

Session 10: Optoelectronics, Displays, and Imagers - Image Sensors

Monday, December 3, 1:30 PM

Plaza B

Co- Chairs: T. Sakai, NHK

L. Grant, OmniVision

1:35 PM - 2:00 PM

10.1 1.5 μ m dual conversion gain, backside illuminated image sensor using stacked pixel level connections with 13ke- full-well capacitance and 0.8e- noise, V. C. Venezia, A. C-W Hsiung, K. Ai, X. Zhao, Zhiqiang Lin, Duli Mao, Armin Yazdani, Eric A. G. Webster, L. A. Grant, OmniVision Technologies

A 1.5 μ m pixel size, 8 mega pixel density, dual conversion gain (DCG), back side illuminated CMOS image sensor (CIS) is described having a linear full-well capacity (FWC) of 13ke- and total noise of 0.8e- RMS at 8x gain. The sensor adopts a world smallest 1.5 μ m pitch, stacked pixel-level connection (SPLC) technology with greater than 8M connections, maximizing fill-factor of the photodiode and dimensions of the associated transistor dimensions to achieve a large FWC and low noise performance at the same time. In addition, by allocating transistors into two different layers, the DCG function can be realized with 1.5 μ m pixel size.

2:00 PM - 2:25 PM

10.2 A 0.68e-rms Random-Noise 121dB Dynamic-Range Sub-pixel architecture CMOS Image Sensor with LED Flicker Mitigation, S. Iida, Y. Sakano, T. Asatsuma, M. Takami, I. Yoshida, N. Ohba, H. Mizuno, T. Oka, K. Yamaguchi, A. Suzuki, K. Suzuki, M. Yamada, M. Takizawa, Y. Tateshita, and K. Ohno, Sony Semiconductor

This is a report of a CMOS image sensor with a sub-pixel architecture having a pixel pitch of 3 μ m. The aforementioned sensor achieves both ultra-low random noise of 0.68e-rms and high dynamic range of 121 dB in a single exposure, further realizing LED flicker mitigation.

2:25 PM - 2:50 PM

10.3 A 24.3Me- Full Well Capacity CMOS Image Sensor with Lateral Overflow Integration Trench Capacitor for High Precision Near Infrared Absorption Imaging, M. Murata, R. Kuroda, Y. Fujihara, Y. Aoyagi, H. Shibata*, T. Shibaguchi*, Y. Kamata*, N. Miura*, N. Kuriyama*and S. Sugawa, Tohoku University, *LAPIS Semiconductor Miyagi Co., Ltd.

This paper presents a 16 μ m pixel pitch CMOS image sensor exhibiting 24.3Me- full well capacity with a record spatial efficiency of 95ke-/ μ m² and high quantum efficiency in near infrared waveband by the introduction of lateral overflow integration trench capacitor on a very low dopant concentration p-type Si substrate. A diffusion of 5mg/dl concentration glucose was clearly visualized by an over 71dB SNR absorption imaging at 1050nm.

2:50 PM *Coffee Break*

3:15 PM - 3:40 PM

10.4 A HDR 98dB 3.2 μ m Charge Domain Global Shutter CMOS Image Sensor (Invited), A. Tournier, F. Roy, Y. Cazaux*, F. Lalanne, P. Malinge, M. McDonald, G. Monnot, N. Roux**, STMicroelectronics, **CEA Leti, **STMicroelectronics**

We developed a High Dynamic Range (HDR) Global Shutter (GS) pixel for automotive applications working in the charge domain with dual high-density storage node using Capacitive Deep Trench Isolation (CDTI). With a pixel size of 3.2 μ m, this is the smallest reported GS pixel achieving linear dynamic range

of 98dB with a noise floor of $2.8e^-$. The pinned memory isolated by CDTI can store $2 \times 8000e^-$ with dark current lower than $5e^-/s$ at 60°C . A shutter efficiency of 99.97% at 505nm and a Modulation Transfer Function (MTF) at 940nm better than 0.5 at Nyquist frequency is also reported.

3:40 PM - 4:05 PM

10.5 High Performance 2.5 μm Global Shutter Pixel with New Designed Light-Pipe Structure, *T. Yokoyama, M. Tsutsui, Y. Nishi, I. Mizuno, V. Dmitry, A. Lahav TowerJazz*

We developed a 2.5 μm global shutter (GS) CMOS image sensor pixel using an advanced Light-Pipe (LP) structure designed with novel guidelines. To the best of our knowledge, it is the smallest reported GS pixel in the world. The developed pixel shows an excellent Quantum Efficiency (QE), Angular Responses (AR) and very low Parasitic Light Sensitivity (PLS). Also, even in oblique light condition of 10 degrees, the 1/PLS is maintained to about half value. These key characteristics allow development of ultra-high resolution sensors, industrial cameras with wide aperture lenses and low form factors optical modules for GS mobile applications.

4:05 PM - 4:30 PM

10.6 Back-Illuminated 2.74 μm -Pixel-Pitch Global Shutter CMOS Image Sensor with Charge-Domain Memory Achieving 10k e- Saturation Signal, *Y. Kumagai, R. Yoshita, N. Osawa, H. Ikeda, K. Yamashita, T. Abe, S. Kudo, J. Yamane, T. Idekoba, S. Noudo, Y. Ono, S. Kunitake, M. Sato, N. Sato, T. Enomoto, K. Nakazawa, H. Mori, Y. Tateshita, and K. Ohno, Sony Semiconductor*

A 3208×2184 global shutter image sensor with back-illuminated architecture is implemented in a 90 nm/65 nm imaging process. The sensor, having 2.74 μm -pitch-pixels, achieves 10000 electrons full-well capacity and -80 dB parasitic light sensitivity. Furthermore, 13.8 e^-/s dark current at 60°C and 1.85 erms random noise are obtained. In this paper, the structure of a pixel with memory along with saturation enhancement technology is described.