POWER ELECTRONICS FOR DC FAST CHARGERS

SEMIKRON DANFOSS

EV Chargers

Performance Range

As electric vehicles become widespread, so must the infrastructure to charge them. One of the main requirements for the widespread use of electric vehicles is an accessible EV charging infrastructure. Governments and industries worldwide are investing in charging infrastructures, with a growing trend toward bidirectional charging.

Availability and costs are the key to success in the fast growing EV Charger market. As the specialist in power electronics, we use state-of-the-art topologies featuring standard components, guaranteeing both excellent efficiency and availability. Semikron Danfoss offers a comprehensive portfolio of products that meet the needs of fast charge equipment from as little as 8kW up to the megawatt range.

- DC wall boxes
- Depot chargers
- Highway chargers
- Heavy-duty vehicle chargers

Compact designs and high power density

High reliability to reduce downtime

Forward-looking topologies

High efficiency

Products

SEMITOP E

SEMiX 2

SEMiX 5

SEMITRANS Classic

SEMITRANS 20

SEMIPACK

Drivers

Power Electronic Stacks

PRODUCT HIGHLIGHT

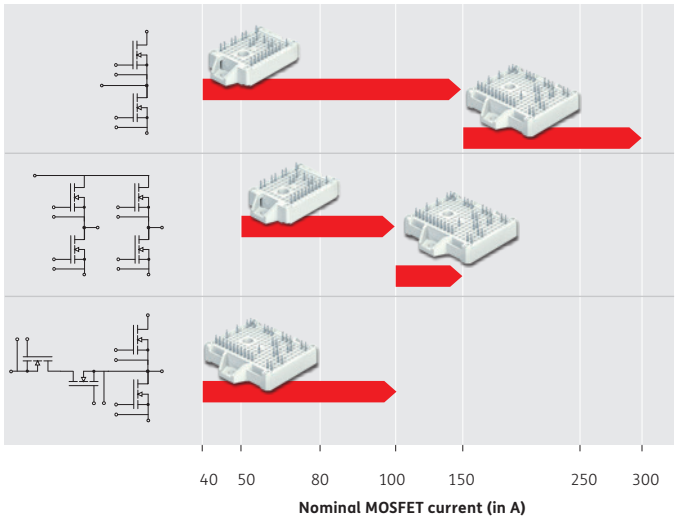
The Ultimate Partner for **Silicon Carbide** Power Modules

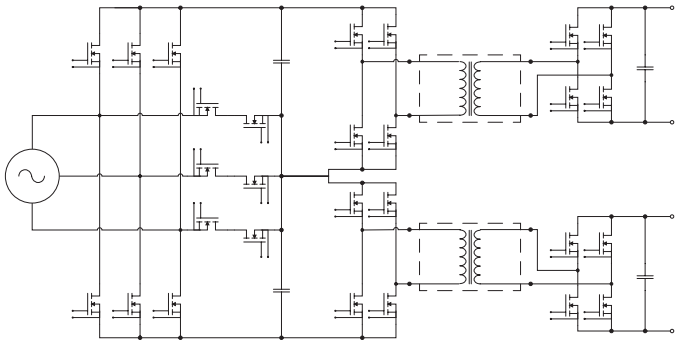
For power dense EV chargers, silicon carbide enables freedom of design for today's power electronics. Silicon carbide exhibits extremely low switching losses which yield less cooling effort and higher efficiency. The result is smaller, lighter power converters and reduced energy usage.

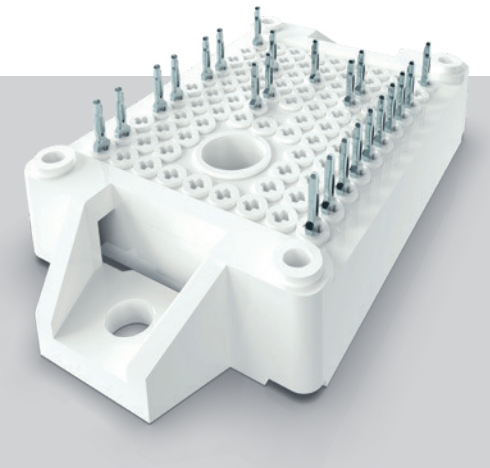
The industry standard SEMITOP E1 and E2 feature high thermal performance and low stray inductance. Standard pinout configurations allow for multiple sourcing to ensure supply chain safety.

Key Features

- 2kV SiC for 1500V_{DC} applications
- Fast switching SiC reduces losses, simplifying cooling effort
- Multiple chip sources for improved supply chain safety
- Matrix hole pattern for flexible topologies and low inductance
- 3-level TNPC topology enables reduced magnetics size and cost







SEMITOP® E1
up to 45kW

PRODUCT HIGHLIGHT

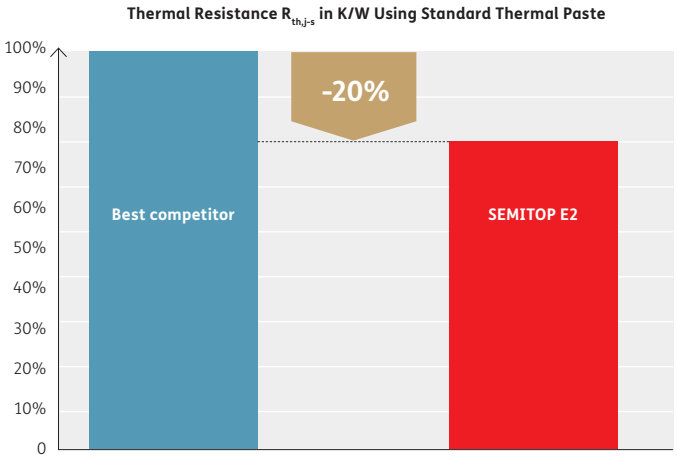
2kV SiC for Increased Charging Power

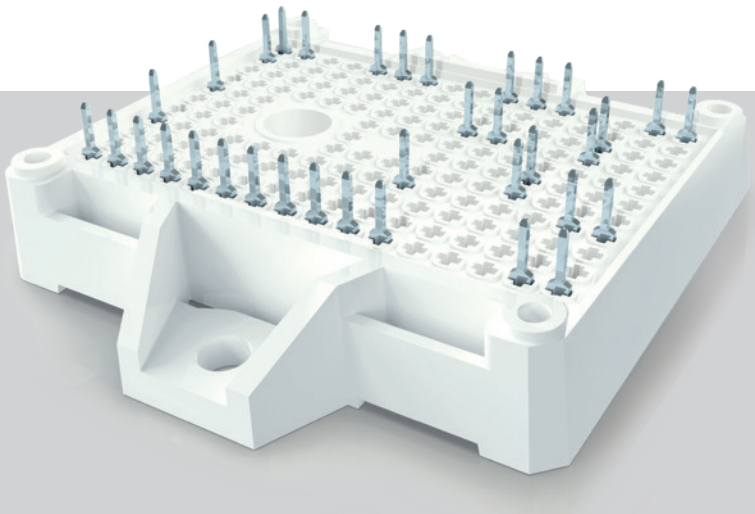
The transition to electric heavy-duty vehicles is driving the need for higher-power chargers. To keep cable sizes manageable, a new standard of 1250V is emerging. Supporting this shift, 2kV SiC technology not only enables higher voltage operation but also facilitates connection to 1500V_{DC} microgrids.

The thermal resistance is up 20% lower than the closest competitor using standard thermal paste. Using High Performance Thermal Paste (HPTP), a further 25% reduction is possible.

Key Features

- Baseplate-less design, optimized for liquid cooling
- Industry standard package design
- 2kV blocking voltage enables 1500V_{DC} with 2-level topology
- Scalable through paralleling
- Low stray inductance case
- Optimized thermal performance





SEMITOP® E2
up to 200kW

Product Portfolio
Power Modules

SEMIPACK®

800V up to 2200V

Bipolar Modules from the Market Leader

Six housing sizes SEMIPACK 1 to 6
800V to 2200V: 20A to 1360A

Semikron Danfoss diode and thyristor chips

Diode and thyristor in un-, half- and full-controlled topologies

Different technologies for certain packages: high reliability pressure contact or cost-effective wire bonded modules

Enhanced isolation voltage of 4.8kV/1s available on request

SEMiX® 2

Up to 50kW

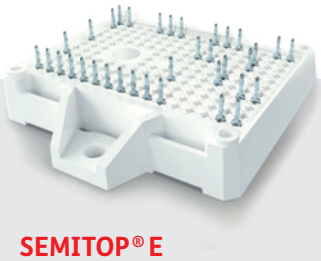
Industry Standard for EV Charging

Press-fit pins

1200V: 130A, 8mΩ Gen 3 SiC MOSFETs

H-bridge topology

Compatible industry standard package for multiple sourcing



SEMITOP® E

8kW up to 200kW

Flexible Pinout for Low Inductance

Baseplate-less industry standard power module

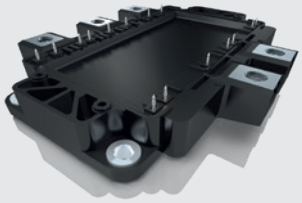
Press-fit pins for solder-less connection to PCB

650V / 1200V IGBT: 10A to 200A
1200V SiC: 30A to 3000A
2000V SiC: 150A to 200A

3-level, H-bridge, half-bridge, sixpack, Vienna and rectifier topologies

Optimized mounting concept and pre-applied High Performance Thermal Paste or High Performance Phase Change Material

Soft and fast switching 650V IGBT S5 and H5



SEMiX® 5

50kW up to 150kW

Extended Standard for Superior Thermal and Dynamic Performance

Industry standard baseplate module

650V / 950 / 1200V / 1700V IGBT: 150A to 400A

Sixpack, NPC, TNPC, PFC, and half-controlled bridge rectifier topologies

Optimized module layout for maximum heat transfer

Enhanced thermal and electrical diode performance

SEMITRANS® Classic

50kW up to 600kW

The Proven Power Electronics Package

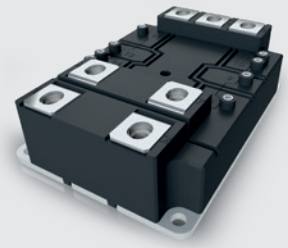
Robust industry standard package for multiple sourcing in six housing sizes

600V / 650V / 1200V / 1700V IGBT:
25A to 900A
1200V SiC: 125A to 500A
2000V SiC: from 350A to 650A

Half-bridge, single switch and brake chopper topology

Multiple IGBT and SiC sources

Extended 62mm portfolio:
1200V IGBT: 800A
1700V IGBT: 500A



SEMITRANS® 20

from 500kW

The New Standard in High Power

The latest industry standard power module for high power applications

1200V / 1700V IGBT: 1200A to 1800A
2000V SiC: 1700A/1mOhm

Half-bridge topology

Low stray inductance, high power density package

High reliability thanks to the latest packaging technology

Power Electronic **Stack Platforms** for **Fully Qualified** Inverter Assemblies Tailored to Your **Specific Needs**

Standard Stacks

Our Power Electronic Stacks enable our customers to succeed in dynamic markets and meet any global challenge. We deliver Rectifier-, IGBT- and SiC-based stacks for AC voltages from 380V to 690V. Our standard stacks cover a output current range from 70A to 4000A.

Water-Cooled IGBT Stacks
SEMISTACK RE
SEMIKUBE MLI

Air-Cooled IGBT Stacks
SEMIKUBE
SEMIKUBE SlimLine

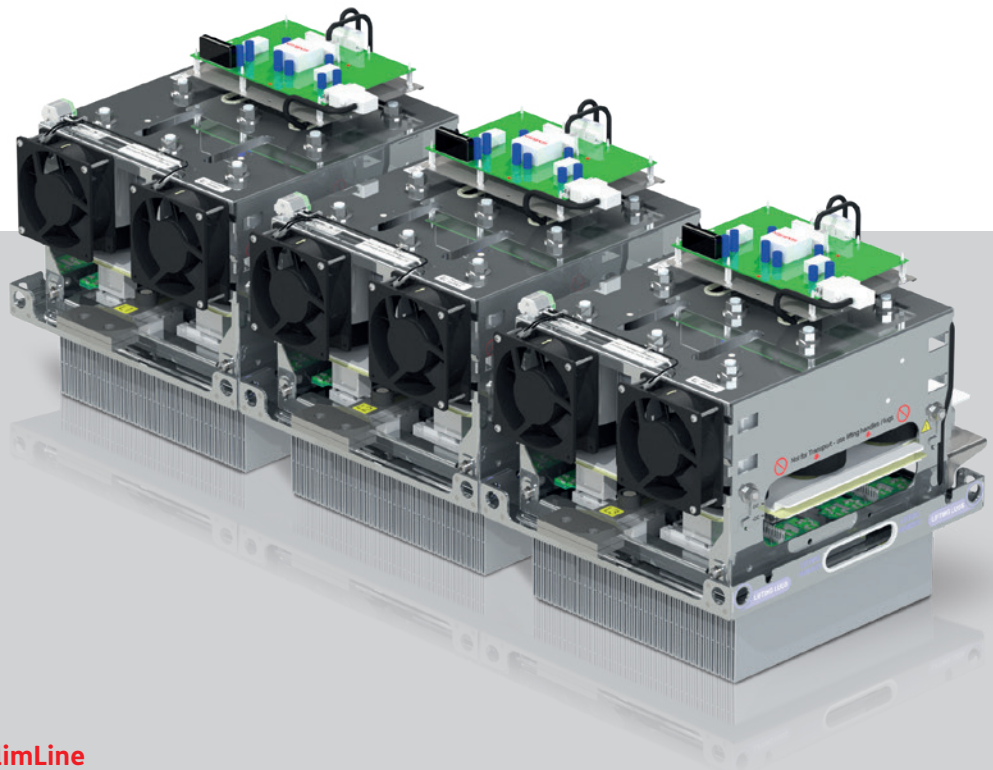
Diode/Thyristor Stacks
SEMISTACK CLASSIC B6U/B6C/W3C

Customized Stacks

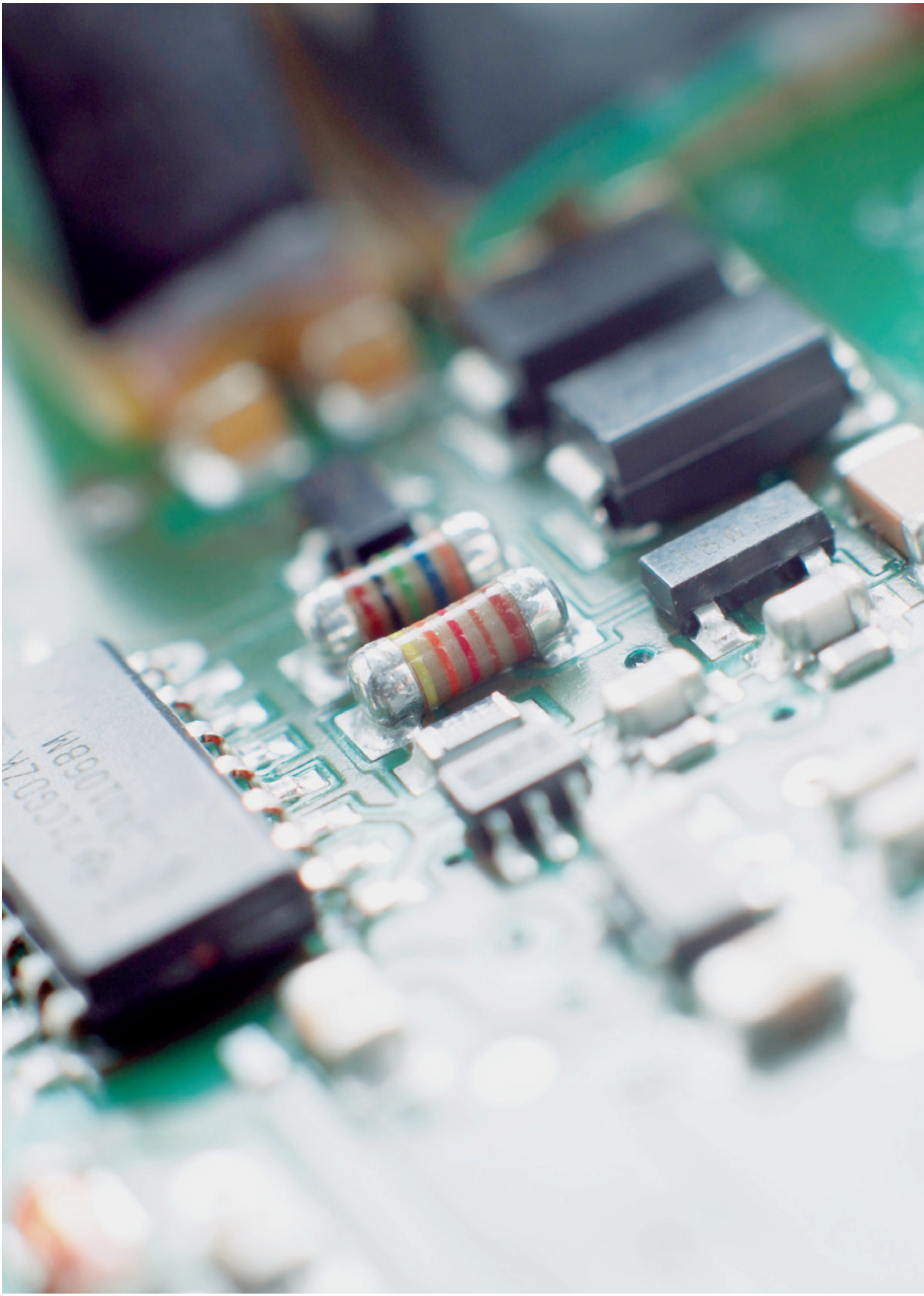
In addition to standard stacks, Semikron Danfoss has vast experience in developing customer-specific solutions. Engineers are available in our stack centers around the globe to offer such solutions by adapting existing platforms or designing customized converters.

Four Key Factors to Your Success

- Shortest time to market
- Cost savings in R&D, production and qualification
- Global Semikron Danfoss stack production footprint
- Highly experienced engineering team



SEMIKUBE® SlimLine
Air-cooled IGBT Power Stack



Product Portfolio
IGBT Driver

The unique product portfolio enables access to all established industries with a one-stop solution that combines state-of-the-art power modules and driver electronics.

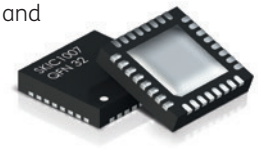
Our IGBT drivers are available as two- channel driver cores suitable for any standard semiconductor power module or as Plug-and-Play solutions, which perfectly fit the SEMiX 3 Press-Fit, SEMITRANS 10 and compatible modules.

Cost Efficient
Achieve outstanding system compactness and create space- and cost-effective inverter designs with our drivers, utilizing highly integrated ASIC technology. Isolated DC-link voltage and temperature sensor signals at the driver's interface along with over-voltage and over-temperature lockout also help to reduce system costs significantly.

Time Efficient
More than 25 years of experience in developing innovative IGBT driver electronics enables Semikron Danfoss to have a short-term solution for almost every challenge related to driver electronics. Our Plug-and-Play drivers connect directly to most common standard IGBT modules. The IGBT driver cores fit with the adapter boards or application sample PCBs. For the latter, Semikron Danfoss shares the entire manufacturing data to decrease development time, speeding up the time-to-market.

Reliable
Our SKYPER are well-known, highly robust and reliable IGBT driver solutions under demanding environmental conditions. Over many years of field operation experience the proprietary IGBT driver technology has been relentlessly developed further. This technology sets new standards for the essential features of safe gate control, reliable gate protection and reinforced insulation.

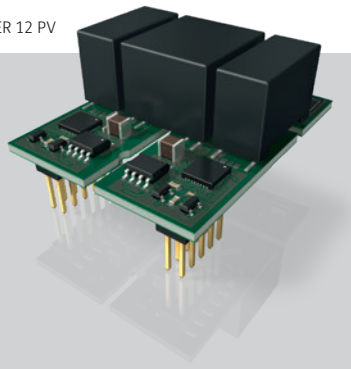
Compact Design
Our SKIC ASIC technology enables very compact system design with minimal peripheral components. With highly integrated signal processing and multi-channel failure management, our ASICs offer robust gate control



Key Factors

Reinforced insulation for signal and power transmission
Two-channel driver
Up to 1700V transients
Up to 1500V continuous DC bus voltage
8Apk to 35Apk per channel
1W to 4.2W peak per channel
Suitable for multi-level topologies and Generation 7 IGBT

SKYPER 12 PV

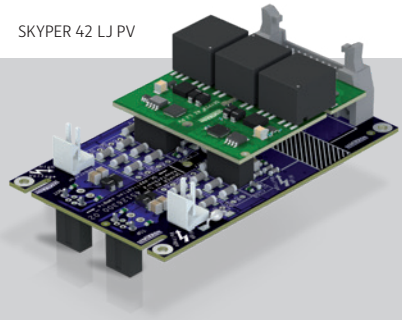


Driver Cores
Two-channel driver cores for PCB integration with Semikron Danfoss ASIC technology and integrated safety functions

SKYPER 12 Press-fit

Plug-and-Play Driver
Two-channel drivers for direct module mounting with electrical or optical interface

SKYPER 42 LJ PV



Adapter Board and Application Samples
Adapter boards for driver core mounting to Semikron Danfoss IGBT and SiC modules

Thermal Interface Materials
Stay Cool: Heat Dissipation is Our Job

Semikron Danfoss was the first power module manufacturer to offer modules with pre-applied thermal interface material (TIM). We now have over two decades of experience and more than 33 million pre-printed modules in the field. We design print patterns for each module type for the best TIM distribution and thickness when the module is mounted to a heatsink. These patterns are printed in a clean environment using automated silkscreen and stencil machines. Statistical process control (SPC) is used to ensure consistency. Special packaging ensures the TIM arrives in pristine condition.

We offer either thermal grease or phase change material (PCM) based on customer needs (e.g., performance or reduced handling effort) and module type. Baseplate-less modules benefit from low-viscosity materials like thermal paste. Our High Performance Thermal Paste (HPTP) provides top-tier thermal performance with optimized filler content.

For easier assembly, most power modules are also available with pre-applied PCM. PCM is solid at room temperature but becomes fluid during operation, filling gaps for thermal contact. HP-PCM, our exclusive High Performance Phase Change Material, combines the benefits of PCM with the performance of the best thermal paste.

For field serviceability, compressible graphite sheets are an innovative option. Panasonic Industry has overcome the shortcomings of traditional graphite sheets with a new compressible pyrolytic graphite sheet called G-TIM (GraphiteTIM).

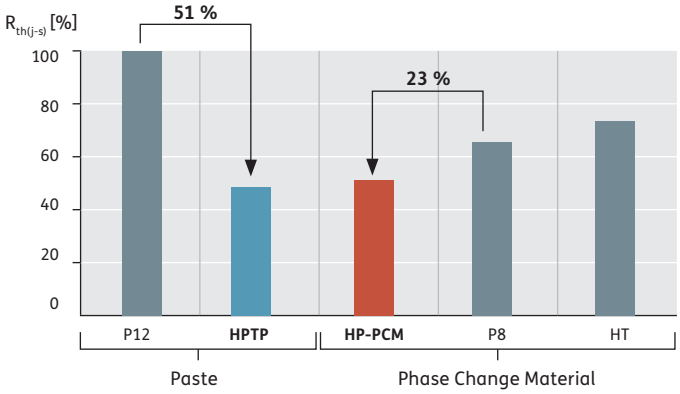
This compressible sheet conforms to the underside of the module during mounting. The crystalline structure of the graphite outstanding long-term stability. Panasonic offers pre-cut graphite sheets for Semikron Danfoss modules.

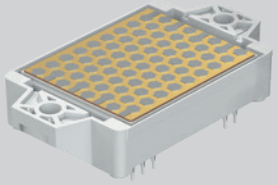
Key Features

- Best possible thermal performance
- Simplified logistics and reduced production costs
- Improved assembly robustness
- Increased lifetime and reliability

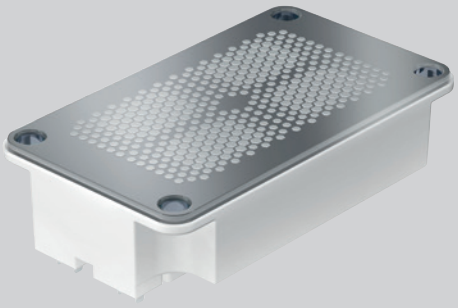
Portfolio

- **HPTP:** High Performance Thermal Paste
- **HP-PCM:** High Performance Phase Change Material





Baseplate-less module with pre-applied thermal paste



Baseplate module with pre-applied phase change material

THE ULTIMATE PARTNER IN POWER ELECTRONICS

Semikron Danfoss is a global technology leader in power electronics. Our product offerings include semiconductor devices, power modules, stacks and systems. In a world that is going electric, Semikron Danfoss technologies are more relevant than ever. With our innovative solutions for automotive, industrial and renewable applications we help the world utilize energy more efficiently and sustainably and thus to significantly reduce overall CO_2 emissions – facing one of the biggest challenges today. We take care of our employees and create value for our customers by investing significantly in innovation, technology, capacity, and service to deliver best-in-industry performance and for a sustainable future.

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