

The logo for EMBERION, featuring the word "EMBERION" in a bold, red, sans-serif font. The letter "O" is replaced by a stylized orange and red hexagonal grid pattern. The background is dark with a grid of glowing orange dots and a wavy, red, wireframe-like pattern on the left side.

EMBERION

Superior infrared cameras enabling
next-level machine vision



EPIC Online Technology Meeting

with Special Focus
on CMOS Imagers Applications

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Emberion

Established in 2016

Working in two R&D hotspots

- Nanomaterials and sensor development in **Cambridge, UK**
- Electronics and system development in **Espoo, Finland**

A team presenting a unique combination of skills and experience

- Novel nanomaterials and CMOS integration
- Product creation and applied research
- Backgrounds in both SME and corporation environments

Efficiently networked to both research and production partners

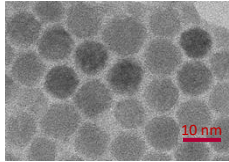
- An active member of European Graphene Flagship program and a member with access to the Cambridge University Graphene Centre
- Established business relationship with selected CMOS foundries



What Makes Our Products Unique



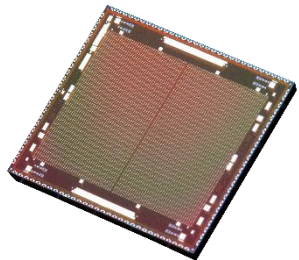
Emberion possesses the unique competence to combine leading-edge materials science with skillfully engineered integrated circuits, camera electronics and optical systems. Emberion's innovative products are based on:



1) **Low-cost manufacturing of new nanocrystalline photon absorber layers** monolithically on complex CMOS wafers. Nanocrystalline materials enable broad wavelength ranges: 400-2500 nm & 3000-5000 nm & LWIR.



2) **Use of 2D graphene in image sensor pixels** enables extreme simplification of the fabrication process together with significant improvements in noise performance and stability, enabling operation at higher temperatures.



3) **High performance readout electronics** based on Emberion's patented measurement principles. Our CMOS integrated readout electronics enable the low power consumption and high frame rate necessary for machine vision.

Emberion VIS-SWIR Products



Cameras

VGA camera

- For night and machine vision applications, hyperspectral imaging and medical imaging
- Monochromatic VIS-SWIR camera based on Emberion's VGA sensor
- Camera system in housing compatible with off-the-self lenses
- Available: samples March 2021

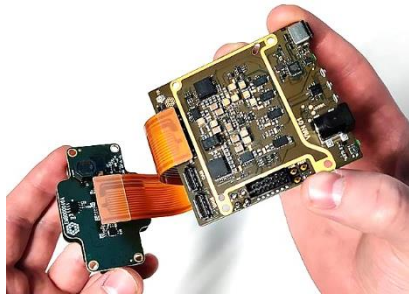


Image sensors

VGA sensor array of 640×512 pixels

- Single-chip imaging sensor for a wide VIS-SWIR spectral range: 400 – 2000 nm
- Pixel size $20 \times 20 \mu\text{m}$, image diameter 16.4 mm
- Excellent dynamic range and noise performance
- Based on a layered colloidal quantum dot and graphene photodiodes monolithically integrated on CMOS ROIC



VIS-SWIR Camera



- First sample cameras for customer evaluation available for purchase in March 2021. To be used with a dedicated and proprietary PC SW tool
- FW update in spring 2021. Offering CameraLink control and data I/O. Can be used with customers' SW tools
- Commercial camera product version available in August 2021

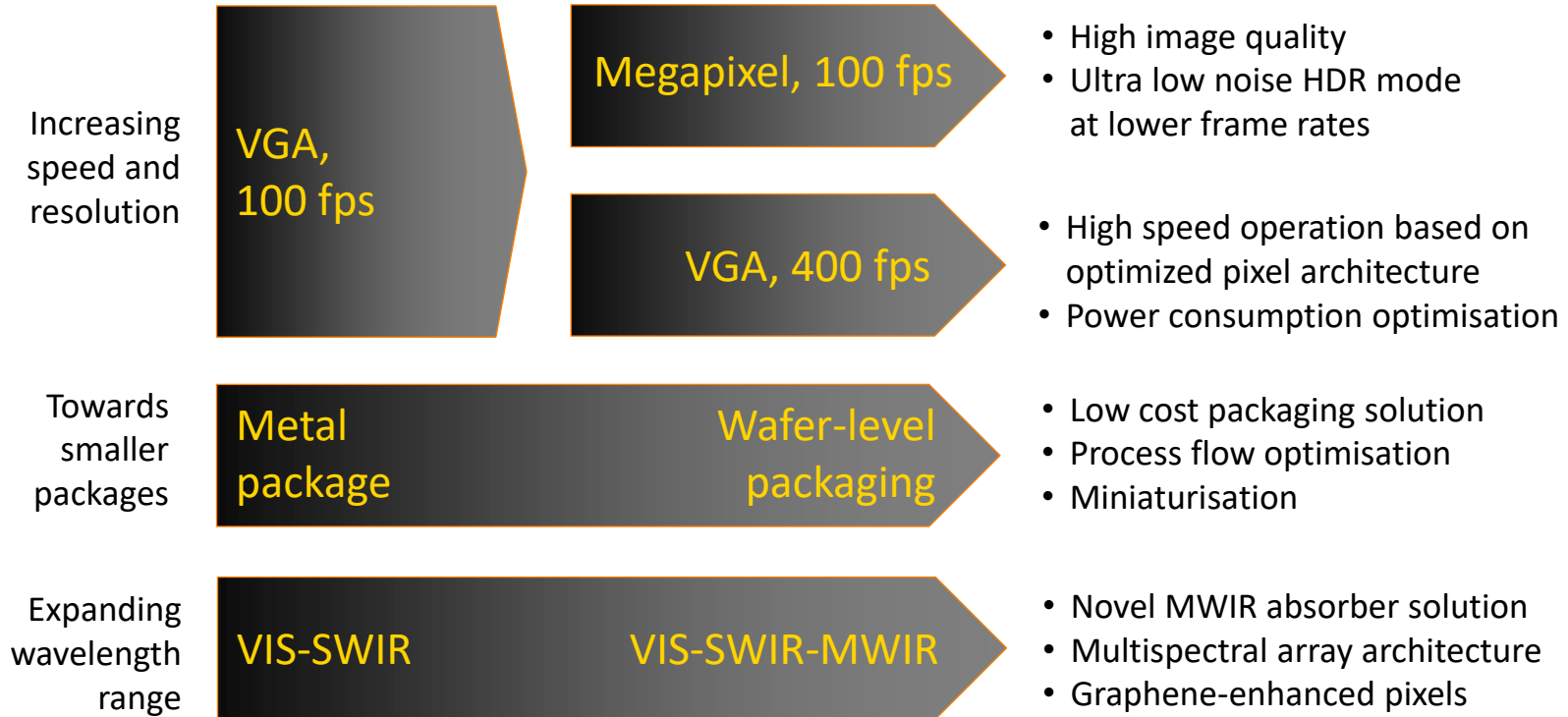
Height 110 mm

Width 100 mm



Length 160 mm

Future Directions



What Are We Looking for



- **VIS-SWIR camera optics**: full spectral range support, up to 2000 nm and beyond
- **Image sensor packaging**: miniaturization, low-cost, filter & optics integration
- **HSI & MSI joint R&D projects**
- **Pilot & field studies** with end customers
- **Customers** – first sample cameras available for purchase in spring 2021

Contacts for Future Discussions

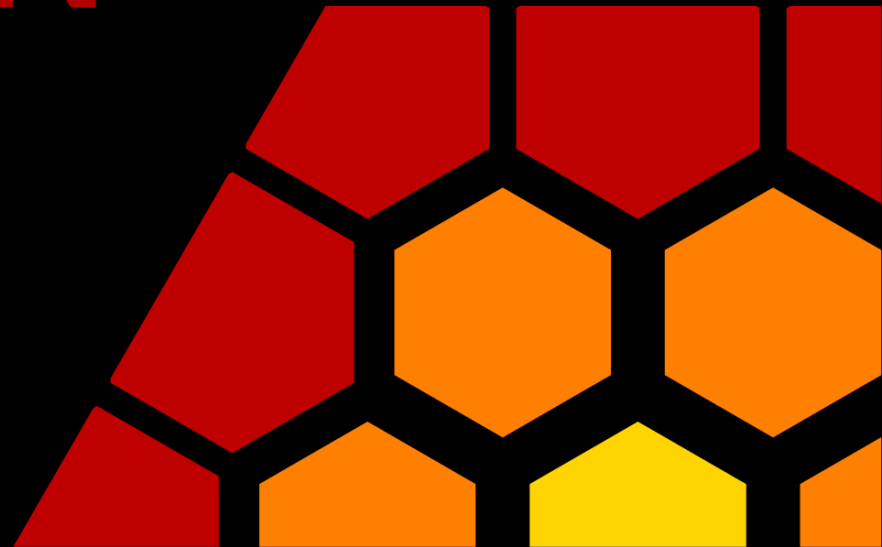


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EMBERION



VIS-SWIR VGA Camera



Very wide-spectrum VIS-SWIR Camera

- Based on Emberion's VGA-resolution VIS-SWIR image sensor: spectral response range spanning from 400 nm up to 2000 nm
- Fully functional camera core comprising implementations for sensor readout & control, ADC conversion, calibration, image pre-processing, thermal control and power management, ready for vision system integration
- Optimized readout modes: full VGA, ROIs, pixel skipping, pixel binning
- Optional camera housing for efficient thermal management and protection against dust and water ingress
- Standard digital camera interface compatible with 3rd party SW tools: CameraLink, GigE Vision, USB3.0 Vision
- Compatible with commercial lens systems, a standard C-mount optical interface
- Applications: machine vision, multispectral and hyperspectral imaging, night vision



Technical Data	
Spectral range:	0.4 – 2.0 μm
Array size:	640 \times 512
Pixel size:	20 \times 20 μm
Image size:	12.8 \times 10.24 / 16.4 mm (area/diameter)
Frame rate:	max 100 fps (full VGA res.)
NEI (30/100 fps):	5×10^{-5} @ -20°C / 2×10^{-4} @ 0°C W/m ²
Dynamic range:	120 / 80 dB (full analog / digital output range)
Shutter:	Global electronic
Optical interface:	C-mount
Operation temp.:	-40 to +55 °C
Supply voltage:	12 V
ADC resolution:	14 bits
Camera I/O:	CameraLink, USB Vision, GigE Vision
Certifications and compliances:	CE (EMC, ESD, RoHS, REACH), GenICam
IP rating:	GigE IP67, USB IP40