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THORLABS

M310D2 - Mar. 22, 2016

Item # M310D2 was discontinued on Mar. 22, 2016. For informational purposes, this is a copy of the website content at that time and is valid only for the stated product.

- **UV, Visible, and IR Models Available**
- **LED Mounted on Metal-Core Printed Circuit Board**
- **Ideal for OEM Applications**

M340D3
340 nm LED, Power Output ≥ 53 mW

M1300D2
1300 nm LED, Power Output ≥ 25 mW

M565D2
565 nm LED, Power Output ≥ 880 mW

Hide Overview

OVERVIEW

Features

- Nominal Wavelengths Ranging from 265 nm to 1550 nm
- Warm White (3000 K), Cold White (6500 K), and Broadband (470 - 850 nm) LEDs Also Available
- Outputs Ranging from 10 mW to 2350 mW
- LED Mounted on Metal-Core Printed Circuit Board for Excellent Heat Management
- Long Lifetimes (See *Specs* Tab for Details)

Thorlabs' LEDs on Metal-Core Printed Circuit Boards (MCPCBs) are designed to provide high-power output in a compact package. Each LED consists of a single LED with multiple emitters that has been soldered to an MCPCB. These LEDs are ideal for OEM or custom applications; they should not be used for household illumination.

Thorlabs uses high-thermal-conductivity MCPCB materials from Bergquist and SinkPAD (see footnote d in the table to the right for the material used in each LED). The MCPCB is designed to provide good thermal management. However, the LED must still be mounted onto an appropriate heat sink using thermal paste to ensure proper operation and to maximize operating lifetime. Mounting holes are provided on the MCPCB surface for attaching the LED to a heat sink; the Ø2 mm through holes are compatible with #1 (M2) screws (not included).

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.

Thorlabs also offers mounted LEDs with an integrated heat sink, as well as collimated mounted LEDs, which are compatible with microscopes from major manufacturers. For fiber applications, we also offer fiber-coupled LEDs. For questions on choosing an appropriate LED and to discuss mounting requirements, please contact Tech Support.

Optimized Thermal Management
These LEDs possess good thermal stability properties, and hence, degradation of optical output power due to increased LED temperature is not an issue when the LED is properly mounted to a heat sink using thermal paste, thermal epoxy, or thermally conductive double-sided tape. For more

Item #	Color (Click for Spectrum)[a]	Nominal Wavelength[a,b]	Minimum LED Power Output[a]
M265D2[c]	Deep UV	265 nm	10 mW
M280D2[c]	Deep UV	280 nm	25 mW
M310D2[c]	Deep UV	310 nm	25 mW
M340D3[c]	Deep UV	340 nm	53 mW
M365D1[c]	UV	365 nm	190 mW
M365D2[c]	UV	365 nm	1150 mW
M375D2[c]	UV	375 nm	387 mW
M385D1[c]	UV	385 nm	270 mW
M385D2[c]	UV	385 nm	1650 mW
M395D3[c]	UV	395 nm	400 mW
M405D1[c]	UV	405 nm	410 mW
M405D2[c]	UV	405 nm	1500 mW
M420D2[c]	Violet	420 nm	750 mW
M450D3	Royal Blue	450 nm	1850 mW
M455D2[d]	Royal Blue	455 nm	900 mW
M470D2[d]	Blue	470 nm	650 mW
M490D2	Blue	490 nm	200 mW
M505D2[d]	Cyan	505 nm	400 mW
M530D2[d]	Green	530 nm	350 mW
M565D2[e]	Lime	565 nm	880 mW
M590D2[d]	Amber	590 nm	160 mW
M595D2[e]	Amber	595 nm	445 mW
M617D2[d]	Orange	617 nm	600 mW
M625D2[d]	Red	625 nm	700 mW
M660D2	Deep Red	660 nm	940 mW
M730D2	Far Red	730 nm	515 mW
M780D2	IR	780 nm	200 mW
M780D3	IR	780 nm	800 mW
M810D2	IR	810 nm	325 mW
M850D2[d]	IR	850 nm	900 mW
M850D3	IR	850 nm	1400 mW
M880D2	IR	880 nm	300 mW
M940D2[d]	IR	940 nm	800 mW
M970D2	IR	970 nm	35 mW
M1050D1	IR	1050 nm	50 mW
M1200D2	IR	1200 nm	30 mW
M1300D2	IR	1300 nm	25 mW

details, please see the *Stability* tab.

White Light and Broadband LEDs
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.

The MBB1D1 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. To view a plot of the spectrum of this broadband source, please see the table to the right.

M1450D2	IR	1450 nm	31 mW
M1550D2	IR	1550 nm	31 mW
MBB1D1[f]	Broadband	470 - 850 nm[g]	70 mW
MWWHD1[e]	Warm White	3000 K[h]	500 mW
MWWHD3[e]	Warm White	3000 K	2000 mW
MCWHD2[d,e]	Cold White	6500 K[h]	800 mW
MCWHD3[e]	Cold White	6500 K	2350 mW

- 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. These values were measured with the back side of the PCB at 25 °C. Output plots and nominal wavelength specs are only intended to be used as a guideline.
- For LEDs in the 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 spectrograph.
- Our 265 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.
- These LEDs use a high-thermal-conductivity MCPCB material from SinkPAD, while the rest of the MCPCB LEDs use a high-thermal-conductivity MCPCB material from Bergquist.
- These LEDs are phosphor-converted and may not turn off completely when modulated above 10 kHz at duty cycles below 50%.
- The MBB1D1 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%.
- 10 dB Bandwidth
- Correlated Color Temperature

Soldering
These LEDs have been soldered to a metal core with low thermal resistance. While this feature allows for good thermal management, it can also prevent the metal pads from reaching the appropriate temperature for soldering when the package is connected to a heat sink. To properly solder wires to the pads, first make sure that the metal core is not in contact with a heat sink or a metal surface. We recommend using a small vise or similar device to hold the MCPCB during the soldering process and wires with a minimum gauge of 24 AWG (0.25 mm^2).

To solder wires to the MCPCB, first hold the copper bit of the soldering iron on one of the pads for approximately 30 seconds using a soldering temperature of about 350 °C. The soldering iron will heat the entire metal-core PCB, so do not touch the LED package until it has cooled down after the soldering process. Test the temperature by touching tin solder to the pad: the solder will melt and flow evenly over the entire pad at the correct temperature. Coat the other pads with tin solder. Now, solder the wires to the pads. Use tweezers or pliers to remove the MCPCB from the vise and place it on a heat sink or metal surface. The metal-core PCB will cool down in several seconds and is now ready for your application.

For convenient connection of the LEDs to the drivers listed on the *LED Drivers* tab, please order the optional CAB-LEDD1 LED connection cable below.

Driver Options and Pin Assignments
Thorlabs offers four drivers: LEDD1B, DC2200, DC4100, and DC4104 (the latter two require the DC4100-HUB). See the *LED Drivers* tab for compatibility information and a list of specifications. The LEDD1B is capable of providing LED modulation frequencies up to 5 kHz, while DC4100, and DC4104 can modulate the LED at a rate up to 100 kHz. The DC2200 can provide modulation at up to 250 kHz if driven by an external source. Please note that MCPCB LEDs are not compatible with the EEPROM feature of the DC2200, DC4100, and DC4104, which automatically adjusts for the current limits of our mounted LEDs. Therefore, care must be taken not to exceed the current limits of the LEDs offered on this page.

To connect the PCB to a controller, please note that the soldering pad labeled "+" is the Anode (+V), and the pad labeled "-" is the Cathode. The other two pads ("IO" and "GND") do not need to be connected and are reserved for future use. The soldering pads on different items may be in different locations, but the labels are the same.

Hide Specs

SPECS

Item #	Color (Click for Spectrum and Data)[a]	Nominal Wavelength[a,b]	Minimum LED Power Output[a]	Typical LED Power Output[a]	Maximum Current (CW)	Forward Voltage	Bandwidth (FWHM)	Irradiance (Typical)[c]	Electrical Power	Typical Lifetime	Viewing Angle (Full Angle at Half Max)	Emitter Size	MCPCB Thickness
M265D2[d]	Deep UV	265 nm	10 mW	12 mW	350 mA	6.8 V	11 nm	-	2.380 W	>1 000 h	130°	1 mm x 1 mm	2.5 mm
M280D2[d]	Deep UV	280 nm	25 mW	30 mW	350 mA	5.9 V	12 nm	3.9 µW/mm²	2.065 W	>500 h	140°	1 mm x 1 mm	1.6 mm
M310D2[d]	Deep UV	310 nm	25 mW	30 mW	350 mA	5.9 V	10 nm	5.8 µW/mm²	2.065 W	>500 h	140°	1 mm x 1 mm	1.6 mm
M340D3[d]	Deep UV	340 nm	53 mW	65 mW	700 mA	4.6 V	11 nm	2.22 µW/mm²	0.322 W	>3 000 h	110°	1 mm x 1 mm	2.4 mm
M365D1[d]	UV	365 nm	190 mW	360 mW	700 mA	4.4 V	7.5 nm	8.9 µW/mm²	3.080 W	>10 000 h	120°	1 mm x 1 mm	1.6 mm
M365D2[d]	UV	365 nm	1150 mW	1400 mW	1400 mA	3.75 V	9 nm	17.6 µW/mm²	5.250 W	>10 000 h	120°	1.4 mm x 1.4 mm	2.5 mm
M375D2[d]	UV	375 nm	387 mW	470 mW	700 mA	3.8 V	9 nm	14.1 µW/mm²	2.660 W	>10 000 h	110°	1 mm x 1 mm	2.4 mm
M385D1[d]	UV	385 nm	270 mW	430 mW	700 mA	4.3 V	10 nm	11.8 µW/mm²	3.010 W	>10 000 h	120°	1 mm x 1 mm	1.6 mm
M385D2[d]	UV	385 nm	1650 mW	1830 mW	1400 mA	3.65 V	12 nm	23.3 µW/mm²	5.110 W	>10 000 h	120°	1.4 mm x 1.4 mm	2.5 mm
M395D3[d]	UV	395 nm	400 mW	535 mW	500 mA	4.5 V	16 nm	6.7 µW/mm²	2.250 W	>10 000 h	126°	1 mm x 1 mm	2.4 mm
M405D1[d]	UV	405 nm	410 mW	760 mW	1000 mA	3.8 V	13 nm	37.1 µW/mm²	3.800 W	100 000 h	85°	1 mm x 1 mm	1.6 mm
M405D2[d]	UV	405 nm	1500 mW	1700 mW	1400 mA	3.45 V	12 nm	24.6 µW/mm²	4.830 W	>10 000 h	120°	1.4 mm x 1.4 mm	2.5 mm
M420D2[d]	Violet	420 nm	750 mW	820 mW	1000 mA	3.5 V	15 nm	13.1 µW/mm²	3.500 W	>10 000 h	125°	1 mm x 1 mm	2.4 mm
M450D3	Royal Blue	450 nm	1850 mW	2100 mW	2000 mA	3.5 V	18 nm	35.6 µW/mm²	7.000 W	1 000 h	120°	1.5 mm x 1.5 mm	1.6 mm
M455D2[e]	Royal Blue	455 nm	900 mW	1020 mW	1000 mA	3.2 V	18 nm	31.2 µW/mm²	3.200 W	100 000 h	80°	1 mm x 1 mm	1.6 mm
M470D2[e]	Blue	470 nm	650 mW	710 mW	1000 mA	3.2 V	25 nm	21.9 µW/mm²	3.200 W	100 000 h	80°	1 mm x 1 mm	1.6 mm
M490D2	Blue	490 nm	200 mW	250 mW	350 mA	3.5 V	23 nm	15.7 µW/mm²	1.225 W	>10 000 h	22°	1 mm x 1 mm	2.4 mm
M505D2[e]	Cyan	505 nm	400 mW	440 mW	1000 mA	3.3 V	30 nm	11.1 µW/mm²	3.300 W	100 000 h	80°	1 mm x 1 mm	1.6 mm
M530D2[e]	Green	530 nm	350 mW	370 mW	1000 mA	3.2 V	33 nm	9.5 µW/mm²	3.200 W	100 000 h	80°	1 mm x 1 mm	1.6 mm

M565D2[f]	Lime	565 nm	880 mW	979 mW	1000 mA	3.1 V	104 nm	11.7 µW/mm²	3.100 W	50 000 h	125°	1 mm x 1 mm	1.6 mm
M590D2[e]	Amber	590 nm	160 mW	170 mW	1000 mA	2.2 V	18 nm	5.3µW/mm²	2.200 W	100 000 h	80°	1 mm x 1 mm	1.6 mm
M595D2[f]	Amber	595 nm	445 mW	502 mW	700 mA	3.05 V	80 nm	6.9 µW/mm²	2.135 W	50 000 h	120°	1 mm x 1 mm	1.6 mm
M617D2[e]	Orange	617 nm	600 mW	650 mW	1000 mA	2.2 V	18 nm	15.7 µW/mm²	2.200 W	100 000 h	80°	1 mm x 1 mm	1.6 mm
M625D2[e]	Red	625 nm	700 mW	770 mW	1000 mA	2.2 V	18 nm	18.0 µW/mm²	2.200 W	100 000 h	80°	1 mm x 1 mm	1.6 mm
M660D2	Deep Red	660 nm	940 mW	1050 mW	1200 mA	2.6 V	20 nm	20.88 µW/mm²	3.120 W	>10 000 h	120°	1.5 mm x 1.5 mm	1.6 mm
M730D2	Far Red	730 nm	515 mW	595 mW	1000 mA	2.3 V	37 nm	13.2 µW/mm²	2.300 W	>10 000 h	160°	1 mm x 1 mm	1.6 mm
M780D2	IR	780 nm	200 mW	300 mW	800 mA	2.0 V	28 nm	47.3 µW/mm²	1.600 W	>10 000 h	20°	1 mm x 1 mm	2.4 mm
M780D3	IR	780 nm	800 mW	950 mW	800 mA	7.8 V	30 nm	13.3 µW/mm²	6.240 W	>10 000 h	120°	Ø3 mm (3 Emitters)	1.6 mm
M810D2	IR	810 nm	325 mW	375 mW	500 mA	3.6 V	25 nm	61.8 µW/mm²	1.800 W	>10 000 h	40°	1 mm x 1 mm	1.6 mm
M850D2[e]	IR	850 nm	900 mW	1100 mW	1000 mA	2.9 V	30 nm	22.9 µW/mm²	2.900 W	100 000 h	90°	1 mm x 1 mm	1.6 mm
M850D3	IR	850 nm	1400 mW	1600 mW	1500 mA	3.85 V	30 nm	19.4 µW/mm²	5.770 W	>10 000 h	150°	1 mm x 1 mm	1.6 mm
M880D2	IR	880 nm	300 mW	350 mW	1000 mA	1.7 V	50 nm	5.6 µW/mm²	1.700 W	>10 000 h	128°	1 mm x 1 mm	2.4 mm
M940D2[e]	IR	940 nm	800 mW	1000 mW	1000 mA	2.75 V	37 nm	19.1 µW/mm²	2.750 W	100 000 h	90°	1 mm x 1 mm	1.6 mm
M970D2	IR	970 nm	35 mW	50 mW	600 mA	1.4 V	50 nm	0.7 µW/mm²	0.840 W	>10 000 h	124°	1 mm x 1 mm	2.4 mm
M1050D1	IR	1050 nm	50 mW	70 mW	700 mA	1.5 V	60 nm	1.9 µW/mm²	1.050 W	>10 000 h	120°	1 mm x 1 mm	2.4 mm
M1200D2	IR	1200 nm	30 mW	35 mW	700 mA	1.4 V	80 nm	0.7 µW/mm²	0.980 W	>10 000 h	134°	1 mm x 1 mm	2.4 mm
M1300D2	IR	1300 nm	25 mW	30 mW	500 mA	1.4 V	80 nm	0.6 µW/mm²	0.700 W	>10 000 h	134°	1 mm x 1 mm	2.4 mm
M1450D2	IR	1450 nm	31 mW	36 mW	700 mA	1.15 V	80 nm	0.4 µW/mm²	0.805 W	>10 000 h	136°	1 mm x 1 mm	2.4 mm
M1550D2	IR	1550 nm	31 mW	36 mW	700 mA	1.5 V	102 nm	0.5 µW/mm²	1.050 W	>10 000 h	136°	1 mm x 1 mm	2.4 mm
MBB1D1[g]	Broadband	470 - 850 nm[h]	70 mW	80 mW	500 mA	3.6 V	280 nm	12.5 µW/mm²	1.800 W	10 000 h	120°	1 mm x 1 mm	1.6 mm
MWWHD1[f]	Warm White	3000 K[i]	500 mW	550 mW	1000 mA	3.1 V	N/A	10.7 µW/mm²	3.100 W	>50 000 h	120°	1 mm x 1 mm	1.6 mm
MWWHD3[f]	Warm White	3000 K[i]	2000 mW	2300 mW	700 mA	11.7 V	N/A	37.0 µW/mm²	8.200 W	>100 000 h	125°	3.5 mm x 3.5 mm	1.6 mm
MCWHD2[e,f]	Cold White	6500 K[i]	800 mW	840 mW	1000 mA	3.2 V	N/A	24.8 µW/mm²	3.200 W	100 000 h	80°	1 mm x 1 mm	1.6 mm
MCWHD3[f]	Cold White	6500 K[i]	2350 mW	2700 mW	700 mA	11.7 V	N/A	41.3 µW/mm²	8.200 W	>100 000 h	125°	3.5 mm x 3.5 mm	1.6 mm

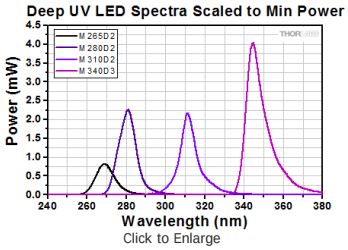
- Due to variations in the manufacturing process and operating parameters such as temperature and current, the actual spectral output of any given LED will vary. These values were measured with the back side of the PCB at 25 °C. Output plots and center wavelength specs are only intended to be used as a guideline.
- For LEDs in the 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 spectrograph.
- Irradiance is measured at a distance of 200 mm from the LED.
- 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.
- These LEDs use a high-thermal-conductivity MCPCB material from SinkPAD, while the rest of the MCPCB LEDs use a high-thermal-conductivity MCPCB material from Bergquist.
- These LEDs are phosphor-converted and may not turn off completely when modulated above 10 kHz at duty cycles below 50%.
- The MBB1D1 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%.
- 10 dB Bandwidth
- Correlated Color Temperature

Hide Relative Power

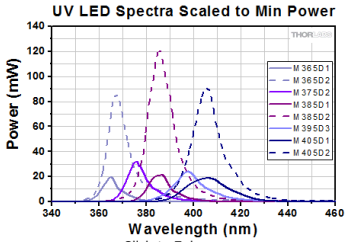
RELATIVE POWER

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. Both a typical and minimum output power are specified to help you select an LED that suits your needs. Each metal-core PCB LED will provide at least the minimum specified output power at the maximum current. 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 minimum output power for each LED. This data is representative, not absolute. An excel file with normalized and scaled spectra for all of the unmounted LEDs can be downloaded here.



Click to Enlarge



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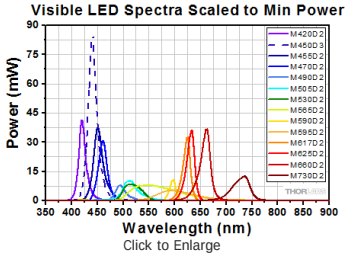

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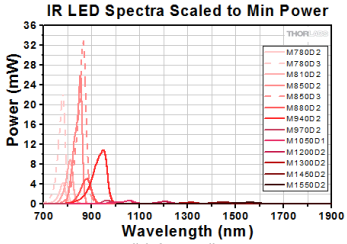
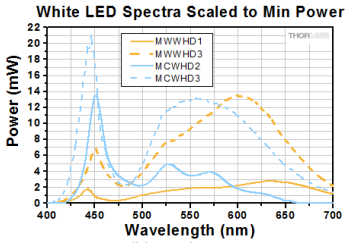


Click for Details



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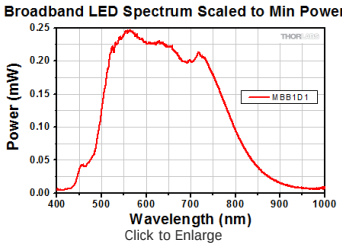

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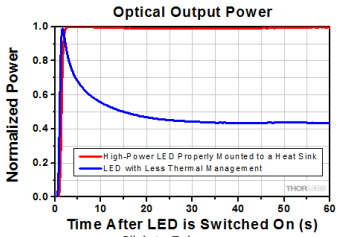
Hide Stability

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.



Click to Enlarge

Optimizing Thermal Management

In order to achieve stable optical output power and maximize lifetime from your LED, the MCPCB must be properly mounted to a heat sink using thermally conductive paste in order to minimize the degradation of optical output power caused by increased LED junction temperature (see the graph to the right).

Hide LED Drivers

LED DRIVERS

Compatible Drivers	LEDD1B[a]	DC2200[b]	DC4100[b,c,d]	DC4104[b,c,d]
Click Photos to Enlarge				
LED Driver Current Output (Max)	1.2 A	LED1 Terminal: 10.0 A LED2 Terminal: 2.0 A[e]	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	250 kHz[f,g]	100 kHz[g] (Simultaneous Across all Channels)	100 kHz[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 LEDD1B should not be used to drive the M340D3, as the current limit can only be set to a minimum of 200 mA (compared to the M340D3's max drive current of 80 mA). LEDs with maximum current ratings higher than 1.2 A can be driven using this driver, but will not reach full power.
- Please note that the EEPROM readout feature that automatically adjusts the driver's current limit for our mounted LEDs is not compatible with our LEDs on MCPCB.
- The DC4100 and 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 and the CAB-LEDD1 cable when used with the DC4100 or DC4104 drivers.
- These LED drivers have a maximum forward voltage rating of 5 V and can provide a maximum current of 1000 mA. As a result, they cannot be used to drive LEDs which have forward voltage ratings greater than 5 V. LEDs with maximum current ratings higher than 1.0 A can be driven using this driver, but will not reach full power.
- The MCPCB LEDs sold below are compatible with the LED2 Terminal via the CAB-LEDD1 (available separately below).
- Small Signal Bandwidth: Modulation not exceeding 20% of full scale current. The driver accepts other waveforms, but the maximum frequency will be reduced.
- Several of these LEDs produce light by stimulating emission from phosphor, which limits their modulation frequencies. The M565D2, M595D2, MWWHD1 and MCWHD2 LEDs may not turn off completely when modulated above 10 kHz at duty cycles below 50%. The MBB1D1 LED may not turn off completely when modulated at frequencies above 1 kHz with a duty cycle of 50%. When the MBB1D1 is modulated at frequencies above 1 kHz, the duty cycle may be reduced; for example, 10 kHz modulation is attainable with a duty cycle of 5%.

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

Hide Ray Data

RAY DATA

Ray data for Zemax is					Click to

available for some of the bare LEDs incorporated into these high-powered light sources. This data is provided in a zipped folder that can be downloaded by clicking on the red document icons ( ) next to the part numbers in the pricing tables below. Every zipped folder contains an information file and one or more ray files for use with Zemax:

Item #	Information File	Available Ray Files	File Size	Download
M365D1	M365_Info.pdf	100,000 Rays and 1 Million Rays	27.4 MB	
M385D1	M385_Info.pdf	1 Million Rays and 5 Million Rays	148 MB	
M405D1	M405_Info.pdf	1 Million Rays	33.1 MB	
M450D3[a]	LD_CQAR_20150731_info.pdf	100,000 Rays, 500,000 Rays, and 5 Million Rays	123 MB	
M455D2[a,b]	LD_CQ7P_290311_info.pdf	100,000 Rays, 500,000 Rays, and 5 Million Rays	125 MB	
M505D2[a]	LV_CK7P_191212_info.pdf	100,000 Rays, 500,000 Rays, and 5 Million Rays	123 MB	
M530D2[a]	LT_Cx7P_290311_info.pdf	100,000 Rays, 500,000 Rays, and 5 Million Rays	124 MB	
M617D2[a,c]	LA_CP7P_030613_info.pdf	100,000 Rays, 500,000 Rays, and 5 Million Rays	125 MB	
M850D2[a]	SFH4715S_100413_info.pdf	100,000 Rays, 500,000 Rays, and 5 Million Rays	140 MB	
M940D2[a]	SFH_4725S_110413_info.pdf	100,000 Rays, 500,000 Rays, and 5 Million Rays	140 MB	
MWWHD1	MWWH_Info.pdf	100,000 Rays, 500,000 Rays, and 1 Million Rays	137 MB	

- **Information File:** This document contains a summary of the types of data files included in the zipped folder and some basic information about their use. It includes a table listing each document type and the corresponding filenames.
- **Ray Files:** These are binary files containing ray data for use with Zemax.

- A radiometric color spectrum, bare LED CAD file, and sample Zemax file are also available for these LEDs.
- The ray data files for the M455D2 can be used for the M470D2 as well by manually resetting the source wavelength in Zemax. Wavelength-specific data and files, such as the radiometric color spectrum and sample Zemax files, only apply to the M455L3.
- The ray data files for the M617D2 can be used for the M590D2 and M625D2 as well by manually resetting the source wavelength in Zemax. Wavelength-specific data and files, such as the radiometric color spectrum and sample Zemax files, only apply to the M617D2.

For the LEDs marked with an superscript "a" in the table to the right, the following additional pieces of information are also included in the zipped folder:

- **Radiometric Color Spectrum:** This .spc file is also intended for use with Zemax.
- **CAD Files:** A file indicating the geometry of the bare LED. For the dimensions of the high-power mounted LEDs that include the package, please see the support drawings provided by Thorlabs.
- **Sample Zemax File:** A sample file containing the recommended settings and placement of the ray files and bare LED CAD model when used with Zemax.

The table to the right summarizes the ray files available for each LED and any other supporting documentation provided.

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	M340L4 (53 mW	-	M340F2 (1.57 mW)	-	-	-	-

		Min)	Min)						
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)	-	-
		M730D2	M730L4	M730L4					

730 nm	-	(515 mW Min)	(515 mW Min)	(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 (13 mW)	M850D2 (900 mW Min) M850D3 (1400 mW)	M850L3 (900 mW Min) M850LP1 (1400 mW)	M850L3 (330 mW)[d]	M850F2 (13.4 mW)	SOLIS-850A(/M) (1700 mW)[e]	-	-	LIU850A (322 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)	-	-	-	-	-	-	-	-
4200 nm	LED4300P (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]	-	-	-

- 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).
- Typical power when used with MM Fiber with Ø400 µm core, 0.39 NA.
- Our LED4D 4-Wavelength LED Source is available with select combinations of the LEDs at these wavelengths.
- Typical power for LEDs with the Leica DMI collimation package (Item # Suffix: -C2).
- Minimum power for the collimated output of these LEDs. The collimation lens is installed with each LED.

Hide LEDs on Metal-Core Printed Circuit Boards

LEDs on Metal-Core Printed Circuit Boards

Part Number	Description	Price	Availability
M265D2	**Deep UV (265 nm) LED on Metal-Core PCB, 350 mA, 10 mW (Min)**	**$1,110.00**	**Today**
M280D2	**Deep UV (280 nm) LED on Metal-Core PCB, 350 mA, 25 mW (Min)**	**$1,110.00**	**Today**
M310D2	**Deep UV (310 nm) LED on Metal-Core PCB, 350 mA, 25 mW (Min)**	**$1,110.00**	**Today**
M340D3	**Deep UV (340 nm) LED on Metal-Core PCB, 700 mA, 53 mW (Min)**	**$183.33**	**Lead Time**
M365D1	**UV (365 nm) LED on Metal-Core PCB, 700 mA, 190 mW (Min)**	**$149.00**	**Today**
M365D2	**UV (365 nm) LED on Metal-Core PCB, 1400 mA, 1150 mW (Min)**	**$183.33**	**Today**
M375D2	**Customer Inspired!UV (375 nm) LED on Metal-Core PCB, 700 mA, 387 mW (Min)**	**$126.00**	**Today**
M385D1	**UV (385 nm) LED on Metal-Core PCB, 700 mA, 270 mW (Min)**	**$149.00**	**Today**
M385D2	**UV (385 nm) LED on Metal-Core PCB, 1400 mA, 1650 mW (Min)**	**$183.33**	**Today**
M395D3	**UV (395 nm) LED on Metal-Core PCB, 500 mA, 400 mW (Min)**	**$123.00**	**Today**
M405D1	**UV (405 nm) LED on Metal-Core PCB, 1000 mA, 410 mW (Min)**	**$149.00**	**Today**
M405D2	**UV (405 nm) LED on Metal-Core PCB, 1400 mA, 1500 mW (Min)**	**$183.33**	**Today**
M420D2	**Violet (420 nm) LED on Metal-Core PCB, 1000 mA, 750 mW (Min)**	**$123.00**	**Today**
M450D3	**Royal Blue (450 nm) LED on Metal-Core PCB, 2000 mA, 1850 mW (Min)**	**$63.00**	**Today**
M455D2	**Royal Blue (455 nm) LED on Metal-Core PCB, 1000 mA, 900 mW (Min)**	**$67.00**	**Today**
M470D2	**Blue (470 nm) LED on Metal-Core PCB, 1000 mA, 650 mW (Min)**	**$67.00**	**Today**
M490D2	**Blue (490 nm) LED on Metal-Core PCB, 350 mA, 200 mW (Min)**	**$67.00**	**Today**
M505D2	**Cyan (505 nm) LED on Metal-Core PCB, 1000 mA, 400 mW (Min)**	**$67.00**	**Today**
M530D2	**Green (530 nm) LED on Metal-Core PCB, 1000 mA, 350 mW (Min)**	**$67.00**	**Today**
M565D2	**Lime (565 nm) LED on Metal-Core PCB, 1000 mA, 880 mW (Min)**	**$56.70**	**Today**
M590D2	**Amber (590 nm) LED on Metal-Core PCB, 1000 mA, 160 mW (Min)**	**$51.50**	**Today**
M595D2	**Amber (595 nm) LED on Metal-Core PCB, 700 mA, 445 mW (Min)**	**$56.70**	**Today**
M617D2	**Orange (617 nm) LED on Metal-Core PCB, 1000 mA, 600 mW (Min)**	**$51.50**	**Today**
M625D2	**Red (625 nm) LED on Metal-Core PCB, 1000 mA, 700 mW (Min)**	**$51.50**	**Today**
M660D2	**Deep Red (660 nm) LED on Metal-Core PCB, 1200 mA, 940 mW (Min)**	**$63.00**	**Today**
M730D2	**Far Red (730 nm) LED on Metal-Core PCB, 1000 mA, 515 mW (Min)**	**$51.72**	**Today**
M780D2	**IR (780 nm) LED on Metal-Core PCB, 800 mA, 200 mW (Min)**	**$56.70**	**Today**
M780D3	**NEW! IR (780 nm) LED on Metal-Core PCB, 800 mA, 800 mW (Min)**	**$101.11**	**Today**
M810D2	**IR (810 nm) LED on Metal-Core PCB, 500 mA, 325 mW (Min)**	**$61.11**	**Today**
M850D2	**IR (850 nm) LED on Metal-Core PCB, 1000 mA, 900 mW (Min)**	**$56.70**	**Today**
M850D3	**NEW! IR (850 nm) LED on Metal-Core PCB, 1500 mA, 1400 mW (Min)**	**$110.56**	**Today**
M880D2	**IR (880 nm) LED on Metal-Core PCB, 1000 mA, 300 mW (Min)**	**$56.70**	**Today**
M940D2	**IR (940 nm) LED on Metal-Core PCB, 1000 mA, 800 mW (Min)**	**$56.70**	**Today**
M970D2	**IR (970 nm) LED on Metal-Core PCB, 600 mA, 35 mW (Min)**	**$56.70**	**Today**
M1050D1	**IR (1050 nm) LED on Metal-Core PCB, 700 mA, 50 mW (Min)**	**$67.00**	**Today**
M1200D2	**Customer Inspired!IR (1200 nm) LED on Metal-Core PCB, 700 mA, 30 mW (Min)**	**$123.00**	**Today**

M1300D2	**Customer Inspired!IR (1300 nm) LED on Metal-Core PCB, 500 mA, 25 mW (Min)**	**$123.00**	**Today**
M1450D2	**IR (1450 nm) LED on Metal-Core PCB, 700 mA, 31 mW (Min)**	**$123.00**	**Today**
M1550D2	**Customer Inspired!IR (1550 nm) LED on Metal-Core PCB, 700 mA, 31 mW (Min)**	**$123.00**	**Today**
MBB1D1	**Broadband (470 - 850 nm) LED on Metal-Core PCB, 500 mA, 70 mW (Min)**	**$366.00**	**Today**
MWWHD1	**Warm White LED on Metal-Core PCB, 1000 mA, 500 mW (Min)**	**$51.50**	**Today**
MWWHD3	**Warm White LED on Metal-Core PCB, 700 mA, 2000 mW (Min)**	**$75.00**	**Today**
MCWHD2	**Cold White LED on Metal-Core PCB, 1000 mA, 800 mW (Min)**	**$51.50**	**Today**
MCWHD3	**Cold White LED on Metal-Core PCB, 700 mA, 2350 mW (Min)**	**$75.00**	**Today**

Hide LED Connection Cable

LED Connection Cable

- 4-Pin M8 Connector on One Side
- 4 Bare Wires on Other Side
- 2 m Long, 24 AWG Wires

The 4-Pin M8 connection cable can be used to connect the LEDs on metal-core PCBs to the following Thorlabs LED drivers: LEDD1B, DC2100, DC4100, and DC4104 (the latter two require the DC4100-HUB).

Male M8x1 Connector

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

Pin Connections

The diagram above shows the male connector for use with the above Thorlabs LED drivers. The connector is a standard M8x1 sensor circular connector. Pins 1 and 2 are the connection to the LED. Please note that the bare PCB board LEDs shown on this page do not include an EEPROM like our mounted LEDs; hence pins 3 and 4 should not be connected. Also, note that the pin connection diagram shown here may not be valid for third-party LED drivers.

For customers using their own power supplies, we also offer a female 4-pin M8 connector cable (Item # CON8ML-4).

Part Number	Description	Price	Availability
CAB-LEDD1	**LED Connection Cable, 2 m, M8 Connector, 4 Wires**	**$15.50**	**Today**