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Driving Circuitry with Active Voltage Clamping across IGBTs in a Marx Configuration

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For a device for treatment of food by pulsed electric fields a modular semiconductor-based Marx generator has been designed. Each stage comprises a parallel configuration of inexpensive IGBT switches forming together the pulse switch. A control signal allows synchonized switching of the stages. It is distributed to the stages inductively via ferrite core transformers. Separate gate drivers have been implemented at each stage next to the IGBTs. Such a design enables fast switching and, hence, low switching losses, without the need for the control signal to transfer the total power required for switching. The gate drivers are powered continuously by a rectified AC current sharing its signal path to the stages with the control signal for synchronized switching. For the mentioned application, the switches are operated mainly as closing switches. However, in case of a flash-over at the load fast opening of the switches is required. For protection against inductive over-voltage across the switches instead of free-wheeling diodes a circuit for active clamping has been added. The driving circuitry has been tested successfully in a Marx configuration. The paper describes selected details of the driving circuitry and presents results of tests.

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