OMNIPULSE TECHNOLOGY

PLDD-120-1-1

User Manual

OmniPulse Technology Corporation
6355 Nancy Ridge Drive, San Diego, CA 92121
(858) 452-7700 ◦ www.omnipulsetechnology.com

Last updated: 4/21/2011
PCB0086B

Specifications

Input voltage range:	2.0-12 VDC, no reverse polarity protection[1]
Peak input current:	0.55 Amps max
Logic supply voltage:	5.0 V +/- 0.25 V (regulated) 10 mA typ.
Output current:	120 Amps peak
Output voltage:	2.5 Volts at 120 Amps
Output pulse width:	300 µS max at 120 Amps peak
Operating temperature:	-40degC to +65degC
Repetition rate:	1 pulse per second over -10degC to +65degC
Output current ripple (tilt):	<2%
Output current rise and fall time:	<10µs (typ.), load inductance dependent
Input trigger:	+3.3 to +5 volt CMOS. The pulse width of the input trigger determines the pulsewidth of the output pulse
Weight:	17.5 grams. (not including output wires)
Anti-parallel diode:	2 Amp Schottky, built-in
Current monitor:	Linear output 1.00 V/100 amps into > 10 kOhms 0.50 V/100 amps into 50 Ohms
Startup time:	<1 second

[1] Input voltage for **Vbat**.

Description

The PLDD-120-1-1 is a high current laser diode driver optimized for driving a single laser diode bar with a nominal voltage drop of 2.5 volts at 120 amps. The current through the laser diode is precisely controlled with two high current MOSFETs.

The high current output connections are two gold plated Mill-Max pins (part number 3149-2-00-34-00-00-08-0) Connection to the pins can be made with a Mill-Max receptacle (part number 0479-0-43-80-34-27-10-0) or a twisted pair can be soldered directly to the pins. The pin in the hole labeled **A** should be connected to the anode of the laser diode and the pin in the hole labeled **C** should be connected to the cathode of the laser diode. To minimize resistance and inductance the length of the twisted pair should be kept below 6 inches prior to twisting and at least 20 AWG wire should be used. The user may use a shorter length without affecting performance. The use of longer length or smaller diameter wire is possible however this may degrade performance. Please consult OmniPulse if you have any questions regarding the choice of wire diameter and length.

In addition to the connection to the laser diode, the driver has one connector which contains both input and output signals. The following is a description of the connector.

Unless otherwise specified, all digital inputs are 3.3 volt CMOS, Schmitt trigger with overvoltage tolerance. A 100 kOhm pulldown resistor prevents floating input signals.

Connector J1:

Pins 2 and 4, **Vbat**, POWER
Battery voltage input from a single 123A LiMn cell. Typical maximum input current is 500 mA. The idling current is about 1 mA while **TxChargeOn** is HIGH and typically less than 1 μA when LOW.

Pin 6, **CapV**, OUTPUT-Analog
This analog signal is equal to 10.0% of the capacitor bank voltage. This signal will be present when **TxChargeOn** AND/OR **CapMon** is HIGH and the +5 volt power has been ON for at least 10 mS. This output has a 499 ohm series resistor (for current limiting).

Pin 8, **TxPulse**, INPUT-Digital
This digital input will activate the laser diode current to a level determined by the analog voltage level applied to **TxLevel** input.

Pin 10, **Imon**, OUTPUT-Analog
This analog output voltage will be proportional to the laser diode forward current. The voltage will be 1.00 volt/100 amps. The +5 volt power must be ON for at least 10 mS before data is valid.

Pin 12, **TxChargeOn**, INPUT-Digital
This input will enable the capacitor charger, the **CapV**, and the **TxReady** lines.

Pin 14, **TxLevel**, INPUT-Analog
The voltage applied to this input defines the laser diode current. The sensitivity is 1.00 volt/100 amps. This input is high impedance. To generate 120 amps, 1.2 volts is applied to **TxLevel**. Higher currents, up to 300 amps are possible (**TxLevel** = 3 volts), but the maximum pulse width will be <100 μs. The peak current and pulse width are load and temperature dependent. Please consult factor regarding your exact application.

Pin 16, **TxReady**, OUTPUT-Digital
This signal will be HIGH when the capacitor bank is charged within 97% of its full charge voltage. This output is enabled when **TxChargeOn** AND/OR **CapMon** is HIGH. Typical capacitor bank charge time is about 800 mS between shots and/or from a *cold* start. The +5 volt power must be ON for at least 10 mS before data is valid. This output has a 499 ohm series resistor (for current limiting).

Pin 18, **CapMon**, INPUT-Digital
This input enables the capacitor bank monitoring circuitry so that **CapV** and **TxReady** outputs will be enabled. Enabling this signal will load the capacitor bank with about 100 kOhms.

Pin 20, **+5V**, POWER
This +5 volt input powers the servo amplifier and 3.3 volt digital logic. The typical current consumption is approx 10 mA regardless of voltage at **Vbat.** This voltage should never go below 4.75 volts during *full* operation. Undervoltage conditions will inhibit operation of the capacitor charger. When applying power, allow at least 10 mS for system to approach equilibrium.

Pins 1-19, odd numbered only: **Ground**.

Figure 1.Photograph of Driver (PLDD-120-1-1)

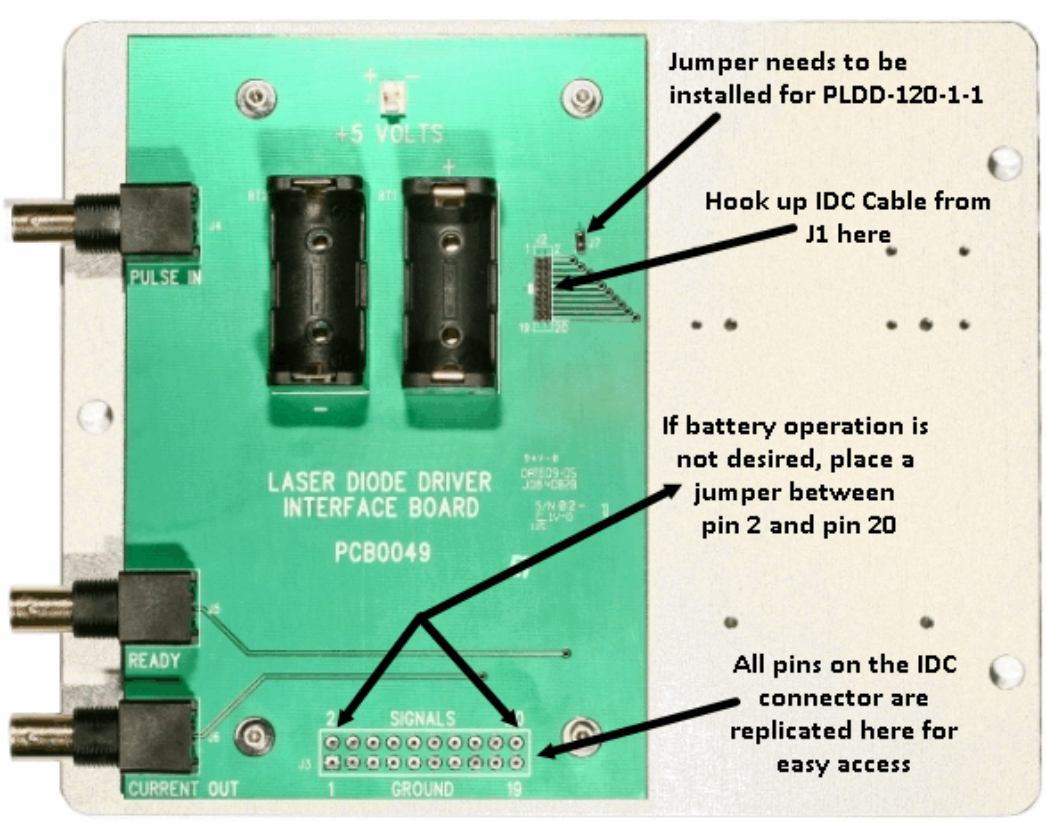

Figure 2. Universal Interface Board

Operation of Unit

The optional Universal Interface Board allows easy access to all 20 pins on the small IDC connector through solder pad connections at callout J3. The input trigger **(TxPulse)**, current monitor **(Imon)** and the end of capacitor charge signal **(TxReady)** are brought out to BNC connectors. Powering the driver is described by two methods below:

***Option 1**: Battery operation plus low power +5 volt supply (Portable operation)*

For this option the user can use the Universal Interface Board to provide battery power to the driver. One or two 123A type batteries are installed in the battery holders. A shorting tube (or jumper wire) is placed in one of the battery holders if single battery cell operation is preferred. The user then needs to supply +5 volts (regulated, at 10 mA) to the power connector J1 on the Universal Interface Board. **There cannot be a jumper from pin 2 to pin 20** as described in Option 2 below!

***Option 2:** Operation from a +5 volt regulated power supply (Lab bench operation)*

For single power supply operation, the batteries MUST BE REMOVED from the UIB! The user simply solders a wire jumper from pin 2 to pin 20 (see pg 6, figure 2) on the Universal Interface Board (callout J3). The user then needs to supply +5 volts (regulated, at least 0.6 Amps) to power connector J1. The power supply must stay in regulation at all times!

To operate the unit the user needs to supply a high signal to **TxChargeOn** which enables the capacitor charger. When the capacitor is fully charged, the **TxReady signal** will go high (**TxChargeOn** and/or **CapMon** must be high). The output current is set by the DC voltage on **TxLevel.** The transfer function is 1.00 volt/100 amps so 1.20 volts is required to generate a 120 amp pulse. A +3.3 to +5 volt pulse is applied to the BNC labeled **Trigger In**. The duration of this pulse must be set to the desired duration of the output current pulse (300 µs max at 120 amps). The user must set the reprate of the signal to be no greater than 1 Hz (refer to Figure 3 for maximum recharge time (inverse of repetition rate) vs. temperature). Laser diode current can be monitored with the **Imon** signal. The transfer function is 1.00 volt/100 amps. Refer to Figure 4 for the timing diagram.

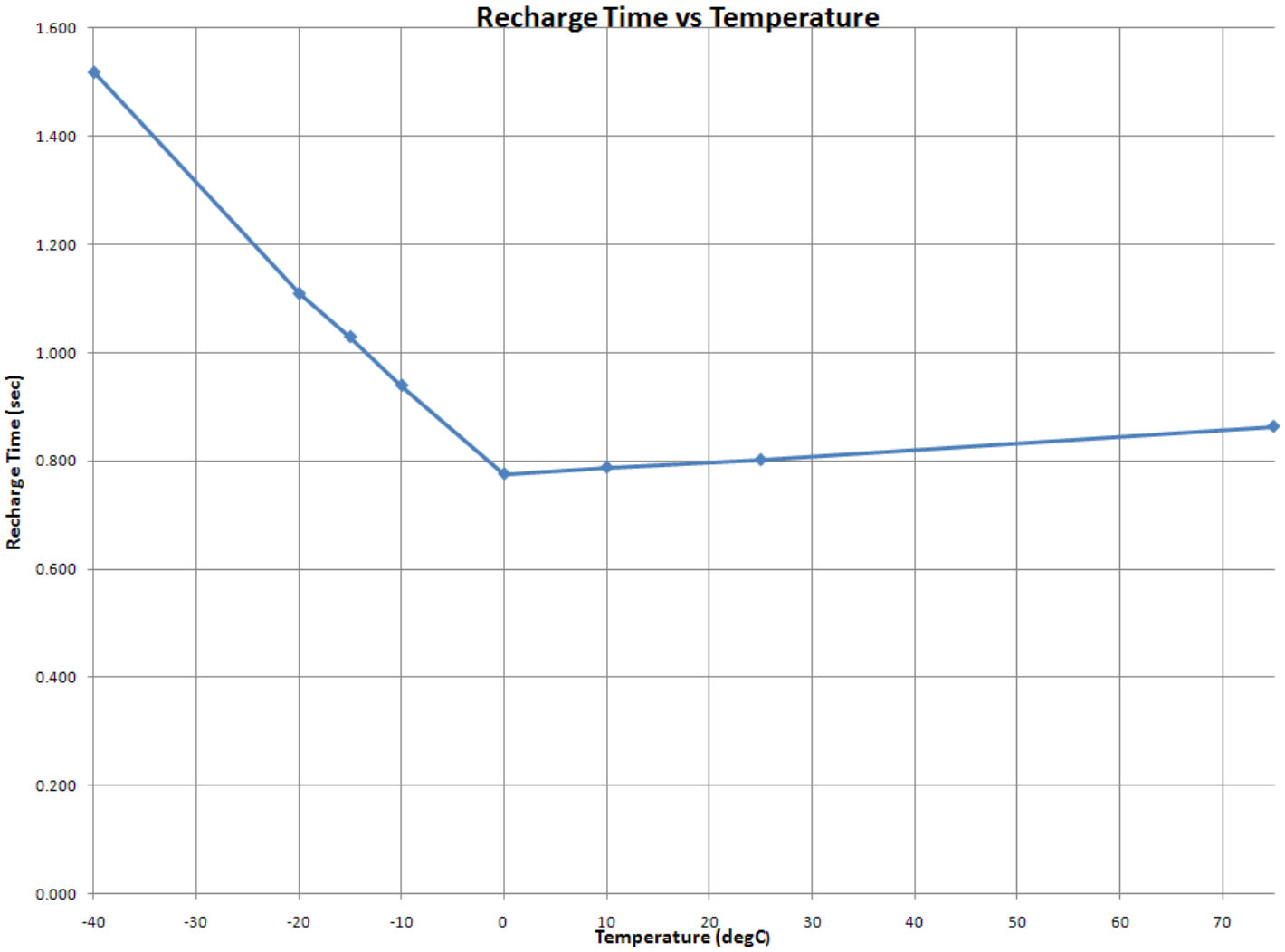

Figure 3. Recharge time (1/reprate) of the capacitor vs. temperature. The driver will operate at a 1 Hz rate for temperatures above -10degC

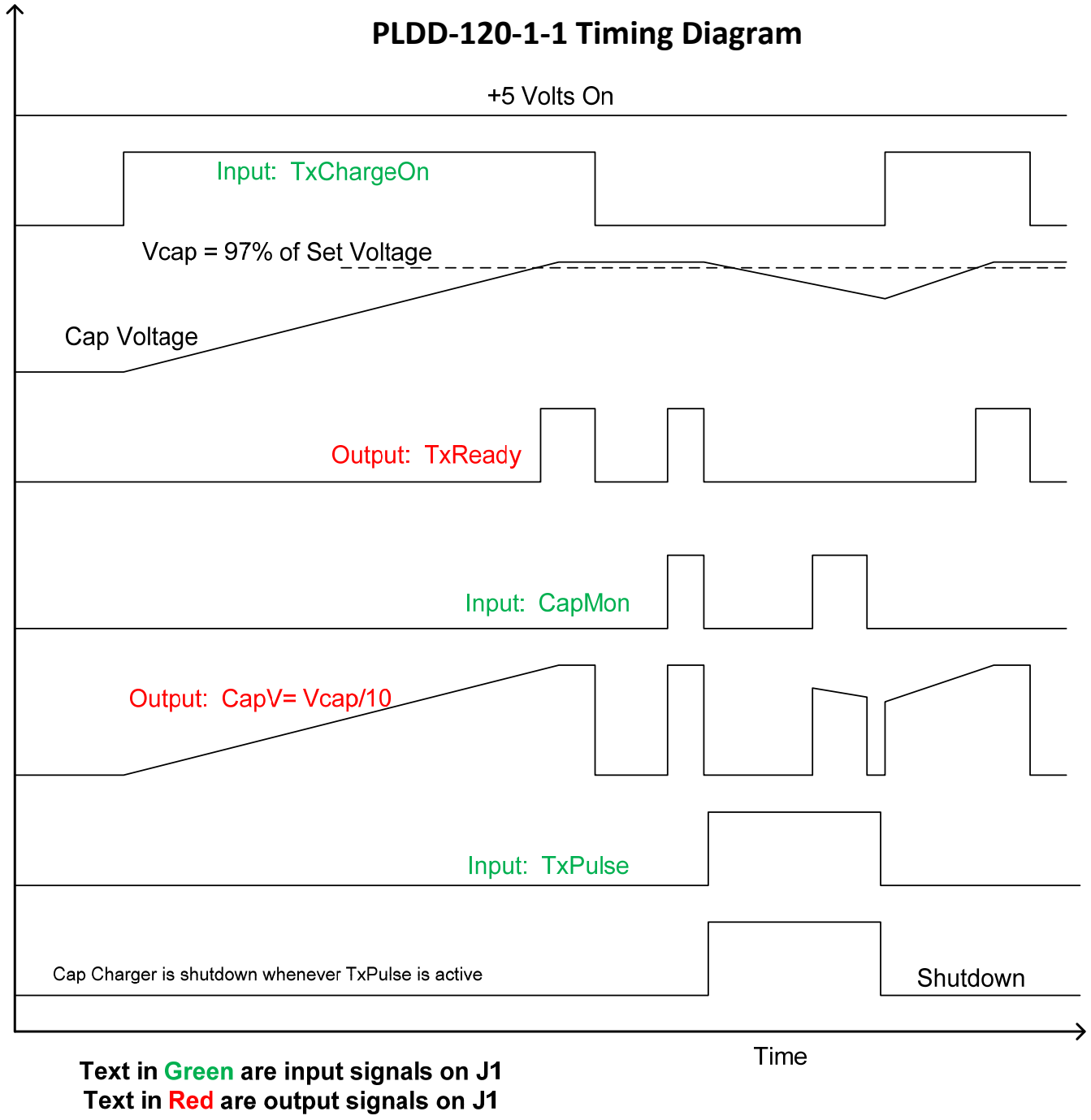

Figure 4. Timing diagram for the PLDD-120-1-1

PLEASE READ ALL WARNINGS!

WARNINGS:

1. *When the power is turned off the main capacitor is still charged. Before performing any changes to the unit, discharge the capacitor with a ~100 ohm, 1 to 2 watt resistor. Use a voltmeter to confirm that the capacitor has been discharged to less than 0.5 volt.*
2. *Never allow either of the output signals which go to the laser diode to come in contact to ANY other signal including ground. Voltage across the laser diode can be measured differentially or with a floating device.*
3. *Do not short the output! This could permanently damage the unit. This unit is designed to drive a single laser diode.*
4. *Always observe the power supply polarity.*

Calibration and Schematics

The Current Monitor output (**I-mon**) of the driver was compared to a Pearson model 110 current transformer. Figure 5 shows the **I-mon** output (into high impedance) and the output of the Pearson current transformer for the PLDD-120-1-1. Figure 4 and Figure 5 show the simplified schematics of the PLDD-120-1-1 and the Universal Interface Board.

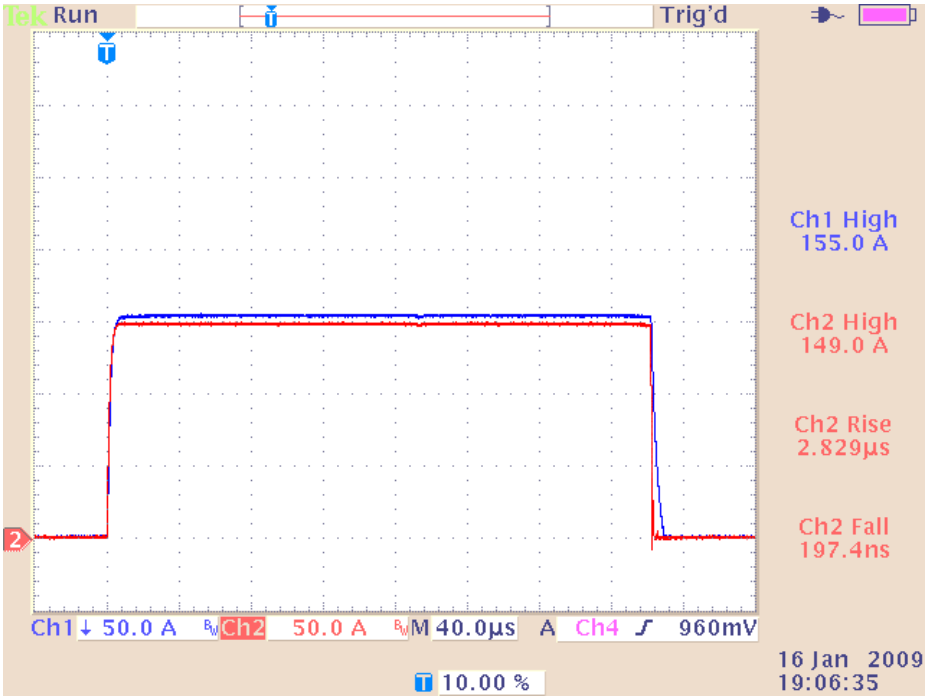

Figure 5. PLDD-120-1-1 comparison of the I-mon (lower trace) output and a Pearson current monitor (upper trace Pearson model 110)

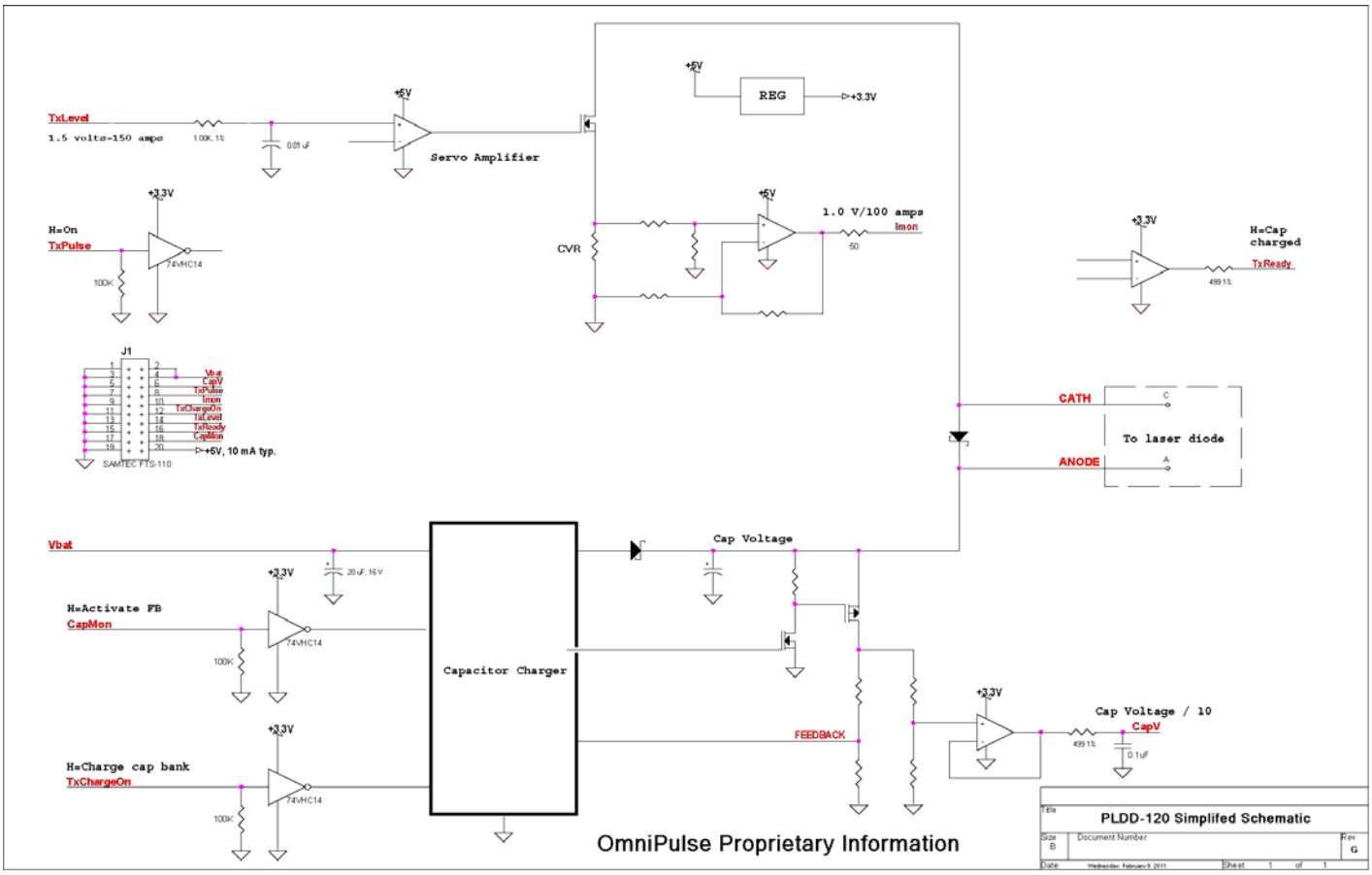

Figure 4. Simplified schematic of the PLDD-120-1-1 (please note two MOSFETs in parallel are used to increase reliability of the driver)

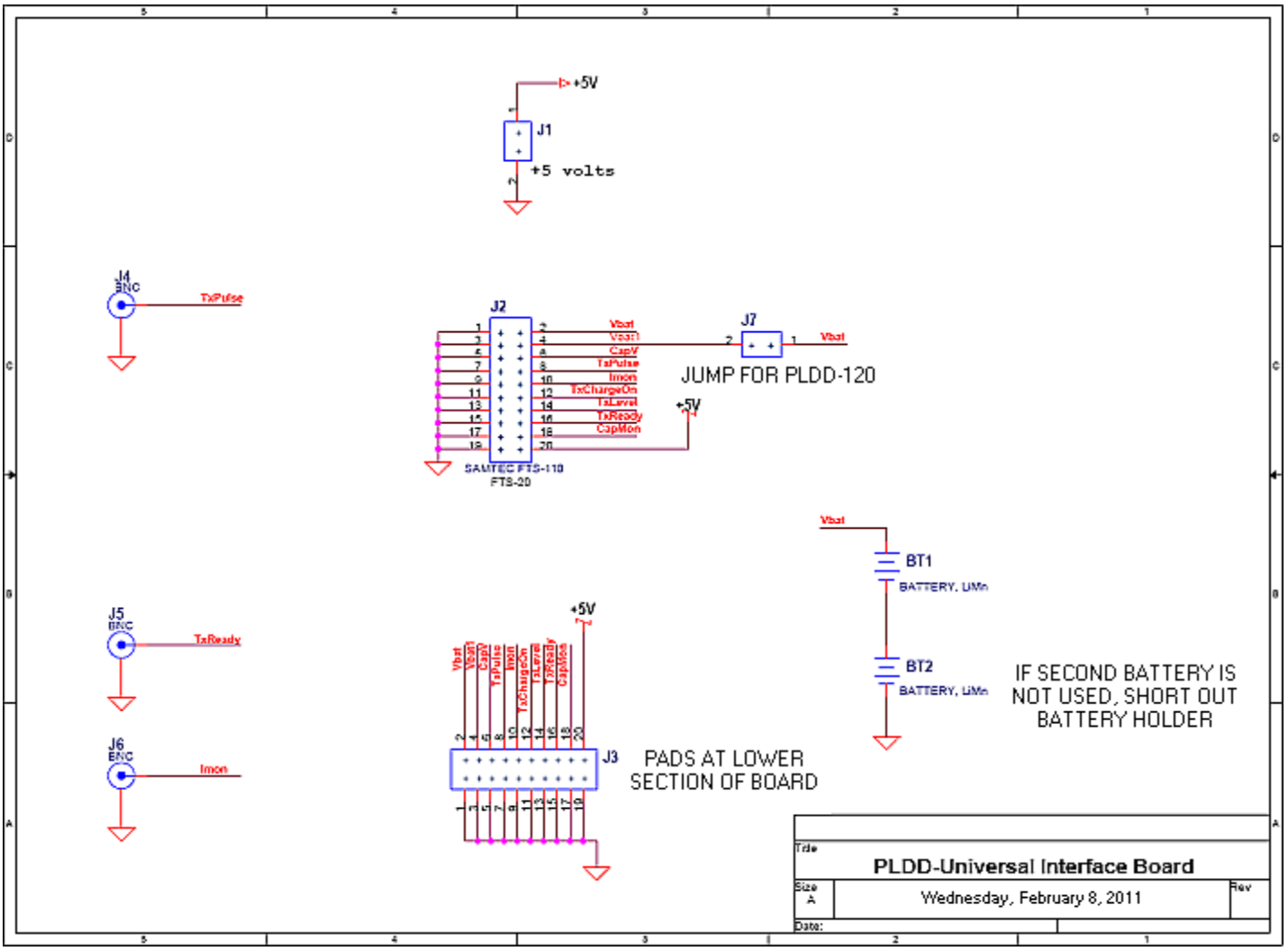

Figure 5. Schematic of the Universal Interface Board.