

Traction

Power Electronics for
Traction Applications





PERFORMANCE RANGE

Whenever we talk about traction applications, we see extremely high demand for reliability, lifetime and safety. SEMIKRON is offering this requirements to our customers since we developed the first isolated power module on the market in 1974. For 25 years, our highly reliable SKiiP IPMs are driving light rails, trams and subways all over the world.

With our new SEMITRANS 20 power module family, SEMIKRON brings latest sinter and bonding technology to the new high power standard package. SEMIKRON stands also for innovative solutions for auxiliary power supplies: our silicon and silicon carbide powered devices, especially the SEMITRANS and SEMITOP module families, allow reliable, efficient and compact systems.

AUXILIARY POWER SUPPLY

5kW - 500kW

Compact designs and high power density

High reliability in harsh environments

High power quality

High efficiency

Products

SEMITOPE1/E2

MiniSKiP

SEMiX 3 Press-Fit

SEMITRANS

SEMITRANS 10

SEMITRANS 20

Drivers

MAIN TRACTION DRIVE

500kW - 10MW

Highest reliability and lifetime

High power cycling capability

Long lifetime and availability

Products

SEMITRANS 10

SEMITRANS 20

SEMIPACK

SKiP 3/4 IPM

Drivers



Product Highlight

The New High Power Standard in Traction Drives

The SEMITRANS 20 product family increases product lifetime and power output. SEMITRANS 20 modules deliver significant advantages for the traction market:

- A simplified inverter design leads to reduced costs for mounting materials as well as in the inverter assembly process
- More space for driver boards and less EMC disturbance from high current bus bars to the driver
- Three AC terminal connectors for low operating temperatures even at high loads
- Less de-rating at parallel operation thanks to the low inductance bus bar layout and the extremely low module inductance
- Ideal for cost-effective inverter design and scaling

On top of this, the SEMITRANS 20 TRACTION module provides SEMIKRON innovative technologies such as sintered chips and AlCu wire bonds. This takes reliability and power density to new levels, resulting in:

- Superior product lifetime
- Lower cost per kW and
- Higher power density

Key features

Standard package for traction and industrial applications

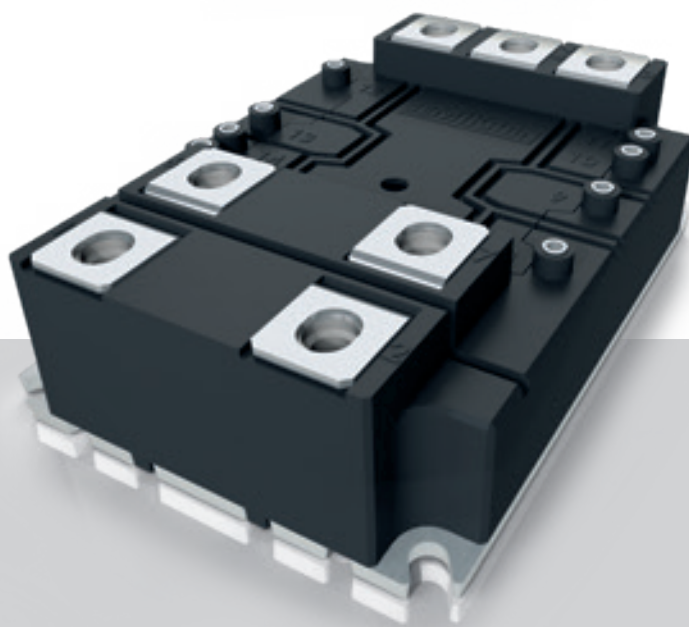
Innovative technologies with sintered chips and AlCu wire bonds

Next level lifetime and power density

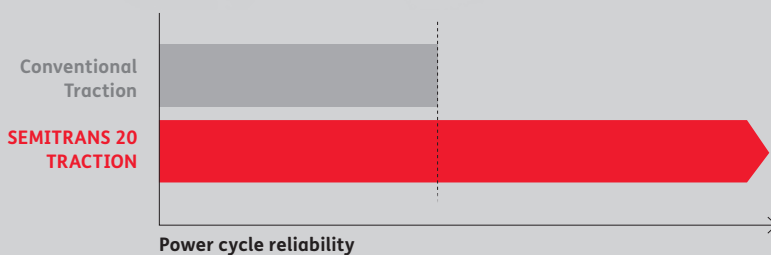
Lower mounting and material cost in inverter assemblies

Ideal for paralleling and scaling

GENERATION
IGBT 7



SEMITRANS® 20
1.7kV half-bridge module



Product Highlight

SiC and Hybrid SiC Modules for Auxiliary Traction Inverters

The SEMITRANS 3 product family is growing with its new Full and Hybrid SiC half-bridge modules in 1200V and 1700V. This new portfolio extension allows highly efficient auxiliary traction inverters. Due to the high switching frequency of the silicon carbide devices, the size of the passive components can be reduced, and inaudible to the human ear, allowing reduced acoustic insulation.

The decreased losses reduce service and maintenance costs, thanks to passive cooling of the power electronic components.

Multiple sourcing down to chip level ensures maximum supply chain safety.

Benefits of SiC technology in auxiliary traction converters

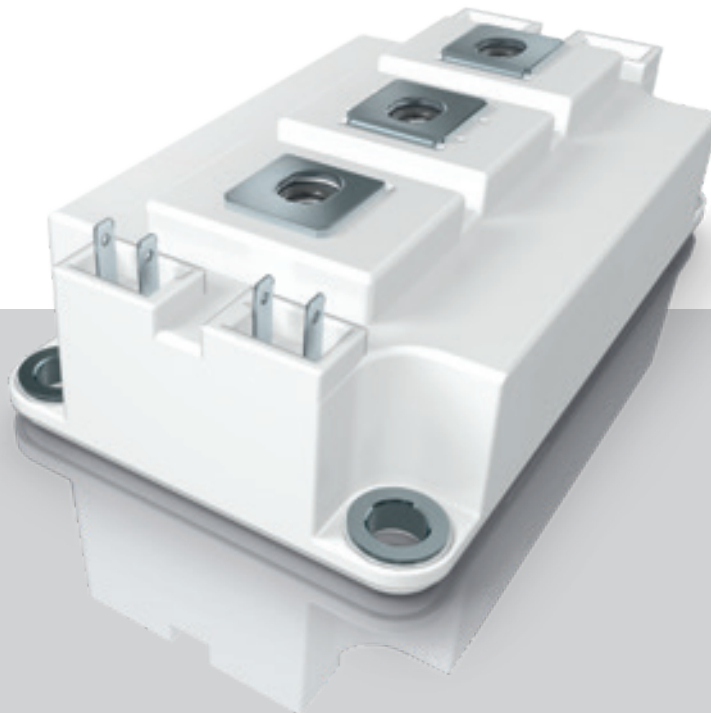
High switching frequencies >20kHz are not audible by human ear

Low switching losses allow passive cooling for reduced maintenance

Dramatically reduced filter size thanks to high switching frequencies

Dramatically reduced transformer size of DC/DC converters

In total smaller size and volume of complete auxiliary converter



SEMITRANS® 3

1.2kV and 1.7kV SiC and Hybrid SiC modules



MiniSKiiP®

8kW up to 300kW

Solder-free spring technology for minimum assembly time

Full family of power modules up to 110kW

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

1200V Hybrid SiC: 50A to 150A

Comprehensive set of topologies: CIB, sixpack, twelvepacks, H-bridge, half-bridge, 3-level, bridge rectifiers with brake chopper

Easy and flexible PCB routing without pin holes



SEMITOP® E1/E2

8kW up to 225kW

Exceeding the standard for superior performance

PCB based and press-fit connected baseplate-less industry standard power module in two housing sizes

650V and 1200V: 10A to 100A

IGBT 4 and IGBT T7

CIB and sixpack topologies

Optimised mounting concept and pre-applied High Performance Thermal Paste provide lowest thermal resistance in class

Increased power density thanks to Generation 7 IGBT T7

Hybrid and full SiC modules up to 1200V/250A

Power Modules



SEMIPACK®

800V up to 2200V

Bipolar modules from the market leader

Industrial standard thyristor/diode modules

Market experience for over 40 years

Broad power and topology range

800V up to 2200V

15A up to 1360A

Un-, half- and full-controlled rectifiers

SiC Schottky Diode modules up to 300A

SEMiX®3 Press-Fit

55kW up to 350kW

Exceeding the standard for superior performance

Industry standard press-fit design with 17mm high housing

650V/1200V/1700V IGBT: 225A to 700A

1200V Hybrid SiC: 600A

Direct driver assembly

Solder-free contacts for highest durability

Increased power density thanks to Generation 7 IGBT M7

Available with integrated shunt resistor



SEMITRANS®

5kW up to 200kW

The proven power electronics package

Robust industry standard package for multiple sourcing in 6 housing sizes

600V/650V/1200V/1700V IGBT: 25A to 900A
1700V SiC: up to 260A

Half-bridge, single switch and brake chopper topology

Multiple IGBT sources including Generation 7 IGBT M7

Increased power range in 62mm thanks to portfolio extension in 1200V and 1700V half-bridges:
1200V/600A
1700V/500A

SEMITRANS® 10

200kW up to 1MW

Robust high power module

Established high power module package

1200V IGBT: 1400A

1700V IGBT: 1000A and 1400A

Half-bridge and split NPC topologies

Latest Generation 7 IGBTs for for 3-level NPC modules

SEMITRANS® 20

200kW up to 1MW

The new standard in high power

The latest industry standard power module for high power applications

1200V: 1400A

1700V: 1000A and 1200A

Half-bridge topology

Low stray inductance, high power density package

Increased reliability thanks to the latest packaging technology



Intelligent Power Modules – IPMs

For Maximum Reliability

The SKiiP IPM product line sets a benchmark for high performance and robust inverter designs. Both SKiiP 3 and SKiiP 4 feature high power densities combined with flexible cooling options such as air- or water cooling, also with customized heat sinks. Reliable driver technology, integrated current sensors and comprehensive protection functions complete the IPM design.

SKiiP 3 has propagated widely through the industrial drive segment. With its sixpack or half-bridge topologies, it covers a current range from 500A up to 2400A.

Key features

1200V and 1700V

Half-bridge and sixpack

500A to 3600A

Flexible cooling options: air, water or customized cooling options, high performance cooling, single and double side mounting water coolers

Paralleled operation for even higher output power possible

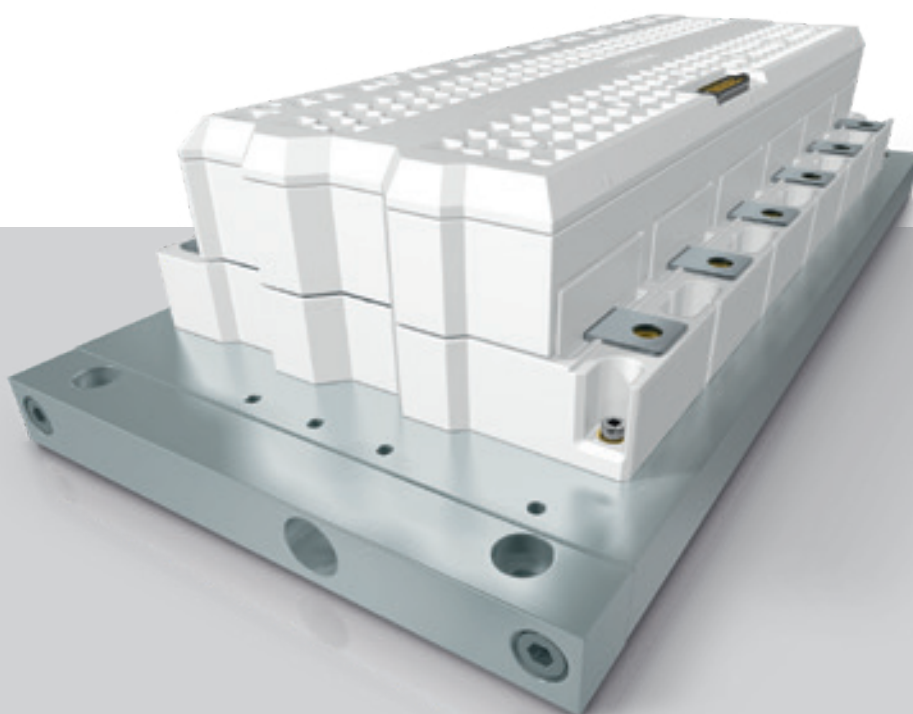
Special version for 1500VDC available

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

To ensure highest reliability and service life, the power circuitry is 100% solder-free. Sinter technology as die attach replaces the solder layer, which usually causes the limitation in lifetime. Hence, sintering improves power and thermal cycling capability.

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 measurement. The CAN interface allows setting the SKiiP 4 configuration parameter and reading application parameter.

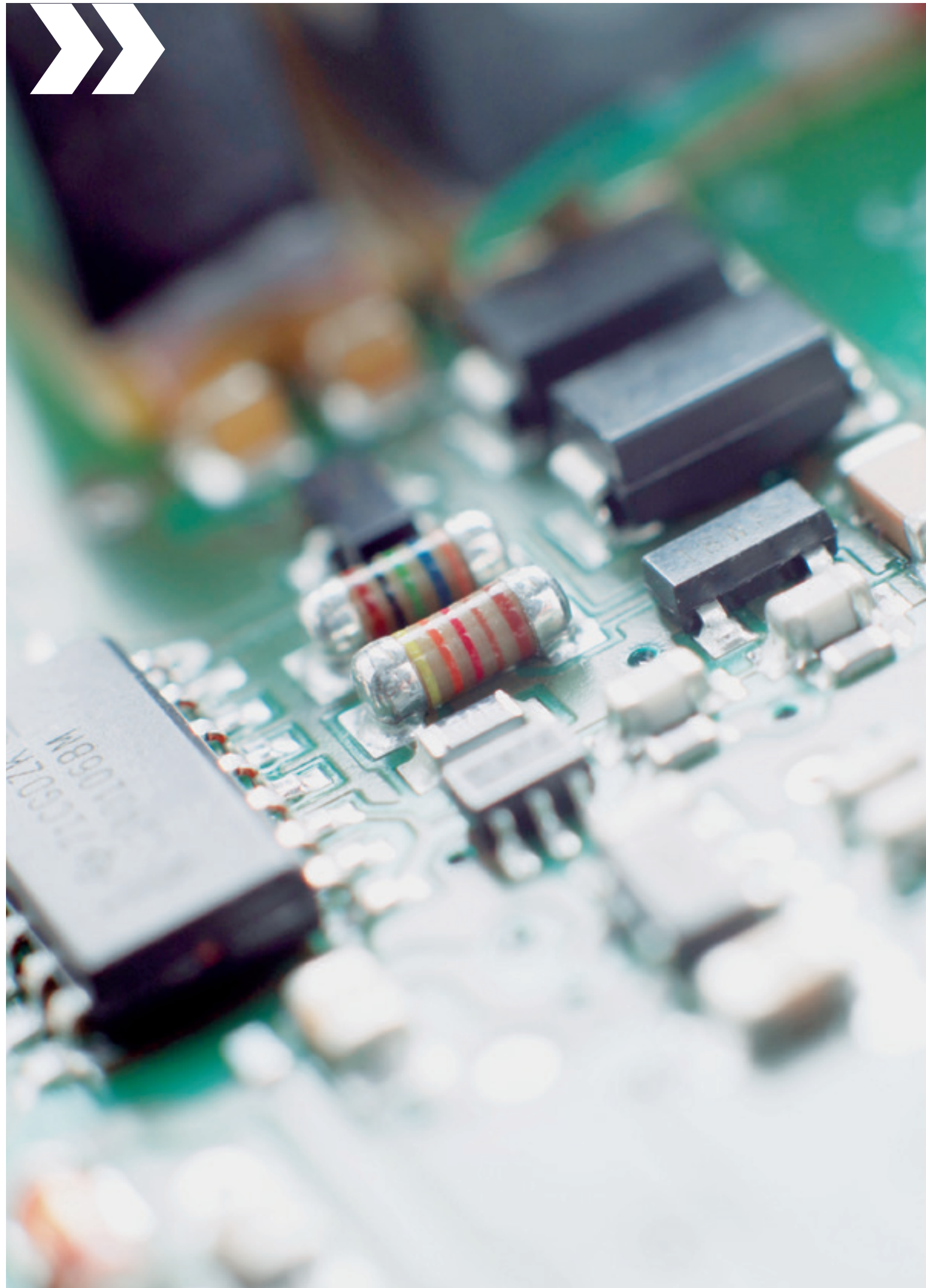
High performance cooling (HPC) technology has been introduced providing approximately 25% more output capability compared to standard water cooling. A double side mounting HPC water cooler is also available and enables an even higher power density.



SKiiP®4

500kW up to 3MW

The most powerful IPM in the market



Product Portfolio IGBT Driver

Above the Standard

SEMIKRON's 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.

SEMIKRON's 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 SEMIKRON's 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 to have a short-term solution for almost every challenge related to driver electronics. SEMIKRON's Plug-and-Play drivers connect directly to most common standard IGBT modules. The IGBT driver cores fit with SEMIKRON's adapter boards or application sample PCBs. For the latter, SEMIKRON shares the entire manufacturing data to decrease development time, speeding up the time-to-market.

Reliable

SEMIKRON's SKYPER and SKHI 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.

Key factors

Reinforced insulation for signal and power transmission

Two-channel driver

Up to 1700V transients

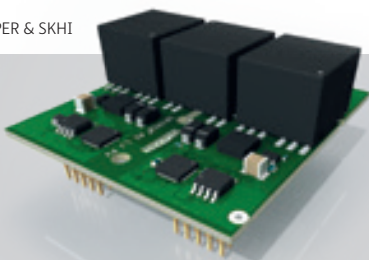
Up to 1500V continuous DC bus voltage

8Apk to 35Apk per channel

1W to 4.2W peak per channel

Suitable for multi-level topologies and Generation 7 IGBT

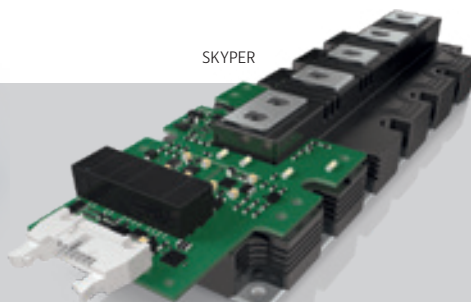
SKYPER & SKHI



Driver Cores

Two-channel driver cores for PCB integration with SEMIKRON ASIC technology and integrated safety functions

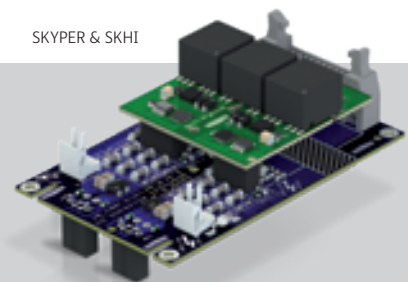
SKYPER



Plug-and-Play Driver

Two-channel drivers for direct module mounting with electrical or optical interface

SKYPER & SKHI



Adapter Board and Application Samples

Adapter boards for driver core mounting to SEMIKRON IGBT and SiC modules



Thermal Interface Materials

Stay Cool – Heat Dissipation is Our Job

SEMIKRON was the first power module manufacturer on the market to offer power modules with pre-applied thermal interface material. With more than two decades of field experience and more than 17 million pre-printed modules in the field, benchmarks are being set. The modules with pre-applied TIM are printed in a clean environment on an automated and SPC controlled silkscreen and stencil printing line.

For each requirement, SEMIKRON offers the right choice of material. In addition to the standard silicone thermal grease, phase change materials and high performance thermal paste with improved thermal performance are also available.

SEMIKRON offers either thermal grease or phase change materials depending on customer requirements (e.g. performance increase, reduced handling effort) and module type (with or without baseplate). Phase change materials have a solid consistency at room temperature, fully exploiting the advantages a non-smearing TIM layer offers, with no drawbacks. Baseplate-less modules, on the other hand, usually require a lower-viscosity material to help improve robustness during assembly. Here, thermal grease is the preferred solution.

Key features

Increased productivity thanks to reduced handling costs and improved logistics

Low thermal resistance with optimised TIM layer thickness

Improved lifetime and reliability

Improved assembly robustness

Modules can be shipped directly to the assembly line without any additional treatment processes

Lower overall costs

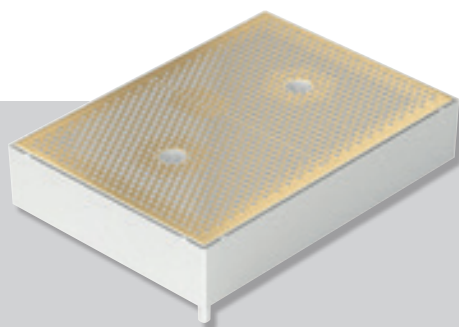
Portfolio

P8: Phase Change Material for highest performance

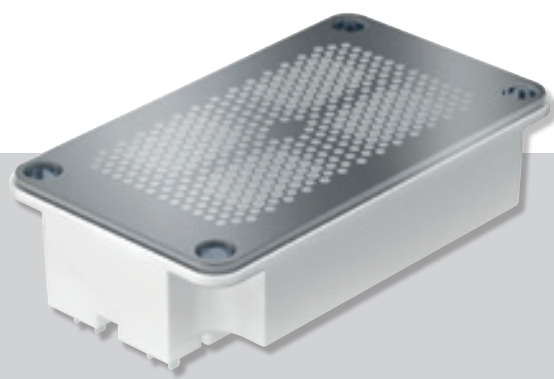
HT: Phase Change Material for highest sink temperature

HPTP: High Performance Thermal Paste

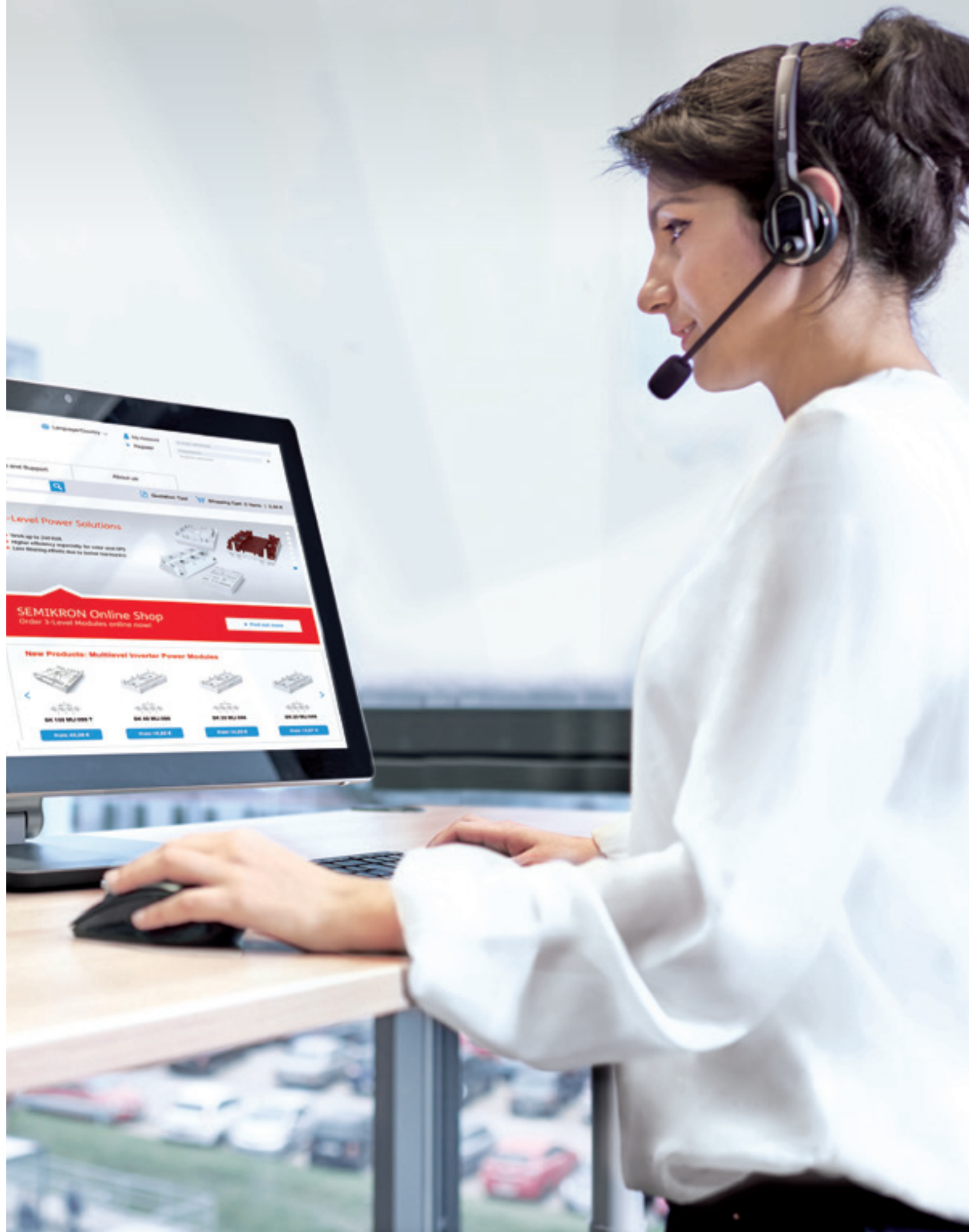
P12: Standard Thermal Paste



**Baseplate-less
Power Modules**



**Baseplate
Power Modules**



Service

Your 24/7 Online Service

SemiSel Simulation

Have you ever asked yourself “Have I selected the right power semiconductors?” Then you should check out SemiSel – SEMIKRON’s simulation tool for losses and temperatures, the perfect tool to help you select the right power semiconductors for the specific needs of your application. The first of its kind almost 20 years ago, SemiSel has been continually improved and now boasts lots of new features and functions.

Product range

Available for all SEMIKRON products:

- Rectifier diode and thyristor modules
- IGBT and fast diode modules
- SiC Schottky diodes and SiC MOSFET modules
- From 3A to 6000A rated current
- From 55V to 3300V devices

Key features

27 different power electronic circuits can be simulated

Simulations with different degrees of complexity, from simple nominal conditions to complex mission profiles

Cooling conditions for air and liquid cooled systems proposed to match the housing and devices selected

Efficiency and temperatures at a glance

Visit us at

www.semikron.com/semisel

Online Shop

Our specialty lies in the delivery of expert support to small and medium-sized enterprises by offering them the following services:

Technical & sales support

- Reply within 24 hours
- Multilingual sales and support
- Design-in-support directly from manufacturers’ specialists

Worldwide shipping

- Fast shipping to more than 100 countries
- Low-volume purchases also possible
- Shipping directly from manufacturer’s warehouse
- Over 600 conventional SCRs, IGBT modules, bridge rectifiers and IPMs in stock

Transparency & efficiency

- Transparent price breakdowns online
- Updated information
- Instant quotes using the online quotation tool

Cross reference search

- Find a fully compatible SEMIKRON device for any other brand:
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de.linkedin.com/company/semikron

SEMIKRON INTERNATIONAL GmbH

Sigmundstrasse 200
90431 Nuremberg, Germany
Tel: +49 911 6559 6663
Fax: +49 911 6559 262
sales@semikron.com

www.semikron.com
shop.semikron.com

