

Torex...Powerfully Small!

60V Step-down DC/DC Product Overview

XC9702(300mA) Series

XC9711(1.0A) Series

July 2026

TOREX Semiconductor

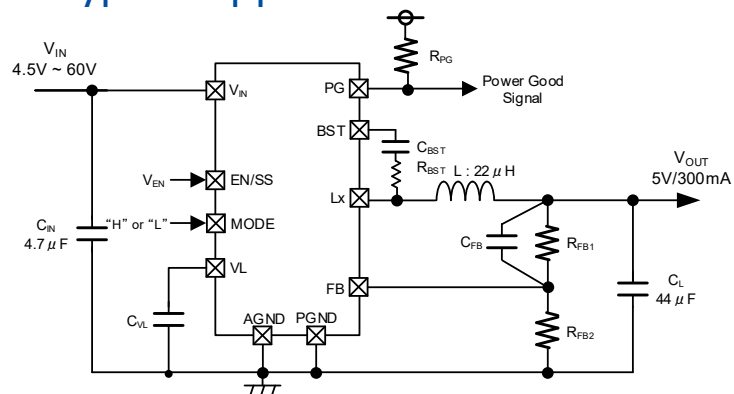
Rev. 1.4

60V Smallest solution size / Low Iq and high efficiency at light loads / Supports high step-down ratios

Features

Input Voltage	: 4.5V ~ 60.0V (Absolute Max. : 66.0V)
Output Voltage Range	: 2.5V ~ 12.0V (FB: 0.75V±1.5%)
Output Current	: 300mA
Supply Current	: 12µA
Oscillation Frequency	: 1.0MHz
Efficiency	: 85.5% ($V_{IN}=12V$, $V_{OUT}=5V$, $I_{OUT}=1mA$)
Control Method	: F-PWM (MODE="H") PWM/PFM (MODE="L")
Function	: Soft-start (External Adj.) Power Good UVLO
Protection	: Current Limit, Over Voltage Protection Thermal Shutdown Lx Short Protection
Package	: HSOP-8N, USP-10B, DFN3030-12A
Operating Ambient Temp	: -40°C ~ 125°C

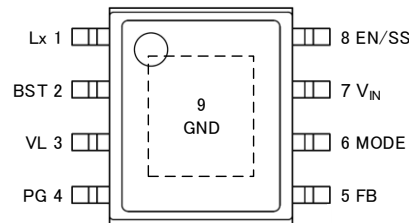
Typical Application Circuit



Package

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

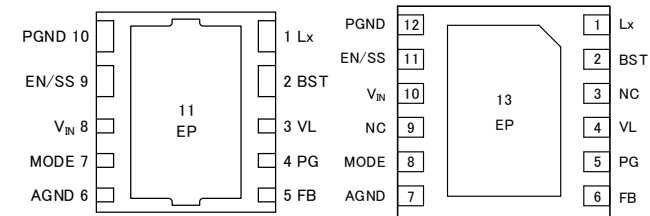
TOREX Longevity
Program (TLP)



USP-10B
(2.6x2.9x0.6mm)

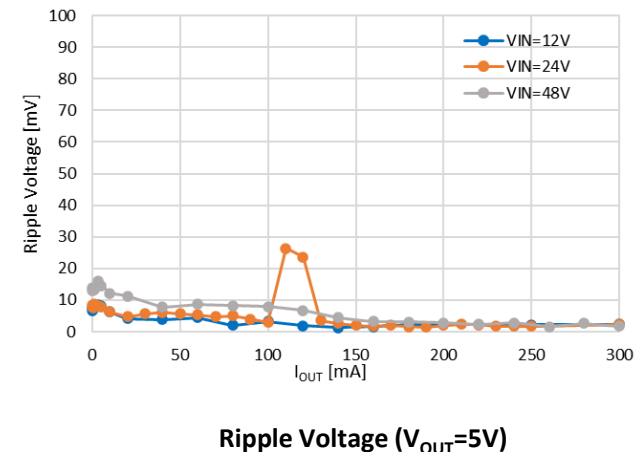
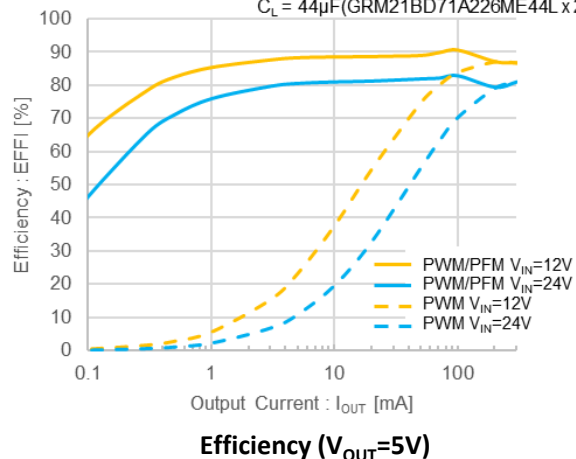
DFN3030-12A
(3.0x3.0x0.75mm)

TOREX Longevity
Program (TLP)



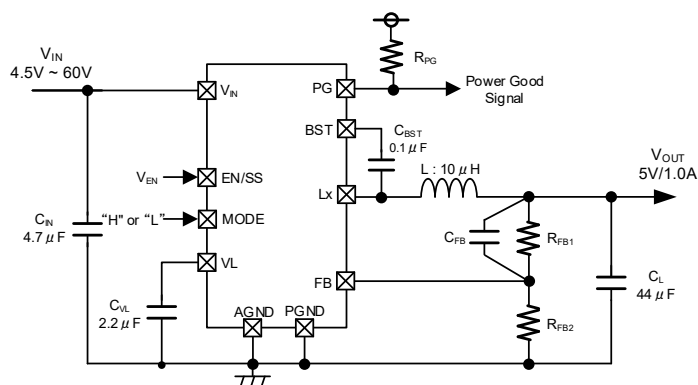
High Efficiency / Low Ripple Voltage

$L = 100\mu H$ (LBXHF5050XAT101MMR)
 $C_{IN} = 4.7\mu F$ (GCM32DC72A475KE02L)
 $C_L = 44\mu F$ (GRM21BD71A226ME44L x 2)



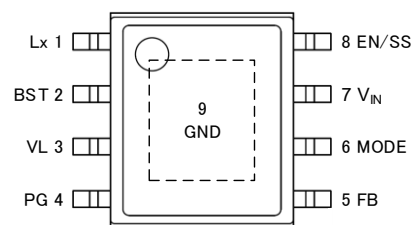
■ Features

■ Typical Application Circuit



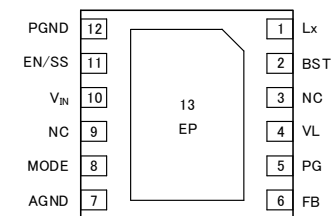
HSOP-8N
(6.2x5.2x1.7mm)

TOREX Longevity Program (TLP)

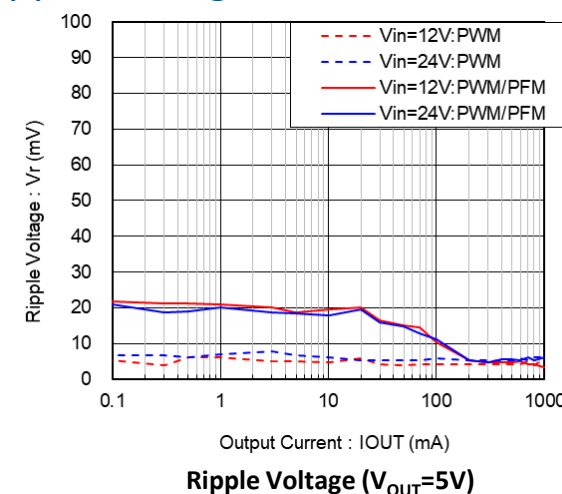


DFN3030-12A
(3.0x3.0x0.75mm)

TOREX Longevity
Program (TLP)



Output Current (mA)	Vin=12V: PWM (%)	Vin=24V: PWM (%)	Vin=12V: PWM/PFM (%)	Vin=24V: PWM/PFM (%)
0.1	0	0	68	52
1	2	0	85	78
10	35	10	88	81
100	85	70	89	82
300	88	85	90	88
1000	88	85	88	86



60V High voltage Step-down DC/DC convertor : Lineup

	XC9702	XC9711
V_{IN}	4.5V to 60.0V (Abs.66.0V)	4.5V to 60.0V (Abs.61.5V)
V_{OUT}	2.5V to 12.0V	2.5V to 18.0V
I_{OUT}	300mA	1A
Fosc	1MHz	800kHz
Control Method	F-PWM (MODE="H") PWM/PFM (MODE="L")	
Topr	-40 to 125°C	
Protection	Current Limit, Over Voltage Protection Thermal Shutdown, Lx Short Protection	
Function	Soft-start (External Adj.), Power Good, UVLO	
Packages	DFN3030-12A(3.0x3.0x0.75mm) HSOP-8N(6.2x5.2x1.6mm) USP-10B(2.6x2.9x0.6mm)	DFN3030-12A(3.0x3.0x0.75mm) HSOP-8N(6.2x5.2x1.6mm)
Circuit	※MODEの信号によって、外付け部品が異なります。	
Solution Size		

60V High voltage Step-down DC/DC convertor

- High voltage step-down DC/DC converter to meet requirements for compact and low Iq step-down from 12V/24V line

60V High voltage Step-down DC/DC XC9702/XC9711



XC9702

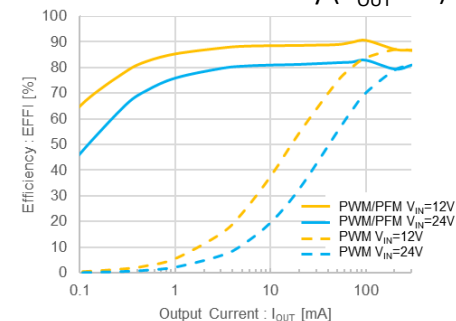
Ultra-small and low Iq

①

① Ultra-small / High efficiency at light load

- ✓ 60V Smallest Class Solution Size
- ✓ For low consumption in standby
- ✓ Solving the heat problem of medium and high voltage input LDOs by replacing them with a smaller area.

XC9702 Efficiency ($V_{OUT}=5V$)

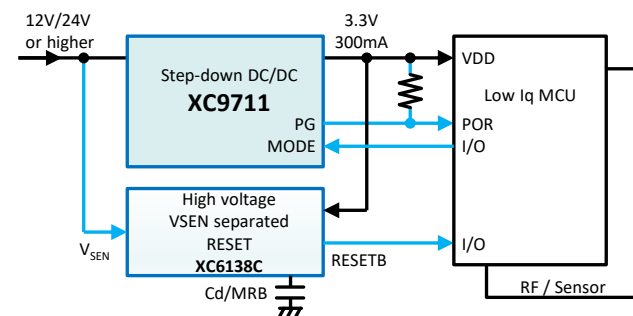


②

② High voltage / Low ripple / High temp.

“60V input”, “High step-down ratio”, “+125°C operation”,
“MODE(PWM↔PWM/PFM)” (XC9711)

- ✓ Low ripple 3.3V/5V output from unstable 24V input to FA/sensors
- ✓ Handling input overshoots and high temperatures



Ideal for miniaturization / heat reduction due to high voltage / small size / low Iq.

Also suitable for replacing conventional high-voltage LDOs.

- Sensors and security for Factories / Buildings / Facilities, etc.

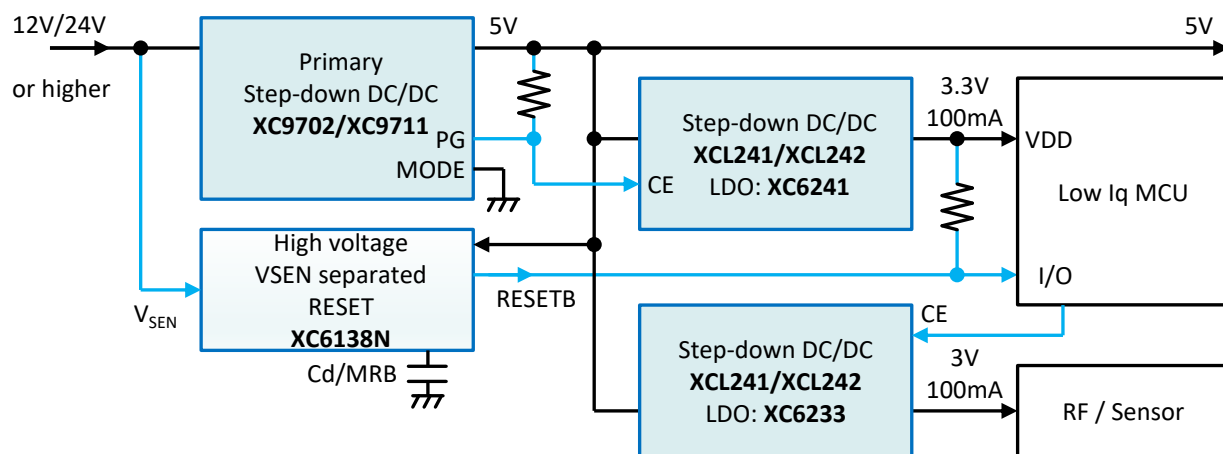
In addition, 125°C operating temperature and 24V line overshooting

- Suitable for various FA sensors

Application Block Diagram for Small industrial sensors

■ Various small devices and modules with 12V/24V or higher input : Industrial sensors / IoT

● Once step-down to 5V, then generate 3.3V

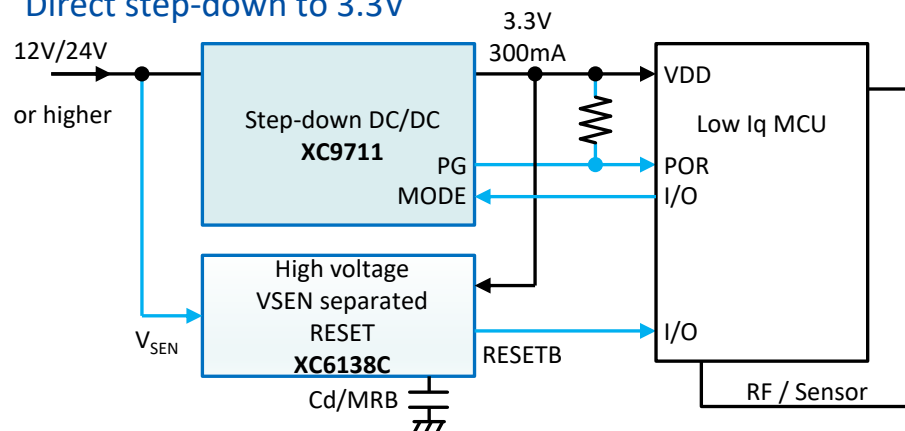


Supplies power to MCUs, sensors, etc., by stepping down from 12V/24V or higher to 5V, and then stepping down to 3.3V, 3.0V, etc.

Controls the sequence of the subsequent power supply with the PG of the XC9702.
MODE "H" ⇒ PWM
MODE "L" ⇒ PWM/PFM

Supervises 12V/24V power voltage with XC6138N and monitor output to MCU.

● Direct step-down to 3.3V



Direct step-down from 12V/24V to 3.3V.
Power source for small sensors used in FA.

Control method can be changed dynamically with the MODE pin. (XC9711 Only)

MODE "H" : PWM ⇒ Low noise (For sensors, etc.)
MODE "L" : PWM/PFM ⇒ High efficiency at light load

- **Monitoring of 12V/24V input lines with large voltage fluctuations**

- **Technical trend and challenges**

- It is necessary to monitor large voltage fluctuations in the power supply line due to loads such as motors and input impedance.
Set the detect /release voltage to suit the application.

- **TOREX Proposal : Reset IC with high voltage tolerance and a wide range of detect/release voltages**

➤ **Wide range of detect/release voltage difference (hysteresis) supported**

- Separate sense pin type, monitoring 12V/24V lines.
- Select a release voltage high enough to ensure a stable rise and select a detect voltage sufficiently different from the release voltage.

XC6138

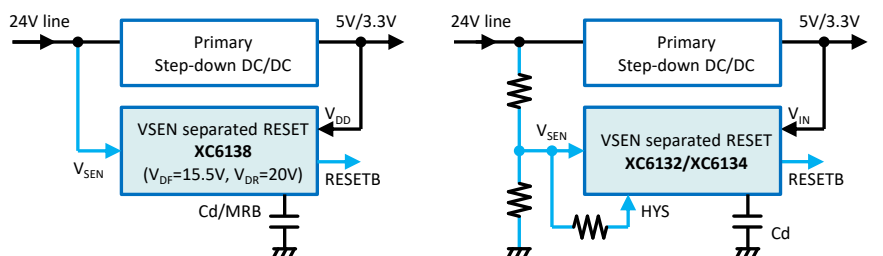
76V High voltage Sense pin

Wide hysteresis range selectable.

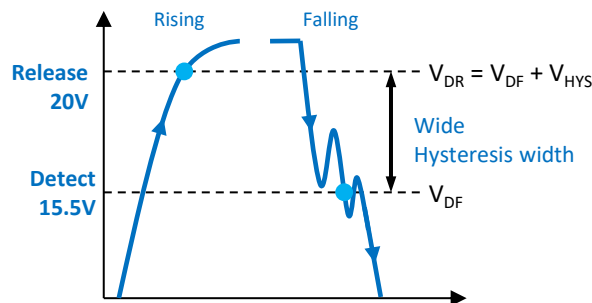
XC6132/XC6134

Detect and release voltages are set using external resistors.

(XC6132 has V_{SEN} pin surge protection)



Example of 24V line voltage monitoring



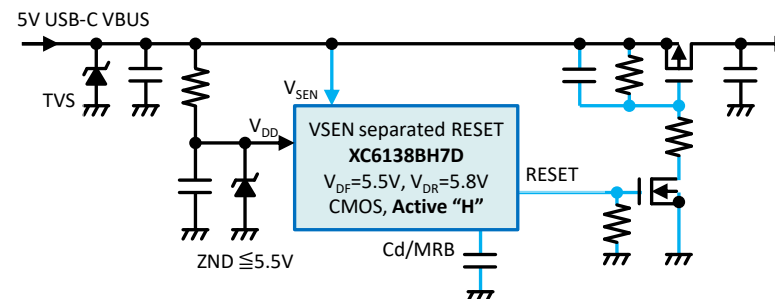
- **USB port Overvoltage protection (OVP)**

- **Technical trend and challenges**

- 5V USB overshoot is an issue due to the spread of low-cost USB-PD adapters.

- **TOREX Proposal : Overvoltage protection with a reset IC suitable for 5V USB**

- **Simple implementation with XC6138BH7D + external FETs.**



- **Simple MPPT using an ultra-low Iq reset IC and a step-up DC/DC**

- **Technical trend and challenges**

- ON/OFF control of step-up DC/DC in response to changes in input voltage is important for energy harvesting and backup power supply from EDLC.

● TOREX Proposal : Input voltage monitoring using an ultra-low Iq reset IC

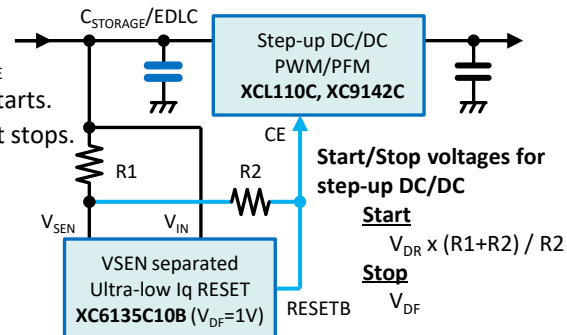
➤ Creating hysteresis with XC6135 + resistors

- **Energy Harvesting**

When voltage of C_{STORAGE} rises enough, boosting starts.
When the voltage falls, it stops.

- EDLC for backup

When the EDLC voltage rises enough, backup supply starts. When the voltage falls, it stops.



Application circuit1 :

Voltage inverting using step-down DC/DC

■ 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~-18V from 5V/12V/24V.

● Applications

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

■ Example specifications

Input Voltage : 4.5V ~ 60.0V + V_{OUT}

Output Voltage : -2.5V ~ -18.0V

Output Current : XC9702 Max. 50mA ~ 100mA

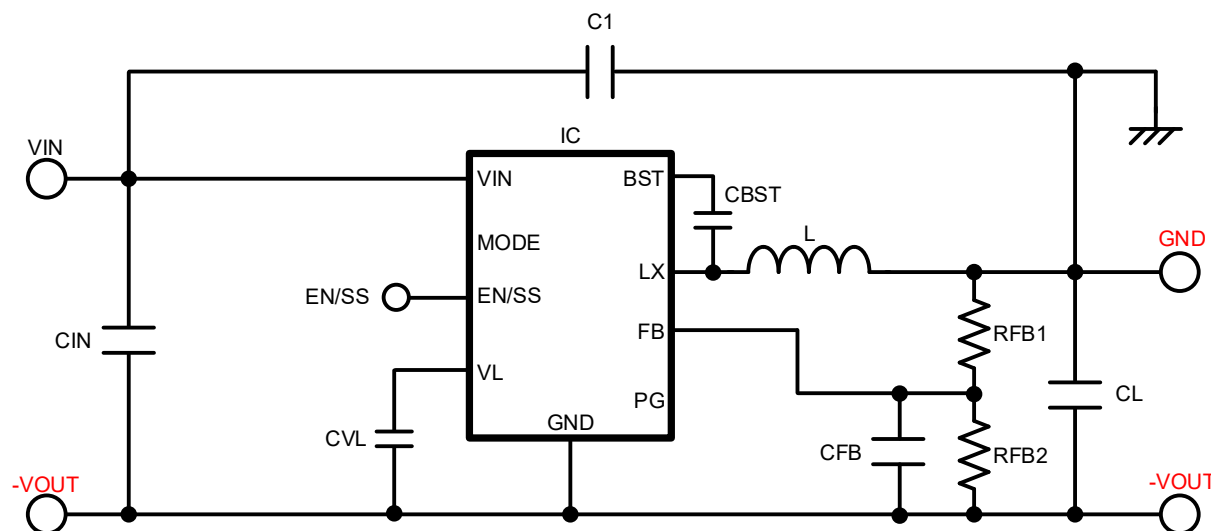
XC9711 Max. 200mA ~ 500mA

Features : Inverting voltage generation
using step-down DC/DC
Small size solution

Low Noise

(XC9711 : PWM controllable)

■ Typical Application Circuit



■ Evaluation Board



Application circuit2-1 : Multi-channel isolated power supplies using transformers

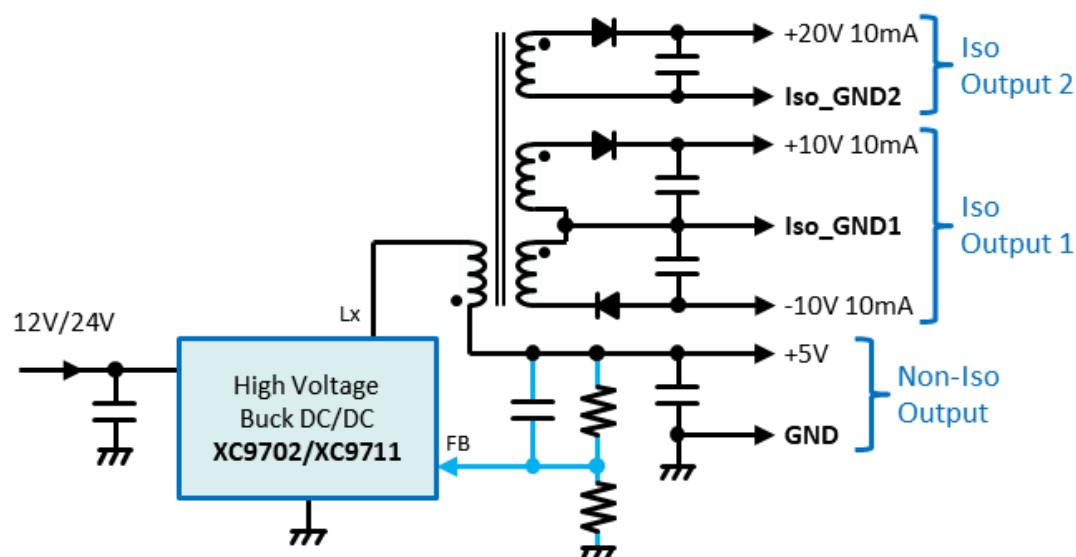
■ Multi-channel isolated power supplies using transformers

To obtain an inexpensive isolated power supplies using transformers.
Ideal for Multi-channel Small, Isolated Power Supply Designs.
Applicable to Floating, Inverting, and Similar Configurations.

● 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)

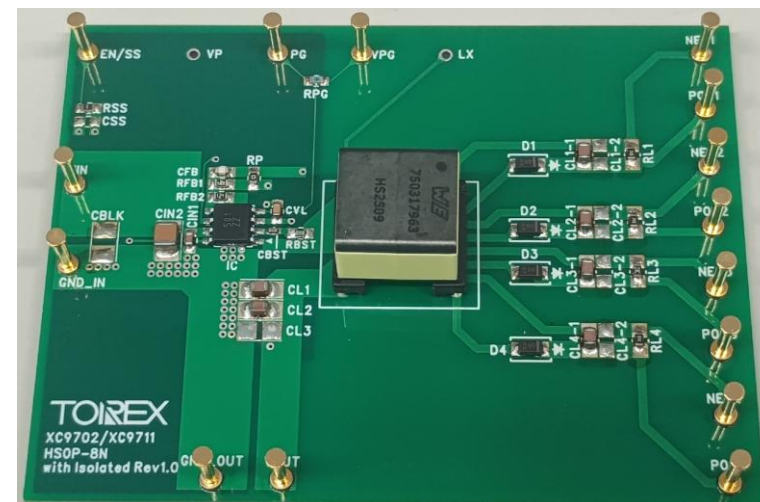
■ Typical Application Circuit



■ Example specifications

Input Voltage	: 4.5V ~ 60.0V
Output Voltage 1	: Non-iso 2.5V ~ 18.0V
Output Voltage 2~	: Iso 5V/12V/15V etc *depending on the winding ratio
Output Current 1 (Non-isolated)	: XC9702 Max 100mA ~ 200mA XC9711 Max 400mA ~ 800mA
Output Current 2~ (Isolated)	: XC9702 Max 10mA ~ 20mA XC9711 Max 20mA ~ 50mA
Features	: Floating voltage available. Multi-channel are possible by transformers.

■ Evaluation Board



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

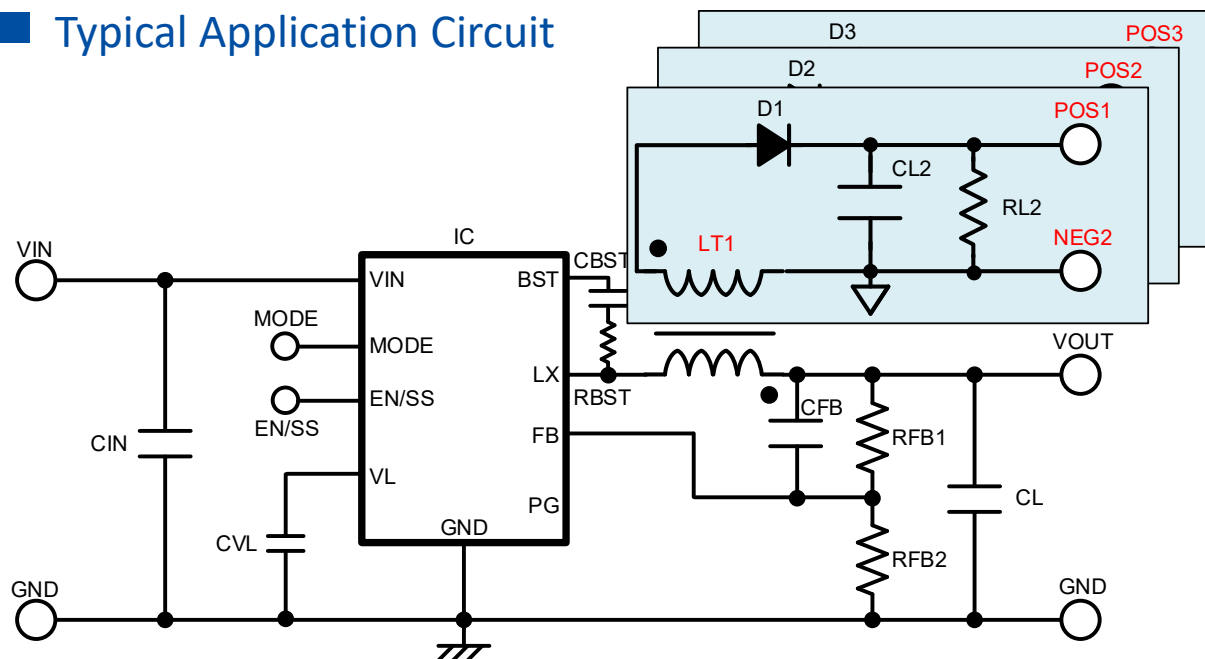
■ Multi-channel isolated power supplies using couple inductors

To obtain an inexpensive isolated power supplies using couple inductors.
Ideal for Small, Isolated Power Supply Designs.
Applicable to Floating and Inverting Configurations.

● 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)
* For 3-phase motor drive, etc

■ Typical Application Circuit



■ Example specifications

Input Voltage	: 4.5V ~ 60.0V
Output Voltage 1	: Non-iso 2.5V ~ 18.0V
Output Voltage 2~	: Iso 5V/12V/15V etc *depending on the winding ratio
Output Current 1 (Non-isolated)	: XC9702 Max 100mA ~ 200mA XC9711 Max 400mA ~ 800mA
Output Current 2 (Isolated)	: XC9702 Max 10mA ~ 20mA XC9711 Max 20mA ~ 50mA
Features	: Floating voltage available. Low Cost.

■ Evaluation Board

