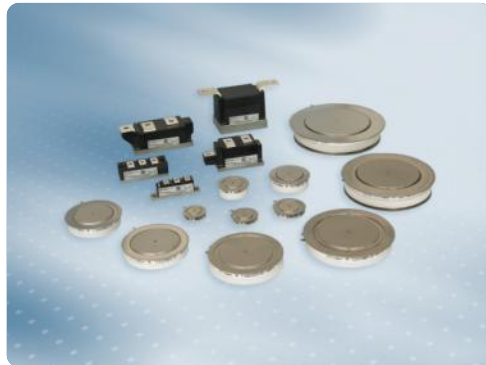
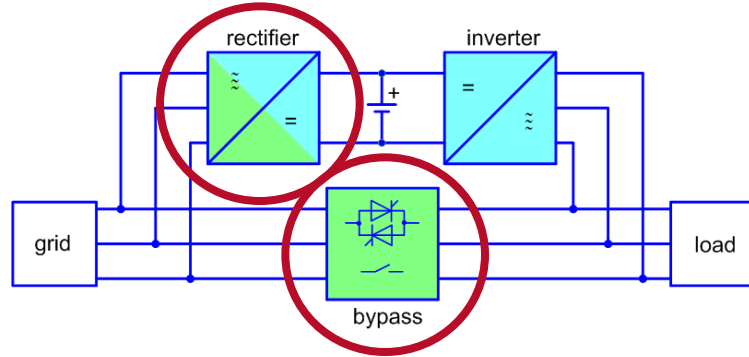


# Thyristors and Disc Devices for Power Supply Applications

PCIM 2014, Nuremberg



# PowerBLOCK Modules and Discs: Thyristors and Diodes for Rectifier and Bypass Switch



## Customer Benefits

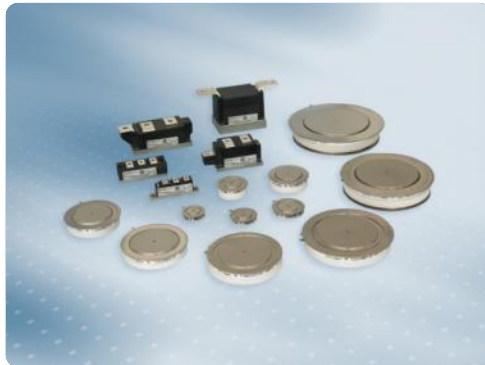
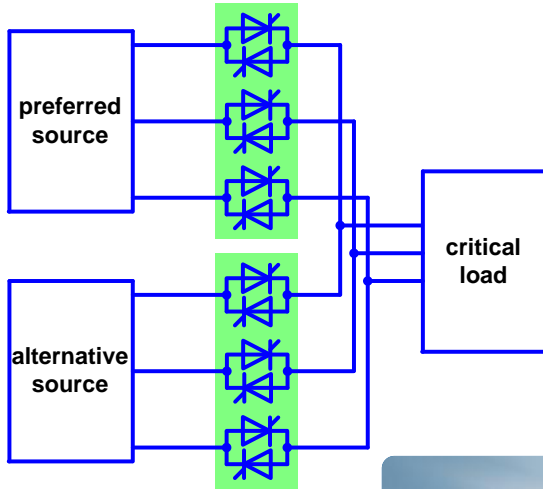
- High overload capability
- High reliability and life time
- Broad portfolio



## Product Highlights

- Thyristor-diode modules **new**
  - TT140N16SOF, TT175N16SOF
  - TT520N22KOF, TT600N16KOF
  - TZ810N22KOF, TZ860N16KOF
- High reliable thyristor disc devices **new**
  - T300N16TOF ... T3160N16TOF
- PowerBLOCK thyristor modules
  - TT60N16SOF ... TZ860N16KOF

# PowerBLOCK Modules and Discs: Thyristors for Static Switch



## Customer Benefits

- High overload capability
- High reliability and life time
- Broad portfolio



## Product Highlights

- Thyristor-diode modules
  - TT140N16SOF, TT175N16SOF
  - TT520N22KOF, TT600N16KOF
  - TZ810N22KOF, TZ860N16KOF
- High reliable thyristor disc devices
  - T300N16TOF ... T3160N16TOF
- PowerBLOCK thyristor modules
  - TT60N16SOF ... TZ860N16KOF

# TRENCHSTOP™ 5

## A new IGBT Generation for Welding Applications

PCIM 2014, Nuremberg



# Improvement at System Level to get best Benefits from TRENCHSTOP™ 5



## A Commercial Welding Machine Redesigned

### H5-Based Improvements

- Increased switching frequency
- Improved thermal performance
- Reduced turn-off losses

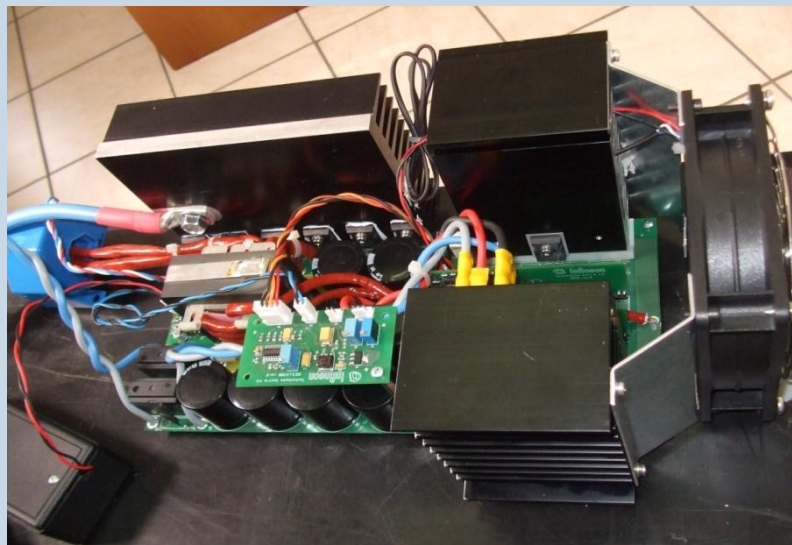
### Benefit

- Reduction of transformer sizes
  - Smaller heat sink
  - Smaller PCB
- Lower amount of resources per kW of output power

**42% Lower Turn-Off Losses**  
**25% Reduction in Footprint Size**  
**35% Reduction in Weight**

# H5 IGBT Demonstrator Improved Layout - $L_{\sigma} \sim 80\text{nH}$

## Physical Appearance

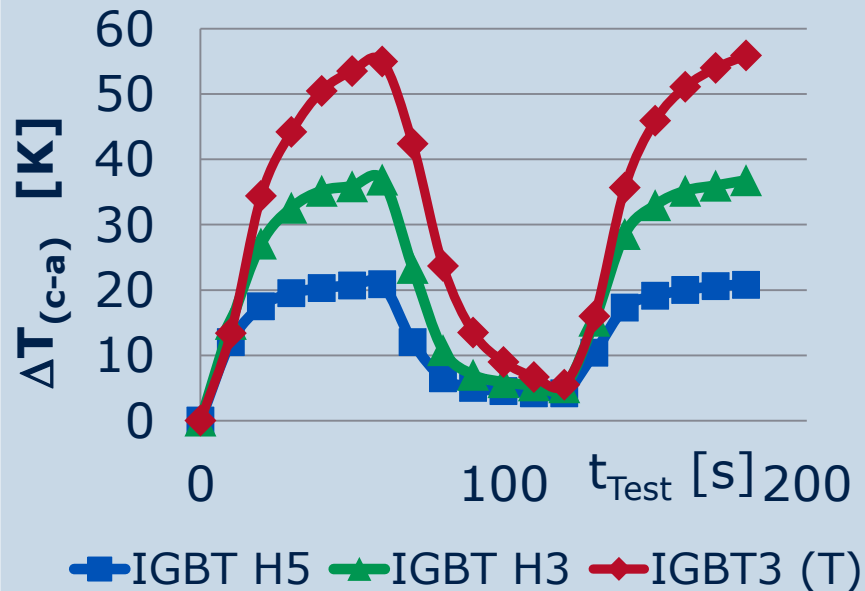


## Features

- Rectifier build using Rapid Diodes
- 50A H5-IGBT
- Further reduction of stray inductance
- Prepared for digital control
- Topology changed from H-Bridge to Halfbridge → reduced part count
- 1ED-IGBT-Driver to eliminate optoelectronics for enhanced thermal stability

# Demonstrator – Thermal Comparison

## Thermal Measurement



## Test Parameters & Findings

- $f_{sw}=38kHz$ ,  $L_{\sigma}\sim 80nH$
- $I_{out}=200A$ ,  $t_{on}=t_{off}=60s$
- IGBT H5 outperformed IGBT H3 by 16K
- IGBT H5 outperformed IGBT3 by 35K
- Trade-Off between extended lifetime and higher output power possible

# TRENCHSTOP™ 5 - Demonstrator 2.0



2<sup>nd</sup> Demonstrator  
with  $L_{\sigma} < 60\text{nH}$

## Additional Achievements

- Half the number of devices using TRENCHSTOP™ 5
- Size reduction by 45%
- Weight reduction by 60%
- Half the number of electrolytic capacitors
- Switching frequency up to 100kHz
- Reduction of transformer Size
- Upgrade from analogue to digital control
- Eliminate optoelectronic drivers using 1ED-ECO



- The new H5 IGBT outperforms all predecessors in regards of switching losses and thermal performance.
- Even the Best in Class devices perform best in holistically optimized systems with reduced stray inductance.

# IGBT Power Modules to Support Power Supply Applications

PCIM 2014, Nuremberg



# Low-Power Solutions for Power Supplies

## Easy1B & Easy2B

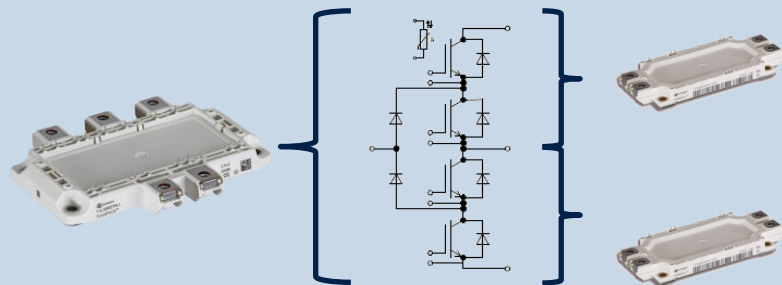


## Module Features

- IGBT-Modules to enhance power density, efficiency and reliability
- Low stray inductance
- Compact module solutions
- Leading chip technologies
- FourPACKs, single-phase solutions
- Phase legs to build 3-Level NPC1 & NPC2 solutions

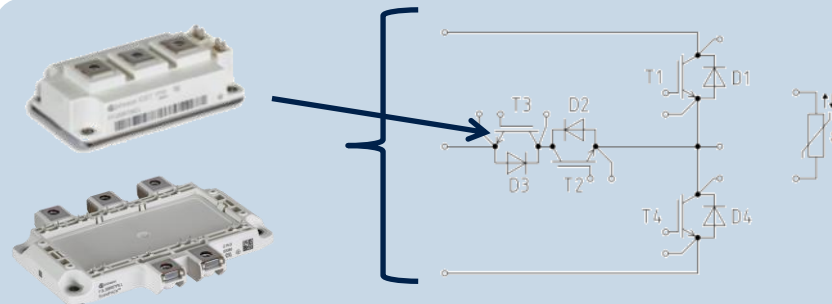
## 3-Level Medium-Power Portfolio extensions

### NPC1-Solutions



- EconoPACK™ 4
  - 200 A – 300 A; 650 V
- EconoDUAL™ 3
  - 400 A; 650 V
  - 300 A; 1200 V

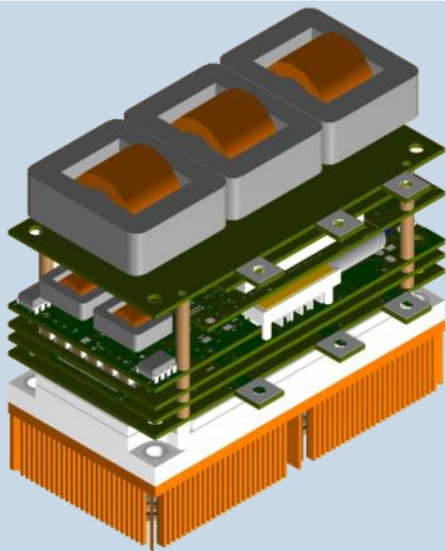
### NPC2-Solutions



- EconoPACK™ 4
  - 200 A – 300 A; 650 V
- 62mm Common Emitter
  - 200 A – 400 A; 1200 V

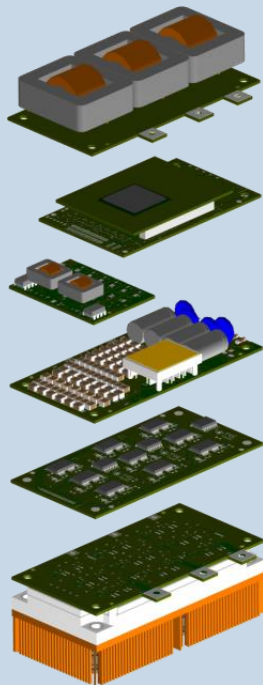
# Power Density – Quo vadis?

## 20kVA/L Inverter



- 885cm<sup>3</sup>, 1.7 kg
- 22 kVA/L, 11kVA/kg

## Detailed View



## Key Components

- TriCore processor
- SMPS-Controller
- Clamp circuit, SiC-Schottky Diodes
- New dual core 2ED-Driver
- Prototype power module SiC-JFET+Shunts



# ENERGY EFFICIENCY MOBILITY SECURITY

Innovative semiconductor solutions for energy efficiency, mobility and security.

