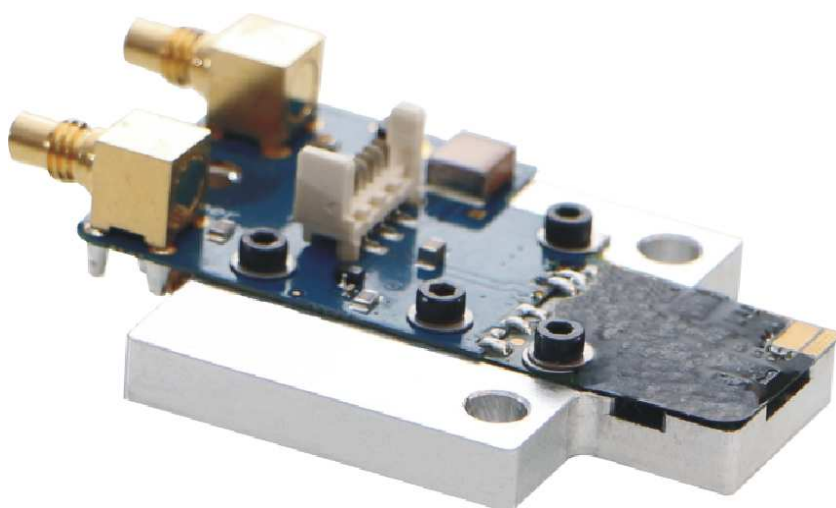




# User Manual

LDP-AV 1N50-450



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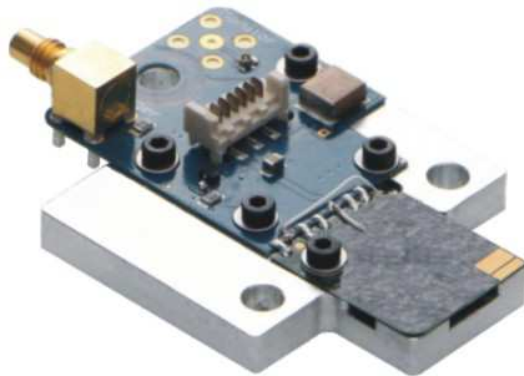
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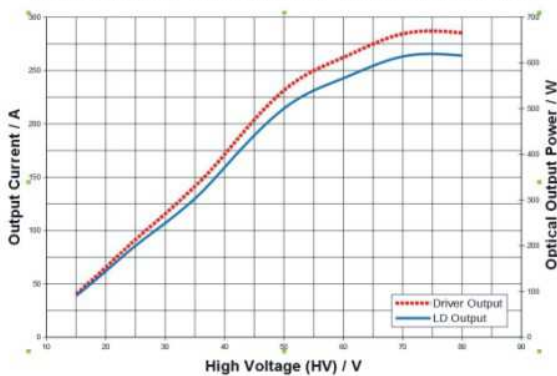
## LDP-AV 1N50-450

Rev. 2004

### LIDAR - Ultra compact Driver Module for pulsed Lasers



Test Parameters:  $f_{rep} = 50 \text{ kHz}$ , Laser Diode = Hamamatsu,  $t_p = 5.5 - 6.5 \text{ ns}$



### Product Description

The LIDAR (Light Distancing and Ranging) driver LDP-AV 1N50-450 is a nanosecond range driver which is capable of driving more than 650 W. The driver is designed to mount the laser diode or similar emitters directly onto the PCB to minimize inductance. LD pads and pulse duration can be customized for your application. The driver consists of two parts: The stamp sized front part which contains the complete driver electronics and the larger evaluation board which contains only the connectors for an easy access to the necessary control and input signals. The advantage of this compact and small design makes it possible to achieve a high power density of  $1.71 \text{ W/mm}^2$  and offers output currents up to 450 A with fixed pulse durations of several ns.

- Ultra compact driver:  $19 \times 20 \text{ mm}^2$
- 20 to 450 A output current
- Fixed pulse duration e.g. 5 ns
- Repetition rates from single shot to 200 kHz
- Easy setting of the output current via an external HV voltage
- Applications: LIDAR, Measurements, Ignition, Rangefinding, Biochemistry, ...
- Flexible platform to install and test laser diodes
- Advanced minimal inductance layout
- High power density

### Technical Data\*

Output current	20 .. 260 A* 20 .. 450 A (typ.)
Pulse duration	Fixed e.g. 5 ns
Repetition rate	Single shot to 200 kHz**
Max. duty cycle	0.1 %
Trigger input	5 V into 50 $\Omega$
Supply voltage	+5 V 0.1 A
Charging voltage	HV: 190 V / 0 .. 0.5 A
Dimensions in mm	19 x 20
Weight	26 g
Operating temperature	0 .. 55 $^{\circ}\text{C}$

\* Tested with Hamamatsu laser diode 4 Emitter and Triple Stack

\*\* See manual for detailed information

### Ordering Options

- HV: Integrated HV module
- EVA: With evaluation board is standard (Without EVA is only available for volumes > 1000 units)
- B: Laser diode pads are suitable for wire-bonding

## How to use the Manual



**Notice:** Depending on the final application and operation regime this unit must be assembled onto a heat sink or may stay non-cooled. Improper cooling may cause damage to the electronic components. Please refer to the section "Power Dissipation" for more details on the thermal power losses during operation.



Before powering on your driver unit read this manual thoroughly and make sure you have understood everything.



Caution: High voltages up to 100 V are present at several PCB components. Do not touch during operation.

Please pay attention to all safety warnings.

If you have any doubts or suggestions, please do not hesitate to contact us!

## Dos and Don'ts

**Never** ground any output connector.

**Never** use any grounded probes at the output.

**Do not** connect your oscilloscope to the output!

This will immediately destroy the driver and the probe!

**Do not** connect voltages in reverse polarity to the device as there is no built-in protection circuit.

**Do** use power-up sequencing: Allow the +5 V supply voltage to fully ramp up before applying any other voltages (HV; Trigger Input).

**Do not** use mechanical force on the PCB components as they are fragile. Resulting damages are not covered by warranty.

**Beware:** Some lab power supplies cause excessive ringing during powering on and off. These may damage the unit!

**Do** keep connecting cables between power supply and driver as short as possible.

## How to get started

Step	What to do	Check
1	Unpack your device.	
2	Attach the laser diode to the driver.	Please see section "Connection of the Laser diode" for further details.
3	Assemble the driver onto an appropriate heat sink. This step may only be omitted if the stress to the driver is kept very low.	See section "Power Losses" for further information on thermal dissipation.
4	Connect GND, +5 V; and +HV to the 6 pin Micro-Match connector. Keep the power supply off.	Please see section "How to connect the Driver" for further details.
5	Connect the pulse generator to the SMA trigger input jack.	Ensure that no pulse is fed before powering up the unit.
6	Carry out the power-up sequence as follows: 1) Fully ramp up the +5 V rail 2) Enable the +HV supply Then, feed a pulse signal to the input terminal. For example 5 V amplitude, 10 ns pulse width and 1 kHz repetition rate.	<b>Security advice:</b> Do not touch the PCB components near the laser diode since they may carry high voltages up to 100 V.  Note: Observe the drivers limits as in section "Power Losses" to avoid overloading the driver.
7	Check the optical output of your laser diode.	
8	Turn off sequence: Disable the pulse generator and then turn off all power sources (+5 V; and +HV).	

## Connection of the Laser Diode

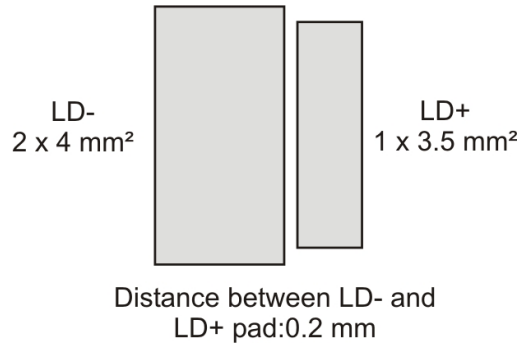


Figure 1: Dimensions of bonding pads for the laser diode

The LD- and LD+ pad are located in the upper edge of the driver. For the standard dimensions please refer to the dimensions in Figure 1. Both pads are also marked with + /- to indicate the correct polarity.

Any additional elements which add impedance/inductance may affect the performance of the driver unit. The stray inductance of the load connected to the driver is very important. The term "load" not only includes the diode itself but also the packaging (bond wires!) and the connection between the driver and the diode. However, PicoLAS has no influence on these parts.

→ Refer to the PicoLAS Application Notes "Impedance of Diodes" and "LD-Connections" for more information on parasitic elements and their effect on the pulse shape.



If you need a different pad sizes for your laser diode, please do not hesitate to contact us. Customized pad layouts are possible for adapting the dimensions of your load.



## How to Connect the Driver

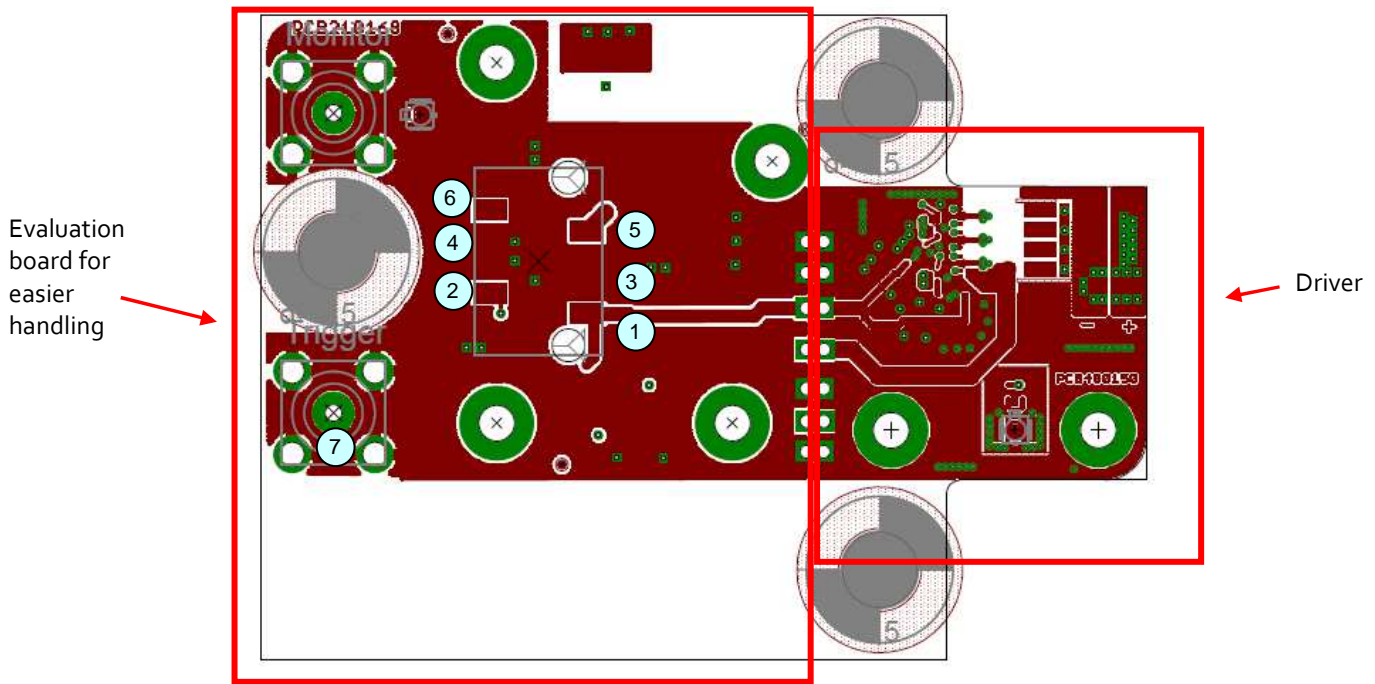


Figure 2: Schematic of the PCB layout

Signals of the 6 pin Micro-Match header:

Pin	Name	Description
1	+5 V	+5 V supply voltage, connect to a stabilized power supply
2	NTC	Internal 10 kOhms NTC versus GND for temperature monitoring B-value: 3380
3	GND	Ground return
4	GND	Ground return
5	HV+	External high voltage supply Input (0 .. 95 V)
6	N. C.	No connection

### Trigger Input (7):

The trigger input requires a signal of 5 V and is terminated with 50 Ohms. The minimum input signal pulse width is 50 ns; 100 ns are recommended. For more details see the next section.

### Security Advice:

Do not touch any leads of the output or the output capacitors as they can carry high voltages of up to 100 V.



## Pulse Input

The trigger generator must be capable of delivering 5 V into 50 Ohms and at least 100 ns in pulse width. The internal Schmitt-Trigger prevents unstable trigger response.

**Note:** It is recommended to keep the trigger pulse width within the range of **50 .. 200 ns** since longer pulses will increase the power loss (especially at high repetition rates). Given a valid trigger signal the output pulse form depends only on the high voltage supply level and the laser diode's characteristics.

## Power Supply Requirements

The driver requires a stabilized +5 V supply (used by control logic).



**Caution:** The +5 V rail must be completely ramped-up within 2 ms to guarantee a proper start-up of the gate driver.

**Adhere to the power-up sequence as follows:**

- 1) Fully ramp up the +5 V rail
- 2) Enable the HV+ supply
- 3) Apply trigger signal

Should you aim to connect a large number of driver units to a single power supply the high start-up current spikes can be taken care of by using an additional capacitor bank and hard power switching at its output. Failure to meet this requirement may cause the gate driver circuitry to stay in a faulty state.

**Note:** The +HV laser diode supply can be interrupted at any time e.g. for safety reasons by the customer.

## Current Consumption

Quiescent currents

Supply Input	Conditions	Min.	Max.	Unit
+5 V	4.8 V .. 5.2 V	5	10	mA

Trigger signal present

Supply Input	Conditions	Typ.	Max.	Unit
+5 V	4.8 V .. 5.2V	200	300	mA

## Cooling

The driver is base plate cooled only. Please assemble the entire unit to a heat sink which is capable to take out the heat.

The heat sink is suitable if the system temperature does not exceed the maximum operating limits.

## Recommended Operating Conditions

Supply Voltages	Min.	Typ.	Max.	Unit
HV+	10 V	-	+95	V
+5 V	+4.75	+5.0	+5.2	V

Trigger Input	Min.	Typ.	Max.	Unit
HIGH level input voltage @ $Z_{in}=50\ \Omega$	4.8	5	+5.2	V
LOW level input voltage @ $Z_{in}=50\ \Omega$	0	-	+0.8	V
Pulse width	50	100	200	ns
Repetition rate	-	-	150	kHz

## Absolute maximum Ratings (destroying limits)

Supply Voltages	Min.	Max.	Unit
HV+	0	+95	V
+5 V	0	+5.3	V

Trigger Input	Min.	Max.	Unit
Trigger signal voltage, unterminated	0	+5.2	V

- **Trigger Signal:**

Note that the maximum ratings for both **pulse width** and **repetition rate** depend on the actual high voltage supply (HV+). See section "Power Losses" for guidance. Since the internal gate driver's pulse width is limited to 20 ns minimum, shorter pulses than 20 ns will not give any performance benefit. However, longer pulse widths than 20 ns will add to the power loss (see section "Recommended Operating Conditions above).

The driving signal to the pulse input should be kept low while the +5 V supply voltage is down.