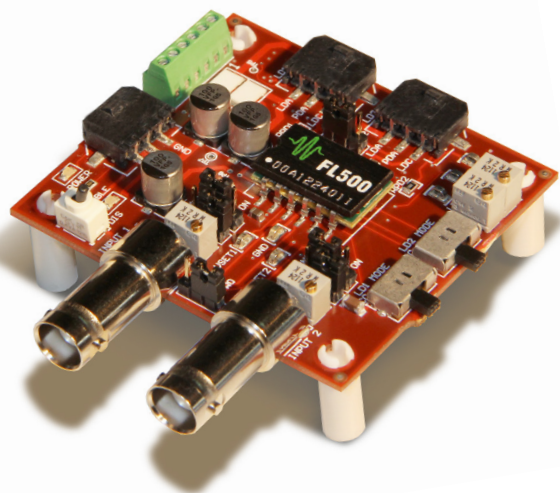


DATASHEET AND OPERATING GUIDE

FL591FL

Laser Diode Driver



FEATURES AND BENEFITS

- Accurately and efficiently characterize the FL500 in your application environment
- Includes FL500 Laser Driver chip already installed
- Utilizes all the safety features of the FL500
 - » Adjustable current limits
 - » Slow-start laser diode protection
 - » Brownout protection
- Onboard trimpots adjust output current and current limits
- Drive two independent 250 mA channels or a single 500 mA output
- Switches set the operating mode to Constant Current or Constant Power
- Operates Type A and Type B Laser Diodes
- Output Enable switch, LED status indicators
- Power and Output cables included

EASY SETUP SAVES YOU TIME

The FL591FL allows you to quickly and easily prototype your laser diode driver system using our popular FL500 laser diode driver chip.

The FL591FL can be configured to drive a single 500 mA output, or two 250 mA independent outputs by setting onboard jumpers. The drivers operate in Constant Current or Constant Power modes.

Onboard current setpoint and limit trimpots mean no external electronics are required to operate the drivers. Simply connect the power supply and laser diodes, and you're ready to go.

ACCURATELY PROTOTYPE YOUR LASER CONTROL SYSTEM

The FL591FL features low-noise electronics and low quiescent current, and the feedback and monitor signals allow you to accurately characterize your laser controller. You can transfer the FL500 prototype configuration directly to your custom laser control system with no surprises.

The FL500 is commonly used in hand-held, portable, and space constrained applications. The small size and light weight makes the FL500 ideal for airborne applications, and the dual-channel output is perfect for sighting-and-detection applications.

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ORDERING INFORMATION

PART NO	DESCRIPTION
FL591FL	Evaluation board with FL500

QUICK CONNECT GUIDE



IT IS IMPERATIVE THAT YOU VERIFY THE UNIT WILL OPERATE WITHIN THE INTERNAL HEAT DISSIPATION SAFE OPERATING AREA (SOA).

OPERATING THE DRIVER OUTSIDE THE SOA MAY DAMAGE OR DESTROY THE DRIVER AND/OR LASER.

Visit the Wavelength Electronics website for the most accurate, up-to-date, and easy to use SOA calculator:

<http://www.teamwavelength.com/support/calculator/soa/soald.php>

Figure 1 is the top view of the FL591FL, illustrating the onboard switches, trimpots, and connectors.

When shipped from the factory, the FL591FL is configured to operate with two independent 250 mA outputs. For information on configuring the FL591FL to drive a single 500 mA output, refer to page 9.

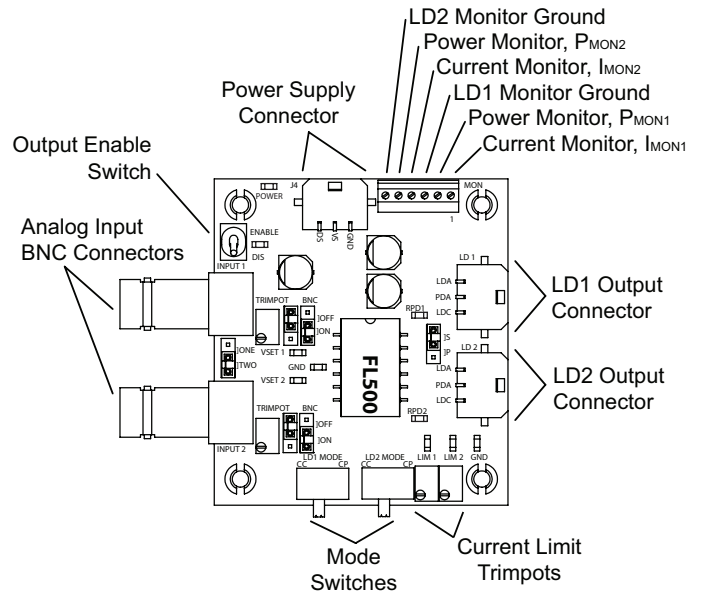
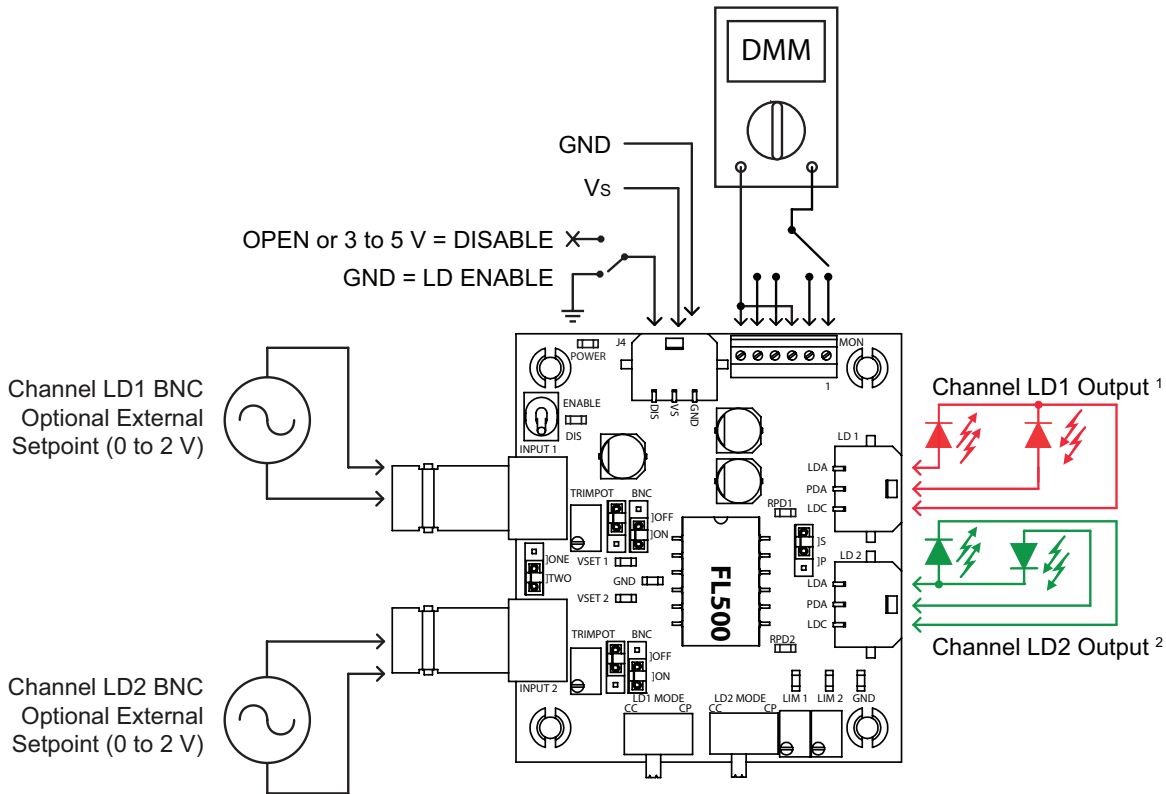


Figure 1. FL591FL Top View

Figure 2 is the Quick Connect diagram for the FL591FL illustrating operation as a two-channel laser diode driver. Two different laser wiring types are shown.



1. Common-Cathode configuration.
2. Laser Anode and Photodiode Cathode common.

Figure 2. FL591FL Quick Connect Wiring Diagram

QUICK CONNECT GUIDE, CONTINUED

The FL591FL is compatible with Type A and Type B lasers, but will not drive Type C lasers; see **Figure 3**.

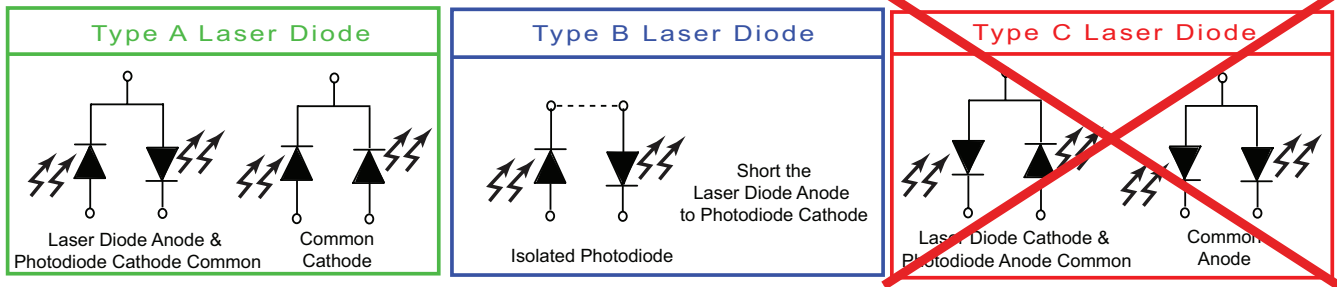


Figure 3. Laser Type Diagrams

Recommended simulated laser loads are shown in **Figure 4**. To determine the actual drive current, measure the voltage drop across the 1 Ω resistor. Do not insert an ammeter in series with the output circuit; doing so may cause instability in the control loop.

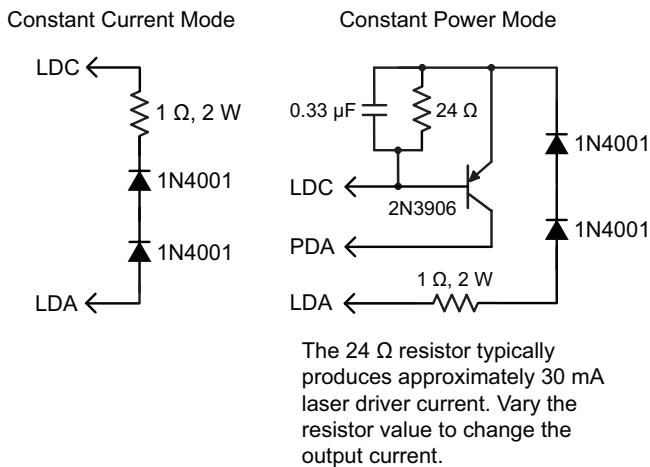


Figure 4. Laser Driver Test Loads

PIN DESCRIPTIONS

Table 1. Pin Descriptions and Wire Colors

PIN	NAME	CABLE COLOR	PIN DESCRIPTION
Connectors LD1, LD2; Cable FL591-00102-A			
1	LDA	Red	Laser Diode Anode connection. When used in 2x–250 mA mode, LD1 and LD2 are independent and isolated from each other. When used in 500 mA mode, the current is output via connector LD1 only.
2	PDA	White	Photodiode Anode connection. When used in 2x–250 mA mode, LD1 and LD2 are independent and isolated from each other. When used in 500 mA mode, the current is output via connector LD1 only.
3	LDC	Black	Laser Diode Cathode connection. When used in 2x–250 mA mode, LD1 and LD2 are independent and isolated from each other. When used in 500 mA mode, the current is output via connector LD1 only.
Connector J4, Cable FL591-00101-A			
1	DIS	White	Laser diode shutdown / interlock input, optional. The onboard Enable switch must be set to ENABLE when this external enable function is used. TTL-compatible. Enable = Ground; Disable = OPEN or 3 to 5 V.
2	VS	Red	Power supply positive terminal.
3	GND	Black	Ground connection for power supply input.
Connectors INPUT 1, INPUT 2			
Inner	V_{SET1} , V_{SET2}		Positive connection for the external setpoint voltage signal
Shield	GND		Ground connection for the external setpoint voltage signal
Connector MON, Six-Pin Header			
1	I_{MON1} , Current Monitor		LD1 laser current monitor output. The signal on this pin is proportional to the actual laser output current. Transfer function shown in Table 2.
2	P_{MON1} , Power Monitor		LD1 photodiode current monitor output. The signal on this pin is proportional to the photodiode current. Voltage range 0 to 2 V. Transfer function shown in Table 2.
3	LD1 Monitor Ground		Low current return for LD1 monitors. Do not use for high current return.
4	I_{MON2} , Current Monitor		LD2 laser current monitor output. The signal on this pin is proportional to the actual laser output current. Transfer function shown in Table 2.
5	P_{MON2} , Power Monitor		LD2 photodiode current monitor output. The signal on this pin is proportional to the photodiode current. Voltage range 0 to 2 V. Transfer function shown in Table 2.
6	LD2 Monitor Ground		Low current return for LD2 monitors. Do not use for high current return.

Table 2. Monitor Transfer Functions

FUNCTION	OUTPUT CONFIGURATION	TRANSFER	NOTE
Current Output Monitor, I_{MON1} and I_{MON2}	Separate	0.125 A / V	The voltage on I_{MONx} is proportional to the current output on that channel
Current Output Monitor, $I_{MON1} + I_{MON2}$	Parallel	When operating the FL591FL as a single channel 500 mA driver, monitor the output current on both I_{MON1} and I_{MON2} . The total output current monitor voltage is determined by summing the voltage measured on both monitors, using the equation: $I_{LD} = (V_{IMON1} + V_{IMON2}) * 0.125$	
Current Limit Monitor, I_{LIM1} and I_{LIM2}	Separate	0.125 A / V	Adjust I_{LIM1} and I_{LIM2} to set the current limit on each channel. See page 9 .
Current Limit Monitor, I_{LIM1}	Parallel	0.250 A / V	Adjust only I_{LIM1} to set the current limit when the FL591FL is operated in parallel-output mode. See page 9 .
Power Monitor, P_{MON1} and P_{MON2}	Separate	500 μ A / V ¹	The voltage on P_{MONx} is proportional to the photodiode current on that channel.
Power Monitor, P_{MON1}	Parallel	500 μ A / V ¹	When operating the FL591FL as a single channel 500 mA driver, the photodiode current is monitored on P_{MON1} .

1. The photodiode feedback transfer function can be changed. See **page 12** for details.

Table 3. Setpoint Transfer Functions

OPERATING MODE	INPUT CONFIG.	OUTPUT CONFIG.	V_{SET} TRANSFER FUNCTION	NOTES
Constant Current	One	Separate	0.125 A / V	Measure the voltage on the V_{SET1} testpoint; adjust the V_{SET1} trimpot to set the output current on both channels. The V_{SET2} trimpot is not used.
		Parallel	0.250 A / V	Measure the voltage on the V_{SET1} testpoint; adjust the V_{SET1} trimpot to set the output current on both channels. The V_{SET2} trimpot is not used.
	Two	Separate	0.125 A / V	Measure the voltage on the V_{SET1} and V_{SET2} testpoints; adjust the V_{SET1} and V_{SET2} trimpots to set the output current level for each channel.
		Parallel	0.125 A / V	The V_{SET1} and V_{SET2} voltages drive each channel independently. The output currents sum. Measure the voltages on the V_{SET1} and V_{SET2} testpoints separately, and add them to determine the effective output current.
Constant Power	One	Separate	500 μ A / V ¹	Measure the voltage on the V_{SET1} testpoint; adjust the V_{SET1} trimpot to set the photodiode current setpoint. The V_{SET2} trimpot is not used.
		Parallel	500 μ A / V ¹	Measure the voltage on the V_{SET1} testpoint; adjust the V_{SET1} trimpot to set the photodiode current setpoint. The V_{SET2} trimpot is not used.
	Two	Separate	500 μ A / V ¹	Measure the voltage on the V_{SET1} and V_{SET2} testpoints; adjust the V_{SET1} and V_{SET2} trimpots to set the photodiode setpoint for each channel.
		Parallel	—	This configuration is not allowed.

1. The photodiode feedback transfer function can be changed. See **page 12** for details.

ELECTRICAL SPECIFICATIONS

ABSOLUTE MAXIMUM RATINGS	SYMBOL	DUAL-CHANNEL OPERATION	SINGLE-CHANNEL OPERATION	UNIT	NOTE
Supply Voltage	V_S	3 to 9		VDC	
Max LD Output Current	I_{LD}	(2x) 250	(1x) 500	mA	
Laser Driver Internal Power Dissipation	P_{MAX}	1 W per channel	2 W total	W	$T_{AMBIENT} = 25^{\circ}C$
Case Operating Temperature	T_{OPR}	-40 to 85		$^{\circ}C$	
Case Storage Temperature	T_{STG}	-55 to 125		$^{\circ}C$	
Weight		1.7		oz	47.6 g
Size		2.97 x 2.50 x 1.07		inches	75.5 x 63.5 x 27.1 mm

LASER DRIVER SPECIFICATIONS	SYMBOL	DUAL-CHANNEL	SINGLE-CHANNEL	UNIT	NOTE
CONSTANT CURRENT CONTROL					
Short Term Stability, 1 hour		35 to 40		ppm	$T_{AMBIENT} = 25^{\circ}C$
Long Term Stability, 24 hours		50 to 75		ppm	$T_{AMBIENT} = 25^{\circ}C$
CONSTANT POWER CONTROL					
Short Term Stability, 1 hour		0.009		%	$T_{AMBIENT} = 25^{\circ}C$
Long Term Stability, 24 hours		0.02		%	
OUTPUT					
Peak Current	I_{MAX}	250 - 260	500 - 520	mA	
Compliance Voltage		$V_S - (0.5 * V_{SET})$		V	$I_{MAX} = 500$ mA
Rise Time		300		nsec	$I_{LD} = 500$ mA
Fall Time		300		nsec	$I_{LD} = 500$ mA
3dB Bandwidth, Constant Current		500		kHz	Sinewave input signal
Delayed Start		100		msec	
Slow Start Ramp		15		mA / msec	
Depth of Modulation		99		%	100 kHz sinewave
POWER SUPPLY					
Power Supply Voltage	V_S	3 to 9		V	
Quiescent Current, V_S		100		mA	at $V_S = 9$ V
V SET INPUT					
Input Impedance		51.1		Ω	
Input Voltage Range	V_{SET1}, V_{SET2}	0 to 2		V	
Damage Threshold		$V_{SET} < -0.3, V_{SET} > (V_S + 0.3)$		V	
NOISE					
Noise and Ripple (RMS)		3		μA	$I_{LD} = 100$ mA
Leakage Current with output disabled		50		μA	$V_{SET} = 0$ V
		100			$V_{SET} = 1$ V
		150			$V_{SET} = 2$ V

SAFETY INFORMATION

SAFE OPERATING AREA – DO NOT EXCEED INTERNAL POWER DISSIPATION LIMITS

Before attempting to operate the FL591FL, it is imperative that you first determine that the FL500 will operate within the *Safe Operating Area* (SOA). Operating the unit outside of the SOA may damage the controller or the laser. Operating outside of the SOA will void the warranty.

Go to the Wavelength Electronics website for the most accurate, up-to-date, and easy to use SOA calculators:

<http://www.teamwavelength.com/support/calculator/soa/soald.php>

SOA charts are included in this datasheet for quick reference (**page 15**), but we recommend you use the online tools instead.



TO ENSURE SAFE OPERATION OF THE FL591FL DRIVER, IT IS IMPERATIVE THAT YOU DETERMINE IF THE FL500 IS GOING TO BE OPERATING WITHIN THE INTERNAL HEAT DISSIPATION SAFE OPERATING AREA (SOA).

THEORY OF OPERATION

The FL591FL employs Wavelength's FL500 laser diode control chip, and can drive a single output up to 500 mA or dual outputs up to 250 mA each.

When operating with two separate outputs, the FL591FL can be configured to use a single setpoint to drive both outputs to the same current, or use separate setpoint signals to drive each current source independently.

It may be useful to remember that you do not directly set the drive current setpoint; instead, you adjust a voltage signal that represents the output current. The setpoint voltage is controlled by the onboard trimpot or by an external input.

The current source continually monitors the actual output current, compares it to the setpoint, and adjusts the current if there is a difference between the two signals.

As current is driven through the load, there is a voltage drop across the load because of the impedance. As the current increases the voltage drop may increase to the point that it reaches the Compliance Voltage limit of the current source. Once that occurs the current source is no longer able to increase the current driven to the load even if you increase the setpoint.

The current sources can be operated in Constant Current (CC) mode or in Constant Power (CP) mode. In CP mode, the photodiode (PD) current is used in the feedback loop, and the driver adjusts the output current in order to keep the PD current constant.

The laser driver includes features that help protect your laser and make the driver more versatile in a wide array of applications:

- The current limit is set by an onboard trimpot and protects the laser from over-current conditions.
- Slow-start delays the current ramp by 100 msec, and then ramps the current to setpoint at a rate of 15 mA / msec.
- The photodiode feedback control loop allows for Constant Power operation whereby the driver adjusts the laser forward current in order to maintain a constant photodiode current.

OPERATING INSTRUCTIONS

The first step in operating the controller is to wire it, and connect a test load. It is critical to properly set the drive current limit before connecting a laser.

We recommend using a test load until you are familiar with operation of the driver and have configured it to safely power your laser. A test load design is provided on **page 3**.

NECESSARY EQUIPMENT

The following equipment is the minimum necessary to configure the FL591FL for basic operation.

- FL591FL controller, plus included cables
- V_s – power supply for the laser driver electronics and the laser diode; must be rated for 1.1-times the maximum laser drive current plus 100 mA quiescent current
- Digital multimeter, 4-½ digit resolution recommended
- Test Load (recommended)
- Laser diode
- Connecting wires

SAFE OPERATING AREA AND THERMAL DESIGN CONSIDERATIONS

SOA charts are included in this datasheet for quick reference, but we recommend you use the online tools instead. Refer to the SOA calculator for the FL500.

<http://www.teamwavelength.com/support/calculator/soa/soald.php>



TO ENSURE SAFE OPERATION OF THE FL591FL CONTROLLER, IT IS IMPERATIVE THAT YOU DETERMINE IF THE UNIT IS GOING TO BE OPERATING WITHIN THE INTERNAL HEAT DISSIPATION SAFE OPERATING AREA (SOA).

PREVENT DAMAGE FROM ELECTROSTATIC DISCHARGE

Before proceeding, it is critical that you take precautions to prevent electrostatic discharge (ESD) damage to the driver and your laser. ESD damage can result from improper handling of sensitive electronics, and is easily preventable with simple precautions.

Enter the search phrase “ESD Precautions for Handling Electronics” in an internet search engine to find information on ESD-safe handling practices.

We recommend that you always observe ESD precautions when handling the FL591FL and laser diodes.

ONBOARD CONTROLS AND MONITORS

Figure 5 shows the jumpers and switches that configure the FL591FL operating mode.

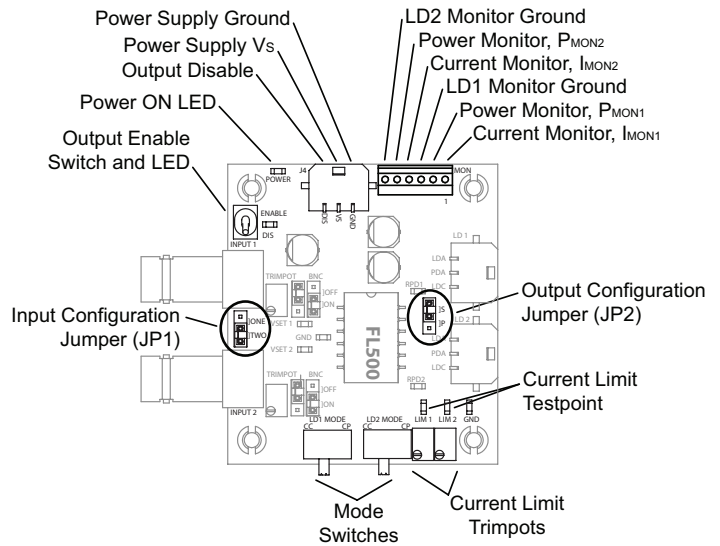


Figure 5. FL591FL Configuration Controls

The FL591FL can be configured to drive two separate 250 mA outputs with tied or separate setpoints, or a single 500 mA output controlled by a single setpoint.

The control mode—Constant Current or Constant Power—is set by onboard switches. The current limit for each channel is set by the trimpots.

SET THE INPUT CONFIGURATION JUMPER

The Input Configuration Jumper (JP1), located between the BNC connectors, determines whether a single setpoint signal controls the output current, or if two independent input signals are used to control each output separately.

Refer to **Table 4**. Set the jumper to position ONE for single setpoint operation; set the jumper to position TWO for independent input signals.

Table 4. Jumper Configuration Overview

JP1	INPUTS
ONE	Input 1 controls both output channels
TWO	Setpoint signals are separated

* When JP1 is set to position ONE, the FL591FL references the setpoint signal on Input 1. Any setpoint signal on Input 2 is disregarded.

When the FL591FL is delivered, the default configuration is to use two independent input signals (jumper set to TWO).

SET THE OUTPUT CONFIGURATION JUMPER

The Output Configuration Jumper (JP2), located between the output connectors, determines whether the outputs are paralleled to drive up to 500 mA output on a single channel, or separate to drive up to 250 mA on two channels.

When the driver outputs are separate, connect each laser diode to the respective output connector, LD1 and LD2.

When the driver outputs are paralleled, each channel drives one-half of the total output current. When operating in parallel driver mode, use output connector LD1 to drive current to the load.

When the FL591FL is delivered, the default configuration is with two separate 250 mA output channels (jumper set to "S").

WIRE THE POWER SUPPLY AND TEST LOAD

Wire the FL591FL power supply according to **Figure 2**, use the test load shown in **Figure 4**.

When the power supply is switched on, power is applied to the FL500 and the POWER LED will illuminate, but the output current is not enabled.

SET THE DRIVE CURRENT LIMITS; SEPARATE OUTPUT CONFIGURATION

First calculate the V_{LIM} voltage; use the transfer function on **page 5** according to your input/output configuration:

$$V_{LIM} = I_{LIMx} / \text{Transfer Function (Separate)} \quad (V)$$

Connect the DMM to the LIM1 testpoint and the GND testpoint, and apply power to the FL591FL. Adjust the LIM1 trimpot until the voltage displayed on the DMM matches the V_{LIM} value calculated above. Turn the trimpot clockwise to increase the current limit.

Connect the DMM to the LIM2 testpoint, and set the current limit on channel two using the same procedure.

SET THE DRIVE CURRENT LIMITS; PARALLEL OUTPUT CONFIGURATION

If the FL591FL is configured to drive paralleled outputs, the current limit is set using the LIM1 trimpot only.

First calculate the V_{LIM} voltage; use the transfer function on **page 5** based on your input/output configuration:

$$V_{LIM} = I_{LIM1} / \text{Transfer Function (Parallel)} \quad (V)$$

Connect the DMM to the LIM1 testpoint and the GND testpoint, and apply power to the FL591FL. Adjust the LIM1 trimpot until the voltage displayed on the DMM matches the V_{LIM} value calculated above.

CONFIGURE FOR CONSTANT CURRENT OR CONSTANT POWER MODE

The FL591FL will drive lasers in Constant Current mode or Constant Power mode. Constant Power mode operation requires photodiode feedback from the laser.

To configure channel one for Constant Current mode operation, set the LD1 MODE switch to CC (left); for Constant Power mode set the switch to CP (right). Set channel two in the same manner.



DO NOT CHANGE SWITCH POSITIONS WHILE POWER IS APPLIED TO THE FL591FL. DOING SO MAY DAMAGE THE LASER. REMOVE POWER FROM THE FL591FL BOARD BEFORE CHANGING MODE SWITCH POSITIONS.

If the FL591FL outputs are paralleled and operated in CP-mode, the signal on the channel one photodiode is used in the control feedback loop.

When the FL591FL is delivered, the default configuration is Constant Current mode on both channels.

SET THE INPUT SIGNAL CONFIGURATION

Figure 6 shows the setpoint adjust section of the FL591FL.

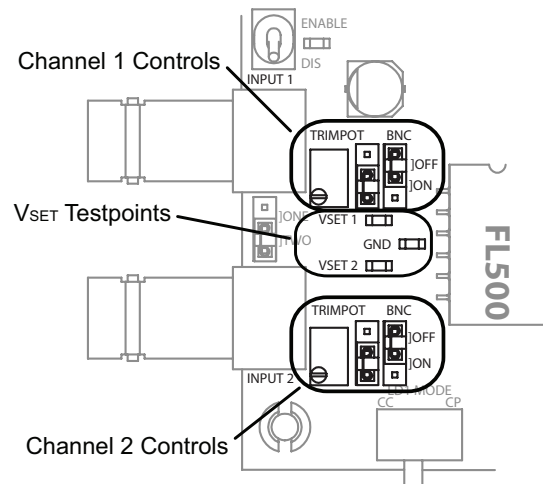


Figure 6. Current Setpoint Section

The drivers can be configured to reference only the signal input on the BNC connector, only the onboard trimpot, or the sum of the two signals. This versatility allows the driver to be configured with a bias current set by the trimpot, and an external modulation signal input on the BNC.

Configure the setpoint jumpers per **Table 5**. Channels one and two are configured independently.

Table 5. Setpoint Jumper Configuration

TRIMPOT	BNC	EFFECT
OFF	OFF	This setting results in no setpoint input signal; Do not use this setting
	ON	Reference only the BNC signal
ON	OFF	Reference only the onboard trimpot
	ON	Add the BNC signal to the onboard trimpot setpoint value

When the FL591FL is delivered it is configured to reference only the onboard trimpot setpoint signals.

CONNECT THE CURRENT AND POWER MONITORS

Connector J4, the screw terminal at the top of the board, includes outputs for monitoring the drive current and photodiode currents of both channels. Wire the DMM per **Figure 2 on page 2** to monitor these signals. The transfer functions are listed in **Table 2 on page 5**.

ENABLE THE OUTPUT CURRENT

In order to enable the output current, two conditions must be met simultaneously:

- The DIS pin on the power connector must be grounded.
- The output ENABLE switch must be set to ENABLE.

Channels one and two are enabled simultaneously, whether the FL591FL is in separate- or parallel-output mode. When the output is enabled, the LED next to the ENABLE switch will illuminate.

The output is disabled by floating the DIS pin or applying a 3 – 5 VDC signal, or by setting the ENABLE switch to DISABLE.

ADJUST THE OUTPUT CURRENT SETPOINT IN CONSTANT CURRENT MODE

Calculate the V_{SET} voltage value using the equation below. Use the proper CC-mode transfer function for dual- or single-channel operation (see **Table 2**).

$$V_{SET} = I_{LD} / \text{Transfer Function} \quad (V)$$

Connect the positive lead of the DMM to the V_{SET1} testpoint, and the negative lead to the GND testpoint and adjust the V_{SET1} trimpot until the voltage value on the DMM matches the value calculated above. Turning the trimpot clockwise increases the output current.

Repeat the process on the second channel if operating in dual-channel mode.

ADJUST THE OUTPUT CURRENT SETPOINT IN CONSTANT POWER MODE

In Constant Power mode, the drive current is not set directly. Rather, the photodiode current setpoint is calculated and set; the controller adjusts the output current in order to maintain the required photodiode current.

Refer to the laser diode datasheet to find the photodiode current at the desired optical output power level. Then calculate the V_{SET} voltage value using the equation below, and the CP-mode transfer function listed in **Table 2**.

$$V_{SET} = I_{PD} / \text{Transfer Function} \quad (V)$$

Connect the positive lead of the DMM to the V_{SET1} testpoint, and the negative lead to the GND testpoint and adjust the V_{SET1} trimpot until the voltage on the DMM matches the V_{SET} voltage. Turning the trimpot clockwise increases the Constant Power setpoint current.

Repeat the process on the second channel if operating in dual-channel mode.

RECONFIGURE FOR YOUR APPLICATION

Once you are familiar with the operation of the FL591FL, switch off the output and power supplies, and remove the test load. Wire your laser diode according to the wire diagram shown in **Figure 2 on page 2**.

TROUBLESHOOTING

PROBLEM	POTENTIAL CAUSES	SOLUTIONS
Driver will not switch on	Improperly configured power supply	Carefully check the wiring diagram on page 2 . Make sure the power supply polarity is not reversed.
	Power supply voltage too low	Check the electrical specifications on page 6 and make sure the power supply is within the required voltage range to operate the FL591FL.
Output will not enable	Improperly configured Enable switch on the FL591FL	The DIS pin on the Power connector must be grounded AND the switch on the FL591FL must be set to ENABLE.
	Power supply voltage too low	Check the electrical specifications on page 6 and make sure the power supply is within the required voltage range to operate the FL591FL.
Driver not working properly in constant current, parallel-output mode	Jumpers configured incorrectly	Check page 9 to make sure the output jumper is set properly.
	Improper output wiring configuration	Check that the connections to the laser diode are made via output connector LD1.
Laser output power too low in Constant Current mode	Laser current setpoint too low	Increase the setpoint either by adjusting the trimpot, or by increasing the signal voltage on the input connector.
	Laser current limit too low	Refer to page 9 for instructions on setting the laser driver current limit.
	Laser driver is compliance limited	Check the laser diode specifications to determine the forward voltage (V_F). Make sure that the FL591FL is not compliance limited. Refer to the Electrical Specifications table on page 6 .
Laser does not reach desired output in Constant Power mode	Current limit too low	Check the laser diode datasheet to determine the approximate laser drive current at the desired optical power output level. Then verify that the current limit is set slightly higher than that. Refer to page 9 for instructions on setting the laser driver current limit.
	Photodiode feedback current is out of range for the FL591FL	Refer to page 12 for information on adjusting the photodiode current range.

TECHNICAL SUPPORT INFORMATION

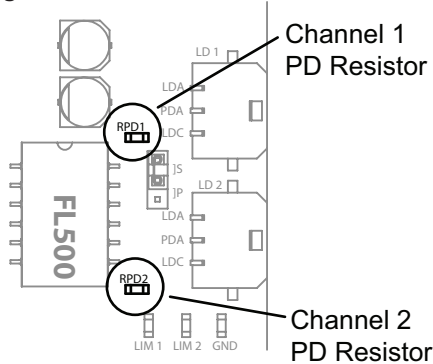
This section includes useful technical information on these topics:

- Adjust the Photodiode Current Range
- FL591FL Schematic
- Safe Operating Area Calculation

ADJUST THE PHOTODIODE CURRENT RANGE

The maximum photodiode current input is 1 mA, but the range can be adjusted by changing a resistor on the FL591FL circuit board. The location of the resistors is shown in **Figure 7**. The default resistor value is $1\text{ k}\Omega \pm 1\%$.

Figure 7. Photodiode Feedback Resistors



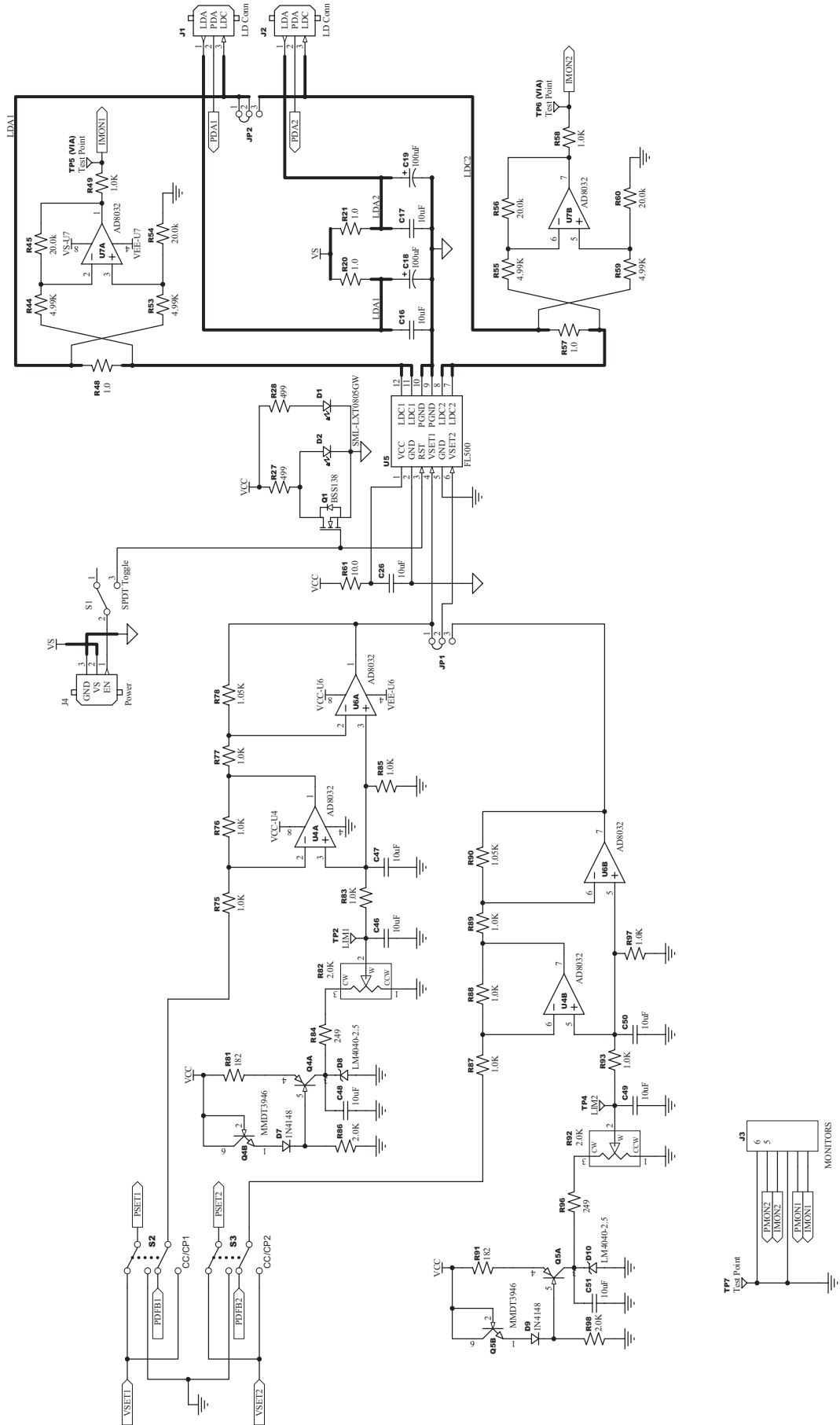
Calculate new resistor values based on the expected maximum photodiode current using this equation:

$$R_{PD} = 1 / I_{PMON} \quad (\Omega)$$

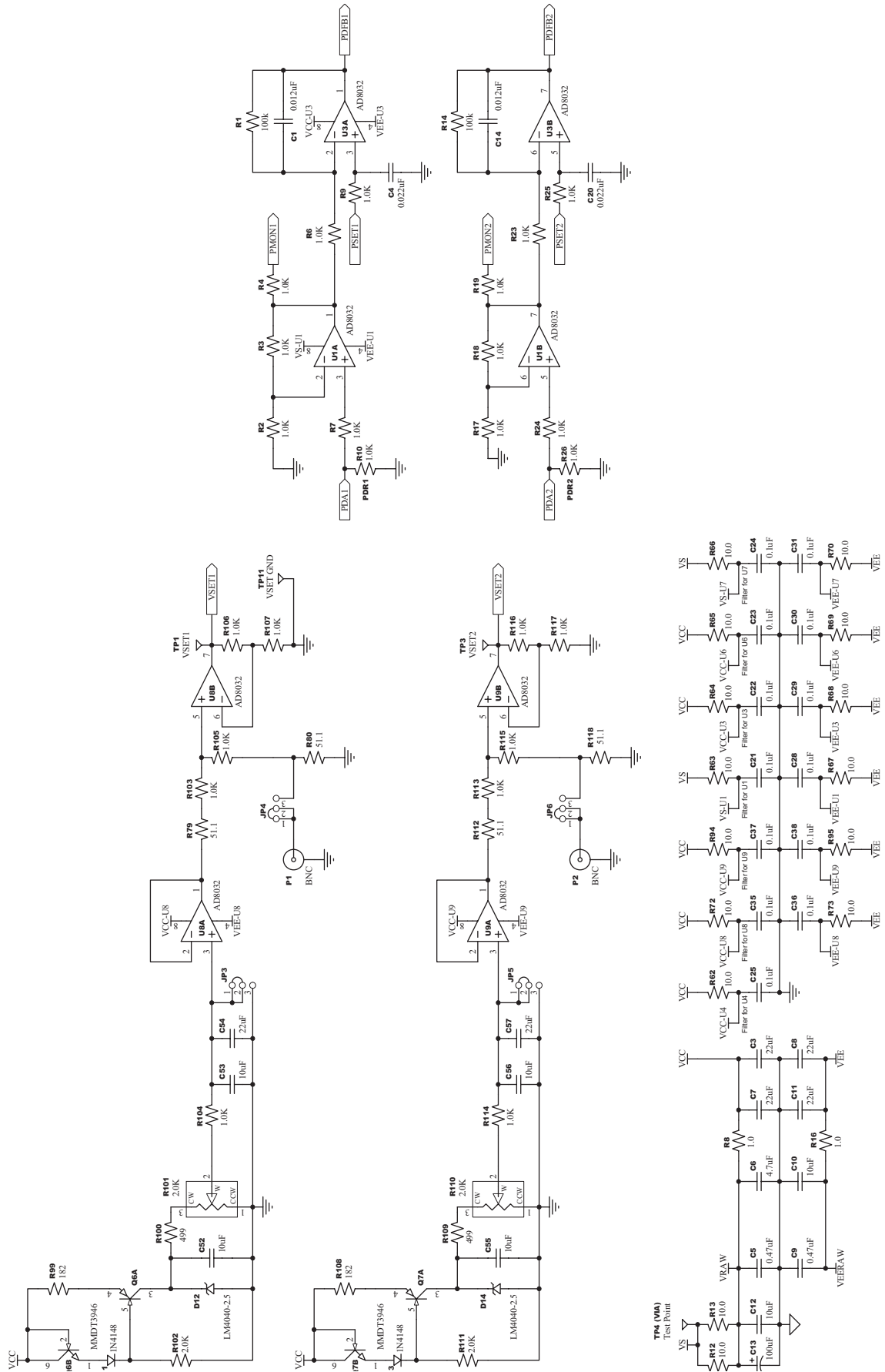
To convert the V_{PMON} value to photodiode current, use this equation:

$$I_{PMON} = V_{PMON} / (2 * R_{PD}) \quad (A)$$

FL59IFL SCHEMATIC, PAGE 1



FL591FL SCHEMATIC, PAGE 2



SAFE OPERATING AREA CALCULATION

Before attempting to operate the FL591FL, it is imperative that you first determine that the FL500 driver will operate within the *Safe Operating Area* (SOA). Consult the instructions for calculating the FL500 Safe Operating Area online at:

<http://www.teamwavelength.com/support/calculator/soa/soald.php>

If you have any questions about the Safe Operating Area calculator, call the factory for free and prompt technical assistance.



IT IS IMPERATIVE THAT YOU VERIFY THE UNIT WILL OPERATE WITHIN THE INTERNAL HEAT DISSIPATION SAFE OPERATING AREA (SOA).

OPERATING THE CONTROLLER OUTSIDE THE SOA MAY DAMAGE OR DESTROY THE FL591FL AND/OR LOADS.

We recommend using the online SOA calculators rather than the charts provided here. The online calculators take into consideration operating temperature.

Follow these steps to use the SOA Chart to determine if the FL591FL will be operating safely. Refer to the example SOA chart in **Figure 8**. Room temperature SOA charts for the FL591FL are shown in **Figure 9** and **Figure 10**.

- Determine the V_s supply voltage for the laser driver. For this example assume $V_s = 8$ VDC.
- Refer to the laser datasheet to find the voltage (V_F) at the required drive current, and maximum current (I_{MAX}) specifications. For this example, assume $V_F = 1.8$ V and $I_{MAX} = 200$ mA.
- Calculate the voltage drop across the controller:

$$V_{DROD} = V_s - V_F$$

- Mark V_{DROD} on the X-axis, and extend a line upward
- Mark I_{MAX} on the Y-axis, and extend a line to the right until it intersects the V_{DROD} line
- On the X-axis, mark the supply voltage (V_s)
- Extend a diagonal line from V_s to the intersection of the V_{DROD} and I_{MAX} lines; this is the Load Line
- If the Load Line crosses the Safe Operating Area line at any point, the configuration is not safe

If the SOA calculator indicates the FL591FL will be outside of the Safe Operating Area, the system must be changed so that less power is dissipated within the driver. See Application Note [AN-LDTC01: The Principle of the Safe Operating Area](#) for information on shifting the Load Line.

After changing any of the parameters, recalculate the SOA to make sure the controller will operate safely. If you have questions, or run into difficulties calculating the SOA, contact Wavelength Electronics for assistance.

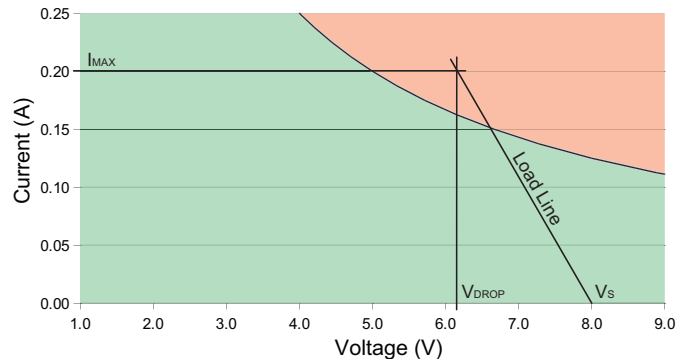


Figure 8. Example SOA Chart, FL591FL Laser Driver

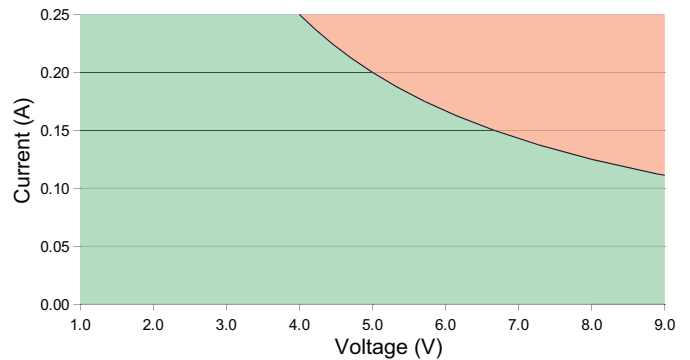


Figure 9. SOA Chart, FL591FL Operating as a 250 mA Driver

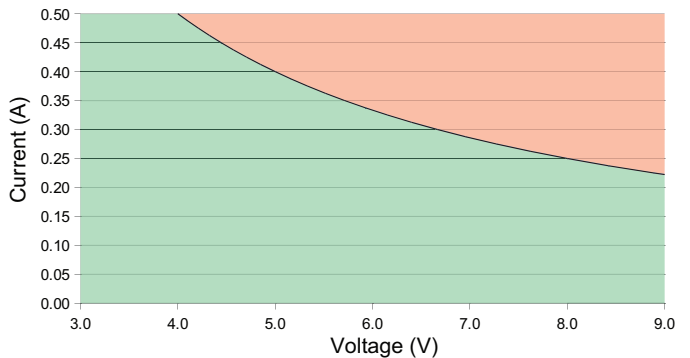
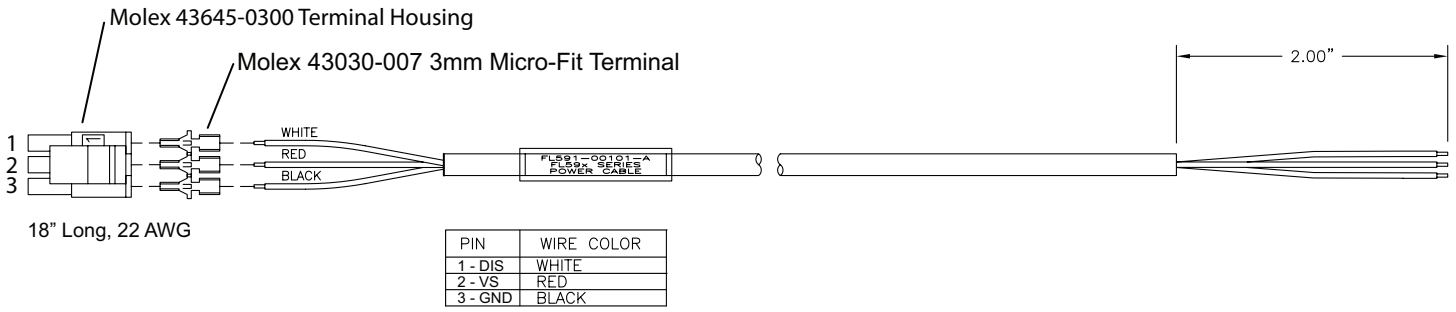


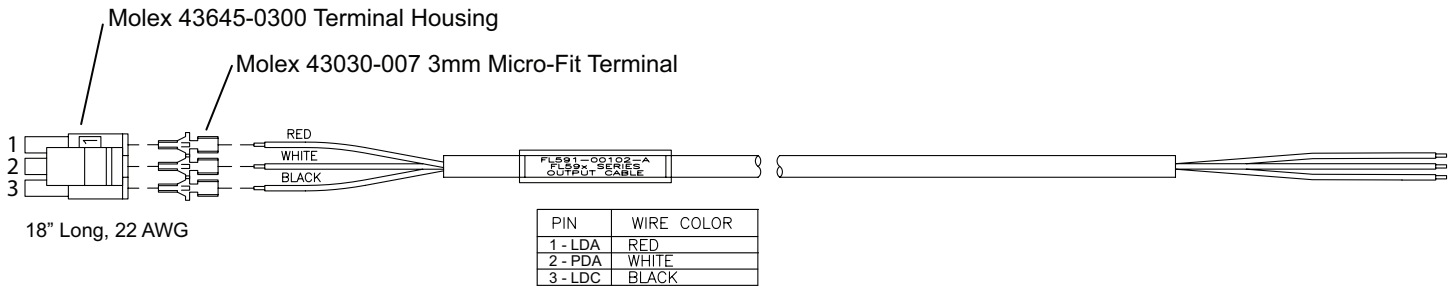
Figure 10. SOA Chart, FL591FL Operating as a 500 mA Driver

CABLE SPECIFICATIONS

POWER CABLE -- FL591-00101-A; INCLUDED WITH FL59IFL



OUTPUT CABLE -- FL591-00102-A; TWO INCLUDED WITH FL59IFL



MECHANICAL SPECIFICATIONS

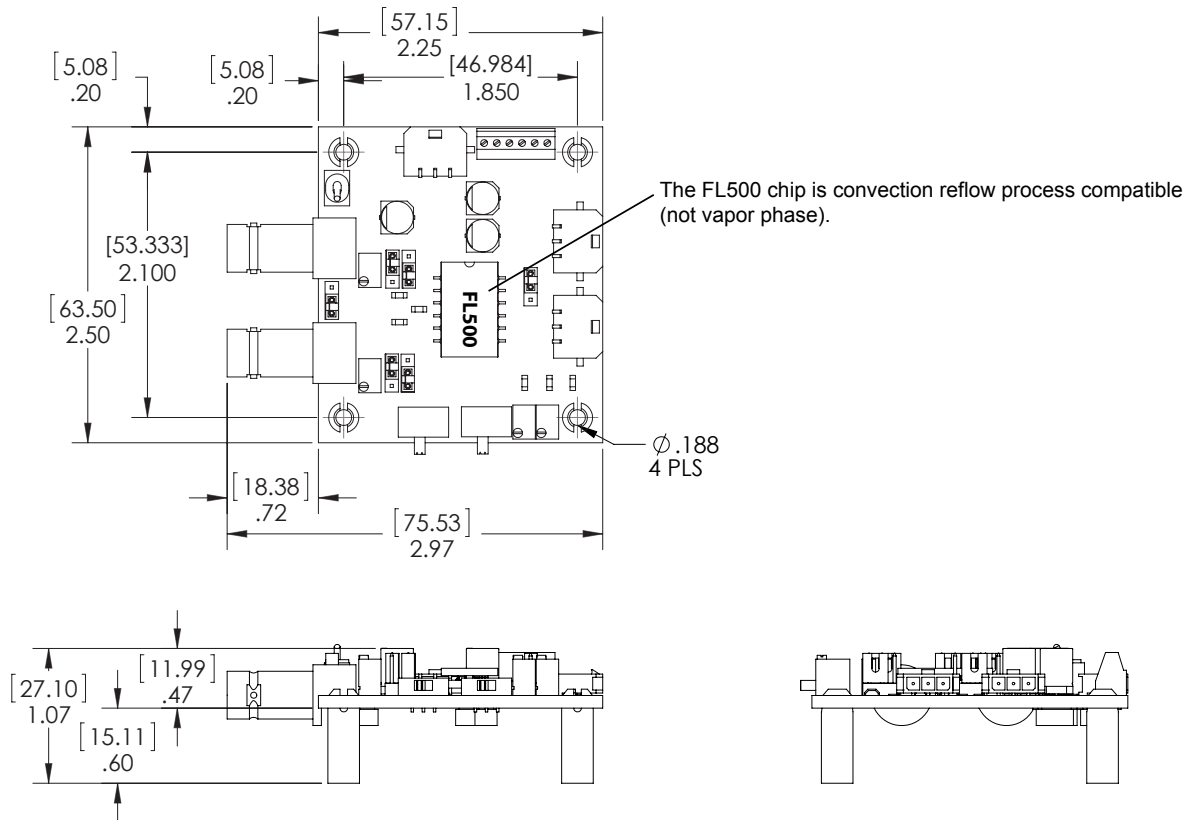


Figure 11. FL591FL Mechanical Dimensions

All dims in [mm] inches; Tolerance $\pm 5\%$

CERTIFICATION AND WARRANTY

CERTIFICATION

Wavelength Electronics, Inc. (Wavelength) certifies that this product met its 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 one (1) year 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. No other warranty is expressed or implied. Wavelength specifically disclaims the implied warranties of merchantability and fitness for a particular purpose.

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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

This important safety information applies to all Wavelength electrical and electronic products and accessories:

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

DOCUMENT NUMBER: FL591-00400

REV.	DATE	CHANGE
F	Nov 2012	Update datasheet for FL591FL product enhancement
G	March 2014	Clarified reflow compatibility
H	June 2014	Updated Transfer Functions
I	February 2017	Updated max supply voltage value

