

Torex...Powerfully Small!

36V Step-down DC/DC Product Overview

XC9704/XC9705(600mA) Series

XC9714(2.0A) Series

36V Built-in inductor Step-down Micro DC/DC Converter

XCL247/XCL248 Series

April 2026

TOREX Semiconductor

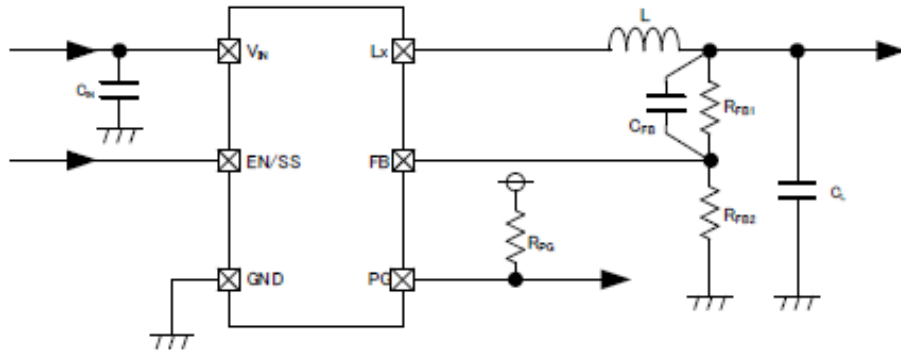
Rev. 1.0

Low Iq and high efficiency at light loads / Sequence controllable with PG function and external Soft Start

■ Features

| | |
|-----------------------|---|
| Input Voltage | : 3.0V ~ 36.0V (Absolute Max.:40.0V) |
| Surge Voltage | : 46.0V (Applied Time \leq 400ms) |
| Output Voltage Range | : 2.8V ~ 20.0V (XC9704) : 2.8V ~ 15.0V (XC9705) |
| FB Voltage | : 0.75V(\pm 1.5%) |
| Output Current | : 600mA |
| Supply Current | : 11 μ A |
| Oscillation Frequency | : 1.2MHz, 2.2MHz |
| Efficiency | : 90% ($V_{IN}=12V, V_{OUT}=5V, I_{OUT}=300mA$) |
| Control Method | : F-PWM (XC9704) PWM/PFM (XC9705) |
| Function | : Soft-start (External Adj.), UVLO Power Good (USP-6C) |
| Protection | : Current Limit, Thermal Shutdown |
| Package | : SOT-89-5, USP-6C |
| Junction Temp | : -40°C ~ 150°C |

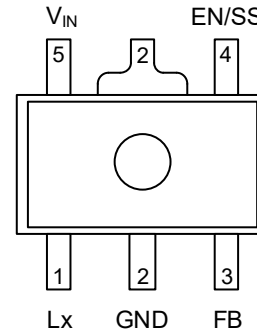
■ Typical Application Circuit



■ Package

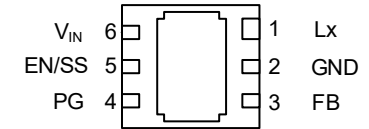
SOT-89-5
(4.5x4.6x1.6mm)

TOREX Longevity
Program (TLP)

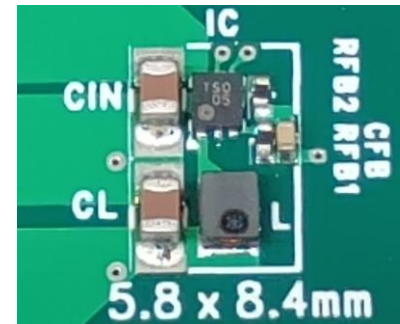


USP-6C
(1.8x2.0x0.6mm)

TOREX Longevity
Program (TLP)



■ Mounting Area



XC9704/XC9705 : 36V 600mA Step-down DC/DC convertor

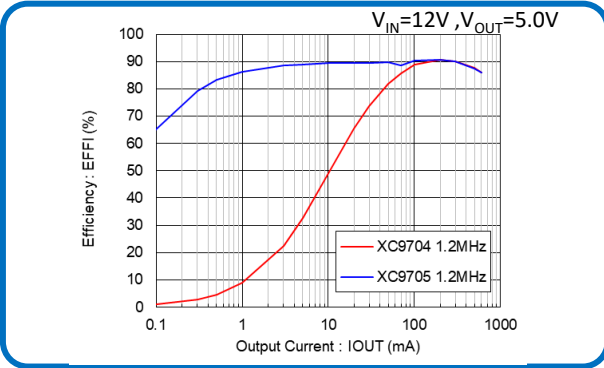
Space-Saving and Low Iq Step-down DC/DC for Medium and High Voltage Inputs

**Compact/Low Iq
36V 600mA Step-down DC/DC
XC9704/XC9705**

Mounting Area
48 mm²

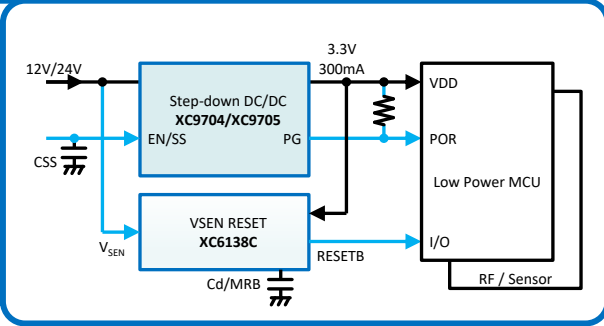
①

- ① **Ultra-small / High efficiency at light load**
 - ✓ Synchronous rectification
 - ✓ Small external components can save space
 - ✓ High efficiency at light load



②

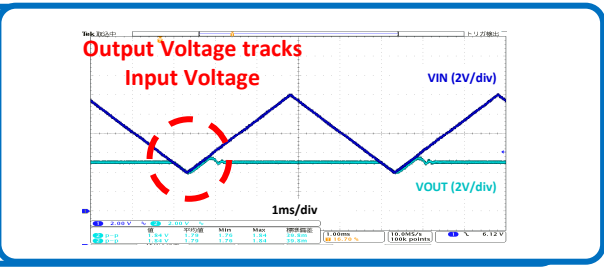
- ② **Simple power source sequence control**
 - ✓ Soft start can be adjusted externally to accommodate large output capacitors
 - ✓ Power Good function can be used to drive the latter-stage IC after the output voltage rises.



Sequence

③

- ③ **Stable output voltage supply even when input voltage drops**
 - ✓ Supplies stable output voltage even when input voltage drops as it supports 100% Max Duty.



Pch driver FET
100% Duty

Ideal for miniaturization / heat reduction due to high voltage / small size / low Iq.
 Also suitable for replacing conventional high-voltage LDOs.

- Primary Step-down DC/DC for 12V/24V input
- For various sensors and security equipment in factories, buildings, and facilities, etc.

Ultra small / Low Iq and high efficiency at light loads / Low noise

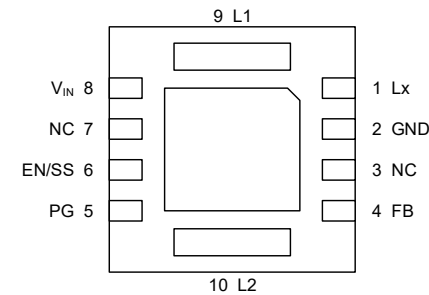
■ Features

| | |
|-------------------------|--------------------------------------|
| Input Voltage | : 3.0V ~ 36.0V (Absolute Max :40.0V) |
| Output Voltage | : 2.8V ~ 6.0V |
| FB Voltage | : 0.75V(±1.5%) |
| Output Current | : 600mA |
| Oscillation Frequency | : 1.2MHz |
| Supply Current | : 11μA (XCL248) |
| Control Method | : F-PWM (XCL247) PWM/PFM (XCL248) |
| Function | : Power Good Soft-start, UVLO |
| Package | : DFN3030-10B |
| Operating Ambient Temp. | : -40°C ~ 105°C |

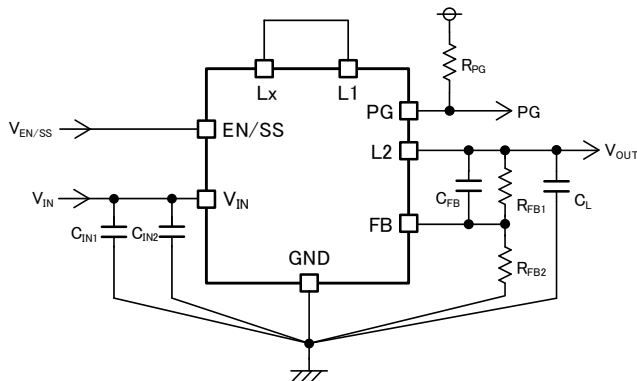
■ Package

DFN3030-10B
(3.0 x 3.0 x 1.7mm)

TOREX Longevity
Program (TLP)



■ Typical Application Circuit



■ Small Size



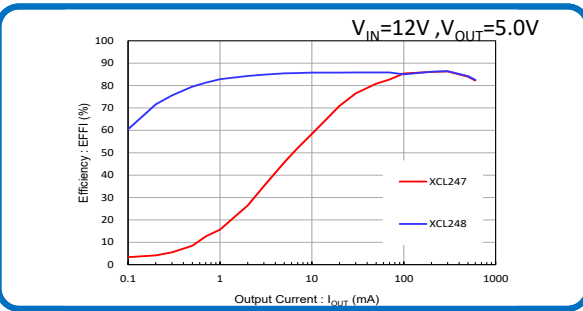
■ Space-Saving and Low Iq Step-down DC/DC for Medium and High Voltage Inputs

**Compact/Low Iq
36V 600mA Step-down
Micro DC/DC
XCL247/XCL248**

- ① Mounting Area
- ② Sequence
- ③ Pch driver FET 100% Duty

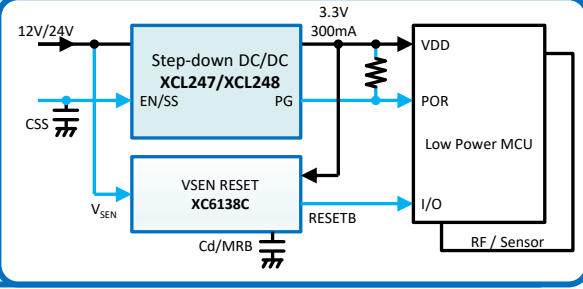
① Ultra-small / High efficiency at light load

- ✓ Synchronous rectification.
- ✓ Small external components can save space.
- ✓ High efficiency at light load.



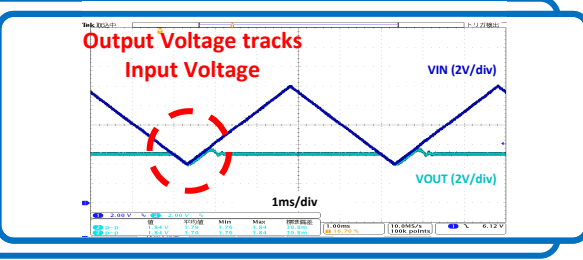
② Simple power source sequence control

- ✓ Soft start can be adjusted externally to accommodate large output capacitors.
- ✓ Power Good function can be used to drive the latter-stage IC after the output voltage rises.



③ Stable output voltage supply even when input voltage drops

- ✓ Supplies stable output voltage even when input voltage drops as it supports 100% Max Duty.



Ideal for miniaturization / heat reduction due to high voltage / small size / low Iq.
 Also suitable for replacing conventional high-voltage LDOs.

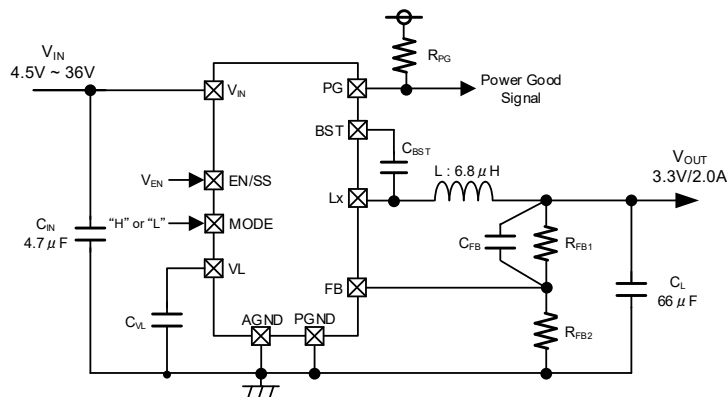
- Primary Step-down DC/DC for 12V/24V input
- For various sensors and security equipment in factories, buildings, and facilities, etc.

Low Iq and high efficiency at light loads / Sequence controllable with PG function and external Soft Start

■ Features

| | |
|-------------------------|---|
| Input Voltage | : 4.5V ~ 36.0V (Absolute Max : 40.0V) |
| Output Voltage | : 2.5V ~ 18.0V |
| FB Voltage | : 0.75V ($\pm 1.5\%$) |
| Output Current | : 2.0A |
| Supply Current | : 9 μ A |
| Oscillation Frequency | : 800kHz |
| Control Method | : F-PWM (MODE="H") PWM/PFM (MODE="L") |
| Function | : Soft-start (External Adj.) Power Good, UVLO |
| Protection | : Current Limit, Over Protection Thermal Shutdown Lx Short-Circuit Protection |
| Package | : HSOP-8N, DFN3030-12A |
| Operating Ambient Temp. | : -40°C ~ 125°C |

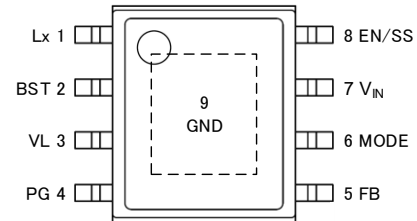
■ Typical Application Circuit



■ Package

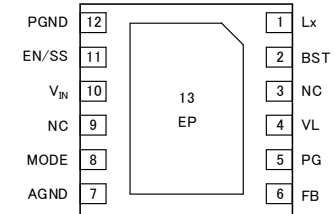
HSOP-8N
(6.2x5.2x1.7mm)

TOREX Longevity
Program (TLP)



DFN3030-12A
(3.0x3.0x0.75mm)

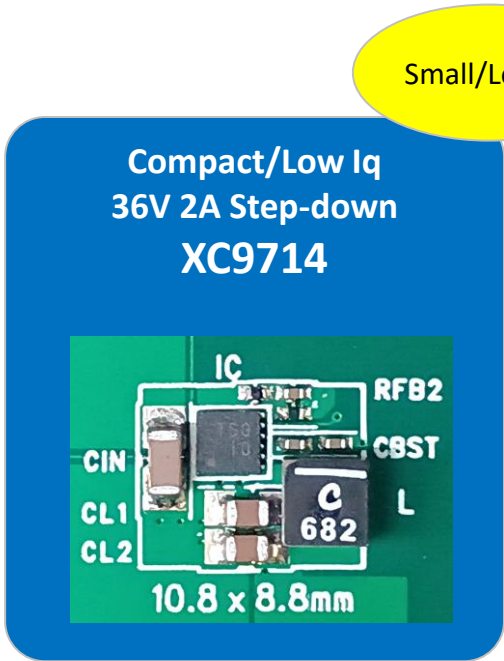
TOREX Longevity
Program (TLP)



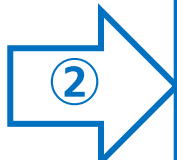
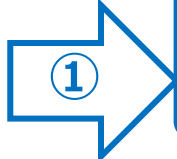
■ Mounting Area



■ Compact, Low-Power 36V/2A Buck DC/DC for 12V/24V Line Applications.



Small/Low Iq



Sequence

① Small / High efficiency at light load

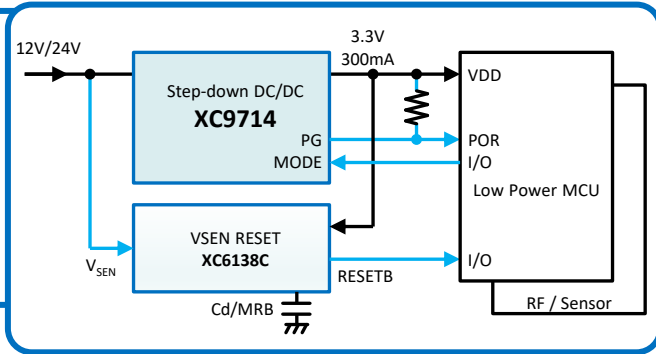
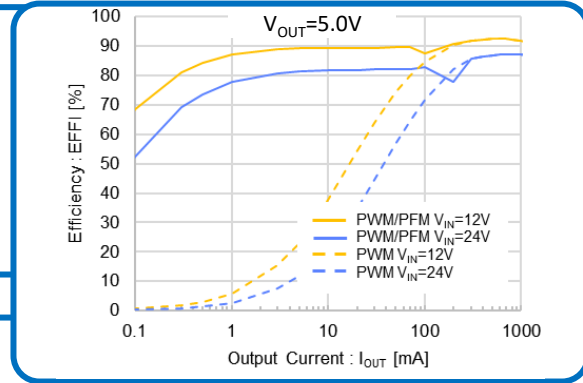
- ✓ Achieves lower standby power for devices.
- ✓ Replace LDOs to resolve heat and save space.

② Low Ripple

- ✓ The MODE pin allows switching between PWM and PWM/PFM control based on system conditions.
- ✓ Features low ripple, making it ideal for a wide range of applications.

③ Simple power source sequence control

- ✓ Soft start can be adjusted externally to accommodate large output capacitors.
- ✓ Power Good function can be used to drive the latter-stage IC after the output voltage rises.



A High-voltage, compact, low-power for device miniaturization and versatility.

- Primary Step-down DC/DC for 12V/24V input
- For various sensors and security equipment in factories, buildings, and facilities.
- White Goods, Power Tools, etc.

36V High voltage Step-down DC/DC convertor : Lineup

| | XC9704/XC9705 | XCL247/XCL248 | XC9714 |
|----------------|--|---|---|
| V_{IN} | 3.0V to 36V (Abs.40.0V) | 3.0V to 36V (Abs.40.0V) | 4.5V to 36V (Abs.40.0V) |
| V_{OUT} | XC9704 : 2.8V to 20V XC9705 : 2.8V to 15V | 2.8V to 6.0V | 2.5V to 18.0V |
| I_{OUT} | 600mA | 600mA | 2A |
| fosc | 1.2MHz, 2.2MHz | 1.2MHz | 800kHz |
| Control Method | XC9704 : F-PWM XC9705 : PWM/PFM | XCL247 : F-PWM XCL248 : PWM/PFM | F-PWM (MODE="H") PWM/PFM (MODE="L") |
| Topr | -40 to 125°C | -40 to 105°C | -40 to 125°C |
| Protection | Current Limit, Thermal Shutdown | Current Limit, Thermal Shutdown | Current Limit, Over Voltage Protection Thermal Shutdown, Lx Short Protection |
| Function | Soft-start (External Adj.), Power Good, UVLO | | |
| Packages | SOT-89-5(4.5x4.6x1.6mm) USP-6C(1.8x2.0x0.6mm) | DFN3030-10B(3.0x3.0x1.7mm) * Built-in Inductor | DFN3030-12A(3.0x3.0x0.75mm) HSOP-8N(6.2x5.2x1.6mm) |
| Circuit | | | |
| Solution Size | | | |

XC9704/XC9705, XCL247/XCL248 :

Stable output voltage supply even when the input voltage drops

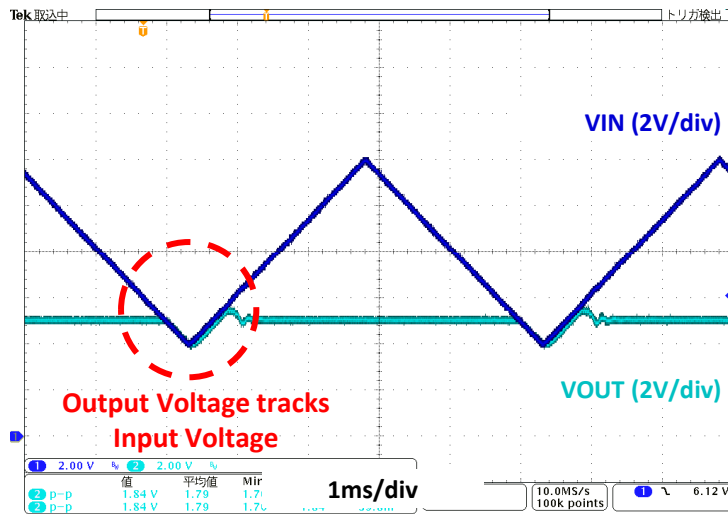
- Supports 100% duty cycle, and maintains a high output voltage even when the input voltage drops.

Features of 100% Max Duty Support

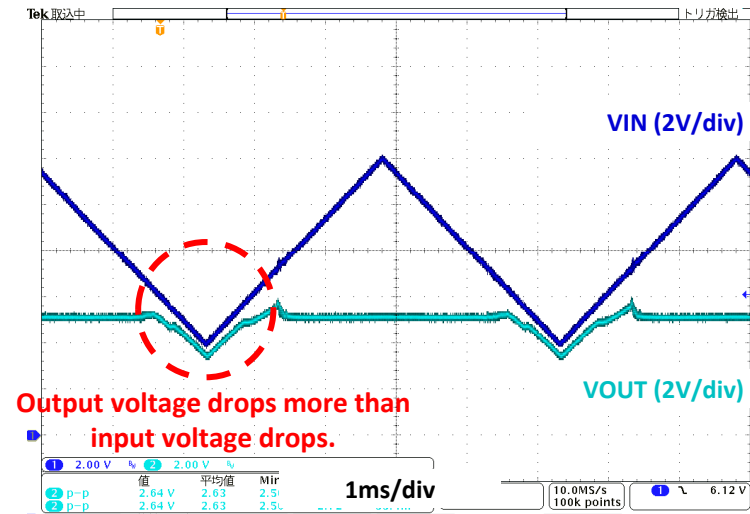
- Even if the input voltage is close to the output voltage, **there is no drop in the output voltage.**
- When the input voltage is lower than the set output voltage, the input voltage is passed through to the output and **the output voltage is maintained as high as possible.**

Even with “load fluctuations/induction in motors, etc.” and “large fluctuations in power supply due to input impedance” the output is maintained as high as possible.

Contributes to preventing system shutdown and maintaining the system due to low power supply voltage.



Max Duty 100% Supported
XC9704/XC9705

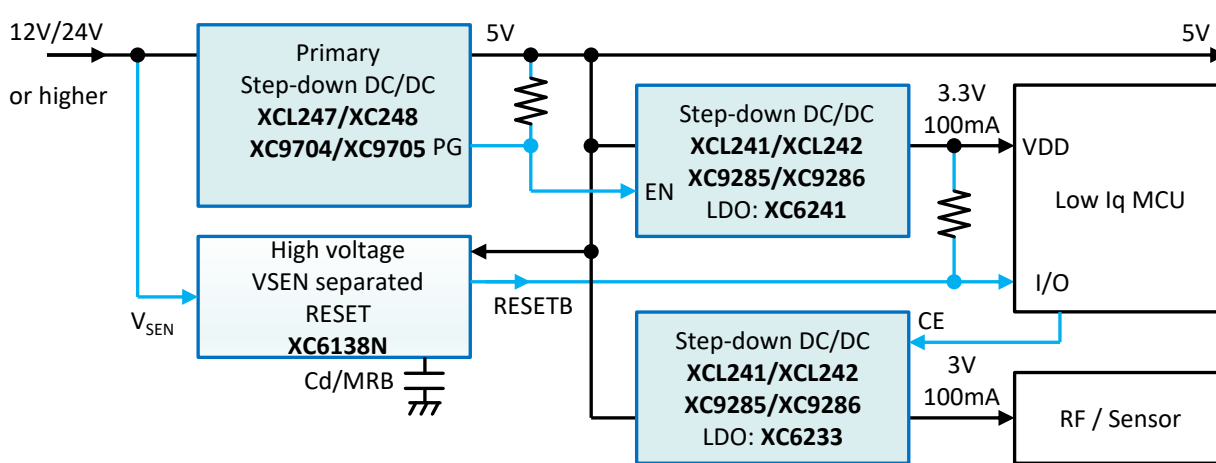


Max Duty 100% Not supported
General Step Down DC/DC

XC9704/XC9705, XCL247/XCL248 : Application Block Diagram for Small industrial sensors

■ For 12V/24V or Higher lines : Various small devices / Industrial sensors / IoT

● Step-down to 5V, then create 3.3V and other secondary voltages

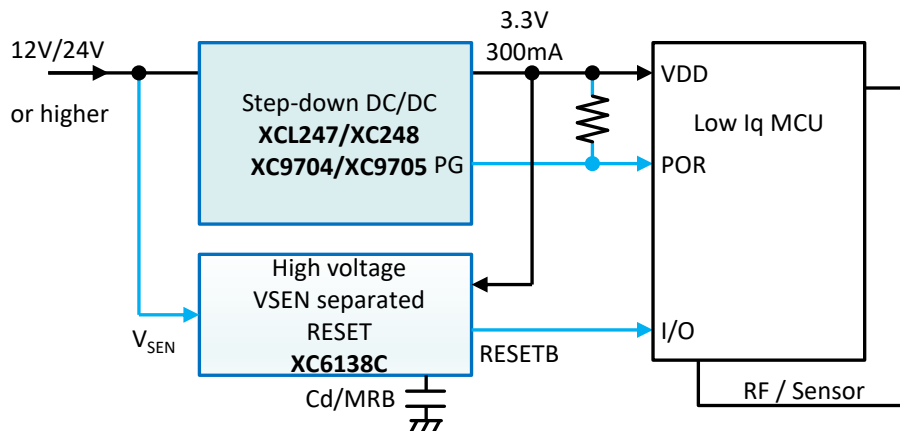


Supplies voltage to MCU/sensors, etc.

Power source sequence control with the PG pin.

Supervises 12V/24V power line with XC6138N.

● Output 3.3V directly



Suitable for small sensors used in FA.

XC9704, XCL247 : F-PWM

⇒ Low noise (For sensors, etc.)

XC9705, XCL248 : PWM/PFM

⇒ High efficiency at light load

Application Block Diagram for 12V/24V Multiple Power Rail Solutions

12V/24V and Higher Input Lines: 12V/24V POL Multi-Power Supply

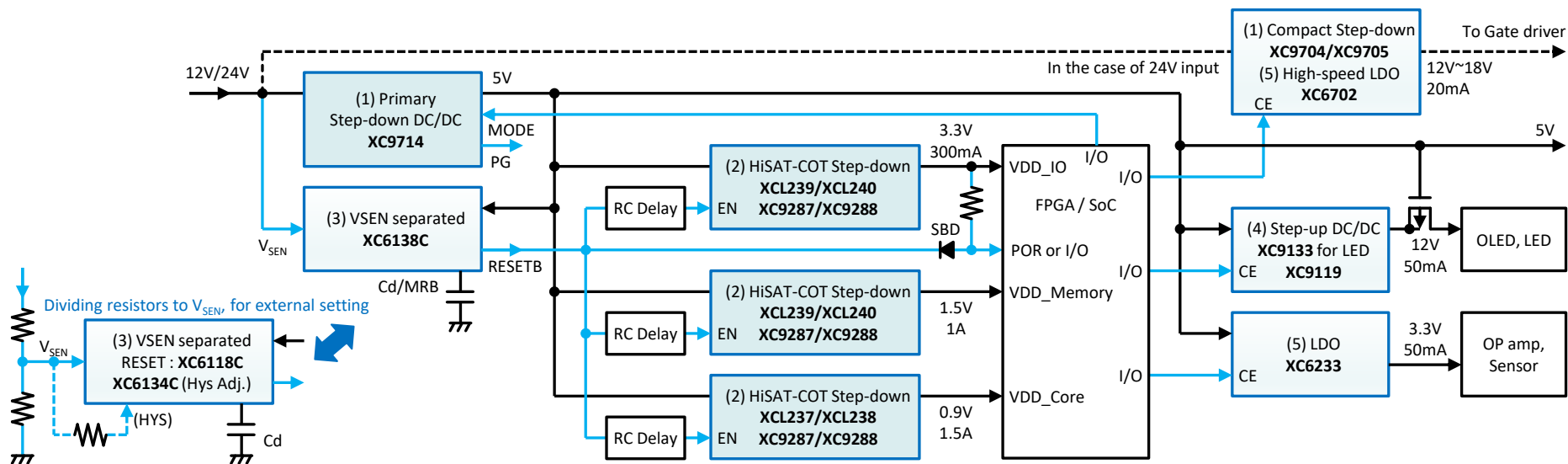
Primary Side Step-Down for 12V/24V Line

These ICs offer a wide input voltage range to accommodate input line overshoots.

For high-current voltage rails, the XC9714 (2A) is suitable.

For low-current lines, such as Gate Drivers, use either the coil-integrated XCL247/XCL248 (600mA) or the XC9704/XC9705 (600mA).

Power Good (PG) and adjustable Soft-Start functions enable precise control over secondary-side power sequencing.



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

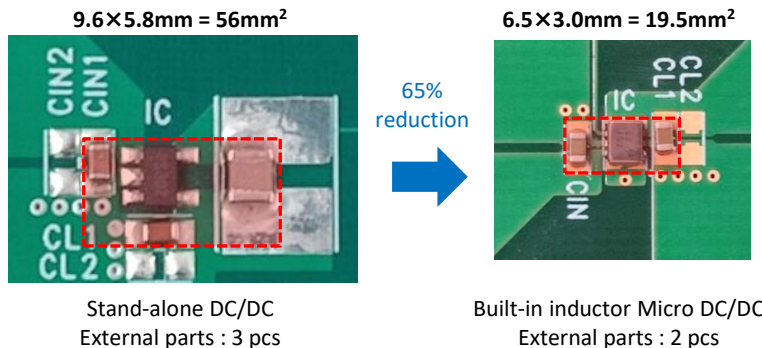
● Technical trend and challenges

- 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

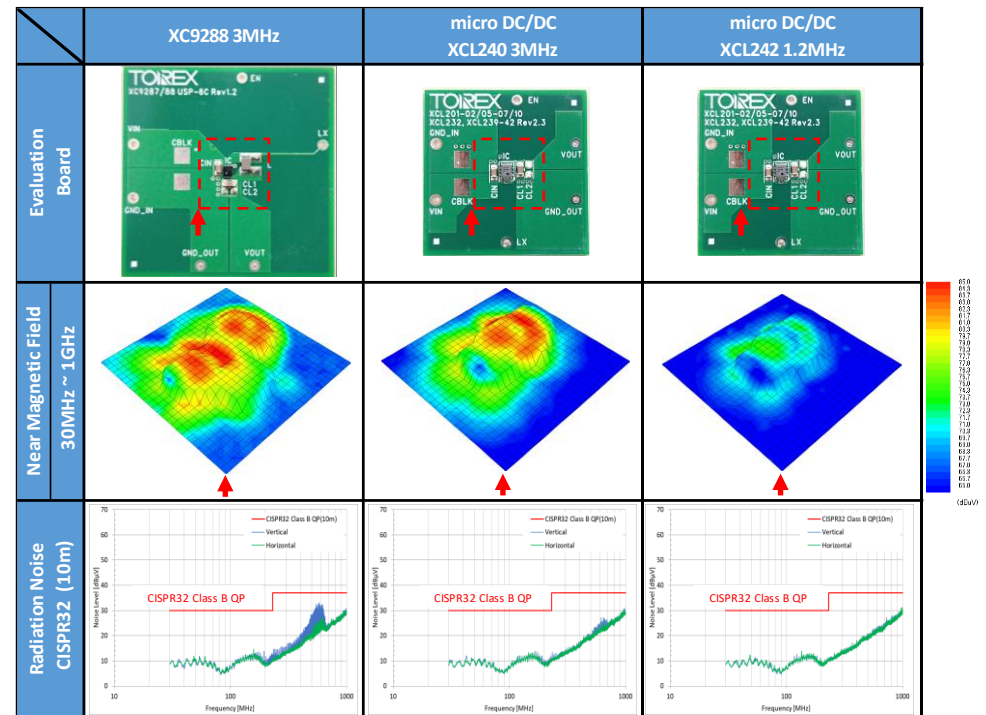
- Achieves a significant reduction in mounting area and providing smallest class of power supply solution.
- Unique package structure / Optimum inductor for the internal IC.
- Efficient heat dissipation performance with structures that connect IC/coil and substrate with low thermal resistance.



➢ EMI reduction due to unique Built-in inductor structure

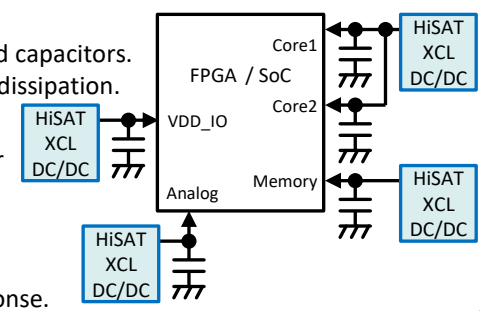
- ✓ The pocket-type structure covering the IC with a coil and the optimum placement of the IC enable a **significant reduction of radiated noise** compared to the stand-alone IC.
- ✓ Can be placed near RF ICs/Sensors, etc., contributing to miniaturization.

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.



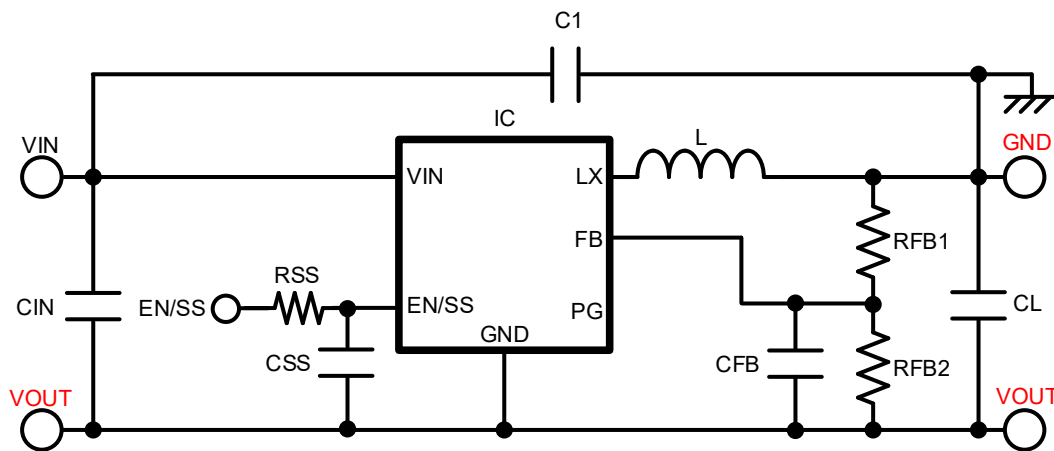
■ Voltage inverting using step-down DC/DC

To obtain an inexpensive inverting voltage using step-down DC/DC.
To generate an inverting voltage of -2.5V~-15V from 5V/12V/24V.

● Applications

- Various negative power supplies (OP amp/measuring amplifiers $\pm 12V$ etc.)
- Gate drive bias (floating power supply / negative power supply)

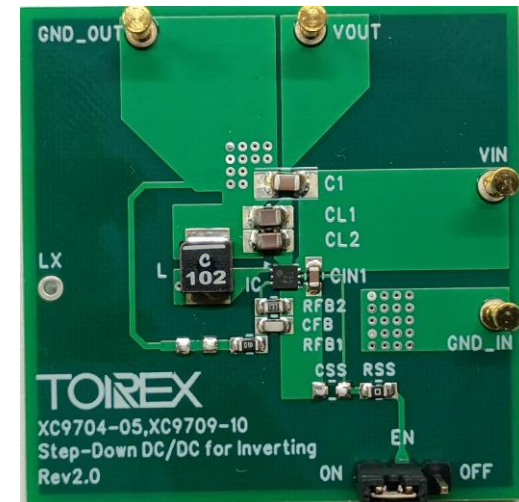
■ Typical Application Circuit



■ Example specifications

| | |
|----------------|---|
| Input Voltage | : XC9705, 3.0V ~ 36.0V + V_{OUT} XC9714, 4.5V ~ 36.0V + V_{OUT} |
| Output Voltage | : XC9705, -2.8V ~ -15.0V XC9714, -2.5V ~ -18.0V |
| Output Current | : XC9705 Max. 50mA ~ 200mA XC9714 Max. 150mA ~ 600mA |
| Features | : Inverting voltage generation using step-down DC/DC Small size solution Low Noise (XC9714 : PWM controllable) |

■ Evaluation Board



Application circuit2-2 : Multi-channel isolated power supplies using couple inductors

Multi-channel isolated power supplies using couple inductors

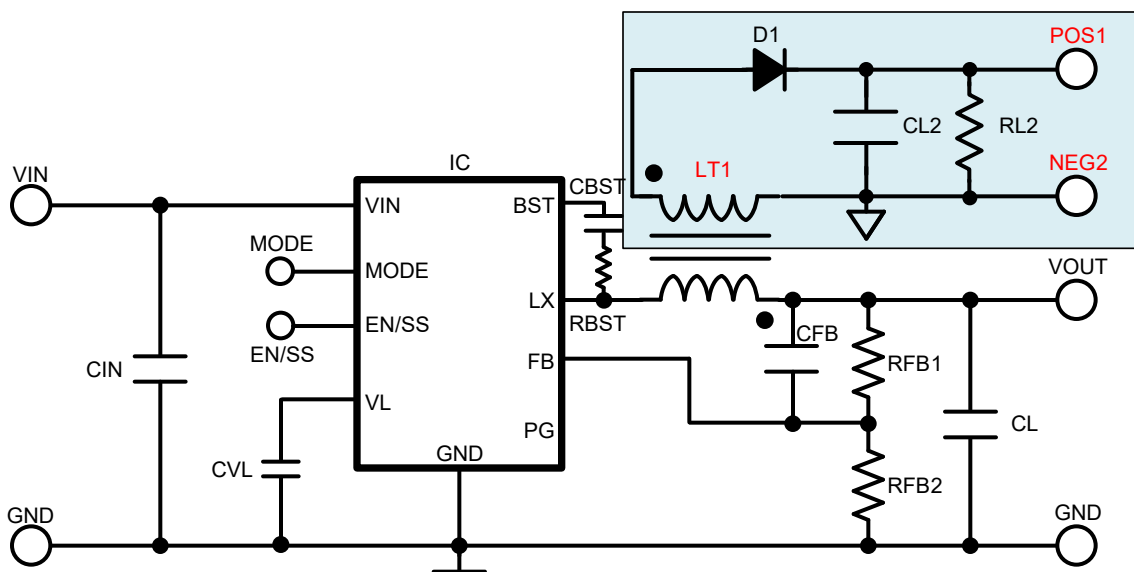
To obtain an inexpensive isolated power supplies using transformers/couple inductors.

To generate multi-channel of small power isolated power supplies
To be used for floating power supplies, inverting power supplies, etc.

Applications

- Isolated power supply
- Various negative power supplies (OP amp/measuring amplifiers $\pm 12V$, $\pm 15V$, etc.)
- Gate drive bias (floating power supply / negative power supply)

Typical Application Circuit



Example specifications

| | |
|------------------|--|
| Input Voltage | : XC9704, 3.0V ~ 36.0V XC9714, 4.5V ~ 36.0V |
| Output Voltage 1 | : XC9704, 2.8V ~ 20.0V XC9714, 2.5V ~ 18.0V |
| Output Voltage 2 | : 5V/12V/15V etc *depending on the winding ratio |
| Output Current 1 | : XC9704 Max 300mA ~ 600mA XC9714 Max 1A ~ 2A |
| Output Current 2 | : XC9704 Max 10mA ~ 100mA XC9714 Max 10mA ~ 300mA |
| Features | : Floating voltage available. Low cost |

Evaluation Board

