LED and Laser Diode Test and Burn-In

Application Note: High Slew Rate Current Modulation

APPLICATIONS

- Laser diode drivers
- HBLED/OLED burn-in and test
- Laser diode application development

LED AND LASER DIODE TECHNOLOGY

High brightness LEDs (HB LEDs) and laser diodes are becoming increasingly popular in a variety of applications. Automotive lighting, aircraft lighting, cell phones, televisions and computer monitors are just a few areas where LEDs are becoming the lighting technology of choice. In addition, high-power laser diodes are being used for a variety of industrial cutting applications as well as optical pumps for solid state lasers (DPSSL). These applications often require pulsed QCW (quasi-continuous wave) waveforms to achieve the desired light profile or a high intensity output with a low operating temperature to improve performance and reliability.

For final test and burn-in, it is frequently required to pulse the power supply output current to the LED stacks and/or strings undergoing test. For example, a 50% duty cycle pulse may be used with a controllable rise time in the tens of microseconds. For high power CW applications a dedicated laser diode driver (such as the Sorensen Model SFA) may be adequate; however, for high slew rates (<200μs rise and fall times), programmable power supplies become an expensive solution. An effective alternative for a fast transient current source is to use an electronic load as a modulator in series with a bulk power supply and the diode string/stack (*Fig. 1*).

SYSTEM SETUP

The power supply is set in voltage mode (CV) at a voltage slightly higher (<5% typical) than the expected drop across the diode string at peak current. The electronic load, in this case the Sorensen SL Series, is set in "dynamic mode" to switch from zero/low current to the source current required for the application. SL Series electronic loads have controllable slew rates to provide square (10-50μs rise time) or sawtooth waveforms. The duty cycle is adjusted by setting the low current timing and high current timing, as shown in *Fig. 2*.

Using a bulk power supply with good regulation characteristics, as found in the Sorensen DLM, DCS or SGA families, the current through the diodes is modulated in accordance with the waveform generated by the SL electronic load. The capability of the load in this configuration is demonstrated in *Fig. 3* using a 20Ω resistance for the diodes. The power supply is set at 41V. The electronic load is set to switch from 0 to 2A at 500Hz. A slew rate of 0.04A/μs was used. A convenient current monitor output, available on the front panel of SLM DC Modules, permits easy connection to an oscilloscope for viewing of the waveform as dynamic mode parameters are adjusted.

For instance, the desired degree of overshoot can be adjusted by changing the slew rate of the current transitions. In this case, a relatively slow slew rate is used to eliminate overshoot.

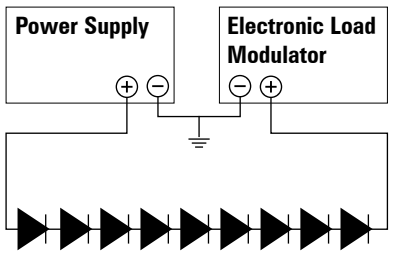


Fig. 1. Conceptual setup of LED pulse test

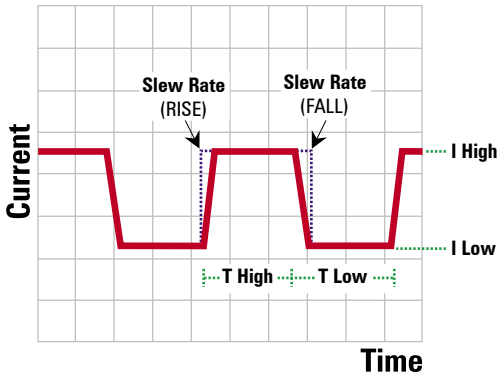


Fig. 2. Dynamic mode settings for SL-series electronic loads.

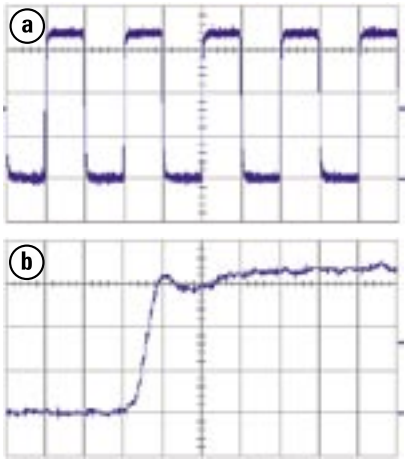


Fig. 3. Current modulation by an Electronic Load.
a.) 0 to 2A transitions, 1ms/div
b.) 20µs/div

The load can also be set in constant current-controlled (CC) mode to allow for CW testing. One key feature of SL Series loads is that even in CC mode, the slew rate can be set to eliminate overshoots.

With many lighting applications utilizing low power LEDs, a modular, electronic load chassis with SLM- or SLD- series loads (75-300W per channel and 100W per channel, respectively) are particularly effective when combined with a bulk supply to provide multiple test channels. (In normal operation, nearly all of the power is dissipated in the diode string and not in the modulating load. However, the load should be sized to dissipate the full power of the maximum compliance voltage x current.)

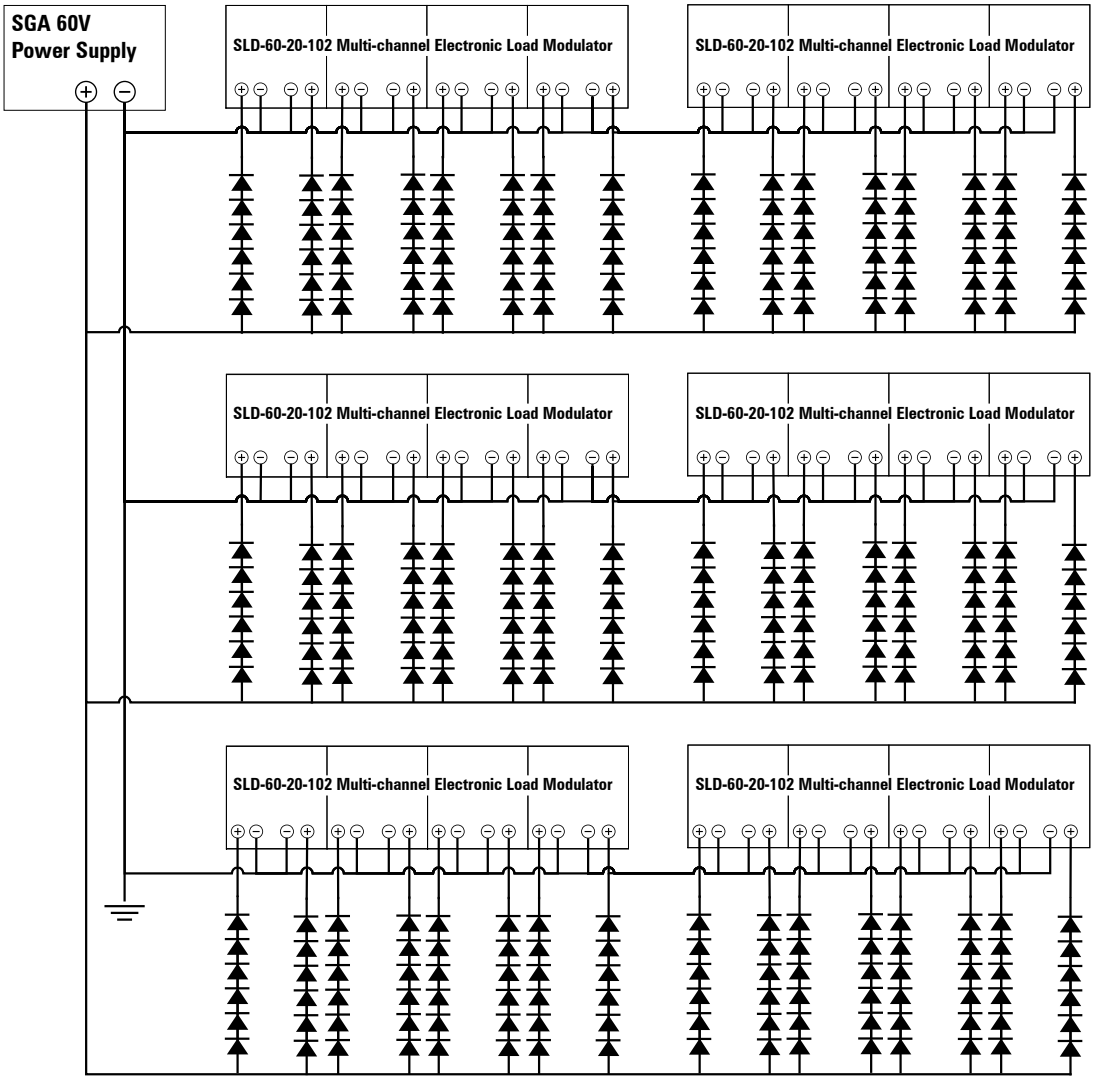
SIMPLE OFF-THE-SHELF SOLUTION

Since many production lines have already installed high power, CW supplies for test, adding the electronic load can add QCW capability at a small incremental cost per channel. A 48 channel QCW test configuration can be added to an existing 5kW CW system with a straightforward addition of a single rack (24U) of loads (*Fig. 4* shown with dual input modules, not including current monitor output). Each test channel can be controlled independently with different electronic load programming. The load also provides built-in current measurement for each diode string/stack.

BENEFITS

- High controllable, slew rate – rise time 20-50μs
- Independent control of each channel
- Low cost per test channel
- Leverage existing base of power supplies
- Standard off-the-shelf test equipment

Fig. 4. Example 48-channel/5KW test configuration



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