

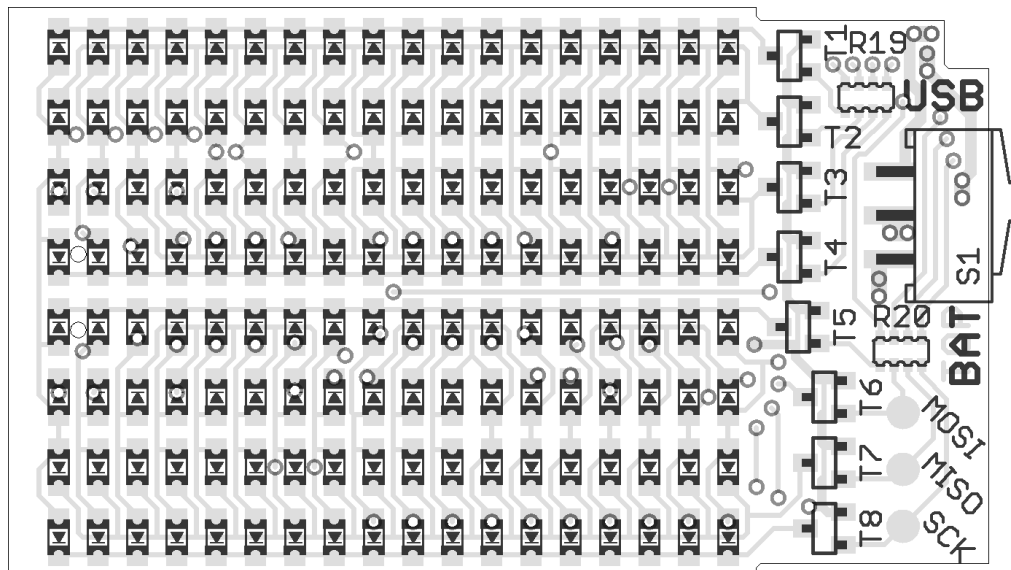
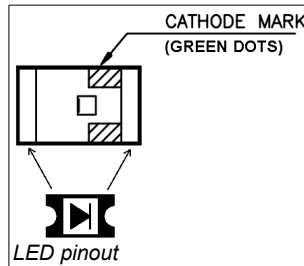
# TicTacLights Construction Kit

## Contents:

- |  |                                      |
|--|--------------------------------------|
| 1 PCB "TicTacLights Rev. 3.0"          | 1 Voltage Regulator 3.0 V (SOT23)    |
| 150 LEDs 0805 "APT2012SECK" (6 spares) | 8 MOSFETs IRLML6244 or IRLML2502     |
| 1 Micro-SD card slot                   | 2 Resistor Arrays 4x 22Ω (1206)      |
| 1 Mini-USB-B connector (SMD, female)   | 18 Resistors 270 Ω (0805)            |
| 1 Slide Switch ESP4020 (SMD, flat)     | 2 Ceramic Capacitors 12 pF (0805)    |
| 1 Crystal, 14.7456 MHz (SMD, 5x3.2 mm) | 1 Ceramic Capacitor 100 nF (0805)    |
| 1 Controller ATmega8515 (TQFP)         | 2 Tantalum Capacitors, 1 μF (size A) |

## 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.

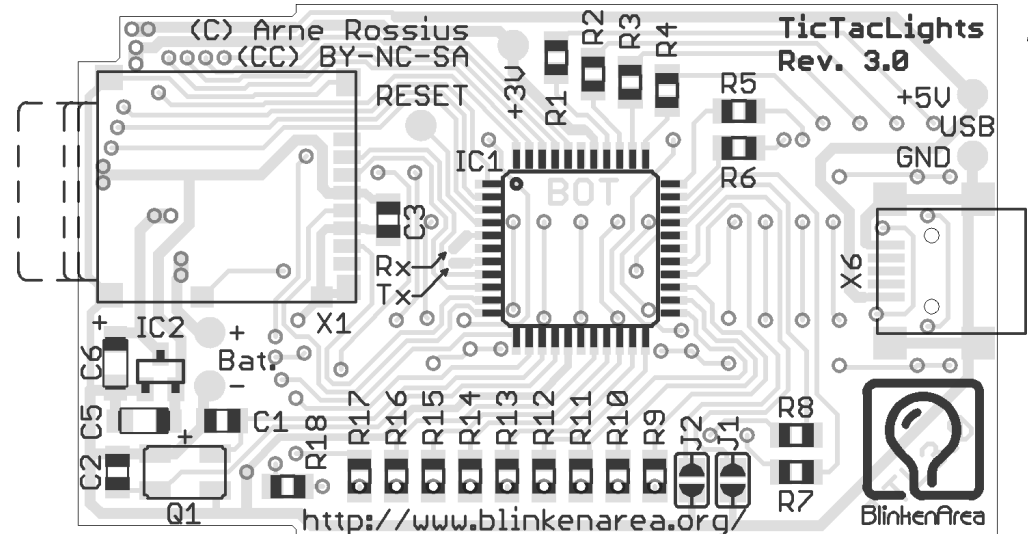


PCB top component placement

**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" meaning  $22 \cdot 10^0 \Omega = 22 \Omega$ , 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 be able to solder the quartz crystal. After soldering the first pad as described above, try to heat the other pads 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.

**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.

**Voltage Regulator (IC2):** The voltage regulator is a low-dropout type with an output voltage of 3.0 V (MCP1703T-3002EC).

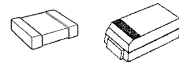


**Resistors (R1-R18):** All resistors have the same value of 270 Ω and are marked “271” ( 27·10<sup>1</sup> ) or “2700” ( 270·10<sup>0</sup> ). Orientation doesn't matter.



**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 12 pF ones, the single capacitor strip is the 100 nF one.

Name	C1, C2	C3	C5, C6
Value	12 pF	100 nF	1 μF
Marking	none	none	105 or A6E



**Switch (S1):** Align the switch so the black (or blue) part is flush with the edge of the board before soldering.



### 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, a cable can be soldered to the two “USB” contact points next to the USB connector. 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. Lithium-ion Battery: The TicTacLights is supplied from a battery connected to the two “Bat” contact points next to the voltage regulator. Since the TicTacLights can't charge the battery, it is recommended that a connector is used so the battery can be removed for charging. A suitable battery type might be replacement batteries for the Walkera “Ladybug” quadcopter. 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 power source (e.g. two AA or AAA batteries): For this method, USB and lithium-ion battery **must** be disconnected. 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.

The allowed voltage ranges are 3.3 V to 6 V for the first two methods and 2.7 V to 3.6 V (up to 5 V when no SD card is inserted) for the third method.

### 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)
BBM	Binary BlinkenMovie (binary, 2 to 256 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: <http://wiki.blinkenarea.org/index.php/DateifomateEnglish>

### Using the serial port

The TicTacLights has two pads for serial communication. The signals are 3 V logic-level RS232, an external level converter and inverter like MAX3232 is needed to connect it to a PC. 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 (error messages included) is available. 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

Also see <http://wiki.blinkenarea.org/index.php/MicroControllerUnitFrameEnglish>

### 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<sub>CC</sub>. If your programmer supplies the target with 5 V or isn't compatible with 3 V targets, make sure to remove the SD card before connecting the programmer and/or the 5 V source to the “+3V” pad. The most recent firmware is available for download from the project wiki page (see below).

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

**Questions? Problems? Comments? Suggestions?** Please contact me:

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

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