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Australian Journal of Electrical and Electronics Engineering
Volume 16, Issue 3, 3 July 2019, Pages 117-126

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.cm²/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

Engineering uncontrolled terms

Active Pixel Sensor CMOS active pixel sensors CMOS technology Linear energy transfer Radiation hardness Radiation tolerant Single event transients Transient current

Engineering main heading:

Transients

Funding details

Funding sponsor	Funding number	Acronym
Ministry of Higher Education, Malaysia	RIGS16-338-0502	MOHE
	SP15-063-0185	
Ministry of Higher Education, Malaysia		MOHE

- 1
This research is supported by a grant from Malaysia Ministry of Higher Education for RIGS grant scheme (RIGS16-338-0502).
- 2
This work was supported by the Ministry of Higher Education, Malaysia [ANGKASA (SP15-063-0185)].

ISSN: 1448837X
Source Type: Journal
Original language: English

DOI: 10.1080/1448837X.2019.1624245
Document Type: Article
Publisher: Taylor and Francis Ltd.

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