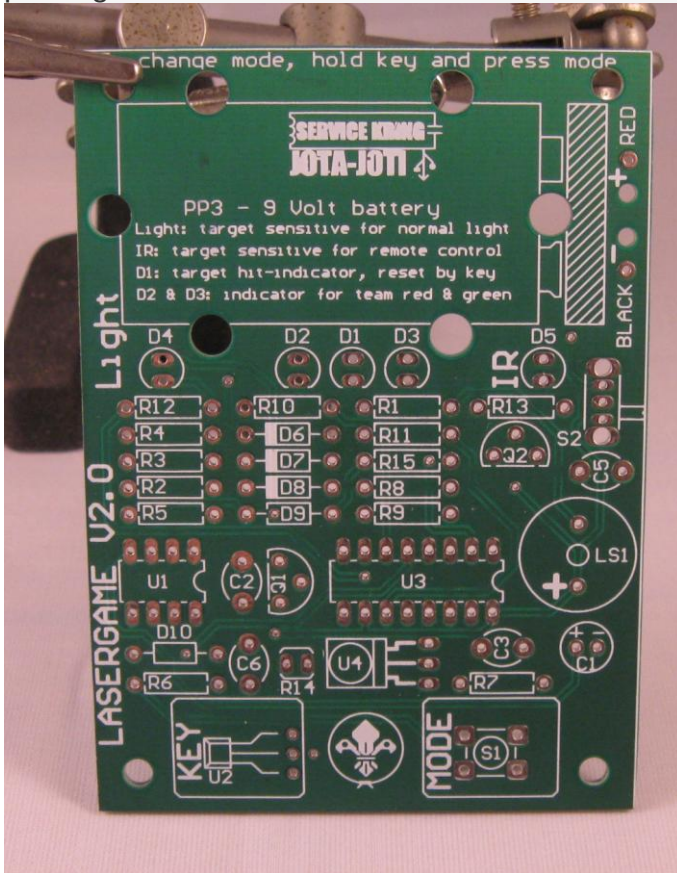


The basis for the construction of the Laser Game Mk II (Mk II represents Mark II = version 2) is a circuit board. This is a printed and unprinted side. The parts are on the side with the printing and to the other side of the PCB soldered.

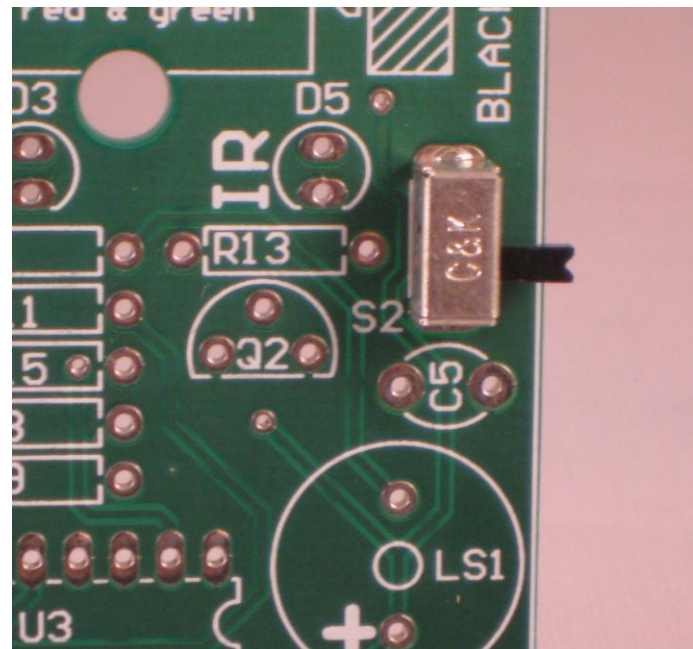


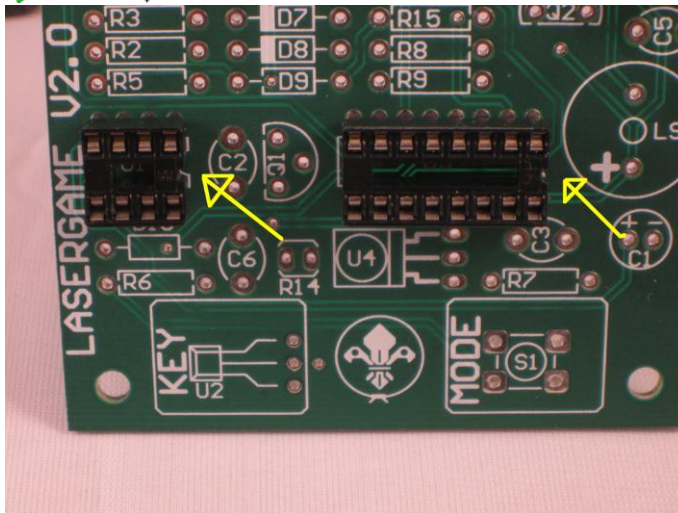
In building the board is basically working components from low to high components. While taking into account "challenging" parts or parts that can break quickly..

When we first Lasergame start with the switch S2. Switch S2 is the small slide switch. The lever of the slide switch points to the side of the PCB.

First, the middle connector of the switch is soldered. After verifying that the switch sits flush against the PCB to it and whether it is legal. If so, then the other connections are soldered.

Note: After soldering the switch is pretty hot!





After mounting the the IC feed can be soldered . pay attention to the following:

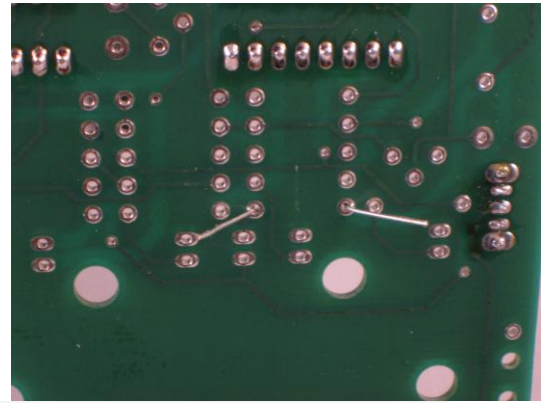
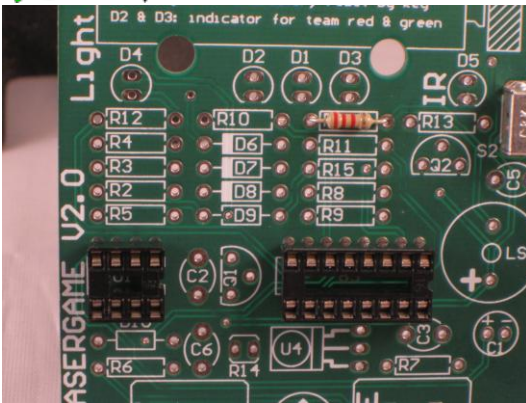
- The notch in the IC- feet. This notch should match the print on the PCB.
- Make sure all legs of the IC socket are in the holes.

Then the resistors and diodes are mounted. The resistors are color

coded. This is read from left to right, with the gold ring on the right hand side.

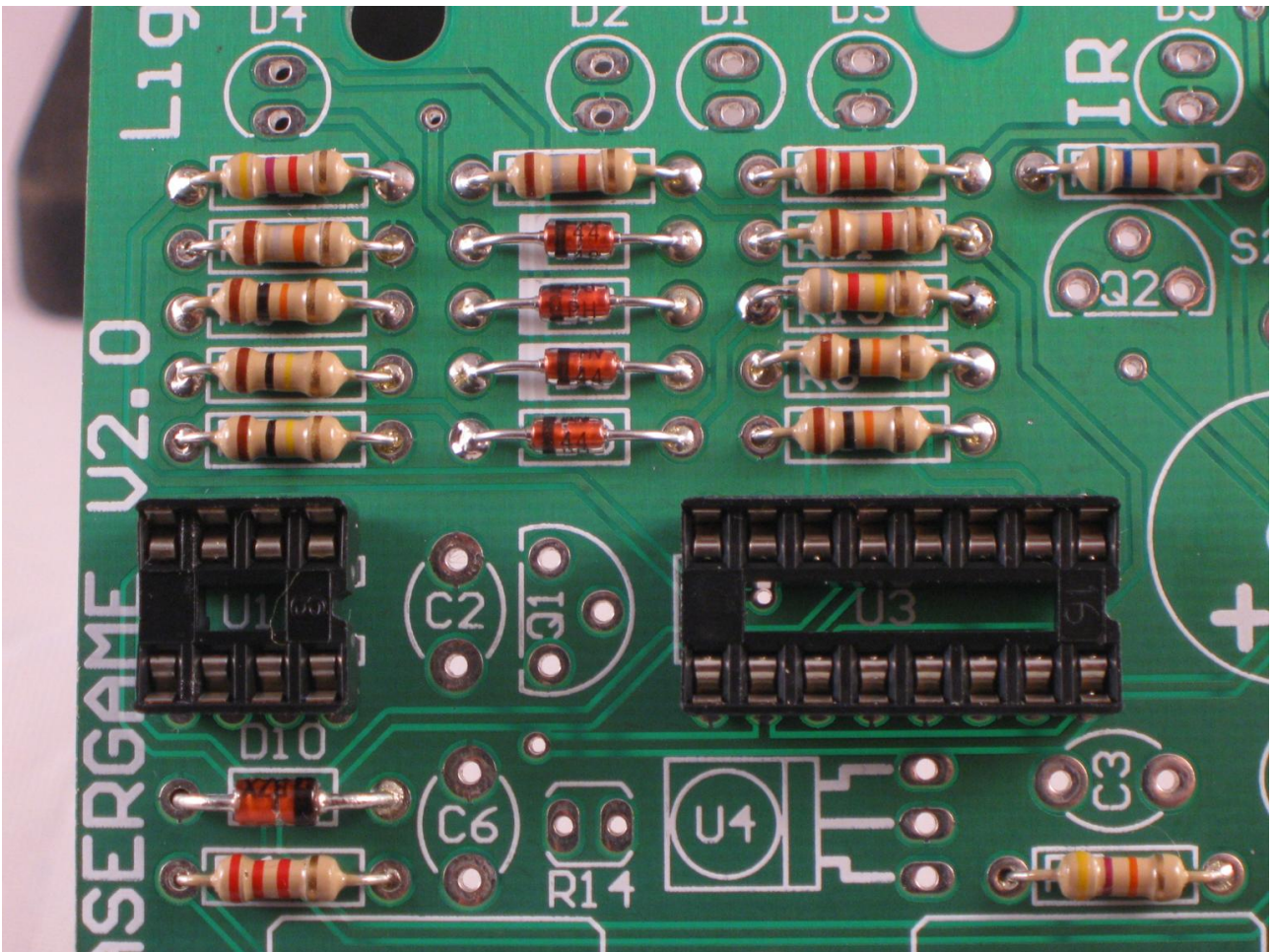
The diodes have a black ring. For the diodes D6, D7, D8 and D9 is it on the left of the print. D10 has the ring on the right hand side of the PCB.

Referentie	Omschrijving	Codering
R1	Resistor 2,2kOhm	Red-Red-Red-Gold
R2	Resistor 100kOhm	Brown-Black-Yellow-Gold
R3	Resistor 10kOhm	Brown-Black-Orange-Gold
R4	Resistor 18kOhm	Brown-Grey-Orange-Gold
R5	Resistor 100kOhm	Brown-Black-Yellow-Gold
R6	Resistor 2,2kOhm	Red-Red-Red-Gold
R7	Resistor 47kOhm	Yellow-Purple-Orange-Gold
R8	Resistor 10kOhm	Brown-Black-Orange-Gold
R9	Resistor 10kOhm	Brown-Black-Orange-Gold
R10	Resistor 1,8kOhm	Brown-Grey-Red-Gold
R11	Resistor 2kOhm	Red-Black-Red-Gold
R12	Resistor 4,7kOhm	Yellow-Purple-Red-Gold
R13	Resistor 5,6kOhm	Groen-Blue-Red-Gold
R14	LDR	
R15	Resistor 75kOhm	Purple-Groen-Orange-Gold
D6	Diode	1N4148
D7	Diode	1N4148
D8	Diode	1N4148
D9	Diode	1N4148
D10	Zenerdiode	4V7



To mount the resistors to the wires reversed. Then the wires through the holes of the print outlet. At the bottom of the wires may be reversed so that the resistance is pulled tightly against the print. Now the wires are soldered. After soldering, the remainder of the wire cut short.

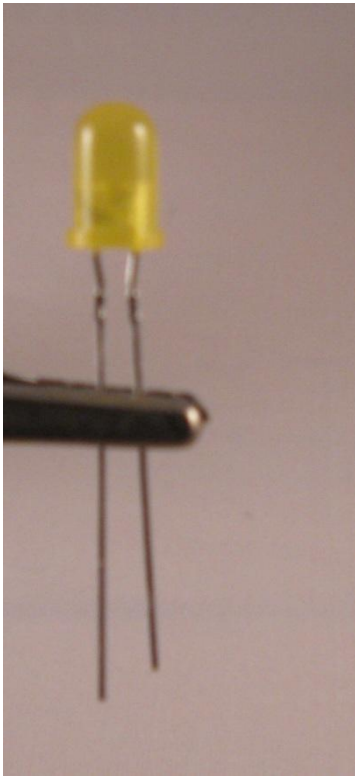
If all resistors (excluding LDR) and the diodes are mounted, one sees the whole as follows::



Warning! Diode D10, the zener diode, is reversed compared to D6, t / m D9.

Now the parts to turn higher. So D1 / D5 and C1 to turn.

All these components are polarity sensitive, so they have a positive end and a negative pole. When wrong installed the Lasergame will NOT work.



An LED housing has a flat side, short side of the connecting wires. The flat side is also indicated on the PCB. Easier to remember: the long wires of the LEDs come on the side of the top of the PCB.

D1: Blue LED in transparent colorless housing
 D2: Green LED
 D3: Red LED
 D4, D5: Yellow LED

Also, capacitor C1 has a long and a short connecting wires. The short wire connecting the negative pole, the long wire connecting the positive pole. The plus and minus are also indicated on the PCB.

Then the other (ceramic) capacitors mounted. The capacitors are equipped with a three-digit code.

The ceramic capacitors are not polarized, it does not matter how they are mounted on the PCB.

C2: 100nF code: 104
 C3: 10nF code: 103
 C5: 100nF code: 104
 C6: 100nF code: 104 Diagram = C4

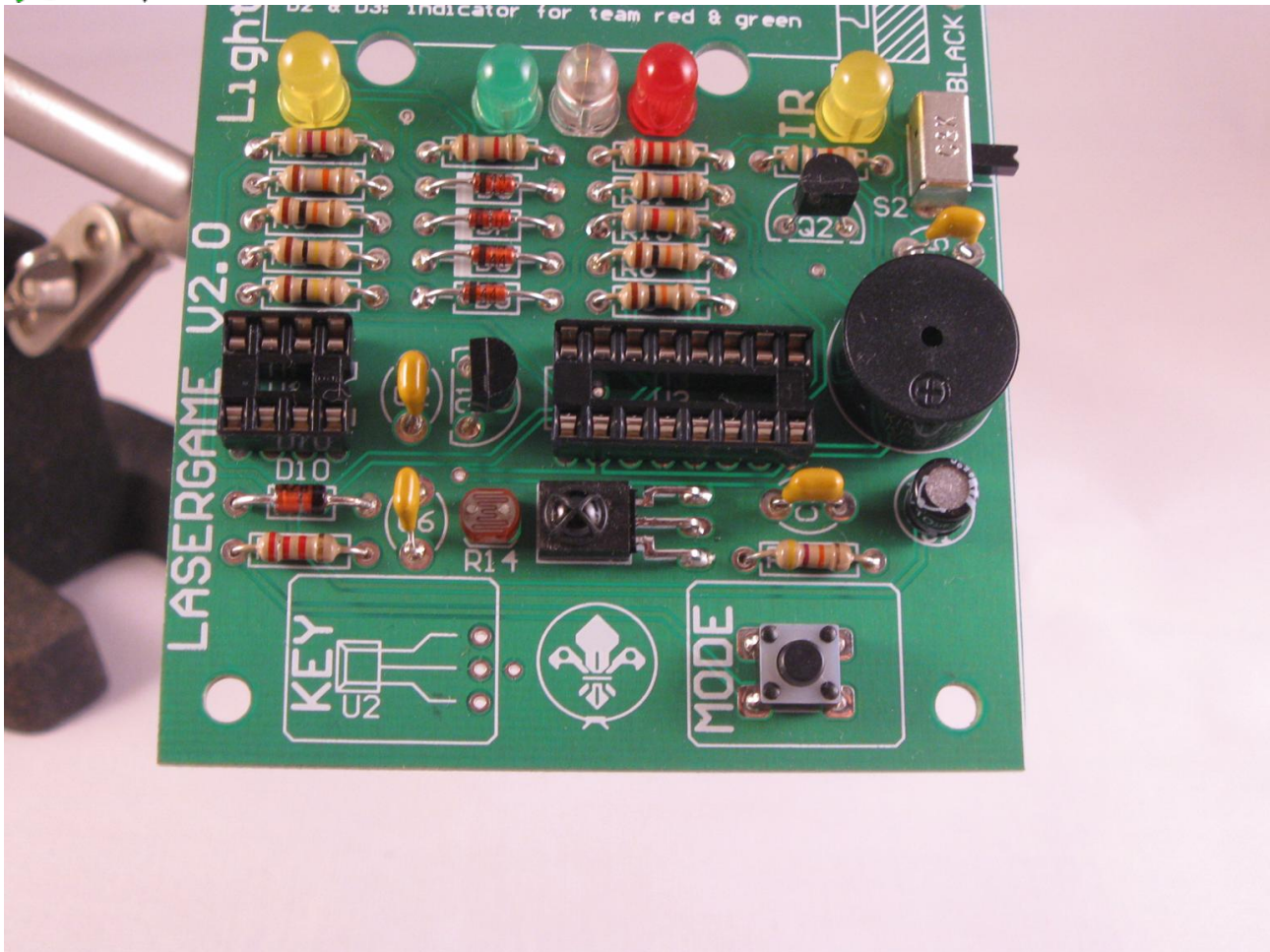
The pressure switch is in position S1. By the shape of the wires, the switch is stuck in the board. It is not necessary to bend the wires. The switch should be soldered!

After the LDR can be mounted. This comes straight from the board on the text R14.

Then the following components are installed, the two transistors. These are two different types, so take care where they were assembled. Transistors are sensitive to heat, so make sure that you do not get them too hot with the soldering iron.

The flat side of the transistor must match the print imprint. The transistors are not mounted flat against the PCB. The transistor body is at about 4 mm from the PCB (see photo)

Q1: 2N3904
 Q2: BS170



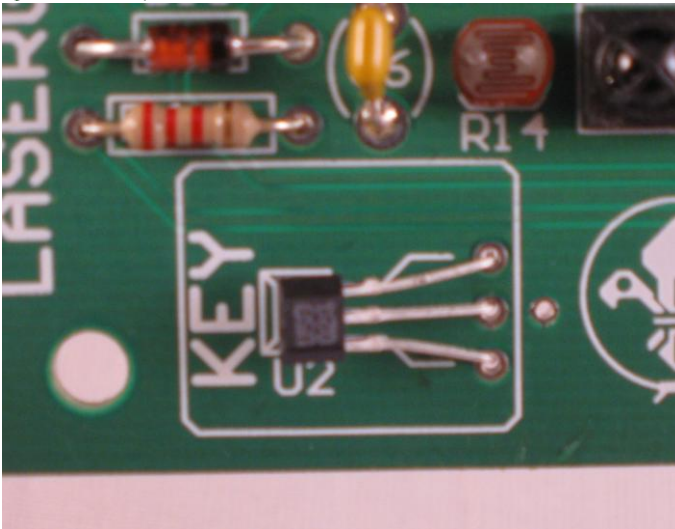
Now the buzzer / speaker LS1 mounted. Pay attention to the plus sign on the housing of the buzzer, this should match with the plus sign on the PCB.



The infrared detector (IR detector) has reference U4. The dot on the housing is the "eye" of the detector. Around 3 .. 4 mm from the housing, the legs are bent at a right angle. Use a flat nose pliers. So the detector can be mounted nicely flat to the board.

Once the wires are inserted through the holes, bent the legs so that the detector does not fall out of the board. Make sure when soldering the detector is not too hot!

Now the magnetic sensor (Hall sensor) is mounted. This falls within the box "Key" on the board and acts as a key for setting and resetting the laser game. The Hall sensor acts as an electronic switch and turns on when a magnet is held nearby.



The magnetic detector can be mounted on the component side, like all other components. But: The detector can also be mounted on the bottom (solder side) of the PCB.

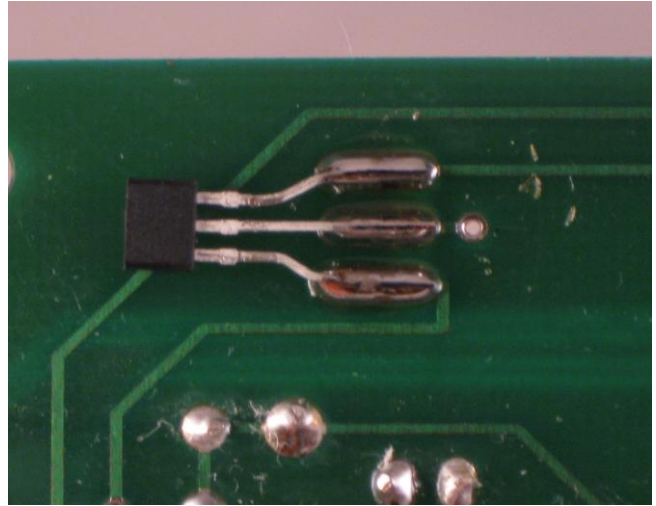
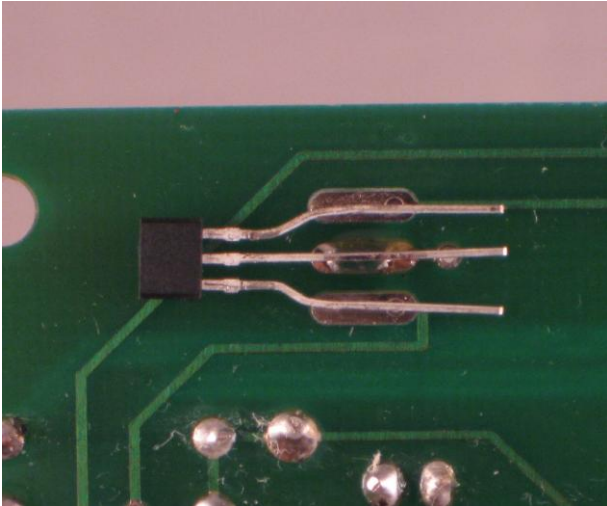
When mounted on the component side:

Bend the legs of the magnetic detector at about 5mm from the body at a right angle. Use a flat nose pliers. Note that the text-printing (U57 or U58, followed by three digits) on the sensor can be read.

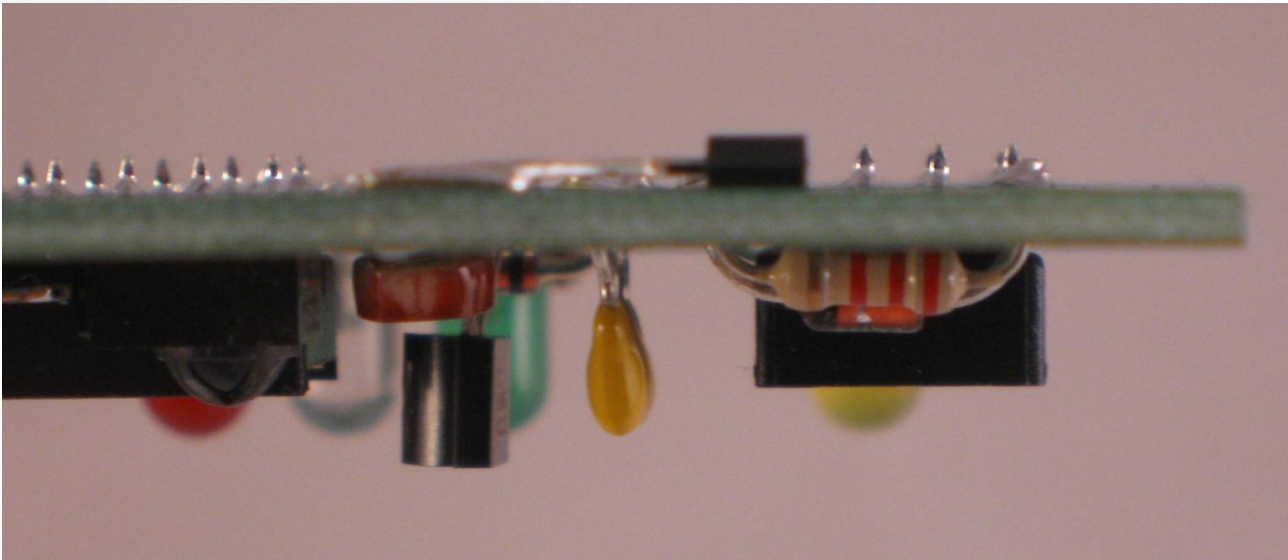
1. When mounted on the solder side:

1. Bend the outside legs as a "pendulum".
2. Do not yet cut the legs.
3. Place the sensor on the underside of the PCB so that the printed text of the sensor is not visible. Do not insert the legs through the holes.
4. Solder the middle leg onto the PCB.
5. Now cut all the legs to the correct length.
6. Solder the two outer fixed legs.

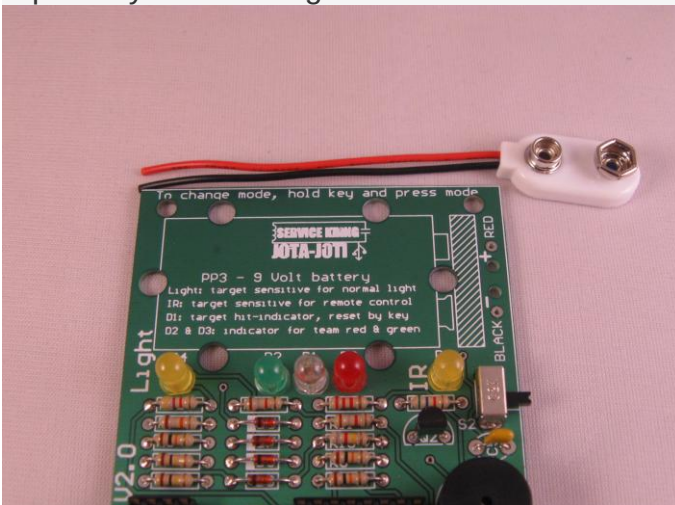




The side view of the PCB looks like this:

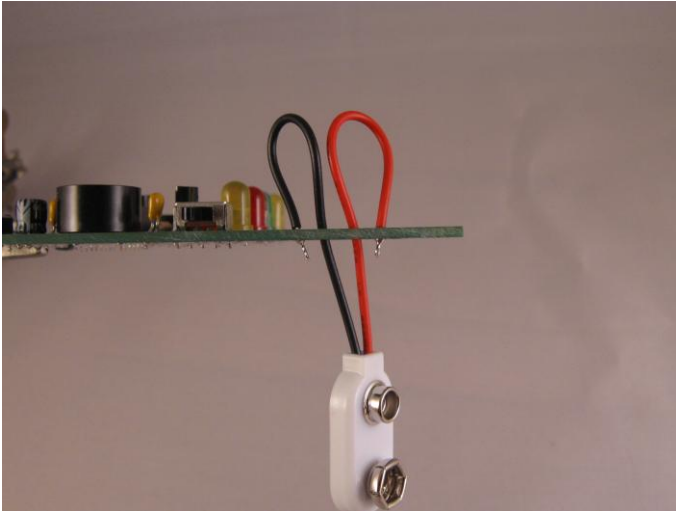


The final component that must be soldered is the battery clip. Shorten the wires from the clip so they are the length of the narrowest side of the PCB.



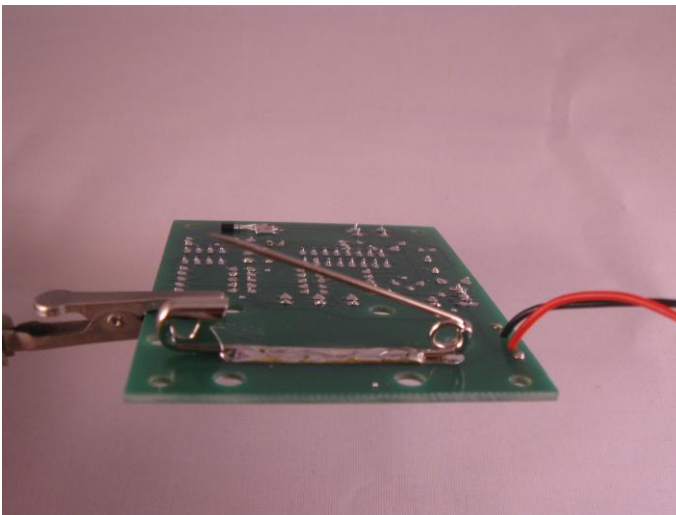
Then remove about 4mm of insulation from the red and black wire. The easiest way to do this is with a wire stripper. Twist the copper wires together and solder it with a little (!) solder.

Insert the wires from the bottom through the holes in the PCB. Insert the tinned ends then in the holes with solder islands. See photo.



The red wire is the "plus", the black wire to the "minus".

Pull the wires tightly after soldering to the PCB.

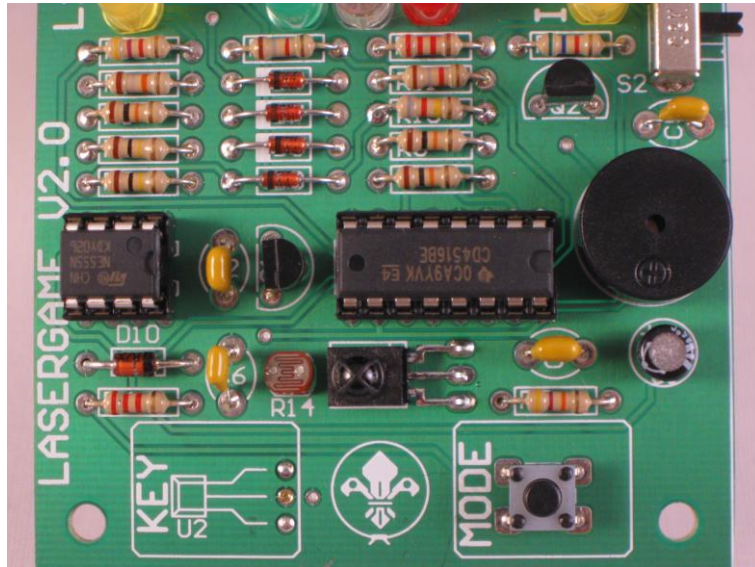


If desired, a safety pin can be mounted to the Lasergame. This allows the laser game to be pinned on the clothes. The safety pin is not necessary and is not part of the kit. The PCB has several holes through which it is possible to sew the Lasergame on a jacket or something or using a rope to hang themselves. The safety pin is not required.

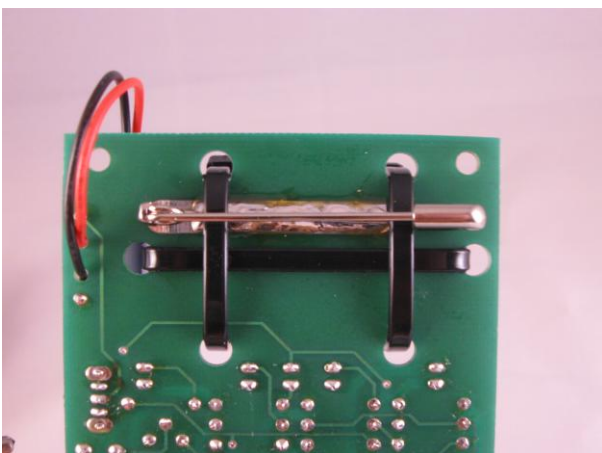
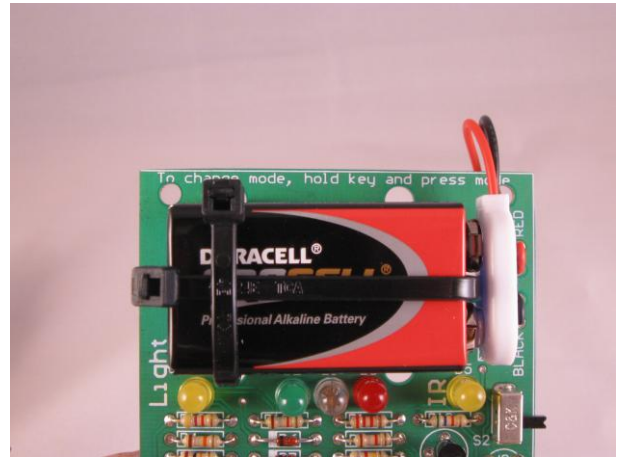
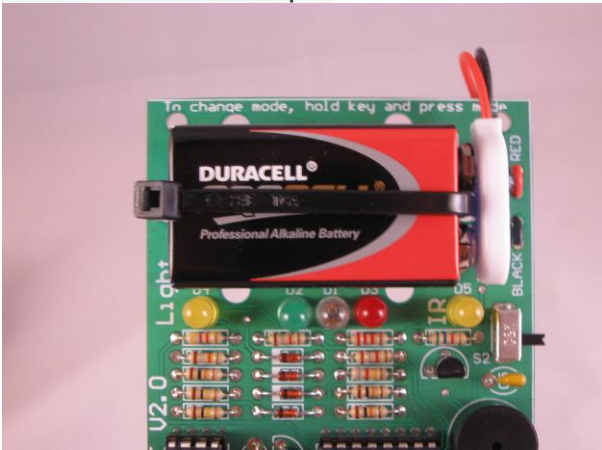
The pin can be soldered on the big solder island.

Now the soldering done. The ICs can be inserted into its socket. Note the notch in the housing. This must match the PCB imprint.

Note that when stabbing the feet of the IC, the legs are not bent double. It is probably necessary to bend them slightly toward each other before inserting the IC into the socket.



The 9V battery (not included with the kit) can be put down with three tie-wraps (as included). First strap the tie-wrap from left to right over the battery and secondly strap the 2 vertical tie-wraps.



The end result looks as good as follows:

Operation and use of the Laser Game

Turn the Laser Game ON with the slide switch.

The Laser Game begins to beep and the blue LED lights up. Reset the Lasergame by keeping a magnet on the "key". If the Laser Game is not responding try to rotate the magnet, the magnet is sensitive to the North / South pole of the magnet.

The yellow LED (D4 and D5) show where the laser game responds to. It is sensitive to visible light (flashlight) or Infrared (IR) (remote control).

The red and green LEDs can be used to refer to a team (Team Red and Team Green). These LEDs can of course be off.

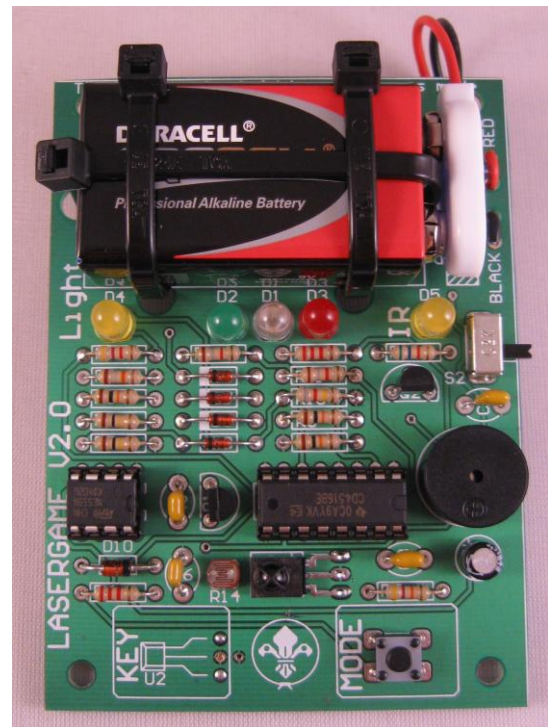
These settings can be made by the key (= magnet) at the Laser game and pressing the mode button. Only if the "key" is present the mode button works!

Green LED (D2): Team Green
Red LED (D3): Team Red

Yellow LED (D4) light: On = sensitive to visible light, out = insensitive to visible light
Yellow LED (D5), IR: On = sensitive to infrared, out = insensitive to infrared
D4 and D5 both On: Sensitive to visible light and infrared
D4 and D5 both off: Lasergame not respond to visible light, not IR = Standby

If a player is "touched", then the Laser Game beep and the blue LED lights turn On. Only with the key the Laser Game can be reset .

If a player tries to reset itself by Lasergame on / off, then the Lasergame keep beeping and is will also loose its settings.



Detector magnet / Hall sensor

If the magnetic detector is mounted wrong, then the Lasergame gives a short beep and the blue LED flashes briefly when turned on. Furthermore, the Laser Game will not respond to the "key" and therefore the mode button also will not work. Solution: The magnetic detector mounted correctly.

finishing touch

The Laser Game will mostly be used outdoors under "harsh conditions". In addition, the Laser Game will be worn on clothing. To make the Lasergame stronger for this purpose it can be completed as follows:

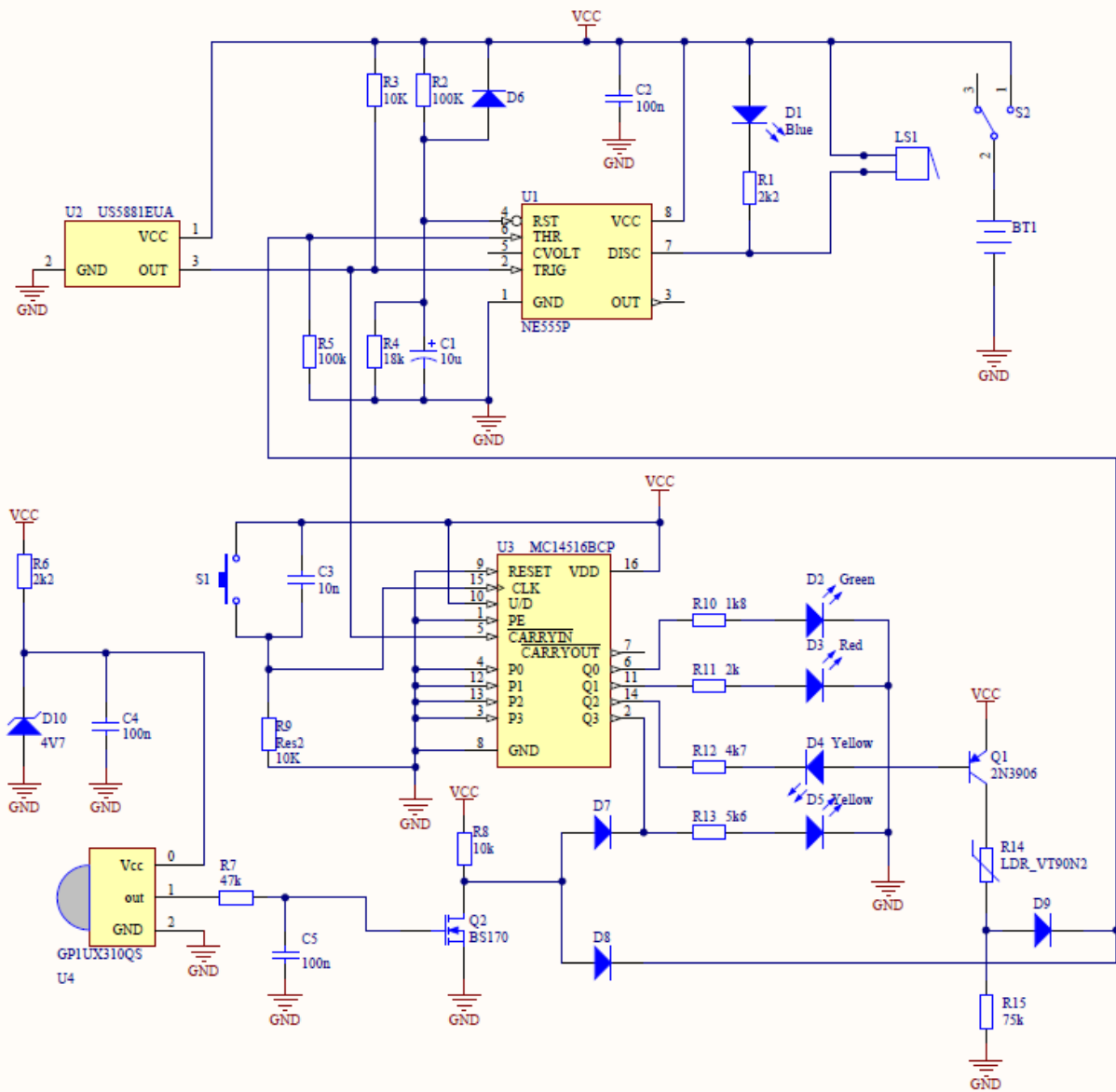
1. Mount the magnetic detector at the bottom of the board using a drop of epoxy glue.
2. The cut-off legs of the soldered parts could damage the clothing. To avoid this you can apply the underside with a foam coating. For example, use a foam tape. Paste several short strips side by side.

For the experts / hobbyists

The used LDR (R14) has a spread in the sensitivity. This one Lasergame will be more or less sensitive compared with another laser game, for visible light. (The infrared detector has no problems with that.) Through resistance R15 to variation of the sensitivity of the laser game can be adapted. Note: this needs to be done separately for each Lasergame then.

You can use a potentiometer in series with a resistor 100kOhm 47kOhm instead of R15. By setting up the lasergames at a fixed distance from a light source in a dark room you can tell if a Lasergame responding or not. To Improve sensitivity: increase the resistance. to reduce sensitivity : reduce the resistance.

Lasergames have the same sensitivity if they respond to the same distance of the light source (go into alarm).



COMPONENTEN LASERGAME V2

Referentie	Aantal per kitje	Omschrijving
R1,R6	2	2k2
R2,R5	2	100k
R3,R8,R9	3	10k
R4	1	18k
R7	1	47k
R10	1	1k8
R11	1	2k
R12	1	4k7
R13	1	5k6
R14	1	LDR VT90N2
R15	1	75k
C1	1	10uF
C2,C4,C5	3	100n
C3	1	10n
D1	1	LED blue
D2	1	LED green
D3	1	LED red
D4,D5	2	LED yellow
D6,D7,D8,D9	4	1N4148
D10	1	Zener 4v7
Q1	1	2N3906
Q2	1	BS170
U1	1	LM555/NE555
U2	1	<u>US5881 of</u>
		<u>US5781</u>
U3	1	CD4516
U4	1	IR-receiver
S1	1	Push button
S2	1	On/Off switch
LS1	1	KPEG242
BT1	1	9V clip/PP3
IC socket 8 pin	1	IC socket 8 pin
IC socket 16 pin	1	IC socket 16 pin
cable ties	3	

To change mode, hold key and press mode

