Data Sheet
Miniature Laser Driver MLD203P2

Features

- Low cost, highly integrated, high-precision laser diode driver with small footprint
- Simple driver for TO can lasers and others
- Small SMT footprint, enabling machine assembly
- Soft start and brownout protection for protection of the laser from current transients
- Up to 200 mA LD current at a maximum 3 V LD voltage
- Laser power setting configurable as fixed setpoint or adjustable with potentiometer
- 2 µA to 2 mA monitor (photo) diode current
- Low Noise Operation

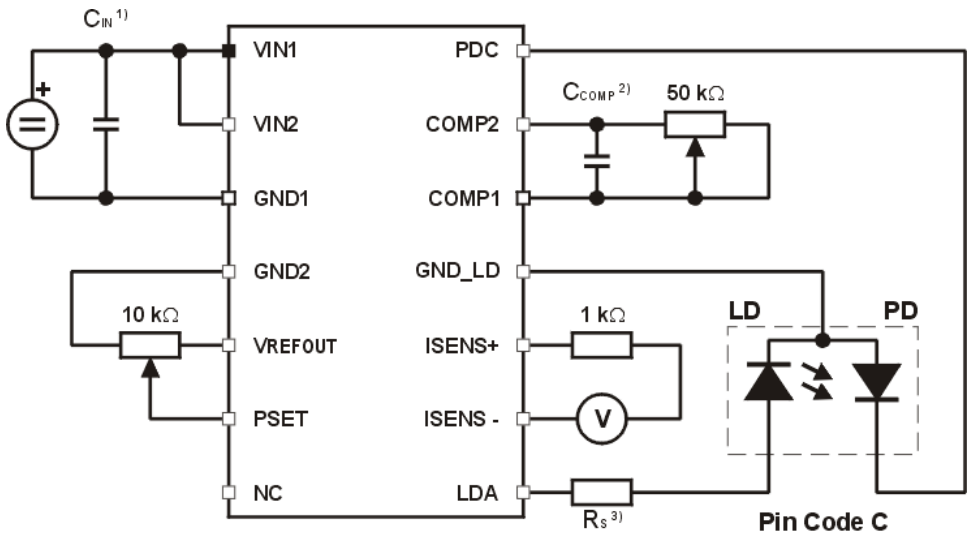
Applications

- Driving low-power laser diodes at
  - Fixed setpoint without external circuitry
  - Adjustable setpoint with external potentiometer or setpoint voltage
- Suitable for laser applications where small size is required, e.g.:
  - Laser pointers
  - Pilot lasers in adjustment applications etc.

Short Description and Typical Application Diagram

The MLD203P2 Miniature Laser Driver allows Constant Power operation. The operating setpoint of the laser diode can be defined by one external resistor (fixed setpoint). For an adjustable setpoint, an external potentiometer or an external control voltage from 0 to 2.5 V is required.
A soft start and a brownout protection prevents the laser from unwanted current transients.
The MLD203P2 supports laser diodes of pin codes C and D.

It features a low current noise below 3 µA.



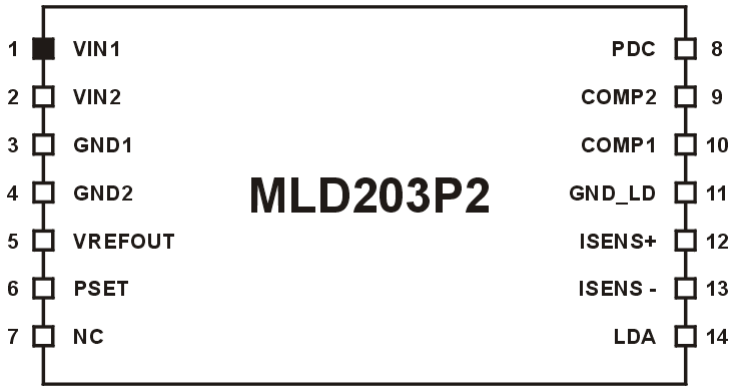
MLD203P2 Typical External Circuit

Revision History

Revision	Changes with respect to previous revision
1.1	Update
1.2	New Company Address; Correction Equation I_{LD} vs U_{ISET}

Contents

1 Pin Configuration and Functions



MLD203P2 Pin Configuration

Pin	Name	Description
1	VIN1	Supply Voltage Input 1
2	VIN2	Supply Voltage Input 2
3	GND1	Supply Voltage Ground
4	GND2	Return Pin (Ground) for Pin 6 (PSET)
5	VREFOUT	Reference Voltage (+2.5 V) Output
6	PSET	Input Control Voltage to Set Power
7	NC	No Connection
8	PDC	Photo (Monitor) Diode - Cathode
9	COMP2	Feedback Resistor Resistor (Gain Control of the TIA)
10	COMP1	
11	GND_LD	Laser Diode Ground (Cathode)
12	ISENS+	Laser Diode Current Sensor Output (Voltage)
13	ISENS-	
14	LDA	Laser Diode Anode

2 Technical Data

2.1 Absolute Maximum Ratings

Supply Voltage	6 V
Power Dissipation	750 mW
Operating Temperature	-25 °C to + 90 °C
Storage Temperature	-40 °C to +100 °C

Note

Stresses beyond those listed above may cause permanent damage to the product. These are stress ratings only; functional operation of the MLD203P2 at these or any other conditions beyond those indicated under *Recommended Operating Conditions* and *Electrical Characteristics* is not implied.

Operation beyond the maximum rated conditions for extended periods may affect product reliability.

2.2 Recommended Operating Conditions

Supply Voltage	4.5 to 5.5 V
Operating Temperature	-20 to + 70 °C

2.3 Electrical Characteristics

Features	
Supported Laser Pin Codes	C, D
Operating Mode	Constant Power (CP)
Current Control	
Control Range of Laser Current	0 to 200 mA
Compliance Voltage (5 V Supply Voltage)	3.0 V
Noise (10 Hz to 10 MHz, rms)	3 µA [1])
Power Control	
Photodiode Current Control Range	2 µA to 2 mA
Accuracy (full scale)	± 2% typ.
Repeatability (full scale)	± 0.1%
Drift (24 h, T_{amb} = 25 °C)	20 nA [2])
Temperature Coefficient	55 ppm/°C
Setpoint Input	
Input Resistance	1 MΩ
Input Voltage Range	0 to 2.5 V
Voltage Conversion Coefficient Range (adjustable)	8 µA/V to 800 µA/V ± 5%
Measurement Output	
Laser Current (1 Ω Measurement Series Resistor)	1 mV/mA
Measurement Accuracy (with Load ≥ 10 kΩ)	1%
General Data	
Storage Temperature	-40°C to +100 °C [3])
Warm-Up Time for Rated Accuracy	10 min
Dimensions (W x H x D)	10 x 2.8 x 17 mm³
Approx. Weight	1 g

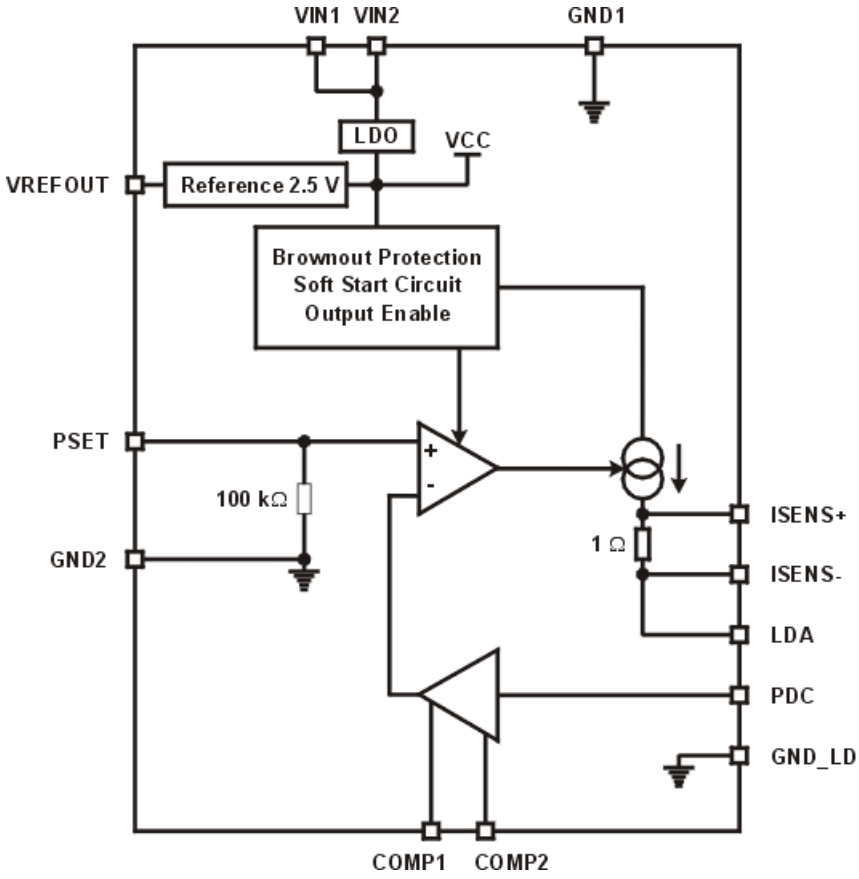
[1]) Measured with a 10 Ω measurement resistor in series with a L637P5 laser diode in constant power mode

[2]) Measured with a L637P5 laser diode in constant power mode, P_0 = 4.5 mW, T_{amb} = 25 °C

[3]) non-condensing

All technical data are valid at 23 ±5 °C and 45 ±15% rel. humidity (non condensing)

3 Functional Block Diagram



Functional Block Diagram MLD203P2

Functional Description

The MLD203P2 is a laser diode driver module that operates in CP (Constant Power) mode. In CP mode, the laser current is controlled in a manner that keeps the photo diode current constant. For adjusting the optical power, a PD current set value must be applied.

The MLD203P2 delivers up to 200 mA at 3 V compliance voltage. It operates with laser diodes of pin codes C and D.

Power Supply

The supply voltage **VIN** ranges from 4.75 V to 5.25 V. From VIN, a stable internal supply voltage for the laser current source and the control circuits is derived by the internal LDO (low-dropout regulator). Further, a reference voltage is generated (**VREFOUT**; 2.5 V).

Laser Diode Control

The laser diode is connected between **LDA** (anode) and **GND_LD** (cathode, common with photodiode anode)

Internal protection circuits provide a safe switch-on of the laser diode during transition conditions after applying the supply voltage. The Brownout Protection blocks the enabling of the laser diode current output until the supply voltage transient is completed and reached a minimum of 4.75 V. The Soft Start enables then the output current with a defined ramp that efficiently avoids laser current transients that might destroy the laser diode.

The voltage between the **ISENS+** and **ISENS-** pins is proportional to the laser diode current and can be calculated by

$$I_{LD}\ [A] = \frac{U_{SENS}\ [V]}{1\ [\Omega]}$$

Power Control by Photodiode Current

The MLD203P2 operates in Constant Power Mode. The criteria for constant power is a constant photo current, delivered by the build-in to the laser housing photodiode (AKA monitor diode). Therefore, the photodiode current is measured (actual value) and converted into a voltage, which is compared with a set value.

The photodiode is connected between **PDC** and **GND_LD**. Its current is applied to the input of a TIA (Transimpedance Amplifier). The output of this stage delivers a voltage equivalent to the optical power and is applied to one of the comparator inputs.

The feedback resistor connected to the **COMP1** and **COMP2** pins determines the gain of the TIA, and this way the maximum possible photodiode current. The relation between maximum photodiode current $I_{PD,MAX}$ and R_{COMP} is expressed by the formulas

$$I_{PD,MAX}\ [A] = \frac{2.5\ V}{R_{COMP}\ [\Omega]} \qquad R_{COMP}\ [\Omega] = \frac{2.5\ V}{I_{PD,MAX}\ [A]}$$

Example

R_{COMP} = 12.5 kΩ limits the photo diode current to 200 µA.

Note

Between COMP1 and COMP2 a frequency compensation capacitor (100 pF) is located.

Setting the Optical Power

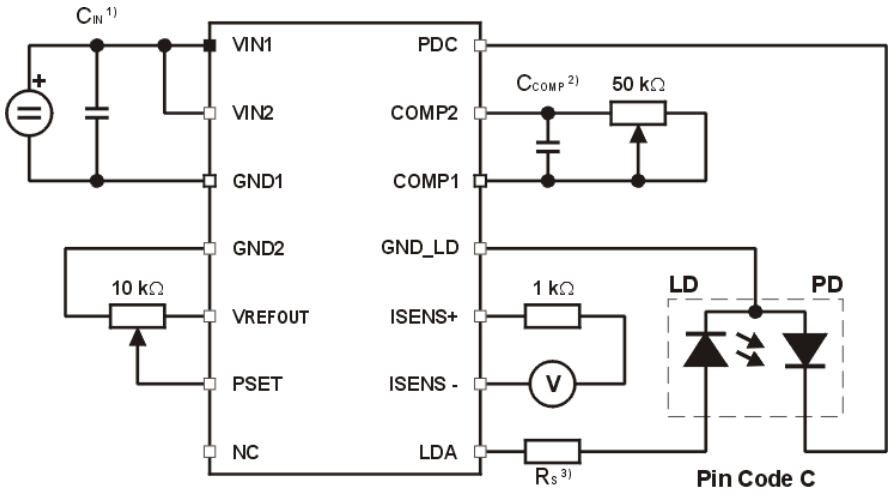
PSET is the second input of the comparator that controls the laser current. Above formulas define the maximum possible setpoint for the photodiode current, at an input voltage at **PSET** of 2.5 V.

The input voltage U_{PSET} ranges from 0 to +2.5 V. The control voltage can be applied from an external source or from the **VREFOUT** reference voltage output (2.5 V) via a potentiometer or fixed voltage divider.

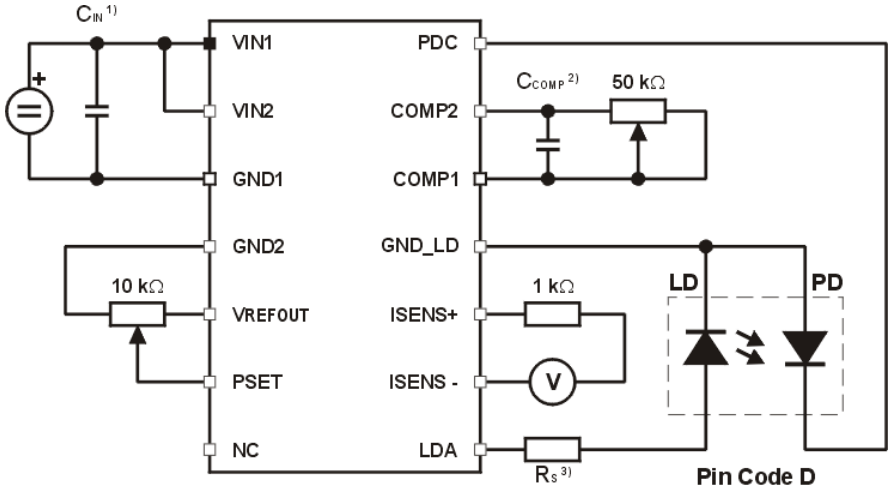
The photo diode current set point is calculated by:

$$I_{PD}\ [A] = \frac{I_{PD,MAX}\ [A]}{2.5\ V} \times U_{PSET}\ [V]$$

4 Typical Application



Typical Application MLD203P2 - Laser Pin Code C



Typical Application MLD203P2 - Laser Pin Code D

Remarks:

[1]) C_{IN}: Optional ceramic capacitor for reduction of power supply ripple

[2]) C_{COMP}: Optional ceramic capacitor for compensation of a large photodiode capacitance

[3]) R_S: Optional resistor for laser current limitation

5 Troubleshooting

The MLD203P2 has an imprinted Data Matrix code, that contains manufacturing information:

Please scan this code with your smartphone, and submit the DataMatrix code information to Thorlabs.

Compatible Android apps are:

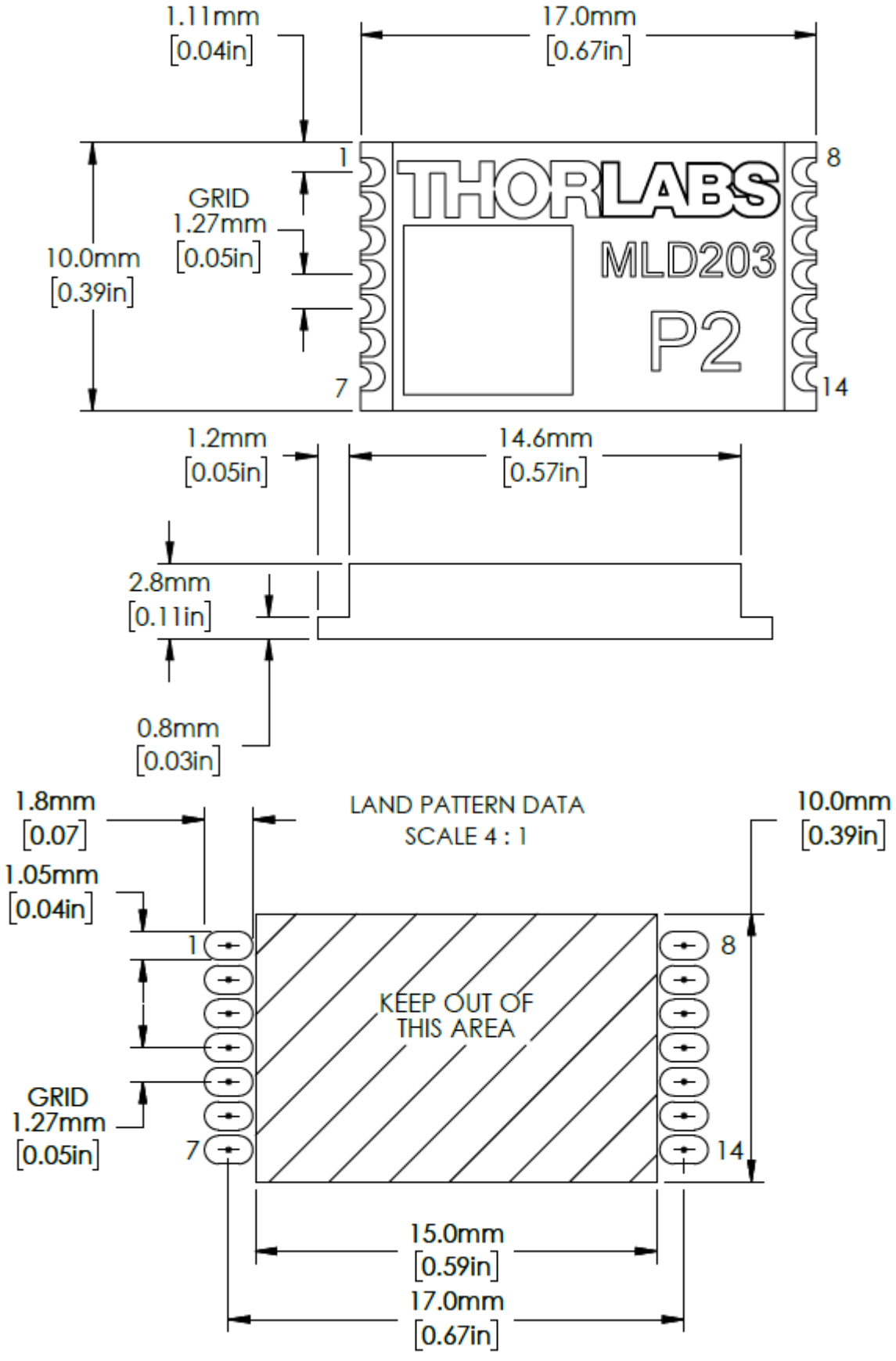
QR & Barcode Scanner **QRbot** by TeaCapps. This scanner allows to share the scanned code directly by email.
(https://play.google.com/store/apps/details?id=net.qrbot&hl=de)

QR Droid Code Scanner QRDroid by DroidLa.
(https://play.google.com/store/apps/details?id=net.qrbot&hl=de)

Compatible iOS apps:

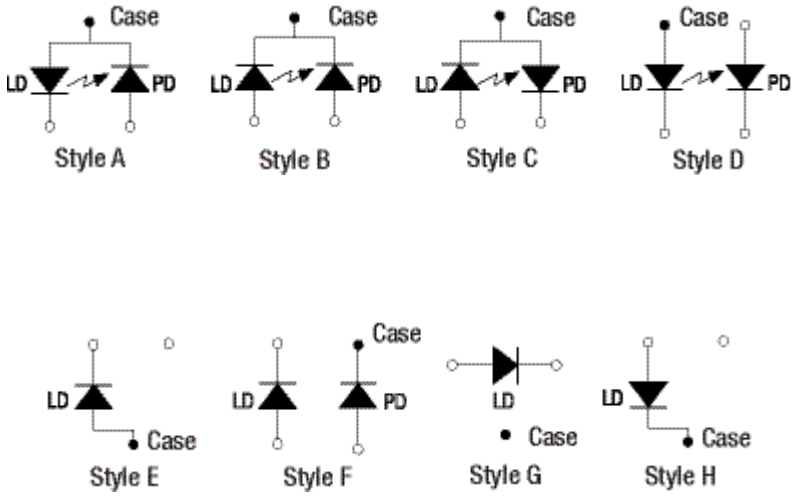
QR & Mobile Barcode Scanner **NeoReader®** by NeoMedia Technologies.
(https://itunes.apple.com/de/app/neoreader-qr-mobile-barcode/id284973754?mt=8)

6 Drawing


1.11mm
[0.04in]
17.0mm
[0.67in]
1
8
GRID
1.27mm
[0.05in]
10.0mm
[0.39in]
THORLABS
MLD203
P2
7
14
1.2mm
[0.05in]
14.6mm
[0.57in]
2.8mm
[0.11in]
0.8mm
[0.03in]
1.8mm
[0.07]
LAND PATTERN DATA
SCALE 4 : 1
10.0mm
[0.39in]
1.05mm
[0.04in]
1
8
KEEP OUT OF
THIS AREA
GRID
1.27mm
[0.05in]
7
14
15.0mm
[0.59in]
17.0mm
[0.67in]

7 Laser Diode Pin Codes

This document refers to the laser diode pin codes **A** to **F** as per the figures below:



Laser Diode Pin Diagrams - Bottom View
(Bold dots indicate case connection)

8 List of Acronyms

The following acronyms and abbreviations are used in this manual:

AC	Alternating Current
DC	Direct Current
ESD	Electrostatic discharges
GND	Ground
GUI	Graphic User Interface
I²C	Inter-Integrated Circuit
LD	Laser Diode
µC	Micro-Controller
NR	Noise Reduction (filter)
LDO	Low-Dropout Regulator
OA	Operational Amplifier
PCB	Printed Circuit Board
PD	Photo Diode
SCPI	Standard Commands for Programmable Instruments
SMT	Surface Mounted Technology
TEC	Thermoelectric cooler
TIA	Transimpedance Amplifier
USB	Universal Serial Bus
USB TMC	USB Test and Measurement Class (device)
VVA	Voltage-to-Voltage Amplifier

9 Warranty

Thorlabs warrants material and production of the MLD203P2 for a period of 24 months starting with the date of shipment. During this warranty period Thorlabs will see to defaults by repair or by exchange if these are entitled to warranty.

For warranty repairs or service the unit must be sent back to Thorlabs. The customer will carry the shipping costs to Thorlabs, in case of warranty repairs Thorlabs will carry the shipping costs back to the customer.

If no warranty repair is applicable the customer also has to carry the costs for back shipment.

In case of shipment from outside EU duties, taxes etc. which should arise have to be carried by the customer.

Thorlabs warrants the hard- and/or software determined by Thorlabs for this unit to operate fault-free provided that they are handled according to our requirements. However, Thorlabs does not warrant a fault free and uninterrupted operation of the unit, of the software or firmware for special applications nor this instruction manual to be error free. Thorlabs is not liable for consequential damages.

Restriction of Warranty

The warranty mentioned before does not cover errors and defects being the result of improper treatment, software or interface not supplied by us, modification, misuse or operation outside the defined ambient stated by us or unauthorized maintenance.

Further claims will not be consented to and will not be acknowledged. Thorlabs does explicitly not warrant the usability or the economical use for certain cases of application.

Thorlabs reserves the right to change this instruction manual or the technical data of the described unit at any time.

10 Copyright and Exclusion of Liability

Thorlabs has taken every possible care in preparing this document. We however assume no liability for the content, completeness or quality of the information contained therein. The content of this document is regularly updated and adapted to reflect the current status of the hardware and/or software. We furthermore do not guarantee that this product will function without errors, even if the stated specifications are adhered to.

Under no circumstances can we guarantee that a particular objective can be achieved with the purchase of this product.

Insofar as permitted under statutory regulations, we assume no liability for direct damage, indirect damage or damages suffered by third parties resulting from the purchase of this product. In no event shall any liability exceed the purchase price of the product.

Please note that the content of this document is neither part of any previous or existing agreement, promise, representation or legal relationship, nor an alteration or amendment thereof. All obligations of Thorlabs result from the respective contract of sale, which also includes the complete and exclusively applicable warranty regulations. These contractual warranty regulations are neither extended nor limited by the information contained in this document. Should you require further information on this product, or encounter specific problems that are not discussed in sufficient detail in the document, please contact your local Thorlabs dealer or system installer.

11 Thorlabs Worldwide Contacts and WEEE Policy

For technical support or sales inquiries, please visit us at
https://www.thorlabs.com/locations.cfm for our most up-to-date contact information.

USA, Canada, and South America
Thorlabs, Inc.
sales@thorlabs.com
techsupport@thorlabs.com

UK and Ireland
Thorlabs Ltd.
sales.uk@thorlabs.com
techsupport.uk@thorlabs.com

Europe
Thorlabs GmbH
europe@thorlabs.com

Scandinavia
Thorlabs Sweden AB
scandinavia@thorlabs.com

France
Thorlabs SAS
sales.fr@thorlabs.com

Brazil
Thorlabs Vendas de Fotônicos Ltda.
brasil@thorlabs.com

Japan
Thorlabs Japan, Inc.
sales@thorlabs.jp

China
Thorlabs China
chinasales@thorlabs.com

Thorlabs 'End of Life' Policy (WEEE)

Thorlabs verifies our compliance with the WEEE (Waste Electrical and Electronic Equipment) directive of the European Community and the corresponding national laws. Accordingly, all end users in the EC may return “end of life” Annex I category electrical and electronic equipment sold after August 13, 2005 to Thorlabs, without incurring disposal charges. Eligible units are marked with the crossed out “wheelie bin” logo (see right), were sold to and are currently owned by a company or institute within the EC, and are not dissembled or contaminated. Contact Thorlabs for more information. Waste treatment is your own responsibility. “End of life” units must be returned to Thorlabs or handed to a company specializing in waste recovery. Do not dispose of the unit in a litter bin or at a public waste disposal site. It is the users responsibility to delete all private data stored on the device prior to disposal.