

CIS STACKING TECHNOLOGY : overview and future outlook

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Abstract

A historical overview and technical background will be given of the CMOS image sensor stacking technology. Stacking technology does allow to extend the pixel volume, available to implement electronic circuitry, in the third dimension. Although the idea of stacking together multiple layers of active silicon already existed in the previous century, only about 10 years ago it was introduced in the imaging world. Despite the complicated technology, the step from first scientific publications till a mature technology for consumer products was realized in a very short time. Back-side illumination, deep-trench isolation, through-silicon vias, hybrid bonding were all prerequisites to establish a cost-effective, reliable and high-performance stacking technology.

Now that double layer stacking in combination with hybrid bonding is available (even in the foundry business), the first experiments and even first products with triple layer stacking are announced. In which direction is this technology going to evolve and what is going to be the added value of having three or maybe even more layers of silicon for the imaging devices ? Which new applications can be addressed ? What are the technological consequences for the performance of the imaging devices ?

Bio



Albert Theuwissen received the MSc and PhD degree in electrical engineering from the Catholic University of Leuven (Belgium) in 1977 and 1983 respectively. In 1983 he joined Philips Research Labs (the Netherlands) and in 2002 he started working for DALSA. He issued several patents and he is author or co-author of 260+ technical papers, including a textbook "Solid-State Imaging with Charge-Coupled Devices". He acted as general chairman of the International Image Sensor Workshop in '97, '03, '09 and in '15, and as International Technical Program Chair of the ISSCC2010.

In 2001, he became part-time professor at the Delft University of Technology, the Netherlands. After he left DALSA in 2007, he founded Harvest Imaging. Since then he is fully focusing on training, teaching and consulting in the field of solid-state imaging technology.

In 2006 he co-founded (together with his peers Eric Fossum and Nobukazu Teranishi) ImageSensors Inc. (a California non-profit public benefit company) to address the needs of the image sensor community. From 2017 till 2021 he was appointed as the president of the International Image Sensor Society (IISS).

In 2008, he received the SMPTE's Fuji Gold medal. In 2011 he was elected as "Electronic Imaging Scientist of the Year", in 2013 he received the Exceptional Service Award of the International Image Sensor Society and in 2014 he was awarded with the SEMI Award. Albert is an IEEE Life Fellow.