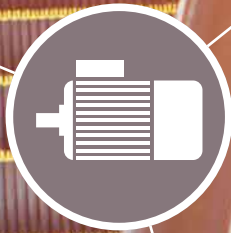
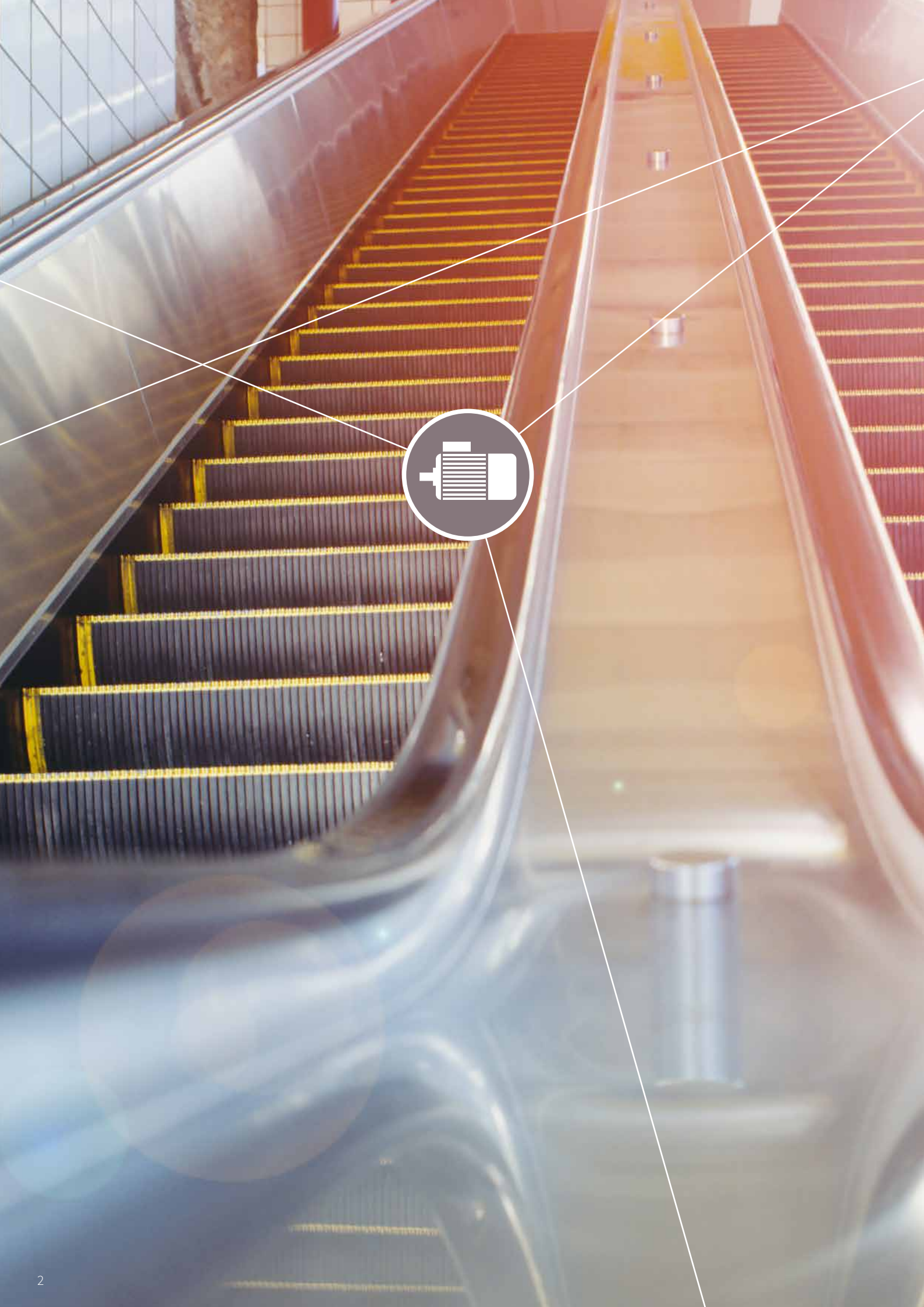




Solutions for industrial drives

Electronic speed control systems for energy and performance gains



Introduction

Solutions for industrial drives

Electrical drive systems play a key role in energy savings. They account for two-thirds of electrical energy consumed in industry and they are a central component of automation systems. There are two distinct industrial drive technology groups. The first group includes electrically driven machines requiring position control. This group includes, for example, machine tools, measuring machines and packaging machines where precision in movement is required. The second group covers all applications where a fluid is moved by pumps and fans. Here variable speed drives allow the flow to be aligned with the needs of the process. Compared with traditional methods of flow control like throttling and bypassing, electronic speed control significantly increases overall efficiency. Furthermore, an inverter enables more efficient motor technologies, like permanent magnet synchronous motors and reluctance motors, to be used. Today, these drives can be implemented in a power range from watts up to megawatts.

Nearly all static converters for electrical drives used today employ a combination of input rectifier, DC link and output inverter. If no regeneration system is required for the electrical drive, the most competitive semiconductor components for the input rectifier are bipolar thyristors and/or diodes offered in various topologies, such as complete 6-pack modules, half-bridge modules or single modules. In high-power electrical drives, the input rectifier consists of thyristors and/or diodes in Presspack housings. If regeneration is required, an active front end can be designed using IGBT modules. In the low-power range, where power factor correction is mandatory in some applications, PFC (power factor correction) circuits can be designed using discrete IGBTs and diodes or dedicated modules.

Visit us on www.infineon.com whenever you need best-in-class active power switches.

Our contribution to your success

We provide the latest chip technology embedded into innovative mechanical module designs. This enables our customers to develop highly reliable and efficient solutions.

Based on our leading industrial technology, the highest quality standards and our in-depth manufacturing know-how, we offer:

- › A variety of innovative power components
- › Reliable and highest-quality products

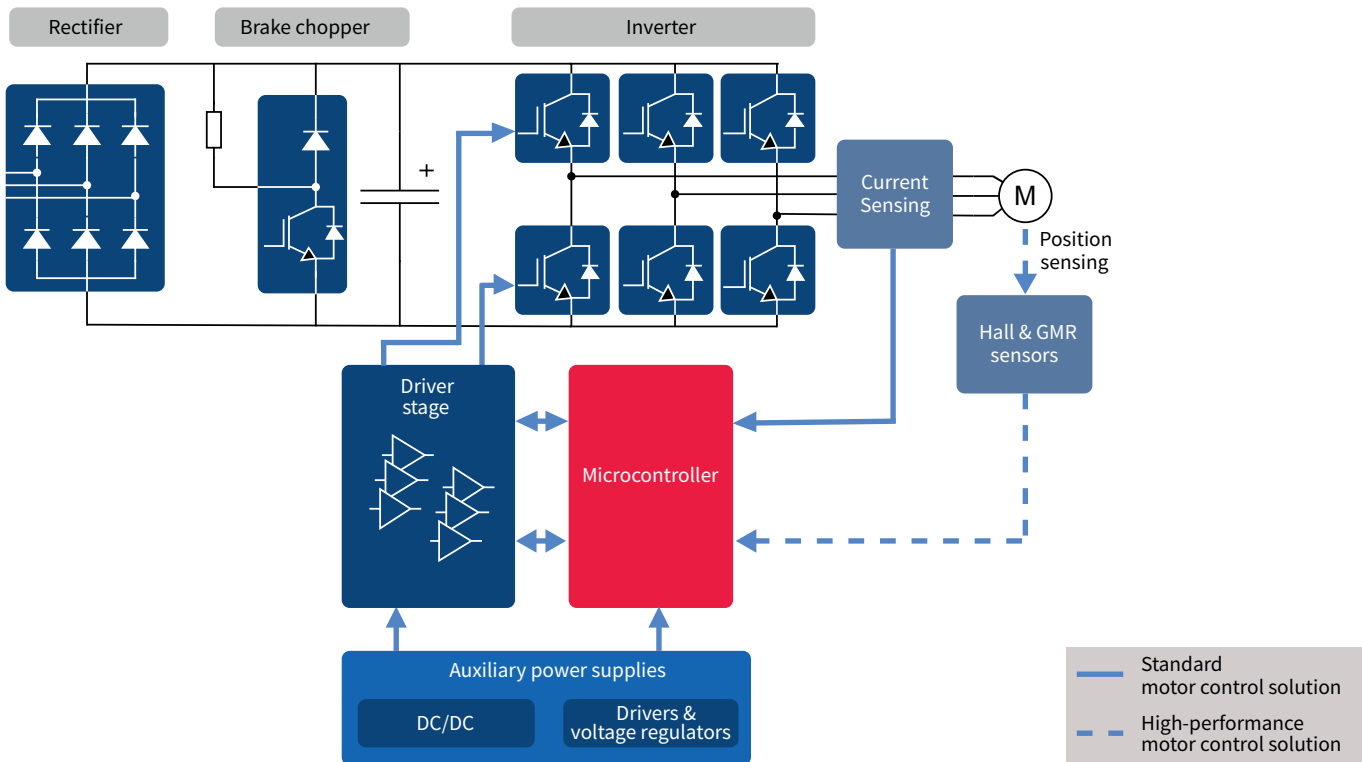
We shorten customer development cycle time and cost by providing design-in support through:

- › Our worldwide application engineering team
- › Evaluation boards for fast prototyping and testing
- › In-depth technical and system support from a dedicated regional team

Our in-depth application insight and extensive technical support combine to help our customers achieve cost-competitive and innovative solutions.



Power converter solution



- Applications: Motor control solution**
- > Fans
 - > Pumps
 - > Compressors
 - > Air-conditioning systems
 - > Home appliance
 - > General-purpose drives

- Applications: High-performance motor-control solution**
- > Servo drives
 - > CNC machines
 - > Process controls
 - > Robotics
 - > High-precision drives

Application examples

discrete IGBTs	IPM - integrated power modules	low-power modules	medium-power modules	high-power modules
50 W		inverter output power		2MW

Examples of module configurations

<p>1ph-PIM + NTC</p>	<p>3ph-PIM + NTC</p>	<p>bridge + NTC</p>	<p>3ph full-bridge</p>	<p>half-bridge</p>
<p>3ph full-bridge + shunt</p>	<p>chopper (FD) + chopper (DF)</p>	<p>4-pack</p>	<p>1ph-PIM + PFC + NTC</p>	

Input rectifier



IGBT4

Features

- › Operating temperature up to 150 °C
- › Higher RMS current in the application up to 17 % possible
- › Increased power cycling capability
- › Optimized switching characteristic
 - softness
 - reduced switching losses
- › Short circuit capability
 - $t_p = 10\mu s$ @ $T_{vj} = 150^\circ C$
- › Existing packages with higher current capability possible

The IGBT4 generation combined with the improved emitter Controlled diode from Infineon provides three optimized chip versions for low, medium and high power IGBT modules. These chips are designed to the needs of the next generation of inverter concepts for the different applications.

These three optimized chip versions are the IGBT4-T4 chip with fast switching behavior for low power modules with $I_{nom} = 10 - 300$ A, the IGBT4-E4 chip with optimized switching and on state characteristics for medium power modules with $I_{nom} = 150 - 1000$ A and the IGBT4-P4 chip with soft switching behavior for high power modules with $I_{nom} > 900$ A.

The improved softness of the high power IGBT4-P4 chip simplifies the use and controllability for high power applications. The low- and the medium power IGBT4 chips offer reduced total losses in comparison to the previous generation at same conditions.

As a further benefit the IGBT4 technology allows a high maximum junction operation temperature of $T_{vjop} = 150^\circ C$.

The optimization of the IGBT4 chip, the assembly and contact technology ensure a noteworthy power cycling (PC) improvement and this offers an increased PC lifetime expectation.



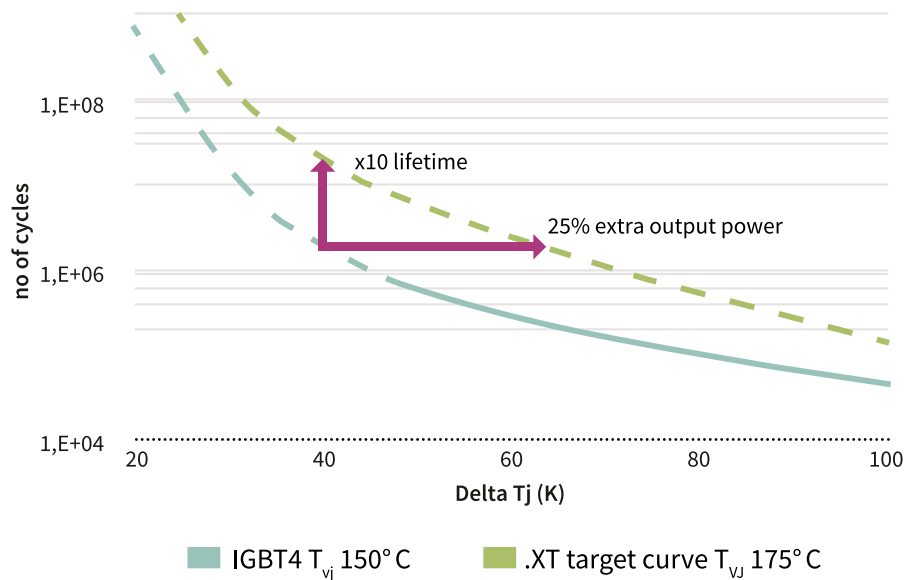
PrimePACK™ with IGBT5 and .XT

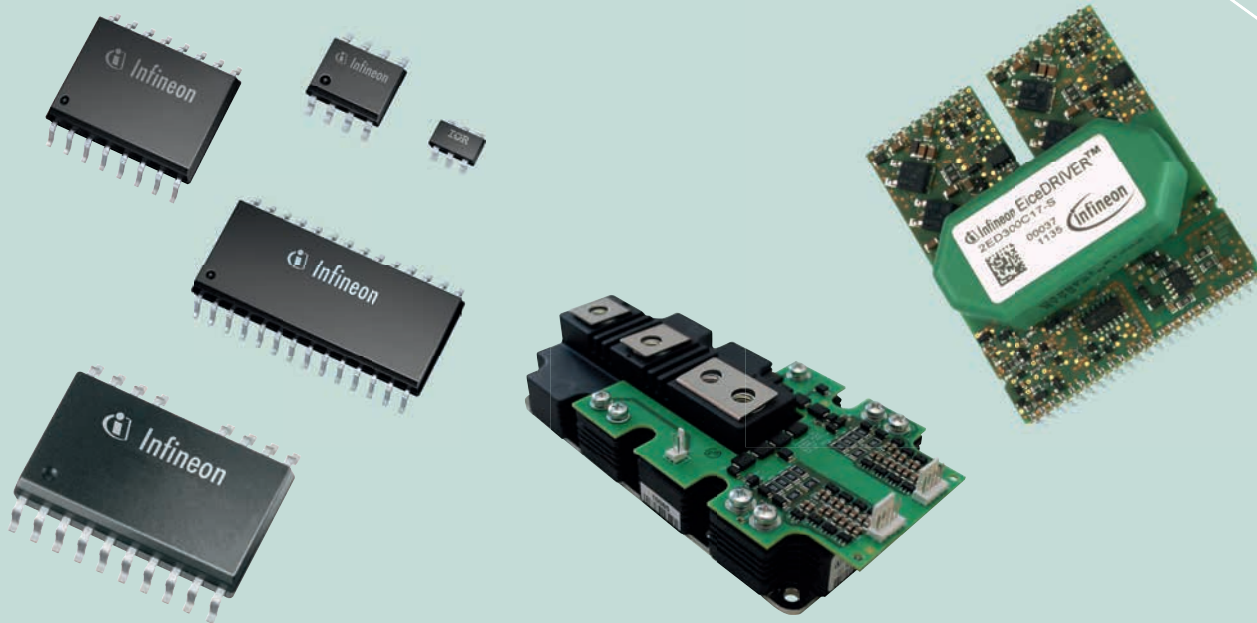
- Features**
- > Reduced static and dynamic losses
 - > Increased thermal and power cycling capabilities
 - > Increased operation temperature up to $T_{vjop} = 175^\circ\text{C}$

- Benefits**
- > Increases power density by 25 % or 10 times longer lifetime
 - > Less cooling effort for same output power
 - > Enables higher system overload conditions

The dawning of a new era

The tremendous success of PrimePACK™ since the introduction in 2006 confirms that it is the optimal choice for the majority of high-power inverters. Now, PrimePACK™ is the first product family using the next generation of IGBTs. IGBT5 and .XT mark a new era in IGBT chip and interconnection technologies. IGBT5 allows higher power densities, while the new interconnection technology .XT extends lifetime through enhanced thermal and power cycling capabilities.





Gate Driver ICs and boards

Features

- > Features
- > Gate Driver Boards up to 1700V
- > Gate Driver ICs from 20V up to 1200V
- > One-stop solution for drivers and power switches

Applications

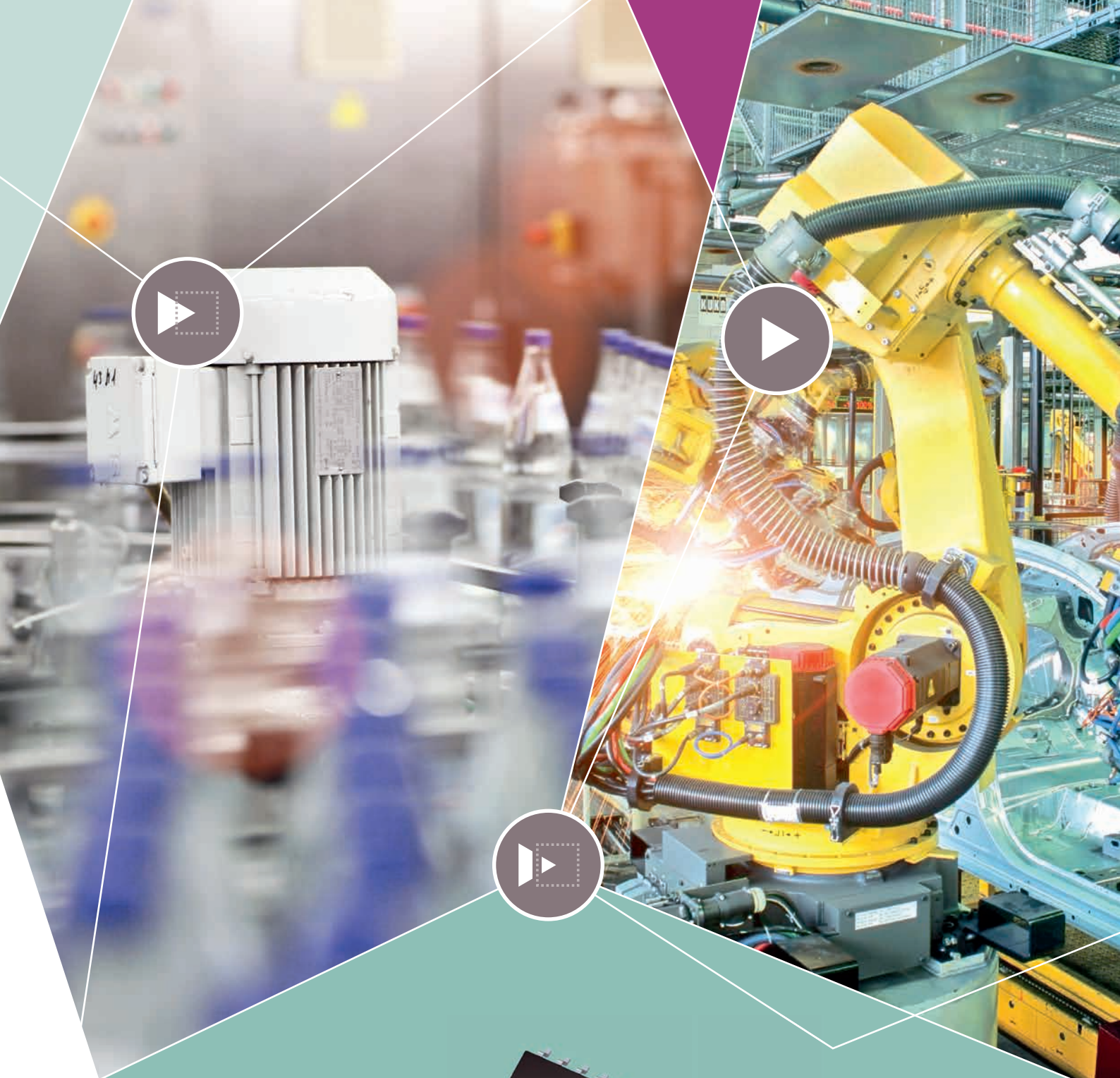
- > General-purpose drives
- > Servo drives
- > Decentralize drives
- > Direct drives
- > Active front ends
- > Solar inverters

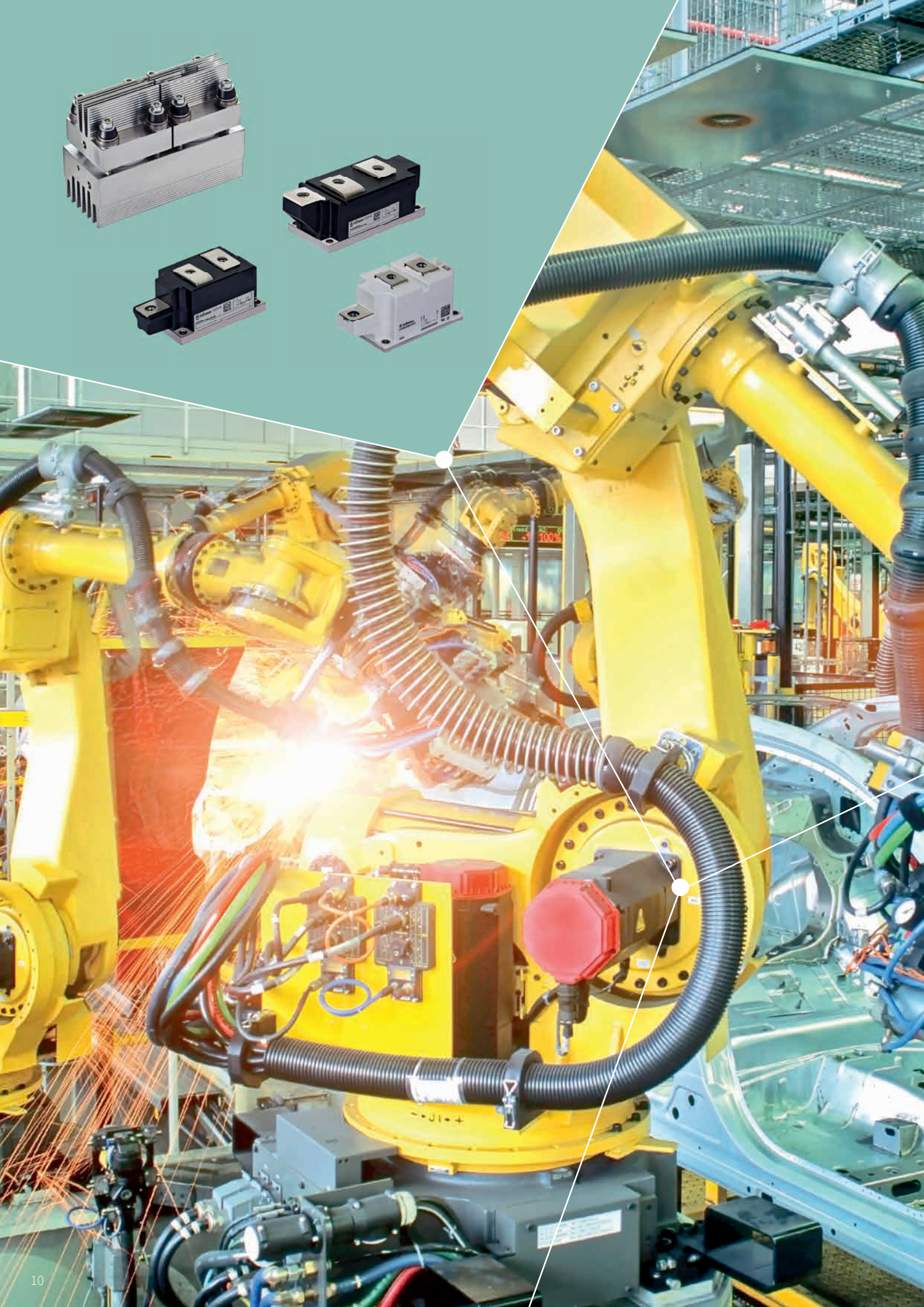
Infineon's Gate Driver ICs are the expert's choice. We offer over 200 devices with a wide range of topologies, voltage classes, current capabilities, switching speeds, and integrated protection features. By combining Infineon drivers with Infineon power devices, customers can quickly design and build efficient and robust systems.

The breadth and depth of the Infineon Gate Driver IC portfolio provides a solution for virtually every application.

Visit the Gate Driver IC selection tool at www.infineon.com/gatedriver

EiceDRIVER™ Boards are suitable for all IGBT modules up to 1700V. Outstanding protection measures and integrated fault management provide safe operation, even if used within noise-intensive industrial environments. Furthermore, these boards are an attractive solution for the parallel connection of IGBT modules. Evaluation Boards are offered as an application support tool. These boards are accompanied by comprehensive application notes containing all information needed to test, modify and qualify a design for production.





Thyristor / Diode Modules

Infineon® Power Start

Main benefit of the new designed Power Start modules for soft starters up to 300 kW is their high current capability in a compact design (LxWxH 134x55x100 mm) and double side cooling for low thermal resistance. Another big advantage in comparison to existing soft starters is that one foot-print fits all current classes.

Furthermore the modules provide integrated heatsink and can be mounted without thermal grease. By using pressure contact technology, these modules can withstand overload currents up to 2200 A for a 21s duration of overload.

Samples and Support? Go to www.infineon.com/powerstart

Customer Values

Soft starter specific product design:

- › ONE foot-print (55 mm) fits ALL current classes
- › Up to 2200 A overload current for 21s in small design space allows 20% space savings compared to module based solutions
- › Easy mounting (pre-assembled and ready to use)
- › Faster time2market (no design effort on heat sink)
- › Excellent design-in support

Infineon® Eco & Power Block

We offer a broad range of Power Block modules which are designed and assembled in pressure contact technology for highest reliability. The modules contain thyristor and diode pellets in a voltage range of 1600 V to 4400 V and a current range of 60 A up to 1100 A.

With the release of the 34 mm and 50 mm Eco Block modules in solder bond technology Infineon Technologies Bipolar complemented the existing product portfolio of bipolar modules.

Solder Bond Modules are offered as dual modules in topologies thyristor/thyristor, thyristor/diode & diode/diode with blocking voltages of 1600 V and in current ranges from 60 A to 130 A for 20 mm from 160 A to 190 A for 34 mm and from 280 A to 330 A for 50 mm. The Rectifier Diode Modules (DD) in 34 and 50 mm are also available in 1800 V, 2000 V and 2200 V for high production volumes.

All Power Block modules are also available with pre-applied silicone-free Thermal Interface Material (TIM). The optimized pattern of this reversible phase change material results in a stable thermal performance over life time which increases reliability and lifetime of your system.

For more information go to www.infineon.com/solderbond and www.infineon.com/pressure-contact

Customer Values

- › One-stop-shop due to complete module technology portfolio

Pressure Contact Modules:

- › Short-on-fail
- › Designed for high overload requirements
- › Excellent power cycling capability

Solder Bond Modules:

- › Cost effective solution for higher competitiveness
- › Solid base plate for fast and easy mounting
- › Predictably high performance and lifetime due to 100% x-ray monitoring



Summary

Great opportunities

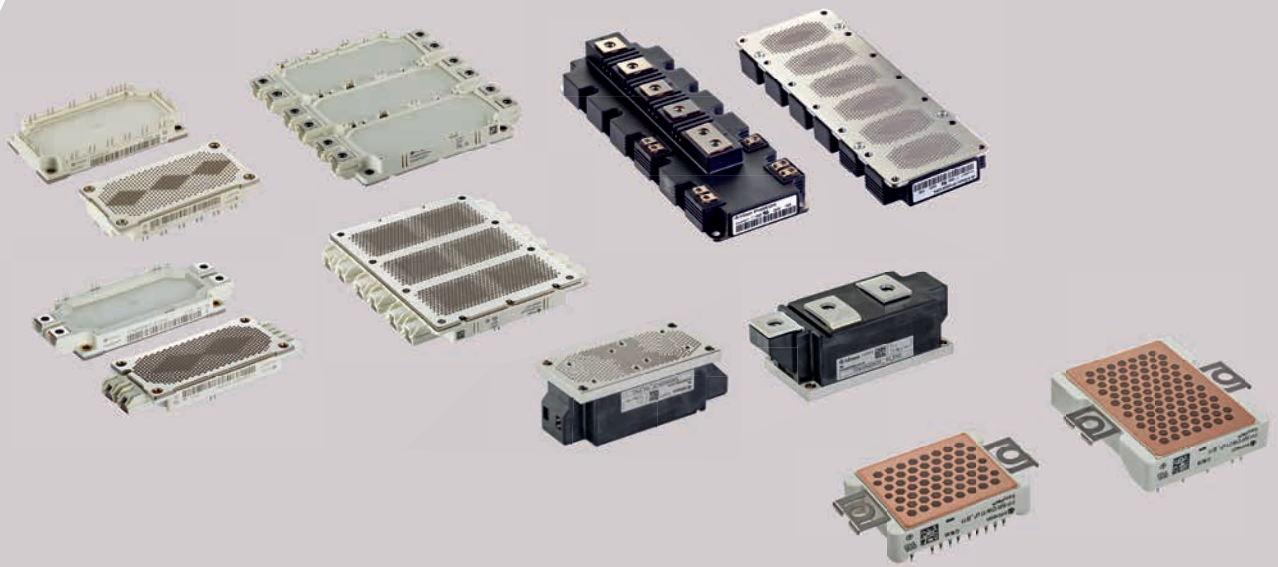
- › Best energy efficiency
- › Innovative module housings and interfaces
- › Proven high quality
- › Product portfolio with wide range of voltages and currents
- › Popular topologies often implemented in one module housing
- › Easy modularity and scalability
- › Proven reliability by best connection techniques

The technology of energy conversion systems for VSDs (Variable Speed Drives) is often driven by innovations in power electronic switches. Improvements to our semiconductor technology and packaging enable our customers to meet the most demanding technical and commercial requirements.

Our new IGBT chip technologies with trench structures and field stop concept, partially empowered by SiC freewheeling diodes, together with innovative packaging guarantee robust and reliable devices with the highest power integration and the lowest power losses. We meet our customers' requirements by offering a broad range of IGBT modules, from EasyPIM™ / EasyPACK for low-power applications up to 6.5 kV IHV devices for megawatt-rated systems.

Over the years, we have set the standards in module packaging. Our leading position is reflected in the fact that our early products subsequently became industry standard. Most of them such as EconoPACK™, EconoPIM™, IHM and IHV are now widely in use. The recently introduced PrimePACK™ IGBT module housing has also become a worldwide industry standard.

We believe our competence in implementing the latest technologies in power electronic switches has revolutionized the industrial drive market. We provide high-quality products and meet the most challenging customer requirements.



Thermal Interface Material (TIM)

The only Infineon-qualified solution

Features

- > Best-in-class thermal resistance
- > Pre-applied to Infineon modules
- > Dry to the touch
- > Optimized for dedicated Infineon modules

Benefits

- > Reduced process time in manufacturing
- > Simplified mounting
- > Increased system reliability
- > Increased system lifetime
- > Optimized thermal management
- > Improved handling in case of maintenance

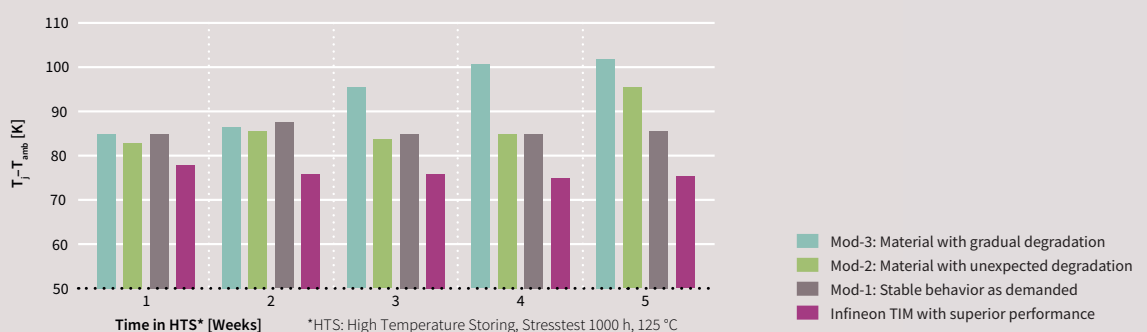
- > Broadest Portfolio of TIM modules:
www.infineon.com/TIM

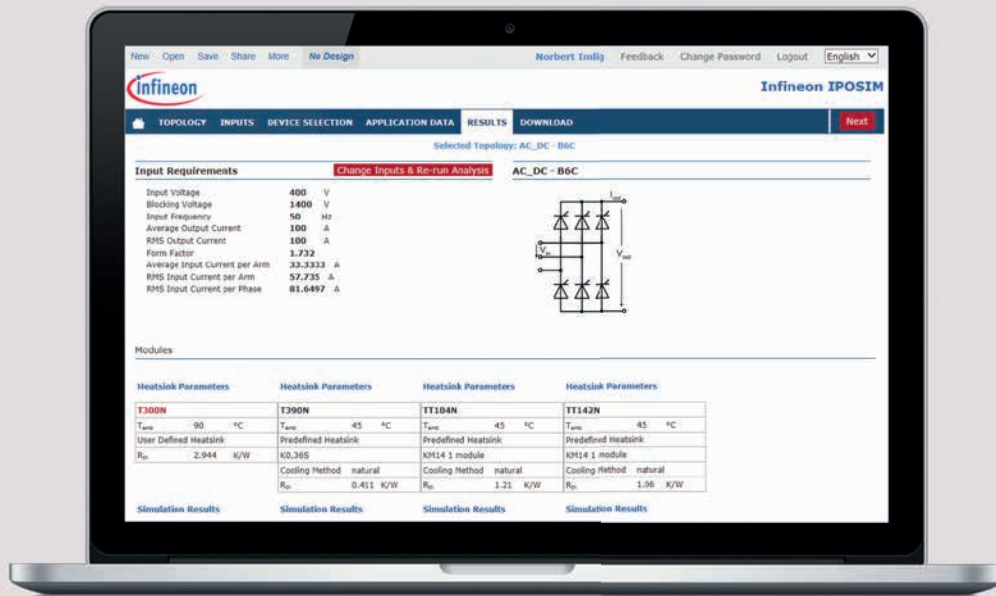
The demand for high power densities in power electronics poses great challenges to the thermal interface between the power module and the heat sink. In addition a short manufacturing process time is essential to make the production of converters more efficient. The easy handling and reproducible application of thermal interface material is one way to improve the manufacturing and obtain a stable process result.

A specially developed thermal interface material pre-applied to our power modules outperforms the general-purpose materials available. TIM not only provides the lowest thermal resistance, it also fulfills the highest quality standards for power modules to achieve the longest lifetime and highest system reliability.

TIM has been developed to fit most of our existing power module packages as well as upcoming future designs. Using modules with pre-applied TIM will enable reproducible thermal performance of power electronic applications.

Thermal improvement and long-term stability





IPOSIM

The Infineon Power Simulation program for loss and thermal calculation of Infineon power modules and disk devices

IPOSIM is an easy to use yet sophisticated online simulation tool for loss and thermal calculation of Infineon power modules and disk devices.

IPOSIM helps you to select the right Infineon bipolar modules or disk devices for your rectifier or AC switch applications as well as suited IGBT modules for your inverter or DC converter applications. B2, B6, M3.2, M6, W1C, W3C, 2-Level, 3-Level, buck and boost topologies can be calculated.

IPOSIM performs a calculation of switching and conduction losses for all components, taking into account conduction and switching characteristics as well as thermal ratings. Where applicable, different control algorithms can be applied.

Thermal conditions can be adapted by user defined or predefined heat sinks. Beside single operation points complete load cycles may be calculated. Results will be shown in tabular and graphic representation and can be saved for later revision or printed as PDF file.

Features

- > Calculation of thermal performance
- > Direct comparison between products
- > Calculation of complete load cycles
- > Save calculations for later revision

- > Where to find IPOSIM:
www.infineon.com/iposim



Our business philosophy is “the customer always comes first”

We always strive to have an open dialogue with our customers, who benefit from our innovative technologies, services and marketing support. Many product innovations have been developed on this collaborative basis.

Our experienced team of regional application engineers actively supports our customers in designing our products into their solutions. We provide evaluation boards to enable fast and reliable integration of our modules and devices into variable-speed drives.

Regular quality certification audits of our company operated together with our customers strengthen our confidence and make our highly reliable production processes more transparent.

As a result of all our efforts, we enjoy outstanding customer satisfaction. Our aim is to build long-term partnerships based on open and intensive cooperation in all areas of our business.

We work together. Visit www.infineon.com and find the right product.

Where to buy

Infiniteon distribution partners and sales offices:

www.infineon.com/WhereToBuy

Service hotline

Infiniteon offers its toll-free 0800/4001 service hotline as one central number, available 24/7 in English, Mandarin and German.

- > Germany 0800 951 951 951 (German/English)
- > China, mainland 4001 200 951 (Mandarin/English)
- > India 000 800 4402 951 (English)
- > USA 1-866 951 9519 (English/German)
- > Other countries 00* 800 951 951 951 (English/German)
- > Direct access +49 89 234-0 (interconnection fee, German/English)

* Please note: Some countries may require you to dial a code other than "00" to access this international number.
Please visit www.infineon.com/service for your country!

www.infineon.com

Published by
Infineon Technologies AG
81726 Munich, Germany

© 2017 Infineon Technologies AG.
All Rights Reserved.

Order Number: B133-H9039-V10-7600-EU-EC-P
Date: 05/2017

Please note!

THIS DOCUMENT IS FOR INFORMATION PURPOSES ONLY AND ANY INFORMATION GIVEN HEREIN SHALL IN NO EVENT BE REGARDED AS A WARRANTY, GUARANTEE OR DESCRIPTION OF ANY FUNCTIONALITY, CONDITIONS AND/OR QUALITY OF OUR PRODUCTS OR ANY SUITABILITY FOR A PARTICULAR PURPOSE. WITH REGARD TO THE TECHNICAL SPECIFICATIONS OF OUR PRODUCTS, WE KINDLY ASK YOU TO REFER TO THE RELEVANT PRODUCT DATA SHEETS PROVIDED BY US. OUR CUSTOMERS AND THEIR TECHNICAL DEPARTMENTS ARE REQUIRED TO EVALUATE THE SUITABILITY OF OUR PRODUCTS FOR THE INTENDED APPLICATION.

WE RESERVE THE RIGHT TO CHANGE THIS DOCUMENT AND/OR THE INFORMATION GIVEN HEREIN AT ANY TIME.

Additional information

For further information on technologies, our products, the application of our products, delivery terms and conditions and/or prices, please contact your nearest Infineon Technologies office (www.infineon.com).

Warnings

Due to technical requirements, our products may contain dangerous substances. For information on the types in question, please contact your nearest Infineon Technologies office.

Except as otherwise explicitly approved by us in a written document signed by authorized representatives of Infineon Technologies, our products may not be used in any life-endangering applications, including but not limited to medical, nuclear, military, life-critical or any other applications where a failure of the product or any consequences of the use thereof can result in personal injury.