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Ultra-fast generator for impact ionization triggering

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Thyristors triggered in impact ionization mode find their dI/dt capability boosted by up to three orders of magnitude. This innovative triggering requires applying an important overvoltage on the anode-cathode of the thyristor with a slew rate > 1kV/ns. Compact pulse generators based on COTS components would allow the spread of this technology into numerous applications, including fast kicker generators for particle accelerators.
Our approach for such a compact pulse generator begins with a HV SiC MOS with an ultra-fast super-boosting gate driver. Super boosting in the gate of a 1.7kV rated SiC MOS allows to reduce its rise time by a factor of > 25 (datasheet tr = 20ns vs. measured tr < 800ps), resulting in an output voltage slew rate > 1kV/ns and an amplitude > 1kV. Parallel MOSFETs triggered in synchronisation deliver higher current at this stage.
Next, additional boosting is obtained by a Marx generator with D2PAK thyristors, reaching an output voltage slew rate > 11kV/ns. Finally, creating sufficient current necessary for the triggering of a big thyristor presents a new challenge. In this paper, we present an upgraded board design with a higher current output capacity.

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Footnotes

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