



# Energy Storage

Power Electronics for  
Energy Storage Systems





## PERFORMANCE RANGE

With decentralized renewable energy sources in our power grid, the demand for energy storage systems to stabilize fluctuations is quickly growing. SEMIKRON's portfolio includes a wide range of products for energy storage systems. From small and medium power modules for residential and industry scale storage systems to high power components for utility-grade storage systems. SEMIKRON products deliver maximum reliability, meeting the extended lifetime requirements of energy storage systems. From individual modules including dedicated drivers to high power SKiiP 4 IPMs and ready-to-use power electronic stacks – SEMIKRON has the solution.

# LOW/MEDIUM POWER

## 8kW - 75kW

- Residential scale
- Commercial/Industrial scale
- Solar and Storage

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Compact designs and high power density

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High efficiency

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High reliability to reduce downtime

### Products

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SEMITOP E1/E2

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MiniSKiiP

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SEMiX 5

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SEMiX 3 Press-Fit

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SEMITRANS

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Drivers

# MEDIUM/HIGH POWER

## 50kW - 5MW

- Commercial/Industrial scale
- Utility scale
- Solar and Storage

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1500V<sub>DC</sub> Capability

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High efficiency

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High reliability to reduce downtime

### Products

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SEMITOP E1/E2

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SEMiX 5

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SEMiX 3 Press-Fit

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SEMITRANS

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SEMITRANS 10

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SEMITRANS 20

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SKiiP 3/4 IPM

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Drivers

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Power Electronics Stacks



## Product Highlight

# The Latest Generation 7 IGBT for Highest Supply Chain Safety

Whenever power quality and efficiency are driving factors in power electronics applications, 3-level topologies are the key. This is especially true for renewable energy applications where the combination with the latest Generation 7 IGBTs sets new benchmarks.

For ANPC topologies, SEMIKRON's new SEMITRANS 20 power module combines low stray inductance, high power density and Generation 7 IGBTs to set a new benchmark. This package design, based on standard half-bridge topology, allows a simple ANPC layout with low inductance DC-link connections.

### Key features

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Reduced magnetics cost thanks to 3-level topology

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Up to 2MW without paralleling

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Reduce switching losses with 1200V IGBT

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Latest Generation 7 IGBTs

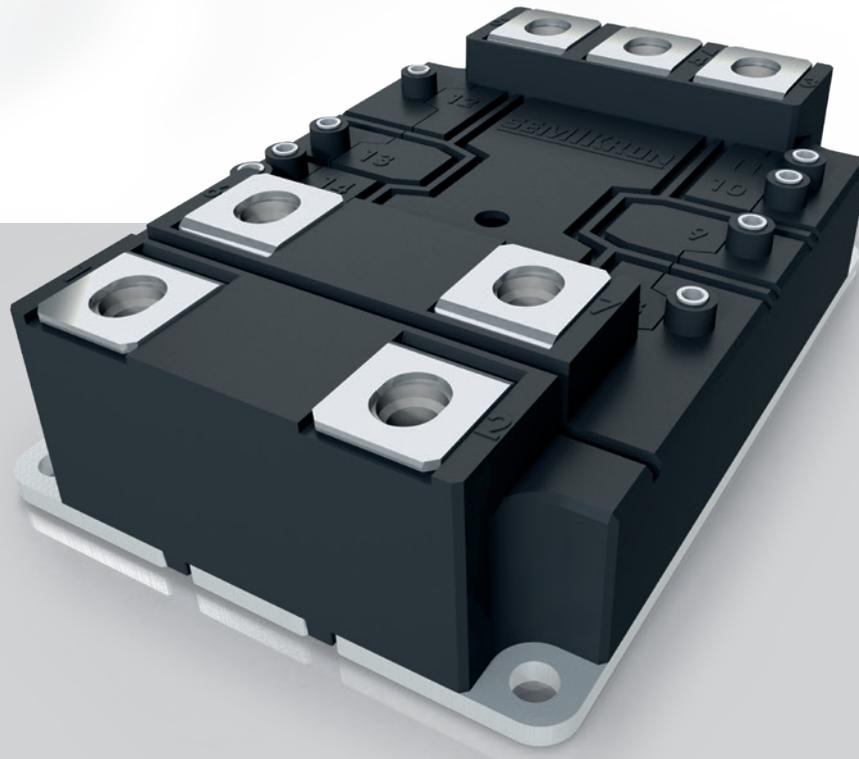
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Reduced cable diameters or cable losses

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Reduced cooling requirements

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**SEMITRANS®20**  
500kW up to 2MW

## Product Highlight

# Comprehensive Sixpack and 3-Level Module Family

With its comprehensive portfolio and its optimised 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.

Adapter boards for easy gate drive integration are also available. The internal chip layout is optimised for enhanced thermal performance, reducing operating temperatures, thus boosting reliability. The housing features rugged moulded power terminals for superior mechanical stability.

### Key features

Low stray inductance package

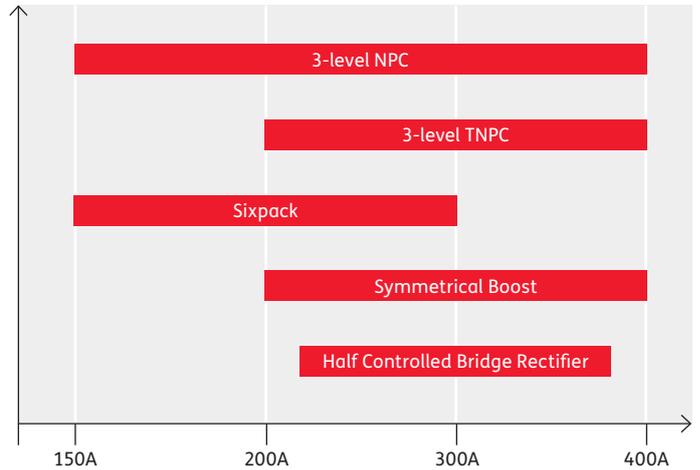
Solder-free assembly

Optimised thermal performance

Flexible architecture

Press-fit design

17mm module height



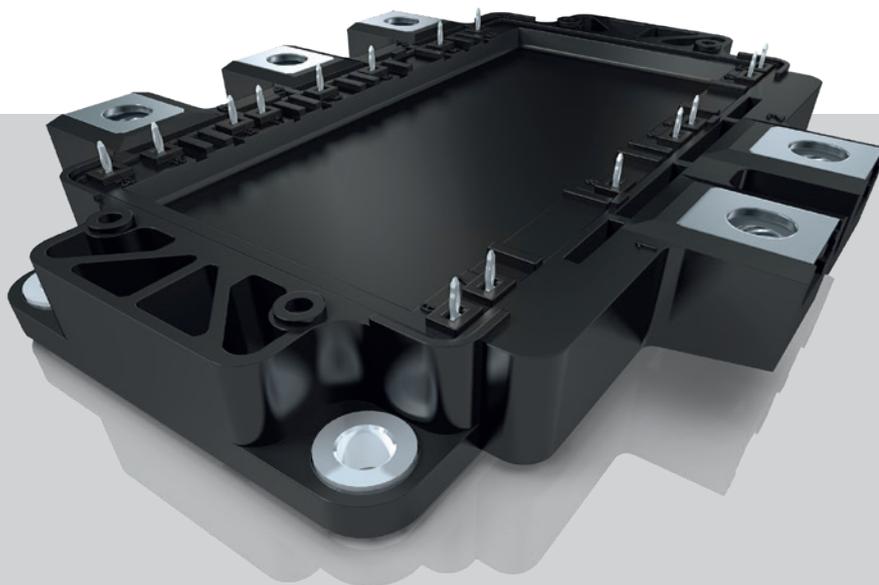
### Exceeding the standard

Optimised module design for ultimate thermal footprint

Effective heat spread for improved thermal performance

Longer lifetime for tighter reliability requirements

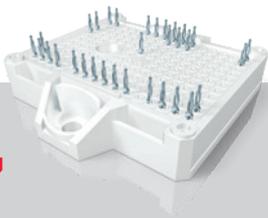
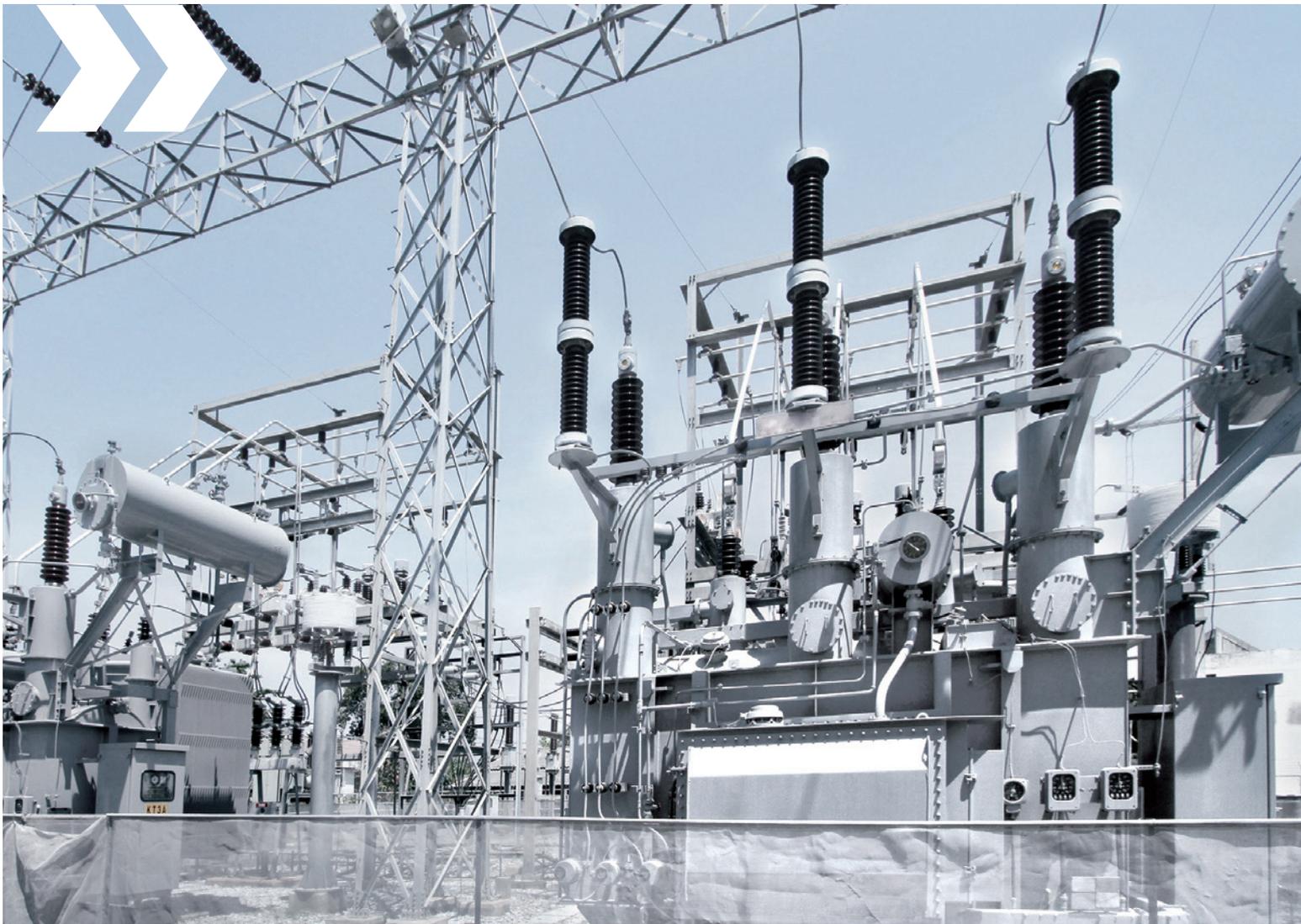
Suitable for very fast switching applications thanks to very low inductance layouts



GENERATION  
IGBT  
7

SEMIX<sup>®</sup>5

50kW up to 150kW



GENERATION  
IGBT  
7

## SEMITOP® E1/E2

8kW up to 225kW

### Exceeding the standard for superior performance

Baseplate-less industry standard power module in two housing sizes

Press-fit pins for solder-less connection to PCB

650V and 1200V: 10A to 250A

3-level NPC and ANPC, sixpack, H-Bridge and Half-Bridge topologies

Optimised mounting concept provides lowest thermal resistance in class

Soft and fast switching 650V IGBT S5 and H5

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



GENERATION  
IGBT  
7

## MiniSKiP®

20kW up to 300kW

### Solder-free spring technology for minimum assembly time

Full family of power modules up to 300kW

650V / 950V / 1200V / 1700V

IGBT: 4A to 400A

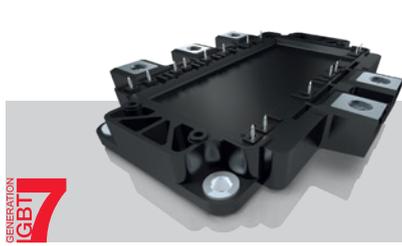
1200V Hybrid SiC: 50A to 150A

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

Easy and flexible PCB routing without pin holes

## Product Portfolio

# Power Modules



### SEMIX<sup>®</sup> 5

50kW up to 150kW

**Extended standard for superior thermal and dynamic performance**

Industry standard baseplate module

650V / 1200V / 1700V IGBT: 100A to 400A

Sixpack, NPC and TNPC topologies

Optimised module layout for maximum heat transfer

Enhanced thermal and electrical diode performance



### SEMIX<sup>®</sup> 3 Press-Fit

100kW up to 400kW

**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

Half-Bridge and split NPC topologies

Direct driver assembly

Available with integrated shunt resistor



### SEMITRANS<sup>®</sup>

25kW up to 1MW

**The proven power electronics package**

Robust industry standard package for multiple sourcing in 6 housing sizes

600V / 650V / 1200V / 1700V

IGBT: 50A to 900A

1200V SiC: 125 to 500A

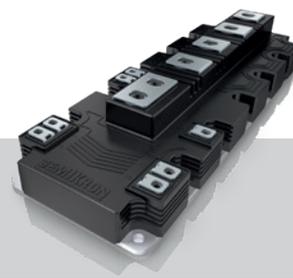
Half-bridge, single switch and brake chopper topology

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<sup>®</sup> 10

500kW up to 2MW

**Robust high power module**

Established high power module package

1200V IGBT: 1400A

1700V IGBT: 1000A and 1400A

Half-bridge and split NPC topologies

Full second source thanks to alternative 1700V chip source and Generation 7 IGBT M7



### SEMITRANS<sup>®</sup> 20

500kW up to 2MW

**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



## Power Electronic Stack Platforms

# Fully Qualified Inverter Assemblies Tailored to Your Specific Needs

### Standard Stacks

SEMIKRON's 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 1000V. Our standard stacks cover a output current range from 70A to 4000A.

### Water-Cooled IGBT Stacks

SKiiPRACK  
SEMIKUBE MLI

### Air-Cooled IGBT Stacks

SEMIKUBE  
SEMIKUBE SlimLine  
SEMIKUBE MLI

### Diode/Thyristor Stacks

SEMISTACK CLASSIC B6U/B6C/W3C

### Customised Stacks

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

#### Four key factors for your success:

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Shortest time to market

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Cost savings in R&D, production and qualification

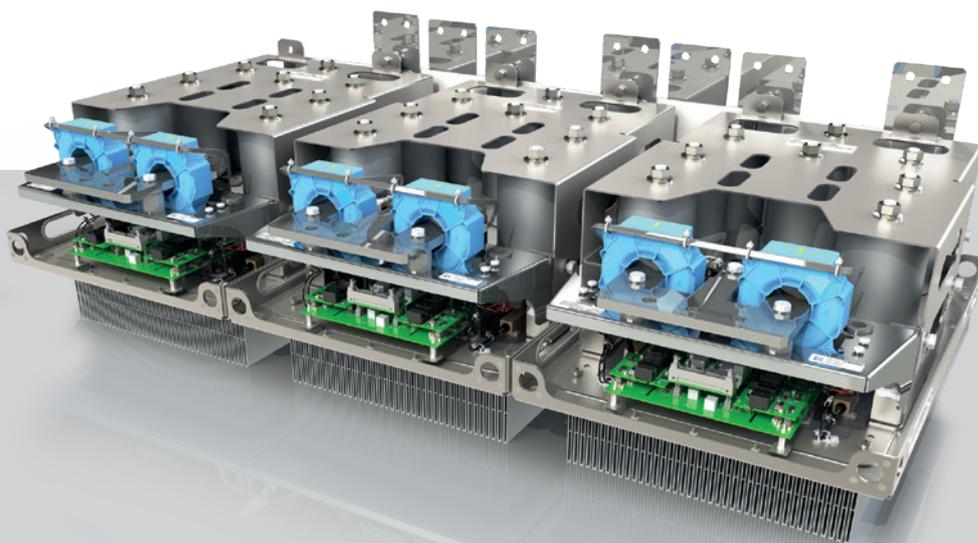
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Global SEMIKRON stack production footprint

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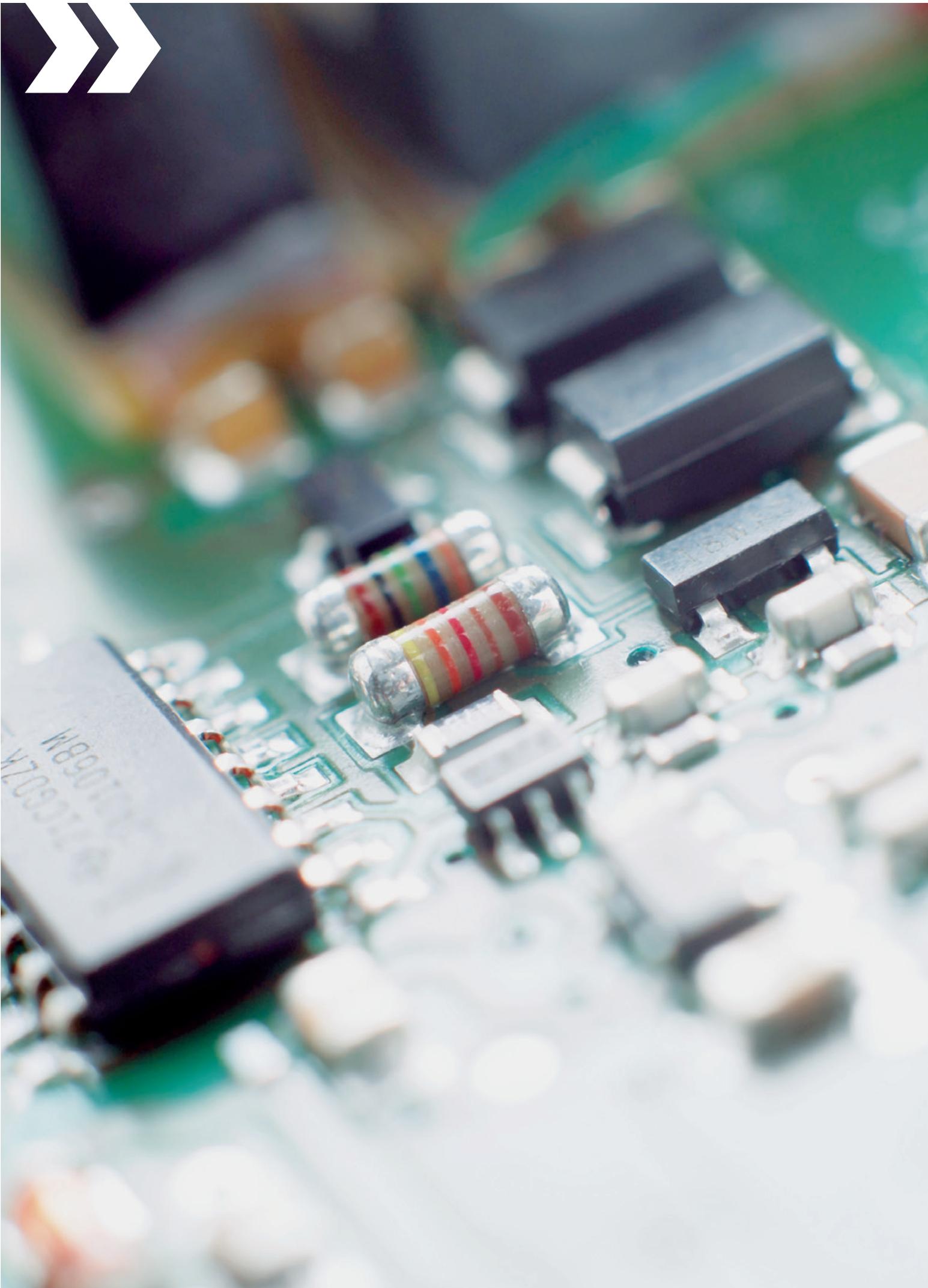
Highly experienced engineering team

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**SEMIKUBE® MLI**

1,5MVA 3-Level IGBT Topology



# 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

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Reinforced insulation for signal and power transmission

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Two-channel driver

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Up to 1700V transients

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Up to 1500V continuous DC bus voltage

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8Apk to 35Apk per channel

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1W to 4.2W peak per channel

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Suitable for multi-level topologies and Generation 7 IGBT

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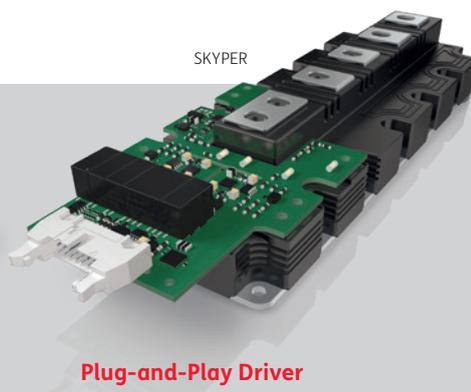
SKYPER & SKHI



### Driver Cores

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

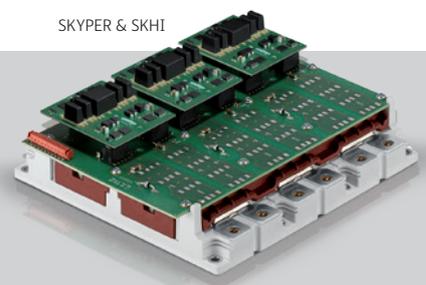
SKYPER



### 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

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Increased productivity thanks to reduced handling costs and improved logistics

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Low thermal resistance with optimised TIM layer thickness

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Improved lifetime and reliability

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Improved assembly robustness

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

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Lower overall costs

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### Portfolio

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**P8:** Phase Change Material for highest performance

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**HT:** Phase Change Material for highest sink temperature

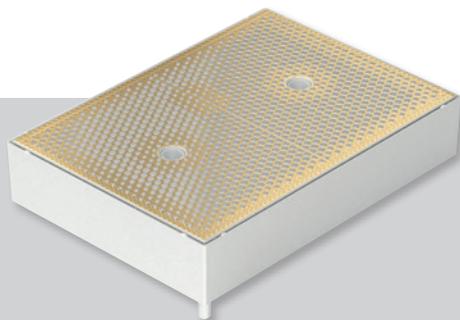
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**HPTP:** High Performance Thermal Paste

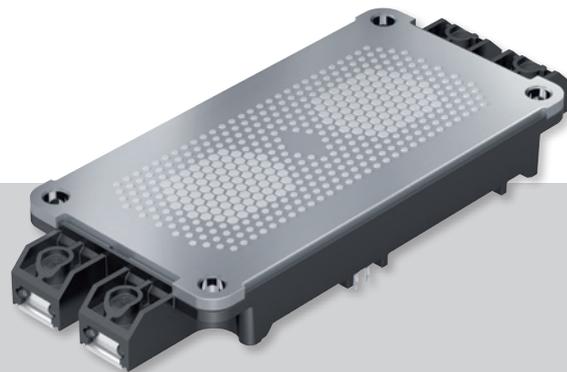
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**P12:** Standard Thermal Paste

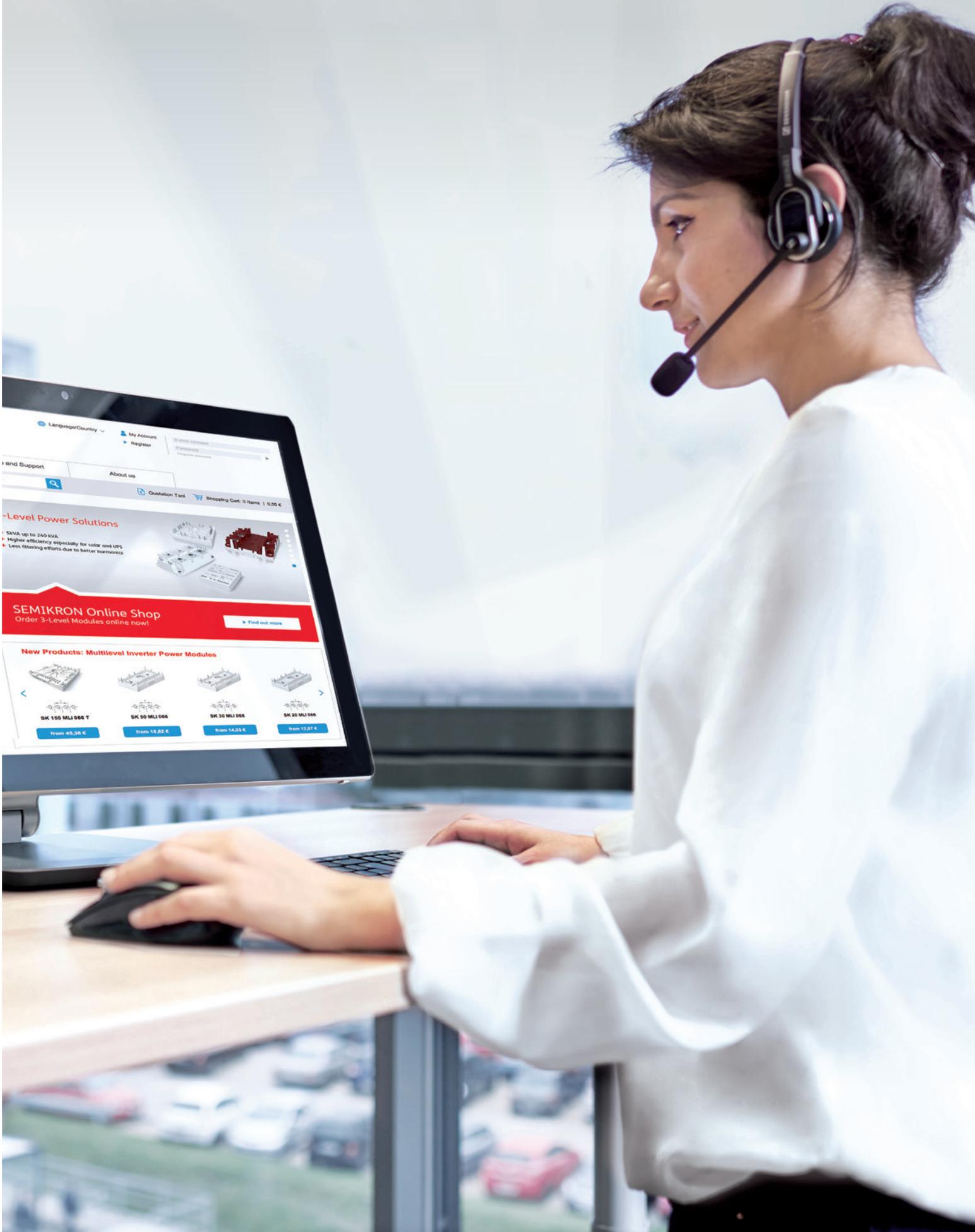
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**Baseplate-less  
Power Modules**



**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

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27 different power electronic circuits can be simulated

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

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

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Efficiency and temperatures at a glance

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[www.semikron.com/semisel](http://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:

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- Multilingual sales and support
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- Low-volume purchases also possible
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- Over 600 conventional SCRs, IGBT modules, bridge rectifiers and IPMs in stock

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