Silicon carbide

Improve efficiency and solution costs

Silicon carbide (SiC) devices belong to the so-called wide bandgap semiconductor group, which offers a number of attractive characteristics for high voltage power semiconductors when compared to commonly used silicon (Si). In particular, the much higher breakdown field strength and thermal conductivity of silicon carbide allow developing devices which by far outperform the corresponding silicon-based ones, and enable efficiency levels unattainable otherwise. Infineon’s portfolio of SiC devices covers 600 V and 650 V to 1200 V Schottky diodes as well as the revolutionary CoolSiC™ MOSFET.

Advantages of silicon carbide over silicon devices

The differences in material properties between silicon carbide and silicon limit the fabrication of practical silicon unipolar diodes (Schottky diodes) to a range up to 100-150 V, with a relatively high on-state resistance and leakage current. In SiC, Schottky diodes can reach a much higher breakdown voltage. Infineon is the world’s first SiC discrete power supplier. Infineon offers products up to 1200 V in discrete packages and up to 1700 V in modules.

Features
- No reverse-recovery charge
- Purely capacitive switching
- High operating temperature ($T_{j, max} = 175^\circ C$)

Benefits
- System efficiency improvement compared to Si-based diodes
- Reduced cooling requirements
- Enabling higher frequency/increased power density
- Higher system reliability due to lower operating temperature
- Reduced EMI

Advantages
- Low turn-off losses
- Reduction of CoolMOS™ SJ MOSFET or IGBT turn-on loss
- Switching losses independent from load current, switching speed and temperature

Applications
- Server power supply
- Telecom power supply
- Solar
- UPS
- EV charging
- Energy storage
- PC power supply
- Motor drives
- Lighting
- CAV
- Industrial welding

Reverse-recovery charge of SiC Schottky diodes versus Si-pin diodes

The majority of carrier characteristics imply no reverse-recovery charge and the only contribution to the switching losses comes from the tiny displacement charge of capacitive nature. In the same voltage range, silicon devices have a bipolar component resulting in much higher switching losses. The graph shows the comparison between various 600 V devices.

Improved system efficiency (PFC in CCM mode operation, full load, low line)

The fast switching characteristics of the SiC diodes provide clear efficiency improvements at system level. The performance gap between SiC and high-end silicon devices increases with the operating frequency.

Infineon is the world’s first SiC discrete power supplier. The long market presence and experience enable Infineon to deliver highly reliable, industry-leading SiC performance. With over 10 years pioneering experience in developing and manufacturing SiC diodes, Infineon’s latest CoolSiC™ Schottky diode generation 6 family sets benchmark in quality, efficiency and reliability.
**Silicon carbide portfolio**

**CoolSiC™ Schottky diodes 650 V G6**

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**CoolSiC™ Schottky diodes 650 V G5**

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**CoolSiC™ Schottky diodes 1200 V G5**

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**PINs**

1. PIN 1
2. PIN 2
3. PIN 3

CASE

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For more details on the product, click on the part number.
Common SiC diodes applications and topologies

**Battery voltage**

**Applications and topologies**

- **Interleaved PFC**
- **CoolSiC™ diode**
- **OptiMOS™**
- **CoolMOS™**

- **Solar microinverter**
- **OptiMOS™**
- **CoolSiC™ diode**
- **CoolMOS™**

- **Solar string inverter**
- **CoolSiC™ diode**
- **CoolMOS™**
- **TRENCHSTOP™ IGBTs**

- **Three-phase modified Vienna PFC**
- **Stacked full-bridge LLC DC-DC converter**
- **Three-phase B6 rectifier PFC**
- **Full-bridge LLC DC-DC converter**

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- India ........................ 000 800 4402 951 (English)
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