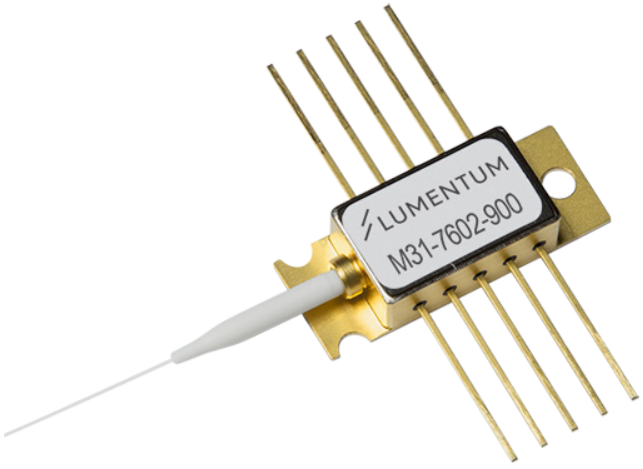
LUMENTUM

Up to 950 mW Fiber Bragg Grating Stabilized Mini-Butterfly 980 nm Pump Modules

M31 Series



The Lumentum M31 Series 980 nm mini-butterfly pump laser module uses a number of revolutionary design steps and the very latest material technologies to significantly improve scalability of the production process. The M31 Series pump module incorporates the high-reliability Lumentum 980 nm laser diode in a cooled fiber Bragg grating-stabilized 10-pin butterfly module. The module meets the stringent requirements of the telecommunications industry, including Telcordia GR-468-CORE for hermetic 980 nm pump modules.

The M31 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 – 955 mW
- 25°C internal temperature
- 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

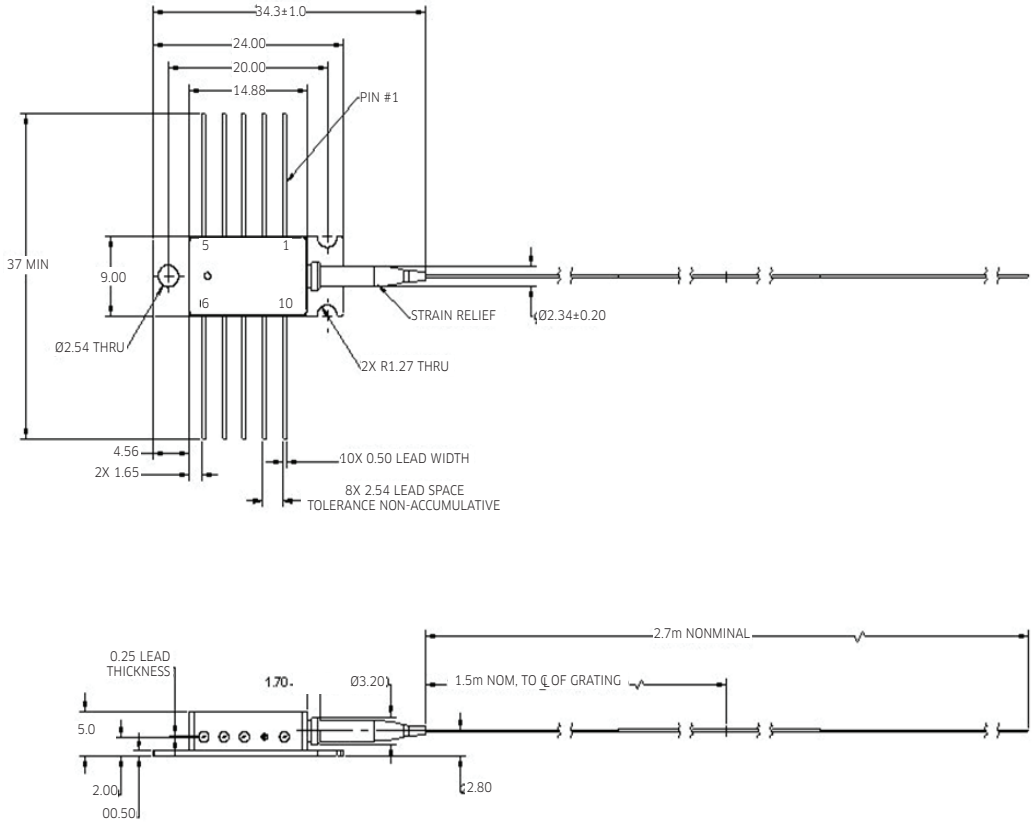
Applications

- 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 (–)

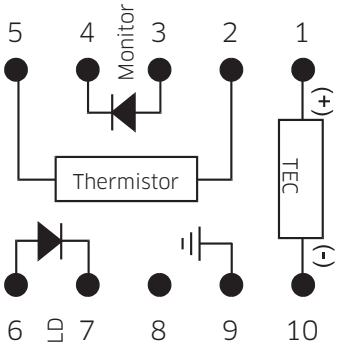


Table 1. Absolute Maximum Ratings

Parameter	Symbol	Test Conditions	Minimum	Maximum
Operating case temperature	T_{op}		–5°C	75°C
Storage temperature	T_{stg}	2000 hr	–40°C	85°C
Laser operating temperature	T_{LD}		15°C	60°C
LD reverse voltage	V_r			2.0 V
LD forward current	I_{f_max}			1800 mA
LD current transient		20 µs maximum		1900 mA
LD reverse current				10 µA
PD reverse voltage	V_{PD}			20 V
PD forward current	I_{PF}			10 mA
LD electrostatic discharge (ESD)	$V_{ESD\ LD}$	C = 100 pF, R = 1.5 kΩ, HBM		1000 V
PD electrostatic discharge (ESD)	$V_{ESD\ PD}$	C = 100 pF, R = 1.5 kΩ, HBM		500 V
TEC current	I_{TEC}		-1.2 A	2 A
TEC voltage	V_{TEC}			4.5 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)
M31-xxxx-480	480	875	528	960
M31-xxxx-500	500	910	550	995
M31-xxxx-520	520	945	572	1035
M31-xxxx-560	560	1015	616	1110
M31-xxxx-600	600	1080	660	1185
M31-xxxx-640	640	1155	704	1270
M31-xxxx-680	680	1225	748	1350
M31-xxxx-700	700	1260	770	1390
M31-xxxx-720	720	1290	792	1430
M31-xxxx-760	760	1350	836	1505
M31-xxxx-800	800	1405	880	1575
M31-xxxx-840	840	1445	924	1610
M31-xxxx-860	860	1460	946	1630
M31-xxxx-880	880	1480	968	1645
M31-xxxx-900	900	1495	990	1660
M31-xxxx-920	920	1530	1012	1675
M31-xxxx-940	940	1565	1034	1690
M31-xxxx-950	950	1585	1045	1695
M31-xxxx-955	955	1595	1050	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
M31-7402-yyy	973.0 nm	975.0 nm
M31-7602-yyy	975.0 nm	977.0 nm
M31-8000-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°C to 75°C, T_{LD} = 25°C, Pf = 30 mW to Pop, –50 dB reflection, unless otherwise noted)

Parameter	Symbol	Test Conditions	Minimum	Maximum
Threshold current	$I_{th\text{-}BOL}$			90 mA
Forward voltage	V_f	$I_f = I_{op}$		2.2 V
Fiber output power range	P_f		30 mW	P_{op}
Pump power in band	P_{pump}	Pump Band = λ_m ±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/°C
Optical power stability	$\Delta P_{f,t}$	Over P_f range, DC to –50 kHz, 50 mW -P_{op}		2.0%
Tracking ratio1	TR	$0.1P_{op} < P_f < P_{op}$	0.6	1.40
Tracking error[2]	TE	P_{op}	–40%	80%
Monitor diode response	I_{BF}	-5 V Bias, at P_{op}	0.5 µA/mW	5 µA/mW
LD temperature	T_{LD}	Nominal T_{LD} = 25°C	24°C	26°C
Thermistor resistance: M31-7402-yyy, M31-7602-yyy	R_{th}	T_{set} = 25°C	9.5 kΩ	10.5 kΩ
Thermistor resistance: M31-8000-yyy	R_{th}	T_{set} = 25°C	9.0 kΩ	11.5 kΩ

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 (Pop) 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 The tracking error is defined as the normalized change of output power relative to Pf at 25°C , i.e., (P_f – P_{f_25})/Pf_25, over case temperature range 0°C to 75°C, at constant back-face monitor current corresponding to lowest back-face monitor current at Pf = P_{op} of 0°C, 25°C ,75°C.

Table 5. TEC and Total Module Power Consumption at T_{LD} = 25°C (BOL, ΔT = 50°C, T_{case} = 75°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)
M31-xxxx-480	1.29	3.07	3.97	5.4
M31-xxxx-500	1.30	3.09	4.02	5.5
M31-xxxx-520	1.31	3.11	4.09	5.6
M31-xxxx-560	1.34	3.15	4.22	5.9
M31-xxxx-600	1.37	3.20	4.37	6.2
M31-xxxx-640	1.39	3.25	4.53	6.5
M31-xxxx-680	1.42	3.30	4.71	6.8
M31-xxxx-700	1.44	3.33	4.80	7.0
M31-xxxx-720	1.46	3.36	4.90	7.2
M31-xxxx-760	1.49	3.43	5.12	7.5
M31-xxxx-800	1.53	3.50	5.37	7.9
M31-xxxx-840	1.58	3.58	5.65	8.4
M31-xxxx-860	1.60	3.63	5.81	8.5
M31-xxxx-880	1.63	3.67	5.98	8.7
M31-xxxx-900	1.65	3.72	6.15	8.9
M31-xxxx-920	1.68	3.78	6.34	9.2
M31-xxxx-940	1.71	3.83	6.55	9.5
M31-xxxx-950	1.72	3.86	6.66	9.7
M31-xxxx-955	1.73	3.88	6.72	9.7

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.

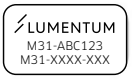
CW laser diodes may be damaged by excessive drive current or switching transients. When using power supplies, the laser diode should be connected with the main power on and the output voltage at zero. The current should be increased slowly while monitoring the laser diode output power and the drive current. 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.

M31 - □□□□ - □□□

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
480 mW	480
500 mW	500
520 mW	520
560 mW	560
600 mW	600
640 mW	640
680 mW	680
700 mW	700
720 mW	720
760 mW	760
800 mW	800
840 mW	840
860 mW	860
880 mW	880
900 mW	900
920 mW	920
940 mW	940
950 mW	950
955 mW	955

LUMENTUM

North America
Toll Free: 844 810 LITE (5483)

Outside North America
Toll Free: 800 000 LITE (5483)

China
Toll Free: 400 120 LITE (5483)