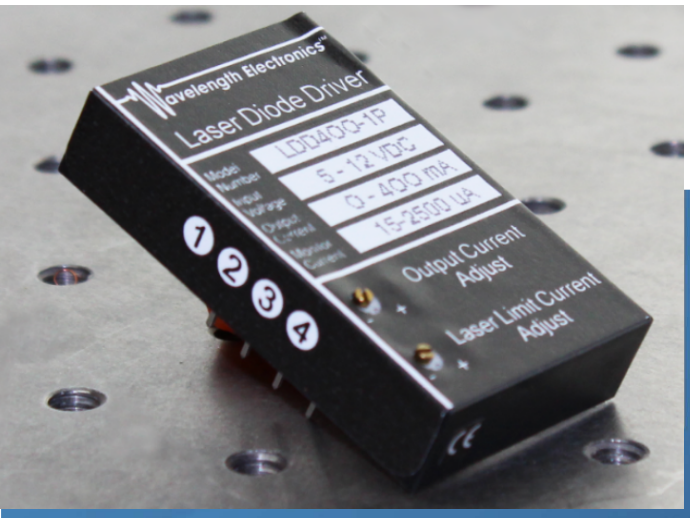



*This product is sold and supported in the USA by*

**LASER LAB SOURCE**
marketplace for **Scientists & Engineers**

**contact@LaserLabSoure.com**

**800.887.5065**

January, 2013

WAVELENGTH ELECTRONICS

# LDD P Series
# Laser Diode Drivers

Low Noise Driver for Laser Diodes


RoHS Compliant

## GENERAL DESCRIPTION:

The LDD P Series of laser diode drivers come in three compact models to work with all laser diode / photodiode configurations. Each model is available in 200 mA and 400 mA versions to best fit your laser diode requirements.

When it is essential to have high performance in your application, these low noise drivers offer excellent current stability in constant current mode or power stability in constant power mode.

Precisely control the laser diode or photodiode setpoint current with the on-board Output Current Adjust trimpot or via a remote voltage to the modulation input. The modulation input's small signal 3 dB bandwidth is DC to 2 MHz in constant current mode and dependent on photodiode speed in constant power mode.

Measure laser diode and photodiode current from two buffered monitor outputs.

Optional evaluation boards are available to assist with operating and evaluating any LDD P series module.

## FEATURES:

- Up to 400 mA Current Drive Capacity
- Operates in Constant Current or Constant Power Modes
- +5 to +12 V single supply operation
- Output power stability <0.02% typical (24 hours, ambient conditions)
- 12-Turn Trimpots control Current Setpoint and Limit Setpoint
- Operates all low power Laser Diodes
- Constant Current Modulation to 2 MHz
- Slow start circuitry
- Buffered Measurement Outputs

***Online Design Tools at***
**www.teamwavelength.com**

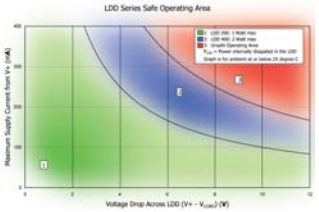
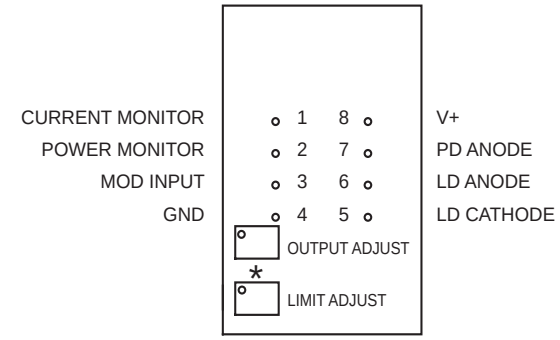


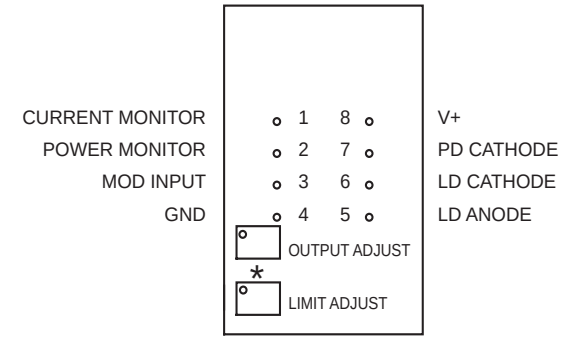

**Figure 1**
Top View Pin Layout and Descriptions

**TOP VIEW**

LDD 1P or LDD 3P




LDD 2P

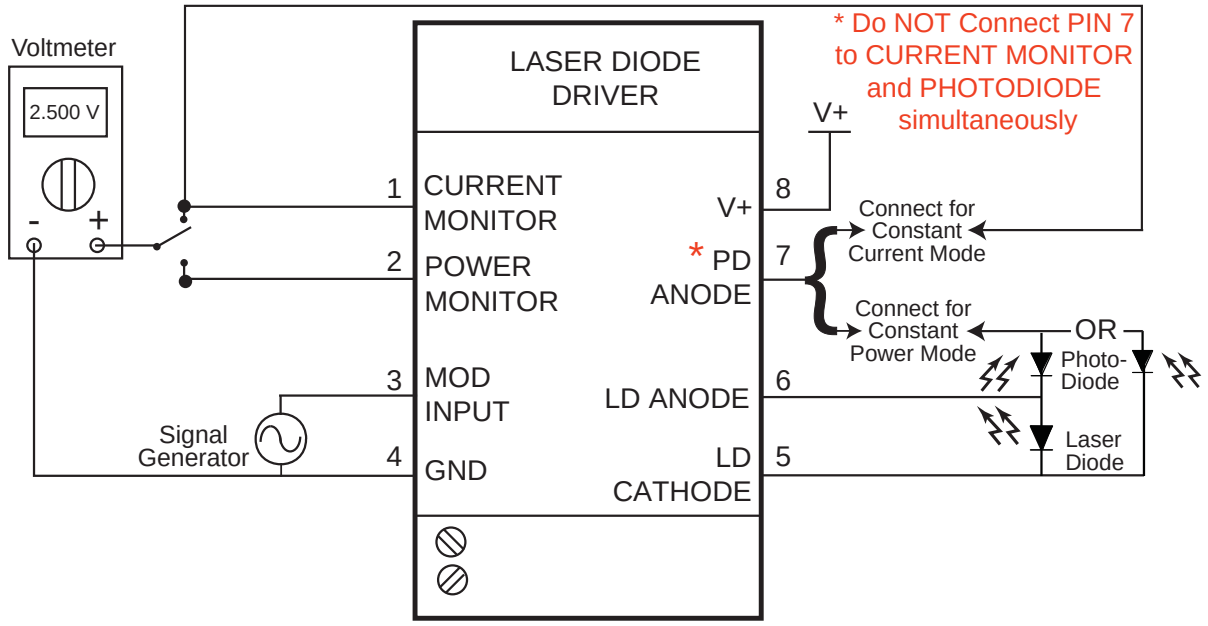


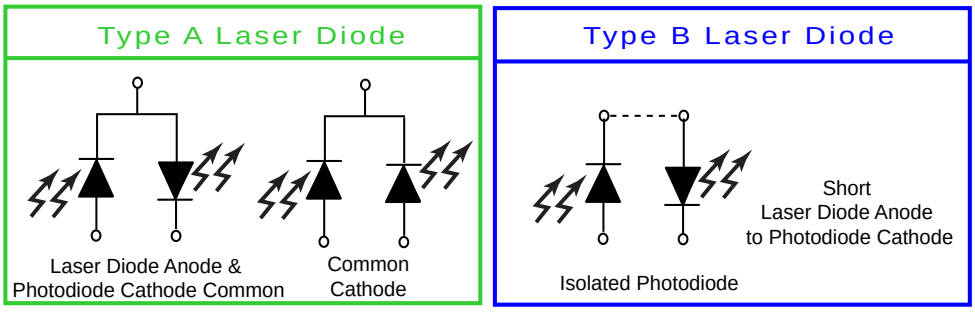

* Trimpots shown for proper orientation

**QUICK CONNECT DIAGRAM**

External Connections For LDD 1P or LDD 3P
(Type A/B Laser Diodes)

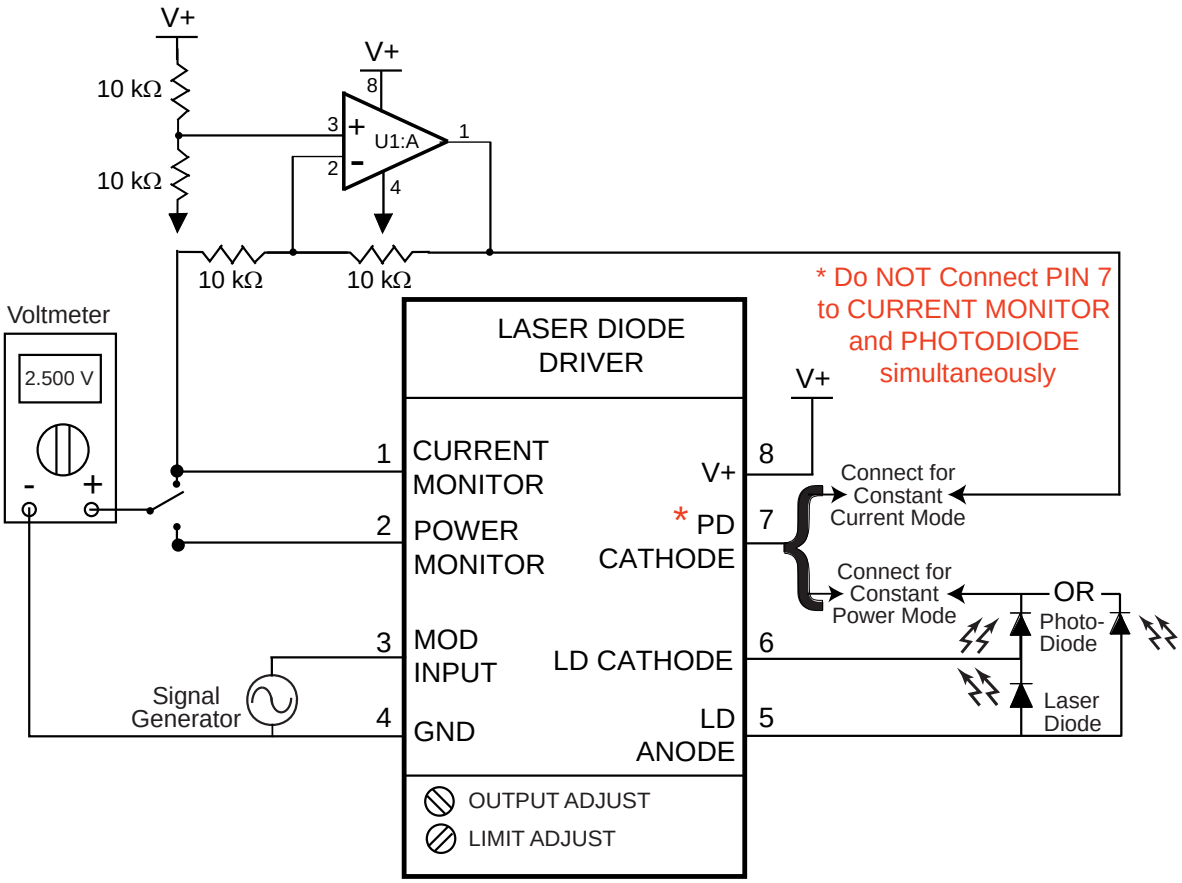
## LDD 1P or LDD 3P Models

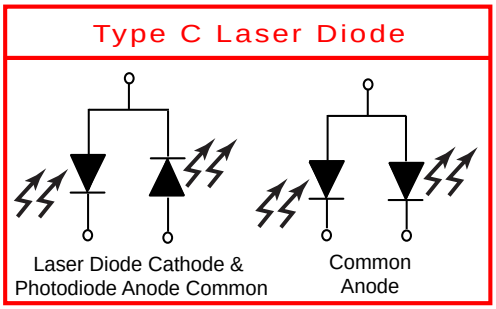


## QUICK CONNECT DIAGRAM

External Connections For LDD 2P
(Type C Laser Diodes)



## ELECTRICAL AND OPERATING SPECIFICATIONS



| ABSOLUTE MAXIMUM RATINGS<br>RATING | SYMBOL | VALUE | UNIT |
|---|---|---|---|
| Supply Voltage (Voltage on Pin 8) | $V_{DD}$ | +5 to +12.5 | Volts DC |
| Output Current (See SOA Chart) | $I_{LD}$ | 200 or 400 | mA |
| Power Dissipation, $T_{AMBIENT}$ = +25˚C [1] | $P_{MAX}$ | 1 or 2 | Watts |
| Operating Temp- case, $T_{AMB}$ = +25˚C [1] | $T_{OPR}$ | 0 to + 50 | ˚C |
| Storage Temperature | $T_{STG}$ | - 40 to +125 | ˚C |
| Weight | | < 1 | oz |
| Soldering Temp | | 260˚C (10 secs) | |

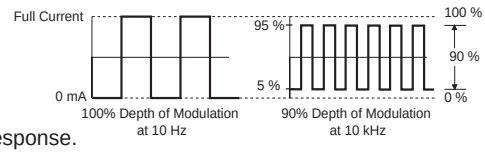
| PARAMETER | | | | | | |
|---|---|---|---|---|---|---|
| **For Laser Type** | **A or B** | | **A or B** | | **C** | |
| **MODEL NUMBER** | **LDD200-1P** | **LDD400-1P** | **LDD200-3P** | **LDD400-3P** | **LDD200-2P** | **LDD400-2P** |
| **CONSTANT CURRENT CONTROL** | 0 - 200 mA | 0 - 400 mA | 0 - 200 mA | 0 - 400 mA | 0 - 200 mA | 0 - 400 mA |
| Temperature Coefficient | < 100 ppm / ˚C | | < 100 ppm / ˚C | | < 100 ppm / ˚C | |
| Long Term Stability, 24 hours [2] | < 50 ppm | | < 50 ppm | | < 50 ppm | |
| Noise and Ripple (rms) [3] | < 5 µA | | < 5 µA | | < 5 µA | |
| Current Limit Range | 0 - 200 mA | 0 - 400 mA | 0 - 200 mA | 0 - 400 mA | 0 - 200 mA | 0 - 400 mA |
| Current Monitor Transfer Function | 80 mA / V | 160 mA / V | 80 mA / V | 160 mA / V | 80 mA / V | 160 mA / V |
| **CONSTANT POWER CONTROL** | | | | | | |
| Photodiode Range | 15-2500 µA | | 5-125 µA | | 15-2500 µA | |
| Power Stability, 24 hours [2] | < 0.02% | | < 0.02% | | < 0.02% | |
| Power Monitor Transfer Function | 1000 µA / V | | 50 µA / V | | 1000 µA / V | |
| **MODULATION** | | | | | | |
| Input Impedance | 1 MΩ | | 1 MΩ | | 1 MΩ | |
| Depth of Modulation (at 10kHz) [4] | 90% | | 90% | | 90% | |
| Constant Current | | | | | | |
| Bandwidth, small signal sine wave 3dB | up to 2 MHz | | up to 2 MHz | | up to 2 MHz | |
| Transfer Function [LD] | -40 mA / V | -80 mA / V | -40 mA / V | -80 mA / V | -40 mA / V | -80 mA / V |
| Constant Power | | | | | | |
| Bandwidth, Constant Power [5] | Depends on PD | | Depends on PD | | Depends on PD | |
| Transfer Function [PD] | -500 µA / V | | -25 µA / V | | -500 µA / V | |
| Mod Input Safe Range | -0.5V < ModIn < $V_{DD}$ + 0.5V | | -0.5V < ModIn < $V_{DD}$ + 0.5V | | -0.5V < ModIn < $V_{DD}$ + 0.5V | |
| **POWER SUPPLY** | | | | | | |
| Voltage, $V_{DD}$, min | 5 V | | 5 V | | 5 V | |
| Voltage, $V_{DD}$, max | 12 V | | 12 V | | 12 V | |
| Current, $V_{DD}$ supply, quiescent | 50 mA | | 50 mA | | 50 mA | |
| Power Up Trip Point [6] | 4.9 V | | 4.9 V | | 4.9 V | |
| Power Down Trip Point [6] | 4.2 V | | 4.2 V | | 4.2 V | |
| **Setpoint vs. Monitor Accuracy** | < 5% | | < 5% | | < 5% | |
| Warm-up to rated accuracy | 1 hour | | 1 hour | | 1 hour | |

[1]. Maximum Operating Power derates above 25˚C. The online Safe Operating Area (SOA) Chart includes this derating. http://www.teamwavelength.com/support/calculator/soa/soald.php

[2]. Stability tests were performed in an ambient air environment.

[3]. Laser diode forward current noise. Test was performed by measuring the AC voltage across a 50 Ω metal film resistor in series with a laser diode.

[4]. As squarewave modulation frequency increases, the peak-to-peak output amplitude diminishes. For example, these graphs show the waveform shape at 10 Hz and 10 kHz. Depth of modulation continues to decrease after 10 kHz.




[5]. Modulation bandwidth in constant power mode depends on photodiode response.

[6]. The LDD P Series has internal control circuitry which turns the output on and off depending on the voltage at pin 8. When the voltage reaches the power up trip point, the module soft starts the laser diode. When the voltage reaches the power down trip point, the module shunts current around the laser diode, powering it down in a controlled fashion.

## PIN DESCRIPTIONS

### LDD 1 P AND LDD 3P

| Pin # | Name | Function |
|---|---|---|
| 1 | CURRENT MONITOR | Current Monitor (measures Laser Diode current). 0 to 2.5 V range. |
| 2 | POWER MONITOR | Power Monitor (measures Photodiode current). 0 to 2.5 V range. |
| 3 | MOD INPUT | Inverting modulation input. 0 to 5 V range. |
| 4 | GND | Power supply and monitor common connection. |
| 5 | LD CATHODE | Laser Diode Cathode. |
| 6 | LD ANODE | Laser Diode Anode. (Pin 6 internally shorted to pin 8.) |
| 7 | PD ANODE | Photodiode Anode. |
| 8 | V+ | Power supply voltage connection. (Pin 6 internally shorted to pin 8.)<br>Supply range: +5 V to +12 VDC |

### LDD 2 P

| Pin # | Name | Function |
|---|---|---|
| 1 | CURRENT MONITOR | Current Monitor (measures Laser Diode current). 0 to 2.5 V range. |
| 2 | POWER MONITOR | Power Monitor (measures Photodiode current). 0 to 2.5 V range. |
| 3 | MOD INPUT | Inverting modulation input. 0 to 5 V range. |
| 4 | GND | Power supply and monitor common connection. (Pin 4 internally shorted to pin 6.) |
| 5 | LD ANODE | Laser Diode Anode. |
| 6 | LD CATHODE | Laser Diode Cathode. (Pin 6 internally shorted to pin 4.) |
| 7 | PD CATHODE | Photodiode Cathode. |
| 8 | V+ | Power supply voltage connection.<br>Supply range: +5 V to +12 VDC |

## ORDERING INFORMATION

**LDD -** (MODEL)

**200 -** (LASER DIODE CURRENT RANGE)
- 200 = 0 to 200 mA
- 400 = 0 to 400 mA

**1** (PHOTODIODE CURRENT RANGE & LASER DIODE PIN CONFIGURATION)
- 1 = 50 to 2500 µA (Type A or B lasers)
- 2 = 50 to 2500 µA (Type C lasers)
- 3 = 5 to 125 µA (Type A or B lasers)

**P** (FUNCTIONS)
- P = Laser Diode Current Limit & Analog Modulation Input

***Evaluation Board and Cable****

| Laser Type | Model Number | Description |
|---|---|---|
| A, B, or C | LDDPCB-P | Evaluation Board |
| A, B or C | LDDCAB-50 | 50 cm cable with 3-pin teflon connector |

*LDD P sold separately

## SAFE OPERATING AREA & HEATSINK REQUIREMENTS

**Caution:**

Do not exceed the Safe Operating Area (SOA). Exceeding the SOA voids the warranty.

To determine if the operating parameters fall within the SOA of the device, the maximum voltage drop across the driver and the maximum current must be plotted on the SOA curves. An online tool for calculating your load line is at http://www.teamwavelength.com/support/calculator/soa/soald.php. For any application that includes the LDD Evaluation PCB, be sure to include the appropriate $R_D$ and $R_{4a}$ resistance values in the series resistance in order to achieve an accurate SOA analysis. Resistances are detailed on page 22.

These values are used for the example SOA determination:

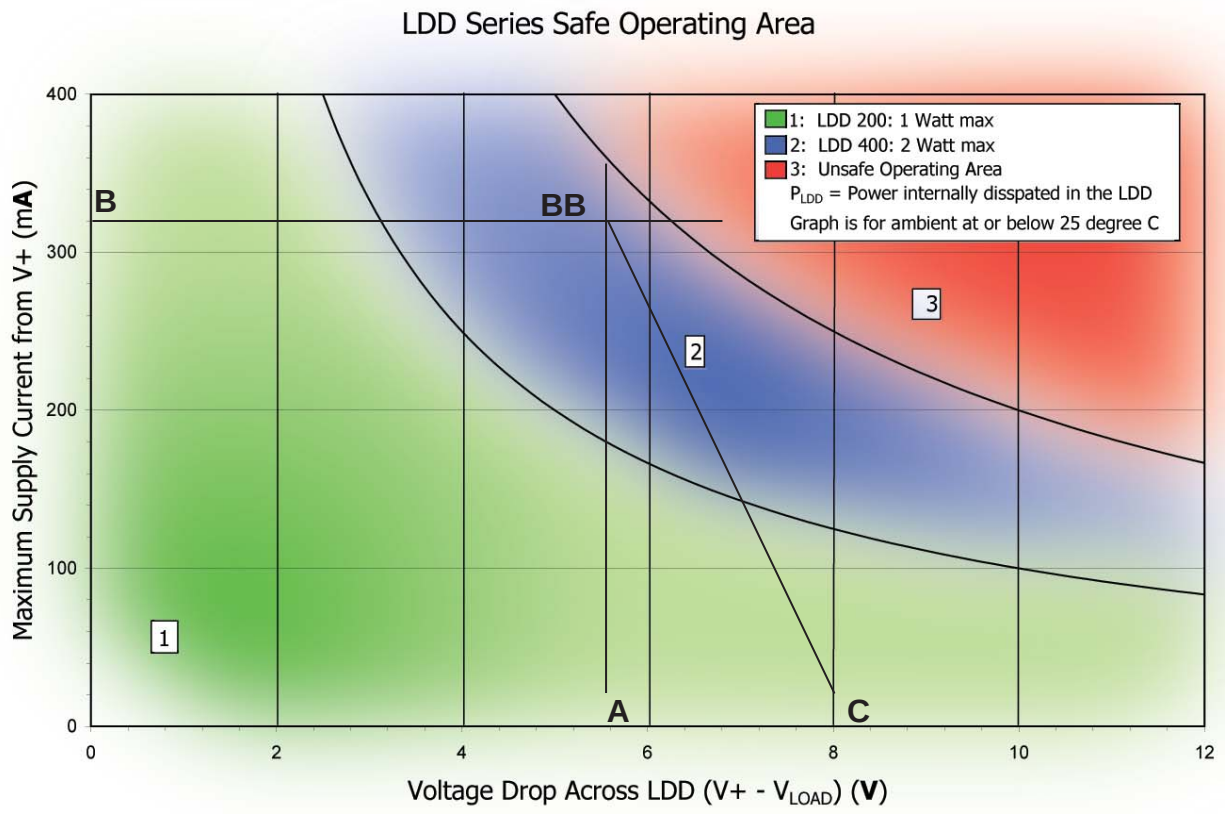
$V_S$ = 8 volts
$V_{LOAD}$ = 2.5 volts
$I_{LOAD}$ = 300 mA

} These values are determined from the specifications of the laser diode.

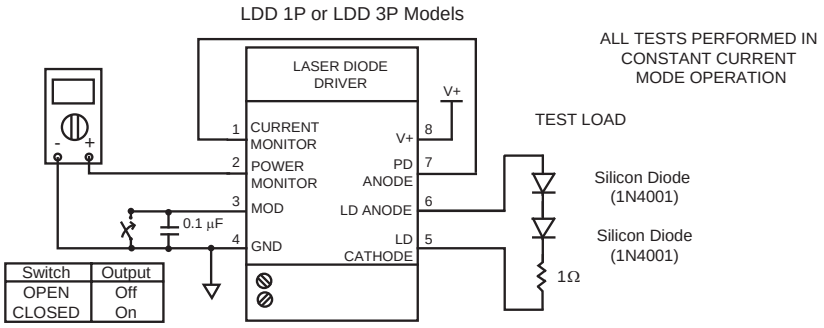
Follow these steps:

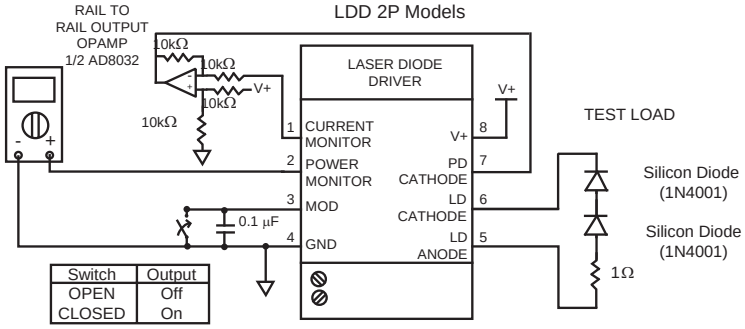
1. Determine the maximum voltage drop across the driver, $V_S$ - $V_{LOAD}$, and mark on the X axis. Example: 8 volts - 2.5 volts = 5.5 volts, Point A)
2. Determine the maximum current, $I_{LOAD}$, through the driver and mark on the Y axis: (300 mA, Point B)
3. Draw a horizontal line through Point B across the chart. (Line BB)
4. Draw a vertical line from Point A to the maximum current line indicated by Line BB.
5. Mark $V_S$ on the X axis. (Point C)
6. Draw the Load Line from where the vertical line from point A intersects Line BB down to Point C.

Refer to the chart shown below and note that the Load Line is in the Safe Operating Areas for the LDD400 at 25°C ambient. Note that only Area 1 is safe for the LDD200. Both Areas 1 and 2 are safe for the LDD400.



# TEST SETUP: TIMING CHARACTERISTICS & PERFORMANCE GRAPHS




## Timing Characteristics

| Symbol | Parameter | Test Points | Test Conditions * | Typical |
|---|---|---|---|---|
| $t_{DELAY}$ | Time delay between Power ON and Laser Diode current start | Load | LDD400-1P - 1.0 Ω | 27.5 ms |
| | | | LDD400-2P - 1.0 Ω | 27.5 ms |
| | | | LDD400-3P - 1.0 Ω | 27.5 ms |
| $t_{RISE}$ | Square Wave Response, 10% to 90% | Load | LDD400-1P - 1.0 Ω | 120 nsec |
| | | | LDD400-2P - 1.0 Ω | 220 nsec |
| | | | LDD400-3P - 1.0 Ω | 120 nsec |
| $t_{FALL}$ | Square Wave Response, 90% to 10% | Load | LDD400-1P - 1.0 Ω | 120 nsec |
| | | | LDD400-2P - 1.0 Ω | 220 nsec |
| | | | LDD400-3P - 1.0 Ω | 120 nsec |
| $t_{SOFT\ START}$ | Minimum (current setpoint 10% full scale) | Load | LDD400-1P - 1.0 Ω | 140 msec |
| | | | LDD400-2P - 1.0 Ω | 180 msec |
| | | | LDD400-3P - 1.0 Ω | 140 msec |
| | Maximum (current setpoint 100% full scale) | Load | LDD400-1P - 1.0 Ω | 300 msec |
| | | | LDD400-2P - 1.0 Ω | 300 msec |
| | | | LDD400-3P - 1.0 Ω | 300 msec |

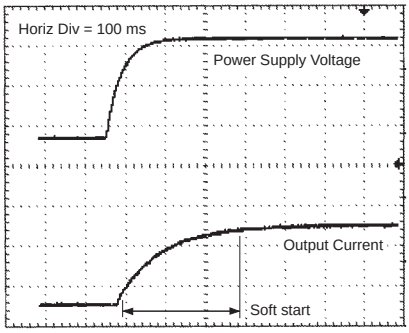
* LDD200 model results are comparable

Note: Keep Operating Setpoint Below Current Limit Setting. These graphs do not represent the LDD P performance while the Current Limit Circuit is triggered.

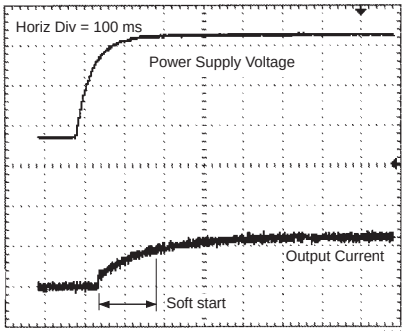
Warning: The Current Limit Circuit is not an absolute/failsafe clamp. If the operating setpoint exceeds the limit setting, and a fast modulation signal is input, very short overshoots of the current limit are possible (150 nsec). If the photodiode feedback signal is lost or very slow, the LDD P can drive to its maximum output current.

# TYPICAL PERFORMANCE GRAPHS
## LDD 1P & LDD 3P: WHEN NOT IN CURRENT LIMIT

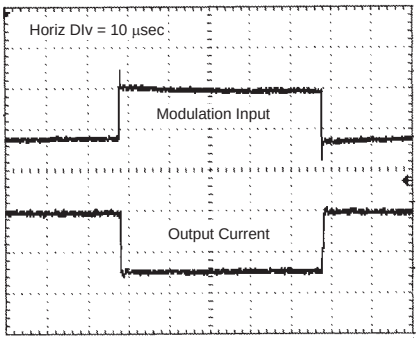
**Typical Soft Start Timing**
**(current setpoint at 100% full scale)**



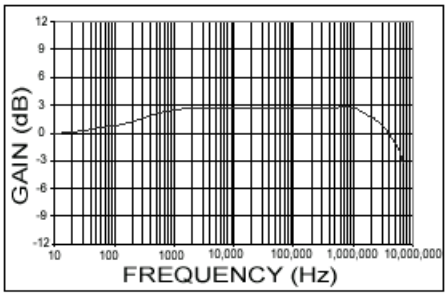

**Typical Soft Start Timing**
**(current setpoint at 10% full scale)**




**10 kHz square wave response**

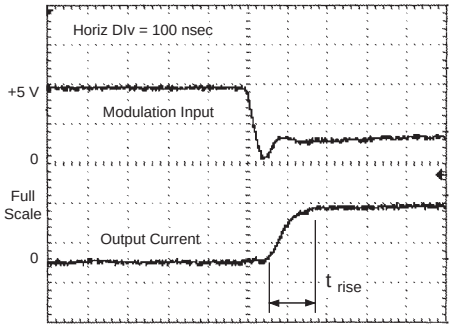



**Large Signal Frequency Response**

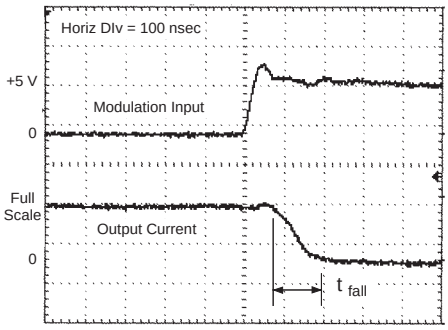



Note: Gain normalized to output at 10 Hz.

**10 kHz square wave rise time**




**10 kHz square wave fall time**

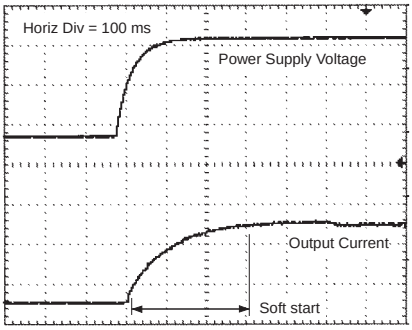



Note: Keep Operating Setpoint Below Current Limit Setting. These graphs do not represent the LDD P performance while the Current Limit Circuit is triggered.

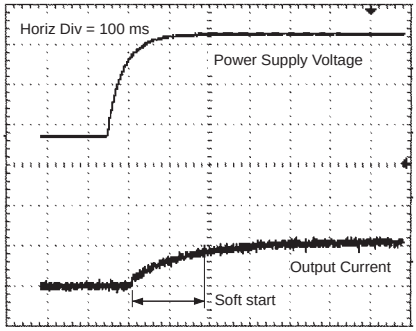
Warning: The Current Limit Circuit is not an absolute/failsafe clamp. If the operating setpoint exceeds the limit setting, and a fast modulation signal is input, very short overshoots of the current limit are possible (150 nsec). If the photodiode feedback signal is lost or very slow, the LDD P can drive to its maximum output current.

# TYPICAL PERFORMANCE GRAPHS
# LDD 2P: WHEN NOT IN CURRENT LIMIT

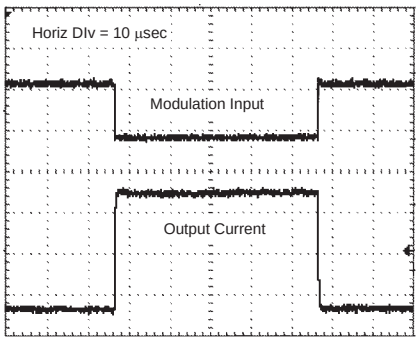
**Typical Soft Start Timing**
**(current setpoint at 100% full scale)**



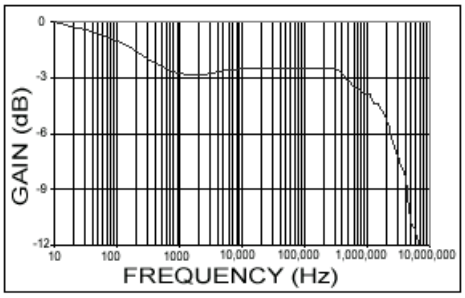

**Typical Soft Start Timing**
**(current setpoint at 10% full scale)**




**10 kHz square wave response**

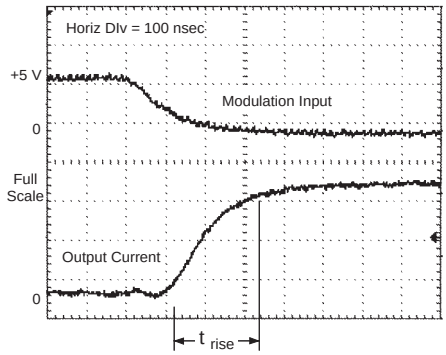



**Large Signal Frequency Response**

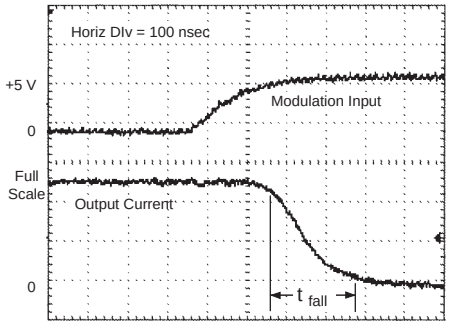



Note: Gain normalized to output at 10 Hz.

**10 kHz square wave rise time**




**10 kHz square wave fall time**




Note: Keep Operating Setpoint Below Current Limit Setting. These graphs do not represent the LDD P performance while the Current Limit Circuit is triggered.

Warning: The Current Limit Circuit is not an absolute/failsafe clamp. If the operating setpoint exceeds the limit setting, and a fast modulation signal is input, very short overshoots of the current limit are possible (150 nsec). If the photodiode feedback signal is lost or very slow, the LDD P can drive to its maximum output current.

## POWER SUPPLY AND NOISE

The LDD P Series Laser Diode Drivers are designed for stable, low noise operation. The power supply you select will directly affect the noise performance of the driver. We recommend using a regulated, linear supply for optimum performance. Depending on your requirements, you may be able to use a switching power supply. Each case must be evaluated independently because a switching power supply will affect noise, transient, and stability performance. The LDD P series can be purchased with the LDDPCB series evaluation kit for easy initial operation.

## LASER SAFETY ISSUES

***ATTENTION:*** If you plan to operate the LDD P with any Wavelength temperature controller, you **may** need to use separate power supplies. If the TE cooler or thermistor is connected to the laser diode, please contact the factory for technical assistance.

***ATTENTION:*** Exceeding the maximum specified operating current ($I_{OP\ MAX}$) will damage your laser diode. Become familiar with the LDD P Series module operation and the exact specifications of your laser diode before attaching it to the LDD P module. Seek assistance from someone with experience working with laser diodes if you have not operated one before.

***ATTENTION:*** The following instruments may cause momentary opens, shorts, or impedance changes that will damage a laser diode if attached to the output of a laser diode driver.

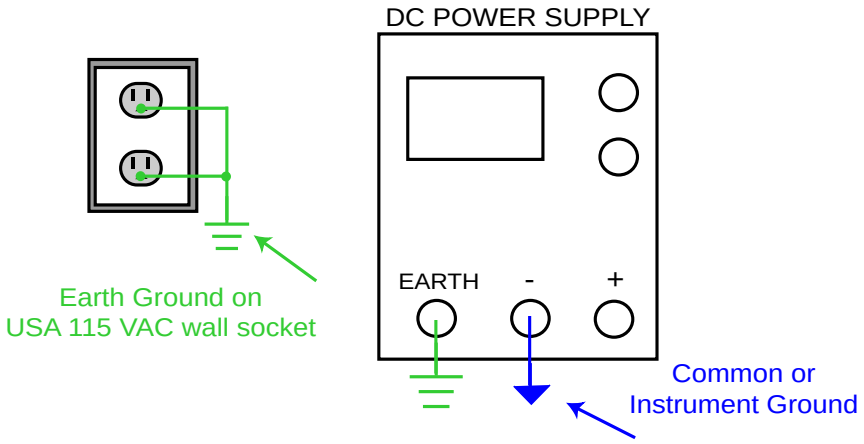
1. A **voltmeter** across the laser diode.
2. An **oscilloscope** across the laser diode.
3. A **current meter** in series with the laser diode.

All measurements made with these instruments on the output should be made with a simulated load attached and not a laser diode.

***ATTENTION: IF LASER DIODE AND PHOTODIODE ARE ISOLATED (TYPE B LASER DIODE)*** Short the laser diode anode to the photodiode cathode. The LDD P Series laser diode drivers require the photodiode be connected to the laser diode. If no connection is made between the laser diode and the photodiode, then the LDD P will not operate properly in constant power mode, and the power monitor will not read the proper photodiode current.

## GROUNDING

Some laser diode packages short either the laser diode anode or cathode to the case, which may connect the laser electrically to earth ground. Review the internal connections of the LDD P to make sure ground loops are not inadvertently created by this situation. Special attention to the details of grounding will ensure safe operation.



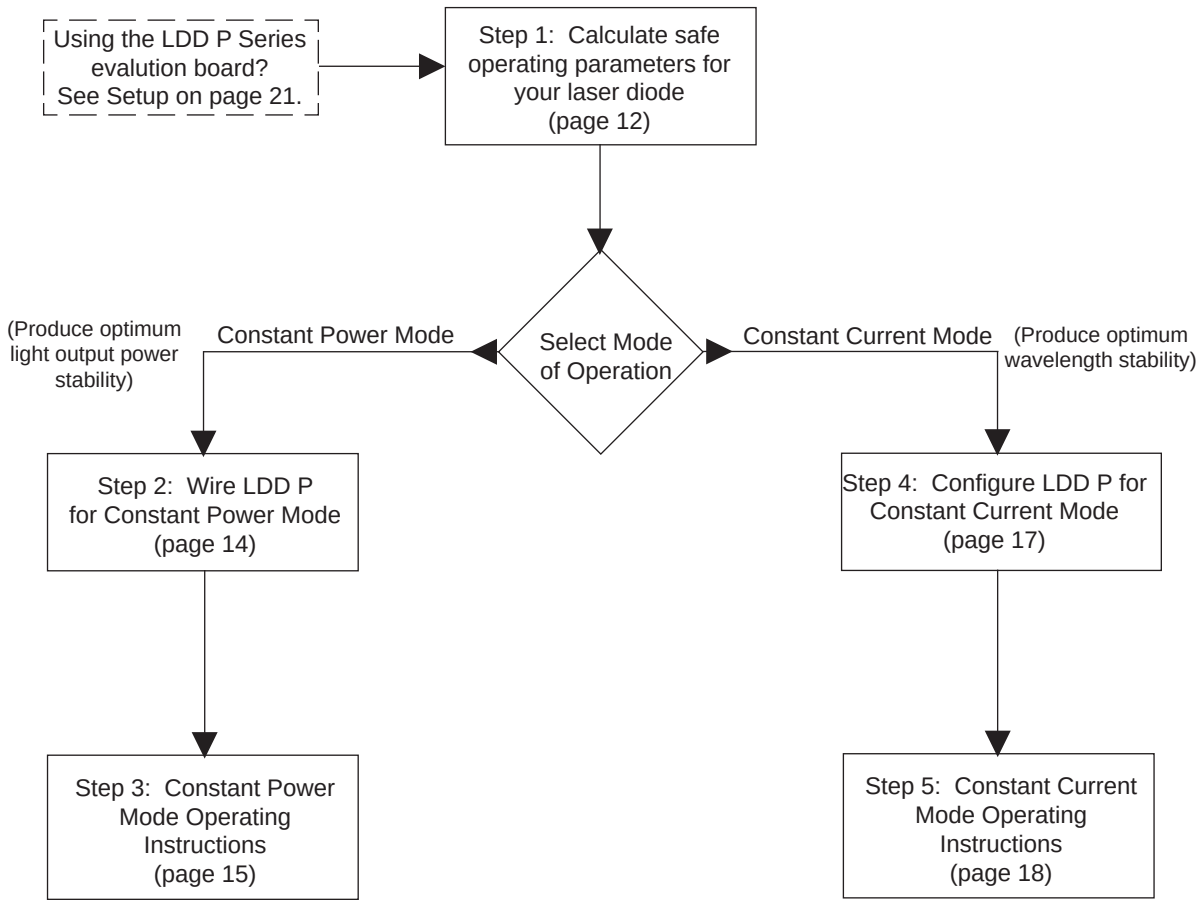

Unless Earth and Instrument Ground are connected via the power supply, Instrument Ground is floating with respect to Earth Ground

# OPERATING GUIDE ORGANIZATION

Operating your LDD P Series laser diode driver is relatively simple. First, complete basic calculations about your laser diode. Then determine if you'll operate in Constant Power or Constant Current mode. Then follow the wiring and operating instructions for that mode.

If you're using an evaluation board, familiarize yourself with the components of the board then follow the regular steps.

To minimize the possibility of damage to your laser diode, follow these steps in order.



# Step 1: Pre-Setup Calculations

### 1.1 Determine Maximum Laser Diode Operating Current

(1) Using the laser diode manufacturer's recommended operating specifications, determine the following four values:

(a) Maximum laser diode light output power:
$P_{MAX}$ = _____ mW

(Note this value should be less than the laser diode's ABSOLUTE MAXIMUM RATINGS)

(b) Typical Laser Diode threshold current:
$I_{TH}$ = _____ mA

(c) Typical Laser Diode operating current:
$I_{OP}$ = _____ mA

(d) Laser Diode slope efficiency:
$\eta$ = _____ mW / mA

(2) Calculate the laser diode limit current using Equation 1.1:

EQUATION 1.1: $I_{LIMIT} = I_{TH} + (P_{MAX}) / (\eta)$ $I_{LIMIT}$ = _____ mA

OR: If the laser diode's slope efficiency is unknown, then choose the laser diode limit current to be close to the operating current. Keep it well below the damage threshold of the laser diode.

$I_{LIMIT} = (1.1) * I_{OP}$

**Example Calculations**

Laser Diode Optical and Electrical Specifications used in this example are found on page 14.

Assume this laser diode application requires the laser diode to produce 25 mW of light output power and uses an LDD200-1P operating from +5 V.
[$P_{OP}$ = 25 mW & $V_{SUPPLY}$ = +5 V]

$P_{MAX}$ = 27.5 mW
($P_{MAX}$ is conservatively estimated at 110% of $P_{OP}$, not the ABSOLUTE MAXIMUM RATING)

$I_{TH}$ = 40 mA
$I_{OP}$ = 80 mA
$\eta$ = 0.75 mW / mA

EQUATION 1.1:
$I_{LIMIT} = I_{TH} + (P_{MAX}) / (\eta)$ =

40 + (27.5) / (0.75) = 76.66 mA

### 1.2 Determine Laser Diode Operating Current for desired Output Power

(1) Determine the following:

(a) Desired laser diode light output power:
$P_{OP}$ = _____ mW

(2) Calculate the laser diode operating current using Equation 1.2 [for $I_{TH}$ & $\eta$, see Step 1.1]:

EQUATION 1.2: $I_{OP} = I_{TH} + (P_{OP}) / (\eta)$ $I_{OP}$ = _____ mA

OR: If the laser diode's slope efficiency is unknown, then assume the laser diode operating current is:

$I_{OP}$ = Laser Diode Current at Rated Power

$P_{OP}$ = 25 mW

EQUATION 1.2:
$I_{OP} = I_{TH} + (P_{OP}) / (\eta)$ =

40 + (25) / (0.75) = 73.33 mA

### 1.3 Determine Laser Diode Monitor Current (Photodiode Current)

(1) Determine the following two values:

(a) Laser Diode Rated Power:
$P_{RATED}$ = _____ mW

(b) Typical Monitor Current (Photodiode current):
$I_{MON}$ = _____ mA

(2) Calculate the laser diode monitor current using Equation 1.3 [for $P_{OP}$ see Step 1.2]:

EQUATION 1.3: $I_{PD} = (P_{OP})\left(\frac{I_{MON}}{P_{RATED}}\right)$ $I_{PD}$ = _____ mA

$P_{RATED}$ = 30 mW

$I_{MON}$ = 0.3 mA

[From specification sheet, $I_{MON}$ typical at $P_O$]

EQUATION 1.3:

$I_{PD} = (P_{OP})\left(\frac{I_{MON}}{P_{RATED}}\right)$ =

(25)(0.3 / 30) = 0.25 mA

## Step 1: Pre-Setup Calculations, continued

### 1.4 Determine Laser Diode Operating Voltage (optional)

(1) Using the laser diode manufacturer's recommended operating specifications, determine the following four values:

(a) Typical Laser Diode operating voltage:
$V_{OP}$ =_____V

(b) Maximum Laser Diode operating voltage:
$V_{MAX}$ = _____V

(c) Typical Laser Diode operating current:
$I_{OP}$ = _____mA

(d) Maximum Laser Diode operating current:
$I_{MAX}$ =_____mA

(2) Calculate the laser diode forward voltage drop using Equation 1.4 [for $I_{LIMIT}$ see Step 1.1]:

EQUATION 1.4:

$$V_{LD} = V_{OP} + (I_{LIMIT} - I_{OP}) \left( \frac{V_{MAX} - V_{OP}}{I_{MAX} - I_{OP}} \right)$$

$V_{LD}$ = _____ V

If not enough data is available, assume
$V_{LD}$ = 1.7 V

**Example Calculations**

$V_{OP}$ = 2.4 V

$V_{MAX}$ = 3.0 V

$I_{OP}$ = 80 mA

$I_{MAX}$ = 120 mA

EQUATION 1.4:

$$V_{LD} = V_{OP} + (I_{LIMIT} - I_{OP}) \left( \frac{V_{MAX} - V_{OP}}{I_{MAX} - I_{OP}} \right)$$

$$V_{LD} = 2.4 + (60.63 - 80) \left( \frac{3 - 2.4}{120 - 80} \right)$$

$V_{LD}$ = 2.11 V

### 1.5 Determine $R_D$,Value for Dominant Resistor Protection (optional)

Resistor $R_D$ is not required for proper operation of the LDD P Series Laser Diode Driver, but provides a very simple and inexpensive method for protecting the laser diode against various electrical and mechanical transients.

NOTE: $R_{4a}$ is another optional safety component discussed on page 22. It is included on the evaluation board. The default value on the evaluation board is 1 Ω.

(1) Determine the following:

(a) Power Supply Voltage applied between pin 8 & pin 4 (V+ & GND):

$V_{SUPPLY}$ = _____V

$V_{SUPPLY}$ = 5 V

(2) Calculate $R_D$ using $I_{LIMIT}$ from Step 1.1, $V_{LD}$ from Step 1.4, and Equation 1.5. [Note: use Equation 1.5A for LDD 200 models and Equation 1.5B for LDD 400 models]:

EQUATION 1.5A:
Use with LDD200-1P, LDD200-2P, and LDD200-3P laser diode drivers

$$R_D = \left( \frac{V_{SUPPLY} - V_{LD} - 0.2}{I_{LIMIT}} \right) - (6.2\ \Omega + R_{4a})$$

$R_D$ = _____ Ω

EQUATION 1.5A:

$$R_D = \left( \frac{V_{SUPPLY} - V_{LD} - 0.2}{I_{LIMIT}} \right) - (6.2\ \Omega + R_{4a})$$

$$\left( \frac{5 - 2.11 - 0.2}{0.06063} \right) - (6.2\ \Omega + 1\ \Omega) = 37\ \Omega$$

EQUATION 1.5B:
Use with LDD400-1P, LDD400-2P, and LDD400-3P laser diode drivers

$$R_D = \left( \frac{V_{SUPPLY} - V_{LD} - 0.2}{I_{LIMIT}} \right) - (3.1\ \Omega + R_{4a})$$

(3) Calculate the minimum power rating for $R_D$ with Equation 1.6:

EQUATION 1.6:
$P_{RD}$ = Minimum power rating for $R_D$
$= (R_D)(I_{LIMIT})^2$

$P_{RD}$ = _____W

EQUATION 1.6:
$P_{RD} = (R_D)(I_{LIMIT})^2$ =
$(38)(0.06063)^2 = 0.14$ W

## Step 1: Pre-Setup Calculations, continued

### EXAMPLE - Laser Diode Electrical and Optical Characteristics

ABSOLUTE MAXIMUM RATINGS

| Symbol | Parameter | Ratings | Units |
|---|---|---|---|
| $P_O$ | Laser Diode Light Output Power | 35 | mW |
| $V_{RL}$ | Laser Diode Reverse Voltage | 2 | V |
| $V_{RD}$ | Photodiode Reverse Voltage | 30 | V |
| $I_{PD}$ | Photodiode Forward Current | 10 | mA |

ELECTRICAL / OPTICAL CHARACTERISTICS

| Symbol | Parameter | Test Conditions | Limits | | | Units |
|---|---|---|---|---|---|---|
| | | | Min | Typical | Max | |
| $I_{TH}$ | Threshold Current | CW | - | 40 | 65 | mA |
| $I_{OP}$ | Operating Current | CW, $P_O$ = 30 mW | - | 80 | 120 | mA |
| $\eta$ | Slope Efficiency | CW, $P_O$ = 30 mW | - | 0.75 | - | mW / mA |
| $V_{OP}$ | Operating Voltage | CW, $P_O$ = 30 mW | 2.0 | 2.4 | 3.0 | V |
| $I_{MON}$ | Monitor Current (photodiode) | CW, $P_O$ = 30 mW, $V_{RD}$ = 1V | - | 0.3 | 0.5 | mA |

## Step 2: Constant Power Operation: Wiring

**Figure 1: LDD 1P or LDD 3P**

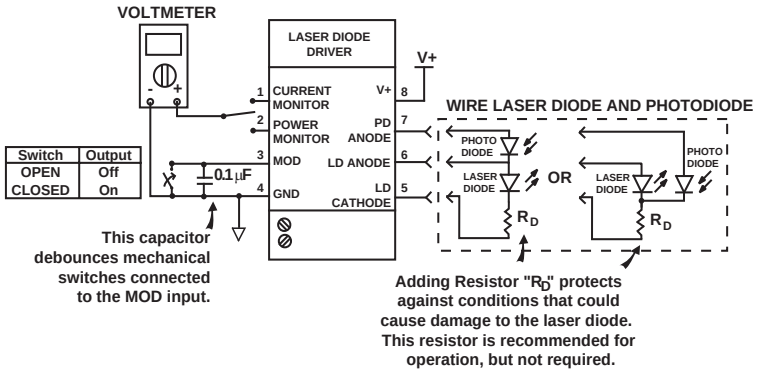



**Figure 2: LDD 2P**

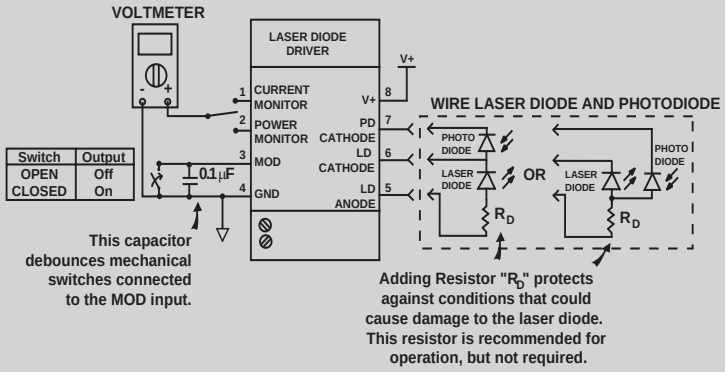



**Figure 3**

**LDD 1P AND LDD 3P MODELS**

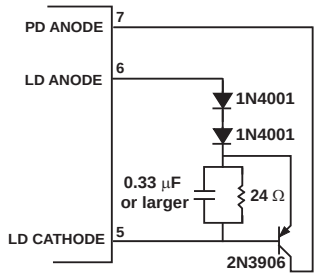
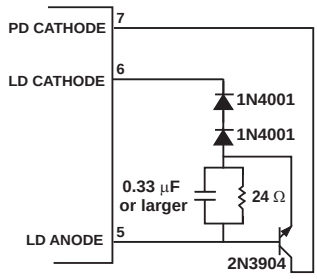



**Figure 4**

**LDD 2P MODELS**



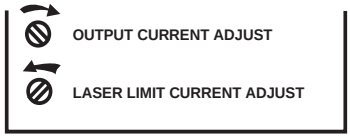

**Using a Constant Power "Simulated" load**

Figures 3 and 4 illustrate how to create constant power simulated loads for the Type A and Type C laser diodes, respectively. The simulated load allows the configuration of the LDD P laser diode driver without initially connecting a laser diode. Once the laser diode driver is adjusted to the correct output power and laser diode limit current, power it down before connecting a laser diode.

## Step 3: Constant Power Operation

**CAUTION:** Do not power on the LDD P Series Laser Diode Driver until all wire connections are completely attached and the Output Current Adjust and Limit Current Adjust trimpots have been correctly configured.

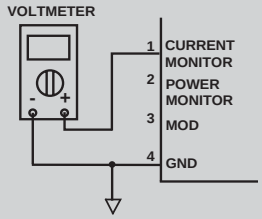
**CAUTION:** Before connecting a power supply to the LDD P Series Laser Diode Driver, measure the supply's output voltage and ensure a reading between +5 and +12 Volts. Turn OFF the power supply before connecting to the LDD P.




### 3.1 Locate and Adjust "on-board" trimpots

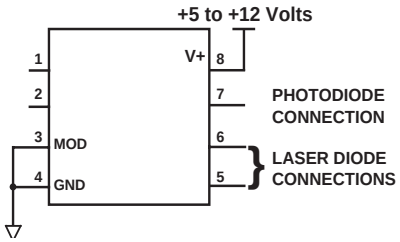
(1) Adjust the OUTPUT CURRENT ADJUST TRIMPOT fully clockwise, at least 12 complete turns.

(2) Adjust the LIMIT CURRENT ADJUST TRIMPOT fully counter-clockwise, at least 12 complete turns.




### 3.2 Measure Laser Current Monitor Output

(1) Attach the positive input of a voltmeter to the current monitor output (pin 1) and the negative input of the voltmeter to ground (pin 4).




### 3.3 Turn on Voltage Source

(1) Apply power to the LDD P only after all connections have been thoroughly reviewed. Notice the modulation input, pin 3, must be connected to ground, pin 4, to properly configure the limit current and photodiode current settings.

### 3.4 Adjust Laser Diode Limit Current

$I_{LIMIT}$ = _____ mA
(from Step 1.1)

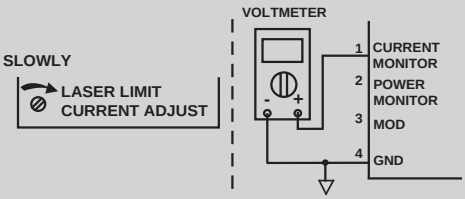
**200 mA models:**

$$V_{PIN\ 1} = (I_{LIMIT}) \left( \frac{2.5\ V}{200\ mA} \right) = \_\_\_\_\_\ V$$

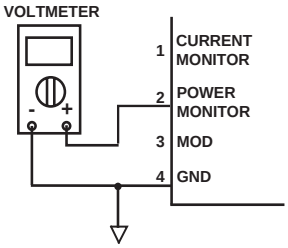
**400 mA models:**

$$V_{PIN\ 1} = (I_{LIMIT}) \left( \frac{2.5\ V}{400\ mA} \right) = \_\_\_\_\_\ V$$

(1) Calculate the current monitor voltage that corresponds to the proper limit current setting (determined in Step 1.1).




(2) SLOWLY adjust the LIMIT CURRENT ADJUST TRIMPOT clockwise until the voltmeter attached to the current monitor (pin 1) reads $V_{LIMIT}$.




### 3.5 Measure Power Monitor Output

(1) Attach the positive input of a voltmeter to the power monitor output (pin 2), and the negative input of a voltmeter to ground, (pin 4).

## Step 3: Constant Power Operation, continued


$I_{PD}$ = _____ mA
(from Step 1.3)

**LDD 1P and LDD 2P models:**

$$V_{PIN\ 2} = (I_{PD})\left(\frac{2.5\ V}{2.5\ mA}\right) = \_\_\_\_\_ V$$

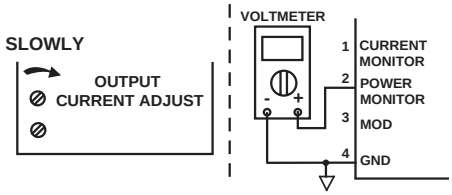
**LDD 3P models:**

$$V_{PIN\ 2} = (I_{PD})\left(\frac{2.5\ V}{0.125\ mA}\right) = \_\_\_\_\_ V$$

### 3.6 Adjust Photodiode Current (light output power)

(1) Rotate the OUTPUT CURRENT ADJUST TRIMPOT fully counter clockwise, at least 12 turns.

(2) Calculate the power monitor voltage that corresponds to the proper photodiode current setting (determined in Step 1.3).




(3) SLOWLY adjust the OUTPUT CURRENT ADJUST TRIMPOT clockwise until the voltmeter attached to the power monitor (pin 2) reads $V_{PD}$.

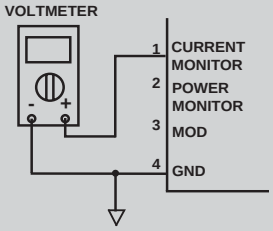
$I_{OP}$ = _____ mA
(from Step 1.2)

**200 mA models:**

$$V_{PIN\ 1} = (I_{OP})\left(\frac{2.5\ V}{200\ mA}\right) = \_\_\_\_\_ A$$

**400 mA models:**

$$V_{PIN\ 1} = (I_{OP})\left(\frac{2.5\ V}{400\ mA}\right) = \_\_\_\_\_ A$$

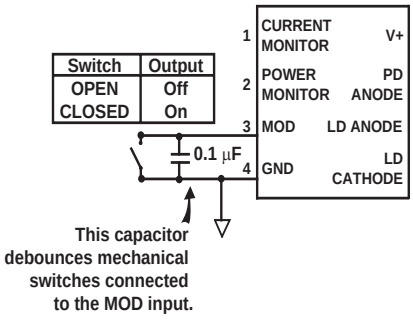



### 3.7. Verify Laser Diode Current level at Current Monitor Output

(1) Determine that the laser diode current measured on the current monitor output corresponds to the value calculated in Step 1.2. This value may vary from the calculated value depending on the temperature of the laser diode. A laser diode with a temperature above 25°C will require more laser diode current to produce the same power than one at or below 25°C.

(2) Confirm that the laser diode current is below the limit current setting.

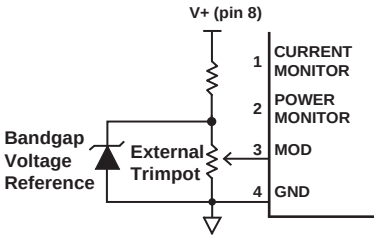
**CAUTION:** If the current monitor indicates that the laser diode is operating in current limit, reduce the laser diode output power using the OUTPUT CURRENT ADJUST TRIMPOT. Turn the power supply OFF and verify calculations made in Step 1. Also inspect the laser diode mounting to insure proper heatsinking for the laser diode.




### 3.8 Disable Laser Diode Current

(1) To disable current, let pin 3 float or connect it to V+. As shown in the diagram, open the switch. NOTE: a residual current is present in the laser diode when disabled. DO NOT DISCONNECT THE LASER DIODE UNLESS POWER IS REMOVED FROM V+ AND GROUND.

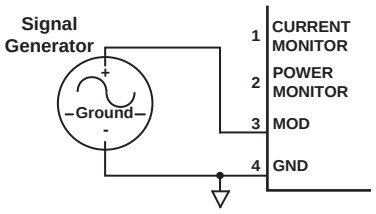
## Step 3: Constant Power Operation, continued




**3.9 Adjust Light Output Power using the Modulation Input (optional)**

(1) An external trimpot or potentiometer can be attached to pin 3 to remotely control the light output power.

OR




Connect a signal generator to pin 3.

$I_{PD}$ = _____ mA
(from Step 1.3)

(2) The modulation input adjusts the light output power by reducing the photodiode current from the setting determined by the OUTPUT CURRENT ADJUST TRIMPOT proportional to the voltage applied to pin 3.

**LDD 1P and LDD 2P models:**

$$I_{MOD} = (I_{PD}) - V_{PIN3} \left(\frac{2.5\ mA}{5\ V}\right) = \_\_\_\_\_\ A$$

**LDD 3P models:**

$$I_{MOD} = (I_{PD}) - V_{PIN3} \left(\frac{0.125\ mA}{5\ V}\right) = \_\_\_\_\_\ A$$

**CAUTION:** The modulation input voltage must always be maintained within the power supply voltage range between pin 8 & pin 4. A voltage on the modulation input below ground may produce excessive laser diode currents.

## Step 4: Constant Current Operation: Wiring

**Figure 5: LDD 1P or LDD 3P**

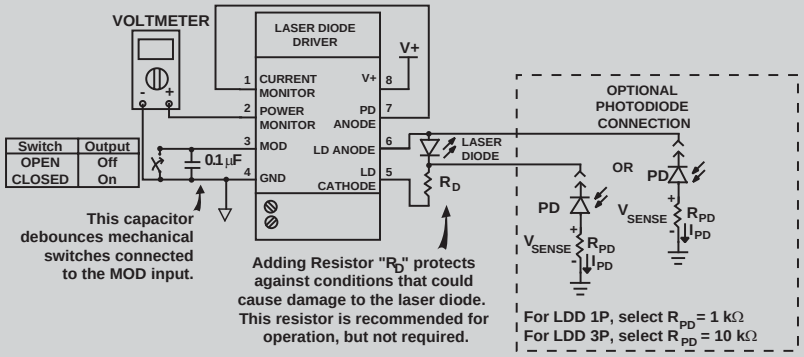
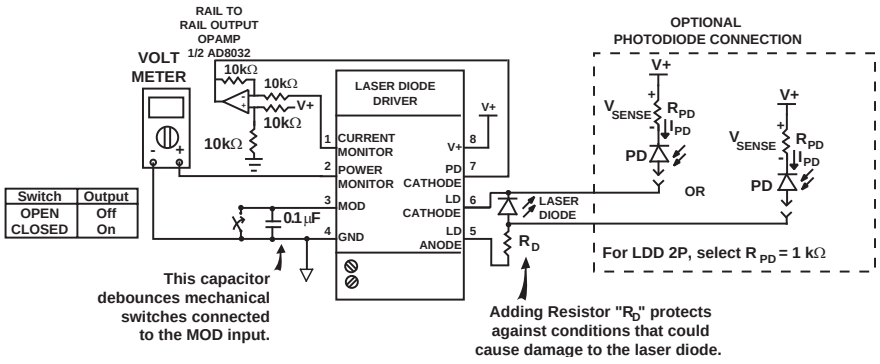



**Figure 6: LDD 2P**



## Step 4: Constant Current Operation: Wiring, continued

**Figure 7**

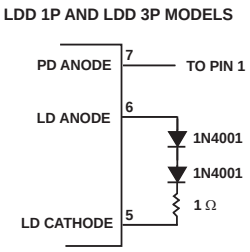
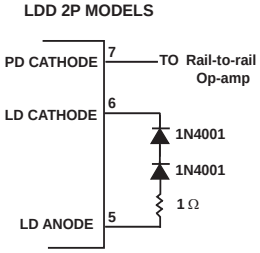



**Figure 8**



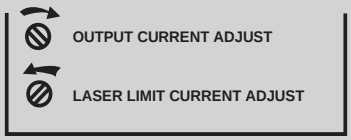

**Using a Constant Current "Simulated" load**

Figures 7 and 8 illustrate how to create constant current simulated loads for the LDD 1P, LDD 3P, or LDD 2P laser diode drivers, respectively. The simulated load allows the configuration of the LDD P laser diode driver without initially connecting the laser diode. Once the laser diode driver is adjusted to the correct output current and laser diode limit current, power it down before connecting a laser diode.

## Step 5: Constant Current Operation

CAUTION: Do not power on the LDD P Series Laser Diode Driver until all wire connections are completely attached and the Output Current Adjust and Limit Current Adjust trimpots have been correctly configured.

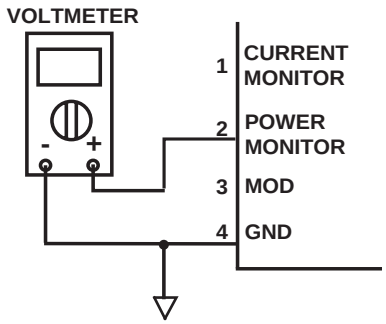
CAUTION: Before connecting a power supply to the LDD P Series Laser Diode Driver, measure the supply's output voltage and ensure a reading between +5 and +12 Volts. Turn OFF the power supply before connecting to the LDD P.




**5.1 Locate and Adjust "on-board" trimpots**

(1) Adjust the OUTPUT CURRENT ADJUST TRIMPOT fully clockwise, at least 12 complete turns.

(2) Adjust the LIMIT CURRENT ADJUST TRIMPOT fully counter-clockwise, at least 12 complete turns.

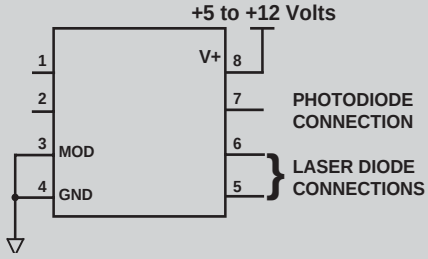



**5.2 Measure Power Monitor Output**

The current monitor and the power monitor outputs produce the same voltage output when the LDD P is configured for Constant Current Operation.

**Since the current monitor is used to provide feedback in constant current mode, the power monitor is used to measure the laser diode current.**

(1) Attach the positive input of a voltmeter to the power monitor output (pin 2) and the negative input of the voltmeter to ground (pin 4).




**5.3 Turn on Voltage Source**

(1) Apply power to the LDD P only after all connections have been thoroughly reviewed. Notice the modulation input, pin 3, must be connected to ground, pin 4, to properly configure the limit current and laser diode current settings.

## Step 5: Constant Current Operation, continued

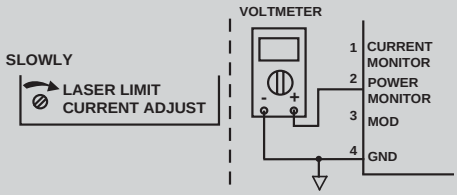
$I_{LIMIT}$ = _____ mA
(from Step 1.1)

**200 mA models:**

$$V_{PIN\ 2} = (I_{LIMIT})\left(\frac{2.5\ V}{200\ mA}\right) = \_\_\_\_\_\ V$$

**400 mA models:**

$$V_{PIN\ 2} = (I_{LIMIT})\left(\frac{2.5\ V}{400\ mA}\right) = \_\_\_\_\_\ V$$




### 5.4 Adjust Laser Diode Limit Current

(1) Calculate the current monitor voltage that corresponds to the proper limit current setting (determined in Step 1.1).

(2) SLOWLY adjust the LIMIT CURRENT ADJUST TRIMPOT clockwise until the voltmeter attached to the power monitor (pin 2) reads $V_{LIMIT}$.


### 5.5 Adjust Laser Diode Current

(1) Rotate the OUTPUT CURRENT ADJUST TRIMPOT fully counter-clockwise, at least 12 turns.

$I_{OP}$ = _____ mA
(from Step 1.2)

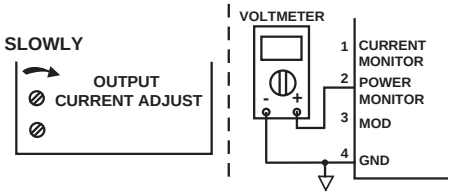
**200 mA models:**

$$V_{PIN\ 2} = (I_{OP})\left(\frac{2.5\ V}{200\ mA}\right) = \_\_\_\_\_\ V$$

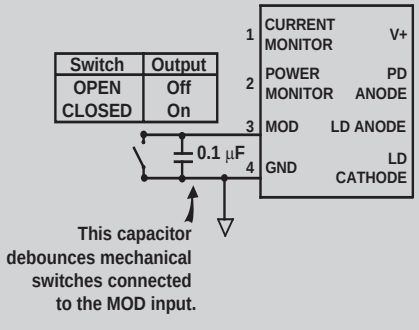
**400 mA models:**

$$V_{PIN\ 2} = (I_{OP})\left(\frac{2.5\ V}{400\ mA}\right) = \_\_\_\_\_\ V$$

(2) Calculate the current monitor voltage that corresponds to the proper laser diode current setting (determined in Step 1.2).




(3) SLOWLY adjust the OUTPUT CURRENT ADJUST TRIMPOT clockwise until the voltmeter attached to the current monitor (pin 2) reads $V_{OP}$.

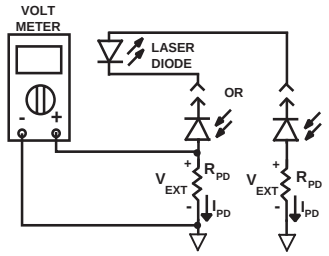



### 5.6 Disable Laser Diode Current

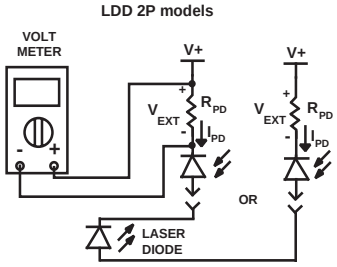
(1) To disable current, let pin 3 float or connect it to V+. As shown in the diagram, open the switch. NOTE: a residual current is present in the laser diode when disabled. DO NOT DISCONNECT THE LASER DIODE UNLESS POWER IS REMOVED FROM V+ AND GROUND.

## Step 5: Constant Current Operation, continued

LDD 1P and LDD 3P models




LDD 2P models




$I_{PD}$ = _____ mA
(from Step 1.3)

**LDD 1P and LDD 2P models:**

$$I_{PD} = \left( \frac{V_{EXT}}{1\ k\Omega} \right) = \_\_\_\_\_ \text{ mA}$$

**LDD 3P models:**

$$I_{PD} = \left( \frac{V_{EXT}}{10\ k\Omega} \right) = \_\_\_\_\_ \text{ mA}$$

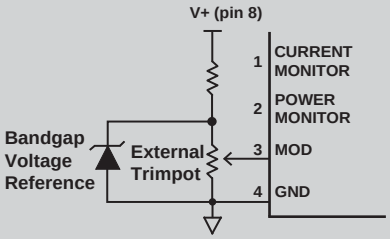
### 5.7 Verify Photodiode Current level (optional)

(1) If you wired an external photodiode in Step 4, attach the leads of a voltmeter across the external resistor as shown.

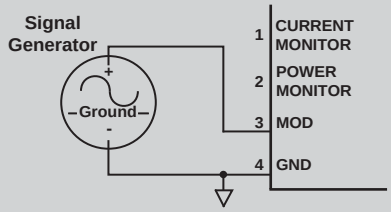
(2) Determine if the measured photodiode current corresponds to the value calculated in Step 1.3. This value may vary from the calculated value depending on the temperature of the laser diode. A laser diode with a temperature above 25°C will produce less photodiode current than one at or below 25°C.

(3) Confirm that the light output power does not exceed the rated output power for the laser diode.

**CAUTION:** If the photodiode current indicates that the laser diode is operating above the rated power, reduce the laser diode output power using the OUTPUT CURRENT ADJUST TRIMPOT. Turn the power supply OFF and verify calculations made in Step 1. Also inspect the laser diode mounting to insure proper heatsinking for the laser diode.




OR




$I_{OP}$ = _____ mA
(from Step 1.2)

**200 mA models:**

$$I_{MOD} = (I_{OP}) - V_{PIN3}\left( \frac{200\ mA}{5\ V} \right) = \_\_\_\_ \text{ mA}$$

**400 mA models:**

$$I_{MOD} = (I_{OP}) - V_{PIN3}\left( \frac{400\ mA}{5\ V} \right) = \_\_\_\_ \text{ mA}$$

### 5.8 Adjust Laser Diode Current using the Modulation Input (optional)

(1) An external trimpot or potentiometer can be attached to pin 3 to remotely control the laser diode current.

Connect a signal generator to pin 3.

(2) The modulation input adjusts the laser diode current by reducing the laser diode current from the setting determined by the OUTPUT CURRENT ADJUST TRIMPOT proportional to the voltage applied to pin 3.

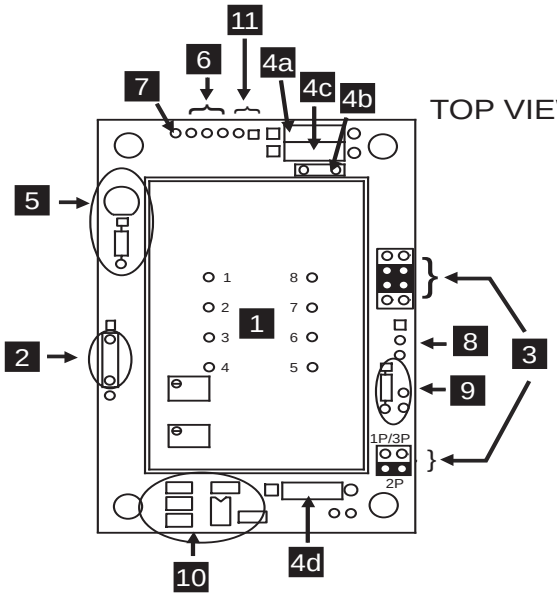
**CAUTION:** The modulation input voltage must always be maintained within the power supply voltage range between pin 8 & pin 4. A voltage on the modulation input below ground may produce excessive laser diode currents.

## Using the LDD Evaluation Board

The LDD P is designed to be soldered to a circuit board. The LDDPCB evaluation board integrates with any LDD P laser diode driver.

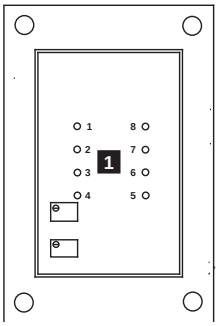
Instructions for using the LDDPCB are on the next four pages. ***Once you are familiar with the board, follow the operating instructions for the LDD P, starting on page 11.***

**Model LDDPCB P Series: Component Diagram**
***For more detail refer to sections on the following pages.***




**Typical Component Functions**

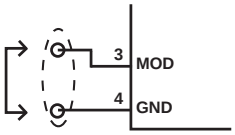
| No. | Component | Function |
|---|---|---|
| 1 | LDD Module | Laser Diode Driver Component location |
| 2 | Enable/ Disable wire pads | Enable / Disable laser current |
| 3 | Jumpers | Select LDD P model and operating mode |
| 4a | Decoupling Resistor | Decouple power supply |
| 4b | Decoupling Capacitor | Decouple power supply |
| 4c | Transzorb | Over-voltage protection |
| 4d | Dominant Impedance | Laser diode over-current and transient protection |
| 5 | LED and bias resistor | Power ON indicator |
| 6 | Measurement wire pads | Measure laser diode or photodiode current |
| 7 | MOD INPUT wire pads | Connections to optional signal generator |
| 8 | Laser diode wire pads | Solder laser diode cable to these pads |
| 9 | External photodiode wire pads | Monitor photodiode current while in constant laser diode current mode |
| 10 | Op-amp, 4 resistors, one capacitor | For operating LDD 2P in constant current mode |
| 11 | Power supply wire pads | Connections to power supply |




**Component #1: Solder LDD P module to accessory board**

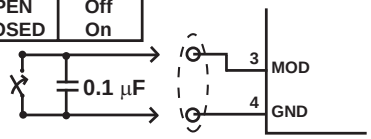
(1) The silkscreen on the top of the board shows the orientation of the two trimpots when the LDD P module is properly positioned. Solder the LDD P to the circuit board. Do not exceed solder tip temperature of 260°C or apply heat to any lead for more than 10 seconds.

## Using the LDD Evaluation Board, continued




OR

| Switch | Output |
|---|---|
| OPEN | Off |
| CLOSED | On |




**Component #2: Enable laser diode current**

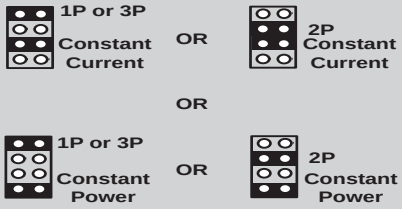
(1) Solder a jumper between the two round solder pads

OR

(2) Use a switch to enable and disable the laser diode current. Connect it across the round solder pads. Place a capacitor across the switch to debounce the connection.

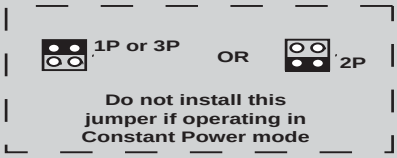
**Component #3: Configure for LDD 1P / LDD 3P or LDD 2P models & Mode of operation**

Use one of these four jumper diagrams to configure the LDDPCB to the model LDD P you are using and the appropriate mode of operation



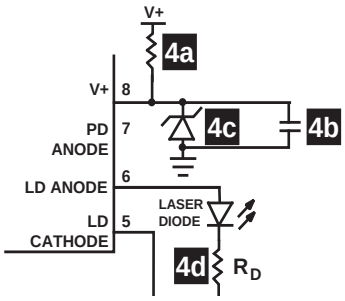

(1) The top two jumpers configure the evaluation board for the model of LDD P.

(2) The second set of jumpers determine the operating mode- Constant Light Output Power, or Constant Laser Diode Current.




(3) A second set of jumpers, lower on the LDDPCB are used only if you operate in Constant Current mode. **CAUTION:** Do not load this jumper when operating in Constant Power Mode.

**Component #4: Determine which safety components to install**




**Component #4a: Power Supply Decoupling Resistor**

A 1 to 10 ohm resistor can be used to decouple the power supply from the LDD P laser diode driver. This series resistor forms a low pass single pole filter with the capacitance seen from pin 8 to ground. This component is not recommended for V+ operation below 6 V. A one ohm resistor is installed on the LDDPCB. **If you do not install the decoupling resistor, install a jumper between the two solder pads.**

**Component #4b: Power Supply Decoupling Capacitor**

A 1 to 10 µF tantalum or low ESR electrolytic capacitor can be used to shunt regulate the power supply around the LDD P laser diode driver. Note the polarity marked on the silkscreen. A 10 µF capacitor is installed on the LDDPCB.

**Component #4c: Over-voltage protection - Transzorb**

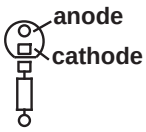
This zener diode limits the voltage differential across the LDD P. A typical transzorb for a +12 V supply would be the Motorola P6KE15A. Solder the cathode of the transzorb in the square solder pad. A P6KE15A is installed on the LDDPCB.

**Component #4d: Dominant Impedance**

This resistor limits the voltage that can develop across the laser diode in the case of a power supply transient or if the connections to the laser diode are broken and reconnected. Select either a metal film power resistor or a non-inductive wire wound resistor. Carbon based resistors add a significant amount of noise and inductive wire wound resistors can damage the laser diode. **If you do not install the dominant impedance resistor, install a jumper between the two solder pads. A value for $R_D$ is calculated in Step 1.5 of the operating instructions (starting on page 13).**

A 1 Ω, 2 W resistor is installed on the LDDPCB.

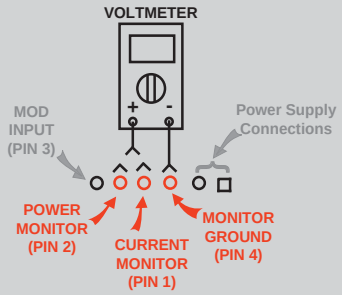
# Using the LDD Evaluation Board, continued




**Component #5: Power ON indicator LED (optional)**

When power is applied to the LDD P evaluation board, this LED will light. A 1 kΩ resistor in series with the LED establishes a bias current

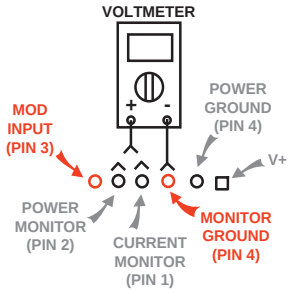
A 1kΩ resistor and a green indicator LED are installed on the LDDPCB.




**Component #6: Connect Voltmeter to monitor laser diode power or current**

Pin 1 (current monitor) and pin 2 (power monitor) are used to monitor laser diode current and power during setup and operation. These pins are brought out to solder pads on the edge of the accessory board.

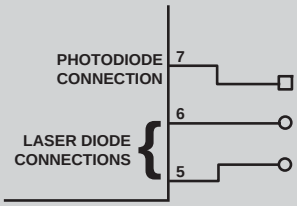
(1) Attach the positive input of a voltmeter to either solder pad and the negative input of the voltmeter to ground. NOTE: For noise reduction, use the Monitor Ground solder pad, not the Power Supply ground solder pad.




**Component #7: Connect signal generator to MOD INPUT (optional)**

Pin 3 is a modulation input. This pin is brought out to a solder pad on the edge of the board.

(1) Attach the positive input of a signal generator to the far left solder pad and the negative input of the signal generator to the monitor ground.




**Component #8: Connect Laser Diode to accessory board**

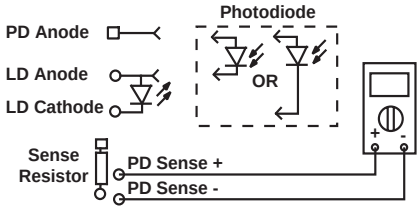
These three pins correspond to pins 5, 6, and 7 of the LDD P module.

Refer to Step 2 for Wiring Instructions for Constant Power mode (page 14).

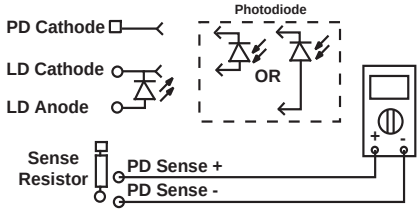
Refer to Step 4 for Wiring Instructions for Constant Current mode (page 17).

If you are operating in constant laser diode current mode and want to monitor the photodiode current, the next section details how to wire the photodiode.

**LDD 1P and LDD 3P**




**LDD 2P**




**Component #9: Monitor Photodiode Current in Constant Laser Diode Current Mode**

(1a) If you are operating an LDD 1P or LDD 3P laser diode driver, connect the anode of the photodiode to pin 7. Connect the photodiode cathode to the laser diode (in most laser diodes, this connection is made inside the laser diode case).

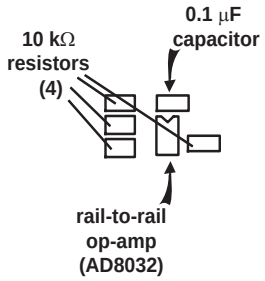
(1b) If you are operating an LDD 2P laser diode driver, connect the cathode of the photodiode to pin 7. The photodiode anode should already be connected to the laser diode inside the laser diode case.

(2) Install the sense resistor across the two wire pads indicated in the diagram. Use a 1kΩ resistor for the LDD 1P and LDD 2P models. Use a 10 kΩ resistor for the LDD 3P models.

(3) During operation, monitor the voltage across the PD Sense + and PD Sense - solder pads with a voltmeter.

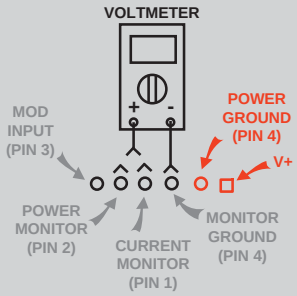
Two resistors are included (loose) in the LDDPCB package. One is 1 kΩ and the other is 10 kΩ.

## Using the LDD Evaluation Board, continued




**Component #10: LDD 2P in Constant Laser Diode Current Operation**

To operate an LDD 2P in constant laser diode current mode, an external op-amp and components are required. These are installed on the LDDPCB.



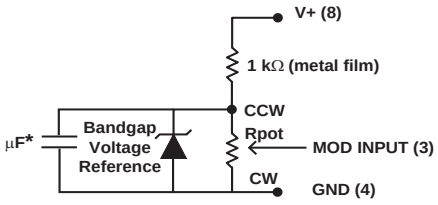

**Component #11: Connect Power Supply**

(1) Connect V+ and Ground to the solder pads indicated. NOTE: To minimize noise, use the Power Ground solder pad, not the Monitor Ground solder pad.

**To complete setup, follow the operating instructions starting on page 11.**

# APPLICATION NOTES

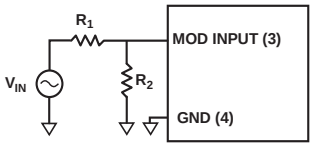
## External Trimpot Circuit




Rpot = 10 to 200 kΩ

* Add capacitor to reduce noise

## Change the Modulation Transfer Function




Keep $R_1$ and $R_2$ below 100 kΩ for maximum accuracy.

$$\text{New Transfer Function} = \left(\frac{R_2}{R_2 + R_1}\right) \text{ Original Transfer Function}$$

Example: (for LDD200-1P, Constant Current Mode)

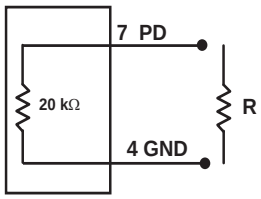
$R_1$ = 1 kΩ

$R_2$ = 9 kΩ

$$\text{New Transfer Function} = \left(\frac{9}{1+9}\right)(-40\text{ mA / V}) = -36\text{ mA / V}$$

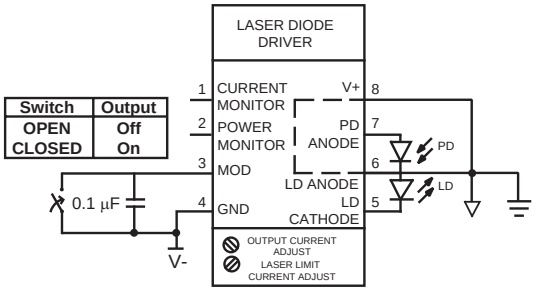
## Change LDD 3P Photodiode Range

Put a resistor across pins 7 (PD) and 4 (GND) to modify the PD range.



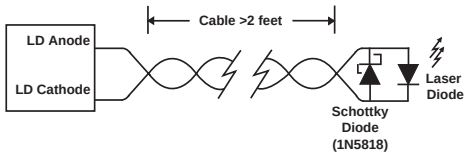

$$\text{Maximum Photodiode Current} = \frac{(2.5\text{ V})}{R \parallel 20\text{ k}\Omega}\ [\text{Amps}] \quad R \parallel 20\text{ k}\Omega = \frac{(R)(20000)}{R + 20000}$$

## Using the LDD 1P and LDD 3P with a Negative Power Supply to earth ground the laser diode anode

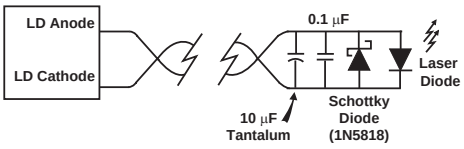



## Laser Diode Protection when using a long cable

With a cable longer than two feet, add a Schottky diode across the laser diode.

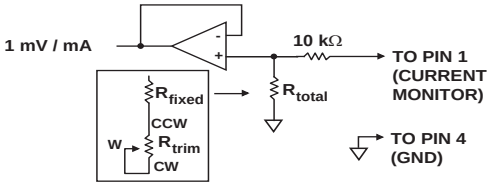



**Filter the LDD P Output** If you are not modulating the laser diode, add capacitors to reduce the noise by filtering the output current.




## Convert Current Monitor to 1 mV / mA

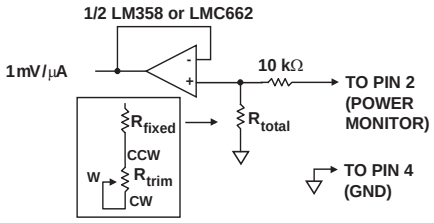
**Op-amp can be 1/2 of: National Semiconductor LM358 or Analog Devices AD8032**




| | LDD200 | LDD400 |
|---|---|---|
| $R_{total}$ | 869 Ω | 1905 Ω |
| $R_{fixed}$ | 750 Ω | 1820 Ω |
| $R_{trim}$ | 200 Ω | 200 Ω |

All resistors are metal film

## Convert Power Monitor to 1mV / ∝A (LDD 3P only)

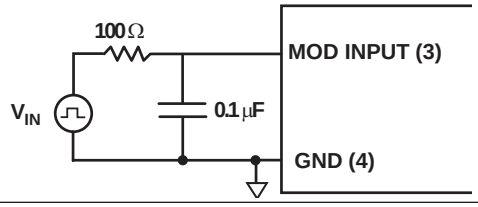



| | LDD 3P |
|---|---|
| $R_{total}$ | 526 Ω |
| $R_{fixed}$ | 475 Ω |
| $R_{trim}$ | 200 Ω |

All resistors are metal film

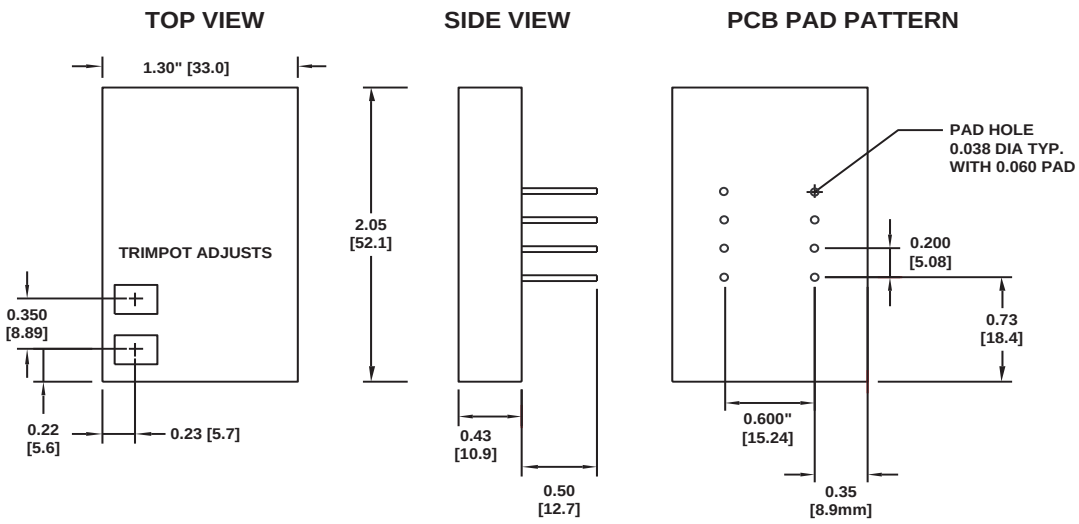
## To use a TTL signal at the MOD INPUT

TTL signals require pre-conditioning. The following circuit filters the TTL signal appropriately (low pass with a corner frequency of 15 kHz). Note: With +5 V applied at the MOD INPUT, a residual output current will still flow through the laser diode.



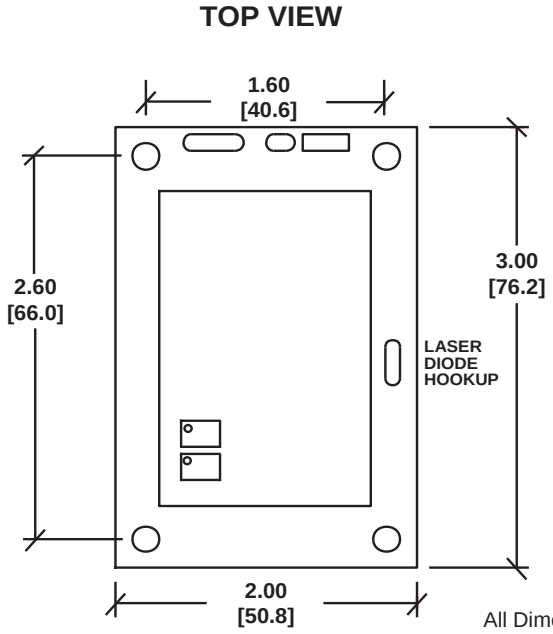
# MECHANICAL SPECIFICATIONS

## LDD P Series Laser Diode Driver




All Dimensions: Inches [mm]

## LDD P Series Laser Diode Driver Evaluation Board




All Dimensions: Inches [mm]

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**CERTIFICATION:**
Wavelength Electronics (Wavelength) certifies that this product met it's published specifications at the time of shipment. Wavelength further certifies that its calibration measurements are traceable to the United States National Institute of Standards and Technology, to the extent allowed by that organization's calibration facilities, and to the calibration facilities of other International Standards Organization members.

**WARRANTY:**
This Wavelength product is warranted against defects in materials and workmanship for a period of 90 days from date of shipment. During the warranty period, Wavelength will, at its option, either repair or replace products which prove to be defective.

**WARRANTY SERVICE:**
For warranty service or repair, this product must be returned to the factory. An RMA is required for products returned to Wavelength for warranty service. The Buyer shall prepay shipping charges to Wavelength and Wavelength shall pay shipping charges to return the product to the Buyer upon determination of defective materials or workmanship. However, the Buyer shall pay all shipping charges, duties, and taxes for products returned to Wavelength from another country.

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The warranty shall not apply to defects resulting from improper use or misuse of the product or operation outside published specifications.

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**SAFETY:**
There are no user serviceable parts inside this product. Return the product to Wavelength Electronics for service and repair to ensure that safety features are maintained.

**LIFE SUPPORT POLICY:**
As a general policy, Wavelength Electronics, Inc. does not recommend the use of any of its products in life support applications where the failure or malfunction of the Wavelength product can be reasonably expected to cause failure of the life support device or to significantly affect its safety or effectiveness. Wavelength will not knowingly sell its products for use in such applications unless it receives written assurances satisfactory to Wavelength that the risks of injury or damage have been minimized, the customer assumes all such risks, and there is no product liability for Wavelength. Examples of devices considered to be life support devices are neonatal oxygen analyzers, nerve stimulators (for any use), auto transfusion devices, blood pumps, defibrillators, arrhythmia detectors and alarms, pacemakers, hemodialysis systems, peritoneal dialysis systems, ventilators of all types, and infusion pumps as well as other devices designated as "critical" by the FDA. The above are representative examples only and are not intended to be conclusive or exclusive of any other life support device.

**REVISION HISTORY**

| REVISION | DATE | NOTES |
|---|---|---|
| **REV. D** | Aug-05 | Initial release |
| **REV. E** | 5-Oct-09 | Updated to reflect RoHS compliance |
| **REV. F** | 17-May-11 | Updated to include $R_{4a}$ and ModInput Safe Range |
| **REV. G** | 22-Dec-11 | Updated Type C Laser Quick Connect Diagram |
| **REV. H** | 25-Jan-13 | Updated Type C Laser Quick Connect |