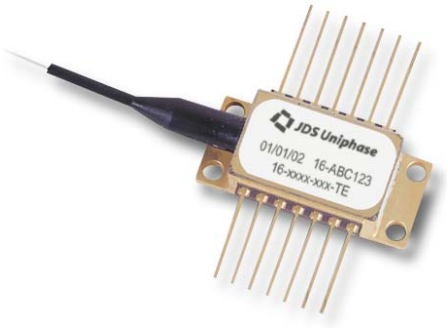
JDS Uniphase

Product Bulletin



High Power 960 nm Pump Modules for L-band EDFAs

1600-TE Series

The JDS Uniphase 1600 Series is a new product line of 960 nm pump modules for use in L-band EDFAs in both long haul and metropolitan area fiber networks. These pumps can be applied in wideband EDFAs in a dense wavelength division multiplexing (DWDM) fiber optic network. They can also be used in a L-band, single channel or low channel count, narrow band erbium doped fiber amplet.

These 300 mW 960 nm pump modules offer the most cost effective and highly efficient solutions for L-band EDFAs. The combination of pump efficiency at 960 nm in a L-band EDFA, high optical output power, low noise figure, and low heat dissipation, enables these pump modules to meet the performance and cost requirements for all of the L-band applications.

The 1600 Series 960 nm pump modules integrate the state-of-the-art 6540 chip technologies and fiber Bragg technologies, deliver very high optical power, warrant superior reliability, ensure rock solid wavelength stability and provide superior wall plug efficiency.

The 1600-TE Series design also offers tight tracking of fiber-coupled power via the monitor diode signal.

Key Features

- Wavelength range: 957 to 970 nm
- High kink-free powers to 300 mW
- Maximum total power consumption of only 5.5 W
- Low-profile, epoxy-free, and flux-free 14-PIN butterfly planar package
- Fiber Bragg grating stabilized
- Wavelength selection available
- Tight tracking of fiber-coupled power
- Integrated thermoelectric cooler, thermistor, and monitor diode
- High dynamic range
- Excellent low power stability

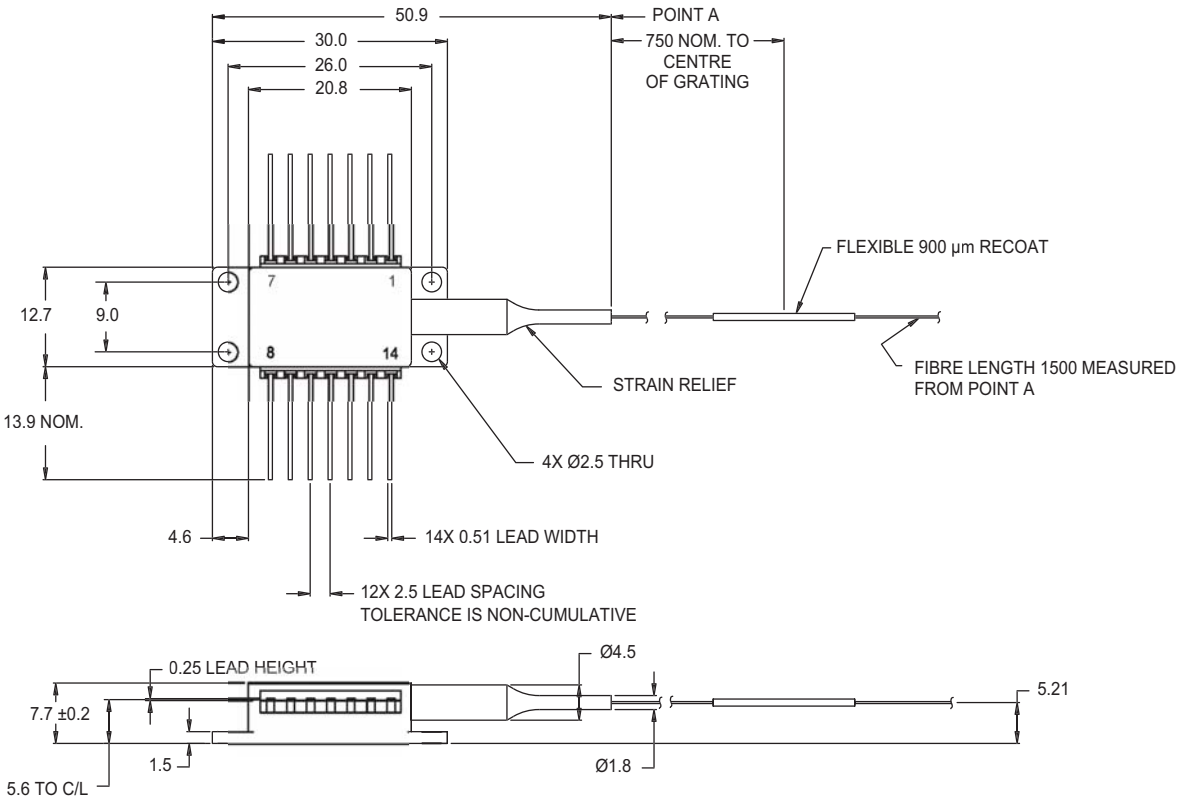
Applications

- Next generation, L-band erbium doped fiber amplifiers (EDFAs) that require low heat dissipation and high pump efficiency

Compliance

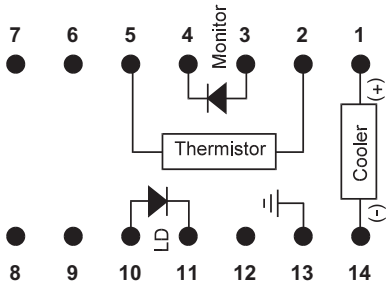
- Telcordia™ GR-468-CORE

Dimensions Diagram 250 µm Bare Fiber Type A Wiring (Specifications in mm unless otherwise noted.)



Note: The module pigtail consists of 250 µm buffered, Corning PureMode™ HI-1060 Single-mode fiber.

Pinout



Pinout

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}	-	-20 °C	75 °C
Storage temperature	T_{stg}	2000 hours	-40 °C	85 °C
LD submount temperature	T_{LD}	-	0 °C	50 °C
LD reverse voltage	V_r	-	-	2 V
LD forward current		-	-	650 mA
LD current transient		1 µs maximum	-	950 mA
LD reverse current		-	-	10 µA
PD reverse voltage	V_{PD}	-	-	20 V
PD forward current	I_{PD}	-	-	10 mA
Electrostatic discharge (ESD)	V_{ESD}	C = 100 pF, R = 1.5 Ω, human body model	-	1000 V
TEC current	I_{TEC}	-	-	2.5 A
TEC voltage	V_{TEC}	-	-	4.0 V
Axial pull force		3 x 10 seconds	-	5 N
Side pull force		3 x 10 seconds	-	2.5 N
Fiber bend radius		-	16 mm	-
Relative humidity	R_H	40 °C	5%	95%
Lead soldering time		260 °C	-	10 seconds

Note: Absolute maximum ratings are the maximum stresses that may be applied to the pump module for short periods of time without causing damage. Stresses in excess of the absolute maximum ratings can permanently damage the device. Exposure to absolute maximum ratings for extended periods, or exposure to more than one absolute maximum rating simultaneously may adversely affect device reliability.

Table 2: Operating Parameters (BOL, T_{case} = 0 to 75 °C, T_{LD} = 25 °C, -50 dB reflection, unless noted otherwise)

Product Code	Maximum Operating Power P_{op} (mW)[1,3]	Maximum Operating Current I_{op} (mA)	Minimum Kink-Free Power P_{max} (mW)[2]	Kink-Free Current I_{max} (mA)[3]
		Maximum[1]		Maximum[2]
16-xxxx-180-TE	160	340	180	380
16-xxxx-190-TE	170	360	190	400
16-xxxx-200-TE	180	380	200	420
16-xxxx-210-TE	190	400	210	440
16-xxxx-220-TE	200	420	220	460
16-xxxx-230-TE	210	440	230	480
16-xxxx-240-TE	220	460	240	500
16-xxxx-250-TE	230	480	250	520
16-xxxx-260-TE	240	500	260	540
16-xxxx-270-TE	250	520	270	560
16-xxxx-280-TE	260	540	280	580
16-xxxx-290-TE	270	560	290	600
16-xxxx-300-TE	280	560	300	600

1: The *maximum operating power* P_{op} will be achieved at a device-specific current, the *maximum operating current* I_{op}. The individual value of I_{op} is noted on the hardcopy data sheet shipped with the device. All values of I_{op} are limited by the maximum value listed in Table 2.

2: The module is kink-free (at least) up to a *minimum kink-free power* P_{max} that the module will achieve at a device-specific current, the *kink-free current* I_{max}. The individual value of I_{max} is noted on the hardcopy data sheet shipped with the device. All values of I_{max} are limited by the maximum value listed in Table 2.

3: The pump laser shall never be operated at a power higher than the *maximum operating power* P_{op} throughout its lifetime. At *Begin of Life* (BOL), the operating current shall never be higher than the device-specific *maximum operating current* I_{op} that is noted on the hardcopy data sheet shipped with the device. At *End of Life* (EOL), the operating current shall never be higher than the device-specific *kink-free current* I_{max} that is noted on the hardcopy data sheet shipped with the device.

Table 3: Available Peak Wavelength Selection (T_{amb} = 25 ±3 °C, 50 mW < P < P_{op})

Product Code	Minimum Peak Wavelength	Maximum Peak Wavelength
16-6002-xxx-TE	959.0 nm	961.0 nm
16-6402-xxx-TE	963.0 nm	965.0 nm
16-6902-xxx-TE	968.0 nm	970.0 nm

Table 4: Electro-Optical Performance (BOL, T_{case} = 0 to 75 °C, T_{LD} = 25 °C, -50 dB reflection, unless noted otherwise)

Parameter	Symbol	Test Condition	Minimum	Maximum
Threshold current	I_{th}	-	-	25 mA
Forward voltage	V_f	$I_f = I_{op}$	-	2.5 V
Spectral width	$\Delta\lambda_{RMS}$	50 mW < P < P_{op}	-	2.0 nm
Peak wavelength tuning	$\Delta\lambda_P/\Delta T_{amb}$	50 mW < P < P_{op}	-	0.02 nm/°C
Side-mode suppression ratio	SMSR	50 mW < P < P_{op}	15 dB	-
Relative optical power stability		Peak-to-peak, T = 10 min, 50 kHz sampling, T_{case} = 25 °C 20 mW < P < P_{op} 12 mW < P < 20 mW 3.5 mW < P < 12 mW	 - - -	 4% 10% 25%
Tracking error	TE	20 mW < P < P_{op} [1]	-8%	8%
Tracking ratio	TR	20 mW < P < P_{op} [2]	0.90	1.10
Monitor diode responsivity	$Resp_{BF}$	20 mW < P < P_{op}	2 µA/mW	10 µA/mW
TEC current	I_{TEC}	T_{case} = 75 °C	-	1.5 A
TEC voltage	V_{TEC}	T_{case} = 75 °C	-	2.5 V
Thermistor resistance	R_{th}	-	9.5 kΩ	10.5 kΩ
Thermistor constant	B	-	3600 K	4200 K
Module power consumption		T_{case} = 75 °C	-	4.5 W
Module power consumption		T_{case} = 75 °C, EOL	-	5.5 W

1. The Tracking Error is defined as the normalized change of output power relative to the operating power over case temperature range 0°C to 75°C, at constant back face monitor current corresponding to the operating power at 25°C.

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 (20 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.

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 .001" and the mounting screws must be torqued down to 1.5 in.-lb.

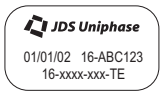
ESD PROTECTION — Electrostatic discharge (ESD) is the primary cause of unexpected laser diode failure. Take extreme precaution to prevent ESD. Use wrist straps, grounded work surfaces, and rigorous antistatic techniques when handling laser diodes.

Labeling

21 CFR 1040.10 Compliance

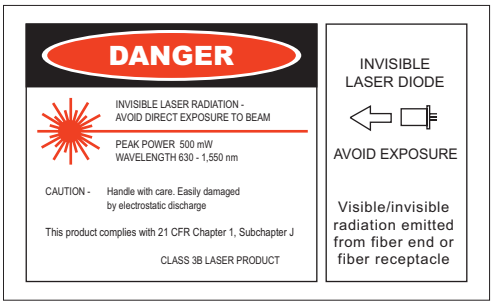
Because of the small size of these devices, the output power and laser emission indicator label shown below is attached to the individual shipping container. All labels are illustrated here to comply with 21 CFR 1040.10 as applicable under the Radiations Control for Health and Safety Act of 1968.

14-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 JDS Uniphase account manager or JDS Uniphase directly at 1-800-498-JDSU (5378) in North America and +800-5378-JDSU worldwide or via e-mail at sales@jdsu.com.

16-xxxx-xxx-TE

- **Minimum Kink Free Power (see Table 2)**
- **Peak Wavelength (see Table 3)**

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