56 Sparta Avenue • Newton, New Jersey 07860
(973) 300-3000 Sales • (973) 300-3600 Fax
www.thorlabs.com

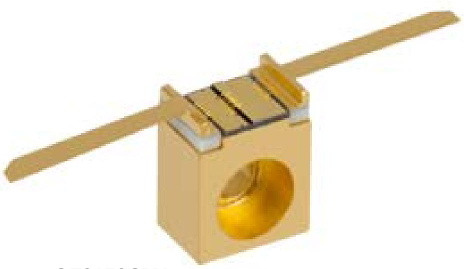
THORLABS

IF3550CM1 - Nov. 02, 2015

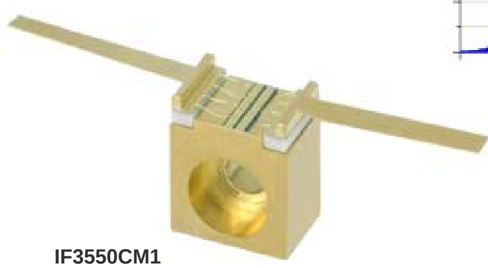
Item # IF3550CM1 was discontinued on Nov. 02, 2015. For informational purposes, this is a copy of the website content at that time and is valid only for the stated product.

QUANTUM CASCADE LASERS AND INTERBAND CASCADE LASERS: FABRY-PEROT

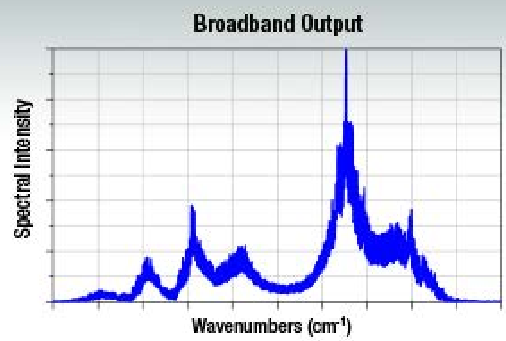
- Center Wavelengths: 3.55 - 9.55 µm (2816 - 1047 cm^{-1})
- Output Powers up to 500 mW
- Broadband Emission over a Roughly 50 cm^{-1} Range
- Shipped from Stock



QF9150CM1
Quantum Cascade Laser



IF3550CM1
Interband Cascade Laser



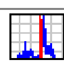
Hide Overview

OVERVIEW

Features

- Broadband Fabry-Perot Quantum Cascade Lasers (QCLs) and Interband Cascade Lasers (ICLs)
- CW Output:
  - 30 mW for ICLs
  - Up to 500 mW for QCLs
- Center Wavelengths Between 3.55 µm and 9.55 µm (2816 cm^{-1} and 1047 cm^{-1})
- Compact Two-Tab C-Mount Package: 6.4 mm x 4.3 mm x 7.9 mm (L x W x H)
- All QCLs and Item # IF3800CM2 are Electrically Isolated from C-Mount
- Custom Wavelengths and Mounts Also Available (Contact Tech Support for Details)
- Gain Chips with AR-Coated Front Facets Also Available as a Custom Order

Thorlabs' Fabry-Perot Quantum Cascade Lasers (QCLs) and Interband Cascade Lasers (ICLs) exhibit broadband emission in a range spanning roughly 50 cm^{-1}. The laser's specified output power is the sum over the full spectral bandwidth. Because these lasers have broadband emission, they are well suited for medical imaging, illumination, and microscopy applications.

MIR Laser Types
Fabry-Perot Lasers
Distributed Feedback Lasers
 Click for Comparison

Laser Diode Selection Guide	
Shop by Wavelength	UV (375 nm) Visible (404 nm - 690 nm) NIR (705 nm - 2000 nm) MIR (3.55 µm - 9.60 µm)
Shop by Package/Type	TO Can (Ø3.8, Ø5.6, Ø9, and Ø9.5 mm) TO Can Pigtail (SM) TO Can Pigtail (PM) TO Can Pigtail (MM) FP Butterfly Package FBG-Stabilized Butterfly Package Chip on Submount MIR Fabry-Perot Two-Tab C-Mount One-Tab C-Mount
	Single Frequency Lasers
	DFB Single-Frequency TO Can Pigtail (SM) VHG-Stabilized Single-Frequency TO Can Pigtail (SM) ECL Single-Frequency Butterfly Package DBR Single-Frequency Butterfly Package MIR DFB Two-Tab C-Mount
Laser Diode Tutorial	

Hungry for Your MIR Thoughts

Thorlabs also manufactures Distributed Feedback QCLs, which emit at a single wavelength and are tunable over a narrow frequency range.

The measured output spectrum and L-I-V curve of each serial-numbered device is available below and is also included on a data sheet with the laser. Each Fabry-Perot laser has an HR-coated back facet. As a custom option, our Fabry-Perot lasers can be ordered with an AR coating on the front facet; however, the custom item will operate as a gain chip and not as a CW laser. Though these QCLs and ICLs are specified for CW output, they are compatible with pulsed applications. To order a Fabry-Perot QCL or ICL with a tested and specified pulsed optical power or other custom features, please contact Tech Support.

Contact Us

Thorlabs is adding products to its portfolio that are specifically designed for the MIR spectral range. In addition, we have started several new R&D collaborations within the last year. If you have new product ideas, comments on our existing MIR portfolio, see Thorlabs as a potential partner for an MIR project, or just want to provide some feedback, we'd welcome the opportunity to hear from you.
For immediate requests for a particular wavelength or power option, please contact Technical Support.

Packages
Each laser is mounted on a two-tab C-mount that provides high thermal conductivity and can be secured using a 2-56 or M2 screw with the counterbored Ø2.4 mm (Ø0.09") through hole. As measured from the bottom of the C-mount, the emission height of the QCLs is 7.15 mm, while that of the ICLs is 7.0 mm (Item # IF3550CM1) or 7.28 mm (Item # IF3800CM2); the outer dimensions of the C-mounts are the same. All QCLs and Item # IF3800CM2 are electrically isolated from their C-mounts, while the other two ICLs are not. Please see the *Handling* tab for more tips and information for handling these laser packages.

Mounts, Drivers, and Temperature Control
We generally recommend the LDMC20 C-Mount Laser Mount and ITC4002QCL or ITC4005QCL Dual Current / Temperature Controller for these lasers. This device combination includes all the necessary components to mount, drive, and thermally regulate a two-tab C-mount laser. Other compatible current and temperature controllers are listed in the *Drivers* tab.

If designing your own mounting solution, note that due to these lasers' heat loads, we recommend that they be mounted in a thermally conductive housing to prevent heat buildup. Our ICLs feature low heat loads of up to 2.5 W, while heat loads for Fabry-Perot QCLs can be up to 18 W (see the *Handling* tab for additional information).

The typical operating voltages of our ICLs and QCLs are 2.5 - 3.1 V and 7 - 16 V, respectively. These lasers do not have built-in monitor photodiodes and must be operated in constant current mode.

Webpage Features	
	Clicking this icon opens a window that contains specifications and mechanical drawings.
	Clicking this icon allows you to download our standard support documentation.
Choose Item	Clicking the words "Choose Item" opens a drop-down list containing all of the in-stock lasers around the desired center wavelength. The red icon next to the serial number then allows you to download L-I-V and spectral measurements for that serial-numbered device.

Hide Drivers

DRIVERS

Use the tables below to select a compatible controller for our MIR lasers. The first table lists the controllers with which a particular MIR laser is compatible, and the second table contains selected information on each controller. Complete information on each controller is available in its full web presentation. We particularly recommend our ITC4002QCL and ITC4005QCL controllers, which have high compliance voltages of 17 V and 20 V, respectively. Together, these drivers support the current and voltage requirements of our entire line of Mid-IR Lasers.

Table Key
Current Controllers
Dual Current / Temperature Controllers

The typical operating voltages of our ICLs and QCLs are 2.5 - 3.1 V and 7 - 16 V, respectively. To get L-I-V and spectral measurements of a specific, serial-numbered device, click "Choose Item" next to the part number below, then click on the Docs Icon next to the serial number of the device.

Laser Mount Compatibility
Thorlabs' LDMC20 C-Mount Laser Mount ships with current and TEC cables for the LDC4005, ITC4001, ITC4002QCL, ITC4005, and ITC4005QCL controllers. To use the LDMC20 with our other controllers, custom cables will be required. If designing your own mounting solution, note that due to these lasers' heat loads, we recommend that they be secured in a thermally conductive housing to prevent heat buildup. Our ICLs feature low heat loads of up to 2.5 W, while heat loads for Fabry-Perot QCLs can be up to 18 W.

Laser and Controller Compatibility

Laser Item			

#	Wavelength	Current Controllers			Dual Current / Temperature Controllers	
		Small Benchtop	Large Benchtop	Rack Mounted	Large Benchtop	Rack Mounted
IF3550CM1	3.55 µm (2816 cm^{-1})	LDC210C, LDC240C	LDC4005	LDC8010, LDC8020, LDC8040	ITC4001, ITC4002QCL, ITC4005, ITC4005QCL	ITC8102
IF3800CM2	3.80 µm (2632 cm^{-1})	LDC210C, LDC240C	LDC4005	LDC8010, LDC8020, LDC8040	ITC4001, ITC4002QCL, ITC4005, ITC4005QCL	ITC8102
QF4050CM1	4.05 µm (2469 cm^{-1})	-	-	-	ITC4002QCL, ITC4005QCL	-
QF4400CM1	4.40 µm (2273 cm^{-1})	-	LDC4005	-	ITC4002QCL, ITC4005, ITC4005QCL	-
QF4550CM1	4.55 µm (2198 cm^{-1})	-	LDC4005	-	ITC4002QCL, ITC4005, ITC4005QCL	-
QF4800CM1	4.80 µm (2083 cm^{-1})	-	-	-	ITC4002QCL, ITC4005QCL	-
QF5300CM1	5.30 µm (1887 cm^{-1})	-	LDC4005	-	ITC4002QCL, ITC4005, ITC4005QCL	-
QF7700CM1	7.70 µm (1299 cm^{-1})	-	LDC4005	-	ITC4002QCL, ITC4005, ITC4005QCL	-
QF8350CM1	8.35 µm (1198 cm^{-1})	-	LDC4005	-	ITC4002QCL, ITC4005, ITC4005QCL	-
QF9150CM1	9.15 µm (1093 cm^{-1})	-	LDC4005	-	ITC4002QCL, ITC4005, ITC4005QCL	-
QF9550CM1	9.55 µm (1047 cm^{-1})	-	LDC4005	-	ITC4002QCL, ITC4005, ITC4005QCL	-

Controller Selection Guide

Controller Item #	Controller Type	Controller Package	Current Range	Current Resolution	Voltage	Cables for LDMC20 Laser Mount
LDC210C	Current	Small Benchtop (146 x 66 x 290 mm)	0 to ±1 A	100 µA	>10 V	Not Included with Mount[b]
LDC240C			0 to ±4 A	100 µA	>5 V	Not Included with Mount[b]
LDC4005		Large Benchtop (263 x 122 x 307 mm)	0 to 5 A	1 mA (Front Panel) 80 µA (Remote Control)	12 V	Included with Mount
LDC8010		Rack Mounted	0 to ±1 A	15 µA	>5 V	Not Included with Mount[b]
LDC8020			0 to ±2 A	30 µA	>5 V	Not Included with Mount[b]
LDC8040			0 to ±4 A	70 µA	>5 V	Not Included with Mount[b]
ITC4001	Current / Temperature	Large Benchtop (263 x 122 x 307 mm)	0 to 1 A	100 µA (Front Panel) 16 µA (Remote Control)	11 V	Included with Mount
ITC4002QCL			0 to 2 A	100 µA (Front Panel) 32 µA (Remote Control)	17 V	Included with Mount
ITC4005			0 to 5 A	1 mA (Front Panel) 80 µA (Remote Control)	12 V	Included with Mount
ITC4005QCL					20 V	Included with Mount
ITC8102		Rack Mounted	0 to ±1 A	15 µA	>5 V	Not Included with Mount[b]

b. Thorlabs does not currently offer cables that connect the LDMC20 mount to this controller.

Hide Handling

HANDLING

Handling C-Mount Lasers

Unlike TO can and butterfly packages, the laser chip of a C-mount laser is exposed to air; hence, there is no protection for the delicate laser chip. Contamination of the laser facets must be avoided. Do not blow on the laser or expose it to smoke, dust, oils, or adhesive films. Do not use thermal grease, as it can creep, eventually contaminating the laser facet. The laser facet is particularly sensitive to dust accumulation. During standard operation, dust can burn onto this facet, which will lead to premature degradation of the laser. If operating a C-mount laser for long periods of time outside a cleanroom, it should be sealed in a container to prevent dust accumulation.

Proper precautions must be taken when handling and using C-mount lasers. Since these lasers may be sensitive to electrostatic shock, they should always be handled using standard static avoidance practices. Additionally, these lasers should be used with a high-quality, constant current driver specifically designed for use with laser diodes.

As with all laser diodes, temperature regulation is necessary for sustained, reliable, long-term operation. The back face of the C-mount package is machined flat to make proper thermal contact with a heat sink. Ideally, the heat sink will be actively regulated to ensure proper heat conduction. A Thermoelectric Cooler (TEC) is well suited for this task and can easily be incorporated into any standard PID servo. A fan may serve to move the heat away from the TEC and prevent thermal runaway. However, the fan should not blow air on or at the laser itself. Water cooling methods may also be employed for temperature regulation. Do not use thermal grease with this package, as it can creep, eventually contaminating the laser facet. Acceptable alternatives to thermal grease include pyrolytic graphite and solder.

When making electrical connections, care must be taken if soldering to the wire lead. Solder with the C-mount already attached to a heat sink to avoid unnecessary heating of the laser chip. The flux fumes created by soldering can also cause laser damage, so care must be taken to avoid this. Do not use thermal grease with this package, as it can creep, eventually contaminating the laser facet. Members of our Technical Support staff are available to help you select a laser and to discuss possible operation issues.

Hide Collimation

COLLIMATION

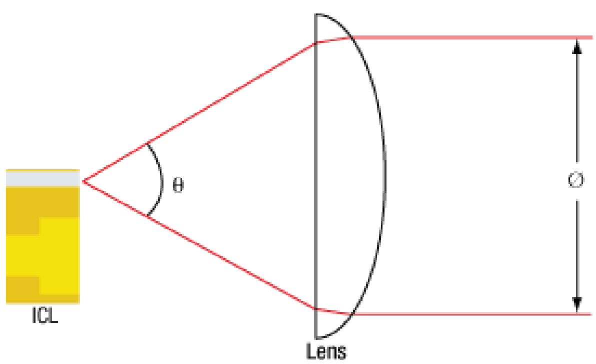
Choosing a Collimating Lens

Since the output of our MIR lasers is highly divergent, collimating optics are necessary. Aspheric lenses, which are corrected for spherical aberration, are commonly chosen when the desired beam diameter is between 1 - 5 mm. The simple example below illustrates the key specifications to consider when choosing the correct lens for a given application.

Example

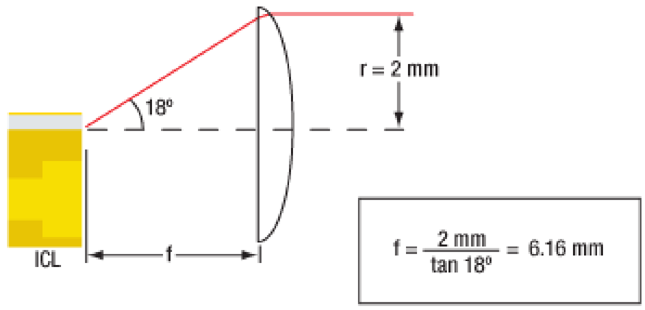
- Center Wavelength: 3.55 µm
- Laser Item #: IF3550CM1
- Desired Collimated Beam Diameter: 4 mm (Major Axis)

The specifications for the IF3550CM1 indicate that the typical parallel and perpendicular FWHM divergences are 29° and 36°, respectively. Therefore, as the light propagates, an elliptical beam will result. To collect as much light as possible during the collimation process, consider the larger of these two divergence angles in your calculations (in this case, 36°).



θ = Divergence Angle
Ø = Beam Diameter

Using the information above, the focal length needed to obtain the desired beam diameter can be calculated:



This information allows the appropriate collimating lens to be selected. Thorlabs offers a large selection of black diamond aspheric lenses for the mid-IR spectral range. Since this laser emits at 3.55 µm, the best AR coating is our -E coating, which provides R_{avg} < 0.6% per surface from 3 to 5 µm. The lenses with focal lengths closest to the calculated value of 6.16 mm are our 390028-E (unmounted) or C028TME-E (mounted) Molded Aspheric Lenses, which have f = 5.95 mm. Plugging this focal length back into the equation shown above gives a final beam diameter of 3.9 mm along the major axis.

Next, we verify that the numerical aperture (NA) of the lens is larger than the NA of the laser:

$$NA_{Lens} = 0.56$$

$$NA_{Laser} \sim \sin(18°) = 0.31$$

$$NA_{Lens} > NA_{Laser}$$

Since $NA_{Lens} > NA_{Laser}$, the 390028-E or C028TME-E lenses will give acceptable beam quality. However, by using the FWHM beam diameter, we have not accounted for a significant fraction of the beam power. A better practice is to use the $1/e^2$ beam diameter. For a Gaussian beam profile, the $1/e^2$ beam diameter is approximately equal to 1.7X the FWHM diameter. The $1/e^2$ beam diameter is therefore a more conservative estimate of the beam size, containing more of the laser's intensity. Using this value significantly reduces far-field diffraction (since less of the incident light is clipped) and increases the power delivered after the lens.

A good rule of thumb is to pick a lens with an NA of twice the NA of the laser diode. For example, either the 390037-E or the C037TME-E could be used as these lenses each have an NA of 0.85, which is more than twice that of our IF3550CM1 laser (NA 0.31). Compared to the first set of lenses we identified, these have a shorter focal length of 1.873 mm, resulting in a smaller final beam diameter of 1.22 mm.

Hide M^2 Measurement

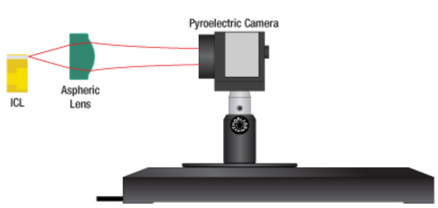
M^2 MEASUREMENT

Beam Profile Characterization of a Mid-IR Laser

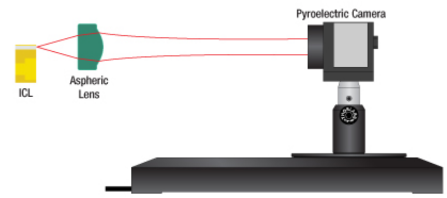
Because quantum cascade lasers (QCLs) and interband cascade lasers (ICLs) have intrinsically large divergence angles, it is necessary to install collimating optics in front of the laser face, as shown in the *Collimation* tab. We are frequently asked what beam quality can be reasonably expected once the beam has been collimated. This tab presents an M^2 measurement we performed using our 3.80 µm Interband Cascade Laser (Item # IF3800CM2).

For this system, we obtained $M^2 = 1.2 \pm 0.08$ in the parallel direction and $M^2 = 1.3 \pm 0.2$ in the perpendicular direction. While this is just one example, we believe these results to be representative of well-collimated mid-IR lasers manufactured by Thorlabs, as corroborated by supplementary measurements we have performed in-house.

Experimental Setup



Click to Enlarge
Pyroelectric Camera Upstream of Focus



Click to Enlarge
Pyroelectric Camera Downstream of Focus

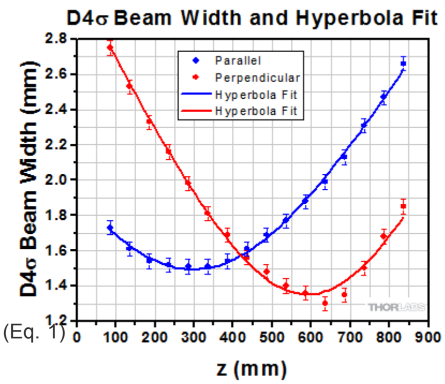
The apparatus we used to determine M^2 is shown schematically in the figure above. In order to ensure that our results were rigorous, all data acquisition and analysis were consistent with the ISO11146 standard.

The IF3800CM2 Interband Cascade Laser used for this measurement emitted CW laser light with a center wavelength of 3.781 µm. Our LDMC20 temperature-stabilized mount held the laser's temperature at 25 °C. The output beam was collimated by a C037TME-E lens located immediately downstream of the laser face. This lens was selected because of its large NA of 0.85 (which helped maximize collection of the emitted light) and because of its AR coating (R_{avg} < 0.6% per surface from 3 µm to 5 µm). We measured 10 mW of output power after the lens.

A pyroelectric camera (Spiricon Pyrocam IV) with 80 µm square pixels was scanned along the beam propagation direction, and the beam width was measured along the parallel and perpendicular directions using the second-order moment (D4σ) definition. Hyperbolas were fit to the beam width to extract M^2 for each direction. The camera's internal chopper was triggered at 50 Hz since the pyroelectric effect is sensitive to changes in temperature rather than absolute temperature differences. A ZnSe window was present in front of the detector array to help minimize visible light contributions to the signal.

Data Analysis

Presented to the right are the second-order moment (D4σ) beam widths for the parallel and perpendicular directions as a function of distance from the laser face (denoted as z). Along the parallel direction, we obtained a minimum beam width of 1.5 mm, while along the perpendicular direction, we obtained a minimum beam width of 1.3 mm. The spatial profiles we observed at the two minimum beam width positions, as obtained by the pyroelectric camera, are shown below.



Click to Enlarge
D4σ Beam Width of Collimated IF3800CM2 Laser

The divergence of the beam can be described by a hyperbola, as written in Equation 1:

$$D4\sigma(z) = \sqrt{a + bz + cz^2} \qquad \text{(Eq. 1)}$$

In order to obtain the hyperbola coefficients a, b, and c for the parallel and perpendicular directions, we fit the discrete beam width measurements along each direction to hyperbolas, as shown in the graph to the right. These coefficients were substituted into Equation 2 (taking λ = 3.781 µm) to yield M^2.

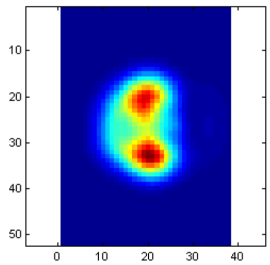
$$M^2 = \frac{\pi}{8\lambda}\sqrt{4ac - b^2} \qquad \text{(Eq. 2)}$$

The hyperbola coefficients and M^2 values derived by this method are listed in the table below.

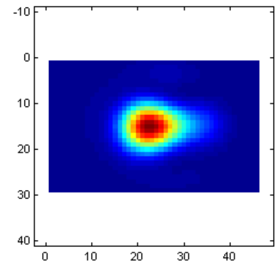
Value	Parallel	Perpendicular
a	3.6 ± 0.1 mm^2	9.7 ± 0.2 mm^2
b	-0.0096 ± 0.0007 mm	-0.0268 ± 0.0008 mm
c	(1.61 ± 0.08) × 10^{-5}	(2.27 ± 0.08) × 10^{-5}
M^2	1.2 ± 0.08	1.3 ± 0.2

The 0.85 NA of the collimating lens we used is the largest NA of any lens for this wavelength range that is offered in our catalog. Despite this large NA, we observed lobes in the far field (shown by the figure below) that are consistent with clipping of the laser-emitted light. An ideal measurement would not contain these artifacts.

As shown by the graph above and to the right, we observed significant astigmatism in the collimated beam: the beam waist of the parallel direction occurred around z = 300 mm, while the beam waist of the perpendicular direction occurred around z = 600 mm. This astigmatism corresponds closely to what is expected for this laser, given that the IF3800CM2 laser is specified with a parallel FWHM beam divergence of 40° and a perpendicular FWHM beam divergence of 60°.



Beam Profile at Beam Waist of Parallel Direction
(Each Pixel is 80 µm Square)



Beam Profile at Beam Waist of Perpendicular Direction
(Each Pixel is 80 µm Square)

Hide 3.55 - 3.80 µm Center Wavelength Fabry-Perot ICLs

3.55 - 3.80 µm Center Wavelength Fabry-Perot ICLs

Item #	Info	Center Wavelength[a]	Power	Typical/Max Operating Current	Wavelength Tested	Spatial Mode
IF3550CM1		3.55 µm (2816 cm^{-1})	30 mW	540 mA / 650 mA	Yes	Single
IF3800CM2		3.80 µm (2632 cm^{-1})	30 mW	550 mA / 650 mA	Yes	Single

- These lasers exhibit broadband emission. The center wavelength is defined as a weighted average over all the modes. Each device has a unique spectrum. To get the spectrum of a specific, serial-numbered device, click "Choose Item" below, then click on the Docs Icon next to the serial number of the device. If you need spectral characteristics different than those shown below, please contact Tech Support to request a custom laser.

Part Number	Description	Price	Availability
IF3550CM1	**Fabry-Perot Interband Cascade Laser, 3.55 µm CWL, 30 mW, Two-Tab C-Mount**	**$4,800.00**	**Lead Time**
IF3800CM2	**Fabry-Perot Interband Cascade Laser, 3.80 µm CWL, 30 mW, Two-Tab C-Mount**	**$4,800.00**	**Lead Time**

Hide 4.05 - 4.80 µm Center Wavelength Fabry-Perot QCLs

4.05 - 4.80 µm Center Wavelength Fabry-Perot QCLs

Item #	Info	Center Wavelength[a]	Power	Typical/Max Operating Current	Wavelength Tested	Spatial Mode
QF4050CM1		4.05 µm (2469 cm^{-1})	150 mW	1030 mA / 1150 mA	Yes	Single
QF4400CM1		4.40 µm (2273 cm^{-1})	500 mW	1020 mA / 1100 mA	Yes	Single
QF4550CM1[b]		4.55 µm (2198 cm^{-1})	450 mW	900 mA / 1100 mA	Yes	Single
QF4800CM1		4.80 µm (2083 cm^{-1})	500 mW	850 mA / 1050 mA	Yes	Single

- These lasers exhibit broadband emission. The center wavelength is defined as a weighted average over all the modes. Each device has a unique spectrum. To get the spectrum of a specific, serial-numbered device, click "Choose Item" below, then click on the Docs Icon next to the serial number of the device. If you need spectral characteristics different than those shown below, please contact Tech Support to request a custom laser.
- If emission at a single wavelength is preferred, please consider our 4.54 - 4.62 µm Distributed Feedback Lasers.

Part Number	Description	Price	Availability
QF4050CM1	**Fabry-Perot Quantum Cascade Laser, 4.05 µm CWL, 150 mW, Two-Tab C-Mount**	**$4,800.00**	**Today**
QF4050CM1	**Center Wavelength: 4.05 µm, 150 mW (1068 mA), 25 °C**	**$4,800.00**	**Today**
QF4400CM1	**Fabry-Perot Quantum Cascade Laser, 4.40 µm CWL, 500 mW, Two-Tab C-Mount**	**$4,800.00**	**Today**
QF4400CM1	**Center Wavelength: 4.42 µm, 500 mW (1097 mA), 25 °C**	**$4,800.00**	**Today**
QF4550CM1	**Fabry-Perot Quantum Cascade Laser, 4.55 µm CWL, 450 mW, Two-Tab C-Mount**	**$4,800.00**	**Today**
QF4550CM1	**Center Wavelength: 4.58 µm, 450 mW (1006 mA), 25 °C**	**$4,800.00**	**Today**
QF4550CM1	**Center Wavelength: 4.58 µm, 450 mW (1015 mA), 25 °C**	**$4,800.00**	**Today**
QF4550CM1	**Center Wavelength: 4.58 µm, 450 mW, (970 mA), 25 °C**	**$4,800.00**	**Today**
QF4800CM1	**Fabry-Perot Quantum Cascade Laser, 4.80 µm CWL, 500 mW, Two-Tab C-Mount**	**$4,800.00**	**Today**
QF4800CM1	**Center Wavelength: 4.80 µm, 500 mW (842 mA), 25 °C**	**$4,800.00**	**Today**
QF4800CM1	**Center Wavelength: 4.81 µm, 500 mW (792 mA), 25 °C**	**$4,800.00**	**Today**

Hide 5.30 µm Center Wavelength Fabry-Perot QCLs

5.30 µm Center Wavelength Fabry-Perot QCLs

Item #	Info	Center Wavelength[a]	Power	Typical/Max Operating Current	Wavelength Tested	Spatial Mode
QF5300CM1[b]		5.30 µm (1887 cm^{-1})	150 mW	1200 mA / 1300 mA	Yes	Single

- These lasers exhibit broadband emission. The center wavelength is defined as a weighted average over all the modes. Each device has a unique spectrum. To get the spectrum of a specific, serial-numbered device, click "Choose Item" below, then click on the Docs Icon next to the serial number of the device. If you need spectral characteristics different than those shown below, please contact Tech Support to request a custom laser.
- If emission at a single wavelength is preferred, please consider our 5.20 - 5.30 µm Distributed Feedback Lasers.

Part Number	Description	Price	Availability
QF5300CM1	**Fabry-Perot Quantum Cascade Laser, 5.30 µm CWL, 150 mW, Two-Tab C-Mount**	**$4,800.00**	**Today**
QF5300CM1	**Center Wavelength: 5.29 µm, 150 mW, (1200 mA), 25 °C**	**$4,800.00**	**Today**
QF5300CM1	**Center Wavelength: 5.22 µm, 150 mW, (1187 mA), 25 °C**	**$4,800.00**	**Today**

Hide 7.70 µm Center Wavelength Fabry-Perot QCLs

7.70 µm Center Wavelength Fabry-Perot QCLs

Item #	Info	Center Wavelength[a]	Power	Typical/Max Operating Current	Wavelength Tested	Spatial Mode
QF7700CM1		7.70 µm (1299 cm^{-1})	250 mW	1100 mA / 1300 mA	Yes	Single

- These lasers exhibit broadband emission. The center wavelength is defined as a weighted average over all the modes. Each device has a unique spectrum. To get the spectrum of a specific, serial-numbered device, click "Choose Item" below, then click on the Docs Icon next to the serial number of the device. If you need spectral characteristics different than those shown below, please contact Tech Support to request a custom laser.

Part Number	Description	Price	Availability
QF7700CM1	**Fabry-Perot Quantum Cascade Laser, 7.70 µm CWL, 250 mW, Two-Tab C-Mount**	**$4,800.00**	**Lead Time**

Hide 8.35 µm Center Wavelength Fabry-Perot QCLs

8.35 µm Center Wavelength Fabry-Perot QCLs

Item #	Info	Center Wavelength[a]	Power	Typical/Max Operating Current	Wavelength Tested	Spatial Mode
QF8350CM1		8.35 µm (1198 cm^{-1})	300 mW	1750 mA / 2000 mA	Yes	Single

- These lasers exhibit broadband emission. The center wavelength is defined as a weighted average over all the modes. Each device has a unique spectrum. To get the spectrum of a specific, serial-numbered device, click "Choose Item" below, then click on the Docs Icon next to the serial number of the device. If you need spectral characteristics different than those shown below, please contact Tech Support to request a custom laser.

Part Number	Description	Price	Availability
QF8350CM1	**Fabry-Perot Quantum Cascade Laser, 8.35 µm CWL, 300 mW, Two-Tab C-Mount**	**$4,800.00**	**Today**
QF8350CM1	**Center Wavelength: 8.44 µm, 300 mW (1760 mA), 25 °C**	**$4,800.00**	**Today**
QF8350CM1	**Center Wavelength: 8.34 µm, 300 mW (1666 mA), 25 °C**	**$4,800.00**	**Today**

Hide 9.15 - 9.55 µm Center Wavelength Fabry-Perot QCLs

9.15 - 9.55 µm Center Wavelength Fabry-Perot QCLs

Item #	Info	Center Wavelength[a]	Power	Typical/Max Operating Current	Wavelength Tested	Spatial Mode
QF9150CM1		9.15 µm (1093 cm^{-1})	180 mW	1500 mA / 1750 mA	Yes	Single

QF9550CM1[b]		9.55 µm (1047 cm^{-1})	80 mW	1500 mA / 1700 mA	Yes	Single

- These lasers exhibit broadband emission. The center wavelength is defined as a weighted average over all the modes. Each device has a unique spectrum. To get the spectrum of a specific, serial-numbered device, click "Choose Item" below, then click on the Docs Icon next to the serial number of the device. If you need spectral characteristics different than those shown below, please contact Tech Support to request a custom laser.
- If emission at a single wavelength is preferred, please consider our 9.50 - 9.60 µm Distributed Feedback Lasers.

Part Number	Description	Price	Availability
QF9150CM1	**Fabry-Perot Quantum Cascade Laser, 9.15 µm CWL, 180 mW, Two-Tab C-Mount**	**$4,800.00**	**Today**
QF9150CM1	**Center Wavelength: 9.16 µm, 180 mW (1544 mA), 25 °C**	**$4,800.00**	**Today**
QF9550CM1	**Fabry-Perot Quantum Cascade Laser, 9.55 µm CWL, 80 mW, Two-Tab C-Mount**	**$4,800.00**	**Today**
QF9550CM1	**Center Wavelength: 9.64 µm, 80 mW, (1417 mA), 25 °C**	**$4,800.00**	**Today**
QF9550CM1	**Center Wavelength: 9.68 µm, 80 mW, (1465 mA), 25 °C**	**$4,800.00**	**Today**