

## WiPDA 2021 – Technical Program at a Glance

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# The 8th IEEE Workshop on Wide Bandgap Power Devices & Applications

Day 1, November 7, 2021 (Tutorials)

	Session 1A		Session 1B	
	Speaker	Topic	Speaker	Topic
<b>8:00 AM</b>	<b>Peter Friedrichs</b> , Infineon Technologies, United States	SiC Technology	<b>Vamsi Putcha</b> , IMEC - Belgium	RF GaN
<b>9:30 AM</b>	<b>Fang Luo</b> , University of Arkansas, United States	Packaging/Modules	<b>Sandeep Bahl, Jungwoo Joh</b> , Texas Instruments, United States	GaN Technology
<b>11:00 AM</b>	<b>Break</b>			
<b>1:00 PM</b>	<b>Victor Veliadis</b> , North Carolina State University, United States	MV SiC - Devices	<b>Srabanti Chowdhury</b> , Stanford University, United States	Vertical GaN
<b>2:30 PM</b>	<b>Subhashish Bhattacharya</b> , North Carolina State University, United States	MV SiC - Circuits	<b>Burak Ozpineci</b> , ORNL, United States	WBG for Automotive

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# The 8th IEEE Workshop on Wide Bandgap Power Devices & Applications

Day 2, November 8, 2021

	<b>Plenary</b>			
<b>8:00 AM</b>	<b>Opening</b>		<b>Sameh Khalil</b> , Infineon Technologies, United States	Welcome Message
<b>8:15 AM</b>	<b>Opening</b>		<b>Matteo Meneghini</b> , University of Padova, Italy	Technical Program of WiPDA 2021
<b>8:30 AM</b>	<b>Keynote 1</b>		<b>Dan Kinzer</b> , Navitas Semiconductor, United States	Advances in GaN Power ICs: Efficiency, Reliability & Autonomy
<b>9:00 AM</b>	<b>Keynote 2</b>		<b>John W. Palmour</b> , Wolfspeed, United States	SiC MOSFETs and the Drive for Electric Vehicles
<b>9:30 AM</b>	Break		<b>Room 1</b>	<b>Room 2</b>
<b>9:50 AM</b>		<b>Session 2A</b> <b>SiC Devices 1: Device Reliability &amp; Robustness</b>	<b>S2A_1</b> - Comparison of Gate Oxide Lifetime Predictions with Charge-to-Breakdown Approach and Constant-Voltage TDDB on SiC Power MOSFET, <b>Shengnan Zhu</b> , Ohio State University, United States	<b>S2B_1</b> - 650V/780A GaN Power HEMT Enabling 10kW-Class High-Efficiency Power Conversion, <b>Carl Neufeld</b> , Transphorm Inc, United States
<b>10:10 AM</b>			<b>S2A_2</b> - Impacts of Area-Dependent Defects on the Yield and Gate Oxide Reliability of SiC Power MOSFETs <b>Tianshi Liu</b> , Ohio State University, United States	<b>S2B_2</b> - Evaluation of 650V, 100A Direct-Drive GaN Power Switch for Electric Vehicle Powertrain Applications, <b>Qihao Song</b> , CPES, Virginia Polytechnic Institute and State University, United States
<b>10:30 AM</b>			<b>S2A_3</b> - A Static, Switching, Short-Circuit Characteristics of 1.2 kV 4H-SiC MOSFETs: Comparison Between Linear and (Bridged) Hexagonal Topology, <b>Dongyoung Kim</b> , State University of New York Polytechnic Institute, United States	<b>S2B_3</b> - Quick Estimation of Chip Scale Package GaN Fets Thermal Performance Using a Simple Circuit Model, <b>Assaad El Helou</b> , Efficient Power Conversion, United States
<b>10:50 AM</b>			<b>S2A_4</b> - Excellent Static and Dynamic Scaling of Power Handling Capability of the BaSiC(DMM) Topology with 1.2 kV SiC Power MOSFETs, <b>Ajit Kanale</b> , North Carolina State University, United States	<b>S2B_4</b> - On-Wafer Investigation of Avalanche Robustness in 1.3kV GaN-on-GaN P-N Diode Under Unclamped Inductive Switching Stress, <b>Bhawani Shankar</b> , Stanford University, United States
<b>11:10 AM</b>			<b>S2A_5</b> - Investigation on the Accuracy of the VSD-Method for Different SiC MOSFET Designs Considering Different Measurement Parameters, <b>Felix Hoffmann</b> , Universität Bremen, Germany	<b>S2B_5</b> - Extreme GaN – What Happens When eGaN® Fets Are Exposed to Voltage and Current Levels Well Above Data Sheet Limits, <b>Alex Lidow</b> , Efficient Power Conversion, United States
<b>11:30 AM</b>	Break			
<b>11:45 AM</b>	<b>Panel</b>		<b>Moderators:</b> Brij N. Singh, Deere & Company, United States; Babak Parkhideh, UNC Charlotte, United States	Wide Bandgap (WBG) devices and their application to automotive, industrial, aerospace, defense, and energy systems
<b>12:45 PM</b>	End of the session			

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## The 8th IEEE Workshop on Wide Bandgap Power Devices & Applications

Day 2, November 8, 2021 (details on Panel Session)

**Title of Panel:** Wide Bandgap (WBG) devices and their application to automotive, industrial, aerospace, defense, and energy systems

**Moderator:** Dr. Brij N. Singh (Deere & Company) and Dr. Babak Parkhideh (UNC Charlotte)

This panel has drawn experts from a variety of industries including automotive, defense, aerospace, industrial, and energy sectors. The panelists share and discuss their views on current and emerging applications of SiC and GaN power devices. An hour-long panel will have brief opening comments from the panelists followed by interactive and thought-provoking discussions on questions asked by WiPDA attendees. Panel discussions will uniquely cover similarity and differences between SiC and GaN power devices and their applications in automotive, industrial, aerospace, defense, and energy systems.

### Panelists:

- Dr. Jing Xu, Senior Principal Scientist at ABB
- Dr. Shengyi Liu, Technical Fellow and Chief Architect of Platform Subsystems at Boeing
- Thomas Byrd, Senior Fellow, Power electronics and Power Systems at Lockheed Martin
- Dr. Sriram Chandrasekaran, Engineering Fellow at Raytheon
- Dr. Sanjeev Naik, Advanced Systems Dev, Electric Drives, Electronics, & Applications Engineering at GM
- Cory Combs, Ampaire Co-founder and TED Fellow
- Michael Harrison, Power Electronics Architect, Enphase Energy, USA

# The 8th IEEE Workshop on Wide Bandgap Power Devices & Applications

Day 3, November 9, 2021

<b>Tuesday</b>	<b>Plenary</b>				
<b>8:00 AM</b>	<b>Keynote 3</b>		<b>Dr. Gerald Deboy</b> , Infineon Technologies, United States		On the benefits of SiC and GaN in high power applications
<b>8:30 AM</b>	<b>Keynote 4</b>		<b>Alex Lidow</b> , Efficient Power Conversion, United States		Gallium Nitride Integration and the End of Discretes
<b>9:00 AM</b>	Break		<b>Room 1</b>		<b>Room2</b>
<b>9:20 AM</b>		Session 3A ITRW	<b>S3A_1</b> - Switching Behavior and Dynamic on-Resistance of Lateral $\beta$ -Ga2O3 MOSFETs Up to 400 V, <b>Carsten Kuring</b> , Technische Universität Berlin, Germany	Session 3B GaN RF	<b>S3B_1</b> - Low Contact Resistance CMOS-Compatible RF GaN-on-Silicon HEMTs, <b>Hao Lu</b> , Xidian University, China
<b>9:40 AM</b>			<b>S3A_2</b> - Reverse Recovery and Rectification Characteristic of $\beta$ -Ga2O3 Schottky Barrier Diode, <b>Inhwan Lee</b> , University at Buffalo, United States		<b>S3B_2</b> - Microstructural Degradation Investigations of OFF-State Stressed 0.15 $\mu$ m RF AlGaIn/GaN HEMTs: Failure Mode Related Breakdown, <b>Prabha Sana</b> , Fraunhofer Institute for Microstructure of Materials and Systems, Germany
<b>10:00 AM</b>			<b>S3A_3</b> - Study of Voltage Balancing Techniques for Series-Connected Wide-Bandgap Semiconductor Devices, <b>Alinaghi Marzoughi</b> , Enphase Energy, United States		<b>S3B_3</b> - Best Practices to Quantify Linearity Performance of GaN HEMTs for Power Amplifier Applications, <b>Rafael Perez Martinez</b> , Stanford University, United States
<b>10:20 AM</b>			<b>S3A_4</b> - Diamond Integration on GaN for Channel Temperature Reduction, <b>Mohamadali Malakoutian</b> , Stanford University, United States		<b>S3B_4</b> - Detrapping Kinetics in N-Polar AlGaIn/GaN MIS-HEMTs, <b>Francesca Chiocchetta</b> , University of Padova, Italy
<b>10:40 AM</b>	Break				
<b>11:00 AM</b>		Session 3C SiC Devices 2: Novel Device Designs	<b>S3C_1</b> - Demonstration of High Voltage (15kV) Split-Gate 4H-SiC MOSFETs, <b>Justin Lynch</b> , State University of New York Polytechnic Institute, United States	Session 3D GaN Applications 1	<b>S3D_1</b> - Compact GaN Power Modules with Direct Bonded Liquid-Cooled Heat Exchanger Suitable for EV Applications, <b>Wei Jia Zhang</b> , University of Toronto, Canada
<b>11:20 AM</b>			<b>S3C_2</b> - Increased 3rd Quadrant Current Handling Capability of 1.2kV 4H-SiC JBS Diode-Integrated MOSFETs (JBSFETs) with Minimal Impact on the Forward Conduction and Blocking Performances, <b>Stephen Mancini</b> , State University of New York Polytechnic Institute, United States		<b>S3D_2</b> - Online Junction Temperature Monitoring of Wide Bandgap Power Transistors Using Quasi Turn-on Delay As TSEP, <b>Kanuj Sharma</b> , ILH, Universität Stuttgart, Germany
<b>11:40 AM</b>			<b>S3C_3</b> - Analytical Method to Optimize Dynamic Performance of the Cascaded SuperCascode Power Switch, <b>Utkarsh Mehrotra</b> , North Carolina State University, United States		<b>S2D_3</b> - Switching Performance in a GaN Power Stage at Extreme Temperature Conditions, <b>Martijn Duraij</b> , Technical University of Denmark, Denmark
<b>12:00 PM</b>			<b>S3C_4</b> - Comparison of the Capacitances and Switching Losses of 1.2 kV Common-Source and Common-Drain Bidirectional Switch Topologies, <b>Ajit Kanale</b> , North Carolina State University, United States		<b>S2D_4</b> - A Generalized Circuit for Measuring GaN Dynamic Resistance, <b>Michael Willhoff</b> , Aerspace Corporation, United States
<b>12:20 PM</b>			<b>S3C_5</b> - Development of Isolated CMOS and HV MOSFET on an N-epi / P-epi / 4H-SiC N+ Substrate for Power IC Applications, <b>Sundar Babu Isukapati</b> , State University of New York Polytechnic Institute, United States		<b>S3D_5</b> - Design and Performance Analysis of High Density Universal Charger Featuring GaN Based Integrated Power Stage, <b>Robert Vartanian</b> , Infineon Technologies, United States
<b>12:40 PM</b>	End of the session				

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# The 8th IEEE Workshop on Wide Bandgap Power Devices & Applications

Day 4, November 10, 2021

	<b>Plenary</b>				
<b>8:00 AM</b>	<b>Keynote 5</b>		<b>Prof. Wai Tung Ng</b> , University of Toronto, Canada		Smart Gate Driver ICs for GaN Power Transistors
<b>8:30 AM</b>	<b>Keynote 6</b>		<b>Keisuke Shinohara</b> , Teledyne Scientific & Imaging, United States		High-Frequency GaN-Based Transistor Technologies: Progress and Future
<b>9:00 AM</b>	Break		<b>Room 1</b>		<b>Room2</b>
<b>9:20 AM</b>		<b>Session 4A</b>  <b>GaN Applications 2</b>	<b>S4A_1</b> - GaN Devices for Motor Drives Applications, <b>Marco Palma</b> , Efficient Power Conversion, United States	<b>Session 4B</b>  <b>SiC Applications 1: Circuits and systems</b>	<b>S4B_1</b> - Design and Fabrication of SiC MOSFET Based Stepper Motor Driver for High-Temperature Environments, <b>Ashwin Chandwani</b> , Arizona State University, United States
<b>9:40 AM</b>			<b>S4A_2</b> - Paralleling GaN Devices in a 13.56MHz Class $\Phi 2$ Inverter for high-Power Applications, <b>Keerti Palanisamy</b> , University of Minnesota, United States		<b>S4B_2</b> - Highly Integrated 200 Kw SiC Three-Phase Dual-Active-Bridge Converter with 3D-Printed Fluid Coolers, <b>David Bündgen</b> , RWTH Aachen University, Germany
<b>10:00 AM</b>			<b>S4A_3</b> - A Capacitor-Based Multilevel Gate Driver for GaN HEMT Only with a Single Voltage Supply, <b>Takehiro Takahashi</b> , Kyoto Institute of Technology, Japan		<b>S4B_3</b> - SiC-Based dv/dt Generator for Insulation Testing with Fast and Adjustable Switching Transients, <b>Vivien Grau</b> , RWTH Aachen University, Germany
<b>10:20 AM</b>			<b>S4A_4</b> - Optimization of Self-Oscillating Power Converter Based on GaN-HEMTs for Wireless Power Transfer, <b>Dominik Koch</b> , ILH, Universität Stuttgart, Germany		<b>S4B_4</b> - High Frequency Injection Sensorless Control for a Permanent Magnet Synchronous Machine Driven by an FPGA Controlled SiC Inverter, <b>Jared Walden</b> , University of Tennessee - Knoxville, United States
<b>10:40 AM</b>			<b>S4A_5</b> - An Isolated Bidirectional DC-DC Converter with High Voltage-Conversion Ratio and Reduced Output Current Ripple, <b>Zhining Zhang</b> , Ohio State University, United States		<b>S4B_5</b> - Development of a 1 kV, 500 a T-Type Modular Dc Circuit Breaker (T-Breaker), <b>Yue Zhang</b> , Ohio State University, United States
<b>11:00 AM</b>	Break				
<b>11:20 AM</b>		Virtual posters 1, November 10, 2021, 11.20 am			
<b>1:00 PM</b>	End of the session				

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# The 8th IEEE Workshop on Wide Bandgap Power Devices & Applications

Day 5, November 11, 2021

	<b>Plenary</b>				
<b>8:00 AM</b>	<b>Keynote 7</b>		<b>Jim w. Witham</b> , GaN Systems, United States		One Size Doesn't Fit All - The Need for Multiple Approaches to GaN Circuit Design
<b>8:30 AM</b>	<b>Keynote 8</b>		<b>Primit Parikh</b> , Transphorm Inc, United States		Reliable and High Performance HV GaN in Production - from Adapters to Automotive
<b>9:00 AM</b>	Break		<b>Room 1</b>		<b>Room2</b>
<b>9:20 AM</b>		<b>Session 5A</b> <b>GaN Power 2: Technology</b>	<b>SSA_1</b> - Analysis of ALD Dielectric Leakage in Bulk GaN MOS Devices, <b>Caleb Glaser</b> , Sandia National Laboratories, United States	<b>Session 5B</b> <b>SiC Applications 2: Device Characterization</b>	<b>SSB_1</b> - Switching Behavior of a Hybrid Si-IGBT and SiC MOSFET Based ANPC Topology, <b>Srikanth Lakshmeesha</b> , Huawei Nuremberg Research Center, Germany
<b>9:40 AM</b>			<b>SSA_2</b> - Dynamic and Capacitive Characterization of 3D GaN n-p-n Vertical Fin-FETs, <b>Thomas Bordignon</b> , University of Padova, Italy		<b>SSB_2</b> - Balancing Unequal Temperature Distributions of Parallel-Connected SiC MOSFETs Using an Intelligent Gate Driver, <b>Christoph Lüdecke</b> , ISEA, RWTH Aachen University, Germany
<b>10:00 AM</b>			<b>SSA_3</b> - Deep-Level Characterization of GaN-on-GaN Current Aperture Vertical Electron Transistors, <b>Matthias Sinnwell</b> , Fraunhofer Institute for Applied Solid State Physics, Germany		<b>SSB_3</b> - An Integrated Active Gate Driver for SiC MOSFETs, <b>Dongwoo Han</b> , Center for Advanced Power Systems, Florida State University, United States
<b>10:20 AM</b>			<b>SSA_4</b> - High Mobility in GaN MOSFETs with AlSiO Gate Dielectric and AlN Mobility Enhancement Layer, <b>Matthew Smith</b> , Toshiba Corporation, Japan		<b>SSB_4</b> - Liquid Metal Based Cooling for Power Electronics Systems with Inductor Integrated Magnetohydrodynamics Pump (MHD Pump), <b>Junchong Fan</b> , Ohio State University, United States
<b>10:40 AM</b>			<b>SSA_5</b> - Etched and Regrown Vertical GaN Junction Barrier Schottky Diodes, <b>Andrew Binder</b> , Sandia National Laboratories, United States		<b>SSB_5</b> - Characterization of Electrical Parameters for Health Monitoring in SiC MOSFETs During AC Power Cycling, <b>Kevin Muñoz Barón</b> , ILH, Universität Stuttgart, Germany
<b>11:00 AM</b>	Break				
<b>11:20 AM</b>		Error! Reference source not found.			
<b>1:00 PM</b>	End of the session				

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# The 8th IEEE Workshop on Wide Bandgap Power Devices & Applications

Virtual posters 1, November 10, 2021, 11.20 am

<b>PO1_1</b>	Modulation Strategy Comprising TCM with Frequency Limit and DPWM for Fast Switching GaN-Inverters <b>Benedikt Kohlhepp</b> , Friedrich-Alexander University, Germany
<b>PO1_2</b>	An Asynchronous Buck Converter by Using a Monolithic GaN IC Integrated by an Enhancement-Mode GaN-on-SOI Process <b>Shumpei Noike</b> , Kyoto Institute of Technology, Japan
<b>PO1_3</b>	Modeling, Simulation and Hardware Implementation of the GaN Based Resonance Current Source for the Ultra-Fast MVDC Circuit Breaker, <b>Md Rakib-Ur Rahman</b> , Marquette University, United States
<b>PO1_4</b>	Three-Phase three-Level GaN-ANPC Inverter with a 1 MHz Switching Frequency, <b>Heikki Järvisalo</b> , LUT University, Finland
<b>PO1_5</b>	Effect of Trap-Filling Bias on the Extraction of the Time Constant of Drain Current Transients in AlGaIn/GaN HEMTs, <b>Nicolò Zagni</b> , Università degli Studi di Modena e Reggio Emilia, Italy
<b>PO1_6</b>	Evaluation of the High Performance 650 V Cascode GaN FET Under Low Temperature, <b>Yuqi Wei</b> , University of Arkansas, United States
<b>PO1_7</b>	Humidity Capability of Enhancement Mode GaN High Electron Mobility Transistors, <b>Alexander Brunko</b> , Universität Bremen, Germany
<b>PO1_8</b>	Dynamic ON-Resistance Characterization of GaN HEMT Under Soft-Switching Condition, Tianyu Zhao, Rolando Burgos, <b>Jing Xu</b> , ABB Corporate Research Center, United States
<b>PO1_9</b>	Integration of $\beta$ -Ga <sub>2</sub> O <sub>3</sub> on Si (100) for Lateral Schottky Barrier Diodes, <b>Manoj K Yadav</b> , Indian Institute of Technology Mandi, India
<b>PO1_10</b>	Commercially Available N-Polar GaN HEMT Epitaxy for RF Applications, <b>Davide Bisi</b> , Transphorm Inc, United States
<b>PO1_11</b>	TCAD Simulations Study on Drain Leakage Current and its Correlation with Gate Current for AlGaIn/GaN HEMTs, <b>Cristina Miccoli</b> , ST Microelectronics, Italy
<b>PO1_12</b>	Design of Ka-Band Doherty Power Amplifier Using 0.15 $\mu$ m GaN on SiC Process Based on Novel Complex Load Modulation, <b>Xinyu Zhou</b> , Stanford University, United States



# The 8th IEEE Workshop on Wide Bandgap Power Devices & Applications

Virtual posters 2, November 11, 2021, 11.20 am

PO2_1	Impact of Soft- and Hard-Switching Transitions on VTH and RON Drifts in Packaged SiC MOSFETs, <b>Marcello Cioni</b> , Università degli Studi di Modena e Reggio Emilia, Italy
PO2_2	Real-Time FPGA Simulation of Silicon Carbide MOSFETs, <b>Gard Lyng Rødal</b> , Norwegian University of Science and Technology, Norway
PO2_3	Critical Design Considerations for Static and Dynamic Performances on 6.5kV 4H-SiC MOSFETs Fabricated in a 6-Inch SiC Foundry, <b>Nick Yun</b> , State University of New York Polytechnic Institute, United States
PO2_4	Performance Evaluation of 3.3 kV SiC MOSFET and Schottky Diode for Medium Voltage Current Source Inverter Application, <b>Sneha Narasimhan</b> , North Carolina State University, United States
PO2_5	Smart Universal Parameter Fitting Method for Static SiC Power MOSFET Behavior Modeling, <b>Daniel Philipps</b> , Norwegian University of Science and Technology, Norway
PO2_6	Online Junction-Temperature Extraction Method for SiC MOSFETs Utilizing Turn-on Delay, <b>Sven Kalker</b> , RWTH Aachen University, Germany
PO2_7	Comparison of Short Circuit Failure Modes in SiC Planar MOSFETs, Trench MOSFETs and Cascode JFETs, <b>Erfan Bashar</b> , University of Warwick, United Kingdom
PO2_8	Development and Thermal Characterization of a Low Resistance SiC Module, <b>Xiaoqing Song</b> , ABB Corporate Research Center, United States
PO2_9	Thermal and Thermomechanical Analysis of a 10 kV SiC MOSFET Package with Double-Sided Cooling, <b>Mark Cairnie</b> , CPES, Virginia Polytechnic Institute and State University, United States
PO2_10	Demonstration of Cell-to-Cell Integrated 4H-SiC Lateral Bi-Directional Junction Field Effect Transistor (LBiDJFET), <b>Seung Yup Jang</b> , State University of New York Polytechnic Institute, United States
PO2_11	Experimental Validations of the SiC MOSFET Based LLC Converter Circuit and Power Loss Models, <b>Yuqi Wei</b> , University of Arkansas, United States
PO2_12	A Balanced Current-Source Inverter and its dc-Link Shunted Variant for Common-Mode Voltage Cancellation, <b>Hang Dai</b> , University of Wisconsin-Madison, United States
PO2_13	Design and Development of SiC MOSFET Based DC-DC Converter for High-Temperature Space Application, <b>Saikat Dey</b> , Arizona State University, United States
PO2_14	Hardware Design of Medium Voltage SiC-Based Modular Multilevel Converters for Grid-Tied Applications, <b>Ke Wang</b> , Ohio State University, United States
PO2_15	Submodule Design for a 2 kV 1 MW Integrated Modular Motor Drive for Aviation Applications, <b>Yizhou Cong</b> , Ohio State University, United States