LUMENTUM

4 x 800 mW Fiber Bragg Grating Stabilized 980 nm Pump Modules

D4 Series

Key Features

- Operating power ranges from 1840 – 3200 mW
- 45°C internal temperature
- Low-profile 5.3 mm 14-PIN butterfly package
- Fiber Bragg grating stabilization
- Wavelength selection available
- Integrated thermoelectric cooler, thermistor, and monitor diode
- High dynamic range
- Excellent low-power stability

Applications

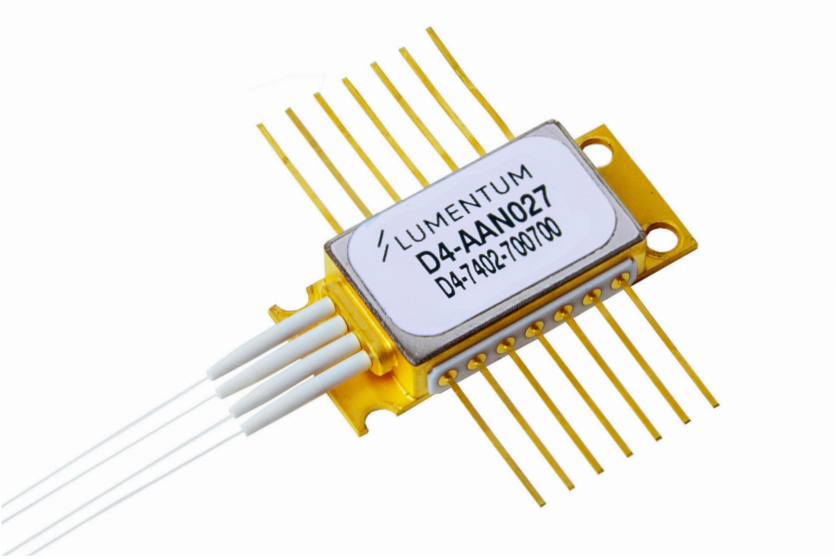
- Dense wavelength division multiplexing (DWDM) EDFAs
- High bit-rate, high channel-count EDFAs
- CATV distribution

Compliance

- Telcordia GR-468-CORE

The Lumentum D4 Series is quad-chip 980 nm pump laser module with each emitter independently controlled. It uses a number of revolutionary design steps to provide high optical power density within a compact space. The D4 series pump module incorporates the Lumentum high-reliability, high-efficiency 980 nm laser diode in a cooled fiber Bragg grating-stabilized 14-pin low profile butterfly design. The module meets the stringent requirements of the telecommunications industry, including Telcordia GR-468-CORE for hermetic 980nm pump modules.

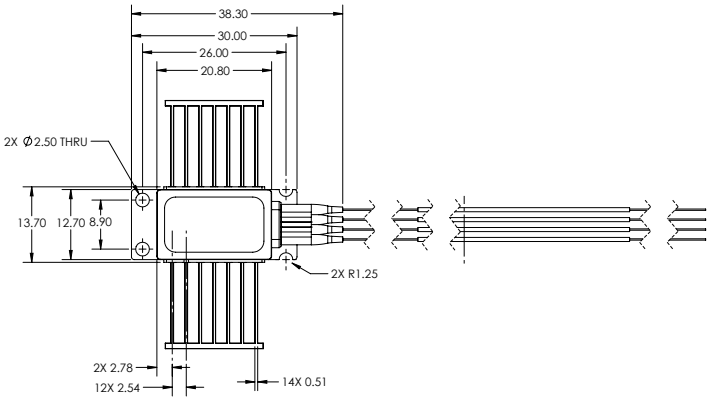
The D4 Series pump module, which uses fiber Bragg grating stabilization to lock the emission wavelength, provides a noise- free, narrowband spectrum, even under changes in temperature, drive current and optical feedback. Wavelength selection is available for applications requiring the highest performance in spectrum control with the highest power available.

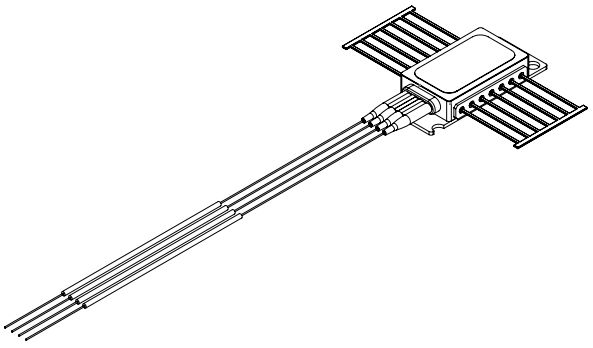


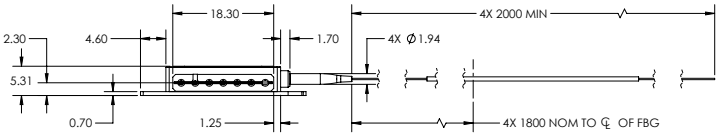
Dimensions Diagram

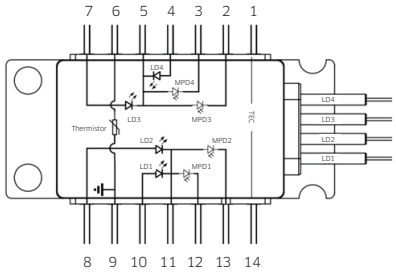
Package dimensions:

- Length (including boot and excluding pins): 38.3 mm
- Width: 40.5 mm (including uncut lead)
- Height: 5.3 mm









Pin Assigments

Pin	Description
1	TEC+
2	MPD3 CATHODE(-)
3	MPD4 CATHODE(-)
4	CH4 LD ANODE(+)
5	CH3, CH4 LD CATHODE(-) & MPD3, MPD4 ANODE (+)
6	THERMISTOR
7	CH3 LD ANODE(+)
8	CH2 LD ANODE(+)
9	THERMISTOR & CASE GROUMD
10	CH1 LD ANODE(+)
11	CH1, CH2 LD CATHODE(-) & MPD1, MPD2 ANODE (+)
12	MPD1, CATHODE (-)
13	MPD2, CATHODE (-)
14	TEC (-)

Table 1 Absolute Maximum Ratings

Parameter	Symbol	Test Conditions	Value		Unit
			Minimum	Maximum	
Operating case temperature	T_{op}		-5	+75	°C
Storage temperature	T_{stg}	2000 hrs	-40	+85	°C
Laser Operating Temperature	T_{LD}		15	60	°C
LD reverse voltage	V_r		–	2	V
D4 LD forward current	I_{f_max}	Unlimited time	–	1800	mA
D4 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}	C = 100 pF, R = 1.5 kΩ, HBM	–	1000	V
PD Electrostatic discharge (ESD)	V_{ESD}	C = 100 pF, R = 1.5 kΩ, HBM	–	500	V
TEC forward current	I_c		–	4	A
TEC reverse current	I_{rc}		-2.2	–	A
TEC voltage	V_c		–	4	V
Axial Pull Force		3X 10 sec.	–	5	N
Side Pull Force		3X 10 sec.	–	2.0	N
Fiber Bend Radius			16	–	mm
Atmospheric Pressure		Storage	11	–	kPa
Atmospheric Pressure		Operating	58	–	kPa
Relative Humidity	RH	Non-condensing	5	95	%
Lead soldering time		350°C	–	10	Sec

Absolute maximum ratings are the maximum stresses that may be applied to the module for short periods of time without causing damage. 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 of D4 Pump (T_{case} = 0°C to 75°C) for different Pop

Product Code	Maximum Operating Power (mW)		Maximum Operating Current (mA)		Minimum Kink-Free Power (mW)		Maximum Kink-Free Current (mA)	
	Low power Ports	High Power Ports	Low power Ports	High Power Ports	Low power Ports	High Power Ports	Low power Ports	High Power Ports
D4-xxxx-460460	460	460	845	845	506	506	925	925
D4-xxxx-500500	500	500	915	915	550	550	1000	1000
D4-xxxx-540540	540	540	985	985	594	594	1075	1075
D4-xxxx-600600	600	600	1085	1085	660	660	1190	1190
D4-xxxx-600660	600	660	1085	1190	660	726	1190	1310
D4-xxxx-600700	600	700	1085	1260	660	770	1190	1395
D4-xxxx-600800	600	800	1085	1455	660	880	1190	1650
D4-xxxx-650650	650	650	1175	1175	715	715	1290	1290
D4-xxxx-660660	660	660	1190	1190	726	726	1310	1310
D4-xxxx-700700	700	700	1260	1260	770	770	1395	1395
D4-xxxx-700800	700	800	1260	1455	770	880	1395	1650
D4-xxxx-720720	720	720	1300	1300	792	792	1435	1435
D4-xxxx-750750	750	750	1355	1355	825	825	1505	1505
D4-xxxx-800800	800	800	1455	1455	880	880	1650	1650

Note: xxxx denotes wavelength and tolerance per Table 3 below.

Table 3 Available Peak Wavelength Selection

Product Code	Minimum Peak Wavelength	Maximum Peak Wavelength
D4-7402-xxxxxx	973 nm	975 nm
D4-7602-xxxxxx	975 nm	977 nm

Note: xxxxxx denotes operating power per Table 2 above.

Table 4 Optical and Electrical Performance (BOL, T_{case} = -5°C to 75°C, P_f range = 30mW to P_{max})

Parameter	Symbol	Test Condition	Limits		Unit
			Minimum	Maximum	
Threshold current per port	I_{th}-BOL	–	–	100	mA
Operating forward current	I_{op}	–	–	Table 2	mA
Forward voltage	V_f	–	V_{min}	2.2	V
Fiber output power range	P_f	–	30 mW	P_{max} per Table 2	mW
Kink-free output power	P_{max}	If = I_{max}, Table 2	P_{max} per Table 2	–	mW
Center emission wavelength	λ_m	Over P_f range,	Table 3		nm
Power in pump band	P_{pump}	Pump band = λm ±1.5 nm, 60 mW <Pop<P_{max}	90	–	%
Power in pump band	P_{pump}	Pump band = λm ±1.5 nm, 30 <Pop<60 mW	80	–	%
Spectral width	$\Delta\lambda_{RMS}$	CW, over P_f range,	–	2.0	nm
Wavelength tuning vs. temperature	Δλ/T	$I_f = I_{op}$	0	0.01	nm/°C
Laser diode 10%-90% rise/fall time	t_r / t_f	Step response	–	100	ns
Return loss	RL	1480 – 1620 nm	–	9	dB
Optical power cross talk	–	Over P_f and T_{case} range	–	1	mW
Thermal cross talk	–	Over P_f and T_{case} range	–	3	°C/A
Monitor diode response per LD	I_{BF}	Over P_{op} range	0.2	10	µA/mW
LD operating temperature	t_{LD}	45°C, nominal	43	47	°C
Thermistor resistance	R_{th}	T_{set} = 45°C	9.5	10.5	kΩ
Thermistor Constant	T_{LD}	–	3700	4100	K
TEC current	TECI	T_{case} -5 to 75C	–	2.49	A
TEC voltage	TECV	T_{case} -5 to 75C	–	3.02	V

Table 5 Total Module Power Consumption at T_{LD} = 45°C (BOL/EOL, T_{CASE} = -5 to 75°C)

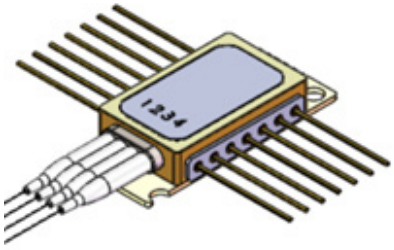
Product Code	TEC Current (A) BOL/EOL	TEC Voltage (V) BOL/EOL	TEC Power Consumption (W) BOL/EOL	Total Module Power Consumption (W) BOL/EOL
D4-xxxx-460460	1.73/1.78	2.27/2.33	3.6/3.8	8.8/9.6 (Typ. 7.7/8.3)
D4-xxxx-500500	1.77/1.84	2.32/2.39	3.8/4.1	9.5/10.4 (Typ. 8.2/9.0)
D4-xxxx-540540	1.83/1.90	2.38/2.45	4.0/4.3	10.2/11.2 (Typ. 8.8/9.7)
D4-xxxx-600600	1.91/2.00	2.45/2.55	4.3/4.7	11.4/12.6 (Typ. 9.8/10.7)
D4-xxxx-600660	1.96/2.07	2.51/2.61	4.6/4.9	12.1/13.4 (Typ. 10.3/11.4)
D4-xxxx-600700	2.00/2.11	2.54/2.66	4.7/5.2	12.5/14.0 (Typ. 10.7/11.8)
D4-xxxx-600800	2.11/2.27	2.65/2.81	5.2/5.9	14.0/16.0 (Typ. 11.7/13.2)
D4-xxxx-650650	1.99/2.09	2.53/2.64	4.6/5.1	12.4/13.8 (Typ. 10.6/11.7)
D4-xxxx-660660	2.00/2.11	2.55/2.65	4.7/5.1	12.6/14.0 (Typ. 10.7/11.9)
D4-xxxx-700700	2.07/2.20	2.61/2.74	5.0/5.5	13.4/15.1 (Typ. 11.4/12.7)
D4-xxxx-700800	2.18/2.36	2.72/2.90	5.5/6.3	14.9/17.1 (Typ. 12.5/14.1)
D4-xxxx-720720	2.10/2.25	2.64/2.79	5.1/5.8	13.9/15.7 (Typ. 11.8/13.2)
D4-xxxx-750750	2.16/2.33	2.70/2.87	5.3/6.1	14.6/16.7 (Typ. 12.3/13.9)
D4-xxxx-800800	2.27/2.49	2.81/3.02	5.8/6.8	16.0/18.7 (Typ. 13.3/15.2)

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 ±0.5 µm

Package Label

LD1 to LD4 ports are marked as shown.



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 heat sinking and proper mounting of this device is required to ensure specified performance over its operating life.

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

Laser Safety

The Lumentum pump laser module emits hazardous invisible laser radiation.

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

Laser classification for the system depends on the system control circuit and any laser safety features provided.

This diode-pumped laser module is not 21CFR 1040.10 or IEC 60825-1: 2014 certified. It is a component intended for system integration.

Compliance with 21CFR 1040.10 and/or IEC 60825-1:2014 will need to be determined at the system level.

Lumentum has registered this laser with the FDA/CDRH as an

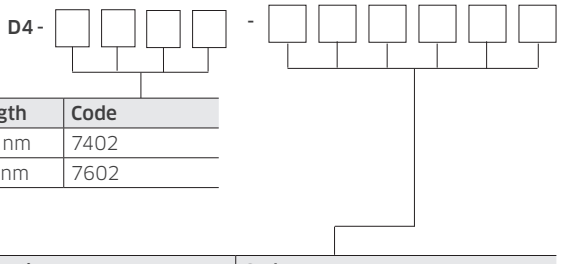
OEM laser component. Please contact Lumentum for an FDA/CDRH accession number for this laser component.

Packaging Labeling

Laser radiation safety warning Laser classification per IEC 60825-1:2014
Maximum output power 2W per port

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.



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

Maximum Operating Power	Code
460mW / 460mW / 460mW / 460mW	460460
500mW / 500mW / 500mW / 500mW	500500
540mW / 540mW / 540mW / 540mW	540540
600mW / 600mW / 600mW / 600mW	600600
660mW / 600mW / 600mW / 660mW	600660
700mW / 600mW / 600mW / 700mW	600700
800mW / 600mW / 600mW / 800mW	600800
650mW / 650mW / 650mW / 650mW	650650
660mW / 660mW / 660mW / 660mW	660660
700mW / 700mW / 700mW / 700mW	700700
800mW / 700mW / 700mW / 800mW	700800
720mW / 720mW / 720mW / 720mW	720720
750mW / 750mW / 750mW / 750mW	750750
800mW / 800mW / 800mW / 800mW	800800

LUMENTUM

North America
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