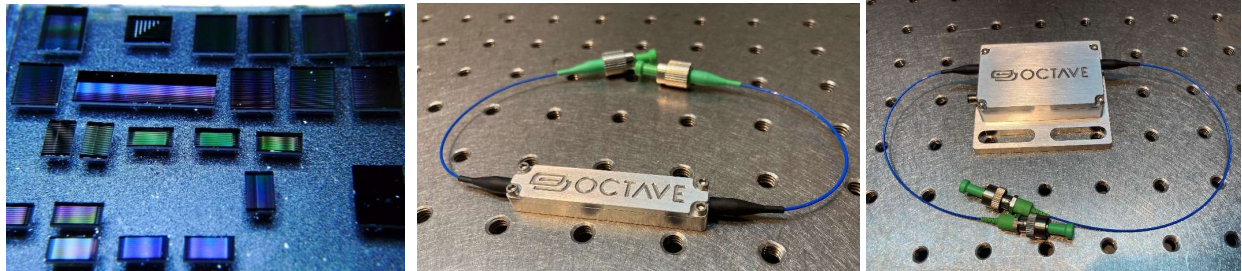


Supercontinuum-Generation Devices

Summary: Octave Photonics provides packaged nonlinear nanophotonic waveguides for supercontinuum generation with pulsed lasers. These devices allow low-pulse-energy, broad-bandwidth supercontinuum generation with the simplicity of standard fiber connectors.



(left) Nanophotonic chips for supercontinuum generation. (middle) Octave Photonics packaged supercontinuum generation devices with fiber input and fiber output. (right) Supercontinuum generation device with thermo-electric cooler and baseplate.

| Specification | SC-1560-780 | SC-1560-780-TEC | SC-Custom |
|------------------------------------|------------------------------|-----------------|------------------------------|
| Input pulse center wavelength | ~1560 nm | | ~1000 to 2000 nm |
| Input pulse duration ¹ | <200 fs | | <350 fs |
| Min. input pulse energy | Typ. 150 pJ, 180 pJ max | | >150 pJ |
| Max. input pulse energy | 1 nJ | | >1 nJ |
| Output spectral range ² | ~750 to 1300 nm | | Customizable |
| Dispersive wave peak | 780±5 nm | | Customizable, 600 to 2500 nm |
| Dispersive wave power ³ | >40 uW (100 MHz f_{rep}) | | >100 uW (100 MHz f_{rep}) |
| Input Type | PM1550 fiber, specify length | | PM Fiber |
| Input connector | FC/APC | | FC/APC, FC/PC, or similar |
| Output Type | PM780 fiber | | Fiber or free space |
| Output Connector | FC/APC | | Fiber or lens |
| Dimensions (excluding fibers) | 57x13x9 mm | 57x35x12 mm | Customizable |
| Thermoelectric cooler (TEC) | No | Yes | Optional |
| Max. average optical power | 400 mW | 3 Watts | 4 Watts (w/ TEC) |
| Operating temp. | 15 to 30 C | -10 to 60 C | -10 to 60 C (w/ TEC) |

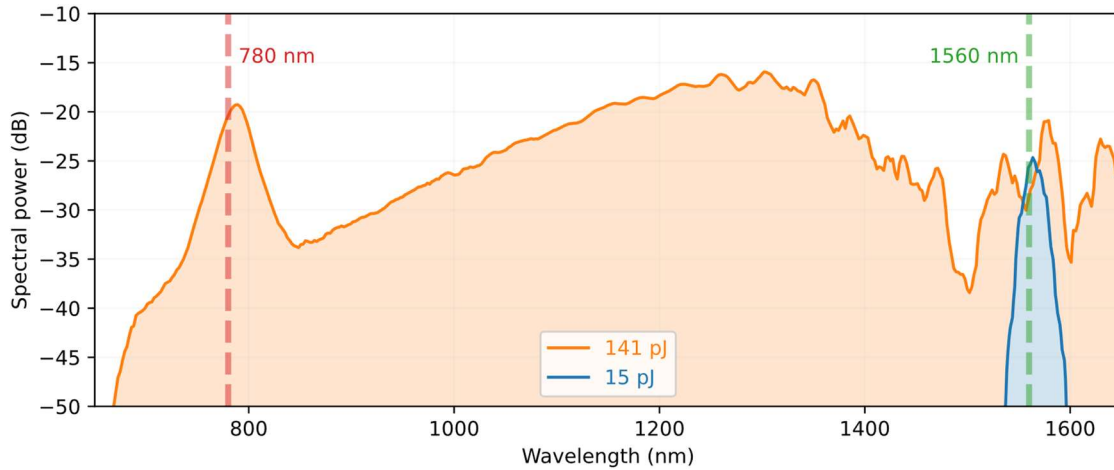
1. Assumes compressed pulse achieved inside module housing, accounting for dispersion of input fiber pigtail.

2. Long-wavelength end of spectrum limited by losses in PM780 output fiber. Alternative fiber options available on request.

3. Power in dispersive wave scales linearly with pulse repetition frequency.

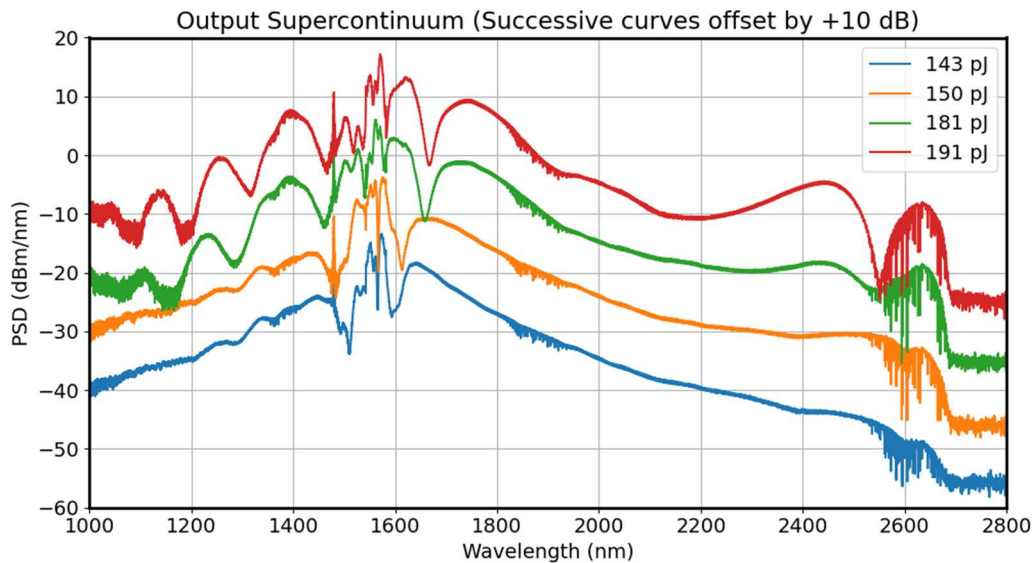
Customization: Nanophotonic waveguides provide tight confinement of the guided light, enabling supercontinuum generation with very low pulse energies. Additionally, the output spectrum can be adjusted simply by changing the dimensions of the waveguide. Thus, Octave Photonics can offer customized spectral output from our standard packaging approach.

Example Output Spectrum: 780 nm generation from 1560 nm fs laser



Output from an Octave Photonics supercontinuum module generating 780 nm light using a 1560 nm input (PM780 output fiber). At low pulse energies (15 pJ), the spectrum is relatively narrow. For pulse energies above 140 pJ, broadband light is generated with a peak at 780 nm, which can be used for f_{ceo} detection of a laser frequency comb. (Note that the output of the module has PM780 nm fiber and light at wavelengths longer than ~ 1300 nm is partially attenuated. Alternative output fibers are available on request.)

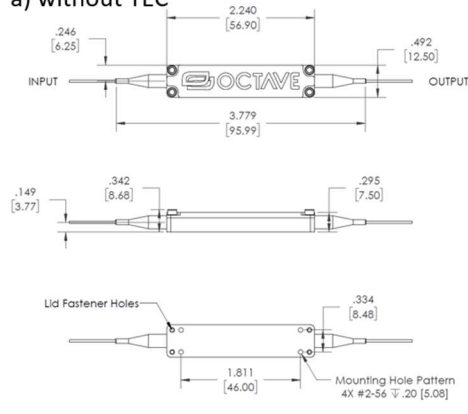
Example Custom Spectrum: Broadband generation in the mid-infrared



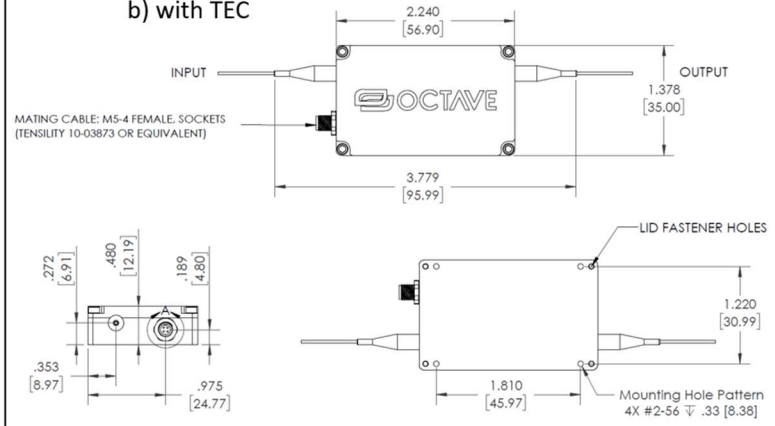
Output from a custom Octave Photonics supercontinuum module, providing broadband light in the mid-infrared region (PM1550 output fiber).

Dimensional drawing:

a) without TEC



b) with TEC



Dimensions are in inches [mm in brackets]. Baseplates for connecting to standard optical tables are available.

Protecting against optical damage

Nanophotonic waveguides combine extremely tight optical mode confinement with high material nonlinearity. This combination allows low-energy input pulses to reach peak intensities nearing 10^{12} W/cm²! However, since these intensities approach the optical damage threshold of the waveguide material, **special care must be taken to ensure the seed laser system does not output large transient pulses. Uncontrolled pulse amplification will permanently damage the waveguide module.**

The most common scenario for optical damage in a research-lab setting is when an optical amplifier is energized before a stably mode-locked seed laser is connected. This can happen, for example, if the seed laser loses its mode-locked state while the amplifier is running. To prevent damage, the amplifier must be turned off before re-modelocking the seed laser if the waveguide module is connected to the amplifier output.

To protect sensitive waveguide modules from this kind of damage, Octave Photonics offers a companion product called the Fast Laser Amplifier Interlock Module (FLAIM) to quickly turn off an optical amplifier system in the event of momentary or extended disruptions of the seed light. The FLAIM is a compact benchtop module that provides an adjustable input threshold for tripping the protection circuitry, shutting off the connected amplifier with a response time <1 ms. When used properly, FLAIM can protect valuable nanophotonic components from accidental damage in laboratory environments.

