Extracted from:

Essential 555 IC

Design, Configure, and Create Clever Circuits

The Pragmatic Bookshelf

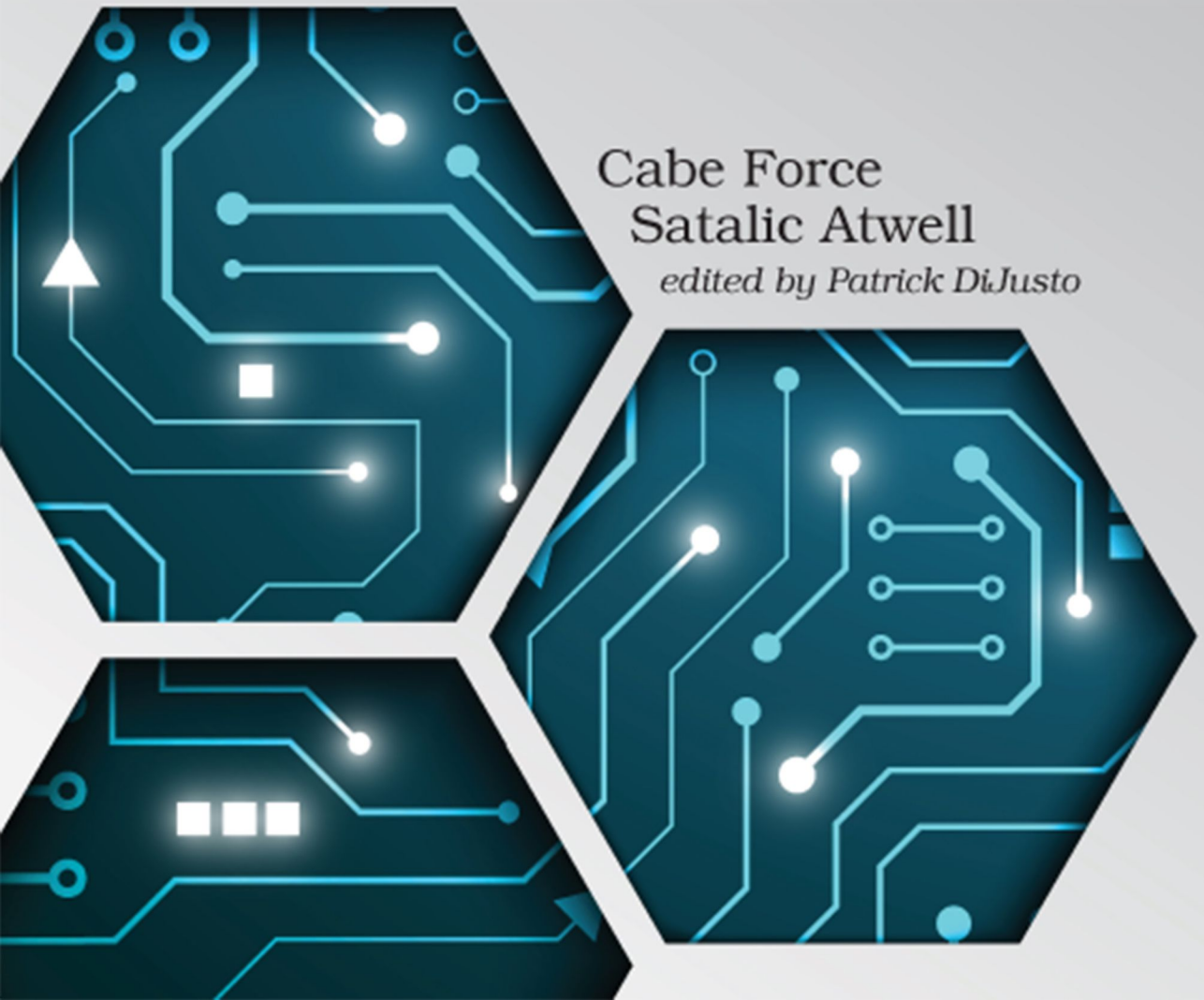
Raleigh, North Carolina

The Pragmatic Programmers

Pragmatic exPress

Essential 555 IC

Design, Configure, and Create Clever Circuits



Cabe Force
Satalic Atwell
edited by Patrick DiJusto

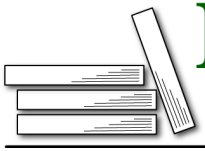
Essential 555 IC

Design, Configure, and Create Clever Circuits

Cabe Force Satalic Atwell

The Pragmatic Bookshelf

Raleigh, North Carolina



For our complete catalog of hands-on, practical, and Pragmatic content for software developers, please visit *https://pragprog.com*.

The team that produced this book includes:

CEO: Dave Rankin
COO: Janet Furlow
Managing Editor: Tammy Coron
Development Editor: Patrick Di Justo
Copy Editor: L. Sakhi MacMillan
Layout: Gilson Graphics
Founders: Andy Hunt and Dave Thomas

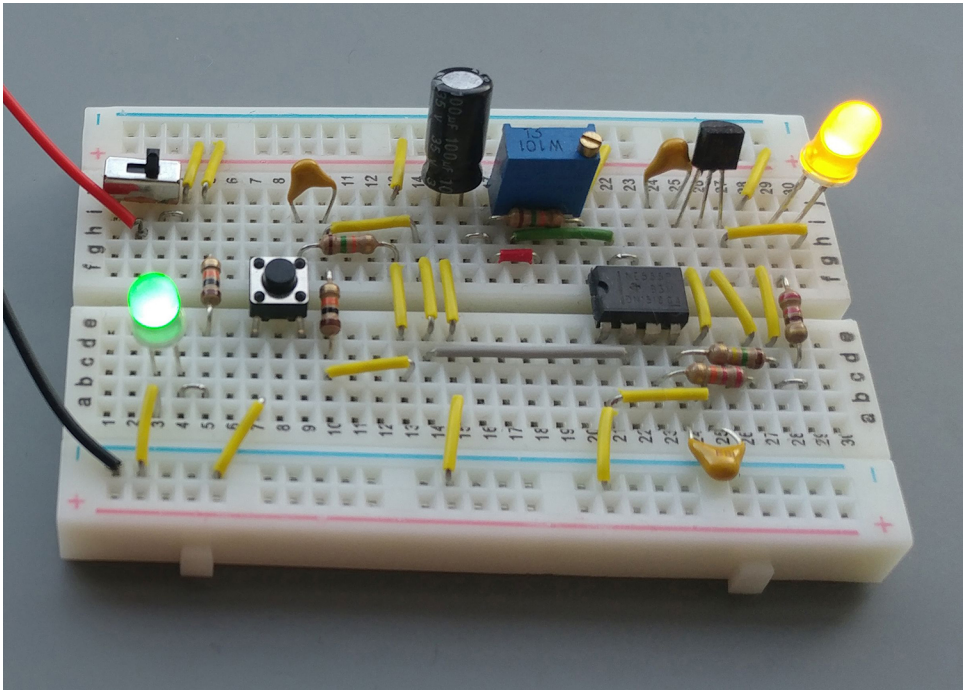
For sales, volume licensing, and support, please contact *support@pragprog.com*.

For international rights, please contact *rights@pragprog.com*.

ISBN-13: 978-1-68050-783-6
Encoded using the finest acid-free high-entropy binary digits.
Book version: P1.0—April 2021

CHAPTER 2

One-Shot



Pressing a button to turn on a light—does it have to be this complex?

One-Shot. One time and done. The name says it all.

In this project, you'll press a button and the circuit will trigger once. Exactly once. You can press the button as many times as you want after that, and it won't make a difference. The circuit stays triggered. This circuit could be used to trigger any sort of action: a siren, beeper, or noise circuit. For this particular project, you'll start with just a single LED.

Parts

555 Timer IC	Newark part number 58K8943	Jameco part number 27423
An LED, any color. I used yellow and green.	Newark part number 97K4048 and 97K4041	Jameco part number 334108 and 693901
NPN Transistor, 2N3904	Newark part number 83C3116	Jameco part number 178597
220 Ω Resistor	Newark part number 38K0351	Jameco part number 690700
4.7 kΩ Resistor	Newark part number 38K0304	Jameco part number 691024
10 kΩ Resistor	Newark part number 38K0328	Jameco part number 691104
2x 15 kΩ Resistor	Newark part number 58K5016	Jameco part number 691147
150 kΩ Resistor	Newark part number 58K5017	Jameco part number 691382
100 kΩ Potentiometer	Digikey part number CF14JT100KCT-ND	Jameco part number 853599
2x 0.01 μF 10 nF Ceramic Capacitor	Newark part number 46P6665	Jameco part number 15229
22 μF Electrolytic Capacitor	Newark part number 69K7919	Jameco part number 1946295
9 V Battery Holder/Strap	Newark part number 31C0662 or 59K0356	Jameco part number 101470
9 V Battery	Newark part number 81F157	Jameco part number 27423
Momentary Contact Tactile Switch	Newark part number 60M5365	Jameco part number 153252
Slider Switch SPDT	Newark part number 10X9279	Jameco part number 2192384
Half-size Breadboard	Newark part number 99W1759	Jameco part number 2157693

A side note about alternative parts and the bill of materials, the BOM:

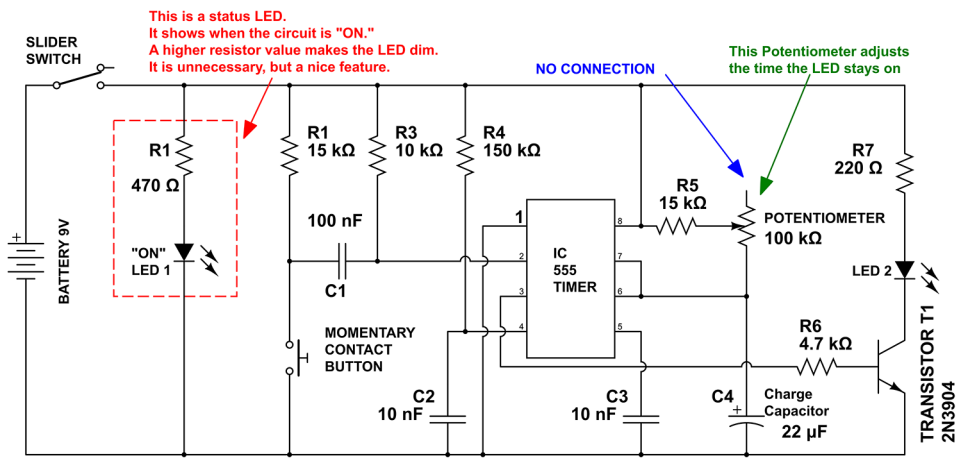
Although I do provide a list of parts and part numbers, there's a chance the supplier is sold out or you don't want to buy just one 1 kOhm resistor for the project at hand. It's OK, to a limit. Be forewarned, you can sway on the values by a handful of percent, and the project may work. Jaunt too far in the value fields, and the project will stop working properly or at all in some cases.

Adding a big resistor, for example, is like pulling a wire out. Air has a resistance, a super-high resistance, like that one you want to add. Adding a bigger capacitor is like adding a super-large gas tank to your car, in some cases. You'll drive forever, just like the LED pulling power from that big capacitor you want to add.

Although not that common, some breadboards will differ from the ones I suggest. So connections will not be accurate. Different slider switches might operate differently than my suggestions. Be aware.

If, for some reason, you select different LEDs than in my list, make sure they have the same forward voltage and current draw.

The Official Schematic



This schematic adds an optional LED that shows when the circuit is on. It is shown within the red square. It's completely optional.

You're setting the 555 timer IC in a state called *monostable multivibrator*, or just monostable for short. This is sometimes called a *one-shot* circuit.

How this works in brief: When the battery is connected to this circuit, pin 2 is set high. When you press the button (which is just a momentary contact switch), pin 2 is set low and pin 3 is set high. Pin 3 turns on the transistor, and in turn the LED.

Note the potentiometer and the capacitor in the circuit. Together they determine how long the LED stays on. When the one-shot is activated, the capacitor begins charging. The resistance of the potentiometer determines how fast the capacitor fills. Once the charge in the capacitor reaches a certain voltage, pin 3 turns off.

This resistor and capacitor combination is often called an RC Circuit. The product of the value of R and the value of C is the time constant: the time that pin 3 stays energized. This is defined by an equation:

(Time = 1.1 * R * C)

The formula reads:

Time in seconds = 1.1 x Potentiometer in ohms x Charge Capacitor in Farads

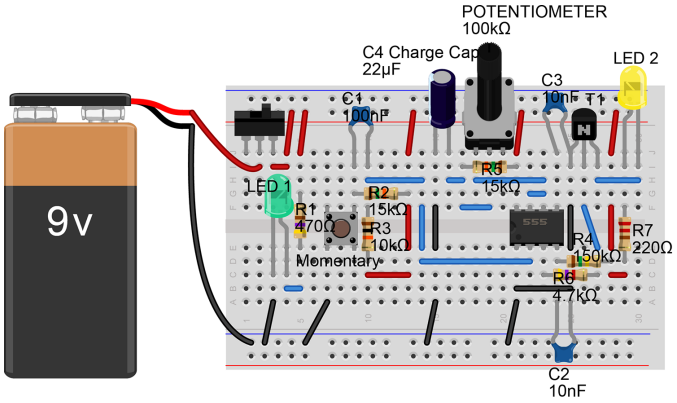
If you set the potentiometer to the maximum of 100 kOhm, the formula would work out as follows:

Time = 1.1 x 100,000 (ohms) x 0.000022 (Farads)

Time = 2.42 seconds

If you want the LED to be on longer than this circuit is designed for, all you need to do is to increase the value of the capacitor.

Breadboard View



Up close and personal with a 555 timer IC.

Make sure to place the momentary contact button somewhere on the breadboard where you can easily access it.