SiC MOSFET

The real breakthrough in high-voltage switching

Silicon Carbide: The Enabling Technology for higher power density in Industrial and Automotive application

Based on the advanced and innovative properties of wide bandgap materials, ST's silicon carbide (SiC) MOSFETs feature very low $R_{DS(on)}$ per area, with the new SCT*N65G2 650 V product family and the SCT*N120G2 1200 V product family in development, combined with excellent switching performance, reserve efficient and compact designs. These new families feature the industry's highest temperature rating of 200 °C for improved thermal design of power electronics systems.

KEY FEATURES

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

KEY BENEFITS

- Smaller form factor and higher power density
- Reduced size/cost of passive components
- Higher system efficiency
- Reduced cooling requirements and heatsink size

KEY APPLICATIONS

- Traction inverter
- EV charge station
- Photovoltaics
- Factory automation
- Motor drive
- Data center power supply
- OBC &DC/DC converter

SIC MOSFET VERSUS SILICON TRANSISTOR

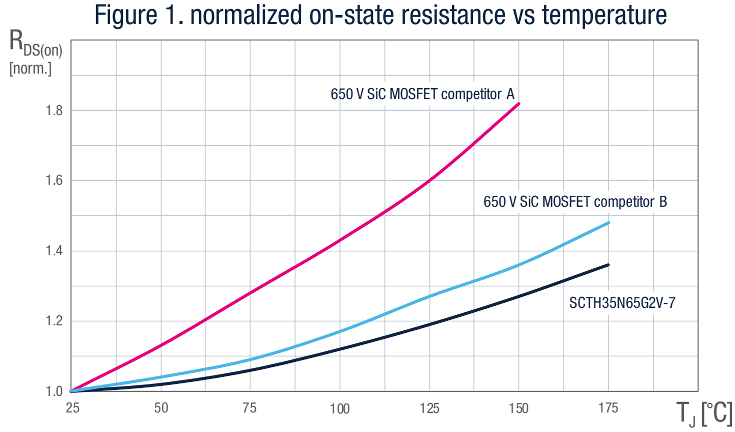
Table 1 compares the new ST's second generation 650 V, 55 mΩ SCTH35N65G2V-7 SiC MOSFET with a trench field-stop (TFS) IGBT of the same voltage rating and equivalent on-state resistance. The SiC MOSFET exhibits significantly reduced switching losses, even at high temperatures. This enables designers to operate at very high switching frequencies, reducing the size of passive components for smaller form factors. In addition, for the SiC MOSFET the variation of E_{ON} and E_{OFF} with temperature is very small. As an example, the E_{OFF} of the SiC MOSFET remains basically unchanged as the temperature rises from 25 °C to 175 °C, while the E_{OFF} of the IGBT increases by the 89%. Even the change in resistance as the temperature rises is very low and lower than the competition, as shown in Figure 1.

Table 1: Switching loss comparison

Device	Von typ. (V) @ 25 °C, 20 A	Von typ. (V) @ 175 °C, 20 A	$E_{on\text{-}typ}$ (µJ) @ 20 A, 400 V 25 °C / 175 °C	$E_{off\text{-}typ}$ (µJ) @ 20 A, 400 V 25 °C / 175 °C	Etot rise with temperature	Die size (Normalized)
SCTH35N65G2V-7	1.1	1.48	100 / 100	35 / 35	negligible variation vs. Temperature	0.53
30 A,650 V TFS IGBT	1.45	1.55	240 / 450	205 / 390	+89% from 25 °C to 175 °C	1.00

Note: Von measured @ VGS-SiC=18 V, VGE-IGBT=15 V - Eon includes the reverse recovery of the diode

Figure 1. normalized on-state resistance vs temperature



Device summary

<table>
<tr><th>Commercial Product</th><th>V_{DSS} (V)</th><th>I_D max (A)</th><th>$R_{DS(ON)}$ Typ (Ω) (@ V_{GS} = 18 V)</th><th>T_J max (°C)</th><th>Package</th></tr>
<tr><td>SCTH35N65G2V-7</td><td rowspan="7">650</td><td rowspan="3">45</td><td rowspan="3">0.055</td><td rowspan="3">175</td><td rowspan="2">H2PAK-7</td></tr>
<tr><td>SCTH35N65G2V-7AG</td></tr>
<tr><td>SCTW35N65G2V</td><td>HiP247</td></tr>
<tr><td>SCTH90N65G2V-7</td><td>116</td><td rowspan="2">0.018</td><td>175</td><td>H2PAK-7</td></tr>
<tr><td>SCTW90N65G2V</td><td>119</td><td>200</td><td>HiP247</td></tr>
<tr><td>SCTH100N65G2-7AG</td><td>95</td><td rowspan="2">0.020</td><td>175</td><td>H2PAK-7</td></tr>
<tr><td>SCTW100N65G2AG</td><td>100</td><td>200</td><td>HiP247</td></tr>
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