

ABSTRACT

LED lifetime has become a crucial aspect in the development of modern lighting technology. Although LED technology offers high efficiency, its lifetime is significantly influenced by the stability of the driver that regulates it. A primary challenge is the conducted emission generated by the Switched Mode Power Supply (SMPS) in LED drivers. These emissions not only cause electromagnetic interference (EMI) that can disrupt other devices but also create electrical and thermal stress that can accelerate degradation and shorten LED lifetime. This study focuses on implementing the spread spectrum technique to mitigate conducted emission in SMPS-based LED drivers. The main objective is to analyze the influence of spread spectrum techniques on LED operational parameters related to lifetime projection. The approach involves switching frequency modulation using Ramp and Sinus waveforms to spread harmonic energy and suppress EMI peaks. Evaluation is conducted by comparing three system configurations: baseline (without modulation), Ramp modulation, and Sinus modulation. Parameters analyzed include ambient temperature, lumen intensity, current, and voltage to understand how spread spectrum techniques affect critical factors that determine operational stability and LED lifetime projection.

Keywords: LED, Conducted Emission, EMI, Spread Spectrum, SMPS