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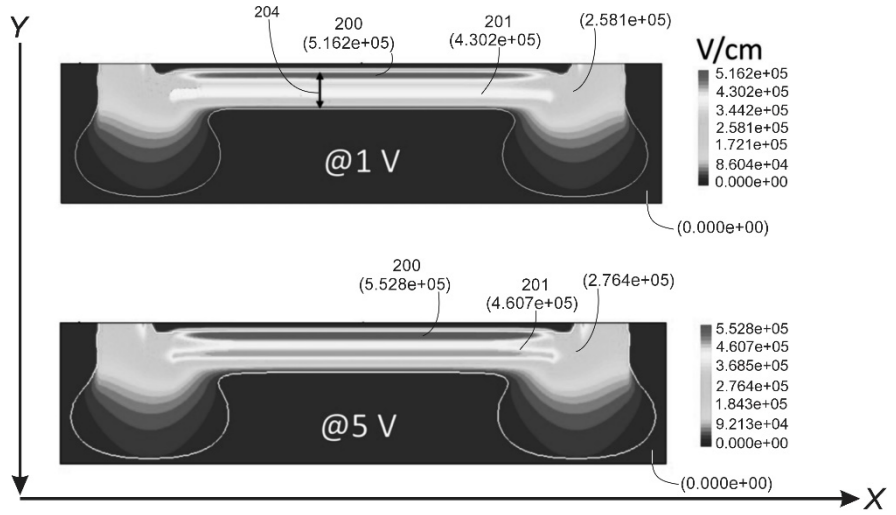
Licensing Opportunity

TTO – Technology Transfer Office

Double multiplication region method for SPAD development



Exemplary single-photon avalanche diodes of the invention and the associated electrical fields.

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Keywords

single-photon avalanche diodes, SPAD, LiDAR

Intellectual Property

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Description

SPADs are widely used in areas like LiDAR, optical tomography, and fiber optic communications, but their ability to detect NIR photons is hindered by low photon detection probabilities and high excess bias voltage requirements. The proposed design introduces an n-p-n-p junction profile formed by a p-well layer and a high-voltage n-well layer. This structure creates a wide depletion region, at least 1 µm in width, enabling efficient absorption of NIR photons. It also incorporates two distinct multiplication regions, with doping concentrations and depths optimized to maintain consistent electric field strength.

Advantages

The innovative double multiplication region configuration significantly enhances sensitivity to NIR wavelengths by improving photon detection probabilities. The design reduces the need for high excess bias voltages, simplifying pixel circuit design and ensuring compatibility with the rail-to-rail voltage range of digital circuits. Additionally, the device is fully compatible with standard silicon CMOS technology, making it cost-effective and easily integrable into existing systems. The inclusion of a wide depletion region further enhances the device's capability to capture deeply absorbed NIR photons, boosting overall efficiency.

Applications

- LiDAR systems for precise distance measurement and mapping in automotive and industrial applications.
- Optical tomography for high-resolution imaging in medical diagnostics and biological research.
- Fiber optic communications to enable high-sensitivity signal detection in telecommunications.
- Photon-counting technologies for advanced imaging and measurement in scientific and industrial domains.