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Study of the spatial distribution of minority carrier diffusion length in epiplanar detector structures

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Abstract:

One of the key parameters determining detection properties of silicon PIN detector structures (p^+-ν-n^+ or n^+-ν-p^+) is minority carrier diffusion length in p-n junction regions p-n (p+-ν or n^+-ν). The parameter concerned strongly depends on quality of the starting material and technological processes conducted and has a significant impact on detector parameters, in particular dark current intensity. Thus, the parameter must be determined in order to optimise the design and technology of detectors. The paper presents a method for measuring the spatial distribution of effective carrier diffusion length in silicon detector structures, based on the measurement of photoelectric current of a non-polarised structure illuminated (spot diameter of 250 µm) with monochromatic radiation of two wavelengths λ_1 = 500 nm (silicon penetration depth of around 0.9 µm) and λ_2 = 900 nm (silicon penetration depth of around 33 µm). The value of diffusion length was determined by analysing the spatial distribution of optical carrier generation and values of photoelectric currents.