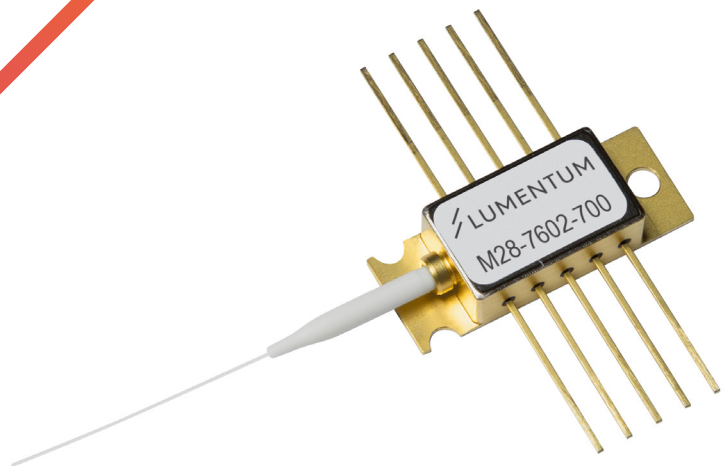


Up to 700 mW Cooled Fiber Bragg Grating Stabilized Mini-Butterfly 980 nm Pump Modules

M28 Series



The Lumentum M28 Series 980 nm mini butterfly pump laser modules uses a number of revolutionary design steps and the very latest material technologies to significantly improve scalability of the production process. The 'semicooled' 45°C laser diode operation provides for a significant reduction in TEC and overall power consumption. The module meets the stringent requirements of the telecommunications industry, including Telcordia GR-468-CORE for hermetic 980 nm pump modules.

The M28 Series pump module, which uses fiber Bragg grating stabilization to lock the emission wavelength, provides a noise-free, narrowband spectrum, even under changes in temperature, drive current and optical feedback. Wavelength selection is available for applications requiring the highest performance in spectrum control with the highest power available.

Key Features

- Operating power range from 100 - 700 mW
- 45°C internal temperature, reduced TEC power consumption
- Low-profile 10-PIN small form factor (mini-butterfly) package
- Fiber Bragg grating stabilization
- Wavelength selection available
- Integrated thermoelectric cooler, thermistor, and monitor diode
- High dynamic range

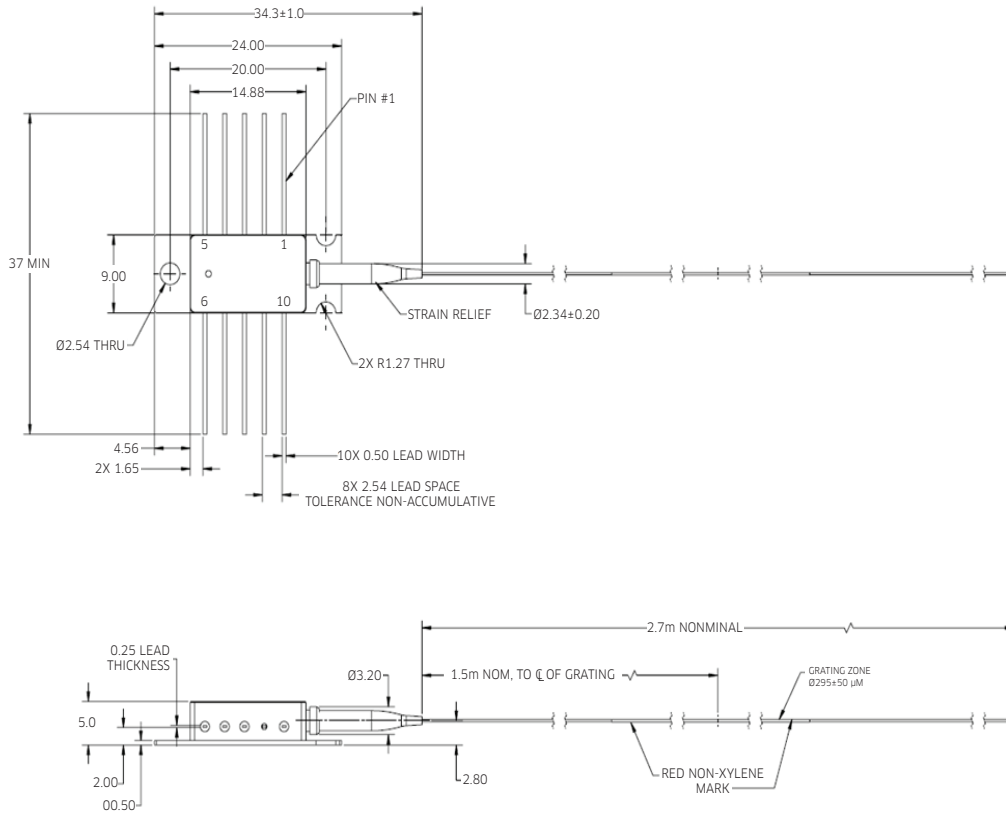
Applications

- Dense wavelength division multiplexing (DWDM) EDFAs for small package designs
- High bit-rate, high channel-count EDFAs
- CATV distribution

Compliance

- Telcordia GR-468-CORE

Dimensions Diagram



Pinout

Pin	Description
1	TEC (+)
2	Thermistor
3	Monitor Anode (-)
4	Monitor Cathode (+)
5	Thermistor
6	Laser Anode (+)
7	Laser Cathode (-)
8	NC
9	Pkg ground
10	TEC (-)

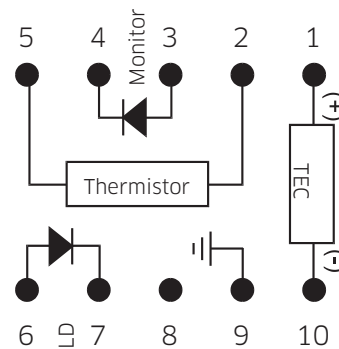


Table 1. Absolute Maximum Ratings

Parameter	Symbol	Test Conditions	Minimum	Maximum
Operating case temperature	T_{op}		-5°C	75°C
Storage temperature	T_{str}	2000 hr	-40°C	85°C
Laser operating temperature	T_{LD}		15°C	60°C
LD reverse voltage	V_r		-	1.2 V
LD forward current	$I_{r,max}$		-	1700 mA
LD reverse current			-	10 μ A
PD reverse voltage	V_{PD}		-	20 V
PD forward current	I_{PF}		-	10 mA
LD electrostatic discharge (ESD)	V_{ESDLD}	C = 100 pF, R = 1.5 k Ω , HBM		1000 V
PD electrostatic discharge (ESD)	V_{ESDPD}	C = 100 pF, R = 1.5 k Ω , HBM		500 V
TEC current	I_{TEC}		-1 A	2 A
TEC voltage	V_{TEC}		-	4 V
Axial pull force		3 x 10 s	-	5 N
Side pull force		3 x 10 s	-	2.5 N
Fiber bend radius			16 mm	-
Relative humidity	RH	Noncondensing	5%	95%
Lead soldering time		300°C	-	10 s

Absolute maximum ratings are the maximum stresses that may be applied to the module for short periods of time without causing damage and are listed in Table 5. Stresses in excess of the absolute maximum ratings can cause permanent damage to the device. Exposure to absolute maximum ratings for extended periods of time or exposure to more than one absolute maximum rating simultaneously may adversely affect device reliability. Specifications may not necessarily be met under these conditions.

Table 2. Operating Parameters (BOL, $T_{case} = -5$ to 75°C, -50 dB reflection, unless otherwise noted.)

Product Code	Maximum Operating Power P_{op} (mW)	Maximum Operating Current I_{op} (mA)	Minimum Kink-Free Power P_{max} (mW)	Maximum Kink-Free Current I_{max} (mA)
M28-xxxx-100	100	285	110	305
M28-xxxx-120	120	320	130	345
M28-xxxx-140	140	360	155	385
M28-xxxx-160	160	400	175	430
M28-xxxx-180	180	440	200	475
M28-xxxx-200	200	475	220	515
M28-xxxx-220	220	515	240	560
M28-xxxx-240	240	555	265	600
M28-xxxx-260	260	595	285	645
M28-xxxx-280	280	635	310	690
M28-xxxx-300	300	675	330	735
M28-xxxx-320	320	715	350	780
M28-xxxx-340	340	755	375	825
M28-xxxx-360	360	795	395	870
M28-xxxx-380	380	840	420	920
M28-xxxx-400	400	880	440	965
M28-xxxx-420	420	925	460	1015
M28-xxxx-440	440	965	485	1060
M28-xxxx-460	460	1010	505	1110
M28-xxxx-480	480	1055	530	1160
M28-xxxx-500	500	1095	550	1210
M28-xxxx-520	520	1140	570	1260
M28-xxxx-540	540	1190	595	1315
M28-xxxx-560	560	1235	615	1365
M28-xxxx-580	580	1280	640	1420

Product Code	Maximum Operating Power P_{op} (mW)	Maximum Operating Current I_{op} (mA)	Minimum Kink-Free Power P_{max} (mW)	Maximum Kink-Free Current I_{max} (mA)
M28-xxxx-600	600	1325	660	1475
M28-xxxx-620	620	1375	680	1525
M28-xxxx-640	640	1425	705	1580
M28-xxxx-660	660	1475	725	1635
M28-xxxx-680	680	1520	750	1690
M28-xxxx-700	700	1525	770	1700

The xxxx denotes the wavelength per the product code in Table 3.

Table 3. Available Peak Wavelength Selection

Product Code	Minimum Center Wavelength	Maximum Center Wavelength
M28-7402-yyy	973.0 nm	975.0 nm
M28-7602-yyy	975.0 nm	977.0 nm
M28-8000-yyy	973.0 nm	981.5 nm

The yyy denotes the power per the product code in Table 2.

Table 4. Electro-Optical Performance (BOL, $T_{case} = -5^{\circ}\text{C}$ to 75°C , $T_{LD} = 45^{\circ}\text{C}$, $P_f = 30\text{mW}$ to P_{op} , -50dB reflection, unless otherwise noted)

Parameter	Symbol	Test Conditions	Minimum	Maximum
Threshold current	I_{th-BOL}		–	125 mA
Forward voltage	V_f	$I_f = I_{op}$	–	2.6 V
Fiber output power range	P_f		30 mW	P_{op}
Pump power in band	P_{pump}	Pump Band = $\lambda_m \pm 1.5$ nm, at P_{op}	90%	
Spectral width	$\Delta\lambda_{RMS}$	Over P_f Range		2.0 nm
Wavelength tuning vs. temperature	$\Delta\lambda/T$	$I_f = I_{op}$		0.01 nm/ $^{\circ}\text{C}$
Optical power stability	$\Delta P_{f,t}$	Over P_f range, DC to -50 kHz, 50 mW $-P_{op}$	–	2.0%
Tracking ratio ¹	TR	$0.1P_{op} < P_f < P_{op}$	0.6	1.4
Tracking error ²	TE	P_{op}	-40%	80%
Monitor diode response	I_{BF}	-5 V Bias, at P_{op}	0.5 $\mu\text{A}/\text{mW}$	5 $\mu\text{A}/\text{mW}$
LD temperature	T_{LD}	Nominal $T_{LD} = 45^{\circ}\text{C}$	44 $^{\circ}\text{C}$	46 $^{\circ}\text{C}$
Thermistor resistance	R_{th}	$T_{set} = 45^{\circ}\text{C}$	9.5 k Ω	10.5 k Ω

1. The tracking ratio is a measure of the front-to-back tracking when the output power is varied. On a plot of optical power versus back-face photocurrent, a straight line is drawn between the minimum power (30 mW) and the operating power (P_{op}) points. The tracking ratio is defined as the ratio between measured optical power (shown as data points on the plot) to the value derived from the straight line.

2. The tracking error is defined as the normalized change of output power relative to P_f at 25°C , i.e., $(P_f - P_{f,25})/P_{f,25}$, over case temperature range 0°C to 75°C , at constant back-face monitor current corresponding to lowest back-face monitor current at $P_f = P_{op}$ of 0°C , 25°C , 75°C .

Table 5. TEC and Total Module Power Consumption at $T_{LD} = 45^{\circ}\text{C}$ (BOL, $\Delta T = 30^{\circ}\text{C}$, $T_{case} = 75^{\circ}\text{C}$)

Product Code	TEC Current I_{max} (A)	TEC Voltage V_{max} (V)	TEC Power Consumption P_{TEC} (W)	Total Module Power Consumption P_{max} (W)
M28-xxxx-100	0.74	1.62	1.19	1.6
M28-xxxx-120	0.74	1.64	1.21	1.69
M28-xxxx-140	0.75	1.66	1.24	1.78
M28-xxxx-160	0.76	1.68	1.27	1.88
M28-xxxx-180	0.77	1.7	1.3	1.98
M28-xxxx-200	0.78	1.73	1.34	2.08
M28-xxxx-220	0.79	1.76	1.38	2.19
M28-xxxx-240	0.8	1.79	1.43	2.31
M28-xxxx-260	0.82	1.82	1.48	2.43
M28-xxxx-280	0.83	1.85	1.53	2.56
M28-xxxx-300	0.85	1.89	1.59	2.7
M28-xxxx-320	0.86	1.93	1.66	2.84
M28-xxxx-340	0.88	1.97	1.73	2.99
M28-xxxx-360	0.9	2.01	1.8	3.15

Table 5. TEC and Total Module Power Consumption at $T_{LD} = 45^{\circ}\text{C}$ (BOL, $\Delta T = 30^{\circ}\text{C}$, $T_{case} = 75^{\circ}\text{C}$) (Continued)

M28-xxxx-380	0.92	2.06	1.88	3.32
M28-xxxx-400	0.94	2.1	1.97	3.49
M28-xxxx-420	0.97	2.15	2.07	3.68
M28-xxxx-440	0.99	2.21	2.17	3.87
M28-xxxx-460	1.01	2.26	2.29	4.08
M28-xxxx-480	1.04	2.32	2.41	4.3
M28-xxxx-500	1.07	2.39	2.54	4.52
M28-xxxx-520	1.1	2.45	2.68	4.77
M28-xxxx-540	1.13	2.52	2.84	5.03
M28-xxxx-560	1.16	2.59	3.01	5.3
M28-xxxx-580	1.2	2.67	3.19	5.59
M28-xxxx-600	1.23	2.75	3.38	5.89
M28-xxxx-620	1.27	2.83	3.59	6.22
M28-xxxx-640	1.31	2.92	3.82	6.57
M28-xxxx-660	1.36	3.01	4.07	6.94
M28-xxxx-680	1.4	3.11	4.33	7.32
M28-xxxx-700	1.44	3.21	4.61	7.73

Table 6. HI 1060 Fiber Nominal Characteristics and Tolerances

Parameters	Specification
Cutoff wavelength	920 nm
Maximum attenuation at 980 nm	2.1 dB/km
Cladding outside diameter	125 ±1 μm
Coating outside diameter	245 ±10 μm
Core-cladding concentricity	≤0.5 μm
Mode field diameter	5.9 ±0.3 μm

User Safety

Safety and Operating Considerations

The laser light emitted from this laser diode is invisible and may be harmful to the human eye. Avoid looking directly into the fiber when the device is in operation.

CAUTION: THE USE OF OPTICAL INSTRUMENTS WITH THIS PRODUCT INCREASES EYE HAZARD.

Operating the laser diode outside of its maximum ratings may cause device failure or a safety hazard. Power supplies used with this component cannot exceed maximum peak optical power.

CW laser diodes may be damaged by excessive drive current or switching transients. When using power supplies, the laser diode should be connected with the main power on and the output voltage at zero. The current should be increased slowly while monitoring the laser diode output power and the drive current. Careful attention to heatsinking and proper mounting of this device is required to ensure specified performance over its operating life. To maximize thermal transfer to the heatsink, the heatsink mounting surface must be flat to within .001inch and the mounting screws must be torqued down to 1.5 in/lb.

ESD PROTECTION—Electrostatic discharge (ESD) is the primary cause of unexpected laser diode failure. Take extreme precaution to prevent ESD. Use wrist straps, grounded work surfaces, and rigorous antistatic techniques when handling laser diodes.

Labeling

Laser Safety

The Lumentum pump laser module emits hazardous invisible laser radiation. Due to the small size of the pump module, the box packaging is labeled with the laser radiation hazard symbol and safety warning labels shown below.



10-pin module label



Shipping box label

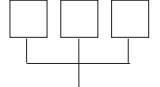
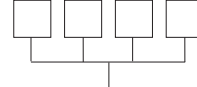


Output power and laser emission indicator label

Ordering Information

For more information on this or other products and their availability, please contact your local Lumentum account manager or Lumentum directly at customer.service@lumentum.com.

M28 -



Peak Wavelength	Code
973.0 to 975.0 nm	7402
975.0 to 977.0 nm	7602
973.0 to 981.5 nm	8000

Maximum Operating Power	Code
100 mW	100
120 mW	120
140 mW	140
160 mW	160
180 mW	180
200 mW	200
220 mW	220
240 mW	240
260 mW	260
280 mW	280
300 mW	300
320 mW	320
340 mW	340
360 mW	360
380 mW	380
400 mW	400
420 mW	420
440 mW	440
460 mW	460
480 mW	480
500 mW	500
520 mW	520
540 mW	540
560 mW	560
580 mW	580
600 mW	600
620 mW	620
640 mW	640
660 mW	660
680 mW	680
700 mW	700



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