

# TicTacLights Colour Construction Kit

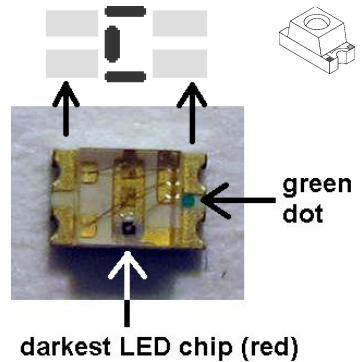
## Contents:

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| <ul style="list-style-type: none"> <li>1 PCB "TicTacLights Colour Rev. 2.0"</li> <li>1 Microcontroller ATmega162 (TQFP44)</li> <li>1 USB/UART converter CH340G (SOIC16)</li> <li>3 Shift Registers 74HC164 (TSSOP14)</li> <li>1 Voltage Reg. MCP1700T-3302 (SOT23)</li> <li>18 p-Ch. MOSFETs IRLML6402 (SOT23)</li> <li>150 LEDs RGB, SMD size 0805 (6 spares)</li> <li>5 Resistor Arrays 4x 22 <math>\Omega</math> (1206)</li> <li>11 Resistor Arrays 4x 220 <math>\Omega</math> (1206)</li> <li>1 Resistor Array 4x 1 k<math>\Omega</math> (1206)</li> </ul> | <ul style="list-style-type: none"> <li>1 Resistor Array 4x 2.2 k<math>\Omega</math> (1206)</li> <li>1 Resistor 4.7 k<math>\Omega</math> (0805)</li> <li>4 Ceramic Capacitors 12 pF/15 pF (0805)</li> <li>6 Ceramic Capacitors 100 nF (0805)</li> <li>1 Tantalum Capacitor, 1 <math>\mu</math>F (size code A)</li> <li>1 Tantalum Capacitor, 100 <math>\mu</math>F (size code C)</li> <li>1 Crystal, 12 MHz (SMD, 5x3.2 mm)</li> <li>1 Crystal, 14.7456 MHz (SMD, 5x3.2 mm)</li> <li>1 Slide Switch ESP4020 (SMD, flat)</li> <li>1 Micro-SD Card Slot (Molex 502774-0891)</li> <li>1 Mini-USB-B connector (SMD, female)</li> </ul> |
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## 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.**

**1. LEDs (top):** The orientation is important for the LEDs, they have a green dot between the pads on one side. This green dot must face away from the thick bar printed on the PCB. If you find it hard to see the green dot, you can use the position of the dark red LED chip inside the LED package (see photo to the right) or the arrow on the back (pointing toward the green dot) instead. Please note that the orientation changes after every row. See next page for placement drawing.



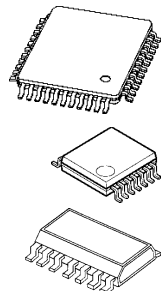
**2. Resistors (top):** These resistors are arrays of 4 resistors in one package. They are a bit fiddly to solder, make sure there are no shorts between adjacent pins. Also be careful not to put too much mechanical stress on the pins as they can tear off quite easily. Orientation doesn't matter. The marking shows the resistance as two (or three) digits mantissa and one digit exponent, e.g. "221" =  $22 \cdot 10^1 \Omega = 220 \Omega$  or "4701" =  $470 \cdot 10^1 = 4700 \Omega = 4.7 k\Omega$ .

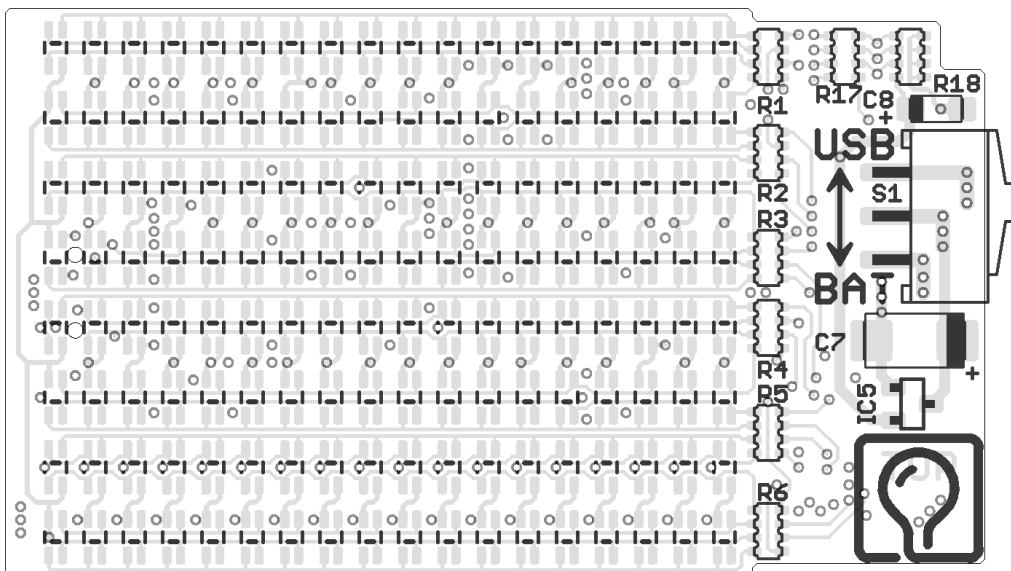
Name	R1~R6	R17	R18
Value	220 $\Omega$	1 k $\Omega$	2.2 k $\Omega$
Marking	221	102	222



**3. Integrated Circuits (top & bottom):** The orientation is important, see the description in the table.

IC1	Microcontroller ATmega162-16AU	Circular dent in one corner must match small circle on PCB silkscreen.
IC2~4	Shift Register 74HC164	Circular dent in one corner must face toward notch in silkscreen outline.
IC6	USB/UART Conv. CH340G	
IC5	Voltage Regulator (3.3 V) MCP1700T-3302E/TT	3-pin package only fits in one orientation.





PCB top component placement

**4. Resistors (bottom):** Most of these resistors are arrays, only R44 is a single resistor.

Name	R7~R11	R12~R16	R44
Value	4x 22 $\Omega$	4x 220 $\Omega$	4.7 k $\Omega$
Marking	220	221	472 or 4701



**5. Quartz Crystals (Q1, Q2, bottom):** You need a fine tip and thin solder wire to solder the quartz crystals. 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 lid. Orientation doesn't matter.

Q1 = 14.7456 MHz	Q2 = 12 MHz
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**6. Capacitors (bottom):** All capacitors on the bottom side are non-polarized ceramic capacitors, i.e. the orientation doesn't matter. The capacitors have no markings, you can only identify them by their quantity (the strip with 4 capacitors in it contains the 12 pF/15 pF ones).

Name	C1, C2, C11, C12	C3~C6, C9, C10
Value	12 pF or 15 pF	100 nF

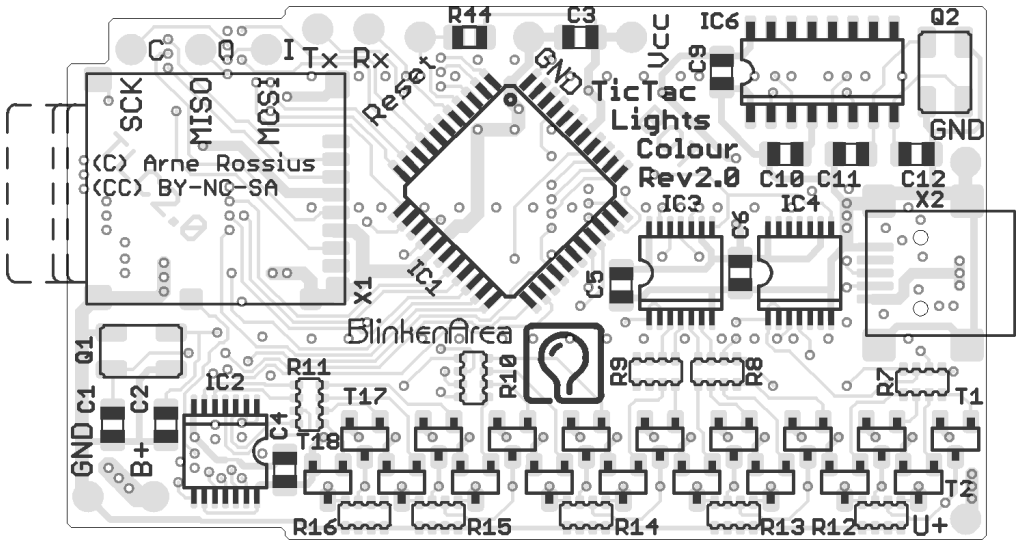


**7. Transistors (T1~T18, bottom):** The transistors only fit in one orientation. They are marked "E...." (only the first letter is important) for IRLML6402.



**8. Micro-SD Card Slot (X1, bottom):** The Micro-SD card slot also needs a 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 Q1 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.





PCB bottom component placement

**9. Capacitors (top):** The capacitors on the top side are tantalum electrolytic capacitors. This type of capacitor is polarized, which means the orientation is important. The printed bar on top of the capacitor identifies the positive side, which must face toward the small “+” sign on the PCB.

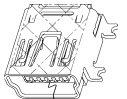
Name	C7	C8
Value	100 $\mu$ F	1 $\mu$ F
Marking	107	105 or A6E



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



**11. USB Connector (X2, bottom):** 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.



## Power Supply

The TicTacLights Colour can be supplied with power in two different ways: USB power or battery supply. The battery supply must be 5 V ( $\pm 10\%$ ) connected to the “B+” and “GND” solder pads on the bottom side of the PCB. The maximum current consumption is 250 mA. USB can be used for data streaming in both cases.

## Using the TicTacLights Colour

After switching it on, the TicTacLights Color should display the BlinkenPlus (B+) 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 Colour, an error message will scroll across the LEDs.

Files on the SD card must be stored in a directory with the name `BP18X8.RGB`. 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 `BP18X8.RGB` directory, an error message will scroll across the LEDs. All files must be 18x8 pixels, 3 channels. The supported file formats are:

Filename extension	Format
BIN	Modified BlinkströmAdvanced file (binary, 8 brightness levels per colour = 512 colours)
BLM	BlinkenLights Movie (simple ASCII format, no brightness level support: each colour can be either on or off, resulting in a total of 8 possible colours)
BML	Blinkenlights Markup Language (XML-based, 2-256 brightness levels per colour, but only 8 levels per colour displayed, i.e. 512 colours)
BBM	Blinken Binary Movie (binary format with up to 256 brightness levels per colour, but only 8 levels per colour displayed, i.e. 512 colours)

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 the USB to UART converter (IC6). You can now use the "Tx" and "Rx" solder pads with 5 V logic-level ("TTL") signals. The input ("Rx") can be fed with an MCUF stream which is then displayed (unless an SD card is inserted). On the output ("Tx"), an MCUF stream of all displayed frames (scrolling error messages included) is available. The baud rate is 115200 Baud.

### Programming the Microcontroller

The kit comes with a pre-programmed controller. If you want to update the firmware or use your own, you can use these solder pads to connect an AVR ISP programmer:

Pad Name	C	O	I	Reset	Vcc	GND
ISP Function	SCK	MISO	MOSI	Reset	+5V	Ground

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

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### Project Webpages

Hardware project page: de: <https://wiki.blinkenarea.org/index.php/TicTacLightsColour>  
 en: <https://wiki.blinkenarea.org/index.php/TicTacLightsColourEnglish>

Firmware project page: de: <https://wiki.blinkenarea.org/index.php/BlinkenPlus>  
 en: <https://wiki.blinkenarea.org/index.php/BlinkenPlusEnglish>