

SchoolBoard][Build Manual

Parallax QuickStart Edition

v0.96

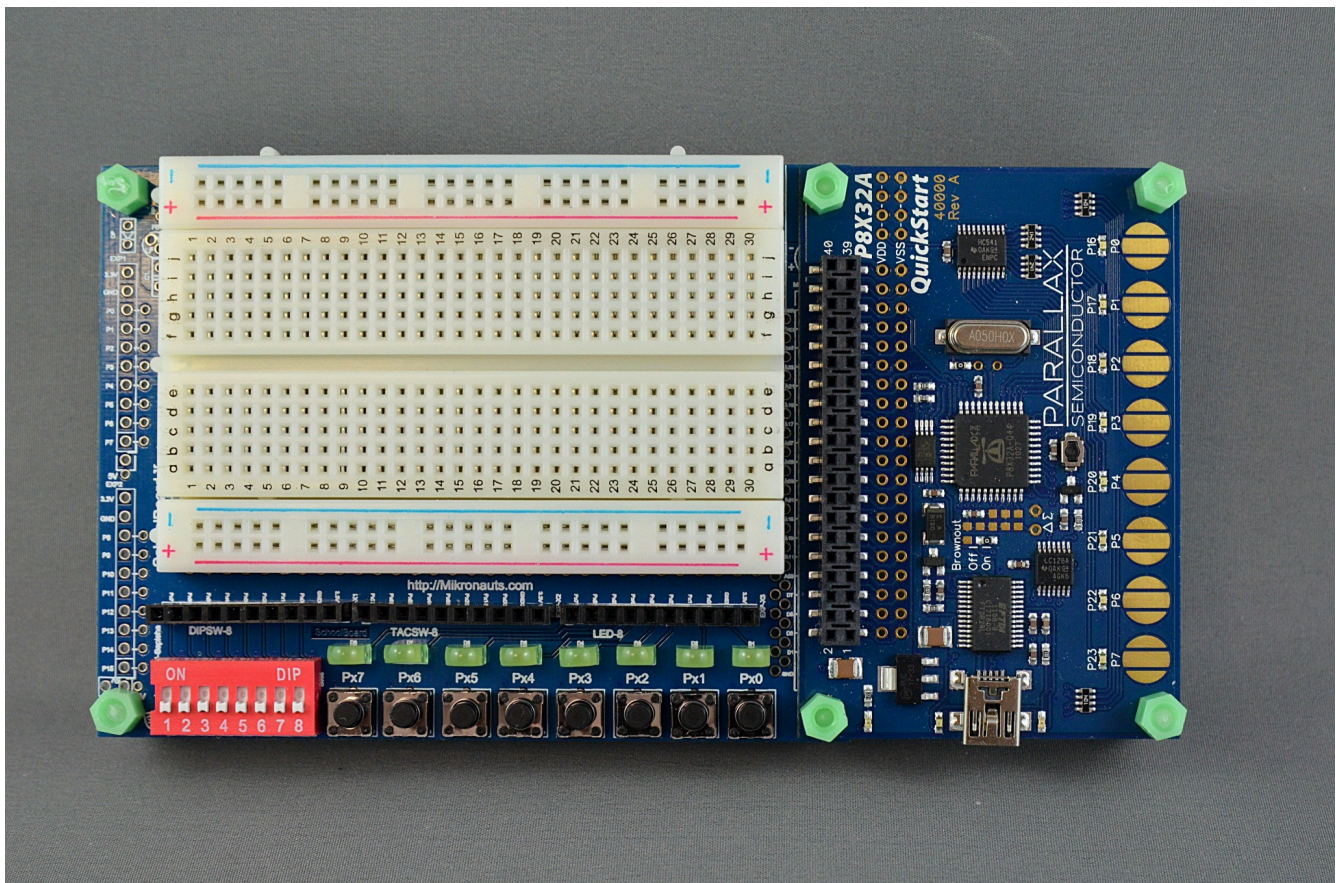


Figure 1: SchoolBoard][mounted on a Parallax QuickStart

Copyright 2012 William Henning

Table of Contents

Table of Contents

Introduction.....	3
SchoolBoard][Features.....	5
Kit Contents.....	6
Building SchoolBoard][.....	7
Step 1: The SMT Resistors.....	7
Step 2: The Push Buttons.....	10
Step 3: The Dip Switch.....	10
Step 4: The LED's.....	10
Step 5: The Ten Pin Female Headers.....	11
Step 5A: Optional Propteus, CPUModule and Morpheus headers.....	11
Step 6: Connecting Ground.....	12
Step 7: Connecting Power.....	12
Step 8: Mounting The Solderless Breadboard.....	12
Step 9: Mounting your QuickStart Board (QuickStart Edition Only).....	13
Using you SchoolBoard][with your Parallax QuickStart.....	13
References.....	14

Introduction

In 2009 I introduced four boards:

- Morpheus - advanced dual processor Propeller based single board computer with 512KB fast parallel memory and high resolution bitmapped VGA graphics with up to 256 colors per pixel
- Mem+ - a 2MB memory expansion board for Mem+ which also added 16 bits of parallel I/O and support for a full size SD card that stacks on top of Morpheus
- Proteus – a simple bussed prototyping board that stacks on top of Morpheus or Propteus
- Propteus – a simple Propeller development board with a large prototyping area

All the boards were designed for the educational and hobbyist markets – but there was no solderless prototyping module!

The original SchoolBoard was simply the combination of:

- Proteus prototyping board
- 400 pin solderless breadboard
- 2x20 Female stacking connector
- 1x10 Female stacking connector(s)

This allowed the breadboard to access P0-P15 on Morpheus or Propteus, as well as MorphBus on Morpheus.

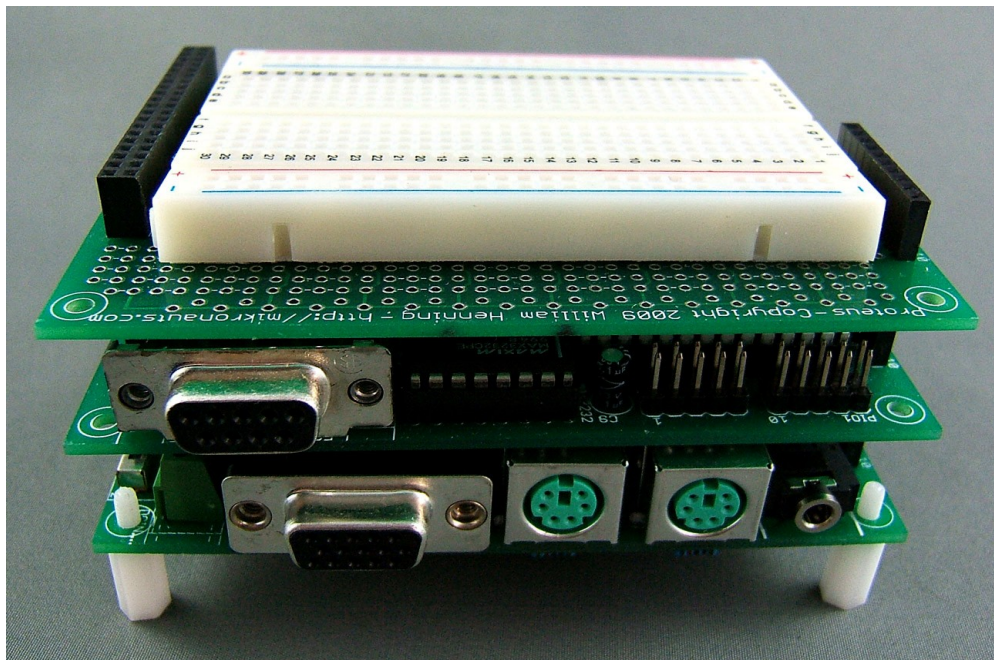


Figure 2: The original SchoolBoard stacked on top of Mem+ (on Morpheus)

The original SchoolBoard was quite useful – but I missed the switches and LED's I'd gotten used to on other development boards.

I also thought that students would find it useful to develop circuits on the solderless breadboard, and make them permanent on a bussed prototyping board that was very similar to the solderless breadboards.

Thus SchoolBoard][was born!

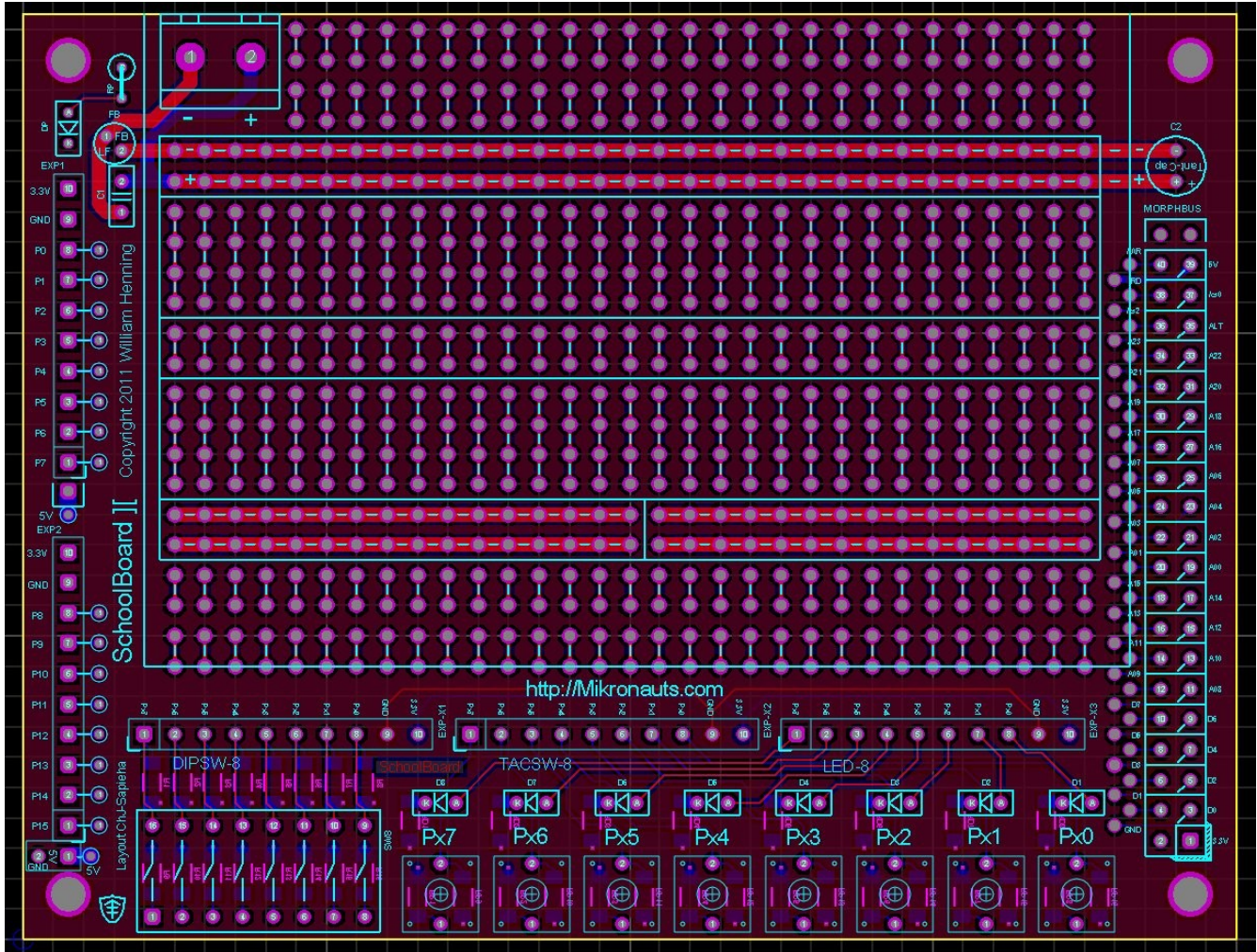


Figure 3: SchoolBoard][pcb layout

SchoolBoard][was designed to be used with various platforms:

- Parallax QuickStart (mounts on either side for integrated development platform)
- Mikronauts Modular System (Morpheus, Propteus, CPUModule and others)
- Parallax Basic Stamp or other 3.3V/5V micro controller board beside SchoolBoard

SchoolBoard][Features

- Large multi-purpose bussed prototyping area (more below)
- eight LED's
- eight normally open tactile push buttons
- eight switch DIP switch
- three ten pin headers for easy connection from breadboard to LED's and switches
- 24 current limiting surface mount resistors for LED's and switches
- 16 pullup resistors for the switches
- optional mounting pads for extra parts for alternate uses (more below)
- 2x20 stacking connector footprint for mounting on Mikronauts Modular System boards
- two 1x10 stacking connector footprint for mounting on Mikronauts Modular System boards

The prototyping area PCB layout is designed for:

- two long power and ground busses connected to optional WAGO screw terminal, filter capacitors and coil
- extra LED and current limiting resistor
- two half-length power busses
- special 2-2-BB-4-2-4-GP-2-2 pattern allows for adding
 - easy additional voltage regulation
 - servo/sensor 3 pin connectors on bottom split bus
 - servo/sensor 3 pin connectors on top power bus
 - two rows of .300" dip devices - or
 - two rows of .600" dip devices - or
 - one row of .600" dip devices and one row of .300" devices

PLEASE NOTE:

- Vcc and Vss are not hardwired as SchoolBoard is designed to be used at either 3.3V or 5V with any microcontroller board
- Use 22 ga. Solid insulated jumper wire or manufactured jumpers

Kit Contents

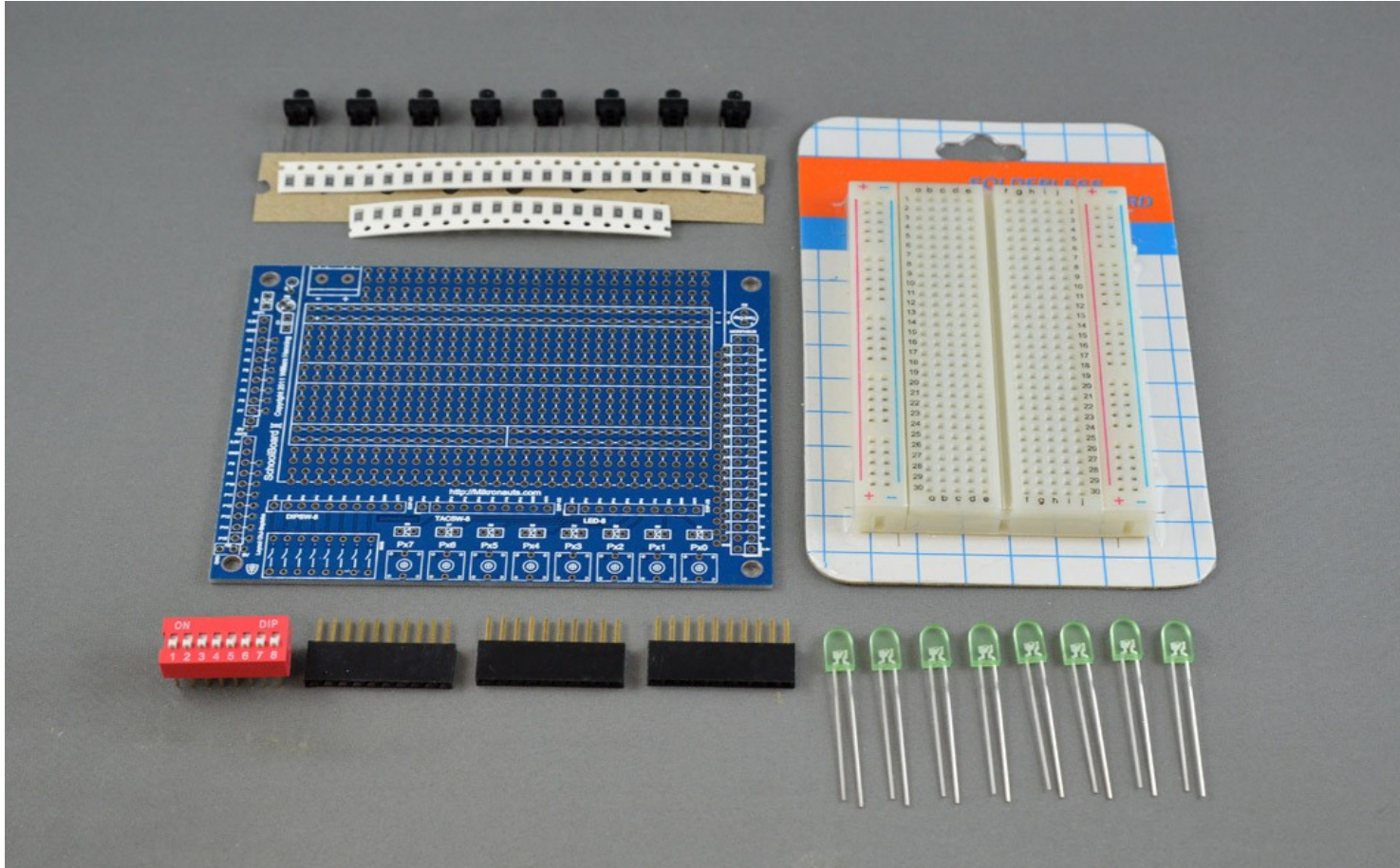


Figure 4: SchoolBoard][Kit

The Full Kit contains:

- SchoolBoard][printed circuit board
- 400 point solderless breadboard (NOT present in the Lite Kit)
- qty. 24 surface mount 470 ohm resistors
- qty. 16 surface mount 10k ohm resistors
- qty. 8 momentary normally open tactile push buttons
- qty. 8 low current 5mm x 2mm LED's
- qty. 1 SPST dip switch with 8 individual slide switches
- qty. 3 female 10 pin header

Building SchoolBoard][

Step 1: The SMT Resistors

As you can see, the resistors are mounted on the back of PCB:

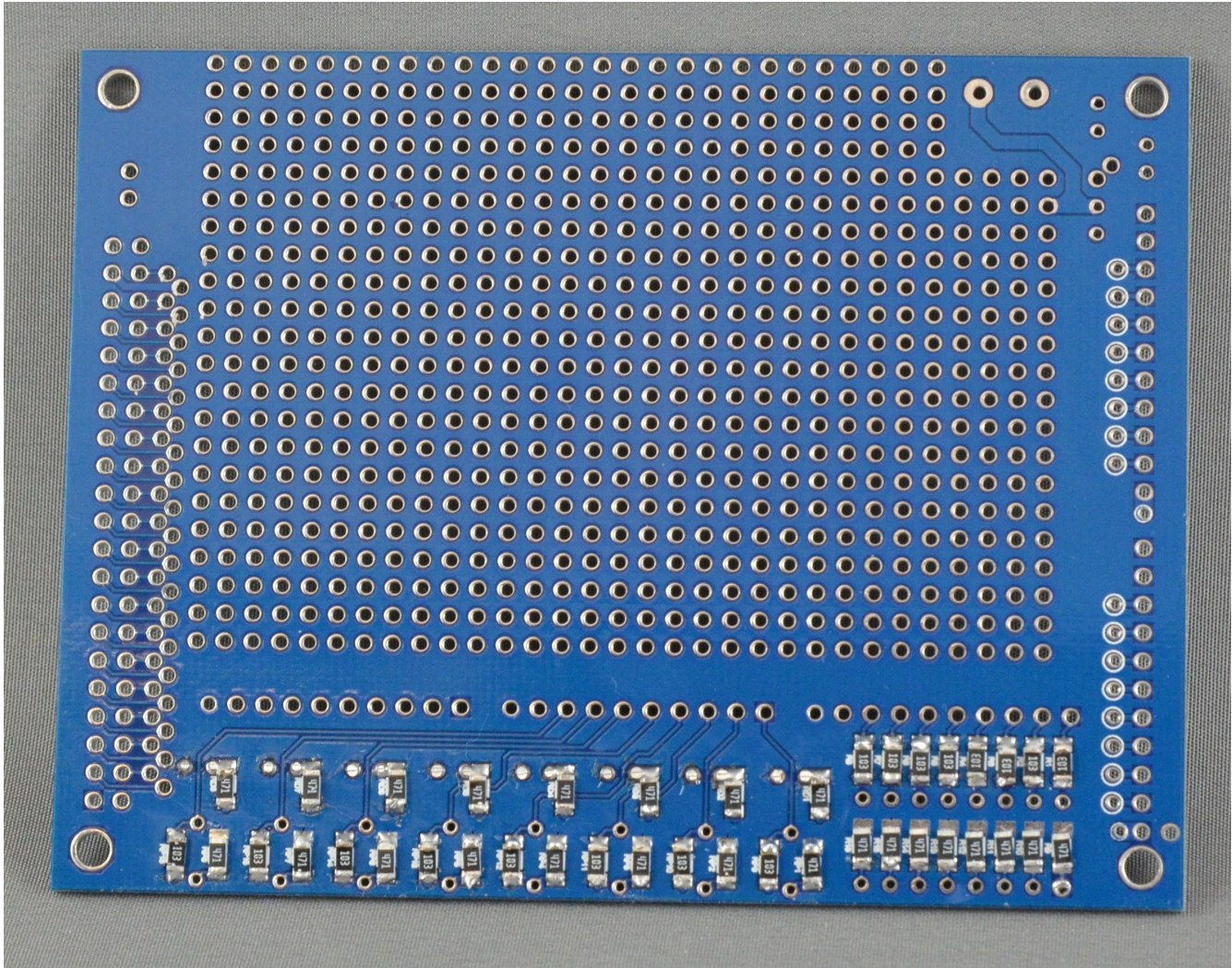


Figure 5: surface mount resistors on the back of the pcb

Of the two groups of eight resistors above each other on the right

- the top row are 103's (10k)
- the bottom row are 471's (470R)

the top wider row on the left/middle of the board are all 471's, with 471's directly below them
the bottom wider row are 103's alternating with 471's

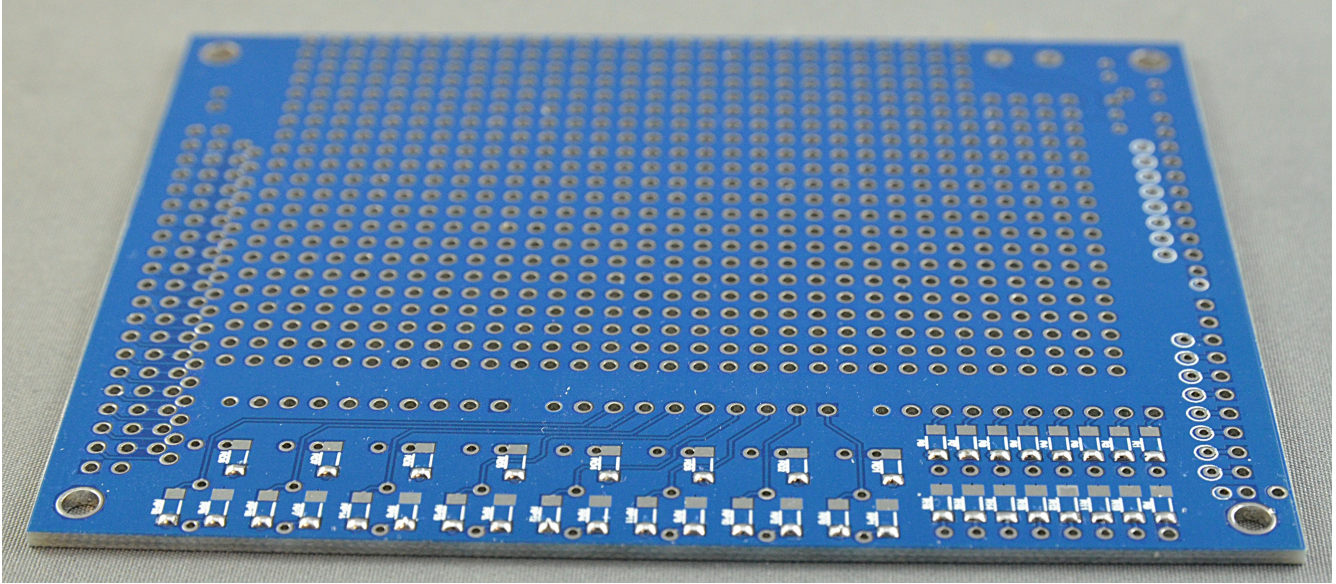


Figure 6: Initial solder blobs for manual soldering

Fastest way to manually solder them is to put a small amount of solder on the bottom pads for each resistor:

Hold resistor in place with tweezers and heat solder blob on the printed circuit board, pressing resistor down to make a good solder connection:

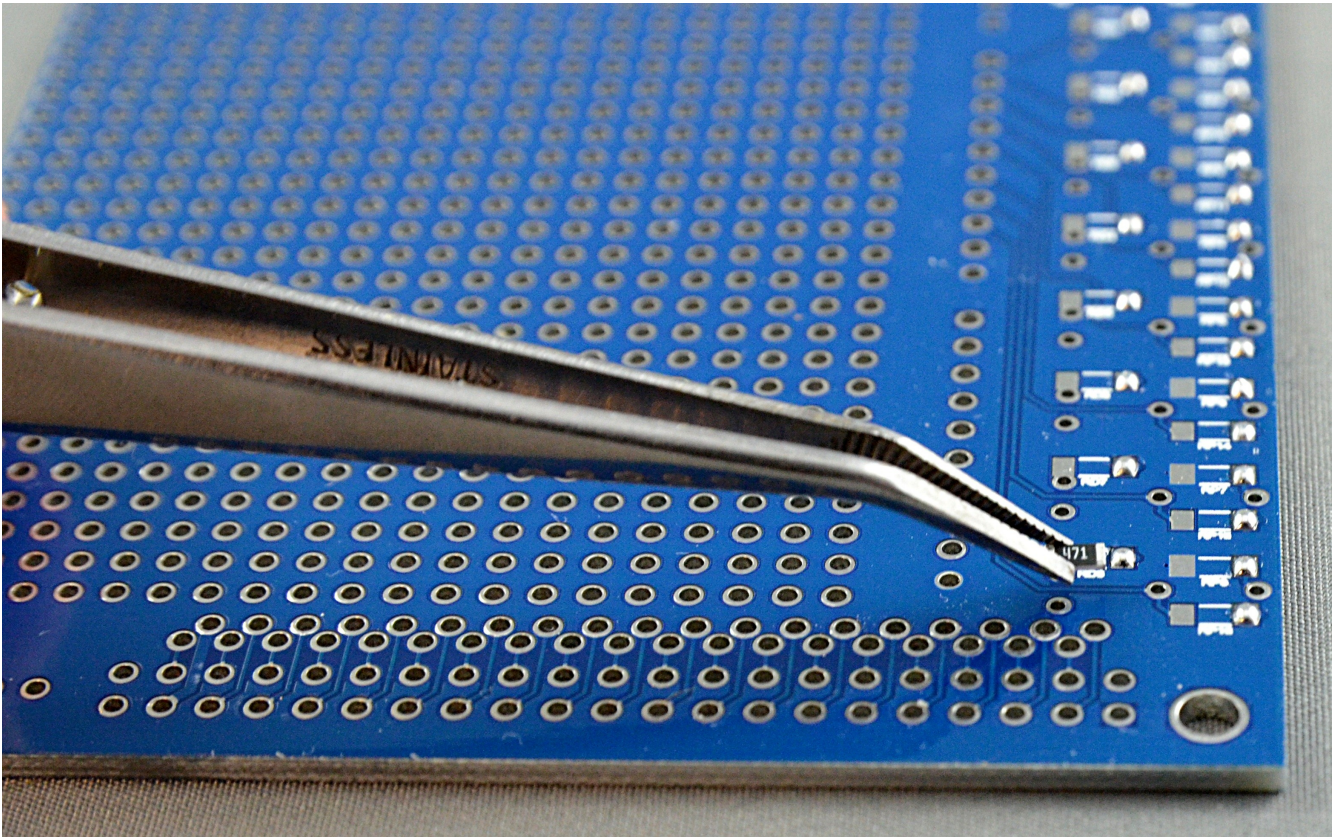


Figure 7: Placing surface mount resistor with tweezers

For the LED 471's (wide top row) don't solder other side of resistor until you are soldering the LED's
all other SMT resistors top pads you can solder before LED's

Step 2: The Push Buttons

Cut the leads on the buttons to about 1/4" as shown below:

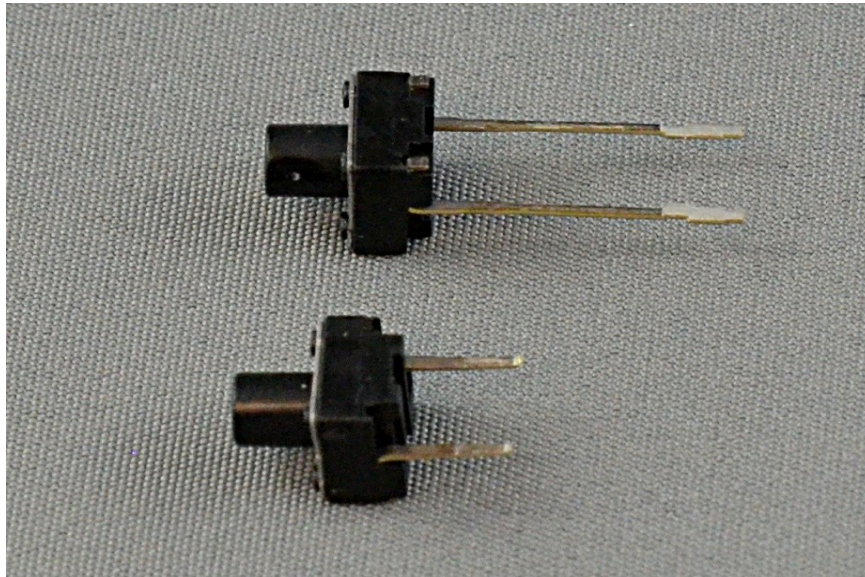


Figure 8: Trimming the leads of the push buttons before soldering

Insert the switches where indicated on the circuit board, and solder :)

Step 3: The Dip Switch

Insert the dip switch on SchoolBoard][where indicated, with the switch numbers 1 – 8 towards the bottom of the printed circuit board.

Step 4: The LED's

You will notice that the two leads of the LED's are not the same length; the longer leg is the “anode” - the positive side.

On the printed circuit board the anode part is indicated by the sideways triangle, and the “cathode” or negative terminal by the vertical line the triangle touches.

Insert the longer leg into the anode (triangle) side, which is towards the right side of the board.

Step 5: The Ten Pin Female Headers

Install the three ten pin headers above the switches and LED's.

Here is the assembled board:

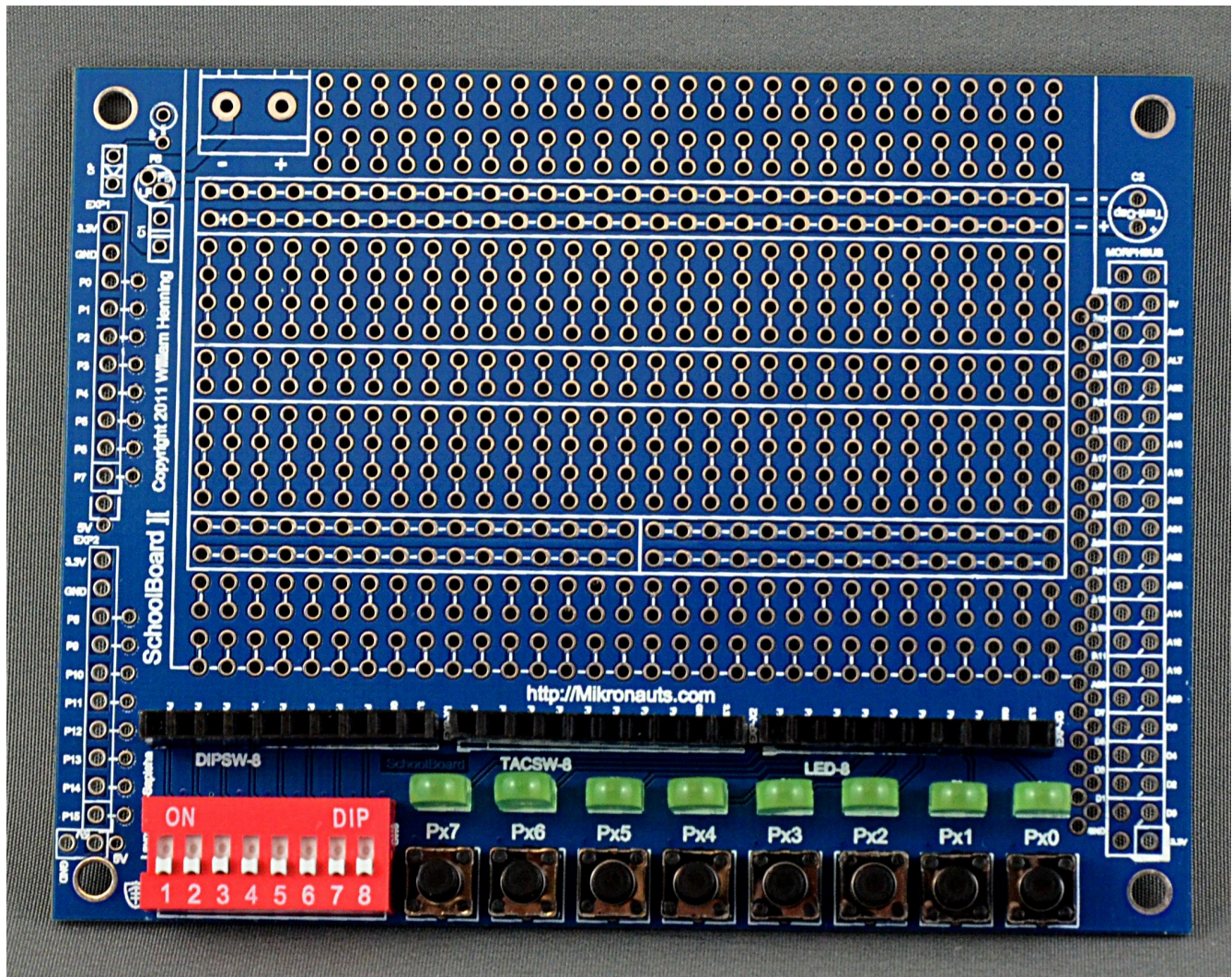


Figure 9: The completed SchoolBoard][

Step 5A: Optional Propteus, CPUModule and Morpheus headers

If you are going to mount SchoolBoard 2 on a Mikronauts board such as Propteus or CPUModule:

- mount two ten pin stacking connectors on the left for EXP1 and EXP2
- optional 2x20 stacking connector on the right for MorphBus

Step 6: Connecting Ground

You will need to connect Vss on one of the three ten pin headers on SchoolBoard][to Vss on QuickStart. I simply use a jumper wire.

You can then connect another wire from one of the other ten pin headers to the power bus on the solderless breadboard.

Vss is the second pin on the right on the ten pin headers, and it is labeled GND on the silk screened text.

Use 22 ga. solid insulated jumper wire or manufactured jumpers.

Step 7: Connecting Power

You will need to connect Vcc (3.3V) on one of the three ten pin headers on SchoolBoard][to Vcc (3.3V) on QuickStart, I simply use a jumper wire.

You can then connect another wire from one of the other ten pin headers to the power bus on the solderless breadboard.

Vcc (3.3V) is the rightmost pin on the ten pin headers, and it is labeled as 3.3V on the silk screened text.

Use 22 ga. solid insulated jumper wire or manufactured jumpers.

Step 8: Mounting The Solderless Breadboard

Peel off the non-stick yellow backing from the back of the solderless breadboard

Carefully line up the breadboard with the printed circuit board, use the bottom prototyping pattern white line to place the smooth side of the breadboard

Have the small breadboard locking fingers extend past the top of the printed circuit board so you can attach additional breadboards there.

You can see the end result on the cover of this manual.

Step 9: Mounting your QuickStart Board (QuickStart Edition Only)

Use two 4-40 screws and nuts to attach your QuickStart to SchoolBoard 2 on either side (your choice)

Please see <http://mikronauts.com/schoolboard/> for more sample photos.

Using your SchoolBoard][with your Parallax QuickStart

Here is a test circuit for an eight bit wide QSPI ram configuration, built on SchoolBoard][

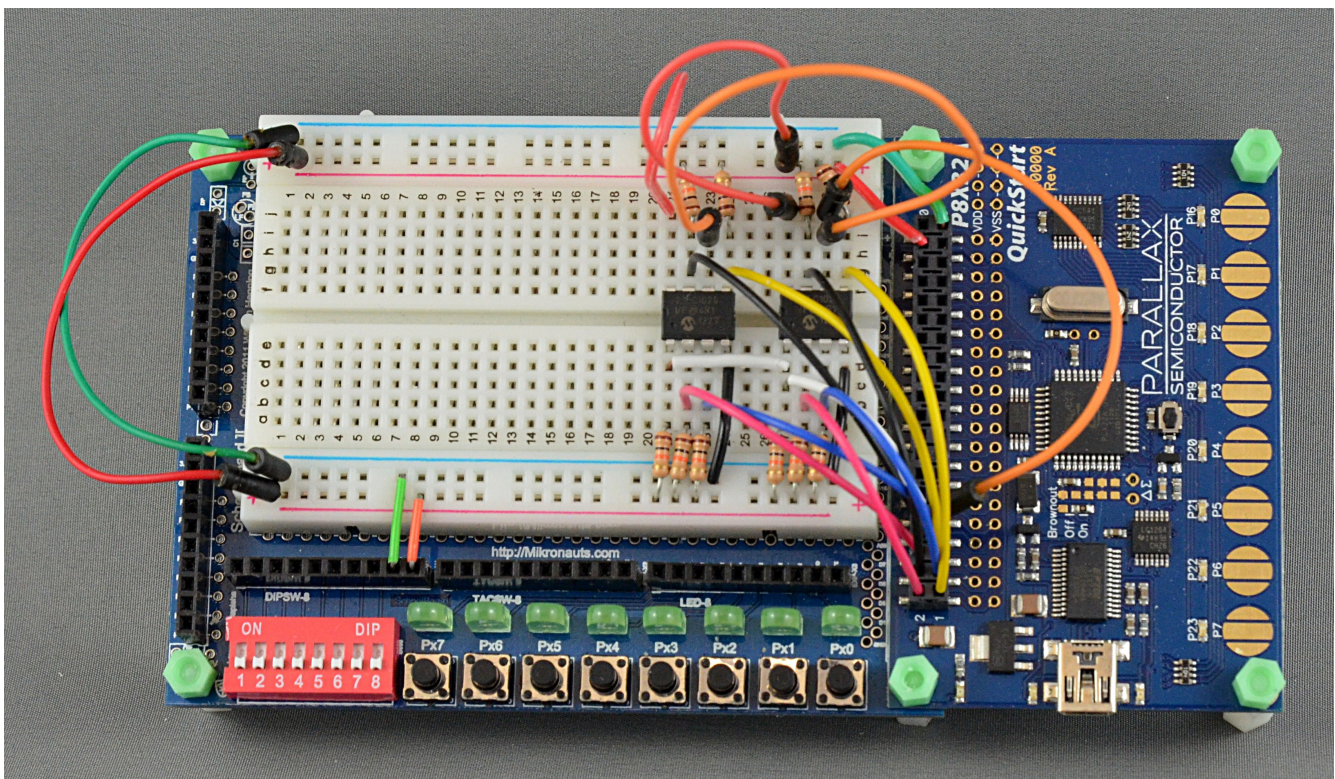


Figure 10: QSPI project being prototyped on SchoolBoard][

SchoolBoard][allows you to easily experiment with your Parallax QuickStart – the only limit is your imagination!

There are plenty of projects for you to try at <http://learn.parallax.com>

If you want even more ideas of what you can do, you can download the PE Kit manual, and try some of the experiments on your SchoolBoard][and QuickStart combination!

References

<http://Mikronauts.com/schoolboard>

SchoolBoard][home page

<http://www.parallaxsemiconductor.com/quickstart>

QuickStart's home page

<http://learn.parallax.com>

Parallax's excellent educational site

<http://http://www.parallaxsemiconductor.com/appnotes>

ParallaxSemiconductor Application Notes

<http://http://www.parallax.com/go/pekit>

Parallax PE Kit downloads and resources

<http://Mikronauts.com>

Mikronauts home page

<http://www.parallax.com>

Parallax home page

<http://www.parallaxsemiconductor.com>

Parallax Semiconductor home page