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HIGH CURRENT AND CURRENT RISE RATE THYRISTOR BASED SWITCHES

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Thyristors of tablet design with diameters of silicon wafers of 40 to 56 mm and an operating vol-tage of 2 to 2.4 kV DC were triggered by an external overvoltage pulse applied across the thyris-tor main electrodes. In experiments a voltage rise rate across the thyristor was changed from 1 to 6 kV/ns. Under such conditions the thyristor closing process occurred due to initiation and propa-gation of a fast ionization front across the semiconductor structure, which fills the structure with dense electron-hole plasma within 200 to 400 ps. The thyristor based switches contained 2 to 9 series connected thyristors and operated in this triggering mode in different discharge circuits. Operating voltage was 5 to 20 kV, capacitance of discharge capacitors was 2 μF to 1.2 mF, and stored energy was 0.4 to 15 kJ. The experimental results obtained covered the following range of discharge parameters: discharge current amplitude of 10 to 200 kA, current-rise rate of 15 to 130 kA/μs, current rise time (0.1-0.9 level) of 0.4 to 5 μs, pulse duration (FWHM) of 1 to 20 μs, and switching efficiency of 0.85 to 0.97. Effect of the voltage rise rate at the triggering stage as well as temperature of the silicon wafer on the thyristors main switching characteristics will be shown. Results of the thyristors testing in pulse repetition mode will be given. The paper will discuss the experimental circuitry, tested switches design, and results obtained. The results of numerical si-mulations of the thyristor switching process will also be given.

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