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THORLABS

LP473-SF6 - December 14, 2017

Item # LP473-SF6 was discontinued on December 14, 2017. For informational purposes, this is a copy of the website content at that time and is valid only for the stated product.

PIGTAILED LASER DIODES, SINGLE MODE FIBER

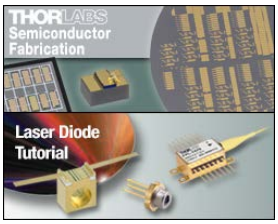
- **Wavelengths from 405 to 1625 nm**
- **FC/PC or FC/APC Connector**
- **Custom Pigtails Available**

Hide Overview

OVERVIEW

Features

- Single Mode Pigtails from 405 nm to 1625 nm
- Internal 8°-Angle-Cleaved Fiber (See the *Design* Tab)
- Connector: FC/PC or FC/APC (2.0 mm Narrow Key)
- 1 m of SM Fiber
- Custom Pigtails Available Upon Request



Thorlabs offers a variety of laser diodes pigtailed with single mode (SM) optical fiber. Diodes are sorted by wavelength and then power, and tables list key specifications for quick identification of diodes suitable for your application. The blue button in the Info column within the tables opens a pop-up window that contains more detailed specifications for each item, as well as mechanical drawings.

Our precise pigtail alignment process for laser diodes includes multiple test and inspection points that ensure that the coupling efficiency of the laser emission into the single mode pigtail is maximized. In addition, the input end of the fiber is cleaved at an 8° angle in order to minimize back reflections that can cause the output intensity to fluctuate (see the *Design* tab for details). We offer versions based on TO-packaged diodes (Ø5.6 mm, Ø9 mm, or non-standard Ø9.5 mm).

While the center wavelength is listed for each laser diode, this is only a typical number. The center wavelength of a particular unit varies from production run to production run, so the diode you receive may not operate at the typical center wavelength. After clicking "Choose Item" below, a list will appear

Laser Diode Selection Guide[a]
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 TO Can Pigtail (SM)
VHG-Stabilized TO Can or Pigtail (SM)
ECL Butterfly Package
DBR Butterfly Package
MIR DFB Two-Tab C-Mount
MIR DFB D-Mount
MIR DFB High Heat Load
Shop By Wavelength

that contains the dominant wavelength, output power, and operating current of each in-stock unit. Clicking on the red Docs Icon next to the serial number provides access to a PDF with serial-number-specific L-I-V and spectral characteristics.

- Our complete selection of laser diodes is available on the *LD Selection Guide* tab above.

The reliability of the laser diode rapidly declines at higher temperatures. Therefore, for stable output power and wavelength, it is highly recommended that you use a temperature controller with these products. Diodes can also be temperature tuned, which will alter the lasing wavelength.

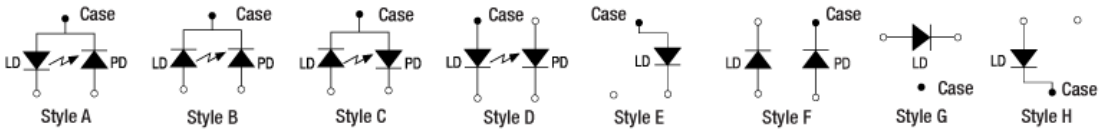
Webpage Features	
	Clicking this icon opens a window that contains specifications and mechanical drawings.
	Clicking this icon allows you to download our standard support documentation.
Choose Item	Clicking the words "Choose Item" opens a drop-down list containing all of the in-stock lasers around the 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.

Laser diodes are sensitive to electrostatic shock. Please take the proper precautions when handling the device, such as using an ESD wrist strap. These lasers are also sensitive to optical feedback, which can cause significant fluctuations in the output power of the laser diode depending on the application.

We recommend cleaning the fiber connector before each use, if there is any chance that dust or other contaminants may have deposited on the surface. To view our fiber cleaning products, click here. The laser intensity at the center of the fiber tip can be very high and may burn the tip of the fiber if contaminants are present. While the connectors on these pigtailed laser diodes are cleaned and capped before shipping, we cannot guarantee that they will remain free of contamination after they are removed from the package. For all of these pigtailed laser diodes, the laser should be off when connecting or disconnecting the device from other fibers, particularly for lasers with power levels above 10 mW.

Please contact Technical Support if you would like a quote on custom pigtailed laser diodes or for a volume order.

Pin Codes



For warranty information and the Thorlabs Life Support and Military Use Policy for laser diodes, please refer to the *LD Operation* tab.

Hide Design

DESIGN

The drawing to the right shows a laser diode's emitted light focused into an angle-polished fiber. By angling the optical fiber at 8°, light that is not coupled into the optical fiber is reflected away from the laser diode. If this reflected light were reflected back toward the diode, light would be coupled into the diode and cause fluctuations in power and wavelength.

Further Reducing Back Reflection

Although we use a fiber coupling design that minimizes back reflections, other factors may couple light back into the fiber. Many of our standard pigtailed laser diodes feature optical fiber with an FC/PC connector. When the FC/PC connector is not connected directly to another FC/PC connector, about 4% of light in the fiber is reflected back toward the laser diode due to the silica/air interface. Customers who require a silica/air interface or minimal back reflections in their application can contact Tech Support to request FC/APC connectors. As FC/APC connectors have an angled polish, light reflected back toward the diode will be further minimized. We stock one pigtailed diode for 808 nm (Item # LP808-SA40) with an FC/APC connector.

Hide LD Operation

LD OPERATION

Laser Diode and Laser Diode Pigtail Warranty

When operated within their specifications, laser diodes have extremely long lifetimes. However most failures occur from mishandling or operating the lasers beyond their maximum ratings. Laser Diodes are among the most static sensitive devices currently made. Since Thorlabs does not receive any warranty credit from our laser manufacturers we cannot guarantee the lasers after their sealed package has been open. Thorlabs will be happy to extend a full refund or credit for any lasers returned in their original sealed package.

Handling and Storage Precautions

Because of their extreme susceptibility to damage from electrostatic discharge (ESD), care should be taken whenever handling and operating laser diodes:

- **Wrist Straps:** Use grounded anti-static wrist straps whenever handling diodes.
- **Anti-static Mats:** Always work on grounded anti-static mats.
- **Storing Lasers:** When not in use, short the leads of the laser together to protect against ESD damage.

Operating and Safety Precautions

Use an appropriate driver, laser diodes require precise control of operating current and voltage to avoid overdriving the lasers. In addition, the laser driver should provide protection against power supply transients. Select a laser driver appropriate for your application. **Do not use a voltage supply with a current limiting resistor** since it does not provide sufficient regulation to protect the laser.

- **Power Meters:** When setting up and calibrating a laser with its driver, use a NIST-traceable power meter to precisely measure the laser output. It is usually safest to measure the laser output directly before placing the laser in an optical system. If this is not possible, be sure to take all optical losses (transmissive, aperture stopping, etc.) into consideration when determining the total output of the laser.
- **Reflections:** Flat surfaces in the optical system in front of a laser diode can cause some of the laser energy to reflect back onto the laser's monitor photodiode giving an erroneously high photodiode current. If optical components are moved within the system and energy is no longer reflected onto the monitor photodiode, a constant power feedback loop will sense the drop in photodiode current and try to compensate by increasing the laser drive current and possibly overdriving the laser. Back reflections can also cause other malfunctions or damage to laser diodes. To avoid this, be sure that all surfaces are angled 5-10° and when necessary, use optical isolators to attenuate direct feedback into the laser.
- **Heat Sinks:** Laser lifetime is inversely proportional to operating temperature. Always mount the laser in a suitable heat sink to remove excess heat from the laser package.
- **Voltage and Current Overdrive:** Be careful not to exceed the maximum voltage and currents even momentarily. Also, reverse voltages as little as 3 V can damage a laser diode.
- **ESD Sensitive Device:** Even when a laser is operating it is susceptible to ESD damage. This is particularly aggravated by using long interface cables between the laser and its driver due to the inductance that the cable presents. Avoid exposing the laser or its mounting apparatus to ESDs at all times.
- **ON/OFF and Power Supply Coupled Transients:** Because of their fast response times, laser diodes can be easily damaged by transients less than 1 µs. High current devices such as soldering irons, vacuum pumps, fluorescent lamps, etc., can cause large momentary transients; use surge-protected outlets.

If you have any questions regarding laser diodes, please call your local Thorlabs Technical Support office for assistance.

Life Support and Military Use Application Policy

THORLABS' PRODUCTS ARE NOT AUTHORIZED FOR USE AS CRITICAL COMPONENTS IN LIFE SUPPORT DEVICES OR SYSTEMS OR IN ANY MILITARY APPLICATION WITHOUT THE EXPRESS WRITTEN APPROVAL OF THE PRESIDENT OF THORLABS, INC.

As used herein:

1. Life support devices or systems are devices or systems which, (a) are intended for surgical implant into the body, or (b) support or sustain life, and whose failure to perform, when properly used in accordance with instructions for use provided in the labeling, can be reasonably expected to result in a significant injury to the user.
2. A critical component is any component in a life support device or system whose failure to perform can be reasonably expected to cause the failure of the life support device or system or to affect its safety or effectiveness.
3. The Thorlabs products described in this document are not intended nor warranted for usage in Military Applications.

Hide Laser Safety

LASER SAFETY

Laser Safety and Classification

Safe practices and proper usage of safety equipment should be taken into consideration when operating lasers. The eye is susceptible to injury, even from very low levels of laser light. Thorlabs offers a range of laser safety accessories that can be used to reduce the risk of accidents or injuries. Laser emission in the visible and near infrared spectral ranges has the greatest potential for retinal injury, as the cornea and lens are transparent to those wavelengths, and the lens can focus the laser energy onto the retina.

Safe Practices and Light Safety Accessories

- Thorlabs recommends the use of safety

eyewear whenever working with laser beams with non-negligible powers (i.e., > Class 1) since metallic tools such as screwdrivers can accidentally redirect a beam.
- Laser goggles designed for specific wavelengths should be clearly available near laser setups to protect the wearer from unintentional laser reflections.
- Goggles are marked with the wavelength range over which protection is afforded and the minimum optical density within that range.
- Laser Safety Curtains and Blackout Materials can prevent direct or reflected light from leaving the experimental setup area.
- Thorlabs' Enclosure Systems can be used to contain optical setups to isolate or minimize laser hazards.
- A fiber-pigtailed laser should always be turned off before connecting it to or disconnecting it from another fiber, especially when the laser is at power levels above 10 mW.
- All beams should be terminated at the edge of the table, and laboratory doors should be closed whenever a laser is in use.
- Do not place laser beams at eye level.
- Carry out experiments on an optical table such that all laser beams travel horizontally.
- Remove unnecessary reflective items such as reflective jewelry (e.g., rings, watches, etc.) while working near the beam path.
- Be aware that lenses and other optical devices may reflect a portion of the incident beam from the front or rear surface.
- Operate a laser at the minimum power necessary for any operation.
- If possible, reduce the output power of a laser during alignment procedures.
- Use beam shutters and filters to reduce the beam power.
- Post appropriate warning signs or labels near laser setups or rooms.
- Use a laser sign with a lightbox if operating Class 3R or 4 lasers (i.e., lasers requiring the use of a safety interlock).
- Do not use Laser Viewing Cards in place of a proper Beam Trap.

Laser Classification

Lasers are categorized into different classes according to their ability to cause eye and other damage. The International Electrotechnical Commission (IEC) is a global organization that prepares and publishes international standards for all electrical, electronic, and related technologies. The IEC document 60825-1 outlines the safety of laser products. A description of each class of laser is given below:

Class	Description	Warning Label
1	This class of laser is safe under all conditions of normal use, including use with optical instruments for intrabeam viewing. Lasers in this class do not emit radiation at levels that may cause injury during normal operation, and therefore the maximum permissible exposure (MPE) cannot be exceeded. Class 1 lasers can also include enclosed, high-power lasers where exposure to the radiation is not possible without opening or shutting down the laser.	
1M	Class 1M lasers are safe except when used in conjunction with optical components such as telescopes and microscopes. Lasers belonging to this class emit large-diameter or divergent beams, and the MPE cannot normally be exceeded unless focusing or imaging optics are used to narrow the beam. However, if the beam is refocused, the hazard may be increased and the class may be changed accordingly.	
2	Class 2 lasers, which are limited to 1 mW of visible continuous-wave radiation, are safe because the blink reflex will limit the exposure in the eye to 0.25 seconds. This category only applies to visible radiation (400 - 700 nm).	
2M	Because of the blink reflex, this class of laser is classified as safe as long as the beam is not viewed through optical instruments. This laser class also applies to larger-diameter or diverging laser beams.	
3R	Lasers in this class are considered safe as long as they are handled with restricted beam viewing. The MPE can be exceeded with this class of laser, however, this presents a low risk level to injury. Visible, continuous-wave lasers are limited to 5 mW of output power in this class.	
	Class 3B lasers are hazardous to the eye if exposed directly. However, diffuse reflections are not harmful. Safe handling of devices in	

3B	this class includes wearing protective eyewear where direct viewing of the laser beam may occur. In addition, laser safety signs lightboxes should be used with lasers that require a safety interlock so that the laser cannot be used without the safety light turning on. Class-3B lasers must be equipped with a key switch and a safety interlock.	
4	This class of laser may cause damage to the skin, and also to the eye, even from the viewing of diffuse reflections. These hazards may also apply to indirect or non-specular reflections of the beam, even from apparently matte surfaces. Great care must be taken when handling these lasers. They also represent a fire risk, because they may ignite combustible material. Class 4 lasers must be equipped with a key switch and a safety interlock.	
All class 2 lasers (and higher) must display, in addition to the corresponding sign above, this triangular warning sign		

Hide 405 - 488 nm Pigtails

405 - 488 nm Pigtails

Item #	Info	Wavelength	Power (Typ.)[a]	Typical/Max Drive Current[a]	Pin Code[b]	Package	Compatible Socket	Wavelength Tested	Recommended Mount(s)	Recommended Driver
LP405-SF10		405 nm	10 mW	50 mA / 60 mA	B	Ø5.6 mm SM Pigtail, FC/PC	S7060R[c]	Yes	LDM9LP or CLD1011LP	ITC4001[d]
LP450-SF15		450 nm	15 mW	85 mA / 120 mA	E	Ø9 mm SM Pigtail, FC/PC	S8060 or S8060-4	Yes	LDM9LP or CLD1010LP	ITC4001[d]
LP473-SF6		473 nm	6 mW	80 mA / 120 mA	B	Ø5.6 mm SM Pigtail, FC/PC	S7060R[c]	Yes	LDM9LP or CLD1011LP	ITC4001[d]
LP488-SF20		488 nm	20 mW	85 mA / 110 mA	B	Ø5.6 mm SM Pigtail, FC/PC	S7060R[c]	Yes	LDM9LP or CLD1011LP	ITC4001[d]

- Do not exceed the maximum optical power or maximum drive current, whichever occurs first.
- Laser diodes with A, B, C, or D pin codes have a built-in monitor photodiode and therefore support constant power operation.
- This socket is included with the purchase of the corresponding laser diode.
- The ITC4001 driver is only necessary if the LDM9LP mount or a custom mount is used, as the CLD1010LP and CLD1011LP are each a combined mount and driver.

Part Number	Description	Price	Availability
LP405-SF10	405 nm, 10 mW, B Pin Code, SM Fiber-Pigtailed Laser Diode, FC/PC	$607.00	Today
LP405-SF10	CWL = 403.9 nm, P = 10.0 mW (I = 47 mA), 25 °C	$607.00	Today
LP405-SF10	CWL = 404.8 nm, P = 10.0 mW (I = 52 mA), 25 °C	$607.00	Today
LP405-SF10	CWL = 403.8 nm, P = 10.0 mW (I = 45 mA), 25 °C	$607.00	Today
LP450-SF15	450 nm, 15 mW, E Pin Code, SM Fiber-Pigtailed Laser Diode, FC/PC	$632.80	Today
LP450-SF15	CWL = 447.4 nm, P = 15.0 mW (I = 103 mA), 25 °C	$632.80	Today
LP450-SF15	CWL = 452.2 nm, P = 15.0 mW (I = 99 mA), 25 °C	$632.80	Today
LP450-SF15	CWL = 449.6 nm, P = 15.0 mW (I = 57 mA), 25 °C	$632.80	Today
LP450-SF15	CWL = 448.7 nm, P = 15.0 mW (I = 81 mA), 25 °C	$632.80	Today
LP450-SF15	CWL = 449.9 nm, P = 15.0 mW (I = 74 mA), 25 °C	$632.80	Today
LP450-SF15	CWL = 449.5 nm, P = 15.0 mW (I = 71 mA), 25 °C	$632.80	Today
LP450-SF15		$632.80	3-5 Days
LP473-SF6	473 nm, 6 mW, B Pin Code, SM Fiber-Pigtailed Laser Diode, FC/PC	$4,602.00	Lead Time
LP488-SF20	488 nm, 20 mW, B Pin Code, SM Fiber-Pigtailed Laser Diode, FC/PC	$2,863.00	Today
LP488-SF20	CWL = 487.5 nm, P = 20.0 mW (I = 64 mA), 25 °C	$2,863.00	Today
LP488-SF20	CWL = 487.5 nm, P = 20.0 mW (I = 68 mA), 25 °C	$2,863.00	Today
LP488-SF20	CWL = 485.1 nm, P = 20.0 mW (I = 63 mA), 25 °C	$2,863.00	Today
LP488-SF20	CWL = 488.4 nm, P = 20.0 mW (I = 86 mA), 25 °C	$2,863.00	Today
LP488-SF20		$2,863.00	3-5 Days

LP473-SF6 - 473 nm, 6 mW, B Pin Code, SM Fiber-Pigtailed Laser Diode, FC/PC

Specifications | Fiber Specs | Drawings

Optical Electrical Characteristics (T_{CASE} = 25 °C, P = 6 mW)				
Characteristic	**MIN**	**TYP**	**MAX**	**UNIT**
Center Wavelength	463	473	483	nm
Optical Output Power (CW)	-	6	7	mW
Operating Voltage	-	5.0	6.0	V
Operating Current	-	80	120	mA
Threshold Current	-	50	80	mA
Monitor Current	0.1	0.5	0.8	mA
Slope Efficiency	0.1	0.25	-	W/A

Absolute Maximum Ratings[a]		
Characteristic		
Fiber Output Power	7	mW
LD Reverse Voltage	5	V
Operating Temperature	0 to 50	°C
Storage Temperature	-10 to 65	°C

a. Absolute Maximum Rating specifications should never be exceeded. Operating beyond these conditions can seriously damage the laser. For more information, please see the Laser Diode Tutorial.

General Specifications	
Characteristic	**Value**
Monitor Photodiode	Yes[a]
Package	Ø5.6 mm SM Pigtail, FC/PC
Pin Code	B
Compatible Socket	S7060R[b]
Recommended Mounts	LDM9LP or CLD1011LP
Recommended Driver	ITC4001[c]
Spatial Mode	Single Mode
Wavelength Tested	Yes

a. Laser diodes with a built-in monitor photodiode can operate at constant power.
b. This socket is included with the purchase of the corresponding laser diode.
c. The ITC4001 driver is only necessary if the LDM9LP mount or a custom mount is used, as the CLD1010LP and CLD1011LP are each a combined mount and driver.

LP473-SF6 - 473 nm, 6 mW, B Pin Code, SM Fiber-Pigtailed Laser Diode, FC/PC

Specifications | Fiber Specs | Drawings

Fiber Specifications	
Characteristic	
Fiber Type	460HP
Mode Field Diameter[a]	3.5 ± 0.5 µm at 515 nm
Numerical Aperture	0.13
Fiber Length	1 m
Connector	FC/PC, 2.0 mm Narrow Key

a. Mode Field Diameter (MFD) is specified as a nominal value.

Specifications | Fiber Specs | Drawings