HAMAMATSU

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CW quantum cascade laser L12004-2190H-C

■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

$T_{op(qcl)}$ = +20 °C, unless otherwise specified.

Characteristics	Symbols	Ratings	Units
Forward current *1)	I_f	This product has individual difference.	A
Forward voltage *1)	V_f	Confirm data sheet attached to a product *2)	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)	$T_{op(c)}$	+10 to +60	°C
Operating temperature (QCL) *7)	$T_{op(qcl)}$	0 to +55	°C
Change speed of operating temperature *8)	-	10	°C/min
Storage temperature *5)	T_{stg}	–20 to +65	°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 : $I_f \geq 1.3$ A, $V_f \geq 16$ V.
*3) Speed when changing the forward currrent (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 $T_{op(qcl)}$.
*8) Speed when changing the operation temperature ($T_{op(qcl)}$) controlled by the built-in TEC.

■Specifications (laser)

Characteristics	Symbols	Test conditions	Min.	Typ.	Max.	Units
Operating temperature (QCL) (2)	$T_{op(qcl)}$	$K^{(1)}$=2190 cm^{-1}	+10	-	+50	°C
Spectral linewidth (3)	ΔK_L	$K^{(1)}$=2190 cm^{-1}	-	-	0.2(4)	cm^{-1}
Wavenumber tuning range (5)	ΔK_T	$K^{(1)}$=2190 cm^{-1}	±1.0	-	-	cm^{-1}
Radiant power	Φ_e	$K^{(1)}$=2190 cm^{-1}	20	-	-	mW
Threshold current	I_{th}	$T_{op(qcl)}$=+20 °C	-	-	1.0	A
Side mode suppression ratio	SMSR	$T_{op(qcl)}$=+20 °C	25(4)	-	-	dB

(1) K: Emission wavenumber (cm^{-1}).
(2) This product is able to emit the target wavenumber at a certain $T_{op(qcl)}$ within the specified temperature range.
(3) FWHM.
(4) These values are limited by resolution and singnal-to-noise ratio of instrument when tested.
(5) Continuously wavenumber scan range; Center of the tunability range is the emission wavenumber (K).

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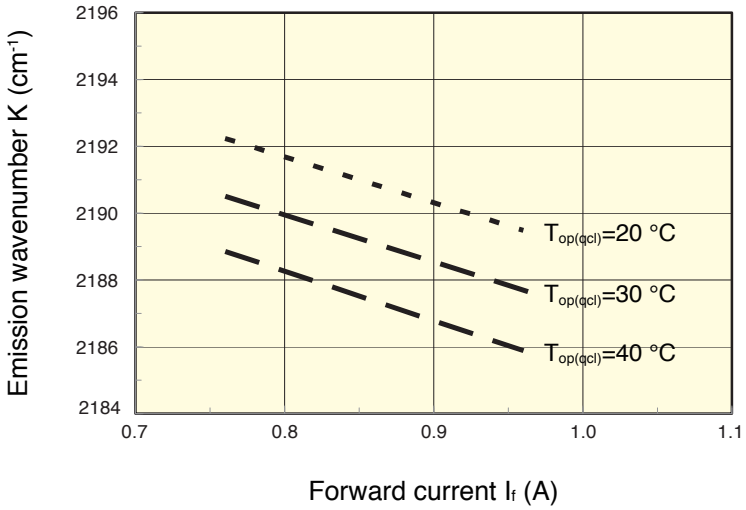
■Typical characteristics



Characteristics	Symbols	Conditions	Typical values
Temperature coefficient of wavenumber	δK_T	I_f= const.	–0.18 cm^{-1}/°C
Current coefficient of wavenumber	δK_C	$T_{op(qcl)}$= const.	–0.015 cm^{-1}/mA

■TEC

Characteristics	Symbols	Test conditions	Specifications
Maximum temperature difference	ΔT_{max}	T_h=27 °C, in N_2, Q_c=0, I_c=+3.7 A	>40 °C
Maximum heat pumping capacity	Q_{cmax}	T_h= 27 °C, in N_2, I_c=+3.7 A, ΔT=0	>18 W
AC resistance	ACR	T_h=27 °C, I_c=0.1 mA, 1 kHz	2.0 Ω±0.4 Ω

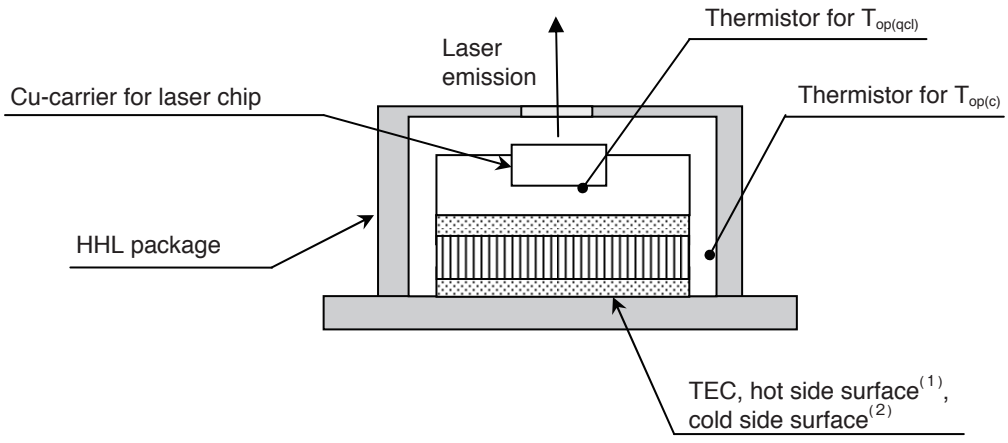
Note) ΔT: Temperature difference
Q_c: Heat pumping capacity
I_c: TEC current
T_h: Temperature of TEC's hot side surface (TEC: cooling mode)

■Thermistor

Characteristics	Symbols	Test conditions	Specifications
Resistance	R_{25}	25 °C	10 kΩ±2.5 %
Beta value	B	0 °C / 100 °C	3450 K

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

■Thermistor configurations (schematic)



(1) : when TEC is operated in cooling mode.
(2) : when TEC is operated in heating mode.

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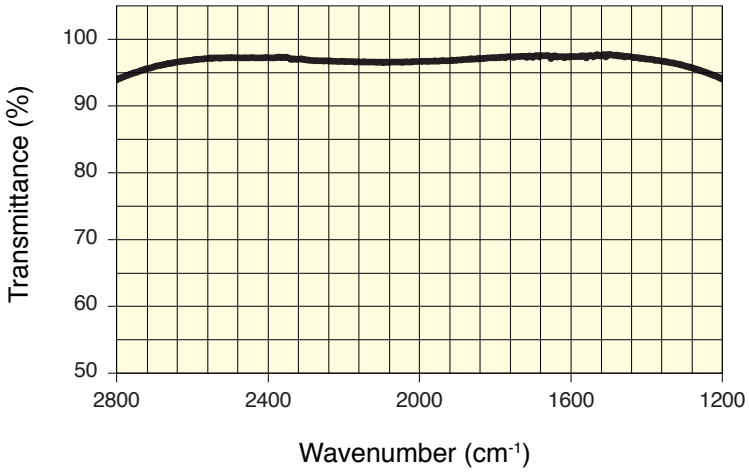
■Window of HHL package

Characteristics		Specifications
Material		ZnSe, Plano-Plano
Dimension	Clear aperture(1)	ϕ4,4 mm
	Thickness	0.7 mm
Coating	Coating	BBAR, both surface
	Bandwidth	2500 cm^{-1} to 1250 cm^{-1}
	Transmittance(2)	> 96 %

(1): Mechanical aperture of HHL package.
(2): Average in the bandwidth.

■Typical transmittance curve of the window



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

Characteristics	Specifications
Output current	≥1.3 A
Output voltage	≥16 V
Function	Surge protect
	Constant current control

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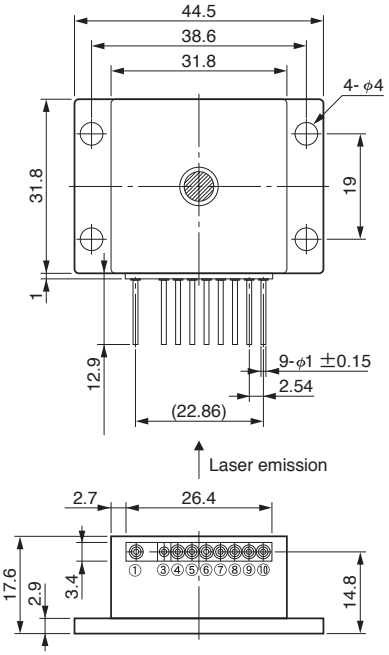
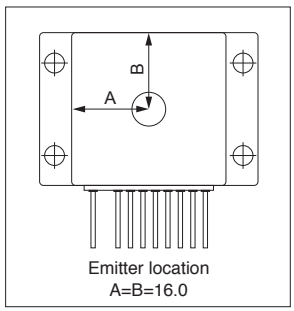
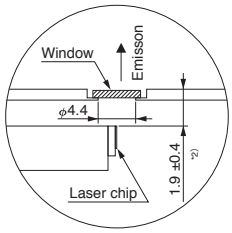
■Dimensional outline and pin connection (unit:mm)







*1) Tolerance is +/- 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, ($T_{op(c)}$)
④	QCL anode (+)	⑨	Thermistor, ($T_{op(c)}$)
⑤	Thermistor, ($T_{op(qcl)}$)	⑩	TEC anode (+)
⑥	Thermistor, ($T_{op(qcl)}$)	-	-

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

CLASS 3B LASER
Invisible Laser Radiation: Avoid Exposure to Beam

●The Laser emits invisible laser radiation.
The instrument which used the LASER, operated under ordinary conditions, is classified as Class 3B according to the laser product classification code IEC 60825-1.
See IEC 60825-1 for more details and safety operation concerning the above countermeasures.

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