Organisational Information

Sign up at: www.ecpe.org/events

Registration Deadline:

21 February 2023

Participation Fee:

€ 670,– *	for industry
€ 520,– *	for universities/institutes
€ 180,– *	for students/PhD students
	(limited spaces; copy of students ID required; dinner € 50,-* extra)

* plus VAT

- 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 50 % of the fee is non-refundable (substitutes are accepted anytime).

The number of participants is limited to 35 attendees.

02/01/23

Organisational Information

Organiser	ECPE e.V. 90443 Nuremberg, Germany www.ecpe.org
Technical Contact	Gudrun Feix, ECPE e.V.
Course Instructors	Prof. Martin Pfost, Technical University Dortmund Dr. Reinhold Bayerer, Physics of Power Electronics Dr. Karsten Fink, Power Integrations GmbH Dr. Arendt Wintrich, Semikron Danfoss
Organisation	Ingrid Bollens, ECPE e.V. +49 911 81 02 88 – 10 ingrid.bollens@ecpe.org
Venue	Novotel Milano Nord Ca' Granda Viale G.Suzzani, 13 20162 Milano | Italy

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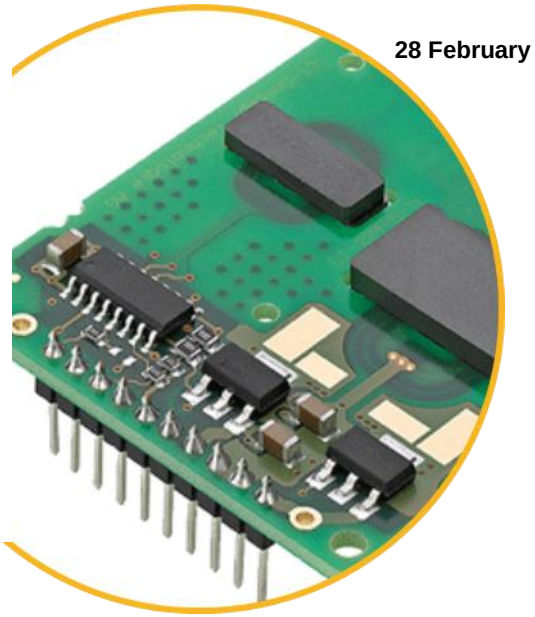
European Center for Power Electronics e.V.

ECPE Tutorial

Gate Drivers and Control Circuits of IGBTs and MOSFETs

28 February – 1 March 2023
Milan, Italy



ECPE Tutorial

Gate Drivers and Control Circuits of IGBTs and MOSFETs

28 February – 1 March 2023
Milan, Italy

Gate Drivers and control circuits are the interface between the signal level and the power stage within a power electronic system. They are responsible for a safe operation of the power switches.

The development of gate driving circuits for ideal operation of power electronics necessitates profound knowledge of semiconductor characteristics (MOSFETs, IGBTs), influence of gate voltage on switching behaviour, power supply of galvanically isolated parts of the circuitry, parasitics, and protection functions.

Beginning with MOSFETs, switching behaviour will be explained, and then derived for superjunction MOSFETs and IGBTs. As the mechanisms are basically the same for all voltage/power classes, no differentiation will be done between high and low power devices.

In the context of the development and adoption of innovative Wide-Band-Gap semiconductors, new challenges concerning robust operation at very fast switching speed and frequencies are also addressed to attain the expected gains at system level.

With this tutorial we want to transfer the necessary knowledge to drive and control IGBTs and MOSFETs in a safe way, both for modules and discrete devices

Course Instructors:

Prof. Dr. Martin Pfost, (Chair)
Technical University of Dortmund

Dr. Reinhold Bayerer,
Physics of Power Electronics

Dr. Karsten Fink
Power Integrations GmbH

Dr. Arendt Wintrich,
Semikron Danfoss

All presentations and discussions will be in English.

Programme

Tuesday, 28 February 2023

09:00 Registration & Welcome Coffee

09:15 Welcome and Introduciton
Gudrun Feix, ECPE e.V.

Systems, Semiconductors and their Control

09:30 Power Semiconductor Physics
- **Device Physics**

Martin Pfost

10:45 Coffee break

11:15 Control of Power Semiconductors
- **Firing or Controlling**
- **Control Behaviour and Trend of MOSFET**
- **Control Behaviour of IGBT**
  WBG Dev. @ Trend
- **Lowering Carrier Conc. Prior to Turn-off**
- **dV/dt- and dI/dt-Control**
- **Gate-Inductance**
- **Safe Operation area**

Reinhold Bayerer

12:45 Lunch

13:45 Continuation - Control of Power Semiconductors
Reinhold Bayerer

15:15 Coffee Break

How to Control the Gate

15:45 Aspects of Driver Supply Voltages
- **Switching Behaviour with Different Turn-on Voltages**
- **Switching with and without Negative Gate Switch-off Voltage**
- **Supply Voltage for SiC MOSFET**
- **Influence on SOA, Losses, Driver Power, Timing**

Arendt Wintrich

17:30 End of 1st Day

19:30 Dinner

Programme

Wednesday, 1 March 2023

09:00 Start of 2nd Day

Control & Design Considerations

09:00 Gate Driver Isolation and Isolation Coordination
- **Galvanic Isolation**
- **Level-Shifter**
- **Bootstrap Power Supply**

Karsten Fink

10:30 Coffee Break

11:00 Fast Switching and Common Mode Noise Immunity
Karsten Fink

12:00 Data Acquisition at Gate Unit Level
- **Transient Current Measurement**
- **On-State Voltage Measurement**
- **Temperature Measurements and Observer-based Temperature Estimation**

Martin Pfost

12:30 Lunch

Advanced Control and Design Considerations

13:30 Gate Driver Protection Function
- **Protection Circuits**
- **Current Measurement and Short Circuit Protection**
- **Overvoltage Protection**
- **Signal Monitoring**

Arendt Wintrich

14:45 Advanced Gate Drive Approaches
- **More Experimental Approaches**
- **Gate Drivers for WBG Semiconductors**

Martin Pfost

15:30 Open Questions and Discussion (all)

16:00 End of Tutorial