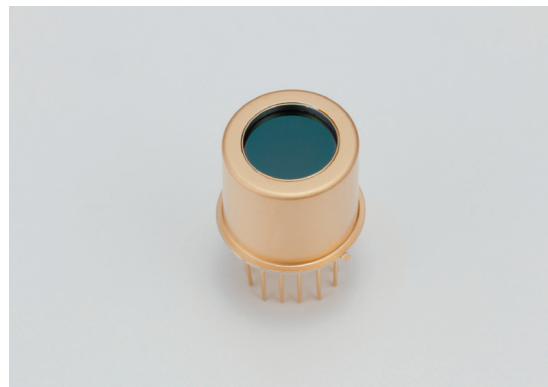


## ■ Features

- Emission wavelength: 7.82  $\mu\text{m}$  (Typ.)
- Output power: 50 mW (Min.)
- Threshold current: 1.5 A (Max.)

## ■ Applications

- Trace gas analysis (CH<sub>4</sub>, N<sub>2</sub>O)



## ■ 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.

Characteristics	Symbols	Ratings	Units
Pulsed forward current <sup>*1)</sup>	$I_{\text{fp}}$	This product has individual difference. Confirm data sheet attached to a product <sup>*2)</sup>	A
Pulsed forward voltage <sup>*1)</sup>	$V_{\text{fp}}$		V
Pulsed reverse voltage <sup>*1)</sup>	$V_{\text{r}}$	(0.0)	V
Current pulse width	$t_{\text{w}}$	500	ns
Duty ratio	DR	5	%
TEC current (cooling mode) <sup>*3)</sup>	$I_{\text{c}}$	+1.6	A
TEC current (heating mode) <sup>*3)</sup>		-0.8	A
TEC voltage	$V_{\text{c}}$	$\pm 2.2$	V
Operating temperature (case) <sup>*4) *5)</sup>	$T_{\text{op(c)}}$	+10 to +70	$^{\circ}\text{C}$
Operating temperature (QCL) <sup>*6)</sup>	$T_{\text{op(qcl)}}$	-15 to +60	$^{\circ}\text{C}$
Storage temperature <sup>*4)</sup>	$T_{\text{stg}}$	-20 to +80	$^{\circ}\text{C}$

\*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 :  $I_{\text{fp}} \geq 3.0\text{ A}$ ,  $V_{\text{fp}} \geq 20\text{ V}$ .

\*3) Even if TEC current ( $I_{\text{c}}$ ) 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.

\*4) Avoid water condensation.

\*5) Temperatures of case (body) of TO-8 package.

\*6) Temperatures of QC-laser when operated; should be monitored by the built-in thermistor for  $T_{\text{op(qcl)}}$ .

# 7.82 μm DFB-Pulsed type Quantum cascade lasers L12017-1278T-C

## Specifications (laser)

$t_w = 50 \text{ ns}$ ,  $f_r^{(1)} = +200 \text{ kHz}$ ,  $T_{\text{op(qcl)}} = +20 \text{ }^\circ\text{C}$ , unless otherwise specified.

Characteristics	Symbols	Test conditions	Min.	Typ.	Max.	Units
Operating temperature (QCL) <sup>(3)</sup>	$T_{\text{op(qcl)}}$	$K^{(2)}=1278 \text{ cm}^{-1}$	-10	-	+50	$^\circ\text{C}$
Spectral linewidth <sup>(4)</sup>	$\Delta K_L$	$K^{(2)}=1278 \text{ cm}^{-1}$	-	-	0.2 <sup>(5)</sup>	$\text{cm}^{-1}$
Wavenumber tuning range <sup>(6)</sup>	$\Delta K_T$	$K^{(2)}=1278 \text{ cm}^{-1}$	$\pm 1.0$	-	-	$\text{cm}^{-1}$
Pulsed radiant power	$\phi_{\text{ep}}$	$K^{(2)}=1278 \text{ cm}^{-1}$	50	-	-	mW
Threshold current	$I_{\text{th}}$	-	-	-	1.5	A
Side mode suppression ratio	SMSR	-	25 <sup>(5)</sup>	-	-	dB

(1)  $f_r$ : Pulse repetition frequency (kHz).

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

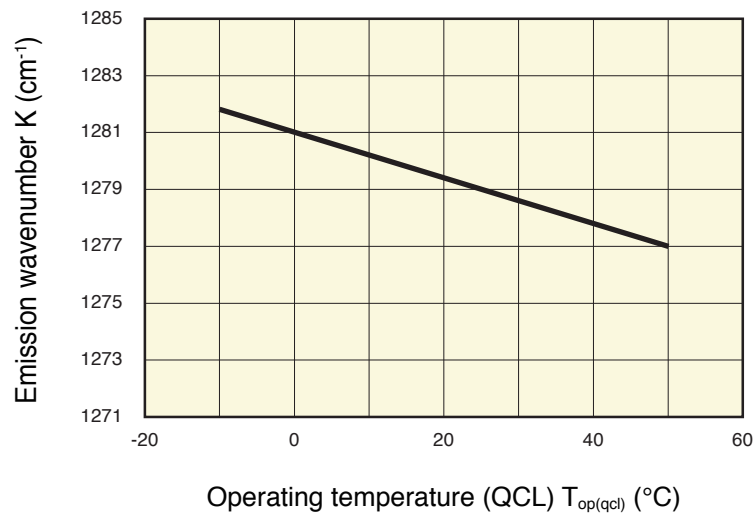
(3) This product is able to emit the target wavenumber at a certain  $T_{\text{op(qcl)}}$  within the specified temperature range.

(4) FWHM. Spectral linewidth depends on current pulse width.

(5) These values are limited by resolution and signal-to-noise ratio of instrument when tested.

(6) Continuously wavenumber scan range; Center of the tunability range is the emission wavenumber (K).

## Typical characteristics



Characteristics	Symbols	Conditions	Typical values
Temperature coefficient of wavenumber	$\delta K_T$	$I_f = \text{const.}$	$-0.08 \text{ cm}^{-1} / ^\circ\text{C}$

## TEC

Characteristics	Symbols	Test conditions	Specifications
Maximum temperature difference	$\Delta T_{\text{max}}$	$T_h=27 \text{ }^\circ\text{C}$ , in $\text{N}_2$ , $Q_c=0$ , $I_c=+1.6 \text{ A}$	65 $^\circ\text{C}$
Maximum heat pumping capacity	$Q_{\text{cmax}}$	$T_h=27 \text{ }^\circ\text{C}$ , in $\text{N}_2$ , $I_c=+1.6 \text{ A}$ , $\Delta T=0$	20 W
AC resistance	ACR	$T_h=27 \text{ }^\circ\text{C}$ , $I_c=0.1 \text{ mA}$ , 1 kHz	1.2 $\Omega \pm 0.3 \Omega$

Note)  $\Delta T$ : Temperature difference

$Q_c$ : Heat pumping capacity

$I_c$ : TEC current

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

## 7.82 μm DFB-Pulsed type Quantum cascade lasers L12017-1278T-C

### Thermistor

Characteristics	Symbols	Test conditions	Specifications
Resistance	$R_{25}$	25 °C	10 kΩ±5 %
Alpha value	$\alpha$	25 °C	-4.39 % / °C
Beta value	B	0 °C / 50 °C	3892 K

### Window of TO-8 package

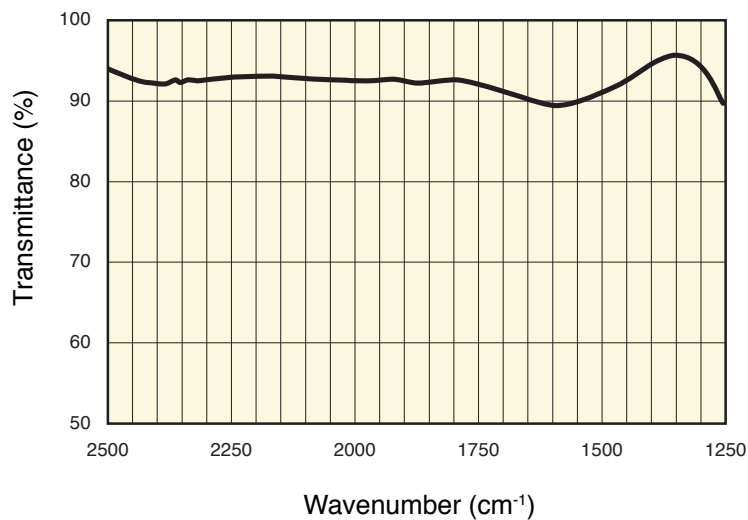
Characteristics		Specifications
Material		Ge, Plano-Plano
Dimension	Clear aperture <sup>(1)</sup>	φ10 mm
	Effective aperture <sup>(2)</sup>	φ7 mm
	Thickness	1 mm
Coating	Coating	BBAR, both surface
	Bandwidth	2500 cm <sup>-1</sup> to 1250 cm <sup>-1</sup>
	Transmittance <sup>(3)</sup>	> 85 %

(1): Mechanical aperture of TO-8 package.

(2): Effective aperture of BBAR-coating.

(3): Average in the bandwidth.

### Typical transmittance curve of the window

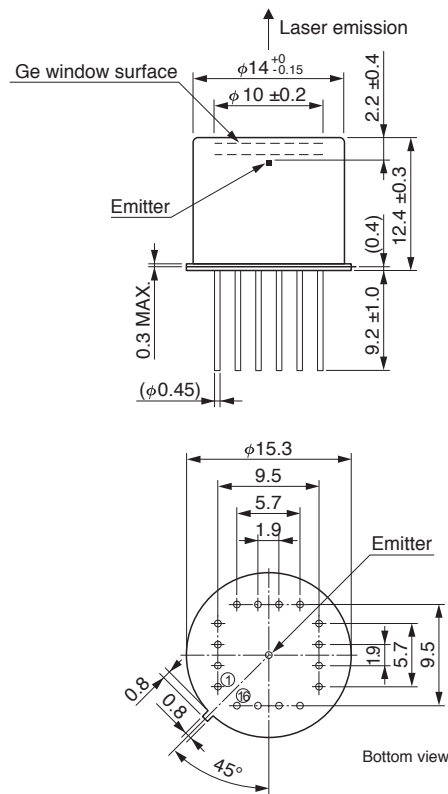


### Necessary specifications of power supply for the laser (QCL)

Characteristics	Specifications
Output current (pulse)	≥1.3 A
Output voltage (pulse)	≥16 V
Output pulse width	10 ns to 500 ns
Output duty ratio	≤5 %
Function	surge protect

## 7.82 μm DFB-Pulsed type Quantum cascade lasers L12017-1278T-C

### Dimensional outline and pin connection (unit:mm)



Pin No.	Function	Pin No.	Function	Pin No.	Function
①	TEC cathode (-)	⑦	QCL anode (+)	⑬	QCL cathode (-)
②	N.C.	⑧	QCL anode (+)	⑭	QCL cathode (-)
③	N.C.	⑨	Thermistor, (T <sub>op(qcl)</sub> )	⑮	QCL cathode (-)
④	TEC anode (+)	⑩	Thermistor, (T <sub>op(qcl)</sub> )	⑯	QCL cathode (-)
⑤	QCL anode (+)	⑪	N.C.	-	-
⑥	QCL anode (+)	⑫	N.C.	-	-

NOTE) All Pin are floating to the case.

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