

SNAPSHOT TILED HYPERSPPECTRAL IMAGE SENSOR

Imec's snapshot imager offers a hyperspectral solution for non-scanning applications by integrating spectral filters monolithically on top of imager wafers in a 'tiled' mode. This product is one of the first ever commercially available solutions offering true multispectral imaging at video rates in a small form factor. Our current sample imagers include 32 different spectral bands and are packaged in a ready-to-use format for application validation.

HYPERSPPECTRAL TECHNOLOGY FOR REAL-WORLD APPLICATIONS

Hyperspectral cameras, compared to traditional cameras, divide the light spectrum in many small wavelength bands. Therefore, a hyperspectral camera captures the spectral fingerprint of an object, a unique spectral signature. This spectral signature gives very detailed information about the material constitution of the imaged object.

Hyperspectral imaging improves considerably the identification and classification of objects and is today recognized as a key enabling technology for next-generation industrial inspection, medical diagnosis and security applications.

IMEC'S UNIQUE SPECTRAL TECHNOLOGY

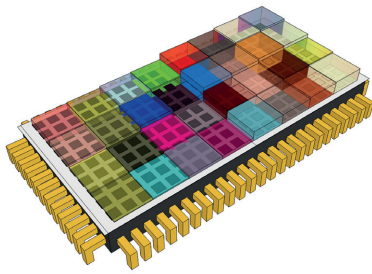
Imec's hyperspectral snapshot imagers are built on commercially available CMOS image sensor wafers, specifically designed for the machine vision market, namely the CMOSIS CMV2000.

The specifications of the current implementation are summarized in the table below:

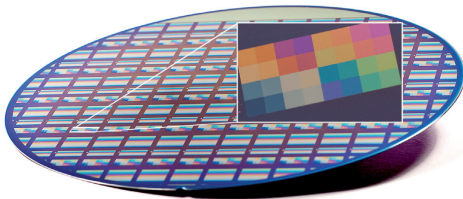
Wavelength range	600-1000nm (NIR)
Number of spectral bands	32
Spectral bandwidth (FWHM)	<10nm, collimated
Base imager type	CMOS imager, CMOSIS CMV2000 based
Resolution	256x256 pixels per band
Frame rate	Up to 340 hyperspectral cubes/second
Pixel pitch	5.5µm
Bit depth	8 or 10 bit

KEY BENEFITS

- **Novel solution for non-scanning hyperspectral applications** as band filters are integrated on image sensors in 'tiled' instead of 'striped' mode
- **High-speed multispectral imaging at video rate:** one of the first commercially available solutions in this small form factor
- **Customizable design** to match filter band selection with your final application requirements
- **Mass manufacturable solution** combining accurate spectral filters processed at wafer level and off-the-shelf optical duplication elements, resulting in an overall cost-effective system



Conceptual drawing of snapshot imager with 32 tiled hyperspectral filter structures



imec hyperspectral imager structures processed at wafer-level on top of commercial CMOS image sensor wafer

SENSOR FEATURES & INTERFACE

- Pipeline global shutter with true CDS
- 340 frames/s in 8 bit mode
- 180 frames/s in 10 bit mode
- X-Y mirroring function
- 16 LVDS-outputs @ 480Mhz multiplexable to 8,4 and 2 at reduced frame rate
- Ceramic 95 pin PGA package (18,6mm x 18,6mm)

APPLICATIONS

- Optical sorting in machine vision
- Chemical analysis of material composition
- Food safety and inspection
- Medical & healthcare
- Pharmaceutical manufacturing
- Semiconductor & photovoltaic
- Waste recycling
- Human machine interface
- Minerology & mining

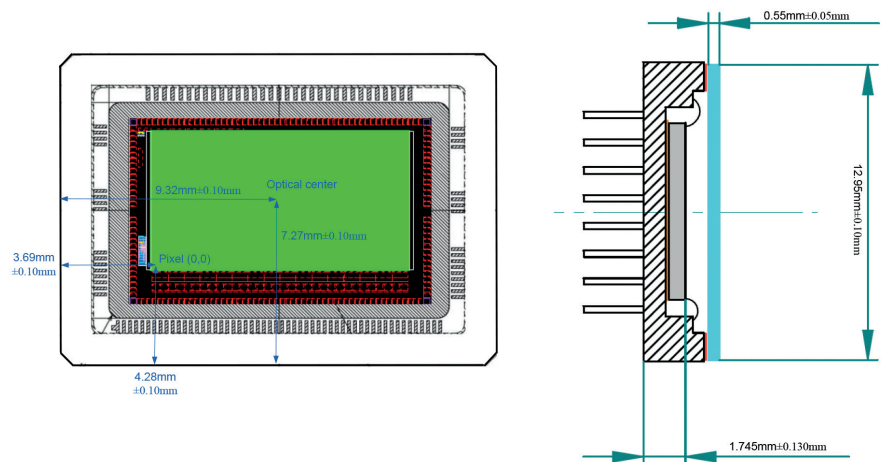
CUSTOMIZED TO FINAL APPLICATION

The current sample imager available from imec has 32 spectral bands in the range of 600-1000nm. To operate, this sensor requires a specific multi-channel optical duplication to match with the 32 bands tiled pattern. Custom snapshot imagers can be developed to match specific application requirements.

This customization can be achieved by modifying the design of our filters over the CMOS sensor pixel array. Spectral filters can be tuned and designed for different number of bands, FWHM and different spectral ranges. Additionally, since no linear scan movement of the sensor or object is needed, it is now possible to further optimize the hyperspectral filters layout towards a specific application requirement (e.g. spectral versus spatial resolution), providing a custom multispectral imaging solution to the end-user, optimized for size, cost and performance.

BASE IMAGER PERFORMANCE

Resolution	2048 x 1088
Pixel size	5.5µm x 5.5µm
Full well charge	13,5 Ke-
Conversion gain	0,075LSB/e- (10bit mode)
Sensitivity	4,64 V/lux.s
Temporal noise	13 e- (RMS)
Dynamic range	60dB
Optical format	2/3"
Parasitic light sensitivity	<1/50000
Dark current	125 LSB/s (@25°C)
Operating temperature	-30°C to +70°C
Power consumption	600mW
Fixed pattern noise	<1 LSB (<0,1% of full swing)



Hyperspectral imager package pin-out configuration

JEROME BARON

jerome.baron@imec.be
+32 16 28 32 82