

Title: Pouch Type Lithium ion Rechargeable Battery	Number: FLPB463535R-170131
Model: <i>FLPB463535R</i>	Date: 2019. 04. 19    Rev: B

**PRODUCT SPECIFICATIONS OF POUCH TYPE LI-ION RECHARGEABLE BATTERY**

**MODEL: FLPB463535R**

**PRESENTED TO:** \_\_\_\_\_

Accepted by:
Date:

***routejade Inc.***

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Date: Apr. 19, 2019.	

## ***Product Specifications***

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### **Documentation History**

Version No	Released date	Author	Comments
A	2017. 01. 31	T. Jung	First release
B	2019. 04. 19	J. Jang	Updated storage characteristic

Title: Pouch Type Lithium ion Rechargeable Battery	Number: FLPB463535R-170131
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### **CONTENTS**

1. Preface
2. Description
3. General Specifications
4. Dimensions of FLPB463535R
5. Standard Test Conditions
6. Electrical Characteristics
7. Environmental Test
8. Safety Test
9. Shipment
10. Warranty
11. Prohibition in handling and battery operation instructions

Title: Pouch Type Lithium ion Rechargeable Battery	Number: FLPB463535R-170131
Model: <i>FLPB463535R</i>	Date: 2019. 04. 19    Rev: B

### 1. Preface

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

### 2. Description

2.1	Product	<b>Lithium-ion Rechargeable Battery</b>
2.2	Model	<b>FLPB463535R</b>

### 3. General Specifications

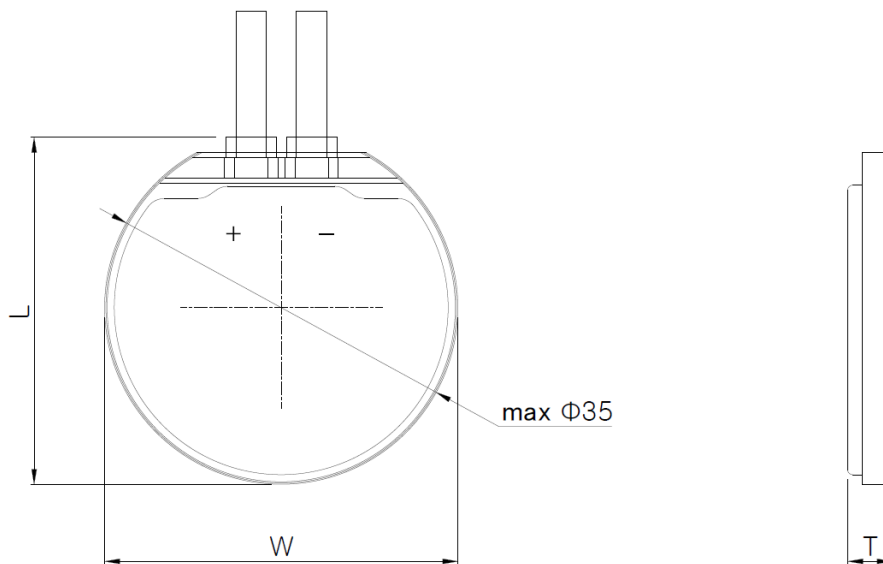
Item	Specification	Remark	
3.1	Nominal Capacity	460mAh	0.2C rate, 3.0V cut-off
3.2	Minimum Capacity	430mAh	0.2C rate, 3.0V cut-off
3.3	Nominal Voltage	3.7V	From 4.2V to 3.0V
3.4	Charging Method	CC/CV	Constant Current / Constant Voltage
3.5	Charging Current (Std.)	0.5CA (215mA)	0 ~ 45°C
3.6	Charging Current (Max.)	1.0CA (430mA)	0 ~ 45°C
3.7	Charging Voltage	4.20 ± 0.03V	
3.8	Charging End Condition	12.9mA	At CV mode
3.9	Charging Time (Std.)	< 3 hours	
3.10	Discharge Current (Std.)	0.2CA (86mA)	- 20 ~ 60°C
3.11	Discharge Current (Max)	2.0CA (860mA)	
3.12	Discharge Cut-off Voltage	3.0V	
3.13	Cycle	> 344mAh@500cycle	0.5C/0.5C cycle @25°C
3.14	Cell Weight	Approx. 8.5g	
3.15	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

Title: Pouch Type Lithium ion Rechargeable Battery	Number: FLPB463535R-170131
Model: <i>FLPB463535R</i>	Date: 2019. 04. 19    Rev: B

#### 4. Dimensions of FLPB463535R (unit: mm, Shipping Max.)

4.1 Cell: Max. 4.3mm (T) X Max. 35.0mm (W) X Max. 35.0mm (L)

(a) Cell



Item	Measure	Cell
T	Thickness (shipping max.)	Max. 4.3mm
T	Thickness (swelling max.)	Max. 4.6mm
W	Width	Max. 35.0mm
L	Length	Max. 35.0mm
A	Distance between centers of 2 tabs	7.5 ± 0.5mm
B	Tab width	3.0 ± 0.1mm

Title: Pouch Type Lithium ion Rechargeable Battery	Number: FLPB463535R-170131
Model: <i>FLPB463535R</i>	Date: 2019. 04. 19    Rev: B

### 5. Standard Test Conditions

Unless otherwise specified, all tests stated in this Product Specification are conducted at temperature 25 ± 3°C and humidity 65 ± 20% RH.

### 6. Electrical Characteristics

#### 6.1 Standard Charge and Discharge Conditions

The "Standard Charge" means charging the Cell with initial charge current 215.0mA (0.5C) and with a constant voltage 4.20V (± 0.03V) and a cut off current 12.9mA at 25 ± 3°C for 3.0hours.

The "Standard Discharge" means discharging the Cell with constant discharge current 86.0mA (0.2C) and with 3.0V cut-off voltage at 25 ± 3°C

#### 6.2 Initial Discharge Capacity

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

Initial Discharge Capacity    Typical 460mAh, Minimum 430mAh

#### 6.3 Initial Internal Impedance

Internal resistance measured at 1 KHz after Standard Charge.

Bare cell(FLPB463535R) Initial Internal Impedance ≤ 100mΩ

#### 6.4 Cycle Life

Cell shall be charged by 0.5C and terminated at 0.03C. Rest 10 mins. Discharged by 0.5C until 3.0V.

Rest 10 mins. before recharge. 0.5C charging and 0.5C discharging states repeat 500cycles continuously.

Capacity ≥ 344mAh after 500cycles

#### 6.5 Temperature Dependence of Discharge Capacity (Cell)

Relative capacity at each temperature, measured with constant discharge current 86.0 mA (0.2C) with 3.0V cut-off after the Standard Charge

Title: Pouch Type Lithium ion Rechargeable Battery	Number: FLPB463535R-170131
Model: <i>FLPB463535R</i>	Date: 2019. 04. 19    Rev: B

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

### 6.6 Discharge rate capabilities (Cell)

Discharge capacity is measured with the various currents in under table and with 3.0V cut-off after standard charge.

Charge Current	Discharge Current				
Standard Charge	0.2C	0.5C	1.0C	1.5C	2.0C
	100%	95%	90%	80%	70%

### 6.7 Storage characteristic

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

Storage condition	Charge state	Capacity retention	Capacity recovery
20 days at 60°C	Full charge (SOC 100%)	> 70%	> 85%
60 days at 60°C		> 40%	> 60%
30 days at 60°C, 90%RH		> 40%	> 70%

Title: Pouch Type Lithium ion Rechargeable Battery	Number: FLPB463535R-170131
Model: <i>FLPB463535R</i>	Date: 2019. 04. 19    Rev: B

### 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 5days at $60^\circ\text{C}$ and 90% RH. ④ Measure the thickness(T2), Capacity(C2) after 2hours at temp $25 \pm 3^\circ\text{C}$ .waiting.	Change ratio of cell thickness should be within 5%
7.2 Thermal Shock	① Standard charge at $25 \pm 3^\circ\text{C}$ . ② Stand for 1hours at $-40^\circ\text{C}$ , and then stand for 1hours at $85^\circ\text{C}$ . ③ Repeat 30 times. ④ Inspect appearance, and measure thickness after stand for 2hours 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 Pressure conditions Temp: $25 \pm 3^\circ\text{C}$ . Pressure: 11.6kPa Time: 6Hours ③ Inspection appearance, and measure voltage and IR.	No leakage, NO explosion
7.4 Abnormal Charge	① SOC 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 7days at temp $25 \pm 3^\circ\text{C}$ . ④ Measure the thickness(T2), Capacity(C2) after 2 hours.	Change ratio of cell thickness should be within 0.5mm



Title: Pouch Type Lithium ion Rechargeable Battery	Number: FLPB463535R-170131
Model: <i>FLPB463535R</i>	Date: 2019. 04. 19    Rev: B

### 8. Safety Test

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  $25 \pm 3^{\circ}\text{C}$  except Heating and External Short test.

In case of 8.1. External Short-circuiting test, 8.2. Overcharge test, 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  $150^{\circ}\text{C}$ . 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 $55^{\circ}\text{C}$ , 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 6hours.	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 2.5hours	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 30minutes 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 1.25inch (32mm) diameter piston. The crushing is to be continued until a pressure reading of 2500psig (17.2Mpa) is reached on the hydraulic ram. Applied force of 3000pounds (13kN). Once the maximum pressure has been obtained it is to be released.	No explosion, No fire

Title: Pouch Type Lithium ion Rechargeable Battery	Number: FLPB463535R-170131
Model: <i>FLPB463535R</i>	Date: 2019. 04. 19    Rev: B

8.5 Impact	A test sample battery is to be placed on a flat surface. A 5/8inch (15.8mm) diameter bar is to be placed across the center of the sample. A 20pound (9.1kg) weight is to be dropped from a height of 24 ± 1inch (610±25mm) onto the sample.	No explosion, No fire
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### 9. Shipment

The Cell shall be shipped less than 30% charging state. (Cell voltage range: 3.6 ~ 3.7V)

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

### 10. Warranty

The Warranty of battery is a half 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. Prohibition in handling and battery operation 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 before 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.

Title: Pouch Type Lithium ion Rechargeable Battery	Number: FLPB463535R-170131
Model: <i>FLPB463535R</i>	Date: 2019. 04. 19    Rev: B

**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 Prohibitions in Handling:

- 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 connect positive (+) and negative (-) with conductive materials (such as metal, wire).
- 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 necklaces, 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 use Lithium-ion battery in mixture.
- 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.
- b. Charge the battery at a constant current of 0.5C until  $4.20 \pm 0.03V$  per cell is attained. Charge rates greater than 1C are NOT recommended. (C: Rated Capacity of Battery)
- c. Maintain charge voltage at 4.2V per cell for 3.0hours (recommended for maximum capacity).  
*Use a constant current, constant voltage (CC/CV) lithium-ion (Li+) battery charge controller.*

Title: Pouch Type Lithium ion Rechargeable Battery	Number: FLPB463535R-170131
Model: <i>FLPB463535R</i>	Date: 2019. 04. 19    Rev: B

*Do not continue to charge battery over specified time.*

### B. Discharging

- a. Recommended cut-off voltage to 3.0V. Recommended maximum discharge rate is 2.0C at constant current.
- b. For maximum performance, discharge the battery in a temperature range of 0°C to 45°C.

### 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 ~ 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 3months), storage the battery at temperature range of -20 ~ 25°C, low humidity, no corrosive gas atmosphere.
  - No condensation on the battery