ISSUE: April 2025

Third-Generation 1200-V SiC MOSFETs Cut Size While Improving Performance

SemiQ's QSiC 1200-V MOSFETs are the company's third-generation SiC devices and feature smaller die size along with improved switching speeds and efficiency. These devices are 20% smaller than QSiC's second-generation SiC MOSFETs and were developed to increase performance and cut switching losses in high-voltage applications such as EV-charging stations, solar inverters, industrial power supplies and induction heating equipment.

These SiC MOSFETs are offered in a range of on-resistances in both bare-die and 4-lead TO-247 packages:

- 16 mΩ: GP3T016A120X and GP3T016A120H
- 20 mΩ: GP3T020A120X and GP3T020A120H
- 40 mΩ: GP3T040A120X and GP3T040A120H
- 80 mΩ: GP3T080A120X and GP3T040A120H

where the X suffix denotes the bare die and the H suffix denotes the packaged part. The TO-247 package measures 31.4 x 16.1 x 4.8 mm and includes a reliable body diode and a driver-source pin for gate driving (see the figure).

In the case of the 16-mΩ device, the MOSFET reduces total switching losses to 1646 µJ.

Known good die (KGD) testing has been conducted using UV tape and tape and reels, with all parts undergoing testing and verification at voltages exceeding 1400 V, as well as being avalanche tested to 800 mJ (in the case of the 16- mΩ part). Reliability is further improved through the device's 100% wafer-level gate-oxide burn-in screening and 100% UIL testing of discrete packaged devices.

The devices have been developed to have a low reverse recovery charge (Q_{RR} = 470 nC for the 16-mΩ device) and lower capacitance, improving switching speed, switching losses, EMI and overall efficiency. They were also designed to be easy to parallel; and with a longer creepage distance (9 mm), improving electrical insulation, voltage tolerance and reliability.

Timothy Han, president at SemiQ said, "The move to Gen3 SiC further increases the benefits of SiC MOSFETs over IGBTs. These devices not only deliver vastly improved performance, but cut die size and cost versus previous generations. As a result, the launch of the QSiC 1200 V opens the technology, and its benefits, to a far greater range of applications. The device delivers industry leading performance figures, notably on gate threshold voltage, and we're delighted to be demonstrating this first at APEC."

The QSiC 1200-V MOSFETs have a continuous operational and storage temperature of -55°C to 175°C. They also have a recommended operational gate-source voltage of -4/18 V, with a V_{GSmax} of -8/22 V, and a power dissipation of 484 W (in the case of the packaged 16-mΩ device with core and junction temperature at 25°C).

For static electrical characteristics, the packaged 16-mΩ device has a junction-to-case thermal resistance of 0.26°C per watt (40°C/W junction to ambient). Its zero gate voltage drain current is 100 nA, with a gate-source voltage current of 10 nA. Its ac characteristics include a turn-on delay time of 21 ns with rise time of 25 ns; its turn-off delay time is 65 ns with a fall time of 20 ns.

Both the 16-mΩ (AS3T016A120X and AS3T016A120H) and 40-mΩ (AS3T040A120X and AS3T040A120H) variants have been automotive qualified per AEC-Q101. For datasheets, see the Gen3 MOSFETs page (bare die and TO-247-4L discrete) here. For further information or to request samples, contact the company.

Figure. Available in die form or packaged in TO-247s, the QSiC 1200-V MOSFETs are SemiQ's third-generation SiC devices that shrink the die size while improving switching speeds and efficiency.