DRIVER BOARD EBD14200

Product Specification Document

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Prepared by: Tim von Niederhäusern
(Project Manager)

Checked by: Marcus Duelk
(VP of R&D)

Approved by: Jan Möstel
(Quality Manager)

Authorized by: Philipp Vorreau
(General Manager)

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1 SCOPE

1.1 PURPOSE

The purpose of this document is to describe the set of functional features, the performance and the user interfaces of the single-channel EXALOS driver board EBD14200 with embedded microcontroller for SLED modules (Super-Luminescent Emitting Diodes) from 390nm to 1700nm.

1.2 BOARD REVISION

This product specification is based on the EBD14200 prototype series, revision V0.

1.3 RESPONSIBILITY

EXALOS is responsible for establishing, implementing and maintaining this specification. The quality representative shall ensure that a timely Engineering Change Notice (ECN) is issued in accordance with EXALOS' procedure for any changes.

2 REFERENCE DOCUMENTS

- EXS-PM-858 EBD Serial Interface & Programming Manual
- EXS-PM-895 Quick Starter Guide for EBD14200

3 LASER SAFETY

This driver board in combination with a SLED is an OEM, low-voltage, DC-powered laser component specifically designed for incorporation or integration into other equipment that is then sold as end product, i.e., as laser system that includes a power supply. As such, this component DOES NOT MEET the full requirements for a stand-alone laser system as defined by 21 CRF 1040.10 and IEC/EN 60825-1:2014.
During installation it is vital that the laser hazard is fully managed. In particular, the laser integrator (i.e., the manufacturer of the laser system as end product) is required to provision the engineering requirements detailed in Clause 4.0 of IEC/EN 60825-1, classify the end product (the laser system) and assure compliance with all clauses of IEC/EN 60825-1.

WARNING: If the OEM driver board is sold with an EXALOS SLED mounted, the laser class of the laser system as end product can be as high as Class 3B per IEC 60825-1:2014 depending on the SLED type. Refer to EXALOS' SLED specification documents for detailed information. For the safe use of the laser system, appropriate laser safety measures including protective equipment such as laser safety glasses may be required depending on SLED type mounted. Also follow the legal regulations on occupational safety in your country.

4 PRODUCT DESCRIPTION

4.1 ARCHITECTURE

The EBD14200 is a high-performance driver board that consists of a multi-layer PCB board on which the 14-pin butterfly (BTF) module is soldered. The multi-layer PCB design with shielding ground layers allows for the co-existence of a highly efficient switched-mode temperature controller (TEC) with an independent low-noise linear SLED drive current controller in a compact form.

A low-power microcontroller is used to control and monitor the operating conditions of the device and provide a comprehensive user interface that can be used for system integration.

Furthermore, the multi-layer PCB design features a sophisticated heat-spreading thermal design that reduces hot spots, which is the basis for stable operation at high ambient temperatures.

4.2 FEATURES

The main characteristics of the EBD14200 are:

- High-efficiency switched-mode TEC supporting high-power SLEDs at high ambient temperatures
- Generation of ultra-stable and ultra-low noise drive currents for InP-based, GaAs-based or GaN-based SLEDs with high compliance voltages up to ~7.5 V
- Adjustment of the SLED drive currents (and thus power levels) either through an external analog control voltage (0-2.5V) or through the USB interface
- Enabling the optical output either through an electrical TTL signal or through the USB interface
- Upon request, high-speed digital on-off modulation with TTL signals up to several 100 kHz
- Low-noise and low-drift monitor photodiode (MPD) detection
- Noise and spike filter network and brown-out detector for input supply voltage
- Low-power, high-performance microcontroller with USB (serial) interface

The EBD14200 features a stabilization feedback loop for the SLED drive currents (automatic current control, ACC). Automatic power control (APC) can be supported through the microcontroller that would adjust the SLED current and thus output power based on the MPD reading.

4.3 OPERATING RANGE

The EBD14200 has been designed for operation over a wide temperature range. Only industrial-grade components have been selected that are qualified for operating temperatures from -40 °C to +85 °C. The standard temperature operating range of the EBD14200 is 0 °C to +50 °C, though. Wider operating temperature ranges are available upon request.

The EBD14200 is designed to ensure proper operation in environments with electro-magnetic interference (EMI) by using a star-like ground concept and various levels of analog grounds throughout the design.

The EBD14200 supports a wide power supply range between +12 V and +24 V. Supply voltages outside this range may result in improper operation or elevated power dissipation of the electronics. Spiky and unstable supply voltages may activate the on-board spike and brown-out detector, resulting in a controlled shut-off followed by a ramp-up of the SLED currents. The required supply current is composed

of the sum of the SLED drive currents and of the Peltier current. The maximum supply current is 2 A for a maximum SLED drive current of 800 mA and a maximum Peltier current of 2400 mA at low supply voltages of 12V. Typical supply current under operation might be significantly lower, depending on the supply voltage, and depending on the SLED and ambient temperature.

4.4 ROHS COMPLIANCE

Based on the information obtained from our suppliers, the EBD14200 is compliant with the Restriction of Hazardous Substances (RoHS) directive 2011/65/EU and its subsequent amendments (including 2015/863/EU).

5 EBD14200 DRIVER BOARD

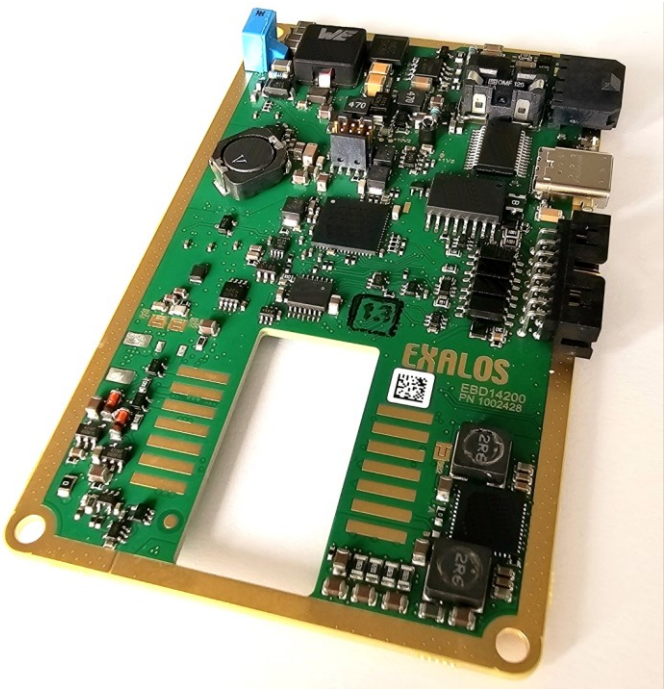

Fig 1: EBD14200 driver board

5.1 PRINTED CIRCUIT BOARD (PCB)

The EBD14200 board has a size of 100 mm (L) x 59 mm (W). Fig. 1 shows a 3D rendered picture of the top side of the EBD14200 board. Fig. 2 shows a schematic top view of the board and the names of connectors, switches, and LED indicators.

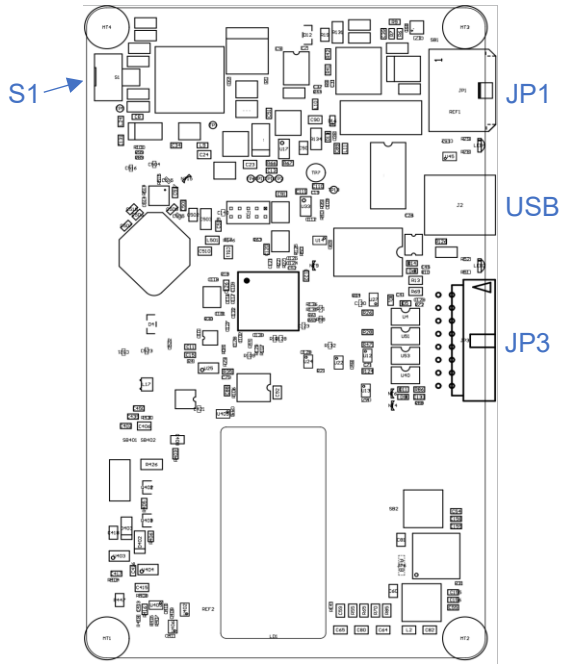

Fig 2: Top view of the EBD14200 indicating the user interfaces

5.2 ELECTRICAL USER INTERFACES

When the EBD14200 is, together with an SLED module, assembled into a metal case only the connectors JP1 and JP3 as well as the USB interface are accessible from the outside. In addition to the electrical interfaces, there are four LED indicators, LED1, LED2, LED3 and LED4, visible on the outside of the enclosure. Hidden inside the metal case and hence not accessible from the outside is the code switch S1, which allows for the selection of various operating modes, and one other LED indicators. Table 1 provides a list of all electrical connectors that belong to the user interface.

Name	Connector on EBD14200 board	Function	Mating connector for cable assembly
JP1	MOLEX "Micro-Fit 3.0"; 43650-0300 Header (male)	+24V power supply, GND, PE	MOLEX "Micro-Fit 3.0"; 43645-0300 Receptacle (female)
JP3	MOLEX "Milli-Grid"; 87833-1620 Header (male)	SLED enable & on-off modulation, analog and digital input & output signals	MOLEX "Milli-Grid"; 51110-1651 Crimp Housing
USB	Type-C USB connector	USB/serial configuration interface between microcontroller and host	Male USB Type-C

Table 1 List of on-board user interface elements including electrical connectors

Fig. 3 shows the front view of the connector JP1 and JP3. The corresponding pinout information is listed in Table 2 and Table 3, respectively.

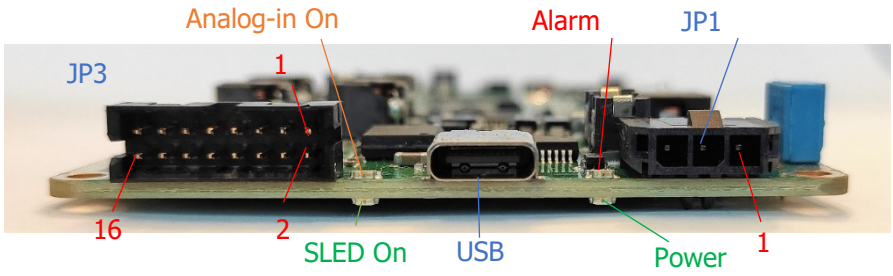

Fig 3: Front view of header JP3 and JP1 with pin indication, USB connector and LED indicators for Power, Alarm and SLED On.

Pin	Name	Function	Description /Comment
1	PE	Input	Protective Earth, to ground the metal case
2	GND	Input	External electrical Ground (2A)
3	+24Vext	Input	External power supply (12-24 V, 2A)

Table 2 Pinout of connector JP1

Pin	Name	Function	Description / Comment
1	Modulation	Input	(LV)TTL digital modulation signal
2	+5V	Output	5V supply voltage from JP1, for configuration purposes only, e.g., enable the SLED through short to pin3. 100mA max.
3	SLED_enable (Interlock)	Input	LV TTL digital signal to enable/disable the SLED current. This pin acts as interlock connector and must be connected to +5V to enable the SLED.
4	GND_ext	Output	GND reference for Modulation or SLED_enable when realized with open-collector outputs, preferably not be used otherwise to avoid GND loops (use instead pin2 of JP1 as GND reference for Modulation and SLED_enable, if possible)
5	MPDcurrent	Output	Analog voltage output proportional to internal monitor photodiode (MPD) current with 1 V corresponding to 1 mA MPD current. To be terminated with high impedance.
6	SLEDcurrent	Output	Analog voltage output proportional to SLED current with 100 mV corresponding to 100 mA SLED current. To be terminated with high impedance.
7	SLED_enabled	Output	Open-collector output indicating the light (SLED) output is on
8	AIN_enabled	Output	Open-collector output indicating that the SLED current is controlled through pin15/pin16
9	AIN_alarm	Output	Open-collector output indicating an excessive analog input voltage at pin15/pin16 is applied and limited to +2.5V
10	Alarm	Output	Open-collector output indicating a temporary or permanent temperature alarm or another alarm condition
11	GND_ext	Output	GND reference for pin7, pin8, pin9, pin10
12	GND_ext	Output	GND reference for pin7, pin8, pin9, pin10
13	AIN_enable	Input	(LV)TTL digital signal to enable the SLED current control through pin15/pin16
14	+5Vin	Output	5V supply voltage from JP1, for configuration purposes only, e.g., create a short to pin13 to enable analog current control
15	+AIN_extern	Input	Analog input voltage (0-2.5V) to control SLED current
16	-AIN_extern	Input	GND reference of analog input signal (pin15)

Table 3 Pinout of connector JP3

Pin7 to pin10 of connector JP3 contain digital alarm or status signals that are decoupled from the rest of the electronics through opto-couplers. They are open-collector outputs with a common ground "GND_ext" that is on pin11 and pin12 of JP3. These status signals are also logically connected to the LED2, LED3 and LED4 that are found on the board, which are listed in Table 4.

LED	Name (color)	Description / Comment
LED1	Power (green)	Indicating supply voltage with correct polarity, measured after fuse and brown-out / spike detector.
LED2	Alarm (red)	Indicating that any kind of alarm was detected by the firmware.

LED3	SLED On (green)	Indicating that the SLED is on (light output enabled).
LED4	AIN enabled (orange)	Indicating that the SLED current is controlled via AINextern. Blinking indicates overvoltage of AINextern >2.5V.

Table 4 Configuration of LED indicators

The "Alarm" signal on pin10 is a general alarm indicator that might be enabled for one of the following reasons:

- the read temperature of the SLED is temporarily 1.5°C above or below the set temperature
- the board is unable to hold the target temperature of the SLED
- the supply voltage is not within specifications
- an unexpected behavior of one of the SLEDs was detected (e.g., excessive MPD signal).

Other alarm reasons are conceivable and may be added later. Specific information about the alarm at hand is available over the USB interface.

The analog output signal "MPDcurrent" (pin5) represents the photocurrent of the integrated monitor photodiode (MPD) of the optical module, which can be used to monitor the optical output power of the light source. In constant-current mode (ACC), gradual power changes due to temperature effects, optical back-reflections or due to small chip degradation effects can be monitored with this output. Furthermore, the analog output signal can be configured as a general-purpose analog monitor output with selectable source e.g. constant voltage, TEC current or board temperature. Other monitor options are conceivable.

The analog output "SLED current" (pin6) represents the drive current of the SLED. In constant-power mode (APC), changes of the SLED drive current to keep the optical output power of the module constant can be monitored using this output. The output voltage of these pins will be between 0 and +2.5V and proportional to the MPD or SLED current.

The analog input (pin15 and pin16) shall be handled with care as they are not decoupled through opto-couplers, which may, in cases of false connectivity, result in unwanted GND loops. They allow for applying an analog control voltage (0 to +2.5V) to control the drive current of the SLED. The analog control input voltage is fed into an instrumentation amplifier of high accuracy, low offset voltage and low drift.

5.3 OPERATING CONDITIONS

Table 5 shows the typical, minimum and maximum operating conditions of the EBD14200 driver board.

Parameter	Min.	Typ.	Max.
Supply Voltage	11.2 V	24 V	28.8 V
Supply current when SLEDs are disabled but TEC is enabled (1)	0.25 A (@ 28.8V)	0.30 A (@ 24.0V)	0.80 A (@ 11.2V)
Supply current when SLEDs are enabled and TEC is enabled (2)		0.7 A	2.0 A
Ambient operating temperature (3)	0 °C		+50 °C
Ambient storage temperature	-40 °C		+85 °C

(1): Typical values at room temperature. Larger than typical supply currents can occur during power-up of the board or at extreme ambient temperatures.
(2): Typical values at room temperature and SLEDs up to 300 mA. Larger than typical supply currents can occur during power-up of the board or at extreme ambient temperatures, or for SLEDs requiring higher drive currents.
(3): Extended temperature range from -40°C to +85°C available upon request.

Table 5 Operating conditions of the EBD14200

5.4 PERFORMANCE CHARACTERISTICS

Table 6 shows the typical performance of an EBD14200 driver board when operated with a short-wavelength SLED module from EXALOS.

Parameter (ptp=peak-to-peak, rms=root mean square)	**Typical**	**Maximum Rating**	**Conditions/Comments**
Drive current		800 mA	
Compliance voltage		7.5 V	
TEC current		1.8 A	Extended TEC currents up to 2.4 A upon request
TEC temperature stability ptp 24h	±0.002 °C	±0.01 °C	Equivalent to ±100 ppm @ 20 °C
TEC temperature drift 1000h	±0.07 ppm/h	±0.1 ppm/h	Linear interpolation over 1000 h
Current stability ptp 24h	±75 ppm	± 100 ppm	Ambient temperature constant within ±0.5 °C
Current stability rms 24h	±20 ppm	±30 ppm	Ambient temperature constant within ±0.5 °C
Current stability ptp 1h	±75 ppm	±100 ppm	Ambient temperature constant within ±0.5 °C
Current stability rms 1h	±20 ppm	±30 ppm	Ambient temperature constant within ±0.5 °C
Mid-term current drift 24h	±9 ppm/h	±12 ppm/h	1h sliding window
Long-term current drift 1000h	±0.5 ppm/h	±0.8 ppm/h	Linear interpolation over 1000 h
Temperature-related current change (1)	10 μA/°C	20 μA/°C	Average value, not including warm-up
Current noise	1.3 μA_{rms}	1.5 μA_{rms}	Extracted from spectral noise measurements (1 kHz – 10 MHz)
Turn-on delay to enable SLEDs (2)	500 ms		
Turn-off delay to disable SLEDs	<1 ms		
Turn-on delay on-off modulation (2,3)	100 ms		Default configuration
10:90 rise time on-off modulation (2,3)	250 ms		Default configuration
90:10 fall time on-off modulation (2,3)	<100 ns		Default configuration
Max. on-off modulation frequency (3,4)		5 Hz	Default configuration
Turn-on delay on-off modulation (2,3)	<10 ms		In "modulation" configuration
10:90 rise time on-off modulation (2,3)	25 μs		In "modulation" configuration
90:10 fall time on-off modulation (2,3)	<100 ns		In "modulation" configuration
Max. on-off modulation frequency (3,4)		500 kHz	In "modulation" configuration
Max. analog modulation frequency (3)	3 Hz		For all analog inputs

(1): Typically, a change of 1.0 mA or less in drive current is expected over temperature range from -40°C to +85°C.

(2): The EBD14200 features a built-in safety circuitry that powers down the electronic driver stage of the SLEDs whenever the SLEDs are disabled. This guarantees that under no circumstances the driver board can generate any light output from the SLEDs as long as the SLEDs are disabled. Furthermore, this turn-on delay also guarantees a controlled power-up behavior of the board in case the supply voltage is cycled while the SLEDs are enabled.

(3): The default configuration of the EBD14200 board is optimized for lowest possible noise performance with modulation rates of a few Hertz. The board can be configured for modulation mode at the EXALOS factory, which allows for on-off modulation frequencies up to several 100 kHz.

Table 6 Typical performance characteristics of the EBD14200

6 PACKAGED SLED DRIVER MODULE

The EBD14200 was designed as an OEM board to be used in various system environments. The EBD14200 is only available as a packaged module with an aluminium metal case, in which the driver board and the combined SLED module are assembled. The bottom part of the aluminium case will act as a heat sink for the optical SLED module. Furthermore, the metal case was designed to be mounted on a base plate of the corresponding system to improve thermal dissipation through heat conduction.

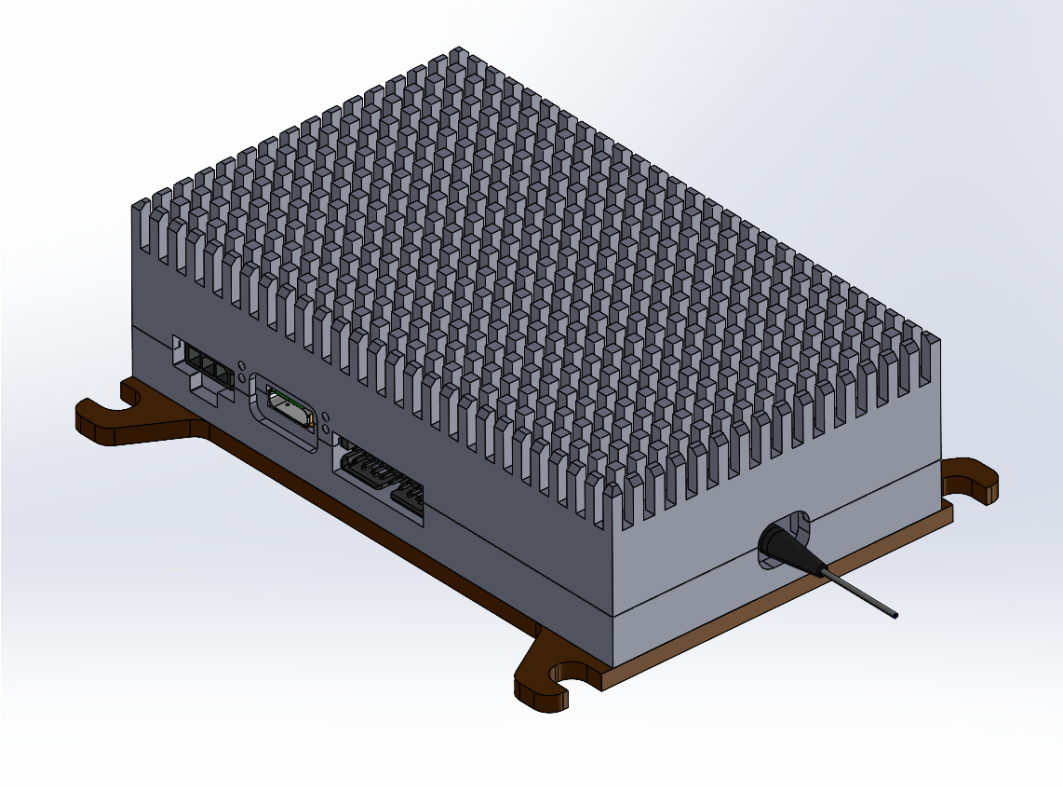

Fig 4: Rendering of the EBD14200 assembly being horizontally mounted.

Fig. 4, Fig. 5, Fig. 6 and Fig. 7 show the metal case for the EBD14200 driver board assembly. The outer dimensions of this assembly without the optional snout are 106 mm (L) x 64 mm (H) x 30.6 mm (W). Fig. 4 shows the driver board and the optical module being assembled horizontally with a mounting plate adapter. The adapter plate offers four screw holes for assembly onto an optical table, for example, or another suitable external heat sink.

The enclosure supports both free-space and fiber-coupled optical modules. In the case of a free-space module, the exit pupil of the beam is at the same position as the fiber snout.

The side of the metal case provides access to the connectors JP1 and JP3 as well as to the USB connector and the four side-facing status LEDs.

Fig. 5 shows the driver board and the optical module being assembled vertically with a different mounting plate adapter. In this case, access to the connectors JP1 and JP3 as well as to the USB connector and the four status LEDs is from the top. The adapter plate offers various screw holes for assembly onto an optical table or another suitable external heat sink.

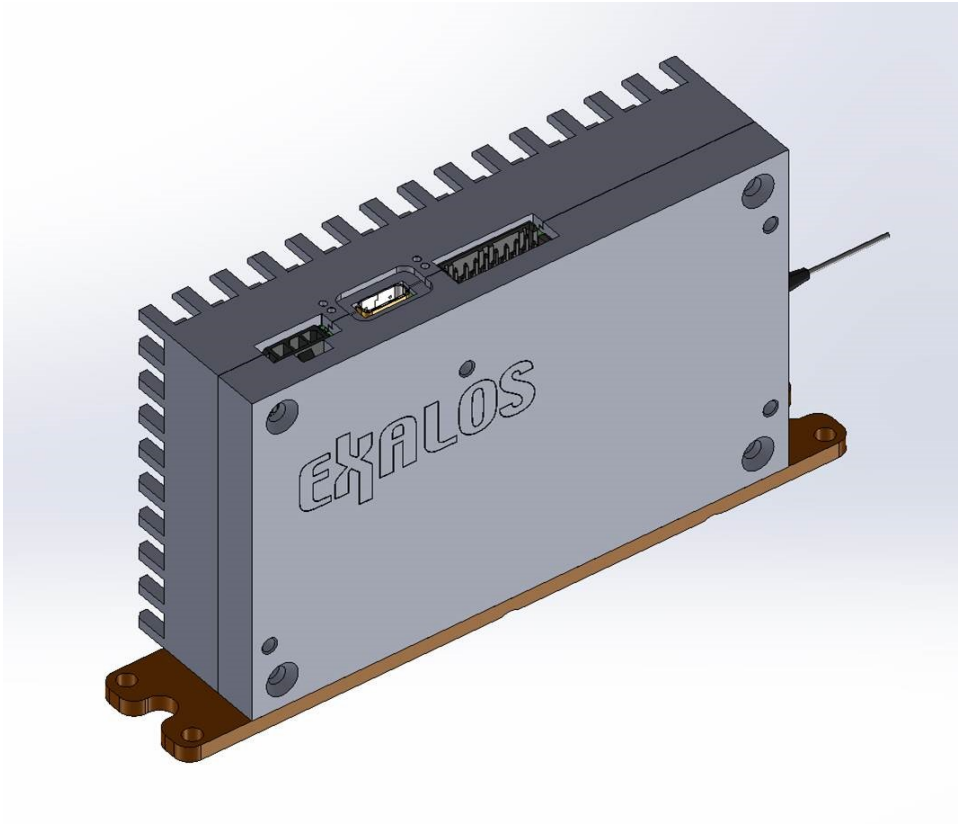

Fig 5: Rendering of the EBD14200 assembly being vertically mounted.

The primary approach for heat dissipation and thus cooling is air convection. The 2D pin structure of the EBD14200 heat sink is compatible with horizontal and vertical air flows to improve heat dissipation and to reduce thermal resistance. For the vertical assembly shown in Figure 5, there is an additional small amount of heat conduction through the mounting adapter plate at the bottom. For the horizontal assembly shown in Figure 4, the additional amount of heat conduction through the mounting adapter plate is larger given the larger surface area. Therefore, the horizontal mounting scheme might be preferred for high-power optical modules with large heat dissipation needs.

In order to provide a shield against electro-magnetic interference (EMI), pin1 of the power supply connector JP1 shall be connected to PE through a short cable. Having a short contact to PE is essential to provide high-frequency shielding of the driver board and the mounted SLEDs. Alternative to pin1 of JP3, a PE cable can be directly connected to the metal case using one of the mounting holes. The passivated surface of the metal case is electrically conductive.

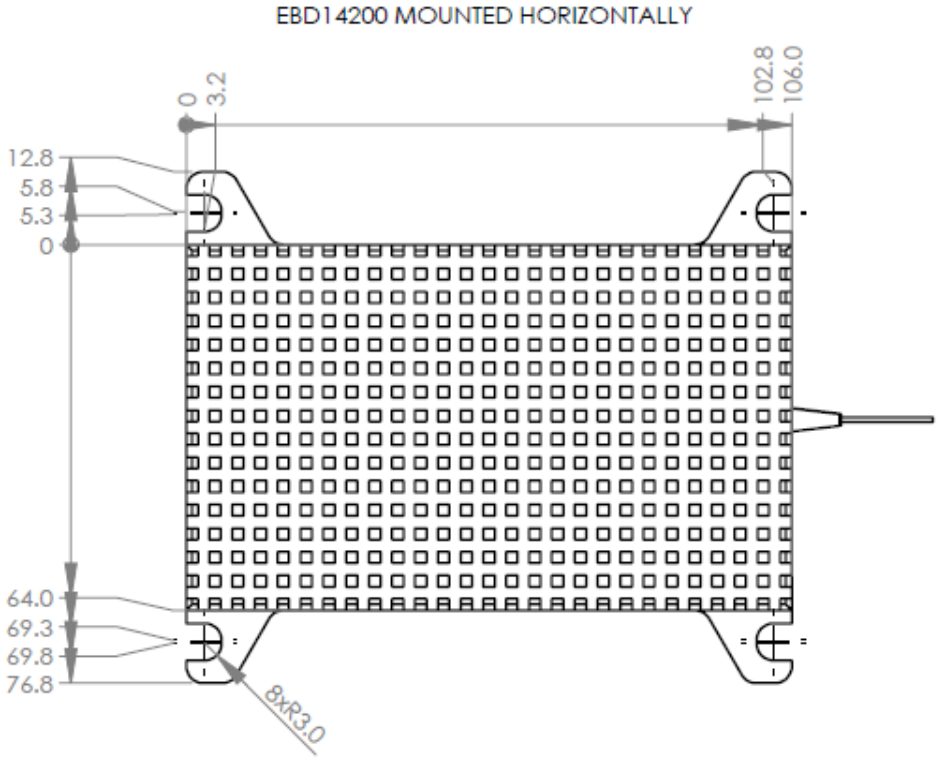

Fig 6: Mechanical drawing of the EBD14200 assembly when being horizontally mounted. Mounting with M6 screws onto an optical breadboard is feasible with the corresponding horizontal mounting adapter.

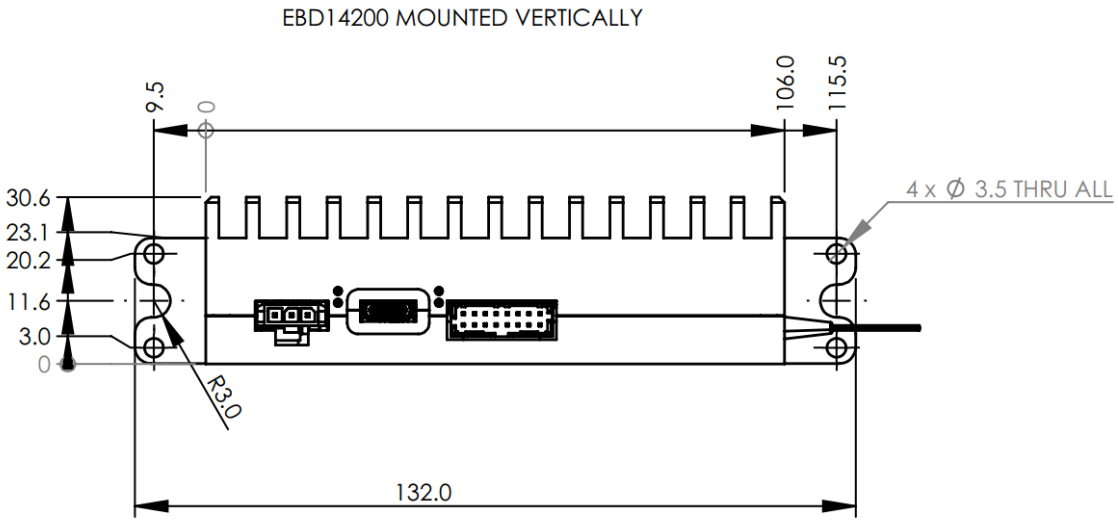

Fig 7: Mechanical drawing of the EBD14200 assembly when being vertically mounted. Mounting with M6 screws onto an optical breadboard is feasible with the corresponding horizontal mounting adapter.

7 OPERATING INSTRUCTIONS

7.1 AMBIENT TEMPERATURE

Make sure the ambient operating temperature is between 0°C to +50°C, unless specified differently by EXALOS.

7.2 SUPPLY VOLTAGE

Make sure a stable supply voltage within 12 V to 24 V is applied with the correct polarity. Polarity inversion will not harm the optical module but might eventually result in damage of the on-board supply voltage filter network. For first testing, it might be useful to set the current limit to 1.0 A. The on-board 3A fuse has a current- and temperature-dependent pre-arcing time, i.e., lower current limits will result in longer pre-arcing times and hence more time for the user to react to accidental polarity inversion. The EBD14200 is not sensitive to noise of the supply voltage as it features various filter networks and ground decoupling stages as well as a spike and brown-out detector.

7.3 PROTECTIVE EARTH (PE)

Make sure to provide a low-impedance connection to protective earth in order to avoid damage due to unwanted and uncontrolled electro-static discharges (ESD). A PE connection can either be realized through a short cable connection at the power supply connector JP1 (pin 1) or through direct connection to the metal case. The anodization of the metal case is electrically conductive. Make sure to realize the PE connection using one of the two options only to avoid ground loops.

7.4 TEMPERATURE CONTROLLER (TEC)

The TEC is working as soon as a supply voltage is applied to the board. The TEC is a high-performance switched-mode controller that works at an internal frequency of 1 MHz. Depending on the ambient temperature, it may take a few seconds after turn-on of the board for the TEC to stabilize the module temperature. During this stabilization period, the TEC may operate the Peltier element at a maximum current of 2.4 A, resulting in a high supply current. It is recommended to enable the optical module only when the TEC is in a stable condition, indicated through the alarm (LED2 and pin10 of JP3) being off.

7.5 ENABLING THE SLEDS

The SLEDs inside the optical module are enabled and the optical power is turned on by applying a 5V signal to pin3 of JP3 (active-HIGH). When using an electronic enable signal, e.g., a 5V TTL signal from an external host or external controller, make sure that the voltage is relative to the GND_ext on pin4 of JP3. Enabling the SLEDs will first power up all OpAmps of the driver stages before the optical power is turned on after a built-in time delay. The turn-on sequence guarantees proper operation of the driver board even when the power supply is hot-plugged though the optical module was enabled. This means that the optical module can be enabled with the drive current being set to the maximum level, i.e. it is not necessary to ramp up the drive current manually. Furthermore, the driver board generates a current ramp of several milliseconds at turn-on to avoid optical power overshoots.

7.6 ADJUSTING THE DRIVE CURRENT

The SLED current levels can be either manually adjusted through the USB interface or through an analog control signal (AIN, 0 to +2.5V) applied to pin15 and pin16 of JP3. When adjusting the current level electronically, make sure that the analog control is enabled (AIN_enable, pin13 of JP3). When using a signal for AIN_enable, e.g., 5V TTL, make sure that the voltage is relative to the GND_ext on pin11 or pint12 of JP3.

The analog input voltage is limited to 2.5V on the board to ensure safe operation. AIN voltages larger than 2.5V are clipped and an alarm signal is enabled (LED4 and pin9 of JP3). The generated SLED drive current is linearly proportional to the analog input voltage, resulting in a typical "L-I-curve" characteristics, as shown in Fig. 7. At the maximum input voltage, the EBD driver board generates the maximum drive current that is factory pre-set individually for each SLED product.

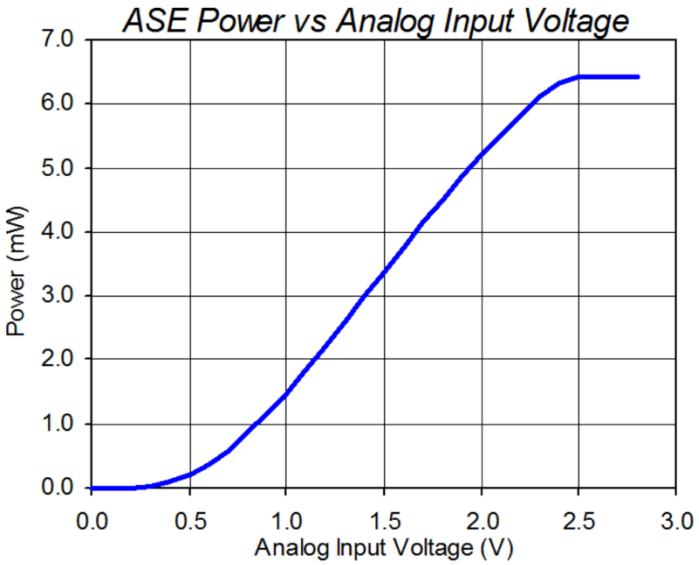

Fig 8: "L-I-curve" of an EBD14200 assembly where the light output is increasing proportional to the analog input voltage at JP3 up to 2.5V.

7.7 ON-OFF MODULATION

The current of the SLEDs can be turned on and off with a TTL modulation signal through pin1 of JP3 (see Table 3). The modulation inputs are weakly pulled-up. Therefore, leaving the pins unconnected or 5V (HIGH) will result in the optical output being enabled if all other conditions are met. Connecting the pins to 0V (LOW) turns the corresponding SLEDs off.

When using an active modulation signal, e.g., 5V TTL, make sure that the voltage is relative to the GNDext on pin4 of JP3.

The maximum modulation frequency is specified in Table 6.

Faster modulation frequencies may be realized upon request. However, faster current rise times can, in principle, lead to unwanted optical power transients if the rise time of the drive current is below the thermalization time of the SLEDs, which is typically in the range of 10 μs. Therefore, EXALOS offers faster modulation rates only based on customer requests. Typical optical rise and fall times that can be achieved using the on-off modulation inputs are shown in Table 7.

There is no intentional time delay or current ramp for the turn-on of the SLED under on-off modulation, different to the procedure of enabling any of the SLEDs. Turning off the SLED through pin1 of JP3 will also not power down the OpAmps of the driver stage.

	Modulation speed = slow (default)	Modulation speed = fast
10:90 rise time	250 ms	25 µs
90:10 fall time	<100 ns	<100 ns

Table 7 Optical rise and fall time of on-off modulation modes

7.8 ANALOG CURRENT MODULATION

The SLED current level and hence the optical power can be varied or slowly modulated through pin15 and pin16 of JP3. The maximum modulation frequency is specified in Table 6. Faster modulation frequencies may be realized upon request.

7.9 OPEN-COLLECTOR OUTPUTS

Status and alarm indicators at JP3 are realized as open-collector outputs that are decoupled from the GND potentials of the EBD14200 driver board. According to Table 3, these digital outputs are "SLED_enabled" (pin7), "AIN_enabled" (pin8), "AIN_alarm" (pin9) and "Alarm" (pin10). In order, for example, to illuminate an external LED in the presence of an alarm, a minimum load has to be considered to limit the current through the open-collector opto-couplers on the EBD14200 board, as shown in Fig. 8. Positive external voltages (+U) in the range of 3V to 28V are acceptable as long as the current does not exceed 20 mA. For example, for a voltage +U=5V a minimum load R of 250 Ohms would be required. The external voltage +U shall be relative to GND_ext at pin4 of JP3.

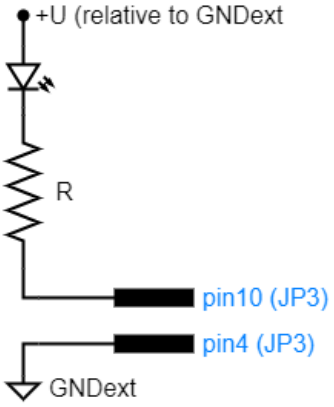

Fig 9: Example of using an open-collector alarm output of JP3 to illuminate an external LED. The load R limits the current to max. 20 mA.

7.10 DISABLING THE SLEDS

To disable the SLEDs and hence the optical output, apply 0V to pin3 of JP3. When the SLEDs are disabled all OpAmps of the SLED driver stages are powered down as an additional safety feature. In case of loss of supply voltage before disabling it, the SLEDs are automatically and safely powered down.

7.11 HOT-PLUGGING THE SUPPLY VOLTAGE

As mentioned earlier the supply voltage of the EBD14200 can be hot-plugged while the SLEDs are enabled without harming the SLED. The SLEDs are safely powered up or powered down when the supply voltage is hot-plugged.

7.12 WARM-UP TIME

As with any other electronics, the EBD14200 has a warm-up time until, for example, the current drift during the turn-on phase is minimized. Typical warm-up time at room temperature is typically 20 minutes for ultimate stability.

7.13 TEMPERATURE ALARM

In case of a permanent temperature alarm for more than 30 seconds, the drive current is automatically disabled in order to protect the SLEDs. This may happen if the heat sinking of the optical module is insufficient or if the ambient temperature is exceeding the specified operating range, or if otherwise the TEC is unable to control the temperature of the SLEDs.

8 REVISION HISTORY

Revision History				
Rev.	**Description**	**ECN Number**	**Date (ECN)**	**Released**
0.1	First release (preliminary)	-	31-May-2024	TNI
0.2	• Updated Figure 1 (photograph of EBD14200) • Updated Figure 4 and Figure 6 (horizontal mounting bracket)	-	03-Jul-2024	TNI