



The Multinational Power Electronics Association

PSMA Magnetics Committee Meeting

April 17TH 2024

Ed Herbert, George Slama, Matt Wilkowski
Committee Chairs

PSMA is a not-for-profit organization and a CO-SPONSOR OF APEC



PSMA Magnetics Committee Meeting Agenda

April 17, 2024

- Introductions
- 2025 Workshop Planning
- 2025 Industry Session Planning
- Power Technology Roadmap
- Special Projects
 - Electrical parameters of magnetic materials
 - Core Loss Database
- Magnetics Forum on PSMA Website
- Next Meeting



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PSMA Magnetics Committee Meeting Agenda Workshop Planning Notes

April 17, 2024

- Integrated Magnetics

- Physical Integration Types

- Heterogeneous Integration
 - 2.5D Vs 3D
 - Lateral Vs Vertical
- Embedded magnetics
 - PCB windings about a magnetic core

- Power System in Package

- Silicon + Discrete Magnetics in semiconductor packaging

- Wafer level (on silicon) magnetics

- Sputtered
- Electroplated

- Issues

- Thermal Limitations
- Assembly methods

- Wurth – Martin Sittner
- Tyndall
- Frenetic
- Bryce – Utah State
- Jose Cobos –
- Roshen, Waseem
- Rico, TriDelta

Afternoon
Session

Agreement of
highlighted topics

- Lukas – LLC design
- Open magnetics – simulation, design
- Cuk – LLC, circuit concept
- Virginia Tech –
- Understanding core Ae/Le
- Dan Jitaru
- Premo Power – 3D magnetics

- Integrated Magnetics

- Electrical Characteristic Integration

- LLC
- Coupled Inductors
- TLVR
- VERT

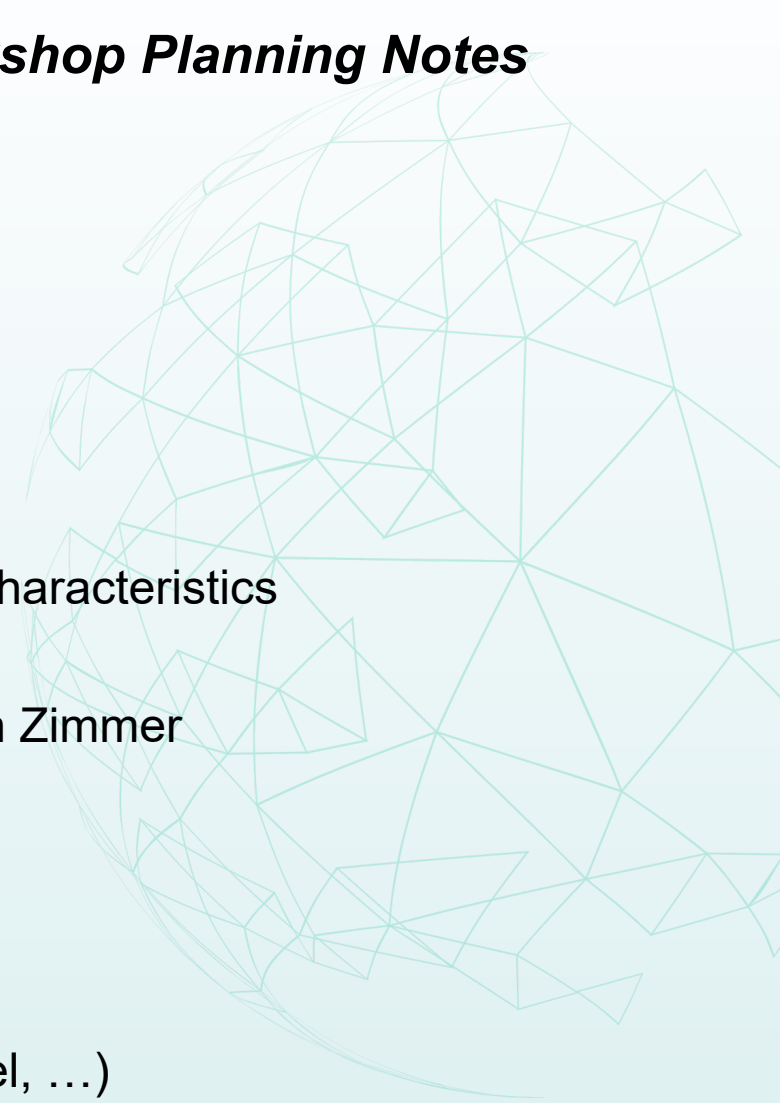
Morning
Session

Integration
has different meaning
for different audiences
Need definition for
workshop audience

PSMA Magnetics Committee Meeting Agenda Workshop Planning Notes

April 17, 2024

- Tech Demos
 - Core Loss Database project
 - Demonstration of the website database
 - Visualization of core loss data
 - Our other project – core permittivity and permeability characteristics
 - Zimmer wattmeter
 - JC Sun – integrated instrument to measure losses with Zimmer
 - Fair-Rite – dimensional resonance
 - PE System – dual pulse test
 - Open magnetics demo
 - MicroMetals – complex perm powder materials
 - Partial Discharge system (Chroma, Hipotronics, Hubbel, ...)
 - Capacitor with magnetics (Alan) LLC – capacitor voltage rating



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PSMA Magnetics Committee Meeting Agenda - Industry Session Planning Notes

April 17, 2024

- All aspects of fabricating a Solid-State Transformer (SST)

- Conductor design
- Insulation/Isolation Issues
 - *Paul Ohodnicki – UPITT – P3105 Subgroup 2 Isolation Issues for SST*
- AC Power Loss
- Magnetic Core materials
- Thermal Design
- Environmental Design
- Capacitance
- Coupling and Leakage Inductance
 - *Drazen Dujic – EPFL – Inductance and Leakage Inductance Measurements for MFT*
- Other? SMART transformer?

What is definition of SST?
Per Kolar (1kHz to 20 kHz)

Jonathon Kimball – Missouri

North Carolina State

Coolmag – thermal potting (demo too)

Charlie Sullivan – heat pipes

- **Focus on the transformer of Solid-State Transformer**

- Too many APEC and ECCE session on SST focus on topology rather than the transformer

PSMA Magnetics Committee Meeting Agenda Workshop Planning Notes

April 17, 2024

- Additional four-presentation industry session
 - Core Loss Testing & Modelling
 - Scientific Network of Magnetics – Jens Friebe – Kassel
 - European Metrology Labs Correlation Project – Massimo Pasquale - HEFMAG
 - Impact of machine learning to predict core loss – Minjie Chen - Princeton
 - PSMA – Core Loss Database website – George Slama – Würth Elektronik
 - ETTC P393 Core Loss measurement proposal – Matt Wilkowski – Würth Elektronik

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2022/2023/2024 PSMA PTR Webinar Series

Potential Contributions from the Magnetics Committee

- Tyndall – Ranajit Sai
 - Core Loss Mechanisms
 - Presentation delivered November 30 ✓
- Utah State University – Reebal Nimri
 - High Power (1 MW) Charging
 - 2024 Q2/Q3
 - Confirmed 8/16/23
- Fraunhofer – Florian Ziegler
 - PowderMEMS – a novel technology for fabrication of functionalized MEMS structures
 - Spring 2024
 - Confirmed 1/16/24 – e-mail of introduction sent March 5, 2024
 - *Follow up sent on April 12, 2024*
- CBMM - Bharadwaj Reddy Andapally
 - Technology Roadmap for Nanocrystalline Cores
 - Spring 2024
 - Confirmed: 9/1/23 – reconfirmed during the 2024 workshop
 - *Need to send follow up*



Potential Source of Additional Presentations
Intermag Japan
Presentations
Measurement Techniques
New Materials

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PSMA Magnetics Committee Meeting Agenda – Special project

April 17, 2024

- Special Projects
 - In Process
 - Core Loss Database
 - Electrical parameters of magnetic materials
 - Pending
 - Steinmetz Like Approximation
 - Electrical parameters of magnetic materials
 - Propagation in magnetic materials
 - Current driven core loss testing
 - Spice model



PSMA Magnetics Committee Meeting Agenda – Special Projects

April 17, 2024

- Electrical parameters of magnetic materials
 - Proposal approved during PSMA BOD meeting on November 17
 - Preliminary results shared with PSMA Magnetics Committee during December 18 meeting
 - Draft report distributed by e-mail to attendees of January 24 PSMA Magnetics committee meeting
 - Final report approved for placement on a tab on the Magnetics Forum during meeting on Feb 28

Discussion Decisions

- Draft dated January 22, 2024 is ready to be placed in the Special projects Tab on Magnetics Forum
 - Confirmed by Ed Herbert and Jonas Muhlethaler
 - This report should be behind a members only firewall
 - Reference Ed Herbert e-mail of February 25, 2024
- Maintain Core Loss Studies as a Separate Tab
- Create a new Special Projects tab for all this and all future special projects
- In the future Core Loss Data Base may be a separate tab from Core Loss Studies

*Special Projects Tab
Has Been Created*

*Need to Populate with Report
“Characterization of Core
Material” by Frederic Mathieu
dated January 22, 2024*

PSMA Magnetics Committee Meeting Agenda – Special Projects

April 17, 2024

psma.com/index.php/technical-forums/magnetics/special-projects



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Magnetics Forum



Magnetics Info & Resources
for the Power Electronics Industry.

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Special Projects

Special Projects

Information on Magnetics Committee Special Projects can be found here.

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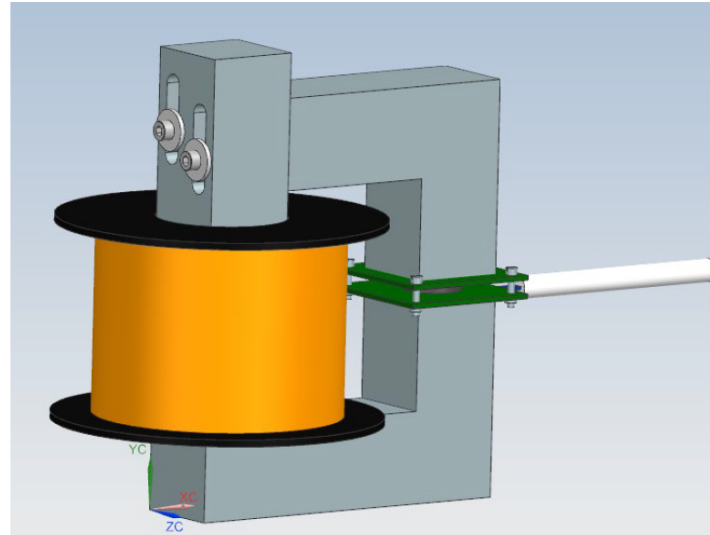


PSMA Magnetics Committee Meeting Agenda – Special Projects

April 17, 2024

Lucerne University of Applied Sciences and Arts

Lucerne School of Engineering and Architecture



Characterization of Core Material

Author: Frédéric Mathieu

Supervisor: Prof. Dr. Jonas Mühlethaler

Expert: Dr. Severin Nowak

Industrial partner: Power Sources Manufactures Association (PSMA)

January 22, 2024

Confidentiality level: Public

JC Sun will provide existing standards that can be used to test material as well for comparison

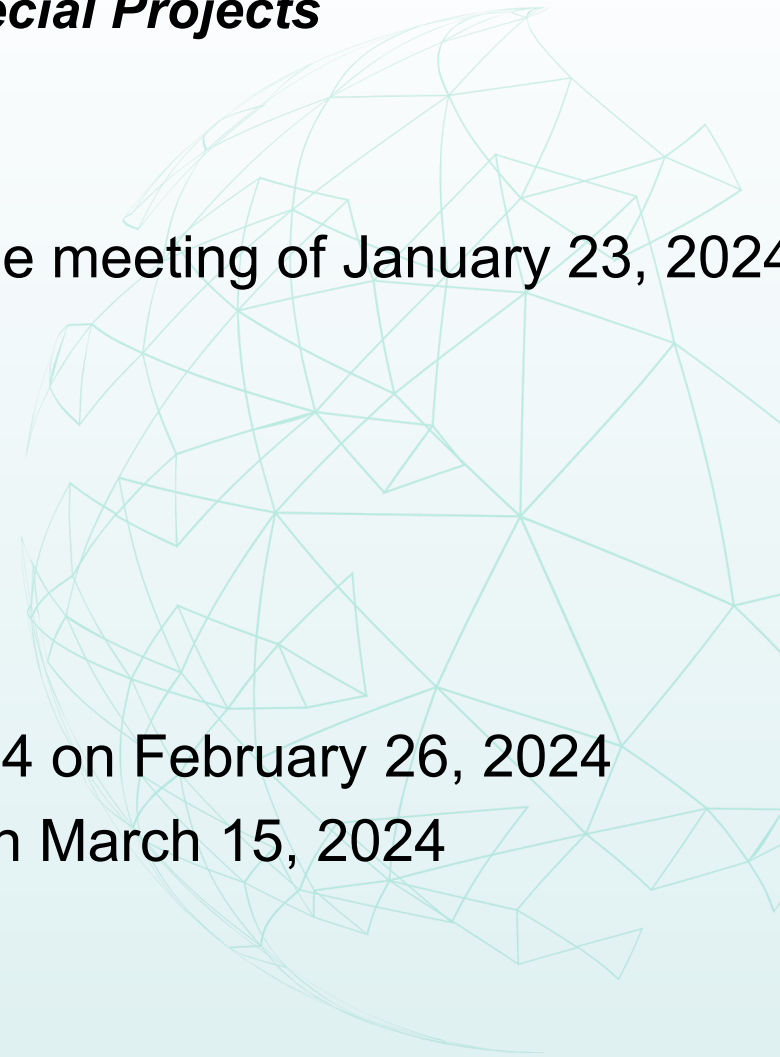
Lukas Mueller will contact a university that is about to publish a paper on the same topic to try get an early copy

IEC 62631 – measure permittivity (to 10 MHz)

PSMA Magnetics Committee Meeting Agenda – Special Projects

April 17, 2024

- Core Loss Database
 - E-mail ballot after PSMA Magnetics Committee meeting of January 23, 2024
 - Ballots sent:13
 - Ballots Returned:11
 - Return Rate: 85%
 - Approve Ballots: 11
 - Disapprove Ballots: 0
 - Approval Rate: 100%
 - Special project proposal to BOD at APEC 2024 on February 26, 2024
 - BOD approved project during BOD meeting on March 15, 2024
 - Ongoing support for three additional years



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PSMA Magnetics Committee –Magnetics Committee Forum on PSMA Website April 17, 2024

- Ongoing discussion to create a Short Videos Tab on Magnetics Forum to address specific topics of general interest
 - This could be the home of a “Magnetics Are Everywhere” introductory video
 - These can be simple redirects to URLs already established by PSMA members
 - Helps traffic to magnetics forum
 - Increases audience access for PSMA member companies
- **Action item for members to review HF task force page for whether to keep, it update it, add to it – could be used to organize information**

<https://www.pdma.com/technical-forums/magnetics/hf-task-force>

PSMA Magnetics Committee –Magnetics Committee Forum on PSMA Website

April 17, 2024

psma.com/index.php/technical-forums/magnetics/hf-task-force

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Magnetics Forum

Magnetics Info & Resources
for the Power Electronics Industry.

Introduction HF Task Force Magnetics Checklist Resources Presentations Core Loss Studies Meeting Minutes Special Projects Workshop

HF Task Force

PSMA Magnetics Committee High Frequency Task Force

January 11, 2015

At the PSMA Planning meeting in September 2013, the PSMA Magnetics Committee was strongly encouraged to do a workshop on high frequency magnetics. Below is the working document in which various topics of interest have been identified and grouped. This document will be revised as new topics are suggested and input is received.

For the various topics, we solicit inputs from experts in the related field. White papers, application notes, slide presentation, audio and video files all are welcome. As inputs are received, they will be summarized in the working document, and links will be added to original files.

We have created a LinkedIn group, "PSMA Magnetics Committee High Frequency Task Force." We will open threads on various topics to provide a forum for questions and open discussion.

We encourage engineers to identify problems with magnetics that have hindered their high frequency designs. The more interesting problems may become discussion threads, looking for solutions.

Steve Carlsen
Ed Herbert
Co-Chairmen
PSMA Magnetics Committee


High frequency magnetics

Revision: January 11, 2015

- ▶ 1. Core materials
- ▶ 2. Core geometry and scaling
- ▶ 3. Transformers
- ▶ 4. Inductors
- ▶ 5. Lossy suppressors
- ▶ 6. Magnetic circuits with saturating cores
- ▶ 7. Combination magnetic structures
- ▶ 8. "Solid state" transformers
- ▶ 9. Windings
- ▶ 10. Parasitic impedance
- ▶ 11. Core loss
- ▶ 12. Fabrication technology
- ▶ 13. Near field noise performance
- ▶ 14. Software, design and simulation
- ▶ 15. Test equipment, quality assurance and production testing
- ▶ 16. Reliability
- ▶ Appendix

PSMA Member Promotion

PSMA members who contribute to the workshop can have their name in a Promotional Box next to their contribution.



The members can include their logos and links to their web sites or promotional material.

[PSMA Membership Information](#)

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- **Next Meeting – Avoid third Wednesday of the month**



PSMA Magnetics Committee Meeting

April 17, 2024

- Attendance (12)
 - John Horzepa
 - Joe Horzepa
 - Mike Arasim
 - Alan Cooper
 - Ed Herbert
 - Alfonso Martinez
 - Lukas Mueller
 - Ranajit Sai
 - George Slama
 - JC Sun
 - Matt Wilkowski
 - Rodney Rogers



PSMA Magnetics Committee
April 17, 2024

Thank You

