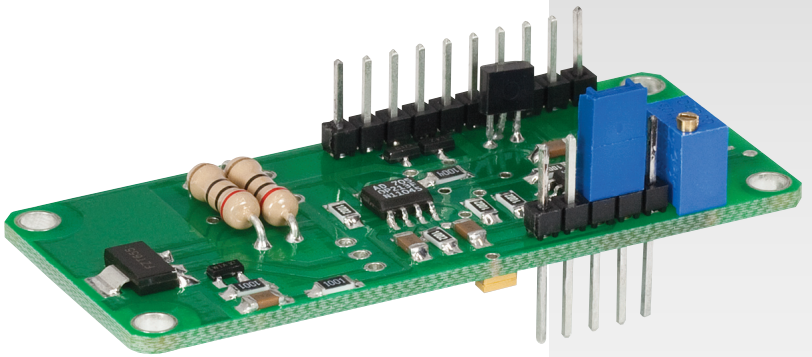
THORLABS

LD1255R
Laser Diode Constant Current Driver

User Guide



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Chapter 1 Warning Symbol Definitions

Below is a list of warning symbols you may encounter in this manual or on your device.

Symbol	Description
	Direct Current
	Alternating Current
	Both Direct and Alternating Current
	Earth Ground Terminal
	Protective Conductor Terminal
	Frame or Chassis Terminal
	Equipotentiality
	On (Supply)
	Off (Supply)
	In Position of a Bi-Stable Push Control
	Out Position of a Bi-Stable Push Control
	Caution: Risk of Electric Shock
	Caution: Hot Surface
	Caution: Risk of Danger
	Warning: Laser Radiation
	Caution: Spinning Blades May Cause Harm

Chapter 2 Safety

WARNING

Direct viewing of laser diode emission may cause eye damage, especially in conjunction with collimating lenses. Extreme care must be taken to prevent any beam from being viewed directly or indirectly through external optics or mirrors.

CAUTION

Do not operate the LD1255R without a laser diode connected because the protection diodes can be damaged and cause the driver to fail.

CAUTION

The LD1255R has a photodiode monitor circuit that only supports lasers having the laser anode attached to the photodiode cathode (such as all of the Toshiba lasers and the Philips laser diodes).

CAUTION

Note: The use of the monitor input with common cathode lasers will cause damage to the laser. However, the LD1255R can be used safely with common cathode lasers as long as the photodiode is not connected to the driver.

Chapter 3 Description

The LD1255R was developed for operating laser diodes in a constant current mode up to a maximum of 250 mA. The LD1255R allows the laser anode to be grounded for added ESD protection of lasers with anodes electrically connected to the case. The laser operating current can be set with an on-board, 12-turn trim pot, an external analog voltage (0 to +5 VDC), or a combination of both. A disable pin and diode protection circuitry have been provided to limit voltage transients produced by the power supply during start up, shut down, or by static shock.

3.1. Features

- Low Current Noise
- Low Temperature Drift
- Added ESD Protection
- Enable/Disable Pin

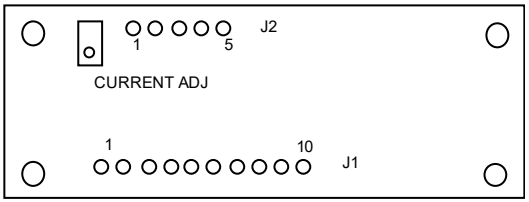

Figure 1 LD1255R Top View4.4

Chapter 4 Specifications

LD1255R	
Output Current	0.2 to 250 mA
Operating Mode	Constant Current
Internal Current Control	12-Turn Potentiometer (On-Board)
External Current Control	0 to 5 V Analog Input Voltage (J1 Pin 4)
Output Current Drift	4.4 µA/°C (Typical)
Current Noise	<1 μA_{RMS}
Operating Voltage	±8 to 12 V
Dimensions	2.45" x 1.03"
ESD Protection	>2 Second Slow-Start Circuit 3.3 V Zener Diode (Forward Voltage Protection for LD) Schottky Diode (Reverse Voltage Protection for LD) LD Disable Pin
Signal Bandwidth	1.2 kHz
Monitor Photodiode Transimpedance Gain	1000 V/A (Note Warnings in Photodiode Monitor Current Section)
Max LD Forward Voltage	3.3 V
Operating Temperature	10 to 30 °C
Storage Temperature	-20 to 50 °C
Warm-Up Time	30 Minutes

Chapter 5 Operation

The LD1255R was designed to be used as either a standalone circuit or a hybrid circuit that can be soldered to another circuit board (using the standard 0.1" headers provided). Four clearance holes are provided at the corners of the board for mounting the LD1255R to stand-offs. These holes may be enlarged to accommodate up to #4 screws.

The LD1255R operates the laser anode at ground potential for added protection against ESD (most laser manufactures mount the laser with the anode to the laser case for thermal benefits). This requires that the LD1255R use a negative power supply to "pull" current from the ground-referenced laser anode. Grounding the laser case helps prevent ESD damage.

There are two single row connectors located on the top of the LD1255R. The 10-pin connector is used for the power supply input, the laser interface, and monitor signals. The signals for J1 are listed below.

J1 Laser and Power Supply Interface	
J1 Pin Number	**Function**
1	+V (+8 to +12 VDC, 10 mA)
2	COMMON
3	-V (-8 to -12 VDC, 0.3 A) Provides Power to Laser
4	EXTERNAL CURRENT CONTROL (0 to +5 V)
5	DISABLE
6	LASER DIODE ANODE (Internally Connected to Pin 2 Ground on LD1255R)
7	LASER DIODE CATHODE
8	MONITOR PHOTODIODE ANODE (from Laser)[1].
9	PHOTODIODE MONITOR OUTPUT (-1 V / mA)
10	LASER CURRENT MONITOR OUTPUT (10 mV / mA)

The 5 pin connector, J2, is used for selecting the External Current Control Mode of operation as shown below.

J2 External Current Control Mode Select	
J2 Pins to Jumper	**Operating Mode**
1 to 2	Mode 1. COMMON Referenced External Current Control
2 to 3	Mode 2. Disable External Current Control

[1] The LD1255R photodiode monitor circuit only supports lasers that have a photodiode with an isolated anode. It will not support common cathode lasers.

Chapter 6 Setup

WARNING

Direct viewing of laser diode emission may cause eye damage, especially in conjunction with collimating lenses. Extreme care must be taken to prevent any beam from being viewed directly or indirectly through external optics or mirrors.

6.1. Laser and Power Supply Connection

The LD1255R requires a clean (not switching) DC bipolar power supply for optimum operation. The positive supply is used only for biasing low power amplifiers and only needs to supply 10 mA of current. The laser drive current is derived from the negative power supply output therefore, it should be capable of providing up to -300 mA of current.

1. Attach the DC power supply to J1.
2. Attach the laser diode to J1.

CAUTION

Do not operate the LD1255R without a laser diode connected because the protection diodes can be damaged and cause the driver to fail.

3. Select the desired Current Control Mode using J2 (see Section 6.3).
4. Turn the Current Control Potentiometer a full 12 turns counter clockwise to ensure the laser current is at a minimum.
5. Apply power to the LD1255R and slowly turn the Current Control Potentiometer clockwise until the desired operating current is achieved. Connect a DVM from Pin 10 of J1 to Pin 4 of J2 to monitor the laser current.

6.2. Circuit Disable

A disable pin has been provided to allow the user to turn the laser diode output on or off without turning the units power supply off. The advantage to this is the elimination of turn-on/ turn-off transients produced by the power supply. If the disable switch is shorted to ground, a transistor will provide a short circuit across the laser diode.

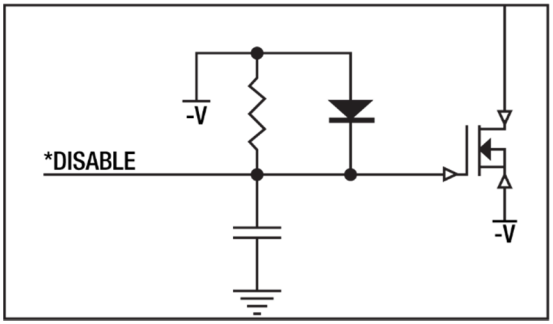

Figure 2 Disable Circuit Schematic

When the disable pin (**J1 Pin 5**) is grounded, it will disable laser operation. When the disable pin (**J1 Pin 5**) is left floating (unconnected), this line will discharge to the negative supply connection and laser operation will be enabled.

Note: It is highly recommended that the laser diode be disabled prior to a power supply turn-on or turn-off to prevent any transients from damaging the laser diode.

6.3. Selecting External Current Control Mode

The current can also be externally controlled by a voltage source applied to J1 pin 4 (function generator, DAC output, etc.). The External Current Control voltage must be referenced to the common output of the power supply. The total drive current is determined by the sum of the manual set point and the External Current Control Voltage.

CAUTION

One of the following Operating modes must be selected BEFORE turning the LD1255R on. Otherwise, the laser will be overdriven and damaged.

Mode 1. COMMON-referenced External Current Control voltage (i.e. 0 to +5 V). An internal level shifter allows the negatively-biased laser to be controlled by a COMMON-referenced positive control voltage. To enable this mode jumper pin 1 to 2 on J2.

In Mode 1, the laser current is: $I_{LD} = 50 * V_{PIN\,4}\ (mA)$

Mode 2. If the External Current Control is not to be used, it should be disabled by jumpering pins 2 and 3 on J2.

6.4. Laser Current Monitor

The laser drive current can be monitored from pin 10 of J1. This output is referenced to the negative supply (J1 Pin 3 or J2 Pin 4) and has the following transfer function:

$$V_{PIN\ 10} = -V + I_{LD} * 10$$

Hint: Using a DVM, the laser current can be read without having to compensate for the -V offset by attaching the (-) lead to J2 Pin 4 and the (+) lead to J1 Pin 10

6.5. Photodiode Current Monitor

CAUTION

The LD1255R has a photodiode monitor circuit that only supports lasers having the laser anode attached to the photodiode cathode (such as all of the Toshiba lasers and the Philips laser diodes).

CAUTION

Note: The use of the monitor input with common cathode lasers will cause damage to the laser. However, the LD1255R can be used safely with common cathode lasers as long as the photodiode is not connected to the driver.

An on-board transimpedance amplifier is provided for lasers with internal monitor photodiodes that are supported by the LD1255R (see warning note above). The amplifier converts the photodiode current to a voltage that can be measured on J1 Pin 9 for monitoring the relative laser output power. The output of Pin 9 has the following transfer function:

Eq. 1 $$V_{PIN\,9} = -1000 * I_{PD}\ (V)$$

If the exact monitor current is known for a given laser power, this output can be converted to laser power as follows:

Eq. 2 $$P = V_{PIN\,9} * \alpha\ (mW)$$

Where α is the monitor photodiode conversion factor (mW / mA).

Note: The LD1255R operates diode lasers only in a constant current mode. Caution must be used to avoid over driving the laser when operating the laser over widely varying temperatures. Diode lasers become more efficient as their operating temperature decreases. It is possible to over drive the laser when operating the laser near the maximum drive current if the laser temperature is lowered. Please consult the laser manufacturer's data sheets.

If you have any questions, please call Thorlabs and an engineer will be happy to assist you.

Chapter 7 Regulatory

As required by the WEEE (Waste Electrical and Electronic Equipment Directive) of the European Community and the corresponding national laws, Thorlabs offers all end users in the EC the possibility to return “end of life” units without incurring disposal charges.

- This offer is valid for Thorlabs electrical and electronic equipment:
- Sold after August 13, 2005
- Marked correspondingly with the crossed out “wheelie bin” logo (see right)
- Sold to a company or institute within the EC
- Currently owned by a company or institute within the EC
- Still complete, not disassembled and not contaminated

Wheelie Bin Logo

As the WEEE directive applies to self-contained operational electrical and electronic products, this end of life take back service does not refer to other Thorlabs products, such as:

- Pure OEM products, that means assemblies to be built into a unit by the user (e.g. OEM laser driver cards)
- Components
- Mechanics and optics
- Left over parts of units disassembled by the user (PCB’s, housings etc.).

If you wish to return a Thorlabs unit for waste recovery, please contact Thorlabs or your nearest dealer for further information.

Waste Treatment is Your Own Responsibility

If you do not return an “end of life” unit to Thorlabs, you must hand it to a company specialized in waste recovery. Do not dispose of the unit in a litter bin or at a public waste disposal site.

Ecological Background

It is well known that WEEE pollutes the environment by releasing toxic products during decomposition. The aim of the European RoHS directive is to reduce the content of toxic substances in electronic products in the future.

The intent of the WEEE directive is to enforce the recycling of WEEE. A controlled recycling of end of life products will thereby avoid negative impacts on the environment.

Chapter 8 Thorlabs Worldwide Contacts

For technical support or sales inquiries, please visit us at
www.thorlabs.com/contact for our most up-to-date contact information.

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