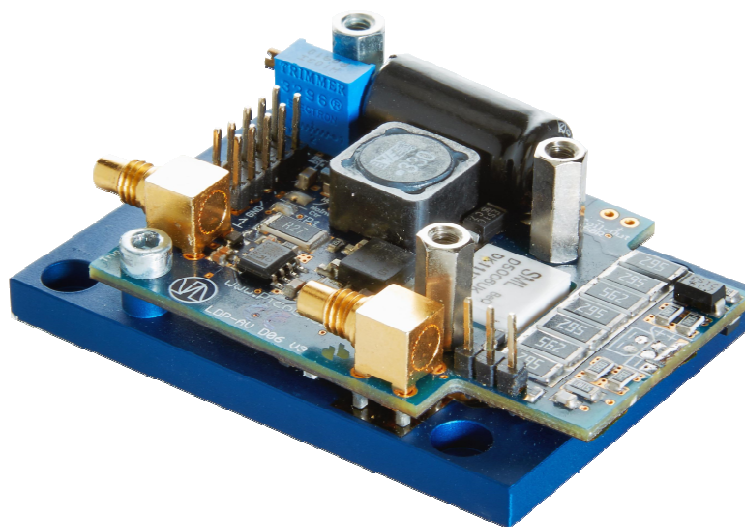




# User Manual

## LDP-AV D06-N10



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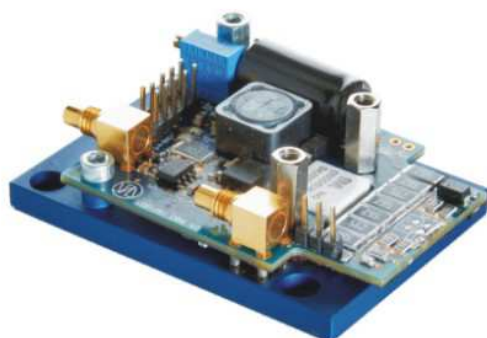
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## LDP-AV D06-N10

Rev. 1907

### Very short pulse driver module



- 4 .. 30 A output current
- 1 ns pulse duration
- < 900 ps rise time
- Very compact OEM module
- Single +15 V supply
- Rep. rates from single shot to 2 MHz
- Current monitor and isolated monitor
- Applications: LIDAR, Measurements, Ignition, Rangefinding, Biochemistry, ...

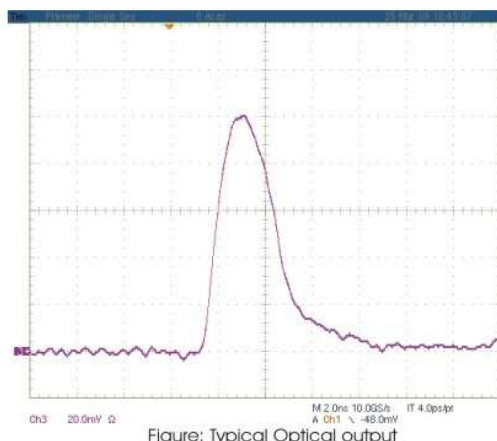


Figure: Typical Optical output

### Product Description

The LDP-AV series provides a small and inexpensive source for fixed picosecond and nanosecond pulses. The LDP-AV D06-N10 is designed for a pulse duration of 1 ns. It is intended to be used as a laser diode driver. The diodes can be mounted directly onto the LDP-AV, eliminating the need for strip lines. The LDP-AV is powered by a single 15 V DC supply, a 120 V high voltage DC source is integrated.

Additionally the LDP-AV can be upgraded with the PLCS-21 controller to enable USB 2.0 communication with a PC or the external operating unit PLB-21.

### Technical Data\*

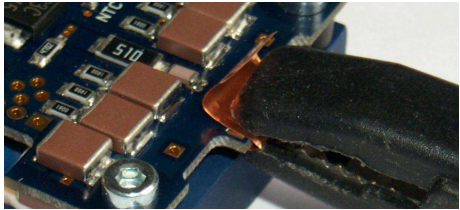
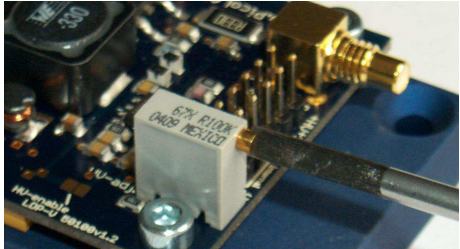
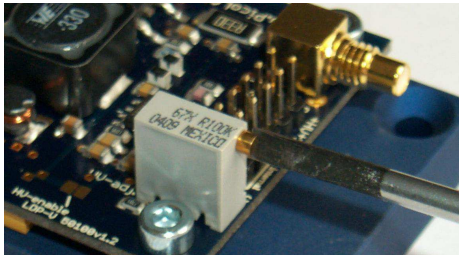

Output current	4 .. 30 A
Max. output voltage	120 V
-Int. high voltage	15 .. 120 V, 0.1 A, 15 W
Rise time	Typ. 800 ps, max. 900 ps
Typ. trigger delay	Typ. 36 ns, max. 40 ns
Pulse duration	1.0 ns
Trigger range	single-shot to 2 MHz **
Trigger input	5 V into 50 $\Omega$ via SMC-jack
Trigger output	Galvanically sep. Rogowski-coil
Current monitor	20 A/V into 50 $\Omega$
Supply voltage	+15 V, 1 A <u>Optional:</u> 0 .. 120 V, 15 W (External high-voltage)
Dimensions in mm	65 x 44 x 20
Weight	76 g
Operating temperature	-20 to + 55 $^{\circ}\text{C}$

\* Measured into a short instead of laser diode. Technical data is subject to change without further notice.

\*\* See manual for detailed information.

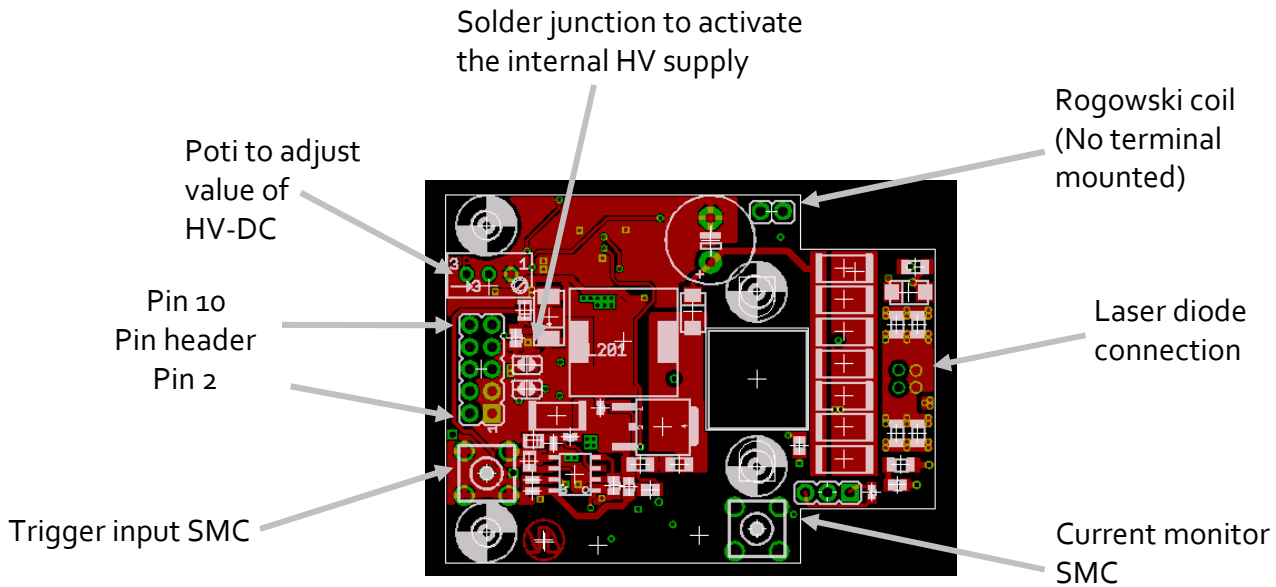
Optional Accessories: PLCS-21  
PLB-21  
LDP-V BOB  
LDP-V KIT

## How to get started

Step	What to do	Check
1	Unpack your device.	
2	Make a short at the output e.g. with a thin copper foil.	
3	Set the high voltage to the lowest value (turn poti fully counterclockwise).	
4	Connect a pulse source to the selected triggering input.	E.g. 100 ns, rep. rate 1 kHz, 5 V TTL 50 Ohm. <b>Note:</b> The applied duty cycle should be less than $d=0.2$ . See section "Trigger Input" for more details.
5	Connect your scope.	Select 50 Ohm termination, trigger on falling edge, 200 mV/div.
6	Apply the supply voltage. <b>Security advice:</b> Do not touch any leads of the output or the output capacitors as they are connected to a high voltage of up to 120 V.	Plug in the delivered plug or adjust your supply to 15.0 V. <b>Note:</b> Some supplies have a voltage overshoot during turn on/turn off. This may damage the device.
7	Adjust the value of the desired pulse current by adjusting the level of the HV with the poti.	
8	Disconnect the supply, remove the short at the output and assemble the laser diode (polarity!).	
9	Reconnect the supply and check the optical output of your laser diode.	<b>Note:</b> The actual current is always some percent lower but never higher than the value of step 7. Adjust the current to the desired value.



## How to connect the LDP-AV



### Connections via Pin header:

Pin	Name	Description
1	GND	Ground return.
2	HV+	External high voltage supply input (0 .. 120 V) for connecting an alternative HV-DC supply. See section "How to use the external HV-DC Input" for details.
3	GND	Ground return.
4	+15 V	Supply voltage, connect to a power supply.
5	Disable_Poti	Disables the internal HV setpoint poti when set high.
6	Pulse_In	Trigger input into 50 Ohm.
7	Disable	Disables the driver when set high.
8	U-Monitor	High voltage monitor output (scale: 40 mV/V) for supervising the actual high voltage.
9	NTC	Internal 10 kOhm NTC versus GND for temperature monitoring (B-value: 3620).
10	Ext_HV_Setpoint	External HV setpoint input (scale: 25 V/V) allows control over the internal HV-DC source.

### Supply Voltage:

The supply voltage could be any out of the range between 15 up to 24 V. However, it has got an impact on the lowest addressable internal high voltage.

Increasing the input voltage increases slightly the lowest configurable output current.

The referenced values in this datasheet are performed with +15V input.

This issue has got no impact on the highest current, any current with HV above 25V or the repetition frequency.

### Trigger Input:

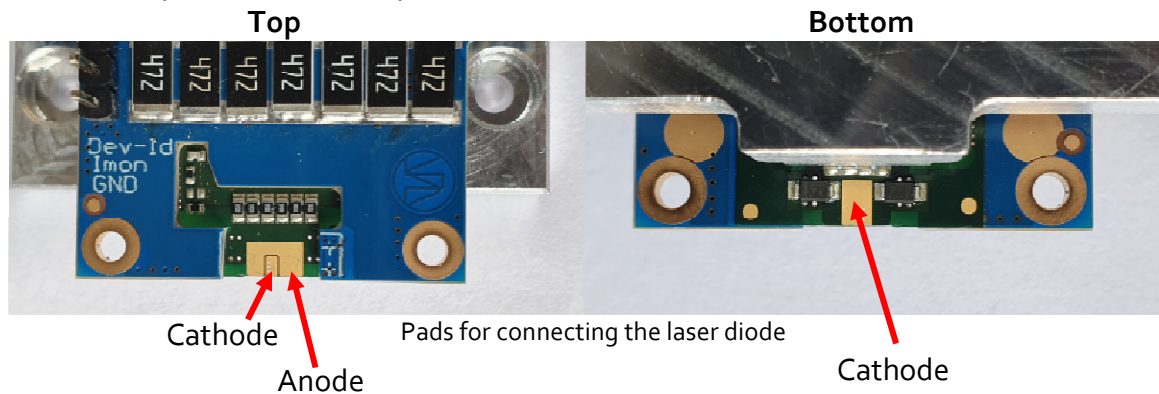
The trigger input requires a signal of 5 V and is terminated with 50 Ohm. The minimum input signal pulse width is 10 ns. For more details see below.

### Current Monitor Output:

The current monitor output has a scale of 20 A/V with a negative signal output. It has a source impedance of 50 Ohm and must be terminated with 50 Ohm to achieve the correct scale.

### Laser Diode Connection:

On the top side of the driver are two pads visible. The larger, outer pad is the anode of the driver. The inner pad is the cathode of the driver and is surrounded on three sides by the anode. On the bottom side is only an additional pad for the cathode. Please see below for a photo from the top and bottom side.



### Security Advice:

Do not touch any leads of the output or the output capacitors as they are connected to a high voltage of up to 120 V.

## Laser Diode Connection

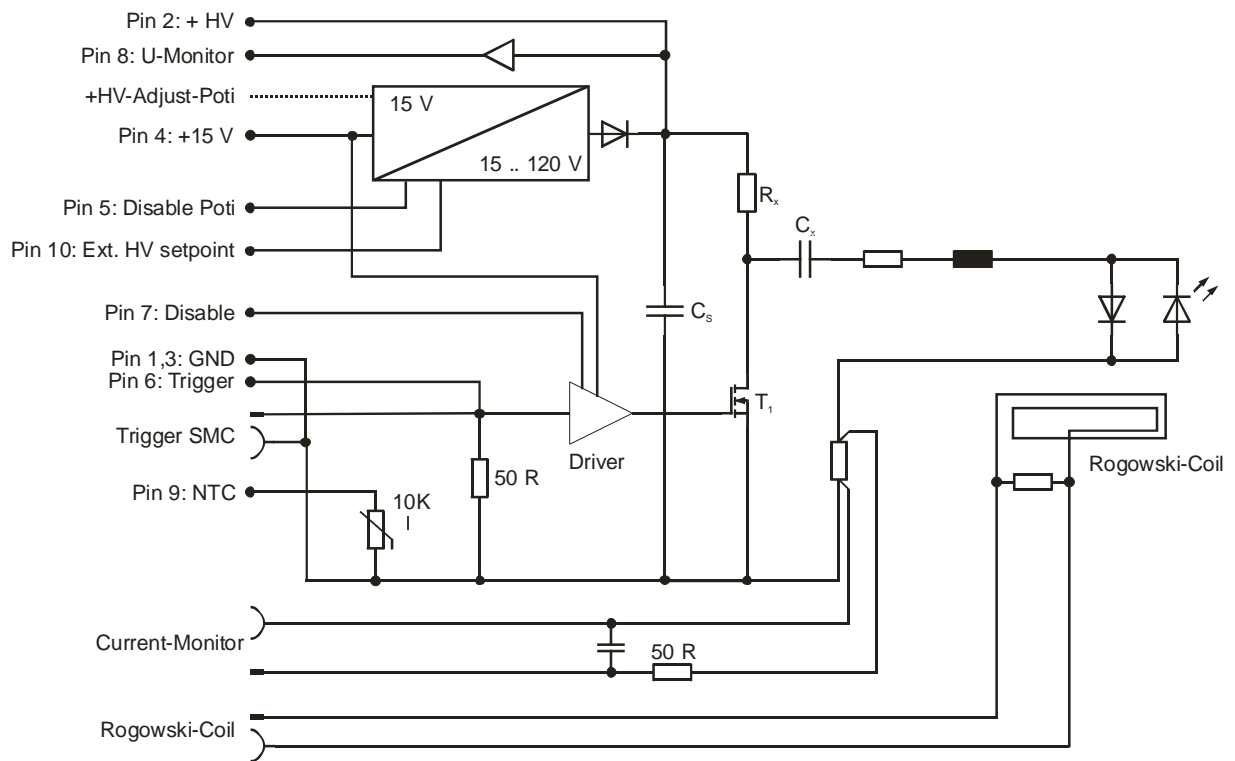
Many elements and parasitic "stray" components may affect the performance of the LDP-AV. The stray inductance of the load connected to the driver is very important. "Load" means not only the diode itself but also the packaging (bondwires!) and leads between the driver and the diode. However, PicoLAS has no influence on these parts. Thus, all measurements have been performed into a short instead of a laser diode.

Refer to the PicoLAS Appnotes "Impedance of Diodes" and "LD-Connections" to get more information about parasitic elements and their effect on the pulse shape.

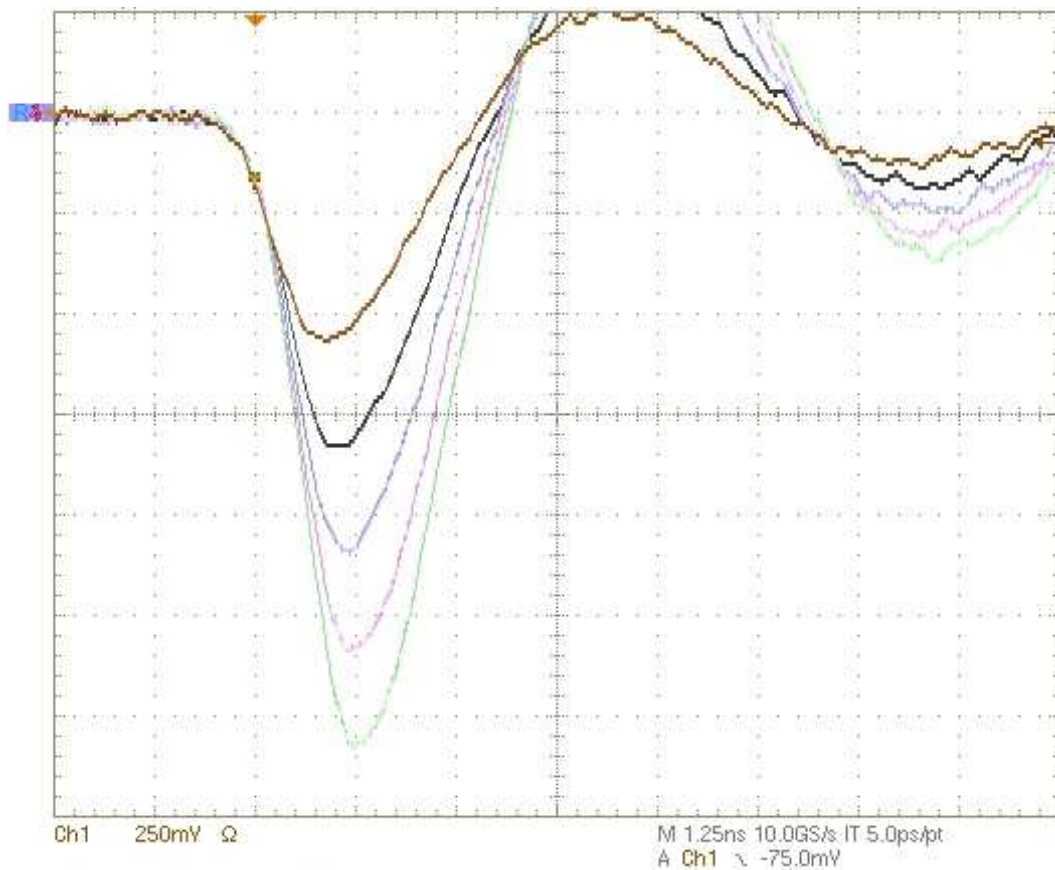
For a quick reference of the influence of the inductance of the load and its connection on the achievable pulse duration and maximum current, please check the following table:

Impedance	Pulse duration	Maximum current
0 nH (short)	780 ps	32 A
1 nH	1.4 ns	26 A
2 nH	1.8 ns	23 A
3 nH	2.2 ns	21 A
4 nH	2.4 ns	19 A
5 nH	2.8 ns	18 A

## Internal Structure of the LDP-AV



The LDP-AV generates the pulses by a simple but efficient principle. First, the capacitors Cx are charged over Rx, whether through the internal HV-DC supply or an external high voltage source. When a pulse is applied at the trigger input the high speed MOSFET T1 closes and the current flows from the capacitor through the laser diode, MOSFET, Coil and resistors. Cx generates an oscillating circuit with the coil and the resistors. Due to the constant values of these elements the oscillating frequency and thereby the pulse width is kept constant. The output pulse is not affected by the length of the trigger input pulse. The generated current depends on the applied high voltage, the laser diode compliance voltage and its differential resistance. The time that T1 is open is not relevant for the pulse length. Certainly the input pulse of the trigger input has to be minimal 10 ns. For longer input pulses the output pulse form is not changing but the stress of the driver increases. So the duty cycle of the input pulse is limited to  $d = 0.2$ . Applications with very high frequencies have special specifications (see section "Operating Range" for more details). The following diagram shows the output current (at current monitor, measured with a short at the output) for different high voltages.



Output Pulse Diagram: LDP-AV Do6-N2o typ. pulse output (1.25 ns/div, 5 A/div)  
Traces corresponding to 40, 60, 80, 100 and 120 V HV precharge

The laser diode current is measured with current sensing resistors (current monitor output) and with the galvanically isolated Rogowski coil. Disable and trigger input provide full control of the driver's pulsing capability to the user. The required DC high voltage can either be applied through an external voltage source or it can be generated with the integrated HV-DC supply. The internal supply is controlled by the HV setpoint poti or, when the Disable\_Poti (pin 5) pin is set high, via the Ext\_HV\_setpoint (pin 10) pin. A voltage monitor (pin 8) provides feedback of the high DC voltage. The antiparallel diode prevents the laser diode from reverse currents; a 10kR NTC provides the possibility to monitor the driver temperature. An over temperature protection is NOT integrated in the driver.

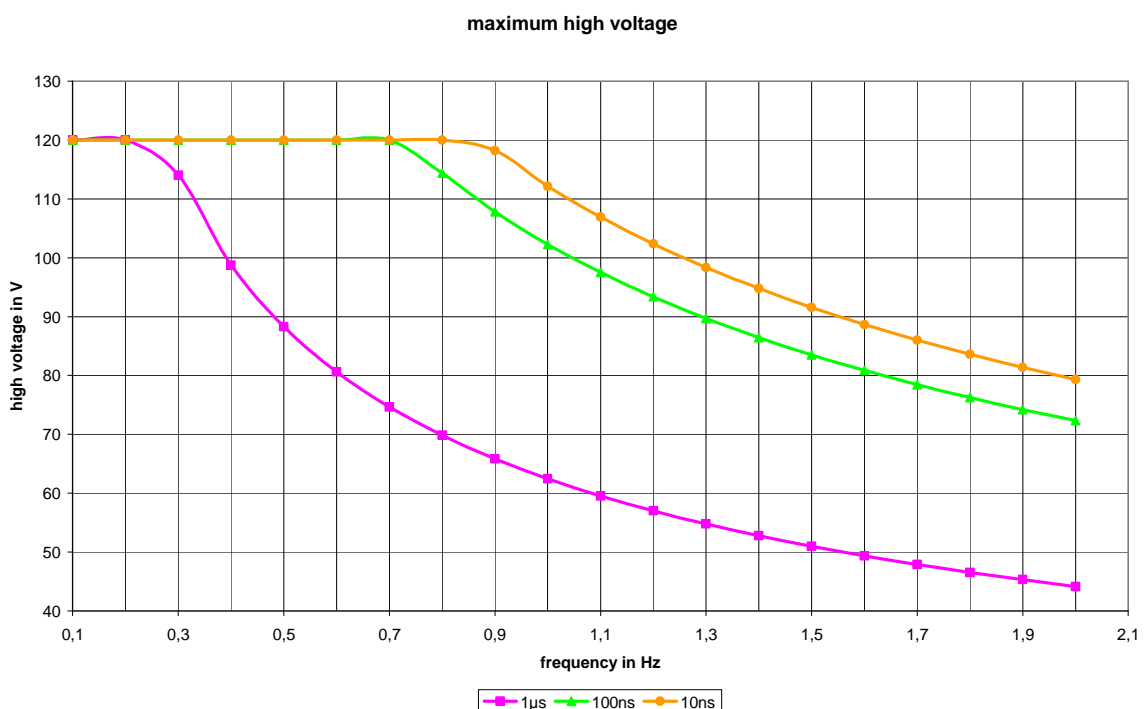
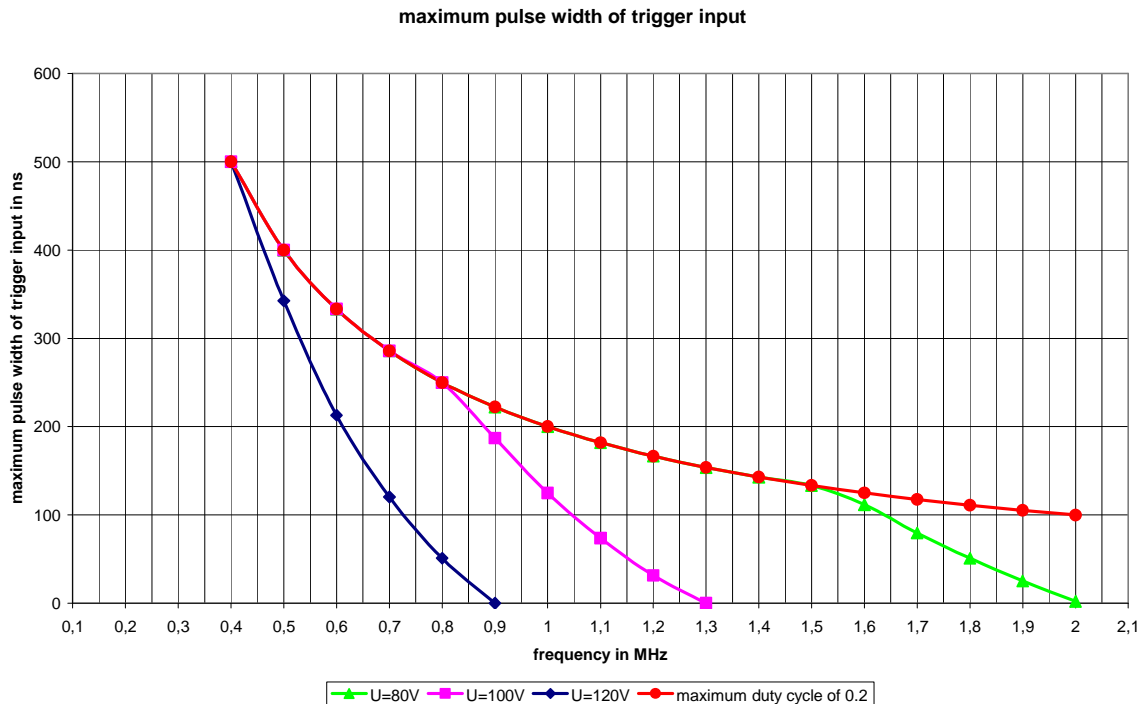
## Dos and Don'ts

- Do not exceed specified parameters.
- Do not connect voltages with a reverse polarity to the device.
- Never connect more than 18.0 V to the power terminals of the device.
- Beware: Some lab power supplies cause excessive ringing during powering on and off. These may damage the unit!
- Pay attention to proper cooling.
- Attention: Do not touch the unit during operation: High voltage!



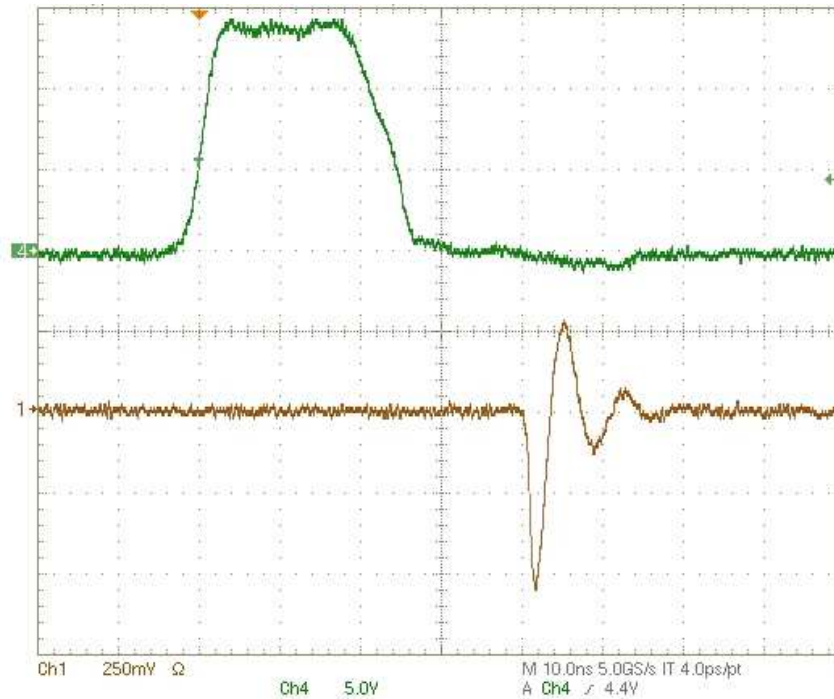
## Operating Range

Due to the structure of the driver the maximum duty cycle of the trigger input (the driver output is not affected!) must be lower than  $d=0.2$ . During a "HIGH" signal at this input the main switching MOSFET is switched on and the high voltage is dropped over the resistor Rx. In fact the stress of this resistor is quite big. When the MOSFET turns off the capacitor Cx is charged over the same resistor and stresses it additionally. Especially for high frequencies ( $f > 500$  kHz) this is the main part of the stress of Rx. If using the driver in a high frequent application, the high voltage and the duty cycle have to be adjusted. The following tables show the maximum parameters for these values.



## Trigger Delay

The delay between the triggering signal and the load current is very low around 35 ns and very constant. The pulse-to-pulse jitter is very stable below 50 ps if supply voltage and temperature are kept constant. The output pulse is not affected by the length of the trigger input pulse.



## How to use the internal HV-DC Supply

The LDP-AV series provides a high power (up to 20 W / 2 A / 120 V) internal high voltage supply. To adjust the laser diode current to the desired value follow the steps below.

**Note:** Make sure that the solder junction is done to activate the HV-DC supply and the supply voltage is 15 V.

1. Turn the poti fully counterclockwise
2. Apply the 15 V supply voltage
3. Start pulses
4. Measure the diode current
5. Adjust the level of the high voltage supply (hence the level of the current) by turning the poti clockwise

### Security Advice:

Do not touch any leads of the output or the output capacitors as they are connected to a high voltage of up to 120 V.

## How to use the external HV–DC Input

First the solder junction has to be opened to disable the internal HV-DC supply. Otherwise the external and internal supplies are shorted and both damaged.

Apply the desired voltage in the range of 0 V to 120 V at pin 2 of the pin header. Obey the operating range diagram!

### **Security Advice:**

Do not touch any leads of the output or the output capacitors as they are connected to a high voltage of up to 120 V.

## Absolute maximum Ratings

Supply voltage range: 10 .. 18 V

Max. voltage at HV pin: 120 V

Max. output current U-monitor, NTC: 1 mA

Input voltage range Disable\_Poti, Ext\_HV\_Setpoint: 0 .. 5 V

Input voltage range trigger input, Disable: 0 .. 15 V

Storage temperature: -20 .. +85 °C non-condensing

### **Security Advice:**

Do not touch any leads of the output or the output capacitors as they are connected to a high voltage of up to 120 V.

## Mechanical Details of the Baseplate

LDP-AV Do6-Nxx

