# Analysis and development of a low voltage GaN-based half-bridge gate driver circuit for DC-DC converter applications

The technology of electronic devices in the low voltage field (<200V) is experiencing a revolution in performance with the advent of Gallium Nitride (GaN) wide-band components. These GaN currently available technologies work as Field Effect Transistors (FET) and are mainly in enhancement technology. In hard switching, they can reach higher frequencies than silicon MOSFETs with higher power density for the same volume of semiconductor used.

GaN FETs require a suitable drive system for the gate voltage levels and the desired switching speed. Furthermore, they need an adequate insulation system and optimized dead-time management when connected in half-bridge or full-bridge circuits. Moreover, when inserted into the desired application, the driving-control circuit must consider the design requirements to maximize the converter performance.

The thesis is oriented to the study and development of a driving-control circuit for GaN FETs in Half-Bridge configuration, in close collaboration with Texas-Instrument (TI) of the Freising site, which specializes in integrated circuits for the piloting of low-voltage power devices.

The thesis work will be mainly carried out in the lab Texas-Instrument (TI) at Freising (Germany)
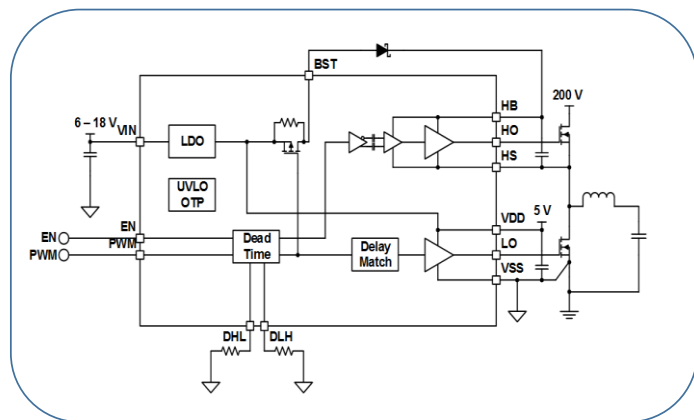
The study includes the following points:

- Study of the state-of-the-art of driver circuits for GaN FET as a single switch and in a Half-Bridge configuration
- Development and simulation of a complete driver circuit for GaN FET devices in Half-Bridge configuration.
- Design feasibility analysis of the described circuit
- Development of a circuit prototype of the driver circuit (Advanced and development objective of the thesis to be agreed upon and elaborated with the industrial partner)

Required skills

- Basic knowledge of power electronics and energy conversion
- Basic knowledge of analog and digital electronics to be developed during the thesis
- Basic knowledge of CAD design (as Cadence) and simulation tools is preferred
- Familiarity with GaN technology is an added advantage

What will you learn

- Know the technology, operation, and applications of GaN FET broadband devices
- Analyze and design the driving circuits of the latest generation GaN FET devices with a single switch and Half Bridge configuration.

- It knows how to critically develop a circuit design of a gate driver through dedicated simulation tools (as Cadence Virtuoso).
- Define the necessary circuit components and their sizing for the project definition.
- Advanced part: definition of the IC layout using the Cadence software to create the prototype, assembly, and testing.

For those interested, contact and send a CV to the attention of prof. Salvatore Musumeci email: salvatore.musumeci@polito.it

Information on the position in TI are available at:

https://careers.ti.com/job/17101058/analog-design-engineering-intern-m-f-d-freising-de/

Reference TI Freising: Ing. Emiliano Puia