

M530L3-C5 - May 11, 2021

Item # M530L3-C5 was discontinued on May 11, 2021. For informational purposes, this is a copy of the website content at that time and is valid only for the stated product.

COLLIMATED LED LIGHT SOURCES FOR MICROSCOPY

- ▶ UV, Visible, and IR LEDs
- ▶ Mounted LED with Adjustable Collimation Optic
- ▶ Compatible with Epi-Illumination Port on Olympus, Leica, Nikon, and Zeiss Microscopes



M625L4-C1
For Olympus BX/IX Microscopes



M405LP1-C2
For Leica DMI Microscopes



M590L3-C5
For Nikon Eclipse Microscopes



M810L3-C4
For Zeiss Axioskop Microscopes

M505L4-C1 Used as a Light Source for an Olympus IX71



[Hide Overview](#)

OVERVIEW

Features

- Illumination Source for Microscope Epi-Illumination Ports, Projectors, and Custom Imaging Systems
- Optimized Thermal Management Provides Output Intensity Stability
- Adjustable Aspheric Collimation Optic with Low *f*# (Approximately 0.8)
- Integrated Identification Chip (EEPROM) Stores LED Operating Parameters
- Higher Power LEDs Mounted to Larger Heat Sink with Ø57.0 mm Plastic Housing (See the Tables Below for Details)
- 4-Pin Female Mating Connector for Custom Power Supplies can be Purchased Separately
- Custom Adapters Available - Contact Tech Support for Details

Thorlabs' collimated LED assemblies can be easily connected to standard and epi-illumination ports on most readily available commercial microscopes, including Olympus, Leica, Nikon, and Zeiss. Each collimated LED consists of a mounted LED and a lamphouse-port-compatible housing that contains an AR-coated aspheric collimation optic (see the *Specs* tab for details). If the wavelength or output power you require is not sold on this page, our mounted LEDs and Solis® High-Power LEDs are available in additional wavelengths and output powers.

Note: Please ensure your microscope is configured to directly accept an external light source. Some microscope assemblies have a permanently installed illuminator or may be otherwise incompatible with the LED light sources below.

The collimation of the beam can be adjusted by changing the position of the aspheric lens with respect to the LED. Interchanging LEDs is easy; simply unscrew one LED from the housing and replace it with a different mounted LED (sold separately). We also offer collimation packages, which can be purchased separately from these LEDs.

The approximate total beam power through the collimation adapter is given in the tables below and on the *Specs* tab. The actual power at the sample plane

Quick Links

- [LEDs for Olympus Microscopes](#)
- [LEDs for Leica Microscopes](#)
- [LEDs for Zeiss Microscopes](#)
- [LEDs for Nikon Microscopes](#)
- [Mounted LED Mating Connector](#)

will be lower due to losses specific to the optical set up of the microscope. If you wish to measure the power at the sample plane for your particular microscope setup, Thorlabs also offers a microscope slide power meter sensor.

Like our mounted LEDs, the package of these collimated LEDs is in direct contact with the heat sink to provide excellent thermal management. This minimizes the degradation of optical output power caused by increased LED temperatures. Please see the *Stability* tab for information on the stable output intensity of these collimated LEDs. Additionally, our M365LP1, M385LP1, and M405LP1 LEDs feature a higher power output and are mounted to a larger Ø57.0 mm heat sink to increase heat dissipation and thermal stability.

For microscope applications requiring compatibility with SM1 (1.035"-40) threading, our mounted LEDs (sold separately) can be collimated using a Ø1" lens and lens tubes. This collimation method also allows for a smaller beam size than the collimators on this page. Please see the *Collimation* tab on our Mounted LEDs presentation for a detailed item list and instructions.

Compatible Controllers

Information concerning compatible controllers is provided on the *LED Drivers* tab. If the LED is driven with a DC2200, DC4100, or DC4104 controller, the integrated EEPROM chip will identify the LED and allow the controller to automatically set the proper current limit to protect the LED from being overdriven. The DC4100 and DC4104 require the DC4100-HUB when used with these LEDs.

[Hide Specs](#)

S P E C S

Common LED Specifications^a

Legend

LED Mounted to a Heat Sink in a Ø57.0 mm Red Housing

LED Mounted to a Heat Sink in a Ø30.5 mm Black Housing

The section of the housing that holds the collimation optics is the same size for all LEDs that share the same item # suffix, regardless of the size of the heat sink.

Item # Prefix	Nominal Wavelength ^{b,c}	Color ^b	Min LED Power ^{b,d}	Typ. LED Power ^{b,d}	Max Drive Current (CW)	Irradiance (Typical) ^d	Electrical Power	Typical Lifetime	Emitter Size
M365L2 ^e	365 nm	UV	190 mW	360 mW	700 mA	8.9 µW/mm ²	3.080 W	>10 000 h	1 mm x 1 mm
M365L3 ^e	365 nm	UV	880 mW	1290 mW	1000 mA	14.4 µW/mm ²	3.850 W	>10 000 h	2.5 mm x 2.5 mm
M365LP1 ^{e,f}	365 nm	UV	1350 mW	2000 mW	1700 mA	21.0 µW/mm ²	6.800 W	>10 000 h	2.5 mm x 2.5 mm
M385L2 ^e	385 nm	UV	270 mW	430 mW	700 mA	11.8 µW/mm ²	3.010 W	>10 000 h	1 mm x 1 mm
M385L3 ^e	385 nm	UV	1240 mW	1780 mW	1000 mA	19.9 µW/mm ²	3.700 W	>10 000 h	2.5 mm x 2.5 mm
M385LP1 ^{e,f}	385 nm	UV	1650 mW	1830 mW	1700 mA	23.3 µW/mm ²	6.630 W	>10 000 h	1.4 mm x 1.4 mm
M405L3 ^e	405 nm	UV	870 mW	980 mW	1000 mA	33.6 µW/mm ²	3.900 W	>100 000 h	1 mm x 1 mm
M405L4 ^e	405 nm	UV	1000 mW	1300 mW	1000 mA	14.53 µW/mm ²	3.400 W	> 1 000 h	1.4 mm x 1.4 mm
M405LP1 ^{e,f}	405 nm	UV	1500 mW	1700 mW	1400 mA	24.6 µW/mm ²	4.830 W	>10 000 h	1.4 mm x 1.4 mm
M455L3	455 nm	Royal Blue	900 mW	1020 mW	1000 mA	31.2 µW/mm ²	3.200 W	100 000 h	1 mm x 1 mm
M455L4	455 nm	Royal Blue	1150 mW	1445 mW	1000 mA	32 µW/mm ²	1.900 W	>100 000 h	1 mm x 1 mm
M470L4	470 nm	Blue	760 mW	965 mW	1000 mA	19.9 µW/mm ²	3.200 W	>100 000 h	1 mm x 1 mm
M505L3	505 nm	Cyan	400 mW	440 mW	1000 mA	11.1 µW/mm ²	3.300 W	100 000 h	1 mm x 1 mm
M505L4	505 nm	Cyan	400 mW	520 mW	1000 mA	5.94 µW/mm ²	3.500 W	>100 000 h	1 mm x 1 mm
M530L3	530 nm	Green	350 mW	370 mW	1000 mA	9.5 µW/mm ²	3.200 W	100 000 h	1 mm x 1 mm
M530L4	530 nm	Green	370 mW	480 mW	1000 mA	9.46 µW/mm ²	3.600 W	>100 000 h	1 mm x 1 mm
M590L3	590 nm	Amber	160 mW	170 mW	1000 mA	5.3 µW/mm ²	2.200 W	100 000 h	1 mm x 1 mm
M590L4	590 nm	Amber	230 mW	300 mW	1000 mA	6.0 µW/mm ²	2.500 W	>100 000 h	1 mm x 1 mm
M617L3	617 nm	Orange	600 mW	650 mW	1000 mA	15.7 µW/mm ²	2.200 W	100 000 h	1 mm x 1 mm
M617L4	617 nm	Orange	660 mW	860 mW	1000 mA	19.86 µW/mm ²	2.600 W	>100 000 h	1 mm x 1 mm
M625L3	625 nm	Red	700 mW	770 mW	1000 mA	18.0 µW/mm ²	2.200 W	100 000 h	1 mm x 1 mm
M625L4	625 nm	Red	700 mW	920 mW	1000 mA	21.9 µW/mm ²	2.500 W	100 000 h	1 mm x 1 mm

M660L4	660 nm	Deep Red	940 mW	1050 mW	1200 mA	20.88 $\mu\text{W}/\text{mm}^2$	3.120 W	>10 000 h	1.5 mm x 1.5 mm
M780L3	780 nm	IR	200 mW	300 mW	800 mA	47.3 $\mu\text{W}/\text{mm}^2$	1.600 W	>10 000 h	1 mm x 1 mm
M810L3	810 nm	IR	325 mW	375 mW	500 mA	61.8 $\mu\text{W}/\text{mm}^2$	1.800 W	>10 000 h	1 mm x 1 mm
M850L3	850 nm	IR	900 mW	1100 mW	1200 mA	22.9 $\mu\text{W}/\text{mm}^2$	3.540 W	100 000 h	1 mm x 1 mm
M940L3	940 nm	IR	800 mW	1000 mW	1000 mA	19.1 $\mu\text{W}/\text{mm}^2$	2.750 W	100 000 h	1 mm x 1 mm
MCWHL5^g	6500 K ^h	Cold White	800 mW	840 mW	1000 mA	24.8 $\mu\text{W}/\text{mm}^2$	3.200 W	100 000 h	1 mm x 1 mm
MCWHL6^g	6500 K ^h	Cold White	990 mW	1430 mW	1200 mA	25.0 $\mu\text{W}/\text{mm}^2$	3.400 W	100 000 h	1 mm x 1 mm

- a. Specifications for the LEDs without collimating adapters are given in this table. Please see the second table on this tab for specifications pertaining to the LED with the collimating adapter attached.
- b. 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.
- c. For LEDs in the visible spectrum, the nominal wavelength indicates the wavelength at which the LED appears brightest to the human eye. For UV and IR LEDs, the nominal wavelength corresponds to the peak wavelength. The nominal wavelength for visible LEDs may not correspond to the peak wavelength as measured by a spectrograph.
- d. For the bare LED. See the table below for total beam power with the collimation package.
- e. Our 365 nm to 405 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. These LEDs have a higher output power (see tables below for total beam power) and are mounted to a $\varnothing 57.0$ mm heat sink for increased heat dissipation.
- g. These 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.
- h. Correlated color temperature. The wavelength range corresponding to >10% power is approximately 435 - 675 nm.

Specifications for LED with Collimating Microscope Adapter Attached

Legend	
LED Mounted to a Heat Sink in a $\varnothing 57.0$ mm Red Housing	LED Mounted to a Heat Sink in a $\varnothing 30.5$ mm Black Housing

The section of the housing that holds the collimation optics is the same size for all LEDs that share the same item # suffix, regardless of the size of the heat sink.

Item # Suffix		-C1	-C2	-C4	-C5
Compatible Microscope^a		Olympus BX and IX	Leica DMI	Zeiss Axioskop and Examiner ^b	Nikon Eclipse (Bayonet Mount)
Beam Diameter^{c,d}		50 mm	37 mm	44 mm	43 mm
Beam Area^c		1960 mm ²	1080 mm ²	1520 mm ²	1450 mm ²
Item # Prefix	Included Collimation Lens	Total Beam Power ^d			
M365L2	ACL5040U-A	120 mW	60 mW	80 mW	80 mW
M365L3	ACL5040U-A	520 mW	320 mW	430 mW	320 mW
M365LP1	ACL5040U-A	745 mW	435 mW	615 mW	435 mW
M385L2	ACL5040U-A	170 mW	90 mW	110 mW	120 mW
M385L3	ACL5040U-A	680 mW	450 mW	570 mW	410 mW
M385LP1	ACL5040U-A	795 mW	520 mW	660 mW	630 mW
M405L3	ACL5040U-A	N/A	440 mW	600 mW	N/A
M405L4	ACL5040U-A	510 mW	N/A	N/A	N/A
M405LP1	ACL5040U-A	750 mW	450 mW	580 mW	570 mW
M455L3	ACL5040U-A	500 mW	N/A	430 mW	400 mW
M455L4	ACL5040U-A	630 mW	490 mW	690 mW	630 mW
M470L4	ACL5040U-A	420 mW	330 mW	460 mW	420 mW
M505L3	ACL5040U-A	N/A	150 mW	180 mW	170 mW
M505L4	ACL5040U-A	220 mW	170 mW	240 mW	220 mW
M530L3	ACL5040U-A	N/A	N/A	N/A	150 mW
M530L4	ACL5040U-A	200 mW	160 mW	220 mW	200 mW
M590L3	ACL5040U-A	N/A	N/A	70 mW	70 mW

M590L4	ACL5040U-A	130 mW	100 mW	140 mW	130 mW
M617L3	ACL5040U-A	320 mW	230 mW	280 mW	260 mW
M617L4	ACL5040U-A	360 mW	280 mW	400 mW	360 mW
M625L3	ACL5040U-A	N/A	270 mW	N/A	300 mW
M625L4	ACL5040U-A	630 mW	490 mW	690 mW	630 mW
M660L4	ACL5040U-A	590 mW	400 mW	570 mW	520 mW
M780L3	ACL5040U-B	210 mW	130 mW	180 mW	170 mW
M810L3	ACL5040U-B	245 mW	210 mW	230 mW	225 mW
M850L3	ACL5040U-B	480 mW	330 mW	400 mW	370 mW
M940L3	ACL5040U-B	430 mW	320 mW	380 mW	340 mW
MCWHL5	ACL5040U-A	N/A	N/A	380 mW	340 mW
MCWHL6	ACL5040U-A	548 mW	354 mW	493 mW	477 mW

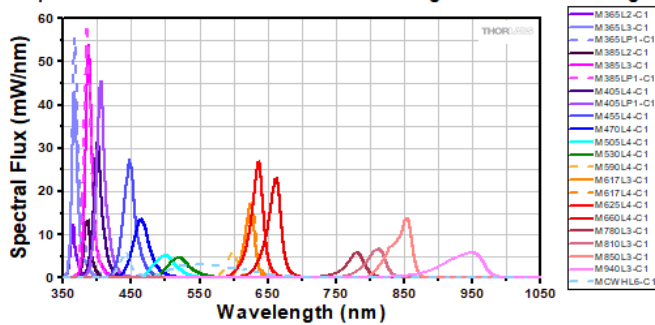
- a. Standard or Epi-Illumination Port Required.
- b. These adapters are compatible with any Zeiss microscopes that use the same dovetail as the Zeiss Axioskop and Examiner microscopes.
- c. Due to variations in the manufacturing process and operating parameters such as temperature and current, the total beam power, beam diameter, and beam area of any given LED will vary.
- d. At the output aperture of the collimation package.

[Hide Relative Power](#)

RELATIVE POWER

The actual spectral output and total output power of any given LED will vary due to variations in the manufacturing process and operating parameters, such as temperature and current. The typical total beam power of each collimated LED is specified to help you select an LED that suits your needs. In order to provide a point of comparison for the relative powers of LEDs with different nominal wavelengths, the spectra in the plots below have been scaled to the typical total beam power of each collimated LED. This data is representative, not absolute. An Excel file containing the normalized and scaled spectra for each collimation package can be downloaded using the link below each plot.

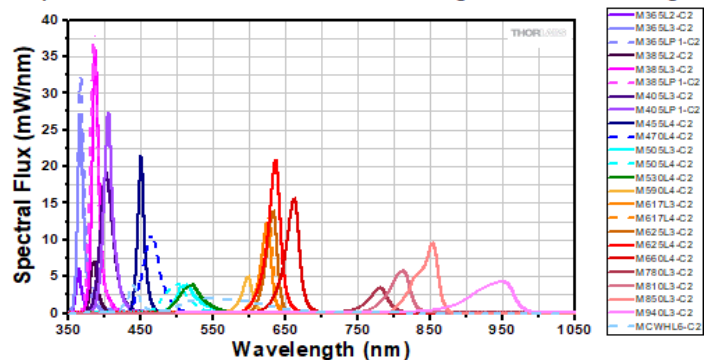
Collimated LEDs for Olympus BX and IX Microscopes Spectra Scaled to Total Beam Power Through Collimation Package



[Click to Enlarge](#)

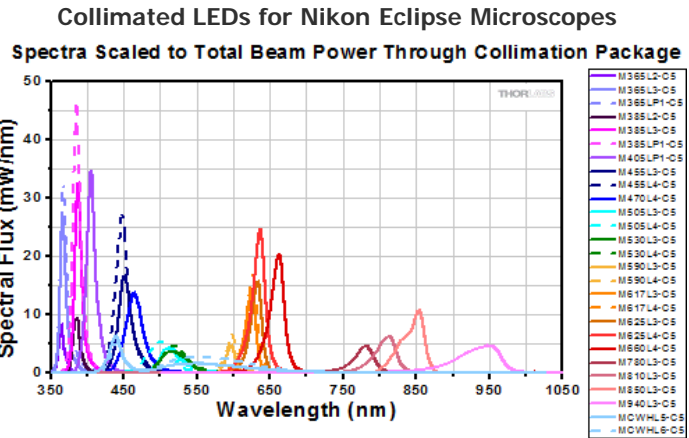
An Excel file containing the data shown in the plot above may be found [here](#).

Collimated LEDs for Leica DMI Microscopes Spectra Scaled to Total Beam Power Through Collimation Package



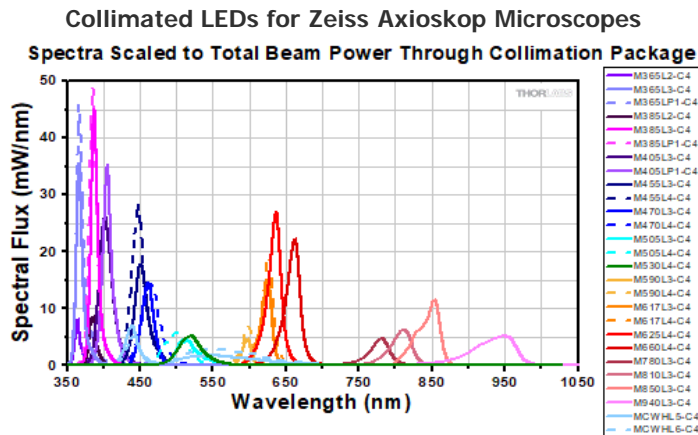
[Click to Enlarge](#)

An Excel file containing the data shown in the plot above may be found [here](#).



[Click to Enlarge](#)

An Excel file containing the data shown in the plot above may be found [here](#).



[Click to Enlarge](#)

An Excel file containing the data shown in the plot above may be found [here](#).

[Hide Stability](#)

STABILITY

LED Lifetime and Long-Term Power Stability

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 collimated 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 (see the graph to the right).

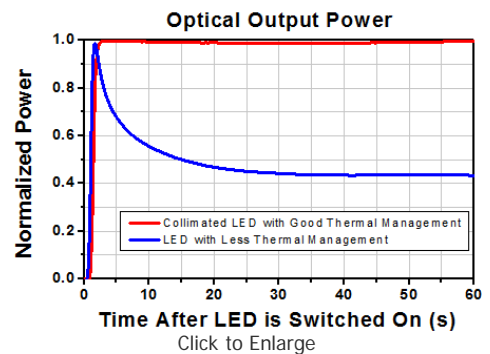












Photo to Enlarge; Not to Scale)										
Wavelength	Unmounted LEDs	Pigtailed LEDs	LEDs in SMT Packages	PCB-Mounted LEDs	Heatsink-Mounted LEDs	Collimated LEDs for Microscopy (Item # Prefix ^a)	Fiber-Coupled LEDs ^b	High-Power LEDs for Microscopy	Multi-Wavelength LED Source Options ^c	LED Arrays
Single Color LEDs										
250 nm	LED250J (1 mW Min)	-	-	-	-	-	-	-	-	-
255 nm	LED255W (0.4 mW)	-	-	-	-	-	-	-	-	-
	LED255J (1 mW Min)									
260 nm	LED260W (1 mW)	-	-	-	-	-	-	-	-	-
	LED260J (1 mW Min)									
265 nm	LED265W2 (1.6 mW)	-	-	M265D2 (10 mW Min)	M265L3 (10 mW Min)	-	-	-	-	-
				M265D3 (24 mW Min)						
275 nm	LED275W (1.6 mW)	-	-	M275D2 (45 mW Min)	M275L4 (45 mW Min)	-	-	-	-	-
	LED275J (1 mW Min)			M275D3 (47.3 mW ^d Min)						
280 nm	LED280J (1 mW Min)	-	-	-	-	-	-	-	-	-
	LED280W (2.3 mW)									
285 nm	LED285W (1.6 mW)	-	-	M285D3 (50 mW Min)	M285L5 (50 mW Min)	-	M285F4 (590 μW)	-	-	-
290 nm	LED290W (1.6 mW)	-	-	-	-	-	-	-	-	-
295 nm	LED295W (1.2 mW)	-	-	-	-	-	-	-	-	-
300 nm	LED300W (1.2 mW)	-	-	M300D3 (26 mW Min)	M300L4 (26 mW Min)	-	M300F2 (320 μW)	-	-	-
308 nm	-	-	-	M310D1 (38.5 mW Min ^d)	M310L1 (38.5 mW Min ^d)	-	M310F1 (0.51 mW ^d)	-	-	-
310 nm	LED310W (1.5 mW)	-	-	-	-	-	-	-	-	-
	LED315W (1 mW)									
325 nm	LED325W2 (1.7 mW)	-	-	M325D3 (25 mW Min)	M325L5 (25 mW Min)	-	M325F4 (350 μW)	-	-	-
340 nm	LED340W (1.7 mW)	-	-	M340D3 (53 mW Min)	M340L4 (53 mW Min)	-	M340F3 (1.06 mW)	-	-	-
	LED341W (0.33 mW)									
365 nm	-	-	-	M365D1 (190 mW Min)	M365L2 (190 mW Min)	M365L2 (60 mW) ^e	M365F1 (4.1 mW)	SOLIS-365C (3.0 W) ^f	Chrolis (1130 mW)	LIU365A (31 mW)
					M365L3 (880 mW Min)					

	(4 mW)									
1600 nm	LED1600L (2 mW)	-	-	-	-	-	-	-	-	-
1650 nm	LED1600P (1.2 mW)	-	-	M1650D2 (13 mW Min)	M1650L4 (13 mW Min)	-	-	-	-	-
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)	-	-	-	-	-	-	-	-	-
2700 nm	LED2700W (0.15 mW Quasi-CW, 1.0 mW Pulsed)	-	-	-	-	-	-	-	-	-
2800 nm	LED2800W (0.3 mW Quasi-CW, 2.0 mW Pulsed)	-	-	-	-	-	-	-	-	-
3400 nm	LED3400W (0.3 mW Quasi-CW, 2.0 mW Pulsed)	-	-	-	-	-	-	-	-	-
3800 nm	LED3800W (0.18 mW Quasi-CW, 1.5 mW Pulsed)	-	-	-	-	-	-	-	-	-
4200 nm	LED4300P (0.03 mW Quasi-CW, 0.2 mW Pulsed)	-	-	-	-	-	-	-	-	-
4300 nm	LED4300W (0.18 mW Quasi-CW, 1.5 mW Pulsed)	-	-	-	-	-	-	-	-	-
4500 nm	LED4600P (0.006 mW Quasi-CW, 0.12 mW Pulsed)	-	-	-	-	-	-	-	-	-
	Unmounted	Pigtailed	LEDs in	PCB-	Heatsink-	Collimated LEDs for	Fiber-	High-Power LEDs	Multi- Wavelength	LED

Wavelength	LEDs	LEDs	SMT Packages	Mounted LEDs	Mounted LEDs	Microscopy (Item # Prefix ^a)	Coupled LEDs ^b	for Microscopy	LED Source Options ^c	Arrays
Multi-Color, Broadband, and White LEDs										
455 nm (12.5% ⁱ) and 640 nm	-	-	-	MPRP1D2 (275 mW Min)	MPRP1L4 (275 mW Min)	-	-	-	-	-
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)	-	-	-	-	-	-	-	-	-
430 - 660 nm (White)	LEDWE-15 (13 mW)	-	-	-	-	-	-	-	-	-
	LEDW7E (15.0 mW)	-	-	-	-	-	-	-	-	-
	LEDW25E (15.0 mW)	-	-	-	-	-	-	-	-	-
6500 K (Cold White)	-	-	-	MCWHD5 (930 mW Min)	MCWHL7 (930 mW Min)	-	-	SOLIS-1C (3.3 W) ^f	-	-
	-	-	-	MCWHD4 (990 mW Min)	MCWHL6 (990 mW Min)	MCWHL5 (340 mW) ^h				
	-	-	-	MCWHD3 (2350 mW Min)	MCWHLP1 (2350 mW Min)	MCWHL6 (354 mW) ^e				
6200 K (Cold White)	-	-	-	-	-	-	MCWHF2 (27.0 mW)	-	-	-
5000 K (Cold White)	-	-	LEDSW50 (110 mW)	-	-	-	-	-	-	-
4600 - 9000 K (Cold White)	-	-	-	-	-	-	-	-	-	LIUCWHA (250 mW)
4000 K (Warm White)	-	-	LEDSW40 (115 mW)	-	-	-	MWWHF2 (23.1 mW)	-	-	-
3000 K (Warm White)	-	-	LEDSW30 (100 mW)	MWWHD3 (2000 mW Min)	MWWHL4 (570 mW Min)	-	-	SOLIS-2C (3.2 W) ^f	-	-
					MWWHLP1 (2000 mW Min)					
5700 K (Day Light White)	-	-	-	-	-	-	-	SOLIS-3C (3.5 W)	-	-
470 - 850 nm (Broadband)	-	-	-	MBB1D1 (70 mW Min)	MBB1L3 (70 mW Min)	-	MBB1F1 (1.2 mW)	-	-	-
770 nm, 860 nm, & 940 nm (Broadband)	-	-	-	MBB2D1 (740 mW ^d Min)	MBB2L1 (650 mW ^d Min)	-	-	-	-	-
					MBB2LP1 (740 mW ^d Min)					























- 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 Multi-Wavelength LED Sources are available with select combinations of the LEDs at these wavelengths.
- d. Measured at 25 °C
- e. Typical power for LEDs with the Leica DMI collimation package (Item # Suffix: -C2).
- f. Minimum power for the collimated output of these LEDs. The collimation lens is installed with each LED.

- g. Typical power for LEDs with the Olympus BX and IX collimation package (Item # Suffix: -C1).
- h. Typical power for LEDs with the Nikon Eclipse collimation package (Item # Suffix: -C5).
- i. Percentage of LED intensity that emits in the blue portion of the spectrum, from 400 nm to 525 nm.

[Hide Collimated LED Light Sources for Olympus BX and IX Microscopes](#)

Collimated LED Light Sources for Olympus BX and IX Microscopes

- ▶ Approximate Beam Diameter: 50 mm
- ▶ Approximate Beam Area: 1960 mm²
- ▶ AR-Coated Aspheric Collimation Lens (EFL: 40 mm)
- ▶ See the Specs Tab for a Complete List of Specifications
- ▶ Cable Length: 2 m

Item #	Color ^a	Housing	Total Beam Power ^b	Item #	Color ^a	Housing	Total Beam Power ^b
M365L2-C1	UV		120 mW	M530L4-C1	Green		200 mW
M365L3-C1	UV		520 mW	M590L4-C1	Amber		130 mW
M365LP1-C1 ^c	UV		745 mW	M617L3-C1	Orange		320 mW
M385L2-C1	UV		170 mW	M617L4-C1	Orange		360 mW
M385L3-C1	UV		680 mW	M625L4-C1	Red		630 mW
M385LP1-C1 ^c	UV		795 mW	M660L4-C1	Deep Red		590 mW
M405L4-C1	UV		510 mW	M780L3-C1	IR		210 mW
M405LP1-C1 ^c	UV		750 mW	M810L3-C1	IR		245 mW
M455L4-C1	Royal Blue		630 mW	M850L3-C1	IR		480 mW
M470L4-C1	Blue		420 mW	M940L3-C1	IR		430 mW
M505L4-C1	Cyan		220 mW	MCWHL6-C1	Cold White		548 mW _a .

- 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 are only intended to be used as a guideline.
- b. After collimation package. Due to variations in the manufacturing process and operating parameters such as temperature and current, the total beam power of any given LED will vary.
- c. These LEDs have a higher output power and are mounted to a Ø57.0 mm heat sink for increased heat dissipation.



[Click to Enlarge](#)



Part Number	Description	Price	Availability
M365L2-C1	365 nm, 120 mW (Typ.) Collimated LED for Olympus BX & IX, 700 mA	\$450.00	Today
M365L3-C1	365 nm, 520 mW (Typ.) Collimated LED for Olympus BX & IX, 1000 mA	\$557.68	Today
M365LP1-C1	365 nm, 745 mW (Typ.) Collimated LED for Olympus BX & IX, 1700 mA	\$653.68	5-8 Days
M385L2-C1	385 nm, 170 mW (Typ.) Collimated LED for Olympus BX & IX, 700 mA	\$450.00	Today
M385L3-C1	385 nm, 680 mW (Typ.) Collimated LED for Olympus BX & IX, 1000 mA	\$577.85	5-8 Days
M385LP1-C1	385 nm, 795 mW (Typ.) Collimated LED for Olympus BX & IX, 1700 mA	\$588.68	Today
M405L4-C1	405 nm, 510 mW (Typ.) Collimated LED for Olympus BX & IX, 1000 mA	\$495.61	Today
M405LP1-C1	405 nm, 750 mW (Typ.) Collimated LED for Olympus BX & IX, 1400 mA	\$588.68	Today
M455L4-C1	455 nm, 630 mW (Typ.) Collimated LED for Olympus BX & IX, 1000 mA	\$577.85	Today
M470L4-C1	470 nm, 420 mW (Typ.) Collimated LED for Olympus BX & IX, 1000 mA	\$577.85	Today
M505L4-C1	505 nm, 220 mW (Typ.) Collimated LED for Olympus BX & IX, 1000 mA	\$577.85	Today
M530L4-C1	530 nm, 200 mW (Typ.) Collimated LED for Olympus BX & IX, 1000 mA	\$577.85	Today
M590L4-C1	590 nm, 130 mW (Typ.) Collimated LED for Olympus BX & IX, 1000 mA	\$495.61	Today
M617L3-C1	617 nm, 320 mW (Typ.) Collimated LED for Olympus BX & IX, 1000 mA	\$349.17	Today
M617L4-C1	617 nm, 360 mW (Typ.) Collimated LED for Olympus BX & IX, 1000 mA	\$495.61	5-8 Days
M625L4-C1	625 nm, 630 mW (Typ.) Collimated LED for Olympus BX & IX, 1000 mA	\$478.95	Today

M660L4-C1	660 nm, 590 mW (Typ.) Collimated LED for Olympus BX & IX, 1200 mA	\$495.61	Today
M780L3-C1	780 nm, 210 mW (Typ.) Collimated LED for Olympus BX & IX, 800 mA	\$548.63	Today
M810L3-C1	810 nm, 245 mW (Typ.) Collimated LED for Olympus BX & IX, 500 mA	\$548.63	Lead Time
M850L3-C1	850 nm, 480 mW (Typ.) Collimated LED for Olympus BX & IX, 1200 mA	\$548.63	5-8 Days
M940L3-C1	940 nm, 430 mW (Typ.) Collimated LED for Olympus BX & IX, 1000 mA	\$548.63	Today
MCWHL6-C1	6500 K, 548 mW (Typ.) Collimated LED for Olympus BX & IX, 1200 mA	\$532.00	Today

[Hide Collimated LED Light Sources for Leica DMI Microscopes](#)

Collimated LED Light Sources for Leica DMI Microscopes

- ▶ Approximate Beam Diameter: 37 mm
- ▶ Approximate Beam Area: 1080 mm²
- ▶ AR-Coated Aspheric Collimation Lens (EFL = 40 mm)
- ▶ See the *Specs* Tab for a Complete List of Specifications
- ▶ Cable Length: 2 m

Item #	Color ^a	Housing	Total Beam Power ^b	Item #	Color ^a	Housing	Total Beam Power ^b
M365L2-C2	UV		60 mW	M530L4-C2	Green		160 mW
M365L3-C2	UV		320 mW	M590L4-C2	Amber		100 mW
M365LP1-C2 ^c	UV		435 mW	M617L3-C2	Orange		230 mW
M385L2-C2	UV		90 mW	M617L4-C2	Orange		280 mW
M385L3-C2	UV		450 mW	M625L3-C2	Red		270 mW
M385LP1-C2 ^c	UV		520 mW	M625L4-C2	Red		490 mW
M405L3-C2	UV		440 mW	M660L4-C2	Deep Red		400 mW
M405LP1-C2 ^c	UV		450 mW	M780L3-C2	IR		130 mW
M455L4-C2	Royal Blue		490 mW	M810L3-C2	IR		210 mW
M470L4-C2	Blue		330 mW	M850L3-C2	IR		330 mW
M505L3-C2	Cyan		150 mW	M940L3-C2	IR		320 mW
M505L4-C2	Cyan		170 mW	MCWHL6-C2	Cold White		354 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 are only intended to be used as a guideline.
- b. After collimation package. Due to variations in the manufacturing process and operating parameters such as temperature and current, the total beam power of any given LED will vary.
- c. These LEDs have a higher output power and are mounted to a Ø57.0 mm heat sink for increased heat dissipation.



Click to Enlarge

Part Number	Description	Price	Availability
M365L2-C2	365 nm, 60 mW (Typ.) Collimated LED for Leica DMI, 700 mA	\$450.00	Today
M365L3-C2	365 nm, 320 mW (Typ.) Collimated LED for Leica DMI, 1000 mA	\$557.68	5-8 Days
M365LP1-C2	365 nm, 435 mW (Typ.) Collimated LED for Leica DMI, 1700 mA	\$678.56	Today
M385L2-C2	385 nm, 90 mW (Typ.) Collimated LED for Leica DMI, 700 mA	\$450.00	Today
M385L3-C2	375 nm, 450 mW (Typ.) Collimated LED for Leica DMI, 1000 mA	\$577.85	5-8 Days
M385LP1-C2	385 nm, 520 mW (Typ.) Collimated LED for Leica DMI, 1700 mA	\$613.56	Today
M405L3-C2	405 nm, 440 mW (Typ.) Collimated LED for Leica DMI, 1000 mA	\$495.61	Today
M405LP1-C2	405 nm, 450 mW (Typ.) Collimated LED for Leica DMI, 1400 mA	\$613.56	Today
M455L4-C2	455 nm, 490 mW (Typ.) Collimated LED for Leica DMI, 1000 mA	\$577.85	Today
M470L4-C2	470 nm, 330 mW (Typ.) Collimated LED for Leica DMI, 1000 mA	\$577.85	Today
M505L3-C2	505 nm, 150 mW (Typ.) Collimated LED for Leica DMI, 1000 mA	\$407.88	5-8 Days
M505L4-C2	505 nm, 170 mW (Typ.) Collimated LED for Leica DMI, 1000 mA	\$577.85	Today

M530L4-C2	530 nm, 160 mW (Typ.) Collimated LED for Leica DMI, 1000 mA	\$577.85	Today
M590L4-C2	590 nm, 100 mW (Typ.) Collimated LED for Leica DMI, 1000 mA	\$495.61	Today
M617L3-C2	617 nm, 230 mW (Typ.) Collimated LED for Leica DMI, 1000 mA	\$349.17	Today
M617L4-C2	617 nm, 280 mW (Typ.) Collimated LED for Leica DMI, 1000 mA	\$495.61	Today
M625L3-C2	625 nm, 270 mW (Typ.) Collimated LED for Leica DMI, 1000 mA	\$495.61	Today
M625L4-C2	625 nm, 490 mW (Typ.) Collimated LED for Leica DMI, 1000 mA	\$478.95	Today
M660L4-C2	660 nm, 400 mW (Typ.) Collimated LED for Leica DMI, 1200 mA	\$495.61	Lead Time
M780L3-C2	780 nm, 130 mW (Typ.) Collimated LED for Leica DMI, 800 mA	\$548.63	5-8 Days
M810L3-C2	810 nm, 210 mW (Typ.) Collimated LED for Leica DMI, 500 mA	\$548.63	Today
M850L3-C2	850 nm, 330 mW (Typ.) Collimated LED for Leica DMI, 1200 mA	\$548.63	Lead Time
M940L3-C2	940 nm, 320 mW (Typ.) Collimated LED for Leica DMI, 1000 mA	\$548.63	5-8 Days
MCWHL6-C2	6500 K, 354 mW (Typ.) Collimated LED for Leica DMI, 1200 mA	\$532.00	5-8 Days

[Hide Collimated LED Light Sources for Zeiss Axioskop and Examiner Microscopes](#)

Collimated LED Light Sources for Zeiss Axioskop and Examiner Microscopes

- ▶ Approximate Beam Diameter: 44 mm
- ▶ Approximate Beam Area: 1520 mm²
- ▶ Compatible with Dovetail Used in Zeiss Axioskop and Examiner Microscopes
- ▶ AR-Coated Aspheric Collimation Lens (EFL: 40 mm)
- ▶ See the *Specs* Tab for a Complete List of Specifications
- ▶ Cable Length: 2 m

Item #	Color ^a	Housing	Total Beam Power ^b	Item #	Color ^a	Housing	Total Beam Power ^b
M365L2-C4	UV		80 mW	M530L4-C4	Green		220 mW
M365L3-C4	UV		430 mW	M590L3-C4	Amber		70 mW
M365LP1-C4 ^c	UV		615 mW	M590L4-C4	Amber		140 mW
M385L2-C4	UV		110 mW	M617L3-C4	Orange		280 mW
M385L3-C4	UV		570 mW	M617L4-C4	Orange		400 mW
M385LP1-C4 ^c	UV		630 mW	M625L4-C4	Red		690 mW
M405L3-C4	UV		600 mW	M660L4-C4	Deep Red		570 mW
M405LP1-C4 ^c	UV		570 mW	M780L3-C4	IR		180 mW
M455L3-C4	Royal Blue		430 mW	M810L3-C4	IR		230 mW
M455L4-C4	Royal Blue		690 mW	M850L3-C4	IR		400 mW
M470L4-C4	Blue		460 mW	M940L3-C4	IR		380 mW
M505L3-C4	Cyan		180 mW	MCWHL5-C4	Cold White		380 mW
M505L4-C4	Cyan		240 mW	MCWHL6-C4	Cold White		493 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 are only intended to be used as a guideline.
- b. After collimation package. Due to variations in the manufacturing process and operating parameters such as temperature and current, the total beam power of any given LED will vary.
- c. These LEDs have a higher output power and are mounted to a Ø57.0 mm heat sink for increased heat dissipation.



[Click to Enlarge](#)















Part Number	Description	Price	Availability
M365L2-C4	365 nm, 80 mW (Typ.) Collimated LED for Zeiss Axioskop & Examiner, 700 mA	\$450.00	Today
M365L3-C4	365 nm, 430 mW (Typ.) Collimated LED for Zeiss Axioskop & Examiner, 1000 mA	\$557.68	5-8 Days
M365LP1-C4	365 nm, 615 mW (Typ.) Collimated LED for Zeiss Axioskop & Examiner, 1700 mA	\$678.56	Today
M385L2-C4	385 nm, 110 mW (Typ.) Collimated LED for Zeiss Axioskop & Examiner, 700 mA	\$450.00	Today











M385L3-C4	385 nm, 570 mW (Typ.) Collimated LED for Zeiss Axioskop & Examiner, 1000 mA	\$577.85	5-8 Days
M385LP1-C4	385 nm, 660 mW (Typ.) Collimated LED for Zeiss Axioskop & Examiner, 1700 mA	\$613.56	Today
M405L3-C4	405 nm, 600 mW (Typ.) Collimated LED for Zeiss Axioskop & Examiner, 1000 mA	\$495.61	5-8 Days
M405LP1-C4	405 nm, 580 mW (Typ.) Collimated LED for Zeiss Axioskop & Examiner, 1400 mA	\$613.56	Today
M455L3-C4	455 nm, 430 mW (Typ.) Collimated LED for Zeiss Axioskop & Examiner, 1000 mA	\$407.88	Today
M455L4-C4	455 nm, 690 mW (Typ.) Collimated LED for Zeiss Axioskop & Examiner, 1000 mA	\$577.85	5-8 Days
M470L4-C4	470 nm, 460 mW (Typ.) Collimated LED for Zeiss Axioskop & Examiner, 1000 mA	\$577.85	Today
M505L3-C4	505 nm, 180 mW (Typ.) Collimated LED for Zeiss Axioskop & Examiner, 1000 mA	\$407.88	Today
M505L4-C4	505 nm, 240 mW (Typ.) Collimated LED for Zeiss Axioskop & Examiner, 1000 mA	\$577.85	5-8 Days
M530L4-C4	530 nm, 220 mW (Typ.) Collimated LED for Zeiss Axioskop & Examiner, 1000 mA	\$577.85	Today
M590L3-C4	590 nm, 70 mW (Typ.) Collimated LED for Zeiss Axioskop & Examiner, 1000 mA	\$349.17	Today
M590L4-C4	590 nm, 140 mW (Typ.) Collimated LED for Zeiss Axioskop & Examiner, 1000 mA	\$495.61	Today
M617L3-C4	617 nm, 280 mW (Typ.) Collimated LED for Zeiss Axioskop & Examiner, 1000 mA	\$349.17	Today
M617L4-C4	617 nm, 400 mW (Typ.) Collimated LED for Zeiss Axioskop & Examiner, 1000 mA	\$495.61	Today
M625L4-C4	625 nm, 690 mW (Typ.) Collimated LED for Zeiss Axioskop & Examiner, 1000 mA	\$478.95	Today
M660L4-C4	660 nm, 570 mW (Typ.) Collimated LED for Zeiss Axioskop & Examiner, 1200 mA	\$532.41	Today
M780L3-C4	780 nm, 180 mW (Typ.) Collimated LED for Zeiss Axioskop & Examiner, 800 mA	\$548.63	Today
M810L3-C4	810 nm, 230 mW (Typ.) Collimated LED for Zeiss Axioskop & Examiner, 500 mA	\$590.84	Today
M850L3-C4	850 nm, 400 mW (Typ.) Collimated LED for Zeiss Axioskop & Examiner, 1200 mA	\$548.63	Today
M940L3-C4	940 nm, 380 mW (Typ.) Collimated LED for Zeiss Axioskop & Examiner, 1000 mA	\$548.63	5-8 Days
MCWHL5-C4	6500 K, 380 mW (Typ.) Collimated LED for Zeiss Axioskop & Examiner, 1000 mA	\$529.15	Today
MCWHL6-C4	6500 K, 493 mW (Typ.) Collimated LED for Zeiss Axioskop & Examiner, 1200 mA	\$532.00	5-8 Days

[Hide Collimated LED Light Sources for Nikon Eclipse \(Bayonet Mount\) Microscopes](#)

Collimated LED Light Sources for Nikon Eclipse (Bayonet Mount) Microscopes

- ▶ Approximate Beam Diameter: 43 mm
- ▶ Approximate Beam Area: 1450 mm²
- ▶ AR-Coated Aspheric Collimation Lens (EFL: 40 mm)
- ▶ See the *Specs* Tab for a Complete List of Specifications
- ▶ Cable Length: 2 m

Item #	Color ^a	Housing	Total Beam Power ^b
M365L2-C5	UV		80 mW
M365L3-C5	UV		320 mW
M365LP1-C5 ^c	UV		435 mW
M385L2-C5	UV		120 mW
M385L3-C5	UV		410 mW
M385LP1-C5 ^c	UV		660 mW
M405LP1-C5 ^c	UV		580 mW
M455L3-C5	Royal Blue		400 mW
M455L4-C5	Royal Blue		630 mW
M470L4-C5	Blue		420 mW
M505L3-C5	Cyan		170 mW
M505L4-C5	Cyan		220 mW
M530L3-C5	Green		150 mW
M530L4-C5	Green		200 mW

Item #	Color ^a	Housing	Total Beam Power ^b
M590L3-C5	Amber		70 mW
M590L4-C5	Amber		130 mW
M617L3-C5	Orange		260 mW
M617L4-C5	Orange		360 mW
M625L3-C5	Red		300 mW
M625L4-C5	Red		630 mW
M660L4-C5	Deep Red		520 mW
M780L3-C5	IR		170 mW
M810L3-C5	IR		225 mW
M850L3-C5	IR		370 mW
M940L3-C5	IR		340 mW
MCWHL5-C5	Cold White		340 mW
MCWHL6-C5	Cold White		477 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 are only intended to be used as a guideline.
- b. After collimation package. Due to variations in the manufacturing process and operating parameters such as temperature and current, the total beam power of any given LED will vary.

- c. These LEDs have a higher output power and are mounted to a Ø57.0 mm heat sink for increased heat dissipation.



Click to Enlarge

Part Number	Description	Price	Availability
M365L2-C5	365 nm, 80 mW (Typ.) Collimated LED for Nikon Eclipse, 700 mA	\$500.00	Today
M365L3-C5	365 nm, 320 mW (Typ.) Collimated LED for Nikon Eclipse, 1000 mA	\$594.65	Today
M365LP1-C5	365 nm, 435 mW (Typ.) Collimated LED for Nikon Eclipse, 1700 mA	\$727.26	Today
M385L2-C5	385 nm, 120 mW (Typ.) Collimated LED for Nikon Eclipse, 700 mA	\$490.00	Today
M385L3-C5	385 nm, 410 mW (Typ.) Collimated LED for Nikon Eclipse, 1000 mA	\$614.65	5-8 Days
M385LP1-C5	385 nm, 630 mW (Typ.) Collimated LED for Nikon Eclipse, 1700 mA	\$662.26	Today
M405LP1-C5	405 nm, 570 mW (Typ.) Collimated LED for Nikon Eclipse, 1400 mA	\$662.26	Today
M455L3-C5	455 nm, 400 mW (Typ.) Collimated LED for Nikon Eclipse, 1000 mA	\$433.63	Today
M455L4-C5	455 nm, 630 mW (Typ.) Collimated LED for Nikon Eclipse, 1000 mA	\$614.65	5-8 Days
M470L4-C5	470 nm, 420 mW (Typ.) Collimated LED for Nikon Eclipse, 1000 mA	\$614.65	Today
M505L3-C5	505 nm, 170 mW (Typ.) Collimated LED for Nikon Eclipse, 1000 mA	\$433.63	Today
M505L4-C5	505 nm, 220 mW (Typ.) Collimated LED for Nikon Eclipse, 1000 mA	\$614.65	5-8 Days
M530L3-C5	530 nm, 150 mW (Typ.) Collimated LED for Nikon Eclipse, 1000 mA	\$433.63	Lead Time
M530L4-C5	530 nm, 200 mW (Typ.) Collimated LED for Nikon Eclipse, 1000 mA	\$614.65	Today
M590L3-C5	590 nm, 70 mW (Typ.) Collimated LED for Nikon Eclipse, 1000 mA	\$375.95	Today
M590L4-C5	590 nm, 130 mW (Typ.) Collimated LED for Nikon Eclipse, 1000 mA	\$532.41	Today
M617L3-C5	617 nm, 260 mW (Typ.) Collimated LED for Nikon Eclipse, 1000 mA	\$375.95	Today
M617L4-C5	617 nm, 360 mW (Typ.) Collimated LED for Nikon Eclipse, 1000 mA	\$532.41	Today
M625L3-C5	625 nm, 300 mW (Typ.) Collimated LED for Nikon Eclipse, 1000 mA	\$532.41	Today
M625L4-C5	625 nm, 630 mW (Typ.) Collimated LED for Nikon Eclipse, 1000 mA	\$525.30	Today
M660L4-C5	660 nm, 520 mW (Typ.) Collimated LED for Nikon Eclipse, 1200 mA	\$495.61	Today
M780L3-C5	780 nm, 170 mW (Typ.) Collimated LED for Nikon Eclipse, 800 mA	\$590.84	Today
M810L3-C5	810 nm, 225 mW (Typ.) Collimated LED for Nikon Eclipse, 500 mA	\$548.63	Today
M850L3-C5	850 nm, 370 mW (Typ.) Collimated LED for Nikon Eclipse, 1200 mA	\$590.84	Today
M940L3-C5	940 nm, 340 mW (Typ.) Collimated LED for Nikon Eclipse, 1000 mA	\$590.84	5-8 Days
MCWHL5-C5	6500 K, 340 mW (Typ.) Collimated LED for Nikon Eclipse, 1000 mA	\$570.28	5-8 Days
MCWHL6-C5	6500 K, 477 mW (Typ.) Collimated LED for Nikon Eclipse, 1200 mA	\$572.00	Today

[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
4	Blue	EEPROM IO

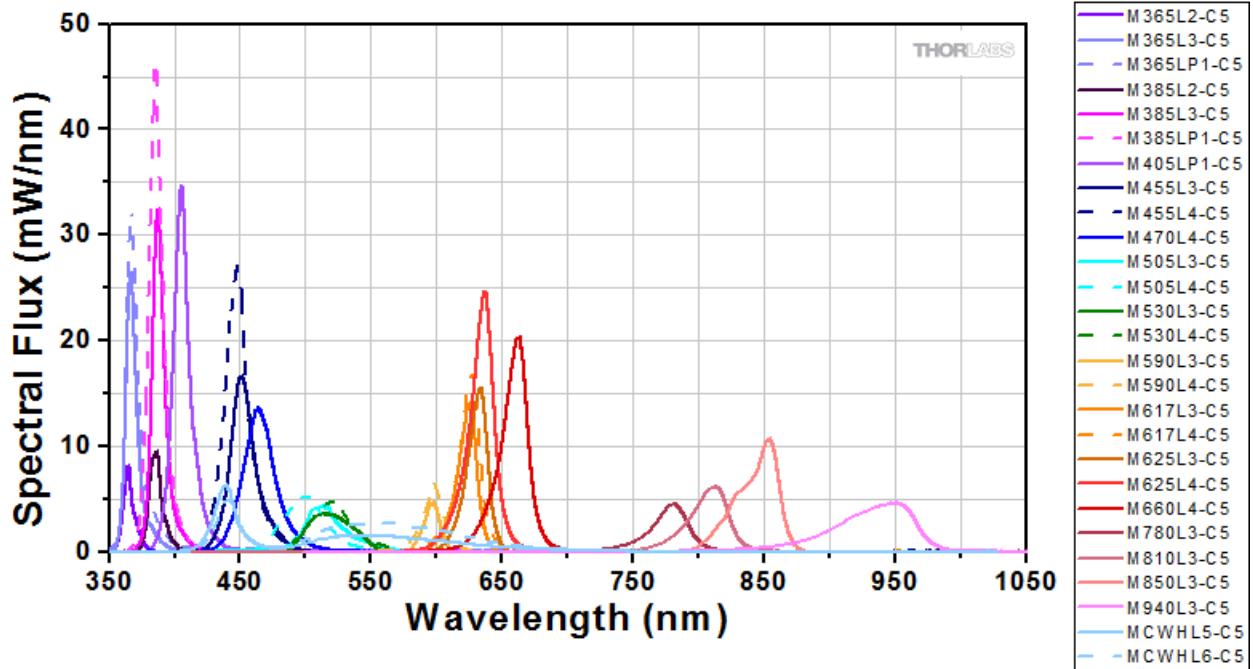


CON8ML-4 Shown Connected to the 4-Pin M8 Plug of Mounted LED

Part Number	Description	Price	Availability
CON8ML-4	4-Pin Female Mating Connector for Mounted LEDs	\$33.28	Today



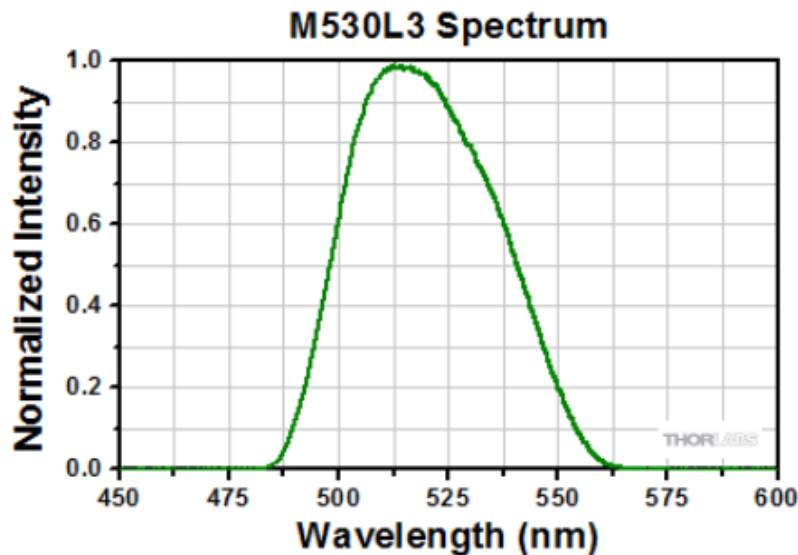
Spectra Scaled to Total Beam Power Through Collimation Package



530 nm Collimated LEDs, 1000 mA



Spectrum



The M530L3-C Collimated LEDs each use an M530L3 Mounted LED attached to a microscope-port-compatible collimation package. The spectrum shown here is for the bare (uncollimated) LED.

Click [here](#) to download an Excel file containing the spectral data for a larger wavelength range than shown in the graph above.