

Specification of lithium iron phosphate battery

磷酸铁锂电池产品规格书

Model/型号 : Lithium-ion Battery

-6.4V3.0Ah19.2Wh

Date/日期 : 2020-06-03

Shandong ZhongXin Dison Power Supply Co., LTD

山东中信迪生电源有限公司

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适用范围 SCOPE

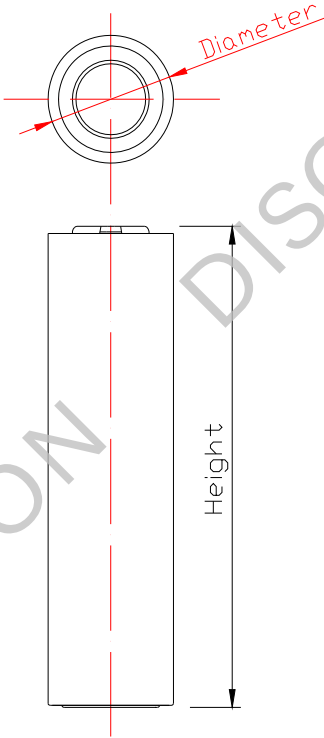
本产品规格书适用于山东中信迪生电源有限公司提供的磷酸铁锂电池产品，同时本规格书提供的产品符合：IEC61960-2011 的要求。

一、基本特性 Basic Property

型号 Type No.		IFR18650
单体外壳材质 Material of Cell Can		镀镍钢 Nickel plated steel
标称容量 Rated capacity (0.2C ₅ A)		1500mAh4.8Wh
额定电压 Rated Voltage		3.2V
最大充电电压 Max. charge voltage		3.65 V
放电截止电压 Discharge cut-off voltage		2.00V
最大充电电流 Max charge current		1.0C ₅ A
最大持续放电电流 Max continuous discharge current		2.0C ₅ A
电池直径（光亮）Diameter of bare cell		18.0±0.05mm
电池高度（光亮）Height of bare cell		65.0±0.5mm
电池重量 Cell Weight		≤42g
内阻 Internal Impedance (Max, at 1000Hz.)		≤70mΩ (充电态 charged state)
充电方法 (CC/CV)	标准 Standard charge	0.2 C ₅ A × 6.5hrs
	快速 Rapid charge	1 C ₅ A × 2.5hrs
操作温度 Operation temperature	充电 Charge	0℃～60℃
	放电 Discharge	-20℃～60℃
	贮存 Storage	-10℃～45℃

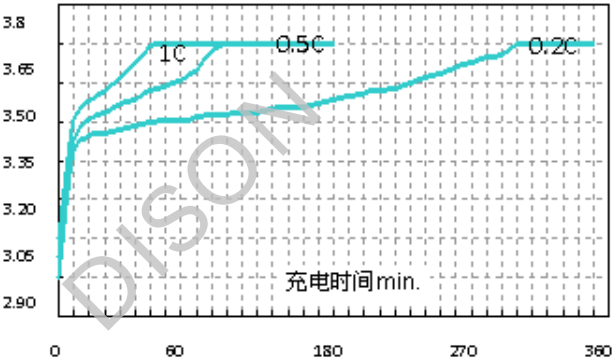
This specification is applied to the reference cell/battery in this Specification and provided by Shandong Zhongxin Dison Power Supply Co., Ltd, and which is compliance with IEC61960-2011.

二、外形图 Outside View

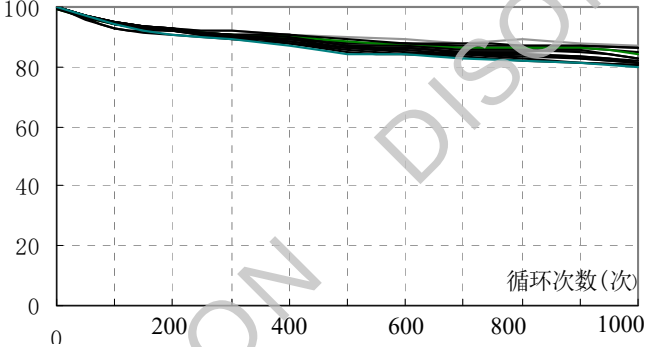


三、特征曲线图 Curve chart of single cell

电压V



容量比率 (%)



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四、电芯性能 Performance of single cell

1、电化学性能 Chemical performance

序号 No.	项目 Item	标准 Standard	测试方法 Testing method
1	常温放电性能 Discharge performance on room temperature	放电容量/标称容量 $\times 100\%$ (Discharge capacity/Rated capacity) A) $0.5C_5A \geq 100\%$ B) $1.0C_5A \geq 95\%$ 充放电曲线应平稳光滑 Charge and discharge curves must be flat and smooth	在 1 标准大气压,环境温度 $25^{\circ}\text{C} \pm 5^{\circ}\text{C}$,相对湿度为 $45\% \sim 80\%$ 的条件下, 电池 $0.2C_5A$ 标准充电后 (以下若没有特别说明, 均在此条件下放置, 皆按此充电方式), 搁置 10min, 分别以 $0.5C_5A$ 、 $1.0C_5A$ 进行放电至下限电压 2.0V, 循环三次, 当有一次达到标准, 即达到标准要求 (下同)。At 1 standard atmospheric pressure, $RT=25^{\circ}\text{C} \pm 5^{\circ}\text{C}$ and $RH=45\% \sim 80\%$, after $0.2C_5A$ standard charge (this is the standard charge method if without specific instruction), rest for 10min, then discharge the cell at $0.5C_5A$ and $1.0C_5A$ respectively till cut-off voltage 2.0V. If one time within 3 cycles the requirement is met with (the same below), it stands for in compliance with the standard.
2	常温荷电保持能力 Charge retention on room temperature	剩余容量 $\geq$ 标称容量 $\times 85\%$ Residual capacity $\geq$ Rated capacity $\times 85\%$ 恢复容量 $\geq$ 标称容量 $\times 90\%$ Restored capacity $\geq$ Rated capacity $\times 90\%$ 开路电压减小率 $\leq 3\%$ Rate of OCV decrease $\leq 3\%$	电池标准充电后, 开路放置 28 天, 以 $0.2C_5A$ 放电至 2.0V, 测量电池的剩余容量; $0.5C_5A/0.5C_5A$ 测量电池的恢复容量。可循环三次, 当有一次达到标准, 即达到标准要求。After standard charge, store the cell for 28 days in open circuit, then discharge at $0.2C_5A$ to cut-off voltage 2.0V, measure the capacity remained; measure the restored capacity by $0.5C_5A/0.5C_5A$ ($0.5C$ charge and discharge). If one of 3 cycles meets the required, it stands for in compliance with the standard.
3	高温荷电保持能力 Charge retention on high temperature	剩余容量 $\geq$ 初始容量 $\times 80\%$ Residual capacity $\geq$ Initial capacity $\times 80\%$ 恢复容量 $\geq$ 初始容量 $\times 90\%$ Restored capacity $\geq$ Initial capacity $\times 90\%$ 开路电压减小率 $\leq 5\%$ Rate of OCV decrease $\leq 3\%$ 内阻增加率 $\leq 55\%$ Rate of IR increase $\leq 55\%$	电池标准充电后, 放置于 $60 \pm 2^{\circ}\text{C}$ 的恒温恒湿箱中搁置 7 天, 再将电池取出在室温下搁置 2h, 并以 $0.2C_5A$ 放电至 2.0V, 测量电池的残余容量; $0.5C_5A/0.5C_5A$ 测量电池的恢复容量。After standard charge, store the cell at $60 \pm 2^{\circ}\text{C}$ in constant temperature and humidity oven for 7 days; then take out and rest at room temperature for 2 h, discharge at $0.2C_5A$ to cut-off voltage 2.0V, measure the capacity remained. Then measure the restored capacity by $0.5C_5A/0.5C_5A$ ($1C$ charge and discharge).
4	循环寿命 Cycle life	容量 $\geq$ 标称容量 $\times 80\%$ Capacity $\geq$ Rated capacity $\times 80\%$	标准充电后, 以 $0.5C_5A$ 放电至终止电压 2.0V 搁置 15min, 以此模式循环 2000 次。After standard charge, discharge the cell at $0.5C_5A$ to cut-off voltage 2.0V, rest for 15min, repeat for 2000 cycles.
5	贮存性能 Storage	$0.2C_5A$ 放电时间 Duration at $0.2C_5A$ discharge 贮存 3 个月的电池 $\geq 4.5\text{h}$; Duration after 3 months' storage $\geq 4.5\text{h}$; 贮存 6 个月的电池 $\geq 4.25\text{h}$; Duration after 6 months' storage $\geq 4.25\text{h}$; 贮存 12 个月的电池 $\geq 4\text{h}$. Duration after 12 months' storage $\geq 4\text{h}$.	电池充电至 $3.65 \pm 0.02\text{V}$ 后, 分别室温贮存 3 个月、6 个月、12 个月, 以 $0.2C_5A$ 进行放电记录放电时间, 然后以 $0.2C_5A/0.2C_5A$ 循环 3 次记录电池的放电时间。After CC charge to $3.65\text{V} \pm 0.02\text{V}$, store the cell at room temperature respectively for 3 months, 6 months and 12 months; discharge the cell at $0.2C_5A$ and record the duration. Then charge the cell at $0.2C$ and discharge at $0.2C$ for 3 cycles, record the duration.

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2、环境适应性能 Acclimation performance

序号 No	项目 Item	标准 Standard	测试方法 Testing method
1	热循环性能 Thermal cycling performance	电池不冒烟、不起火、不爆炸 No smoke, No fire, No explosion	电池标准充电后, 在环境温度为 75 °C 的条件下开路放置 48h, 后在-20 °C 条件下开路放置 6h, 后在室温条件下开路放置 24h, 然后 1C ₅ A 进行放电至 2.0V。以 1C/1C 连续做 3 次充放电循环。 After standard charge, place the cell at 75 °C for 48h in open circuit state; then store the cell at-20 °C for 6h, and remove to room temperature for 24h, after that discharge the cell at 1C ₅ A to 2.0V. Charge and discharge at 1C ₅ A for 3 cycles.
2	恒定湿热性能 Constant damp heat property	搁置后放电容量 Discharge capacity after storage / 标称容量 Rated capacity <100%>60% 电池外观无明显变形、不冒烟、不爆炸 No obvious deformation, No smoke, No explosion	电池标准充电后, 置于温度为 40±5°C, 相对湿度为 95% 的恒温恒湿箱中, 搁置 168h 后, 取出电池搁置 2h, 以 1C ₅ A 放电至 2.0V。 After standard charge, place the cell at 40±5°C and RH=95% in constant temperature and humidity oven for 168h; take out the cell and store at room temperature for 2h, then discharge at 1C ₅ A to 2.0V.
3	跌落性能 Drop test	电池不冒烟、不起火、不爆炸 No smoke, No fire, No explosion 放电时间 Duration≥51min	标准充电后, 将电池样品由高度 (最低点高度) 为 1.0m 的位置从 XYZ 正负六个方向自由跌落在木板上。跌落完成后测量电池的最终状态, 然后以 1C ₅ A 放电至 2.0V, 测量电池的剩余容量。 After standard charge, drop the cell from a min. height of 1.0m per axis of XYZ axes for 6 directions to hard board. Test the final state of the cell after the dropping completed, then discharge at 1C ₅ A to 2.0V and measure the capacity/duration remained.
4	不同温度下的放电性能 Discharge performance at different temperatures	搁置后放电容量 Capacity after storage/额定容量 Rated capacity ×100% A)60 °C时≥95%; B)0 °C时≥85%; C)-10 °C时≥70%; D)-20 °C时≥50%。 电池不冒烟、不爆炸、不起火。 No smoke, No explosion, No fire.	电池标准充电后, 在 60±2°C 条件下恒温搁置 3h、以 0.5C ₅ A 放电至 2.0V, 然后在室温条件下标准充电, 依此按照 0±2 °C /-10±2 °C /-20±2 °C 的顺序在相应的恒温条件下搁置 20h, 以 0.2C ₅ A 测量电池对应的终止容量, 最后在室温状态下搁置 2h。 After standard charge, store the cell at constant temperature of 60±2 °C for 3h, discharge at 0.2C ₅ A to 2.0V; Repeat this test respectively at 0±2 °C /-10±2 °C /-20±2 °C; and finally store the cell at room temperature for 2 h.
5	振动环境适应性能 Vibration test	剩余容量 Residual capacity≥初始容量 Initial capacity *95% 电压衰减 Rate of Voltage decrease≤0.5% 电池内阻增大率 Rate of IR increase≤20% 电池外观无明显损伤、不冒烟、不爆炸 No obvious deformation, No smoke, No explosion	电池标准充电后, 电池充电后, 安装在振动台面上, 按下面的振动频率和对应的振幅调整好试验设备,X、Y、Z 三个方向每个方向上从 10Hz~55Hz 循环扫频振动 30min, 扫频速率为 1oct/min: After standard charge, fix the cell to vibration table, adjust the frequency and relative amplitude of the vibration on the machine, and along XYZ axes subject to vibration and cycling of frequency from 11Hz to 55Hz for 30mins with speed of 1oct/min. A)振动频率 Frequency of vibration: 10Hz~30Hz 位移幅值 (单振幅) Displacement amplitude(single amplitude): 0.38mm B)振动频率 Frequency of vibration: 30Hz~55Hz 位移幅值 (单振幅) Displacement amplitude(single amplitude): 0.19mm。 扫频结束后以 0.5C ₅ A/0.5C ₅ A 测量电池的剩余容量 Measure the residual capacity by 1C/1C after the frequency scanning completed..

备注: 以上标准中的一些术语的定义: Note: Definition of terms in the above standard

- (1) 标准充电: 在环境温度 20°C±5°C 的条件下, 以 0.2C₅A 充电, 当电池端电压达到充电限制电压 3.65V 时, 改为恒压充电, 直到充电电流小于或等于 0.02C₅A 后停止充电. Standard charge: at room temperature 20°C±5°C, CC

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(constant current) charge at $0.2C_5A$ to voltage limit 3.65V and then CV(constant voltage) charge until charge current becomes less or equal to $0.02C_5A$.

- (2) 初始状态: 电池的初始外观、开路电压、交流内阻。Initial state: Initial Appearance, OCV and AC Internal Resistance.
- (3) 最终状态: 电池的最终外观、开路电压、交流内阻。Final state: Final Appearance, OCV and AC Internal Resistance.
- (4) 剩余容量: 电池经过特定的检测程序后的首次放电容量。Residual capacity: The first time discharge capacity after specific inspection/testing procedures.
- (5) 恢复容量: 电池经过特定的检测程序后, 通过反复充放电使状态恢复后的放电容量。Restored capacity: Through repeated charge and discharge to restore the capacity of the cell, after specific inspection/ testing procedures.

五、电池性能测试规范 Performance And Test Conditions

1、外观 Appearance

电池外表面清洁, 无电解液泄漏, 无明显的划痕及机械损伤, 无变形, 无影响电池价值的其它外观缺陷。The appearance of the cell must be clean, no leakage, no obvious scars or mechanical damage, no deformation, no other faults which will affect the value of the cell.

2、测试设备 Testing instruments

测量尺寸的仪器的精度应不小于 0.01mm。The instrument for dimension measurement must be equal or more precision scale of 0.01mm

电压表: 国家标准或更灵敏等级, 内阻不小于 $10\text{ K}\Omega/V$ 。Voltmeter: Standard class specified in the national standard or more sensitive class having inner 电流表: 国家标准或更灵敏等级, 外部总内阻包括电流表和导线应小于 0.01Ω 。Ammeter: Standard class specified in the national standard or more sensitive class. Total external resistance including ammeter and wire is less than 0.01Ω .

内阻测试仪: 内阻测试仪测试方法为交流阻抗法 (AC 1kHz LCR)。Impedance Meter: Impedance shall be measured by a sinusoidal alternating current method (1kHz LCR meter).

3、测试条件 (除非另作说明) Test Conditions(unless specified)

温度 Temperature: $20\pm 5^\circ\text{C}$; 相对湿度 RH: $60\pm 20\%$; 大气压强 Atmospheric pressure : $86\sim 106\text{Kpa}$.

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六、电池组特性 Performance of Battery Pack

1、基本电性能 Basic Performance

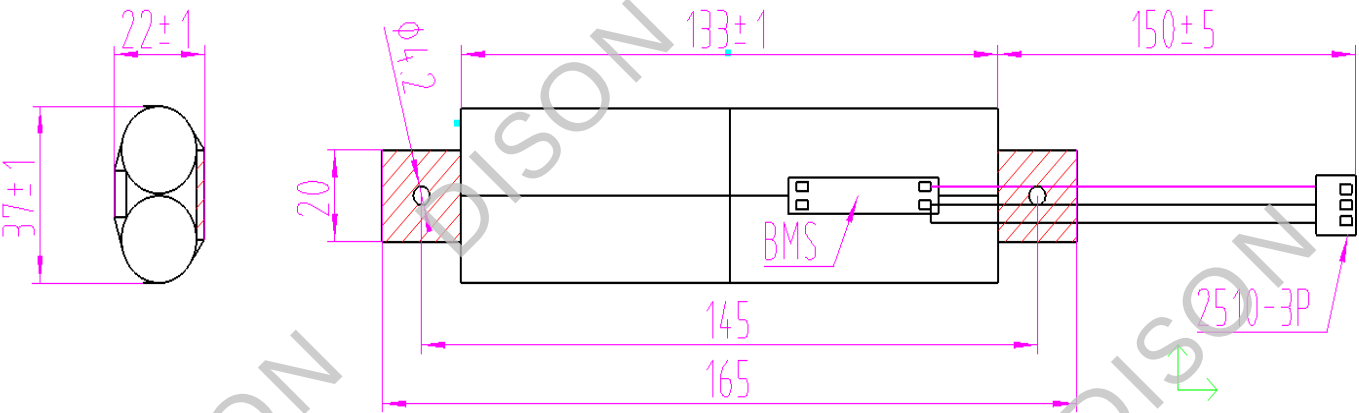
型 号 Type No.		IFR18650 6.4V3.0 Ah19.2Wh
组合形式 Assembly Form		2 并 2 串+保护板 (2P2S+BMS)
单体电池型号 Type of Cell		IFR18650 1500mAh
外壳材质 (单体) Material of Cell Can		镀镍钢 Nickel plated steel
标称容量 Rated capacity (0.2C ₅ A)		3.0Ah
最小容量 Min. capacity (0.2C ₅ A)		2.95Ah
额定电压 Rated Voltage		6.4V
开路电压 OCV (70% capacity)		6.4V~6.7V
最大充电电压 Max. Charge Voltage		7.3V
放电截止电压 Discharge Cut-off Voltage		≥4.0V
最大充电电流 Max Charge current		2.4A
最大持续放电电流 Max Continuous Charge Current		2.4A
充电方法 Charge method (恒流/恒压)(CC/CV)	标准 Standard	600mA×6.5hrs (Max.)
	快速 Rapid	2.4A×2.5hrs (Max.)
操作温度 Operation Temperature	充电 Charge	0℃~60℃, ≤85%RH
	放电 Discharge	-20℃~60℃, ≤85%RH
	贮存 Storage	-10℃~45℃, ≤85%RH

2、主要物料清单 Major BOM (所有物料满足 ROHS、REACH 环保要求)

No.	物料名 Materials	规格型号 Specification	数量 QTY
1	电芯 Cell	IFR18650 1500mAh	4
2	保护板 BMS	TP-DS-20030F	1
3	连接线 Wires with connector	3239 22AWG 红、黑、黑线三条+2510-3P 插头, 外露 150±5mm	1 套 1set
4	背板 backboard	PVC 白板: 长*宽*厚: 165*20*1.5mm φ4.2 圆孔, 孔距 145mm	1
5	外包装套 Overall packing	蓝色 PVC 热缩套	1
6	尺寸 Size(Max.)	134mm*23mm*38mm	

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七、电池组结构图 Structure of battery pack: 单位 (mm)



八、保护板 BMS

1、电路原理图及性能参数 Performance parameter

序号	项目		符号	检验方法及设备	检验标准			单位
					最小值	典型值	最大值	
4.1	过充保护	过充电检测电压	V _{DET1}	锂电保护板测试仪	3.875	3.900	3.925	V
		过充电检测延迟时间	tV _{DET1}	锂电保护板测试仪	0.7	1.0	1.3	S
		过充电解除电压	V _{REL1}	锂电保护板测试仪	3.400	3.450	3.500	V
		过充恢复方式		锂电保护板测试仪	低于过充恢复值			
4.2	过放保护	过放电检测电压	V _{DET2}	锂电保护板测试仪	1.950	2.000	2.050	V
		过放电检测延迟时间	tV _{DET2}	锂电保护板测试仪	89	128	167	ms
		过放解除电压	V _{REL2}	锂电保护板测试仪	2.437	2.500	2.563	V
		过放恢复方式			自动恢复			
4.3	过流保护	过电流检测电压	V _{DET3}	锂电保护板测试仪	0.185	0.200	0.215	V
		过电流保护电流	I _{DP}	锂电保护板测试仪	6.5	9.5	12.5	A
		检测延迟时间	tV _{DET3}	锂电保护板测试仪	8	12	16	ms
		过流保护解除方式			断开负载			
4.4	短路保护	检测延迟时间	T _{SHORT}	锂电保护板测试仪	150	300	500	μS
		保护解除条件		万用表	断开外部短路负载或充电恢复			
4.5	内阻	主回路通态电阻	R _{DS}	锂电保护板测试仪		20	40	mΩ
4.6	消耗电流	通常工作时消耗电流	I _{DD}	锂电保护板测试仪		4.0	8.0	μA
4.7	静态电流	休眠时消耗电流	I _{PWN}	锂电保护板测试仪		1.2	2.0	μA
4.8	识别电阻	S 端电阻值	R _S	万用表				KΩ
4.9	NTC 电阻	T 端电阻值	R _T	万用表				KΩ
4.10	充电电流	持续充电电流	I _c	直流电源	/	/	2.4	A

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4.11	放电电流	持续工作电流	I_b	电子负载	/	/	2.4	A
4.12	0V 充电功能	电芯 0V 时的充电功能		直流电源	■ 有 □ 无			
4.13	推荐存储条件		温度范围：22℃～28℃ 湿度范围：45%～85%RH					
4.14	建议储存时间		3 个月					

九、运输及存储

运输注意事项 Caution in Transportation

- 1、锂电池产品外包装应坚固，避免搬运或者在运输中受震动解体。The outside packing for Lithium battery must be strong enough to prevent from damage during carriage or due to vibration in transportation.
- 2、避免外包装受重物压迫致使外包装变形而使锂电池产品受压。Outside packing is prohibited being pressed by other heavy load, so as to avoid the battery being pressed.
- 3、电池应被保护以防止短路，在同一包装内须预防与可能引发短路的导电物质接触。Battery must be protected from short circuit, and preventive measures must be taken to avoid contacting conductive materials in the same package which may lead to short-circuit.
- 4、应避免与水等液体一起运输，避免受潮或者淋雨淋水。Must avoid transportation with liquids, like water; Avoid damp, raining or watering on it.
- 5、电池应在半电（40-70%）状态下运输。Must be transported at half-charged state (40~70%)
- 6、若锂电池安装在设备中，运输时需保证：If transported after installed in equipment, must guarantee:
 - 6.1 设备应进行固定以防止电池在包装内移动，应防止电池在运输途中意外启动。The equipment must be fixed to prevent the battery from moving in the package, and measures must be taken to prevent the battery from starting operation in accident during transportation.
 - 6.2 外包装应能够防水，或通过使用内衬(如塑料袋)达到防水，除非设备本身的构造特点已经具备防水特性。The outside packing shall be water-proof, or by using inner polybag as lining for water-proof purpose, unless the structure of equipment itself has the feature of water-proof.
- 7、如产品需航空运输，外包装均须贴 9 类危险品标签，贴有"仅限全货机运输"操作标签，并需提供航空公司所需要的手续材料。If to ship by Air, the outside packing must be labeled Class 9 Hazardous Goods, and must be put on operation label ONLY FULL CARGO TRANSPORT, and the certificates and documents needed by carrier must be provided.

存储注意事项 Caution in Storage

- 1、锂电池应存储于-10℃~45℃清洁、通风干燥的室内。Lithium battery must be stored at -10℃~45℃ in clean, dry and ventilated room place.
- 2、载体应牢固，避免产品受压、受挤。The package must be strong enough to avoid the Lithium battery being crushed or crimped.

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- 3、应远离火源与热源，远离强磁场环境。Must be store far away from the fire and heat sources, and from strong magnetic circumstances.
- 4、避免与腐蚀性物质接触，避免受潮或者淋雨淋水。Avoid contacting corrosive materials, Keep away from moisture, raining and water.
- 5、产品存储过程中，应 6 个月进行一次充放电循环。Charge and discharge the battery for 1 cycle every 6 months during storage.

十、电池使用时警告事项及注意事项 Warning and Caution in Use

为防止电池可能发生泄漏、发热、爆炸，请注意以下预防措施：To prevent the battery from leakage, heating or explosion, the following measures must be taken:

警告！Warning!

- 严禁将电池浸入海水或水中，保存不用时,应放置于阴凉干燥的环境中。Do not immerse the cell/battery in water or sea water, it should be kept in cool and dry place.
- 禁止将电池在热高温源旁，如火、加热器等使用和留置。Do not use/expose the cell/battery to extreme heat sources, like fire or heater.
- 充电时请选用锂离子电池专用充电器。Use the special Li-ion charger to charge the cell/battery.
- 严禁颠倒正负极使用电池。Do not reverse the polarity of the cell/battery for any reason.
- 严禁将电池直接插入电源插座。Do not connect cell to the plug socket or car-cigarette-plug.
- 禁止将电池丢于火或加热器中。Do not throw the cell/battery into heater or fire.
- 禁止用金属直接连接电池正负极短路。Do not connect the cell/battery with metal directly.
- 禁止将电池与金属,如发夹、项链等一起运输或贮存。Do not handle or store with metallic like necklaces, coins or hairpins, etc.
- 禁止敲击或抛掷、踩踏电池等。Do not strike the cell/battery by hammer or tread it.
- 禁止直接焊接电池和用钉子或其它利器刺穿电池。Do not make the direct soldering onto a cell/battery or drive a nail into the cell/battery.

小心！Caution

- 禁止在高温下（炙热的阳光下或很热的汽车中）使用或放置电池，否则可能会引起电池过热、起火或功能失效、寿命减短。Do not use or leave the cell in high temp.(under the blazing sun or in hot car),to avoid fire, disabled or life shorter of the cell.
- 禁止在强静电和强磁场的地方使用，否则易破坏电池安全保护装置，带来不安全的隐患。Do not use the cell/cell under strong static or magnetic field, to avoid destroying of the protect device; or lead to safety risk.
- 如果电池发生泄露电解液进入眼睛，请不要揉擦；应用清水冲洗眼睛并立即送医治疗，否则会伤害眼睛。If the electrolyte came into the eyes, do not rub, you should wash with water and contact a doctor at once.
- 如果电池发出异味、发热、变色、变形或使用、贮存、充电过程中出现任何异常，立即将电池从装置或充电器中移离并停用。If find any peculiar smell, heat, color change, distortion of the cell or there is any abnormity in using, storing or charging process, you should take it from the device or charger and stop its use;
- 如果电极弄脏，使用前应用干布抹净；否则可能会导致接触不良功能失效。To avoid bad contact or function disabled, please use a dry cloth to clean the battery if it is dirty;
- 废弃电池应用绝缘纸包住电极，以防起火、爆炸。Wasted cells/battery should be packed with a insulated paper, to avoid fire or explosion.