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**MAIMAN
ELECTRONICS**

SF8075-ZIF14

Laser diode driver

Datasheet & UserManual

Before powering on your driver, read this manual thoroughly.

If you have any doubt or suggestion, please do not hesitate to contact us!

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1. Laser diode driver features

- Low current ripple $\leq 10\mu\text{A}$
- 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 $\leq 2\text{mA}$
- Integrated PID controller, doesn't require setup
- Adjustable TEC output voltage limit
- Working with sensor NTC 10kOhm

3. Applications

- Supplying laser diodes in butterfly case

4. Description

SF8075 contains a laser diode driver and a temperature controller (TEC).

Laser diode driver is a non isolated low drop out (LDO) regulator with constant current output. Driver produces high stability and low ripple current.

TEC is a non isolated DC/DC. TEC produces low current ripples. Additional features include an adjustable TEC output voltage limit and Integrated self-adjusted PID controller, providing optimal temperature regulation.

SF8075 can be controlled by analogue signals.

SF8075 is housed in 61 × 101.6mm package with aluminum base plate to aid thermal dissipation from laser diode. The laser diode mount 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 and TEC output power and losses. The power supply must provide 25W or more.

7. Electrical characteristics

PARAMETER	TEST CONDITIONS	MIN	TYP	MAX	UNIT
Vin			5		V
Consumption current	standby		0.01		A
	operative			6	

8. Electrical characteristics laser diode driver

PARAMETER	TEST CONDITIONS	MIN	TYP	MAX	UNIT
Output voltage		0.5		3	V
Output current		0		750	mA
Current ripple			10	15	uA pk-pk
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 pk-pk
Temperature set range		+17		+40	°C
Internal measurements accuracy			±2		%

10. Typical Performance Characteristics

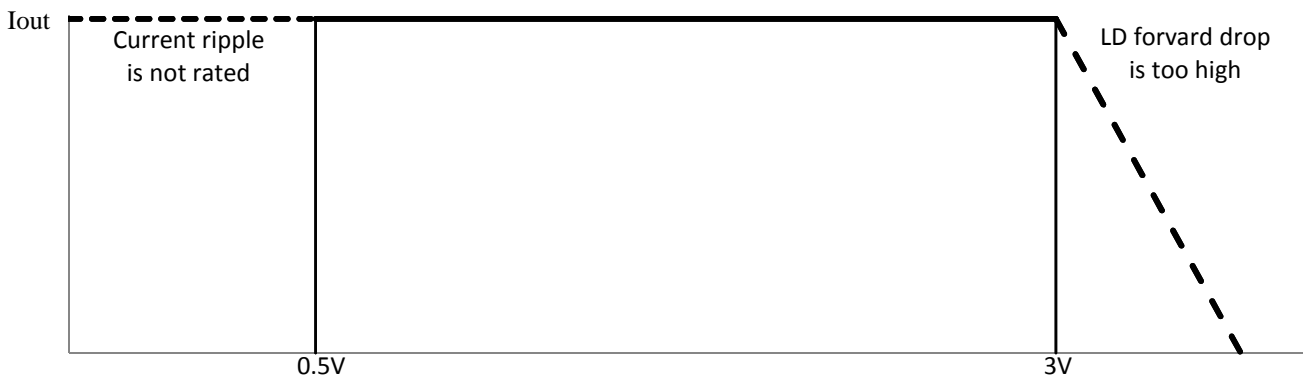


Fig. 1 - output characteristics of laser diode driver

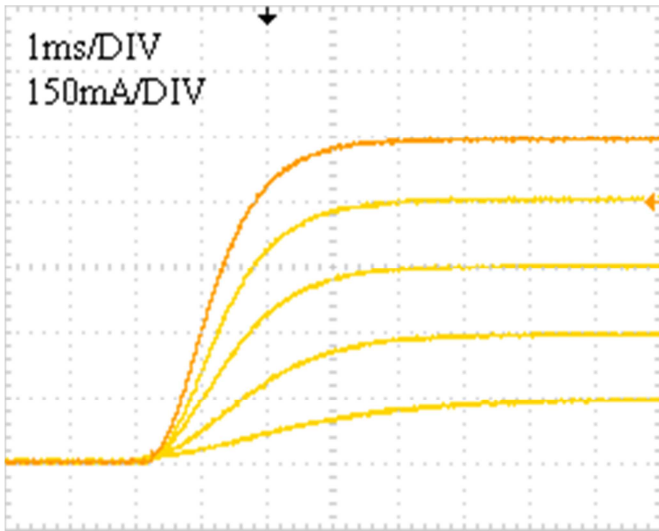


Fig. 2 – Typical start up sequence

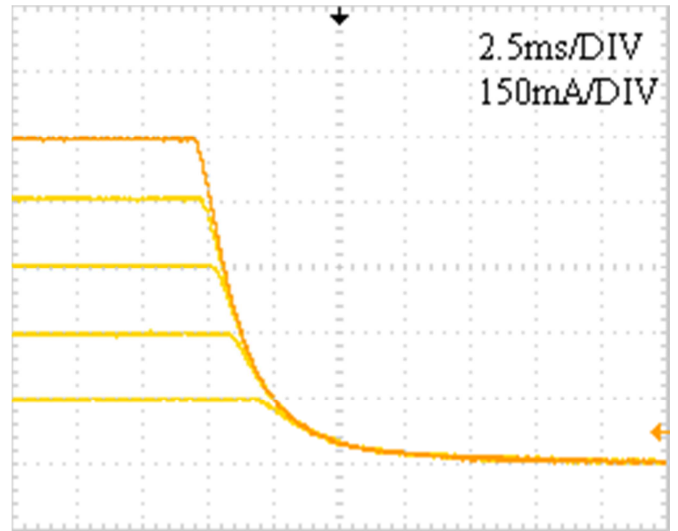


Fig. 3– Typical stop sequence

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!

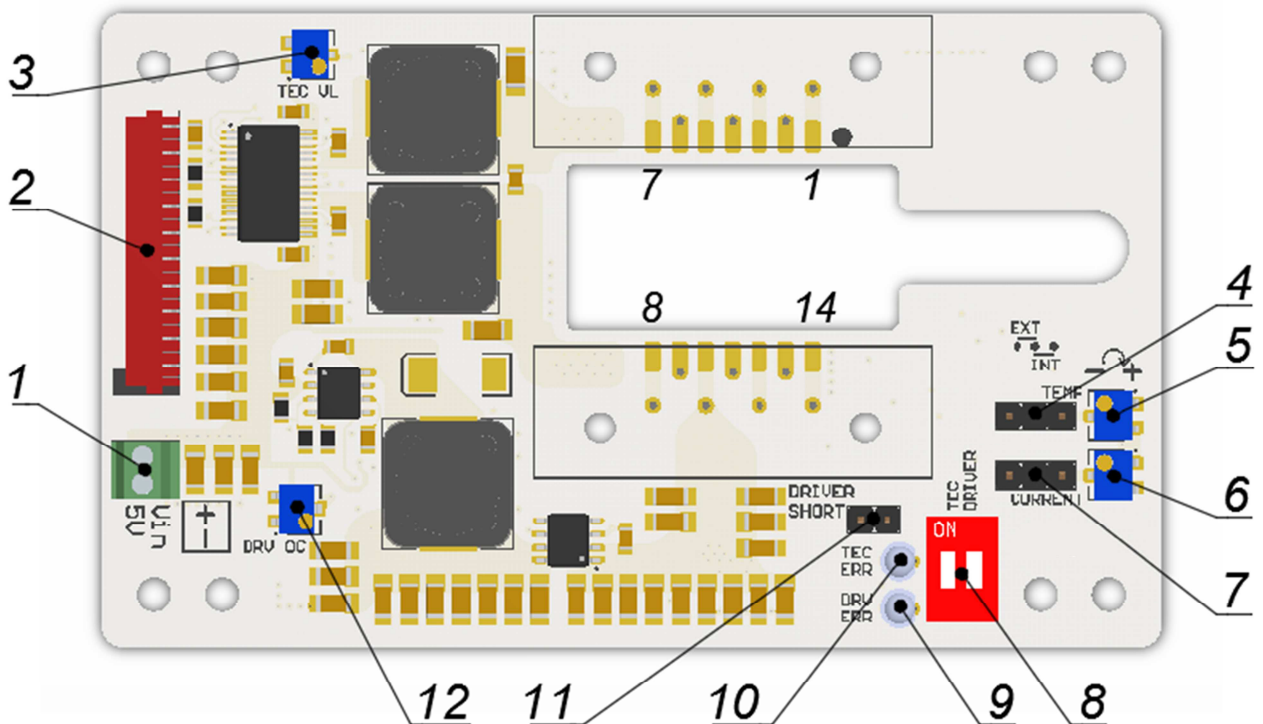


Fig. 4 –Controls

№	Description
1	Terminal for connecting the power supply 5V. Maximum wire cross-section 0.75 mm ² . Please, note polarity!
2	Analogue connector
3	TEC voltage limit potentiometer. Turning the potentiometer clockwise increases the value, counterclockwise - reduces.
4	The temperature control selector. Close 1-2 to use analog control connector (EXT), 2-3 to use potentiometer (INT).
5	TEC temperature adjustment potentiometer. Turning the potentiometer clockwise increases the value, counterclockwise - reduces.
6	Output current of laser diode driver adjustment potentiometer. Turning the potentiometer clockwise increases the value, counterclockwise-reduces.
7	Current control selector. Close 1-2 to use analog control connector (EXT), 2-3 to use potentiometer (INT).
8	Two-position switch. Left switch enables temperature controller, right switch enables laser diode driver. Switches are duplicated on the analog control connector.
9	Laser diode driver overcurrent protection indicator. Lights red when the protection is activated. To reset, you must restart the driver.
10	TEC error indicator. Lights red when the protection is activated. To reset, you must restart the TEC.
11	ESD protection LD short. Remove when the laser module is set up!
12	Current limit adjustment potentiometer. Turning the potentiometer clockwise increases the value, counterclockwise - reduces.

The laser diode connector

№	Description	№	Description
1	TEC Anode	14	TEC Cathode
2	Thermistor	13	n/c
3	Monitor PD Anode	12	n/c
4	Monitor PD Cathode	11	LD Cathode
5	Thermistor	10	LD Anode
6	n/c	9	n/c
7	n/c	8	n/c

Analogue control connector

Würth 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 +2.5V power supply.
7	I	Laser Current Set	0-2.5V = 0-750mA 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 = 0-750mA 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 of Butterfly.
20		Monitor PD Anode	Connected to pin 3 of Butterfly.

12. Analogue control description

12.1. Laser diode driver/TEC temperature enable

The "Enable" contacts are logic inputs.

Apply high level to «*TEC Enable*» pin to start temperature stabilization. Apply low level to «*TEC Enable*» pin to stop temperature stabilization.

Apply high level to «*Laser Driver Enable*» pin to initiate soft-start sequence of laser diode driver. Apply low level to «*Laser Driver Enable*» pin to stop the driver.

The enable features are duplicated with on-off switches located on the board (8 in Fig. 4).

12.2. TEC Error

The «*TEC Error*» contact is logic output.

TEC error signal generates in overcurrent, short-circuit or circuitry overheat condition.

If an error occurs the corresponding LED on the board lights up red, «*TEC Error*» pin becomes high.

A TEC error stops the laser driver. To reset the error, restart the TEC.

12.3. Laser Driver Overcurrent

The «*Laser Driver Overcurrent*» contact is logic output.

The «*Laser Driver Overcurrent*» pin is intended for monitoring the status of the protection circuits. When the current protection is activated, the laser driver stops, the output terminals are shunted, the LED on the board lights up red. The high logic level in the contact indicates the presence of shunting of the output terminals. The current generator cannot 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 etc., which used for current and temperature setting.

12.5. Laser Current Set

The «*Laser Current Set*» pin is an analog input.

The «*Laser Current Set*» is intended for setting the driver output current amplitude. Apply voltage to the «*Laser Current Set*» with respect to GND to control the output current. 1V at the contact = 300mA 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 determines 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.

The «*TEC temperature set*» is intended for setting the desired temperature of laser module. Apply voltage to the «*TEC temperature set*» with respect to GND To set the desired temperature.

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 = 0-300mA with +/- 2% accuracy.

12.8. TEC voltage monitor

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

The «*TEC + voltage monitor*» pin displays positive voltage, 1V on Pin = 1V on Peltier module. When the voltage at the Peltier module is negative, the Pin = GND.

The «*TEC - voltage monitor*» pin displays negative voltage, 1V on Pin = - 1V on Peltier module. When the voltage at the Peltier module is positive, the Pin = GND.

12.9. TEC temperature monitor

The «*TEC temperature monitor*» pin is an analog output and allows you to track the temperature of the laser diode.

Proportion described in paragraph 12.6 are valid for this Pin.

13. How to get started

Unpack the device. The new device is configured with the following values:

Parameter	Value
Peltier module voltage limit (potentiometer TEC VL)	2V
Temperature control (switch TEMP)	INT
TEC temperature set (potentiometer TEMP)	10kOhm(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)	300mA

13.1. Change the voltage limit on the Peltier module

If it is necessary, the level of voltage limit on the Peltier module can be changed before connecting the laser diode. Connect a 10 kOhm resistor to the thermistor contacts, connect a 2ohm resistor with max. power 10W or higher to the Peltier module contacts.

Connect the measuring instruments to «TEC + voltage monitor» and «TEC - voltage monitor» pins. The temperature control switch TEMP must be in the INT position to use the potentiometer TEMP.

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

Start the TEC. Indications on the voltage monitors should be 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 exceeds the required level of limitation by 0.1-0.2V. Then slowly turn potentiometer TEC VL counterclockwise to set the required level of limitation. Turn the potentiometer TEMP back until the signals on the voltage monitors becomes zero. Turn off the TEC.

13.2. Change the current protection threshold of the driver

If it is 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 to use the potentiometer CURRENT.

Connect the measuring instrument to the «Driver Current Monitor» pin.

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

Turn on the driver. Set the current equal to the desired current protection threshold with the potentiometer CURRENT. Then slowly turn the potentiometer DRV OC counterclockwise until the protection is activated. Restart the driver to reset an error. Make sure that the protection is triggered at the correct current.

Set 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 provides several security features to ensure the safety of the laser module.

The jumper shunts the outputs of driver, to protect the laser diode from static discharges while installing.

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

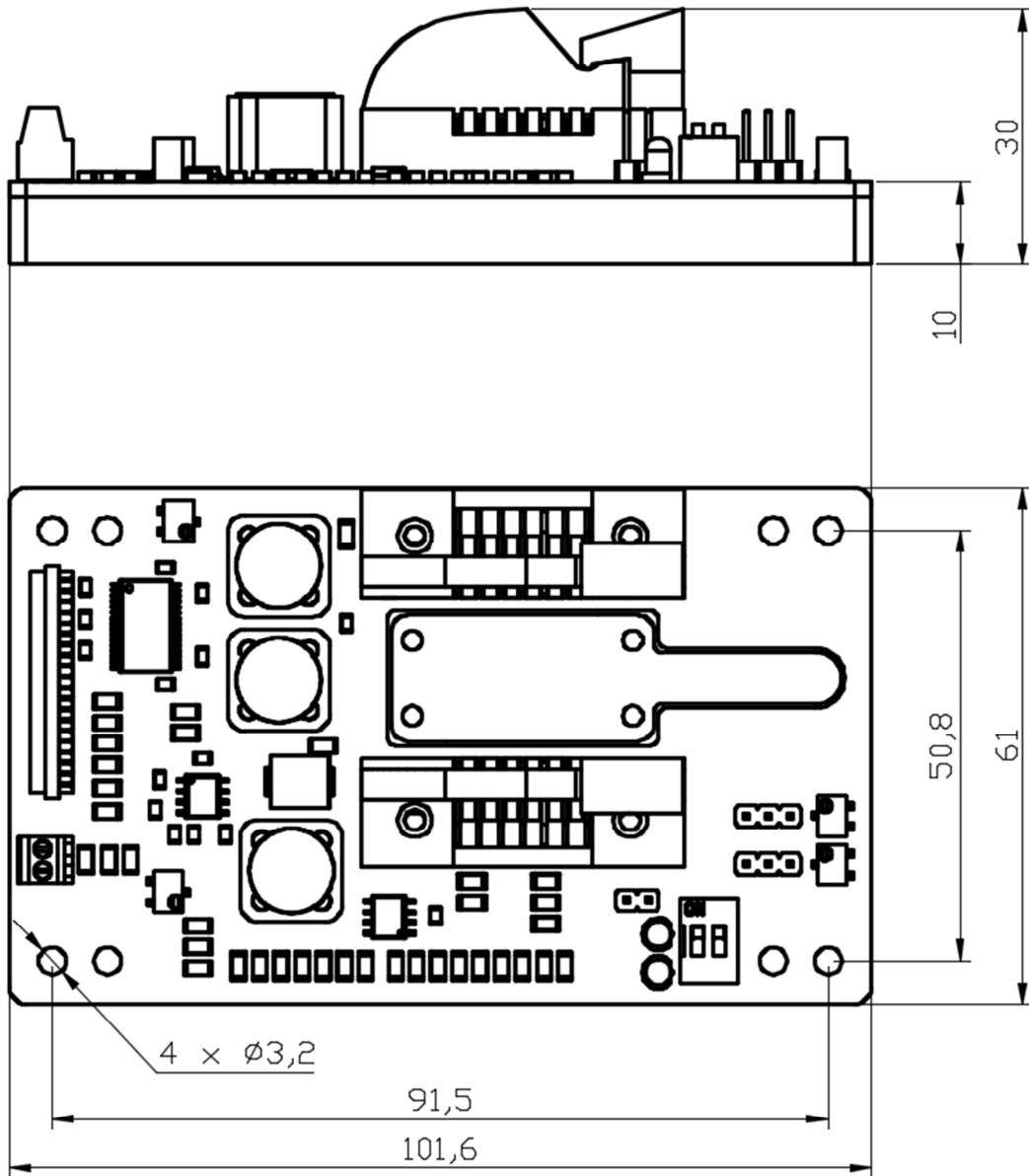
Reverse diode protects the laser diode from reverse current and reverse voltage.

In case of an over-current or an over temperature condition, the control logic disables the driver and the output shorts with 2 mOhm shunt. Setting the current protection threshold is described in paragraph 13. The current protection threshold must be less than the laser module absolute maximum ratings.

The TEC voltage limit allows 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
150		
300		
450		
600		
750		

Tested by _____ Date _____