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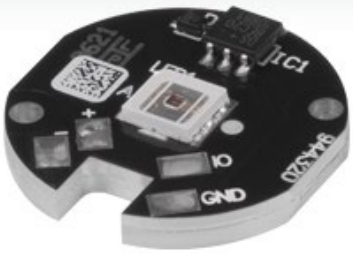
M505D3 - March 31, 2025

Item # M505D3 was discontinued on March 31, 2025. For informational purposes, this is a copy of the website content at that time and is valid only for the stated product.

LEDS ON METAL-CORE PCBS

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

M340D4
340 nm LED,
≥45.5 mW Power Output



M1300D3
1300 nm LED,
≥122.8 mW Power Output

M565D2
565 nm LED,
≥880 mW Power Output

OVERVIEW

Features

- Nominal Wavelengths Ranging from 265 nm to 5200 nm
- White, Dual-Peak, and Broadband LEDs Also Available
- Minimum Outputs Ranging from 1.1 mW to 2000 mW
- LED Mounted on Metal-Core Printed Circuit Board for Excellent Heat Management
- Long Lifetimes (See Tables Below for Details)

LED on MCPCB Quick Links
Deep UV (265 - 340 nm)
UV (365 - 405 nm)
Cold Visible (415 - 565 nm)
Warm Visible (590 - 730 nm)
IR (780 - 1900 nm)
Mid-IR (3400 - 5200 nm)
Purple (455 nm / 640 nm)
White (400 - 700 nm)
Broadband LEDs
LED Connection Cable

Thorlabs' LEDs on Metal-Core Printed Circuit Boards (MCPCBs) are designed to provide high-power output in a compact package. Each LED package consists of a single LED 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. 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 complete specifications can be viewed by clicking on the info icon ( ) for each LED below for details. 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; hence, degradation of the 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.

White Light, Dual-Peak, and Broadband LEDs
Our warm, neutral, and cold white LEDs feature broad spectra that span several hundred nanometers. The difference in appearance amongst these three 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; neutral white LEDs provide a more even illumination spectrum over the visible range than warm white or cold white LEDs. 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. Neutral white LEDs are ideal for horticultural applications.

For horticultural applications requiring illumination in both red and blue portions of the spectrum, Thorlabs offers the MPRP1D2. This purple LED features dual peaks at 455 nm and 640 nm, respectively, to stimulate photosynthesis (see graph to compare the absorption peaks of photosynthesis pigments with the LED spectrum). The LED was designed to maintain the red/blue ratio of the emission spectrum over its lifetime to provide high uniformity of plant growth.

The MBB1D1 broadband LED has a relatively flat spectral emission over a wide wavelength range. Its FWHM bandwidth ranges from 500 nm to 780 nm, while its 10 dB bandwidth ranges between 470 nm and 940 nm. The MBB2D1 broadband LED features a spectrum with peaks at approximately 770 nm, 860 nm, and 940 nm.

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 six drivers compatible with some or all of these LEDs: LEDD1B, UPLED, DC40, 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 UPLED, DC40, DC2200, DC4100, and DC4104 drivers are capable of reading the current limit from the EEPROM chip of the connected LED and automatically adjusting the maximum current setting to protect the LED.

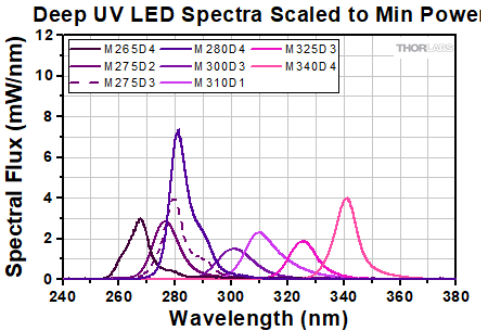
To connect the PCB to a driver, please note that the soldering pad labeled "+" is the Anode (+V), and the pad labeled "-" is the Cathode. These LEDs can be operated without connecting EEPROM IO and EEPROM GND, but both must be connected in order for the driver to read the current limit. The soldering pads on different items may be in different locations, but the labels are the same.

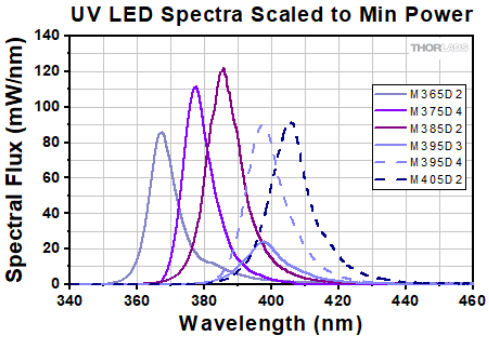
Collimation
These LEDs have large viewing angles, so for many applications it is beneficial to collimate the beam. See the *Collimation* tab for information on collimating the light from an LED.

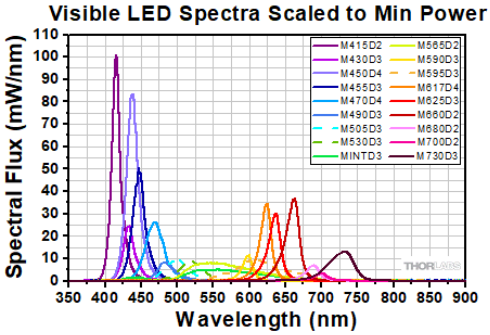
RELATIVE POWER

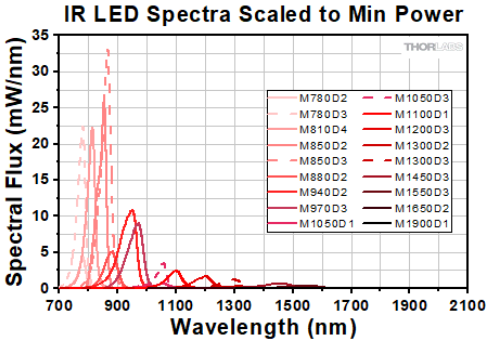
Relative Power

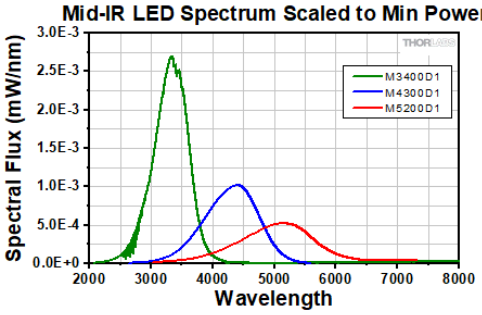
The actual spectral output and total output power of any given LED will vary due to variations in the manufacturing process and operating parameters, such as temperature and current. Both a typical and minimum output power are specified to help you select an LED that suits your needs. Each metal-core 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. Excel files with normalized and scaled spectra for each set of the mounted LEDs can be downloaded by clicking below the graphs.



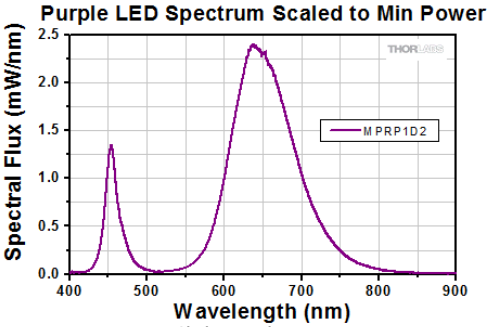




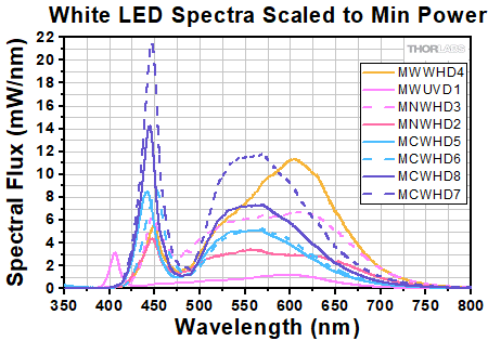


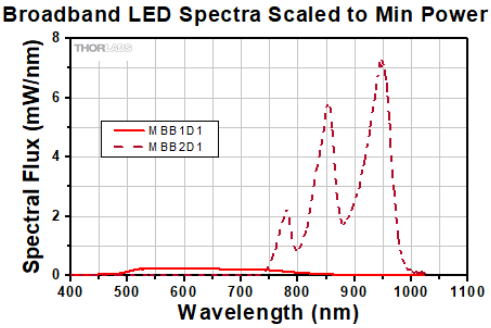


The spectrum shown for M4300D1 and M5200D1 are ideal.
Please see their Spec Sheets for more information.



Click to Enlarge
Click Here for Data

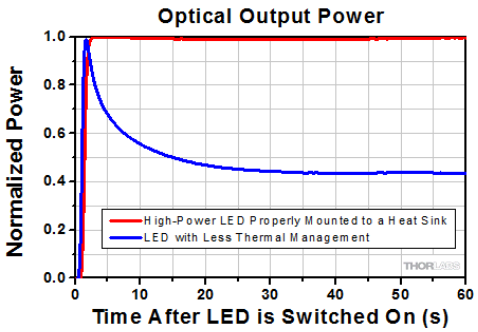




STABILITY

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.

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).

LED DRIVERS

To fully support the max optical power of the LED you intend to drive, ensure that the max voltage and max current of the driver are equal to or greater than those of the LED.

Compatible Drivers	LEDD1B	UPLED[a]	DC40[a]	DC2200[a]	DC4100[a,b]	DC4104[a,b]
Click Photos to Enlarge						
LED Driver Current Output (Max)[c]	1.2 A	1.2 A	4.0 A[d]	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)[f]	12 V	8 V	14.0 V[d]	50 V	5 V	5 V
Modulation Frequency Using External Input (Max)	5 kHz[g]	-	5 kHz[g]	250 kHz[g,h]	100 kHz[g] (Simultaneous Across all Channels)	100 kHz[g] (Independently Controlled Channels)
External Control Interface(s)	Analog (BNC)	USB 2.0	USB 2.0, TTL, and 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)	USB-Controlled	Driver Current Up to 4.0 A, Manual and USB-Controlled	Touchscreen Interface with Internal and External Options for Pulsed and Modulated LED Operation	4 Channels[b]	4 Channels[b]
EEPROM Compatible: Reads Out LED Data for LED Settings	-	✓	✓	✓	✓	✓
LCD Display	-	-	-	✓	✓	✓

a. Automatically Adjusts the Driver's Current Limit via EEPROM Readout from LED
b. 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.
c. LEDs with maximum current ratings higher than the driver's maximum current output can be driven, but will not reach full power. See the tables below for the maximum current rating of each LED.
d. The DC40 LED Driver is designed to automatically select the appropriate current/voltage combination for Thorlabs LEDs. The LEDs on this page all require the CAB-LEDD1 cable when used with the DC40 LED Driver. Please note that the maximum current and forward voltage are interdependent; the DC40 driver cannot drive an LED with a 14.0 V forward voltage at 4.0 A. Please see the full web presentation for more information.
e. The MCPCB LEDs sold below are compatible with the LED2 Terminal via the CAB-LEDD1 (available separately below).
f. LEDs with forward voltage greater than the driver's maximum forward voltage cannot be driven. See the tables below for the forward voltage specification of each LED.
g. Several of these LEDs produce light by stimulating emission from phosphor, which limits their modulation frequencies. The M565D2, M595D3, and all purple or white 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%.
h. Small Signal Bandwidth: Modulation not exceeding 20% of full scale current. The driver accepts other waveforms, but the maximum frequency will be reduced.

COLLIMATION

Video Insight: Collimate Light from an LED

Collimating light from an LED or other large, incoherent source can be a surprisingly challenging task. The emitter's size and the collimating lens' focal length and numerical aperture (NA) all influence the characteristics of the collimated beam. It can also be hard to know when the lens is positioned optimally. In this video, two lenses with different NAs and focal lengths are used to demonstrate a couple of collimation approaches. In addition, the emerging image of the emitter and other typical features of beams provided by collimating lenses are explored.

RAY DATA

Ray data for Zemax is 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	Click to Download
M385D1	M385_Info.pdf	1 Million Rays and 5 Million Rays	147 MB	
M850D2[a]	SFH4715S_100413_info.pdf	100,000 Rays, 500,000 Rays, and 5 Million Rays	139 MB	
M940D2[a]	SFH_4725S_110413_info.pdf	100,000 Rays, 500,000 Rays, and 5 Million Rays	140 MB	

a. A radiometric color spectrum, bare LED CAD file, and sample Zemax file are also available for these LEDs.

- **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.

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.

LED SELECTION GUIDE

This tab includes all LEDs sold by Thorlabs. Click on *More [+]* to view all available wavelengths for each type of LED pictured below.

Light Emitting Diode (LED) Selection Guide						More [+]
Click Photo to Enlarge (Representative; Not to Scale)						
Type	**Unmounted LEDs**	**Pigtailed LEDs**	**LEDs in SMT Packages**	**LED Arrays**	**LED Ring Light**	**Cage-Compatible Diffuse Backlight LED**
Light Emitting Diode (LED) Selection Guide						More [+]
Click Photo to Enlarge (Representative; Not to Scale)						
Type	**PCB-Mounted LEDs**	**Heatsink-Mounted LEDs**	**Collimated LEDs for Microscopy[b]**	**Fiber-Coupled LEDs[c]**	**High-Power LEDs for Microscopy**	**Multi-Wavelength LED Source Options[d]**

a. Measured at 25 °C
b. 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).
c. Typical power when used with MM Fiber with Ø400 µm core, 0.39 NA.
d. Our Multi-Wavelength LED Sources are available with select combinations of the LEDs at these wavelengths.
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 Zeiss Axioskop collimation package (Item # Suffix: -C4).
i. Percentage of LED intensity that emits in the blue portion of the spectrum, from 400 nm to 525 nm.

Deep UV LEDs (265 - 340 nm)

Please note that our deep UV 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 UV light should be avoided.

Item #	Info[a,b]	Nominal Wavelength	LED Output Power		Bandwidth (FWHM)	Irradiance[c]	Maximum Current (CW)	Forward Voltage	Viewing Angle (Full Angle at Half Max)	Emitter Size	MCPCB Thickness
			Minimum	Typical							
M265D4		265 nm	38.4 mW	55.7 mW	11 nm	0.5 µW/mm^2	440 mA	6.9 V	120°	1 mm x 0.75 mm	1.6 mm
M275D2		275 nm	45 mW	80 mW	11 nm	0.8 µW/mm^2	700 mA	7.3 V	118°	2 mm x 2 mm	1.6 mm
M275D3		275 nm	47.3 mW	68.3 mW	10 nm	0.5 µW/mm^2	300 mA	12 V	120°	2.7 mm x 3.3 mm	1.6 mm
M280D4		280 nm	78 mW	114 mW	10 nm	1 µW/mm^2	500 mA	6.26 V	114°[d]	1 mm x 1 mm	1.6 mm
M300D3		300 nm	26 mW	32 mW	20 nm	0.3 µW/mm^2	350 mA	8.0 V (Max)	130°	1 mm x 1 mm	1.6 mm
M310D1		310 nm	38.5 mW	56.5 mW	30 nm	0.76 µW/mm^2	600 mA	5 V	120°[d]	1 mm x 1 mm	1.6 mm
M325D3		325 nm	25 mW	35 mW	12 nm	0.44 µW/mm^2 (Max)	600 mA	5.2 V	120°	1 mm x 1 mm	1.6 mm
M340D4		340 nm	45.5 mW	69.2 mW	10 nm	0.6 µW/mm^2	600 mA	6.6 V	120°[d]	1 mm x 1 mm	2.4 mm

a. Click on the blue info icon for complete specifications and LED spectrum.
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. These values were measured with the back side of the PCB at 25 °C at the maximum current, unless otherwise noted. Output plots and center wavelength specs are only intended to be used as a guideline. Values are typical unless otherwise stated.

c. Irradiance is measured at a distance of 200 mm from the LED. Typical value unless otherwise noted.
d. When driven at a current of 350 mA.

Part Number	Description	Price	Availability
M265D4	265 nm, 38.4 mW (Min) LED on Metal-Core PCB, 440 mA	$365.90	Today
M275D2	275 nm, 45 mW (Min) LED on Metal-Core PCB, 700 mA	$262.04	2 Weeks
M275D3	275 nm, 47.3 mW (Min) LED on Metal-Core PCB, 300 mA	$153.33	Lead Time
M280D4	280 nm, 78 mW (Min) LED on Metal-Core PCB, 500 mA	$278.52	Today
M300D3	300 nm, 26 mW (Min) LED on Metal-Core PCB, 350 mA	$401.50	2 Weeks
M310D1	308 nm, 38.5 mW (Min) LED on Metal-Core PCB, 600 mA	$495.32	Today
M325D3	325 nm, 25 mW (Min) LED on Metal-Core PCB, 600 mA	$532.43	2 Weeks
M340D4	340 nm, 45.5 mW (Min) LED on Metal-Core PCB, 600 mA	$309.42	Today

UV LEDs (365 - 405 nm)

Please note that our UV 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 UV light should be avoided.

Item #	Info[a,b]	Nominal Wavelength	LED Output Power		Bandwidth (FWHM)	Irradiance (Typical)[c]	Maximum Current (CW)	Forward Voltage	Viewing Angle (Full Angle at Half Max)	Emitter Size	MCPCB Thickness
			Minimum	Typical							
M365D2		365 nm	1150 mW[d]	1400 mW[d]	9 nm	17.6 µW/mm^2 [d]	1700 mA	4.0 V	120°	1.4 mm x 1.4 mm	2.4 mm
M375D4		375 nm	1270 mW	1540 mW	9 nm	19.2 µW/mm^2	1400 mA	3.6 V	130°	1 mm x 1 mm	2.4 mm
M385D2		385 nm	1650 mW	1830 mW	12 nm	23.3 µW/mm^2	1700 mA	3.9 V	120°	1.4 mm x 1.4 mm	2.4 mm
M395D3		395 nm	400 mW	535 mW	16 nm	6.7 µW/mm^2	500 mA	4.5 V	126°	1 mm x 1 mm	2.4 mm
M395D4		395 nm	1420 mW	2050 mW	11 nm	22.8 µW/mm^2	1400 mA	4.0 V	120°	2.5 mm x 2.5 mm	2.4 mm
M405D2		405 nm	1500 mW	1700 mW	12 nm	24.6 µW/mm^2	1400 mA	3.45 V	120°	1.4 mm x 1.4 mm	2.5 mm

a. Click on the blue info icon for complete specifications and LED spectrum.
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. These values were measured with the back side of the PCB at 25 °C at the maximum current, unless otherwise noted. Output plots and center wavelength specs are only intended to be used as a guideline.Values are typical unless otherwise stated.
c. Irradiance is measured at a distance of 200 mm from the LED.
d. When Driven with a Current of 1000 mA

Part Number	Description	Price	Availability
M365D2	365 nm, 1150 mW (Min) LED on Metal-Core PCB, 1700 mA	$222.14	Today
M375D4	375 nm, 1270 mW (Min) LED on Metal-Core PCB, 1400 mA	$64.06	Today
M385D2	385 nm, 1650 mW (Min) LED on Metal-Core PCB, 1700 mA	$222.14	Today
M395D3	395 nm, 400 mW (Min) LED on Metal-Core PCB, 500 mA	$149.69	2 Weeks
M395D4	395 nm, 1420 mW (Min) LED on Metal-Core PCB, 1400 mA	$222.14	2 Weeks
M405D2	405 nm, 1500 mW (Min) LED on Metal-Core PCB, 1400 mA	$222.14	Today

Single-Color Cold Visible LEDs (415 - 565 nm)

Please note that the 415 nm (violet), 430 nm (violet), and 450 nm (royal blue) 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.

Item #	Info[a,b]	Nominal Wavelength[c]	LED Output Power		Bandwidth (FWHM)	Irradiance (Typical)[d]	Maximum Current (CW)	Forward Voltage	Viewing Angle (Full Angle at Half Max)	Emitter Size	MCPCB Thickness
			Minimum	Typical							
M415D2		415 nm	1640 mW	1940 mW	14 nm	19.5 µW/mm^2	2000 mA	3.15 V	138°	1.4 mm x 1.4 mm	2.4 mm
M430D3		430 nm	529.2 mW	757.6 mW	17 nm	25.7 µW/mm^2	500 mA	3.66 V	126° [e]	1 mm x 1 mm	2.4 mm
M450D4		450 nm	2118.1 mW	3041.5 mW	18 nm	34.2 µW/mm^2	2000 mA	3.2 V	120° [f]	1.5 mm x 1.5 mm	2.4 mm
M455D3		455 nm	1150 mW	1445 mW	18 nm	32 µW/mm^2	1000 mA	3.25 V	80°	1 mm x 1 mm	1.6 mm
M470D4		470 nm	809 mW	1161.7 mW	28 nm	21.4 µW/mm^2	1000 mA	3.8 V	80°	1 mm x 1 mm	1.6 mm
M490D3		490 nm	205 mW	240 mW	26 nm	2.5 µW/mm^2	350 mA	3.8 V (Max)	128°	1 mm x 1 mm	2.4 mm
M505D3		505 nm	400 mW	520 mW	37 nm	5.94 µW/mm^2	1000 mA	3.5 V	130°	1 mm x 1 mm	1.6 mm
M530D3		530 nm	370 mW	480 mW	35 nm	9.46 µW/mm^2	1000 mA	3.6 V	80°	1 mm x 1 mm	1.6 mm
MINTD3		554 nm	650 mW	815 mW	-	12.4 µW/mm^2	1225 mA	3.5 V	120°	1 mm x 1 mm	2.4 mm
M565D2[g]		565 nm	880 mW	979 mW	104 nm	11.7 µW/mm^2	1000 mA	3.1 V (Max)	125°	1 mm x 1 mm	1.6 mm

a. Click on the blue info icon for complete specifications and LED spectrum.
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. These values were measured with the back side of the PCB at 25 °C at the maximum current, unless otherwise noted. Output plots and center wavelength specs are only intended to be used as a guideline. Values are typical unless otherwise stated.
c. 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.
d. Irradiance is measured at a distance of 200 mm from the LED.
e. When driven with a Current of 100 mA
f. When driven with a Current of 700 mA
g. This LED is phosphor-converted and may not turn off completely when modulated above 10 kHz at duty cycles below 50%.

Part Number	Description	Price	Availability
M415D2	415 nm, 1640 mW (Min) LED on Metal-Core PCB, 2000 mA	$81.53	2 Weeks
M430D3	430 nm, 529.2 mW (Min) LED on Metal-Core PCB, 500 mA	$91.24	Today
M450D4	450 nm, 2118.1 mW (Min) LED on Metal-Core PCB, 2000 mA	$67.82	2 Weeks
M455D3	455 nm, 1150 mW (Min) LED on Metal-Core PCB, 1000 mA	$57.83	Today
M470D4	470 nm, 809 mW (Min) LED on Metal-Core PCB, 1000 mA	$70.68	Today
M490D3	490 nm, 205 mW (Min) LED on Metal-Core PCB, 350 mA	$84.94	Today
M505D3	505 nm, 520 mW (Typ.) LED on Metal-Core PCB, 1000 mA	$81.38	Lead Time
M530D3	530 nm, 370 mW (Min) LED on Metal-Core PCB, 1000 mA	$81.38	Today
MINTD3	554 nm, 650 mW (Min) LED on Metal-Core PCB, 1225 mA	$135.68	Today
M565D2	565 nm, 880 mW (Min) LED on Metal-Core PCB, 1000 mA	$68.90	Today

Single-Color Warm Visible LEDs (590 - 730 nm)

Item #	Info[a,b]	Nominal Wavelength[c]	LED Output Power		Bandwidth (FWHM)	Irradiance (Typical)[d]	Maximum Current (CW)	Forward Voltage	Viewing Angle (Full Angle at Half Max)	Emitter Size	MCPCB Thickness
			Minimum	Typical							
M590D3		590 nm	230 mW	300 mW	15 nm	6.0 µW/mm^2	1000 mA	2.5 V	80°	1 mm x 1 mm	1.6 mm

M595D3[e]		595 nm	820 mW	1217 mW	64 nm	13.5 µW/mm^2	1500 mA	3.0 V	120°	2.9 mm x 2.9 mm	2.4 mm
M617D4		617 nm	737.4 mW	1006.2 mW	16 nm	19.4 µW/mm^2	1000 mA	2.9 V	80°[f]	1 mm x 1 mm	1.6 mm
M625D3		625 nm	700 mW	920 mW	17 nm	21.9 µW/mm^2	1000 mA	2.5 V	80°	1 mm x 1 mm	1.6 mm
M660D2		660 nm	940 mW	1050 mW	20 nm	20.9 µW/mm^2	1200 mA	2.6 V	120°	1.5 mm x 1.5 mm	1.6 mm
M680D2		680 nm	180 mW	210 mW	22 nm	14.5 µW/mm^2	600 mA	2.5 V	18°	1 mm x 1 mm	2.4 mm
M700D2		700 nm	80 mW	125 mW	20 nm	1.0 µW/mm^2	500 mA	2.7 V	128°	1 mm x 1 mm	2.4 mm
M730D3		730 nm	540 mW	680 mW	40 nm	13.1 µW/mm^2	1000 mA	2.9 V	80°	1 mm x 1 mm	1.6 mm

a. Click on the blue info icon to view a typical spectrum for the LED.
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. These values were measured with the back side of the PCB at 25 °C at the maximum current, unless otherwise noted. Output plots and center wavelength specs are only intended to be used as a guideline. Values are typical unless otherwise stated.
c. 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.
d. Irradiance is measured at a distance of 200 mm from the LED.
e. This LED is phosphor-converted and may not turn off completely when modulated above 10 kHz at duty cycles below 50%.
f. When Driven at the Current of 350 mA

Part Number	Description	Price	Availability
M590D3	**590 nm, 230 mW (Min) LED on Metal-Core PCB, 1000 mA**	**$74.62**	**Today**
M595D3	**595 nm, 820 mW (Min) LED on Metal-Core PCB, 1500 mA**	**$93.32**	**Today**
M617D4	**617 nm, 737.4 mW (Min) LED on Metal-Core PCB, 1000 mA**	**$69.99**	**Today**
M625D3	**625 nm, 700 mW (Min) LED on Metal-Core PCB, 1000 mA**	**$79.15**	**Today**
M660D2	**660 nm, 940 mW (Min) LED on Metal-Core PCB, 1200 mA**	**$76.61**	**Today**
M680D2	**Customer Inspired! 680 nm, 180 mW (Min) LED on Metal-Core PCB, 600 mA**	**$90.87**	**Today**
M700D2	**700 nm, 80 mW (Min) LED on Metal-Core PCB, 500 mA**	**$90.87**	**Today**
M730D3	**730 nm, 540 mW (Min) LED on Metal-Core PCB, 1000 mA**	**$84.80**	**Lead Time**

IR LEDs (780 - 1900 nm)

Item #	Info[a,b]	Nominal Wavelength	LED Output Power		Bandwidth (FWHM)	Irradiance (Typical)[c]	Maximum Current (CW)	Forward Voltage	Viewing Angle (Full Angle at Half Max)	Emitter Size	MCPCB Thickness
			Minimum	Typical							
M780D2		780 nm	200 mW	300 mW	28 nm	47.3 µW/mm^2	800 mA	2.0 V	20°	1 mm x 1 mm	2.4 mm
M780D3		780 nm	800 mW	950 mW	30 nm	13.3 µW/mm^2	800 mA	7.8 V	120°	Ø3 mm (3 Emitters)	1.6 mm
M810D4		810 nm	810 mW	1190 mW	30 nm	15.9 µW/mm^2	1000 mA	3.6 V	128°	1 mm x 1 mm	2.4 mm
M850D2		850 nm	900 mW	1100 mW	30 nm	22.9 µW/mm^2	1200 mA	2.95 V	90°	1 mm x 1 mm	1.6 mm
M850D3		850 nm	1400 mW	1600 mW	30 nm	19.4 µW/mm^2	1500 mA	3.85 V (Max)	150°	1 mm x 1 mm	1.6 mm
M880D2		880 nm	300 mW	350 mW	50 nm	5.6 µW/mm^2	1000 mA	1.7 V	132°	1 mm x 1 mm	2.4 mm
M940D2		940 nm	800 mW	1000 mW	37 nm	19.1 µW/mm^2	1000 mA	2.75 V	90°	1 mm x 1 mm	1.6 mm
M970D3		970 nm	600 mW	720 mW	60 nm	7.4 µW/mm^2	1000 mA	1.9 V	130°	1 mm x 1 mm	2.4 mm
M1050D1		1050 nm	50 mW	70 mW	60 nm	1.9 µW/mm^2	700 mA	1.5 V	120°	1 mm x 1 mm	2.4 mm
M1050D3		1050 nm	160 mW	210 mW	37 nm	3.7 µW/mm^2	600 mA	1.6 V (Max)	128°	1 mm x 1 mm	2.4 mm
M1100D1		1100 nm	168 mW	252 mW	50 nm	18.1 µW/mm^2	1000 mA	1.4 V	18°	1 mm x 1 mm	2.4 mm
M1200D3		1200 nm	136 mW	200 mW	65 nm	2.6 µW/mm^2	1000 mA	2.2 V	130°	1 mm x 1 mm	2.4 mm
M1300D2		1300 nm	25 mW	30 mW	80 nm	0.6 µW/mm^2	500 mA	1.4 V	134°	1 mm x 1 mm	2.4 mm

M1300D3		1300 nm	122.8 mW	182.1 mW	80 nm	1.6 µW/mm^2	1000 mA	1.7 V	130°	1 mm x 1 mm	2.4 mm
M1450D3		1450 nm	81.8 mW	120.7 mW	95 nm	1.5 µW/mm^2	700 mA	1.88 V	130°	1 mm x 1 mm	2.4 mm
M1550D3		1550 nm	46 mW	70 mW	120 nm	1.1 µW/mm^2	1000 mA	1.3 V	128°[d]	1 mm x 1 mm	2.4 mm
M1650D2		1650 nm	13 mW	16 mW	120 nm	1.2 µW/mm^2	600 mA	1.1 V	20°	1 mm x 1 mm	2.4 mm
M1900D1		1900 nm	10 mW	15 mW	120 nm	2.2 µW/mm^2	1000 mA	1.2 V	18°	1 mm x 1 mm	2.4 mm

a. Click on the blue info icon for complete specifications and LED spectrum.
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. These values were measured with the back side of the PCB at 25 °C at the maximum current, unless otherwise noted. Output plots and center wavelength specs are only intended to be used as a guideline. Values are typical unless otherwise stated.
c. Irradiance is measured at a distance of 200 mm from the LED.
d. When Driven at the Current of 100 mA

Part Number	Description	Price	Availability
M780D2	**780 nm, 200 mW (Min) LED on Metal-Core PCB, 800 mA**	**$68.90**	**Today**
M780D3	**780 nm, 800 mW (Min) LED on Metal-Core PCB, 800 mA**	**$123.54**	**Today**
M810D4	**810 nm, 810 mW (Min) LED on Metal-Core PCB, 1000 mA**	**$121.15**	**Today**
M850D2	**850 nm, 900 mW (Min) LED on Metal-Core PCB, 1200 mA**	**$68.90**	**2 Weeks**
M850D3	**850 nm, 1400 mW (Min) LED on Metal-Core PCB, 1500 mA**	**$134.24**	**Today**
M880D2	**880 nm, 300 mW (Min) LED on Metal-Core PCB, 1000 mA**	**$68.90**	**Today**
M940D2	**940 nm, 800 mW (Min) LED on Metal-Core PCB, 1000 mA**	**$68.90**	**Today**
M970D3	**970 nm, 600 mW (Min) LED on Metal-Core PCB, 1000 mA**	**$87.35**	**Today**
M1050D1	**1050 nm, 50 mW (Min) LED on Metal-Core PCB, 700 mA**	**$81.38**	**2 Weeks**
M1050D3	**1050 nm, 160 mW (Min) LED on Metal-Core PCB, 600 mA**	**$194.49**	**Today**
M1100D1	**1100 nm, 168 mW (Min) LED on Metal-Core PCB, 1000 mA**	**$212.96**	**Today**
M1200D3	**1200 nm, 136 mW (Min) LED on Metal-Core PCB, 1000 mA**	**$165.45**	**2 Weeks**
M1300D2	**Customer Inspired! 1300 nm, 25 mW (Min) LED on Metal-Core PCB, 500 mA**	**$126.35**	**Today**
M1300D3	**1300 nm, 122.8 mW (Min) LED on Metal-Core PCB, 1000 mA**	**$169.10**	**Today**
M1450D3	**1450 nm, 81.8 mW (Min) LED on Metal-Core PCB, 1000 mA**	**$163.19**	**2 Weeks**
M1550D3	**1550 nm, 46 mW (Min) LED on Metal-Core PCB, 1000 mA**	**$178.85**	**2 Weeks**
M1650D2	**1650 nm, 13 mW (Min) LED on Metal-Core PCB, 600 mA**	**$209.63**	**2 Weeks**
M1900D1	**1900 nm, 10 mW (Min) LED on Metal-Core PCB, 1000 mA**	**$224.44**	**Today**

Mid-IR LEDs (3400 - 5200 nm)

Item #	Info[a,b]	Nominal Wavelength	LED Output Power		Bandwidth (FWHM)	Maximum Current (CW)	Forward Voltage	Viewing Angle (Full Angle at Half Max)	Emitter Size	MCPCB Thickness
			Minimum	Typical						
M3400D1		3400 nm	2.2 mW	3.3 mW	800 nm	200 mA	4.1 V	130°	0.8 mm x 1 mm	1.6 mm
M4300D1		4300 nm	1.1 mW	1.67 mW	800 nm	200 mA	3.9 V	130°	0.8 mm x 1 mm	1.6 mm
M5200D1		5200 nm	0.8 mW	1.3 mW	800 nm	200 mA	4 V	130°	0.8 mm x 1 mm	1.6 mm

a. Click on the blue info icon for complete specifications and LED spectrum.
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. These values were measured with the back side of the PCB at 25 °C at the maximum current, unless otherwise noted. Output plots and center wavelength specs are only intended to be used as a guideline. Values are typical unless otherwise stated.

Part Number	Description	Price	Availability
M3400D1	**3400 nm, 2.2 mW (Min) LED on Metal-Core PCB, 200 mA**	**$1,182.25**	**Today**

M4300D1	4300 nm, 1.1 mW (Min) LED on Metal-Core PCB, 200 mA	$1,182.25	Lead Time
M5200D1	5200 nm, 0.8 mW (Min) LED on Metal-Core PCB, 200 mA	$1,159.08	Today

Purple LED (455 nm / 640 nm)

Our dual-peak LED was designed for applications requiring illumination in both red and blue portions of the spectrum, such as horticulture. This purple LED features dual peaks at 455 nm and 640 nm, respectively, to stimulate photosynthesis (see graph to compare the absorption peaks of photosynthesis pigments with the LED spectrum). The LED was designed to maintain the red/blue ratio of the emission spectrum over its lifetime to provide high uniformity of plant growth.

Item #	Info[a,b]	Nominal Wavelength	LED Output Power		Bandwidth (FWHM)	Irradiance (Typical)[c]	Maximum Current (CW)	Forward Voltage	Viewing Angle (Full Angle at Half Max)	Emitter Size	MCPCB Thickness
			Minimum	Typical							
MPRP1D2[d]		455 nm (12.5%[e]) / 640 nm	275 mW	325 mW	N/A	3.7 µW/mm^2	300 mA	3.1 V	115°	1 mm x 2 mm	1.6 mm

a. Click on the blue info icon for complete specifications and LED spectrum.
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. These values were measured with the back side of the PCB at 25 °C at the maximum current, unless otherwise noted. Output plots and center wavelength specs are only intended to be used as a guideline. Values are typical unless otherwise stated.
c. Irradiance is measured at a distance of 200 mm from the LED.
d. This LED is phosphor-converted and may not turn off completely when modulated above 10 kHz at duty cycles below 50%.
e. Percentage of LED intensity that emits in the blue portion of the spectrum, from 400 nm to 525 nm. Click on the blue info icon for details.

Part Number	Description	Price	Availability
MPRP1D2	455 nm (12.5%) / 640 nm, 275 mW (Min) LED on Metal-Core PCB, 300 mA	$47.76	Lead Time

White LEDs (400 - 700 nm Wavelength Range)

Our warm, neutral, and cold white LEDs feature broad spectra that span several hundred nanometers. The difference in appearance among these 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; neutral white LEDs provide a more even illumination spectrum over the visible range than warm white or cold white LEDs. 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. Neutral white LEDs are ideal for horticultural applications.

Item #	Info[a,b]	Correlated Color Temperature	LED Output Power		Bandwidth (FWHM)	Irradiance (Typical)[c]	Maximum Current (CW)	Forward Voltage	Viewing Angle (Full Angle at Half Max)	Emitter Size	MCPCB Thickness
			Minimum	Typical							
MWWHD4[d]		3000 K	1713 mW	2499 mW	N/A	27.2 µW/mm^2	700 mA	12.1 V	135°	Ø3.6 mm	1.6 mm
MWUVD1[d]		4000 K[e]	235 mW	338 mW	N/A	4.0 µW/mm^2	125 mA	6.3 V	120°[f]	2 mm x 1 mm	1.6 mm
MNWHD3[d]		4000 K	1400 mW[g]	2040 mW[g]	N/A	25 µW/mm^2 [g]	2500 mA	3.1 V[g]	120°[h]	Ø1.58 mm	2.4 mm
MNWHD2[d]		4900 K	740 mW	880 mW	N/A	7.7 µW/mm^2	1225 mA	2.9 V	150°	1 mm x 1 mm	2.4 mm
MCWHD5[d]		6500 K	930 mW	1370 mW	N/A	25.9 µW/mm^2	1300 mA	3.3 V	80°	1 mm x 1 mm	1.6 mm
MCWHD6[d]		6500 K	942 mW	1353 mW	N/A	11.8 µW/mm^2	1300 mA	4.51 V	150°	1 mm x 1 mm	1.6 mm
MCWHD8[d]		6500 K	1300.9 mW	1882.0 mW	N/A	22.5 µW/mm^2	2000 mA	3.6 V	125°	Ø3 mm	1.6 mm
MCWHD7[d]		6500 K	2064.8 mW	2998.0 mW	N/A	33.3 µW/mm^2	700 mA	12.9 V	135°	Ø3.7 mm	1.6 mm

a. Click on the blue info icon for complete specifications and LED spectrum.
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. These values were measured with the back side of the PCB at 25 °C at the maximum current, unless otherwise noted. Output plots and center

wavelength specs are only intended to be used as a guideline. Values are typical unless otherwise stated.

c. Irradiance is measured at a distance of 200 mm from the LED.

d. This LED is phosphor-converted and may not turn off completely when modulated above 10 kHz at duty cycles below 50%.

e. Neutral White LED Spectrum with a Peak at 406 nm

f. When Driven with a Pulsed Forward Current of 75 mA

g. When Driven with 2000 mA Current

h. When Driven with 700 mA Current

Part Number	Description	Price	Availability
MWWHD4	3000 K, 1713 mW (Min) LED on Metal-Core PCB, 700 mA	$82.21	Today
MWUVD1	4000 K, 235 mW (Min) LED on Metal-Core PCB, 125 mA	$59.97	Lead Time
MNWHD3	4000 K, 1400 mW (Min) LED on Metal-Core PCB, 2500 mA	$76.76	2 Weeks
MNWHD2	4900 K, 740 mW (Min) LED on Metal-Core PCB, 1225 mA	$52.41	Today
MCWHD5	6500 K, 930 mW (Min) LED on Metal-Core PCB, 1300 mA	$69.76	Today
MCWHD6	6500 K, 942 mW (Min) LED on Metal-Core PCB, 1300 mA	$68.33	Today
MCWHD8	6500 K, 1300.9 mW (Min) LED on Metal-Core PCB, 2000 mA	$73.87	Today
MCWHD7	6500 K, 2064.8 mW (Min) LED on Metal-Core PCB, 700 mA	$86.17	2 Weeks

Broadband LEDs

The MBB1D1 broadband LED has a relatively flat spectral emission over a wide wavelength range. Its 10 dB bandwidth ranges between 470 nm and 850 nm. The MBB2D1 broadband LED features a spectrum with peaks at approximately 770 nm, 860 nm, and 940 nm.

Item #	Info[a,b]	Wavelength	LED Output Power		Bandwidth (FWHM)	Irradiance (Typical)c	Maximum Current (CW)	Forward Voltage	Viewing Angle (Full Angle at Half Max)	Emitter Size	MCPCB Thickness
			Minimum	Typical							
MBB1D1[d]		470 - 850 nm (10 dB Bandwidth)	70 mW	80 mW	280 nm	0.9 µW/mm^2	500 mA	3.6 V	120°	1 mm x 1 mm	2.4 mm
MBB2D1		770 nm, 860 nm & 940 nm (Peak Wavelengths)	740 mW	1090 mW	N/A	13.5 µW/mm^2	1000 mA	4.8 V	120°	1 mm x 1 mm	1.6 mm

a. Click on the blue info icon for complete specifications and LED spectrum.

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. These values were measured with the back side of the PCB at 25 °C at the maximum current, unless otherwise noted. Output plots and center wavelength specs are only intended to be used as a guideline. Values are typical unless otherwise stated.

c. Irradiance is measured at a distance of 200 mm from the LED.

d. The 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%

Part Number	Description	Price	Availability
MBB1D1	470 - 850 nm Broadband LED, 70 mW (Min) on Metal-Core PCB, 500 mA	$444.28	Today
MBB2D1	IR Broadband LED (770 nm, 860 nm & 940 nm), 740 mW (Min) on Metal-Core PCB, 1000 mA	$492.20	Today

LED Connection Cable

- 4-Pin M8 Connector on One Side

	Pin	Description	Wire Color

- 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, DC40, DC2200, DC4100, and DC4104 (the latter two require the DC4100-HUB).

Male M8x1 Connector

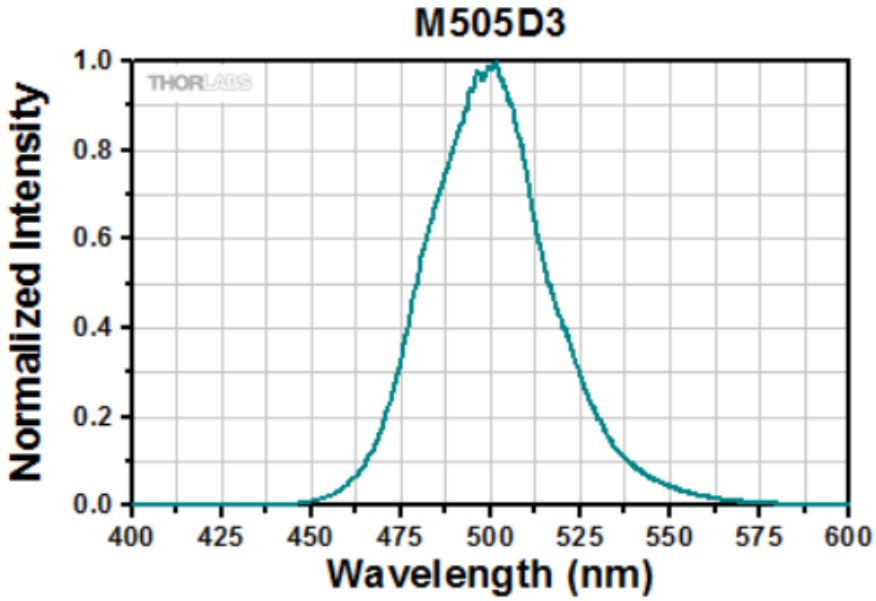
1	LED Anode	Brown
2	LED Cathode	White
3	EEPROM GND	Black
4	EEPROM IO	Blue

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**	**$18.89**	**Today**



M505D3 Characteristics				
Optical Specifications[a]	**MIN**	**TYP**	**MAX**	**UNIT**
Nominal Wavelength[b]	-	505	-	nm
Peak Wavelength	493	500	507	nm
Bandwidth (FWHM)	-	37	-	nm
LED Output Power	400	520	-	mW
Irradiance[c]	-	5.94	-	$\mu W/mm^2$
Viewing Angle (Full Angle at Half Max)	-	130	-	deg.
Electrical Specifications[a]				
Current (CW)	-	-	1000	mA
Forward Voltage	-	3.5	-	V
Electrical Power	-	3500	-	mW

General Specifications	
Characteristic	**Value**
Emitter Size	1 mm x 1 mm
MCPCB Thickness	1.6 mm
Color	Cyan
Lifetime	>100 000 h
Operating Temperature	0 to 40 °C
Storage Temperature	-40 to 70 °C
Risk Group	RG2 – Moderate Risk Group

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. These values were measured with the back side of the PCB at 25 °C at the maximum current, unless otherwise noted. Output plots and center wavelength specs are only intended to be used as a guideline.
b. 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.
c. Irradiance is measured at a distance of 200 mm from the LED.