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Implementation of High-Voltage Switch Using Inductive Energy for Switch Synchronization

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For discrete semiconductor switches with smaller ratings stacked for high-voltage high-current applications, there is the need to ensure reliable gate synchronization of all the switches in the stack. The delay of switching of separate stages must be minimized by reducing the effects of stray inductances in the switch operation. This paper describes the design of a HV switch for high-voltage, high-current pulsed power applications with reliable switch synchronization. In this design, insulated-gate bipolar transistor (IGBTs) and their gate driver circuits are compactly fitted on a switch module. A single power source serving as the primary of the isolation transformers of all stacked IGBTs provides synchronized gating signal to drive the stacked switches. Due to the fast di/dt rise of this inductive energy, switch turn-on delay time is greatly improved, allowing for reliable switch synchronization at fast speed. Rated pulse output voltage and current of 10 kV and 1.5 kA respectively were applied to a load using a configuration of the developed HV switch and a capacitor charger, and by experimental results, the operation of the proposed circuit was verified to be effectively used as a switch for pulse discharging

Index Terms —High-voltage switches, gate drive circuit, switch synchronization, pulsed-power application

Authors: APPIAH, Gideon Nimo (University of Science and Technology); Mr BAE, Jung Soo (University of Science and Technology, Korea); Dr JANG, Sung-Roc (KERI); Dr KIM, Hyoung-Suk (korea Electrotechnology Research Institute); RYOO, Hong-Je (Chung-Ang University); Mr YU, Chan Hun (KOREA ELECTROTECHNOLOGY RESEARCH INSTITUTE)

Presenter: APPIAH, Gideon Nimo (University of Science and Technology)

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