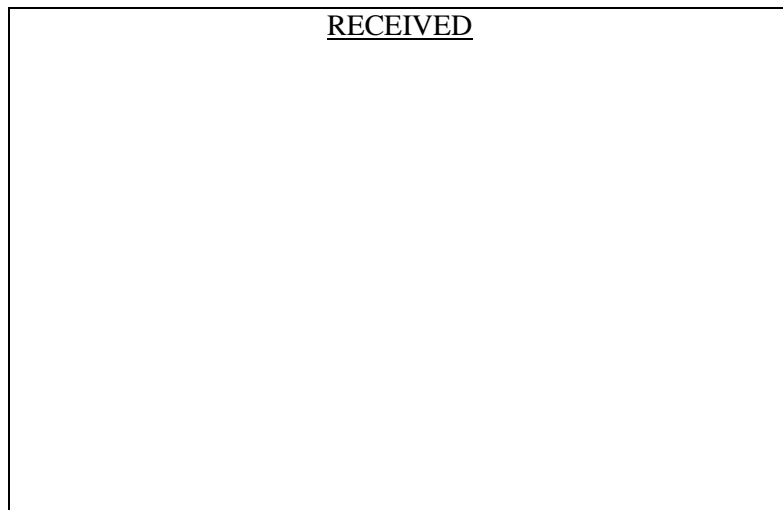


SPECIFICATION FOR  
MANGANESE DIOXIDE LITHIUM BATTERY  
Type : CR1616PWNC [TOSHIBA Brand]



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**TOSHIBA LIFESTYLE PRODUCTS & SERVICES CORPORATION**

G. Manager	Manager	Issued by

## PRODUCT SPECIFICATION

1. Applicability : This specification is applicable to the following product :  
Coin Type Manganese Dioxide Lithium Battery CR 1 6 1 6 PWNC

2. Ratings :

2.1 Battery Type : CR1616

2.2 Nominal Voltage : 3.0 V

2.3 Standard Capacity : 50 mAh

(on continuous discharge at 20°C under 30kΩ load to 2.0V end-voltage )

2.4 Dimensions : Shape and dimensions shall be as shown in Fig.1.

2.5 Standard Weight : 1.1 g

2.6 Operating Temperature : -20 ~ 65°C

2.7 Chemical System :  
Anode : Lithium  
Cathode : Manganese Dioxide  
Electrolyte : Organic Solvent with Lithium Salt

3. Quality requirements :

3.1 Dimensions : Shape and dimensions shall be as shown in Fig.1.

3.2 Appearance : Batteries shall have no deformation, dent, flaw, stain and leakage, that spoils commercial value of the product.

3.3 Characteristics : The characteristics shown below in Table 1 should be satisfied.

3.4 Use recommendation limit : Recommended date of use shall be within 5 years after battery manufacture.

(Table 1)

No	Test Item		Characteristic		Test Condition
			Initial*1	After 1 Year	
1	Open-Circuit Voltage	20℃	3.00 ~ 3.40 V	3.00 ~ 3.40 V	
2	Closed-Circuit Voltage	20℃	3.00 ~ 3.40 V	3.00 ~ 3.40 V	Load Resistance : 30k Ω 0.8sec
3	Duration	60℃	480 h minimum	—	Load Resistance : 30k Ω Cutoff Voltage : 2.0 V
		20℃	500 h minimum	480 h minimum	
		0℃	350 h minimum	—	
4	Duration (Acceleration)	20℃	480 h minimum		After storage at 60℃ for 20 days Load Resistance : 30k Ω Cutoff Voltage : 2.0 V
			425 h minimum*2		After storage at 60℃ for 100 days Load Resistance : 30k Ω Cutoff Voltage : 2.0 V
5	Leakage		No leakage being obstacles to practical use.		After storage at 60℃ for 30 days

\*1 Initial : within 1 month after delivery.

\*2 Duration after storage at 60°C 100 days are reference value.

#### 4. Test :

##### 4.1 Test Condition and Storage Condition

###### (1) Test Condition :

Unless otherwise specified elsewhere, tests shall be conducted at ordinary temperature ( $20\pm 2^{\circ}\text{C}$ ) and ordinary humidity ( $55\pm 20$ )%RH.

###### (2) Storage Condition :

Unless otherwise specified elsewhere, Storage shall be conducted at ordinary temperature ( $20\pm 2^{\circ}\text{C}$ ) and ordinary humidity ( $55\pm 20$ )%RH.

##### 4.2 Measuring instruments and devices

###### (1) Dimension Measuring Instruments :

Micrometers, dial gauges and vernier callipers specified by JIS or those having equal or better precision shall be used for measuring dimensions.

###### (2) Voltmeter :

The tolerance shall be  $\pm 0.005\text{V}$  and input resistance shall be  $10\text{M}\Omega$  or more.

###### (3) Load Resistance :

Load resistance shall include resistance throughout external circuits, and its tolerance shall be  $\pm 0.5\%$ .

##### 4.3 Test methods

###### (1) Dimension :

The diameter and overall height of batteries shall be measured with instruments specified in Subparagraph 4 above, provided that either one or both sides of such instruments shall be insulated in measuring the overall height of batteries.

###### (2) Appearance :

Appearance of batteries shall be inspected by visual means.

###### (3) Open-Circuit Voltage :

Test specimen batteries shall be kept standing open for 8 hours or longer at the ambient temperature specified in Table 1 above, and the voltage between both terminals at the same ambient temperature shall be measuring with a voltmeter as specified in Subparagraph 4 above.

###### (4) Closed-Circuit Voltage :

Test Specimens shall be kept standing open for 8 hours at the ambient temperature specified in Table 1 above, and then the voltage between both terminals shall be measured with a voltmeter as specified in Subparagraph 4 above while the specified load is connected between both terminal at the same ambient temperature as specified above; provided that the measured value shall be based on meter readings taken 0.8 seconds after the circuit is closed.

###### (5) Discharge :

Test specimen batteries shall be kept for 8 hours at the ambient temperature specified in Table 1 above, and then be continuously discharged at the same ambient temperature and through the specified load resistance. The discharge shall be continued until the terminal voltage of the test specimens falls below the end voltage of 2.0V.

The time during which the terminal voltage has been maintained equal to and above the end voltage shall be taken as the service life.

###### (6) Duration (Acceleration) :

Test specimens shall be discharged while they are kept at ordinary temperature ( $20\pm 2^{\circ}\text{C}$ ) and at ordinary humidity ( $55\pm 20$ )%RH after having been stored at the temperature specified in Table 1 above.

###### (7) Leakage :

Test specimens shall be examined for electrolyte leakage while they are kept for 8 hours at ordinary temperature ( $20\pm 2^{\circ}\text{C}$ ) and at ordinary humidity ( $55\pm 20$ )%RH after having been stored at the temperature specified in Table 1 above.

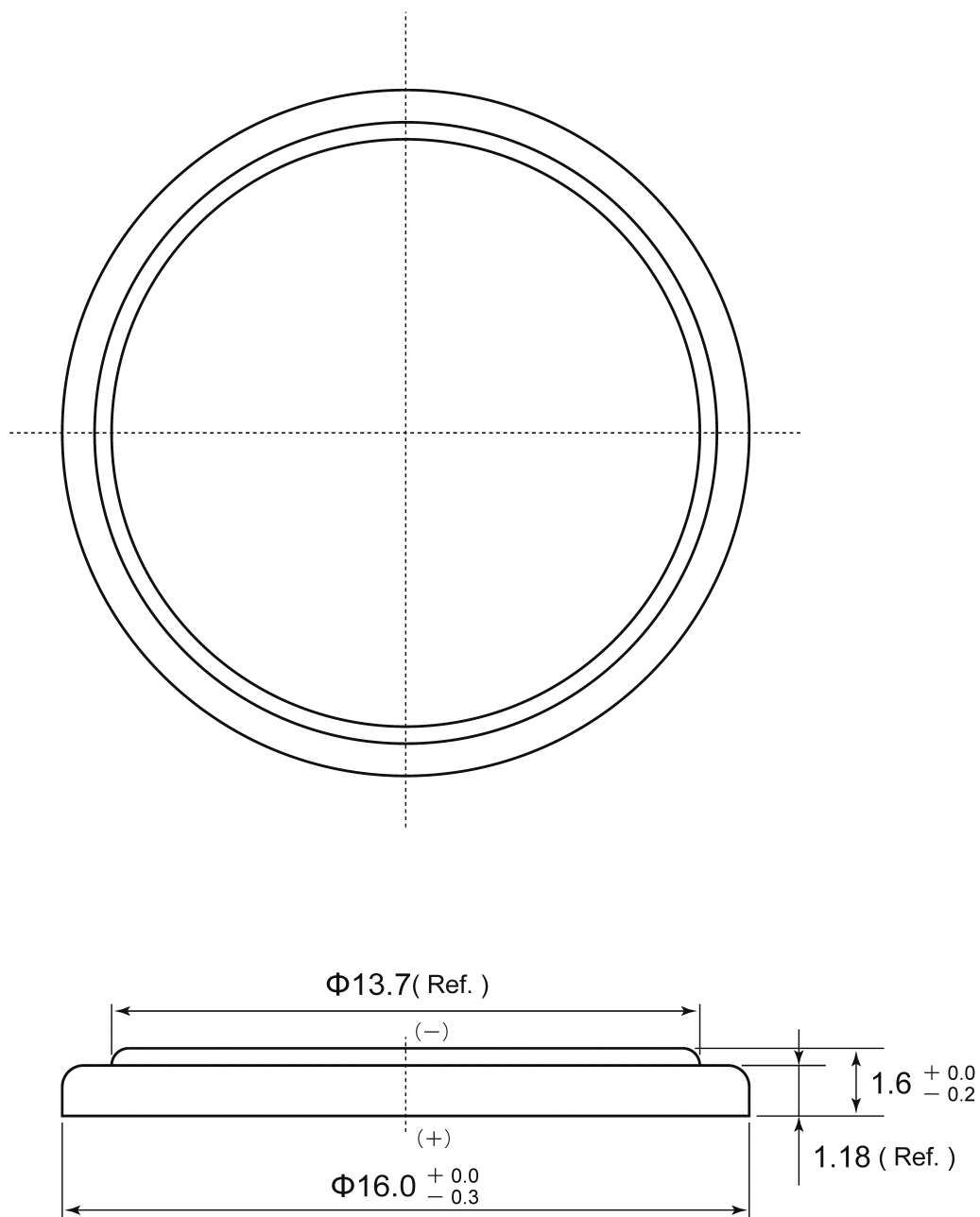
5. Marking of Batteries:

5.1 Polarity	<b>+</b> (— shall not be indicated)
5.2 Brand of Battery	<b>TOSHIBA</b>
5.3 Battery System	<b>LITHIUM BATTERY 1</b>
5.4 Battery Type	<b>CR1616</b>
5.5 Nominal Voltage	<b>3V</b>

6. Safe Certification : Our products are recognized by Underwriters Laboratories Inc. (an American organization testing for public safety) that they are meeting UL requirements.  
Our products are highly appraised for their reliability and safety.  
Approval No.: UL file No.MH12828

7. Term of Guarantee : 12 months after delivery.

(Fig.1) Dimension



Unit : mm

## **Precautions when using Coin type manganese dioxide lithium batteries**

### **1 . Precautions when designing battery appliances.**

If the batteries are improperly used, leakage, heat, explosion, fire, etc. may happen. Pay attention to the following matters at the designing of appliances.

#### **(1) Precautions when designing battery compartment.**

- ① The battery compartment should be made so that replacing of batteries is easy, while after loading of batteries easy release should be avoided.
- ② About the battery loading parts of battery compartment, pay attention for instance to the cover fixing method of the battery compartment so that the babies and little children cannot touch or take out batteries easily, to prevent swallowing by babies and little children or their injuries. Besides, make known to everyone about “Keep batteries out of reach of babies and little children” with operating instructions or other ways.
- ③ When designing the dimensions and shapes of the battery compartment and the contacts, consider the dimensions and the tolerances of the batteries and their  $\oplus\ominus$  terminals to prevent contact failure or reverse insertion and to assure the adaptation of batteries put on the market. The dimensions of the battery compartment should conform to IEC (International standards) and JIS (Japanese industrial standards) are adaptable.
- ④ Indicate clearly on the battery compartments, the type of the battery which suits the apparatus and the correct direction of insertion(polarity).  
If the space for indication is not available, indicate them clearly in the operating instruction.
- ⑤ The electric circuit inside the battery compartment should be limited to the circuit connected to battery contacts; except contact section, the circuit should be completely isolated from the other electric circuits.
- ⑥ To minimize the damage of apparatus caused by leakage from the battery, if any, pay attention to the construction and arrangement of the battery compartment such as to detach completely the battery compartment from the mechanism compartment.
- ⑦ The battery compartment should maintain permeability for heat radiated from the compartment and for gas escaped from the batteries.  
If complete airtight is unavoidable, pay attention to give a function such as safety vent for gas escape.
- ⑧ When there is a heat source in the apparatus, set the battery compartment away from the heat source, as much as possible.
- ⑨ When choosing the material for the battery compartment, shocks and environment should be considered. If vibration or shocks can be estimated, take a measure so that the construction of the compartment can absorb it.

- ⑩ Pay attention to the material and the shape of the battery contacts so that the electric contact will be perfect even by use of batteries having the dimensions prescribed by JIS.  
The material of the contact should be chosen among nickel-plated iron, nickel-plated stainless steel or the like. If an especially low contact resistance is required, adopt gold-plating or the like.
- ⑪ The desirable battery contact pressure of the apparatuses is at minimum 1N(0.1 kg f) and at maximum 10N( 1 kg f).
- ⑫ The circuit in the apparatus should not make electric contact with the batteries except at terminal contact point.
- ⑬ To avoid reverse insertion of batteries, the form of the contact point should make use of the shape difference of  $\oplus\ominus$  battery terminals, as much as possible.
- ⑭ When the external substitute electric source is used, the circuit should be designed to avoid charging or forced discharging of batteries.
- ⑮ To ensure the prevention of charging batteries, a protective circuit should be installed.

## (2) Precautions when using memory back up battery.

- ① These battery cannot be recharged and do not try to charged.

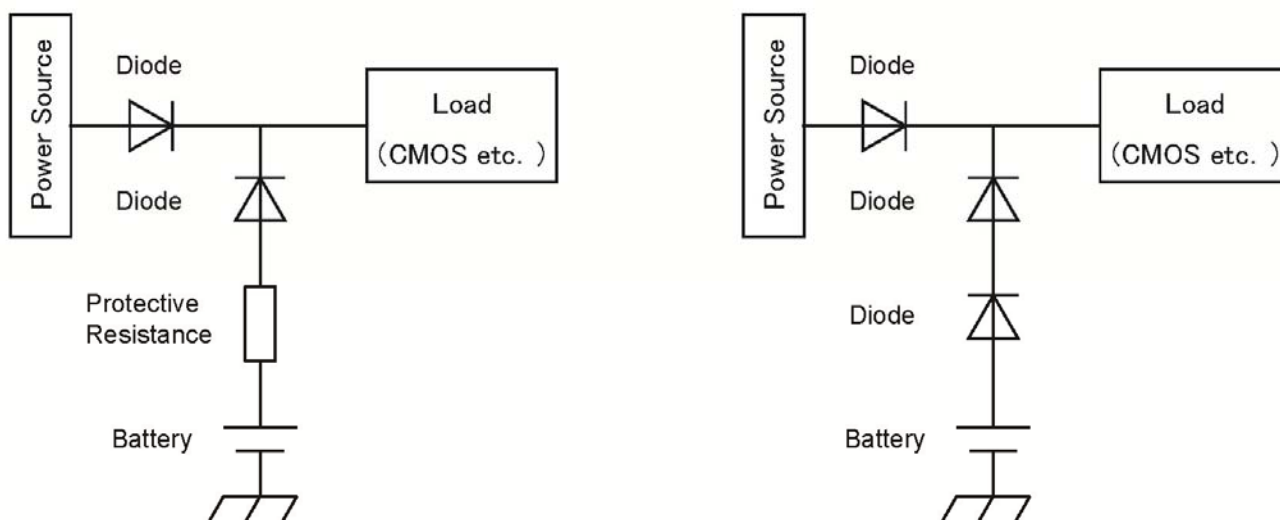
If they are recharged, the electrolyte of the batteries heats, gas is generated, the pressure in the batteries may increase, and the batteries may leak, heat, explode or fire.

When used as memory back up battery, to prevent current from the main power source from flowing into the circuit with the battery, use blocking diodes to prevent reverse current(charging) and a protective resistance.

UL Standard for Safety for Lithium Batteries, UL1642 prescribes that, if lithium primary battery is used as back up of apparatuses the above-mentioned diode and protective resistor should be connected in series.(See figure below) Low current leakage type diodes should be used.

Besides, design so that, during the whole using term the charged quantity due to reverses current is kept within 1% of nominal capacity.

### Example



- ② Under condition where normal current flow through the battery will increase, the battery should not be connected in series with the power supply.
- ③ Direct soldering and direct spot welding to the batteries should be avoided.  
When connecting a lead wire to the battery, direct soldering or direct spot welding to the battery should be avoided. Connect always to a tab or a pin terminal. In the case of hand soldering, practice it at the following condition; temperature of soldering iron tip: 370°C and less, soldering time: 5 sec. and less.
- ④ In the case of automated soldering, dip only the tab terminal in solder bath; be careful not to let the batteries stop or fall in the bath.  
Place a screen (printed board, etc.) between the battery and the solder bath.  
If by any chance, the battery falls, explosion or fire may happen.
- ⑤ For the apparatuses that generates heat, set the battery away from the heating section or if the battery is near the heat source, isolate it from the heating section, making sure that the temperature at the battery does not exceed 65°C.

### **(3) Precautions at apparatus manufacturing**

- ① Do not give ultrasonic vibration to the batteries. By ultrasonic vibration, the contents of batteries will be finely powdered, which may cause internal short-circuit resulting in heat, leakage or explosion of batteries.
- ② These batteries are allowed to be disposed as general incombustible refuse.  
However, if rules for battery disposal exist, such as regulations of local government, dispose of the batteries in accordance with the rules.
- ③ At the storage or disposal of the batteries, insulate the terminal parts with tape or the like. If the batteries are mixed up together or mixed with other metallic objects, the batteries may be short-circuited and may heat, explode or fire. As a result, injury or fire may happen. Besides, do not dispose of batteries in fire. If the batteries are put in fire, they may explode by rapid heating.
- ④ Wipe clean with a cloth or the like the terminals of the apparatus and the batteries before the insertion of the batteries in the apparatus.  
If the terminals are soiled, the apparatus may not operate normally due to contact failure.
- ⑤ To measure voltage of the batteries, use a voltmeter having high internal resistance.  
The tolerance of the voltmeter shall be not more than  $\pm 0.005V$ . Use voltmeter with an input resistance shall be not less than 1M $\Omega$ .

### **(4) Precautions when replacing the batteries.**

These batteries are recognized by Underwriters Laboratories that they are meeting UL requirements. UL indicates the servicing of end product's circuitry involving batteries and the replacement of batteries should be done by a trained technician. However, the user-replacement of batteries is prescribed in the standard; according to this prescription these batteries may be used in end product where batteries are user-replaceable, if the following conditions satisfied.



- ① The packaging for replacement batteries shall be marked with the following caution notice or equivalent statements.

**CAUTION :**

Risk of fire and burns. Do not recharge, disassemble, heat above 100°C (212°F) or incinerate. Keep battery out of reach of children and in original package until ready to use. Dispose of used batteries promptly.

For replaceable lithium primary coin cells (3V) the packaging shall also include the following or equivalent.

**CAUTION :**

Never put batteries in mouth. Swallowing may lead to serious injury or death. If ingested, immediately seek medical attention and have the doctor phone the National Capital Poison Control Center at (202)625-3333.

**(5) Precautions against transport, display and storage.**

- ① For the storage of batteries, avoid high temperature and high humidity; and to prevent dew condensation choose a well ventilated dry place where the temperature is not so high.  
For store the batteries, the temperature should be between 10°C and 25°C and never exceed 30°C. Extremes of humidity (over 95% and below 40% relative humidity) for sustained periods should be avoided.  
Storage of the batteries at high temperature or high humidity may increase their performance deterioration or leakage.
- ② For storage in warehouse or display in shop window, keep the batteries away from long duration direct sunlight and from rain water. The exposition of the batteries to high temperature may increase their deterioration or induce leakage. Besides, if the batteries get wet, the insulation will decrease and rust gathering or leakage will occur more easily.  
Besides, batteries stocked by families are increasing; in this case, the matters that require attention are as mentioned above.
- ③ Avoid rough handling during transport.  
Rough handling may cause dent or deformation, which can bring decrease of performance or leakage. Moreover, the battery compartment may be damaged, causing the batteries in disorder; If  $\oplus\ominus$  are short-circuited the batteries may be damaged by heating, and moreover leakage, explosion, fire, etc. may happen.
- ④ When piling up the outer packages of batteries, the number of tiers should be limited to the amount indicated on the outer-package. If the packages are excessively piled up, the batteries in the lower layer may be deformed or leakage may be accelerated.
- ⑤ As for the distribution, such as transport, display, storage and others, observe strictly the first-in, first-out method and pay attention to avoid long-term stock.  
The batteries have enough storage property at normal temperature and humidity conditions (temperature: 10°C~25°C, relative humidity: 40~95%); however since the long-term stock may deteriorate their performance, observe strictly the appropriate volume of inventories and the first-in, first-out method.

## 2. Warning notices to the customers regarding battery handling.

For the correct use of batteries when the apparatuses are used by the customers, the operating instructions of the apparatuses should contain the following warning statement regarding batteries.

〈Warning notices regarding battery handling, to be contained in the operating instructions of the apparatuses〉

- These batteries contain combustible materials such as lithium, organic solvent, etc.  
By misuse, this may cause battery leakage, heat, explosion or ignition, bringing about injury or apparatus failure. So, observe strictly the following matters.



- ① Keep batteries out of reach of babies and little children.  
If by any chance, the batteries are swallowed, consult the doctor without delay.
- ② Never try to recharge the batteries.  
If they are recharged, the electrolyte of the batteries heats, gas is generated, the pressure in the batteries may increase, and the batteries may leak, heat, explode or fire.
- ③ Do not incinerate, heat or disassemble the batteries.  
The insulator and so on will be damaged, and the batteries may leak, heat, explode or fire.
- ④ Do not insert batteries in reverse polarity.  
By charging, short-circuiting or the like, the batteries may show abnormal reactions, and may leak, heat, explode or fire.
- ⑤ If the liquid of the batteries touches the eyes, the eyes may be injured.  
Do not rub the eyes but flush the eyes amply with clean water such as city water and then receive medical treatment without delay.
- ⑥ If the liquid of the batteries is licked, rinse out the mouth immediately and consult the doctor.
- ⑦ Do not connect  $\oplus\ominus$  of the batteries with wire and do not carry or keep metallic necklace, hairpin, etc. together with batteries.  
The batteries may be short-circuited, causing over-current and they may leak, heat, explode or fire.
- ⑧ If leakage or nasty smell happens to batteries, the leaked electrolyte may catch fire; therefore keep the batteries away from fire without delay.
- ⑨ Do not solder anything directly to the batteries.  
The insulator or the like may be damaged by heat, and the batteries may leak, heat, explode or fire.
- ⑩ At the storage or disposal of the batteries, insulate the terminal parts with tape or the like.  
If the batteries are mixed up together or mixed with other metallic objects, the batteries may be short-circuited and may leak, heat, explode or fire.
- ⑪ Do not mix and use “brand and different types of batteries” nor “used and new batteries” together. The difference of characteristics may cause leakage, heat, explosion or fire.
- ⑫ Do not adhere to the batteries onto skin by scotch tape or the like, skin injury may be caused.

## CAUTION

- ① Do not drop the batteries or expose them to strong impact, and do not deform the batteries. The insulator and so on will be damaged, and the batteries may leak, heat or explode.
- ② Do not use nor keep batteries at places exposed to strong direct sunlight or in cars under burning sun, etc. The batteries may leak, heat or explode.
- ③ Keep the batteries away from water. The batteries may heat.
- ④ In some apparatuses, near the battery insertion opening, the apparatus metal parts and the battery  $\oplus\ominus$  terminals may contact together.
- ⑤ Pay attention to avoid short-circuit when inserting the batteries in the apparatus.
- ⑥ The specification or the performance of the batteries may be sometimes not appropriate, depending on applications or apparatus; use correctly the appropriate batteries in accordance with the operating instructions and notices of the apparatus.
- ⑦ these batteries are allowed to be disposed as general incombustible refuse.  
However, if rules for battery disposal exist, such as regulations of local government, dispose of the batteries in accordance with the rules.
- ⑧ Do not forget to turn off the switch of the apparatus.
- ⑨ To keep the batteries taken out from packages, or to stock the batteries by families, pay attention to avoid contact between batteries and to keep out of short-circuit.
- ⑩ As to the voltage or the shape, coin type manganese dioxide lithium primary batteries(3.0V) are not compatible with following batteries; therefore, only use manganese dioxide lithium batteries in specified apparatuses specially designed for them.