

○ TECHNICAL ARTICLE

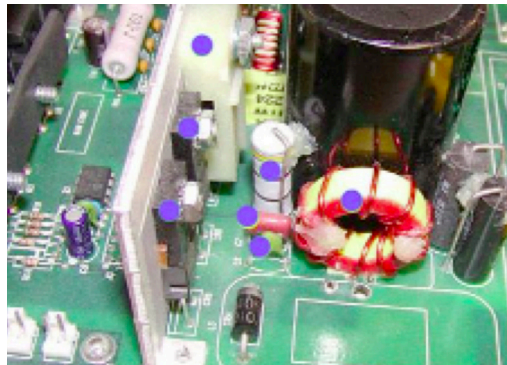
ELIMINATING SNUBBER CIRCUITS IN AC/DC POWER SUPPLIES THROUGH THE USE OF SILICON CARBIDE DIODES

Silicon carbide diodes have been around for some time now but have had little take-up in power supplies due to their relatively high cost. XP Power has recently adopted a silicon carbide (SiC) diode for the first time in the design of its latest family of modular, configurable power supplies known as fleXPower.

The company's previous generation of configurable power supplies, the LP and MP series, used conventional diodes as boost converter rectifiers. The challenge with conventional diodes in boost converters is the high reverse current. This creates wasted power in the diode and switching transistor because the energy in the reverse current spikes needs to be dissipated using a snubber circuit.

Six additional components – 2 diodes, two capacitors, a resistor and an inductor – are used to dissipate the power generated by the unwanted reverse current. The resulting PCB board area is shown in Figure 1, the relevant components are highlighted with blue dots

Figure 1



The SiC diode has very low reverse current so can be used without additional components, resulting in space saving on the board (as shown in Figure 2), lower assembly costs and greater reliability. In addition, because almost no power is lost due to reverse current, the efficiency of the power supply is increased by around 1% - a significant improvement.

Figure 2



With respect to cost, the SiC solution is now comparable to using a conventional diode and snubber circuit. Estimates of component costs used based on XP Power's 1000 W MP series power supply are shown in Table 1.

The lower component cost of the conventional solution is compensated for by lower assembly costs for the power supply. Furthermore, the price of SiC diodes from the main manufacturers, Infineon and Cree, is continuing to fall as the technology becomes more widely adopted. In conclusion, using SiC diodes is now comparable in overall cost to using conventional boost rectifiers, with the added benefits of improved power supply efficiency, space saving and enhanced reliability due to the reduced component count.

Conventional diode and snubber		Silicon carbide diode	
Component	Cost (US\$)	Component	Cost (US\$)
D1 20A/600V diode	1.75	D1 SiC diode 12A	4.80
D2 Diode	0.70		
D3 Diode	0.70		
L inductor	0.17		
R resistor	0.03		
C1 capacitor	0.09		
C2 capacitor	0.06		
TOTAL	3.50	TOTAL	4.80

Table 1