FEATURES

High Efficiency: ≥90%

Maximum Output Current: 4A

Current Output Noise: 0.05%

High Stability: 100ppm/°C

Zero EMI

Compact Size

DIP Package Available

APPLICATIONS

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

DESCRIPTION

This laser driver is for driving diode lasers with constant current, high efficiency, low noise, high reliability, zero EMI, and small package. 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).

A high stability low noise 2.5V reference voltage is provided internally for setting the output current. This reference can also be used as the voltage reference for external ADCs and DACs.

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

The ATLS4A201-D is packaged in a 6 sided metal enclosure, which blocks EMIs (Electro-Magnetic Interferences) to prevent the controller and other electronics from interfering each other.

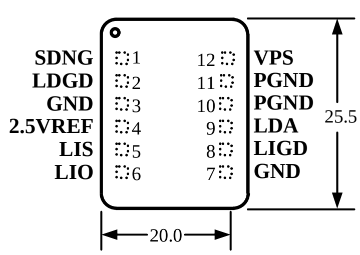

Figure 1 Pin Names and Locations

Figure 1 is the actual size top view of the ATLS4A201-D, which shows the pin names and locations. Its thickness is 4.2mm. The ATLS4A201-D physical photo is shown in Figure 2.The ATLS4A201-D pin functions are shown in table 1.

Figure 2 Physical photo

Table 1 Pin Function Descriptions

Pin #	Mnemonic	Type	Description
1	SDNG	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	GND	Signal Ground	Signal ground pin. Connect ADC and DAC grounds to here.
4	2.5VREF	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 4A linearly.
6	LIO	Analog Output	Laser current output indication. 0V to 2.5V indicates the laser current of from 0A to 4A linearly.
7	GND	Signal Ground	The same as Pin 3
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. 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.
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 = 3.0V to 5.5V.

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SPECIFICATIONS

Laser current control signal level:	0 to 2.5V
Control accuracy:	±0.2%
Laser current indication signal level:	0 to 2.5V
Indication accuracy:	±0.2%
Maximum output current:	4A
Current output noise:	0.05%
Laser driver efficiency:	≥90%
Power input DC voltage:	3.0V to 5.5V
Output reference voltage:	2.5V
Operating temperature:	−20°C to +85°C

OPERATION PRINCIPLE

Figure 3 is the block diagram of the controller.

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 controller is shut down. Only when all these 3 signals go up, the soft start circuit starts enabling the low noise driver.

The laser diode status indication circuit, digital output. 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.

The laser current control indication, analog output. 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. 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 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 4A linearly.

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

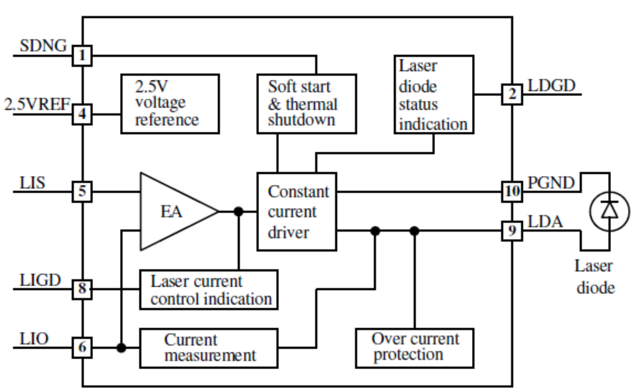

Figure 3 Block Diagram

APPLICATIONS

Figure 4 shows a typical stand-alone application circuit.

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

In Figure 4, the switch S1 is external shut down switch, it can turn on and off the controller with the SDNG 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-controller, with an either open drain or push/pull output. See Figure 5. If not using a switch (S1) to control the laser, leave the SDNG 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-controller, when software/firmware is utilized in the system. See Figure 5.

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 4A 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 controller.

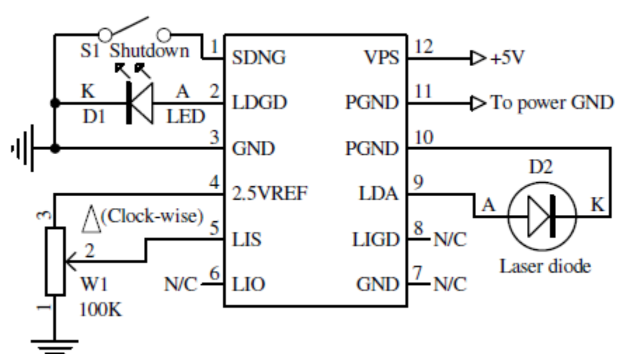

Figure 4 A Typical Stand-alone Application Schematic

Turning the Controller On and Off

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

To turn on: turn on the power by providing the power supply voltage to the controller, turn on the controller by releasing the SDNG pin.

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

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When not controlling by the SDNG pin: leave it unconnected and turn on and off the controller 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 = 4.0×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 4A linearly.

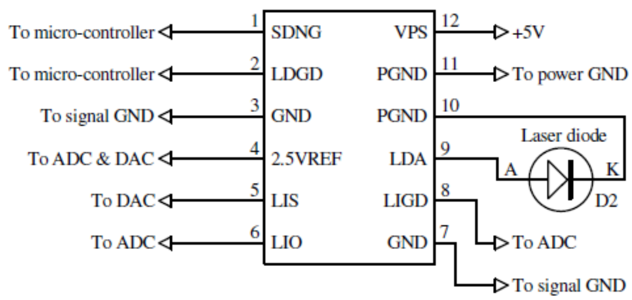

Figure 5 A Typical Micro-processor-based Application

Monitoring the Output Current

The output current of the controller can be monitored by measuring the voltage on the LIO pin. This feature is very useful for miro-controller 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/4.0 (V).

For example, when the output signal equals to 2.5V, the output current is 4A.

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

Controller Power Consumption

The power consumption of the controller can be calculated by:

P_controller = I_output*(VPS – V_laser_diode),

where I_output is the output current;

VPS is the power supply voltage;

V_laser_diode is the voltage across the laser diode.

When the P_controller exceeds 1W, a heat sink might be needed. Under this situation, if prefer not to use the heat sink, this is an option: lowering the controller power consumption by reducing the power supply voltage VPS. Please make sure:

VPS ≥ V_laser_diode_max + 1V,

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 controller during soldering process may damage the laser permanently.

To protect the laser, it is highly recommend to use 3 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 controller 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 controller output voltage range for the laser is between 0.5 to 4V when powered by a 5V power supply.

MECHANICAL DIMENSIONS AND MOUNTING

The controller 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: ATLS4A201-D.

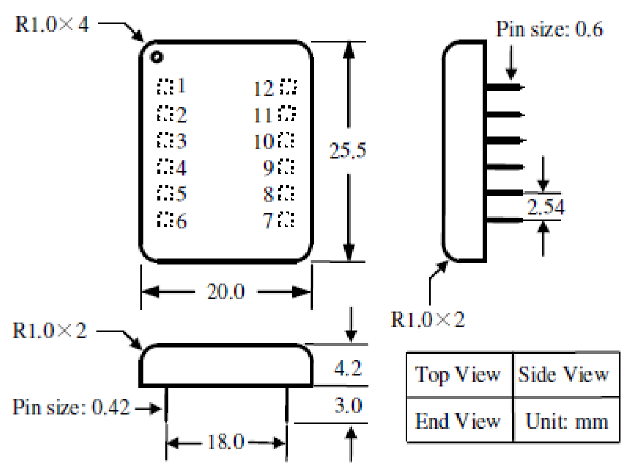

Figure 6 Dimensions of the DIP Package Controller

Figure 6 shows dimensions of the DIP Package Controller.

Figure 7 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 controller, otherwise, the vias can be shorted by the bottom plate of the controller which is internally connected the ground.

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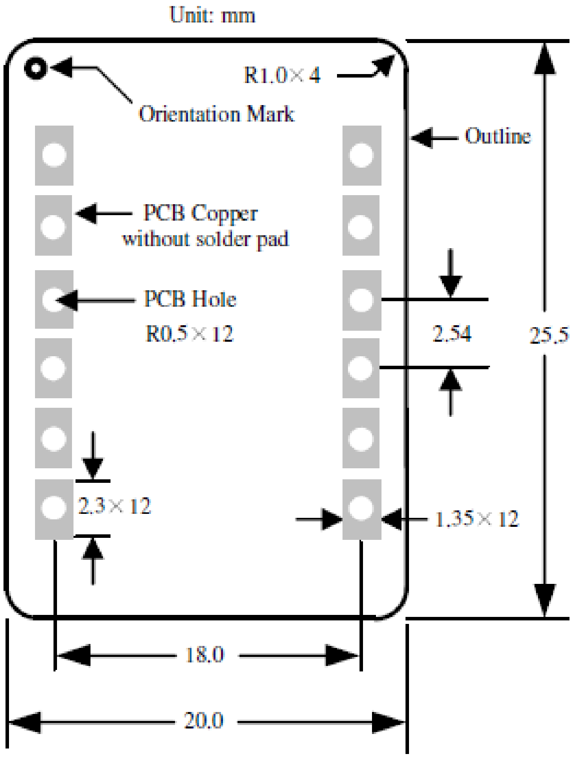

Figure 7 Top Side PCB Foot-print for the DIP Package

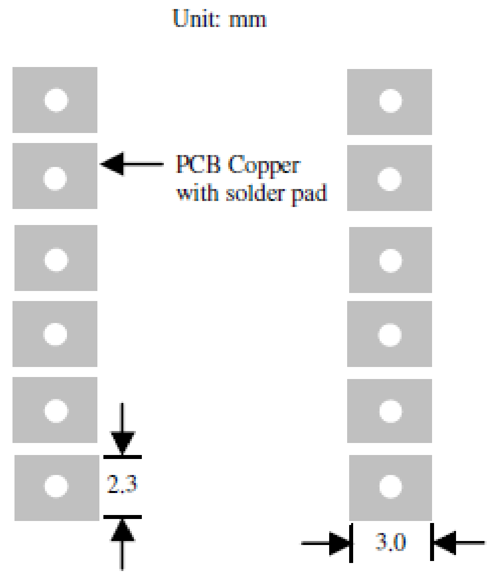

Figure 8 Top View of the Bottom Side PCB Foot-print

Figure 8 shows top View of the Bottom Side PCB Foot-print.

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.

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ORDERING INFORMATION

Part #	Description
ATLS4A201-D	4A constant current controller in DIP package

PRICES

Quantity	1 – 9	10 – 49	50 – 199	200 – 999	≥1000
ATLS4A201-D	$95	$85	$78	$69	$62

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