MONOSTABLES

A monostable circuit provides a single output pulse (one-shot) of fixed duration when a **short pulse** is applied at its trigger input.

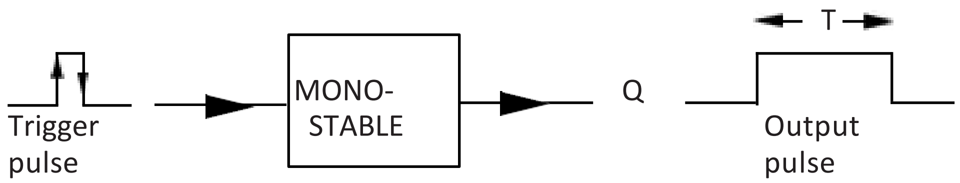

Fig. 1. Function of a monostable

Under normal conditions, the monostable will be in a **stable state** with its output Q at logic level 0. When it receives a **short trigger pulse**, it enters an **unstable state** and output Q changes to logic level 1. It remains in this state for a time (T) then changes back to its stable state. The duration of T depends upon values for resistors and capacitors in the timing circuit.

While in its unstable state, the monostable ignores any pulses applied at its input. It can only be re-triggered after it has returned to its stable state.

Some monostable circuits are triggered by the rising edge of the trigger pulse while others are triggered by the falling edge. You will come across examples of both types in your Practical Exercise.

PRACTICAL APPLICATIONS

TIMERS

Monostables are often used as timers e.g. to switch on a light for a fixed period of time after being triggered.

PULSE STRETCHERS

Logic probes are often fitted with pulse stretching circuits so that an indicator stays on for a few seconds when a very short pulse appears in a logic circuits.

THE 555 TIMER IC

The 555 IC was the first general-purpose timer (ASIC - **A**pplication **S**pecific **I**ntegrated **C**ircuit) capable of both monostable and astable operation. The device is available in an 8-pin dual in line (DIL) package with pin outs shown in fig.2.

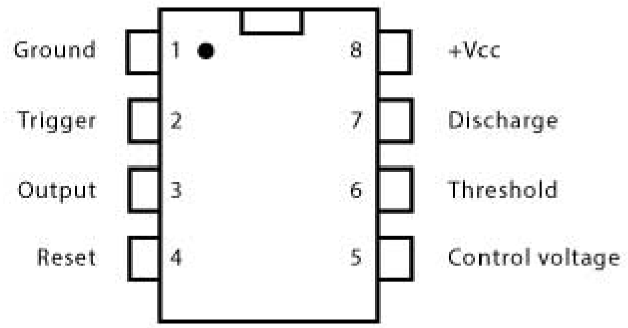

Fig. 2 The pin layout of the 555

THE 555 AS A MONOSTABLE

The 555 timer can be configured as a monostable using only 3 external components.

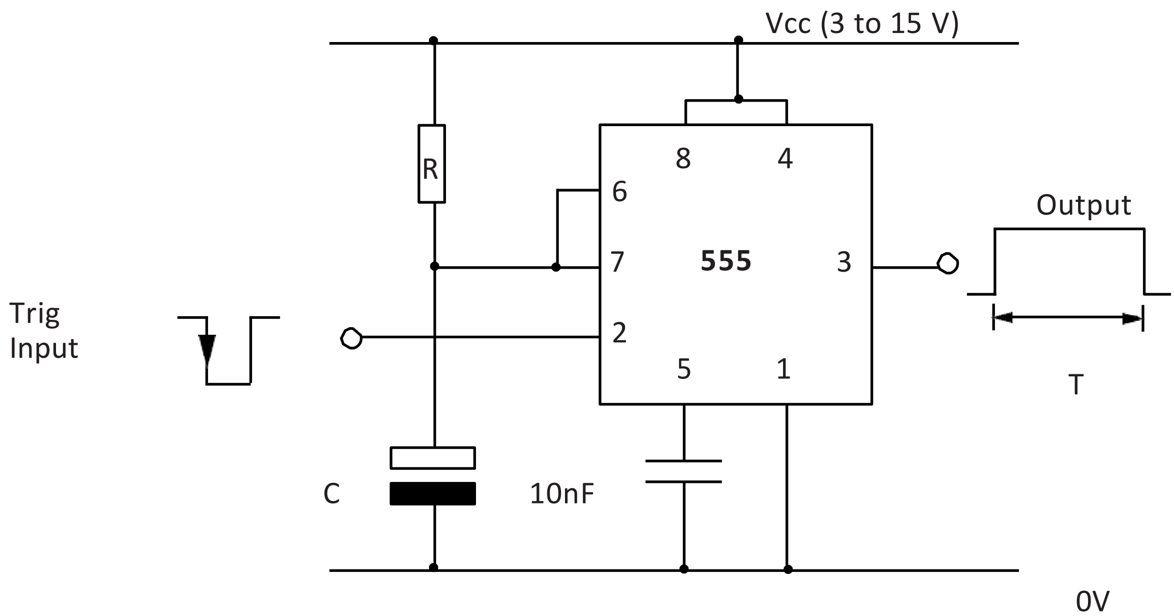

Fig.3 The 555 as a monostable

A 10nF capacitor is connected to pin number 5 to reduce noise at the input of the comparator.

The trigger is active low, producing an output pulse of duration:

$$T = 1.1\ R \times C$$

It is recommended that R is in the range of 10 kΩ to 10 MΩ and C in the range of 100pF to 1000uF for power economy and predictability.

Practical use:

To produce a delay of 5 seconds the values of R and C must be derived. The simplest method is construct the resistor from a fixed 1kΩ and a 100kΩvariable. The fixed value limits the lower resistance.

Therefore R is in the range 1 to 101 kΩ.

If we assume that R is a mid value approximately 50kΩ then we are able to find a value for C

$$T = 1.1 \times R \times C$$

$$C = T / (1.1 \times R)$$

$$C = 5 / (1.1 \times 50 \times 10^{3})$$

$$C = 9.1 \times 10^{-5}\ F = 91\mu F$$

The closest value would be a 100µF capacitor, the 100kΩvariable resistor could be adjusted to produce a 10 second delay.