Chapter 3

Rechargeable Coin Type Lithium Batteries

INDEX

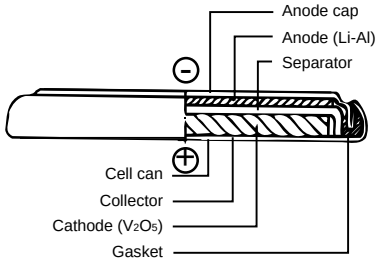
3-1 Vanadium Pentoxide Lithium Coin Type Batteries (VL series)

Vanadium Pentoxide Lithium Rechargeable Batteries (VL series)

Features

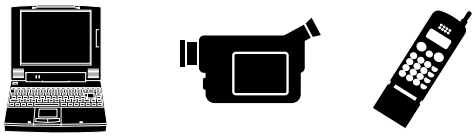
These completely new coin-type lithium batteries feature vanadium oxide for the positive pole, lithium alloy for the negative pole and a non-aqueous solvent for the electrolyte.

Construction



Applications

- Memory backup power supplies for office automation equipment (personal computers, fax machines, etc.), audio-video equipment (VTRs, etc.), communications equipment (mobile phones, etc.), etc.
- Hybrid systems with solar batteries (solar remote controllers, etc.)



General Specifications

Model No.	Electrical characteristics (20°C)			Dimensions (mm)		Weight (g)	JIS	IEC
	Nominal voltage (V)	*Nominal capacity (mAh)	Continuous drain (mA)	Diameter	Height			
VL621	3	1.5	0.01	6.8	2.1	0.3	-	-
VL1216	3	5.0	0.03	12.5	1.6	0.7	-	-
VL1220	3	7.0	0.03	12.5	2.0	0.8	-	-
VL2020	3	20.0	0.07	20.0	2.0	2.2	-	-
VL2320	3	30.0	0.10	23.0	2.0	2.8	-	-
VL2330	3	50.0	0.10	23.0	3.0	3.7	-	-
VL3032	3	100.0	0.20	30.0	3.2	6.3	-	-

* Nominal capacity shown above is based on standard drain and cut off voltage down to 2.5V at 20°C.

Charging

■ Charging circuits

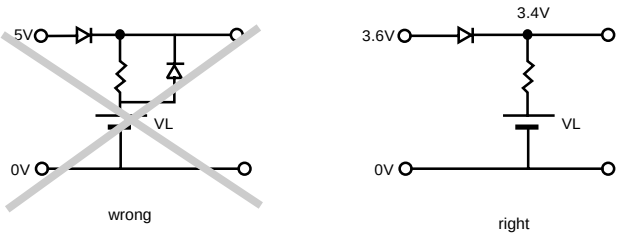
Charging/discharging cycle	Approx. 1,000 times at 10% discharge depth to nominal capacity
Charging system*	Constant-voltage charging.(Please strictly adhere to the specified charge voltage)
Operating temperature	-20 °C ~ + 60 °C

* Consult with Panasonic concerning constant-current charging systems.

The charging circuit is crucial in terms of ensuring that full justice will be done to the battery characteristics. Consider it carefully as the wrong charging circuit can cause trouble.

■ Precautions regarding the charge voltage setting

Under no circumstances should trickle charging, which is used for nickel-cadmium batteries, be used. Ignoring this precaution will cause the battery voltage to rise to about 5V, resulting in a deterioration of performance.



■ Charge voltage range

If a fixed-charging method is applied, please adhere to the specified charging voltage.

The guaranteed value over an operating temperature range from -20 to +60°C is 3.4V ± 0.15V.

(Actual value: 3.4V ± 0.20V)

* If the charging voltage exceeds the specifications, the internal resistance of the battery will rise and may cause battery deterioration. Also,with a charge voltage around 4V, corrosion of the (+) terminal (case) may occur, causing leakage. ("Influence of the charge voltage on VL batteries" in Chapter 3-59.)
* It is not possible for the battery capacity to recover completely when the charging voltage is below the specification.

■ Recommended charging circuits

● Basic conditions

Charge voltage: 3.4V±0.15V

Charge current: For a battery voltage of 3V

VL621	Approx. 0.2 mA or below
VL1216, VL1220	Approx. 0.5 mA or below
VL2020	Approx. 1.5 mA or below
VL2320, VL2330	Approx. 2.0 mA or below
VL3032	Approx. 4.0 mA or below

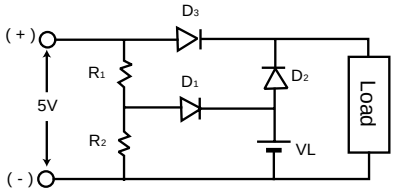
(It is permissible for the current to increase beyond the above level when the battery voltage drops below 3V.)

■ Mixed usage of batteries

Do not use these batteries and lithium primary batteries or other rechargeable batteries together, and do not use new batteries and old batteries together even if they are of the same type.

● Reference: Examples of 5-V charging circuits

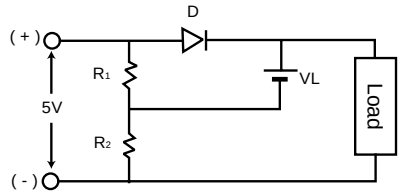
① Standard circuits



For D_2, select a diode of small inverse current (I_R=1μA below / 5V)
D_1, D_2 : MA716(Diode type code)
D_3 : MA704, MA700

	R_1	R_2
VL621	2.2kΩ	5.6kΩ
VL1220, VL1216	750Ω	2000Ω
VL2020	200Ω	510Ω
VL2320, VL2330	150Ω	390Ω
VL3032	68Ω	160Ω

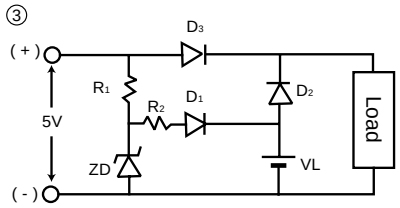
② Simple economical circuits



D : MA700 (Very small inverse current)

Load with 5V applied	100μA~10mA		100μA below	
D,Vf	0.2V~0.6V		0~0.2V	
	R_1	R_2	R_1	R_2
VL621	8.2kΩ	2.4kΩ	6.8kΩ	2.7kΩ
VL1220, VL1216	2000Ω	510Ω	1500Ω	560Ω
VL2020	1300Ω	330Ω	470Ω	180Ω
VL2320, VL2330	1100Ω	270Ω	390Ω	150Ω
VL3032	510Ω	120Ω	180Ω	68Ω

③

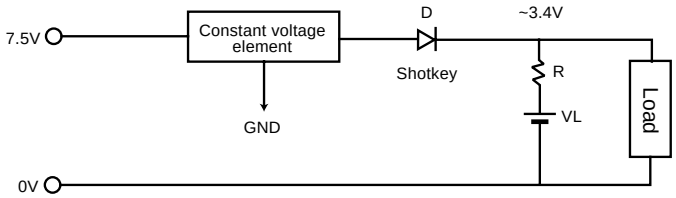


	ZD	D_1	R_1	
A	MA3036L	MA704	300Ω	Common to all types
B	MA3036H	MA700	270Ω	

Type		VL3032	VL2330	VL2320	VL2020	VL1220	VL1216	VL621
R_2	A	Not required				470Ω		1.5kΩ
	B	Not required				560Ω		1.6kΩ

For D_2, select a diode of small inverse current (I_R=1μA below / 5V)

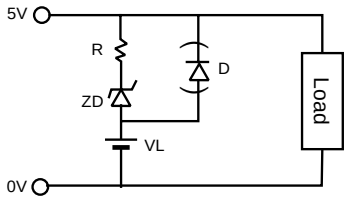
④ For minimizing current leakage due to resistance, etc., as when charging by another battery.



REG	D
3.7V	MA700

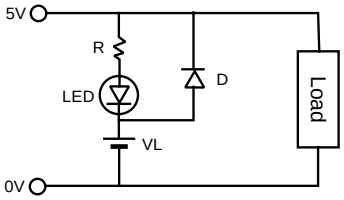
For details, refer to the constant voltage element specifications

⑤ Zener control



ZD : HZ2ALL
R : 43Ω/VL2320
68Ω/VL2020
＊D : MA700 or MA704
＊ Patent pending

⑥ LED control

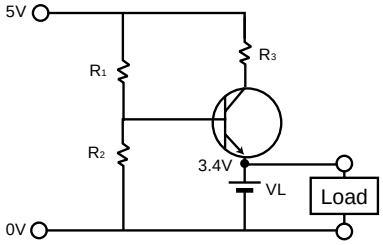


LED
R=51Ω for VL2320
＊D : MA700 or MA704

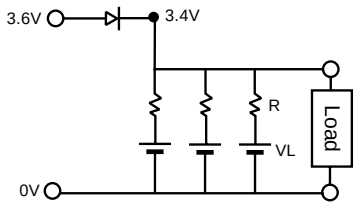
Select a diode having an inverse current as small as possible. (I_R=1μA below / 5V)

⑦ Transistor control(for VL2320)

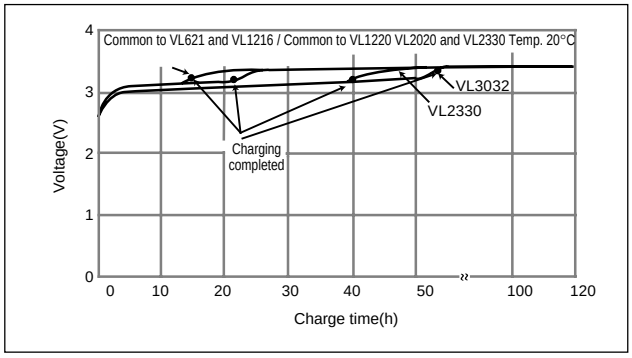
R_1: 4.3kΩ R_2 : 15.0kΩ R_3 : 680Ω



⑧ Parallel circuit

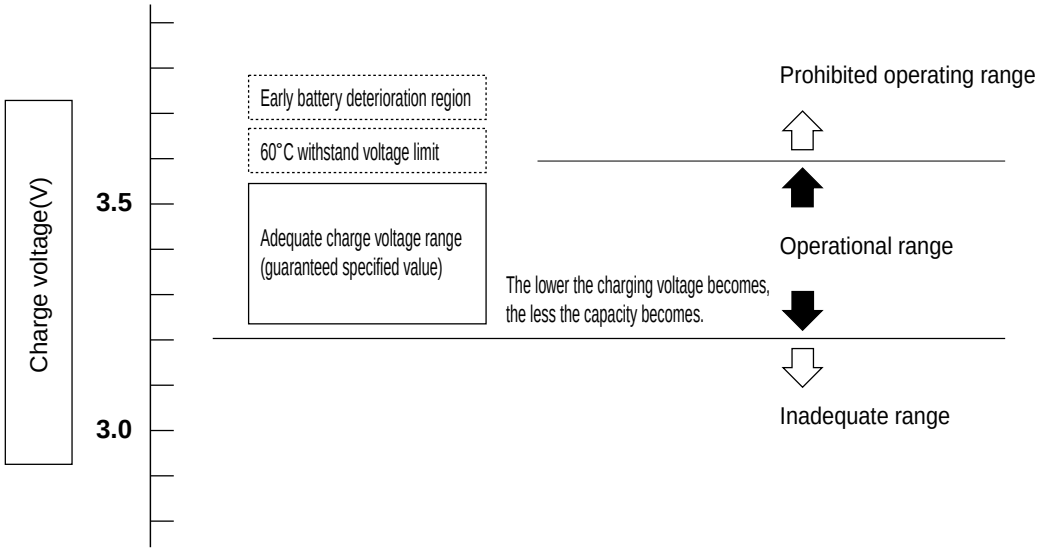


● Charging characteristics



● Influence of the charge voltage on VL batteries

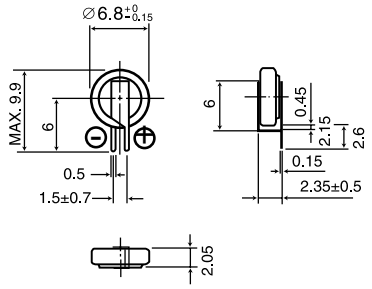
If the charge voltage goes beyond its adequate range, battery performance may deteriorate early. Be sure to observe the guaranteed charge voltage.



VL621

■ Dimensions(mm)

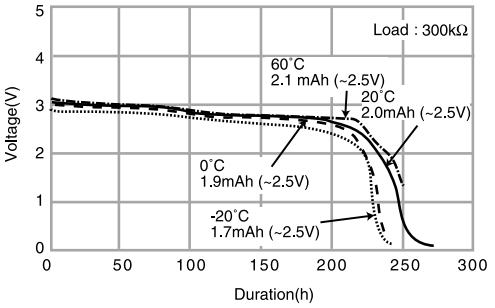
(VL621 / F9D)



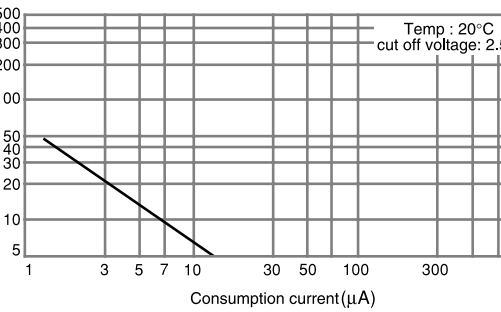
■ Specification

Nominal voltage(V)	3
Nominal capacity(mAh)	1.5
Continuous standard load(mA)	0.01
Operating temperature(˚C)	-20 ~ +60

■ Discharge Temperature Characteristics



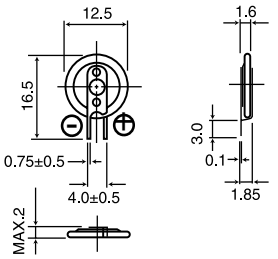
■ Consumption current vs. Duration time



VL1216

■ Dimensions(mm)

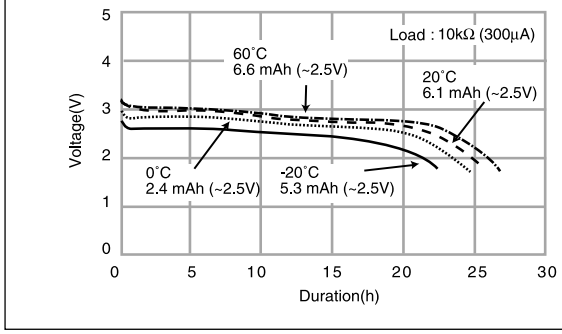
(VL1216 / 1F5U)



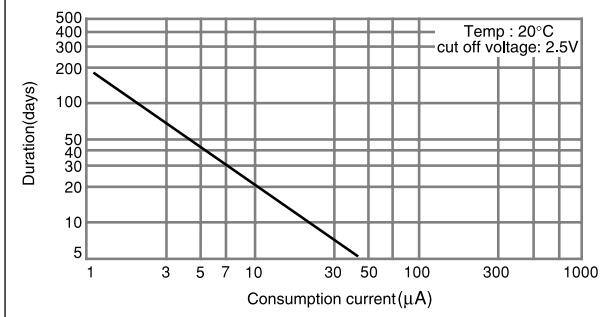
■ Specification

Nominal voltage(V)	3
Nominal capacity(mAh)	5.0
Continuous standard load(mA)	0.03
Operating temperature(˚C)	-20 ~ +60

■ Discharge Temperature Characteristics



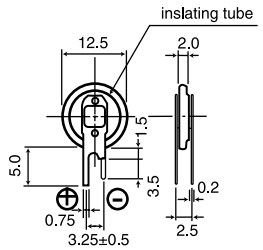
■ Consumption current vs. Duration time



VL1220

■ Dimensions(mm)

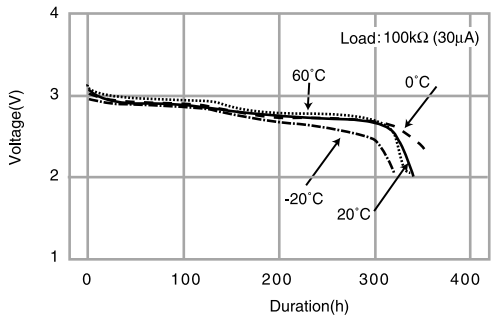
(VL1220 / 1F5U)



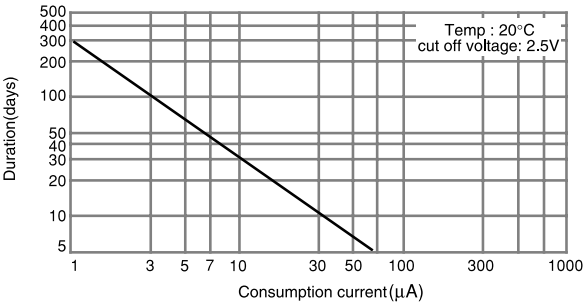
■ Specification

Nominal voltage(V)	3
Nominal capacity(mAh)	7.0
Continuous standard load(mA)	0.03
Operating temperature(˚C)	-20 ~ +60

■ Discharge Temperature Characteristics



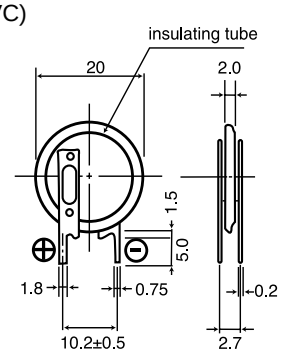
■ Consumption current vs. Duration time



VL2020

■ Dimensions(mm)

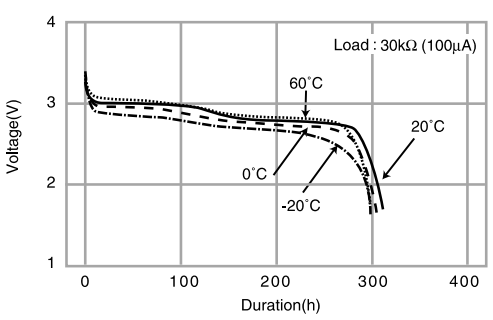
(VL2020 / 1VC)



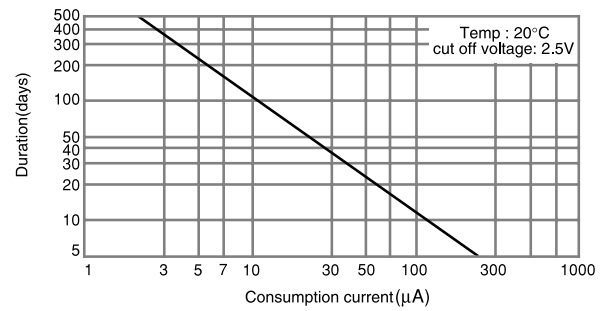
■ Specification

Nominal voltage(V)	3
Nominal capacity(mAh)	20.0
Continuous standard load(mA)	0.07
Operating temperature(˚C)	-20 ~ +60

■ Discharge Temperature Characteristics



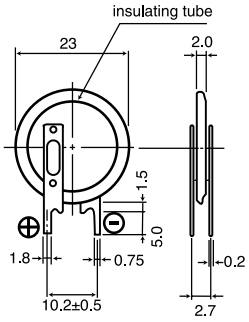
■ Consumption current vs. Duration time



VL2320

■ Dimensions(mm)

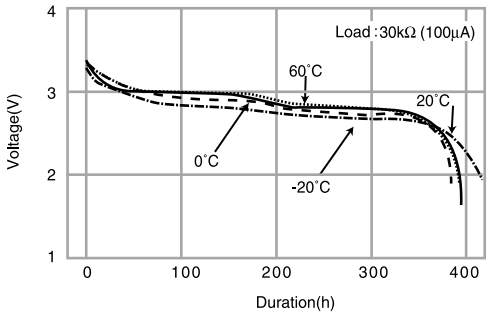
(VL2320 / 1VC)



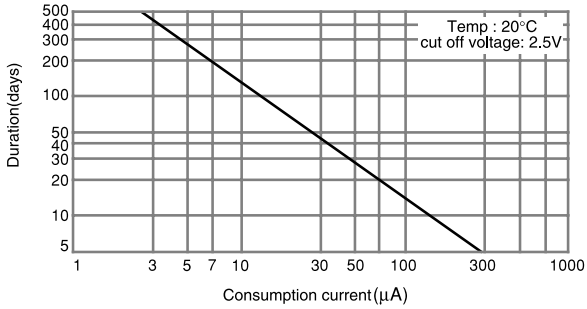
■ Specification

Nominal voltage(V)	3
Nominal capacity(mAh)	30.0
Continuous standard load(mA)	0.1
Operating temperature(˚C)	-20 ~ +60

■ Discharge Temperature Characteristics



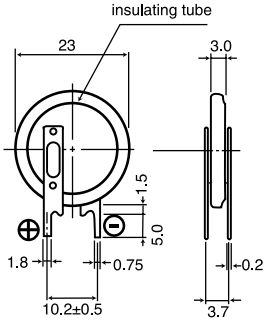
■ Consumption current vs. Duration time



VL2330

■ Dimensions(mm)

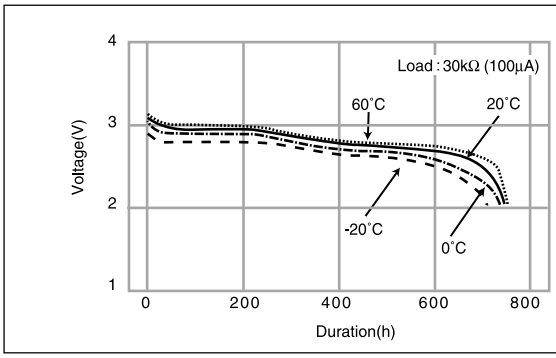
(VL2330 / 1VC)



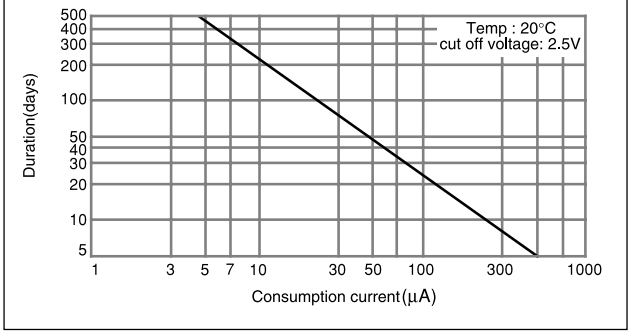
■ Specification

Nominal voltage(V)	3
Nominal capacity(mAh)	50.0
Continuous standard load(mA)	0.1
Operating temperature(˚C)	-20 ~ +60

■ Discharge Temperature Characteristics



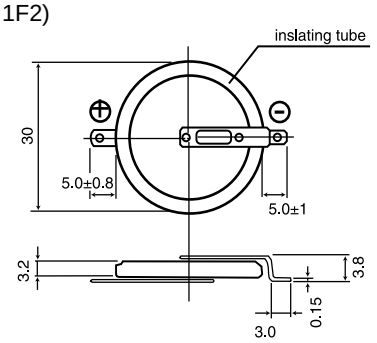
■ Consumption current vs. Duration time



VL3032

■ Dimensions(mm)

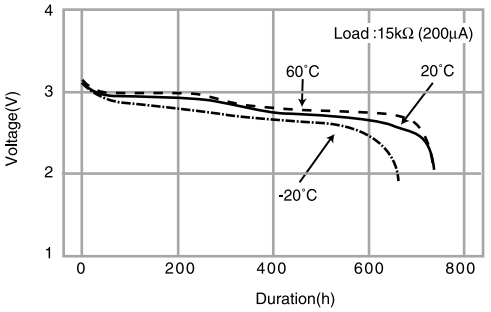
(VL3032 / 1F2)



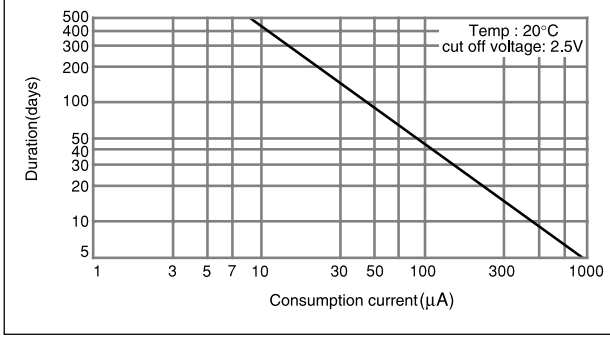
■ Specification

Nominal voltage(V)	3
Nominal capacity(mAh)	100.0
Continuous standard load(mA)	0.2
Operating temperature(˚C)	-20 ~ +60

■ Discharge Temperature Characteristics



■ Consumption current vs. Duration time



3-2 Manganese Lithium Coin Type Batteries (ML series)

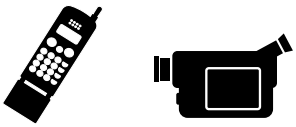
Manganese Lithium Rechargeable Batteries (ML series)

Features

These super compact lithium rechargeable batteries feature a manganese compound oxide for the positive electrode, a lithium/aluminum alloy for the negative electrode and a special non-aqueous solvent for the electrolyte. They can easily be incorporated into circuits where 3V ICs are used to save space.

Applications

- Memory backup power supplies for mobile phones, memory cards, pagers and other compact communications equipment, data terminals and office automation equipment



General Specifications

Model No.	Electrical characteristics (20°C)			Dimensions(mm)		Weight(g)	JIS	IEC
	Nominal voltage(V)	*Nominal capacity(mAh)	Continuous drain(mA)	Diameter	Height			
ML612S	3	2.6	0.01	6.8	1.2	0.15	-	-
ML614S	3	3.4	0.01	6.8	1.4	0.17	-	-
ML616S	3	2.9	0.01	6.8	1.6	0.2	-	-
ML621S	3	5.0	0.01	6.8	2.1	0.3	-	-
ML920S	3	11.0	0.03	9.5	2.0	0.5		
ML1220	3	17.0	0.03	12.5	2.0	0.8		
ML2020	3	45.0	0.10	20.0	2.0	2.2	-	-
ML2430(Under development)	3	120.0	0.30	24.5	3.0	4.0		

*Nominal capacity shown above is based on standard drain and cut off voltagedown to 2.0V at 20°C.

Charging

■ Charging circuits

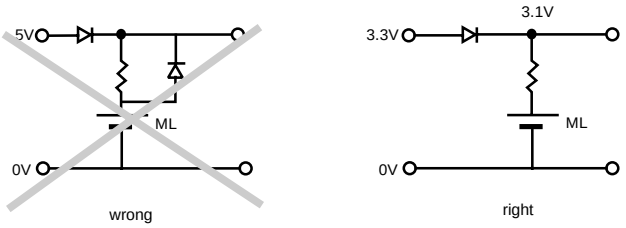
Charging/discharging cycle	Approx. 1,000 times at 10% discharge depth to nominal capacity
Charging system*	Constant-voltage charging.(Please strictly adhere to the specified charge voltage)
Operating temperature	-20 °C ~ + 60 °C

* Consult with Panasonic concerning constant-current charging systems.

The charging circuit is crucial in terms of ensuring that full justice will be done to the battery characteristics. Consider it carefully as the wrong charging circuit can cause trouble.

■ Precautions regarding the charge voltage setting

Under no circumstances should trickle charging, which is used for nickel-cadmium batteries, be used.
Ignoring this precaution will cause the battery voltage to rise to about 5V, resulting in a deterioration of performance.



■ Charge voltage range

If a fixed-charging method is applied, please adhere to the specified charging voltage.
Guaranteed voltage is 2.8V ~ 3.2V at the temperature of -20°C~60°C.

* If the charging voltage exceeds the specifications, the internal resistance of the battery will rise and may cause battery deterioration. Also, with a charge voltage around 4V, corrosion of the (+)terminal (case) may occur, causing leakage. ("Influence of the charge voltage on ML batteries" on the back.)
* It is not possible for the battery capacity to recover completely when the charging voltage is below the specification.

■ Recommended charging circuits

● Basic conditions

Fixed-voltage charge
Charge voltage: 2.8~3.2V (Standard voltage: 3.1V)
Charge current: For a battery voltage of 2.5V

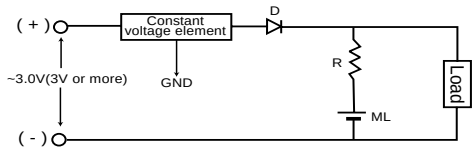
ML612S,ML614S,ML616S	Approx. 0.3 mA or below
ML621S	Approx. 0.6 mA or below
ML920S	Approx. 1.2 mA or below
ML1220	Approx. 1.2 mA or below
ML2020	Approx. 3.0 mA or below

■ Mixed usage of batteries

Do not use these batteries and lithium primary batteries or other rechargeable batteries together, and do not use new batteries and old batteries together even if they are of the same type.

● Reference: Examples of 5-V charging circuits

①



When charging using another battery

ML612S, ML614S, ML616S

REG	D	R
3.2V	MA700	1.8KΩ
3.1V	MA700	1.5KΩ

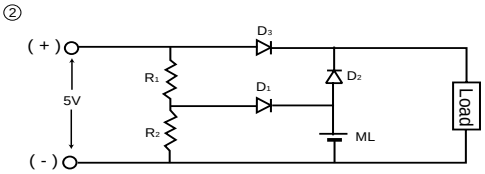
ML621S

REG	D	R
3.2V	MA700	910Ω
3.1V	MA700	750Ω

ML2020

REG	D	R
3.2V	MA700	180Ω
3.1V	MA700	150Ω

②



Standard circuits

For D_2 , select a diode of small inverse current

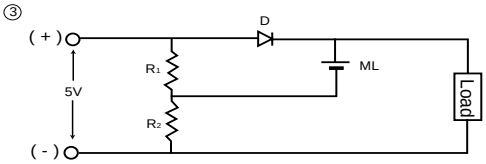
D_1, D_2 : MA716(Diode type code)

D_3 : MA704, MA700

(I_R=1μA/5V)

	R_1	R_2
ML612S, ML614S ML616S	2.7k Ω	5.1k Ω
ML621S	1.1kΩ	2.0k Ω
ML2020	180Ω	330 Ω

③



Pat No.JP284170

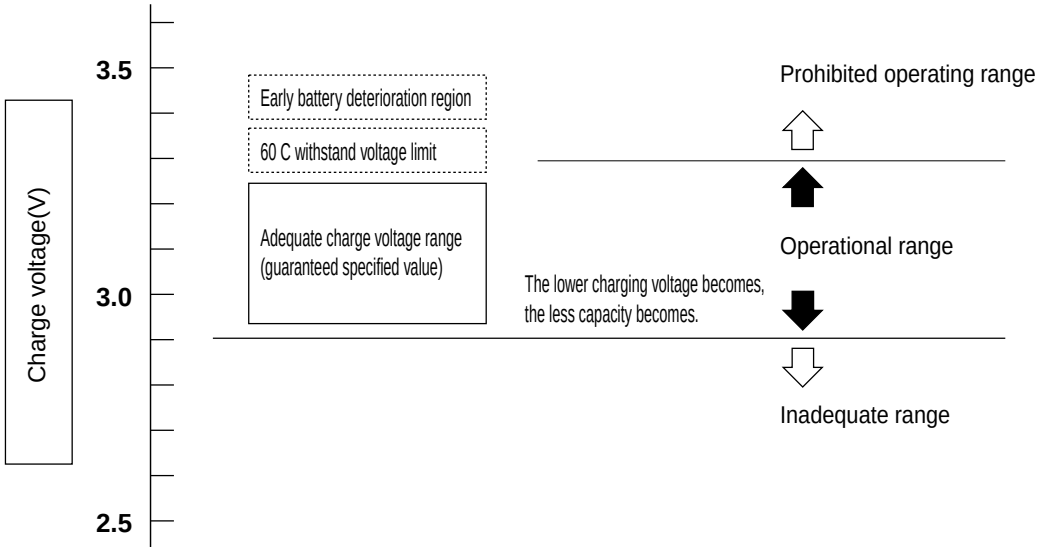
Simple economical circuits D : MA700 : Very small inverse current

Load	100μA below	
D,Vf	0~0.2V	
	R_1	R_2
ML612S, ML614S ML616S	5.1kΩ	2.7kΩ
ML621S	2.4kΩ	1.3kΩ
ML2020	330 Ω	180 Ω

* VF of D will be different from the value given above if a current in excess of 100μA flows to the load during operation. Compensation must be provided by the resistors in such cases.

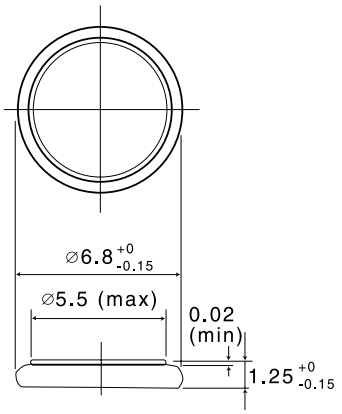
● Influence of the charge voltage on ML batteries

If the charge voltage goes beyond its adequate range, battery performance may deteriorate early. Be sure to observe the guaranteed charge voltage.



ML612S

■ Dimensions(mm)

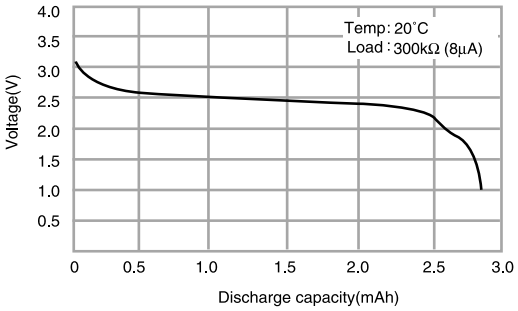


Weight: 0.15g

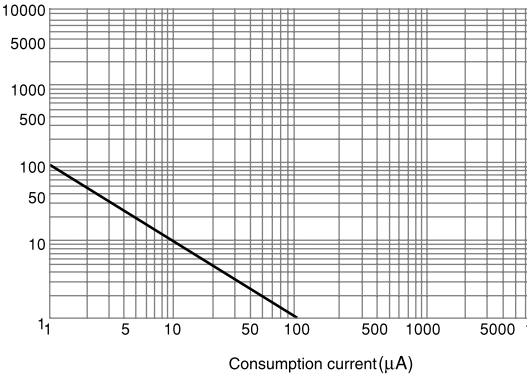
■ Specification

Nominal voltage(V)	3
Nominal capacity(mAh)	2.6
Continuous standard load(mA)	0.01
Operating temperature(˚C)	-20 ~ +60

■ Discharge characteristics

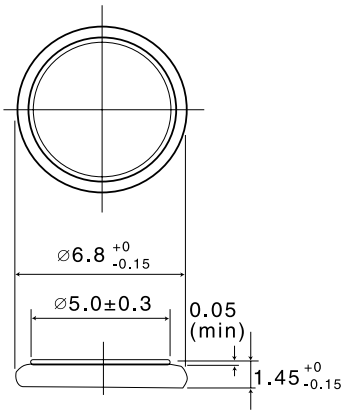


■ Consumption current vs. Duration time



ML614S

■ Dimensions(mm)

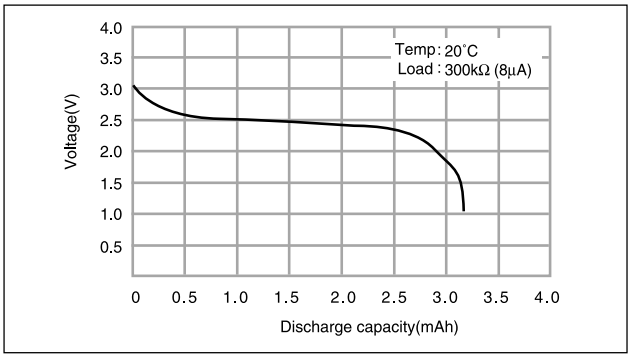


Weight: 0.17g

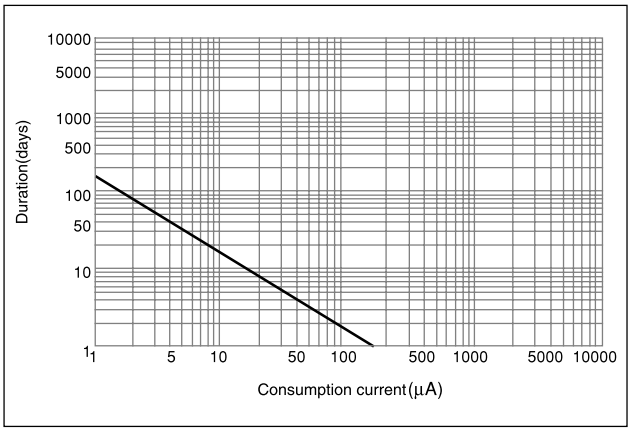
■ Specification

Nominal voltage(V)	3
Nominal capacity(mAh)	3.4
Continuous standard load(mA)	0.01
Operating temperature(˚C)	-20 ~ +60

■ Discharge characteristics

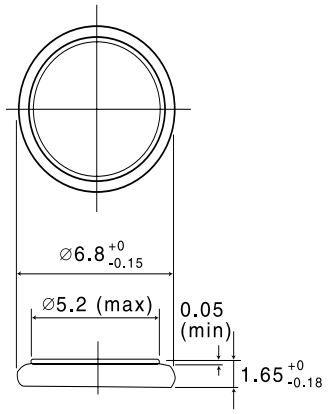


■ Consumption current vs. Duration time



ML616S

■ Dimensions(mm)

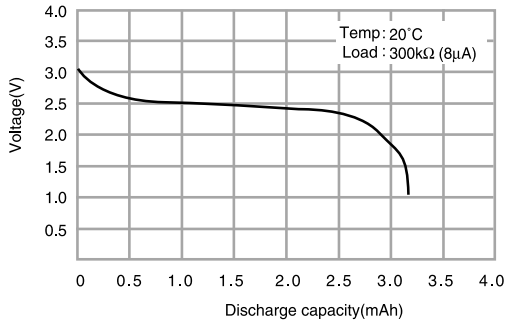


Weight: 0.20g

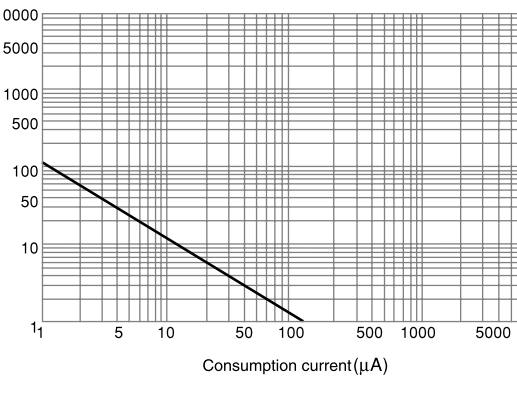
■ Specification

Nominal voltage(V)	3
Nominal capacity(mAh)	2.9
Continuous standard load(mA)	0.01
Operating temperature(˚C)	-20 ~ +60

■ Discharge characteristics



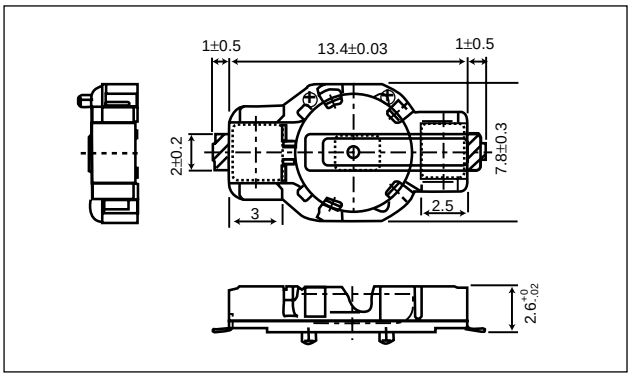
■ Consumption current vs. Duration time



Lithium Battery Holders for ML616S

These battery holders are designed for sure and easy loading/removal of Panasonic coin type lithium batteries in/from equipment enabling the batteries to fully exploit their capabilities as the backup power supply in C-MOS RAM memory and microcomputer memory. All of the battery holders are designed to prevent inverted insertion of the battery.

BML06H1

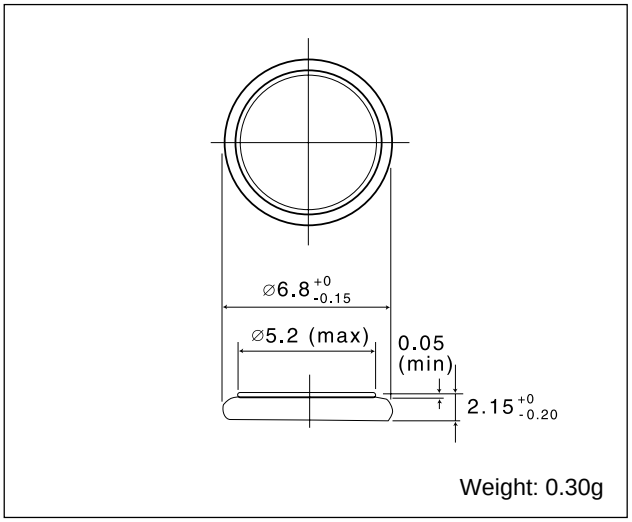


■ Precaution for washing battery holders

The battery holders can be adversely affected by some detergents used in the circuit board washing process and may result in cracks forming in the holder. Please test the holders in your washing process before use.

ML621S

■ Dimensions (mm)

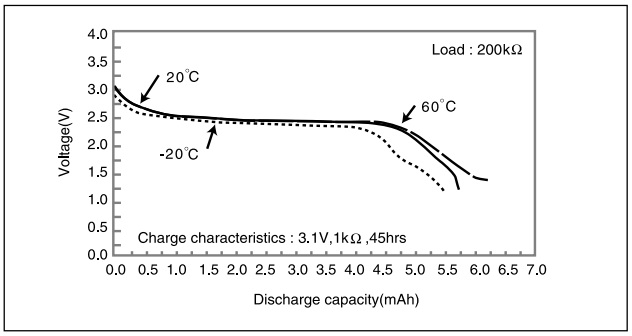


Weight: 0.30g

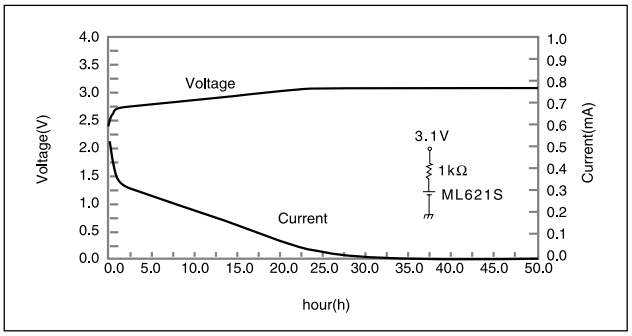
■ Specification

Nominal voltage(V)	3
Nominal capacity(mAh)	5
Continuous standard load(mA)	0.01
Operating temperature(˚C)	-20 ~ +60

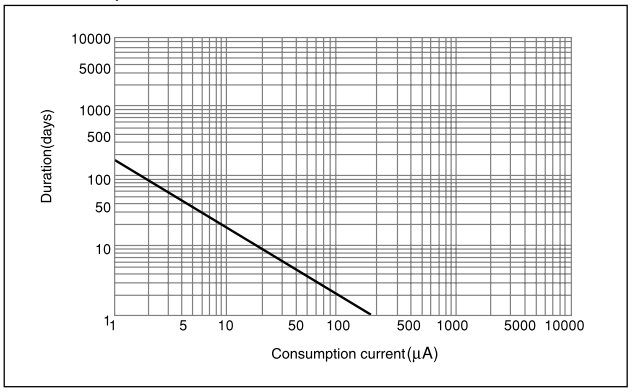
■ Discharge characteristics



■ Charge / discharge characteristics



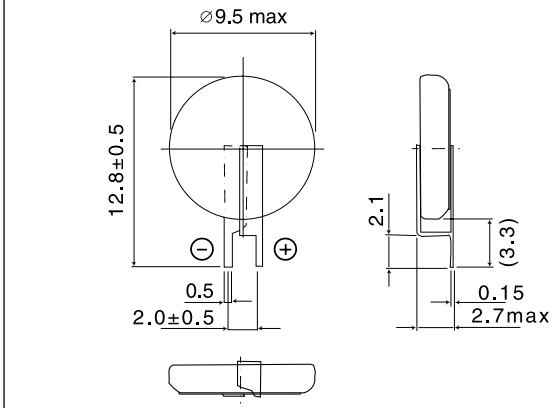
■ Consumption current vs. Duration time



ML920S

■ Dimensions (mm)

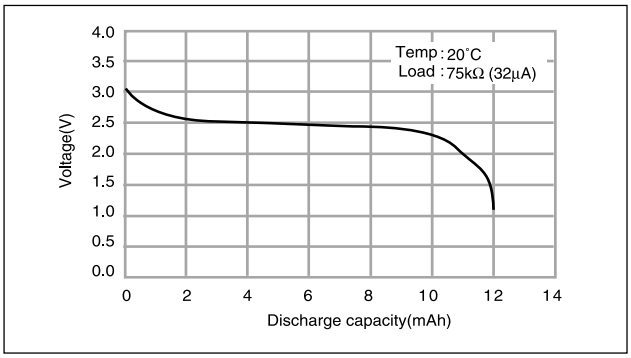
(ML920S / F9D)



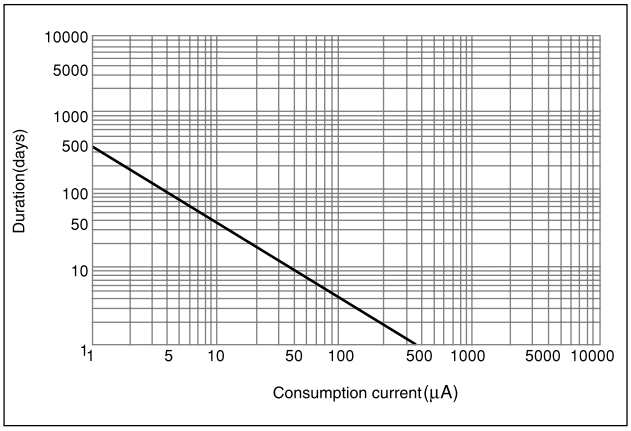
■ Specification

Nominal voltage(V)	3
Nominal capacity(mAh)	11.0
Continuous standard load(mA)	0.03
Operating temperature(˚C)	-20 ~ +60

■ Discharge characteristics



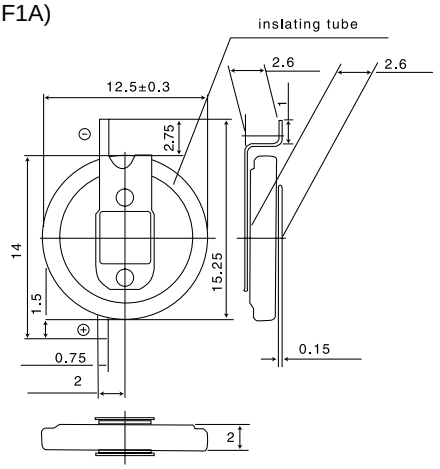
■ Consumption current vs. Duration time



ML1220

■ Dimensions(mm)

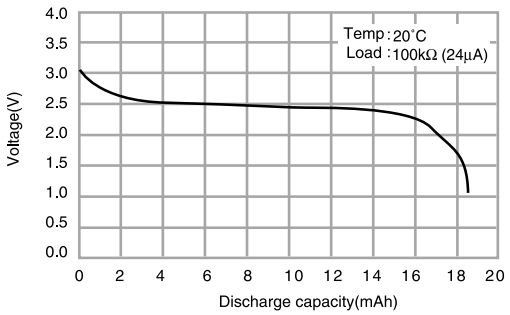
(ML1220 / F1A)



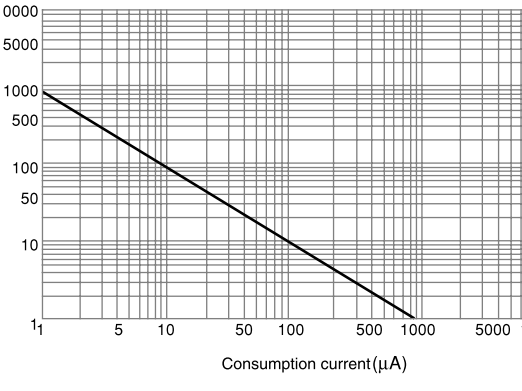
■ Specification

Nominal voltage(V)	3
Nominal capacity(mAh)	17.0
Continuous standard load(mA)	0.03
Operating temperature(˚C)	-20 ~ +60

■ Discharge characteristics



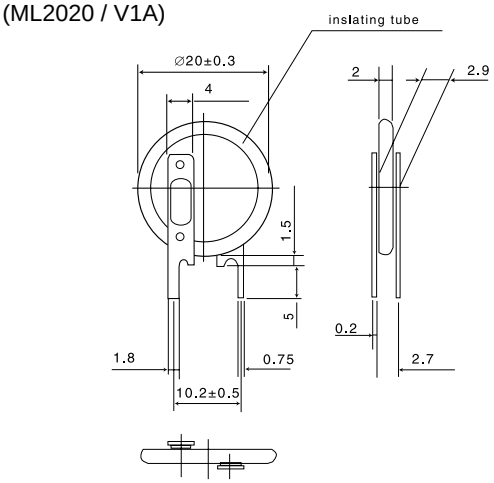
■ Consumption current vs. Duration time



ML2020

■ Dimensions(mm)

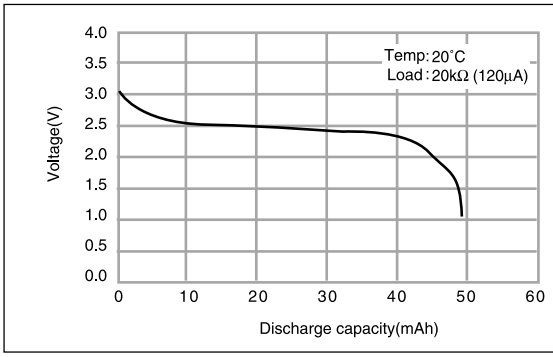
(ML2020 / V1A)



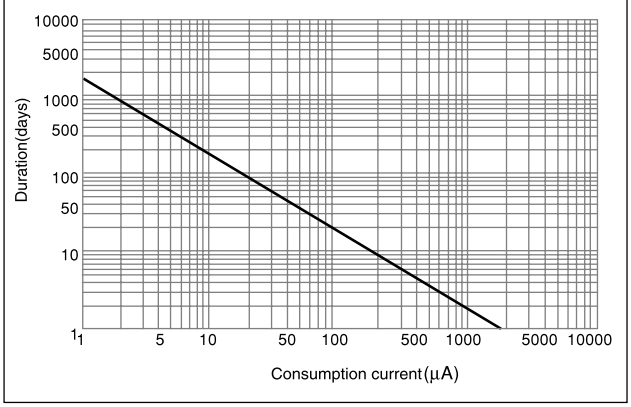
■ Specification

Nominal voltage(V)	3
Nominal capacity(mAh)	45
Continuous standard load(mA)	0.1
Operating temperature(˚C)	-20 ~ +60

■ Discharge characteristics



■ Consumption current vs. Duration time



ML2430(Under development)

■ Dimensions(mm)

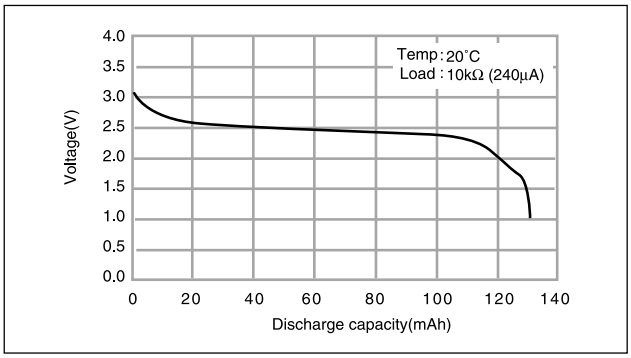
Under development

Weight: 4.0g

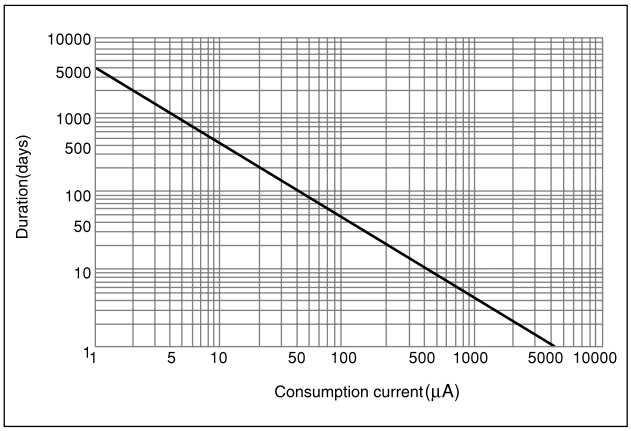
■ Specification

Nominal voltage(V)	3
Nominal capacity(mAh)	120
Continuous standard load(mA)	0.3
Operating temperature(˚C)	-20 ~ +60

■ Discharge characteristics



■ Consumption current vs. Duration time



3-3 Niobium-Lithium Coin Type Batteries (NBL series)

Niobium-Lithium Rechargeable Batteries (NBL series)

Features

The NBL series eliminates the need for a voltage boosting circuit since they can be charged at a low voltage. They help to simplify charging circuits.

Applications

- Memory backup power supplies for mobile phones using ICs which reduce the voltage to lower levels and which are driven at 2.5V or so.

General Specifications

Model No.	Electrical characteristics (20°C)			Dimensions(mm)		Weight(g)	JIS	IEC
	Nominal voltage(V)	*Nominal capacity(mAh)	Continuous drain(mA)	Diameter	Height			
NBL621	2	4	0.01	6.8	2.1	0.25	-	-

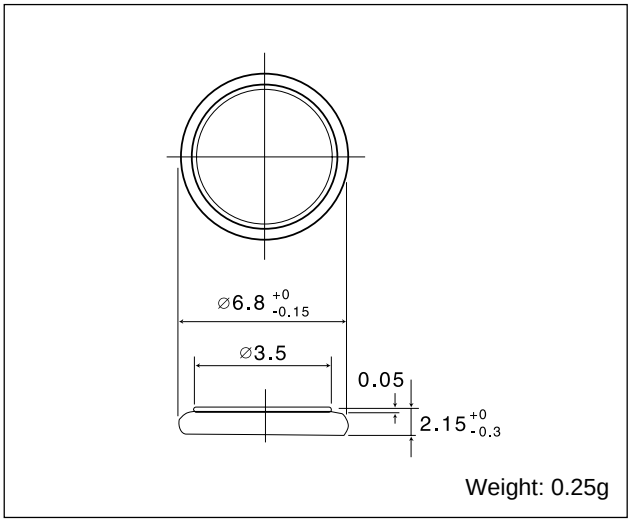
*Nominal capacity shown above is based on standard drain and cut off voltage down to 1.0V at 20°C.

Charging

Consult Panasonic for charging conditions.

NBL621

■ Dimensions(mm)

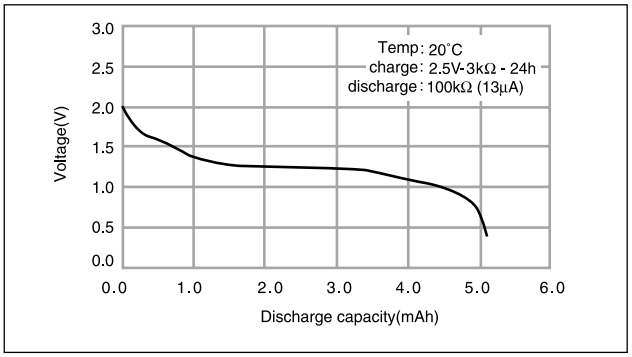


Weight: 0.25g

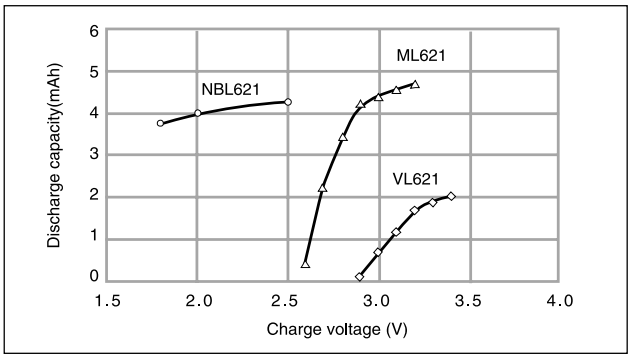
■ Specification

Nominal voltage(V)	2
Nominal capacity(mAh)	4
Continuous standard load(mA)	0.01
Operating temperature(˚C)	-20 ~ +60

■ Discharge characteristics



■ Recovered capacity (According to charge voltage)



3-4 Manganese Titanium Lithium Coin Type Batteries (MT series)

Manganese Titanium Lithium Rechargeable Batteries (MT series)

Features

These coin-type manganese titanium lithium coin batteries use a lithium-manganese complex oxide for the positive pole and a special lithium-titanium complex oxide for the negative pole. They provide a capacity which is more than 10 times that of capacitors of the same size.

Applications

- Main power supplies in compact products such as rechargeable watches
- Memory backup power supply for pagers, timers, etc.

General Specifications

Model No.	Electrical characteristics (20°C)			Dimensions(mm)		Weight(g)	JIS	IEC
	Nominal voltage(V)	*Nominal capacity(mAh)	Continuous drain(mA)	Diameter	Height			
MT516	1.5	0.9	0.05	5.8	1.6	0.15	-	-
MT616	1.5	1.05	0.05	6.8	1.6	0.20	-	-
MT621	1.5	2.5	0.05	6.8	2.1	0.25	-	-
MT920	1.5	4.0	0.10	9.5	2.0	0.45	-	-
MT1620	1.5	11.0	0.50	16.0	2.0	1.25	-	-

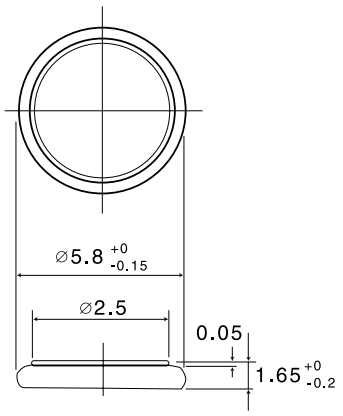
*Nominal capacity shown above is based on standard drain and cut off voltage down to 1.0V at 20°C.

Charging

Consult Panasonic for charging conditions.

MT516

■ Dimensions (mm)

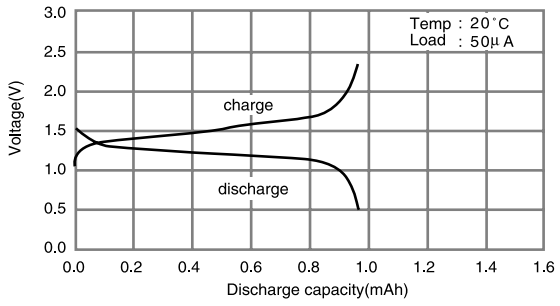


Weight: 0.15g

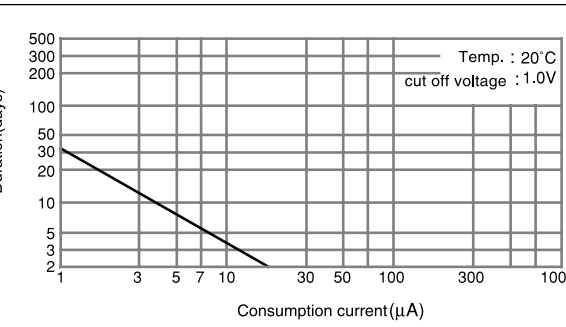
■ Specification

Nominal voltage(V)	1.5
Nominal capacity(mAh)	0.9
Continuous standard load(mA)	0.05
Operating temperature(˚C)	-20 ~ +60

■ Charge / discharge characteristics

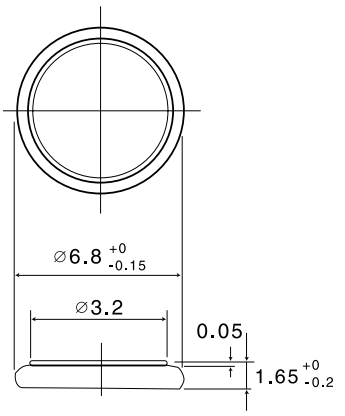


■ Consumption current vs. Duration time



MT616

■ Dimensions (mm)

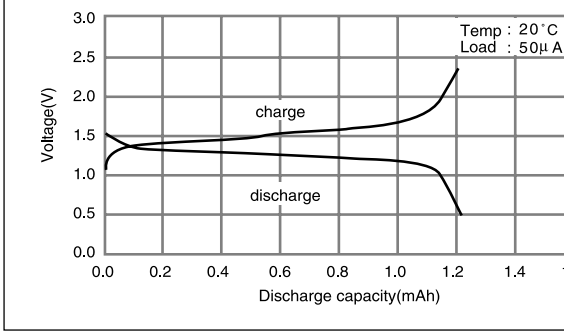


Weight: 0.20g

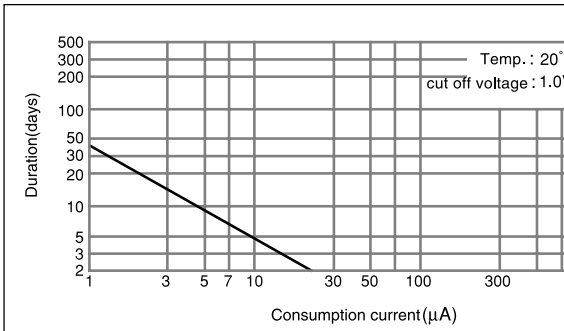
■ Specification

Nominal voltage(V)	1.5
Nominal capacity(mAh)	1.05
Continuous standard load(mA)	0.05
Operating temperature(˚C)	-20 ~ +60

■ Charge / discharge characteristics

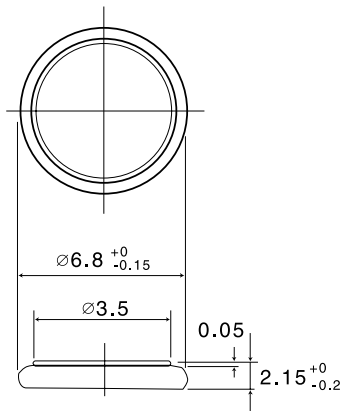


■ Consumption current vs. Duration time



MT621

■ Dimensions (mm)

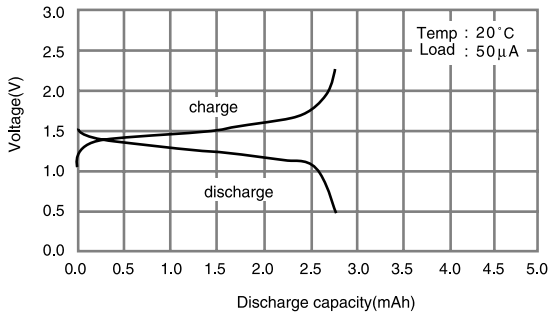


Weight: 0.25g

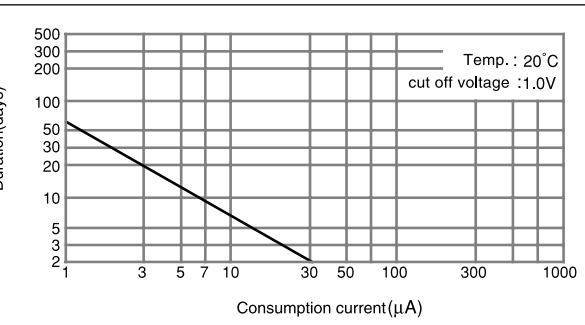
■ Specification

Nominal voltage(V)	1.5
Nominal capacity(mAh)	2.5
Continuous standard load(mA)	0.05
Operating temperature(˚C)	-20 ~ +60

■ Charge / discharge characteristics

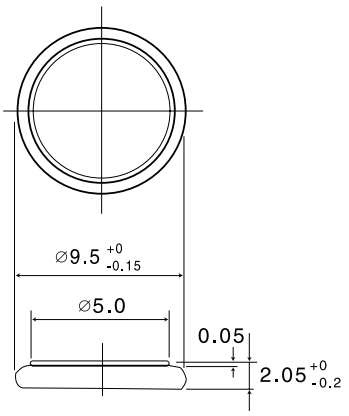


■ Consumption current vs. Duration time



MT920

■ Dimensions (mm)

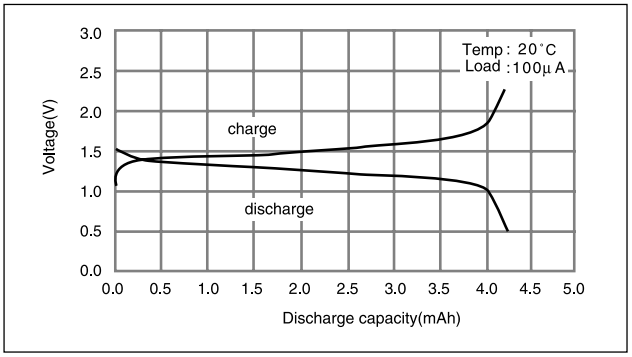


Weight: 0.45g

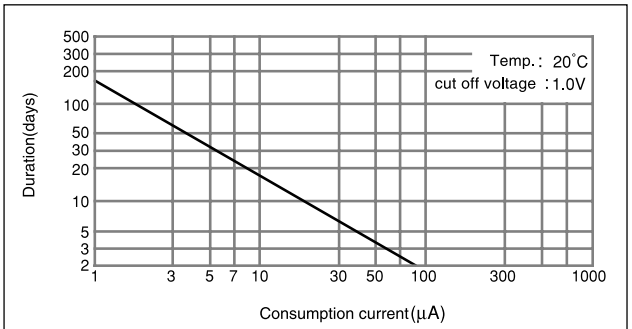
■ Specification

Nominal voltage(V)	1.5
Nominal capacity(mAh)	4.0
Continuous standard load(mA)	0.10
Operating temperature(˚C)	-20 ~ +60

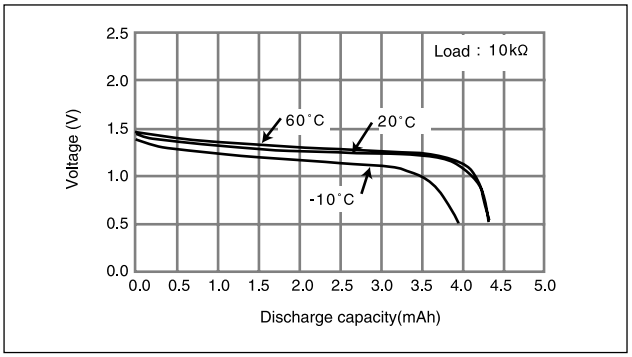
■ Charge / discharge characteristics



■ Consumption current vs. Duration time

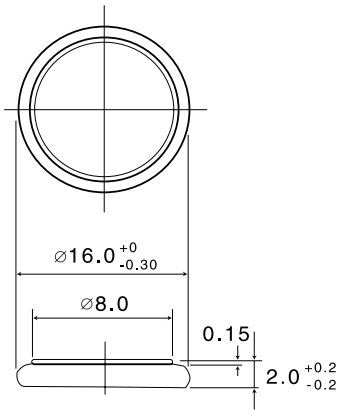


■ Discharge characteristics



MT1620

■ Dimensions (mm)

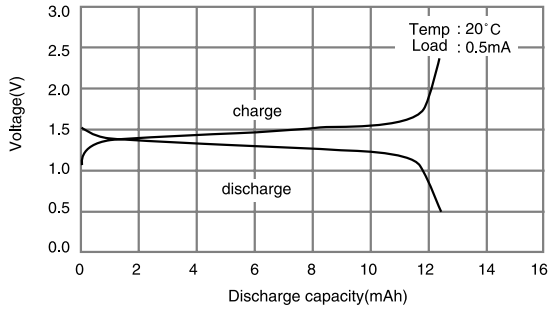


Weight: 1.25g

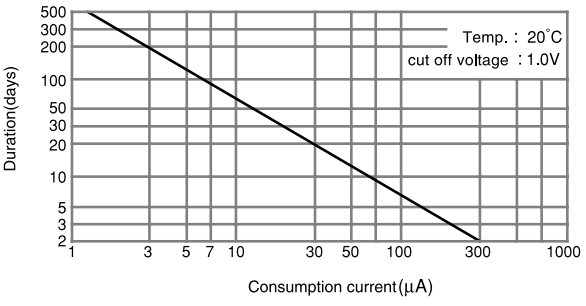
■ Specification

Nominal voltage(V)	1.5
Nominal capacity(mAh)	11.0
Continuous standard load(mA)	0.50
Operating temperature(˚C)	-20 ~ +60

■ Charge / discharge characteristics



■ Consumption current vs. Duration time



Chapter 4

Batteries with Terminals and Soldering Lithium Batteries

INDEX

Batteries with Terminals

Highly Reliable Terminal Welding

(1) Using a laser to weld terminals

Panasonic uses a laser welding method to weld the terminals onto the batteries so they can be mounted onto PC boards by soldering. This method has the effect of boosting the tensile strength accompanying a welding strength to approximately 100N (approx.10kgf) compared with 20N to 50N (approx. 2 to 5 kgf) yielded by the conventional resistance welding method. The method also more or less cuts in half the individual variations occurring in the welding. Furthermore, it enables terminals to be welded onto thin batteries, such as those with a thickness of 1.6 mm, and it improves compatibility with many other uses. This highly reliable terminal soldering method can be used in a wide range of applications, obviating eliminating the need for reinforcement or other such means.

(2) Execution of pre-soldering

The tips of the terminals are pre-soldered in order to enhance the reliability of the soldering.

Complete Line-up

Panasonic offers a full range of batteries with terminals for PCB mounting. Since the terminals come in a variety of types, please contact Panasonic for further details. A more limited selection of simple battery holders to support the batteries is also available.

Soldering

(1) Using a soldering iron

Do not allow the soldering iron to make direct contact with the bodies of the batteries. Proceed with the soldering quickly within 5 seconds while maintaining the iron tip temperature at about 350°C, and do not allow the temperature of the battery bodies to exceed 85°C.

(2) Automatic dip-soldering bath

Soldering with a dip-soldering bath can be used but do not allow the temperature of the battery bodies to exceed 85°C. It is important to note, depending on the temperature conditions inside the dipping device,that the battery body temperature may rise after dipping due to the residual heat retained. When a post-dipping temperature rise is observed, review the temperature conditions and consider a dipping time reduction or a way of forcibly cooling the batteries after dipping.

Basic conditions	
Dip-soldering bath temperature	260˚C or less
Dipping time	Within 5 sec.
Number of dips	Not more than 2

* Consult Panasonic if the battery body temperature will exceed 85°C.

⚠ Never Use Reflow Soldering

Never use reflow soldering since doing so directly heats the battery surface to high temperatures, causing electrolyte leakage, deterioration of battery characteristics and risking bursting or ignition.

Cautions

Example where the terminals were soldered straight onto a coin-type lithium battery, the terminals were connected to a PC board or other electronic components, and the heat generated by the soldering adversely affected the battery, resulting in a deterioration of the battery characteristics:

The heat generated when terminals are mounted using solder causes lithium to melt.

↓

The separator melts and becomes perforated.

↓

The positive and negative poles are welded together, causing "internal shorting."

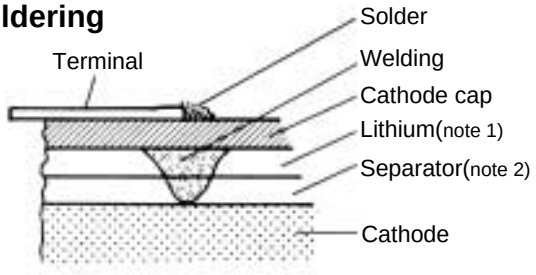
↓

In terms of the battery characteristics, the open-circuit voltage and electrical capacity are both reduced.

↓

The battery loses its functions or it bursts in rare cases.

Soldering



(note 1)Metal whose melting point is about 180°C
(note 2)Non woven cloth of polypropylene whose melting point is about 165°C

Chapter 5

Standards and Regulations

INDEX

QS9000 / ISO9001 Approval

The Lithium & Micro Battery Division has acquired certification under ISO9001, the international standard for quality assurance, for its cylindrical type lithium batteries and coin-type lithium batteries.

In addition, we have acquired certification under QS-9000, the quality standard for the automobile manufacturing industry, for its coin-type lithium primary batteries.

QS-9000

The QS-9000 standard was established by the "Big Three" U.S. automakers (Daimler-Chrysler, Ford and GM) on the basis of the ISO9001 international standard governing quality assurance but with additional requirements of their own.

A company which has been certified under this standard can supply highly reliable products by incorporating into its quality system proven "predictive management" techniques which are substantiated by numerical data from a customer satisfaction survey, failure mode and effects analysis (FMEA), process capability analysis, measurement systems analysis, etc. which are required under the standard.

Transporting Lithium Batteries

■ **Regulations for transporting lithium batteries (only batteries which have a solid cathode electrode are listed)**

(as of March / 2000)

Name of regulations		ICAO IATA		IMDG	Highway, Railway
Means of transportation		airplane	air cargo	ship	DOT
Application range		international		international	United States
A	Total weight of lithium battery	1g or less	1g or less	1g or less	1g or less
	Total weight of lithium battery pack	2g or less	2g or less	2g or less	2g or less
B	Total weight of lithium battery	5g or less	5g or less	5g or less	5g or less
	Total weight of lithium battery pack	25g or less	25g or less	25g or less	25g or less
C	Total weight of lithium battery	12g or less	12g or less	12g or less	12g or less
	Total weight of lithium battery pack	500g or less	500g or less	500g or less	500g or less
	Total weight of a carton	500g or less	500g or less	500g or less	500g or less
		Up to 5kg of batteries can be carried if they are packed in a container which is approved 2nd class by UN.	Up to 35kg of batteries can be carried if they are packed in a container which is approved 2nd class by UN.	Up to 250kg of batteries can be carried if they are packed in a container which is approved 2nd class by UN.	DOT;49CFR173.185

A: The batteries listed above are not subject to these restrictions provided that they satisfy the A45 conditions,IATA.

B: The batteries listed above are not subject to these restrictions provided that they have been certified as satisfying the test standards specified in the U.N. recommendation and as not falling under the classification of hazardous items.

C: The batteries listed above can be transported provided that they satisfy the conditions stipulated by the laws and regulations listed below and that they meet the packaging standards.

The regulation above is an extract of the latest version. See the original for details.

U N (United Nations)

ICAO (International Civil Aviation Organization)

IATA (International Air Transport Association)

IMO (International Marin Organization)

DOT (Department Of Transportation)

This section of the catalog is quoted by transportation hazards issued by the organizations shown above.

Security Export Control

"Security export control" entails observing the legislation provided to maintain international peace and safety by preventing the proliferation of weapons of mass destructions (nuclear weapons, chemical warfare weapons, biological weapons and missiles) and the excessive buildup of conventional weapons. COCOM, the committee that imposed controls on exports to the Communist bloc, was disbanded on March 31, 1994. However, the items, etc. which were restricted by COCOM are still the target of the restrictions but they are now also subject to some amendments which were made in September 1996.

Lithium batteries are on the list of items subject to the Export and Trade Control Regulation (Item 7 in annex Table 1) but all the products mentioned in this catalog are exempt from these regulations.

The above notwithstanding, these batteries may be subject to the regulations depending on their ultimate destination, application and other conditions.

When a non-exemption/exemption certificate is required for exportation, etc. or if you have any queries, contact a Panasonic sales representative.

Chapter 6

Avoiding Hazards and Preventing Quality Problems

INDEX

Avoiding Hazards

Case Study and Explanation

To store batteries, place each of the batteries in the sections provided on the designated tray in such a way that they will not make contact with one another.

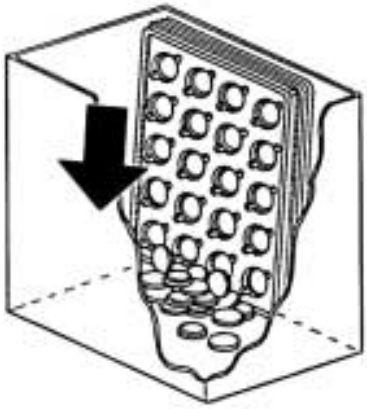
Ignition

2,000 new batteries were taken out from the 20-piece tray containers and thrown randomly into a cardboard box where they were stacked on top of one another. About 30 minutes later, smoke was seen emanating from the batteries followed by ignition several minutes after that.

Case study: Ignition of batteries stacked together

Rupture

This particular case involves batteries which were packed in trays and destined for OEMs. The batteries were packed in an intermediate package consisting of 10 trays with each tray containing 20 (or 40) batteries, and the trays were stacked on top of each other. The intermediate package (of the 10 trays) was opened at the distribution stage of our operations, and five of the trays were delivered to one customer. Since the trays were stored at an angle inside the box, the batteries fell out of their positions on the trays and became stacked up on the bottom inside the small box. As a result, some of the batteries burst.

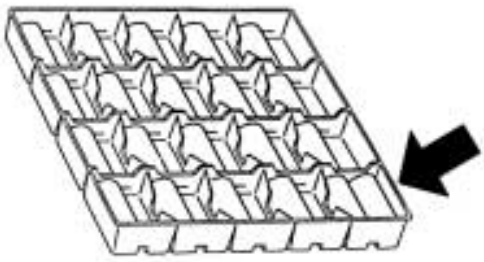


Case study: Bursting of batteries stacked on top of one another

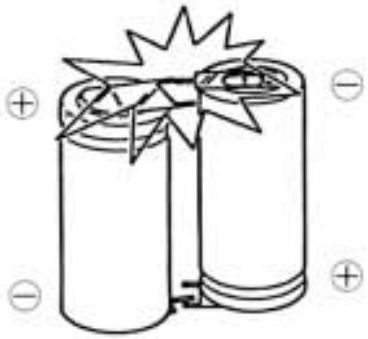
Generating Heat

21 cylindrical type lithium batteries with tab terminals were placed in a 20 piece tray--one battery more than the capacity of the 20-piece tray shown in the figure--two of the batteries were placed together with their poles reversed. As a result, the tab terminals came into contact with each other, causing external shorting, and the temperature of the two batteries rose dramatically, generating heat and causing the halon tubes to burst.

Since two batteries were placed in a space (indicated by ⬅) allocated to one battery, their terminals made contact with each other, and external shorting resulted.



➡ an enlargement



Generating heat and deterioration of capacity

To store batteries, place each of the batteries in the sections provided on the designated tray in such a way that they will not make contact with one another.

Reduction of Battery Voltage and Deterioration of Capacity

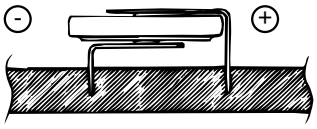
(1) Reduction of battery voltage and deterioration of capacity through contact with antistatic conductive materials

Incidents have been reported where terminal-mounted batteries for memory backup or coin-type lithium batteries have come into contact with antistatic conductive materials, thus forming external discharge circuits and leading to voltage drops or capacity deterioration.

In manufacturing plants using ICs, LSI and other semiconductor components, thoroughgoing antistatic measures are taken. Various protective materials are used to prevent static: most of them have special compounds of carbon, aluminum foil and other metals and are therefore conductive. These protective materials are used, for example, in the form of packaging bags, trays, mats, sheets, films, corrugated boards and resin cases.

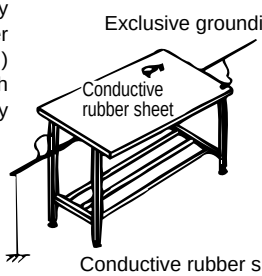
A protective material may have a resistance ranging from 10^3 to 10^6 Ω/cm, for instance. This means that if the (+) and (-) terminals of a battery come into contact with this material, a current ranging from several milliamperes to several microamperes will flow and the battery will discharge, causing voltage drop and capacity deterioration.

A terminal-mounted battery was inserted into a conductive mat. The battery charge was exhausted in several days.

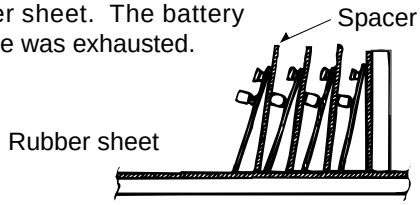


Conductive mat

A battery was placed directly on a rubber sheet spread over a worktable. The (+) and (-) terminals were in contact with the sheet and the battery charge was exhausted.



Battery-mounted PC boards were inadvertently brought into contact with spacers and a conductive rubber sheet. The battery charge was exhausted.



When batteries are to be used near protective materials, take every possible care to ensure that the (+) and (-) terminals of the batteries or PC boards, etc. on which batteries are mounted do not touch these protective materials directly.

A battery-mounted PC board was inadvertently brought into contact with a conductive resin case. The battery charge was exhausted.

Conductive resin case

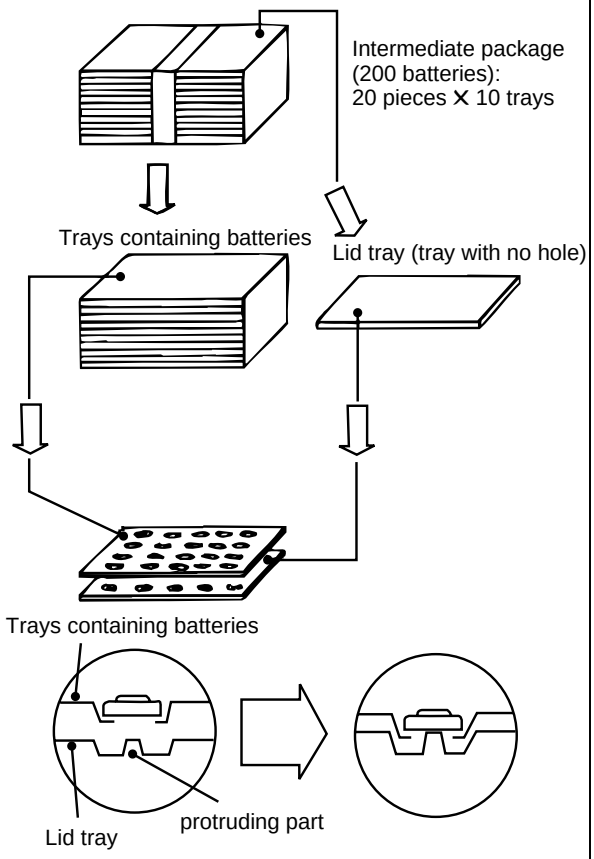
(2) Reduction of battery voltage and deterioration of capacity through contact between batteries

Incidents have been reported where terminal-mounted batteries for memory backup or coin-type lithium batteries have come into contact each other, thus forming discharge circuits (shorted state) and leading to voltage drops or capacity deterioration. Observe the following precautions.

1. Remove the batteries from the tray one at a time.
   If the tray is turned upside down, the batteries will come into contact with each other, forming discharge circuits.
2. Do not place batteries randomly in a parts box or other container.
   Discharge circuits will be formed by multiple batteries coming into contact numbers of the batteries, causing the batteries to discharge and drain.

○ Recommended procedures

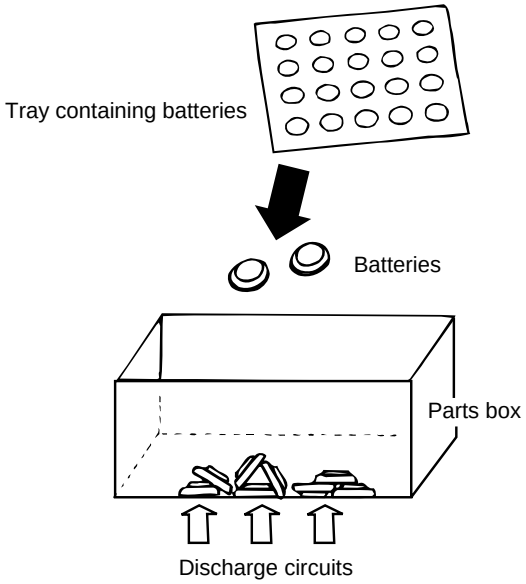
*Utilize the tray lid in taking out batteries

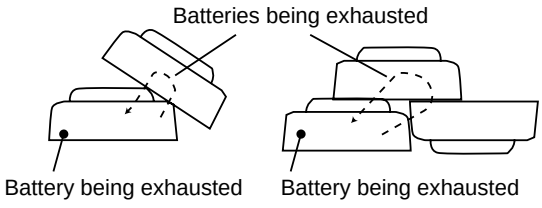


*Lay a tray lid flat and place a tray containing batteries on top of it: batteries are pushed up by protrusions of the lid tray so that they can be easily picked up with fingers.

× Prohibited procedures

*Do not throw batteries randomly into a parts box by turning over trays containing batteries.





*Contact of batteries with each other forms discharge circuits, thus the batteries are drained.

Memory Erasure Problems

Coin-type lithium batteries are often used as the power supplies for memory backup in various equipment. However problems with the erasure of valuable data in the memory due to improper contact between the batteries and equipment have been reported.

1. When batteries are to be used continuously for a prolonged period.

●Select tab terminal-mounted batteries, and solder the tabs to the battery connection terminals of the equipment. (See Fig. 1)

●When batteries need to be replaced, use a battery holder (see Fig. 2) or battery with lead wire connectors (see Fig. 3). Battery holders made by Panasonic (exclusively for the CR2032 and BR2032, see Fig. 2) are available for use.

2. When batteries need to be replaced in the short term, select batteries with no terminals or lead wire connectors.

●Use of Y-shaped terminals (2-point contact) for both the (+) and (-) poles as the shape of the connection terminals in the equipment helps to achieve a more stable contact. (See Fig. 4)

The contact pressure of the contacts should be no less than 2 to 10N (approx. 200 to 1000 gf). (See Fig. 5)

●To prevent momentary contact failure of several milliseconds in the circuit, the use of a tantalum capacitor, etc. with a capacitance of several microfarads is effective. (See Fig. 6)

●For the connection terminals of the equipment, use iron or stainless steel with nickel plating at the very least. Gold-plating is more suitable when the contact resistance must be reduced.

Note: Do not touch batteries with bare hands because perspiration (salt), body oil etc. will increase the surface resistance which may lead to defective contact.

<Reference Sample>

Fig.1: soldering

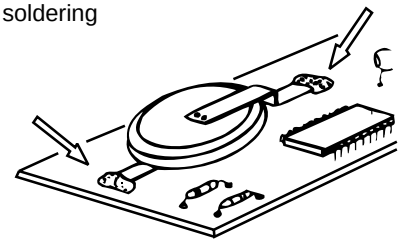


Fig. 2

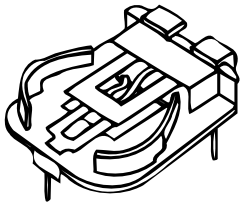


Fig. 3

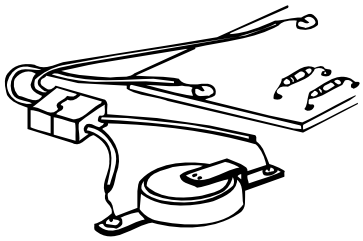


Fig. 4

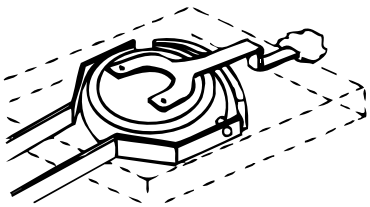


Fig. 5: excessive load

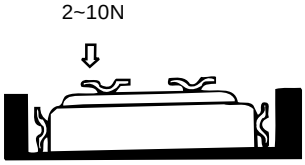
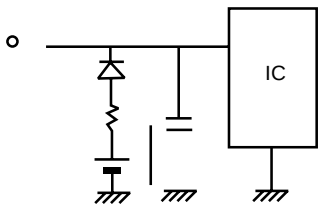


Fig. 6



Panasonic

Batteries - Create A New World

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