Organisational Information

Sign up at: www.ecpe.org/events

Registration Deadline:

12 October 2021

Participation Fee:

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	Part I 21-22 Sept.	Part II 19-20 Oct.	Both Tutorials	
	770,- €*	660,- €*	1.200,-€*	Industry
	655,- €*	545,- €*	955,-€*	University
	240,- €*	210,- €*	360,-€*	Students/ PhD stud.**

^{*} plus VAT; **students seats are limited

- The regular participation fee includes dinner, lunches, coffee/soft drinks. The reduced (PhD) students fee includes all the above except for dinner (can be booked for an extra fee of € 50,-*).
- The presentations will be provided by email via a download link short before the event. A printed version of the tutorial handout is available on request (€ 50,-*).
- Upon receipt of registration confirmation via email you are signed-up for the event. The invoice will be sent via email.
- 25 % discount for participants from ECPE member companies.
- 10 % discount for participants from ECPE competence centres.
- Cancellation policy: Full amount will be refunded in case of cancellation up to 2 weeks prior to the event. After this date and in case of no-show 50 % of the fee is non-refundable (substitutes are accepted anytime).
- The number of participants is limited to 35 attendees.

Organisational Information

ECPE e.V. **Organiser**

90443 Nuremberg, Germany

www.ecpe.org

Prof. Dr. Uwe Scheuermann. Chairman

Semikron Elektronik

Organisation Ingrid Bollens, ECPE e.V.

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Seminaris Hotel Nürnberg Venue

Valznerweiherstraße 200 90480 Nuremberg, Germany New Venue



Travel information (hotel list and maps) are available on the ECPE webpage under Travel Information Nuremberg



European Center for Power Electronics e.V.

ECPE Tutorial

Seminaris Hotel

Leistungselektronik

Thermal Engineering of Power **Electronic Systems Part II: Thermal Management** and Reliability



ECPE Tutorial

Thermal Engineering of Power Electronic Systems Part II

19 – 20 October 2021 Nuremberg, Germany

Thermal engineering of power electronic systems is a key to achieve high performance and reliability. The focus of the tutorial is the thermal design and validation of a power electronic inverter exemplified by a 100 kW SEMIKUBE IGBT converter equipped with additional thermal sensors. The attendees should have basic knowledge on power semiconductor devices and power electronics systems.

Part 1: After a review of the basic theory of heat transfer, the calculation of losses in a voltage source inverter will be explained. For selected stationary operating conditions, the expected device temperatures of the sample converter will be calculated from datasheet values. Application of online tools to facilitate this process will be demonstrated. Participants can chose between FEM simulations and equivalent thermal network calculation with LTspice™ to simulate these operating conditions. The results are compared to thermal measurements using thermocouples and an IR camera.

Furthermore, a 3rd practical training group will deal with modeling of a power board with 3D CFD thermal analysis.

Part 2: Following a brief summary of the results of the first part, failure mechanisms, both at semiconductor and package levels will be introduced. After that, thermo-/damage-sensitive parameters will be discussed, together with theoretical background of thermal impedance measurement. A practical experiment about measurement of thermal impedance with standard laboratory equipment will end the first day. The second day will start from concrete design for reliability concepts, then aim straight at lifetime estimation, based on both power cycling and mission-profile approaches. Advanced electro-thermal and thermo-mechanical simulation will follow, and an overview about cooling systems will conclude the 2-day tutorial.

Programme

Tuesday, 19 October 2021

09:30 Start of Registration

09:45 Welcome ECPF e.V.

10:00 Short Summar of the Results of Tutorial Part 1
Arendt Wintrich

10:20 Semiconductor-Level Thermal and Electrical Failure Mechanism
Francesco Jannuzzo

11:20 Temperature and Reliability: Package-Level Failure Mechanisms I

Uwe Scheuermann

12:00 Lunch

13:00 Temperature and Reliability: Package-Level Failure Mechanisms II

Uwe Scheuermann

14:00 Thermo-/Damage-Sensitive Electrical Parameters
Francesco Jannuzzo

14:45 Thermal Impedance Measurement - Preparation
Arendt Wintrich

15:00 Introduction to Experiment
Arendt Wintrich

15:15 Coffee Break

15:45 Thermal Impedance Measurement – Results and Interpretation
Uwe Scheuermann

17:30 Wrap up 1st Day

18:00 End of 1st Day

19:30 Dinner

Programme

Wednesday, 20 October 2021

08:30 Start of 2nd Day

08:30 Design for Reliability
Uwe Scheuermann

09:30 Lifetime Models based on Power Cycling Test
Uwe Scheuermann

10:00 Coffee Break

10:20 Mission Profile based Lifetime Estimation Francesco lannuzzo

11:15 Electro-Thermal and Thermo-Mechanical Simulation

Martin Pfost

12:30 Lunch

13:30 Thermal Simulation of Complex Power Packages Considering Reliability Issues Andreas Simon-Kajda

14:30 Cooling Technologies - Overview
Uwe Scheuermann

15:15 TIM Materials
Arendt Wintrich

15:45 Wrap up 2nd Day, Final Discussion, Feedback

16:00 End of Tutorial

Course instructors:

- Prof. Francesco lannuzzo, Aalborg University
- Prof. Martin Pfost, TU Dortmund University
- Prof. Uwe Scheuermann, Semikron Elektronik
- Andreas Simon-Kajda, Siemens Industry Software
- Dr. Arendt Wintrich, Semikron Elektronik