Product Information for Automotive

RoHS Compliant

Halogen Antimony FREE

TOREX...*Powerfully Small!*

Expanding Applications for In Vehicle Products

The growth of automotive electronics, which began with stereos and air conditioners, has expanded to include information devices such as various meters, automotive navigation systems, and ETC systems, and the installation of electronic devices will accelerate in the future with the goals of achieving greater security, safety, and comfort.
Together with the progress of this spread of electronics, the total electric power of such devices is rising, increasing the importance of power supply ICs to control them.
Since its establishment, Torex has provided power supply ICs to a wide range of customers as the only specialized manufacturer of analog power supply ICs in Japan, and we will continue to offer the best possible solutions for in vehicle electronic products by applying the miniaturization and low power consumption technology we have developed up to this point.

Reasons our Customers Choose Torex's Power Supply Solutions

Small packages allow flexibility in layouts	High-efficiency power supplies can suppress heat generation	High-efficiency power supplies can simplify power supply related areas	Extremely infrequent maintenance and discontinuance mean they can be used with peace of mind

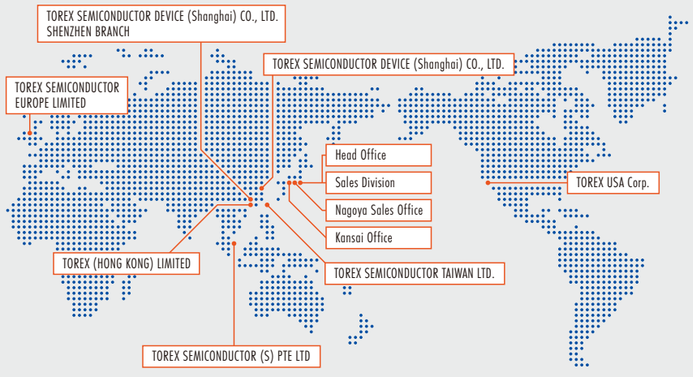
Design Support

In addition to detailed information on each product, evaluation boards can be provided for many of our products. Please contact Torex Sales for details.

Evaluation Board

Sales Support

Torex has established its own sales offices in various areas around the world, ensuring that we can offer a complete global support system.



Applications For Use

※ Examples of Use In Vehicles

Torex's power supply ICs, which skillfully apply their small sizes and low power consumption, are used in various in vehicle products.

DC/DC converters

A series of DC/DC converters can be high-efficiently used to configure power supplies. Torex has applied the expertise developed over its long history to offer a lineup including step-down DC/DCs which can achieve efficiencies of over 90%, and products which can operate at high efficiency even with small sizes.

Inductor Built-in DC/DC converters

A series of ultra-small inductor built-in DC/DC converters in which the coil and control IC are unified using Torex's independent technology.
They can contribute to reduced design workloads, lower noise, and smaller sizes.

Voltage Regulators

Stable power supplies are essential for the operation of electronic devices. We provide a lineup of high-performance LDOs which can be configured in the most suitable arrangements to support conditions from low to high voltages.

Reset ICs

Voltage detector ICs to monitor voltage and send signals to microcomputers or other equipment. Since they have low quiescent current specifications, they can constantly monitor voltage at various locations, including input voltage and output voltage. Their high-precision, stable operation allows them to be used for microcomputer resets, and to be set with delay times as required.

Product Lineup

Torex's automotive ICs conforms to **AEC-Q100**※

		Series	Input Voltage	Output Current	Features
For Primary Power +48V +24V +12V	VR Voltage Regulator	XD6216	28V	150mA	Low Power Consumption Ldo
		XD6702	36V	300mA	High-speed Ldo
		XD6704 Developing	60V	150mA	Low Power Consumption Ldo
	DC/DC DC/DC Converter	XD9267/68	36V	600mA	Light Load High Efficiency Ultra-small Synchronous Step-Down DC/DC
		XDL605/606	36V	600mA	Light Load High Efficiency Ultra-small Inductor Built-in Synchronous Step-Down DC/DC
For Secondary Power Supply	VR Voltage Regulator	XD6506	5.5V	150mA	Low Power Consumption Ldo
	DC/DC DC/DC Converter	XD9260/61	5.5V	1.5A	Light Load High Efficiency Ultra-small Synchronous Step-Down DC/DC
		XDL601/602	5.5V	1.5A	Light Load High Efficiency Ultra-small Inductor Built-in Synchronous Step-Down DC/DC
		XD9242/43	6.0V	2A	Light Load High Efficiency Synchronous Step-Down DC/DC
		XD9263/64	18V	500mA	Light Load High Efficiency Ultra-small Synchronous Step-Down DC/DC
		XDL603/604	18V	500mA	Light Load High Efficiency Ultra-small Inductor Built-in Synchronous Step-Down DC/DC
	VD+WDT Reset Ic + Watchdog Timer	XD6121-24	6V		Wdt with On/Off VD+WDT
		XD6130/31	6V		Delay Time Setting Pin VD+WDT
	VD Reset Ic	XD6132	6V		Delay Time Setting Pin Separated Sense Pin HYS External Adjustment
		XD6133	6V		Delay Time Setting Pin Separated Sense Pin

※AEC (Automotive Electronics Council) This standard, specified by the AEC, designates reliability tests and quality tests which apply to integrated circuits. These tests use stricter conditions than general consumer products and therefore guarantee high quality for in vehicle products.

Step-Down DC/DC Converters

Series	Operating Ambient Temperature	Control Methods	Operating Voltage (Maximum Rating)	Output Voltage	Accuracy	Output Current	Oscillation Frequency	Package	Others
XD9260	-40～105℃	PWM	2.7～5.5V (6.2V)	0.8～3.6V	±2.0%	1.5A	1.2MHz 3.0MHz	USP-6C	Synchronous Rectifier, Heat Protection, Current Limit, Soft-start Circuit Built-in, CL High Speed Auto Discharge (B Type), UVLO, HiSAT-COT Control
XD9261		PWM/PFM							
XD9242	-40～85℃	PWM	2.7～6.0V (7.0V)	Externally Set (0.9～VIN)	±2.0%	2A	1.2MHz 2.4MHz	USP-10B	Synchronous Rectifier, Heat Protection, Current Limit, Soft-start Circuit Built-in, CL High Speed Auto Discharge, UVLO
XD9243		PWM/PFM							
XD9263	-40～105℃	PWM	3.0～18.0V (20.0V)	Externally Set (1.0～15V)	±1.5%	500mA	2.2MHz	SOT-25 USP-6C	Synchronous Rectifier, Heat Protection, Current Limit, Soft-start Circuit Built-in, UVLO, Power Good Output (USP-6C)
XD9264		PWM/PFM							
XD9267	-40～105℃	PWM	3.0～36.0V (40.0V)	Externally Set (1.0～25V)	±1.5%	600mA	2.2MHz	SOT-89-5 USP-6C	Synchronous Rectifier, Heat Protection, Current Limit, Soft-start Circuit Built-in, UVLO, Power Good Output (USP-6C), Short-circuit Protection, Hiccup or Short Circuit Protection
XD9268		PWM/PFM							

Point! DC/DC Converter

Torex's DC/DC converter control with HiSAT-COT which is proprietary high-speed transient response technology developed uniquely by Torex.

Products XD9260/61 XDL601/602

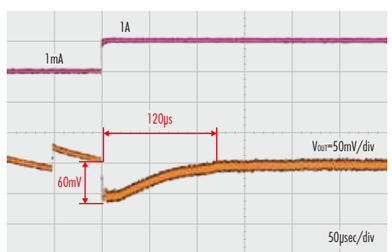
HiSAT-COT

High **S**peed circuit **A**rchitecture for **T**ransient with **C**onstant **O**n **T**ime

High-speed Transient Response | COT=PFM mode

Existing Product (fosc=2.4MHz)

VIN=5V, VOUT=1.8V, L=2.2μH, CIN=10μF, CL=20μF



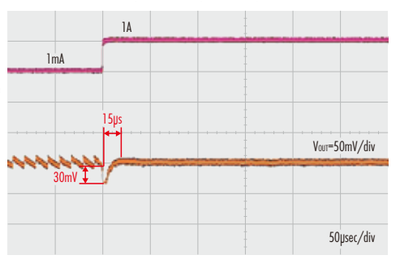
Compared with existing product, load transient response characteristics

Drop Volume 1/2

Response Speed 8 Times

XD9260/XD9261 (fosc=3.0MHz)

VIN=5V, VOUT=1.8V, L=1μH, CIN=10μF, CL=20μF



Inductor Built-in DC/DC Converters

Series	Operating Ambient Temperature	Control Methods	Operating Voltage (Maximum Rating)	Output Voltage	Accuracy	Output Current	Oscillation Frequency	Package	Others
XDL601	−40～105°C	PWM	2.7～5.5V (6.2V)	0.8/1.0/1.1/ 1.2/1.25/1.3/ 1.35/1.5/1.8/ 2.5/3.0/3.3V	±2.0%	1.5A	3.0MHz	DFN3625-11A	Synchronous Rectifier, Heat Protection, Current Limit, Soft-start Circuit Built-in, CL High Speed Auto Discharge (B Type), UVLO, HiSAT-COT Control
XDL602		PWM/PFM							
XDL603	−40～105°C	PWM	3.0～18.0V (20.0V)	Externally Set (1.0～15V)	±1.5%	500mA	2.2MHz	DFN3625-11B	Synchronous Rectifier, Heat Protection, Current Limit, Soft-start Circuit Built-in, UVLO, Power Good Output
XDL604		PWM/PFM							
XDL605	−40～105°C	PWM	3.0～36.0V (40.0V)	Externally Set (1.0～5.0V)	±1.5%	600mA	2.2MHz	DFN3625-11B	Synchronous Rectifier, Heat Protection, Current Limit, Soft-start Circuit Built-in, UVLO, Power Good Output, Short-circuit Protection, Hiccup or Short Circuit Protection
XDL606		PWM/PFM							

Point! Inductor Built-in DC/DC Converter

Inductor built-in DC/DC converter has the following merits.

Simplified Design The only peripheral components are externally-mounted capacitors, allowing design evaluation time to be shortened.

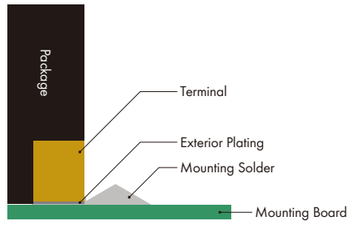
Noise Reduction Circuits are optimized within the package to suppress switching noise and achieve lower EMI.

Space savings The completed board wiring of peripheral components is minimized, for increased space benefits.

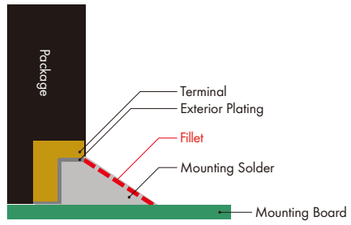
Simple thermal design Power supply circuits containing heat dissipating structures are optimized, to achieve DC/DC capacitors with small sizes and high efficiency.

Their package used wettable flank plated.

Existing Leadless Product



Wettable Flank Plated



If fillets (areas with a flared shape) exist on the side faces, they indicate a high likelihood that junctions have been completed. This makes it possible for automatic appearance inspections to be employed.

Voltage Regulators

Series	Operating Ambient Temperature	Output Current	Input Voltage (Maximum Rating)	Output Voltage	Output Voltage Accuracy	Quiescent Current	Dropout Voltage @100mA	Package	Others
XD6506	−40～105°C	150mA	1.5～6.0V (7V)	1.0/1.1/1.2/ 1.3/1.5/1.8/ 2.5/3.0/3.3V	±2.0%	0.8μA	320mV	SOT-25	Current Limit
XD6216	−40～105°C	150mA	2.0～28V (30V)	3.3/5.0/8.0V	±2.0%	5μA	1.5V	SOT-89-5 SOT-25	Current Limit, Heat Protection
XD6702	−40～105°C	300mA	4.5～36V (42V)	1.8/2.5/2.8/ 3.0/3.3/5.0/ 8.0V	±1.0%	40μA	350mV	SOT-89-5	Current Limit, Heat Protection, Soft-start Circuit Built-in, 65dB@1kHz
Developing XD6704	−40～125°C	150mA	3.0～60V	1.8/2.5/2.8/ 3.0/3.3/5.0/ 8.0/9.0/12.0V	±1.0%	2μA	250mV @50mA	SOT-89-5 HSOP-6J DFN3030-10	Current Limit, Heat Protection

Voltage Detectors

Series	Operating Ambient Temperature	Input Voltage (Maximum Rating)	Detect Voltage	Detect Voltage	Accuracy	Hysteresis	Quiescent Current	Release Delay Time	Watchdog	Package	Others
XD6121 XD6122 XD6123 XD6124	−40～85°C	1.0～6.0V (7.0V)	V_{IN}	1.6/2.2/2.3/ 2.4/2.9/3.0/ 3.1/4.4/4.5/ 4.6V	±2.0%	5%	10μA	Built In	○	SOT-25	Built-in Delay Time&Built-in Watchdog, Timeout Time Variation, Watchdog Function and On/Off Control
XD6130	−40～125°C	1.5～6.0V (7.0V)	V_{IN}	1.6/2.2/2.3/ 2.4/2.9/3.0/ 3.1/4.4/4.5/ 4.6V	±1.0%	5%	9.8μA	Adjustment	○	SOT-26	External Capacitor Type Delay Function, Watchdog Timeout Time, Combination of Release Delay Time Setting Pin, Manual Reset Function
XD6131	−40～125°C	1.5～6.0V (7.0V)	V_{IN}	1.6/2.2/2.3/ 2.4/2.9/3.0/ 3.1/4.4/4.5/ 4.6V	±1.0%	5%	9.8μA	Adjustment	○	SOT-26	External Capacitor Type Delay Function, Watchdog Timeout Time, Combination of Release Delay Time Setting Pin, Watchdog Function and On/Off Control
XD6132	−40～125°C	1.6～6.0V (7.0V)	SENSE	1.0V	±1.2%	0.10%	1.65μA	Adjustment	—	SOT-26 USP-6C	Surge Voltage Protection Function, External Capacitor Type Delay Function, Output Logic Can Be Selected with "H" or "L", Adjustable Hysteresis Width with External Resistor
XD6133	−40～125°C	1.6～6.0V (7.0V)	SENSE	1.3/1.6/2.2/ 2.3/2.4/2.9/ 3.0/3.1/4.4/ 4.5/4.6V	±1.2%	5%	1.65μA	Adjustment	—	SOT-26 USP-6C	External Capacitor Type Delay Function, Output Logic Can Be Selected with "H" or "L"

Point! Voltage Detector

Torex's voltage detector corresponds to the operating ambient temperature of 125 °C.

Products XD6130/31 XD6132/33

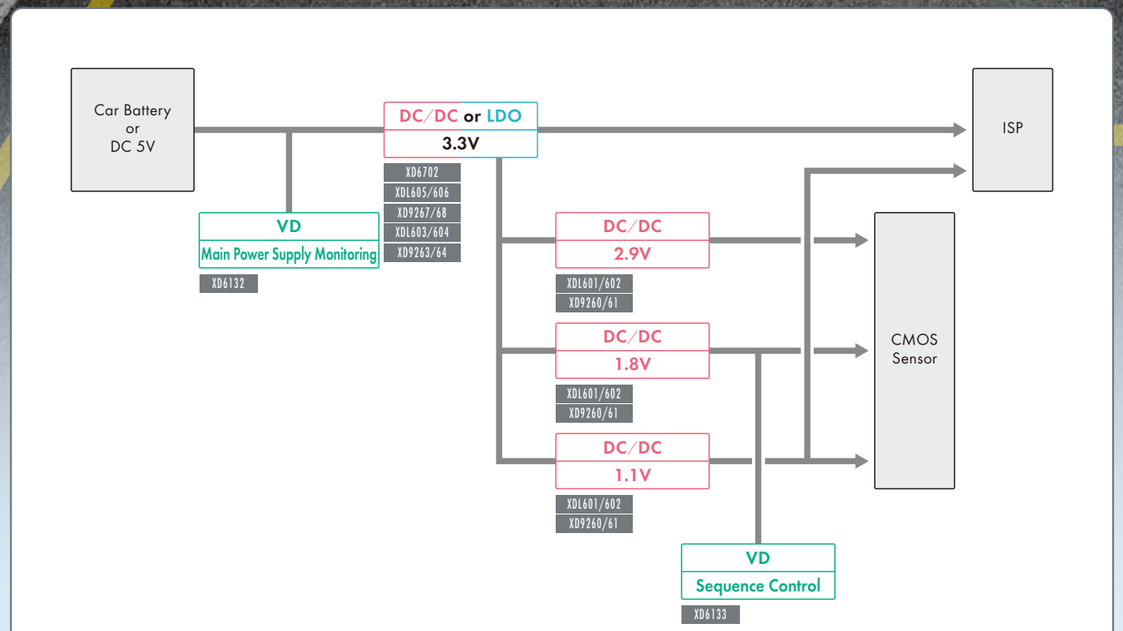
Others

- Hysteresis can be set as desired with just one resistor — Products XD6132
- Surge voltage protection functions make CLamp diodes unnecessary — Products XD6132
- Built-in cancellation delay times — Products XD6121-24
- Watchdog ON/OFF functions — Products XD6121-24 XD6131

These and many other functions can satisfy the varying needs of our customers.

Dashcam

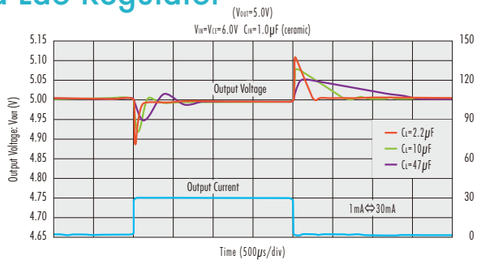
The in-vehicle camera is expected to grow greatly in the future because of the introduction to electric mirror etc. and increasing of the vehicle camera installation with the spread of ADAS (Advanced driving support system) in additional to the conventional surround view systems.



36V Input 300mA
Low Quiescent Current High Speed Ldo Regulator
XD6702

AEC-Q100 Grade2 | For Primary Power Supply

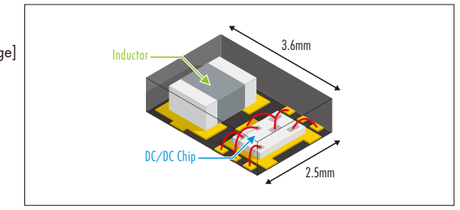
- **Wide Range of Input Voltage** 4.5～36V [46V (≦400ms) Surge Withstand Voltage]
- **Low Noise** Ripple rejection ratio 65dB@1kHz
- **High-speed Transient Response**



36V 600mA
Inductor Built-in Step-Down DC/DC Converter (micro DC/DC)
XDL605/606

AEC-Q100 Grade2 | For Primary Power Supply

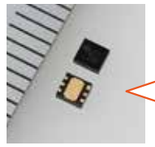
- **Wide Range of Input Voltage** 3.0～36V [46V (≦400ms) Surge Withstand Voltage]
- **Space-saving** Space Savings than Configuring Separately
- **Low Noise** Optimized Realizes Low EMI
- **Light Load High Efficiency, Low Quiescent Current**
- **High Reliability** Wettable Flank Plated, High Heat Dissipation



36V Withstand Voltage 600mA
Ultra-small Step-Down DC/DC Converter
XD9267/68

AEC-Q100 Grade2 | For Primary Power Supply

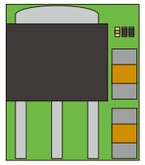
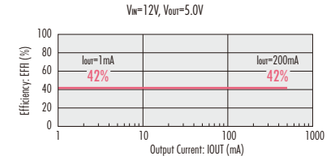
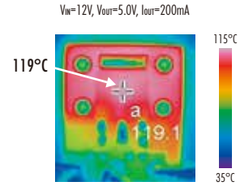
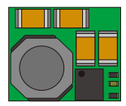
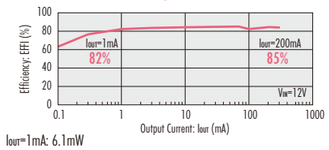
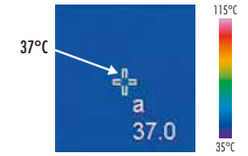
- **Wide Range of Input Voltage** 3.0～36V [46V (≦400ms) Surge Withstand Voltage]
- **Space-saving** Ultra-small Package (USP-6C)
  Small size coil can be used with oscillation frequency of 2.2 MHz
- **Light Load High Efficiency, Low Quiescent Current (12.6μA)**



Small Package USP-6C
(1.8*2.0*h0.6mm)

World's Smallest Class
36V Synchronous Step Down DC/DC

Since these two products have low loads with high efficiency and excellent space-saving properties, they can easily be used as replacements for voltage regulators.

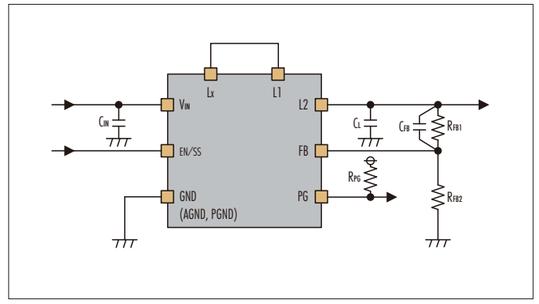
	Part Area	Efficiency	Heating
Voltage Regulator	 85.85mm²	 VIN=12V, VOUT=5.0V; IOUT=1mA 42%; IOUT=200mA 42%; IOUT=1mA: 12mW; IOUT=0.2A: 2400mW	 VIN=12V, VOUT=5.0V, IOUT=200mA; 119°C; 115°C; 35°C
Mounting Area 1/2		Power 1/2	Temperature 1/3
XD9268	 43.2mm²	 IOUT=1mA 82%; IOUT=200mA 85%; VIN=12V; IOUT=1mA: 6.1mW; IOUT=0.2A: 1175mW	 37°C; 115°C; 35°C
Mounting Area 1/3			
XDL606	 30.16mm²		

18V Operation Voltage 500mA Inductor Built-in Step-Down DC/DC Converter (micro DC/DC)

XDL603/604

AEC-Q100 Grade2 | For Primary Power Supply | For Secondary Power Supply

- **Wide Range of Input Voltage**
  3.0～18V (Absolute Max 20V)
- **Space-saving**
  Space Savings than Configuring Separately
- **Low Noise**
  Optimized Realizes Low EMI
- **Light Load High Efficiency, Low Quiescent Current**
- **High Reliability**
  Wettable Flank Plated, High Heat Dissipation

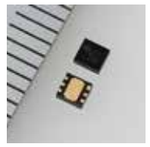


18V Operation Voltage 500mA Step-Down DC/DC Converter (micro DC/DC)

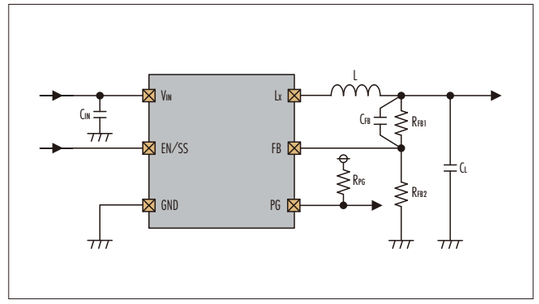
XD9263/64

AEC-Q100 Grade2 | For Primary Power Supply | For Secondary Power Supply

- **Wide Range of Input Voltage**
  3.0～18V (Absolute Max 20V)
- **Space-saving**
  Ultra-small Package (USP-6C)
  Small Size Coil Can Be Used with Oscillation Frequency of 2.2 MHz
- **Light Load High Efficiency,**
  Low Quiescent Current (13.5μA)



Small Package USP-6C
(1.8×2.0×h0.6mm)

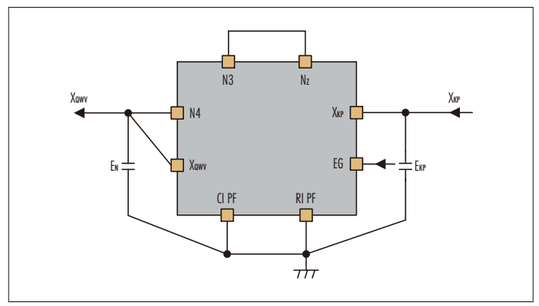


5.5V Operation Voltage 1.5A Inductor Built-in Step-Down DC/DC Converter (micro DC/DC)

XDL601/602

AEC-Q100 Grade2 | For Secondary Power Supply

- **Space-saving**
  Space Savings than Configuring Separately
- **Low Noise**
  Optimized Realizes Low EMI
- **High-speed Response**
  HiSAT-COT is proprietary High-speed transient response technology developed uniquely by Torex.
- **Light Load High Efficiency, Low Quiescent Current**
- **High Reliability**
  Wettable Flank Plated, High Heat Dissipation

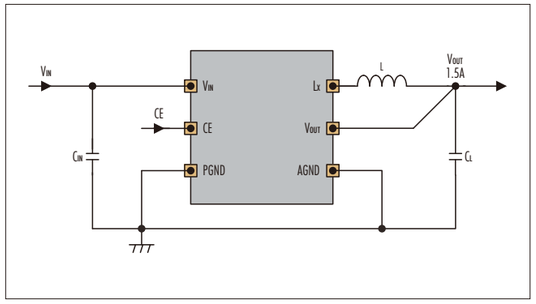


5.5V Operation Voltage Cot-Control 1.5A Synchronous Step-Down DC/DC

XD9260/61

AEC-Q100 Grade2 | For Secondary Power Supply

- **Space-saving**
  Ultra-small Package (USP-6C)
  Small Size Coil Can Be Used with Oscillation Frequency of 3.0MHz
- **High-speed Response**
  HiSAT-COT is proprietary High-speed transient response technology developed uniquely by Torex.
- **Light Load High Efficiency, Low Quiescent Current**



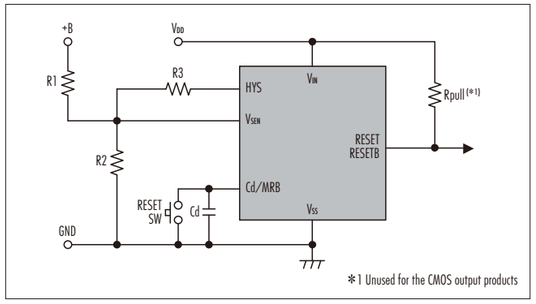
Delay Capacity Adjustable Voltage Detectors with Sense Pin Isolation, Surge Voltage Protection, and HYS External Adjustment

XD6132

AEC-Q100 Grade1

- **Selectable Detection Delay / Release Delay Time Ratio**
- **Output Logic Can Be Selected with "H" or "L"**
- **External Hysteresis Width Adjustment**
- **Surge Protection**
- **Ultra-small Package (USP-6C)**
- **～125 °C (AEC-Q100 Grade1)**

Battery voltage (+B) monitoring:
High voltages are detected by the division of R1/R2 resistors. R3 can be connected between the VSEN-HYS terminals to add hysteresis as desired.



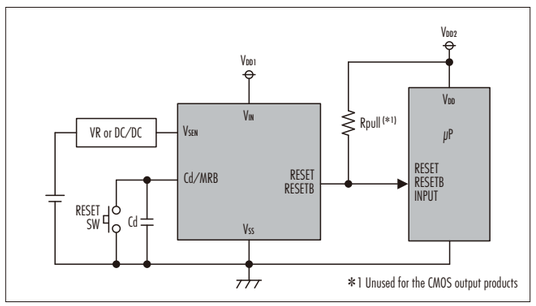
*1 Unused for the CMOS output products

Delay Capacity Adjustable Voltage Detectors with Sense Pin Isolation

XD6133

AEC-Q100 Grade1

- **Selectable Detection Delay / Release Delay Time Ratio**
- **Output Logic Can Be Selected with "H" or "L"**
- **Ultra-small Package (USP-6C)**
- **～125 °C (AEC-Q100 Grade1)**



*1 Unused for the CMOS output products

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