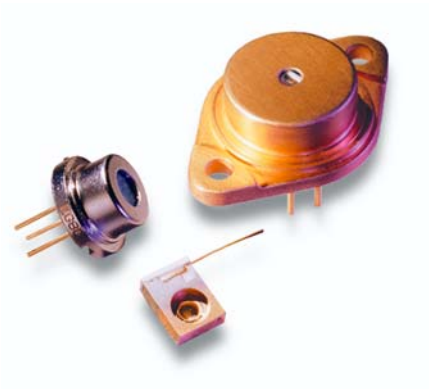
50 to 200 mW, 810/830/852 nm Single-mode Diode Lasers

5400 Series



Key Features

- **Up to 200 mW continuous wave (CW) output power**
- **Various operating wavelength ranges within the 800 to 862 nm region**
- **Diffraction-limited beam**
- **TEM$_{00}$ single transverse mode**

Applications

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

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 JDSU's high-reliability 5400 series single-mode diode lasers.

Available in power levels up to 200 mW kink-free, this advanced diode laser 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. 5400 series diode lasers are among the most reliable high-power diode lasers available in the industry today.

The 5400 series diode lasers operate in single longitudinal mode under some conditions. Like in all Fabry-Perot index-guided diode lasers, 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 5430.

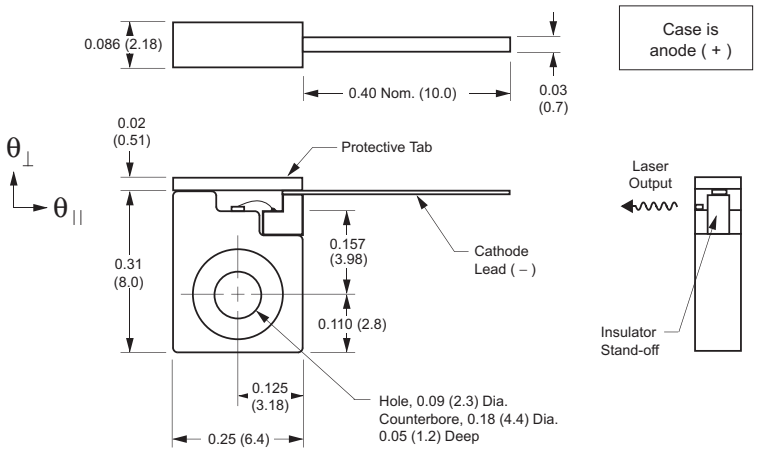
Useful packaging options include open heatsink, SOT or TO-3 packages, internal photodiode, thermoelectric cooler and wavelength selection.

2

Dimensions Diagram

(Specifications in inches [mm] unless otherwise noted.)
Standard Tolerances
inches: x.xx = ±0.02 mm: x.x = ±0.5
x.xxx = ±0.010 x.xx = ±0.25

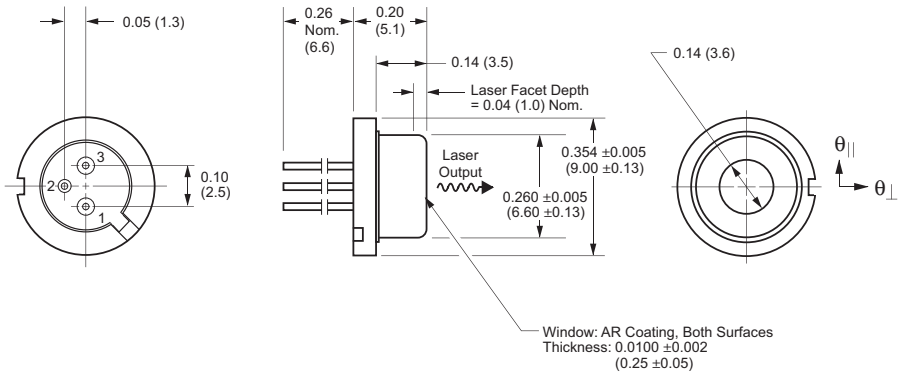
Package Style: Open Heatsink (C)



Package Style: SOT-148 Window (G1)

Pinout

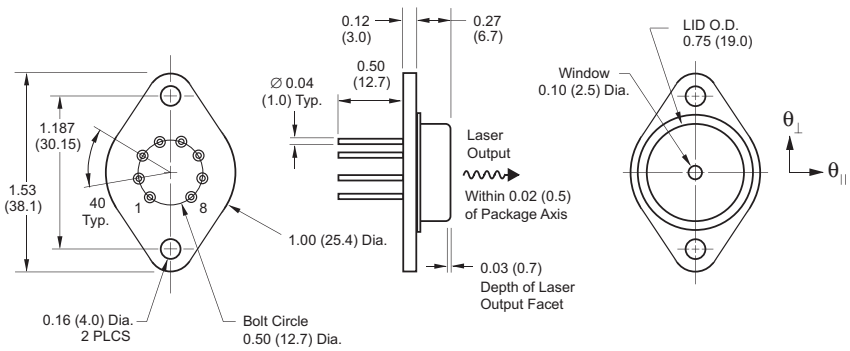
Pin	Description
1	Laser cathode (–)
2	Laser anode, MPD cathode and case ground
3	Monitor photodiode anode (+)



Package Style: TO-3 Window (H1)

Pinout

Pin	Description
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 (–)



Available Configurations

5400 Series	5410 Series	5420 Series	5430 Series
5400-C	5410-C	5420-C	5430-C
5401-G1	5411-G1	5421-G1	5431-G1
5402-H1	5412-H1	5422-H1	5432-H1

Electro-optical Specifications

Parameter	Symbol	5400 Series			5410 Series			Unit
		Min.	Typ.	Max.	Min.	Typ.	Max.	
Laser Characteristics								
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 5400 series diode lasers 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 5400 and 5410 series:
   800-820 nm
   810-850 nm
   842-862 nm
   A variety of part numbers are available that each designate a particular subset within these wavelength ranges. Consult tables on page 5.
8. Astigmatism is less than 5 µm.

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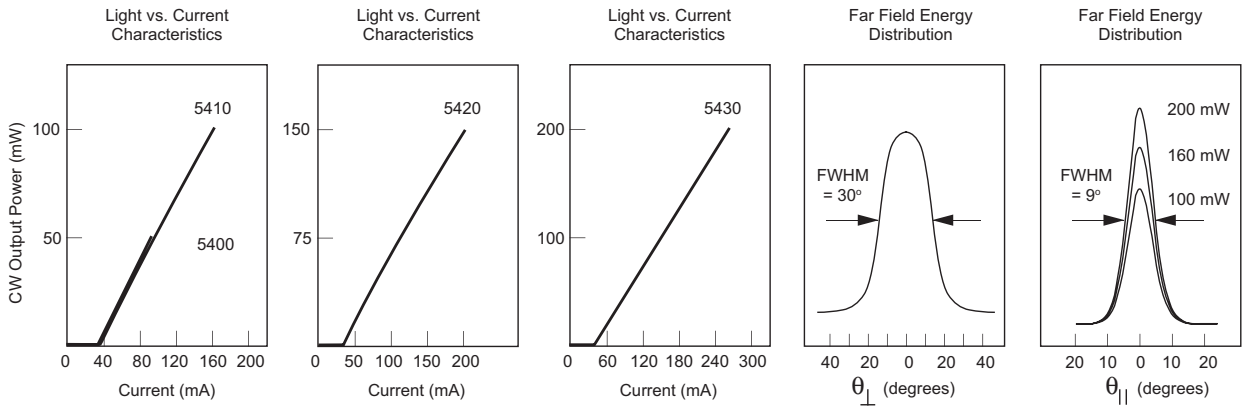
Electro-optical Specifications | Continued

Parameter	Symbol	5420 Series			5430 Series			Unit
		Min.	Typ.	Max.	Min.	Typ.	Max.	
Laser Characteristics								
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 5400 series diode lasers 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 5420 series:
   800-820 nm
   810-850 nm
   842-862 nm
   Wavelength range for the 5430 series is limited to 820-840 nm.
   A variety of part numbers are available that each designate a particular subset within these wavelength ranges. Consult tables on page 5.
8. Astigmatism is less than 5 µm.

5

Typical Optical Characteristics



Ordering Information

For more information on this or other products and their availability, please contact your local JDSU account manager or JDSU directly at 1-800-498-JDSU (5378) in North America and +800-5378-JDSU worldwide or via e-mail at customer.service@jdsu.com.

Sample: 54-00004

Package Style: Open Heat Sink with No MPD

Part Number	Wavelength	Power
54-00004	810 ± 4 nm	50 mW
54-00007	830 ± 4 nm	50 mW
54-00009	852 ± 4 nm	50 mW
54-00176	852 ± 10 nm	50 mW
54-00148	810 ± 4 nm	100 mW
54-00161	830 ± 10 nm	100 mW
54-00162	852 ± 4 nm	100 mW
54-00177	852 ± 10 nm	100 mW
54-00150	810 ± 4 nm	150 mW
54-00053	830 ± 10 nm	150 mW
54-00055	852 ± 4 nm	150 mW
54-00178	852 ± 10 nm	150 mW
54-00070	830 ± 10 nm	200 mW

Package Style: TO-3 with TEC and MPD

Part Number	Wavelength	Power
54-00020	810 ± 4 nm	50 mW
54-00023	830 ± 10 nm	50 mW
54-00025	852 ± 4 nm	50 mW
54-00149	810 ± 4 nm	100 mW
54-00164	830 ± 10 nm	100 mW
54-00165	852 ± 4 nm	100 mW
54-00152	810 ± 4 nm	150 mW
54-00067	830 ± 10 nm	150 mW
54-00069	852 ± 4 nm	150 mW
54-00074	830 ± 10 nm	200 mW

Package Style: SOT-148 with MPD

Part Number	Wavelength	Power
54-00012	810 ± 4 nm	50 mW
54-00166	806-812 nm	50 mW
54-00015	810 ± 10 nm	50 mW
54-00016	830 ± 10 nm	50 mW
54-00141	820-850 nm	50 mW
54-00001	830 ± 20 nm	50 mW
54-00018	852 ± 4 nm	50 mW
54-00017	852 ± 10 nm	50 mW
54-00201	806-812 nm	100 mW
54-00159	810 ± 4 nm	100 mW
54-00187	806-814 nm	100 mW
54-00038	810 ± 10 nm	100 mW
54-00039	830 ± 10 nm	100 mW
54-00179	830 ± 20 nm	100 mW
54-00163	852 ± 4 nm	100 mW
54-00040	852 ± 10 nm	100 mW
54-00151	810 ± 4 nm	150 mW
54-00076	805-815 nm	150 mW
54-00058	811 ± 4 nm	150 mW
54-00061	810 ± 10 nm	150 mW
54-00200	809-816 nm	150 mW
54-00060	830 ± 10 nm	150 mW
54-00062	852 ± 4 nm	150 mW
54-00180	852 ± 10 nm	150 mW
54-00072	830 ± 10 nm	200 mW

User Safety

Safety and Operating Considerations

The laser light emitted from this diode laser is invisible and may be harmful to the human eye. Avoid looking directly into the diode laser 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 diode laser 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 diode lasers may be damaged by excessive drive current or switching transients. When using power supplies, the diode laser should be connected with the main power on and the output voltage at zero. The current should be increased slowly while monitoring the diode laser 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 diode laser 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 diode laser failure. Take extreme precaution to prevent ESD. Use wrist straps, grounded work surfaces and rigorous antistatic techniques when handling diode lasers.

Labeling

21 CFR 1040.10 Compliance

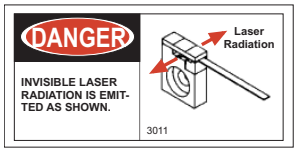
Because of the small size of these devices, each of the labels shown is attached to the individual shipping container. They are illustrated here to comply with 21 CFR 1040.10 as applicable under the Radiation Control for Health and Safety Act of 1968.

Serial Number Identification Label

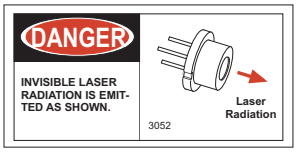
JDS Uniphase Corporation
SAN JOSE, CALIFORNIA 95134 U.S.A.
MODEL: S/N:
MANUFACTURED:
WAVELENGTH: I op:
This laser product complies with 21 CFR 1040 as applicable

Output Power Danger Label

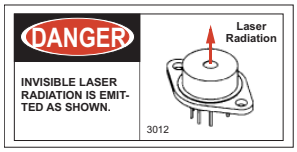
Package Aperture Labels



C Package Diodes



G1 Package Diodes



H1 Package Diodes