

Electrical Testing

Driver Efficiency

Driver efficiency is calculated by dividing the electrical output power supplied to the LEDs by the total input power to the luminaire or lamp. The output power to the LEDs is the sum of the product of the forward voltage and current for each LED. The input power was measured at an input voltage of 230VAC.

$$\text{Driver Efficiency} = \text{LED power} / \text{Total input power}$$

$$\text{Driver Efficiency} = (V_f * I_f) / P_{in}$$

$$\text{Driver Efficiency} = (11.9 * 0.806) / 11.15$$

Driver Efficiency = 86 %

Power Factor and Harmonic Distortion

Power factor is an important metric for LED driver performance, and in the case of street lighting, utility companies may require that luminaires have power factor greater than some specified value. In general the closer the value is to 1, the better the performance. For this luminaire, the power factor is 0.904.

Total harmonic distortion (THD) is defined as the ratio of the sum of the powers of all harmonic components to the power of the fundamental frequency. Harmonic currents are a concern because they can produce problems such as noise interference and overheating of electrical distribution system wiring. The total current harmonic distortion (aTHD) was measured to be less than 26%.

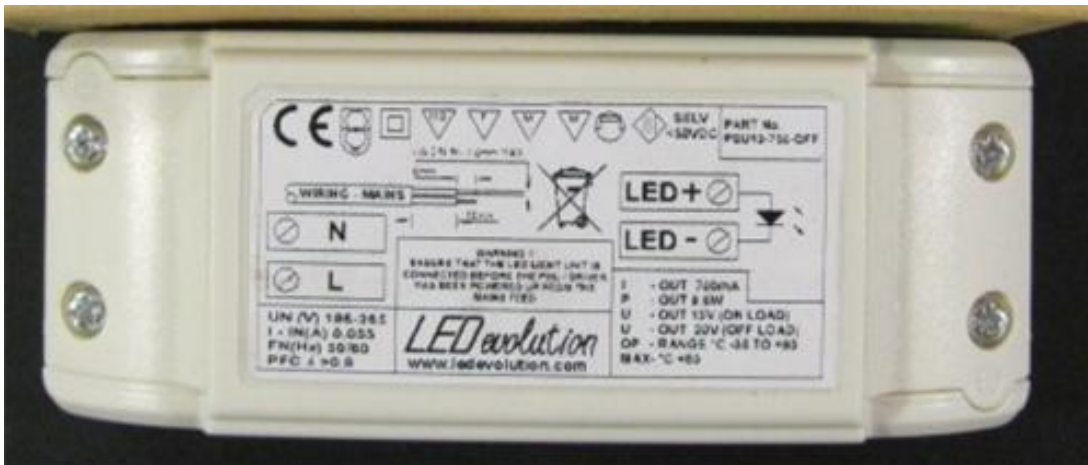


Figure 6: Picture of LED driver

Transient Analysis

Hot plugging and turn-on electrical overstress is occasionally seen with LED Drivers. See Cree Application Note [Electrical Overstress](#) for further information on the effects this has on LED performance and lifetime. The driver output current was measured with a current probe and oscilloscope and the waveforms were captured in the following figures. Figure 7 shows the initial inrush current which reaches a maximum amplitude of 1.28 A. Figure 8 shows the continuous output current which has a peak-to-peak ripple of 1.2 A with a maximum of 1.28 A. Figure 9 shows a hot-plug current spike which reaches a maximum of 2.13A. The maximum rated current for the XT-E is 1.5 A, but the device is capable of handling pulse currents up to 3 A.

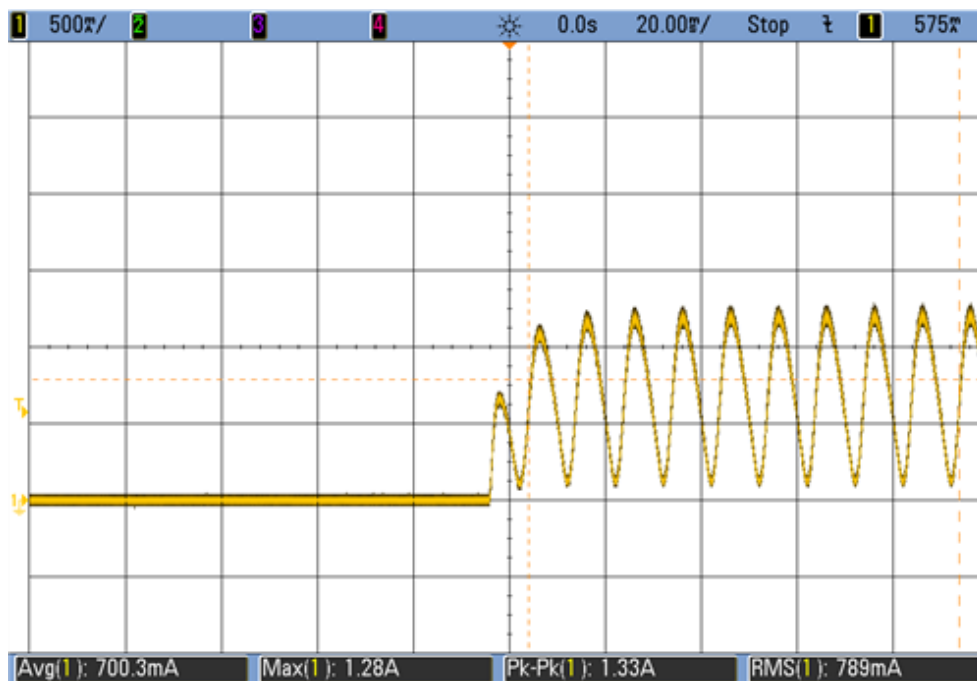


Figure 7: Initial turn-on (inrush) current

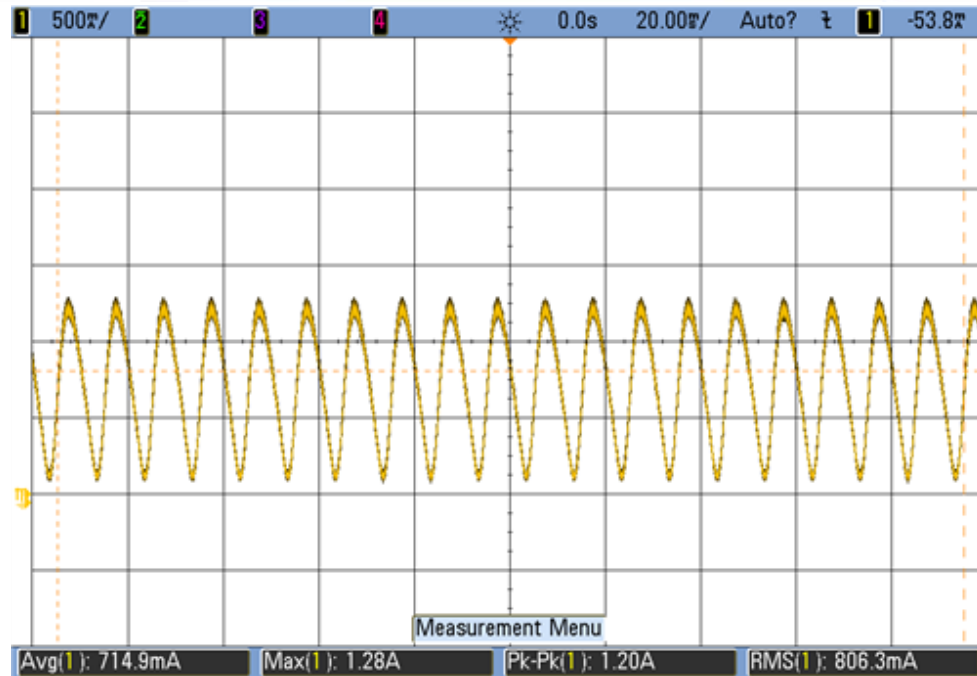


Figure 8: Ripple Current



Figure 9: Hot Plug Current

Vf/Current Balance

Luminaires utilizing multiple emitters are often configured using parallel strings which are then driven by a single constant-current source. One drawback to this approach is that careful attention must be paid to minimize the difference in forward voltage between the individual strings; otherwise, the currents will not balance evenly. The LEDs in this luminaire are configured in series, therefore current balancing is not a concern.

Driver / String	Current (mA)	Vf	Total LED Wattage
1	806	11.9	9.6

Table 10: LED Load Current, Forward Voltage, and Power