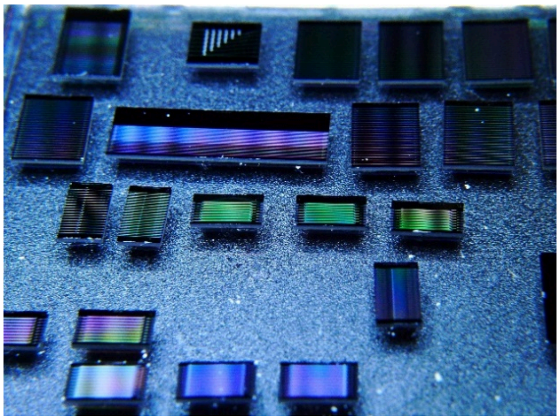
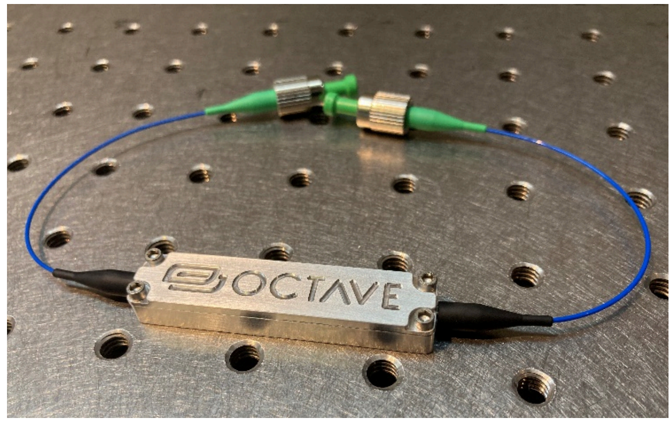
Supercontinuum-Generation Devices

Summary: Octave Photonics supercontinuum-generation devices allow broadband supercontinuum generation from femtosecond lasers with exceptionally low pulse energies. These devices utilize waveguides on nanophotonic chips, allowing the supercontinuum spectrum to be customized to meet specific applications. The devices utilize standard fiber connectors, making them simple to use.





(left) Nanophotonic chips for supercontinuum generation. **(middle)** Packaged supercontinuum device with fiber input/output.

Specification	SC-1560-780	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
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 fiber	PM1550 fiber	Customizable
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	Customizable
Max. average optical power	400 mW	3 Watts
Operating temp.	5 to 40 C	-10 to 70 C with optional thermoelectric cooler

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.

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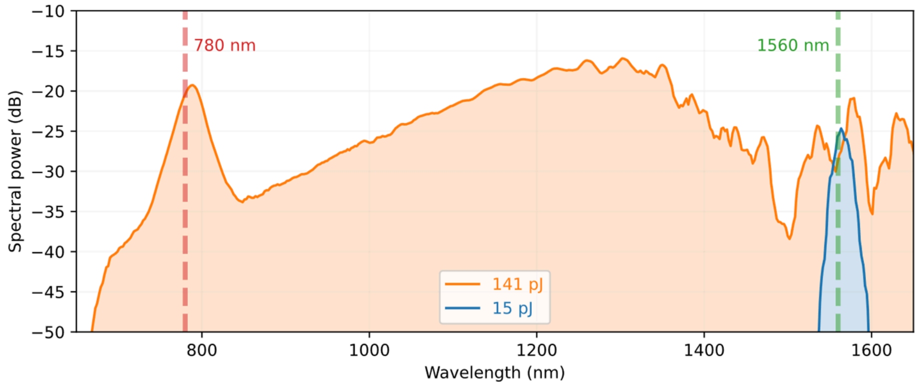
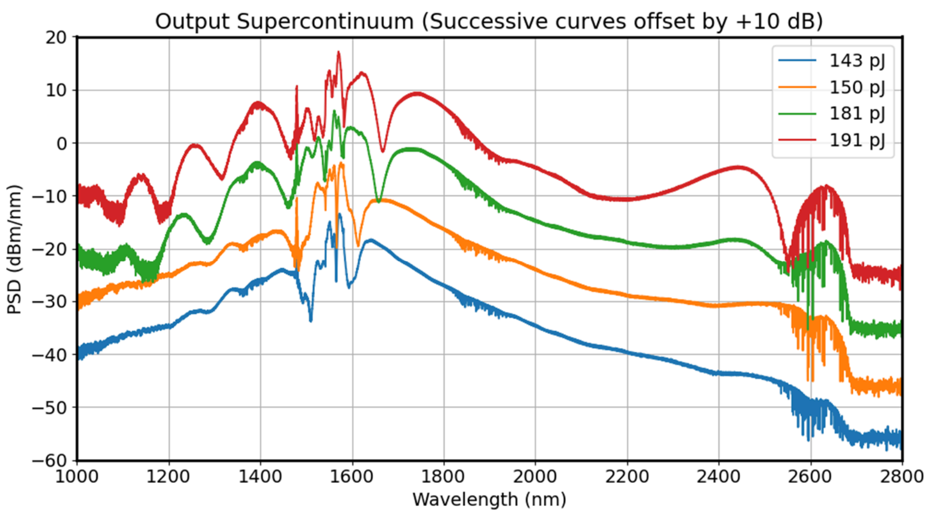
Example spectra:

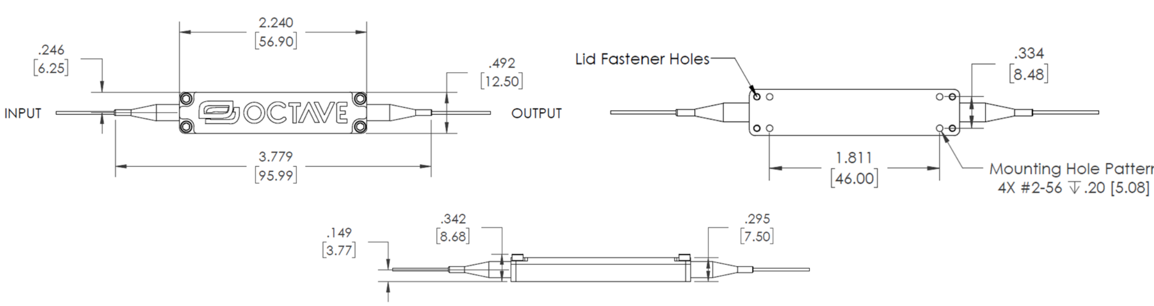


780 nm generation from 1560 nm fs laser. At low pulse energies (15 pJ), the spectrum is relatively narrow. For pulse energies above 140 pJ, broadband light is generated with a peak at 780 nm, useful for f_{ceo} detection of a laser frequency comb. (Note: output PM780 fiber partially attenuates wavelengths longer than 1300 nm. Alternative output fibers are available on request.)



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 drawings:



Dimensions are in inches [mm in brackets]. Baseplate for connecting to standard optical tables is included.

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/cm^2! 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.