



Specialists in M2M
Communications

APPROVAL SHEET

For

Lithium ion polymer rechargeable battery

Customer : _____

Cell's model name : BAT-LIPO800A-10

Assembly : _____

Date : 2006/11/29

REVISED : 0

Customer approval

Comment :

Customer's signature/ Date : _____

| Approved | Cheched | Prepared |
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REVISION AND UPDATES

| REVISED | DESCRIPTION | Date |
|---------|-------------|------|
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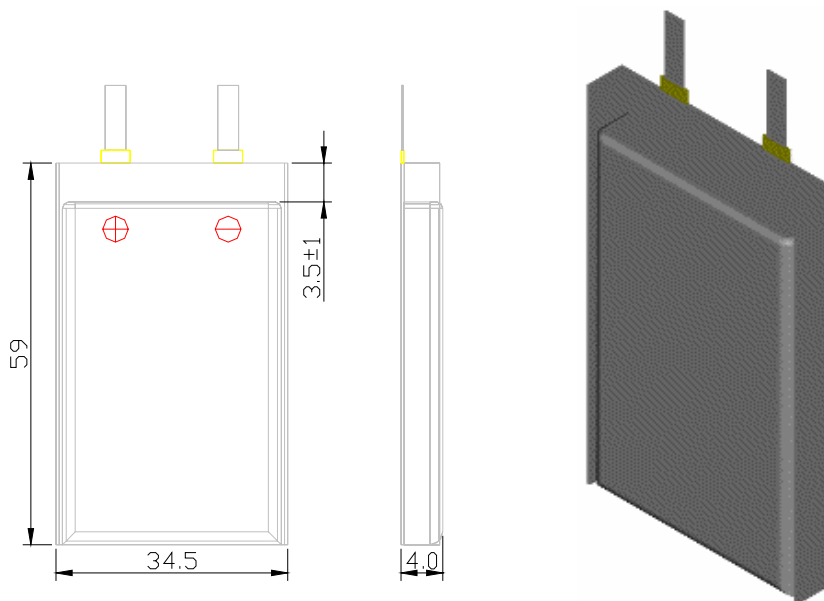
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1. Cell Type and Model

1.1 Cell Type : Lithium Ion Polymer Battery

1.2 Cell Model : BAT-LIPO800A-10

1.3 Cell Outer Dimension: 4.0±0.2 (T) X 34.5 ±0.5(W) X 59±0.75(L) mm



2. Performance

| Item | Specification | Remark※ | |
|------------------------------------|-------------------|----------------------------------|---|
| 2.1 Minimum Capacity | 800mAh | 0.2C discharge | |
| 2.2 Nominal Voltage | 3.7V | | |
| 2.3 End Voltage | 2.75V | | |
| 2.4 Charging Current (Std.) | 0.2CA(=160mA) | Ambient temperature 0~+40°C | |
| 2.5 Charging Current (Max.) | 1.0CA(=800mA) | Ambient temperature 0~+40°C | |
| 2.6 Charging Voltage | 4.2±0.03V | | |
| 2.7 Charging Time (Std.) | 6~7.0 hours | | |
| 2.8 Charging Time (Max.) | 2~3.0 hours | | |
| 2.9 Discharging Current (Std.) | 160mA | Ambient temperature -20~+60°C | |
| 2.10 Discharging Current (Max.) | 2400mA | Ambient temperature -20~+60°C | |
| 2.11 Internal Resistance | <140mΩ | AC Impedance 1KHz | |
| 2.12 Weight | 19g | Battery only | |
| 2.13 Temperature range for storage | less than 1 month | -20~+60°C | Percentage of recoverable capacity 80% |
| | less than 3 month | -20~+45°C | |
| | less than 1 year | -20~+20°C | |

※ (1).Percentage of recoverable capacity

= (discharging time after storage / discharging time Initial) × 100%

(2).Discharging time is estimated by the discharge at 0.2CA to end voltage 2.75V after fully charged according to specification at approximately 25°C.

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| 3. Electrical Characteristics | | | | |
| Item | Test Method | | Criterion | |
| 3.1 Fully Charge | <p>(1)Standard Charge: Supply 0.2C (=0.16A) constant current until battery voltage reaches 4.2V, then supply a decreasing current endlessly. Charging time is 6~7 hours.</p> <p>(2)Quick Charge: Supply 1.0C (=0.8A) constant current until battery voltage reaches 4.2V, then supply a decreasing current endlessly. Charging time is 2~3 hours.</p> | | Ambient temperature 0 ~+40°C | |
| 3.2 Capacity | <p>(1)Within 1 hour after fully charged, discharge at 0.2C (=0.16 A) continuously down to end voltage 2.75V.</p> <p>(2)Within 1 hour after fully charged, discharge at 0.5C (=0.4A) continuously down to end voltage 2.75V.</p> | | <p>more than 300 min (100%)</p> <p>more than 108 min (90%)</p> | |
| 3.3 Cycle Life | (1)A battery unit shall be repeated 500 charge/discharge cycles, charged at CC-CV (0.2C =0.16A to 4.20 V) for 6~ 7 hours, discharged at 0.8A to 2.75V end voltage, After 500 cycles, discharging time is estimated as specified in paragraph 3.2(2) | | more than 36 min (60%) | |
| 3.4 Temperature | <p>(1)Within 1 hour after fully charged at 20°C, a battery unit is stored at -20°C. Discharge time is estimated by discharging at 0.5C (=0.4A) continuously down to 2.75V end voltage.</p> <p>(2)Within 1 hour after fully charged at 20°C, a battery unit is stored at 60°C. Discharge time is estimated by discharging at 0.5C (=0.4A) continuously down to 2.75V end voltage.</p> | | <p>more than 78 min (65%)</p> <p>more than 102 min (85%)</p> | |
| 3.5 Full Charged State Storage | <p>(1)After fully charged, stored for 10days at 60 °C and rested at room temperature for 1 hour. Discharge time is estimated by discharging at 0.5C (=0.4A) continuously down to 2.75V end voltage.</p> <p>(2)Then next discharge time is estimated as specified in paragraph 3.2(2).</p> | | <p>more than 84 min (70%)</p> <p>more than 96 min (80%)</p> | |
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| 3.6 Full Discharged State Storage | (1) After fully charged, discharge as specified in paragraph 3.2(2), then store for 10 days at 60°C and rest at room temperature for 1hour. Discharging time is estimated as specified in paragraph 3.2(2). | | more than 90 min (75%) | |
| 4. Safety Performance | | | | |
| Item | Test Method | | Criterion | |
| 4.1 High Temperature Storage | After fully charged, store for 10 days at 60 °C. | | No rupture, fire , smoke or swell and leakage of liquid electrolyte apparently | |
| 4.2 Leak Test | After fully charged, store for 10 days at 60°C and at humidity 70±20% . | | No rupture, fire , smoke or swell and leakage of liquid electrolyte apparently | |
| 4.3 Drop-Test | The battery is dropped 3 times for three-dimensional face of the battery (total of 9 times dropping) from a height of 76cm on the hard wooden board. | | There shall be no abnormal performance and structure or excessive deformation. | |
| 4.4 Vibration Test | Vibrate for 60 minutes to any direction with amplitude 4mm and frequency 16.7Hz. | | There shall be no abnormal performance and structure or excessive deformation. | |
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5. Appearance

There shall be no practical damage such as conspicuous liquid leakage, flaw, rust, dirt, swell, and deformation.

6. Cell capacity condition at the shipment

About 20~50% charged state.

7. Protection Circuit Characteristics (at 25°C)--This specification item is option.

7.1 Electrical Characteristic

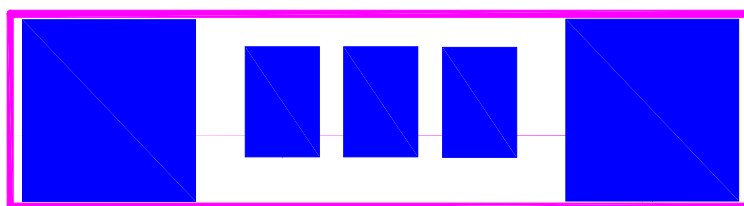
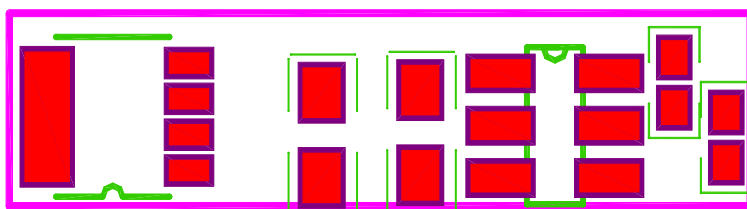
| Item | Symbol | Content | Criterion |
|---------------------------|-------------|-------------------------------------|--------------------------------------|
| Over charge Protection | V_{DET1} | Over charge detection voltage | 4.30V ~ 4.35V |
| | tV_{DET1} | Over charge detection delay time | 0.8 ~ 1.4s |
| Over discharge protection | V_{DET2} | Over discharge detection voltage | 2.242V ~ 2.55V |
| | tV_{DET2} | Over discharge detection delay time | 20ms ~ 144ms |
| | | | |
| Over current protection | V_{DET3} | Over current detection voltage | 135mv ~ 165mv |
| | I_{DP} | Over current detection current | 4A ~ 6A |
| | tV_{DET3} | Detection delay time | 4ms ~ 16ms |
| | | Release condition | Cut load |
| Short protection | | Detection condition | Exterior short circuit |
| | T_{SHORT} | Detection delay time | 250-500u |
| | | Release condition | Cut short circuit |
| Interior resistance | R_{DS} | Main loop electrify resistance | $V_C=4.2V$; $R_{DS} \leq 65m\Omega$ |
| Current consumption | I_{DD} | Current consume in normal operation | 3.5 μ A Type 8.0 μ A Max |

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7.2 Bill of Materials

| NO. | Location | Part name | Specification | Pack type | Q' ty | Maker/Remark |
|-----|----------|-----------------------|--|-----------|-------|--------------|
| 1 | IC1 | Battery protection IC | R5402N120KD | SOT-23-6 | 1 | RICOH |
| 2 | IC2 | Battery protection IC | S-8261AAJMD-G2J-T2G | SOT-23-6 | 1 | SEIKO |
| 3 | U1 | Silicon MOSFET | ECH8621 | ECH8 | 1 | SANYO |
| 4 | U2 | Silicon MOSFET | ECH8601R | ECH8 | 1 | SANYO |
| 5 | R1 | Resistance | G2J:SMD 330Ω ± 5% 120KD:SMD 470 Ω ±5% | 0402 | 1 | SKYWELL |
| 6 | R2 | Resistance | G2J:SMD 1KΩ ± 5% 120KD:SMD 2K Ω ±5% | 0603 | 1 | SKYWELL |
| 7 | C1 | Capacitance | SMD 0.1μ F | 0402 | 1 | SKYWELL |
| 8 | PCB | Print circuit board | 15*3.5*0.6mm | ± 0.15mm | 1 | ASSUN |

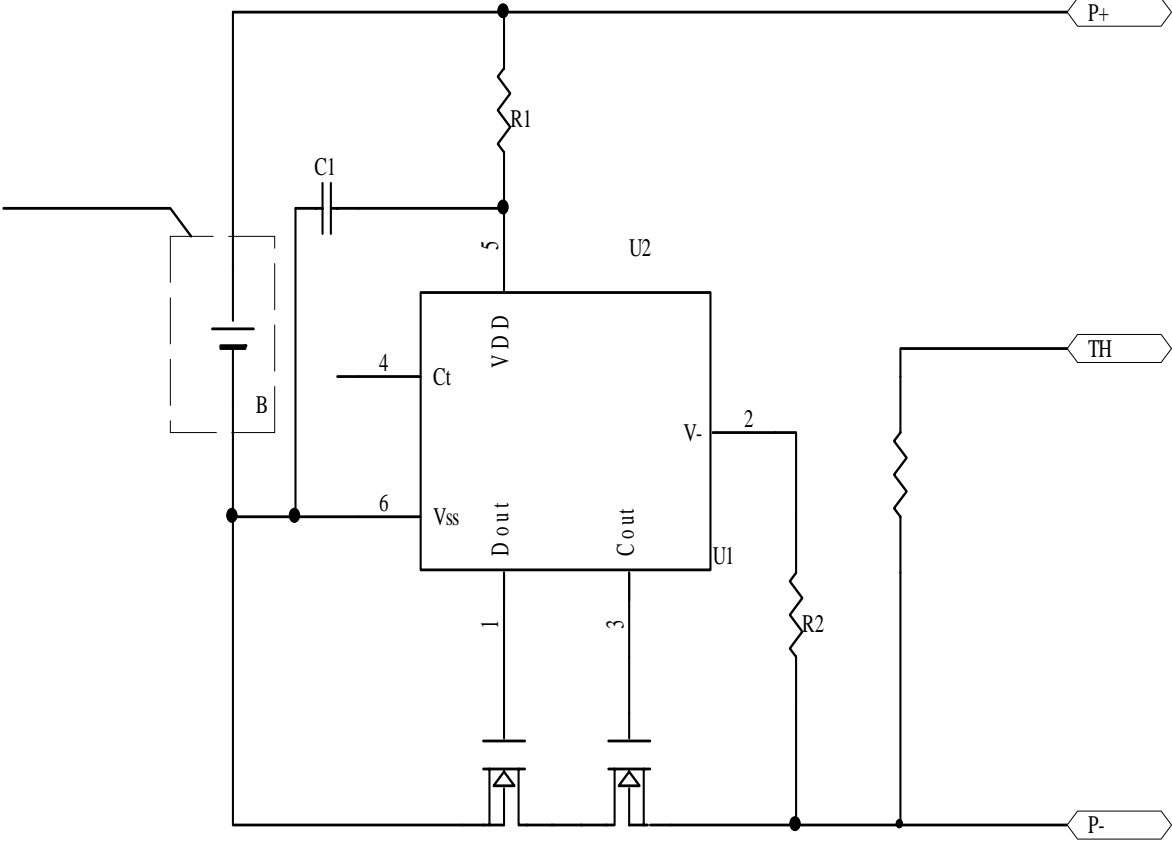
7.3 PCB Pad description



B- P- T P+ B+

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7.4 Application Circuit



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8. Pre-charging Method

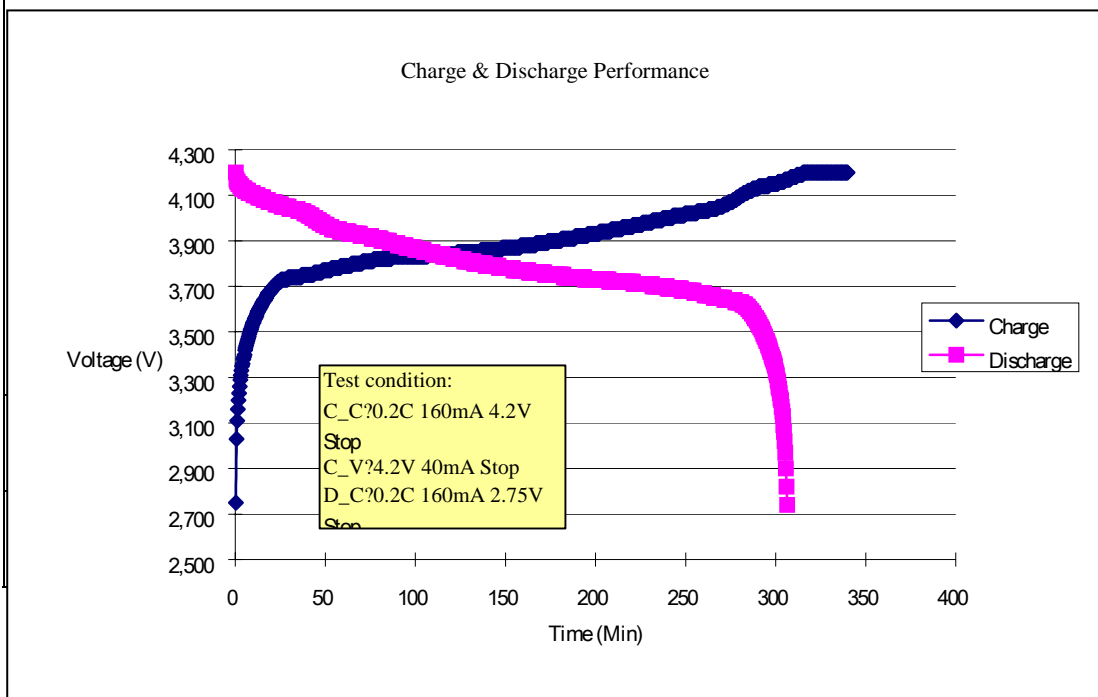
- (1) It's possible that the battery voltage decreases about 0V by the storage. If that battery is rapid-charged, there is much possibility that the temperature of the FET is growing highly. The charger must have the pre-charge system in consideration of the drop of battery voltage.
- (2) Pre-charge current of charger is approximately 0.1C (=80mA). When the battery voltage becomes 3.0V, standard charge start. If the battery voltage never reach to 3.0V in specified of the time clock, charging turns off.
- (3) Standard charge method is 0.1C (80mA)~4.20V(Constant current-constant voltage). Charging turns off when the specified condition of time clock, current, or O.C.V. is satisfied.

9. Safety Instruction

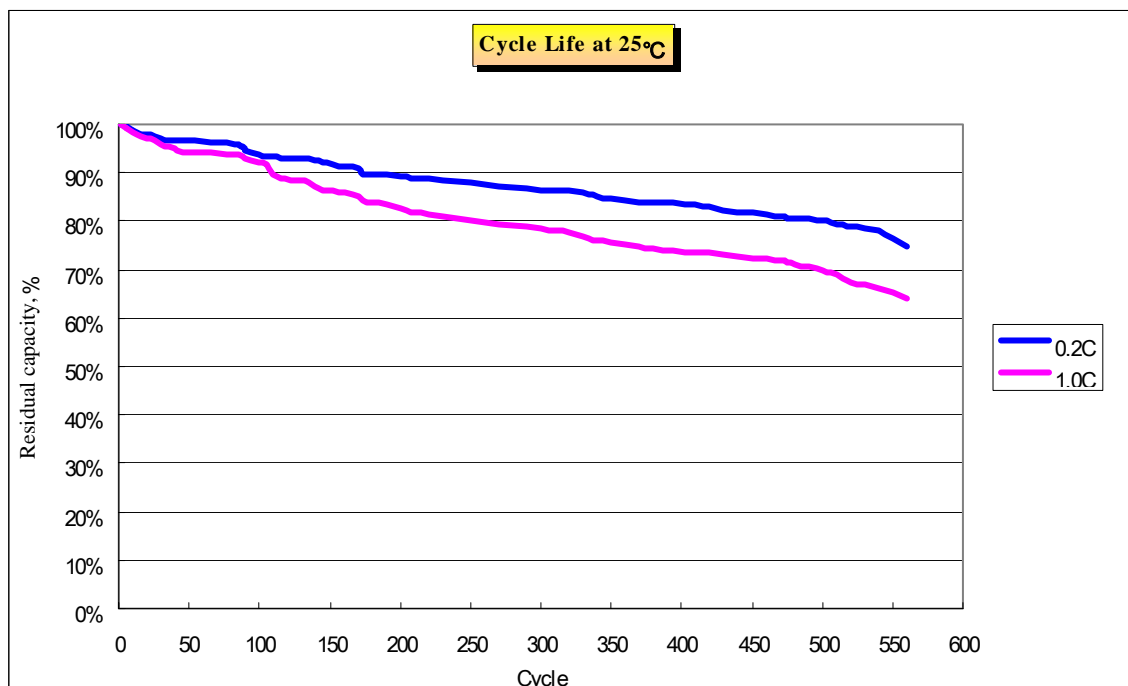
The battery pack includes the flammable objects such as the organic solvent. If the handling is missed, there will be possibility that the battery rupture, Flames or hot, or it will cause the deterioration or damage of battery. Please observe the following prohibitive matters. And the protection Device the equipment for fear that the trouble would affect the battery by the Abnormality of equipment. In addition the following matters as "Prohibition Points on Handle" in the instruction manual of the equipment.

10. Performance Curves

10.1 Charge & Discharge Performance



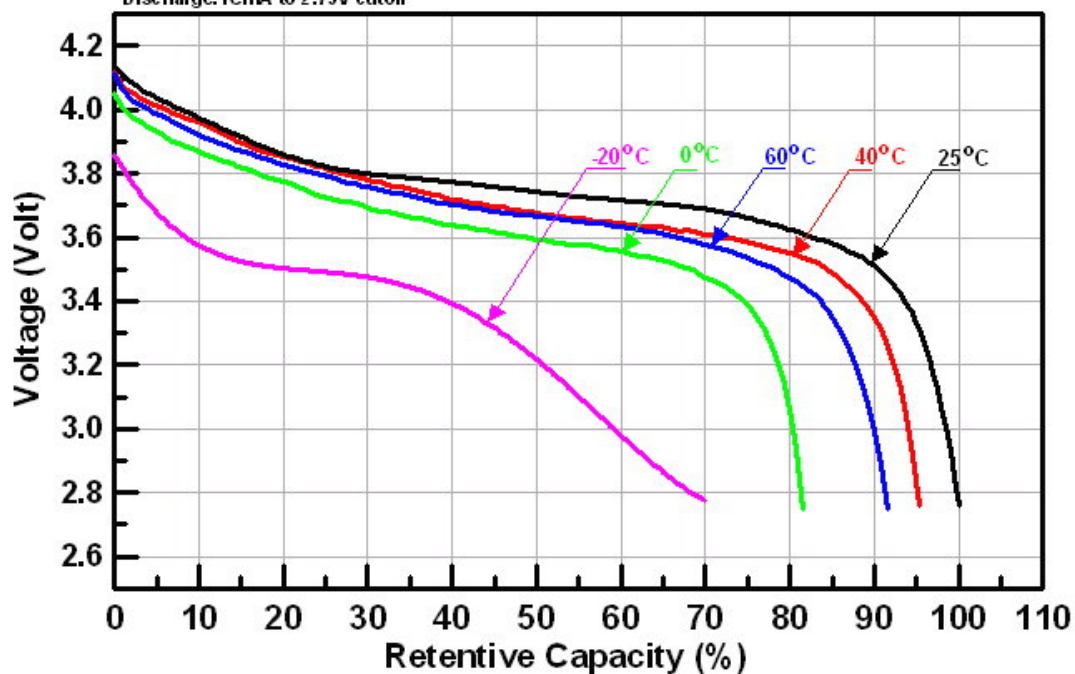
10.2 Cycle Life Curves



10.3 Discharge Curves

1C Rate Discharge At Various Environment Temperature

Charge Condition: 0.5CmA C.C. to 4.2V, 4.2V C.V. to 0.05CmA cutoff
 Discharge: 1CmA to 2.75V cutoff



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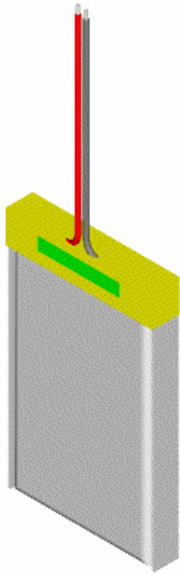
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11 Pack Drawing

11.1 Soft pack drawing (Product Outer Dimension: 4.0 ± 0.2 (T) X 35 ± 0.5 (W) X 60 ± 0.5 (L) mm)



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11.2 BOM of Product

| | Item | Model | Specification | Remarks |
|---------|--|---------------------------|---|-----------|
| 1 | Red Wire | AWG#28 | Outer Diameter:0.9±0.1mm | |
| 2 | Black Wire | AWG#28 | Outer Diameter:0.9±0.1mm | |
| 3 | PCM | Li-ion single cell PCM | Over Voltage Protect: 4.30V ~ 4.35V Over Discharge Protect: 2.242V ~ 2.55V | See Table |
| 4 | Tape | Kapton | See figure | |
| 5 | Cell | BAT-LIPO800A-10 | 800mAh | |
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12. Danger !

1. Disassemble and Reconstruction

“Do not disassemble or reconstruct battery”

The battery has safety function and protection circuit to avoid the danger. If they have serious damage, it will cause the generating, smoke, rupture or flaming.

2. Short-circuit

“Do not short-circuit battery”

Do not connect the + and – terminals with metals (such as wire). Do not carry or store the battery with metal objects (such as wire, chain, necklet or hairpins). If the battery is short-circuited, excessive large current will flow and then the generating, smoke, rupture or flaming will occur. And also, it causes generating of metals.

3. Use nearby Heated Place

“Do not use or leave battery nearby fire, stove or heated place (more than 80°C)”

In case that separator made of polymer is melted by high temperature, the internal short-circuit occurs in individual cells and then it causes the generating, smoke, rupture or flaming. In addition, do not use the battery under the heated place (more than 80°C) for same reason.

4. Immersion

“Do not immerse the battery in water or sea water, or get it wet”

If the protection circuit included in the battery is broken, the battery will be charged at extreme current or voltage and the abnormal chemical reaction occurs in it. And then it causes the generating, smoke, rupture or flaming.

5. Charge nearby heated place

“Do not charge battery nearby the fire or under the blazing sun”

If the protection circuit to avoid the danger works under high temperature or it is broken, the battery will be charged at abnormal current (or voltage) and abnormal chemical reaction will occur. It causes the generating, smoke, rupture or flaming.

6. Charger and Charge Condition

“Do use the specified charger and observe charging requirement”

If the battery is charged with unspecified condition (under high temperature over the regulated value, excessive high voltage or current over regulated value, or remodeled charger). There are cases that it will be overcharged or the abnormal chemical reaction will occur in cells. It causes the generating, smoke, rupture or flaming.

7. Penetration

“Do not drive a nail into the battery. Strike it by hammer, or tread it”

As the battery might be broken or deformed and then it will be short-circuited, It causes the generating, smoke, rupture, or flaming.

8. Impact

“Do not give battery impact or fling it”

If the protection circuit assembled in the battery is broken, the battery will be charged at abnormal voltage or current and abnormal chemical reaction will occur. It causes the generating, smoke, rupture or flaming.

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9. Soldering

“Do not make the direct soldering on battery”

It causes the generating, smoke or flaming.

10. Reverse Charge and Over discharge

“Do not make the direct soldering on battery”

On charging, the battery is reverse-charged and abnormal chemical reaction occurs.

And also, there may be case that unexpected large current flows on discharging. These cause the generating, smoke, rupture or flaming.

12. Reversed Polarity Use

“Do not reverse-charge or reverse-connect”

The battery has polarity. If the battery is connected to opposite polarity with charger, it will generating, smoke, rupture or flaming.

13. Connect Battery To the Plug

“Do not connect battery to the plug socket or car-cigarette-plug”

Added high voltage to the battery, the excessive current will flow in it and then it will cause the generating, smoke, rupture or flaming.

14. Inappropriate Use For unspecified Equipment

“Do not use battery for unspecified equipment”

If the battery is used for unspecified equipment, it will deteriorate its performance and cycle-life. At worst, abnormal current will flow or battery may generate, smoke, rupture or flame.

15. Leakage

“Do not touch a leaked battery directly”

In case the leaked electrolyte gets into eyes, wash them with fresh water as soon as possible without rubbing eyes. And then, see a doctor immediately. If leave damaged eyes undone, it will cause eye-trouble.

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13. Warning !

1. Mixed Use

“Do not use Lithium ion battery in mixture”

Do not use Lithium ion battery with the primary batteries or secondary batteries whose capacity kind or maker is different, if do that, the battery will be discharged or charged excessively in use. And it may cause the generating, smoke, rupture or flaming because of the abnormal chemical reaction in cells.

2. Ingestion

“Keep the battery away from babies”

Keep the little battery out of the reach of babies in order to avoid troubles by swallowing. In case of swallowing the battery, see a doctor immediately.

3. Charging Time

“Do not continue to charge battery over specified time”

If the battery is not finished charging over regulated time, let it stop charging. There is possibility that the battery might generate, smoke, rupture or flame.

4. Store

“Do not get into a microwave or a high pressure container”

It causes the generating, smoke, rapture or flaming because of a sudden heat or damage of sealing condition of battery.

5. Leakage

“Do not use a leaked battery nearby fire”

If the liquid leaks from the battery (or the battery gives out bad smell), let the battery leave from flammable objects immediately. Unless do that, the electrolyte leaked from battery will catch fire and it will cause the smoke, flaming or rupture of it.

6. Rust, Changing color and Deformation

“Do not use an abnormal battery”

In case the battery has bad smell, it generates, its color changes or it is warped in using (includes charging and storage), let it take out from equipment or charger and do not use it. If an abnormal battery is used, it wilt generate, smoke, rupture or flame.

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14. Caution !

1. Use under strong sunshine

Do not use or leave the battery under the blazing sun(or heated car by sunshine). The battery may smoke, heat or flame. And also, it might cause the deterioration of battery's characteristics or cycle life.

2. Static Electricity

The battery has the protection circuit to avoid the danger. Do not use nearby the place where generates static electricity (more than 100V) which gives damage to the protection circuit. If protection circuit were broken, the battery would generate, smoke, rupture or flame.

3. Charging Temperature Range

Charging temperature range is regulated 0°C and 60°C. Do not charge the battery out of recommended temperature range. Charging out of recommended range might cause the generating or serious damage of battery. And also, it might cause the deterioration of battery's characteristics and cycle life.

4. Manual

Please read the manual before using the battery

5. Charging Method

Please read the manual of specified charger about charging method.

6. First time use

When the battery has rust, bad smell or something abnormal at first-time-using, do not use the equipment and go to bring the battery to the shop which it was bought.

7. Used by children

In case younger children use the battery, their parents teach how to use batteries according to the manual with care. And also, when children are using the batteries, pay attention to use it according to that or not.

8. Keep Battery away from children

Keep the battery out of the reach of younger children. And also, using the battery, pay attention to be taken out it from the charger or equipment by little children.

9. Leakage

If the skin or cloth is smeared with liquid from the battery, wash with fresh water. It may cause the skin inflammation.

10. Consultation

If there's any problem about the battery , contact the following

11. Warranty Period of Battery

The warranty period of battery is a one year from the date of shipment. However, even though the problem occurs within this period, factory won't replace a new battery for free as long as the problem is not due to the failure of factory manufacturing process or is due to customer's abuse or misuse.

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