What Makes Our Long-life Products Unique?

INVENTRONICS

Introduction

The EUD-DTL and DVL series of drivers have a revolutionary design backed by a 10-year warranty. They are Controls-Ready, programmable drivers specifically designed for those applications demanding extremely long operational lifetimes. To achieve this target, changes were made to capacitors, PCB material, magnetics, and derating guidelines which will be reviewed further in this paper. These are truly robust products using an innovative design tailored for applications requiring ultra-long life.

Design Collaboration

Inventronics contracted a leading third-party reliability firm to identify traditional power electronics weaknesses. Working together and utilizing a wide range of predictive modeling, critical areas of the LED driver design were targeted for optimization and innovation.

Film Caps Only

LED drivers conventionally utilize electrolytic capacitors. These capacitors rely on an electrolytic liquid that will eventually dry out. The speed of this dry out behavior is related to time and temperature. This relationship is where the traditional lifetime curve is derived from (Figure 1).

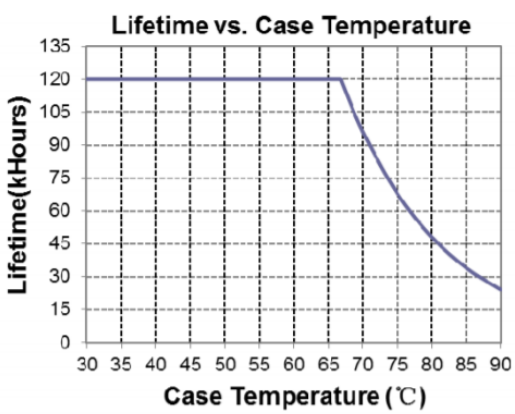

Figure 1: Traditional Lifetime Curve

The Inventronics 10-year drivers eliminate this traditional wear out mechanism by using only film capacitors (Figure 2). The lifetime curve is no longer limited by electrolytic capacitors. The film capacitors also allow for higher ripple current and an overall higher lifetime expectancy.

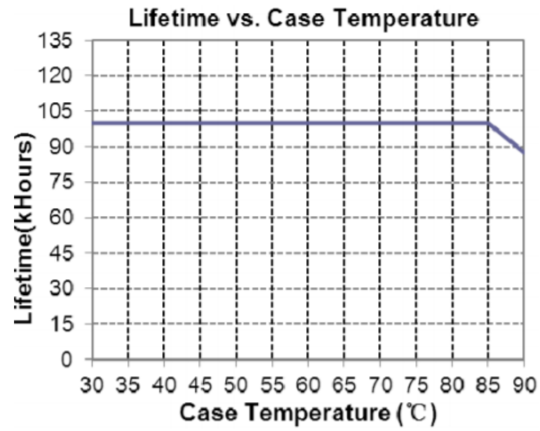

Figure 2: EUD-DTL/DVL Series Lifetime Curve

High Glass Transition Temperature (Tg) PCB

The glass transition temperature (Tg) of a printed circuit board (PCB) is the temperature when the PCB shifts from its solid state to a soft, elastic state. By increasing this temperature, the PCB is strengthened and becomes more resistance to heat, moisture, and chemicals.

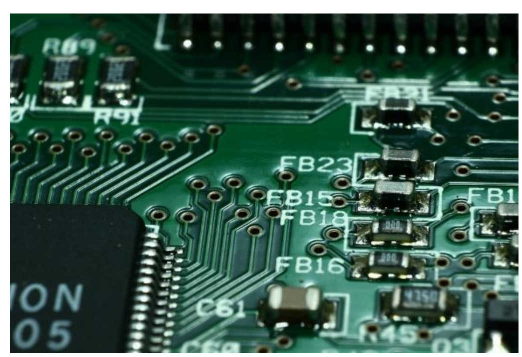

Figure 3: Example of a printed circuit board

The Inventronics long-life drivers utilize a high Tg PCB, which is an industry definition equal to or greater than 170°C.

With increasing the PCB Tg, the mechanical stability of the PCB is improved along with the PCB reliability, even under the harshest conditions.

Coated Transformer Wiring

Transformers are made by wrapping thin, conductive wire around a specified core. This wire is insulated, but abrasions can occur throughout the manufacturing process and during the winding of the transformer. If these abrasions are close together, the windings will short internally, causing immediate failure. With added operational time and heat, the abrasions can also lead to the breakdown of the wire’s insulation over time, passing initial burn-in testing, but still failing prematurely in the field.

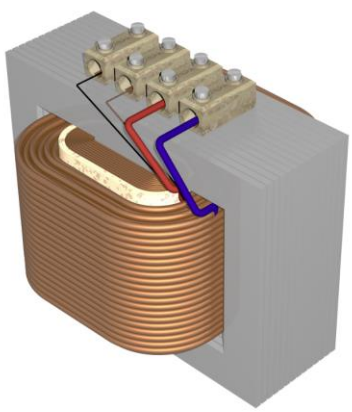

Figure 4: Example of transformer windings

The EUD-DTL and DVL series add additional coating to the transformer wires to combat this failure mode. The added coating reduces the coefficient of friction during the winding process, reducing the total number of abrasions, and minimizes insulation breakdown over time.

Increased Design Margin According to IPC-9592

The average car’s speedometer may show that it can be driven up to 160 mph (260 kph); however, these vehicles were not designed to be driven at their maximum speed regularly and would soon need repair. In the same way, components have maximum operating specifications, but often are not intended to operate at their maximums for normal use.

Intentionally using components below their specified maximums is called derating. Likewise, ensuring there is room above the required operating point is called adding margin. A generic design rule is to derate all components to 80% (20% added margin); however, each manufacturer has their own internal guidelines that they follow for derating practices.

Knowing that the Telecommunications industry has extreme need for all power supplies to remain live, Inventronics looked to them for inspiration. To meet such a stringent requirement, their industry has established strict derating guidelines. These guidelines were established by the Association Connecting Electronics Industries (IPC) under standard 9592. The IPC-9592 Appendix A goes further to recommend derating based on a 10-year stress factor. The EUD-DTL and DVL drivers utilize this standard to ensure enough margin is added even for the strictest of industries.

Summary

Back to the car analogy – if driving at high speeds is truly required, an average car would not work, and a race car would be needed instead. Similarly, if long life is truly required for an application, a specialized LED driver with a different design approach is needed instead. Inventronics supports these targeted applications with the ultra-long life EUD-DTL and DVL series.

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Breanna McElroy is the North American field application engineer for Inventronics, a leading manufacturer of LED drivers for the solid-state lighting market. She is responsible for helping identify and define the company's broad portfolio of LED drivers and Lighting Controls while also supporting technical sales. Based in Oklahoma City, OK, McElroy works closely with Lighting OEMs to design-in the best LED driver to meet both application and commercial needs and continues to support these projects long after release. She has a BSEE from Worcester Polytechnic Institute and 4 years' experience in power and lighting.

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