

Spec. No.	ICR18650-28A	Version No.	1.1
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# SPECIFICATION OF PRODUCT

**for Lithium-ion Rechargeable Cell**

**Model : ICR18650-28A**

**June, 2009**

**Samsung SDI Co.,Ltd.**

**Mobile Energy Division**

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### 1. Scope

This product specification has been prepared to specify the rechargeable lithium-ion cell ('cell') to be supplied to the customer by Samsung SDI Co., Ltd.

### 2. Description and Model

- 2.1 Description            Cell (lithium-ion rechargeable cell)
- 2.2 Model                 ICR18650-28A

### 3. Nominal Specifications

Item	Specification
3.1 Nominal Capacity	2800mAh (0.2C, 2.75V discharge)
3.2 Minimum Capacity	2700mAh(0.2C, 2.75V discharge)
3.3 Charging Voltage	4.3 ±0.03 V
3.4 Nominal Voltage	3.75V
3.5 Charging Method	CC-CV (constant voltage with limited current)
3.6 Charging Current	Standard charge: 1400mA Rapid charge : 2800mA
3.7 Charging Time	Standard charge : 3hours Rapid charge : 2.5hours
3.8 Max. Charge Current	2800mA(ambient temperature 25℃)
3.9 Max. Discharge Current	5600mA(ambient temperature 25℃)
3.10 Discharge Cut-off Voltage	2.75V
3.11 Cell Weight	48.0g max
3.12 Cell Dimension	Height : 65.00mm max Diameter : 18.40mm max
3.13 Operating Temperature	Charge : 0 to 45℃ Discharge: -20 to 60℃
3.14 Storage Temperature	1 year    : -20~25℃(1*) 3 months : -20~45℃(1*) 1 month  : -20~50℃(1*)

Note (1): If the cell is kept as ex-factory status (50% of charge),  
the capacity recovery rate is more than 80%.

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#### 4. Outline Dimensions

See the attachment (Fig. 1)

#### 5. Appearance

There shall be no such defects as scratch, rust, discoloration, leakage which may adversely affect commercial value of the cell.

#### 6. Standard Test Conditions

##### 6.1 Environmental Conditions

Unless otherwise specified, all tests stated in this specification are conducted at temperature  $25\pm 5^{\circ}\text{C}$  and humidity  $65\pm 20\%$ .

##### 6.2 Measuring Equipment

###### (1) Ammeter and Voltmeter

The ammeter and voltmeter should have an accuracy of the grade 0.5 or higher.

###### (2) Slide caliper

The slide caliper should have 0.01 mm scale.

###### (3) Impedance meter

The impedance meter with AC 1kHz should be used.

#### 7. Characteristics

##### 7.1 Standard Charge

This "Standard Charge" means charging the cell with charge current 1400mA and constant voltage 4.3V at  $25^{\circ}\text{C}$  for 3hours.

##### 7.2 Standard Discharge Capacity

The standard discharge capacity is the initial discharge capacity of the cell, which is measured with discharge current of 560mA with 2.75V cut-off at  $25^{\circ}\text{C}$  within 1 hour after the standard charge.

$$\text{Standard Discharge Capacity} \geq 2700\text{mAh}$$

##### 7.3 Initial internal impedance

Initial internal impedance measured at AC 1kHz after rated charge.

$$\text{Initial internal impedance} \leq 100\text{m}\Omega$$

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#### 7.4 Temperature Dependence of Discharge Capacity

Capacity comparison at each temperature, measured with discharge constant current 560mA and 2.75V cut-off after the standard charge is as follows.

Charge Temperature	Discharge temperature			
	-10℃	0℃	25℃	40℃
25℃				
Relative Capacity	50%	80%	100%	80%

Note: If charge temperature and discharge temperature is not the same, the interval for temperature change is 3 hours.

Percentage as an index of the capacity at 25℃ (=2700mAh) is 100%.

#### 7.5 Temperature Dependence of Charge Capacity

Capacity comparison at each temperature, measured with discharge constant current 560mA and 2.75V cut-off after the standard charge is as follows.

	Charge temperature			Discharge temperature
	0℃	25℃	45℃	
Relative Capacity	80%	100%	80%	25℃

Note: If charge temperature and discharge temperature is not the same, the interval for temperature change is 3 hours.

Percentage as an index of the capacity at 25℃ (=2700mAh) is 100%.

#### 7.6 Charge Rate Capabilities

Discharge capacity is measured with constant current 560mA and 2.75V cut-off after the cell is charged with 4.3V as follows.

	Charge Condition		
	0.2C (560mA)	0.5C (1400mA)	1.0C (2800mA)
Cut-off	7h or 0.05C	3.0h or 0.05C	2.5h or 0.05C
Relative Capacity	100%	95%	90%

Note: Percentage as an index of the capacity at 25℃ (=2700mAh) is 100%.

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### 7.7 Discharge Rate Capabilities

Discharge capacity is measured with the various currents in under table and 2.75V cut-off after the standard charge.

	Discharge Condition			
Current	0.2C (560mA)	0.5C (1400mA)	1.0C (2800mA)	2.0C (5600mA)
Relative Capacity	100%	95%	90%	80%

Note: Percentage as an index of the capacity at 25°C (=2700mAh) is 100%.

### 7.8 Cycle Life

Each cycle is an interval between the charge (charge current 1400mA) with 3.0h or 0.05C cut-off and the discharge (discharge current 1400mA) with 2.75V cut-off. Capacity after 299cycles and plus 1 day, measured under the same condition in 7.2

$$\text{Capacity} \geq 1890\text{mAh}(70\% \text{ of the capacity at } 25^\circ\text{C})$$

### 7.9 Storage Characteristics

Capacity after storage for 30days at 25°C after the standard charge, measured with discharge current 560mA with 2.75V cut-off at 25°C.

$$\text{Capacity retention(after the storage)} \geq 2160\text{mAh} (80\% \text{ of the capacity at } 25^\circ\text{C})$$

### 7.10 Status of the cell as of ex-factory

The cell should be shipped in 50% charged state. In this case, OCV is from 3.65V to 3.85V.

## 8. Mechanical Characteristics

### 8.1 Drop Test

Test method: Cell(as of shipment or full charged) drop onto the oak-board (thickness:  $\geq 30\text{mm}$ ) from 4feet height at a random direction 6 times.

Criteria: No leakage

### 8.2 Vibration Test

Test method: Cell(as of shipment) is vibrated along 2 mutually perpendicular axes with total excursion of 1.6mm and with frequency cycling between 10Hz and 55Hz by 1Hz/min.

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Criteria: No leakage

## 9. Safety

### 9.1 Overcharge Test

Test method: To charge the standard charged cell with 12V and 2.8A at 25 °C for 2.5 hours.

Criteria: No fire, and no explosion.

### 9.2 External Short-circuit Test

Test method: To short-circuit the standard charged cell by connecting positive and negative terminal by less than 50mΩ wire for 3hours.

Criteria: No fire, and no explosion.

### 9.3 Reverse Charge Test

Test method: To charge the standard charged cell with charge current 2.8A By –12V for 2.5 hours.

Criteria: No fire, and no explosion.

### 9.4 Heating Test

Test method: To heat up the standard charged cell at heating rate 5 °C per minute up to 130 °C and keep the cell in oven for 60 minutes.

Criteria: No fire, and no explosion.

## 10. Warranty

Samsung SDI will be responsible for replacing the cell against defects or poor workmanship for 15months from the date of shipping. Any other problem caused by malfunction of the equipment or mix-use of the cell is not under this warranty.

The warranty set forth in proper using and handling conditions described above and excludes in the case of a defect which is not related to manufacturing of the cell.

## 11. Others

### 11.1 Storage for a long time

If the cell is kept for a long time(3months or more), It is strongly recommended that the cell is preserved at dry and low-temperature.

### 11.2 Other

Any matters that specifications does not have, should be conferred with between the both parties.

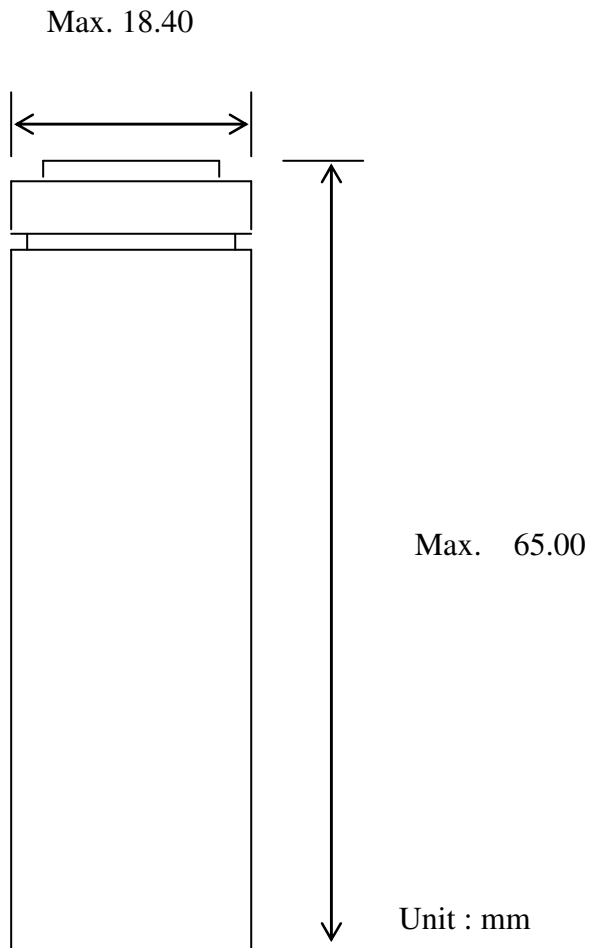
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### 11.3 PTC Specification

	PTC Specification (in the Cell)			
Item	Hold Current	Resistance	Power Dissipation	Resistance After Trip
Spec.	3.0A	6~14m $\Omega$	Max. 2.5W	Max. 26m $\Omega$

## 12. Cell Dimensions

See Fig.1,

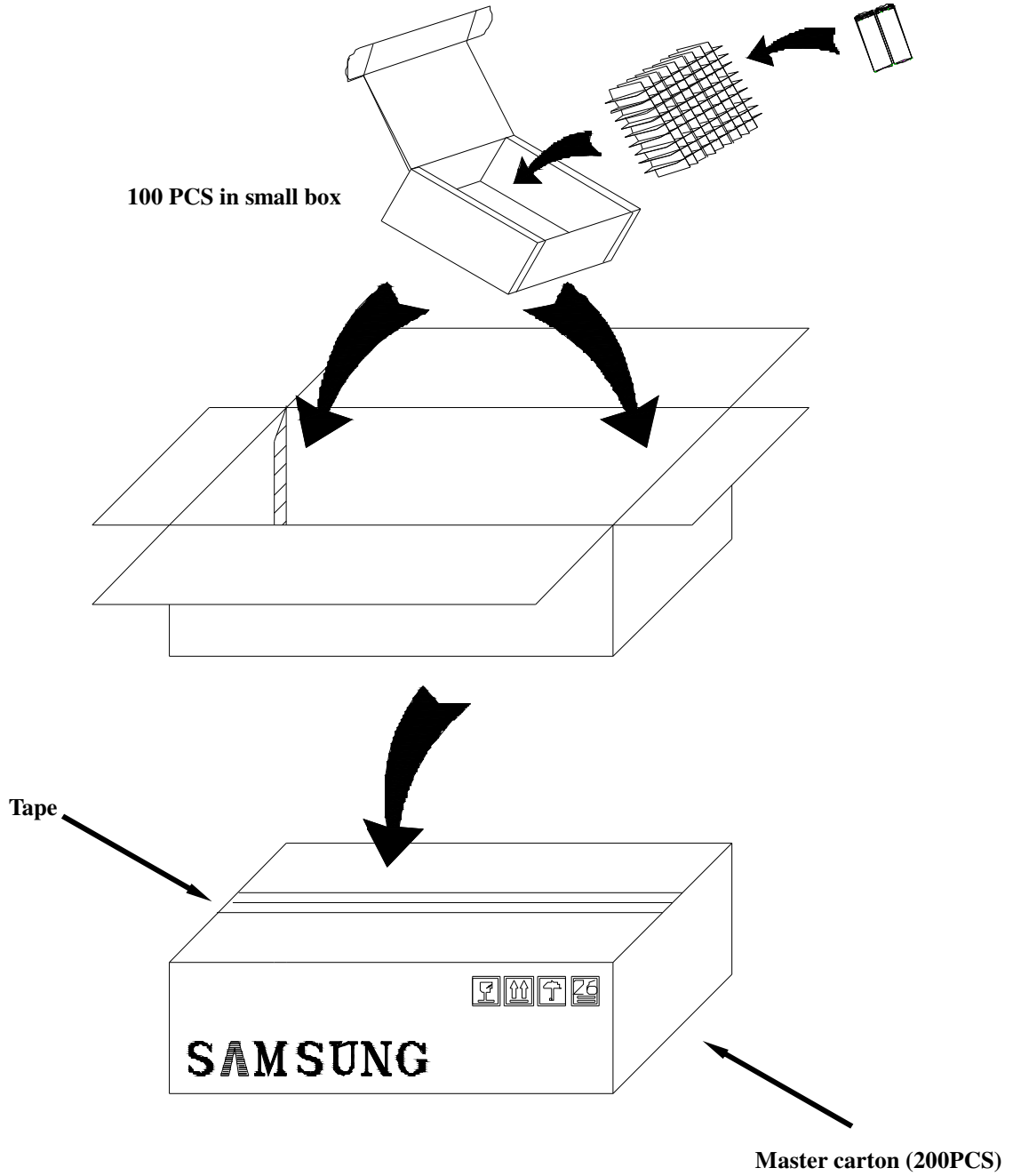


**Fig.1. Outline Dimensions of ICR18650-28A (with Tube)**

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**13. Packing**

See Fig.2,



**Fig.2. Package Drawing**