



The Multinational Power Electronics Association

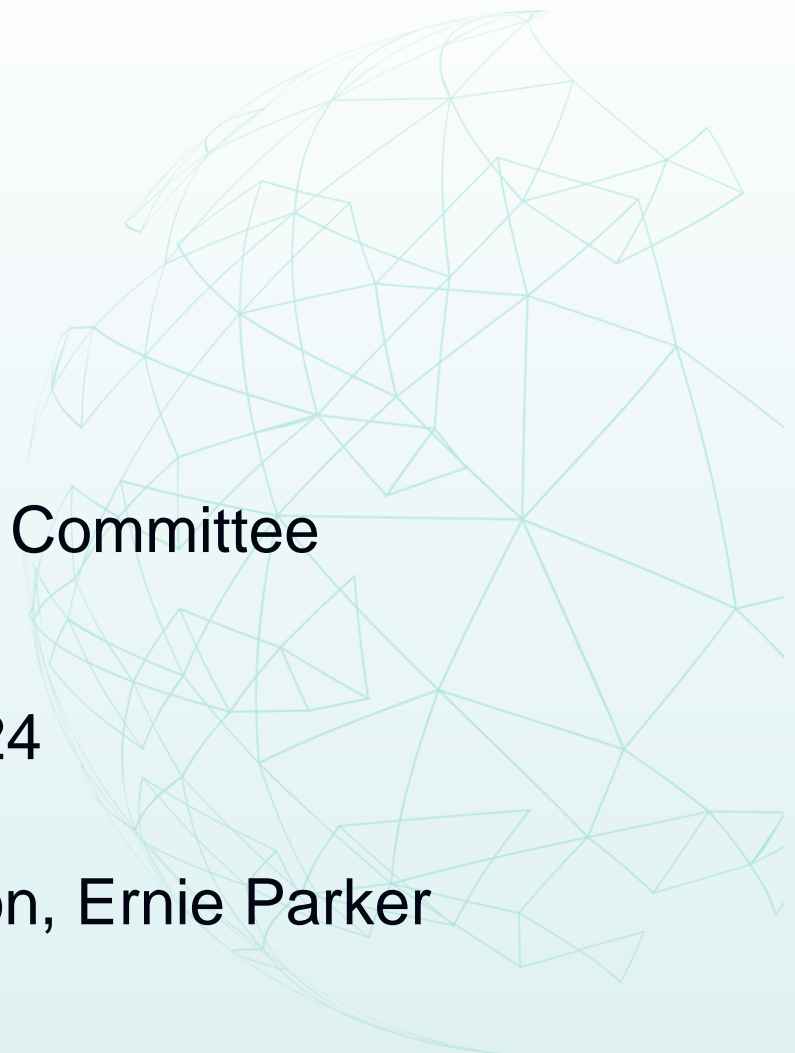
PSMA

Packaging/Manufacturing Committee

January 16, 2024

John Bultitude, Brian Narveson, Ernie Parker

Co-chairman



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1985-2020



Meeting Agenda

- APEC 2024 Industry Session
- APEC 2025
 - Focus Topic Brainstorm for Packaging and Manufacturing
- Organization of 3D-PEIM 2025
 - 3D-PEIM Organizing Committee – Update
 - 3D-PEIM Technical Committee Update
- Power Technology Report on Embedded and Integrated Magnetics- Update
- Update
 - IWIPP 2024

APEC 2024 Industry Session - Wednesday February 28

IS10 Advances in 3D-Packaging Technology for Power Electronics

Focus:

The PSMA Packaging Committee is organizing and proposing an Industry Session for APEC 2024 that is focused on advances in 3D-Packaging Technology for power electronics, such as embedding, with a range of different applications of AI higher power systems. The latest developments in onshoring of packaging will also be presented. This session will bring together leading academic and industrial researchers in this area.

- **APEC 2024 was well attended**
- **Presentation attendees in range 30-80**

Higher power densities, packaging needs for a broader range of power systems. Application demands for higher density,

Start	Finish	ID	Presentation Title	Presenter	Title/Affiliation
8:30 AM	8:55 AM	IS 10.1	Common Mode Noise and Minimizing Emissions through Packaging Technology	Douglas C. Hopkins	Professor in Electrical and Computer Engineering, Director of the Laboratory for Packaging Research in Electronic Energy Systems (PREES), NC State, USA
8:55 AM	9:20 AM	IS 10.2	Packaging for IoT Device Energy Harvesting Solutions – Roadmap and Considerations	Mike Hayes / Brian Zahnstecher	Head of Group ICT for Energy Efficiency, Tyndall National Institute, County Cork, Ireland / Founder & Principal, PowerRox, Niantic, CT, USA
9:20 AM	9:45 AM	IS 10.3	Efficiency improvements for power conversion units by means of PCB embedding technology for fast switching devices like SiC and GaN	Thomas Gottwald	Vice President Technology Schweizer Electronic AG, Germany
9:45 AM	10:10 AM	IS 10.4	Innovation and Collaboration in Power Module Packaging and HVM in the fast-changing world	Thomas Wang	Director of ASE Corporate R&D, ASE, Taiwan
10:10 AM	10:40AM	BREAK			
10:40 AM	11:05 AM	IS 10.5	On-Shoring Power Packaging	Charles Woychik	Enhanced Semiconductor, Inc. formerly Sr. Director Advanced Packaging Platforms at Skywater Technology Foundry, Kissimmee, Florida, USA
11:05 AM	11:30 AM	IS 10.6	Chiplets and Integration in Power Distribution Networks	Siddarth Ravichandran	Chipletz, Austin, TX, USA
11:30 AM	11:55 AM	IS 10.7	AI-Driven Reliability of Solar Power Inverters	Patrick McCluskey	Professor and Director of Undergraduate Studies Dept. of Mechanical Engineering University of Maryland, College Park, MD USA

APEC 2025 Focus Topic Brainstorm

- **Comparison of Packages**
- **Efficiency at High Frequency**
- **Cost Effectiveness**
- **Electromagnetic Simulations**
- **Multiphysics Modeling, Design & Packaging**
- **Advanced Design for Assembly**
- **Digital Twin Tools**
- **Electronic Design Automation**
- **Design Validation Techniques**
- **Physical Changes, Temperature 3D –Failure Mechanisms and how to avoid them**
- **Lower Cost materials & Manufacturing processes**
- **Higher temperatures 175 to 200°C**
- **Process Time and Cost Down**
- **Thermal compounds**

APEC 2025 Focus Topic Brainstorm

- **Double sided cooling**
- **HALT testing – Auto Reliability**
- **Cost Effective Modeling**
- **System Architecture – higher end phase redundancy**
- **Multi-chip processors – multi voltages**
- **Power converters onto processors**
 - **Control each chip**
 - **Lower system cost**
 - **Improved Reliability**
 - **Magnetics buck regulation**
- **Integration high current high frequency GPUs**
- **Power Supply on chip**
- **Larger Scale Vehicle electrification**
- **Address problems at many levels chips/module/system – how does this differ?**

APEC 2025 Focus Topic Brainstorm

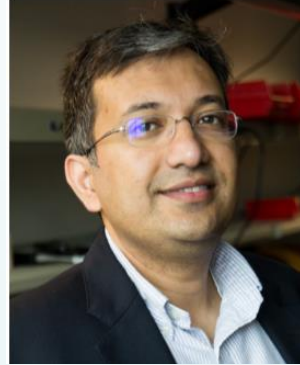
- **Panel level packaging of GaN**
 - **Large Area & volume assembly**
 - **Optical System Inspection**
 - **Organic Vs. Glass substrates**
- **AI models**
 - **Train the model**
 - **Reduce time-to-market**
- **Immersion Cooling**
 - **Realize higher power and currents**
 - **AI datacenters**
- **Convergence trends in Power Packaging – Academia—Industry**
- **Power passives as part of tools/database – integrated power problem the packaging community needs to own this**
- **Review ECTC agenda for presenters – TSMC, Samsung, Intel, Vicor....**

APEC 2025 Focus Topic Brainstorm

- **Integration on chip – innovations pushing the technology forward**
- **How to verify manufacturing process after each stage**
- **Implement AI for inspection**
- **Integrated Components**
 - **Figures of Merit (FOM)**
 - **Component Level or System Level**
 - **What is the true FOM for the system**
 - **What is being optimized**
- **Validated database of Multiphysics Models**

3D-PEIM 2025 - NREL & Dr. Faisal Khan General Chair

Golden Campus >



Dr. Faisal Khan

- Faisal Khan serves as the chief researcher in the field of power electronics and electric machines, power semiconductor device packaging, transportation electronics, reliability and degradation analysis of power converters and batteries. He has introduced several new techniques to determine the useful remaining life of converters and batteries and designed high-efficiency modular power conversion and resonator-based power conversion systems for biomedical and low electromagnetic interface applications.

Research Interests

- Scalable multilevel-modular >10 kV silicon carbide MOSFET architecture
- Estimating remaining life and availability of power semiconductor devices using sympathetic string theory, dynamic safe operating area, and ultrasound resonators
- Designing power converters for emerging applications
- Resonator design for power converters for biomedical applications
- Multilevel modular switched-capacitor converters

3D-PEIM 2025 Technical Co-chairs Chairs

Sreekant Narumanchi, Ph.D.,

ASME Fellow

Group Manager, Advanced Power Electronics and
Electric Machines Group

Center for Integrated Mobility Sciences

National Renewable Energy Laboratory, MS 1633

Email: sreekant.narumanchi@nrel.gov

Jason Rouse Ph.D.,

Manager Strategic Growth & Ventures

Taiyo America Inc.

Email: jhrouse@taiyo-america.com

- **Currently we are Recruiting for the Technical Committee to help Organize the Program**

Power Technology Report on Embedded and Integrated Magnetics

- Background
 - Why is the report needed?
 - The purpose of the Technology report is to provide and up to date reference for member companies on the present state of integrated and embedded magnetics. The report will loosely follow the format of the previous 3 Technology Reports published by the PSMA Packaging and manufacturing committee. Chapter 4 of the 2018 report focused on embedded magnetics. There is a lot that has happened in that area since 2018. The other area that has exploded is integrated magnetics. The report would focus on those two topics in greater depth than the previous one. The intend is the report would look at what's available today, What is in the pipeline for the next 2-3 years. What the main roadblocks are and a potential roadmap for the future.
 - Industry trends? Yes, as part of what is mentioned above
 - Correlation to IEEE Heterogeneous Integration Roadmap (HIR)? It can be used as a resource to help guide the research for the report.
- What is required from the PSMA Magnetics Committee?
 - Two members to serve on the oversight committee.
 - To help develop the RFP including the statement of work.
 - Review vendor proposals and pick a vendor.
 - Attend monthly progress reviews with the vendor.
 - Review sections as they are completed.
- Is there a baseline proposal document that we can reference?
 - No, the RFP will be written by Brian Narveson with input from the oversight committee.

Power Technology Report on Embedded and Integrated Magnetics – Meeting Actions

- Brian will present a rough draft at PSMA APEC 2024 review
- Actions noted from this meeting:
 - Mike expressed Tyndall interest and asked for his colleagues to be included in the sub-committee: cian.omathuna@tyndall.ie & Ranjit.Sai@tyndall.ie
 - Doug to email details of NanoOpts company for inclusion
 - Raj will be added to sub-committee and will ask some companies about participation

IWIPP 2025 Planning

- IWIPP International Workshop on Integrated Power Packaging is a biennial IEEE event dedicated to advancing the state of the art in power semiconductor packaging, which is widely recognized as one of the critical factors influencing the performance and reliability of today's power electronics
- **IWIPP April 8-10, 2025**
- In-person Conference
- University of Alabama, **Tuscaloosa, Alabama**
- Connect with world's top power, device, integrations and system researchers
- Contact Brian if you would like to be on the technical program committee or give a presentation



IWIPP is Sponsored By:



Thank You

Next Committee Meeting (in person) APEC 2024:

Tuesday February 27, 12noon-2pm

Hyatt Long Beach Beacon B

Following Meeting (on-line)

Tuesday March 19, 9am Central Time



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