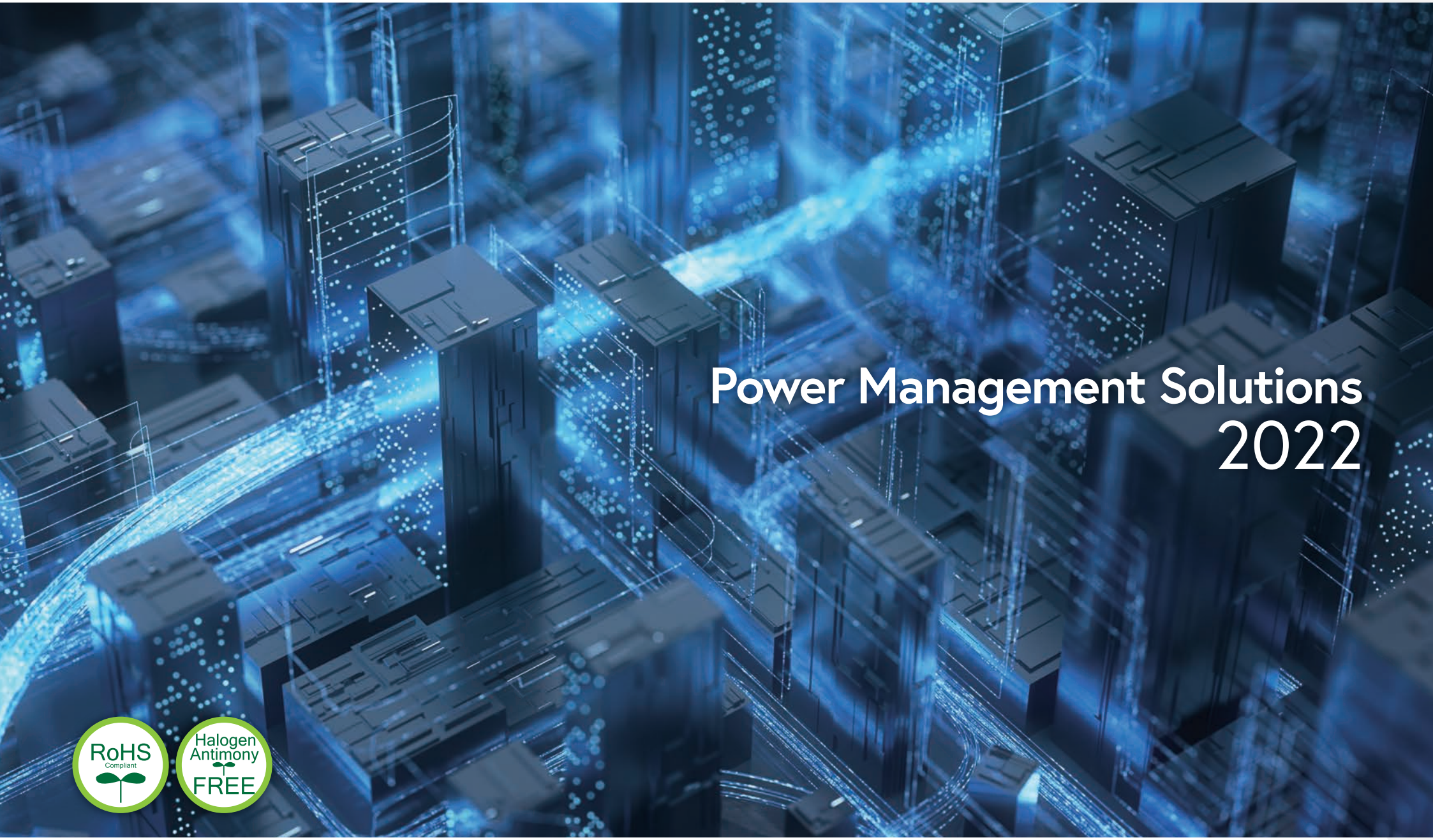
TOREX



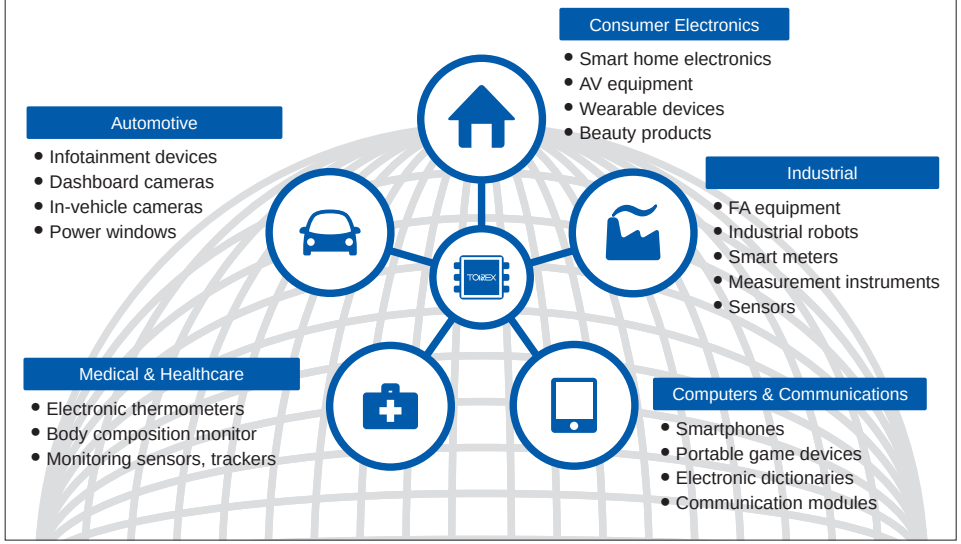
Power Management Solutions 2022

Contents

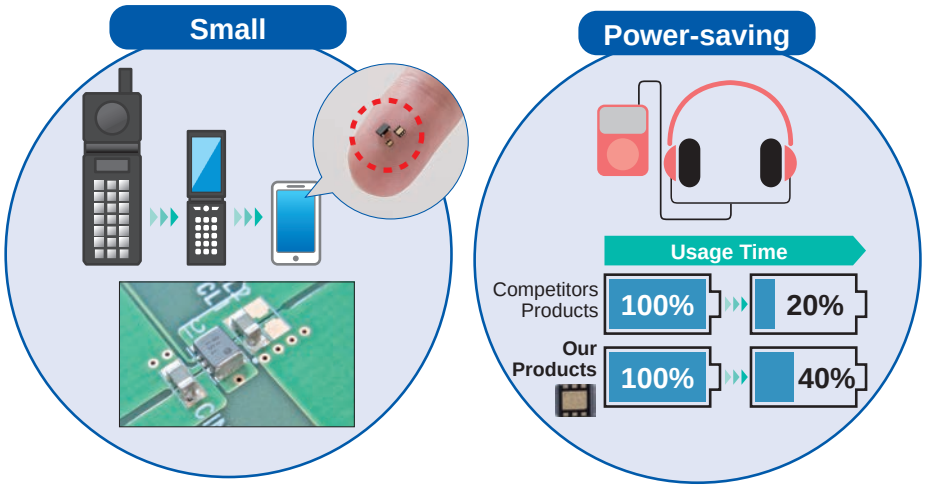
Corporate Data

TOREX SEMICONDUCTOR is a specialized manufacturer of power management ICs featuring small size, low Iq, and low noise. We provide the optimum ICs and solutions for our customers to meet their electronic component needs.

Torex power management ICs: Supporting electronic devices in every field



Our proprietary technology contributes to the miniaturization and power savings of electronic devices.



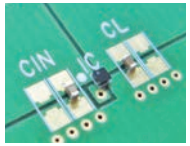
TOREX SEMICONDUCTOR LTD. https://www.torexsemi.com/

Address	: 3F DAIHO ANNEX 1-24-1 Shinkawa, Chuo-Ku, Tokyo 104-0033 Japan
Founded	: March 1995
Capital	: 2967.93 million JPY
Operations	: 1.Research and Development, Manufacturing of ICs and active discrete components.
	: 2.Sales of ICs and active discrete components.
Stock Exchange	: Prime Market of the Tokyo Stock Exchange

New Products, Featured Products Introduction

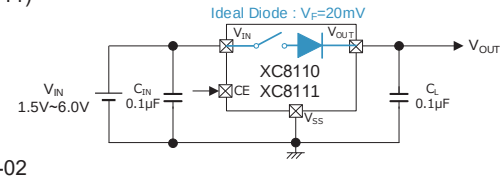
NEW

■XC8110 / XC8111 - Ideal diode load SW



- ●Load SW with Ideal diode function equivalent to VF = 20mV
- ●For OR connection of multiple power lines and backup

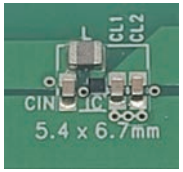
VIN	: 1.5 ~ 6.0V
IOUT	: 500mA (XC8110), 1A (XC8111)
Ron	: 120mΩ @ WLP-4-02
Iq	: 3.6μA (at Forward bias) 0μA (at Reverse bias)
Standard	: IEC 62368-1:2018 Certified
Topr	: -40°C ~ 105°C
Package	: SOT-25, USP-6B06, WLP-4-02



Product/performance overview: P.31,36 , Example usage circuits: P.29,35

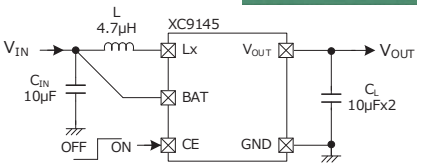
NEW

■XC9145 - Small and high efficiency, Ultra Low Iq Step-up DC/DC



- ●Achieves high efficiency of 89.9% even at IOUT = 10μA with 400nA Ultra Low Iq
- ●Longer battery operation time for battery, IoT, and wearable applications

VIN	: 0.65 ~ 5.5V
VOUT	: 3.0 ~ 5.5V
fosc	: 1.2MHz
IOUT	: 430mA @3.3V → 5V 300mA @1.8V → 3.3V
Control	: PWM/PFM
Topr	: -40°C ~ 105°C
Package	: USP-6C, WLP-6-05

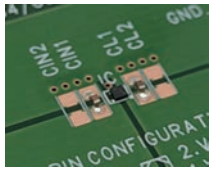


* XC9141/XC9142 Pin-to-pin compatible

Example usage circuits: P.28,39

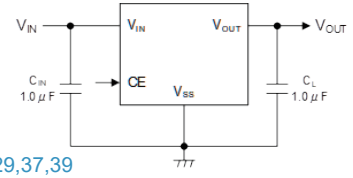
NEW

■XC6241 - low Iq, high speed “GO” LDO



- ●Low Ron and 105℃ operation while achieving both low Iq and high speed response
- ●Suitable for a variety of applications in addition to batteries, IoT, and wearable devices

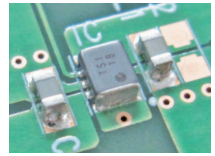
VIN	: 1.6 ~ 6.0V
VOUT	: 1.2 ~ 5.0V
IOUT	: 150mA
Iq	: 0.6μA
Ron	: 1.1Ω @3.3V
PSRR	: 60dB@1kHz
Topr	: -40°C ~ 105°C
Package	: USPQ-4B05, SSOT-24



Example usage circuits: P.29,37,39

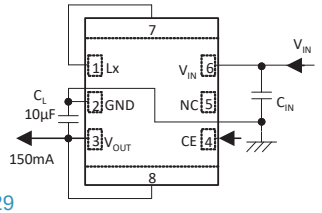
NEW

■XCL232 - Inductor built-in, Ultra Low Iq Step-down DC/DC



- ●Inductor built-in makes possible small size, easier designing, and low EMI
- ●High efficiency of 80% or more even at IOUT = 10μA with 200nA Ultra Low Iq

VIN	: 1.8 ~ 6.0V
VOUT	: 0.5 ~ 3.6V
IOUT	: 150mA
Iq	: 200nA
Control	: PFM
Topr	: -40°C ~ 85°C
Package	: CL-2025-03

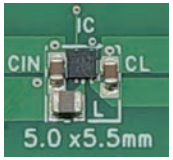


* XCL210 Pin-to-pin compatible

Example usage circuits: P.29

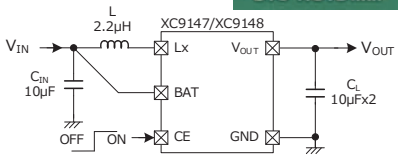
NEW

■XC9147 / XC9148 - Small and high efficiency multifunctional Step-up DC/DC



- ●Space-saving including peripheral parts, high-efficiency Step-up DC/DC
- ●Load disconnection / VOUT OR / Bypass types can be selected according to the usage

VIN	: 0.9 ~ 6.0V
VOUT	: 1.8 ~ 5.5V
fosc	: 1.2MHz, 3MHz
IOUT	: 750mA @3.3V → 5V 500mA @1.8V → 3.3V
Control	: F-PWM (XC9147), PWM/PFM (XC9148)
Topr	: -40°C ~ 105°C
Package	: SOT-89-5, USP-6C



* XC9141/XC9142 Pin-to-pin compatible

Product/performance overview: P.30,36 , Example usage circuits: P.28

Links to Product Pages

XC8110 : https://www.torexsemi.com/products/load-switches/series/?name=xc8110

XC8111 : https://www.torexsemi.com/products/load-switches/series/?name=xc8111

XCL232 : https://www.torexsemi.com/products/built-in-dcdc-converters/series/?name=xcl232

XC9145 : https://www.torexsemi.com/products/step-up-dcdc-converters/series/?name=xc9145

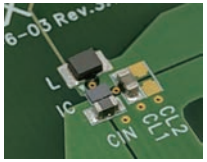
XC9147 : https://www.torexsemi.com/products/step-up-dcdc-converters/series/?name=xc9147

XC9148 : https://www.torexsemi.com/products/step-up-dcdc-converters/series/?name=xc9148

XC6241 : https://www.torexsemi.com/products/single-type-voltage-regulators/series/?name=xc6241

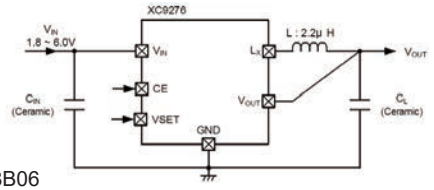
FEATURED

■XC9276 - Ultra Low Iq Step-down DC/DC with VSET function



- ●High efficiency of 80% or more even at IOUT = 10μA with 200nA Ultra Low Iq
- ●Further lower power consumption with the VSET function that changes VOUT according to the operation of the MCU

VIN	: 1.8 ~ 6.0V
VOUT	: 0.5 ~ 3.6V (2 values set) Selected by H/L of VSET pin
IOUT	: 150mA
Iq	: 200nA
Control	: PFM
Topr	: -40°C ~ 85°C
Package	: WLP-6-03, SOT-26W, USP-8B06



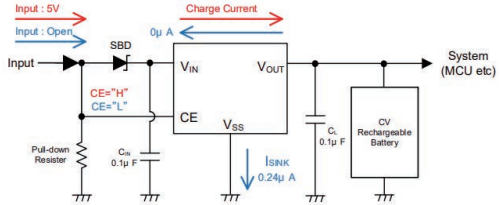
Product/performance overview: P.30 , Example usage circuits: P.29

NEW

■XC6240 / XC6242 - Charger IC for LTO batteries compatible with CV charging(LDO)

- ●Adopted as a reference for LTO batteries of each battery manufacturer
- ●Charge at max 2.70V including temperature range to match LTO battery characteristics
- ●For 105 °C compatible LTO batteries, **XC6242** which can handle high temperatures is suitable

VIN	: 1.5 ~ 6.0V
IOUT	: ~150mA
VOUT	: 2.63V
Iq	: 0.8μA
ISINK	: 0.24μA
Topr	: -40°C ~ 85°C (XC6240) -40°C ~ 105°C (XC6242)
Package	: SSOT-24, USPN-4, USP-6B06 (XC6242 : for USPN-4)



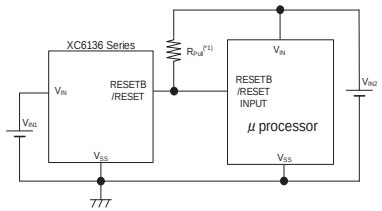
Product/performance overview: P.38 , Example usage circuits: P.35,39

FEATURED

■XC6136 - Ultra Low Iq (88nA) voltage detector

- ●Consumption current 100nA class Ultra Low Iq contributes to long battery life during operation

Operating Voltage	: 1.1 ~ 6.0V
Detect Voltage Range	: 1.2 ~ 5.0V (±0.8%)
Hysteresis	: 5% (A/C) 2mV ~ 28mV (B/D)
Iq	: 88nA
Output Type	: CMOS, Nch Open drain
Output Logic	: H level or L level at detection
Topr	: -40°C ~ 105°C
Package	: USPQ-4B05, SSOT-24, SOT-25



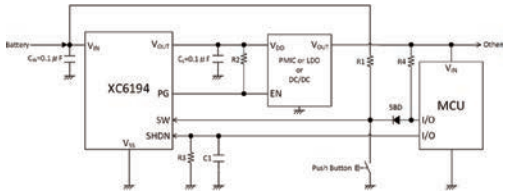
Example usage circuits: P.28,29,37

FEATURED

■XC6194 - Push button load SW equipped with a shutdown function for during shipping

- ●The Ship function prevents battery discharge during shipment and can also be used as the main power switch
- ●Suitable for long battery life, and also for forced off in case of system freeze

VIN	: 1.8 ~ 6.0V
IOUT	: 1A
Ron	: 0.14Ω@3.0V
ISTB	: 1nA (at shutdown)
Iq	: 0.13μA
Topr	: -40°C ~ 85°C
Package	: USP-8B06



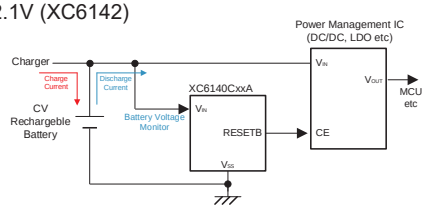
Product/performance overview: P.31 , Example usage circuits: P.28,29,37

NEW

■XC6140 / XC6142 - Voltage monitoring IC for LTO batteries

- ●Adopted as a reference for LTO batteries of each battery manufacturer
- ●Optimal release / detect voltage for LTO batteries
- ●For 105 °C compatible LTO batteries, **XC6142** with optimized Release voltage is suitable

VIN	: 1.1 ~ 6.0V
Detect Voltage	: 1.6 ~ 2.2V (XC6140), 1.6 ~ 2.1V (XC6142)
Release Voltage	: 2.475V (XC6140), 2.450V (XC6142)
Iq	: 104nA @Release, 139nA @Detect
Output	: CMOS or Nch Open Drain Active “L” or “H”
Topr	: -40°C ~ 105°C
Package	: SSOT-24(XC6240 Only), USPQ-4B05



Product/performance overview: P.38 , Example usage circuits: P.35,39

Links to Product Pages

XC9276 : https://www.torexsemi.com/products/step-down-dcdc-converters/series/?name=xc9276

XC6194 : https://www.torexsemi.com/products/push-button-controllers/series/?name=xc6194

XC6240 : https://www.torexsemi.com/products/single-type-voltage-regulators/series/?name=xc6240

XC6242 : https://www.torexsemi.com/products/single-type-voltage-regulators/series/?name=xc6242

XC6140 : https://www.torexsemi.com/products/single-type-voltage-detectors/series/?name=xc6140

XC6142 : https://www.torexsemi.com/products/single-type-voltage-detectors/series/?name=xc6142

XC6136 : https://www.torexsemi.com/products/single-type-voltage-detectors/series/?name=xc6136

TOREX Main Product Groups and Features

■**We offer a lineup of product groups required for the power supplies of automotive, industrial, and consumer equipment including DC/DC converters, voltage regulators, and voltage detectors**

Inductor Built-in “micro DC/DC” (XCL series)

- DC/DC converter and coil integrated ICs
- Space-saving low EMI DC/DC converters that are easy to design like LDO

DC/DC Converter

- Step-down, Step-up, and other DC/DC from low voltage to medium and high voltages, and small to high currents
- Ultra small sizes, Ultra Low Iq, and ultra fast transient response

Voltage Regulator (LDO)

- Low Iq, high speed response type LDOs
- Low to medium and high voltages, small to high currents
- Broad package lineup

Voltage Detector & Watchdog Timer (Reset &WDT)

- Ultra Low Iq of the nA order that is suitable for battery operations
- Various functions and 125°C operation compatible that are required for industrial equipment etc.

TOREX Product Groups

Small size, High performance, Low Iq, Low noise

Load Switch & Push Button Controller

- From simple load switches to those for USB protection and ideal diodes
- Push button load switches support long battery life and the push button reboot controller is a measure for system freezes

Charger IC (for Li-ion/Polymer & LTO Batteries)

- Small, simple, and easy-to-use charger IC for Li-ion / Polymer
- LDOs for charging and battery voltage monitoring ICs that are optimum for LTO (lithium titanate) batteries

Automotive IC (XD series)

- AEC-Q100 compliant automotive products quality
- Product groups such as LDO, voltage detectors, and watchdog timers that utilize TOREX's small, high-performance devices

Discrete (MOSFET, SBD)

- MOSFET and schottky diode (SBD) are used around power management ICs and for various other applications

Inductor Built-in DC/DC Converter “micro DC/DC”

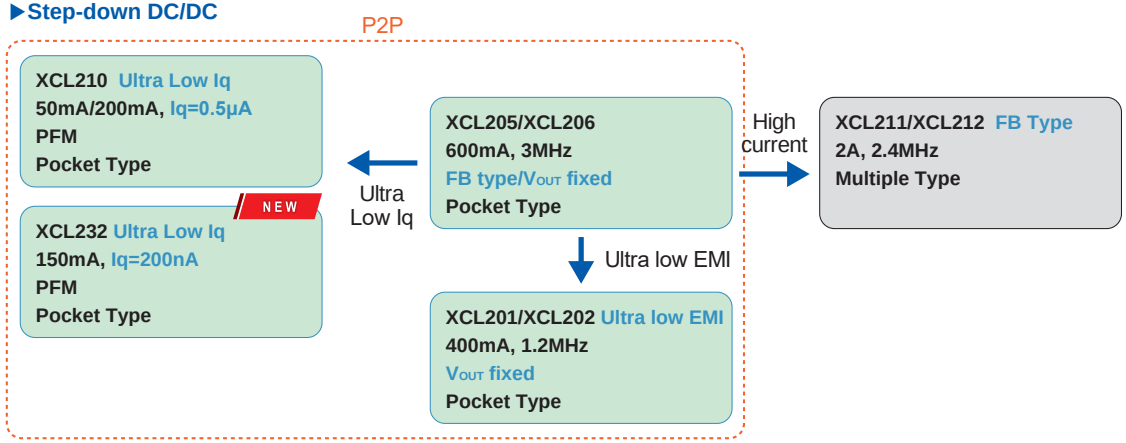
■Features of TOREX Inductor built-in DC/DC converter “micro DC/DC”

- ●Space saving : Minimizes the circuit board wiring for peripheral components. Makes small shape solutions possible.
- ●Design simplification : Only an input/output capacitor for the main components. Greatly reduces the evaluation man-hours.
- ●Noise reduction : The package configuration is optimized to suppress switching noise and achieve a low EMI.
- ●Easy thermal design : Uses a proprietary high heat dissipation package. Small, high-efficiency DC/DC.

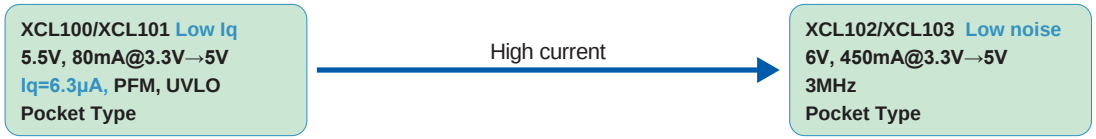
■Typical Inductor built-in DC/DC converter

Standard | Low Iq | Small

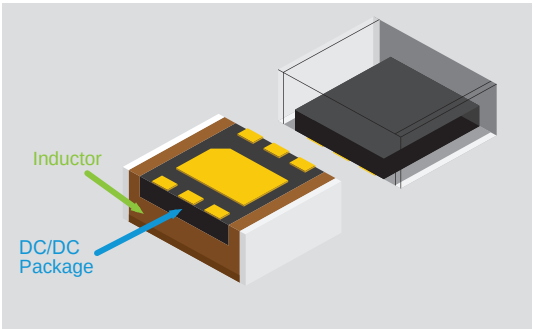
▶Step-down DC/DC



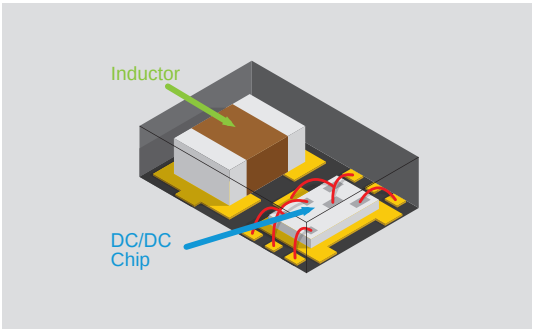
▶Step-up DC/DC



Pocket Type



Multiple Type



Selection Points

- ✓Ultra low Iq : Battery-powered devices
- ✓Fast transient response : Core voltage for MPU, FPGA, memory, etc.
- ✓Low noise : Industrial device, mobile device sensor, and RF applications

Selection Guide P.12,14-15
Solution Guide P.33

DC/DC Converter

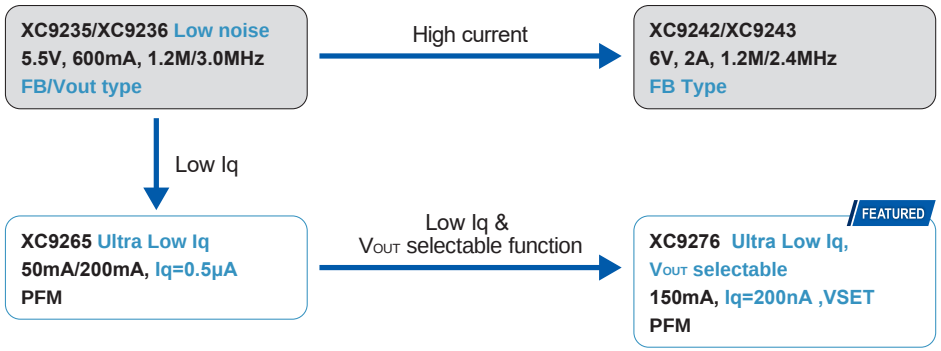
■Features of TOREX DC/DC converters

●Space-saving : Achieves space-saving solutions where not only the IC but the peripheral components can be made smaller
●Ultra-low supply current : High efficiency achieved through Ultra Low Iq technology. Achieves long battery life.

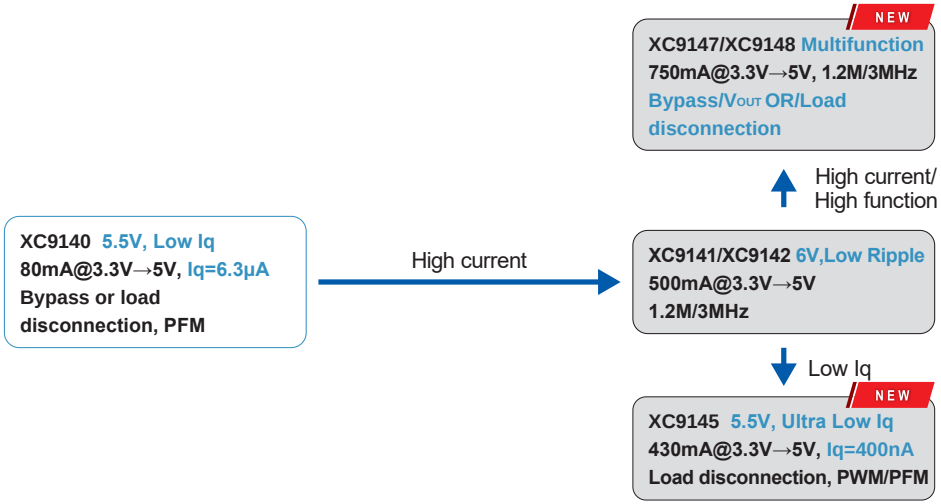
■Typical DC/DC converter

Standard | Low Iq

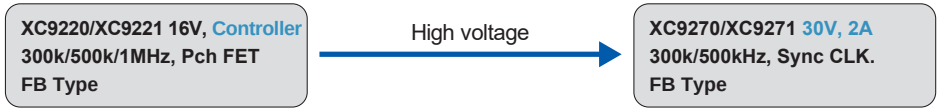
▶Low voltage Step-down DC/DC



▶Low voltage Step-up DC/DC



▶Medium and high voltage Step-down DC/DC



▶Medium and high voltage Step-up DC/DC

Selection Points

✓Ultra small size : Lightweight, thin, and compact devices, such as mobile, wearable, IoT devices, and smart cards
✓Ultra Low Iq/high efficiency : Battery-powered devices and devices that require heat generation countermeasures
✓High speed response : Core voltage for MPU, FPGA, memory, etc.
✓Medium and high voltage : Industrial equipment sensors, FA units/modules, security equipment, IoT devices, etc.

Selection Guide P.13-15
Solution Guide P.30 etc.

Voltage Regulator

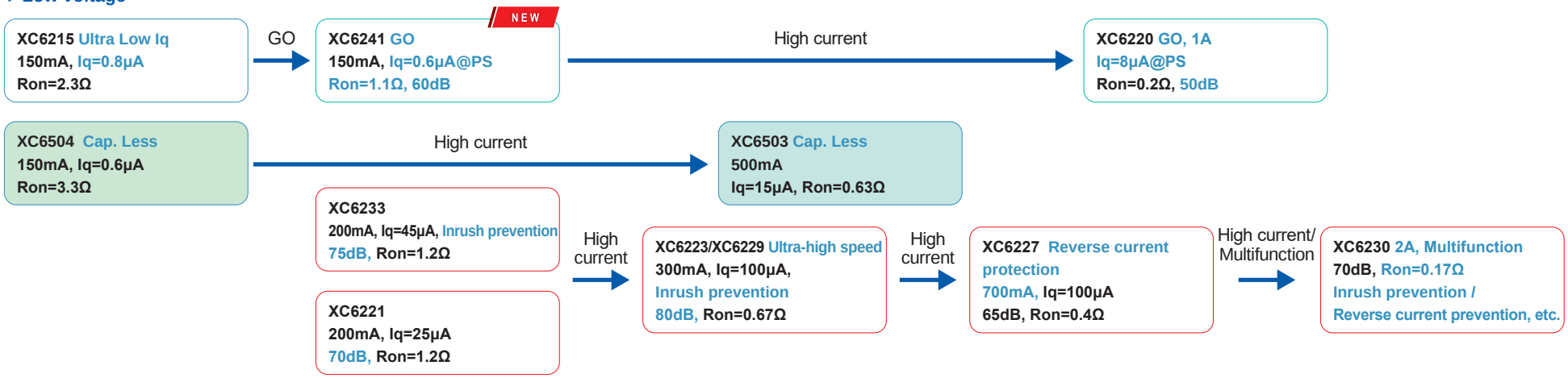
■Features of TOREX voltage regulator

- ●Ultra-small size : Wafer level and low-profile packages
- ●Ultra-low supply current : nA level low supply current achieves long battery life
- ●Multiple control : Green Operation (GO) achieves low Iq, high speed response types or low Iq + high speed response

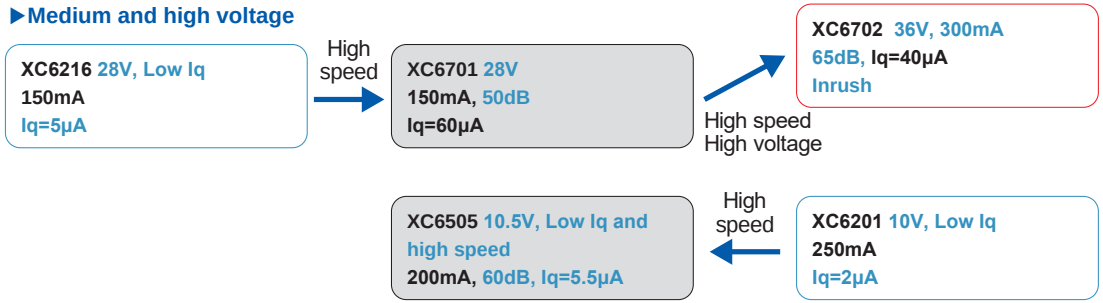
■Typical voltage regulator

Standard | Low Iq | High Speed | GO (Low Power/High PSRR) | Cap Less

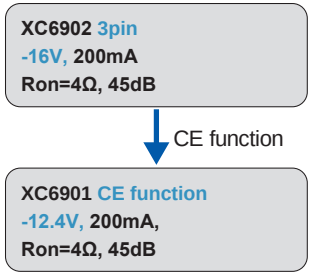
▶Low voltage



▶Medium and high voltage



▶Negative voltage



Selection Points

- ✓Low Iq : Battery-powered devices
- ✓High speed : Applications that require high-speed transient response, such as sensors and RF applications
- ✓Low noise : Industrial equipment, mobile device sensors, RF applications
- ✓Green Operation (GO) : Applications that require both low Iq and high-speed transient response

Selection Guide P.16-19

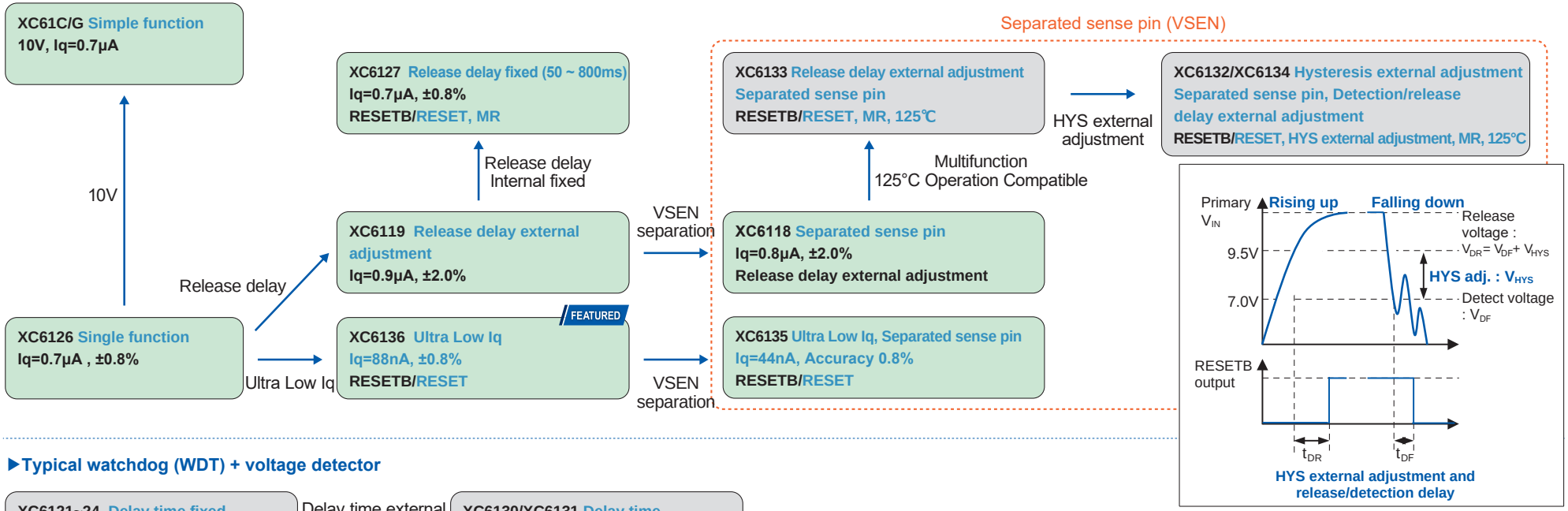
Voltage Detector & Watchdog

■Features of TOREX voltage detector & watchdog

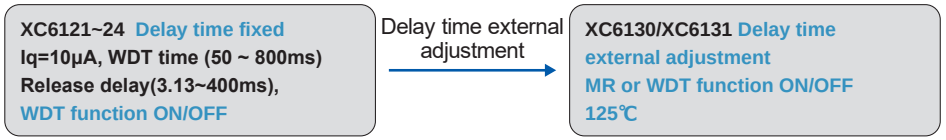
- ●Ultra-small size : Ultra-small package and low profile package
- ●Ultra-low supply current : nA level low supply current achieves long battery life
- ●High temperature : 125°C compatible for applications where the operating environment is severe.
- ●Functions : Hysteresis (HYS) external adjustment, manual reset (MR), output logic H/L, Separated sense pin (VSEN), etc.

■Typical voltage detector

Standard | Low Iq | Small



▶Typical watchdog (WDT) + voltage detector



Selection Points

- ✓Detection delay : Power sequence
- ✓Separated sense pin (VSEN) : Monitoring of 12V/24V lines, etc. The monitoring line and IC power supply are separated.
- ✓Hysteresis external adjustment : Applications with large power supply voltage fluctuations, such as industrial equipment, automotive product, etc.
- ✓Other functions : Manual reset, output logic H/L, detection/release delay, unstable operation prevention, etc.

Selection Guide P.20-21
Solution Guide P.34

Load Switch & Push Button Controller

■Load switch

- ●Simple type : Internal power supply line distribution
- ●Output protection for power supply lines : Current limit/protection for USB lines, etc. Built-in current limit external adjustment/error flag function.
- ●Built-in ideal diode function : Load SW with an ideal diode and equivalent reverse current prevention function. Also has a built-in protection function.

■Typical load switch

Standard | Low Iq | Small

▶Simple type

XC8101 Switch for internal power supply lines
6V, 200mA
Ron=0.75Ω, Iq=3μA

High current →

XC8102 Switch for internal power supply lines
6V, 400mA
Ron=0.28Ω, Iq=4μA

▶Output protection for power supply lines

XC8107 Selectable current limits
5.5V, 0.5A/1.0A/1.5A/2.0A, Ron=85mΩ,
Soft-start, Reverse current prevention, Flag function

Current limit external adjustment →

XC8108/XC8109 Current limit external adjustment
5.5V, 0.9~2.4A/0.075~1.3A external adjustment, Ron=85mΩ,
Soft-start, Reverse current prevention, Flag function

▶Built-in ideal diode function

NEW
XC8110 500mA, Ideal diode
6V, Ron=120mΩ, True reverse current prevention
IEC 62368-1 Certified

High current →

NEW
XC8111 1A, Ideal diode
6V, Ron=120mΩ, True reverse current prevention
IEC 62368-1 Certified

■Push button controller

- ●Push button load SW : Shutdown during shipment, power consumption cut as the main power switch.
  Also handles shutdown during system freezes. Also has built-in protection functions.
- ●Push button reboot controller : Long pushing the push button outputs a reboot signal.
  Used as a reset measure during a system freeze and as a toggle to enable the power management IC

■Typical load switch

▶Push button load SW

FEATURED
XC6194 Shutdown/Wake-up SW
1.8V~6V, 1A, 0.14Ω, Power Good
I_{STB}=1nA, Iq=0.13μA

High current External FET →

XC6193 High current shutdown/start-up switch
1.8V ~ 6V, External Pch FET
I_{STB}=1nA, Iq=0.13μA

▶Push button reboot controller

XC6190 Reset with Push SW for system freeze
2 input SW, Press hold time: 7.5s/12.5s/adj.
Iq=0.01μA

Selection Guide P.23-24
Solution Guide P.31,36

Secondary Battery Charger IC: For Li-ion/Polymer & LTO Batteries

■Charger IC for Li-ion/polymer, LTO (lithium titanate) batteries

●Li-ion/polymer battery : Simple and easy-to-use charger IC
●LTO battery : LDO for charging and battery voltage monitoring IC that is optimum for LTO batteries

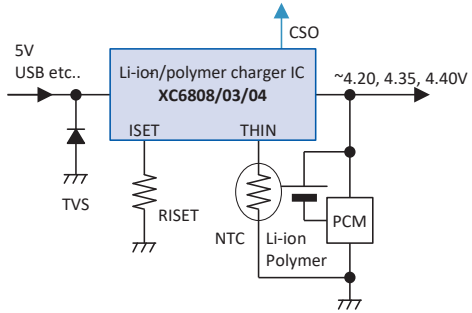
■Charger IC for Li-ion/polymer

●By the 3 products of Pin-to-pin compatible (P2P) supports for 5 ~ 800mA charging current
●Built-in battery temperature monitoring/control function by NTC thermistor
●Built-in CSO terminal to output the charging status

Standard / Low Leakage

P2P

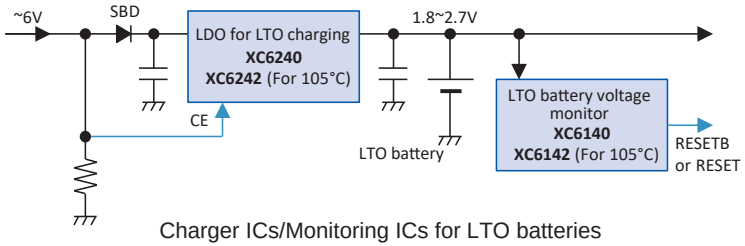
XC6808 CC = 5~40mA, Ultra low leakage CV=4.20/4.35/4.40V I_{BAT}=0.1μA, Battery Temp. Monitor	← Low leakage	XC6803 CC=40~280mA CV=4.20V Battery Temp. Monitor	High current →	XC6804 CC=200~800mA CV=4.20V Battery Temp. Monitor



Selection Guide P.24

■LTO battery Charger & monitoring IC

●LDO for charging and battery voltage monitoring ICs recommended for the LTO batteries of the various manufacturers
●LDO for charging is selected based on operating temperature and output voltage including temperature variation
●For battery voltage monitoring ICs, the voltage is set to the voltage that is released as soon as charging starts in accordance with the battery.
Select a product to match the upper limit temperature of the LTO battery



Charger ICs/Monitoring ICs for LTO batteries
The recommended part No. might differ depending on the usage battery and conditions.
For details, contact the battery manufacturer or TOREX.

Standard / High Temperature

▶LDO for charging

FEATURED XC6240 For 85°C V_{OUT} = 2.63V (2.70V@85℃) 150mA, Iq=0.8μA, I_{SINK}=0.24μA	High temperature →	NEW XC6242 For 105°C V_{OUT} = 2.63V (2.70V@105℃) 150mA, Iq=0.8μA, I_{SINK}=0.24μA

*When suppressing the voltage during charging, use XC6215, V_{OUT} = 2.5V.

▶LTO battery voltage monitoring IC

FEATURED XC6140 For 85°C Detection 1.6~2.2V, Release 2.475V Iq=104nA	High temperature →	NEW XC6142 For 105°C Detection 1.6~2.1V, Release 2.450V Iq=104nA

Selection Guide P.24
Solution Guide P.38-39

Automotive IC

■Features of TOREX automotive IC (XD Series)

- ●Automotive reliability support : AEC-Q100 compliant
- ●Quality management : Statistical Process Control (SPC) and Measurement System Analysis (MSA) are used for process control
- ●Manufacturing process control : AEC-Q001 / AEC-Q002 guidelines compliant
- ●Traceability : Manufacturing/sales traceability is stronger than that of general products (XC/XCL Series)

Initiatives for automotive products

To ensure high quality for automotive products, stricter reliability testing, quality testing, and production management, etc., than for general consumer products (XC Series) is conducted.

■Automotive IC (XD Series)

Standard | Low Iq | High Speed

▶Voltage regulator

XD6506 Low Iq
6V, 150mA
Iq=0.8μA

→ High voltage →

XD6216 28V, Low Iq
150mA, Iq=5μA
30dB@1kHz

→ High speed →

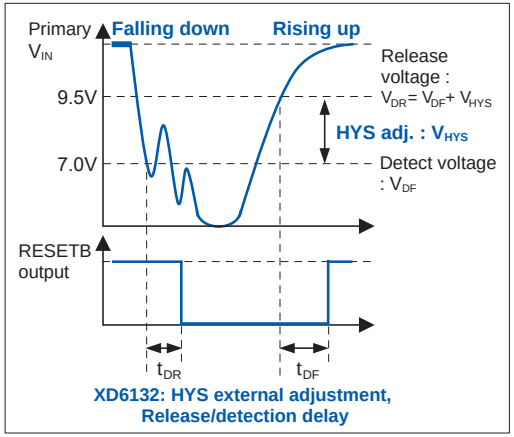
XD6702 36V, High speed response
300mA, Iq=40μA
65dB@1kHz

▶Voltage detector

XD6133
Delay time external adjustment
Separated sense pin, RESETB/ RESET
MR, 125℃

→ Multifunction →

XD6132 Separated sense pin
Hysteresis width external adjustment
(cold crank support)
Detection/release delay external adjustment
MR, 125℃



XD6132: HYS external adjustment, Release/detection delay

▶Watchdog timer (WDT)

XD6121~24 Delay internal fixed
Iq=5μA
WDT function ON/OFF

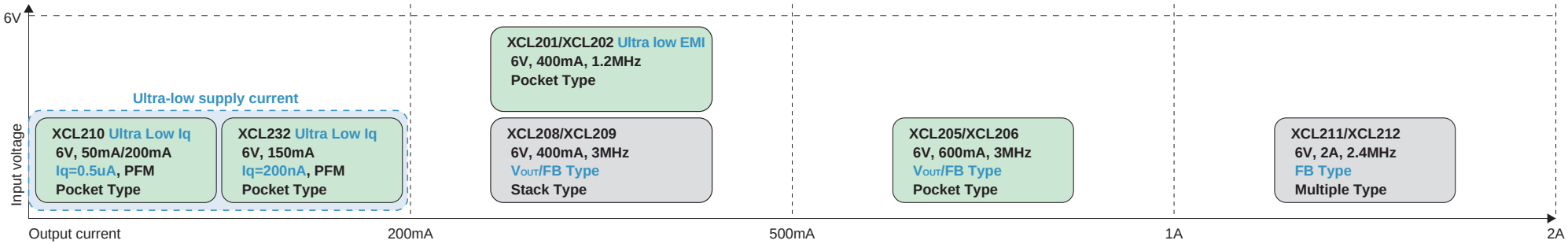
→ Multifunction →

XD6130/XD6131
Delay time external adjustment
WDT function ON/OFF or MR

Selection Guide P.25

Step-down DC/DC: Inductor Built-in

Standard | Low Iq | Small



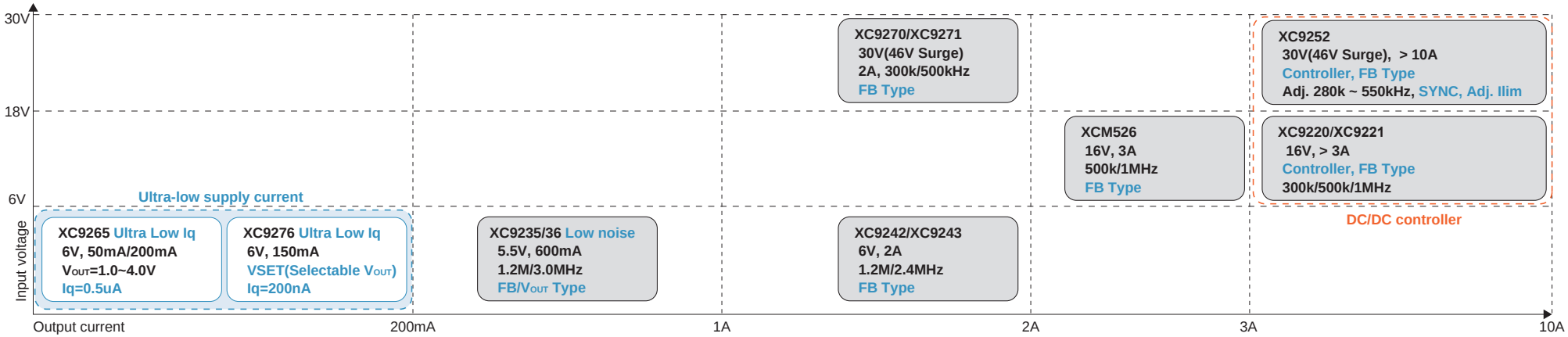
F-PWM: Compulsory PWM mode
PWM: PWM mode

Maximum Output Current

Series Name	Features	Control Method	V_{IN} [V]	V_{OUT} [V]	I_{OUT} [mA]	fosc [Hz]	Function				Topr max.	Package
							External FET/SBD	Output Setting Method	Protection Function	Other		
NEW XCL232	Ultra Low Iq, Iq=200nA	PFM	1.8~6.0	0.5~3.6	150	-	-	V_{OUT}	Short	UVLO/C_L Discharge	85°C	CL-2025-03 (2.5x2.0xh1.04mm)
XCL210	Ultra Low Iq, Iq=0.5uA	PFM	2.0~6.0	1.0~4.0	200	-	-	V_{OUT}	Short	UVLO/C_L Discharge	85°C	CL-2025-02 (2.5x2.0xh1.04mm)
XCL209 / XCL208	400mA, 3MHz V_{OUT} internal fixed/FB type can be selected	PWM/PFM / PWM	1.8~6.0	0.8~4.0	400	3.0M	-	V_{OUT} or FB	ILIM/Short	SS/UVLO/C_L Discharge	85°C	USP-10B03 (2.5x2.15xh1.05mm)
XCL202 / XCL201	400mA, 1.2MHz Ultra low EMI	PWM/PFM / PWM	2.0~6.0	0.8~4.0	400	1.2M	-	V_{OUT}	ILIM/Short	SS/UVLO/C_L Discharge	85°C	CL-2025-02 (2.5x2.0xh1.04mm)
XCL206 / XCL205	600mA, 3MHz V_{OUT} internal fixed/FB type can be selected	PWM/PFM / PWM	1.8~6.0	0.8~4.0	600	3.0M	-	V_{OUT} or FB	ILIM/Short	SS/UVLO/C_L Discharge	85°C	CL-2025-02 (2.5x2.0xh1.04mm)
XCL212 / XCL211	2A, 2.4MHz	PWM/PFM / PWM	2.7~6.0	0.9~6.0	2000	2.4M	-	FB	TSD/ILIM	SS/UVLO/C_L Discharge	85°C	USP-11B01 (3.1x4.70xh1.35mm)

Step-down DC/DC

Standard | Low Iq | High Speed | Small



F-PWM: Forced PWM mode
PWM: PWM mode

Low voltage DC/DC: Input voltage 6V or less

Maximum Output Current

Series Name	Features	Control Method	VIN [V]	VOUT [V]	IOUT [mA]	fosc [Hz]	Function: External FET/SBD	Function: Output Setting Method	Function: Protection Function	Function: Other	Topr max.	Package
FEATURED XC9276	Ultra Low Iq, Iq=200nA VSET (Output voltage 2-value selectable function)	PFM	1.8~6.0	0.5~3.6	150	-	-	VOUT	Short	UVLO/CL Discharge /VSET (Selectable VOUT)	85°C	WLP-6-03 (1.72x1.07xh0.33mm) USP-8B06 (2.0x2.0xh0.33mm) SOT-26W (2.9x2.8xh1.3mm)
XC9265	Ultra Low Iq, Iq=0.5uA	PFM	2.0~6.0	1.0~4.0	200	-	-	VOUT	Short	UVLO/CL Discharge	85°C	SOT-25 (2.9x2.8xh1.3mm) USP-6EL (1.8x2.0xh0.4mm)
XC9236	600mA, Low noise/EMI VOUT internal fixed/ FB type can be selected	PWM/PFM	1.8~5.5	0.8~6.0	600	1.2M 3.0M	-	VOUT or FB	ILIM/Short	SS/UVLO/CL Discharge	85°C	SOT-25 (2.9x2.8xh1.3mm) USP-6C (1.8x2.0xh0.6mm) USP-6EL (1.8x2.0xh0.4mm) WLP-5-03 (1.06x1.26xh0.4mm)
XC9235		PWM										
XC9243	2A	PWM/PFM	2.7~6.0	0.9~6.0	2000	1.2M 2.4M	-	FB	TSD/ILIM	SS/UVLO/CL Discharge	85°C	USP-10B (2.9x2.60xh0.6mm) SOP-8FD (4.9x6.0xh1.75mm)
XC9242		F-PWM										

Medium voltage DC/DC: Input voltage 18V or less

Maximum Output Current

Series Name	Features	Control Method	VIN [V]	VOUT [V]	IOUT [mA]	fosc [Hz]	Function: External FET/SBD	Function: Output Setting Method	Function: Protection Function	Function: Other	Topr max.	Package
XCM526A	16V DC/DC controller	PWM/PFM	4.0~16.0	1.2~15.0	3000	500k 1.0M	SBD	FB	ILIM/Short	SS Adj/UVLO	85°C	USP-12B01 (2.3×2.8x0.6mm)
XCM526B		PWM										
XC9221	16V DC/DC controller	PWM/PFM	2.8~16.0	1.2~15.0	5000	300k 500k 1.0M	Pch+SBD	FB	ILIM/Short	SS Adj/UVLO	85°C	SOT-25 (2.9x2.8xh1.3mm) USP-6C (1.8x2.0xh0.6mm)
XC9220		PWM										

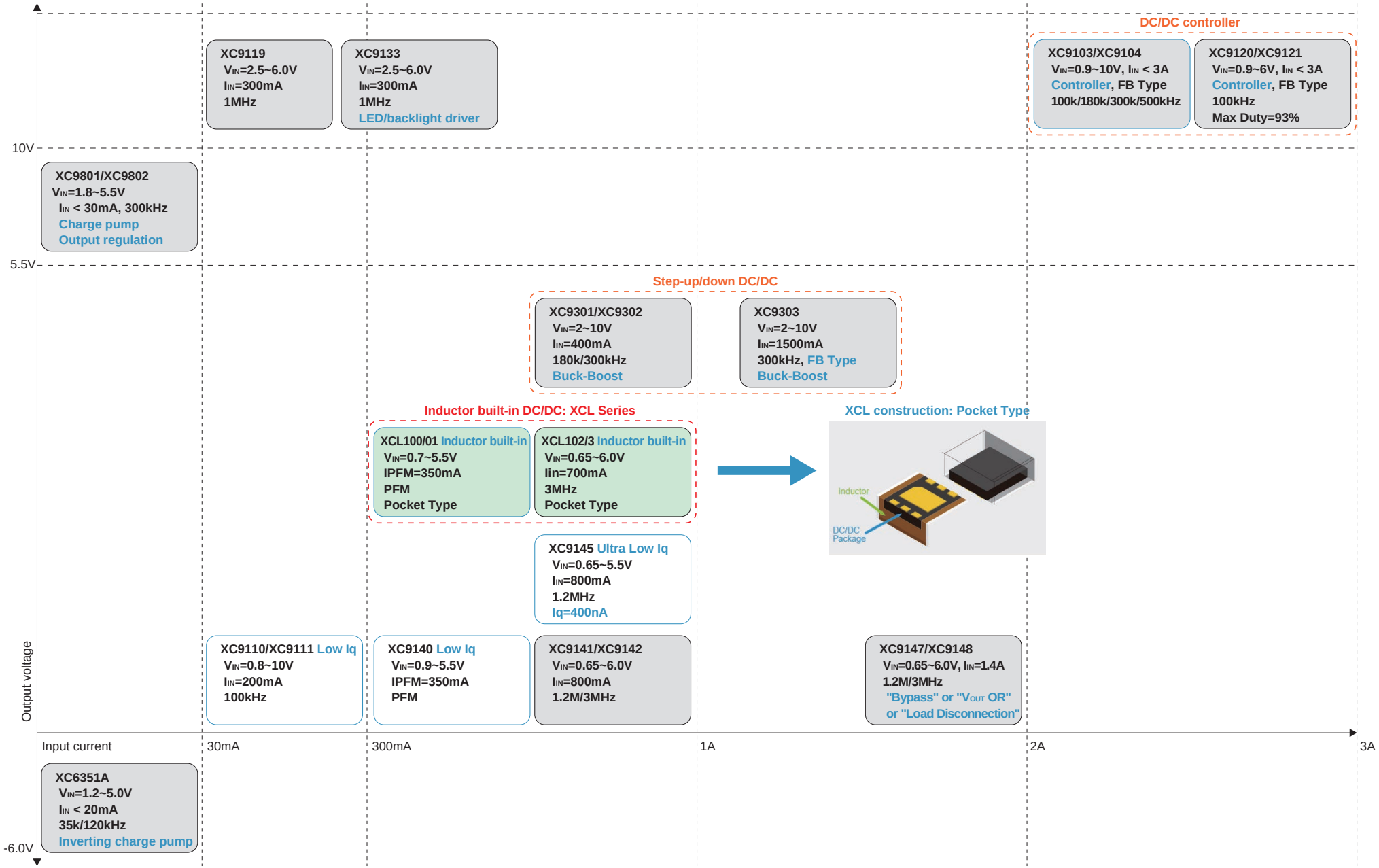
High voltage DC/DC: Input voltage 36V or less

Maximum Output Current

Series Name	Features	Control Method	VIN [V]	VOUT [V]	IOUT [mA]	fosc [Hz]	Function: External FET/SBD	Function: Output Setting Method	Function: Protection Function	Function: Other	Topr max.	Package
XC9271	30V (46V/400ms), 2A Ext CLK Sync	PWM/PFM	7.0~30.0	1.2~12.0	2000	300k 500k Ext CLK	SBD	FB	TSD/ILIM/Short	SS Adj/UVLO/SYNC	105°C	SOP-8FD (4.9x6.0xh1.75mm)
XC9270		PWM										
XC9252	30V (46V/400ms) Ext CLK Sync, DC/DC controller	PWM or PWM/PFM	3.0~30.0	1.5~30.0	10000	Adj(280k ~550k) Ext CLK	Pch+SBD	FB	TSD/ILIM/Short	SS Adj/UVLO/PG/SYNC	105°C	TSSOP-16 (5.10x6.4xh1.4mm) USP-10B (2.9x2.60xh0.6mm)

Step-up DC/DC, Step-up Charge Pump, Step-up/down DC/DC, Inverting Charge Pump

Standard | Low Iq | High Speed | Small



F-PWM: Forced PWM mode
PWM: PWM mode

▶Inductor built-in Step-up DC/DC

Maximum Output Current

Series Name	Features	Control Method	V_{IN} [V]	V_{OUT} [V]	I_{OUT} [mA] (V_{IN}=3.3V, V_{OUT}=5.0V)	fosc [Hz]	Function: External FET/SBD	Function: Output Setting Method	Function: Protection Function	Function: Other	Topr max.	Package
XCL100/101	Inductor built-in DC/DC, Low Iq, Iq=6.3uA	PFM	0.7~5.5	1.8~5.0	80	-	-	V_{OUT}	-	UVLO/C_L Discharge	85°C	CL-2025-02 (2.5x2.0xh1.04mm)
XCL103 XCL102	Inductor built-in DC/DC, Iin=0.8A Load disconnection or bypass	PWM/PFM F-PWM	0.65~6.0	2.2~5.5	450	3.0M	-	V_{OUT}	ILIM/Short	SS/C_L Discharge	85°C	CL-2025-02 (2.5x2.0xh1.04mm)

▶Low voltage Step-up DC/DC, charge pump: Output voltage 7V or less

Maximum Output Current

Series Name	Features	Control Method	V_{IN} [V]	V_{OUT} [V]	I_{OUT} [mA] (V_{IN}=3.3V, V_{OUT}=5.0V)	fosc [Hz]	Function: External FET/SBD	Function: Output Setting Method	Function: Protection Function	Function: Other	Topr max.	Package
XC9802 XC9801	Charge pump Output regulation function	PWM/PFM PWM	1.8~5.5	2.5~6.0 or V_{IN}x2	40	300k	-	V_{OUT}	-	-	85°C	MSOP-8A, USP-8 (2.7x2.5xh0.6mm) USP-8B05 (2.4x2.4xh0.33mm)
XC9111 XC9110	2step PFM DC/DC PFM DC/DC	PFM	0.9~10.0	1.5~7.0	70	100k	SBD or SBD+Nch	V_{OUT}	-	-	85°C	SOT-23, SOT-25, SOT-89, USP-6C SOT-25, USP-6C
XC9140	Iq=6.3uA, Load disconnection or bypass	PFM	0.7~5.5	1.8~5.0	80	-	-	V_{OUT}	-	UVLO/C_L Discharge	85°C	SOT-25, USP-6EL (1.8x2.0xh0.4mm)
NEW XC9145	I_{IN}=0.8A, Ultra Low Iq, Iq=400nA Load disconnection	PWM/PFM	0.65~5.5	3.0~5.5	430	1.2M	-	V_{OUT}	ILIM	SS	105°C	USP-6C, WLP-6-05(1.08x1.28xh0.4mm)
XC9142 XC9141	I_{IN}=0.8A, Load disconnection or bypass or OR connection (XC9142 Only)	PWM/PFM F-PWM	0.65~6.0	1.8~5.5	500	1.2M 3.0M	-	V_{OUT}	ILIM/Short	SS/C_L Discharge	85°C	SOT-25, USP-6C (1.8x2.0xh0.6mm) WLP-6-01 (1.08x1.28xh0.4mm)
NEW XC9148	I_{IN}=1.4A, Load disconnection or bypass or OR connection	PWM/PFM	0.65~6.0	1.8~5.5	750	1.2M 3.0M	-	V_{OUT}	ILIM/TSD/Short	SS/C_L Discharge/UVLO	105°C	USP-6C (1.8x2.0xh0.6mm) SOT-89-5 (4.5x4.6xh1.6mm)
NEW XC9147	I_{IN}=1.4A, Load disconnection	F-PWM										

▶Step-up DC/DC Mid Voltage DC/DC: Output voltage 7V or more

Maximum Output Current

Series Name	Features	Control Method	V_{IN} [V]	V_{OUT} [V]	I_{OUT} [mA] (V_{IN}=5.0V, V_{OUT}=12V)	fosc [Hz]	Function: External FET/SBD	Function: Output Setting Method	Function: Protection Function	Function: Other	Topr max.	Package
XC9133	LED/backlight driver	PWM	2.5~6.0	2.5~17.5	60	1.0M	SBD	FB	ILIM/OVP	-	85°C	SOT-25 (2.9x2.8xh1.3mm)
XC9119	Simple PWM	PWM	2.5~6.0	2.5~19.5	100	1.0M	SBD	FB	ILIM	SS Adj	85°C	SOT-25, USP-6C
XC9121 XC9120	Max Duty = 93% DC/DC controller	PWM/PFM PWM	0.9~6.0	1.5~30.0	2000	100k	Nch+SBD	FB	-	SS	85°C	SOT-25 (2.9x2.8xh1.3mm) USP-6C (1.8x2.0xh0.6mm)
XC9104 XC9103	Standard DC/DC controller	PWM/PFM PWM	0.9~10.0			100k/180k/ 300k/500k						SOT-25 (2.9x2.8xh1.3mm) USP-6B (1.8x2.0xh0.6mm)

▶Step-up/down DC/DC

Maximum Output Current

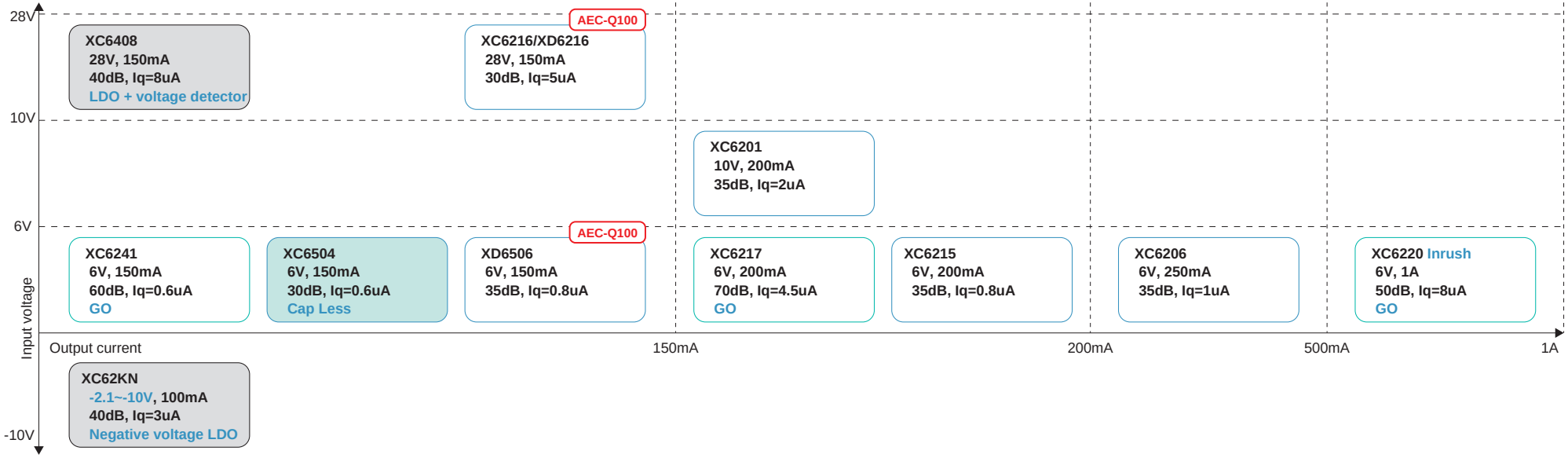
Series Name	Features	Control Method	V_{IN} [V]	V_{OUT} [V]	I_{OUT} [mA] (V_{IN}=5.0V, V_{OUT}=5.0V)	fosc [Hz]	Function: External FET/SBD	Function: Output Setting Method	Function: Protection Function	Function: Other	Topr max.	Package
XC9302 XC9301	Step-up/down DC/DC controller	PWM/PFM PWM	2.0~10.0	2.4~6.0	400	180k 300k	Pch+ SBDx2	V_{OUT}	-	SS	85°C	SOT-25 (2.9x2.8xh1.3mm)
XC9303	Basic step-up/down DC/DC controller	PWM or PWM/PFM	2.0~10.0	2.0~6.0	1500	300k	Pch+Nch x2+SBD	FB	-	SS	85°C	MSOP-8A (4.9x3.0xh1.22mm)

▶Inverting charge pump

Series Name	Features	Control Method	V_{IN} [V]	V_{OUT} [V]	I_{OUT} [mA] (V_{IN}=3.3V, V_{OUT}=-3.3V)	fosc [Hz]	Function: External FET/SBD	Function: Output Setting Method	Function: Protection Function	Function: Other	Topr max.	Package
XC6351A	Inverting charge pump	PWM	1.2~5.0	-1.2~-5.0	10	35k, 120k	-	-	-	-	80°C	SOT-25, USP-6B (1.8x2.0xh0.6mm)

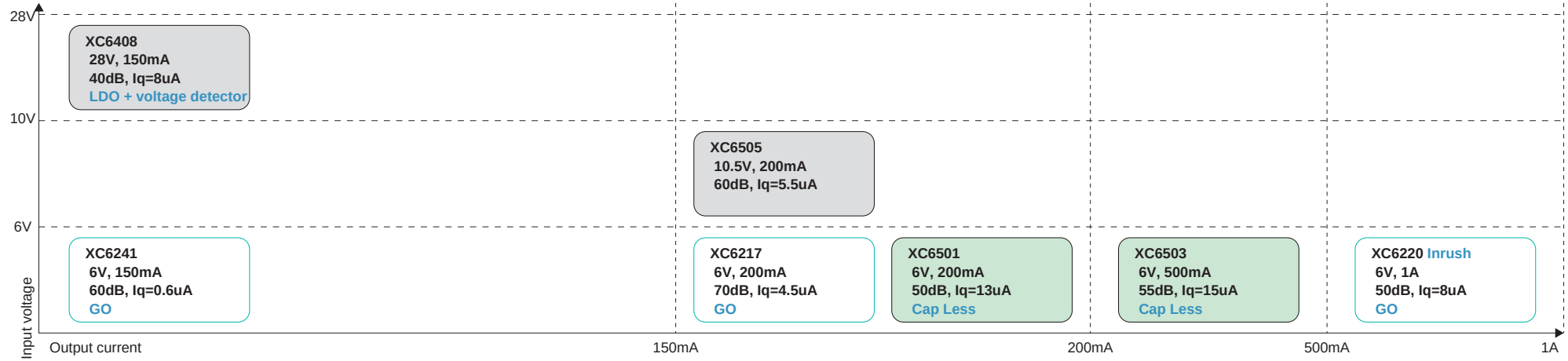
Voltage Regulator: Low Iq (low speed) Type

Standard | Low Iq | High Speed | GO (Low Power/High Speed) | Cap Less



Voltage Regulator: Medium Speed Type

Standard | Low Iq | High Speed | GO (Low Power/High Speed) | Cap Less



Voltage Regulator: Low Iq (low speed) Type / Medium Speed Type

▶Low voltage regulator: Input voltage 6V or less

Output Current

Series Name	Features	V_{IN} [V]	V_{OUT} [V]	I_{OUT} [mA]	Iq [μA]	Ron [Ω]	PSRR @1kHz [dB]	Function			Topr max.	Package
								CE	Current Limit	Other		
NEW XC6242	Charger IC for LTO batteries Iq=0.8uA, 150mA LDO	1.5~6.0	2.60	150	0.8	4.50	35	Yes	ILIM	-	105°C	SSOT-24 (2.0x2.1xh1.1mm) USPN-4 (0.90x1.2xh0.4mm) USP-6B06 (1.8x1.5xh0.33mm)
FEATURED XC6240			2.63								85°C	
NEW XC6241	Iq=0.6uA, High speed, 150mA	1.6~6.0	1.2~5.0	150	0.6	0.87	60	Yes	FB+ILIM	GO/C_L Discharge	105°C	SSOT-24 (2.0x2.1xh1.1mm) USPQ-4B05 (1.0x1.0xh0.33mm)
XC6504	Cap Less, Iq=0.6uA, 150mA	1.4~6.0	1.1~5.0	150	0.6	2.13	30	Yes	FB+ILIM	Cap less/C_L Discharge	85°C	SOT-25. SSOT-24 USPN-4B02. USPQ-4B04
XC6217	Iq=4.5uA, High speed, 200mA	1.6~6.0	0.8~4.0	200	4.5	0.80	70	Yes	FB	GO/C_L Discharge	85°C	SOT-25, SSOT-24 USP-4D, USPN-4
XC6215P	Iq=0.8uA, 200mA	1.5~6.0	0.9~5.0	200	0.8	2.30	35	-	FB+ILIM	-	85°C	USP-3 (1.2x1.2xh0.6mm)
XC6215B								Yes				SOT-25. SSOT-24 USP-4. USPN-4, USP-6B06
XC6501P	Cap Less, High speed, 200mA	1.4~6.0	1.2~5.0	200	13	1.20	50	-	FB	Cap less/C_L Discharge	85°C	USP-3 (1.2x1.2xh0.6mm)
XC6501A-D								Yes				SOT-25, SSOT-24 USP-4, USPN-4, WLP-4-01
XC6206	Iq=1uA, 250mA	1.8~6.0	1.2~5.0	250	1	1.75	35	-	FB+ILIM	-	85°C	USP-6B (1.8x2.0xh0.6mm) SOT-89, SOT-23
XC6503P	Cap Less, High speed, 500mA	1.7~6.0	1.2~5.0	500	15	0.47	55	-	FB+ILIM	Cap less/C_L Discharge	85°C	SOT-89 (4.5x4.0xh1.6mm)
XC6503A-D								Yes				SOT-89-5, SOT-25 USP-4 (1.2x1.6xh0.6mm)
XC6220	Iq=8uA, High speed, 1A	1.6~6.0	0.8~5.0	1000	8	0.18	50	Yes	FB+ILIM	GO/Inrush/TSD/C_L Discharge	85°C	USP-6C (1.8x2.0xh0.6mm) SOT-25, SOT-89-5

▶Medium voltage regulator: Input voltage 18V or less

Output Current

Series Name	Features	V_{IN} [V]	V_{OUT} [V]	I_{OUT} [mA]	Iq [μA]	Ron [Ω]	PSRR @1kHz [dB]	Function			Topr max.	Package
								CE	Current Limit	Other		
XC6505	Iq=5.5uA 10.5V, 200mA	1.7~10.5	1.5~8.0	200	5.5	1.10	60	Yes	FB+ILIM	TSD/C_L Discharge	105°C	USP-6C (1.8x2.0xh0.6mm) SOT-89-5 ,SOT-25
XC6201	Iq=2uA 10V, 200mA	1.8~10.0	1.3~6.0	200	2	2.00	35	-	ILIM	-	85°C	USP-6B (1.8x2.0xh0.6mm) SOT-89 ,SOT-25

▶High voltage regulator: Input voltage 36V or less

Output Current

Series Name	Features	V_{IN} [V]	V_{OUT} [V]	I_{OUT} [mA]	Iq [μA]	Ron [Ω]	PSRR @1kHz [dB]	Function			Topr max.	Package
								CE	Current Limit	Other		
XC6216B	28V, 150mA FB type (XC6216C)	2.0~28.0	1.8~12.0	150	5	6.50	30	Yes	FB+ILIM	TSD	85°C	USP-6C ,SOT-25 USP-6B06,SOT-89-5
XC6216C			2.0~23.0									USP-6C (1.8x2.0xh0.6mm) SOT-89-5 ,SOT-25
XC6216D			1.8~12.0					-				TO-252 SOT-89 ,SOT-223
XC6408	28V, 150mA Built-in voltage detector	2.0~28.0	2.0~18.0	150	8	3.50	40	No	FB+ILIM	TSD/RESET	85°C	USP-6C (1.8x2.0xh0.6mm) SOT-89-5 ,SOT-25

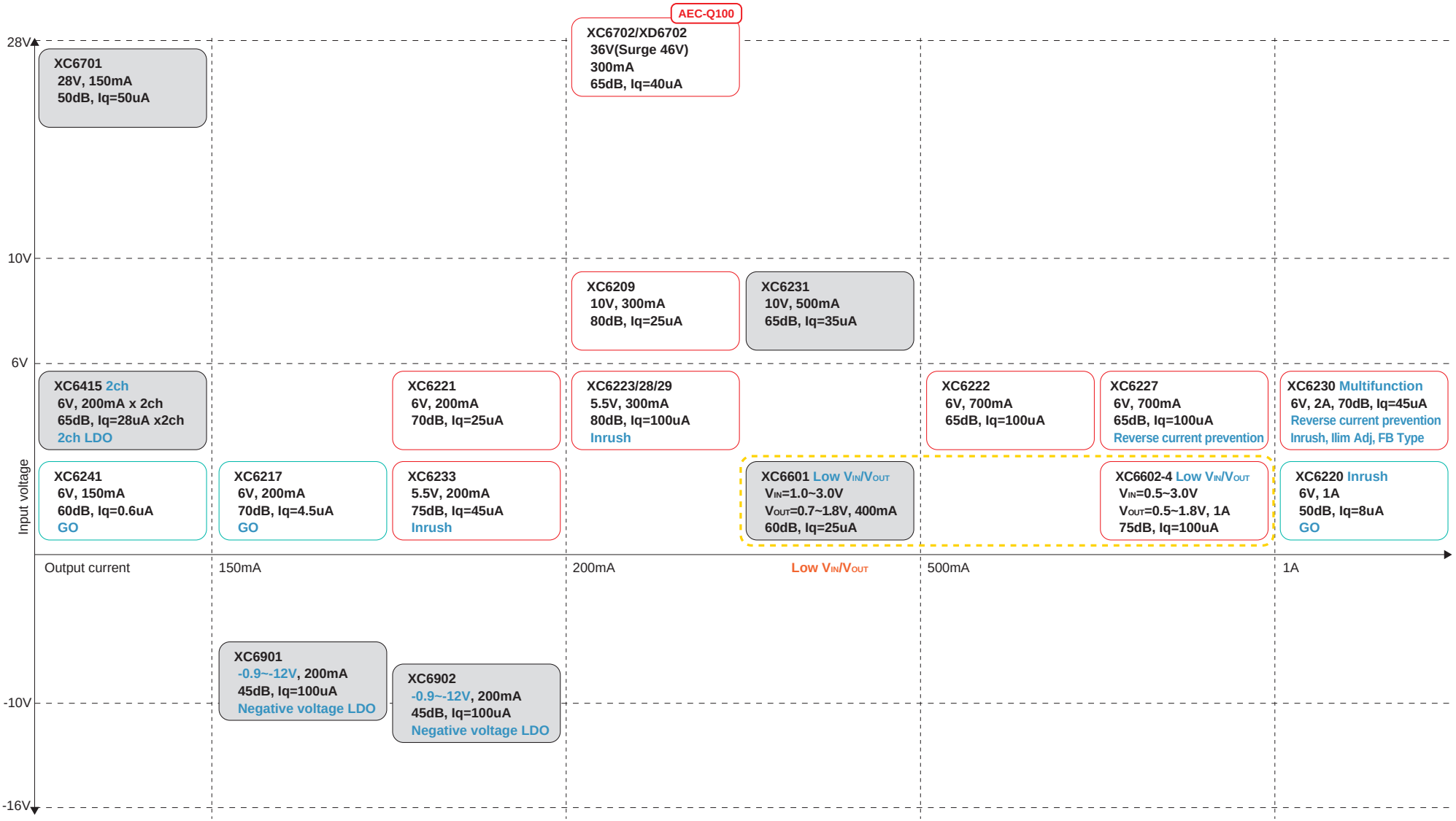
▶Negative voltage regulator

Series Name	Features	V_{IN} [V]	V_{OUT} [V]	I_{OUT} [mA]	Iq [μA]	Ron [Ω]	PSRR @1kHz [dB]	Function			Topr max.	Package
								CE	Current Limit	Other		
XC62KN	-10V, 100mA	-10.0~-2.1	-6.0~-2.1	100	3	3.80	40	-	ILIM	-	85°C	USP-6B (1.8x2.0xh0.6mm) SOT-89, SOT-23

*Automotive ICs are shown on page 25.

Voltage Regulator: High Speed Type

Standard | Low Iq | High Speed | GO (Low Power/High Speed)



▶Low input voltage regulator (V_{IN} =0.5V ~ 3.0V)

Output Current

Series Name	Features	V_{IN} [V]	V_{OUT} [V]	I_{OUT} [mA]	Iq [μA]	Ron [Ω]	PSRR @1kHz [dB]	Function			Topr max.	Package
								CE	Current Limit	Other		
XC6601	Low Voltage input, Vbias=2.5~6V, 400mA	1.0~3.0	0.7~1.8	400	25	0.34	60	Yes	FB+ILIM	UVLO/TSD/SoftStart/ C_L Discharge	85°C	USP-6C (1.8x2.0xh0.6mm) SOT-89-5 ,SOT-25
XC6604	Low Voltage input, 1A Vbias=2.5~6V	0.5~3.0	0.5~1.8	1000	100	0.15	75	Yes	FB	UVLO/TSD/SoftStart/ILIM Adj/C_L Discharge	85°C	USP-6C (1.8x2.0xh0.6mm) SOT-26W (2.9x2.8xh1.3mm)
XC6603										UVLO/TSD/SoftStart Adj/C_L Discharge		
XC6602										UVLO/TSD/SoftStart/C_L Discharge		USP-6C, SOT-89-5 SOT-26W, WLP-5-02

▶Low voltage regulator: Input voltage 6V or less

Output Current

Series Name	Features	V_{IN} [V]	V_{OUT} [V]	I_{OUT} [mA]	Iq [μA]	Ron [Ω]	PSRR @1kHz [dB]	Function			Topr max.	Package
								CE	Current Limit	Other		
NEW XC6241	Iq=0.6uA, High speed, 150mA	1.6~6.0	1.2~5.0	150	0.6	0.87	60	Yes	FB+ILIM	GO/C_L Discharge	105°C	SSOT-24 (2.0x2.1xh1.1mm) USPQ-4B05 (1.0x1.0xh0.33mm)
XC6233	Inrush current prevention, High speed, 200mA	1.7~5.5	1.2~3.6	200	45	1.20	75	Yes	FB+ILIM	Inrush/C_L Discharge	85°C	SOT-25 ,SSOT-24 USP-4 ,USPQ-4B04
XC6221	High speed, 200mA	1.6~6.0	0.8~5.0	200	25	0.80	70	Yes	FB	C_L Discharge	85°C	SOT-25. SSOT-24 USP-4. USPN-4
XC6217	Iq=4.5uA, High speed, 200mA	1.6~6.0	0.8~4.0	200	4.5	0.80	70	Yes	FB	GO/C_L Discharge	85°C	SOT-25, SSOT-24 USP-4D, USPN-4
XC6415	2ch LDO, 200mA x 2ch	1.5~6.0	0.8~5.0	200 x 2ch	28/ch	1.00	65	Yes	FB	C_L Discharge	85°C	USP-6C (1.8x2.0xh0.6mm) SOT-26, USPN-6
XC6229	High speed, 300mA, Inrush current prevention	1.6~5.5	1.2~4.0	300	100	0.53	80	Yes	FB+ILIM	Inrush/TSD/C_L Discharge	85°C	LGA-4B01 (0.75x0.75xh0.3mm)
XC6228										Inrush/C_L Discharge		USPQ-4B04 (1.0x1.0xh0.6mm)
XC6223						0.67				Inrush/TSD/C_L Discharge	105°C	SOT-25. SSOT-24 ,SOT-89-5 USP-4. USPQ-4B03
XC6219	High speed, 300mA	2.0~6.0	0.9~5.0	300	25	1.60	70	Yes	FB+ILIM	-	85°C	USP-6B (1.8x2.0xh0.6mm) SOT-25 ,SOT-89-5
XC6227	Internal reverse current prevention function High speed, 700mA	1.7~6.0	0.8~5.0	700	100	0.40	65	Yes	FB	Reverse/TSD	85°C	USP-6C (1.8x2.0xh0.6mm) SOT-89-5 ,SOT-25
XC6222	High speed, 700mA	1.7~6.0	0.8~5.0	700	100	0.40	65	Yes	FB	Reverse/TSD/C_L Discharge	85°C	USP-6C (1.8x2.0xh0.6mm) SOT-89-5 ,SOT-25
XC6220	Iq=8uA, High speed, 1A	1.6~6.0	0.8~5.0	1000	8	0.18	50	Yes	FB+ILIM	GO/Inrush/TSD/C_L Discharge	85°C	USP-6C (1.8x2.0xh0.6mm) SOT-25, SOT-89-5
XC6230	High speed, 2A FB type	1.7~6.0	1.2~5.0	2000	45	0.18	70	Yes	FB+ILIM	Reverse/Inrush/TSD/ ILIM Adj/C_L Discharge	105°C	USP-6C (1.8x2.0xh0.6mm) SOP-8FD(6.0 x 4.9 xh1.75mm)

▶Medium voltage regulator: Input voltage 18V or less

Output Current

Series Name	Features	V_{IN} [V]	V_{OUT} [V]	I_{OUT} [mA]	Iq [μA]	Ron [Ω]	PSRR @1kHz [dB]	Function			Topr max.	Package
								CE	Current Limit	Other		
XC6209	10V, 300mA High speed	2.0~10.0	0.9~6.0	300	25	1.60	80	Yes	FB+ILIM	-	85°C	USP-6B (1.8x2.0xh0.6mm) SOT-89-5, SOT-25
XC6231	10V, 500mA High speed	2.0~10.0	0.9~5.5	500	35	1.60	65	-	FB+ILIM	-	85°C	SOT-89-5 (4.5x4.6xh1.6mm)

▶High voltage regulator: Input voltage 36V or less

Output Current

Series Name	Features	V_{IN} [V]	V_{OUT} [V]	I_{OUT} [mA]	Iq [μA]	Ron [Ω]	PSRR @1kHz [dB]	Function			Topr max.	Package
								CE	Current Limit	Other		
XC6701A	28V, 150mA High speed	2.0~28.0	1.8~18.0	150	50	6.50	50	Yes	FB+ILIM	TSD	105°C	USP-6C (1.8x2.0xh0.6mm) SOT-89-5 ,SOT-25
XC6701D								-			85°C	TO-252 SOT-223 ,SOT-89
XC6702	36V (46V/400ms), High speed, Low Iq	4.5~36.0	1.8~18.0	300	40	3.50	65	Yes	FB	SoftStart/TSD	105°C	USP-6C (1.8x2.0xh0.6mm) SOT-89-5 ,SOP-8FD

▶Negative voltage regulator

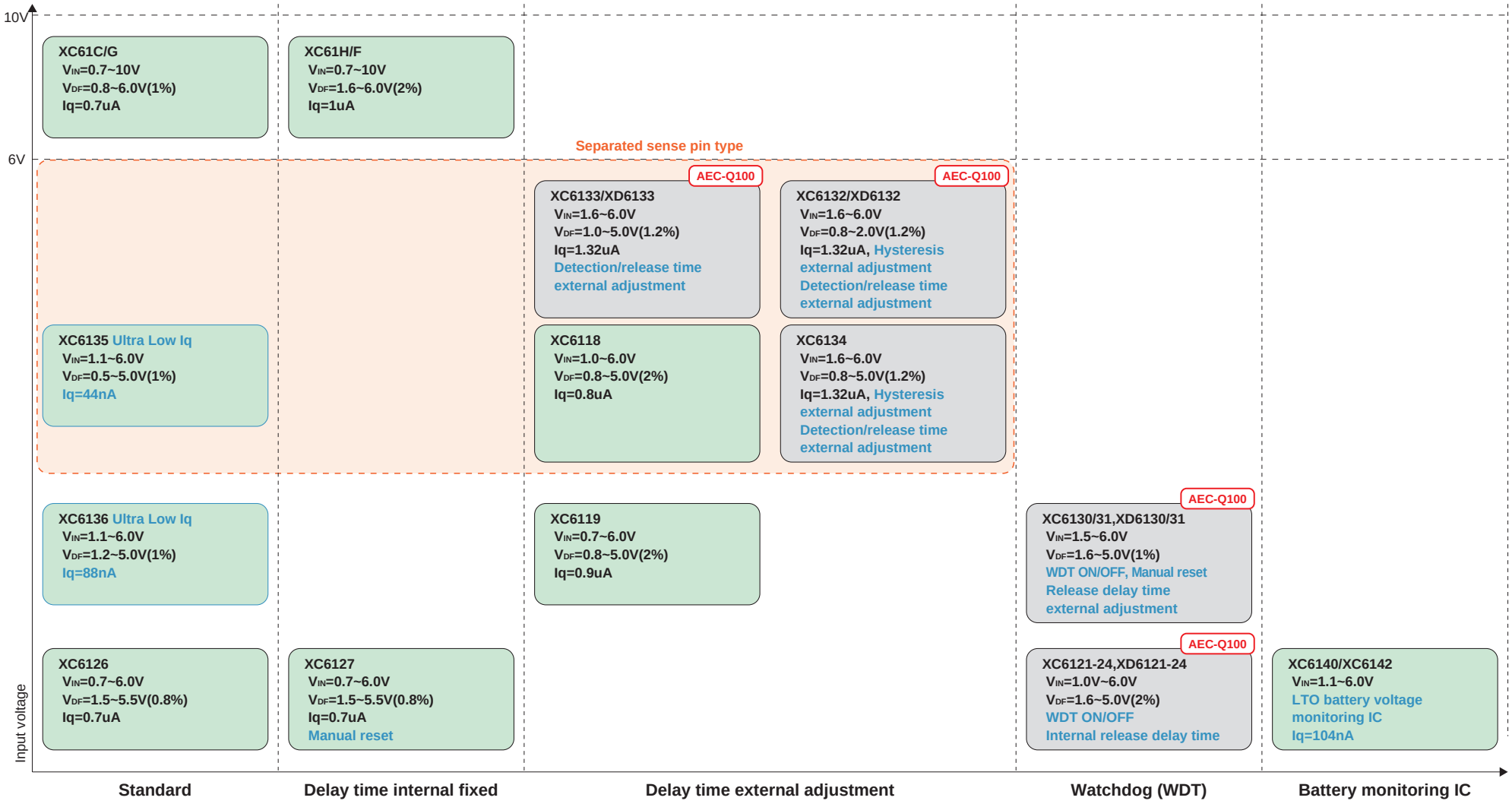
Output Current

Series Name	Features	V_{IN} [V]	V_{OUT} [V]	I_{OUT} [mA]	Iq [μA]	Ron [Ω]	PSRR @1kHz [dB]	Function			Topr max.	Package
								CE	Current Limit	Other		
XC6902	-16V, 200mA High speed	-16.0~-2.4	-12.0~-0.9	200	100	3.90	45	-	FB	TSD/SoftStart	85°C	USP-6C (1.8x2.0xh0.6mm) SOT-89 ,SOT-23
XC6901	-12.4V, 200mA High speed	-12.4~-2.4	-12.0~-0.9	200	100	2.50	45	Yes	FB	TSD/SoftStart/C_L Discharge	85°C	USP-6C (1.8x2.0xh0.6mm) SOT-89-5 ,SOT-25

*Automotive ICs are shown on page 25.

Voltage Detector

Standard | Low Iq | Small



Voltage Detector

▶Low voltage, voltage detector: Input voltage 6V or less

Series Name	Features	V_{IN} [V]	Detect Voltage V_{DF} [V]	Accuracy	Iq [μA]	Output		Voltage Detector						Watchdog		Topr max.	Package
						Config.	Output Logic	Separated Sense Pin	Detection Delay	Release Delay	Hys	Manual Reset	Undefined operation Protection	Timeout Time	EN/ ENB		
NEW XC6142	Battery voltage monitoring IC for LTO batteries	1.1~6.0	1.6~2.1	0.8%	0.104	CMOS N-ch	Detect "H" Detect "L"	-	-	-	0.350V-0.850V	-	CMOS Only	-	-	105°C	USPQ-4B05(1.0x1.0xh0.33mm) SSOT-24(2.0x2.1xh1.1mm)
FEATURED XC6140			1.6~2.2								0.275V-0.875V						
FEATURED XC6136	Ultra Low Iq	1.1~6.0	1.2~5.0	1.0%	0.088	CMOS N-ch	Detect "H" Detect "L"	-	-	-	V_{DF}x0.1% V_{DF}x5%	-	CMOS Only	-	-	105°C	USPQ-4B05(1.0x1.0xh0.33mm) SSOT-24 (2.0x2.1xh1.1mm) SOT-25 (2.9x2.8xh1.3mm)
XC6135	Ultra Low Iq, Separated sense pin		0.5~5.0		0.044			Yes									
XC6134	Ta=-40~125°C, Hysteresis external adjustment, Separated sense pin, Release/detection delay external adjustment	1.6~6.0	0.8~5.0	1.2%	1.32	CMOS N-ch	Detect "H" Detect "L"	Yes	Adj	Adj	Adj	Yes	-	-	-	125°C	SOT-26 (2.9x2.8xh1.3mm) USP-6C (1.8x2.0xh0.6mm)
XC6133			1.0~5.0								V_{DF}x5%						
XC6132			0.8~2.0								Adj						
XC6127	Internal release delay time, Manual reset	0.7~6.0	1.5~5.5	0.8%	0.7	CMOS N-ch	Detect "H" Detect "L"	-	-	50ms ~800ms	V_{DF}x5%	Yes	-	-	-	85°C	SOT-25,SSOT-24 USPN-4 (0.90x1.2xh0.4mm)
XC6126	High accuracy	0.7~6.0	1.5~5.5	0.8%	0.7	CMOS N-ch	Detect "L"	-	-	-	V_{DF}x5%	-	-	-	-	85°C	SSOT-24 (2.0x2.1xh1.1mm) USPN-4B02(0.75x0.95xh0.4mm)
XC6119	Release delay time external adjustment	0.7~6.0	0.8~5.0	2.0%	0.9	CMOS N-ch	Detect "L"	-	-	Adj	V_{DF}x5%	-	CMOS Only	-	-	85°C	SSOT-24 (2.0x2.1xh1.1mm) USPN-4 (0.90x1.2xh0.4mm)
XC6118	Separated sense pin, Release delay time external adjustment	1.0~6.0			0.8			Yes			V_{DF}x0.1% V_{DF}x5%						SOT-25 (2.9x2.8xh1.3mm) USP-4 (1.2x1.6xh0.6mm)

▶Low voltage, voltage detector with watchdog function

Series Name	Features	V_{IN} [V]	Detect Voltage V_{DF} [V]	Accuracy	Iq [μA]	Output		Voltage Detector						Watchdog		Topr max.	Package
						Config.	Output Logic	Separated Sense Pin	Detection Delay	Release Delay	Hys	Manual Reset	Undefined operation Protection	Timeout Time	EN/ ENB		
XC6131	Ta = -40 ~ 125°C, Watchdog, Release delay time external adjustment	1.5~6.0	1.6~5.0	1.0%	2.5@EN=L 9.8@EN=H	N-ch	Detect "L"	-	-	Adj	V_{DF}x5%	-	-	Adj	Yes	125°C	SOT-26 (2.9x2.8xh1.3mm) DFN1515-6A (1.5x1.5xh0.38mm)
XC6130					9.8							Yes			-		
XC6121-XC6124	Watchdog with EN function, Internal release delay time	1.0~6.0	1.6~5.0	2.0%	10	N-ch	Detect "L"	-	-	3.13ms ~400ms	V_{DF}x5%	-	-	50ms ~1600ms	Yes	85°C	SOT-25 (2.9x2.8xh1.3mm) USP-6C (1.8x2.0xh0.6mm)

▶Medium voltage, voltage detector: Input voltage 10V or less

Series Name	Features	V_{IN} [V]	Detect Voltage V_{DF} [V]	Accuracy	Iq [μA]	Output		Voltage Detector						Watchdog		Topr max.	Package
						Config.	Output Logic	Separated Sense Pin	Detection Delay	Release Delay	Hys	Manual Reset	Undefined operation Protection	Timeout Time	EN/ ENB		
XC61G	10V	0.7~10.0	0.8~6.0	2.0%	0.7	CMOS N-ch	Detect "L"	-	-	-	V_{DF}x5%	-	-	-	-	85°C	USP-3 (1.2x1.2xh0.6mm)
XC61C																	SOT-23,SSOT-24 SOT-89
XC61H	10V, Internal release delay time	0.7~10.0	1.6~6.0	2.0%	1	CMOS N-ch	Detect "L"	-	-	1ms ~400ms	V_{DF}x5%	-	-	-	-	80°C	SOT-23 (2.9x2.8xh1.3mm)
XC61F																	SOT-23 (2.9x2.8xh1.3mm) SOT-89 (4.5x4.0xh1.6mm)

*Automotive ICs are shown on page 25.

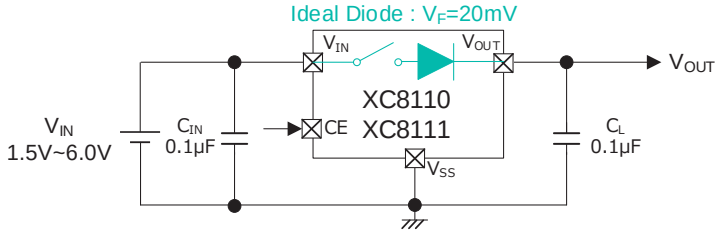
Load SW

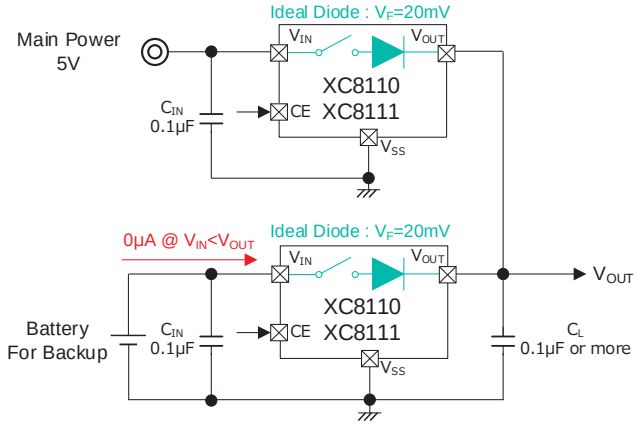
▶Load SW

Maximum Output Current

Series Name	Features	V_{IN} [V]	I_{OUT} [mA]	Current Limit		Iq [μA]	I_{STB} [μA]	Ron [mΩ]	Function		Topr max.	Package
				Limit Value [mA]	Setting Method				Current Limit	Other		
XC8101	Iq=3uA, 200mA	1.8~6.0	200	300	Fixed	3	0.01	550	FB+ILIM	C_L Discharge	85°C	SOT-25, SSOT-24 USP-4 (1.2x1.6xh0.6mm)
XC8102	Iq=3uA, 400mA	1.2~6.0	400	480	Fixed	3	0.01	280	FB+ILIM	C_L Discharge	85°C	SOT-25, SSOT-24 USP-4 (1.2x1.6xh0.6mm) USP-6B06 (1.8x1.5xh0.33mm) USPN-4 (0.90x1.2xh0.4mm)
XC8109	900mA, 85mΩ, Multifunction	2.5~5.5	900	75~1300	Adj by External	40	0.01	85	FB+ILIM or ILIM+Latch	TSD SS UVLO Reverse FLG	105°C	USP-6C (1.8x2.0xh0.6mm)
XC8107	0.5A~2A, 85mΩ, Multifunction		500/1000 1500/2000	900/1400 1900/2400	Fixed							SOT-25 (2.9x2.8xh1.3mm) USP-6C (1.8x2.0xh0.6mm)
XC8108	2A, 85mΩ, Multifunction		2000	900~2400	Adj by External							USP-6C (1.8x2.0xh0.6mm)

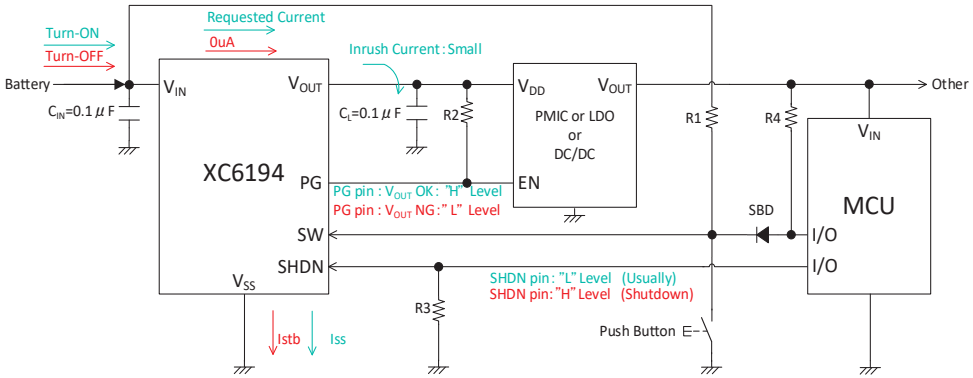
▶Load SW with ideal diode

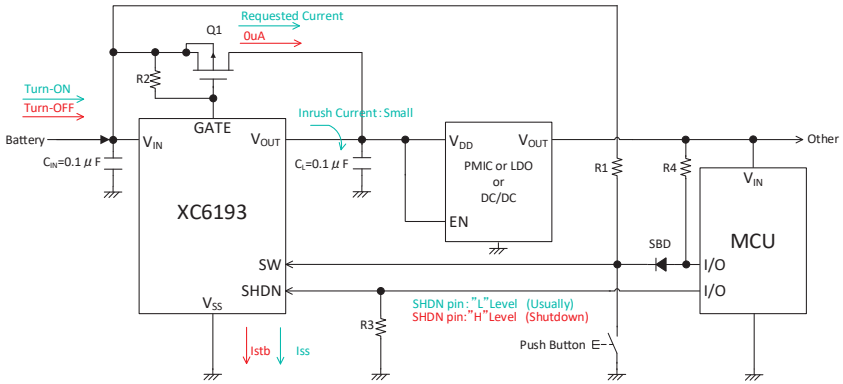




Series Name	Features	V_{IN} [V]	I_{OUT} [mA]	Current Limit		Iq [μA]	I_{STB} [μA]	Ron [mΩ]	Function		Topr max.	Package
				Limit Value [mA]	Setting Method				Current Limit	Other		
NEW XC8110	Ideal diode V_F=20mV, 500mA, Iq=3.6uA	1.5~6.0	500	850	Fixed	3.6	0.8	120	FB+ILIM	TSD Inrush True Reverse	105°C	WLP-4-02 (0.82x0.82xh0.5mm) SOT-25 (2.9x2.8xh1.3mm) USP-6B06 (1.8x1.5xh0.33mm)
NEW XC8111	Ideal diode V_F=20mV, 1A, Iq=3.6uA		1000	1700								

Push Button Load SW



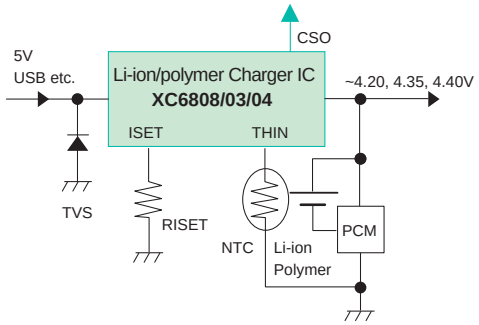


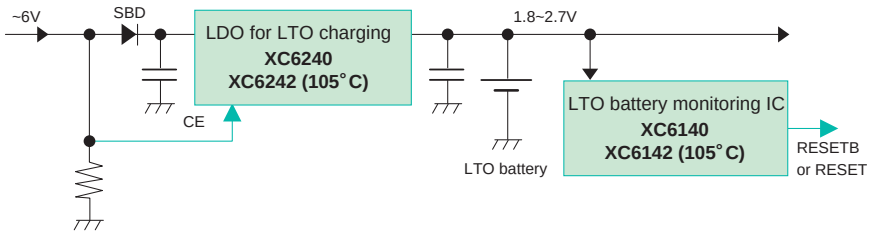
Series Name	Features	VIN [V] Min.	VIN [V] Max.	IOUT [mA]	Istb [μA]	Iq [μA]	Startup: Operation Method	Startup: SW "L" time	Shutdown: Operation Method	Shutdown: SW "L" time	Function	Topr max.	Package
FEATURED XC6194A	Push button load SW equipped with Ship function	1.8	6.00	1000	0.001	0.13	SW pin	0.2s / 1s / 3s / 5s	SHDN pin or SW pin	3s / 5s / 10s / 15s	Power Good Forced Shutdown Inrush Current Protection UVLO / Short Protection Thermal Shutdown Output CL Discharge	85°C	USP-8B06 (2.0x2.0xh0.33mm)
FEATURED XC6194B									SHDN pin	-			
XC6193A				5000					SHDN pin or SW pin	3s / 5s / 10s / 15s	Forced Shutdown Inrush Current Protection UVLO / Short Protection Thermal Shutdown Output CL Discharge		
XC6193B									SHDN pin	-			

Push Button Reboot Controller

Series Name	Features	VIN [V] Min.	VIN [V] Max.	Iq [μA]	RSTB Sink Current [mA]	Output Configuration	Shutdown: Setting Method	Shutdown: Reboot Delay Time	Shutdown: Reboot Time	Topr max.	Package
XC6190A	Push button reboot controller	1.75	6.00	0.01	30	N-ch CMOS	External Resister	1s ~ 20s (±5%)	0.4s (±5%)	85°C	USPN-6 (1.3x1.3x0.4mm) USPN-6B01 (1.0x1.45x0.4mm)
XC6190B							Internal Fix	7.5s or 12.5s (±5%)			

Charger IC





▶Charger IC for Li-ion/ Li-polymer

Charge Current

Series Name	Features	Battery	V_{IN} [V]	Charge Voltage [V]	Charge Current[mA]	Iq [uA]	Battery Leakage Current [uA]	Shutdown				Topr max.	Package
								Temperature Monitoring	Safety Timer	Protection Function	Other		
XC6808x2/3/4	5mA~40mA, 4.20V/4.35V/4.40V, 1 cell Li-ion linear charger IC	Li-ion/Polymer 1Cell	4.5~6.0	4.20 4.35 4.40	5~40	100	0.1	Yes	Main:5h/10h Trickle:0.5h	TSD UVLO	Trickle Charge Selectable	85°C	USP-6B07 (1.8x2.0xh0.33mm)
XC6808xN								-					
XC6803	40mA~280mA, 1 cell Li-ion linear charger IC	Li-ion/Polymer 1Cell	4.5~6.0	4.20	40~280	100	0.5	Yes	Main:5h Trickle:0.5h	TSD UVLO	-	85°C	USP-6EL (1.8x2.0xh0.4mm)
XC6804	200mA~800mA, 1 cell Li-ion linear charger IC	Li-ion/Polymer 1Cell	4.5~6.0	4.20	200~800	100	4.5	Yes	Main:10h Trickle:2h	TSD UVLO	-	85°C	SOP-8FD (4.9x6.0xh1.75mm) USP-6EL (1.8x2.0xh0.4mm)

▶Charger IC for LTO batteries

Series Name	Features	Battery	V_{IN} [V]	Charge Voltage [V]	Charge Current[mA]	Iq [uA]	Battery Leakage Current [uA]	Shutdown				Topr max.	Package
								Temperature Monitoring	Safety Timer	Protection Function	Other		
NEW XC6242	Charger IC for LTO batteries Iq=0.8uA, 150mA LDO	LTO Batteries /EDLC	1.5~6.0	2.63	~150	0.8	0.24	-	-	ILIM	-	105°C	USPN-4 (0.90x1.2xh0.4mm)
FEATURED XC6240												85°C	SSOT-24, USPN-4 (0.90x1.2xh0.4mm) USP-6B06 (1.8x1.5xh0.33mm)

▶Battery monitoring IC for LTO batteries

Series Name	Features	V_{IN} [V]	V_{DF} [V]	Accuracy	Iq [µA]	Output		Shutdown								Topr max.	Package
						Configuration	Logic	Separated Sense Pin	Detection Delay	Release Delay	Hys	Manual Reset	Inconsistency Prevention	Timeout Time	EN /ENB		
NEW XC6142	LTO battery voltage monitoring IC Release voltage = 2.450V (XC6142) Release voltage = 2.475V (XC6140)	1.1~6.0	1.6~2.1	0.8%	0.104	CMOS N-ch	Active "H" Active "L"	-	-	-	0.350V-0.850V	-	CMOS Only	-	-	105°C	USPQ-4B05(1.0x1.0xh0.33mm)
FEATURED XC6140			1.6~2.2								0.275V-0.875V						USPQ-4B05(1.0x1.0xh0.33mm) SSOT-24(2.0x2.1xh1.1mm)

Automotive IC (AEC-Q100 compliant)

■Voltage Regulator

Series Name	AEC-Q100	Features	V_{IN} [V]	V_{OUT} [V]	I_{OUT} [mA]	Iq [μA]	Ron [Ω]	PSRR @1kHz [dB]	Function			Topr max.	Package
									CE	Current Limit	Other		
XD6506	Grade2	Iq=0.8uA, 150mA	1.5~6.0	1.2~5.0	150	0.8	2.60	35	Yes	FB+ILIM	-	105°C	SOT-25 (2.9x2.8xh1.3mm)
XD6216	Grade2	28V, 150mA	2.0~28.0	1.8~12.0	150	5	6.50	30	Yes	FB+ILIM	TSD	105°C	SOT-25 (2.9x2.8xh1.3mm) SOT-89-5 (4.5x4.60xh1.6mm)
XD6702	Grade2	36V (46V/400ms), High speed, Low Iq	4.5~36.0	1.8~18.0	300	40	3.50	65	Yes	FB+ILIM	SoftStart/TSD	105°C	SOT-89-5 (4.5x4.60xh1.6mm)

■Voltage Detector

▶Voltage Detectors

Series Name	AEC-Q100	Features	V_{IN} [V]	Detect Voltage V_{DF} [V]	Accuracy	Iq [μA]	Output		Voltage Detector						Watchdog		Topr max.	Package
							Config.	Output Logic	Separated Sense Pin	Detection Delay	Release Delay	Hys	Manual Reset	Inconsistency Prevention	Timeout Time	EN/ENB		
FEATURED XD6132	Grade1	Ta=-40~125°C, Hysteresis external adjustment, Separated sense pin, Release/ detection delay external adjustment	1.6~6.0	0.8~2.0	1.2%	1.32	CMOS N-ch	Active "H" Active "L"	Yes	adj	adj	adj	Yes	-	-	-	125°C	SOT-26 (2.9x2.8xh1.3mm) USP-6C (1.8x2.0xh0.6mm)
XD6133				1.0~5.0								V_{DF}x5%						

▶Voltage Detectors with Wacthdog function

Series Name	AEC-Q100	Features	V_{IN} [V]	Detect Voltage V_{DF} [V]	Accuracy	Iq [μA]	Output		Voltage Detector						Watchdog		Topr max.	Package
							Config.	Output Logic	Separated Sense Pin	Detection Delay	Release Delay	Hys	Manual Reset	Inconsistency Prevention	Timeout Time	EN/ENB		
XD6130	Grade1	Ta=-40~125°C, Watchdog, Release delay time external adjustment	1.5~6.0	1.6~5.0	1.0%	9.8	N-ch	Active "L"	-	-	adj	V_{DF}x5%	Yes	-	adj	-	125°C	SOT-26 (2.9x2.8xh1.3mm)
XD6131						2.5@EN=L 9.8@EN=H							-			Yes		
XD6121-XD6124	Grade3	Watchdog with EN function, Internal release delay time	1.0~6.0	1.6~5.0	2.0%	10	N-ch	Active "L"	-	-	3.13ms ~400ms	V_{DF}x5%	-	-	50ms ~1600ms	Yes	85°C	SOT-25 (2.9x2.8xh1.3mm)

N-channel MOSFET

Series Name	Package	V_{DSS} [V]	V_{GSS} [V]	I_D [A]	$R_{DS(on)}$ (Max.) [Ω]				Ciss [pF]
					V_{GS}=1.5V	V_{GS}=2.5V	V_{GS}=4.5V	V_{GS}=10V	
XP222N03017R-G	SOT-723 (8,000pcs/Reel)	20	±8	0.3	-	1.8	1.3	-	18
XP231N02017R-G		30	±20	0.2	-	11	5	-	6.5
XP232N03017R-G				0.3	-	-	2.5	2	22
XP261N70027R-G		60	±20	0.15	-	-	5.5	5	18
XP222N03015R-G	SOT-523 (3,000pcs/Reel)	20	±8	0.3	-	1.8	1.3	-	18
XP231N02015R-G		30	±20	0.2	-	11	5	-	6.5
XP232N03015R-G				0.3	-	-	2.5	2	22
XP261N70025R-G		60	±20	0.15	-	-	5.5	5	18
XP222N03013R-G	SOT-323-3A (3,000pcs/Reel)	20	±8	0.3	-	1.8	1.3	-	18
XP224N06013R-G				0.6	-	0.85	0.7	-	60
XP223N10013R-G				1.0	10	0.35	0.3	-	99
XP231N02013R-G		30	±20	0.2	-	11	5	-	6.5
XP232N03013R-G				0.3	-	-	2.5	2	22
XP233N05013R-G				0.5	-	4	1.5	-	40
XP234N08013R-G				0.8	-	-	0.4	0.29	64
XP261N70023R-G		60	±20	0.15	-	-	5.5	5	18
XP262N70023R-G				0.3	-	-	2.1	1.6	30
XP222N0301TR-G	SOT-23(TO-236) (3,000pcs/Reel)	20	±8	0.3	-	1.8	1.3	-	18
XP224N0601TR-G				0.6	-	0.85	0.7	-	60
XP223N1001TR-G				1.0	10	0.35	0.3	-	99
XP225N2001TR-G				2.0	-	0.13	0.1	-	280
XP231N0201TR-G		30	±20	0.2	-	11	5	-	6.5
XP232N0301TR-G				0.3	-	-	2.5	2	22
XP233N0501TR-G				0.5	-	4	1.5	-	40
XP234N0801TR-G				0.8	-	-	0.4	0.29	64
XP235N2001TR-G				2.0	-	-	0.14	0.11	220
XP236N2001TR-G			±8	2.0	-	0.14	0.11	-	230
XP261N7002TR-G		60	±20	0.15	-	-	5.5	5	18
XP262N7002TR-G				0.3	-	-	2.1	1.6	30
XP264N0301TR-G				0.3	-	-	2.1	1.6	30
XP263N1001TR-G				1.0	-	-	0.33	0.25	180
XP151A13A0MR-G	SOT-23 (3,000pcs/Reel)	20	±8	1.0	0.25	0.14	0.1	-	220
XP151A12A2MR-G			±12	1.0	-	0.16	0.1	-	180
XP151A11B0MR-G		30	±20	1.0	-	-	0.17	0.12	150
XP161A1265PR-G	SOT-89 (1,000pcs/Reel)	20	±12	4.0	-	0.095	0.055	-	320
XP161A1355PR-G			±8	4.0	0.15	0.07	0.05	-	390
XP161A11A1PR-G		30	±20	4.0	-	-	0.105	0.065	270

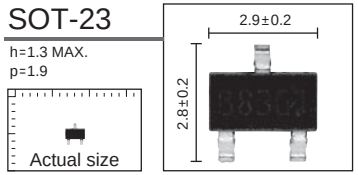
P-channel MOSFET

Series Name	Package	V_{DSS} [V]	V_{GSS} [V]	I_D [A]	$R_{DS(on)}$ (Max.) [Ω]				Ciss [pF]
					V_{GS}=-1.5V	V_{GS}=-2.5V	V_{GS}=-4.5V	V_{GS}=-10V	
XP231P02017R-G	SOT-723 (8,000pcs/Reel)	-30	±8	-0.2	-	8	5	-	34
XP231P02015R-G	SOT-523 (3,000pcs/Reel)	-30	±8	-0.2	-	8	5	-	34
XP221P05013R-G	SOT-323-3A (3,000pcs/Reel)	-20	±8	-0.5	-	1.9	1.3	-	60
XP222P08013R-G				-0.8	-	0.65	0.56	-	118
XP231P02013R-G		-30	±8	-0.2	-	8	5	-	34
XP232P05013R-G				-0.45	-	2.15	1.25	-	56
XP221P0501TR-G	SOT-23(TO-236) (3,000pcs/Reel)	-20	±8	-0.5	-	1.9	1.3	-	60
XP222P0801TR-G				-0.8	-	0.65	0.56	-	118
XP223P1501TR-G				-1.5	-	0.23	0.17	-	165
XP231P0201TR-G		-30	±8	-0.2	-	8	5	-	34
XP232P0501TR-G				-0.45	-	2.15	1.25	-	56
XP233P1501TR-G			±20	-1.5	-	-	0.33	0.19	160
XP152A12C0MR-G	SOT-23 (3,000pcs/Reel)	-20	±12	-0.7	-	0.5	0.3	-	180
XP152A11E5MR-G		-30	±20	-0.7	-	-	0.45	0.25	160
XP202A0003MR-G				-3.0	-	-	0.095	0.067	435
XP162A12A6PR-G	SOT-89 (1,000pcs/Reel)	-20	±12	-2.5	-	0.3	0.17	-	310
XP162A11C0PR-G		-30	±20	-2.5	-	-	0.28	0.15	280
XP202A0003PR-G				-5.0	-	-	0.1	0.059	450

Package

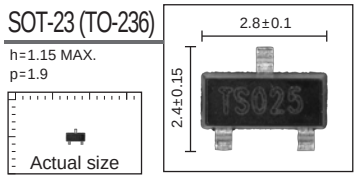
SOT-23

h=1.3 MAX.
p=1.9



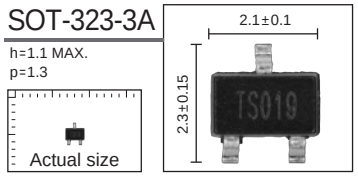
SOT-23 (TO-236)

h=1.15 MAX.
p=1.9



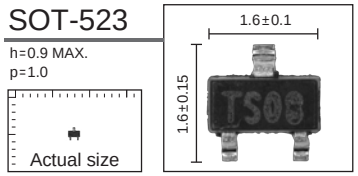
SOT-323-3A

h=1.1 MAX.
p=1.3



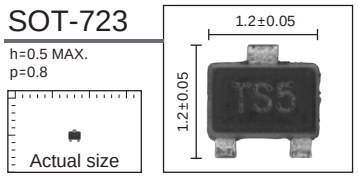
SOT-523

h=0.9 MAX.
p=1.0



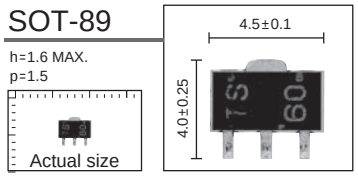
SOT-723

h=0.5 MAX.
p=0.8



SOT-89

h=1.6 MAX.
p=1.5

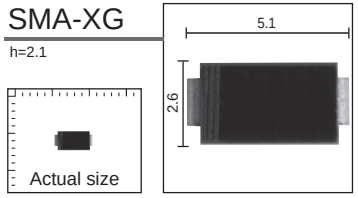


Schottky Barrier Diode

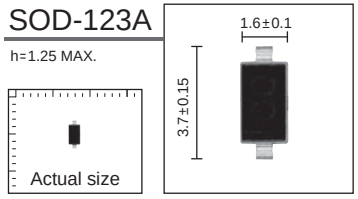
Series Name	Package	VR : Reverse Voltage [V]	IF : Forward Current [A]	VF : Forward Voltage [V]	IR : Reverse Current [mA]	Ct : Capacity between Pins [pF]
XBS013S16R-G	SOD-723 (3,000pcs/Reel)	30	0.1	0.71	0.002	6
XBS053V15R-G	SOD-523 (8,000pcs/Reel)	20	0.5	0.40	0.1	12
XBS013S15R-G		30	0.1	0.71	0.002	6
XBS024S15R-G		40	0.2	0.53	0.002	5
XBS053V13R-G	SOD-323A (3,000pcs/Reel)	20	0.5	0.40	0.1	12
XBS104S13R-G		40	1.0	0.49	0.2	35
XBS104S14R-G	SOD-123A (3,000pcs/Reel)	40	1.0	0.49	0.2	35
XBS104V14R-G				0.37	2	150
XBS203V19R-G	SMA-XG (2,000pcs/Reel)	30	2.0	0.35	3	280
XBS303V19R-G			3.0	0.36	3	385
XBS204S19R-G		40	2.0	0.49	0.2	180
XBS204V19R-G				0.46	0.1	75
XBS304S19R-G			3.0	0.47	0.3	180
XBS206S19R-G		60	2.0	0.62	0.3	120
XBS306S19R-G			3.0	0.59	0.3	195

▶Package

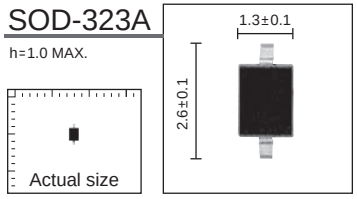
SMA-XG



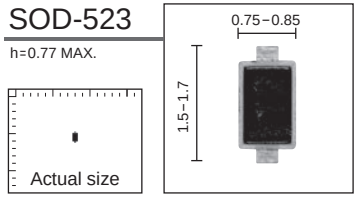
SOD-123A



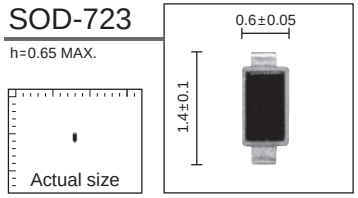
SOD-323A



SOD-523



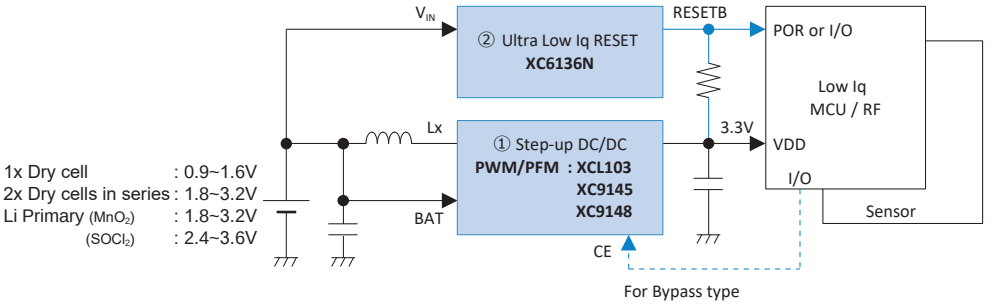
SOD-723



For Primary Battery, Low Iq Solution

■From 3V Li primary battery or 1-2 dry batteries to MCU by Step-up DC/DC

●Issue: High efficiency / Low EMI / Low ripple Step-up DC/DC
Small size / Low consumption / Long battery life



	Product	Features
①Step-up DC/DC	XCL103	Inductor built-in, PWM/PFM, 3MHz, 450mA@3.3V→5V
	XC9145 NEW	PWM/PFM, 1.2MHz, 430mA@3.3V→5V Ultra Low Iq, Iq=400nA
	XC9148 NEW	PWM/PFM, 1.2MHz/3MHz, 750mA@3.3V→5V Low Ron Bypass function
②RESET IC	XC6136 FEATURED	Iq=100nA class Ultra Low Iq

①Step-up DC/DC for MCU

(a) For low power consumption

●General usage : Always step-up
High efficiency, including at light load, is achieved using an Iq = 400nA Ultra Low Iq PWM/PFM control Step-up DC/DC **(XC9145)** for always-on.

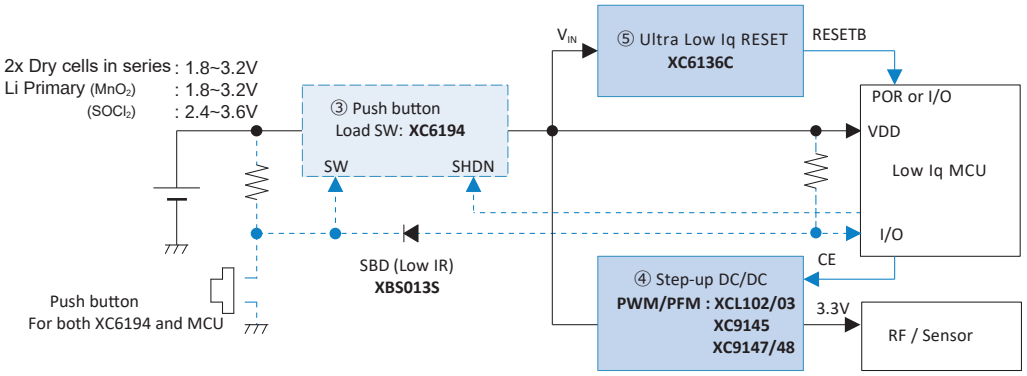
●Low consumption method : Step-up only when the MCU is active
The "Bypass function" of Step-up DC/DC supplies battery voltage directly to the MCU during sleep of the MCU, and boosts only when needed. **(XC9148)**

(b) For small size / low EMI

The inductor built-in "micro DC/DC" **XCL103** is suitable for small & low EMI.

■3V Li primary battery or 2 dry batteries to MCU directly

●Issue: Discharge prevention of battery at shipment / Countermeasure for system freeze
Low EMI and low ripple Step-up DC/DC for RF / Sensor



	Product	Features
③Push button SW	XC6194 FEATURED	I_{STB}=1nA, Ship (shutdown at shipment) For system freeze, Preventing liquid leakage (UVLO)
④Step-up DC/DC	XCL102/03	Inductor built-in, PWM/PFM, 3MHz, 450mA@3.3V→5V
	XC9145 NEW	PWM/PFM, 1.2MHz, 430mA@3.3V→5V Ultra Low Iq, Iq=400nA
	XC9147/48 NEW	PWM/PFM, 1.2MHz/3MHz, 750mA@3.3V→5V
⑤RESET IC	XC6136 FEATURED	Iq=100nA class Ultra Low Iq

③Push button load SW with built-in Ship function : XC6194

The added Push button load SW **XC6194** with built-in Ship function (shutdown during shipment) makes the discharge current from the battery during shipment to 1nA. Also suitable for use as a main power switch, forced turn off when the system freezes, and preventing liquid leakage from a battery.

④Step-up DC/DC for RF / Sensor

●Boost when the sensor / RF is operating, and shut off when unnecessary with the "Load disconnection function". The inductor built-in "micro DC/DC" **XCL103** is suitable for small size, low EMI and low ripple.

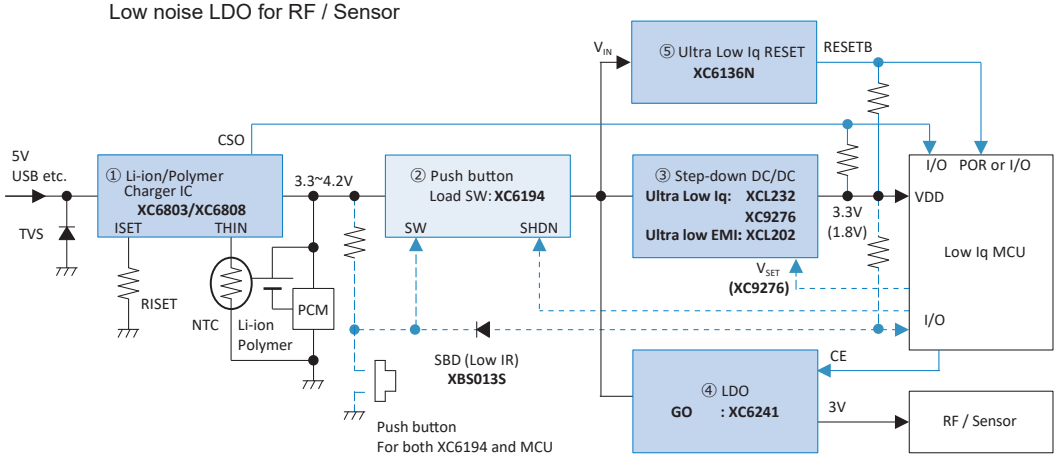
●For Always-on RF / Sensor
The **XC9145**, Ultra Low Iq PWM/PFM control with Iq = 400nA, always provides high efficiency.

Selection Guide P.14-23

For Li-ion Rechargeable Battery, Low Iq solution

■Equipment using Li-ion / Polymer rechargeable battery : IoT sensor / wearable etc.

●Issue: Discharge prevention at shipment / Countermeasure for system freeze
High efficiency / Ultra Low Iq Step-down DC/DC
Low noise LDO for RF / Sensor



	Product	Features
①Li Charger IC	XC6803/08	CC/CV charging, CC=~280mA/40mA
②Push button SW	XC6194 FEATURED	ISTB=1nA, Ship (shutdown at shipment), Counter system freeze, 1A
③Step-down DC/DC	XCL232 NEW	Inductor built-in, Iq=200nA, PFM, 150mA
	XC9276 FEATURED	Iq=200nA, PFM, 150mA, VSET
	XCL202	Inductor built-in, PWM/PFM, 1.2MHz, 400mA, Ultra low EMI
④LDO	XC6241 NEW	Iq=0.6μA, PSRR=60dB, GO, 150mA
⑤RESET IC	XC6136 FEATURED	Iq=100nA class Ultra Low Iq

②Push button load SW with built-in Ship function : XC6194

Shutdown at shipment, and suitable as a countermeasure for system freeze.

③Ultra low Iq Step-down DC/DC for MCU

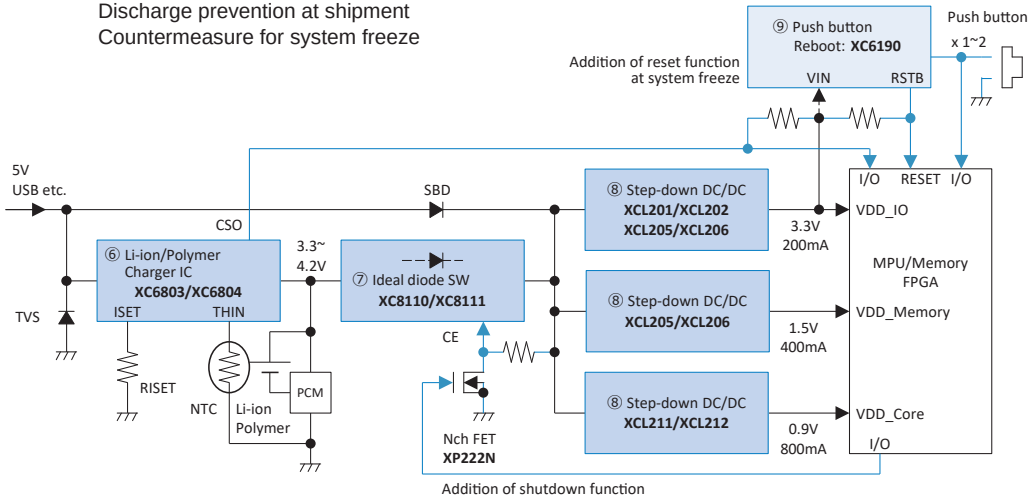
Ultra low Iq DC/DC are suitable (**XCL232, XC9276 : Iq=200nA**), in particular, the VSET function of **XC9276** which lowers VOUT when the MCU is sleeping.
The ultra low EMI "micro-DC/DC" **XCL202** is suitable for the sensor.

④LDO for RF / Sensor

The GO function which changes operation of the LDO automatically between Low Iq and high speed achieves both low Iq and high speed response. (**XC6241**)

■Equipment that requires multi-voltage from a Li-ion/Polymer rechargeable battery

●Issue: Small / High efficiency / High speed / Low EMI Step-down DC/DC
Automatic switching of 5V input / Li battery
Discharge prevention at shipment
Countermeasure for system freeze



	Product	Features
⑥Charger IC	XC6803/04	CC/CV charging, CC=~280mA/800mA
⑦Ideal diode	XC8110/11 NEW	Ideal diode IC VF=20mV, 500mA (XC8110), 1A (XC8111)
⑧Step-down DC/DC	XCL201/02	Inductor built-in, PWM/PFM, 1.2MHz, 400mA, Ultra low EMI
	XCL205/06	Inductor built-in, PWM/PFM, 3MHz, 600mA
	XCL211/12	Inductor built-in, PWM/PFM, 2.4MHz, 2A
⑨Reboot IC	XC6190	Output reset signal by holding SW1 and 2 at "L"

⑦Ideal diode IC

Automatic switching of 5V input and Li battery with ideal diode. (**XC8110/XC8111**)
Adding an Nch FET realizes a shutdown function at the time of shipment.

⑧Step-down DC/DC for MPU / Memory / FPGM (POL)

Stable operation / small size / low EMI are realized by placing Inductor built-in "micro DC/DC" in vicinity as POL. (**XCL201/XCL202, XCL205/XCL206, XCL211/XCL212**)

⑨Push button reboot controller : XC6190

Adding a push button reboot IC that can reboot the system by pressing and holding a physical SW as a countermeasure for the system freeze.
The SW can be shared with other functions such as MCU control.

Selection Guide P.12-23

Low power consumption method utilizing operation range of MCU/SoC

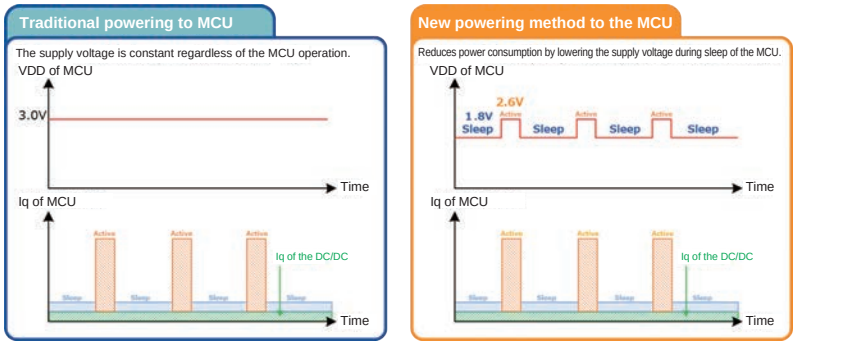
■Changing the output voltage according to the operation of the MCU for low power consumption of the entire system / long battery life

Tech trend and challenges

- Current MCU / SoC can operate in a wide voltage range (e.g. 1.6 to 3.8V)
  3V is often required for analog operation and high-speed processing, but the power supply voltage can be reduced to 1.8V during sleep mode of the MCU / SoC.

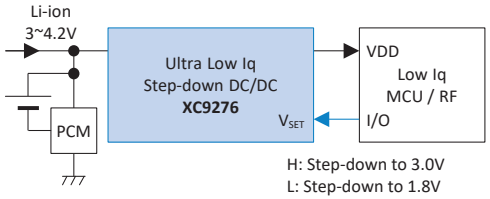
TOREX Proposal : Low Power Consumption Method

- Changing the output voltage according to the operation of the MCU / SoC, the power consumption in the standby state can be significantly reduced.
  - Step-down DC/DC : Switch the V_{OUT} using the V_{SET} function. **(XC9276)**
  - Step-up DC/DC : Switch the V_{OUT} using the Bypass function. **(XC9148)**



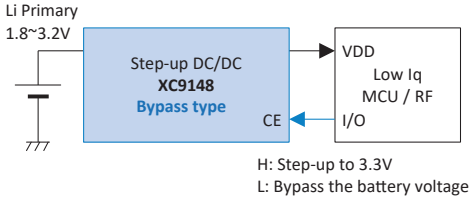
Ultra Low Iq Step-down DC/DC with V_{SET}

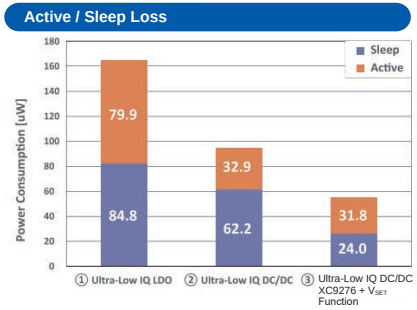
V_{OUT} can be switched by the V_{SET} pin.
Ultra low Iq always realizes high efficiency.

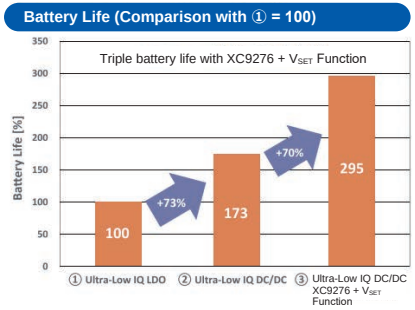


Low Iq Step-up DC/DC with Bypass

Switching the operation between step-up and bypass.
During sleep of the MCU, Iq of the DC/DC is 0μA
in the Bypass mode.





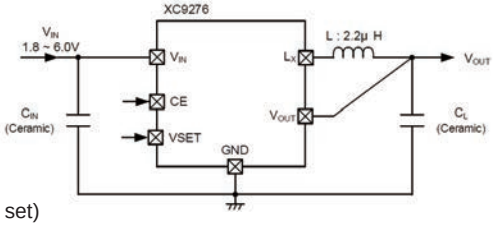


FEATURED

■XC9276 - Ultra Low Iq Step-down DC/DC with V_{SET} function

- High efficiency of 80% or more even at I_{OUT} = 10μA with 200 nA Ultra Low Iq
- Further lower power consumption with the V_{SET} function that changes V_{OUT} according to the operation of the MCU

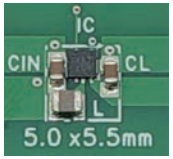
V_{IN}	: 1.8 ~ 6.0V
V_{OUT}	: 0.5 ~ 3.6V (2 values set)
	Selected by H/L of V_{SET} pin
I_{OUT}	: 150mA
Iq	: 200nA
Control	: PFM
Function	: V_{SET} (Select V_{OUT} from 2 values set)
Topr	: -40℃ ~ 85℃
Package	: WLP-6-03, SOT-26W, USP-8B06



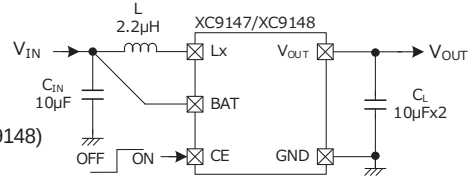
NEW

■XC9147 / XC9148 - Small and high efficiency multifunctional Step-up DC/DC

- Space-saving including peripheral parts, high-efficiency Step-up DC/DC
- Load disconnection / V_{OUT} OR / Bypass types can be selected according to the usage



V_{IN}	: 0.9 ~ 6.0V
V_{OUT}	: 1.8 ~ 5.5V
fosc	: 1.2MHz, 3MHz
I_{OUT}	: 750mA @3.3V → 5.0V
	500mA @1.8V → 3.3V
Control	: F-PWM (XC9147), PWM/PFM (XC9148)
Type	: Load disconnection (XC9147/XC9148),
	V_{OUT} OR connection (XC9148) or Bypass (XC9148)
Topr	: -40℃ ~ 105℃
Package	: SOT-89-5, USP-6C



For further lower power consumption / Battery life improvement

■The Ideal diode that reduces power loss at Schottky diode

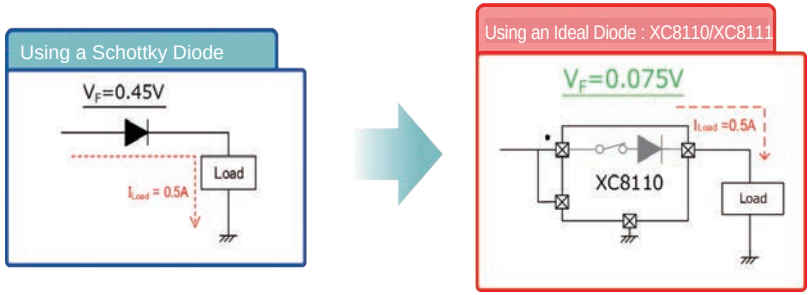
Tech trend and challenges

- There are many diodes in power lines for preventing reverse current
- The SBD has a V_F loss of about 0.4V and a loss due to leakage current. With IF = 1A, the V_F loss is as large as 0.4W, which is an obstacle to high efficiency and miniaturization.

TOREX Proposal : Replacement from SBD to Ideal diode

Achieves V_F = 20mV with a Load SW equipped with Ideal diode function.
Power loss below 200mA is reduced to 1/20 of SBD, and loss at 500mA is significantly reduced to 1/6.
The large leakage current of the SBD is now reduced to 0μA with the Ideal diode.

In addition, protection functions such as current limiting greatly improve safety.



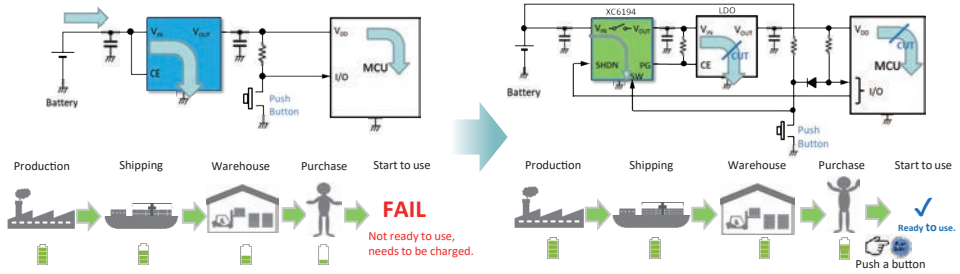
■The Ship function that suppresses battery discharge during shipment

Tech trend and challenges

- The customer may not be able to start using the new product because the battery discharge current during shipment is large and the battery is exhausted when the package is opened.
- In terms of waterproofing and ease of use, it's getting difficult to prevent discharge by using a conventional plastic insulation tab on the battery.

TOREX Proposal : Suppression of battery discharge by Ship function

The Ship function of the push button load SW suppresses battery discharge to 1nA during shipment.
Start using just by pressing the push button.



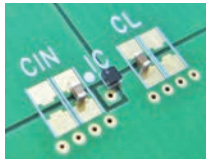
Without Ship function　　With Ship function

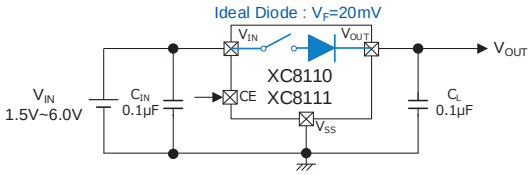
NEW

■XC8110 / XC8111 - Ideal diode load SW

●Load SW with Ideal diode function equivalent to V_F = 20mV
●For OR connection of multiple power lines and backup

V_{IN}	: 1.5 ~ 6.0V
I_{OUT}	: 500mA (XC8110), 1A (XC8111)
V_F	: 20mV @200mA or lower 75mV @500mA
Ron	: 120mΩ @ WLP-4-02
Iq	: 3.6μA (at Forward bias) 0μA (at Reverse bias)
Standard	: IEC 62368-1:2018 Certified
Topr	: -40℃ ~ 105℃
Package	: SOT-25, USP-6B06, WLP-4-02



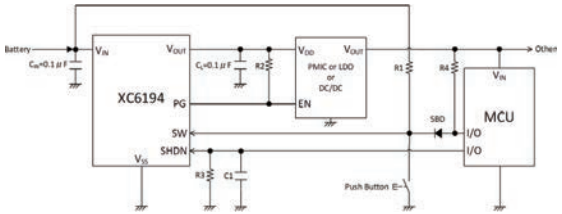


FEATURED

■XC6194 - Push button Intelligent load SW with built-in Ship function

●The Ship function prevents battery discharge during shipment and can also be used as the main power switch
●Suitable for long battery life, and also for forced off in case of system freeze

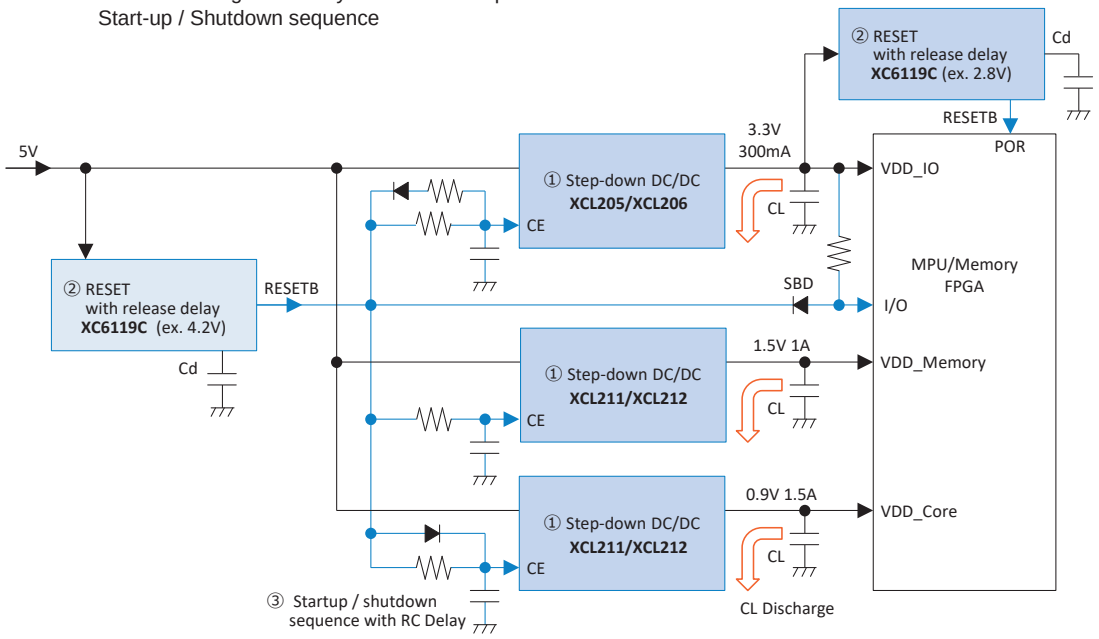
V_{IN}	: 1.8 ~ 6.0V
I_{OUT}	: 1A
Ron	: 0.14Ω@3.0V
ISTB	: 1nA (at shutdown)
Iq	: 0.13μA
Topr	: -40℃ ~ 85℃
Package	: USP-8B06



POL Solution for Multiple Power Rails

■POL multiple power rails for MPU / FPGA

●Issue: Stable operation and reduction of CL and decoupling capacitors
Small size / High efficiency / Good heat dispersion / Low EMI
Start-up / Shutdown sequence



	Product	Features
①Step-down DC/DC	XCL205/XCL206	Inductor built-in, PWM/PFM, 3MHz, 600mA
	XCL211/XCL212	Inductor built-in, PWM/PFM, 2.4MHz, 2A
②RESET IC	XC6119	Low Iq, Release delay with external Cd

①Step-down DC/DC for MPU / Memory / FPGA as POL

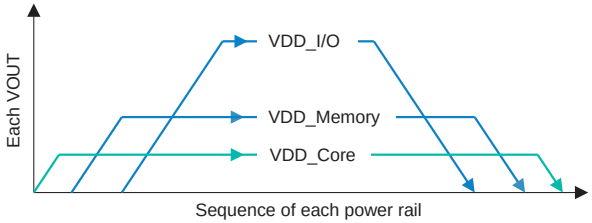
Stable operation / small size / low EMI are realized by placing the Inductor built-in “micro DC/DC” in the immediate vicinity as POL. **(XCL205/XCL206, XCL211/XCL212)**

②Monitoring 5V input

Monitor 5V input with the voltage detector.
For start-up / shutdown sequence control and notification of voltage drop to MPU. **(XC6119)**

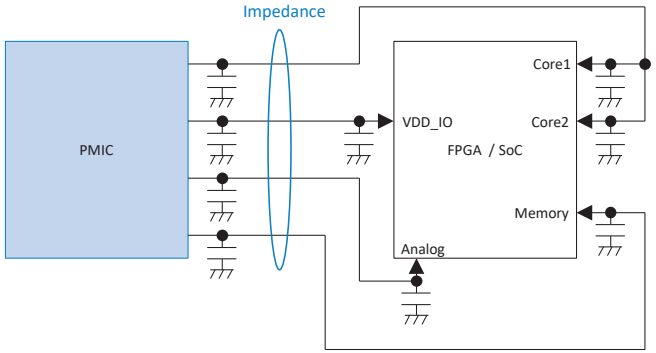
③Start-up / Shutdown sequence

The RC delay to each CE terminal of the DC/DC and the CL discharge function make it easy to implement start-up / shutdown sequences.
Drive the RC delays with the CMOS output type **(XC6119C)** voltage detector.



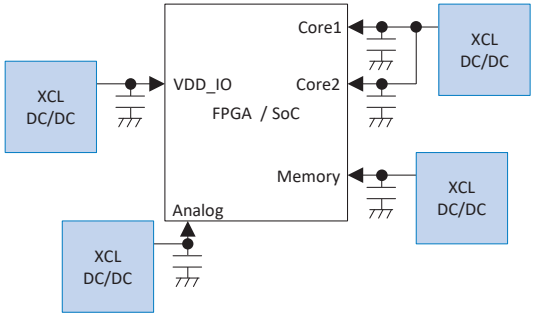
■Benefit of POL (Point of Load)

Case of PMIC



POL

Case of POL



Problems of PMIC

- Unstable operation due to long wiring and GND interference
- Therefore, many capacitors are required for each part
- Heat concentration and EMI from long wiring

Benefit of POL and TOREX proposal

- Short wiring length by placement in the immediate vicinity
  - Achieves stable operation and reduction of capacitors
  - Easy heat dissipation due to heat source separation, and reduced EMI
- By using the Inductor built-in "micro DC/DC" XCL, it can be easily placed in the immediate vicinity, and stable operation, lower EMI, and easier design are possible

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Inductor built-in "micro DC/DC" that realizes small size / low EMI

■TOREX original Inductor built-in "micro DC/DC"

Tech trend and challenges

- In order to improve the power quality, it is ideal to place power supplies as POL in the immediate vicinity to the FPGA / SoC, but this may cause noise interference and there is a risk of abnormal operation
- If the power supply circuit itself is large, it cannot be placed in the immediate vicinity of the FPGA / SoC, and the characteristics as the POL power supply cannot be fully utilized

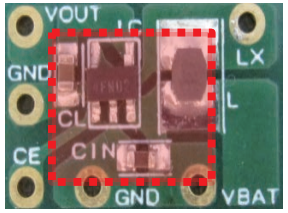
TOREX Proposal : Original Inductor built-in “micro DC/DC”

1. Significant miniaturization of power supply circuit

With the following features, we have achieved a significant reduction in mounting area and provided the smallest class power supply solution.

- Unique structure / Select the optimum inductor for the internal IC chip
- Efficient heat dissipation performance is realized by being able to connect the IC chip / coil directly to the PCB

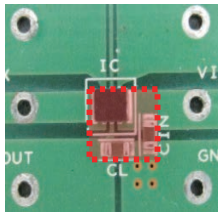
10×7mm = 70mm²



Stand alone DC/DC
Main external parts : 3 pcs

75% reduction

4.5×4.0mm = 18mm²



Inductor built-in “micro DC/DC”
Main external parts : 2 pcs

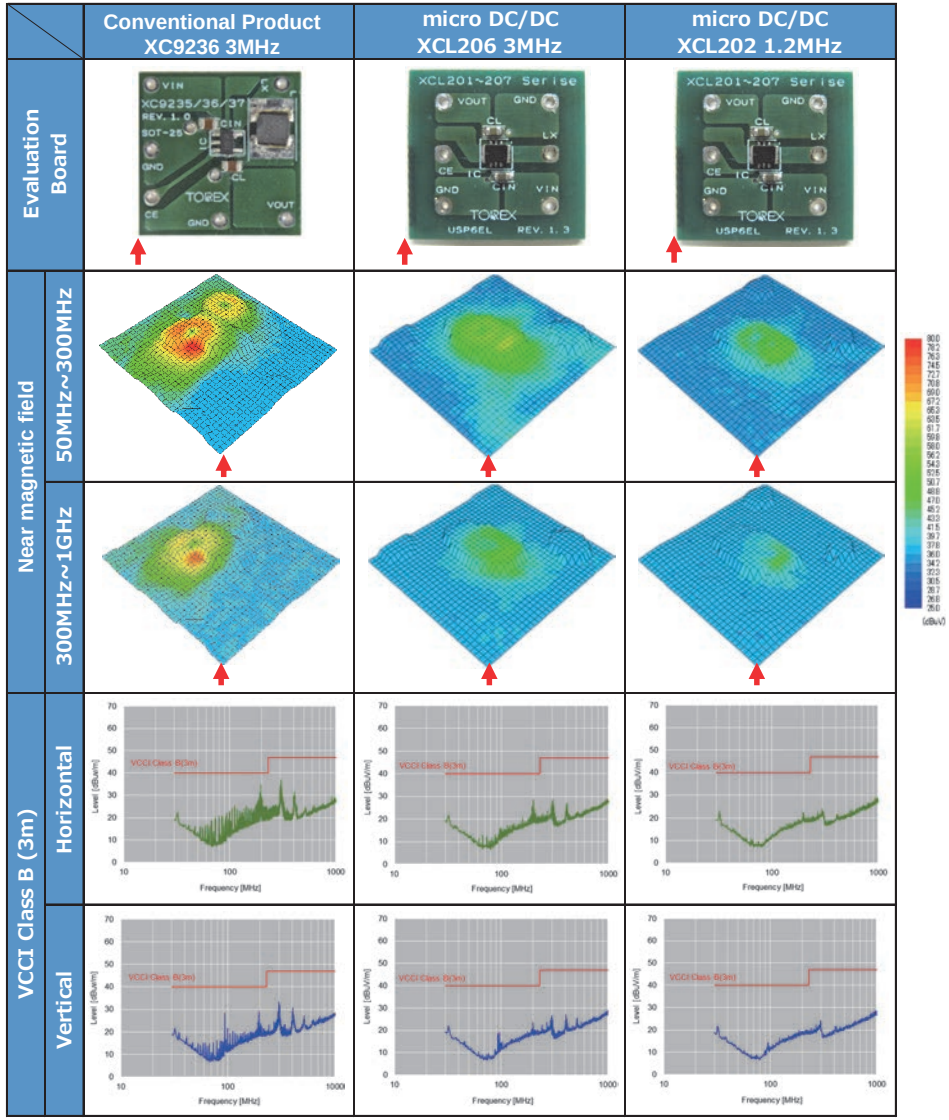
2. EMI reduction due to unique Inductor built-in structure

The noise radiated from the IC can be significantly reduced compared to the IC alone due to the unique structure such as the pocket type that covers the IC chip with a coil.

Low EMI

It can be placed in the immediate vicinity of RF ICs / Sensors, etc., contributing to miniaturization.

EMI comparison of Inductor built-in DC/DC and standalone DC/DC

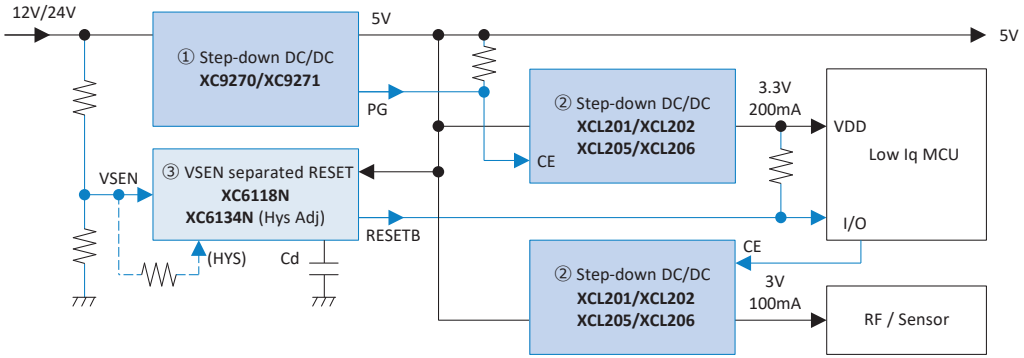


Bias Condition : VIN=3.7V, VOUT=1.8V, IOUT=200mA

Solution for 12V/24V input

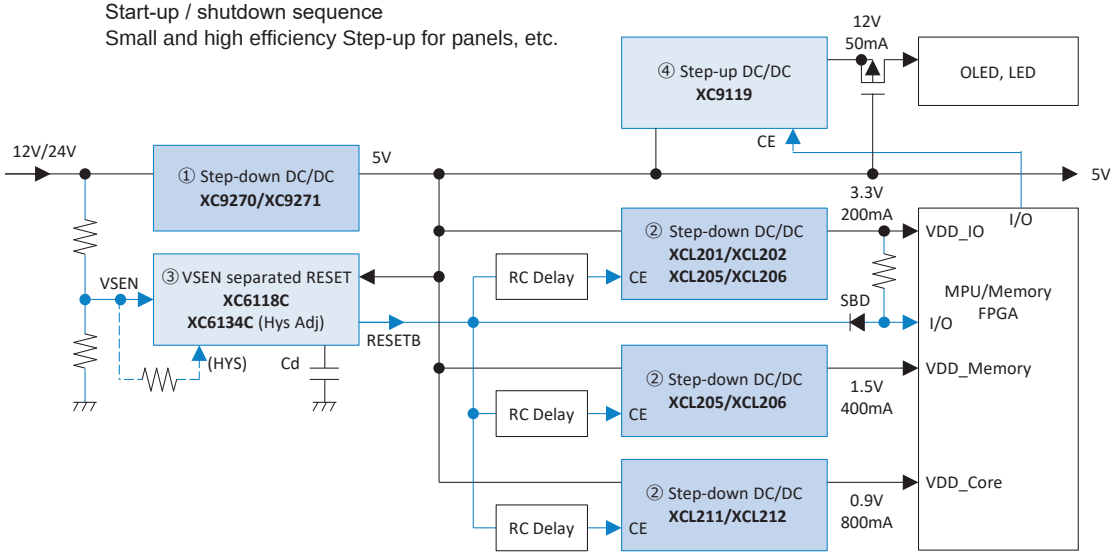
■12V/24V input, various small devices / modules : Industrial Sensor / IoT

●Issue: Miniaturization / Low EMI / Heat dissipation
Correspondence to input voltage fluctuation



■POL solution for multiple power rails from 12V input

●Issue: Small size / high efficiency / heat dissipation / low EMI power supply from 12V input
Start-up / shutdown sequence
Small and high efficiency Step-up for panels, etc.



	Product	Features
①Step-down DC/DC	XC9270/ XC9271	30V, 300k/500kHz, 2A
②Step-down DC/DC	XCL201/ XCL202	Inductor built-in, PWM/PFM, 1.2MHz, 400mA, Ultra low EMI
	XCL205/ XCL206	Inductor built-in, PWM/PFM, 3MHz, 600mA
	XCL211/ XCL212	Inductor built-in, PWM/PFM, 2.4MHz, 2A
③RESET IC	XC6118	Separated sense pin, Low Iq, Release delay with external Cd
	XC6134	Separated sense pin, External adjustable hysteresis, Release / Detection delay with external Cd
④Step-up DC/DC	XC9119	~19.5V, PWM, 1MHz, 100mA@5V→12V

①For 12V/24V input, Primary Step-down DC/DC

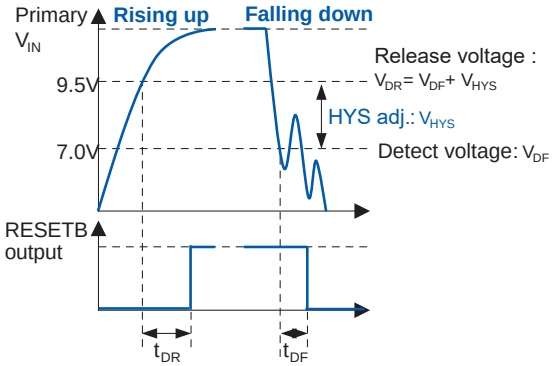
Sufficient input voltage range and output current for various industrial equipment, and easy-to-use frequency. **(XC9270/ XC9271)**

②For MCU / FPGA / Sensor, Secondary Step-down DC/DC

Stable operation / small size / low EMI are realized by placing Inductor built-in D “micro DC/DC” in the immediate vicinity as POL. **(XCL201/ XCL202, XCL205/ XCL206, XCL211/ XCL212)**

③For monitoring 12V/24V input, Voltage detector

12V/24V input monitoring by the voltage detector with separated sense pin. RESETB signal monitoring at 12V/24V input voltage drop is output to the MCU / FPGA, and after the shutdown process, the DC/DC can be stopped according to the sequence using the RC delay. It can be easily configured using the CMOS output type of the voltage detector.
Any detect / release voltage can be set by using the external adjustable hysteresis function.
In addition, it supports not only release delay but also detection delay. **(XC6134)**



④Step-up DC/DC for various input or output devices such as OLED / LED

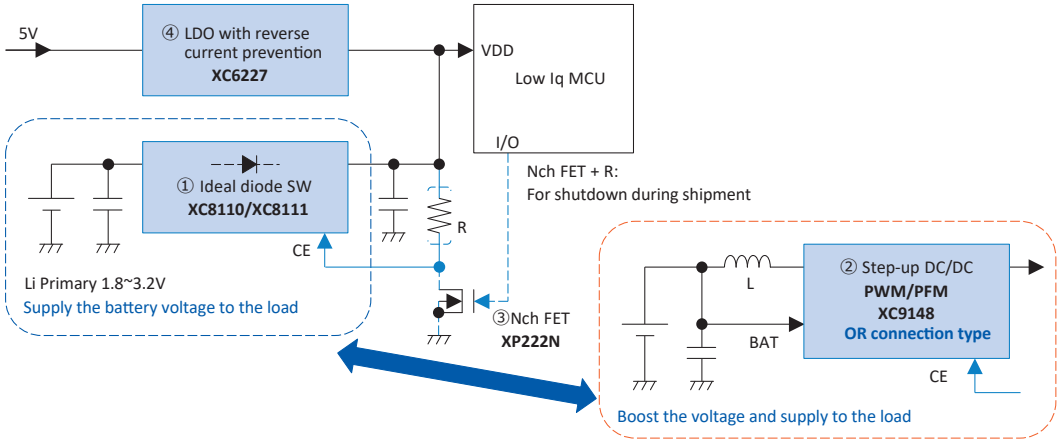
Small size Step-up DC/DC for OLED / LED etc. **(XC9119)**

Selection Guide P.12-21

For Backup / Supply from multiple sources, "OR" Connection Solution

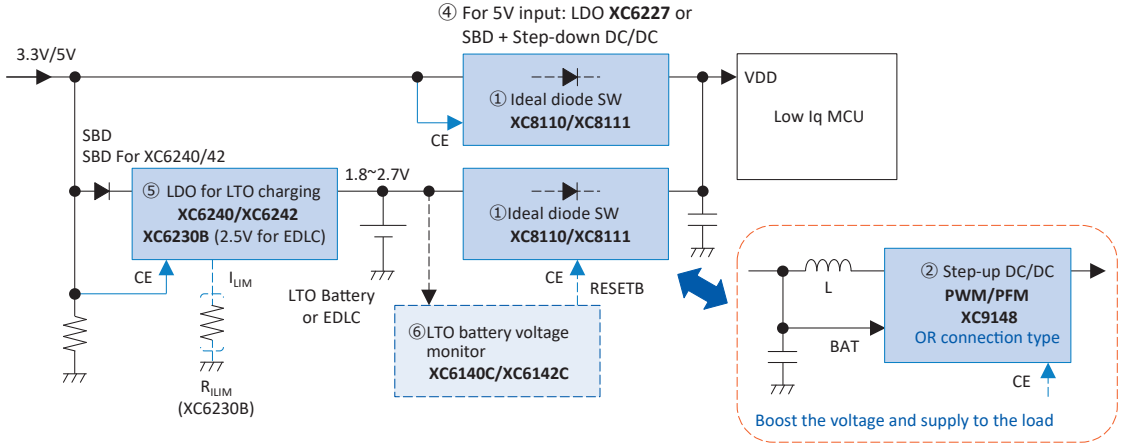
■Backup power supply with primary coin battery

●Issue: Seamless switching to backup when the main power is lost
Reduces power loss from backup batteries



■Backup power supply with LTO battery / Supercap (EDLC)

●Issue: Seamless switching to backup when the main power is lost
Efficient charging and discharging of the backup batteries / Supercaps



	Product	Features
①Ideal diode	XC8110/11 NEW	Ideal diode IC, IEC 62368-1 Certified V_F=20mV, 500mA (XC8110)/1A (XC8111)
②Step-up DC/DC	XC9148 NEW	1.2MHz/3MHz, 750mA@3.3V→5V, For OR connection
④LDO	XC6227 NEW	High speed PSRR=65dB, 700mA, True reverse current prevention
⑤Charger IC (LDO)	XC6240/42	For LTO charging, 150mA, Topr=105°C (XC6242)
	XC6230B NEW	2A, External adj. current limit, True reverse current prevention
⑥LTO battery voltage monitor	XC6140/42	LTO battery voltage monitor Release voltage=2.475V/2.450V, Iq=104nA For 105°C compatible LTO battery: XC6142

“OR” connection

Case ① : Apply backup battery voltage directly to the MCU

OR connection by using the Ideal diode. **(XC8110/XC8111)**
Compared to using SBD, V_F / leakage current loss can be significantly reduced.

Case ② : Apply a Step-up voltage such as 3.3V to the MCU

Uses the Step-up DC/DC that supports OR connection. **(XC9148C/F/M/L)**
Please note that OR connection availability differs depending on the product and its option.

Method to extend battery life with the Ship function

③Before shipping, turn on the Nch FET to cut off the supply from the backup battery. It is possible to significantly suppress the discharge from the battery until the start of use.

④LDO, DC/DC for main power

LDO with reverse current prevention function prevents reverse current to the main power supply input. **(XC6227)**
Also, SBD + Step-down DC/DC can be used for OR connection as well.

⑤Charging LTO battery / Supercap

The dedicated LDO **XC6240/42** is used to charge the LTO battery.
LDO with current limit external adjustment / reverse current prevention is the best for charging the Supercap. **(XC6230B)**

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Ideal diode / Step-up DC/DC suitable for "OR" connection

■OR connection of power rails

Tech trend and challenges

- In contrast to improving the efficiency and battery life, circuits using SBD have a large V_F loss / leakage current
- The voltage change due to V_F is large, so there is concern about stable operation

TOREX Proposal : Dedicate ICs for OR connection

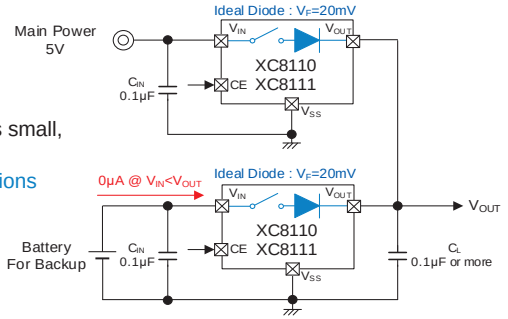
- Low Iq that suppresses battery discharge
- Easily switch power supply to another without IC control
- Low V_F / sufficient transient response to minimize changes in output voltage

Diode OR connection using the Ideal diodes

OR connection configuration on the output of Step-up DC/DC

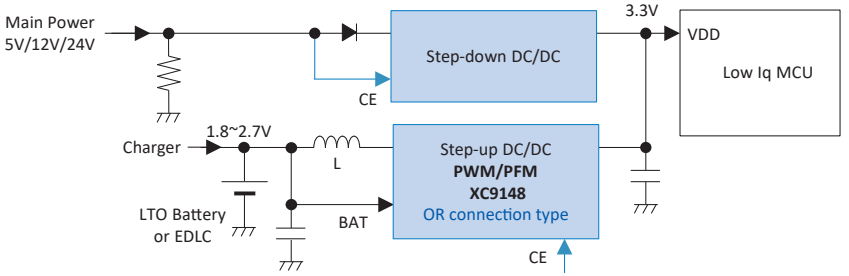
Benefit of Ideal diode

- Low V_F : V_F=20mV
- Low leakage current
- The change in output voltage is small, contributing to stable operation
- Various built-in protection functions
- Small size



Benefits of Step-up DC/DC XC9148 for OR connection

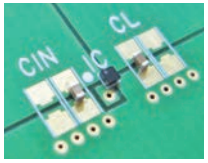
- Easy OR connection is possible without control when input / disconnect the main power supply
- When the main power supply is lost, the power can be supplied by boosting the voltage momentarily from the battery
- Low Iq design that minimizes battery discharge current



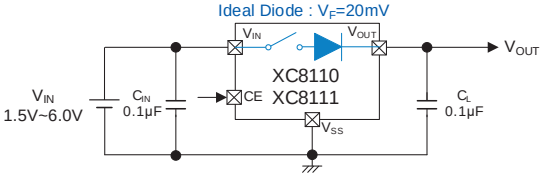
NEW

■XC8110 / XC8111 - Ideal diode load SW

- Load SW with Ideal diode function equivalent to V_F = 20mV
- For OR connection of multiple power lines and backup



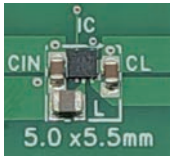
V_{IN}	: 1.5 ~ 6.0V
I_{OUT}	: 500mA (XC8110), 1A (XC8111)
V_F	: 20mV @200mA or lower 75mV @500mA
Ron	: 120mΩ @ WLP-4-02
Iq	: 3.6µA (at Forward bias) 0µA (at Reverse bias)
Standard	: IEC 62368-1:2018 Certified
Topr	: -40°C ~ 105°C
Package	: SOT-25, USP-6B06, WLP-4-02



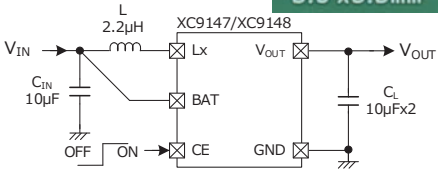
NEW

■XC9147 / XC9148 - Small and high efficiency multifunctional Step-up DC/DC

- Space-saving including peripheral parts, high-efficiency Step-up DC/DC
- Load disconnection / V_{OUT} OR / Bypass types can be selected according to the usage



V_{IN}	: 0.9 ~ 6.0V
V_{OUT}	: 1.8 ~ 5.5V
fosc	: 1.2MHz, 3MHz
I_{OUT}	: 750mA @3.3V → 5.0V 500mA @1.8V → 3.3V
Control	: F-PWM (XC9147), PWM/PFM (XC9148)
Type	: Load disconnection (XC9147/XC9148), V_{OUT} OR connection (XC9148) or Bypass (XC9148)
Topr	: -40°C ~ 105°C
Package	: SOT-89-5, USP-6C

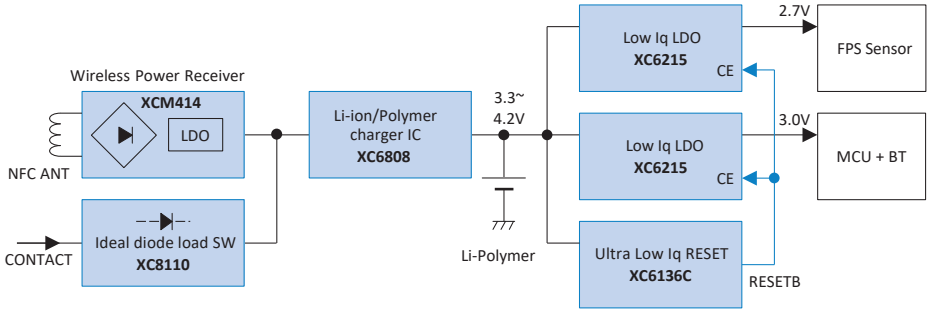


Low Profile Power Supply Solution for h = 0.33mm/0.40mm max.

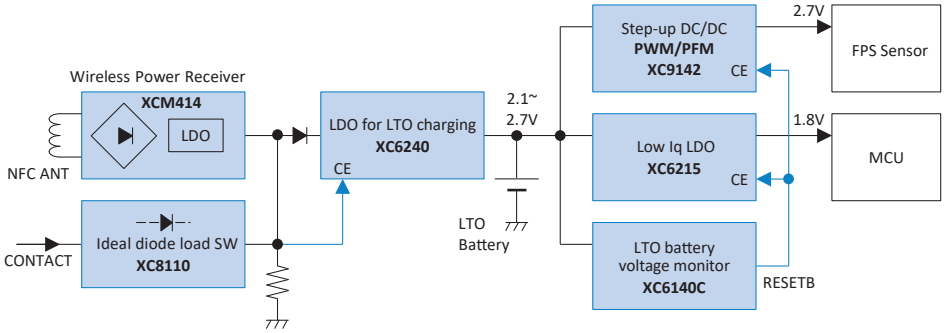
■Example of thin power supply configuration with h = 0.33mm max. for Smart card

●Issue: Must support h = 0.33mm max including external parts
Highly efficient charging circuit for wireless power supply such as NFC

Li-Polymer battery : Low profile solution



LTO battery : Low profile solution



■List of low profile power management IC, h ≤ 0.33mm and 0.40mm

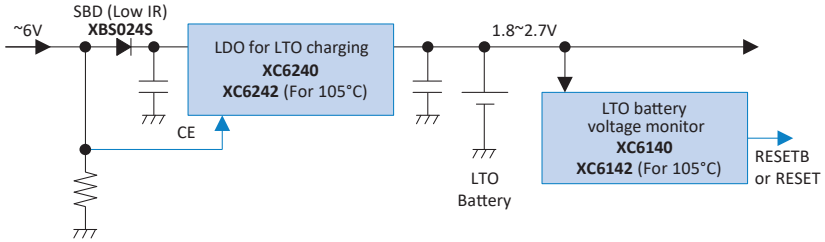
	Product	Features	V_{IN} (V)	V_{OUT} (V)	I_{OUT} (mA)	Package	Size
LDO	XC6216	28V	2.0 ~ 28.0	1.8 ~ 12.0	150	USP-6B06	1.8 x 1.5 x h 0.33mm
	XC6215	Iq=0.8μA	1.5 ~ 6.0	0.9 ~ 5.0	200		
	XC6241 FEATURED	High speed, Iss=0.6μA, GO	1.6 ~ 6.0	1.5 ~ 5.0	150	USPQ-4B05	1.0 x 1.0 x h 0.33mm
	XC6504	Cap. Less, Iq=0.6μA	1.4 ~ 6.0	1.1 ~ 5.0	150	USPN-4B02	0.75 x 0.95 x h 0.40mm
LDO + Bridge Diode	XCM414	For wireless power receiving LDO with internal bridge diode	2.0 ~ 26.0	2.0 ~ 12.0	150	USP-8B10	2.6 x 2.9 x h 0.33mm
Step-up DC/DC	XC9142 XC9141	I_{IN}=0.8A, Step-up DC/DC XC9141 (F-PWM), XC9142 (PWM/PFM)	0.65 ~ 6.0	1.8 ~ 5.5	500	WLP-6-01	1.08 x 1.28 x h 0.40mm
Charge pump	XC9802 XC9801	Charge pump (no inductor required) XC9801 (PWM), XC9802 (PWM/PFM)	1.8 ~ 5.5	2.5 ~ 6.0 or V_{IN} x 2	80	USP-8B05	2.4 x 2.4 x h 0.33mm
Battery voltage monitor / Voltage detector	XC6140 FEATURED	LTO battery voltage monitor Release voltage = 2.475V	1.1 ~ 6.0	1.2 ~ 5.0	-	USPQ-4B05	1.0 x 1.0 x h 0.33mm
	XC6136 FEATURED	Iq=88nA		1.6 ~ 2.2			
Charger IC	XC6808	Charger IC for 1 cell Li-ion	4.5 ~ 6.0	4.2, 4.35, 4.4	5 ~ 40	USP-6B07	1.8 x 2.0 x h 0.33mm
	XC6240 FEATURED	Charger IC for LTO battery	1.5 ~ 6.0	2.63	~ 150	USP-6B06	1.8 x 1.5 x h 0.33mm
Load SW	XC8102	Load SW, Iq=3uA	1.2 ~ 6.0	-	400	USP-6B06	1.8 x 1.5 x h 0.33mm
	XC8110 NEW	Ideal diode	1.5 ~ 6.0		500		
	XC6194	Push button Load SW, I_{STB}=1nA	1.8 ~ 6.0		1000		

- We have a wide lineup of IC that can be used in applications that require thinness, such as smart cards and various wearables
- TOREX proposes the optimum power configuration for both NFC and contact inputs, as well as any combination of various other input sources, Li-Polymer, LTO batteries, Supercap, and battery less

Selection Guide P.14-24

LTO Battery: Charge / Discharge Reference Solution

■Reference circuit for charging LTO battery and monitoring battery voltage



■Reference solution / evaluation board for LTO batteries

Adopted as a reference as the charge control IC and battery monitoring IC for LTO batteries of each company.
We have prepared an evaluation board for charging and supplying the power supply circuit for each battery.

NGK Insulators:
EnerCera ET series

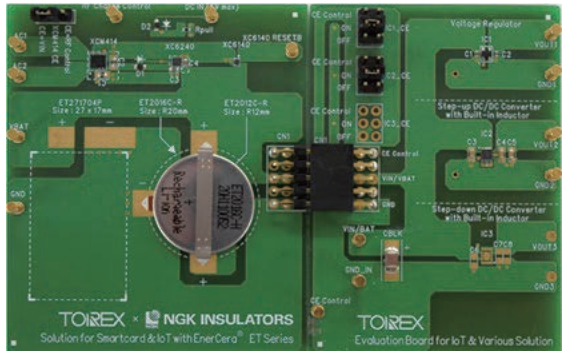
Nichicon:
SLB series

Murata Manufacturing:
CT series

■About LTO battery

Ideal for power supply and backup for industrial equipment / IoT / Automotive small devices / modules

- Constant voltage charging by LDO is possible. No need for a dedicated expensive charger IC
- Highly reliable, safe, long life, and resistant to repeated charging and discharging
- Over-discharge countermeasures can be taken with simple voltage drop detection
- Since a battery, the voltage is stable at 2.1 to 2.4V
  Easier than Supercap to extract whole energy
- 105 °C high temperature operation, reflow compatible, thin and hot lamination compatible, etc. are also available



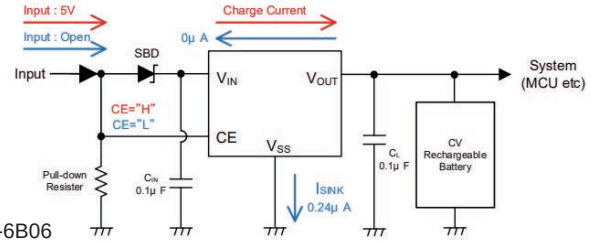
Charging unit　　Power supply unit

NEW

■XC6240 / XC6242 - Charger IC (LDO) for CV charging compatible LTO batteries

- ●Adopted as a reference for LTO batteries of each battery manufacturer
- ●Charge at max 2.70V including temperature range to match LTO battery characteristics
- ●For 105 °C compatible LTO batteries, **XC6242** which can handle high temperatures is suitable

V_{IN}	: 1.5 ~ 6.0V
I_{OUT}	: ~150mA
V_{OUT}	: 2.63V
Iq	: 0.8μA
I_{SINK}	: 0.24μA
Topr	: -40℃ ~ 85℃ (XC6240) -40℃ ~ 105℃ (XC6242)
Package	: SSOT-24, USPN-4, USP-6B06 (XC6242 : USPN-4 only)

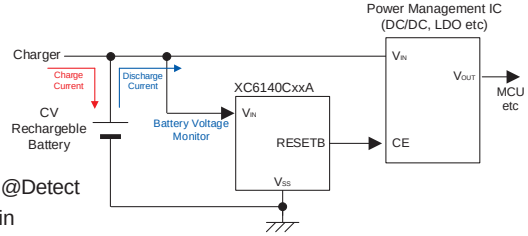


NEW

■XC6140 / XC6142 - Battery voltage monitoring IC for LTO batteries

- ●Adopted as a reference for LTO batteries of each battery manufacturer
- ●Optimal release / detect voltage for LTO batteries
- ●For 105 °C compatible LTO batteries, **XC6142** with optimized Release voltage is suitable

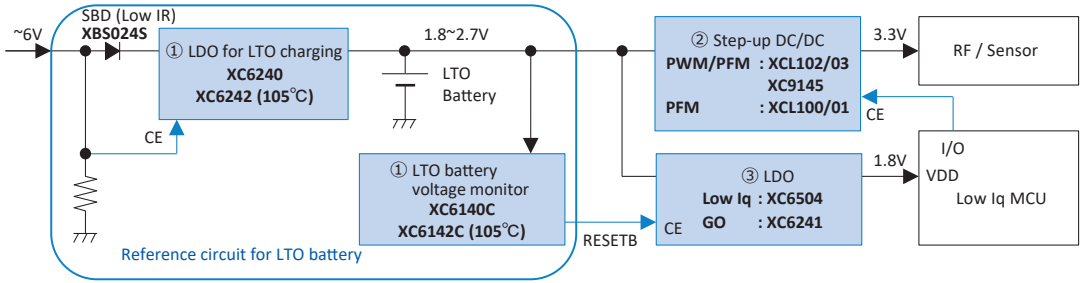
V_{IN}	: 1.1 ~ 6.0V
Detect Voltage	: 1.6 ~ 2.2V (XC6140) 1.6 ~ 2.1V (XC6142)
Release Voltage	: 2.475V (XC6140) 2.450V (XC6142)
Iq	: 104nA @Release, 139nA @Detect
Output	: CMOS or Nch Open Drain Active “L” or “H”
Topr	: -40℃ ~ 105℃
Package	: SSOT-24(XC6240 Only), USPQ-4B05



Selection Guide P.24

LTO Battery: Solutions for IoT devices and Energy Harvesting

■IoT Sensor / Wearable : Circuit example of supply to MCU / Sensor / RF



	Product	Features
①Charger Battery monitor	XC6240/42 NEW	Charger IC for LTO battery
	XC6140/42 NEW	LTO battery voltage monitor
②Step-up DC/DC	XCL100/01	Inductor built-in, PFM Low Iq, UVLO, 80mA@3.3V→5V
	XCL102/03	Inductor built-in, 3MHz, 450mA@3.3V→5V
	XC9145 NEW	PWM/PFM, 1.2MHz, 430mA@3.3V→5V Ultra Low Iq, Iq=400nA
③LDO	XC6504	Iq=0.6μA, Low Iq, 150mA
	XC6241 NEW	Iq=0.6μA, PSRR=60dB, GO, 150mA

①Charger IC / Battery monitoring IC for LTO batteries

Easily charge LTO batteries with **XC6240/XC6242**.
Monitor the voltage with **XC6140/XC6142** and turn ON/OFF the next power management IC with “RESETB”.

②Step-up DC/DC for RF / Sensor

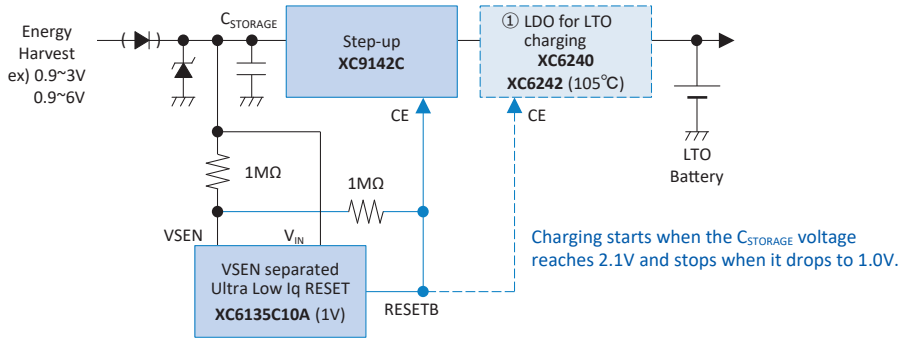
Inductor built-in "micro DC/DC" with load disconnection function and PWM/PFM is optimal for small size / low EMI / low ripple and high efficiency. **(XCL103)**

③LDO for MCU

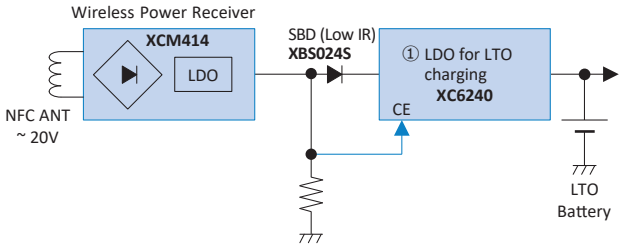
LDO with low Iq or GO function is suitable.

■Example of charging from Energy harvesting to LTO battery

●Issue: Supports energy harvesting (Wireless power transfer / NFC / Solar panel / Piezo, etc.)
Resolves the difficulty of optimal charging circuit served from unstable / very small energy source



Input source: Energy harvesting (Solar cells / Piezo, etc.)



Input source: Wireless power supply AC input

●Select the optimum charging circuit and control voltage according to the voltage characteristics and power capacity of the energy harvest.
●With the control that charging starts after the CSTORAGE voltage rises using the hysteresis voltage judgment (Detect / Release voltage is set individually) by the Ultra Low Iq voltage detector, it is possible to charge the LTO battery even with a very small energy source.

TOREX proposes the optimum power supply configuration that matches the characteristics of each energy harvest.

Selection Guide P.14-24

Design support tool: Web DC/DC Measured Electrical Characteristics Comparison Tool

■Web DC/DC Measured Electrical Characteristics Comparison Tool

●For those looking to select a DC/DC converter!

- You can easily compare the actual device characteristics and mounting area among products!
- You can select the optimum IC for the power supply specifications even if you are not very familiar with the products!

Point 1

Shows the "efficiency", "ripple voltage", and "load regulation" that hard to grasp on the data sheet/simulation.

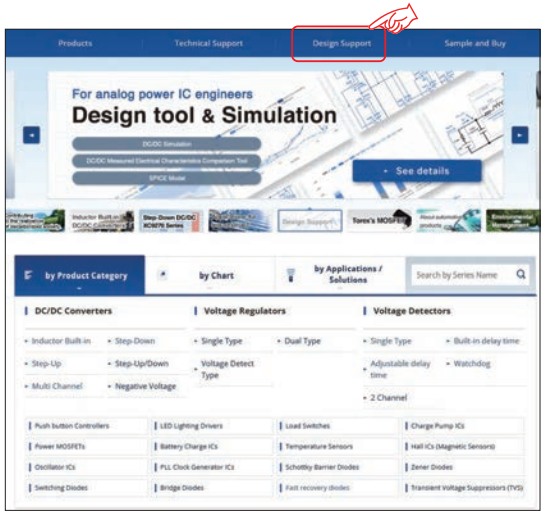
Point 2

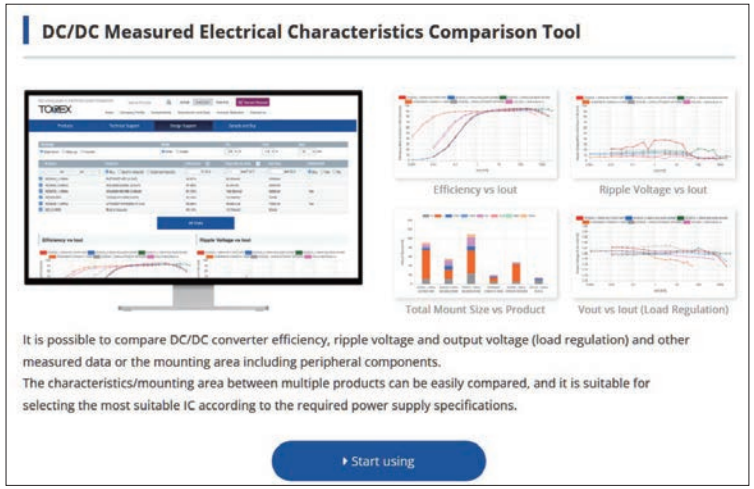
You can select the optimum product for the power supply specifications by comparing the actual device characteristics and mounting area among products.

Point 3

There is data for various power supply specifications and peripheral components to allow you to check data that is close to the actual conditions.

■Access to the Web DC/DC Measured Electrical Characteristics Comparison Tool





Design support tool: Web DC/DC Simulation

■Web DC/DC Simulation

●For those who want to check the detailed operation of the products!

- This specializes in the static characteristics to display the simulation results at the same time the power supply specifications are entered!
- The simulation results can be instantly checked, so contributes to the reduction of IC selection and design man-hours!

Point 1

The difficult to calculate DC/DC junction temperature can be calculated taking into consideration the on resistance, switching loss, heat dissipation performance, etc.

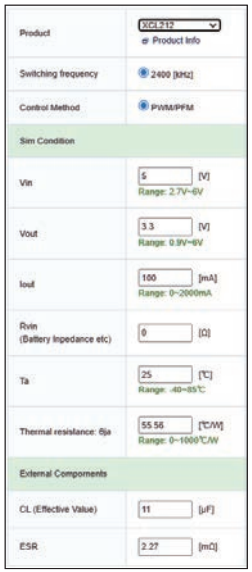
Point 2

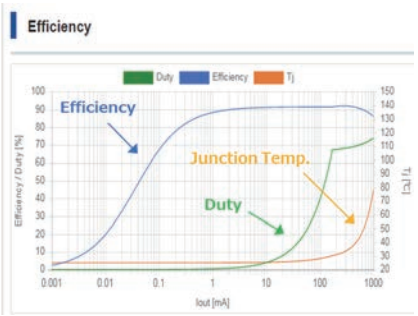
Simulation taking into consideration the input resistance (battery impedance) is possible.
→ The Step-up DC/DC maximum output current, which is greatly affected by the input resistance, can be calculated.

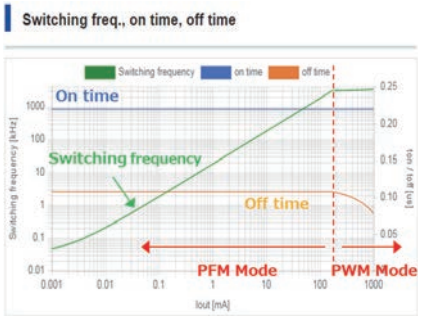
Point 3

The PFM mode switching frequency and switching current to the PWM mode, which vary greatly depending on the I/O voltage and peripheral components, can be calculated.
→ You can select a DC/DC that does not interfere with the radio band or peripheral devices.

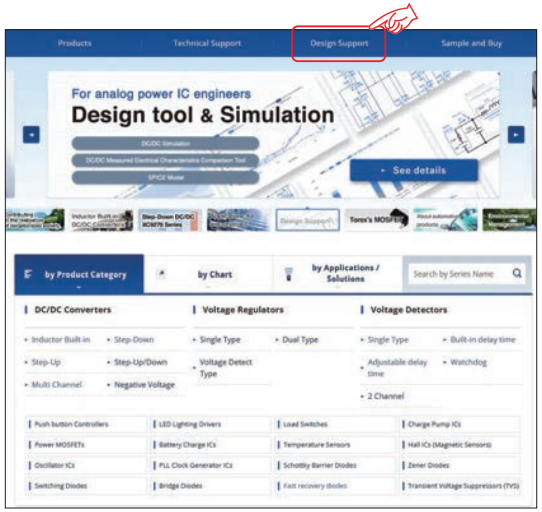
Input Items

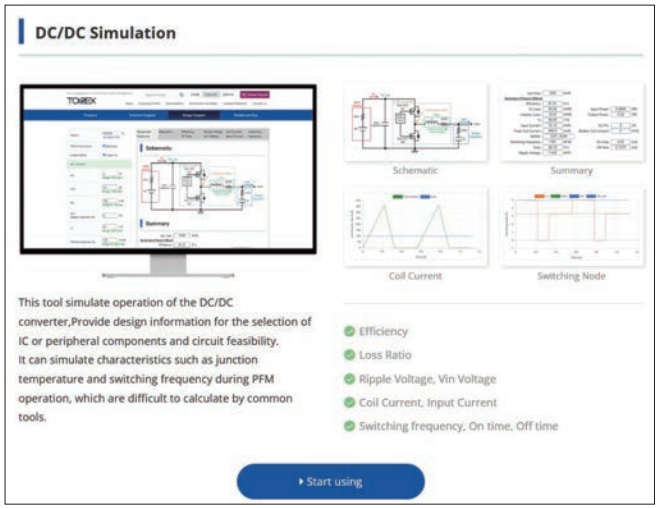






■Access to the Web DC/DC Simulation

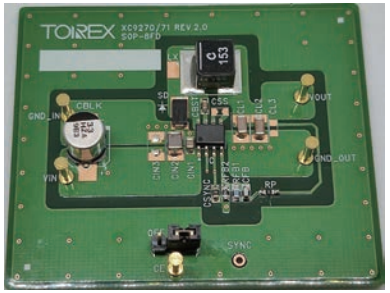




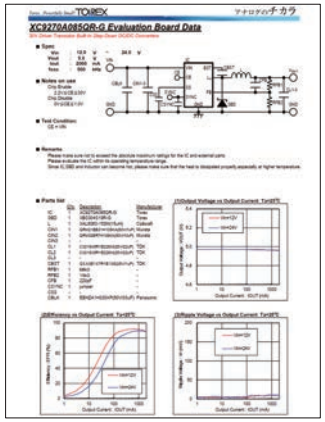
TOREX Customer Support

■Providing evaluation boards for a variety of products

Evaluation boards of variety ICs are provided free of charge to those considering TOREX products. "Evaluation boards optimized for power supply specifications" can be provided by "selecting optimum ICs and peripheral components" based on the power supply specifications. In addition to standalone IC evaluation boards, we can also provide evaluation boards for application circuits, etc.



Example Provision of Evaluation Boards



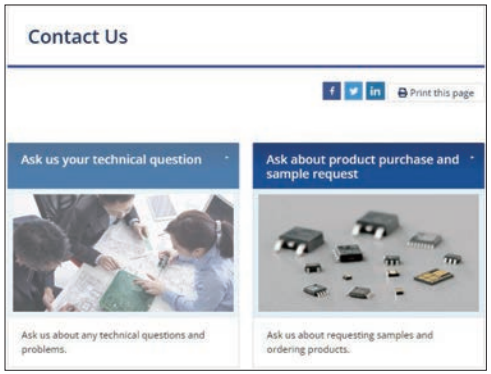
Evaluation Board Report

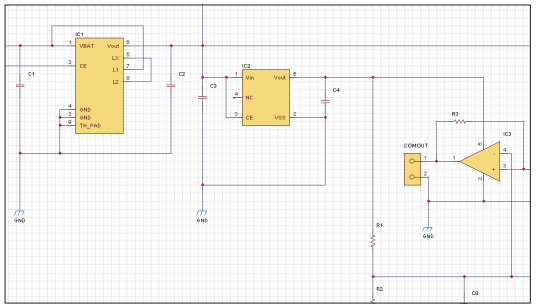
■Technical Inquiries/Online Technical Consultation

For power supply IC and power supply circuit related technical consultations, please contact TOREX website "Ask us your technical question" page or the TOREX Sales Department or a sales agent.

Technical consultation with a TOREX FAE is also available via online technical consultation.

It is now possible to smoothly hold for previously difficult to check the customer's "circuit diagram" and "PCB layout" and technical consultations of complex issues.





■Provision of ECAD model and Gerber files

ECAD Models, Gerber files can be downloaded from the product page.

■Online Purchase of ICs and Evaluation Boards

TOREX products and evaluation boards can be purchased from the following site.

Digi-Key ELECTRONICS
MOUSER ELECTRONICS
Farnell AN AVNET COMPANY
ONEYAC 唯样
chip 1 stop An Arrow Company

List of Links

■Design Support Tools

●Web DC/DC Simulation

From the website : "Design Support" → "DC/DC Simulation"
URL : https://www.torexsemi.com/design-support/dcdc-simulation/

●Web DC/DC Measured Electrical Characteristics Comparison Tool

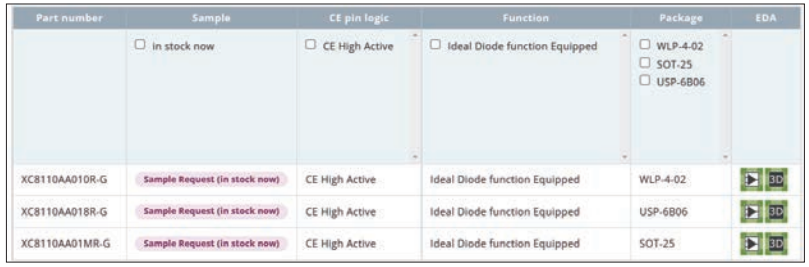
From the website : "Design Support" → "DC/DC Measured Electrical Characteristics Comparison Tool"
URL : https://www.torexsemi.com/design-support/dcdc-efficiency-size-comparison/

●Spice Model

From the website : "Design Support" → "SPICE Model"
URL : https://www.torexsemi.com/design-support/

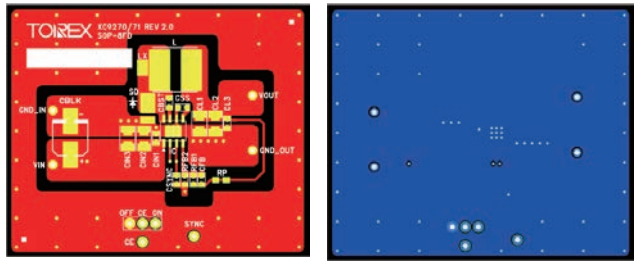
●ECAD Model

From the website : "Product Pages" → "Sample Request" → "EDA"



●Gerber File

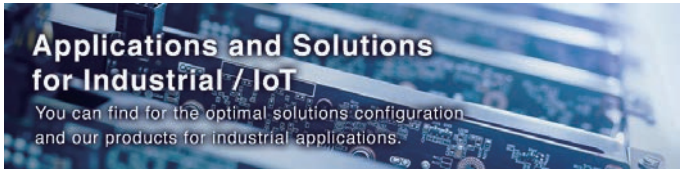
From the website : "Product Pages"
→ "Technical Document"



■Applications and Solutions

●Applications for industrial equipment and IoT

From the website : "by Applications / Solutions"
→ "Applications and Solutions for Industrial/IoT"
URL : https://www.torexsemi.com/by-application/industrial/



●Technical Inquiries/Online Technical Consultation

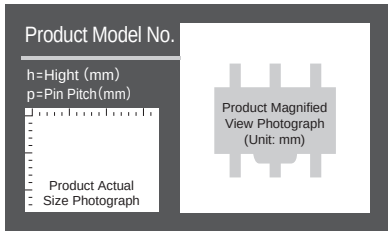
From the website : "Contact Us"
→ "Ask us your technical question"
URL : https://www.torexsemi.com/contact-us/technical-inquiry/

●Evaluation Board Requests

From the website : "Sample and Buy" → "Requesting Evaluation Boards"
URL : https://www.torexsemi.com/sample-and-purchase/evaboard

Package Lineup

■External Dimensions Drawing



CL-2025
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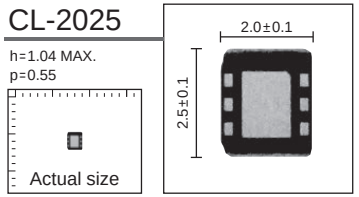

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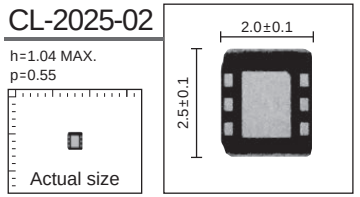
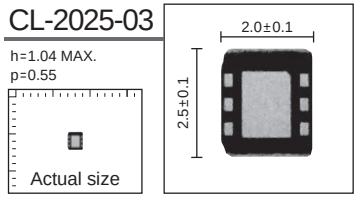
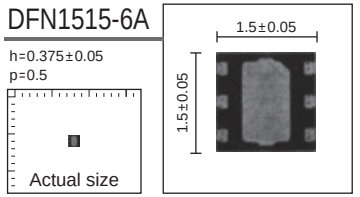


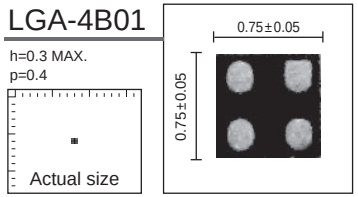
CL-2025-03
h=1.04 MAX.
p=0.55



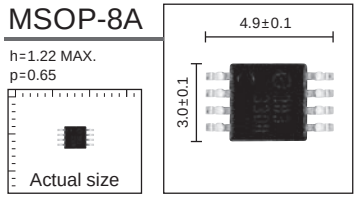
DFN1515-6A
h=0.375±0.05
p=0.5



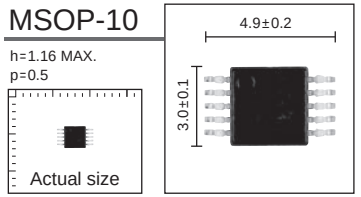
LGA-4B01
h=0.3 MAX.
p=0.4



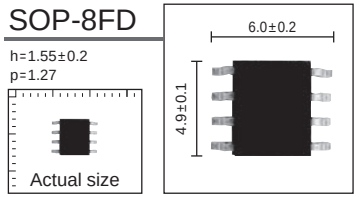
MSOP-8A
h=1.22 MAX.
p=0.65



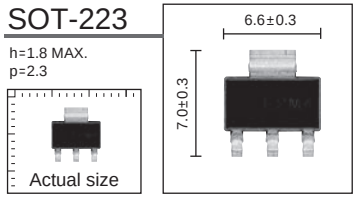
MSOP-10
h=1.16 MAX.
p=0.5



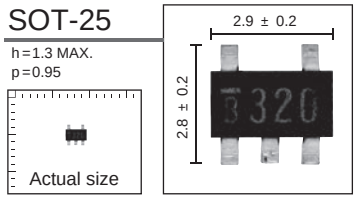
SOP-8FD
h=1.55±0.2
p=1.27



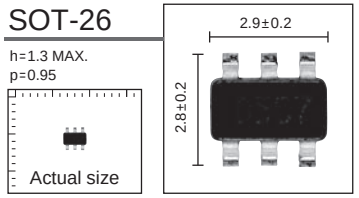
SOT-223
h=1.8 MAX.
p=2.3



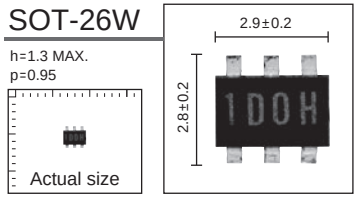
SOT-25
h=1.3 MAX.
p=0.95



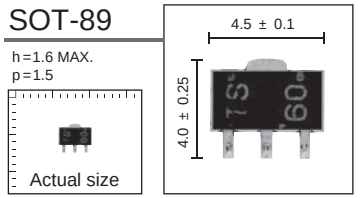
SOT-26
h=1.3 MAX.
p=0.95



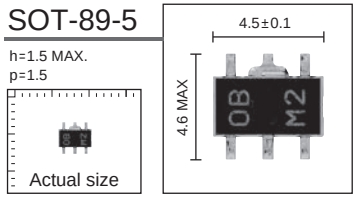
SOT-26W
h=1.3 MAX.
p=0.95



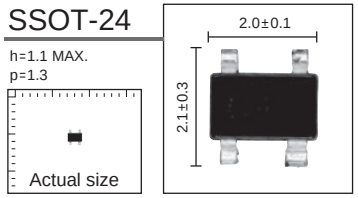
SOT-89
h=1.6 MAX.
p=1.5



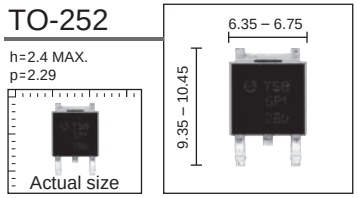
SOT-89-5
h=1.5 MAX.
p=1.5



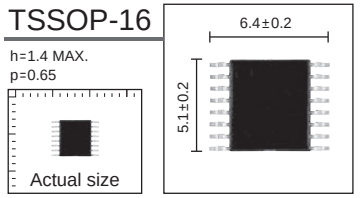
SSOT-24
h=1.1 MAX.
p=1.3



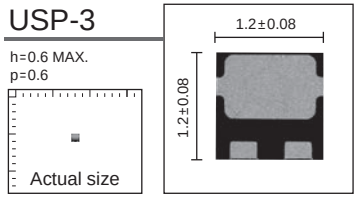
TO-252
h=2.4 MAX.
p=2.29



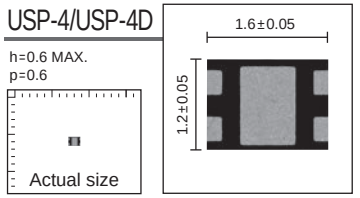
TSSOP-16
h=1.4 MAX.
p=0.65



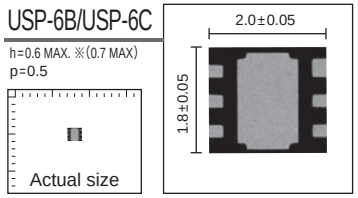
USP-3
h=0.6 MAX.
p=0.6



USP-4/USP-4D
h=0.6 MAX.
p=0.6

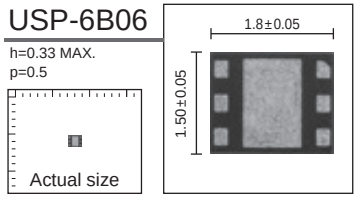


USP-6B/USP-6C
h=0.6 MAX. ※(0.7 MAX)
p=0.5

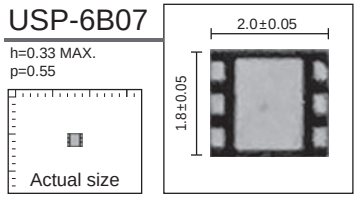


※USP-6B

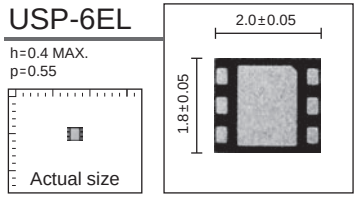
USP-6B06
h=0.33 MAX.
p=0.5



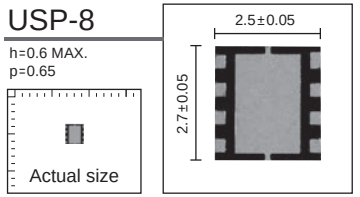
USP-6B07
h=0.33 MAX.
p=0.55



USP-6EL
h=0.4 MAX.
p=0.55



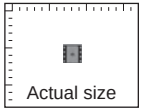
USP-8
h=0.6 MAX.
p=0.65

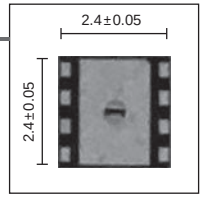


Package Lineup

USP-8B05

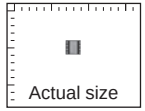
h=0.33±0.3
p=0.6

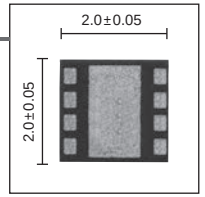




USP-8B06

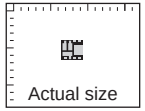
h=0.33 MAX.
p=0.5

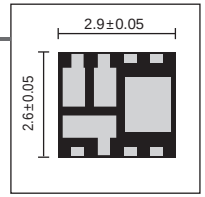




USP-8B10

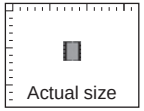
h=0.33 MAX.
p=0.65

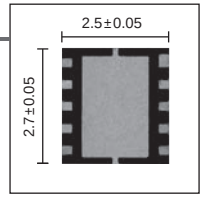




USP-10

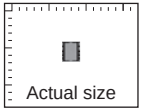
h=0.6 MAX.
p=0.5

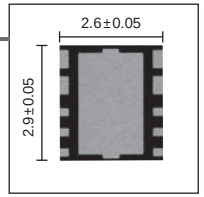




USP-10B

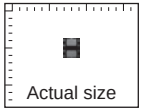
h=0.6 MAX.
p=0.65/0.5

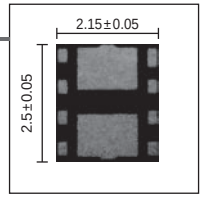




USP-10B03

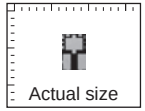
h=1.0±0.05
p=0.65

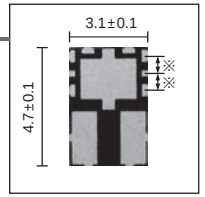




USP-11B01

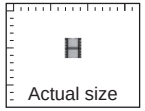
h=1.35 MAX.
※p=0.675

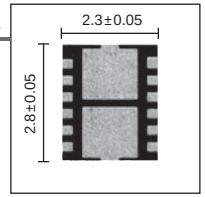




USP-12B01

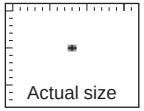
h=0.6 MAX.
p=0.4

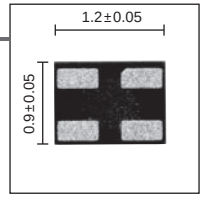




USPN-4

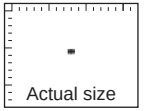
h=0.4 MAX.
p=0.55

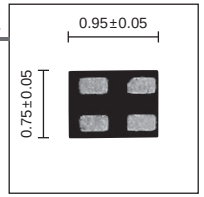




USPN-4B02

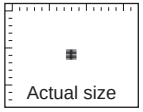
h=0.4 MAX.
p=0.4

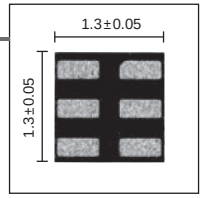




USPN-6

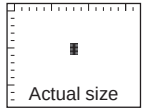
h=0.4 MAX.
p=0.45

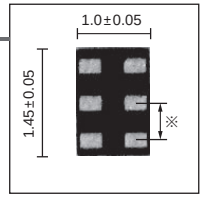




USPN-6B01

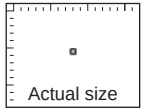
h=0.4 MAX.
※p=0.5

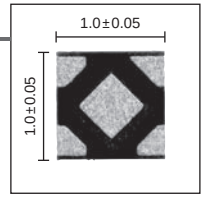




USPQ-4B03

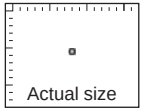
h=0.4 MAX.
p=0.65

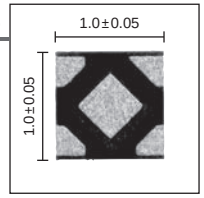




USPQ-4B04

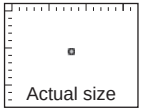
h=0.6 MAX.
p=0.65

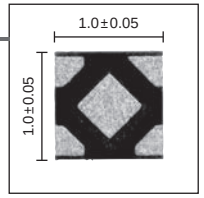




USPQ-4B05

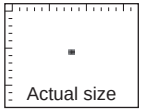
h=0.33 MAX.
p=0.65

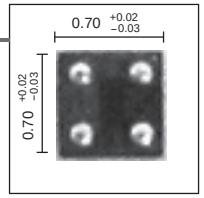




WLP-4-01

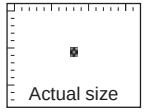
h=0.2 MAX.
p=0.4

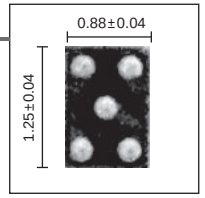




WLP-5-02

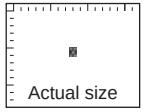
h=0.4 MAX.
p=0.5

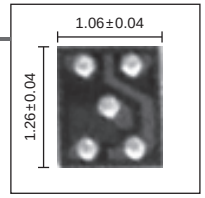




WLP-5-03

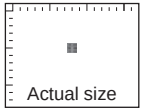
h=0.4 MAX.
p=0.5/0.625

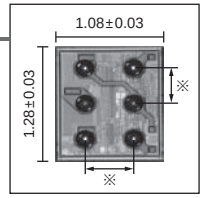




WLP-6-01

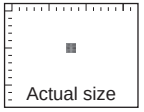
h=0.4 MAX.
※p=0.4/0.5

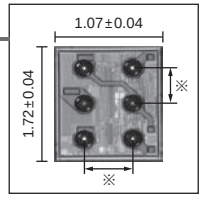




WLP-6-03

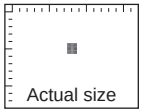
h=0.33 MAX.
※p=0.6

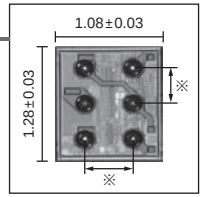




WLP-6-05

h=0.4 MAX.
※p=0.4/0.5





https://www.torexsemi.com/

TOREX SEMICONDUCTOR LTD.

Head office
3F DAIHO ANNEX 1-24-1 Shinkawa, Chuo-ku, Tokyo 104-0033 Japan
TEL.+81-3-6222-2851　FAX.+81-3-6222-2892

Sales Contacts

Sales division
6F DAIHO ANNEX 1-24-1 Shinkawa, Chuo-ku, Tokyo 104-0033 Japan
Tel:+81-3-6222-2860　Fax:+81-3-6222-2894

Kansai office sales
1-9-23 Esaka-cho, Suita, Osaka 564-0063 Japan
Tel:+81-6-7670-1114　Fax:+81-6-7670-0768

Nagoya Office
605 NK Marunouchi Bldg., 2-17-13 Marunouchi, Naka-ku, Nagoya, Aichi 460-0002 Japan
Tel:+81-52-766-3183

TOREX SEMICONDUCTOR (S) PTE LTD
60 Kaki Bukit Place Eunos Techpark　#05-17 Singapore 415979
Tel:+65-6745-1352　Fax:+65-6741-0389

TOREX USA Corp.
2 Venture Suite 470　Irvine, CA 92618
Tel:+1-949-261-2022　Fax: +1-949-261-2066

TOREX SEMICONDUCTOR EUROPE LIMITED
Unit 1, The Courtyard Whitwick Business Park, Stenson Road, Coalville LE67 4JP, UK
Tel:+44-1530-510190　Fax:+44-1530-512400

TOREX SEMICONDUCTOR DEVICE (Shanghai) CO., LTD.
Room 401, West Tower, Sun Plaza, No.88 Xianxia Road, Shanghai, China
Tel:+8621-6209-1166　Fax:+8621-3255-0536

TOREX SEMICONDUCTOR DEVICE (Shanghai) CO., LTD. SHENZHEN OFFICE
RM1705, E BLDG of BAONENG Center, No.3008, North BAOAN Road, LUOHU District, Shenzhen, Guangdong, China
Tel:+86-755-8326-6338　Fax:+86-755-8326-6383

TOREX (HONG KONG) LIMITED
Unit 505, Energy Plaza, 92 Granville Road, TST East, Kowloon, HK
Tel:+852-2312-7489　Fax:+852-2312-7589

TOREX SEMICONDUCTOR TAIWAN LTD.
11F-1, No21, Sec.6, Zhong Xiao E. Rd., Taipei City 11575, Taiwan
Tel:+886-2-2789-2089　Fax:+886-2-2789-0799

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