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Single event transient effects on 3T and 4T CMOS active pixel sensors for different technologies (Article)

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Abstract

The widely used CMOS Active Pixel Sensors (APS) in space imaging mission are vulnerable to radiations known as Single Event Transient (SET). This paper focus on 3T and 4T CMOS APS with technology from 130 nm scaling down to 32 nm, simulated using various Linear Energy Transfer (LET) magnitudes ranging from 3.3 to 67.7 MeV.cm^2/mg. Larger transient currents were observed at higher LET for both APS architectures. The peak drain current of 3T increases with slightly steeper slope by roughly 8% than 4T due to the difficulty of electron transfer in 4T. In 3T, 130 nm, 90 nm, 65 nm and 45 nm override the 32 nm technology by 13.93%, 9.09%, 4.43% and 2.06%, respectively. The total charge collection of the 3T is constantly higher than the 4T APS by the ratio of at least 1.25 indicates 4T has a higher radiation hardness. A bright spot degradation is expected to occur in the image if the transient signal is more than 20% of the original signal which mainly attributed to the lower operating voltage and smaller nodal capacitance. From this study, 4T CMOS APS shown more radiation hardness than the 3T CMOS APS and 32 nm technology exhibits lowest radiation-tolerant. © 2019, © 2019 Engineers Australia.

SciVal Topic Prominence

Topic: Radiation damage | Charge coupled devices | Dark signal

Prominence percentile: 75.893

Author keywords

Active pixel sensor | CMOS technologies | linear energy transfer | radiation | single event transient

Indexed keywords

Engineering controlled terms: Capacitance | CMOS integrated circuits | Drain current | Energy transfer | Hardness | Heat radiation | Nanotechnology | Pixels | Radiation hardening

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