



Approval Sheet

Lithium-Ion Rechargeable Battery

Attend to: 能寶

Product: Cell Pack

Model: INR-18650-M35A

Doc #: INR18650M35A-02 Rev.: 0.1 Date: 10/21/2019

Accepted by Customer

Title:

Signature:
(Date)

E-One Moli Energy Corp.

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| Approved by (Date) | Check by (Date) | Check by (Date) | Check by (Date) | Originator (Date) |
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Name Cell Specifications of INR-18650-M35A

| | | | | | |
|--------------|---------------------|------|-----|------|---------|
| Document No. | INR18650M35A-0 2 | Ver. | 0.1 | Page | 1 of 14 |
|--------------|---------------------|------|-----|------|---------|

TABLE OF CONTENTS

1. SCOPE 2 2.

PRODUCT DESCRIPTION 2 3.

APPEARANCE 3 4.

RATED SPECIFICATIONS 3 5.

PERFORMANCE 4 6.

REGULATORY COMPLIANCE 8 7.

PRECAUTIONS FOR USING LITHIUM ION RECHARGEABLE CELL 8 8.

REQUIREMENT FOR BATTERY PACK DESIGN 13 9.

WARRANTY OF CELL 13 10.

SHIPPING STATE OF CELL 13 11.

PACKING SPECIFICATION 14 12.

AMENDMENT OF SPECIFICATION CONTENT 14

-- CONFIDENTIAL --

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Document

Name Cell Specifications of INR-18650-M35A



| | | | | | |
|--------------|---------------------|------|-----|------|---------|
| Document No. | INR18650M35A-0 2 | Ver. | 0.1 | Page | 2 of 14 |
|--------------|---------------------|------|-----|------|---------|

1. SCOPE

This specification defines the characteristics of a lithium ion rechargeable cell, INR-18650-M35A, 3.5 Ah, designed and manufactured by E-One Moli Energy Corp.

2. PRODUCT DESCRIPTION

2.1 Cell Name

Lithium ion rechargeable cell ('cell')

2.2 Cell Model

INR-18650-M35A

2.3 Cell designation: INR19/66

2.4 Cell Construction

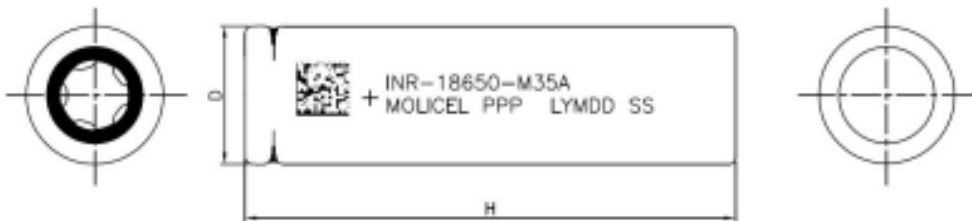
2.4.1 Shape: Cylindrical


2.4.2 Outline Dimensions (refer to 2.4.3 finished cell drawing)

Outline Dimensions (mm) Weight (g)

| Diameter [D] Height [H] | | |
|-------------------------|-----------------|------------|
| 18.30 ± 0.30 mm | 65.05 ± 0.15 mm | 48.0 (Max) |

2.4.3 Finished Cell Drawing



2Dimensional code: , includes (PPP LYMDD SS)

Cell Date Code: YMDDSS

Y: indicates calendar year, 9=2009, A=2010, B=2011, C=2012, D=2013, E=2014, F=2015, G=2016, H=2017, I=2018 etc.

M: indicates calendar month, 1~9, 10=A, 11=B, 12=C

DD: indicates calendar date of a month, 01~31

SS: indicates the sequence number in a day, 01, 02, etc.

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Document

Name Cell Specifications of INR-18650-M35A

| | | | | | |
|--------------|---------------------|------|-----|------|---------|
| Document No. | INR18650M35A-0 2 | Ver. | 0.1 | Page | 3 of 14 |
|--------------|---------------------|------|-----|------|---------|

3. APPEARANCE

There shall be no visual defects such as dent, rust, deformation or leakage.

4. RATED SPECIFICATIONS

Items Specifications Remarks

1 Rated charge Limiting 1.7A and constant 4.2V charge for 2.5h or 100mA at 23 °C. 2 Rated discharge Constant 0.68A discharge until 2.5V at 23 °C.

3 Rated capacity 3.35Ah (Minimum) 3.45Ah (Typical) Rated discharge capacity after rated charge.

4 Nominal voltage 3.6V Mean voltage during rated discharge after rated charge.

5 Shipping voltage ≥ 3.45V Nominal approximate state of charge ≤ 30%. 6 Internal resistance ≤ 35mΩ Fresh cell measured by AC impedance at 1kHz

7 End of charge voltage 4.20 ± 0.05V

8 End of discharge voltage 2.5V Discharge voltage for determination of rated capacity.

9 Charging time 150 min Rated charge.

10 Maximum charging current

10 A Cycle life is reduced at high rates.

Maximum discharging current

1.7 A See Section 4.14

4.14 Discharging -40 ~ 60 °C

11 Operating temperature

Charging 0 ~ 60 °C See Section

12 Storage temperature for shipping cell 23 °C for long term storage.

< 35 °C Recommended temperature less than

| | | |
|------------|--------|------------------|
| Shelf life | 1 year | See Section 5.4. |
|------------|--------|------------------|

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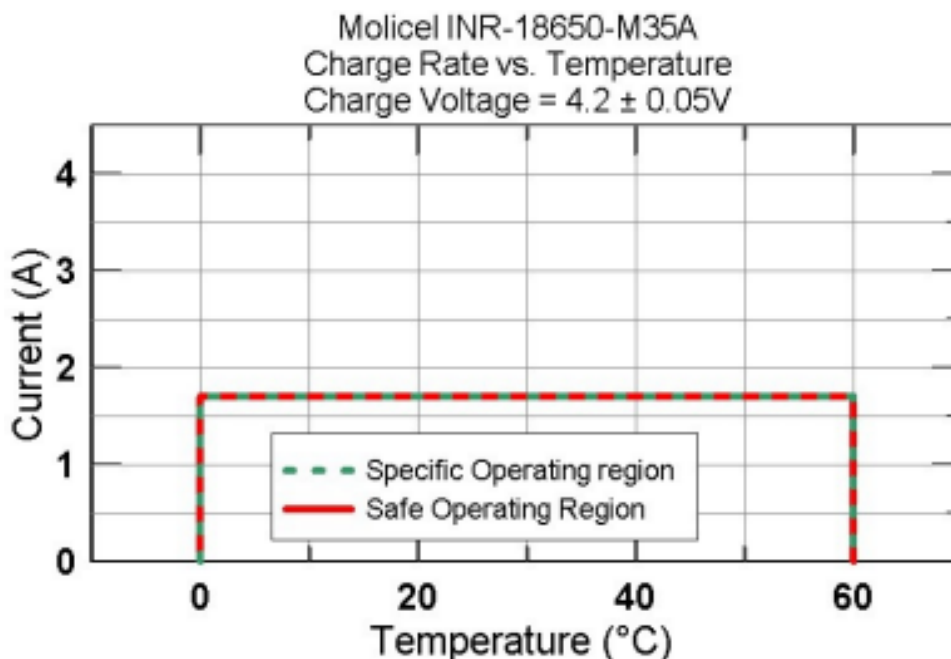
Document

Name Cell Specifications of INR-18650-M35A



| | | | | | |
|--------------|---------------------|------|-----|------|---------|
| Document No. | INR18650M35A-0 2 | Ver. | 0.1 | Page | 4 of 14 |
|--------------|---------------------|------|-----|------|---------|

4.14 Maximum charge current versus cell surface temperature.



5. PERFORMANCE

5.1 Standard Test Conditions

5.1.1 Tolerance on temperatures is $\pm 2^{\circ}\text{C}$. All tests performed at a relative humidity between 45% and 85% unless noted otherwise.

5.1.2 3 hours minimum soak time at specified temperature prior to discharging. 5.1.3 The accuracy of measuring equipment (voltmeter and ammeter, etc.) shall be higher than class 0.5.

5.1.4 1.7A cycling: 1.7A charge to 4.2V for 100mA and 1.7A discharge to 2.5V, rest 10 minutes between discharge and charge.

5.1.5 3.4A cycling: 1.7A charge to 4.2V for 100mA and 3.4A discharge to 2.5V, rest 10 minutes between discharge and charge.

5.1.6 6.0A cycling: 1.7A charge to 4.2V for 100mA and 6.0A discharge to 2.5V, rest 10 minutes between discharge and charge.

5.1.7 For incoming inspection purpose, the cells should be used in the tests within one week of receipt at customer.

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Document

Name Cell Specifications of INR-18650-M35A



| | | | | | |
|--------------|---------------------|------|-----|------|---------|
| Document No. | INR18650M35A-0 2 | Ver. | 0.1 | Page | 5 of 14 |
|--------------|---------------------|------|-----|------|---------|

5.2 Electrical Performance

| Item | Condition | Capacity | Test Method |
|-----------------------------|-----------|----------|---|
| | | 0.68 A | $\geq 3.35\text{Ah}$ Discharge capacity to 2.5V after rated charge (4.1). |
| | | 1.7 A | $\geq 3.30\text{Ah}$ Discharge capacity to 2.5V after rated charge |
| 1 | 2 | 10 A | $\geq 3.00\text{Ah}$ Discharge capacity to 2.5V after rated charge (4.1). |
| | | 45 °C | $\geq 3.35\text{Ah}$ Discharge capacity to 2.5V after rated charge at 23 °C (4.1). |
| | | 0 °C | $\geq 3.10\text{Ah}$ Discharge capacity to 2.5V after rated charge at 23 °C (4.1). |
| Discharge Capacity at 23 °C | | 3.4 A | $\geq 3.20\text{Ah}$ Discharge capacity to 2.5V after rated charge (4.1). |
| | | 6 A | $\geq 3.10\text{Ah}$ Discharge capacity to 2.5V after rated charge (4.1). |
| | | -20 °C | $\geq 2.70\text{Ah}$ Discharge capacity to 2.5V after rated charge at 23 °C. (4.1). |



| | | |
|--------|----------------------|---------------------|
| -30 °C | $\geq 2.00\text{Ah}$ | Discharge at 23 °C. |
|--------|----------------------|---------------------|

5.3 Cycle Life

| Item | Condition | Criterion | Test Method |
|------|-----------|-----------------------|---|
| 1 | 23°C | 1.7A C500 $\geq 70\%$ | 2 23°C |
| | | 3.4A C500 $\geq 70\%$ | Per 5.1.4, 1.7A cycling at 23°C to 500 cycles. The % = (Ah / 3.30) x 100% |
| | | | Per 5.1.5, 3.4A cycling at 23°C to 500 cycles. The % = (Ah / 3.30) x 100% |

| | | | | |
|---|--------------|------|-------------|--|
| 3 | 23°C 6.0A | C500 | $\geq 60\%$ | Per 5.1.6 6.0A cycling at 23°C to 500 cycles. The % = (Ah / 3.10) x 100% |
|---|--------------|------|-------------|--|



Document

Name Cell Specifications of INR-18650-M35A

| | | | | | |
|--------------|---------------------|------|-----|------|---------|
| Document No. | INR18650M35A-0 2 | Ver. | 0.1 | Page | 6 of 14 |
|--------------|---------------------|------|-----|------|---------|

5.4 Storage Performance (SOC: State of Charge)

Item Condition Capacity Retention Test Method

1 23 °C 1 month
SOC ≥ 25% After storage, rated discharge (4.2) and rated 30% charge (4.1) for two cycles. The retention discharge after storage.
2 23 °C 3 months
30% SOC ≥ 20% capacity (Ah) is defined at 1st The % = (Ah / 3.35) x 100%

| | | | | |
|---|-------------------|---------|-------|--|
| 3 | 23 °C 6 months | 30% SOC | ≥ 15% | |
|---|-------------------|---------|-------|--|

5.5 Safety Performance

5.5.1 Environmental Endurance Performance

Items Criteria Conditions

1 Temperature Shock and 85 °C for 1h, transfer time within 10 seconds. Repeat cycle 10 times.
No fire or explosion Storage: -45 °C for 1h
2 Heating No fire or explosion At 100% SOC heat cell up in gravity convection and/or circulating air oven. Oven temperature is to be raised at a rate of 5°C (□ 2°C) per minute to a temperature of 130°C (□ 2°C). Hold oven at 130°C for 10 minutes.

| | | |
|--|--------------|--|
| | Thermal test | Mass loss <0.1%, No leakage, venting, explosion, fire, disassembly, or rupture. |
|--|--------------|--|

| | | | |
|---|---------------|--|--------------------------------------|
| 1 | Short Circuit | No disassembly, rupture or fire within 6 hours of test. Max temp: □ 150°C. | Whil reac exte temp metr |
|---|---------------|--|--------------------------------------|

5.5.2 Electrical Endurance Performance -- CONFIDENTIAL --

Items Criteria Conditions

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Document

Name Cell Specifications of INR-18650-M35A

| | | | | | |
|--------------|---------------------|------|-----|------|---------|
| Document No. | INR18650M35A-0 2 | Ver. | 0.1 | Page | 7 of 14 |
|--------------|---------------------|------|-----|------|---------|

Overcharge No fire or explosion Charging at a current of 10.2A to 15V from the fully 2 charged state for 2.5hrs.

| | | | |
|---|------------------|--|--|
| 3 | Forced Discharge | No disassembly and no fire within 7 days of test | Connect cell in series with a 12V DC power supply at a current equal to maximum discharge specified. (UN method) |
|---|------------------|--|--|

5.5.3 Mechanical Endurance Performance

Items Criteria Conditions

Crush No fire or explosion Crush between two flat plates. Applied force is 1 about 13KN.

| | | | |
|---|--------|----------------------|---|
| 2 | Impact | No fire or explosion | Impact by 15.8mm□ bar with 9.1kg weight dropped from 61cm height on the flat surface. |
|---|--------|----------------------|---|

5.6 Environmental Reliability

Items Criteria Conditions

Shock No leakage, mass 1
loss, no venting,
disassembly, no
rupture and no fire.
90% voltage

recovery
Drop No visible
2
electrolyte leakage,
no temperature
rising.

Vibration No leakage, mass 3
 loss, no venting,
 disassembly, no
 rupture and no fire.
 90% voltage
 recovery
 Subject to 6 shocks/axis, 18 total, of peak
 acceleration of 150g and pulse duration of 6
 ms. (UN method)

3 times each for bottom, side and header
 orientations (total=9 drops).

Subject to 7↔200Hz / 15 min vibration, 12x15
 min /3 axes at amplitude of 0.8mm (1.6 mm
 total excursion). (UN method)

Drop from a height of 4ft onto a concrete floor

| | | | |
|---|------------------------------|---|--|
| 4 | High Altitude Exposure | No leakage, weight loss, no vent, fire or explosion, 90% voltage recovery | Stored at a pressure of 11.6 kPa for 6 hrs at 20°C. (UN method) |
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Document

Name Cell Specifications of INR-18650-M35A



| | | | | | |
|-----------------|---------------------|------|-----|------|---------|
| Document No. | INR18650M35A-0 2 | Ver. | 0.1 | Page | 8 of 14 |
|-----------------|---------------------|------|-----|------|---------|

6. REGULATORY COMPLIANCE

6.1 Comply with UN Recommendations on the Transport of Dangerous Goods: Manual of
 Tests and Criteria.

7. PRECAUTIONS FOR USING LITHIUM ION RECHARGEABLE CELL The precautions
 described below are important to assure the performance and safety of designed pack.
 Mishandling may cause cell leakage, heat, smoke, explosion or fire. Please follow
 instructions carefully.

7.1 Intended Use

E-bike, E-scooter, EV, Medium power application

7.2 Handling Precautions

7.2.1 Charging

The lithium ion rechargeable cell is to be charged by “constant current/constant voltage” method. The lithium ion cell is charged at a constant current (CC Mode) until the cell voltage reaches a specific voltage, followed by a constant voltage charge (CV Mode) at the specific voltage. The charging current at this constant voltage tapers off. As long as the tapering current is down to a particular current, the charge process is deemed complete.

1) Charge voltage:

Do not exceed the specified charge voltage (4.2V per single cell). If the cells are used in battery packs, the maximum voltage is 4.2 x N (N= number of cells connected in series) V.

2) Charge current:

Charge the cell at the specified charge current listed in section 4.10 or less.

3) Charge temperature:

Charge the cell at the temperature range of 0 °C ~ 60 °C. Due consideration should also be given to the arrangement of the battery pack so that it is in that temperature range even though it is effected by heat generated from the cell charger.

7.2.2 Reverse charging:

The cell must be prevented from reverse-polarity charging.

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Document

Name Cell Specifications of INR-18650-M35A



| | | | | | |
|--------------|---------------------|------|-----|------|---------|
| Document No. | INR18650M35A-0 2 | Ver. | 0.1 | Page | 9 of 14 |
|--------------|---------------------|------|-----|------|---------|

7.2.3 Discharging

A lithium ion rechargeable cell starts to discharge at 4.2V and terminates at a cut off voltage of 2.5V.

1) Discharge current:

Discharge the cell at the specified discharge current listed in section 4.10 or less. In case a peak current of higher than maximum discharge current depending on the pulse interval may reduce the cell capacity.

2) Discharge temperature:

Discharge the cell at temperature range from -40°C to 60°C. At a temperature of -30°C or less, the cell will show a significant decrease in discharge capacity. The cell surface temperature must not exceed 80°C. Recommended thermal cut-off of 70°C at high rates.

3) Discharge termination voltage/Over discharge:

Avoid discharge to voltage less than 2.5V per single cell. A leakage current

to the equipment may over discharge the cell, which may damage the performance of cell.

7.2.4 Long-term Storage

- 1) In case of long-term storage, store the cell at $<23^{\circ}\text{C}$, low humidity, noncorrosive gas atmosphere.
- 2) When storing the cell for a long period longer than 1 year, charge it at least once 1 year. And in this case, the cell is recommended to be charged to 30% capacity.
- 3) Do not store cell in humid environment.

7.3 Safety Precautions

7.3.1 When using the cell

□WARNING

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Document

Name Cell Specifications of INR-18650-M35A



| | | | | | |
|--------------|---------------------|------|-----|--|-------|
| Document No. | INR18650M35A-0 2 | Ver. | 0.1 | | 10 of |
|--------------|---------------------|------|-----|--|-------|

- 1) Mishandling of a cell can lead to generation of heat, possible explosion or ignition and potential serious injury. Safe handling guidelines include the following:
 - (1) Do not expose cell to fire or heat.
 - (2) Do not install the cell backwards.
 - (3) Do not expose the cell to water or salt water, or allow the cell to get wet.
 - (4) Do not carry or store the cells together with necklaces, hairpins or other metal objects.
 - (5) Do not place the cells in microwave ovens, high-pressure containers, or on induction cookware.
 - (6) Do not connect the positive terminal and the negative terminal of the cell to each other with any metal objects such as chains, coins or wire.
 - (7)

Do not pierce the cell with nails, strike the cell with a hammer, step on the cell, or otherwise subject it to strong impacts or shocks.

- 2) Do not disassemble or modify the cell. The cell contains safety and protection devices, that if damaged, may cause the cell to generate heat, explode or ignite.
- 3) Do not place the cell in or near fire, stoves, or other high-temperature locations. Do not place the cell in direct sunshine or use or store the cell inside cars in hot weather. Doing so may cause the cell to generate heat, explode, or ignite. Using the cell in this manner may also result in a loss of performance and a shortened life expectancy.

4) Venting device description

Safety Valve: Allowing controlled release of pressure in the event of excessive internal gas build up.

TOP VIEW

□ CAUTION

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Document

Name Cell Specifications of INR-18650-M35A



| | | | | | |
|--------------|---------------------|------|-----|--|-------|
| Document No. | INR18650M35A-0 2 | Ver. | 0.1 | | 11 of |
|--------------|---------------------|------|-----|--|-------|

- 1) If the device is to be used by small children, the caregiver should explain the contents of the user's manual to the children. The caregiver should provide adequate supervision to ensure that the device is being used as explained in the user's manual.
- 2) When the cell is worn out, insulate the terminals with adhesive tape or similar materials before disposal.
- 3) Immediately discontinue use of the cell if, while using, charging, or storing the cell, the cell emits an unusual smell, feels hot, changes color, changes shape, or appears abnormal in any other way. Contact your sales location or E-One Moli Energy if any of these problems are observed.
- 4) In the event that the cell leaks and the fluid get into one's eye, do not rub the eye. Rinse well with water and immediately seek medical care. If left untreated the cell fluid could cause damage to the eye.

7.3.2 When charging the cell

□ WARNING

- 1) Be sure to follow the rules listed below while charging the cell. Failure to do so may cause the cell to become hot, explode, or ignite and cause serious injury.
 - (1) Do not attach the cell to a power supply plug or directly to a car's cigarette lighter plug.
 - (2) When charging the cell, use a specified cell charger or ensure that the cell charging conditions specified by E-One Moli Energy are met.
 - (3) Do not place the cells in or near fire, or into direct sunlight. When the cell becomes hot, the built in safety equipment is activated, preventing the cell from charging further, and heating the cell can destroy the safety equipment and can cause additional heating, breaking, or ignition of the cell.
- 2) Do not continue charging the cell if it does not recharge within the specified charging time. Doing so may cause the cell to become hot, explode, or ignite.

□ CAUTION

- 3) The temperature range over which the cell can be charged is 0 °C to 60 °C. Charging the cell at temperatures outside of this range may cause the cell

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Document

Name Cell Specifications of INR-18650-M35A

| | | | | | |
|--------------|---------------------|------|-----|--|-------|
| Document No. | INR18650M35A-0 2 | Ver. | 0.1 | | 12 of |
|--------------|---------------------|------|-----|--|-------|



to become hot or malfunction. Charging the cell outside of this temperature range may also harm the performance of the cell or reduce the cell's life expectancy.

7.3.3 When Discharging the Cell

□ WARNING

- 1) Do not discharge the cell using any device except for the specified device. When the cell is used in unspecified devices it may damage the performance of the cell or reduce its life expectancy, and if the device causes an abnormal current to flow, it may cause the cell to become hot, explode, or ignite and cause serious injury.

□ CAUTION

2) The temperature range over which the cell can be discharged is -40°C to 60°C (Consult E-One Moli Energy if you plan to discharge the cells at temperature less than -30°C . Use of the cell outside of this temperature range may damage the performance of the cell or may reduce its life expectancy.

7.4 Pack-Assembly Precautions

7.4.1 Avoid excessive force on the cell terminals and prevent sparking during welding.

7.4.2 Do NOT mix different cell types or manufacturers within a battery pack. 7.4.3 Do NOT over-stress or rotate at positive terminal. It is possible to cause over-stress by removing the welding point.

7.4.4 All battery packs should be inspected for voltage, impedance, and function of protection circuit prior to shipment.

7.4.5 Do NOT assemble damaged cells into packs.

7.4.6 If the cells are re-shipped to assembling manufacturer, package carefully into the original shipping boxes.

7.5 Disposal Instructions

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

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Document

Name Cell Specifications of INR-18650-M35A

| | | | | | |
|--------------|---------------------|------|-----|--|-------|
| Document No. | INR18650M35A-0 2 | Ver. | 0.1 | | 13 of |
|--------------|---------------------|------|-----|--|-------|



8. REQUIREMENT FOR BATTERY PACK DESIGN

E-One Moli Energy recommends that cells be assembled in a pack with protection circuit. Various protection circuit modules are available for applications of multiple series and parallel configurations. In order to ensure safe use of cell, be sure to consult with E-One Moli Energy regarding charging and discharging specifications and contact E-One Moli Energy in advance when designing a device with this cell.

8.1 Protective circuit function recommendations:

8.1.1 Overcharge protection: recommend overcharge voltage under $4.3\text{V}/\text{cell}$ within a tolerance $0.05\text{V}/\text{cell}$ maximum. The voltage tolerance is better under $0.03\text{V}/\text{cell}$. The charge current shall be shut down once overcharge protection function working.

8.1.2 Over discharge protection: recommend over discharge voltage range 2.5V/cell. Below this level the discharge current shall be shut down and the consumption current should be below 10uA

8.1.3 Over temperature protection: The battery should have over temperature warning system. The battery shall control FET directly and stop charge/discharge once cell over temperature.

8.2 Battery position: To prevent degradation of battery performance by heat exposure, battery shall be positioned away from heat generating source inside application equipment and charger.

8.3 Cell configuration: An isolation design that involves a plastic barrier or non-thermal conductive material between cell and PCBA is recommended.

9. WARRANTY OF CELL

Warranty period is one year after shipment under normal conditions. Within this period, E-One Moli Energy will replace the cell for free against defects as long as it is confirmed such defects are the failure of the cell manufacturing process. Any other defects caused by pack assembly equipment/system malfunction or abnormal usage of the cell are not covered by this warranty.

10. SHIPPING STATE OF CELL

The cell is shipped at a state of charge not to exceed 30% of rated capacity. Less than 35 °C is recommended for cell shipping during transportation.

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Document

Name Cell Specifications of INR-18650-M35A

| | | | | | |
|--------------|---------------------|------|-----|--|-------|
| Document No. | INR18650M35A-0 2 | Ver. | 0.1 | | 14 of |
|--------------|---------------------|------|-----|--|-------|



11. PACKING SPECIFICATION

The maximum quantity of the cells is 100pcs in inner box, 200pcs in master box.

12. AMENDMENT OF SPECIFICATION CONTENT

This specification stipulates the final and comprehensive characteristics of the product. It is the responsibility of the customer to explicitly disclose in writing any additional requirements to E-One Moli Energy prior to agreement of purchase.

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