

Build a LED torch without soldering!

Electronic kits normally require soldering, but this simple torch takes a different approach—using screws to hold components to the PCB.

Normally when building an electronics kit you would need to solder the components to the circuit board. But for those without a soldering iron, or for whom soldering isn't allowed, such as younger schoolkids, this kit provides a simple alternative.

The circuit

The torch is extremely simple, and consists of a 0.5W, 10mm LED as the light source. This is controlled by a slide switch, while current through the LED is controlled by the 10 ohm resistor. Why do we need a resistor? See the box “How to feed LEDs” at the end of these instructions.

All three components are connected in series, along with the battery holder. In simple terms, power flows from the battery through the switch (when it's in the On position), through the LED, through the resistor, and back to the battery.

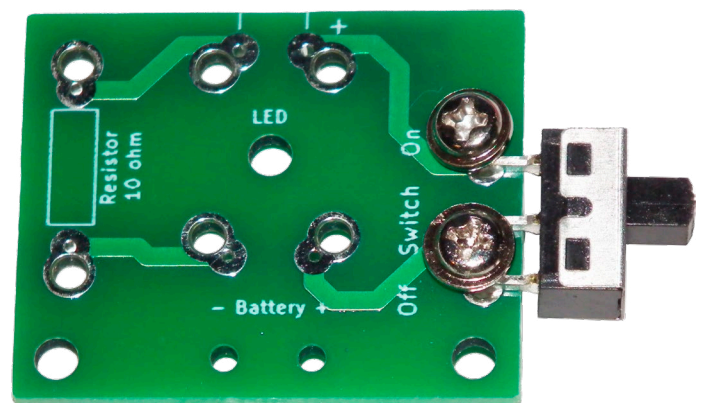
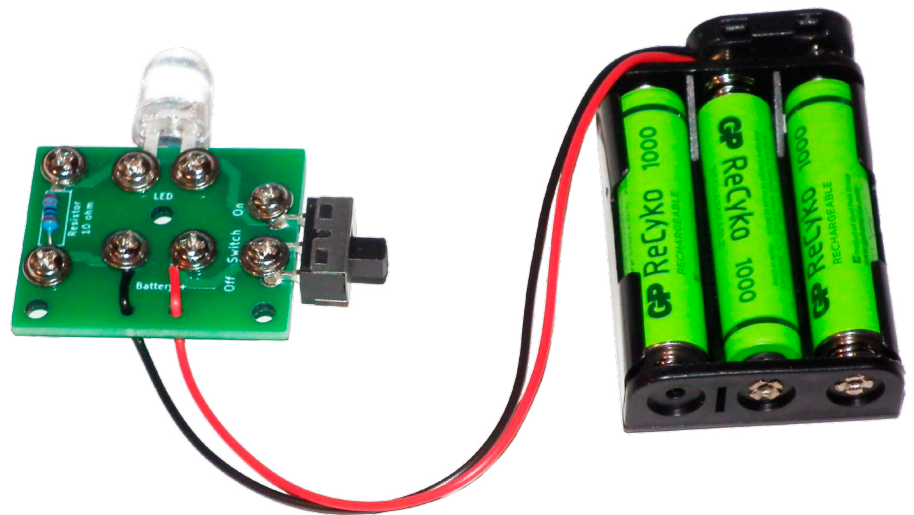
Note that it doesn't matter where the resistor is located in the circuit, so long as it is in series with the LED and switch, it will limit the LED current in the same way.

Assembly

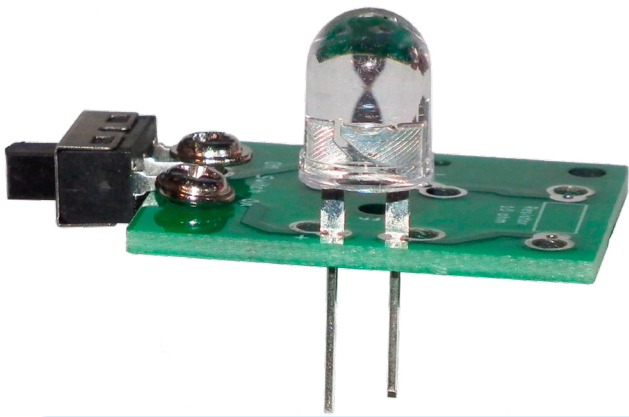
The kit is very simple to assemble. The components are held in place by short screws—use the screws with the wide heads (see the screw types below). You will need a good quality Philips #2 screwdriver and a pair of side cutters to build this kit.

Start with the switch. Place it into its allocated position on the PCB, and using two screws, lock it into place. The screws are the self-tapping type, and will need a little bit of effort to cut into the holes in the circuit board—this is easier if the screws are put in as close to perpendicular to the PCB as possible. Screw them down until the switch is held firmly—it should not move around.

Note that T10 Torx screws may be supplied instead of the Philips screws for fixing the components. Torx screws are easier to screw in as the Torx driver holds the screw better and doesn't try to cam out. We highly recommend using the Torx screws for fixing the components.



There are three types of screws in the kit. The screw on the left is used to hold the components in place on the PCB (note that T10 Torx screws (also shown) are available as an option and may be included in the kit instead). There are 10 in the kit (two spares). The screw in the middle is used to hold the PCB into the case (three in kit) and the countersunk screw on the right is used to hold the battery holder into the case (two in kit).



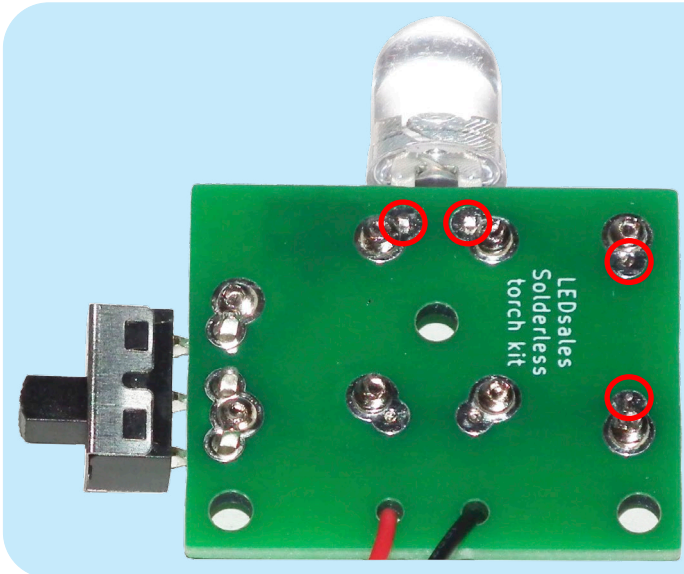
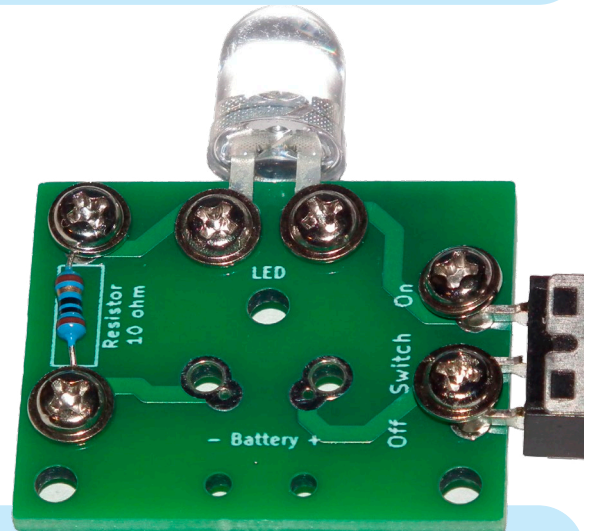
The LED is done the same way. Place the longer lead of the LED into the hole marked “+” and insert the LED leads into the holes until they stop (there is a wider section on each lead which should stop the LED going any further). Note that the LED leads are a tight fit in the holes, but they do fit!



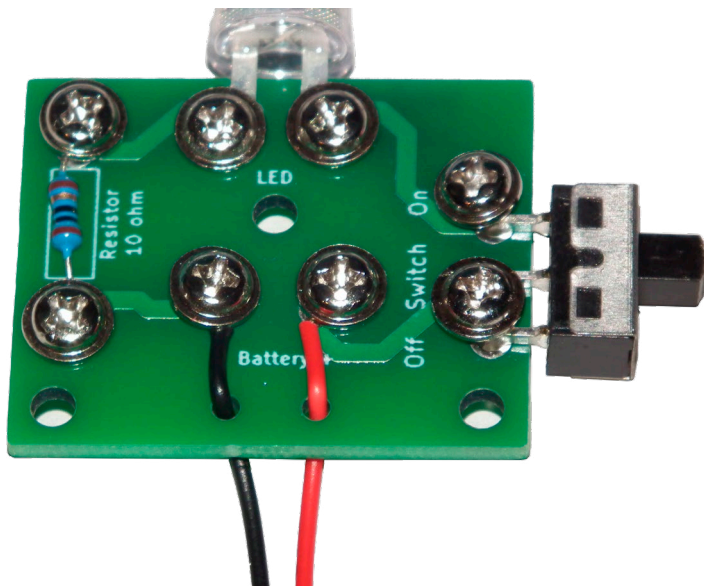
Now bend the LED flat with the PCB and lock it into place with two more screws.



Next, do the same thing with the resistor. Cut off the paper tape at the end of each lead and bend the leads at right-angles so that they drop into their allocated holes. Using two more screws, lock it into place. Don't be concerned if the screws bend the resistor leads a little, this is fine, so long as you don't overtighten the screws to the point where the resistor leads get ripped from the resistor (it's possible, but unlikely)



Now, turn the circuit board over and clip off the excess leads of the LED and resistor (where the red circles are) to neaten things up. This will also make it easier to fit the torch PCB into your desired case. Just trim them as well as you can, down to the length of the screws is fine. There is no need to trim the switch leads as they are already quite short.



Last comes the battery clip. Feed the red wire up from underneath through the bare hole near the edge of the board marked “+” and insert the bare end of the wire into the corresponding connection hole, bending it flat like you did with the LED. Fix that lead with a screw, making sure the screw is holding the lead by the inner conductive core, not the outer insulation.

You might want to strip a bit more insulation off the wire if you find this too difficult with the length of bare wire the leads are supplied with, or you can pre-bend the leads with pliers as shown below.

Now, do the same with the black wire and the terminal marked “-” and the torch is ready for testing.



Does it work?

Place three AAA batteries in the battery holder, and, after making sure the switch is in the “Off” position, connect the battery holder to the battery clip. It should just click into place like a regular 9V battery would.

Once done, turn on the switch and your LED should light up.

If it doesn’t work, check that the LED was put in the right way around and that all leads are properly held down by their respective screws. It’s also possible to damage the resistor leads when tightening the screws, so check for damage there (in the numerous test kits we built, this never happened, but it is possible).

Final assembly

The kit can be assembled into the case of your choice. You can use a 3D printed unit of your own design or a small electronics enclosure. You will need to drill a hole for the LED and cut a slot for the switch.

Note that a LEDsales customer has developed a 3D printed case design for this kit. A link to this case will be available on the product page at bit.ly/3WhnEds

An even simpler option is to screw the torch PCB and the battery holder to a flat piece of material cut to appropriate size. The PCB has three holes suited to 3mm screws (short screws to suit the 3D case mentioned above are supplied), while the battery holder has two screw holes for countersunk screws (also supplied).

How you use the completed kit is up to you, really.

Note that should you damage one of the components during assembly, replacements are available from LEDsales. Email orders@ledsales.com.au or go to ledsales.com.au

How to feed LEDs

With regular light bulbs, you apply the bulb’s rated voltage (voltage is the “pressure” that makes electricity flow) and it draws the current it needs (current is “how much” electricity flows). With bare LEDs like the one in this kit, you have to do the opposite—you feed the LED its rated current and it sets its own voltage (around 3V).

The simplest way to limit current through an LED is to use a component called a resistor. Resistors act like a restriction in the circuit, causing current to flow at a specific rate depending on the voltage across the resistor.

In this circuit, we are using 4.5V (3 x AAA batteries), and the LED needs around 3V, so the rest, 1.5V, is lost across the resistor. This lets us calculate the current through the resistor (and hence through the LED as they are connected in series) by dividing the resistor’s voltage drop by it’s rating in ohms. In this case, we get 1.5V/10 ohms, which gives a current of 0.15A, or 150mA.

Parts list

Part	Value	Qty
PCB	Solderless torch PCB	1
SW1	Right-angle slide switch	1
LED1	0.5W 10mm white LED	1
R1	10 ohm resistor	1
BC1	Battery clip with leads	1
BH1	3xAAA battery holder	1
SC1	Component mounting screws	8
SC2	PCB mounting screws	3
SC3	Battery holder mounting screws	2