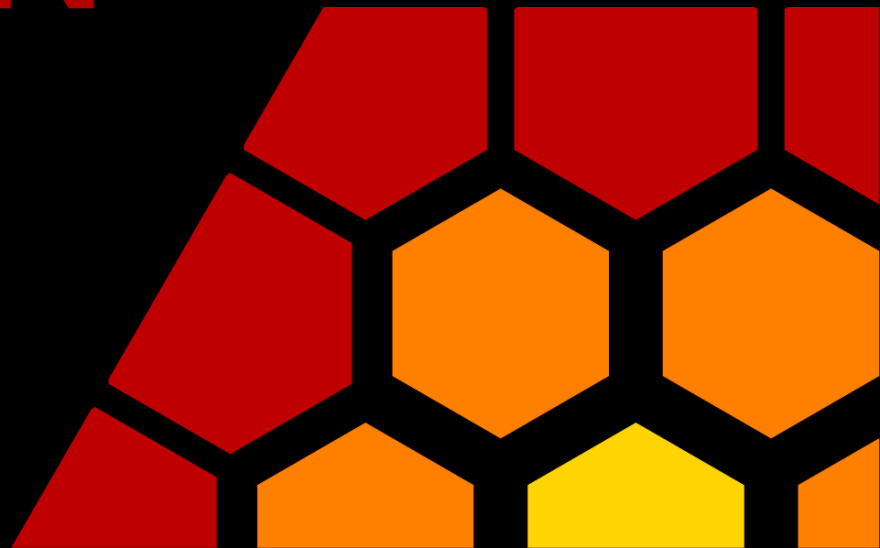


EMBERION

Broaden your Vision



Emberion Team

A team of 30 top experts representing a unique combination of skills and experience:

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

Working in two R&D hotspots:

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

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

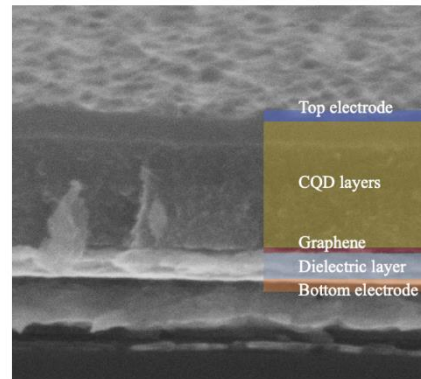
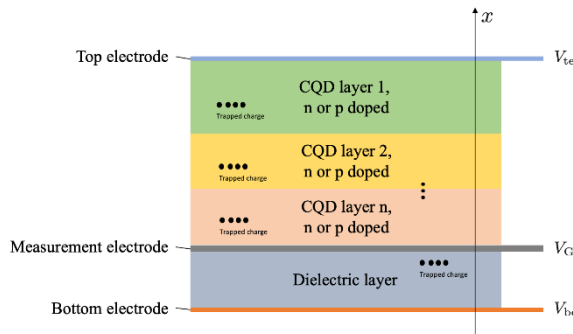


VIS-SWIR Detector Technology



Technology in brief

- Ultra-sensitive image sensors based on a layered colloidal quantum dot and graphene photodiodes
- Broad wavelength range (400 - 2000 nm) achieved by careful engineering of the light absorber layers
- Photosensitive layers are monolithically integrated on optimized CMOS readout IC: both linear array and VGA sensor configurations



Unique benefits

- Broad and tailorable spectral range
- Low noise (NEP, NEI)
- Large dynamic range
- Scalable pixel size
- Cost efficient manufacturing

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-shelf lenses
- Available for purchase as an evaluation sample

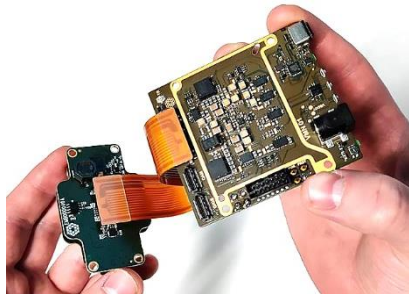


Image sensors

VGA sensor array of 640×512 pixels

- For night and machine vision applications, hyperspectral imaging and medical imaging
- Single-chip monochromatic imaging sensor for a wide VIS-SWIR spectral range



Solid Materials Analysis: 450-2000 nm, 10 ms



Baking soda, potato starch, sugar and table salt samples appear very similar in colour (all white) in visible light.



Samples show a very distinct colour difference in SWIR, due to their different chemical composition, making it easy to distinguish them from each other.

VIS-SWIR outdoors imaging



A wide-spectrum VIS-SWIR image resembles a VIS image but there are some prominent dissimilarities in the contrast differences, e.g. tree leaves appear much lighter IR than in VIS light.



The non-linear response characteristic and the wider spectral sensitivity range of Emberion cQD sensor offer a wider dynamic range, see the contrast differences in the clouds, balconies and car windows.

VIS-SWIR VGA Camera Core



Very wide-spectrum VIS-SWIR Camera Core

- 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 (e.g. spectral lines & columns, scalable zooming), 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 and USB3.0 Vision in future product variants in 2022)
- Compatible with commercial lens systems, a standard C-mount optical interface
- Potential applications: machine vision, multispectral and hyperspectral imaging, night vision
- Available for purchase as a technology evaluation sample



Technical Data

Spectral range:	0.4 – 2.0 μm
Array size:	640 × 512
Pixel size:	20 × 20 μm
Image size:	12.8 × 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 (optical input / 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

VIS-SWIR camera

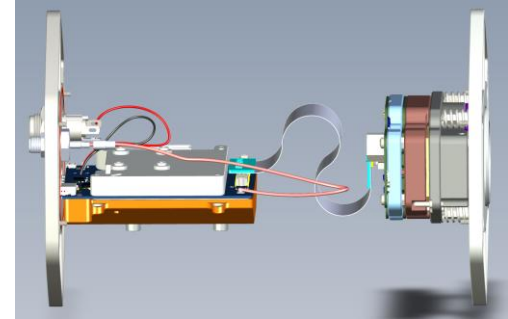
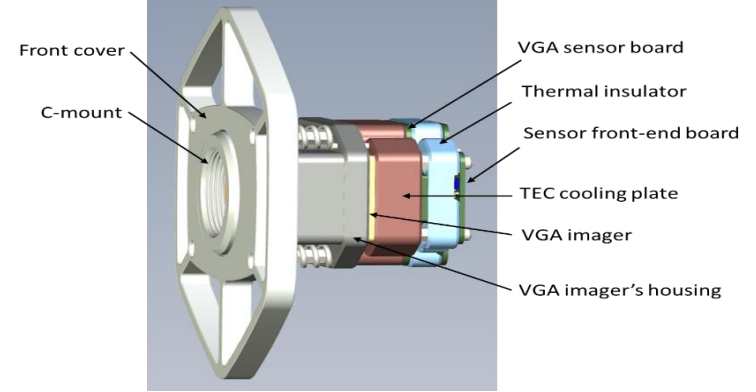


Width 102 mm

Height 111.5 mm



Length 168.7 mm



Mounting from two sides with 3 screw holes (1/4-20 UNC)