

CIPS 2020

Paper is available

Paper is not available

Keynote

Chairs: Nando Kaminski (University of Bremen, Germany), Andreas Lindemann (University of Magdeburg, Germany)

***Wide-Bandgap Semiconductor Power Electronics: Overcoming Barriers in Materials to Circuits for a more Electrified Future*..... 1**

Isik C. Kizilyalli (Advanced Research Projects Agency – Energy (ARPA-E), USA); Eric Carlson (Booz Allen Hamilton, USA); Daniel Cunningham (Advanced Research Projects Agency - Energy (ARPA-E), USA)

Session Power Packages and Modules (1)

Chairs: Martin Rittner (Robert Bosch GmbH, Germany), Katsuaki Suganuma (Osaka University, Japan)

Design innovations and performance of GaN Power Modules and MCMs

Charles Bailley (GaN Systems Inc., USA)

***Evaluation of a GaN HEMT half-bridge embedded to a Multilayer Aluminum Nitride Substrate*..... 8**

Carsten Kuring (Technische Universität Berlin, Germany); Mihaela Wolf (Ferdinand-Braun-Institut Leibniz-Institut für Höchstfrequenztechnik, Germany); Xiaomeng Geng (Technische Universität Berlin, Germany); Oliver Hilt (FBH, Germany); Jan Böcker and Nick Wiczorek (Technische Universität Berlin, Germany); Joachim Wuerfl (Ferdinand-Braun-Institut, Germany); Sibylle Dieckerhoff (TU Berlin, Germany)

***Surface-Mount Package IPM with Highly Reliable Transfer Molding Resin*..... 14**

Hodaka Rokubuichi (Mitsubishi Electric Corporation, Japan)

Session Components to be Integrated (1)

Chair: Fang Luo (University of Arkansas, USA)

***Simple and Precise Calorimetry Method for Evaluation of Losses in Power Electronic Converters*..... 19**

Nicolas Mary (Mitsubishi Electric R&D Centre Europe, Laboratoire Ampère, France); Rémi Perrin and Stefan Mollov (Mitsubishi Electric R&D Centre Europe, France); Cyril Buttay (Université de Lyon Laboratoire Ampère CNRS UMR 5005 & Insa de Lyon, France)

***Experimental Study of the Coss-Losses Occurring During ZVS Transitions – Emphasis on Low and High Voltage GaN-HEMTs*..... 25**

Benedikt Kohlhepp, Daniel Kübrich and Thomas Dürbaum (Friedrich-Alexander University Erlangen-Nürnberg (FAU), Germany)

***Implementation and validation of a dynamic calorimetric method to evaluate the losses in switching discrete power MOSFETs*..... 31**

Do Phuong Uyen Tran (G2Elab, France); Stephane Lefebvre (SATIE, ENS-CACHAN, France); Yvan Avenas (Grenoble Université, France)

Session Power Packages and Modules (2)

***Is Pressureless Sintering Ready for Power Electronic Modules?*..... 37**

Thomas Blank, Marc Weber, Helge Wurst, Bao Ngoc An, Benjamin Leyrer and Torsten Scherer (Karlsruhe Institute of Technology, Germany); Vanessa Trouillet and Stephan Pochert (KIT, Germany); Dai Isikawa (Karlsruhe Institute of Technology (KIT), Germany)

***Comparison of Silver Sintered Assemblies on Non-DCB Substrates*..... 43**

Nilavazhagan Subbiah (University of Freiburg & IMTEK, Germany); Alexander Schiffmacher (University of Freiburg - IMTEK, Germany); Jürgen H. Wilde (Universität Freiburg - IMTEK & Microsystems Engineering, Germany); Xiayingfang Song (University of Freiburg, Germany)

Sintered-copper Die-attach: Processing, Properties, and Reliability50
 Meiyu Wang, Yanliang Shan, Yun-Hui Mei and Xin Li (Tianjin University, China); Guo-Quan Lu (Virginia Tech, USA)

Thick film paste systems for multifunctional copper power modules56
 Kathrin Reinhardt and Stefan Körner (Fraunhofer Institute of Ceramic Technologies and Systems, Germany); Uwe Partsch (Fraunhofer Institute Ceramic Technologies and Systems, Germany)

Session Components to be Integrated (2)

Chairs: Sibylle Dieckerhoff (TU Berlin, Germany), Oliver Hilt (FBH, Germany)

Monolithic Integration of Inductive Components in a GaN-on-Si Technology63
 Michael Basler (Fraunhofer Institute for Applied Solid State Physics, Germany); Stefan Moench (Fraunhofer IAF, Germany); Richard Reiner (IAF Fraunhofer, Germany); Patrick Waltereit and Rüdiger Quay (Fraunhofer IAF, Germany); Ingmar Kallfass (University of Stuttgart, Germany); Oliver Ambacher (Fraunhofer IAF & IMTEK, University Freiburg, Germany)

A 600 V GaN-on-Si Power IC with Integrated Gate Driver, Freewheeling Diode, Temperature and Current Sensors and Auxiliary Devices.....69
 Stefan Moench (Fraunhofer IAF, Germany); Richard Reiner (IAF Fraunhofer, Germany); Patrick Waltereit (Fraunhofer IAF, Germany); Jan Hüchelheim (University of Stuttgart, Germany); Dirk Meder and Rüdiger Quay (Fraunhofer IAF, Germany); Oliver Ambacher (Fraunhofer IAF & IMTEK, University Freiburg, Germany); Ingmar Kallfass (University of Stuttgart, Germany)

Novel back-end-of-line compatible method for integration of inductances with magnetic core on silicon75
 Malte Paesler, Thomas Lisec and Holger Kapels (Fraunhofer Institute for Silicon Technology, Germany)

Ultra-low loss integrated magnetics platform for high frequency power delivery networks81
 Pranay Podder (Tyndall National Institute, University College Cork, Ireland); Zoran Pavlovic, Ansar Masood, Guannan Wei, Daniel Lordan and Seamus O'Driscoll (Tyndall National Institute, Ireland); Lulu Peng, Zishan Ali, Lawrence Selvaraj and Chor Shu Cheng (GlobalFoundries Corporation, Singapore); Cian Ó Mathúna and Paul McCloskey (Tyndall National Institute, Ireland)

Session Power Packages and Modules (3)

Thermal analysis of power module with double sided direct cooling using ceramic heat sinks85
 Nicolas Botter (University of Grenoble & Safran Tech, France); Yvan Avenas, Jean-Michel Missiaen and Didier Bouvard (Grenoble Université, France); Rabih Khazaka (Safran SA, Safran Tech, France)

High Performance Power module with double side cooling for automotive
 Junhee Park (Hyundai Motors, Korea (South))

Low voltage switching cell for high density and modular 3D power module with integrated air cooling.....90
 Wendpanga Fadel Bikinga, Walid Deffous, Bachir Mezrag, Alexis Derbey, Florian Dumas and Benoit Sarrazin (G2Elab, France); Yvan Avenas (Grenoble Université, France)

Direct heat sink printing on metallized ceramic substrate for power electronics applications: heat treatment identification and its im-pacts.....96
 Rabih Khazaka (Safran SA, Safran Tech, France); Elodie Martin and Joel Alexis (LGP, INP-ENIT, France); Donatien Martineau (Safran, France); Stephane Azzopardi (Safran SA, France)

Session Components to be Integrated (3)

Chair: Stefan Mollov (Mitsubishi Electric R&D Centre Europe, France)

Dynamic Current Balancing of Parallel Connected IGBT Devices using PCB Sensors for Integration in Power Modules.....101
 Ravi Nath Tripathi (Kyushu Institute of Technology, Japan); Masanori Tsukuda (Kyushu Institute of Technology & Green Electronics Research Institute, Kitakyushu, Japan); Ichiro Omura (Kyushu Institute of Technology, Japan)

<i>Detecting Three-Phase Power Inverter Output Currents By A Single PCB Current Sensor</i>	106
Bat-Otgon Bat-Ochir and Ichiro Omura (Kyushu Institute of Technology, Japan); Masanori Tsukuda (Kyushu Institute of Technology & Green Electronics Research Institute, Kitakyushu, Japan)	
<i>Three-State Output Gate Driver for IGBTs</i>	110
Paula Diaz Reigosa (University of Applied Sciences, Windisch, Switzerland); Bogdan Marian Urcan (Aalborg University, Denmark); Martin Iriondo Gascue (Aalborg University, Denmark); Francesco Iannuzzo (Aalborg University, Denmark)	
<i>Optimisation and Application Studies for the M-Shunt Structure applied to Printed Circuit Boards</i>	114
Hauke Lutzen (University of Bremen, Germany); Koji Mitsui (Tokyo Metropolitan University, Japan); Dieter Silber (Bremen University, Germany); Keiji Wada (Tokyo Metropolitan University, Japan); Nando Kaminski (University of Bremen, Germany)	

Session Power Packages and Modules (4)

Chair: Jürgen H. Wilde (Universität Freiburg - IMTEK & Microsystems Engineering, Germany)

<i>The Opportunities of Integration Technologies for Active and Passive Components (Invited).....</i>	120
Andreas Ostmann (Fraunhofer IZM, Germany)	
<i>System integration and analysis of SiC-based high power inverter with up to 250 kW and switching slopes of up to 50 kV/μs for novel powertrain concepts.....</i>	126
Christian Meyne (Infineon Technologies AG, Germany); Alexander Otto and Sven Rzepka (Fraunhofer ENAS, Germany); Omar Vanegas and Lea Fuchs (Infineon Technologies AG, Germany); Christoph Luedecke (ISEA RWTH-Aachen, Germany); De Doncker Rik W. (RWTH Aachen University, Germany); Christian Strenger (Infineon Technologies AG, Germany); Thomas Reum (CE-LAB GmbH, Germany); Alexander Nisch, Maximilian Hepp and Wolfgang Wondrak (Daimler AG, Germany); Andre Uhlemann (Infineon Technologies AG, Germany)	
<i>Thermally Integrated 3D Package for SiC Based DC-DC Full Bridge Converter</i>	
Patrick McCluskey, He Yun, Clifton Buxbaum, Sevet Yuruker, Raphael Mandel, Michael Ohadi, Yongwan Park, Shiladri Chakraborty and Alireza Khaligh (University of Maryland, USA)	
<i>A low inductive PSiP packaging technology with multilayer ceramic substrate and integrated active cooling (Invited)</i>	
Karsten Schmidt, Olivier Mathieu, Tilo Welker and Andreas Meyer (Rogers Germany GmbH, Germany)	

Session Components to be Integrated (4)

Chairs: Cyril Buttay (Université de Lyon Laboratoire Ampere CNRS UMR 5005 & Insa de Lyon, France), Kaspars Kroics (Riga Technical University, Latvia)

<i>Challenges and opportunities for magnetic components in the low to medium power applications (Invited)</i>	
Marek S. Rylko (SMA Magnetics Sp. z o. o., Germany)	
<i>PCB Embedded dies for low thickness Wireless rotary transformer</i>	132
Rémi Perrin (Mitsubishi Electric R&D Centre Europe, France); Julien Morand (Mitsubishi Electric Research, France); Guilherme Bueno Mariani and Stefan Mollov (Mitsubishi Electric R&D Centre Europe, France)	
<i>Integration of Printed Electronics in Potted Power Electronic Modules.....</i>	137
Victoria Zimmermann (Fraunhofer Institute for Integrated Systems and Device Technology, Germany); Alicia Zoerner (Fraunhofer IISB, Germany); Zechun Yu (Fraunhofer Institute for Integrated Systems and Device Technology IISB, Germany); Michael Jank (Friedrich-Alexander Universität Erlangen-Nürnberg, Germany); Christoph Friedrich Bayer (Fraunhofer Institute for Integrated Systems and Device Technology, Germany); Andreas Schletz (Fraunhofer Institute for Integrated Systems and Device Technology IISB, Germany); Martin März (FhG Erlangen, Germany)	

<i>SiC Power Module with integrated RC-Snubber Design for Voltage Overshoot and Power Loss Reduction</i>	142
Cornelius Rettner and Maximilian Schiedermeier (Friedrich-Alexander-University Erlangen-Nürnberg, Germany); Andreas Apelsmeier (Friedrich-Alexander-University Erlangen-Nuremberg, Germany); Thomas Heckel (Friedrich-Alexander University Erlangen-Nürnberg (FAU), Germany); Antonia Diepgen (Fraunhofer Institute for Integrated Systems and Device Technology, Germany); Alexander Klische (Fraunhofer Institute of Integrated Systems and Device Technology, Germany); Daniel Dirksen (Fraunhofer Institute for Integrated Systems and Device Technology, Germany); Martin März (FhG Erlangen, Germany)	

Keynote

Chair: Regine Mallwitz (Technische Universität Braunschweig, Germany)

Capacitor-Based Power Converters for High Power Density and Efficiency - the Theoretical Promises and Practical Challenges

Robert Pilawa (University of California Berkeley, USA)

Session Power Packages and Modules/Mechatronic Systems (1)

Chairs: Bruno Allard (INSA Lyon, France), Regine Mallwitz (Technische Universität Braunschweig, Germany)

<i>Full-SiC Integrated Power Module based on Planar Packaging Technology for High Efficiency Power Converters in Aircraft Applications</i>	148
Oliver Raab (Siemens AG, Germany); Mattia Guacci (ETH Zurich, Switzerland); Antonio Griffo (The University of Sheffield, Great Britain); Kai Kriegel (Siemens AG, Germany); Morris Heller (ETH Zurich, Switzerland); Jiabin Wang (The University of Sheffield, Great Britain); Dominik Bortis (ETH Zurich, Switzerland); Martin Schulz (Siemens AG, Germany); Johann. W. Kolar (ETH Zurich, Switzerland)	

Cooling Jacket Design for High Power Electric Smart Motor

Zhaoxi Yao, Yonatan Saadon, Raphael Mandel and Patrick McCluskey (University of Maryland, USA)

<i>Multi-chip Medium Voltage SiC MOSFET Power Module with Focus on Low Parasitic Capacitance</i>	154
---	------------

Jannick K. Jørgensen, Dipen N. Dalal, Szymon Beczkowski, Stig Munk-Nielsen and Christian Uhrenfeldt (Aalborg University, Denmark)

Session General Aspects of Packaging (1)

Chair: Andreas Schletz (Fraunhofer Institute for Integrated Systems and Device Technology IISB, Germany)

<i>Ultra-high power density server supplies employing GaN power semiconductors and PCB-integrated Magnetics (Invited)</i>	160
Matthias J Kasper (Infineon Technologies Austria AG & Power Electronic Systems Laboratory, Austria); Luca Peluso and Gerald Deboy (Infineon Technologies Austria AG, Austria); Gustavo Knabben (ETH Zurich, Switzerland); Guillod Thomas (Swiss Fed Inst Technol, Switzerland); Johann. W. Kolar (ETH Zurich, Switzerland)	

<i>WBG power semiconductor packaging with advanced interconnection technologies (Invited)</i>.....	168
---	------------

Katsuaki Suganuma (Osaka University, Japan)

Session Power Packages and Modules/Reliability(2)

<i>Improvement of High-temperature Reliability of Power Modules by Multi-step Temperature Bonding Process of Zn-Al Solder</i>	173
Hiroshi Hozoji, Fumiki Kato, Hiroshi Sato, Shinji Sato and Hiroshi Yamaguchi (National Institute of Advanced Industrial Science and Technology, Japan)	

<i>SiCmodul - Modular high-temperature SiC power electronics for fail-safe power control in electrical drive engineering</i>	179
---	------------

Christoph Marczok (Fraunhofer IZM, Germany); Manuel Martina (Schweizer Electronic AG, Germany); Michael Laumen (RWTH Aachen University, Germany); Sebastian Richter (AixControl GmbH, Germany); Andreas Birkhold (Robert Bosch GmbH, Germany); Björn Flieger and Oliver Wendt (TLK Thermo GmbH, Germany); Thomas Päsler (Vitesco Technologies Germany GmbH, Germany)

<i>End-of-life mechanism due to cyclic thermomechanical loading of power modules with .XT joining technology</i>	185
Torsten Methfessel and Hendrik Jähme (Infineon Technologies AG, Germany)	
<i>Power Cycling Reliability and Failure Modes in Power Modules with Novel Emitter Contact and Sintering Technologies</i>	190
Harald Beyer (ABB Switzerland Ltd., Switzerland); Milad Maleki (ABB Semiconductors Ltd., Switzerland); Martin Bayer (ABB Switzerland Ltd., Switzerland); Swen König and Fabian Fischer (ABB Semiconductors Ltd., Switzerland); Gontran Paques (ABB Switzerland Ltd., Switzerland)	
<i>Power Cycle Testing at Low Temperature Swings – Evaluating the Stability of SAC- and SnSb-based Chip Solder Layers</i>	196
Ralf Schmidt, Michael Kaesbauer, Marcel Sippel and Patrick Dreher (Siemens AG, Germany)	

Session Clean Switching, EMC (1)

Chairs: Reinhold Bayerer (Germany), Eckart Hoene (Fraunhofer-Institut für Zuverlässigkeit und Mikrointegration IZM, Germany)

<i>High Power Density EMI Mitigation in Power Electronics Converters: Active and Integrated Solutions (Invited)</i>	202
Fang Luo (University of Arkansas, U.S.)	
<i>Reduction of Common Mode EMI noise in microstrip line based commutation paths designed for sub-nH loop inductance</i>	208
Norbert Seliger and Eduard Dechant (Technische Hochschule Rosenheim, Germany); Christian Brendel (Dr. Johannes Heidenhain GmbH, Germany); Ralph Kennel (Technical University of Munich, Germany)	
<i>Impact of multilevel converters on EMC filter weight of a 70 kVA power drive system for More Electrical Aircraft</i>	214
Hans Hoffmann Sathler (IRT Saint-Exupery, France); Bernardo Cougo and Lucas Nagano (IRT Saint Exupery, France); Francois Costa and Denis Labrousse (SATIE, France)	
<i>Control scheme for EMI reduction via spread spectrum modulation for triangular current mode (TCM) DC/DC converters</i>	222
Burkhard Ulrich (University of Cooperative Education Baden-Wuerttemberg (DHBW) Stuttgart Campus Horb, Germany)	

Poster Session Clean Switching, EMC

Chairs: Reinhold Bayerer (Germany), Eckart Hoene (Fraunhofer-Institut für Zuverlässigkeit und Mikrointegration IZM, Germany)

<i>Analysis of the gate driver stray inductance in a Vienna rectifier through parametric Electromagnetic simulations</i>	228
Francesco Palomba (Keysight Technologies Italy, Italy); Francesco Gennaro, Mario Pavone and Giuseppe Aiello (STMicroelectronics, Italy); Mario Cacciato (Università degli Studi di Catania, Italy); Simon Muff (Keysight Technologies, Germany); Ludwig Eichinger (Keysight Technologies Deutschland GmbH, Germany)	
<i>Investigation of the Current Ripple caused by the Main Inverter in the High Voltage DC Bus of Electric Vehicles</i>	235
Marius Gentejohann and Michael Schlüter (Technische Universität Berlin, Germany); Sibylle Dieckerhoff (TU Berlin, Germany)	
<i>Low-Inductance DC-link Design dedicated to SiC-based Highly Integrated Inverters</i>	241
Jasper Schnack, Jan Philipp Gördes and Victor Golev (University of Applied Sciences Kiel, Germany); Ulf Schümann (Fachhochschule Kiel, Germany); Stefan Stahl and Herwig Süncksen (FTCap GmbH, Germany); Regine Mallwitz (Technische Universität Braunschweig, Germany)	
<i>Operating a du/dt Filter with a SiC Halfbridge Module and Integrated Active Snubber</i>	248
Michael Schlüter (Max-Planck-Strasse 5 & Infineon Technologies AG, Germany); Martin Pfof (TU Dortmund, Germany)	

Switching speed evaluation of e-mode GaN HEMTs in ultra-low inductive switching cell designs	253
Raffael Risch, Anliang Hu and Jürgen Biela (ETH Zurich, Switzerland)	
Wideband Macro-Modeling of Power Modules for Transient Electro-magnetic Analysis	259
Arne Schröder (ABB Switzerland); Bernhard Wunsch (ABB Switzerland Ltd, Switzerland); Slavo Kicin (ABB Corporate Research Centre, Switzerland)	

Poster Session Components to be Integrated

Chair: Radoslava Mitova (Schneider Electric, France)

Thin-film magnetics-on-silicon integrated transformer for isolated power conversion applications	264
Zoran Pavlovic (Tyndall National Institute, Ireland); Pranay Podder (University College Cork & Tyndall National Institute, Ireland); Dermot Dobbyn, Ansar Masood, Guannan Wei, Daniel Lordan, Paul McCloskey, Cian Ó Mathúna and Seamus O'Driscoll (Tyndall National Institute, Ireland)	
Digital Gate Drive Control Method for Active Voltage Balancing of Series-connected IGBT Devices	269
Ravi Nath Tripathi and Takaaki Arimoto (Kyushu Institute of Technology, Japan); Masanori Tsukuda (Kyushu Institute of Technology & Green Electronics Research Institute, Kitakyushu, Japan); Ichiro Omura (Kyushu Institute of Technology, Japan)	
Ultra-Compact Combined Common Mode (CM)- and Differential Mode (DM)-Inductors	274
Patrick Deck, Martin Nießen and Christian Dick (TH Köln, Germany)	
PCB Embedded Toroidal Inductor for 2MHz Point-of-Load Converter	280
Ruaidhrí E Murphy (University College Cork & Tyndall National Institute, Ireland); Paul McCloskey, Seamus O'Driscoll and Cian Ó Mathúna (Tyndall National Institute, Ireland); Gerald Weidinger (AT&S, Austria); Zoran Pavlovic (Tyndall National Institute, Ireland)	
Design of Interleaved GaN transistor based Buck Converter with Directly Coupled Foil Winding Inductor	286
Kaspars Kroics (Riga Technical University, Latvia)	
Investigation on static and dynamic behavior of integrated current sensor in Automotive IGBT module with SPICE based model	292
Shinichiro Adachi (Fuji Electric.,co Ltd); De Doncker Rik W. (RWTH Aachen University, Germany); Masahito Otsuki (Fuji Electric.,co Ltd); Nurhan Averous (RWTH Aachen University, Germany)	
Improved Performances of 6,5kV IGBT Module by using Current Source Gate Driver	297
Vincent Escrouzailles (ALSTOM SA, France); Eric Rabasse and Jean-Yves Coiret (Alstom, France)	
A General Model Translation Approach for Vertical Power MOSFETs Based on BSIM3 Model	303
Lixi Yan and Ingmar Kallfass (University of Stuttgart, Germany)	
Study and Design of an Integrated CMOS Laser Diode Driver for an iToF-based 3D Image Sensor	309
Romain David (University of Lyon & STMicroelectronics, France); Xavier Branca (STMicroelectronics, France); Bruno Allard (INSA Lyon, France); Charles Joubert (Academia, France)	

Poster Session General Aspects of Packaging

Application of Neural Networks to Accelerate Thermomechanical Simulations of Power Modules	315
Javier Acuna and Ingmar Kallfass (University of Stuttgart, Germany); Thomas Rupp, Marcus Sonner and Markus Klingler (Robert Bosch GmbH, Germany); Valentyna Afanasenko (University of Stuttgart, Germany)	

<i>Deformation Measurements during Active Operation of Power Modules with Novel Assembly and Packaging Technology</i>	321
Alexander Schiffmacher and Arben Qelibari (University of Freiburg - IMTEK, Germany); Jacek Rudzki and Frank Osterwald (Danfoss Silicon Power GmbH, Germany); Jürgen H. Wilde (Universität Freiburg – IMTEK & Microsystems Engineering, Germany)	
<i>Paste Processing and Structural Properties of Copper Metal-Matrix Composites Containing Short Carbon Fibers</i>	327
Helge Wurst, Thomas Blank, Benjamin Leyrer and Marc Weber (Karlsruhe Institute of Technology, Germany); Dai Isikawa (Karlsruhe Institute of Technology (KIT), Germany)	
<i>Thermal simulation for power density optimization of SiC-MOSFET drive train inverters.....</i>	333
Nathalie Becker (Ilmenau University of Technology, Germany); Reinhard Herzer, Roland Bittner and Sandro Bulovic (SEMIKRON Elektronik GmbH & Co. KG, Germany)	
<i>Experimental Analysis and Modeling of Bond Formation in Ultrasonic Thick Wire Bonding....</i>	339
Reinhard Schemmel (University of Paderborn, Germany); Claus Scheidemann (Universität Paderborn, Germany); Tobias Hemsel (Paderborn University, Germany); Walter Sextro (Universität Paderborn, Germany); Olaf Kirsch (Infineon Technologies AG Warstein, Germany)	
<i>Influence of process and stress conditions on microstructure and failure mechanisms of 2nd level sintered Ag joints</i>	345
Constanze Weber and Matthias Hutter (Fraunhofer IZM, Germany); Martin Schneider-Ramelow (Fraunhofer IZM & TU Berlin, Germany)	
<i>Copper wire bonding process characterization and simulation</i>	351
Alberto AM Mancaleoni (STMicroelectronics); Alessandro Sitta (STMicroelectronics & Università degli Studi di Catania, Italy); Alexandra Colombo and Riccardo Villa (STMicroelectronics, Italy); Giuseppe Mirone (University of Catania, Italy); Marco Renna and Michele Calabretta (STMicroelectronics, Italy)	
<i>PCB layout tool integrated loss and inductance estimation.....</i>	355
Stefan Hoffmann (Fraunhofer IZM, Germany); Eckart Hoene (Fraunhofer-Institut für Zuverlässigkeit und Mikrointegration IZM, Germany); Bernd Schroeder, Bernd Stube and Akram Alraai (TU Berlin, Germany); Oliver Moritz (Enasys GmbH, Germany); Olaf Müller (AEconversion GmbH & Co. KG, Germany)	

Poster Session Mechatronic Systems and their Applications

Chairs: Klaus Hoffmann (Helmut-Schmidt-Universität, Germany), Kai Kriegel (Siemens AG, Germany)

<i>Design and integration of inductive components for a high-frequency 11 kW / 800 V off-board charger for electric vehicles</i>	360
Michael Schmidhuber and Christoph Drexler (SUMIDA Components & Modules GmbH, Germany); Christopher Joffe (Fraunhofer Institute for Integrated Systems and Device Technology IISB, Germany); Stefan Ditze and Stefan Ehrlich (Fraunhofer Institute for Integrated Systems and Device Technology, Germany); Bastian Arndt, Peter Olbrich and Hartwig Reindl (AVL Software and Functions GmbH, Germany)	
<i>Low-inductive SiC H-Bridge for Direct-Inverter-Single-Tooth-Integration (German BMBF Public Funded Research Project 'VERSE')</i>	366
Gerhard Reber, Martin Rittner, Michael Guyenot, Alexander Klemm, Rainer Holz, Ulrich Kessler and Manfred Reinold (Robert Bosch GmbH, Germany)	
<i>High Frequency DC-DC Converter for an Integrated Electrical Excitation of an Axial Flux Machine with Fiber-composite Rotor: a Multidisciplinary Approach</i>	371
Philipp Schneider, Tobias Reimann and Benedikt Neitzel (Technische Universität Ilmenau, Germany); Andreas Moeckel (Ilmenau University of Technology, Germany); Tobias Heidrich (Technische Universität Ilmenau, Germany)	

Poster Session Power Packages and Module

<i>Half-bridge Concepts for High Blocking Voltage GaN HEMTs.....</i>	377
Martin Rittner, Ulrich Kessler and Tine Konjedic (Robert Bosch GmbH, Germany); Joerg Naundorf, Kai Kriegel and Martin Schulz (Siemens AG, Germany); Gaudenzio Meneghesso (University of Padova, Italy)	

<i>Two-layered planar SiC power module for industrial applications</i>	382
Oliver Raab, Kai Kriegel and Pol Ghesquiere (Siemens AG, Germany)	
<i>Characterization of the Junction Temperature of SiC Power Devices via Quasi-Threshold Voltage as Temperature Sensitive Electrical Parameter.....</i>	386
Kanuj Sharma, Kevin Muñoz Barón, Johannes Ruthardt, Jan Hüchelheim, Dominik Koch, Florian Münzenmayer and Ingmar Kallfass (University of Stuttgart, Germany)	
<i>Design, Manufacturing and Evaluation of a Highly Integrated Low Voltage High Current Inverter</i>	392
Johan Le Leslé, Vincent Quemener, Julien Morrand, Rémi Perrin, Roberto Mrad and Stefan Mollov (Mitsubishi Electric R&D Centre Europe, France)	
<i>Highly Integrated Switching Cell Design based on Copper Diamond Heat Spreader, 3D Printed Heat Sink and HTCC Logic Board</i>	397
Alexander Sewergin (RWTH Aachen University, Germany); Martin Rittner and Andreas Burghardt (Robert Bosch GmbH, Germany); Kai Kriegel (Siemens AG, Germany); Gerhard Mitic (Siemens, Germany); Thomas Zetterer (Schott AG, Germany); Thomas Hutsch (Fraunhofer Institute for Manufacturing Technology and Advanced Materials IFAM, Germany); Albert Neumann (Austerlitz Electronic GmbH, Germany); Flaviu Simon (Fraunhofer Institute for Integrated Systems and Device Technology IISB, Germany); Rik De Doncker (RWTH Aachen University & Institute for Power Generation and Storage Systems, Germany)	
<i>PCB Embedded Transformer for Isolated DC-DC Power Supplies</i>	403
Gerald Weis and Ivan Salkovic (AT & S Austria Technologie & Systemtechnik Aktiengesellschaft, Austria)	
<i>Improved Stress Distribution in Railway Traction Converters Using New High Power Half-Bridge Modules</i>	408
Michel Piton (Alstom, France); Emmanuel Batista (ALSTOM, France); Vincent Escrouzailles (ALSTOM SA, France)	
<i>Double pulse vs. indirect measurement: Characterizing switching losses of integrated power modules with wide bandgap semiconductors.....</i>	414
Adam Kuczmik (Ingenieurbüro Kuczmik, Germany); Stefan Hoffmann (Fraunhofer IZM, Germany); Eckart Hoene (Fraunhofer-Institut für Zuverlässigkeit und Mikrointegration IZM, Germany)	
<i>Electrical characteristics of double-sided cooling SiC power module using Ni micro plating bonding</i>	422
Tomoya Itose, Akihiro Kawagoe and Akihiro Imakiire (Kyushu Institute of Technology, Japan); Masahiro Kozako and Masayuki Hikita (Kyusyu Institute of Technology, Japan); Kohei Tatsumi, Tomonori Iizuka and Isamu Morisako (Waseda University, Japan); Nobuaki Sato, Koji Shimizu and Kazutoshi Ueda (Mitsui High-tec Inc., Japan)	
<i>Application considerations for Double Sided Cooled Modules in Automotive Environment.....</i>	428
Sebastian Möller (Virtual Vehicle Research Center, Austria); Danial Karimi (Vrije Universiteit Brussel & Flanders Make, Belgium); Omar Vanegas (Infineon Technologies AG, Germany); Mohamed El Baghdadi (Vrije Universiteit Brussels, Belgium); Alexander Kospach (Virtual Vehicle Research Center, Austria); Adrian Lis (Infineon Technologies AG, Germany); Benedikt Rabl (Virtual Vehicle Research GmbH, Austria); Omar Hegazy (Vrije Universiteit Brussels, Austria); Christoph Abart (AVL List GmbH, Austria)	
<i>Smart Ultrasonic Welding in Power Electronics Packaging</i>	435
Matthias Hunstig, Waldemar Schaermann, Michael Brökelmann, Sebastian Holtkämper, Dirk Siepe and Hans J. Hesse (Hesse GmbH, Germany)	

Poster Session Reliability

<i>A Review on the Application of On-Line Von (On-State Voltage) Sensing for Junction Temperature Estimation of Power Semiconductor Modules</i>	441
Nicolas Degrenne, Julio Brandelero, Chihiro Kawahara and Stefan Mollov (Mitsubishi Electric R&D Centre Europe, France)	

<i>Mechanical and microstructural characterization of LTCC and HTCC ceramics for high temperature and harsh environment application</i>	449
Falk Naumann, Georg Lorenz, Michael Bernasch, Bianca Boettge and Jan Schischka (Fraunhofer Institute for Microstructure of Materials and Systems IMWS, Germany); Steffen Ziesche (Fraunhofer IKTS, Germany); Hans-Fridtjof Pernau and Martin Jaegle (Fraunhofer Institute for Physical Measurement Techniques IPM, Germany); Sandy Klengel (Fraunhofer Institute for Microstructure of Materials and System, Germany); Holger Kappert (Fraunhofer institute of Microelectronic Circuits and Systems, Germany)	
<i>Introducing the LEGO Mission Profile Analysis Methodology</i>	455
Martin Bendix Fogsgaard and Francesco Iannuzzo (Aalborg University, Denmark)	
<i>Microstructure And Shear Strength Correlation After Reliability Testing Of Bond Contacts Using Alternative Al Heavy Wire Materials.....</i>	460
Robert Klengel, Jan Schischka and Tino Stephan (Fraunhofer Institute for Microstructure of Materials and Systems IMWS, Germany); Sandy Klengel (Fraunhofer Institute for Microstructure of Materials and System, Germany); Martin Hempel (Fraunhofer Institute for Reliability and Microintegration IZM, Germany); Martin Schneider-Ramelow (Fraunhofer IZM & TU Berlin, Germany); Anne Groth (Technische Universität Berlin, Germany)	
<i>Loop formation effects on the lifetime of wire bonds for power electronics.....</i>	467
Hans-Georg von Ribbeck (F & K DELVOTEC Bondtechnik GmbH, Germany); Torsten Döhler (TH Wildau, Germany); Bernhard Czerny and Golta Khatibi (TU Wien, Austria); Ute Geißler (TH Wildau, Germany)	
<i>Thermo-mechanical reliability of nanosilver sintered joints for large-area substrate bonding</i>	473
Jingru Dai, Pearl A Agyakwa, Christopher Johnson, Abubakar Bello and Martin Cofield (University of Nottingham, United Kingdom (Great Britain))	

Session Reliability (1)

Chairs: Guo-Quan Lu (Virginia Tech, USA), Josef Lutz (Chemnitz University of Technology, Germany)

<i>Reliability of Capacitors and Magnetic Components in Power Electronic Applications (Invited).....</i>	479
Huai Wang, Haoran Wang and Zhan Shen (Aalborg University, Denmark)	
<i>H3TRB Test on 6.5 kV SiC-JBS Diodes.....</i>	485
Felix Hoffmann (University of Bremen, Germany); Andrei Mihaila (ABB Switzerland Ltd., Germany); Victor Soler (Centre Nacional de Microelectrònica, Spain); Nando Kaminski (University of Bremen, Germany)	
<i>A Method for the Characterization of Adhesion Strength Degradation of Thin Films on Si-Substrate under thermal cycling test.....</i>	490
Dawei Zhao (Friedrich-Alexander-Universität Erlangen-Nürnberg, Germany); Sebastian Letz and Andreas Schletz (Fraunhofer Institute for Integrated Systems and Device Technology IISB, Germany); Martin März (FhG Erlangen, Germany)	
<i>Survey on Generative and Discriminative Approaches with Focus on SiC.....</i>	496
Afshin Loghmani Moghaddam Toussi, Amir Sajjad Bahman and Frede Blaabjerg (Aalborg University, Denmark)	

Session Clean Switching, EMC (2)

Chairs: Reinhold Bayerer (Germany), Eckart Hoene (Fraunhofer-Institut für Zuverlässigkeit und Mikrointegration IZM, Germany)

<i>EMI Imaging System Using Double-pulse-compose-method</i>	502
Kota Matsuo (Kyushu Institute of Technology & Omura Laboratory, Japan); Masanori Tsukuda (Kyushu Institute of Technology & Green Electronics Research Institute, Kitakyushu, Japan); Ichiro Omura (Kyushu Institute of Technology, Japan)	
<i>Gallium Nitride in Automotive High-Speed Drive Applications</i>	508
Benjamin Antensteiner (Magna Powertrain, Austria); Patrick Lamplmayr (MAGNA ECS, Austria); Michael Moerwald (Magna Powertrain, Austria); Martin Reisinger (Linz Center of Mechatronics GmbH, Austria); Wolfgang Gruber (Johannes Kepler University Linz & Institute for Electrical Drives and Power Electronics, Austria); Lukas Haeusler (Magna Powertrain Engineering Center Steyr GMBH & CO KG, Austria)	

Keynote

Power cycling – methods, measurement accuracy, comparability 516
Josef Lutz (Chemnitz University of Technology, Germany)

Session Reliability (2)

Chair: Norbert Seliger (Technische Hochschule Rosenheim, Germany)

Comparative study of determining junction temperature of SiC MOSFETs during power cycling tests by a T_j sensor and the VSD(T)-method 524

Carsten Kempiak (Otto-von-Guericke-Universität Magdeburg, Germany); Andreas Lindemann (University of Magdeburg, Germany); Shiori Idaka and Eckhard Thal (Mitsubishi Electric Europe B. V., Germany)

Power Cycling of SiC MOSFET Single-Chip Modules with Additional Measurement Cycles for Life End Determination 530

Felix Wagner, Gerhard Reber, Martin Rittner and Michael Guyenot (Robert Bosch GmbH, Germany); Maximilian Nitzsche (University of Stuttgart, Germany); Bernhard Wunderle (Technische Universität Chemnitz, Germany)

Impact of load-pulse duration on power-cycling capability of SiC devices 536

Paul Salmen (Infineon Technologies AG, Germany); Oliver Schilling (Infineon AG, Germany); Torsten Methfessel (Infineon Technologies AG, Germany); Cesare Künzel (TU Chemnitz, Germany)

Session General Aspects of Packaging (2)

PCB Embedding using Single-Switch-Pre-Packages as Modular Building Blocks 540

Ankit Bhushan Sharma, Johann Schnur and Niko Haag (Hochschule Kempten - University of Applied Science, Germany); Vladimir Polezhaev (Hochschule Kempten, Germany); Till Huesgen (Hochschule Kempten - University of Applied Science, Germany)

Generic thermal cooling design for multicell converters 546

Jean-Christophe Crebier and Yvan Avenas (Grenoble Université, France); Yves Lembeye (Grenoble Electrical Engineering Laboratory, France); André Andreta (Université Grenoble Alpes, France)

Electromagnetic switching cell design and characterization for WBG power semiconductors 552

Kirill Klein (Technical University Berlin, Germany); Eckart Hoene (Fraunhofer-Institut für Zuverlässigkeit und Mikrointegration IZM, Germany); Klaus-Dieter Lang (Technische Universität Berlin, Germany)

Session Reliability (3)

Chairs: Huai Wang (Aalborg University, Denmark), Eckhard Wolfgang (ECPE e. V., Germany)

IGBT current filamentation observation by segmented collector sensing under UIS condition 559

Seiya Matsuura (Kyusyu Institute of Technology, Japan); Masanori Tsukuda (Kyushu Institute of Technology & Green Electronics Research Institute, Kitakyushu, Japan); Ichiro Omura (Kyushu Institute of Technology, Japan)

Simultaneous Imaging of Strain and Temperature using Single IR Camera 565

Yoshiki Masuda (Kyusyu Institute of Technology, Japan); Akihiko Watanabe and Ichiro Omura (Kyushu Institute of Technology, Japan)

Power cycling close to 50 Hz load, low temperature swings combined with an adjustable part of switching losses 570

Peter Seidel, Christian Schwabe and Josef Lutz (Chemnitz University of Technology, Germany)

Dynamic AC Power Cycling with Coupled Inverters Operating Under Application-Oriented Conditions 576

Maximilian Nitzsche, Kevin Muñoz Barón and Philipp Ziegler (University of Stuttgart, Germany); Felix Wagner (Robert Bosch GmbH, Germany); Jörg Roth-Stielow (University of Stuttgart, Germany)

Session General Aspects of Packaging (3)

Development of sinter paste with surface modified copper alloy particles for die-attach bonding 582

Gordon Elger (Technische Hochschule Ingolstadt & Institut für Innovative Mobilität, Germany); Sri Krishna Bhogaraju (Institute of Innovative Mobility (IIMo), Technische Hochschule Ingolstadt, Germany); Markus R. Meier (Zestron Europe, Germany); Maximilian Schmid (Technische Hochschule Ingolstadt, Germany); Fosca Conti (University of Padova, Italy); Helmut Schweigart (ZESTRON Europe, Germany)

Application of Response Surface Methodology for Optimization of Ag-Ag Direct Bonding for Wafer-Level Power Electronics Packaging 588

Zechun Yu and Weijian Zeng (Fraunhofer Institute for Integrated Systems and Device Technology IISB, Germany); Christoph Friedrich Bayer (Fraunhofer Institute for Integrated Systems and Device Technology, Germany); Andreas Schletz (Fraunhofer Institute for Integrated Systems and Device Technology IISB, Germany); Martin März (FhG Erlangen, Germany)

A new development of micro-copper sinter material for high power electronics application 596

Christian Schwarzer (Aschaffenburg University of Applied Sciences & Heraeus Deutschland GmbH & Co KG, Germany); Ly May Chew (Heraeus Deutschland GmbH & Co. KG, Germany); Thomas Stoll (Friedrich-Alexander-Universität Erlangen-Nürnberg & Lehrstuhl für Fertigungsautomatisierung und Produktionssystematik (FAPS), Germany); Jörg Franke (FAU Erlangen-Nuremberg, Germany); Michael Kaloudis (Aschaffenburg University of Applied Sciences, Germany)

Numerical material design for reliable power electronics with cement-based encapsulation 602

Falk Naumann and Bianca Boettge (Fraunhofer Institute for Microstructure of Materials and Systems IMWS, Germany); Stefan Behrendt (FuE-Zentrum FH Kiel GmbH, Germany); Ronald Eisele (FH Kiel, Germany); Sandy Klengel (Fraunhofer Institute for Microstructure of Materials and System, Germany)

Keynote

Chair: Eckhard Wolfgang (ECPE e. V., Germany)

Present and Future of Fault Tolerant Drives applied to Transport Applications..... 608

Xu Deng, Haimeng Wu, Bowen Gu, Glynn Atkinson, Barrie Mecrow and Volker Pickert (Newcastle University, United Kingdom (Great Britain))