



The Multinational Power Electronics Association

PSMA Magnetics Committee Meeting

December 11TH 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 December 11, 2024

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



PSMA Magnetics Committee Meeting Agenda

December 11, 2024

- Introductions
- **2025 Workshop Planning**
- 2025 Industry Session Planning
- Special Projects
 - Electrical parameters of magnetic materials
 - Core Loss Database
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PSMA Magnetics Committee Meeting Agenda Workshop Planning Notes

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- Workshop Tab
 - Workshop partners
 - 2025 Workshop partners updated

The screenshot shows the PSMA website's Magnetics Forum page. At the top, there is a navigation bar with links for News, Publications, Resources, Conferences, Technical Forums, Membership, and About PSMA. Below this is a breadcrumb trail: PSMA / Technical Forums / Magnetics / Workshop / Magnetics Forum. The main heading is "Magnetics Forum" with a sub-heading "Magnetics Info & Resources for the Power Electronics Industry." A horizontal menu contains links for Introduction, HF Task Force, Magnetics Checklist, Resources, Presentations, Core Loss Studies, Meeting Minutes, Special Projects, and Workshop. The "Workshop" link is highlighted. Below the menu is a banner for the "10th Annual Magnetics @ High Frequency Workshop" organized by the PSMA Magnetics Committee on 15 March 2025 in Atlanta, GA USA. The banner includes the PSMA logo and the PELS (IEEE Power Electronics Society) logo. Below the banner, a text block states: "Registration for the 2025 Power Magnetics @ High Frequency Workshop on Saturday March 15, 2025 at the Georgia World Congress Center in Atlanta, GA is now open." Two large blue buttons labeled "REGISTRATION" and "AGENDA" are prominently displayed. A text block below the buttons provides partnership information: "Partnership Opportunities available. Sign up to be a Workshop Partner. Please contact the organizing committee through via e-mail to workshop@psma.com for more information. Click here for the pricing and benefits:". At the bottom, the "2025 Workshop Partners" are listed under three categories: Platinum Partners (Frenetic, RUBADUEWIRE, WURTH ELEKTRONIK, YAGEO), Gold Partner (CBMM, Niobium N5), and Media Partners (HOW2POWER, Bodo's Power Systems).

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- Workshop Tab
 - Registration
 - Open

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2025 Power Magnetics @ High Frequency Workshop Registration



10th Annual Magnetics @ High Frequency Workshop

PSMA Magnetics Committee — 15 March 2025, Atlanta, GA USA



Registration Rates (Early Bird Pricing Deadline: Friday January 31, 2025)*

- Member Early/ Regular \$295/ \$345
- Non-Member Early/ Regular \$395/ \$445

Workshop Partners:

   WURTH ELEKTRONIK MORE THAN YOU EXPECT   Niobium N₅  

First name* **Last name***

First name for name badge, if different from above

Title/ Job Function

Company/ Organization*

Address*

Address 2

City/Town* **State/Province** **ZIP/Postal Code**

Country*

Telephone:*

PSMA Magnetics Committee Meeting Agenda Workshop Planning Notes December 11, 2024

- APEC webpage
 - Schedule at a glance

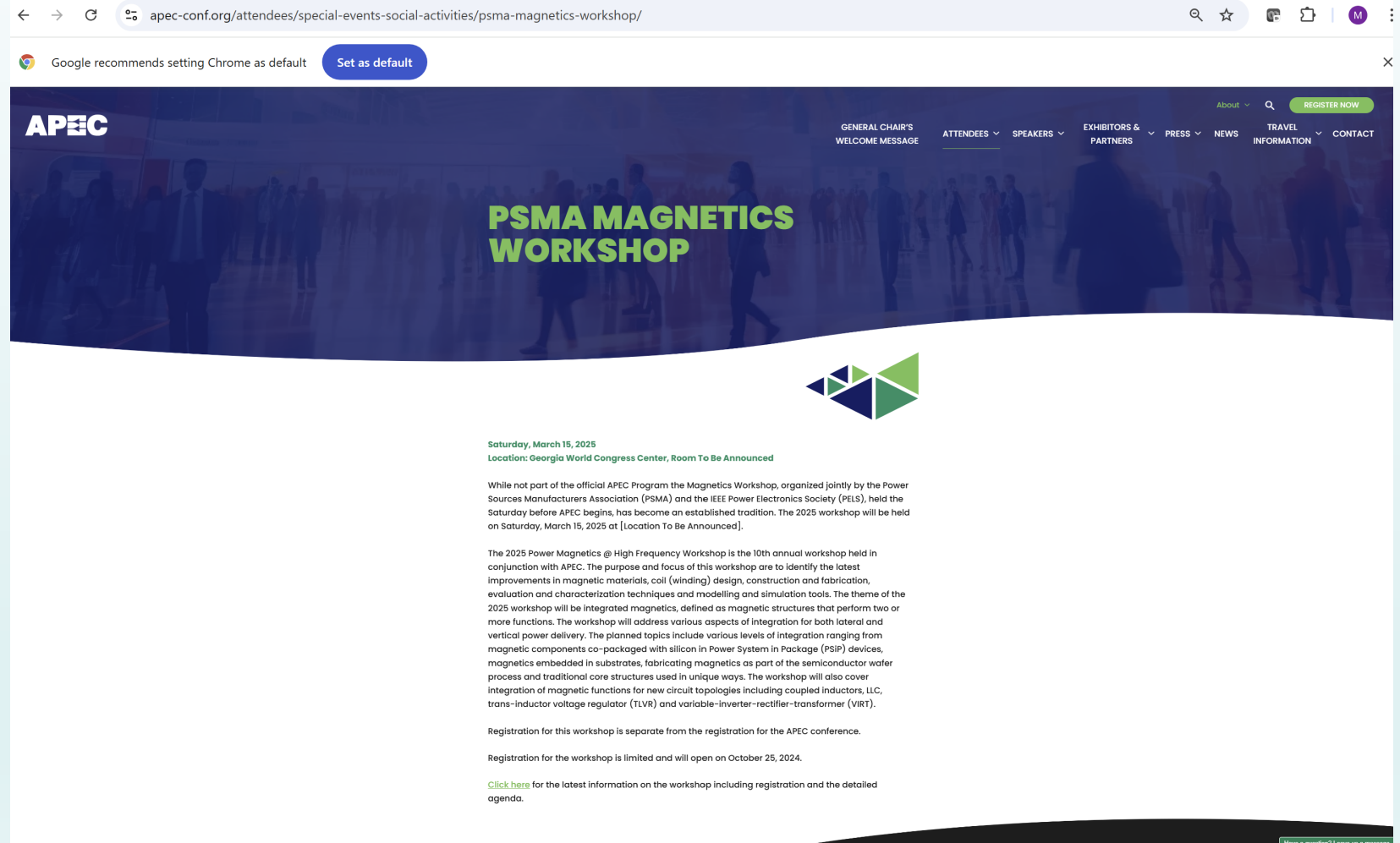
The screenshot shows the APEC 2025 website. The main heading is "APEC 2025 SCHEDULE AT A GLANCE". Below the heading, there is a note: "Please note that times are subject to change as the final details of the conference are settled. Locations will be announced as they become available." Another note states: "Unless otherwise specified all sessions and events are held in the Georgia World Congress Center." A table lists the schedule for Saturday, March 15.

SATURDAY, MARCH 15	
7:00 AM – 5:00 PM	PSMA/PELS Magnetics Workshop , Location To Be Announced (Separate Registration Required)
4:00 PM – 7:00 PM	Registration Open, Location TBA

PSMA Magnetics Committee Meeting Agenda Workshop Planning Notes

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- APEC webpage
 - PSMA Magnetics Workshop



The screenshot shows a web browser displaying the APEC website page for the PSMA Magnetics Workshop. The browser's address bar shows the URL: apec-conf.org/attendees/special-events-social-activities/psma-magnetics-workshop/. The page features a dark blue header with the APEC logo on the left and a navigation menu on the right. The main content area has a dark blue background with a blurred image of people at a conference. The title "PSMA MAGNETICS WORKSHOP" is prominently displayed in green and white text. Below the title is a logo consisting of three overlapping triangles in blue, green, and white. The text on the page provides details about the workshop, including the date (Saturday, March 15, 2025), the location (Georgia World Congress Center, Room To Be Announced), and a description of the workshop's focus on magnetic materials, coil design, and integration. It also mentions that registration is separate from the APEC conference and will be limited.

APEC

GENERAL CHAIR'S WELCOME MESSAGE | **ATTENDEES** | SPEAKERS | EXHIBITORS & PARTNERS | PRESS | NEWS | TRAVEL INFORMATION | CONTACT

PSMA MAGNETICS WORKSHOP

Saturday, March 15, 2025
Location: Georgia World Congress Center, Room To Be Announced

While not part of the official APEC Program the Magnetics Workshop, organized jointly by the Power Sources Manufacturers Association (PSMA) and the IEEE Power Electronics Society (PELS), held the Saturday before APEC begins, has become an established tradition. The 2025 workshop will be held on Saturday, March 15, 2025 at [Location To Be Announced].

The 2025 Power Magnetics @ High Frequency Workshop is the 10th annual workshop held in conjunction with APEC. 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. The theme of the 2025 workshop will be integrated magnetics, defined as magnetic structures that perform two or more functions. The workshop will address various aspects of integration for both lateral and vertical power delivery. The planned topics include various levels of integration ranging from magnetic components co-packaged with silicon in Power System in Package (PSIP) devices, magnetics embedded in substrates, fabricating magnetics as part of the semiconductor wafer process and traditional core structures used in unique ways. The workshop will also cover integration of magnetic functions for new circuit topologies including coupled inductors, LLC, trans-inductor voltage regulator (TLVR) and variable-inverter-rectifier-transformer (VIRT).

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

Registration for the workshop is limited and will open on October 25, 2024.

[Click here](#) for the latest information on the workshop including registration and the detailed agenda.

[Have a question? Leave us a message.](#)

PSMA Magnetics Committee Meeting Agenda Workshop Planning Notes

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Power Magnetics @ High Frequency Workshop 2025 Agenda



Date: Saturday, March 15, 2025

Location: Georgia World Congress Center, Atlanta, GA

Preliminary Agenda, Subject to change

7:00 AM - 8:00 AM Registration, Technical Demonstrations, Posters and Breakfast

8:00 AM - 8:05 AM Opening Remarks

8:05 AM - 9:25 AM Technical Session - Physical Construction and Structure for Integration of Power Magnetic Devices Part I

- **Keynote:** Trends of Physical Structures of Magnetic Devices for Power Applications Over the Past Ten Years; *Minjie Chen, Princeton University*
- Magnetics Integrations for 2.5D and 3D Packaging; *Ranajit Sai, Tyndall*

9:25 AM - 9:45 AM Break

9:45 AM - 12:00 Noon Technical Session - Physical Construction and Structure for Integration of Power Magnetic Devices Part II

- Inductive Components on Silicon Substrate 300mm Wafer; *Jens Kehl, Würth Elektronik*
- Ferrite Technology in Transition - Process and Shaping; *Sebastian Bachman, Tridelta Weichferrite*
- Magnetics for Power System in Package (PSiP); *John McDonald, Atlas Magnetics*
- Panel Discussion



PSMA Magnetics Committee Meeting Agenda Workshop Planning Notes

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12:00 Noon - 2:00 PM Technology Demonstration and Poster Session

- Wattmeter for AC Power Loss Measurements; *Gregg Schaeppi, ZES Zimmer*
- Active Damping of EMI Filters Using Low Q Powder Materials; *Lukas Mueller, Micrometals*
- Open Magnetics Demo; *Alfonso Martinez, Open Magnetics*
- Double Pulse Testing of Magnetic Components; *Kevin Hermanns, PE Systems*
- Core Permeability and Permittivity Measurements of Shielding Materials; *Akihiko Saito, Daido Steel*
- Construction of an Electromagnetic Wave Shielding Effect Measurement Method Using a Loop Antenna; *Kosuke Yuasa, Daido Steel*
- Integrated Magnetics, Optimization Common Mode Chokes (CMC) Integrated with Differential Mode Chokes (DMC), and Review of LLC Transformer with Integrated Inductor; *Andres Arias, Risha Yu, Premier Magnetics*
- Triple Pulse Testing Open-Source Project; *Jun Wang, University of Bristol*
- PowerBrain: AI-based Magnetic Database: Experimental and Generative Data; *Wilmar Martinez, KU Leuven*
- Linear Versus Non-Linear Magnetic Characteristics; *JC Sun, Bs&T*
- Dimensional Resonance and Fringing Mitigation Considerations for Magnetic Core Design; *Mike Arasim, Fair-Rite Products Corp.*
- Simple and Effective Technique to Verify Impact of High Temperature and High Voltage High Frequency Stresses on Inductor Electrical Performance; *Efrain Bernal, Würth Elektronik*

Posters:

- Automated Temperature Regulated Core Loss Testing with High-Frequency Class D Amplifiers; *Jacob Anderson, Nick Kirkby, Arizona State University (ASU)*
- Optimization of Magnetics Design Across Broad Application Ranges; *Rachel Yang, MIT*
- Laminated Cores for High-power Inductive Power Transfer Application: High-efficiency Design with Fe-based Nanocrystalline Material; *Yibo Wang, City University of Hong Kong*
- TBD; *Todd Marzec, UPITT*

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2:00 PM - 3:50 PM Technical Session - Electrical Parameter Integration - Part I

- **Keynote:** Trends of Electrical Requirements, Modelling and Simulation Over the Past Ten Years; *Charles Sullivan, Dartmouth College*
- Variable-Inverter-Rectifier-Transformer (VIRT) Hybrid Electronics; *Mike Ranjram, Arizona State University*
- Simulation Techniques for Integrated Magnetic Functions; *Alfonso Martinez, Wurth Elektronik*

3:50 PM - 4:10 PM Break

4:10 PM - 5:10 PM Technical Session - Electrical Parameter Integration - Part II

- Designing Soft Saturating, Low Loss TLVR 's Avoiding Air Gaps for Better Coupling and Highly Efficient Nanocrystalline Power Core Material; *Michael Freitag, Yageo*
- Panel Discussion

5:10 PM - 5:30 PM Closing Remarks

5:30 PM - 6:30 PM Networking Hour

- Technology Demonstrations and Posters

REGISTRATION

Workshop Partners:



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IEEE.org | IEEE Xplore Digital Library | IEEE Standards | IEEE Spectrum | More Sites Join IEEE

IEEE POWER ELECTRONICS SOCIETY

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Powering a sustainable future for the benefit of humanity

ABOUT US
IEEE Power Electronics Society

IEEE PELS is one of the fastest growing technical societies within IEEE. Our 13,000+ members, representing both academia and industry, span the globe and drive our success. Mission-focused, we strive to build knowledge and awareness of the latest technologies and other advances in power electronics, all to make the world a better place!

With access to a wide array of benefits and resources, both technical and professional, our members can stay current and competitive in the workplace. We invite you to join us!

[Read More](#)

Become a Member

Discover the advantages and become a member of IEEE PELS!

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NEWS, EVENTS & WEBINARS

What's Happening

News	Events	Webinars
<p>DECEMBER 9, 2024 OPEL Transparent Peer Review - Deadline Extended</p> <p>NOVEMBER 27, 2024 Register Today!!! WIE Power at the Table Webinar</p> <p>NOVEMBER 14, 2024 November 2024 Products Newsletter</p> <p>NOVEMBER 12, 2024 Meet the Candidates: PELS Member at Large Election for 2025-2027</p> <p>View News</p>	<p>JAN 7 3:00 PM - 4:00 PM TC 9 Monthly Meeting</p> <p>FEB 4 3:00 PM - 4:00 PM TC 9 Monthly Meeting</p> <p>MAR 4 3:00 PM - 4:00 PM TC 9 Monthly Meeting</p> <p>MAR 15 7:00 AM - 6:30 PM Power Magnetics @ High Frequency Workshop</p> <p>APR 1 3:00 PM - 4:00 PM TC 9 Monthly Meeting</p> <p>View Calendar</p>	<p>12/12/2024 Photonic / BESS Power Converters and The Control Techniques for Energy Access</p> <p>12/12/2024 A Review on High Power Density DC-DC Converters for Electromobility Applications</p> <p>View Webinars</p>

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IEEE POWER ELECTRONICS SOCIETY

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Calendar

Power Magnetics @ High Frequency Workshop

HOME / EVENTS / POWER MAGNETICS @ HIGH FREQUENCY WORKSHOP

10th Annual Magnetics @ High Frequency Workshop

PSMA Magnetics Committee - 15 March 2025, Atlanta, GA USA


The PSMA Magnetics Committee together with IEEE PELS are currently planning to conduct the tenth "Power Magnetics @ High Frequency" Workshop on Saturday, March 15, 2025, which is the day before and at the same venue as APEC 2025 in Atlanta, GA. The 2025 workshop builds on the ongoing dialogue of the workshop series over the first nine workshops.

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 semiconductor devices.



PSMA Magnetics Committee Meeting Agenda Workshop Planning Notes

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Answering Your Questions About Power Design

Design Guide | Newsletter | Special Sections | Resources | About Us | Sponsors | Home

infineon Power up, size down!
GaN transistor | 200 mΩ R_{DS(on)typ.} | For consumer SMPS

Download datasheet

Calendar of Events

HOW2POWER's Events Calendar lists selected conferences, tradeshows, and workshops related directly or indirectly to power conversion. This listing includes a wide range of application or market-focused events where suppliers of power components or power supplies may be exhibiting, or where technical presentations related to power conversion/power electronics may be presented.

This section also lists seminars and workshops offering instruction in power supply design, magnetics design, EMI/EMC and various power electronics and related topics.

Virtual
 In-Person
 Hybrid
 USA
 International
 Find:
 Clear All

Sort by: Date Event City State Country Industry/Application
 From:

Date	Event	City	State	Country	Industry	News
03/03/25 - 03/06/25	Device Packaging	Phoenix	AZ	USA	Packaging	
03/05/25 - 03/06/25	BATTERY TECH USA	Orange County	CA	USA	Batteries, Electric Vehicles	
03/10/25 - 03/13/25	Satellite	Washington	D.C.	USA	Space	
03/10/25 - 03/14/25	SEMI-THERM	San Jose	CA	USA	Thermal Management	
03/11/25 - 03/13/25	Embedded World	Nuremberg		Germany	Computing	
03/12/25 - 03/13/25	Data Centre World	London		U.K.	Data Centers	
03/15/25 - 03/15/25	PSMA Magnetics @ High Frequency Workshop	Atlanta	GA	USA	Magnetics, Power Electronics	

In-Person Seminar/Workshop.
Visit the event website
How2Power is a media partner for this event.

Sponsored Links (Webinars)

High-switching-frequency applications - Efficiency boost with OptiMOS 6 power MOSFET Technology

Semiconductor System Offering Enabling Combustion to Electric Transition in Power Tools

Novelties in battery-powered applications. From motor control to chargers

Webinar: High-performance PCB Layout and thermal design techniques

Webinar: Modular DC-DC System Design Done Right

Probing in Power



OTHER TOP POWER NEWS [Top ^](#)

- Infineon Technologies has announced a breakthrough in handling and processing the **thinnest silicon power wafers**, with a thickness of only 20 micrometers and a diameter of 300 mm, in a high-scale semiconductor fab.
- Texas Instruments has announced a massive expansion of its **internal GaN manufacturing**, increasing capacity 4x, by adding GaN manufacturing at its facility in Aizu, Japan and using the most advanced GaN manufacturing equipment available today.
- Wolfspeed has announced a total of **\$2.5 billion in funding** from various sources, which will aid its investments in next-generation 200-mm technology.

DMC 18 - 20 Novembre 2024 **Grenoble, France**

DESIGN METHODOLOGIES FOR POWER ELECTRONICS

10th Annual Magnetics @ High Frequency Workshop

PSMA Magnetics Committee - 15 March 2025, Atlanta, GA USA

PSMA

- Early bird registration is now open for the conference and professional education seminars at **APEC 2025**.
- Advanced Energy Industries has launched its 2025 - 2026 **STEM Scholarship Program**, which offers a \$20,000 grant toward payment of tuition fees. In addition, selected recipients will receive professional mentoring and internship opportunities.
- For a technical facelift and renovation of its North Area, CERN has selected the DM1200 zero-flux dc current transducer (DCCT) from **Danisense** for use in the CERN-designed POLARIS power converters.

URL: <https://www.how2power.com/newsletters/index.php>

URL: https://www.how2power.com/calendar/h2p_cal.php



PSMA Magnetics Committee Meeting Agenda Workshop Planning Notes

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2024 December Bodo Newsletter

Early Bird Registration Now Open for the 40th Annual APEC 2025 in Atlanta

Early bird registration is now open for the 40th Annual Applied Power Electronics Conference (APEC), running March 16-20 at the Georgia World Convention Center in Atlanta. The APEC 2025 conference and exposition gathers power electronics engineers, academics



and students from all over the world to learn about the latest research, technologies and products. Early bird registration ends Jan. 13, 2025. Full registration includes access to the APEC Technical Program, comprising nearly 800 paper presentations, sessions and seminars, the conference offers a broad scope of content: APEC Plenary Session (visionary talks by distinguished speakers), Technical Sessions (lecture sessions and dialogue sessions based on peer-reviewed papers), Industry Sessions (presentations showcasing work in all areas of power electronics), Professional Education Seminars (in-depth seminars on practical aspects of power electronics), Debate – formerly RAP – Sessions (expert panelists identify three hot topics for friendly debate) as well as Exhibitor Presentations (exhibitor companies highlight new products and technologies). Also included in the full registration package is admission to the APEC 2025 Exposition and Special Events. The 2025 exposition will gather nearly 300 exhibitors to the sold-out exhibit floor. With its lively, interactive trade show environment, APEC 2025 offers participation in such events as the MicroMouse contest, the FIRST Robotics demonstration and the Wednesday evening Social Event celebrating APEC's 40th anniversary.

www.apec-conf.org

3D Power Design and Manufacturing Symposium (3D-PEIM) 2025

The PSMA Packaging and Manufacturing Committee announce its Fifth International Symposium on 3D Power Electronics Integration and Manufacturing (3D-PEIM-2025). 3D-PEIM will take place July 8-10, 2025 at the National Renewable Energy Laboratory (NREL) in Golden, Colorado. The symposium is designed for any engineer or manager involved in the design and manufacturing of high-density power sources using 3D technology. It will feature key speakers and technical sessions focused on increasing the power density and performance of power solutions. Plenary presentations will include: "Beyond 2030: Powering the E-Powertrain with High-Value and High-Efficiency Power Conversion Systems - A BorgWarner Perspective", presented by Harsha Nanjundaswamy, BorgWarner, "Ad-



vanced Packaging to System Integration - Trends and Challenges", presented by Devan Iyer, IPC and "The Power Delivery and Energy Storage Challenge in Advanced Packaging", presented by Subramanian Iyer, University of California Los Angeles. Attendees are also invited to tour the power electronics facilities of the National Renewable Energy Laboratory.

www.3d-peim.org

Strategic Partnership for Onboard Chargers and more

Nexperia has entered into a strategic partnership with Kostal, which will enable it to produce wide bandgap devices that more closely match the exacting requirements of automotive applications. Under the terms of this partnership, Nexperia will supply, develop, and manufacture WBG power electronics devices which will be designed-in and validated by Kostal. The collaboration will initially focus on the development of SiC MOSFETs in top-side-cooled QDPAK packaging for onboard chargers in electric vehicles.

www.nexperia.com



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Power Magnetics @ High Frequency Workshop

USA Atlanta, GA 1 day

psma.com

URL: <https://www.bodospower.com/events.aspx>



PSMA Magnetics Committee Meeting Agenda December 11, 2024

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 - Core Loss Database
- 2025 Workshop Planning
- **2025 Industry Session Planning**
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PSMA Magnetics Committee Meeting Agenda - Industry Session Planning Notes

December 11, 2024



Wednesday, March 19, 2025

8:30 AM – 11:55 AM ET	IS07 - The Transformer in the Solid-State Transformer Industry Session Chair: George Slama – Wurth Elektronik Industry Session Chair: Ed Herbert , BEEE – None	^
PSMA Session		
8:30 AM – 8:55 AM ET	IS07.1 - Recommended Practices for Solid State Transformer Design and Testing Location: A412 Industry Session Presenter: Paul Ohodnicki – University of Pittsburgh	★
8:55 AM – 9:20 AM ET	IS07.2 - Addressing Insulation and Isolation Issues in the Solid State Transformer Location: A412 Industry Session Presenter: Zhicheng Guo – Arizona State University	★
9:20 AM – 9:45 AM ET	IS07.3 - Enabling High Power Transformer Design With Advanced Magnetic Mmaterials Location: A412 Industry Session Presenter: Veda Duppalli – CorePower Magnetics	★
9:45 AM – 10:10 AM ET	IS07.4 - Thermal Design and Limits of the Transformer in the Solid State Transformer Location: A412 Industry Session Presenter: Subhashish Bhattacharya , PhD – North Carolina State University	★
10:40 AM – 11:05 AM ET	IS07.5 - Managing Trade-Offs in Design of High-Power Medium Frequency Transformers for Solid-State Transformers Location: A412 Industry Session Presenter: Drazen Dujic – PEL EPFL	★
11:05 AM – 11:30 AM ET	IS07.6 - Medium Frequency Transformers for Data Centers Location: A412 Industry Session Presenter: Isaac Wong – North Carolina State University	★
11:30 AM – 11:55 AM ET	IS07.7 - Evolution of the Solid State Transformer for Different Applications Location: A412	★

IS Committee		IS072: "The Transformer in the Solid State Transformer"				
REQUIRED	REQUIRED	REQUIRED	REQUIRED	REQUIRED	REQUIRED	REQUIRED
8:30 AM	8:55 AM	Recommended Practices for Solid State Transformer Design and Testing	Paul	Ohodnicki	PRO8@pitt.edu	University of Pittsburg
8:55 AM	9:20 AM	Addressing Insualtion and Isolation Issues in the Solid State Transformer	Zhicheng	Guo	Zhicheng.Guo@asu.edu	Arizona State University
9:20 AM	9:45 AM	Impact of Standards on Design Choices and Material Options	Veda	Duppalli	veda.duppalli@corepo	CorePower Magnetics
9:45 AM	10:10 AM	Thermal Design and Limits of the Transformer in the Solid State Transformer	Subhashish	Bhattacharya	sbhatta4@ncsu.edu	North Carolina State University
10:40 AM	11:05 AM	Managing Trade-Offs in Design of High-Power Medium Frequency Transformers for Solid-State Transformers	Drazen	Dujic	drazen.dujic@epfl.ch	EPFL
11:05 AM	11:30 AM	Medium Frequency Transformers for Data Centers	Isaac	Wong	twong3@ncsu.edu	North Carolina State University
11:30 AM	11:55 AM	Evolution of the Solid State Transformer for Different Applications	Rafal	Wojda	wojdarp@ornl.gov	Oak Ridge National Laboratory

PSMA Magnetics Committee Meeting Agenda - Industry Session Planning Notes

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8:00 AM – 9:40 AM ET	IS24 - Core Loss - Making the Data Reliable and Relevant Industry Session Chair: Matt Wilkowski, MSEE – Wurth Elektronik Industry Session Chair: Ed Herbert, BEEE – None	PSMA Session
8:00 AM – 8:25 AM ET	IS24.1 - Core Evaluation Kit Initiative for the comparison of core loss measurement Location: A404-405 Industry Session Presenter: Jens Freibe – University of Kassel Co-Author: Wilmar Martinez, PhD – KU Leuven - EnergyVille	★
8:25 AM – 8:50 AM ET	IS24.2 - HFEMAG European Metrology Labs Correlation Project Location: A404-405 Industry Session Presenter: Massimo Pasquale – Istituto Nazionale Di Ricerca Metrologica	★
8:50 AM – 9:15 AM ET	IS24.3 - Triple Pulse Core Loss testing Location: A404-405 Industry Session Presenter: Jun Wang, PhD – University of Bristol	★
9:15 AM – 9:40 AM ET	IS24.4 - PSMA Core Loss Data Base Location: A404-405 Industry Session Presenter: George Slama – Wurth Elektronik	★

IS Committee		IS24: "Core Loss - Making the Data Reliable and Relevant"				
REQUIRED	REQUIRED	REQUIRED	REQUIRED	REQUIRED	REQUIRED	REQUIRED
8:00 AM	8:25 AM	Core Evaluation Kit Initiative for the comparison of core loss measurement	Jens	Freibe	Friebe@uni-kassel.de	University of Kassel
8:25 AM	8:50 AM	HFEMAG European Metrology Labs Correlation Project	Massimo	Pasquale	m.pasquale@inrim.it	Istituto Nazionale Di Ricerca Metrologica
8:50 AM	9:15 AM	Triple Pulse Core Loss testing	Jun	Wang	jun.wang@bristol.ac.uk	University of Bristol
9:15 AM	9:40 AM	PSMA Core Loss Data Base	George	Slama	george.slama@we-online.com	Wurth Elektronik

PSMA Magnetics Committee Meeting Agenda – Industry Session

December 11, 2024

- What's next?
 - Review drafts that are due in January



PSMA Magnetics Committee Meeting Agenda December 11, 2024

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



PSMA Magnetics Committee Meeting Agenda – Special Project December 11, 2024

- Special Projects
 - In Process
 - Electrical parameters of magnetic materials – interim activities since September 2024
 - Core Loss Database - active
 - 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

December 11, 2024

- Permittivity measurements with a saturating magnetic field
 - Background Info
 - We have a new student for the fall semester, Fabrice Locher. He is an undergraduate and will work under the supervision of Jonas Mühlethaler
 - Jonas has tailored the work under the project to the abilities of the student, the time and equipment available and the budget. Briefly, the work will continue the work started by Frédéric Mathieu, verifying it and extending the measurements to a higher frequency
 - Activities since September by Fabrice Lacher and Jonas Mühlethaler
 - Work on publication for APEC (The paper has been accepted for the Poster Session)
 - Re-did permeability measurements with DC field through extra wire, rather than through electromagnet (so we have a DC field in the same orientation as main flux)
 - “4-wire” measurements with Bode 100 (so far the results were almost the same, so we have a high confidence in the results)
 - Prepared toroid for permittivity / conductivity measurements
 - Ed started making sense of the results with a literature review (still ongoing, needs time, and cannot be outsourced to student)

PSMA Magnetics Committee Meeting Agenda – Special Projects

December 11, 2024

- Permittivity measurements with a saturating magnetic field
 - Activities going forward
 - 4 November, 2024
 - Permittivity measurements on toroid, see whether we have same results and can go to higher frequencies
 - Work on APEC publication / Literature study by Jonas
 - 11 November, 2024
 - Work on APEC publication / Literature study by Jonas
 - Try to observe dimensional resonance with new measurement setup (4-wire, toroids)
 - Try to make sense on the abrupt changes of permittivity under DC bias at higher frequency (see Frédéric's work)
 - 18 November, 2024
 - APEC Deadline publication
 - Work on new PCBs for permittivity measurements (reduce skin effect) / see E. H. Email with some suggestions; Include study of skin effect here (a comment: skin effect is a well understood problem, and can be simulated with FEM; in other words: I suggest to do a FEM study of the PCB. Try to make sense on the abrupt changes of permittivity under DC bias at higher frequency (see Frédéric's work)
 - FEM is not good in non-linear core materials, but good in linear copper

PSMA Magnetics Committee Meeting Agenda – Special Projects

December 11, 2024

- Permittivity measurements with a saturating magnetic field
 - Activities going forward
 - 25 November, 2024
 - FEM/Skin effect study by Fabrice (Fabrice will most likely not find time to go into the flux propagation study)
 - *Here and in the following weeks Jonas can start thinking about flux propagation and 4-wire with scope, until here Jonas have to focus on the APEC paper which is related to the project as well*
 - 2 December, 2024
 - FEM/Skin effect study by Fabrice (Fabrice will most likely not find time to go into the flux propagation study)
 - 9 December, 2024
 - Flux propagation and 4-wire with scope by Jonas
 - 16 December, 2024
 - Flux propagation and 4-wire with scope by Jonas
 - Christmas break/Next year
 - We will work out a plan in detail, maybe with a graduate student. But keep in mind, the USD 10k is a limited budget and we did a lot already...

PSMA Magnetics Committee Meeting Agenda – Special Projects

December 11, 2024

- Core Loss Database
 - Database should be on its own website
 - Link to the website on a tab in the PSMA Magnetics Forum
 - Project meetings separate from monthly magnetics committee meeting
 - Initial meeting during last week of September
 - September 25 10:00 AM CDT
 - Regular monthly project updates starting in November
 - November 13 10:00 AM CST (noting standard time begins on November 3)



PSMA Magnetics Committee Meeting Agenda December 11, 2024

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



PSMA Magnetics Committee Meeting Agenda – Open Magnetics

December 11, 2024

- URL: https://openmagnetics.com/magnetic_tool



Welcome

Welcome to OpenMagnetics design tool.

Since this is the first time you use it, allow me to explain how it works.

In this tool you don't need to specify if you want an inductor, a transformer, or a flyback. It will be defined by the requirements.

In the first step you will be asked for the requirements of your magnetic component. This usually implies the magnetizing inductance, the number of windings, and their turns ratio; but more things, like the insulation or the maximum dimensions can be added.

In the second step, you need to define the excitation of your component. This implies specifying the voltage and current of each of the ports (primary, secondary, etc.) of the device. You can do this by manually defining them, or by uploading a simulation from your favorite circuit simulator.

In the third step, you will be able to choose what you want to achieve with this specifications: getting a report of your specification, finding a COTS core, getting advise for designing a full magnetic, or even doing it yourself manually.

You can advance or move between the different step using the menu of the left. Press continue now to start your first design.

PSMA Magnetics Committee Meeting Agenda – Open Magnetics December 11, 2024

- URL: <https://openmagnetics.com/>

OpenMagnetics All's Musings New magnetic Continue design Insulation Coordinator Donate to OM Report bug Beta

THE FREE OPEN-SOURCE PLATFORM FOR MAGNETICS DESIGN AND SIMULATION

We believe that the access to knowledge and tools are a right, not a privilege, so we offer the best tools in the market for free, so the whole of humanity can benefit.

Give us a star on Github! Start designing! Follow us on LinkedIn!

What you can do right now

- Import waveforms**
Introduce any waveform (even by hand!) or upload the file exported you exported from your favorite Circuit Simulator.
- Build your own magnetic!**
Customize any magnetic component as you like! Choose your core, wires and play with different winding distributions, and get instantaneous simulation results!
- Magnetic Synthesis**
Input your specifications, get a full manufacturable magnetic design. That simple.
- Calculate insulation**
Get the insulation coordination needed to comply with IEC 60664, IEC 62368, IEC 61558, and IEC 60335.
- Find COTS Core**
Find the in-stock COTS core perfect for your application, along with the number of turns, core losses, and the link to buy it right now!

PSMA Magnetics Committee Meeting Agenda – Open Magnetics

December 11, 2024

- URL: <https://openmagnetics.com/>

OpenMagnetics Alf's Musings New magnetic Continue design Insulation Coordinator Donate to OM Report bug Beta

What you'll be able to do soon

- Create custom core shapes, core materials, and wires for your magnetics.
- Design not only power cores, but common mode chokes.

OpenMagnetics is for everyone

For Researchers

You are working on improving Magnetics? OpenMagnetics is for you:

- Compare your models against the state of the art.
- Have access to our cured datasets to create your own models.
- Your contribution is a place where it is used and not forgotten.
- Talk me data! Help creating a community based on validation, not on marketing.
- Have access to all our tools.

For Designers

You are creating Magnetics? OpenMagnetics is for you:

- Have access to the latests and most accurate models.
- All tools are accessible and all results can be exported without registration.
- No black magic, have access to the implementation of all the models and run them by yourself.
- Use our advanced automatic [advisers](#) to help you design your magnetic.
- Use, compare and access all properties from any commercially available part:
 - Magnetic cores and bobbins: Ferroxcube, TDK, Magnetics, Fair-Rite, Micrometals, etc.
 - Wires: MWS Wire Industries, Rubadue, Elektrisola, New England Wire Technologies, etc.
 - Or create your own library!

For Manufacturers

You are building Magnetics? OpenMagnetics is for you:

- Have access to data from all parts distributors.
- Have access to the best models to reduce iterations.
- Introduce your own stock and use let our advisers help you design something you can assembly today.
- Integrate your products in our Open Database, and let your users use them in our tools.

PSMA Magnetics Committee Meeting Agenda – Open Magnetics

December 11, 2024

- URL: <https://openmagnetics.com/>

Tools and Roadmap

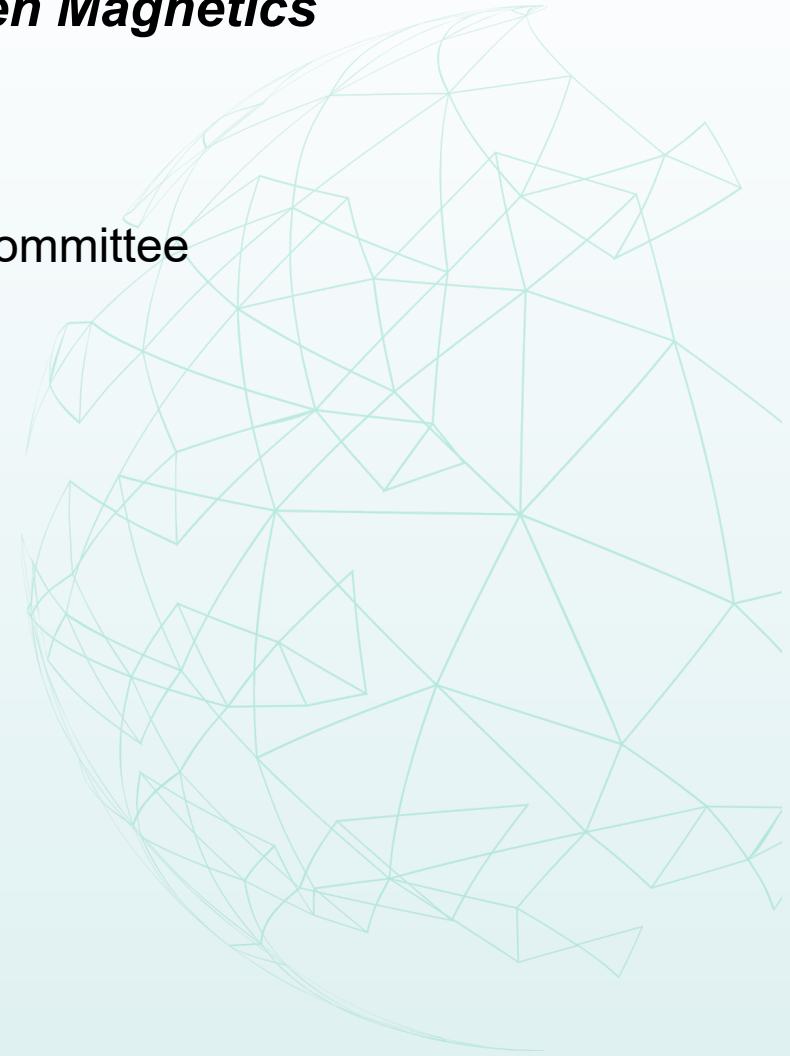
OpenMagnetics is maintained and developed by volunteers, and we do it because we believe in what Open Source brings to the world. Each one of us makes their living by some other meaning and works on these in our free time, so there won't be any deadlines. Despite of that, we will do our best to make this tool as good as we are capable.

If you want to support this project, consider joining our [Discord server](#) and let us know what you enjoy doing the most!.

PSMA Magnetics Committee Meeting Agenda – Open Magnetics

December 11, 2024

- What's next?
 - Distribute Nov 6 presentation to the PSMA Magnetics Committee
 - Decide to proceed then integrate into PSMA webpage –
 - need final decision
 - need to discuss with PSMA webmaster



PSMA Magnetics Committee Meeting Agenda December 11, 2024

- Introductions
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- Magnetics Forum on PSMA Website
- Next Meeting



2025 Edition PSMA Power Technology Roadmap

Magnetics Section

- 2022 Topics (Published)

- Energy Harvestings
- Integrated Voltage Regulators (IVR)
- Fully Integrated Voltage Regulators (FIVR)
- Hybrid Integrated Voltage Regulators (HIVR)
- Isolated Signal and Low Power Transformers
- Power Supply on Chip (PwrSoC)
- Power Management Integrated Circuits (PMIC)
- Power Systems in Package (PSiP)
- Mother Board Voltage Regulators (MBVR)
- Wireless Power Transfer (WPT)
- Solid State Transformers (SST)

- 2025 Topics (Proposed)

- Embedded Magnetics
 - Integrated Voltage Regulators (IVR)
 - Fully Integrated Voltage Regulators (FIVR)
 - Hybrid Integrated Voltage Regulators (HIVR)
 - Isolated Signal and Low Power Transformers
 - PwrSoC (Power Supply on Chip)
 - Power Systems in Package (PSiP)
- Solid State Transformers (SST)
- Trans-Inductor Voltage Regulators (TLVR)
- Mother Board Voltage Regulators (MBVR)
 - Lateral Power Delivery (LPD)
 - Vertical Power Delivery (VPD)
 - Dual Phase Power Block (DPPB)
- Wireless Power Transfer (WPT)
 - EV Charging
- Core Loss Measurement Methods & Databases
- Magnetic Material Alternatives Opportunities and Limitations

PSMA Magnetics Committee Meeting Agenda December 11, 2024

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PSMA Magnetics Committee –Magnetics Committee Forum on PSMA Website December 11, 2024

- In process
 - Section 1.3 Powdered metal
 - Proposal by Lukas Mueller has been accepted
 - Need to add to HF task force tab under magnetics Technical Forum on PSMA website
- Proposed additions/updates
 - Section 1 Core Materials
 - Sputtered (addition)
 - Electroplated (addition)
 - Section 1.4 Nanocrystalline and amorphous metals (populate)
 - Section 4 Inductors
 - TLVR inductors (addition)
 - Section 8 “Solid state” transformers (populate)
 - Section 12 Fabrication Technology
 - Section 12.3.2 Substrate embedded (populate)
 - Section 12.6 PSiP (populate)
 - Section 12.7 PwrSoc (populate)



PSMA Magnetics Committee –Magnetics Committee Forum on PSMA Website

December 11, 2015

https://psma.com/technical-forums/magnetics/hf-task-force

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PSMA / Technical Forums / Magnetics / HF Task Force / Magnetics Forum

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 to 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](#)

Update

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

PSMA Magnetics Committee –Magnetics Committee Forum on PSMA Website December 11, 2024

High frequency magnetics

Revision: January 11, 2015

▼ 1. Core materials

This section discusses the characteristics of various materials used to make inductor and transformer cores. Manufacturers are encouraged to provide their catalogs and data sheets to be included. Manufacturers who are PSMA members may have a promotional block placed in this report.

A good over-view of the various magnetic materials and their selection criteria can be found in "Magnetic Core Materials in HF Applications."¹

- 1.1. Ferrite
- 1.2. Low temperature cured ferrites
- 1.3. Powdered metal
- 1.4. Nanocrystalline and amorphous metals
- 1.5. Composite cores
- 1.6. Tape-wound cores
- 1.7. Selection criteria

Populate section 1.3 and 1.7 with content proposed by Lukas Mueller

¹ Magnetic Core Materials in HF Applications; Dr. Jonas Mühlethaler, Gecko-Simulations, AG; an APEC2014 Industry Session

- ▶ 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 Membership Information](#)

PSMA Member Promotion



Tyndall National Institute



Add Micrometals logo with link to Micrometals website to this section of HF task force

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

PSMA Magnetics Committee –Magnetics Committee Forum on PSMA Website December 11, 2024

Proposal By Lukas Mueller on June 28, 2024

Section 1.3 Powder Materials

Powdered metal-based cores are made from small particles of magnetic material that are insulated, mixed with a binder and pressed into a solid core shape. The defining characteristic of powder cores is their low starting permeability ranging from 4 to 550 and soft-saturation characteristic. Unlike a gapped high permeability material, a powder material will gradually lose its permeability with increasing magnetization force. Coupled with powder materials with high saturation flux density, these materials can store higher amounts of energy per unit volume than ferrite. Core loss is generally higher for powder materials than ferrite.

There are three broad subtypes of powder metal cores depending on the base raw material used: iron, carbonyl iron and alloy.

1.3.1 Powder iron cores are made from reduced iron. The main advantage of powder iron is the materials high saturation flux density, high amplitude permeability, high damping and low cost. The main disadvantage of powder iron is its high core loss compared to other materials, making it more suitable for low frequency power conversion, line reactor or EMI filtering applications

1.3.2 Carbonyl iron-based cores feature low eddy current losses due its unique magnetic particle structure. This gives these types of materials a stable permeability over a wide frequency range. The main application for carbonyl iron-based cores is in high Q resonant inductors and broadband transformers at frequencies above 1MHz.

1.3.3 Alloy powder cores feature lower hysteresis losses than powder iron cores. The stability of these materials' permeability versus magnetization force is also significantly better. Alloy powder cores excel in DC inductors in filtering and power conversion applications. There is a large variety of alloy cores including but not limited to: Sendust, Permalloy, Molypermalloy and Silicon Steel.

PSMA Magnetics Committee –Magnetics Committee Forum on PSMA Website December 11, 2024

Proposal By Lukas Mueller on June 28, 2024

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PSMA Magnetics Committee –Magnetics Committee Forum on PSMA Website December 11, 2024

Proposal By Lukas Mueller on June 28, 2024

Section 1.7 Selection criteria

The defining selection criteria for magnetic materials are: core loss, saturation flux density, inductance stability, temperature range and mechanical ruggedness.

For AC applications like high Q resonant inductors or transformers low core loss at the intended switching frequency is the primary concern. The performance factor of different material grades can be used to identify the material with the lowest core loss at a certain frequency.

For DC switching inductors, like PFC inductors, a mixture of inductance stability and core loss is desirable.

For EMI filter inductors, high damping is beneficial to limit parasitic resonances in the filter. In addition, a high impedance over the desired filtering frequency range is crucial. For DC filter inductors, a high DC bias stability is desired. The material saturation constant can be used to evaluate different materials in this regard. For AC line filter inductors, a high saturation flux density and high amplitude permeability are beneficial.

PSMA Magnetics Committee –Magnetics Committee Forum on PSMA Website December 11, 2024

Proposal By Lukas Mueller on June 28, 2024

Section 1.7 Selection criteria (Continued)

Application	Material 1	Material 2	Material 3	Note
Common Mode Choke	MnZn Ferrite	Nanocrystalline	NiZn Ferrite	Carbonyl iron above 500MHz an option as well
DC Filter Choke	Powder Alloy	MnZn Ferrite	Powder Iron	
AC Line Choke	Power Iron	Powder Alloy	Fe-Si (laminated)	
AC Filter Choke	Carbonyl iron	Powder Alloy	MnZn Ferrite	
CCM Switching inductor	Powder Alloy	MnZn Ferrite	Nanocrystalline	Evaluate DC bias stability vs. core loss
DCM Switching Inductor	MnZn Ferrite	NiZn Ferrite	Carbonyl Iron	Carbonyl iron has higher core loss but lower AC copper loss due to distributed air gap
Tuned RF inductor	Carbonyl Iron	NiZn Ferrite	Air	
Transformer	MnZn Ferrite	Nanocrystalline	NiZn Ferrite	

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PSMA Magnetics Committee Meeting Agenda December 11, 2024 – Next Meeting

- Wednesday January 8 10:00 AM CST – 11:00 AM CST



PSMA Magnetics Committee Meeting December 11, 2024

- Attendance (7)
 - John Horzepa
 - Mike Arasim
 - Alan Cooper
 - Jim Cox
 - Doug Eaton
 - Frank Feng
 - Ed Herbert
 - Alfonso Martinez
 - Lukas Mueller
 - Mike Ranjram
 - Rodney Rogers
 - Ranajit Sai
 - George Slama
 - JC Sun
 - Mark Swihart
 - Jun Wang
 - Matt Wilkowski



PSMA Magnetics Committee
December 11, 2024

Thank You

