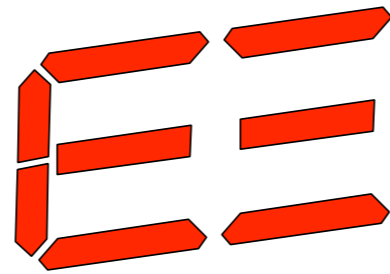


LIGHT EMITTING PEGBOARD DISPLAY PANEL KITS

AN OPEN-SOURCE HARDWARE+SOFTWARE PROJECT
DESIGNED BY



Evil Mad Scientist Laboratories

*Making the World a Better Place,
One Evil Mad Scientist at a Time*

DISTRIBUTED BY EVIL MAD SCIENCE LLC

SUPPORT: [HTTP://WWW.EVILMADSCIENTIST.COM/FORUM/](http://www.evilmadscientist.com/forum/)

KIT VERSION 1.1
MANUAL: REV. B

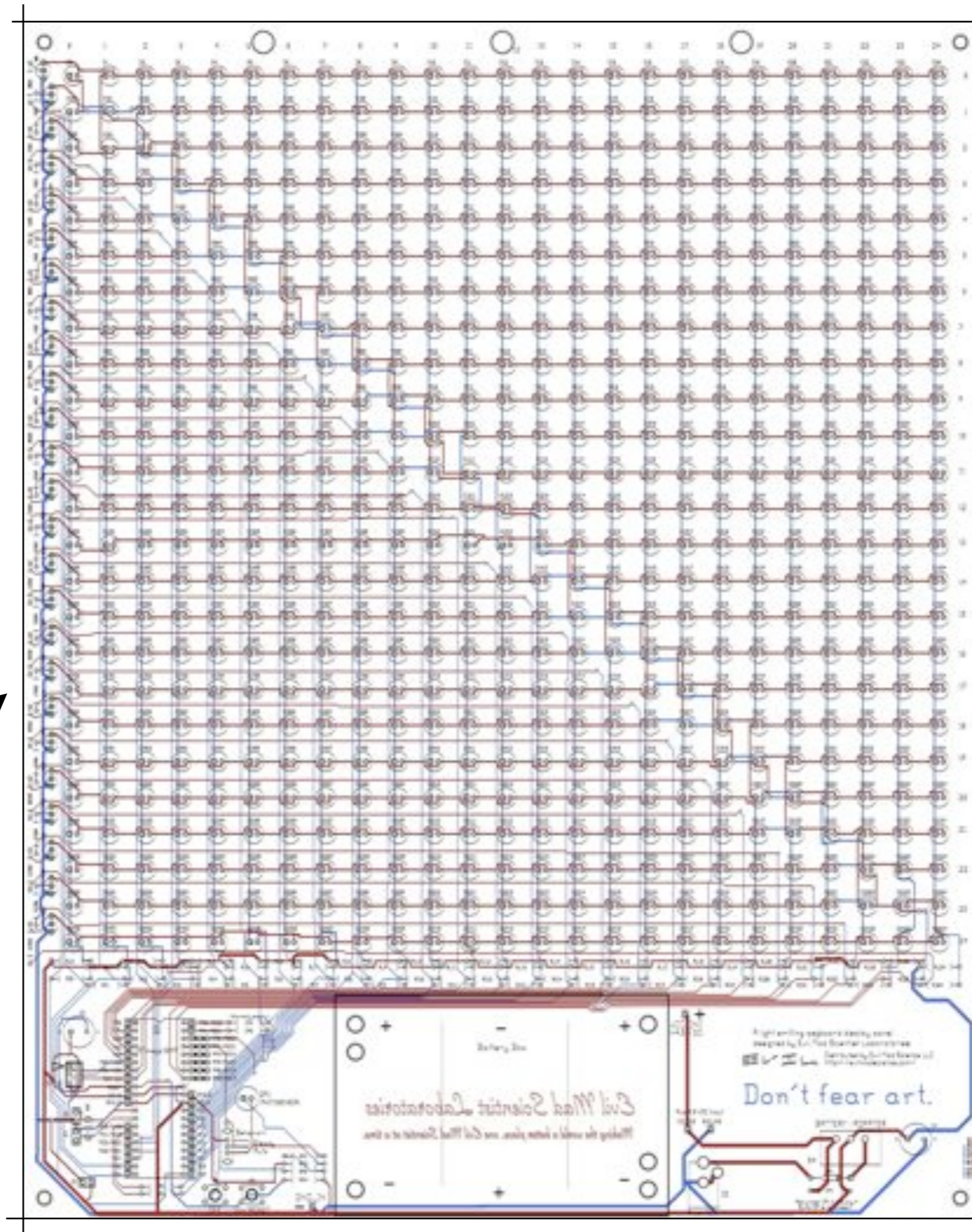
Tour

Printed circuit board:
Overall size: 12" x 15"
(30.5 x 38.1 cm)

Transistors and resistors
along left edge of LED field.

Big CPU: ATmega164,
an AVR microcontroller.

Also: light sensor, switches,
buttons, places to hack in...



Mounting holes:
4 corners for panel mounting
Top center: Hang a nail
Top 1/4, 3/4: hang a string

The 25 Rows and 25 columns are
numbered along the edges, 0-24

LED Field: Each location has room
for a 10 mm LED, although smaller
5 mm (T-1 3/4, "standard size") and
3 mm LEDs will work just as well.



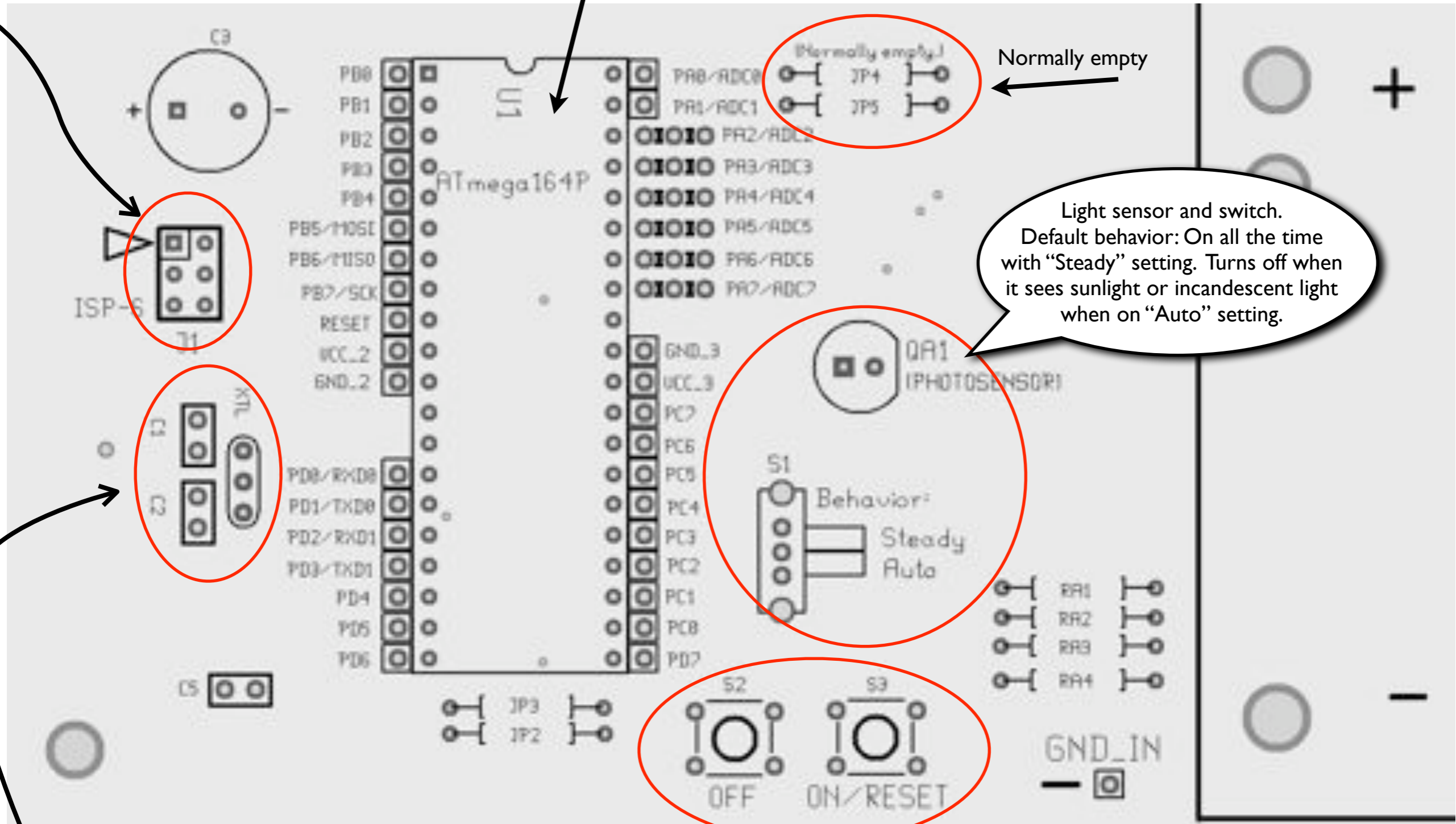
(US Quarter for scale)

Bottom center and right:
power management

Detailed tour: Lower left corner of board

Optional AVR-ISP interface: leave empty by default.
 [Fits a 6-pin DIL header--
 you'll need a programming interface too.]

U1: ATmega164P microcontroller in a 40-pin socket.
 Pay attention to the orientation. Extra holes are
 provided to access most pins directly.
 (Can also work with ATmega324P or 644P.)

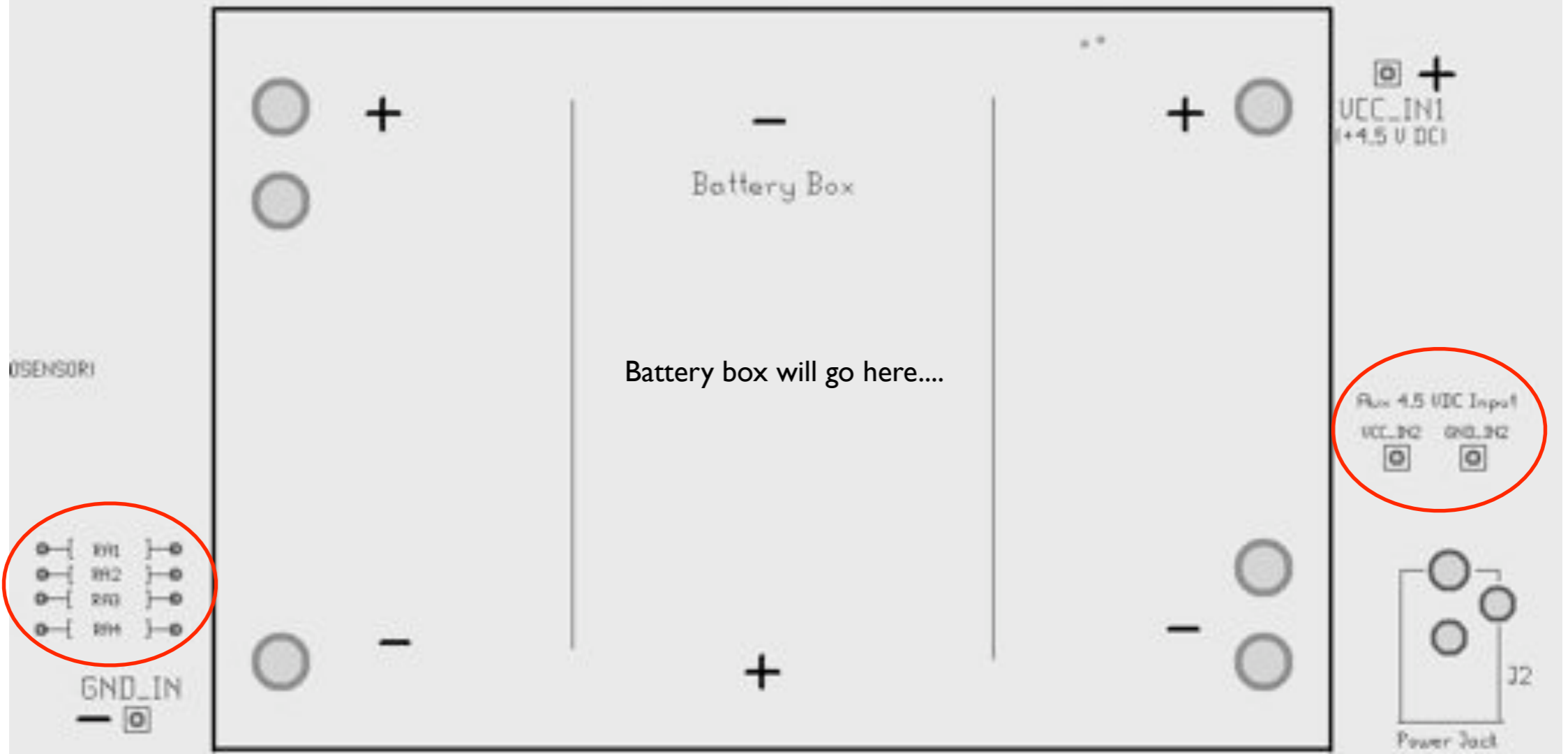
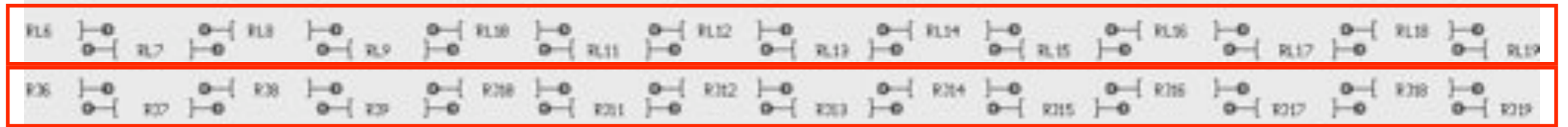


Optional clock area: leave empty by default.
 [Can use a 3-pin ceramic resonator or
 a (two-pin) low power crystal along with two caps.]

“On” button actually resets microcontroller.
 (Other functions are handled in software,
 can potentially be changed.)

Detailed Tour: Lower center of board

Two horizontal rows: possible places to put resistors;
Usually all “RL” locations are filled and all “RJ” locations are left empty



Four resistors will end up here.

Normally empty.

Optional power jack

What do you make of this?

Our standard assembly instructions, beginning on the next page, will produce a static “pegboard” display, that will light up LEDs in whichever locations you choose to install them, with near-uniform illumination.

They will be driven in an energy-efficient multiplexed arrangement and the infrared light sensor can be used to turn on the display when it gets dark.

Reprogramming the “smart” display is possible, however note that the LEDs are not individually addressable.

Hardware hackers may want to flip through the schematics (pages 13-15) before going further to see if inspiration strikes. It is, for example, *potentially* possible to reconfigure this display to produce limited, simple animations-- with additional electronics and programming. Many other hacks and mods are possible as well-- the circuit board was actually designed with hacking in mind. Places have been left to put certain extra components that you might want and holes have been added to allow direct access to the microcontroller pins.

If you do wish to reprogram the display, you will need to supply a 6-pin DIL header and an AVR hardware programmer with a 6-pin ISP interface. (We recommend the USBtinyISP by Adafruit Industries.)

Assembly: First steps

1. Add resistors RA1, RA3, RA4

5.1 k resistors (Green-Brown-Red-Gold), installed in 3 places.

Implied procedure for components like this:

- Bend the leads of a resistor as shown
- Place it in the circuit board, at its location
- Solder the two pins from the back side
- Clip off extra leads on back side.



2. Add resistors RA2, RB0-RB24

1.0 k resistor (Brown-Black-Red-Gold), installed in 26 places.

RB0-RB24 are located along the *left side* of the circuit board.
Note: Be careful to avoid making solder bridges between the pins.

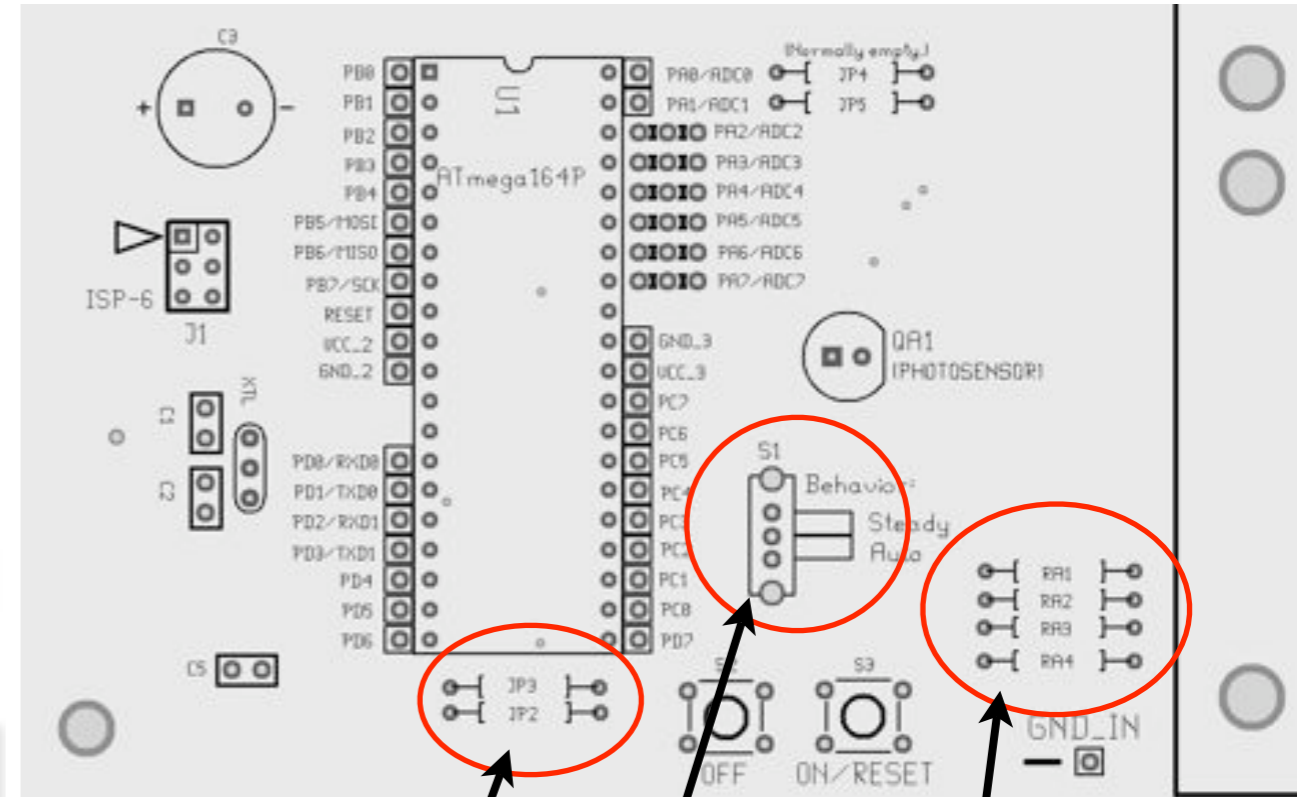
3. Add wire jumpers JP2, JP3

Jumpers are Zero-ohm resistors (One black stripe), installed in 2 places.

4. Add slider switch S1

Match the part to the white outline drawing on the circuit board.
Solder all five pins.

(Lower left corner of printed circuit board)



JP2, JP3

S1

RA1 - RA4

Assembly: More stuff to solder

5. Install socket for U1

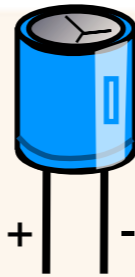
A 40-pin DIP socket.

Orientation matters. Match the half-moon shape at one end of the socket to the one drawn on the circuit board. Solder it in place. (Same for chip, later.)

6. Install capacitor C3

1000 uF electrolytic cap

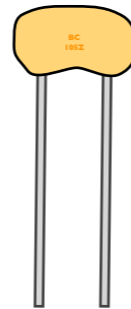
Orientation matters. The NEGATIVE side of the capacitor is marked with a broad white stripe. Solder it with this negative side towards "-" on the circuit board.



7. Install capacitor C5

1 uF ceramic cap (Orientation: Either way.)

Capacitor C5

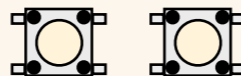


8. Add tactile button switches S2 and S3

Match the parts to the drawing on the circuit board.

Orientation: pins stick out on left and right sides, not top and bottom.

Solder all four pins of each switch.

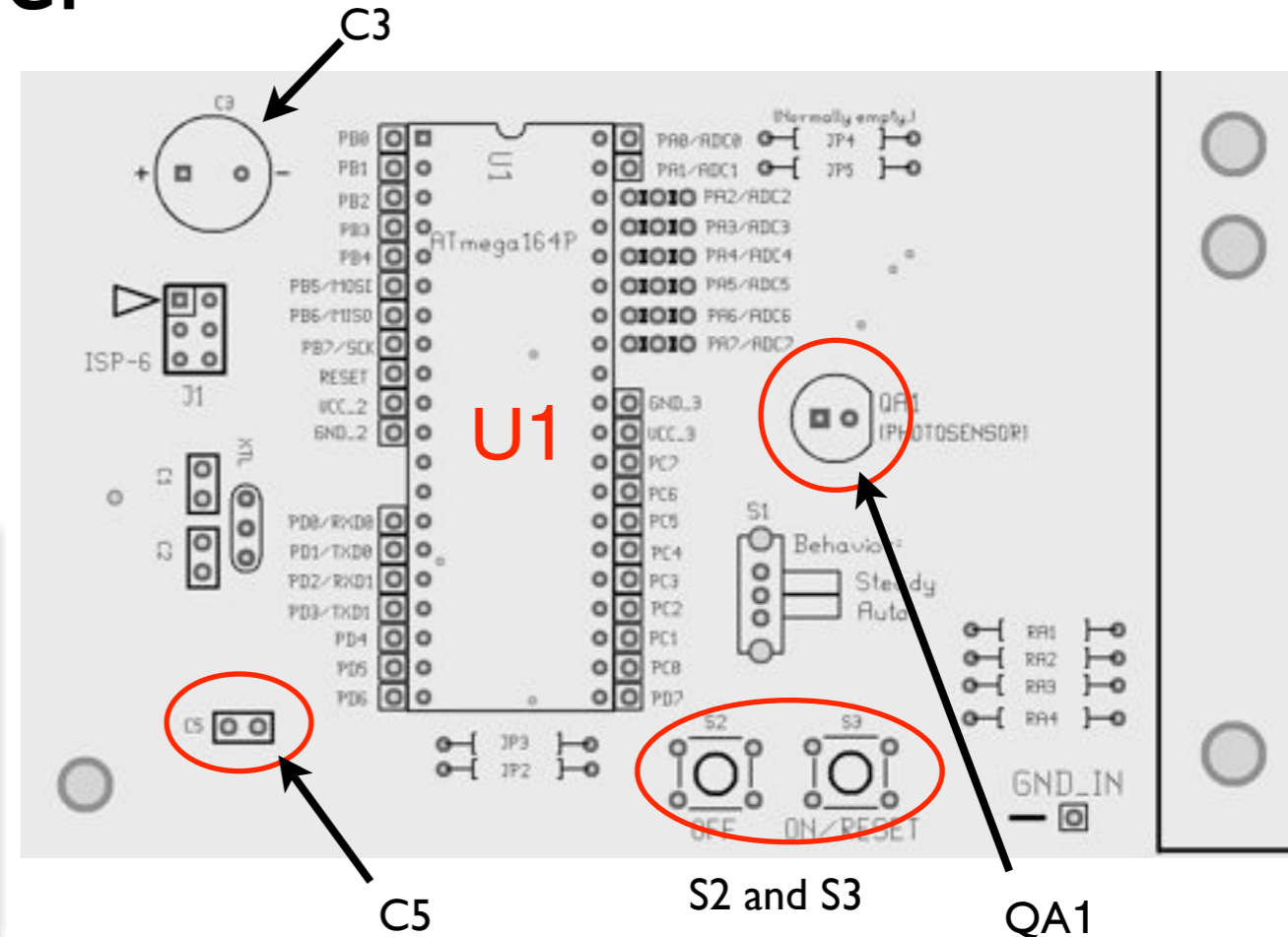
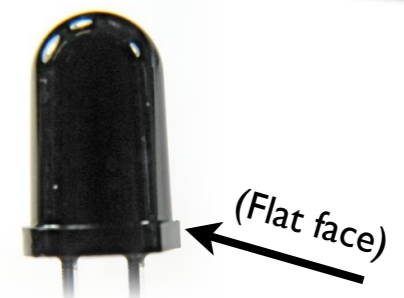


9. Install phototransistor QA1

LTR-3208E, infrared sensor with dark lens

Orientation matters. Long lead goes in the square hole. The flat face of the sensor lines up with the outline drawing.

Phototransistor QA1



Assembly: Resistors & Transistors, oh my!

10. Add resistors RL0- RL25

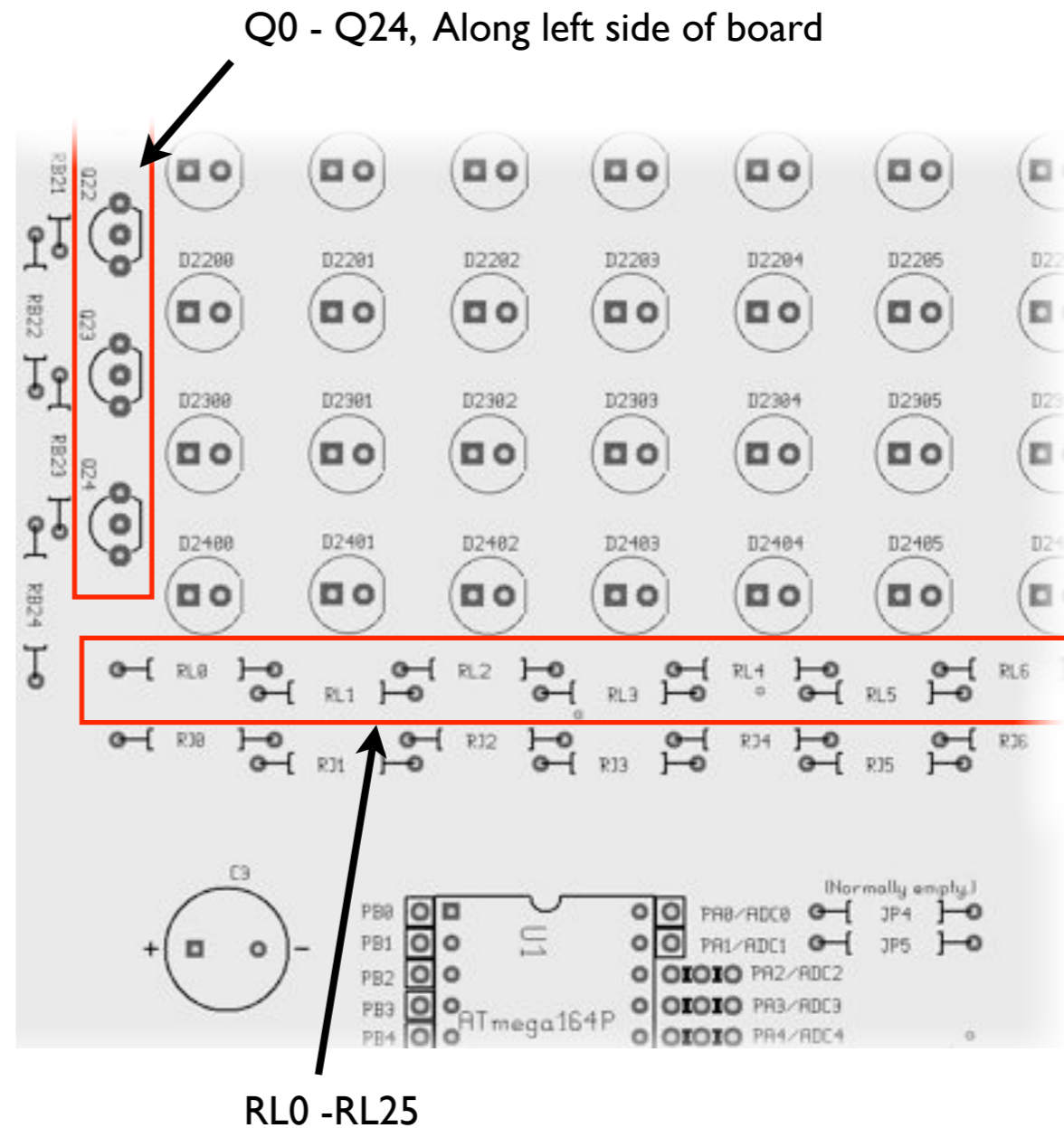
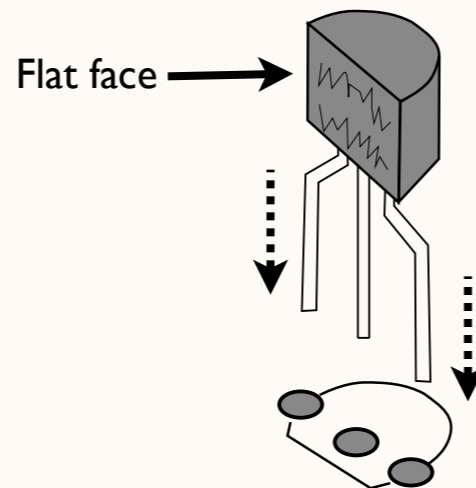
75 ohm resistor (Violet-Green-Black-Gold), installed in 26 places.

RL0-RL25 are in a wavy row at the bottom of the LED field.

Note: RJ0-RJ25 should be left empty.

11. Add transistors Q0-Q24, 2N4401 NPN transistors, installed in 25 places.

Orientation matters. Match the flat face of the transistors to the drawing on the board.

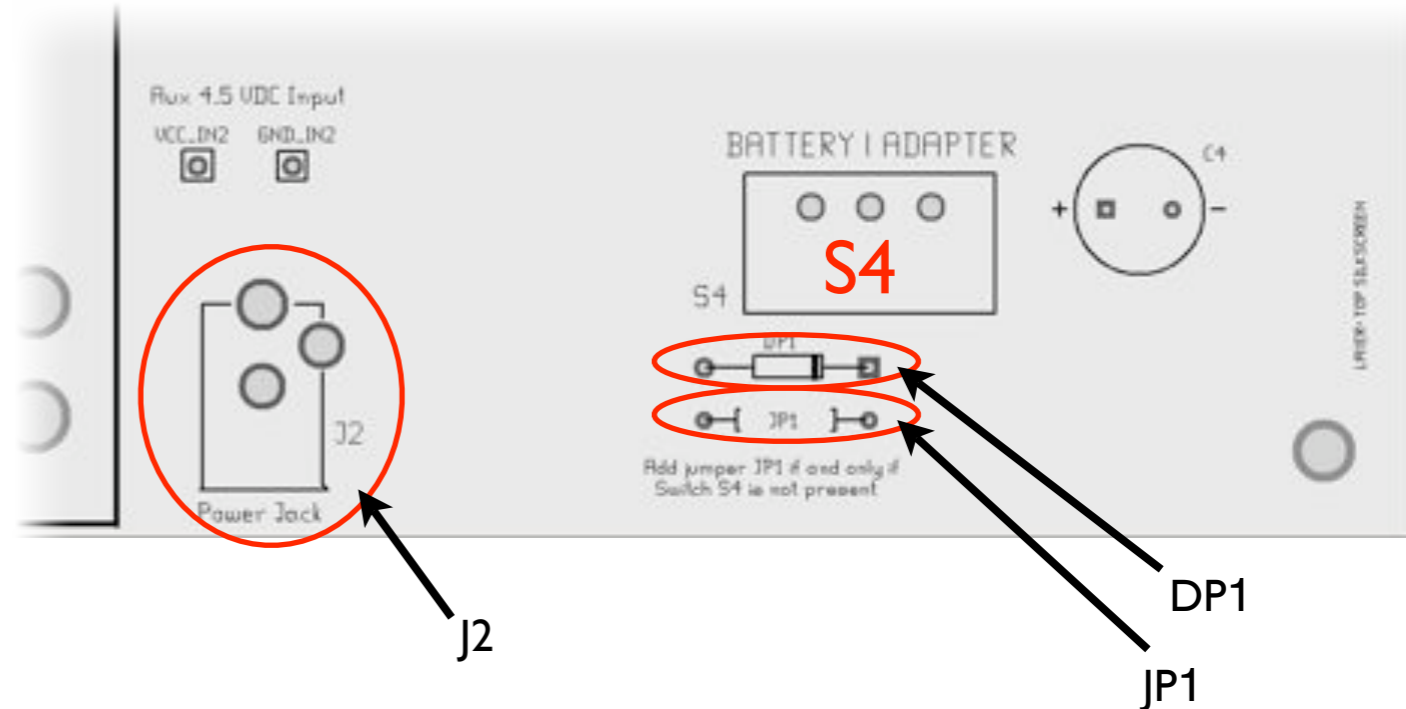


Assembly: Power supply details

(Lower right corner of printed circuit board)

Procedure depends on the type of ac adapter (if any) that you are using:

	Battery Only (4.5 V DC)	US/Canada Power supply (4.5 V DC)	International Power supply (5 V DC)
Jumper JP1	Install	Empty	Empty
Power Jack J2	Empty	Install	Install
Power source switch S4	Empty	Install	Install
Diode DPI	Empty	Use wire jumper	Use Schottky diode
Can still run on battery	No. (Just kidding!)	Yes	Yes



12. (Battery only)

Install a wire jumper (Zero-ohm resistor) in location JP1.

J2, S4, and DPI are left empty.

12. (US/Canada 4.5 V power supply)

Install power jack J2, Switch S4 and Install wire jumper (Zero-ohm resistor) in location DPI.

Location JP1 is left empty.

12. (International 5 V power supply)

Install power jack J2, Switch S4 and Install Schottky diode in location DPI.

Location JP1 is left empty.

(Adding your own external power? Make sure it's well regulated, protected, and capable of at least 600 mA.)

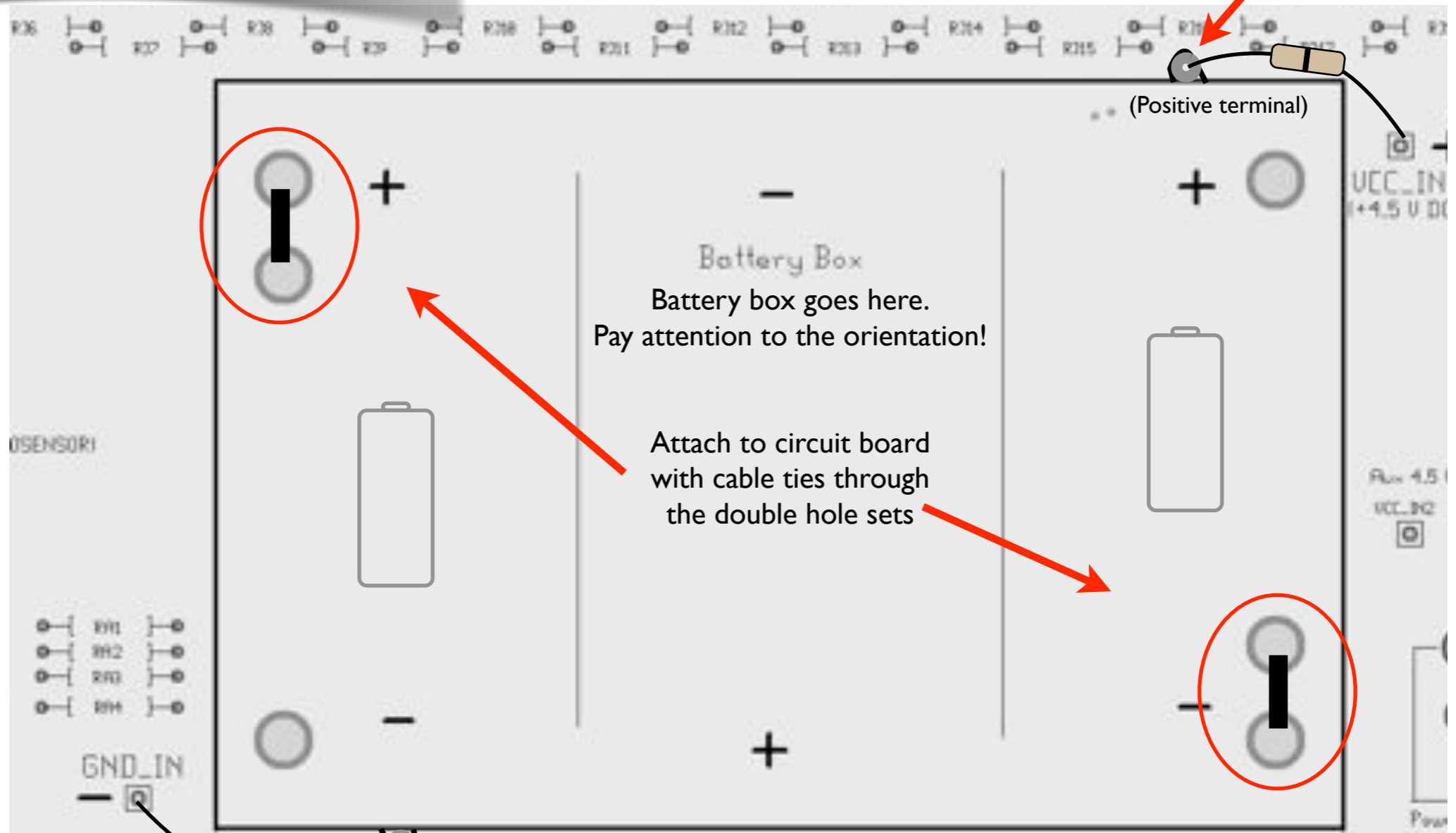
Install Battery Box

13. Add battery box

Held in place with cable ties, wired up with a pair of wire jumpers.

(Note: If you have an alternate power source, e.g., you plan to run from an AC adapter all the time, you *can* skip this step without ill effect.)

“Solder lug” at positive terminal of battery box



Battery box goes here.
Pay attention to the orientation!

Attach to circuit board
with cable ties through
the double hole sets

“Solder lug” at negative
terminal of battery box

Add a zero-ohm jumper from
the solder lug to the
GND_IN pin on the board.

Then, repeat for the positive
terminal of the battery box,
hooking up to VCC_IN1.

Note: when soldering to the two solder lugs, be quick-- the plastic of the battery box can melt if you aren't careful.

Assembly: Adding Chip & LEDs

14. Add microcontroller UI

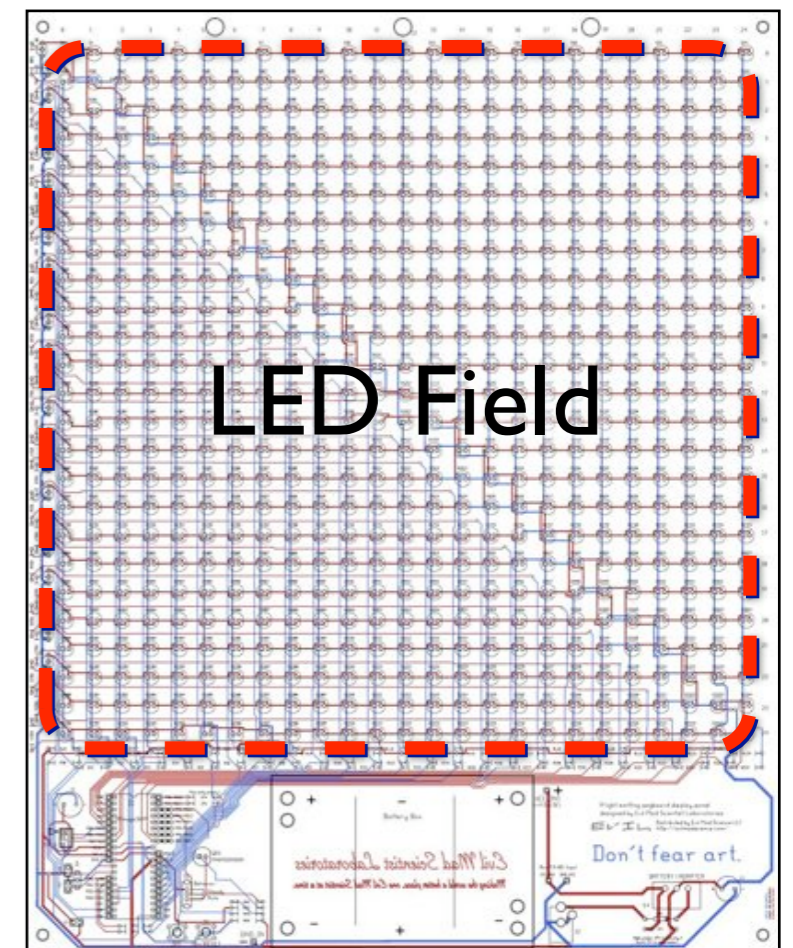
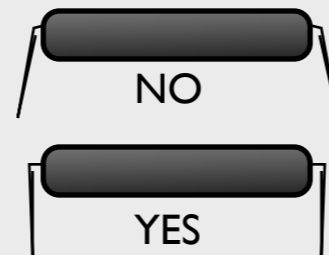
The ATmega164P chip goes in the 40-pin socket from step 5.

Pay attention to the orientation!

If necessary, bend the leads of the chip to straight up and down before inserting the chip into the socket. Do not bend them by hand; bend all pins on one side at a time by pushing them against a hard flat surface.

The chip goes into the socket with firm, even pressure.

From end of chip:



15. Add LEDs to the LED field.

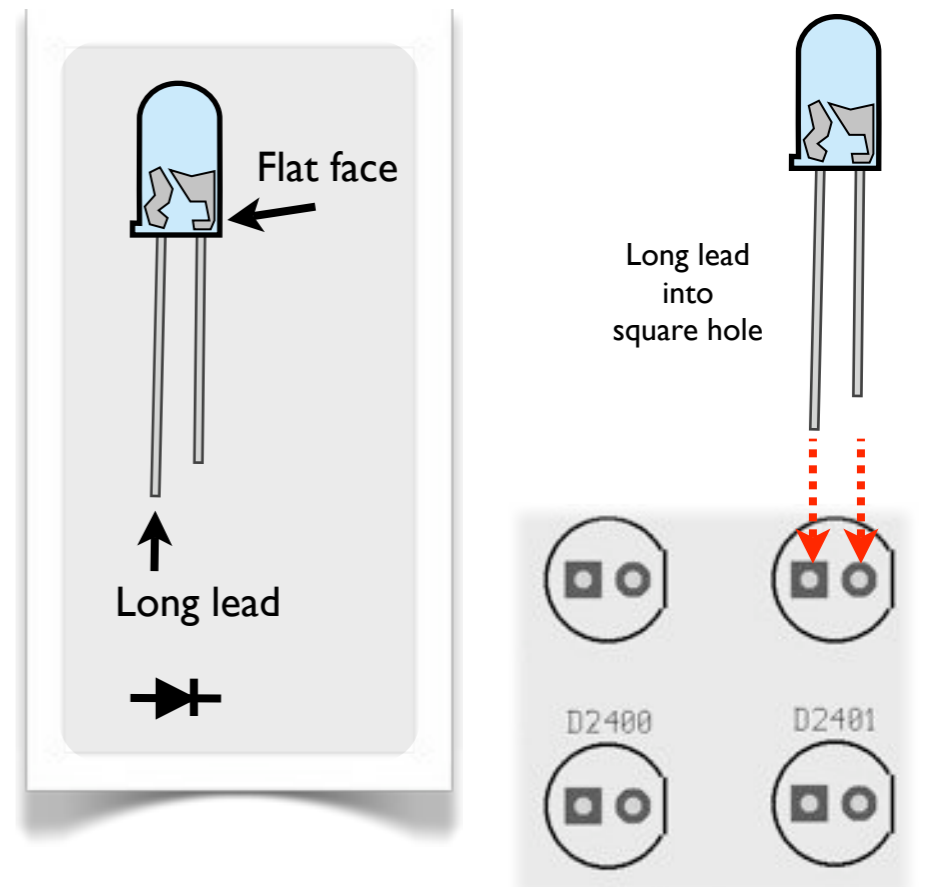
The board accommodates up to 625 LEDs in standard sizes up to 10 mm. 3 mm, 5 mm, and 8 mm LEDs will work just fine. Put them where you like, or everywhere.

For standard types of LEDs, the long lead goes in the square hole (the one on the left), and the flat face of the LED package matches the drawing on the circuit board.

It is recommended that only blue, green, white, and purple LEDs be used-- some resistors may need to be adjusted if you wish to use other LED colors instead. Mixing red/orange/yellow with blue/green/white types does not generally work well.

For reference, each LED location is labeled DXXYY, where XX is the row number and YY is the column number. If you do not fill all the holes and wish to blacken the unused labels, a black permanent marker works well.

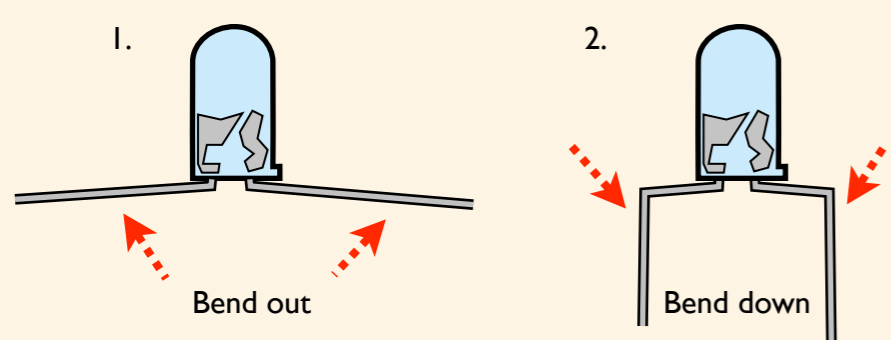
See additional notes on following page.



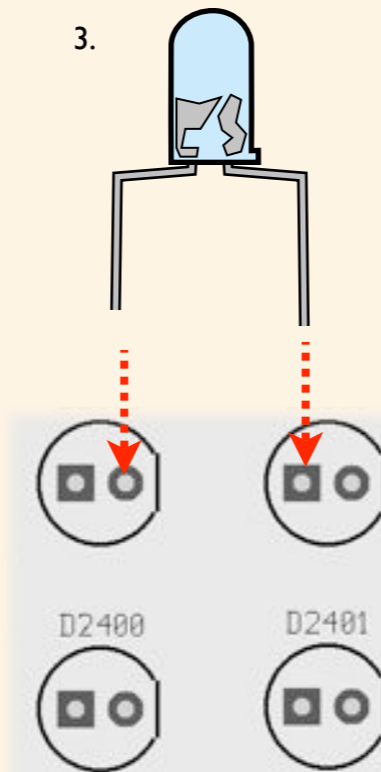
LED placement tricks

Alternative build idea #1: put all the LEDs on the back side of the circuit board. In this case, the long lead *still* goes in the square hole.

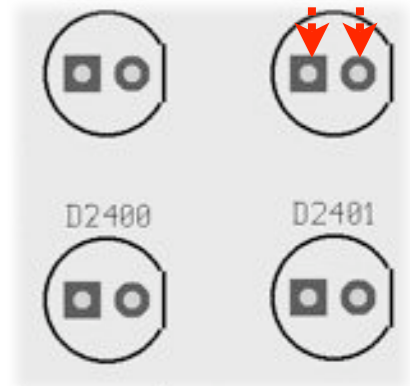
When the grid really won't do, the LEDs *can* go between grid locations!



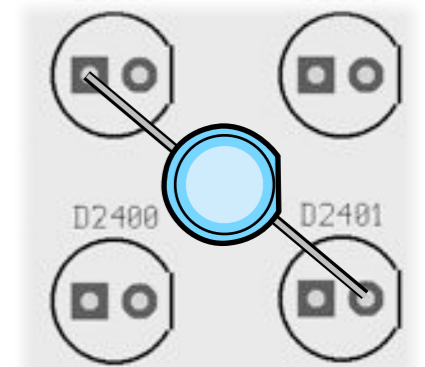
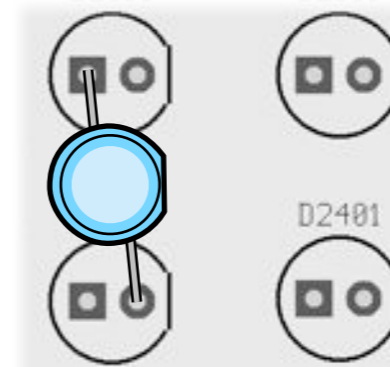
For all variations:
Side of LED with long lead *still* goes to square hole.
Side with flat still goes to round hole.



Normal:
Long lead into
square hole



And so forth...



Wrapping it up!

Last step: Add the rubber feet

Attach one rubber foot in each corner on the back side of the circuit board-- make sure that the circuit board lies flat on these bumpers, not on wire leads.

These will help to avoid accidental short circuits, as well as protect your wall if you hang it up by a hook or string.

An open-source project

The hardware and software designs used in this project are being released under an open-source license. For more information, please see:

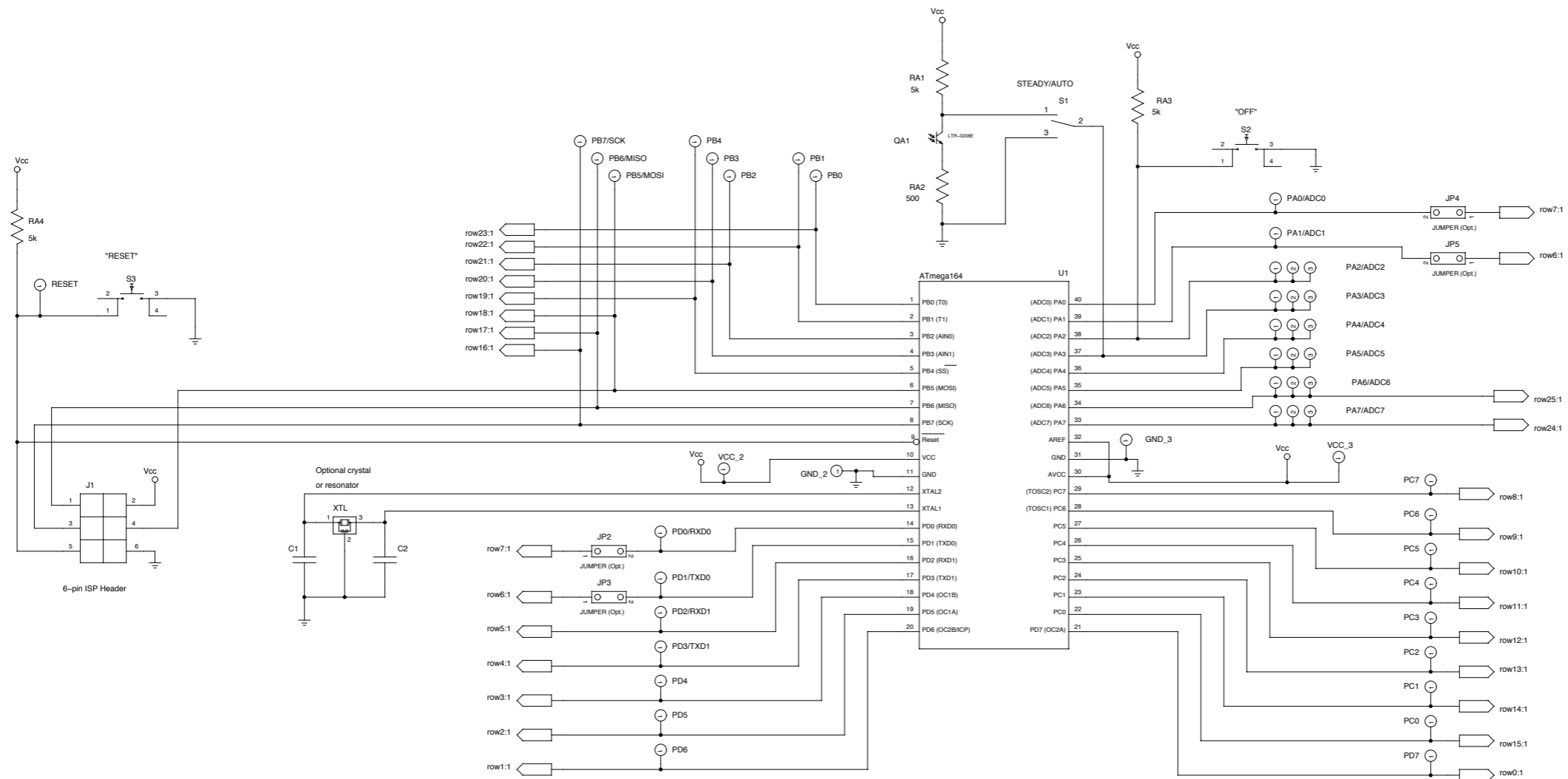
<http://www.evilmadscientist.com/article.php/peggy>

The firmware is written in AVR-GCC, and we'd love to see what you can do with it!

Got pictures?

If you have interesting pictures of things built using this kit or the hardware or software designs, we'd love to see them in the Evil Mad Science Auxiliary:

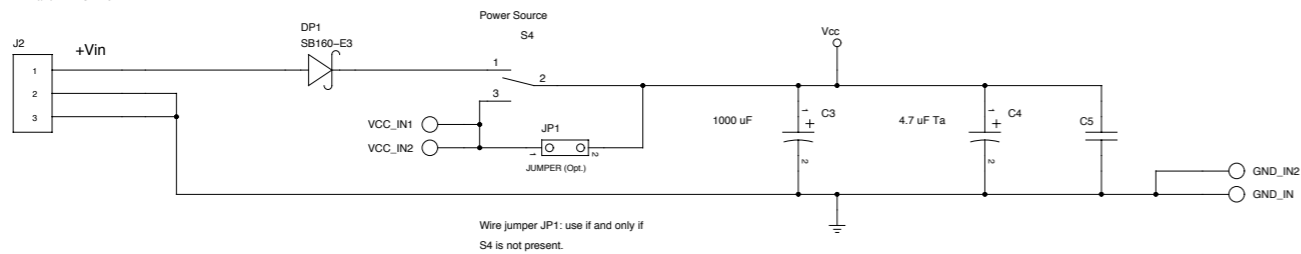
<http://www.flickr.com/groups/evilmadscience/>



Normally wire jumpers are installed in locations JP2 and JP3, while JP4 and JP5 are left empty. If, however, access to TXD0/RXD0 is needed, one could put jumpers in JP4 & JP5 instead, with a corresponding software change.

Optional Power Supply:
5 V REGULATED, > 500 mA
To use, add J2, DP1, S4
and REMOVE JP1

If using 4.5 V power supply,
use a wire jumper instead of a diode
for DP1.



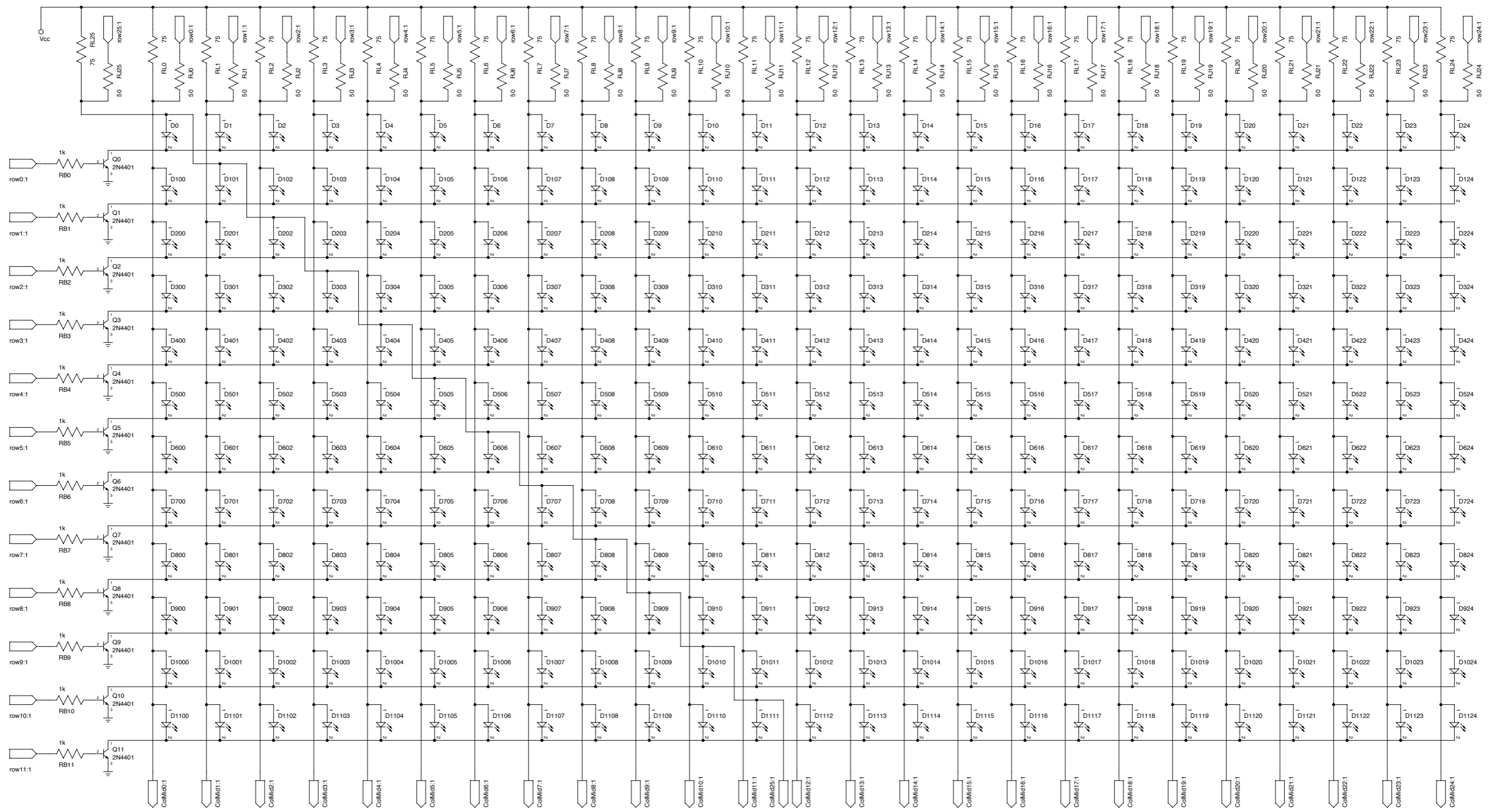
Wire jumper JP1: use if and only if S4 is not present.

An Open-Source Design by
Evil Mad Scientist Laboratories
www.evilmadscientist.com

Fabricated for
Evil Mad Science LLC
<http://evilmadscience.com/>

TITLE "Peggy"	
FILE: LEDdisp_X.sch	REVISION: A
PAGE: 1 OF 3	DRAWN BY: Windell H. Oskay

Schematics: Page 2 of 3



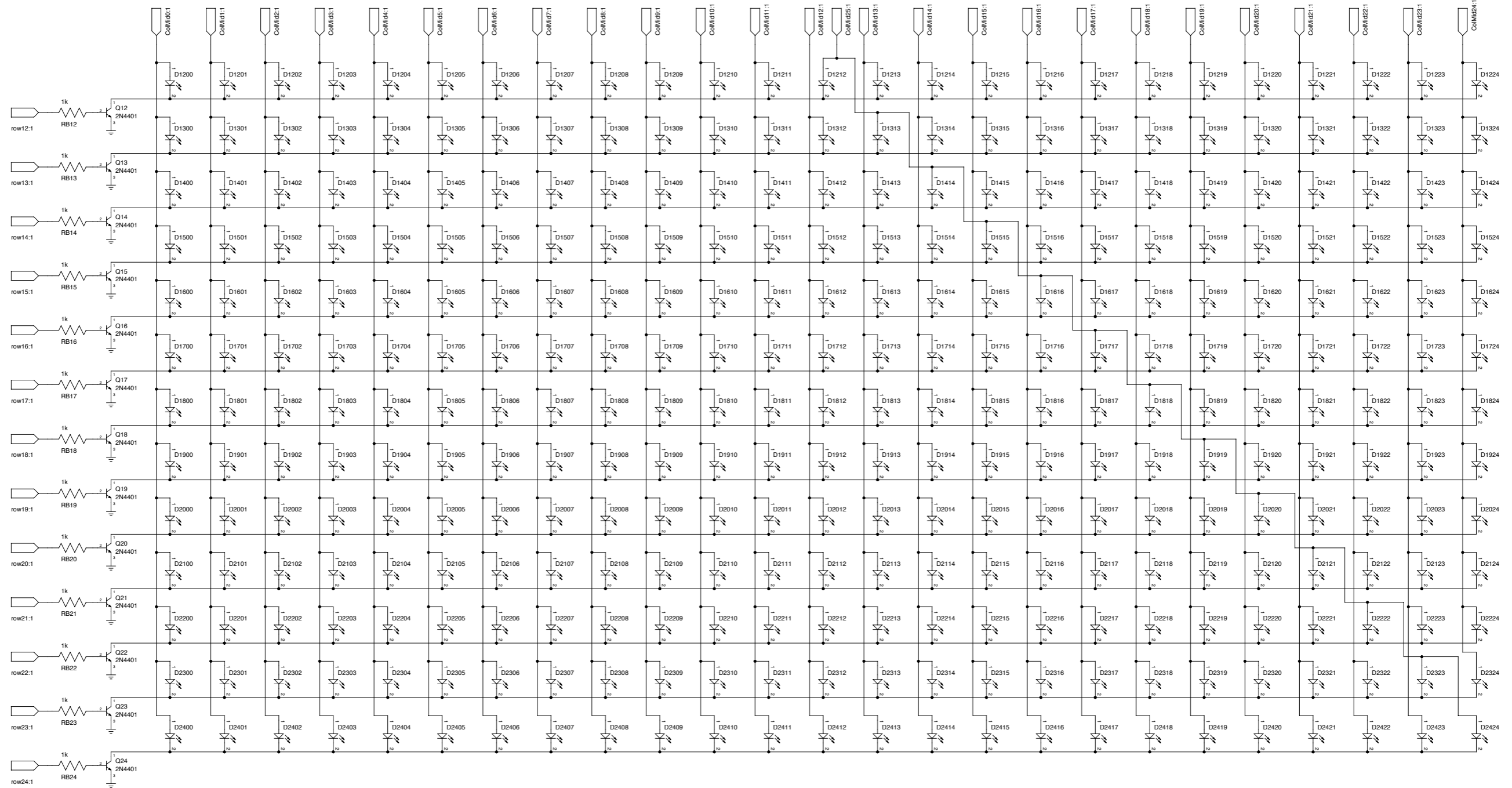
An Open-Source Design by
Evil Mad Scientist Laboratories
www.evilmadscientist.com

Fabricated for
Evil Mad Science LLC
<http://evilmadscience.com/>

"Peggy"		
TITLE A light-emitting pegboard display panel		
FILE: LEDdisp_X.sch	REVISION: A	
PAGE 2 OF 3	DRAWN BY: Windell H. Oskay	



Schematics: Page 3 of 3



An Open-Source Design by
Evil Mad Scientist Laboratories
www.evilmadscientist.com

Fabricated for
Evil Mad Science LLC
<http://evilmadscience.com/>

"Peggy"		
TITLE	A light-emitting pegboard display panel	
FILE	LEDdisp_X.sch	REVISION: A
PAGE	3 OF 3	DRAWN BY: Windell H. Oskay