

## *Ultra-Thin Lithium Battery (ULB) Introduction*



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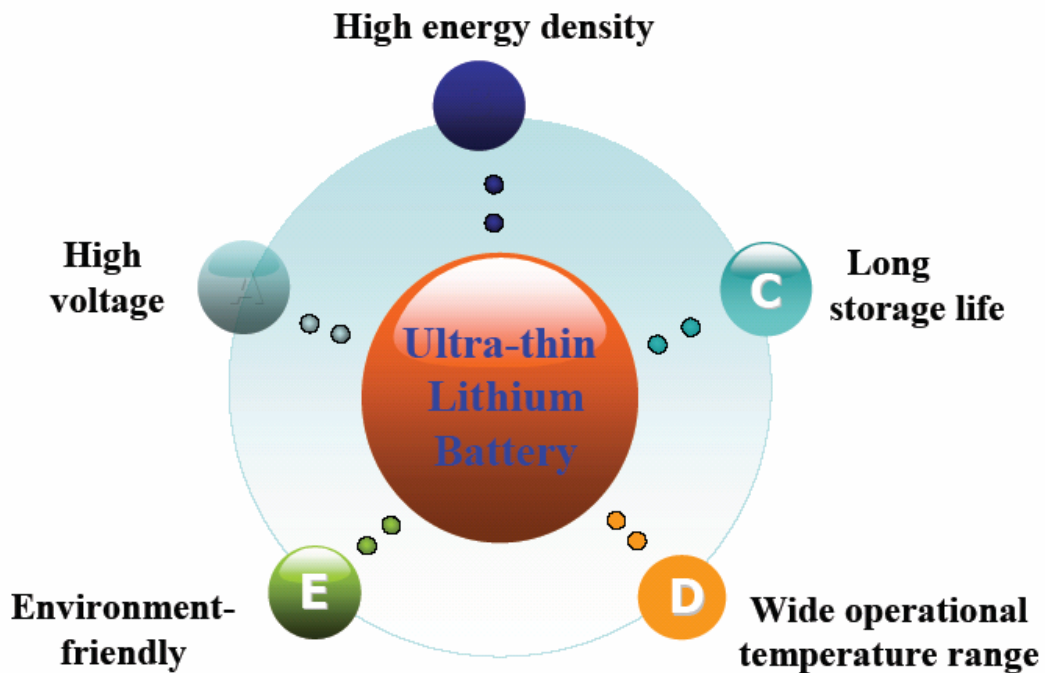
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## Introduction I —What 's ultra-thin lithium battery?

- \* Ultra-thin **Lithium Battery**, abbreviated ULB, is a type of **Lithium Manganese Dioxide Battery**, which belongs to CF series
- \* The battery is designed to provide a thin electronic device with power
- \* ULB's three superiorities: ultra-thin, flexible, and safe



## Introduction II —Five features



## Applications

### → Powered Cards

One Time Password  
Smart Card - Biometrics, ID  
Financial



### → RFID

Powered Tags  
Physical Access Control  
Time & Temperature Indicators



### → Medical

Transdermal Drug Delivery  
Patient Monitoring & Tracking  
Accelerated Healing Devices



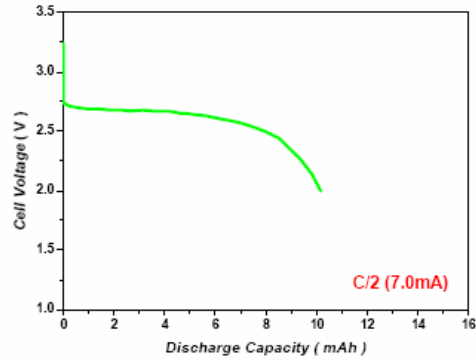
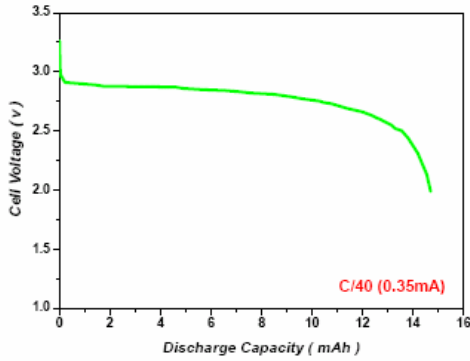
## Specification of prototype I -1

### Model No.: ULB262940

Chemical system	Li/MnO <sub>2</sub> Primary Battery
Nominal voltage	3.0 V
Nominal capacity	14 mAh@C/40 (@30°C, E.V.=2.0V)
Max. continuous discharge current	C/2 (@30°C)
Pulse discharge current	25mA for 3s with a 27s interval ( E.V.=1.55V)
Operating temperature	-20°C~60°C
Storage temperature	-20°C~60°C
Dimension	W26×L29×Tmax.0.45
Weight Approx.	0.45 g
Positive/Negative terminals	Copper / Aluminum
Self-discharge rate	Under 10 % for 3 years @ 30 °C
Configuration	Flexible aluminum foil packaging

## Specification of prototype I -2

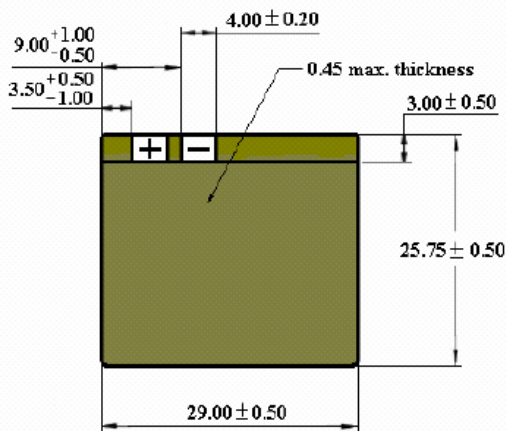
### ► Typical Discharge Curves



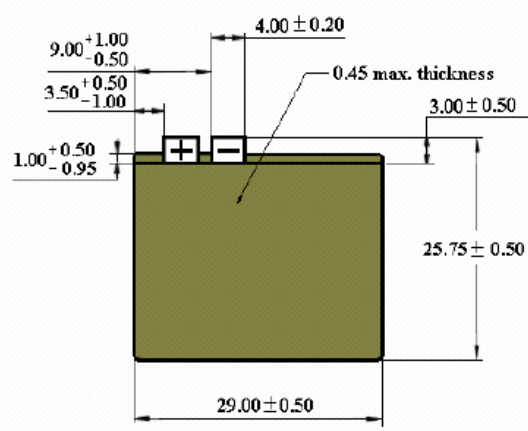
Test condition: Continuous current discharge to 2.0V @ 30°C

## Specification of prototype I -3

### ► Dimension (mm)



Supported Terminals / ST



Extended Terminals / ET

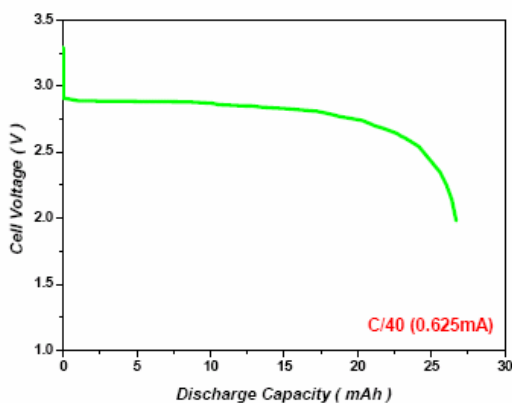
## Specification of prototype II -1

### Model No.: ULB234840

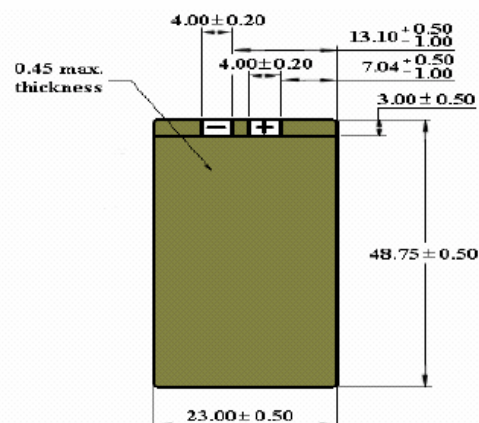
Chemical system	Li/MnO <sub>2</sub> Primary Battery
Nominal voltage	3.0 V
Nominal capacity	25 mAh@C/40 (@30°C, E.V.=2.0V)
Max. continuous discharge current	C/2 (@30°C)
Pulse discharge current	50mA for 3s with a 27s interval (E.V.=1.55V)
Operating temperature	-20°C~60°C
Storage temperature	-20°C~60°C
Dimension	W23×L48×Tmax.0.45
Weight Approx.	0.75 g
Positive/Negative terminals	Copper / Aluminum
Self-discharge rate	Under 10 % for 3 years @ 30 °C
Configuration	Flexible aluminum foil packaging

## Specification of prototype II -2

### ► Typical Discharge Curve



### ► Dimension (mm)



Test condition:

Continuous current discharge to 2.0V @ 30°C

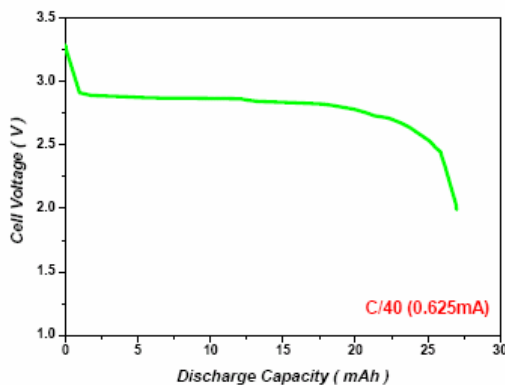
## Specification of prototype III-1

### Model No.: ULB304640

Chemical system	Li/MnO <sub>2</sub> Primary Battery
Nominal voltage	3.0 V
Nominal capacity	25 mAh@C/40 (@30°C, E.V.=2.0V)
Max. continuous discharge current	C/2 (@30°C)
Pulse discharge current	50mA for 3s with a 27s interval ( E.V.=1.55V)
Operating temperature	-20°C~60°C
Storage temperature	-20°C~60°C
Dimension	W30×L46×Tmax.0.45
Weight Approx.	0.90 g
Positive/Negative terminals	Copper / Aluminum
Self-discharge rate	Under 10 % for 3 years @ 30 °C
Configuration	Flexible aluminum foil packaging

## Specification of prototype III-2

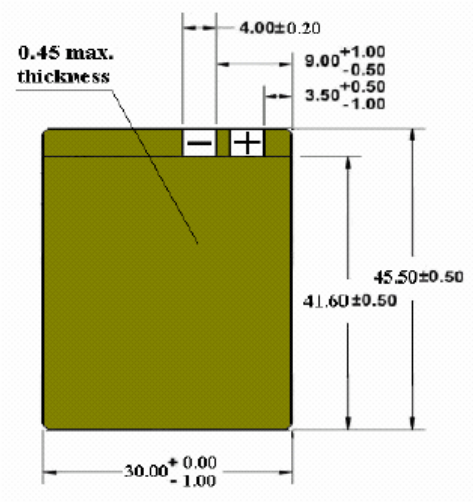
### ► Typical Discharge Curve



Test condition:

Continuous current discharge to 2.0V @ 30°C

### ► Dimension (mm)



## Specification IV

### ► Comparison table between our ULB

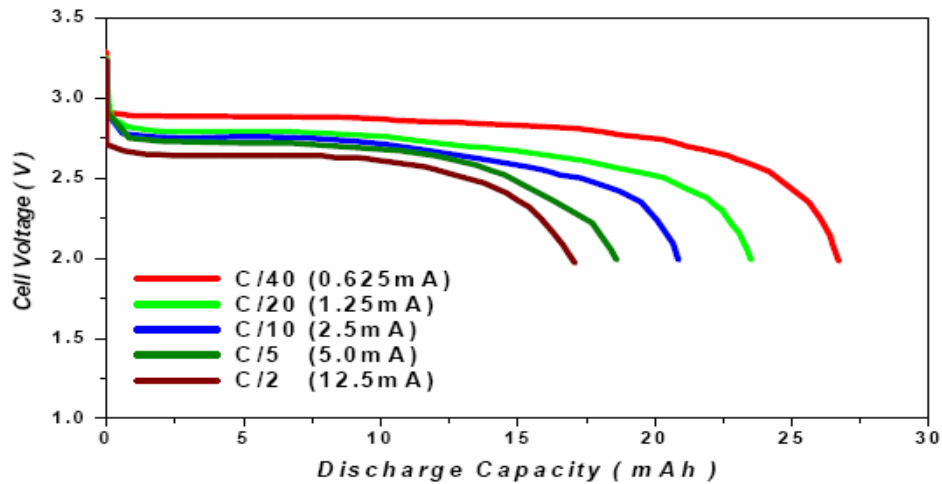
Model No.	ULB262940	ULB234840	ULB304640	Remarks
Battery system	Li/MnO <sub>2</sub> primary battery			Unrechargeable
OCV(V)	≥3.20			
Dimension(mm)	W26×L29×Tmax.0.45	W23×L48×Tmax.0.45	W30×L46×Tmax.0.45	Including terminals
Battery area(cm <sup>2</sup> )	7.54	11.04	13.80	
Volume(cm <sup>3</sup> )	0.34	0.50	0.62	
Weight(g)	0.45	0.75	0.90	
Capacity(mAh)	14	25	25	Based on C/40 discharge
Specific capacity (mAh/cm <sup>2</sup> )	1.86	2.26	1.81	Based on battery size
Specific capacity (mAh/g)	31.11	33.33	27.78	Based on battery weight

Notes: 1) Every model has two styles, ST and ET

2) Welcome custom models

## Characteristics I

### ► Capacity with various discharge current



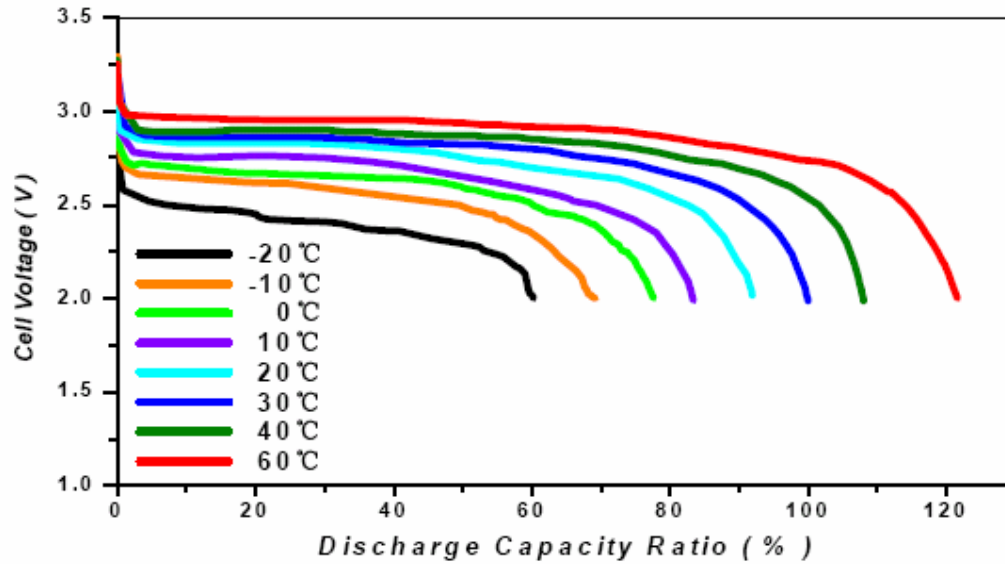
Battery model No.: ULB234840

Test condition: Constant current discharge to 2.0V @30°C



## Characteristics II

### ► Dependence of temperature on discharge capacity

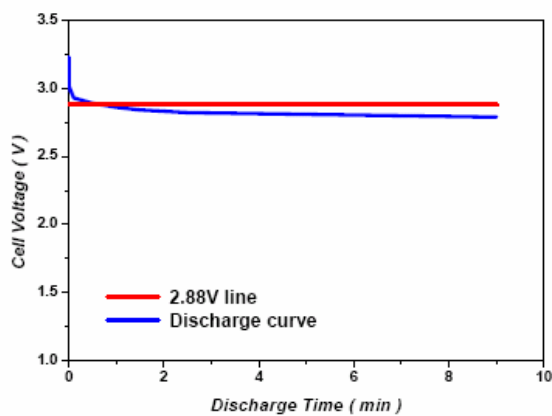


Battery model No.: ULB234840

Test condition: C/40 (0.625mA) continuous current discharge to 2.0V

## Characteristics III

### ► Close loop voltage with 1.2Kohm resistor



Battery model No.: ULB234840

**Test condition:**

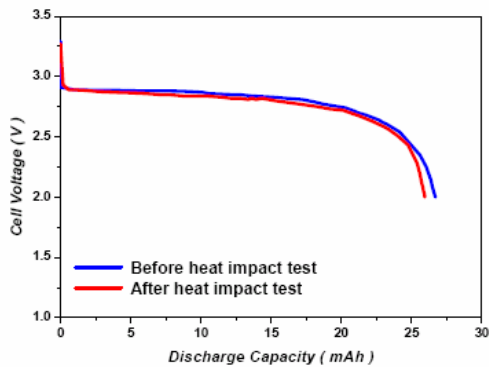
Test batteries were discharged in the close loop system with 1.2Kohm resistor @ 30°C

**Test result:**

Close loop voltage: more than 2.88V

## Characteristics IV

### ► Heat impact test



**Battery model No.:** ULB238040

#### Test procedure:

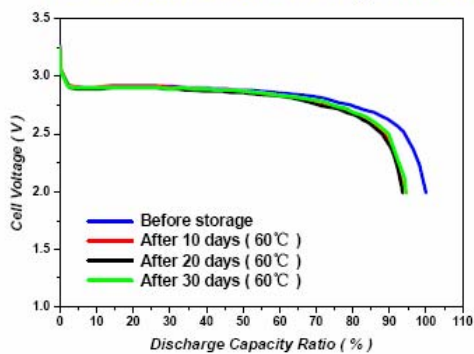
Test batteries were stored for 1.0hr at a temperature of  $(80 \pm 2) ^\circ\text{C}$ , followed by storage for 2hrs at  $(30 \pm 2) ^\circ\text{C}$ .

#### Discharge condition:

C/40(0.625mA) continuous discharge to 2.0V@  $(30 \pm 2) ^\circ\text{C}$

## Characteristics V

### ► Accelerated storage life test



**Battery model No.:** ULB238040

#### Test procedure:

Test batteries were stored for 10days, 20days, and 30days at a temperature of  $(60 \pm 2) ^\circ\text{C}$ , followed by storage for 2hrs at  $(30 \pm 2) ^\circ\text{C}$ .

#### Discharge condition:

C/40(0.625mA) continuous discharge to 2.0V@  $(30 \pm 2) ^\circ\text{C}$

# Safety Performance

## ► Table on reliability tests

Test	Intended use simulation	Requirements	Our test results
Electrical tests	Discharge	NL, NV, NE, NF	Pass
	Forced-discharge	NE, NF	Pass
	External short circuit	NE, NF, $T_{em} \approx 150^{\circ}\text{C}$	Pass
Mechanical tests	Vibration	NW, ND, NL, NV, NE, NF	Pass
	Shock	NW, ND, NL, NV, NE, NF	Pass
	Acupuncture	NE, NF	Pass
Environmental tests	Thermal shock	NL, NV, NE, NF	Pass
	High temperature	NV, NE, NF	Pass
	Altitude simulation	NW, ND, NL, NV, NE, NF	Pass
	Thermal abuse	NE2, NF	Pass

Notes: 1) Reference: IEC60086-4 and Great Power company safety standard

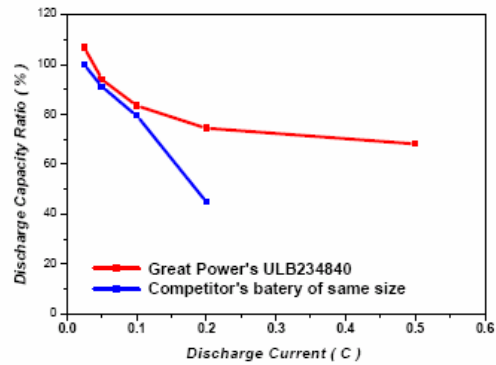
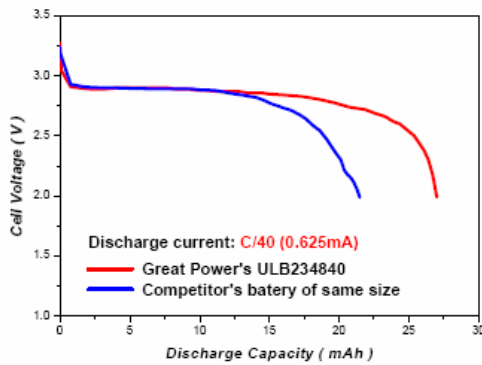
2) Abbreviations mean: NW: No weight loss; ND: No distortion; NL: No leakage;

NV: No venting; NE: No explosion; NF: No fire; NE2: See the following

3) NE2: Battery explodes but ejected solid material does not pass through the specified mesh chamber

# Bench marking I

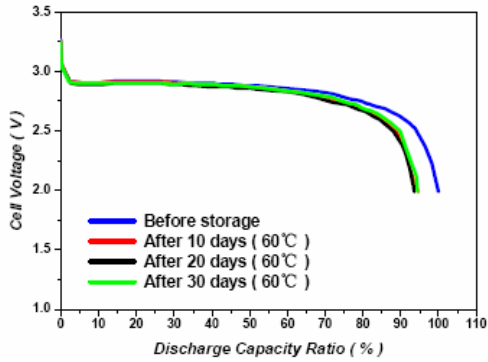
## ► Discharge Characteristics



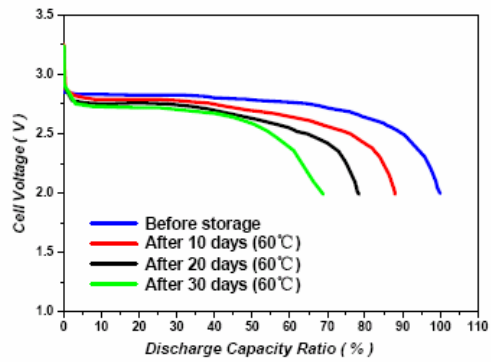
Test condition: Constant current discharge to 2.0V @30°C

## Bench marking II

### ► Accelerated storage life test



Great Power's ULB234840



Competitor's thin lithium battery

## Bench marking III

### ► Prediction for storage life

