Cell Specification

INR 18650 22E

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INR 18650 22E
Cylindrical Lithium Ion Cell

1. Scope

This product specification has been prepared to specify the rechargeable lithium-ion cell ('cell') to be supplied to the Customer by TerraE.

2. Description and Model

2.1	**Description**	Cell (lithium-ion rechargeable cell)
2.2	**Model Name**	INR 18650 22E

3. General Specifications

3.1	**Nominal Capacity**	2200mAh (standard charge / 440mA discharge, 2.75V cut-off)
3.2	**Minimum Capacity**	2100mAh (the cut-off discharge at 2.75 V when the discharge current is 440mA)
3.3	**Iternal Impedance AT 1000 HZ**	≤20 (mΩ) (25 ± 3°C)
3.4	**Charging Voltage**	4.2V
3.5	**Nominal Voltage**	3.7V
3.6	**Charging Method**	CC-CV (44mA cut-off)
3.7	**Maximum Charge Voltage**	4.20 ± 0.03V
3.8	**Charging Current**	Standard charge: 1100mA Rapid charge: 2200 mA Standard charge : 120 minutes
3.9	**Charging Time**	Rapid charge: 60 minutes (at 25 ± 2°C)
3.10	**Max. Discharge Current (Continuous)**	15A (25C± 3°C)
3.11	**Discharge Cut-Off Voltage**	2.75V
3.12	**Cell Weight**	45.0g max.
3.13	**Cell Dimension**	Height ≤65.10mm Diameter: ≤18.55mm
3.14	**Operating Temperature (Surface Temperature)**	Charge : 0<T≤10°C 440mA 10<T≤20°C 1100mA 20<T≤45°C 2200mA Discharge: -20<T≤75°C
3.15	**Storage Temperature**	1 month: -20 ~ 60°C (*) 3 month : -20 ~ 45°C (*) 1 year: -20 ~ 25°C (*)
3.16	**Storage Humidity**	≤60%RH
3.17	**Weight**	≤49g

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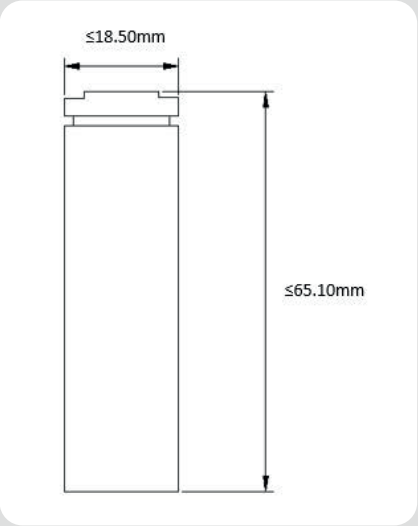
4. Outline Dimension with Tube (Unit: mm)

Attached 1: Outline Dimensions of INR 18650 22E



5. Cell Marking

Attached 2: Standard Marking

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6. Appearance

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

7. Test Condition and Definitions

7.1 Measuring Equipment

7.1.1	**Charge/Discharge Machine**	Voltage precision: ± 10mV Current precision: ± 0.2%
7.1.2	**Slide Caliper**	The slide caliper should have a scale of 0.01mm.
7.1.3	**Voltage-Impedance Meter**	Impedance precision: ± 0.5mΩ Voltage precision: ± 1mV The impedance meter should be operated at AC 1kHz

7.2 Unless otherwise specified, all tests shall be performed at 25 ± 3°C and humidity of 65 ± 20% RH. The cells used for the test mentioned should be delivered within a week.

7.3 Definition

C Rate ("C"):
The rate (milliamperes) at which a fully charged cell is discharged to its end voltage in one (1) hour.

8. Electrical Characteristics

8.1 Standard Charge
This „Standard charge" means charging the cell with constant current 0.5C and then with constant voltage 4.2V 44mA cut-off at 25 ± 3°C.

8.2 Standard Discharge Capacity
The standard discharge capacity is the initial discharge capacity of the cell, which is measured with discharge current of 440mA with 2.75V cut-off at 25 ± 3°C after the standard charge. Standard discharge capacity≥ 2100 mAh

8.3 Standard Rated Discharge Capacity
The standard discharge capacity is the initial discharge capacity of the cell, which is measured with discharge current of 1C with 2.75V cut-off at 25 ± 3°C after the standard charge. Standard discharge capacity≥ 1911 mAh

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8.4 Temperature Dependence of Discharge Capacity

Capacity comparison at each temperature, measured with discharge constant current 2200 mA and 2.75V cut-off after the standard charge is as follows.has tapered to 0.05C.

Temperature	Available Capacity
-20°C	50%
-10°C	60%
0°C	70%
25°C	91%
60°C	91%

Note: If charge temperature and discharge temperature is not the same, the interval for temperature change is three (3) hours. Percentage as an index of the capacity at 25°C (=2100 mAh) is 100%.

8.5 Charge Rate Capabilities

Charge capacity defines as charging the cell with constant current and then with constant voltage 4.2V 100mA cut-off at 25±3°C, charge capacity by different current shows below.

Charge Condition		
Current	1100mA	2200mA
Relative Capacity	100%	97%

Note: Percentage as an index of the capacity at 25°C (= 2100 mAh) is 100%.

8.6 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	0.44A	1A	5A	10A	15A
Relative Capacity	100%	91%	93%	95%	90%

Note: Percentage as an index of the capacity at 25°C (= 2100 mAh) is 100%.

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8.7 Cycle Life
Each cycle is an interval between the standard charge at 25±3 °C, rest 10 minutes, and then discharge (discharge current 15A) to 2.75 V, and rest 30 minutes again. After 250 cycles, the capacity is higher than 80% of the first discharge capacity.

8.8 Storage Characteristics
Storage for 30 days at 25 ± 3°C from the standard charge, measured with discharge constant current 440 mA with 2.75V cut-off at 25°C. Capacity retention (after the storage) ≥ 90% of the standard discharge capacity at 25°C.

8.9 Status of the Cell as of Ex-Factory
The cell should be shipped in 60% charged state. In this case, OCV is from 3.500 V to 3.750 V

9 Mechanical Characteristics

9.1 Vibration Test
After standard fully charge, cell shall be attached to a vibration table directly and subjected to vibration that consists of 10 Hz to 55 Hz to 10 Hz at the speed of 1Hz/min in 90~100 mins. The total excursion of the vibration is 0.8mm(0.060 inches). The cell shall be vibrated in each direction along axis of the cylinder and the vertical directions of axis of the cylinder.
Criteria: No leakage

9.2 Mechanical Shock
In direction X, Y, and Z intersecting one another at right-angles, apply impacts having a minimum mean acceleration of 75 G in the first 3mSec and a peak acceleration that falls between 125 G and 175 G.
Criteria: No leakage, no fire, no explosion

10. Safety

10.1 Abnormal Charging Test
Cell fully discharged, then overcharged with 3 C to 10 V. Monitoring cell temperature during testing. Stop the test when cell temperature decays to room temperature.
Criteria: No fire and no explosion

10.2 Over-Discharge Test
After standard charge, it is to be over-discharged with 1C for 90mins.
Criteria: No fire and no explosion

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10.3 Short-Circuit Test
After standard charge, short-circuit the cell at 20°C±5°C until the cell temperature returns to ambient temperature.(cross section of the wire or connector should be less than 100 mΩ).
Criteria: No fire and no explosion

10.4 Crush Test
After standard charge, cell is to be crushed between two flat surfaces and with cell longitudinal axis parallel to the flat surfaces of the crushing apparatus. The crushing is to be continued until apressure reading of 2500 psig(17.2 MPa) is reached on the hydraulic ram, applied force of 3000 pounds (13 kN). Once themaximum pressure has been obtained it is to be released.
Criteria: No fire and no explosion

10.5 Heating Test
After standard charge, cell is to be placed in the hot oven. Store the testing cells connecting with thermocouple in constant temperature box, heating the cells and box (speed of ascending temperature is 5 ±2 ºC per min) together at room temperature simultaneity, monitor the temperature change of the box, keep for 10 minutes after the box temperature reaches 130 ±2ºC,then stop the test.
Criteria: No fire and no explosion

10.6 Free Fallin (Drop)
Each fully charged cell is dropped three times from a height of 1.0m onto a concrete floor. The cells are dropped so as to obtain impacts in random orientations
Criteria: No fire and no explosio#n

11. Warranty

11.1 The warranty period of a Cell is one (1) year after the delivery to the Customer. However, even though the problem occurs within this period, TerraE won't replace a new cell for free as long as the problem is not due to the failure of TerraE manufacturing process or the problem is due to Customer's abuse or misuse.

11.2 TerraE will not be responsible for trouble occurred by handling outside of the precautions in safety instructions.

11.3 TerraE will not be responsible for packing, trouble occurred by matching electric circuit, cell pack and charger.

11.4 TerraE will be exempt from warrantee any defect cells during assembling after acceptance by the Customer.

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12. Others

12.1 Storage for a long Time

If the storage time is more than one month, it should be stored in an environment where the temperature is between 20-25°C and the humidity is less than 60% RH and there is no corrosive gas. The batteries should be stored with state of charge 30-50% . We recommend to charge the batteries once per year to prevent over discharging.

12.2 Others

Any matter not included in that specification should be discussed and confirmed by both parties.

13. Packing

Small box 10 X 10 cells

14. Shipping

The capacity of delivery cell is approximately at 60% of charging. Due to the self-discharge, it is not specified more than 60% capacity remain at customer, during transportation, keep the cell from acutely vibration, impacting, solarization, drenching.

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The following caution and warning should appear in manuals and/or instructions for users, especially at the point of use.

Handling Instructions for Lithium Ion Rechargeable Cell

1. Charging Electric Car, Charger and Battery Pack Design Considerations

1.1 Charging voltage must be set 4.2V/cell. Concerning charge voltage tolerance of charger, charging voltage must be set below 4.25V/cell. Even if the charge could be out of order, charge voltage of charger should not be above 4.25V/cell to avoid over-charging. Cell life will be shorten by charging voltage above 4.25V, leading to cell failure, serious can appear safety problems.

1.2 Cell must be charged with CC (constant current) - CV (constant voltage) method. Do not use the continuous charging method.

1.3 In case of cell voltage is below 3.0V, Cell should be charged with pre-charge that current is below 200mA. Then cell voltage reach over 3.0V, standard charge starts. And if cell voltage never reaches to 3.0V in specified period (timer), charger will stop charging.

1.4 By timer, current detection and open circuit voltage detection, charger detects full charge. When charger detect cell is full charged, charger stop charging.

2. Discharging

2.1 The discharge current of a cell must be below specified in the product specification.

2.2 The discharge end voltage of a cell must be over specified in the product specification.

2.3 The cell should not be over-discharged below 2.0V.

2.4 The cell should be discharged within a range of temperatures specified in the product specification.

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3. Storage

3.1 The cell should be stored in a dry area and no corrosive gas.

3.2 No press on the cell.

3.3 When stored within 1 month : -20°C ~ +60°C
When stored within 3 months: -20°C ~ +45°C
When stored within 12 months : -20°C ~ +25°C

3.4 After the cell assembled in pack, the pack should be recharged to 60% SOC if the pack has never been used for one (1) year, this will avoid the cell voltage drop too low.

4. Cycle Life

4.1 Charge or discharge out of recommended range might cause the generating heat or serious damage of cell. And also, it might cause the deterioration of cell's characteristics and cycle life.

4.2 **Cycle Life Performance**
The cell can be charged/ discharged repeatedly up to times with a certain level of capacity specified in the production specification.

4.3 Cycle life may be determined by conditions of charging, discharging, operating temperature and storage.

5. Precautions on Battery Pack Design

5.1 Do not make the shape and mechanism which static electricity and water easy go through the battery pack inside.

5.2 Overcharge protection should work below 4.25 V/cell by charge. Then charge current shall be shut down.

5.3 Within a voltage range of 2.75V/cell, over-discharge protection should work. Then discharge current shall be shut down and consumption current is below 1μA.

5.4 When discharge current exceeds 60A, over-discharge current protection should work. Then over discharge current shall be shut down.

5.5 To avoid discharging during storage, design the low consumption current electronic circuit (e.g. Protection circuit, fuel gauge, etc) inside battery pack.

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6. Battery Pack Assembly

6.1 Prohibition of usage of damaged cell. Do not use abnormal cell which has been damaged by shipping stress, drop, short, twice spot or something else, and which gives off electrolyte odor.

6.2 The cell should be inspected visually before battery assembly.

6.3 Inspect voltage and internal impedance before using.

6.4 Do not solder onto a cell in order to avoid damage on the cell. Weld spot welding lead plate onto cell, and solder lead wire or lead plate.

6.5 The battery assembly must pay attention to anti-static, Avoid electronic components damaged by electrostatic.

6.6 Battery assembly should pay attention to prevent the short circuit.

Safety Instruction

Lithium-ion battery if use undeserved can cause cell damage and even harm the personal safety, read it carefully before using and pay attention to the prevention measures. Should there be any additional information required by the Customer, please contact BMZ Germany GmbH,
Zeche Gustav 1, 63791 Karlstein.

Danger

1. Electrical Misusage

1.1 Use or charge the battery only in the stipulated application.

1.2 Use the correct charger for Lithium-ion batteries.

1.3 When connecting a battery pack to a charger, ensure correct polarity.

1.4 Do not reverse charge batteries.

1.5 Do not maintain secondary batteries on charge when not in use.

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2. Environmental Misusage

2.1 Never put a battery into water or seawater.

2.2 Don't throw the battery into the fire.

2.3 Do not use or leave the cell under the blazing sun (or in heated car by sunshine). The cell may generate heat, smoke or flame. And also, it might cause the deterioration of cell's characteristics or cycle life.

2.4 Do not dismantle, open or shred cells. Batteries should be dismantled only by trained personnel. Multicell battery cases should be designed so that they can be opened only with the aid of a tool.

2.5 Do not solder directly to batteries.

2.6 Do not subject batteries to adverse condition such as extreme temperature, deep cycling and excessive overcharge/over discharge.

2.7 Do not short-circuit batteries. Do not store batteries haphazardly in a box or drawer where they may short-circuit each other or be short-circuited by conductive materials, permanent damage to batteries may result.

2.8 Do not incinerate or mutilate batteries, may burst or release toxic material.

2.9 Do not subject batteries to mechanical shock.

Warning

1.1 When using a new battery or a battery to be used for the first time after long term storage, please fully charge the battery before using.

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

1.3 Do not mix our batteries with other battery brands or batteries of a different chemistry such as alkaline and zinc carbon.

1.4 Do not mix new batteries in use with semi-used batteries, over-discharge may occur.

1.5 If find any noise, excessive temperature or leakage from a battery, please stop its use.

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1.6 When the battery is hot, please do not touch it and handle it, until it has cooled down.

1.7 Do not remove the outer sleeve from a battery pack nor cut into its housing.

1.8 When find battery power down during use, please switch off the device to avoid over discharge.

1.9 After using, if the battery is hot, before recharging it, allow it to cool in a well-ventilated place out of direct sunlight.

1.10 Do not attempt to take batteries apart or subject them to pressure or impact. Heat may be generated or fire may result. The alkaline electrolyte is harmful to eyes and skin, and it may damage clothing upon contact.

1.11 Never put a battery into water or seawater.

1.12 Keep the battery away from babies and children. If swallowed, see a doctor immediately.

1.13 In the event of a cell leaking, do not allow the liquid to come into contact with the skin or eyes. If contact has been made, wash the affected area with copious amounts of water and seek medical advice.

CAUTION

1.1 When not using a battery, disconnect it from the device.

1.2 Unplug a battery by holding the connector itself and not by pulling at its cord.

1.3 Used batters should be treated by authorized units.

1.4 After extended periods of storage, it may be necessary to charge and discharge the batteries several times to obtain maximum performance.

1.5 Secondary batteries give their best performance when they are operated at normal room temperature.

1.6 Keep batteries clean and dry.

1.7 Wipe the battery terminals with a clean dry cloth if they become dirty.

1.8 When disposing of secondary batteries, keep batteries of different electrochemical systems separate from each other.

Any questions?

Contact us, we will be pleased to advise you.

A full load of advantages

Customized cells tailored to your individual requirements with the best choice in Li-Ion technology for the coming development.

- One-Stop Shop
- Customized
- High Quality
- More Power
- High Energy

Headquarter Germany

TerraE GmbH
Zeche Gustav 1
63791 Karlstein am Main

+49(0) 6188-9956-0
info@terrae.com
www.terrae.com

Power – the result of a better battery