Wolfspeed
A CREE COMPANY

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SiC Schottky Diodes

Simply put, silicon carbide (SiC) outperforms silicon (Si) at higher voltages. Due to differences in material properties, SiC can be used to enable unipolar Schottky diodes for voltages where Si is restricted to bipolar devices. These unipolar devices have lower switching losses, resulting in more efficient power conversion systems than are capable with silicon diodes.

One of the biggest benefits of the SiC Schottky diode is that it provides an excellent gateway to the benefits of using SiC. Selecting a SiC Schottky diode as a drop-in replacement for a Si PIN will result in immediate gains in efficiency, as well as lower operating temperatures without requiring any additional system modification. The more enterprising design engineer willing to redesign their system around SiC Schottky diodes can take advantage of the higher frequency and temperature capabilities to create a system that is smaller, cooler, faster, and lower cost than possible with Si bipolar devices.

In addition to the benefits of SiC, Wolfspeed diodes offer several key benefits:

1. Based on a Merged PIN Schottky (MPS) process, our Wolfspeed diodes enable drastically higher forward surge capability and lower reverse leakage. This design is more robust and more reliable than a standard Schottky design.

2. Wolfspeed engineers are here to help you design with SiC. Our team has more than 25 years of experience with SiC devices, and we were one of the first to offer a commercial SiC device. We have a vast library of reference designs, SPICE models, and technical articles to help you get started or to solve the most complex of design problems.

3. Our record of quality speaks for itself. Our SiC MPS diodes have more than two trillion field device hours,with a combined failure-in-time (FIT) rate of significantly less than one per billion fielded device hours. Silicon devices cannot come close to this value, and neither can most of our competitors.

FEATURES	BENEFITS
High temperature and high frequency operation	SiC inside
Practically no switching losses	Unipolar rectifier
Improved system efficiency	Zero reverse recovery
Best-in-class forward surge capability	Merged PIN Schottky (MPS) design
Low leakage	Positive temperature coefficient of V_F
Easy to parallel – no derating required	AEC-Q101 qualified for many products at no additional charge
dV/dt rated up to 200V/ns	

600/650V PORTFOLIO

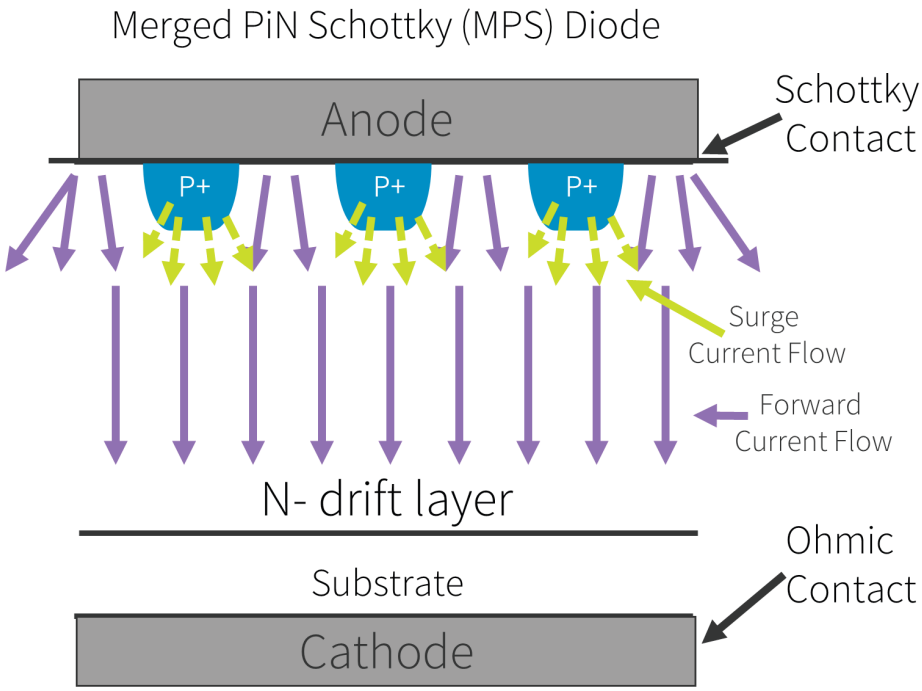
Forward Current Rating (A)	Bare Die	TO-220	TO-220 FullPAK	TO-220 Iso	TO-247	TO-252 DPAK	TO-263 DPAK	QFN
1	■	■				■		
1.7								■
2	■	■	■			■		
3	■	■	■			■		
4	■	■	■			■		
6	■	■	■	■		■	■	
8	■	■		■		■	■	
10	■	■		■		■	■	
12	■	■						
16	■	■			■			
20		■			■			
30	■				■			
50	■				■			

1200V PORTFOLIO

Forward Current Rating (A)	Bare Die	TO-220	TO-247	TO-252 DPAK
2	■	■		■
5	■	■		■
8	■	■		■
10	■	■	■	■
15	■	■		
20	■	■	■	
30			■	
40			■	
50	■			

1700V PORTFOLIO

Forward Current Rating (A)	Bare Die	TO-247
10	■	■
25	■	■
50	■	



Our diodes feature the MPS (Merged PIN Schottky) design which is more robust and reliable than standard Schottky barrier diodes. MPS diodes also offer superior surge current capability, low leakage current and are less vulnerable to surface imperfections.

Figure 1: Reverse Recovery Losses: C3D 650V

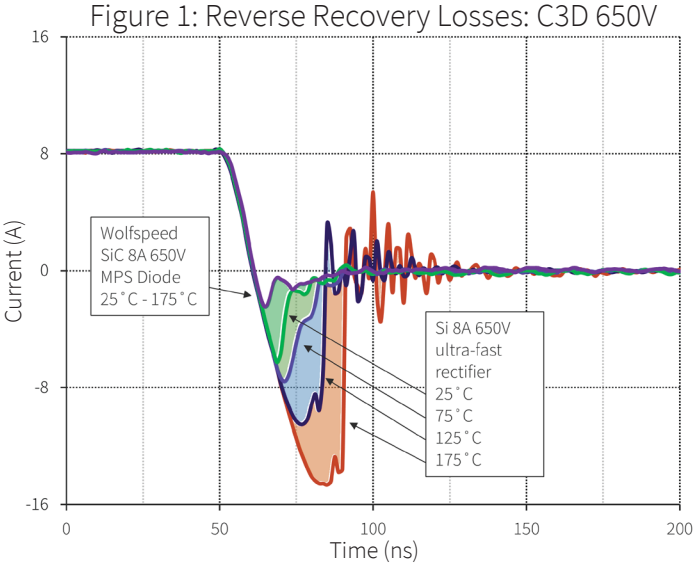
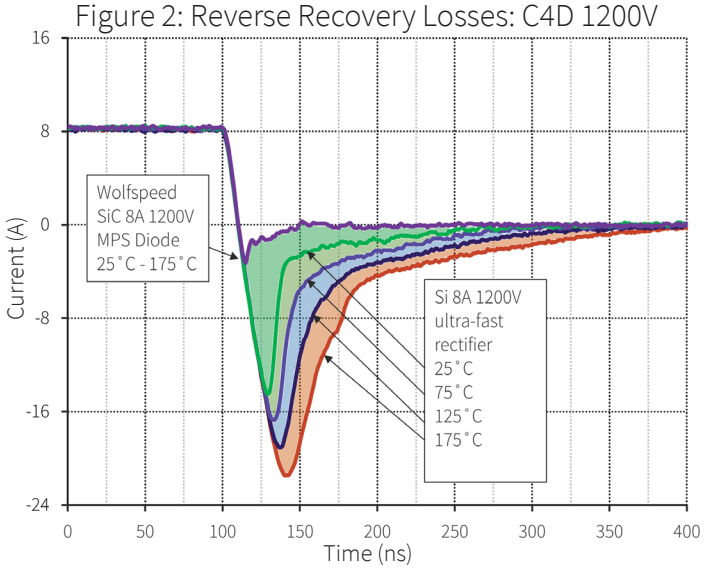
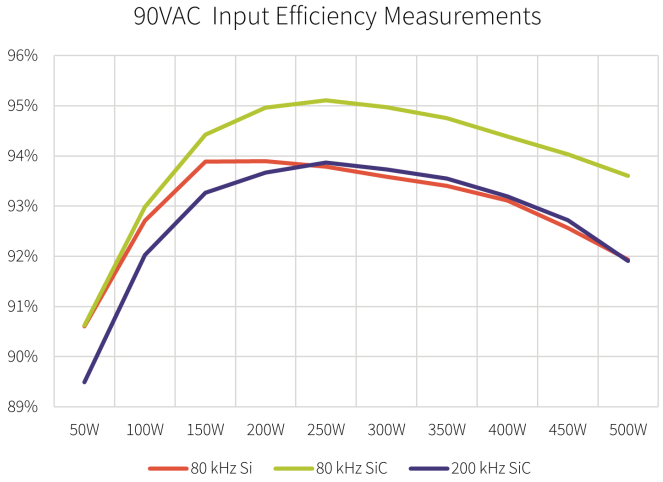


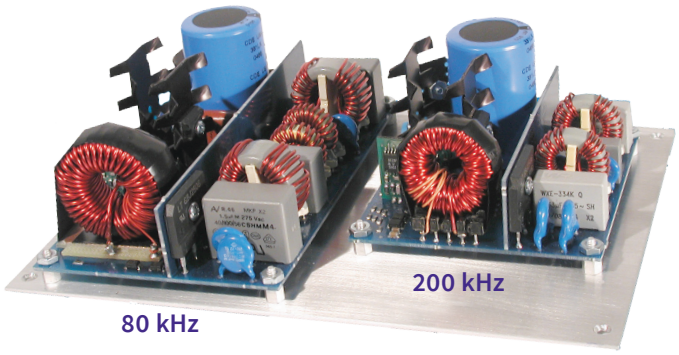
Figure 2: Reverse Recovery Losses: C4D 1200V



These graphs compare the reverse-recovery charge (Q_{rr}) of 650V (figure 1) and 1200V (figure 2) SiC Schottky diodes and silicon bipolar diodes at various temperatures. The shaded areas represent the wasted energy due to the recombination of the minority carriers of the silicon bipolar diode.

Optimizing System Performance with Wolfspeed SiC Schottky Diodes





Clockwise from top left:

- Efficiency curves for a 500W boost PFC operating at 80 kHz with a silicon boost diode (red); the same system with a Wolfspeed SiC Schottky drop-in replacement for the boost diode (green); and an improved system redesigned to operate at 200 kHz with the Wolfspeed SiC Schottky (purple).
- Boost PFC designed to operate at 80 kHz (left) compared to 200 kHz (right). The 200 kHz system is enabled by replacing the inefficient silicon boost diode with a Wolfspeed SiC Schottky diode.
- Table comparing additional system gains achieved by redesigning the 500W boost PFC to operate at 200 kHz with a Wolfspeed SiC Schottky diode.

Low Frequency Si vs. High Frequency SiC Boost

	Si at 80 kHz	SiC at 200 kHz	Change
PCB Area	23.9 in.^{2} *(154.1 cm.^{2})*	14.8 in.^{2} *(95.5 cm.^{2})*	-38%
Volume	47.8 in.^{3} *(782.8 cm.^{3})*	29.6 in.^{3} *(485.1 cm.^{3})*	-38%
Weight	18.4 oz. *(521.6 gm.)*	10.4 oz. *(294.8 gm.)*	-44%
Power Density	10.5 W/in.^{3} *(0.64 W/cm.^{3})*	16.9 W/in.^{3} *(1.03 W/cm.^{3})*	+61%

Learn More:

Visit **wolfspeed.com/power** to learn more about our SiC Schottky diodes and other products and services. There you can access our reference designs, models, evaluation tools and more.

Have additional questions? Contact us at **power@wolfspeed.com**