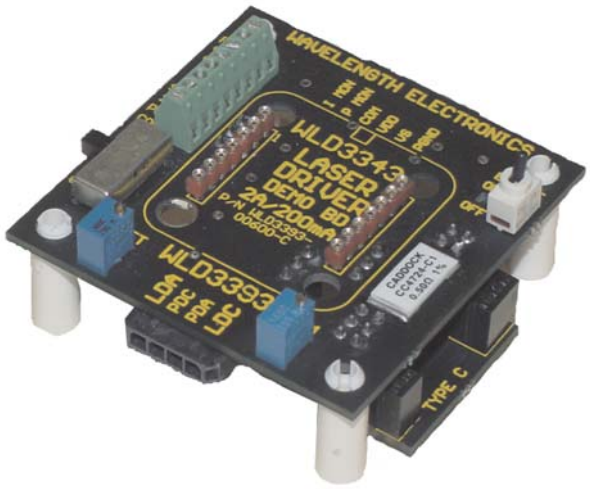
October 8, 2003

WAVELENGTH ELECTRONICS

WLD3393 Rev B

WLD3343 Laser Diode Driver
Demo Board

WLD3343 NOT INCLUDED



GENERAL DESCRIPTION:

Use the WLD3393 Demo Board to rapidly prototype a complete laser diode control system using the cutting edge technology of the WLD3343 Laser Diode Driver. Onboard switches, connectors, and trimpots make configuration and operation simple. Input and output cables are also included.

Operate in either constant current (CC) or constant power (CP) mode. An onboard 12-turn trimpot allows fine adjustment of laser diode forward current (CC Mode) or monitor photodiode current (CP Mode). Another trimpot sets the laser diode forward current limit. The input cable allows easy connection to your power supply and monitoring equipment while the output cable quickly connects to your laser diode and monitor photodiode.

High power applications can use the onboard fan connector to power a WXC303 or WXC304 (+5 VDC or +12 VDC) fan attached to a WHS302 heatsink.

FEATURES:

- Operates all Laser Diode Pin Configurations
- Two Configurable Output Current Ranges (200 mA or 2.0 Amps)
- Constant Current or Constant Power Operation
- Onboard Current Setpoint Trimpot
- Adjustable Current Limit
- Enable/Disable Switch and LED
- Includes Input/Output Cable Set
- Includes a Fan Connector
- Easily Connects to an External Control Potentiometer or Voltage Source

Figure 1: Top View

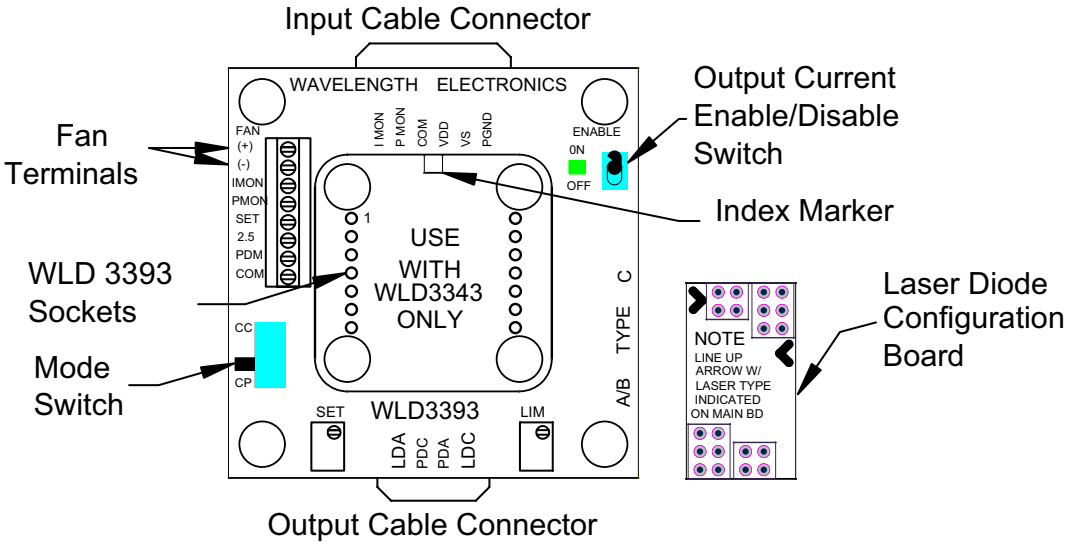
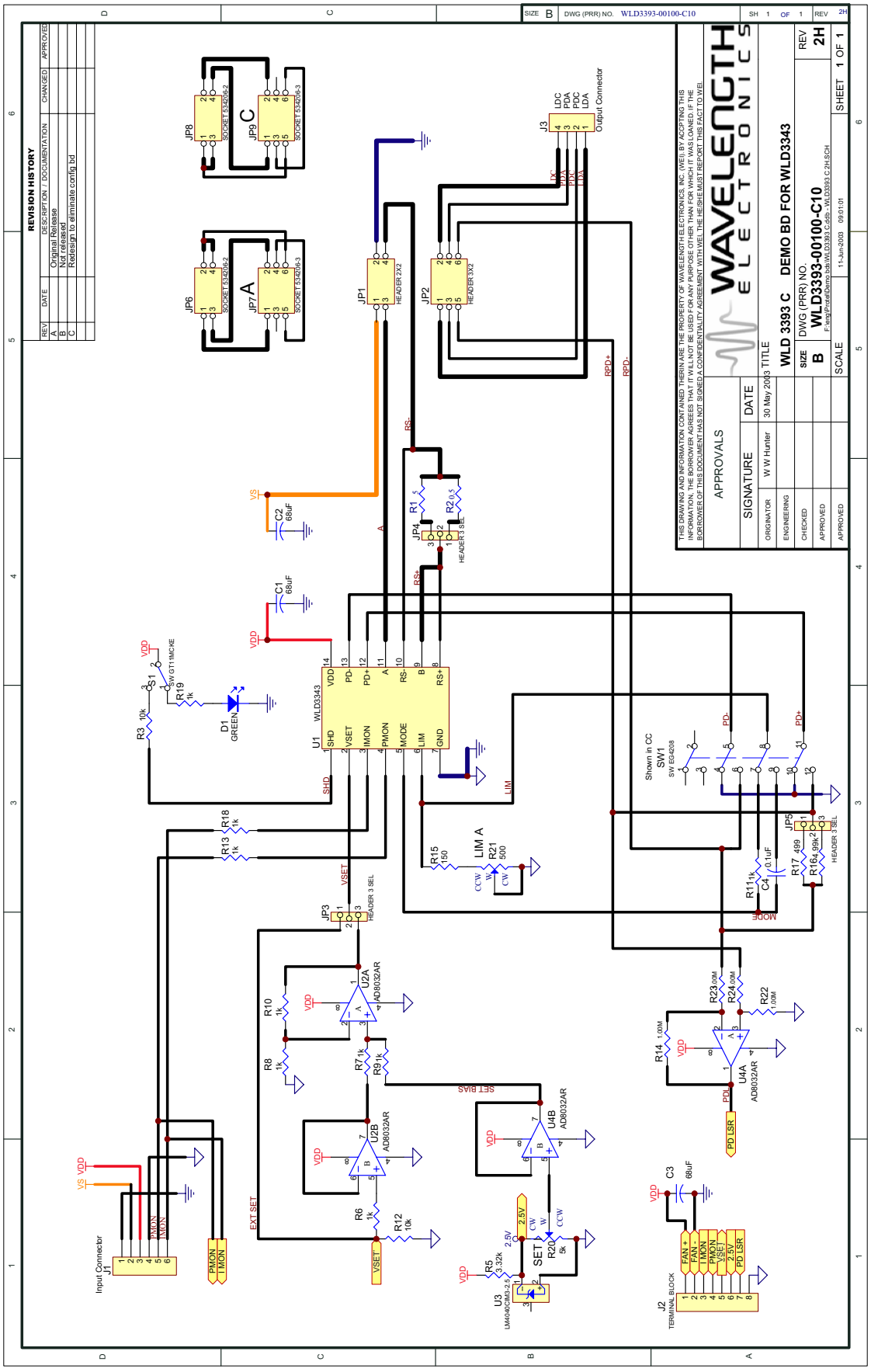


Figure 2: WLD3393 Schematic



SETUP INFORMATION

To set up the WLD for your project, you'll need a few pieces of information. Here's a handy list of what you'll need to know before you start wiring [it's also good to have this information if you need to call for technical support].

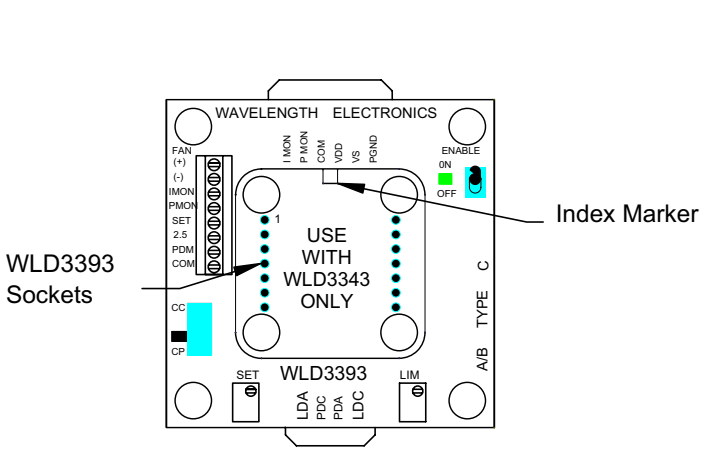
Description	Value in your application	Notes
Laser Diode Configuration	**A** **B** or **C**	See Figure 4 for schematics. If you have no photodiode, follow instructions for Type A laser diodes.
Laser Diode Max Current		
Operating LD Current		If greater than 200mA, make sure to check the SOA curve in the WLD3343 datasheet and use a Thermal Solutions kit (Fan, Heatsink, and Thermal Washer) or equivalent
Operating PD Current		
Operating Mode	**CP** or **CC**	Constant Current: Laser diode current is fixed, power varies. Constant Power: Laser diode current varies. Photodiode current is fixed. Power output is fixed.
Power Supply Voltage		If greater than 5V, make sure to check the SOA curve in the WLD3343 datasheet and use a Thermal Solutions kit (Fan, Heatsink, and Thermal Washer) or equivalent

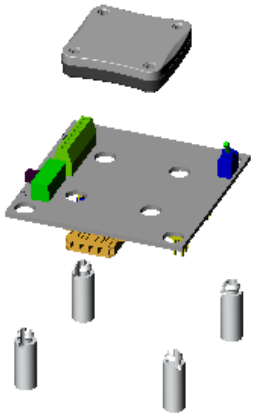
Follow the next ten steps sequentially to safely operate the WLD with your laser diode. Complete steps 1 through 4 before applying power to the board.

STEP 1: INSTALL the WLD3343 on the demo board

Match up the notch in the WLD3343 with the index marker shown in Figure 3. Align the WLD3343 pins with the WLD3393 sockets ensuring that all pins are lined up. Press firmly to seat the WLD3343. **Make sure that none of the pins of the WLD3343 were bent during insertion before continuing.**

Figure 3: Location of Index Marker and sockets; Standoff assembly





4-40 x 0.625" NYLON
STANDOFFS
4 REQUIRED

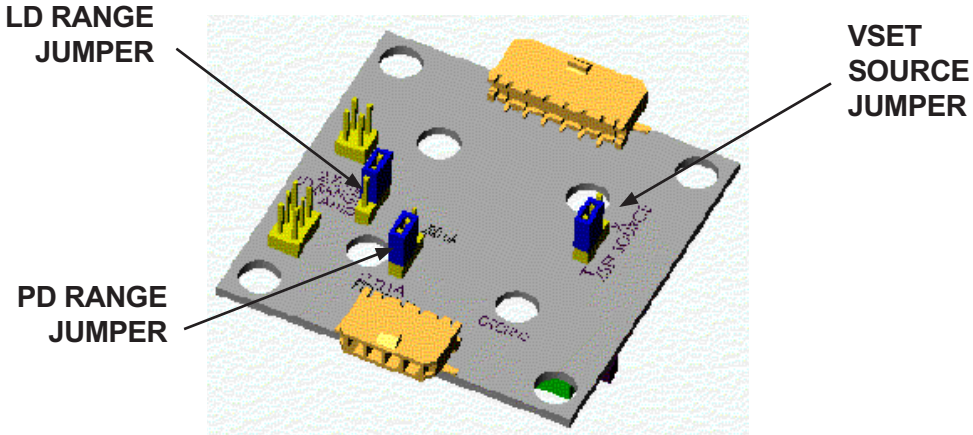
STEP 2: CONFIGURE FOR CONSTANT CURRENT OR CONSTANT POWER MODE

The two modes of operation supported by the WLD3393 are constant current and constant power mode. **It is very important to note that the WLD3393 should be configured for either constant current or constant power mode BEFORE power is applied. Changing operating mode while the WLD3393 is operating can result in damage to your laser diode.** In constant current mode, V_{Set} correlates directly to the laser diode current, regardless of laser diode power intensity. In constant power mode, the WLD controls the laser diode using the photodiode to achieve a laser intensity that is directly proportional to V_{Set}.

Constant Current mode ignores the laser's photodiode. The WLD3393, however, is designed to allow you to monitor the laser's photodiode while running in this mode. Monitor the voltage at the PDM pin on the terminal block on the top side of the WLD3393. Before powering the unit on to operate in constant current mode, make sure that the mode switch is in the CC position (see Figure 1). Select the output current range by setting the LD RANGE jumper on the back of the WLD3393 to either the 200mA or the 2A position. See Figure 4 for location.

Constant power mode utilizes the laser's photodiode to regulate the intensity of the laser in proportion to V_{Set}. While the unit is NOT powered, make sure the mode switch is in the CP position to configure the WLD3393 for constant power mode (see Figure 1). Set the PD RANGE jumper on the bottom of the WLD3393 to either the 200μA or the 2mA range, depending on the specifications of your photodiode. See Figure 6 for the location of the PD Current Range jumper. It is important to make sure that the correct PD current range is selected as the WLD3393 may overdrive the laser if the PD range is configured incorrectly, resulting in permanent damage to the laser. Use the LD RANGE jumper to select between the 200mA and 2A range based on the rating of the laser load. See Figure 4 for the location of this jumper.

Figure 4: Bottom View, Jumper Locations



STEP 3: INSTALL THE LASER DIODE CONFIGURATION BOARD

CAUTION: If the WLD3393 is configured incorrectly for the type of laser diode you are using, damage can result to your laser diode and/or the WLD3393. Refer to Figure 5 to determine the type of laser diode being used. To configure the WLD3393 for your laser diode type, connect the configuration board to the bottom of the WLD3393 so that the arrow on the protruding edge of the configuration board points to either A/B or C. Refer to Figure 6 for example installation.

Figure 5: Laser Diode Type Schemaics: A/B or C

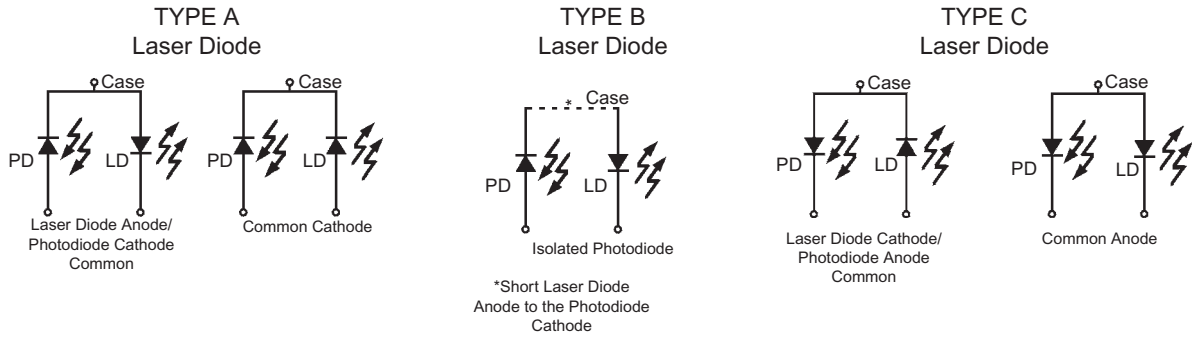
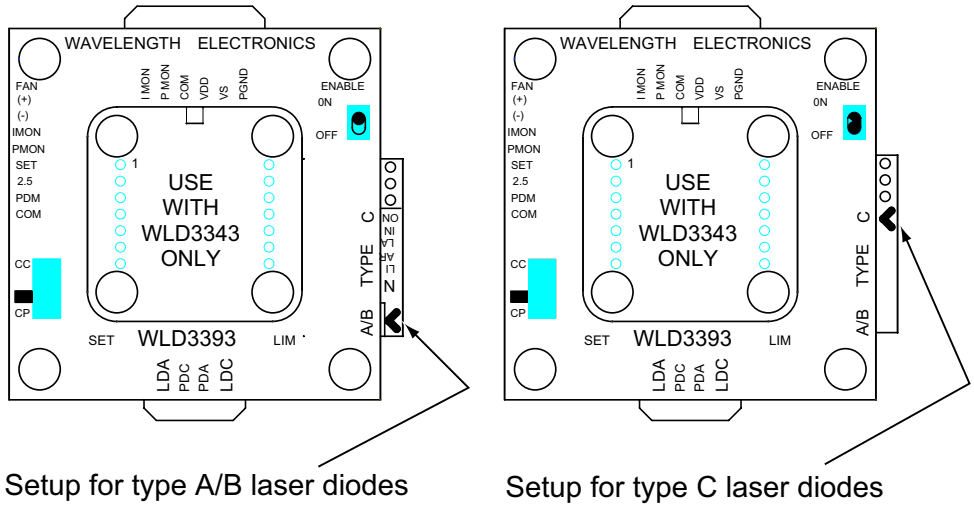


Figure 6 - Examples of proper alignment of Laser Diode Configuration Board



STEP 4: ATTACH THE HEATSINK AND FAN (optional for less than +5V, 200mA operation)

HEATSINK REQUIREMENTS. The WLD3343 is designed to handle currents as high as 2.2A. The WLD3393 demo board, however, limits output current to 2.0A. Attach a heatsink (such as WHS302 with thermal washer WTW002) to the WLD3343 when driving currents higher than 500mA. Attach a fan (such as WXC303 (+5VDC) or WXC304 (+12VDC)) to the heatsink for output currents exceeding 1.0A. If using Wavelength accessories, refer to the WHS302, WTW002, WXC303, and / or the WXC304 datasheets for assembly instructions.

FAN CONNECTIONS. Connect the fan leads to the (+) and (-) fan terminal positions on the terminal block and secure with a small flat head screwdriver. The fan connects to the V_{DD} supply, not V_S, so care must be exercised to ensure that the proper fan is selected, either +5VDC or +12VDC, when using dual power supplies. Optionally, for lower noise operation, the fan leads may be connected directly to a separate power supply compatible with the fan.

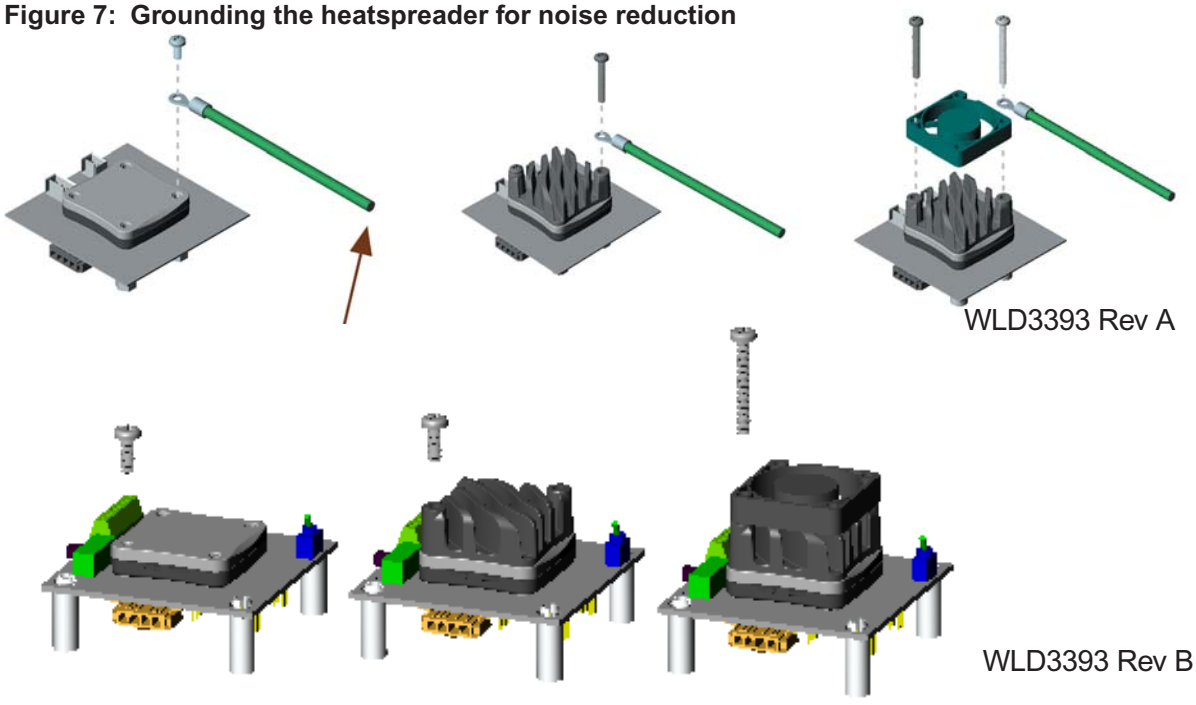
STEP 5: ATTACH THE V_{DD} AND V_S POWER SUPPLIES

The WLD3393 has two power supply connections, V_S and V_{DD}. V_S provides power for driving the laser (minimum current capacity greater than limit current setting). V_{DD} provides power to the control electronics (minimum 100mA). V_{DD} can range from +5 to +12V. V_S can range from +4.5 to +12V. For simple operation tie V_{DD} to V_S. Use PGND for the power return. The common (COM) terminal on the WLD3393 is not intended to act as a power connection, but as the low noise ground reference for connecting an external VSET source, and for monitoring the IMON, PMON, and PDM signals.

A separate V_S power supply allows the output current stage to operate below the minimum 5V required for the control electronics or up to the +12V maximum (for multiple laser diodes in series). Select V_S approximately 2.0 volts above the maximum voltage drop across the laser diode to reduce the power dissipation in the WLD3343 component and minimize your heatsinking requirements. Note that for type C laser diodes in Constant Power mode V_{DD} must be greater than or equal to V_S to keep the photodiode signal in range.

NOISE REDUCTION. For better performance, to reduce noise in the control electronics, it is recommended to connect V_{DD} and V_S together at the power supply, running separate wires for V_{DD} and V_S. Grounding the heatspreader also can reduce noise. With WLD3393 Rev. B, the screw threads contact a grounded PEM on the board; no ground strap is necessary.

Figure 7: Grounding the heatspreader for noise reduction



STEP 6: SET THE LASER DIODE CURRENT LIMIT

The WLD3393 LIM trimpot adjusts the laser diode current limit from zero to the full 200 mA or 2.0 Amps, depending on the laser diode current range selected. For accurate laser diode current limit configuration follow these steps sequentially:

1. Connect the demo board's LDA and LDC terminals directly to an ammeter capable of sensing your maximum laser diode current. If you are using more than +5VDC power supply voltage, place a resistor in series with the ammeter to reduce power dissipation across the WLD. The following equations should be used.

$$R_{LOAD} = \frac{V_S - 2.5}{I_{LIM}} \qquad R_{LOAD}\text{ power rating} = I^2_{LIM} * R_{LOAD}$$

   Example calculation: V_S = +12V, I_{LIM} = 2A; R_{LOAD} = (12-2.5)/2 = 4.75 ohm; 2^2*4.75= 19W

   Another example: V_S = +9V, I_{LIM} = 0.5A; R_{LOAD} = (9-2.5)/0.5 = 13 ohm; $(0.5)^2$*13 = 3.25W

2. Configure the demo board for Constant Current (CC) mode operation. See Step 2.
3. Turn the SET trimpot fully counter clockwise (OFF). Adjust the LIM trimpot fully clockwise (ON).
4. Apply power to the WLD3393 and enable the output current by switching the enable switch to the "ON" position. See Figure 1 to locate the switch.
5. Turn the SET trimpot clockwise until the desired maximum current is achieved. Turn the LIM trimpot counter clockwise until the current just begins to decrease. Turn the SET trimpot back fully counterclockwise.
6. Disable the output current by switching the enable switch to the "OFF" position. Remove power from the WLD3393.

STEP 7: CONNECT THE LASER DIODE AND MONITOR PHOTODIODE

With power removed from the WLD3393 board, connect the output (4 wire cable) to your laser diode as indicated in Table 1. Firmly press the output cable into the output connector.

Table 1: Output Cable color code

PIN #	Wire Color	Function
1	RED	LDA
2	GREEN	PDC
3	WHITE	PDA
4	BLACK	LDC

STEP 8: MONITOR THE LASER DIODE AND PHOTODIODE CURRENTS

The input connector includes three signals for externally monitoring the WLD3343 laser driver output. IMON, PMON, and PDM allow for monitoring of laser diode current and power intensity depending on the selected mode of operation. The voltages at IMON, PMON, and PDM are all referenced to the common terminal (COM) on the input connector.

Table 2: Input Cable color code

PIN #	Wire Color	Function
1	BLUE	PGND
2	ORANGE	VS
3	RED	VDD
4	BLACK	COM
5	WHITE	P MON
6	GREEN	I MON

IMON provides a mechanism for externally monitoring the laser diode current. IMON is available at all times in both CC and CP modes. In the 200mA range, V_{IMON} has a transfer function of 100mA/V. In the 2.0A range, V_{IMON} has a transfer function of 1.0A/V. Table 3 summarizes this data.

PMON provides an external indication of the laser diode intensity by measuring photodiode current. Since PD+ and PD- on the WLD3343 are shorted together in CC mode, PMON will only monitor photodiode current in CP mode. When operated in the 200μA range, V_{PMON} has a transfer function of 100μA/V. When operated in the 2mA range, V_{PMON} has a transfer function of 1mA/V. Table 4 summarizes this data.

PDM provides a mechanism for monitoring photodiode current in either CC or CP mode. While PMON monitors the feedback used by the control electronics to maintain constant power of the laser, PDM is an external monitor that is independent of the control electronics of the WLD3343. The transfer function for V_{PDM} to I_{PD} is the same as for the PMON signal. PDM is only accessible on the terminal block.

Table 3: Convert IMON voltage to Laser Diode Current

200 mA Range	2.0 Amp Range
$LDI = V_{IMON} * 100$ [mA]	$LDI = V_{IMON}$ [AMPS]

Table 4: Convert PMON or PDM voltage to Photodiode Current

200 μA Range	2 mA Range
$PDI = V_{PMON} * 100$ [μA]	$PDI = V_{PMON}$ [mA]

STEP 9: ADJUST THE SETPOINT VOLTAGE

The setpoint controls the output of the WLD3343. In constant current mode the setpoint is directly proportional to the laser diode current. In constant power mode the setpoint is directly proportional to photodiode current, allowing for control of the power of the light emitted from the laser diode.

The setpoint voltage can be adjusted either by using the onboard SET trimpot, by applying an external setpoint voltage, or by summing an external setpoint voltage with the setpoint dialed in using the SET trimpot. The sum of the external setpoint voltage and the value dialed in using the SET trimpot can be adjusted from 0 to 2.5 Volts.

To use only the onboard SET trimpot, place the VSET SOURCE jumper on the bottom of the WLD3393 evaluation board in the "T" position, and do not connect an external voltage source to the SET terminal on the terminal block. The SET trimpot will allow the setpoint be be adjusted from 0V to 2.5V. Figure 6 shows the jumper location.

To use an external voltage source summed with the setpoint voltage from the on board SET trimpot, place the VSET SOURCE jumper on the bottom of the WLD3393 to the "T" position. Connect an external voltage source to the SET terminal on the terminal block on the top of the WLD3393 evaluation board. The resulting setpoint voltage will be the sum of the voltage dialed in using the SET trimpot, and the voltage applied to the SET terminal. Figure 6 shows the jumper location.

To use an external voltage source only for the setpoint, place the VSET SOURCE jumper on the bottom of the WLD3393 board to the "X" position and connect the external setpoint voltage source to the SET terminal on the terminal block on the top side of the WLD3393 evaluation board. When the SET SOURCE jumper is in the "X" position, the voltage dialed in using the SET trimpot on the WLD3393 is ignored. Figure 6 shows the jumper location.

In case an external voltage source is not availabe, but setpoint adjustment needs to be external, a remotely located potentiometer can easily be connected to the WLD3393 to adjust the setpoint. To used a remote potentiometer, connect the CW lead of the potentiometer to the terminal position marked 2.5 on the terminal block on the top of the WLD3393 board. Connect the CCW lead of the potentiometer to the COM terminal and connect the wiper to the SET terminal and ensure that the VSET SOURCE jumper on the bottom of the board is set to the X position.

Table 5: Relate VSET voltage to Laser Diode Current

200 mA Range	2.0 Amp Range
$LDI = V_{SET} * 100$ [mA]	$LDI = V_{SET}$ [AMPS]

Table 6: Relate V_{SET} voltage to Photodiode Current

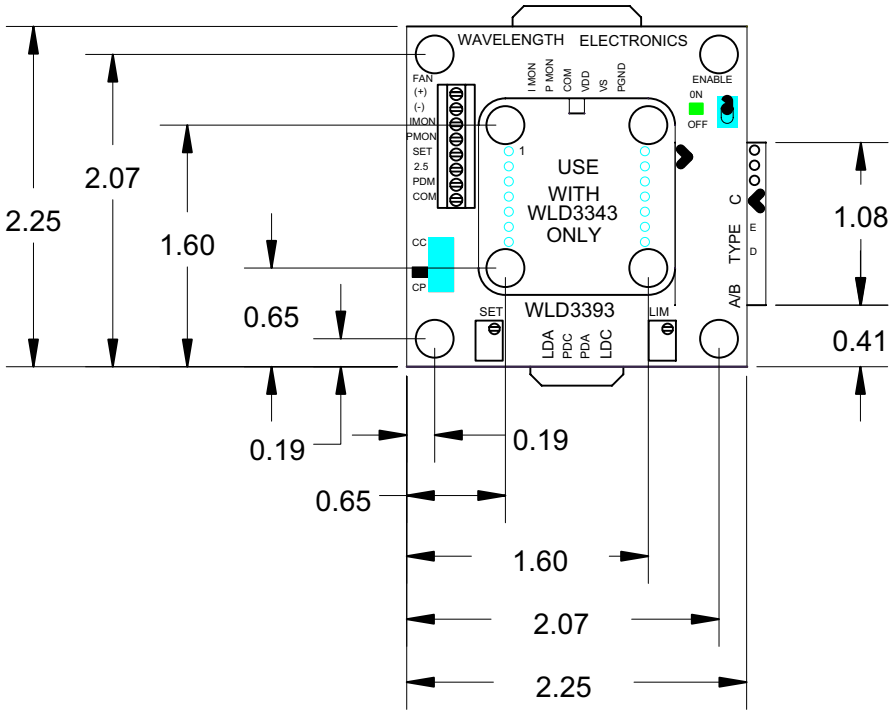
200 µA Range	2 mA Range
$PDI = V_{PMON} * 100$ [µA]	$PDI = V_{PMON}$ [mA]

STEP 10: ENABLE OR DISABLE THE OUTPUT CURRENT

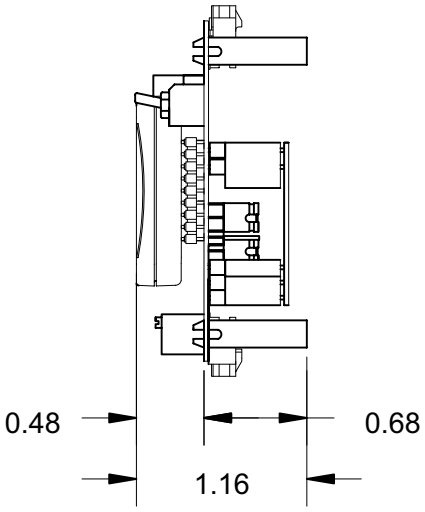
The WLD3343 output current can be enabled and disabled using the onboard toggle switch. The output is enabled when the green ON LED indicator is lit (see Figure 1).

CHARACTERIZE YOUR LASER DIODE. Configure the WLD3393 for Constant Current mode. Step the external voltage setpoint to scan laser diode current. Monitor the intensity of the laser diode using PDM.

TOP VIEW (inches)



RIGHT SIDE VIEW



CERTIFICATION AND WARRANTY

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