

Lee, Kwan Soo

PRODUCT SPECIFICATION CONFIDENTIAL

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Approved LGC MED/BTC

Ryu, Dukhyun

Description Lithium Ion ICR18650 D1 3000mAh

PRODUCT SPECIFICATION

Rechargeable Lithium Ion Battery Model : ICR18650 D1 3000mAh



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Revision History

Revision	Date	Originator	Description
0	2009-12-04	Lee, Kwan Soo	- Original Release
1	2010-03-18	Lee, Kwan Soo	- Cell Picture Updated
2	2011-02-01	Lee, Kwan Soo	- Bottom tubing was applied

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1. General Information

1.1 Scope

This product specification defines the requirements of the rechargeable lithium ion battery to be supplied to the Customer by LG Chem.

- 1.2 Application: Note PC
- 1.3 Product classification: Cylindrical rechargeable lithium ion battery
- 1.4 Model name: ICR18650D1

2. Nominal Specification

Item	Condition / Note	Specification	
2.1 Capacity	Std. charge / discharge	Nominal 3000mAh / 11.20 Wh(C _{nom})	
		Minimum 2900mAh	
2.2 Nominal Voltage	Average	3.75V	
2.3 Standard Charge	Constant current	0.5C (1450mA)	
(Refer to 4.1.1)	Constant voltage	4.35V	
	End current(Cut off)	50mA	
2.4 Max. Charge Voltage		4.35V	
2.5 Max. Charge Current		1.0C (2900mA)	
2.6 Standard Discharge	Constant current	0.2C (580mA)	
(Refer to 4.1.2)	End voltage(Cut off)	3.0V	
2.7 Max. Discharge Current	-20 ~ 5℃	0.5C(1450mA)	
	5 ~ 45 ℃	2.0C(5800mA)	
	45 ~ 60 ℃	1.5C(4350mA)	
2.8 Weight	Approx.	Max. 48.5 g	
2.9 Operating Temperature	Charge	0 ~ 45 ℃	
	Discharge	-20 ~ 60 ℃	
2.10 Storage Temperature	1 month	-20 ~ 60 ℃	
(for shipping state)	3 month	-20 ~ 45 ℃	
	1 year	-20 ~ 20 ℃	



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3. Appearance and Dimension

3.1 Appearance

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

3.2 Dimension

Diameter : 18.29 ± 0.11 mm

Diameter is defined as the largest data value measured on the "A" area of a cylindrical cell Height : \leq 65.05 mm



4. Performance Specification

4.1 Standard test condition

4.1.1 Standard Charge

Unless otherwise specified, "Standard Charge" shall consist of charging at constant current of 0.5C. The cell shall then be charged at constant voltage of 4.35V while tapering the charge current. Charging shall be terminated when the charging current has tapered to 50mA. For test purposes, charging shall be performed at $23^{\circ}C \pm 2^{\circ}C$.

4.1.2 Standard Discharge

"Standard Discharge" shall consist of discharging at a constant current of 0.2C to 3.0V. Discharging is to be performed at 23 °C \pm 2 °C unless otherwise noted (such as capacity versus temperature).



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4.1.3 Fast Charge / discharge condition

Cells shall be charged at constant current of 0.5C to 4.35V with end current of 50mA. Cells shall be discharged at constant current of 0.5C to 3.0V. Cells are to rest 10 minutes after charge and 20 minutes after discharge.

4.2 Electrical Specification

Item	Condition	Specification
4.2.1	Cell shall be measured at 1kHz after charge per	\leq 70 m Ω , with PTC
Initial AC Impedance	4.1.1.	
4.2.2	Cells shall be charged per 4.1.1 and discharged	\geq 2900 mAh (C _{min})
Initial Capacity	per 4.1.2 within 1h after full charge.	
4.2.3	Cells shall be charged and discharged per 4.1.3	\geq 75% (of C _{min} in 2.1)
Cycle Life	300 cycles. A cycle is defined as one charge	
	and one discharge. 301st discharge capacity	
	shall be measured per 4.1.1 and 4.1.2	

4.3 Environmental specification.

Item	Condition	Specification
4.3.1	Cells shall be charged per 4.1.1 and stored in a	Capacity remaining rate
Storage Characteristics	temperature-controlled environment at 23°C ±	\geq 90% (C _{min} in 2.1)
	2°C for 30 days. After storage, cells shall be	
	discharged per 4.1.2 to obtain the remaining	
	capacity*.	
4.3.2	Cells shall be charged per 4.1.1 and stored in a	No leakage,
High Temperature	temperature-controlled environment at 60°C for	Capacity recovery rate \geq
Storage Test	1 week. After storage, cells shall be discharged	80%
	per 4.1.2 and cycled per 4.1.3 for 3 cycles to	
	obtain recovered capacity**.	
4.3.3	Cells are charged per 4.1.1 and stored at 60°C	No leakage, No rust
High Temperature and	(95% RH) for 168 hours. After test, cells are	Capacity recovery rate \geq
High Humidity Test	discharged per 4.1.2 and cycled per 4.1.3 for 3	80%
	cycles to obtain recovered capacity.	



^{*} Remaining Capacity : After storage, cells shall be discharged with Std. condition(4.1.2) to measure the remaining capacity. ** Recovery Capacity : After storage, cells shall be discharged with fast discharge condition(4.1.3), and then cells shall be charged with std. charge condition(4.1.1), and then discharged with Std. condition(4.1.2). This charge / discharge cycle shall be repeated three times to measure the recovery capacity.



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4.3.4	65°C (8h) ← 3hrs →	-20°C (8h) for 8 cycles	No leakage
Thermal Shock Test	with cells charged per 4.1.1 After test, cells are		Capacity recovery rate \geq
	discharged per 4.1.2 and cycled per 4.1.3 for 3		80%
	cycles to obtain recove		
4.3.5	Cells shall be charged		
Temperature	and discharged per		
Dependency of	temperatures.		
Capacity	Charge	Discharge	Capacity
	22 %	-10℃	70% of C _{ini}
23℃		℃ 0	80% of C _{ini}
	230	23 ℃	100% of C _{ini}
		60 ℃	95% of C _{ini}

4.4 Mechanical Specification

Item	Condition	Specification
4.4.1	Cells charged per 4.1.1 are dropped onto an wooden	No leakage
Drop Test	floor from 1.0 meter height for 1 cycle, 2 drops from	No temperature rising
	each cell terminal and 1drop from the side of cell can	
	(Total number of drops = 3).	
4.4.2	Cells charged per 4.1.1 are vibrated for 90 minutes per	No leakage
Vibration Test	each of the three mutually perpendicular axis (x, y, z)	
	with total excursion of 0.8mm, frequency of 10Hz to	
	55Hz and sweep of 1Hz change per minute	

4.5 Safety Specification

Item	Condition	Specification	
	Cells are discharged per 4.1.2, then charged at constant		
4.5.1	current of 3 times the max. charge condition and	: No ovolodo. No firo	
Overcharge Test	constant voltage of 4.2V while tapering the charge	: No explode, No fire	
	current. Charging is continued for 7 hours (Per UL1642).		
4.5.2	Cells are charged per 4.1.1, and the positive and		
External Short -	negative terminal is connected by a 100m Ω -wire for 1	: No explode, No fire	
Circuiting Test	hour (Per UL1642).		







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4,5.3 Overdischarge Test	Cells are discharged at constant current of 0.2C to 250% of the minimum capacity.	: No explode, No fire
4.5.4 Heating Test	Cells are charged per 4.1.1 and heated in a circulating air oven at a rate of 5°C per minute to 130°C. At 130°C, oven is to remain for 10 minutes before test is discontinued (Per UL1642).	: No explode, No fire
4.5.5 Impact Test	Cells charged per 4.1.1 are impacted with their longitudinal axis parallel to the flat surface and perpendicular to the longitudinal axis of the 15.8mm diameter bar (Per UL1642).	: No explode, No fire
4.5.6 Crush Test	Cells charged per 4.1.1 are crushed with their longitudinal axis parallel to the flat surface of the crushing apparatus (Per UL1642).	: No explode, No fire

5. Caution and Prohibition in Handling

Warning for using the lithium ion rechargeable battery. Mishandling of the battery may cause heat, fire and deterioration in performance. Be sure to observe the following.

Caution

- When using the application equipped with the battery, refer to the user's manual before usage.
- Please read the specific charger manual before charging.
- Charge time should not be longer than specified in the manual.
- When the cell is not charged after long exposure to the charger, discontinue charging.
- Battery must be charged at operating temperature range 0 ~ 45 °C.
- Battery must be discharged at operating temperature range $-20 \sim 60$ °C.
- Please check the positive(+) and negative(-) direction before packing.
- When a lead plate or wire is connected to the cell for packing, check out insulation not to short-circuit.
- Battery must be stored separately.
- Battery must be stored in a dry area with low temperature for long-term storage.
- Do not place the battery in direct sunlight or heat.
- Do not use the battery in high static energy environment where the protection device can be damaged.
- When rust or smell is detected on first use, please return the product to the seller immediately.
- The battery must be away from children or pets
- When cell life span shortens after long usage, please exchange to new cells.



Prohibitions

- Do not use different charger. Do not use cigarette jacks (in cars) for charging.
- Do not charge with constant current more than maximum charge current.
- Do not disassemble or reconstruct the battery.
- Do not throw or cause impact.
- Do not pierce a hole in the battery with sharp things. (such as nail, knife, pencil, drill)
- Do not use with other batteries or cells.
- Do not solder on battery directly.
- Do not press the battery with overload in manufacturing process, especially ultrasonic welding.
- Do not use old and new cells together for packing.
- Do not expose the battery to high heat. (such as fire)
- Do not put the battery into a microwave or high pressure container.
- Do not use the battery reversed.
- Do not connect positive(+) and negative(-) with conductive materials (such as metal, wire)
- Do not allow the battery to be immerged in or wetted with water or sea-water.