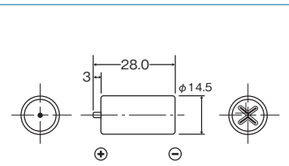
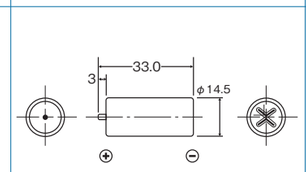
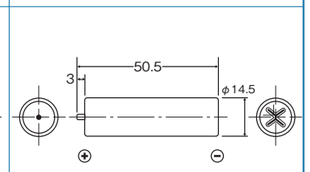
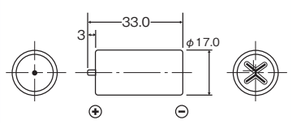
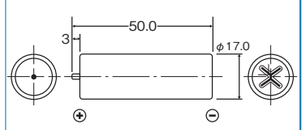
OVERVIEW

- Thionyl Chloride Lithium Battery (ER series) uses highly active thionyl chloride ($SOCl_2$) for the positive electrode reactant, and lithium for the negative electrode reactant. The voltage is the highest among lithium primary batteries at 3.6V, and the electric energy in a AA size is 7000mWh, realizing high energy.
- Self-discharge is minimized by using highly pure materials. The battery can be used in a wide range of temperatures (-55℃ to +85℃) and is highly reliable, as fluid leakage is not a concern due to the use of Laser Weld Sealing for complete enclosure.
  The product is especially suited for long term use, such as memory backup power supply, and as the power for electricity/gas/water meters (Please contact us when using for extended periods of time in high temperature or low temperature conditions).
- Our Thionyl Chloride Lithium Battery is a UL (safety standard) certified part, and its safety and reliability have been proven (Certification Number: MH12828).

Rated Value

Model No.	ER3V	ER4V	ER6V
Nominal Voltage (V)	3.6	3.6	3.6
Nominal Capacity (mAh)*1	1000	1200	2000
Dimensions (mm)*2			
Maximum Discharge Current (mA)	1.0	1.0	3.5
Weight (g) *3	8.5	10	16
Usable Temperature Range	-55℃ to +85℃		

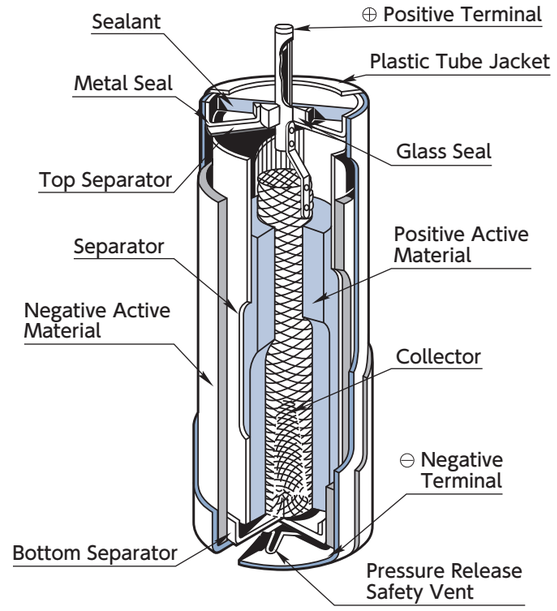
Model No.	ER17330V	ER17500V
Nominal Voltage (V)	3.6	3.6
Nominal Capacity (mAh)*1	1700	2700
Dimensions (mm)*2		
Maximum Discharge Current (mA)	1.0	3.5
Weight (g) *3	13	19
Usable Temperature Range	-55℃ to +85℃	

*1: Nominal capacity is figured out of the duration until the voltage drop down to 2.5V when discharged at a Maximum Discharge Current at 20℃
*2: Data and Dimensions are reference levels
*3: The above weight information are limited to battery itself. Actual product weight depends on the final specifications

FEATURES

- High Voltage
  The voltage is the highest among lithium primary batteries at 3.6V, and one unit can take the place of 2 to 3 batteries which were needed in the past.
- High Energy Density
  High energy density of approximately 1000mWh/cm³ is realized by the use of a special carbon cathode body in addition to a highly active positive electrode reactant (thionyl chloride).
- Excellent Discharge Characteristics
  The battery is designed for small changes in internal resistance during discharge, delivering stable operational voltage even with the progressing depth of discharge.
- Wide Range of Operating Temperature
  Unlike batteries of the past, the battery can be used in a wide range of temperatures (-55°C to +85°C).
  (Please contact us when using for extended periods of time in high temperature or low temperature conditions).
- Long Term Reliability
  The battery is highly reliable in the long term due to a structural design which allows very small self-discharge and due to the adoption of Laser Sealing which encloses completely.

Structure of ER6V



TERMINAL SHAPE

- ER series terminals are offered in types for soldering directly onto the circuit board, for using connectors allowing detachment, and with lead wire.

Type	Type Code	Attachment to Board		Pitch Dimensions by Battery (mm)				
		+ Terminal	− Terminal	ER3V	ER4V	ER6V	ER17330V	ER17500V
Board Mounting	T1	1 line	1 line	25.5	30.5	49.0	31.0	49.0
	T2	1 line	2 lines	25.5	30.5	49.0	31.0	49.0
	P	1 line	1 line	30.5	35.5	53.0	36.0	53.0
With Connector	C	Connector		Please contact us for details				
Without Connector	LY	Lead Wire						

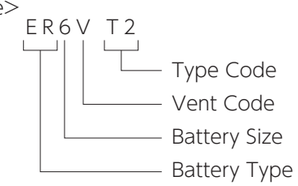
SAFETY VALVE

- To improve safety, all Thionyl Chloride Lithium Batteries are equipped with safety valves. Thionyl Chloride Lithium Batteries adopt Laser Weld Sealing and Glass Seal for complete enclosure in order to secure long term reliability. When the battery is mishandled, such as by charging or by placing in fires, this structure may cause a rapid increase of internal pressure and heat expansion of the battery which may cause violent explosion. Safety Valves are installed on all batteries to improve safety by preventing these accidental dangers.

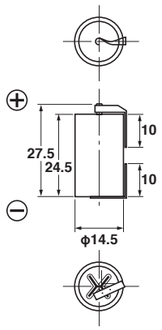
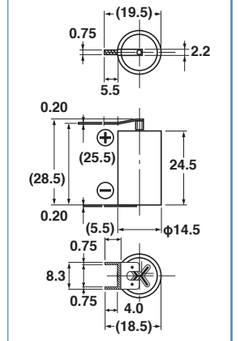
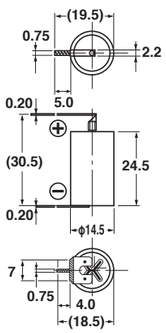
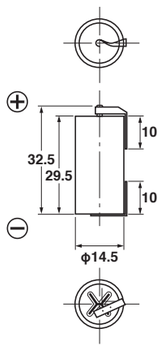
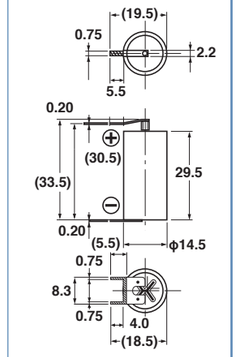
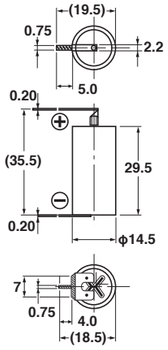
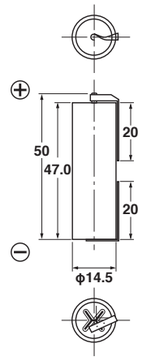
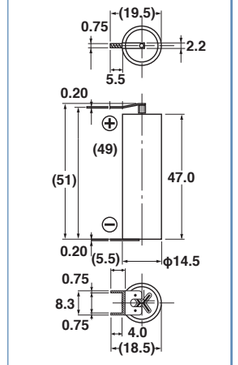
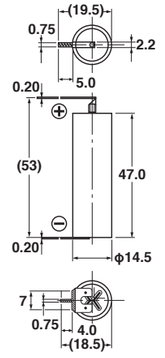
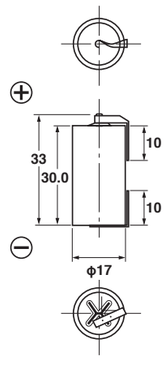
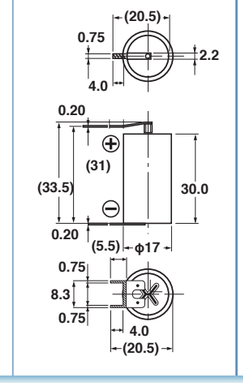
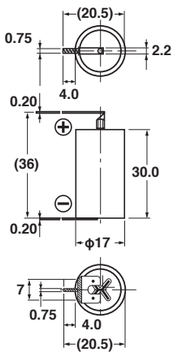
PRODUCT NAME

- Major product names are listed below ;

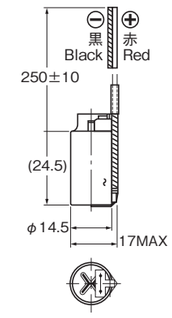
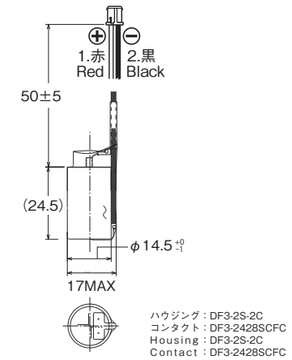
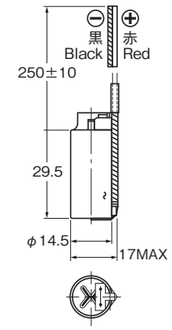
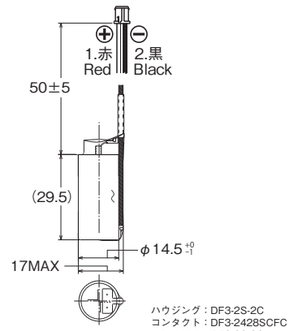
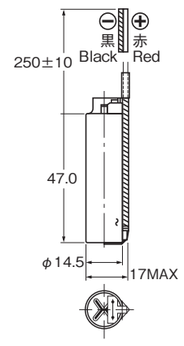
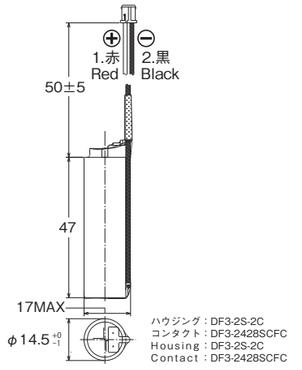
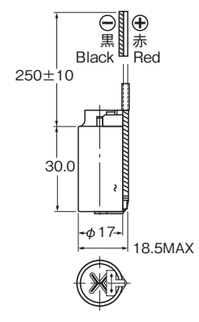
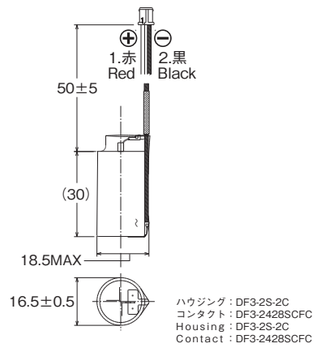
<For Example>



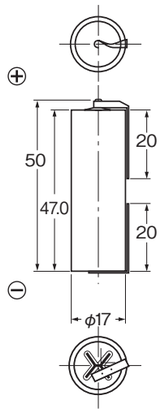
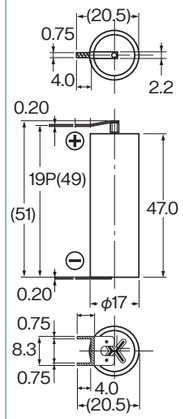
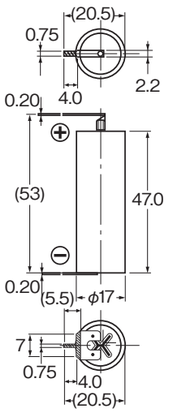
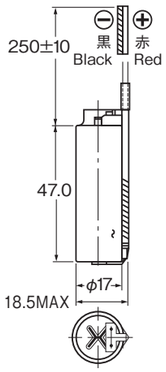
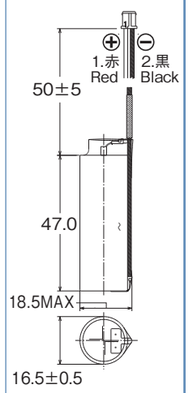
■ 形状と寸法図（標準仕様） | Overall Dimensions（Standard Specifications）

品番 | Model	形状(mm) | Shape(mm)	品番 | Model	形状(mm) | Shape(mm)	品番 | Model	形状(mm) | Shape(mm)
 **ER3V T1**		 **ER3V T2**		 **ER3V P**	
 **ER4V T1**		 **ER4V T2**		 **ER4V P**	
 **ER6V T1**		 **ER6V T2**		 **ER6V P**	
 **ER17330V T1**		 **ER17330V T2**		 **ER17330V P**	

■ 形状と寸法図（標準仕様） | Overall Dimensions（Standard Specifications）

品番 | Model	形状 (mm) | Shape (mm)	品番 | Model	形状 (mm) | Shape (mm)
 **ER3V LY**		 **ER3V C1**	 ハウジング：DF3-2S-2C コンタクト：DF3-2428SCFC Housing：DF3-2S-2C Contact：DF3-2428SCFC
 **ER4V LY**		 **ER4V C1**	 ハウジング：DF3-2S-2C コンタクト：DF3-2428SCFC Housing：DF3-2S-2C Contact：DF3-2428SCFC
 **ER6V LY**		 **ER6V C1**	 ハウジング：DF3-2S-2C コンタクト：DF3-2428SCFC Housing：DF3-2S-2C Contact：DF3-2428SCFC
 **ER17330V LY**		 **ER17330V C1**	 ハウジング：DF3-2S-2C コンタクト：DF3-2428SCFC Housing：DF3-2S-2C Contact：DF3-2428SCFC

■ 形状と寸法図（標準仕様） | Overall Dimensions（Standard Specifications）

品番 | Model	形状(mm) | Shape(mm)	品番 | Model	形状(mm) | Shape(mm)	品番 | Model	形状(mm) | Shape(mm)
					
ER17500V T1		**ER17500V T2**		**ER17500V P**	
					
ER17500V LY		**ER17500V C1**			

ハウジング：DF3-2S-2C
コンタクト：DF3-2428SCFC
Housing：DF3-2S-2C
Contact：DF3-2428SCFC

◆ 安全認証

弊社塩化チオニルリチウム電池は、UL（Underwriter Laboratories Inc.）の部品認定を取得しており（テクニカル・リプレースメント）、さらに、ULの実施するフォローアップサービス・プログラムに従い検査を受けた工場で製造されています。

認可番号： MH12828

ULとは、米国最大の独立安全性機関であり、機器、材料、部品などに対して安全性の見地から調査、試験を行い認定を行うとともに、UL規格を作成、発行しています。

◆ Safety Certification

Our Thionyl Chloride Lithium Batteries are UL (Underwriter Laboratories Inc.) certified parts (technical replacements), and are manufactured in inspected factories that conform to the follow up service program conducted by UL.

Certification Number： MH12828

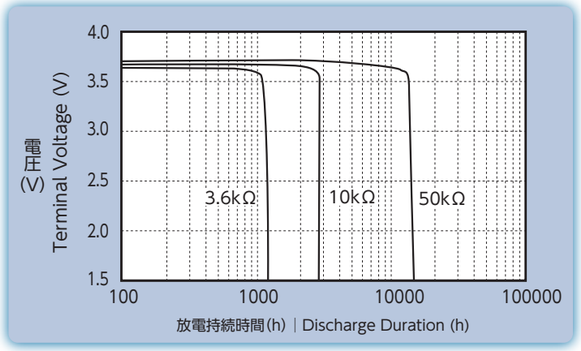
UL is the largest independent safety organization in the U.S. that conducts investigations and tests on instruments, materials, and parts from a safety perspective, and provides certifications along with the formulating and introducing UL standards.

ER3V 標準特性 | ER3V STANDARD CHARACTERISTICS

■ 放電特性 放電条件： 定抵抗連続放電、初度、20℃

Discharge Characteristics

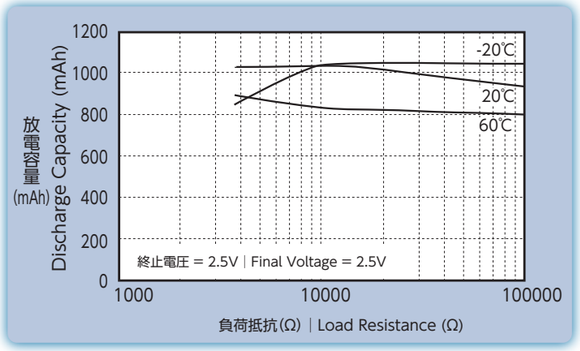
Discharge - Conditions： Continuous Discharge with Fixed Resistance, Initial, 20℃



■ 負荷抵抗 — 放電容量 初度、連続放電

Load Resistance - Discharge Capacity

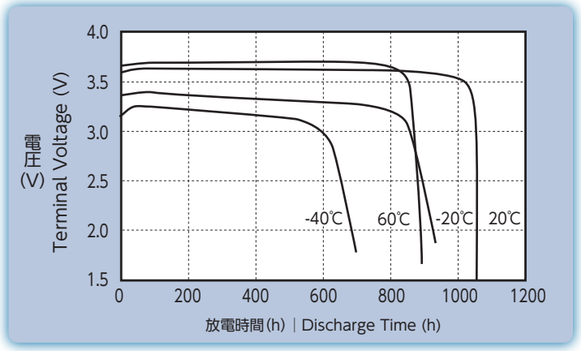
Initial, Continuous Discharge



■ 放電温度特性 放電条件： 3.6kΩ連続放電、初度

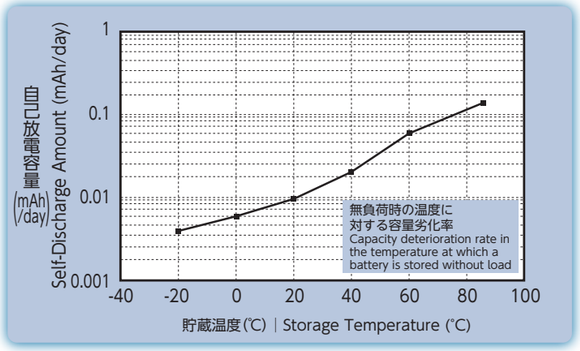
Discharge Temperature Characteristics

Discharge - Conditions： Continuous Discharge with 3.6kΩ, Initial



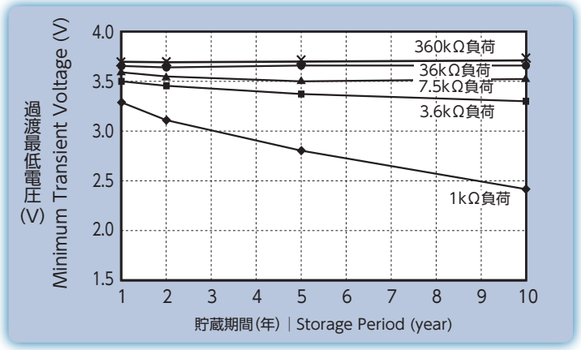
■ 自己放電特性（無負荷貯蔵）

Self - Discharge Characteristics (Storage without Load)



■ 貯蔵品 VD特性

Stored Product - VD Characteristics

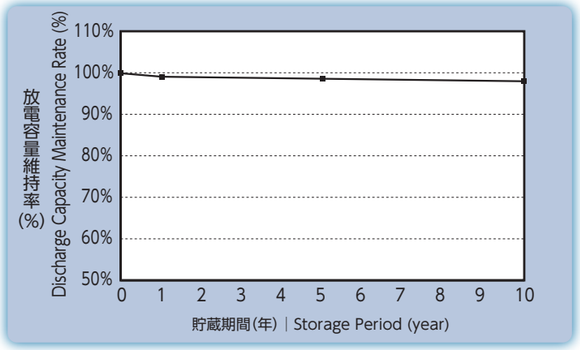


貯蔵条件：
未使用電池を製造後20℃にて、無負荷で貯蔵
測定条件：
貯蔵後の電池に各負荷をかけ放電し、放電開始直後のVoltage Delayによる電圧低下の最低値を測定
温度： 20℃
・VD特性は貯蔵条件で大きく変わり、電池個々のバラつきあり
・この資料は実験の結果であり、グラフの範囲での放電を保証するものではない

・Storage Condition：
After manufacturing, store unused battery without load at 20℃
・Measurement Condition：
Apply each of the loads to the battery after storage to discharge, and measure the minimum value of voltage reduction caused by Voltage Delay immediately after the start of discharge
・Temperature： 20℃
- VD Characteristics change largely according to storage conditions. Variances between individual batteries also exist.
- This information is based on the results of experiments and does not guarantee Discharge Characteristics within the graphed region.

■ 貯蔵後放電特性 測定結果

Measurement Results of Discharge Characteristics after Storage

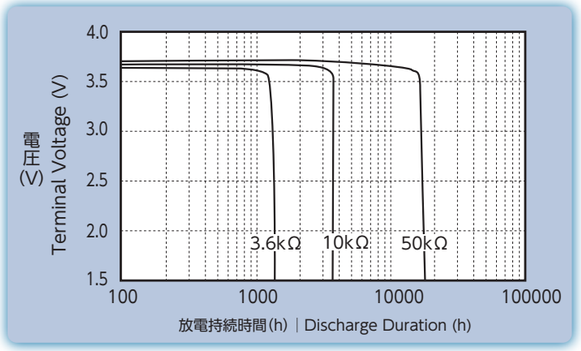


貯蔵条件： 20℃
放電条件： 3.6kΩ連続放電, 2.5V cut - off, 20℃
＊ キープサンプルの測定データ
標準試験での放電容量データ平均
試験条件により、放電容量の変更あり

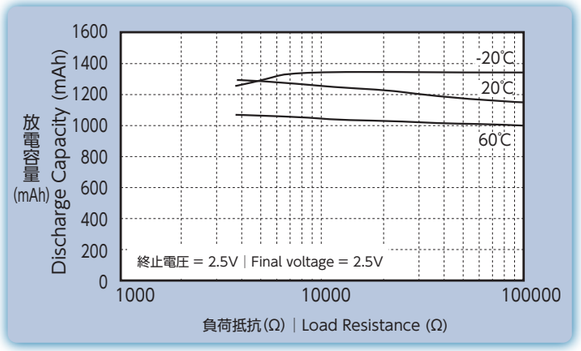
・Storage Condition： 20℃
・Discharge Conditions： Continuous discharge with 3.6kΩ, 2.5V cut - off, and 20℃
＊ Measured data of key sample.
Average Discharge Capacity from standard tests.
Discharge Capacity changes according to test conditions.

ER4V 標準特性 | ER4V STANDARD CHARACTERISTICS

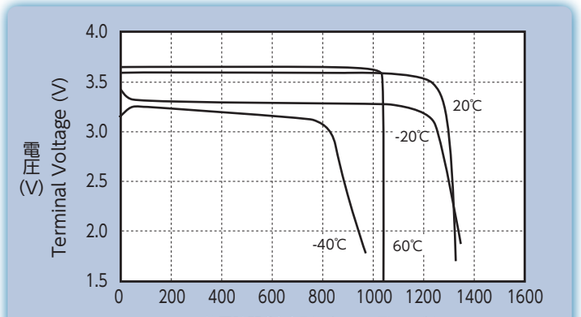
放電特性 放電条件： 定抵抗連続放電、初度、20℃
Discharge Characteristics
Discharge - Conditions： Continuous Discharge with Fixed Resistance, Initial, 20℃



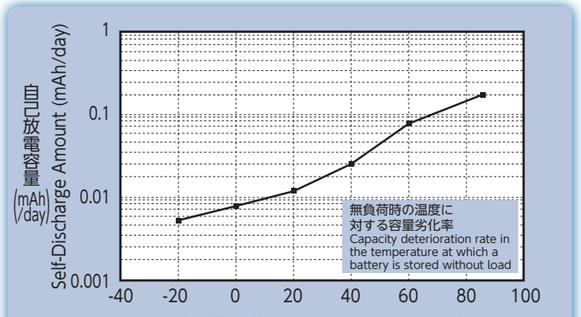
負荷抵抗 — 放電容量 初度、連続放電
Load Resistance - Discharge Capacity
Initial, Continuous Discharge



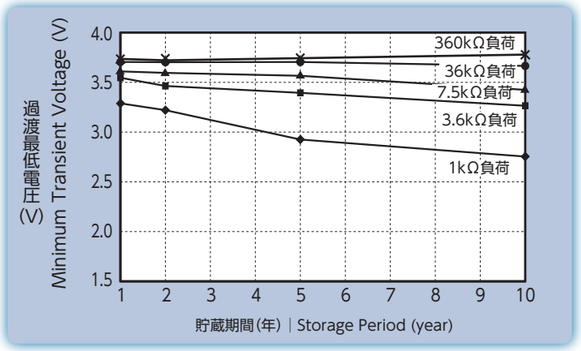
放電温度特性 放電条件： 3.6kΩ連続放電、初度
Discharge Temperature Characteristics
Discharge - Conditions： Continuous Discharge with 3.6kΩ, Initial



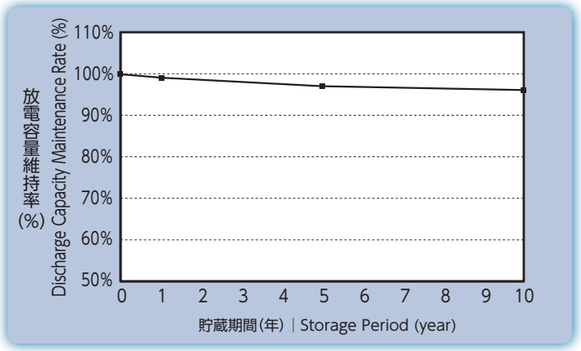
自己放電特性 （無負荷貯蔵）
Self - Discharge Characteristics (Storage without Load)



貯蔵品 VD特性
Stored Product - VD Characteristics



貯蔵後放電特性 測定結果
Measurement Results of Discharge Characteristics after Storage



貯蔵条件：
未使用電池を製造後20℃にて、無負荷で貯蔵
測定条件：
貯蔵後の電池に各負荷をかけ放電し、放電開始直後のVoltage Delayによる電圧低下の最低値を測定
温度： 20℃
・VD特性は貯蔵条件で大きく変わり、電池個々のバラつきあり
・この資料は実験の結果であり、グラフの範囲での放電を保証するものではない

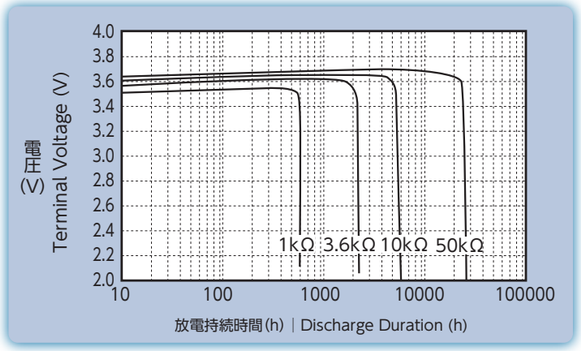
・Storage Condition :
After manufacturing, store unused battery without load at 20℃
・Measurement Condition :
Apply each of the loads to the battery after storage to discharge, and measure the minimum value of voltage reduction caused by Voltage Delay immediately after the start of discharge
・Temperature : 20℃
- VD Characteristics change largely according to storage conditions. Variances between individual batteries also exist.
- This information is based on the results of experiments and does not guarantee Discharge Characteristics within the graphed region.

貯蔵条件： 20℃
放電条件： 3.6kΩ連続放電, 2.5V cut - off, 20℃
＊ キープサンプルの測定データ
標準試験での放電容量データ平均
試験条件により、放電容量の変更あり

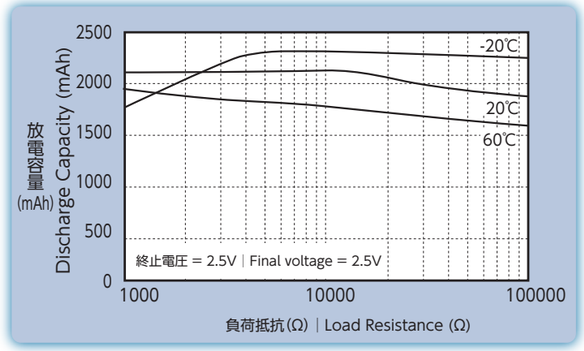
・ Storage Condition : 20℃
・ Discharge Conditions : Continuous discharge with 3.6kΩ, 2.5V cut - off, and 20℃
＊ Measured data of key sample.
Average Discharge Capacity from standard tests.
Discharge Capacity changes according to test conditions.

ER6V 標準特性 | ER6V STANDARD CHARACTERISTICS

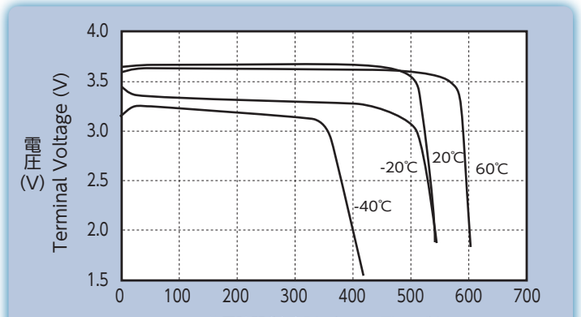
放電特性 放電条件： 定抵抗連続放電、初度、20℃
Discharge Characteristics
Discharge - Conditions： Continuous Discharge with Fixed Resistance, Initial, 20℃



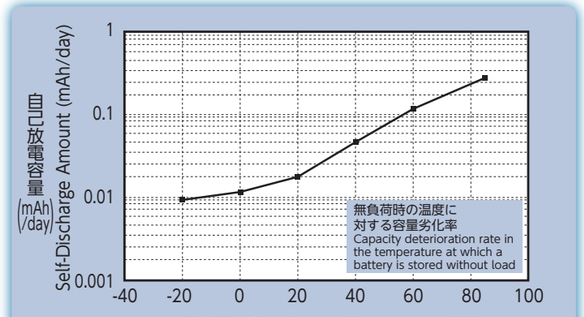
負荷抵抗 — 放電容量 初度、連続放電
Load Resistance - Discharge Capacity
Initial, Continuous Discharge



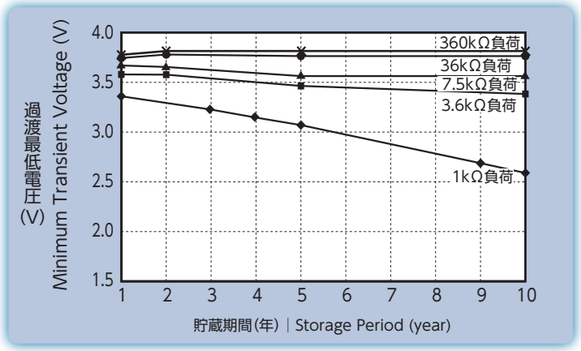
放電温度特性 放電条件： 3.6kΩ連続放電、初度
Discharge Temperature Characteristics
Discharge - Conditions： Continuous Discharge with 3.6kΩ, Initial



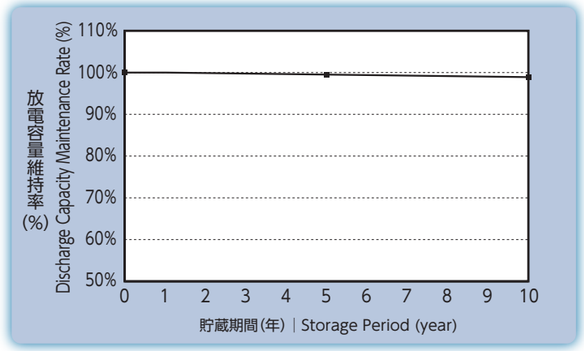
自己放電特性 （無負荷貯蔵）
Self - Discharge Characteristics (Storage without Load)



貯蔵品 VD特性
Stored Product - VD Characteristics



貯蔵後放電特性 測定結果
Measurement Results of Discharge Characteristics after Storage



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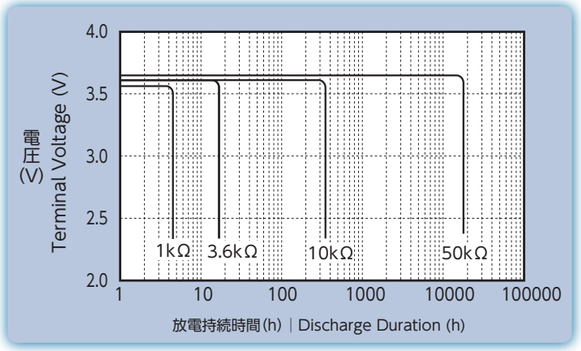
・Measurement Condition :
Apply each of the loads to the battery after storage to discharge, and measure the minimum value of voltage reduction caused by Voltage Delay immediately after the start of discharge
・Temperature : 20℃
- VD Characteristics change largely according to storage conditions. Variances between individual batteries also exist.
- This information is based on the results of experiments and does not guarantee Discharge Characteristics within the graphed region.

貯蔵条件： 20℃
放電条件： 1kΩ連続放電, 2.5V cut - off, 20℃
＊ キープサンプルの測定データ
標準試験での放電容量データ平均
試験条件により、放電容量の変更あり

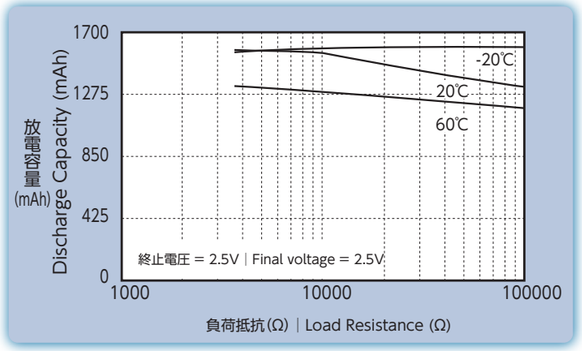
・ Storage Condition : 20℃
・ Discharge Conditions : Continuous discharge with 1kΩ, 2.5V cut - off, and 20℃
＊ Measured data of key sample.
Average Discharge Capacity from standard tests.
Discharge Capacity changes according to test conditions.

ER17330V 標準特性 | ER17330V STANDARD CHARACTERISTICS

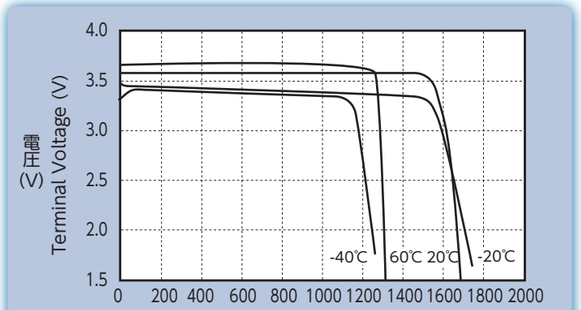
放電特性 放電条件： 定抵抗連続放電、初度、20℃
Discharge Characteristics
Discharge - Conditions： Continuous Discharge with Fixed Resistance, Initial, 20℃



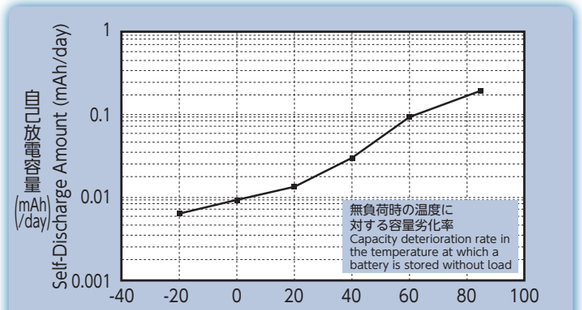
負荷抵抗 — 放電容量 初度、連続放電
Load Resistance - Discharge Capacity
Initial, Continuous Discharge



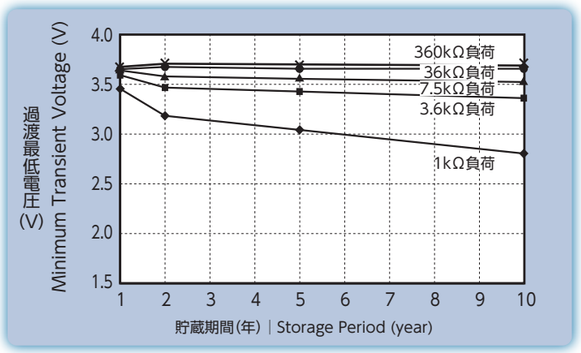
放電温度特性 放電条件： 3.6kΩ連続放電、初度
Discharge Temperature Characteristics
Discharge - Conditions： Continuous Discharge with 3.6kΩ, Initial



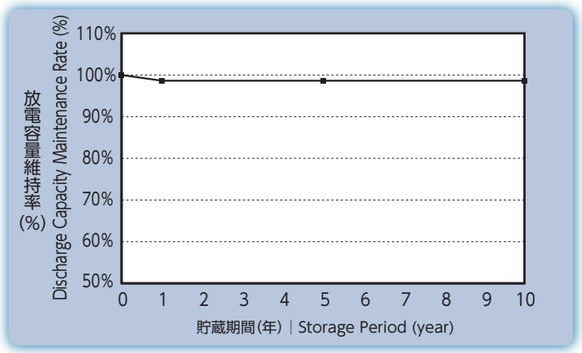
自己放電特性 （無負荷貯蔵）
Self - Discharge Characteristics (Storage without Load)



貯蔵品 VD特性
Stored Product - VD Characteristics



貯蔵後放電特性 測定結果
Measurement Results of Discharge Characteristics after Storage



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- This information is based on the results of experiments and does not guarantee Discharge Characteristics within the graphed region.

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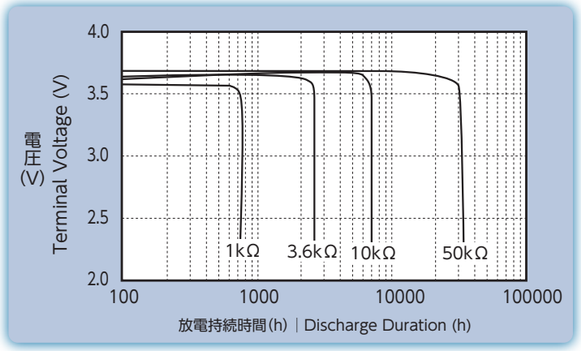
放電条件： 1kΩ連続放電, 2.5V cut - off, 20℃
＊ キープサンプルの測定データ
標準試験での放電容量データ平均
試験条件により、放電容量の変更あり

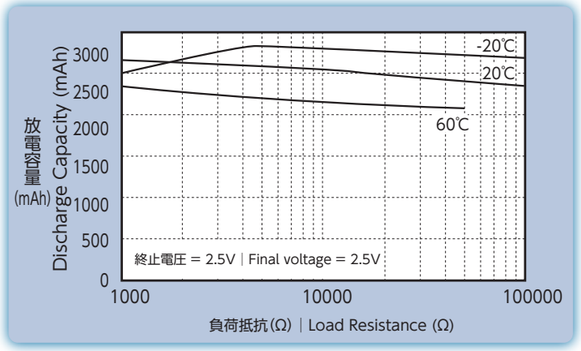
・ Storage Condition： 20°C
・ Discharge Conditions： Continuous discharge with 1kΩ, 2.5V cut - off, and 20°C
＊ Measured data of key sample.
Average Discharge Capacity from standard tests.
Discharge Capacity changes according to test conditions.

ER17500V 標準特性 | ER17500V STANDARD CHARACTERISTICS

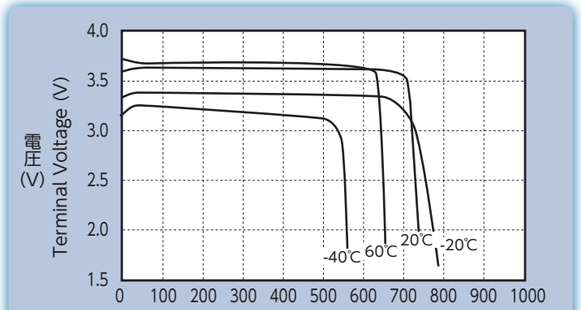
放電特性 放電条件： 定抵抗連続放電、初度、20℃
Discharge Characteristics
Discharge - Conditions： Continuous Discharge with Fixed Resistance, Initial, 20℃



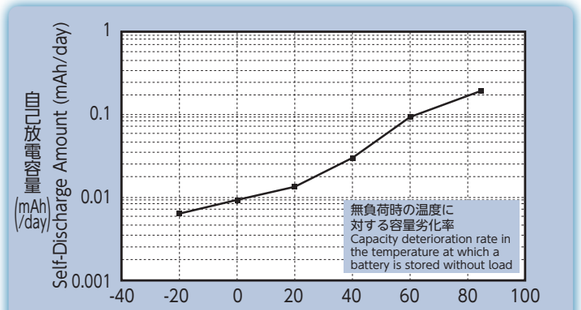
負荷抵抗 — 放電容量 初度、連続放電
Load Resistance - Discharge Capacity
Initial, Continuous Discharge



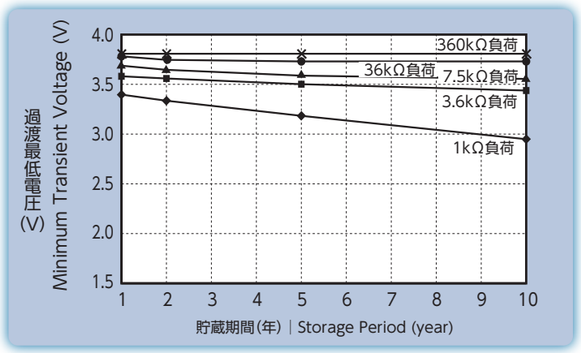
放電温度特性 放電条件： 3.6kΩ連続放電、初度
Discharge Temperature Characteristics
Discharge - Conditions： Continuous Discharge with 3.6kΩ, Initial



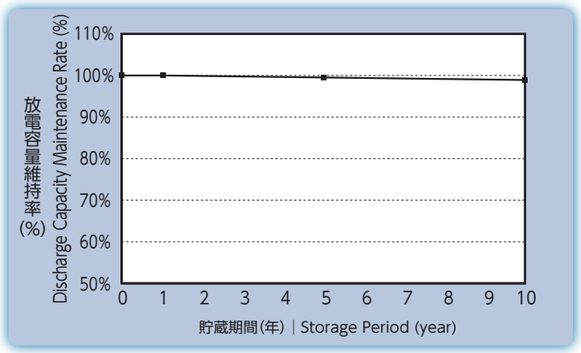
自己放電特性 （無負荷貯蔵）
Self - Discharge Characteristics (Storage without Load)



貯蔵品 VD特性
Stored Product - VD Characteristics



貯蔵後放電特性 測定結果
Measurement Results of Discharge Characteristics after Storage



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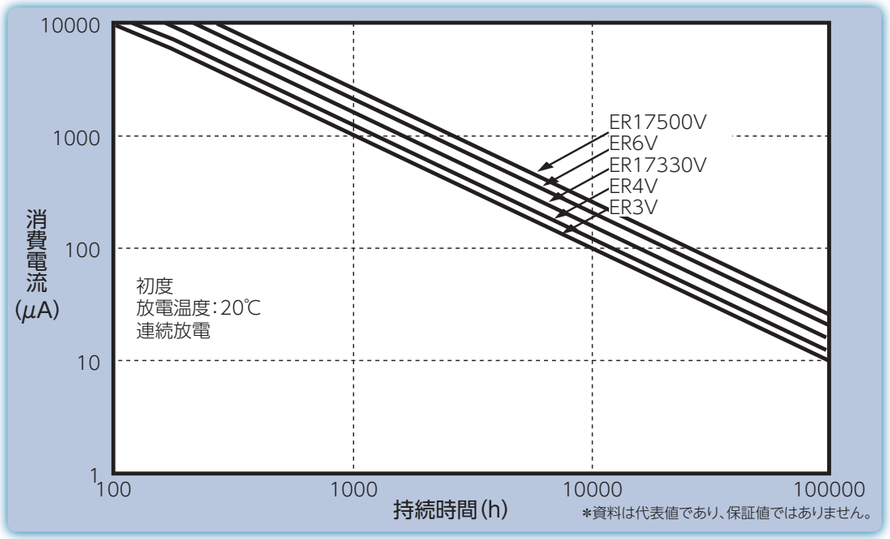
- VD Characteristics change largely according to storage conditions. Variances between individual batteries also exist.
- This information is based on the results of experiments and does not guarantee Discharge Characteristics within the graphed region.

貯蔵条件： 20℃
放電条件： 1kΩ連続放電, 2.5V cut - off, 20℃
＊ キープサンプルの測定データ
標準試験での放電容量データ平均
試験条件により、放電容量の変更あり

・ Storage Condition： 20°C
・ Discharge Conditions： Continuous discharge with 1kΩ, 2.5V cut - off, and 20°C
＊ Measured data of key sample.
Average Discharge Capacity from standard tests.
Discharge Capacity changes according to test conditions.

■ 放電特性

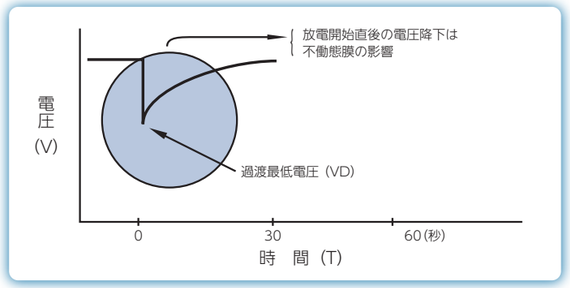


■ 過渡最低電圧 (Voltage Delay)

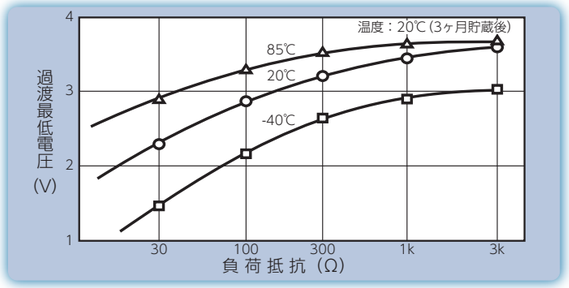
● 塩化チオニルリチウム電池の自己放電は極めて少なくなっています。これは負極電極表面に不動態膜(塩化リチウム皮膜)が形成されており、この不動態膜により長期貯蔵を可能にしています。その反面、電池に負荷を掛けた時にこの不動態膜が抵抗となり一時的に電圧低下が起こります。 ……(図1)
貯蔵期間が長期になればなるほどリチウム表面の皮膜は成長し、電圧低下(Voltage Delay現象)を引き起こします。機器の使用条件(環境、電流値)にもよりますが、この電圧低下によって作動不良を起こす恐れがありますので、長期の貯蔵は推奨いたしません。弊社としては、1年以内に使用開始していただくことを推奨しています。

● マイクロアンペア(μA)オーダーでの使用では、問題となる様な電圧低下はありませんが、数mA(ミリアンペア)以上の電流を必要とする場合には、電圧低下が顕著になります。……(図2)

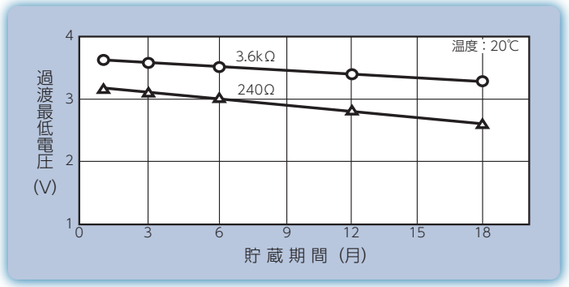
● この現象は使用温度が低く、貯蔵温度が高く、貯蔵期間が長くなる程顕著に現れます。 ……(図2) (図3)



(図1)過渡最低電圧

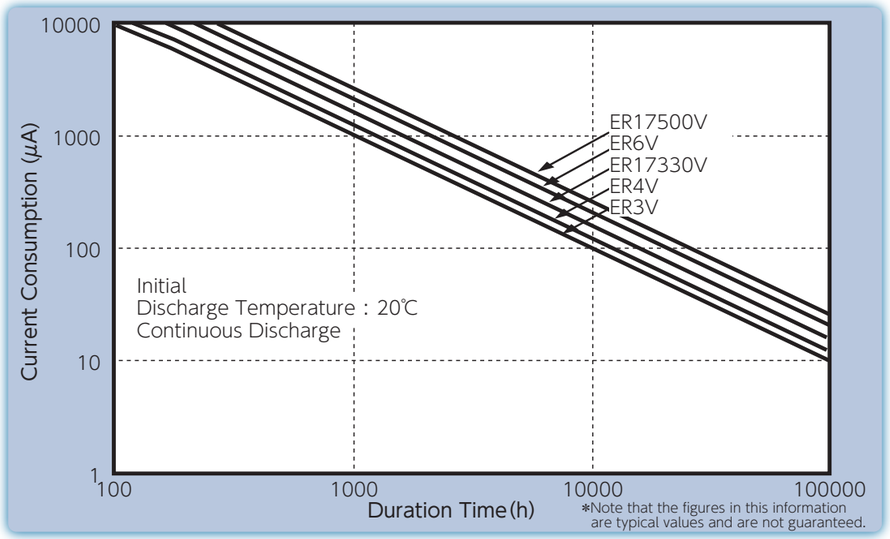


(図2)過渡最低電圧 - 負荷抵抗



(図3)過渡最低電圧 - 貯蔵期間

■ Discharge Characteristics



■ Minimum Transient Voltage (Voltage Delay)

● The self-discharge amount of Thionyl Chloride Lithium Batteries are very low. This is due to the passive film (lithium chloride film) formed on the surface of the negative electrode which allows long term storage. On the other hand, when load is applied to the battery, this passive film acts as resistance, creating a temporary voltage drop. ····· Fig. 1
As the storage period is prolonged, the film formation on the lithium surface will grow accordingly, thus leading to a voltage drop known as the voltage delay phenomenon. Any prolonged storage should be avoided because such a voltage drop might cause malfunction, although the situation varies depends on device usage conditions (such as the environment and current value). We also recommend that you will start using the battery sometime within one year after purchase.

● When the current is in the micro-ampere order, the voltage drop will not create problems, but when the current is over a few milli-amperes, the voltage drop becomes noticeable. ····· Fig. 2

● This phenomena occurs more prominently at lower use temperatures, higher storage temperatures, and longer storage periods. ····· Fig. 2, Fig. 3

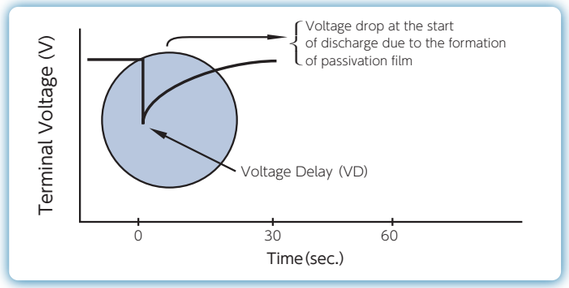


Fig. 1 Voltage Delay

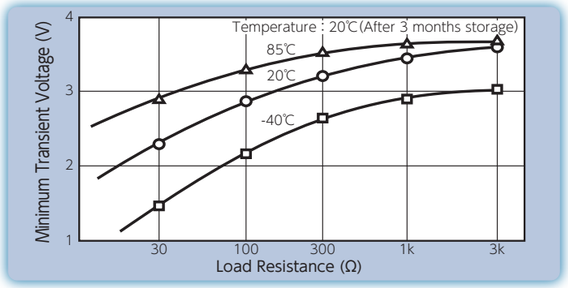


Fig. 2 Voltage Delay - Load Resistance

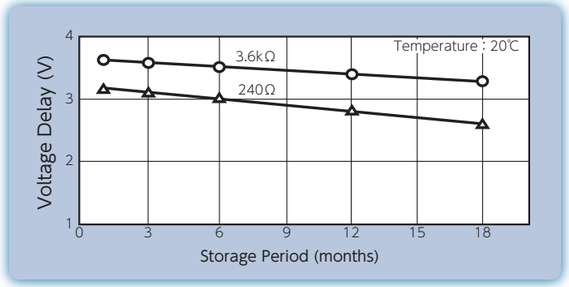


Fig. 3 Voltage Delay - Storage Period

Use of Toshiba Thionyl Chloride Lithium Batteries

Thionyl Chloride Lithium Batteries (ER batteries) offer excellent features such as high-voltage, long-term preservation property, stable operating voltage, and wide operating temperature range. However, these features are made possible only when the battery is used under a suitable condition.

Be sure to notify Toshiba of the use condition, e.g. ambient temperature, discharge specifications, and final voltage before designing a device to confirm that it is suitable for the use of ER batteries.

*Note that the figures in this information are typical values and are not guaranteed. They are for reference only.

ER6V Reliability Test

No.	Item	Battery Under Test	Test Conditions	Result
1	Short Circuit	Unused	Temperature: 25℃ External Short	The current reaches the peak of 1.6A immediately after shorting. The current then decreases and reaches 100mA, 30 minutes later. The battery temperature reaches the peak of 60℃ to 70℃ in 3 to 4 minutes. The temperature gradually declines through radiational cooling. Battery does not deform or leak fluid.
2	Charging	Unused	Temperature: 25℃ Charging: 1mA constant current Time: 1000h	Voltage increases to 3.7V to 3.8V. Battery temperature does not rise. Battery does not deform or leak fluid.
		Unused	Temperature: 25℃ Charging: 10mA constant current Time: 100h	Voltage increases to 3.7V to 4.0V. Battery temperature rises by 2℃ to 3℃. Battery does not deform or leak fluid.
		Unused	Temperature: 25℃ Charging: 100mA constant current Time: 10h	Voltage increases to 4.0V to 5.0V. Battery temperature rises to 35℃ one hour later. Battery does not deform or leak fluid.
		1kΩ fixed resistance after discharged (300h)	Temperature: 25℃ Charging: 1mA constant current Time: 1000h	Voltage increases to 3.7V to 3.8V. Battery temperature does not rise. Battery does not deform or leak fluid.
		1kΩ fixed resistance after completely discharged	Temperature: 25℃ Charging: 1mA constant current Time: 1000h	Voltage increases to 3.6V to 3.7V. Battery temperature does not rise. Battery does not deform or leak fluid.
3	Over Discharging	1kΩ fixed resistance after completely discharged	Temperature: 25℃ Discharging: 100mA constant current Time: 10h	Voltage reverses to 0V to -5.0V. Battery temperature rises to 33℃ at reversed state. The temperature then decreases and stabilizes at 27℃ to 30℃. Battery does not deform or leak fluid.
		1kΩ fixed resistance after completely discharged	Temperature: 25℃ Discharging: 1mA constant current Time: 1000h	Voltage becomes 0V to -0.1V. Battery does not deform or leak fluid.
4	Thermal Shock	Unused	-54℃ → 71℃ (12h) ← (12h) 10 cycles (10 day duration) 1kΩ discharge capacity	Open circuit voltage rises from 3.68V to 3.75V, and internal resistance increases. Irregularity is not found in the 1kΩ discharging test after the examination. Battery does not deform or leak fluid.
		Unused	-55℃ → 85℃ (1h) ← (1h) 250 cycles (21 day duration) 1kΩ discharge capacity	Open circuit voltage rises from 3.68V to 3.77V, and internal resistance increases. Irregularity is not found in the 1kΩ discharging test after the examination. Battery does not deform or leak fluid.
5	High Temperature with Humidification	Unused	Temperature: 45℃ Humidity: 93%RH Duration: 60 days	Open circuit voltage rises from 3.68V to 3.71V, and internal resistance increases. Battery does not deform or leak fluid. Rust partly begins to develop on the positive terminal due to condensation.
		Unused	Temperature: 60℃ Humidity: 93%RH Duration: 60 days	Open circuit voltage rises from 3.68V to 3.75V, and internal resistance increases. Battery does not deform or leak fluid. Rust begins to develop on the positive terminal due to condensation.
6	Water Immersion	Unused	Temperature: 25℃ Immersion: Tap water Duration: 14 days	3 days after immersion, electrolyte elutes from the positive terminal and gas is generated along with a large quantity of red rust. After two weeks, the positive terminal completely disappears. Gas is generated internally and sulfur is deposited. Water acidification occurs.
7	Vertical Fall	Unused	Drop with the positive terminal facing down, from the height of 1.5 meter to a flat concrete ground.	Leakage occurs in 10 out of 100 units. Open circuit voltage and internal resistance do not change in batteries without leakage.
		Unused	Drop 3 times with the battery bottom section facing down, from the height of 1.0 meter to a flat concrete ground.	Irregularity in external structure (either fluid leakage nor dislocated top) is not found, and changes in the open circuit voltage and internal resistance do not occur.
8	Depressurization	Unused	Temperature: 25℃ Depressurization: 1.33kPa Time: 50h	Changes are not observed in the open circuit voltage, internal resistance, and battery mass. Battery does not deform or leak fluid.
9	Pressurization	Unused	Temperature: 25℃ Depressurization: 405.3kPa Time: 12h	Changes are not observed in the open circuit voltage, internal resistance, and battery mass. Battery does not deform or leak fluid.
10	Perforation Under Water Immersion	Unused	Pull out the positive terminal and immerse into water	Bubbles emerge from the hole caused by the missing positive terminal, but the bubbles gradually decrease and stop after 10 minutes. Sulfur deposits and water acidification occurs.
		1kΩ fixed resistance after completely discharged	Pull out the positive terminal and immerse into water	Bubbles emerge from the hole caused by the missing positive terminal, but the bubbles gradually decrease and stop after 15 minutes. Water acidification occurs.
		Unused	Perforate a hole sized ϕ2mm at the bottom of the can and immerse into water	Bubbles emerge from the hole, but the bubbles gradually decrease and stop after 15 minutes. Sulfur deposits and water acidification occurs.
		1kΩ fixed resistance after completely discharged	Perforate a hole sized ϕ2mm at the bottom of the can and immerse into water	Bubbles emerge from the hole, but the bubbles gradually decrease and stop after 15 minutes. Water acidification occurs.
		Unused	Remove the cap and immerse into water at fully open state	Bubbles emerge intensely from the hole in the can, but the bubbles gradually decrease and stop after 5 minutes. Sulfur deposits and water acidification occurs.
11	Glass Seal Rupture	Unused	Hammer on the positive terminal and rupture the Glass Seal Temperature: 25℃	One hour after rupture, loss of mass amounting to 2mg is observed, but noticeable change in mass is not found thereafter. Assuming that the leaked thionyl chloride was diffused in a room with floor area of 60m², this would be around 2ppb.
		1kΩ fixed resistance after completely discharged	Amount of SO_2 due to $BaSO_4$ deposition after damaging the Glass Seal by hammering the positive terminal	SO_2 per battery is 110mol, approximately 280ml is generated at 25℃ / 101.3kPa. In a room with floor area of 60m², SO_2 density is 2.7ppb.
12	Saline Solution Immersion	Unused	Temperature: 25℃ Immersion: 5% saline solution Duration: 14 days	4 hours after immersion, the positive terminal electrolyzes and falls off. The internal electrolyte leaks along with the gas generated from hydrolysis into the saline solution, and acidification occurs. Gas generation ceases almost entirely in 15 hours, and the voltage becomes 0 (zero) volts in 48 hours. 3 days later, the negative terminal corrodes, and the internal lithium and electrolyte were both depleted. Thereafter, the corrosion of the can proceeds, but gas is not generated.
13	Vibration	Unused	Vibration Frequency: 35Hz Full Amplitude: 2mm Time: 2h x 3 (X, Y, Z)	Changes are not observed in the open circuit voltage, internal resistance, and battery mass. Battery does not deform or leak fluid.
		Unused: Solder battery with terminal onto the PC board	Vibration Frequency: 35Hz Full Amplitude: 2mm Time: 2h x 3 (X, Y, Z)	Changes are not observed in the open circuit voltage, internal resistance, and battery mass. Battery does not deform or leak fluid. Dislocation or rupture of the lead terminal do not occur.

* Typical values listed on this information are not guaranteed, and the specifications are subject to change without notice.

塩化チオニルリチウム電池の使用に当っての注意事項

1. 電池応用機器設計上の注意事項

この電池は、取扱いを誤ると漏液、発熱、破裂、発火等のおそれがあり、機器設計の際には下記の事項に注意してください。

(1) 電池室設計上の注意

① 電池室は、電池が容易に交換でき、かつ、装填後ははずれ難いように配慮してください。

② 電池室の電池装填部は、乳幼児による誤飲やけがを防止するため、乳幼児が簡単に電池を取り出したり、電池に触れることのできないように電池室のふたの固定方法など配慮してください。同時に『電池は乳幼児の手の届かない所においてください。』の趣旨を取扱説明書等で周知徹底をしてください。

③ 電池室及び接点の寸法、形状を設計するときは、接触不良や逆装填を防止するため、電池及び電池の⊕、⊖端子の形状寸法と公差を考慮してください。電池室の寸法は製品寸法図に規定された電池が適合するようにしてください。

④ 電池室には、その機器に使用する電池の種類と、電池の正しい装填方向(極性)を明示してください。表示場所がない場合には、取扱説明書に明記してください。

⑤ 電池室内の電気回路は、電池の接点接続関係だけとし、他の電気回路とは独立の回路にしてください。

⑥ 万一の電池からの漏液に対し機器側の損傷が最小になるように、電池室は機器室から完全に独立させるなど電池室の構造、配置を考慮してください。

⑦ 電池室は、放熱や電池からもれたガスが抜けるように配慮してください。完全密閉を避けることができない場合は、ガス抜き用安全弁などの機能を持たせるように考慮してください。

⑧ 機器に熱源がある場合、電池室は機器の熱源からできるだけ離れた場所に設けてください。

⑨ 電池室の材質は、衝撃や環境への配慮をしてください。振動や衝撃が予測される場合、電池室の構造はそれらを吸収するための方策を講じてください。

⑩ 製品寸法図で規定された公差限界寸法の電池を使用しても電気的接触が確実に行われるように電池用端子の接点材質及び形状については充分注意をしてください。接点の材質は、鉄、ステンレス等にニッケルめっきを施したものを選んでください。特に接触抵抗を低くする必要のある場合には、金めっきなどを使用してください。

⑪ 機器の電池用端子の接点力は、最低10N(1kgf)以上、上限は30N(3kgf)以内にしてください。ただし、Mタイプの電池のみに適用します。

⑫ 機器内部の回路は、電池用端子の接点以外の部分で電池と電気的接触をしないように配慮してください。

⑬ 電池用端子の接点の構造は、できるだけ電池の⊕極、⊖極の形状の差異を利用して、逆装填ができないようにしてください。

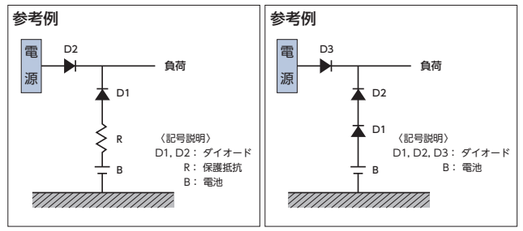
⑭ 外部代替電源を利用するときは、電池が充電されたり、強制放電されることのないように回路設計してください。

⑮ 電池への充電を確実に防止するための保護回路を設けてください。

⑯ 電池の機器への設置に関しては、正極端子が下向きにならないように設計してください。正極作用物質である塩化チオニルが液体のため、正極端子を下向きにして放電すると正極作用物質が偏在して反応が不均一となり、特に大きな電流で使用した場合に所定の特性が得られないことがあります。

(2) メモリーバックアップ用として使用する場合の注意

① 電池は充電できませんので、充電しないでください。充電すると電池内の電解液が加熱され、ガスの発生で内部圧力が上昇したりして、電池を漏液、発熱、破裂、発火させるおそれがあります。メモリーバックアップ仕様の場合は、主電源から電池用回路に電流が流れないように、逆電流(充電)防止ダイオードと保護抵抗を取り付けてください。UL 1642 リチウム電池(米国の安全規格)では、機器のバックアップ用としてリチウム一次電池を使用する場合、上記ダイオードと保護抵抗を直列に入れること等を規定しています。(下図参照)ダイオードには漏れ電流値が0.5μA以下のものを選択し、逆電流による充電量は全使用期間で公称容量の3%以内となるように設計してください。



② 電池に流れる順電流が増加するような状態で電源と直列に接続しないでください。

③ 電池への直接のはんだ付け及びスポット溶接はしないでください。リード線を電池に接続する場合は、電池への直接のはんだ付けやスポット溶接をしないで必ずタブ端子に接続してください。タブ端子に手はんだ付けする場合は、はんだこて先温度370℃以下、はんだ付け時間5秒以内の条件で行ってください。

④ 自動はんだ付けを行う場合は、電池のタブ端子のみをはんだ槽に浸し、はんだ槽で電池が停止したり、落下したりしないように注意してください。電池とはんだ槽との間には遮蔽物(プリント基板等)を介してください。万一落下した場合は、破裂、発火のおそれがあります。

⑤ 発熱を生ずる機器には、発熱部から離すか、熱源に近い場合は熱源部と電池とを遮断してください。

⑥ 製造後6ヵ月以上長期貯蔵された電池、または使用条件として負荷電流が大きかったり、また放電時の温度が低い状態で初めて使用する場合、負極リチウム表面に塩化リチウムの被膜が形成され一時的な電圧降下が生じますので、機器設計時には留意してください。この様な時は、放電処理で電圧降下を防止できます。放電処理条件については弊社にご相談ください。

(3) 機器製造時の注意

① 電池に超音波振動を与えないでください。電池に超音波振動を与えると内容物が微粉化することで電池が内部短絡し、電池を漏液、発熱、破裂させるおそれがあります。

② 電池の廃棄は、一般の不燃ごみとして処理してよいことになっていますが、自治体の条例などの定めがある場合は、条例に従って廃棄してください。電池を保管する場合及び廃棄する場合は、テープなどで端子部を絶縁してください。電池をごちゃ混ぜにしたり、他の金属と電池を混ぜたりすると、電池がショートして発熱、破裂、発火することがあり、けがをしたり火災にいたるおそれがあります。また、火の中に電池を投棄しないでください。電池を火の中に投入すると、急激に加熱され破裂などを起こすおそれがあります。

③ 電池を機器に装填する前に乾いた布等で機器や電池の端子部をきれいに拭いてください。端子部が汚れていると、接触不良のため機器が正常に作動しないことがあります。

④ 電池の電圧を測定する時は、内部抵抗の大きな電圧計を使用してください。電圧計の許容差は公称電圧の0.25%以下で、その入力抵抗が定格10MΩ以上のものを使用してください。

(4) 電池の交換時の注意

この電池は、UL規格の認定を取得しています。この電池をUL規格認定取得あるいは認定取得計画の機器にUL認定部品として登録し使用する場合、原則として電池に関連した回路の修理及びリチウム電池の交換は、熟練した技術者によって行なわれることが定められています。ユーザー向けの機器の取扱説明書には電池交換が出来ないことを記載してください。

(5) 電池の輸送、陳列及び保管時の注意

① 電池の保管場所は、高温や高湿の場所を避け、結露しないように風通しのよい、乾燥したあまり温度が上がらない所にしてください。電池の保管温度は、10 ～ 25℃が適切であり、30℃を超えないことが望ましい。湿度は、相対湿度(55±20)%以下の場所で保管してください。高温や高湿での保管は、電池の性能を劣化させたり、漏液を促進させるおそれがあります。

② 保管時や店頭陳列で直射日光に長時間さらされたり、雨水のかかる所に置いたりしないでください。高温にさらすと、性能劣化が大きくなったり、漏液が起こりやすくなります。また、電池を濡らすと絶縁性の低下をもたらし、さびの発生や漏液を起こしやすくなります。

③ 輸送中、乱暴な荷扱いは避けて下さい。乱暴な荷扱いによって、へこみ、変形等が起こり、そのため性能が劣化したり、漏液することがあります。また、電池を収めているケースが損傷して多数の電池がごちゃ混ぜになり、⊕、⊖が短絡すると発熱のため電池が破損し、漏液、破裂、発火等を起こすおそれがあります。

④ 外装箱単位での電池の積み上げは、外装箱に指定する段数以内にしてください。積み上げ過ぎると下積みの電池が変形したり、漏液を促進させたりします。

⑤ 流通での輸送、陳列、保管等においては、先入れ、先出しを励行し、長期間の在庫とならぬように注意してください。電池は通常の温度、湿度の条件下(常温20℃±15℃、相対湿度70%以下)において十分な貯蔵性を持っていますが、長期間在庫されますと性能低下をきたすおそれがありますので、適切な在庫量と先入れ、先出しを徹底してください。

2. 使用者への使用上の注意事項

お客様が機器を使用される場合でも、正しく電池を扱っていただくために、機器取扱説明書に下記の電池取扱い注意文言を記載してください。

<機器取扱説明書への電池取扱い注意事項記載内容>

電池は、ガラスシールとレーザー溶接シールによる密閉構造で、リチウム、塩化チオニルを内蔵しており、使い方を誤ると、電池が漏液、発熱、破裂、発火したり、けがや機器故障の原因となるので、次のことを必ず守ってください。

⚠警告

① 充電禁止

② 電池は、乳幼児の手の届かない所に置いてください。万一、電池を飲み込んだ場合は、すぐに医師に相談してください。…(小形電池のみ表示対象)

③ 電池は絶対に充電しないでください。充電すると電池内の電解液が加熱され、ガスの発生で内部圧力が上昇したりして、電池を漏液、発熱、破裂、発火させるおそれがあります。

④ この電池は、指定された用途以外に使用しないでください。端子構造などが機器と適合せず、接触不良を起こしたり、仕様や性能が合わない場合があります。電池を漏液、発熱、破裂、発火させるおそれがあります。

⑤ 電池を火の中に入れたり、加熱、分解、改造しないでください。ガラスシール部やベント部(ガス排出弁)などを損傷させたりして、電池を漏液、発熱、破裂、発火させるおそれがあります。

⑥ 電池の⊕と⊖を逆にして使用しないでください。充電やショートなどで異常反応を起こしたりして、電池を漏液、発熱、破裂、発火させるおそれがあります。

⑦ 電池の液が目に入ったときは、目に障害を与えるおそれがありますので、こすらずにすぐに水道水などのきれいな水で充分に洗った後、医師の治療を受けてください。

⑧ 電池の液を舐めた場合には、すぐにうがいをして医師に相談してください。

⑨ 電池の⊕と⊖を針金などで接続したり、また金属製のネックレスやヘアピンなどを一緒に持ち運んだり、保管しないでください。電池がショート状態となり、過大電流が流れたりして、電池を漏液、発熱、破裂、発火させるおそれがあります。

⑩ この電池に漏液や異臭があるときは、漏れた電解液で金属を腐食するおそれがありますので、すぐに廃棄してください。

⑪ 新しい電池と一度使用した古い電池、銘柄や種類の異なる電池などを混ぜて使用しないでください。特性の違いから、電池を漏液、発熱、破裂、発火させるおそれがあります。

⑫ 電池に直接はんだ付けをしないでください。熱によりガラスシール部やベント部(ガス排出弁)などを損傷させたりして、電池を漏液、発熱、破裂、発火させるおそれがあります。

⑬ 電池の外装ラベル(熱収縮チューブ)をはがしたり、傷つけないでください。電池がショートして、電池を漏液、発熱、破裂、発火するおそれがあります。

⑭ 電池に落下させたり、投げつけたりして、強い衝撃を与えないでください。電池を漏液、発熱、破裂、発火させるおそれがあります。

⑮ 電池を変形させないでください。電池のガラスシール部やベント部(ガス排出弁)などを損傷させたりして、電池を漏液、発熱、破裂、発火させるおそれがあります。

⑯ 電池を保管する場合及び廃棄する場合は、電池をテープなどで端子部を絶縁してください。他の電池や金属製のものと混ぜると、電池がショートして発熱、破裂、発火のおそれがあります。

⚠注意

① 電池は、直射日光の強い所や炎天下の車内などの高温の場所で使用、放置しないでください。電池を漏液、発熱、破裂させるおそれがあります。

② 電池を水などに濡らさないでください。電池を発熱させるおそれがあります。

③ 電池は、使用方法や機器によっては仕様や性能が合わない場合がありますので、機器の取扱説明書や注意書に従って、用途に適した電池を正しく使用してください。

④ 電池は、直射日光・高温・高湿の場所を避けて保管してください。電池を漏液、発熱、破裂させるおそれがあります。また、電池の性能や寿命を低下させることがあります。

⑤ この電池は、一般の不燃ごみとして捨ててもよいことになっていますが、自治体の条例などの定めがある場合には、その条例に従って廃棄してください。

⑥ 機器のスイッチの切り忘れをしないように注意してください。

⑦ 包装より取り出した電池の保管する場合等は、電池がお互いに接触し、ショートすることのないように注意してください。

⑧ 塩化チオニルリチウム電池(3.6V)は、他の一次電池などと電圧や形状の互換性がありませんので、指定された専用機器のみにご使用ください。

Precautions for using Thionyl Chloride Lithium Batteries

1. Precautions for designing instruments which use the battery

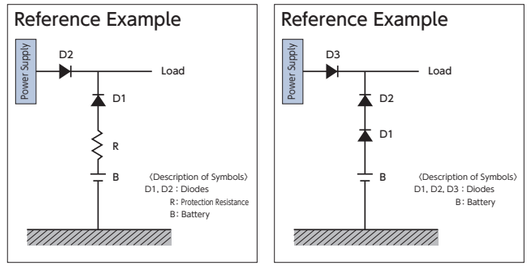
Mishandling this battery may cause leakage, heating, explosion, and ignition, so please follow the precautions listed below.

(1) Precautions for designing the battery compartment

① Please design the battery compartment to allow for easy battery replacement and difficult to detach secured mounting.
② In order to prevent swallowing or injury, please design the mounting method of the battery compartment cover in such a way that small children cannot easily remove or access the battery. At the same time, please provide a caution notice stating "Please do not leave the battery where small children can access it" to everybody through methods such as placing it in the users manual.
③ When designing the battery compartment and the contact dimensions and shape, in order to prevent contact failures and reverse mounting, please consider the dimensions and the tolerances of the battery and its positive (+) and negative (-) terminals. The battery compartment dimensions should be designed to match the product dimension diagram defined for the battery.
④ In the battery compartment, please clearly indicate the battery type to be used in the instrument and the correct battery mounting position (polarity). When the area for indication is not available, please clearly note this in the users manual.
⑤ The electrical circuit within the battery compartment should be only contact related and should be independent from the other electrical circuits.
⑥ To minimize damage to the instrument due to fluid leakage from the battery, please design a battery compartment structure and position which is completely independent from the rest of the instrument.
⑦ Please design the battery compartment to allow for the exhaust of gas and heat generated by the battery. When a completely airtight enclosure cannot be avoided, please attach functions such as safety valves for gas exhaust.
⑧ If the instrument generates heat, please position the battery compartment as far away from the heat source as possible.
⑨ The material used in the battery compartment should account for shock absorption and the environment. When vibration and impact are expected, the battery compartment structure should be designed to absorb such forces.
⑩ Please exercise caution regarding the contact material and shape of the battery terminals to ensure electrical contact even when a battery with the boundary tolerance dimensions defined in the product dimension diagram is used.
Please use nickel plated stainless or steel materials for the contact points. When reducing the contact resistance is particularly necessary, please use gold plating.
⑪ The contact force on the instrument battery terminals should be over 10N (1kgf) and less than 30N (3kgf).
This applies to M type batteries only.
⑫ The instrument's internal circuit should avoid electrical contact with the battery other than through the battery terminal contact points.
⑬ Please design the battery terminal contact structure such a way that reverse mounting is not possible, by utilizing the difference in shape between the battery's positive (+) electrode and its negative (-) electrode.
⑭ Please design the circuit such that forced discharge or charging of the battery does not occur when using an external, replacement power source.
⑮ Please install a protection circuit to ensure the prevention of battery charging.
⑯ Please design the battery position in the instrument such that the positive terminal is not faced downward.
When the battery is discharged with the positive electrode faced down, liquid thionyl chloride, the positive electrode substance, may become unevenly distributed and cause ununiform response. Especially when large current is used, the battery may not perform to the designed characteristics.

(2) Precautions for using as memory backup

① Please do not charge the battery because the battery is not chargeable.
When charged, electrolyte heating inside the battery may generate gas and increase internal pressure, resulting in fluid leakage, heating, explosion, and ignition.
When using as memory backup, please attach the reverse current (charging) prevention diode and protection resistance to avoid current flow from the main power source to the battery circuit.
UL1642 Lithium Batteries (U.S. safety standard) defines the installation of the above diode and the protection resistance in series when using lithium primary battery as a backup in instruments (Refer to the diagram below).
Use a diode with a leakage current below 0.5μA, and design the circuit to contain the reverse current charge amount for the entire use period to be below 3% of the nominal capacity.



② Please do not connect to the power source in series under the condition where the forward current in the battery increases.
③ Please do not directly solder or spot weld onto the battery when connecting lead wires; always connect to tab terminals. When soldering onto the tab terminal, use a soldering iron temperature below 370℃ and solder for under 5 seconds.
④ When using the automatic soldering machine, immerse only the battery tab terminals into the bath, and exercise caution to not stop or drop the battery in the bath. Please position a barrier (such as the printed circuit board) between the battery and the soldering bath. Dropping the battery may cause explosion or ignition.
⑤ For instruments which generate heat, separate the battery from the heat source. When the heat source is close, attach a barrier between the heat source and the battery.
⑥ When designing the instrument, please consider the fact that in batteries stored for a length of time longer than 6 months following manufacture, in batteries used with large load current, and in batteries used for the first time in low discharge temperatures, a film of lithium chloride may form on the negative electrode lithium surface and cause a temporary drop in voltage. In such cases, discharging can prevent voltage drops. Please contact us regarding the conditions for discharging.

(3) Precautions in manufacturing the instrument

① Please do not apply ultrasonic vibrations to the battery. When ultrasonic vibration is applied to the battery, the contents may pulverize and cause internal shorts in the battery, resulting in fluid leakage, heating, and explosion.
② Battery may be disposed as general, non-combustible garbage. However, please dispose in accordance with local government regulations if applicable.
When storing or discarding batteries, please attach insulation to the terminals, such as tape.
When batteries are mixed together or mixed with other metals, they may become shorted, causing heating, explosion, and ignition which may result in injuries and fire. Do not dispose batteries into fires. Batteries thrown into fires may rapidly heat and cause explosions.
③ Prior to mounting batteries to instruments, please clean the instrument and the battery terminals. When the terminals are dirty, the instrument may not operate properly due to contact failure.
④ When measuring battery voltage, please use voltage meters with high internal resistance.
Please use voltage meters with a tolerance under 0.25% of nominal voltage, and a rated input impedance above 10MΩ.

(4) Precautions for battery replacement

This battery is certified by the UL standard. When registering this battery as a UL standard certified part in instruments certified by the UL standard or planned to be certified by the UL standard, the repair of the circuit related to the battery and replacement of the lithium battery basically must be performed by a skilled engineer, as a rule.
Please mention that the battery cannot be replaced in the instrument users manual for customers.

(5) Precautions for the transportation, display, and storage of the battery

① The storage location of the battery should not have a high temperature or high humidity. The location should have good air circulation, with dry air and moderate temperature in order to prevent dew condensation.
It is requested to store battery at 10～25℃ range, but not to exceed 30℃, and relative humidity under (55±20)%.
Storage at high temperatures and high humidity will degrade battery performance and accelerate fluid leakage.
② When storing or displaying in shops, please do not position in direct sunlight for extended periods of time or in the rain.
Exposure to high temperature increases performance degradation and makes fluid leakage more likely. Wetting the battery decreases insulation, making corrosion and fluid leakage more likely.
③ During transportation, please do not handle roughly.
Rough handling may cause dents and deformities which may cause performance degradation and fluid leakage. When the case that houses the batteries is damaged and several batteries are mixed together, the positive (+) terminals and the negative (-) terminals may short, causing heating, damage, fluid leakage, explosion, and ignition.
④ When stacking batteries in shipping boxes, please limit the number of stack levels to within the number specified on the shipping box. When the shipping boxes are stacked too high, the batteries at the bottom may become deformed or fluid leakage may be accelerated.
⑤ When transporting, displaying, and storing during distribution, first-in first-out is recommended in order to avoid extended storage in inventory.
Under normal temperature and humidity conditions (normal temperature 20℃±15℃, relative humidity under 70%), the battery has sufficient storage quality. However, extended periods of inventory may cause performance to degrade, observe strictly the appropriate volume of inventories and the first-in first-out.

2. Precautions for product use

Please mention the following cautionary note regarding battery handling in the instrument users manual, for the customers to use the product properly.

<Precautionary note on battery handling for placement in the instrument users manual>

The battery uses a sealed construction made of Glass Seal and Laser Welding Seal to contain lithium and thionyl chloride. Improper handling may cause fluid leakage, heating, explosion, and ignition, resulting in injuries and instrument failure, so please follow the precautions below

⚠Warning

① **Do Not Charge**
② Please store the battery in locations that small children cannot reach. If the battery is accidentally swallowed, please see a doctor immediately (to be displayed for small batteries only).
③ Please do not charge the battery, ever.
When charged, the electrolyte inside the battery is heated which may generate gas and increase internal pressure, resulting in fluid leakage, heating, explosion, and ignition.
④ Please do not use this battery for purposes other than the specified objective. Terminal construction may not match the instrument and may cause contact failure or be unsuitable for specification and performance. The battery may leak fluid, heat up, explode, or ignite.
⑤ Please do not throw the battery into fires, heat, disassemble, or modify. The Glass Seal or the Ventilation (Gas Exhaust Valve) may be damaged and may cause the battery to leak fluid, heat up, explode, or ignite.
⑥ Please do not use the battery with the positive (+) and negative (-) terminals reversed. Irregular reaction may be caused by charging and shorting, and may cause the battery to leak fluid, heat up, explode, or ignite.
⑦ If the battery fluid comes in contact with the eye, eye disorders may result. Do not rub the eyes, wash thoroughly with clean tap water, and see a doctor for medical treatment.
⑧ If battery fluid comes in contact with the tongue, immediately gargle and see a doctor at once.
⑨ Please do not connect the battery's positive (+) terminal with the negative (-) terminal using wires, or carry or store while wearing metallic necklaces and hair pins. Irregular reaction may be caused by charging and shorting, and may cause the battery to leak fluid, heat up, explode, or ignite.
⑩ When battery fluid leaks or a foul odor is emitted, immediately discard the battery as the electrolyte may cause metal corrosion.
⑪ Please do not mix new batteries with used batteries or batteries of a different brand or type. The battery may leak fluid, heat up, explode, or ignite due to differences in characteristics.
⑫ Please do not solder directly onto the battery.The heat may cause the Glass Seal or the Ventilation (Gas Exhaust Valve) to be damaged and may cause the battery to leak fluid, heat up, explode, or ignite.
⑬ Please do not remove or damage the battery's external label (Thermal Contraction Tube). The battery may short, leak fluid, heat up, explode, or ignite.
⑭ Please do not apply strong force to the battery by dropping or throwing it. The battery may leak fluid, heat up, explode, or ignite.
⑮ Please do not deform the battery.The Glass Seal or Ventilation (Gas Exhaust Valve) may be damaged and may cause the battery to leak fluid, heat up, explode, or ignite.
⑯ When storing or discarding batteries, please attach insulation to the terminals, such as tape. Mixing with other batteries and metal objects may cause the battery to short, causing heating, explosion, and ignition.

⚠Caution

① Please do use or leave batteries unattended in a high temperature environment such as inside vehicles or locations that are exposed to strong direct sunlight.The battery may leak fluid, heat up, or explode.
② Please do not wet the battery. The battery may heat up.
③ Batteries may not have suitable specification or performance depending on the method of use or the instrument. Please follow the instrument's user manual and cautionary notes, and use the battery correctly for its intended purpose.
④ Please store the battery in locations without direct sunlight, high temperature, and high humidity. The battery may leak fluid, heat up, or explode. Also, the performance and life cycle of the battery may degrade.
⑤ This battery may be disposed as general, non-combustible garbage. However, please dispose in accordance with local government regulations where applicable.
⑥ Please remember to turn the instrument's power off.
⑦ When storing batteries extracted from the package, please exercise caution to not short the batteries through contact with each other.
⑧ Thionyl Chloride Lithium Battery (3.6V) is not compatible in voltage or shape with the other primary batteries. Please use only with the specified, dedicated instrument.