Kitronik

WHO ANSWERED FIRST? FIND OUT WITH THIS

QUIZ BUZZER KIT
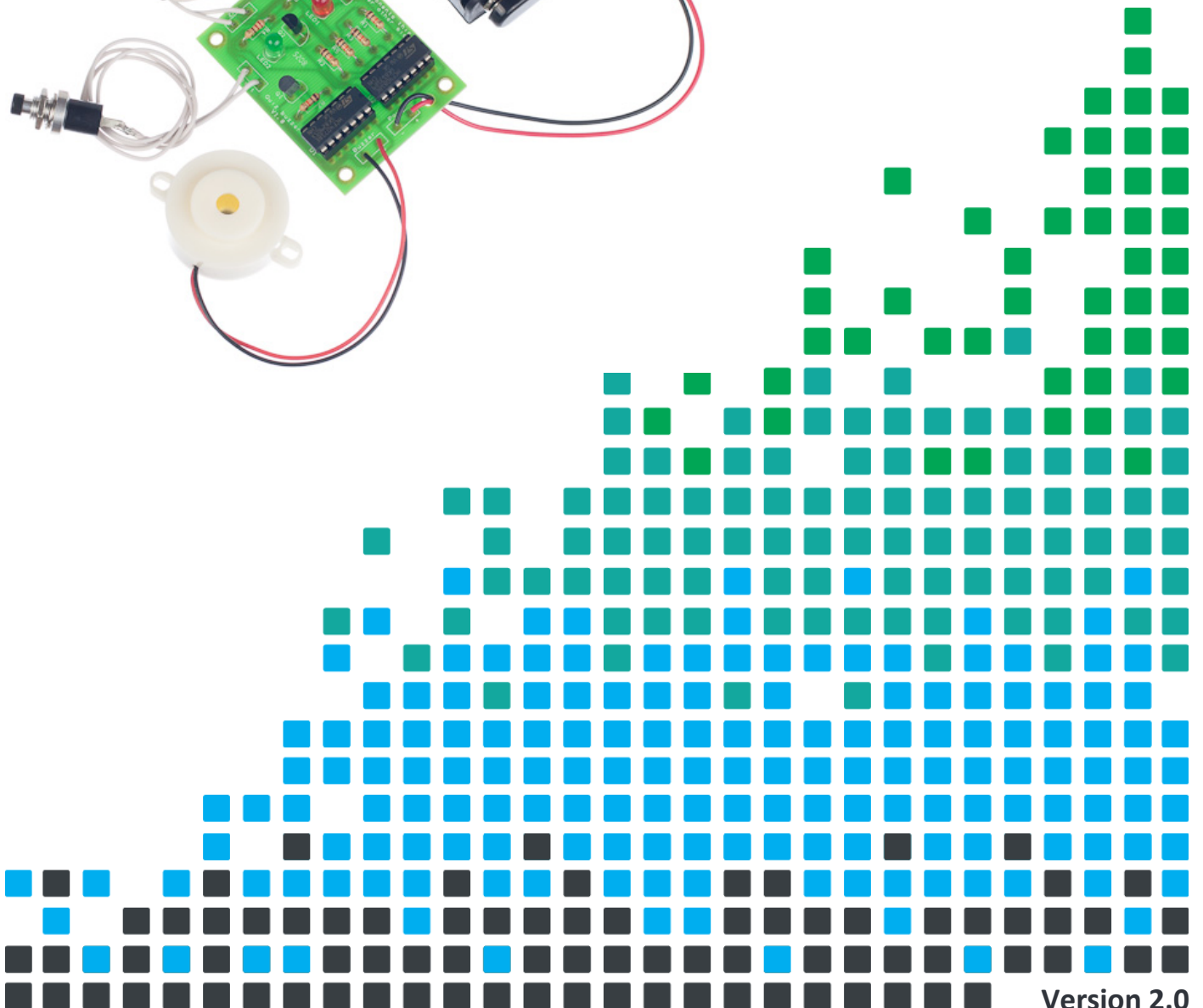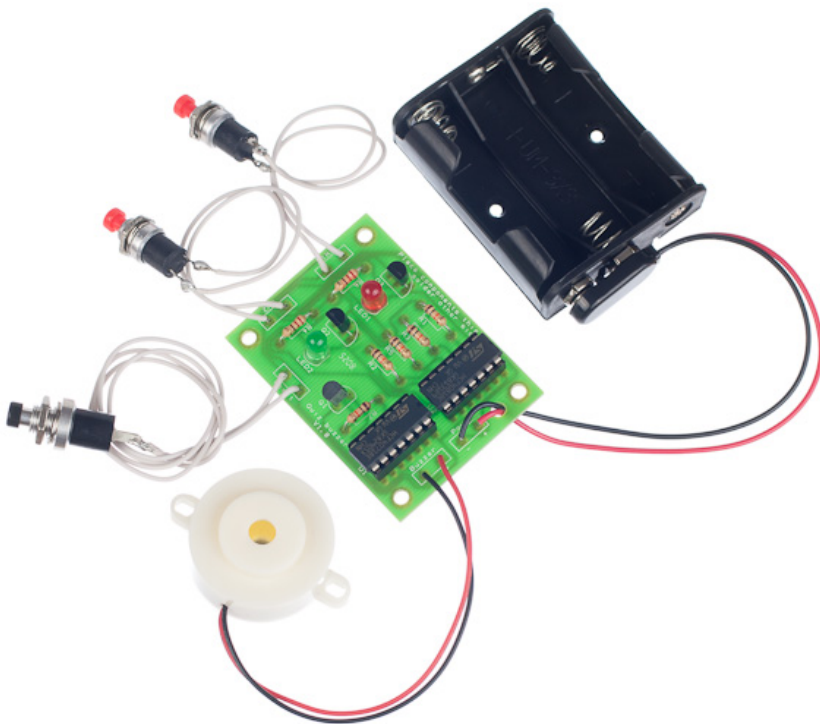
Version 2.0

Build Instructions

Before you start, take a look at the Printed Circuit Board (PCB). The components go in the side with the writing on and the solder goes on the side with the tracks and silver pads.

1 PLACE RESISTORS

Start with the seven resistors:
The text on the PCB shows where R1, R2 etc go.
Ensure that you put the resistors in the right place.

PCB Ref	Value	Colour Bands
R1, R2, R3, R5 & R7	10K	Brown, black, orange
R4 & R6	220Ω	Red, red, brown
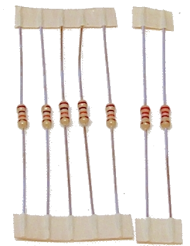
2 SOLDER THE IC HOLDERS

Solder the two Integrated Circuit (IC) holders into U1 and U2. When putting them into the board, be sure to get them the right way around. The notch on the IC holders should line up with the notch on the lines marked on the PCB.

3 SOLDER THE TRANSISTORS

Solder the transistor into the board where it is labelled Q1. The transistor is a BC547B and will be marked C547B on the body of the device. Make sure that the device is the correct way around. The shape of the device should match the outline on the PCB.

4 SOLDER THE THYRISTORS

Solder the two thyristors into the board where it is labelled Q2 and Q3. These are marked with the part number 2N5061. Again, make sure that the device is the correct way around. The shape of the device should match the outline on the PCB.
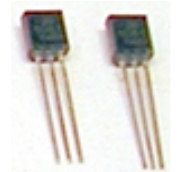
5 SOLDER THE LEDs

Solder the two Light Emitting Diodes into LED1 and LED2. The red LED should go in LED1 and the green LED in LED2. The LEDs won't work if they don't go in the right way around. If you look carefully one side of the LED has a flat edge, which must line up with the flat edge on the lines on the PCB. You may want to solder them in at a specific height depending upon how you have designed your enclosure (if you are making one). Once you are happy, solder them into place.
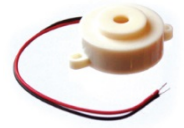
Quiz Buzzer Essentials

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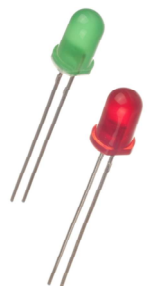
6 SOLDER THE BUZZER

The buzzer should be soldered into the 'buzzer' terminal. The red wire must go to the '+' terminal and the black wire must go to the '-' terminal.
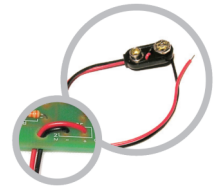
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7 ATTACH THE BATTERY CLIP

Now you must attach the battery clip. Start by feeding the leads through the strain relief hole near U2. The wire should be fed in from the rear of the board.

The red lead should be soldered to the '+' terminal and the black lead should be soldered to the '-' terminal.

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8 ATTACH THE SWITCHES

Attach the two Push to Make Switches – these have a **red button**. First cut and strip four short lengths of the wire supplied. Solder one to each of the two terminals on the switches. Then solder the other end of the wires on one of the switches to the PCB where it is marked 'SW1'. It does not matter which way around the two wires go. Then do the same with the wires on the other switch but this time connect them to the PCB where it is marked 'SW2'.

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9 ATTACH THE RESET SWITCH

Attach the reset switch, this has a black button. First cut and strip two short lengths of the wire supplied. Solder one to each of the two terminals on the switch. Then solder the other end to the PCB where it is marked 'reset'. It does not matter which way around the two wires go.

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10 INSERT THE IC INTO THE HOLDER

The ICs can now be put into the holder, ensuring the notch on the chip lines up with the notch on the holder. IC HCF4071 should go into U1 and IC HCF4081 should go into U2.
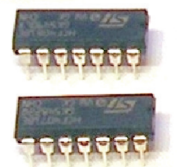
Checking Your Quiz Buzzer PCB

Carefully check the following before you insert the batteries:

Check the bottom of the board to ensure that:
- All holes (except the 4 large (3mm) holes in the corners) are filled with the lead of a component.
- All these leads are soldered.
- Pins next to each other are not soldered together.

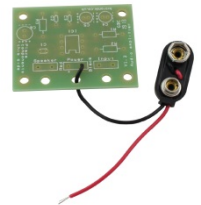**Check the top of the board to ensure that:**
- The shape of the transistors and thyristors match the outline on the PCB.
- The notch on the IC holders, ICs and PCBs all match.
- The flat edge on each of the LEDs matches the outline on the PCB.
- The colour bands on R4 and R6 are red, red and brown.
- The red wire on battery clip goes to 'Power' '+' and the black to power '–'.
- The red wire on buzzer goes to 'Buzzer' '+' and the black to Buzzer '–'.
- The switch with the black button is connected to 'Reset'.

Adding an On / Off Switch

If you wish to add a power switch, don't solder both ends of the battery clip directly into the board, instead:

1

Solder one end of the battery clip to the PCB, either black to '-' or red to '+'.

2

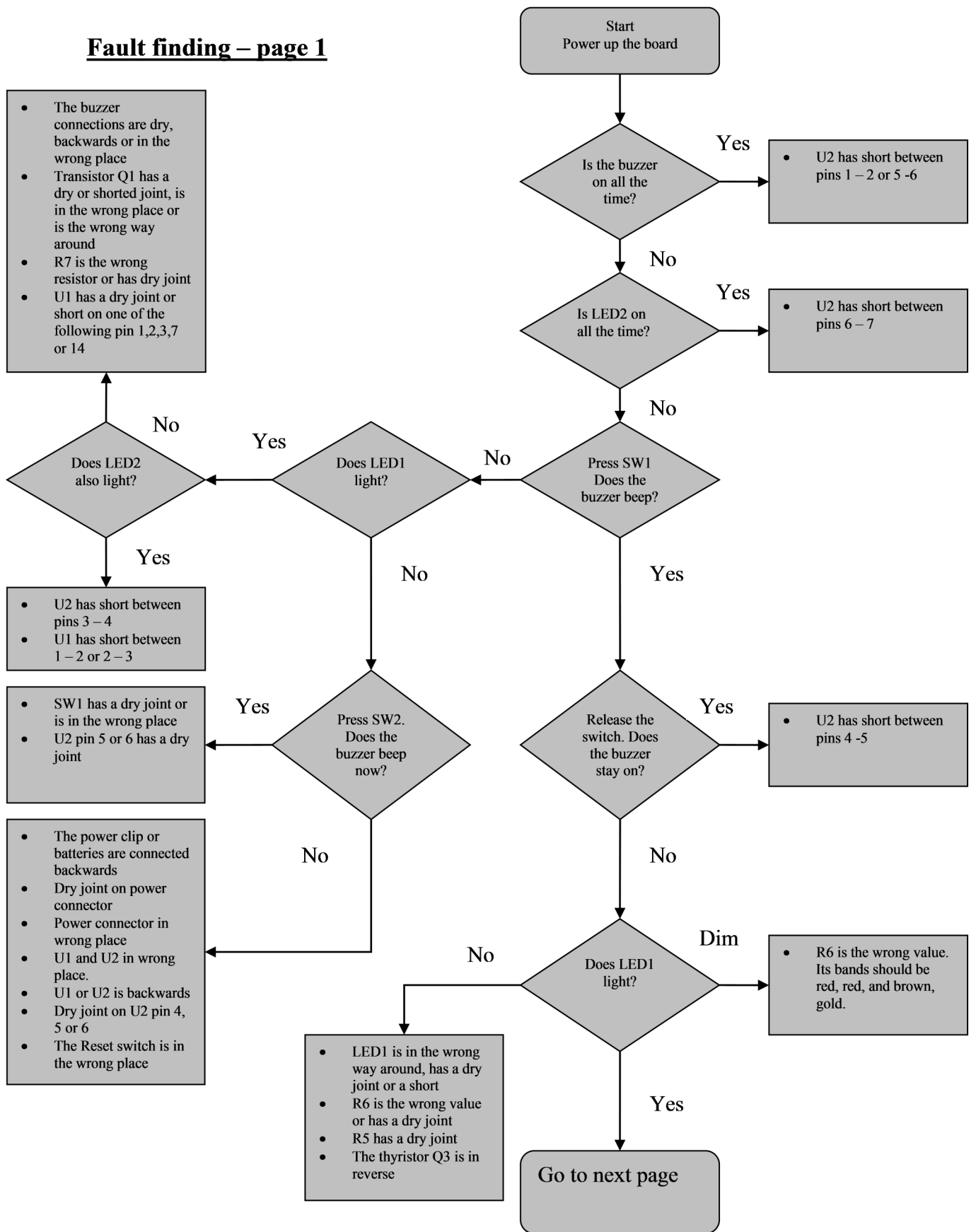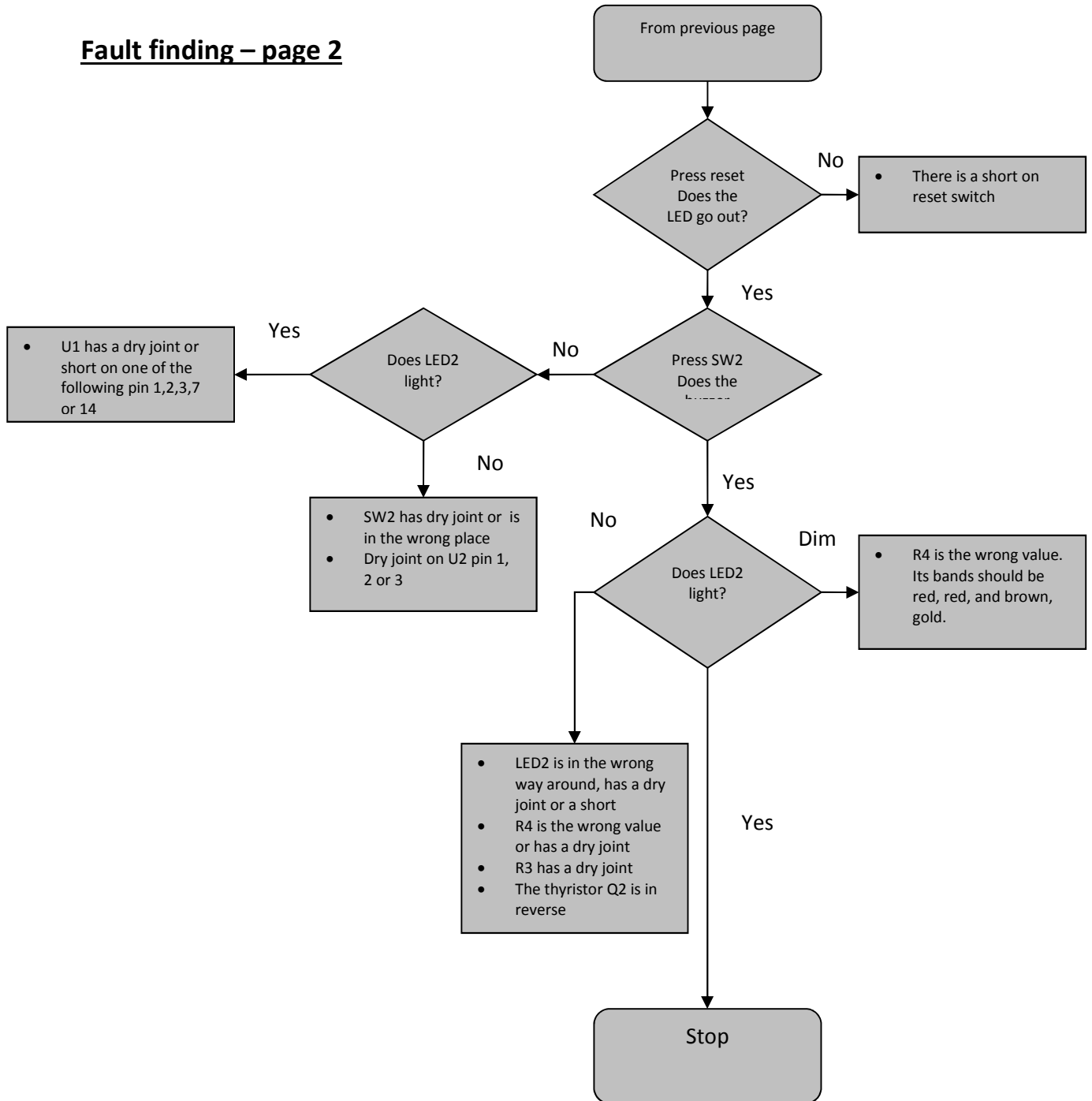Solder the other end of the battery clip to the on / off switch.

3

Using a piece of wire, solder the remaining terminal on the on / off switch to the remaining power connection on the PCB.

Quiz Buzzer Essentials

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Fault finding – page 1

- The buzzer connections are dry, backwards or in the wrong place
- Transistor Q1 has a dry or shorted joint, is in the wrong place or is the wrong way around
- R7 is the wrong resistor or has dry joint
- U1 has a dry joint or short on one of the following pin 1,2,3,7 or 14

Start
Power up the board

Is the buzzer on all the time?

Yes → U2 has short between pins 1 – 2 or 5 -6

No

Is LED2 on all the time?

Yes → U2 has short between pins 6 – 7

No

Press SW1 Does the buzzer beep?

No → Does LED1 light?

Yes → Does LED2 also light?

No → (to top left box)

Does LED2 also light?

Yes →
- U2 has short between pins 3 – 4
- U1 has short between 1 – 2 or 2 – 3

Does LED1 light? **No** →

Press SW2. Does the buzzer beep now?

Yes →
- SW1 has a dry joint or is in the wrong place
- U2 pin 5 or 6 has a dry joint

No →
- The power clip or batteries are connected backwards
- Dry joint on power connector
- Power connector in wrong place
- U1 and U2 in wrong place.
- U1 or U2 is backwards
- Dry joint on U2 pin 4, 5 or 6
- The Reset switch is in the wrong place

Press SW1 Does the buzzer beep? **Yes** →

Release the switch. Does the buzzer stay on?

Yes → U2 has short between pins 4 -5

No

Does LED1 light?

Dim → R6 is the wrong value. Its bands should be red, red, and brown, gold.

No →
- LED1 is in the wrong way around, has a dry joint or a short
- R6 is the wrong value or has a dry joint
- R5 has a dry joint
- The thyristor Q3 is in reverse

Yes → **Go to next page**

Fault finding – page 2

From previous page

Press reset
Does the
LED go out?

No → • There is a short on reset switch

Yes

Press SW2
Does the
buzzer

No → Does LED2 light?

Yes → • U1 has a dry joint or short on one of the following pin 1,2,3,7 or 14

No → • SW2 has dry joint or is in the wrong place
• Dry joint on U2 pin 1, 2 or 3

Yes

Does LED2 light?

Dim → • R4 is the wrong value. Its bands should be red, red, and brown, gold.

No → • LED2 is in the wrong way around, has a dry joint or a short
• R4 is the wrong value or has a dry joint
• R3 has a dry joint
• The thyristor Q2 is in reverse

Yes

Stop
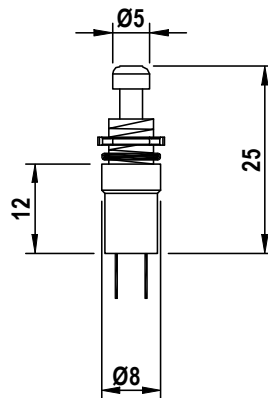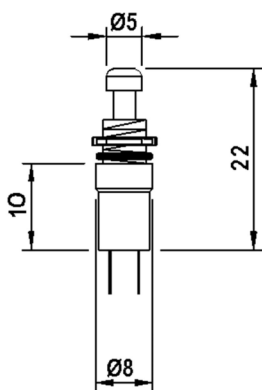
Designing the Enclosure

When you design the enclosure, you will need to consider:

- The size of the PCB (right).
- Where the LEDs are mounted and how big they are.
- Where the batteries will be housed (bottom left, height 16mm).
- Where the switches will be mounted (Push to Make bottom middle, Push to Break bottom right).
- Where the buzzer will be mounted (below right).
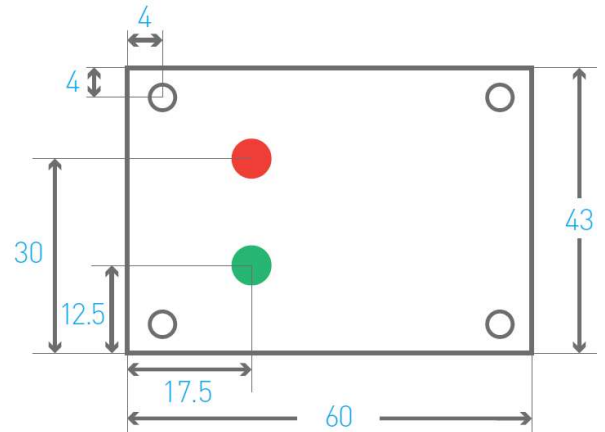
These technical drawing of the parts and the PCB should help you to plan this.

All dimensions in mm
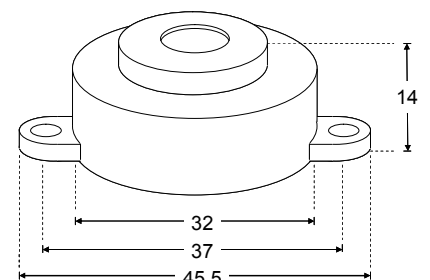x4 holes 3.3 mm diameter
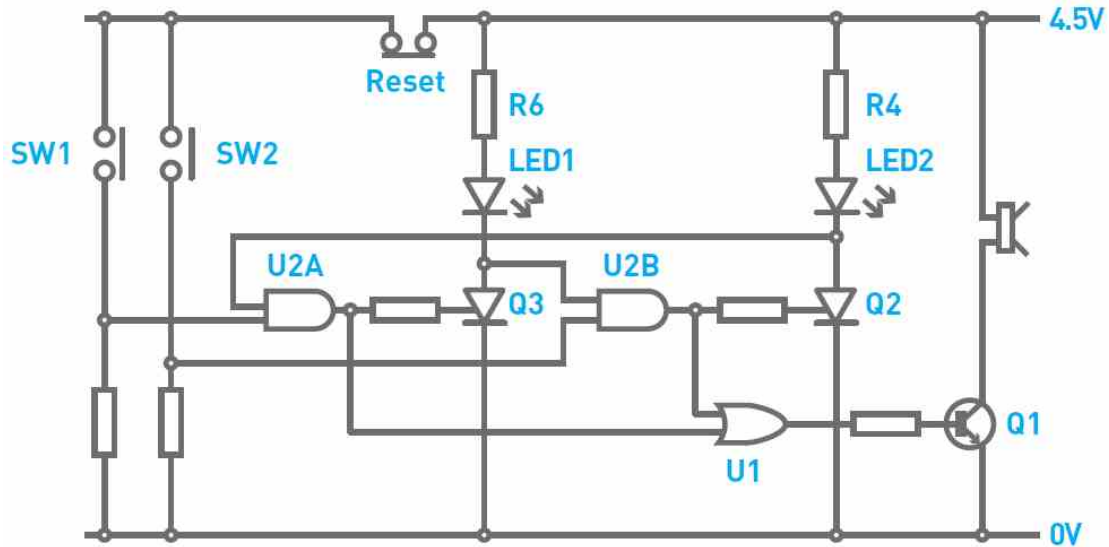x2 LEDs 5 mm diameter
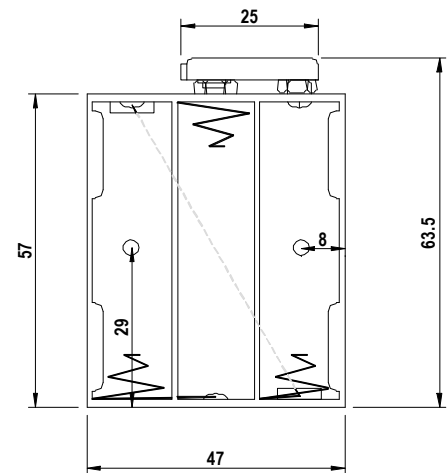
Mounting the PCB to the enclosure

The drawing to the left shows how a hex spacer can be used with two bolts to fix the PCB to the enclosure.

Your PCB has four mounting holes designed to take M3 bolts.

How the Quiz Buzzer Works

The quiz buzzer is based around two types of logic gates. There are two AND Gates and one OR Gate. Let's first examine Gate U2a. One input of the AND Gate is connected to the Push to Make Switch SW1 on the left of the circuit. These are the switches used by the quiz contestants.

The input on the AND Gate that this switch is connected to is normally in a 'low' state (when the button is not pressed). By pressing the button the input to the AND Gate is connected to V+, taking it 'high'. The other input to AND Gate U2a (that's not connected to the switch) is held 'high' when the circuit is reset. By taking the switch input 'high', both inputs to the AND Gate will be 'high' and, therefore, the output will go 'high'. This causes the gate of thyristor Q3 to go high.

This turns it on allowing electricity to flow through it, turning on LED1. As a result of this the anode of the thyristor will be at a 'low' voltage. This thyristor stays latched even if the switch is released. As the anode of the thyristor is connected to an input of U2b, it means that the output of that AND Gate cannot go high until the circuit is reset. The Other switch works in the same way with AND Gate U2b. The circuit is reset by putting the thyristors into a non-latched state, which happens when the Push to Break Switch is pressed and the voltage across the thyristors is removed.

When either the output of Gate U2a OR U2b is 'high', the output of U1 (OR Gate) will be 'high'. This causes the transistor Q1 to turn and the buzzer to sound.

Online Information

Two sets of information can be downloaded from the product page where the kit can also be reordered from. The 'Essential Information' contains all of the information that you need to get started with the kit and the 'Teaching Resources' contains more information on soldering, components used in the kit, educational schemes of work and so on and also includes the essentials. Download from:

www.kitronik.co.uk/2116

This kit is designed and manufactured in the UK by Kitronik

Telephone: +44 (0) 845 8380781

Sales email: sales@kitronik.co.uk

Tech support email: support@kitronik.co.uk

Web: www.kitronik.co.uk

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