

■ Features

- Emission wavelength: 4.57 μm (Typ.)
- Output power: 20 mW (Min.)
- Threshold current: 1.0 A (Max.)

■ Applications

- Trace gas analysis (N_2O , CO)



■ 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. 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	± 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_{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) *2	$T_{\text{op(qcl)}}$	$K^{*1}=2190\text{ cm}^{-1}$	+10	—	+50	$^{\circ}\text{C}$
Spectral linewidth *3	ΔK_L	$K^{*1}=2190\text{ cm}^{-1}$	—	—	0.2 *4	cm^{-1}
Wavenumber tuning range *5	ΔK_T	$K^{*1}=2190\text{ cm}^{-1}$	± 1.0	—	—	cm^{-1}
Radiant power	Φ_e	$K^{*1}=2190\text{ cm}^{-1}$	20	—	—	mW
Threshold current	I_{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 K: Emission wavenumber (cm^{-1}).

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

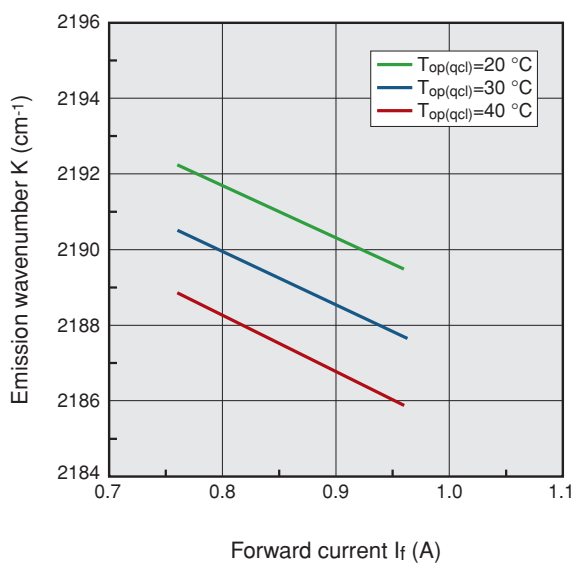
*3 WHM.

*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 L12004-2190H-C

Figure 1: Typical characteristics



Parameter	Symbol	Condition	Typical values	Unit
Temperature coefficient of wavenumber	δK_T	$I_f = \text{const.}$	-0.18	cm ⁻¹ /°C
Current coefficient of wavenumber	δK_C	$I_{op(qcl)} = \text{const.}$	-0.015	cm ⁻¹ /mA

■ TEC

Parameter	Symbol	Condition	Specification	Unit
Maximum temperature difference	$\Delta T_{\max}$	$T_h = 27\text{ °C}$, in N ₂ , $Q_c = 0$, $I_c = +3.7\text{ A}$	>40	°C
Maximum heat pumping capacity	$Q_{c\max}$	$T_h = 27\text{ °C}$, in N ₂ , $I_c = +3.7\text{ A}$, $\Delta T = 0$	>18	W
AC resistance	ACR	$T_h = 27\text{ °C}$, 1 kHz	2.5 ± 0.3	Ω

* ΔT : Temperature difference

Q_c : Heat pumping capacity

I_c : TEC current

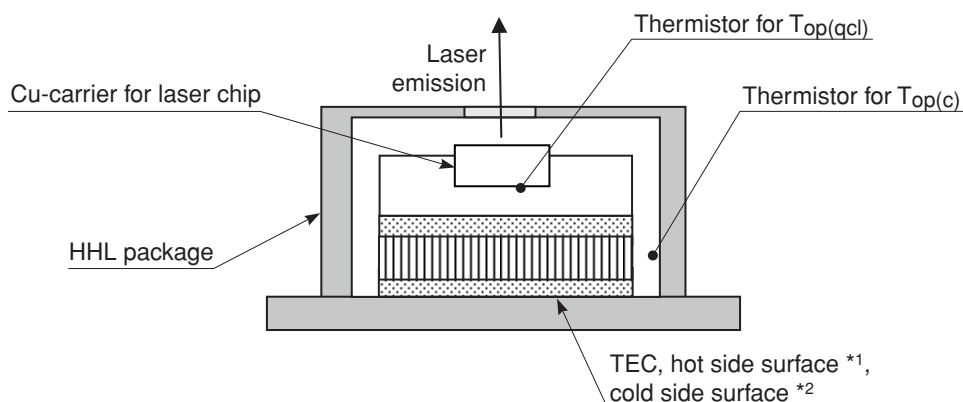
T_h : Temperature of TEC's hot side surface (TEC: cooling mode)

■ Thermistor

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

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

Figure 2: Thermistor configurations (schematic)



*1 when TEC is operated in cooling mode.

*2 when TEC is operated in heating mode.

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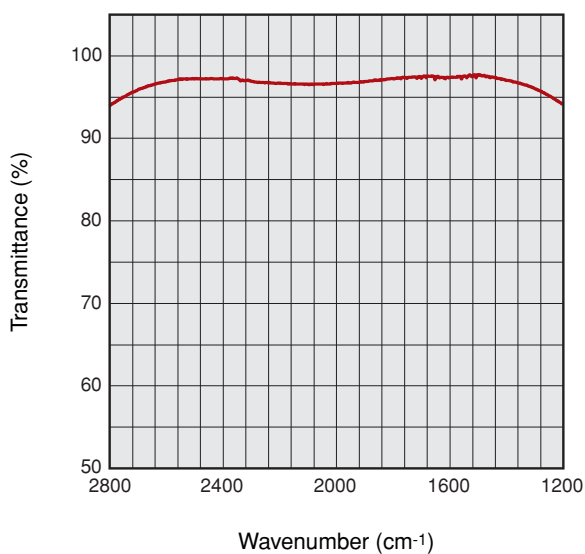
■ Window of HHL package

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 ⁻¹
	Transmittance *2	>96	%

*1 Mechanical aperture of HHL package.

*2 Average in the bandwidth.

Figure 3: Typical transmittance curve of the window



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

Parameter	Specification	Unit
Output current	≥ 1.3	A
Output voltage	≥ 16	V
Function	Surge protect	—
	Constant current control	—

