

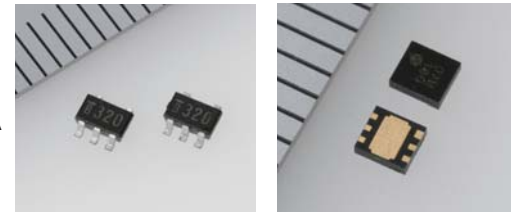
Step-Up Synchronous PFM DC/DC Converter

# XC9140 Series



The XC9140 series is a synchronous rectification type step-up DC/DC converter. The combination of PFM control and a CMOS structure achieves a low supply current, making these converters ideal for portable devices where battery life is a concern.

Product startup is possible from an input voltage  $V_{IN}=0.9V$  when the load current is 1mA and the output voltage is 3.3V, enabling these ICs to be used in devices that use one alkaline battery or one nickel-hydrogen battery. Two types are available: one that breaks continuity between the input and output using the load break function at shutdown, and one that maintains continuity between the input and output using the bypass mode function at shutdown.



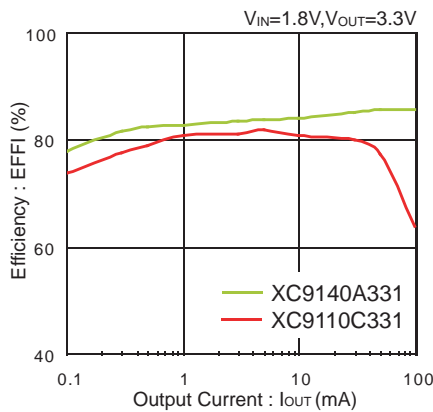
SOT-25

USP-6EL



### Synchronous rectification improves efficiency

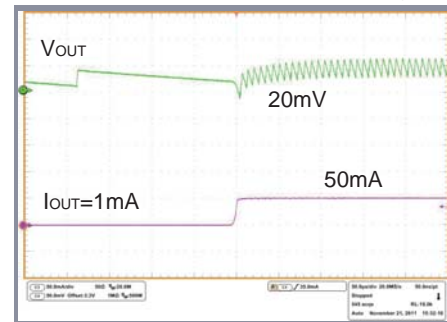
The XC9140 series uses the synchronous rectification control method to reduce energy loss and improve efficiency compared to the previous XC9110 series.



### Improved load transient response characteristics

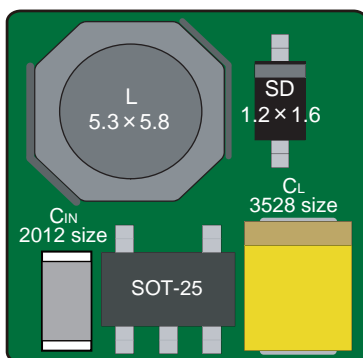
The XC9140 series improves the load transient response to limit output voltage drops when the load current fluctuates. In addition, current control is used to control the coil current, enabling improvement of ripple voltage.

XC9140A331, L=4.7  $\mu$  H, C<sub>IN</sub>=10  $\mu$  F, C<sub>L</sub>=20  $\mu$  F (ceramic)



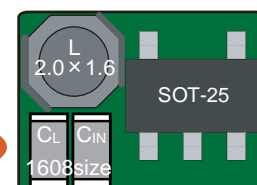
### Miniaturization is achieved

#### XC9110/XC9111



The switching frequency is 1.2MHz, making it possible to use a small coil and ceramic capacitors. This enables mounting on an area that is approximately 74% smaller than previous products.

#### XC9140



$52.98\text{mm}^2 \Rightarrow 13.88\text{mm}^2$

Total component area

Features			
Input Voltage Range	0.9V~5.5V	High Speed Load Transient Response	20mV@V <sub>OUT</sub> =3.3V, V <sub>BAT</sub> =1.8V, I <sub>OUT</sub> =1→50mA
Fixed Output Voltage Range	1.8V~5.0V (±2.0%), 0.1V Increments	PFM Switch Current	350mA
Output Current	100mA@V <sub>OUT</sub> =3.3V, V <sub>BAT</sub> =1.8V	Function	Input bypass mode function or load break function
Driver Transistor Built-in	0.6 $\Omega$ (N-ch Driver Tr.)		UVLO
	0.65 $\Omega$ (P-ch Driver Tr.)	Capacitor	Ceramic Capacitor Compatible
Power Consumption	6.3 $\mu$ A (V <sub>BAT</sub> =V <sub>OUT</sub> +0.5V)	Packages	SOT-25, USP-6EL



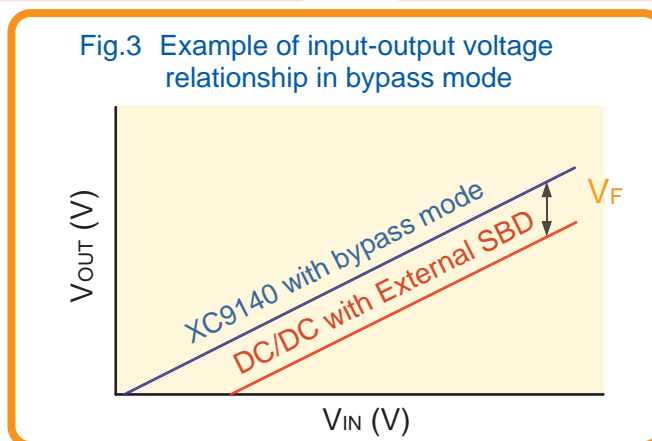
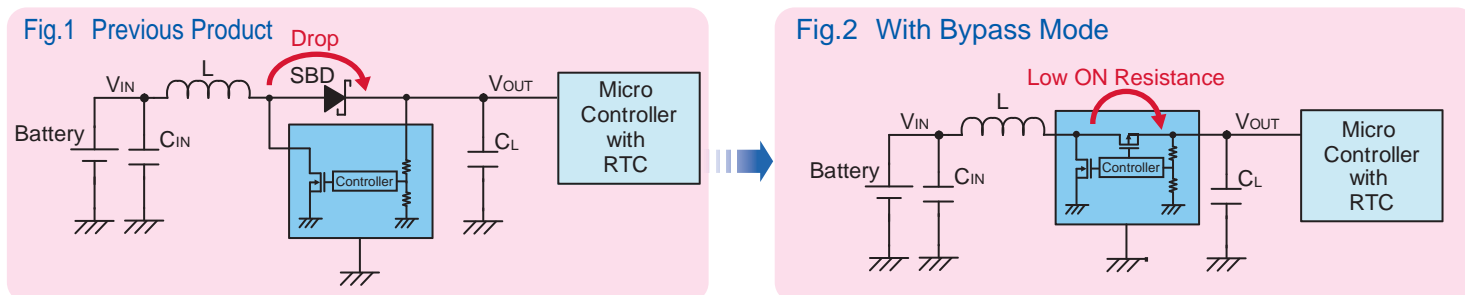
## Step-Up Synchronous PFM DC/DC Converter XC9140 Series



### Bypass mode function

Even when the step-up IC is not operating, the real-time clock (RTC) of the microcontroller in healthcare and other devices operates, and thus power must be supplied from a battery. To handle these types of applications, the bypass mode function is available in the XC9140 series as an option.

In previous step-up DC/DC controllers (refer to Fig.1), the output voltage is lower than the input voltage by the amount of the forward voltage ( $V_F$ ) of the Schottky diode (SBD), resulting in lower efficiency. In bypass mode of the XC9140 series (refer to Fig.2), the output voltage is only lower than the input voltage by the amount due to the Pch driver ON-resistance (about  $0.65\Omega$ ), the DC resistance component of the coil, and the load current, resulting in improved efficiency as shown in Fig.3. This is ideal for application devices where battery life is a concern. Bypass mode operates at shutdown in the C type.



### Comparison of characteristics with previous products

	XC9140	XC9110/XC9111	XC9135
Circuit Configuration (internal driver)	Synchronous (N-ch,P-ch Built-in)	Non-synchronous (N-ch Built-in)	Synchronous (N-ch,P-ch Built-in)
Low ON Resistance	$0.6\Omega$ (N-ch), $0.65\Omega$ (P-ch)	$2.5\Omega$ (N-ch)	$0.2\Omega$ (N-ch), $0.2\Omega$ (P-ch)
Control Method	PFM	PFM (2-step PFM:XC9111)	PWM/PFM Auto (With PWM fixed control pin)
Input Voltage Range	0.9V ~ 5.5V	0.9V ~ 10.0V	0.65V ~ 5.5V
Operation Holding Voltage	0.7V	0.7V	0.65V
Output Voltage Range (Accuracy)	1.8V ~ 5.0V ( $\pm 2\%$ )	1.5V ~ 7.0V ( $\pm 2\%$ )	1.8V ~ 5.0V ( $\pm 2\%$ )
Oscillation Frequency	1.2MHz	100kHz, 180kHz	1.2MHz
Power Consumption	$6.3\mu\text{A}$ (TYP.)	$2\mu\text{A}$ (TYP.)	$37\mu\text{A}$ (TYP.)
Protection Circuit	Current Limit	Lx Voltage Limit	Current Limit Thermal Shutdown
Function	Load Disconnection, Input Bypass UVLO	-	Load Disconnection, $C_L$ Discharge UVLO, FO (Error lamp)
Ceramic Capacitor	Supported	Not Supported	Supported
Package	SOT-25 USP-6EL	SOT-23, SOT-25 SOT-89, USP-6C	USP-10B

