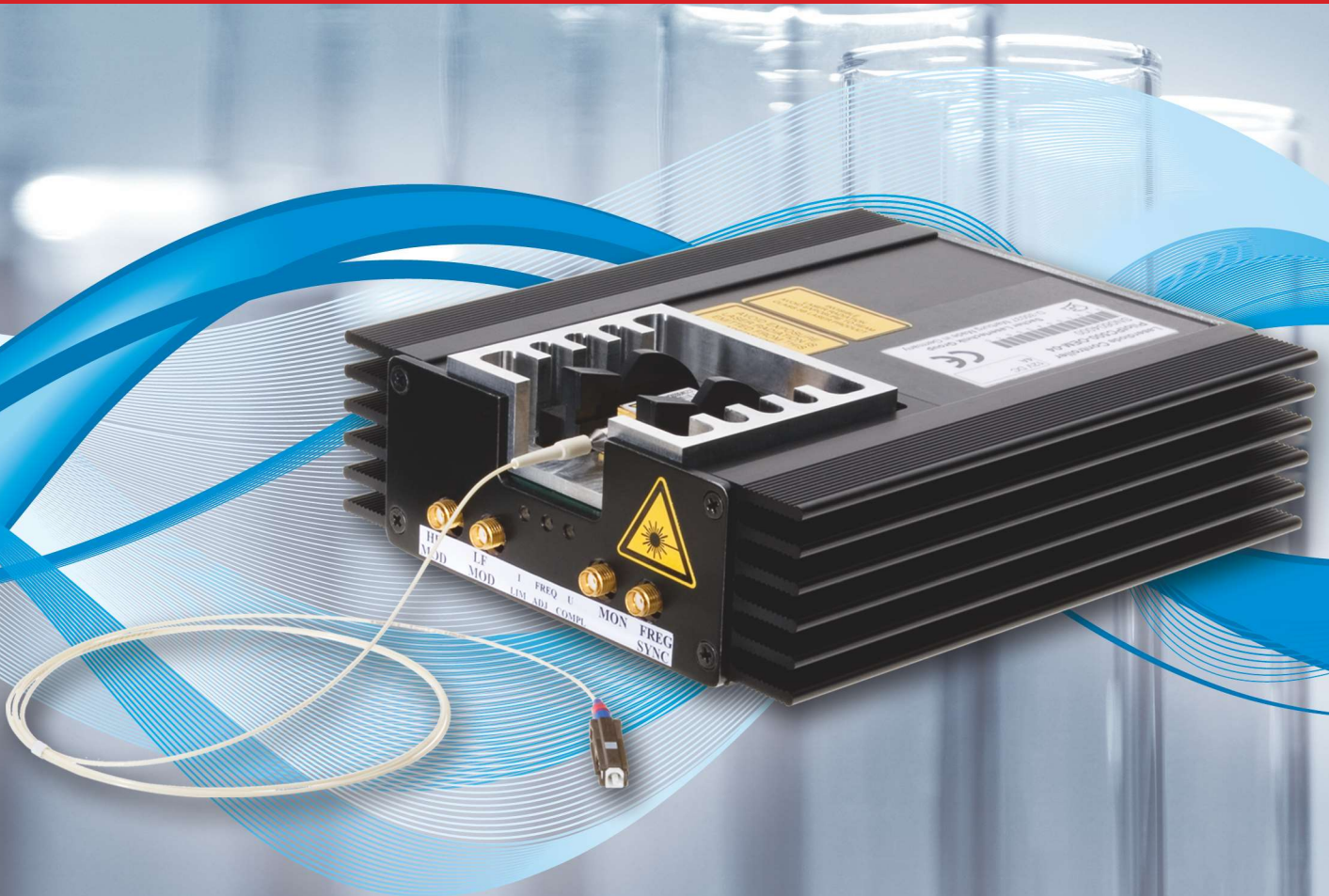


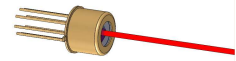
Distributed Feedback (DFB) Laser

Narrow Linewidth, Tunable Diode Lasers
for Applications in Industry and Science

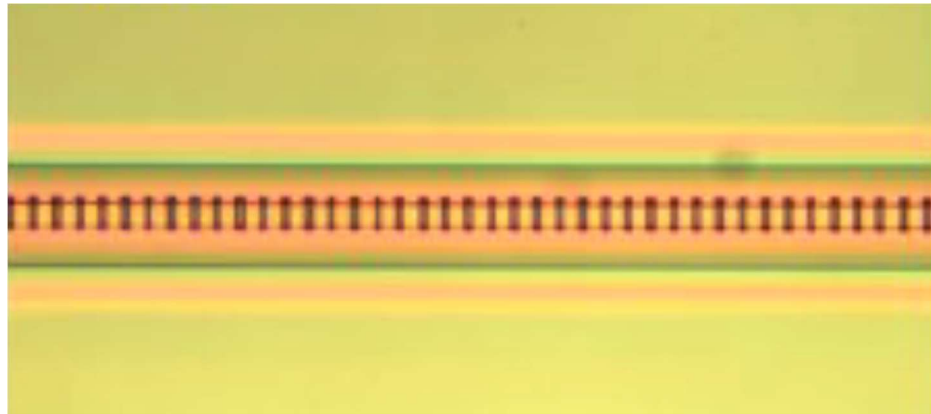
Industrial Lasers



DFB Laser Diodes emitting in the wavelength range 0770nm - 0800nm



Description: DFB laser diodes of this product family emit in a single spatial and longitudinal single mode. Devices with emission wavelength between $760 \text{ nm} \leq \lambda \leq 800 \text{ nm}$ are available while other wavelengths are available on request. Devices are MOVPE grown AlGaInAsP/GaAs Distributed Feedback diode lasers. The lasers are available in several housing options.



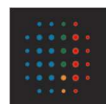
Microscope View of the Bragg grating

Product Specification:

Parameter	Symbol	Unit	Min.	typ.	max.
Center Wavelength	λ_C	nm	$\lambda_C - 1$	λ_C	$\lambda_C + 1$
Wavelength Selection Range	λ_s	nm	0760	780	0800
Temperature Tuning Coefficient	$\Delta\lambda/\Delta T$	nm/K	0.15	0.2	0.25
Current Tuning Coefficient	$\Delta\lambda/\Delta I$	nm/mA	0.01	0.02	0.04
Spectral Width	$\Delta\nu$	MHz		1.5	10
Output Power (TO39)	P_{opt}	mW		10	15
Output Power (BFY)	P_{opt}	mW		5	7
Slope Efficiency (TO39)	η	mW/mA	0.1	0.15	0.2
Slope Efficiency (BFY)	η	mW/mA	0.05	0.07	0.1
Threshold Current	I_{th}	mA	35	45	70
Operation Current (TO39)	$I_{op} @ 40\text{mW}$	mA		100	140
Operation Current (BFY)	$I_{op} @ 3\text{mW}$	mA		100	140
Storage Temperature	T_s	$^{\circ}\text{C}$	-40	+25	+80
Case Temperature during Operation	T_c	$^{\circ}\text{C}$	-20	+25	+50
Chip Length	L_c	μm		1300	
Emitter Width	W_c	μm		3 x 1.5	
Beam Divergence (TO39) (FWHM)	$\theta_{ }$	deg.		12	
Beam Divergence (TO39) \perp (FWHM)	θ_{\perp}	deg.		28	
Polarization				TM	
Mode Structure			Single longitudinal, fundamental transverse mode		

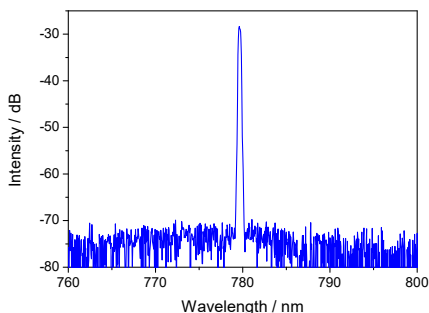
Document: <http://data.sacher-laser.com/dfb/P1732D.pdf>

Note: Specifications are subject to change without further notice.

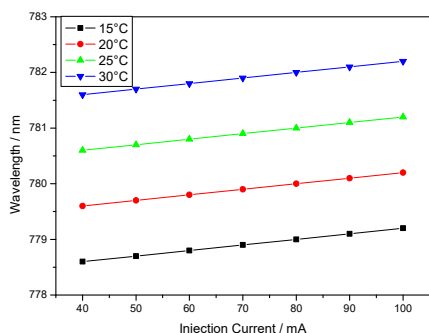




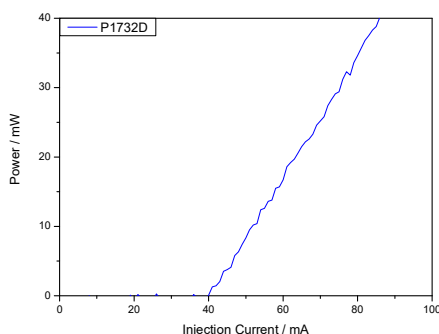
Typical Test Data:



Emission spectrum of a CW operated Sensor Photonics single-mode DFB laser with emission at $\lambda = 780\text{nm}$



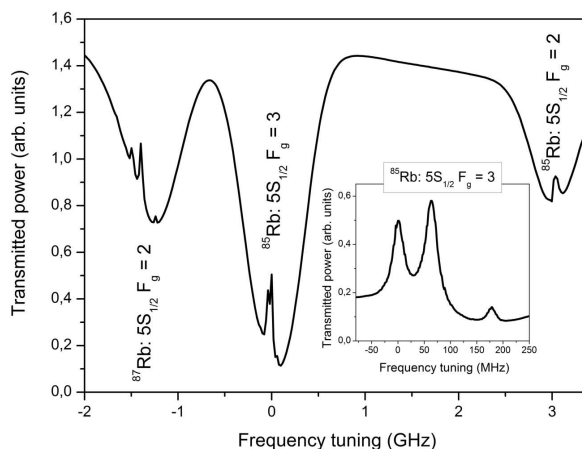
Wavelength tuning achieved via laser current variation for different temperature values



CW Laser Power vs. Injection Current Characteristic for a DFB laser

Application Example:

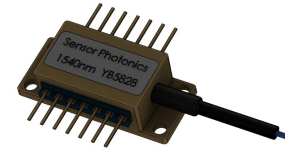
Rubidium vapor absorption is commonly used for atomic clocks and magnetographic by the Zeeman splitting of the absorption lines of Rubidium.



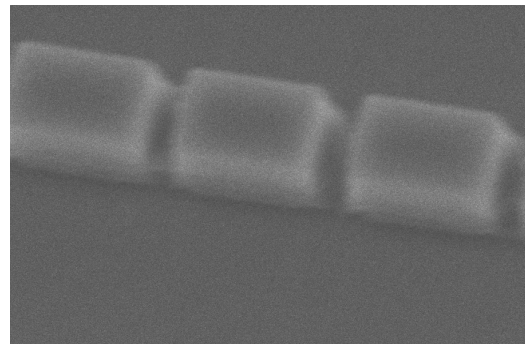
Document: <http://data.sacher-laser.com/dfb/P1732D.pdf>
Note: Specifications are subject to change without further notice.



DFB Laser Diodes emitting in the wavelength range 1520nm - 1580nm



Description: DFB laser diodes of this product family emit in a single spatial and longitudinal single mode. Devices with emission wavelength λ in the range $1520 \text{ nm} \leq \lambda \leq 1580 \text{ nm}$ are available while other wavelengths are available on request. Devices are MOVPE grown GaInAsP/InP Distributed Feedback diode lasers. The lasers are available in several housing options.



SEM micrograph of the Bragg grating

Product Specification:

Parameter	Symbol	Unit	Min.	typ.	max.
Center Wavelength	λ_c	nm	$\lambda_c - 1$	λ_c	$\lambda_c + 1$
Wavelength Selection Range	λ_s	nm	1520	1540	1580
Temperature Tuning Coefficient	$\Delta\lambda/\Delta T$	nm/K	0.1	0.12	0.15
Current Tuning Coefficient	$\Delta\lambda/\Delta I$	nm/mA	0.05	0.06	0.08
Spectral Width	$\Delta\nu$	MHz		1.5	10
Output Power (TO39)	P_{opt}	mW		5	10
Output Power (BFY)	P_{opt}	mW		3	5
Slope Efficiency (TO39)	η	mW/mA	0.1	0.15	0.2
Slope Efficiency (BFY)	η	mW/mA	0.05	0.08	0.1
Threshold Current	I_{th}	mA	15	25	45
Operation Current (TO39)	$I_{op} @ 5mW$	mA		65	120
Operation Current (BFY)	$I_{op} @ 3mW$	mA		65	120
Storage Temperature	T_s	°C	-40	+25	+80
Case Temperature during Operation	T_c	°C	-20	+25	+50
Chip Length	L_c	μm		300	
Emitter Width	W_c	μm		3 x 1.5	
Beam Divergence (TO39) (FWHM)	$\theta_{ }$	deg.		24	
Beam Divergence (TO39) \perp (FWHM)	θ_{\perp}	deg.		30	
Polarization				TE	
Mode Structure			Single longitudinal, fundamental transverse mode		

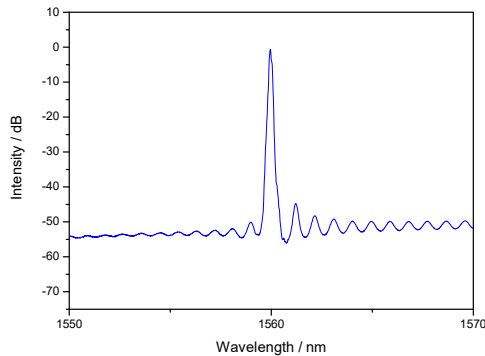
Document: <http://data.sacher-laser.com/dfb/B0002.pdf>

Note: Specification are subject to change without further notice.

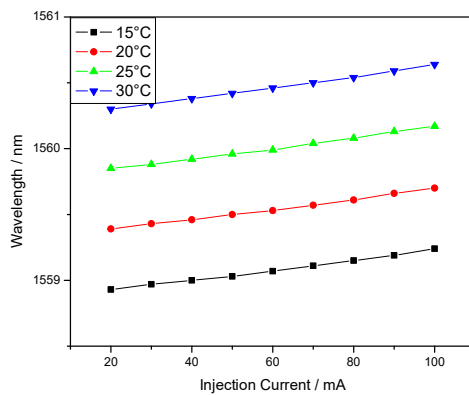




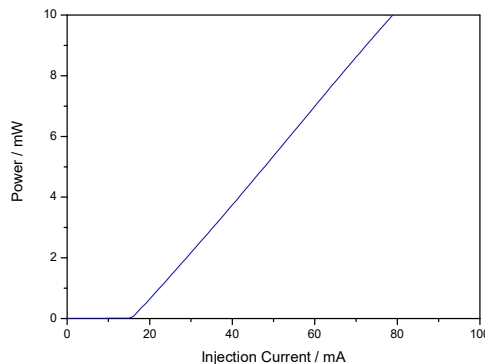
Typical Test Data:



Emission spectrum of a CW operated Sensor Photonics single-mode DFB laser with emission at $\lambda = 1560\text{nm}$



Wavelength tuning achieved via laser current variation for different temperature values



CW Laser Power vs. Injection Current Characteristic for a DFB laser

Application Example:

Wafer contains special types of diode lasers:

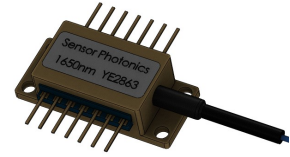
- Y-shaped two Mode Diodes for Tera Hertz Generation
- Narrow Linewidth Laser Diodes with Linewidth < 200kHz
- Lasers with Absorbers for passive mode-locking
- 1530nm Laser diodes for Acetylene spectroscopy

Document: <http://data.sacher-laser.com/dfb/B0002.pdf>

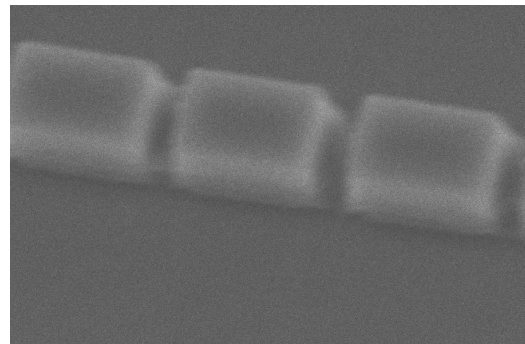
Note: Specifications are subject to change without further notice.



DFB Laser Diodes emitting in the wavelength range 1630nm - 1680nm



Description: DFB laser diodes of this product family emit in a single spatial and longitudinal single mode. Devices with emission wavelength λ in the range $1630 \text{ nm} \leq \lambda \leq 1680 \text{ nm}$ are available while other wavelengths are available on request. Devices are MOVPE grown GaInAsP/InP Distributed Feedback diode lasers. The lasers are available in several housing options.



SEM micrograph of the Bragg grating

Product Specification:

Parameter	Symbol	Unit	Min.	typ.	max.
Center Wavelength	λ_c	nm	$\lambda_c - 1$	λ_c	$\lambda_c + 1$
Wavelength Selection Range	λ_s	nm	1630	1650	1680
Temperature Tuning Coefficient	$\Delta\lambda/\Delta T$	nm/K	0.1	0.12	0.15
Current Tuning Coefficient	$\Delta\lambda/\Delta I$	nm/mA	0.05	0.06	0.08
Spectral Width	$\Delta\nu$	MHz		1.5	10
Output Power (TO39)	P_{opt}	mW		5	10
Output Power (BFY)	P_{opt}	mW		3	5
Slope Efficiency (TO39)	η	mW/mA	0.1	0.15	0.2
Slope Efficiency (BFY)	η	mW/mA	0.05	0.08	0.1
Threshold Current	I_{th}	mA	15	25	45
Operation Current (TO39)	$I_{op} @ 5mW$	mA		65	120
Operation Current (BFY)	$I_{op} @ 3mW$	mA		65	120
Storage Temperature	T_s	°C	-40	+25	+80
Case Temperature during Operation	T_c	°C	-20	+25	+50
Chip Length	L_c	μm		300	
Emitter Width	W_c	μm		3 x 1.5	
Beam Divergence (TO39) (FWHM)	$\theta_{ }$	deg.		24	
Beam Divergence (TO39) \perp (FWHM)	θ_{\perp}	deg.		30	
Polarization				TE	
Mode Structure			Single longitudinal, fundamental transverse mode		

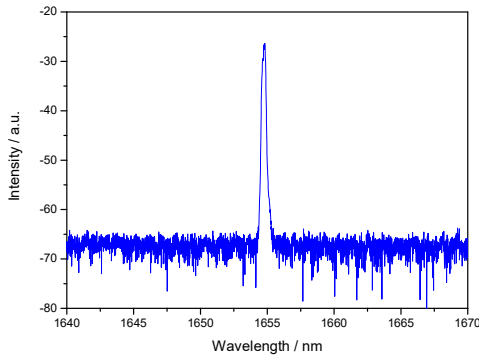
Document: <http://data.sacher-laser.com/dfb/B2690.pdf>

Note: Specifications are subject to change without further notice.

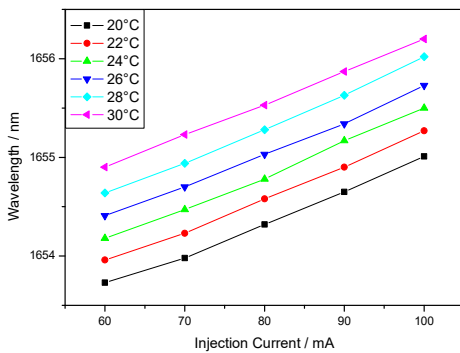




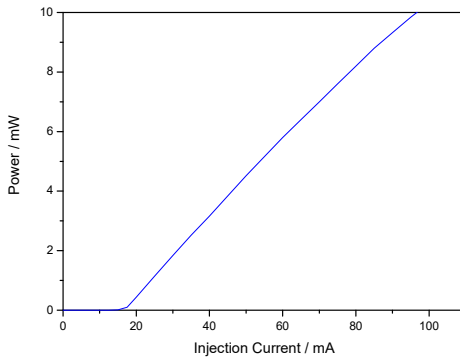
Typical Test Data:



Emission spectrum of a CW operated Sensor Photonics single-mode DFB laser with emission at $\lambda = 1655\text{nm}$



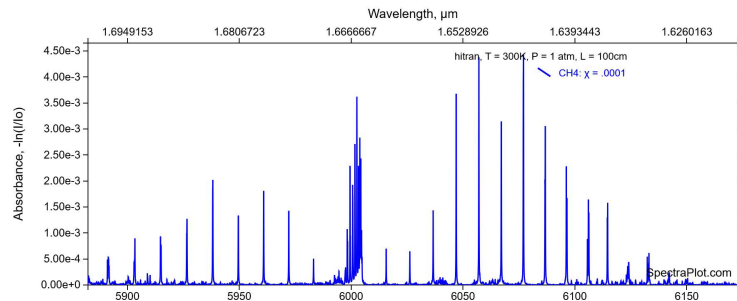
Wavelength tuning achieved via laser current variation for different temperature values



CW Laser Power vs. Injection Current Characteristic for a DFB laser

Application Example:

Methane is one of the most important hydrocarbon molecules used in both process applications and combustion. Unfortunately, it is explosively combustible. It is also an important greenhouse gas. Consequently, in many 'applications' the amount of fugitive methane needs to be exactly measured. In the Hitran database, many transitions can be identified which are suitable for optical detection. For example, there are several strong absorption lines in the 1655nm regime. Some of these strong absorption lines in the 1655nm regime that can be detected with a simple optical absorption set-up are shown in the figure above.

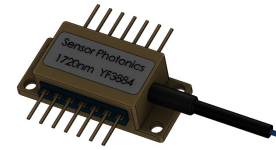


Document: <http://data.sacher-laser.com/dfb/B2690.pdf>
 Note: Specification are subject to change without further notice.

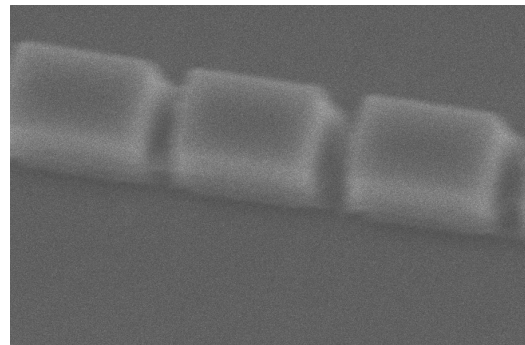




DFB Laser Diodes emitting in the wavelength range 1680nm - 1740nm



Description: DFB laser diodes of this product family emit in a single spatial and longitudinal single mode. Devices with emission wavelength λ in the range $1680 \text{ nm} \leq \lambda \leq 1740 \text{ nm}$ are available while other wavelengths are available on request. Devices are MOVPE grown GaInAsP/InP Distributed Feedback diode lasers. The lasers are available in several housing options.



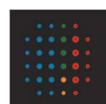
SEM micrograph of the Bragg grating

Product Specification:

Parameter	Symbol	Unit	Min.	typ.	max.
Center Wavelength	λ_c	nm	$\lambda_c - 1$	λ_c	$\lambda_c + 1$
Wavelength Selection Range	λ_s	nm	1680	1720	1740
Temperature Tuning Coefficient	$\Delta\lambda/\Delta T$	nm/K	0.1	0.12	0.15
Current Tuning Coefficient	$\Delta\lambda/\Delta I$	nm/mA	0.05	0.06	0.08
Spectral Width	$\Delta\nu$	MHz		1.5	10
Output Power (TO39)	P_{opt}	mW		5	10
Output Power (BFY)	P_{opt}	mW		3	5
Slope Efficiency (TO39)	η	mW/mA	0.1	0.15	0.2
Slope Efficiency (BFY)	η	mW/mA	0.05	0.08	0.1
Threshold Current	I_{th}	mA	15	25	45
Operation Current (TO39)	$I_{op} @ 5mW$	mA		65	120
Operation Current (BFY)	$I_{op} @ 3mW$	mA		65	120
Storage Temperature	T_s	°C	-40	+25	+80
Case Temperature during Operation	T_c	°C	-20	+25	+50
Chip Length	L_c	μm		300	
Emitter Width	W_c	μm		3 x 1.5	
Beam Divergence (TO39) (FWHM)	$\theta_{ }$	deg.		24	
Beam Divergence (TO39) \perp (FWHM)	θ_{\perp}	deg.		30	
Polarization				TE	
Mode Structure			Single longitudinal, fundamental transverse mode		

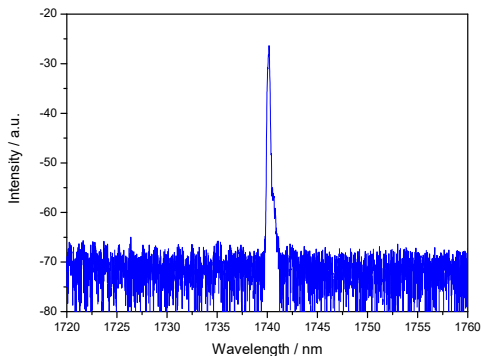
Document: <http://data.sacher-laser.com/dfb/B2675.pdf>

Note: Specifications are subject to change without further notice.

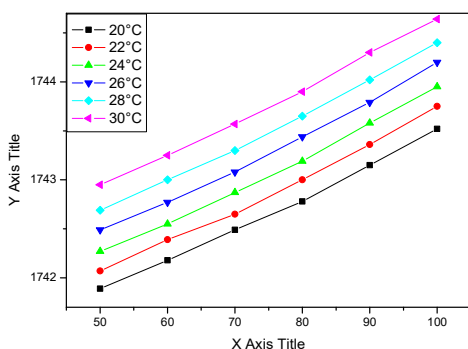




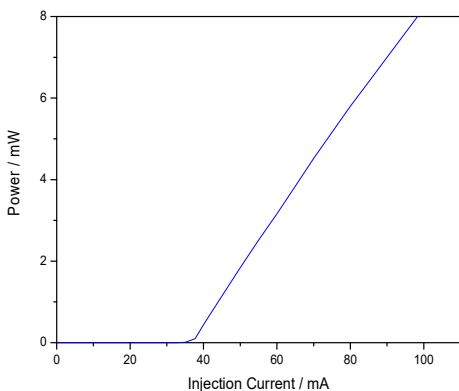
Typical Test Data:



Emission spectrum of a CW operated Sensor Photonics single-mode DFB laser with emission at $\lambda = 1740\text{nm}$



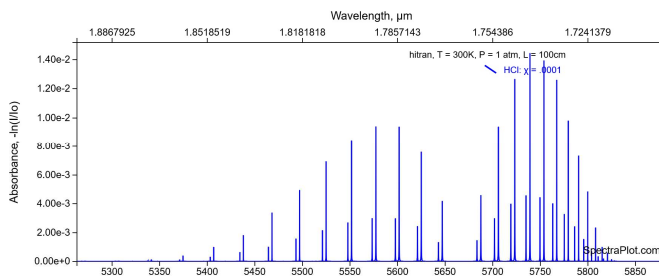
Wavelength tuning achieved via laser current variation for different temperature values



CW Laser Power vs. Injection Current Characteristic for a DFB laser

Application Example:

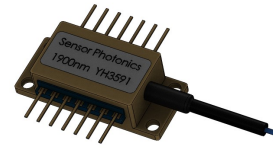
Fig. 5: Hydrogen Chloride is one of the most important process acids. As an extremely toxic gas, in many applications the amount of hydrogen chloride as a “fugitive emission” needs to be exactly measured. In the Hitran database, several transitions can be found. A popular transition used in gas detection is around the first vibrational overtone in 1740nm spectral region. Some of these strong absorption lines in the 1740nm regime can be detected with a simple optical absorption set-up and are shown in the figure above.



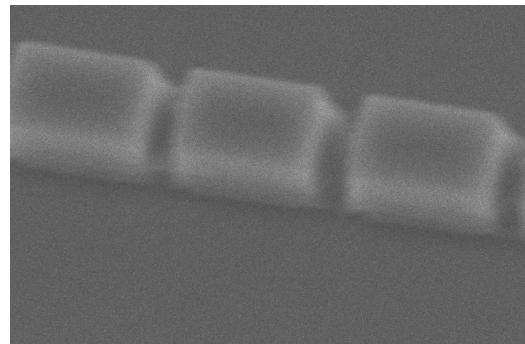
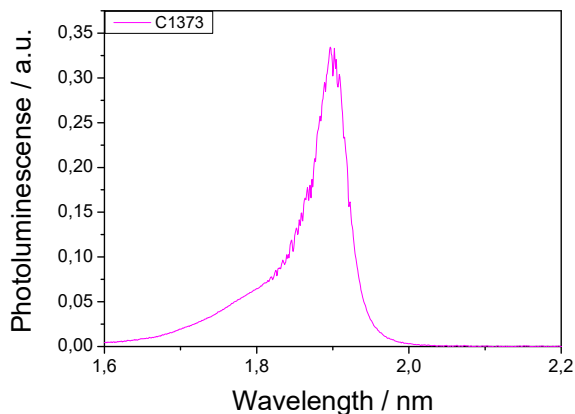
Document: <http://data.sacher-laser.com/dfb/B2675.pdf>
 Note: Specifications are subject to change without further notice.



DFB Laser Diodes emitting in the wavelength range 1860nm - 1980nm



Description: DFB laser diodes of this product family emit in a single spatial and longitudinal single mode. Devices with emission wavelength λ in the range $1860 \text{ nm} \leq \lambda \leq 1980 \text{ nm}$ are available while other wavelengths are available on request. Devices are MOVPE grown AlGaInAsSb/GaSb Distributed Feedback diode lasers. The lasers are available in several housing options.



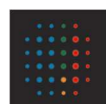
SEM micrograph of the Bragg grating

Product Specification:

Parameter	Symbol	Unit	Min.	typ.	max.
Center Wavelength	λ_c	nm	$\lambda_c - 1$	λ_c	$\lambda_c + 1$
Wavelength Selection Range	λ_s	nm	1860	1900	1980
Temperature Tuning Coefficient	$\Delta\lambda/\Delta T$	nm/K	0.15	0.2	0.25
Current Tuning Coefficient	$\Delta\lambda/\Delta I$	nm/mA	0.01	0.02	0.04
Spectral Width	$\Delta\nu$	MHz		1.5	10
Output Power (TO39)	P_{opt}	mW		15	20
Output Power (BFY)	P_{opt}	mW		10	15
Slope Efficiency (TO39)	η	mW/mA	0.1	0.15	0.2
Slope Efficiency (BFY)	η	mW/mA	0.05	0.08	0.1
Threshold Current	I_{th}	mA	15	25	45
Operation Current (TO39)	$I_{op} @ 5mW$	mA		120	140
Operation Current (BFY)	$I_{op} @ 3mW$	mA		120	140
Storage Temperature	T_s	°C	-40	+25	+80
Case Temperature during Operation	T_c	°C	-20	+25	+50
Chip Length	L_c	μm		600	
Emitter width	W_c	μm		4 x 1.5	
Beam Divergence (TO39) (FWHM)	$\theta_{ }$	deg.		22	
Beam Divergence (TO39) \perp (FWHM)	θ_{\perp}	deg.		38	
Polarization				TE	
Mode Structure			single longitudinal, fundamental transverse mode		

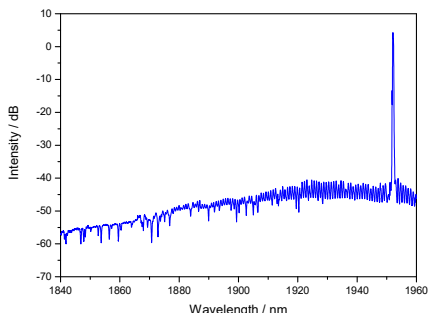
Document: <http://data.sacher-laser.com/dfb/c1373.pdf>

Note: Specifications are subject to change without further notice.

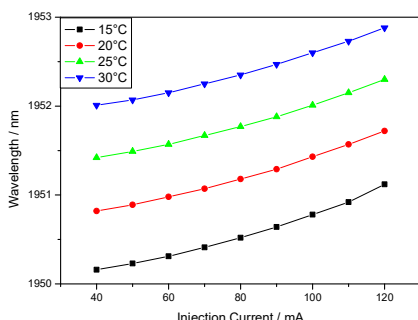




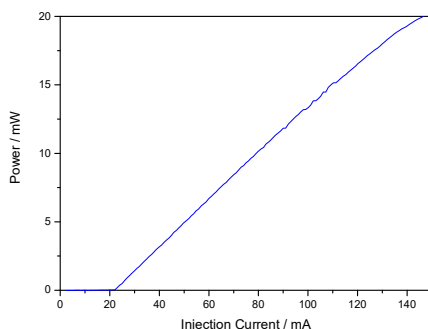
Typical Test Data:



Emission spectrum of a CW operated Sensor Photonics single-mode DFB laser with emission at $\lambda = 1952\text{nm}$



Wavelength tuning achieved via laser current variation for different temperature values

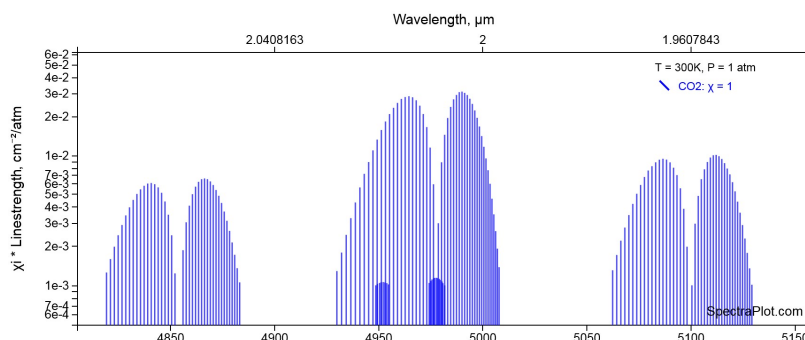


CW Laser Power vs. Injection Current Characteristic for a DFB laser

Application Example:

Carbon Dioxide is one of the most important molecules used in process applications and combustion. It is also an important greenhouse gas. Consequently, in many 'applications' the amount of Carbon Dioxide needs to be exactly

measured. In the Hitran database, many transitions can be identified which are suitable for optical detection. For example, there are several strong absorption lines in the 1950 nm spectral region. Some of these strong absorption lines around the 1950 nm regime can be detected with a simple optical absorption set-up.

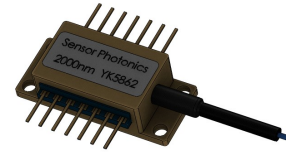


Document: <http://data.sacher-laser.com/dfb/c1373.pdf>

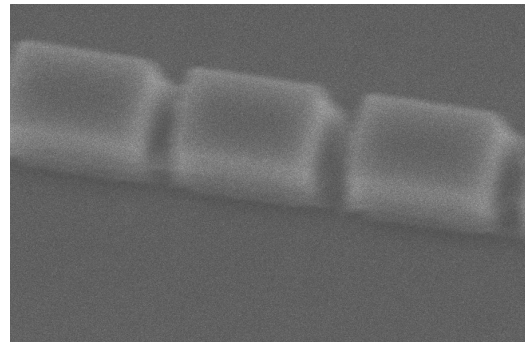
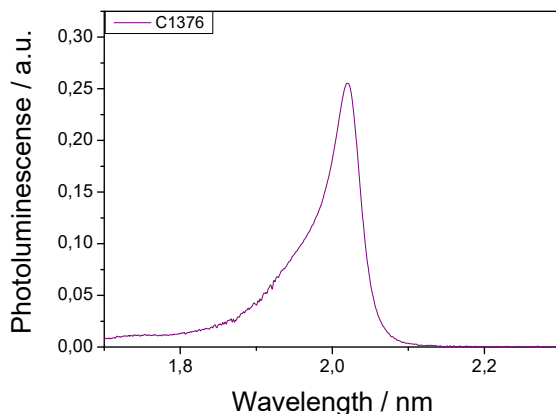
Note: Specifications are subject to change without further notice.



DFB Laser Diodes emitting in the wavelength range 1960nm - 2080nm



Description: DFB laser diodes of this product family emit in a single spatial and longitudinal single mode. Devices with emission wavelength λ in the range $1960 \text{ nm} \leq \lambda \leq 2080 \text{ nm}$ are available while other wavelengths are available on request. Devices are MOVPE grown AlGaInAsSb/GaSb Distributed Feedback diode lasers. The lasers are available in several housing options.



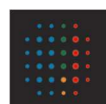
SEM micrograph of the Bragg grating

Product Specification:

Parameter	Symbol	Unit	Min.	typ.	max.
Center Wavelength	λ_c	nm	$\lambda_c - 1$	λ_c	$\lambda_c + 1$
Wavelength Selection Range	λ_s	nm	1960	2000	2080
Temperature Tuning Coefficient	$\Delta\lambda/\Delta T$	nm/K	0.15	0.2	0.25
Current Tuning Coefficient	$\Delta\lambda/\Delta I$	nm/mA	0.01	0.02	0.04
Spectral Width	$\Delta\nu$	MHz		1.5	10
Output Power (TO39)	P_{opt}	mW		15	20
Output Power (BFY)	P_{opt}	mW		10	15
Slope Efficiency (TO39)	η	mW/mA	0.1	0.15	0.2
Slope Efficiency (BFY)	η	mW/mA	0.05	0.08	0.1
Threshold Current	I_{th}	mA	15	25	45
Operation Current (TO39)	$I_{op} @ 5mW$	mA		120	140
Operation Current (BFY)	$I_{op} @ 3mW$	mA		120	140
Storage Temperature	T_s	°C	-40	+25	+80
Case Temperature during Operation	T_c	°C	-20	+25	+50
Chip Length	L_c	μm		600	
Emitter width	W_c	μm		4 x 1.5	
Beam Divergence (TO39) (FWHM)	$\theta_{ }$	deg.		22	
Beam Divergence (TO39) \perp (FWHM)	θ_{\perp}	deg.		38	
Polarization				TE	
Mode Structure			single longitudinal, fundamental transverse mode		

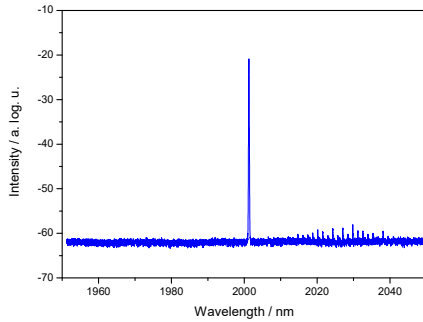
Document: <http://data.sacher-laser.com/dfb/c1376.pdf>

Note: Specifications are subject to change without further notice.

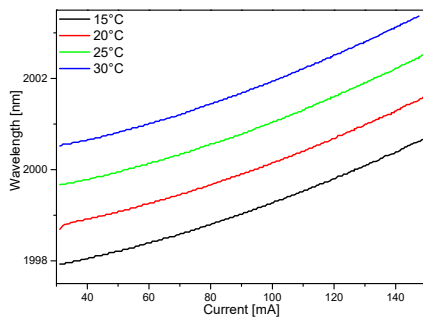




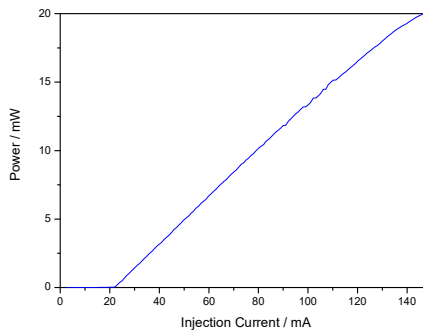
Typical Test Data:



Emission spectrum of a CW operated Sensor Photonics single-mode DFB laser with emission at $\lambda = 2004\text{nm}$



Wavelength tuning achieved via laser current variation for different temperature values

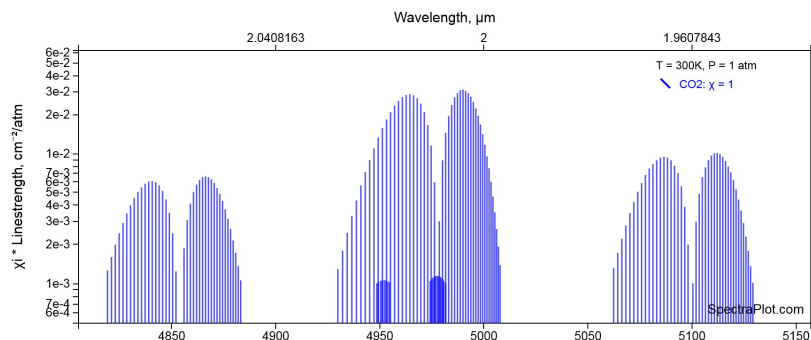


CW Laser Power vs. Injection Current Characteristic for a DFB laser

Application Example:

Carbon Dioxide is one of the most important molecules used in process applications and combustion. It is also an important greenhouse gas. Consequently, in many 'applications' the amount of Carbon Dioxide

needs to be exactly measured. In the Hitran database, many transitions can be identified which are suitable for optical detection. For example, there are several strong absorption lines the 2000 nm spectral region. Some of these strong absorption lines around the 2000 nm regime can be detected with a simple optical absorption set-up.



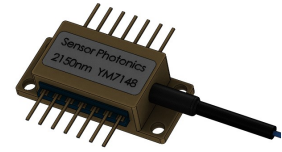
Document: <http://data.sacher-laser.com/dfb/c1376.pdf>

Note: Specifications are subject to change without further notice.

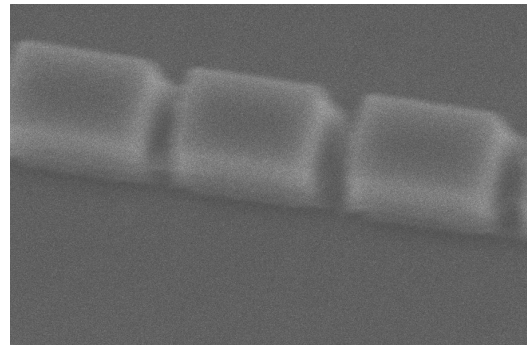
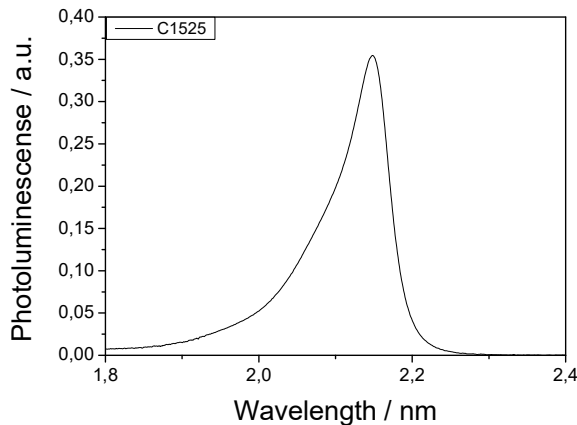




DFB Laser Diodes emitting in the wavelength range 2050nm - 2180nm



Description: DFB laser diodes of this product family emit in a single spatial and longitudinal single mode. Devices with emission wavelength λ in the range $2050 \text{ nm} \leq \lambda \leq 2180 \text{ nm}$ are available while other wavelengths are available on request. Devices are MOVPE grown AlGaInAsSb/GaSb Distributed Feedback diode lasers. The lasers are available in several housing options.



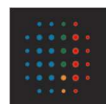
SEM micrograph of the Bragg grating

Product Specification:

Parameter	Symbol	Unit	Min.	typ.	max.
Center Wavelength	λ_c	nm	$\lambda_c - 1$	λ_c	$\lambda_c + 1$
Wavelength Selection Range	λ_s	nm	2050	2150	2180
Temperature Tuning Coefficient	$\Delta\lambda/\Delta T$	nm/K	0.15	0.2	0.25
Current Tuning Coefficient	$\Delta\lambda/\Delta I$	nm/mA	0.01	0.02	0.04
Spectral Width	$\Delta\nu$	MHz		1.5	10
Output Power (TO39)	P_{opt}	mW		15	20
Output Power (BFY)	P_{opt}	mW		10	15
Slope Efficiency (TO39)	η	mW/mA	0.1	0.15	0.2
Slope Efficiency (BFY)	η	mW/mA	0.05	0.08	0.1
Threshold Current	I_{th}	mA	15	25	45
Operation Current (TO39)	$I_{op} @ 5mW$	mA		120	140
Operation Current (BFY)	$I_{op} @ 3mW$	mA		120	140
Storage Temperature	T_s	°C	-40	+25	+80
Case Temperature during Operation	T_c	°C	-20	+25	+50
Chip Length	L_c	μm		600	
Emitter width	W_c	μm		4 x 1.5	
Beam Divergence (TO39) (FWHM)	$\theta_{ }$	deg.		22	
Beam Divergence (TO39) \perp (FWHM)	θ_{\perp}	deg.		38	
Polarization				TE	
Mode Structure			single longitudinal, fundamental transverse mode		

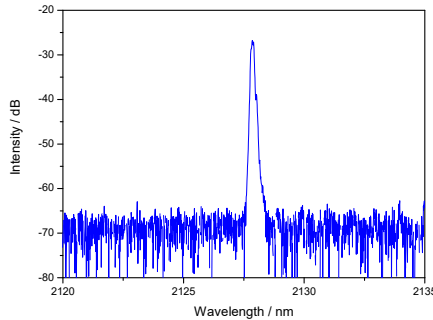
Document: <http://data.sacher-laser.com/dfb/c1525.pdf>

Note: Specification are subject to change without further notice.

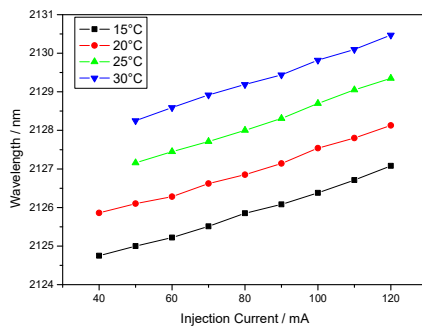




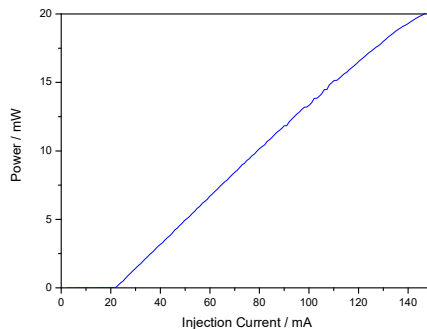
Typical Test Data:



Emission spectrum of a CW operated Sensor Photonics single-mode DFB laser with emission at $\lambda = 2128\text{nm}$



Wavelength tuning achieved via laser current variation for different temperature values

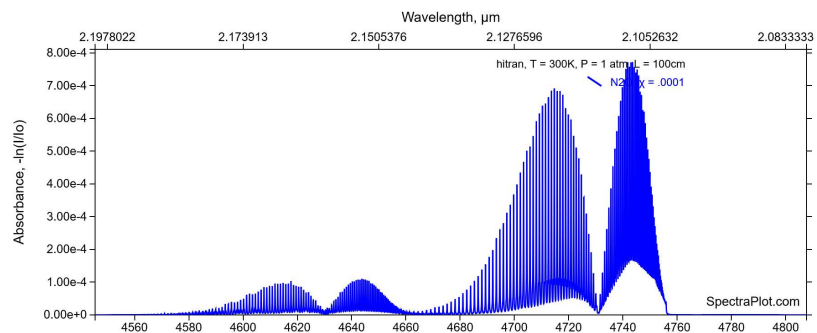


CW Laser Power vs. Injection Current Characteristic for a DFB laser

Application Example:

Nitrous Oxide is commonly known as laughing gas. It is used in surgery and dentistry for its anesthetic and analgesic effects. It is also used as an oxidizer in rocket propellants, and in motor racing to increase the power output of engines. At

elevated temperatures, nitrous oxide is a powerful oxidizer similar to molecular oxygen. In the Hitran database, many transitions can be identified which are suitable for optical detection. For example, there are several strong absorption lines in the 2150 nm spectral region. Some of these strong absorption lines in the 2150 nm regime can be detected with a simple optical absorption set-up.

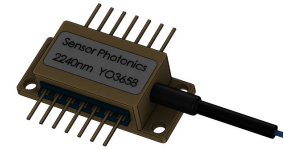


Document: <http://data.sacher-laser.com/dfb/c1525.pdf>

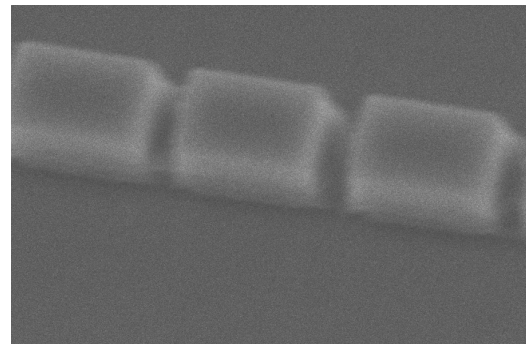
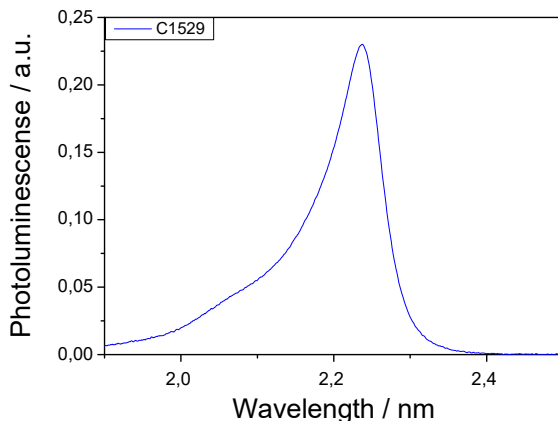
Note: Specifications are subject to change without further notice.



DFB Laser Diodes emitting in the wavelength range 2150nm - 2270nm



Description: DFB laser diodes of this product family emit in a single spatial and longitudinal single mode. Devices with emission wavelength λ in the range $2150 \text{ nm} \leq \lambda \leq 2270 \text{ nm}$ are available while other wavelengths are available on request. Devices are MOVPE grown AlGaInAsSb/GaSb Distributed Feedback diode lasers. The lasers are available in several housing options.



SEM micrograph of the Bragg grating

Product Specification:

Parameter	Symbol	Unit	Min.	typ.	max.
Center Wavelength	λ_c	nm	$\lambda_c - 1$	λ_c	$\lambda_c + 1$
Wavelength Selection Range	λ_s	nm	2150	2240	2270
Temperature Tuning Coefficient	$\Delta\lambda/\Delta T$	nm/K	0.15	0.2	0.25
Current Tuning Coefficient	$\Delta\lambda/\Delta I$	nm/mA	0.01	0.02	0.04
Spectral Width	$\Delta\nu$	MHz		1.5	10
Output Power (TO39)	P_{opt}	mW		15	20
Output Power (BFY)	P_{opt}	mW		10	15
Slope Efficiency (TO39)	η	mW/mA	0.1	0.15	0.2
Slope Efficiency (BFY)	η	mW/mA	0.05	0.08	0.1
Threshold Current	I_{th}	mA	15	25	45
Operation Current (TO39)	$I_{op} @ 5mW$	mA		120	140
Operation Current (BFY)	$I_{op} @ 3mW$	mA		120	140
Storage Temperature	T_s	°C	-40	+25	+80
Case Temperature during Operation	T_c	°C	-20	+25	+50
Chip Length	L_c	μm		600	
Emitter width	W_c	μm		4 x 1.5	
Beam Divergence (TO39) (FWHM)	$\theta_{ }$	deg.		22	
Beam Divergence (TO39) \perp (FWHM)	θ_{\perp}	deg.		38	
Polarization				TE	
Mode Structure			single longitudinal, fundamental transverse mode		

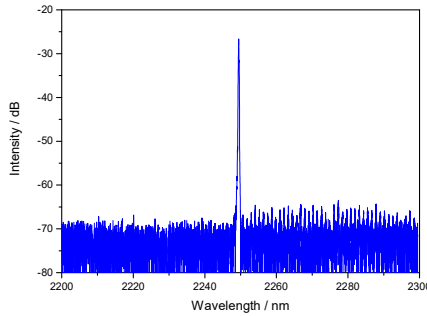
Document: <http://data.sacher-laser.com/dfb/c1529.pdf>

Note: Specifications are subject to change without further notice.

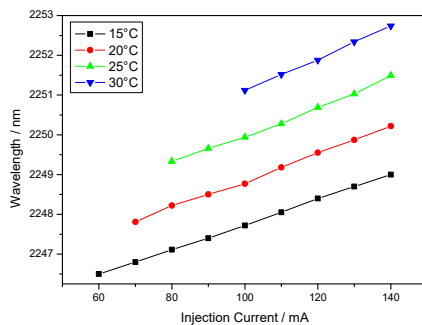




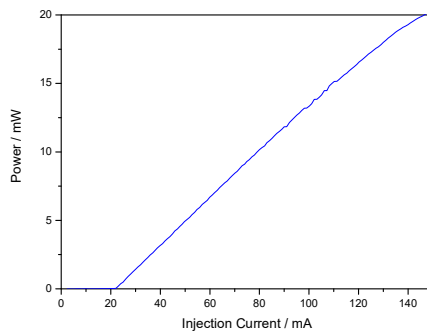
Typical Test Data:



Emission spectrum of a CW operated Sensor Photonics single-mode DFB laser with emission at $\lambda = 2250\text{nm}$



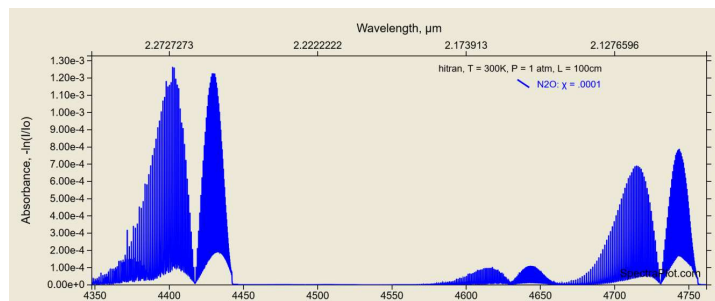
Wavelength tuning achieved via laser current variation for different temperature values



CW Laser Power vs. Injection Current Characteristic for a DFB laser

Application Example:

Nitrous Oxide is commonly known as laughing gas. It is used in surgery and dentistry for its anesthetic and analgesic effects. It is also used as an oxidizer in rocket propellants, and in motor racing to increase the power output of engines. At elevated temperatures, nitrous oxide is a powerful oxidizer similar to molecular oxygen. In the Hitran database, many transitions can be identified which are suitable for optical detection. For example, there are several strong absorption lines in the 2250 nm spectral region. Some of these strong absorption lines in the 2250 nm regime can be detected with a simple optical absorption set-up.



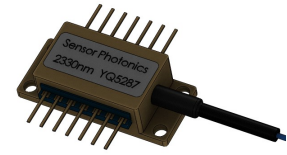
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Note: Specification are subject to change without further notice.

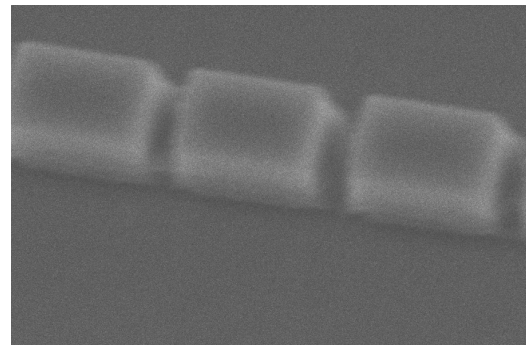
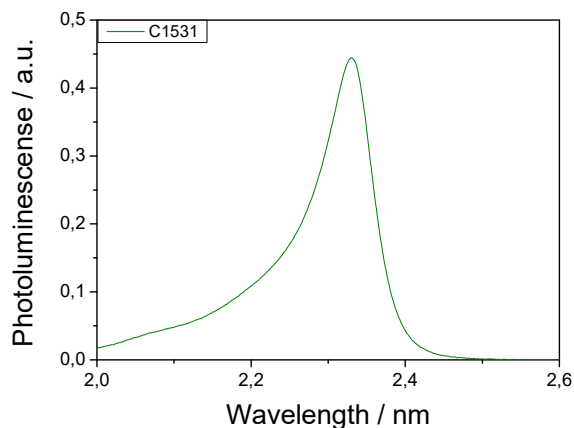




DFB Laser Diodes emitting in the wavelength range 2250nm - 2370nm



Description: DFB laser diodes of this product family emit in a single spatial and longitudinal single mode. Devices with emission wavelength λ in the range $2250 \text{ nm} \leq \lambda \leq 2370 \text{ nm}$ are available while other wavelengths are available on request. Devices are MOVPE grown AlGaInAsSb/GaSb Distributed Feedback diode lasers. The lasers are available in several housing options.



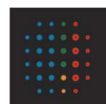
SEM micrograph of the Bragg grating

Product Specification:

Parameter	Symbol	Unit	Min.	typ.	max.
Center Wavelength	λ_C	nm	$\lambda_C - 1$	λ_C	$\lambda_C + 1$
Wavelength Selection Range	λ_S	nm	2250	2330	2370
Temperature Tuning Coefficient	$\Delta\lambda/\Delta T$	nm/K	0.15	0.2	0.25
Current Tuning Coefficient	$\Delta\lambda/\Delta I$	nm/mA	0.01	0.02	0.04
Spectral Width	$\Delta\nu$	MHz		1.5	10
Output Power (TO39)	P_{opt}	mW		15	20
Output Power (BFY)	P_{opt}	mW		10	15
Slope Efficiency (TO39)	η	mW/mA	0.1	0.15	0.2
Slope Efficiency (BFY)	η	mW/mA	0.05	0.08	0.1
Threshold Current	I_{th}	mA	15	25	45
Operation Current (TO39)	$I_{op} @ 5mW$	mA		120	140
Operation Current (BFY)	$I_{op} @ 3mW$	mA		120	140
Storage Temperature	T_S	°C	-40	+25	+80
Case Temperature during Operation	T_C	°C	-20	+25	+50
Chip Length	L_C	μm		600	
Emitter width	W_C	μm		4 x 1.5	
Beam Divergence (TO39) (FWHM)	$\theta_{ }$	deg.		22	
Beam Divergence (TO39) \perp (FWHM)	θ_{\perp}	deg.		38	
Polarization				TE	
Mode Structure			single longitudinal, fundamental transverse mode		

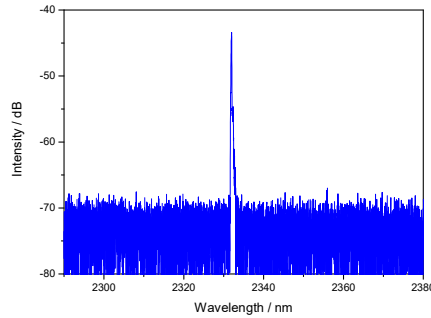
Document: <http://data.sacher-laser.com/dfb/c1531.pdf>

Note: Specification are subject to change without further notice.

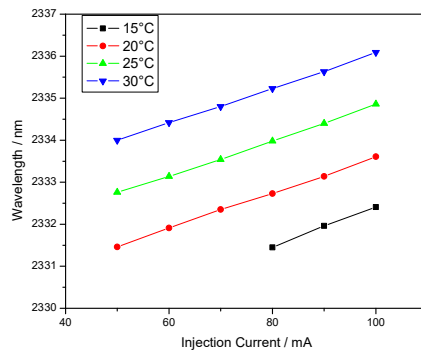




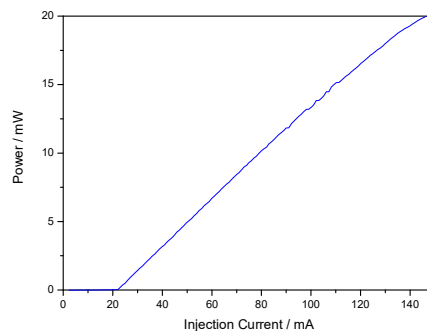
Typical Test Data:



Emission spectrum of a CW operated Sensor Photonics single-mode DFB laser with emission at $\lambda = 2335\text{nm}$



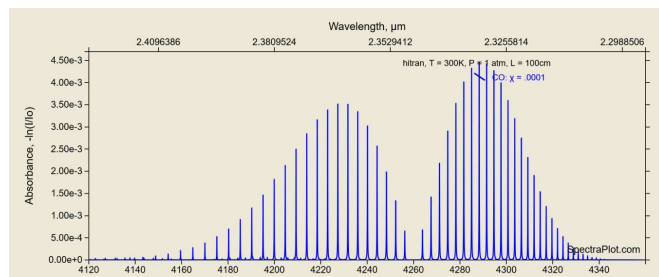
Wavelength tuning achieved via laser current variation for different temperature values



CW Laser Power vs. Injection Current Characteristic for a DFB laser

Application Example:

Carbon monoxide is a high toxic gas generated via an incomplete oxidation of carbons. In the Hitran database, many transitions can be identified which are suitable for optical detection. For example, there are several strong absorption lines in the 2330 nm spectral region. Some of these strong absorption lines in the 2330 nm regime can be detected with a simple optical absorption set-up.

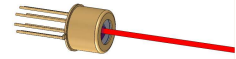


Document: <http://data.sacher-laser.com/dfb/c1531.pdf>
Note: Specifications are subject to change without further notice.

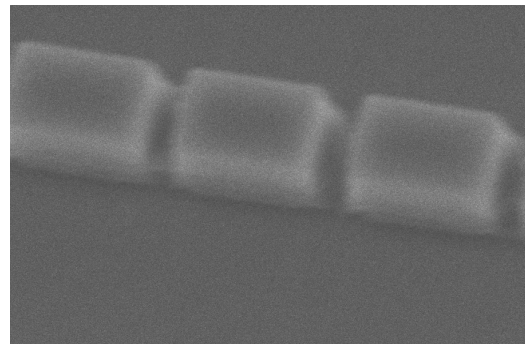
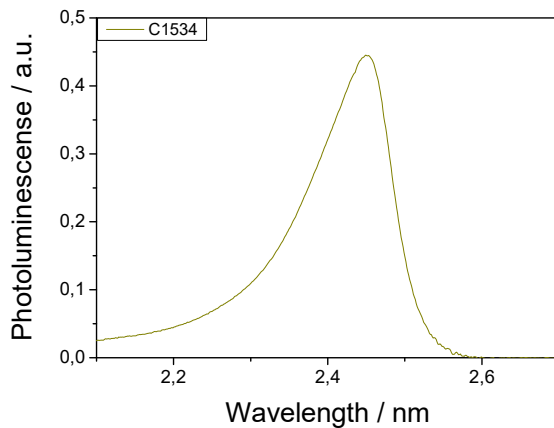




DFB Laser Diodes emitting in the wavelength range 2370nm - 2490nm



Description: DFB laser diodes of this product family emit in a single spatial and longitudinal single mode. Devices with emission wavelength λ in the range $2370 \text{ nm} \leq \lambda \leq 2490 \text{ nm}$ are available while other wavelengths are available on request. Devices are MOVPE grown AlGaInAsSb/GaSb Distributed Feedback diode lasers. The lasers are available in several housing options.



SEM micrograph of the Bragg grating

Product Specification:

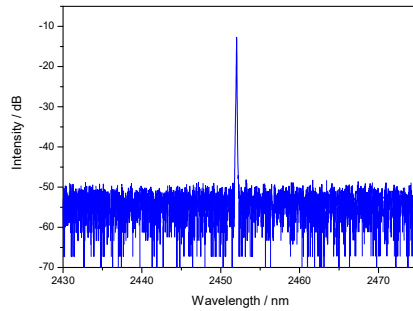
Parameter	Symbol	Unit	Min.	typ.	max.
Center Wavelength	λ_c	nm	$\lambda_c - 1$	λ_c	$\lambda_c + 1$
Wavelength Selection Range	λ_s	nm	2370	2450	2490
Temperature Tuning Coefficient	$\Delta\lambda/\Delta T$	nm/K	0.15	0.2	0.25
Current Tuning Coefficient	$\Delta\lambda/\Delta I$	nm/mA	0.01	0.02	0.04
Spectral Width	$\Delta\nu$	MHz		1.5	10
Output Power (TO39)	P_{opt}	mW		15	20
Output Power (BFY)	P_{opt}	mW		10	15
Slope Efficiency (TO39)	η	mW/mA	0.1	0.15	0.2
Slope Efficiency (BFY)	η	mW/mA	0.05	0.08	0.1
Threshold Current	I_{th}	mA	15	25	45
Operation Current (TO39)	$I_{op} @ 5mW$	mA		120	140
Operation Current (BFY)	$I_{op} @ 3mW$	mA		120	140
Storage Temperature	T_s	°C	-40	+25	+80
Case Temperature during Operation	T_c	°C	-20	+25	+50
Chip Length	L_c	μm		600	
Emitter width	W_c	μm		4 x 1.5	
Beam Divergence (TO39) (FWHM)	$\theta_{ }$	deg.		22	
Beam Divergence (TO39) \perp (FWHM)	θ_{\perp}	deg.		38	
Polarization				TE	
Mode Structure			single longitudinal, fundamental transverse mode		

Typical Test Data:

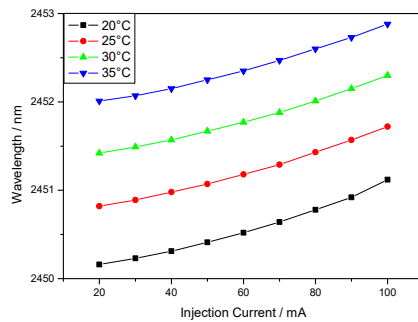
Document: <http://data.sacher-laser.com/dfb/c1534.pdf>

Note: Specification are subject to change without further notice.

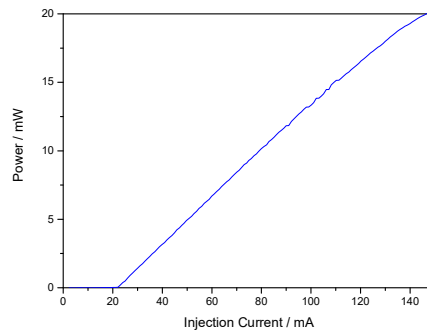




Emission spectrum of a CW operated Sensor Photonics single-mode DFB laser with emission at $\lambda = 2452\text{nm}$



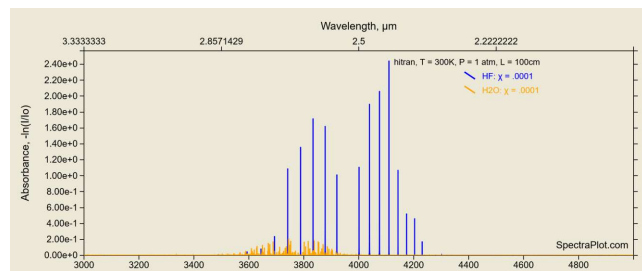
Wavelength tuning achieved via laser current variation for different temperature values



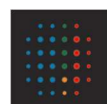
CW Laser Power vs. Injection Current Characteristic for a DFB laser

Application Example:

Hydrofluoric acid is a highly toxic gas used in semiconductor devices processing. In the Hitran database, many transitions can be identified which are suitable for optical detection. For example, there are several strong absorption lines in the 2500 nm spectral region. Some of these strong absorption lines in the 2500 nm regime can be detected with a simple optical absorption set-up.

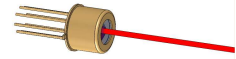


Document: <http://data.sacher-laser.com/dfb/c1534.pdf>
Note: Specifications are subject to change without further notice.

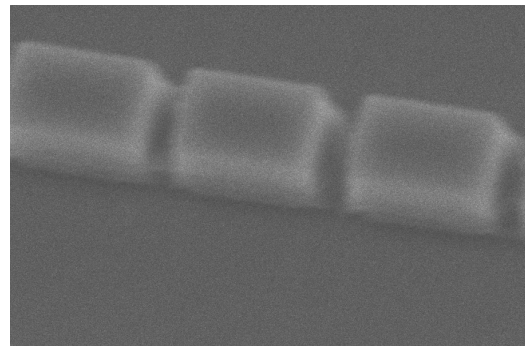
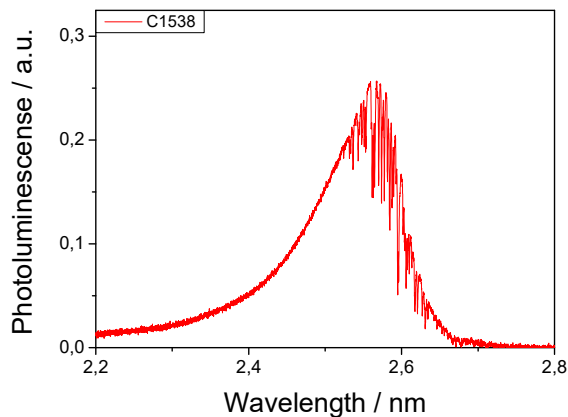




DFB Laser Diodes emitting in the wavelength range 2480nm - 2610nm



Description: DFB laser diodes of this product family emit in a single spatial and longitudinal single mode. Devices with emission wavelength λ in the range $2480 \text{ nm} \leq \lambda \leq 2610 \text{ nm}$ are available while other wavelengths are available on request. Devices are MOVPE grown AlGaInAsSb/GaSb Distributed Feedback diode lasers. The lasers are available in several housing options.



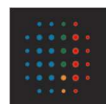
SEM micrograph of the Bragg grating

Product Specification:

Parameter	Symbol	Unit	Min.	typ.	max.
Center Wavelength	λ_c	nm	$\lambda_c - 1$	λ_c	$\lambda_c + 1$
Wavelength Selection Range	λ_s	nm	2480	2570	2610
Temperature Tuning Coefficient	$\Delta\lambda/\Delta T$	nm/K	0.15	0.2	0.25
Current Tuning Coefficient	$\Delta\lambda/\Delta I$	nm/mA	0.01	0.02	0.04
Spectral Width	$\Delta\nu$	MHz		1.5	10
Output Power (TO39)	P_{opt}	mW		15	20
Output Power (BFY)	P_{opt}	mW		10	15
Slope Efficiency (TO39)	η	mW/mA	0.1	0.15	0.2
Slope Efficiency (BFY)	η	mW/mA	0.05	0.08	0.1
Threshold Current	I_{th}	mA	15	25	45
Operation Current (TO39)	$I_{op} @ 5mW$	mA		120	140
Operation Current (BFY)	$I_{op} @ 3mW$	mA		120	140
Storage Temperature	T_s	°C	-40	+25	+80
Case Temperature during Operation	T_c	°C	-20	+25	+50
Chip Length	L_c	μm		600	
Emitter width	W_c	μm		4 x 1.5	
Beam Divergence (TO39) (FWHM)	$\theta_{ }$	deg.		22	
Beam Divergence (TO39) \perp (FWHM)	θ_{\perp}	deg.		38	
Polarization				TE	
Mode Structure			single longitudinal, fundamental transverse mode		

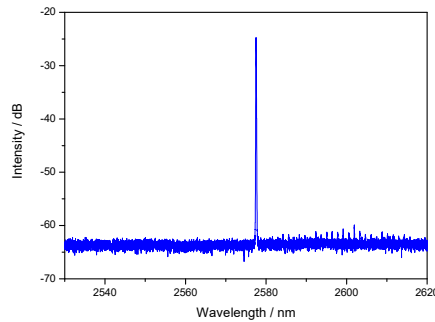
Document: <http://data.sacher-laser.com/dfb/c1538.pdf>

Note: Specification are subject to change without further notice.

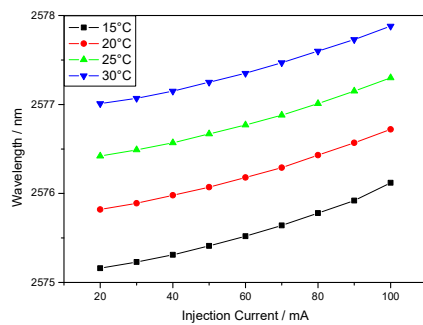




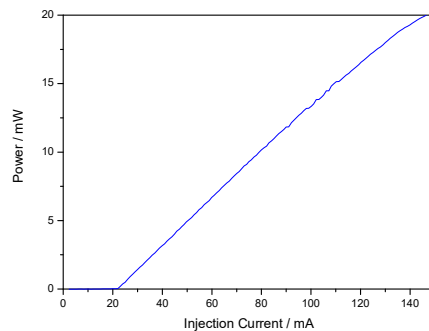
Typical Test Data:



Emission spectrum of a CW operated Sensor Photonics single-mode DFB laser with emission at $\lambda = 2577\text{nm}$



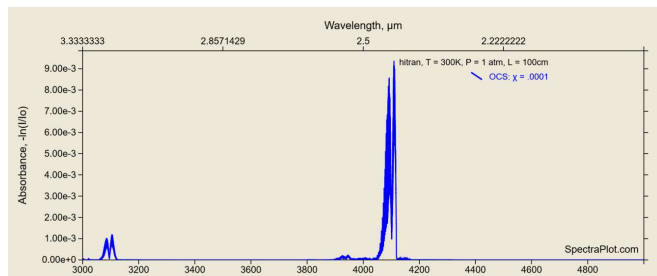
Wavelength tuning achieved via laser current variation for different temperature values



CW Laser Power vs. Injection Current Characteristic for a DFB laser

Application Example:

Carbonyl sulfide is the most abundant sulfur compound naturally present in the atmosphere, at 0.5 ± 0.05 ppb, because it is emitted from oceans, volcanoes and deep-sea vents. As such, it is a significant compound in the global sulfur cycle. In the Hitran database, many transitions can be identified which are suitable for optical detection. For example, there are several strong absorption lines in the 2500 nm spectral region. Some of these strong absorption lines in the 2500 nm regime can be detected with a simple optical absorption set-up.

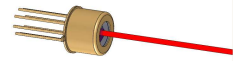


Document: <http://data.sacher-laser.com/dfb/c1538.pdf>
Note: Specifications are subject to change without further notice.

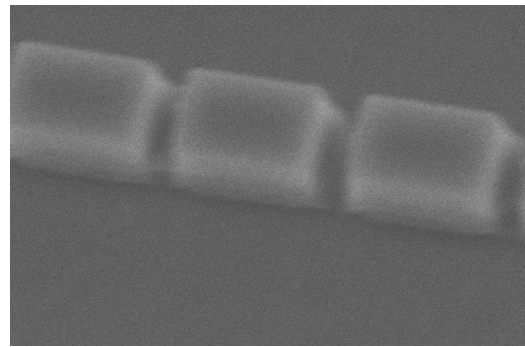
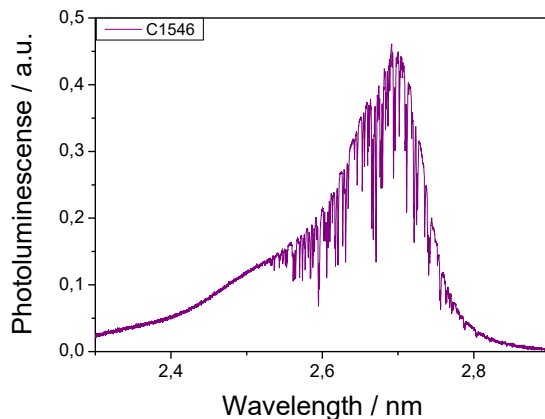




DFB Laser Diodes emitting in the wavelength range 2610nm - 2740nm



Description: DFB laser diodes of this product family emit in a single spatial and longitudinal single mode. Devices with emission wavelength λ in the range $2610 \text{ nm} \leq \lambda \leq 2740 \text{ nm}$ are available while other wavelengths are available on request. Devices are MOVPE grown AlGaInAsSb/GaSb Distributed Feedback diode lasers. The lasers are available in several housing options.



SEM micrograph of the Bragg grating

Product Specification:

Parameter	Symbol	Unit	Min.	typ.	max.
Center Wavelength	λ_c	nm	$\lambda_c - 1$	λ_c	$\lambda_c + 1$
Wavelength Selection Range	λ_s	nm	2610	2700	2740
Temperature Tuning Coefficient	$\Delta\lambda/\Delta T$	nm/K	0.15	0.2	0.25
Current Tuning Coefficient	$\Delta\lambda/\Delta I$	nm/mA	0.01	0.02	0.04
Spectral Width	$\Delta\nu$	MHz		1.5	10
Output Power (TO39)	P_{opt}	mW		15	20
Output Power (BFY)	P_{opt}	mW		10	15
Slope Efficiency (TO39)	η	mW/mA	0.1	0.15	0.2
Slope Efficiency (BFY)	η	mW/mA	0.05	0.08	0.1
Threshold Current	I_{th}	mA	15	25	45
Operation Current (TO39)	$I_{op} @ 5mW$	mA		120	140
Operation Current (BFY)	$I_{op} @ 3mW$	mA		120	140
Storage Temperature	T_s	°C	-40	+25	+80
Case Temperature during Operation	T_c	°C	-20	+25	+50
Chip Length	L_c	μm		600	
Emitter width	W_c	μm		4 x 1.5	
Beam Divergence (TO39) (FWHM)	$\theta_{ }$	deg.		22	
Beam Divergence (TO39) \perp (FWHM)	θ_{\perp}	deg.		38	
Polarization				TE	
Mode Structure			single longitudinal, fundamental transverse mode		

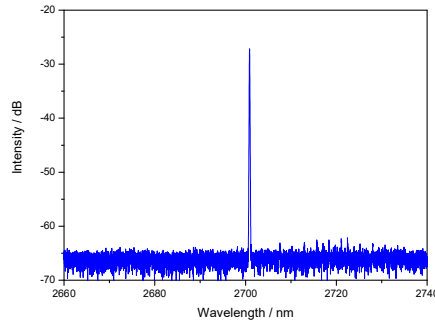
Document: <http://data.sacher-laser.com/dfb/c1546.pdf>

Note: Specifications are subject to change without further notice.

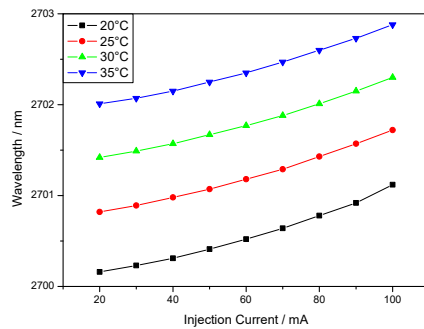




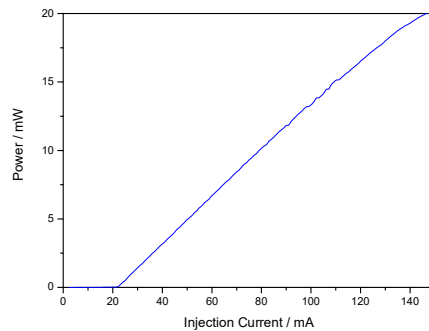
Typical Test Data:



Emission spectrum of a CW operated Sensor Photonics single-mode DFB laser with emission at $\lambda = 2700\text{nm}$



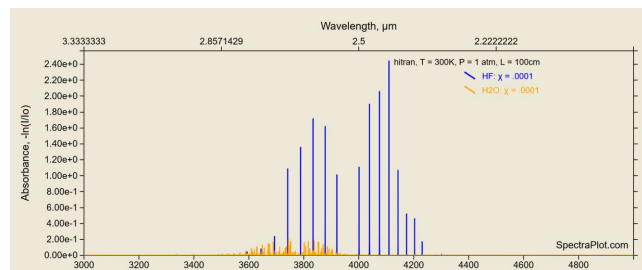
Wavelength tuning achieved via laser current variation for different temperature values



CW Laser Power vs. Injection Current Characteristic for a DFB laser

Application Example:

Hydrofluoric acid is a highly toxic gas used in semiconductor devices processing. In the Hitran database, many transitions can be identified which are suitable for optical detection. For example, there are several strong absorption lines in the 2500 nm spectral region. Some of these strong absorption lines in the 2500 nm regime can be detected with a simple optical absorption set-up.



Document:
Note:

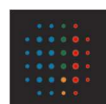
<http://data.sacher-laser.com/dfb/c1546.pdf>
Specifications are subject to change without further notice.

Sensor Photonics GmbH
Rudolf Breitscheid Str. 1-5
D-35037 Marburg, Germany

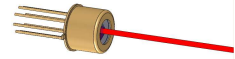
Tel.: +49 6421 305307
Fax: +49 6421 305308
Email: info@sensorphotonics.com

Sensor Photonics, LLC
215 Orange Avenue
Cranford, NJ 07016, U. S. A.

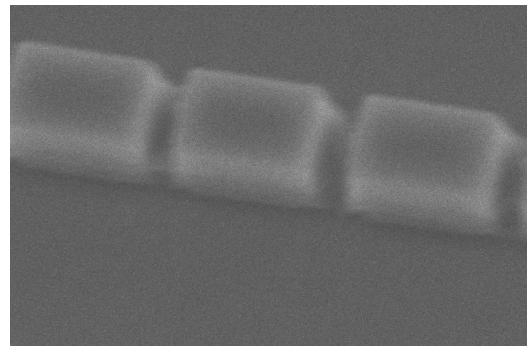
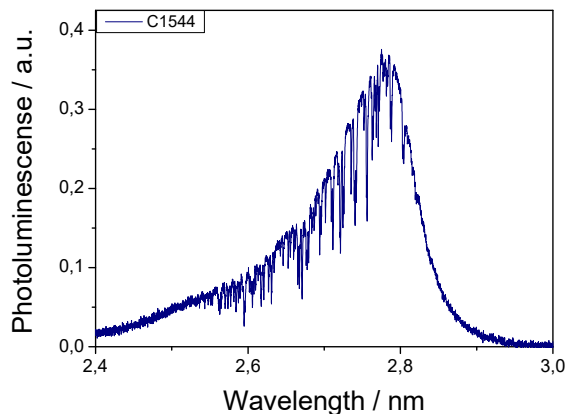
Tel.: +1 908 301 6801
Email: info@sensorphotonics.com



DFB Laser Diodes emitting in the wavelength range 2690nm - 2830nm



Description: DFB laser diodes of this product family emit in a single spatial and longitudinal single mode. Devices with emission wavelength λ in the range $2690 \text{ nm} \leq \lambda \leq 2830 \text{ nm}$ are available while other wavelengths are available on request. Devices are MOVPE grown AlGaInAsSb/GaSb Distributed Feedback diode lasers. The lasers are available in several housing options.



SEM micrograph of the Bragg grating

Product Specification:

Parameter	Symbol	Unit	Min.	typ.	max.
Center Wavelength	λ_c	nm	$\lambda_c - 1$	λ_c	$\lambda_c + 1$
Wavelength Selection Range	λ_s	nm	2690	2790	2830
Temperature Tuning Coefficient	$\Delta\lambda/\Delta T$	nm/K	0.15	0.2	0.25
Current Tuning Coefficient	$\Delta\lambda/\Delta I$	nm/mA	0.01	0.02	0.04
Spectral Width	$\Delta\nu$	MHz		1.5	10
Output Power (TO39)	P_{opt}	mW		15	20
Output Power (BFY)	P_{opt}	mW		10	15
Slope Efficiency (TO39)	η	mW/mA	0.1	0.15	0.2
Slope Efficiency (BFY)	η	mW/mA	0.05	0.08	0.1
Threshold Current	I_{th}	mA	15	25	45
Operation Current (TO39)	$I_{op} @ 5mW$	mA		120	140
Operation Current (BFY)	$I_{op} @ 3mW$	mA		120	140
Storage Temperature	T_s	°C	-40	+25	+80
Case Temperature during Operation	T_c	°C	-20	+25	+50
Chip Length	L_c	μm		600	
Emitter width	W_c	μm		4 x 1.5	
Beam Divergence (TO39) (FWHM)	$\theta_{ }$	deg.		22	
Beam Divergence (TO39) \perp (FWHM)	θ_{\perp}	deg.		38	
Polarization				TE	
Mode Structure			single longitudinal, fundamental transverse mode		

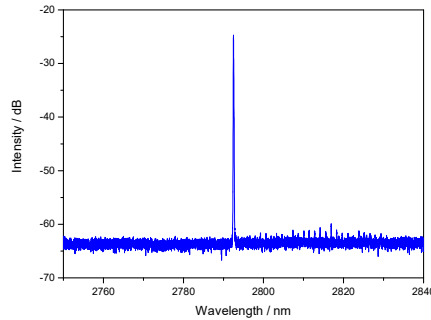
Document: <http://data.sacher-laser.com/dfb/c1544.pdf>

Note: Specifications are subject to change without further notice.

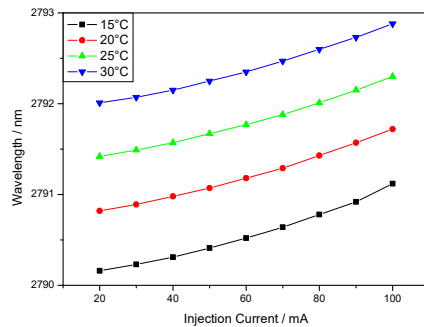




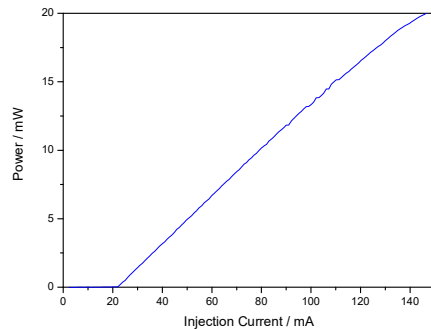
Typical Test Data:



Emission spectrum of a CW operated Sensor Photonics single-mode DFB laser with emission at $\lambda = 2792\text{nm}$



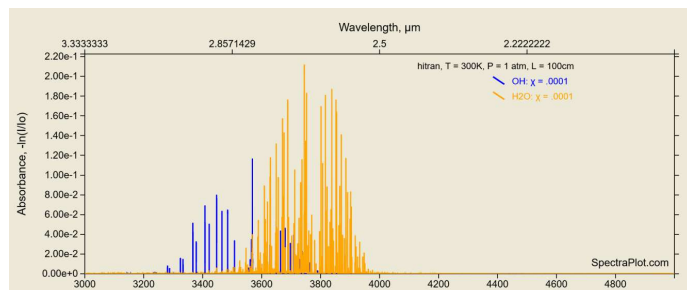
Wavelength tuning achieved via laser current variation for different temperature values



CW Laser Power vs. Injection Current Characteristic for a DFB laser

Application Example:

Water vapor and Hydroxide are very common gases with high importance in production processes. In the Hitran database, many transitions can be identified which are suitable for optical detection. For example, there are several strong absorption lines in the 2800 nm spectral region. Some of these strong absorption lines in the 2800 nm regime can be detected with a simple optical absorption set-up.

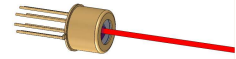


Document: <http://data.sacher-laser.com/dfb/c1544.pdf>
Note: Specifications are subject to change without further notice.

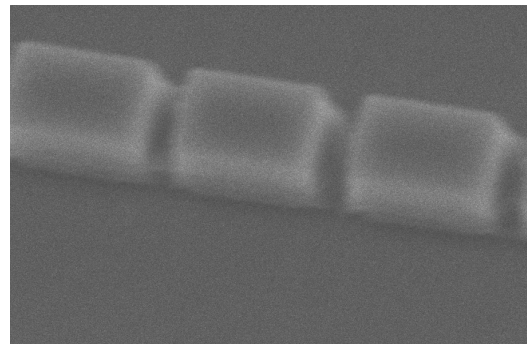
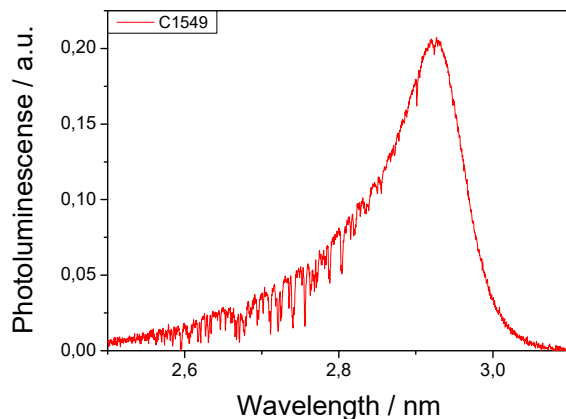




DFB Laser Diodes emitting in the wavelength range 2830nm - 2980nm



Description: DFB laser diodes of this product family emit in a single spatial and longitudinal single mode. Devices with emission wavelength λ in the range $2830 \text{ nm} \leq \lambda \leq 2980 \text{ nm}$ are available while other wavelengths are available on request. Devices are MOVPE grown AlGaInAsSb/GaSb Distributed Feedback diode lasers. The lasers are available in several housing options.



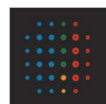
SEM micrograph of the Bragg grating

Product Specification:

Parameter	Symbol	Unit	Min.	typ.	max.
Center Wavelength	λ_c	nm	$\lambda_c - 1$	λ_c	$\lambda_c + 1$
Wavelength Selection Range	λ_s	nm	2830	2920	2980
Temperature Tuning Coefficient	$\Delta\lambda/\Delta T$	nm/K	0.15	0.2	0.25
Current Tuning Coefficient	$\Delta\lambda/\Delta I$	nm/mA	0.01	0.02	0.04
Spectral Width	$\Delta\nu$	MHz		1.5	10
Output Power (TO39)	P_{opt}	mW		15	20
Output Power (BFY)	P_{opt}	mW		10	15
Slope Efficiency (TO39)	η	mW/mA	0.1	0.15	0.2
Slope Efficiency (BFY)	η	mW/mA	0.05	0.08	0.1
Threshold Current	I_{th}	mA	15	25	45
Operation Current (TO39)	$I_{op} @ 5mW$	mA		120	140
Operation Current (BFY)	$I_{op} @ 3mW$	mA		120	140
Storage Temperature	T_s	°C	-40	+25	+80
Case Temperature during Operation	T_c	°C	-20	+25	+50
Chip Length	L_c	μm		600	
Emitter width	W_c	μm		4 x 1.5	
Beam Divergence (TO39) (FWHM)	$\theta_{ }$	deg.		22	
Beam Divergence (TO39) \perp (FWHM)	θ_{\perp}	deg.		38	
Polarization				TE	
Mode Structure			single longitudinal, fundamental transverse mode		

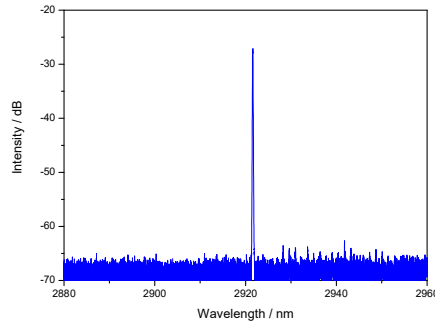
Document: <http://data.sacher-laser.com/dfb/c1549.pdf>

Note: Specifications are subject to change without further notice.

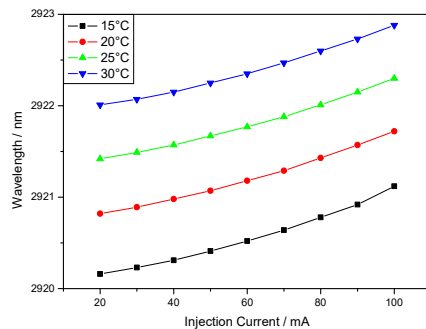




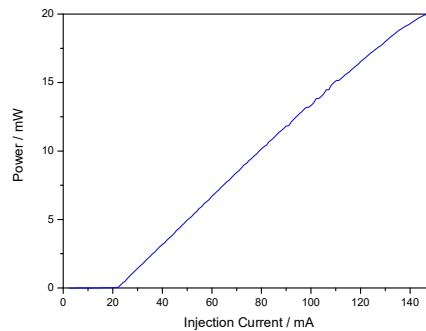
Typical Test Data:



Emission spectrum of a CW operated Sensor Photonics single-mode DFB laser with emission at $\lambda = 2922\text{nm}$



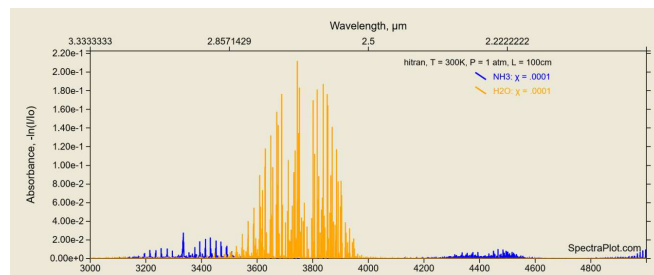
Wavelength tuning achieved via laser current variation for different temperature values



CW Laser Power vs. Injection Current Characteristic for a DFB laser

Application Example:

Ammonia is a toxic gas with high importance in production processes. In the Hitran database, many transitions can be identified which are suitable for optical detection. For example, there are several strong absorption lines in the 2900 nm spectral region. Some of these strong absorption lines in the 2900 nm regime can be detected with a simple optical absorption set-up.



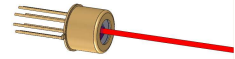
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Note: Specifications are subject to change without further notice.

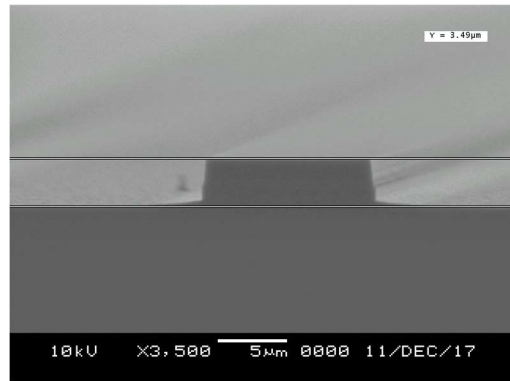




ICL DFB Laser Diodes available from 3000nm to 5000nm



Description: ICL DFB laser diodes of this product family emit in a single spatial and longitudinal single mode. Devices with emission wavelength λ between $3000 \text{ nm} \leq \lambda \leq 5000 \text{ nm}$ are available while other wavelengths are available on request. Devices are MOVPE grown Interband Cascade Distributed Feedback diode lasers. The lasers are available in several housing options.



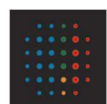
SEM micrograph of the Bragg grating

Product Specification:

Parameter	Symbol	Unit	Min.	typ.	max.
Center Wavelength	λ_C	nm	$\lambda_C - 1$	λ_C	$\lambda_C - 1$
Wavelength Selection Range	λ_s	nm	3000	4000	5000
Temperature Tuning Coefficient	$\Delta\lambda/\Delta T$	nm/K	0.15	0.2	0.25
Current Tuning Coefficient	$\Delta\lambda/\Delta I$	nm/mA	0.01	0.02	0.04
Spectral Width	$\Delta\nu$	MHz		1.5	10
Output Power (TO39)	P_{opt}	mW		3	5
Output Power (BFY)	P_{opt}	mW		n/a	
Slope Efficiency (TO39)	η	mW/mA	0.1	0.15	0.2
Slope Efficiency (BFY)	η	mW/mA		n/a	
Threshold Current	I_{th}	mA	30	80	100
Operation Current (TO39)	$I_{op} @ 5mW$	mA		200	250
Operation Current (BFY)	$I_{op} @ 3mW$	mA		n/a	
Storage Temperature	T_s	°C	-40	+25	+80
Case Temperature during Operation	T_c	°C	-20	+25	+50
Chip Length	L_c	μm		2500	
Emitter width	W_c	μm		6 x 1.5	
Beam Divergence (TO39) (FWHM)	$\theta_{ }$	deg.		23	
Beam Divergence (TO39) \perp (FWHM)	θ_{\perp}	deg.		39	
Polarization				TE	
Mode Structure			single longitudinal, fundamental transverse mode		

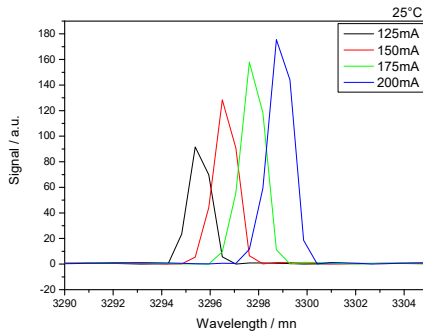
Document: <http://data.sacher-laser.com/dfb/c0001.pdf>

Note: Specifications are subject to change without further notice.

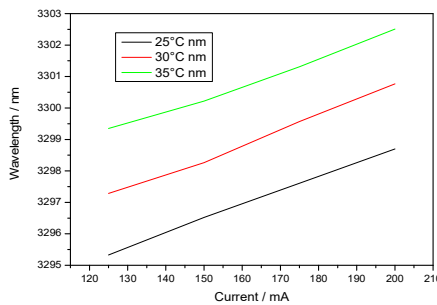




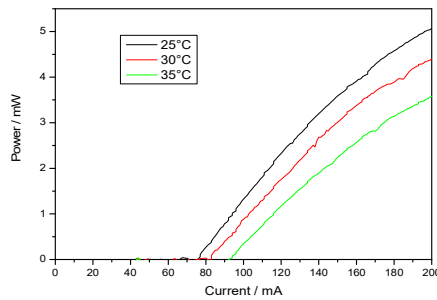
Typcial Test Data:



Emission spectrum of a CW operated Sensor Photonics single-mode ICL DFB laser with emission at $\lambda = 3298$ nm operated at 25°C



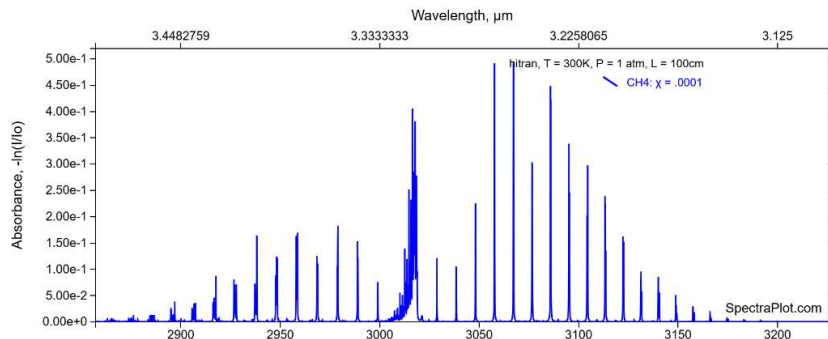
Wavelength tuning achieved via laser current variation for different temperature values



CW Laser Power vs. Injection Current Characteristic for DFB laser with emission at 3298nm operated at 25°C

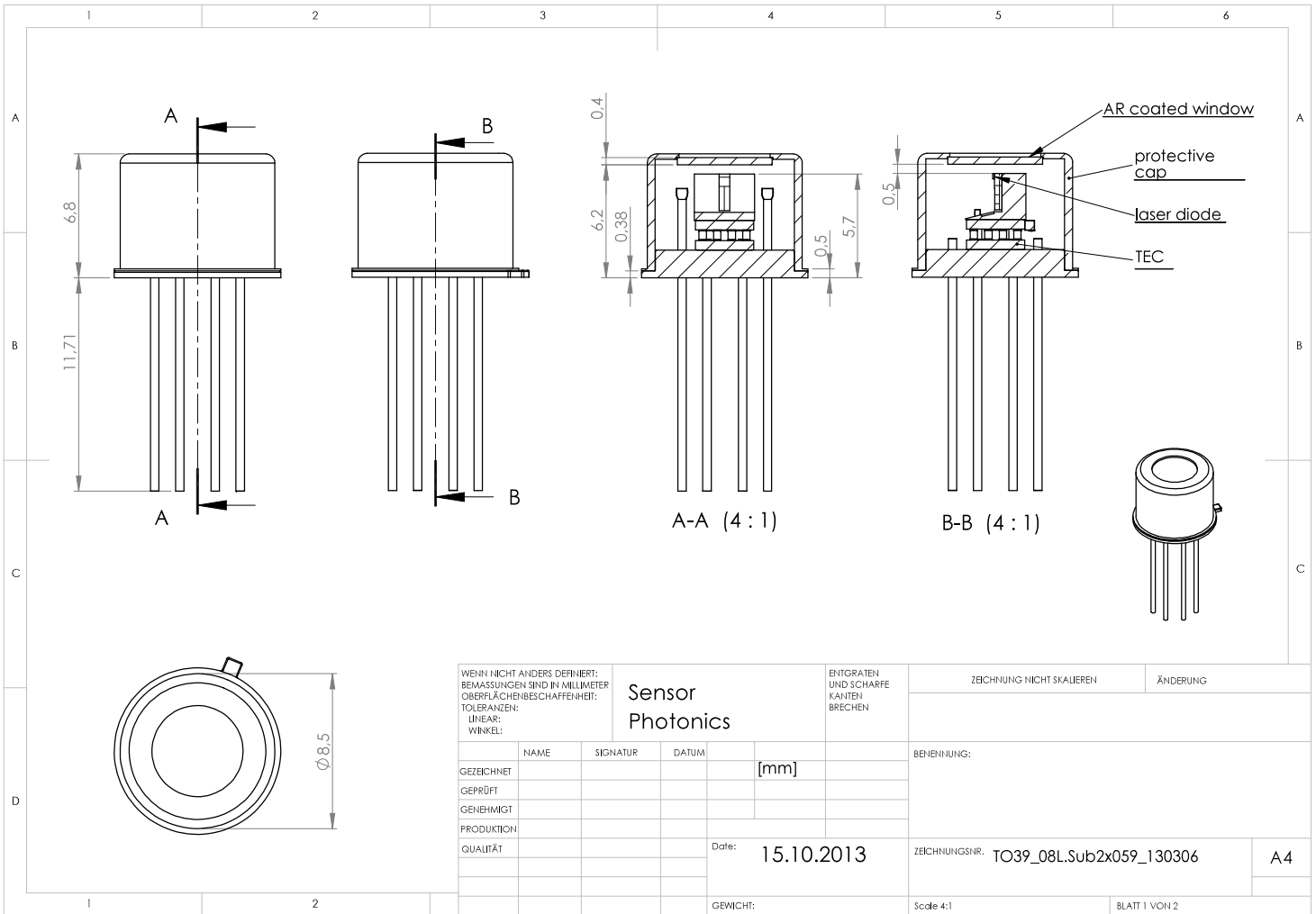
Application Example:

Fig. 5: Methane is an important gas for combustion as well as an important greenhouse gas. It is also a by-product of animal farming. Some applications required an exact detection of the methane concentration over long distances. In the Hitran database, many transitions can be found, and there are several strong absorption lines the 3300nm regime which can be detected with a simple optical absorption set-up.

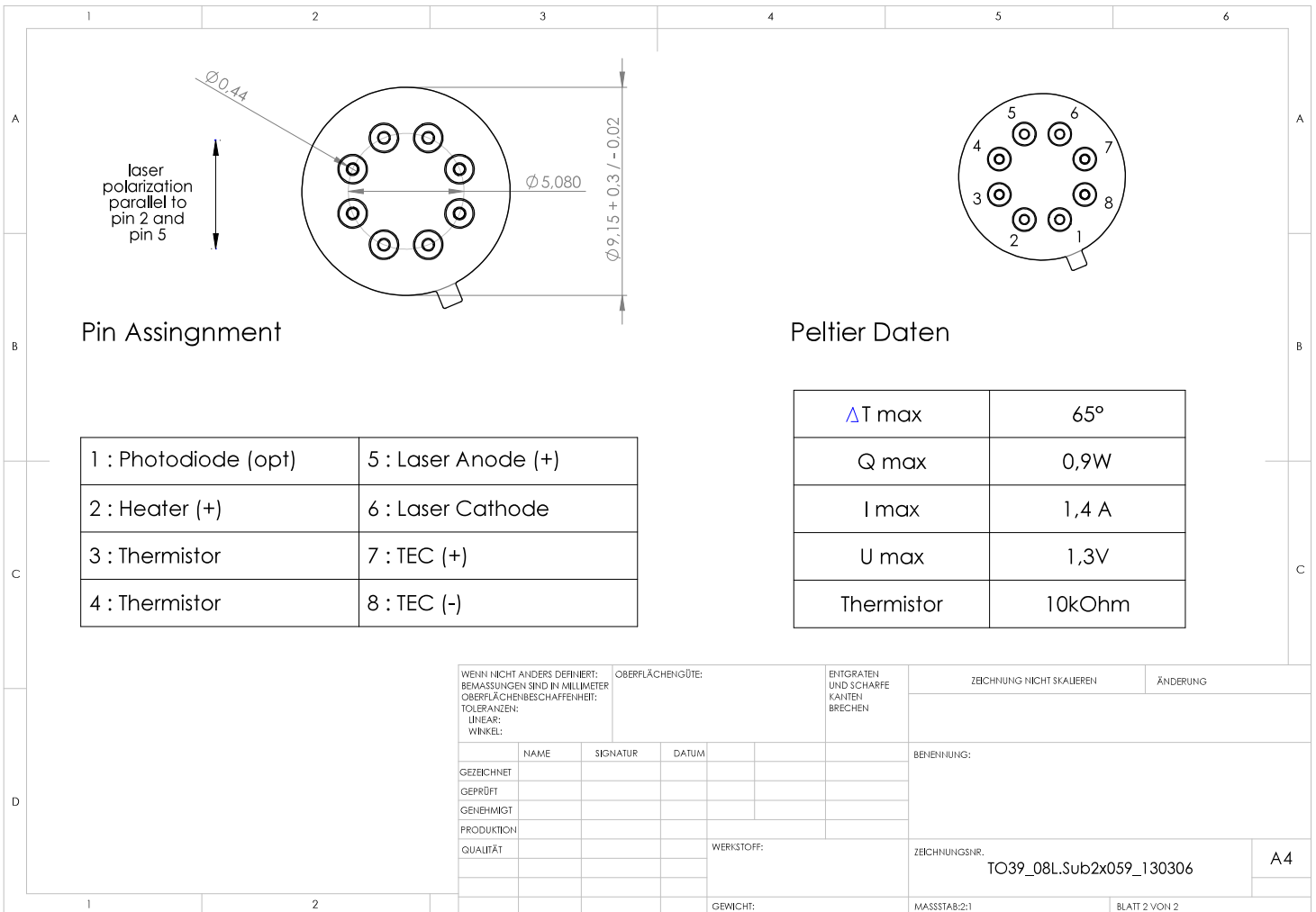


Document: <http://data.sacher-laser.com/dfb/c0001.pdf>
Note: Specifications are subject to change without further notice.





WENN NICHT ANDERS DEFINIERT: BEMASSUNGEN SIND IN MILLIMETER OBERFLÄCHENBESCHAFFENHEIT: TOLERANZEN: LINEAR: WINKEL:				Sensor Photonics		ENTGRATEN UND SCHARFE KANTEN BRECHEN		ZEICHNUNG NICHT SKALIEREN		ÄNDERUNG	
GEZEICHNET	NAME	SIGNATUR	DATUM	[mm]		BENENNUNG:					
GEPRÜFT											
GENEHMIGT											
PRODUKTION											
QUALITÄT				Date: 15.10.2013		ZEICHNUNGSNR. TO39_08L.Sub2x059_130306				A4	
				GEWICHT:		Scale 4:1				BLATT 1 VON 2	



Pin Assingment

1 : Photodiode (opt)	5 : Laser Anode (+)
2 : Heater (+)	6 : Laser Cathode
3 : Thermistor	7 : TEC (+)
4 : Thermistor	8 : TEC (-)

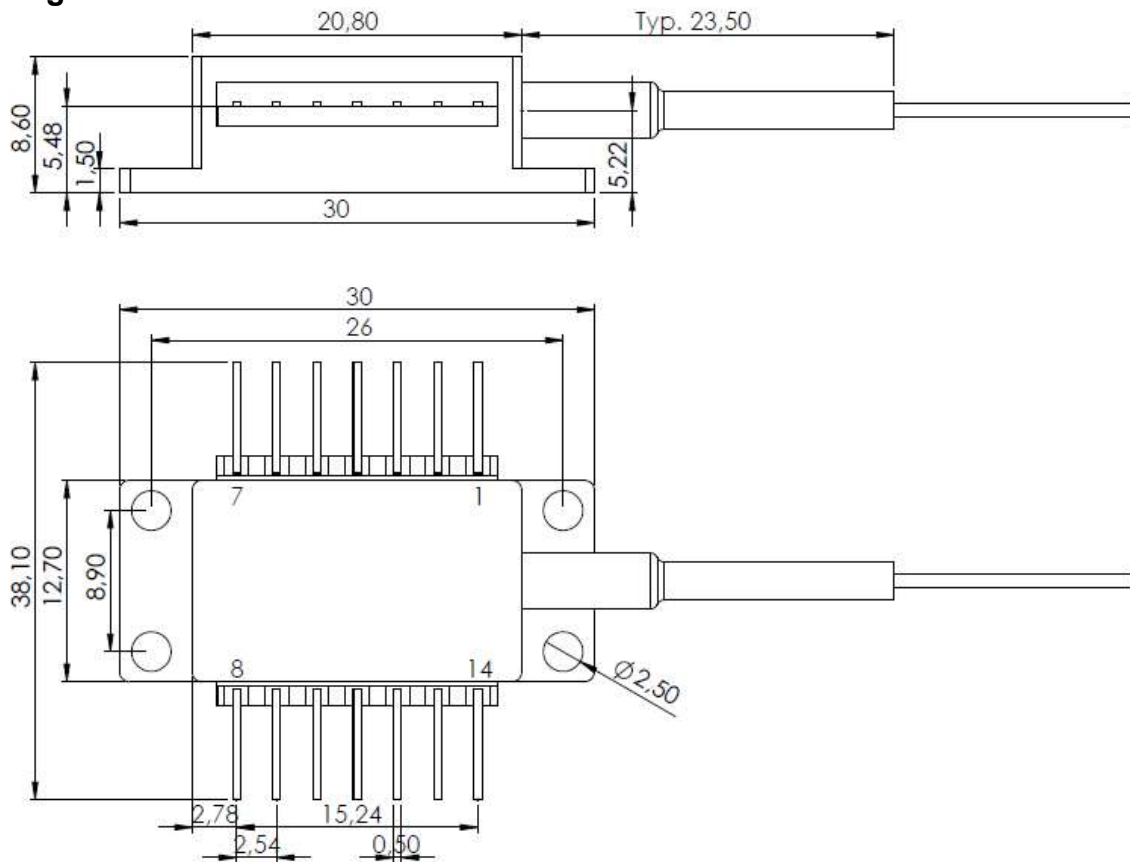
Peltier Daten

ΔT max	65°
Q max	0,9W
I max	1,4 A
U max	1,3V
Thermistor	10kOhm

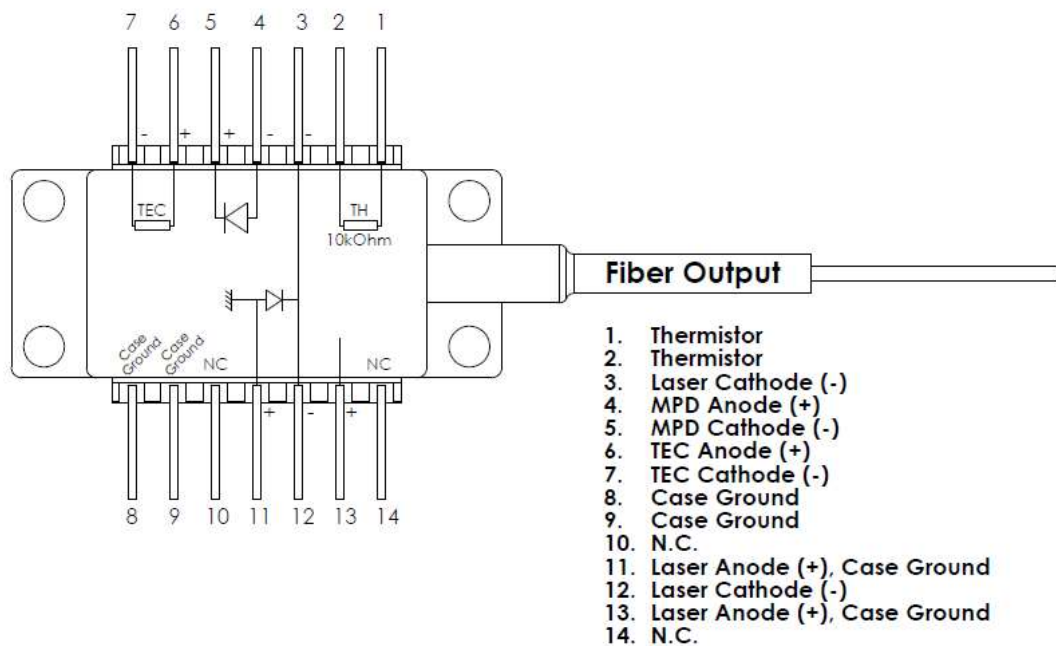
WENN NICHT ANDERS DEFINIERT: BEMASSUNGEN SIND IN MILLIMETER OBERFLÄCHENBESCHAFFENHEIT: TOLERANZEN: LINEAR: WINKEL:				OBERFLÄCHENGÜTE:		ENTGRATEN UND SCHARFE KANTEN BRECHEN		ZEICHNUNG NICHT SKALIEREN		ÄNDERUNG	
GEZEICHNET	NAME	SIGNATUR	DATUM			BENENNUNG:					
GEPRÜFT											
GENEHMIGT											
PRODUKTION											
QUALITÄT				WERKSTOFF:		ZEICHNUNGSNR. TO39_08L.Sub2x059_130306				A4	
				GEWICHT:		MASSSTAB:2:1				BLATT 2 VON 2	

Housing Option 14 Pin Butterfly:

Drawing:



PIN Layout:



Document:

Note:

Specification are subject to change without further notice.

