

Development of the Coin type LIB (Lithium ion battery)

We are developing a small lithium-ion secondary battery at standard size as the main power supply use of small portable machinery easily. Battery shape is a coin cell with Stainless Steel can. Protection circuit will be needed.

Model	Nominal voltage / V	Capacity / mAh	Max. discharge current	Dimension (Initial state)/ mm		Weight / g
				Diameter	Thickness (Full charge)	
CLB2032	3.7	70	2C	20.0 +0/-0.2	3.25 +0/-0.2	3.1
CLB1845	3.7	70	2C	18.0 +0/-0.2	4.5 +0/-0.2	3.1



Remarks

Charge temp. : 0 to 45 deg. C (current is 0.5C)

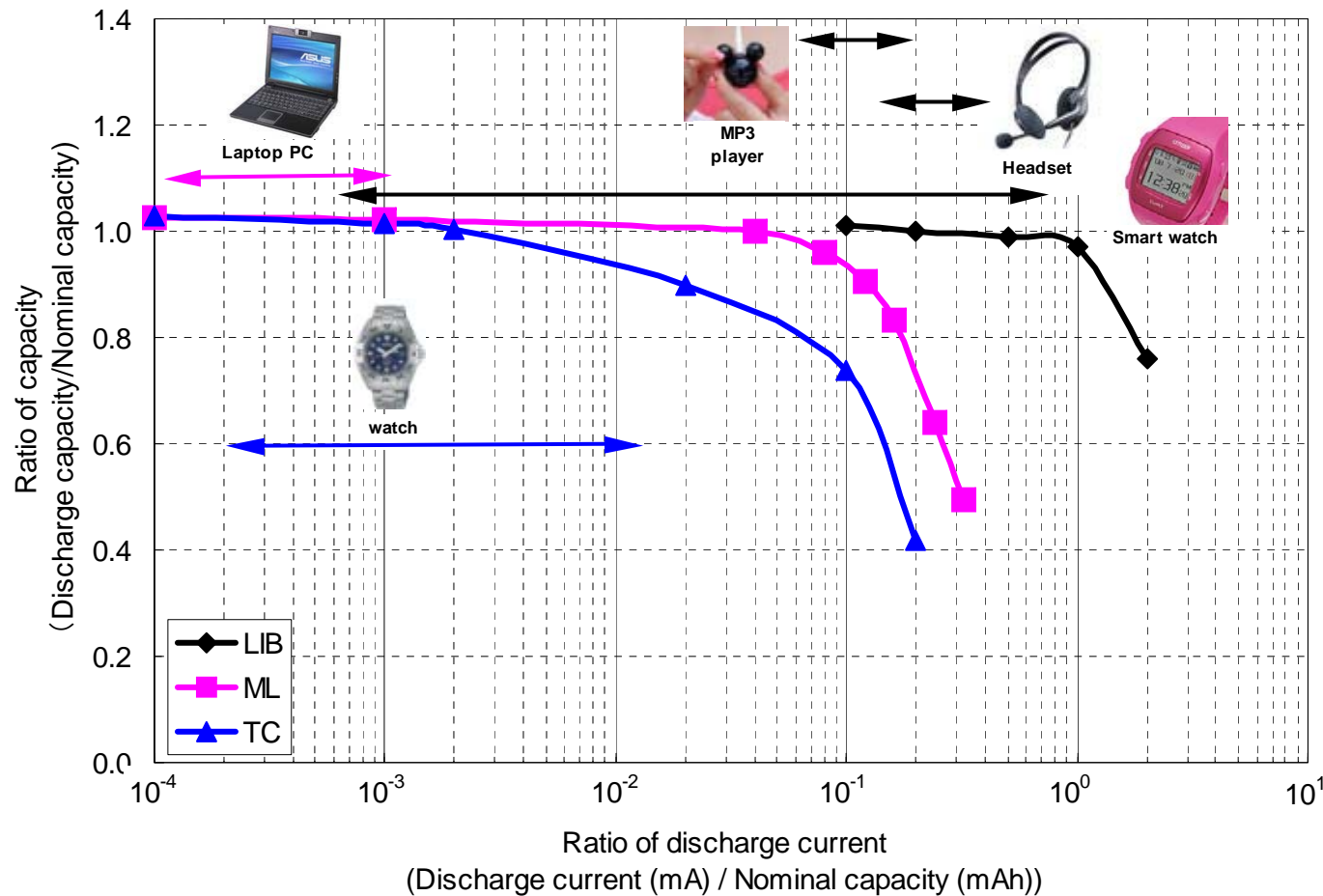
Discharge temp. : -20 to 60 deg. C

Storage: -20 to 50 deg.C For up to 1 month

-20 to 35 deg. C For up to 3 month

WS: Apr. 2009, ES: Dec. 2009, MP: Apr. 2010

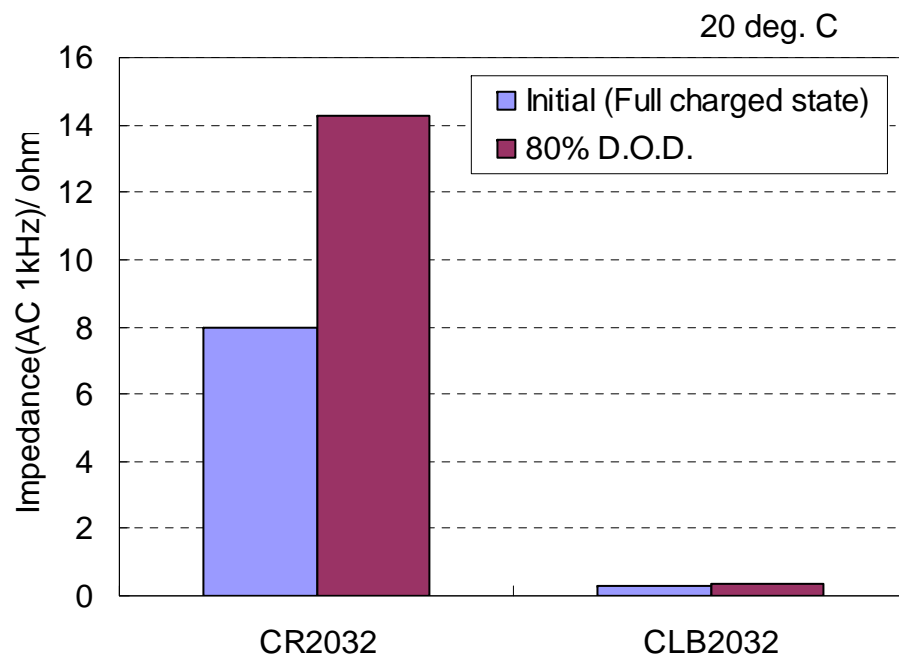
Characteristics of rechargeable batteries



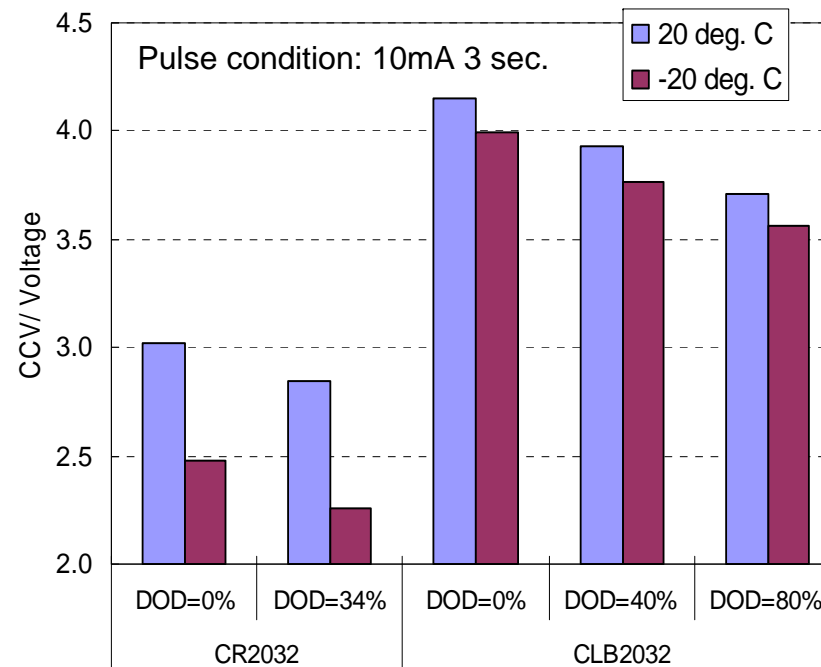
Lithium ion battery (LIB) is suitable for heavy duty applications.

Comparison with another coin type lithium battery

DOD-Impedance characteristics



DOD-CCV characteristics

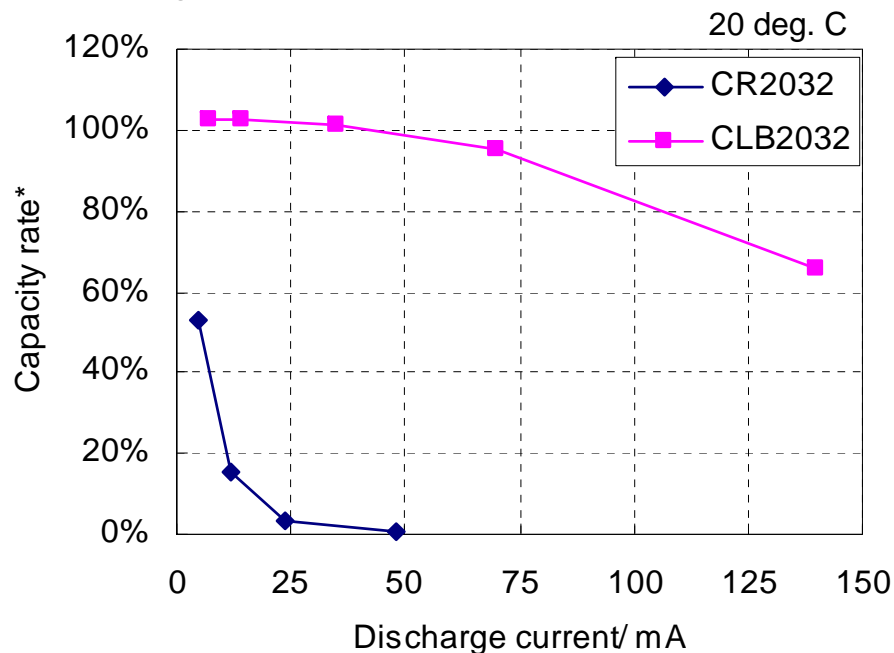


CR2032: 100%DOD=240mAh
CLB2032: 100%DOD=70mAh

CLB has low impedance at deep discharge state
and it brings good CCV especially at heavy duty use.

Relationship between discharge current and capacity

Discharge characteristics



***Capacity rate means
(Discharge capacity/ Nominal capacity)**

CLB has low impedance and it brings good capacity ratio especially at heavy duty use.

Available energy

	CR2032	CLB2032
11mA discharge (Wh)	0.094	93.7
4.8mA discharge (Wh)	0.345	93.7

Available energy means "Voltage X Capacity X Cycle time"

-Voltage means

"average voltage at each discharge rate at 20 deg. C"

-Capacity means

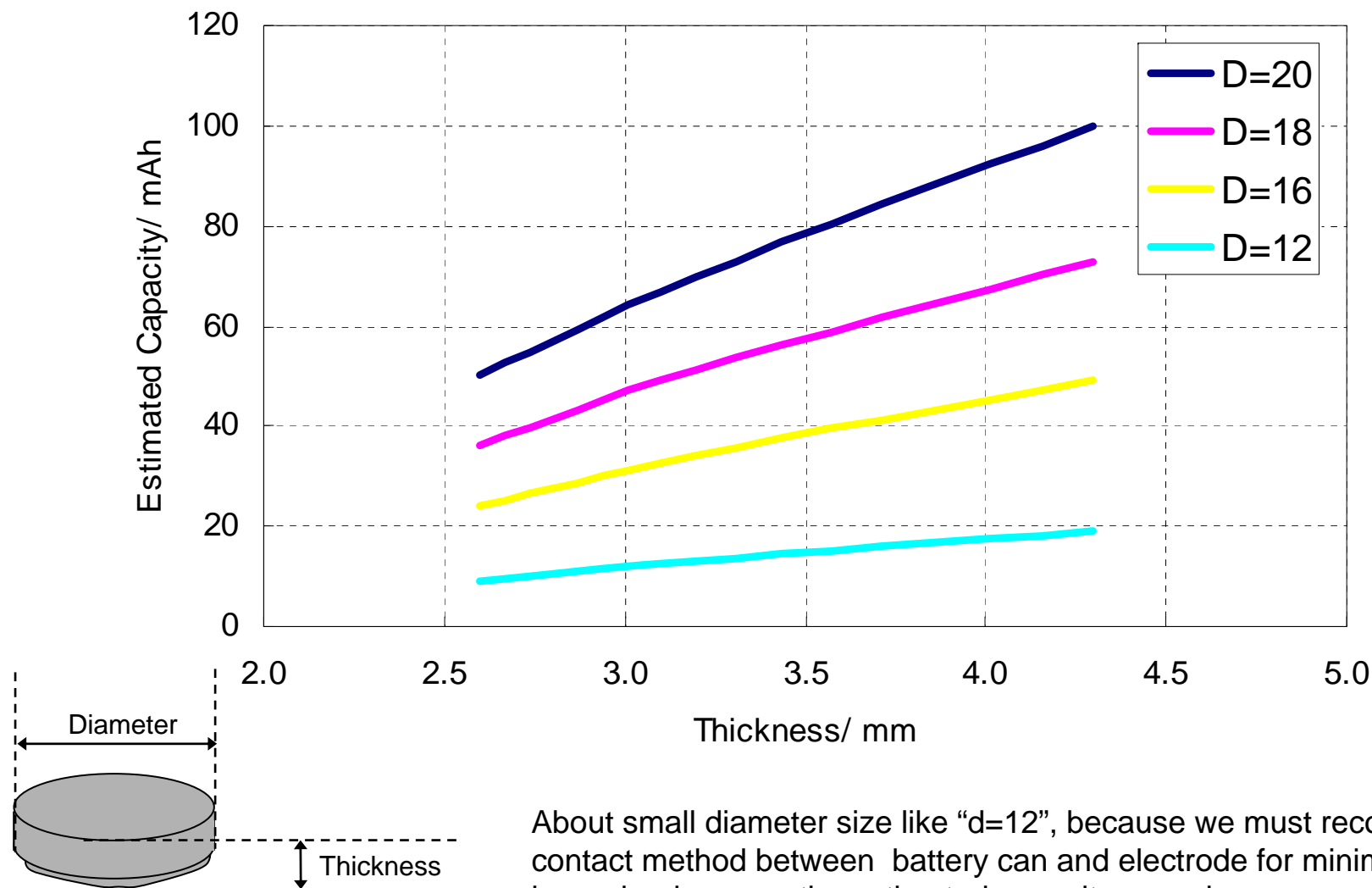
"real capacity of each discharge rate at 20 deg. C"

-Cycle time means

"1 time for CR and 400 times for CLB

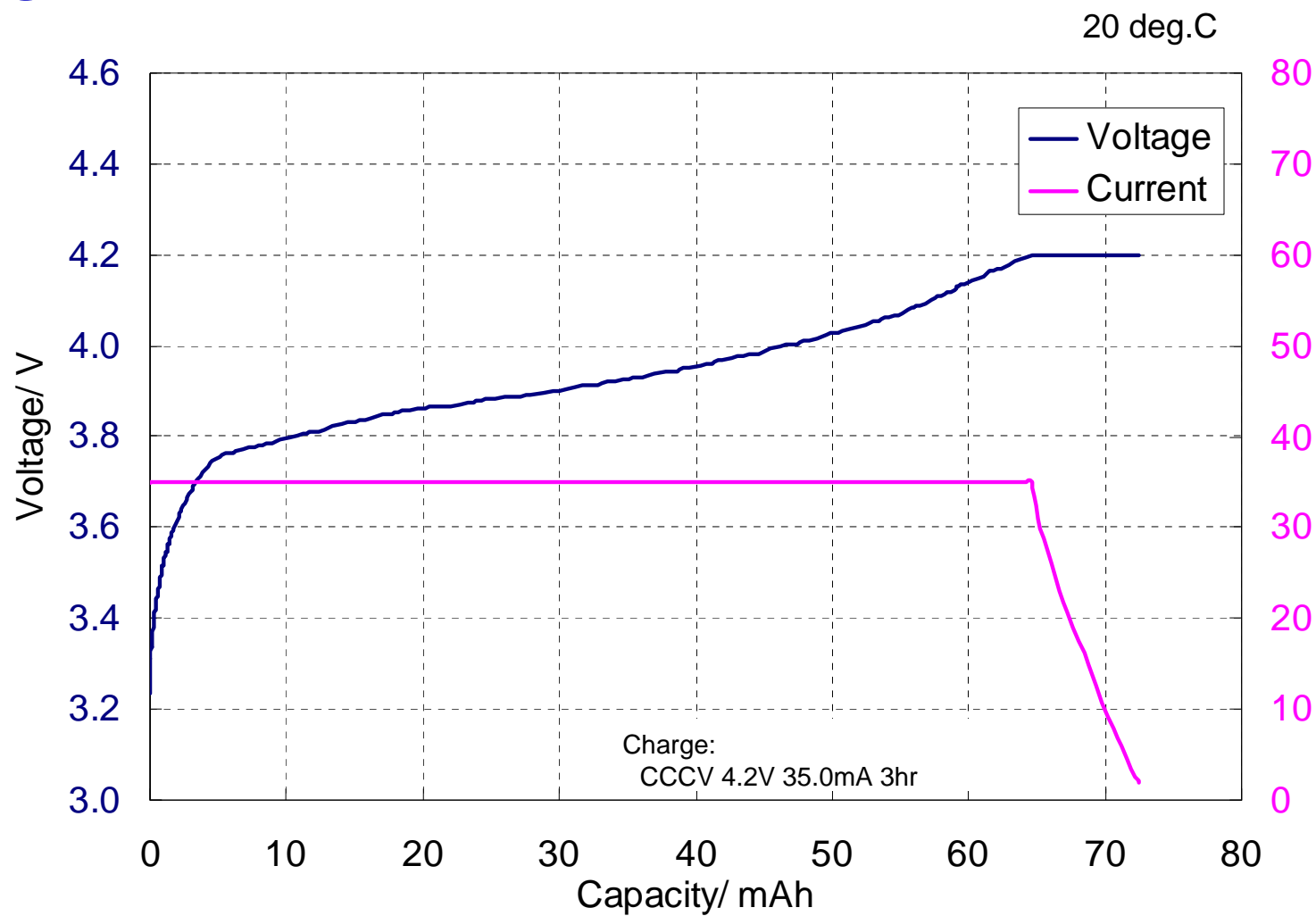
(CLB becomes 80% capacity of initial state after 400 cycle)"

Estimated capacity of CLB



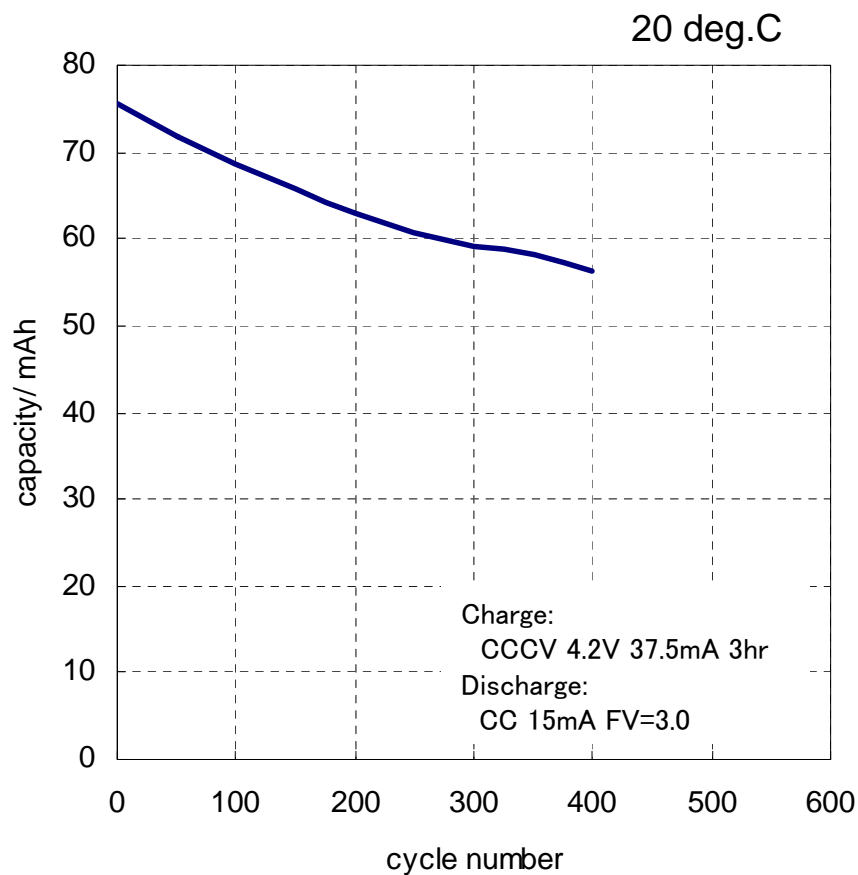
About small diameter size like “d=12”, because we must reconsider contact method between battery can and electrode for minimizing inner dead space, the estimated capacity may change.

Charge characteristics of CLB2032

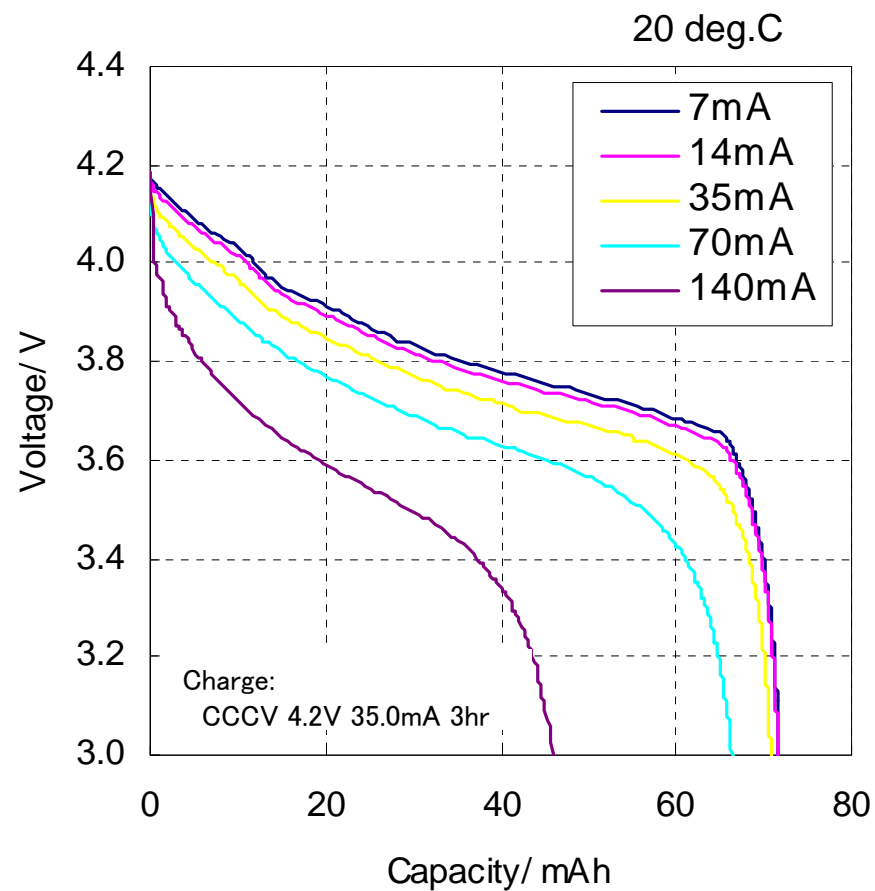


Discharge characteristics of CLB2032

Std. Cycle characteristics



Discharge current characteristics



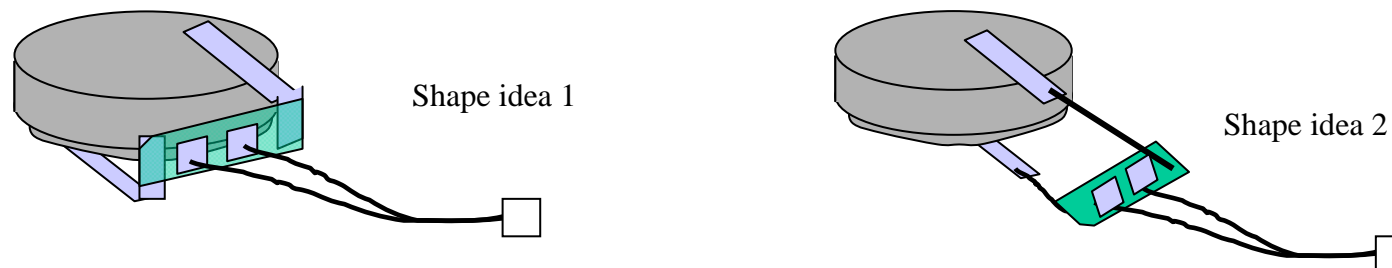
Safety characteristics of 2032 size

Test	Method	Charge condition (CCCV)	Result	Max. battery temp. / deg. C
Over charge	Charging a fully charged battery (4.25V) in the "Charge condition".	37.5mA 12V 24hr	NF, NE, NV	35.3
		75mA 12V 2.5hr	NF, NE, NV	44.3
		150mA 12V 1.25hr	NF, NE, NV	69.2
		225mA 12V 0.23hr	NF, NE, NV	39.8
Forced discharge	Discharging a fully charged battery (4.25V) in the "Charge condition".	75mA 2hr	NF, NE, NV	42.2
		150mA 1hr	NF, NE, NV	42.5
		225mA 0.67hr	NF, NE, NV	71.7
External short circuit	Short circuiting a fully charged battery (4.25V) under 100 mOhm.		NF, NE, NV	72.2
Nail penetration	Penetrating a fully charged battery (4.25V) with a nail of fai 2.5 by 5 mm per sec.		NF, NE, NV	81.2
Impact	Laying a stick of fai 15.8 to a fully charged battery (4.25V) and let a weight of 9.1kg fall over height of 61cm.		NF, NE	90.5
Crush	Picking up a battery (4.25V) with flat boards and crushing it by power of 13kN for two seconds.		NF, NE	ND
Heating	Holding a fully charged battery (4.25V) at 130 deg. C for 1h after pre-heating (5 deg. C /min. from 20 deg. C) with a container made by metal.		NF, NE, NV	131.7
Drop	Dropping a fully charged battery (4.25V) on concrete side from height of 1.9m for 10 times.		NF, NE, NV	ND

NF=no fire, NE=no explosion,
NV= no venting, ND=no data

Protection circuit module (PCM)

The PCM is needed to the battery (or application).

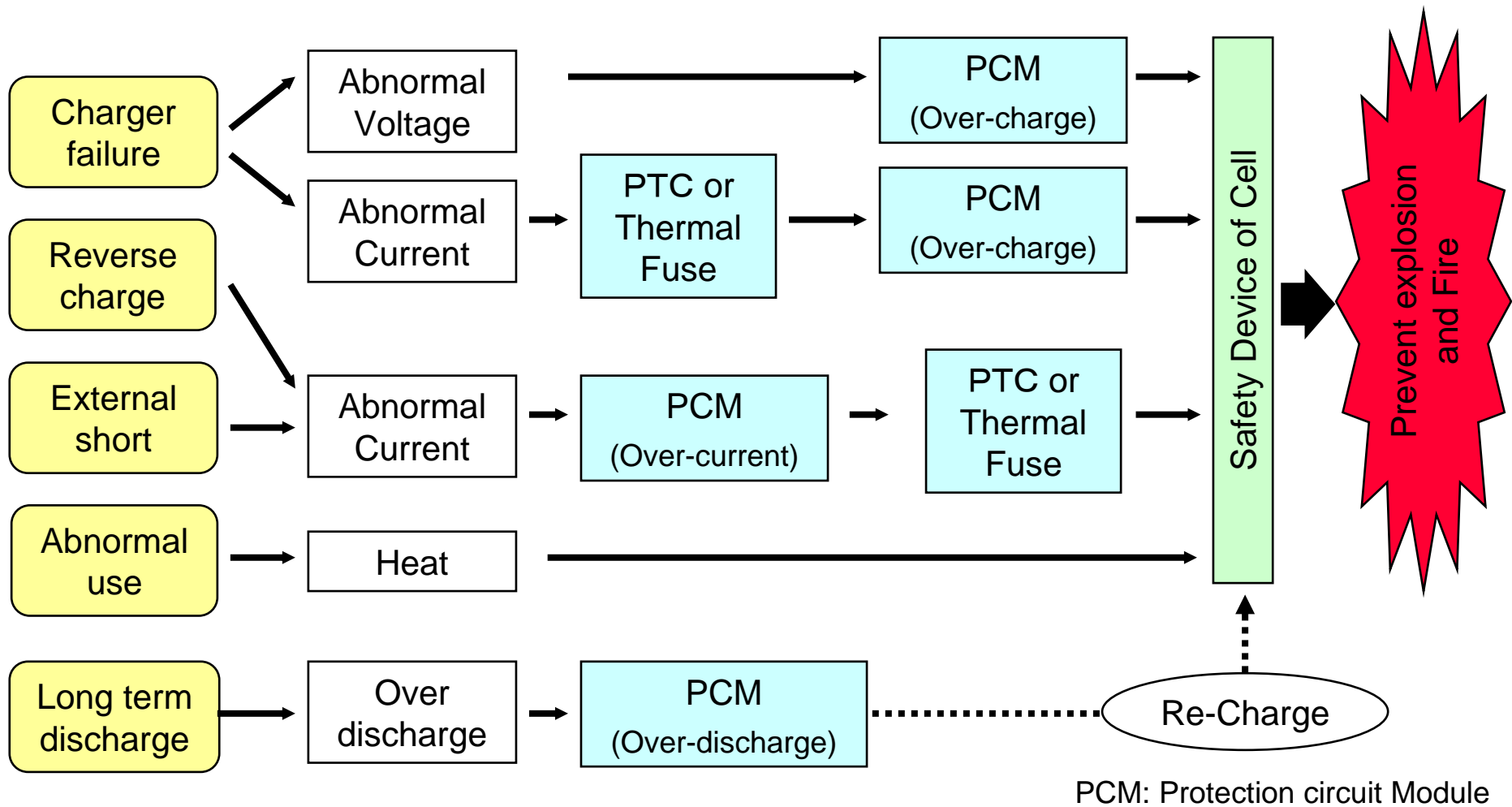


Generally, the PCM has the function of checking

- 1) Charge current
- 2) Charge voltage
- 3) Discharge current
- 4) Discharge voltage
- 5) Temperature

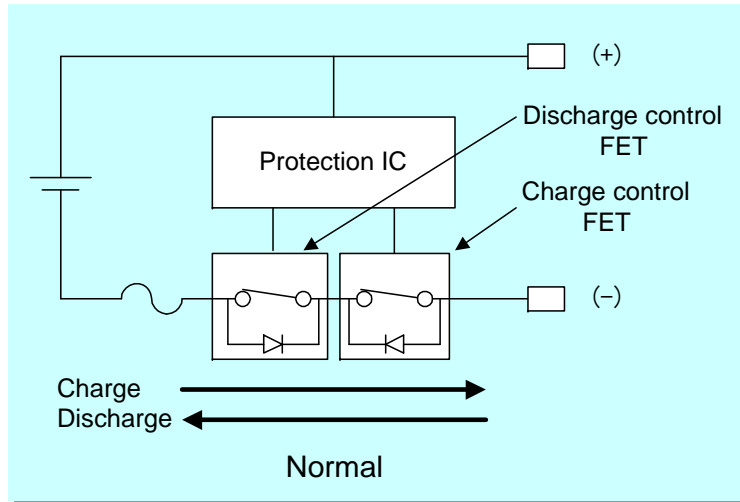
(We guess mostly all application has the temperature check function and no check function on PCM)

Act as Protection Device



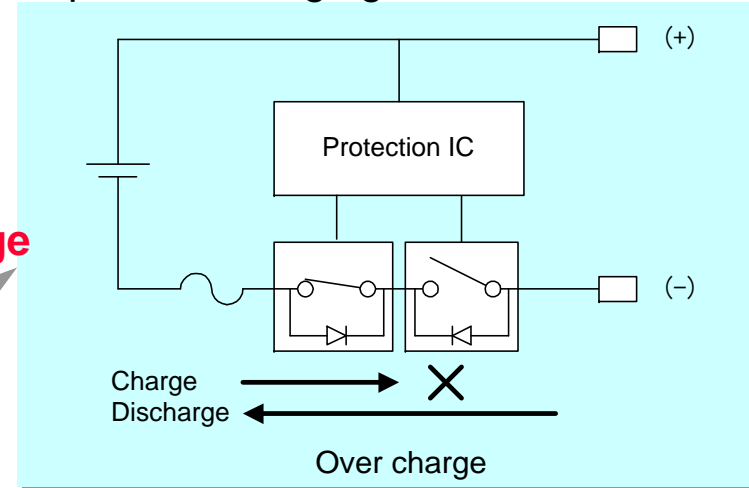
Function of Protection circuit

- Protection IC monitors cell voltage and current

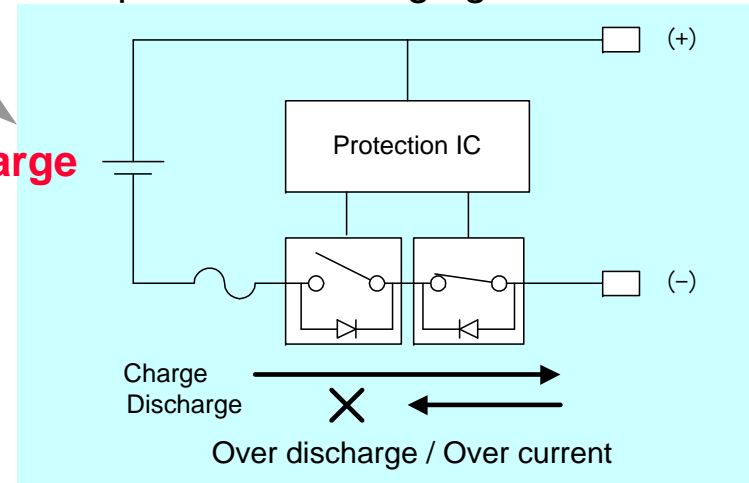


Over-charge

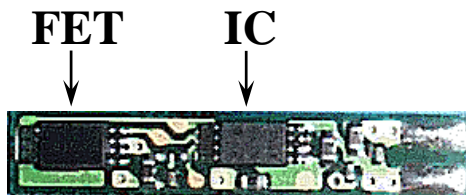
- Turn off the charge control FET to prohibit charging



- Turn off the discharge control FET to prohibit discharging



Over-discharge
Over-load



Detect Voltage of Protection Circuit

● 4.2V charge type (Coin type LIB)

