

# MANGANESE LITHIUM RECHARGEABLE BATTERIES (ML SERIES)

## Overview

These super-compact lithium secondary batteries feature a new configuration in which a manganese compound oxide is used for the positive electrode, a lithium/aluminum alloy for the negative electrode and a special nonaqueous solvent for the electrolyte. They can be charged at voltage levels of 3V or so, they have a large capacity and excellent overcharge and over-discharge withstanding characteristics. Their space-saving design enables them to be incorporated quite easily into 3V ICs.

## Features

- Charging at voltage levels even under 3V**  
 In order to support the current trend in ICs toward lower voltages, these batteries can be charged at a  $3 \pm 0.2$  voltage level, and this makes it easier to set the charging circuits for the circuits which employ 3V ICs.

- Large capacity for hour-after-hour back-up**  
 The ML621 has a nominal capacity of 3 mAh, and when the load is 5 $\mu$ A, it provides back-up for 600 hours after a full charge.
- Excellent withstand voltage characteristics**  
 These batteries can withstand the application of a continuous 3.2V voltage at a high temperature of 60°C.
- Outstanding overcharge and overdischarge withstanding characteristics.**  
 Even when these batteries have been left standing for a long time with no charge at all, their performance can be restored by recharging them.

## Applications

Power source for backing up memory data in mobile telephones, personal handyphone systems, memory cards, pagers and other small-sized communications devices as well as in data terminals and office automation equipment.

## Specification Table

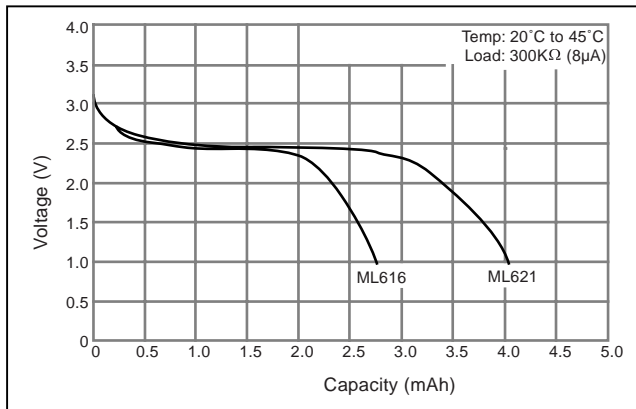
Model No.	JIS	IEC	Electrical characteristics 20°C			Dimensions (Max.)		Approx. weight (g)
			Nominal voltage (V)	Nominal capacity *1 (mAh)	Continuous drain	Diameter (mm)	Height (mm)	
					Standard (mA)			
ML612S	---	---	3	2.3	0.01	6.8	1.2	0.15
ML616	---	---	3	2	0.01	6.8	1.6	0.2
ML616S	---	---	3	2.9	0.01	6.8	1.6	0.19
ML621	---	---	3	3	0.01	6.8	2.1	0.25
ML621S	---	---	3	4.5	0.01	6.8	2.1	0.23
ML2020	---	---	3	45	0.1	20.0	2.0	2.2

\* 1 Nominal capacity shown above is based on standard drain and cut off voltage down to 2.0 V at 20°C

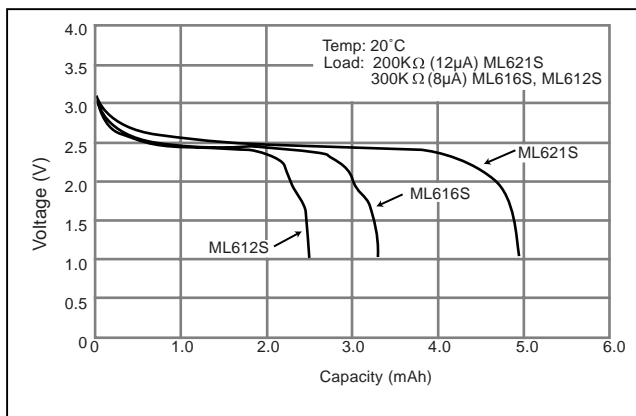
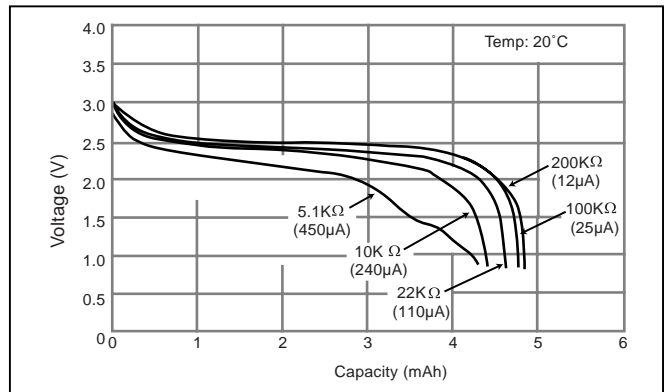
Charge/discharge cycle	About 1,000 times at 10% discharge depth to nominal capacity
Charge	Constant-voltage charging (refer to recommended charging circuit)
Operating temperature	-20°C to 60°C

# MANGANESE LITHIUM RECHARGEABLE BATTERIES – CONTINUED

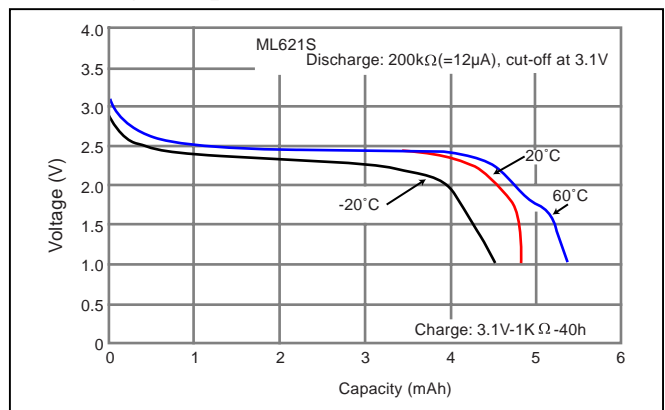
## Discharge characteristics



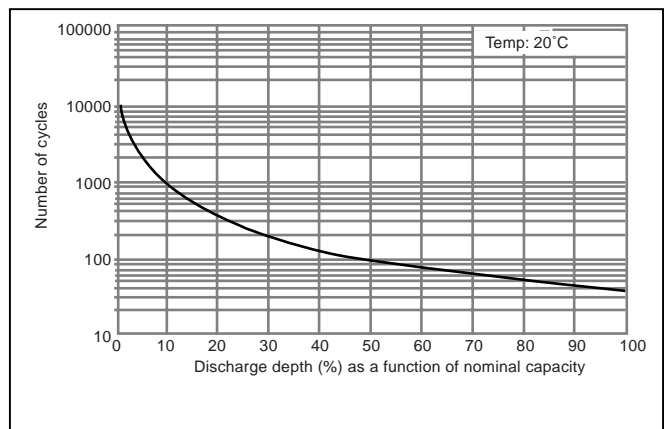
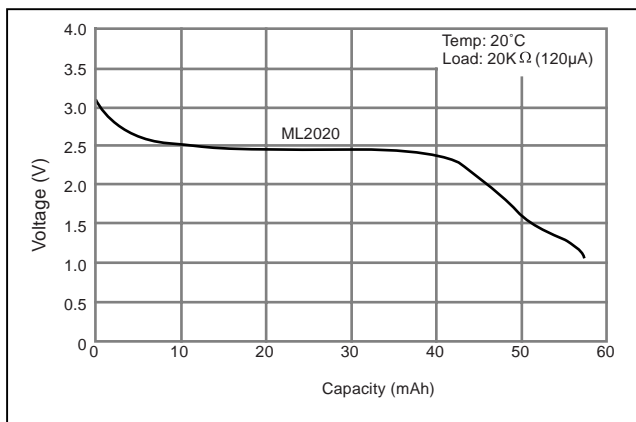
## Discharge load characteristics (ML621S)



## Discharge temperature characteristics (ML621S)

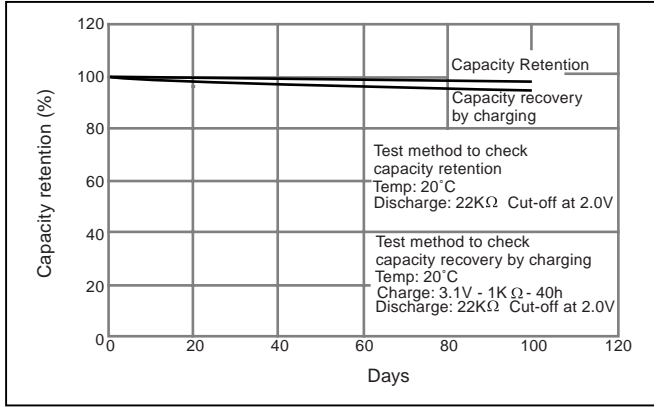


## Charge/discharge characteristics vs. discharge depth (ML621S)

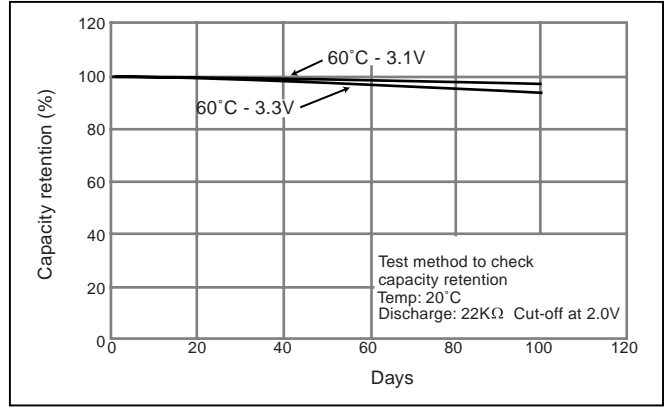


# MANGANESE LITHIUM RECHARGEABLE BATTERIES – CONTINUED

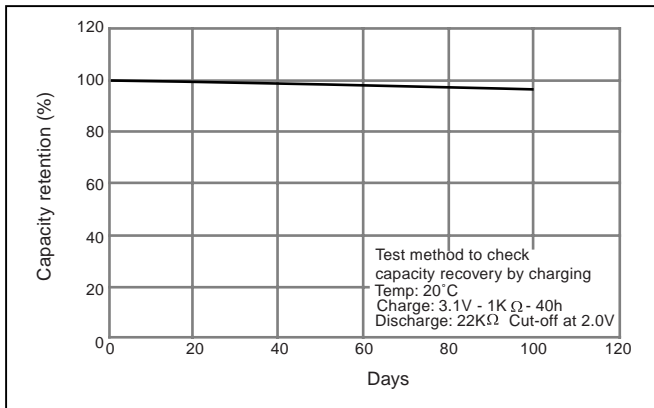
## Storage characteristics (ML621S)



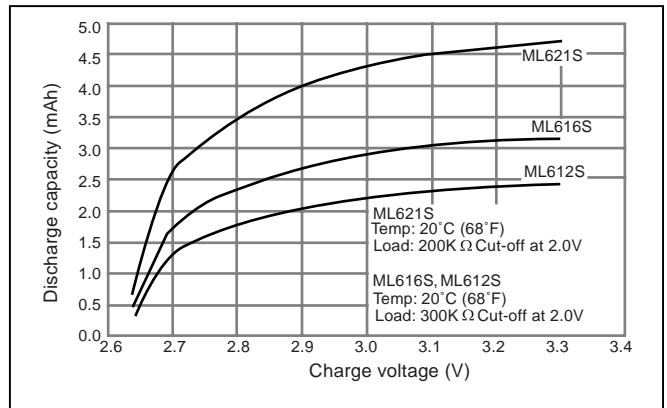
## Withstand voltage characteristics (Overcharge characteristics) (ML621S)



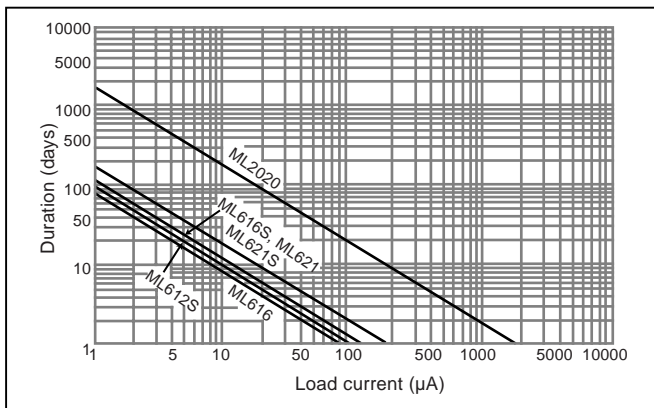
## Overdischarge withstanding characteristics (ML621S)



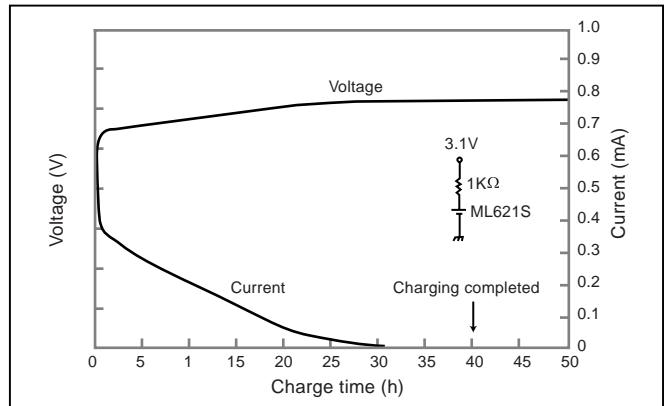
## Relationship between charging voltage and charge acceptance



## Relationship between current consumption and charge retention time



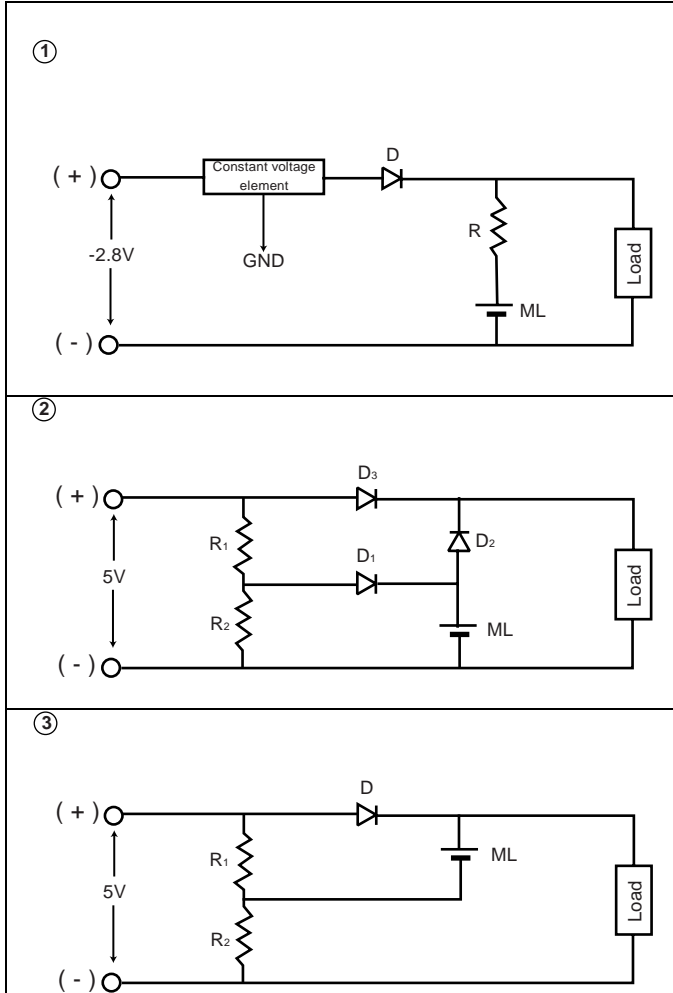
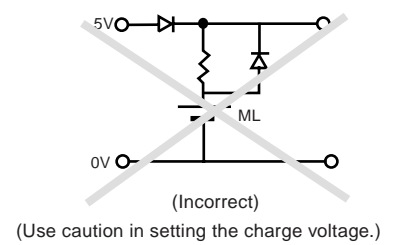
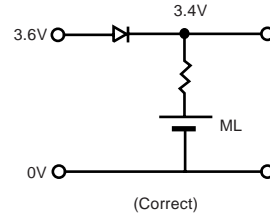
## Constant-voltage charging characteristics (ML621S)



# RECOMMENDED CHARGING CIRCUIT

The choice of the charging circuit is extremely critical if full rein is to be given to the battery characteristics. Make every effort to ensure that the proper charging circuit is used; otherwise, trouble may result.

Basic conditions: Constant-voltage charging  
 Charging voltage: 2.8 to 3.2V (Standard voltage: 3.1V)  
 Current: (0.3mA for ML616, ML621 with 2.5V battery Voltage)



When charging using another battery		
ML612S, ML616, ML616S, ML621		
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

Standard circuit		
<ul style="list-style-type: none"> <li>Select a diode with a low reverse current for D2. (I<sub>r</sub>=1μA/5V)</li> </ul>		
D1, D2: MA716		
D3: MA704, MA700		
	R <sub>1</sub>	R <sub>2</sub>
ML612S, ML616 ML616S, ML621	2.7KΩ	5.1KΩ
ML621S	1.1KΩ	2.0KΩ
ML2020	180Ω	330Ω

Simple circuit which can be configured at low cost		
Load with 5V applied	100μA	
VF of D	0~0.2V	
	R <sub>1</sub>	R <sub>2</sub>
ML616	5.1KΩ	2.7KΩ
ML621		

\* 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.

## UL Recognition

UL recognition for the ML621 and ML616 was received in April 1997.

In filling application for UL recognition, a maximum value of 300mA was given as the condition restricting the current when a short-circuit or open-circuit situation occurs.

When a protective component is shorted or opened, maximum charge current is regulated to the following values:

ML616	300mA
ML621	300mA
ML2020	300mA

Call Panasonic for answers to specific questions about UL.