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THORLABS

M530F1 - March 22, 2016

Item # M530F1 was discontinued on March 22, 2016. For informational purposes, this is a copy of the website content at that time and is valid only for the stated product.

FIBER-COUPLED LEDS

- ► UV, Visible, and NIR Versions
- ► Optimized Heat Management Results in Stable Output
- ► Integrated Chip Stores LED Operating Parameters
- ► Accepts SMA Fiber Connector

Hide Overview

OVERVIEW

Fiber-Coupled LED Features

- Nominal Wavelengths Ranging from 280 nm to 1050 nm
- Warm White (3000 K), Cold White (5600 K), and Broadband (470 - 850 nm) LEDs Also Available
- Integrated Identification Chip (EEPROM) Stores LED Operating Parameters
- Optimized Thermal Properties Lead to Stable Output Power
- SMA Bulkheads are Ideal for use with Multimode Fiber Optic Patch Cables

Each fiber-coupled LED consists of a single LED that is coupled to the optical fiber using the butt-coupling technique. During this process, the fiber connector is positioned so that the end of the fiber will be as close as possible to the emitter, thereby minimizing losses at the fiber input and maximizing output power. The coupling efficiency is primarily dependent on the core diameter and the numerical aperture (NA) of the connected fiber. Larger core diameters and higher NA values give rise to reduced losses and

Item #	Color (Click for Spectrum)[a]	Nominal Wavelength[a,b]	Ø200 µm Core Fiber Output (Typ.)[c]	Ø400 µm Core Fiber Output (Typ.)[d]
M280F2[e]	UV	280 nm	65.7 µW	323 µW
M340F2[e]	UV	340 nm	0.58 mW	1.57 mW
M365F1[e]	UV	365 nm	1.0 mW	4.1 mW
M365FP1[e]	UV	365 nm	5.29 mW	15.5 mW
M375F2[e]	UV	375 nm	1.57 mW	4.23 mW
M385F1[e]	UV	385 nm	2.68 mW	10.7 mW
M385FP1[e]	UV	385 nm	7.7 mW	23.2 mW
M395F3[e]	UV	395 nm	1.91 mW	6.8 mW
M405F1[e]	UV	405 nm	0.93 mW	3.7 mW
M405FP1[e]	UV	405 nm	7.7 mW	24.3 mW
M420F2[e]	Violet	420 nm	8.91 mW	16.2 mW
M455F1	Royal Blue	455 nm	2.75 mW	11.0 mW
M470F1	Blue	470 nm	2.53 mW	10.1 mW
M490F2	Blue	490 nm	0.42 mW	2.0 mW
M505F1	Cyan	505 nm	2.0 mW	8.0 mW
M530F1	Green	530 nm	1.3 mW	5.1 mW

increased output power at the end of the fiber. Additionally, high-OH content or solarization-resistant fibers are recommended for use with LED wavelengths below 400 nm (please refer to the table below for recommended patch cables).

The spectrum of each LED and associated data file can be viewed by clicking on the links in the table to the right. Multiple windows can be opened simultaneously in order to compare LEDs.

Optimized Thermal Management

These fiber-coupled LEDs possess good thermal stability properties. The 34 mm long, passively-cooled heat sink used in most of our fiber-coupled LEDs is in direct contact with the metal-core circuit board on which the LED is mounted. This minimizes the degradation of optical output power caused by increased LED junction temperature. Some of our fiber-coupled LEDs with a higher power output (M365FP1, M385FP1, and M405FP1) are mounted to a 50 mm long heat sink for increased heat dissipation and thermal stability.

White Light and Broadband LED

Our cold white and warm white LEDs feature broad spectra that span several hundred nanometers. The difference in appearance between these two LEDs can be described using the correlated color temperature, which indicates that the LEDs color appearance is similar to a black body radiator at that temperature. In general, warm white LEDs offer a spectrum similar to a tungsten source, while cold white LEDs have a stronger blue component to the spectrum. Cold white LEDs are more suited for fluorescence microscopy applications or cameras with white balancing, because of a higher intensity at most wavelengths compared to warm white LEDs.

M565F1	Green Yellow	565 nm	0.50 mW	2.0 mW
M590F1	Amber	590 nm	0.80 mW	3.2 mW
M617F1	Orange	617 nm	2.70 mW	10.8 mW
M625F1	Red	625 nm	2.53 mW	10.1 mW
M660F1	Deep Red	660 nm	3.63 mW	14.5 mW
M740F2	Far Red	740 nm	2.1 mW	6.0 mW
M780F2	IR	780 nm	1.15 mW	7.5 mW
M810F2	IR	810 nm	2.31 mW	6.5 mW
M850F2	IR	850 nm	3.35 mW	13.4 mW
M880F2	IR	880 nm	0.58 mW	3.4 mW
M940F1	IR	940 nm	1.6 mW	6.5 mW
M970F2	IR	970 nm	0.04 mW	0.3 mW
M1050F1	IR	1050 nm	0.35 mW	1.4 mW
MBB1F1[f]	Broadband	470 - 850 nm[g]	0.30 mW	1.2 mW
MWWHF1[h]	Warm White	3000 K[i]	1.8 mW	7.0 mW
MCWHF1[h]	Cold White	5600 K[i]	1.8 mW	7.0 mW

a. Due to variations in the manufacturing process and operating parameters such as temperature and current, the actual spectral output of any given LED will vary. Output plots and nominal wavelength specs are only intended to be used as a guideline.
b. For LEDs with a visible spectrum, the nominal wavelength indicates the wavelength at which the LED appears brightest to the human eye. The nominal wavelength for visible LEDs may not correspond to the peak wavelength as measured by a spectrometer.
c. All LEDs except M280F2 were tested using MM Fiber with Ø200 µm core, 0.22 NA (Item # FG200UCC); the M280F2 was tested using Item # FG200AEA. See the *Output Power* tab for more output power test data.
d. All LEDs except M280F2 were tested using MM Fiber with Ø400 µm core, 0.39 NA (Item # FT400EMT); the M280F2 was tested with 0.22 NA fiber (Item # FG400AEA). See the *Output Power* tab for more output power test data.
e. Our 280 nm to 420 nm LEDs radiate intense UV light during operation. Precautions must be taken to prevent looking directly at the UV light and UV light protective glasses must be worn to avoid eye damage. Exposure of the skin and other body parts to the UV light should be avoided.
f. The MBB1F1 LED may not turn off completely when modulated at frequencies above 1 kHz with a duty cycle of 50%, as the broadband emission is produced by optically stimulating emission from phosphor. For modulation at frequencies above 1 kHz, the duty cycle may be reduced. For example, 10 kHz modulation is attainable with a duty cycle of 5%.
g. 10 dB Bandwidth.
h. The MWWHF1 and MCWHF1 LEDs may not turn off completely when modulated at frequencies above 5 kHz, as the white light is produced by optically stimulating emission from phosphor.
i. Correlated Color Temperature

The MBB1F1 fiber-coupled LED has been designed to have relatively flat spectral emission over a wide wavelength range. Its FWHM bandwidth ranges from 500 nm to 780 nm, while the 10 dB bandwidth ranges between 470 nm and 850 nm. For more information on the spectrum of this broadband source, please see the table to the right.

Driver Options

Each LED is equipped with an integrated EEPROM (read-only memory) chip storing information about the LED (e.g., current limit, wavelength, and forward voltage) that can be read by Thorlabs' DC2200, DC4100, and DC4104 Controllers (the latter two require the DC4100-HUB). These drivers can automatically adjust the maximum current setting based on the information stored in the EEPROM chip to protect the connected LED. The DC4100 and DC4104 can modulate the LED at a rate up to 100 kHz while the DC2200 can provide modulation at up to 250 kHz if driven by an external source. A fourth driver, the LEDD1B, is capable of providing LED modulation frequencies up to 5 kHz, but is not capable of reading information from the EEPROM chip. For more information about all of these LED drivers, see the *LED Drivers* tab.

Optogenetics Applications

Our fiber-coupled LEDs are ideal light sources for optogenetics applications. They feature a variety of wavelength choices and a convenient interconnection to optogenetics patch cables. Additionally, up to four different light sources can be driven and modulated simultaneously with our DC4100 controller and DC4100-HUB hub. Click here for our entire line of optogenetics products.

Recommended Fiber Patch Cables	

LED Wavelength	Recommended Fiber
<300 nm	M113L01 (Ø400 µm, 0.22 NA, Solarization Resistant, SMA-SMA)
350 - 400 nm	Custom Patch Cable Using FT400UMT (Ø400 µm, 0.39 NA, High-OH, SMA-SMA)
400 nm - 700 nm	M28L01 (Ø400 µm, 0.39 NA, Low-OH, SMA-SMA) Custom Patch Cable Using FT400UMT (Ø400 µm, 0.39 NA, High-OH, SMA-SMA)
>700 nm	M28L01 (Ø400 µm, 0.39 NA, Low-OH, SMA-SMA)

Hide Specs

SPECS

Item #	Color (Click for Spectrum and Data)[a]	Nominal Wavelength[a,b]	Typical Ø200 µm Core Fiber Output Power[c]	Minimum Ø400 µm Core Fiber Output Power[d]	Typical Ø400 µm Core Fiber Output Power[d]	Test Current for LED Power	Maximum Current (CW)	Forward Voltage	Bandwidth (FWHM)	Typical Lifetime
M280F2[e]	UV	280 nm	65.7 µW	260 µW	323 µW	350 mA	350 mA	5.9 V	12 nm	>500 h
M340F2[e]	UV	340 nm	0.58 mW	1.22 mW	1.57 mW	700 mA	700 mA	4.6 V	11 nm	>3 000 h
M365F1[e]	UV	365 nm	1.0 mW	3.0 mW	4.1 mW	700 mA	700 mA	4.4 V	7.5 nm	>10 000 h
M365FP1[e]	UV	365 nm	5.29 mW	9.8 mW	15.5 mW	1400 mA	1400 mA	3.75 V	9 nm	>10 000 h
M375F2[e]	UV	375 nm	1.57 mW	3.2 mW	4.23 mW	500 mA	500 mA	4.5 V	9 nm	>10 000 h
M385F1[e]	UV	385 nm	2.68 mW	9.0 mW	10.7 mW	700 mA	700 mA	4.3 V	10 nm	>10 000 h
M385FP1[e]	UV	385 nm	7.7 mW	18 mW	23.2 mW	1400 mA	1400 mA	3.65 V	12 nm	>10 000 h
M395F3[e]	UV	395 nm	1.91 mW	4.8 mW	6.8 mW	500 mA	500 mA	4.5 V	16 nm	>10 000 h
M405F1[e]	UV	405 nm	0.93 mW	3.0 mW	3.7 mW	500 mA	500 mA	3.6 V	12 nm	>10 000 h
M405FP1[e]	UV	405 nm	7.7 mW	19.3 mW	24.3 mW	1400 mA	1400 mA	3.45 V	12 nm	>10 000 h
M420F2[e]	Violet	420 nm	8.91 mW	8.90 mW	16.2 mW	1000 mA	1000 mA	3.5 V	15 nm	>10 000 h
M455F1	Royal Blue	455 nm	2.75 mW	9.5 mW	11.0 mW	1000 mA	1000 mA	3.2 V	25 nm	>50 000 h
M470F1	Blue	470 nm	2.53 mW	8.0 mW	10.1 mW	1000 mA	1000 mA	3.6 V	25 nm	>50 000 h
M490F2	Blue	490 nm	0.42 mW	1.5 mW	2.0 mW	350 mA	350 mA	3.5 V	23 nm	>10 000 h
M505F1	Cyan	505 nm	2.0 mW	7.0 mW	8.0 mW	1000 mA	1000 mA	3.3 V	30 nm	>50 000 h
M530F1	Green	530 nm	1.3 mW	4.0 mW	5.1 mW	1000 mA	1000 mA	3.6 V	33 nm	>50 000 h
M565F1	Green Yellow	565 nm	0.50 mW	1.8 mW	2.0 mW	500 mA	500 mA	3.2 V	80 nm	>10 000 h
M590F1	Amber	590 nm	0.80 mW	2.5 mW	3.2 mW	1000 mA	1000 mA	2.5 V	18 nm	>50 000 h
M617F1	Orange	617 nm	2.70 mW	9.0 mW	10.8 mW	1000 mA	1000 mA	2.5 V	18 nm	>50 000 h
M625F1	Red	625 nm	2.53 mW	8.0 mW	10.1 mW	1000 mA	1000 mA	2.5 V	18 nm	>50 000 h
M660F1	Deep Red	660 nm	3.63 mW	13.0 mW	14.5 mW	1000 mA	1000 mA	2.15 V	25 nm	>50 000

										h
M740F2	Far Red	740 nm	2.1 mW	4.1 mW	6.0 mW	800 mA	800 mA	2.7 V	22 nm	>10 000 h
M780F2	IR	780 nm	1.15 mW	5.5 mW	7.5 mW	800 mA	800 mA	2.1 V	28 nm	>10 000 h
M810F2	IR	810 nm	2.31 mW	4.9 mW	6.5 mW	500 mA	500 mA	3.6 V	25 nm	>10 000 h
M850F2	IR	850 nm	3.35 mW	10.5 mW	13.4 mW	1000 mA	1000 mA	3.0 V	30 nm	>50 000 h
M880F2	IR	880 nm	0.58 mW	2.7 mW	3.4 mW	1000 mA	1000 mA	1.7 V	50 nm	>10 000 h
M940F1	IR	940 nm	1.6 mW	5.5 mW	6.5 mW	1000 mA	1000 mA	1.4 V	30 nm	>50 000 h
M970F2	IR	970 nm	0.04 mW	0.2 mW	0.3 mW	600 mA	600 mA	1.4 V	50 nm	>10 000 h
M1050F1	IR	1050 nm	0.35 mW	1.1 mW	1.4 mW	700 mA	700 mA	1.5 V	60 nm	>10 000 h
MBB1F1[f]	Broadband	470 - 850 nm[g]	0.30 mW	0.8 mW	1.2 mW	500 mA	500 mA	3.6 V	280 nm	10 000 h
MWWHF1[h]	Warm White	3000 K[i]	1.8 mW	6.0 mW	7.0 mW	1000 mA	1000 mA	3.5 V	N/A	>10 000 h
MCWHF1[h]	Cold White	5600 K[i]	1.8 mW	6.0 mW	7.0 mW	1000 mA	1000 mA	3.6 V	N/A	>50 000 h

a. Due to variations in the manufacturing process and operating parameters such as temperature and current, the actual spectral output of any given LED will vary. Output plots and nominal wavelength specs are only intended to be used as a guideline.
b. For LEDs with a visible spectrum, the nominal wavelength indicates the wavelength at which the LED appears brightest to the human eye. The nominal wavelength for visible LEDs may not correspond to the peak wavelength as measured by a spectrometer.
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f. The MBB1F1 LED may not turn off completely when modulated at frequencies above 1 kHz with a duty cycle of 50%, as the broadband emission is produced by optically stimulating emission from phosphor. For modulation at frequencies above 1 kHz, the duty cycle may be reduced. For example, 10 kHz modulation is attainable with a duty cycle of 5%.
g. 10 dB Bandwidth.
h. The MWWHF1 and MCWHF1 LEDs may not turn off completely when modulated at frequencies above 5 kHz, as the white light is produced by optically stimulating emission from phosphor.
i. Correlated Color Temperature

Hide Output Power

OUTPUT POWER

Output Power with Connected Multimode Patch Cables

The table below lists the minimum optical power values measured at the output of different fibers that were coupled to a M530F1 LED driven at 1000 mA. In conjunction with the output powers listed in the *Specs* tab, this can be used as an estimate for the usable power for all the fiber-coupled LEDs sold below when connected to a multimode patch cable.

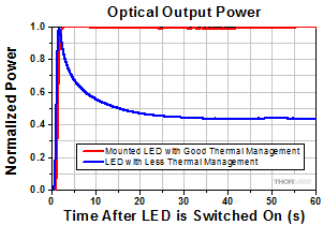
Patch Cable Item #	Fiber	Core Size	NA	Min. Power
M14L0x	FG050LGA	Ø50 µm	0.22	0.022 mW
M15L0x	FG105LCA	Ø105 µm	0.22	0.09 mW
M16L0x	FG050LGA	Ø50 µm	0.22	0.02 mW
M18L0x	FG105LCA	Ø105 µm	0.22	0.097 mW
M112L0x	FG200AEA	Ø200 µm	0.22	0.52 mW
M113L0x	FG400AEA	Ø400 µm	0.22	1.54 mW
M25L01	FG200LCC	Ø200 µm	0.22	1.34 mW
M25L02	FG200LCC	Ø200 µm	0.22	1.2 mW

M25L05	FG200LCC	Ø200 µm	0.22	0.95 mW
M28L01	FT400EMT	Ø400 µm	0.39	3.99 mW
M28L02	FT400EMT	Ø400 µm	0.39	3.34 mW
M28L05	FT400EMT	Ø400 µm	0.39	3.58 mW
M29L0x	FT600EMT	Ø600 µm	0.39	7.34 mW
M35L0x	FT1000EMT	Ø1000 µm	0.39	17.61 mW
M37L0x	FG550LEC	Ø550 µm	0.22	6.86 mW
M38L0x	FT200EMT	Ø200 µm	0.39	0.861 mW

Hide Stability

STABILITY

LED Lifetime



Click to Enlarge

One characteristic of LEDs is that they naturally exhibit power degradation with time. Often this power degradation is slow, but there are also instances where large, rapid drops in power, or even complete LED failure, occur. LED lifetimes are defined as the time it takes a specified percentage of a type of LED to fall below some power level. The parameters for the lifetime measurement can be written using the notation B_{XX}/L_{YY}, where XX is the percentage of that type of LED that will provide less than YY percent of the specified output power after the lifetime has elapsed. Thorlabs defines the lifetime of our LEDs as B_{50}/L_{50}, meaning that 50% of the LEDs with a given Item # will fall below 50% of the initial optical power at the end of the specified lifetime. For example, if a batch of 100 LEDs is rated for 150 mW of output power, 50 of these LEDs can be expected to produce an output power of ≤75 mW after the specified LED lifetime has elapsed.

Optimized Thermal Management

The thermal dissipation performance of these fiber-coupled LEDs has been optimized for stable power output. The heat sink is directly mounted to the LED mount so as to provide optimal thermal contact. By doing so, the degradation of optical output power that can be attributed to increased LED junction temperature is minimized.

Hide LED Drivers

LED DRIVERS

Compatible Drivers	LEDD1B[a]	DC2200[b]	DC4100[b,c]	DC4104[b,c]
Click Photos to Enlarge				
LED Driver Current Output (Max)	1.2 A	LED1 Terminal: 10.0 A LED2 Terminal: 2.0 A[d]	1.0 A per Channel	1.0 A per Channel
LED Driver Forward Voltage (Max)	12 V	50 V	5 V	5 V
Modulation Frequency Using External Input (Max)	5 kHz[d]	250 kHz[e,f,g]	100 kHz[f,g] (Simultaneous Across all Channels)	100 kHz[f,g] (Independently Controlled Channels)
External Control Interface(s)	Analog (BNC)	USB 2.0 and Analog (BNC)	USB 2.0 and Analog (BNC)	USB 2.0 and Analog (8-Pin)
Main Driver Features	Very Compact Footprint 60 mm x 73 mm x 104 mm (W x H x D)	Touchscreen Interface with Internal and External Options for Pulsed and Modulated LED Operation	4 Channels[c]	4 Channels[c]
EEPROM Compatible: Reads Out LED Data for LED Settings	-	✓	✓	✓
LCD Display	-	✓	✓	✓

- The pictured cord is included for custom applications, and is not required for fiber-coupled LEDs.
- Automatically limits to LEDs max current via EEPROM readout.
- The DC4100 or DC4104 can power and control up to four LEDs simultaneously when used with the DC4100-HUB. The LEDs on this page all require the DC4100-HUB when used with the DC4100 or DC4104.
- The fiber-coupled LEDs sold below are compatible with the LED2 Terminal.
- Small Signal Bandwidth: Modulation not exceeding 20% of full scale current. The driver accepts other waveforms, but the maximum frequency will be reduced.
- The MBB1F1 LED may not turn off completely when modulated at frequencies above 1 kHz with a duty cycle of 50%, as the broadband emission is produced by optically stimulating emission from phosphor. For modulation at frequencies above 1 kHz, the duty cycle may be reduced. For example, 10 kHz modulation is attainable with a duty cycle of 5%.
- The MWWHF1 and MCWHF1 LEDs may not turn off completely when modulated at frequencies above 5 kHz, as the white light is produced by optically stimulating emission from phosphor.

Note: The LEDs sold on this page are not compatible with the DC3100 driver sold with our Modulated LEDs for FLIM Microscopy kits.

Hide Pin Diagram

PIN DIAGRAM

Pin Connection

The diagram to the right shows the male connector of the fiber-coupled LED assembly. It is a standard M8 x 1 sensor circular connector. Pins 1 and 2 are the connection to the LED. Pin 3 and 4 are used for the internal EEPROM (electrically erasable programmable read-only memory) in these LEDs. If using an LED driver that was not purchased from Thorlabs, be careful that the appropriate connections are made to Pin 1 and Pin 2 and that you do not attempt to drive the LED through the EEPROM pins.

Pin	Specification	Color
1	LED Anode	Brown
2	LED Cathode	White
3	EEPROM GND	Black
4	EEPROM IO	Blue

Hide LED Selection Guide

LED SELECTION GUIDE

Light Emitting Diode (LED) Selection Guide									
(Click Representative Photo to Enlarge; Not to Scale)									
Type	**Unmounted LEDs**	**PCB-Mounted LEDs**	**Heatsink-Mounted LEDs**	**Collimated LEDs for Microscopy (Item # Prefix[a])**	**Fiber-Coupled LEDs[b]**	**High-Power LEDs for Microscopy**	**4-Wavelength LED Source Options[c]**	**Modulated LEDs for FLIM Microscopy**	**LED Arrays**
Wavelength									
245 nm	LED245W (0.07 mW)	-	-	-	-	-	-	-	-
250 nm	LED250J (1 mW Min)	-	-	-	-	-	-	-	-
255 nm	LED255J (1 mW Min)	-	-	-	-	-	-	-	-
260 nm	LED260W (0.3 mW) LED260J (1 mW Min)	-	-	-	-	-	-	-	-
265 nm	LED265W (0.3 mW)	M265D2 (10 mW Min)	M265L3 (10 mW Min)	-	-	-	-	-	-
275 nm	LED275W (0.8 mW) LED275J	-	-	-	-	-	-	-	-

	(1 mW Min)								
280 nm	LED280J (1 mW Min)	M280D2 (25 mW Min)	M280L3 (25 mW Min)	-	M280F2 (323 µW)	-	-	-	-
285 nm	LED285W (0.8 mW)	-	-	-	-	-	-	-	-
290 nm	LED290W (0.8 mW)	-	-	-	-	-	-	-	-
300 nm	LED300W (0.5 mW)	-	-	-	-	-	-	-	-
310 nm	-	M310D2 (25 mW Min)	-	-	-	-	-	-	-
315 nm	LED315W (0.6 mW)	-	-	-	-	-	-	-	-
340 nm	LED341W (0.33 mW)	M340D3 (53 mW Min)	M340L4 (53 mW Min)	-	M340F2 (1.57 mW)	-	-	-	-
365 nm	-	M365D1 (190 mW Min)	M365L2 (190 mW Min)	M365L2 (60 mW)[d]	M365F1 (4.1 mW)	SOLIS-365A(/M) (850 mW)[e]	Available (85 mW)	DC3100-365	LIU365A (31 mW)
		M365D2 (1150 mW Min)	M365LP1 (1150 mW Min)	M365LP1 (350 mW)[d]	M365FP1 (15.5 mW)				
370 nm	LED370E (2.5 mW)	-	-	-	-	-	-	-	-
375 nm	-	M375D2 (387 mW Min)	M375L3 (387 mW Min)	-	M375F2 (4.23 mW)	-	-	-	-
385 nm	-	M385D1 (270 mW Min)	M385L2 (270 mW Min)	M385L2 (90 mW)[d]	M385F1 (10.7 mW)	SOLIS-385A(/M) (1300 mW)[e]	Available (95 mW)	-	-
		M385D2 (1650 mW Min)	M385LP1 (1650 mW Min)	M385LP1 (520 mW)[d]	M385FP1 (23.2 mW)				
395 nm	-	M395D3 (400 mW Min)	M395L4 (400 mW Min)	-	M395F3 (6.8 mW)	-	-	-	-
405 nm	LED405E (10 mW)	M405D1 (410 mW Min)	M405L2 (410 mW Min)	M405L2 (260 mW)[d]	M405F1 (3.7 mW)	SOLIS-405A(/M) (1800 mW)[e]	Available (95 mW)	DC3100-405	-
		M405D2 (1500 mW Min)	M405LP1 (1500 mW Min)	M405LP1 (450 mW)[d]	M405FP1 (24.3 mW)				
420 nm	-	M420D2 (750 mW Min)	M420L3 (750 mW Min)	-	M420F2 (16.2 mW)	-	Available (290 mW)	-	-
445 nm	-	-	-	-	-	SOLIS-445B(/M) (2900 mW)[e]	-	-	-
450 nm	-	M450D3 (1850 mW Min)	M450LP1 (1850 mW Min)	-	-	-	-	-	-
455 nm	-	M455D2 (900 mW Min)	M455L3 (900 mW Min)	M455L3 (360 mW)[d]	M455F1 (11.0 mW)	-	Available (310 mW)	-	-
465 nm	LED465E (20 mW)	-	-	-	-	-	-	-	-
470 nm	LED470L (170 mW)	M470D2 (650 mW Min)	M470L3 (650 mW Min)	M470L3 (250 mW)[d]	M470F1 (10.1 mW)		Available (250 mW)	DC3100-470	LIU470A (253 mW)

490 nm	-	M490D2 (200 mW Min)	M490L3 (200 mW Min)	-	M490F2 (2.0 mW)		Available (50 mW)	-	-
505 nm	-	M505D2 (400 mW Min)	M505L3 (400 mW Min)	M505L3 (150 mW)[d]	M505F1 (8.0 mW)		Available (170 mW)	-	-
525 nm	LED525E (2.6 mW Max) LED528EHP (7 mW)	-	-	-	-	SOLIS-525A(/M) (1650 mW)[e]	-	-	LIU525A (111 mW)
530 nm	-	M530D2 (350 mW Min)	M530L3 (350 mW Min)	M530L3 (130 mW)[d]	M530F1 (5.1 mW)	-	Available (100 mW)	-	-
565 nm	-	M565D2 (880 mW Min)	M565L3 (880 mW Min)		M565F1 (2.0 mW)	-	Available (106 mW)	-	-
590 nm	LED591E (2 mW)	M590D2 (160 mW Min)	M590L3 (160 mW Min)	M590L3 (60 mW)[d]	M590F1 (3.2 mW)	-	Available (65 mW)	-	LIU590A (109 mW)
595 nm	-	M595D2 (445 mW Min)	M595L3 (445 mW Min)	-	-	-	-	-	-
617 nm	-	M617D2 (600 mW Min)	M617L3 (600 mW Min)	M617L3 (230 mW)[d]	M617F1 (10.8 mW)	-	Available (210 mW)	-	-
623 nm	-	-	-	-	-	SOLIS-623A(/M) (2530 mW)[e]	-	-	-
625 nm	-	M625D2 (700 mW Min)	M625L3 (700 mW Min)	M625L3 (270 mW)[d]	M625F1 (10.1 mW)	-	Available (240 mW)	-	-
630 nm	-	-	-	-	-	-	-	DC3100-630	LIU630A (208 mW)
635 nm	LED631E (4 mW) LED635L (170 mW)	-	-	-	-	-	-	-	-
639 nm	LED630E (7.2 mW)	-	-	-	-	-	-	-	-
660 nm	-	M660D2 (940 mW Min)	M660L4 (940 mW Min)	M660L4 (400 mW)[d]	M660F1 (14.5 mW)	-	Available (210 mW)	-	-
730 nm	-	M730D2 (515 mW Min)	M730L4 (515 mW Min)	M730L4 (165 mW)[d]	-	-	-	-	-
740 nm	-	-	-	-	M740F2 (6.0 mW)	-	-	-	-
780 nm	LED780E (18 mW)	M780D2 (200 mW Min) M780D3 (800 mW Min)	M780L3 (200 mW Min) M850LP1 (800 mW Min)	M780L3 (130 mW)[d]	M780F2 (7.5 mW)	-	-	-	LIU780A (315 mW)
810 nm	-	M810D2 (325 mW Min)	M810L3 (325 mW Min)	M810L3 (210 mW)[d]	M810F2 (6.5 mW)	-	-	-	-
850 nm	LED851W (8 mW) LED851L	M850D2 (900 mW Min) M850D3	M850L3 (900 mW Min) M850LP1	M850L3 (330 mW)[d]	M850F2 (13.4 mW)	SOLIS-850A(/M) (1700 mW)[e]	-	-	LIU850A (322 mW)

	(13 mW)	(1400 mW)	(1400 mW)						
870 nm	LED870E (22 mW)	-	-	-	-	-	-	-	-
880 nm	-	M880D2 (300 mW Min)	M880L3 (300 mW Min)	-	M880F2 (3.4 mW)	-	-	-	-
910 nm	LED910E (12 mW)	-	-	-	-	-	-	-	-
940 nm	LED940E (18 mW)	M940D2 (800 mW Min)	M940L3 (800 mW Min)	M940L3 (320 mW)[d]	M940F1 (6.5 mW)	-	-	-	-
970 nm	-	M970D2 (35 mW Min)	M970L3 (35 mW Min)	-	M970F2 (0.3 mW)	-	-	-	-
1050 nm	LED1050E (2.5 mW) LED1050L (4 mW)	M1050D1 (50 mW Min)	M1050L2 (50 mW Min)	-	M1050F1 (1.4 mW)	-	-	-	-
1070 nm	LED1070E (7.5 mW)	-	-	-	-	-	-	-	-
1200 nm	LED1200E (2.5 mW) LED1200L (5 mW)	M1200D2 (30 mW Min)	M1200L3 (30 mW Min)	-	-	-	-	-	-
1300 nm	LED1300E (2 mW)	M1300D2 (25 mW Min)	M1300L3 (25 mW Min)	-	-	-	-	-	-
1450 nm	LED1450E (2 mW) LED1450L (5 mW)	M1450D2 (31 mW Min)	M1450L3 (31 mW Min)	-	-	-	-	-	-
1550 nm	LED1550E (2 mW) LED1550L (4 mW)	M1550D2 (31 mW Min)	M1550L3 (31 mW Min)	-	-	-	-	-	-
1600 nm	LED1600L (2 mW)	-	-	-	-	-	-	-	-
1650 nm	LED1600P (1.2 mW)	-	-	-	-	-	-	-	-
1750 nm	LED1700P (1.2 mW Quasi-CW, 30 mW Pulsed)	-	-	-	-	-	-	-	-
1850 nm	LED1800P (0.9 mW Quasi-CW, 20 mW Pulsed)	-	-	-	-	-	-	-	-
1950 nm	LED1900P (1.0 mW Quasi-CW, 25 mW Pulsed)	-	-	-	-	-	-	-	-
2050 nm	LED2050P (1.1 mW Quasi-CW, 28 mW Pulsed)	-	-	-	-	-	-	-	-
2350 nm	LED2350P (0.8 mW Quasi-CW, 16 mW Pulsed)	-	-	-	-	-	-	-	-
	LED4300P								

4200 nm	(0.01 mW Quasi-CW, 0.2 mW Pulsed)	-	-	-	-	-	-	-	-
4500 nm	LED4600P (0.006 mW Quasi-CW, 0.12 mW Pulsed)	-	-	-	-	-	-	-	-
572 nm and 625 nm	LEDGR (0.09 mW and 0.19 mW)								
588 nm and 617 nm	LEDRY (0.09 mW and 0.19 mW)								
467.5 nm, 525 nm, and 627.5 nm	LEDRGBE (5.8 mW, 6.2 mW, and 3.1 mW)	-	-	-	-	-	-	-	-
440 - 660 nm (White)	LEDWE-15 (13 mW)	-	-	-	-	-	-	-	-
470 - 850 nm (Broadband)	-	MBB1D1 (70 mW Min)	MBB1L3 (70 mW Min)	-	MBB1F1 (1.2 mW)	-	-	-	-
6500 K (Cold White)	-	MCWHD2 (800 mW Min) MCWHD3 (2350 mW Min)	MCWHL5 (800 mW Min) MCWHLP1 (2350 mW Min)	MCWHL5 (320 mW)[d]	-	SOLIS-1A(/M) (3070 mW)[e]	-	-	-
5600 K (Cold White)	-	-	-	-	MCWHF1 (7.0 mW)	-	-	-	
4600 - 9000 K (Cold White)	-	-	-	-	-	-	-	-	LIUCWHA (250 mW)
3000 K (Warm White)	-	MWWHD1 (500 mW Min) MWWHD3 (2000 mW Min)	MWWHL3 (500 mW Min) MWWHLP1 (2000 mW Min)	-	MWWHF1 (7.0 mW)	SOLIS-2A(/M) (2000 mW)[e]	-	-	-

a. These Collimated LEDs are compatible with the standard and epi-illumination ports on the following microscopes: Olympus BX/IX (Item # Suffix: -C1), Leica DMI (Item # Suffix: -C2), Zeiss Axioskop (Item # Suffix: -C4), and Nikon Eclipse (Bayonet Mount, Item # Suffix: -C5).

b. Typical power when used with MM Fiber with Ø400 µm core, 0.39 NA.

c. Our LED4D 4-Wavelength LED Source is available with select combinations of the LEDs at these wavelengths.

d. Typical power for LEDs with the Leica DMI collimation package (Item # Suffix: -C2).

e. Minimum power for the collimated output of these LEDs. The collimation lens is installed with each LED.

Hide Fiber-Coupled LEDs

Fiber-Coupled LEDs

- Integrated EEPROM for Automated LED Settings with Compatible Thorlabs Controllers
- Long Lifetimes ≥10 000 Hours (Except M280F2 and M340F2; See *Specs* Tab for Details)
- Output can be Modulated with Suitable Controller (See *LED Drivers* Tab)
- Stable Output Intensity by Optimized Thermal Management
- Accepts SMA Fiber Connector

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M365FP1, M385FP1, and M405FP1 are mounted to a 50 mm long heat sink.

These fiber-coupled LEDs consist of an LED mounted to a heat sink with an SMA fiber bulkhead. They can be easily integrated into an optical setup using one of our SMA-terminated multimode fiber patch cables; when the patch cable is connected to the SMA bulkhead on the LED housing, the LED will be butt-coupled to the SMA fiber connector. For compatible drivers to power these LEDs, please see the *LED*

Drivers tab. Please note that the minimum output powers specified below are for when the LED is used with a Ø400 µm core multimode fiber patch cable.

Part Number	Description	Price	Availability
M280F2	UV (280 nm) Fiber-Coupled LED, SMA, 350 mA, 21.3 µW (Min)	$1,623.33	Today
M340F2	UV (340 nm) Fiber-Coupled LED, SMA, 700 mA, 1.22 mW (Min)	$530.00	Today
M365F1	UV (365 nm) Fiber-Coupled LED, SMA, 700 mA, 3.0 mW (Min)	$530.00	Today
M365FP1	UV (365 nm) Fiber-Coupled LED, SMA, 1400 mA, 9.8 mW (Min)	$600.00	Today
M375F2	UV (375 nm) Fiber-Coupled LED, SMA, 500 mA, 3.2 mW (Min)	$438.00	Today
M385F1	UV (385 nm) Fiber-Coupled LED, SMA, 700 mA, 9.0 mW (Min)	$520.00	Today
M385FP1	UV (385 nm) Fiber-Coupled LED, SMA, 1400 mA, 18 mW (Min)	$600.00	Today
M395F3	UV (395 nm) Fiber-Coupled LED, SMA, 500 mA, 4.8 mW (Min)	$438.00	Today
M405F1	Customer Inspired!UV (405 nm) Fiber-Coupled LED, SMA, 500 mA, 3.0 mW (Min)	$438.00	Today
M405FP1	UV (405 nm) Fiber-Coupled LED, SMA, 1400 mA, 19.3 mW (Min)	$600.00	Today
M420F2	Violet (420 nm) Fiber-Coupled LED, SMA, 1000 mA, 8.90 mW (Min)	$438.00	Today
M455F1	Royal Blue (455 nm) Fiber-Coupled LED, SMA, 1000 mA, 9.5 mW (Min)	$377.00	Today
M470F1	Blue (470 nm) Fiber-Coupled LED, SMA, 1000 mA, 8.0 mW (Min)	$377.00	Today
M490F2	Blue (490 nm) Fiber-Coupled LED, SMA, 350 mA, 1.5 mW (Min)	$377.00	Today
M505F1	Cyan (505 nm) Fiber-Coupled LED, SMA, 1000 mA, 7.0 mW (Min)	$377.00	Today
M530F1	Green (530 nm) Fiber-Coupled LED, SMA, 1000 mA, 4.0 mW (Min)	$377.00	Today
M565F1	Customer Inspired!Green (565 nm) Fiber-Coupled LED, SMA, 500 mA, 1.8 mW (Min)	$648.00	Today
M590F1	Amber (590 nm) Fiber-Coupled LED, SMA, 1000 mA, 2.5 mW (Min)	$377.00	Today
M617F1	Orange (617 nm) Fiber-Coupled LED, SMA, 1000 mA, 9.0 mW (Min)	$377.00	Today
M625F1	Red (625 nm) Fiber-Coupled LED, SMA, 1000 mA, 8.0 mW (Min)	$377.00	Today
M660F1	Deep Red (660 nm) Fiber-Coupled LED, SMA, 1000 mA, 13.0 mW (Min)	$377.00	Today
M740F2	Far Red (740 nm) Fiber-Coupled LED, SMA, 800 mA, 4.1 mW (Min)	$438.00	Today
M780F2	IR (780 nm) Fiber-Coupled LED, SMA, 800 mA, 5.5 mW (Min)	$377.00	Today
M810F2	IR (810 nm) Fiber-Coupled LED, SMA, 500 mA, 4.9 mW (Min)	$418.89	Today
M850F2	IR (850 nm) Fiber-Coupled LED, SMA, 1000 mA, 10.5 mW (Min)	$377.00	Lead Time
M880F2	IR (880 nm) Fiber-Coupled LED, SMA, 1000 mA, 2.7 mW (Min)	$377.00	Today
M940F1	IR (940 nm) Fiber-Coupled LED, SMA, 1000 mA, 5.5 mW (Min)	$377.00	Today
M970F2	IR (970 nm) Fiber-Coupled LED, SMA, 600 mA, 0.2 mW (Min)	$377.00	Today
M1050F1	IR (1050 nm) Fiber-Coupled LED, SMA, 700 mA, 1.1 mW (Min)	$438.00	Today
MBB1F1	Broadband (470 - 850 nm) Fiber-Coupled LED, SMA, 500 mA, 0.8 mW (Min)	$670.00	Today
MWWHF1	Warm White Fiber-Coupled LED, SMA, 1000 mA, 6.0 mW (Min)	$377.00	Today
MCWHF1	Cold White Fiber-Coupled LED, SMA, 1000 mA, 6.0 mW (Min)	$377.00	3-5 Days

Hide Mounted LED Mating Connector

Mounted LED Mating Connector

- Pico (M8) Receptacle
- Female 4-Pin for Front Mounting
- 0.5 m Long, 24 AWG Wires
- M8 x 0.5 Panel Mount Thread
- IP 67 and NEMA 6P Rated

The CON8ML-4 connector can be used to mate mounted LEDs featured on this page to user-supplied power supplies. We also offer a male 4-Pin M8 connector cable (Item # CAB-LEDD1).

Pin	Color	Specification
1	Brown	LED Anode
2	White	LED Cathode
3	Black	EEPROM GND

CON8ML-4 Shown Connected to the 4-Pin M8 Plug of Mounted LED

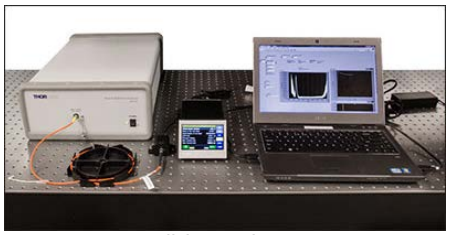
4	Blue	EEPROM IO	

Part Number	Description	Price	Availability
CON8ML-4	**4-Pin Female Mating Connector for Mounted LEDs**	**$30.00**	**Today**

WAVELENGTH SHIFT

LED Spectral Variation as a Function of Current

All LEDs will show some variation in their spectral profile and peak wavelength as a function of the drive current. For our fiber-coupled LEDs, we used an OSA201 Optical Spectrum Analyzer (OSA) to track this wavelength shift as the current of the LED was increased from near zero to the maximum current.



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The setup for testing the relationship between LED wavelength and current. See the table below for a complete item list.

LEDs have relatively broad, asymmetric emission profiles. The centroid wavelength of an LED is a weighted average of the wavelength across the emission profile (following a similar concept to center of mass calculations). It is defined as

$$Centroid\,Wavelength = \frac{\int_{\lambda_1}^{\lambda_2} \lambda \cdot I(\lambda)\, d\lambda}{\int_{\lambda_1}^{\lambda_2} \lambda\, d\lambda}$$

Item #	Description
-	Fiber-Coupled LED
-	SMA-to-FC/PC Fiber Patch Cable LEDs with Wavelengths ≤405 nm: Custom Cable with FG105ACA Solarization Resistant Fiber LEDs with Wavelengths >405 nm: M16L01
DC2200	High-Power LED Driver, 2 A Current Limit
OSA201	Fourier Transform Optical Spectrum Analyzer, 350 - 1100 nm

where I(λ) is the intensity at each wavelength, λ. As a result, we chose to follow each LED's centroid wavelength as the current was varied in order to capture effects of both the peak wavelength shift and any changes to the overall spectral profile. The OSA's Peak Track mode will automatically calculate the centroid wavelength of a spectral peak, using a user-set lower intensity limit to determine the upper and lower limits (λ_2 and λ_1) of the wavelength range included in the calculation. In our case, we set the lower limit to 6 dB below the peak intensity.

For each LED, a DC2200 High-Power LED Driver was used to drive the LED over a range of preset current values. At each current value, the OSA took five scans across the LED spectrum and combined them to create an average spectrum. The OSA identified the peak wavelength by finding the highest intensity value within 50 nm of the predicted peak wavelength and then calculated a centroid wavelength as described above. Centroid wavelengths were identified every 0.05 A up to the current limit of the LED. The entire process was repeated four times for each LED. All measurements were taken with the OSA in the absolute power and high-resolution spectrometer modes (for more information on the OSA201 operating modes, see the full web presentation).

The results of these measurements are provided in the table below and can be viewed by clicking on the graph icons. For each LED, the centroid wavelengths over all of the runs were averaged for each current point and plotted. To give a sense of possible variation in performance, the minimum and maximum wavelengths measured at each current point over all of the experimental runs are indicated by red error bars. At the lowest current values, the LED intensity was too weak to rise above the level of the noise and provide a reasonably accurate measurement of the wavelength. In these cases, we have omitted the affected currents from the graphs.

Experimental Limitations

- Only one unit of each item # was tested. These plots are intended to provide a general sense of how the centroid wavelength changes with current and do not provide an absolute measure of the wavelength output; some variation in the centroid wavelength is expected for different LEDs with the same item #.
- The LEDs were not temperature controlled.