# High Power
# 1300 nm FP Laser

**STH51004x**
**STH51005x**

## Features

- Designed for applications in fiber optic networks
- Laser Diode with Multi-Quantum Well structure
- Suitable for bit rates up to 1 Gbit/s
- Ternary Photodiode at rear mirror for monitoring and control of radiant power
- Hermetically sealed subcomponents, similar to TO 46
- SM pigtail with optional connector

## Pin Configuration and Flange

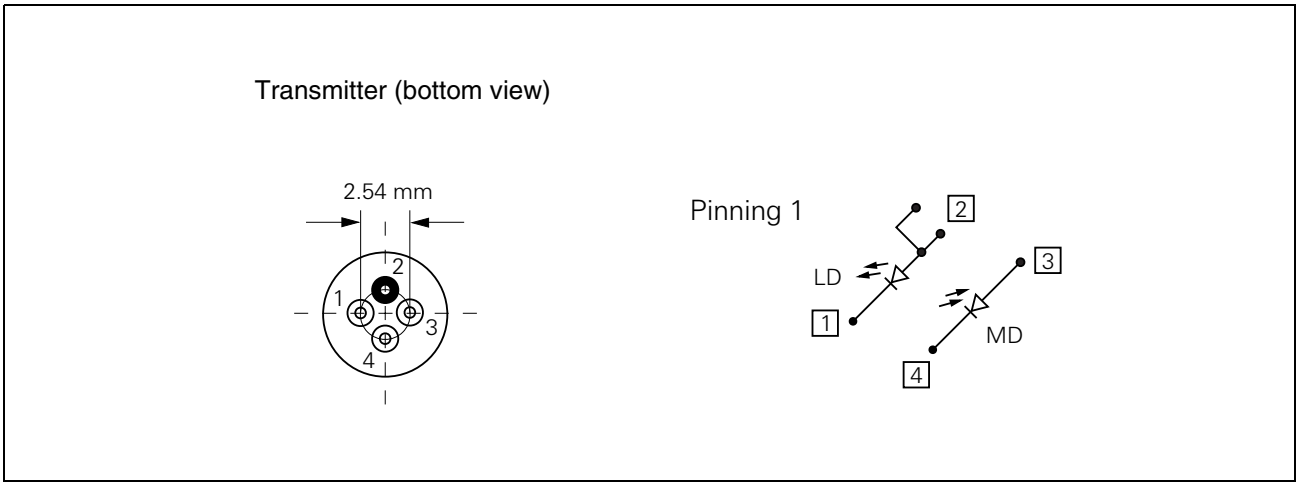



**Figure 1 Transmitter**

### Available Pinnings with and without Flange

| Type | Transmitter | Flange |
|---|---|---|
| STH51004x | 1 | without |
| STH51005x | 1 | with |

## Description

### Differences between a Fabry-Perot and a DFB Laserdiode

A conventional laser consists of an amplifying medium and two end mirrors. The cavity is longer than one wavelength, and a standing wave is created. The number n of half wavelengths λ is $n = 2 \times \frac{L}{\lambda}$. If L >> λ then we speak of a Fabry-Perot Laser because the laserdiode emits multi-longitudinal modes. Typically the laserdiode is 250 µm long. For λ = 1310 nm/1550 nm n is about 350. Therefore for many neighboring wavelengths the “standing wavelength” condition specified above is fulfilled. For a DFB-Laser a special grating acts as a distributed filter allowing only one of the cavity’s longitudinal modes to propagate. This can be described with a reduced oscillator length $\tilde{L}$ which is in the range of λ. For such a reduced oscillator length the standing wavelength condition will be fulfilled for n ≈ 2 what means for only one wavelength.

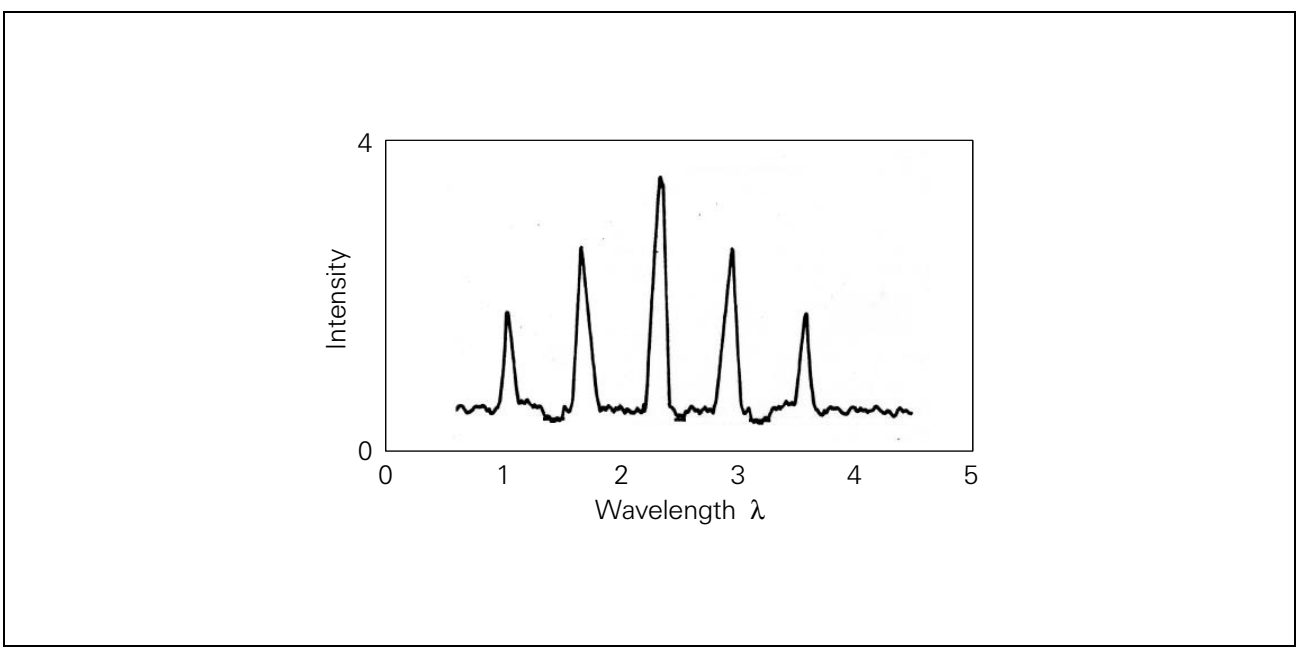



**Figure 2 Fabry-Perot Laserdiode**

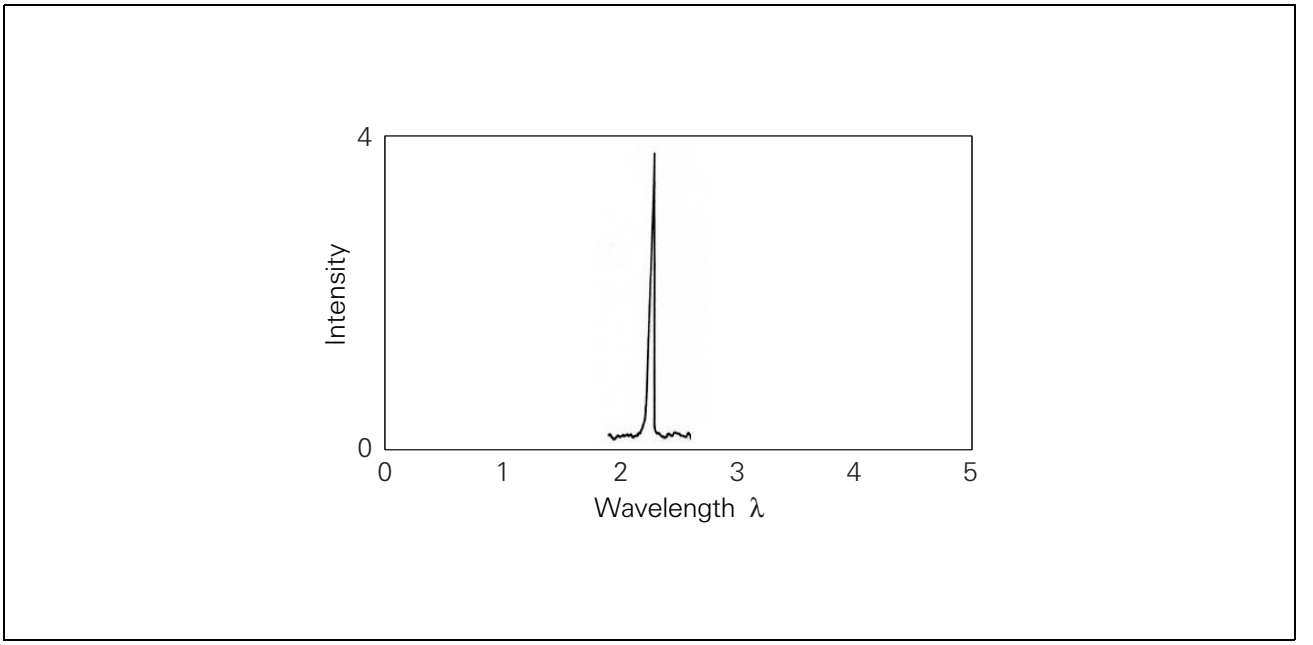



**Figure 3 DFB Laserdiode**

## Regulatory Compliance

| Feature | Standard | Comments |
|---|---|---|
| Electrostatic Discharge (ESD) to the Electrical Pins | MIL-STD 883D Method 3015.7 | Class 1 (<500 V) |

## Technical Data

### Absolute Maximum Ratings

| Parameter | Symbol | Limit Values | | Unit |
|---|---|---|---|---|
| | | min. | max. | |
| **Module** | | | | |
| Operating temperature range at case | $T_C$ | –40 | 85 | °C |
| Storage temperature range | $T_{stg}$ | –40 | 85 | |
| Soldering temperature ($t_{max}$ = 10 s, 2 mm distance from bottom edge of case) | $T_S$ | | 260 | |
| **Laser Diode** | | | | |
| Direct forward current | $I_{F\ max}$ | | 120 | mA |
| Radiant power CW | $P_{F,\ rad}$ | | 4 | mW |
| Reverse Voltage | $V_R$ | | 2 | V |
| **Monitor Diode** | | | | |
| Reverse Voltage | $V_R$ | | 10 | V |
| Forward Current | $I_F$ | | 2 | mA |

The electro-optical characteristics described in the following tables are only valid for use within the specified maximum ratings or under the recommended operating conditions.

### Transmitter Electro-Optical Characteristics

| Parameter | Symbol | Limit Values | | | Unit |
|---|---|---|---|---|---|
| | | min. | typ. | max. | |
| Optical output power (maximum) | $P_{F,\ max}$ | 2 | | | mW |
| Emission wavelength center of range, $P_F$ = 0.5 $P_{F,\ max.}$ | $\lambda_{trans}$ | 1280 | | 1330 | nm |
| Spectral width (RMS) | $\sigma_\lambda$ | | | 5 | |
| Temperature coefficient of wavelength | $TC$ | | | 0.5 | nm/K |
| Threshold current (whole temperature range) | $I_{th}$ | 2 | | 45 | mA |
| Forward voltage, $P_F$ = 0.5 $P_{F,\ max.}$ | $V_F$ | | | 1.5 | V |
| Radiant power at $I_{th}$ | $P_{th}$ | | | 80 | µW |

## Transmitter Electro-Optical Characteristics (cont'd)

| Parameter | Symbol | Limit Values | | | Unit |
|---|---|---|---|---|---|
| | | min. | typ. | max. | |
| Slope efficiency (–40...85°C) | $\eta$ | 40 | | 160 | mW/A |
| Variation of 1st derivative of P/I (0.1 to 2 mW) | $S_{var}$ | –30 | | 30 | % |
| Differential series resistance | $R_S$ | | | 8 | Ω |
| Rise time (10%–90%) | $t_r$ | | 100 | 200 | ps |
| Fall time (10%–90%) | $t_f$ | | 270 | 500 | |

## Monitor Diode Electro-Optical Characteristics

| Parameter | Symbol | Limit Values | | Unit |
|---|---|---|---|---|
| | | min. | max. | |
| Dark current, $V_R$ = 5 V, $P_F$ = 0, $T = T_{max}$ | $I_R$ | | 500 | nA |
| Photocurrent, $V_R$ = 5 V, $P_F$ = 0.5 $P_{F, max}$ | $I_P$ | 100 | 1000 | µA |
| Capacitance, $V_R$ = 5 V, $f$ = 1 MHz | $C_5$ | | 10 | pF |
| Tracking error[1], $V_R$ = 5 V | TE | –1 | 1 | dB |

[1] The tracking error TE is the maximum deviation of $P_F$ at constant current $I_{mon}$ over a specified temperature range and relative to the reference point: $I_{mon, ref} = I_{mon}$ ($T$ = 25°C, $P_F$ = 0.5 $P_{F, max.}$). Thus, TE is given by:

$$TE[dB] = 10 \times \log \frac{P_F[T_C]}{P_F[25°C]}$$

## End of Life Time Characteristics

| Parameter | Symbol | Limit Values | | Unit |
|---|---|---|---|---|
| | | min. | max. | |
| Threshold current at $T = T_{max}$ | $I_{th}$ | | 60 | mA |
| Current above threshold, over full temperature range, at $I_{mon, ref} = I_{mon}$ ($T$ = 25°C, $P_F$ = 0.5 $P_{F, max.}$, BOL) | $\Delta I_F$ | 7 | 70 | |
| Tracking Error | TE | –1.5 | 1.5 | dB |
| Monitor Dark Current, $V_R$ = 2 V, $T = T_{max}$ | $I_R$ | | 1 | µA |

## Fiber Data

The mechanical fiber characteristics are described in the following table.

### Fiber Characteristics

| Parameter | Limit Values | | | Unit |
|---|---|---|---|---|
| | min. | typ. | max. | |
| Mode Field Diameter | 8 | 9 | 10 | µm |
| Cladding Diameter | 123 | 125 | 127 | |
| Mode Field/Cladding Concentricity Error | | | 1 | |
| Cladding Non-circularity | | | 2 | % |
| Mode Field Non-circularity | | | 6 | |
| Cut off Wavelength | 1270 | | | nm |
| Jacket Diameter | 0.8 | | 1 | mm |
| Bending Radius | 30 | | | |
| Tensile Strength Fiber Case | 5 | | | N |
| Length | 0.8 | | 1.2 | m |

## Eye Safety

Ensure to avoid exposure of human eyes to high power laser diode emitted laser beams. Especially do not look directly into the laser diode or the collimated laser beam when the diode is activated.

### Class 3B Laser Product According to IEC 60825-1

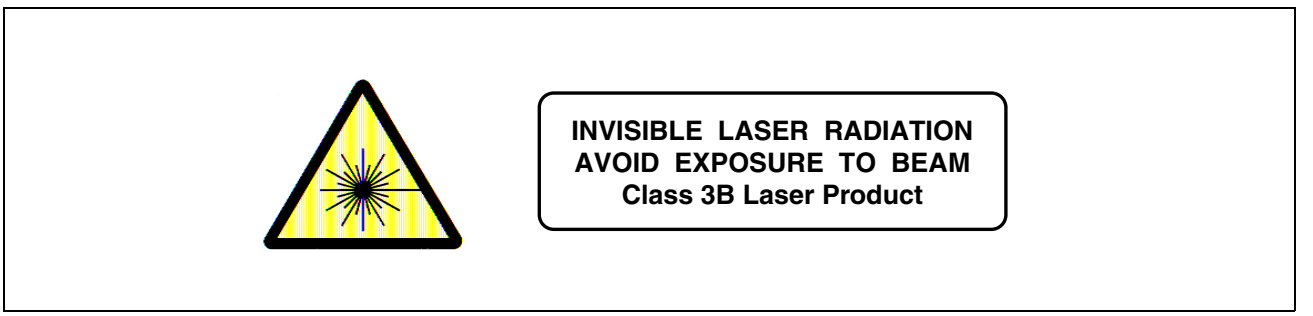



**Figure 4 Required Labels**

### Class IIIb Laser Product According to FDA Regulations Complies with 21 CFR 1040.10 and 1040.11

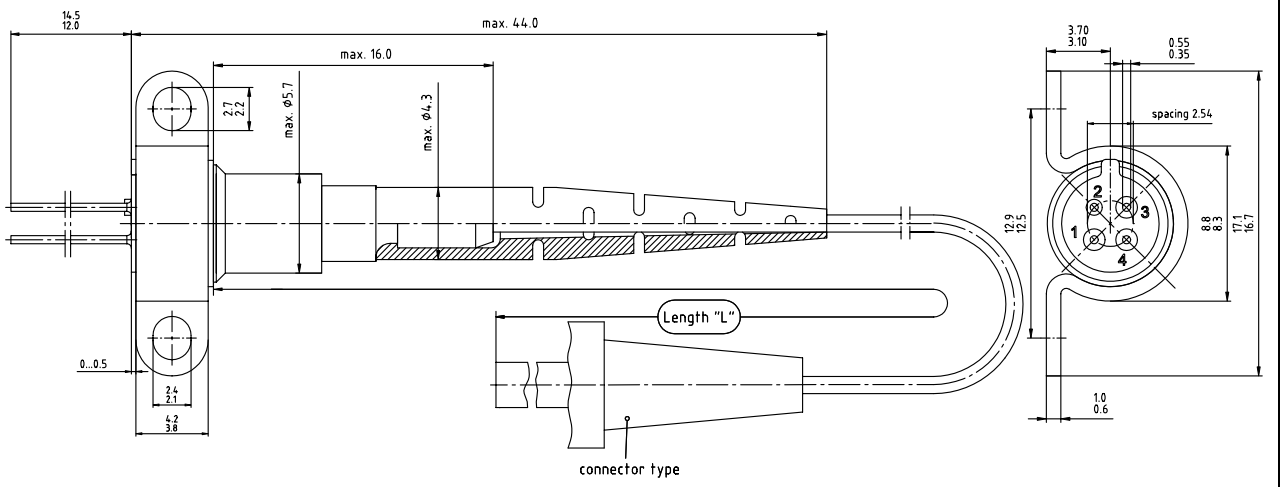

**Figure 5 Required Label**

### Laser Data

| | |
|---|---|
| Wavelength | 1300 nm |
| Maximum total output power | less than 50 mW |
| Beam divergence ($1/e^2$) | 10° |

## Package Outlines

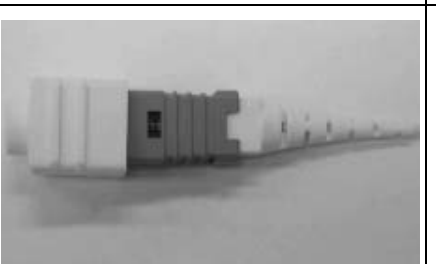
### STH51005G




Dimensions in mm

**Figure 6**

## Connector Options

| Model | Connector | Type |
|---|---|---|
| STH51004G<br>STH51005G |  | SM FC/PC |
| STH51004N<br>STH51005N |  | SM SC/PC 0° |
| STH51004Z<br>STH51005Z | | without connector |

**STH51004x**
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**Revision History: 2001-06-01** DS0

Previous Version:

| Page | Subjects (major changes since last revision) |
|---|---|
| | Document's layout has been changed: 2002-Aug. |

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