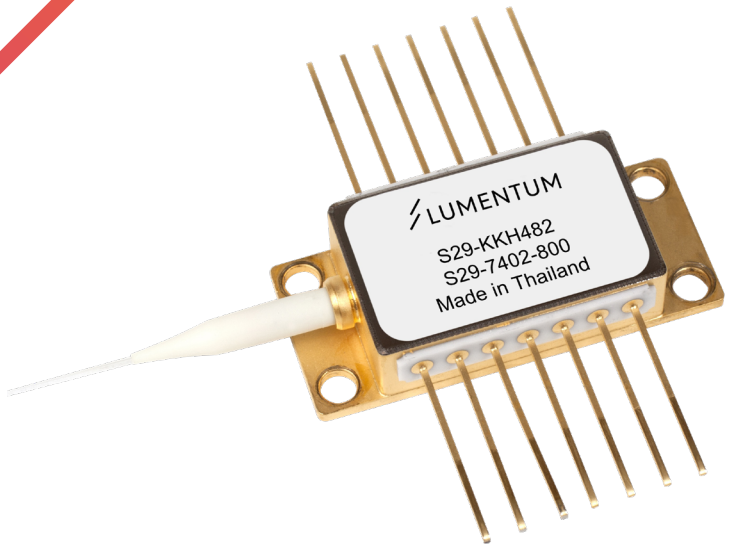
LUMENTUM

Up to 800 mW Fiber Bragg Grating Stabilized 980 nm Pump Modules with Low-Power Consumption

S29 Series



The Lumentum S29 Series 980 nm 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 significantly reduces TEC and overall power consumption. The module meets the stringent telecommunications industry requirements, including Telcordia GR-468-CORE for hermetic 980 nm pump modules.

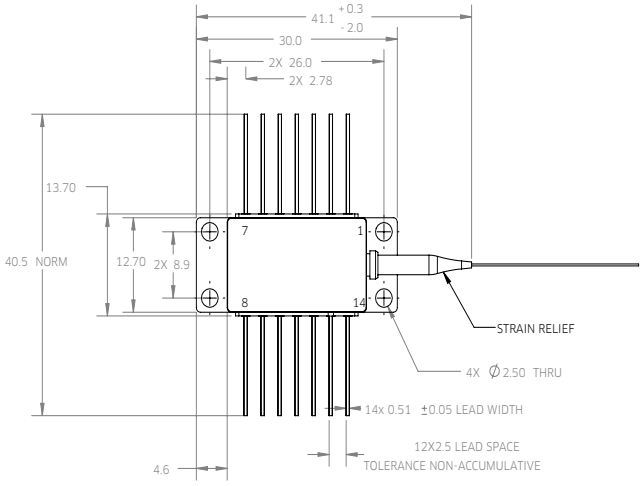
The S29 Series pump module, which uses fiber Bragg grating stabilization to lock the emission wavelength, provides a noise-free, narrowband spectrum, even under changes in temperature, drive current and optical feedback. Wavelength selection is available for applications requiring the highest performance in spectrum control with the highest power available.

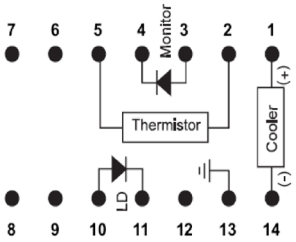
Key Features
- Operating power range from 400 – 800 mW
- Reduced TEC power consumption
- Low-profile 14-PIN butterfly package
- Fiber Bragg grating stabilization
- Wavelength selection available
- Integrated thermoelectric cooler, thermistor, and monitor diode
- High dynamic range
- Excellent low-power stability

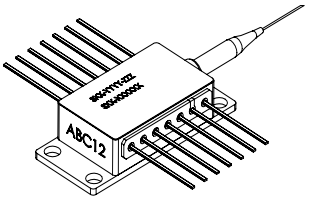
Applications
- Dense wavelength division multiplexing (DWDM) EDFAs
- High bit-rate, high channel-count EDFAs
- CATV distribution

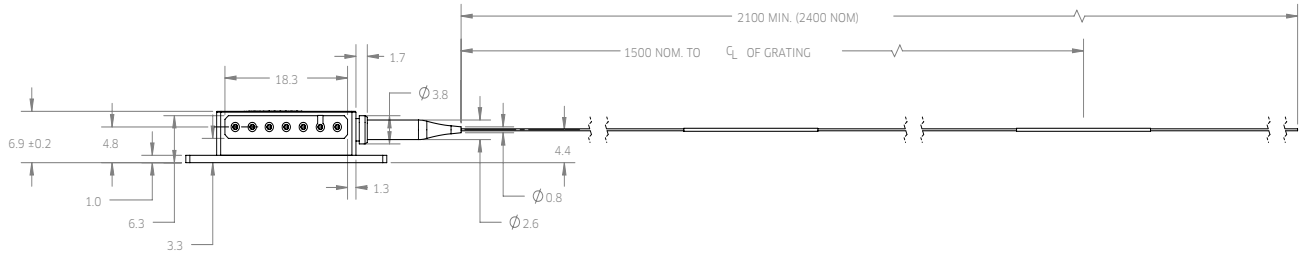
Compliance
- Telcordia GR-468-CORE

Dimensions Diagram









Pin Assignments

Pin	Description
1	Cooler (+)
2	Thermistor
3	Monitor PD anode
4	Monitor PD cathode
5	Thermistor
6	N/C
7	N/C
8	N/C
9	N/C
10	Laser anode
11	Laser cathode
12	N/C
13	Case ground
14	Cooler (–)

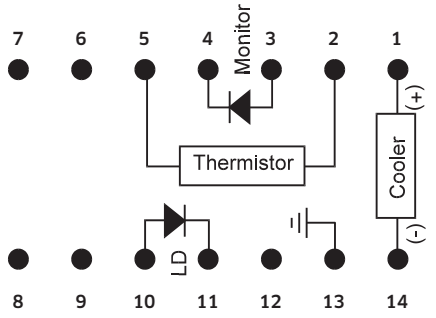


Table 1 Absolute Maximum Ratings

Parameter	Symbol	Test Condition	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}		–5°C	50°C
LD reverse voltage	V_r			2 V
LD forward current	I_{f_max}			1750 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}		-1.4 A	4A
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)
S29-xxxx-400	400	760	440	830
S29-xxxx-420	420	795	462	870
S29-xxxx-440	440	830	484	910
S29-xxxx-460	460	865	506	950
S29-xxxx-480	480	900	528	990
S29-xxxx-500	500	940	550	1030
S29-xxxx-520	520	975	572	1070
S29-xxxx-540	540	1010	594	1110
S29-xxxx-560	560	1050	616	1150
S29-xxxx-580	580	1085	638	1190
S29-xxxx-600	600	1120	660	1230
S29-xxxx-620	620	1155	682	1275
S29-xxxx-640	640	1195	704	1320
S29-xxxx-660	660	1235	726	1370
S29-xxxx-680	680	1270	748	1420
S29-xxxx-700	700	1315	770	1445
S29-xxxx-720	720	1355	792	1470
S29-xxxx-740	740	1400	814	1500
S29-xxxx-760	760	1445	836	1550
S29-xxxx-780	780	1475	858	1590
S29-xxxx-800	800	1500	880	1655

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
S29-7402-yyy	973.0 nm	975.0 nm
S29-7602-yyy	975.0 nm	977.0 nm
S29-8000-yyy	973.0 nm	981.5 nm

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

Table 4 Electro-Optical Performance[1]

Parameter	Symbol	Test Condition	Minimum	Maximum
Threshold current	$I_{th\text{-}BOL}$			100 mA
Forward voltage	V_f	$I_f = I_{op}$		2.1 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	ΔP_{f_t}	Over P_f range, DC to –50 kHz, 50 mW - P_{op}		2.0%
Tracking ratio[2]	TR	$0.1P_{op} < P_f < P_{op}$	0.60	1.40
Tracking error[3]	TE	P_{op}	–40%	40%
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} = 45°C	44°C	46°C
Thermistor resistance	R_{th}	T_{set} = 25°C T_{set} = 45°C T_{set} = 45°C for S29-8000-yyy	9.5 kΩ 4.1 kΩ 3.8 kΩ	10.5 kΩ 4.7 kΩ 5.1 kΩ

Note:
1. BOL, T_{case} = –5°C to 75°C, T_{LD} = 45°C, Pf = 30 mW to Pmax, –50 dB reflection, MPD with –5 V bias, unless otherwise noted
2. 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.
3. 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[1]

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)
S29-xxxx-400	0.96	1.25	1.11	2.4
S29-xxxx-420	0.97	1.26	1.13	2.4
S29-xxxx-440	0.98	1.27	1.15	2.5
S29-xxxx-460	0.99	1.29	1.18	2.6
S29-xxxx-480	1.01	1.30	1.20	2.7
S29-xxxx-500	1.02	1.31	1.22	2.8
S29-xxxx-520	1.03	1.32	1.25	2.8
S29-xxxx-540	1.04	1.33	1.28	2.9
S29-xxxx-560	1.06	1.34	1.30	3.0
S29-xxxx-580	1.07	1.35	1.33	3.1
S29-xxxx-600	1.08	1.36	1.35	3.2
S29-xxxx-620	1.10	1.38	1.39	3.3
S29-xxxx-640	1.12	1.40	1.43	3.4
S29-xxxx-660	1.13	1.42	1.46	3.5
S29-xxxx-680	1.15	1.43	1.50	3.6
S29-xxxx-700	1.17	1.45	1.54	3.8
S29-xxxx-720	1.19	1.47	1.58	3.9
S29-xxxx-740	1.21	1.49	1.62	4.0
S29-xxxx-760	1.23	1.51	1.67	4.2
S29-xxxx-780	1.26	1.53	1.71	4.3
S29-xxxx-800	1.28	1.55	1.77	4.4

Note:
1. BOL, ΔT = 30°C, T_{case} = 75°C, $_{TLD}$ = 45°C

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.

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

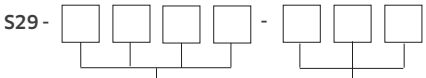
The Lumentum pump laser module emits hazardous invisible laser radiation. Due to the small size of the pump module, the box packaging is labeled with the laser radiation hazard symbol and safety warning labels shown below.

14-pin module 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.



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
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
720 mW	720
740 mW	740
760 mW	760
780 mW	780
800 mW	800

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