TOREX

Torex...Powerfully Small!

Wireless power transfer compatible, Multi-function Ultra-compact charger IC for Li-ion batteries
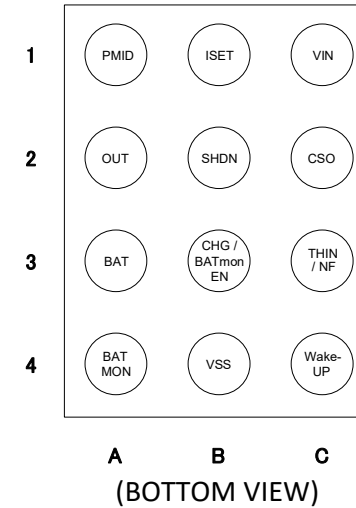# XC6810 Series Product Overview

May 2023

TOREX Semiconductor

Rev. 1.0

XC6810 : Ultra-compact charger IC for Li-ion batteries compatible with wireless power transfer

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For Small Li-ion / Shutdown for shipping / V_{IN} Two-wire communication / Charging & Battery Monitor
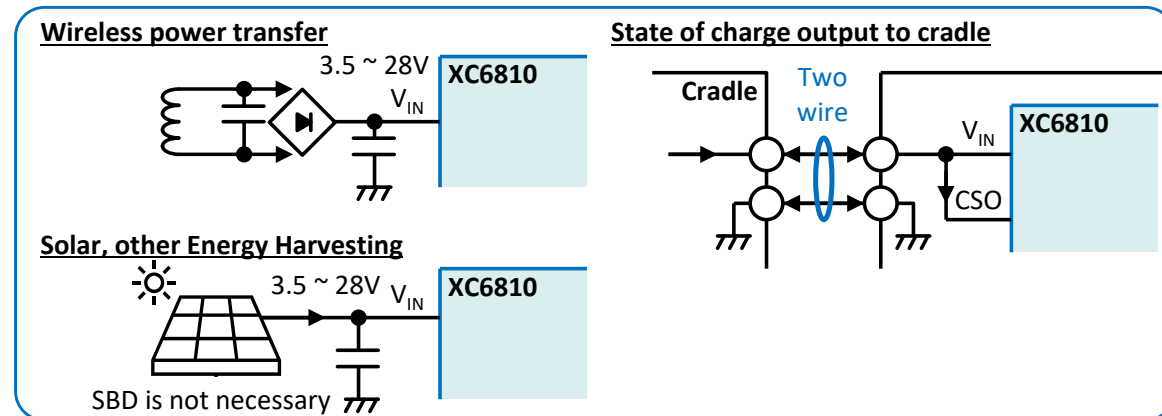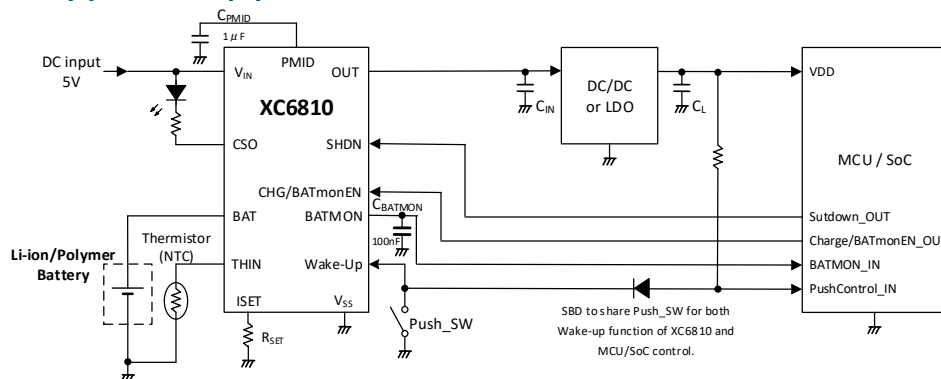
■ Features

Input Voltage (Chargeable)	: 3.5V ~ 28.0V (Absolute Max. : 30V)
Charge Voltage	: 3.80V ~ 4.40V (0.05V increments)
Charge Current	: 1mA ~ 25mA (Set by an external resistor)
BAT Sink Current	: 10nA (TYP. at Shutdown)
Functions	: Shutdown, Wake-up
	Battery Voltage Monitor or Low Notification
	Current path with Input Current limit (110mA)
	OUT line switch interlocked with UVLO (option)
	Battery temperature monitor
	Charge Enable Control
Protections	: Battery Over Discharge Protection
	Output Short Protection
	Thermal Control
	Reverse Current Prevention
	Safety Timer of Charging, UVLO
Package	: WLP-12-01
Operating Ambient Temp.	: -40℃ ~ 85℃

■ Package

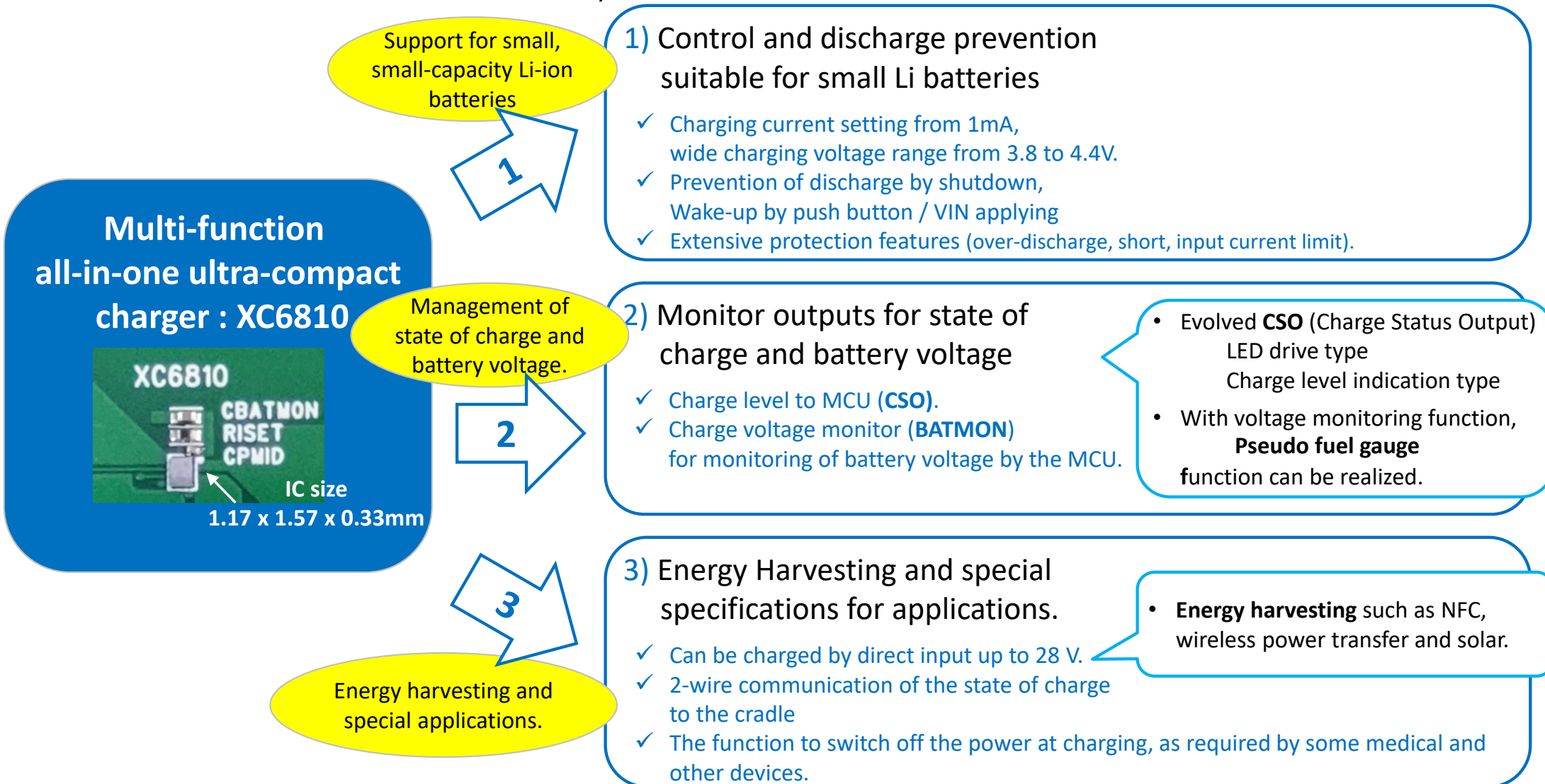|	A	B	C
1	PMID	ISET	VIN
2	OUT	SHDN	CSO
3	BAT	CHG / BATmon EN	THIN / NF
4	BAT MON	VSS	Wake-UP

(BOTTOM VIEW)

WLP-12-01
(1.17 x 1.57 x 0.33mm)

■ Typical Application Circuit

All-in-one charger XC6810
for ultra-compact, low-consumption devices.

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■ Ultra-compact charger with optimal charge/discharge management and various functions for small Li-ion batteries in wearable, hearable and IoT devices.

Support for small, small-capacity Li-ion batteries

1 →

Multi-function all-in-one ultra-compact charger : XC6810

XC6810
CBATMON
RISET
CPMID

IC size 1.17 x 1.57 x 0.33mm

1) Control and discharge prevention suitable for small Li batteries

✓ Charging current setting from 1mA, wide charging voltage range from 3.8 to 4.4V.
✓ Prevention of discharge by shutdown, Wake-up by push button / VIN applying
✓ Extensive protection features (over-discharge, short, input current limit).

Management of state of charge and battery voltage.

2 →

2) Monitor outputs for state of charge and battery voltage

✓ Charge level to MCU (**CSO**).
✓ Charge voltage monitor (**BATMON**) for monitoring of battery voltage by the MCU.

- Evolved **CSO** (Charge Status Output) LED drive type Charge level indication type
- With voltage monitoring function, **Pseudo fuel gauge f**unction can be realized.

3 →

Energy harvesting and special applications.

3) Energy Harvesting and special specifications for applications.

✓ Can be charged by direct input up to 28 V.
✓ 2-wire communication of the state of charge to the cradle
✓ The function to switch off the power at charging, as required by some medical and other devices.

- **Energy harvesting** such as NFC, wireless power transfer and solar.

By controlling this charging IC and MCU, various inputs such as energy harvesting can be supported and power supply control including battery charging/discharging can be easily constructed.

XC6810 : Features and Target Applications

All-in-one multi-function charger IC for small-capacity Li-ion/polymer batteries
that provides the functions required by small devices/modules in an ultra-small package.

■ Features

1) Charge Controls / Protections

- ✓ Charge controls and Current Path suitable for small capacity Li-ion/Polymer batteries
- ✓ Shutdown function to suppress battery discharge after shipment
- ✓ Extensive protection functions

2) Condition monitor

- ✓ Charge status and battery voltage monitoring

3) Support for various applications and power supplies

- ✓ V_{IN} 2-wire communication with cradle
- ✓ Supports wireless power transfer and other energy harvesting
- ✓ Options suitable for some medical and other wearables / hearables

■ Target Applications

- ● Wearables / Hearables
  - ✓ Wearables, Tracker devices
  - ✓ Hearing aids, Wireless earphones, Headsets
  - ✓ Medical / Nursing care wearables / monitors
- ● IoT sensors/monitors
  - ✓ Sensors / Monitors for Home / Office / FA
- ● Wireless and other energy harvesting devices
- ● Smart cards

WLP-12-01 (1.17 x 1.57 x 0.33 mm)
Ultra-small package and a few external components
provide a space-saving, low-profile solution.
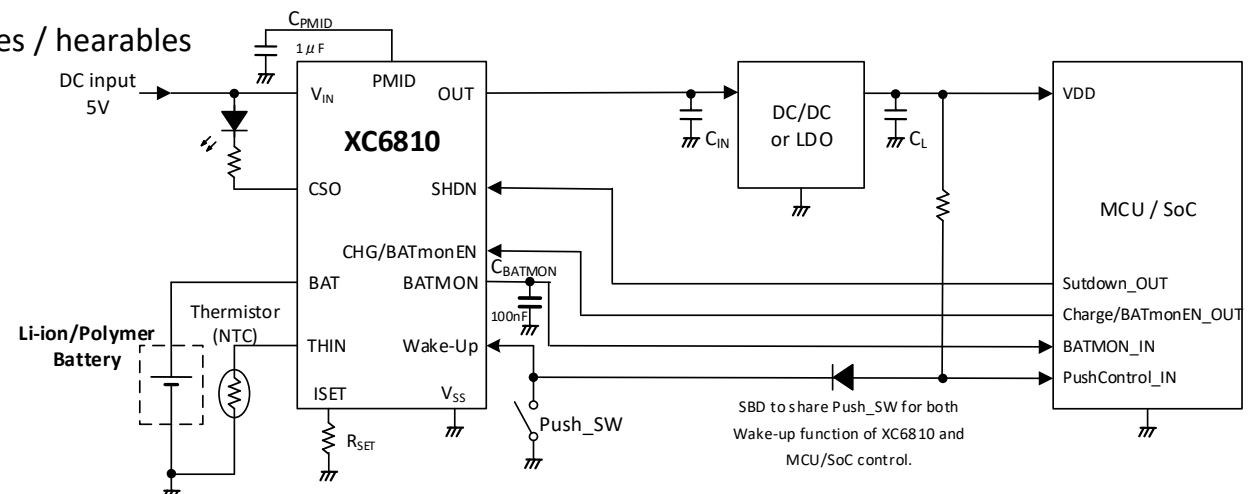
■ Charge Control / Protection

A) Charge control and functions suitable for small-capacity Li-ion/Polymer

B) Extensive protection features

C) Shutdown function to prevent Li battery discharge

A) Current Path
Supply current from the V_{IN} pin to **OUT** pin, separated from the charge current to **BAT** pin.

B) Protection SW: Turns off when **OUT** pin is shorted.

A) ON/OFF control of charging
Charging ON/OFF is controlled by the **CHG/BATmonEN** pin.

B) Protection functions

V_{IN} pin: UVLO, Current limit of 110 mA, Reverse current prevention.

Battery over discharge protection.

OUT pin short protection.
Simplified protection for Li battery together with over-discharge.

Current limit during overheating of IC.

C) Shutdown Function

Shutdown (Ship)
Shutdown by pulse to **SHDN** pin.
Prevention of discharge after shipment is essential for small Li batteries.
Also used as main power supply SW.

Wake-up
Startup by a "L" pulse to the **Wake-Up** pin or by applying a voltage to the V_{IN} pin.

A) Charge control   CC/CV (Constant Voltage / Constant Current) control

Charge Voltage   CV (V_{CV}) = 3.8 ~ 4.4V, selectable in 0.05V increments. Wide range of charge voltage and low voltage such like 4.1V settings for long life and all-solid-state batteries.

Charge Current   CC (ICHG) = 1~25mA can be set by R_{SET}. For Li-ion/Polymer batteries up to ~50mAh.

Temperature Control   Monitored and controlled by NTC on **THIN** pin.

State Monitor

A) Charge status output function

B) Battery voltage monitoring function
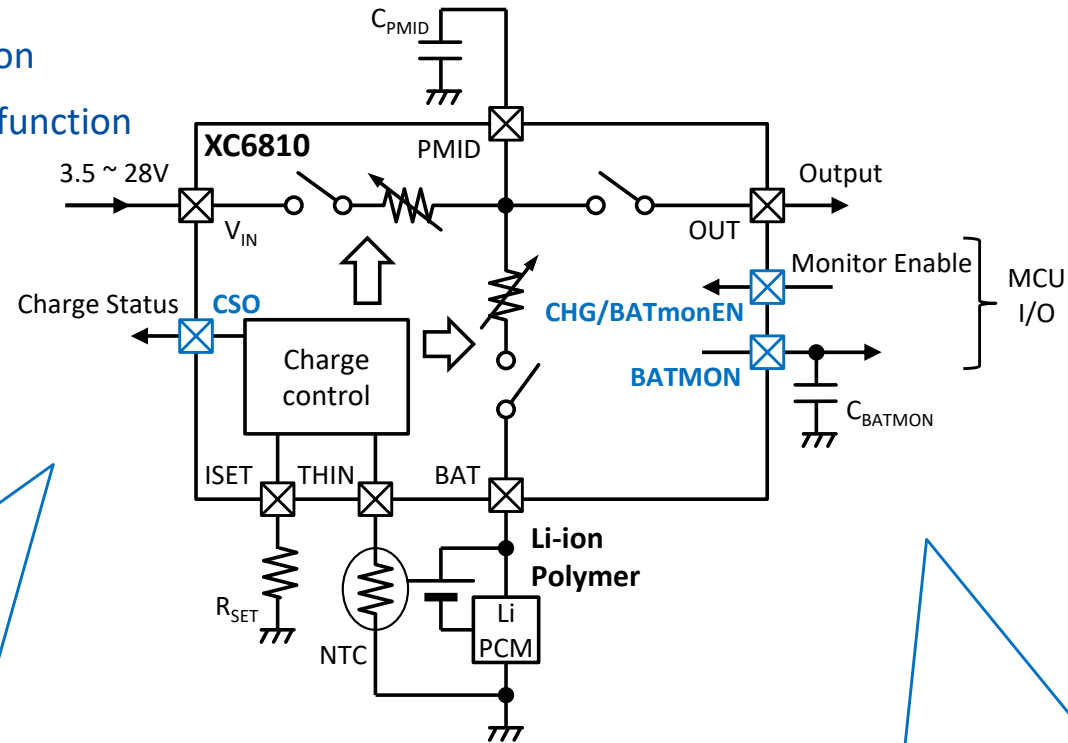
A) CSO : Charge Status Output : Two types

Battery LED Indicator

Charging (ON) / Stopped (OFF, including charge completion) / Error (Flashing at 8Hz).

Drives LED or outputs to MCU with pull-up resistor.

Battery Status Indicator

1mA constant current sink to GND.

Charge level (Sinks in 32, 16, 8kHz pulses for each state of < 60%, < 90%, 90% ≤)
Charge completion (4kHz) / **Stopped** (OFF) / **Error** (1kHz)

Outputs to MCU with pull-up resistor,
or Modulates V_{IN} for two-wire communication to the cradle.

B) BATMON : Battery Monitor Output : Two types

Battery Voltage Monitor

At "H" for **CHG/BATmonEN**,

Battery voltage **(V_{BAT}) x 0.2**

is output.

Provide suitable voltage for A/D of MCU.
Consumption during monitoring is only 0.55μA.

Low Voltage Notification (Option)

Outputs "L" when battery voltage is 3.0V or lower.
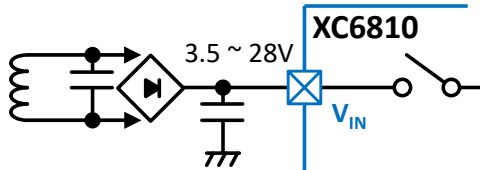
XC6810 : Extensive features (3)

■ Support for various applications and power supplies

A) Charge status output to cradle

B) Supports wireless power transfer and other energy harvesting
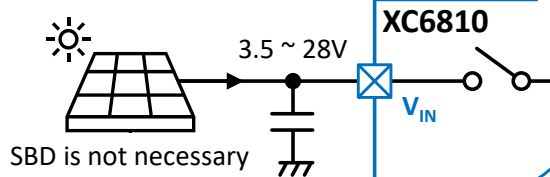
C) Output OFF type when V_{IN} is supplied (Option)

C) Output OFF type when VIN is supplied (Option)
OUT line switch interlocked with UVLO

A, B, E, F types
When V_{IN} is connected, output (**OUT**) is turned off with this SW to stop device operation.
To reset devices as well.

Supports requirements **of wearables, hearables and sensors, such as some hearing aids and medical, etc.**

B) Wireless power transfer, Energy harvesting
Supports a wide range of supply/charge input voltage up to 28V.

Wireless power transfer

3.5 ~ 28V XC6810 V_{IN}

Solar and other energy harvesting

3.5 ~ 28V XC6810 V_{IN}

SBD is not necessary

XC6810 C_{PMID} PMID Output
3.5 ~ 28V V_{IN} OUT
CSO
Charge Status Charge control
ISET THIN BAT **Li-ion Polymer**
R_{SET} NTC Li PCM

A) Charge status output/communication to cradle

Use **CSO: Battery Status Indicator** type.
Two-wire communication via V_{IN} ; modulates with 1mA pulses.

Charge level (Sinks in 32, 16, 8kHz pulses for each state of < 60%, < 90%, 90% ≤)
Charge completion (4kHz) / **Stopped** (OFF) / **Error** (1kHz)

By detecting changes in current, the cradle can display the charge status on LED and control ON/OFF of power feeding.

USB 5V Charger Step-up 5V CE
Li-ion LDO 3V MCU LED
Detects current modulation with a resistor
2-wire Charge current
V_{IN}
CSO
1mA
CSO modulates charge current
Charge control
XC6810
Cradle **Device**