NEDA LD4-A: Datasheet and User Manual

Short Description

NEDA LD4-A is a 4-channel driving engine for laser diodes (LDs), super-luminescence diodes (SLDs), semiconductor optical amplifiers (SOAs), light emitting diodes (LEDs) and low resistance ohmic loads able to apply up to 4 V compliance (load) voltage and provide up to 500 mA output current per channel. Each driving channel implements a voltage controlled current source based on a common-cathode architecture making the driving engine in this way an ideal driving solution not only for bulk optoelectronic devices but also for active and passive photonic elements in multi-element chips and photonic integrated circuits (PICs). NEDA LD4-A offers manual control of the compliance voltage limit and the current limit at each channel, and incorporates by analog design all required safety features, such as soft-start and hot-plug protection features, for spike-free operation of precious optoelectronic loads. The output current at each channel is set by the corresponding input voltage control provided by an external source. Each input control within the range 0-10 V is linearly translated to an output current within the 0-50 mA or 0-500 mA range depending on the state of the corresponding toggle switch. Use of NEDA LD4-A as a standalone driving equipment without use of an external source is also possible. C-VC4 is offered to this end as an add-on printed circuit board (PCB) for manual adjustment of the input controls using two internal voltage supplies of the NEDA LD4-A engine.

Applications

Semiconductor lasers, external cavity lasers, optical transmitters and receivers, microwave photonics (mmWave/THz), OTDR/OFDR systems, LIDAR systems, optical coherence tomography (OCT), Raman spectroscopy, biochemical sensors.

Features

- 4 independent voltage controlled current sources.
- 500 mA maximum output current per channel.
- Selectable 50/500 mA current range per channel.
- User-defined voltage compliance protection limit per channel.
- User-defined output current limit per channel.
- Soft start output current ramp.
- 2 seconds startup delay after powering on.
- Hot-plug protection of the optoelectronic loads.
- Single power supply with 14.5-25 V supply range.

Electrical Characteristics

PARAMETER	NOTES	MIN	TYP	MAX	UNIT
ABSOLUTE MAXIMUM RATINGS					
Power Supply Voltage	-	0		30	V
Output Current	Per channel			600	mA
Input Control Voltage	-	-2		20	V
Power Dissipation	Per channel			2	W
RECOMMENDED OPERATING CONDITIONS					
Power Supply Voltage	-	15		25	V
Input Control Voltage	-	0		10	V
Ambient Operating Temperature	T_A	-25		70	^oC

PARAMETER	NOTES	MIN	TYP	MAX	UNIT
INPUT					
Impedance	Power ON		10k		Ohm
	Power OFF		20k		Ohm
Input Control Voltage	0-50 mA range	0		10	V
	0-500 mA range	0		10	V
Common Mode range		-2		12	V
OUTPUT					
Load current	Per channel	0		500	mA
Soft start	Current ramp		20		mA / ms
Turn-on delay	After power on		2		s
Current limit	Per channel	0		600	mA
Voltage compliance limit	Per channel	0		4	V
POWER SUPPLY					
Voltage range		14.5		25	V
Idle current (no output faults)	Supply voltage: 15-25V		88		mA
Maximum current demand having all channels set at 500 mA	Supply voltage: 15 V		1.17		A
	Supply voltage: 20 V		0.88		A
	Supply voltage: 25 V		0.72		A

Typical operation curves

Figures 1-4 show typical operation curves of NEDA LD4-A. Figure 1 presents in particular an example of standard operation, wherein the power voltage supply of the engine and the input voltage control of a specific channel are provided at the same time by an external source. As shown, the output current is created at the corresponding channel approximately 2 seconds after power-on. Figure 2 presents an example of the current limit protection offered by NEDA LD4-A. The output current follows the increase in the input voltage control until the point, where the latter starts exceeding the voltage level that corresponds to the user-defined current limit. From that point on, the output current remains clipped. Figure 3 presents in turn an example of the voltage compliance limit protection offered by NEDA LD4-A. The output current follows again the increase in the input voltage control, and the corresponding increase in the load voltage (not

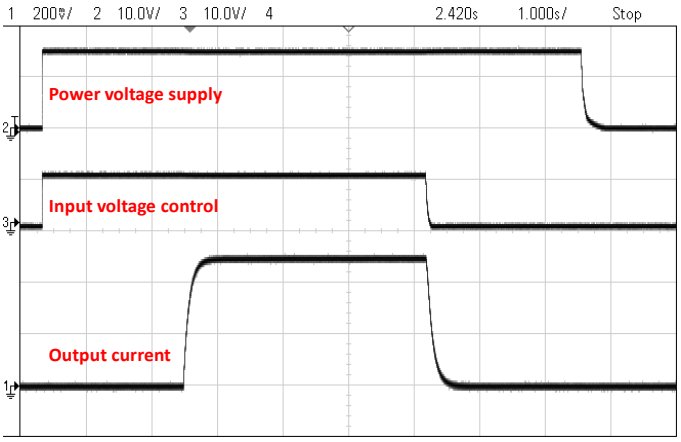

Figure 1: Normal power-on / power-off procedure.

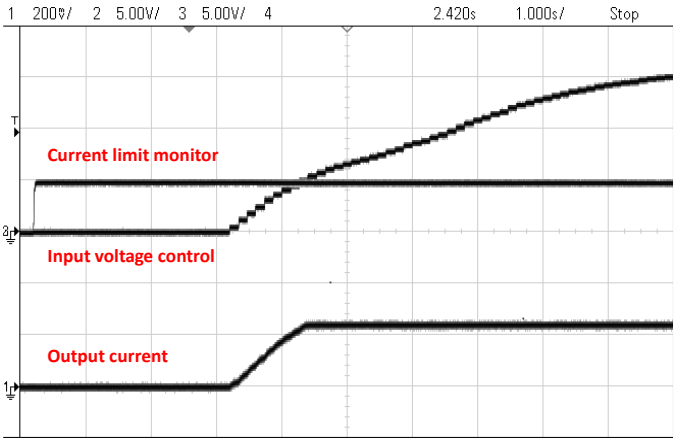

Figure 2: Activation of current limit protection.

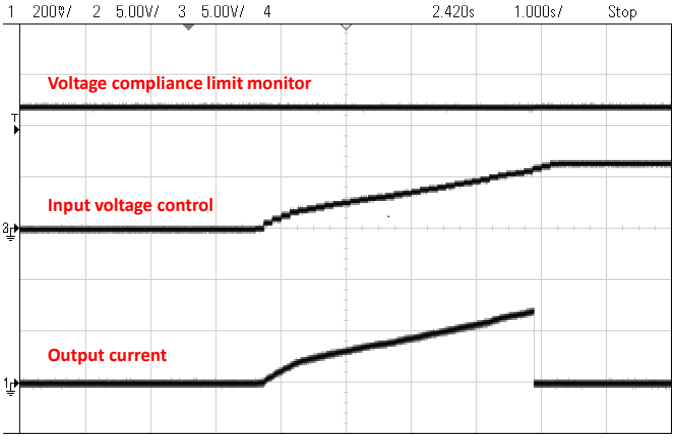

Figure 3: Activation of voltage compliance limit protection.

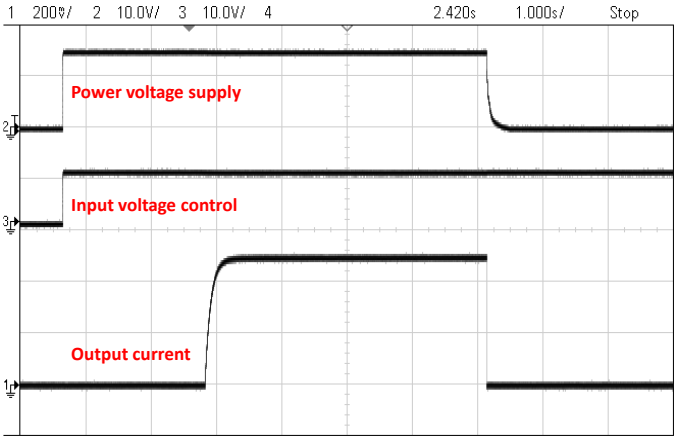

Figure 4: Activation of power disconnection protection.

shown in the diagram). When the latter starts exceeding the user-defined voltage compliance limit, the channel is instantaneously deactivated, and the output current returns to zero regardless of the input voltage control. Finally, Figure 4 presents an example of the protection offered against an accidental power disconnection. Even though the channel in this case is abruptly deactivated, the output current can safely return to zero without spikes. A detailed description of the above protection features and of further operation characteristics are provided in the next paragraphs.

Quick connection guide

Figure 5 provides a quick guide for the connection of the power supply and the input/output ports, and explanatory labels for the usage of the test points, the toggle switches, the potentiometers and the LEDs of the NEDA LD4-A engine. Operation instructions are presented in the next paragraph.

Operation instructions

NEDA LD4-A offers 4 independent, high-precision, voltage-controlled current sources for operation control of optoelectronic components and PICs.

A. Output current range

Four toggle switches in the front panel of the NEDA LD4-A enclosure are responsible for the selection of the output current range of each channel (Figure 5a). When a toggle switch is in the upper position, the output current range of the corresponding channel is 0-500 mA, whereas when it is in the lower position the same range is 0-50 mA. Even though no spikes are observed in lab tests when we have a switch between the two positions with the driving engine in use, it is strongly advised that each toggle switch is set to the desired position prior to powering on. Obviously, any accidental switch from 0-50 to 0-500 mA with the driving engine in use may damage any low-current loads.

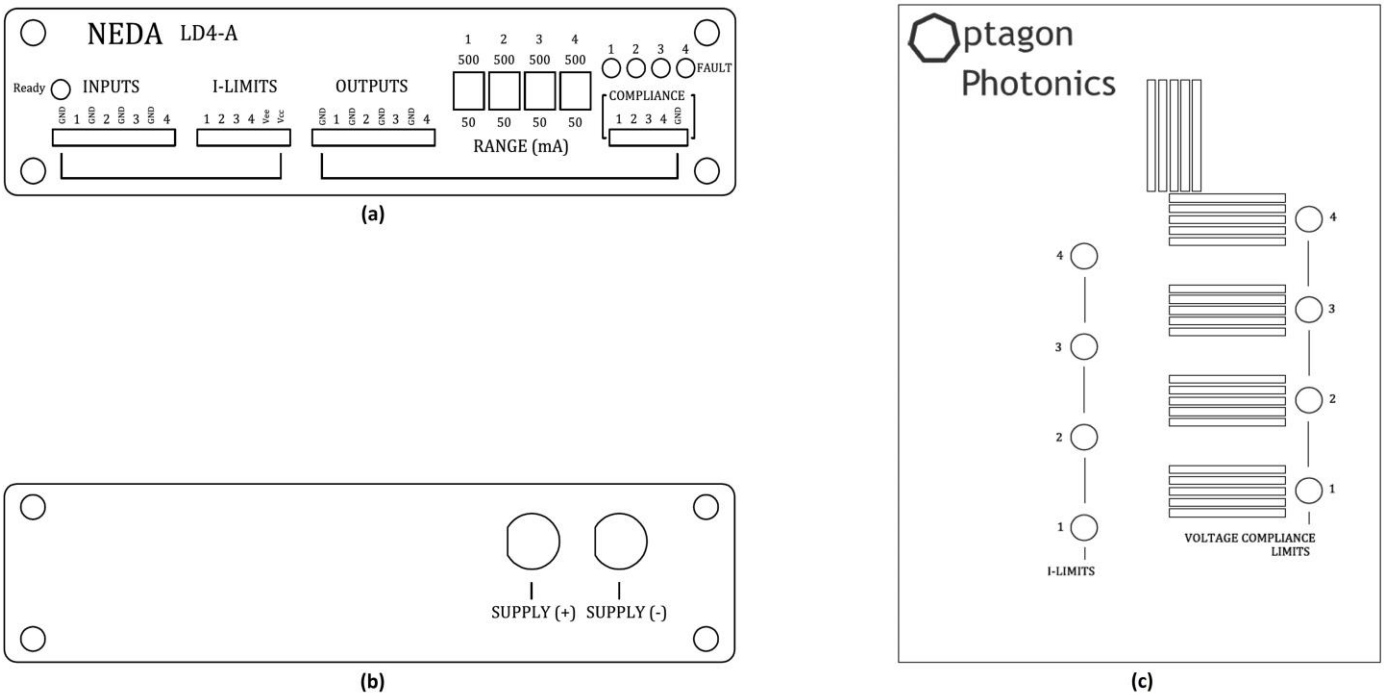

Figure 5: NEDA LD4-A box and labels of the main ports and elements: a) Front panel, b) back panel, and c) top panel.

A. Input voltage controls

The output current of each channel is controlled by an external voltage level applied at the respective port in the front panel of NEDA LD4-A (Figure 5a). Each input voltage control within the range 0-10 V is linearly translated to an output current within the 0-50 mA or 0-500 mA range depending on the position of the respective togg33le switch. It is self-evident that in order to meet the performance specs of NEDA LD4-A (see electrical characteristics on page 2), the stability of the input voltage controls has to be equal or higher than those specs.

B. Output current limits

User-defined current limits can be individually set for each channel. Each limit is set by the respective potentiometer on the top-panel of NEDA LD4-A (Figure 5c). Its value can be monitored with the driving engine in use through the measurement of the voltage between the respective monitoring pin and any GND pin in the front panel (Figure 5a). The measured value can be linearly translated to the current limit using the same transfer function as for the input voltage controls: 1V/50mA for 0-500 mA operation and 1V/5mA for 0-50 mA operation. The actual current limit measurement range is 0-12 V.

C. Voltage compliance limits

NEDA LD4-A incorporates by design a large number of safety features including an output voltage monitoring circuit that instantaneously disables an output channel if that channel exceeds the voltage compliance limit set by the user. The voltage compliance limits are independently set for each channel within the range 0-4 V using the respective potentiometer on the top panel of NEDA LD4-A (Figure 5c). The values of those limits can be monitored with the driving engine in use through the measurement of the voltage between the corresponding monitoring pin and the proximal GND pin in the front panel of the driving engine (Figure 5a). When the voltage compliance limit is exceeded in one or more channels, those channels are disabled and the corresponding LEDs in the front panel are lit up to indicate the fault. In order to re-enable the channels, the power supply must be removed and re-applied to the driving engine.

E. Power-on/off sequence

All critical connections of NEDA LD4-A including the power supply voltage connection, the input voltage control connections and the output current connections to the loads must be established prior

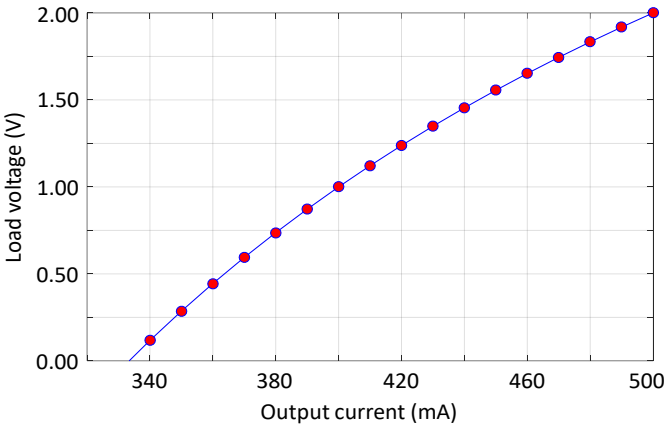

Figure 6: Minimum load voltage so as to remain below the power dissipation limit/channel inside the NEDA LD4-A box.

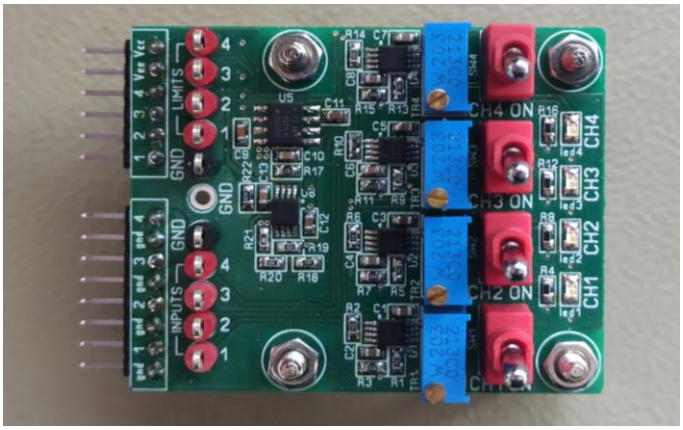

Figure 7: C-VC4 add-on PCB for autonomous operation of NEDA LD4-A without external provision of voltage controls.

to powering on. The toggle switches that select the output current range must also be brought to the desired positions before the same action. Power-on is realized with the application of a power supply voltage within the specified range (14.5-25 V). NEDA LD4-A offers a two second (2 s) time delay after power-on until the input voltage controls can create the corresponding output currents. Even though it is advised that the input voltage controls are applied after power-on, it is also safe to apply them within the specified voltage range even before that. The recommended power-off sequence involves the same steps in reverse order: First the input voltage controls are zeroed, and then the power supply voltage is removed. It is noted that the design of NEDA LD4-A offers protection against a violation of the above power-off sequence or against a power interruption: if for example the power supply voltage is accidentally disconnected or switched-off, all output currents are disabled regardless of the presence of non-zero input voltage controls or not (Figure 3c). When power is back, the same 2 second delay is applied to re-enable the outputs, and resume operation.

F. Setting current/voltage compliance limits

For load protection reasons it is advised that the current and the voltage compliance limits are set with zero input voltage controls in all channels. If this is not possible, the following sequence is also safe for the optoelectronic loads: Before power-on, all current and voltage compliance limits are set to zero by turning the eight potentiometers to their extreme counter-clockwise positions. After power-on the voltage compliance limits (first) and the current compliance limits (right thereafter) can be set to their target values using the potentiometers and the respective monitoring pins as described in the previous paragraphs. It is noted that at the moment that the driving engine is powered on during the course of this process, it is possible that one or more LEDs in the front panel of NEDA LD4-A are lit up indicating a fault operation condition. This indication can be ignored, and the setting of the current and voltage compliance limits can safely resume. After the end of this process however, the power supply voltage has to be removed and re-applied in order to re-enable all output channels, and get them ready for operation.

G. Thermal and power considerations

For maximum driving engine protection and for optimum current stability performance as per the specifications on page 2, the electrical power dissipation of each channel inside the NEDA LD4-A enclosure (box) must be kept below 2 W. Given that the voltage that is divided between the driving circuit inside the box and the load outside the box is approximately 6 V, this power dissipation limit implies that the voltage applied to the load should be higher than 2 V at 500 mA output current. If by any chance this is not possible for a non-standard LD or for any other load, a resistor can be used in series with this load in order to reach the required load voltage. Figure 6 presents the dependence of the minimum load voltage as a function of the

output current in order to remain below the power dissipation limit per channel (2 W) inside the box. In addition to this instruction it is noted that the ambient operating temperature should remain within the specified limits, and that for maximum stability this temperature should be kept constant.

Manual setting of input voltage controls

Use of NEDA LD4-A as a standalone driving equipment without external provision of input voltage controls is also possible. C-VC4 is offered to this end as an add-on PCB for the creation and the manual adjustment of the input voltage controls, leveraging an internal -3 V voltage supply (Vee) and an internal 12 V voltage supply (Vcc) of the driving engine (Figure 7). C-VC4 can be directly connected to the front panel of NEDA LD4-A fitting to the 8-pin female header of the driving engine for the input voltage controls, and its 6-pin female header for the current limit monitors and the internal voltage supplies Vee and Vcc (Figure 5a). Four toggle switches are present in the rear part of C-VC4 to enable the creation of the input controls, independently for each channel. Each input control is manually adjusted within the range 0-10 V using the corresponding trimmer potentiometer in the middle part of the PCB (Figure 7). Finally, test points are also present in the front part of the PCB in order to monitor the input voltage controls and the current limits in all 4 channels of NEDA LD4-A.

Mechanical Specifications

The external dimensions of the aluminum enclosure (box) of the NEDA LD4-A driving engine are: (L) 160.0 mm x (W) 125.0 mm x (H) 31.0 mm. The dimensions of the companion C-VC4 PCB are in turn: (L) 51.0 mm x (W) 42.0 mm x (H) 35.0 mm.

Warranty

NEDA LD4-A is guaranteed to be free from defects, and shall conform to its specifications for a period of one year from the shipment date of the product.

Contact and ordering information

For technical questions and ordering information please contact us at: sales@optagon-photonics.eu.