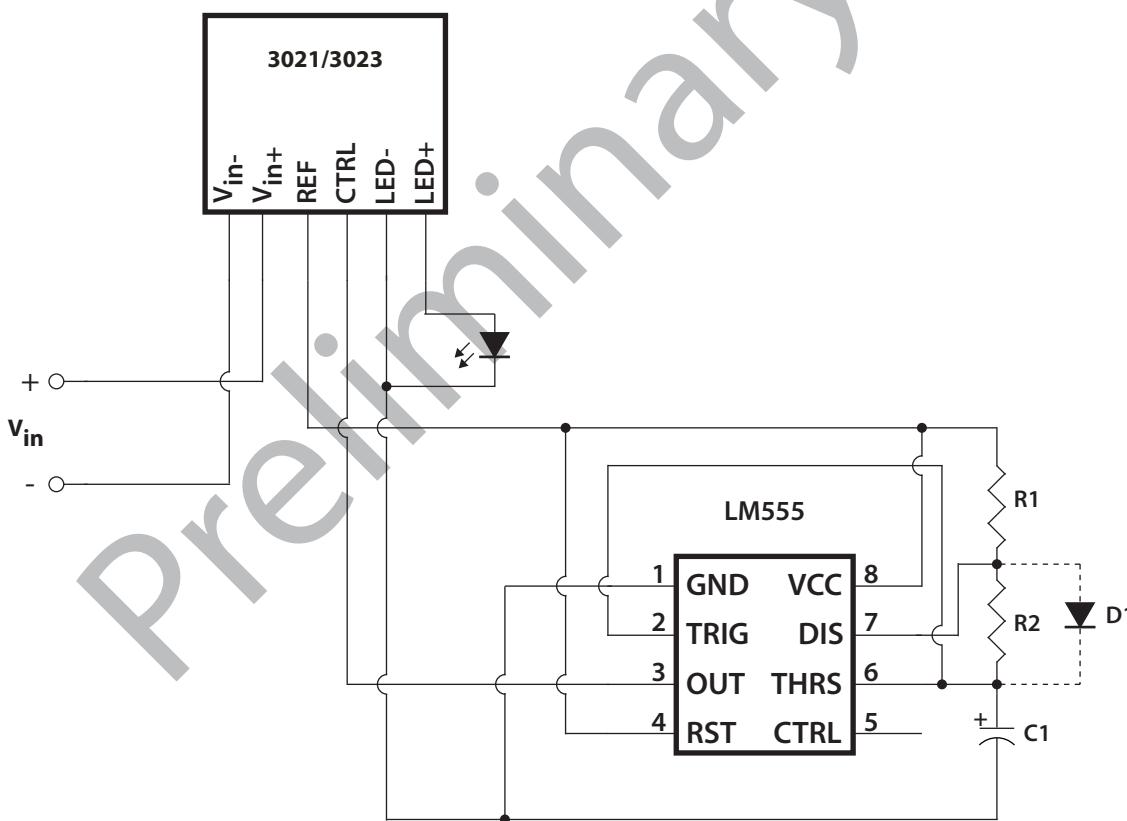


## Overview

There are many LED applications where a flashing light is desired. This application note covers the use of an LM555 timer IC with an LED driver to make a high-power LED flash at a given rate.

## Circuit

The circuit shown in Figure 1 is just a slight modification of the Astable Operation schematic given in National Semiconductor's datasheet for the LM555 timer [2]. For a power supply for the LM555, we will use the REF pin of the LED driver, which provides up to 20mA of regulated +5V for us to use with circuits such as this [1]. The output of the LM555 will be connected to the CTRL pin of the driver, which will allow the 555 to turn the LED on and off.



**Figure 1.**  
**A flashing circuit for high-power LEDs**

The only major change is the addition of diode D1, which allows us to control the on and off times separately. In this circuit, the LED off time will be controlled by the values used for R1 and C1, while the LED on time will be controlled by R2 and C1.

The LED off time (in seconds) will be approximately  $(0.7 \times R1 \times C)$ .

The LED on time (in seconds) will be approximately  $(0.7 \times R2 \times C)$ .

While an LEDdynamics 3021 (Buckpuck) driver is shown in the schematic, this circuit also works with all 3023, 4015, 7021, and 7023 drivers.

## Circuit Notes

Because resistors come in many more common values than capacitors, it is generally best to select a capacitor first, and then calculate the two resistors needed. While C1 is shown in the schematic as a polarized capacitor (such as an aluminum electrolytic capacitor, common for values over 1uF), a non-polarized capacitor can also be used. If a polarized capacitor is used, take care during circuit construction, as an overvoltaged or improperly installed (backwards) electrolytic capacitor can explode. The voltage and polarity of one of the leads should be clearly marked on the capacitor.

Capacitors are often rated with +/- 20% tolerances, allowing their actual value to be off by 20% of what they say they are. In the case of electrolytics, they may be rated as wide as -20 to +100%. This value can also change with the age of the part, the temperature, the voltages used, etc., so the actual timing of this circuit will vary somewhat under different conditions.

An adjustable delay circuit can be constructed by replacing either resistor with a potentiometer.

The ground for the LM555 is obtained from the LED- pin of the LED driver. This allows use with the AC input versions of some of the drivers. The LM555 is run off the REF pin of the driver to ensure it's output, which is fed back into the CTRL pin, only swings between 0 and 5V.

## Example Application

As an example, we will make a flashing light that repeatedly flashes on for 1 second, off for 3 seconds.

To get started, a 10uF cap is selected for C1. This is a good place to start for delays around 1 second.

Solving the off time equation for R1 gives:

$R1 = 3\text{sec} / (0.7 \times 0.000010) = 430\text{K Ohms}$ . The next closest standard value is 470K Ohms.

Solving the on time equation for R2 gives:

$R2 = 1\text{sec} / (0.7 \times 0.000010) = 140\text{K Ohms}$ . The next closest standard value is 150K Ohms.

Please note that, in the equations, the capacitor units need to be given in Farads. 1 uF (micro-Farad) is 0.000001 Farads.

The actual values for our circuit will be  $C1 = 10\mu\text{F}$ ,  $R1 = 470\text{K}$  and  $R2 = 150\text{K}$ . After building this circuit, the actual measured on and off times are measured at approximately 1.1 seconds on and 3.5 seconds off. Because the next higher standard resistor size was used in each case, the actual delays are slightly longer.

## References

- [1] LEDdynamics, "3021/3023 Buckpuck," Buckpuck Datasheet, July 2005
- [2] National Semiconductor, "LM555," LM555 Datasheet, July 2006

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