FEATURES

High Efficiency: ≥90%
Maximum Output Current: 2A
Current Output Noise: 0.05%
High Stability: 100ppm/°C
Zero EMI
Compact Size
DIP Package Available

APPLICATIONS

Driving laser diodes with low noise, including DPSSL, EDFA, fiber laser, direct diode lasers, etc.

DESCRIPTION

This laser driver is an electronic module designed for driving diode lasers with up to 2A constant current, high efficiency, low noise, high reliability, zero EMI, and small package. Figure 1 shows physical photo of ATLS2A201D.

It provides these the functions: laser constant current control, laser current monitoring, over current and thermal protection, laser current control indication, laser diode status indication, soft start, and shut down.

It comes with a high stability low noise 2.5V voltage reference output which can be used for setting the output current. The reference output can also be used for the ADCs (Analog to Digital Converters) and/or DACs (Digital to Analog Converters).

Figure 1 Physical Photo

The ATLS2A201D is packaged in a 6 sided metal enclosure, which blocks EMIs (Electro-Magnetic Interferences) to prevent the driver and other electronics from interfering each other.

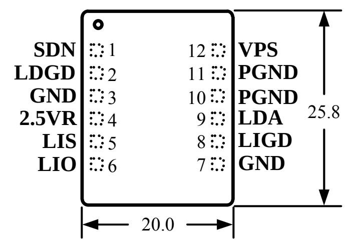

Figure 2 Pin Names and Locations

Figure 2 is the actual size top view of the ATLS2A201D, which shows the pin names and locations. Its thickness is 5.0mm. The ATLS2A201D pin functions are shown in Table 1.

Table 1 Pin Function Descriptions

Pin #	Name	Type	Description
1	SDN	Digital Input	Shut down control. Negative logic, at the internal chip control input: >1.4V = enable, <0.95V = shut down, normal threshold voltage = 1.2V.
2	LDGD	Digital Output	Laser diode good. When this pin is high, >2V, the control loop is working properly. When this pin is low, <0.3V, the laser diode is bad, or there is a short or open circuit at the laser diode.
3, 7	GND	Signal Ground	Signal ground pin. Connect ADC and DAC grounds to here.
4	2.5VR	Analog Output	Reference voltage. It can source 3mA max, with 5µVp-p noise @ 0.1 to 10 Hz and 25ppm/°C stability max.
5	LIS	Analog Input	Laser current set-point voltage. There is an input resistor of 100K tied to GND. Setting it from 0V to 2.5V will set the laser current from 0A to 2A linearly.
6	LIO	Analog Output	Laser current output indication. 0V to 2.5V indicates the laser current of from 0A to 2A linearly.
8	LIGD	Analog Output	Laser current good, control loop indication. When this pin is stabilized and the value is between 0.2V and 1.8V, the output voltage to the laser, Pin 9 LDA, will be 4.8V to 0V linearly, the laser current is stabilized, and the control loop is stable.

9	LDA	Analog Output	Laser diode anode. Connect it to the anode of the laser diode.
10	PGND	Power Ground	Power ground pin. Connect this pin directly to the cathode of the laser diode.
11	PGND	Power Ground	Power ground pin. Connect this pin directly to power supply return pass.
12	VPS	Power Input	Power supply voltage. The driver will work from VPS = 3.3V to 5.5V.

SPECIFICATIONS

Table 2 Characteristics ($T_{ambient}$ = 25°C)

Parameter	Value	Unit
Laser driver efficiency	≥90	%
Maximum output current	2	A
Current output noise	0.05	%
Stability	100	ppm/°C
Laser current control signal level	0 ~ 2.5	V
Control accuracy	±0.2	%
Laser current indication signal level	0 ~ 2.5	V
Indication accuracy	±0.2	%
Output reference voltage	2.5	V
Power supply voltage range	3.3 ~ 5.5	V
Maximum input voltage	6	V
Start-up time	4	ms
Operating case temperature	–40 ~ 125	°C

OPERATION PRINCIPLE

The block diagram of the driver is shown in Figure 3. The shut down control circuit accept signals from 3 sources: external shut down, over current and over temperature signals. When one of these signals is activated, the driver is shut down. Only when all these 3 signals go up, the soft start circuit starts enabling the low noise driver.

An internal soft start circuit allows a slow start up and a quick shut down.

The high stability low noise 2.5V voltage reference can be used for setting the output current, and also be used for the ADCs and/or DACs.

It comes with a laser diode status indication circuit. When LDGD pin is high, >2V, the control loop is working properly. When this pin is low, <0.3V, the laser diode is bad, or there is a short or open circuit at the laser diode.

It comes with a laser current control indication. This pin has a similar function as Pin 2 LDGD, except that this pin is of an analog output and Pin 2 is of a digital output.

The current measurement circuit monitors the output current and shuts down the driver upon detecting the output current exceeds the pre-set value.

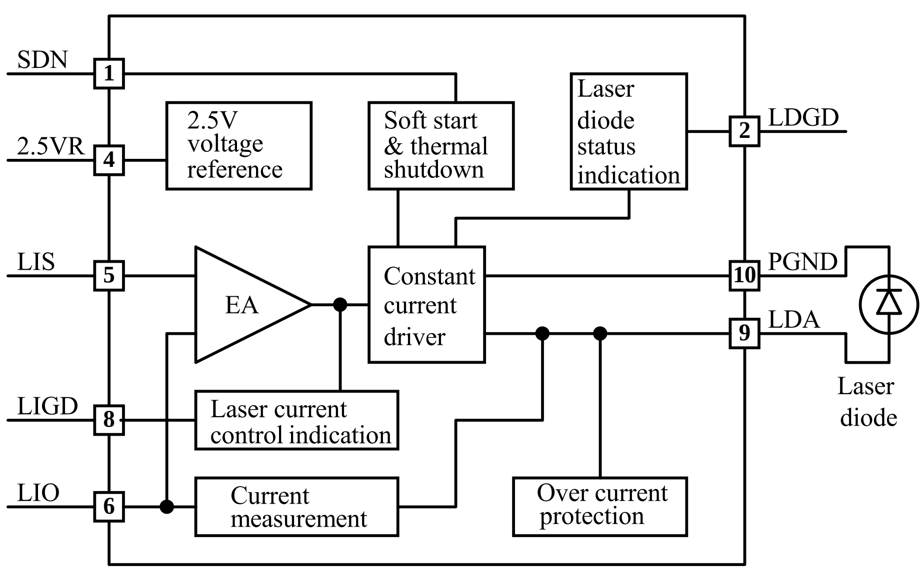

Figure 3 Block Diagram

APPLICATION INFORMATION

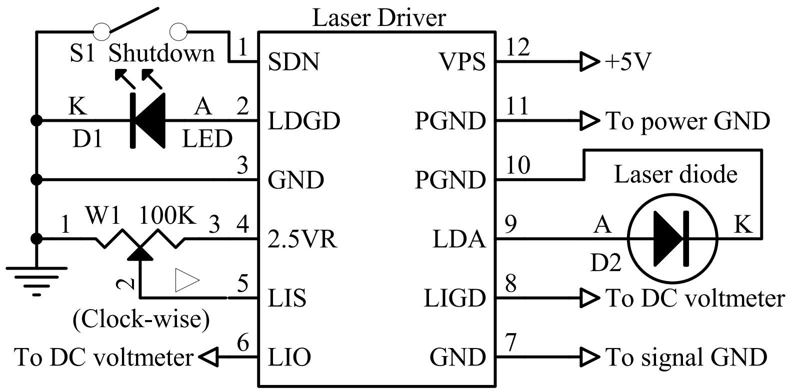

Figure 4 A Typical Stand-alone Application Schematic

Figure 4 shows a typical stand-alone application circuit.

In Figure 4, the switch S1 is external shut down switch, it can turn on and off the driver with the SDN pin high and lower respectively, at the internal chip control input: >1.4V = enable, <0.95V = shut down, normal threshold voltage = 1.2V. The switch S1 can also be an electronic switch, such as an I/O pin of a micro-driver, with an either open drain or push/pull output. See Figure 5. If not using a switch (S1) to control the laser, leave the SDN pin unconnected.

In Figure 4, the LED D1 is used to indicating laser diode status. When LDGD pin is high, >2V, the laser diode control loop is working properly. When LDGD pin is low, <0.3V, the laser diode is bad, or there is a short or open circuit at the laser diode. The LDGD pin can also be connected to a digital input pin of a micro-driver, when software/firmware is utilized in the system. See Figure 5.

Figure 5 shows a typical micro-processor-based application circuit.

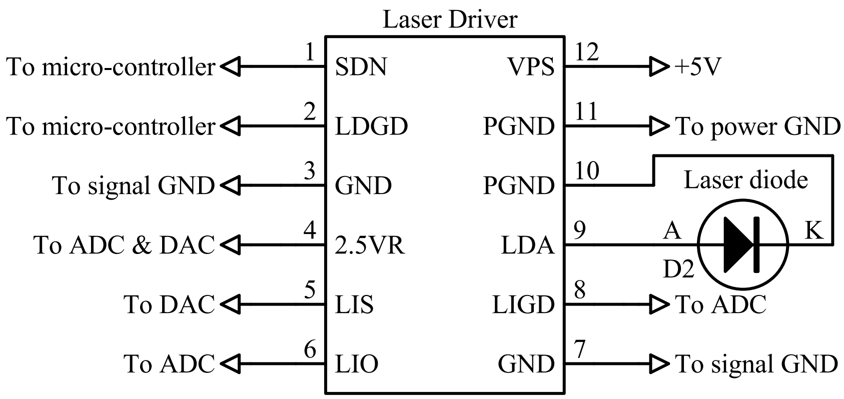

Figure 5 A Typical Micro-processor-based Application

In Figure 4, the adjustable resistor W1 is used to setting the output current. Setting LIS from 0V to 2.5V will set the laser current from 0A to 2A linearly.

The laser diode D2 is connected between LDA and PGND. It is worth mentioning that the power supply return terminal should be connected to the pin 11 PGND and the cathode of the laser diode should be connected to the pin 10 PGND. These 2 nodes should not be connected together externally and they are connected together internally already by the driver.

Turning the Driver On and Off

The driver can be turned on and off by setting the SDN pin high and lower respectively. It is recommended to turn the driver on by this sequence:

To turn on: turn on the power by providing the power supply voltage to the driver, turn on the driver by releasing the SDN pin.

To turn off: turn off the driver by lowering the voltage of SDN pin, turn off the power by stopping the voltage supply on the VPS pin.

When not controlling by the SDN pin: leave it unconnected and turn on and off the driver by the power supply.

Adjusting the Output Current

The output current is set by adjusting W1, which sets input voltages of LIS, pin 5. See Figure 4. The output current will be:

I_output = 2.0×V_{LIS} /2.5 (A).

LIS can be configured by using a DAC, to replace the W1 in Figure 4. Make sure that the DAC has output low noise, or, if no modulation is needed, an RC low pass filtered by be inserted between the DAC and the LIS pin. See Figure 5.

The LIO can still be used to monitor the output current when the LIS is adjusted. 0V to 2.5V indicates the laser current of from 0A to 2A linearly.

Monitoring the Output Current

The output current of the driver can be monitored by measuring the voltage on the LIO pin. This feature is very useful for micro-driver based system where the ADC is available and monitoring the current in real time is required. This pin provides a very low noise voltage signal which is proportional to the output current:

LIO (V) = 2.5×I_out/2.0 (V).

For example, when the output signal equals to 2.5V, the output current is 2A.

LIO can be used to drive an ADC directly, and also be measured by a multimeter during debugging process.

Driver Power Consumption

The power consumption of the driver can be calculated by:

P_driver = I_input × V_{PS} – I_output × V_{LDA},

where P_driver is the power consumed by the driver itself; I_output is the output current;

I_input is the power supply's input current;

V_{PS} is the power supply voltage;

V_{LDA} is the voltage across the laser diode;

η = (I_output × V_{LDA}) / (I_input × V_{PS}).

When P_driver of ATLS2A201D exceeds 1W, a heat sink might be needed. The best way for arranging the heat sinking for the driver is as follows: transferring the heat by sandwiching a piece of gap filler material between the top metal surface of ATLS2A201D and the internal metal surface of the final product as shown in Figure 6 below.

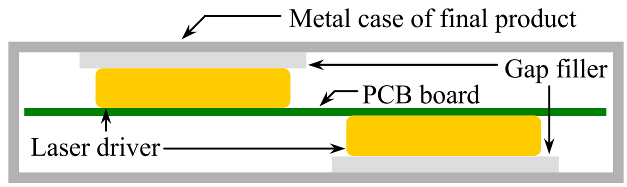

Figure 6 Transferring heat by the gap filler

The gap filler material needs to be mechanically elastic and thermally conductive. One of such products is the T-flex 200 filler sheet made by Lairdtech, the available thickness is between 1mm to 4mm. More detail technical data about this material can be found here: www.lairdtech.com.

To reduce the power consumed by the driver, we recommend using a power supply with its voltage being only about 0.5V (approximately, see below for a more accurate estimate) above the maximum output voltage. For example, for most diode lasers at 2A, the maximum forward voltage across the laser is about 2.8V, thus, using a 3.3V power supply would result in a much lower power consumption compared with using a 5V power supply. Please make sure:

V_{PS} ≥ V_laser_diode_max + 0.15 V_{PS},

where V_laser_diode_max is the maximum possible laser diode voltage.

First Time Power Up

Laser is a high value and vulnerable device. Faults in connections and damages done to the driver during soldering process may damage the laser permanently.

To protect the laser, it is highly recommend to use 2 to 4 regular diodes of >1A to form a "dummy laser" and insert it in the place of the real laser diode, when powering up the driver for the first time. Use an oscilloscope to monitor the LDA voltage at times of power-up and power-down, make sure that there is not over-shoot in voltage. At the same time, use an ammeter in serious with the dummy laser, to make sure that the output current is correct.

After thorough checking free of faults, disconnect the dummy laser and connect the real laser in place.

The driver output voltage range for the laser is between 0.5 to 4V when powered by a 5V power supply.

OUTLINE DIMENSIONS AND MOUNTING

The driver comes in only one package: through hole mount. It is often called DIP (Dual Inline package) or D (short for DIP) package and has a part number: ATLS2A201D. Dimensions of the DIP package driver are shown in Figure 7.

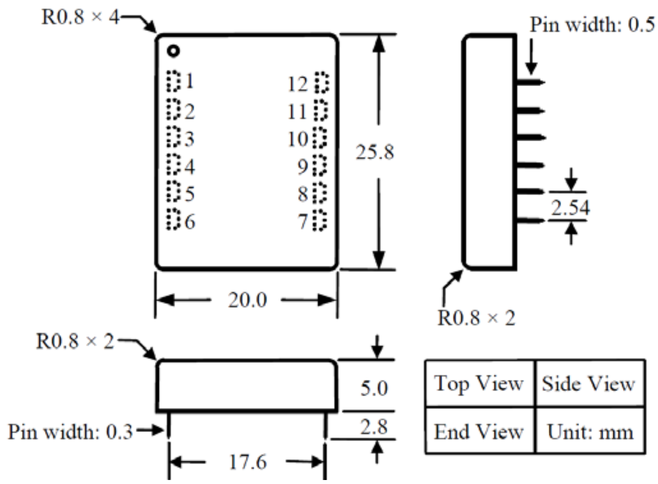

Figure 7 Dimensions of the DIP Package Driver

Figure 8 shows the foot-print which is seen from the end side of the PCB.

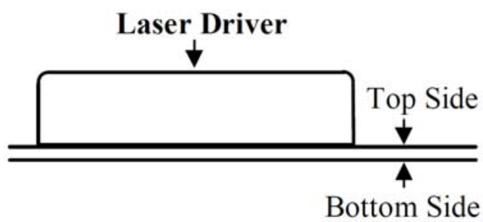

Figure 8 End View of the PCB Foot-print

Figure 9 shows the foot-print which is seen from the top side of the PCB, therefore, it is a "see through" view.

"Tent" (i.e. cover the entire via by the solder mask layer) all the vias under the driver, otherwise, the vias can be shorted by the bottom plate of the driver which is internally connected the ground.

See Figure 9 and 10, it is recommended to use large copper fills for VPS, PGND, and the LDA pins, and other pins if possible, to decrease the thermal resistance between the module and the supporting PCB, to lower the module temperature.

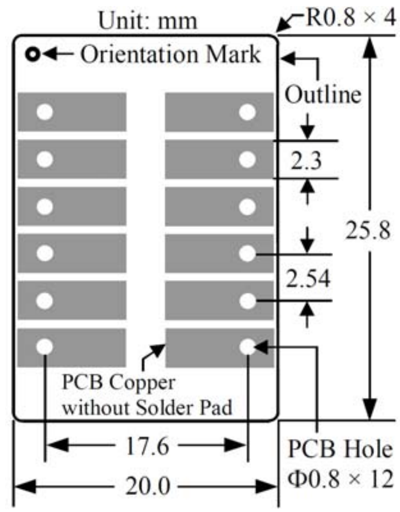

Figure 9 Top View of the Top Side PCB Foot-print

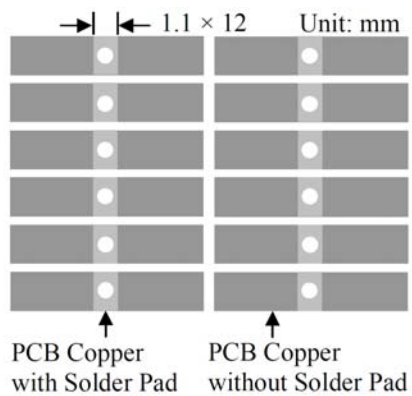

Figure 10 Top View of the Bottom Side PCB Foot-print

Figure 10 shows the foot-print which is seen from the bottom side of the PCB.

ORDERING INFORMATION

Table 3 Part Number

Part #	Description
ATLS2A201D	2A constant current driver in DIP package

Table 4 Unit Price

Quantity	1 – 9	10 – 49	50 – 199	200-499	≥500
ATLS2A201D	\$78.0	\$74.0	\$70.2	66.3	\$62.4

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