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2P57 - Silicon Carbide drift step recovery diode structures evaluated as >10kV nanosecond pulse power switches using Mixed-Mode simulation

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Mixed-Mode modeling, is a combination of SPICE circuit and finite element device physics, is used to evaluate SiC drift step recovery diode structures for optimal operation as opening switches for the generation of narrow high voltage pulses in a single loop resonant LC circuit. This comparison is made as a practical means to define device design elements and process steps prior to the fabrication of actual SiC devices.
Parameter entitlements of single devices are made for diodes in the 2000 –3000 voltage rating range, anticipating serial stacks of these devices to achieve > 10 KV peak nanosecond voltage pulses. Epitaxial structures, high voltage terminations, and carrier lifetime are explored as device variables, with resultant peak voltage, rates of rise, and voltage gain are calculated across a 50-ohm resistive load.
Model results to date indicate for single devices with peak voltages of ˜ 2600 volts, dV/dt (90 to 10% of peak) ˜2100 volts/nanosecond are possible, pulse FWHM of 2 nanoseconds, and voltage gains (Vpeak/Vsupply) in the range of 12 to 17 can be achieved.
Such devices have potential uses in a variety of pulse power applications e.g. ignition, cell membrane modifications, and environmental (pollution) control.

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