

# Charging

## ■ Charging circuits

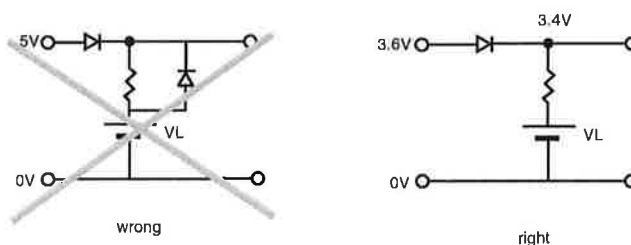
Charging/discharging cycle	Approx. 1,000 times at 10% discharge depth to nominal capacity
Charging system*	Constant-voltage charging. (Please strictly adhere to the specified charge voltage)
Operating temperature	-20°C to +60°C

\* 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  $3.4V \pm 0.15V$ . (Actual value:  $3.4V \pm 0.20V$ )

\* 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  $\oplus$  terminal (case) may occur, causing leakage. ("Influence of the charge voltage on VL batteries" in Chapter 3-55.)

\* 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:  $3.4V \pm 0.15V$

Charge current: For a battery voltage of 3V

VL621                      Approx. 0.2 mA or below

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

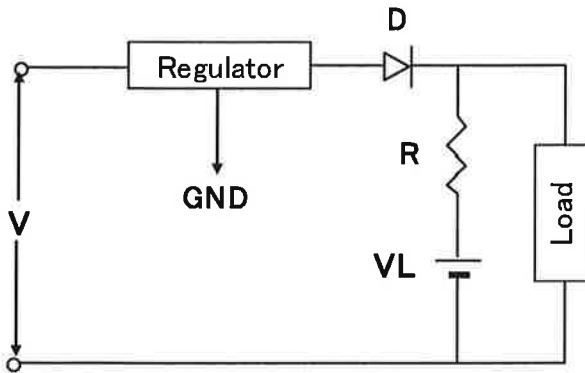
(It is permissible for the current to increase beyond the above level when the battery voltage drops below 3V.)

## ■ 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 : VL - Example of Charging Circuits

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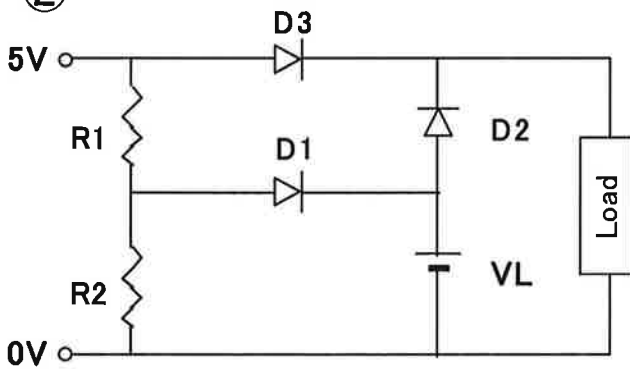


## Standard Circuit

Diode D : DB2J314

Model	Reg.	R
VL621	3.5V	1.8kΩ
	3.4V	1.3kΩ
VL1220	3.5V	750Ω
	3.4V	510Ω
VL2020	3.5V	240Ω
	3.4V	180Ω
VL2320	3.5V	180Ω
	3.4V	130Ω
VL2330	3.5V	180Ω
	3.4V	130Ω
VL3032	3.5V	91Ω
	3.4V	68Ω

②



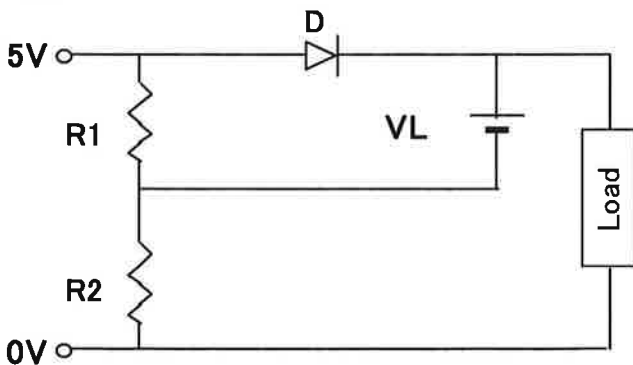
## Standard Circuit (Charging from 5V line)

Diode D : DB2J314

Model	R1	R2
VL621	2.4kΩ	5.6kΩ
VL1220	750Ω	1.8kΩ
VL2020	240Ω	590Ω
VL2320	200Ω	510Ω
VL2330	200Ω	510Ω
VL3032	68Ω	180Ω

For diode D2, select a diode of small inverse current (  $I_R = 1\mu A$  below / 5V )

③



## Cost performance type

During charging, there is voltage drop  $V_f$  at D.

Diode D : DB2J314

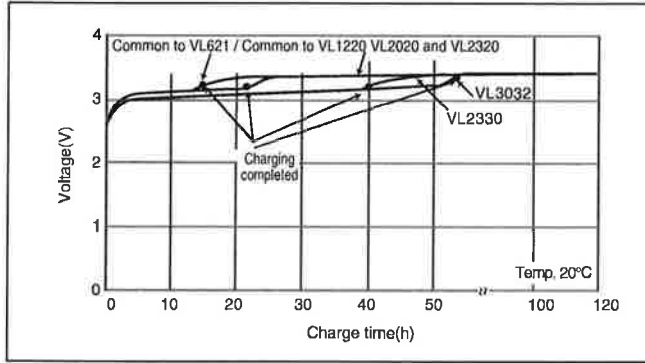
In case the current flows through D is less than 1mA, when the battery is full charged.

Model	R1	R2
VL621	5.6kΩ	2.4kΩ
VL1220	1.8kΩ	750Ω
VL2020	590Ω	240Ω
VL2320	510Ω	200Ω
VL2330	510Ω	200Ω
VL3032	180Ω	68Ω

※If the current exceeds 1mA, these value of resistances is different.

# Charging

## ● 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.

