M700F3 - March 27, 2024

Item M700F3 was discontinued on March 27, 2024. For informational purposes, this is a copy of the website content at that time and is valid only for the stated product.

FIBER-COUPLED LEDS

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

OVERVIEW

Features

- Nominal Wavelengths Ranging from 280 nm to 1450 nm
- Warm White (4000 K), Cold White (6200 K), and Broadband (470 - 850 nm) LEDs Also Available
- Integrated Identification Chip (EEPROM) Stores LED Operating Parameters
- Optimized Thermal Properties Lead to Stable Output Power
- SMA Bulkheads Are Ideal for Use with Multimode Fiber Optic Patch Cables

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

Legend	
LED Mounted to a 50 mm Long Heat Sink	LED Mounted to a 34 mm Long Heat Sink

Item #	Color (Click for Spectrum)[a]	Nominal Wavelength[a,b]	Ø200 µm Core Fiber Output (Typ.)[c,d]	Ø400 µm Core Fiber Output (Typ.)[d,e]
M280F5[f]	Deep UV	280 nm	0.2 mW	0.8 mW
M310F1[f]	Deep UV	308 nm	0.14 mW[g]	0.51 mW[g]
M325F4[f]	Deep UV	325 nm	100 µW	350 µW
M340F4[f]	Deep UV	340 nm	0.16 mW[g]	0.75 mW[g]
M365FP1[f]	UV	365 nm	5.29 mW	15.5 mW
M375F3[f]	UV	375 nm	1.57 mW[g]	4.23 mW[g]
M385F1[f]	UV	385 nm	2.68 mW	10.7 mW
M385FP1[f]	UV	385 nm	7.7 mW	23.2 mW
M395F3[f]	UV	395 nm	1.91 mW	6.8 mW
M395FP1[f]	UV	395 nm	7.7 mW	29.8 mW
M405F3[f]	UV	405 nm	0.93 mW[g]	3.7 mW[g]

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

Please note that the connectors on these fiber-coupled LEDs are intended for SMA connectors only. To prevent mechanical damage to the LED, the ferrule length of the attached connector must not exceed the maximum length for SMA connectors of 9.812 mm as defined by the EN61754-22:2005 standard.

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

Optimized Thermal Management
These fiber-coupled LEDs possess good thermal stability properties. The 34 mm long, passively cooled heat sink used in most of our fiber-coupled LEDs is in direct contact with the metal-core circuit board on which the LED is mounted. This minimizes the degradation of optical output power caused by increased LED junction temperature. Some of our fiber-coupled LEDs with a higher power output (M365FP1, M385FP1, M395FP1, M405FP1, and M660FP1) are mounted to a 50 mm long heat sink for increased heat dissipation and thermal stability.

White Light and Broadband LED
Our cold white and warm white LEDs feature broad spectra that span several hundred nanometers. The difference in perceived color between these two LEDs can be described using the correlated color temperature, which indicates that the LED's 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 MBB1F1 fiber-coupled LED has been designed to have relatively flat spectral emission over a wide wavelength range. Its FWHM bandwidth ranges from 500 nm to 780 nm, while the 10 dB bandwidth ranges between 470 nm and 850 nm. For more information on the spectrum of this broadband source, please see the table to the right.

Driver Options
Thorlabs offers five drivers compatible with some or all of these LEDs: LEDD1B, UPLED, DC2200, DC4100, and DC4104 (the latter two require the DC4100-HUB). See the *LED Drivers* tab for a list of specifications, and the *Specs* tab for driver compatibility information. The UPLED, DC2200, DC4100, and DC4104 drivers are

M405FP1	UV	405 nm	7.7 mW	24.3 mW
M415F3[f]	Violet	415 nm	7.0 mW	21.3 mW
M430F1[f]	Violet	430 nm	2.9 mW	7.5 mW
M455F3	Royal Blue	455 nm	5.4 mW	24.5 mW
M470F4	Blue	470 nm	6.5 mW[g]	20 mW[g]
M490F4	Blue	490 nm	0.9 mW[g]	2.8 mW[g]
M505F3	Cyan	505 nm	3.7 mW	11.7 mW
M530F3	Green	530 nm	3.2 mW[g]	9.6 mW[g]
MINTF4	Mint	554 nm	8.5 mW	28 mW
M565F3[h]	Lime	565 nm	4.4 mW	13.5 mW
M590F3	Amber	590 nm	1.5 mW	4.6 mW
M595F2[h]	Amber	595 nm	4.0 mW	11.5 mW
M617F2	Orange	617 nm	4.4 mW	13.2 mW
M625F2	Red	625 nm	5.7 mW	17.5 mW
M660FP1	Red	660 nm	4.7 mW	15.5 mW
M680F4	Deep Red	680 nm	2.8 mW[g]	9 mW[g]
M700F3	Deep Red	700 nm	0.4 mW	1.7 mW
M740F2	Far Red	740 nm	2.1 mW	6.0 mW
M780F2	IR	780 nm	1.15 mW	7.5 mW
M810F3	IR	810 nm	6.1 mW[g]	19.3 mW[g]
M850F3	IR	850 nm	4.1 mW	13.4 mW
M880F2	IR	880 nm	0.58 mW	3.4 mW
M940F3	IR	940 nm	4.2 mW	14.2 mW
M970F3	IR	970 nm	2.4 mW	8.1 mW
M1050F3	IR	1050 nm	0.92 mW	3.0 mW
M1100F1	IR	1100 nm	1.1 mW[g]	5.4 mW[g]
M1200F1	IR	1200 nm	0.9 mW[g]	2.5 mW[g]
M1300F1	IR	1300 nm	0.77 mW[g]	2.31 mW[g]
M1450F1	IR	1450 nm	0.44 mW[g]	1.34 mW[g]
MBB1F1[i]	Broadband	470 - 850 nm[j]	0.30 mW	1.2 mW
MWWHF2[k]	Warm White	4000 K[l]	7.9 mW	23.1 mW
MCWHF2[k]	Cold White	6200 K[l]	8.8 mW	27.0 mW

a. Due to variations in the manufacturing process and operating parameters such as temperature and current, the actual spectral output of any given LED will vary. Output plots and nominal wavelength specs are only intended to be used as a guideline.
b. For LEDs with a visible spectrum, the nominal wavelength indicates the dominant wavelength at which the LED appears brightest to the human eye. The nominal wavelength for visible LEDs may not correspond to the peak wavelength as measured by a spectrometer.
c. The M280F5, M300F2, M310F1, M325F4, and M340F4 LEDs were tested using FG200AEA Ø200 µm Core, 0.22 NA Solarization-Resistant Multimode Fiber; the M1450F1 LED was tested using the FG200LCC Ø200 µm Core, 0.22 NA Multimode Fiber; all other LEDs were tested using FG200UCC Ø200 µm Core, 0.22 NA Multimode Fiber.
d. When Driven with the Maximum Current
e. The M280F5, M300F2, M310F1, M325F4, and M340F4 LEDs were tested using FG400AEA Ø400 µm Core, 0.22 NA Solarization-Resistant Multimode Fiber; all other LEDs were tested using FT400EMT Ø400 µm Core, 0.39 NA Multimode Fiber.
f. Our 280 to 430 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.

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.

Optogenetics Applications

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

g. Measured at 25 °C
h. These LEDs are phosphor-converted and may not turn off completely when modulated above 10 kHz at duty cycles below 50%.
i. The MBB1F1 LED may not turn off completely when modulated at frequencies above 1 kHz with a duty cycle of 50%, as the broadband emission is produced by optically stimulating emission from phosphor. For modulation at frequencies above 1 kHz, the duty cycle may be reduced. For example, 10 kHz modulation is attainable with a duty cycle of 5%.
j. 10 dB Bandwidth
k. The MWWHF2 and MCWHF2 LEDs may not turn off completely when modulated at frequencies above 5 kHz, as the white light is produced by optically stimulating emission from phosphor.
l. Correlated Color Temperature

Patch Cable Options

These LEDs are compatible with many of our multimode fiber patch cables; see below for a list of recommended fiber patch cables for different wavelength LEDs. In addition to SMA-terminated patch cables, we also offer hybrid patch cables with an SMA connector on one end and an FC/PC connector, ferrule end, or bare fiber on the other end. Cable configurations not available from stock can be requested through our custom patch cable tool.

Recommended Fiber and Patch Cables		
LED Wavelength	**Fiber Type**	**Stock Patch Cable**
<350 nm	FG400AEA Ø400 µm, 0.22 NA, Solarization Resistant	M113L SMA - SMA
350 nm - 700 nm	FT400UMT Ø400 µm, 0.39 NA, High OH	Custom Patch Cables
>400 nm	FT400EMT Ø400 µm, 0.39 NA, Low OH	M28L SMA - SMA
		M76L SMA - FC/PC
		M118L SMA - Flat Cleave
		M79L SMA - Ferrule

SPECS

Legend	
LED Mounted to a 50 mm Long Heat Sink	LED Mounted to a 34 mm Long Heat Sink

Item #	Color (Click for Spectrum and Data)[a]	Nominal Wavelength[a,b]	Typical Ø200 µm Core Fiber Output Power[c,d]	Minimum Ø400 µm Core Fiber Output Power[d,e]	Typical Ø400 µm Core Fiber Output Power[d,e]	Maximum Current (CW)	Forward Voltage	Bandwidth (FWHM)	Typical Lifetime	Recommended Drivers[f]
M280F5[g]	Deep UV	280 nm	0.2 mW	0.5 mW	0.8 mW	500 mA	6.26 V[d]	10 nm	>1 000 h	LEDD1B, UPLED, or DC2200
M300F2[g]	Deep UV	300 nm	110 µW	320 µW	370 µW	350 mA	8.0 V[d]	15 nm	>10 000 h	
M310F1[g]	Deep UV	308 nm	0.14 mW[h]	0.3 mW[h]	0.51 mW[h]	600 mA[h]	5 V[h]	30 nm[h]	>10 000 h[h]	LEDD1B, UPLED, DC2200, DC4100[i], or DC4104[i]
M325F4[g]	Deep UV	325 nm	100 µW	260 µW	350 µW	600 mA	5.2 V[d]	12 nm	>5 000 h	LEDD1B, UPLED, or DC2200
M340F4[g]	Deep UV	340 nm	0.16 mW[h]	0.45 mW[h]	0.75 mW[h]	600 mA[h]	6.6 V[d,h]	10 nm[h]	>1 000 h[h]	
M365FP1[g]	UV	365 nm	5.29 mW	9.8 mW	15.5 mW	1400 mA	3.75 V	9 nm	>10 000 h	DC2200
[g]			[h]	[h]	[h]	[h]	[d,h]	[d,h]	>10 000	

M375F3	UV	375 nm	1.57 mW	3.2 mW	4.23 mW	500 mA	3.7 V	9 nm	h[h]	LEDD1B, UPLED, DC2200, DC4100[i], or DC4104[i]
M385F1[g]	UV	385 nm	2.68 mW	9.0 mW	10.7 mW	700 mA	4.3 V	10 nm	>10 000 h	
M385FP1[g]	UV	385 nm	7.7 mW	18 mW	23.2 mW	1400 mA	3.65 V	12 nm	>10 000 h	DC2200
M395F3[g]	UV	395 nm	1.91 mW	4.8 mW	6.8 mW	500 mA	4.5 V	16 nm	>10 000 h	LEDD1B, UPLED, DC2200, DC4100[i], or DC4104[i]
M395FP1[g]	UV	395 nm	7.7 mW	20.1 mW	29.8 mW	1400 mA	4.0 V[d]	11 nm	>10 000 h	DC2200
M405F3[g]	UV	405 nm	0.93 mW[h]	3.0 mW[h]	3.7 mW[h]	500 mA[h]	3.6 V[h,j]	12 nm[h,j]	>10 000 h[h]	LEDD1B, UPLED, DC2200, DC4100[i], or DC4104[i]
M405FP1[g]	UV	405 nm	7.7 mW	19.3 mW	24.3 mW	1400 mA	3.45 V	12 nm	>10 000 h	DC2200
M415F3[g]	Violet	415 nm	7.0 mW	14.4 mW	21.3 mW	1500 mA	3.1 V	14 nm	>10 000 h	DC2200
M430F1[g]	Violet	430 nm	2.9 mW[h]	5.3 mW[h]	7.5 mW[h]	500 mA[h]	3.66 V[h]	17 nm[h]	>10 000 h[h]	LEDD1B, UPLED, DC2200, DC4100[i], or DC4104[i]
M455F3	Royal Blue	455 nm	5.4 mW	17 mW	24.5 mW	1000 mA	3.5 V[d]	14 nm	>10 000 h	
M470F4	Blue	470 nm	6.5 mW[h]	14 mW[h]	20 mW[h]	1000 mA[h]	3.1 V[d,h]	20 nm[h]	>50 000 h[h]	
M490F4	Blue	490 nm	0.9 mW[h]	1.8 mW[h]	2.8 mW[h]	350 mA[h]	3.2 V[d,h]	26 nm[h]	>10 000 h[h]	
M505F3	Cyan	505 nm	3.7 mW	8.5 mW	11.7 mW	1000 mA	3.7 V[d]	25 nm	>10 000 h	
M530F3	Green	530 nm	3.2 mW[h]	6.8 mW[h]	9.6 mW[h]	1000 mA[h]	2.9 V[d,h]	30 nm[d,h]	>10 000 h[h]	
MINTF4	Mint	554 nm	8.5 mW	21 mW	28 mW	1225 mA	3.5 V[d]	-	>10 000 h	DC2200, LEDD1B[k], UPLED[k], DC4100[i], or DC4104[i]
M565F3[l]	Lime	565 nm	4.4 mW	9.9 mW	13.5 mW	700 mA	2.85 V	105 nm	>10 000 h	LEDD1B, UPLED, DC2200, DC4100[i], or DC4104[i]
M590F3	Amber	590 nm	1.5 mW	3.3 mW	4.6 mW	1000 mA	2.6 V[d]	16 nm	>10 000 h	
M595F2[l]	Amber	595 nm	4.0 mW	8.7 mW	11.5 mW	1000 mA	3.1 V[d]	80 nm	>50 000 h	
M617F2	Orange	617 nm	4.4 mW	10.2 mW	13.2 mW	1000 mA	2.2 V[d]	15 nm	>50 000 h	
M625F2	Red	625 nm	5.7 mW	13.2 mW	17.5 mW	1000 mA	2.2 V[d]	15 nm	>50 000 h	
M660FP1	Deep Red	660 nm	4.7 mW	10.6 mW	15.5 mW	1400 mA	2.7 V[d]	18 nm	>1 000 h	DC2200
M680F4	Deep Red	680 nm	2.8 mW[h]	5.9 mW[h]	9 mW[h]	600 mA[h]	2.4 V[d,h]	20 nm[d,h]	>10 000 h[h]	
M700F3	Deep Red	700 nm	0.4 mW	1.3 mW	1.7 mW	500 mA	2.7 V	20 nm	>10 000 h	
M740F2	Far Red	740 nm	2.1 mW	4.1 mW	6.0 mW	800 mA	2.7 V	22 nm	>10 000 h	
M780F2	IR	780 nm	1.15 mW	5.5 mW	7.5 mW	800 mA	2.1 V	28 nm	>10 000 h	
M810F3	IR	810 nm	6.1 mW[h]	12.7 mW[h]	19.3 mW[h]	1000 mA[h]	3.6 V[d,h]	30 nm[h]	>10 000 h	

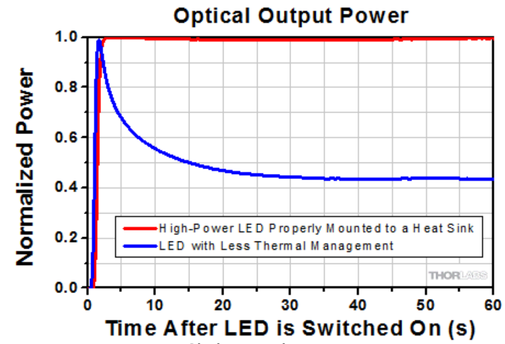
									h	
M850F3	IR	850 nm	4.1 mW[h]	8.6 mW[h]	13.4 mW[h]	1000 mA[h]	3.2 V[d,h]	30 nm[h]	>10 000 h[h]	
M880F2	IR	880 nm	0.58 mW	2.7 mW	3.4 mW	1000 mA	1.7 V	50 nm	>10 000 h	
M940F3	IR	940 nm	4.2 mW	10 mW	14.2 mW	1000 mA	3.8 V[d]	60 nm	>50 000 h	
M970F3	IR	970 nm	2.4 mW	5.9 mW	8.1 mW	1000 mA	1.9 V	60 nm	>10 000 h	LEDD1B, UPLED, DC2200, DC4100[i], or DC4104[i]
M1050F3	IR	1050 nm	0.92 mW	2.3 mW	3.0 mW	600 mA	1.4 V[d]	37 nm	>10 000 h	
M1100F1	IR	1100 nm	1.1 mW[h]	2.0 mW[h]	5.4 mW[h]	1000 mA[h]	1.4 V[d,h]	50 nm[h]	>10 000 h[h]	
M1200F1	IR	1200 nm	0.9 mW[h]	1.6 mW[h]	2.5 mW[h]	1000 mA[h]	2.2 V[d,h]	65 nm[h]	>10 000 h[h]	
M1300F1	IR	1300 nm	0.77 mW[h]	1.42 mW[h]	2.31 mW[h]	1000 mA[h]	1.7 V[d,h]	80 nm[h]	>10 000 h[h]	
M1450F1	IR	1450 nm	0.44 mW[h]	0.86 mW[h]	1.34 mW[h]	1000 mA[h]	1.88 V[d,h]	95 nm[h]	>10 000 h[h]	
MBB1F1[m]	Broadband	470 - 850 nm[n]	0.30 mW	0.8 mW	1.2 mW	500 mA	3.6 V	280 nm	>10 000 h	
MWWHF2[o]	Warm White	4000 K[p]	7.9 mW	16.3 mW	23.1 mW	1000 mA	2.9 V[d]	N/A	>50 000 h	
MCWHF2[o]	Cold White	6200 K[p]	8.8 mW	21.5 mW	27.0 mW	1000 mA	2.9 V[d]	N/A	>50 000 h	

a. Due to variations in the manufacturing process and operating parameters such as temperature and current, the actual spectral output of any given LED will vary. Output plots and nominal wavelength specs are only intended to be used as a guideline.
b. For LEDs with a visible spectrum, the nominal wavelength indicates the dominant wavelength at which the LED appears brightest to the human eye. The nominal wavelength for visible LEDs may not correspond to the peak wavelength as measured by a spectrometer.
c. The M280F5, M300F2, M310F1, M325F4, and M340F4 LEDs were tested using FG200AEA Ø200 µm Core, 0.22 NA Solarization-Resistant Multimode Fiber; the M1450F1 LED was tested using the FG200LCC Ø200 µm Core, 0.22 NA Multimode Fiber; all other LEDs were tested using FG200UCC Ø200 µm Core, 0.22 NA Multimode Fiber.
d. Driven at the Max Current
e. The M280F5, M300F2, M310F1, M325F4, and M340F4 LEDs were tested using FG400AEA Ø400 µm Core, 0.22 NA Solarization-Resistant Multimode Fiber; all other LEDs were tested using FT400EMT Ø400 µm Core, 0.39 NA Multimode Fiber.
f. Drivers for which max current and max voltage are greater than or equal to the max current and forward voltage of the LED, respectively. See the *LED Drivers* tab for the specifications of each driver.
g. Our 280 to 430 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.
h. Measured at 25 °C
i. This is a four-channel driver and requires the DC4100-HUB connector hub to drive fiber-coupled LEDs.
j. Driven at a Current of 350 mA
k. Due to the maximum current that can be provided by this driver, this LED can be driven near, but not at, full power.
l. These LEDs are phosphor-converted and may not turn off completely when modulated above 10 kHz at duty cycles below 50%.
m. The MBB1F1 LED may not turn off completely when modulated at frequencies above 1 kHz with a duty cycle of 50%, as the broadband emission is produced by optically stimulating emission from phosphor. For modulation at frequencies above 1 kHz, the duty cycle may be reduced. For example, 10 kHz modulation is attainable with a duty cycle of 5%.
n. 10 dB Bandwidth
o. The MWWHF2 and MCWHF2 LEDs may not turn off completely when modulated at frequencies above 5 kHz, as the white light is produced by optically stimulating emission from phosphor.
p. Correlated Color Temperature

STABILITY

LED Lifetime

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

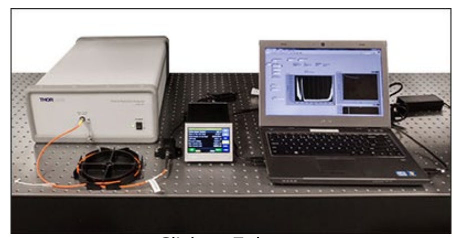
Optimized Thermal Management

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

WAVELENGTH SHIFT

LED Spectral Variation as a Function of Current

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


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

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

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

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

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

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

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

Experimental Limitations

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

Item #	Nominal Wavelength	Max Current (CW)	Centroid Wavelength vs. Current (Click for Plot)
M365FP1[a]	365 nm	1400 mA	
M375F3[a]	375 nm	500 mA	
M385F1[a]	385 nm	700 mA	
M385FP1[a]	385 nm	1400 mA	
M405F3[a]	405 nm	500 mA	
M405FP1[a]	405 nm	1400 mA	
M530F3	530 nm	1000 mA	

a. The spectra for these UV LEDs are close to the lower wavelength limit of the OSA201, where the noise floor of the instrument is highest. As a result, the larger error bars on the measurements at low currents are due to systematic noise in the measurement and not indicative of the LED performance. The OSA201 was operated in absolute power mode for all measurements; more information on how the noise floor of the OSA varies with wavelength can be found here.

Item #	Nominal Wavelength	Max Current (CW)	Centroid Wavelength vs. Current (Click for Plot)
M595F2	595 nm	1000 mA	
M617F2	617 nm	1000 mA	
M625F2	625 nm	1000 mA	
M740F2	740 nm	800 mA	
M780F2	780 nm	800 mA	
M880F2	880 nm	1000 mA	

PIN DIAGRAM

Pin Connection

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

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

LED DRIVERS

To fully support the maximum 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]	DC2200[a]	DC4100[a,b]	DC4104[a,b]

Click Photos to Enlarge					
LED Driver Current Output (Max)[c]	1.2 A	1.2 A	LED1 Terminal: 10.0 A LED2 Terminal: 2.0 A[d]	1.0 A per Channel	1.0 A per Channel
LED Driver Forward Voltage (Max)[e]	12 V	8 V	50 V	5 V	5 V
Modulation Frequency Using External Input (Max)	5 kHz	-	250 kHz[f,g,h,i]	100 kHz[g,h,i] (Simultaneous Across all Channels)	100 kHz[g,h,i] (Independently Controlled Channels)
External Control Interface(s)	Analog (BNC)	USB 2.0	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	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 Limits to LEDs Max Current Via EEPROM Readout
b. The DC4100 or DC4104 can power and control up to four LEDs simultaneously when used with the DC4100-HUB. The LEDs on this page all require the DC4100-HUB when used with the DC4100 or DC4104.
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 *Specs* tab for the maximum current rating of each LED.
d. The fiber-coupled LEDs sold below are compatible with the LED2 Terminal.
e. LEDs with forward voltage greater than the driver's maximum forward voltage cannot be driven. See the *Specs* tab for the forward voltage specification of each LED.
f. Small Signal Bandwidth: Modulation not exceeding 20% of full scale current. The driver accepts other waveforms, but the maximum frequency will be reduced.
g. The MBB1F1 LED may not turn off completely when modulated at frequencies above 1 kHz with a duty cycle of 50%, as the broadband emission is produced by optically stimulating emission from phosphor. For modulation at frequencies above 1 kHz, the duty cycle may be reduced. For example, 10 kHz modulation is attainable with a duty cycle of 5%.
h. The MWWHF1 and MCWHF1 LEDs may not turn off completely when modulated at frequencies above 5 kHz, as the white light is produced by optically stimulating emission from phosphor.
i. The M565F3 and M595F2 are phosphor-converted and may not turn off completely when modulated above 10 kHz at duty cycles below 50%.

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.

Fiber-Coupled LEDs

- Integrated EEPROM for Automated LED Settings with Compatible Thorlabs Controllers
- Long Lifetimes >10 000 Hours (Except M280F5, M325F4, M340F4, and M660FP1; See *Specs* Tab for Details)
- Output can be Modulated with Suitable Controller (See *LED Drivers* Tab)
- Stable Output Intensity by Optimized Thermal Management
- Accepts SMA Fiber Connector


Click to Enlarge
M365FP1, M385FP1, M395FP1, M405FP1, and M660FP1 are each mounted to a 50 mm long heat sink.

These fiber-coupled LEDs each consist of an LED mounted to a heat sink with an SMA fiber bulkhead. They can be easily integrated into an optical setup using one of our SMA-terminated multimode fiber patch cables. When the patch cable is connected to the SMA bulkhead on the LED housing, the LED will be butt-coupled to the SMA fiber connector. Hybrid patch cables can be used to transition from an SMA connector to an FC/PC connector, ferrule end, or bare fiber. For compatible drivers to power these LEDs, please see the *LED Drivers* tab. Please note that the minimum output powers specified below apply when the LED is used with a Ø400 µm core multimode fiber patch cable.

For applications where a hybrid patch cable is not practical, we can configure these fiber-coupled LEDs with FC/PC bulkheads; contact Tech Support for details.

Part Number	Description	Price	Availability
M280F5	280 nm, 0.5 mW (Min) Fiber-Coupled LED, 500 mA, SMA	$480.70	Today
M300F2	300 nm, 320 µW (Min) Fiber-Coupled LED, 350 mA, SMA	$775.71	Today
M310F1	308 nm, 300 µW (Min) Fiber-Coupled LED, 600 mA, SMA	$661.11	Today
M325F4	325 nm, 260 µW (Min) Fiber-Coupled LED, 600 mA, SMA	$977.02	Today
M340F4	340 nm, 0.45 mW (Min) Fiber-Coupled LED, 600 mA, SMA	$467.02	7-10 Days
M365FP1	365 nm, 9.8 mW (Min) Fiber-Coupled LED, 1400 mA, SMA	$727.02	7-10 Days
M375F3	375 nm, 3.2 mW (Min) Fiber-Coupled LED, 500 mA, SMA	$531.00	Today
M385F1	385 nm, 9.0 mW (Min) Fiber-Coupled LED, 700 mA, SMA	$630.80	7-10 Days

M385FP1	385 nm, 18 mW (Min) Fiber-Coupled LED, 1400 mA, SMA	$727.02	7-10 Days
M395F3	395 nm, 4.8 mW (Min) Fiber-Coupled LED, 500 mA, SMA	$417.16	Today
M395FP1	395 nm, 20.1 mW (Min) Fiber-Coupled LED, 1400 mA, SMA	$634.16	Today
M405F3	405 nm, 3.0 mW (Min) Fiber-Coupled LED, 500 mA, SMA	$531.00	Today
M405FP1	405 nm, 19.3 mW (Min) Fiber-Coupled LED, 1400 mA, SMA	$727.02	Today
M415F3	415 nm, 14.4 mW (Min) Fiber-Coupled LED, 1500 mA, SMA	$471.67	Today
M430F1	430 nm, 5.3 mW (Min) Fiber-Coupled LED, 500 mA, SMA	$257.17	Today
M455F3	455 nm, 17 mW (Min) Fiber-Coupled LED, 1000 mA, SMA	$469.25	Today
M470F4	470 nm, 14 mW (Min) Fiber-Coupled LED, 1000 mA, SMA	$296.82	Today
M490F4	490 nm, 1.8 mW (Min) Fiber-Coupled LED, 350 mA, SMA	$352.34	Today
M505F3	505 nm, 8.5 mW (Min) Fiber-Coupled LED, 1000 mA, SMA	$436.74	7-10 Days
M530F3	530 nm, 6.8 mW (Min) Fiber-Coupled LED, 1000 mA, SMA	$450.00	Today
MINTF4	554 nm, 21 mW (Min) Fiber-Coupled LED, 1225 mA, SMA	$582.32	Today
M565F3	565 nm, 9.9 mW (Min) Fiber-Coupled LED, 700 mA, SMA	$510.10	Today
M590F3	590 nm, 3.3 mW (Min) Fiber-Coupled LED, 1000 mA, SMA	$511.08	Today
M595F2	595 nm, 8.7 mW (Min) Fiber-Coupled LED, 1000 mA, SMA	$449.03	Today
M617F2	617 nm, 10.2 mW (Min) Fiber-Coupled LED, 1000 mA, SMA	$449.03	Today
M625F2	625 nm, 13.2 mW (Min) Fiber-Coupled LED, 1000 mA, SMA	$449.03	Today
M660FP1	660 nm, 10.6 mW (Min) Fiber-Coupled LED, 1400 mA, SMA	$494.12	Today
M680F4	NEW! 680 nm, 5.9 mW (Min) Fiber-Coupled LED, 600 mA, SMA	$0.00	Lead Time
M700F3	700 nm, 1.3 mW (Min) Fiber-Coupled LED, 500 mA, SMA	$460.92	Lead Time
M740F2	740 nm, 4.1 mW (Min) Fiber-Coupled LED, 800 mA, SMA	$531.00	Today
M780F2	780 nm, 5.5 mW (Min) Fiber-Coupled LED, 800 mA, SMA	$457.35	Today
M810F3	810 nm, 12.7 mW (Min) Fiber-Coupled LED, 1000 mA, SMA	$328.03	Today
M850F3	850 nm, 8.6 mW (Min) Fiber-Coupled LED, 1000 mA, SMA	$332.64	Today
M880F2	880 nm, 2.7 mW (Min) Fiber-Coupled LED, 1000 mA, SMA	$457.35	Today
M940F3	940 nm, 10 mW (Min) Fiber-Coupled LED, 1000 mA, SMA	$452.29	Today
M970F3	970 nm, 5.9 mW (Min) Fiber-Coupled LED, 1000 mA, SMA	$401.80	Today
M1050F3	1050 nm, 2.3 mW (Min) Fiber-Coupled LED, 600 mA, SMA	$634.72	7-10 Days
M1100F1	1100 nm, 2.0 mW (Min), Fiber-Coupled LED, 1000 mA, SMA	$379.99	Today
M1200F1	1200 nm, 1.6 mW (Min) Fiber-Coupled LED, 1000 mA, SMA	$382.35	Today
M1300F1	1300 nm, 1.42 mW (Min), Fiber-Coupled LED, 1000 mA, SMA	$386.39	7-10 Days
M1450F1	1450 nm, 0.86 mW (Min), Fiber-Coupled LED, 1000 mA, SMA	$380.47	Today
MBB1F1	Broadband (470 - 850 nm), 0.8 mW (Min) Fiber-Coupled LED, 500 mA, SMA	$812.53	Today
MCWHF2	6200 K, 21.5 mW (Min) Fiber-Coupled LED, 1000 mA, SMA	$449.03	Today
MWWHF2	4000 K, 16.3 mW (Min) Fiber-Coupled LED, 1000 mA, SMA	$449.03	Today

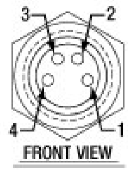
Mounted LED Mating Connector

- Female 4-Pin Pico (M8) Receptacle
- M8 x 1 Thread for Connection to Mounted LED Power Cable
- M8 x 0.5 Panel-Mount Thread for Custom Housings
- 0.5 m Long, 24 AWG Wires
- IP 67 and NEMA 6P Rated

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

Pin	Color	Specification

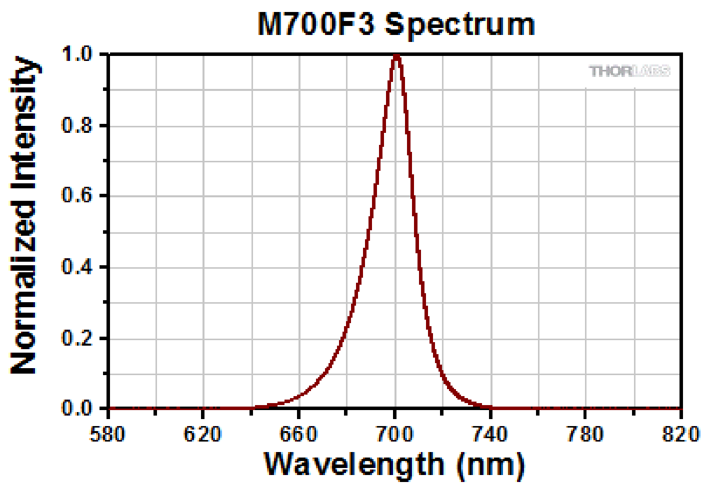
1	Brown	LED Anode
2	White	LED Cathode
3	Black	EEPROM GND
4	Blue	EEPROM IO



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

Part Number	Description	Price	Availability
CON8ML-4	**4-Pin Female Mating Connector for Mounted LEDs**	**$36.54**	**Today**


M700F3


M700F3 Spectrum
Normalized Intensity
Wavelength (nm)
1.0
0.8
0.6
0.4
0.2
0.0
580
620
660
700
740
780
820
THORLABS