

Firebug Instructor Guide

Design principles

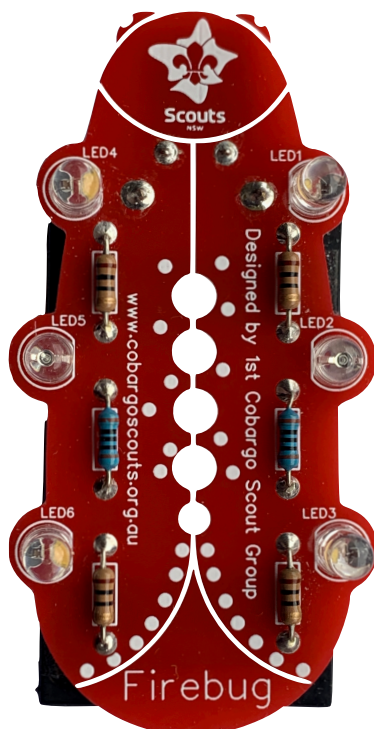
The Firebug is designed to be built by young Scouting youth members with limited to no soldering experience. It has many design principles that should ensure lower assembly failure rate, and a longer lasting robust kit.

Design features

- Low profile on/off switch, partially shielded by the battery holder - to reduce the ability to be accidentally turned on, when squashed up against other things in a bag.
- PCB Mount battery holder
- Larger solder pads 2.5-3mm, to make soldering easier for Scouts
- Wide spacing for radial component leads to prevent solder bridges, and components laid down to prevent breakage.
- Wider tracks so that if through holes are delaminated, then the component lead can be soldered to the track - saves replacing the board and starting again,
- No more than 1 track connected to a through hole to reduce the number of tracks to be reconnected if a pad is delaminated.

Design notes

- The light will run in excess of 20 hours if you use a good quality AA batteries.
- 4 Warm white simulated candle flash LEDs. (could not find bright enough yellow LEDs, using low enough power)
- 2 Orange LEDs to add an orange glow to make it more realistic.

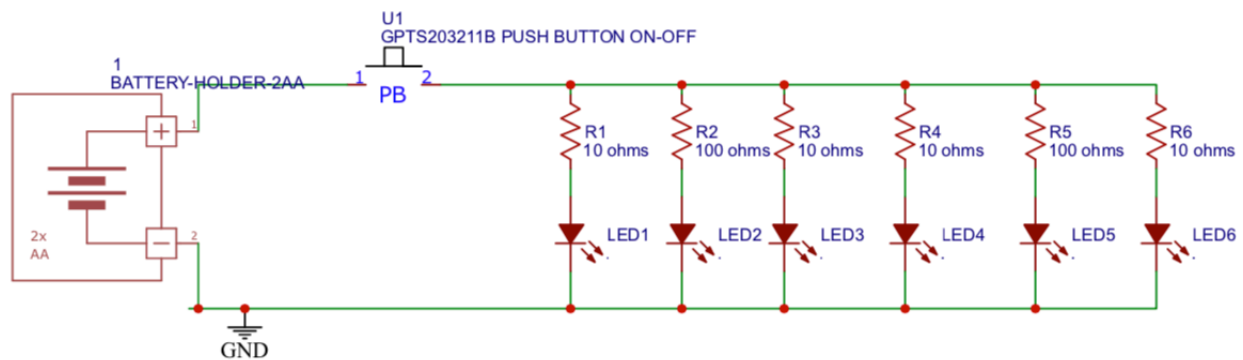


Circuit details

The Firebug circuit is based on simulated Candle type LEDS. There are 4 of them in a warm white colour, and 2 standard orange LEDS to add an orange glow.

R1,R3,R4,R5 are the Candle Led's

R2 and R4 are the orange Led's



Battery Holder options

The Board can accommodate different size battery holders, with a pin spacing of 12.5-14mm.

The battery holder is on the back of the board so that it covers the pins.

As the battery holder is on the back and above the soldered component pins, it will not sit flat on the board.

It is highly recommended that you use a piece of soft 2-2.3mm double sided foam tape to hold it in place, and prevent it from being broken off.

Tape required

3MVHB 4991 (2.3mm Thick) 10-12 mm wide - you will need

2*10mm lengths per battery holder.

can get 3M lengths from aliexpress



Name label

As the board is small, there is no room to put a white space to write the youth members name and group on.

It is recommended that you order the following avery label and stick it on the side of the battery holder so that they can write their name and group name on it.

<https://www.averyproducts.com.au/product/white-rectangle-stickers-932009>

LEDS

There are 2 different LEDS used in this project.

- 1) 4 - simulated candle LEDS. The ones I have used are Warm white, i have not found a yellow or orange candle LED that is bright enough for this project.
- 2) To get the colour output to look more like a fire, I have used 2 - Orange wide angle LEDS that give the light output an orange glow.

See the shopping list for which ones to order.

Preferred Switch options

There are a two different switches you can use.

The main ones I have designed the board for, are made by HENGQI <https://www.hqdz123.com/en/> and are available on Aliexpress and Amazon, they are all 12mm switches with 90 degree pins.

Option 1 - 1212-112DB - best option

Search for 1212-112DB on Aliexpress

2 pin on/off switch - this needs 0.8mm Tape under it to stop it lifting



Option 2 - 1212-112YB

Search for 1212-112YB on Aliexpress

2 pin on/off switch

Pins are not as long as Option 1 so do not protrude much through the board.

So you will need 0.4mm double sided tape under it to stop it lifting



Tape required for the Switch

These switches only have pins on one side, so if they get knocked they may lift up. Ideally a piece of 3M VHB tape under them will help prevent this. Note 3M VHB tapes can take up to 72 hours to achieve full bonding strength, so it is advisable to stick this to the bottom of the switch a few days before they are due to be assembled by the Scouts.



- If using Switch Option 1 they can take up to 0.8mm tape as the pins are longer.
 - 3M VHB 5608 tape (0.8mm thick) order the 10mm width
<https://www.aliexpress.com/item/1005002745126695.html>
- If using Switch Option 2, use 0.4 mm tape, anything thicker and the pins will not protrude enough through the board for soldering.
 - 3M VHB 5604 tape (0.4mm thick) 10-12mm wide
<https://www.aliexpress.com/item/1005004775152425.html>

To Do list before the Day

- 1) Order Boards
- 2) Order Components
- 3) Source and buy the 2- Double sided tapes,
- 4) Put the double sided tape on the battery holder, and the switch.



- 5) Put the name label on the side of the battery holder.

- 6) Put the double sided tape onto the back of the switch



- 5) **Solder requirements** - 30cm solder (approx 1.2g) (Can do it with about 20cm)
- 6) Print one copy of the Component Sorter per Soldering station, and laminate them. These are used by the Scouts to sort the components, do not let them start soldering until you have checked that they have sorted them correctly
- 7) Print two copies of the Assembly guide (double sided) per table (4 - 6 scouts) - they can just share them. It is recommended that you laminate them.
- 9) Package only the following components
 - 6 * Resistors
 - 1 * switch
 - 6 * Leds
 - PCB
 - Solder
 - Do not give out the battery holder, or battery. When the youth members are assembling them, get the Youth to assemble all the components up to and including step 4, 1st (see assembly guide), then test the board by putting a batteries in the battery holder and just putting it into the board and twisting is slightly so that it contacts the battery socket pads, and check that it works. Also check that the switch turns off and on.
10. Then let them solder in the battery holder.