Conserve Power With Simple LED Flasher

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Technology Edge

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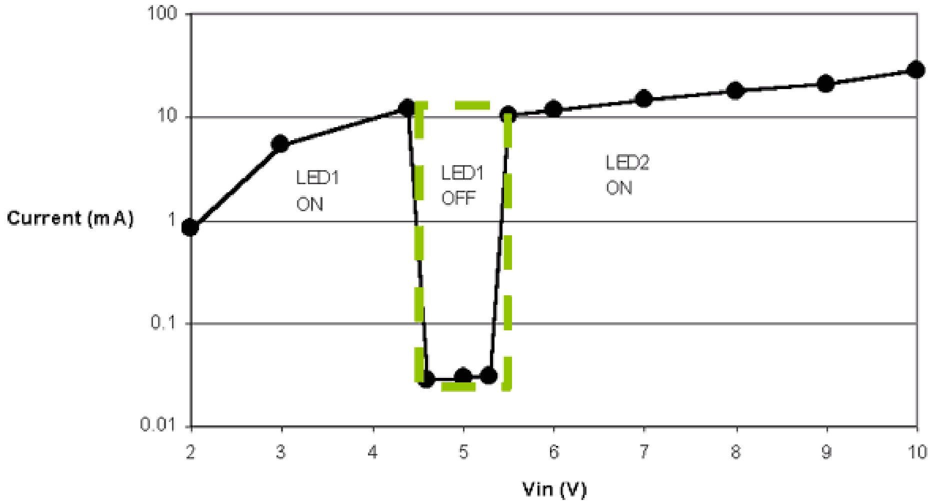
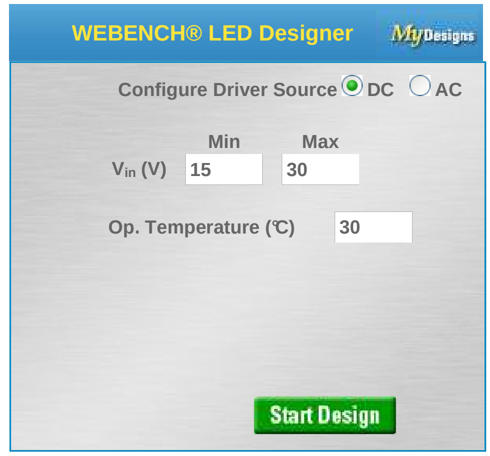


Figure 1. *This 'power good' controller blinks the green LED1 ON, which results in less than 0.2 mA average current drain*



The LED is a commonly used device that indicates when power is ON for most electronic devices. For the LED to produce discernible visible light in daylight the forward bias current needs to be in the moderate range (10mA-20mA). This amount of current may be too large in many low power designs. And, it results in wasted power when all that is needed in most cases is a once-in-a-while or on-demand indication that there is power to an electronic device. In figure 1, the supervisory circuit, LM3710, is configured to reduce the power consumption of a traditional LED indicator by 99%.

With Vin above 4.4V, the green LED1 blinks ON for 200ms and OFF for 25.6s, repetitively. IC1's reset timeout pulses the LED1 ON for 200ms. This 200ms ON period is customizable from 1.4ms to 1600ms from the factory. The LED1 OFF period is controlled by IC1's watchdog timeout period, which is also customizable from 6.2ms to 25.6s. The watchdog input monitors transitions at WDI; if there are no changes at WDI, then reset engages. The WDI in figure 1 is grounded to prevent a change. Thus the reset timeout and watchdog timeout form two one-shots that produce a repetitive pulse train. The 25.6s pause between the LED1 flashes can be short cycled by pressing the momentary switch, SW1. The average current in LED1 is reduced by the ratio of these two time periods, thereby providing immediate feedback of good power. A 13mA continuous bias current would be reduced to 0.1mA in average LED1 current. This is a power savings of 130X.

LED1's current is limited by IC1's RESET pin, which is approximately 13mA. The 28uA quiescent current of IC1 can be ignored. The approximate Vin set-point equation to initiate blinking is:

$$Vin(blink) = 3.08V + R1 * I_{RESET}. \quad (I_{RESET}=13mA \text{ for } R1 < 200 \text{ ohm})$$

If Vin goes above 5.5V, the red LED2 illuminates as an over voltage indicator. The resistor divider of R2 and R3 and the PFI input of IC1 set this power fault level. IC1's PFI threshold voltage is 1.225V. This over-voltage condition causes PFO to drive LED2 continuously. The Vin set-point equation to initiate over-voltage is:

$$Vin(over\text{-}voltage) = 1.225V * (R2 + R3)/R3.$$

Any brief time before Vin reaches 4.4V, the LED1 is on continuously. Figure 2 shows the current-voltage waveform of the circuit.

Here are a couple of other examples. For a 5V±5% monitor set R1=121 ohm and R3=301 Kohm. For a 3.3V±10% monitor set R1=0 ohm and R3=511 Kohm. Remember the absolute maximum ratings of IC1 in your design.

You can add an optional capacitor, C1, to provide an energy reservoir that will increase the brightness of LED1's flash and its average current. You should select values in the microfarad range for a noticeable change.

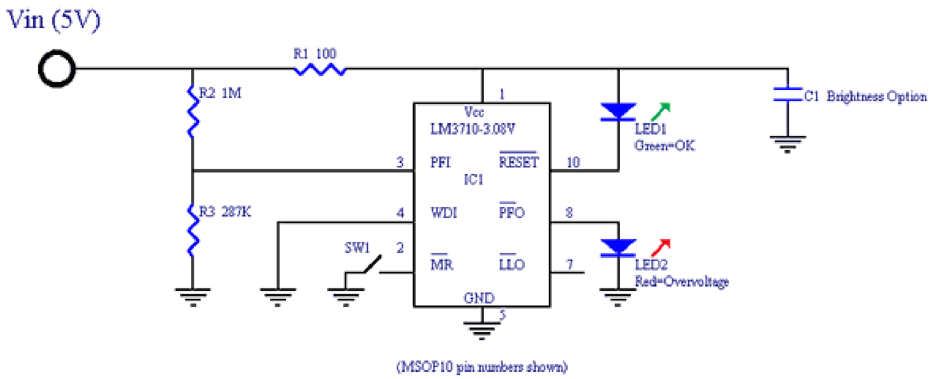


Figure 2. *The average input current becomes very low for an input voltage from 4.5V to 5.5V*