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TITLE OF THE TECHNOLOGY

Avalanche photodiode based imagers in conventional CMOS/Bipolar/BiCMOS processes, and electronics

FUNCTION

Ultra fast, ultra sensitive and low cost development of Si-based photon/ionizing particle detectors

ABSTRACT/DESCRIPTION (no more than 700 characters, spaces included)

The technology corresponds to the generation of solid-state imagers based on Geiger-mode Avalanche Photodiodes developed in conventional processes used for the fabrication of today microelectronics. This technology can achieve the accuracy, precision and speed required in many outstanding applications. The basis of the technology is to obtain access to individual pixels of very small size. This is achieved by integrating together the sensor and the readout. The biasing of the photodiodes far above the breakdown voltage, makes the electric field in the multiplication region of a few hundreds of kV/cm, which provides sufficient internal gain to operate without complex amplification circuits.

TYPE: (expertise, SW, technology, process, packaging/integration, others)

Expertise

FEATURES (targeted / achieved)

Pixel pitch < 15µm

Detection time < 150fs; Jitter time < 2ns

Sensitivity to 550nm light > 18 bits

Sensor integrated with readout electronics in the same device (die)

PURPOSE / OBJECTIVES

Develop large arrays of imaging/detection devices

Improve noise figures, fill factor.

TECHNOLOGY STAGE (EX.: R&D, prototype, available, ready for licensing, patented technology...)

R&D

APPLICATION DOMAINS (as applicable for this specific item)

EX.: medical imaging, radiation therapy dosimetry, high-energy physics, astronomy/astrophysics, material analysis, systems for radiation detection and monitoring.

3D imaging (automotive industry, human-computer interfacing, machine-vision, biometrics, ...)

Photon counting (optical fiber communications, general low-light-level detection, laser radar, biomedical devices, ...)

Particle tracking

ADVANTAGES

Access to individual pixels:

- High granularity; 10um pixels is demonstrated
- High speed; with integrated readout circuits

Low cost and low power

Very high sensitivity compared with other vision devices (CCDs, APDs, ...)

LIMITATIONS

Fill factor (limitation in tracking, not in vision), sensitivity, noise and other characteristic parameters are dependent of the fabrication process, which CAN NOT be usually controlled by the user.