The C13560 spectroscopic module is a ultra-compact Raman spectroscopic module that incorporates a mini-spectrometer, compact optical system, and other Hamamatsu original technologies. The dedicated SERS substrate J13856 is used to perform Raman spectroscopy. It is also possible to perform Raman spectroscopy without using the J13856. It can be used for simple onsite point-of-care testing (POCT) and other screening tests.

**Features**

- Built-in laser, spectrometer, and driver circuit
- Ultra-compact and lightweight
- Low power consumption
- High-sensitivity measurements using a SERS substrate

**Applications**

- Environment (water quality inspection, agricultural and toxic substance inspection, etc.)
- Safety control (foreign matter checking in foods and medicine and the like)

**Structure**

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Specification</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dimensions (W × D × H)</td>
<td>96¹ × 14.5 × 60</td>
<td>mm</td>
</tr>
<tr>
<td>Weight</td>
<td>90</td>
<td>g</td>
</tr>
<tr>
<td>Interface</td>
<td>USB 2.0</td>
<td>-</td>
</tr>
</tbody>
</table>

¹: With the SERS substrate holder and module close together (spacing adjustable with the focus knob)

**Absolute maximum ratings**

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Condition</th>
<th>Symbol</th>
<th>Value</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Operating temperature</td>
<td>No dew condensation</td>
<td>Topr</td>
<td>+15 to +35</td>
<td>ºC</td>
</tr>
<tr>
<td>Storage temperature</td>
<td>No dew condensation</td>
<td>Tstg</td>
<td>-10 to +50</td>
<td>ºC</td>
</tr>
<tr>
<td>Power supply voltage</td>
<td></td>
<td>Vs</td>
<td>5.25</td>
<td>V</td>
</tr>
</tbody>
</table>

**Electrical and optical characteristics (Ta=25 ºC)**

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Condition</th>
<th>Min.</th>
<th>Typ.</th>
<th>Max.</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Laser</td>
<td>A specific 5 ºC range within the operating temperature range</td>
<td>-</td>
<td>785</td>
<td>-</td>
<td>nm</td>
</tr>
<tr>
<td>Output⁡2</td>
<td>-</td>
<td>5, 10, 15</td>
<td>-</td>
<td>mW</td>
<td></td>
</tr>
<tr>
<td>Line width</td>
<td>-</td>
<td>0.2</td>
<td>-</td>
<td>nm</td>
<td></td>
</tr>
<tr>
<td>Detection area</td>
<td>High-sensitivity CMOS image sensor</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Spectral range</td>
<td>-</td>
<td>400 to 1850</td>
<td>-</td>
<td>cm⁻¹</td>
<td></td>
</tr>
<tr>
<td>Resolution</td>
<td>-</td>
<td>10</td>
<td>-</td>
<td>cm⁻¹</td>
<td></td>
</tr>
<tr>
<td>USB bus power consumption</td>
<td></td>
<td>-</td>
<td>-</td>
<td>0.9</td>
<td>W</td>
</tr>
</tbody>
</table>

²: Can be changed with the sample software
Example of Raman measurements using SERS or Si substrate

On SERS substrate
4,4' bipyridyl aqueous solution 10 µM

On Si substrate
4,4' bipyridyl aqueous solution 1 mM

Integration time: 1 s, average count: 10
- When using SERS substrate: Laser intensity: 5 mW
- When using Si substrate: Laser intensity: 15 mW

Example of Raman measurements of polystyrene board (SERS substrate not used)

Integration time: 1 s, average count: once
Laser intensity: 15 mW

Block diagram

High-sensitivity CMOS image sensor
A/D converter
Control circuit
USB I/F
Power supply
Laser diode
Beam splitter
Excitation light
Raman scattered light
Lens
SERS substrate holder
Module

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Connection example

Sample software (accessory)

By installing the sample software (C13560_OperationSoftware)*3 into a PC, you can perform the following basic operations.

- Acquire and save measured data
- Set measurement conditions
- Display graphs
- Arithmetic functions
  - Wave number calibration
  - Dark subtraction
  - Peak search
  - Gaussian fitting
  - Lorentz fitting
  - Baseline collection

*3: Compatible OS
  - Microsoft® Windows® 7 (32-bit, 64-bit)
  - Microsoft Windows 8.1 (32-bit, 64-bit)
  - Microsoft Windows 10 (32-bit, 64-bit)

A DLL for controlling the hardware is available.
Users can develop original measurement programs using the following development platform.
Microsoft Visual Studio® 2008 (SP1) Visual C++®
Microsoft Visual Studio 2008 (SP1) Visual Basic®

Note: Microsoft, Windows, Visual Studio, Visual C++, and Visual Basic are either registered trademarks or trademarks of Microsoft Corporation in the United States and/or other countries.
**Spectroscopic module**

**Dimensional outline (unit: mm)**

<table>
<thead>
<tr>
<th>Part</th>
<th>Dimension (mm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>SERS substrate holder</td>
<td>16</td>
</tr>
<tr>
<td>Module</td>
<td>80.0</td>
</tr>
<tr>
<td>Focus knob</td>
<td>60.0</td>
</tr>
<tr>
<td>Hole for inserting a SERS substrate</td>
<td>14.5</td>
</tr>
<tr>
<td></td>
<td>12.5</td>
</tr>
</tbody>
</table>

Tolerance unless otherwise noted: ±0.5
Note: With the SERS substrate holder and module close together

**Accessories**
- CD-ROM (sample software*)
- USB cable
- Si substrate for calibration

*4: Software development materials can be provided.

**Safety measures of laser products**

This product is a class 3B laser product designed to be embedded in a device. As such, shutters, interlocks, and other requirements defined in JIS C 6802: 2014 are not met. Be very careful in handling this product.

During use, be sure to provide the safety measures described in JIS C 6802: 2014 (Radiation Safety Standards for Laser Products).
SERS substrate J13856 (sold separately)

A surface-enhanced Raman spectroscopy (SERS) substrate enhances the Raman scattered light from the molecules, making high-sensitivity Raman spectroscopic analysis possible. A fine metal structure (chip) is mounted on Hamamatsu original handling plate to protect the active area. The active area of the handling plate has a well structure for easy attaching solution or the like. Note that this is a disposable product and cannot be reused.

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Specification</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Substrate size</td>
<td>10 × 2.5 × 25</td>
<td>mm</td>
</tr>
<tr>
<td>Chip size</td>
<td>4 × 4</td>
<td>mm</td>
</tr>
<tr>
<td>Active area</td>
<td>3.0</td>
<td>mm</td>
</tr>
<tr>
<td>Activated surface structure</td>
<td>Metal nanostructure</td>
<td>-</td>
</tr>
<tr>
<td>Handling plate material</td>
<td>Polypropylene</td>
<td>-</td>
</tr>
<tr>
<td>Raman excitation wavelength</td>
<td>785</td>
<td>nm</td>
</tr>
</tbody>
</table>

Note: This is a disposable product and cannot be reused.

The J13856 is a product for customers that have purchased the C13560.

Related information

www.hamamatsu.com/sp/ssd/doc_en.html

- Precautions
- Disclaimer