Li-Polymer Battery Technology Specification

Customer ________________________________

Part name Li-Polymer Battery

Model No LIPO503562 1200mAh 3.7V

Serial No ________________________________

Produce No ________________________________

<table>
<thead>
<tr>
<th>Approved by</th>
<th>Drafted by</th>
<th>Signed by</th>
<th>Valid Date</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Xiaojun Nie</td>
<td>Wenfei Liang</td>
<td>2019-05-10</td>
</tr>
</tbody>
</table>

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If manufacturer want to modify the product technology specification, we won’t inform you additionally.)
1. SCOPE
This document describes the performance characteristics and testing methods for polymer Lithium-ion batteries produced by Shenzhen Pkcell battery co.,limited.

2. SPECIFICATION

<table>
<thead>
<tr>
<th>No.</th>
<th>Item</th>
<th>Characteristics</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Nominal Capacity</td>
<td>Minimum: 1140mAh Typical: 1200mAh</td>
<td>Standard discharge (0.2C) after Standard charge</td>
</tr>
<tr>
<td>2</td>
<td>Nominal Voltage</td>
<td>3.7V</td>
<td>—</td>
</tr>
<tr>
<td>3</td>
<td>Charging Cut-off Voltage</td>
<td>4.2V</td>
<td>—</td>
</tr>
<tr>
<td>4</td>
<td>Discharge Cut-off Voltage</td>
<td>3.0V</td>
<td>—</td>
</tr>
<tr>
<td>5</td>
<td>Standard Charge</td>
<td>Constant Current 0.5C Constant Voltage 4.2V 0.01 C cut-off</td>
<td>Charge Time : Approx 4.0h</td>
</tr>
<tr>
<td>6</td>
<td>Maximum Constant Charging Current</td>
<td>1200mA</td>
<td>—</td>
</tr>
<tr>
<td>7</td>
<td>Standard Discharge</td>
<td>Discharge at 0.2 C to 3.0V</td>
<td>—</td>
</tr>
<tr>
<td>8</td>
<td>Maximum Continuous Discharging Current</td>
<td>1200mA</td>
<td>—</td>
</tr>
<tr>
<td>9</td>
<td>Operating Temperature</td>
<td>Charge 0<del>45°C Discharge -20</del>60°C</td>
<td>—</td>
</tr>
<tr>
<td>10</td>
<td>Storage Temperature</td>
<td>-20<del>45°C for 1Month -10</del>35°C for 6Months</td>
<td>—</td>
</tr>
<tr>
<td>11</td>
<td>Storage Voltage</td>
<td>3.7-3.85V</td>
<td>—</td>
</tr>
<tr>
<td>12</td>
<td>Environmental request</td>
<td>RoHS</td>
<td>If the materials of the product and packaging accord with RoHS standard. there will be a RoHS Id on the box.</td>
</tr>
</tbody>
</table>

3. Dimensions
Please refer the drawing in appendix.

4. Appearance
No scratches, dirt, defect, leakage of electrolyte or gassing should be observed as a new product.

5. Standard Testing Environment
Temperature : 25±2°C
Relative humidity: 65±20% (unless specially requested)

6. Characteristics
6.1 Electrochemical performance characteristics

<table>
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<tr>
<th>No.</th>
<th>Item</th>
<th>Testing Method</th>
<th>Requirements</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Fully Charged State</td>
<td>CCCV or Constant current charge to 4.2V @0.5C follow by a constant voltage holding at 4.2V until current drops below 12±2mA.</td>
<td>—</td>
</tr>
<tr>
<td>2</td>
<td>Rated Capacity</td>
<td>0.5c CCCV 0.01c at 4.2V (per 6.1.1) at room temp. (20±5C), rest for 1-2 hrs then discharge at a constant current of 0.2C to 3.0V, testing will be terminated by either 5 cycles or any one discharge time exceeds 5 hrs.</td>
<td>≥1140mAh</td>
</tr>
<tr>
<td>3</td>
<td>Cycle Life @25°C</td>
<td>Discharge to 3.0V @0.2C, then 0.5c CCCV 0.01C charge to 4.2V, rest for 10 min. discharge @ 0.2C to 3.0V and rest for 10 min. Continue the charge/discharge cycles until discharge capacity lower than 70% of rated capacity.</td>
<td>Cycle life ≥500</td>
</tr>
<tr>
<td>4</td>
<td>Internal Impedance</td>
<td>Internal impedance is measured on a 50% charged battery at 1KHz AC at ambient temperature (20±2) °C.</td>
<td>—</td>
</tr>
<tr>
<td>5</td>
<td>Capacity Retention</td>
<td>Fully charge cells per 6.1.1, store them at (20±2)°C for 28 days, then discharge the cells to 3.0V at 0.2C.</td>
<td>Discharge Capacity≥960mAh</td>
</tr>
<tr>
<td>6</td>
<td>High Temperature Characteristics</td>
<td>Fully charge cells per 6.1.1, store them at (55±2)°C for 2 hours, then discharge the cells to 3.0V at 0.2C.</td>
<td>Discharge Capacity≥960mAh</td>
</tr>
<tr>
<td>7</td>
<td>Low Temperature Characteristics</td>
<td>Fully charge cells per 6.1.1, store them at (-10±2)°C for 16~24 hours, then discharge the cells to 3.0V at 0.2C.</td>
<td>Discharge Capacity≥720mAh</td>
</tr>
<tr>
<td>8</td>
<td>Cell Voltage during Transportation</td>
<td>Check open circuit voltage (OCV) of cells prior to the delivery to customers.</td>
<td>≥3.75V</td>
</tr>
</tbody>
</table>

6.2 Safety characteristic

<table>
<thead>
<tr>
<th>No.</th>
<th>Item</th>
<th>Test Method</th>
<th>Requirements</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Over charge</td>
<td>Discharge cells to 2.4V at 0.2C, then charge to 4.45V at 3C and rest for 8 hours.</td>
<td>No fire No explosion No leakage</td>
</tr>
<tr>
<td></td>
<td>Overdischarg e</td>
<td>Fully charge cells per 6.1.1, then discharge the battery to 3.0V with 0.2CmA at room temperature, connect with external load of 30Ω for 24 hours.</td>
<td>No fire No explosion No leakage</td>
</tr>
</tbody>
</table>
### 6.3 Reliability

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<thead>
<tr>
<th>No.</th>
<th>Item</th>
<th>Test Method</th>
<th>Requirements</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>High Temperature Test</td>
<td>Fully charged per 6.1.1, then rest at 60±2°C for 2 hours.</td>
<td>Electrochemical performance, visual test not changed</td>
</tr>
<tr>
<td>2</td>
<td>Low Temperature Test</td>
<td>Fully charged per 6.1.1, rest at -20±2°C for 2 hours. Then the cells are placed at room temperature for 3 hours.</td>
<td>No appreciable alternation electrochemically and visually</td>
</tr>
<tr>
<td>3</td>
<td>Humidity Test</td>
<td>Fully charged cells per 6.1.1, rest at 40±2°C with 90% ~ 95RH% for 48 hours. Then the cells are placed at room temperature to “dry out” for 2 hours.</td>
<td>No appreciable alternation electrochemically and visually</td>
</tr>
<tr>
<td>4</td>
<td>Vibration Test</td>
<td>After standard charged, fixed the 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 1.6mm. The cell shall be vibrated for 30 minutes per axis of XYZ axes.</td>
<td>No fire, No explosion, No leakage</td>
</tr>
<tr>
<td>5</td>
<td>Drop Test</td>
<td>The cell is to be dropped from a height of 1 meter onto concrete ground.</td>
<td>No fire, No explosion, No leakage</td>
</tr>
<tr>
<td>6</td>
<td>Collisions</td>
<td>After the vibration test, according to X.Y.Z each battery average three vertical pulse peak acceleration, the setting for the 100m/s², every minute, 40 ~ 80 collision frequency, pulse duration 16ms collision frequency ± 10 thousand.</td>
<td>No fire, No explosion, No leakage</td>
</tr>
<tr>
<td>7</td>
<td>Crush (Fresh, Fully charged)</td>
<td>Crush between two flat plates. Applied force is about 13kN(1.72Mpa) for 30min.</td>
<td>No fire, No explosion, No leakage</td>
</tr>
<tr>
<td>8</td>
<td>Short Circuit</td>
<td>This test will be placed the battery electric dipole in the fume hood, short-circuit the anode (total resistance is not more than 50mΩ lines), monitor temperature changes, when the battery is low temperature dropped to about 10 degrees than peak, the end of experiment.</td>
<td>No explosion, No fire, No explosion, The temperature of the surface of the Cell ≤ 150°C</td>
</tr>
</tbody>
</table>

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<table>
<thead>
<tr>
<th></th>
<th>Impact (Fresh, Fully charged)</th>
<th>Thermal shock (Fresh, Fully charged)</th>
<th>Constant damp performance</th>
</tr>
</thead>
<tbody>
<tr>
<td>9</td>
<td>A 56mm diameter bar is inlayed into the bottom of a 10kg weight. And the weight is to be dropped from a height of 1m onto a sample battery and then the bar will be across the center of the sample.</td>
<td>Batteries in hot box. Temperature in 5°C ±2°C/min, rising to 50°C ±2°C keep 30min</td>
<td>After Standard charge of battery, Will a battery into 40°C ±2°C, Relative humidity 90% ~ 95%. At constant temperature and humidity box after 48h Battery will in environmental temperature 20±5°C. Aside 2h, 0.2C5A to terminate discharge current voltage,</td>
</tr>
<tr>
<td>10</td>
<td>No fire No explosion No leakage.</td>
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<td>No obvious deformation, hands rust, smoke, explosion, discharge time ≥ 36 min</td>
</tr>
</tbody>
</table>

7. **Warranty**

Warranty period for this product is 6 months starting from the date when the products left the door of manufacturer.

8. **Liability**

The user has to operate the products according to the instructions printed on the battery label or follow the advices described in this “Product Specification for Lithium Ion Batteries published by shenzhen pkcell battery Co., Limited. In case the battery were overheated or even catch fire or explosion caused by mishandling of the user side, shenzhen pkcell battery Co., Limited. will not be liable for the lose caused by any of such mishandling. shenzhen pkcell battery Co., Limited. will notify the users in written form if any modifications in specification, raw material, production process control.

9. **Battery Packing Label**

The following warnings should be indicated on the battery pack labels.

- Use a specified charger.
- Do not throw the battery into fire, or heat.
- Do not short-circuit the battery terminals.
- Do not disassemble the battery.

10. **Warnings and Cautions in Handling the Lithium-ion Battery**

To prevent potential leaking, overheating or explosion of batteries please be advised to take following precautions:

**WARNINGS!**

- Do not immerse the battery in water or seawater, and keep the battery in a cool dry environment during stands by period.
- Do not use or leave the battery near a heat source such as fire or heater.
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- When recharging, use the battery charger specifically for that purpose.
- Do not reverse the position (+) and negative (-) terminals.
- Do not connect the battery to an electrical outlet.
- Do not dispose the battery in fire or heat.
- Do not short-circuit the battery by directly connecting the positive (+) and negative (-) terminal with metal objects such as wire.
- Do not transport or store the battery together with metal objects such as necklaces, hairpins etc.
- Do not strike or throw the battery against hard surface.
- Do not connect the battery to an electrical outlet.
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11. Protection board principle diagram

12. Protection board component

<table>
<thead>
<tr>
<th>Item</th>
<th>Part Name</th>
<th>Description</th>
<th>QTY</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>U1</td>
<td>S-8261DAA-M6T1U</td>
<td>1pcs</td>
</tr>
<tr>
<td>2</td>
<td>U2/U3</td>
<td>8205</td>
<td>1pcs</td>
</tr>
<tr>
<td>3</td>
<td>R1</td>
<td>SMD 470Ω ±5%</td>
<td>1pcs</td>
</tr>
<tr>
<td>4</td>
<td>R2</td>
<td>SMD 2KΩ ±5%</td>
<td>1pcs</td>
</tr>
<tr>
<td>5</td>
<td>C1</td>
<td>SMD 0.1μF ±20%</td>
<td>1pcs</td>
</tr>
</tbody>
</table>

13. Protection board electrical properties

<table>
<thead>
<tr>
<th>No</th>
<th>Items</th>
<th>Criteria</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Overcharge Detection Voltage</td>
<td>4.28±0.025</td>
<td>V</td>
</tr>
<tr>
<td>2</td>
<td>Overdischarge Detection Voltage</td>
<td>3.0±0.05</td>
<td>V</td>
</tr>
<tr>
<td>3</td>
<td>Overcurrent Detection current</td>
<td>1-3</td>
<td>A</td>
</tr>
<tr>
<td>4</td>
<td>Supply current</td>
<td>≤8.0</td>
<td>uA</td>
</tr>
<tr>
<td>5</td>
<td>Protection board resistance</td>
<td>10-60</td>
<td>mΩ</td>
</tr>
</tbody>
</table>

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14. Dimensions

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