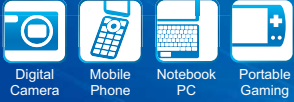
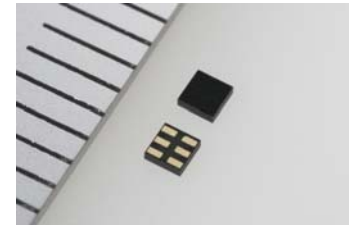


400mA Synchronous Step-Down DC/DC Converters

# XC9244/XC9245 Series



The XC9244/XC9245 series are small step-down synchronous DC/DC converters with an internal  $0.65\Omega$  P-ch driver transistor and an internal  $0.45\Omega$  N-ch switch transistor. A stable current up to 400mA maximum can be supplied using only a coil and two small ceramic capacitors as external components. The XC9244 uses PWM fixed control and the XC9245 uses PWM/PFM auto switching control to achieve a high-efficiency DC/DC converter with low ripple voltage. The small USP6 package is used to enable space-saving.

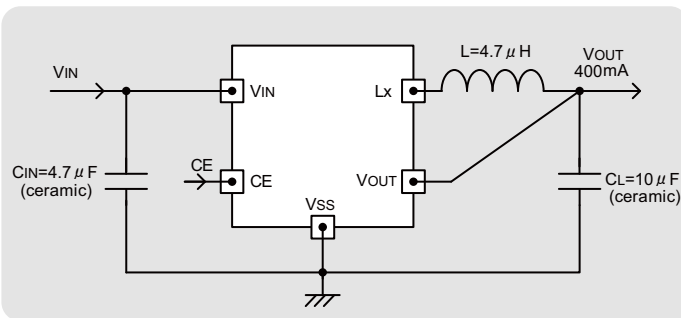


USPN-6  
(1.3mm × 1.3mm × 0.4mm)

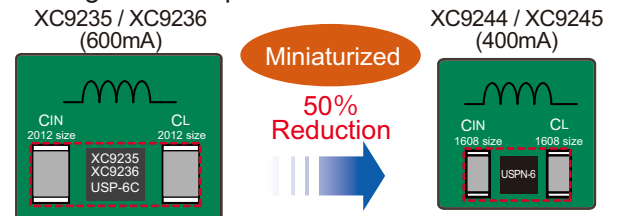


Miniaturization achieves space-saving!

■ TYPICAL APPLICATION CIRCUIT



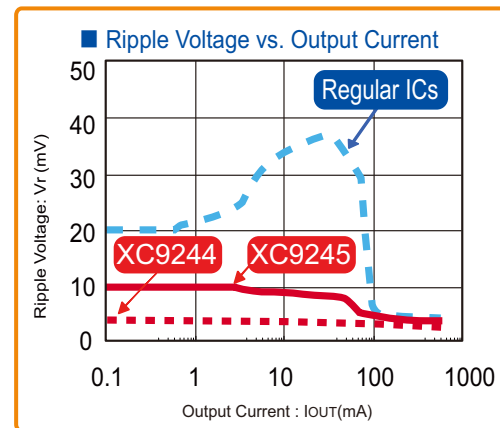
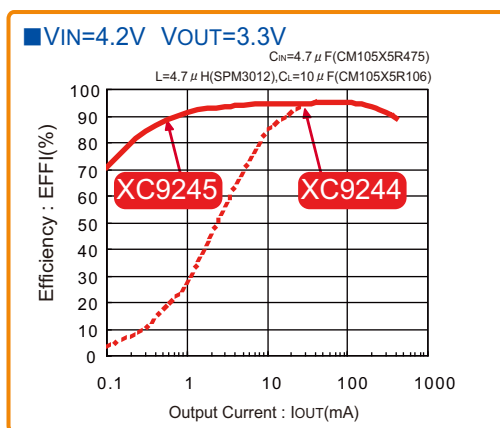
■ Mounting area comparison



Using a small coil and small capacitors, a high-efficiency DC/DC converter can be mounted using only about half the area of previous products. By simply adding a coil to the small LDO mounting area, a space-saving, high-efficiency power supply with low heat generation can be configured.



Low-ripple voltage is maintained from light-load currents to heavy-load currents.



To maintain high efficiency from light loads to heavy loads, the XC9245 automatically switches between PWM control and PFM control based on the load current. Near the switching point, ripple voltage normally grows large due to coil current overlay. The XC9245 uses unique circuit technology to enable smooth switching that holds down current overlay while maintaining high efficiency. This achieves low ripple voltage across the full range of loads. The ripple voltage depends on the ESR (Equivalent Series Resistance) of the capacitor, and the efficiency depends on the DCR (Direct Current Resistance) of the coil.

Features			
Input Voltage	2.3V ~ 6.0V	Maximum Duty Cycle	100%
Output Voltage Selectable	0.8V ~ 4.0V(0.05V Increments)	Function	Current Limiter Circuit (Constant Current & Latching) Ct.High Speed Discharge, Soft Start Circuit
Driver Transistor Built-In	0.65Ω P-ch Driver Transistor 0.45Ω N-ch Synchronous Switch Transistor	Capacitor	Low ESR Ceramic Capacitor
High Efficiency	94% (VIN=4.2V VOUT=3.3V)	Control Methods	PWM (XC9244) PWM/PFM Auto(XC9245)
Output Current	400mA	Package	USPN-6
Oscillation Frequency	1.2MHz ±15%		

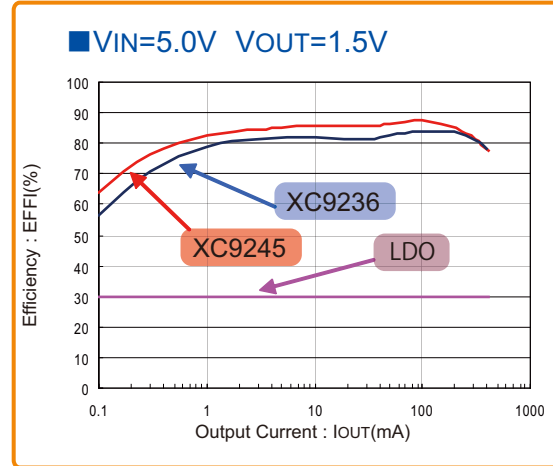
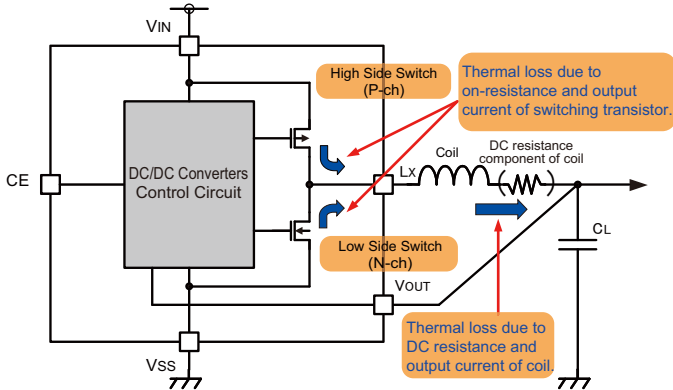


400mA Synchronous Step-Down DC/DC Converters **XC9244/XC9245 Series**

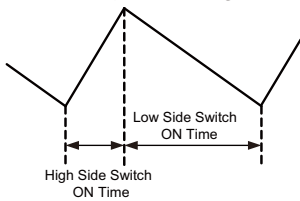


High efficiency is achieved by optimization of the switching transistor size.

■ Power loss in a step-down synchronous DC/DC



■ Coil current waveform (continuous) when the dropout voltage is large



Power loss in a synchronous step-down DC/DC converter is partly due to loss in the switching transistors.

As an innovation to miniaturize the XC9244/XC9245 series without losing efficiency, we optimized the size of the synchronous rectification switching transistor.

Step-down DC/DC converters are often used when the dropout voltage is large. Focusing on the fact that the on-time of the low-side switch becomes longer when the dropout voltage is large, we set the low-side (N-ch) on-resistance to 0.45Ω, smaller than the 0.65Ω high-side (P-ch) on-resistance. Also, we succeeded to reduce parasitic capacitances of the switching transistors with the miniaturization. As shown in the above graph, the result is a high-efficiency greater than our standard-size XC9236 series, particularly when the dropout voltage is large and output current is small.



Comparison of step-down synchronous DC/DC converter characteristics.

【The optimum product can be selected for the current】

	XC9244/XC9245	XC9235/XC9236/XC9237	XC9223/XC9224	XC9242/XC9243
Maximum Output Current	400mA	600mA	1000mA	2000mA
Output Voltage	0.8V~4.0V (0.05V Increments)	0.8V~4.0V (0.05V Increments)	0.9V~VIN can be set with using externally connected resistors	0.9V~VIN can be set with using externally connected resistors
Input Voltage	2.3V~6.0V	1.8V~6.0V	2.5V~6.0V	2.7V~5.5V
Oscillation Frequency	1.2MHz±15%	1.2MHz±15% 3MHz±15%	1MHz±15% (Synchronous external clock) 2MHz±15% (Synchronous external clock)	1.2MHz±15%
Control	PWM: (XC9244) PWM/PFM Auto: (XC9245)	PWM: (XC9235) PWM/PFM Auto: (XC9236) Manual: (XC9237)	PWM/PFM Auto (With PWM Fixed Pin): (Both XC9223/XC9224)	PWM: (XC9242) PWM/PFM Auto: (XC9243)
High Side P-ch ON Resistance	0.65Ω @ VIN=5.0V	0.35Ω @ VIN=5.0V	0.19Ω @ VIN=5.0V	0.11Ω @ VIN=5.0V
Low Side N-ch ON Resistance	0.45Ω @ VIN=5.0V	0.45Ω @ VIN=5.0V	0.21Ω @ VIN=5.0V	0.11Ω @ VIN=5.0V
Supply Current	18 μA	15 μA (1.2MHz)	30 μA (1MHz)	41 μA
Package (mm)	USPN-6 (1.3×1.3×0.4)	SOT-25 (2.9×2.8) USP-6C (1.8×2.0×0.6) USP-6EL (1.8×2.0×0.4)	MSOP-10 (3.0×4.9) USP-10B (2.9×2.6×0.6)	USP-10B (2.9×2.6×0.6)
Function	<ul style="list-style-type: none"> <li>•CE Function</li> <li>•Current Limiter Circuit (Constant Current &amp; Latching)</li> <li>•CL High Speed Discharge</li> <li>•High Speed Soft Start</li> </ul>	<ul style="list-style-type: none"> <li>•CE Function</li> <li>•Current Limiter Circuit (Constant Current &amp; Latching)</li> <li>•CL High Speed Discharge</li> <li>•High Speed Soft Start</li> </ul>	<ul style="list-style-type: none"> <li>•Synchronous External Clock</li> <li>•CE Function</li> <li>•Current limit binary switching selection (Constant Current &amp; Latching)</li> <li>•Short-circuit Protection</li> <li>•Thermal Shutdown</li> <li>•Soft Start</li> <li>•Voltage Detect Function (XC9224 is always on)</li> </ul>	<ul style="list-style-type: none"> <li>•CE Function</li> <li>•Current Limiter Circuit (Constant Current &amp; Automatic Recovery)</li> <li>•Thermal Shutdown</li> <li>•CL High Speed Discharge</li> <li>•Soft Start</li> </ul>

