# RECHARGEABLE COIN TYPE LITHIUM BATTERIES

Vanadium pentoxide lithium rechargeable batteries (VL series)

## Overview

This coin type lithium rechargeable battery has a totally new composition, employing vanadium pentoxide cathode, lithium alloy anode, and non-aqueous solvents in the electrolyte solution. With an energy density about twice that of button type nickel cadmium batteries, this battery is especially suited for applications such as memory backup power supply in electronic devices.

## Applications

- Memory backup power supplies for OA equipment (personal computers, facsimiles, etc.), AV equipment (VTRs), and communications equipment (portable telephones, etc.)
- Hybrid systems with solar batteries (solar remote controls, etc.)

## Features

- **Flat high voltage of about 3 V**
  A single battery can provide the voltage equivalent to two or even three nickel cadmium batteries (approx. 1.2 V) and capacitors. Benefits include: Compact design and cost reduction.
- **Several months of continuous backup**
  VL3032 (nominal capacity l00mAh) is capable of continuous backup for 10,000 hours at a memory backup load of 10µA (when discharged to 2.5 V).
- **Small self-discharge allows use without recharging even after long storage**.
  Unlike nickel cadmium batteries which lose considerable capacity in 6 months due to self-discharge, the vanadium lithium secondary battery's self-discharge is very small, i.e., annual rate of approximately 2% at normal temperature.
- **Stable to continuous overcharging and overdischarging.**
  Vanadium lithium batteries exhibit stable characteristics in continuous overcharging and overdischarging to 0V, important in memory backup considerations.

## Specification Table

| Model No. | JIS | IEC | Electrical characteristics 20°C | | | Dimensions (Max.) | | Approx. weight (g) |
|---|---|---|---|---|---|---|---|---|
| | | | Nominal voltage (V) | Nominal *1 capacity (mAh) | Continuous drain Standard (mA) | Diameter (mm) | Height (mm) | |
| VL621 | --- | --- | 3 | 1.5 | 0.01 | 6.8 | 2.1 | 0.3 |
| VL1216 | --- | --- | 3 | 5 | 0.03 | 12.5 | 1.6 | 0.7 |
| VL1220 | --- | --- | 3 | 7 | 0.03 | 12.5 | 2.0 | 0.8 |
| VL2020 | --- | --- | 3 | 20 | 0.07 | 20.0 | 2.0 | 2.2 |
| VL2320 | --- | --- | 3 | 30 | 0.10 | 23.0 | 2.0 | 2.8 |
| VL2330 | --- | --- | 3 | 50 | 0.10 | 23.0 | 3.0 | 3.7 |
| VL3032 | --- | --- | 3 | 100 | 0.20 | 30.0 | 3.2 | 6.3 |

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

| | |
|---|---|
| Charge and 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 |

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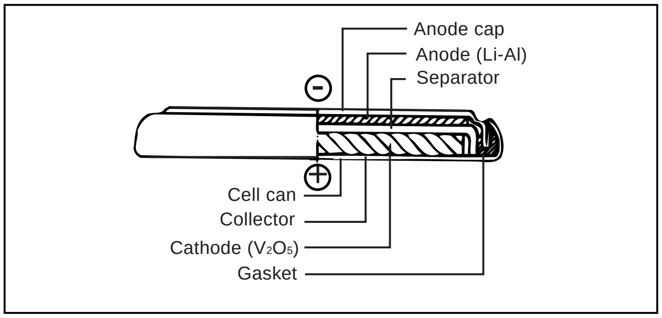
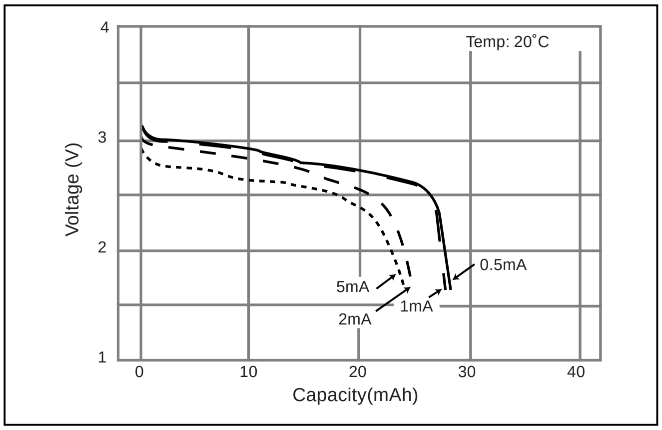
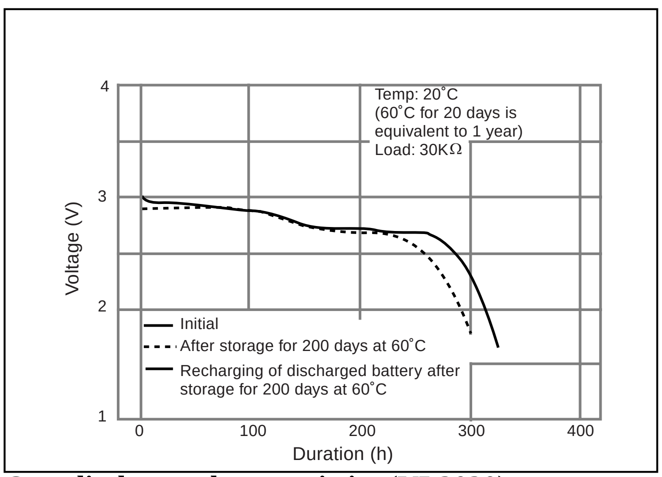
## Cutaway view



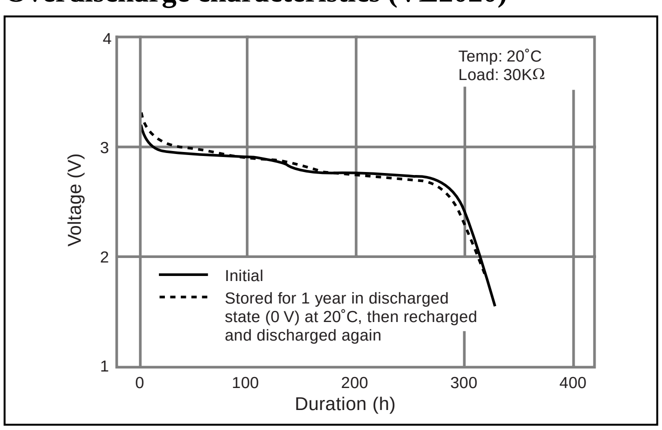

## Load characteristics (VL2020)



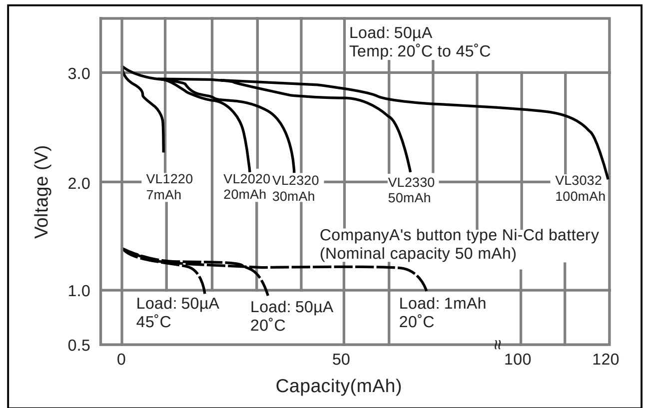

## Storage characteristics (without charge) (VL2020)



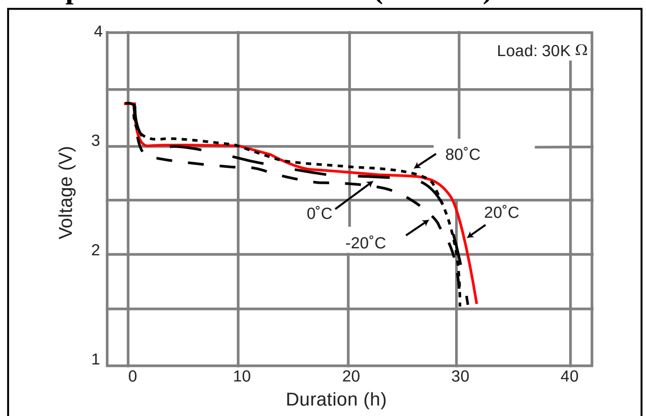

## Overdischarge characteristics (VL2020)



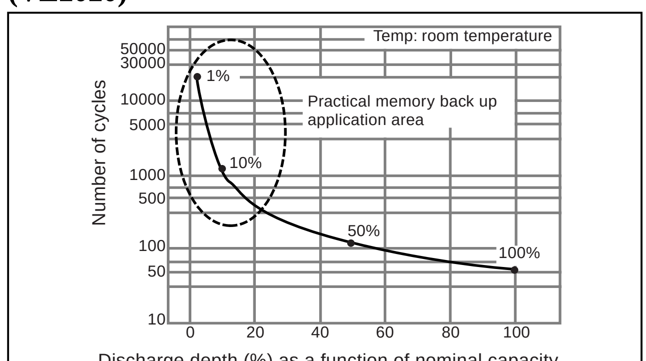

## VL discharge characteristics



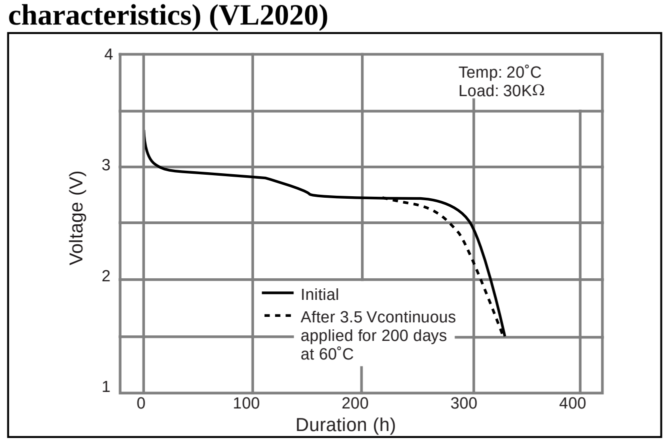

## Temperature characteristics (VL2020)



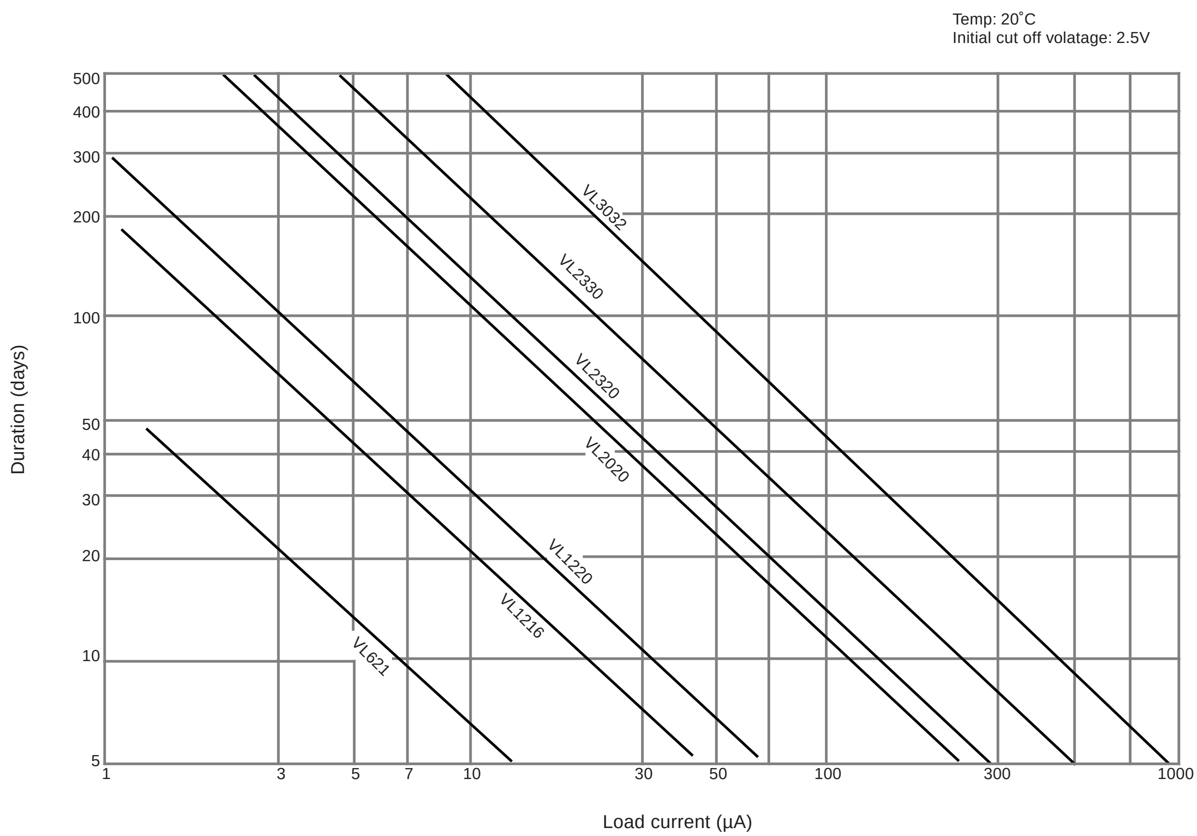

## Charge/discharge characteristics vs. discharge depth (VL2020)




## Withstand voltage characteristics (Overcharge characteristics) (VL2020)



## Current drain as a function of duration



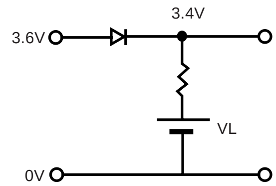
# RECOMMENDED CHARGING CIRCUITS

Basic conditions: Fixed-voltage charging
Charge voltage: 3.4± 0.15 V
Current: at battery voltage 3 V

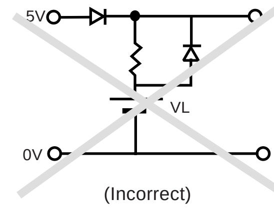
| | |
|---|---|
| VL 621 | approx. 0.2 mA or below |
| VL 1216,VL1220 | approx. 0.5 mA or below |
| VL 2020 | approx. 1.5 mA or below |
| VL 2320,VL2330 | approx. 2.0 mA or below |
| VL 3032 | approx. 4 mA or below |

(Note: current can be increased when voltage is below 3 V.)

Charging circuits are important. Be sure to refer to "Precautions in handling "(page 61).

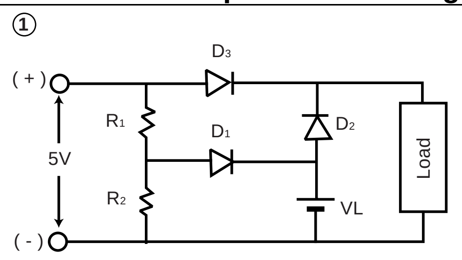


(Correct)



(Incorrect)
(Use caution in setting the charge voltage.)

## Reference: Examples of 5-V charging circuits

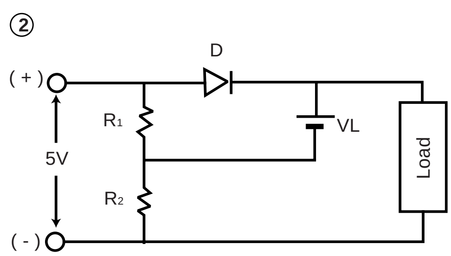


* Patent pending

### Standard circuits

For $D_2$, select a diode of small inverse current ($I_R$ = 1µA or below / 5 V)
$D_1$, $D_2$ = 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 |

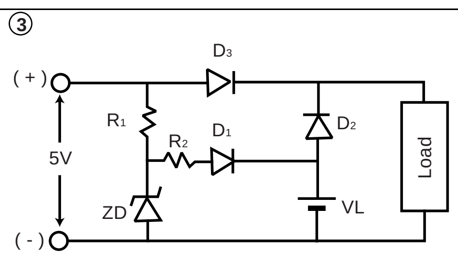


* Patent pending

### Simple economical circuits

D: MA700 = (very small inverse current)

| Load with 5 V applied | 100µA to 10mA | | 100µA or below | |
|---|---|---|---|---|
| Vf of D | 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 |



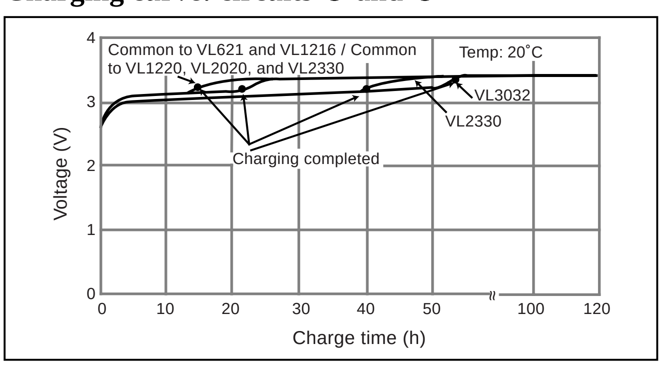
* Patent pending

| | 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 or below /5 V)

### Charging curve: circuits ① and ②




### UL recognition conditions

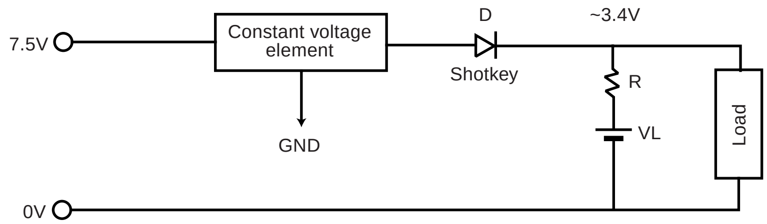
When a protective component is shorted or opened, maximum charge current is regulated to the following value.

| | |
|---|---|
| VL621 | 300mA |
| VL1216 | 300mA |
| VL1220 | 300mA |
| VL2020 | 300mA |
| VL2320 | 300mA |
| VL2330 | 300mA |
| VL3032 | 300mA |

Call Panasonic for answers to specific questions about UL.

Sample circuits

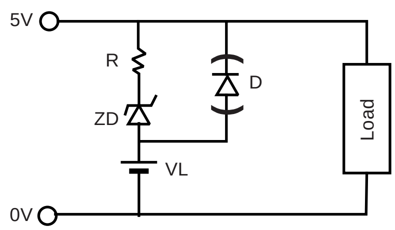
### ④For minimizing current leakage due to resistance, etc., In such a case as charging by another battery




| REG. | D |
|---|---|
| 3.7V | MA700 |

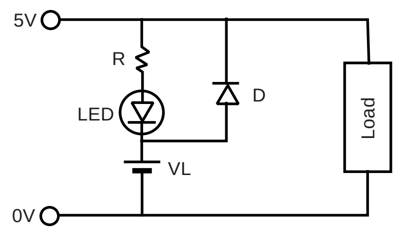
For the details, refer to the constant voltage element specifications

### ⑤Zener control




ZD = HZ2ALL
R - 43 ohm for VL 2320
68 ohm for VL2020
* D = MA700 or MA704

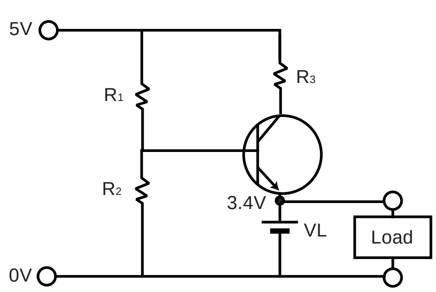
### ⑥ LED control




LED
R = 51 ohm for VL2320
* D = MA700 or MA704

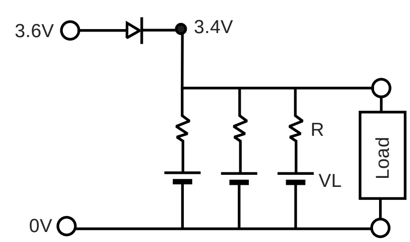
* Patent pending
* Select a diode having an inverse current as small as possible. (IR=1μA or below / 5 V)

### ⑦ Transistor control




(for VL2320)
$R_1$ = 4.3k Ω
$R_2$ = 15.0k Ω
$R_3$ = 680 Ω

### ⑧ Parallel circuit




(Note) Be sure to consult with us regarding the charge circuit to be used.