SiC MOSFET
The real breakthrough in high-voltage switching

Industry-leading 200 °C rating for more efficient and simplified designs

Based on the advanced and innovative properties of wide bandgap materials, ST's silicon carbide (SiC) MOSFET feature very low $R_{DS(on)}$ per area for the 1200 V rating combined with excellent switching performance, translating into more efficient and compact designs. ST is among the first companies to produce high-voltage SiC MOSFET.
This new family features the industry's highest temperature rating of 200 °C for improved thermal design of power electronics systems. Compared to silicon MOSFET, SiC MOSFET also feature significantly reduced switching losses with minimal variation versus the temperature.

KEY FEATURES

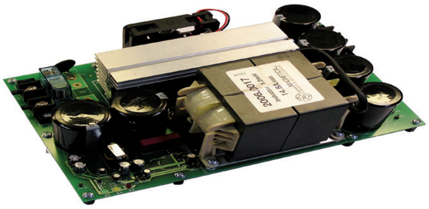
- Very low switching losses
- Low power losses at high temperatures
- Higher operating temperature (200 °C)
- Body diode with no recovery losses
- Easy to drive

KEY BENEFITS

- Smaller form factor and lighter systems
- Reduced size/cost of passive components
- Higher system efficiency
- Reduced cooling requirements and heatsink size

TARGETED APPLICATIONS

- Solar inverters
- High-frequency power supplies
- Motor drives



SiC MOSFET VERSUS SILICON IGBT

Table 1 compares the 1200 V, 80 mΩ SCT30N120 SiC MOSFET with a trench field-stop IGBT of the same voltage rating and equivalent R_{ON}. You can see that the SiC MOSFET exhibits significantly reduced switching losses, even at high temperatures. This enables designers to operate at very high switching frequencies, reducing the size of passive components for smaller form factors. In addition, the variation of E_{ON} and E_{OFF} with temperature is very small. For example, the E_{OFF} of the SiC MOSFET increases only by 25% as the temperature rises from 25 °C to 175 °C, while the E_{OFF} of the IGBT increases by 90%. Also the on-state resistance variation versus temperature is very tight, as shown in Figure 1.

TABLE 1 - SWITCHING LOSS COMPARISON

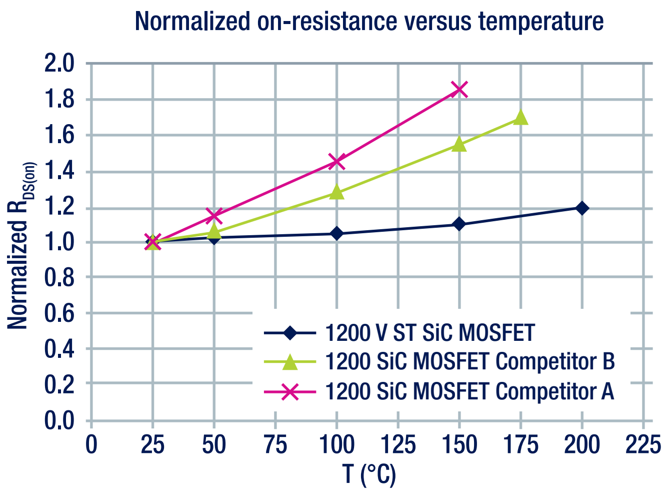
Device	V_{ON} typ (V) @ 25 °C, 20 A	V_{ON} typ (V) @ 175 °C, 20 A	E_{ON} (µJ) @ 20 A, 900 V		E_{OFF} (µJ) @ 20 A, 900 V		Chip size
			25 °C	175 °C	25 °C	175 °C	
SCT30N120 SiC MOSFET	2	2.4	725*	965*	245	307	0.45
Trench field-stop IGBT	1.95	2.35	2140	3100	980	1850	1

Note: * E_{ON} measured using the SiC intrinsic body diode

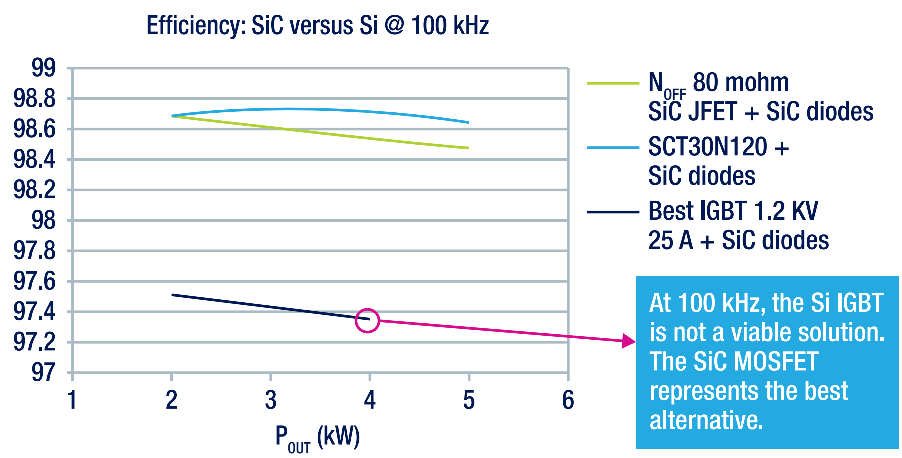
+25% from 25 °C to 175 °C

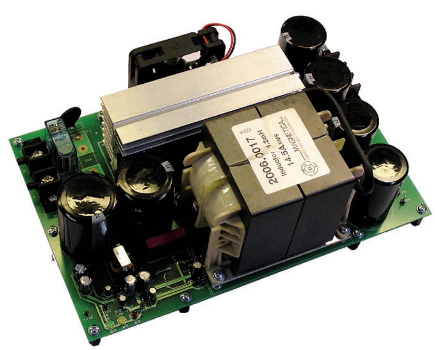
+90% from 25 °C to 175 °C

FIGURE 1 - ON-RESISTANCE VARIATION VERSUS TEMPERATURE



When tested on a CCM 5 kW boost converter application board at a switching frequency of 100 kHz, ST's SiC MOSFET solution provides the highest efficiency, as can be seen in the figure below.





SiC MOSFET

Part number	V_{DSS} (V)	I_D max (A) (@ 25 °C)	$R_{DS(on)}$ max (Ω) (@ V_{GS} = 20 V)	Total gate charge Q_g typ (nC)	T_j max (°C)	Package
SCT10N120	1200	12	0.69	22	200	HiP247™
SCT20N120	1200	20	0.239	45	200	HiP247™
SCT30N120	1200	45	0.1	105	200	HiP247™
SCT50N120	1200	65	0.069	122	200	HiP247™
SCTWA50N120	1200	65	0.069	122	200	HiP247™ long leads

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