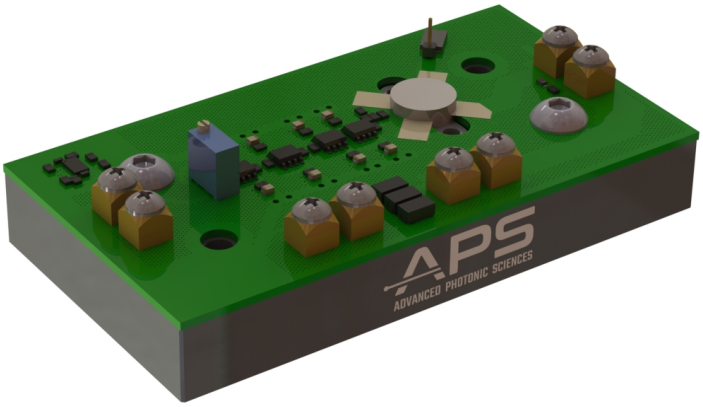
ADVANCED PHOTONIC SCIENCES

ION-10A
Operating Manual & Datasheet

Version 1.2.1



January 24, 2023

1 Introduction

The ION-10A is a novel laser driver meant to achieve very high modulation capabilities at very high current. With high gain, many different types of lasers that require high current can be driven with this device. With the incorporation of a separate voltage option connection, very high voltage lasers can be used with this as well.

It utilizes fast hysteresis circuitry along with charge pump voltage regulation to achieve high-frequency/high-power modulation.

Mounted onto an aluminum heat-sink, the device comes with a standard 1/4-20" 1" spacing through holes for optical table mounting. It can achieve frequencies of up to 10MHz with peak currents of 25 amps if desired.

With an average maximum current of 10 amps, the device can also be used as a conventional DC driver with interlocking and enabling features, perfect for plug in applications requiring a source to power a laser.

With it's feed-forward circuitry approach, high speeds at high current can allow any kind of load source to be driven. It only requires the user to measure the desired output current which can then be maintained for the rest of its operation.

Features

- Feed-Forward Control Approach
- Up to 10A of Average Current
- 10 MHz of Modulation at 25A
- Very High Peak Current
- Breadboard Mounting Pattern
- Selectable Laser Voltage Supply
- Fast Hysteresis
- Dual-Rail Charge Pump Topology

Applications

- High Speed Laser Modulation
- Overdriving Laser Diodes
- Clean Laser Power Driver
- Frequency Domain Radiation Thermography
- System Integration
- High Voltage Laser Supplies
- And More...

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2 Safety

Any regards to safety to the user in this document is with the assumption that the device is being operated properly and in a safe environment. Care needs to be made to ensure that the user follows the operation procedures listed in this manual and understands that any deviation to the operation procedures could cause damage to the lasers used with this driver.

There are no protective features on this product. Contact info@apslasers.com for a list of protective measures that can be done to prevent laser or electric shock damage.

3 Absolute Maximum Ratings(*)

Terminal Pin	Minimum Value	Maximum Value
+VMOD	0V	10V
-VMOD	-10V	10V
+12V	0V	16V
LD+	0V	126V

(*) Stresses beyond these limits are at users risk of damage to system and peripheral devices.

4 Specifications

Discipline	Parameter	Value	
Mechanical	Width	2.44 in. (62.0 mm)	
	Length	4.52 in. (114.7 mm)	
	Total Height	1.12 in. (28.2 mm)	
	Weight	0.4 lbs. / 0.181 kg	
	Terminal Screw Size	M3	
Electrical	Max. Average Short-Circuit Current	10 A	
	Peak Operating Current(*)	25 A	
	Operating Input Voltage	9 V Min.	16 V Max.
	Max Bandwidth	Sinusoid	10 MHz
		Square	5 MHz
	Modulation Voltage	0-10 V	
	Rise Time	10 ns	
	Fall Time	10 ns	
	Modulation Input Impedance(1)	10 kΩ	
	Soft Start Duration	100 ns	
	Connections	-VMOD	
		+VMOD	
		+12V	
		Laser Power	
		+LD	
		-LD	
		Ground (x2)	
Environmental	Max. Operating Temperature	150°C	
	Storage Temperature	-40°C Min.	150°C Max.
	Heat Power at Max. Load	389 W	

(*) Stresses beyond these limits are at users risk of damage to system and peripheral devices.
(1) It is recommended to operate the input waveform with a "High Z" impedance to ensure sufficient transmission. Contact APS further information is required besides what is explained in Section 5.1.

5 Operation

This section goes through the various controls and functions of the ION-10A.

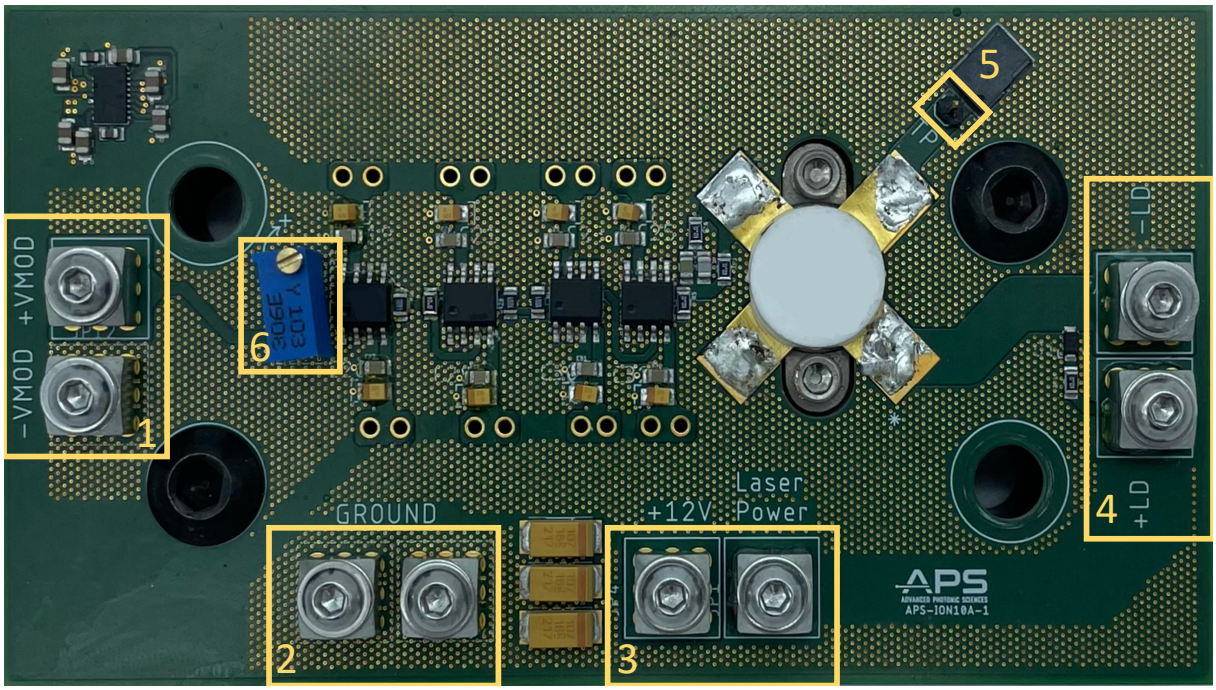

Figure 1: Circuit Board

Figure 1 shows all the interfaces the user has with the device. These are explained in detail with the following pin out Table 5.

#	Pin	Description
1	+VMOD	Positive Modulation Input. Can Also be Used as a DC Enable Input
	-VMOD	Negative Modulation Input. A Bias can be Applied to this Input.
2	Ground	Connection for Negative Power Supplies and for Measurements.
3	+12V	Positive Power Supply Connection. 12V is recommended.
	Laser Power	Positive Power Supply for Laser. Tie to +12V for loads requiring less than 12V. More detail in Section 5.1.
4	+LD	Anode of Laser (+).
	-LD	Cathode of Laser (-).
5	TP	(Test Point) Location to Measure Peak or Average Current flowing through the Load. Use a High impedance postive probe.
6	N.A.	Potentiometer for current control. Clockwise increases current gain in MOSFET. Turn counterclockwise at least 10 times before initial operation.

5.1 Terminal Connections

+VMOD (Input): This is the positive connection for enabling the laser. Atleast 5V is required for an enable threshold, however, 10V can be used in order to further amplify the current to load. When applying a waveform to this pin, it is **recommended** to use a high impedance ("High Z" on most devices) as an input in order to achieve the best transmission results. Leaving this pin floating or connected to ground will act as a disabling source and therefore shut the laser off. It is best to re-calibrate the system when using a new waveform source.

-VMOD (Input): This circuit does not accept a negative waveform flowing through the device. If a negative signal is sent, it will be chopped off by the ground voltage or rail of the device. This pin is best served as the grounding input of the waveform. Care is needed in order to prevent rail saturation and loss of signal clarity from input to load output.

Ground: There are two ground terminals on the board. These can be used for power and for connecting test probes. Connecting this to a chassis or an Earth ground can improve the noise performance of the driver.

+12V (Input): This is the positive power input for the peripheral circuitry. Tie this to **Laser Power** if the laser voltage is below the **+12V** input voltage. +12V is recommended, but this pin can accept from 9V - 16V. If the laser is being operated **above** these voltages, do not connect this pin to the Laser Power terminal. This will damage the device. Refer to the next paragraph for proper operation with the Laser Power pin. **NEVER EXCEED MORE THAN 16V ON THE +12V TERMINAL OR RISK DAMAGING THE DEVICE.**

Laser Power (Input): This pin is used to apply voltage to the laser. If the Load of the laser is less than the voltage applied to the +12V Input, the Laser Power Terminal can be tied together with the other power pin. When the laser voltage is beyond the maximum operating voltage of the +12V terminal, a separate voltage source is required to be connected to the Laser Power Terminal and Ground. **NEVER EXCEED MORE THAN 16V ON THE +12V TERMINAL OR RISK DAMAGING THE DEVICE.**

+LD (Output): This terminal is the **positive** output for the laser (anode).

-LD (Output): The **negative** terminal output for the laser (cathode)

TP (Output): A probing terminal to measure the current flowing throught the laser. Refer to Section 5.2 for voltage conversion information. Use a high impedance probe to connect a probe to this terminal.

Potentiometer: The potentiometer has 11 full turns. Counterclockwise (turning left) will lower the gain and current to the laser. Clockwise (turning right) will increase the gain and current. Special care is needed to prevent overcurrent to your laser (or other load). The gain is nonlinear and should be increased slowly.

5.2 Measuring Current

The ION-10A comes with a testing point (TP) to measure the current flowing through the load connected to LD+ and LD- (refer to Table 5. When measuring the current, use a high impedance probe either connected to a voltmeter, oscilliscope or lock-in detector (for waveforms), or other processing units in a larger system. To convert the voltage read to current, apply the following equation:

$$I_L = \frac{V_{TP}}{0.1}. \tag{1}$$

Here V_{TP} is the Voltage read at the TP Terminal and I_L is the Laser (or Load) Current.

6 Drawings/Dimensions

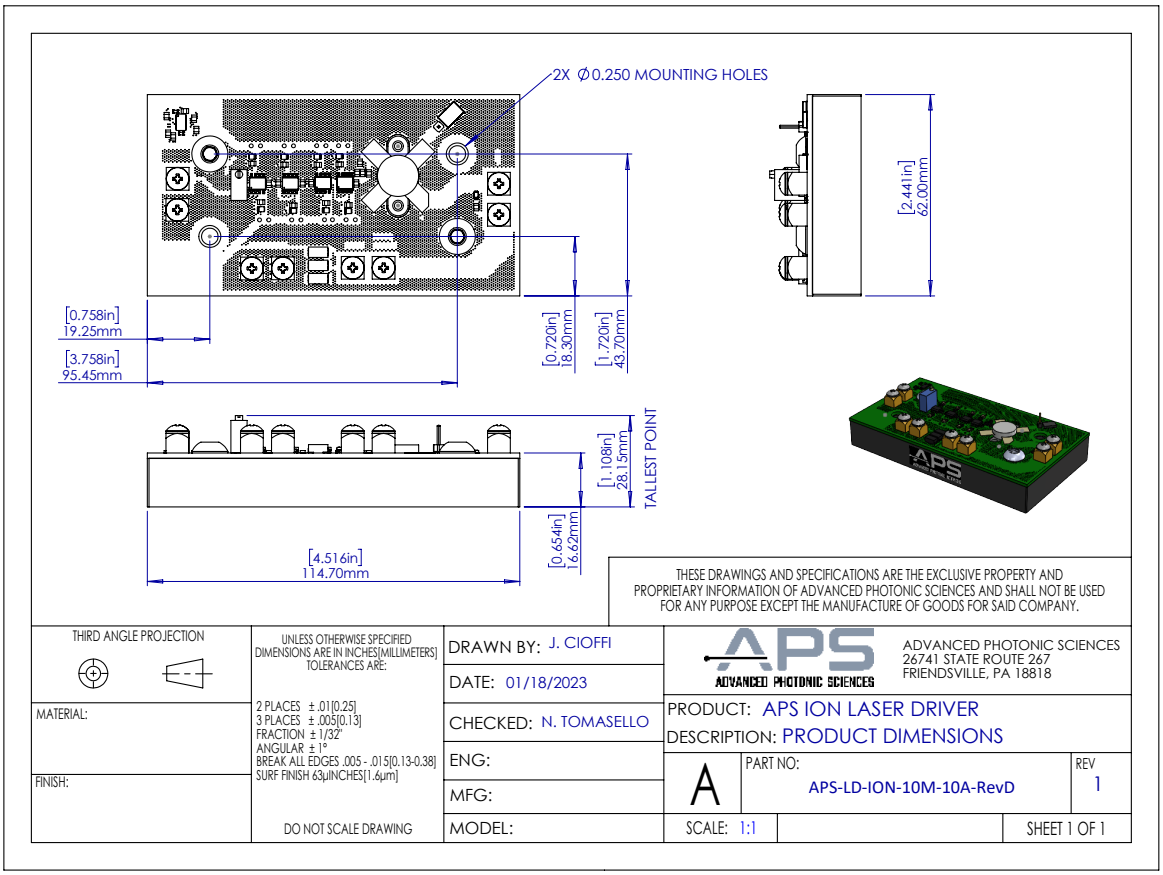

Figure 2: Product Dimensions

Document Revisions

Rev. -	11/01/22	Initial Documentation
Rev. 1	1/24/23	Documentation Release

Support

Please contact Advanced Photonic Sciences for technical support: www.apslasers.com

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