TECH NOTE

LDP-3830 Pulse Performance

PURPOSE

This technical note discusses the pulse performance of the LDP-3830 Precision Pulsed Current Source with the LPB-386 Pulse Board. Also included in this technical note are techniques used in configuring the LDP-3830 to achieve optimal pulse performance.

BACKGROUND

To achieve the rated rise times and pulse widths, the pulse generating circuitry was moved close to the device under test (DUT). Moving the pulse generating circuitry near the load minimized pulse performance problems associated with long cable connections. The LPB-386 Pulse Board contained a voltage pulse generator with integrated series resistance that acts as a current sense resistor for the LDP-3830. The LDP-3830 provided pulse timing information as well as the digitized pulse current amplitude from the sense resistor. This allows it to generate the proper voltage for the pulse board to maintain the current setpoint.

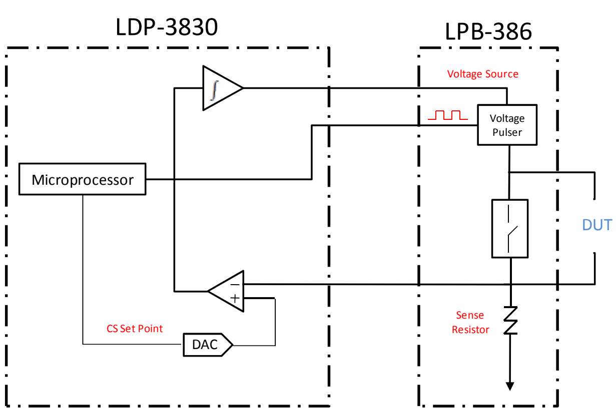

Figure 1: Schematic diagram of the LDP-3830 and LPB-386 pulse current source

TEST PROCEDURE

Three LedEngin LZ1-00NW05 High Brightness LEDs were connected in series and were mounted on the LPB-386 Pulse Board which was connected to a LDP-3830 Pulsed Current Source. Pulse performance was captured by a Tektronix TDS 3054 Oscilloscope by connecting the oscilloscope to the LPB-386 current monitor output. Rise time, fall time, and overshoot were calculated using the traces from the oscilloscope. Amplitude and pulse width repeatability was calculated by taking the population standard deviation over 100 pulses at the same setpoint.

RESULTS

Rise time and fall times of the LDP-3830 were limited by the inductance of the load and connecting cable as seen in equation 1.

Equation 1: $V = L\frac{di}{dt}$

$$i(t) = \frac{1}{L}\int V dt$$

Figure 2 below shows pulse performance as inductance was increased. By reducing inductance, the LDP-3830 produced faster rise times.

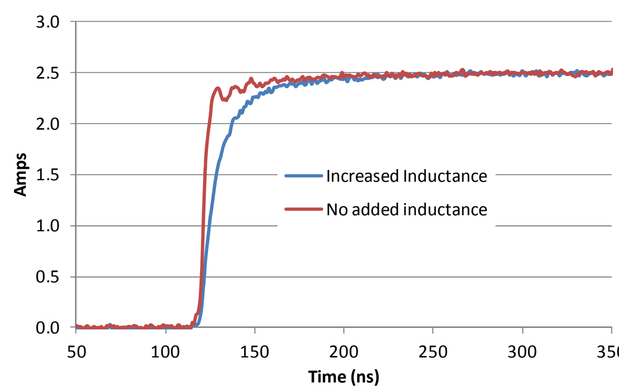

Figure 2: A small 50mm 26 gauge wire was added between the LEDs and the cathode. The wire acted as an open air inductor increasing the inductance of the load.

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Overshoot is governed by equation 2 where $C\frac{dv}{dt}$ is the characteristic of the DUT and I_{Pulse} is the nominal current of the LDP-3830 through a purely resistive load.

Equation 2: $$i(t) = C\frac{dv}{dt} + I_{Pulse}$$

Assuming typical laser diode capacitance remains constant through the operating range, the $C\frac{dv}{dt}$ portion of equation influences the ability of the LDP-3830 at low laser currents because of the large change in voltage during initial turn on of a laser diode. This behavior can cause high overshoots at lower currents as seen in figure 3. As the current increased and the laser diode was operated in a more linear voltage range, the overshoot was minimized. In order to further minimize overshoot, additional resistance or inductance may be added to the load. However, additional resistance will reduce the compliance voltage and additional inductance will reduce the rise time of the LDP-3830.

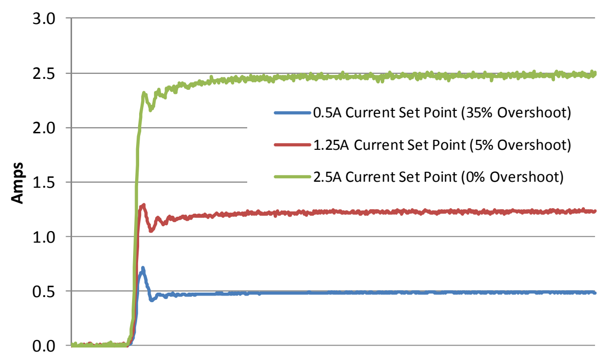

Figure 3: Typical overshoot at varying currents.

Figure 4 and 5 show typical pulse repeatability performance at an amplitude of 2.5A and pulse width of 100ns. The LDP-3830 amplitude repeatability specification is <0.005+0.5% of set point. The standard deviation in this experiment was 0.002A and the specification at this set point is <0.0175A. The standard deviation of the pulse width in the test was 0.13ns, which is within the specification of 0.15ns.

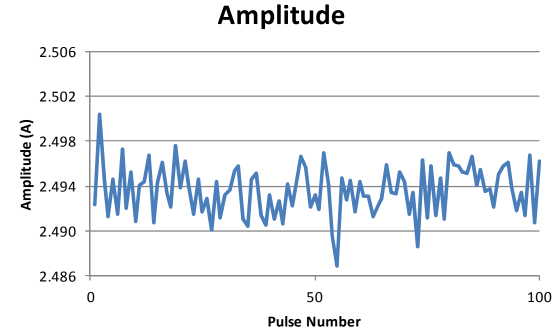

Figure 4: Measured pulsed current for a trail of 100 pulses.

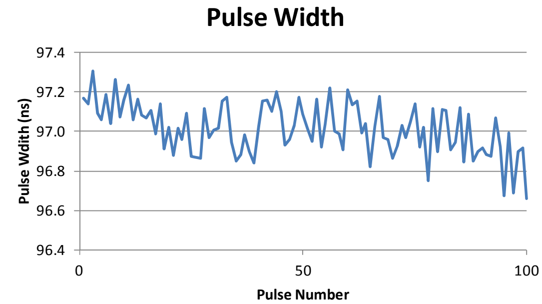

Figure 5: Measured pulse width for 100 pulses.

CONCLUSION

The LDP-3830 with LPB-386 is capable of providing precision pulsed current with fast rise time and low overshoot to laser diodes and quantum cascade lasers. However, tradeoffs must be made between fast rise times and low overshoot. An increase in resistance or inductance to minimize overshoot can lead to a decrease in compliance voltage and in the rise time of the pulse. Reduced inductance to increase the rise times will lead to higher overshoot. By balancing what is acceptable in your application for rise time and overshoot, the LDP-3830 can deliver high performance pulse current.