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Solar Energy
Power Electronics for Solar Inverters
SEMIKRON’s portfolio includes a wide range of products for efficient solar inverters in all power ranges: residential, industrial and utility scale applications. From individual modules including dedicated drivers to high power SKiiP 4 IPMs and ready-to-use power electronic stacks – SEMIKRON has the solution.

SEMIKRON offers a large portfolio of 3-level modules, IPMs and power electronic stacks which can reduce system costs significantly as well as optimize annual energy production, especially for increased DC voltages of up to $1500\text{V}_\text{DC}$. 
STRING INVERTERS

5kW - 250kW

- Residential
- Commercial/Industrial

1500Vdc Capability
High efficiency
High reliability to reduce downtime

Products
- SEMITOP
- MiniSKiiP
- SEMIX 5
- SEMIX 3 Press-Fit
- SEMITRANS
- SKYPER Driver Series

CENTRAL INVERTERS

250kW - 6MW

- Commercial/Industrial
- Utility

1500Vdc Capability
High efficiency
High reliability to reduce downtime

Products
- SEMIX 5
- SEMIX 3 Press-Fit
- SKIM 63/93
- SEMITRANS 10
- SEMITRANS 20
- SKiiP 3 IPM
- SKiiP 4 IPM
- SKYPER Driver Series
- Power Electronic Stacks
SEMIKRON has introduced 950V and 1200V Generation 7 IGBTs from two different manufacturers. Both Generation 7 IGBTs have fundamental improvements over the previous versions. Thanks to a new chip design, the chip size is an average of 25% smaller across all current classes. This technology allows higher current density and an approximately 20% reduction in saturation voltage $V_{ce,sat}$.

This new chip generation allows for compact inverters with unprecedented power density. Especially the new 950V IGBTs, in a variant for high switching frequencies as well as a variant with optimized $V_{ce,sat}$, are ideally suited for use in 3-level topologies up to 1500V$_{dc}$.

Additionally the Generation 7 IGBTs share the following features:

- 20% lower on-state voltage $V_{ce,sat}$
- Operation junction temperature of 175°C during overload
- About 25% smaller chip size
- Optimized 950V chipset for 1500V$_{dc}$ 3-level topologies

**Technology**

The New Benchmark 3-Level Topologies in Combination with Generation 7 IGBT Technology

*Images of SEMITOP® E1/E2, MiniSKiiP®, SEMiX® 3 Press-Fit, SEMITRANS® 10 modules*
The SEMITOP E1/E2 packages provide supply chain security with a standard industrial design. Press-fit pins offer reduced manufacturing time and a low inductance design. Ideal for fast switching chips, such as SiC, the SEMITOP has a wide portfolio of topologies, ready for your string inverter design. The SEMITOP E1/E2 family also includes latest 950V and 1200V Generation 7 IGBTs.

Key features
- Low stray inductance case
- Solder-free, press-fit assembly
- Optimised thermal performance
- Flexible architecture
- Available with Si, SiC and Si/SiC Hybrid

Highlight
Comprehensive 3-Level and Booster Module Family

SEMITOP® E1/E2
Up to 200kW
The Power Density Master: New Levels Utilizing the latest Generation IGBT 7 Chips

For increased power density and high reliability, SEMIKRON now utilizes 950V IGBTs in the MiniSKiiPs. With this Generation 7 IGBT chip, both boosters and 3-level topologies have been optimized for the 1500VDC market. Along with the existing portfolio, the MiniSKiiP provides a power dense design for the string inverter market up to a power range of 300kW without paralleling of modules.

**Key features**
- Low stray inductance case
- Solder-free assembly
- Optimised thermal performance
- Flexible architecture
- 17mm module height
- Available with Si, SiC and Si/SiC Hybrid

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**MiniSKiiP®**
Up to 300kW
SEMITOP® E1/E2

Exceeding the standard for superior performance
PCB based and press-fit connected, baseplate-less industry standard power module in two housing sizes
650V, 950V and 1200V:
10A to 200A
IGBT 4 and Generation 7 IGBTs
Sixpack, half-bridge and 3-level topologies
Optimised mounting concept provides lowest thermal resistance in class
Increased power density thanks to Generation 7 IGBT T7
Hybrid and full SiC modules up to 1200V/250A

MiniSKiiP®

Solder-free spring technology for minimum assembly time
Full family of power modules up to 300kW
650V/950V/1200V/1700V IGBT: 4A to 600A
950V/1200V Hybrid SiC: 50A to 600A
1200V Full SiC: 25 to 85A
Sixpack, H-bridge, half-bridge, booster and 3-level topologies
Easy and flexible PCB routing without pin holes
Product Portfolio

Power Modules

**SKiM® 63/93**

High reliability design using sinter technology

- Power module in sixpack configuration with three separate half-bridges
- 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
- Solder-free module and driver PCB mounting

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**SEMITRANS® 5**

Extended standard for superior thermal and dynamic performance

- Industry standard baseplate module
- 650V/1200V/1700V IGBT: 100A to 400A
- Sixpack, NPC, TNPC, PFC and half-controlled Bridge Rectifier topologies
- Optimised module layout for maximum heat transfer
- Enhanced thermal and electrical diode performance

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**SEMITRANS®**

The proven power electronics package

- Robust industry standard package for multiple sourcing in 6 housing sizes
- 600V/650V/1200V/1700V IGBT: 25A to 900A
- 1200V SiC: 125A to 500A
- Half-bridge, single switch and brake chopper topology
- Multiple IGBT sources
- Increased power range in 62mm thanks to portfolio extension in 1200V and 1700V half-bridges:
  - 1200V/600A
  - 1700V/500A

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**SEMITRANS® 10**

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 3-level NPC modules

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**SEMITRANS® 20**

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

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**SEMiX® 3 Press-Fit**

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

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**SEMiX® 5**

Extended standard for superior thermal and dynamic 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
- Solder-free module and driver PCB mounting
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
- Paralleled operation for even higher output power possible
- Special version for 1500V 
  
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 technology will be gradually introduced providing approximately 20% more output capability compared to standard water cooling.

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**SKiiP®4**

500kW up to 2.5MW

The most powerful IPM in the market
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 an output current range from 70A to 4000A.

**Water-cooled IGBT Stacks**
SKiiPRACK
SEMIKUBE MLI

**Air-cooled IGBT Stacks**
SEMIKUBE
SEMIKUBE SlimLine

**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 succes**
- Shortest time to market
- Cost savings in R&D, production and qualification
- Global SEMIKRON stack production footprint
- Highly experienced engineering team
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 IGBT drivers 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
**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 15 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 silk screen 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
**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 Schotty diodes and SiC MOSFET modules
- From 3A to 6000A rated current
- From 55V to 3300V devices

**Key features**

- 26 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

**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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