	Document #	Date
ENDURANCE LASER TECHNICAL NOTE	**EL-TN56DIY-A**	July 2018
	Author(s)	
	Subsystem: Laser module assembly, installation and testing	
Document Title **5.6W DIY Laser Assembly**		

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ABSTRACT

This tech note details all the steps necessary to assemble the 5.6W DIY laser kit

SAFETY

- *Visible lasers can PERMANENTLY damage your eyes. Use protection and ensure any other person or animal in the same area is suitably protected.*
- *ALWAYS wear safety goggles when operating the laser, even if you have it inside a case*
- *BE RESPONSIBLE – ensure a clear work area, ensure you have fire-suppression at hand*
- *Use the laser at your own risk – you only have ONE set of eyes.*
- *NEVER aim a laser beam at anyone and use it only for its designed purposes: laser cutting or engraving.*
- *NEVER leave the laser unattended - to avoid accidental fires and careless actions of humans and animals.*
- *When choosing your material, keep in mind that during the laser operation combustion products are released, some of which can be harmful to health or to your machine.*
- *ALWAYS use an air funnel and ventilation.*
- *If you plan to cut any material underlay a piece of metal to protect the worktable from damage and fire.*
- *If you are not sure about anything, please contact us (email, fill the website form or call) for advice.*

KIT OVERVIEW

Supplied Parts

With the kit you will receive:

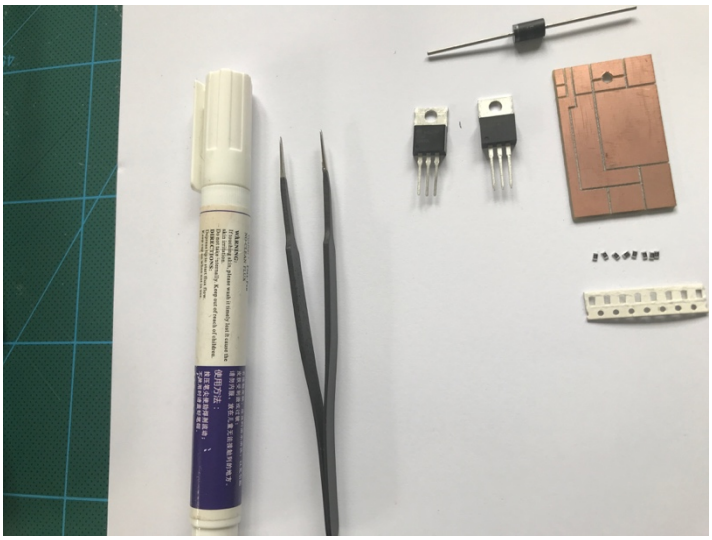
- Aluminium Laser housing
- 12V fan
- DC:DC step-=down converter
- Laser diode installed in 12mm two-part housing
- LM338 Adjustable Regulator
- 13N10 MOSFET
- 8x 2.7OHM SMD resistors
- D540 Schottky Power Rectifier Diode
- 100-ohm through-hole resistor
- Copper PCB
- Laser heatsink
- Power jack socket
- Power jack lead
- TTL lead
- Construction wires for PCB – DC:DC stand off
- 1x 10mm M3 screw
- 4x 16mm M3 screws
- 1x 25mm M3 screws

Required Parts

- A suitable 3A+/12V power supply
- 20-12awg wire to connect the laser to your power supply
- Mounting hardware to fit your CNC/3D printer device
- A quality solder suitable for electronics work (~1.5mm tin/lead 60:40 – 63:37)
- Solder flux

Tools

- Drill – drill press preferred
- Vice - suitable for pressing the laser module into the heatsink
- Quality soldering iron capable of soldering a MOSFET to a raw copper PCB (60W+)
- Electronic tweezers for the SMD devices
- ‘Helping hands’ for assembly
- Wire cutter/snips
- A decent digital multimeter that can measure amps and volts and continuity



Process

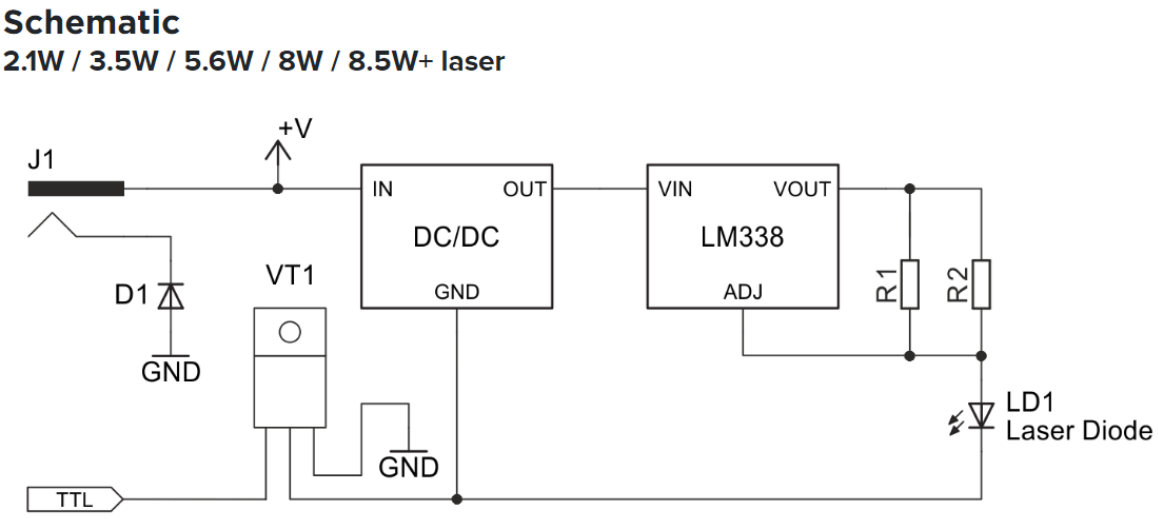
Laser Driver

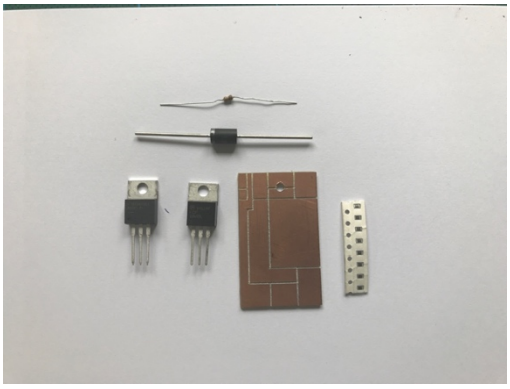
Check your parts/Lay out your parts

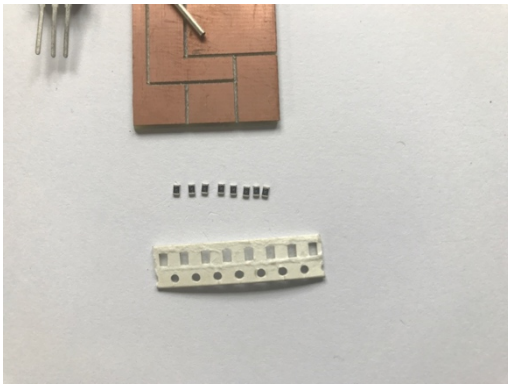
Lay out all your parts and identify each one – take particular care with the 13N10 MOSFET and the LM338 voltage regulator, as they look very similar.

Take care with the tiny SMD resistors.

Review the circuit schematic.

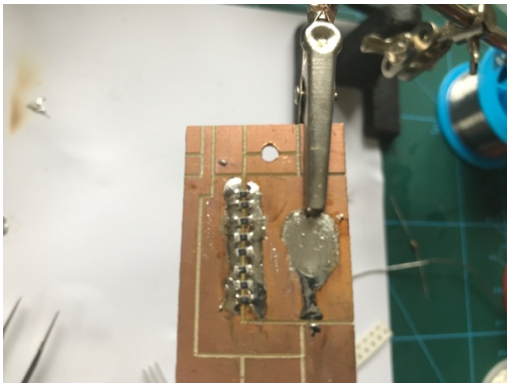




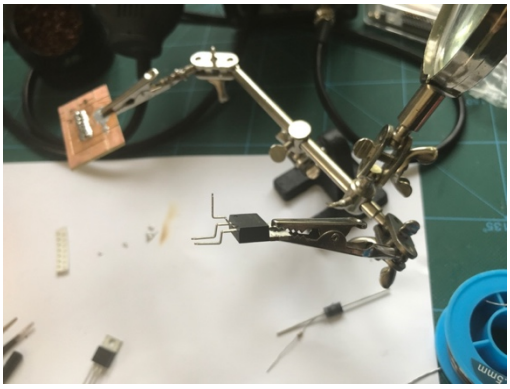


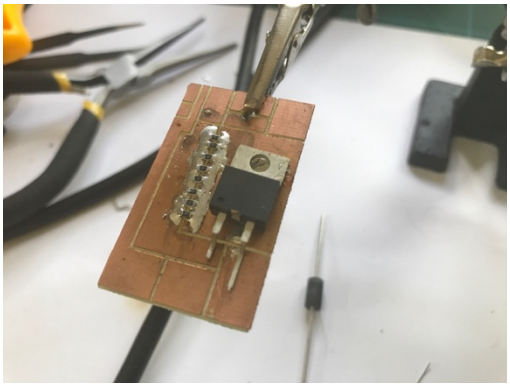
Solder PCB

Flux and pre-solder for the 13N10 MOSFET and SMD resistors. Ensure the channel between the two halves of the resistor is clear of solder. Solder the resistors across the two PCB sections. Check for continuity as you go.

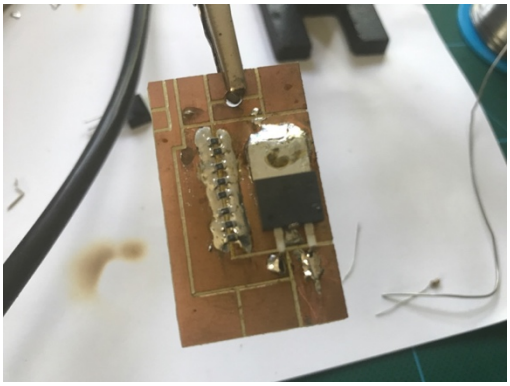


The centre connector on the 13N10 is not needed – ground is completed through the back plate soldered to the PCB. Trim it off, then solder the 13N10 to the PCB





Be sure to use enough solder to create a thermal connection – the 13N10 dissipates a lot of heat to the PCB. Insufficient solder will result in overheating of the MOSFET.



Test PCB

Mount DC:DC step-down converter

Adjust and test final voltage

The components supplied with the kit are designed to operate with a 12V power supply.

However, the DC:DC converter will work with a range of voltages, up to 30V input. To use a voltage over ~12V would require replacing the 40mm fan, as it is powered directly from the source power. All other components of the driver are powered after the DC:DC converter, and so as long as the regulated power is set properly, you can use a PSU higher than 12V, as many CNC machines do.

Laser Module

Assemble laser module and heatsink
Test fit parts into housing
Complete driver to laser connection
Fit laser and driver assembly into housing.

Testing

Overview

The reason for using a constant-current driver vs just giving the diode a constant voltage is that, given the opportunity, a diode will run away, taking more and more power, getting hotter and hotter until it blows up.

The difference between the current needed for the diode to lase and the maximum current it can take is about 15%, so we need a controllable, stable, linear, noiseless supply of power to drive the diode while leaving room to adjust its output power so we can make full use of its beam.

In order to be able to run for a long time, reliably, and to ensure your diode has a long life, three things are needed: clean, controllable power; prevention of heat build-up in the diode; quality components in the driver.

Correctly setting up the driver is the key to getting the most out of your laser. Incorrectly set drivers will shorten the life of your diode.

Setting

Installation

Calibration

Tuning, Mods and Pushing the Boundary

As the kit is aimed at the serious, technically-capable hobbyist, its likely you are going to be wondering where you can make things better, stronger, faster…

Here are some handy pointers.

Voltage

The components supplied with the kit are designed to operate with a 12V power supply.

However, the DC:DC converter will work with a range of voltages, up to 30V input. To use a voltage over ~12V would require replacing the 40mm fan, as it is powered directly from the source power. All other components of the driver are powered after the DC:DC converter, and so as long as the regulated power is set properly, you can use a PSU higher than 12V, as many CNC machines do.

Alternative components

Areas to look at to improve are, as with any circuit, removing losses, keeping cool, using thicker wires and better-quality components. Of these, the most improvement will come with removing losses; heavier-duty cable using solid core copper will give the least resistance and thus, the most power to the diode. The cables will need to be able to withstand the heat reached inside the diode housing, which means you are probably looking at silicone-sheathed copper.

Alternative drivers

There are many designs of constant-current driver, with all sorts of features you may wish to have, such as temperature control, digital power adjustment, altrernative feedback modes, etc. The laser diode used in the kit is not going to care – it's a diode. As long as you can make it all fit and it delivers the correct power and voltage, it's going to work.