**Safety Precautions and Usage Guidance**

Some batteries contain flammable substance which, if mishandled, may result in electrolyte leakage, deformation, heat-generation, rupture, and/or fire. Please be sure to observe the following safety precautions.

**DANGER: READ BEFORE USE**

1. Do not expose batteries to hot water, radiation, varnish heat, or any other liquid, or allow batteries to get wet. Submersion in water may be accompanied, potentially resulting in heat-generation, smoke-generation, rupture, and/or fire.

2. Do not use or store batteries next to fire, stove, or other high-temperature objects at 60 °C or over. If the battery separator gets damaged due to heat exposure, short-circuiting inside batteries may cause heat-generation, smoke-generation, rupture, and/or fire.

3. Never charge any battery type except rechargeable batteries. Ensure the device’s circuit design prevents current injection from other power sources.

4. If an abnormal odor, discoloration, deformation, or other unusual symptom is detected when using, charging, or storing batteries, take them out of the device or charger, and do not use them. Using them as-is may result in heat-generation, smoke-generation, rupture, and/or fire.

5. Every battery has a predetermined polarity. If the battery does not fit comfortably in a battery charger or appliance, do not insert the battery by force. Instead, check the battery’s polarity. In case of reverse connection, batteries may charge backwards causing an abnormal chemical reaction which may result in leakage, heat-generation, smoke-generation, rupture, and/or fire.

6. Do not attach batteries to an AC source or directly to a vehicle’s electrical outlet. The may result in electric shock, voltage spikes, and excessive current flow within the battery causing leakage, heat-generation, smoke-generation, rupture, and/or fire. Please visit our website for the latest information: https://industrial.panasonic.com/

7. Using batteries for unapproved applications may affect battery performance or reduce battery life. Change in some devices may damage batteries due to exposure to excessive heat, short-circuiting, overheating, or solarization. In some cases, charging in high-generation, smoke-generation, rupture, and/or fire.

8. Do not store batteries near or in high-temperature. This will melt the insulator, damaging the gas valve and other safety measures, or ignite the electrolyte, resulting in heat-generation, smoke-generation, rupture, and/or fire.

9. Do not connect the positive terminal and negative terminal of a battery with any metal objects. Also, do not store or carry batteries where they could contact keys, hardware, paper clips, jewelry, etc. This may cause short-circuiting and excessive current flow resulting in heat-generation, smoke-generation, rupture, and/or fire.

10. Do not perform actions that may deform the positive electrode. For this reason, do not deform the positive electrode.

11. Do not charge batteries in direct sunlight, use, or store batteries inside cars in hot weather. This may result in battery leakage, heat-generation, and/or smoke-generation. Product performance and lifespan may be also be reduced.

**WARNING**

1. To avoid accidental ingestion of small batteries, keep devices and batteries out of reach of children. If swallowed, seek emergency medical care immediately.

2. Do not place batteries in microwave ovens, high-pressure containers, or induction cookers. This may result in heat-generation, smoke-generation, rupture, and/or fire.

3. Keep new batteries separate from used batteries, and never mix batteries of different capacities, types, or brands. This may result in heat-generation, smoke-generation, rupture, and/or fire due to over-discharging or over-charging and other abnormal chemical reactions inside the batteries when in use.

4. Never charge or discharge batteries beyond their maximum current flow. Over-discharging or over-charging may result in heat-generation, and/or fire.

5. When charging exceeds the specified replacement time, stop charging the battery as soon as possible. Failing to do so may cause over-charging or result in heat-generation, smoke-generation, rupture, and/or fire.

6. Take extreme care to prevent batteries from contacting fire or leakage of an unusual material. Avoid excessive vibration, shock, or jolting, preventing abnormal reactions inside the batteries.

7. If leaked electrolyte contacts eyes, do not rub them. Immediately wash the affected area with clean water and consult a doctor. Exposure to electrolyte may result in loss of eyesight if left untreated.

8. Do not incinerate batteries or heat them to high temperatures. This will melt the insulation, damaging the gas valve and other safety measures, or ignite the electrolyte, resulting in heat-generation, smoke-generation, rupture, and/or fire.

9. When discarding used batteries, follow all relevant government laws and regulations in your country or region.

10. Secure batteries in locked storage areas to prevent theft or accidental ingestion. Always dispose of batteries properly.

11. Never disassemble, modify, or twist batteries inside the pack. Built-in safety equipment may be compromised, potentially resulting in heat-generation, smoke-generation, rupture, and/or fire.

12. If you notice oxidization, abnormal odor, excessive heat, or any other unusual symptoms when using batteries for the first time after purchasing, do not use them and return them to point of purchase.

13. When batteries are likely to be used by small children, caregiver should provide advice on safe usage based on the user manual and provide adequate supervision to ensure the batteries are properly used.

14. Do not use batteries when the battery temperature is greater than 80 °C or damage may damage batteries due to abnormal chemical reactions inside the batteries when in use.

15. If batteries are used in a vehicle, keep them as far away from the fuel tank as possible. Failing to do so may cause over-charging or result in heat-generation, smoke-generation, rupture, and/or fire.

16. Some batteries cannot be installed in hermetically sealed equipment. Doing so may cause gas buildup inside the device, which may result in rupture or explosion if ignited.

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18. Some batteries contain absorbable electrolyte. Accidental exposure may result in loss of eyesight. In contact cases, do not rub the eye, but immediately wash with clean water and have medical assistance as soon as possible.

**CAUTION**

1. Do not place batteries in direct sunlight, use, or store batteries inside cars in hot weather. This may result in battery leakage, heat-generation, and/or smoke-generation. Product performance and lifespan may be also be reduced.

2. Do not use batteries where the temperature exceeds the specified values in the user manual. Batteries may charge abnormally, causing an abnormal chemical reaction inside the battery which may result in heat-generation, smoke-generation, rupture, and/or fire.

3. Regarding temperature range when charging batteries, contact your Panasonic sales representative or dealer for more details. Charging batteries outside the designated temperature range may result in battery leakage, heat-generation, and/or rupture, or reduce battery performance and lifespan.

4. Be sure to read instruction manual before use. Keep it in a safe place and refer to it when needed.

5. Carefully read the instruction manual(s) of the dedicated charger to learn how to properly and safely charge the battery.

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9. If batteries are used in a vehicle, keep them as far away from the fuel tank as possible. Failing to do so may cause over-charging or result in heat-generation, smoke-generation, rupture, and/or fire.

10. Do not peel or scratch off the protective outer tube of a battery. Doing so can easily cause the batteries to leak, generate heat, and/or explode.

11. Do not charge batteries in hot weather. In high-temperature locations, a safety mechanism works to prevent danger but may impede charging or keep the charging duration longer than usual. In heat-generation, smoke-generation, rupture, and/or fire due to charging via abnormal current flow/voltage or abnormal chemical reaction inside the battery.

12. Some batteries incorporate a gas-venting structure to discharge internal gases. For this reason, do not use the positive electrode.

13. Some batteries cannot be installed in hermetically sealed equipment. Doing so may cause gas buildup inside the device, which may result in rupture or explosion if ignited.

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Panasonic Energy Device Business Division

Panasonic commenced in-house dry battery production in 1931. For almost 90 years, we’ve developed countless batteries and overcome the challenges of mass-production to deliver a cumulative total of over 200 billion units to more than 120 countries. Panasonic batteries play a vital role in the automotive industry, where our products contribute to on-road safety; in commercial infrastructure where 5G/LPWA wireless networks are deployed; and in IoT-based medical equipment. We will continue creating high-quality batteries that support healthy society while contributing to the growth of our customers’ businesses.

History of Energy Device Business Division

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Batteries for Automotive Applications

Panasonic batteries for automotive applications, such as anti-theft security systems and eCall systems (emergency call systems), can be counted on to function reliably in emergencies. They are safe, long-lasting, and ideally suited to automotive backup applications.

- Coin-type Lithium Batteries / Rechargeable Lithium Batteries
- Nickel-Metal Hydride Batteries

Remote Keyless Entry / Anti-theft Security Systems

eCall Systems (Emergency Call Systems)

Event Data Recorder (EDR)

Tire Pressure Monitoring Systems (TPMS)

Batteries to Support Infrastructure

We offer a range of batteries developed for infrastructure support where they serve as main power sources in smaller devices or as emergency backup supplies. They are engineered to sustain long-life performance in the toughest environments. Infrastructure-type batteries contribute to a comfortable, safe, and secure society by supplying requisite electricity in a way that protects people and the environment.

- Coin-type Lithium Batteries / Rechargeable Lithium Batteries
- Cylindrical-type Lithium Batteries
- Nickel-Metal Hydride Batteries

Emergency Lights / Guide Lights

Gas Meters / Water Meters

Elevators

Fire Alarms
IoT devices connected to LPWA networks enable data communication over long distances with minimal power consumption and are usually installed in difficult-to-access locations, meaning cell replacement should be infrequent. Batteries for IoT / LPWA applications must therefore possess outstanding endurance. Panasonic offers a variety of long-lasting battery types designed for stable discharge over long periods.

- Pin-type Lithium Batteries
- Cylindrical-type Lithium Batteries
- Nickel-Metal Hydride Batteries
- Alkaline Dry Batteries

Pin-type lithium-ion batteries are perfectly adapted power-sources for small portable devices. The super-small slimline batteries not only enable more compact, stylish device design, but also deliver high output, excellent levels of safety, and extended reliability. They are used in wearable technology and in small medical appliances such as hearing aids. Panasonic pin-type lithium-ion batteries play an important role in product development and are already expanding application possibilities in these markets.
Lithium Battery Features

(1) Wide Product Range
We provide a wide selection of different products engineered to suit an even wider range of applications from primary power supply to backup power insurance in emergency situations.

(2) Proven Reliability
We possess more than 40 years’ experience in lithium battery design, innovation, product development, and mass production techniques with a proven track record for safety and reliability.

(3) Durable Performance in Tough Conditions
Expect dependable performance in the harshest conditions and excellent resistance to extremes in temperature—a welcome characteristic when deployed in meters that are in use for extended periods.

Primary Lithium Batteries (Non-chargeable)
- Coin-type Lithium Batteries
- Cylindrical-type Lithium Batteries
- Pin-type Lithium-ion Batteries

Rechargeable Lithium Batteries
- Coin-type Rechargeable Lithium Batteries
- Pin-type Rechargeable Lithium Batteries

Pin-type Lithium-ion Battery Features

(1) Ultra Small, Super Slim Batteries
Tiny slimline batteries support stylish device design with high power output.

(2) High Safety and Reliability
High-strength stainless exterior case enhances safety and reliability.

(3) Supports Rapid Charging
Faster recharge times make portable devices easier to use.

Example Lithium Battery Model-Number Composition (Coin Type)
Example: CR2032
- Size

- Example: CG-320A
- Size

Nickel-Metal Hydride Battery Features

(1) Works in a Range of Temperatures
Stable performance in harsh conditions with a wide operating temperature.

(2) Eco-friendly Power
Rechargeable designs limit wastage for reduced environmental impact.

(3) Ideal Replacement for Nickel-Cadmium Batteries
A longer-lasting alternative to nickel-cadmium batteries.

Nickel-Metal Hydride Batteries
- CR Series (Manganese Dioxide Lithium Batteries)
- BR Series (Poly-carbonmonofluoride Lithium Batteries)
- CR Series (Manganese Dioxide Lithium Batteries)
- BR Series (Poly-carbonmonofluoride Lithium Batteries)
- BR Series (Poly-carbonmonofluoride Lithium Batteries)
- VL Series (Vanadium Rechargeable Lithium Batteries)
- ML Series (Manganese Rechargeable Lithium Batteries)
- MS Series (Manganese Silicon Rechargeable Lithium Batteries)
- CTL Series (Cobalt Titanium Rechargeable Lithium Batteries)
- MT Series (Manganese Titanium Rechargeable Lithium Batteries)

Dry Battery Features

(1) A Tradition of Quality and Reliability
Panasonic continues to innovate on a foundation of almost 90 years’ experience in battery design and now production on a global scale.

(2) Excellent Reliability in Various Devices
High- to low-rate discharge recommended for use in a wide variety of devices.

(3) Designed for Global Users
Our exclusive industrial batteries are labeled in English, Japanese, and Chinese.

Dry Batteries
- Alkaline Batteries
- Manganese Batteries
Panasonic Coin-type Lithium is renowned for stellar performance in small electric appliances and for flexible implementation in memory-backup applications in temperatures as high as 125 °C. Select from a CR or BR chemistries, a choice of sizes, and a range of capacities up to 1,000 mAh.

### Coin-type Lithium Batteries

**Features**
- Offers high-rate pulse discharge
- Available in a range of compact sizes and capacities, from thin-type to high-capacity models
- Excellent low-temperature performance enhanced by manganese-dioxide positive pole

**Applications**
- Remote keyless entry, card remote controls, memory backup, security price tags, smart transmitter tags, etc.

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### CR Series Manganese Dioxide Lithium Batteries

**Features**
- Superior discharge characteristics
- Designed for use in equipment operating in high-temperature environments (max. 125 °C)

**Applications**
- Automotive electronic components (TPMS, ETC), hot water and electricity meters, etc.

---

### CR Series Manganese Dioxide Lithium Batteries for High Temperatures

**Features**
- Superior discharge characteristics
- Designed for use in equipment operating in high-temperature environments (max. 125 °C)

**Applications**
- Automotive electronic components (TPMS, ETC), hot water and electricity meters, etc.

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### BR Series Poly-carbonmonofluoride Lithium Batteries

**Features**
- BR Series batteries developed with exclusive Panasonic technology
- Exhibits stable performances after long periods in storage due to low self-discharge characteristics
- Primarily used for memory-backup power in low-drain applications

**Applications**
- Commercial equipment (communication/measurement devices), electricity meters, memory backup (security cameras, security sensors), automotive electronic components (ETC), etc.

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### BR Series Poly-carbonmonofluoride Lithium Batteries for High Temperatures

**Features**
- In addition to the appeal of our BR Series coin-type lithium batteries, poly-carbonmonofluoride cells can operate in temperatures up to 125 °C

**Applications**
- Automotive electronic components (TPMS, ETC), hot water and electricity meters, memory backup (host computers, FA equipment), etc.

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The data provided in this document is for descriptive purposes only and does not imply any guarantee or warranty.
Cylindrical-type Lithium Batteries

CR Series Manganese Dioxide Lithium Batteries (Standard Type)

Features
- Offers super-high-rate discharge with ample power and extended life when used in cameras, lights, etc.
- Also available in the consumer marketplace

Applications
- Lights, security devices (electronic door locks, fire alarms), automotive electronic components (ID card systems), medical equipment (AEDs), etc.

BR Series Poly-carbonmonofluoride Lithium Batteries

Features
- Uncommonly long storage-life to suit metering devices and memory-backup

Applications
- Commercial equipment (communication/measurement devices), meters (gas, water, electricity, hot water), memory backup (large FA equipment), automotive electronic components (security alarms), etc.

BR Series Poly-carbonmonofluoride Lithium Batteries (Long-life Type)

Features
- Long-life batteries exhibiting excellent discharge stability for long-term use
- The superior choice for in-vehicle apparatus with compact design and outstanding discharge performance at very low temperatures

Applications
- Security devices (electronic door locks, fire alarms), automotive electronic components (tracking systems, security alarms), meters (gas, water, electricity), medical equipment (AEDs), etc.

Pin-type Lithium Batteries

BR Series Poly-carbonmonofluoride Lithium Batteries

Features
- Panasonic original battery design
- Tiny device that can generate continuous power for LED lights, etc.

Applications
- Electrical fishing-float lights, small transmitters, etc.
Coin-type rechargeable lithium is intended for applications where battery replacement is inconvenient, or the device’s construction renders replacement impractical. These batteries are ideal for memory backup or solar watches.

### VL Series Vanadium Rechargeable Lithium Batteries

**Features**
- Retains high-discharge voltage performance

**Applications**
- Memory backup printers, composite machines, medical equipment, RA equipment, remote keyless entry, fire alarms, etc.

<table>
<thead>
<tr>
<th>Model No.</th>
<th>Nominal voltage (V)</th>
<th>Nominal capacity (mAh)*1</th>
<th>Continuous drain (mA)</th>
<th>Mass (g)</th>
<th>Charge voltage (V)</th>
<th>Operating temperature range</th>
</tr>
</thead>
<tbody>
<tr>
<td>VL621</td>
<td>3.0</td>
<td>500</td>
<td>50</td>
<td>1.6</td>
<td>2.3</td>
<td>-20 °C to 60 °C</td>
</tr>
<tr>
<td>VL1220</td>
<td>3.0</td>
<td>1000</td>
<td>50</td>
<td>7.9</td>
<td>3.2</td>
<td>-20 °C to 60 °C</td>
</tr>
<tr>
<td>VL2020</td>
<td>3.0</td>
<td>1500</td>
<td>50</td>
<td>32.6</td>
<td>2.3</td>
<td>-20 °C to 60 °C</td>
</tr>
<tr>
<td>VL3020</td>
<td>3.0</td>
<td>2000</td>
<td>50</td>
<td>100.0</td>
<td>3.2</td>
<td>-20 °C to 60 °C</td>
</tr>
</tbody>
</table>

* Nominal capacity shown above is based on standard drain and cutoff voltage down to 3.0 V at 20 °C.

### MS Series Manganese Silicon Rechargeable Lithium Batteries

**Features**
- Supports more than 100 complete charge-discharge cycles

**Applications**
- Memory backup cameras, etc.

<table>
<thead>
<tr>
<th>Model No.</th>
<th>Nominal voltage (V)</th>
<th>Nominal capacity (mAh)*1</th>
<th>Continuous drain (mA)</th>
<th>Mass (g)</th>
<th>Charge voltage (V)</th>
<th>Operating temperature range</th>
</tr>
</thead>
<tbody>
<tr>
<td>MS614</td>
<td>3.0</td>
<td>600</td>
<td>50</td>
<td>2.7</td>
<td>2.9</td>
<td>-20 °C to 60 °C</td>
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<tr>
<td>MS1220</td>
<td>3.0</td>
<td>1200</td>
<td>50</td>
<td>5.0</td>
<td>2.6</td>
<td>-20 °C to 60 °C</td>
</tr>
<tr>
<td>MS2020</td>
<td>3.0</td>
<td>2000</td>
<td>50</td>
<td>10.0</td>
<td>2.3</td>
<td>-20 °C to 60 °C</td>
</tr>
</tbody>
</table>

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

### ML Series Manganese Rechargeable Lithium Batteries

**Features**
- Ideal for long-term memory backup with extra high capacity

**Applications**
- Digital/solar watches, sensing devices, etc.

<table>
<thead>
<tr>
<th>Model No.</th>
<th>Nominal voltage (V)</th>
<th>Nominal capacity (mAh)*1</th>
<th>Continuous drain (mA)</th>
<th>Mass (g)</th>
<th>Charge voltage (V)</th>
<th>Operating temperature range</th>
</tr>
</thead>
<tbody>
<tr>
<td>ML421</td>
<td>2.0</td>
<td>4.8</td>
<td>50</td>
<td>0.05</td>
<td>1.5</td>
<td>-20 °C to 60 °C</td>
</tr>
<tr>
<td>ML614</td>
<td>3.0</td>
<td>6.8</td>
<td>50</td>
<td>0.01</td>
<td>1.4</td>
<td>-20 °C to 60 °C</td>
</tr>
<tr>
<td>ML621</td>
<td>3.0</td>
<td>10.0</td>
<td>50</td>
<td>1.0</td>
<td>2.2</td>
<td>-20 °C to 60 °C</td>
</tr>
<tr>
<td>ML920</td>
<td>3.0</td>
<td>15.0</td>
<td>50</td>
<td>2.3</td>
<td>2.2</td>
<td>-20 °C to 60 °C</td>
</tr>
<tr>
<td>ML1220</td>
<td>3.0</td>
<td>20.0</td>
<td>50</td>
<td>2.0</td>
<td>2.5</td>
<td>-20 °C to 60 °C</td>
</tr>
<tr>
<td>ML2020</td>
<td>3.0</td>
<td>30.0</td>
<td>50</td>
<td>2.1</td>
<td>2.5</td>
<td>-20 °C to 60 °C</td>
</tr>
</tbody>
</table>

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

### CTL Series Cobalt Titanium Rechargeable Lithium Batteries

**Features**
- Rechargeable batteries with excellent charge-discharge cycle stability
- Compared to MT Series, CTL Series retains a higher voltage (2.3 V)
- Long-term reliability proved by applications in many solar watch designs

**Applications**
- Digital/solar watches, sensing devices, etc.

<table>
<thead>
<tr>
<th>Model No.*1</th>
<th>Nominal voltage (V)</th>
<th>Nominal capacity (mAh)*2</th>
<th>Continuous drain (mA)</th>
<th>Mass (g)</th>
<th>Charge voltage (V)</th>
<th>Operating temperature range</th>
</tr>
</thead>
<tbody>
<tr>
<td>CTL621F</td>
<td>2.6</td>
<td>240</td>
<td>100</td>
<td>1.4</td>
<td>2.6</td>
<td>-20 °C to 60 °C</td>
</tr>
<tr>
<td>CTL1220F</td>
<td>2.6</td>
<td>480</td>
<td>100</td>
<td>2.0</td>
<td>2.6</td>
<td>-20 °C to 60 °C</td>
</tr>
<tr>
<td>CTL1616F</td>
<td>2.6</td>
<td>960</td>
<td>100</td>
<td>3.6</td>
<td>2.7</td>
<td>-20 °C to 60 °C</td>
</tr>
</tbody>
</table>

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

### MT Series Manganese Titanium Rechargeable Lithium Batteries

**Features**
- High-current 1.5 V lithium rechargeable battery with sustained discharge endurance

**Applications**
- Watches, etc.

<table>
<thead>
<tr>
<th>Model No.*1</th>
<th>Nominal voltage (V)</th>
<th>Nominal capacity (mAh)*2</th>
<th>Continuous drain (mA)</th>
<th>Mass (g)</th>
<th>Charge voltage (V)</th>
<th>Operating temperature range</th>
</tr>
</thead>
<tbody>
<tr>
<td>MT126F</td>
<td>1.5</td>
<td>600</td>
<td>50</td>
<td>0.07</td>
<td>1.4</td>
<td>-10 °C to 60 °C</td>
</tr>
<tr>
<td>MT1220</td>
<td>1.5</td>
<td>1200</td>
<td>50</td>
<td>0.62</td>
<td>1.4</td>
<td>-10 °C to 60 °C</td>
</tr>
</tbody>
</table>

* Nominal capacity shown above is based on standard drain and cutoff voltage down to 1.5 V at 20 °C.
Pin-type Lithium-ion Batteries

This battery type is ideal for wearable devices and other nominal-drain applications. Our range delivers safe, stable output in a small, slim form.

### Features
- Small, slim battery design enables high output in smaller, more stylish products
- High-strength stainless casing boosts safety and reliability
- Rapid charging improves usability of portable devices

### Applications
Hearing aids, small medical devices, wireless earphones, stylus pens, smart glasses, wristband devices, etc.

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**Super-small and slim high-output battery for stylish devices**

Tiny, vibration-resistant form-factor lets designers make their products smaller, lighter, and more stylish, with power to support Bluetooth Low Energy and other functions that demand strong discharge stability.

**High-strength stainless case, high safety, high reliability**

No swelling, no leaks, no explosions, no fire. Certified to IEC62133/UL1642 standards (mass-produced models only)

* Panasonic testing

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**Pin-type Lithium-ion Batteries**

- **Super-small and slim high-output battery for stylish devices**
- **High-strength stainless case, high safety, high reliability**
- **Rapid charging makes everyday devices user-friendly**

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**Specifications**

- **Capacity retention (%)**
- **Voltage (V)**
- **Charge condition:** CC/CV
- **Charging time (min.)**
- **Operating temperature range**
- **Dimensions (mm)**
  - Pin Type
  - Height x Diameter: 3.65 mm x 20 mm
  - Weight: 6.0 g

---

**Note:** Panasonic lithium batteries are available in a selection of terminal shapes to meet your needs in a variety of applications. Typical types are shown above. For the latest technical and product information, please visit our website at [https://industrial.panasonic.com/ww/products/batteries/primary-batteries/lithium-batteries](https://industrial.panasonic.com/ww/products/batteries/primary-batteries/lithium-batteries)

---

**Pin-type Lithium-ion Batteries with Terminals**

- **Through-hole Type**
- **Surface-mount Type**

Note: Panasonic lithium batteries are available in a selection of terminal shapes to meet your needs in a variety of applications. Typical types are shown above. For the latest technical and product information, please visit our website at [https://industrial.panasonic.com/ww/products/batteries/primary-batteries/lithium-batteries](https://industrial.panasonic.com/ww/products/batteries/primary-batteries/lithium-batteries)

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**General Li-ion 18650-size**

- **Diameter:** 3.65 mm
- **Height:** 20 mm
- **Weight:** 6.0 g

---

**Pulse discharge characteristics**

- **Charge condition:** CC/CV
- **Discharging time (hr.)**
- **Charge condition:** CC/CV
- **Discharging time (hr.)**

---

**For more information, please visit:** [https://industrial.panasonic.com/ww/products/batteries/secondary-batteries/pin-li-ion](https://industrial.panasonic.com/ww/products/batteries/secondary-batteries/pin-li-ion)
### Nickel-Metal Hydride Batteries

**Infrastructure Backup (High-rate Discharge Type)**

<table>
<thead>
<tr>
<th>Features</th>
<th>Applications</th>
</tr>
</thead>
<tbody>
<tr>
<td>● Long 8–10-year operational life*</td>
<td>Emergency lights, guidance lights, LED lights, wireless base-stations, servers, elevators, ATMs, POS equipment, vending machines, medical equipment, etc.</td>
</tr>
<tr>
<td>● Excellent recharging performance in high temperatures (up to 75 °C)</td>
<td></td>
</tr>
<tr>
<td>● High-rate discharge (3 to 5 lt discharge/20 °C)</td>
<td></td>
</tr>
<tr>
<td>● Great alternative to other nickel-cadmium batteries</td>
<td></td>
</tr>
</tbody>
</table>

**Example charge characteristics**

<table>
<thead>
<tr>
<th>Voltage (V)</th>
<th>-20 °C</th>
<th>20 °C</th>
<th>60 °C</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.8</td>
<td>1.7</td>
<td>1.6</td>
<td>1.5</td>
</tr>
<tr>
<td>1.7</td>
<td>1.6</td>
<td>1.5</td>
<td>1.4</td>
</tr>
<tr>
<td>1.6</td>
<td>1.5</td>
<td>1.4</td>
<td>1.3</td>
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<tr>
<td>1.5</td>
<td>1.4</td>
<td>1.3</td>
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<tr>
<td>1.3</td>
<td>1.2</td>
<td>1.1</td>
<td>1.0</td>
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<tr>
<td>1.2</td>
<td>1.1</td>
<td>1.0</td>
<td>0.9</td>
</tr>
<tr>
<td>1.1</td>
<td>1.0</td>
<td>0.9</td>
<td>0.8</td>
</tr>
</tbody>
</table>

**Features**

- Long 8–10-year operational life*
- Excellent recharging performance in high temperatures (up to 75 °C)
- High-rate discharge (3 to 5 lt discharge/20 °C)
- Great alternative to other nickel-cadmium batteries

**Applications**

- Emergency lights, guidance lights, LED lights, wireless base-stations, servers, elevators, ATMs, POS equipment, vending machines, medical equipment, etc.

---

**Infrastructure Backup (Long-life Type)**

<table>
<thead>
<tr>
<th>Features</th>
<th>Applications</th>
</tr>
</thead>
<tbody>
<tr>
<td>● Long 4–6-year operational life*</td>
<td>Automated guided vehicles, rail vehicles, wireless base-stations, UPS systems, etc.</td>
</tr>
<tr>
<td>● Excellent recharging performance in high temperatures (up to 75 °C)</td>
<td></td>
</tr>
<tr>
<td>● High-rate discharge (3 to 5 lt discharge/20 °C)</td>
<td></td>
</tr>
<tr>
<td>● Ideal substitute for nickel-cadmium batteries</td>
<td></td>
</tr>
</tbody>
</table>

**Example charge characteristics**

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<th>Voltage (V)</th>
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<td>0.9</td>
<td>0.8</td>
</tr>
</tbody>
</table>

**Features**

- Long 4–6-year operational life*
- Excellent recharging performance in high temperatures (up to 75 °C)
- Ideal substitute for nickel-cadmium batteries

**Applications**

- Automated guided vehicles, rail vehicles, wireless base-stations, UPS systems, etc.

---

**Infrastructure Backup (General Type)**

<table>
<thead>
<tr>
<th>Features</th>
<th>Applications</th>
</tr>
</thead>
<tbody>
<tr>
<td>● Long 4–6-year operational life*</td>
<td>Automated guided vehicles, rail vehicles, wireless base-stations, UPS systems, etc.</td>
</tr>
<tr>
<td>● Stable performance in a wide range of temperatures (-10 °C to 60 °C)</td>
<td></td>
</tr>
<tr>
<td>● Ideal substitute for nickel-cadmium batteries</td>
<td></td>
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</tbody>
</table>

**Example charge characteristics**

<table>
<thead>
<tr>
<th>Voltage (V)</th>
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</table>

**Features**

- Long 4–6-year operational life*
- Stable performance in a wide range of temperatures (-10 °C to 60 °C)
- Ideal substitute for nickel-cadmium batteries

**Applications**

- Automated guided vehicles, rail vehicles, wireless base-stations, UPS systems, etc.

---

**Large-type for Infrastructure Applications**

**Features**

- Designed for extra-large power capacity
- Highly efficient power supply even in low temperatures
- 5-stage LED indicates remaining battery life (BK-10V10T)

**Applications**

- Automated guided vehicles, rail vehicles, wireless base-stations, UPS systems, etc.
### Nickel-Metal Hydride Batteries

Panasonic nickel-metal hydride batteries provide for safety and longevity in automotive backup applications as well as devices that suit button-top and high-rate-discharge battery types.

#### W Automotive Backup

**Features**
- Stable power delivery in a wide range of temperatures (-30 °C to 65 °C)
- Installation in tough environments as electrolyte solution is aqueous
- Easy charging and battery health checks

**Applications**
- TID, SCID systems, dashboard cameras, anti-theft security systems, etc.

### Example charge characteristics

<table>
<thead>
<tr>
<th>Voltage (V)</th>
<th>Voltage (V)</th>
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<th>Voltage (V)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.4</td>
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<td>1.7</td>
<td>1.7</td>
<td>1.7</td>
<td>1.7</td>
</tr>
</tbody>
</table>

### Example discharge characteristics

<table>
<thead>
<tr>
<th>Discharging time (hr.)</th>
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<th>Discharging time (hr.)</th>
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</tr>
</thead>
<tbody>
<tr>
<td>0.8</td>
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</tbody>
</table>

#### B Button Top

**Features**
- Offers extended charge/discharge life of about 1,800 cycles
- Low self-discharge and long storage life
- Excellent temperature resistance especially in freezing conditions

**Applications**
- Electric toothbrushes, electric shavers, remote controllers, etc.

### Example charge characteristics

<table>
<thead>
<tr>
<th>Voltage (V)</th>
<th>Voltage (V)</th>
<th>Voltage (V)</th>
<th>Voltage (V)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.4</td>
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</tr>
</tbody>
</table>

#### N Standard

**Features**
- Secure and safe performance with proven reliability
- Offers a wide range of models to suit various applications

**Applications**
- Radios, intercommunication systems, cordless phones, medical equipment, etc.

### Example charge characteristics

<table>
<thead>
<tr>
<th>Voltage (V)</th>
<th>Voltage (V)</th>
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<tr>
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</tr>
</tbody>
</table>

#### P High-rate Discharge

**Features**
- Excellent high-current discharge characteristics
- Rapid charging capability

**Applications**
- Power tools, cordless cleaners, electric toys (e.g. radio-controlled cars), etc.

### Example charge characteristics

<table>
<thead>
<tr>
<th>Voltage (V)</th>
<th>Voltage (V)</th>
<th>Voltage (V)</th>
<th>Voltage (V)</th>
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<tr>
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</tbody>
</table>

### Example discharge characteristics

<table>
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<tr>
<th>Discharging time (hr.)</th>
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<tr>
<td>0.9</td>
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<tr>
<td>1.1</td>
<td>1.1</td>
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</tr>
</tbody>
</table>

*The data provided in this document is for descriptive purposes only and does not imply any guarantee or warranty.

---

*Note: 1 lt (A) = rated capacity (Ah)/(hr.)

*1 0.2 lt discharge capacity after charging at 0.1 lt for 16 hours.
*2 Temperature for rapid charge.
*3 Temperature for standard rapid charge.
*4 Recommended temperature.
*5 It depends on usage conditions. Please contact Panasonic.

---

*1 0.2 lt discharge capacity after charging at 0.1 lt for 16 hours.
*2 Measured under conditions complying with JIS C8708 2013 (7.5.1.1). Actual capacity depends on usage conditions.  *3 AAA-size compatible. *4 AA-size compatible. Note: 1 lt (A) = rated capacity (Ah)/(hr.)

---

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Nickel-Metal Hydride Batteries

■ General Comparison of Various Charging

<table>
<thead>
<tr>
<th>Charge system</th>
<th>Cycle (repeat) use</th>
<th>Standby backup use</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Conduct current charge</td>
<td>Semi-conduct current charge method**</td>
</tr>
<tr>
<td>intermittent charging method</td>
<td>**Dc offset charging method</td>
<td><strong>Dc offset charging method</strong>*</td>
</tr>
<tr>
<td>trickle charging method</td>
<td>ΔV cutoff charging method</td>
<td></td>
</tr>
<tr>
<td>ΔT cutoff charging method</td>
<td></td>
<td></td>
</tr>
<tr>
<td>VB: Battery voltage</td>
<td>Initial charge</td>
<td></td>
</tr>
<tr>
<td></td>
<td>0 – 1 hr</td>
<td>0.0 – 1 hr</td>
</tr>
<tr>
<td></td>
<td>0.1 lt x 15 hours</td>
<td>0.1 – 0.5 lt</td>
</tr>
<tr>
<td></td>
<td>Features</td>
<td>**applicable to devices requiring continuous charging for long periods (Not limited in life than trickle-charging)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Charging circuit is simple and affordable</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Applicable to devices requiring continuous charging for long periods</td>
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</table>

Battery Pack

Many of our industrial batteries are sold in packs. When battery packs are installed, the battery type, number of cells, pack shape, and constituent parts are determined by the application. Considerations include voltage and current; charging specifications; available space; and usage conditions. We design and manufacture the most common industrial applications to best meet customer needs while maintaining safety, quality, and reliability as our central focus.

Reliable Battery Packs for Automotive Applications

Compared to the consumer market, a higher standard of quality and reliability is expected in industrial battery applications, particularly where batteries are intended for vehicles where harsh vibration and high temperature fluctuations are commonplace. To ensure quality and reliability in this environment, Panasonic selects components for battery packs with utmost care and applies stringent controls for structural assembly and battery production. Suitability for automotive use is evidenced by PPAP (Production Part Approval Process) certification and AIT16949 compliance.

Dry Batteries

Our industrial dry-battery range features user-friendly labeling in English, Japanese, and Chinese language. These OEMP dry batteries are engineered with high quality and easy usability in mind.

Alkaline Batteries

Features

- Manganese dioxide is used for the cathode material, zinc for the anode’s active material, and potassium-hydride for the electrolyte solution.
- An ideal choice for a variety of applications thanks to compatibility with manganese dry batteries.

Applications

Self-kindled gas/oil equipment, electric toys, portable radios, flashlights, wireless mice, electric toothbrushes, wall clocks, clocks, remote controllers, etc.

Manganese Batteries

Features

- Manganese dioxide is used for cathode material, zinc for the anode’s active material, and solutions including zinc chloride as the electrolyte.
- Used for general-electric device applications such as gas igniters.

Applications

Self-kindled gas/oil equipment, electric toys, portable radios, flashlights, wall clocks, clocks, remote controllers, etc.