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Thorlabs Model LD1255
Laser Diode Constant Current Driver

Description:

The LD1255 was developed for operating laser diodes in a constant current mode up to a maximum of 250mA. The LD1255 allows the laser anode to be grounded for added ESD protection of lasers that have their anode 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 +5VDC) 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.

New Feature:

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

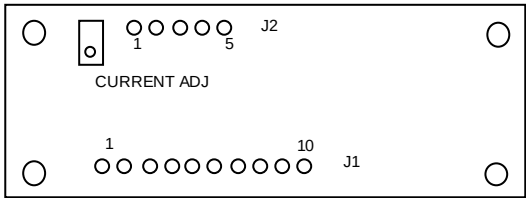

Figure 1 LD1255 Top View

Specifications:

Output Current:	0.2 to 250mA
Operating Mode:	Constant Current
Internal Current Control:	12 turn potentiometer (on board)
Ext. Current Control:	0 – 5 Volt analog input voltage (J1 pin 4)
Output Current Drift:	2 μA/°C (Typ)
Current Noise:	< 1 μA_{RMS}
Operating Voltage:	+/- 8 to 12 Volts
Dimensions:	2.5” x 1”
ESD Protection:	160 msec slow start circuit 3.3V zener diode (forward voltage protection for LD) Schottky diode (reverse voltage protection for LD) LD DISABLE pin
Signal Bandwidth:	1.2 kHz
Monitor Photo Diode Transimpedance Gain:	1000 μV/μA (note warnings in Photodiode monitor current section)
Max LD forward voltage:	3.3 Volts
Operating Temp.:	10 to 30 °C
Storage Temp.:	-20 to 50 °C
Warm-up Time:	30 min.

LD1255 OPERATION:

The LD1255 was designed to be used as either a stand alone 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 LD1255 to stand-offs. These holes may be enlarged to accommodate up to #4 screws.

The LD1255 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 LD1255 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 LD1255. The 10 pin connector is used for the power supply input, the laser interface, and monitor signals. Table 1 lists the signals on J1:

J1 Pin Number	Function
1	+V (+8 to +12VDC, 10mA)
2	COMMON
3	-V (-8 to -12VDC, 0.3A) provides power to laser
4	EXTERNAL CURRENT CONTROL (0 to +5V, or -V to (-V + 5))
5	DISABLE
6	LASER DIODE ANODE (internally connected to pin 2 ground on LD1255)
7	LASER DIODE CATHODE
8	MONITOR PHOTO DIODE ANODE (from laser) see Note 1.
9	PHOTODIODE MONITOR OUTPUT (-1V / mA)
10	LASER CURRENT MONITOR OUTPUT (10mV / mA)

Table 1 - J1 Laser & Power Supply Interface

Note 1: The LD1255 photodiode monitor circuit only supports lasers that have a photodiode with an isolated anode. It will not support common cathode lasers such as the CQL7825/D and CQL7840/D.

The 5 pin connector, J2, is used for selecting the External Current Control Mode of operation as shown in Table 2:

J2 Pins to Jumper	Operating Mode
1to 2	Mode 1. COMMON referenced External Current Control
2 to 3	Mode 2. Disable External Current Control

Table 2 - J2 External Current Control Mode Select

SETUP:

Laser & Power Supply Connection:

The LD1255 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 10mA of current. The laser drive current is derived from the negative power supply output therefore, it should be capable of providing up to -300mA of current.

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

   Warning: Do not operate the LD1255 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 below).

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 LD1255 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.

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.

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.

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.

WARNING: One of the following Operating modes must be selected BEFORE turning the LD1255 on. Otherwise, the laser will be overdriven and damaged.

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

In Mode 1, the laser current is: $I_{LD} = 50 * V_{PIN4}$ (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.

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:

$$V_{PIN10} = -V + I_{LD} * 10$$

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.

Photodiode Current Monitor:

Warning: The LD1255 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 with the exception of the CQL7825/D and the CQL7840/D).

The use of the monitor input with common cathode lasers will cause damage to the laser. However, the LD1255 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 LD1255 (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 $V_{PIN9} = -1000 * I_{PD}$ (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 $P = V_{PIN9} * \alpha$ (mW)

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

IMPORTANT NOTE: The LD1255 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 manufacturers data sheets.

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

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