

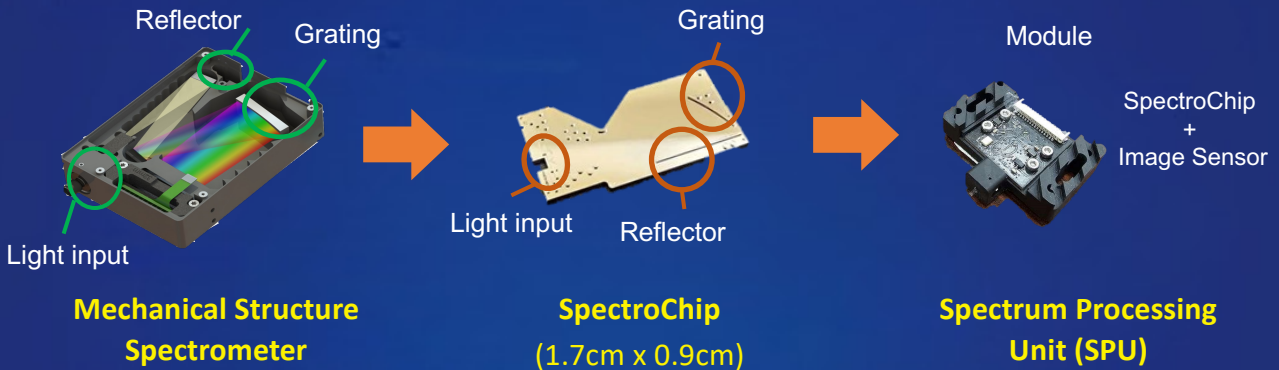
SPECTROCHIP

**An Optical System-on-Chip (SOC)
Manufactured via 0.5 nm X-ray Lithography**



- *High aspect ratio 400:1*
- *4-10 Key photon energy lithography*
- *Monolithic MEMS for mass production*

Packing the Full Function of A Spectrometer into a Fingernail-size Chip



SpectroChip-based Modules Have Huge Application Potentials in Many Industries

MODULES & SENSORS IN PIPELINE

Micro VIS-NIR High Resolution Spectrometers

In-situ Real-time Production Line Spectrum Profiling Sensors

Regular Detection Sensors (ppm or ppb levels)

High Sensitivity Detection Sensors (Sub-ppb levels)

Compact Raman Spectrometers with SPU System embedded



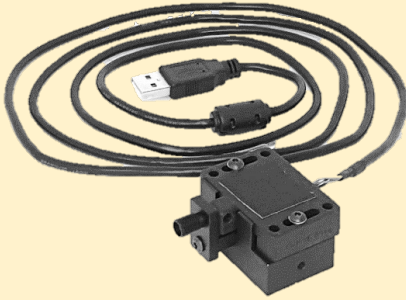
Opportunities for R&D Collaboration & Customized Service for Varous Applications

USB Micro VIS-NIR High-Resolution Spectrometer

Micro-
Spectrometer

A high-resolution micro spectrometer with a wide spectral range easily connected via a USB connector.

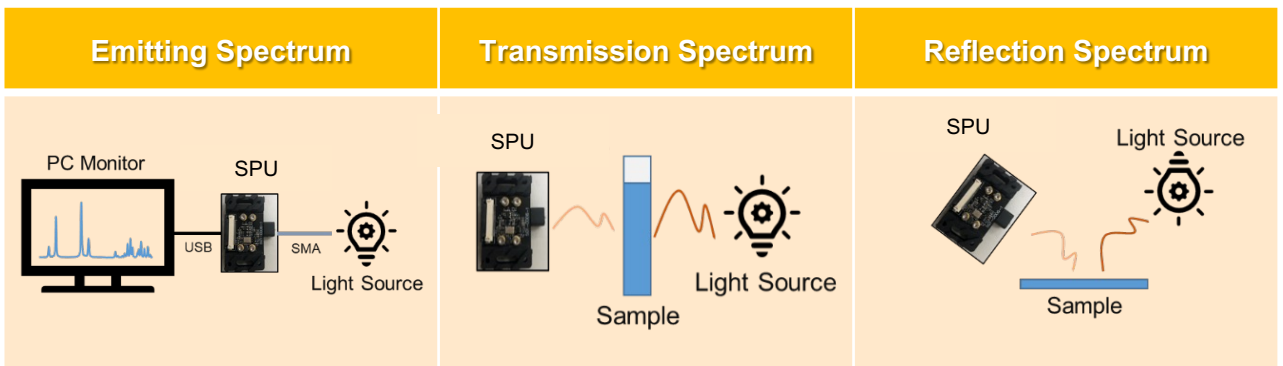
MSU-100



Features

- USB connector to PC / Mac
- Plug and play
- Downsized
- Open-source imaging software
- Compatible for all OS
- Broad wavelength range
- High spectral resolution
- Real time monitor
- Diverse applications (Optics, Medical...etc)

Application Examples

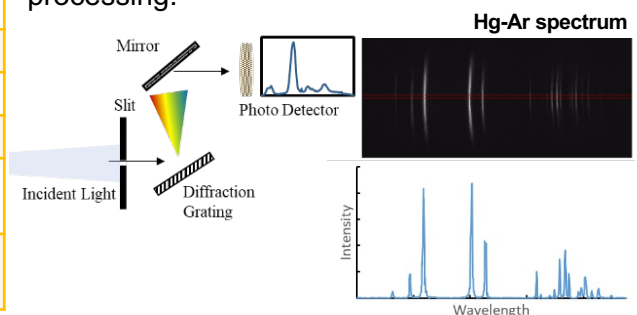


Model Number	MSU-100
Wavelength range	300 ~ 1000 nm
Spectral Resolution	5 nm
Spectral Accuracy	0.5 nm
Stray light	0.04 %
SNR	300:1
Image sensor	OV9281 Mono
A/D Conversion	8 bits
Optical connector*1	SMA905
Measurement time	10 Hz ⁻²
Working temperature	5 ~ 35 °C
Connector type	USB
Dimensions (WxDxH) / Weight (module only)	44 x 26.5 x 11 mm ³ / 12 g
Dimensions (WxDxH) / Weight (module + holder)	44 x 47.28 x 26.25 mm ³ / 50 g

Principles

Using Spectrochip technology, we have integrated optical structures onto a single chip to create a miniature spectrometer.

The incident light is dispersed by the micro grating, focused on the image sensor, and then a spectrum is obtained through image processing.



*1 Switchable to other types of optical connectors.

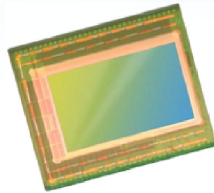
*2 Depending on system performance.

USB Micro VIS-NIR High-Resolution Spectrometer

Customizable module

--- A plug-and-play spectrometer that every lab dreams of
--- Directly capture the spectrums using computer built-in camera tools

Specs of the USB
Micro-spectrometer
module integrated
with OV9281 image
sensor:



- Spectral range: 300-1000 nm
- Spectral resolution (FWHM): 5 nm
- Spectral accuracy: +/- 0.375 nm
- Stray light: 0.04%
- Slit width: 20 urn
- Acceptance numerical aperture (N.A.): 0.21 (Full acceptance angle: 24 deg.)

Peak Quantum Efficiency:

The following figure shows the quantum efficiency of OV9281 and SONY IMX252. The quantum efficiency is 67% at wavelength 530 nm.[2]

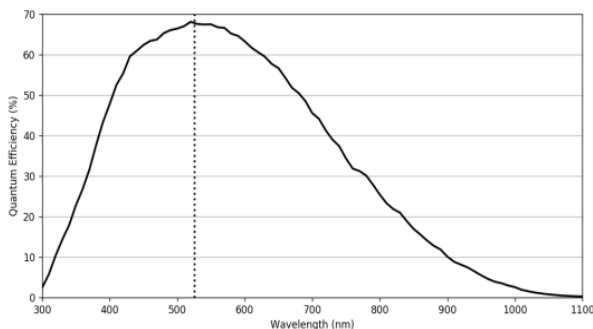


Fig. Quantum efficiency of OV9281 and SONY IMX252

OV9281-B&W image sensor specs:

- Pixel size: 3 um
- Pixel number: 1280 x 800
- A/D depth: 8 bits (The OV9281 A/D depth reaches 10 bit, however the driver provided by USB 2.0 can only operate in 8 bit mode).

Full well capacity and readout noise are related to the following factors:

- Max S/N ratio: 38 dB [1]
- Dynamic range: 68 dB [1]
- Sensitivity: 6500 to 13000 mV/uW [1]
- Dark current: not listed in the datasheet

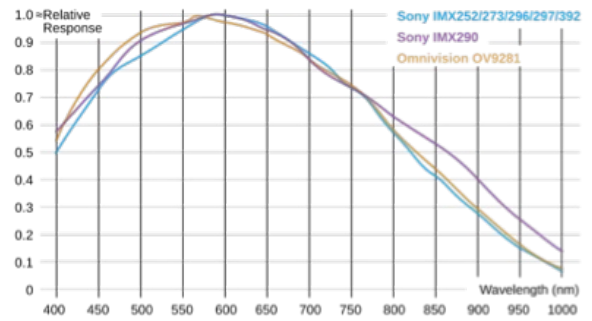


Fig. Relative spectral response of OV9281 vs. SONY IMX 252

References:

- [1] Max S/N ratio, dynamic range and sensitivity <http://www.camera-module.com/product/globalshuttercameramodule/global-shutter-monochrome-ov9281-usb-camera-module.html>
- [2] Quantum efficiency of OV9281 and SONY IMX252 <http://softwareservices.flir.com/BFS-U3-32S4/latest/EMVA/EMVA.html>
- [3] Relative spectral response of OV9281 vs. SONY IMX252 https://www.vision-components.com/fileadmin/external/documentation/hardware/VC_MIPI_Camera_Module/index.html

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