TicTacLights Nano Construction Kit

Contents:

2	PCBs (Main & Power/Data)
1	Microcontroller ATmega8515 (QFN)
1	USB/UART converter FT230X (QFN)
1	Charge Controller MCP73831-2 (SOT23)
1	Voltage Reg. MCP170x-3302 (SOT23)
8	n-Channel MOSFETs DMG1012T
150	LEDs 0603 "APT1608SECK" (5 spares)
2	Resistors 22 Ω (0603)
5	Resistor Arrays 4x 220 Ω (1206)
1	Resistor 4.7 kΩ (0603)
1	Resistor 10 kΩ (0603)
2	Ceramic Capacitors 12 pF/15 pF (0603)

2	Ceramic Capacitors 47 pF (0603)
2	Ceramic Capacitor 100 nF (0603)
3	Ceramic Capacitors 4.7 µF (0805)
1	Crystal, 14.7456 MHz (SMD, 3.2x2.5 mm)
1	Slide Switch MSS-1290BN (SMD, flat)
1	Micro-SD Card Slot (Molex 502774-0891)
1	Micro-USB-B Connector (SMD, female)
1	Board-to-Board Connector (Plug)
1	Board-to-Board Connector (Receptacle)
1	LiPo Battery (size 051823)
1	USB Cable, A to Micro-B
1	Stranded wire, 0.14mm²
1	Heat-shrink sleeve, Ø 1.2 mm

SMD Soldering Advice

The QFN packages have a large pad underneath which requires the use of hot air for soldering. The remaining components can be soldered with a regular soldering iron using a fine, pointy tip. Use flux (e.g. Edsyn FL 22) to facilitate soldering the fine pitch components. I **recommend soldering the components in the order listed below.**

Main PCB

1. Microcontroller (IC1): Pin 1 indicated by triangle on PCB, circle in corner on IC. When using hot air method, tin bottom pad on PCB and IC with *thin* layer of solder. Warm up PCB with hot air until solder melts, then position IC with tweezers and continue heating until IC is placed correctly (don't rely on silkscreen). Solder pins on side of IC using very fine tip by dragging solder along the sides. Alternatively, use solder paste and hot air or reflow oven.

2. Board-to-Board Connector (X2): Orientation doesn't matter. Use flux to avoid bridges between pins and run soldering iron along the ends of the pins (not on top of the pins). Avoid getting any flux or solder inside the connector.

3. USB Connector (X1): Solder the two mechanical pins on side of connector first, then the two on back of connector. Keep heating the pads after soldering to allow solder to flow underneath the connector. Use flux to solder the fine pitch pins (see above).

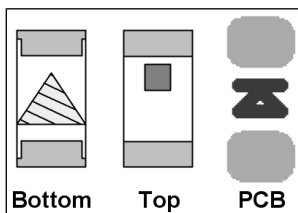**4. Quartz Crystal (Q1):** Orientation doesn't matter.

5. Resistors (R1~R5): Resistor arrays marked "221". Orientation doesn't matter.

6. Capacitors (C1~C3): Orientation doesn't matter.
C1, C2 = 12 pF. C3 = 100 nF.

7. Transistors (T1~T8): Orientation is obvious.

8. LEDs: See image to right for LED polarity. Orientation changes every two rows. Complete at least the first row and the first column (sufficient to see if circuit is working). 144 LEDs are located on the main PCB, one on the power/data PCB (bottom, to the left of the word "CHARGE").

Bottom   Top   PCB

Power/Data PCB

1. ICs (IC2~IC4): For soldering IC2, see IC1. Orientation is obvious for IC3 and IC4.

2. Switch (S1): Plastic Pins on bottom of switch lock into holes in PCB.

3. MicroSD Card Slot (X4): Solder mechanical pads in the corners first. Don't forget the two pads on the bottom side of the slot (near R6 and "Charge" LED).

4. Resistors (R6~R9): Orientation doesn't matter.
R6 = 4.7 kΩ (marked "472"). R7 = 10 kΩ (marked "103"). R8, R9 = 22 Ω (marked "220").

5. Capacitors (C4~C9): Ceramic capacitors, orientation doesn't matter.
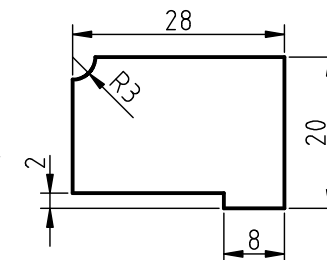C4 = 100 nF. C5, C6 = 47 pF. C7~C9 = 4.7 µF (size 0805, larger than the others).

6. Board-to-Board Connector (X3): See X2.

7. Battery: Test the TicTacLights Nano (using USB for power) before installing battery. Strip one end of red piece of wire and solder to battery. Use heatshrink to insulate the join. Orient battery so wires come out near "X4" designator on PCB. Solder black wire to "−" pad on PCB (wire must be long enough so battery doesn't overlap with cut-out in PCB). Cut red wire to needed length, strip and solder to "+" pad. **Battery wires must never touch each other!**

Assembly and Operation

Connect the two PCBs by plugging the board-to-board connectors into each other. Cut a piece of cardboard in the shape shown to the right (1:1) and insert between the power/data PCB and the battery (to protect the battery from anything pointy). Cut holes for switch and USB connector into a mini TicTac box using a sharp, pointy knife and carefully insert the stack into the box.

Power Supply

- USB power: switch must be in bottom position (toward "+" pad). Also charges battery.
- Battery power: switch must be in top position (toward "−" pad). Since the current drawn by the TicTacLights Nano can be larger than the battery charge current, the battery might still be drained even if USB is connected with the switch in this position.

Using the TicTacLights Nano

After turning it on, the TicTacLights Nano 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 format for streaming is described at http://wiki.blinkenarea.org/index.php/MicroControllerUnitFrameEnglish
MMC, SD and SDHC cards are supported with a FAT16 or FAT32 filesystem. The first primary partition with a FAT16 or FAT32 partition ID (0x04, 0x06, 0x0B, 0x0C) will be used. Files on the SD card must be stored in a directory with the name `BLPLUS` and will be played in the order listed in the FAT. If there is no `BLPLUS` directory, the file `BS2.BIN` in the root directory will be used instead. 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 BIN, BLM, BML and BBM, described at http://wiki.blinkenarea.org/index.php/FileFormats

Programming the Controller: The controller is pre-programmed. To update, connect an AVR programmer to the solder pads on main PCB. Make sure programmer supports 3.3 V targets.

Pad (Main PCB)	I	O	C	R	GND	Vcc
Programmer	MOSI	MISO	SCK	RESET	GND	V_{CC} (V_{Target})

Questions? Problems? Comments? Ideas? Please contact me:
E-Mail: arne@blinkenarea.org   XMPP: ArneRossius@jabber.ccc.de

Hardware project page: http://wiki.blinkenarea.org/index.php/TicTacLightsNanoEnglish
Firmware project page: http://wiki.blinkenarea.org/index.php/BlinkenPlusEnglish