

Model	INR18650-25R	Version No.	1.0
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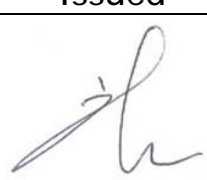

Specification of Product

- 1. Customer :
- 2. Product : Lithium-ion Rechargeable Cell
- 3. SDI Model : INR18650-25R
- 4. Approved by

Division			
Signature			
Date	/ /	/ /	/ /

5. Date of Application (YY/MM/DD) : 2016/04/15

6. Supplier : **SAMSUNG SDI Co., Ltd.**
Battery Business Division

Issued	Checked	Approved
		
Benjamin Han Assistant Engineer, CSG		Michael Rim Director, CSG

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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 lithium-ion rechargeable cell
- 2.2 Model name INR18650-25R
- 2.3 Site Manufactured in Korea, Malaysia & China

3. Nominal specifications (*1)

Item	Specification
3.1 Standard discharge capacity	Min. 2,500mAh - Charge: 0.5C(1.25A), 4.20V, 0.05C(125mA) cut-off@ RT - Discharge: 0.2C(500mA), 2.5V cut-off @ RT * 1C = 2,500mA
3.2 Rated discharge capacity	Min. 2,450mAh - Charge: 4A, 4.20V, CCCV 100mA cut-off @ RT - Discharge: 10A , 2.5V cut-off @ RT
3.3 Nominal voltage	3.6V
3.4 Standard charge	CCCV, 1.25A, 4.20V, 125mA cut-off
3.5 Rated charge	CCCV, 4A, 4.20V, 100mA cut-off
3.6 Charging time	Standard charge : 180min / 125mA cut-off (@ RT) Rated charge: 62min / 100mA cut-off (@ RT)
3.7 Max. continuous discharge	20A (@ RT)
3.8 Discharge cut-off voltage	2.5V (End of discharge)
3.9 Cycle life	Capacity \geq 1,500mAh @ after 250cycles (60% of the standard capacity @ RT) - Charge : 4.0A, 4.20V, CCCV 100mA cut-off @ RT - Discharge: 20A , 2.5V cut-off @ RT
3.10 Recovery characteristics	Capacity recovery(after the storage) \geq 1,960mAh (80% of the rated capacity @ RT) - Charge : 4A, 4.20V, CCCV 100mA cut-off @ RT - Storage : 30 days (@ 60°C) - Discharge : 10A , 2.5V cut-off @ RT

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Item	Specification
3.11 Cell weight	45.0g max
3.12 Cell dimension	Height : Max. 65.00 mm Diameter : Max. 18.40 mm
3.13 Operating temperature(*2)	Charge : 0 to 45°C (Ambient) Discharge: -20 to 60°C (Ambient)
3.14 Storage temperature(*3)	1 year 0~23°C 3 months 0~45°C 1 month 0~60°C

Note (*1): Protection function of the battery pack should be set within the specified charge, discharge and temperature range in the Cell Specification.

Note (*2): Discharge OTP(over temp. protection) should not be over 70°C of the cell surface temperature. Protection set should be based on the location of the cell surface with the highest temp increase part of the battery pack.

Note (*3): If the cell is kept as ex-factory status (30% of charge), the capacity recovery rate is more than 80%.

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4. Outline dimensions

See the attachment (Fig. 1)

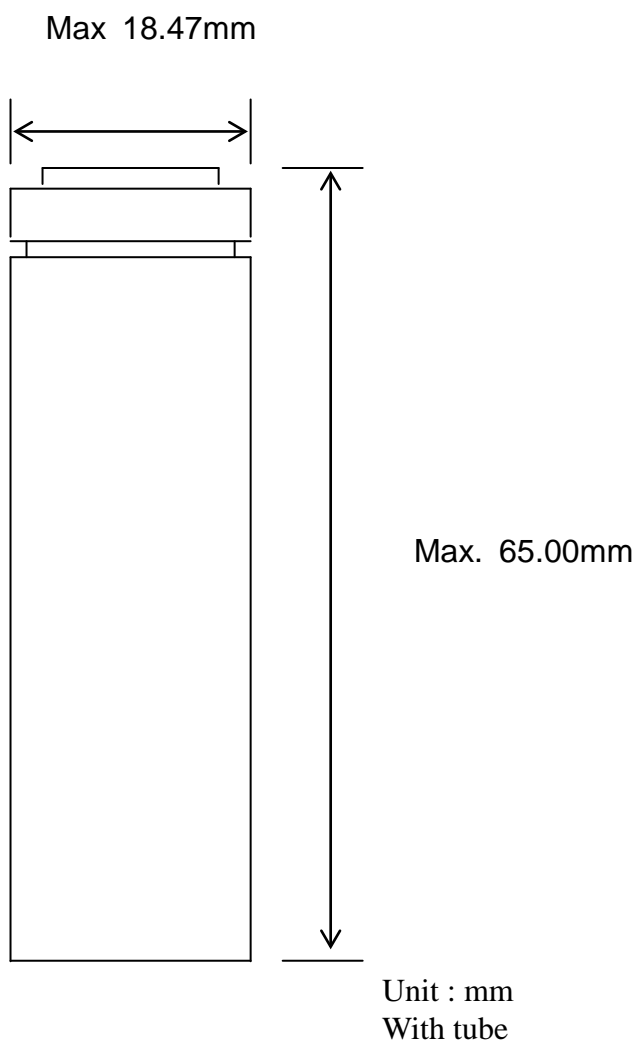


Fig.1. Outline dimensions of INR18650-25R

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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 $23\pm 3^{\circ}\text{C}$ (@ RT) and humidity under 65%.

6.2 Measuring equipment

(1) Amp-meter and volt-meter

The amp-meter and volt-meter should have an accuracy of the grade 0.5mA and mV 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 CCCV with charge current 0.5C (1,250mA), constant voltage 4.2V and 125mA cut-off in CV mode at 23°C for capacity.

7.2 Rated charge

Rated charge means charging the cell CCCV with charge current 4A and 100mA cut-off at 23°C

7.3 Standard discharge capacity

The standard capacity is the initial discharge capacity of the cell, which is measured with discharge current of 0.2C(500mA) with 2.5V cut-off at 23°C within 1hour after the standard charge.

Standard discharge capacity $\geq 2,500\text{mAh}$
Which complying to the minimum capacity of IEC61960 standard.

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7.4 Rated discharge capacity

The rated capacity is the discharge capacity of the cell, which is measured with discharge current of 10A with 2.5V cut-off at 23°C within 1hour after the rated charge.

$$\text{Rated discharge capacity} \geq 2,450\text{mAh}$$

7.5 Initial internal impedance

Initial internal impedance measured at AC 1kHz after standard charge

$$\text{Initial internal impedance} \leq 18\text{m}\Omega$$

7.6 Temperature dependence of discharge capacity

Capacity comparison at each temperature, measured with discharge constant current 10A and 2.5V cut-off after the rated charge is as follows.

Discharge temperature	
23°C	60°C
100%	100%

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 Rated discharge capacity at 23°C (=2,450mAh) is 100%.

7.7 Temperature dependence of charge capacity

Capacity comparison at each temperature, measured with discharge constant current 10A and 2.5V cut-off after the rated charge is as follows.

	Charge temperature		Discharge temperature
	23°C	50°C	
Relative capacity	100%	95%	23°C

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 Rated discharge capacity at 23°C (=2,450mAh) is 100%.

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7.8 Discharge rate capabilities

Discharge capacity is measured with the various currents in under table and 2.5V cut-off after the rated charge.

	Discharge condition		
Current	5A	10A	20A
Relative Capacity	97%	100%	95%

Note: Percentage as an index of the Rated discharge capacity at 23°C (=2,450mAh) is 100%.

7.9 Cycle life

With rated charge and maximum continuous discharge.
Capacity after 250cycles,

Capacity \geq 1,500mAh (60% of the standard capacity at 23°C)

7.10 Recovery characteristics

Capacity after storage for 30 days at 60°C from the rated charge,
measured with discharge current 10A with 2.5V cut-off at 23°C.

Capacity recovery(after the storage) \geq 1,960mAh (80% of the rated capacity at 23°C)

7.11 Status of the cell as of ex-factory

The cell should be shipped in 3.43V ~ 3.58V Charging voltage range

8. Mechanical Characteristics

8.1 Drop test

Test method: Fully rated charged Cells drop onto the concrete floor from 1.0m height at a random direction 3 times. The cells or batteries are dropped so as to obtain impacts in random orientations. After the test, the sample shall be put on rest for a minimum of one hour and then a visual inspection shall be performed.

Criteria: No fire, no explosion.

Drop test shall be performed with the IEC62133 standard

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8.2 Vibration test

Test method: As to the UN transportation regulation (UN38.3), for each axis (X and Y axis with cylindrical cells) 7Hz→200Hz→7Hz for 15min, repetition 12 times totally 3hours, the acceleration 1g during 7 to 18Hz and 8g (amplitude 1.6mm) up to 200Hz.

Criteria: No leakage, with less than 10% of OCV drop
Vibration test shall be performed with the UN38.3 standard

9. Safety

9.1 Overcharge test

Test method: Cell is to be discharged at a constant current of 0.5A to 2.5V. The cell is then to be charged with a 20V and 20A. Charging duration is to be 7 h.

Criteria: No fire, and no explosion.
Overcharge test shall be performed with the UL1642 standard

9.2 External short-circuit test

Test method: Fully rated charged cell is to be short-circuited by connecting the positive and negative terminals of the battery with a circuit load having a resistance load of $80 \pm 20 \text{ m}\Omega$. The battery is to discharge until a fire or explosion is obtained, or until it has reached a completely discharged state of less than 0.2 V and the battery case temperature has returned to $\pm 10^\circ\text{C}$ of ambient temperature. The return to near ambient of the battery (cell) casing in an indication of ultimate results.
Tests are to be conducted at $20 \pm 5^\circ\text{C}$ and at $55 \pm 5^\circ\text{C}$.

Criteria: No fire, and no explosion.
External short-circuit test shall be performed with the UL1642 standard

9.3 Forced discharge test

Test method: A discharged cell is subjected to a reverse charge at 1.0C (2.5A) for 90 min.

Criteria: No fire, and no explosion.
Forced discharge test shall be performed with the IEC62133 standard

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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 30 min..

Criteria: No fire, and no explosion.

Heating test shall be performed with the UL1642 standard(10 min) & GB31241 standard(30 min).

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 (3 months or more), It is strongly recommended that the cell is preserved at dry and low-temperature.

11.2 Others

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