

Torex...Powerfully Small!

**Highly performance / Multi-function
Built-in inductor Step-up DC/DC Converters
XCL104 / XCL105 Series Product Overview**

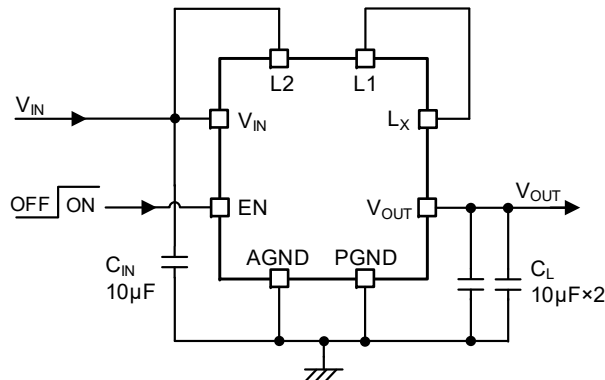
May 2023
TOREX Semiconductor
Rev. 1.0

Small and Multi-function: Load Disconnection / Bypass / OR connection Selectable

■ Features

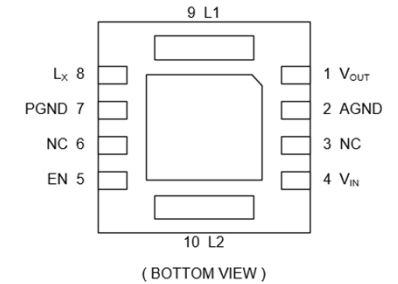
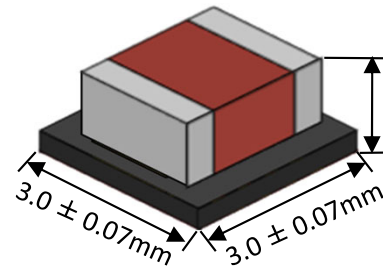
Input Voltage Range	: 0.65 ~ 6.0V (Absolute Max. : 7.0V)
Operation start voltage	: 0.9V
Fixed Output Voltage	: 1.8 ~ 5.5V (Accuracy: $\pm 2.0\%$)
Output Current	: 710mA@ $V_{OUT}=5.0V, V_{IN}=3.3V$ 490mA@ $V_{OUT}=3.3V, V_{IN}=1.8V$
Oscillation Frequency	: 1.2MHz
Supply Current	: 19 μA
Control Mode Selection Type	: F-PWM (XCL104), PWM/PFM (XCL105) Load Disconnection (A/C/D/F/G/M/J/L types) Bypass Mode (XCL105B/E/H/K types) OR connection (XCL105 C/F/M/L types) C_L Discharge (A/D/G/J types)
Function Protection	: ON/OFF, Soft-start, UVLO (G/H/M/J/K/L types) Current limit, Thermal shutdown Integral latch & Short protection (D/E/F/J/K/L types)
Packages	: DFN3030-10B
Operating Ambient Temp.	: $-40^{\circ}C \sim 105^{\circ}C$

■ Typical Application Circuit

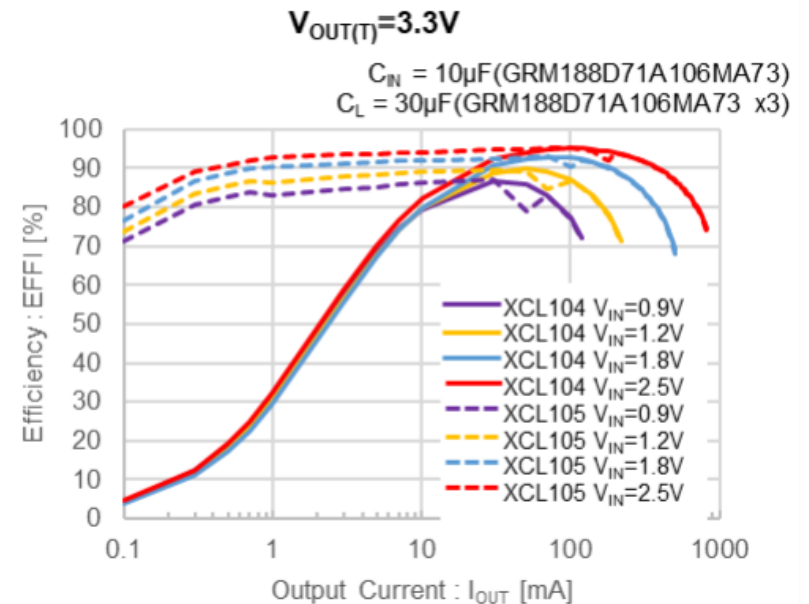


■ Packages

DFN3030-10B
(3.0x3.0x1.7mm)



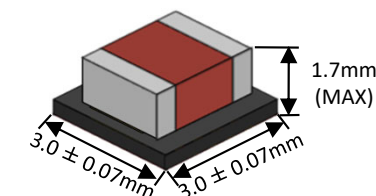
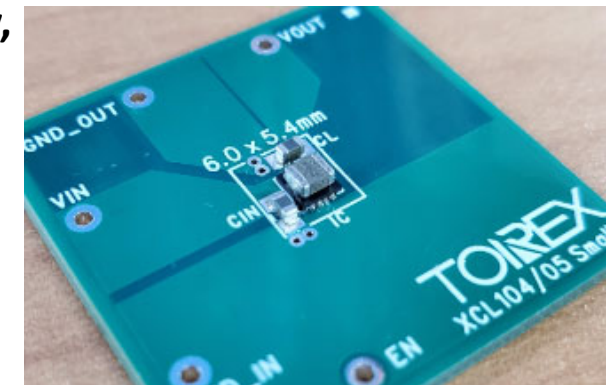
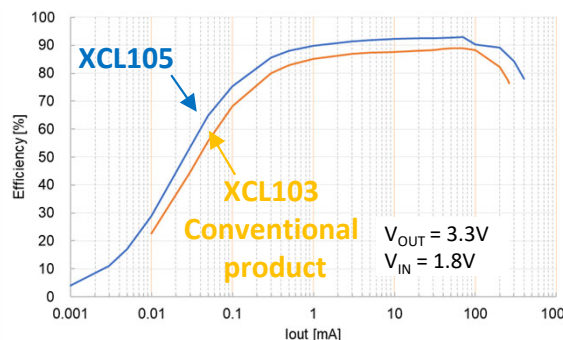
■ TYPICAL CHARACTERISTICS: EFFICIENCY



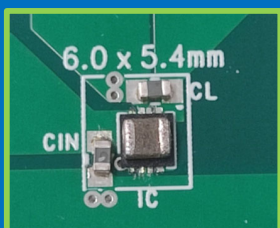
- Step-up DC/DC to achieve low power consumption of MCUs and high performance of IoT devices.

① Space-saving, high functionality, efficiency and heat dissipation with built-in inductor.

- ✓ 1.4 times higher output current.
- ✓ EMI reduction due to Built-in inductor
- ✓ Wider operating temperature range.



Built-in inductor
Step-up DC/DC
XCL104 : PWM
XCL105 : PWM/PFM



Small
 Low EMI
 High performance



XCL104
XCL105

XCL105



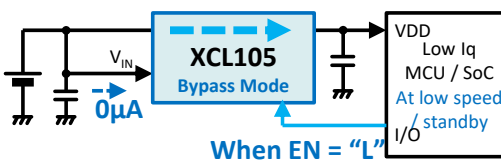
For low
 consumption
 MCUs

For Backup

② Load Disconnection / Bypass / OR connection Selectable

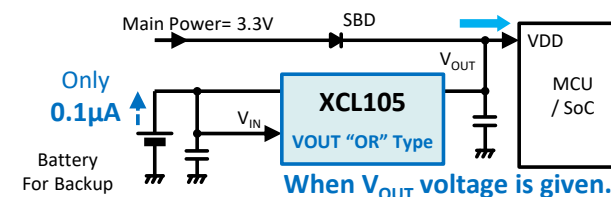
“Bypass type”

Significantly reduced total power consumption.
 Achieving long battery life.



VOUT “OR” type

Suitable for output OR connection
 of main power supply and backup battery



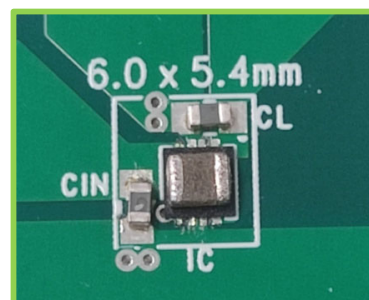
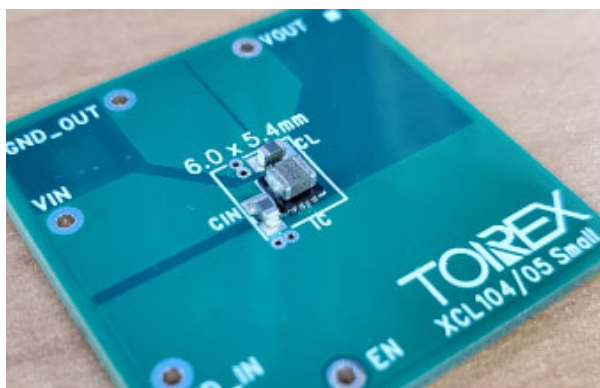
The two types, "Bypass" and "VOUT OR", contribute to long battery life, as well as high performance.

TOREX Built-in inductor Micro DC/DC for achieving small / low EMI

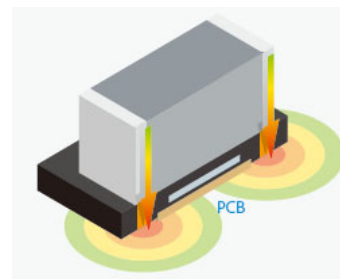
TOREX original Built-in inductor Micro DC/DC XCL Series

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.

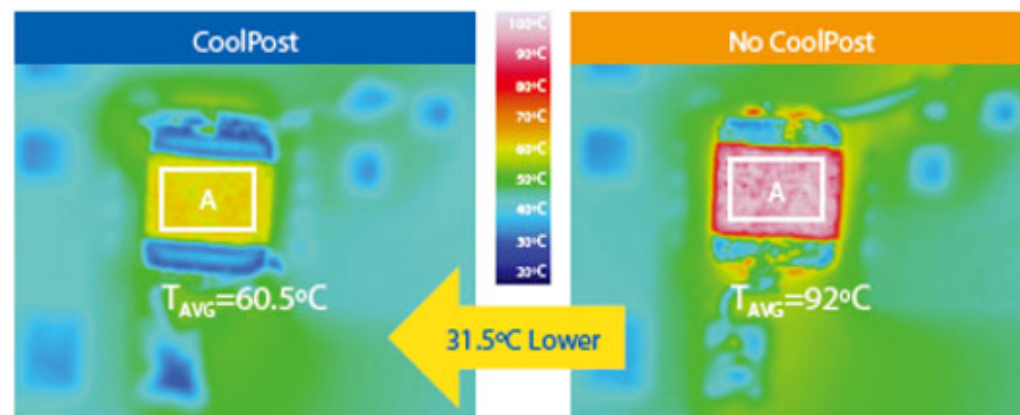


High heat dissipation due to CoolPost structure



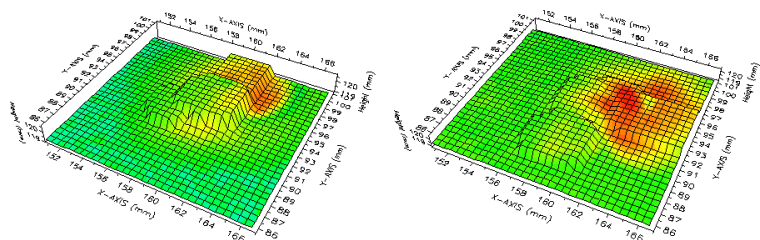
Improved heat dissipation by more than 50%

- Copper cool post for heat reduction by transferring coil heat to PCB.
- DC/DC chip mounted directly on heat pad for improved heat dissipation.



EMI reduction due to unique Built-in inductor structure

- Optimum layout of the IC and coil in an integrated structure significantly reduces **radiated noise**.
- Can be placed near RF ICs/Sensors, etc., contributing to miniaturization.

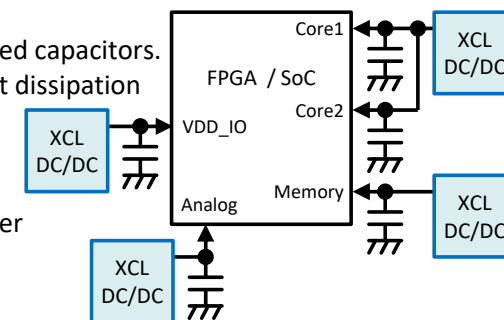


XCL105

Stand-alone DC/DC

Benefits of POL (Point of Load) power supply and Micro DC/DC

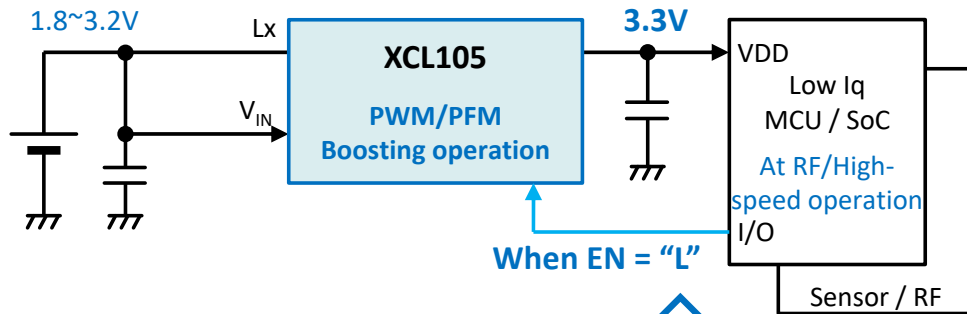
- Shorter power supply wiring length. In addition to stable operation, reduced capacitors. Heat source dispersion facilitates heat dissipation
- Using Micro DC/DC XCL Series with built-in inductor for POL converter enables further miniaturization, lower EMI, and easier design



Bypass mode control by MCU/SoC for low power consumption

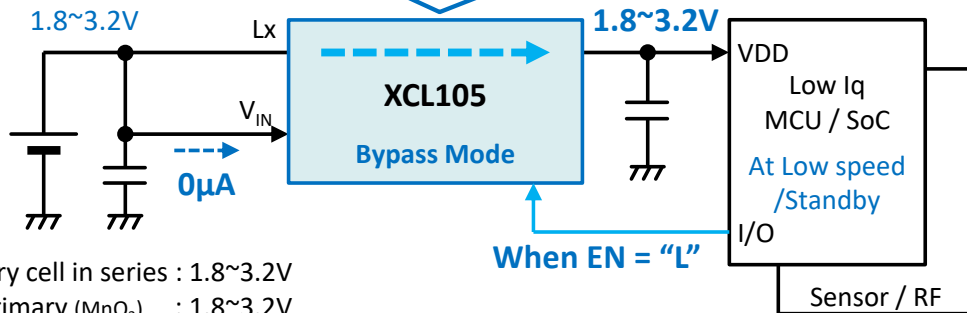
■ XCL105 Bypass type operation

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 (MnO₂) : 1.8~3.2V
 (SOCl₂) : 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 XCL105 Bypass type

a. Boosting : High efficiency with PWM/PFM operation.

b. Bypass mode : Supplying through battery voltage.

XCL105 bypass mode with no voltage loss and no current consumption, 0 µA.

→ **Approximately twice the battery life**

in a typical IoT device.

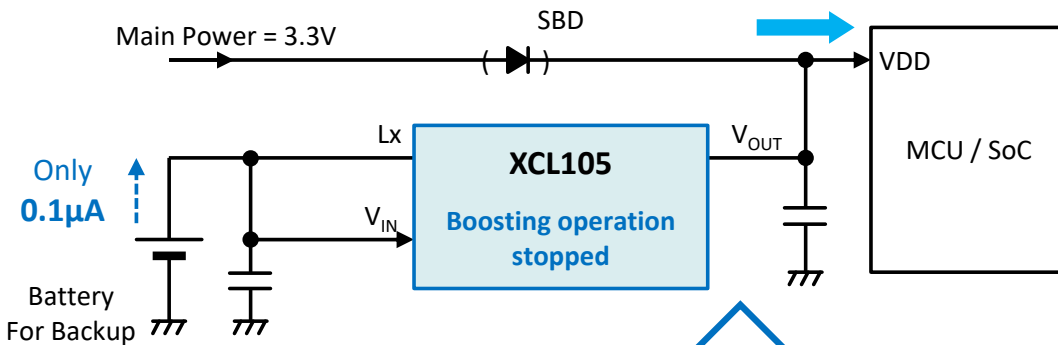
※ Sleep 5µA ⇔ Active 5mA/Duty0.1% ⇔ RF100mA/Duty 0.01%

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

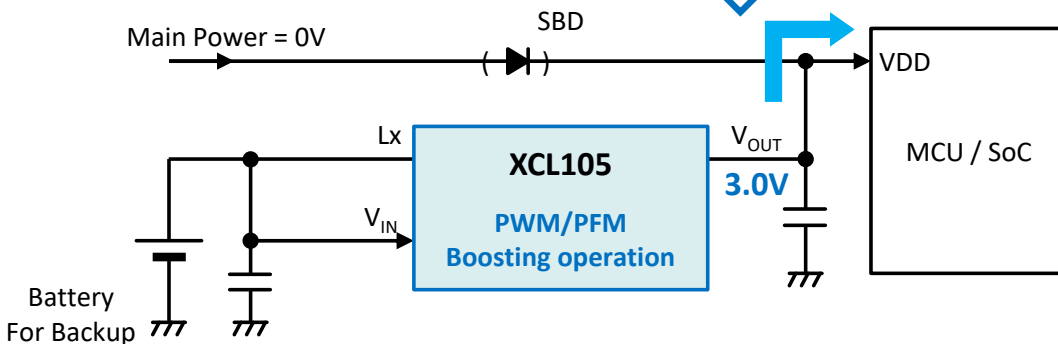
Backup circuit with Primary battery / Rechargeable battery / Super Cap (EDLC)

■ XCL105 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 XCL105 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.

Select from the line-up below according to your purpose.

IC	Type	Purpose	Input to Output (at CE=L)	Latch	C _L Discharge	UVLO	Reference page for usage examples
XCL104 / XCL105	A	Load Disconnection	Disconnect		✓		• Power is supplied only during the post-stage operation.
	D			✓	✓		
	G				✓	✓	
	J			✓	✓	✓	
XCL105	B	Bypass	Bypass				• Supporting low I _q MCU • Reduction of power consumption at receiving of RF communication
	E			✓			
	H					✓	
	K			✓		✓	
	C	VOUT "OR"	Disconnect				• Backup power supply
	F			✓			
	M					✓	
	L			✓		✓	

Options

● 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_L Discharge

- ✓ The Nch FET connected between the V_{OUT} 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 = 1.6 V/1.45 V).