

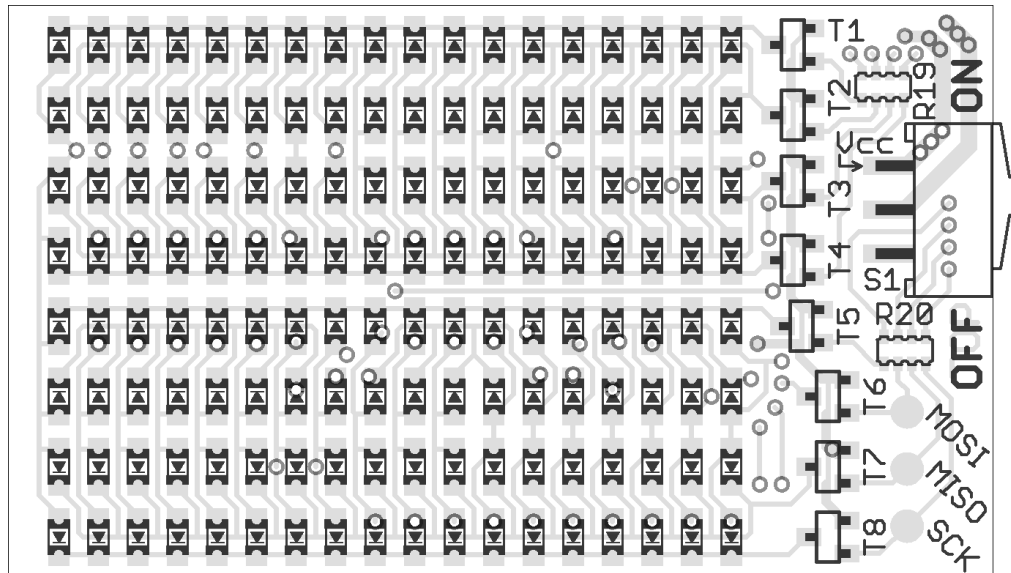
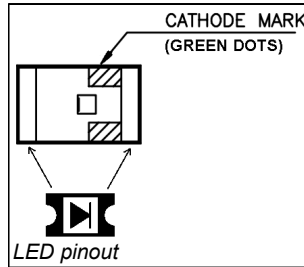
TicTacLights Construction Kit

Contents:

- | | |
|--|--|
| 1 Battery CR2032 | 1 Controller ATmega8515 (TQFP) |
| 1 PCB "TicTacLights Rev.1" | 8 MOSFETs IRLML6244 or IRLML2502 |
| 150 LEDs 0805 "APT2012SECK" (6 spares) | 2 Resistor Arrays 4x 22Ω (1206) |
| 1 Micro-SD card slot | 276 Resistors 270Ω (0805) |
| 1 Battery holder CR2032, SMD | 2 Capacitors 15pF (0805) |
| 1 Switch ESP4020 (SMD, flat) | 1 Capacitor 100nF (0805) |
| 1 Crystal, 14.7456 MHz (SMD, 5x3 mm) | 1 Tantalum Electrolytic Cap., 100μF (size D) |

SMD Soldering Advice

To solder the SMD components, tin only one of the pads, then grab the component with tweezers, re-heat the tinned pad and slide the component in sideways. When the component is aligned properly, remove the soldering iron, let the solder joint cool down and solder the rest of the pins. It is recommended to solder the components in the order listed below.



PCB top component placement

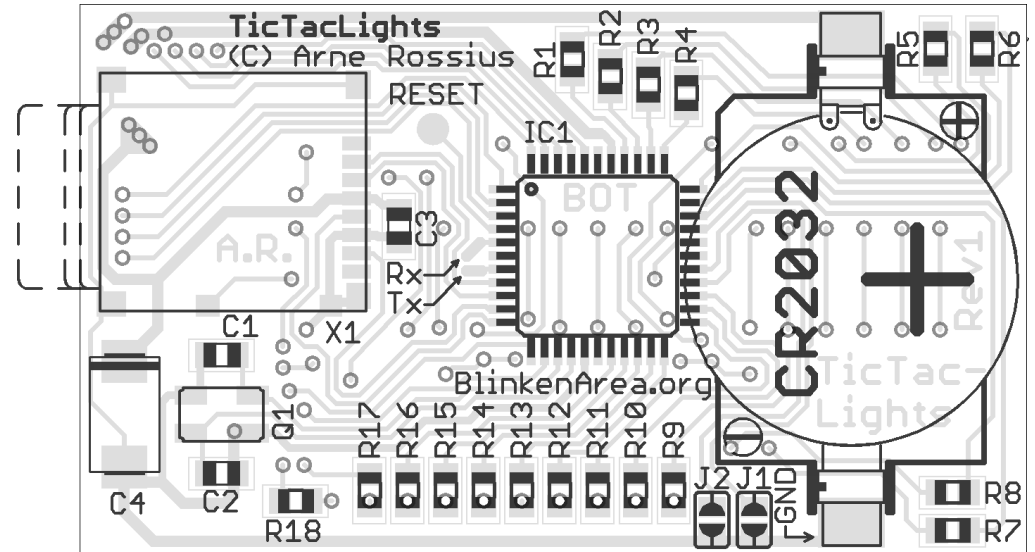
Resistor Arrays (R19, R20): Start with the resistor arrays. They are a bit fiddly to solder, make sure there are no shorts between adjacent pins. Both arrays are marked "220", orientation doesn't matter.



Transistors (T1~T8): The kit contains 8 identical transistors marked "S...." (for IRLML6244) or "G...." (for IRLML2502).

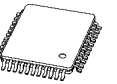


LEDs: The orientation is important for the LEDs, there are two green dots on one side (the same side the arrow on the bottom of the LEDs is pointing to). This side must face in the direction of the triangular arrow for that particular LED in the component placement image (see LED pinout drawing). Please note that the orientation changes after every two rows. If you don't want to solder all LEDs at first, you should at least complete the first row and the first column (which is enough to see if the circuit is working).



PCB bottom component placement

Microcontroller (IC1): The microcontroller comes in a TQFP package with pins on all four sides. A small dent in one corner indicates the pin 1 position and should match the position of the small circle in the top-left corner on the silkscreen outline. If you're holding the board as shown above, the text on the microcontroller should be the right way up.



Quartz Crystal (Q1): You need a fine tip and thin solder wire to solder the quartz crystal. After soldering the first pad as described above, try to heat a pad and then squeeze some solder wire between the board and the crystal. Don't use too much solder wire, or you'll end up soldering a bridge between the pad and the crystal's metal case. Use a continuity tester to check for shorts between the two non-grounded pads and the lid.



Micro-SD Card Slot (X1): The Micro-SD card slot is another component that will need a very fine tip to solder. The pads on the corners are connected to the case and require little care when soldering, but the pad next to C1 is very easy to short to the metal case. Use very little solder here and check for shorts with a continuity tester. If there is a short, the SD-Card detection will not work.



Resistors (R1-R18): All resistors have the same value of 270Ω and are marked “271” or “2700”. The orientation doesn't matter.

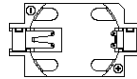


Capacitors: Only the large tantalum capacitor (100 μF) has a specific orientation, marked by the white(-ish) bar printed on the case. This bar should match the one in the component placement image. The smaller ceramic capacitors are unmarked, make sure not to mix them. The cardboard strip with two capacitors in it contains the 15 pF ones, the single capacitor strip is the 100 nF one.

Name	C1, C2	C3	C4
Value	15 pF	100 nF	100 μF
Marking	none	none	107



Battery Holder: Make sure to orient the battery holder correctly. You can go by the small “+” and “-” symbols on the holder and the silkscreen, or the arrangement of the contacts (one goes on top of the battery, the other below, as shown on the silkscreen). Use plenty of solder for the battery holder to make a good mechanical connection.



Switch (S1): Align the switch so the black part is flush with the side of the board before soldering. As with the battery holder, make sure to get a good mechanical connection between the switch and the board.



Battery: Insert the CR2032 battery with the (+) side facing away from the board.

Using the TicTacLights

After switching it on, the TicTacLights should display the TTL+ logo followed by a “Chaosknoten”. You can now insert a Micro-SD card.

MMC, SD and SDHC cards are supported with a FAT16 or FAT32 filesystem. Very small MMC and SD cards (up to 32 MB) use FAT12 and must be reformatted to FAT16 before they can be used with this kit. If there are several partitions on the card, the first primary partition with a FAT16 or FAT32 partition ID (0x04, 0x06, 0x0B, 0x0C) will be used. Some SD cards come with no partition at all, in which case a partition must be created and formatted. If your SD card isn't compatible with the TicTacLights, an error message will scroll across the LEDs.

Files on the SD card must be stored in a directory with the name `BLPLUS`. The files in that directory will be played in the order listed in the FAT (usually the order in which they were copied onto the SD card). If there is no `BLPLUS` directory, the file `BS2.BIN` in the root directory will be used instead (BlinkströmAdvanced compatible mode). If that doesn't exist either, an error message will be displayed. The supported file formats for the `BLPLUS` directory are:

File extension	Format
BIN	modified BlinkströmAdvanced file (binary, 8 grayscales)
BLM	BlinkenLights Movie (simple ASCII format, no grayscale support)
BML	Blinkenlights Markup Language (XML-based, 2 to 256 grayscales, but only 8 grayscales displayed by the TicTacLights)

More information about the file formats is available in the BlinkenArea Wiki.

Other power sources

The button cell battery has a very short lifetime in the TicTacLights, especially if it is left on for more than a few minutes at a time. When the battery voltage becomes too low, display quality will degrade and the animation will usually stop shortly thereafter. The battery might recover somewhat if the TicTacLights is turned off at this point and stays off for some time.

If you intend to operate the TicTacLights for extended periods of time, you can use a different power source. A lithium-ion rechargeable battery might be possible if a 3.3V voltage regulator is added. The circuit operates from 2.7 V to 5 V, but the maximum voltage for the SD card is 3.6 V.

Using the serial port

The TicTacLights has two pads for serial communication. The signals are TTL-level RS232, an external level converter is needed to connect it to a PC. The input level should be the same as the battery voltage. The input (“Rx” pad) can be fed with an MCUF stream which is then displayed (unless an SD card is inserted). On the output (“Tx” pad), an MCUF stream of all displayed images is available (internal images, error messages, animations from the SD card or incoming stream). The baud rate is set with the solder jumpers J1 and J2:

Baud rate	115200	57600	38400	19200
J1	open	shorted	open	shorted
J2	open	open	shorted	shorted

Programming the Controller

The kit comes with a pre-programmed controller. If you want to update the firmware or use your own, you can use the solder pads to connect an AVR ISP programmer. All pads are labelled on the silkscreen. If your programmer supplies the target with 5 V, make sure to remove the battery and the SD card before connecting the programmer. The most recent firmware is available for download from the project page in the BlinkenArea wiki (see below for URL).

Pad	MOSI	MISO	SCK	RESET	GND	Vcc
Location	top	top	top	bottom	bottom	top
Type	dedicated pad			battery holder pad		switch pad

Questions? Problems? Comments?

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Project webpage

<http://wiki.blinkenarea.org/index.php/TicTacLights>

<http://wiki.blinkenarea.org/index.php/TicTacLightsEnglish>