3. How to use small li-ion rechargeable batteries

3-1 How to charge small li-ion rechargeable batteries

The recommended charging method is to first charge to the maximum rated voltage of 2.8V using constant-current charging, and then maintain the charge at the rated voltage of 2.8V (constant-voltage charging). Figure 3-1 shows the voltage and charging current value when the ϕ3x7L is charged at a current value of 5C (1.75mA). After being charged using constant-current charging to the maximum rated voltage of 2.8V, the battery was held at its rated voltage of 2.8V. Charging was halted when current value reached 5% of current value capacity (0.0175mA).

* The following data are not guaranteed values.

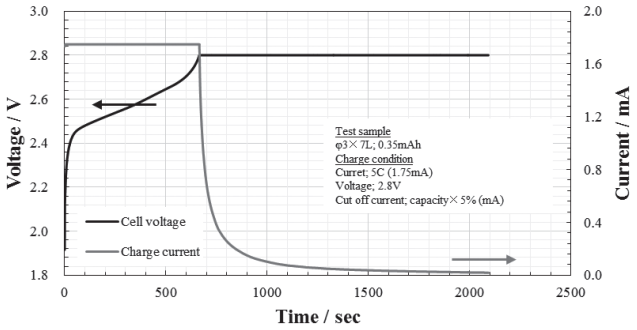

Figure 3-1. Constant current-constant voltage charging curve for ϕ3x7L

3-2 How to discharge small li-ion rechargeable batteries

The cycle properties deteriorates when the charge on the SLB falls below 1.8V. Figure 3-2 shows the discharge capacity relationship for various discharge current values. When the ϕ3x7L is discharged at 1C (0.35mA), the discharge takes approximately 1 hour. At 20C (7mA), discharging occurs in around 3 minutes. As the discharging current increases, the internal resistance causes the voltage to drop substantially, so as the discharge capacity decreases, the discharge current increases.

* The following data are not guaranteed values.

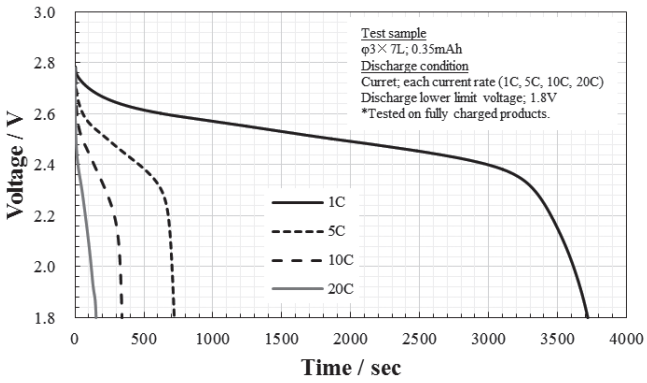

Figure 3-2. Relationship between discharging current value and discharging time for ϕ3x7L

3-3 Recommended ICs for charging/discharging

Because a maximum charging voltage and minimum discharge voltage have been set for small li-ion rechargeable batteries, voltage control is required. Table 3-1 gives examples of ICs that can be used in monitoring the charging and discharging of the SLB series. NICHICON does not guarantee the operation of the ICs listed in the table, so please check with their manufacturers when considering the use of these ICs. For details on control ICs, please check the data sheets provided by the ICs' manufacturers.

Table 3–1. Recommended ICs

No.	Supplier	Part No.	Feature	Nichicon type No.
1	Analog Devices	LTC4079	Linear Charger	SLB08115L140 SLB12400L151
2	Analog Devices	LTM4661	µModule Regulator	SLB08115L140 SLB12400L151
3	Renesas Electronic	RE01	Renesas MCU	SLB03070LR35 SLB08115L140 SLB12400L151
4	RICOH Electronic Devices	R1800 R1801	Buck DC/DC Converter	SLB03070LR35 SLB08115L140
5	RICOH Electronic Devices	RP604 RP605	Buck-Boost DC/DC Converter	SLB03070LR35 SLB08115L140
6	ROHM	BD99954GW /MWV	Battery Manager	SLB12400L151
7	ROHM	BD71631QWZ	Linear Charger	SLB03070LR35 SLB08115L140
8	TOREX SEMICONDUCTOR	XC8109	High Function Power Switch	SLB03070LR35 SLB08115L140 SLB12400L151
9	TOREX SEMICONDUCTOR	XC6504	LDO	SLB03070LR35 SLB08115L140 SLB12400L151
10	TOREX SEMICONDUCTOR	XC6240	LDO	SLB03070LR35 SLB08115L140 SLB12400L151

11	TOREX SEMICONDUCTOR	XC6140C	Reset IC	SLB03070LR35 SLB08115L140 SLB12400L151
12	TOREX SEMICONDUCTOR	XCL103	DC/DC Converter	SLB03070LR35 SLB08115L140 SLB12400L151
13	e-peas	AEM10330 AEM30330 AEM00330	AEM10330 – Solar Energy Harvesting - Buck Boost AEM30330 – Vibration/RF Energy Harvesting - Buck Boost AEM00330 – Ambient Energy Manager with Source Voltage Level Configuration	SLB03070LR35 SLB08115L140 SLB12400L151
14	e-peas	AEM10300 AEM30300 AEM00300	AEM10300 – Solar Energy Harvesting - Storage Charger only - Buck boost AEM30300 – Vibration/RF Energy Harvesting - Storage Charger only - Buck boost AEM00300 – Ambient Energy Manager - Storage Charger only - Buck boost	SLB03070LR35 SLB08115L140 SLB12400L151
15	e-peas	AEM10941	AEM10941-Solar Energy Harvesting with boost and LDO	SLB03070LR35 SLB08115L140 SLB12400L151
16	e-peas	AEM20940	AEM20940 - AmbientThermal energy harvesting-Buck boost and LDO	SLB03070LR35 SLB08115L140 SLB12400L151

The data sheet for each recommended IC are as follows.

○**LTC4079**
https://www.analog.com/media/en/technical-documentation/data-sheets/4079f.pdf

○**LTM4661**
https://www.analog.com/media/en/technical-documentation/data-sheets/LTM4661.pdf

○**RE01(with 256KB flash memory)**
https://www.renesas.com/jp/ja/document/dst/re01-group-256-kb-flash-memory-datasheet?language=en

○**RE01(with 1.5MB flash memory)**
https://www.renesas.com/jp/ja/document/dst/re01-group-products-15-mbyte-flash-memory-datasheet-0?language=en

○**R1800**
https://www.n-redc.co.jp/en/pdf/datasheet/r1800-ea.pdf

○**R1801**
https://www.n-redc.co.jp/en/pdf/datasheet/r1801-ea.pdf

○**RP604**
https://www.n-redc.co.jp/en/pdf/datasheet/rp604-ea.pdf

○**RP605**
https://www.n-redc.co.jp/en/pdf/datasheet/rp605-ea.pdf

○**BD99954GW/MWV**
https://fscdn.rohm.com/en/products/databook/datasheet/ic/power/battery_management/bd99954xxx-e.pdf

○**XC8109**
https://www.torexsemi.com/file/xc8109/XC8109.pdf

○**XC6504**
https://www.torexsemi.com/file/xc6504/XC6504.pdf

○**XC6240**
https://www.torexsemi.com/file/xc6240/XC6240.pdf

○**XC6140C**
https://www.torexsemi.com/file/xc6140/XC6140.pdf

○**XCL103**
https://www.torexsemi.com/file/xcl103/XCL102-103.pdf

○**AEM10330**
https://e-peas.com/product/aem10330

○**AEM30330**
https://e-peas.com/product/aem30330

○**AEM00330**
https://e-peas.com/product/aem00330-ambient-energy-manager-with-source-voltage-level-configuration

○**AEM10300**
https://e-peas.com/product/aem10300-solar-battery-charger-up-to-7-cells

○**AEM30300**
https://e-peas.com/product/aem30300-rf-battery-charger

○**AEM00300**
https://e-peas.com/product/aem00300-ambient-energy-manager-battery-charger

○**AEM10941**
https://e-peas.com/product/aem10941

○**AEM10240**
https://e-peas.com/product/aem20940