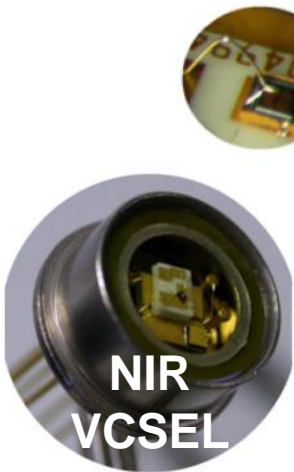



## Product Catalog for Near-IR Gas Analysis from 1.27 $\mu\text{m}$ to 2.3 $\mu\text{m}$





**NIR  
VCSEL  
Analysis**

**Environmental  
Monitoring**



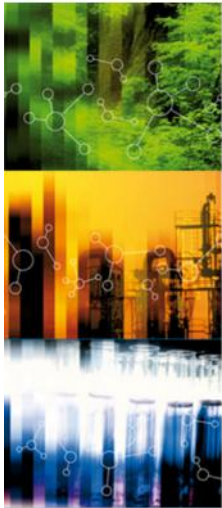
**Industry and  
Safety**



**Detectable Gases**  
**HF, H<sub>2</sub>O, NH<sub>3</sub>, H<sub>2</sub>S, CH<sub>4</sub>, CO, CO<sub>2</sub>, HCl, and more**



## Available VCSEL Wavelengths



### VCSEL Products for NIR Gas Analysis (TDLAS)

#### Standard Wavelengths

- 1280 nm: HF
- 1392 nm: H<sub>2</sub>O
- 1512 nm: NH<sub>3</sub>
- 1564 nm
- 1579 nm: H<sub>2</sub>S
- 1590 nm: H<sub>2</sub>S
- 1654 nm: Methane, CH<sub>4</sub>
- 1680 nm: Combustables
- 1730 and 1742nm: HCl
- 1854 nm: H<sub>2</sub>O
- 2004nm and 2008nm : CO<sub>2</sub>

#### Application Specific Wavelengths

- Any wavelength from 1.3µm to 2.3µm
- Examples:
  - 1560nm : CO
  - 1645nm: Ethylen Oxide
  - 1800nm, 1877nm : H<sub>2</sub>O
  - 1960nm : N<sub>2</sub>O
  - 2012nm : CO<sub>2</sub>

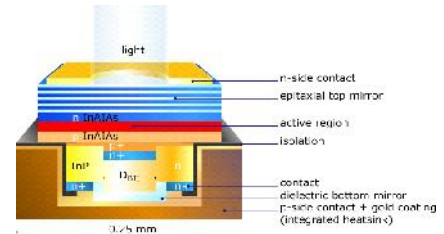
## Available Packaging Options

Package Version	Description	Ordering Information
SE-R4	TO-46 with protective ring, uncooled	VL-xxxx-1-SE-R4
SE-A4	TO-46 with angled cap, AR coated window, uncooled	VL-xxxx-1-SE-A4
SQ-R5	TO-5 (TO-39) with protective ring, TEC/Thermistor	VL-xxxx-1-SQ-R5
SQ-A5	TO-5 (TO-39) with cap, AR coated window, TEC/Thermistor	VL-xxxx-1-SQ-A5
SE-H4	TO-46, SSMF pigtail with FC/APC, uncooled	VL-xxxx-1-SE-H4
ST-H4	TO-46, SSMF Pigtail with FC/APC, TEC/Thermistor	VL-xxxx-1-ST-H4



## Single-mode VCSELs from 1278 nm to 23xx nm for sensing applications

**Gases: H<sub>2</sub>O, NH<sub>3</sub>, H<sub>2</sub>S, CH<sub>4</sub>, CO, CO<sub>2</sub>, HCl**



### Key Features

- Long wavelength single mode VCSEL for spectroscopy applications
- Available standard wavelengths range between 1278 nm and 2050 nm
- Operating temperature: -20 to +70 °C (max.)
- Wide tunability and wavelength accuracy
- Fast performance for current modulation
- Cooled and un-cooled versions available
- Various packaging options (TO, pigtail, hermetically sealed, etc.)
- Low power dissipation and low threshold voltage and current



### Description

VERTILAS' long wavelength VCSEL technology offers a wide range of products for various applications applying spectroscopy and gas detection methodologies.

The product line offers several packaging options, ranging from open packages for prototyping to a hermetically sealed packaged with cap and anti reflective coated window. It also includes pigtail solutions and further customer specific options are available on request.

The high performance VERTILAS technology and products enable customers to design and manufacture spectroscopy solutions that offer high sensitivity, low power dissipation, small system size and cost effective manufacturing.

### Applications

- Tunable diode laser absorption spectroscopy TDLS
- Near-IR gas analysis
- Safety
- Environmental measurements
- Agriculture and food storage
- Industrial and production control
- Test and measurement
- Consumer applications
- Automotive



## Standard Wavelength Product Offering

Product No.	VL-xxxx-1-SE/ST/SQ-y
<b>VL</b>	VCSEL SM
1278 nm 1392 nm 1512 nm 1560 nm 1570 nm 1580 nm 1590 nm 1654 nm 1680 nm 1742 nm 1854 nm 2004 nm, 2012nm 23xx nm	VL-1278-1 VL-1392-1 VL-1512-1 VL-1560-1 VL-1570-1 VL-1580-1 VL-1590-1 VL-1654-1 VL-1680-1 VL-1742-1 VL-1854-1 VL-2004-1, VL-2012-1 VL-23xx-1
<b>SE</b> <b>ST</b> <b>SQ</b>	Uncooled TO-46: SE Cooled TO-46: ST Cooled TO-39: SQ
<b>Y (Package)</b>	R4: TO-46, protective ring A4: TO-46, angled cap + window R5: TO-39, protective ring A5: TO-39, cap + angled window H4: TO-46 with SMF pigtail FC/APC

Application Specific Wavelengths  
 Please contact us.  
 We can manufacture wavelengths on demand.

Application Specific Packages  
 Please contact us.  
 We can offer various packages on demand.

## Configuration and operating conditions

	Symbol	Min.	Typ	Max	Unit
<b>Ambient operating case temperature</b>					
<b>SE, ST, SQ</b>	Top	-10	-	+70	°C
<b>Pigtail H4</b>	Top	0	-	+70	°C
<b>Non-hermetic</b>	Top	+15	-	+70	°C
<b>Extended temp. range available on request</b>					
<b>Storage temperature</b>					
<b>SE, ST, SQ</b>	Tstg	-20	-	+80	°C
<b>Pigtail H4</b>	Tstg	0	-	+70	°C
<b>Non-hermetic</b>	Tstg	+15	-	+70	°C
<b>Soldering temp.</b>	Stemp	-	-	260	°C
<b>Soldering time</b>	Stime	-	-	3	sec
<b>Reverse voltage</b>	VR	-	-	1.0	V

**Soldering procedure:** Do not use wave or reflow soldering. Solder one pin at a time. Allow for sufficient time (> 10s) for cooling between soldering of individual pins. Package must have thermal contact to heat sink. Use ESD protection and a grounded soldering iron.





**VL-1278-1**  
**SM VCSEL 1278 nm**

For adjacent wavelengths  $\pm 5\text{nm}$   
 please contact us.

**Gases: HF**

**Optical and electrical characteristics**

Parameter	Condition	Symbol	Units	Ratings	
Target Wavelength	vacuum	$\lambda_0$	nm	1278	
				Min	Max
Current at Target Wavelength	$T_O=T_{\lambda 0}^b$	$I_{\lambda 0}$	mA	2.0	10.0
Temperature at Target Wavelength	$I_O=I_{\lambda 0}^c$	$T_{\lambda 0}$	°C	15	35
Optical Power at Target Wavelength	$T_O=T_{\lambda 0}^b, I_O=I_{\lambda 0}^c$	$P_{\lambda 0}$	mW	0.3	2.0
Maximum Optical Power	$T_O=10^\circ\text{C}^b, I_O=I_{\text{max}}^c$	$P_{\text{max}}$	mW	1.0	2.5
Threshold Current	$T_O=T_{\lambda 0}^b$	$I_{\text{th}}$	mA	0.1	3.0
Operating Voltage @ $P_{\text{max}}$	$T_O=10^\circ\text{C}^b, I_O=I_{\text{max}}^c$	$V_{\text{max}}$	V		2.0
Current Tuning Coefficient	$T_O=T_{\lambda 0}^b, I_O=I_{\lambda 0}^c, f=0\text{ Hz}^a$	$\Delta\lambda/\Delta I$	nm/mA	0.2	0.9
Temperature Tuning Coefficient	$T_O=T_{\lambda 0}^b, I_O=I_{\lambda 0}^c$	$\Delta\lambda/\Delta T$	nm/K	0.08	0.2
Slope Efficiency	$T_O=T_{\lambda 0}^b, I_O=I_{\lambda 0}^c$	$\Delta P/\Delta I$	mW/mA	0.05	0.4
Side Mode Suppression Ratio at Target Wavelength	transverse and polarisation modes, $T_O=T_{\lambda 0}^b, I=I_{\lambda 0}^c$	SMSR	dB	25	

Note a: higher modulation frequency will decrease tuning range, change <10% with  $f < 10\text{kHz}$

Spec\_1278\_V2.1.0

Note b:  $T_O$ : TEC operating temperature

Note c:  $I_O$ : Laser operating current

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**Packaging options and ordering information**

Package Version	Description	Ordering Information
SE-R4	TO-46 with protective ring, uncooled	VL-1392-1-SE-R4
SE-A4	TO-46 with angled cap, AR coated window, uncooled	VL-1392-1-SE-A4
SQ-R5	TO-39 with protective ring, TEC/Thermistor	VL-1392-1-SQ-R5
SQ-A5	TO-39 with cap, AR coated window, TEC/Thermistor	VL-1392-1-SQ-A5
SE-H4	TO-46, SSMF pigtail with FC/APC, uncooled	VL-1392-1-SE-H4
ST-H4	TO-46, SSMF Pigtail with FC/APC, TEC/Thermistor	VL-1392-1-ST-H4

Non-hermetically sealed lasers with TEC: Do not operate at or below 15°C



**VL-1392-1**  
**SM VCSEL 1392 nm**

For adjacent wavelengths  $\pm 5\text{nm}$   
 please contact us.

**Gases: H<sub>2</sub>O**

**Optical and electrical characteristics**

Parameter	Condition	Symbol	Units	Ratings	
Target Wavelength		$\lambda_0$	nm	1392	
				Min	Max
Current at Target Wavelength	$a, T_0=T_0^c$	$I_0$	mA	2	8
Temperature at Target Wavelength	$a, I_0=I_0^d$	$T_0$	°C	15	35
Optical Power at Target Wavelength	$a, T_0=T_0^c, I_0=I_0^d$	$P_0$	mW	0.2	3.0
Maximum Optical Power	$T_0=20^\circ\text{C}, I_0=I_{\text{max}}^d$	$P_{\text{max}}$	mW	0.4	3.5
Threshold Current	$T_0=T_0^c$	$I_{\text{th}}$	mA	0.1	3.0
Operating Voltage @ $P_{\text{max}}$	$T_0=20^\circ\text{C}, I_0=I_{\text{max}}^d$	$V_{\text{max}}$	V		2.1
Current Tuning Coefficient	$T_0=T_0^c, I_0=I_0^d, f=0\text{ Hz}^b$	$\frac{\lambda}{I}$	nm / mA	0.2	0.9
Temperature Tuning Coefficient	$T_0=T_0^c, I_0=I_0^d$	$\frac{\lambda}{T}$	nm / K	0.08	0.2
Slope Efficiency	$T_0=T_0^c, I_0=I_0^d$	$\frac{P}{I}$	mW / mA	0.05	0.5
Side Mode Suppression Ratio at Target Wavelength	transverse and polarisation modes, $T_0=T_0^c, I=I_0^d$	SMSR	dB	25	

Note a: target wavelength  $\lambda=\lambda_0$

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Spec\_1392\_V2.1.0

Note b: higher modulation frequency will decrease tuning range, change <10% with  $f<10\text{kHz}$

Note c:  $T_0$ : Submount temperature

Note d:  $I_0$ : Laser operating current

**Packaging options and ordering information**

Package Version	Description	Ordering Information
SE-R4	TO-46 with protective ring, uncooled	VL-1392-1-SE-R4
SE-A4	TO-46 with angled cap, AR coated window, uncooled	VL-1392-1-SE-A4
SQ-R5	TO-39 with protective ring, TEC/Thermistor	VL-1392-1-SQ-R5
SQ-A5	TO-39 with cap, AR coated window, TEC/Thermistor	VL-1392-1-SQ-A5
SE-H4	TO-46, SSMF pigtail with FC/APC, uncooled	VL-1392-1-SE-H4
ST-H4	TO-46, SSMF Pigtail with FC/APC, TEC/Thermistor	VL-1392-1-ST-H4

Non-hermetically sealed lasers with TEC: Do not operate at or below 15°C



**VL-1512-1**  
**SM VCSEL 1512 nm**

For adjacent wavelengths  $\pm 5\text{nm}$   
 please contact us.

**Gases: NH<sub>3</sub>**

**Optical and electrical characteristics**

Parameter	Condition	Symbol	Units	Ratings	
Target Wavelength		$\lambda_o$	nm	1512	
				Min	Max
Current at Target Wavelength	$a, T_o=T_o^c$	$I_o$	mA	2	10
Temperature at Target Wavelength	$a, I_o=I_o^d$	$T_o$	°C	15	35
Optical Power at Target Wavelength	$a, T_o=T_o^c, I_o=I_o^d$	$P_o$	mW	0.2	3.0
Maximum Optical Power	$T_o=20^\circ\text{C}, I_o=I_{o\max}^d$	$P_{\max}$	mW	0.4	3.5
Threshold Current	$T_o=T_o^c$	$I_{th}$	mA	0.1	3.0
Operating Voltage @ $P_{\max}$	$T_o=20^\circ\text{C}, I_o=I_{o\max}^d$	$V_{\max}$	V		2.1
Current Tuning Coefficient	$T_o=T_o^c, I_o=I_o^d, f=0\text{ Hz}^b$	$\frac{\lambda}{I}$	nm / mA	0.2	0.9
Temperature Tuning Coefficient	$T_o=T_o^c, I_o=I_o^d$	$\frac{\lambda}{T}$	nm / K	0.08	0.2
Slope Efficiency	$T_o=T_o^c, I_o=I_o^d$	$\frac{P}{I}$	mW / mA	0.05	0.5
Side Mode Suppression Ratio at Target Wavelength	transverse and polarisation modes, $T_o=T_o^c, I_o=I_o^d$	SMSR	dB	25	

Note a: target wavelength  $\lambda=\lambda_o$       VERTILAS confidential      Spec\_1512\_V2.1.0  
 Note b: higher modulation frequency will decrease tuning range, change <10% with  $f<10\text{kHz}$   
 Note c:  $T_o$ : Submount temperature  
 Note d:  $I_o$ : Laser operating current

**Packaging options and ordering information**

Package Version	Description	Ordering Information
SE-R4	TO-46 with protective ring, uncooled	VL-1512-1-SE-R4
SE-A4	TO-46 with angled cap, AR coated window, uncooled	VL-1512-1-SE-A4
SQ-R5	TO-39 with protective ring, TEC/Thermistor	VL-1512-1-SQ-R5
SQ-A5	TO-39 with cap, AR coated window, TEC/Thermistor	VL-1512-1-SQ-A5
SE-H4	TO-46, SSMF pigtail with FC/APC, uncooled	VL-1512-1-SE-H4
ST-H4	TO-46, SSMF Pigtail with FC/APC, TEC/Thermistor	VL-1512-1-ST-H4

Non-hermetically sealed lasers with TEC: Do not operate at or below 15°C



**VL-1550-1 nm, VL-1560-1 nm  
 VL-1570-1 nm, VL-1580-1 nm  
 VL-1590-1 nm**

For adjacent wavelengths  $\pm 5$ nm  
 please contact us.

**SM VCSEL 1550 nm, 1560 nm, 1570 nm, 1580 nm and 1590 nm  
 Gases: H<sub>2</sub>S, CO<sub>2</sub>, CO**

### Optical and electrical characteristics

Parameter	Condition	Symbol	Units	Ratings	
Target Wavelength		$\lambda_0$	nm	1550 - 1590	
				Min	Max
Current at Target Wavelength	$a, T_0 = T_0^c$	$I_0$	mA	2	10
Temperature at Target Wavelength	$a, I_0 = I_0^d$	$T_0$	°C	15	35
Optical Power at Target Wavelength	$a, T_0 = T_0^c, I_0 = I_0^d$	$P_0$	mW	0.2	3.0
Maximum Optical Power	$T_0 = 20^\circ\text{C}, I_0 = I_{\text{max}}^d$	$P_{\text{max}}$	mW	0.4	3.5
Threshold Current	$T_0 = T_0^c$	$I_{\text{th}}$	mA	0.1	3.0
Operating Voltage @ $P_{\text{max}}$	$T_0 = 20^\circ\text{C}, I_0 = I_{\text{max}}^d$	$V_{\text{max}}$	V		2.1
Current Tuning Coefficient	$T_0 = T_0^c, I_0 = I_0^d, f = 0 \text{ Hz}^b$	$\frac{\lambda}{I}$	nm / mA	0.2	0.9
Temperature Tuning Coefficient	$T_0 = T_0^c, I_0 = I_0^d$	$\frac{\lambda}{T}$	nm / K	0.08	0.2
Slope Efficiency	$T_0 = T_0^c, I_0 = I_0^d$	$\frac{P}{I}$	mW / mA	0.05	0.5
Side Mode Suppression Ratio at Target Wavelength	transverse and polarisation modes, $T_0 = T_0^c, I = I_0^d$	SMSR	dB	25	

Note a: target wavelength  $\lambda = \lambda_0$

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Spec\_1580\_V2.1.0

Note b: higher modulation frequency will decrease tuning range, change <10% with  $f < 10\text{kHz}$

Note c:  $T_0$ : Submount temperature

Note d:  $I_0$ : Laser operating current

### Packaging options and ordering information

Package Version	Description	Ordering Information
SE-R4	TO-46 with protective ring, uncooled	VL-15xx-1-SE-R4
SE-A4	TO-46 with angled cap, AR coated window, uncooled	VL-15xx-1-SE-A4
SQ-R5	TO-39 with protective ring, TEC/Thermistor	VL-15xx-1-SQ-R5
SQ-A5	TO-39 with cap, AR coated window, TEC/Thermistor	VL-15xx-1-SQ-A5
SE-H4	TO-46, SSMF pigtail with FC/APC, uncooled	VL-15xx-1-SE-H4
ST-H4	TO-46, SSMF Pigtail with FC/APC, TEC/Thermistor	VL-15xx-1-ST-H4
		xx = 50, 60, 70, 80 or 90

Non-hermetically sealed lasers with TEC: Do not operate at or below 15°C





**VL-1654-1 and VL-1680-1  
 SM VCSEL 1654 nm or 1680 nm**

For adjacent wavelengths  $\pm 5$ nm please contact us.

**Gases: CH<sub>4</sub>**

**Optical and electrical characteristics**

Parameter	Condition	Symbol	Units	Ratings	
Target Wavelength		$\lambda_0$	nm	1654	
				Min	Max
Current at Target Wavelength	$T_0 = T_0^c$	$I_0$	mA	2	10
Temperature at Target Wavelength	$I_0 = I_0^d$	$T_0$	°C	15	35
Optical Power at Target Wavelength	$T_0 = T_0^c, I_0 = I_0^d$	$P_0$	mW	0.2	3.0
Maximum Optical Power	$T_0 = 20^\circ\text{C}, I_0 = I_{\text{max}}^d$	$P_{\text{max}}$	mW	0.4	3.5
Threshold Current	$T_0 = T_0^c$	$I_{\text{th}}$	mA	0.1	3.0
Operating Voltage @ $P_{\text{max}}$	$T_0 = 20^\circ\text{C}, I_0 = I_{\text{max}}^d$	$V_{\text{max}}$	V		2.1
Current Tuning Coefficient	$T_0 = T_0^c, I_0 = I_0^d, f = 0 \text{ Hz}$	$\frac{dI_0}{d\lambda}$	nm / mA	0.2	0.9
Temperature Tuning Coefficient	$T_0 = T_0^c, I_0 = I_0^d$	$\frac{dT_0}{d\lambda}$	nm / K	0.08	0.2
Slope Efficiency	$T_0 = T_0^c, I_0 = I_0^d$	$\frac{dP}{dI}$	mW / mA	0.05	0.5
Side Mode Suppression Ratio at Target Wavelength	transverse and polarisation modes, $T_0 = T_0^c, I = I_0^d$	SMSR	dB	25	

Note a: target wavelength  $\lambda = \lambda_0$

VERTILAS confidential

Spec\_1654\_V2.1.1

Note b: higher modulation frequency will decrease tuning range, change <10% with  $f < 10$ kHz

Note c:  $T_0$ : Submount temperature

Note d:  $I_0$ : Laser operating current

**Packaging options and ordering information**

Package Version	Description	Ordering Information
SE-R4	TO-46 with protective ring, uncooled	VL-1654-1-SE-R4
SE-A4	TO-46 with angled cap, AR coated window, uncooled	VL-1654-1-SE-A4
SQ-R5	TO-39 with protective ring, TEC/Thermistor	VL-1654-1-SQ-R5
SQ-A5	TO-39 with cap, AR coated window, TEC/Thermistor	VL-1654-1-SQ-A5
SE-H4	TO-46, SSMF pigtail with FC/APC, uncooled	VL-1654-1-SE-H4
ST-H4	TO-46, SSMF Pigtail with FC/APC, TEC/Thermistor	VL-1654-1-ST-H4

Non-hermetically sealed lasers with TEC: Do not operate at or below 15°C



**VL-1742-1**  
**SM VCSEL 1742 nm**

For adjacent wavelengths  $\pm 5\text{nm}$   
 please contact us.

**Gases: HCl**

**Optical and electrical characteristics**

Parameter	Condition	Symbol	Units	Ratings	
Target Wavelength		$\lambda_0$	nm	1742	
				Min	Max
Current at Target Wavelength	$a, T_0=T_0^c$	$I_0$	mA	2	10
Temperature at Target Wavelength	$a, I_0=I_0^d$	$T_0$	$^{\circ}\text{C}$	15	35
Optical Power at Target Wavelength	$a, T_0=T_0^c, I_0=I_0^d$	$P_0$	mW	0.2	3.0
Maximum Optical Power	$T_0=20^{\circ}\text{C}, I_0=I_{\text{max}}^d$	$P_{\text{max}}$	mW	0.4	3.5
Threshold Current	$T_0=T_0^c$	$I_{\text{th}}$	mA	0.1	3.0
Operating Voltage @ $P_{\text{max}}$	$T_0=20^{\circ}\text{C}, I_0=I_{\text{max}}^d$	$V_{\text{max}}$	V		2.1
Current Tuning Coefficient	$T_0=T_0^c, I_0=I_0^d, f=0\text{ Hz}$	$\frac{\lambda}{I}$	nm / mA	0.2	0.9
Temperature Tuning Coefficient	$T_0=T_0^c, I_0=I_0^d$	$\frac{\lambda}{T}$	nm / K	0.08	0.2
Slope Efficiency	$T_0=T_0^c, I_0=I_0^d$	$\frac{P}{I}$	mW / mA	0.05	0.5
Side Mode Suppression Ratio at Target Wavelength	transverse and polarisation modes, $T_0=T_0^c, I=I_0^d$	SMSR	dB	25	

Note a: target wavelength  $\lambda=\lambda_0$

VERTILAS confidential

Spec\_1742\_V2.1.0

Note b: higher modulation frequency will decrease tuning range, change <10% with  $f<10\text{kHz}$

Note c:  $T_0$ : Submount temperature

Note d:  $I_0$ : Laser operating current

**Packaging options and ordering information**

Package Version	Description	Ordering Information
SE-R4	TO-46 with protective ring, uncooled	VL-1742-1-SE-R4
SE-A4	TO-46 with angled cap, AR coated window, uncooled	VL-1742-1-SE-A4
SQ-R5	TO-39 with protective ring, TEC/Thermistor	VL-1742-1-SQ-R5
SQ-A5	TO-39 with cap, AR coated window, TEC/Thermistor	VL-1742-1-SQ-A5
SE-H4	TO-46, SSMF pigtail with FC/APC, uncooled	VL-1742-1-SE-H4
ST-H4	TO-46, SSMF Pigtail with FC/APC, TEC/Thermistor	VL-1742-1-ST-H4

Non-hermetically sealed lasers with TEC: Do not operate at or below 15°C



**VL-1854-1**  
**SM VCSEL 1854 nm**

For adjacent wavelengths  $\pm 5\text{nm}$   
 please contact us.

**Gases: H<sub>2</sub>O**

**Optical and electrical characteristics**

Parameter	Condition	Symbol	Units	Ratings	
				1854	
Target Wavelength		$\lambda_0$	nm	Min	Max
Current at Target Wavelength	$a, T_0=T_0^c$	$I_0$	mA	2	11
Temperature at Target Wavelength	$a, I_0=I_0^d$	$T_0$	°C	15	35
Optical Power at Target Wavelength	$a, T_0=T_0^c, I_0=I_0^d$	$P_0$	mW	0.2	3.0
Maximum Optical Power	$T_0=20^\circ\text{C}, I_0=I_{\text{max}}^d$	$P_{\text{max}}$	mW	0.4	3.5
Threshold Current	$T_0=T_0^c$	$I_{\text{th}}$	mA	0.1	3.0
Operating Voltage @ $P_{\text{max}}$	$T_0=20^\circ\text{C}, I_0=I_{\text{max}}^d$	$V_{\text{max}}$	V		2.1
Current Tuning Coefficient	$T_0=T_0^c, I_0=I_0^d, f=0\text{ Hz}^b$	$\frac{dI_0}{d\lambda}$	nm / mA	0.2	0.9
Temperature Tuning Coefficient	$T_0=T_0^c, I_0=I_0^d$	$\frac{dI_0}{dT}$	nm / K	0.08	0.2
Slope Efficiency	$T_0=T_0^c, I_0=I_0^d$	$\frac{dP}{dI}$	mW / mA	0.05	0.5
Side Mode Suppression Ratio at Target Wavelength	transverse and polarisation modes, $T_0=T_0^c, I_0=I_0^d$	SMSR	dB	25	

Note a: target wavelength  $\lambda=\lambda_0$  VERTILAS confidential Spec\_1854\_V2.1.0  
 Note b: higher modulation frequency will decrease tuning range, change <10% with  $f<10\text{kHz}$   
 Note c:  $T_0$ : Submount temperature  
 Note d:  $I_0$ : Laser operating current

**Packaging options and ordering information**

Package Version	Description	Ordering Information
SE-R4	TO-46 with protective ring, uncooled	VL-1854-1-SE-R4
SE-A4	TO-46 with angled cap, AR coated window, uncooled	VL-1854-1-SE-A4
SQ-R5	TO-39 with protective ring, TEC/Thermistor	VL-1854-1-SQ-R5
SQ-A5	TO-39 with cap, AR coated window, TEC/Thermistor	VL-1854-1-SQ-A5
SE-H4	TO-46, SSMF pigtail with FC/APC, uncooled	VL-1854-1-SE-H4
ST-H4	TO-46, SSMF Pigtail with FC/APC, TEC/Thermistor	VL-1854-1-ST-H4

Non-hermetically sealed lasers with TEC: Do not operate at or below 15°C



**VL-2004-1m VL-2008 or VL-2012-1  
 SM VCSEL 2004 nm, 2008 nm or 2012 nm**

For adjacent wavelengths  $\pm 5$ nm  
 please contact us.

**Gases: CO<sub>2</sub>**

**Optical and electrical characteristics**

Parameter	Condition	Symbol	Units	Ratings	
				Min	Max
Target Wavelength		$\lambda_0$	nm	2004	
Current at Target Wavelength	a, $T_0=T_0^c$	$I_0$	mA	2	11
Temperature at Target Wavelength	a, $I_0=I_0^d$	$T_0$	°C	15	35
Optical Power at Target Wavelength	a, $T_0=T_0^c$ , $I_0=I_0^d$	$P_0$	mW	0.2	3.0
Maximum Optical Power	$T_0=20^\circ\text{C}$ , $I_0=I_{\text{max}}^d$	$P_{\text{max}}$	mW	0.4	3.5
Threshold Current	$T_0=T_0^c$	$I_{\text{th}}$	mA	0.1	3.0
Operating Voltage @ $P_{\text{max}}$	$T_0=20^\circ\text{C}$ , $I_0=I_{\text{max}}^d$	$V_{\text{max}}$	V		2.1
Current Tuning Coefficient	$T_0=T_0^c$ , $I_0=I_0^d$ , $f=0$ Hz <sup>b</sup>	$\frac{dI}{dI}$	nm / mA	0.2	0.9
Temperature Tuning Coefficient	$T_0=T_0^c$ , $I_0=I_0^d$	$\frac{dT}{dT}$	nm / K	0.08	0.2
Slope Efficiency	$T_0=T_0^c$ , $I_0=I_0^d$	$\frac{dP}{dI}$	mW / mA	0.05	0.5
Side Mode Suppression Ratio at Target Wavelength	transverse and polarisation modes, $T_0=T_0^c$ , $I_0=I_0^d$	SMSR	dB	25	

Note a: target wavelength  $\lambda=\lambda_0$

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Spec\_2004\_V2.1.0

Note b: higher modulation frequency will decrease tuning range, change <10% with  $f<10$ kHz

Note c:  $T_0$ : Submount temperature

Note d:  $I_0$ : Laser operating current

**Packaging options and ordering information**

Package Version	Description	Ordering Information
SE-R4	TO-46 with protective ring, uncooled	VL-20xx-1-SE-R4
SE-A4	TO-46 with angled cap, AR coated window, uncooled	VL-20xx-1-SE-A4
SQ-R5	TO-39 with protective ring, TEC/Thermistor	VL-20xx-1-SQ-R5
SQ-A5	TO-39 with cap, AR coated window, TEC/Thermistor	VL-20xx-1-SQ-A5
SE-H4	TO-46, SSMF pigtail with FC/APC, uncooled	VL-20xx-1-SE-H4
ST-H4	TO-46, SSMF Pigtail with FC/APC, TEC/Thermistor	VL-20xx-1-ST-H4
		xx = 04 or 12



**VL-23xx-1**  
**SM VCSEL 23xx nm**

For adjacent wavelengths  $\pm 5\text{nm}$   
 please contact us.

**Gases: CO**

**Optical and electrical characteristics**

Parameter	Condition	Symbol	Units	Ratings	
Target Wavelength		$\lambda_0$	nm	23xx	
				Min	Max
Current at Target Wavelength	$a, T_0=T_0^c$	$I_0$	mA	5	15
Temperature at Target Wavelength	$a, I_0=I_0^d$	$T_0$	$^{\circ}\text{C}$	15	35
Optical Power at Target Wavelength	$a, T_0=T_0^c, I_0=I_0^d$	$P_0$	mW	0.1	0.8
Maximum Optical Power	$T_0=20^{\circ}\text{C}, I_0=I_{\text{max}}^d$	$P_{\text{max}}$	mW		1.0
Threshold Current	$T_0=T_0^c$	$I_{\text{th}}$	mA	0.1	5
Operating Voltage @ $P_{\text{max}}$	$T_0=20^{\circ}\text{C}, I_0=I_{\text{max}}^d$	$V_{\text{max}}$	V		2.5
Absolute Maximum Current		$I_{\text{max}}$	mA		16
Current Tuning Coefficient	$T_0=T_0^c, I_0=I_0^d, f=0\text{ Hz}^b$	$\frac{\lambda}{I}$	nm / mA	0.2	0.9
Temperature Tuning Coefficient	$T_0=T_0^c, I_0=I_0^d$	$\frac{\lambda}{T}$	nm / K	0.08	0.2
Slope Efficiency	$T_0=T_0^c, I_0=I_0^d$	$\frac{P}{I}$	mW / mA	0.05	0.3
Side Mode Suppression Ratio at Target Wavelength	transverse and polarisation modes, $T_0=T_0^c, I=I_0^d$	SMSR	dB	25	

Note a: target wavelength  $\lambda=\lambda_0$

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Spec\_23xx\_V3.1.2

Note b: higher modulation frequency will decrease tuning range, change <10% with  $f<10\text{kHz}$

Note c:  $T_0$ : Submount temperature

Note d:  $I_0$ : Laser operating current

**Packaging options and ordering information**

Package Version	Description ES = Engineering Sample	Ordering Information
SE-R4	TO-46 with protective ring, uncooled (ES)	VL-23xx-1-SE-R4
SE-A4	TO-46 with angled cap, AR coated window, uncooled (ES)	VL-23xx-1-SE-A4
SQ-R5	TO-39 with protective ring, TEC/Thermistor (ES)	VL-23xx-1-SQ-R5
SQ-A5	TO-39 with cap, AR coated window, TEC/Thermistor (ES)	VL-23xx-1-SQ-A5





## General notes and recommendations

- This product is a class 1 laser product and emits invisible laser radiation. Do not expose eyes to this laser beam, as it may be harmful to the eye.
- Do not operate or store this product beyond the specified operating or storage conditions. Doing so may damage the product and VERTILAS does not assume any responsibility or warranty in this case.
- Any product that is supplied in a non-hermetically sealed package is subject to limited warranty. A non-hermetically sealed VCSEL is potentially exposed to hazardous conditions, such as moisture, gases, physical damage, in the customer application, that may damage the product or alter its performance. VERTILAS does not assume responsibility in this case.
- Handle and operate this product with care. VCSEL products are sensitive, and can be easily damaged, e.g. by electro-static discharge, supply power peaks, signal peaks, overload and other operating or storage conditions. Failing to prevent these conditions may damage the product and VERTILAS does not assume any responsibility or warranty in this case.
- This specification is subject to change without prior notification. The information is believed to be correct and accurate at the time of printing. However, VERTILAS does not take responsibility for omissions or inaccuracies.
- VERTILAS general terms and conditions apply. They can be viewed on the VERTILAS website at [www.vertilas.com](http://www.vertilas.com) or we can send them on request.



[www.vertilas.com](http://www.vertilas.com)

