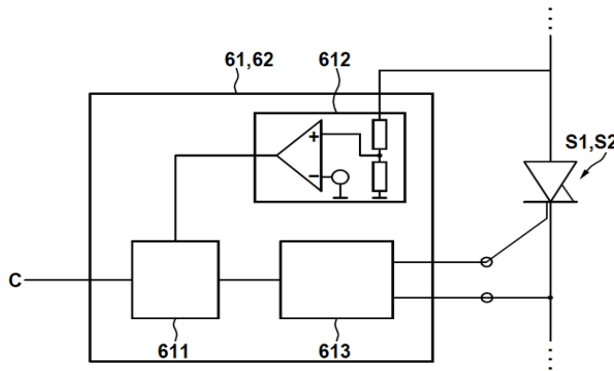


A Method for Operating and Protecting a Converter



A simplified illustration of the protection scheme integrated into gate drive unit

Ref. Nr

6.2213

Keywords

DC Transformer, DC-DC converter, power electronics, protection

Intellectual Property

PCT/EP2022/072361

Publications

Shoot-Through Protection for an IGCT-Based ZVS Resonant DC Transformer, IEEE Transactions on Industrial Electronics (2022)
[10.1109/TIE.2022.3170614](https://doi.org/10.1109/TIE.2022.3170614)

Date

24/11/2023

Description

A method to operate a resonant DC-DC converter and achieve protection against the short circuit in the switching leg. The converter has two active power stages and a medium frequency operated transformer, which provides galvanic isolation. The converter operates under zero voltage switching conditions and under normal operating conditions every active power semiconductor device (e.g., an IGCT) commutates the current of its own antiparallel freewheeling diode during a turn-on event. A method monitors the conduction state of the antiparallel diode by observing the voltage drop across the device and relates this information with expected operating conditions. If it is determined that at the time when the turn-on command is available for the active device, the antiparallel diode is conducting, the corresponding active switching device is allowed to be turned on, as this implies that the complementary active device has been safely turned off before and it is not in the short circuit conditions. Such monitoring can be realized directly on the gate unit (gate driver) or on a dedicated electronic circuit connected across the switching device or in a central control unit.

Advantages

Increased use of resonant converters for high-power DC-DC conversion needs adequate solutions to protect sensitive converter elements and increase the reliability of solutions. Determining the conductive state of the antiparallel diode can be achieved relatively inexpensively. The advantage of the proposed method is the ability to integrate protection very close to the semiconductor devices, namely into the gate driver, even though other realizations are possible. Information gathered in the gate driver can be easily passed to the upper control layer for further postprocessing or condition health monitoring. Method requires minimum number of external signals, and they are mostly available for protection reasons.

Applications

- Power semiconductors
- Power electronics
- Power systems
- DC grids
- DC-DC converters