



Specification Approval Sheet

Name: Li-ion Polymer battery

Model: 34451

Spec: 3.8V 1600mAh with PCM, NTC, Connector

Approved By	Checkup	Make

Customer Confirmation	Signature	Date
	Company Name ::	
	Stamp ::	

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<https://www.tenergybattery.com/>

1.Scope

This specification is made to describe the product, product characteristics and performance, relevant measurement conditions and methods applied to the rechargeable polymer lithium ion battery as specified in following details.

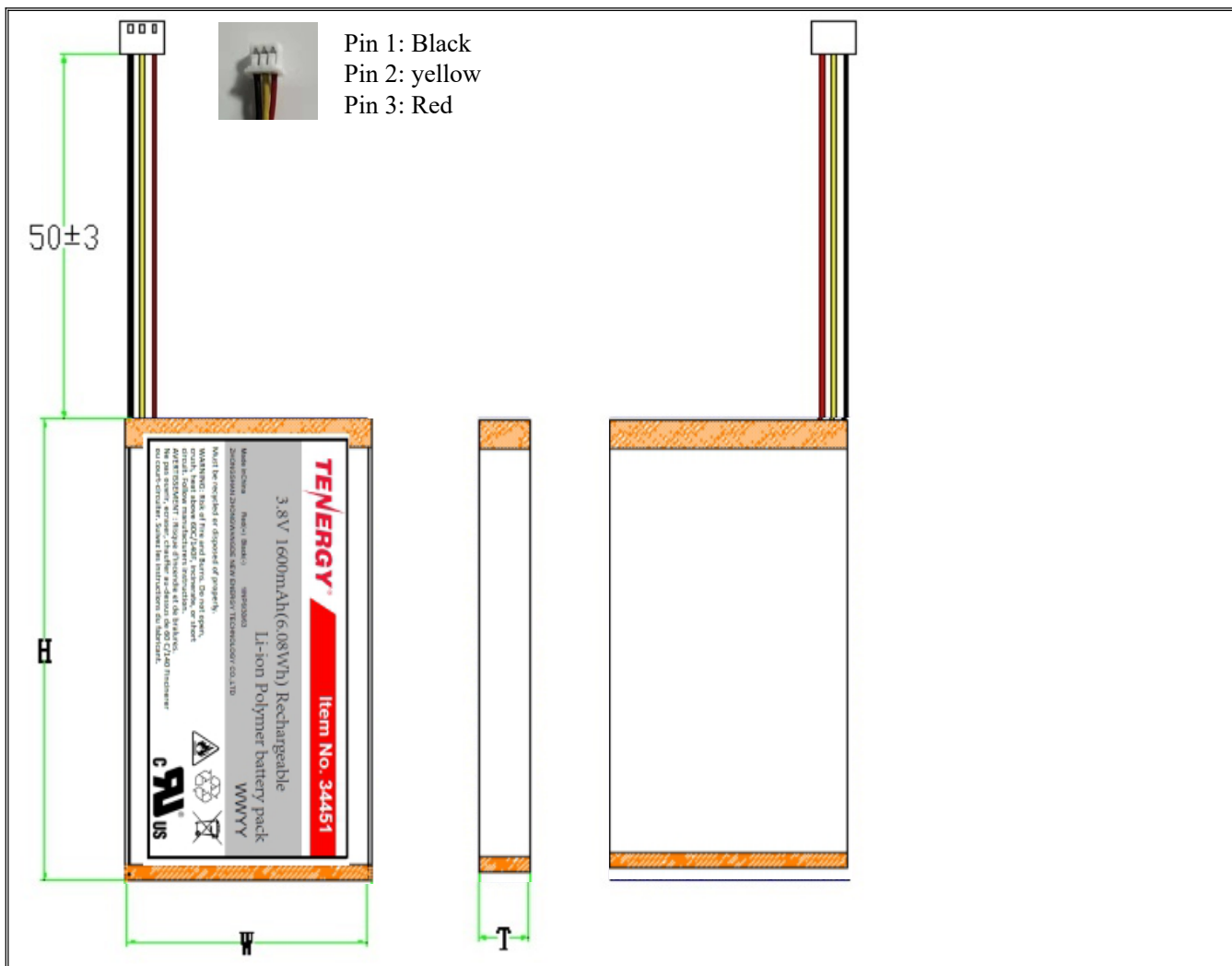
2.DESCRPTION AND MODEL

2.1 Description: Rechargeable Li-ion Battery

2.2 Model: 34451

2.3 The design is complies with: UL 1642, UL2054, CB(IEC62133-2:2017), UL/CSA 62368-1, UN38.3 (with UN3480, UN3481)

3. OUTLINE DIMENSION



Label:

TENERGY®

Item No. 34451

**3.8V 1600mAh(6.08Wh) Rechargeable
Li-ion Polymer battery pack**

Made in China Red(+) Black(-) 1INP6/30/63

ZHONGSHAN ZHONGWANGDE NEW ENERGY TECHNOLOGY CO.,LTD

WWYY

Must be recycled or disposed of properly.

WARNING: Risk of Fire and Burns. Do not open,
crush, heat above 60C/140F, incinerate, or short
circuit. Follow manufacturers instruction.

AVERTISSEMENT : Risque d'incendie et de brulures.

Ne pas ouvrir, écraser, chauffer au-dessus de 60 C/140 F incinérer
ou court-circuiter. Suivez les instructions du fabricant.



Unit (mm)

thickness (T)	Cell(initial)	<u>Max:5.98</u>	width (W) include PVC	<u>Max:31</u>	height (H) include PVC	<u>Max:66</u>
	Cell (after cycles)	<u>Max:6.45</u>				
	cell+label (initial)	<u>Max:6.08</u>				
	cell+label (after cycles)	<u>Max:6.55</u>				
Line length (L)	<u>50±3</u>		Connector	<u>LHE-A 1251-H03</u>	Wire specifications	<u>UL3302 28AWG</u>
PCM	<u>FR-4</u>		IC	<u>CM1003-S11ED</u>	MOS	<u>8205*2pcs</u>
NTC	<u>10K±1% NCP15XH103F03RC</u>					

4.Specification

Item	Specification	Remark※
4.1.1Nominal Capacity	<u>1600mAh</u>	0.2C charge 0.2C discharge
4.1.2 Nominal Voltage	<u>3.8V</u>	
4.1.3 Open Circuit Voltage	<u>3.8-4.1V</u>	
4.1.4 Charge Cutoff Voltage	<u>4.35V</u>	
4.1.5Voltage at end discharge	3.0V	
4.1.6 Standard charge	500mA	0~45℃
4.1.7 Recommended charging method	500mA	<u>500mA to 4.35V, then CV to0.02C</u>
		<u>cutoff</u>
4.1.8 Max continuous charge current	500mA	0~20℃
	1A	20~45℃
4.1.9 Maximum burst charging current	3A	16ms
4.2.0 Standard discharge	<u>300mA</u>	-10~60℃
4.2.1 Maximum continuous discharge current	2A	15~60℃
4.2.2 Maximum burst discharge current	4A	0.25s
4.2.5 Storage Temperature and Humidity Range	1month:-20℃-60℃	The battery is stored in 3.70~4.0 V, tested once every three months, and needs to be replenished in time when it is less than 3.7 V.
	3month:-20℃-45℃	
	1year:-20℃-25℃	
4.2.6 Soft Pack Internal Resistance (25℃)	<u><250mΩ</u>	AC Impedance 1KHz

5. General performance

No.	Item	Test methods and condition	Criteria
5.1	Capacity testing	Under $23\pm 2^{\circ}\text{C}$ ambient conditions, charge with 0.2 c charging current constant current, when the battery voltage reaches the charging voltage, change to constant voltage charge until the charging current is less than or equal to 0.02 c.. and then discharge continuously at a current of 0.2 c to the capacity released by the termination voltage.	\geq nominal capacity
5.2	Internal resistance test	At $23 \pm 2^{\circ}\text{C}$ condition, the battery after standard charged, use AC impedance tester (1KHz) measuring the initial impedance.	\leq standard resistance
5.3	0.2C Discharge performance	After fully charging the battery, discharge with 0.2C to the cut-off voltage.	Discharge time ≥ 300 minutes
5.4	1C Discharge performance	Fully charge the battery, then discharge with 1C until the voltage downs to 3.0V.	Discharge time ≥ 51 minutes
5.5	Storage Characteristic	After fully charging the battery, rest the battery for 28 days, then discharge with 0.2C to the cut-off voltage.. Recycle it for 1 time.	The first discharge time must $\geq 4.25\text{h}$. The second discharge time must $\geq 4.5\text{h}$.
5.6	High Temperature Discharge	Let the battery stay at $(55\pm 2)^{\circ}\text{C}$ for 2h and then discharge with 0.2C until drops to the cut-off voltage.	The discharge time must $\geq 5\text{h}$. Thickness expansion rate $\leq 5\%$
5.7	Low Temperature Discharge	Let the fully charged battery stay at $(-10\pm 2)^{\circ}\text{C}$ for 4h and then discharge with 0.2C until drops to the cut-off voltage.	The discharge time must $\geq 180\text{min}$.

5.8	Cycle life ($23\pm 2^{\circ}\text{C}$)	<u>Constant current 0.5C charge to 4.35V, then constant voltage charge to current declines to 0.02C, constant current 0.5C discharge to 3.0V, Repeat above steps till continuously discharging capacity Higher than 80% of the Min Capacities of the Cells</u>	≥ 500 times <u>thickness</u> <u>increasing $\leq 8\%$</u>
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6. Environment performance

No.	Item	Test methods and condition	Criteria
6.1	Storage	Discharge the battery with 0.2C to the cut-off voltage, then charge it with 40%~45% capacity. Store the battery at (20 ± 5) $^{\circ}\text{C}$ with 45%~75% relative humidity for 12 months. Finally, discharge the fully charged battery with 0.2C to cut-off voltage.	Discharge time $\geq 4\text{h}$.
6.2	High temperature storage	Use 0.5C charge-discharge capacity as the initial capacity of the battery. After the battery is fully charged, put it into a $60\pm 2^{\circ}\text{C}$ oven for 7D, take it out and let it stand for 2h at room temperature to confirm the appearance and thickness of the battery, and measure it with a 0.2C current. The remaining capacity of the battery, the recovery capacity.	The thickness change rate $< 10\%$, capacity retention rate $> 85\%$, capacity recovery rate $> 90\%$, the battery does not fire, does not leak, does not explode
6.3	High Humidity and Temperature Characteristics	Measured the initial Capacity at 0.2C. Stored the recharged cells for 48hrs at $40\pm 2^{\circ}\text{C}$ and 90%RH, then rest for 4hrs at room temperature. 0.2C discharged after checked the cells' appearance. Measured recoverable capacity at 0.2c .	Residual Capacity $\geq 50\%$ initial capacity Recoverable Capacity $\geq 80\%$ initial capacity Swelling: $\leq 10\%$ initial thickness Appearance: No explosion, No fire

6.4	Hot Oven Characteristics	Put the cells in the oven. The temperature of the oven is to be raised at $5\pm2^{\circ}\text{C}$ per minute to a temperature of $130\pm2^{\circ}\text{C}$ and remains 30 minutes.	No fire, no explosion																
6.5	Temperature performance	the discharge capacity contrast at different temperature conditions, that is, after the battery is charged at 25°C normal temperature, discharge to 3.0 v capacity at 0.2 c at the temperature shown in the following table. if the charge and discharge temperature is not the same temperature, the temperature change interval time is 3 h.	<table><tr><th rowspan="2">充电温度</th><th rowspan="2">放电截止电压</th><th colspan="4">放电温度</th></tr><tr><th>-10℃</th><th>0℃</th><th>25℃</th><th>60℃</th></tr><tr><td>25℃</td><td>3.0V放电容量比</td><td>≥60%</td><td>≥80%</td><td>≥100%</td><td>≥95%</td></tr></table>	充电温度	放电截止电压	放电温度				-10℃	0℃	25℃	60℃	25℃	3.0V放电容量比	≥60%	≥80%	≥100%	≥95%
充电温度	放电截止电压	放电温度																	
		-10℃	0℃	25℃	60℃														
25℃	3.0V放电容量比	≥60%	≥80%	≥100%	≥95%														

7. Safe characteristic

No.	Item	Test methods and condition	Criteria
7.1	Overcharge testing (NO PCM)	At $25\pm 5^{\circ}\text{C}$, charging cells with constant current 3C to voltage 4.6V, then with constant voltage 4.6V till current decline to 0. Stop test till cells temperature 10°C lower than max temperature.	No fire, no explosion
7.2	Over-discharge testing (NO PCM)	At $25\pm 5^{\circ}\text{C}$, According to the requirements of standard charge, the cells will be discharge to cut-off voltage, then connect with external load of 30 ohm for 24 hours.	No fire, no explosion, no leakage.
		Connect the positive and negative poles of the fully charged battery with a load of $80 \pm 20\text{m}$	No fire, no explosion battery surface temperature not exceeding 150°C

7.3	normal temperature short-circuit test	Ω at room temperature of $25\text{ }^{\circ}\text{C} \pm 5\text{ }^{\circ}\text{C}$ to short circuit the outside of the battery	
7.4	55 $^{\circ}\text{C}$ short circuit test	The positive and negative poles of the cell are connected at 55 to $5\text{ }^{\circ}\text{C}$ with a load of 80 to $20\text{ m}\Omega$ at a temperature of 55 to $5\text{ }^{\circ}\text{C}$, and the external short circuit of the battery is made short	No fire, no explosion battery surface temperature not exceeding $150\text{ }^{\circ}\text{C}$
7.5	Crush Test	After standard charged, the cell is to be crushed between two flat surfaces. The force for the crushing is to be applied by a hydraulic ram with a 1.25inch(32mm) diameter piston. The crushing is to be continuing until a pressure reading of 2500 psig(17.2Mpa) is reached on the hydraulic ram, applied force of 3000 pounds(13KN). Once the maximum pressure has been obtained it is to be released.	NO fire, No explode
7.6	Vibration	Battery charged by the regulation, after the battery is fixed on the vibration table, don't make the battery out of shape, with sinusoidal vibration, and within 15 min in logarithmic sweep from 7 hz frequency sweep to 200 hz and return to the 7 hz. Vibration along three mutually perpendicular direction of sample (one direction is perpendicular to the plane of the cathode) must match the sample, according to the logarithmic sweep in each direction way to 12 repetitions, vibration 3h. Logarithmic	No leakage, no fire and no explosion.

		frequency sweeping method is as follows: 7 hz ~ 18 hz maintain peak acceleration of 9.8 m/s ² . Hold the amplitude at 0.8 mm (displacement of 1.6 mm) until the peak acceleration of 78.4 m/s ² (frequency is about 50 hz). Keep 78.4 m/s ² peak acceleration until the frequency increased to 200 hz.	
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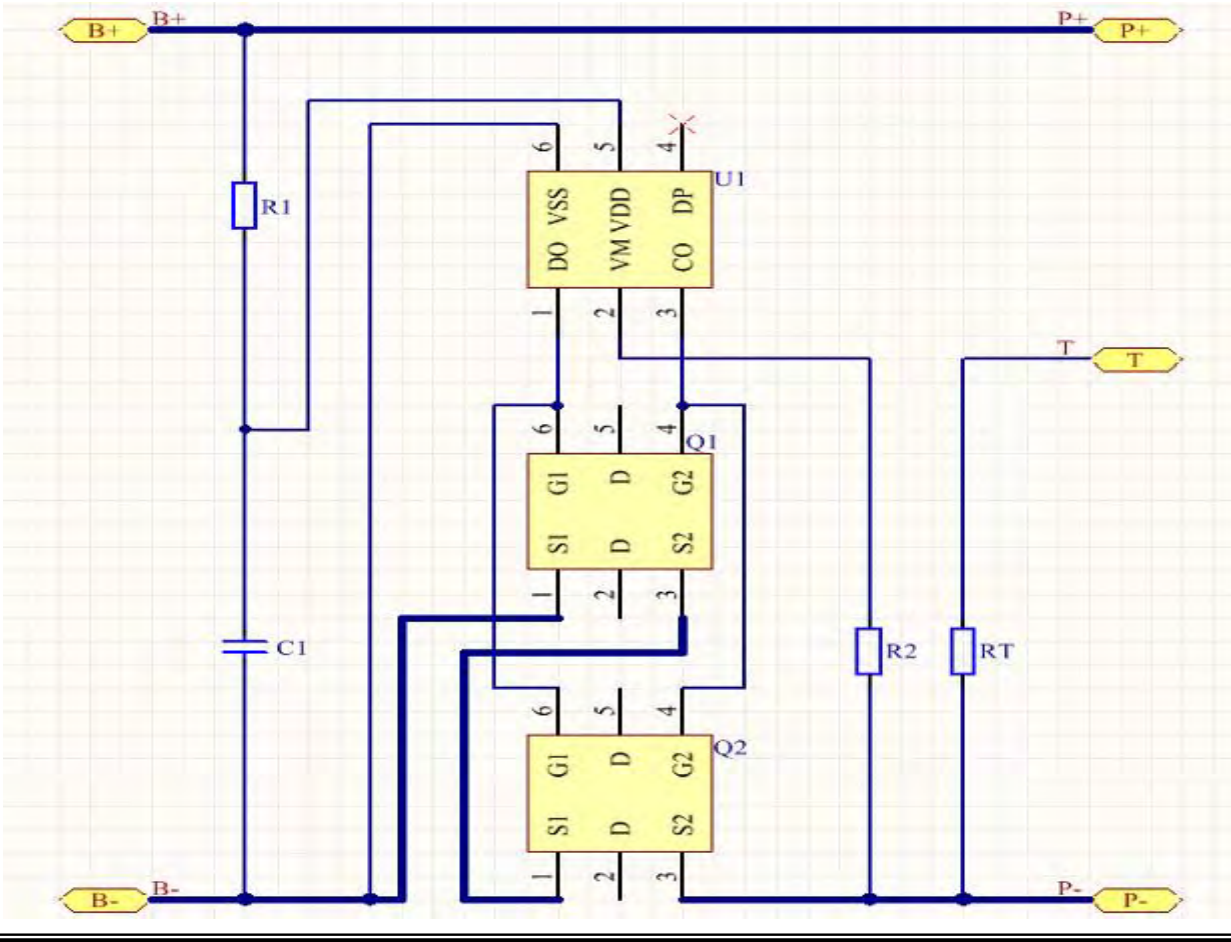
8. PCM

8.1 PCM Parameters

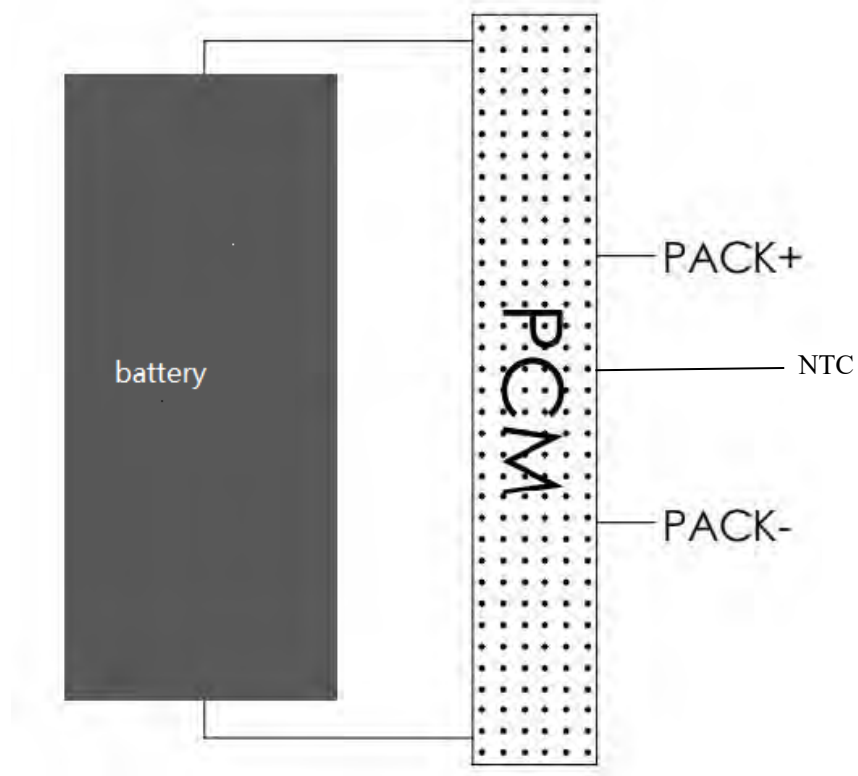
Item	Symbol	Content	Criterion			
			Min	Typ	Max	Unit
Over charge Protection	V _{DET1}	Over charge detection voltage	4.375	4.4	4.425	V
	tV _{DET1}	Over charge detection delay time	700	1000	1300	ms
	V _{REL1}	Over charge release voltage	4.305	4.35	4.395	V
Over discharge protection	V _{DET2}	Over discharge detection voltage	2.95	3.0	3.05	V
	tV _{DET2}	Over discharge detection delay time	89.6	128	166.4	ms
	V _{REL2}	Over discharge release voltage	3.1	3.2	3.3	V
Over current protection		Over discharge current protection current	2-4			A

		Over discharge current protection delay time	11.2-20.8			ms
		Charge over current detection current	1-3			A
		Charge over current detection delay time	5-16			ms
		Release condition	Cut load			
Short protection		Detection condition	Exterior short circuit			
	T_{SHORT}	Detection delay time	230-500			us
		Release condition	Cut short circuit			
Interior resistance	R_{SS}	Main loop electrify resistance			120	m Ω
Current consumption	I_{DD}	Current consume in normal operation	<8			uA

8.2 Schematic diagram



8.3 Battery architecture



8.4 Parts list

NO.	Location	Part name	Specification	Q' ty	Maker/Remark
1	U1	Battery protection IC	CM1003-S11ED	1	Madechip
2	Q1	MOSFET	8205	1	Depuw
3	Q2	MOSFET	8205	1	Depuw
4	R1	Resistance	470 Ω , $\pm 5\%$, 1/16W	1	YAGEO
5	R2	Resistance	2K Ω , $\pm 1\%$, 1/10W	1	YAGEO
6	C1	Capacitance	0.1uF, $\pm 10\%$, 16V	1	YAGEO
7	NTC	NTC	10K $\pm 1\%$ NCP15XH103F03RC	1	Murata
8	PCB	Print circuit board	FR_4	1	

9. Transportation and storage

9.1 transport

The battery should be charged in the semi state (50%-80% state of charge under transport packages, The play should be prevented in the course of transportation Strong vibration, Shock or extrusion, prevent the sun and rain, land and air transportation to Yu Hai.

9.2 Storage

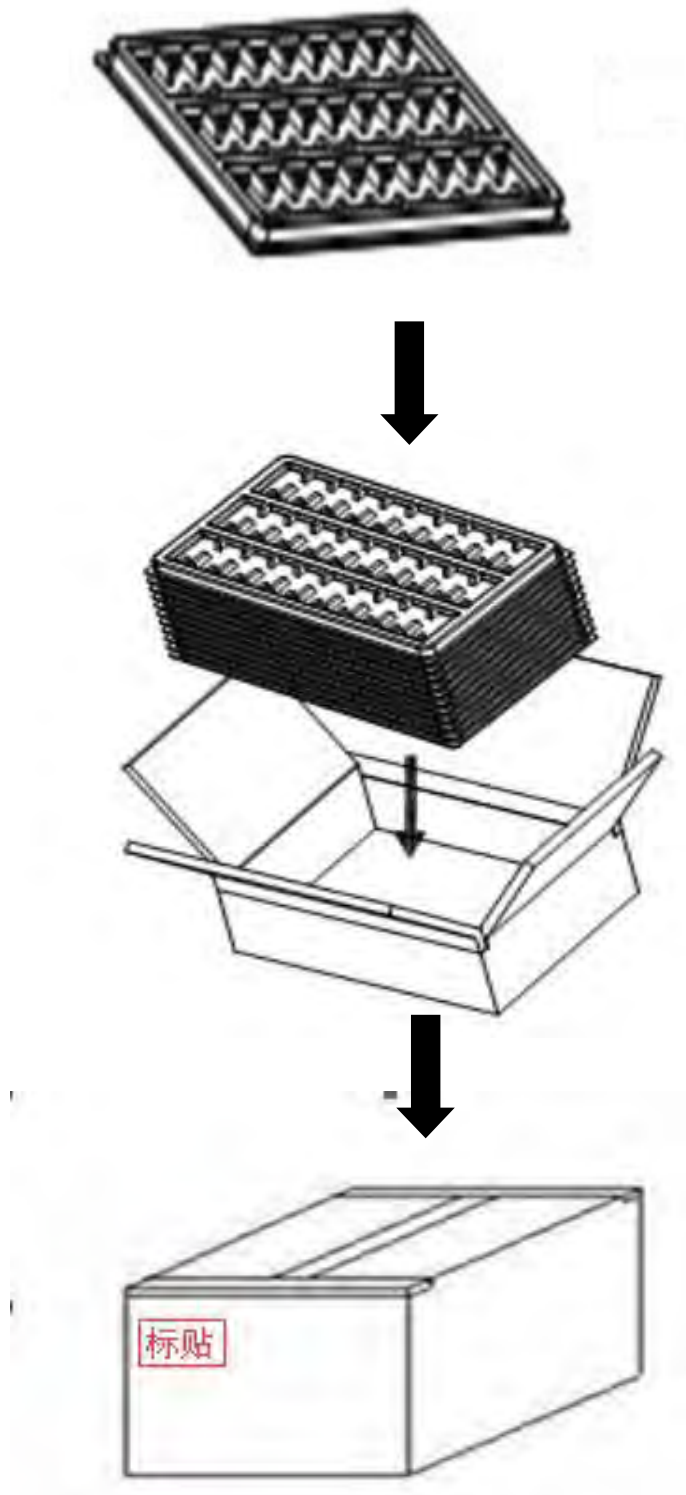
The storage environment of the battery shall meet the temperature and humidity requirements of the specification. If it is not used for a long time, please charge the battery to half full charge, remove the battery from the equipment and place it separately to avoid metal contact with the battery, short circuit or damage, and contact with corrosive substances; During use or storage, if the battery is found to have high temperature heating, liquid leakage, peculiar smell, deformation and other abnormal phenomena, please stop using it immediately and stay away from the battery.

10 Packaging and marking

10.1 Packing

Packing method: a single battery is placed into the plastic suction tray, the whole package is wrapped with plastic wrap, and 1 layers of protective layer are added to the upper and lower layers of the carton, and the packing boxes with battery products should be placed in the dry, dustproof and moistureproof packing boxes;

The product name, type, quantity, gross weight, date of manufacture should be marked outside the packing box, and the necessary marks such as "fragile goods", "fear of rain" and "upward" should be marked. The packaging, storage and transportation icon shall conform to the provisions of GB191-2008.



10.2 sign

Each battery should have the following Chinese Symbols: model, voltage, rated capacity, energy, positive and negative polarity, batch number.

11. Caution in use

To ensure proper use of the battery please read the manual carefully before using it. Handling

- Do not expose to, dispose of the battery in fire.
- Do not put the battery in a charger or equipment with wrong terminals connected.
- Avoid shorting the battery
- Avoid excessive physical shock or vibration.
- Do not disassemble or deform the battery.
- Do not immerse in water.
- Do not use the battery mixed with other different make, type, or model batteries.
- Keep out of the reach of children.

. charge and discharge

- Battery must be charged in appropriate charger only.
- Never use a modified or damaged charger.
- Do not leave battery in charger over 24 hours.

. storage

- Store the battery in a cool, dry and well-ventilated area.

. disposal

- Regulations vary for different countries. Dispose of in accordance with local regulations.

. Soft Aluminium Foil: The soft aluminum packing foil may be damaged by sharp matter such as Ni-tabs, pins and needles or other tooling and fixtures.

- 1) Do not strike Cells with any sharp matter.
 - 2) Trim your nail or wear gloves before taking Cells.
 - 3) Clean worktable to make sure that there is no sharp particle.
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-



Top Sealing Edge: Sealing edge on the top of the Cell is very flimsy and easy to be delaminated. Do not bend or fold this area.



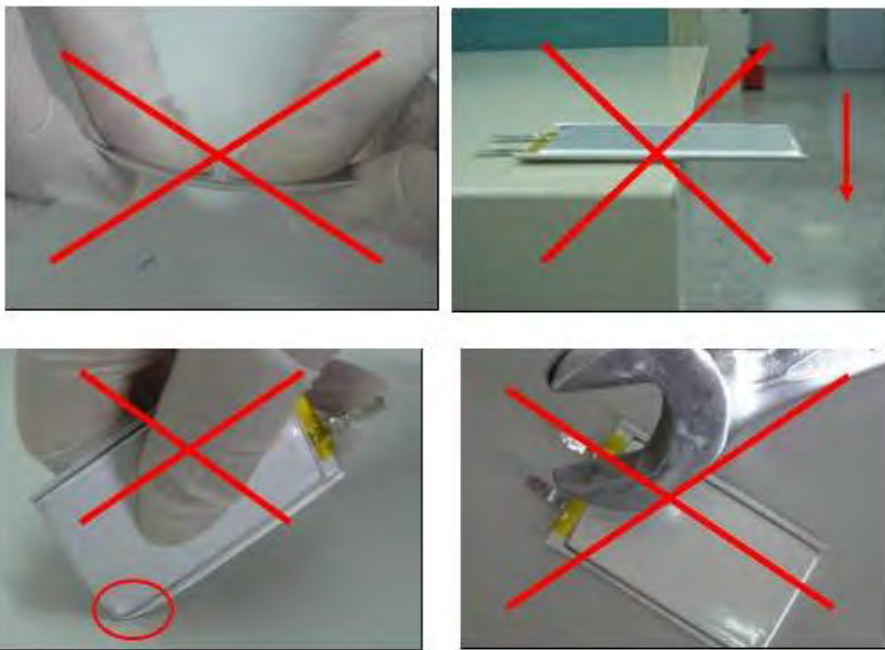
Side Sealing Edge: The side sealing edge has been folded and fixed in cell forming processes and passed hermetic test. The Aluminum foil may brake by re-folding time after time. Don't open and refold this edge.



Tabs: The Cell tabs are easy to be broken especially for Aluminum tab. Do not bend the tabs.



Mechanical Shock: Do not drop, shock or bend Cell body.



Short: Short terminal of the Cell is strictly prohibited. It may damage the Cell and result in safety accident.



12. Battery operation instruction

12.1 Charging

Charging current: Cannot surpass the biggest charging current which in this specification book stipulated.

Charging voltage: Does not have to surpass the highest amount which in this specification book stipulated to decide the voltage.

Charge temperature: The battery must carry on the charge in the ambient temperature scope which this specification book stipulated.

Uses the constant electric current and the constant voltage way charge, the prohibition reverse charges. If the battery positive electrode and the cathode meet instead, can damage the battery.

12.2 Discharging current

The cell shall be discharged at less than the maximum discharge current specified in the Product Specification. High discharging current may reduce the discharging capacity significantly or cause over-heat.

12.3 discharge temperature

The battery discharge must carry on in the ambient temperature scope which this specification book stipulated

12.4 Over-discharges

It should be noted that the cell would be at over-discharged state by its self-discharge characteristics in case the cell is not used for long time. In order to prevent over-discharging, the cell shall be charged periodically to maintain between 3.6V and 3.9V. Over-discharging may cause loss of cell performance, characteristics, or battery functions. The charger shall be equipped with a device to prevent further discharging exceeding a cut-off voltage specified in the Product Specification. Also the charger shall be equipped with a device to control the recharging procedures as follows: The cell battery pack shall start with a low current (0.2C) for 15-30 minutes, i.e. -charging, before rapid charging starts. The rapid charging shall be started after the (individual) cell voltage has been reached above 3V within 15-30 minutes that can be determined with the use of an appropriate timer for pre-charging. In case the (individual) cell voltage does not rise to 3V within the pre-charging time, then the charger shall have functions to stop further charging and display the cell/pack is at abnormal state.

13. Other The Chemical Reaction

Because batteries utilize a chemical reaction, battery performance will deteriorate over time even if stored for a long period of time without being used. In addition, if the various usage conditions such as charge, discharge, ambient temperature, etc. are not maintained within the specified ranges the life expectancy of the battery may be shortened or the device in which the battery is used may be damaged by electrolyte leakage. If the batteries cannot maintain a charge for long periods of time, even when they are charged correctly, this may indicate it is time to change the battery.

14.Note:

Any other items which are not covered in this specification shall be agreed by both parties.
