1200 V G5 CoolSiC™ Schottky Diode
New level of system efficiency and reliability

Aug. 2019
Agenda

1. Benefits of CoolSiC™ diode
2. Target applications
3. 1200 V G5 CoolSiC™ Schottky Diode portfolio
4. Additional information and support channels
5. Summary
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SiC diode benefit - less leads to more

- **SiC**: low $Q_c$
- **Ultrafast Si**: large $Q_{rr}$

### Features
- No reverse recovery charge
- No forward recovery
- Purely capacitive switching

### Technical benefits
- $E_{rec}$ close to zero
- 40-50% reduction in IGBT turn-on loss
- No voltage overshoots
- Switching losses independent from load current, switching speed and temperature

### Customer benefits
- 20-30% higher output power in same form factor
- Reduced EMI
- No need for snubber circuitry, reduced parts count
- High system reliability
Great system impact thanks to the also reduced IGBT turn-on losses by SiC’s low recovery losses

Up to 40-50% reduction in IGBT turn-on loss

- Decreased $I_{RRM}$ means decreased S1 (IGBT) turn-on losses
- $E_{on} = \int_{t_1}^{t_2} V_O \cdot I_C \cdot dt$
No more pain with dynamic losses

Example:
1200 V Si IGBT + SiC diode in a boost stage topology ($f_{sw}=20$ kHz); used in e.g. EV DC charging/UPS…

SiC diode compared to Si diode, has …
... higher system efficiency,
... lower device thermals, for
... increased power density and reliability!

+0.8% efficiency enables higher output power!

15°C cooler
Switching losses, $P_{sw}$, in SiC and Si diodes

**SiC diode**

$$P_{sw} = 0.5 \cdot V_o \cdot f \cdot Q_C$$

**Si diode**

$$P_{sw} = 0.5 \cdot V_o \cdot f \cdot I_{RRM} \cdot t_B$$

**SiC switching loss is very low compared to Si:**
- Si shows 7-20 x higher $P_{sw}$ than SiC due to $I_{RRM}$
- $I_{RRM}$ and $t_B$ values depends on diode forward current, $di/dt$ and diode junction temperature
Low \( V_F \) with low temperature dependency give low static losses over entire load range

Zero reverse recovery charge

10 A CoolSiC™ diode matches \( V_F \) of 30 A rated Si ultrafast diode thanks to its superior efficiency

Up to 40 A diode rating
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The enabler: 1200 V G5 CoolSiC™ Schottky diode

System improvements?
› Reach new efficiency targets
› Higher power density
› Upgrade designs towards higher output power
  …while maintaining reliable system!

Easily enabled by CoolSiC™ Schottky diodes
Our components are a perfect match with customer system needs

Vienna rectifier
- SiC Schottky diode: CoolSiC™ Schottky diode 1200 V G5
- High voltage MOSFET: CoolMOS™ 650 V
- IGBT: TRENCHSTOP™ 5 650 V

Drive and control unit
- Gate driver: EiceDRIVER™
- μController: XMC1000, XMC4000

Full-bridge LLC
- SiC MOSFET: CoolSiC™ MOSFET 1200 V
- SiC Schottky diode: CoolSiC™ Schottky diode 1200 V G5

Application example: EV DC charging
Our components are a perfect match with customer system needs

MPPT
- SiC Schottky diode
  - CoolSiC™ Schottky diode 1200 V G5
- SiC MOSFET
  - CoolSiC™ MOSFET 1200 V
- IGBT
  - TRENCHSTOP™ IGBT6 1200 V

3-Level T-type inverter
- SiC MOSFET
  - CoolSiC™ MOSFET 1200 V
- IGBT
  - TRENCHSTOP™ IGBT6 1200 V
  - TRENCHSTOP™ 5 650 V

Drive and control unit
- Gate driver
  - 2EDN EiceDRIVER™
  - 1EDN EiceDRIVER™
- μController
  - XMC4000

Application example: solar string inverters
Our components are a perfect match with customer system needs

Vienna rectifier

<table>
<thead>
<tr>
<th>Component</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>SiC Schottky diode</td>
<td>CoolSiC™ Schottky diode 1200 V G5</td>
</tr>
<tr>
<td>High voltage MOSFET</td>
<td>CoolMOS™ 650 V</td>
</tr>
<tr>
<td>IGBT</td>
<td>TRENCHSTOP™ 5 650 V</td>
</tr>
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</table>

2-Level 3phase inverter

<table>
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<th>Description</th>
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</thead>
<tbody>
<tr>
<td>IGBT</td>
<td>TRENCHSTOP™ IGBT6 1200 V</td>
</tr>
<tr>
<td>SiC Schottky diode</td>
<td>CoolSiC™ Schottky diode 1200 V G5</td>
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</tbody>
</table>

Drive and control unit

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<th>Description</th>
</tr>
</thead>
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<tr>
<td>Gate driver</td>
<td>EiceDRIVER™</td>
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<tr>
<td>μController</td>
<td>XMC1000</td>
</tr>
<tr>
<td></td>
<td>XMC4000</td>
</tr>
</tbody>
</table>

Application example: UPS

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# 1200 V CoolSiC™ G5 Schottky Diode

<table>
<thead>
<tr>
<th>Continuous Forward Current, $I_F$ [A]</th>
<th>TO-252-2 (DPAK real 2-leg)</th>
<th>TO-263-2 (D²PAK real 2-leg)</th>
<th>TO-220-2 (real 2-leg)</th>
<th>TO-247-3</th>
<th>TO-247-2</th>
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<tbody>
<tr>
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<td>IDK02G120C5</td>
<td>IDH02G120C5</td>
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<td>IDM10G120C5</td>
<td>IDK10G120C5</td>
<td>IDH10G120C5</td>
<td>IDW10G120C5B $^1$</td>
<td>IDWD10G120C5</td>
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<tr>
<td>15-16</td>
<td>IDK16G120C5</td>
<td>IDH16G120C5</td>
<td>IDW15G120C5B $^1$</td>
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<td>20</td>
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<td>IDWD40G120C5</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

$^1$ $"B"$ = common-cathode configuration

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Nomenclature

**Company**
$I = \text{Infineon}$

**Device**
$D = \text{Diode}$

**Package type**
$H = \text{TO220 R2L}$  
$M = \text{DPAK R2L}$  
$W = \text{TO247}$  
$WD = \text{TO247 R2L}$  
$K = \text{D²PAK R2L}$

**Continuous forward current**
$[A]$  

**G = Low thermal resistance**

**Breakdown voltage**
$[V]/10$

**Series name**
$5 = \text{Generation 5}$

**B = Common-cathode configuration**

$120$  
$C5 \ (B)$
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Infineon has more than 15 years of field experience in SiC.
Support

Collaterals and brochures

› Product briefs
› Selection guides
› Application brochures
› Presentations
› Press releases, Ads

Technical material

› Application notes
› Technical articles
› Simulation models
› Datasheets

Support & tools

› PCB design data
› Simulation models

Videos

› Technical videos
› Product information videos

www.infineon.com/sicdiodes1200v
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Summary – Key take aways

- By using SiC diodes, designers for solar inverters, UPS, motor drives and other industrial applications can design in a new level of system efficiency, higher power density and reliability compared with Si based solution. 1200 V CoolSiC™ Schottky diode generation 5 supports this by low-loss turn-off, low static losses and increased surge current capability.

- Infineon is in mass production for SiC diodes since the year 2001 with proven high volume capability.

CoolSiC™

New
TO-247-2
(10A to 40A)

New
TO-263-2 (D²PAK-2)
(2A to 20A)
Part of your life. Part of tomorrow.