

*Torex...Powerfully Small!*

**Highly functionality, Step-up micro DC/DC Converters**  
**XCL109/XCL110 Series Product Overview**

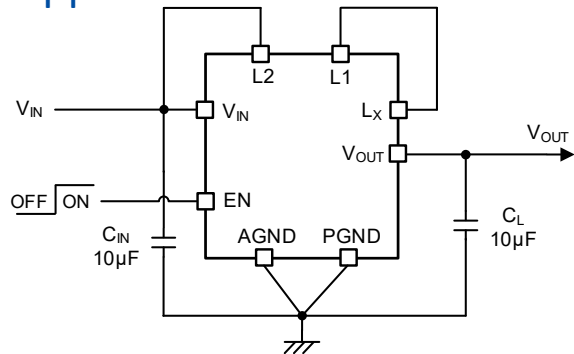
July 2024  
TOREX Semiconductor  
Rev. 1.1

## Load Disconnection / Bypass / OR connection Selectable

### ■ Features

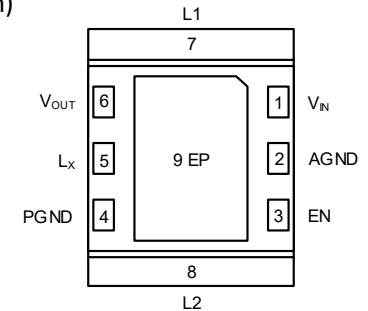
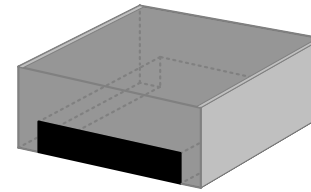
Input Voltage	: 0.65V ~ 6.0V (Absolute Max.:7.0V)
Operation Start Voltage	: 0.9V
Output Voltage	: 1.8V ~ 5.5V ( $\pm 2.0\%$ )
Output Current	: 610mA@ $V_{OUT}=5.0V, V_{IN}=3.3V$ 380mA@ $V_{OUT}=3.3V, V_{IN}=1.8V$
Supply Current	: 30 $\mu$ A
Oscillation Frequency	: 3MHz
Control Method	: F-PWM (XCL109), PWM/PFM (XCL110)
Type	: Load Disconnection & $C_L$ Discharge (A/D) Bypass (XCL110B) OR connection (XCL110C)
Function	: ON/OFF, Soft-Start
Protection	: Thermal shutdown Current limit Integral latch & Short Protection (D)
Package	: CL-2025-02
Operating Ambient Temp.	: -40°C ~ 105°C

### ■ Typical Application Circuit



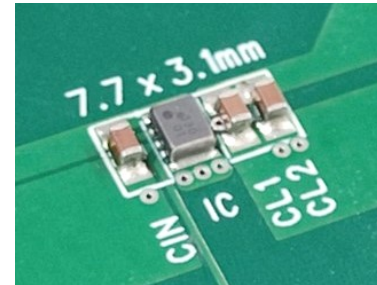
### ■ Package

CL-2025-02  
(2.0x2.5x1.04mm)



(BOTTOM VIEW)

### ■ Solution Size



P2P compatible with other step-up XCL products (XCL102/XCL103, XCL108)

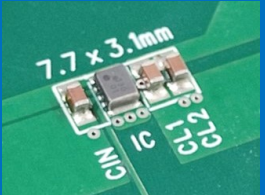
- Step-up DC/DC to achieve low power consumption of MCUs and Space-saving of IoT devices.

Types

Highly functionality  
Step-up micro DC/DC

XCL109 : PWM

XCL110 : PWM/PFM



Lineup

①

Highly functionality, micro DC/DC

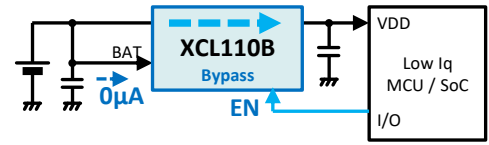
- ✓ 3 types selectable
- Load Disconnection / Bypass / OR connection
- ✓ Significant miniaturization and EMI reduction due to unique Built-in inductor structure

②

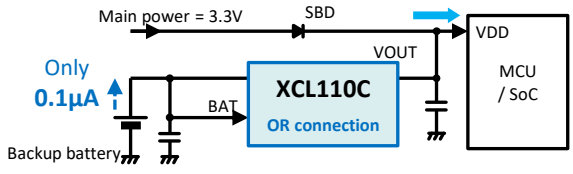
Expanded lineup of step-up XCL

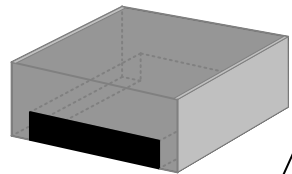
- ✓ P2P compatible with XCL102/XCL103
- 105°C / Low R<sub>ON</sub> / Additional functions
- ✓ P2P compatible with XCL108
- ✓ High current is supported by XCL104/XCL105.

● Bypass



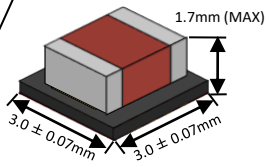
● OR connection





CL-2025-02

XCL109/XCL110  
XCL108  
XCL102/103



DFN3030-10B

XCL104/XCL105



Contributes to higher functionality and longer battery life in various devices

- IoT / Sensor / Security equipment
- Backup circuit for industrial equipment

+105°C operation and Low EMI

- Suitable for sensors of Smart Factory

## TOREX original Built-in inductor Micro DC/DC XCL Series

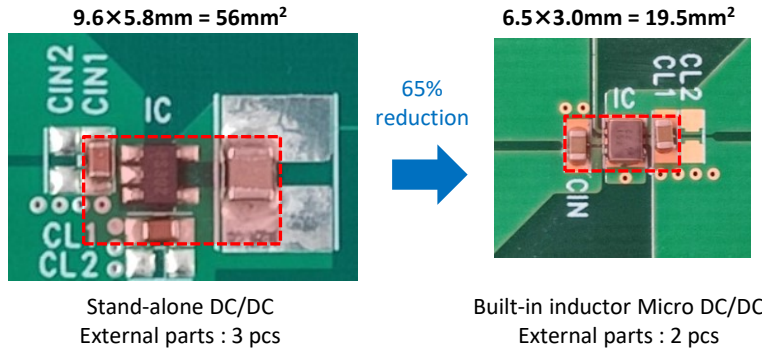
### ● Technical trend and challenges

- For stable operation of devices, it is important to place power supply ICs close to MCUs and FPGAs. Especially in cases where multiple power supplies are required, selecting power supply ICs suitable for POL (Point of Load) is a challenge.
- Miniaturization of power circuits including ICs and low EMI are essential.

### ● TOREX Proposal : Built-in inductor Micro DC/DC

#### ➢ Significant miniaturization of power supply circuit

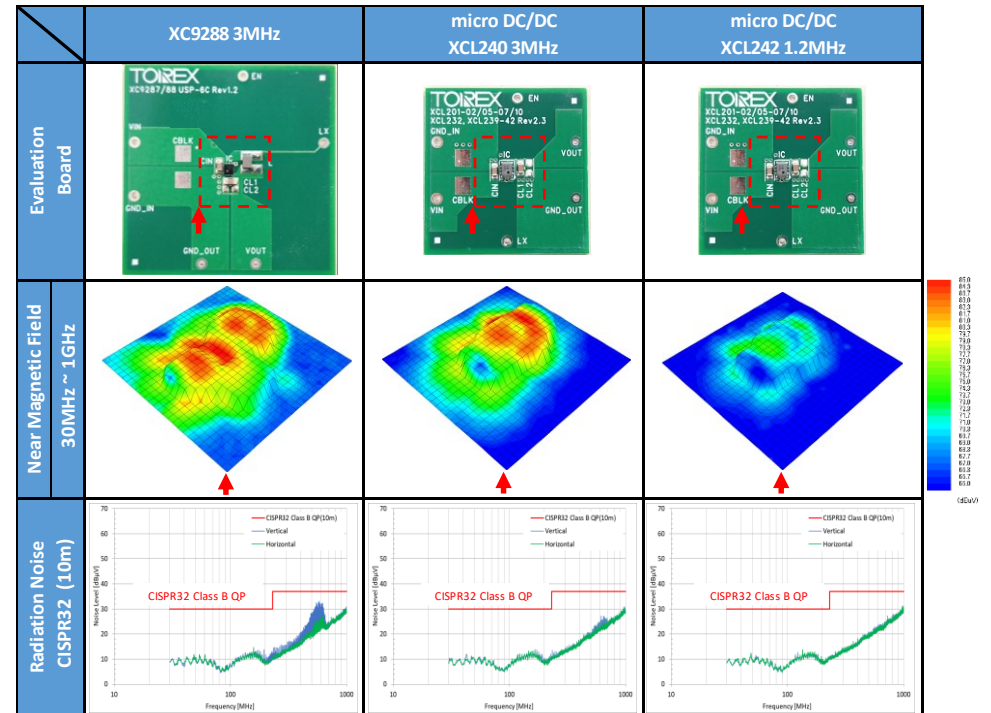
- Achieves a significant reduction in mounting area and providing smallest class of power supply solution.
- Unique package structure / Optimum inductor for the internal IC.
- Efficient heat dissipation performance with structures that connect IC/coil and substrate with low thermal resistance.



#### ➢ EMI reduction due to unique Built-in inductor structure

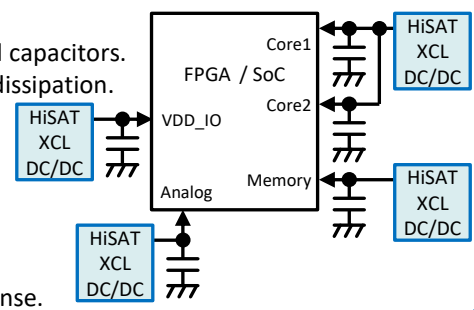
- ✓ The pocket-type structure covering the IC with a coil and the optimum placement of the IC enable a **significant reduction of radiated noise** compared to the stand-alone IC.
- ✓ Can be placed near RF ICs/Sensors, etc., contributing to miniaturization.

## EMI comparison of Built-in inductor Micro DC/DC and stand-alone DC/DC



### Benefits of POL (Point of Load) power supply and Micro DC/DC & HiSAT-COT®

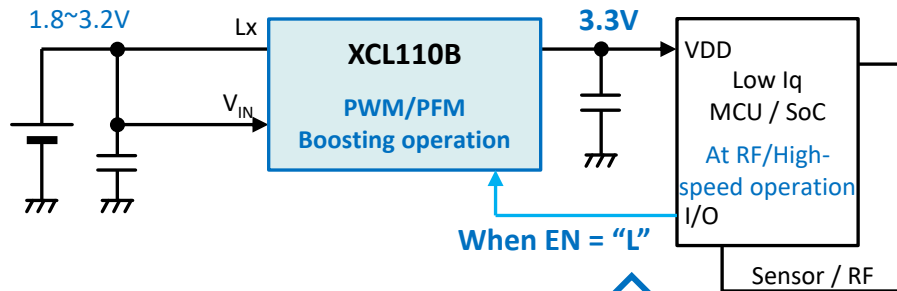
- Shorter power supply wiring length. In addition to stable operation, reduced capacitors. Heat source dispersion facilitates heat dissipation.
- Using Micro DC/DC XCL Series with built-in inductor for POL converter enables further miniaturization, lower EMI, and easier design.
- **HiSAT-COT** provides highly stable power supply, including transient response.



## Bypass mode control by MCU/SoC for low power consumption

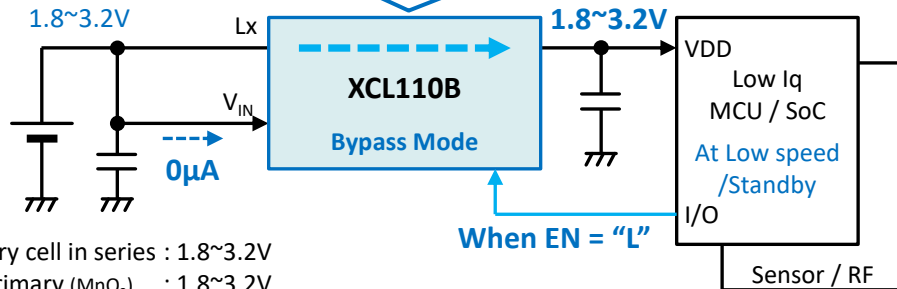
### ■ XCL110 Bypass type operation

#### a. EN = "H" : Step-up operation



#### b. EN = "L" : Bypass Mode

Supplying through battery voltage.



2-dry cell in series : 1.8~3.2V  
 Li Primary (MnO<sub>2</sub>) : 1.8~3.2V  
 (SOCl<sub>2</sub>) : 2.4~3.6V

### ■ Power requirements for low power MCU/SoC

- a. RF/High-speed operation : Stable voltage, e.g. 3.3 V
- b. Low speed/Standby :  
 Acceptable at low voltages, e.g. 1.8~2.4 V  
 This period is major for IoT equipment

Boosting the voltage only during the "a." period ensures low consumption by supplying battery energy without waste.

### ■ Features of XCL110 Bypass type

- a. Boosting : High efficiency with PWM/PFM operation.
- b. Bypass mode : Supplying through battery voltage.

**XCL110 bypass mode with no voltage loss and no current consumption, 0 µA.**

→ **Approximately twice the battery life**

in a typical IoT device.

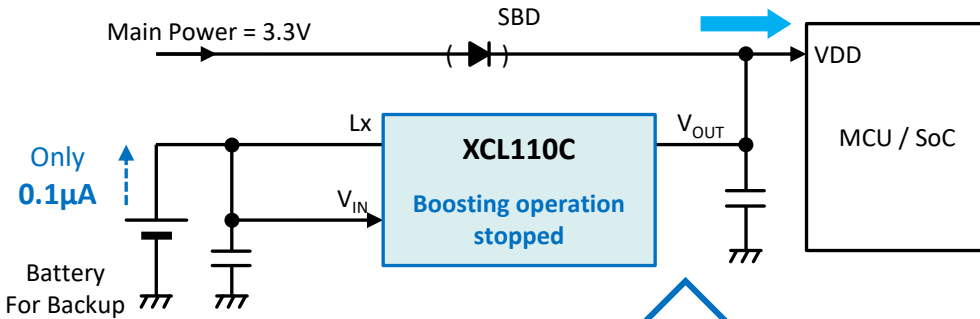
※ Sleep 5µA ⇔ Active 5mA/Duty0.1% ⇒ RF100mA/Duty 0.01%

Switch between "Bypass mode" and "Boost operation" by controlling the EN pin from the MCU.

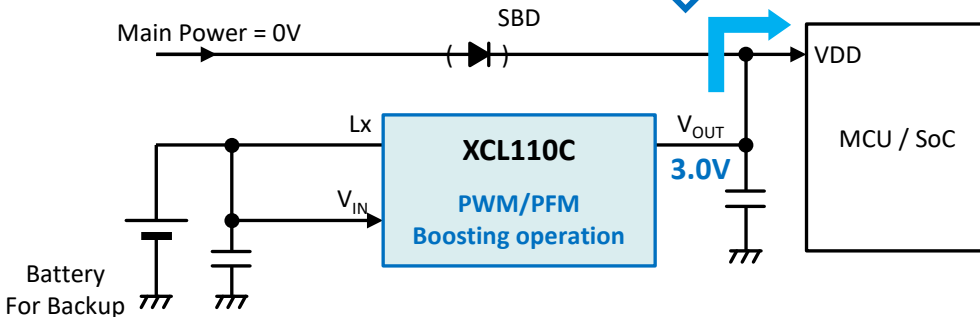
## Backup circuit with Primary battery / Rechargeable battery / Super Cap (EDLC)

### ■ XCL110 VOUT “OR” type operation

#### a. Mains power supplied / Backup on standby



#### b. When supplied from Backup



### ■ Requests for backup circuits

- No power should be consumed from the backup source when mains power is supplied
  - Starts boosting immediately when the mains power supply drops.
- Backup sources are,
- Li Primary Batteries
  - LTO Batteries, High reliability Rechargeable batteries (Semi-solid-state/All-solid-state batteries)
  - Super Cap (EDLC)

### ■ Features of XCL110 VOUT "OR" type

- Current consumption from the backup battery when the backup is on standby is **only 0.1 µA**.
- When the output voltage falls below a set value, boost operation is immediately activated, and power is supplied from a backup source. No external control is required.

When the mains power falls, **boost operation starts automatically**.

The voltage supplied from the backup source to the MCU can be supplied without any drop in voltage.

## Standard product

IC	Type	Purpose	Input to Output (at EN=L)	Latch	C <sub>L</sub> Discharge	UVLO	Reference page for usage examples
XCL109 / XCL110	A	Load Disconnection	Disconnect		✓		• Power is supplied only during the post-stage operation.
XCL110	B	Bypass	Bypass				• Supporting low Iq MCU • Reduction of power consumption at receiving of RF
	C	VOUT "OR"	Disconnect				• Backup power supply

## Custom product

IC	Type	Purpose	Input to Output (at EN=L)	Latch	C <sub>L</sub> Discharge	UVLO	Reference page for usage examples
XCL109 / XCL110	D	Load Disconnection	Disconnect	✓	✓		• Power is supplied only during the post-stage operation.
	G				✓	✓	
	J			✓	✓	✓	
XCL110	E	Bypass	Bypass	✓			• Supporting low Iq MCU • Reduction of power consumption at receiving of RF communication
	H				✓		
	K			✓		✓	
	F	VOUT "OR"	Disconnect	✓			• Backup power supply
	M					✓	
L			✓		✓		

### ● Current Limit / Short Protection

- ✓ Current Limit : Monitors and limits the current of the Nch FETs at Lx pin. Combined type with current limit and latch-stop also available.
- ✓ Short Protection: Types with latch-stop function also stop and latch when the short-circuit protection threshold voltage is reached in an overcurrent condition.

### ● C<sub>L</sub> Discharge

- ✓ The Nch FET connected between the V<sub>OUT</sub> and GND enables high-speed discharge from the CL capacitor when shutting down (EN= "L").
- ✓ Prevents malfunctions of the subsequent system due to the remaining voltage in the CL capacitor during shutdown.

### ● UVLO

- ✓ Function for 2-cell dry cell batteries and primary lithium batteries to reduce the risk of battery liquid leakage by stopping the IC operation when the battery voltage drops. (UVLO release/detection = 1.6V/1.45V).