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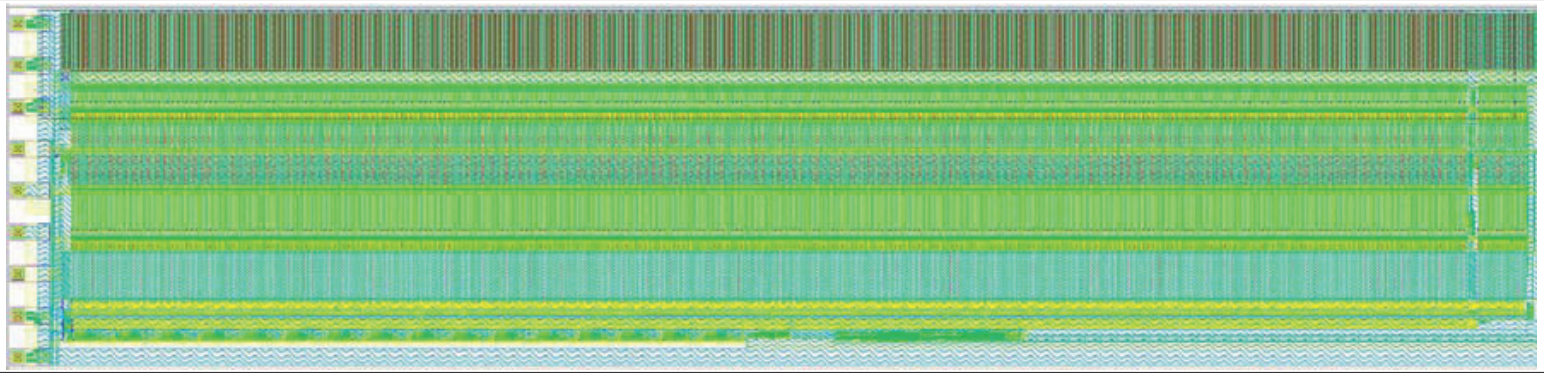

1 *Layout of 512 Pixel linear image sensor*

IMS LS-512-HS CMOS LINEAR PHOTOSENSOR ARRAY

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Introduction

Linear image sensors are used in numerous commercial and industrial applications, bar code readers, line cameras, scanners, co-piers, and facsimile machines. The classical approach to the realization of such arrays is based on using one-dimensional CCDs. This technique has matured during the last 25 years and CCD users got accustomed to their limitations in resolution, dynamic range, temperature behaviour, and the complex interfacing. Though the first silicon image sensor was fabricated in a MOS process, this approach has been neglected by image sensor developers. But today's submicron CMOS processes can compete with CCDs in performance and offer a lot of additional features:
Wide temperature range, random pixel access, and, above all, the possibility of cointegration of complex electronic circuitry in a standard CMOS process.

The IMS LS-512-HS

The IMS LS-512-HS is a linear CMOS image sensor featuring high responsivity, low dark current, and high dynamic range. Besides the photosensor array, the chip contains bias control, readout select, and an output buffer. It is operated from a single 3.3 Volt power supply. Above a layout plot of the LS-512-HS is shown. The element exhibits high photosensivity of 230 V/(µJ/cm2), a wide temperature range (-25°C to 70°C) and a noise equivalent exposure (NEE) of 2*10-6 µJ/cm2 whereas the saturation equivalent exposure (SEE) is about 10*10-3 µJ/cm2.

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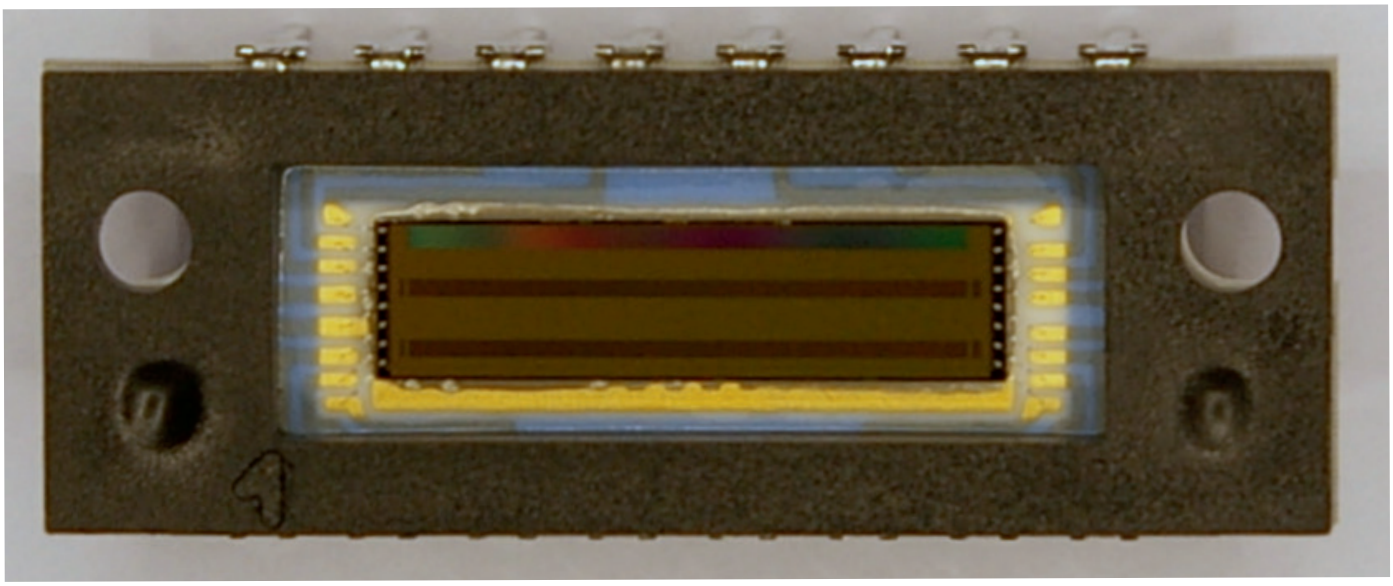

IMS LS-512-HS

Above, a chip microphotograph of the LS-512-HS is shown. It is a 512 pixel line sensor with 23 µm pixel pitch employing the photodiodes as sensing elements. In a 0.5µm standard CMOS process the chip size is 13.14mm x 3.2mm. The device features high speed operation of up to 50,000 frames/sec., anti-blooming by high speed overexposure suppression, random block access for fast readout of „regions of interest", and offset and 1/f noise compensation. An additional dark signal output channel enables dark current and temperature compensation. With a variation of the integration time, the chip covers a dynamic illumination range of 125 dB. Interfacing the sensor is quite simple since it uses a single 3.3 Volt supply and a single external clock (up to 25 MHz) for readout.

Summary

In addition to the presented device we have prototyped several other different CMOS line sensors. These include a velocity sensor for contactless speed measurement, and a sensor with an analog EEPROM in each pixel to perform automatic FPN correction and online subtraction of shading and background patterns. This feature is of great importance for high performance quality monitoring in production processes. To summarize, the integration of optical line sensors in standard CMOS technology offers an enormous potential for improvement of sensor performance and addition of on-chip signal processing which will lead to new applications and products in the near future.