Full Function Linear LED Driver IC for Automotive Interior Lighting

Simple Yet Elegant LED Lighting Solution

The IS32LT3175 is a feature-rich AEC-Q100 (Automotive Electronics Council) certified linear LED driver enabling reduced BOM count for low-cost and compact designs. The IS32LT3175 integrates a single channel LED driver with a programmable 150mA current source, push-button control, courtesy signal input and integrated programmable fade-in/fade-out lighting control, Fig1A. The device is designed for use in LED-based map lights, dome lights, door lights and other automotive lighting applications, Fig1B.

The IS32LT3175 integrates functions which normally require a microcontroller and several discrete components. Individual resistors are all that is required to adjust the LED current from 10 to 150mA as well as the fade up/down ramp speed; there is no software programming required. The LED driver can be controlled by either a momentary contact switch or a courtesy signal input. An integrated debounce and latch circuit conditions the switch input so a single press of the mechanical switch does not appear like multiple presses, Fig3.

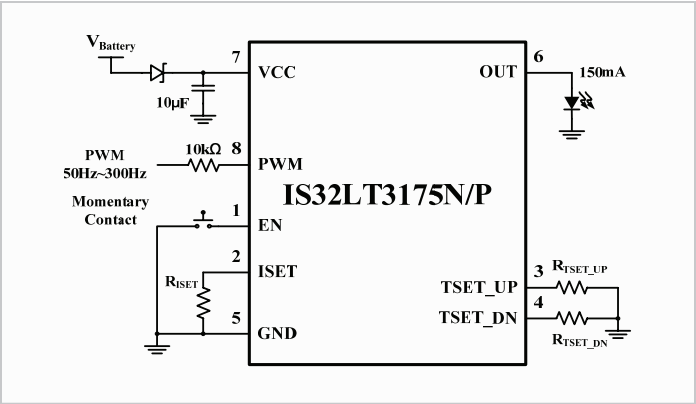


Fig1A. IS32LT3175 Circuit

Fig1B. Typical Application

IS32LT3175 Features

A major function of the IS32LT3175 is to perform LED light dimming in a way optimized for the human eye. The graph below (Fig 2) is an over simplification to illustrate that the human eye perceives brightness changes in a non-linear fashion, ie the eye has better sensitivity at low luminance than at high luminance.

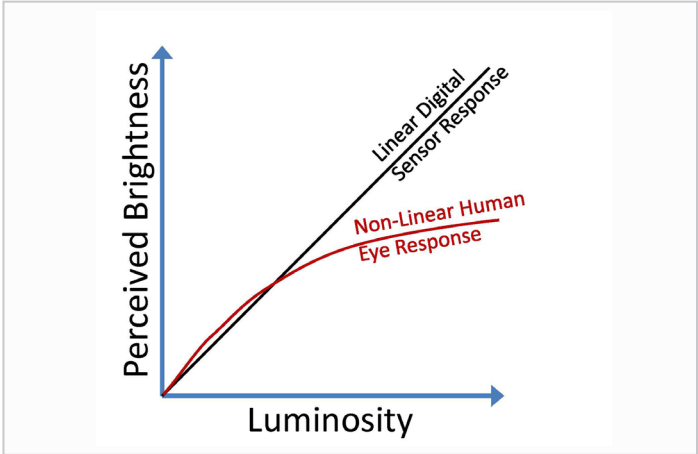


Fig2. Brightness Response Curves

Typically when dimming UP or DOWN, an LED driver would tend to follow the linear curve shown in Fig2 resulting in noticeable dimming performance at the low brightness but a minimal response at the high brightness levels. This results in perceived jumps in brightness levels for what should be a smooth PWM dimming. The IS32LT3175 compensates for this by integrating a PWM dimming correction in the form of a lookup table that compensates or corrects the PWM value to fit the human eye response curve. The end result is a smooth and appealing dimming transition.

A single resistor RTEST_UP sets the ON dimming transition speed from instant to 1 second when the switch is pressed, while RTEST_DN sets the OFF dimming transition speed.

The target application for the IS32LT3175 is pushbutton activated map or dome reading lights found in automotive, airplane, train and commuter bus interior cabins. These applications typically implement a momentary contact button to turn ON and OFF the light source. Two problems arise from this use; one pressing the momentary button results in many signal transitions which need to be filtered

out and two, the state of the ON/OFF needs to be remembered. The IS32LT3175 resolves both of these issues by integrating a de-bounce circuit and a memory latch to keep track of the button operation status, see Fig 3. In addition the IS32LT3175 can maintain the memory latch state even during automotive start/stop conditions where the battery voltage dips below 6V for a few milliseconds.

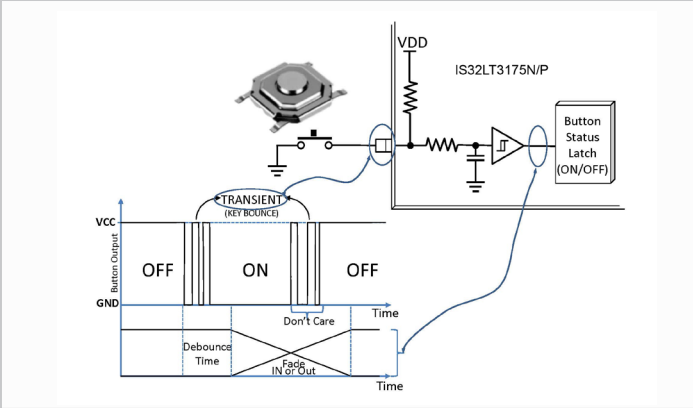


Fig3. Button de-Bounce and Status Latch

Key Features and Benefits of the IS32LT3175:

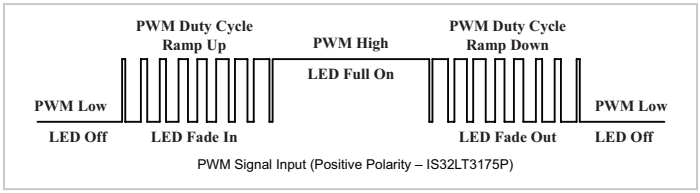
- **Reduced BOM:** LED driver with theatrical dimming in one small 8 pin SOP package resulting in 65% less components requiring less printed circuit board area.
- **Linear LED Driver:** Low-noise, low-EMI, linear current source adjustable from 10~150 mA into one or more LEDs.
- **Switch Input:** Integrates switch debounce and latching logic to enable use of low cost momentary contact switch. The switch On/Off state is held during start-stop operation when voltage drops below 6V for a short period of time.
- **Local or Remote:** Can be controlled remotely by the automobile's Body Control Module (BCM) or locally with a momentary contact switch. The local switch has priority over the remote BCM providing the user with direct control of the LED lamp.
- **No Microcontroller:** Advanced LED performance can be adjusted with simple resistors, eliminating the need for a microcontroller.
- **AEC-Q100:** Meets stress testing specifications making it suitable for use in the harsh automotive environment with guaranteed operation from –40°C to +125°C.

The device also integrates protection features, such as open and short LED fault detection, thermal rollback and thermal shut down to increase system longevity and reliability. The LED current remains at the configured level as long as the junction die temperature of the IC remains below 145°C (typical). If the die temperature exceeds this threshold, the output current of the device will begin to reduce at a rate of 3%/°C. The device will enter thermal shutdown if the die temperature exceeds 175°C.

The IS32LT3175 is available in either of two options depending on the polarity of the incoming courtesy signal, Fig4. The IS32LT3175P is for applications requiring a "positive going" courtesy signal while the IS32LT3175N is meant for interfacing with "negative going" courtesy signals. Both versions are offered in a RoHS-compliant thermally enhanced SOP-8EP package.

The device datasheet and evaluation board documentation are available for download from our website.

www.issi.com



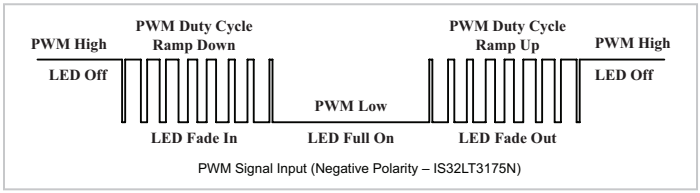


Fig4. Positive or Negative Polarity Courtesy Signal Input