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High repetition tests of a pulsed power supply using SiC-MOSFETs for a fast kicker system in KEK-PF

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A pulsed power supply (PPS) using SiC-MOSFETs is an essential component in the camshaft-bunch system at KEK-PF *. The system requires the PPS to generate half-sine pulses with a peak current of 500 A, a pulse width of 200 ns, and a repetition rate (rep-rate) of 800 kHz. We have developed a prototype PPS consisting of a resonant circuit (RC) to generate half-sine pulses with a SiC-MOSFET switching module (SWM). The SWM, manufactured by NexFi Technology, has a rated voltage of 24 kV and a maximum rep-rate of 400 kHz. The main challenges in RC development were to reduce the charging time of the RC and power consumption during high-frequency operation. Additionally, film capacitors used in a previous prototype * required replacement because their permittivity had degraded during high-frequency operation. To overcome these challenges, we designed a RC with an energy recovery circuit, which reduced the charging time to 1 μ s and power consumption by 90%. To ensure reliability, the film capacitors were replaced with vacuum capacitors. This report presents the prototype design, performance tests at a rep-rate of 400 kHz, and evaluation of long-term reliability at a rep-rate of 100 kHz.

Footnotes

*S. Shinohara et al., Proc. IPAC23, THPA168

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