MAIMAN ELECTRONICS

SF8025-10

Laser diode driver

Datasheet &
User Manual

Before powering on your driver, read this manual thoroughly.
If you have any doubt or suggestion, please do not hesitate to contact us!

Maiman Electronics LLC, st. Sedova, 37, lit. "A", Saint-Petersburg, Russia, 192148
e-mail: info@maimanelectronics.com
web site: www.maimanelectronics.com

1. Laser diode driver features

- **Low current ripple ≤ 10uA**
- **Current stability 0.1%**
- **No need to adjust voltage**
- **Soft-start**
- **Adjustable current limit**
- **Reverse current protection**
- **Crowbar circuit protection**

2. TEC controller feature

- **Low current ripple ≤ 2mA**
- **Integrated PID controller, doesn't require setup**
- **Adjustable TEC voltage limit**
- **Working with sensor NTC 10kOhm**

3. Applications

- **Supplying laser diodes in butterfly case**

4. Description

SF8025 contains a laser diode driver and a temperature controller (TEC).

Laser diode driver is a non isolated DC/DC SMPS (POL) with constant current output. Driver produces high stability and low ripple current.

TEC is a non isolated DC/DC. It has a low current ripples and adjustable TEC voltage limit. Integrated PID controller, providing optimal access to the required temperatures and do not have adjustable requires.

SF8025can be controlled by analogue signals.

SF8025 has dimensions 61 × 101.6mm with aluminum base plate to aid thermal dissipation from laser diode. The laser diode mount place for is located on the board. Driver can be mounted on any thermal conductive surface enough to dissipate laser diode losses.

5. Absolute maximum ratings*

	MIN	MAX	UNIT
Vin+ to Vin-	-0.3	5.5	V
Analogue control pins to GND	-0.3	5.5	V
Operating temperature	-30	50	°C

*** Stresses beyond those listed under absolute maximum ratings may cause permanent damage to the device. These are stress ratings only, which do not imply functional operation of the device at these or any other conditions beyond those indicated under recommended operating conditions. Exposure to absolute-maximum-rated conditions for extended periods may affect device reliability.**

6. Power supply requirements

The driver requires a DC power supply. The power supply must be able to cover the driver output power and losses. The power supply must provide 25W or more.

The power supply voltage must be at least 25% higher than the voltage drop of your laser diode. If you are not sure with power supply selection, please, don’t hesitate to contact us.

7. Electrical characteristics

PARAMETER	TEST CONDITIONS	MIN	TYP	MAX	UNIT
Vin			5		V
Consumption current	waiting		0.01		A
	operative			5	

8. Electrical characteristics laser diode driver

PARAMETER	TEST CONDITIONS	MIN	TYP	MAX	UNIT
Output voltage		0.5		3	V
Output current		0		250	mA
Current ripple			10	15	uA
Current set step	Set by analogue pin		→0		mA
Current set accuracy			±1		%
Internal measurements accuracy			±2		%

9. Electrical characteristics TEC

PARAMETER	TEST CONDITIONS	MIN	TYP	MAX	UNIT
Output voltage		0		±4	V
Output current		0		±4	A
Current ripple			2	4	mA
Temperature set step	Set by analogue pin		→0		°C
Temperature change range		+17		+40	°C
Internal measurements accuracy			±2		%

10. Typical Performance Characteristics

Fig. 1 - output characteristics laser diode driver

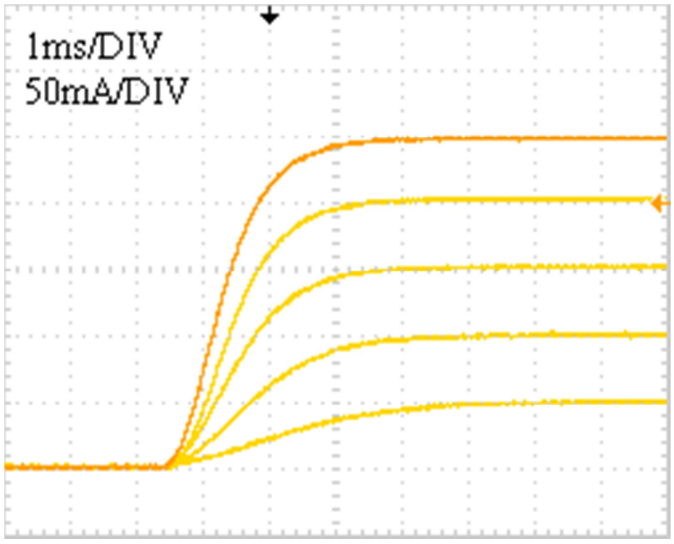


Fig. 2 – Typical start up sequence

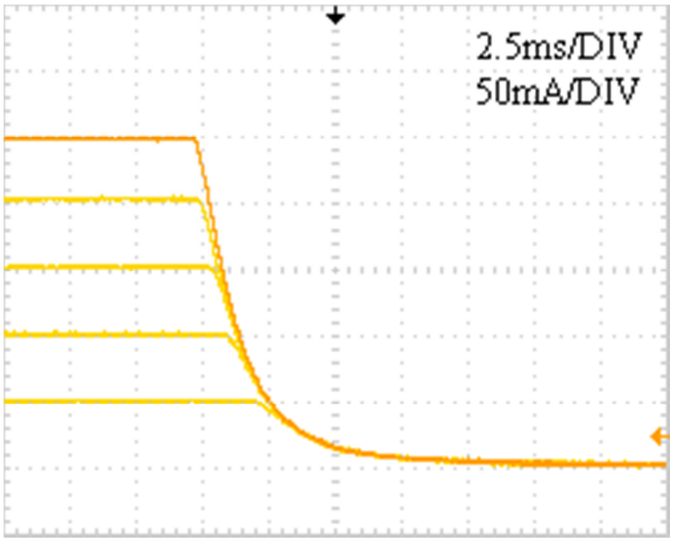


Fig. *3* – Typical stop sequence

11. Pin and terminal functions

Please, note polarity!
Never ground any lead of the output, this may cause permanent damage to the laser diode and the driver!
Never use any grounded probes (e.g. from the oscilloscope) at the output!
Control pins are not isolated!

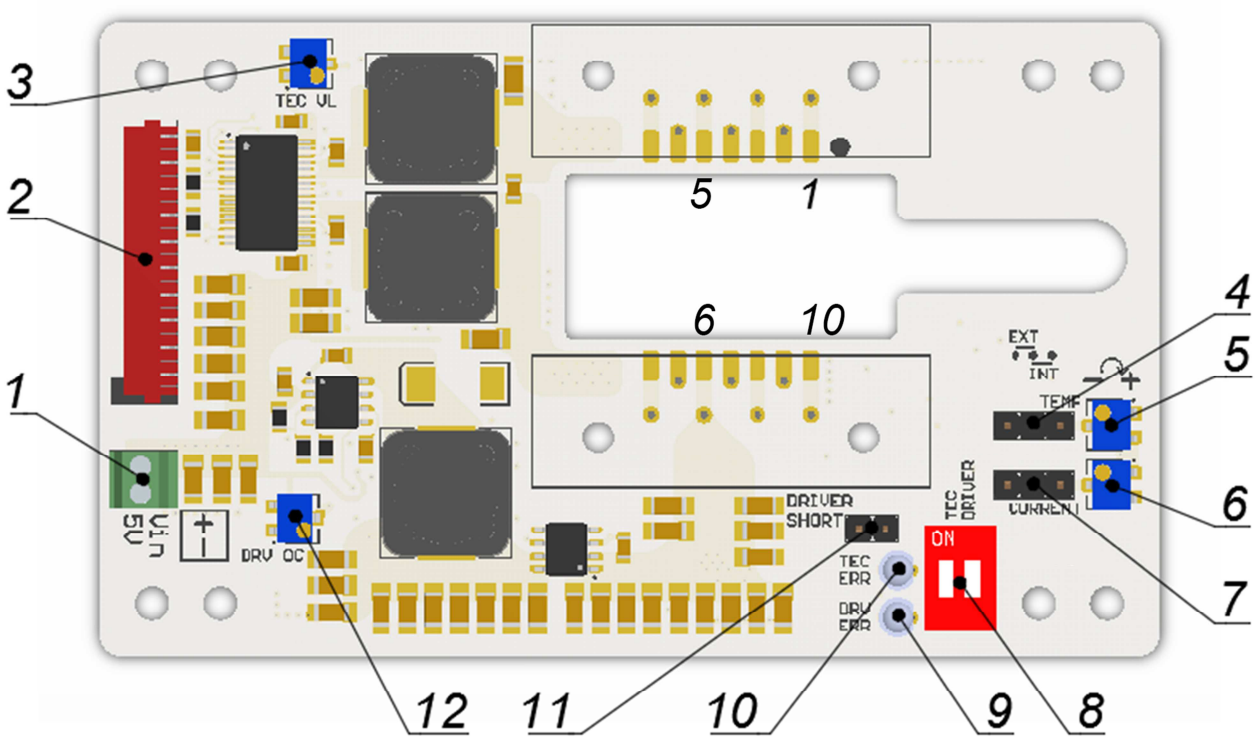


Fig. *4* – Controls

№	Description
1	Terminal for connecting the power supply 5V. Maximum wire cross-section 0.75 mm^2. Please, note polarity!
2	Analogue pin
3	TEC voltage limit adjustment potentiometer. Turn the potentiometer clockwise increases the value, counterclockwise - reduces.
4	The temperature control switching. Close 1-2 for control with analog control connector (EXT), 2-3 for control with potentiometer (INT).
5	TEC temperature adjustment potentiometer. Turn the potentiometer clockwise increases the value, counterclockwise - reduces.
6	Output current laser diode driver adjustment potentiometer. Turn the potentiometer clockwise increases the value, counterclockwise - reduces.
7	Current control switching. Close 1-2 for control with analog control connector (EXT), 2-3 for control with potentiometer (INT).
8	Two-Position switch. Left switch enable temperature controller, right switch enable laser diode driver. Contact switching duplicated on the analog control connector.
9	Laser diode driver current protection indication of the driver. Lights red when the protection is activated. To reset, you must restart the driver.
10	Indication thermocontrollers error. Red when the protection is activated. To reset the temperature controller must be restarted.
11	The short the contacts of the laser diode. Remove before turning on the driver!
12	Current limit adjustment potentiometer. Turn the potentiometer clockwise increases the value, counterclockwise - reduces.

The laser diode mounting place

№	Description	№	Description
1	TEC Anode	10	TEC Cathode
2	Thermistor	9	n/c
3	Monitor PD Anode	8	n/c
4	Monitor PD Cathode	7	LD Cathode
5	Thermistor	6	LD Anode

Analogue control connector

Wurth WR-MM 6901 5700 20 72 or TE Connectivity 2-215083-0

PIN	I/O	Name	Description
1	O	+5V	Auxiliary +5V power supply, connected to Vin.
2	I	TEC Enable	HIGH = operates, LOW = stop. Internally pulled down.
3	I	Laser Driver Enable	HIGH = operates, LOW = stop. Internally pulled down.
4	O	TEC Error	HIGH = fault, LOW = normal operation.
5	O	Laser Driver Overcurrent	HIGH = fault, LOW = normal operation.
6	O	+2.5V	Auxiliary +5V power supply.
7	I	Laser Current Set	0-2.5V = 0-250mA at the output.
8		**GND**	
9	I	TEC temperature set	0V = 42°C, 2.5V = 16°C.
10		**GND**	
11	O	Driver Current Monitor	0-2.5V = 0-250mA at the output.
12		**GND**	
13	O	TEC + voltage monitor	1V = 1V at the output.
14		**GND**	
15	O	TEC - voltage monitor	1V = -1V at the output.
16		**GND**	
17	O	TEC temperature monitor	0V = 42°C, 2.5V = 16°C.
18		**GND**	
19		Monitor PD Cathode	Connected to pin 4 Butterfly.
20		Monitor PD Anode	Connected to pin 3 Butterfly.

12. Analogue control description

12.1. Laser diode driver/ TEC temperature enable

The "Start" contacts are the turn on inputs.

For TEC enable apply to *«TEC Enable»* pin input power. This operation starts the process of temperature stabilization. To stop, it is necessary to remove the power from the contact.

For laser diode driver enable apply to *«Laser Driver Enable»* pin input power. This operation initiates the soft-start of laser driver and output current continuously exceeds the set values. To stop, it is necessary to remove the power from the contact. The contacts are connected in parallel with the on-off switch located on the board (8 in Fig. 4).

12.2. TEC Error

Thermocontroller generates an error when the maximum current is exceeded by the output, short-circuit at the output or input, circuitry overheating.

If an error occurs the corresponding LED on the board lights up red, on the analog connector «TEC Error» pin applied logic high.

A thermocontrollers error stops the current driver. To reset the error, restart the thermalcontroller.

12.3. Laser Driver Overcurrent

The *«Laser Driver Overcurrent»* pin is intended for monitoring the status of the protection circuits. When the current protection is activated, the current generator stops, the output terminals are shunted, the LED on the board lights up. The high logic level in the contact indicates the presence of shunting on the output terminals. The current generator can not be restarted after the protection has tripped. To reset the protection, restart the driver.

12.4. Reference voltage 2,5B

The *«+2.5V»* pin is intended for supplying a reference voltage to external potentiometers, which used for setting current and temperature.

12.5. Laser Current Set

The *«Laser Current Set»* pin is an analog input and is intended for setting the current amplitude in the analog control mode. To control the output current, you must apply voltage to the *«Laser Current Set»* with respect to GND. 1V at the contact = 100mA in the load, the maximum amplitude of the signal is 2.5V.

The *«Laser Current Set»* pin can be used for analogue modulation by applying sign, square or ramp signal with the DC component. Please, control the output current while using this feature. In this case, the value of the DC component determines the average current in the load, and the amplitude of the signal is the modulation amplitude. It is necessary to ensure that the current for analog modulation does not exceed the current protection threshold. Analogue modulation amplitude depends on frequency.

ATTENTION! If you use arbitrary/function generator or lab PS for current set, make sure it is in High Z mode, please, control the current set and current monitor pin voltages while getting started. When you using a generator with an output "50 Ohms", the value on the screen of the device can be less than the actually set 2 times. Be careful, monitor the voltage on the contact "Laser diode driver current *«Laser Current Set»* with an oscilloscope.

12.6. TEC temperature set

The *«TEC temperature set»* pin is an analog input and is intended for setting the temperature of stabilization of the thermocontroller. To set the TEC temperature, you must apply voltage to the *«TEC temperature set»* with respect to GND.

The applied voltage must correspond to the desired resistance of the thermistor.

The specified voltage U [V] is related to the resistance of the thermistor R [Ohm] by the formula:

$$U = \frac{2.5\,R}{10000} - 1.25$$

For example, to obtain a thermistor resistance of 10000 Ohm, a voltage of 1.25 V must be applied to the *«TEC temperature set»* pin. The 10 kOhm resistance corresponds to 25 ° C for the NTC thermistor 10k. A lower input voltage corresponds to a lower resistance of the thermistor (higher temperature) and vice versa.

When you translating the resistance of the thermistor to the temperature t [° C], it is necessary to consider the coefficient B25 / 100 [K], specified in the manufacturer's specifications:

$$t = \frac{1}{\frac{\ln\frac{R}{10000}}{B_{25/100}} + \frac{1}{298.15}} - 273.15$$

12.7. Driver Current Monitor

The output current of the driver can be monitored by current monitor. 0-1V = 0-100 mA with +/- 2% accuracy.

12.8. TEC voltage monitor

Pin *«TEC + voltage monitor»* and *«TEC - voltage monitor»* are analog inputs and allow you to monitor the voltage drop on the Peltier module.

Pin *«TEC + voltage monitor»* displays + voltage, 1V on Pin = 1V on Peltier module, when the voltage at the Peltier module is lower than 0V, the Pin = GND.

Pin *«TEC - voltage monitor»* displays - voltage, 1V on Pin = - 1V on Peltier module, when the voltage at the Peltier module is more than 0V, the Pin = GND.

12.9. TEC temperature monitor

Pin *«TEC temperature monitor»* Is an analog output and allows you to track the temperature of the thermistor of the laser diode.

Proportion described in paragraph 12.6 are valid for this Pin.

13. How to get started

Unpack the device. On the new device, the switches and knobs are set to the following values:

Control switches and knobs	Value
Limitation of voltage on the Peltier module (potentiometer TEC VL)	2V
Temperature control (switch TEMP)	INT
TEC temperature set (potentiometer TEMP)	10 kOhm (25°C)
Laser diode driver current set (potentiometer CURRENT)	0mA
Laser diode driver current control (switch CURRENT)	INT
Laser diode driver current protection threshold (potentiometer DRV OC)	100mA

13.1. Change the voltage limit on the Peltier module

If it necessary, the level of the maximum voltage limit on the Peltier module can be changed before connecting the laser diode. To do this, connect a 10 kOhm resistance resistor to the thermistor contacts, connect Peltier module contacts to a 2 ohm resistance resistor with and power is not less than 10W.

For monitoring, connect the measuring instruments to the signals *«TEC + voltage monitor»* and *«TEC - voltage monitor»*. The temperature control (switch TEMP) must be in the INT position for control with the potentiometer TEMP.

If it is necessary to increase the limitation level, turn the potentiometer TEC VL clockwise for several turns.

Start the TEC temperature controller. Indications on the voltage monitors should be are close to zero if the position of the potentiometer TEMP has not changed. Slightly rotate potentiometer TEMP in any direction, until the indication on one of the voltage monitors will not exceed the required level of limitation by 0.1-0.2V. Then slowly turn potentiometer TEC VL counter-clockwise until the display on the monitor the voltage will not decrease to the required level of limitation. Turn the potentiometer TEMP in the opposite direction so that the indications on the voltage monitors began approach zero. Turn off the TEC temperature controller.

13.2. Change the current protection threshold of the driver

If necessary, the current protection threshold can be changed before connection of a laser diode. Make sure that the jumper DRIVER SHORT is installed. Current control (switch CURRENT) must be in the INT position for control potentiometer CURRENT.

For monitoring, connect the measuring instrument to the signal «*Driver Current Monitor*».

If it is necessary to increase the limitation level, turn the potentiometer DRV OC clockwise for a few turns.

Turn on the driver. With the potentiometer CURRENT, set the current equal to the desired current protection threshold. Then slowly turn the potentiometer DRV OC counterclockwise until the protection is triggering. To continue work after current protection triggering, you must restart the driver. By changing the current with the potentiometer CURRENT make sure that the protection is triggered at the correct current.

At the end, reduce the current to zero, turn off the driver.

14. Cooling

The board does not require active cooling. Aluminum mount is designed to remove heat from the laser diode.

15. Internal protections

The device uses a series of protection to ensure the safety of the laser diode. The board provides a jumper, which shunt outputs of the driver, to protect the laser diode from static discharges when installing the diode on the board and connecting the board to other devices.

Before installing the diode on the board, make sure there is a jumper! Remove the jumper before turning on the driver.

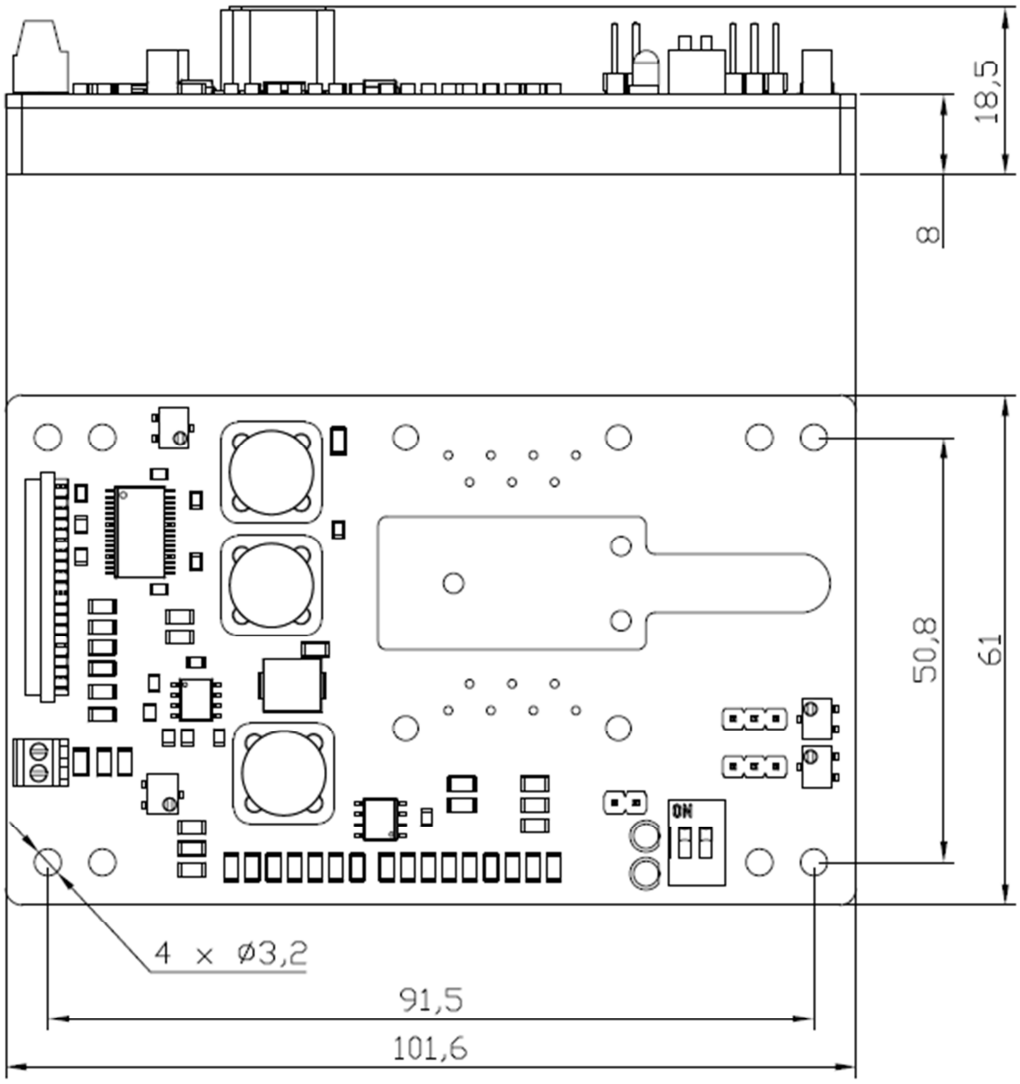
Reverse diode protects the laser diode from reverse currents and reverse voltage at the diode driver output.

The current protection threshold the safe operation of the laser diode in its acceptable current range. The setting of the current protection threshold is described in paragraph 13. The current protection threshold must be less than the current limit. When the current protection is activated, the current generator is switched off and the output is shunted. Shunt resistance 2 mOhm. Output shunting allows you to secure the load even if the driver components fail.

Voltage limit on the TEC temperature controller allows you to set the maximum voltage safe for the Peltier module.

16. Mechanical dimensions

All dimensions are in millimeters.



Test report

Test conditions:

- Test driver load – diode US1K, 1 pc;
- Test TEC controller load – resistors 4.7 Ohm, 3 pcs in parallel;
- There is no cooling.

Measuring instruments:

- Oscilloscope Tektronix TDS2024C;
- Arbitrary / function generator Tektronix AFG3021C.

Serial No.: _____

1. TEC controller

Check control

Internal enable	
Internal temperature set	
External enable	
External temperature set	
Voltage limit	

2. Laser driver

Check control

Internal enable	
Internal current set	
External enable	
External current set	
Over current protection	

CW mode test

Current set (mA)	**Output current (mA)**	
	Data from current monitor	**Data from external sensor**
50		
100		
150		
200		
250		

Tested by _____ Date_____