

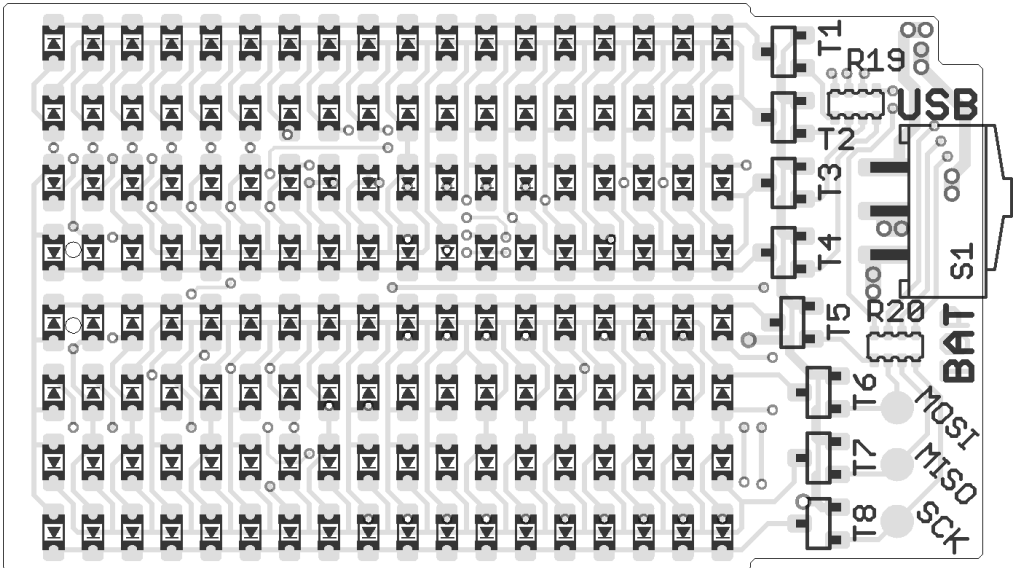
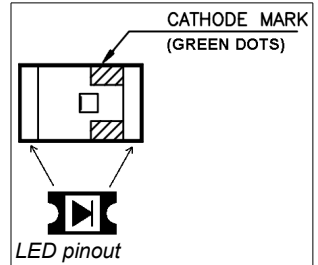
TicTacLights Construction Kit

Contents:

- 1 PCB "TicTacLights Rev. 4.0"
- 1 Microcontroller ATmega8515 (TQFP)
- 1 USB/UART converter CH340G (SOIC16)
- 1 Voltage Reg. MCP170x-3302 (SOT23)
- 8 n-Ch. MOSFETs IRLML6244/IRLML2502
- 150 LEDs 0805 "APT2012SECK" (6 spares)
- 2 Resistor Arrays 4x 22 Ω (1206)
- 18 Resistors 270 Ω (0805)
- 4 Ceramic Capacitors 12 pF/15 pF (0805)
- 3 Ceramic Capacitor 100 nF (0805)
- 3 Tantalum Capacitors, 1 μ F (size code A)
- 1 Crystal, 12 MHz (SMD, 5x3.2 mm)
- 1 Crystal, 14.7456 MHz (SMD, 5x3.2 mm)
- 1 Slide Switch ESP4020 (SMD, flat)
- 1 Micro-SD Card Slot (Molex 502774-0891)
- 1 Mini-USB-B Connector (SMD, female)

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. **I recommend soldering the components in the order listed below.**



PCB top component placement

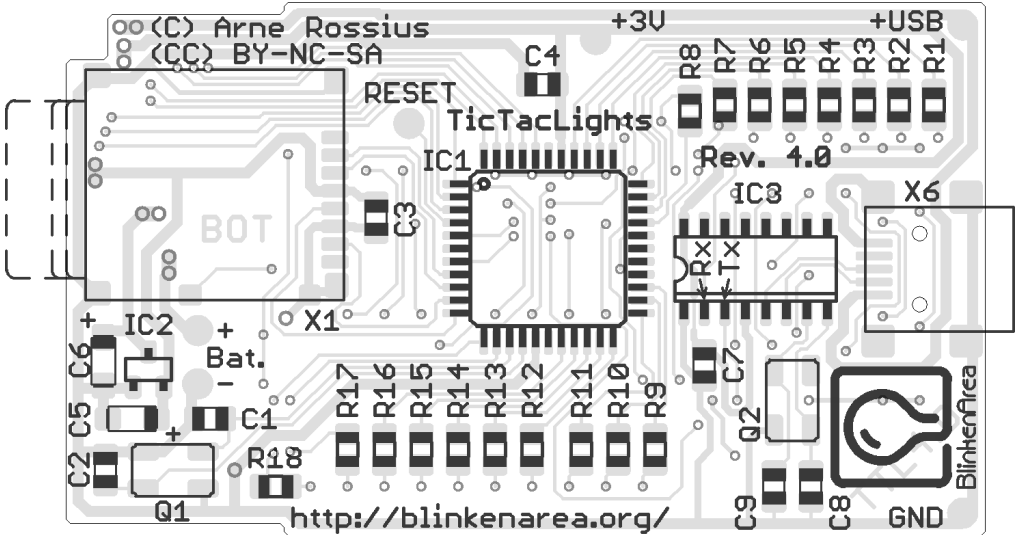
1. Resistor Arrays (R19, R20): Start with the resistor arrays. They are a bit fiddly to solder, make sure there are no shorts between adjacent pins. Both arrays are marked "220" meaning $22 \cdot 10^0 \Omega = 22 \Omega$, orientation doesn't matter.



2. Transistors (T1~T8): The kit contains 8 identical transistors marked "S...." (for IRLML6244) or "G...." (for IRLML2502). They only fit in one orientation.

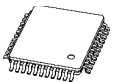


3. LEDs: The orientation is important for the LEDs, there are two green dots on one side (the same side the arrow on the bottom of the LEDs is pointing to). This side must face in the direction of the triangular arrow for that particular LED in the component placement image (see LED pinout drawing to the left). 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

4. 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.



5. Quartz Crystals (Q1, Q2): 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 lid. Use a continuity tester to check for shorts between the two non-grounded pads and the lid. Make sure you don't mix up the two frequencies, they are clearly marked on the crystal. Orientation doesn't matter.



Q1 = 14.7456 MHz	Q2 = 12 MHz
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6. 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 to the right of IC2 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.



7. Voltage Regulator (IC2): The voltage regulator IC, which looks like a transistor, is a low-dropout type with an output voltage of 3.3 V. It only fits in one orientation.



8. Resistors (R1-R18): All resistors have the same value of 270 Ω and are marked “271” ($27 \cdot 10^1 \Omega$) or “2700” ($270 \cdot 10^0 \Omega$). Orientation doesn't matter.

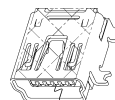


9. Capacitors: Only the large tantalum capacitor (1 μF) has a specific orientation, marked by the thick bar printed on the top. This bar must face toward the small plus sign on the PCB. The smaller ceramic capacitors are unmarked, make sure not to mix them up. The cardboard strip with *four* capacitors in it contains the 12 pF ones, the strip with *three* capacitors contains the 100 nF ones.

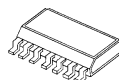
Name	C1, C2, C8, C9	C3, C4, C7	C5, C6
Value	12 pF	100 nF	1 μF
Marking	<i>none</i>	<i>none</i>	A6E or 105 ($10 \cdot 10^5 \text{ pF} = 1 \mu\text{F}$)



10. USB Connector (X6): The USB connector locks in place with the two plastic pins on the bottom side. Solder the four large pads first to secure the connector in place, then continue with the five smaller pins.



11. USB/UART Converter (IC3): The orientation for this IC is indicated by a circular dent near pin 1 on the IC. It has to face toward the notch in the silkscreen outline. Solder one corner pin first, then the diagonally opposite corner. If the IC is still aligned correctly, continue with the other pins.



12. Switch (S1): Align the switch so the black (or blue) part is flush with the edge of the board before soldering. Make sure to get a good mechanical solder connection between the switch and the board.



Power Supply

The TicTacLights can be supplied with power in three different ways:

1. USB Power: The TicTacLights is supplied with power through the Mini-USB connector. Alternatively, wires can be soldered to the “+USB” and “GND” contact points on the USB connector end of the board. The switch must be in the “USB” position to use this method, the “BAT” position may be used to switch the TicTacLights off if no battery is connected.
2. Battery: The TicTacLights is supplied from a battery connected to the two “Bat” contact points next to the voltage regulator. Suitable battery types are three 1.5 V alkaline or 1.2 V rechargeable (NiCd, NiMH) cells or a single lithium-ion cell (3.7 V). It is recommended that a connector is used so the battery can be removed for replacement or charging. The switch must be in the “BAT” position to use this method, the “USB” position may be used to switch the TicTacLights off without disconnecting the battery.
3. Any 3.0 V or 3.3 V power source (e.g. two AA or AAA alkaline cells). For this method, IC2 must be removed. Power is then supplied to the “+3V” and “GND” contact points on the bottom side of the PCB. The switch position doesn't matter for this method. Avoid lithium coin cells like CR2032, their internal resistance is too high for use with the TicTacLights.

The allowed voltage range for the first two methods is 3.6 V to 6 V. When using the third method, the voltage must be between 2.7 V and 3.6 V. USB can be used for data streaming with all three methods.

Using the TicTacLights

After turning it on, the TicTacLights should display the TTL+ logo followed by a “Chaosknoten”. You can now send an MCUF stream through the USB virtual serial port (115200 Baud) or insert a Micro-SD card. The MCUF streaming format is described at <http://wiki.blinkenarea.org/index.php/MicroControllerUnitFrameEnglish>

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. 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, or use 'fatsort' from <http://fatsort.sourceforge.net/>). 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 scroll across the LEDs. All files must be 18x8 pixels, 1 channel. The supported file formats are:

Filename extension	Format
BIN	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)
BBM	Binary BlinkenMovie (binary, 2 to 256 grayscales)

More information about the file formats: <http://wiki.blinkenarea.org/index.php/FileFormats>

Using the UART serial port

If you want to use the UART to send data rather than the USB connection, you can do that by removing IC3. The two pads for the serial connection are labeled in the silkscreen under the removed IC. The signals are 3.3 V logic-level – don't apply a 5 V signal! 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 frames (scrolling error messages included) is available. The baud rate is 115200 Baud.

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. Always use the “+3V” pad for V_{cc} . Make sure your programmer is capable of programming 3.3 V targets before connecting. The latest firmware is available for download from the BlinkenArea wiki (see below for URL).

Pad Name	MOSI	MISO	SCK	RESET	GND	+3V
Location	top			bottom		

Questions? Problems? Comments? Ideas? Please contact me:

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Project Webpage

Hardware project page: <http://wiki.blinkenarea.org/index.php/TicTacLightsEnglish>
Software project page: <http://wiki.blinkenarea.org/index.php/BlinkenPlusEnglish>