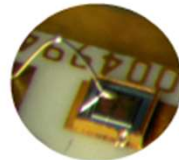


Product Catalog for Near-IR Gas Analysis from 1.27 μm to 2.3 μm

Environmental
Monitoring



NIR
VCSEL

Analysis

Industry and
Safety



Detectable Gases

HF, H₂O, NH₃, H₂S, CH₄, CO, CO₂, HCl, and more

Available VCSEL Wavelengths



VCSEL Products for NIR Gas Analysis (TDLAS)

Standard Wavelengths

- 1280 nm: HF
- 1392 nm: H₂O
- 1512 nm: NH₃
- 1564 nm
- 1579 nm: H₂S
- 1590 nm: H₂S
- 1654 nm: Methane, CH₄
- 1680 nm: Combustables
- 1730 and 1742nm: HCl
- 1854 nm: H₂O
- 2004nm and 2008nm : CO₂

Application Specific Wavelengths

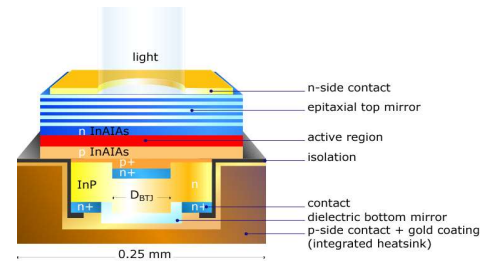
- Any wavelength from 1.3μm to 2.3μm
- Examples:
 - 1560nm : CO
 - 1645nm: Ethylen Oxide
 - 1800nm, 1877nm : H₂O
 - 1960nm : N₂O
 - 2012nm : CO₂

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

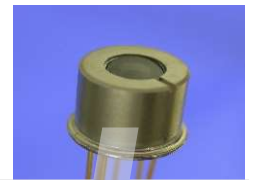
Single-mode VCSELs from 1278 nm to 23xx nm for sensing applications

Gases: H₂O, NH₃, H₂S, CH₄, CO, CO₂, 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

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 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



CLASS 1 LASER PRODUCT

Standard Wavelength Product Offering

Product No.	VL-xxxx-1-SE/ST/SQ-y
VL	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
SE ST SQ	Uncooled TO-46: SE Cooled TO-46: ST Cooled TO-39: SQ
Y (Package)	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
Ambient operating case temperature					
SE, ST, SQ	Top	-10	-	+70	°C
Pigtail H4	Top	0	-	+70	°C
Non-hermetic	Top	+15	-	+70	°C
Extended temp. range available on request					
Storage temperature					
SE, ST, SQ	Tstg	-20	-	+80	°C
Pigtail H4	Tstg	0	-	+70	°C
Non-hermetic	Tstg	+15	-	+70	°C
Soldering temp.	Stemp	-	-	260	°C
Soldering time	Stime	-	-	3	sec
Reverse voltage	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.

电话:4006 888 532 邮箱:info@auniontech.com 网址: <https://www.auniontech.com/>

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	λ_0	nm	1278	
				Min	Max
Current at Target Wavelength	$T_O = T_{\lambda_0}^b$	I_{λ_0}	mA	2.0	10.0
Temperature at Target Wavelength	$I_O = I_{\lambda_0}^c$	T_{λ_0}	$^{\circ}\text{C}$	15	35
Optical Power at Target Wavelength	$T_O = T_{\lambda_0}^b, I_O = I_{\lambda_0}^c$	P_{λ_0}	mW	0.3	2.0
Maximum Optical Power	$T_O = 10^{\circ}\text{C}^b, I_O = I_{\text{max}}^c$	P_{max}	mW	1.0	2.5
Threshold Current	$T_O = T_{\lambda_0}^b$	I_{th}	mA	0.1	3.0
Operating Voltage @ P_{max}	$T_O = 10^{\circ}\text{C}^b, I_O = I_{\text{max}}^c$	V_{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, $T_O = T_{\lambda_0}^b, I_O = I_{\lambda_0}^c$	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

电话:4006 888 532 邮箱:info@auniontech.com 网址: <https://www.auniontech.com/>

VL-1392-1 SM VCSEL 1392 nm

For adjacent wavelengths ± 5 nm
please contact us.

Gases: H₂O

Optical and electrical characteristics

Parameter	Condition	Symbol	Units	Ratings	
Target Wavelength		λ_0	nm	1392	
				Min	Max
Current at Target Wavelength	^a , $T_O=T_{\lambda_0}^c$	I_{λ_0}	mA	2	8
Temperature at Target Wavelength	^a , $I_O=I_{\lambda_0}^d$	T_{λ_0}	°C	15	35
Optical Power at Target Wavelength	^a , $T_O=T_{\lambda_0}^c$, $I_O=I_{c0}^d$	P_{λ_0}	mW	0.2	3.0
Maximum Optical Power	$T_O=20^\circ\text{C}^c$, $I_O=I_{\text{max}}^d$	P_{max}	mW	0.4	3.5
Threshold Current	$T_O=T_{\lambda_0}^c$	I_{th}	mA	0.1	3.0
Operating Voltage @ P_{max}	$T_O=20^\circ\text{C}^c$, $I_O=I_{\text{max}}^d$	V_{max}	V		2.1
Current Tuning Coefficient	$T_O=T_{\lambda_0}^c$, $I_O=I_{\lambda_0}^d$, $f=0$ Hz ^b	$\Delta\lambda/\Delta I$	nm/mA	0.2	0.9
Temperature Tuning Coefficient	$T_O=T_{\lambda_0}^c$, $I_O=I_{\lambda_0}^d$	$\Delta\lambda/\Delta T$	nm/K	0.08	0.2
Slope Efficiency	$T_O=T_{\lambda_0}^c$, $I_O=I_{\lambda_0}^d$	$\Delta P/\Delta I$	mW/mA	0.05	0.5
Side Mode Suppression Ratio at Target Wavelength	transverse and polarisation modes, $T_O=T_{\lambda_0}^c$, $I=I_{\lambda_0}^d$	SMSR	dB	25	

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

Spec_1392_V2.1.0

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

电话:4006 888 532 邮箱:info@auniontech.com 网址: <https://www.auniontech.com/>

VL-1512-1 SM VCSEL 1512 nm

For adjacent wavelengths ± 5 nm
please contact us.

Gases: NH₃

Optical and electrical characteristics

Parameter	Condition	Symbol	Units	Ratings	
Target Wavelength		λ_0	nm	1512	
				Min	Max
Current at Target Wavelength	^a , $T_O=T_{\lambda_0}^c$	I_{λ_0}	mA	2	10
Temperature at Target Wavelength	^a , $I_O=I_{\lambda_0}^d$	T_{λ_0}	°C	15	35
Optical Power at Target Wavelength	^a , $T_O=T_{\lambda_0}^c$, $I_O=I_{\lambda_0}^d$	P_{λ_0}	mW	0.2	3.0
Maximum Optical Power	$T_O=20^\circ\text{C}^c$, $I_O=I_{\text{max}}^d$	P_{max}	mW	0.4	3.5
Threshold Current	$T_O=T_{\lambda_0}^c$	I_{th}	mA	0.1	3.0
Operating Voltage @ P_{max}	$T_O=20^\circ\text{C}^c$, $I_O=I_{\text{max}}^d$	V_{max}	V		2.1
Current Tuning Coefficient	$T_O=T_{\lambda_0}^c$, $I_O=I_{\lambda_0}^d$, $f=0$ Hz ^b	$\Delta\lambda/\Delta I$	nm/mA	0.2	0.9
Temperature Tuning Coefficient	$T_O=T_{\lambda_0}^c$, $I_O=I_{\lambda_0}^d$	$\Delta\lambda/\Delta T$	nm/K	0.08	0.2
Slope Efficiency	$T_O=T_{\lambda_0}^c$, $I_O=I_{\lambda_0}^d$	$\Delta P/\Delta I$	mW/mA	0.05	0.5
Side Mode Suppression Ratio at Target Wavelength	transverse and polarisation modes, $T_O=T_{\lambda_0}^c$, $I=I_{\lambda_0}^d$	SMSR	dB	25	

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

Spec_1512_V2.1.0

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

电话:4006 888 532 邮箱:info@auniontech.com 网址: <https://www.auniontech.com/>

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

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

SM VCSEL 1550 nm, 1560 nm, 1570 nm, 1580 nm and 1590 nm
Gases: H₂S, CO₂, CO

Optical and electrical characteristics

Parameter	Condition	Symbol	Units	Ratings	
Target Wavelength		λ_0	nm	1550 - 1590	
				Min	Max
Current at Target Wavelength	^a , $T_0=T_{\lambda_0}^c$	I_{λ_0}	mA	2	10
Temperature at Target Wavelength	^a , $I_0=I_{\lambda_0}^d$	T_{λ_0}	°C	15	35
Optical Power at Target Wavelength	^a , $T_0=T_{\lambda_0}^c$, $I_0=I_{\lambda_0}^d$	P_{λ_0}	mW	0.2	3.0
Maximum Optical Power	$T_0=20^\circ\text{C}^c$, $I_0=I_{\text{max}}^d$	P_{max}	mW	0.4	3.5
Threshold Current	$T_0=T_{\lambda_0}^c$	I_{th}	mA	0.1	3.0
Operating Voltage @ P_{max}	$T_0=20^\circ\text{C}^c$, $I_0=I_{\text{max}}^d$	V_{max}	V		2.1
Current Tuning Coefficient	$T_0=T_{\lambda_0}^c$, $I_0=I_{\lambda_0}^d$, $f=0\text{ Hz}^b$	$\Delta\lambda/\Delta I$	nm/mA	0.2	0.9
Temperature Tuning Coefficient	$T_0=T_{\lambda_0}^c$, $I_0=I_{\lambda_0}^d$	$\Delta\lambda/\Delta T$	nm/K	0.08	0.2
Slope Efficiency	$T_0=T_{\lambda_0}^c$, $I_0=I_{\lambda_0}^d$	$\Delta P/\Delta I$	mW/mA	0.05	0.5
Side Mode Suppression Ratio at Target Wavelength	transverse and polarisation modes, $T_0=T_{\lambda_0}^c$, $I_0=I_{\lambda_0}^d$	SMSR	dB	25	

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

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

电话:4006 888 532 邮箱:info@auniontech.com 网址: <https://www.auniontech.com/>

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

For adjacent wavelengths ± 5 nm
 please contact us.

Gases: CH₄

Optical and electrical characteristics

Parameter	Condition	Symbol	Units	Ratings	
				Min	Max
Target Wavelength		λ_0	nm	1654	
Current at Target Wavelength	^a , $T_O=T_{\lambda_0}^c$	I_{λ_0}	mA	2	10
Temperature at Target Wavelength	^a , $I_O=I_{\lambda_0}^d$	T_{λ_0}	°C	15	35
Optical Power at Target Wavelength	^a , $T_O=T_{\lambda_0}^c$, $I_O=I_{c0}^d$	P_{λ_0}	mW	0.2	3.0
Maximum Optical Power	$T_O=20^\circ\text{C}^c$, $I_O=I_{\text{max}}^d$	P_{max}	mW	0.4	3.5
Threshold Current	$T_O=T_{\lambda_0}^c$	I_{th}	mA	0.1	3.0
Operating Voltage @ P_{max}	$T_O=20^\circ\text{C}^c$, $I_O=I_{\text{max}}^d$	V_{max}	V		2.1
Current Tuning Coefficient	$T_O=T_{\lambda_0}^c$, $I_O=I_{\lambda_0}^d$, $f=0$ Hz ^b	$\Delta\lambda/\Delta I$	nm/mA	0.2	0.9
Temperature Tuning Coefficient	$T_O=T_{\lambda_0}^c$, $I_O=I_{\lambda_0}^d$	$\Delta\lambda/\Delta T$	nm/K	0.08	0.2
Slope Efficiency	$T_O=T_{\lambda_0}^c$, $I_O=I_{\lambda_0}^d$	$\Delta P/\Delta I$	mW/mA	0.05	0.5
Side Mode Suppression Ratio at Target Wavelength	transverse and polarisation modes, $T_O=T_{\lambda_0}^c$, $I=I_{\lambda_0}^d$	SMSR	dB	25	

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

Spec_1654_V2.1.1

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-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

电话:4006 888 532 邮箱:info@auniontech.com 网址: <https://www.auniontech.com/>

VL-1742-1 SM VCSEL 1742 nm

For adjacent wavelengths ± 5 nm
please contact us.

Gases: HCl

Optical and electrical characteristics

Parameter	Condition	Symbol	Units	Ratings	
Target Wavelength		λ_0	nm	1742	
				Min	Max
Current at Target Wavelength	^a , $T_O=T_{\lambda_0}^c$	I_{λ_0}	mA	2	10
Temperature at Target Wavelength	^a , $I_O=I_{\lambda_0}^d$	T_{λ_0}	°C	15	35
Optical Power at Target Wavelength	^a , $T_O=T_{\lambda_0}^c$, $I_O=I_{c0}^d$	P_{λ_0}	mW	0.2	3.0
Maximum Optical Power	$T_O=20^\circ\text{C}^c$, $I_O=I_{\text{max}}^d$	P_{max}	mW	0.4	3.5
Threshold Current	$T_O=T_{\lambda_0}^c$	I_{th}	mA	0.1	3.0
Operating Voltage @ P_{max}	$T_O=20^\circ\text{C}^c$, $I_O=I_{\text{max}}^d$	V_{max}	V		2.1
Current Tuning Coefficient	$T_O=T_{\lambda_0}^c$, $I_O=I_{\lambda_0}^d$, $f=0$ Hz ^b	$\Delta\lambda/\Delta I$	nm/mA	0.2	0.9
Temperature Tuning Coefficient	$T_O=T_{\lambda_0}^c$, $I_O=I_{\lambda_0}^d$	$\Delta\lambda/\Delta T$	nm/K	0.08	0.2
Slope Efficiency	$T_O=T_{\lambda_0}^c$, $I_O=I_{\lambda_0}^d$	$\Delta P/\Delta I$	mW/mA	0.05	0.5
Side Mode Suppression Ratio at Target Wavelength	transverse and polarisation modes, $T_O=T_{\lambda_0}^c$, $I=I_{\lambda_0}^d$	SMSR	dB	25	

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

Spec_1742_V2.1.0

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

电话:4006 888 532 邮箱:info@auniontech.com 网址: <https://www.auniontech.com/>

VL-1854-1
SM VCSEL 1854 nm

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

Gases: H₂O

Optical and electrical characteristics

Parameter	Condition	Symbol	Units	Ratings	
				Min	Max
Target Wavelength		λ_0	nm	1854	
Current at Target Wavelength	^a , $T_O=T_{\lambda_0}^c$	I_{λ_0}	mA	2	11
Temperature at Target Wavelength	^a , $I_O=I_{\lambda_0}^d$	T_{λ_0}	°C	15	35
Optical Power at Target Wavelength	^a , $T_O=T_{\lambda_0}^c$, $I_O=I_{c0}^d$	P_{λ_0}	mW	0.2	3.0
Maximum Optical Power	$T_O=20^\circ\text{C}^c$, $I_O=I_{\text{max}}^d$	P_{max}	mW	0.4	3.5
Threshold Current	$T_O=T_{\lambda_0}^c$	I_{th}	mA	0.1	3.0
Operating Voltage @ P_{max}	$T_O=20^\circ\text{C}^c$, $I_O=I_{\text{max}}^d$	V_{max}	V		2.1
Current Tuning Coefficient	$T_O=T_{\lambda_0}^c$, $I_O=I_{\lambda_0}^d$, $f=0\text{ Hz}^b$	$\Delta\lambda/\Delta I$	nm/mA	0.2	0.9
Temperature Tuning Coefficient	$T_O=T_{\lambda_0}^c$, $I_O=I_{\lambda_0}^d$	$\Delta\lambda/\Delta T$	nm/K	0.08	0.2
Slope Efficiency	$T_O=T_{\lambda_0}^c$, $I_O=I_{\lambda_0}^d$	$\Delta P/\Delta I$	mW/mA	0.05	0.5
Side Mode Suppression Ratio at Target Wavelength	transverse and polarisation modes, $T_O=T_{\lambda_0}^c$, $I=I_{\lambda_0}^d$	SMSR	dB	25	

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

Spec_1854_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-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 $\pm 5\text{nm}$
 please contact us.

Gases: CO₂

Optical and electrical characteristics

Parameter	Condition	Symbol	Units	Ratings	
Target Wavelength		λ_0	nm	2004	
				Min	Max
Current at Target Wavelength	^a , $T_O=T_{\lambda_0}^c$	I_{λ_0}	mA	2	11
Temperature at Target Wavelength	^a , $I_O=I_{\lambda_0}^d$	T_{λ_0}	°C	15	35
Optical Power at Target Wavelength	^a , $T_O=T_{\lambda_0}^c$, $I_O=I_{CO}^d$	P_{λ_0}	mW	0.2	3.0
Maximum Optical Power	$T_O=20^\circ\text{C}^c$, $I_O=I_{max}^d$	P_{max}	mW	0.4	3.5
Threshold Current	$T_O=T_{\lambda_0}^c$	I_{th}	mA	0.1	3.0
Operating Voltage @ P_{max}	$T_O=20^\circ\text{C}^c$, $I_O=I_{max}^d$	V_{max}	V		2.1
Current Tuning Coefficient	$T_O=T_{\lambda_0}^c$, $I_O=I_{\lambda_0}^d$, $f=0\text{ Hz}^b$	$\Delta\lambda/\Delta I$	nm/mA	0.2	0.9
Temperature Tuning Coefficient	$T_O=T_{\lambda_0}^c$, $I_O=I_{\lambda_0}^d$	$\Delta\lambda/\Delta T$	nm/K	0.08	0.2
Slope Efficiency	$T_O=T_{\lambda_0}^c$, $I_O=I_{\lambda_0}^d$	$\Delta P/\Delta I$	mW/mA	0.05	0.5
Side Mode Suppression Ratio at Target Wavelength	transverse and polarisation modes, $T_O=T_{\lambda_0}^c$, $I=I_{\lambda_0}^d$	SMSR	dB	25	

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

Spec_2004_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-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

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VL-23xx-1
SM VCSEL 23xx nm

For adjacent wavelengths ± 5 nm
 please contact us.

Gases: CO

Optical and electrical characteristics

Parameter	Condition	Symbol	Units	Ratings	
				Min	Max
Target Wavelength		λ_0	nm	23xx	
Current at Target Wavelength	$T_0 = T_{\lambda_0}^c$	I_{λ_0}	mA	5	15
Temperature at Target Wavelength	$I_0 = I_{\lambda_0}^d$	T_{λ_0}	$^{\circ}\text{C}$	15	35
Optical Power at Target Wavelength	$T_0 = T_{\lambda_0}^c, I_0 = I_{\lambda_0}^d$	P_{λ_0}	mW	0.1	0.8
Maximum Optical Power	$T_0 = 20^{\circ}\text{C}, I_0 = I_{\text{max}}^d$	P_{max}	mW		1.0
Threshold Current	$T_0 = T_{\lambda_0}^c$	I_{th}	mA	0.1	5
Operating Voltage @ P_{max}	$T_0 = 20^{\circ}\text{C}, I_0 = I_{\text{max}}^d$	V_{max}	V		2.5
Absolute Maximum Current		I_{max}	mA		16
Current Tuning Coefficient	$T_0 = T_{\lambda_0}^c, I_0 = I_{\lambda_0}^d, f = 0 \text{ Hz}^b$	$\Delta\lambda/\Delta I$	nm/mA	0.2	0.9
Temperature Tuning Coefficient	$T_0 = T_{\lambda_0}^c, I_0 = I_{\lambda_0}^d$	$\Delta\lambda/\Delta T$	nm/K	0.08	0.2
Slope Efficiency	$T_0 = T_{\lambda_0}^c, I_0 = I_{\lambda_0}^d$	$\Delta P/\Delta I$	mW/mA	0.05	0.3
Side Mode Suppression Ratio at Target Wavelength	transverse and polarisation modes, $T_0 = T_{\lambda_0}^c, I_0 = I_{\lambda_0}^d$	SMSR	dB	25	

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

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 manufacture 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. manufacture 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 manufacture does not assume any responsibility or warranty in this case.