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## Increasing the Pulse Repetition Rate for Solid State Thyatron Replacements

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Silicon Power reports increased pulse repetition rate capability for Solid State Thyatron Replacements (SSTR) utilizing enhanced SolidTRON technology. Varying amounts of minority carrier lifetime killing in our semi-conductors has enabled demonstration of 300ns wide capacitive discharge pulses up to 10kA/cm<sup>2</sup> at pulse repetition rates up to 50kHz at a junction temperature of 110°C.

While Silicon Power has found success in displacing some Thyatrons, the higher pulse repetition rates enjoyed by Thyatrons and Ignitrons had been a challenge to overcome. Finally, a well-documented procedure produces quantifiable tradeoffs for frequency capability versus conduction losses.

The superior conduction efficiency and low leakage currents of SolidTRON products permits modest lifetime killing to increase operational pulse repetition rates without suffering detrimental increases in energy losses. Specifically, at 110°C a 20x improvement in frequency capability is achieved with a modest 75% increase in conduction losses (at 1kA/cm<sup>2</sup>). More importantly, comparing the peak current achieved in identical setups between as-fabricated devices and those with the highest frequency capability differ by only 1.5%.

Additionally, these gains are achieved without a complicated gating scheme. The improved pulse repetition rate was demonstrated using a simple pulse transformer; where galvanic isolation is provided with magnetic coupling. The modest minority carrier lifetime killing allows the device to self-commutate without gate assisted turn-off.

This paper includes plots of the effects of lifetime killing on the minimum period required between pulses, the impact of conduction losses as a function of current density, and leakage currents at junction temperatures ranging from 25°C to 110°C.

**Author:** WALDRON, John (Silicon Power)

**Presenter:** WALDRON, John (Silicon Power)

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