

Product Specifications

Pouch Type Li-ion Rechargeable Battery

Model	FLPB462536
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PRESENTED TO:

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1. Preface

This Product Specification describes the requirements of Pouch Type Lithium-ion Rechargeable Battery ("Cell") to be supplied to customers by **routejade Inc.**

2. Description

2.1 Product Lithium-ion Rechargeable Battery

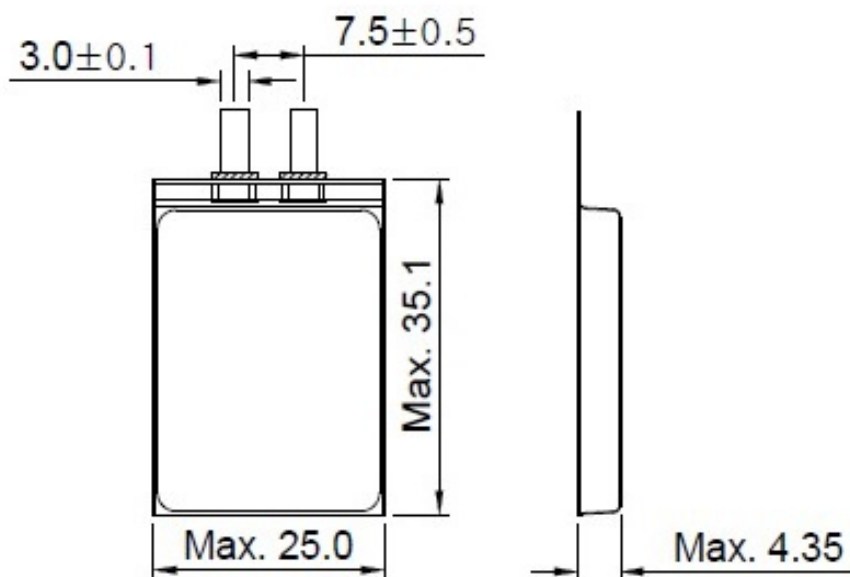
2.2 Model **(Cell) FLPB462536**

3. General Specifications

Item	Specification	Remarks
3.1 Nominal Capacity	450 mAh	0.5C/0.2C, 3.0V cut-off at 25°C
3.2 Minimum Capacity	420 mAh	0.5C/0.2C, 3.0V cut-off at 25°C
3.3 Nominal Voltage	3.8 V	3.0V ~ 4.35V
3.4 Charging Method	CC/CV	Constant Current / Constant Voltage
3.5 Charging Current (Std.)	210 mA	0.5C, 0 ~ 45°C
3.6 Charging Voltage	4.35 V	± 0.03V
3.7 Charging End Condition	12.6 mA	0.03C, at CV mode
3.8 Charging Time (Std.)	3 hours	CC + CV mode
3.9 Discharging Current (Std.)	84 mA	0.2C, -20 ~ 60°C
3.10 Discharging Current (Max.)	840 mA	2C
3.11 Discharge Cut-off Voltage	3.0 V	
3.12 Cycle (Min.Capacity)	336 mAh	0.5C/0.5C, 500cycle @25°C
3.13 Cell Weight	11.5 g	Approx.
3.14 Storage Temperature Range	-20 ~ 60 °C	For up to one month
	-20 ~ 40 °C	For up to three month
	-20 ~ 25 °C	For up to half year

4. Dimensions of FLPB462536 (unit: mm, shipping max.)

(a) Cell



Item	Specification
Thickness (shipping max.)	Max. 4.35mm
Thickness (swelling max.)	Max. 4.60mm
Width	Max. 25.0mm
Length	Max. 35.1mm
Distance between centers of 2 tabs	7.5 ± 0.5 mm
Tab width	3.0 ± 0.1 mm

5. Standards Test Conditions

Unless otherwise specified, all tests stated in this Product Specification are conducted at **temperature $25 \pm 3^{\circ}\text{C}$ and humidity $65 \pm 20\% \text{ RH}$.**

6. Electrical Characteristics

6.1 Standard Charge and Discharge Conditions

The "Standard Charge" means charging the Cell with initial charge current **210mA (0.5C)** and with a constant voltage **4.35V ($\pm 0.03\text{V}$)** and a cut-off current **12.6mA (0.03C)** at $25 \pm 3^{\circ}\text{C}$ for less than **3 hours**. The "Standard Discharge" means discharging the Cell with constant discharge current **84mA (0.2C)** and with **3.0V** cut-off voltage at $25 \pm 3^{\circ}\text{C}$.

6.2 Initial Discharge Capacity

The initial discharge capacity measured under the standard test conditions stated in 6.1

Initial Discharge Capacity: Typical **450mAh**, Minimum **420mAh**

6.3 Initial Internal Impedance

Internal impedance measured at 1KHz after Standard Charge.

Cell ACIR $\leq 100 \text{ m}\Omega$

6.4 Cycle Life

Cell shall be charged by **210mA (0.5C)** and terminated at **12.6mA(0.03C)**. Rest 10mins. Discharged by **210mA(0.5C)** until **3.0V**. Rest 10mins. Before recharging, **210mA(0.5C)** charging and **210mA(0.5C)** discharging states repeat **500cycles** continuously.

Capacity after 500 cycles $\geq 336\text{mAh}$

6.5 Temperature Dependence of Discharge Capacity (Cell)

Relative capacity at each temperature, measured with constance discharge current **84mA (0.2C)** with **3.0V** cut-off after the Standard Charge.

	Discharge Condition and Criteria				
Temperature	-20°C	0°C	25°C	45°C	60°C
Relative Capacity	50%	80%	100%	90%	80%

6.6 Discharge Characteristics on Current Load

Relative capacity at each load, measured with constant discharge current **0.2C, 0.5C, 1C, 1.5C, 2C** with **3.0V** cut-off after the Standard Charge.

	Discharge Condition and Criteria				
C-rate	0.2C	0.5C	1C	1.5C	2C
Relative Capacity	100%	95%	90%	80%	70%

6.7 Storage characteristics

After stored at the following several conditions, the battery is measured at the standard charge and discharge condition stated in 6.1.

Charge state	Storage condition	Capacity retention	Capacity recovery
Full charge (SOC 100%)	One month at $25 \pm 3^{\circ}\text{C}$	> 90%	> 95%
	Three months at $25 \pm 3^{\circ}\text{C}$	> 85%	> 90%
	Six months at $25 \pm 3^{\circ}\text{C}$	> 80%	> 85%

7. Environmental TEST

TEST Item	TEST Method	Criteria
7.1 High Temperature and High Humidity	① Standard charge at $25 \pm 3^{\circ}\text{C}$. ② Measure the thickness(T1), Capacity(C1) at temp. $25 \pm 3^{\circ}\text{C}$. ③ Put the test samples in a thermal chamber. Store during 5 days at 60°C and 90 % RH. ④ Measure the thickness(T2), Capacity(C2) after 2 hours at temp. $25 \pm 3^{\circ}\text{C}$ waiting.	Change ratio of cell thickness from T1 to T2 should be within 5%
7.2 Thermal Shock	① Standard charge at $25 \pm 3^{\circ}\text{C}$. ② Stand for 1 hour at -40°C , and then stand for 1 hour at 85°C . ③ Repeat 30 times. ④ Inspect appearance and measure thickness after stand for 2 hours at $25 \pm 3^{\circ}\text{C}$. ⑤ Standard discharge at $25 \pm 3^{\circ}\text{C}$. ⑥ Measure the capacity during Standard discharge after Standard charge at $25 \pm 3^{\circ}\text{C}$.	No leakage, Capacity recovery rate $\geq 80\%$
7.3 Low Pressure	① Standard charge at $25 \pm 3^{\circ}\text{C}$. ② Test condition: $25 \pm 3^{\circ}\text{C}$, 11.6kPa, 6 hours ③ Inspect appearance and measure voltage and IR.	No leakage, No explosion
7.4 Abnormal Charge	① SOC(State of Charge) is 100%. ② Measure the thickness(T1), Capacity(C1) at temp. $25 \pm 3^{\circ}\text{C}$. ③ Continuously charge test samples by 4.23V, constant current of 1C rate for 7 days at temp. $25 \pm 3^{\circ}\text{C}$. ④ Measure the thickness(T2), Capacity(C2) after 2 hours at temp. $25 \pm 3^{\circ}\text{C}$ waiting.	Change ratio of cell thickness from T1 to T2 should be within 0.5mm

8. Safety

Safety Test shall be performed with the following Standard and conditions;

- Each Cell is satisfied with UL1642 basically.
- Fully charged cell as Standard Charging condition.
- No protection component should be permitted.
- Testing shall be performed at $25^{\circ}\text{C} \pm 3^{\circ}\text{C}$ except Heating and External Short Test.

In case of 8.1. External Short, 8.2. Overcharge, 8.3. Heating test, 8.4. Crush and 8.5 Impact test should comply with the procedures as defined in this document. There should be neither fire nor explosion on test and the cell temperature should be under of 150°C . All test samples must be aged during 2 hours after Standard Charging initially.

TEST Item	TEST Method	Criteria
8.1 External Short-circuiting	Cell, fully charged. Then it is stored in an ambient temperature of 55°C , and is to be short circuited by connecting the positive and negative terminals with a total external resistance of less than $80 \pm 20 \text{ m}\Omega$ wire. Finish the test after remaining on test for 6 hours.	No explosion, No fire
8.2 Overcharge	Charge the test samples with constant current 3C and voltage 4.5V. Test samples remain on test for 2.5 hours	No explosion, No fire
8.3 Heating	A cell is to be heated in a gravity convection oven. 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 $130 \pm 2^{\circ}\text{C}$ and remain for 30 minutes at the temperature before the test is discontinued.	No explosion, No fire
8.4 Crush	A battery is to be crushed between two flat surfaces. The force for the crushing is to be applied by a hydraulic ram with a 1.25 inch (32mm) diameter piston. The crushing is to be continued 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 explosion, No fire
8.5 Impact	A test sample battery is to be placed on a flat surface. A 5/8 inch (15.8mm) diameter bar is to be placed across the center of the sample. A 20 pound (9.1kg) weight is to be dropped from a height of 24 ± 1 inch (610 ± 25 mm) onto the sample.	No explosion, No fire

9. Shipment

The cell shall be shipped less than 30% charging state. (Cell voltage range: 3.6 ~ 3.8V)

The remaining capacity before charging shall be changed depending on the storage time and conditions.

10. Warranty

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

- routejade will not be responsible for trouble occurred by handling outside of the precautions in this specification.
- routejade will not be responsible for trouble occurred by matching electric circuit, battery pack and charger.
- routejade will be exempt from warrantee any defect cells during assembling after acceptance.

11. Precautions and Safety instructions

Lithium-ion rechargeable batteries subject to abusive conditions can cause damage to the battery and/or personal injury. Please read and observe the standard battery precautions below using utilization.

Note 1. The customer is required to contact routejade in advance, if and when the customer needs other applications or operating conditions than those described in this document.

Note 2. routejade will take no responsibility for any accident when the cell is used under other conditions than those described in this document.

11.1 Precaution and Safety instructions

- a. Do not expose the battery to extreme heat or flame.
- b. Do not short circuit, over-charge or over-discharge the battery.
- c. Do not subject the battery to strong mechanical shocks.
- d. Do not immerse the battery in water or sea water, or get it wet.
- e. Do not reverse the polarity of the battery for any reason.
- f. Do not disassemble or modify the battery.
- g. Do not remove charge/discharge protection circuitry.
- h. Do not handle or store with metallic like necklace, coins or hairpins, etc.

- i. Do not use the battery with conspicuous damage or deformation.
- j. Do not connect battery to the plug socket or car-cigarette-plug.
- k. Do not make the direct soldering onto a battery. Weld spot welding lead plate onto a battery.
- l. Do not touch a leaked battery directly.
- m. Do not use for other equipment.
- n. Do not connect other Lithium-ion battery electrically.
- o. Do not use or leave the battery under the blazing sun (or in heated car by sunshine).
- p. Keep battery away from children.
- q. Do use the specified charger and observe charging requirement.
- r. Do not drive a nail into the battery, strike it by hammer or tread it.
- s. Do not give battery impact or fling it.

11.2 Battery Operation instructions

A. Charging

- a. Charge the battery in a temperature range of 0°C to 45°C. But it is recommended using the 10°C to 35°C range.
- b. Charge the battery at a constant current of **0.5C** until **4.35V** (± 0.03 V) per cell is attained. Charge rates greater than 1C are NOT recommended. (C: Rated Capacity of Battery)
- c. Maintain charge voltage at **4.35V** per cell for less than **3 hours** (recommended for maximum capacity).
- * Use a constant current / constant voltage (CC/CV) lithium-ion battery charge controller.
- * Do not continue to charge battery over specified time.

B. Discharging

- a. Recommended cut-off voltage is **3.0V**. Recommended nominal discharge rate is under 0.5C at constant current.
- b. Discharge the battery in a temperature range of -20°C to 60°C, But it is recommended using the 0°C to 40°C range.

C. Protection Circuit

Protection circuit can be provided upon request. However, protection circuit may be omitted for most applications without damaging performance and safety. Please consult our engineering staff for technical advice.

D. Storage Recommendations

- a. Storage Temperature and Humidity
 - Storage the battery at temperature range of -20°C to 45°C, low humidity and no corrosive gas atmosphere.

- No condensation on the battery
- b. Long Period Storage
 - In case of long period storage (more than 3 months), storage the battery at temperature range of -20°C to 25°C, low humidity, no corrosive gas atmosphere.
 - No condensation on the battery

12. Requirement for Safety Assurance

For the sake of safety assurance, please discuss the equipment design, its system and protection circuit of lithium-ion battery with routejade in advance.

And consult about the high rate current, rapid charge and special application in the same way.