

Table of Content PCIM Asia 2018

Intelligent Power Modules and Integrated Devices

01 RC-IGBT Based Transfer Molded SMD Type IPM for Home Appliance Application 14

Jian Chen, Mitsubishi Electric GEM Power Device (Hefei) Co., Ltd., China
Hongguang Huang, Mitsubishi Electric & Electronics (Shanghai) Co., Ltd, China,
Yazhe Wang, Power Device Works, Mitsubishi Electric Corporation, Japan
Hongbo Zhang, Power Device Works, Mitsubishi Electric Corporation, Japan
Ming Shang, Power Device Works, Mitsubishi Electric Corporation, Japan

02 A New Generation of Minimized 1200 V Intelligent Power Module for the Low and Medium Power Motor Drive Applications 18

JunHo Lee, ON Semiconductor, Republic of Korea
SeungJae Lee, ON Semiconductor, Republic of Korea
JinYong Jeong, ON Semiconductor, Republic of Korea
TaeSung Kwon, ON Semiconductor, Republic of Korea
KiHyun Lee, ON Semiconductor, Republic of Korea
HyunSoo Bae, ON Semiconductor, Republic of Korea

03 Low power loss level-shifter based gate driver ICs enable high frequency switching ... 22

Jinsheng Song, Infineon Technologies Americas Corp., USA

04 High Power next Core (HPnC) package with 3.3 kV SiC Hybrid chip combination 25

Yusuke Sekino, Fuji Electric Co., Ltd, Japan
Akira Iso Fuji Electric Co., Ltd., Japan
Yuichi Harada Fuji Electric Co., Ltd., Japan
Tomohiro Moriya Fuji Electric Co., Ltd., Japan
Susumu Iwamoto Fuji Electric Co., Ltd., Japan
Hideaki Kakiki Fuji Electric Co., Ltd., Japan
Osamu Ikawa Fuji Electric Co., Ltd., Japan

High Frequency Power Conversion

05 A Synchronous FET Class E Rectifier for >30 W Highly Resonant Wireless Power Receivers 33

Michael de Rooij, Efficient Power Conversion, USA
Yuanzhe Zhang, Efficient Power Conversion, USA

06 Kilowatt Laser Driver with 120 A, sub – 10 nanosecond pulses in <3 cm² using an GaN FET 39

John Glaser, Efficient Power Conversion Corp., USA



07 800 V synchronous buck converter with series-connected GaN power transistors 45

Alexander Hensler, Siemens AG, Germany
Steffen Franz, Siemens AG, Germany
David Shapiro, VisIC Technologies Ltd., Israel
Gregory Bunin, VisIC Technologies Ltd., Israel

08 CCM Totem Pole PFC with Single-Shunt Peak Current Sensing and Indirect Differential AC Voltage Sensing 52

Wei Wu, Infineon Technologies Corp., USA

Keynote

09 A Vision on Industrial Induction Heating Converter Technology: Trends and Challenges 55

Enrique J. Dede, University of Valencia, Spain

Poster Session

10 Low Inductance 3.3 kV / 1800 A High Power IGBT Module 56

Daohui Li, Dynex, UK
Fang Qi, Dynex Semiconductor Ltd, UK
Wei Zhou, CRRC Times Electric Co. Ltd, Zhuzhou, China
Guiqing Chang, CRRC Times Electric Co. Ltd, Zhuzhou, China
Yongdian Peng, CRRC Times Electric Co. Ltd, Zhuzhou, China
Yangang Wang, Dynex Semiconductor Ltd, UK
Haihui, Luo, CRRC Times Electric Co. Ltd, Zhuzhou, China
Xiaoping Dai, CRRC Times Electric Co. Ltd, Zhuzhou, China
Guoyou Liu, CRRC Times Electric Co. Ltd, Zhuzhou, China

11 Rugged Automotive IGBTs for Reliable Electronic Ignition..... 60

Gianluca, Aureliano, STMicroelectronics, Italy
Filippo, Scrimizzi, STMicroelectronics, Italy
Agatino, Palermo, STMicroelectronics, Italy
Giusy, Gambino, STMicroelectronics, Italy

12 Ruggedness Evaluation of Low Voltage Trench MOSFET against Repetitive Avalanche..... 64

Yan Lai, Nexperia, UK
Barry Wynne, Nexperia, UK

13 High Performance 2nd Generation Trench Schottky Diodes for Switch Mode Power Supplies..... 70

Aibin Hu, WeEn Semiconductors, China
Ed Huang, WeEn Semiconductors, UK

14 Innovative protection concept for single-ended parallel resonant induction heaters 74

Giuseppe De Falco, Infineon Technologies Austria AG, Austria
Jorge Cerezo, Infineon Technologies Austria AG, Austria

15 Calculating On-State Voltage Drop of Bipolar Semiconductors using the $\alpha\beta$-Model.....	79
Stefan Wettengel, TU Dresden, Germany	
Lars Lindenmüller, TU Dresden, Germany	
Tiago Kommers Jappe, TU Dresden, Germany	
Steffen Bernet, TU Dresden, Germany	
Michael Stelte, Infineon Technologies Bipolar, Germany	
Christof Drilling, Infineon Technologies Bipolar, Germany	
Matthias Leifeld, Infineon Technologies Bipolar, Germany	
Jürgen Schiele, Infineon Technologies Bipolar, Germany	
Mario Schenk, Infineon Technologies Bipolar, Germany	
16 Evaluation of Active Current Source Gate Driver for IGBT Module Switching Transitions	85
Kun Tan, University of Leicester	
Bing Ji, University of Leicester, UK	
Tao Xie, Dalian University of Technology, China	
Chen Li, Dalian University of Technology, China	
Zhiqiang Wang, Dalian University of Technology, China	
17 Extended life time of new IGBT module for traction applications	91
Volker Demuth, Semikron, Germany	
18 Status and Trend of SiC device Power module Packaging	95
Fang Qi, Dynex, UK	
Daohui Li, Dynex Semiconductor Ltd, UK	
Yangang Wang, Dynex Semiconductor Ltd, UK	
Helong Li, Dynex Semiconductor Ltd, UK	
Wei Zhou, CRRC Times Electric Co. Ltd, Zhuzhou, China	
Guiqing Chang, CRRC Times Electric Co. Ltd, Zhuzhou, China	
Xiaoping Dai, CRRC Times Electric Co. Ltd, Zhuzhou, China	
19 New package design to enhance the reliability performance of power module	99
Jian Sun, Mitsubishi Electric & Electronics, China	
Gaosheng Song, Mitsubishi Electric & Electronics, China	
Xiankui Ma, Mitsubishi Electric & Electronics, China	
20 Power Factor Corrected LED Direct AC Driver with Self-Adaptive Control	102
Ningliang Mi, On Semiconductor, USA	
21 High reliability and robust monolithic 1200 V three-phase gate driver with integrated bootstrap diode for multiple applications	109
Jinsheng Song, Infineon Technologies Americas Corp., USA	
Diego Raffo, Infineon Technologies Americas Corp., USA	
Weidong Chu, Infineon Technologies Americas Corp., USA	

SiC Technologies for Efficient and Reliable Application

22 3.3 kV / 500 A SiC Power Module for Railway Traction Application 114

Haotao, Ke, Zhuzhou CRRC Times Electric
Guqin, Chang, Zhuzhou CRRC Times Electric, China
Wei, Zhou, Zhuzhou CRRC Times Electric, China
Chengzhan, Li, Zhuzhou CRRC Times Electric, China
Yongdian, Peng, Zhuzhou CRRC Times Electric, China
Xiaoping, Dai, Zhuzhou CRRC Times Electric, China



pcim Asia
Young Engineer Award
WINNER

23 USiC SiC JFET Cascode and Super Cascode Technologies 117

Zhongda Li, United Silicon Carbide, USA
Anup Bhalla, United Silicon Carbide, USA



pcim Asia
Young Engineer Award
FINALIST

24 Parallel Connection of Silicon Carbide MOSFETs for Electric Vehicle Application 123

Wei Liu, ZF Japan, Japan
Xiaoguang Liang, ZF Japan, Japan
Thomas Chiron, ZF Japan, Japan

25 A Reliable Gate Driver with Desaturation and Over-Voltage Protection Circuits for SiC MOSFET 127

Shan Yin, China Academy of Engineering Physics, China
Yitao Liu, Shenzhen University, China

Special Session

26 Electric Vehicle 132

Chairperson: Prof. Zhihong Wu, Tongji University, China

Motor Drives and Motion Control

27 Power analysis of effects of MOSFET intrinsic characteristics on motor drive application 133

Alan Wai-Keung Lun, Infineon Technologies, China

28 Higher efficiency and power density of variable speed drives with new TRENCHSTOP™ IGBT 7 138

Song Shen, Infineon Technologies, China
B. Sahan, Infineon Technologies, Germany
C. Jaeger, Infineon Technologies, Germany
A. Puyadena, Infineon Technologies, Germany
A. Brodt, Infineon Technologies, Germany
A. Lenze, Infineon Technologies, Germany
C. R. Müller, Infineon Technologies, Germany

29 MiniSKiiP Dual Enables High Power Density Motor Drive up to 90 kW.....	144
Yufeng Li, SEMIKRON Electronics, China	
Wei Jing, SEMIKRON Electronics, China	
Norbert Pluschke, SEMIKRON Hong Kong, China	

30 Dual SOGI-Network Based Current Ripple and Position Error Fluctuation Elimination for PMSM Sensorless Drives	149
Guoqiang Zhang, Harbin Institute of Technology, China	
Gaolin Wang, Harbin Institute of Technology, China	
Dianguo Xu, Harbin Institute of Technology, China	

IGBT Application Performance

31 The third generation 6.5 kV HiPak2 module rated 1000 A and 150°C.....	154
Makan Chen, ABB, Switzerland	
C. Papadopoulos, ABB, Switzerland	
Evgeny Tsyplakov, ABB, Switzerland	

32 Influence of negative voltage between gate and emitter to the turn-off behavior of IGBT device	162
Fumio Yukawa, Fuji Electric Co. Ltd., Japan	
Taku Takaku, Fuji Electric Co., Ltd., Japan	
Naoto Fujisawa, Fuji Electric Co., Ltd., Japan	
Seiki Igarashi, Fuji Electric Co., Ltd., Japan	
Koji Yano, University of Yamanashi, Japan	

33 Expansion of power rating with 7th-Generation “X Series” RC-IGBT Modules for Industrial Applications	168
Akio Yamano, Fuji Electric, Japan	
H. Ichikawa, Fuji Electric, Japan	
M. Takahashi, Fuji Electric, Japan	
T. Ajiki, Fuji Electric, Japan	
Y. Onozawa, Fuji Electric, Japan	
S. Takahashi, Fuji Electric, Japan	
M. Isozaki, Fuji Electric, Japan	
S. Okita, Fuji Electric, Japan	
Y. Kobayashi, Fuji Electric, Japan	
O. Ikawa, Fuji Electric, Japan	

34 High I² t capability power modules for x EV power train with leadframe and RC-IGBT combination.....	176
Akihiro Osawa, Fuji Electric, Japan	
Keiichi Higuchi, Fuji Electric, Japan	
Hayato Nakano Fuji Electric, Japan	
Akio Kitamura, Fuji Electric, Japan	
Shunji Takenoiri, Fuji Electric, Japan	
Daisuke Inoue, Fuji Electric, Japan	
Souichi Yoshida, Fuji Electric, Japan	
Hiromichi Gohara, Fuji Electric, Japan	
Masahito Otsuki, Fuji Electric, Japan	

Keynote

- 35 Technology Trend of e-Mobility Charging..... 181**
Herman Zhang, Delta Electronics, China

Poster Session

- 36 Application of High-voltage 750 V Aluminum Electrolytic Capacitor in Inverter 182**
Kezhuang Yu, Shenzhen Zeasset Electronic Technology, China
Yixun Ma, Shenzhen Zeasset Electronic Technology, China
Jianwen Wang, Shenzhen Zeasset Electronic Technology, China
Xuejun Du, Shenzhen Zeasset Electronic Technology, China

- 37 Improved Analysis and Modelling of Leakage Inductance for Planar Transformers 185**
Ziwei Ouyang, Technical University of Denmark, Denmark
William Gerard Hurley, National University of Ireland, Ireland
Michael A. E. Andersen, Technical University of Denmark, Denmark

- 38 A Comprehensive Loss Analysis for Quasi Resonant Flyback Converter with Design Purpose..... 193**
Halil Alper Onay, Akim Metal San. Ve Tic. A.Ş., Turkey
Volkan Süel, Akim Metal A. Ş, Turkey
Ahmet Hava, Middle East Technical University, Turkey

- 39 Comparison of Modeling and Analyzing Methods for Magnetic Resonance Wireless Power Transmission (MR-WPT) System..... 201**
Jingjing Yang, Fuzhou University, China
Wei Chen, Fuzhou University, China

- 40 An Improved Magnetic Coupling Resonant Wireless Charging System for Cell Phones..... 209**
Binlei Ju, Hefei University of Technology, China
Hailong Pan, Hefei University of Technology, China
Niu Jia, Hefei University of Technology, China
Xiao Zhang, Hefei University of Technology, China
Xuedi Liu, Hefei University of Technology, China

- 41 Introduction of temperature protection for a small IPM for home appliances application..... 217**
Xiaoling Wang, Mitsubishi Electric & electronics, China
Hongtao He, Mitsubishi Electric & electronics, China

- 42 A Novel SVPWM Strategy for High-Frequency Noise Suppression of Dual Three-phase PMSM 222**
Guan Wang, Harbin Institute of Technology, China
Boyuan, Zheng, Harbin Institute of Technology, China
Yongxiang, Xu, Harbin Institute of Technology, China

43 Improved Smart Power Module for up to 9 kW Industrial Motor Applications	226
Sang-Min Park, ON Semiconductor, South Korea	
Ki-Nam Song, ON Semiconductor, South Korea	
Seung-Hyun Hong, ON Semiconductor, South Korea	
Adam Lee, ON Semiconductor, South Korea	
Tae-Sung Kwon, ON Semiconductor, South Korea	
44 Research on Software RDC Decoding Algorithm and Conditioning Circuit	231
Hengyu Li, Chinese Academy of Sciences, China	
Tao Fan, Chinese Academy of Sciences, China	
Xuhui Wen, Chinese Academy of Sciences, China	
45 High efficiency 1.5 kW 48 V – 12 V DCDC converter with Leadless MOSFET for Mild Hybrid Electric Vehicle	237
Rui Rong, Infineon Integrated Circuit, China	
RenBo WANG, Infineon Technologies, China	
46 Analysis of Negative Vce which can be generated in PFC IGBT under the Low Input Voltage Condition	243
JunHo Lee, ON Semiconductor, South Korea	
JinYong Jeong, ON Semiconductor, South Korea	
Masao Tsukizawa, ON Semiconductor, Japan	
SeungJae Lee, ON Semiconductor, South Korea	
HyunSoo Bae, ON Semiconductor, South Korea	
47 High Power Eelectronics: Cleaning Requirements for Improved Efficiency and Reliability.....	246
Thomas Kucharek, ZESTRON Europe, Germany	
Ravi Parthasarathy, ZESTRON Americas, USA	
Jigar Patel, ZESTRON Americas, USA	
Jerry Ji, ZESTRON, China	

Renewable Energy Technologies



48 Active Clamping with Nonlinear Gate Voltage Control Unit	253
Jianping Ying, Delta Electronics, China	
Ming Wang, Delta Electronics, China	
Xiaobo Huang, Delta Electronics, China	
Lifeng Qiao, Delta Electronics, China	
Xin Wang, Delta Electronics, China	
Jun Liu, Delta Electronics, China	

49 Power Optimization and Fault-Tolerant Control for Power Converter of Wind Energy Conversion System Using Permanent Magnet Synchronus Generator	260
Muhammad Noman, Southeast Univeristy, China	
Wang, Wei, Southeast University, China	
50 A Review on Low Voltage Ride-through for DFIG Based Wind Turbines.....	268
Zakiud Din, Southeast Univeristy, China	
Jianzhong, Zhang, Southeast University, China	
Zheng, Xu, Southeast University, China	

51 Tandem Diode Solution with Split NPC Topology for 1500 V Renewable Energy 275
Nosung Park, Vincotech, South Korea

52 Analysis of voltage stress of NPC 2 power module in PV string inverter 276
Zhenbo Zhao, Infineon Technologies, China
Xujian Li, Shanghai Maritime University, China
Sichao Ma, Infineon Technologies, China

Power Electronics in Electric Vehicle Application

53 High performance high power modules for MV converter application 277
Xiankui Ma, Hefei University of Technology – Mitsubishi Electric Joint Laboratory, China
Jianfei Li, Sineng Electric, China
Xing Zhang, Hefei University of Technology – Mitsubishi Electric Joint Laboratory, China

54 Compact regenerative elevator drive with one unique power module 282
Ye ChangSheng, Semikron Electronics, China

55 1,700 V IGBT module with newly developed 7th Generation technology 288
T. Yamamoto, Fuji Electric, Japan
D. Nagai, Fuji Electric, Japan
S. Yoshiwatari, Fuji Electric, Japan
S. Miyashita, Fuji Electric, Japan
Y. Sakurai, Fuji Electric, Japan
Y. Onozawa, Fuji Electric, Japan
T. Ito, Fuji Electric, Japan
S. Okita, Fuji Electric, Japan
J. Li, Fuji Electric, China
S. Chen, Fuji Electric, China
Y. Kobayashi, Fuji Electric, Japan
O. Ikawa, Fuji Electric, Japan

56 Best fit between baseplate geometry and ceramic thickness to achieves excellent thermal performance 294
Song Shen, Infineon Technologies, China
Jia Zhao, Infineon Integrated Circuit (Beijing), China
Ziqing Zheng, Infineon Technologies, China

57 Investigation of power cycling capability of a novel Cu wires bonded interconnection system 298
Nan Jiang, Chemnitz University of Technology, Germany
Anton-Zoran Miric, Heraeus, Germany
Andreas Steffen Klein, Heraeus,, Germany
Martin Becker, Danfoss Silicon Power GmbH, Germany
Andreas Hinrich, Heraeus, Germany
Benjamin Fabia, Heraeus, Germany
Marko Kalajica, Heraeus, Germany
Josef Lutz, Chemnitz University of Technology, Germany

Special Session:

58 Intelligence of Electrical Motion System 304

Organized by Prof Guoqin Xu, Shanghai University, China

Cyber-physical System (CPS) of Electrical Motion Control System

Guoqing Xu, Shanghai University, China

Operational reliability technique for power electronic converter systems

Dawei Xiang, Tongji University, China

The overview of electrical drive system for electrical vehicle oriented to safety and energy saving

Wei Cheng, SAIC Motor, China

Intelligence of Industrial Drive System

Yuesheng Hu, Danfoss, China

Power Converters



59 Fully Optimized Discrete Coupled Inductor DC / DC converter as the TriMagiC ConverterTM 305

Mitsunao Fujimoto, Alps Electric, Japan

Yutaka Naito, ALPS Electric, Japan

60 An Improved Topology Derivation Method for Battery-Integrated DC / DC Converters in Distributed Photovoltaic System 311

Tiancan Pang, Madhav Manjrekar, University of North Carolina at Charlotte, USA



61 A Novel Carrier-Overlapped PWM Based Voltage Balancing Method for Four-Level Neutral-Point Clamped Converters..... 318

Kui Wang, Tsinghua University, China

Zedong Zheng, Tsinghua University, China

Lie Xu, Tsinghua University, China,

Yongdong Li, Tsinghua University, China

62 Novel approach for power electronics in efficient DC fast charging systems..... 319

Bernhard Kalkmann, SEMIKRON Elektronik, Germany

Timo Gassauer, SEMIKRON Elektronik, Germany