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 $R_{\text{DS(on)}}$. 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 $E_{\text{on}}$ and $E_{\text{off}}$ with temperature is very small. For example, the $E_{\text{off}}$ of the SiC MOSFET increases only by 25% as the temperature rises from 25 °C to 175 °C, while the $E_{\text{off}}$ 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**

<table>
<thead>
<tr>
<th>Device</th>
<th>$V_{\text{ON}}$ typ (V) @ 25 °C, 20 A</th>
<th>$V_{\text{ON}}$ typ (V) @ 175 °C, 20 A</th>
<th>$E_{\text{on}}$ (µJ) @ 20 A, 900 V</th>
<th>$E_{\text{off}}$ (µJ) @ 20 A, 900 V</th>
<th>Chip size</th>
</tr>
</thead>
<tbody>
<tr>
<td>SCT30N120 SiC MOSFET</td>
<td>2</td>
<td>2.4</td>
<td>725*</td>
<td>965*</td>
<td>0.45</td>
</tr>
<tr>
<td>Trench field-stop IGBT</td>
<td>1.95</td>
<td>2.35</td>
<td>2140</td>
<td>3100</td>
<td>1</td>
</tr>
</tbody>
</table>

Note: * $E_{\text{on}}$ measured using the SiC intrinsic body diode

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.

![Efficiency: SiC versus Si @ 100 kHz](image)

At 100 kHz, the Si IGBT is not a viable solution. The SiC MOSFET represents the best alternative.

**SiC MOSFET**

<table>
<thead>
<tr>
<th>Part number</th>
<th>$V_{\text{DS}}$ (V)</th>
<th>$I_{\text{max}}$ (A) @ 25 °C</th>
<th>$R_{\text{DS(on)}}$ max (Ω) @ $V_{\text{DS}}$ = 20 V</th>
<th>Total gate charge $Q_{\text{gs}}$ typ (nC)</th>
<th>$T_{\text{j(max)}}$ (°C)</th>
<th>Package</th>
</tr>
</thead>
<tbody>
<tr>
<td>SCT10N120</td>
<td>1200</td>
<td>12</td>
<td>0.69</td>
<td>22</td>
<td>200</td>
<td>HiP247™</td>
</tr>
<tr>
<td>SCT20N120</td>
<td>1200</td>
<td>20</td>
<td>0.239</td>
<td>45</td>
<td>200</td>
<td>HiP247™</td>
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<tr>
<td>SCT30N120</td>
<td>1200</td>
<td>45</td>
<td>0.1</td>
<td>105</td>
<td>200</td>
<td>HiP247™</td>
</tr>
<tr>
<td>SCT50N120</td>
<td>1200</td>
<td>65</td>
<td>0.069</td>
<td>122</td>
<td>200</td>
<td>HiP247™ long leads</td>
</tr>
<tr>
<td>SCTWA50N120</td>
<td>1200</td>
<td>65</td>
<td>0.069</td>
<td>122</td>
<td>200</td>
<td>HiP247™ long leads</td>
</tr>
</tbody>
</table>