling performance	No smoke, no fire, no explosion	After standard charge, rest for 48h at $75\pm 2\text{ }^{\circ}\text{C}$ , then rest for 6h at $-20\text{ }^{\circ}\text{C}$ , last rest for 24h at room temperature; watch battery appearance change.
5.2.2	Drop	Discharge Time $\geq 51\text{min}$ ; No leakage, no explosion, no fire	After standard charge, measuring the initial state. The cell drop onto a hard board with the thickness of 20mm from 1m in six directions, test the final state of the cell; then discharge at $1C_5A$ to 2.75 V, test discharge time.
5.2.3	Discharge performance under different temperatures	Discharge capacity / Nominal Capacity * 100% $55^{\circ}\text{C} \geq 95\%$ $-20^{\circ}\text{C} \geq 70\%$ No smoke, explosion and fire	Measuring cell initial capacity and initial state. After standard charge, rest for 2h at $60\pm 2\text{ }^{\circ}\text{C}$ , $0.2C_5A$ discharge to 2.75 V. Then after standard charge at room temperature, rest for 4h at $-20\pm 2^{\circ}\text{C}$ , $0.2C_5A$ discharge to 2.75 V and measuring final capacity. Finally put aside at room temperature for 2h, measuring the final state of the battery and observe the battery appearance change.
5.2.4	Vibration	Residual capacity $\geq$ nominal capacity * 95% Voltage decay rate $\leq 0.5\%$ Internal resistance increasing rate $\leq 20\%$ No obvious damage, no smoke, no explosion	Batteries are vibrated 30 min in three mutually perpendicular directions with amplitude of 0.38mm (10~30Hz) or 0.19mm (30~55Hz) and the scanning rate of 1oct per min

## 5.3 Safety Characteristics

No.	Item	Criteria	Test Instructions
5.3.1	Overcharge	No explosion or fire Max. temperature $< 130^{\circ}\text{C}$	After standard charge, charging with $1C_5A$ to 10V; then change to charge with constant voltage till the current less than or equal to $0.01C_5A$ . Observe the temperature and the appearance of the cell.
5.3.2	Over discharge	No fire or explosion;	After standard charge, discharge with $0.5C_5A$ to 2.75 V, then connect the cathode with $10\Omega$ resistance, rest for 14 days. Measuring the final state of the cell.

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5.3.3	Short-circuit	No explosion or fire Max. temperature<130°C	After standard charge, place the battery with thermocouple into a fume hood, and short-circuit by connecting the positive and negative terminals (resistance load of 50mΩ), end the test when the battery temperature drops to about 10°C lower than peak value.
5.3.4	Impact	No fire or explosion	After full charge, test the initial state of battery, place it on the flat and connect to the thermocouple, put a bar with 15.8 mm diameter to the middle of the cell, a 9.1kg weight drop from 610mm height to the table, watch battery appearance and temperature changes.
5.3.5	Compression	No explosion or fire Max. temperature<130°C	After full charge, test the initial state of cell, place it on the flat and connect to the thermocouple, placed it between two iron flat mould, quickly compress the battery with 13KN. Observe the temperature of the cell and appearance change.
5.3.6	Thermal shock	No fire or explosion;	Cell is heated in a circulating air oven at a rate of (5±2)°C per minute to 130±2°C, and then placed for 30min at 130±2°C, Observe appearance change of the cell

## 6. Warranty

One year warranty after the date of production.

## 7. Matters Needing Attention

Strictly observes the following needing attention. EEMB will not be responsible for any accident occurred by handling outside of the precautions in this specification.

### **! Danger**

- Strictly prohibits heat or throw cell into fire.
- Strictly prohibits throw and wet cell in liquid such as water、 gasoline or drink etc.
- Strictly prohibits use leave cell close to fire or inside of a car where temperature may be above 60°C. Also do not charge / discharge in such conditions.
- Strictly prohibits put batteries in your pockets or a bag together with metal objects such as necklaces. Hairpins, coins, or screws. Do not store or transportation batteries with such objects.
- Strictly prohibits short circuit the (+) and (-) terminals with other metals.
- Do not place Cell in a device with the (+) and (-) in the wrong way around.
- Strictly prohibits pierce Cell with a sharp object such as a needle.
- Strictly prohibits disassemble or modify the cell.
- Strictly prohibits welding a cell directly.
- Do not use a Cell with serious scar or deformation.
- Thoroughly read the user's manual before use, inaccurate handling of lithium ion rechargeable cell may cause leakage, heat, smoke, an explosion, or fire, capacity decreasing.

### **! Warning**

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- Strictly prohibits put cell into a microwave oven, dryer, or high-pressure container.
- Strictly prohibits use cell with dry cells and other primary batteries, or new and old battery or batteries of a different package, type, or brand.
- Stop charging the Cell if charging is not completed within the specified time.
- Stop using the Cell if abnormal heat, odor, discoloration, deformation or abnormal condition is detected 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 Cell gets into your eyes, do not rub your eyes. Wash them well with clean edible oil and go to see a doctor immediately.

### **! Caution**

- Before using the Cell, be sure to read the user's manual and cautions on handling thoroughly.
- Charging with specific charger according to product specification. Charge with CC/CV method. Strictly prohibits reversed charging. Connect cell reverse will not charge the cell. At the same time, it will reduce the charge-discharge characteristics and safety characteristics; this will lead to product heat and leakage.
- Store batteries out of reach of children so that they are not accidentally swallowed.
- If younger children use the Cell, their guardians should explain the proper handling.
- Before using the Cell, be sure to read the user's manual and cautions on handling thoroughly.
- Batteries have life cycles. If the time that the Cell powers equipment becomes much shorter than usual, the Cell life is at an end. Replace the Cell with a new same one.
- When not using Cell for an extended period, remove it from the equipment and store in a place with low humidity and low temperature.
- While the Cell pack is charged, used and stored, keep it away from objects or materials with static electric charges.
- If the terminals of the Cell become dirty, wipe with a dry clothe before using the Cell.
- Storage the cells in storage temperature range as the specifications. After full discharged, we suggest that charging to 3.6~4.0V. with no using for a long time.
- Battery should be charged and discharged every 3 months at 0.2 C during long term storage, and then charge to 50-70% of the capacity for storage.
- Do not exceed these ranges of the following temperature ranges:
  - Charge temperature range: 0°C to 45°C;
  - Discharge temperature range: -20°C to 60°C.
  - Storage temperature range: -20°C to 45°C



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## **! 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 3.6~4.0V. And store the battery in cool and dry place.