

A Low Cost, Single Stage, Dimmable Electronic Ballast for Compact Fluorescent Lamps (CFL)

There is a global trend to eliminate incandescent bulbs in favor of CFLs due to their higher lamp efficiency and longer lamp lifetime. The electronic ballast used in CFLs is required to perform functions such as proper lamp ignition, lamp current stabilization and additionally support compatibility with standard dimmers.

Today's consumer electronic ballasts have poor power factors, resulting in a net efficiency that is significantly less than the rated efficiency of the lamp. For example, a CFL with a rated power of 13W and a power factor of 0.5 actually consumes 26VA from the grid. This well documented power factor problem will cause significant problems for power utilities if not corrected as CFLs become more widely used.

The typical consumer CFL today is generally not compatible with standard triac dimmers used all over the world to dim conventional incandescent bulbs. Dimming today's CFLs typically leads to dramatically shortened life-spans for the CFL, and also further degrades the power factor of the bulb.

There is clear need in the lighting industry for an electronic ballast and controller design that allows consumer grade CFLs to meet the simultaneous requirements of low cost, high efficiency, high power factor and compatibility with standard dimmers.

Description

Researchers at Queen's University have solved these issues by combining both the power factor correction stage and the resonant inverter into one stage using a single-switch power inverter and dimmer controller technology.

This new ballast and controller offers:

- High efficiency operation over all operating conditions
- High power factor over all operating conditions
- Compatibility with standard dimmers, including robustness during brown-out and power toggling conditions
- A simple, compact, low component count, low cost architecture

Potential Areas of Application

- Household/Commercial lighting fixtures

Main Advantages

- Nearly ideal power factor throughout the dimming range using the standard incandescent lamp dimmer;
- Significantly lower cost due to the use of a single switch topology and the elimination of a transformer; simple MOSFET driver design;
- Smoothly dims the CFL without any observed lamp flickering and glow mode operation;
- Maintains the dimmed light output at the same power level when the AC main power is off and on;

Figure 1a shows the experimental waveform of the line current obtained from [a standard consumer 26W CFL](#) with a [poor power factor of 0.52](#).

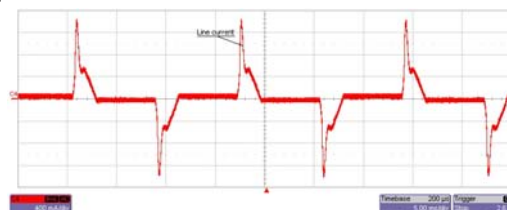


Figure 1a: Line current from a commercial 26W CFL

Figure 2a shows the line current with a power factor of 0.975 obtained from the proposed ballast on a 4-pin 26W CFL using full power. Figure 2b shows the line current with a power factor of 0.841 obtained from the proposed ballast on a 4-pin 26W CFL that is dimmed.

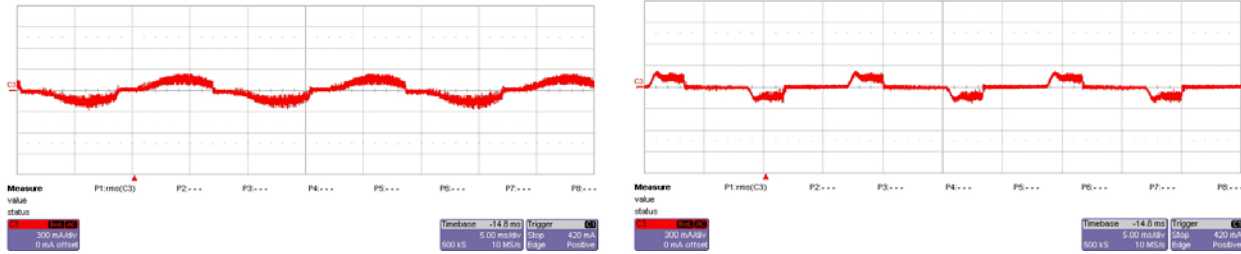


Figure 2a: Line current from proposed prototype on full power Figure 2b: Line current from proposed prototype on dimmed

Figure 3a shows the efficiency performance for the proposed prototype and a comparable consumer dimmable CFL. Figure 3b shows the power factor performance for the proposed prototype and a comparable consumer dimmable CFL.

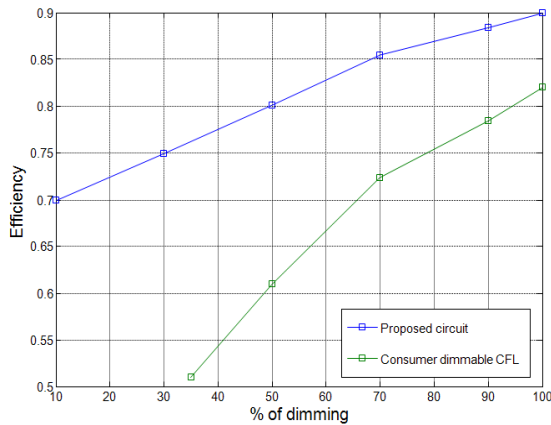


Figure 3a: Efficiency vs. % of Dimming

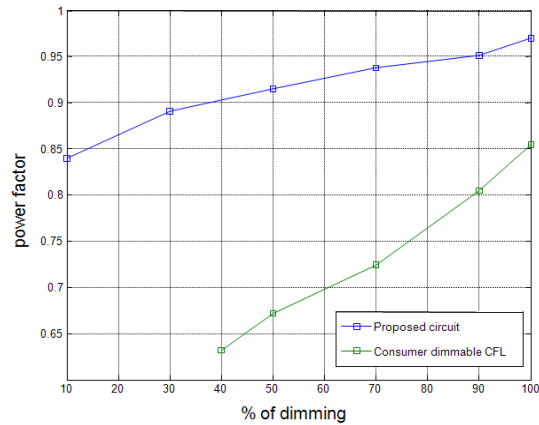


Figure 3b: Power Factor vs. % of Dimming

Stage of Development

A prototype of the proposed electronic ballast has been developed and tested. The proposed circuit is simple and features high power factor/dimming performance with the electronic ballast power and control circuit designed in a compact size.

Status of Commercialization

PARTEQ Innovations is a non-profit organization that commercializes Queen's University research. We have an exclusive, worldwide, royalty-bearing license to make, use and sell intellectual property owned by Queen's University. We are interested in commercializing this technology with an established company in the CFL industry.

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