JDS Uniphase

Product Bulletin

SDL-5400 Series 50 to 200 mW, 810/830/852 nm Single-mode Laser Diodes

High-resolution applications including optical data storage, image recording, spectral analysis, printing, point-to-point free-space communications and frequency doubling all require diffraction-limited sources. Faster writing, wider dynamic range and better signal-to-noise ratio may be achieved with JDS Uniphase's high-reliability SDL-5400 series single-mode laser diodes.

Available in power levels up to 200 mW kink-free, this advanced laser diode combines a quantum well structure and a real-refractive index-guided single-mode waveguide to provide high power, low astigmatism, narrow spectral width and a single spatial mode Gaussian far field. SDL-5400 series laser diodes are among the most reliable high-power laser diodes available in the industry today.

The SDL-5400 series laser diodes operate in single longitudinal mode under some conditions. Like in all Fabry-Perot index-guided laser diodes, spectral broadening, mode hopping, and longitudinal mode instability may occur due to small changes in drive current, diode junction temperature, or optical feedback.

The unique diode structure features high reliability with long operating life and very low early failure rate. Very high brightness (20 MW/cm^2 steradian) is provided by the SDL-5430.

Useful packaging options include open heatsink, SOT or TO-3 packages, internal photodiode, thermoelectric cooler and wavelength selection.

Key Features

- Up to 200 mW continuous wave (CW) output power
- Wavelengths available:
  - 810 ±4 nm or ±10 nm
  - 830 ±10 nm or ±20 nm
  - 852 ±4 nm or ±10 nm
- Diffraction-limited beam
- TEM_{00} single transverse mode

Applications

- Image recording
- Printing
- Spectral analysis
- Optical data storage
- Point-to-point communications

Available Configurations

SDL-5400 Series	SDL-5410 Series
SDL-5400-C	SDL-5410-C
SDL-5401-G1	SDL-5411-G1
SDL-5402-H1	SDL-5412-H1

Electro-optical Performance

Laser Characteristics	Symbol	SDL-5400 Series Min.	SDL-5400 Series Typ.	SDL-5400 Series Max.	SDL-5410 Series Min.	SDL-5410 Series Typ.	SDL-5410 Series Max.	Unit
CW output power, kink-free	P_o	–	–	50	–	–	100	mW
Center wavelength	λ_c	–	(note[7])	–	–	(note[7])	–	
Spectral width[1]	$\Delta\lambda$	–	3	5	–	3	5	nm
Slope efficiency	$\eta_D = P_o/(I_{op}–I_{th})$	0.75	0.85	–	0.75	0.85	–	mW/mA
Conversion efficiency	$\eta = P_o/(I_{op}V_{op})$	–	30	–	–	30	–	%
Emitting dimensions	W x H	–	3 x 1	–	–	3 x 1	–	µm
FWHM beam divergence								
Parallel to junction	$\theta_{//}$	–	9	–	–	9	–	degrees
Perpendicular to junction	$\theta_{\perp}$	–	30	–	–	30	–	degrees
Threshold current	I_{th}	–	35	45	–	35	45	mA
Operating current	I_{op}	–	95	105	–	160	170	mA
Operating voltage	V_{op}	–	(note[6])	–	–	(note[6])	–	
Series resistance	R_s	–	4.0	6.0	–	4.0	6.0	Ω
Thermal resistance	R_{th}	–	60	–	–	60	–	°C/W
Recommended case temperature	T_c	-20	–	30	-20	–	30	°C
Absolute Maximum Ratings								
Reverse voltage	V_{rl}	–	–	3	–	–	3	V
Case operating temperature	T_{op}	-20	–	50	-20	–	50	°C
Storage temperature range	T_{stg}	-40	–	80	-40	–	80	°C
Lead soldering temperature	T_{is}	–	–	250	–	–	250	°C (5 sec.)
Monitor Photodiode[2]								
Sensitivity	–	0.1	–	20	0.1	–	20	µA/mW
Capacitance	–	–	6	–	–	6	–	pF
Breakdown voltage	V_{bd}	–	25	–	–	25	–	V
Operating voltage	V_{op}	–	10	–	–	10	–	V
Thermoelectric Cooler[2,3]								
Drive current	I_{TE}	–	2.0	–	–	2.0	–	A
Drive voltage	V_{TE}	–	4.0	–	–	4.0	–	V
Thermal resistance	R_{th}	–	15	–	–	15	–	°C/W
Thermistor resistance	R_{therm}	–	10	–	–	10	–	kΩ

1. Emission bandwidth for 90% integrated power.
2. Not available on C package.
3. Not available on G1 package.
4. Typical values at 25 °C and 0.6 NA collection optics.
5. Features common to all SDL-5400 series laser diodes include:
   a. Duty factor of 100%.
   b. Temperature coefficient of wavelength is approximately 0.3 nm/°C.
   c. Temperature coefficient of threshold current can be modeled as: $I_{TH2} = I_{TH1} \exp[(T_2 – T_1)/T_0]$ where T_0 is a device constant of about 110 °K.
   d. Temperature coefficient of operating current is approximately 0.5 to 0.7% per °C.
6. Forward voltage is typically: $V_f = 1.5\ V + I_{op} \times R_s$.
7. Wavelength ranges for the SDL-5400 and 5410 series:
   810 ±4 nm or ±10 nm
   830 ±10 nm or ±20 nm
   852 ±4 nm or ±10 nm
8. Astigmatism is less than 5 µm.
9. **SDL-54X X** – (C, G1 or H1 package)
   - 0 – No options
   - 1 – Monitor photodiode
   - 2 – Monitor photodiode, TE cooler
   - 0 – 50 mW CW
   - 1 – 100 mW CW

Available Configurations

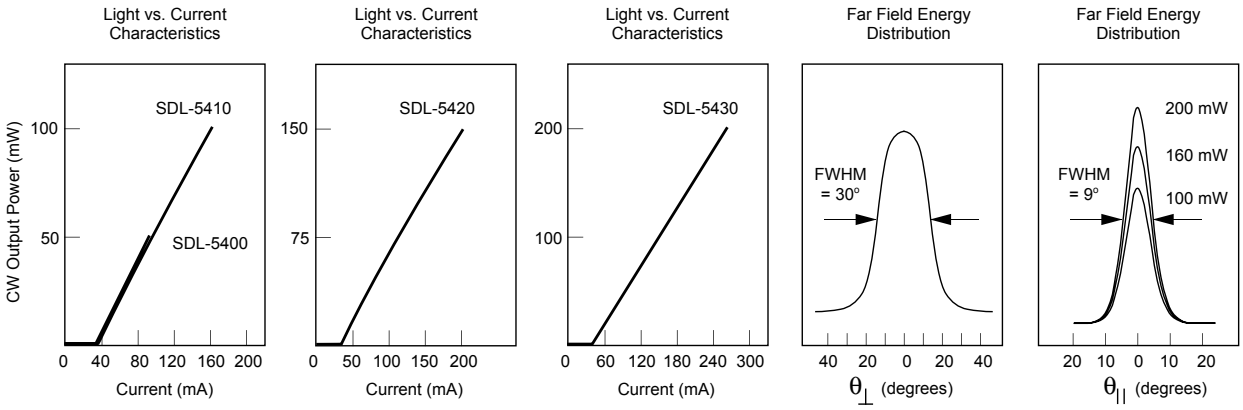
SDL-5420 Series	SDL-5430 Series
SDL-5420-C	SDL-5430-C
SDL-5421-G1	SDL-5431-G1
SDL-5422-H1	SDL-5432-H1

Electro-optical Performance

Laser Characteristics	Symbol	SDL-5420 Series Min.	SDL-5420 Series Typ.	SDL-5420 Series Max.	SDL-5430 Series Min.	SDL-5430 Series Typ.	SDL-5430 Series Max.	Unit
CW output power, kink-free	P_o	–	–	150	–	–	200	mW
Center wavelength	λ_c	–	(note[7])	–	–	(note[7])	–	
Spectral width[1]	$\Delta\lambda$	–	3	5	–	3	5	nm
Slope efficiency	$\eta_D = P_o/(I_{op}–I_{th})$	0.75	0.85	–	0.75	0.85	–	mW/mA
Conversion efficiency	$\eta = P_o/(I_{op}V_{op})$	–	30	–	–	30	–	%
Emitting dimensions	W x H	–	3 x 1	–	–	3 x 1	–	µm
FWHM beam divergence								
Parallel to junction	$\theta_{//}$	–	9	–	–	9	–	degrees
Perpendicular to junction	$\theta_{\perp}$	–	30	–	–	30	–	degrees
Threshold current	I_{th}	–	35	45	–	40	50	mA
Operating current	I_{op}	–	210	230	–	270	300	mA
Operating voltage	V_{op}	–	(note[6])	–	–	(note[6])	–	
Series resistance	R_s	–	4.0	6.0	–	4.0	6.0	Ω
Thermal resistance	R_{th}	–	60	–	–	60	–	°C/W
Recommended case temperature	T_c	-20	–	30	-20	–	30	°C
Absolute Maximum Ratings								
Reverse voltage	V_{rl}	–	–	3	–	–	3	V
Case operating temperature	T_{op}	-20	–	50	-20	–	50	°C
Storage temperature range	T_{stg}	-40	–	80	-40	–	80	°C
Lead soldering temperature	T_{is}	–	–	250	–	–	250	°C (5 sec.)
Monitor Photodiode[2]								
Sensitivity	–	0.1	–	20	0.1	–	20	µA/mW
Capacitance	–	–	6	–	–	6	–	pF
Breakdown voltage	V_{bd}	–	25	–	–	25	–	V
Operating voltage	V_{op}	–	10	–	–	10	–	V
Thermoelectric Cooler[2,3]								
Drive current	I_{TE}	–	2.0	–	–	2.0	–	A
Drive voltage	V_{TE}	–	4.0	–	–	4.0	–	V
Thermal resistance	R_{th}	–	15	–	–	15	–	°C/W
Thermistor resistance	R_{therm}	–	10	–	–	10	–	kΩ

1. Emission bandwidth for 90% integrated power.
2. Not available on C package.
3. Not available on G1 package.
4. Typical values at 25 °C and 0.6 NA collection optics.
5. Features common to all SDL-5400 series laser diodes include:
   a. Duty factor of 100%.
   b. Temperature coefficient of wavelength is approximately 0.3 nm/°C.
   c. Temperature coefficient of threshold current can be modeled as: $I_{TH2} = I_{TH1} \exp[(T_2 – T_1)/T_0]$ where T_0 is a device constant of about 110 °K.
   d. Temperature coefficient of operating current is approximately 0.5 to 0.7% per °C.
6. Forward voltage is typically: $V_f = 1.5\ V + I_{op} \times R_s$.
7. Wavelength ranges:
   SDL-5420 810 ±4 nm or ±10 nm
   830 ±10 nm
   852 ±4 nm or ±10 nm
   SDL-5430 830 ±10 nm
8. Astigmatism is less than 5 µm.
9. **SDL-54X X** – (C, G1 or H1 package)
   - 0 – No options
   - 1 – Monitor photodiode
   - 2 – Monitor photodiode, TE cooler
   - 2 – 150 mW CW
   - 3 – 200 mW CW

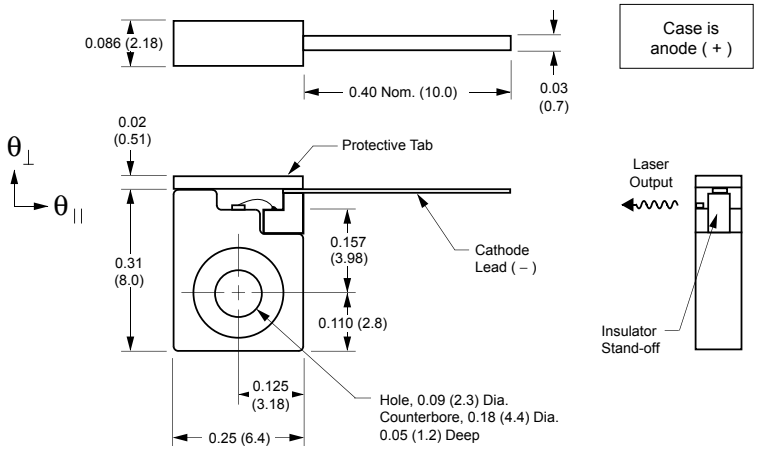
Typical Optical Characteristics



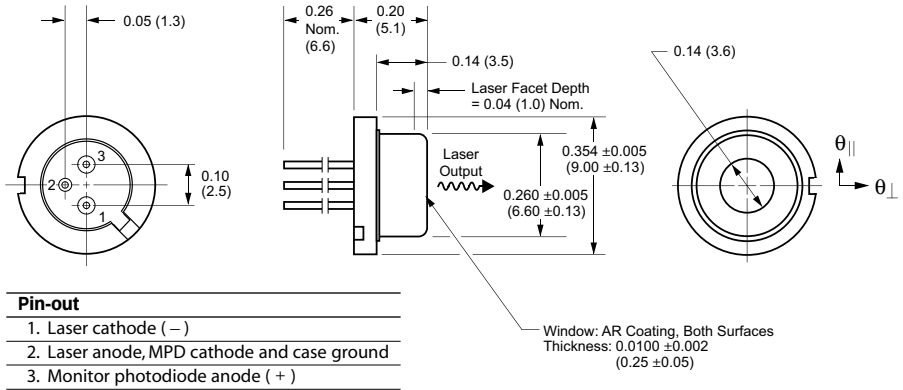
Package Dimensions (inches [mm])

Standard Tolerances
inches: x.xx = ±0.02 mm: x.x = ±0.5
x.xxx = ±0.010 x.xx = ±0.25

C
Open Heatsink
Package

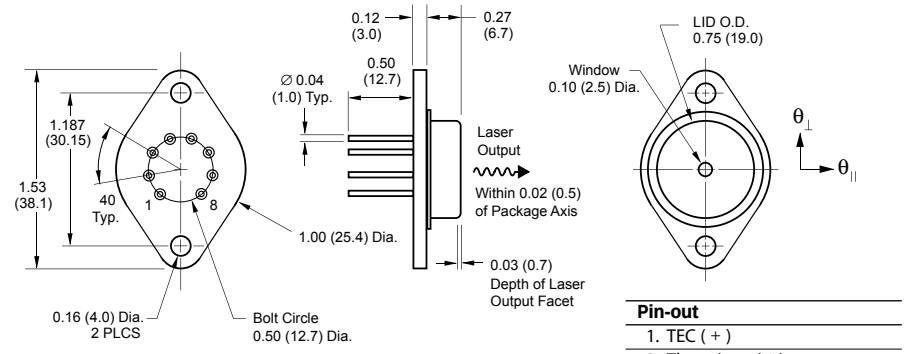


G1
SOT-148
Window Package



Pin-out
1. Laser cathode (–)
2. Laser anode, MPD cathode and case ground
3. Monitor photodiode anode (+)

H1
TO-3
Window Package



Pin-out
1. TEC (+)
2. Thermistor (1)
3. Thermistor (2)
4. Laser cathode (–)
5. Laser anode (+), case
6. Monitor photodiode anode
7. Monitor photodiode cathode
8. TEC (–)

User Safety

Safety and Operating Considerations

The laser light emitted from this laser diode is invisible and may be harmful to the human eye. Avoid looking directly into the laser diode or into the collimated beam along its optical axis when the device is in operation.

CAUTION: THE USE OF OPTICAL INSTRUMENTS WITH THIS PRODUCT WILL INCREASE EYE HAZARD.

Operating the laser diode outside of its maximum ratings may cause device failure or a safety hazard. Power supplies used with the component must be employed such that the maximum peak optical power cannot be exceeded. CW laser diodes may be damaged by excessive drive current or switching transients. When using power supplies, the laser diode should be connected with the main power on and the output voltage at zero. The current should be increased slowly while monitoring the laser diode output power and the drive current.

Device degradation accelerates with increased temperature, and therefore careful attention to minimize the case temperature is advised. For example, life expectancy will decrease by a factor of four if the case is operated at 50 °C rather than 30 °C.

A proper heatsink for the laser diode on a thermal radiator will greatly enhance laser life. Firmly mount the laser on a radiator with a thermal impedance of less than 2 °C/W for increased reliability.

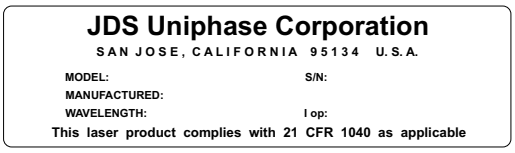
ESD PROTECTION – Electrostatic discharge is the primary cause of unexpected laser diode failure. Take extreme precaution to prevent ESD. Use wrist straps, grounded work surfaces and rigorous antistatic techniques when handling laser diodes.

This product is export controlled under COCOM. The ECCN is A005; Harmonized Commodity is 8541.40.6050.

21 CFR 1040.10 Compliance

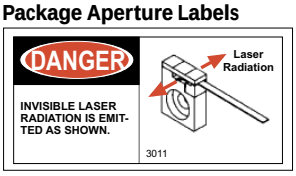
Because of the small size of these devices, each of the labels shown is attached to the individual shipping container. They are illustrated here to comply with 21 CFR 1040.10 as applicable under the Radiation Control for Health and Safety Act of 1968.

Serial Number Identification Label

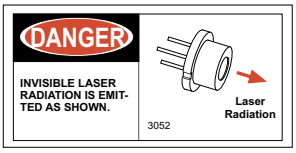


Output Power Danger Label

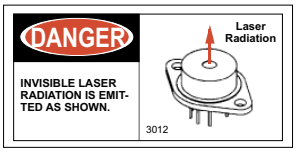
Package Aperture Labels



C Package Diodes



G1 Package Diodes



H1 Package Diodes

Ordering Information

For more information on this or other products and their availability, please contact your local JDS Uniphase account manager or JDS Uniphase directly at 800-871-8537 in North America and 1-800-8735-5378 worldwide or via e-mail at jdsu.sales@jdsu.com.

JDS Uniphase

North America toll-free: 800-871-8537
Worldwide toll-free: 1-800-8735-5378
www.jdsu.com

10127872 Rev. 001 01/02