

Organisational Information

Sign up at: www.ecpe.org/events

Registration Deadline:

19 October 2023

Participation Fee:

Part I 11-12 July	Part II 25-26 Oct.	Both Tutorials	
770,- €*	670,- €*	1.250,- €*	Industry
655,- €*	520,- €*	955,- €*	University
240,- €*	180,- €*	380,- €*	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.
- Further information (hotel list and maps) will be provided after registration and can be found on the ECPE web page.
- 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

Organiser ECPE e.V.
90443 Nuremberg, Germany
www.ecpe.org

Chairman Prof. Dr. Uwe Scheuermann,
Friedrich-Alexander-Universität Erlangen-
Nürnberg (DE)

Organisation Ingrid Bollens, ECPE e.V.
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Venue Hotel Holiday Inn Nürnberg City Centre
Engelhardsgasse 12
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Graph: Holiday Inn Nürnberg City Centre
Graph front page: source: Istock



European Center for
Power Electronics e.V.

ECPE Tutorial

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

25 - 26 October 2023
Nuremberg, Germany



Cluster
Leistungselektronik

Thermal Engineering of Power Electronic Systems Part II

25 – 26 October 2023
Nuremberg, Germany

Thermal engineering of power electronic systems is a key to achieve high performance and reliability. With a clear focus on power modules the tutorial addresses the thermal design and validation of power electronic components exemplified by a 100 kW 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 choose 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 the comparison of a simulated power board with measurement and calibrate afterwards the simulation model.

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.

All presentations and discussions will be in English.

Programme

Wednesday, 25 October 2023

- 09:30 Start of Registration
- 09:45 Welcome
ECPE e.V.
- 10:00 Short Summary of the Results of
Tutorial Part1
Arendt Wintrich
- 10:20 Semiconductor-Level Thermal and Electrical
Failure Mechanisms
Francesco Iannuzzo
- 11:30 Temperature and Reliability: Package-Level
Failure Mechanisms I
Uwe Scheuermann

12:10 Lunch

- 13:10 Temperature and Reliability: Package-Level
Failure Mechanisms II
Uwe Scheuermann
- 14:10 Thermo-/Damage-Sensitive Electrical
Parameters
Francesco Iannuzzo
- 15:00 Thermal Impedance Measurement -
Preparation
Arendt Wintrich
- 15:15 Introduction to Experiment
Arendt Wintrich

15:30 Coffee Break

- 16:00 Thermal Impedance Measurement – Results
and Interpretation
Arendt Wintrich
- 16:15 Extraction and Application of Thermal
Networks
Martin Pfost
- 17:30 Wrap up 1st Day
- 18:00 End of 1st Day

19:30 Dinner

Programme

Thursday, 26 October 2023

- 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 Iannuzzo
- 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 Special Effects and Alternative Cooling
Technologies
Arendt Wintrich
- 15:15 TIM Materials
Arendt Wintrich
- 15:45 Wrap up 2nd Day, Final Discussion, Feedback

16:00 End of Tutorial

Course instructors:

- Prof. Francesco Iannuzzo, Aalborg University
- Prof. Martin Pfost, TU Dortmund University
- Prof. Uwe Scheuermann, Friedrich-Alexander-Universität Erlangen-Nürnberg
- Andreas Simon-Kajda, Siemens Industry Software
- Dr. Arendt Wintrich, Semikron Danfoss