

Load Assembly for Laser Drivers

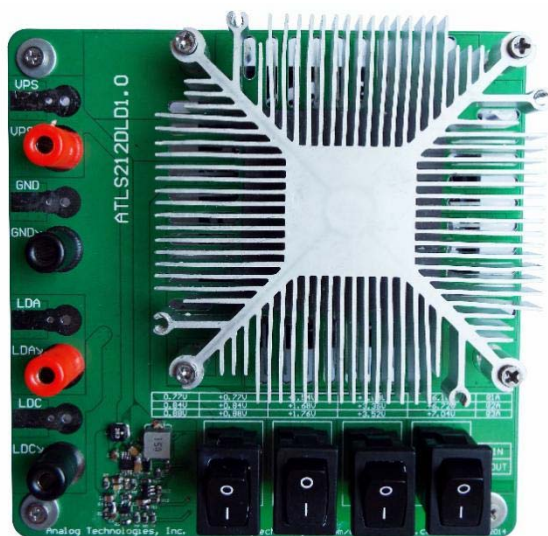


Figure 1. Physical Photo of ATLS212DLD1.0

MAIN FEATURES

Emulate the non-linearity of laser diodes
 High continuous current capability: up to 4A.
 Extremely high pulse current capability: 100A
 High reverse voltage on each diode: 100V
 Variable voltage drop steps: 0.88V, 1.76V, 2.64V, ...
 14.08V@3A
 Constant fan speed at wide input voltage: 4.5V to 15V
 Over temperature shutdown @ diode temperature > 90°C
 Low noise high airflow fan

INTRODUCTION

This load assembly, ATLS212DLD1.0, is designed to emulate laser diodes for evaluating a series of laser drivers, including [ATLS1A212D](#), [ATLS2A212D](#) and [ATLS3A212D](#). These laser drivers can be used to drive one or multiple laser diodes with high efficiency and low noise for DPSSL, EDFA, or fiber laser applications. They accept wide range input voltage and their output voltage can be from 0V to almost the same as the input voltage. Their size is very small, but can output high current, high voltage, thus high output power. The efficiency is so high that no heat sink is needed. In addition, these laser drivers have low output noise (except that there is a 500kHz 4mV_{p-p} ripple voltage at the output) and wide modulation bandwidth. In order to evaluate this

series laser drivers more conveniently, we have designed and made the evaluation board, ATLS212EV1.0. This laser load assembly can be used with this evaluation board, or be used alone, as a dummy laser load, to emulate one or multiple laser diodes.

It is recommended to read this application note along with the [ATLS1A212D](#), [ATLS2A212D](#) or [ATLS3A212D](#) datasheet.

The laser drivers can be evaluated by using real lasers. However, the real laser diodes are very vulnerable: the maximum current allowed is only about 1.5 to 2 times higher than their normal values, and the allowed reverse voltage is only 2V to 4V. The dummy laser uses regular durable diodes, and the maximum allowed current is up to 100A for a short time, the maximum reverse voltage is 100V for each diode. All these make the dummy laser almost unbreakable, so that even the users may make some mistakes when using the laser drivers for the first time, there won't be any costly damages, as opposed to using real laser diodes. After making sure that the laser driver works well, all the connections are made correctly and reliably, and then connect the real laser diodes with the laser driver.

This laser load assembly has 4 portions:

1. A series of regular diodes with configuration switches, S1, S2, S3 and S4. The switch allows inserting different number of diodes into the circuit so that under the same current, such as 3A, the voltage drop will varies from 0.88V to 14.08V. The total voltage drop values vs. the switch position combinations and the load current are listed in Table 1.
2. Heat sink and fan to cool down the diodes temperature.
3. Fan control circuit. To keep the fan running at a consistent speed even as the input power supply voltage varies from 4.5V to 15V.
4. Over temperature detection and shutdown circuit. To measure the diodes temperature and disconnect them from the laser driver upon detecting the temperature exceeds 90°C, thus the diodes will not be damaged by over temperature.

Table 1. The Voltage Drop Values vs. Switch Position Combinations at Different Load Current

S1	S2	S3	S4	Voltage@1A (V)	Voltage@2A (V)	Voltage@3A (V)	Voltage@4A (V)
OUT	OUT	OUT	OUT	0.77	0.84	0.88	0.92
IN	OUT	OUT	OUT	1.54	1.68	1.76	1.84
OUT	IN	OUT	OUT	2.31	2.52	2.64	2.76
IN	IN	OUT	OUT	3.08	3.36	3.52	3.68
OUT	OUT	IN	OUT	3.85	4.20	4.40	4.60
IN	OUT	IN	OUT	4.62	5.04	5.28	5.52
OUT	IN	IN	OUT	5.39	5.88	6.16	6.44
IN	IN	IN	OUT	6.16	6.72	7.04	7.36
OUT	OUT	OUT	IN	6.93	7.56	7.92	8.28
IN	OUT	OUT	IN	7.70	8.40	8.80	9.20
OUT	IN	OUT	IN	8.47	9.24	9.68	10.12
OUT	OUT	IN	IN	10.01	10.92	11.44	11.96
IN	IN	OUT	IN	9.24	10.08	10.56	11.04
IN	OUT	IN	IN	10.78	11.76	12.32	12.88
OUT	IN	IN	IN	11.55	12.60	13.20	13.80
IN	IN	IN	IN	12.32	13.44	14.08	14.72

BOARD DESCRIPTION

The top silkscreen layer of the load assembly board is shown in Figure 2 with other top layers, such as top copper, top solder mask, and multilayer (vias). To make it easier to see, the top silkscreen is also shown without other top layers in Figure 3.

On the left edge of the PCB, there are 4 solder pads for connecting to VPS, GND, LDA and LDC ports from the evaluation board. The connections can be made by soldering wires onto the pads, using alligator clip terminated cables to clip onto the pads, or using cables with banana plugs to plug into the banana sockets, see Figure 1. On the lower right area of the PCB, there are 4 switches, S1, S2, S3 and S4. Each of

them shorts out different number of diodes, so that different combinations of the switch positions make the load having different values of drop out voltages, see Table 1. When the switch is set to the upper position, it insert the diode into the circuit, otherwise, it shorts out the diodes, see the schematic shown in Figure 7. Switch S1 controls one diode, when in ON position, the diode is inserted into the circuit, producing a 0.88V voltage drop for the load; on the OUT position, it shorts out the diode. Switch S2 controls 2 diodes, S3 controls 4 diodes, and S4 controls 8 diodes. Please notice that even when all the 4 switches are in the OUT position, there is still one diode remains inserted in the load, producing about 0.77V @ 1A.

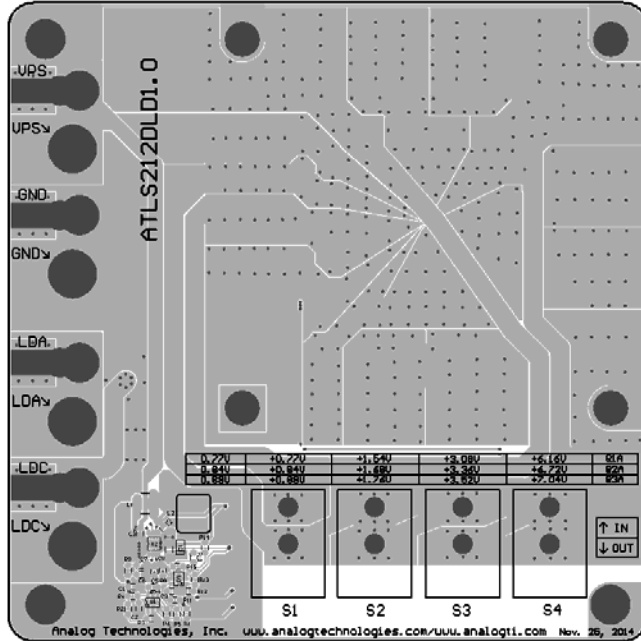


Figure 2. Top Silkscreen Layer with Other Top Layers

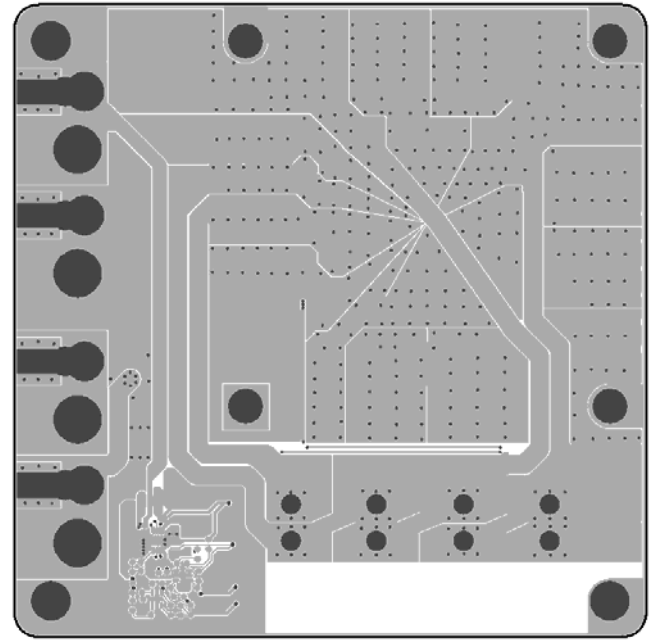


Figure 4. Top Layers without Top Screen Layer

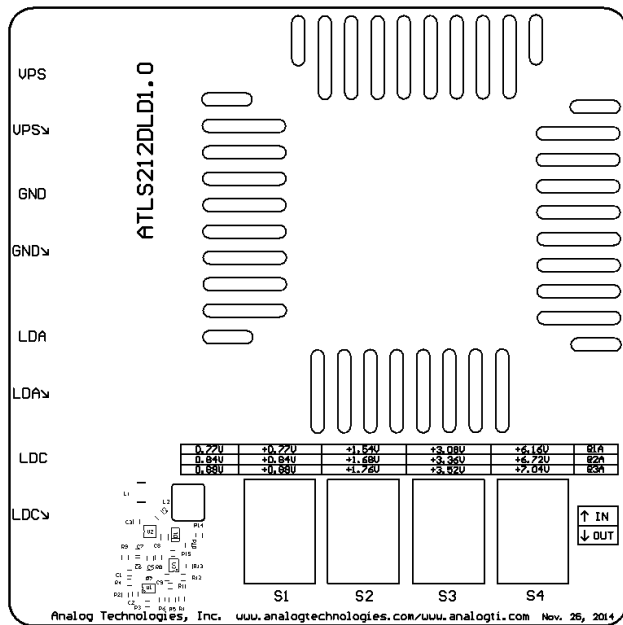


Figure 3. Top Silkscreen

Figure 4 shows all the top layers except the silkscreen layer.

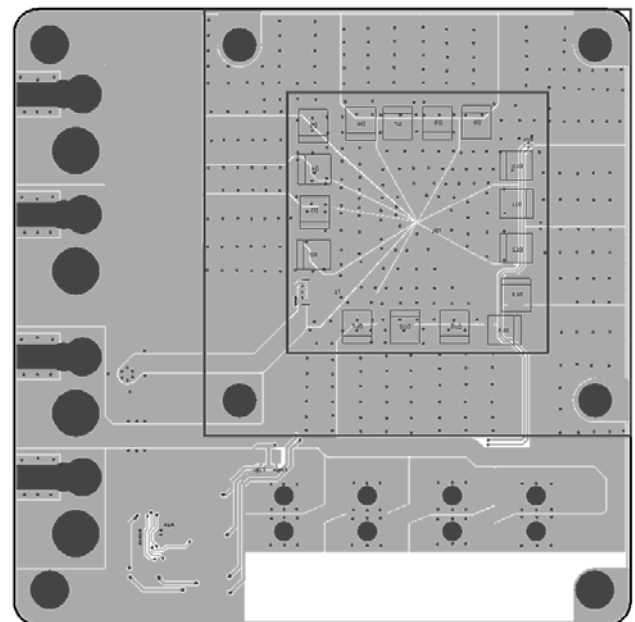


Figure 5. Bottom Layers

Figure 5 below shows the bottom layers, including bottom copper, bottom solder mask, and multilayer (vias). Please notice that it is a “see through” image from the top side.

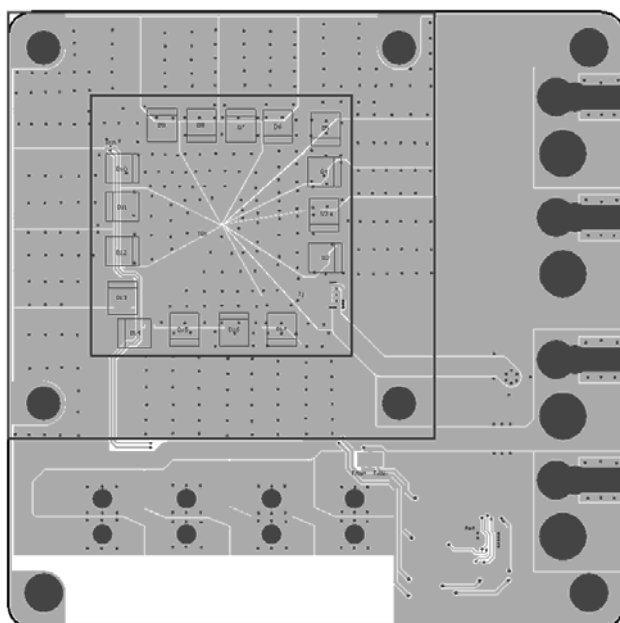


Figure 6. Mirrored Bottom Layers

Figure 6 shows the mirrored bottom layers which is a directly-seen image from the bottom side.

The schematic is shown in Figure 7 below.

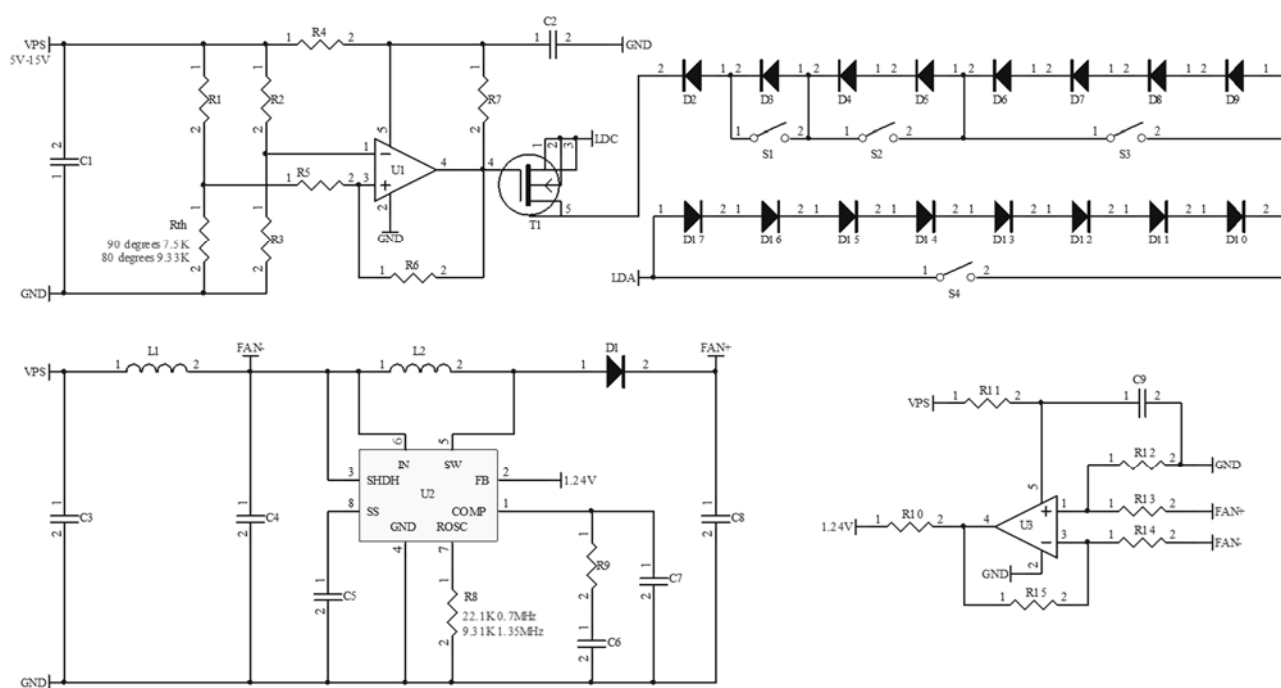


Figure 7. Schematic of ATLS212DLD1.0

GETTING STARTED

1. Hook up a power supply. It is needed for 2 purposes: turn on the electronic protection switch and power the cooling fan. There are 2 solder pads and 2 banana sockets for these 2 nodes respectively. The connection can be done by clipping, soldering onto the pads, or using banana cables. The power supply can be set to any value between 4.5V~15V. The higher the power supply voltage, the smaller the current drawn.
2. Use the switches S1 to S4 set the load voltage drop value to be similar to the actual laser diode voltage drop value, use Table 1 to look up for the switch position needed.
3. Connect the LDA and LDC output either from the evaluation board or from the laser driver to this load assembly board by the same way as described above, and turn on the laser driver by releasing the shutdown pin. Make sure that the power supply must be turned on before applying current/voltage between the LDA and LDC ports. This is because without the power supply be turned on, the diodes are not connected to the input ports, LDA and LDC.
4. **Warning: when injecting 4A current to the load at a high voltage drop value, such as >14V, the bottom heat sink may get very hot, don't touch them with your fingers.**
5. The switch bank and their corresponding diodes are shown in the table below. The diode D2 is always inserted in the circuit so that the total forward voltage range is from 0.88V to $0.88V + 0.88 \times 15 = 14.08V$. Please be aware of this fact: when the output voltage is low by shorting circuit all the diodes, the driver will consume more power and get too hot that the internal temperature protection circuit will shut off the driver automatically. When this happens, wait a few seconds, let the driver cool down, the driver will restart automatically after the temperature is lowered to certain level.

Switch Name	Corresponding Diode
S1	Diode D3
S2	Diode D4 and D5
S3	Diode D6, D7, D8 and D9
S4	Diode D10, D11, D12, D13, D14, D15, D16 and D17.

6. Monitor the output voltage. This can be done by measuring the voltage between LDA and LDO ports with a volt meter. These 2 nodes can be approached at the left edge of the board. If the driver works well, the output current should remain the same as the output voltage changes with the temperature or changes with the change of the diode switch positions.
7. Connecting real laser diode(s) to the evaluation board. After making sure that the driver works properly and all the connections are made reliably, a real laser diode or a laser diode array can be connected to the evaluation board to replace this load assembly. This is the procedure:
 - A. Solder the laser diode terminal wires to the LDA and LDC solder pads of the evaluation board, make sure that the connections are made very reliably, no intermittent disconnection will occur.
 - B. Turn on the power to the evaluation board. At this time, the operator needs to be very careful in touching or moving the evaluation board set up. Any mistake in operating the board or any intermittent disconnections for connections on the board may result in damaging the laser diode(s) permanently.
 - C. If everything still works fine after step B above, the user can proceed to test the laser itself. The output current can be adjusted while the laser is turned on, but make sure that the output current will never exceed the laser's current limit.
 - D. In case there are any suspicious or any problem occurs, turn off the shutdown switch to turn off the laser driver.



E. **Warning: Many old bench top power supplies have high voltage spikes when power is up or power is down and these spikes may kill the laser driver. Thus, kill the laser diode(s). To avoid this from happening: use an oscilloscope to check the power supply before using it. If it does have the spike, keep the power supply on and use an external mechanical switch to connect and disconnect the power supply output to the laser driver or laser driver evaluation board.**

F. Contact us at any time if you have any questions related to using our products, we always try best to help you. Thank you for reading and using our products.

NOTICE

1. ATI warrants performance of its products for one year to the specifications applicable at the time of sale, except for those being damaged by excessive abuse. Products found not meeting the specifications within one year from the date of sale can be exchanged free of charge.
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