An Investigation of Functional Design in Si Integrated Photodiode Sensors

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Mikio Kyoumasu

An integrated photodiode sensors, composed of Si photodiode and integrated circuits, have many convienient characteristics for I-V conversion and data processing, such as a forming flexibility or numbers, the capability of interconnection with sensors and integrated circuits, and the high external noise rejection ratio. This paper describes the study of improving the operating speed, the sensitivity and the capability of applications through different two approaches.

One is to investigate the suitable optical and circuits designs for applying the above excellent characteristics, and obtaining the expected functions. From this approach, an optical pushpull circuit, an auto DC photocurrent correction circuit under exposure light, a differential logarithmic amplifier and a charge amplifierer were investigated.

The other is to produce a new integrated photodiode with PIN structure, which results in the high speed operation, high sensitivity and optical response. This structure was realised using double buried layer and double epitaxial technology ($N/P^{--}/P^{++}$ structure) based on P^{++} substrate and obtained 700 MHz cut-off frequency at 10 V bias.

Above technology was applied to optical link, transimpedance amplifier and integrated photosensor. Although this study is restricted to developping the operating speed, the sensitivity and the capability of applications integrated photodiode sensors using two different aproches, we will develop the low power consumption and the miniatuarization technology with further investigations.