Charging

■ Charging circuits

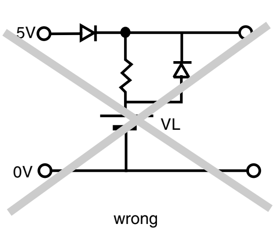
Charging/discharging cycle	Approx. 1,000 times at 10% discharge depth to nominal capacity
Charging system*	Constant-voltage charging.(Please strictly adhere to the specified charge voltage)
Operating temperature	-20°C to +60°C

* Consult with Panasonic concerning constant-current charging systems.

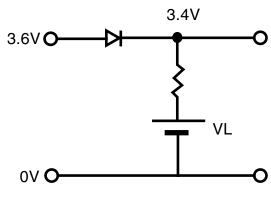
The charging circuit is crucial in terms of ensuring that full justice will be done to the battery characteristics. Consider it carefully as the wrong charging circuit can cause trouble.

■ 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.



wrong



right

■ 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±0.15V. (Actual value: 3.4V±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 ⊕ 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±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

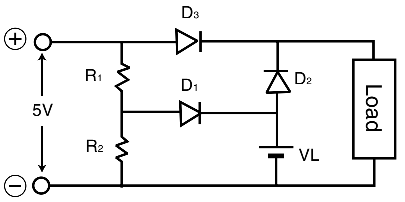
(It is permissible for the current to increase beyond the above level when the battery voltage drops below 3V.)

■ 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: Examples of charging circuits

①



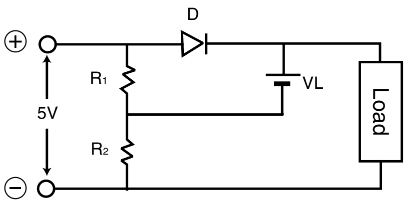
Patent acquired

Standard circuits

For D2 , select a diode of small inverse current (I_R=1µA below / 5V)
D1, D2 : MA3X716(Diode type code)
D3 : MA3X704,MA2J728

	R1	R2
VL621	2.2kΩ	5.6kΩ
VL1220	750Ω	1.8kΩ
VL2020	200Ω	510Ω
VL2320, VL2330	150Ω	390Ω
VL3032	68Ω	180Ω

②



Patent acquired

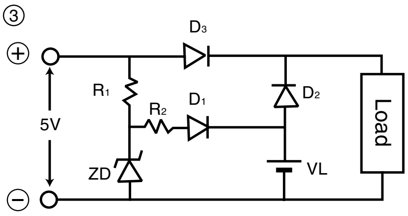
Simple economical circuits

D : MA2J728 (Very small reverse current)

Load with 5V applied	1mA below	
D,Vf	0~0.30V	
	R1	R2
VL621	6.2kΩ	2.4kΩ
VL1220	1500Ω	560Ω
VL2020	470Ω	180Ω
VL2320, VL2330	390Ω	150Ω
VL3032	180Ω	68Ω

✻VF of D will be different from the value given above if a current in excess of 1mA flows to the load during operation. Compensation must be provided by the resistors in such cases.

③

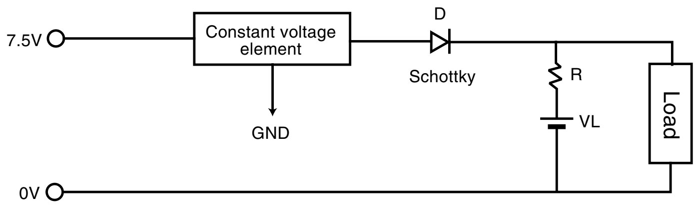


	ZD	D1	R1	
A	MAZ30360L	MA3X704	300Ω	Common to all types
B	MAZ30360H	MA2J728	270Ω	

Type		VL3032	VL2330	VL2320	VL2020	VL1220	VL621
R2	A	Not required				470Ω	1.5kΩ
	B	Not required				560Ω	1.6kΩ

For D2 , select a diode of small inverse current (I_R=1µA below / 5V)

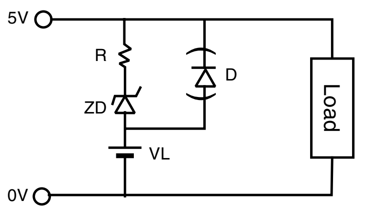
④ For minimizing current leakage due to resistance, etc., as when charging by another battery.



REG	D
3.7V	MA2J728

For details, refer to the constant voltage element specifications

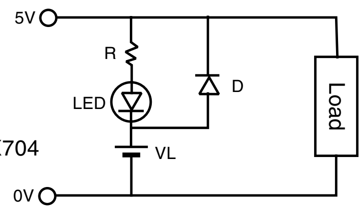
⑤ Zener control



ZD : HZ2ALL
R : 43Ω/VL2320
68Ω/VL2020
✻D : MA2J728 or MA3X704

Select a diode having an inverse current as small as possible. (I_R=1µA below / 5V)

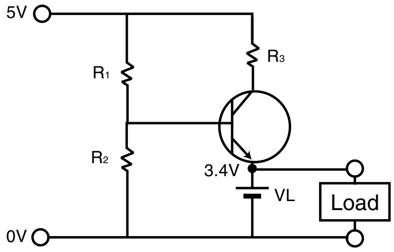
⑥ LED control



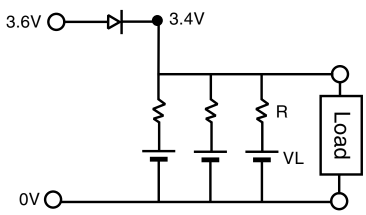
LED
R=51Ω for VL2320
✻D : MA2J728 or MA3X704

⑦ Transistor control(for VL2320)

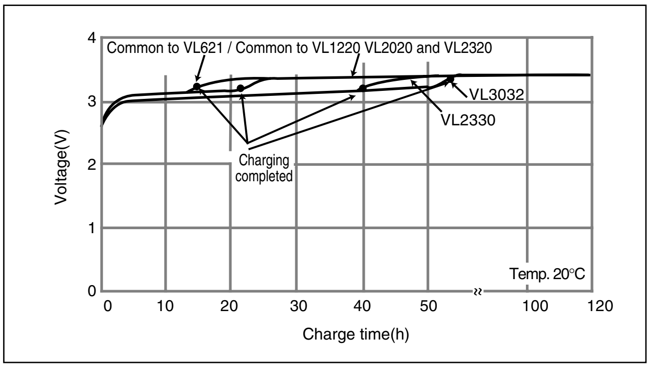
R1 : 4.3kΩ R2 : 15.0kΩ R3 : 680Ω



⑧ Parallel circuit

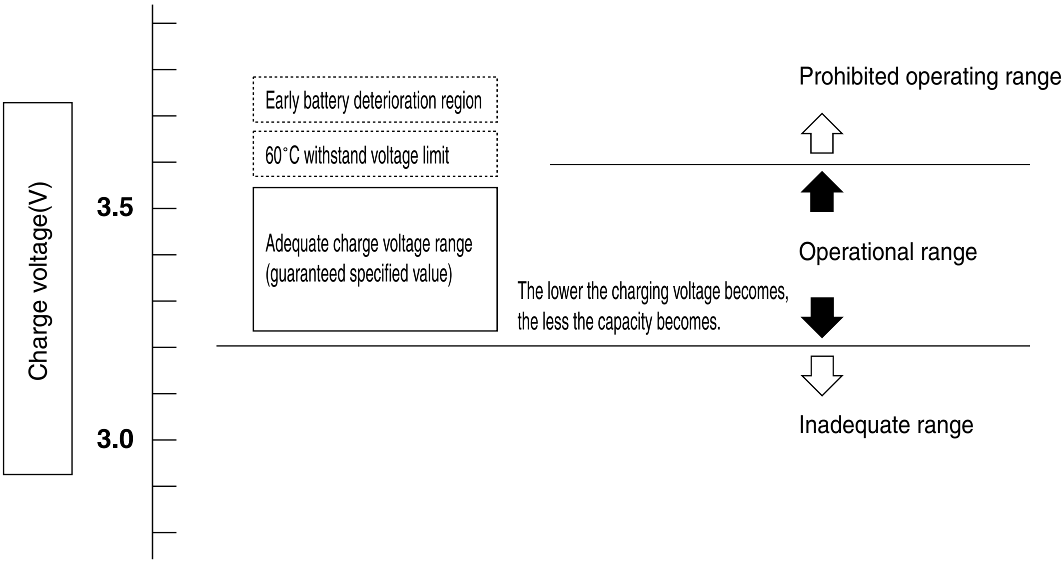


● Charging characteristics



● 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.



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