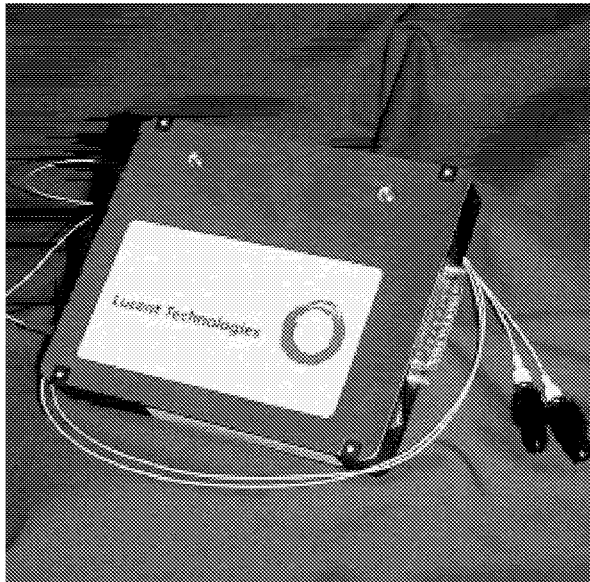




Optical Amplifier Platform, 1724-Type Erbium-Doped Fiber Amplifier (S and V Series)



Designed for use in single-channel or video applications, the standard 1724-Type EDFA incorporates a DB-25 connector and a microcontroller with TTL compatible alarm monitoring.

Features

- High saturation output power, >22 dBm
- Low power consumption, <12 W @ 45 °C
- Low noise
- Single 5 V operation
- Wide input signal bandwidth
- Wide operating temperature range, 0 °C to 65 °C
- Optical input and output taps
- Isolated input and output
- Programmable input and output
- Connectorized single-mode fiber pigtail
- Standard serial communication channels

Applications

- Designed for a variety of applications:
 - S Series: single channel
 - V Series: video
- Booster/power amplifier
- Line amplifier
- Pre-amplifier

Description

The 1724-Type Erbium-Doped Fiber Amplifier (EDFA) has been designed for use in a variety of applications and is available in application-specific versions:

- S Series for single-channel, preamplifier applications (see Table 5, page 6, for performance specifications)
 - High gain
 - Low noise figure
- V Series for video, analog, or booster applications (see Table 6, page 6, for performance specifications)
 - Supports a wide range of output powers
 - Low noise figure
 - Low power dissipation
 - Adjustable output power

Description (continued)

The versatile 1724-Type EDFA operates over a wide temperature range, exhibits extremely low power dissipation, and offers a variety of alarms and monitors. Optimum performance and system stability are supported through the use of optical isolation at the input and output. Optical input and output are through single-mode fiber pigtails terminated with optical connectors.

The EDFA incorporates optical input and output taps that are monitored via an integral microcontroller. Significant performance benefits are achieved with the microcontroller, which stabilizes the temperature of the pumps and maintains constant optical output power or gain.

Contact your Lucent Technologies Microelectronics Group Account Manager to discuss electrical or optical connector options not listed in the Ordering Information section.

Standard Features

The standard 1724-Type EDFA incorporates the optical architecture illustrated in Figure 1. The standard features include:

- Exceptional performance benefits with the integral microcontroller, which precisely controls the output power and allows for changes to power settings as necessary.
- Single 5 V power supply eliminates the need for dual voltage source circuits.
- DB-25 electrical connector allows for easy electrical connectivity.
- Optical input tap enables input monitoring and control.
- Optical output tap enables precise output monitoring and control and, when used in conjunction with the microcontroller, typically provides 0.2 dB of output power stability over temperature and wavelength.
- SC/PC optical connector
- Low power dissipation

- Alarms:
 - Loss of input power alarm
 - Loss of output power alarm
 - Pump bias alarm (>95% of EOL value)
 - Pump temperature alarm ($T_L > 35\text{ }^\circ\text{C}$)
 - EDFA temperature alarm ($T_c > 60\text{ }^\circ\text{C}$)
- Advanced microprocessor design requires minimal engineering for a shelf-level product.
- Standard mechanical outline includes metric screws and fiber outputs (using SC/PC optical connectors) at 180 degrees relative to a DB25 electrical connector. The standard product does not include a heat sink.

TTL-Compatible Alarm Outputs

Loss of Input Power Alarm

If the input power is more than 2 dBm below the minimum P_{IN} , the loss of input power alarm (pin 19) will activate (TTL-logic 1).

Loss of Output Power Alarm

If the output power decreases by more than 2 dB from its beginning-of-life value, the loss of output power alarm (pin 8) will activate (TTL-logic 1).

Pumps Temperature Alarm

If the laser temperature for the pump(s) exceeds $35\text{ }^\circ\text{C}$, the pump temperature alarm (pin 10) will activate (TTL-logic 1).

Pumps Bias Alarm

If the bias current for the pump(s) exceeds 95% of its EOL value, the pump bias alarm (pin 9) will activate (TTL-logic 1).

EDFA Temperature Alarm

If the case temperature exceeds $60\text{ }^\circ\text{C}$, then the EDFA temperature alarm (pin 7) will activate (TTL-logic 1).

Optional Features

Other feature and package options for the 1724-Type EDFA include:

- Multiple optical outputs available:
 - 4 @ 16 dBm
 - 8 @ 13 dBm

- Alternative optical connectors
- Integral heat sink
- Gain block version

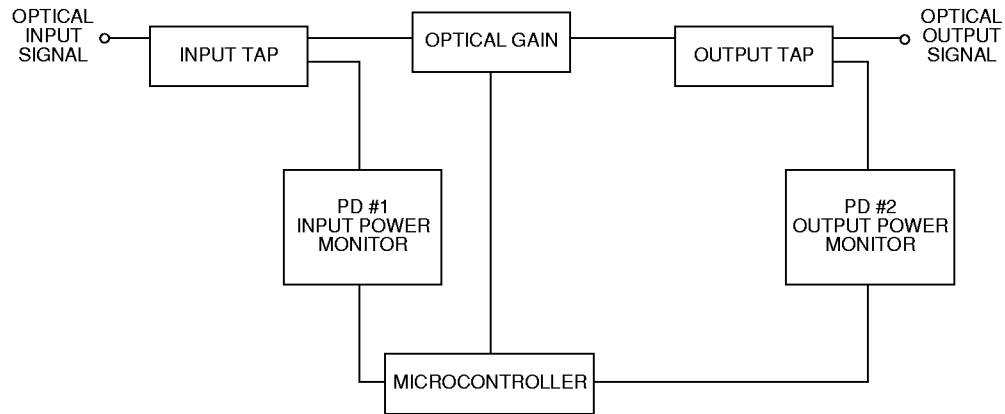


Figure 1. 1724-Type EDFA Block Diagram

1-904 (C)

Pin Information

Table 1. Pin Descriptions for a Microcontrolled (Full) Amplifier

Pin	Description	Pin	Description
1	5.0 V (± 0.25 V)	14	GND
2	5.0 V (± 0.25 V)	15	GND
3	5.0 V (± 0.25 V)	16	GND
4	5.0 V (± 0.25 V)	17	GND
5	Reserved ¹	18	RS-232 OUT (TTL)
6	Reserved ¹	19	Loss of Input Power Alarm ⁶
7	EDFA Temperature Alarm	20	Reserved ¹
8	Loss of Output Power Alarm ²	21	Amplifier Disable Input ⁷
9	Pumps Bias Alarm ³	22	RS-232 IN (TTL)
10	Pumps Temperature Alarm ⁴	23	Reserved ¹
11	EDFA Shutdown Override ⁵	24	5.0 V (± 0.25 V)
12	5.0 V (± 0.25 V)	25	GND
13	GND	—	—

1. Do not connect to reserved pins.

2. Normal = TTL low, alarm = TTL high if the output power falls below 2 dB the minimum value.

3. Normal = TTL low, alarm = TTL high if pump bias exceeds 95% of its end-of-life value.

4. Normal = TTL low, alarm = TTL high if pump temperature exceeds 35 °C.

5. The EDFA is equipped with an optical transient suppression feature when this pin is tied to GND. The EDFA will turn all pumps off, if the input power is too low. Tying this pin to 5 V will disable this feature; however, damage to the optical connectors and components may occur if the amplifier is turned on without the presence of an optical signal.

6. Normal = TTL low, alarm = TTL high if input power is less than 2 dB below minimum P_{IN}.

7. Amplifier enable (all pumps are on) = TTL low, amplifier disable (all pumps are off) = TTL high.

Pin Information (continued)

Table 2. Pin Descriptions for Gain Block Version

Pin	Description	Pin	Description
1	LD2—TEC POS	14	LD2—TEC NEG
2	LD2—Laser Cathode	15	LD2—Back-facet Anode
3	Output Tap—Anode	16	LD2—Thermistor (–)
4	Output Tap—Cathode	17	Thermistor Common, Laser Anode Common, EDFA Case
5	LD1—Thermistor (–)	18	Thermistor Common, Laser Anode Common, EDFA Case
6	LD1—Laser Cathode	19	Thermistor Common, Laser Anode Common, EDFA Case
7	Input Tap—Anode	20	LD1—Back-facet Cathode
8	LD1—TEC NEG	21	LD2—Back-facet Cathode
9	Input Tap—Cathode	22	LD3—Back-facet Cathode
10	LD1—TEC POS	23	LD3—Thermistor (–)
11	LD1—Back-facet Anode	24	LD3—Back-facet Anode
12	LD3—Laser Cathode	25	LD3—TEC POS
13	LD3—TEC NEG	—	—

Absolute Maximum Ratings

Stresses in excess of the absolute maximum ratings can cause permanent damage to the device. These are absolute stress ratings only. Functional operation of the device is not implied at these or any other conditions in excess of those given in the operational sections of the data sheet. Exposure to absolute maximum ratings for extended periods can adversely affect device reliability.

Parameter	Symbol	Min	Typ	Max	Unit
Storage Temperature	T _{stg}	–40	20	70	°C
Operating Case Temperature	T _c	0	35	65	°C
Absolute Humidity	—	—	—	0.024	lbs. H ₂ O/lbs. dry air

Electrical Characteristics

Table 3. Power Supply

Parameter	Symbol	Min	Typ*	Max	Unit
dc Power Supply Voltage	V_{PS1}	4.75	5.0	5.25	V
Power Supply Current (beginning of life):					
≤ 19 dBm	I_{PS1}	—	1.0	—	A
≤ 22 dBm	I_{PS1}	—	2.4	—	A
Power Supply Current (end of life):					
≤ 19 dBm	I_{PS1}	—	—	1.9	A
≤ 22 dBm	I_{PS1}	—	—	3.8	A
Electrical Power Consumption (beginning of life):					
≤ 19 dBm	—	—	5.0	—	W
≤ 22 dBm	—	—	12.0	—	W
Electrical Power Consumption (end of life):					
≤ 19 dBm	—	—	—	10.0	W
≤ 22 dBm	—	—	—	20.0	W

* Typical operating characteristics: $V_{PS1} = 5.0$ V, $T_C = 35$ °C.

Table 4. TTL Inputs/Outputs

Under normal operating conditions, the various alarm outputs will be TTL level low. If the corresponding parameter is outside a predesignated range, the associated alarms will become TTL level high.

Parameter	Symbol	Min	Typ	Max	Unit
Input Voltage:					
High	V_{IH}	2	—	—	V
Low	V_{IL}	—	—	0.8	V
Output Voltage:					
High	V_{OH}	2.4	—	—	V
Low	V_{OL}	0	0.1	0.4	V
Input Current:					
High	I_{IH}	—	—	-1	μ A
Low	I_{IL}	—	—	1	μ A
Output Current:					
High	I_{OH}	—	—	-4	mA
Low	I_{OL}	—	—	20	μ A

Optical Characteristics

Table 5. Performance Specifications for S Series

Parameter	Symbol	Min	Typ	Max	Unit
Signal Wavelength Range	λ_L	1530	—	1560	nm
Measurement Wavelength	λ_M	—	1550	—	nm
Input Signal Power:					
Preamp—S1724A-Type	P_{IL}	-30	—	—	dBm
Booster/In Line—S1724B/C/D-Types	P_{IL}	-6.0	—	—	dBm
Gain ($P_{IL} = -30$ dBm):					
Preamp—S1724A-Type	G	30	—	—	dB
Peak Output Power ($T_C = 35$ °C; over λ_M):					
Booster/In Line—S1724B-Type		13	—	—	dBm
—S1724C-Type		16	—	—	dBm
—S1724D-Type		19	—	—	dBm
Noise Figure:					
Preamp—S1724A-Type ($P_{IL} = -30$ dBm; λ_M)	NF	—	—	5.0	dB
Booster/In Line—S1724B/C/D-Types ($P_{IL} = -6.0$ dBm; λ_M)	NF	—	—	5.5	dB
Return Loss	RL	—	—	-40	dB
Output Power Stability (over temperature, at a constant input power)	ΔP_O	—	± 0.2	± 0.5	dB

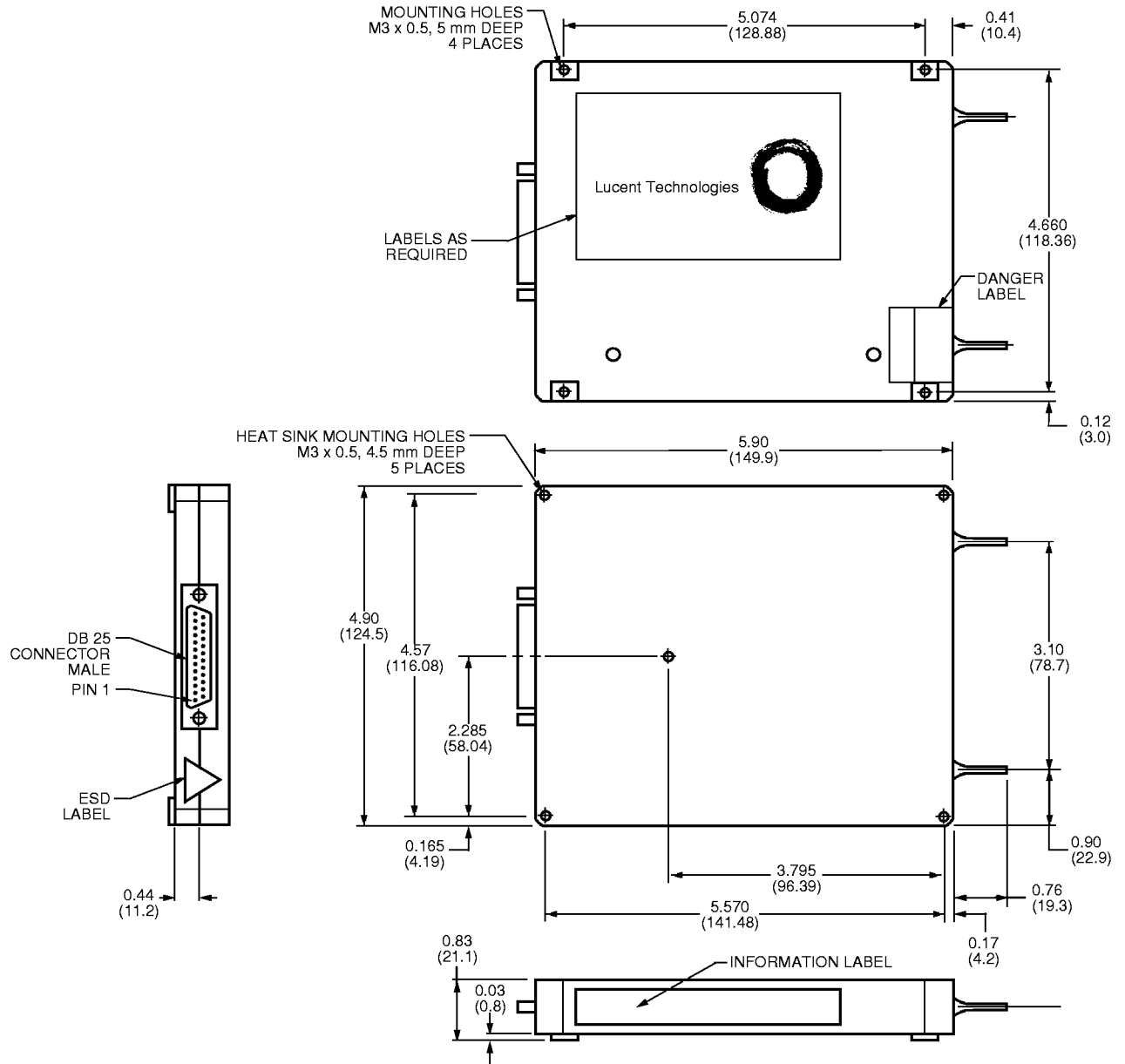
Table 6. Performance Specifications for V Series

Parameter	Symbol	Min	Typ	Max	Unit
Signal Wavelength Range	λ_L	1540	—	1560	nm
Measurement Wavelength	λ_M	—	1550	—	nm
Input Signal Power	P_{IL}	0	—	10	dBm
Peak Output Power (at λ_M and $T_C = 35$ °C):					
V1724B-Type	P_O	13	—	—	dBm
V1724C-Type	P_O	16	—	—	dBm
V1724D-Type	P_O	19	—	—	dBm
V1724E-Type	P_O	22	—	—	dBm
Noise Figure ($P_{IL} = 0$ dBm, λ_M)	NF	—	4.75	5.5	dB
Return Loss	RL	—	—	-40	dB
Composite Second Order	CSO	—	< -70	—	dBc
Composite Third Beat	CTB	—	< -70	—	dBc
Output Power Stability (over temperature and input power variations)	ΔP_O	—	± 0.2	± 0.5	dB

Outline Drawings

1724-Type EDFA Package

Dimensions are in inches and (millimeters).

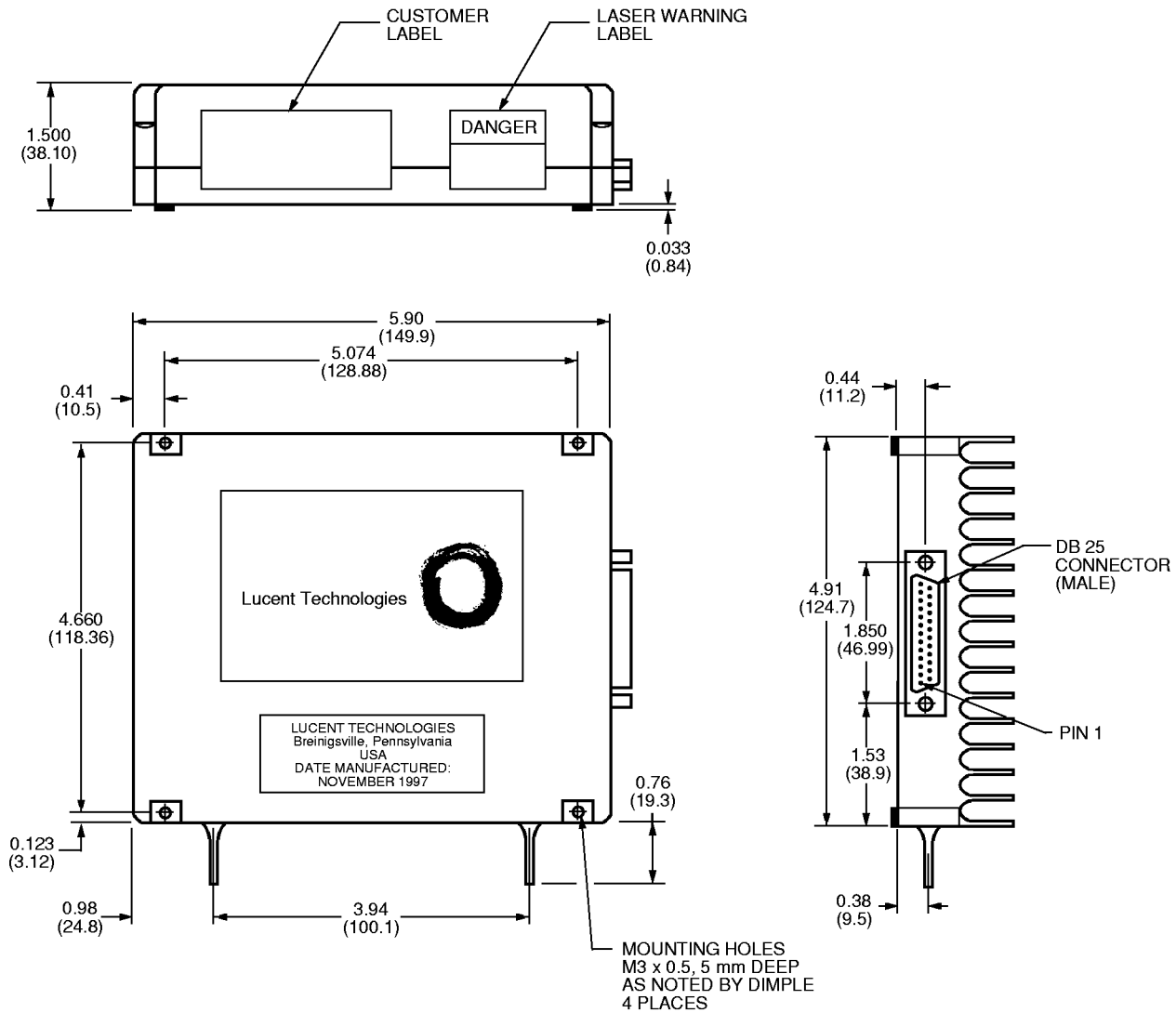


1-997(C)

Outline Drawings (continued)

Optional Package Configuration: 1724-Type EDFA Package with Integral Heat Sink

Dimensions are in inches and (millimeters).



1-998(C)

Ordering Information

Table 7. Ordering Information*

Device Code	Connector	Po	Comcode
V1724BBBA	SC/PC	13.0 dBm	108331547
V1724CBBA	SC/PC	16.0 dBm	108331554
V1724DBBA	SC/PC	19.0 dBm	108331562
V1724EBBA	SC/PC	22.0 dBm	108331984
S1724CDBA	FC/PC	16.0 dBm	108313727
S1724DDBA	FC/PC	19.0 dBm	108319088
V1724DHBA	SC/APC	19.0 dBm	108351842
V1724EHBA	SC/APC	22.0 dBm	108351859
V1724CGDA	FC/APC	16.0 dBm	108363680
1724EB (Evaluation Board)	—	—	—

* The 1724-Type EDFA is also available:
— With multiple optical outputs.
— With integral heat sink.

Notes:

- Contact your Account Manager to discuss your requirements. (If you do not know your Account Manager, please call Microelectronics Group, Optoelectronics unit directly at (610) 391-2520.)
- Contact your Account Manager for ordering and technical information regarding the 1724EB Evaluation Board.

Coding Scheme

Example: $\gamma 1724\alpha\beta\chi\delta\phi$

γ = 1724 series indicator
 α = output power indicator
 β = optical connector indicator
 χ = housing type indicator
 δ = number of outputs indicator
 ϕ = gain identifier

Related Product Information

Table 8. Related Product Information

Description	Part Number	Document Number
High-Speed Lightwave Receiver	1319-Type	DS97-106LWP
Lithium Niobate Modulator	—	DS96-135LWP
Electroabsorption Modulated Isolated Laser Module	E2500-Type	DS98-368LWP
1.5 μm Isolated DFB Laser Module	D2500-Type	DS98-339LWP
1.3 μm Isolated DFB Laser Module	D2300-Type	DS97-122LWP
0.98 μm Pump Laser Module	263-Type	DS98-207LWP
Long-Wavelength PIN Photodetectors	131-Type	DS98-206LWP
Interfacing the 1724-Type Microprocessor-Controlled Erbium-Doped Fiber Amplifier via a Serial Communication Port	1724-Type EDFA	AP99-020LWP

Laser Safety Information

Class IIIb Laser Product

This product complies with 21 CFR 1040.10 and 1040.11.

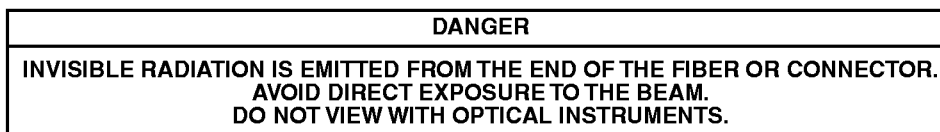
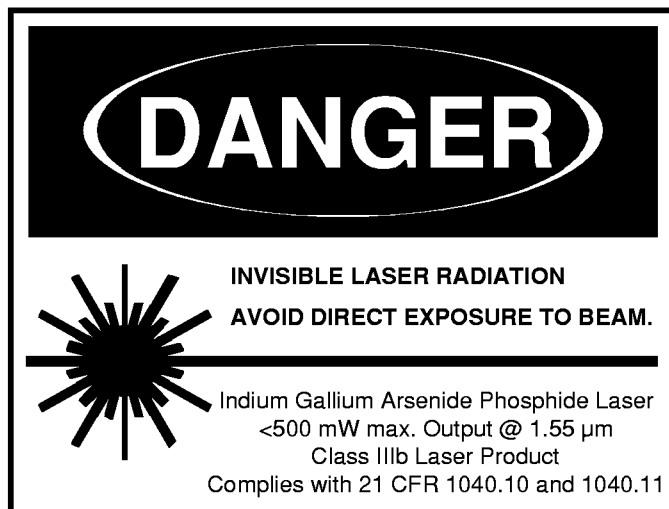
Single-mode connector

Wavelength = 1.55 μm

Maximum power <500 mW

Product is not shipped with power supply.

CAUTION: Use of controls, adjustments, and procedures other than those specified herein may result in hazardous laser radiation exposure.



Notes

For additional information, contact your Microelectronics Group Account Manager or the following:

INTERNET: <http://www.lucent.com/micro>, or for Optoelectronics information, <http://www.lucent.com/micro/opto>

E-MAIL: docmaster@micro.lucent.com

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