

Date 12/20/02

**SANYO LITHIUM ION  
BATTERY SPECIFICATIONS**

BATTERY CLASSIFICATION LITHIUM ION BATTERY

BATTERY TYPE UR18650F (Typ.2200mAh)

APPLICATION \_\_\_\_\_

**【 ACCEPTANCE 】**

Accepted by: \_\_\_\_\_

Name in block letters: \_\_\_\_\_

Date: \_\_\_\_\_

**SANYO Electric Co., Ltd**

Soft Energy Company  
Technology Division Ion  
Battery Technical Business Unit  
Business Development Department No.2  
Ion Battery Section No.2

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**1. Extent of the application**

This specification is applied to the SANYO Lithium Ion Battery of the above mentioned type

**2. Battery Classification and Type**

2.1 Battery Classification                   SANYO Lithium Ion Battery  
 2.2 Battery Type                               UR18650F (Typ.2200mAh)

**3. NOMINAL SPECIFICATIONS (For Cell Performance)**

Item	Specification	Remark	
3.1 Nominal Capacity	2100mAh	0.2CA discharge	
3.2 Typical Capacity	2200mAh	0.2CA discharge	
3.3 Nominal Voltage	3.7V		
3.4 End Voltage	2.75V		
3.5 Charging Current(Std.)	1470mA	0~40°C	
3.6 Charging Voltage	4.2±0.03V		
3.7 Charging Time(Std.)	3hours		
3.8 Discharging Current(Typ.)	2100mA	0~60°C	
3.9 Discharging Current(Max.)	4200mA	0~40°C	
3.10 Internal Resistance	Less than 120mΩ	1kHz AC Method	
3.11 Weight	Less than 47g		
3.12 Surroundings temperature range for shipped battery	less than 1month	-20 ~ +60°C	Percentage of recoverable capacity 80%
	less than 3months	-20 ~ +45°C	
	less than 1year	-20 ~ +20°C	

※ Percentage of recoverable capacity  
 = (discharging time after storage / Initial discharging time) × 100

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

No.	Date	Remark	Note
1	12/20/02	Specification Issued	First Edition

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<b>4. ELECTRICAL CHARACTERISTICS</b>				
Item	Test Method		Criterion	
4.1 Charge Full Charge	The charger supply 1.47A( $\approx$ 0.7C) constant current until battery voltage reaches 4.2V, then Supply a decreasing current endlessly. Charging time is 3.0 hours in all.			
4.2 Capacity	① Within 1 hour after fully charged, discharge at 0.2C (=0.42)A continuously down to 2.75V end voltage.		more than 300min.	
4.3 Cycle Life	② Within 1 hour after fully charged, discharge at 0.5C (=1.05)A continuously down to 2.75V end voltage.		more than 108min.	
4.4 Temperature	A battery unit shall be repeated charge/discharge cycles, charged at CC-CV(1.47A-4.2V) 4hrs. cut off, discharged at 1.47A to 2.75V end voltage. After 300 cycles, discharging time is estimated as specified in paragraph 4.2 ②.		more than 76min.	
4.5 Full Charged State Storage	① Within 1 hour after fully charged at 20°C, a battery unit is stored at 0°C. Discharge time is estimated as specified in paragraph 4.2 ②.		more than 70min.	
	② Within 1 hour after fully charged at 20°C, a battery unit is stored at 60°C. Discharge time is estimated as specified in paragraph 4.2 ②.		more than 100min.	
	① After fully charged, stored for 10 days at 60°C and rested at room temperature for 1 hour. Discharge time is estimated as specified in paragraph 4.2 ②.		more than 70min.	
	Then next discharge time is estimated as specified in paragraph 4.2 ②.		more than 90min.	
	② After fully charged, stored for 20 days at 60°C and rested at room temperature for 1 hour. Discharge time is estimated as specified in paragraph 4.2 ②.		more than 60min.	
	Then next discharge time is estimated as specified in paragraph 4.2 ②.		more than 80min.	
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4.6 Full Discharged State Storage	After fully charged, discharge as specified in paragraph 4.2 ②, then store for 20days at 60°C and rest at room temperature for 1hour. Discharging time is estimated as specified in paragraph 4.2 ②.		more than 100min.	
<p><b>STANDARD TEST CONDITIONS:</b>  The battery used for the test mentioned above shall be new one delivered a week before at most. The test shall be performed at <math>20 \pm 2^{\circ}\text{C}</math> (Standard temperature of fifth grade adopted in <i>JIS Z 8703</i>(Standard Test Conditions)), <math>65 \pm 5\%</math> (Standard humidity of twentieth grade adopted in <i>JIS Z 8703</i>(Standard Test Conditions)). It is allowed however to test at <math>15 \sim 25^{\circ}\text{C}</math>, <math>45 \sim 85\%</math> humidity, as long as there is no big difference in test results. The battery used for the test without residual capacity indicator. The grade of voltmeter and ammeter used in the test shall be higher than class 0.5 adopted in <i>JIS C 1102</i>(Electric Indicator).</p> <p><b>5. Design,Construction</b>  A battery unit shall be shown in the drawing of the design, construction and physical dimensions. (Drawing No. UR18650F )</p> <p><b>6. Appearance</b>  There shall be no practical damage such as conspicuous liquid electrolyte leakage, flaw electrolyte leakage, flaw, rust, dirt, and deformation. The battery must have marketability.</p> <p><b>7. Shipment</b>  The battery shall be shipped in 40% charged state.  It is not specified more than 40% capacity remain at , because of self-discharging.</p>				
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<p><b>8 . Precautions on Design of Note PC, Charger and Battery Pack</b></p> <p><b>8-1. Precautions on Design of Note PC and charger.</b></p> <p><b>① Charge</b></p> <ul style="list-style-type: none"> <li>· A battery must be charged with constant current-constant voltage.</li> <li>· In case of UR18650F, charge current must be below 2.1A/cell.</li> <li>· Charge voltage must be up to 4.20(+0.03)V/cell. Concerning charge voltage tolerance of charger, charge voltage must be up to 4.20(+0.03)V /cell. If the charger was out of order, charge voltage should not be above 4.5V/cell.</li> <li>· Have pre-charge system in charger. In case of a battery voltage is below 3.0V, a battery should be charged with pre-charge that current is below 0.21A. Then a battery voltage reach over 3.0V, standard charge starts. And if a battery voltage never reach to 3.0V in specified period (timer), charger stop charging.</li> <li>· Have full charge detection in charger. By timer, current detection and open circuit voltage detection, charger detects full charge. When charger detect full charge, charger stop charging.</li> <li>· Charger should start charging at temperature range 0~40°C</li> </ul> <p><b>② Discharge</b></p> <ul style="list-style-type: none"> <li>· Discharge current must be below 4.2A/cell.</li> <li>· Discharge temperature range should be 0~60°C.</li> <li>· Discharge end voltage must be over 2.75V/cell.</li> </ul> <p><b>③ Over-discharge</b></p> <ul style="list-style-type: none"> <li>· Do not over-discharge a battery below 2.0V/cell.</li> </ul> <p><b>④ Battery position in application and charger</b></p> <ul style="list-style-type: none"> <li>· To avoid degradation of battery performance by heat, a battery should set the place apart from heat generating electronic parts inside the application and charger.</li> </ul> <p><b>8-2. Precautions on Battery Pack Design.</b></p> <p><b>① Battery pack Shape, Mechanism and Material</b></p> <ul style="list-style-type: none"> <li>· Do not make the shape which easy connect to other chargers expect exclusive charger.</li> <li>· Do not make the shape and mechanism which easy use another equipment expect exclusive Note PC and charger.</li> <li>· Do not make the terminal shape which easy cause short circuit by metal object such as necklaces, hairpins, etc. And further, have over current protection function to prevent outer short circuit.</li> <li>· Do not make the terminal shape and mechanism which connect reverse to equipment. Do not make the shape and mechanism which static electricity and water easy go through the battery pack inside.</li> <li>· Make the shape and mechanism which can inspect protection circuit function (specified paragraph 8-2②) before the battery pack makes completely.</li> </ul>			
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<ul style="list-style-type: none"> <li>· Fix cells with mold case by rib, tape, glue etc., but do not make damage cells (especially sealing part) by rib or sharp part of mold case. In case of the battery pack is struck by hard shock or vibration, the battery pack has possibility to cause leakage, smoke, explosion.</li> <li>· Weld mold case by glue. Not weld mold case by ultra sonic welding.</li> </ul> <p><b>② Protection Circuit</b></p> <p>Have protection circuit function which is described below inside battery pack, to insure safety of battery in case of misuse.</p> <ul style="list-style-type: none"> <li>· <b><u>Over charge Protection</u></b> At the voltage range 4.24~4.35V/cell by charge, overcharge protection should work. Then charge current shall be shut down.</li> <li>· <b><u>Over discharge Protection</u></b> At the voltage range 2.2~2.4V/cell, over discharge protection should work. Then discharge current shall be shut down and consumption current is below 1 μA.</li> <li>· <b><u>Over discharge Current Protection</u></b> When discharge current exceed about 4.2 A, over discharge current protection should work. Then over discharge current shall be shut down.</li> </ul> <p><b>③ Electric circuit</b></p> <ul style="list-style-type: none"> <li>· To avoid to discharge during storage, design the low consumption current electronic circuit (e.g. Protection circuit, Fuel gauge, etc) inside battery pack.</li> </ul> <p><b>④ Battery connection</b></p> <ul style="list-style-type: none"> <li>· Do not solder onto a battery in order to avoid a damage on the battery. Weld spot welding lead plate onto battery, and solder lead wire or lead plate.</li> </ul> <p><b>⑤ Precautions on label</b></p> <ul style="list-style-type: none"> <li>· Write maker's name , trade mark , maker's nation , model number and precautions on label. Precautions are based on chapter 14. Write the precaution manual based on chapter 14.</li> </ul> <p><b>9. Storage Condition</b></p> <p><b>9-1 Storage Temperature and Humidity</b></p> <ul style="list-style-type: none"> <li>· Store the battery at temperature range -20~+35°C, low humidity and no corrosive gas atmosphere.</li> <li>· No condensation on the battery.</li> </ul> <p><b>9-2 Long Period Storage</b></p> <ul style="list-style-type: none"> <li>· In case of long period storage (more than 3 months), store the battery at temperature range -20~+25°C ,low humidity, no corrosive gas atmosphere. And in this case, charge condition of the battery is Sanyo shipment charge state or discharge state.</li> <li>· No condensation on the battery.</li> </ul>				
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## **1 0 . Precautions on Handling Lithium Ion Cells**

In term of shipping and assembling the battery pack, this chapter describes precautions on handling Sanyo lithium ion cells which are assembled for Note PC's battery packs by

### **10-1 Precautions on series connection of cell**

- When the cells are connected in series, use same rank cells, use same lot number cells and use same charging date cells. These data show label for carton on the master carton. Further, the cell's voltage has to be checked and confirm the voltage to be within 10mV voltage difference.

### **10-2 Precautions on terminals of cell**

- Do not over-stress or rotate at negative terminal and positive cap.  
By over-stress, it has possibility to remove the welding point and cause leakage.

### **10-3 Inspection Before Shipment of The Battery pack**

- About all battery pack, inspect voltage, internal impedance and function of protection circuit before shipment.

### **10-4 Packing and shipping cells**

- When cells are re-shipped to assembling factory, make enough attention the packing to avoid stress by shipping.  
Sanyo recommends the same package shipped from Sanyo when re-shipping.  
Even if after open package, when re-shipping, use the same parts and materials from Sanyo for re-packing.

### **10-5 Abnormal cell**

- Do not use abnormal cell which has damages by shipping stress, drop, short or something else, and which gives off electrolyte odor.

## **1 1 . Exemption from Warrantee**

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

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<p><b>1 2 . Other Remarks</b></p> <ul style="list-style-type: none"> <li>· If there are problems in this specification ,Sanyo can consider to change specification after discussion.</li> <li>· About the things not covered by this specification, Sanyo will have discussion.</li> <li>· Do not use this cell for other models or equipment.</li> </ul> <p><b>1 3 . Standard Charging Method</b></p> <p>(1) The battery voltage fall to about 0V by storage. If the battery is rapidly charged at this state, FET of a protection circuit may generate heat. The charger must have the pre-charge system.</p> <p>(2) Pre-charge current of charger should be approximately 0.1C(=0.21)A/cell. When the battery voltage becomes 3.0V/cell, standard charge should be started. When the battery voltage is less than 3.0V/cell even after the set period of timer, charging should be stopped.</p> <p>(3) Rapid charge is 1.47A-4.20V (Constant current-constant voltage). Charging should be suspended when the time, OCV or current is certain value.</p> <p>(4) The maximum current of the battery pack should be 2.1A. Charge current of charger must not exceed 2.1A.</p>			
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## 1 4 . SAFETY INSTRUCTION

### Prohibition Points on Handle

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 also, add the protection device the equipment for fear that the trouble would affect the battery by the abnormality of equipment. In addition, mention the following matters as "Prohibition Points on Handle" in the instruction manual of the equipment.



#### 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, chainneckless 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. Incineration and Heating

##### **"Do not incinerate or heat the battery"**

These occur the melting of insulator, damage of gas release vent or safety function, or ignition on electrolyte. Above mentioned matters cause the generating, smoke, rupture or flaming.

#### 4. 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.

#### 5. 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.

#### 6. 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.

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**7. 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.

**8. 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.

**9. Impact**

***"Do not give battery impact or throwing it"***

The impact might cause leakage, heat, smoke, rupture, and/or fire of cell in the battery. And also if the protection circuit in the battery was broken, the battery would be charged at abnormal voltage or current, and abnormal chemical reaction might occur. It might cause leakage, heat, smoke, rupture, and/or fire.

**10. Deformation**

***"Do not use the battery with conspicuous damage or deformation"***

It causes the generating, smoke, rupture or flaming.

**11. Soldering**

***"Do not make the direct soldering on battery"***

As the insulator is melted by heat or the gas release vent (or safety function) is broken, it causes the generating, smoke, rupture or flaming.

**12. Reverse Charge and Overdischarge**

***"Do not reverse polarity (and terminals)"***

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.

**13. Reversed Polarity Use**

***"Do not reverse-charge or reverse-connect"***

The battery has polarity. In case the battery is not connected with charger or equipment smoothly, do not force them to connect and do check polarity of battery. If the battery is connected to opposite polarity with charger, it will be reverse-charged and abnormal chemical reaction will occur. It causes the generating, smoke, rupture or flaming.

**14. 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.

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### **15. Inappropriate Use For Other Equipment**

***"Do not use battery for other 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.

### **16. 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.



### **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 will generate, smoke, rupture or flame.

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**1. Use under strong sunshine**

Do not use or leave the battery under the blazing sun(or in 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 the protection circuit were broken, the battery would generate, smoke, rupture or flame.

**3. Charging Temperature Range**

Charging temperature range is regulated between 0°C and 40°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 and let it keep after reading. And also, please reread if necessary.

**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.

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**1 5 . WARRANTY PERIOD OF BATTERY**

The warranty period of a battery is for one year after shipment. However, even if a battery is unusual within this period, SANYO will replace a new battery for free as long as it is clear that the problem is the failure of battery manufacturing process and the battery isn't used at the abnormal usage.

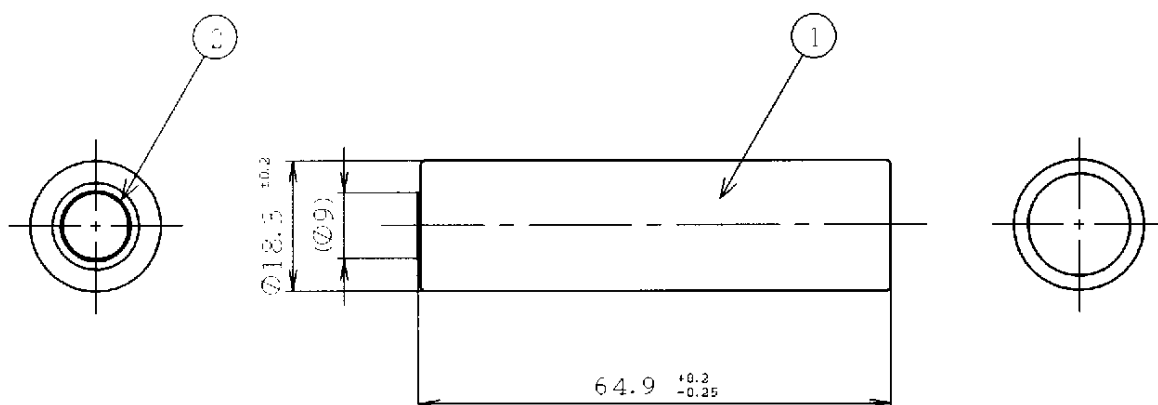
**1 6 . REQUIREMENT FOR SAFETY ASSURANCE**

For the sake of safety assurance, please discuss the equipment design, its system and protection circuit of Lithium ion battery with SANYO in advance. And also, consult SANYO about the high rate current, rapid charge and special application such as extreme condition and / or environment.

- END -

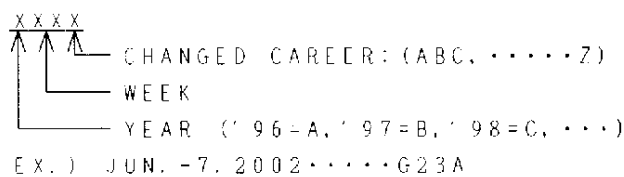
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NO.	PART NAME	APPLICATION PART CODE	QTY.	MATERIAL SPECIFICATION	NOTE
	BATTERY		1	UR18650F	SHIPPING WITH CHARGE
1	TUBE		1	SUMITUBE I	RED
2	INSULATION RING		1	PAPER 0.25	RED



NOTES.

1. STAMP LOT NO. ON THE TUBE.



DRAWING NOT TO SCALE

DATE JUN. 7. 2002		REMARK		JUL. 19. 2002		ADDED COLOR OF INSULATION RING.	
DR	T. HARADA	MODEL: UR18650F		SYM	DATE	DESCRIPTION	
CHK	K. ISHIIHAMA	CUSTOMER CODE:		MATERIAL			
CHK	T. TAKATSU	TOLERANCE	WEIGHT	MATERIAL			
ENG		250 < L ≤ ± 5	APPROX. g	FINISH			
APP	O. KAITE	< L ≤ ± 4	UNIT	部品名		完成電池	
		18 < L ≤ 50 ± 3	mm	PART NAME	BATTERY PACK (finish goods)		
		L ≤ 18 ± 2	QTY	PART CODE	Rev.		
			1	SCALE	DRAWING NO		
			1/1	UR18650F		0A	