Design principles

V1 - Nov 2022

Blue Peak, 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

- Right angle slide switch, with the case also acting as an anchor as its soldered to the board, to reduce the risk of the switch being broken off,
- PCB Mount battery holder
- Recommend using a small 2mm thick piece of double sided tape to help hold the battery holder on - see assembly section.
- Larger solder pads 2.5-3mm, to make soldering easier for Scouts
- Wider spacing for radial component leads to prevent solder bridges, and components laid down to prevent breakage.
- Longer IC pads to help with Soldering,
- Hole at the top for connecting to a Lanyard
- 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.
- Space for youth members name and group on the back

Circuit details

The circuit is based on a CD4093BE and CD40192BE, and CD4028BE IC's.

The circuits is comprised of 2 Astable multivibrators consisting of LDR1,R1,C1 and LDR2,R2,C2 and 2 Schmidt Nand gates. The frequency of these are controlled by varying the amount of light falling on the LDR's

The output of these 2 oscillators are connected the Up/Down inputs on the CD40192, they effectively compete with each other to make ether CD40192 either count up or down depending on which oscillator is running faster.

The CD40192 binary output is connected to the CD4028 which decodes the binary input to decimal and illuminates the appropriate LED.

The other half of the CD4093 looks for the Binary condition (from the CD40192 output) where only LED 5 and 6 are illuminated, if this condition is met, then LED 1 (Blue LED) is solidly illuminated.
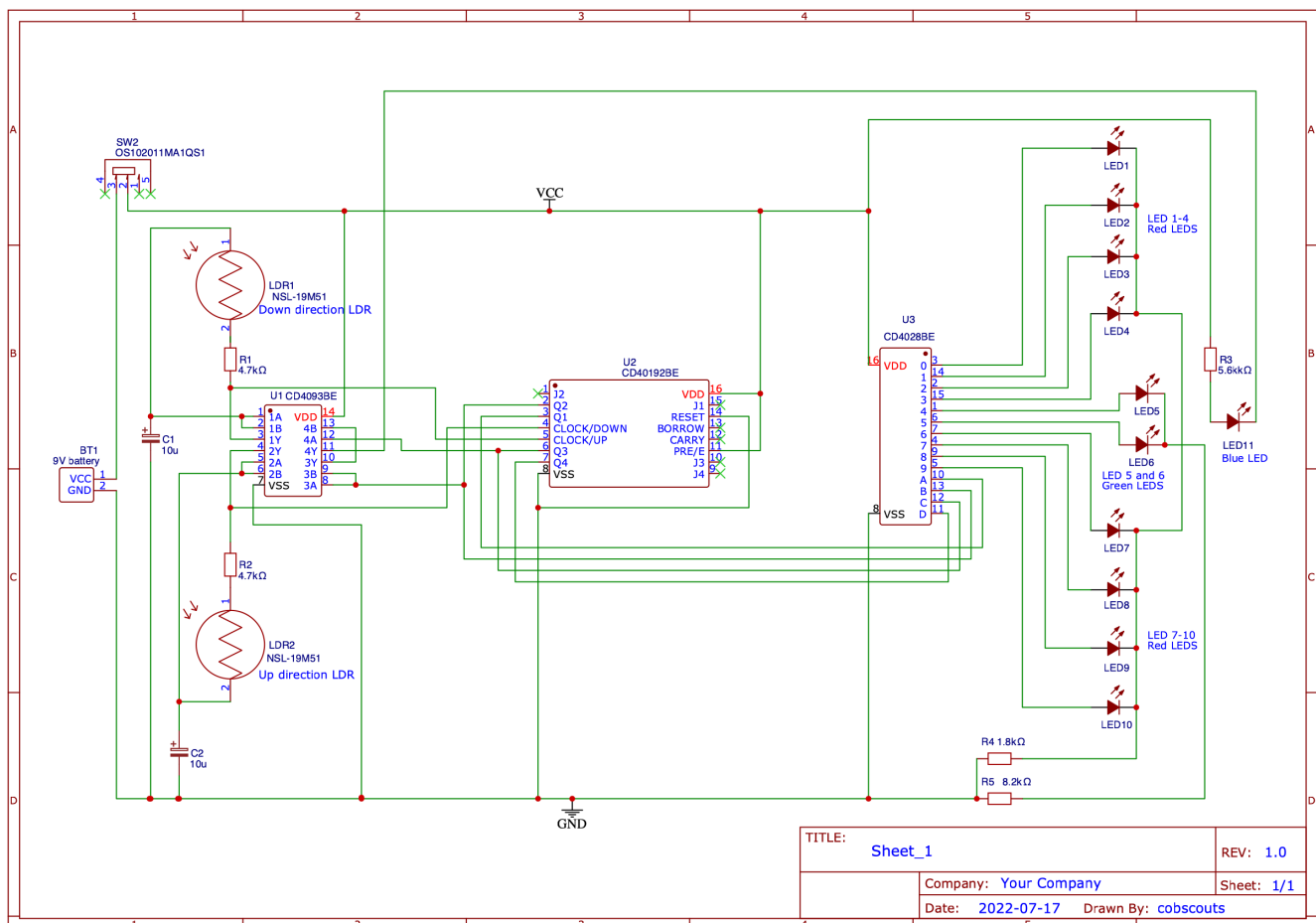
Battery Holder

For the PCB Mount battery holder, there are many different brands available, in qty of 10 or more they are about $1 each. See the shopping list for suggestions. The recommended one in the shopping list is available from Altronics,
Different manufacturers have different pin spacing, the board has slotted holes for the battery holder that can accommodate pin spacing from approx 12.5 to 14 mm.

Double sided tape for the battery holder

It is advisable to use a piece of 2mm thick double sided tape (automotive tape is nice and strong) at the end of the battery holder near the on /off switch end. This will secure the battery holder firmly to the board at both ends, and prevent it from being broken off.

Name and Group name

There is a space on the Back for them to write their name and group name. This is best done with a CD Pen

Protective Tape

It is recommended that the battery pins on the front of the board be covered with protective tape, to prevent shorts, and also, all the soldered pins on the back of the board, as this circuit has 3 CMOS IC's that are static sensitive, and it will also double as basic protection from sharp pins. Without the tape on the back, the circuit will not behave consistently if some of the pins are touched. Two pieces of 40mm wide tape are required on the back. Kapton tape is preferable for this.

Note - if you are assembling a lot of kits, they you may want to look at an automatic tape dispenser for some of the tapes that have to be cut to a specific length. I use a ZCUT-9 dispenser, that can cut tapes from 6-60mm wide to a length from 5mm upwards.

Kapton Tape
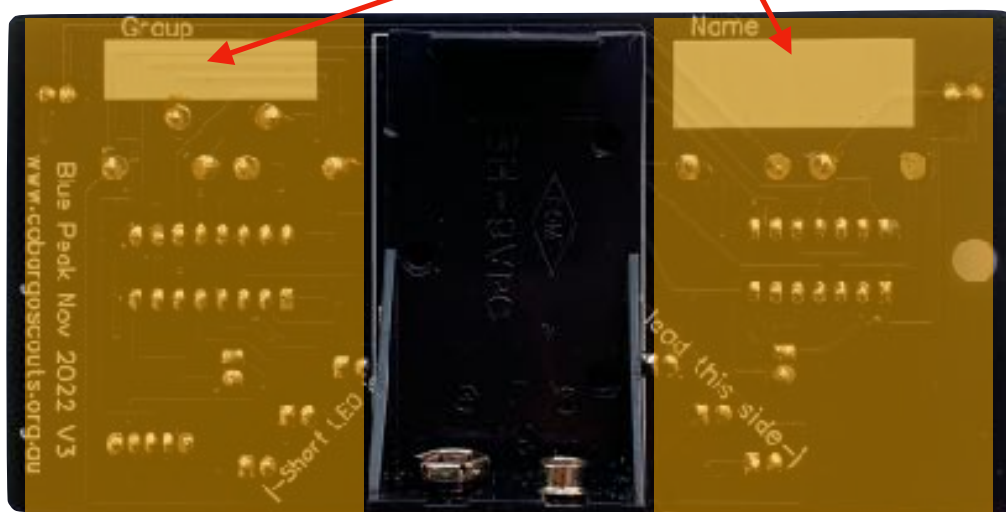
Assembly guide suggestion

Install the components in the following order (the board will stay relatively flat on the bench this way, and will not require you to splay the wires much to keep the component from falling out.

1. LDR's- 2
2. Resistors - 5 (use the lead bending tool - 10mm)
3. 1 -14 pin IC socket and 2-16 pin.
4. C1 and C2
5. Switch
6. LED's - 11

Test the Board before soldering in any more components.

It is important to test the board before letting them solder in the battery holder, as it is hard to unstick and desolder if one of the components underneath is not in correctly.

• Check the soldering before going any further, and ensure that they have put in all the components the right way round, and that the soldering is ok.
• Put in the 3 IC's,
• To test it, put a battery in the holder put it into the board and twist it slightly so that it contacts the holes in the board. Then turn on the switch and ensure that you can get the LEDS to flash in either direction.
• If all is ok, then remove the battery, get the person assembling it, to remove the cover on the double sided tape and solder it in.

7. Get them to write their name and Scout Group on the back in the space provided.
8. Then put the Caption Tape on the front and back.

To Do list before the Day

1) Order Boards
2) Order Components
3) Source and buy the Double sided tape for the battery holder.
4) **Solder requirements** - 90cm solder (approx 3.45g) (Can do it with about 70cm, if you are a good at soldering)
5) Print one copy of the Component Sorter per Soldering station, and laminate them. Stick these to the table so that the Scouts do not take them with 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

6) Print two copies of the Assembly guide (double sided) per table (4 - 6 scouts) - they can just share them. Laminate this as well.
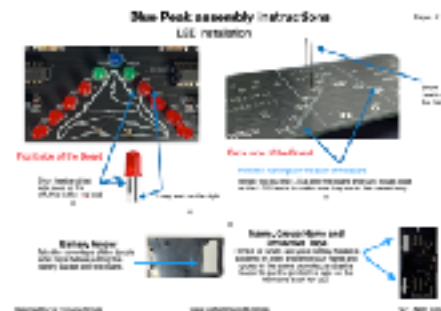
7) Cut the double sided tape and stick it on the lower bottom edge of the battery holder, (see previous page)

8) Package the kits in the small bags. Only put in the 5-resistors, 2 electrolytic capacitors, 1-switches, 3-IC sockets 11-Leds and 2 LDR"S. As per the component sorter do not give out the battery holder, battery, or the IC's until the soldering has been checked, and board tested.