

## 6500 nm DFB Quantum Cascade Laser, 80 mW

QD6500HHLH



### Description

The QD6500HHLH is a single spatial mode, single longitudinal mode, distributed feedback quantum cascade laser contained in a high heat load (HHL) package, designed and manufactured by Thorlabs. This laser operates in continuous wave (CW) mode at room temperature.

The QD6500HHLH has a collimated output and offers a standard HHL pinout for electrical and temperature control. Its package is sealed, although the seal is not hermetic. There is no monitor photodiode.

### Specifications

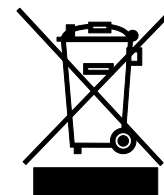
| Absolute Maximum Ratings (T <sub>CHIP</sub> = 20 °C, CW Operation) |                                     |
|--------------------------------------------------------------------|-------------------------------------|
| Absolute Max Operating Current                                     | Varies Between Devices <sup>a</sup> |
| Absolute Max Output Power                                          | 300 mW                              |
| LD Reverse Voltage (Max)                                           | 1 V                                 |
| PD Reverse Voltage (Max)                                           | N/A                                 |
| TEC Current (Max)                                                  | 4.5 A                               |
| TEC Voltage (Max)                                                  | 6.5 V                               |
| Operating Temperature                                              | 20 to 40 °C <sup>b</sup>            |
| Storage Temperature                                                | 0 to 85 °C <sup>b</sup>             |

- The absolute maximum current is determined on a device-by-device basis and is listed on the device's data sheet.
- Non-condensing environment. Single mode performance is tested and guaranteed at 20 - 40 °C.

| Thermistor Characteristics (T <sub>CASE</sub> = 25 °C)     |                 |     |                                          |     |
|------------------------------------------------------------|-----------------|-----|------------------------------------------|-----|
|                                                            | Symbol          | Min | Typical                                  | Max |
| Thermistor Resistance <sup>a</sup>                         | R <sub>th</sub> | -   | 10 kΩ                                    | -   |
| Steinhart-Hart Coefficients<br>(T <sub>case</sub> = 25 °C) | A               | -   | 1.129 × 10 <sup>-3</sup> K <sup>-1</sup> | -   |
|                                                            | B               | -   | 2.341 × 10 <sup>-4</sup> K <sup>-1</sup> | -   |
|                                                            | C               | -   | 0.878 × 10 <sup>-7</sup> K <sup>-1</sup> | -   |

- Thermistor resistance follows the Steinhart-Hart equation:

$$\frac{1}{T} = A + B(\ln R_{th}) + C(\ln R_{th})^3$$

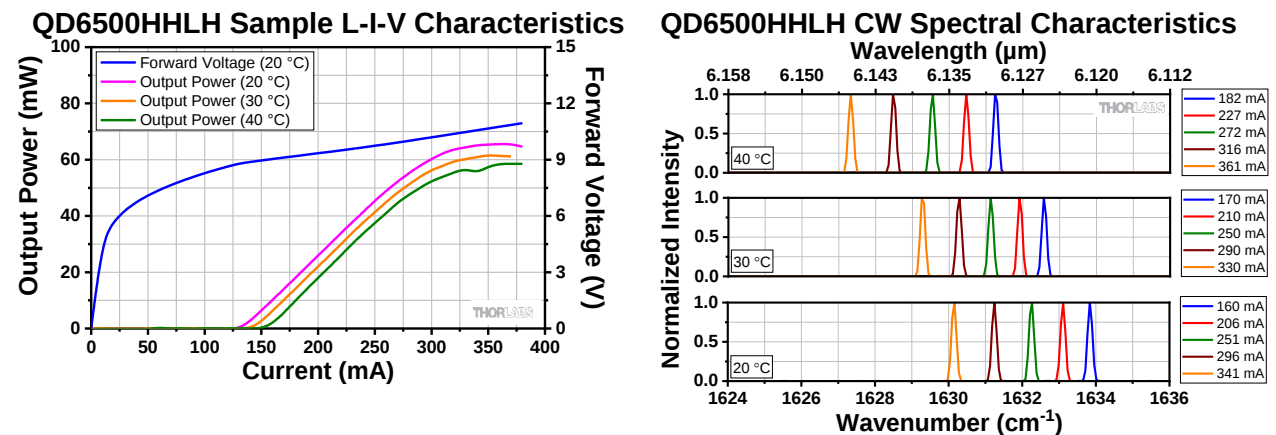


## Specifications (Cont.)

| Optical Electrical Characteristics ( $T_{\text{chip}} = 20\text{ }^{\circ}\text{C}$ , CW Operation) |                            |                      |                                        |                    |
|-----------------------------------------------------------------------------------------------------|----------------------------|----------------------|----------------------------------------|--------------------|
|                                                                                                     | Symbol                     | Min                  | Typical                                | Max                |
| Center Wavelength                                                                                   | $\lambda$                  | 6.00 $\mu\text{m}$   | -                                      | 7.00 $\mu\text{m}$ |
| Tuning Range                                                                                        | $\Delta\bar{\nu}$          | -                    | 3 $\text{cm}^{-1}$                     | -                  |
| Temperature Tuning                                                                                  | $\Delta\bar{\nu}/\Delta T$ | -                    | -0.1 $\text{cm}^{-1}/^{\circ}\text{C}$ | -                  |
| Side Mode Suppression                                                                               | SMSR                       | 20 dB                | -                                      | -                  |
| Optical Output Power                                                                                | $P_{\text{out}}$           | 20 mW                | 80 mW                                  | -                  |
| Operating Current                                                                                   | $I_{\text{op}}$            | -                    | 300 mA                                 | 600 mA             |
| Threshold Current                                                                                   | $I_{\text{th}}$            | -                    | 170 mA                                 | -                  |
| Forward Voltage                                                                                     | $V_F$                      | -                    | 11 V                                   | 14 V               |
| Beam Pointing                                                                                       | Parallel <sup>a</sup>      | -                    | -0.75 $^{\circ}$                       | 0 $^{\circ}$       |
|                                                                                                     | Perpendicular <sup>a</sup> | -                    | -2.75 $^{\circ}$                       | -1.25 $^{\circ}$   |
| Beam Divergence Angle (FWHM)                                                                        | Parallel <sup>a</sup>      | $\theta_{\parallel}$ | 3 mrad                                 | 6 mrad             |
|                                                                                                     | Perpendicular <sup>a</sup> | $\theta_{\perp}$     | 3 mrad                                 | 6 mrad             |
| $M^2$                                                                                               | Parallel <sup>a</sup>      | $M^2_{\parallel}$    | 1.0                                    | 1.1                |
|                                                                                                     | Perpendicular <sup>a</sup> | $M^2_{\perp}$        | 1.0                                    | 1.1                |
| Minimum Beam Diameter (D4 $\sigma$ Method) <sup>b</sup>                                             | D                          | 0.5 mm               | 1.5 mm                                 | 2.5 mm             |

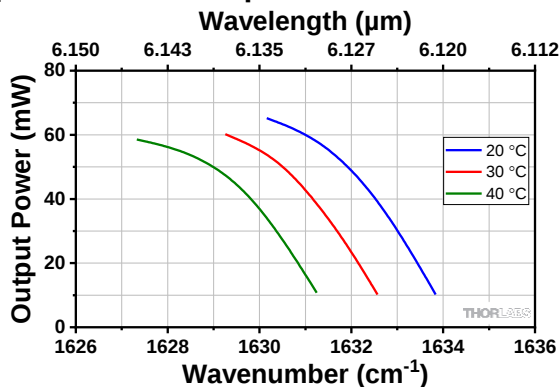
- a. For this laser, these terms are defined with respect to the plane of the base plate.  
b. Obtained by fitting the 10% and 90% points of total beam intensity on the horizontal and vertical beam axes from images taken on a Mid-IR beam profiler.

## Sample Performance Plots

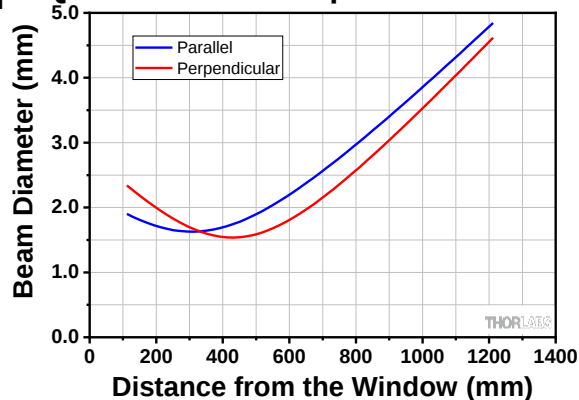


## Sample Performance Plots (Cont.)

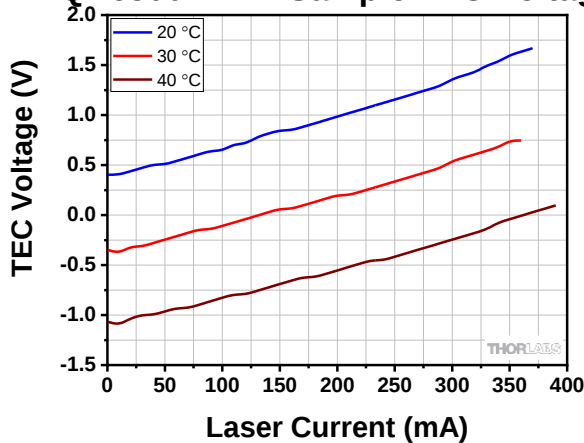
QD6500HHLH Output Power vs. Wavelength



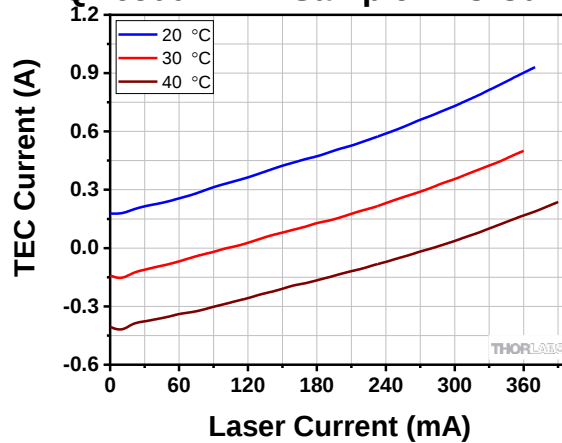
QD6500HHLH Sample Beam Diameter



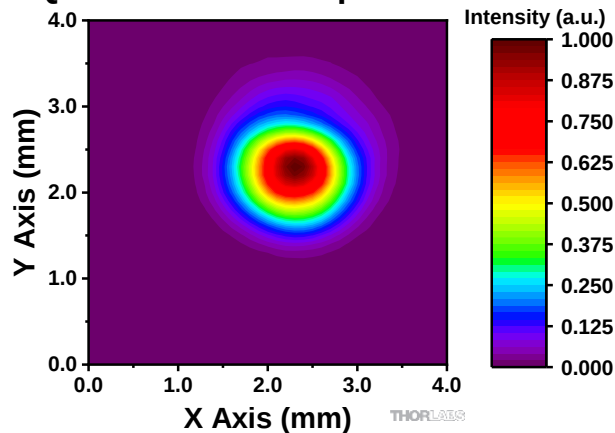
QD6500HHLH Sample TEC Voltage



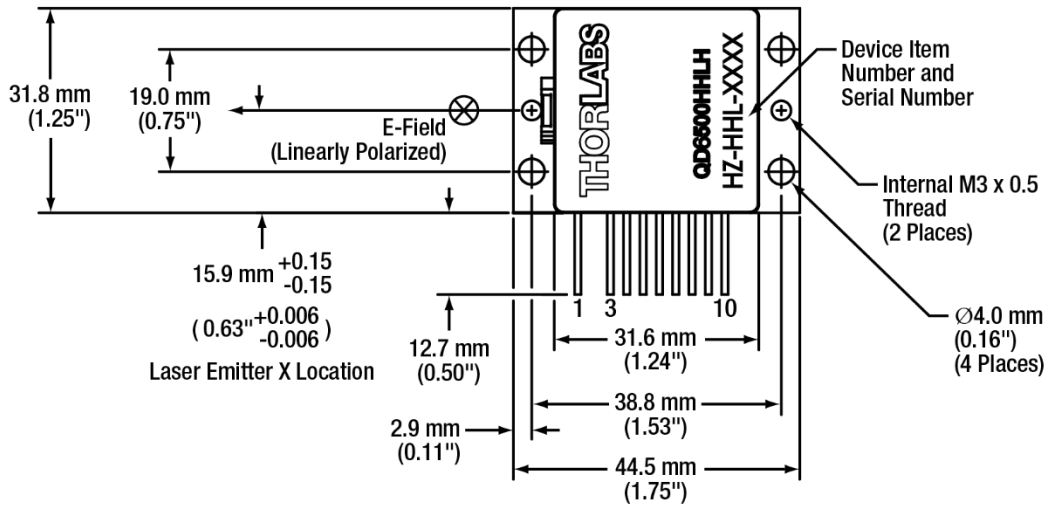
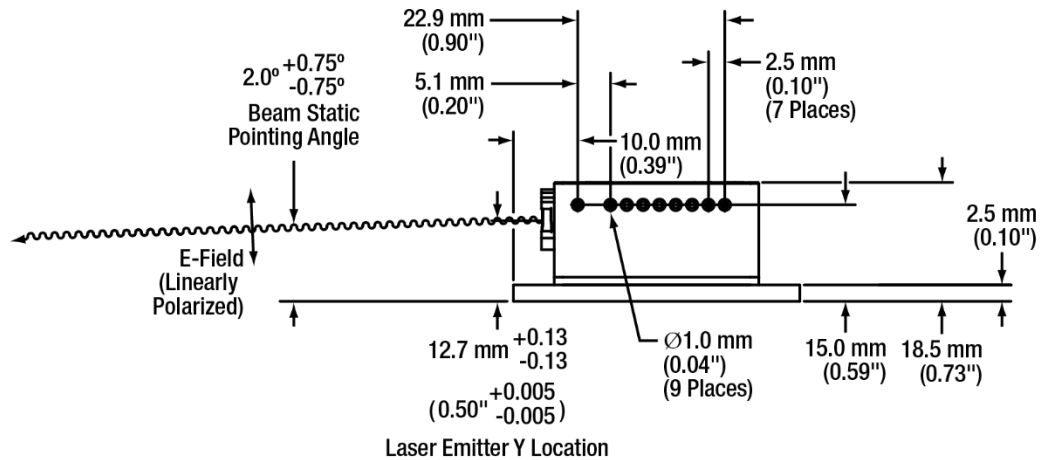
QD6500HHLH Sample TEC Current



QD6500HHLH Sample Beam Profile



## Drawing for QD6500HHLH



| Pin | Description                           |
|-----|---------------------------------------|
| 1   | TEC (-)                               |
| 2   | Not Present                           |
| 3   | No Connection                         |
| 4   | Laser Anode                           |
| 5   | TEC Control Thermistor, 10 k $\Omega$ |
| 6   | TEC Control Thermistor, 10 k $\Omega$ |
| 7   | Laser Cathode                         |
| 8   | No Connection                         |
| 9   | No Connection                         |
| 10  | TEC (+)                               |

June 6, 2024

QTN041463-S01, Rev A