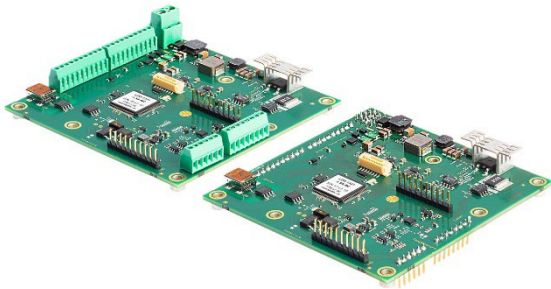


OEM Laser Diode Driver



Overview

The LDD-1321 is a current driver designed to precision-drive low-current laser diodes or other loads in continuous wave applications.

The LDD-1321 offers various safety features, including two inputs for laser diode temperature monitoring.

The device can be fully digitally controlled, the firmware can be upgraded, and various digital and analog interfaces are available.

Features

- DC input voltage: 12–24V

Laser Diode Driver

- Output Voltage: 0–14V (nominal)
- Output Current: 0–1.5A (nominal)
- Target application: low current CW

Main Features

- Digital control
- Easy configuration via provided GUI software
- Can be integrated in a system via a variety of interfaces or used as a stand-alone driver (set and forget)

Communication Interfaces

- USB
- RS485
- RS232 TTL

Digital I/O

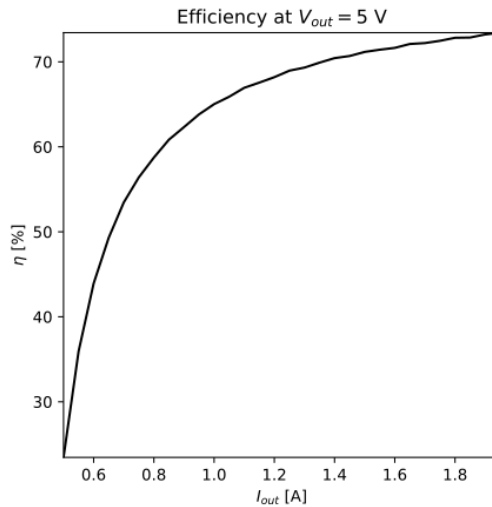
- Assortment of configurable functions
- Interlock input

Absolute Maximum Ratings

Supply voltage (DC)	27 V
Supply current (DC)	7 A (fused)
Storage temperature	-40–90 °C
Humidity	5–95 %, non-condensing

Thermal Information

Operating temperature range (board temperature, upper limit enforced by overtemperature protection)	0–70 °C
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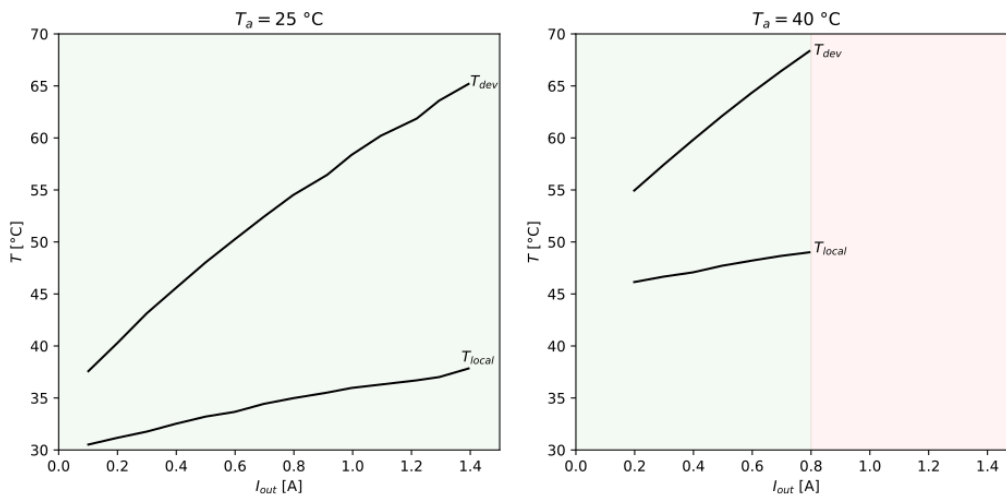
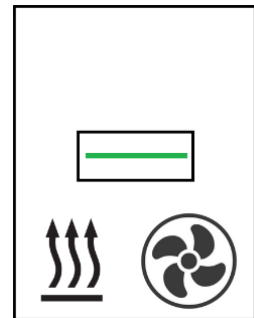


Note on heat sinking

Depending on your setup, additional cooling might be needed to avoid an overtemperature error during operation of the LDD.

This note shows a possible application scenario. The LDD-1321 was placed in a closed aluminum case with one perforation, which was then placed inside a ventilated climatic chamber. The device was driving a constant voltage load of 5 V, and was set to drive a load with a forward voltage of 5 V, a differential resistance of zero, and a maximum current of 1.5 A. The power supply voltage chosen was 12 V.

Three temperatures were measured. T_a is the ambient temperature inside the chamber, T_{local} is the air temperature inside the case, and T_{dev} is the PCB temperature of the device. In the operating area marked in red, the heatsinking (or lack thereof) of this setup becomes insufficient for continuous use over several minutes.



Power Input Characteristics

Unless otherwise noted: $T_A = 25\text{ °C}$.

Symbol	Parameter	Test Conditions/Notes	Min	Typ	Max	Unit
U_{in}	Supply voltage	Nominal	11.5		25.5	V
$U_{in\text{ripple}}$	Tolerated ripple voltage	U_{in} always in range specified above		300		mV _{pp}

LDD Output Characteristics

Unless otherwise noted: $T_A = 25\text{ °C}$.

Symbol	Parameter	Test Conditions/Notes	Min	Typ	Max	Unit
Static						
$I_{out\text{max}}$	Maximum nominal output current	Operating area limitations apply separately.		1.5		A
$I_{out\text{leak}}$	Leakage output current <small>Applies with current output disabled but anode supply enabled (use case: current modulation down to zero). Disabling the anode power supply turns off this current (use case: static on or off use of the current source).</small>	$V_{LDA} > 1\text{ V}$, $R_{load} \cong 0\ \Omega$		$0.84 \cdot V_{LDA}$		mA
$I_{out\text{min}}$	Zero-setpoint output current <small>Due to calibration. Can be reduced to the specification above by applying a user calibration offset (reduces current accuracy).</small>	$V_{LDA} = 6\text{ V}$, $R_{load} \cong 0\ \Omega$		4		
		$V_{LDA} = 15\text{ V}$, $R_{load} \cong 0\ \Omega$		5		
ΔI_{out}	Set current resolution			0.1		mA
$V_{LDA\text{max}}$	Maximum anode voltage	Whichever is lower		$V_{in} - 1$ or 20		V
$V_{out\text{max}}$	Maximum output voltage (on load)	Corresponding anode voltage must be reachable		14		V
$\alpha_{T\text{drive}}$	Output current temperature coefficient/drift (relative to device temperature)	$I_{out} = 0.5\text{ A}$, $T_0 = 15\text{ °C}$, $T_1 = 40\text{ °C}$		± 125		ppm/K
$\alpha_{T\text{meas}}$	Output current temperature measurement coefficient/drift (relative to device temperature)	$I_{out} = 0.5\text{ A}$, $T_0 = 15\text{ °C}$, $T_1 = 40\text{ °C}$		± 80		ppm/K
Dynamic						
f_{BW}	Analog bandwidth	1.5A on 1 Ω resistor. 50% sine amplitude. This specification is relevant to changing load characteristics. Applies independently of the refresh rate.		190		kHz
t_{rise}	Analog rise time	1.5A on 1 Ω resistor. This specification is relevant to step changes in the load and applies independently of the modulation rise time. Pulsing not supported at time of publication.		6		ms
f_s	Setpoint refresh rate	Applies to internally generated current ramping. Current modulation not supported at time of publication.		1562.5		Hz

Operating area

This device features a linear-mode laser diode driver, which uses a transistor (pictured as a current source) to control the current in the laser. This topology requires to consider the power dissipated on the current sink, as the portion of the voltage that does not fall on the load will fall on it.

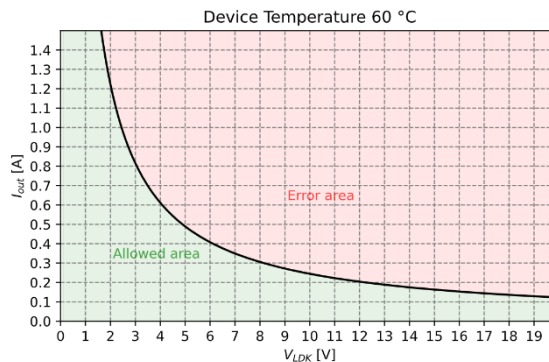
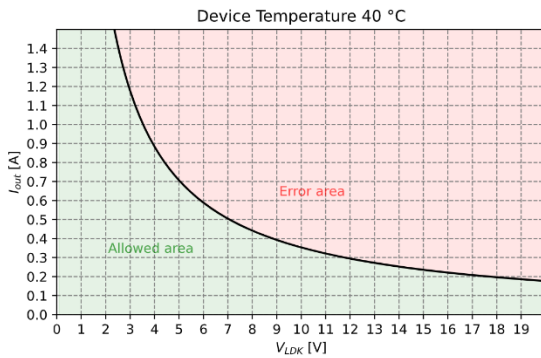
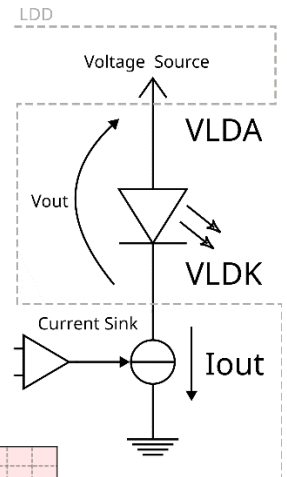
To enable simple and safe use, this device automatically shuts down if the safe operating area of the current sink is not respected.

The shutdown limit is shown in the charts below, at a typical device temperature and at the limit device temperature (worst-case).

The voltage of the voltage source, V_{LDA} (laser diode anode voltage), is automatically set by the device based on the laser characteristics and maximum current set by the user.

Note: these points are not all thermally stable without additional cooling.

See User Manual for details on how to use this curve to see if your load is compatible with the LDD-1321.



Safety Characteristics

Unless otherwise noted: $T_A = 25\text{ °C}$.

Symbol	Parameter	Test Conditions/Notes	Min	Typ	Max	Unit
Current shut-off time (current < TBD):						
$t_{off\overcurrent}$	Overcurrent (against set threshold)			TBD		μs
$t_{off\overcurrent}$	Fast overcurrent (fixed threshold)			TBD		μs
$t_{off\text{PIDover}}$	PID upper saturation			TBD		μs
$t_{off\text{interlock}}$	Interlock signal low			TBD		μs
$t_{off\text{error}}$	Generic software-initiated error			TBD		μs

External Temperature Measurement (NTC only)

$T_A = 25\text{ °C}$, measurement configuration: 12 bit / 2-wire / unshielded cable < 50 mm, temperature probe: NTC B25/100 3988K R₂₅ 10k.

Symbol	Parameter	Test Conditions/Notes	Min	Typ	Max	Unit
$R_{LR, \text{RANGE}}$	Range		295		106400	Ω
		Corresponding temperature range		130 to -21		$^{\circ}\text{C}$

General Purpose Digital I/O Characteristics (GPIO1 ... GPIO10)

Unless otherwise noted: $T_A = 25\text{ °C}$.

Symbol	Parameter	Test Conditions/Notes	Min	Typ	Max	Unit
Input Characteristics:						
U_{IH}	Logic high input threshold		2			V
U_{IL}	Logic low input threshold				1	V
U_{IMAX}	Maximum input voltage		-0.3		5.5	V
Output Characteristics:						
U_{OH}	Logic high output voltage	Output current 8mA	2.8		3.3	V
U_{OL}	Logic low output voltage	Input current 8mA			0.4	V
Z_{OUT}	Output Impedance		110	120	150	Ω
I_{OUT}	Output Sink or Source Current			± 8	± 20	mA
ESD Protection:						

U_{PP}	ESD discharge	IEC61000-4-2		18		kV
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Interlock Input Characteristics

Unless otherwise noted: $T_A = 25\text{ °C}$.

Symbol	Parameter	Test Conditions/Notes	Min	Typ	Max	Unit
Input Characteristics:						
V_{IAct}	Interlock active input voltage range	Voltage range which is detected as active input	3		30	V
V_{IORM}	Maximum working insulation voltage				120	V
	Safety information	Firmware feature. Not a hardware interlock.				

Photodiode Input Characteristics (optional)

Unless otherwise noted: $T_A = 25\text{ °C}$.

Symbol	Parameter	Test Conditions/Notes	Min	Typ	Max	Unit
Input Characteristics:						
I_{In}	Photodiode current measurement nominal limits	-PD0.5	0		4	mA
		-PD1	0		2	
		-PD2	0		1	
		-PD4	0		0.5	

Device Connectors

Connector configurations

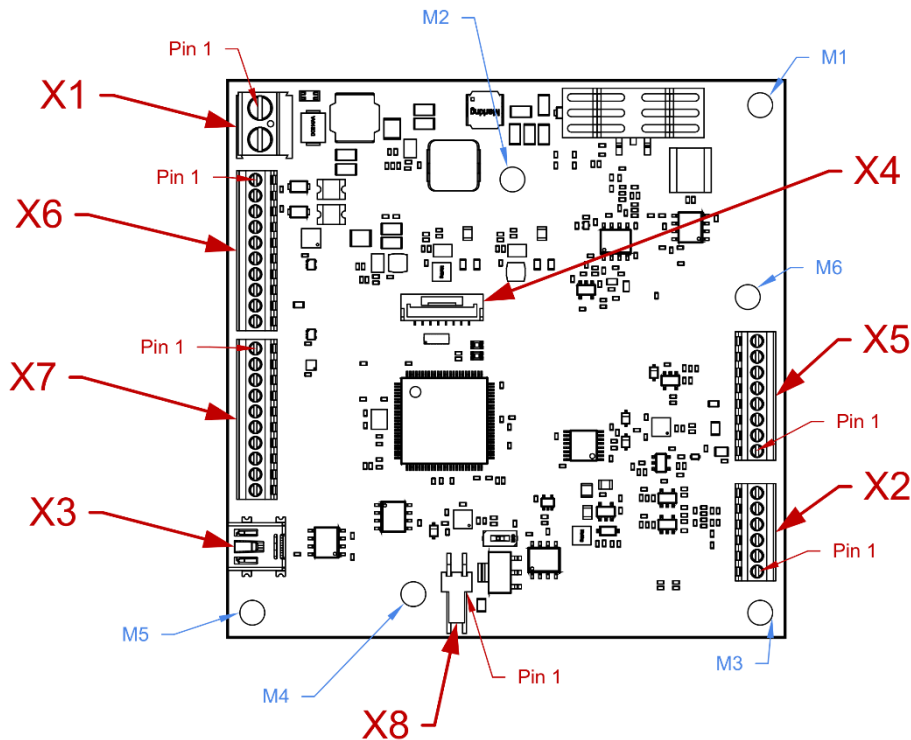
-SCREW: X1, X6, X7, X5, X2 are populated with screw headers and X8 is populated with a connector. See connector details below.

-PIN: X1, X6, X7, X5, X2 and X8 are populated with 2.54 mm pin headers on the bottom side of the board.

-NC: X1, X6, X7, X5, X2 and X8 are not populated.

Customized configurations available on request.

Connector Overview



-SCREW version pictured for reference, top view. Connector locations analogous in other versions.

X1

Screw terminal: stripping length 6.5 mm, wire section 0.05 ÷ 2.5 mm².

No connector or pin: 2.54 mm pitch pads/pins.

Pin	Name	Description
1	VIN	Power Input +
2	GND	Power Input -

X6

Screw terminal: stripping length 5 mm, wire section 0.05 ÷ 1 mm².

No connector or pin: 2.54 mm pitch pads/pins.

Pin	Name	Description
1	5V	5V supply for ancillary circuits
2	GND	GND connection for ancillary circuits
3	3.3V	3.3V supply for ancillary circuits
4	RS485 1 A/D+	RS485 communication interface.
5	RS485 1 B/D-	
6	RS232 TTL RX	RS232 TTL communication interface.
7	RS232 TTL TX	

8	GND	GND connection for communication interfaces. Internally shorted to pin 2.
9	CAN1 H	CAN communication interface. Firmware feature not available at time of publication.
10	CAN2 L	

X7

Screw terminal: stripping length 5 mm, wire section $0.05 \div 1 \text{ mm}^2$.

No connector or pin: 2.54 mm pitch pads/pins.

Pin	Name	Description
1	GPIO1	Configurable digital input/output pins.
2	GPIO2	
3	GPIO3	
4	GPIO4	
5	GPIO5	
6	GPIO6	
7	GPIO7	
8	GPIO8	
9	GPIO9	
10	GPIO10	

X3

Mini USB type B. ID pin not connected.

X4

Reserved. Do not connect.

X5

Screw terminal: stripping length 5 mm, wire section $0.05 \div 1 \text{ mm}^2$.

No connector or pin: 2.54 mm pitch pads/pins.

Pin	Name	Description
1	SYNC OUT	Reserved. Do not connect.
2	AIN-	Differential analog input, negative terminal.
3	AIN+	Differential analog input, positive terminal.
4	AGND	Ground connection for ancillary analog circuits.
5	PDC	Photodiode cathode terminal. Must be independent from GND (floating).
6	PDA	Photodiode anode terminal. Internally connected to GND.
7	LDC	Laser diode cathode terminal. Must be independent from GND (floating).
8	LDA	Laser diode anode terminal. Must be independent from GND (floating).

X2

Screw terminal: stripping length 5 mm, wire section $0.05 \div 1 \text{ mm}^2$.

No connector or pin: 2.54 mm pitch pads/pins.

Pin	Name	Description
1	TEC-	Reserved. Do not connect.
2	TEC+	Reserved. Do not connect.
3	T2B	Resistive temperature sensor input 2 terminal B. Internally connected to GND.
4	T2A	Resistive temperature sensor input 2 terminal A. Must be independent from GND (floating).
5	T1B	Resistive temperature sensor input 1 terminal B. Internally connected to GND.
6	T1A	Resistive temperature sensor input 1 terminal A. Must be independent from GND (floating).

X8

Populated with connector in -SCREW version of the device, compatible mating part: Molex 0022013027 with pre-crimped leads 0797580015.

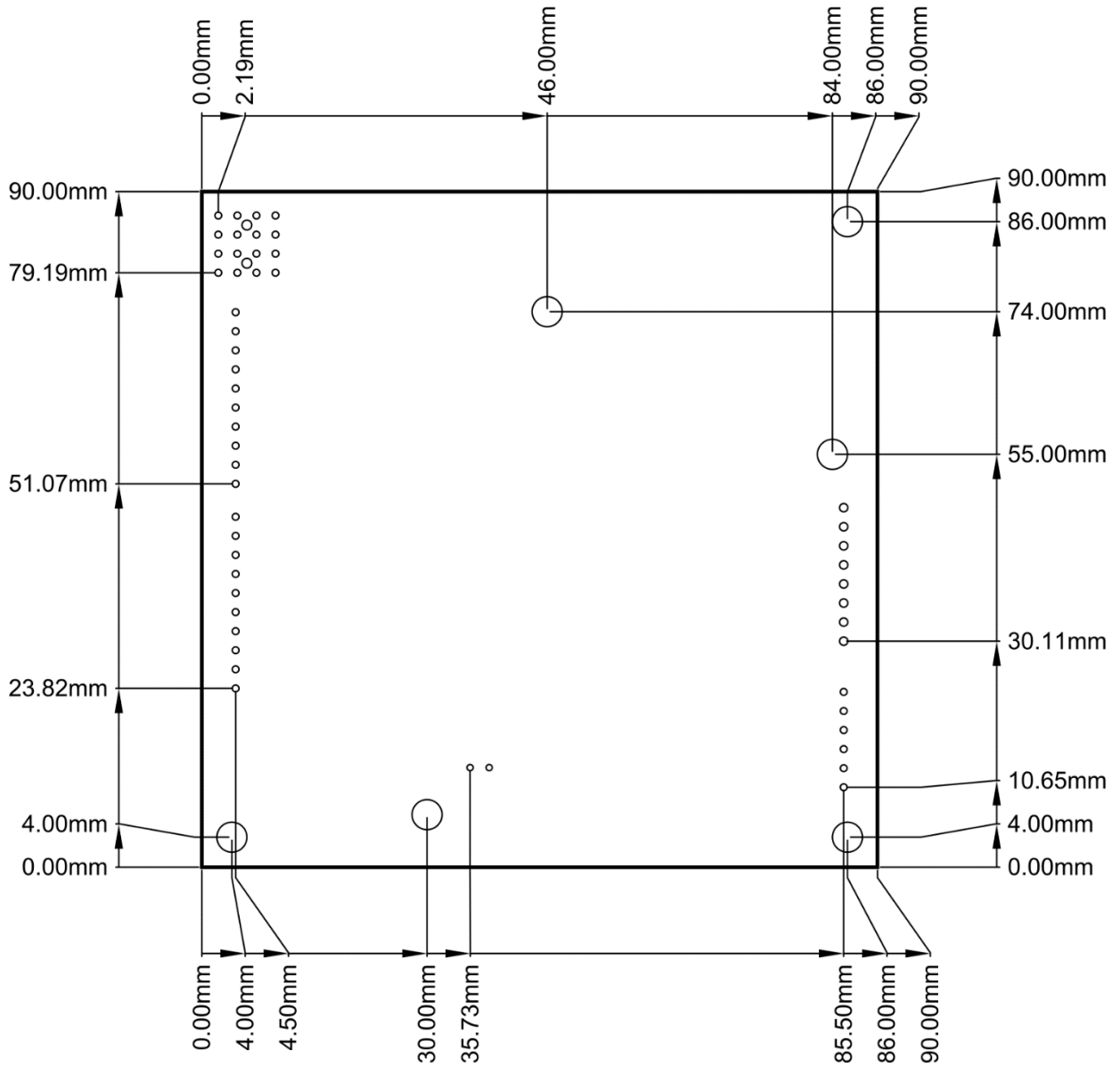
No connector or pin: 2.54 mm pitch pads/pins.

Pin	Name	Description
1	5V	5V supply for external circuits

M1-M6

Mounting holes. Internal capacitive connection to GND. M1 and M4: 1 M Ω connection to GND.

Mechanical Information



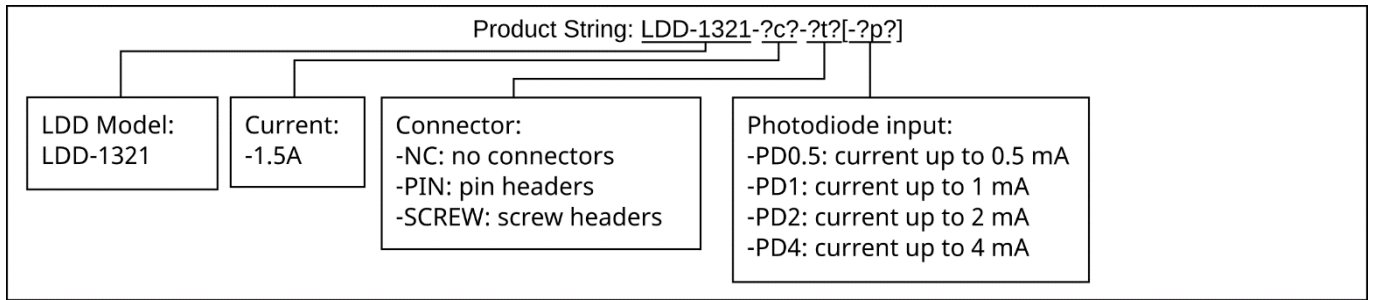
All dimensions nominal.

Connector pads: 2.54 mm pitch, compatible with 2.54mm pin headers.
 Mounting holes nominal diameter: 3.05 mm (compatible with M3 screws).
 3.17 mm spacer on the bottom side.



3D models of the device are available on our website or on request.

Ordering Information



Laser diode, temperature probes, power supply and connectors not included.

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Revision History

Date	Document Version	Changed / Approved	Change
2023-06-14	A	RS / HS	<ul style="list-style-type: none">• First edition