Lovell Laser Diode driver

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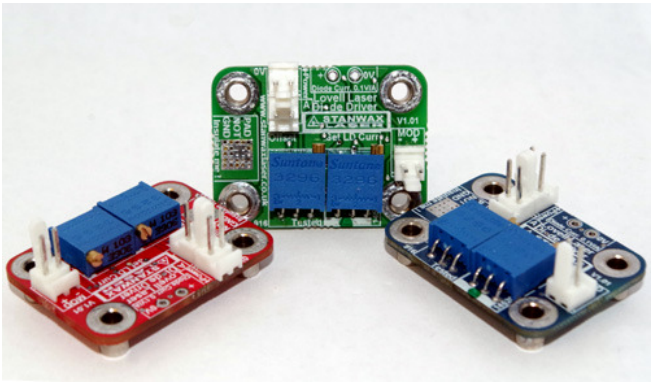
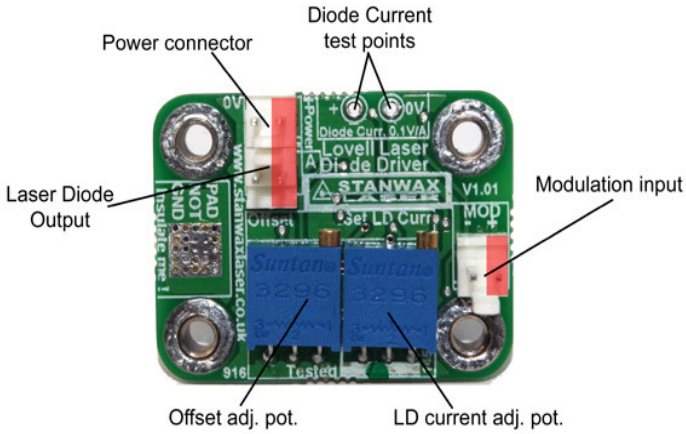
Lovell Laser diode driver from Stanwax Laser is a small basic laser diode driver available with a number of options.
It comes in two types one is optimised for low power single mode diodes and is referred to as Lovell LP, and the other is for higher power diodes requiring up to 2A of current, ideal for the most popular red green and blue laser diodes.
This is the first in a range of drivers which will include a version with an external power transistor for higher current requirements and dual and tripple channel versions.
Each version is available in red, green or blue coloured PCB, the circuits are exactly the same, with just the colour of the solder resist being different.
Wiring and setup of the driver is very straight forward, but we would recommend you read the full manual to ensure you are fully familiar with all aspects of fitting and setup. The Lovell driver is compact at only 28 x 37mm, which means it's easy to locate.



Lovell laser diode drivers in red green and blue PCB



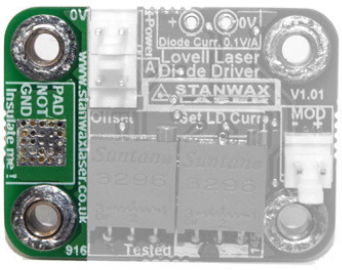
The image left shows an over view of the PCB with the most important parts marked. The image shows the connections for the driver and the areas marked red indicate the positive connection, or in the case of the LD the Anode connection (though all the details are marked on the PCB silkscreen).
The two adjustment pots are also marked and are adjusted with a small screwdriver in the clockwise direction to increase current. (see 'setup' section)
A pair of test points are provided to measure the diode current (see the section below).

Mounting

The board can be mounted using the holes provided in a number of ways. The standard board comes with spacers soldered to the PCB though we can provide the board without the spacers if needed. M3 screws should be used to mount through the spacers using the diagram at the end of this document. Though 4 mounting points are provided the small size and low weight of the board mean you can get away with just using 2 screws if you wish. If using a board without the spacers fitted then you can use M4 screws for mounting.

Heatsinking of the driver.

The square pad on the top of the circuit board (see image below) is where a heat sink can be applied if needed to keep the power transistor cool. The amount of heat generated will depend on a number of aspects (see section 'Power Supply Consideration').



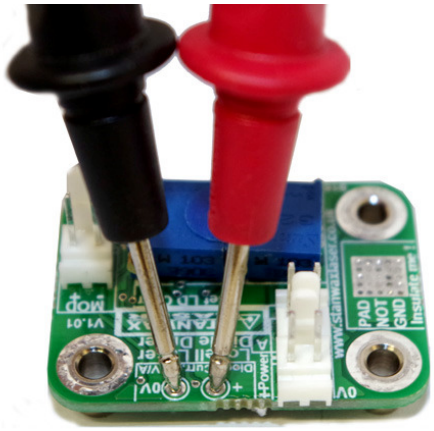
If the pad is attached to a heatsink that is not 'free standing' and is connected to the equipment grounded chassis then this pad MUST be insulated, using a silicone or mica pad that will provide good thermal conductivity while keeping the pad electrically isolated. Failure to do this will place the full supply voltage to the board across your laser diode and will kill it instantly.
The transistor will work without heat sink if the power on it is under 2W (though this will depend on the duty cycle of the laser) but failure to apply adequate heatsinking to the transistor will void the warranty. if you are not sure about your setup please get in touch with us and we will be happy to advise.
The area shown in colour in the image left, can be covered with a heat sink and the screw holes in the pcb can be used to hold a heatsink or mount the board against the chassis where heat can be dissipated.

Wiring

Wiring of the board is simple with the power supply, laser diode connections and modulation input and their polarities marked on the PCB. We supply an optional connector kit that can be purchased with the board. Alternatively you can solder direct to the PCB if you wish and if you choose to do this we would recommend removing the Molex connectors first and using their holes for your wires.

Test points

To ensure ease of measurement a pair of test points have been provided that allow the use of standard test probes. Rather than trying to test across an SMD resistor the pads provided are suitable for receiving the point of a test probe and allowing it to locate positively. Not only do they make measuring and setting of the diode current much easier, but the points provide a buffered signal so in the unlikely event of shorting the test points together, no damage will occur to your laser diode.
Test using a voltmeter set to a 200mV range providing a 2A full scale reading.



Using the test points to measure the laser diode current

Power supply consideration.

Lovell is designed to work from a low voltage dc supply of between 5 and 12v. We recommend using a low voltage to minimise heat on the driver.

Why does the supply voltage matter to the heat generated?

The heat generated in the output circuitry is equal to the energy in Watts that is generated in each part of the circuit. The output circuitry of Lovell consists of three elements (see image below). Following electrical laws, the voltages across these three elements MUST add up to the supply voltage of the circuit. The type of diode in use determines the voltage across the laser diode. For a red diode this voltage is aprox 2-2.2V for green and blue diodes it will be between 4 and 6V. (the voltage across a Blue or Green diode will vary with the current passing through it more than with a red diode), The important thing is that this value is fixed and out of our control. The monitor resistor is a fixed resistance, therefore the voltage across it is determined by the current flowing through it, following Ohms law (volts = current x resistance).
Using simple maths we can see that the voltage across the power transistor is equal to

Voltage across the transistor = Supply Voltage – (monitor resistor voltage + laser diode voltage)

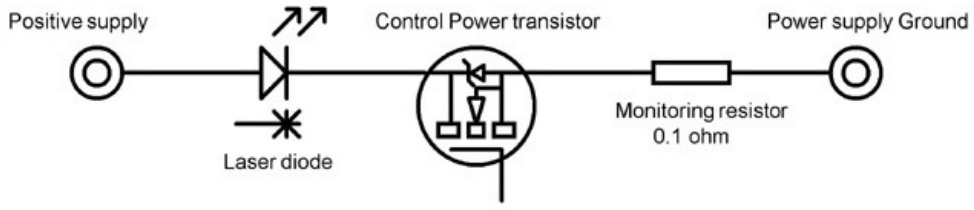
From this we can therefore work out the power in Watts that will be dissipated by the transistor. This is equal to

Transistor Power = Voltage across the transistor x Current

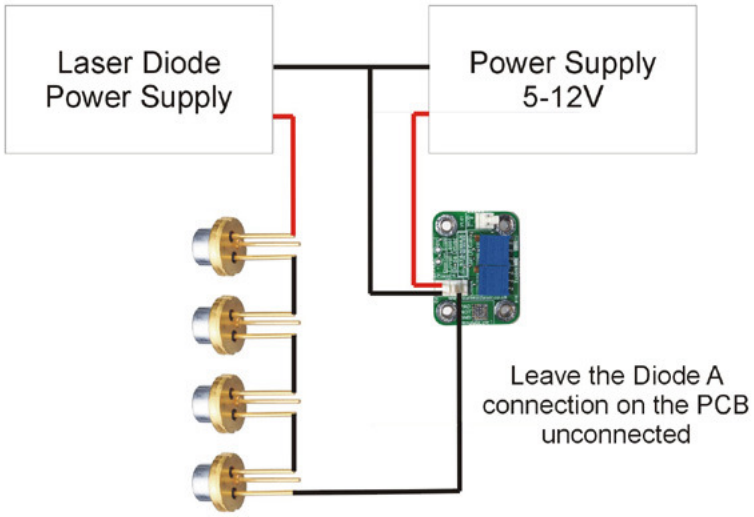
Obviously we set the current to get the best out of the diode so the only way to control the heat generated on the transistor is by changing the supply voltage. When there is a higher voltage across the transistor, there are more Watts of power to be dissipated by the transistor, which must be removed by a heatsink.

It is also important to remember that you cant break the laws of physics, so that if you have too little voltage across the whole circuit then the only way ohms law can work is if the current become a lower value. Therefore if you cannot achieve the desired current setting even when turning the current pot up, and assuming you are not at full scale of the pot, then your power supply voltage will be too low.

Note: all of this information is based on the driver providing current to a diode at full power continuously, in a laser show application this is very unlikely to occur so the heat generated will often be less than calculated but using the calculations above you will be building in a margin for error.
It is possible to drive a 1W 520nm diode at 1.6A current from 6V supply in a laser projector application without a heatsink being fitted.



Should you wish to operate a number of diodes in series and the voltage across them would be greater than the power supply to the board you can use a higher voltage supply to the laser diodes as long as the supply to the driver and the diodes have a good common ground connection (see diagram right).
In this example the laser diode supply must have a voltage output of the total volt drop across the diodes (individual voltage x 4) plus enough 'overhead' for the driver board circuitry (see previous page). For a 445nm laser diode this circuit would work with a laser diode power supply of 22V or more.
If the diodes were red diodes then the laser diode power supply could be 10-12V with Lovell powered from a 5V or 6V supply.



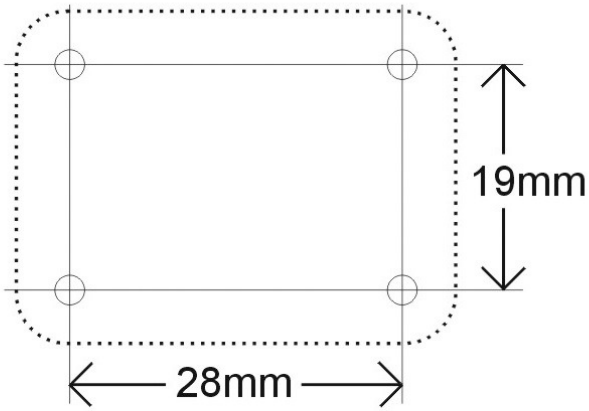
Setup

Before you start ensure that the two pots on the PCB are set to minimum by turning them anti-clockwise until you feel a soft click, indicating the minimum has been reached (note the pots are 20 turn so ensure you make enough turns).
The pots on the board are used to adjust the threshold point (offset pot) and the maximum laser diode current (set LD curr). To correctly set the pots you will need a 5V DC signal, from a source such as a bench power supply or by using the full power setting of a Stanwax Laser ILDA GEM testing tool. (Do not use the output of a laser controller, as this will not provide the constant signal required and will result in an incorrect current setting)
Set the power supply or ILDA GEM to apply 5V to the modulation input, there should be no output from the laser diode at this point. Increase the offset pot, by turning it clockwise, until the laser diode reaches threshold. Turn the pot back 1 to 1.5 turns, this is to accommodate for the interaction between the current setting pot and the offset pot. Now you can set the diode current by adjusting the 'Set LD Curr' pot while monitoring the current with a voltmeter on the test points as shown above
Once the current has been set turn the input voltage down slowly to ensure that the threshold point is acceptable. If not you can make an adjustment but remember to recheck the LD current if you make any adjustment to the offset.

Specifications

	Lovell Standard	Lovell LP (low power)
Supply Voltage	5-12V DC	
Supply Current	Max 55mA @12v	
Range of laser diode current Adjustment	1500mA	900mA
Range of Threshold	750mA	200mA
Dimensions	28mm x 37mm	
Modulation input	0-5V	
Modulation Frequency	0-120kpps	
Current monitoring	Short Circuit protected and buffered 100mV/A	

Drilling Diagram for Lovell Laser Diode Driver



Drill holes 2.5mm For M3 tap
(board with bushes fitted)

Drill holes 3.2mm For M4 tap
(board without bushes)