

Re: High brightness white LEDs damaged by custom switcher

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- *From:* D from BC <myrealaddress@xxxxxxxxxx>
 - *Date:* Fri, 04 May 2007 07:00:11 GMT
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On Fri, 4 May 2007 02:21:33 -0400, "Paul E. Schoen" <pstech@xxxxxxxxxx> wrote:

Some of you may recall my discussions about a 12 VDC powered switching converter to drive strings of 7 or 13 high power white LEDs, in posts from 1/5/07 (transients), 2/22/07 (Inductor gaps), and 3/10/07 (TC1410 driver problems). We built the circuit, found a few problems, then tested it and it seemed OK. Basically this is a switching boost regulator using a 10 uH inductor and a PIC with PWM at 100 kHz. I did a lot of LTSpice simulations as well.

The circuit is somewhat unique in that the PIC is programmed to produce alternate high and low brightness modes, at about 700 and 100 mA, when power is applied and removed. The PWM is controlled by the voltage on a 1 ohm sense resistor, and it is designed to ramp up slowly and cut back quickly. There are also undervoltage input and overvoltage output sensing circuits to shut down the PWM until the next power on reset.

My friend had three different 7-LED clusters (made by Cree), of low, medium, and high brightness. While testing the medium-brightness cluster, he noticed a less than normal difference in brightness, and found that two of the LEDs were not lit. They tested open, but apparently the voltage was enough to bridge the gap and provide a current path for the remaining 5 in series.

The manufacturer examined the LEDs and stated: "#1 appeared to have an evidence of damaged chip which looked to be a burnt metal traces around the bond pads, it also had a blown wire bond on the Anode side which had an appearance of a fused wire. The lamp #4 had the blown off bond pads on the chip side." They concluded it was a high current surge.

My recommendation to my friend was to perform a deliberate destructive test on one or two lamps to see what level of current would cause such damage. I think he had previously tried up to 1.5 or 2 amps for a few seconds without sign of damage, although possibly not with these exact model LEDs.

Without going into more detail for the sake of brevity, I would like to

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discuss possible scenarios, testing suggestions, and design improvements to minimize the risk of more failures in the field. Terry Given was kind enough to analyze my circuit and layout, with many suggestions for improvement, and I plan to implement them in the next iteration of the design. However, someone else was adamant that a PIC would never be as reliable as a pure analog design, and suggested an off-the shelf Linear Tech or other part, which would involve a complete redesign and loss of the dual brightness feature.

Thanks,

Paul

How about asking Microchip Inc. if PIC's are just as reliable as dedicated smps PWM controller IC's.

D from BC

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