

Table of Content PCIM Asia 2016

Renewable Energy Technologies

Input Admittance Modeling and Small Signal Stability Analysis of DFIG System.....12



Xueguang Zhang, Harbin Institute of Technology, China
Yan Ma, Harbin Institute of Technology, China
Tianyi Wang, Harbin Institute of Technology, China
Dianguo Xu, Harbin Institute of Technology, China

IGBT Power Module Solution in Three-Level Topologies for 1 MW 1500 V_{oc} Solar Applications 19

Kevin Lenz, Danfoss Silicon Power, Germany
Toke Franke, Danfoss Silicon Power, Germany
Henning Ströbel-Maier, Danfoss Silicon Power, Germany

Integrated Three-Port DC-DC Converter for Photovoltaic (PV) Battery Stand-alone Systems 27

Ziwei Ouyang, Technical University of Denmark, Denmark
Michael A. E. Andersen, Technical University of Denmark, Denmark

Flexible IGBT Modules for High Power PV-inverters 35

Xiankui Ma, Mitsubishi Electric & Electronics (Shanghai), China
Jianfei Li, Sineng Electric, China
Xing Zhang, Hefei University of Technology, China

The 62Pak IGBT Modules employing 1700 V SPT++ Chip Set for 175 °C Operation 43

Sven Matthias, ABB, Switzerland
Chiara Corvasce, ABB, Switzerland
Athanasios Mesemanolis, ABB, Switzerland
Martin Bayer, ABB, Switzerland
Emilia Gustafsson, ABB, Switzerland
Charalampos Papadopoulos, ABB, Switzerland
Arnost Kopta, ABB, Switzerland
Dominik Trüssel, ABB, Switzerland
Raffael Schnell, ABB, Switzerland
Munaf Rahimo, ABB, Switzerland

Advanced Packages

The Next Generation High Voltage Package and IGBT/Diode Technologies 50



Raffael Schnell, ABB, Switzerland
Sven Matthias, ABB, Switzerland
Munaf Rahimo, ABB, Switzerland
Chiara Corvasce, ABB, Switzerland
Maxi Andenna, ABB, Switzerland
Arnost Kopta, ABB, Switzerland
Samuel Hartmann, ABB, Switzerland
Fabian Fischer, ABB, Switzerland

Selection of Materials for IGBT Modules to achieve Stable Short Circuit Failure Behaviour 58



Jianfeng Li, University of Nottingham, Great Britain
Imran Yaqub, Dynex Semiconductor Limited, Great Britain
Christopher Mark Johnson, University of Nottingham, Great Britain

Cu Paste Sinter joining for Die-attach of High T_J Power Devices Realized by PEG Solvent Optimization 66



Hiroki Yoshikawa, Osaka University, Japan
Shijo Nagao, Osaka University, Japan
Takahiko Sakaue, Mitsui Mining & Smelting, Japan
Yoichi Kamikoriyama, Mitsui Mining & Smelting, Japan
Takahumi Sasaki, Hikoshima Smelting, Japan
Katsuaki Suganuma, Osaka University, Japan

Compact and Reliable Medium Voltage Inverter Power Cell without Cabling 72

Bo Chen, Semikron Hongkong, Hongkong
Jianwen Qiu, Semikron Electronics (Zhuhai), China

Integrating a Real Time T_{VJ} Calculation into an IPM 80

Stefan Schmies, Infineon Technologies, Germany
Yizheng Zhou, Infineon Technologies, Germany
Peter Lahl, Infineon Technologies, Germany
Wolfram Kruschel, Infineon Technologies, Germany
Matthias Lassmann, Infineon Technologies, Germany

Keynote

Driving for Zero Switching Loss Power Solutions 87

Dan Kinzer, Navitas Semiconductor, USA

Poster Session

A Method to evaluate IGBT Module Losses on System Level 88

Song Shen, Infineon Technologies, China
Zheng Ziqing, Infineon Technologies, China
Yang Ruicheng, Shenzhen Inovance Technology, China
Mu Chao, Shenzhen Inovance Technology, China

StakPak 4500 V / 3000 A IGBT Module for High Power HVDC and DC-Breaker Applications 93

Makan Chen, ABB, Switzerland
Evgeny Tsyplakov, ABB, Switzerland
Vasileios Kappatos, ABB, Switzerland
Franc Dugal, ABB, Switzerland
Raffael Schnell, ABB, Switzerland
Peng Hong, ABB, China
Hao Wang, ABB, China
Sven Klaka, ABB, Switzerland

Unlocking the Door to More Compact Designs with New Highly Integrated 1200 V flowIPM	100
Michele Portico, Vincotech, Germany Roger Chen, Vincotech, China	
How to select HVIGBT Modules for your Application	104
Sun Jian, Mitsubishi Electric & Electronic (Shanghai), China Song Gaosheng, Mitsubishi Electric & Electronic (Shanghai), China	
Application of Silicon Carbide Field Effect Tube in Photovoltaic Inverter	109
Chunmei Zhang, Xi'an University of Technology, China	
Applying Locked Loop Circuits and their Applications in Voltage Regulator Modules	110
Yi Huang, Intersil Corporation, USA Lin Li, Intersil Corporation, China Chun Cheung, Intersil Corporation, USA Richard Zhu, Intersil Corporation, USA	
Current Sensorless Direct Predictive Control for Permanent-Magnet Synchronous Motor Drives	118
Zhemin Hu, Harbin Institute of Technology, China Ming Yang, Harbin Institute of Technology, China Kaixuan Yang, Harbin Institute of Technology, China Dianguo Xu, Harbin Institute of Technology, China	
Discussions on Trouble Shootings for the Application of Small IPMs for Inverter Air Conditioner	126
Jian Chen, Mitsubishi Electric GEM Power Device (Hefei), China Xiaoling Wang, Mitsubishi Electric & Electronics (Shanghai), China Hongtao He, Mitsubishi Electric & Electronics (Shanghai), China	
 Special Session: More Electronic Distributed Power Systems	
Power Electronics Synchronous Generator (PESG) Technology & Application	132
Hongyang Wu, Delta Electronics (Shanghai) Co. Ltd, China	
Design Challenges of High-Power Converters with Low Switching Frequencies	133
Jie Shen, GE Global Research, China Bo Qu, GE Global Research, China Jingkui Shi, GE Global Research, China Hongwu She, GE Global Research, China	
Small-Signal Stability of Three-Phase AC Distributed Power System: Theory and Implementation	134
Zeng Liu, CPES – Virginia Tech, USA	

Shipboard Microgrids: Maritime Islanded Power Systems Technologies 135

Josep M. Guerrero, Aalborg University, Denmark
Zheming Jin, Aalborg University, Denmark
Wenzhao Liu, Aalborg University, Denmark
Muzaidi B. Othman, Aalborg University, Denmark
Mehdi Savaghebi, Aalborg University, Denmark
Amjad Anvari-Moghaddam, Aalborg University, Denmark
Lexuan Meng, Aalborg University, Denmark
Juan C. Vasquez, Aalborg University, Denmark

Motor Drive and Motion Control

New 1200 V SPM® Smart Power Module Development for Low Power Industrial Applications 143



Taesung Kwon, Fairchild Semiconductor, South Korea
Min Park, Fairchild Semiconductor, South Korea
Kang-Yoon Lee, Fairchild Semiconductor, South Korea
Seung-Hyun Hong, Fairchild Semiconductor, South Korea
Sung-II Yong, Fairchild Semiconductor, South Korea

A System Approach to understanding the Impact of Non-ideal Effects in a Motor Drive Current Loop 150

Tao Li, Analog Devices, China
Jens Sorensen, Analog Devices, USA
Dara O'Sullivan, Analog Devices, Ireland

Thermal Evaluation of a 200 A NPC2 Module used in a 3-Level Inverter up to 60 kW 158

Sichao Ma, Infineon Technologies, China

The 2nd Generation Small Intelligent Power Module for General-purpose Inverter 164

Hidetomo Ohashi, Fuji Electric, Japan
Chen Song, Fuji Electric, China
Tadanori Yamada, Fuji Electric, Japan
Tohru Shirakawa, Fuji Electric, Japan
Hiroki Kogawa, Fuji Electric, Japan
Li Jun, Fuji Electric, China
Hiroyuki Ota, Fuji Electric, Japan

High Frequency Converter Technologies

Effect of Solvents on Sintering Behaviors of Silver Paste for Power-device Packaging 171

Zhang Hao, Osaka University, Japan
Jinting Jiu, Osaka University, Japan
Youji Suzuki, Daicel Corporation, Japan
Yasuyuki Akai, Daicel Corporation, Japan
Katsuaki Suganuma, Osaka University, Japan

A High-Speed Switching Discrete IGBT, High-Speed W Series	178
Kai Yang, Fuji Electric, China	
Yukihito Hara, Fuji Electric, Japan	
Yoshiharu Kato, Fuji Electric, Japan	
Tatsuya Naito, Fuji Electric, Japan	
Yoshihisa Suzuki, Fuji Electric, Japan	
Kazunori Matsumoto, Fuji Electric, Japan	
Taketo Watashima, Fuji Electric, Japan	

Wireless Power Transmission with High Efficiency and Wide Dynamic Range for Extensive Applications	185
Markus Rehm, IBR Ingenieurbüro Rehm, Germany	

Low-loss, Fast-acting Solid State AC/DC Breaker	192
John Waldron, Silicon Power, China	

Keynote

Automotive Power Electronics Development for New Energy Vehicles	198
Xingyi Xu, Dajuntech, China	

Poster Session

New Transfer-Molded SLIMDIP-S for Refrigerator	199
Kai Jiang, Mitsubishi Electric & Electronics (Shanghai), China	
Hongtao He, Mitsubishi Electric & Electronics (Shanghai), China	
Gaosheng Song, Mitsubishi Electric & Electronics (Shanghai), China	
Jian Chen, Mitsubishi Electric GEM Power Device (Hefei), China	

A New Generation of 600V Smart Power Module (SPM®) for Motor Drive Applications	205
Bumseung Jin, Fairchild Semiconductor, South Korea	
Samuell Shin, Fairchild Semiconductor, South Korea	
Sung-dae Shin, Fairchild Semiconductor, South Korea	
Geun-hyoung Lee, Fairchild Semiconductor, South Korea	
Hyunsoo Bae, Fairchild Semiconductor, South Korea	
Taesung Kwon, Fairchild Semiconductor, South Korea	

A New 600 V Smart Power Module with the High Power Density for Motor Drive Applications in Home Appliances	210
Samuell Shin, Fairchild Semiconductor, South Korea	
Bumseung Jin, Fairchild Semiconductor, South Korea	
Kinam Song, Fairchild Semiconductor, South Korea	
Hyunsoo Bae, Fairchild Semiconductor, South Korea	
Taesung Kwon, Fairchild Semiconductor, South Korea	

Analysis of Different IGBT Gate Driver Strategies Influencing Dynamic Paralleling Performance	218
Vishal Jadhav, Infineon Technologies, Germany	
Yizheng Zhou, Infineon Technologies, Germany	
Uwe Jansen, Infineon Technologies, Germany	

Investigation of Output Voltage Ripple of Synchronous Buck DC-DC Converters 227

Yi Huang, Intersil Corporation, USA
Lin Li, Intersil Corporation, China
Chun Cheung, Intersil Corporation, USA
Richard Zhu, Intersil Corporation, USA

A new Versatile Compact Power Module Family for EV and HEV Applications 235

Arata Iizuka, Mitsubishi Electric Corporation, Japan
Seiichiro Inokuchi, Mitsubishi Electric Corporation, Japan
Mikio Ishihara, Mitsubishi Electric Corporation, Japan
Shinsuke Godo, Mitsubishi Electric Corporation, Japan
Shinji Hatae, Mitsubishi Electric Corporation, Japan

The Design of a Novel Bidirectional High-efficiency DC-DC Converter 242

Wenping Chai, Shenyang University of Technology, China

Based on nRF905 Wireless Voltage Acquisition System in Low-voltage Power Network ...243

Ru Wei Ma, Xi'an University of Technology, China
Zhiyu Zhang, Xi'an University of Technology, China

Evaluation of a Lithium-ion Battery Model for Power Systems249

Hartmut Hinz, Frankfurt University of Applied Sciences, Germany

Advanced Power Semiconductors

Surge Current Capability of Power Electronics for Surge Protection 257



Franz Schork, Dehn + Söhne, Germany
Ralph Brocke, Dehn + Söhne, Germany
Michael Rock, Technical University Ilmenau, Germany

Thyristors with Full-Wave Blocking Capability for Industrial Applications 265

Jan Vobecky, ABB, Switzerland
Makan Chen, ABB, Switzerland
Karlheinz Stiegler, ABB, Switzerland
Marco Bellini, ABB, Switzerland
Roger Siegrist, ABB, Switzerland
Urban Meier, ABB, Switzerland
Florian Weber, ABB, Switzerland

A 1000 A 6.5 kV Power Module Enabled by Reverse-Conducting Trench-IGBT-Technology 269

Dorothea Werber, Infineon Technologies, Germany
Thomas Hunger, Infineon Technologies, Germany
Matthias Wissen, Infineon Technologies, Germany
Thomas Schütze, Infineon Technologies, Germany
Matthias Lassmann, Infineon Technologies, Germany
Burkhard Stemmer, Infineon Technologies, Germany
Volodymyr Komarnitsky, Infineon Technologies, Austria
Frank Pfirsch, Infineon Technologies, Germany

A 10 W Multi-mode Capable Wireless Power Amplifier for Mobile Devices 277
Michael de Rooij, Efficient Power Conversion Corporation, USA
Yuanzhe Zhang, Efficient Power Conversion Corporation, USA

New Transfer Mold Type SLIMDIP with RC-IGBT and High Precision Short Circuit Protection Function 285
Yazhe Wang, Mitsubishi Electric Corporation, Japan
Shogo Shibata, Mitsubishi Electric Corporation, Japan

Gate-Driver with Full Protection for SiC-MOSFET Modules 292
Karsten Fink, Power Integrations, Germany
Andreas Volke, Power Integrations, Germany
Winson Wei, Power Integrations, China
Eugen Wiesner, Mitsubishi Electric Europe, Germany
Eckhard Thal, Mitsubishi Electric Europe, Germany

Automotive Power Electronics

Heavy Duty Applications – A Challenge for Power Semiconductor Devices 299
Martin Schulz, Infineon Technologies, Germany

High Reliability 600 V High Voltage Integrated Circuit for Automotive Applications 304
Hitoshi Makishima, Mitsubishi Electric Corporation, Japan
Takanobu Takeuchi, Mitsubishi Electric Corporation, Japan
Masahiro Yamamoto, Mitsubishi Electric Corporation, Japan
Hashimoto Nobuo, Melco Semiconductor Engineering Corporation, Japan
Yamano Tomoya, Melco Semiconductor Engineering Corporation, Japan
Yamamoto Kyosuke, Melco Semiconductor Engineering Corporation, Japan

Automotive Power Module Technologies for High Speed Switching Performance 310
Takuma Kouge, Fuji Electric, Japan
Shinichiro Adachi, Fuji Electric, Japan
Souichi Yoshida, Fuji Electric, Japan
Hiroshi Miyata, Fuji Electric, Japan
Daisuke Inoue, Fuji Electric, Japan
Yoshikazu Takamiya, Fuji Electric, Japan
Fumio Nagaune, Fuji Electric, Japan
Kazuo Enomoto, Fuji Electric, Japan
Hideto Kobayashi, Fuji Electric, Japan
Jun Li, Fuji Electric, China
Akira Nishiura, Fuji Electric, Japan

Novel Automotive Hybrid-IGBT-Module without Solder Technology 317
Norbert Pluschke, Semikron, Hong Kong

Strong Linear Mode Performance for Automotive N-channel Power MOSFETs 325
Gianluca Aureliano, STMicroelectronics, China
Filippo Scrimizzi, STMicroelectronics, Italy
Giuseppe Longo, STMicroelectronics, Italy
Giusy Gambino, STMicroelectronics, Italy