

## ■ Features

- Emission wavelength: 7.18  $\mu\text{m}$  (Typ.)
- Output power: 20 mW (Min.)
- Threshold current: 1.0 A (Max.)

## ■ Applications

- Trace gas analysis ( $\text{SO}_3$ )



## ■ Outline

Quantum Cascade Lasers, using structures of SPC (Single Phonon-Continuum) depopulation and DFB (Distributed Feedback), emit CW (Continuous Wave) mid-IR laser under room temperature.

By controlling the chip's operating temperature through the Peltier element installed in the HHL package, it is possible to tune the emission wavelength without mode hopping while keeping longitudinal single mode operation.

## ■ Absolute and characteristics

$T_{\text{op(qcl)}} = +20\text{ }^{\circ}\text{C}$ , unless otherwise specified.

| Parameter                                | Symbol               | Ratings  | Unit                          |
|--|----------------------|--|-------------------------------|
| Forward current *1                       | $I_f$                | This product has individual difference.<br>Confirm data sheet attached to a product *2 | A                             |
| Forward voltage *1                       | $V_f$                |  | V                             |
| Reverse voltage *1                       | $V_r$                | 0.0  | V                             |
| Change speed of forward current *3       | —                    | 5  | mA/s                          |
| TEC current (cooling mode) *4            | $I_c$                | +3.7   | A                             |
| TEC current (heating mode) *4            |                      | -1.5   | A                             |
| TEC voltage                              | $V_c$                | $\pm 13.0$   | V                             |
| Operating temperature (case) *5*6        | $T_{\text{op(c)}}$   | +10 to +60   | $^{\circ}\text{C}$            |
| Operating temperature (QCL) *7           | $T_{\text{op(qcl)}}$ | 0 to +55   | $^{\circ}\text{C}$            |
| Change speed of operating temperature *8 | —                    | 10   | $^{\circ}\text{C}/\text{min}$ |
| Storage temperature *5                   | $T_{\text{stg}}$     | -20 to +65   | $^{\circ}\text{C}$            |

\*1 Confirm data sheet attached to a product. Sensitive to electrical surges and instability. Reverse current/voltage cause damage in laser specifications and out of warranty.

\*2 Necessary specifications of power supply:  $I_f \geq 1.3\text{ A}$ ,  $V_f \geq 16\text{ V}$ .

\*3 Speed when changing the forward current ( $I_f$ ).

\*4 Even if TEC current ( $I_c$ ) is below the absolute maximum, insufficient heat dissipation from this product may cause damage in laser and TEC specifications and out of warranty. Especially there are possibilities of damage, degradation and less reliability when TEC is operated in heating mode since heated-up side (laser chip) is thermally isolated from case of package and ambience. Refer to schematic configuration in 3-2-4.

\*5 Avoid water condensation.

\*6 Temperatures of case (body) of HHL-package.

\*7 Temperatures of QC-laser when operated; should be monitored by the built-in thermistor for  $T_{\text{op(qcl)}}$ .

\*8 Speed when changing the operation temperature ( $T_{\text{op(qcl)}}$ ) controlled by the built-in TEC.

## ■ Specifications (laser)

| Parameter                      | Symbol               | Condition  | Min.      | Typ. | Max.   | Unit               |
|--------------------------------|----------------------|--|-----------|------|--------|--------------------|
| Operating temperature (QCL) *1 | $T_{\text{op(qcl)}}$ | $K^{*2}=1392\text{ cm}^{-1}$                     | +10       | —    | +50    | $^{\circ}\text{C}$ |
| Spectral linewidth *3          | $\Delta K_L$         | $K^{*2}=1392\text{ cm}^{-1}$                     | —         | —    | 0.2 *4 | $\text{cm}^{-1}$   |
| Wavenumber tuning range *5     | $\Delta K_T$         | $K^{*2}=1392\text{ cm}^{-1}$                     | $\pm 1.0$ | —    | —      | $\text{cm}^{-1}$   |
| Radiant power                  | $\Phi_e$             | $K^{*2}=1392\text{ cm}^{-1}$                     | 20        | —    | —      | mW                 |
| Threshold current              | $I_{\text{th}}$      | $T_{\text{op(qcl)}}=+20\text{ }^{\circ}\text{C}$ | —         | —    | 1.0    | A                  |
| Side mode suppression ratio    | SMSR                 | $T_{\text{op(qcl)}}=+20\text{ }^{\circ}\text{C}$ | 25 *4     | —    | —      | dB                 |

\*1 This product is able to emit the target wavenumber at a certain  $T_{\text{op(qcl)}}$  within the specified temperature range.

\*2 K: Emission wavenumber ( $\text{cm}^{-1}$ ).

\*3 WHM.

\*4 These values are limited by resolution and signal-to-noise ratio of instrument when tested.

\*5 Continuously wavenumber scan range; Center of the tunability range is the emission wavenumber (K).

# CW Quantum Cascade Laser L12007-1392H-C

## ■ TEC

| Parameter                      | Symbol            | Condition   | Specification | Unit             |
|--------------------------------|-------------------|---|---------------|------------------|
| Maximum temperature difference | $\Delta T_{\max}$ | $T_h=27\text{ }^\circ\text{C}$ , in $\text{N}_2$ , $Q_c=0$ , $I_c=+3.7\text{ A}$      | >40           | $^\circ\text{C}$ |
| Maximum heat pumping capacity  | $Q_{c\max}$       | $T_h=27\text{ }^\circ\text{C}$ , in $\text{N}_2$ , $I_c=+3.7\text{ A}$ , $\Delta T=0$ | >18           | W                |
| AC resistance                  | ACR               | $T_h=27\text{ }^\circ\text{C}$ , 1 kHz  | $2.5 \pm 0.3$ | $\Omega$         |

\*  $\Delta T$ : Temperature difference

$Q_c$ : Heat pumping capacity

$I_c$ : TEC current

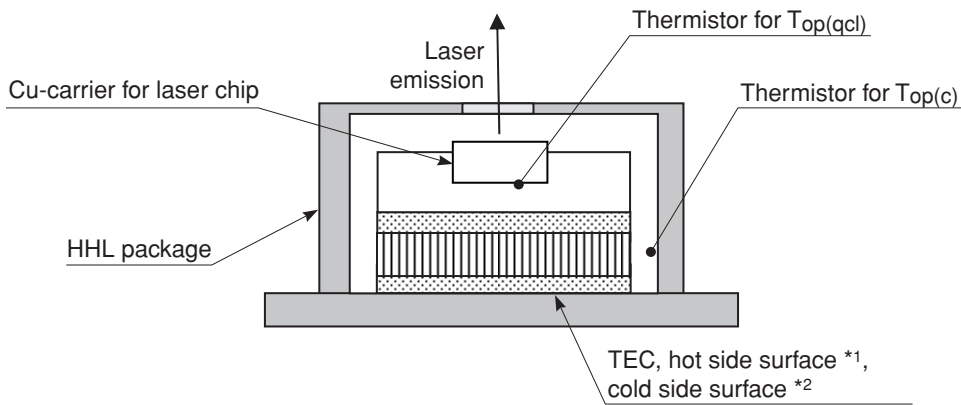
$T_h$ : Temperature of TEC's hot side surface (TEC: cooling mode)

## ■ Thermistor

| Parameter  | Symbol   | Condition   | Specification                 | Unit |
|------------|----------|---|-------------------------------|------|
| Resistance | $R_{25}$ | $25\text{ }^\circ\text{C}$                            | $10\text{ k}\Omega \pm 2.5\%$ | —    |
| Beta value | B        | $0\text{ }^\circ\text{C} / 100\text{ }^\circ\text{C}$ | 3450 K                        | —    |

\* Same specifications for both thermistors of  $T_{op(qcl)}$  and  $T_{op(c)}$ .

Figure 1: Thermistor configurations (schematic)



\*1 when TEC is operated in cooling mode.

\*2 when TEC is operated in heating mode.

# CW Quantum Cascade Laser L12007-1392H-C

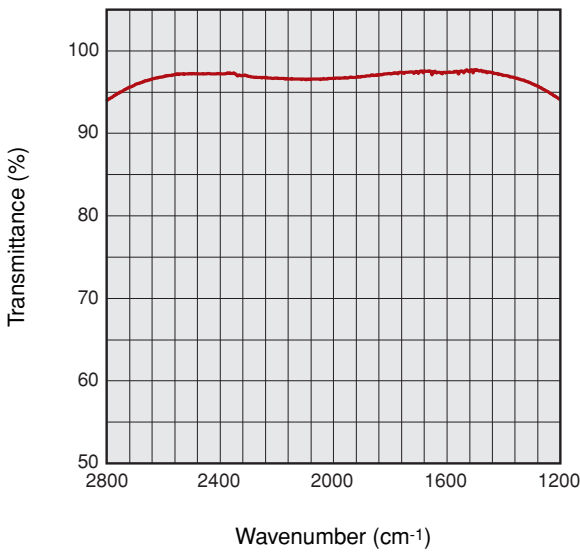
## ■ Window of HHL package

| Parameter |                   | Specification      | Unit             |
|-----------|-------------------|--------------------|------------------|
| Material  |                   | ZnSe, Plano-Plano  | —                |
| Dimension | Clear aperture *1 | $\phi 4.4$         | mm               |
|           | Thickness         | 0.7                | mm               |
| Coating   | Coating           | BBAR, both surface | —                |
|           | Bandwidth         | 2500 to 1250       | cm <sup>-1</sup> |
|           | Transmittance *2  | >96                | %                |

\*1 Mechanical aperture of HHL package.

\*2 Average in the bandwidth.

Figure 2: Typical transmittance curve of the window

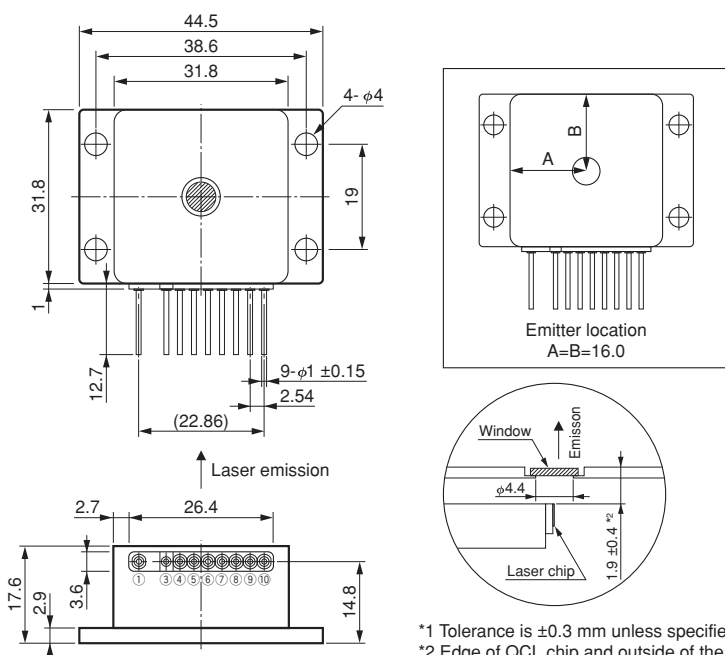


## ■ Necessary specifications of power supply for the laser (QCL)

| Parameter      | Specification            | Unit |
|----------------|--------------------------|------|
| Output current | $\geq 1.3$               | A    |
| Output voltage | $\geq 16$                | V    |
| Function       | Surge protect            | —    |
|                | Constant current control | —    |

# CW Quantum Cascade Laser L12007-1392H-C

Figure 3: Dimensional outline and pin connection (unit: mm)



\*1 Tolerance is  $\pm 0.3$  mm unless specified.  
\*2 Edge of QCL chip and outside of the package.

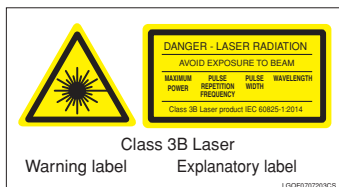
| Pin No. *3 | Function               | Pin No. *3 | Function             |
|------------|------------------------|------------|----------------------|
| ①          | TEC cathode (-)        | ⑦          | QCL cathode (-)      |
| ③          | N.C.                   | ⑧          | Thermistor, (Top(c)) |
| ④          | QCL anode (+)          | ⑨          | Thermistor, (Top(c)) |
| ⑤          | Thermistor, (Top(qcl)) | ⑩          | TEC anode (+)        |
| ⑥          | Thermistor, (Top(qcl)) | —          | —                    |

\*3 Pin of ③ is electrically connected to the case; package body. Other all pins are floating to the case.

## Warning (Class 3B Laser)

Invisible laser radiation: Avoid exposure to beam

● The laser radiation emitted from this product is an invisible laser beam that cannot be seen by the human eye. This product falls within "Class 3B Laser" according to IEC 60825-1 laser product classification. Always comply with IEC 60825-1 safety standards when using this product.



● Information described in this material current as of October 2023. Specifications are subject to change without notice.

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