

**Specification of  
LiMnNi Rechargeable: 26650 Cell 3.7V  
4000 mAh, 10A Rate, 14.8Wh**



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## 1. General

### 1.0 Scope

This specification defines the characteristics of a lithium ion rechargeable battery 26650 4.0Ah (40A) LiPF<sub>6</sub> Spinel - Graphite cell

### 1.1 Safety Standards and Regulations

IEC 61960	International Electrotechnical Commission, Secondary Lithium Cells and Batteries for Portable Applications.
IEC 62133	International Electrotechnical Commission, Safety Requirements for Portable Sealed Secondary Cells, and for Batteries made from them, for use in Portable Applications.
IEC 62281	Safety of Primary and Secondary Lithium Cells during Transport.
UL 1642	Standard for Safety of Lithium Batteries.
UN ST/SG/AC.10/11/Rev 3	Recommendations on the Transport of Dangerous Goods, Manual of Tests and Criteria.

### 1.2 Specifications

26650 Lithium-Ion Battery Power Cell

## 2. Applied Product Name and Product Designation

### 2.0 Name

Lithium ion rechargeable battery, 26650 size, LiPF<sub>6</sub> electrolyte, Manganese Spinel structure cathode.

### 2.1 Designation

The Negative Electrode System = The Lithium-Ion system with an intercalation electrode

The Positive Electrode System = A Manganese Spinel-based electrode

The Shape of cell = A cylindrical (rounded) shape cell

The Diameter x overall height of cell = 26mm x 65mm

The rate capacity of cell = 4.0Ah rate capacity for 10A cells and original design LiMn<sub>2</sub>O<sub>4</sub> in the cathode and

no PTC header

## 2.2 Rated Specification

Definitions of items are described in accordance with IEC 61960.

Items		Specifications	Remarks
1a	Rated charge(4A)	Limiting 4.0 A, 120 min and constant 4.2V charge at 23±2°C.	
1b	Recommended charge	Reference 1a	
2	Rated discharge	Constant 0.8 A discharge until 2.5V at 23±2°C.	
3	Rated capacity	4.0Ah	Minimum of rated discharge capacity after recommended charge.
4	Nominal voltage	3.7V	Mean voltage during rated discharge after rated charge.
5	Shipping voltage	4.03 ± 0.01V	Nominal. Approximate state of charge = 80%.
6	Internal resistance at shipping	23 ± 1 mΩ	By AC 1 kHz.
7	End of charge voltage	4.20 ± 0.05V	
8	End of discharge voltage	2.5V	Discharge voltage used for determination of rated capacity.
9	Charging time	120min	Rated charge.
10	Maximum continuous charging current	6.5A	
	Maximum continuous discharging current	10A	
11	Operating temperature	Charging	0 ~ 45°C
		Discharging	-20 ~ 60°C
12	Storage temperature	-20 ~ 60°C	Recommended temperature for long term storage is 23 ± 2°C
13	Shelf life	6 months	Typical value at 23±2°C, from ship state.
14	Self-discharge rate /month	≤0.5%	

## 3. Dimension and Appearance

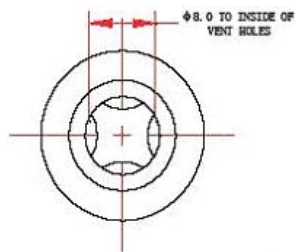
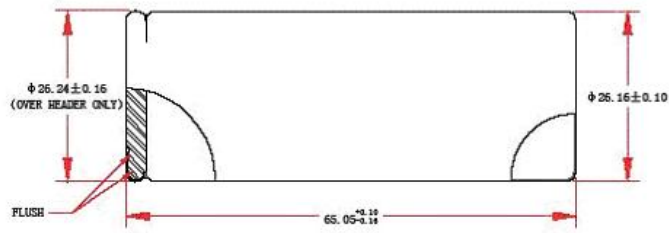
### 3.0 Shape

Cylindrical

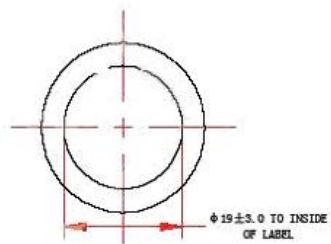
### 3.1 Dimensions

Overall Height:  $65.05 + 0.10/-0.15$  mm

Diameter (incl. label):  $26.24 \pm 0.16$  mm (top end),  $26.16 \pm 0.10$  mm (bottom end)



TOP VIEW



BOTTOM VIEW

### 3.2 Weight

$91.7 \pm 1$ g

### 3.3 Cell Marking



xxxxxxx = Cell lot number  
+ / - = Cell Polarity

#### 4. Performance

##### 4.0 Test Condition

- 1) The cells used in the following tests are sampled after 3 days storage.
- 2) All tests are carried out at 23°C ±2°C, and at a relative humidity between 45% and 85% except where otherwise noted.

##### 4.1 Performance

##### 4.1.1 Electrical Performance

Items			Criteria		Conditions
1a)	Discharge capacity and energy (Rate capability at 23°C)	0.8A	mAh	≥4280	Discharge capacity and energy at 0.8A to 2.5V after rated charge (C1).
			Wh	≥16.06	
		4A	mAh	≥4198	Discharge capacity and energy at 4A to 2.5V after rated charge (C2).
			Wh	≥15.17	
		8A	mAh	≥4193	Discharge capacity and energy at 8A to 2.5V after rated charge (C3).
			Wh	≥14.52	
		10A	mAh	≥4177	Discharge capacity and energy at 10A to 2.5V after rated charge (C4).
			Wh	≥14.17	
		15A	mAh	≥4086	Discharge capacity and energy at 15A to 2.5V after rated charge (C5).
			Wh	≥13.20	
		20A	mAh	≥3888	Discharge capacity and energy at 20A to 2.5V after rated charge (C6).
			Wh	≥11.96	
1b)	Discharge capacity (Rate capability at 45°C)	4A	mAh	≥4100	Discharge capacity and energy at 4A to 2.5V after rated charge (C10).
			Wh	≥14.73	
2)	Rated energy density	Volumetric	Wh/l	439.8±3	Calculated energy density based on max. volume and weight specifications using 4A discharge to 2.5V at 23°C after rated charge (C2).
		Gravimetric	Wh/kg	165.4±3	
3)	Rate Map Impedance	23°C	Ohms	≤8	Maximum resistance of cell measured during 8A, 10A, 15A and 20A Discharge to 2.5V after rated charge (C3 to C6).

#### 4.1.2 Life

Items		Criteria	Conditions
23°C 4A	C50	Ah	≥95.7%
		Wh	≥94.4%
	C100	Ah	≥94.7%
		Wh	≥93.8%
	C150	Ah	≥80.0%
		Wh	≥78.4%
	C200	Ah	≥64.5%
		Wh	≥62.9%
	C250	Ah	TBD
		Wh	TBD
	C300	Ah	TBD
		Wh	TBD
			4A discharge at 23°C to 2.5V on cycle 50, 100, 150, 200, 250 and, 300. Energy ratio to cycle 10. (Cycling: rated charge, 4A discharge, at 23°C)
23°C 8A	C50	Ah	≥96.7%
		Wh	≥94.7%
	C100	Ah	≥93.7%
		Wh	≥91.0%
	C150	Ah	≥88.8%
		Wh	≥85.5%
	C200	Ah	≥78.5%
		Wh	≥74.7%
			8A discharge at 23°C to 2.5V on cycle 50, 100, 150 and 200. Energy ratio to cycle 10. (Cycling: rated charge, 8A discharge, at 23°C)
45°C 4A	C50	Ah	≥94.7%
		Wh	≥93.6%
	C100	Ah	≥89.2%
		Wh	≥88.4%
	C150	Ah	≥83.2%
		Wh	≥82.6%
			4A discharge at 45°C to 2.5V on cycle 50, 100 and 150. Energy ratio to cycle 10. (Cycling: rated charge, 4A discharge, at 45°C)
45°C 8A	C50	Ah	≥94.5%
		Wh	≥92.8%
	C100	Ah	≥86.4%
		Wh	≥84.6%
	C150	Ah	≥71.7%
		Wh	≥69.1%
			8A discharge at 45°C to 2.5V on cycle 50, 100 and 150. Energy ratio to cycle 10. (Cycling: rated charge, 8A discharge, at 45°C)

## 4.2 Safety Performance

### 4.2.1 Electrical Endurance Performance

Items		UL1642 Test Conditions	UL1642 Criteria	Criteria
1)	Short Circuit @ 20°C	Short circuit cell using a total external resistance < 0.1 ohm until cell has ignited or burned out, or in the fully discharged state (< 0.1V) cell temperature has returned to $\pm 10^\circ\text{C}$ of ambient temperature and then be examined.	The samples shall not explode or catch fire. The temperature of the exterior cell or battery casing shall not exceed $150^\circ\text{C}$ .	in accordance with UL1642 criteria
2)	Short Circuit @ 55°C	While in preheated oven and cell temperature reaches $55 \pm 5^\circ\text{C}$ , Short circuit cell using a total external resistance < 0.1 ohm until cell has ignited or burned out, or in the fully discharged state (< 0.1V) cell temperature has returned to $\pm 10^\circ\text{C}$ of ambient temperature and then be examined.	The samples shall not explode or catch fire. The temperature of the exterior cell or battery casing shall not exceed $150^\circ\text{C}$ .	in accordance with UL1642 criteria
3)	Abnormal Charging	Each test sample battery is to be discharged at a constant current of 0.2 C/1 hour, to a manufacturer specified discharge endpoint voltage. The cell or battery is then to be charged with a constant maximum specified output voltage and a current limit of three times the maximum charging current, $I_c$ , specified by the manufacturer. Charging duration is to be 7 hours or the time required to reach the manufacturer's specified end-of-charge condition, whichever is greater.	The samples shall not explode or catch fire.	in accordance with UL1642 criteria

### 4.2.2 Mechanical Endurance Performance

Items		UL1642 Test Conditions	UL1642 Criteria	Criteria
1)	Crush	A battery is to be crushed between two flat plates. 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 reach to 17.2 MPa, applied force of 13 kN. Once the maximum pressure has been obtained it is to be released.	The samples shall not explode or catch fire.	in accordance with UL1642 criteria
2)	Impact	A test sample battery is to be placed on a flat surface. A 5/8 inch (15.8 mm) diameter bar is to be placed across the center of the sample. A 20 pound (9.1 kg) weight is to be dropped from a height of $24 \pm 1$ inch ( $610 \pm 15$ mm) onto the sample.	The samples shall not explode or catch fire.	in accordance with UL1642 criteria
3)	Shock	Each cell shall be subjected to a total of three shocks of equal magnitude. Each shock is to be applied in a direction normal to the face of the cell. For each shock the cell is to be accelerated in such a manner that during the initial 3 milliseconds the minimum average acceleration is 75 g (where g is the local acceleration due to gravity). The peak acceleration shall be between 125 and 175 g.	The samples shall not explode or catch fire. In addition, the sample shall not vent or leak.	in accordance with UL1642 criteria
4)	Vibration	The frequency is to be varied at the rate of 1 hertz per minute between 10 and 55 hertz, and return in not less than 90 nor more than 100 minutes. The battery is to be tested in three mutually perpendicular directions. For a battery that has only two axes of symmetry, the battery is to be tested perpendicular to each axis.	The samples shall not explode or catch fire. In addition the sample shall not vent or leak.	in accordance with UL1642 criteria

#### 4.2.3 Additional Mechanical Endurance Performance

Items		Test Conditions	Criteria
1)	Nail penetration	a 3.2mm diameter nail forced radially through the cell and the nail will stay in cell until record is over.	The sample shall not explode or catch fire.
2)	Drop	Drop height of 0.9 meters. Drop each cell three times on bottom onto a plastic plate then Drop each cell three times on side onto concrete surface, and Drop each cell three times on header onto a plastic plate.	The sample shall not explode, catch fire, no leakage, weight less, and disassemble.

#### 4.2.4 Environmental Endurance Performance

Items		UL1642 Test Conditions	UL1642 Criteria	Criteria
1)	Heating	A battery is to be heated in a gravity convection or circulating air oven with an initial temperature of $20 \pm 5^\circ\text{C}$ . 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 10 minutes. The sample shall return to room temperature ( $20 \pm 5^\circ\text{C}$ ) and then be examined.	The samples shall not explode or catch fire.	in accordance with UL1642 criteria
2)	Temperature Cycling	The batteries are to be placed in a test chamber and subjected to the following cycles: a) 30min ramp to $70 \pm 3^\circ\text{C}$ , $70^\circ\text{C}$ for 4h; b) 30min ramp to $20 \pm 3^\circ\text{C}$ , $20^\circ\text{C}$ for 2h; c) 30min ramp to $-40 \pm 3^\circ\text{C}$ , $-40^\circ\text{C}$ for 4h; d) 30min ramp to $20 \pm 3^\circ\text{C}$ ; e) Repeat cycle 9times; f) Measurements taken after 10 cycles and 7 days storage at $20 \pm 5^\circ\text{C}$	The samples shall not explode or catch fire. In addition, the samples shall not vent or leak.	in accordance with UL1642 criteria
3)	Low Pressure	Sample batteries are to be stored for 6 hours at an absolute pressure of 11.6 kPa (1.68 psi) and a temperature of $20 \pm 3^\circ\text{C}$ .	The samples shall not explode or catch fire as a result of the Low Pressure Test. In addition, the samples shall not vent or leak.	in accordance with UL1642 criteria
4)	Projectile	The sample is to be heated and shall remain on the screen until it explodes or the cell or battery has ignited and burned out.	No part of an exploding cell or battery shall penetrate the wire screen such that some or all of the cell or battery protrudes through the screen.	in accordance with UL1642 criteria



## **5. Warning and Recommendation for Using the Lithium Ion Rechargeable Battery**

### **5.0 Prohibition Clause**

- 1) Do not disassemble the cell;
- 2) Do not crush the cell;
- 3) Do not heat above 100°C(212°F)
- 4) Do not incinerate the cell;
- 5) Keep battery out of reach of children and in original package until ready to use;
- 6) Never put batteries in mouth. If swallowed, contact your physician or local poison control center.
- 7) Dispose of used batteries promptly according to local recycling or waste regulations.
- 8) Use of another battery may present a risk of fire or explosion.
- 9) Do not solder lead directly to the body.
- 10) Do not short(+) and (-)terminal of the cell with kind of metal.
- 11) Do not add strong shock,nor drop the cell.
- 12) Do not stab the cell with a nail etc.,nor make a hole in the cell.
- 13) Do not put into a microwave oven, nor high temperature container.
- 14) Do not connect cell to wall sockets and cigarette wall sockets etc. in vehicle.

### **5.1 Charging**

- 1) Charge within the limits of 0°C~+45°C cell surface temperature.
- 2) Do not charge reversal
- 3) Charge only with charge exclusively designed for this battery.

### **5.2 Discharging**

- 1) Discharge within the limits of -20°C~+60°C cell surface temperature.
- 2) Avoid discharging below 2.5V.

### **5.3 Storage**

- 1) Recommended temperature for long term store within the limits of -20°C~+60°C ambient temperature area,and condition in Container is also included.
- 2) Use within 3months (90days) after shipping.