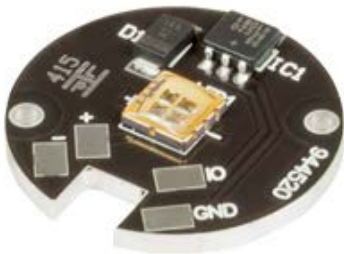


M735D1 - June 1, 2015

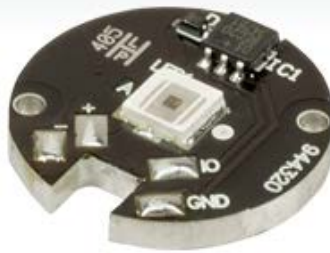
Item # M735D1 was discontinued on June 1, 2015. For informational purposes, this is a copy of the website content at that time and is valid only for the stated product.

HIGH-POWER LEDs ON METAL-CORE PCB

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



M340D2
 340 nm LED, Power
 Output ≥ 10 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 280 nm to 1550 nm
- Warm White, Cold White, and Broadband LEDs Also Available
- High-Power Outputs Ranging from 10 mW to 900 mW
- LED Mounted on Metal-Core Printed Circuit Board for Excellent Heat Management
- Long Lifetimes (See Specs Tab for Details)
 - >10,000 Hours for LEDs with a Nominal Wavelength of ≥365 nm
 - >500 Hour Lifetime for LEDs with a Nominal Wavelength of ≤340 nm

Thorlabs' High-Power 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 high-power LED with multiple emitters that has been soldered to an MCPCB. These LEDs are ideal for OEM or custom applications.

Thorlabs uses high-thermal-conductivity MCPCB

Item #	Color (Click for Spectrum) ^a	Nominal Wavelength ^{a,b}	Minimum LED Power Output ^a
M280D2 ^c	UV	280 nm	25 mW
M310D2 ^c	UV	310 nm	25 mW
M340D2 ^c	UV	340 nm	10 mW
M365D1	UV	365 nm	190 mW
M375D2	UV	375 nm	387 mW
M385D1	UV	385 nm	270 mW
M395D3	UV	395 nm	400 mW
M405D1	UV	405 nm	410 mW
M420D2	Violet	420 nm	750 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
e	Amber	595 nm	445 mW

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 a 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).

Thorlabs also offers mounted high-power 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 high-power LEDs. For questions on choosing an appropriate LED and to discuss mounting requirements, please contact Tech Support.

Optimized Thermal Management

These high-power 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 or thermally conductive double-sided tape. For more details, please see the *Stability* tab.

Broadband LED Option

The MBB1D1 MCPCB-mounted 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.

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 mm²).

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, DC2100, 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 DC2100, DC4100, and DC4104 can modulate the LED at a rate up to 100 kHz. Please note that MCPCB LEDs are not compatible with the EEPROM feature of the DC2100, 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.

M595D2			
M617D2 ^d	Orange	617 nm	600 mW
M625D2 ^d	Red	625 nm	700 mW
M660D1	Deep Red	660 nm	270 mW
M735D1	Far Red	735 nm	260 mW
M780D2	IR	780 nm	200 mW
M850D2 ^d	IR	850 nm	900 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
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
MCWHD2 ^{d,e}	Cold White	6500 K ^h	800 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. 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.
- The M280D2, M310D2, and M340D2 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.
- The M565D2, M595D2, MWWHD1, and MCWHD2 are phosphor-converted LEDs and may not turn on 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.

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](#)

S P E C S

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)	Typical Lifetime	MCPCB Thickness
M280D2 ^c	UV	280 nm	25 mW	30 mW	350 mA	5.9 V	12 nm	>500 h	1.6 mm
M310D2 ^c	UV	310 nm	25 mW	30 mW	350 mA	5.9 V	10 nm	>500 h	1.6 mm
M340D2 ^c	UV	340 nm	10 mW	12 mW	80 mA	8.1 V	8 nm	>3 000 h	2.4 mm
M365D1	UV	365 nm	190 mW	360 mW	700 mA	4.4 V	7.5 nm	>10 000 h	1.6 mm
M375D2	UV	375 nm	387 mW	470 mW	700 mA	3.8 V	9 nm	>10 000 h	2.4 mm
M385D1	UV	385 nm	270 mW	430 mW	700 mA	4.3 V	10 nm	>10 000 h	1.6 mm
M395D3	UV	395 nm	400 mW	535 mW	500 mA	4.5 V	16 nm	>10 000 h	2.4 mm
M405D1	UV	405 nm	410 mW	760 mW	1000 mA	3.8 V	13 nm	100 000 h	1.6 mm
M420D2	Violet	420 nm	750 mW	820 mW	1000 mA	3.5 V	15 nm	>10 000 h	2.4 mm
M455D2	Royal Blue	455 nm	900 mW	1020 mW	1000 mA	3.2 V	18 nm	100 000 h	1.6 mm
M470D2	Blue	470 nm	650 mW	710 mW	1000 mA	3.2 V	25 nm	100 000 h	1.6 mm
M490D2	Blue	490 nm	200 mW	250 mW	350 mA	3.5 V	23 nm	>10 000 h	2.4 mm
M505D2	Cyan	505 nm	400 mW	440 mW	1000 mA	3.3 V	30 nm	100 000 h	1.6 mm
M530D2	Green	530 nm	350 mW	370 mW	1000 mA	3.2 V	33 nm	100 000 h	1.6 mm
M565D2 ^d	Lime	565 nm	880 mW	979 mW	1000 mA	3.1 V	104 nm	50 000 h	1.6 mm
M590D2	Amber	590 nm	160 mW	170 mW	1000 mA	2.2 V	18 nm	100 000 h	1.6 mm
M595D2 ^d	Amber	595 nm	445 mW	502 mW	700 mA	3.05 V	80 nm	50 000 h	1.6 mm
M617D2	Orange	617 nm	600 mW	650 mW	1000 mA	2.2 V	18 nm	100 000 h	1.6 mm
M625D2	Red	625 nm	700 mW	770 mW	1000 mA	2.2 V	18 nm	100 000 h	1.6 mm
M660D1	Deep Red	660 nm	270 mW	640 mW	1200 mA	3.0 V	17 nm	100 000 h	1.6 mm
M735D1	Far Red	735 nm	260 mW	380 mW	1200 mA	2.5 V	37 nm	100 000 h	1.6 mm
M780D2	IR	780 nm	200 mW	300 mW	800 mA	2.0 V	28 nm	>10 000 h	2.4 mm
M850D2	IR	850 nm	900 mW	1100 mW	1000 mA	2.9 V	30 nm	100 000 h	1.6 mm
M880D2	IR	880 nm	300 mW	350 mW	1000 mA	1.7 V	50 nm	>10 000 h	2.4 mm
M940D2	IR	940 nm	800 mW	1000 mW	1000 mA	2.75 V	37 nm	100 000 h	1.6 mm
M970D2	IR	970 nm	35 mW	50 mW	600 mA	1.4 V	50 nm	>10 000 h	2.4 mm
M1050D1	IR	1050 nm	50 mW	70 mW	700 mA	1.5 V	60 nm	>10 000 h	2.4 mm
M1200D2	IR	1200 nm	30 mW	35 mW	700 mA	1.4 V	80 nm	>10 000 h	2.4 mm
M1300D2	IR	1300 nm	25 mW	30 mW	500 mA	1.4 V	80 nm	>10 000 h	2.4 mm
M1450D2	IR	1450 nm	31 mW	36 mW	700 mA	1.15 V	80 nm	>10 000 h	2.4 mm
M1550D2	IR	1550 nm	31 mW	36 mW	700 mA	1.5 V	102 nm	>10 000 h	2.4 mm
MBB1D1 ^e	Broadband	470 - 850 nm ^f	70 mW	80 mW	500 mA	3.6 V	280 nm	10 000 h	1.6 mm
MWWHD1 ^d	Warm White	3000 K ^g	500 mW	550 mW	1000 mA	3.1 V	N/A	>50 000 h	1.6 mm
MCWHD2 ^d	Cold White	6500 K ^g	800 mW	840 mW	1000 mA	3.2 V	N/A	100 000 h	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. 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.
- The M280D2, M310D2, and M340D2 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.

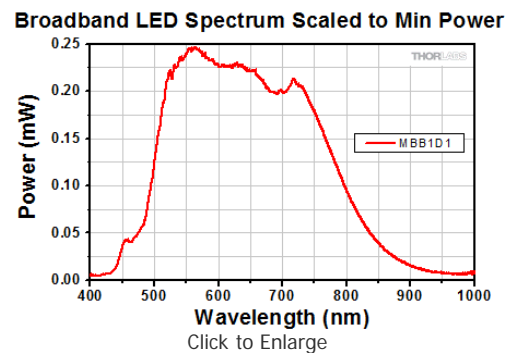
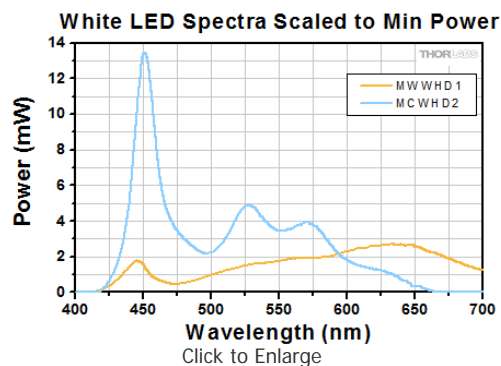
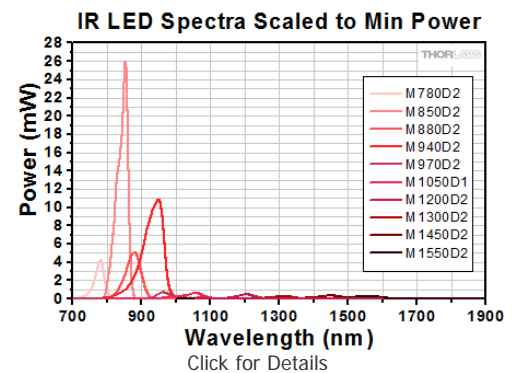
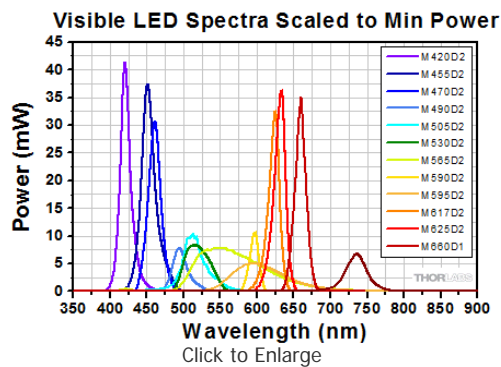
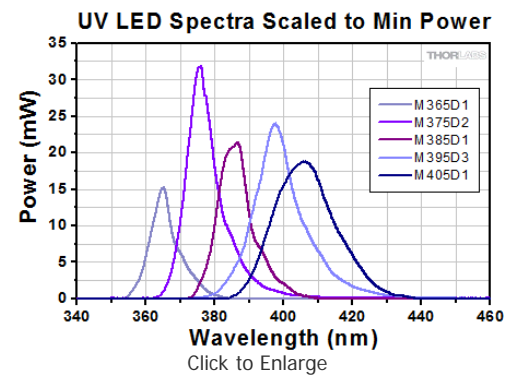
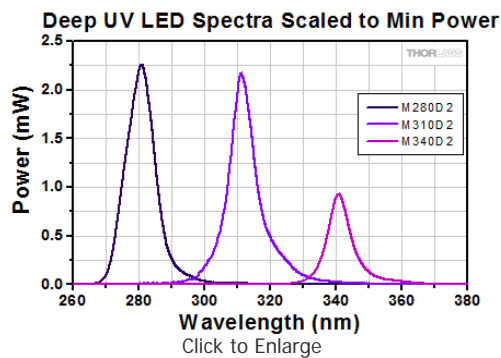
- The M565D2, M595D2, MWWHD1, and MCWHD2 are phosphor-converted LEDs and may not turn on completely when modulated above 10 kHz at duty cycles below 50%.
- The MBB1D1 LED may not turn off completely when modulated at frequencies above 1 kHz with a duty cycle of 50%, as the broadband emission is produced 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 high-power LEDs can be downloaded [here](#).



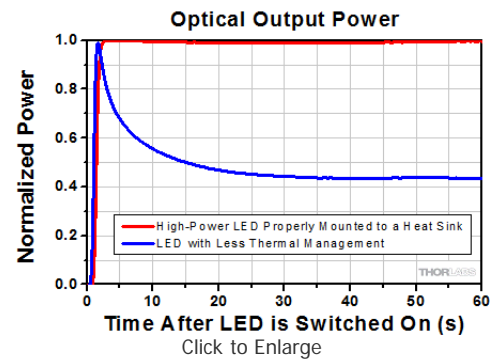
[Hide Stability](#)

STABILITY

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	DC2100 ^b	DC4100 ^{b,c,d}	DC4104 ^{b,c,d}
Click Photos to Enlarge				
Max LED Driver Current Output	1.2 A	2.0 A	1.0 A per Channel	1.0 A per Channel
Max LED Driver Forward Voltage	12 V	24 V	5 V	5 V
Max Modulation Frequency Using External Input	5 kHz	100 kHz ^e	100 kHz ^e (Simultaneous Across all Channels)	100 kHz ^e (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)	Individual Pulse Width Control	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 M340D2, as the current limit can only be set to a minimum of 200 mA (compared to the M340D2's max drive current of 80 mA).
- 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 the M280D2, M310D2, or M340D2 LEDs, which have forward voltage ratings of >5 V. They can be used to drive the M660L3 and M735L3 LEDs, but will not be able to provide the LEDs' maximum current of 1200 mA.
- 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 on 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 High-Power LEDs on Metal-Core Printed Circuit Boards](#)

High-Power LEDs on Metal-Core Printed Circuit Boards

Part Number	Description	Price	Availability
M280D2	UV (280 nm) LED on Metal-Core PCB, 350 mA, 25 mW (Min)	\$1,440.00	Today
M310D2	UV (310 nm) LED on Metal-Core PCB, 350 mA, 25 mW (Min)	\$1,440.00	Today
M340D2	Customer Inspired!UV (340 nm) LED on Metal-Core PCB, 80 mA, 10 mW (Min)	\$1,120.00	Today
M365D1	UV (365 nm) LED on Metal-Core PCB, 700 mA, 190 mW (Min)	\$149.00	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
M395D3	NEW! 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
M420D2	Violet (420 nm) LED on Metal-Core PCB, 1000 mA, 750 mW (Min)	\$123.00	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	3-5 Days
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
M660D1	Deep Red (660 nm) LED on Metal-Core PCB, 1000 mA, 270 mW (Min)	\$56.70	Today
M735D1	Far Red (735 nm) LED on Metal-Core PCB, 800 mA, 260 mW (Min)	\$56.70	Today
M780D2	IR (780 nm) LED on Metal-Core PCB, 800 mA, 200 mW (Min)	\$56.70	Today
M850D2	IR (850 nm) LED on Metal-Core PCB, 1000 mA, 900 mW (Min)	\$56.70	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	3-5 Days
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
MCWHD2	Cold White LED on Metal-Core PCB, 1000 mA, 800 mW (Min)	\$51.50	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 high-power LEDs on metal-core PCBs to the following Thorlabs LED drivers:

LEDD1B, DC2100, DC4100, and DC4104 (the latter two require the DC4100-HUB).

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

Male M8x1 Connector

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 high-power 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

Visit the *High-Power LEDs on Metal-Core PCB* page for pricing and availability information:
http://www.thorlabs.com/newgrouppage9.cfm?objectgroup_id=6071