Bandwidth Analysis of a p-π-n Si Photodetector

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Abstract

The aim of this study is the bandwidth analysis of a p-π-n photodetector, three different junction areas (0.008, 0.014, 0.02) mm\(^2\) were used with π-layer width of 5 μm, and the π-layer width required to get maximum bandwidth is 3.4 μm. The results showed that the bandwidth increases with the decreasing of detector area, this is because when detector area decreases the junction capacitance also decreases. The obtained bandwidth is 7.8 GHz at π-layer width of 5 μm, the required biasing voltage is 17.55 V. The best bandwidth obtained is 9 GHz at a π-layer width of 3.4 μm, an area of 0.008 mm\(^2\) and required biasing voltage is 11.934 V. In this paper mathematical relations have been found to get bandwidth, maximum bandwidth, and the requirements to achieve it. The requirements include choosing values of, π-layer width, biasing voltage, electric field, and carriers velocity. The mathematical relations results are very close to the experimental results. The results are achieved with the aid of MATLAB programming tool version 8.5.0.1976013 (R2015a).
References


Index Terms

Computer Science

Circuits and Systems
Keywords

Si, p-π-n, Photodetector, Bandwidth, Photodiode.