Intensify Nx50

Specifications & User guide 8.2014

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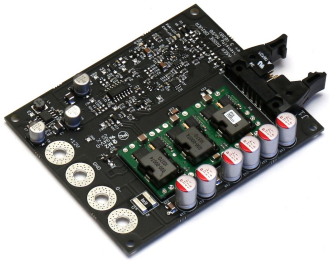
Intensify Nx50

Intensify Nx50	
	
Device type	Laser diode driver
Control modes	Current control
Status	In production & available from stock
Electrical	
DC supply voltage	12 ± 1 VDC
Output current range	0.1 - 50A × number of stacked boards
Setpoint signals	Analog reference for current control, Digital signals for enable & pulsing
Protections	Over temperature, under voltage, short circuit, ESD, laser diode protection
LD forward voltage	0.8 .. 5.0 VDC
Ripple current (typ @ 50A)	0.2A RMS, 1.25A pk-pk
General	
Dimensions	94×77.5×15 mm (3.7"×3.1")
Configuration tool	No software tools needed
Web site	Intensify product site [1]

Intensify Nx 50 is a compact stackable constant current laser diode bar driver featuring the latest multiphase switched-mode topology delivering up to 50A continuous current at unforeseen efficiency. Parallel capability allows stacking multiple Intensify boards to scale up the current to 150A and beyond. Intensify is intended for OEM applications such as fiber laser pumping, laser tooling and laser diode burn-in.

Overview

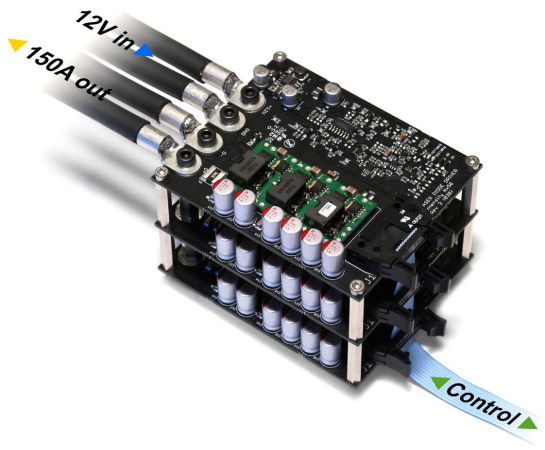
Nx50 is one of the first laser diode drives deploying an state of the art high frequency three-phase switching converter. Each driver has three switching regulator running in separate time phases to minimize output ripple and passive component sizes.

- Designed for CW/QCW laser bar driving
- 50 A, 250 W constant output per board
- Small form factor of 94×77.5 mm / 3.7"×3.1"
- Parallel by stacking, scale to 150 A and beyond
- Laser diode current & voltage spike protection
- Overtemperature, undervoltage, ESD and short circuit proof
- Fully differential analog 0-10 V setpoint input

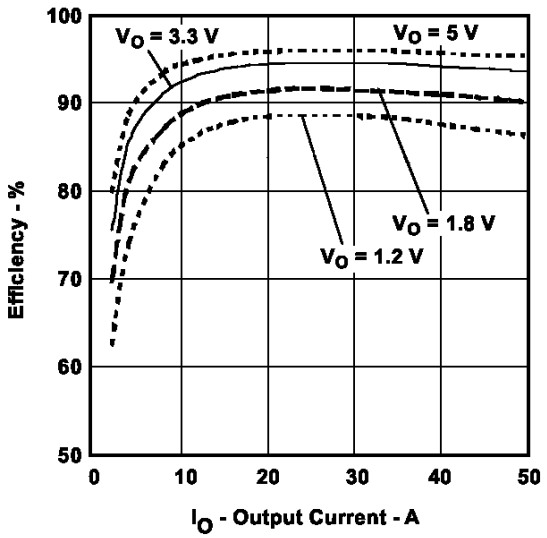
- Current and voltage monitor 0-10 V outputs
- Pulsing via digital pulse input or analog modulation
- OEM friendly pricing

Technical specifications

Power



Three Nx50 boards connected parallel by stacking



Nx50 (single board) efficiency vs load current at various laser diode forward voltages

Property	Value	Units	Remarks
Supply voltage	12 ± 1	V	
Supply current	0.1 - 23 (1)	A	Depends on output power
Max output power	250 (1)	W	50A @ 5.0V
Output voltage	0.8 - 5.0	V	Determined by laser diode voltage drop
Output current	0 - 50 (1)	A	Continuous rating
Efficiency	96	%	Efficiency when I_O > 20A and V_O = 5V

(1) For single Nx50 board. Multiply this by the number of stacked Nx50 boards.

Timing properties

Property	Value	Units	Remarks
Pulsed LD current rise time	0.5 typ	ms	Current rise from 10% to 90% of setpoint
Pulsed LD current rise time	0.6 typ	ms	Current fall from 10% to 90% of setpoint
Enable delay	< 60	ms	From disabled to enabled state
Disable delay	< 2	ms	From enabled to disabled state
Power-up/down sequence	Any order. Any I/O line states not causing spiking above setpoint		

Inputs/outputs

List of I/O

- Enable, digital 3-24V logic
- Pulse, digital 3-24V logic
- Current setpoint input, analog 0-10 V
- Current monitor output, analog 0-10 V
- Voltage monitor output, analog 0-5 V

Characteristics

Property	Value	Units	Remarks
Current setpoint voltage	0..10	V	0..10 V sets LD current between 0..50 A (1)
Current setpoint input impedance	51k (2)	Ω	Differential input
Current monitor output voltage	0..10	V	0..10 V represents LD current between 0..50 A
Current monitor output impedance	≤ 1k (2)	Ω	
Voltage monitor output voltage	0..5.0	V	Represents LD voltage drop 1:1
Voltage monitor output impedance	≤ 1k (2)	Ω	
Enable input voltage	• Logic LOW: -0.3..0.6 V or open circuit = disabled • Logic HIGH: 3..26 V = enabled	V	Enable is 3.3V, 5V, 12V and 24V logic compatible
Pulse input voltage	• Logic LOW: -0.3..0.6 V or open circuit (I_O=100% of setpoint) • Logic HIGH: 3..26 V (I_O3.5% of setpoint)	V	Pulse is 3.3V, 5V, 12V and 24V logic compatible. Pulse high outputs current defined by setpoint, pulse low outputs current 0.035*setpoint.

(1) For single Nx50 board. Multiply this by the number of stacked Nx50 boards.

(2) For single Nx50 board. Divide this value by the number of stacked Nx50 boards.

Mechanical & environmental

Property	Value	Units	Remarks
Dimensions	• 94×77.5×15 (PCB) • 107×77.5×15 (with J1 hooks)	mm	W×H×D
Operating temperature range	-40..85	°C	Non condensing. Output rating may derate at high temperature without forced convection
Reliability MTBF	1.2	10^6 Hrs	Per Bellcore TR-332 50% stress, T_{amb} = 40 °C
ESD protection	Exceeds ESD Protection to IEC61000-4-2 Level 4, ±12 kV discharge		All I/O lines

Purchasing

Intensify Nx50 is available from stock through Granite Devices web shop [2]. Item ships world wide.

Setup guide

- Intensify Nx50 setup & user guide

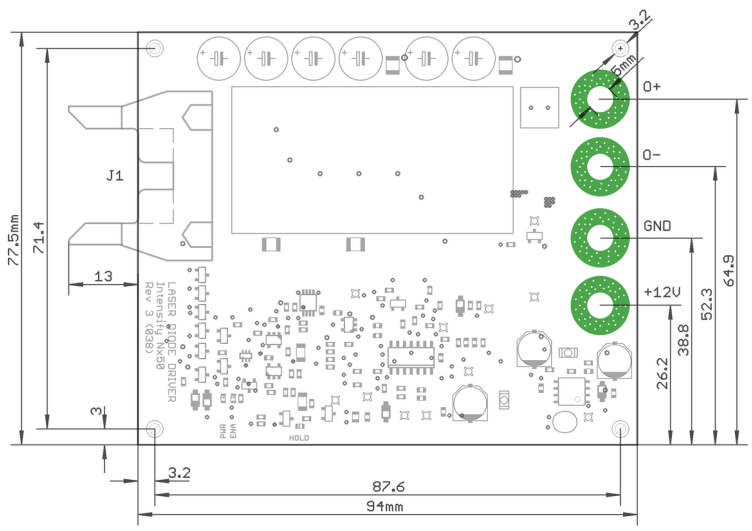
References

[1] http://granitedevices.com/index.php?q=oem-laser-bar-diode-driver
[2] http://shop.granitedevices.com/product/46/intensify-nx50-laser-diode-driver

Intensify Nx50 setup guide

This is the intallation & user guide for the Intensify Nx50 laser diode driver. Read it through before operating the device.

In case of any questions, please don't hesitate to contact us.



Intensify Nx50 PCB from top side

Pre-production version of Nx50 setup guide can be found [here [1]]. Please note that some I/O signal characteristics and pin out has changed.

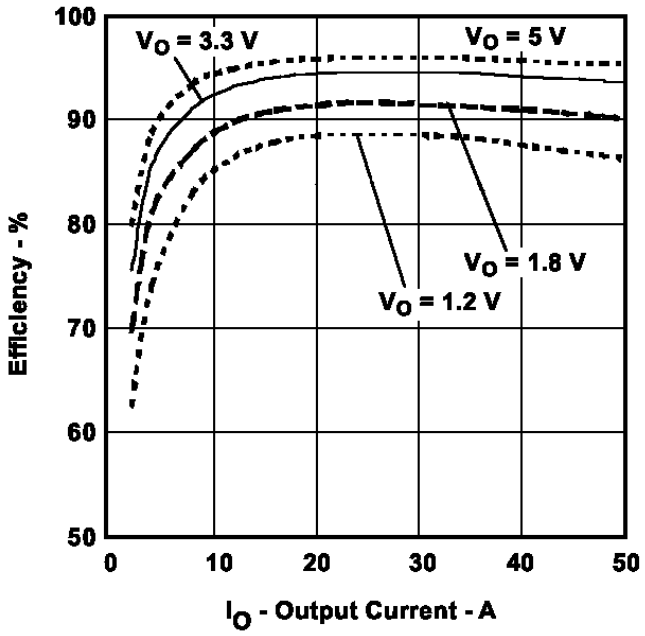
Physical installation and cooling

Nx50 should be mounted inside an enclosure by using spacer feet attached to the four corner holes.

Nx50 has low power losses due to highly efficient multiphase switching converter technology. Power loss can be calculated by using the offered efficiency data as setpont.

In most cases Nx50 is sufficiently cooled with **natural convection**. This is best achieved by mounting boards vertically and leaving at least 25 mm free air space around both sides.

However, if natural convection does not offer sufficient cooling (i.e. if peak surface temperature is near or exceeds 100°C), then **forced convection** is necessary. This can be achieved by placing a fan or blower on the side of PCB so that air flow passes along board surface.



Nx50 (single board) efficiency vs load current at various laser diode forward voltages

Wiring

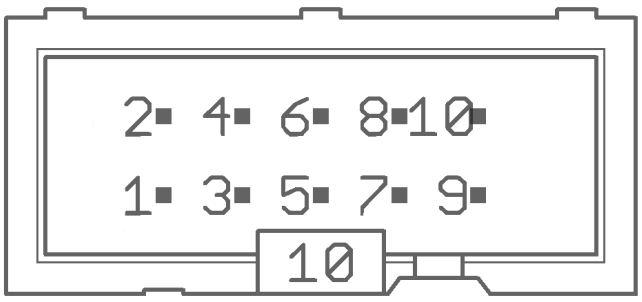
Before wiring, review Nx50 electrical specifications.

J1 connector

J1 connector is the user side I/O of the driver. This connector contains the control and feedback signals. All signal lines of the port are ESD protected by dedicated suppressors.

Mating connector type is a 10 pin flat ribbon cable connector with 0.1"/2.54 mm pin pitch and a polarity key. See spec sheet of compatible connector here.

J1 pin out



10 Pin IDC connector pinout. Pin order is relative to the connector's polarity key.

Pin #	Signal name	Direction	Signal description	Impedance vs GND
1	PULSE	In	Pulse control: • When LOW or open, output current is 100% of ISET • When HIGH, output current is 3.5% of ISET	10 kOhm
2	GND	I/O and power ground	I/O and Analog ground	0 Ohm
3	IMON	Out	Current monitor 0-10 V analog output	1 kOhm
4	GND	I/O and power ground	I/O and Analog ground	0 Ohm
5	VMON	Out	Voltage monitor 1:1 analog output	1 kOhm
6	GND	I/O and power ground	0 Ohm	
7	ISET+	In	Current setpoint 0-10 V positive input (differential)	51 kOhm
8	ISET-	In	Current setpoint 0-10 V negateive input (differential)	51 kOhm
9	ENABLE	In	LDD enable: • When HIGH, LDD output enabled • When LOW or open circuit, LDD output disabled	6.6 kOhm
10	GND	I/O and power ground	I/O and Analog ground	0 Ohm

Impedances

When driving an J1 input pin, the source impedance of controller should be significantly lower than input impedance of the corresponding pin. I.e. if input impedance is 51 kOhm, then recommended source impedance is less than 5 kOhm max, preferrably 0.5 kOhm. Lower source impedance yields lower voltage drop error.

Also when an output of J1 is connected to the input of controller, the controller input impedance should be significantly higher than J1 pin impedance. I.e. when connecting VMON (1 kOhm) to analog input or ADC, the controller input impedance should be at least 10 kOhm. However all outputs are short circuit proof and input impedance recommendation affects only monitor accuracy.

See impedance column of pin out table

Digital signals

All digital signals (PULSE & ENABLE) are referenced to GND and applicable voltage levels are:

State	Voltage range
Logic LOW	-0.3 .. 0.6V
Logic HIGH	3.0 - 26 V

Analog signals

Analog input signal support differential signaling to cancel noise and ground loop induced error. These are designed to be compatible with another differential source as well as single ended systems. The differential signals allow up to +/- 1.5V difference on ground reference potentials between Nx50 and controller without losing accuracy.

Connection to **differential** 0-10V analog I/O:

Controller	J1 signal
Analog in 1 +	IMON
Analog in 1 -	GND
Analog in 2 +	VMON
Analog in 2 -	GND
Analog out 1 +	ISET+
Analog out 1 -	ISET-
Ground	GND

Connecting to **single ended** 0-10V analog I/O. Assuming that I/O is referenced to Ground.

Controller	J1 signal
Analog in 1	IMON
Analog in 2	VMON
Analog out 1	ISET+
Ground	ISET-
Ground	GND

Power

A regulated 12VDC power supply should be connected to hole terminals labeled **GND** and **+12V**. Required power is nearly directly proportional to output power plus losses.

For example outputting 40A to 2.0V diode equals output power of 80W. With losses the needed power is about 85-90W which equals 7.0-7.5A @ 12V.

Laser diode

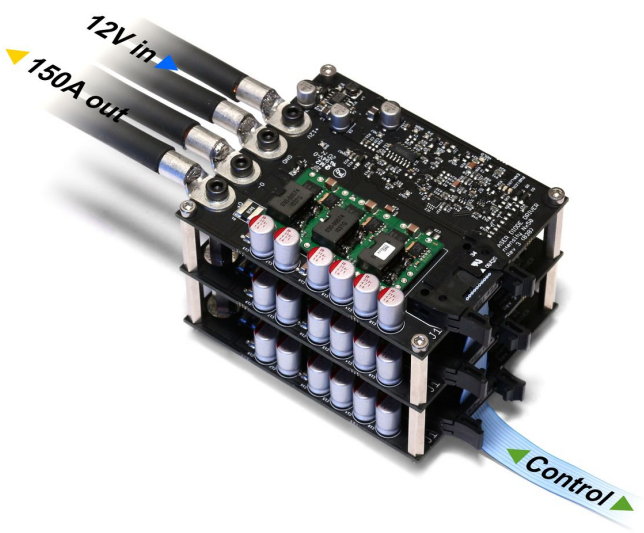
Laser diode is connected to hole terminals labeled **O+** and **O-**. O+ goes to LD anode and 0- to cathode.

Connecting parallel

Nx50 boards may be connected parallel to increase output current range simply by connecting all power and I/O lines parallel pin-by-pin basis.

This can be achieved by stacking them by using metallic standoffs to form conductive path between O+, O-, GND, and +12V terminals. Use M4, M5, 10-24, 8-36, or #8 threaded standoffs with minimum height of 16 mm / 0.63".

J1 connector may be paralleled by inserting multiple 10 pin IDC connectors to the single ribbon cable. By this method all J1 pins are properly connected parallel pin-to-pin basis.



Three Nx50 drives connected parallel by stacking with hex standoffs and ribbon cable with three IDC connectors

Usage

The device starts operating instantly after powered and and proper signals fed to J1 pins. No other initialization is needed. Sequence order of signals and power are not critical - device will not get harmed or produce erratic output regardless of start-up order.

CW usage

Mandatory connections

- LD connected between O+/O-
- 12VDC supply connecter between +12V/GND
- J1 connector pins:
  - GND connected to controller's ground reference:
  - 0-10V current setpoint signal fed to ISET+/ISET-
  - ENABLE set to HIGH or tied to GND

Optional J1 connections

- IMON wired to analog input
- VMON wired to analog input
- PULSE set to HIGH or left open

Pulsed usage

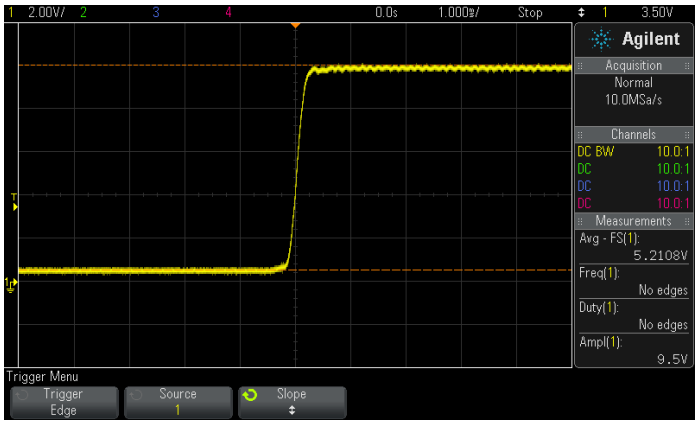
For pulsed usage it is recommended to use PULSE input or modulate the ISET analog voltage. It is not recommended to set current to 0 during off-periods for to achieve faster pulse rise times and zero overshoot. Recommended bias current during off-periods is 2-10% of current setpoint.

Mandatory connections

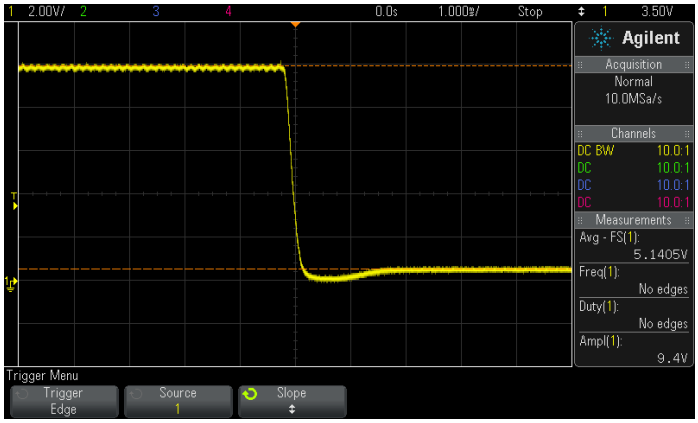
- LD connected between O+/O-
- 12VDC supply connecter between +12V/GND
- J1 connector pins:
  - GND connected to controller's ground reference:
  - 0-10V current setpoint signal fed to ISET+/ISET-
  - ENABLE set to HIGH or tied to GNDA
  - PULSE set pulse source. Logic LOW means 100% of set current and HIGH reduces output current to 3.5% (bias current to allow faster rise time)

Optional J1 connections

- IMON wired to analog input
- VMON wired to analog input



LD current rise from 2.5A to 50A when PULSE set to LOW



LD current fall from 50A to 2.5A when PULSE set to HIGH. Current typically dips to 0A temporarily.

References

[1] http://granitedevices.com/w/index.php?title=Intensify_Nx50_setup_guide&stableid=1748

Article Sources and Contributors

Intensify Nx50 *Source*: http://granitedevices.com/w/index.php?oldid=3305 *Contributors*: Tero K

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