## Advanced OEM CW Laser Diode Driver

**Description:**

The LDD-1301 is a current source designed to precision-drive laser diodes in continuous wave applications. Its power converter topology allows for an output voltage smaller than the input voltage. This enables the LDD to drive laser diodes with up to 44 V compliance voltage from a single 48 V power supply.

The LDD-1301 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, < 0.5% Ripple
- Compliance Voltage: 0.5 - 45 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): 100 mm x 70 mm x 20mm
- 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

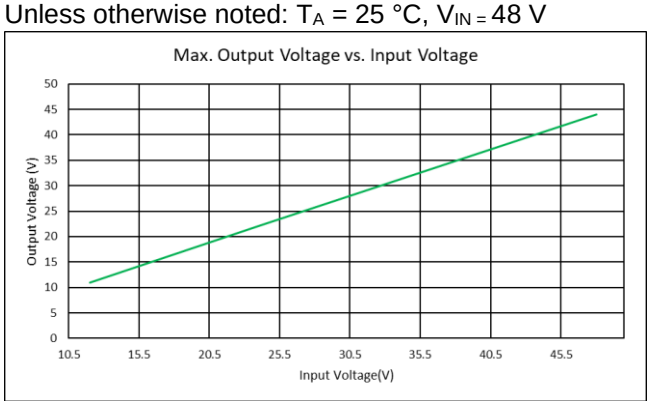
- Enable
- LDD Run Output
- And more configurable functions

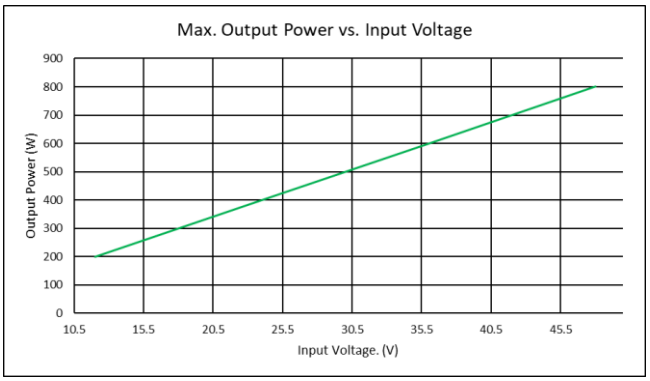
| **Absolute Maximum Ratings**[1] | |
|---|---|
| Supply voltage (DC) | 53 V |
| Supply current (DC) | 20 A |
| Output current | 25 A |
| Output voltage | 53 V |

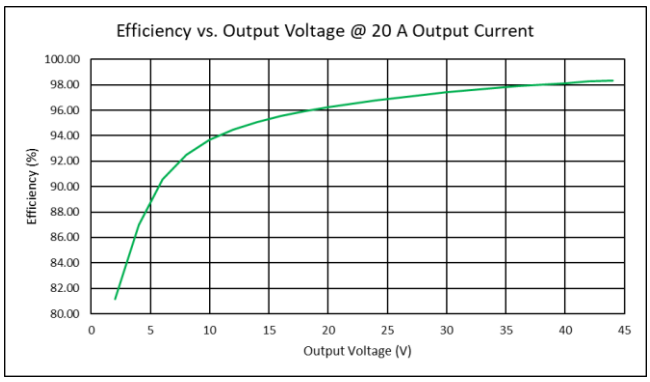
| **Operating Ratings** | |
|---|---|
| System base plate | < 50 °C |
| Operation temperature | 0 – 50 °C |
| Storage | -40 – 80 °C |
| Humidity | 5 – 95 %,<br>non-condensing |

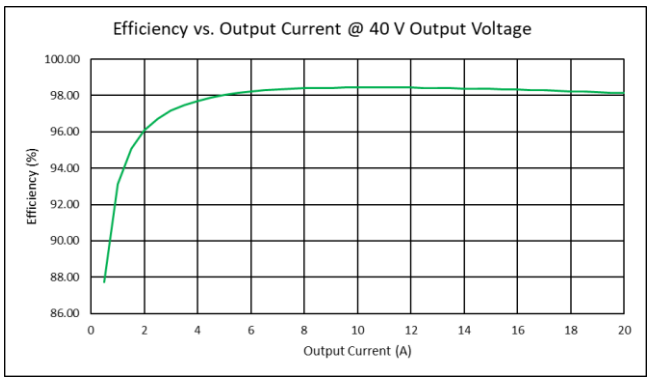
**Operating Characteristics**

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




[1] Exceeding the Absolute Maximum Ratings may permanently damage the device

**Electrical Characteristics**

Unless otherwise noted: $T_A$ = 25 °C, $V_{IN}$ = 48 V, $V_{LD}$ = 44 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°C, $V_{IN}$ = 48 V, $V_{LD}$ = 44 V

| Symbol | Parameter | Conditions | Min | Typ | Max | Units |
|---|---|---|---|---|---|---|
| **Output CW:** | | | | | | |
| $I_{OUT}$ | Current range | | 0 | | 20 | A |
| $T_{coefficient}$ | Temp. coefficient | $I_{out}$ = 20 A, $T_A$ = +25 °C - +50 °C | | TBD | | ppm/K |
| $I_{OUT\_RES}$ | Current resolution | | | 2 | | mA |
| $I_{OUT\_RIPPLE}$ | Current ripple pp | $I_{out}$ > 2 A | | 0.5[3] | | % |
| $I_{OUT\_ACC}$ | Current accuracy | Calibrated | | TBD | | mA |
| $V_F$ | Diode compliance voltage | $V_{IN}$ = 48 V | 0.5 | | 45 | V |
| $V_{OUT\_MAX}$ | Output voltage maximum | | | 46 | | V |
| $V_{OUT\_ACC}$ | Voltage accuracy | Calibrated, $I_{out}$ < 1 A | | 100 | | mV |
| $P_{OUT}$ | Output power | $V_{LD}$ = 40V | | | 800 | W |
| $I_{OUT\_Rise}$ | Output current rise time | 10% to 90%, PID Optimized, $L_{Load}$ < 500 nH, $I_{OUT}$ = 20 A | | | 250 | µs |

**Safety Characteristics**

Unless otherwise noted: $T_A$ = 25 °C, $V_{IN}$ = 48 V, $V_{LD}$ = 40 V

| Symbol | Parameter | Comments | Min | Typ | Max | Units |
|---|---|---|---|---|---|---|
| **I/O Ports:** | | | | | | |
| $t_{OFF\_CURRENT}$ | Overcurrent | | | | 50 | µs |
| $t_{OFF\_OPVAL}$ | Operating Values | Voltages, currents | | | 100 | µs |
| $t_{OFF\_SFAIL}$ | System failure | System status | | | 250 | µs |

**External Temperature Measurement (NTC only)**

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

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

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

[3] Measured at $I_{OUT}$ = 20A and $V_{LD}$ = 40V

**General Purpose Digital I/O Characteristics (GPIO1 … GPIO10)**

Unless otherwise noted: $T_A$ = 25 °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 °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 °C.

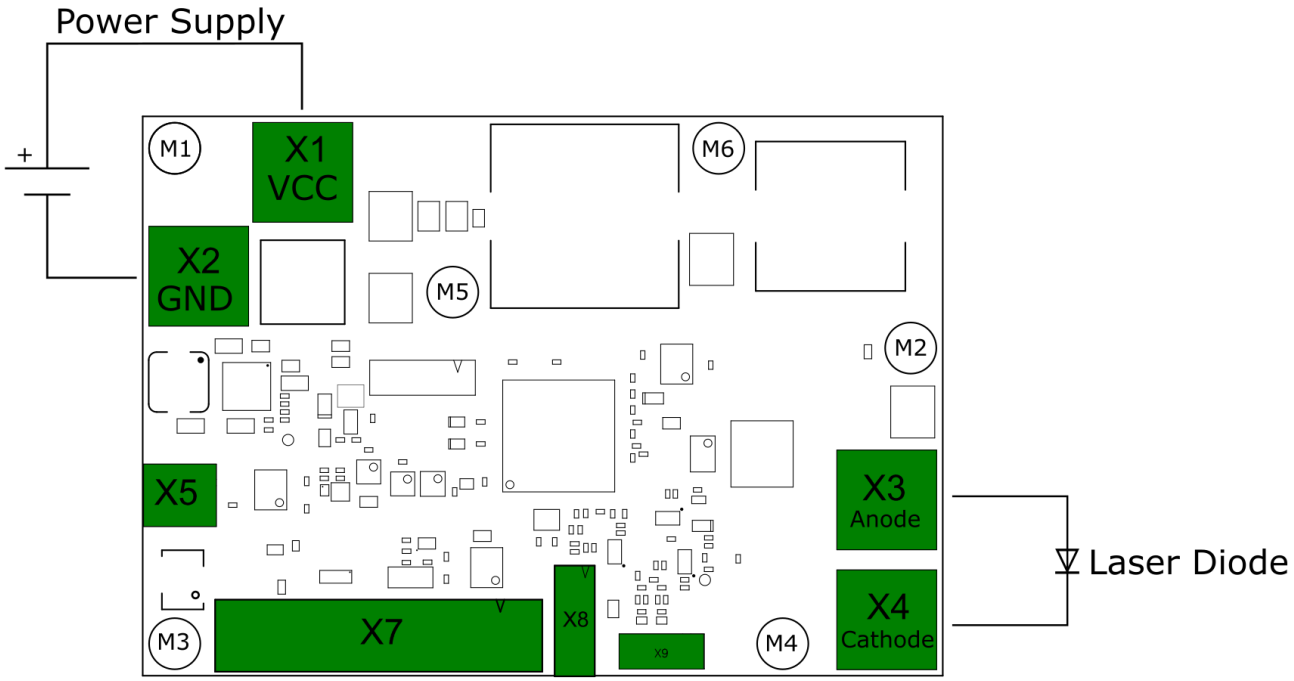
| Symbol | Parameter | Test Conditions | Min | Typ | Max | Units |
|---|---|---|---|---|---|---|
| Input Characteristics: | | | | | | |
| $V_{IAct}$ | Interlock active input voltage range | Voltage range which is detected as active input | 3 | | 30 | V |
| $V_{IORM}$ | Maximum Working Insulation Voltage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

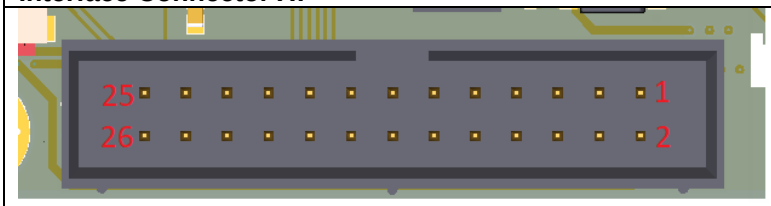
**Photodiode Input Characteristics**

Unless otherwise noted: $T_A$ = 25 °C.

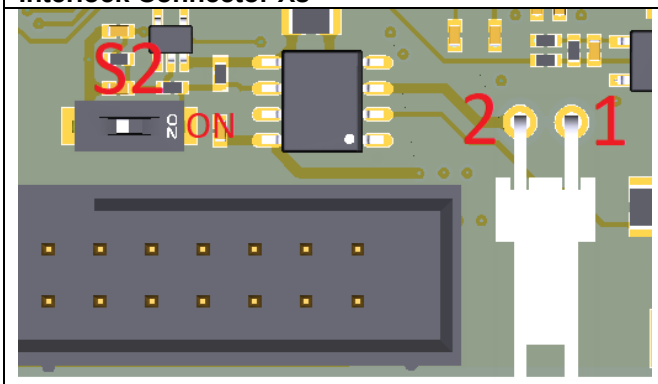
| Symbol | Parameter | Test Conditions | Min | Typ | Max | Units |
|---|---|---|---|---|---|---|
| Input Characteristics: | | | | | | |
| $I_{In}$ | Photodiode current | | 0 | | 4.2 | mA |

**Device Connectors Overview**



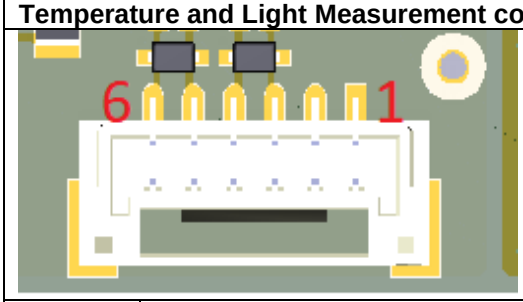

| **Interface Connector X7** | | | |
|---|---|---|---|
|   | | Mating Connector: Würth 61202623021 | |
| Pin | | Pin | |
| 1 | +5V | 14 | GPIO4 |
| 2 | GND | 15 | GPIO5 |
| 3 | +3.3V | 16 | GPIO6 |
| 4 | RS485 1 A/D+ | 17 | GPIO7 |
| 5 | RS485 1 B/D- | 18 | GPIO8 |
| 6 | RS232 TTL RX | 19 | GPIO9 |
| 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.<br><br>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**

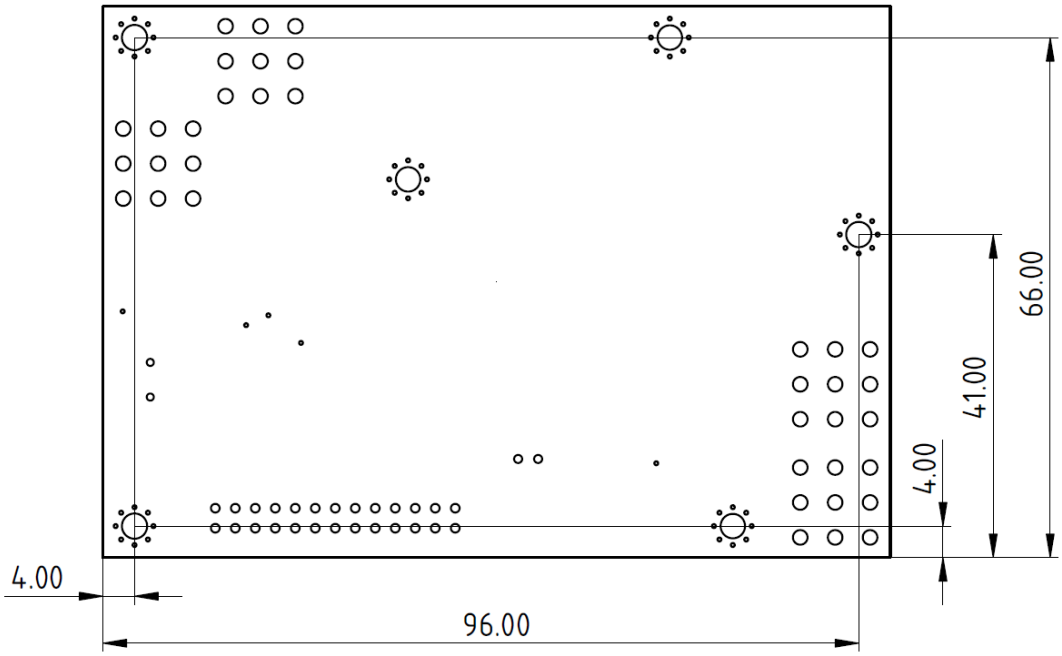



Mating Connector:
JST GHR-06V-S

| 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 three holes can be used to mount the device onto a heatsink. Hole diameter =3.2mm.
All Measurements are in mm. A 3D model of the device is available on our website.




**LDD-1301 Ordering Information, Hardware Configuration**

Example Configuration: LDD-1301-CSX

**LDD Model:**
LDD-1301

**Customer Specific Hardware:**
- Indicates a Customer Specific Hardware Configuration Normally left blank

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

**Current-Controlled Operation-Modes and Communication Option**

The LDD-1301 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-1301 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 |
|---|---|---|---|
| 1 March 2022 | B | ME/ME | Preliminary information |
| 21 April 2022 | C | HS/PV | Add Change History<br>Add Connector Drawings and Pinout<br>Add Ripple and Rise Time Values<br>Update max compliance voltage to 45V |
| | | RS/CU | Edit compliance/output voltage text for clarity |
| | | CU/HS | Change current ripple unit<br>Add ripple current footnote to clarify |
| | | HS/RS | Remove redundant efficiency figures |