Board of Education Shield (#35000)

Plug this shield into your own Arduino® module to give it the useful features and form factor of the original Board of Education®. This shield makes circuit prototyping simple and convenient with a 2 row x 17 column breadboard. Headers along the side. top, and bottom provide easy access to supply voltages and the Arduino module's digital I/O and analog inputs. The Board of Education Shield's four corner mounting holes and servo ports make it compatible with the Boe-Bot robot chassis, continuous rotation servos, and many sensors and accessories from Parallax.

The 3-position power switch allows you to turn on power in stages, first to the power header above the breadboard, and then to any servos plugged into the ports. This is especially useful for cutting servo power so that you can monitor sensors on your breadboard while keeping motors from moving. This board also has a RESET button for restarting the program and pass-through headers for stacking more shields on top.

Features

- 17 row x 2 column breadboard with adjacent headers for Vin, 5 V, 3.3 V, GND, digital I/O and analog in
- Onboard 5 V regulator supplies up to 1 A for robotics and animatronics applications
- Onboard 3.3 V regulator supplies up to 250 mA for project circuits and accessories such as Digi's XBee® RF modules
- 4 servo ports with power selection jumper for regulated 5 V or Vin (Arduino's supply voltage)
- 3-position power switch for power header or header + servo ports
- RESET button resets the Arduino
- Supply indicator LEDs for breadboard and servo power

Key Specifications

- Power Requirements: 7 to 12 VDC
- Communication: Serial over USB through Arduino (sold separately)
- Operating temperature: 32 to 158 °F (0 to 70 °C)
- Dimensions: 4 x 3.05 in (102 x 77.5 mm)
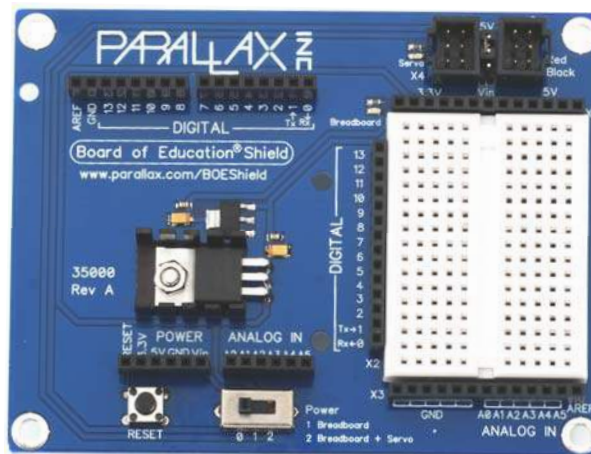
Application Ideas

- Mount your Arduino microcontroller brain on the Boe-Bot robot chassis—see *Robotics with the Board of Education Shield for Arduino* at http://learn.parallax.com/ShieldRobot.
- Use in the classroom for electronics, robotics and STEM lessons with the Arduino.
- Make an inexpensive Propeller microcontroller prototyping platform with the Propeller ASC module from MGH Designs (http://mghdesigns.com).

Assembly Instructions (Arduino module not included)

Step 1

The four groups of pins under the Board of Education Shield plug into the four Arduino socket headers. If you have an Arduino Mega, the four pin groups fit into the four headers closest to the USB and power connectors. If your Arduino is Revision 3 it will have UNO R3 or MEGA R3 on the back. When you have socketed the shield, Revision 3 and newer revisions will have two empty pairs of sockets at the far left, closest to the USB and power connectors. Earlier revisions such as 2, 1, and Duemilanove have the same number of sockets as the shield has pins, so there should be no empty sockets on the Arduino's left side.
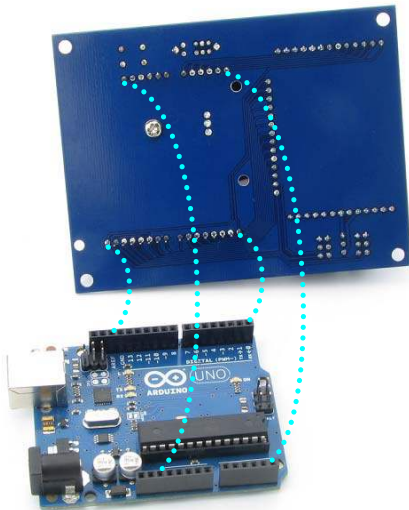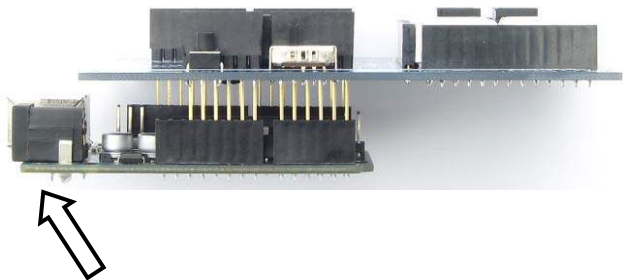
Uno R3
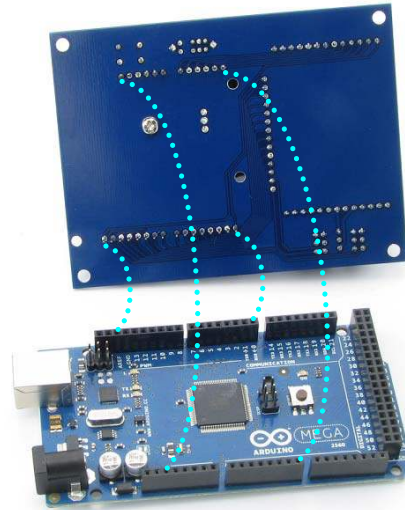
Mega R3

Step 2

Carefully line up the shield's pins with the Arduino's sockets. Before pressing the two boards together, look through the shield's three smaller mounting holes from straight above. They should line up with the mounting holes on the Arduino module.

Align BOE Shield pins with Arduino Sockets

Arduino power and programming ports are away from the BOE Shield's breadboard
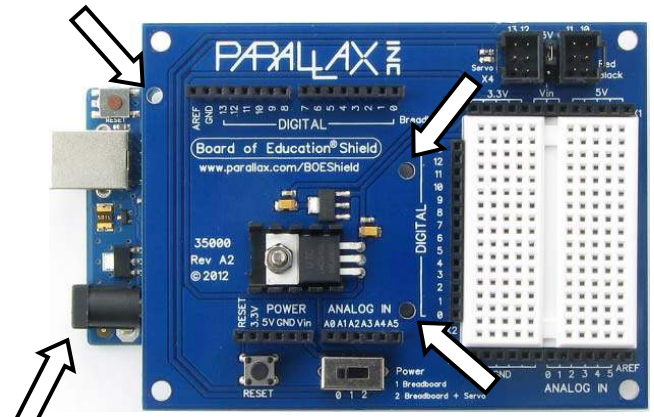
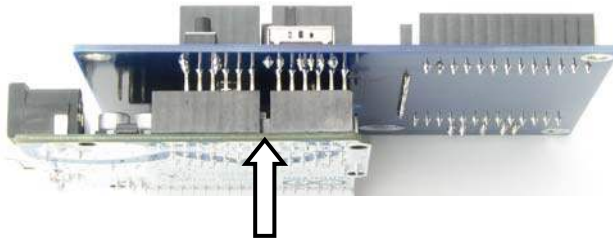Make sure BOE Shield mounting holes align with Arduino's

Step 3
Make absolutely sure you have the pins correctly aligned before continuing! If the pins are aligned wrong, your Arduino module could be damaged when you connect power.
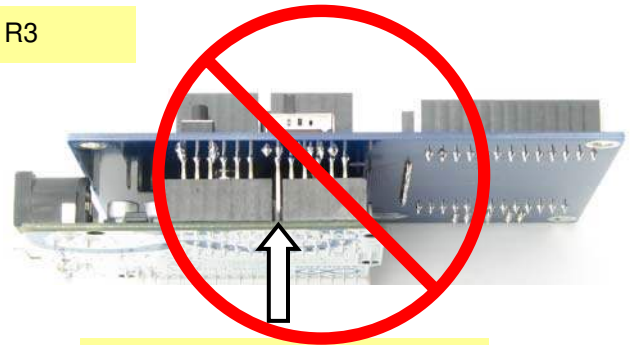
GOOD: pin alignment correct.

BAD: pin alignment wrong!

Uno R3

Correct: gap in pins lines up with gap in sockets.

WRONG! STOP!

There's a pin between the gap in the sockets, so it's not correctly aligned. Unplug it and try again.
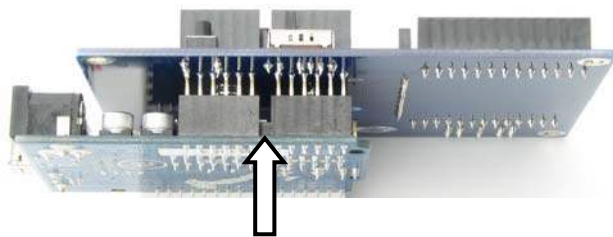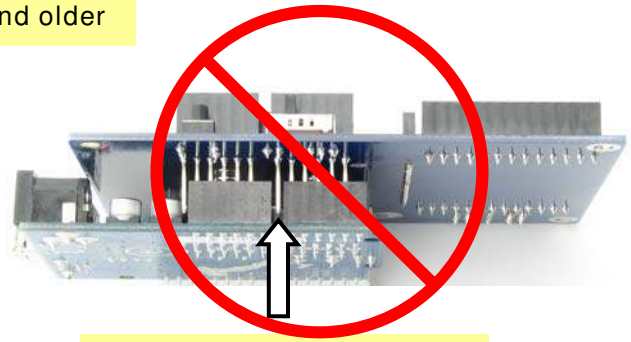
Uno R2 and older

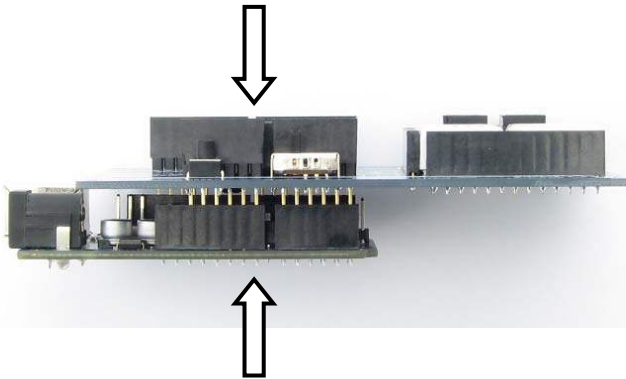Correct: gap in pins lines up with gap in sockets.

WRONG! STOP!

There's a pin between the gap in the sockets, so it's not correctly aligned. Unplug it and try again.

Step 4
Press firmly to insert the Board of Education Shield into the Arduino board's sockets.

Press the BOE Shield onto the Arduino

Standoff Assembly Options (additional hardware sold separately)

Tabletop standoffs are recommended to keep your board from tipping while you build circuits.

- (4) Parallax # 700-00028 – Machine screw, 4-40 x 1/ 4" pan-head Phillips
- (4) Parallax # 700-00060 – Standoff, threaded aluminum, round 4-40
- # 1 Phillips point screwdriver
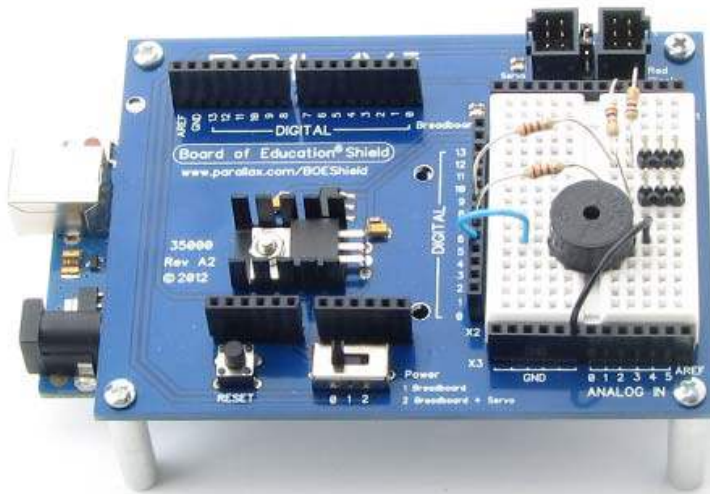
Thread a screw through each corner hole on the Board of Education Shield hole from the top side. Thread an aluminum standoff onto each screw and tighten gently.

Note: the corner mounting holes are plated and connected to the Board of Education Shield's ground plane, and so will the aluminum standoffs when attached in this manner.

Board-connection standoffs attach the two boards together. They are recommended if you frequently connect and disconnect the Arduino's programming cable or external power. They are also useful for applications that involve vibration or acceleration forces.

- (3) Parallax #700-00036 – Nut, #4-40 Nylon
- (3) Parallax #713-00051 – Spacer, #4x1/2", Nylon
- (3) Parallax #710-00007 – Screw, #4-40x7/8", Phillips, Zinc plated
- #1 Phillips point screwdriver

Check to see how many spacers will fit on your particular Arduino module. Most boards will accommodate either two or three of the screws and spacers. Before you socket the Shield into the Arduino, insert Phillips screws into the Arduino mounting holes that will fit.
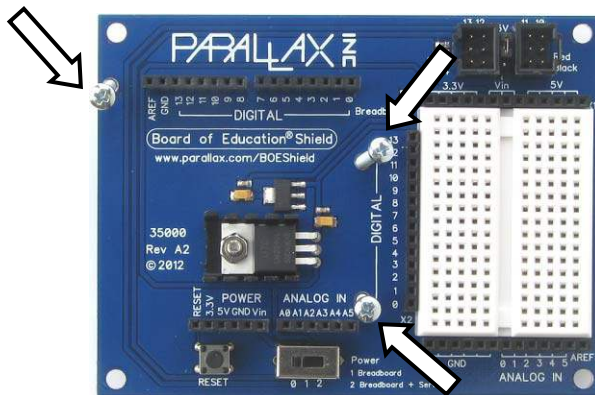
Screws into Arduino mounting holes.

Slide the nylon spacers over the screws and then fit the Arduino onto the screws and Board of Education Shield's pins. After the Shield is firmly socketed, secure the screws with the nylon nuts. In the example here, only two of three screws fit onto the Uno R3. The third screw could optionally be used without a spacer; just be careful not to over-tighten it.
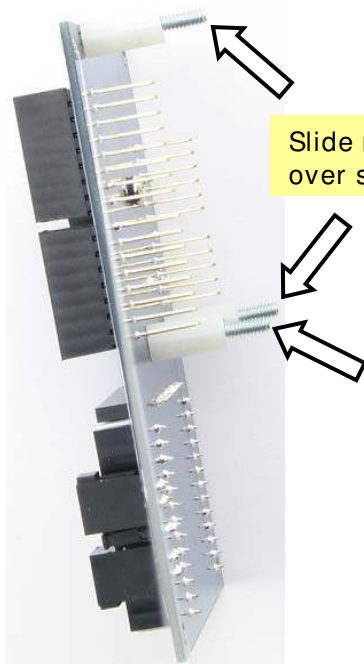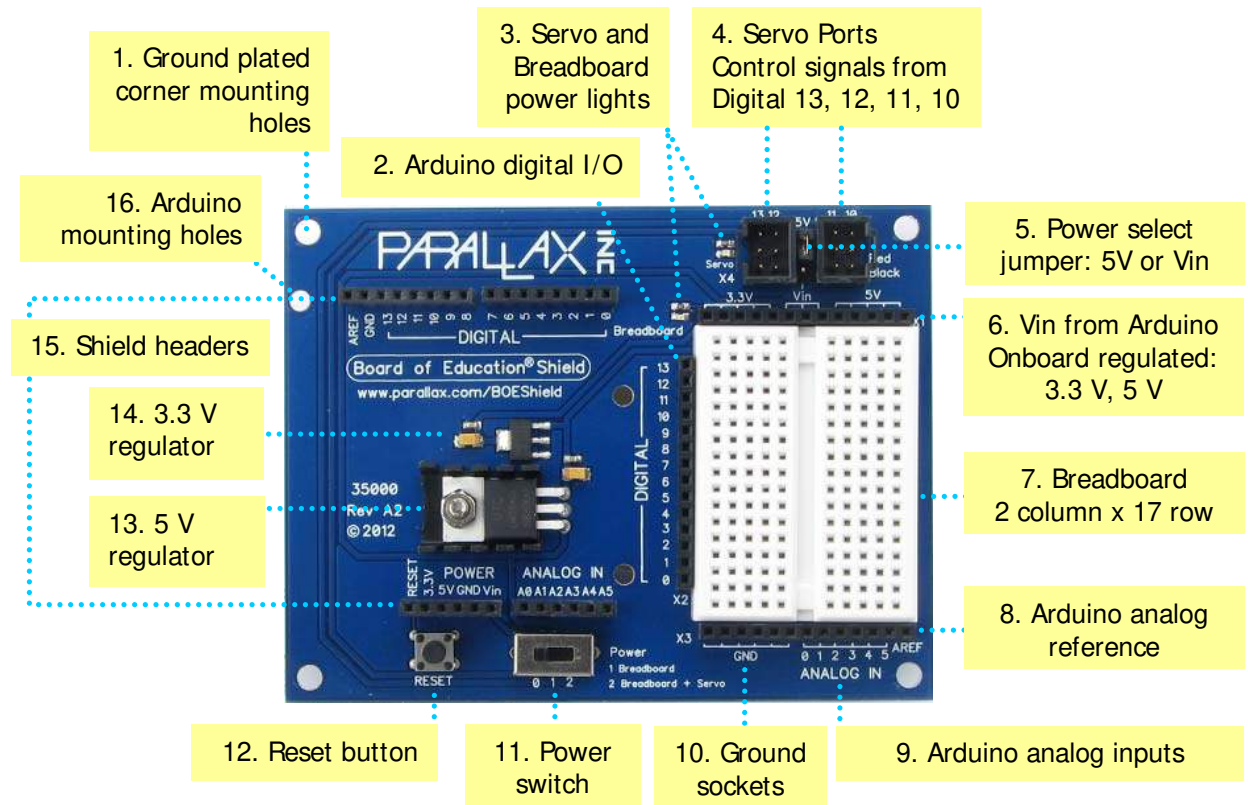

Slide nylon spacers over screws.
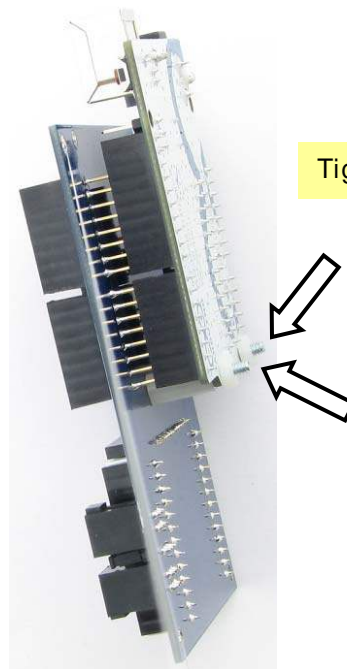
Tighten nylon nuts.

Functional Description

1. Ground plated corner mounting holes
2. Arduino digital I/O
3. Servo and Breadboard power lights
4. Servo Ports Control signals from Digital 13, 12, 11, 10
5. Power select jumper: 5V or Vin
6. Vin from Arduino Onboard regulated: 3.3 V, 5 V
7. Breadboard 2 column x 17 row
8. Arduino analog reference
9. Arduino analog inputs
10. Ground sockets
11. Power switch
12. Reset button
13. 5 V regulator
14. 3.3 V regulator
15. Shield headers
16. Arduino mounting holes

1. Four plated mounting holes, one on each corner, are connected to GND. They are useful for mounting the board on the Boe-Bot robot chassis, and with tabletop standoff mounting hardware.
2. Arduino digital I/O sockets are electrically connected to the same-named sockets on the Arduino module. These sockets are not affected by the shield's power switch.
3. Servo and breadboard power lights indicate when those headers have power, controlled by the 3-position switch.
4. Servo ports connect to Digital 13, 12, 11, and 10, sharing access with the Digital I/O header by the breadboard.
5. The power select jumper between the servo ports can be set to either 5V (regulated by the shield's 5 V, 1 A regulator) or Vin (unregulated power from the Arduino).
6. The 5V and 3.3V sockets above the breadboard are regulated by the BOE Shield's onboard 5 V, 1 A and 3.3 V, 200 mA regulators. Vin above the breadboard receives unregulated Vin from the Arduino, and is disconnected when the Board of Education Shield's power switch is set to 0.
7. 2 column x 17 row breadboard provides a convenient solderless prototyping area.
8. Socket labeled AREF (analog reference) electrically connects to the same-named socket on the Arduino.
9. Sockets labeled ANALOG IN 0...5 electrically connect to the same-named sockets on the Arduino.
10. Sockets labeled GND electrically connect to the same-named sockets on the Arduino.
11. Setting the power switch to 1 supplies voltages to the power header above breadboard and turns on the breadboard indicator light. Setting the power switch to 2 supplies both the header above the breadboard AND the servo ports and turns on the both the breadboard and servo indicator lights.
12. The RESET button is for making the Arduino restart its program.
13. The onboard 5 V regulator supplies up to 1 A.
14. The onboard 3.3 V regulator supplies up to 200 mA.
15. Three non-plated mounting holes are for mechanically attaching the BOE shield to the Arduino. One is labeled in the diagram, and the other two flank the DIGITAL label to the left of the breadboard.
16. All shield header sockets pass power and signals straight through from the Arduino.

Precautions

- Disconnect programming cable and batteries when not in use. Since most Arduino modules do not have on/off switches, they keep running as long as power is connected. So, you may notice some circuit activity, even when the shield's power switch is set to 0. If your application is battery powered, make sure to disconnect the batteries when not in use.

- Supplying your Arduino with power from USB will result in lower voltages at the Vin and 5V sockets. When more recent Arduino revisions draw power from the USB connection, they supply Vin with less than 5 V due to diodes that make the supply source decisions for the board. Vin typically receives 4.2 to 4.3 V, and the board will supply the 5V sockets with a few hundredths of a volt less.

- The BOE Shield requires supply voltage from the Arduino's Vin socket. Newer model Arduino boards automatically route the supply input voltage to Vin. Some older models may need to be configured for an external supply. Some modules with the Arduino form factor may or may not be compatible. If in doubt, check your module's Vin socket's voltage with a power supply connected.

- A servo connected to port 13 may twitch during startup. The Arduino blinks its onboard LED connected to digital pin 13 after reset. Digital pin 13 also controls a servo if it's connected to port 13, so it may twitch in response to this on/off signal when the program restarts.

- Sockets on a new breadboard are very snug. Small pliers are recommended for inserting wires to avoid bending them. If a socket resists a soft wire, such as a resistor lead, try plugging in a firmer jumper wire a few times first, to break in the socket.

Dimensions
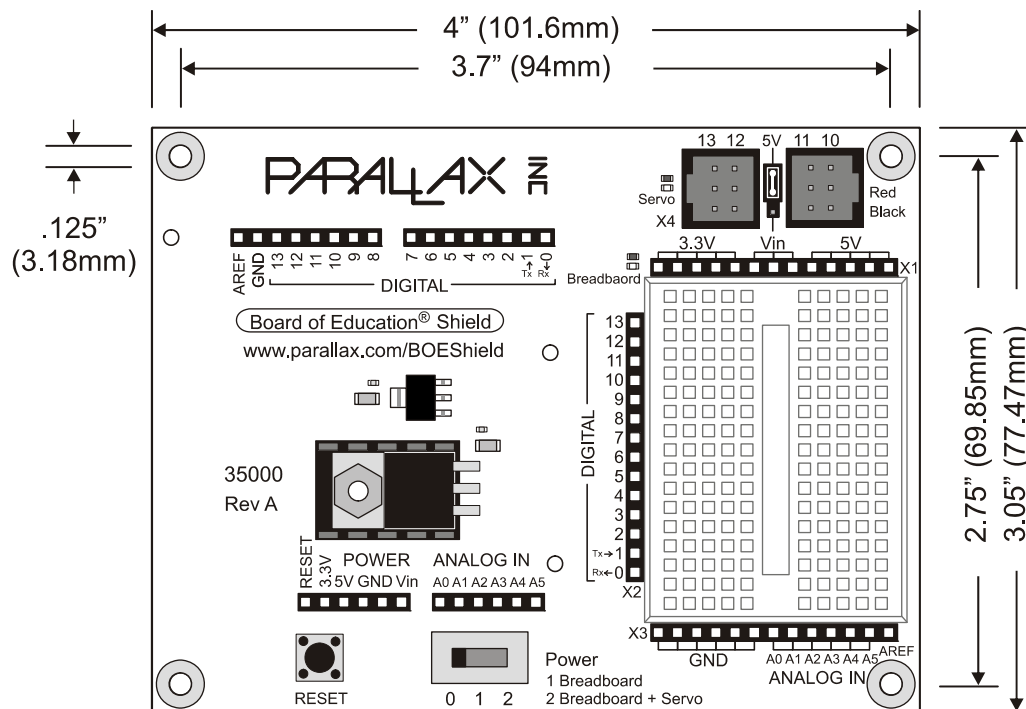
Resources and Downloads

Go to www.parallax.com/BOEShield for the latest version of this document and links to a variety of Board of Education Shield resources.

Revision History

Version 1.0: Original document, 2/22/2012

Version 1.1: Replaced prototype A2 photo with Rev A production unit photo. Added item regarding breadboard sockets, to Precautions, page 7.

Version 1.2: Assembly instructions updated: Corrected images in Step 1 (page 2); added additional text box in Step 2 (page 2); added an entire step to show potential for pin misalignment (Step 3, page 3).