

RWTH Technology

An Isolated Gate Driver Utilising Simultaneous Wireless Information and Power Transfer



Challenge

An isolated gate driver is a crucial component in power electronic systems to drive power electronic semiconductor switching devices. In numerous power electronic circuits the source potentials of these power devices will not be fixed to a common ground potential. Instead, they are at a floating high voltage potential, which depends on the circuits operating point. The difference between the ground potential on the control circuit side and this high voltage potential at the power electronic circuit side can be up to several kilo volts. Isolated gate drivers ensure correct switching operation while providing galvanic and safety isolation between the low voltage control circuitry and the high voltage floating potential. Modern power electronics rely on isolated gate drivers for the implementation of numerous applications, e.g. solar/wind energy harvesting, power converters in electric vehicles or home appliances.

However, a typical isolated gate driver requires transformer-based power transmission and signal transmission based on optocouplers, which lead to bulky and costly designs.

Solution

Our solution is an isolated gate driver which transmits both power and the switching signal via a single giga hertz frequency coupler to the power electronic circuit side. By waveform-engineering, the switching signal for the power electronic switch is modulated onto the giga hertz frequency signal at the control circuit side, transmitted via the high frequency coupler to the power electronic circuit side, and demodulated here to regain the switching signal and the signal power separately. Thereby, a compact size can be realized due to the use of a single coupler at giga hertz frequency while the transferred switching signal and signal power can be set independent of each other. Furthermore, the giga hertz frequency coupling channel has the benefit of minimal coupling capacitance between control circuit and power electronic circuit side which reduces transient coupling from the power electronic circuit to the control circuit.

Advantages

- Compact size
- Support of fast switching speeds and low duty-cycles
- Robustness and high-temperature operation
- Cost-efficiency
- Potential semiconductor process integration
- Reduced coupling capacitance

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Fields of application

Isolated Gate-Drivers for Power
Electronic Semiconductor Switches

Keywords

#Gate-Driver;
#Power-Semiconductor;
#Isolated;
#Wireless;

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Status

- Patent application at the German Patent and Trademark office. The patent application pending is not yet published in the Patent Gazette. Only after the first publication of the patent application, the applicant can derive rights therefrom and can especially claim compensation from third parties.
- International patent application
- The concept has been proven in simulations and a prototype is currently being designed.

RWTH Aachen University is looking for partners for patent exploitation and for research partners for joint development or contract research.