

PRODUCT SPECIFICATION

Customer Approval Sheet

| | | | | |
|--------------------|-------------------|--------------------|------------------------------|---|
| Application | | | | |
| Model No. | | | | NUE PACK LIPO 3.7V 20mAh 1S1P 251515 0.074Wh |
| Part Number | | | | NUE11SJJ251515X02A |
| CPN | | | | |
| Issued By | Checked By | Approved By | Customer Confirmation | |
| BT | VN | JZ | | |

2.0 Scope

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

Reference standard

GB/T 18287-2013

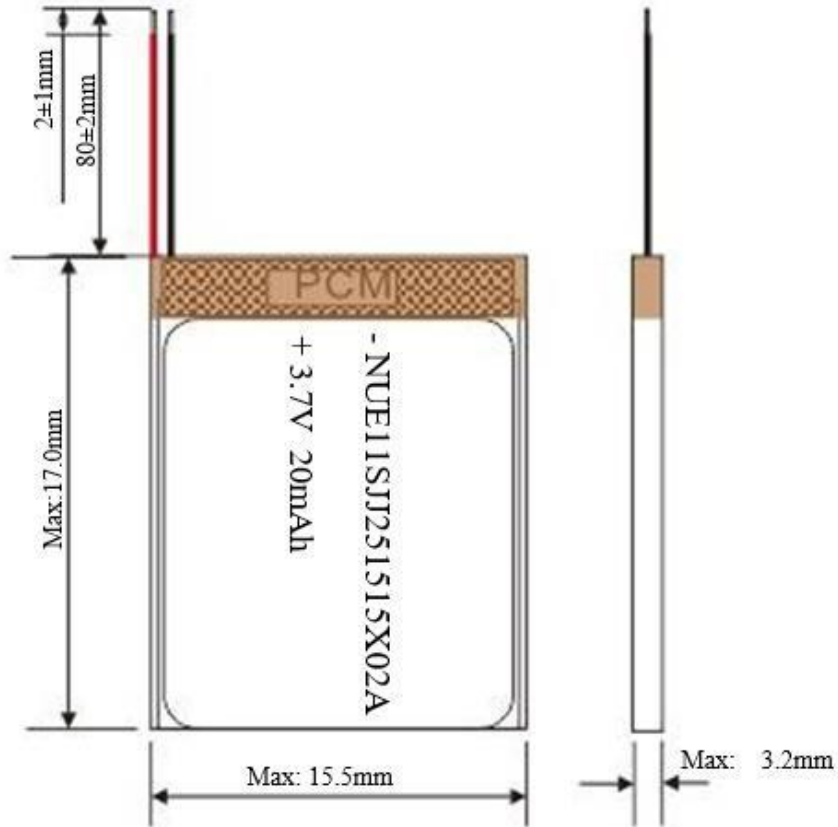
IEC/EN61960

UL1642

3.0 Basic Product Information

| Items | Parameter |
|--|--|
| Battery model | 251515 |
| Design scheme | S-8261ABMMD-G3MT2x+8205A |
| Nominal voltage | 3.7V |
| Minimum capacity | 20mAh(0.2C discharge) |
| Typical capacity | 23mAh(0.2C discharge) |
| Charging voltage | 4.2V |
| Discharging cut-off voltage | 2.8V |
| Standard charging | 0.2C /4.2V |
| Max charging | 1.0C /4.2V |
| Standard discharging | 0.2C/2.8V |
| Max discharging | 1.0C/2.8V |
| Weight | Appr: 0.8g |
| Shipment voltage | ≥3.85V |
| Battery pack impedance | ≤400mΩ |
| Operating temperature | Charging: 0°C ~ 45°C |
| | Discharging: -20°C ~55°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, bolts, cauterization, deformations, swelling , leakage and so on on the surface of the cell. |

4.0 Battery Outline Drawing



BOM (Bill of materials)

| NO. | Material Name | Specification | Qty | Remark |
|-----|------------------|----------------------|-----|--------|
| 1 | Cell | 251515/20mAh/3.7V | 1 | RoHS |
| 2 | Protection board | PCB3035 | 1 | RoHS |
| 3 | Wire | Red Wire UL3302#28 | 1 | RoHS |
| | | Black Wire UL3302#28 | 1 | RoHS |

5.0 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 4.35V 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. | $\geq 20\text{mAh}$ |
| 3 | Charge/Discharge Cycle | The capacity on 0.2C discharge shall be measured after 700 cycles of 0.2C charge and discharge at $23 \pm 2^\circ\text{C}$. | Capacity $\geq 80\%$ |
| 4 | Retention Capability | After full charging, storing the battery 28 days with $20 \pm 5^\circ\text{C}$ condition, and then staying 1 hours with discharge current of 0.2C till 3.0V cut-off voltage. | Capacity $\geq 85\%$ |

Typical Capacity:

Capacity refers to the average discharge capacity of the cell. This is measured with discharge current of 0.2C with 3.0V cut-off voltage after the standard charge at $23 \pm 2^\circ\text{C}$ environment temperature, unit : mAh.

6.0 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 2hours, 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 $\geq 51\text{min}$ |
| 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 $\geq 3\text{h}$ |

7.0 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, stop 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. |

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|---|----------------|--|--|
| 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> | No leakage, no smoke, no fire, no explosion. |
| 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 ~100minutes per axis of XYZ axes.</p> | No explosion, no fire. no leakage. |
| 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> | No explosion and no fire. |

8.0 Pack Safety Performance

| No. | Items | Test Method | Criteria |
|-----|---------------------------|---|--|
| 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 2C5A current. | No fire, no explosion. The electrical properties are normal. |
| 2 | Over discharge protection | After the battery is fully charged, discharge at 20±5°C conditions with 0.2C5A 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 are 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 0.1 Ω at room temperature, the test is discontinued when the surface temperature lower than 10°C. | The battery shall not rupture, smoke, catch fire, or leakage. Battery Voltage ≥3.6V |

9.0 Others

Any matters that this specification does not cover should be conferred between the customer and NuE.

100 Testing Requirements

Battery test environment

- Temperature: $23 \pm 2^\circ\text{C}$
- Relative humidity: $60 \pm 20\%$ RH
- Atmospheric pressure: 86~106 KPa

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

110 Charge/Discharge Definitions

Fully charged definition

- With charging voltage 4.35V, current 0.2C continued to charge the cell, when charging current drops to 0.02C charging is terminated, shall be full charged.

Fully discharged definition

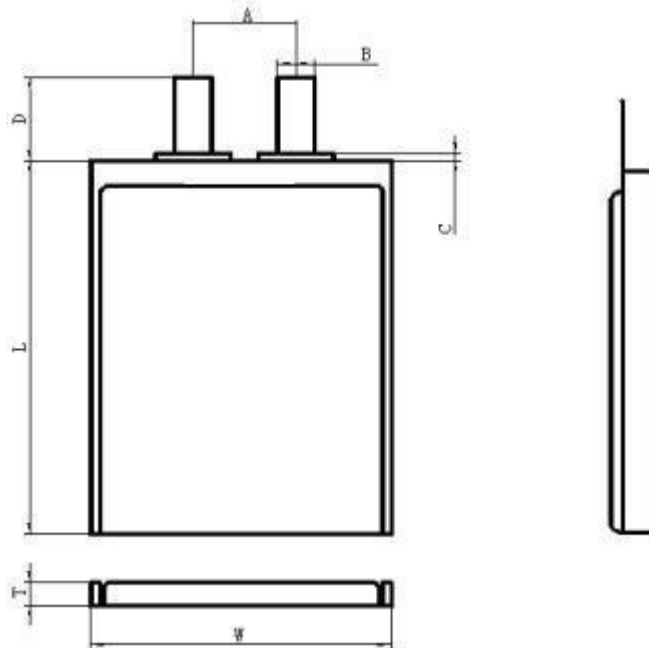
- Standard discharge current 0.2 C for continuous discharge, when the voltage drops to discharge cut-off voltage 3.0V discharge is terminated shall be full discharged.

12.0 Cell

Performance Parameters

| No. | Item | Specification | Remark |
|-----|-----------------------|-------------------|--|
| 1 | Cell minimum capacity | 20mAh | 0.2C discharge |
| 2 | Initial impedance | $\leq 400m\Omega$ | 1kHz AC Impedance |
| 3 | Nominal voltage | 3.7V | / |
| 4 | Dimensions | T | 2.5mm Max |
| | | W | 15.5mm Max |
| | | L | 15.5mm Max |
| | | A | $7.0 \pm 2.0mm$ |
| | | B | $4.0 \pm 0.2mm$ |
| | | | Thickness |
| | | | Width |
| | | | Cell length does not include Tab sealant |
| | | | Distance of tab center |
| | | | Tab width |

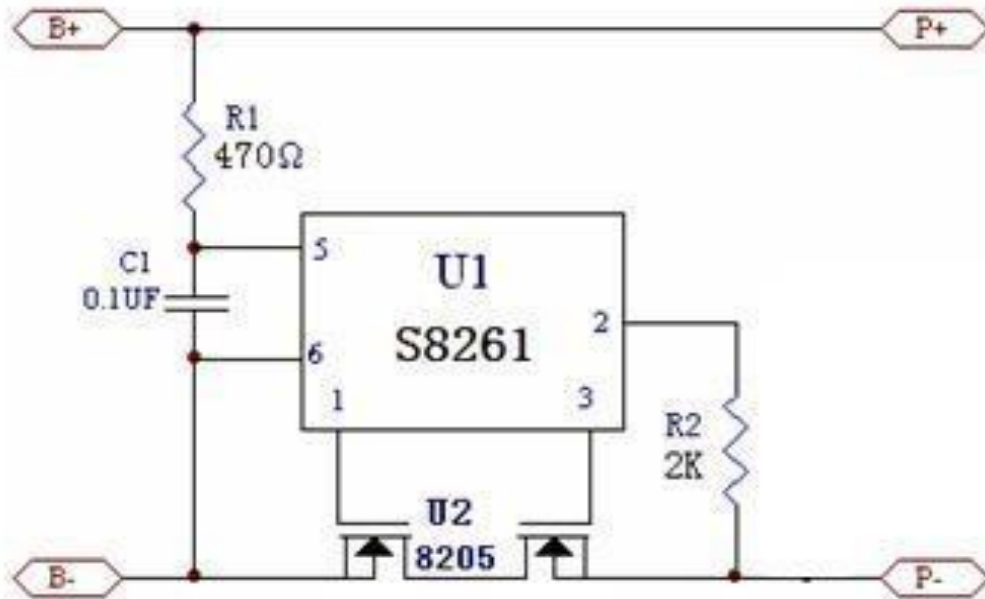
Cell Outline Drawing



13.0 Electrical Protection Features

| Item | Symbol | Content | Criteria |
|---------------------------------|--------|---|--------------------------|
| Over charge Protection | VDET1 | Over charge detection voltage | 4.28V±0.035V |
| | TvDET1 | Over charge detection delay time | 1.4s (MAX) |
| | VREL1 | Over charge release voltage | 4.08V±0.1V |
| Over discharge protection | VDET2 | Over discharge detection voltage | 2.8V±0.08V |
| | TvDET2 | Over discharge detection delay time | 173ms (MAX) |
| | VREL2 | Over discharge release voltage | 2.8±0.10V |
| Over current protection | VDET3 | Over current detection voltage | 100mV±15mV |
| | IDP | Over current detection current | MIN: 1.5A MAX: 3.0A |
| | TvDET3 | Detection delay time | 11ms (MAX) |
| | / | Release condition | Cut load |
| Short protection | / | Detection condition | Exterior short circuit |
| | TSHORT | Detection delay time | 400µs (MAX) |
| | / | Release condition | Cut short circuit |
| Internal resistance | RDS | Main loop electrical resistance | B- P- RDS≤60mΩ |
| Current consumption | IDD | Current consumption in normal operation | MIN: 0.3µA MAX: 8.0µA |
| 0V Prohibition/ 0V Allowance | | Allowance | / |

14.0 Circuit Schematic

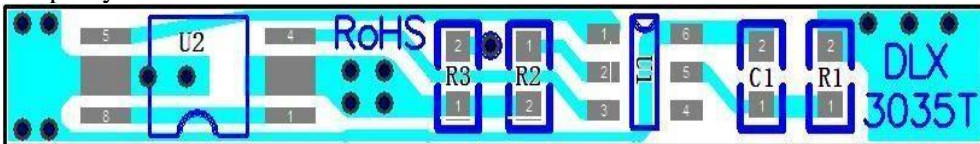


15.0 PCB Part List

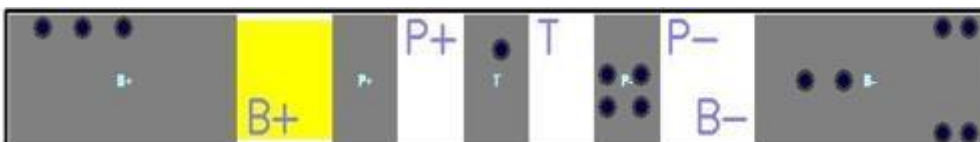
| Item | Part Name | Description | QTY | Footprint | Supplier | Remark |
|------|-----------|------------------------|------|-----------|---|--------|
| 1 | U1 | S-8261ABMMD-G 3MT2x | 1pcs | SOT-23-6 | SEIKO | |
| 2 | U2 | 8205A | 1pcs | TSSOP-8 | MT | |
| 3 | C1 | 0.1μF | 1pcs | 0603 | Any approved vendor | |
| 4 | R1 | 470Ω±5% | 1pcs | 0603 | Any approved vendor SKYWELL, YAGEO, or | |
| 5 | R2 | 2.0KΩ±5% | 1pcs | 0603 | Any approved vendor SKYWELL, YAGEO, or | |
| 6 | PCB | PCB3035T | 1pcs | | Any approved vendor | |

16.0 PCB Layout

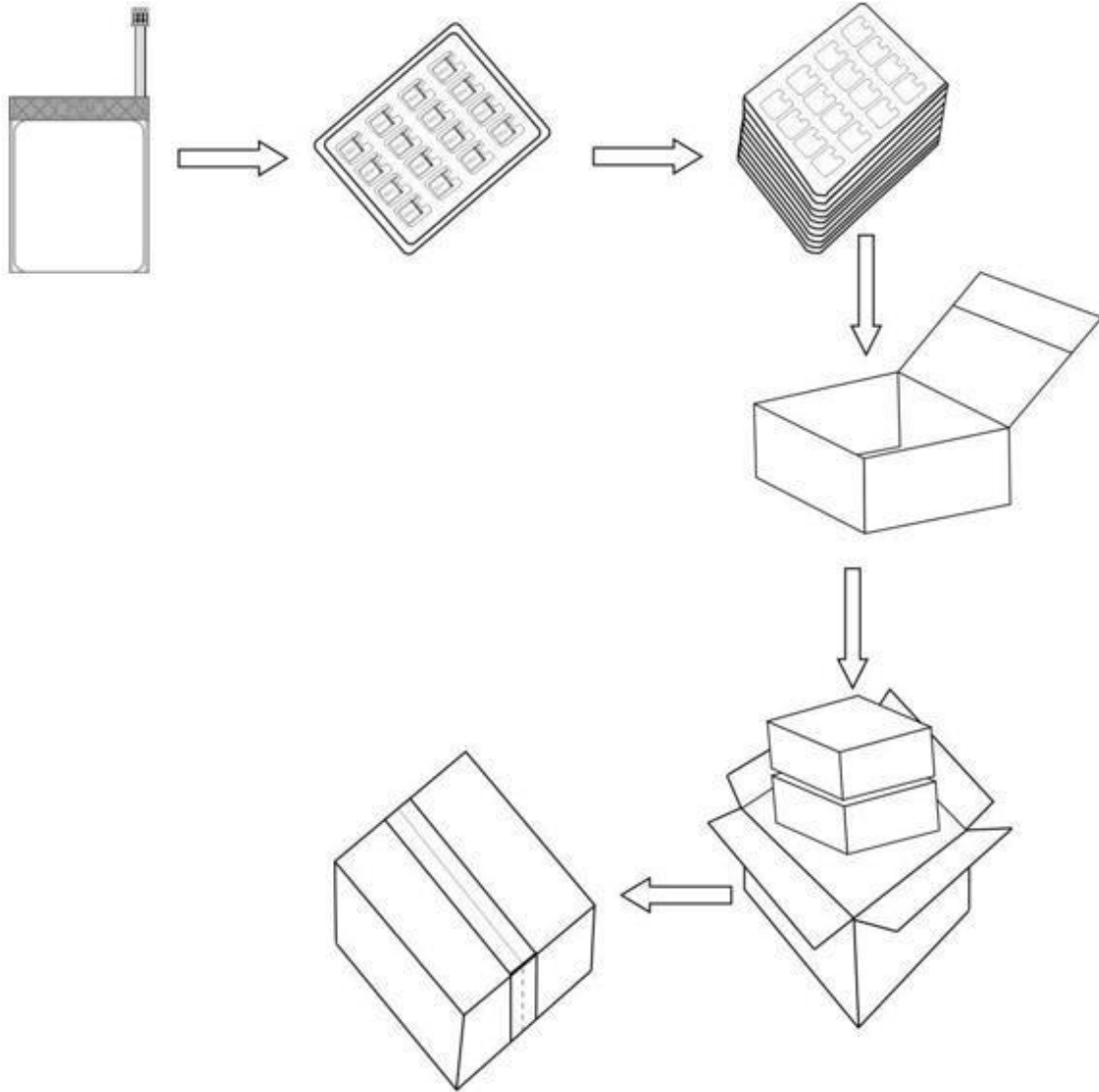
Top Layer



Bottom Layer



17.0 Packaging



18.0 Warranty and Liability

Please be sure to comply with the specifications and follow the precautions when using batteries. If the user fails to follow the specifications for the operation and any incidents are caused, NuEnergy Storage Technologies will not be liable.

NuEnergy offers a limited warranty for 1 year from the date of manufacture.

19.0 Battery Precautions and Safety Instructions

- Please use 0.5C current to charge up 60% capacity after the battery has been stored for more than 3 months.
- Before using 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.
- When not in use for long periods of time, charge the battery to 50% SOC, and store battery separated from charger to prevent any short circuit conditions.
- While in use or during storage, if the battery is found to have a high temperature, leakage, odor, distortion, etc., stop using it immediately and consult with NuE.
- Do not short-circuit the battery's positive and negative leads.
- Keep the battery away from heat, high pressure, and moisture. Do not crush battery.
- Follow all local guidelines regarding proper disposal of batteries.

Customer Inquiry

If the client 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: _____