

Specification Approval Sheet

Customer Name: _____

Customer Model: _____

Part Number: NUE11SJJ1134502X4A

Product Model: 113450-3.7V-2400mAh

| | | |
|--------------|-------------|-------------|
| Prepared by | Checked by | Approved by |
| Zhou Xinping | Ou Jianping | Wu Fuquan |

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| Customer Approved (Stamp) | Test by | Checked by | Approved by |
| | | | |

Revision History

| Revision | Description | Date | Approval |
|----------|--------------|------------|-----------|
| A0 | New released | 2016-12-06 | Wu Fuquan |
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Instructions Customer Inquiry

1. Scope

The specification shall be applied to Lithium-ion Polymer (LIP) rechargeable battery pack which is manufactured by **NuEnergy Storage Technologies**.

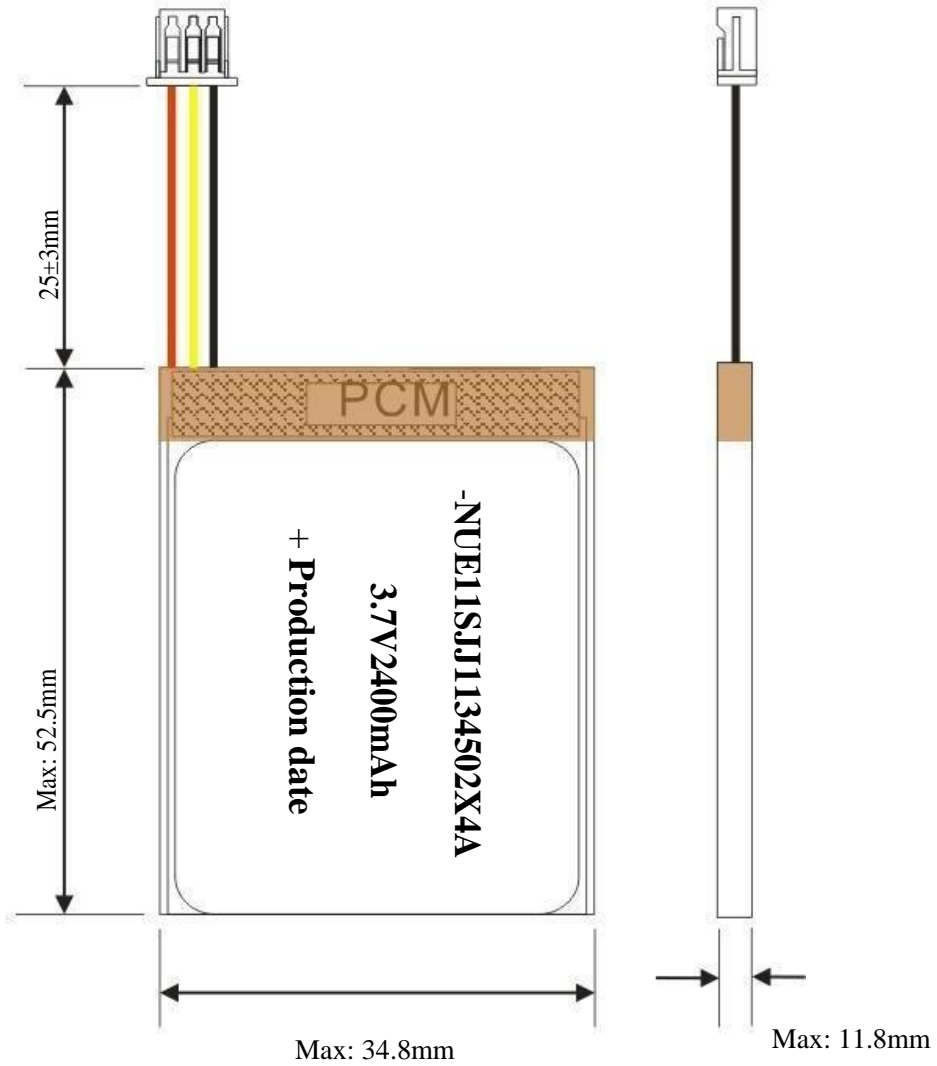
Reference standard

GB/T 18287-2013IEC/EN61960UL1642

2. Product basic information

| Items | Parameter | |
|---|--|-------------------|
| Battery model | 113450-3.7V-2400mAh | |
| Design scheme | S-8261ABJMD-G3JT2x +8205+10KNTC | |
| Nominal voltage | 3.7V | |
| Minimum capacity | 2350mAh (0.2C discharge) | |
| Typical capacity | 2400mAh (0.2C discharge) | |
| Charging voltage | 4.2V | |
| Discharging cut-off voltage | 3.0V | |
| Standard charging | 0.2C /4.2V | |
| Max charging | 1.0C /4.2V | |
| Standard discharging | 0.2C/3.0V | |
| Max discharging | 1.0C/3.0V | |
| Weight | Appr. 46.0g | |
| Shipment voltage | ≥3.95V | |
| Battery pack impedance | ≤190mΩ | |
| Operating temperature | Charging: 0°C ~ 45°C | |
| | Discharging: -20°C ~60°C | |
| Storage (At 50% SOC and specified temp, recoverable capacity in % vs time.) | -10°C~25°C | (12 months, ≥85%) |
| | -10°C ~45°C | (6 months, ≥85%) |
| | -10°C~55°C | (1 month, ≥90%) |
| | 20±5°C is the recommended storage temperature | |
| Visual Inspection | There should not be any remarkable scratches, cracks, bolt cauterization, deformations, swelling, leakage and so on the surface of the cell. | |

3. Battery Outline Drawing



| BOM(Bill of materials) | | | | |
|------------------------|------------------|-----------------------|-----|--------|
| NO. | Material Name | Specification | Qty | Remark |
| 1 | Cell | 113450/2350mAh/3.7V | 1 | RoHS |
| 2 | Protection board | PCB9838T | 1 | RoHS |
| 3 | Wire | Red Wire UL1571#28 | 1 | RoHS |
| | | Black Wire UL1571#28 | 1 | RoHS |
| | | Yellow Wire UL1571#28 | 1 | RoHS |
| 4 | Connector | DF13-3P | 1 | RoHS |

4. Electrical characteristics

| No. | Items | Test Method | Criteria |
|-----|------------------------|--|--------------|
| 1 | Standard Charge | Charging the cell initially with constant current at 0.2C and then with constant voltage at 4.2V till charge current declines to 0.02C. | N/A |
| 2 | Minimal Capacity | The capacity means the discharge capacity of the cell, which is measured with discharge current of 0.2C with 3.0V cut-off voltage after the standard charge. | ≥2350mAh |
| 3 | Charge/Discharge Cycle | The capacity on 0.2C discharge shall be measured after 500 cycles of 0.2C charge and discharge at 23±2°C. | Capacity≥80% |
| 4 | Retention Capability | After full charging, storing the battery 28 days with 20 ± 5°C condition, and then staying 1 hours with discharge current of 0.2C till 3.0V cut-off voltage. | Capacity≥85% |

※ **Typical capacity**

The capacity means the average discharge capacity of the cell, which is measured with discharge current of 0.2C with 3.0V cut-off voltage after the standard charge at 23±2°C environment temperature, unit: mAh

5. Condition adapting characteristics

| No. | Items | Test Method | Criteria |
|----------|-----------------------------------|--|--|
| 1 | Constant temperature and Humidity | After standard charging, put cell into the box that the temperature is $40\pm 2^{\circ}\text{C}$ and the humidity ranges between 90-95% for 48hours, then put it at $23\pm 2^{\circ}\text{C}$ for 2 hours, then discharge with current of 0.2C to the cut-off voltage. | No distortion, no rust, no leakage, no venting, no rupture, no fire, no explosion, the discharge time is not less than 3hrs. |
| 2 | High Temperature Performance Test | After full charging, put the cell into box with high temperature of $55^{\circ}\text{C}\pm 2^{\circ}\text{C}$ for 2h, then discharge with current of 1.0C to the cut-off voltage. | No distortion, no rupture, no fire, no smoke or leakage Discharge time ≥ 51 min |
| 3 | Low Temperature Performance Test | After full charging, put the cell into box with low temperature of $-10\pm 2^{\circ}\text{C}$ for 16~24h, then discharge with current of 0.2C to the cut-off voltage. | No distortion, no rupture no fire, smoke or leakage Discharge time ≥ 3 h |

6. Cell safety performance

| No. | Items | Test Method | Criteria |
|-----|-----------------------------|---|---------------------------|
| 1 | Cell Overcharge | After discharge to limit voltage, charged at constant current of 3C and constant voltage of 4.6V, while voltage reaches to the max, if charging continued over 7 hours or temperature is 20% less than the top, close the test. | No explosion and no fire. |
| 2 | External Short-circuit Test | Cell terminals are short-circuited to discharged state less than 0.1V or longer time with a resistance of 50mΩ or less. Tests are to be conducted at room temperature. | No explosion and no fire. |
| 3 | Over-Discharge Test | Cell is discharged at a current of 1C rate for 2.5 hours. (If current stops by safety or passive circuit on the battery, test is finished). | No explosion and no fire. |
| 4 | Crush Test | Crush between two flat plates. Applied force is about 13kN. | No explosion and no fire. |
| 5 | Impact Test | Impact between bar (15.8mm diameter) and 9.1Kg falling material (at a height of 6.1cm). Bar is laid across the center of the test sample. | No explosion and no fire. |

| | | | |
|----------|----------------|---|---|
| 6 | Drop | <p>After standard charging, the cell is to be dropped from a height of 1.2meter onto a thickness of 20mm board, dropped once in the positive and negative directions of three mutually perpendicular X, Y, Z axes.</p> | <p>No leakage, no smoke, no fire, no explosion.</p> |
| 7 | Vibration Test | <p>Fixed the fully charged cell to vibration table and subjected to vibration cycling that the frequency is to be varied at the rate of 1Hz per minute between 10Hz and 55Hz, the excursion of the vibration is 0.8mm. The cell shall be vibrated for 90 ~100 minutes per axis of XYZ axes.</p> | <p>No explosion, no fire, no leakage.</p> |
| 8 | Heating | <p>After standard charging, put cell in the baking oven and start, the temperature of the oven is to be raised at a rate of $5\pm 2^{\circ}\text{C}$ per minute to a temperature of $130\pm 2^{\circ}\text{C}$, remain for 30minutes at that temperature.</p> | <p>No explosion and no fire.</p> |

7. Battery safety performance

| | | | |
|---|---------------------------|---|---|
| 1 | Overcharge protection | After battery charge finished, then charge the battery for 8 hours with a power which can provide 2 times more than nominal voltage and $2C_5A$ current. | No fire, no explosion. The electrical properties of normal. |
| 2 | Over discharge protection | After the battery is fully charged, discharge at $20\pm 5^\circ C$ conditions with $0.2C_5A$ until the battery voltage drops to the over discharge voltage, then discharge with a 30Ω resistor for 24 hours. | No fire, no explosion. The electrical properties of normal. |
| 3 | Short protection | After standard charging, connect the positive and negative terminals of the cell with copper wire having a maximum resistance load of 0.1Ω at room temperature, the test is discontinued when the surface temperature lower than $10^\circ C$. | The battery shall no rupture, smoke, catch fire, or leakage. Battery Voltage $\geq 3.6V$ |

8. Others

Any matters that this specification doesn't cover should be conferred between the customer and NuE.

9. Testing requirements

9.1 Battery test environment

Temperature: $23 \pm 2^{\circ}\text{C}$ Relative humidity: $60 \pm 20\%$ RH

Atmospheric pressure: 86106 KPa

9.2 Measuring instrumentation requirements

Voltage instrumentation requirements: Measuring the voltage meter accuracy no less than 0.5 magnitude

Current instrumentation requirements: Measuring the current meter accuracy no less than 0.5 magnitude

Time instrumentation requirements: Measuring the time meter accuracy no less than 0.1%

Temperature instrumentation requirements: Measuring the temperature meter accuracy no less than 0.5°C

Impedance instrumentation requirements: Measuring impedance should by sinusoidal alternating (1 KHZ) test

10. Electrical Characteristics

10.1 Battery charge/discharge

10.1.1 Full charged definition

With charging voltage 4.2V, current 0.2C continued to charge the battery pack, when charging current drops to 0.02C charging is terminated, shall be full charged.

10.1.2 Full discharged definition

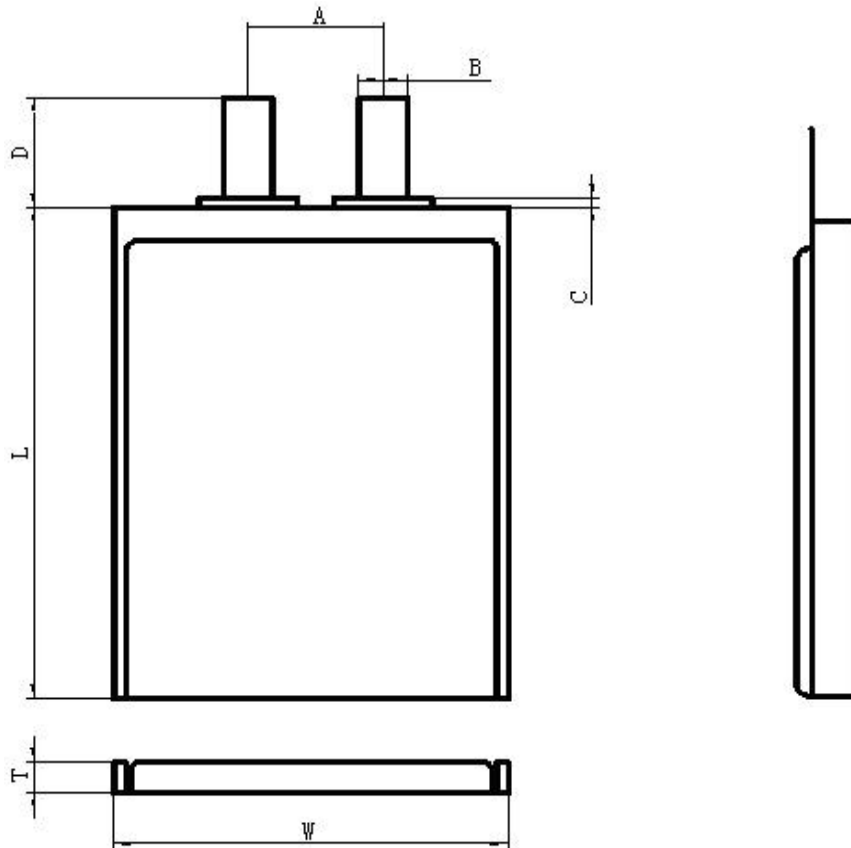
Standard discharge current 0.2 C for continuous discharge, when the voltage drops to discharge cut-off voltage 3.0V discharge is terminated, shall be full discharged.

11. Cell

11.1 Performance parameters

| Item | Description | Specification | Remarks | |
|------|-----------------------|---------------|------------------------------|--|
| 1 | Cell minimum capacity | 2350mAh | 0.2C discharge | |
| 2 | Initial impedance | ≤65mΩ | 1kHz AC Impedance AC 1kHz | |
| 3 | Nominal voltage | 3.7V | / | |
| 4 | Dimensions | T | 11.0mm Max | Thickness |
| | | W | 34.5mm Max | Width |
| | | L | 50.5mm Max | Cell length, not including Tab sealant |
| | | A | 6.0±2.0mm | Distance of tab center |
| | | B | 2.0±0.2mm | Tab width |

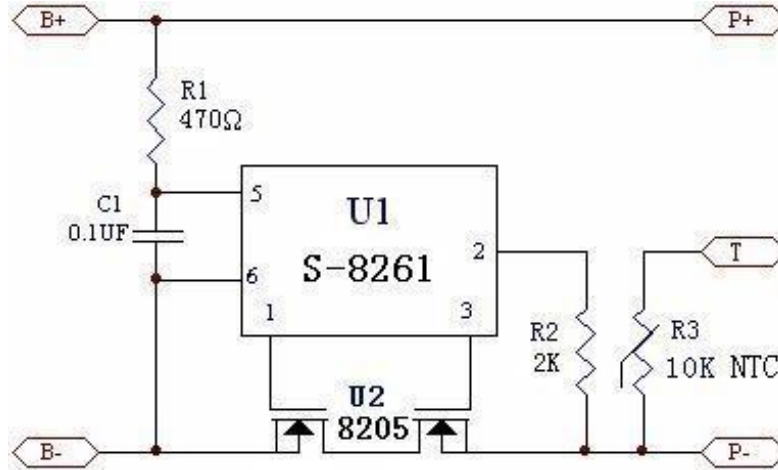
11.2 Cell outline drawing



12. Electric Protect Features

| Item | Symbol | Content | Criterion |
|---------------------------|-------------|--------------------------------------|-------------------------------------|
| Over charge Protection | V_{DET1} | Over charge detection voltage | 4.28±0.05V |
| | tV_{DET1} | Over charge detection delay time | 0.961.4s |
| | V_{REL1} | Over charge release voltage | 4.08±0.05V |
| Over discharge protection | V_{DET2} | Over discharge detection voltage | 3.0±0.10V |
| | tV_{DET2} | Over discharge detection delay time | 115173ms |
| | V_{REL2} | Over discharge release voltage | 3.0±0.10V |
| Over current protection | V_{DET3} | Over current detection voltage | 80±30mv |
| | I_{DP} | Over current detection current | 1.03.0A |
| | tV_{DET3} | Detection delay time | 7.211.0ms |
| | | Release condition | Cut load |
| Short protection | | Detection condition | Exterior short circuit |
| | T_{SHORT} | Detection delay time | 220380µs |
| | | Release condition | Cut short circuit |
| Interior resistance | R_{DS} | Main loop electrify resistance | $V_C=4.2V R_{DS} \leq 70m\Omega$ |
| Current consumption | I_{DD} | Current consumes in normal operation | 3.0µA Type 7.0µA Max 0V Charging |
| 0V Prohibition /allowance | | allowance | |

13. Schematic circuit diagram

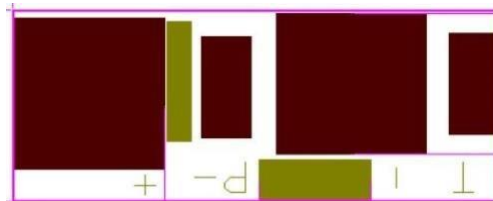


14. PCB Parts List BOM

| Item | Part Name | Description | QTY | Footprint | Supplier |
|------|-----------|--------------------|------|-----------|---------------------|
| 1 | U1 | S-8261ABJMD-G3JT2x | 1pcs | SOT-23-6 | SEIKO |
| 2 | U2 | 8205 | 1pcs | SOT-23-6 | MT |
| 3 | R1 | SMD 470Ω±5% | 1pcs | 0402 | Any approved vendor |
| 4 | R2 | SMD 2KΩ±5% | 1pcs | 0402 | Any approved vendor |
| 5 | C1 | SMD 0.1µF±20% | 1pcs | 0402 | Any approved vendor |
| 6 | R4 | 10KΩ±5%B=3435±3% | 1pcs | 0402 | Any approved vendor |
| 7 | PCB | 9838T | 1pcs | | |

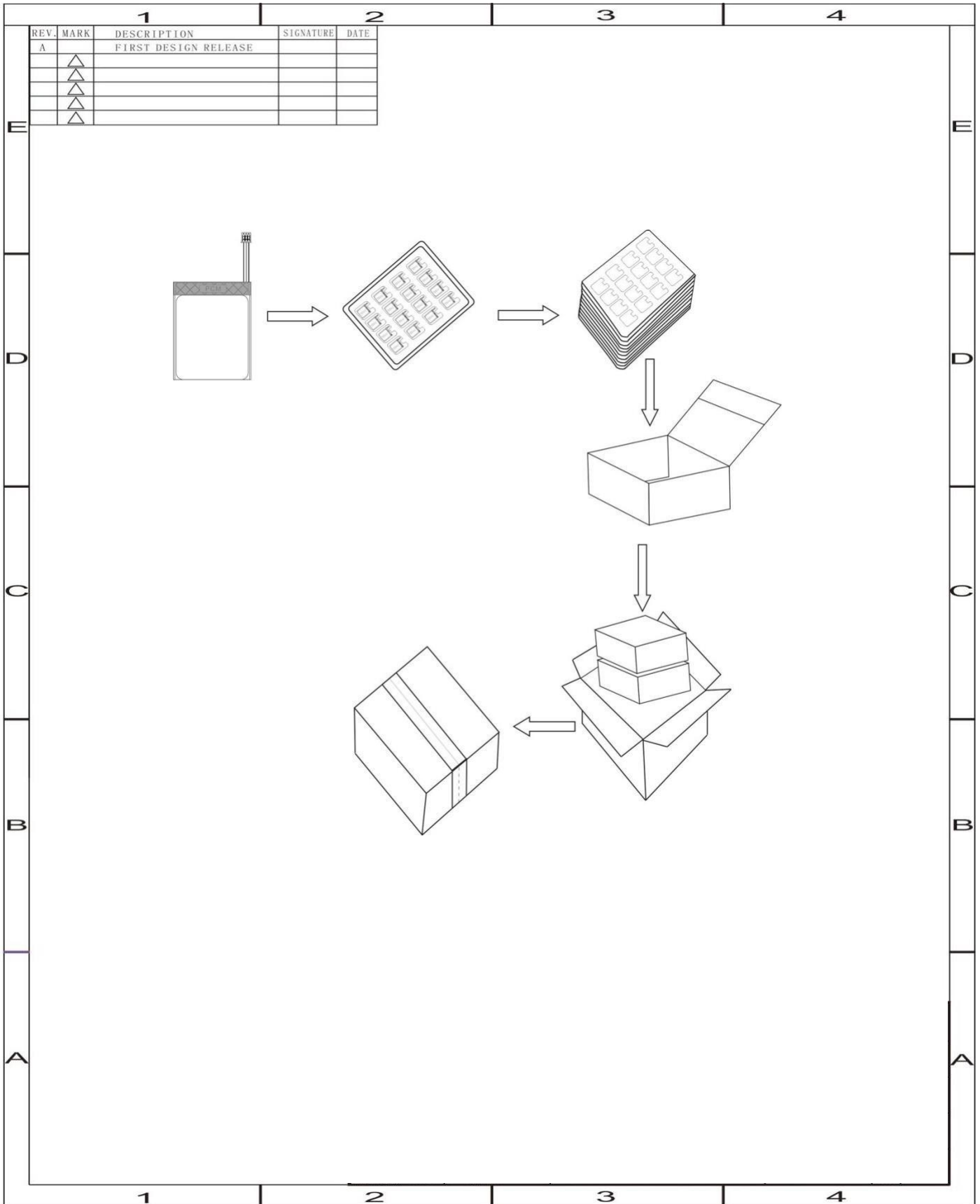
15. PCB Layout PCB

Top Layer



Bottom Layer

16. Package



17. Battery Precautions and Safety Instructions

Please be sure to take to comply with the specifications and the following precautions to use with batteries, if any incidents occur due to not following the specification parameters, and maintenance conditions, NuEnergy Storage Technologies will not accept any responsibility. Limited Warranty Period is 1 year from date of manufacture.

- Maintenance: Please use 0.5C charge current to charge up battery to 60% SOC every 3-6 months to prevent over discharge and degradation while in storage. Every 12 months a full cycle shall be performed to prevent degradation.
- Before Use the battery, carefully read the instruction manual and battery labels.
- Need to use the original battery charger and should be placed in a dry ventilated place.
- Such as long-term when not in use, the battery charger to charge state half full, remove the battery from the device and separated, to avoid metal contact with the battery, causing short-circuit or damage to the phenomenon.
- In use or during storage, battery found there has been high fever, leakage, odor, distortion and other anomalies, please stop using it immediately and stay away from the battery.
- Do not short-circuit the battery positive and negative, and careful not to allow the battery to moisture, to avoid danger.
- When using keep away from heat, High pressure environments, and do not beat, hit the battery.
- Battery end of life should be immediately removed from the equipment, please properly handle security of spent batteries, do not put into fire or water.

Customer Inquiry

1. If clientele wishes to ratify this specification and showpiece, please sign and return this specification to NuE in 1 week.
2. The customer is requested to write down your information and contact NuE in advance, if and when the customer needs applications or operating conditions other than those described in this document. NuE could design and build such products according to your special request.

| | Special Request | Criteria |
|---|-----------------|----------|
| 1 | | |
| 2 | | |
| 3 | | |
| 4 | | |
| 5 | | |
| 6 | | |

Company Name:

Signature:

Date: