

# SimpleClock Construction Kit

## Contents:

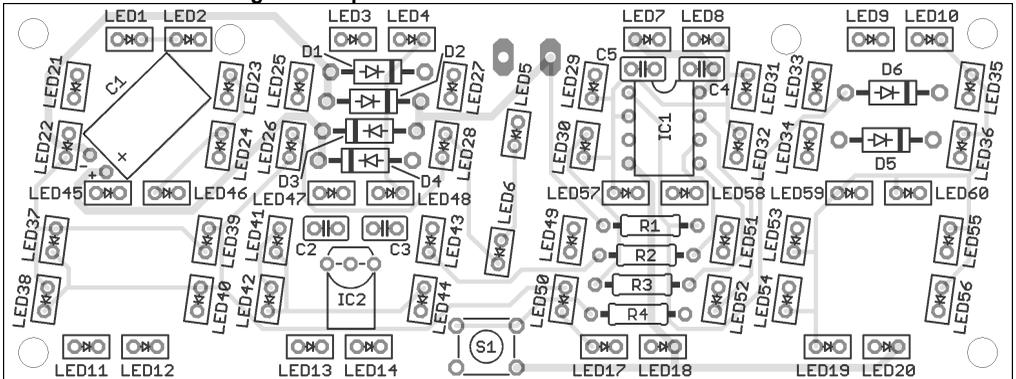
- |  |                                       |
|--|---------------------------------------|
| 1 PCB "SimpleClock Rev. 1.0"   | 1 Resistor, 1 k $\Omega$              |
| 1 Controller ATtiny13 (programmed)   | 1 Resistor, 27 k $\Omega$             |
| 60 LEDs red, rectangular, super bright<br>(Lucky Light LL-254VD1E-V1-2B, 2 spares) | 1 Ceramic Capacitor, 100 nF           |
| 6 Diodes 1N4007  | 3 Ceramic Capacitor, 100 nF           |
| 2 Resistors, 18 $\Omega$   | 1 Electrolytic Capacitor, 100 $\mu$ F |
|  | 1 Push-button, 6x6 mm, length 8 mm    |
|  | 1 Power supply with AC output         |

## General Soldering Advice

Insert the components one at a time and bend the leads outward slightly to prevent the component from falling out. Heat up the solder joint for a second before feeding some solder wire between the soldering iron's tip, the board and the component's lead. Wait for a few more seconds before removing the tip from the solder joint. Don't move the board until the solder has solidified. After soldering, trim the leads with a wire cutter to about 1-2 mm length.

See [http://mightyohm.com/files/soldercomic/FullSolderComic\\_EN.pdf](http://mightyohm.com/files/soldercomic/FullSolderComic_EN.pdf) for more detailed instructions.

## I recommended soldering the components in the order listed below.



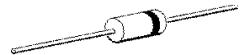
**1. Screws and spacers:** Install a spacer in each corner of the PCB. Use a screw from below the PCB to fasten it. **Make sure the components below protrude less than the spacers!**

**2. Resistors (R1~R4):** Bend the leads 90° gently before inserting them into the board. Orientation doesn't matter.

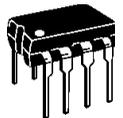
Resistor	Value	Colour Code
R1	27 k $\Omega$	red, violet, orange, gold <i>or</i> red, violet, black, red, brown
R2, R3	18 $\Omega$	brown, grey, black, gold <i>or</i> brown, grey, black, gold, brown
R4	1 k $\Omega$	brown, black, red, gold <i>or</i> brown, black, black, brown, brown



**3. Diodes (D1~D6):** Like the resistors, but the orientation is important! The white ring on the diode must match the thick line on the silkscreen outline.



**4. Microcontroller (IC1):** Insert the microcontroller into the board. The small dent in one corner must face towards the notch in the silkscreen outline. You might have to bend the pins inward slightly before it will fit. Avoid bending the pins after inserting to make it easier to remove the controller again, in case something is wrong or the firmware needs to be upgraded (e.g. to use the clock in a country with 60 Hz mains frequency).



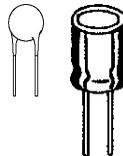
**5. Voltage Regulator:** Insert the voltage regulator, making sure the orientation of the flat side matches the silkscreen outline. Bend it down so the round side lies flat against the PCB before soldering.



**6. Capacitors (C1~C5):** The orientation is only important for C1, which is an electrolytic capacitor. The *negative* side is indicated with a printed bar containing (–) signs on the side of the capacitor, which also has the shorter lead. On the PCB, both sides are marked with small (+) and (–) signs next to the pads. Insert C1 and bend the leads 90° so it fits in the board cutout, approximately flush with the bottom side of the board. Double-check the polarity before soldering.

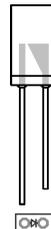
The other capacitors are ceramic and don't have a specific orientation. The value is marked in pF, using a 2 digit and exponent code (e.g. "104" =  $10 \cdot 10^4$  pF = 100'000 pF = 100 nF).

Make sure the ceramic capacitors are installed as close to the board as possible.



Capacitor	Value	Marking
C1	100 µF	100 µF (and polarity)
C2~C4	100 nF	104
C5	10 nF	103

**6. LEDs (LED1~LED14, LED17~LED60):** The orientation is important for the LEDs. The triangle symbol points toward the cathode, which is the shorter pin on the LED with the larger electrode inside the LED body. Insert all LEDs, but **don't solder them yet!** Then install the black front bezel over the LEDs and fix it with the remaining screws. Place the board on a flat surface with holes or cut-outs for the screws (or use foam), then solder the LEDs and clip the leads one-by-one. If an LED isn't flat against the board after soldering, you can push it toward the board with a finger while heating up both solder joints at the same time.



**7. Push-button (S1):** Remove the front bezel again and insert the push-button to the intended location. The push-button will fit in two orientations, both are fine.



**8. Power Supply (X1):** Cut the plug off the end of the power supply's output cable, separate the two wires for a length or approx. 2 cm and strip 2-3 mm insulation of insulation off the ends. Tin the wire ends and solder them to the two large pads on the PCB. If you want to hang the clock on a wall, route the cable as shown on the right. For other mounting options, you can also route the cable to the top or solder it to the pads on the other side of the PCB.



**9. Plug it in!** The display should show a flashing "0:00" immediately. The colon should flash at a slightly different frequency. If you see the "0:00" but the colon doesn't flash, check R1, C5 and D6. Also check that your power supply actually has an AC output. The clock uses the mains frequency as a time base, so it can't be run off DC power.

**10. Front Bezel:** If the first test was successful, remove the protective film and install the front bezel again. Angle it very slightly and start pushing the LEDs through on one side, then work your way across. Fitting the bezel will be harder if you angle it too much.

**11. Set the time:** Push and hold the push-button until only the hours are flashing. Some LEDs might glow faintly while the button is held down, this is normal. Press the button shortly several times until the hours are correct, then press and hold again until the minute-10s flash. Set the minute-10s (the minute-1s will reset to zero), advance to the minute-1s with another long press and set the minute-1s. The internal seconds counter is reset every time the minute-1s are adjusted. Finally, press and hold the button until the display stops flashing.

**12. Mount the clock.** If you want to mount the clock to a wall, you can use two nails exactly 60 mm apart. They will fit in the two unused holes on the back of the clock. The screw heads act as spacers so the solder joints don't scratch the wall.

**Questions? Problems? Comments? Ideas?** Please contact me!  
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**Project webpage:** de: <http://wiki.blinkenarea.org/index.php/SimpleClock>  
en: <http://wiki.blinkenarea.org/index.php/SimpleClockEnglish>