The 5th International Conference on Integrated Power Electronics Systems CIPS 2008

CIPS 2008 took place in Nuremberg/Germany from March 11 to 13, 2008. 232 attendees from industry, research institutes and universities came together at the Georg-Simon-Ohm University where they enjoyed an exciting and diversified programme. The conference was organized by ETG, the Power Engineering Society within VDE, and co-organized by ECPE, the European Center for Power Electronics. The topics of the conference were:

Robustness and reliability of power modules
EMC and thermal management
Advanced packaging technology
Gate drives and control
Passive components
SiC devices and Si integrated smart power
Power electronics and system integration

According to these topics, the conference was structured by 12 invited papers accompanied by 35 regular papers and 15 posters.

Helmut Keller (ZVEI) explained in the opening session the new concept of robustness validation for automotive and aerospace electronic components and systems. It means a paradigm shift from “fit for test” to “fit for application”. As a consequence the new philosophy is based on the good knowledge of mission profiles (it describes all the stresses applied during operation), physics-of failure and the end-of-life tests. The robustness validation initiative is a joint effort of ZVEI, SAE (Society of Automotive Engineers) and JSAE (Japanese SAE). As another consequence modelling and simulation becomes more and more important. Chris Bailey (University of Greenwich, UK) presented his approach on “predictive reliability, prognostics and risk assessment for power modules”. Accurate lifetime prediction based on realistic mission profiles represents a challenge for the design of complex devices and systems. Mauro Ciappa (ETH Zurich) gave some examples where this problem has been solved by proper analysis, by dedicated physical modelling, and by efficient calculation tools.

It is a common understanding that reliability has to be built-in from the beginning in a design process. This is true as well for building-in EMI (electromagnetic interference). Jean-Luc Schanen (G2ELab, CNRS, France) and Eckart Hoene (Fraunhofer IZM, Berlin) described in detail the effects which may occur and methods how to avoid electromagnetic disturbances. Examples were given for power modules and power electronic systems.

A review on highly integrated solutions for power electronics devices was given by Jürgen Schulz-Harder (Electrovac Curamic, Germany). He described several concepts how to extract heat from the IGBT- and diode-chips best. Of great interest are double-sided liquid cooling concepts like from Alstom, Toyota, Fraunhofer and Curamik. Uwe Scheuermann (Semikron) introduced the new solderless SKIM module and showed very promising reliability data. Solderless means applying the silver sintering technology instead of soft solder. One of the big advantages is the high melting temperature of silver (962°C) which yields to more stable thermomechanical properties of the joint. Guo-Quan Lu (CPES, USA) described pros and cons of the nano-silver joining: For getting good and reliable joints a small pressure in comparison to “classic” silver sintering is needed.

SiC based power semiconductors are becoming more and more mature. Peter Friedrichs (SiCED, Germany) reported on system solutions where SiC– Schottky diodes and –JFETs are yielding to compact systems which have good potential for cost reductions. Dominique Bergogne (Ampere, INSA-Lyon, France) discussed circuit topologies for normally-on SiC JFETs. He showed that inverters using normally-on power switches do not differ from inverters based on normally-off devices when the gate driver is taken into account. He proposed building blocks of a gate driver solely using SiC normally-on JFETs.

Three invited papers were presented in the system integration session. Gerald Deboy (Infineon, Austria) took the power supply for server applications to discuss specific challenges for power factor correction, isolating PWM stage and synchronous rectification. A deep understanding of the behaviour of the CoolMOS, however, is necessary to optimize the overall system.

Dushan Boroyevich (CPES, USA) gave an overview of the results achieved during 10 years of operation of CPES (Center of Power Electronics Systems, Virginia Tech). Many of the demonstrators built and tested were accepted by industry like non-wirebond packages. The activities at Virginia Tech will continue even CPES as a NSF center of excellence will stop.

Hiromichi Ohashi (AIST/PERC, Japan) reported on SiC activities and achievements made. These are: micropipe-free wafers, MOSFETs, high voltage devices, Power electronics systems. It was interesting to learn that Japan is aiming for a full electrified society in 2050 to be independent from fossil materials. Power electronics will be a dominant technology.

ECPE has organised a panel discussion on ´Intelligent Power Electronics for Energy Efficiency - Research Needs and Opportunities´ focussing on the future role of power electronics research topics in the ICT Programme of EC FP7. Manuel Sanchez (EC, ICT for Sustainable Growth) presented actions at EU level in the field of Information & Communication Technologies for Energy Efficiency. Experts from CPES, AIST/PERC and ECPE highlighted the key role of power electronics for energy saving and improved energy efficiency.

In the last session ECPE proposed Research and Technology Roadmaps in the fields of automotive, high frequency power conversion < and > than 1 kW. To support the seven power electronics roadmaps a bottom-up roadmap, containing roadmaps for all parts and components used in the power electronics system was introduced as well.

It is planned that the 6th CIPS Conference will take place again in Nuremberg in spring 2010.

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