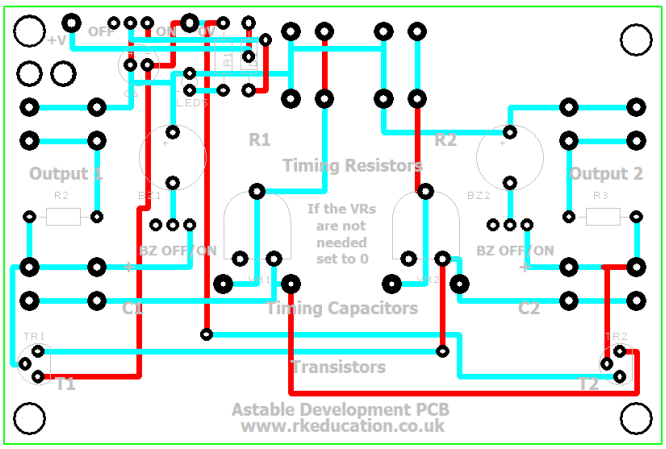
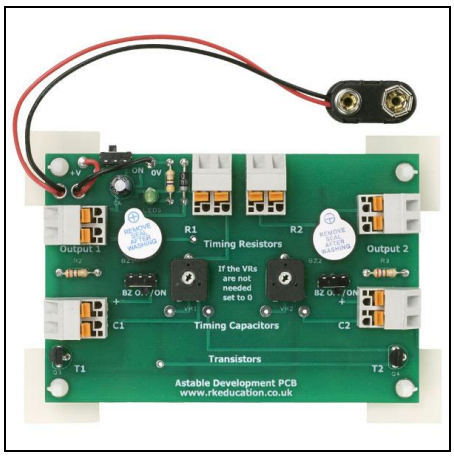
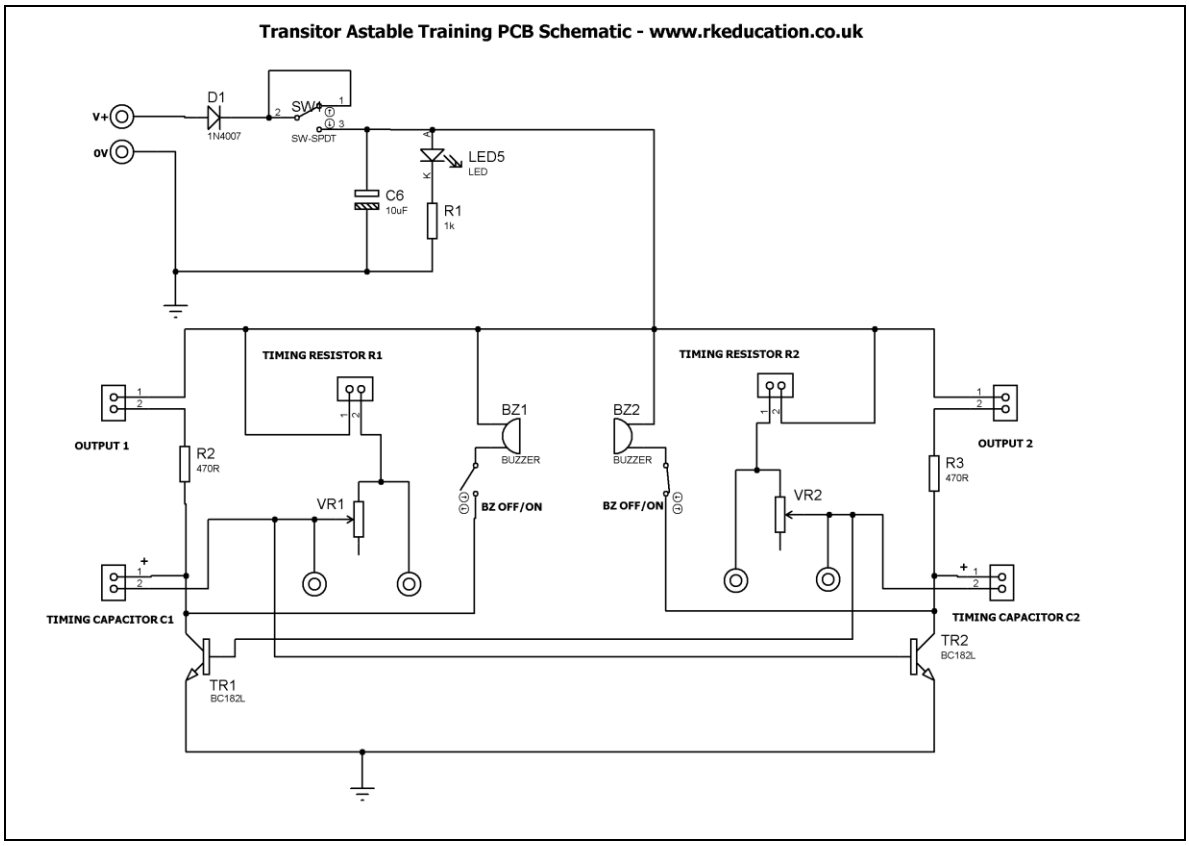
Transistor Astable Training PCB Component List and Instructions



PCB layout



Constructed PCB



Schematic Diagram

Description

This system has been specifically designed to be used alongside the **Transistor Astable Project PCB**, **70-6028**. For details of the **Transistor Astable Project** and other projects please visit our website, www.rkeducation.co.uk

Using this system students can gain an understanding of the operation and application of the transistor astable and this system also helps students make important decisions that will affect the final outcome of their project.

- Simple, low cost and portable
- Curriculum-based
- Uses a resistor, capacitor timing networks to switch on outputs
- Allows students to learn about resistors, capacitors and transistors
- Allows students to test their designs prior to final construction
- Battery powered to remove the need for power cables and access to power sockets
- Screwless terminal blocks are used to allow students to easily insert different values of resistors and capacitors for the timing circuit and outputs
- Clear silkscreen text has been used to aid learning
- Large pads have been included to allow the relevant values to be measured using a multi meter
- Professional double-sided PCB with clear white silkscreen and solder-resist
- Suitable for **Key Stages 2, 3 & 4** (ages 7 to 16)
- Powered from 1 PP3 battery
- High quality, professional double sided PCB
- Power switch and LED power indicator
- Perfect for electronic decorations and nightlights

Component List

Battery clip – PP3 with PCB leads - **SOLDER LAST!**
BZ1, BZ2 – PCB mount buzzer
C6 – Smoothing cap, 10uF electrolytic or suitable alternative
Slide Switches – Ultra miniature slide switch x3
D1 – 1N400x
R1 – 1k ~ BROWN, BLACK, RED
R2, R3– 470R ~ YELLOW, VIOLET, BROWN
LED5 – 3 or 5mm Green LED
T1, T2 – BC182L NPN transistor or equivalent
VR1, VR2 – 100k preset resistor 085 type or equivalent
2 way screwless terminal blocks x6
PCB feet x4

When constructing always start with the components that have the lowest profile and work high, for example start with the resistors and end on the electrolytic capacitor. For this kit please solder the battery clip last. The battery clip leads should be twisted and threaded thorough the 2 holes to the left of C6.

Please only attempt to construct this unit if you are confident you are able to do this, if you are not confident please purchase a constructed unit. We will not accept responsibility for damaged and faulty units due to poor soldering.

Instructions

This system has been specifically designed to be used alongside the Transistor Astable Project PCB, **70-6028**

There are 6 areas to familiarize yourself with.

1. Power
2. Pads for measuring values
3. Screwless terminal blocks
4. Timing Components
5. Transistors
6. Outputs

Connecting Power

The first step is to power the PCB, use a 9V PP3 battery attached to the battery clip. It is also possible to use other battery voltages using a suitable battery case, for example 4 x AA batteries giving a supply of 6VDC. Never use mains voltages with unit, only ever use low voltage batteries.

The system can now be turned on using the ultra-miniature slide switch at the top of the PCB, it is marked **ON** and **OFF.** The green power LED should light up, it is below the power switch. If it does not light up it may indicate faulty batteries or power supply, check them carefully or a short circuit.

Pads for measuring values

There are 4 large pads around the PCB that are used to measure the resistance of the variable resistors that are used to vary timing. The pads located either side of the variable resistors – VR1 and VR2. To measure the resistance simply put the probes from a digital multimeter, DVM, on each of the pads.

Screwless terminal blocks

This PCB has been designed around screwless terminal blocks, these allow components to be quickly and easily inserted and changed. Screwless terminal blocks are located around the PCB where the user may want to change/vary components, for example changing an output. This innovative approach allows for flexible project outcomes as the student experiment with their designs prior to manufacture in order to achieve the desired practical outcome. To insert a component simply press the levers on the terminal block and insert the leads into the holes, care should be taken to ensure a good contact.

Timing Components

This transistor astable circuit is based around 2 timing capacitors and 2 timing resistors. The transistor will turn on and off at a given frequency determined by the timing components which in turn will turn on or off an output. A way to visualise the operation of the transistor astable is to imagine a see saw, each end of the see saw represents a side of the transistor astable. The frequency of the astable is

determined by the values of the timing components. A resistor is used to control the flow of current, higher resistance = less current flowing, by increasing the timing resistor resistance the frequency will be slowed. A capacitor is used to store electrical charge, a higher value capacitor can store more current, if the timing capacitor value is decreased it can store less electrical charge so the frequency will be increased. There are 2 variable resistors on the PCB that allow timing resistors to be varied without having to physically change components, simply insert a screwdriver to adjust the resistance, the resistance can also be measured using a DMM, place the probes on the pads near the variable resistors. A good way to visualise the operation of timing capacitors and resistors is to use the analogy of a water pipe for a resistor and water bucket for the capacitor, this is something that can be quite easily set up in the classroom as a whole class activity.

Transistors

The timing circuit in this circuit is used to switch on or off the BC182L transistors, T1 and T2. The BC182L will switch on when approximately 0.7VDC is applied to the base (top leg). The 2 transistors in this circuit are used as a transistor astable which is also known as a multivibrator circuit. The collectors of the transistors are connected to the outputs.

Outputs

The collector of the transistor is connected to 2 outputs on either side of the transistor astable circuit, an LED and buzzer. These are in parallel and the LED is protected with a resistor (470R) and the buzzer does not need a resistor but it can be turned on and off with a slide switch, if the noise from the buzzer is a problem cover the buzzer to reduce the noise or remove it from the circuit.

Using the PCB

The PCB has been designed to be simple to use. In order to become familiar with the unit it is advisable to do the following.

- Turn the unit and buzzers off
- Insert 1k resistors (brown, black, red) into the terminal blocks marked **Timing Resistors**
- Insert 47uF electrolytic capacitors into the terminal blocks **Timing Capacitors** labelled **C1** and **C2**, be sure to use the correct polarity, long leg is +ve
- Insert an LED into each of the output terminal blocks, be sure to insert the longer leg above the shorter leg
- Turn on the unit, the LEDs should flash
- Adjust the terminal blocks using a terminal screwdriver, doing so should change the frequency the LEDs flash
- Turn off the unit
- Now change the 47uF caps for 100uF, note the change in frequency
- Now change the timing resistors, note the change in frequency
- Turn on the buzzers, the unit should behave like an emergency vehicle, to reduce noise cover the buzzers

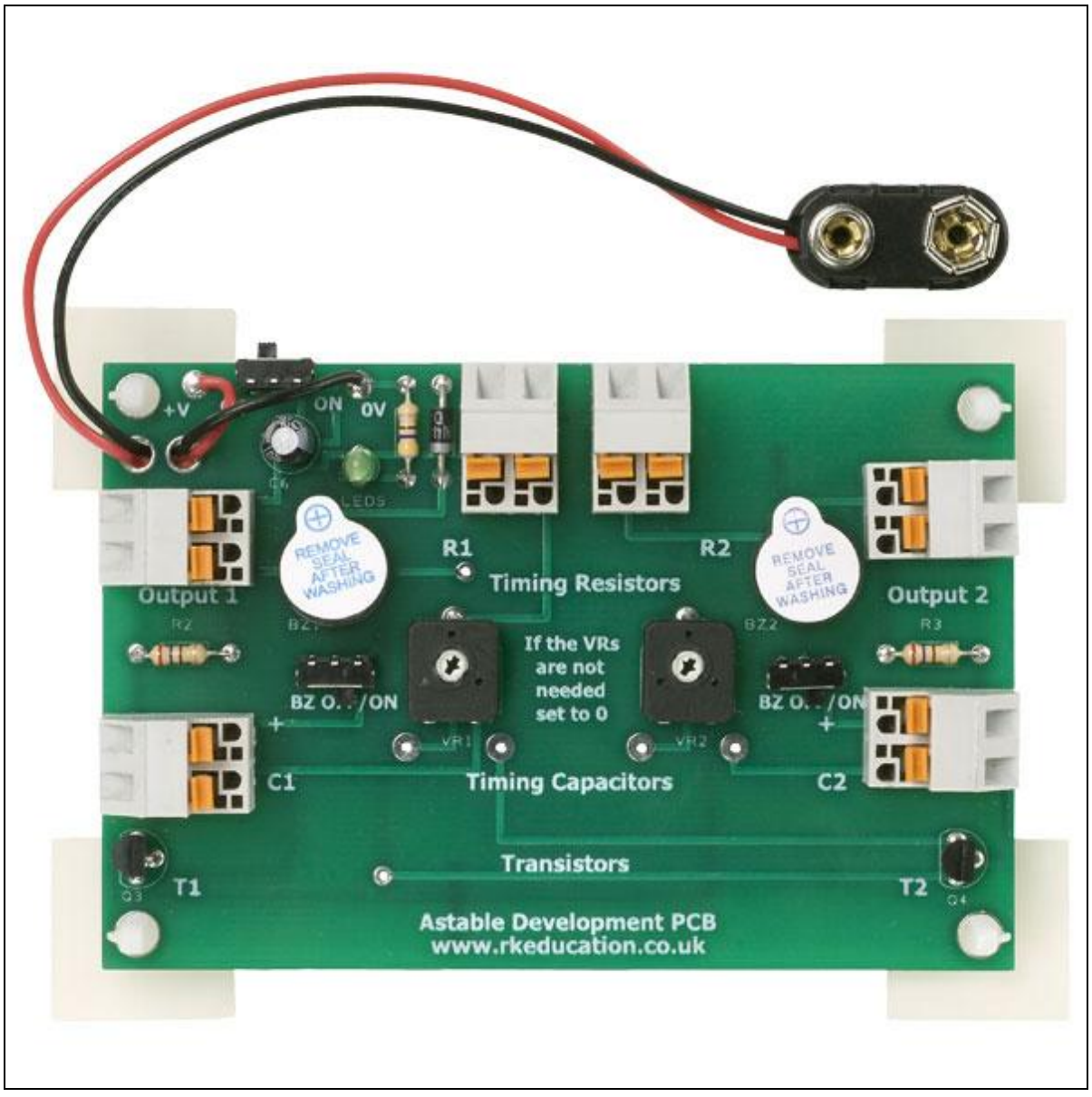
The purpose of the unit is to allow students to observe the effects of timing components on timing circuits and to allow them to select appropriate timing component values in a visual way rather than by using complicated calculations and theory. It is far better to allow students to select component values based on what they need rather than simply giving them pre-selected values, it allows for differentiated outcomes.

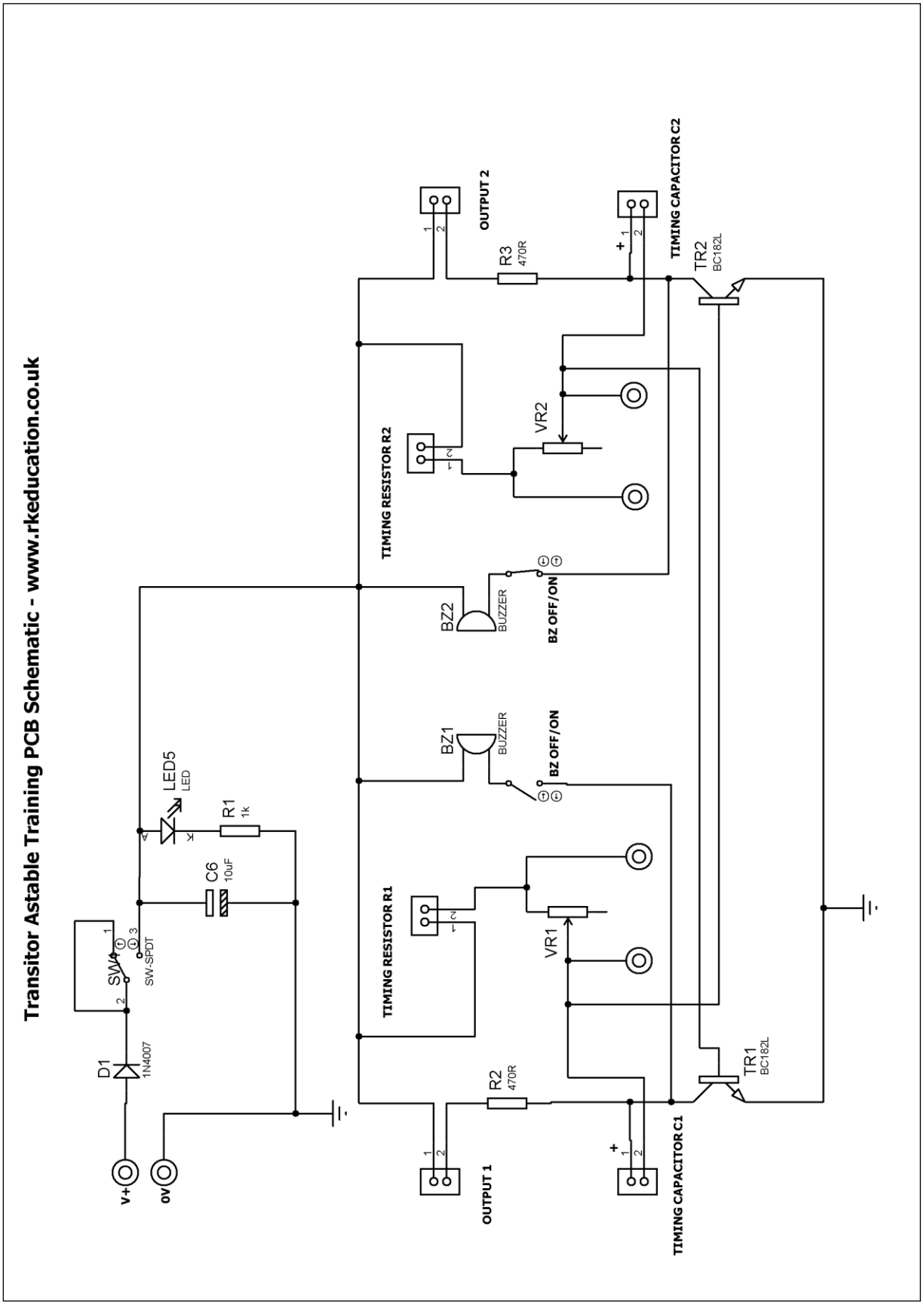
Please visit our website

www.rkeducation.co.uk

If you have any comments or queries please email us at

technical@rkeducation.co.uk




Transitor Astable Training PCB Schematic - www.rkeducation.co.uk
V+
0V
D1
1N4007
SW1
SW-SPDT
LED5
LED
R1
1k
C6
10uF
OUTPUT 1
R2
470R
TIMING RESISTOR R1
VR1
BZ1
BUZZER
BZ OFF/ON
BZ2
BUZZER
BZ OFF/ON
TIMING RESISTOR R2
VR2
OUTPUT 2
R3
470R
TIMING CAPACITOR C1
TR1
BC182L
TIMING CAPACITOR C2
TR2
BC182L