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An Active Gate Control for Press-Pack IGBTs in Series applied for high-voltage switch

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Due to safety and reliability concerns, fast switch is required for the J-TEXT ECRH system to cut off the 100 kV power supply within 20 us when fault occurs. For its high switching speed, excellent controllability and small size, IGBT is an ideal choice as the basic component of the switch to satisfy the fast response requirement. Obviously, connecting multiple IGBTs in series is an essential approach in high-voltage applications. However, due to the on-state characteristic deviations of each IGBT and stray parameters of the main circuit, static and dynamic overvoltage problems may occur. It will damage the IGBTs, even gives rise to device failure. So voltage balance between the IGBTs connected in series is the main task in the design of the switch. This paper presents an active gate control method for IGBTs in series. It limits the dv/dt on IGBT to inhibit overvoltage by multi-changing gate resister. In the meantime, the trigger time of each IGBT would be compensated for voltage balance purpose. In addition, considering the significant advantage of Press-Pack technology in series application, Press-Pack IGBT (PPI) has been applied to enhance the reliability of the switch. The test prototype is a 5000 V/150 A switch with 4 PPIs in series. The simulation and experimental results show that the method can effectively improve the dynamic-voltage balance. All in all, the work presented in this paper has a significant reference value for practical engineering applications.

Eligible for student paper award?

Yes

Authors: Prof. ZHANG, Ming; Mr WANG, Dongyu; Dr MA, Shaoxiang; Dr YANG, Yong; Dr LI, Chuan

Co-authors: Prof. YU, Kexun; Prof. PAN, Yuan

Presenter: Mr WANG, Dongyu

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