A Single-Switch AC–DC LED Driver Based on a Boost-Flyback PFC Converter with Lossless Snubber

Introduction:
With the advances in light-emitting-diode (LED) technology, LEDs have drawn much interest in a wide range of lighting applications. Compared to conventional lighting devices such as fluorescent lamps, LEDs have many advantages: lower power consumption, longer lifetimes (typically 80,000 h), higher optical efficiency, higher contrast ratios and superior environmental safety.

Therefore, many studies of LED drivers (to replace conventional fluorescent lamp systems) have been produced. To operate LEDs, ac–dc or dc–dc converters are used in LED drivers to satisfy the demand for high efficiency, low cost, and low size. Especially, for an ac input voltage, the active power factor correction (PFC) circuit must produce little harmonic pollution and a high power factor.

Existing system:
The fly back LED driver was proposed to reduce switching losses and recycle the leakage inductor energy. Another fly back LED driver, which has low voltage stress and low output current ripple because of its interleaved structure, was proposed.

However, this driver has several drawbacks such as requiring many components, a large size, and complex control.
Neither of these LED drivers is suitable for tightly regulated output voltage because of the absence of a buffer capacitor. Most single-stage converters do not have a buffer capacitor.

Two-stage-type LED drivers are suitable for tightly controlled output voltages because they utilize a dc-bus capacitor, which reduces the difference between the input power and the output power. However, these LED drivers have two switches and two control circuits in each stage; therefore, they are usually.

**Drawbacks:**

- Large size,
- Have a large components,
- Are more expensive,
- And are less energy efficient

**Proposed system:**

A single-stage ac–dc LED driver based on a boost-flyback PFC converter with a lossless snubber is proposed. Because the proposed LED driver is based on the boost-flyback structure, it achieves a high power factor based on the boost PFC, which is operated in the discontinuous-conduction mode (DCM).
Additionally, the proposed LED driver provides electrical isolation due to the dc–dc flyback module. And, because the lossless snubber circuit is used, the leakage inductor energy is recycled into the dc–dc flyback circuit and the peak voltage spike in the main switch is clamped to a low voltage. Moreover, the dc-bus capacitor is divided into two capacitors, i.e., the snubber capacitor and another dc-bus capacitor.

**Advantages:**
- Energy conversion efficiency is improved.
- Voltage of dc-bus capacitor is also reduced.
- Can provide a high power factor
- Achieve a high power conversion efficiency

**Applications:**
- Used in Lossless snubber applications,
- Power factor correction (PFC) Applications.
Block diagram:

- AC source
- Boost PFC circuit
- Flyback converter
- LED driver

- 12VDC
  - Gate driver circuit

- 5VDC
  - Buffer circuit
  - Microcontroller circuit