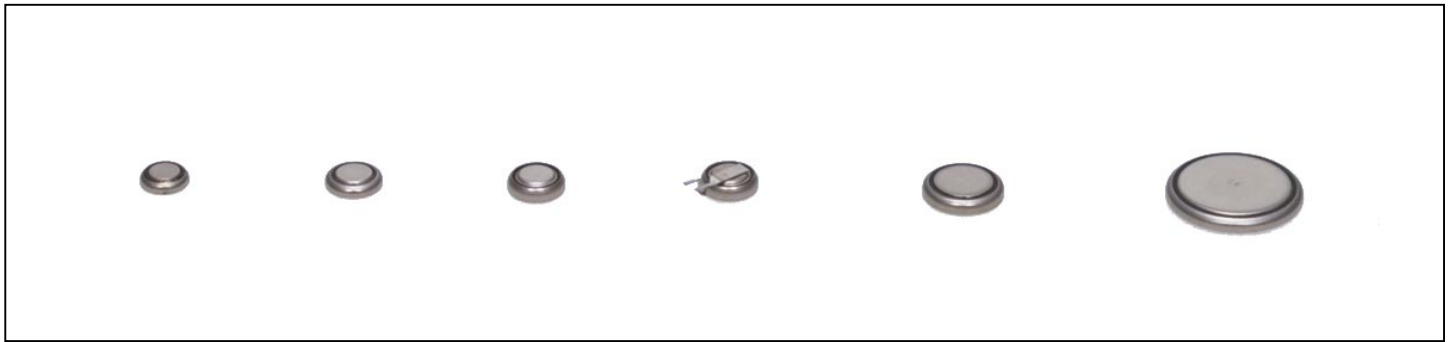


MANGANESE TITANIUM LITHIUM RECHARGEABLE BATTERIES (MT SERIES)



Overview

Manganese titanium lithium rechargeable batteries are compact rechargeable batteries developed for rechargeable watches, and backup power supplies for pagers and timers. The batteries employ lithium-manganese complex oxide as the cathode material, and lithium-titanium oxide (AB204) as the anode material. The batteries provide a capacity that is more than 10 times that of capacitors of the same size. Panasonic was the first company to introduce them (Note 1).

(Note 1: Press announcement on March 29, 1995)

Features

- Large capacity in a miniature size comparable to chip components**
 When fully charged, MT621 and MT920 are operable for about 1000 and 2500 hours respectively at a 1.2mA load.
- Flat operating voltage**
 The operating voltage is comparatively flat in the range between 1.5 V and 1.2 V.
- Superior charge characteristics**
 Charging efficiency is nearly 100% with small charging loss. The charge voltage can be set flexibly in the range between 1.6 V and 2.6 V.

- Charging/discharging over a long period is possible.**

More than 500 charging and discharging cycles to a discharge low limit voltage of 1 V (i.e. charge/discharge of discharge depth 100%) is possible.

- Excellent voltage and overdischarge withstanding characteristics**

The batteries can withstand a continuous voltage application of 2.6V at a temperature as high as 60° (140°F) and furthermore can withstand continuous over discharge at OV.

- Small self discharge**

The self discharge in 20 days at 60°C (equivalent to 1 year at normal temperature) is not more than approximately 10%.

Applications

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

Specification Table

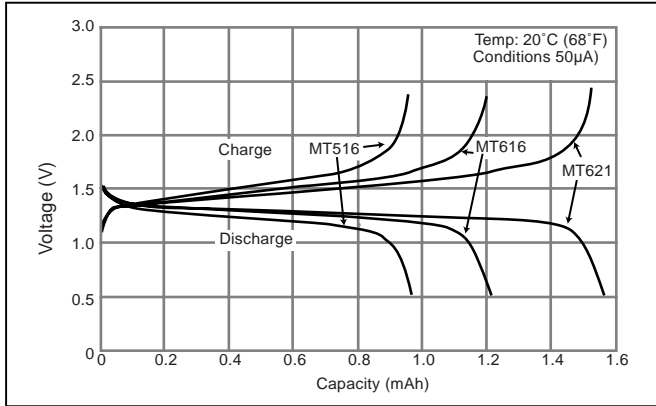
Manganese Titanium Lithium rechargeable batteries (MT series)

| Model No. | JIS | IEC | Electrical characteristics 20°C (68°F) | | | Dimensions (Max.) | | Approx. weight g (oz) |
|-----------|-----|-----|--|---------------------------|------------------|-------------------|-----------------|-----------------------|
| | | | Nominal voltage (V) | Nominal capacity *1 (mAh) | Continuous drain | Diameter mm(inch) | Height mm(inch) | |
| | | | | | Standard (mA) | | | |
| MT516 | --- | --- | 1.5 | 0.9 | 0.1 | 5.8 (0.23) | 1.6 (0.06) | 0.15 (0.005) |
| MT616 | --- | --- | 1.5 | 1.05 | 0.1 | 6.8 (0.27) | 1.6 (0.06) | 0.2 (0.007) |
| MT621 | --- | --- | 1.5 | 1.5 | 0.1 | 6.8 (0.27) | 2.1 (0.08) | 0.3 (0.01) |
| MT920 | --- | --- | 1.5 | 4.0 | 0.2 | 9.5 (0.37) | 2.0 (0.08) | 0.5 (0.02) |
| MT1620 | --- | --- | 1.5 | 14.0 | 0.5 | 16.0 (0.63) | 2.0 (0.08) | 1.3 (0.04) |

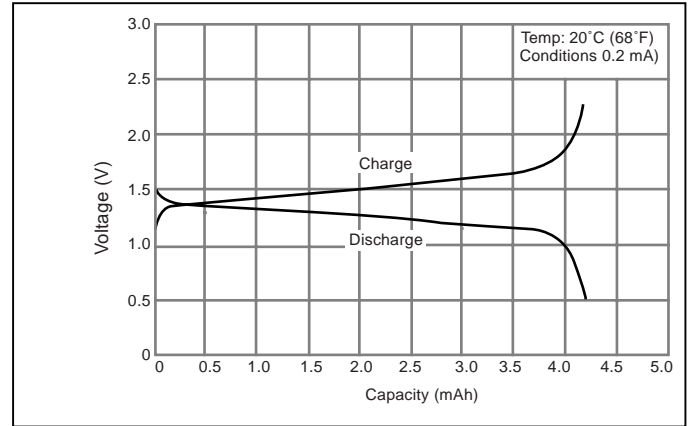
*1 Nominal capacity shown above is based on standard drain and cut off voltage down to 1.0 V at 20°C (68°F)

MANGANESE TITANIUM LITHIUM RECHARGEABLE BATTERIES - CONTINUED

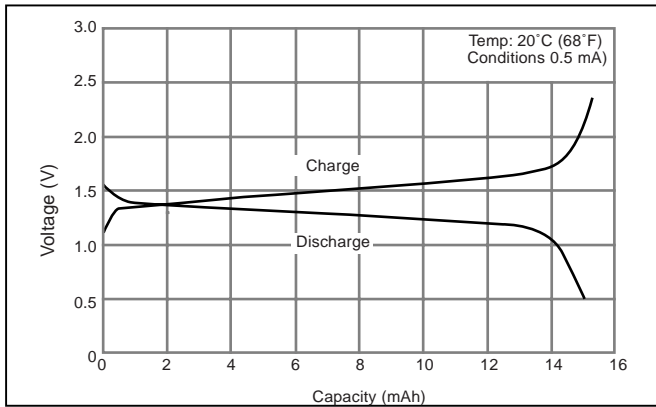
- Charge/discharge characteristics (MT516/MT616/MT621)



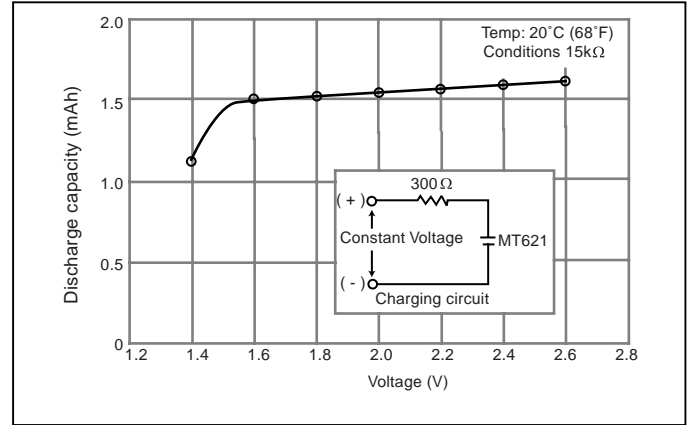
Charge/discharge characteristics (MT920)



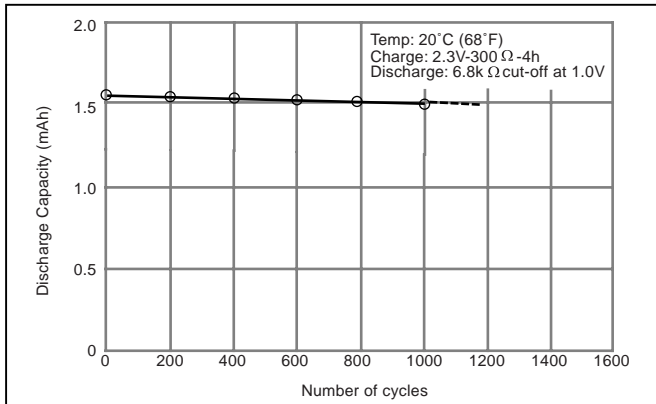
Charge/discharge characteristics (MT1620)



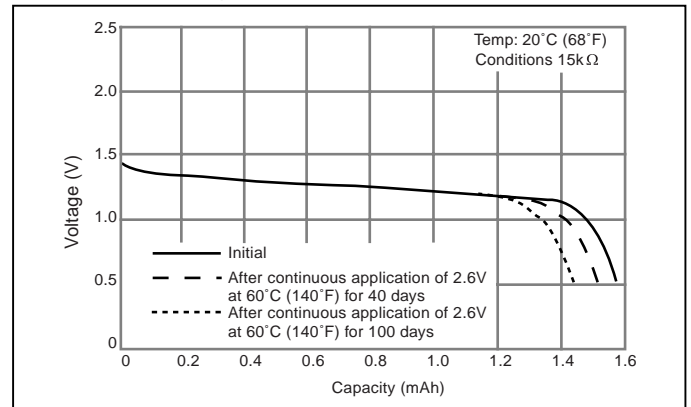
Constant voltage charging characteristics (Capacity recovery as a function of charge voltage: MT621)



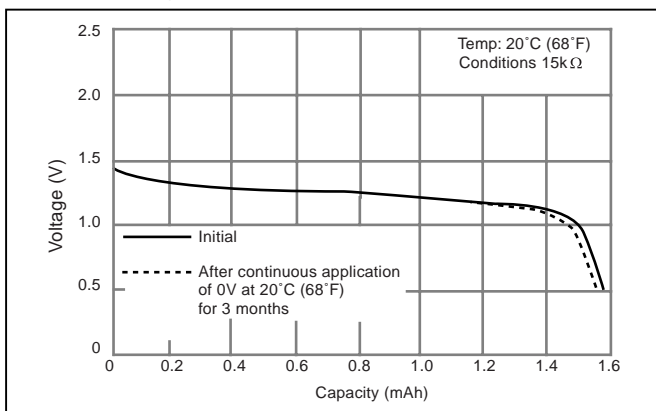
Cycle life characteristics (MT621)



Withstand voltage characteristics (MT621)

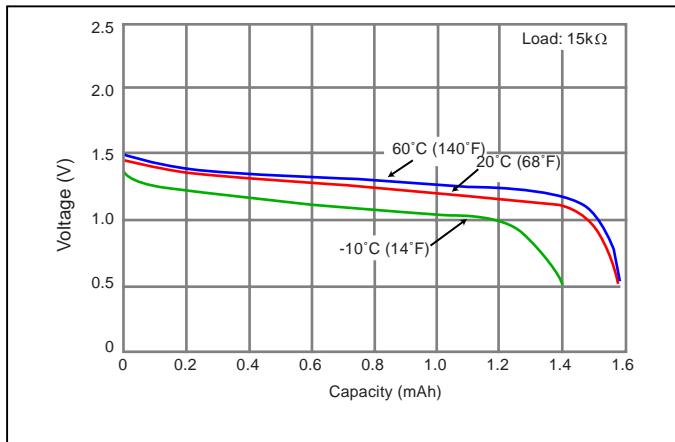


Overdischarge characteristics (MT621)

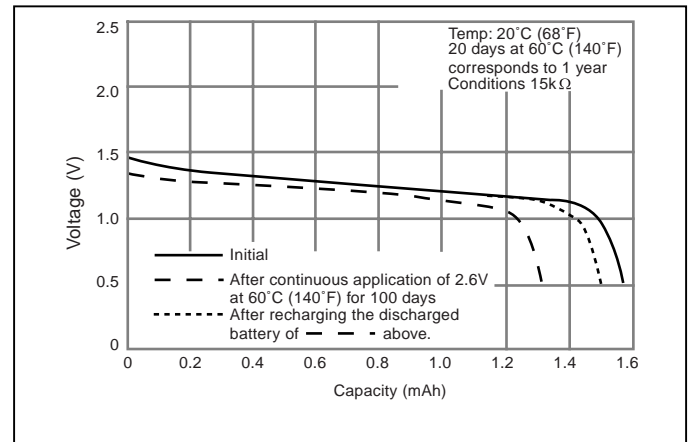


MANGANESE TITANIUM LITHIUM RECHARGEABLE BATTERIES-CONTINUED

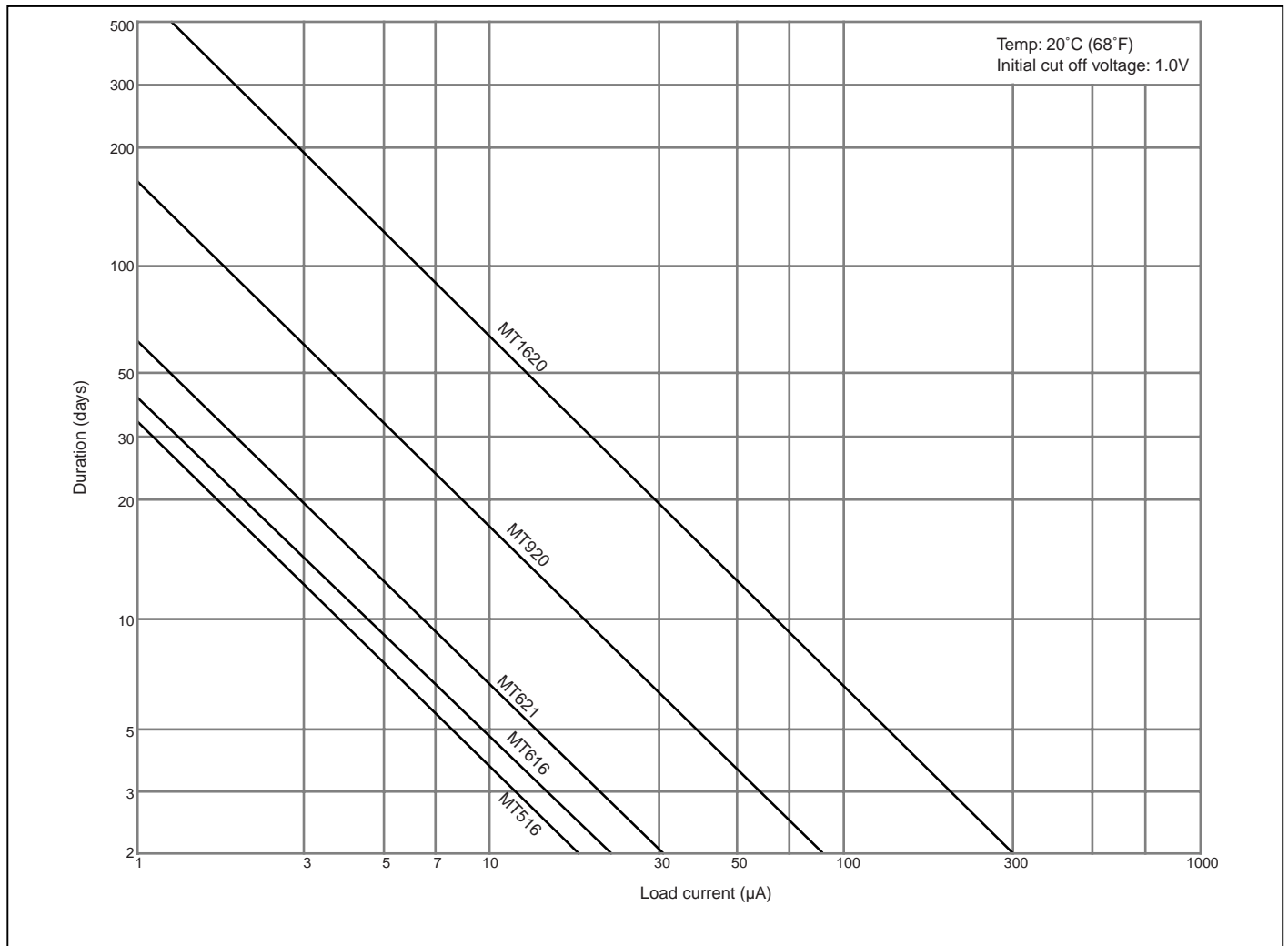
Discharge temperature characteristics (MT621)



Storage characteristics (MT621)



Current drain as a function of duration



PRECAUTIONS

Precautions for handling rechargeable coin type lithium batteries

Please observe the following precautions to keep the batteries in good condition.

Precautions for storage

- Avoid storing batteries at unusually high temperatures.
- Store batteries in a low-humidity location with little temperature variation. If batteries are stored in humid areas, moisture may condense on their surface, exerting an adverse influence on their electrical characteristics.
- Store batteries away from direct sunlight.

Precautions in handling

- For measuring the battery voltage, use an instrument with a resistance of 10 M Ω or higher.
- The operating temperature range of batteries is from -20°C to 60°C (-4°F to 140°F). When batteries are used or stored for a long time at 60°C (140°F) or higher temperatures, their performance may deteriorate. Consult Panasonic if batteries are to be used at temperatures above 60°C.
- Do not use batteries with their (+) and (-) electrodes reversed; this incorrect use deteriorates battery performance and may cause corrosion of the (-) terminal (anode cap) during charging, leading to leakage of battery solution.
- Absolutely avoid mixed use of the batteries and other primary or rechargeable batteries. Also avoid mixed use of batteries with different sizes even if they belong to the same series, and avoid mixed use of new and used batteries. Performance differences among different batteries may damage equipment.
- When mounting terminal-attached batteries onto a printed circuit board, etc., by dipping in a solder bath, limit the dipping time to a maximum of 5 seconds: dipping for a longer time may cause an adverse influence on the electrical characteristics such as voltage and capacity. Use extreme caution not to drop batteries into the solder bath during dipping; if dropped into the solder tank, batteries may burst due to abrupt heating. Do not apply solder directly to batteries. Also, do not use reflow soldering.
* For details, refer to "Guide to correct soldering of lithium batteries with terminals" on page 97.
- Do not insert batteries into antistatic materials or wrap the battery-mounted PC board in conductive sheets. These materials can cause a voltage drop or drain the batteries.
* For details, refer to "Use caution with antistatic conductive materials" on page 99.

- Do not place two or more batteries together into a bag or container; external shorting between batteries may cause a voltage drop or drain the batteries.
* For details, refer to "Use caution in allowing batteries to contact each other" on page 100.

Precautions in equipment design

Common precautions for vanadium pentoxide, manganese titanium lithium and manganese lithium rechargeable batteries

- Do not mount batteries in a high-temperature or heat-generating location; protect batteries from foreign materials.
- If lead wires and connection terminals like tab terminals are needed for the batteries, Panasonic can supply external terminals (connectors, etc.) on request.
- Please be sure to consult Panasonic when two or more batteries are to be used in series or in parallel; special circuit design is required.
- Take into account during design that the internal resistance of batteries increases as they approach the end of service life.

Vanadium pentoxide lithium rechargeable batteries

- When constant-voltage charging, observe the specified range of charge voltage. If the charge voltage is above the upper limit, the internal resistance of batteries may increase, causing battery performance to deteriorate; if the charge voltage is below the lower limit, battery capacity cannot recover completely. If charge voltage exceeds approximately 4 V, the (+) terminal (case) may become corroded, causing leakage of the solution.
* For details, refer to "Influence of charge voltage of vanadium pentoxide lithium rechargeable batteries" on page 92. When using fixed-current charging, call Panasonic for consultation.

Manganese titanium lithium rechargeable batteries

- For the charging circuit of manganese titanium rechargeable batteries, please be sure to consult us.
- Give careful thought to the contact design as weak electrical contact may cause defective operation of the batteries.

Manganese Lithium rechargeable batteries

- Restrictions on the charging voltage range apply in exactly the same way as for Vanadium pentoxide rechargeable batteries.
- For the charging circuit of manganese lithium rechargeable batteries, please be sure to consult us.