How to Fix Thermal Design Issues in the LED Design

Thermal management in solid-state lighting applications is a crucial part of the LED design framework because important system parameters like the light quality, output, and lifetime largely depend on it. When it comes to thermal design, you can often encounter problems. Obviously, the best practice is to do the thermal design right from the conceptual phase of the LED fixture. However, things get a bit critical when the TC point goes high and out of control after the fixture design is all done.

Here we'll discuss some remedies that LED designers can implement to straighten out the thermal design issues.

Decrease the drive current

First and foremost, the most effective way to reduce excessive thermal load is by lowering the drive current. LED drivers that can be configured to lower the drive current can be particularly suitable for decreasing the thermal load.

Lower drive current will slightly reduce the lumen output but at the same time, the concept ensures increased Lumen Per Watt (LPW) and higher system efficiency. This is probably the easiest way to resolve thermal load issues provided the concept fits into the design criteria.

Higher flux bin LEDs

Another way to lower the drive current is to use higher flux bin LEDs. Higher flux bin LEDs are more efficient in producing higher lumens, so even if the current is lowered, the LEDs can still leverage the same lumen output at a lower wattage. This essential means less thermal load, and subsequently, reduced heat generation.

Moreover, designers can also put into use better optics in their applications to prevent optical loss. Improving the optical efficiency by 5% to 10% can considerably reduce the drive current while maintaining the same system performance at a much lower thermal load.

In extreme cases, when the TC is way too high and none of these work, engineers might have to introduce more aggressive and intrusive changes into the LED design.

Designers, in such adverse conditions, will most likely have to redesign the LED board with an increased number of LEDs. This will technically enhance the overall system efficiency by meeting the lumen output target at a lower thermal load.

There are basically two ways to handle extreme crisis situations. Engineers can either throw in more LEDs or improve the thermal architecture by essentially providing more surface area and better air flow to the heat sink design.

Nevertheless, there's a cost involvement for both the cases so there has to be a detailed cost analysis to figure out which methodology will be a more cost-effective option.

Finally, lowering the ambient temperature in the driver housing can remarkably solve most thermal design issues. This can be attained by -

- Making holes to the driver chamber in order to allow the hot air to escape
- Keeping the driver away from the main heat source, which is usually the LEDs
- Considering an insulator along with the LED driver
- Adding a simple chimney effect to the design to move out the hot air away from the driver

The above points, if taken into account, can dramatically improve the thermal design and the overall system performance.