

Advanced OEM CW Laser Diode Driver



Description:

The LDD-1303 is a current source designed to precision-drive laser diodes in continuous wave applications. Its power converter topology allows for an output voltage smaller, equal, or larger than the input voltage. This enables the LDD to drive laser diodes with up to 120 V compliance voltage from a single 48 V power supply.

The LDD-1303 offers various safety features, including two inputs for laser diode temperature monitoring.

The device can be fully digitally controlled, the firmware is upgradeable and various digital communications interfaces are available.

A 0 - 10 V analog Input as well as a 0 - 10 V analog output are integrated. Additionally, Laser Power Control using a photodiode is possible using the on-board amplifier.

Laser Diode Driver:

- Output Current: 0 - 20 A, < Ripple TBD
- Compliance Voltage: 1 - 120 V

Input Characteristics:

- DC Input Voltage: 10.5 to 48 V

Main Features:

- Internal Generators: Nominal Current
- Error: Ultra-Fast Switch-off for optimal LD protection
- Configuration / Diagnosis: via USB / RS485 / RS232 TTL
- Dimensions (L x W x H): 190 mm x 70 mm x 28 mm
- Efficiency: > 95 % (@ > 50 % Load)
- Cooling: Over Base Plate

Communication Interfaces:

- USB 2.0
- RS485
- RS232 TTL

Other Features

- 2 Temperature Sensor Inputs for NTC Thermistors
- Light Measurement Input for Photodiode
- 0-10 V Analog Input
- 0-10 V Analog Output
- Interlock Input

Digital I/O Configurable Features

- Enable
- LDD Run Output
- And more configurable functions

Absolute Maximum Ratings¹

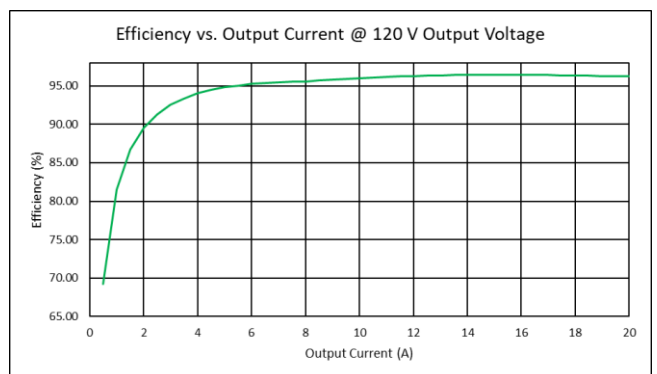
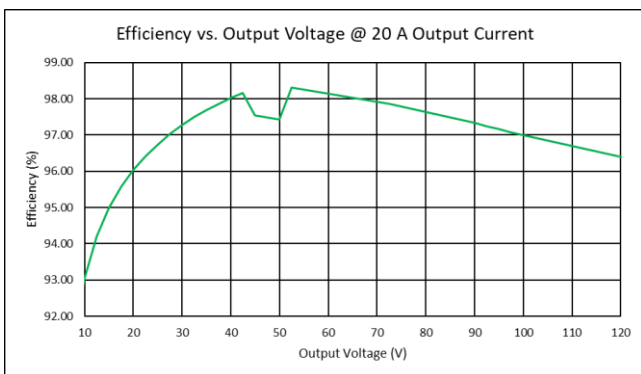
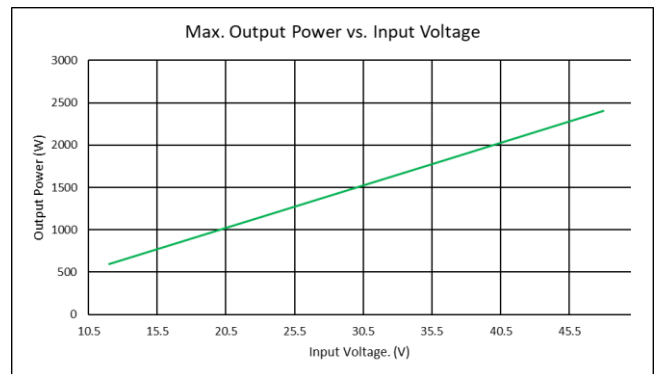
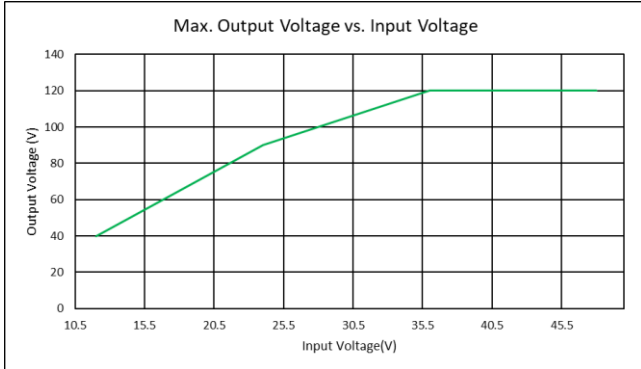
| | |
|---------------------|-------|
| Supply voltage (DC) | 53 V |
| Supply current (DC) | 53 A |
| Output current | 25 A |
| Output voltage | 130 V |

Operating Ratings

| | |
|-----------------------|--------------------------|
| System base plate | < 50 °C |
| Operation temperature | 0 – 50 °C |
| Storage | -40 – 80 °C |
| Humidity | 5 – 95 %, non-condensing |

Operating Characteristics

Unless otherwise noted: $T_A = 25\text{ °C}$, $V_{IN} = 48\text{ V}$



¹ Exceeding the Absolute Maximum Ratings may permanently damage the device

Electrical Characteristics

Unless otherwise noted: $T_A = 25\text{ °C}$, $V_{IN} = 48\text{ V}$, $V_{LD} = 120\text{ V}$

| Symbol | Parameter | Conditions | Min | Typ | Max | Units |
|-------------------------------|-------------------------------|------------|------|-----|-----|------------------|
| DC Power Supply Input: | | | | | | |
| V_{IN} | Supply voltage | | 10.5 | 48 | 53 | V |
| V_{IN_RIPPLE} | Ripple tolerance ² | | | 300 | | mV _{PP} |

Output Characteristics

Unless otherwise noted: $T_A = 25\text{ °C}$, $V_{IN} = 48\text{ V}$, $V_{LD} = 120\text{ V}$

| Symbol | Parameter | Conditions | Min | Typ | Max | Units |
|--------------------------|--------------------------|---|----------------|-----|-----|---------------|
| Output CW: | | | | | | |
| I_{OUT} | Current range | | 0 | | 20 | A |
| $T_{\text{coefficient}}$ | Temp. coefficient | $I_{out} = 20\text{ A}$, $T_A = +25\text{ °C} - +50\text{ °C}$ | | TBD | | ppm/K |
| I_{OUT_RES} | Current resolution | | | 2 | | mA |
| I_{OUT_RIPPLE} | Current ripple | $I_{out} > 2\text{ A}$ | | TBD | | mA |
| I_{OUT_ACC} | Current Accuracy | Calibrated | | TBD | | mA |
| V_F | Diode compliance voltage | $V_{IN} = 48\text{ V}$ | 1 ³ | | 120 | V |
| V_{OUT_MAX} | Output voltage maximum | | | 120 | | V |
| V_{OUT_ACC} | Voltage accuracy | Calibrated, $I_{out} < 1\text{ A}$ | | 100 | | mV |
| P_{OUT} | Output power | $V_{LD} = 120\text{ V}$ | | | 2.4 | kW |
| I_{OUT_Rise} | Output current rise time | 10% to 90%, PID Optimized, $L_{Load} < 500\text{ nH}$, $I_{OUT} = 20\text{ A}$ | | | 350 | μs |

Safety Characteristics

Unless otherwise noted: $T_A = 25\text{ °C}$, $V_{IN} = 48\text{ V}$, $V_{LD} = 120\text{ V}$

| Symbol | Parameter | Comments | Min | Typ | Max | Units |
|--------------------|------------------|--------------------|-----|-----|-----|---------------|
| I/O Ports: | | | | | | |
| $t_{OFF_CURRENT}$ | Overcurrent | | | | TBD | μs |
| t_{OFF_OPVAL} | Operating Values | Voltages, currents | | | TBD | μs |
| t_{OFF_SFALL} | System failure | System status | | | TBD | μs |

External Temperature Measurement (NTC only)

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

| Symbol | Parameter | Test Conditions / Hints | Min | Typ | Max | Units |
|-----------------|-----------|---------------------------------|-----|------------|-------|----------------|
| $R_{LR, RANGE}$ | Range | Corresponding temperature range | 295 | 130 to -21 | 10640 | Ω °C |

² Input ripple voltage can directly influence the ripple current at the output

³ Current Ripple may increase, and current control performance may decrease at compliance voltages below 5V depending on load

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

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

| Symbol | Parameter | Test Conditions | Min | Typ | Max | Units |
|--------------------------------|-------------------------------|--------------------|------|---------|----------|----------|
| 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: | | | | | | |
| UPP | ESD discharge | IEC61000-4-2 | | 18 | | kV |

Analog Input and Output Characteristics

Unless otherwise noted: $T_A = 25\text{ °C}$. Voltages referenced to X2 (GND)

| Symbol | Parameter | Test Conditions | Min | Typ | Max | Units |
|--------------------------------|--|-----------------|-----|-----|-----|-------|
| Input Characteristics: | | | | | | |
| U_{I+} | Voltage at the Analog In + Pin | | -1 | | 11 | V |
| U_{I-} | Voltage at the Analog In - Pin | | -1 | | 11 | V |
| U_{IN} | Nominal Input Voltage (difference between In + and In -) | | 0 | | 10 | V |
| Output Characteristics: | | | | | | |
| U_o | Analog Output Voltage | | 0 | | 10 | V |
| I_{OUT} | Analog Output Current | | | | 20 | mA |

Interlock Input Characteristics

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

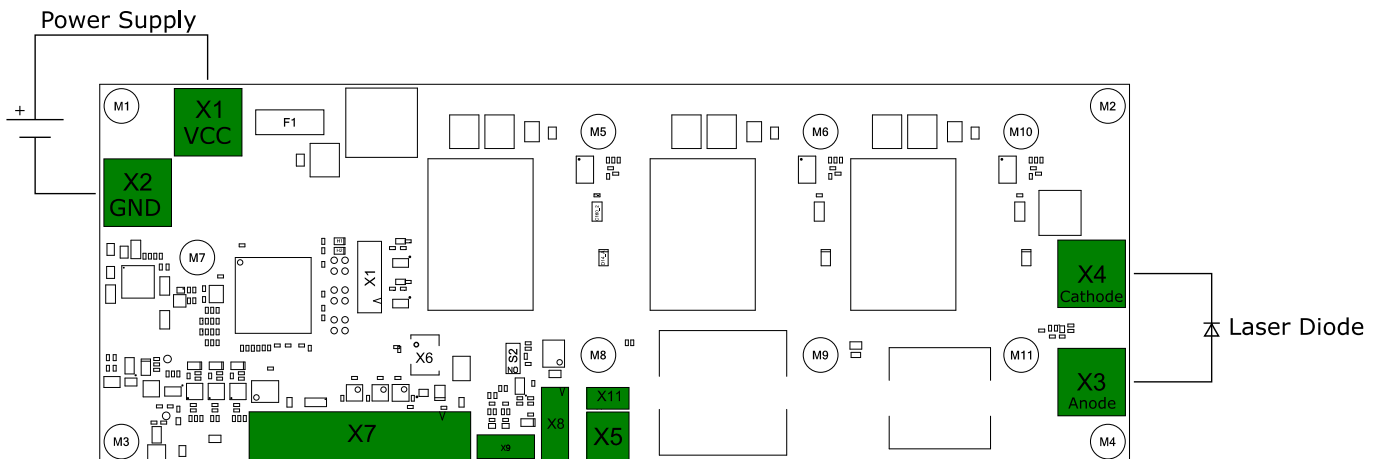
| Symbol | Parameter | Test Conditions | Min | Typ | Max | Units |
|-------------------------------|--------------------------------------|---|-----|-----|-----|-------|
| Input Characteristics: | | | | | | |
| V_{IAct} | Interlock active input voltage range | Voltage range which is detected as active input | 3 | | 30 | V |
| V_{IORM} | Maximum Working Insulation Voltage | | | | 120 | V |

Photodiode Input Characteristics

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

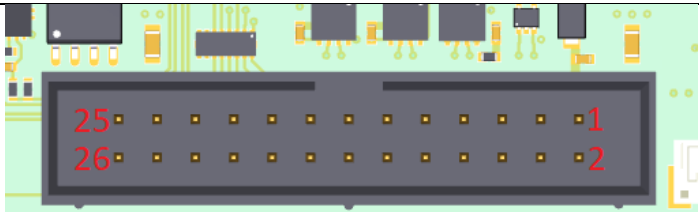
| Symbol | Parameter | Test Conditions | Min | Typ | Max | Units |
|-------------------------------|--------------------|-----------------|-----|-----|-----|-------|
| Input Characteristics: | | | | | | |
| I_{in} | Photodiode current | | 0 | | 4.2 | mA |

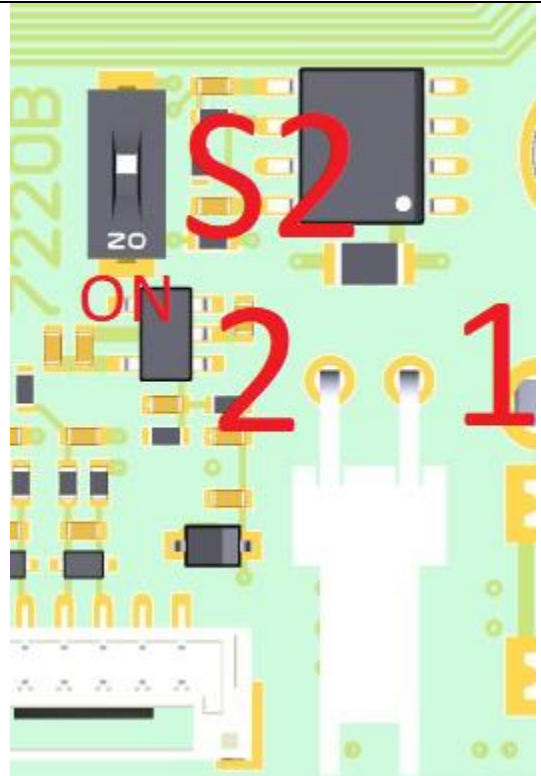
Device Connectors Overview

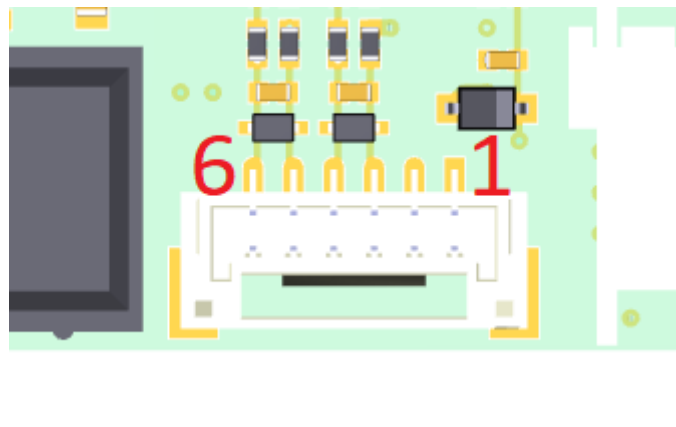


USB Connector X5 and X11

The LDD-1303 can be equipped with a vertical and/or a horizontal USB-Connector (See “LDD-1303 Ordering Information”). If both USB-Connectors are soldered in only use one connector at a time. Otherwise, serious damage to the USB Host may occur.

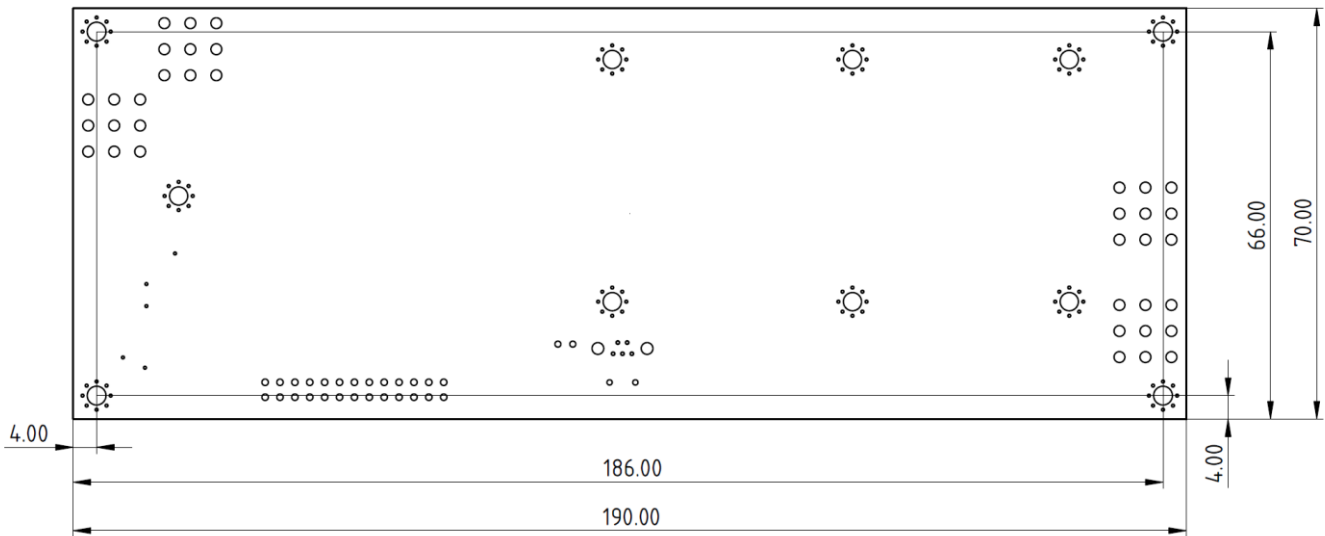
| Interface Connector X7 | | Mating Connector: Würth 61202623021 | |
|--|----------------|--|------------------------|
|  | | | |
| Pin | | Pin | |
| 1 | +5V | 14 | GPIO4 |
| 2 | GND | 15 | GPIO5 |
| 3 | +3.3V | 16 | GPIO6 |
| 4 | RS485 1 A/D+ | 17 | GPIO7 |
| 5 | RS485 1 B/D- | 18 | GPIO8 |
| 6 | RS232 TTL RX | 19 | GPIO9 |
| 7 | RS232 TTL TX | 20 | GPIO10 |
| 8 | GND | 21 | Not Connected/Reserved |
| 9 | Do Not Connect | 22 | Not Connected/Reserved |
| 10 | Do Not Connect | 23 | Analog GND |
| 11 | GPIO1 | 24 | 0-10V Analog Out |
| 12 | GPIO2 | 25 | 0-10V Analog In + |
| 13 | GPIO3 | 26 | 0-10V Analog In - |

| Interlock Connector X8 | | |
|--|------------------|---|
|  | Pin | To enable the LDD apply a voltage between the Interlock + and Interlock – Pins. The Interlock Pins are galvanically isolated from the LDD. The DIP-Switch S2 can be switched ON to disable the Interlock functionality |
| | 1 | Interlock + |
| | 2 | Interlock – |
| | Mating connector | Molex 0022013027 |

| Temperature and Light Measurement connector X9 | | | |
|---|---------------------|------------------------------------|---------|
|  | | Mating Connector: JST GHR-06V-S | |
| Pin | | Pin | |
| 1 | Photo Diode Anode | 4 | NTC 2 B |
| 2 | Photo Diode Cathode | 5 | NTC 1 A |
| 3 | NTC 2 A | 6 | NTC 1 B |

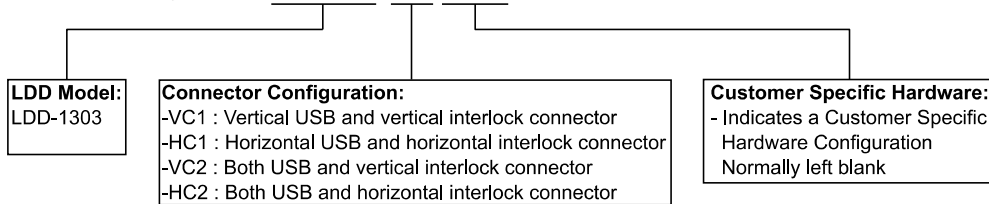
Mounting holes Position

The four holes in each corner can be used to mount the device onto a heatsink. Hole diameter =3.2mm.
A 3D model of the device is available on our website.



LDD-1303 Ordering Information, Hardware Configuration

Example Configuration: LDD-1303-VC1-CSX



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

Current-Controlled Operation-Modes and Communication Option

The LDD-1303 is an OEM high performance current source that is primarily designed to operate in CW mode. It is configured over an industry-standard RS485, RS232 TTL or a USB connection, either GUI-driven using the included LDD Service Software, or by direct parameter control using the predefined communication protocol. Basic system status is visually indicated by on-board LEDs, more detailed status information can be polled at any time. The LDD-1303 can operate in a stand-alone configuration as well as in a remotely controlled manner, with parameters adjusted on the fly. The laser diode driver is current-PID-controlled.

Configuration parameters further include: Control source selection, maximum current limits, nominal current ramping, PID controller settings, NTC temperature sensor modeling coefficients, measurement circuitry calibration, error thresholds, etc. Please refer to the user manual for further information.

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Change History

| Date of change | Doc/Version | Changed/Approved | Change/Reason |
|-----------------|-------------|------------------|---|
| 12 January 2022 | B | LS | Add Change History |
| | | LS/RK/ML | Review, small changes (types, format) |
| | | RK/HS | Release |
| 21 April 2022 | C | XF/HS | Fix document formatting errors |
| | | HS/PV | Edit minimum compliance voltage |
| | | RS/HS | Edit compliance/output voltage text for clarity |
| | | HS/RS | Remove redundant efficiency figures |