

Back to Growth

PCIM Europe 2010 was held from May 4 - 6 in Nuremberg and confirmed with an increase of 3% in visitors (6300), 619 conference delegates and last but not least 255 exhibitors its leading position.

The majority of international exhibitors came from the USA, followed by Italy, Great Britain and France. The number of Asian companies was on the rise. As well as the major players, many aspiring young companies were present. The PCIM Conference encouraged an intensive dialogue between science and industry. 170 previously unpublished papers have been orally presented over the three days. In 22 presentations and 2 poster sessions, the latest developments have been discussed with the conference delegates.

Awards for outstanding papers

The conference focused on solar power, in particular the awarded papers and PEE's Special Session.

Again this year three Young Engineer Awards (€1000.00 each) were presented to exceptional contributions from young professionals (under 35 years old). The papers were selected by the Conference Directors from more than 100 papers and sponsored by ECPE, Infineon Technologies and International Rectifier.

Dayana El Hage, EPFL, Switzerland, was awarded for the

paper "A high current pulse-power supply for flash lamps in PV-panel measurement-facilities".

A high current pulse power supply for the feeding of a flash lamp has been developed, on the base of a multilevel converter with cascaded cells. The pulsed high power is provided by capacitive energy storage, directly connected to the cells of the converter. A low current ripple is reached by interleaved switching technique. The original topology, its design regarding the sizing of the storage cells, and the associated control were presented.

Christoph Klarenbach, UAS Cologne, Germany, was the second awardee with the paper "Fast and high precision motor control for high performance servo drives".

He presented a new architecture of a fast current controller with two feedback signals for high performance motion control. Due to parallel processing inside the Field Programmable Gate Array (FPGA), the control algorithm computing time is significantly less than 1µs. Together with advanced control technologies in combination with a new current observer the bandwidth of fast switching IGBT or MOSFET

power stages is not limited by the delay time of high precision (integrating) current measurement any longer. Using that technology high control bandwidth in conjunction with high precision current control is now possible at no trade off. The control strategy relies on a simplified machine model without incurring performance degradations. The presented results have been produced with a high speed Computerized Numerical Controlled (CNC) machine (high speed lathe).

Andreas Munding, Liebherr-Elektronik GmbH, Germany, won the price for "Compact PCB-packaging and water cooling of a 25-kW inverter".

This work featured simulation results of a sandwich PCB assembly with an electronic board and a high current board attached to either side of an aluminum heat sink. This heat sink is thermally attached to the metal housing and to a liquid cooling channel which was optimized for low pressure drop. In addition, the effect of the low pressure drop cooler structure on the IGBTs of a directly cooled pin-fin based power module was simulated and characterized. It

was found that a geometry with lateral coolant impingement exhibit lowest pressure drop and allows for a large flow rate operation range in automotive applications.

The determining criteria for the Best Paper Award (a PEE-sponsored paid trip to PCIM China 2011 in Shanghai) were originality, topicality and quality. Christian Nöding from University of Kassel, Germany, won this price for the paper "Evaluation of a Three-Phase Two-HF-Switch PV Inverter with Thyristor-Interface and Active Power Factor Control". The certificate was handed over by PCIM Organizer Udo Weller and PEE Editor Achim Scharf on the PCIM 2010 opening ceremony. A short version of this paper is published in our feature section.

For the third time time Power Electronics Europe has organised a Special Session with this year's focus on Renewable Energy Applications featuring papers from Björn Backlund, ABB Switzerland Ltd; Dejan Schreiber, SEMIKRON Elektronik (Germany); Alberto Guerra, International Rectifier (USA) and Shang Ming, Mitsubishi Electric Corporation (Japan). These papers can also be found in the feature section of this issue.

New products and services

ABB Switzerland Ltd, Semiconductors starts mass production of 4.5kV SPT+ IGBT modules after successful qualification and proven ramp-up phase in the traction market.

"Our 4.5kV HV-HiPak2 IGBT modules employ the well established SPT+ IGBT and diode technologies. These modules have significantly lower conduction and switching losses while exhibiting higher SOA capability when compared to the previous generation", commented Sven Klaka, ABB's VP Technology & Product Management.

The SPT+ platform exploits an

Best paper awardee Christian Nöding (middle), PEE Editor Achim Scharf (left) and PCIM Organizer Udo Weller (right) at the PCIM 2010 opening ceremony





ABB's new 4.5kV SPT+ IGBT modules

enhanced carrier profile through planar cell optimization, which is compatible with ABB's cell design. The on-state losses of the new 4.5kV IGBT exhibit approximately a 30%



"These 4.5 kV modules have significantly lower losses while exhibiting higher SOA capability when compared to the previous generation", commented ABB's Sven Klaka

reduction as compared to the standard SPT device while keeping the same E_{off} value. For the 1200A rated HiPak2 module the typical on-state voltage drop at nominal current and $T_j=125^\circ\text{C}$ is 3.55V. For the same module the typical turn-off switching energy (E_{off}) at 2800 V_{cc} and $T_j=125^\circ\text{C}$ is 6J. The new 4.5kV HV-HiPak2 modules will provide high voltage system designers with enhanced current ratings and simplified cooling while further enhancing the recently acquired robustness of the SPT IGBTs. ABB's 4.5kV modules are available in current ratings ranging from 650A - 1200A in single IGBT as well as diode configurations.

www.abb.com/semiconductors

Avago introduced three Miniature Precision Isolation Amplifiers with increased accuracy, bandwidth and high insulation made possible by proprietary optical isolation. Widely used for motor phase and rail current sensing, servo motor drive, switching power supply feedback isolation, DC link voltage monitoring, inverter current sensing and switching power supply feedback isolation, the ACPL-C97x targets industrial automation and instrumentation, renewable energy, and HVAC markets. In a typical motor drive application, currents through a small value current sense resistor cause a voltage drop that is sensed by the ACPL-C79x isolation amplifier and a differential output voltage, proportional to the current, is created on the output side of the isolation barrier. Based on sigma-delta analog-to-digital converters and chopper stabilized amplifiers, the new isolation amplifiers feature high gain accuracy, low temperature drift, 3.3 V/5 V output supply operation and a wide -40 to +105°C operating temperature range. These features are delivered in a stretched SO-8 package that has a footprint 30% smaller than the standard DIP-8 package. "When mounted on a PCB, it occupies a space that is a fraction of that for a traditional Hall Effect or transformer based isolation amplifier. The high common-mode transient immunity of 15kV/ μs provides the precision and stability needed to accurately monitor current in high noise motor control environments. This ensures smoother control with less torque ripple in many motor control applications", commented Erik Halvordsson, Avago's European Business Development Manager.

www.avagotech.com/optocoupler

Cree announced the first commercially available 1700V SiC Junction Barrier Schottky (JBS) diodes targeted at high-voltage applications in motor drive, wind energy and traction.

Initial products in the 1700V series include 10A and 25A JBS diodes in die form, ready for integration into 1700V power modules ranging from 50 to 600A. "The 1700V diodes extend our offering in energy-efficient power systems for datacenter and solar power to new markets such as wind energy, train, tram and electric vehicle power converters," said Cengiz Balkas, General Manager Power and RF. "The advantages of Silicon Carbide are clear, and for high-voltage, high-frequency systems, you can't afford not to use SiC"

www.cree.com/power

Dongbu HiTek from Seoul/Korea offered its foundry services at PCIM. "Our BCDMOS processes are compatible with those of National Semiconductor or Texas Instruments and tailored for power management ICs. June 2008 we launched the world's first BCDMOS process at the 0.18 micron level node. This year we plan to introduce mid-voltage chips for cell-phones as well as a high-voltage, more than 200V, BCDMOS process for industrial applications, which is certainly of interest for the European customers", said Lou N. Hutter, GM of the Analog Foundry Business Division. The company operates two fabs currently process



"This year we plan to introduce a high-voltage BCDMOS process for industrial applications within our foundry services", said Dongbu HiTek's Lou N. Hutter

200mm wafers at nodes ranging from 350 to 90 nanometers, supported by design support (IP and design libraries), prototype development/verification, and packaging/module development. Recent references are a Low Frequency (LF) receiver IC for Micro Analog Systems Oy (MAS), a fabless analog semiconductor company based in Espoo/Finland, or high-voltage LED Driver ICs for 60V operation developed in collaboration with ADDtek, a Taiwanese fabless company. Market researcher IC Insights recently ranked Dongbu HiTek as one of the world's top specialized foundries. Among the other foundries that IC Insights ranked in the specialized sector were Vanguard in Taiwan, TowerJazz in Israel and X-FAB in Germany.

According to market researcher Gartner Dongbu held in 2009 with revenues of \$370 million position 8 in the worldwide foundry ranking, followed by TowerJazz (\$298 million). Market leader was TSMC with roughly \$9 billion in revenues. www.dongbuhitek.com

Infineon Technologies presented new developments in MOSFETs, IGBTs, SiC diodes and packaging. The latter is called .XT technology which optimizes all interconnections within an IGBT module in regard of lifetime. Lifetime of a power module can be defined as the operating time under specific load conditions. The joining technologies such as soldering or bonding define the lifetime, basically once a failure mechanism occurs. Firstly, a copper front-side metallization of the Silicon dies and a copper bond process was implemented. Secondly, the chip-substrate connection is done via diffusion soldering consisting of high-melting intermetallic phases with joint thickness of 10 μm (compared to soldering a reduction by a factor up to 8). These efforts lead to a module lifetime simulation of ten times longer compared to a standard module. Alternatively the output power can be increased by 25%. The new .XT technology covers all critical areas on power cycling capability within an IGBT module: bond wiring on the chip front side, soldering on the chip back side (die to DCB) and the DCB (Direct Copper Bond) to base plate soldering. The new set of interconnection technology has been developed to



Infineon's Martin Hierholzer (left) and Arunjai Mittal presented the specifications of the first .XT power module

fit into most of the existing packages as well as into new module packages. All three new joining technologies are adaptable to the standard processes and suitable for junction temperatures up to 200°C and for high volume production. "By introducing the new .XT technology Infineon is setting a new benchmark in power cycling capability and as a key enabler for higher junction temperature operation", said Martin Hierholzer, General Manager Industrial Power. The first .XT product is the PrimePACK 2 module FF900R12IP4LD based on IGBT4 chips (150°C operation) with dual configuration providing 900Arms.

Also Infineon Technologies and Mitsubishi Electric Corporation will both serve the industrial motion controls and drives market worldwide as sources for the advanced IGBT module packages SmartPACKs and SmartPIMs. This package concept, recently developed by Infineon, will be available with the latest generation of power chip technologies from the two companies. Under this agreement, Mitsubishi Electric will market its latest generation power chips of various ratings (15A up to 150A, 600V and 1200V) in the Smart-1,-2 and -3 housings.

Additionally SiC Schottky diodes in the TO-220 FullPAK package have been introduced. The new TO220 FullPak portfolio combines the high electrical performance standards of the 2nd generation SiC Schottky diodes with the advantages of a fully isolated package, including easier and more reliable mounting without having to use isolating bushing and foil. The new TO220 FullPAK devices

show a similar junction-to-heatsink thermal resistance as the standard non-isolated TO-220 devices. This is accomplished by using patented diffusion soldering technique, which reduces the chip-to-leadframe thermal resistance. The 600V FullPAK portfolio is offered in current ratings from 2A to 6A. According to Arunjai Mittal, President of the Division Industrial & Multimarket, Infineon is also evaluating the upcoming GaN power technology and will increase wafer size for SiC production from 4 to 6 inch shortly. "And, by the way, I am very pleased to see Infineon again as the leading supplier of power semiconductors in the IMS statistics."

In Power MOSFETs Infineon announced a packaging partnership with Fairchild Semiconductor for their power MOSFETs in the Infineon PowerStage 3x3 or Fairchild MLP 3x3 (Power33™) packages. The compatibility agreement is in response to the need for supply security while balancing the drive towards best-in-class efficiency and thermal performance in DC/DC conversion. It takes advantage of the expertise both companies offer for asymmetric, dual and single MOSFETs for DC/DC applications from 3A to 20A.

"Standardizing power packages benefits our customers as we minimize the amount of 'unique' packages available in the market place, while offering solutions that enhance performance levels in smaller form factors than the previous generations," commented Richard Kuncic, Infineon's product line manager low voltage MOSFETs. www.infineon.com

Besides its automotive activities Semikron introduced the first vacuum-sealed packaging for power modules called SEMISEAL. The packaging provides proven mechanical and environmental protection from harmful influences such as humidity, corrosive elements and dust, but also from shock and vibration. "The power modules are vacuum-sealed between a plastic film and adhesive coated paperboard. After production, the module is immediately sealed using a close-fitting transparent foil on one side and coated paperboard on the other side. The packaging stays intact during stock handling and transport. In comparison to standard packaging, SEMISEAL provides a seal of integrity for the customer. The quality of the module is ensured until the packaging is opened by the customer", explained Semikron's Technical Director Stefan Starovecky.

The transparency of the state-of-the-art packaging allows for a visual quality check, inspection by customs and data matrix reading for module identification. SEMISEAL packaging allows for different quantities of one module type to be included in a single package that is perforated to



Semikron's Technical Director Stefan Starovecky introduced the first vacuum-sealed packaging for power modules

allow for easy separation of the modules in given quantities as needed. Fast unpacking is simply done by first lifting and taking away the cardboard and then removing the film by pressing down the

cardboard template. The paperboard and plastic film used for SEMISEAL are environment-friendly and recyclable. The vacuum-sealed packaging units for SEMIPACK 2 and SEMITRANS 2 weight is approximately 50% less than standard packaging units. www.semikron.com

Vincotech announced a new family of products called flowPHASE 2 S. Designed for fast-switching power applications beyond 100 kW, these new power modules (600/1200V, up to 400A) provide an ultra-low inductive path for transient current. Parasitic inductances are a major problem in power modules, particularly in fast-switching



Vincotech's Peter Sontheimer showing a model of the new low-inductance power module design

applications. To solve this problem, an ultra-low inductive path for transient current to today's standard power module design has been added. "This reduces parasitic inductance to 7nH and allows for switching frequencies up to 20kHz", commented VP R&D Peter Sontheimer. According to Vincotech's GM Joachim Fietz solar power is one of the booming markets the company is addressing and average lead time is 24 weeks. www.vincotech.com

PCIM Europe 2011 will be held from May 17 - 19.

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