



The Multinational Power Electronics Association

PSMA Magnetics Committee Meeting

October 16TH 2023

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

October 16, 2023

- Introductions
- 2024 Workshop Planning
- 2024 Industry Session Planning
- Power Technology Roadmap
- Special Projects - Ad Hoc Meeting on Wednesday October 18
 - Core Loss Database
 - Need to rank and identify champion
 - Electrical parameters of magnetic materials
 - Steinmetz Like Approximation
 - Propagation in magnetic materials
 - Current driven core loss testing
 - Spice model
- Planning for next twelve – eighteen months



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PSMA Magnetics Committee Meeting Agenda – Workshop Planning

September 11, 2023

- Workshop Themes
 - Overall: Design of Optimal Magnetics Across Applications and Environments
 - Morning Session: Design and Optimization of Magnetics for Different Applications
 - Afternoon Session: Thermal design and other special issues such as insulation, partial discharge, etc.,
 - Tech Demos
- Industry Session Theme
 - Circuit and Construction Simulation and Modelling of Magnetic Components
- Propose not to cover core loss modelling for the 2024 workshop due to
 - Survey results requesting core loss modelling was based on a survey on Saturday March 18 however there were two PSMA Magnetics Committee related activities at APEC 2023 after the survey
 - George Slama Professional Education Seminar on Sunday March 19 – Core Loss Data for Everyone
 - Magnetics Committee Industry Session on Tuesday March 21 – Core Loss Measurements For Different Materials and Excitations
 - MagNet Activities will may results in some presentation and sessions on core loss modelling at APEC 2024
 - May have some tech demos related to MagNet

PSMA Magnetics Committee Meeting Agenda – Workshop Planning

October 16, 2023

- When does registration open?
- Workshop on PSMA Website
- Workshop on APEC website
- Workshop on How2Power
- Presentations from 2023 Workshop page of Magnetics Technical Forum
- Workshop on PELS Website
- Tentative Agenda - Update



PSMA Magnetisms Committee Meeting Agenda – Workshop Planning

October 16, 2023

- From Workshop URL: <https://www.pdma.com/technical-forums/magnetism/workshop>



PSMA News Publications Resources Conferences Technical Forums Membership About PSMA
The multinational power electronics association

PSMA / Technical Forums / Magnetism / Workshop / Magnetism Forum

Magnetism Forum

Magnetism Info & Resources for the Power Electronics Industry.

Introduction HF Task Force Magnetism Checklist Resources Presentations Core Loss Studies Meeting Minutes Workshop

Workshop

**Power Magnetism @ High Frequency Workshop**
PSMA Magnetism Committee - 24 February 2024, Long Beach, CA USA

Registration for the 2024 Power Magnetism @ High Frequency Workshop on Saturday February 24, 2024 at the Long Beach Convention Center in Long Beach, CA will open soon. Click here to be notified by email when registration opens.

REGISTRATION

Partnership Opportunities available. Sign up to be a Workshop Partner Please contact the organizing committee through via e-mail to power@psma.com for more information. Click here for the pricing and benefits:

2024 Workshop Partners:

Platinum Partners

Media Partner

CBMM
Niobium N₂

Frenetic

HOW2POWER

RUBADUEWIRE
Wire Experts Group

WE
WURTH ELEKTRONIK
MORE THAN YOU EXPECT

Power Magnetism @ High Frequency
Saturday February 24 2024
Prior to APEC 2024
Long Beach Convention Center
Long Beach, CA 90802

Opens to a mail to link
When does registration open?
Does registration open just after APEC Planning meeting or
After APEC registration opens?

Target registration trial for week of October 16 – 20
Target open registrations for week of October 23 – 27
Matt to send tabular agenda to John/Lisa

PSMA Magnetics Committee Meeting Agenda – Workshop Planning

October 13, 2023

- From Workshop URL: <https://www.psmag.com/technical-forums/magnetics/workshop>

Power Magnetics @ High Frequency

Saturday February 24 2024

Prior to APEC 2024

Long Beach Convention Center

Long Beach, CA 90802

The PSMA Magnetics Committee together with IEEE PELS are currently planning to conduct the ninth "Power Magnetics @ High Frequency" Workshop on Saturday, February 24, 2024, which is the day before and at the same venue as APEC 2024 in Long Beach, CA. The 2024 workshop returns to the site of the inaugural workshop held in 2016 in Long Beach California, and plans to build on the success of the 2023 workshop held before APEC 2023 in Orlando Florida earlier this year.

The purpose and focus of this workshop are to identify the latest improvements in magnetic materials, coil (winding) design, construction and fabrication, evaluation and characterization techniques and modelling and simulation tools. This is to target the advancements that are deemed necessary by the participants for power magnetics to meet the technical expectations and requirements of new market applications for higher operating frequencies and emerging topologies that are being driven by continuous advances in circuits topologies and semi-conductor devices.

The target audiences for the **2024 Power Magnetics @ High Frequency** workshop include the designers of power magnetic components for use in electronic power converters responsible to implement the most technologically advanced power magnetic components that are necessary to achieve higher power densities, specific physical aspect ratios such as low profile, higher power efficiencies and improved thermal performance. The target audiences also include people involved in the supply chain for the power magnetics industry ranging from manufacturers of magnetic materials and magnetic structures, fabricators of magnetic components, providers of modelling and simulation software as well as manufacturers of test and characterization equipment.

The theme of the **2024 Power Magnetics @ High Frequency** workshop will be the design of optimal magnetics across applications and environments. A number of recognized experts have already confirmed their presentations for the workshop. The full agenda will be added to this webpage in the coming weeks.

The workshop will open with a keynote presentation by Johan Kolar and Jannik Schafer of ETH Zentrum covering the opportunities for new magnetics designs to address a broad range of market driven technology trends across automotive and data center applications. The morning session will consist of lecture presentations by Jonas Muehlethaler of Frenetic addressing design and optimization of magnetics for different applications, Qiang Li of CPES addressing magnetics for VRM applications, Lukas Mueller of Micrometals addressing optimizing inductors based on choice of magnetic materials and David Zawacki of Cornell Dubilier addressing tradeoffs between capacitors and inductors.

During the provided breakfast, lunch and the networking hour at the end of the workshop there will be an interactive session of tabletop technology demonstrations and posters each addressing specific technical disciplines and capabilities consistent with the workshop agenda. Workshop attendees typically spend ten to fifteen minutes at each technology demonstration station viewing informal interactive presentations. Interaction between the attendees and the presenters is highly encouraged during this portion of agenda as a segue between the morning and afternoon technical presentation sessions.

Technology demonstrations are confirmed by JC Sun of Bs&T, Mike Arasim of Fair Rite, Arturo Mediano of HF Magic Labs, Lukas Mueller of Micrometals, Juris Vencels of Trafolo, Bharadwaj Reddy Andapally of CBMM and Tom Wilson of Simplis Additional technology demonstrations are pending. If anyone is interested to present a technology demonstration, they are encouraged to contact the workshop organizing committee via e-mail to power@psmag.com.

The afternoon session will begin with a keynote presentation by Charles Sullivan of Dartmouth addressing special design issues ranging from thermal design, dielectric design, and insulation design. The keynote presentation will be followed by lecture presentations by Roman Jamy of Yageo addressing multi-dimensional optimization relative to electrical, thermal, and commercial objectives, Zhicheng Guo of Arizona State University addressing partial discharge characterization for high frequency transformers and Subhashish Bhattacharya of North Carolina University addressing thermal design issues for solid state transformers.

If your company is interested in financially supporting the workshop as a partner, please contact the organizing committee through PSMA via e-mail to power@psmag.com. Visit https://www.psmag.com/2024_workshop_partnership to learn more about the benefits of being a workshop partner.

Registration for the workshop is limited and will open soon. Please check back for updates on registration.

More information including the agenda for the **2024 Power Magnetics @ High Frequency Workshop** as well as registration for the workshop will become available on this page over the coming months.

PSMA Magnetics Committee Meeting Agenda – Workshop Planning

October 16, 2023

- From APEC URL: <https://apec-conf.org/>

apec-conf.org

APEC

Attendees • Speakers • Exhibitors/Partners • News • Travel Information • About • Contact • Search

APEC 2024

IEEE Applied Power Electronics Conference and Exposition
Long Beach, CA
February 25-29, 2024

[About APEC](#)

Join Us At The Beach!

APEC 2023 was a smashing success with record attendance! Start making your plans now to join us at APEC 2024 in Long Beach, California.

We Are Hard At Work Preparing The APEC 2024 Program

APEC 2024 would like to thank everyone who submitted a digest for the Technical Sessions, a proposal for an Industry Session, or a proposal for Professional Education Seminar. APEC 2024 is no longer accepting submissions and the review process is underway. The program chairs and program committee members are hard at work reviewing the submissions and organizing the APEC 2024 program.

Stay tuned for announcements. Registration for APEC 2024 will open in the middle of October so start making your travel plans now.

PSMA Workshop: Power Magnetics At High Frequency

While not an official part of APEC, the PSMA magnetics workshop, held the Saturday before APEC starts, is a well established tradition. The PSMA has announce the 2024 workshop, "Power Magnetics At High Frequency". The theme of the 2024 Power Magnetics At High Frequency will be the design of optimal magnetics across applications and environments.

[Learn More About The PSMA Magnetics Workshop](#)

Latest News

Partnership Opportunities For APEC 2024 Exhibitors Now Available
Monday, Aug 14, 2023
[Read More](#)

[See All](#)

Need to fix this link

PSMA Magnetics Committee Meeting Agenda – Workshop Planning

October 16, 2023

- From APEC URL: <https://apec-conf.org/conference/special-events/psma-magnetics/>

 apec-conf.org/conference/special-events/psma-magnetics/



While not part of the official APEC Program the PSMA Magnetics Workshop, held the Saturday before APEC begins, has become an established tradition. The 2024 workshop, titled 'Power Magnetics At High Frequency', will be held on Saturday, February 24, 2024, at the Long Beach Convention Center.

The purpose and focus of this workshop are to identify the latest improvements in magnetic materials, coil (winding) design, construction and fabrication, evaluation and characterization techniques and modelling and simulation tools. This is to target the advancements that are deemed necessary by the participants for power magnetics to meet the technical expectations and requirements of new market applications for higher operating frequencies and emerging topologies that are being driven by continuous advances in circuits topologies and semi-conductor devices.

The target audiences for the 2024 Power Magnetics At High Frequency workshop include the designers of power magnetic components for use in electronic power converters responsible to implement the most technologically advanced power magnetic components that are necessary to achieve higher power densities, specific physical aspect ratios such as low profile, higher power efficiencies and improved thermal performance. The target audiences also include people involved in the supply chain for the power magnetics industry ranging from manufacturers of magnetic materials and magnetic structures, fabricators of magnetic components, providers of modelling and simulation software as well as manufacturers of test and characterization equipment.

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Registration for this workshop is separate from the registration for the APEC conference.

Registration for the workshop is limited and will open soon. Please visit the workshop's page (<https://www.psma.com/technical-forums/magnetics/workshop>) for updates on registration.

PSMA Magnetics Committee Meeting Agenda – Workshop Planning

October 16, 2023

- From Tentative Agenda Workbook

Time	Event	Presenter	Affiliation	
7:00 AM - 8:00 AM	Breakfast Plus Technology Demonstrations			
8:00 AM - 8:05AM	Opening Remarks	Ed Herbert	PSMA	
8:05 AM - 8:45 AM	Keynote Speaker Power Magnetics Design - Design and Optimization of Magnetics for Different Applications - Intro Opportunities for new magnetics designs to address a broad range of market driven technology trends across automotive and data center applications	George Slama Johan Kolar	Wurth Elektronik ETH	Confirmed
8:45 AM - 9:20 AM	Technical Session - Design and Optimization of Magnetics for Different Applications <i>Overview of Different Optimization Effort</i>	Jonas Muhlethaler	Frenetic	Confirmed
9:20 AM - 9:40 AM	Q&A		Kolar, Muhlethaler	
9:40 AM - 10:00 AM	Break			
	Technical Session - Design and Optimization of Magnetics for Different Applications - Part 2			
10:00 AM - 10:35 AM	<i>Magnetics for VRM Applications</i>	Qiang Li	Virginia Tech - CPES	Accepted
10:35 AM - 11:10 AM	<i>Inductor Optimization Based on Choice of Different Magnetic Materials</i>	Lukas Mueller	Micrometals	Accepted
11:10 AM - 11:45 AM	<i>Optimizing Trade-Offs Between Capacitors and Inductors</i>	David Zawacki	Cornell Dublier	Accepted
11:45 AM - 12:00 Noon	Panel Q & A		Kolar, Muhlethaler, Li, Mueller, Zawacki	

2:00 PM - 2:50 PM	Keynote Speaker Addressing Thermal Design and other special issues as partial discharge, insulation, etc., Intro <i>Overview of special issues for the design of magnetics</i>	George Slama Charlers Sullivan	Wurth Elektronik Dartmouth College Sullivan	Accepted
	Q & A			
	Technology Session - Thermal Design and other special issues as partial discharge, insulation, etc., - Part 1			
	Opening Remarks	George Slama	Wurth Elektronik	
2:50 PM - 3:15 PM	Leading Edge Power Magnetics design - multi -physical, multi-dimensional Optimization Relative to Electrical, Thermal and Commercial Objectives	Roman Jamy	Yageo - Kemet	Accepted
3:15 PM - 3:40 PM	Characterization of Partial Discharges in High-frequency Transformer under PWM Pulses	Zhicheng Guo	Arizona State University	Accepted
3:40 PM - 4:00 PM	Break			
	Technology Session - Thermal Design and other special issues as partial discharge, insulation, etc., - Part 2			
4:00 PM - 4:25 PM	<i>Thermal Issues with Power Magnetics</i>	Subhashish Bhattacharya	NCSU	Accepted
4:25 PM - 4:45 PM	Panel Q & A		Sullivan, Roman, Guo, Bhattacharya	
	Closing Remarks			
4:45 PM - 5:00 PM	Best of the Best Survey	Alex Gerfer George Slama	Wurth Elektronik PSMA	Accepted Accepted
5:15 PM - 6:30 PM	Networking Hour			

PSMA Magnetics Committee Meeting Agenda – Workshop Planning

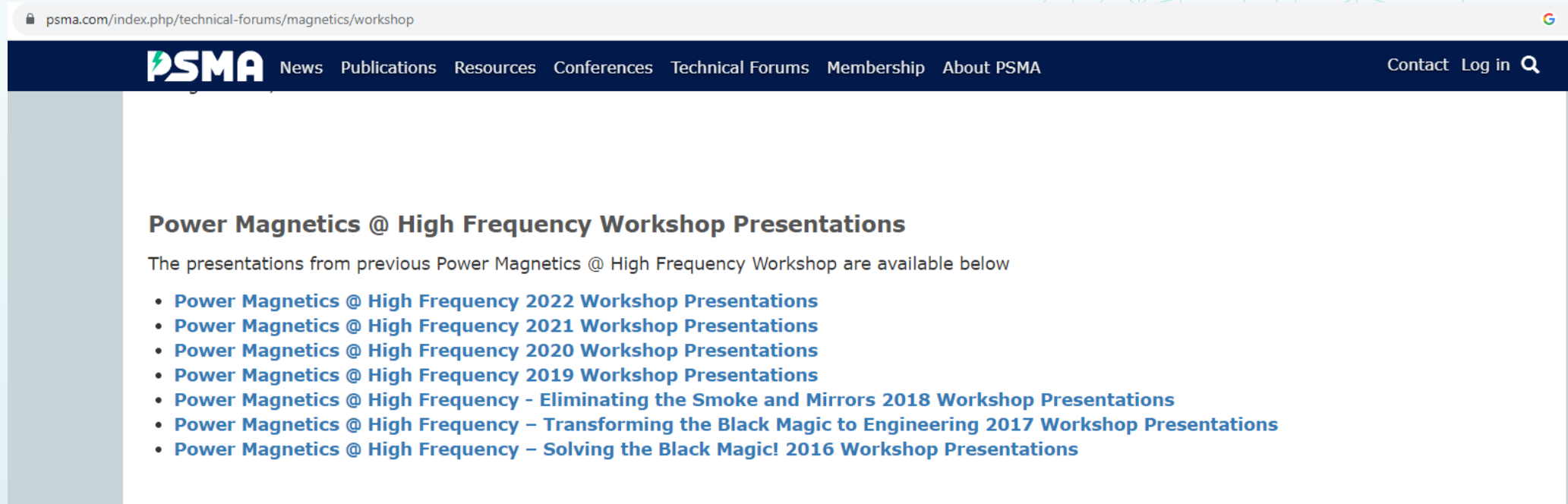
October 16, 2023

- From Tentative Agenda Workbook

12:00 Noon - 2:00 PM	Technology Demonstration Session	George Slama	Würth Elektronik	
	Oscilloscope	George Slama	LeCroy, Keysight or Tektronix, Pico	Pending
	Near field measurements useful techniques for electronics engineers	Arturo Mediano	HF Magic Labs	Accepted
	Computer Aided Inductor Optimization	Lukas Mueller	Micrometals	Accepted
	Magnetics for Energy Harvesting Applications	Sergiy Tykhonov	Fraba Ubito	Invited (Responded)
	Core Loss Correlations Across Equipment and Different Core Materials	George Slama	Würth Elektronik	Pending
	Capacitor/Inductor Filter	Frank Puhane	Würth Elektronik	Accepted
	High-Q SMD measurements of various components (low ESR and ESL measurements)	Frank Puhane	Zunch Instruments	Invited
	Circuit Simulation of Magnetic Components	Tom Wilson	SIMPLIS Technologies	Accepted
		Aminul Mehedi	CMM	Invited
	Nanocrystalline-based CMC filters for EV – reducing footprint	Bharadwaj Reddy Andapally	CBMM	Accepted
	3D FEM-based software for low-frequency electromagnetic behavior in transformers and inductors	Juris Vencels	Trafo	Accepted
		Mike Arasim	Fair Rite	Accepted
		Chuck Wild	Miles Platt	Pending
		Naomichi Nao Miyari	Hioki	Invited
		Mark Rine	Proterial America	Pending
	Non Linearity of metal alloyed powdered core with micro Pulse 2.0	JC Sun	Bs&T	Accepted
	Posters			
	Regroup for Next Session	-	-	-

PSMA Magnetism Committee Meeting Agenda – Workshop Planning October 16, 2023

- Publish presentation and recording from 2023 workshop on Workshop page of magnetic forum
Plan to open public link coincident with registration



- Add wrap up of 2023 workshop between text for 2024 and 2022 workshops on workshop page of magnetism forum
Plan coincident with registration

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PSMA Magnetics Committee Meeting Agenda – Industry Session Planning

October 13, 2023

- Simulation (magnetic & circuit) & modelling
 - Proposal Uploaded to APEC website on Thursday August 10
 - Invitation Sent
 1. Simulation including material data – Minjie Chen Princeton - **ACCEPTED**
 - a) Or High frequency material simulation tools – Minjie Chen Princeton
 2. 2D Vs 3D FEA for magnetics – Mark Christini Ansys - **Accepted**
 3. Circuit Simulation Tools – Tom Wilson/Andrija Supas SIMPLS Technologies - **ACCEPTED**
 4. Near Magnetic Fields – Arturo Mediano HF Magic Labs - **ACCEPTED**
 5. Impedance Over Wide Frequency Ranges for EMI Filtering – Fang Luo Stony Brook University - **ACCEPTED**
 6. Coupling – Bryce Hesterman Utah State University – **ACCEPTED**
 7. Thermal Modeling of Magnetic Components - Juris Vencels Trafolo – **Accepted**
 - Potential Backups
 7. 2D Vs 3D FEA for Magnetics Anderson Hoke formerly of Dartmouth
 8. 2D Vs 3D FEA for Magnetics Jonathan Kimball Missouri University of Science & Technology
 9. Near Magnetic Fields – Matt Wilkowski EnaChip

**7 of 7 slots
confirmed**

PSMA Magnetism Committee Meeting Agenda – Industry Session Planning

October 16, 2023

- Session as IS01 acceptance received from APEC on October 9
- Session agenda with presenters and topics due November 3
- Presenter Instructions
 - Need to send to presenters - soon

Schedule conflict with one magnetism technical session
Tuesday morning
T08 Modelling and Simulation
Same topic as IS01

T16 Magnetism Modelling and Applications
Schedule for Wednesday morning

Contact Tim McDonald to resolve schedule conflicts
Potential swap with SiCarbide session T20
Need to contact Christina Demarino and Dave Gill to see if they are willing to swap

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2022/2023/2024 PSMA PTR Webinar Series

Potential Contributions from the Magnetics Committee

- Tyndall – Ranajit Sai
 - Core Loss Mechanisms
 - Second Half 2023 – need to confirm November 30
 - Connected with Dhaval and Conor
- Utah State University – Reebal Nimri
 - High Power (1 MW) Charging
 - 2023 Q1/Q2
 - Confirmed 8/16/23
- Fraunhofer – Florian Ziegler (Powder MEMS Micromagnets - Technology for innovative magnetic MEMS)
 - MEMS
 - Fall 2023
 - Confirmed 8/18/23
- CBMM - Bharadwaj Reddy Andapally (Technology Roadmap for Nanocrystalline Cores)
 - New magnetic materials
 - Fall 2023/Spring 2024
 - Confirmed: 9/1/23

Potential Source of Info Inter Mag
Japan
Presentations
Measurement Techniques
New Materials

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Ad Hoc meeting on October 18

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Overall vision 2020-2025 - Sustenance & smart growth

Pillar	Progress to date	Outlook & Suggestions
Magnetics @ High Frequency Workshop	<ul style="list-style-type: none">• 2024 theme...• AM - Design and Optimization of Magnetics for Different Applications• PM – Special issues as thermal, partial discharge, insulation, etc.• Projected Attendees: 125+ based on 2023 attendance (125)• Coordinate with semiconductor workshop• Coincident with 40TH anniversary of PSMA	<ul style="list-style-type: none">• 2025• would be 10th annual workshop• Next gen of organizers
APEC Industry Session	<ul style="list-style-type: none">• 2024 theme• Modelling and simulation of magnetics – closing the loop• Seven confirmed presenters	<ul style="list-style-type: none">• 2025• Next gen of organizers

Overall vision 2020-2025 - Sustenance & smart growth

Pillar	Progress to date	Outlook & Suggestions
Webinars	<ul style="list-style-type: none">• Pre 2022 – provided training webinars on various subjects	<ul style="list-style-type: none">• Is there a need for training webinars during the fall timeframe to help promote the workshop and industry session tied to APEC in spring? This may be competing with other industry webinars that are prevalent in the fall.• Short 15-minute videos on demand for specific topics accessible from magnetics forum
Roadmap	<ul style="list-style-type: none">• 2023 Fall – identified two presenters...• Core Loss Mechanisms – Tyndall – Ranajit Sai• Wafer Level Magnetism – Imec – Florian Ziegler	<ul style="list-style-type: none">• 2024 – identified two presenters• High power charging – Utah State University – Reebal Nimri• Technology Roadmap for Nanocrystalline Cores – CBMM – Bharadwaj Reddy Andapally

Overall vision 2020-2025 - Sustenance & smart growth

Pillar	Progress to date	Outlook & Suggestions
Special Projects	<ul style="list-style-type: none">• Considering...• Core Loss Database• Electrical parameters of magnetic materials• Study propagation in magnetic materials• Spice model BH loop• Current driven core loss testing• Steinmetz like approximation	<ul style="list-style-type: none">• Looking for partners/sponsors to share the cost
Collaboration	<ul style="list-style-type: none">• 2022 Previous collaborations outside of PSMA – stalled has become more of an individual effort rather a committee effort for design engineer training webinar/presentations	<ul style="list-style-type: none">• Coordinate magnetics workshop with capacitors committee and semiconductors workshop• Support Manufacturing and packaging committee –Power Technology Report for embedded and integrated

PSMA Magnetics Committee Meeting

October 16, 2023

- Attendance (14)
 - John Horzepa
 - Joe Horzepa
 - Mike Arasim
 - Doug Eaton
 - Ed Herbert
 - Alfonso Martinez
 - Lukas Mueller
 - George Slama
 - Rodney Rogers
 - Ranajit Sai
 - JC Sun
 - Mark Swihart
 - Chuck Wild
 - Matt Wilkowski



Thank You

**Looking Forward to Your Inputs
During
the Special Projects Ad Hoc Meeting
on Wednesday October 18**