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# A Review of Voltage Sharing Control Methods for Applications of Series-Connected IGBTs in Pulsed Power Generation

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Pulsed power generation is required by various types of industrial applications, including food and water sterilization, particle acceleration, low-temperature plasma, or Tokamak vertical stabilization, etc. The voltage level of pulsed power generators ranges from a few kV to hundreds of kV. With the past development of semiconductor devices, solid-state pulse generation has been growing due to longer life span, higher voltage rise rate, and more flexibility in pulse shape. Based on the requirements of power rating and operation frequency, different types of semiconductor devices can be selected as switching units [1]. Silicon IGBTs offer a good balance between power capacity and switching frequency. Furthermore, recent development in wide bandgap devices, such as silicon carbide(SiC) IGBTs, has expanded limits in voltage capacity and switching speed considerably, presenting more potential for solid-state pulse generators. To fully exploit the merits of Si and SiC IGBTs, series connection of the devices is usually needed for high-voltage applications since the voltage levels of available commercial Si and SiC IGBTs are no higher than 6.5 kV and 1.2 kV, respectively. Proper control must be implemented to achieve balanced voltage sharing among the IGBTs and to prevent device damage or derating.

In the paper, a review of major contemporary series IGBT control methods for both silicon and silicon carbide IGBTs will be provided, including a self-balancing control implemented and verified experimentally by the authors. The methods will be analyzed and benchmarked based on their performance, loss, speed, and estimated cost. The paper will also compare series-connected devices to a single high rating device in the above-mentioned aspects. The paper is aimed to serve as a guideline for benchmarking as well as selecting series IGBT control methods for high-voltage pulsed power generations with solid-state units.

REFERENCES

[1] W. Jiang, K. Yatsui, K. Takayama, M. Akemoto, E. Nakamura, N. Shimizu, A. Tokuchi, S. Rukin, V. Tarasenko, and A. Panchenko, “Compact solid state-switched pulsed power and its applications,”Proceedings of IEEE, pp. 1180–1196, Jul. 2004.

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