

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

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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
- Preamplifier

### 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 4, page 6, for performance specifications)
  - High gain
  - Low noise figure
- V Series for video, analog, or booster applications (see Table 5, 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.

Contact your Agere Systems Inc. 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 PIN, 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 °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**

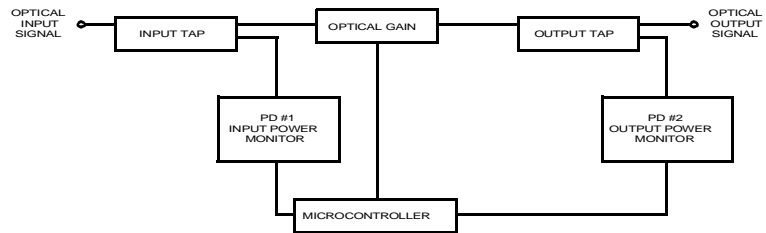
If the case temperature exceeds 60 °C, then the EDFA temperature alarm (pin 7) will activate (TTL-logic 1).

## **Optional Features**

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

- Alternative optical connectors
- Integral heat sink

## Block Diagram



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Figure 1. 1724-Type EDFA Block Diagram

## Pin Information

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

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

1. Do not connect to reserved pins.

2. Normal = TTL low, alarm = TTL high if the output power falls 2 dB below 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<sub>IN</sub>.

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

## 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 <sub>stg</sub>	-40	20	70	°C
Operating Case Temperature	T <sub>c</sub>	0	35	65	°C
Absolute Humidity	—	—	—	0.024	lbs. H <sub>2</sub> O/lbs. dry air

## Electrical Characteristics

Table 2. Power Supply

Parameter	Symbol	Min	Typ*	Max	Unit
dc Power Supply Voltage	V <sub>PS1</sub>	4.75	5.0	5.25	V
Power Supply Current (beginning of life):					
ø19 dBm	I <sub>PS1</sub>	—	1.0	—	A
ø22 dBm	I <sub>PS1</sub>	—	2.4	—	A
Power Supply Current (end of life):					
ø19 dBm	I <sub>PS1</sub>	—	—	1.9	A
ø22 dBm	I <sub>PS1</sub>	—	—	3.8	A
Electrical Power Consumption (beginning of life):					
ø19 dBm	—	—	5.0	—	W
ø22 dBm	—	—	12.0	—	W
Electrical Power Consumption (end of life):					
ø19 dBm	—	—	—	10.0	W
ø22 dBm	—	—	—	20.0	W

\* Typical operating characteristics: V<sub>PS1</sub> = 5.0 V, T<sub>c</sub> = 35 °C.

**Electrical Characteristics** (continued)

**Table 3. 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	$\mu A$
Low	$I_{IL}$	—	—	1	$\mu A$
Output Current:					
High	$I_{OH}$	—	—	-4	mA
Low	$I_{OL}$	—	—	20	$\mu A$

## Optical Characteristics

Table 4. Performance Specifications for S Series

Parameter	Symbol	Min	Typ	Max	Unit
Signal Wavelength Range	$\lambda_L$	1530	—	1560	nm
Measurement Wavelength	$\lambda_M$	—	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 $\lambda_M$ ):					
Booster/In Line—S1724B-Type	$P_O$	13	—	—	dBm
—S1724C-Type	$P_O$	16	—	—	dBm
—S1724D-Type	$P_O$	19	—	—	dBm
Noise Figure:					
Preamp—S1724A-Type ( $P_{IL} = -30$ dBm; $\lambda_M$ )	NF	—	—	5.0	dB
Booster/In Line—S1724B/C/D-Types ( $P_{IL} = -6.0$ dBm; $\lambda_M$ )	NF	—	—	5.5	dB
Return Loss	RL	—	—	-40	dB
Output Power Stability (over temperature, at a constant input power)	$\Delta P_O$	—	$\pm 0.2$	$\pm 0.5$	dB

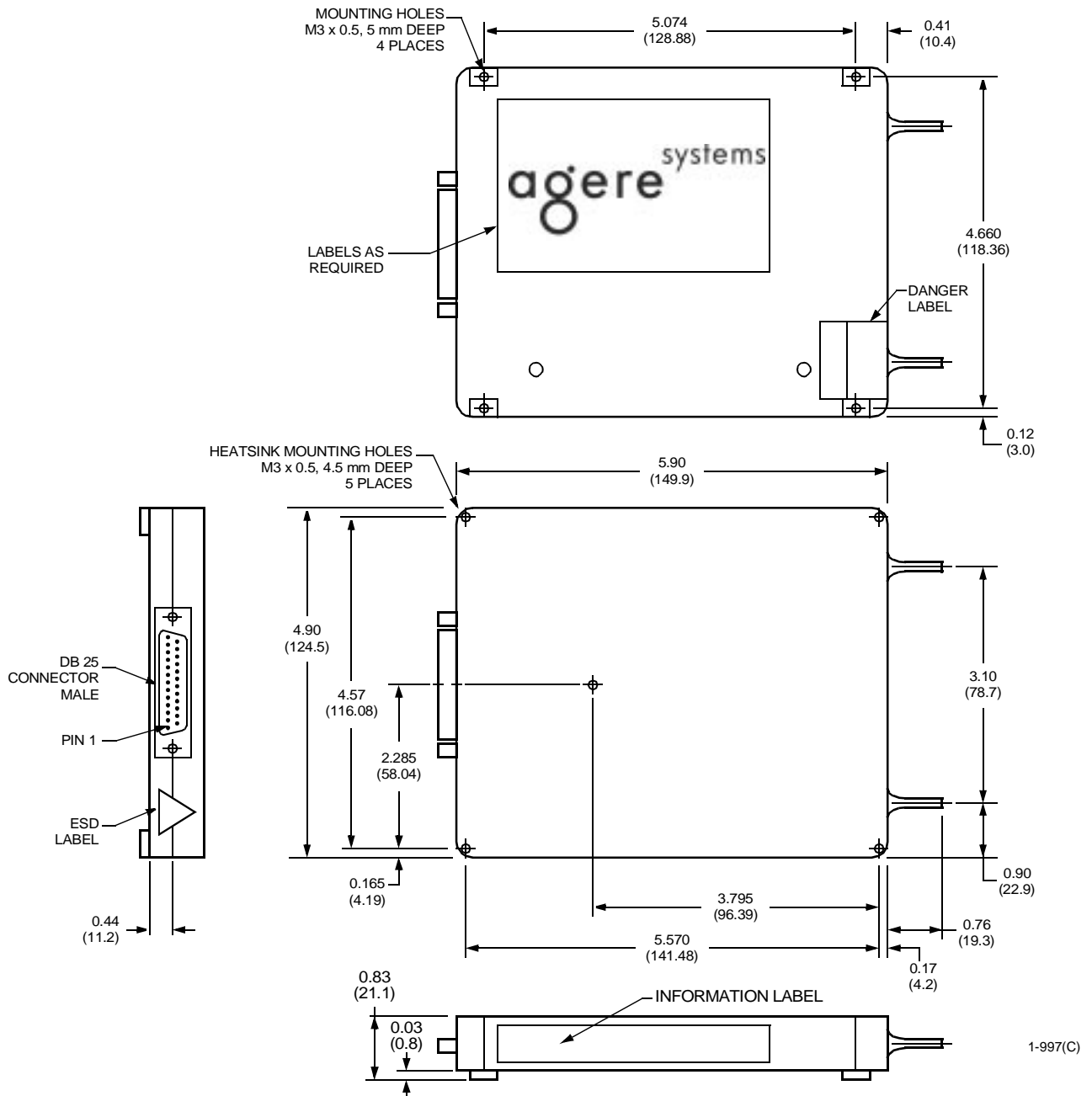
Table 5. Performance Specifications for V Series

Parameter	Symbol	Min	Typ	Max	Unit
Signal Wavelength Range	$\lambda_L$	1540	—	1560	nm
Measurement Wavelength	$\lambda_M$	—	1550	—	nm
Input Signal Power	$P_{IL}$	0	—	10	dBm
Peak Output Power (at $\lambda_M$ 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, $\lambda_M$ )	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)	$\Delta P_O$	—	$\pm 0.2$	$\pm 0.5$	dB

## Outline Drawings

### 1724-Type EDFA Package\*

Dimensions are in inches and (millimeters).

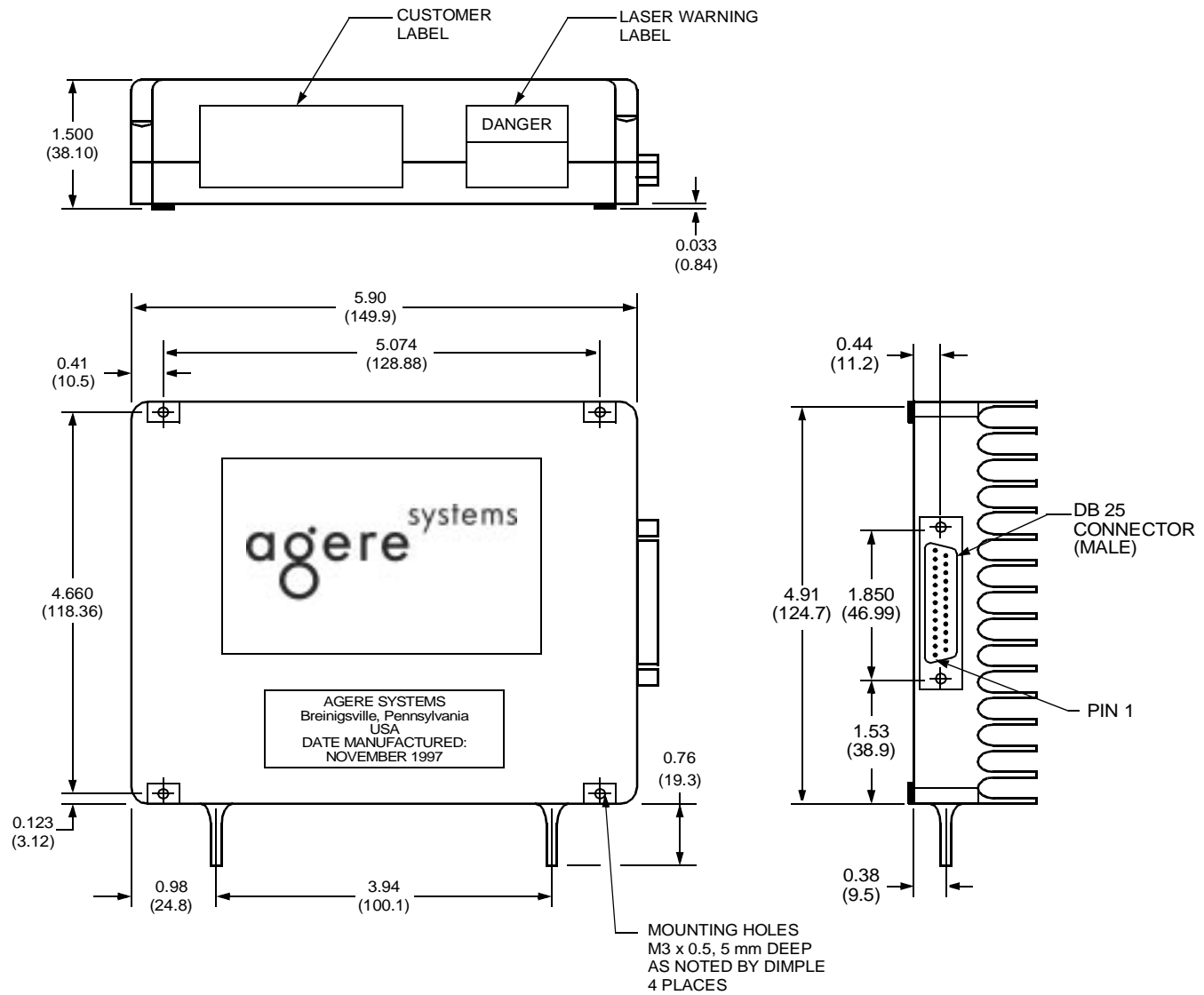


\* B version shown; see coding scheme in Table 6, Ordering Information.

**Outline Drawings** (continued)

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

Dimensions are in inches and (millimeters).



\* F version shown; see coding scheme in Table 6, Ordering Information.

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## Ordering Information

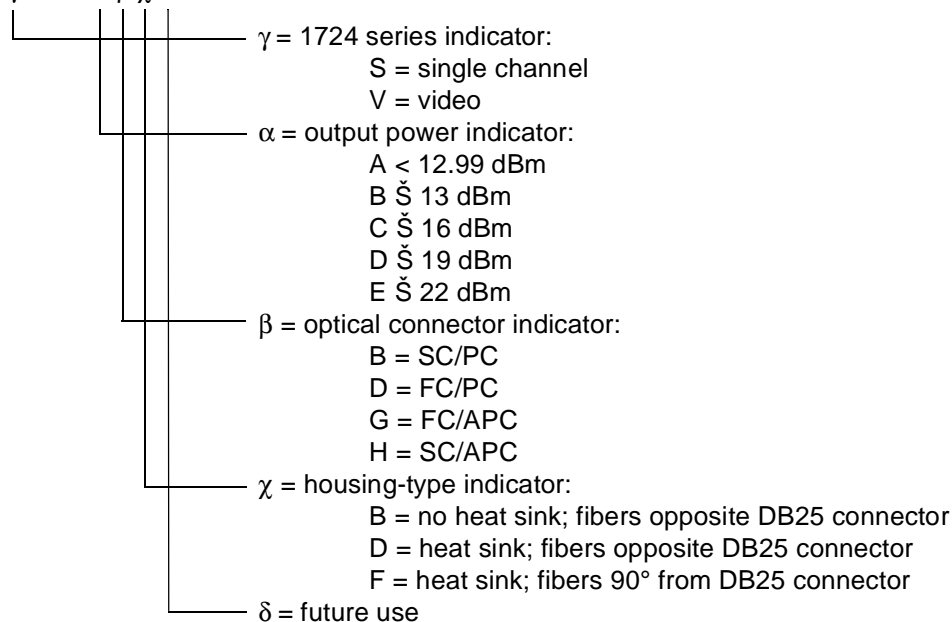
Table 6. Ordering Information\*

Device Code	Po	Connector	Heat Sink	Comcode
S1724BBBA	13.0 dBm	SC/PC	No	108321472
S1724BDBA	13.0 dBm	FC/PC	No	108313719
S1724CBBA	16.0 dBm	SC/PC	No	108331539
S1724CDBA	16.0 dBm	FC/PC	No	108313727
S1724DDBA	19.0 dBm	FC/PC	No	108319088
V1724BBBA	13.0 dBm	SC/PC	No	108331547
V1724BHBA	13.0 dBm	SC/APC	No	108468398
V1724CBBA	16.0 dBm	SC/PC	No	108331554
V1724CGDA	16.0 dBm	FC/APC	Yes	108363680
V1724CHBA	16.0 dBm	SC/APC	No	108468406
V1724DBBA	19.0 dBm	SC/PC	No	108331562
V1724DHBA	19.0 dBm	SC/APC	No	108351842
V1724EBBA	22.0 dBm	SC/PC	No	108331984
V1724EHBA	22.0 dBm	SC/APC	No	108351859

\* Contact your Account Manager to discuss your requirements. (If you do not know your Account Manager, please call Agere Systems, Opto-electronics unit directly at (610) 391-2520.)

## Coding Scheme

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



## Related Product Information

Table 7. Related Product Information

Description	Part Number	Document Number
High-Speed Lightwave Receiver	1319-Type	DS97-106LWP
Lithium Niobate Modulator	—	DS98-110LWP
Electroabsorption Modulated Isolated Laser Module	E2500-Type	DS98-368LWP
1.5 $\mu\text{m}$ Isolated DFB Laser Module	D2500-Type	DS98-339LWP
1.3 $\mu\text{m}$ Isolated DFB Laser Module	D2300-Type	DS97-122LWP
0.98 $\mu\text{m}$ Pump Laser Module	263-Type	DS99-199LWP
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.

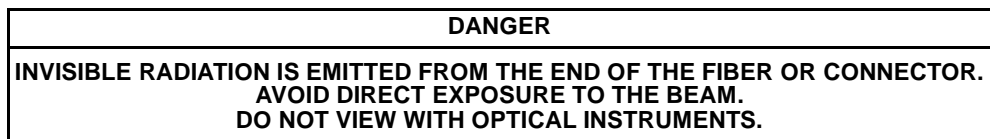
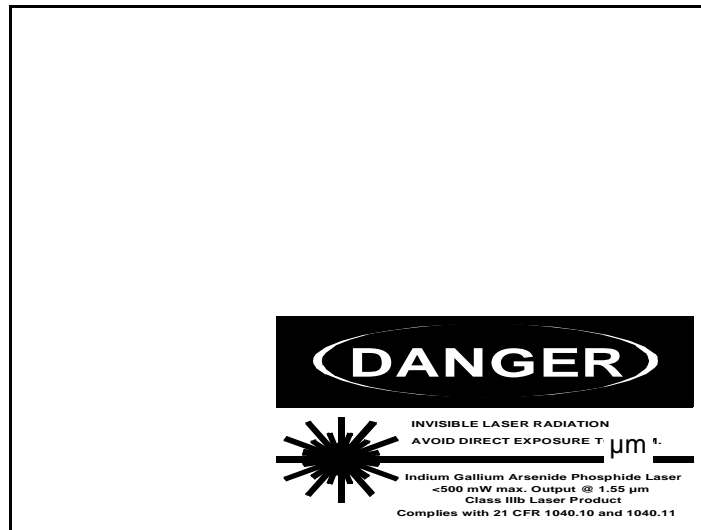
Single-mode connector

Wavelength = 1.55  $\mu\text{m}$

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.**



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For additional information, contact your Agere Systems Account Manager or the following:

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