CR

Lithium Manganese Dioxide Battery (Li/MnO_2)

Primary Battery

LITHIUM MANGANESE DIOXIDE BATTERY

Safety Instructions

This battery contains lithium, organic solvents, and other combustible materials. For this reason, improper handling of the battery could lead to distortion, leakage*, overheating, explosion, or fire, causing bodily injury or equipment trouble. Please observe the following instructions to prevent accidents.
(* Leakage is defined as the unintentional escape of a liquid from a battery.)

⚠ Warnings — Handling

■ **Never swallow.**
Always keep the battery out of the reach of infants and young children to prevent it from being swallowed. If swallowed, consult a physician immediately.

■ **Never charge.**
The battery is not designed to be charged by any other electrical source. Charging could generate gas and internal short-circuiting, leading to distortion, leakage, overheating, explosion, or fire.

■ **Never heat.**
Heating the battery to more than 100 deg. C* could increase the internal pressure, causing distortion, leakage, overheating, explosion, or fire. (* Consult Maxell regarding heat resistant coin type lithium manganese dioxide batteries.)

■ **Never expose to open flames.**
Exposing to flames could cause the lithium metal to melt, causing the battery to catch on fire and explode.

■ **Never disassemble the battery.**
Do not disassemble the battery, because the separator or gasket could be damaged, leading to distortion, leakage, overheating, explosion, or fire.

■ **Never reverse the positive and negative terminals when mounting.**
Improper mounting of the battery could lead to short-circuiting, charging or forced-discharging. This could cause distortion, leakage, overheating, explosion, or fire.

■ **Never short-circuit the battery.**
Do not allow the positive and negative terminals to short-circuit. Never carry or store the battery with metal objects such as a necklace or a hairpin. Do not take multiple batteries out of the package and pile or mix them when storing. Otherwise, this could lead to distortion, leakage, overheating, explosion, or fire.

■ **Never weld the terminals or weld a wire to the body of the battery directly.**
The heat of welding or soldering could cause the lithium to melt, or cause damage to the insulating material in the battery. This could cause distortion, leakage, overheating, explosion, or fire. When soldering the battery directly to equipment, solder only the tabs or leads. Even then, the temperature of the soldering iron must be below 350 deg. C and the soldering time less than 5 seconds. Do not use a soldering bath, because the circuit board with battery attached could stop moving or the battery could drop into the bath. Moreover do not use excessive solder, because the solder could flow to unwanted portions of the board, leading to a short-circuit or charging of the battery.

■ **Never use different batteries together.**
Using different batteries together, i.e. different type or used and new or different manufacturer could cause distortion, leakage, overheating, explosion, or fire because of the differences in battery property. If using two or more batteries connected in series or in parallel even same batteries, please consult with Maxell before using.

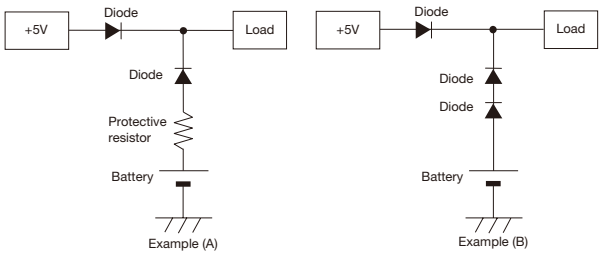
■ **Never allow liquid leaking from the battery to get in your eyes or mouth.**
Because this liquid could cause serious damage, if it does come in contact with your eyes, flush them immediately with plenty of water and consult a physician. Likewise, if the liquid gets in your mouth, rinse immediately with plenty of water and consult a physician.

■ **Keep leaking batteries away from fire.**
If leakage is suspected or you detect a strong odor, keep the battery away from fire, because the leaked liquid could catch on fire.

■ **Never touch the battery electrodes.**
Do not allow the battery electrodes to come in contact with your skin or fingers. Otherwise, the moisture from your skin could cause a discharge of the battery, which could produce certain chemical substances causing you to receive a chemical burns.

⚠ Warnings — Circuit Design for Back-up Use

This is a primary battery and cannot be charged. If used in memory or RTC back-up applications, be sure to use diodes to prevent charging from the main power source or other batteries, and a protective resistor to regulate the current as shown in the figure below. Note that the points described below should be taken into careful consideration when selecting diodes and protective resistors.



■ Supplied voltage to load

Because a diode and a resistor generate the voltage drop on operating, please take into consideration these voltage drops for supplied voltage to load.

■ Using diodes to prevent charging

Please choose diodes with leak current as small as possible. Please keep the charged capacity due to leak current to within 1% of nominal capacity.

■ Using and setting protective resistors

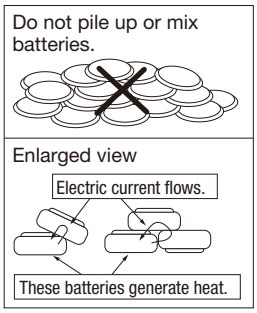
A protective resistor is used to prevent the battery from being charged by large surges of current during diode failure. Please set the resistor so that the maximum current shown in the right table is not exceeded. For example, say a CR2032 battery is used in sample circuit (A) in combination with a main power source 5 volt. Since the permitted charge current is 10mA and this battery's voltage is 3V, let the resistor be R≧(5V-3V)/10mA=0.2k ohm, meaning that at least 0.2k ohm is required.

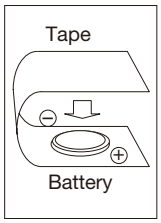
Type	Maximum Current
CR2450HR	15mA
CR2450HR-Ex	15mA
CR2050HR	10mA
CR2450	15mA
CR2430	15mA
CR2032H	10mA
CR2032	10mA
CR2025	10mA
CR2016	10mA
CR1632	4.0mA
CR1620	4.0mA
CR1616	2.5mA
CR1220	3.0mA
CR1216	2.5mA
CR1025	2.5mA
CR17450	20mA
CR17335	20mA

Note: If the diodes broke down, it is necessary for safety to replace them as soon as possible even though using a protective resistor. Considering the trouble of diodes and resistors, other safety measures should be incorporated in the circuit design.

⚠ Warnings — Disposal

The battery may be regulated by national or local regulation. Please follow the instructions of proper regulation. As electric capacity is left in a discarded battery and it comes into contact with other metals, it could lead to distortion, leakage, overheating, or explosion, so make sure to cover the (+) and (-) terminals with friction tape or some other insulator before disposal.





(Example of battery insulation)

⚠ Caution — Handling/Storage

■ Never expose the battery to ultrasonic sound.

Exposing the battery to ultrasonic sound may cause short-circuiting because the inside material is broken into pieces, leading to distortion, leakage, overheating, explosion, or fire.

■ Never subject the battery to severe shock.

Dropping, throwing or stomping on the battery may cause distortion, leakage, overheating, explosion, or fire.

■ Never short-circuit the battery while installing into equipment.

Please be careful when installing the battery not to short-circuit it with metal portions of the equipment.

■ Use the correct battery suitable for the equipment.

The battery may not be suitable for the specific equipment due to the using conditions or type of equipment. Please select the suitable battery according to the handling instructions of the equipment.

■ Never use or leave the battery in a hot place such as under the direct rays of the sun or in a car in hot weather.

If you do, this may cause distortion, leakage, overheating, explosion, or fire.

■ Never allow the battery to come in contact with water.

If it does, this may cause the battery to rust or lead to distortion, leakage, overheating, explosion, or fire.

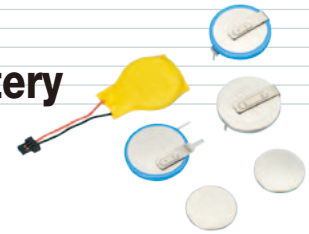
■ Never store the battery in a hot and highly humid environment.

Doing so may cause the performance of the battery to deteriorate. In certain environments, this may lead to distortion, leakage, overheating, explosion, or fire.

■ Keep contact pressure more than 2N.

The battery voltage may be lower than intended value because of poor contact condition, please keep contact pressure more than 2N for suitable contact resistance.

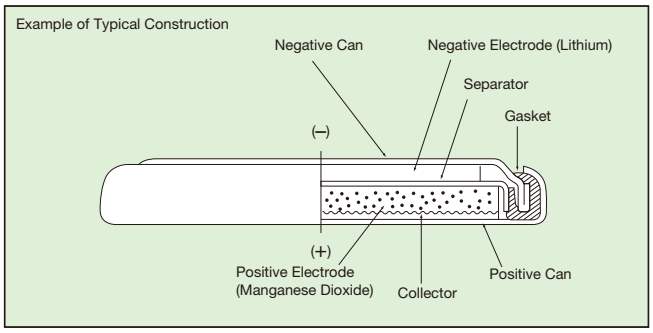
Coin Type Lithium Manganese Dioxide Battery



Overview

The coin type lithium manganese dioxide battery (CR battery) is a small, lightweight battery with an operating voltage of 3V and the ability to operate over a wide temperature range. It has a wide range of applications, both for powering devices such as wristwatches and electronic calculators and can be used in all types of electronic devices mainly as memory and RTC backup.

Construction



Principle and Reactions

The coin type lithium manganese dioxide battery uses manganese dioxide (MnO_2) as its positive active material, lithium (Li) as its negative active material, and an organic electrolyte solution.

■ Battery reactions

Positive reaction: $MnO_2 + Li^+ + e^- \rightarrow MnOOLi$
Negative reaction: $Li \rightarrow Li^+ + e^-$
Total reaction: $MnO_2 + Li \rightarrow MnOOLi$

Features

■ Optimum for Memory and RTC Backup (Fig. 1)

Displays long-term stable operating voltage at low load discharge.

■ High 3 volt energy density

High energy density. At 3 volts (nominal voltage), it has about twice the voltage of alkaline button batteries and silver oxide batteries.

■ Stable discharge characteristics through low internal resistance and high operating voltage

Employs highly conductive electrolyte, lowering internal resistance and providing stable operating voltage. This allows stable power to be obtained, with little change in operating voltage at room temperature as well as high and low temperatures.

■ Superior leakage resistance and excellent storage characteristics (Fig. 2)

Employs a leak-resistant organic electrolyte, giving it better leakage resistance than battery types using alkaline electrolytes. Furthermore, the high degree of seal of the seal structure and application of sealant keep self-discharge to about 1% per year.

■ Superior high rate discharge characteristics (Fig. 3)

Fig. 1 Relationship between Discharge Current Consumption and Duration Time

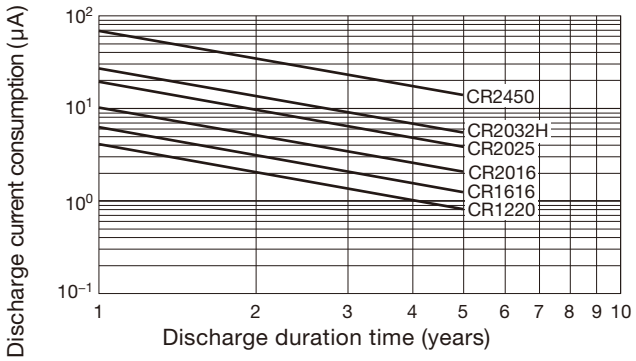


Fig. 2 Discharge Characteristics after Storage

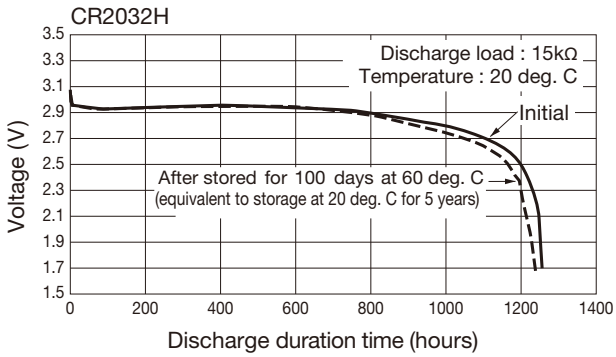
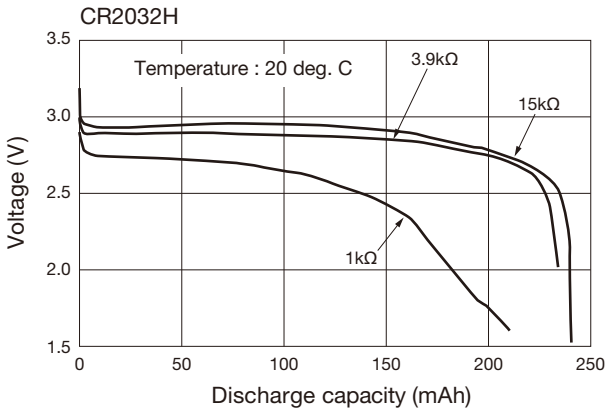


Fig. 3 High Rate Discharge Characteristics



UL Recognized Components

The coin type lithium manganese dioxide battery is a UL (Underwriters Laboratories Inc.) recognized component and user replaceable.

Recognized models:
CR2450, CR2430, CR2032, CR2032H,CR2025, CR2016, CR1632, CR1620, CR1616, CR1220, CR1216, CR1025

Certification Number: MH12568

Applications

- Communication Tags
- OA Machines (Fax, Copiers, Printers)
- PDAs
- Camcorders
- Portable CD/MD Players
- Electronic Meters (Water, Gas, Electricity)
- FA Instruments (Measuring Instruments, Onboard Microcomputers, Sensors)
- Notebook PCs
- Electronic Dictionaries
- Digital Still Cameras
- Watches
- Keyless Entry Systems
- Remote Controllers
- Desktop PCs
- Calculators
- Film Cameras
- Medical Instruments, Cash Registers
- Portable Game Devices

Products

Model		CR2450	CR2430	CR2032H	CR2032	CR2025	CR2016	CR1632	CR1620	CR1616	CR1220	CR1216
Nominal Voltage (V)		3	3	3	3	3	3	3	3	3	3	3
Nominal Capacity (mAh)**		610	290	240	220	170	90	140	80	55	36	25
Nominal Discharge Current (mA)		0.2	0.2	0.2	0.2	0.2	0.1	0.1	0.1	0.1	0.1	0.1
Operating Temperature Range (deg. C)***		−20 to +85										
Dimensions*	Diameter (mm)	24.5	24.5	20.0	20.0	20.0	20.0	16.0	16.0	16.0	12.5	12.5
	Height (mm)	5.0	3.0	3.2	3.2	2.5	1.6	3.2	2.0	1.6	2.0	1.6
Weight (g)*		6.6	4.6	3.0	3.0	2.5	1.7	1.9	1.3	1.1	0.8	0.6

* Dimensions and weight are for the battery itself, but may vary depending on terminal specifications and other factors.

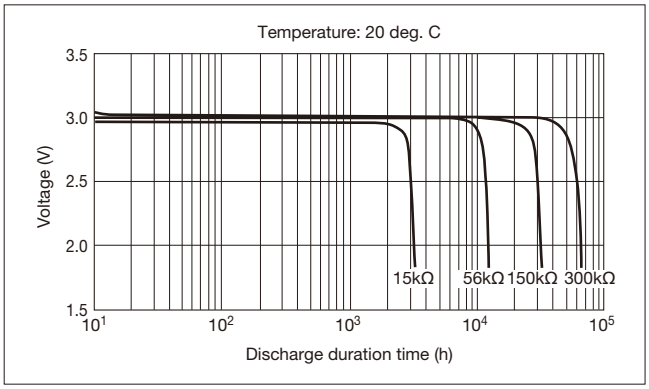
** Nominal capacity indicates duration until the voltage drops down to 2.0V when discharged at a nominal discharge current at 20 deg. C.

*** When using these batteries at temperatures outside the range of 0 to +40 deg. C, please consult Maxell in advance for conditions of use.

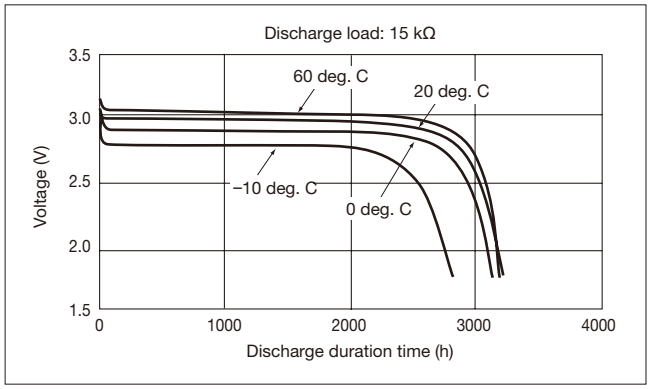
• Data and dimensions are just reference values. For further details, please contact your nearest Maxell dealer or distributor.

CR2450 (610mAh)

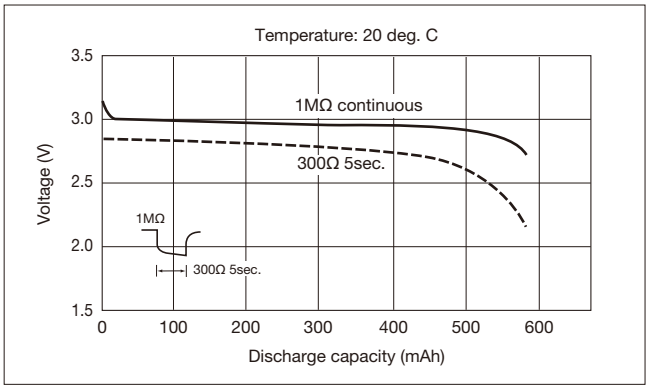
Discharge Characteristics



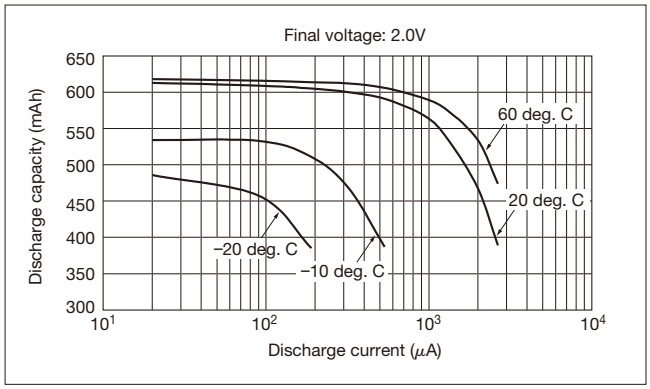
Temperature Characteristics



Pulse Discharge Characteristics

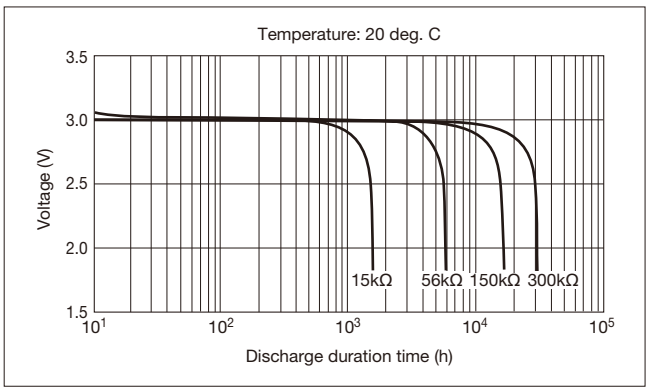


Relationship between Discharge Current and Discharge Capacity

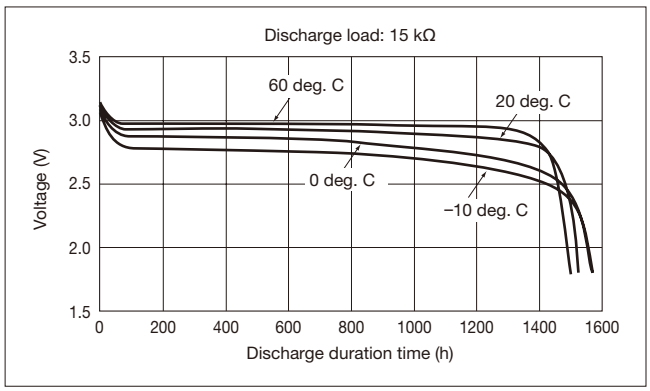


CR2430 (290mAh)

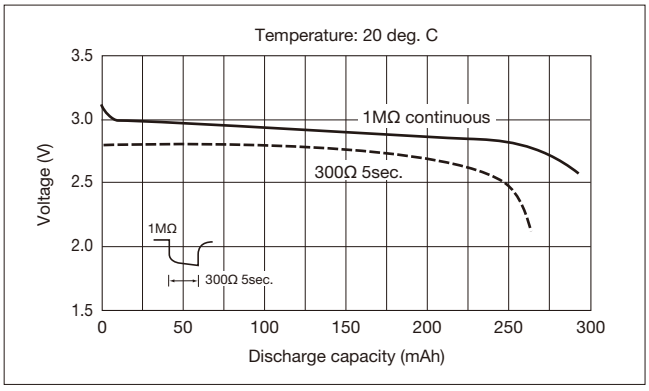
Discharge Characteristics



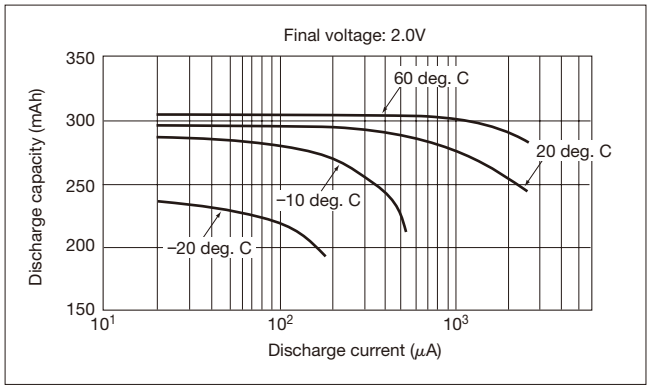
Temperature Characteristics



Pulse Discharge Characteristics

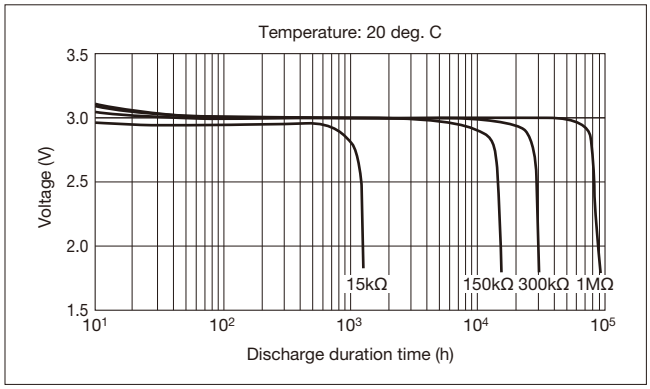


Relationship between Discharge Current and Discharge Capacity

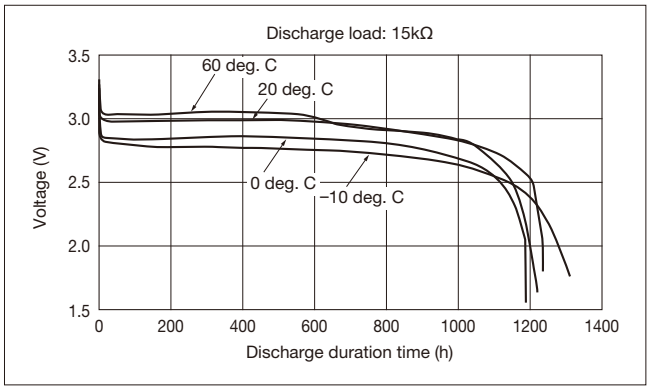


CR2032H (240mAh)

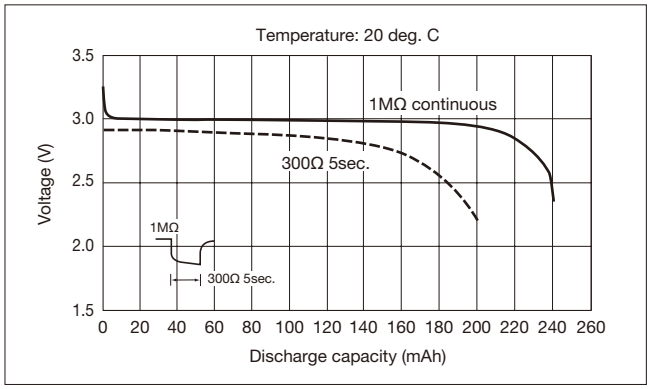
Discharge Characteristics



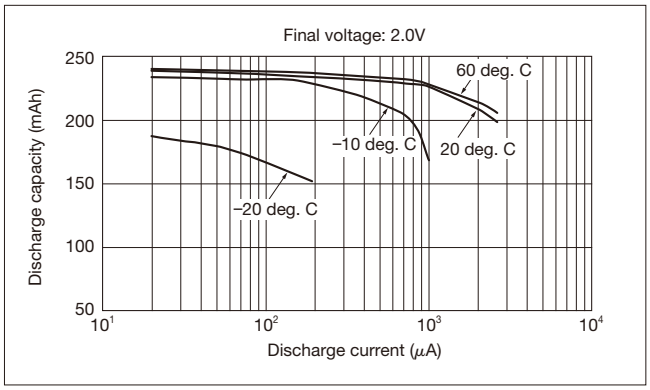
Temperature Characteristics



Pulse Discharge Characteristics

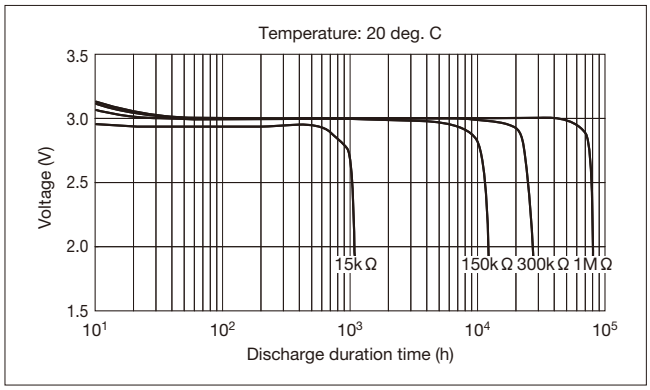


Relationship between Discharge Current and Discharge Capacity

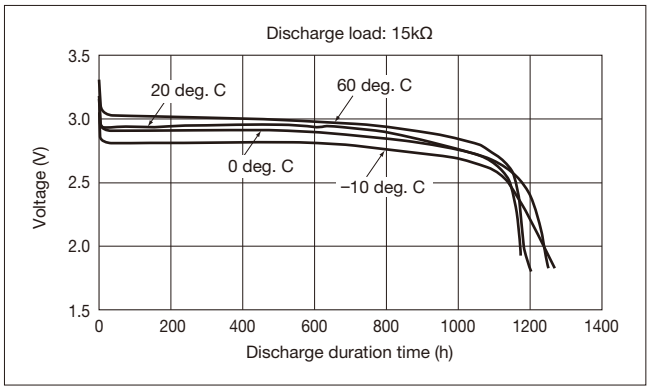


CR2032 (220mAh)

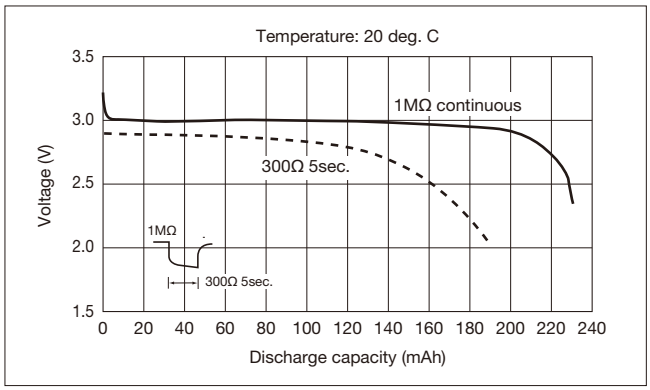
Discharge Characteristics



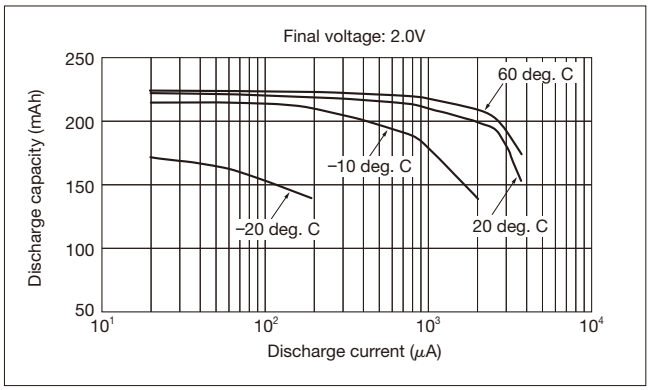
Temperature Characteristics



Pulse Discharge Characteristics

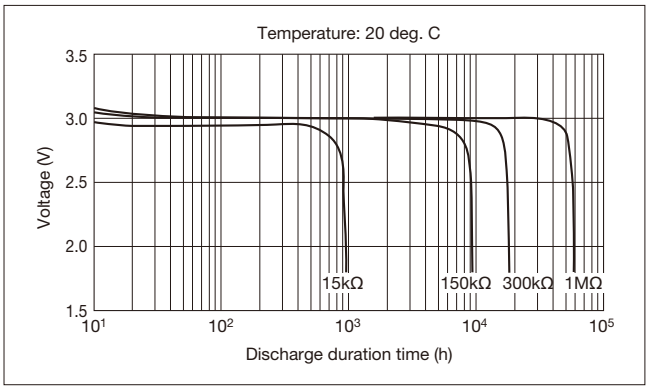


Relationship between Discharge Current and Discharge Capacity

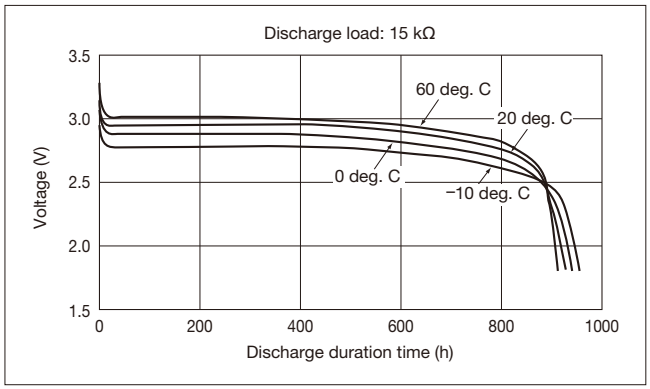


CR2025 (170mAh)

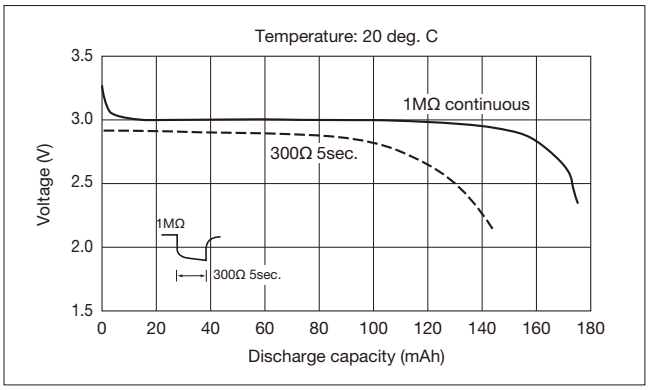
Discharge Characteristics



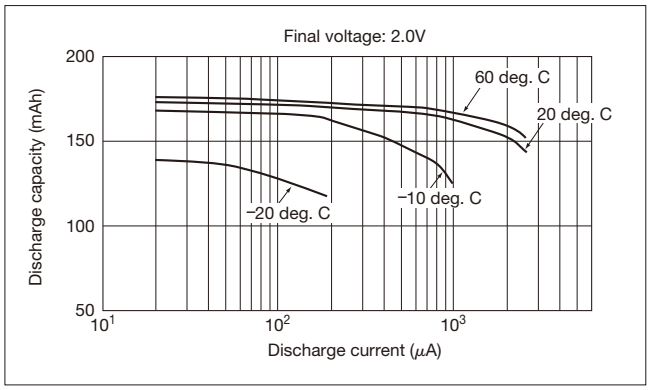
Temperature Characteristics



Pulse Discharge Characteristics

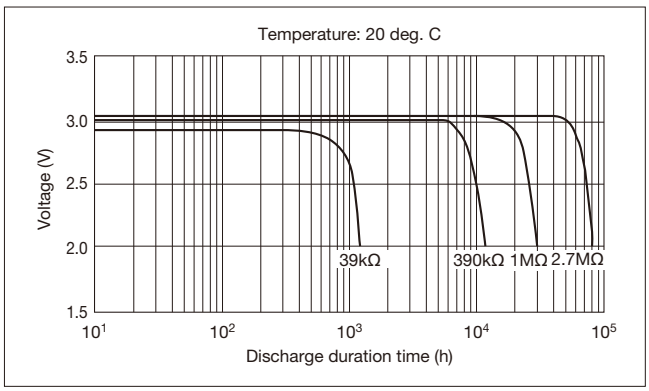


Relationship between Discharge Current and Discharge Capacity

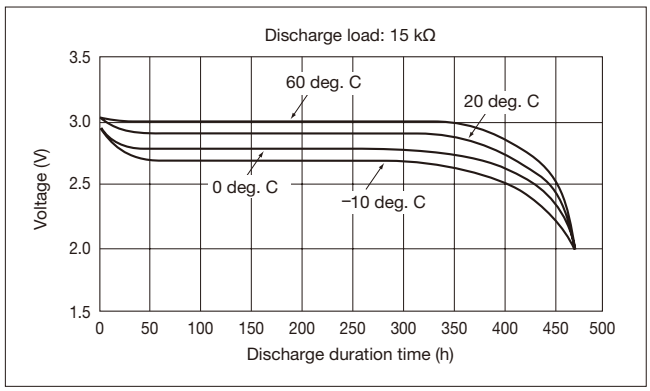


CR2016 (90mAh)

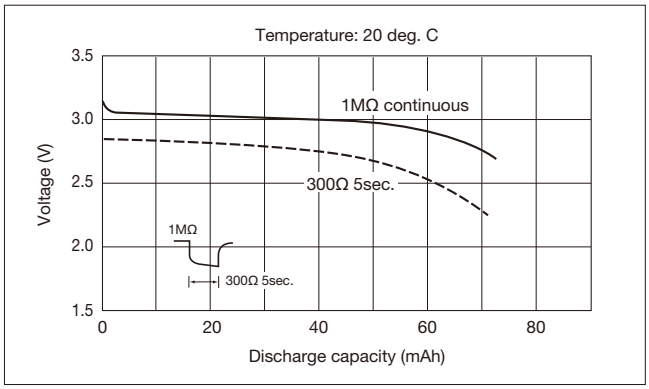
Discharge Characteristics



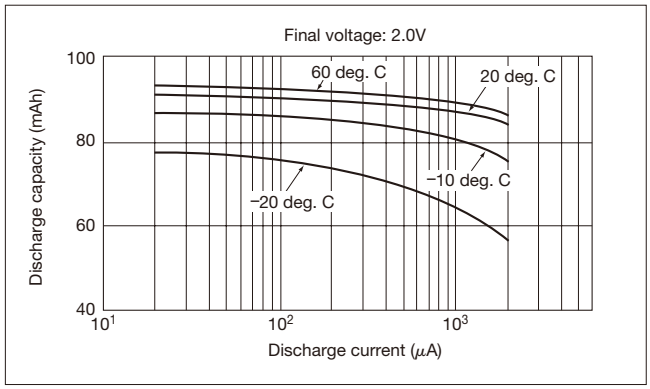
Temperature Characteristics



Pulse Discharge Characteristics

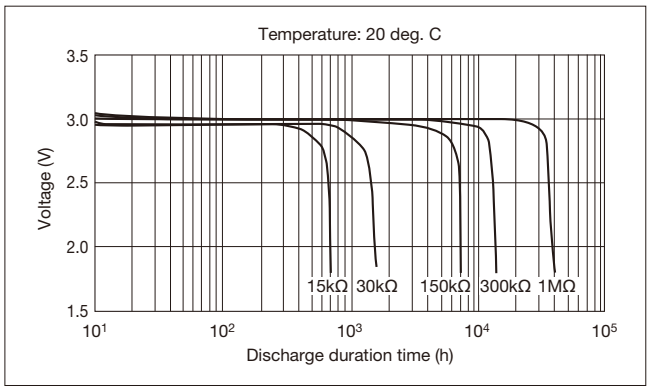


Relationship between Discharge Current and Discharge Capacity

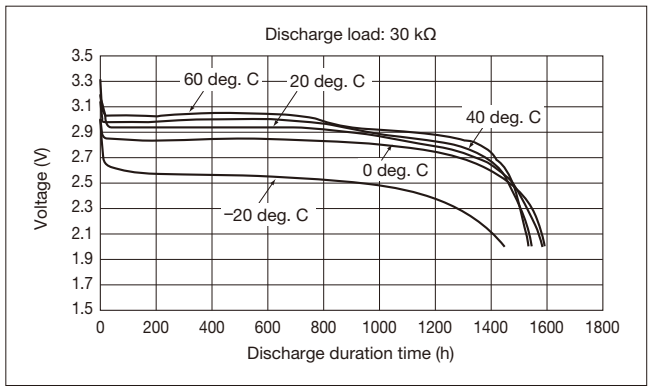


CR1632 (140mAh)

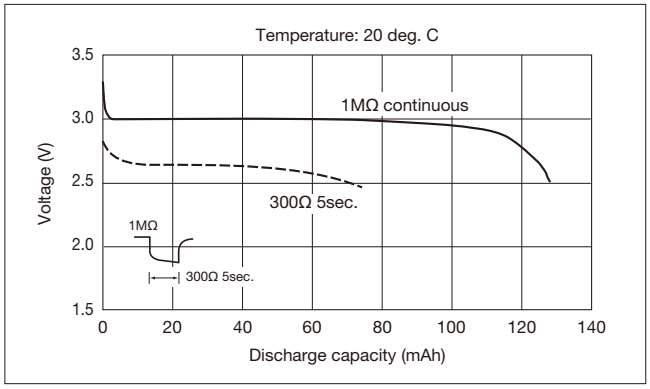
Discharge Characteristics



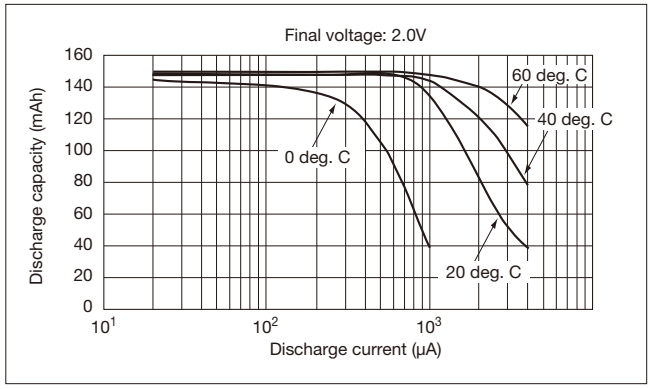
Temperature Characteristics



Pulse Discharge Characteristics

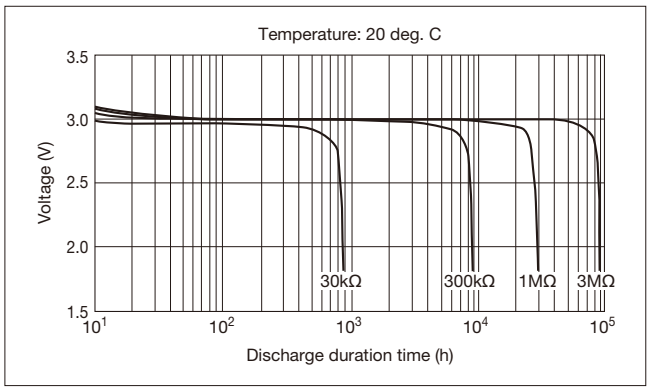


Relationship between Discharge Current and Discharge Capacity

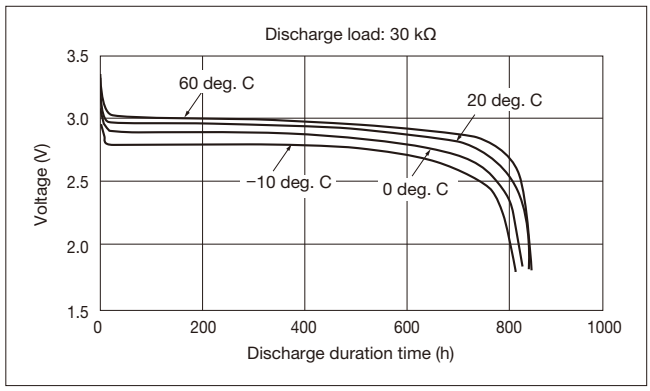


CR1620 (80mAh)

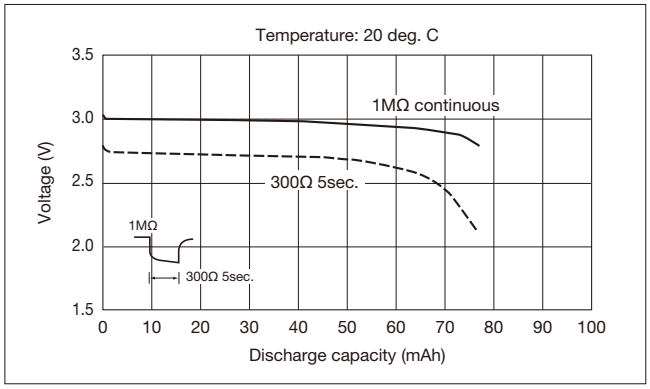
Discharge Characteristics



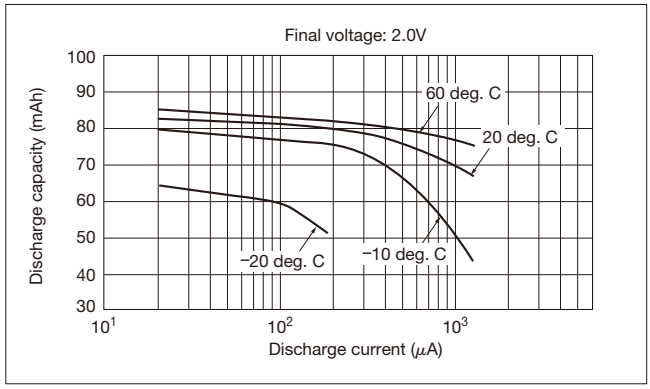
Temperature Characteristics



Pulse Discharge Characteristics

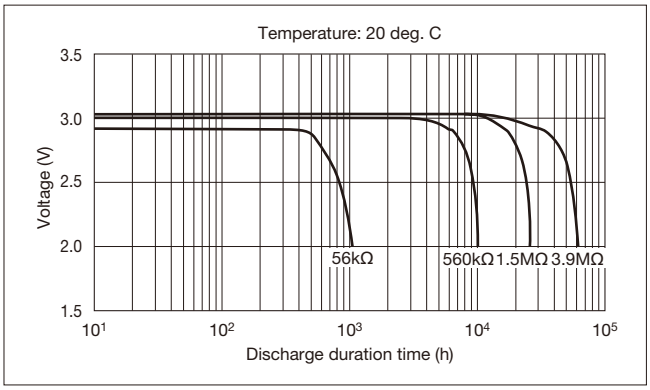


Relationship between Discharge Current and Discharge Capacity

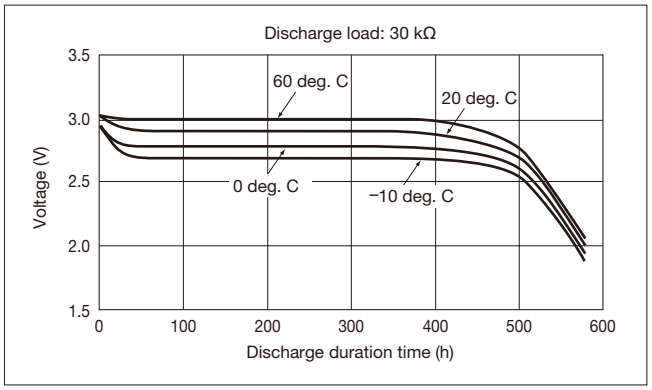


CR1616 (55mAh)

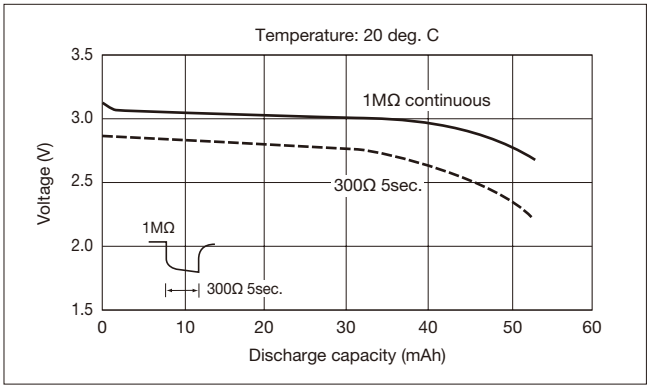
Discharge Characteristics



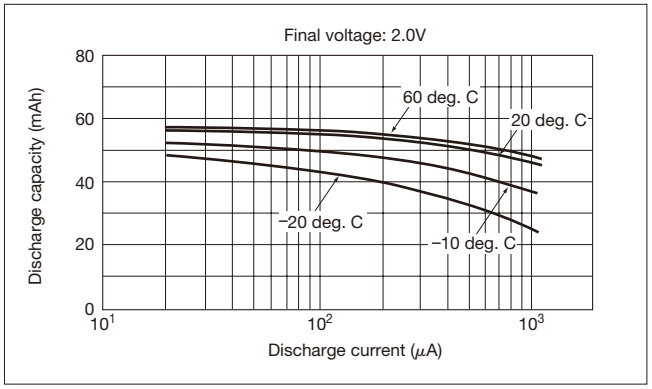
Temperature Characteristics



Pulse Discharge Characteristics

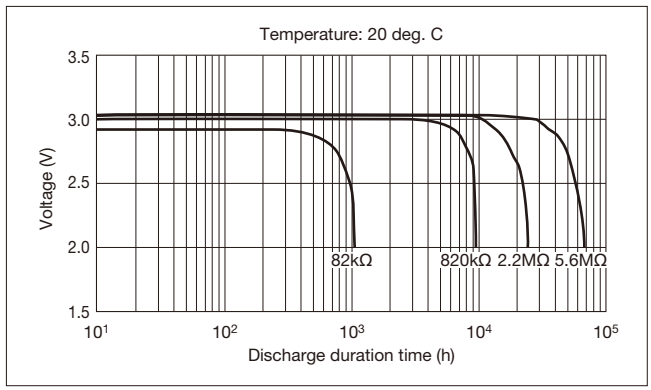


Relationship between Discharge Current and Discharge Capacity

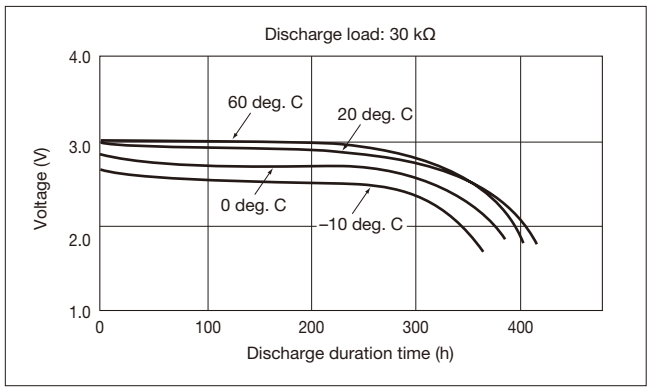


CR1220 (36mAh)

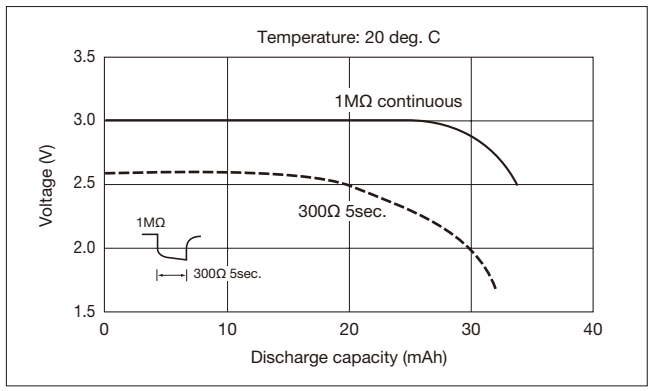
Discharge Characteristics



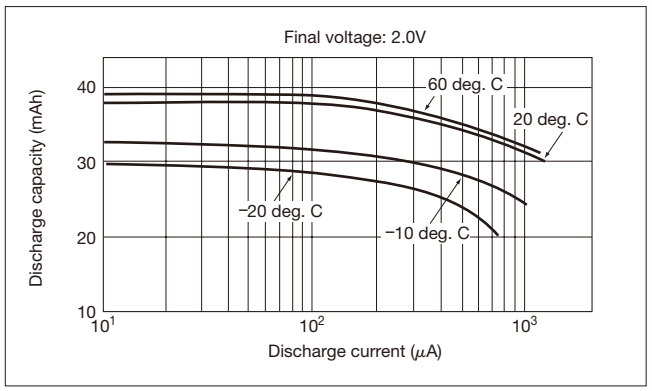
Temperature Characteristics



Pulse Discharge Characteristics

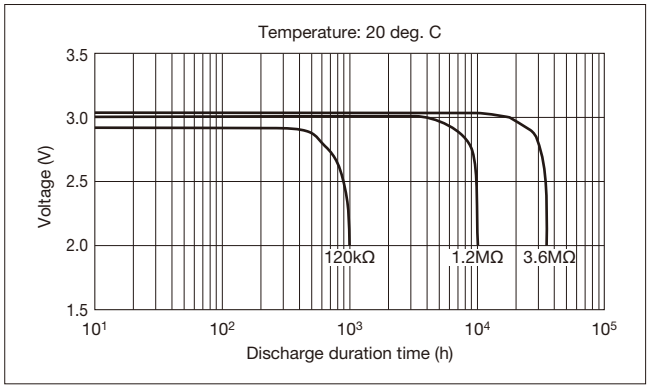


Relationship between Discharge Current and Discharge Capacity

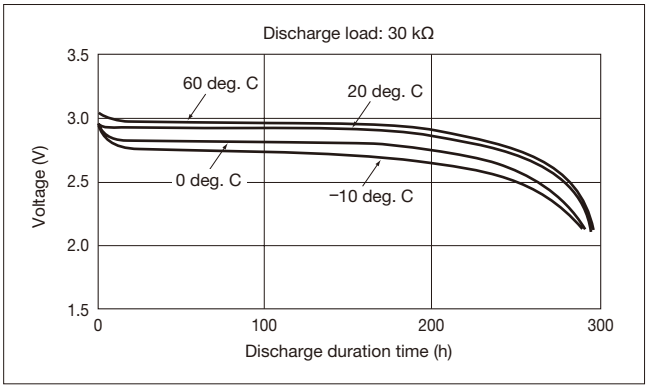


CR1216 (25mAh)

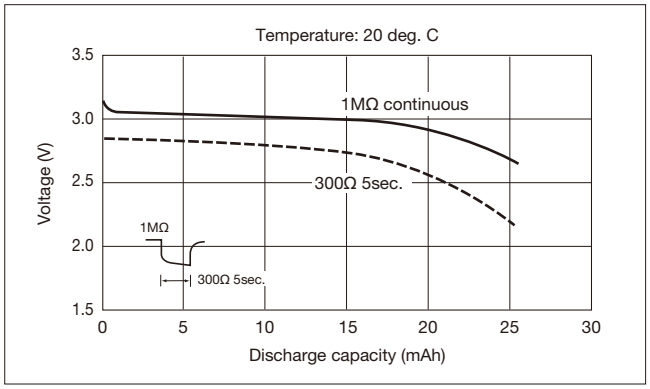
Discharge Characteristics



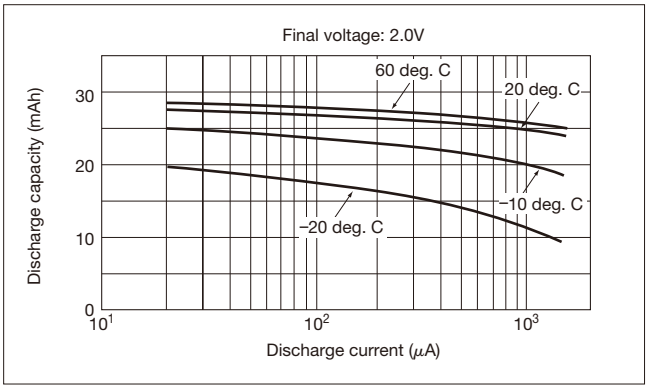
Temperature Characteristics



Pulse Discharge Characteristics

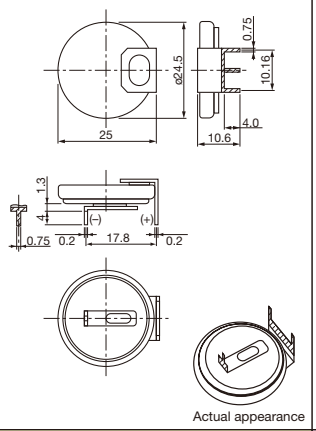


Relationship between Discharge Current and Discharge Capacity

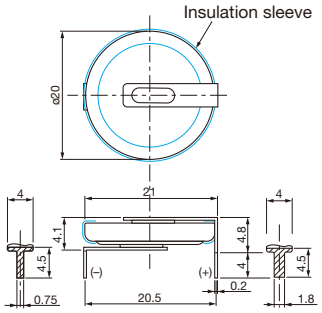


External Dimensions with Terminals and Wire Connectors (unit : mm)

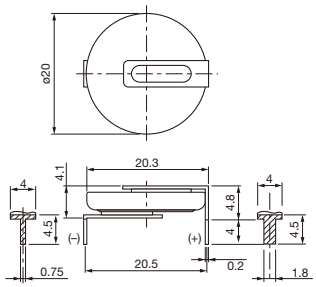
CR2450 T25S



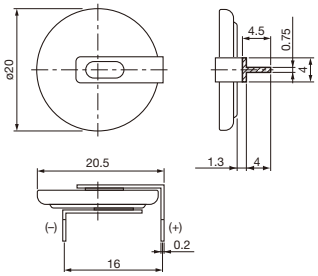
CR2032 T6



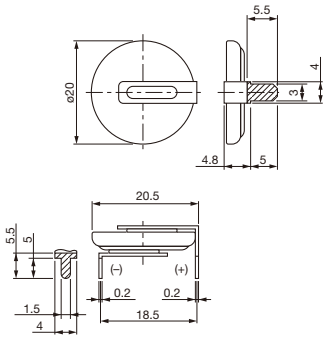
CR2032 T6LES



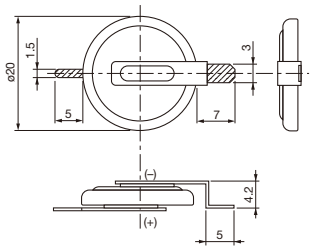
CR2032 T19



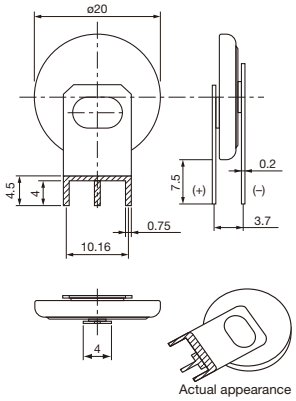
CR2032 T23



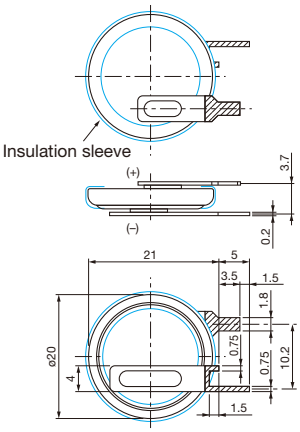
CR2032 T33



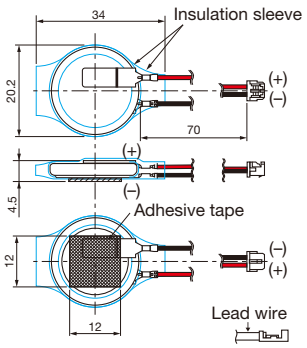
CR2032 T26



CR2032 T34

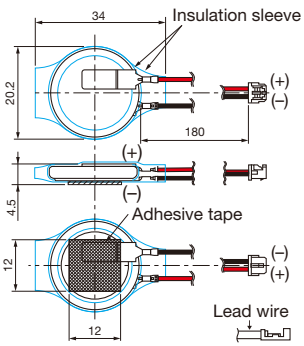


CR2032 WK11



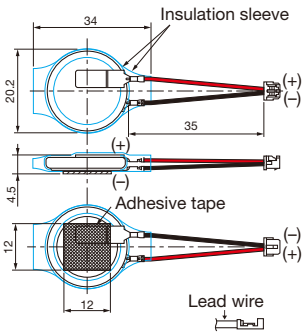
Housing: DF13-2S-1.25C (Hirose)
Contact: DF13-2630SCF (Hirose)
Wire: AWG28 UL1571

CR2032 WK12



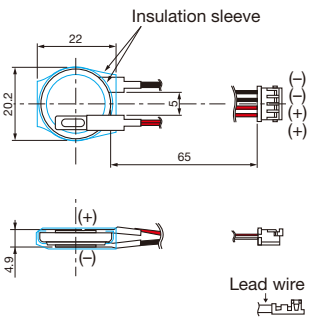
Housing: DF13-2S-1.25C (Hirose)
Contact: DF13-2630SCF (Hirose)
Wire: AWG28 UL1571

CR2032 WK13



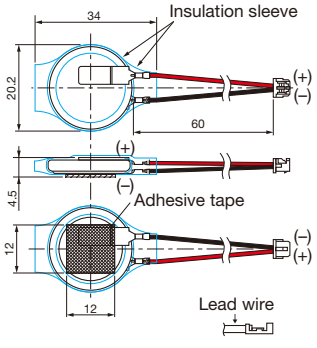
Housing: DF13-2S-1.25C (Hirose)
Contact: DF13-2630SCF (Hirose)
Wire: AWG28 UL1571

CR2032 WK14



Housing: DF3-4S-2C (Hirose)
Contact: DF3-2428SCF (Hirose)
Wire: AWG26 UL1007

CR2032 WK15



Housing: DF13-2S-1.25C (Hirose)
Contact: DF13-2630SCF (Hirose)
Wire: AWG28 UL1571

: Tin plating

: Horizontal & Through hole Type
: Horizontal & Surface mounting Type
: Vertical & Through hole Type
: Wire connector Type

Dangerous Goods Transportation Regulations for Lithium Cells and Batteries

Some transportation regulations have been recently revised and will come into effect after Jan. 1, 2013. Revised UN recommendations require cells and batteries to be manufactured under a quality management program. This requirement has been incorporated into the IMDG Code and ICAO TI/IATA DRG. Maxell factories have been certified for ISO 9001 and therefore meet this requirement.

1) Transportation except by air: Actual operation is the same as before. (see ref.)
2) Air transportation: Former packing instructions 965 and 968 have been divided into Section I (class 9 dangerous goods) and Section II (exempt from class 9 dangerous goods). The revised packing instructions consist of Section IA, Section IB and Section II. Section IA (class 9 dangerous goods) is almost the same as the former Section I. Former Section II is divided into Section IB (class 9 dangerous goods) and Section II (exempt from class 9 dangerous goods). The new Section IB covers items that were formerly exempted from regulation but which must be shipped as class 9 dangerous goods from 2013. A summary is shown in the following table. Please use updated IATA regulations (54th edition and later) to confirm details.

Technical Instructions for lithium metal batteries (PI 968)

Section		Section II		Section IB	Section IA
Lithium Metal Content		Cell: ≤ 0.3 g Battery: ≤ 0.3 g	Cell: ≤ 1.0 g Battery: ≤ 2.0 g	Cell: ≤ 1.0 g Battery: ≤ 2.0 g	Cell: > 1.0 g Battery: > 2.0 g
Package Limits	Quantity	N/A	≤ 2 batteries or ≤ 8 cells	> 2 batteries or > 8 cells	N/A
	Weight	2.5 kg net weight	N/A	2.5 kg gross weight Passenger and cargo aircraft	2.5 kg net weight (Pass.) 35 kg net weight (Cargo)
Classification		Exempted		**Class 9**	
Packaging		1.2 M drop test			UN performance packaging
Labels		 Note 1)		 Note 2)  Note 3)	
Documents		Invoice (Air Waybill) Additional document		**Air Waybill** **Additional document**	**Declaration for DG** **Air Waybill**
Training		Adequate instructions		**DG training**	

Note 1): Handling label Note 2): Class 9 hazardous label
Note 3): Cargo aircraft only label 1) For USA: Label is required for Section IB or Section IA.
2) Not for USA: Label is required for Section IA and over 2.5 kg of packing weight.

Technical Instructions for lithium ion batteries (PI965)

Section		Section II		Section IB	Section IA
Watt Hour Rating		Cell: ≤ 2.7 Wh Battery: ≤ 2.7 Wh	Cell: ≤ 20 Wh Battery: ≤ 100 Wh	Cell: ≤ 20 Wh Battery: ≤ 100 Wh	Cell: > 20 Wh Battery: > 100 Wh
Package Limits	Quantity	N/A	≤ 2 batteries or ≤ 8 cells	> 2 batteries or > 8 cells	N/A
	Weight	2.5 kg net weight	N/A	10 kg gross weight Passenger and cargo aircraft	5 kg net weight (Pass.) 35 kg net weight (Cargo)
Classification		Exempted		**Class 9**	
Packaging		1.2 M drop test			UN performance packaging
Labels					 Note 4)
Documents		Invoice (Air Waybill) Additional document		**Air Waybill** **Additional document**	**Declaration for DG** **Air Waybill**
Training		Adequate instructions		**DG training**	

Note 4): Cargo aircraft only label: Label is required for Section IA and over 2.5 kg of packing weight.

(Ref.)
Except air transportation, the necessary requirements to transport lithium metal batteries or lithium ion batteries as exempted from class 9 dangerous goods (non-restricted goods) are as follows;

1. The minimum requirements to transport lithium metal batteries;

1) For a lithium metal or a lithium alloy cell, the lithium content must not be more than 1 g. For a lithium metal or lithium alloy battery, the aggregate lithium content must not be more than 2 g.
2) Each cell or battery must be of the type proven to meet the requirement of each test in the UN Manual of Tests and Criteria, 5th revised edition, Part III, sub-section 38.3.
3) A battery handling label must be displayed on each package. A telephone number must be printed on the label for additional information.
4) Each consignment must be accompanied by a document for transport with an indication that:
   the package contains lithium metal cells or batteries;
   the package must be handled with care and that a flammability hazard exists if the package is damaged;
   special procedure should be followed in the event that the package is damaged, to include inspection and repackaging if necessary; and a telephone number for additional information.
5) Each package must be capable of withstanding a 1.2 m drop test.

2. The minimum requirements to transport lithium ion batteries;

1) For lithium ion cells, the Watt-hour rating is not more than 20 Wh. For lithium ion batteries, the Watt-hour rating is not more than 100 Wh. The Watt-hour rating must be marked on the outside of the battery case except for batteries manufactured before January 1, 2009.
2) Each cell or battery is of the type proven to meet the requirement of each test in the UN Manual of Tests and Criteria, 5th revised edition, Part III, sub-section 38.3.
3) A battery handling label must be displayed on each package. A telephone number must be printed on the label for additional information.
4) Each consignment must be accompanied by a document for transport with an indication that:
   the package contains lithium ion cells or batteries;
   the package must be handled with care and that a flammability hazard exists if the package is damaged;
   special procedure should be followed in the event the package is damaged, to include inspection and repackaging if necessary; and a telephone number for additional information.
5) Each package must be capable of withstanding a 1.2 m drop test.

Maxell will provide certificates for 1) and 2) as the need arises. Documentation for 3) and 4) needs to be prepared by the customer. If our package is used for transport, Maxell will provide the certificate for 5) as the need arises. However, if the customer's package is used, the customer must confirm the package can withstand a 1.2 m drop test. Furthermore, even if our package is used for transport, the telephone number printed on the label must be changed to that of the sender (customer).

Certified Management Systems (Japan)

ISO 14001

The Maxell group has been certified for the ISO14001 Environmental Management System and has made efforts to reduce environmental impacts throughout the product lifecycle.

ISO14001
Hitachi Maxell, Ltd.
Certificate No.: EC97J1148
Registration Date: December 24, 1997
Recertification Date: December 15, 2011
Certificate Expiry: December 14, 2014
Scope of Registration: Development, design, manufacture, sales and related services of information media, batteries, parts, devices and electronic appliances

ISO9001

CM009

JQA-0986

ISO9001
HITACHI MAXELL, LTD.
ENERGY DIVISION
MICRO BATTERY DEPARTMENT
Certificate Number: JQA-0986
Registration Date: September 29, 1995
Last Renewal Date: December 19, 2012
Expiry Date: December 18, 2015

Scope of Registration: The design/development and the manufacture of cylindrical alkaline battery, silver oxide battery, alkaline button battery, manganese dioxide lithium battery (coin type and cylindrical type), thionyl chloride lithium battery, manganese dioxide lithium rechargeable battery, titanium carbon lithium rechargeable battery and coin type lithium rechargeable battery.

JQA-3029

ISO9001
HITACHI MAXELL, LTD.
ENERGY DIVISION
LITHIUM ION BATTERY DEPARTMENT
Certificate Number: JQA-3029
Registration Date: January 29, 1999
Last Renewal Date: December 27, 2011
Expiry Date: December 26, 2014

Scope of Registration:
- The design/development and manufacture of lithium-ion rechargeable battery.
- The design/development and manufacture (outsources) of lithium-ion rechargeable battery.

ISO/TS 16949

JQA-AU0078

ISO/TS16949
HITACHI MAXELL, LTD.
ENERGY DIVISION
MICRO BATTERY DEPARTMENT
ONO WORKS
Certificate Number: JQA-AU0078
Registration Date: January 7, 2005
Last Renewal Date: January 7, 2011
Expiry Date: January 6, 2014

Remote Supporting Functions: MAXELL EUROPE LTD.
MAXELL CORPORATION OF AMERICA

Scope of Registration: The design/development and manufacture of manganese dioxide lithium batteries (coin type) for automobile use.

maxell

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