

# Specification Approval Sheet

Model: ICR 18650-3350mAh

Type: Cylindrical Li-ion battery

## Cylindrical Lithium ion Cell Specification

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### 1. Scope

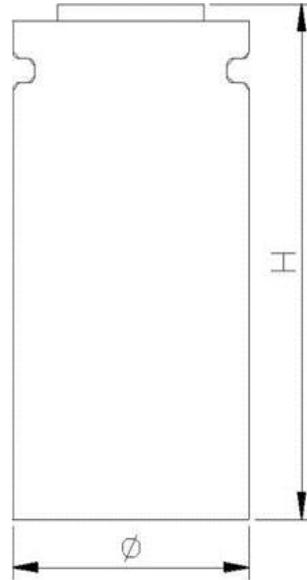
### 2. Specification

NO	Items	Criteria	Remarks
2.1	Typical Capacity	<u>3350mAh</u>	0.2C discharge to 2.5V
2.1	Minimum Capacity	<u>3250mAh</u>	
2.2	Nominal Voltage	3.60V	
2.3	Internal Impedance	$\leq$ <u>60m<math>\Omega</math></u>	AC 1KHz after standard charge
2.4	Charge cut-off voltage	4.20 V	
2.5	Standard charge current	<u>975mA</u>	0.3C
2.6	Max. charge current	<u>1625mA(0.5C)</u>	0~10 0.3C 10~45 0.5C
2.7	Standard dis-charge current	<u>650mA</u>	0.2C
2.8	Max. discharge current	<u>3350mA</u>	1.0C
2.9	Discharge cut-off voltage	2.5V	
2.10	Operating Temperature	0~+45°C	Charging
		-20°C~+50°C	Discharging
2.11	Storage Temperature	-10°C ~ 45°C	Less than 1 month
		0°C ~ 45°C	Less than 6 month
		0°C ~ 35°C	Less than 12 months

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### 4. Dimesion



	<b>Max.18.6mm</b>	<b>Max.65.5mm</b>



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### 6. Battery Performance

#### 6.1 Visual Inspection

There shall be no such defects as scratch, flaw, crack, and leakage, which may adversely affect commercial value of the battery.

#### 6.2 Standard Testing Condition

Unless otherwise specified, all tests stated in this product specification are conducted at below condition:

Temperature:  $25 \pm 5^{\circ}\text{C}$

Humidity: 45% – 75% RH

#### 6.3 Electric Performance

No.	Items	Test Method and Condition	Criteria
1	Standard Charge	975mA(0.3C) Charge to 4.2V at constant current 975mA (0.3C), then constant voltage charge to taper current 50mA	Constant voltage 4.2V for 5.0 hours in all at $25 \pm 2^{\circ}\text{C}$ .
2	Minimum Capacity	Measure the capacity through standard charge model and standard discharge model	$\geq 3250\text{mAh}$
3	Cycle Life	Charge to 4.2V at constant current 0.3C, then constant voltage charge to taper current 50mA Discharge to 2.75V at constant current 0.5C Repeat the procedures below 300 cycles	80% Residual capacity $\geq 80\%$ after 300 cycles vs. Discharge capacity of first cycle
4	Impedance	Internal resistance measured at 1KHz AC impedance at 50% capacity	$\leq 60\text{m}\Omega$
5	Battery Voltage	Measure OCV by multimeter	$\geq 3.80\text{V}$ $\geq 3.80\text{V}$
6	Temperature Performance of Battery	Charge: Standard charge model Discharge: Discharge to 2.5V at 0.2C constant current at $-10^{\circ}\text{C}$ , $0^{\circ}\text{C}$ and $45^{\circ}\text{C}$ respectively	$-10^{\circ}\text{C}$ 70% $0^{\circ}\text{C}$ 80% $45^{\circ}\text{C}$ 95% $-10^{\circ}\text{C}$ , capacity $\geq 70\%$ $0^{\circ}\text{C}$ , capacity $\geq 80\%$ $45^{\circ}\text{C}$ , Capacity $\geq 95\%$

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### 6.4 Mechanical Performance Testing

No.	Items	Test Method and Condition	Criteria
1	Vibration Test	After standard charging, fixed the capacitor to vibration table and subjected to vibration cycling that the frequency is to be varied at the rate of 1Hz per minute between 10Hz and 55Hz, the excursion of the vibration is 1.6mm. The capacitor shall be vibrated for 30 minutes per axis of XYZ axes.	No fire, no explode, no smoke or no leakage
2	Drop Test	Battery is dropped from a height of 1.3 meters 6 times at six angles (X, Y, Z plus positive, negative) to concrete ground, then cycle three times at 1C current.	No fire, no explode, no smoke or no leakage

### 6.5 Safety Performance Testing

No.	Items	Testing condition	标准 Criteria
1	Overcharge testing	3C/4.2V DC power supply charge 7 hrs after fully charge	No fire, no explode, no smoke or no leakage
2	Short circuit testing	Short circuit 0.1hr through less than 0.1Ω resistor after fully charge	No fire, no explode, no smoke or no leakage
3	Hot oven test	Put a fully charged battery in a forced air oven and raise the temperature at $5 \pm 2^\circ\text{C}/\text{min}$ . to $130 \pm 2^\circ\text{C}$ Rest for 10 minutes.	No fire, no explode
4	Overdischarge testing	Discharge 28hrs through 30Ω resistor after fully charge	No fire, no explode, no smoke or no leakage



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### **7. Storage and Others**

#### **7.1 Long Time Storage**

If stored for a long time(exceed three months), the cell should be stored in drying and cooling place. The cell's storage voltage should be 3.75~3.95V



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### **Appendix**

#### Handling Precautions and Guideline For (Lithium-Ion) Rechargeable Batteries

#### 1 Charging

##### 1.1 Charging current

Charging current should be less than maximum charge current specified in the Product Specification. Charging with higher current than recommended value may cause damage to cell electrical, mechanical, and safety performance and could lead to heat generation or leakage.

##### 1.2 Charging voltage

Charging shall be done by voltage less than that specified in the Product Specification (4.2V/cell). Charging beyond 4.30V, which is the absolute maximum voltage, must be strictly prohibited. The charger shall be designed to comply with this condition. It is very dangerous that charging with higher voltage than maximum voltage may cause damage to the cell electrical, mechanical safety performance and could lead to heat generation or leakage.

##### 1.3 Charging temperature

The cell shall be charged within 0°C~45 °C range in the Product Specification.



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### 1.4 Prohibition of reverse charging

Reverse charging is prohibited. The cell shall be connected correctly. The polarity has to be confirmed before wiring. In case of the cell is connected improperly, the cell cannot be charged. Simultaneously, the reverse charging may cause damaging to the cell which may lead to degradation of cell performance and damage the cell safety, and could cause heat generation or leakage.

## 2 Discharging

### 2.1 Discharging current

The cell shall be discharged at less than the maximum discharge current specified in the Product Specification. High discharging current may reduce the discharging capacity significantly or cause over-heat.

### 2.2 Discharging temperature

The cell shall be discharged within  $-10^{\circ}\text{C}\sim 60^{\circ}\text{C}$  range specified in the Product Specification.

### 2.3 Over-discharging

It should be noted that the cell would be at an over-discharged state by its self-discharge characteristics in case the cell is not used for long time. In order to prevent over-discharging, the cell shall be charged periodically to maintain between 3.75V and 3.95V.

Over-discharging may causes loss of cell performance, characteristics, or battery functions.

## 3. Protection Circuit Module

The cell/battery pack shall be with a PCM that can protect cell/battery pack properly. PCM shall have functions of (1) overcharging prevention, (2) over-discharging prevention, (3) over



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current prevention to maintain safety and Prevent significant deterioration of cell performance. The over current can occur by external short circuit

### 3.1 overcharging prohibition:

Overchargingprohibition function shall stop charging if any one of the cells of the battery pack reaches  $4.28 \pm 0.025V$

### 3.2 over-discharging prohibition:

Over-discharging prevention function shall work to avoid further drop in cell voltage of  $3.0V \pm 0.1V$  Or less per cell in any cell of the battery pack. It is recommended that the dissipation current of PCM Shall be minimized to 0.5uA or less with the over-discharging prevention.The protection function shall monitor each bank of the battery pack and control the current all the time .

## 4. Storage

The cell shall be storied within  $-10^{\circ}C \sim 40^{\circ}C$  range environmental condition.

If the cell has to be storied for a long time (Over 3 months), the environmental condition should be: Temperature:  $23 \pm 5^{\circ}C$  Humidity:  $65 \pm 20\%RH$

The voltage for a long time storage shall be 3.75V~3.95V range.

## 5. Handling Instructions

Read and observe the following warnings and precautions to ensure correct and safe use of Li-ion batteries.



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### **Danger!**

#### **Caution and Guideline**

Before using battery, please read specification and safety caution, insure proper application and safety.

#### **Caution**

Failing in following items can cause leakage, heat even fire:

Prohibition of reverse charge of battery.

Prohibition of overcharge of battery.

Prohibition of overdischarge of battery.

Prohibition of short circuit of positive and negative of battery.

Please charge by specified charger.

Don't knock, beat, nail or disassemble battery.

Please keep away from fire or other heating sources and prohibition of dumping of battery into fire.

#### **Guideline**

If electrolyte comes into contact with the skin or eyes where shall flush the electrolyte immediately with fresh water and physicians' advice is to be sought.

Don't use or storage battery under the circumstance beyond specified, unless will weaken battery performance and shorten battery life-span, even will cause heating, fire or explosion.

Please insure battery in quality guarantee duration before using.

If batteries are too dirty, please clean them before using. Unless will cause abnormal work of battery.

Please don't make the battery side edge of direct contact with the metal.