

UPS Systems



Performance Range

The availability of infrastructure systems strongly depends on reliable power, irrespective of whether these systems are servers for cloud storage systems, critical traffic control, or hospital services.

Uninterruptible Power Supplies (UPS) ensure continuous operation of these critical systems. Semikron Danfoss power modules, equipped with the latest chips and flexible circuit topologies, ensure maximum efficiency for double conversion UPS systems. This efficiency can be further improved using silicon carbide technology.



**LOW POWER AND
MODULAR UPS SYSTEMS**

10kVA - 125kVA

- Server rooms
- Data centers

High efficiency systems

Compact designs and high power density

Products

SEMITOP E

MiniSKiiP

SEMiX 5

SEMIPACK

Drivers

**HIGH POWER MODULAR AND
MONOLITHIC UPS SYSTEMS**

100kVA - 5MVA

- Server rooms
- Data centers
- Hospitals and critical control systems
- Industrial applications

High efficiency systems

Compact designs and high power density

Products

MiniSKiiP

SEMiX 5

SEMiX 3 Press-Fit

SEMISTRANS Classic

SEMISTRANS 10

SEMISTRANS 20

SEMIPACK

SKiiP 4/7 IPM

Drivers





**Silicon
Carbide**

The Highest UPS Efficiency with Silicon Carbide

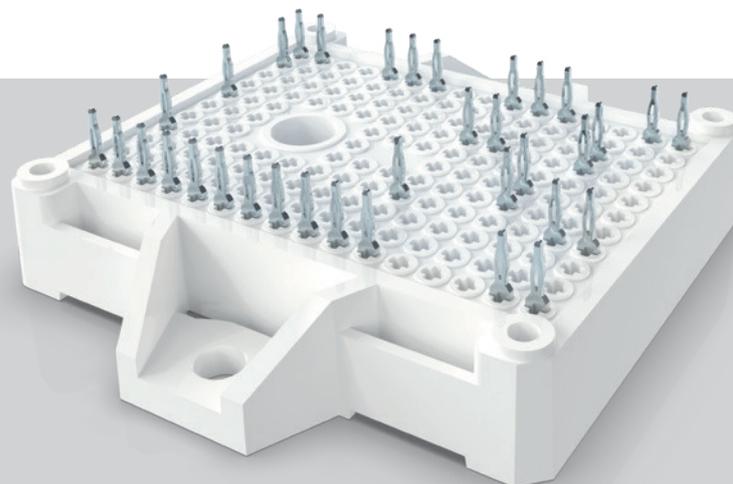
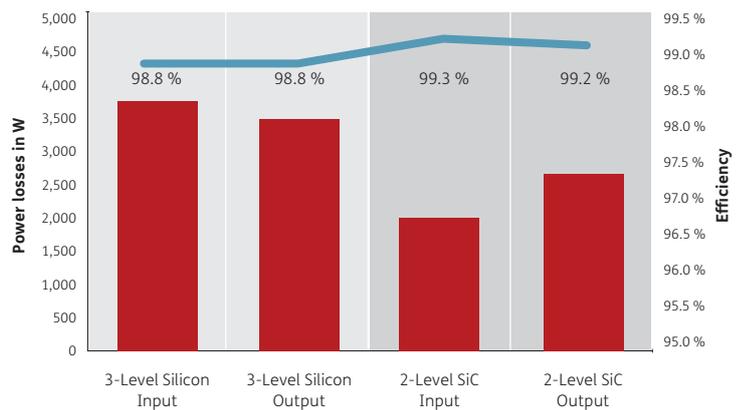
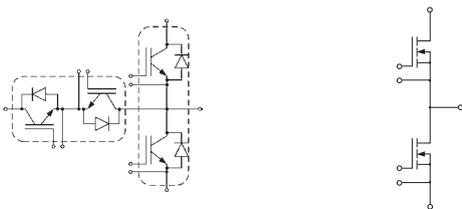
Besides power density, efficiency is one of the major design targets in UPS systems. It is especially important in double conversion / online systems where energy must flow through two power stages.

One proven way to achieve both power density and efficiency is the use of 3-level topologies such as TNPC. This topology reduces power losses over a 2-level solution, thus lower cooling efforts and heat sink size. Additionally, a 3-level topology increases the effective ripple frequency to nearly twice the switching frequency of the IGBTs. A higher ripple frequency brings down filtering effort and hence, filter size and cost. A second option for increasing efficiency is silicon carbide. SiC not only increases efficiency

and output power but also greatly simplifies the design. It allows the use of 2-level topologies while also switching at frequency similar to the effective ripple frequency in a 3-level converter. The use of SEMITOP E2 power modules can transition busbar-based designs (e.g. using SEMITRANS 3 power modules) to PCB-based systems. This reduces weight and cost of peripheral components such as current sensors and DC bus capacitors, as already proven in other applications such solar inverters and motor drives.

Most importantly, with SiC the highest efficiency values can be reached. With an increase of 0.5% in total (input + output stage) efficiency, even the ambitious target of 99% system efficiency can be reached!

SEMISTRANS 3	SEMITOP E
300kW Online UPS System	
125% load for output and low input voltage for input side considered as overload condition	
6kHz	12kHz
resulting in similar effective ripple frequency	
Low losses	Lowest losses (-50%)
High efficiency	Highest efficiency (+0.5%)
Conventional laminated busplates	High current PCB



SEMITOP® E2

PRODUCT HIGHLIGHT

Low-Profile Thyristor Module For Bypass Circuits

Bypass and static transfer switch (STS) circuits are as critical as IGBT converters in UPS systems. Whether under intermittent (bypass) or continuous (STS) load, these circuits must be robust. Thyristors with high steady-state and surge current ratings are a must.

Bypass and STS have traditionally used large, industrial rectifier modules. The SEMiX 3 Press-Fit bipolar variants offer a cost-effective, low-profile alternative to the traditional rectifier types. By leveraging the proven, SEMiX 3 Press-Fit housing, standard wire bond connection technologies can be employed. This allows for connections inside the power module that normally require external busbars. The KQ type integrates the common anti-parallel thyristor connection used in AC switches.

A current rating of $I_{T(AV)} = 508A$ can replace the largest existing dual-thyristor modules. With a blocking voltage of $V_{RRM} = 1600V$, the SEMiX 3 Press-Fit is for 400V or 480V lines. KH and KQ types even offer an integrated temperature sensor for added system monitoring.

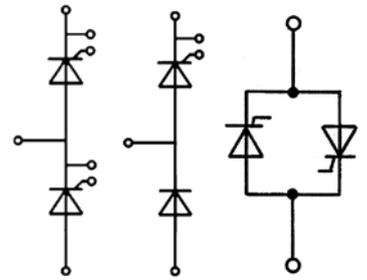
Key Features

Industry standard press-fit design with 17mm-high housing

Integrated anti-parallel connection (KQ type)

Semikron Danfoss diode and thyristor chips

Integrated temperature sensor (KH and KQ types)



KT, KH, and KQ types



SEMiX® 3 Press-Fit
Rectifier Modules
up to 500A

PRODUCT HIGHLIGHT

High Power Density UPS with a Classic Power Module

One of the main design targets for UPS systems is power density as installation space is costly. For medium to high power UPS systems, 3-level topologies like TNPC are a quasi standard. The SEMITRANS Classic TNPC fulfills both requirements and is the perfect choice for your medium and high power UPS systems.

Thanks to the integration of the latest Generation 7 IGBTs, the SEMITRANS 3 TNPC increases power density significantly. Two modules form an effective 3-level phase leg, scalable from 450A to 800A nominal current, allowing 200kVA to 300kVA output power before paralleling.

With silicon carbide MOSFET versions of the vertical half-bridge the output power density can be further increased. The pre-applied High Performance Phase Change Material gives it another boost, making the SEMITRANS 3 TNPC topology the most cost-effective medium power solution for UPS systems.

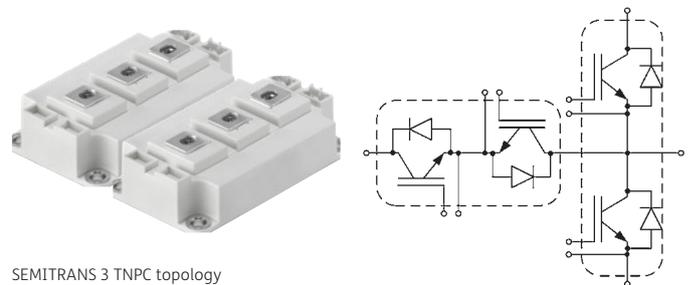
Key Features

High power density thanks to latest Generation 7 IGBTs

Well-proven SEMITRANS Classic power module

Designed for medium and high power building blocks up to 600kVA and parallel connection

Further power density increase thanks to silicon carbide power module variants



SEMITRANS 3 TNPC topology



SEMITRANS® 3
TNPC Topology
up to 600kVA



PRODUCT HIGHLIGHT

Most Comprehensive UPS Portfolio

Highest UPS Power Density with SEMiX[®]5

With its comprehensive portfolio and its optimized design, the SEMiX 5 is ideal for high-performance inverter architectures. The press-fit contacts ensure fast and solder-free driver board assembly, increased reliability and reduced assembly cost. An adapter board for easy gate drive integration is also available.

The internal chip layout is optimized for enhanced thermal performance, reducing operating temperatures and thus boosting reliability. The housing features rugged molded power terminals for superior mechanical stability.

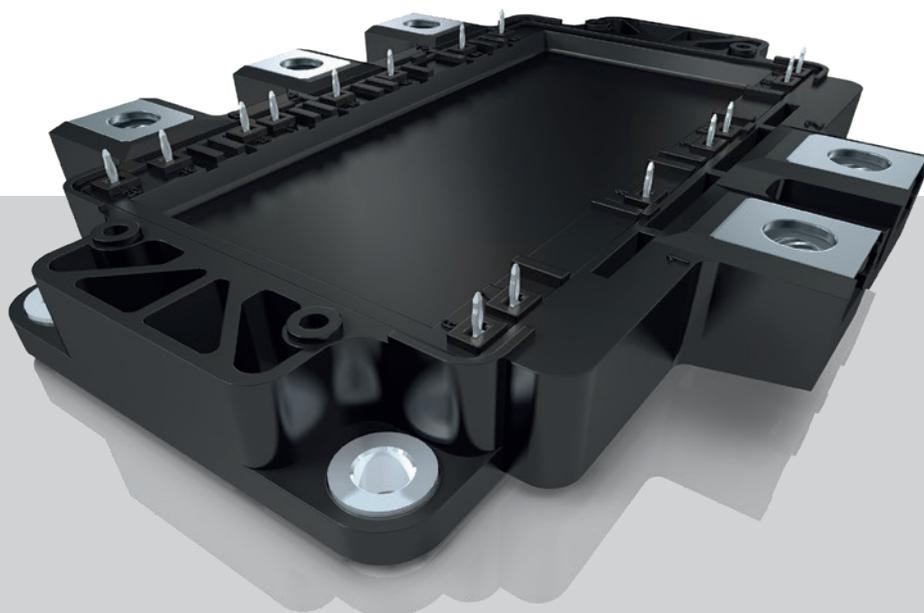
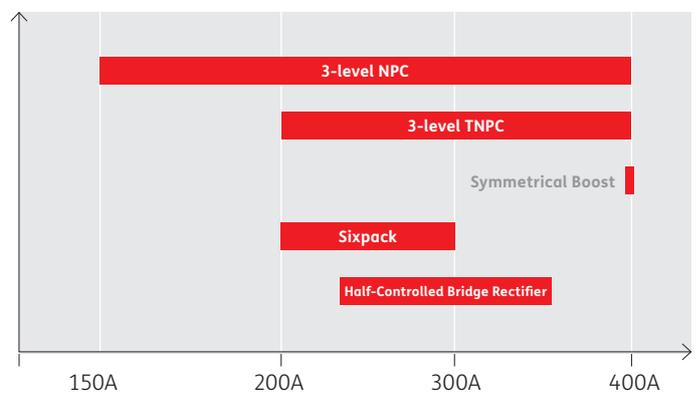
High Power Density and a Comprehensive Portfolio

Biggest range of NPC and TNPC up to 400A nominal current

Exceeding the Standard: higher power density thanks to higher nominal currents in the same package

Full range of symmetrical boost portfolio for input and battery charging

Ready to use 3-level stack designs and application samples up to 500kW



SEMiX[®] 5

50kVA up to 500kVA



SEMiX® 5

50kVA up to 500kVA

Extended Standard for Superior Thermal and Dynamic Performance

Industry standard baseplate module

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

Sixpack, symmetrical boost, NPC and TNPC topologies

Optimized module layout for maximum heat transfer and enhanced thermal and electrical diode performance

Most complete 3-level and booster portfolio, up to 500kVA in parallel connection



MiniSKiiP®

20kVA up to 100kVA

Solder-Free Spring Technology for Minimum Assembly Time

Full family of power modules up to 100kVA

650V / 950V / 1200V / 1700V IGBT: 4A to 400A

1200V Hybrid SiC: 50A to 150A

1200V SiC: 50A to 150A

Sixpack, twelvepack, H-bridge, half-bridge, 3-level and symmetrical boost topologies

Easy and flexible PCB routing without pin holes

MiniSKiiP UPS power modules for 100kVA 19" based modular systems

Product Portfolio

IGBT and Rectifier 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

Diodes, thyristors in un-, half- and full-controlled topologies

Different technologies for certain packages:

high reliability pressure contact or cost-effective wire bonded modules

Perfect for charging and bypass topologies



SEMITOP® E

5kVA up to 100kVA

Exceeding the Standard for Superior Performance

Industry standard baseplate-less housing in two sizes

PCB-based, press-fit connections

650V / 1200V IGBT: 10A to 200A

1200V / 2000V SiC: 30A to 300A

Standard and high speed IGBTs, IGBT T7

Sixpack, half-bridge, buck/boost/ symmetrical boost and 3-Level NPC/TNPC/ ANPC topologies

Optimized mounting concept and pre-applied TIM provide lowest thermal resistance in class



SEMIX® 3 Press-Fit

100kVA up to 400kVA

Exceeding the Standard for Superior Performance

Industry standard press-fit design with 17mm high housing

650V / 1200V / 1700V IGBT: 225A to 900A

1200V Hybrid SiC: 600A

1600V diodes and thyristors: 500A

Half-bridge, buck/boost, and rectifier topologies

Direct driver assembly

Available with integrated shunt resistor

Optional H₂S protection



SEMITRANS® Classic

100kVA up to 600kVA

The Proven Power Electronics Package

Robust industry standard package for multiple sourcing in six housing sizes

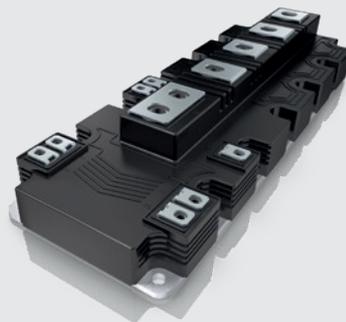
600V / 650V / 1200V / 1700V IGBT: 50A to 900A

1200V / 2000V Hybrid and Full SiC: 200A to 650A

Half-bridge, single switch and buck/boost topologies, ready for TNPC / NPC / ANPC topology

Multiple IGBT sources including Generation 7 IGBT M7

Full power TNPC topology thanks to half-bridge and AC switch (common emitter) with increased free-wheeling diode rating



SEMITRANS® 10

300kVA up to 1.5MVA

Robust High Power Module

Established high power module package

1200V / 1700V / 2300V IGBT: 450A to 1800A

1200V Split-NPC: 1400A

1200V TNPC: 1100A

Half-bridge, split NPC, TNPC and buck/boost topologies

Full multiple sourcing thanks to Generation 7 IGBT M7



SEMITRANS® 20

from 500kVA

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 (1mΩ)

Half-bridge topology

Low stray inductance, high power density package

Increased reliability thanks to the latest packaging technology



Intelligent Power Modules – IPMs

The Most Powerful IPM in the Market

The SKiiP IPM product line sets a benchmark for high performance and robust inverter designs. Both SKiiP 4 and SKiiP 7 feature high power densities combined with flexible cooling options such as air or water cooling, also with customized heatsinks. Reliable driver technology, integrated current sensors and comprehensive protection functions complete the IPM design.

SKiiP 7 has become increasingly popular through the industrial applications. With its sixpack or half-bridge topologies, it covers a current range of 500A to 2400A.

The SKiiP 4, available in half-bridge topology, has been optimized for ultra-high power cycling requirements and covers a higher power range up to 3600A.

To ensure maximum reliability and service life, the power circuitry is 100% solder-free. Sinter die attach technology replaces the solder layer, the common cause of module lifetime limitations, thus improving power and thermal cycling capability.

High Performance Cooling (HPC) technology has been introduced, to provide 25% more output power capability compared to standard water cooling. A double-sided mounting HPC is also available, enabling ever higher power density.

The integrated gate driver in the SKiiP 4 has set new standards in terms of reliability and enhanced functionality through its CAN interface. The digital driver guarantees safe isolation between the primary and secondary side for both switching signals and parameter measurements. The CAN interface allows setting the SKiiP 4 configuration parameter and reading application parameter.

Key Features

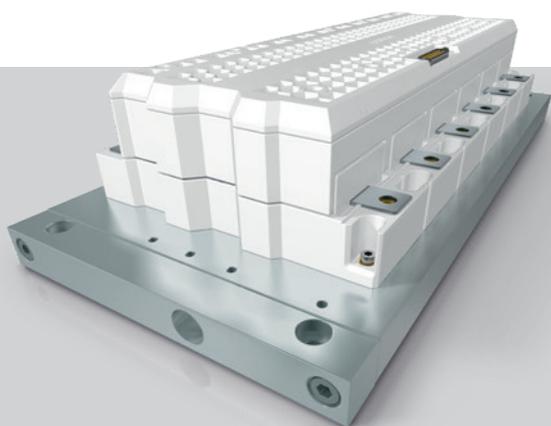
Half-bridges and sixpacks

1200V / 1700V IGBT: 500A to 3600A

2000V SiC: 1200A to 2400A

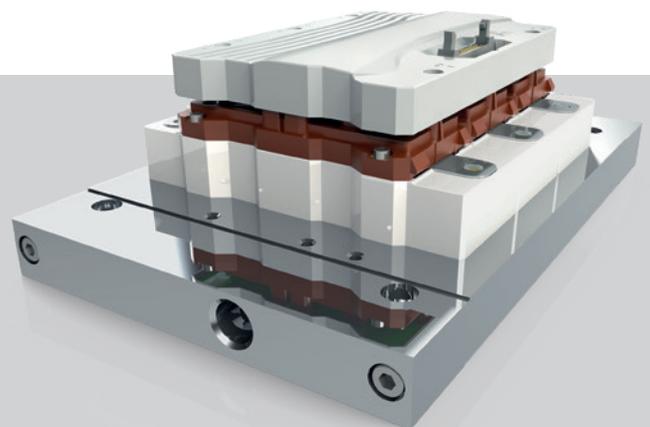
Flexible cooling options: air, water or customized cooling options

Parallel operation for even higher output power possible



SKiiP®4

Up to 2MW
available with SiC MOSFETs



SKiiP®7

150kW up to 2.4MW



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

Standard Stacks

The 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 an output current range from 70A to 4000A.

Water-Cooled IGBT Stacks

SKiiPRACK

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 specific solutions by adapting existing platforms or designing customized converters.

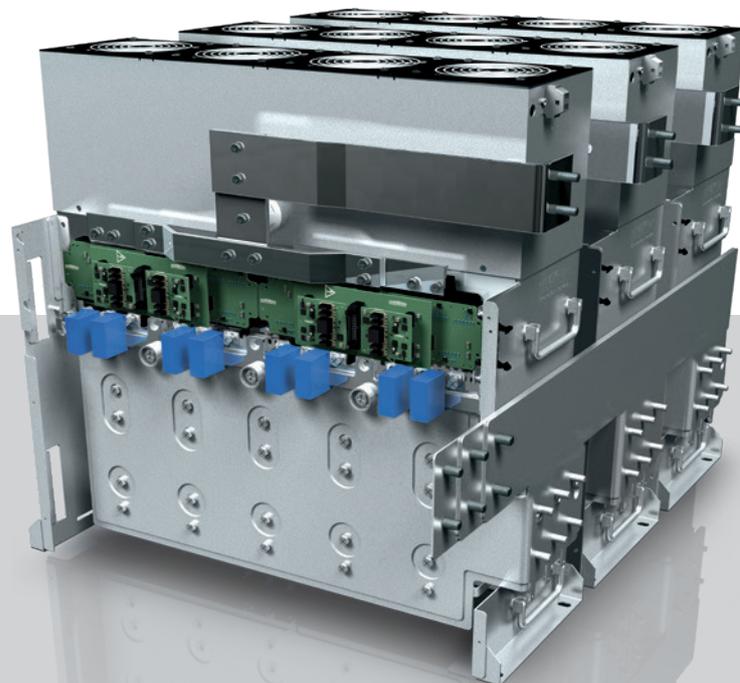
Four Key Factors to Your Success

Shortest time to market

Cost savings in R&D, production and qualification

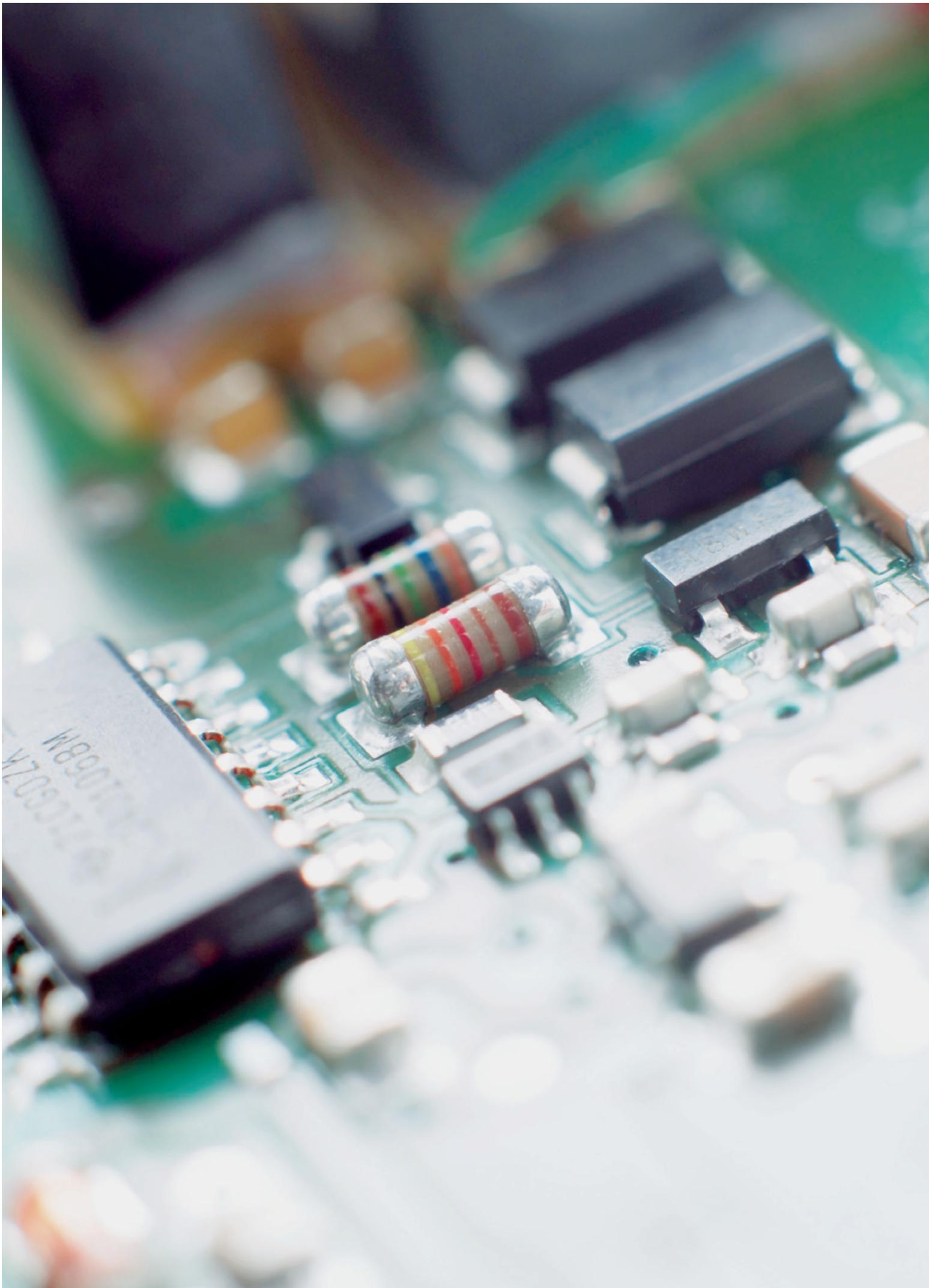
Global Semikron Danfoss stack production footprint

Highly experienced engineering team



Customer-Specific Stack

500kW, based on SEMIX 5 TMLI



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

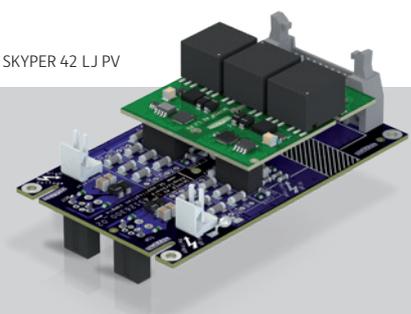
SKYPER 12 Press-fit



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).

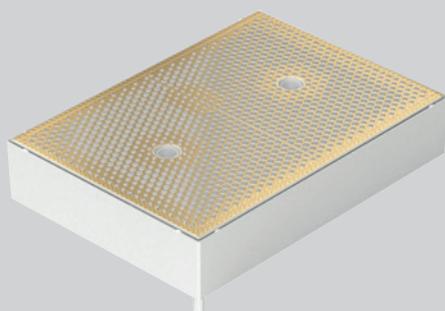
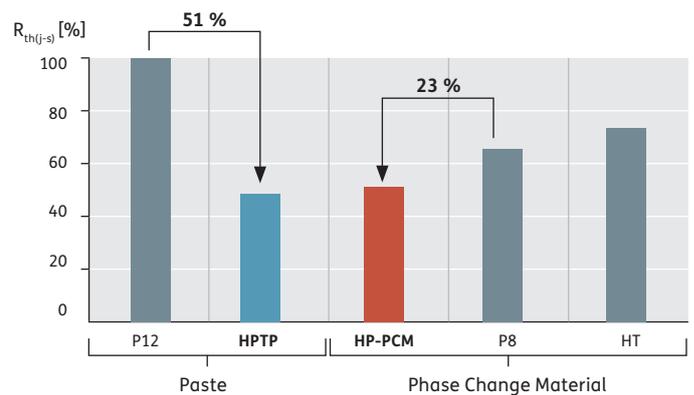
This compressible sheet conforms to the underside of the module during mounting. The crystalline structure of the graphite outstanding long-term stability. Panasonic offers pre-cut graphite sheets for Semikron Danfoss modules.

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 CO₂ 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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Note: All information is based on our present knowledge and is to be used for information purposes only. The specifications of our products may not be considered as an assurance of component characteristics.

