Teensy 3.1 Breakout (Revision C)

Standard Included Parts

- (1×) Teensy 3.1 Breakout (Revision C) bare printed circuit board
- (3×) 40-pin (1 row x 40 pins) through-hole male header
- (1×) 14-pin (2 rows x 7 pins) surface-mount male header
- (2×) #6-32 × 3/16" stainless steel pan-head machine screw
- (1×) gold-plated pogo pin (spring-loaded connector)
 - Mill-Max Manufacturing **0906-1-15-20-75-14-11-0**
 - Digi-Key part number **ED8181–ND**

Optionally Included Parts

- (1×) 32.768 kHz tuning fork crystal
 - Citizen Finetech Miyota CFS-20632768HZFB
 - Digi-Key part number **300-8763-ND**
- (1×) 150 μ F tantalum capacitor
 - Vishay Sprague **TR3D157K016C0060**
 - Digi-Key part number 718-1775-1-ND
- (1×) surface-mount DIP switch
 - Copal Electronics CHS-01TB
 - Digi-Key part number **563–1004–1–ND**

Detailed Specs

- **Grid Spacing** 0.1 in (2.54 mm)
- **Board Dimensions** 2.4 in (60.96 mm) × 0.9 in (22.86 mm)
- **Board Surface Area** 2.16 in² (13.94 cm²)
- Number of Breakout Pins 48 pins (2 rows × 24 pins)
- Number of Mounting Holes 2 holes
- Mounting Hole Distance 2.0 in (50.8 mm)
- Mounting Hole Diameter 0.15 in (3.81 mm)
- Mounting Hole Pad Diameter 0.27 in (6.858 mm)

Recommended Tools

- Soldering iron
- Solder
- Flux
- Breadboard
- Diagonal cutters
- Needle-nose pliers
- Masking tape
- Prying tool

Assembly Instructions

- Gather the necessary tools, setup a clean workspace, and warm up your soldering iron. Before proceeding with assembly of the Teensy Breakout, decide if you want to use the **real time clock** (by adding a 32.768 kHz crystal), **USB host mode** (by adding a 150 μF capacitor), or **external power for USB device mode** (by cutting a trace to separate VIN from VUSB). Since these changes are made on the bottom side of the Teensy, **you must make them before continuing!** For more information about these modifications, please see the Teensy documentation. If you're installing a DIP switch on the bottom of the breakout board, **you must cut the VIN-VUSB trace!** When you're ready to proceed, position the Teensy so its bottom side is facing up (*Drawing 1*).
- 2. Cut a 5-pin length of through-hole header and position it on the underside of the Teensy along the shorter edge so that it interfaces with the A14 (or RESET on the Teensy 3.0), PROGRAM, GND, 3.3V, and VBAT pins (*Drawing 2*). Flip the board over and solder the header in place. Using an empty breadboard to position the components (here, and for all subsequent soldering steps) can ensure that the headers are installed perfectly perpendicular to the board.
- 3. Position the provided 14-pin (2 rows x 7 pins) surface-mount header on the underside of the Teensy. The bent pins should sit directly on the rectangular pads, and the straight end of the pins should stick up (*Drawing 3*). Secure the header in place (tape works well) making sure the pins are centered over all the pads. Tack two corners with solder and remove the tape.
- 4. Fit the straight pin ends of the attached headers through the central 14-pin opening in the Teensy Breakout board (and the 5-pin opening next to it) to check for proper alignment (*Drawing 4*). If alignment is poor and the pins don't fit, adjust the position of the 14-pin header until the boards fit together easily. Once they fit well, solder all the remaining pins on the surface-mount header to the pads on the bottom of the Teensy. The distance between the boards will be determined by the surface-mount header since it sits higher than the through-hole header. As a result, there will be a small gap between the 5-pin header and the breakout board, which is normal. Holding the boards so they're parallel to each other, trim the extending pins (all 19 of them) with your diagonal cutters so they're flush with the board, then separate the two boards.

- 5. Cut another piece of 5-pin header and remove just the metal pin from the 2nd position using a pair of needle-nose pliers, leaving a blank position in the header. Fit this modified header (now with 4 pins and one blank space) on the underside of the Teensy so it occupies the A11, A10, AREF, and VUSB pins (*Drawing 5*). Solder it in place, using your breadboard as a guide to ensure proper alignment.
- 6. Repeating what you did in step 4, insert the Teensy's attached headers into the breakout board and hold the two boards together (*Drawing 6*), applying pressure over the surface-mount header so the gaps along the other headers are even. Trim the four extending pin ends with diagonal cutters, then separate the two boards.
- 7. Cut two 14-pin lengths of through-hole header, and fit them along the two longer edges on the underside of the Teensy (*Drawing 7*). Solder them, ideally continuing to use your breadboard as a temporary holder to ensure proper alignment.
- 8. Once again (as in steps 4 and 6) align the Teensy with the breakout board (*Drawing 8*) and trim the extending pins (28 of them) with diagonal cutters so they're nearly flush with the underside of the board. As before, make sure the gaps on each side are even. Once all the remaining pins are trimmed, separate the two boards.
- 9. If you're NOT using a switch (to select the power source) then SKIP THIS STEP! You should have already cut the VIN-VUSB trace on the Teensy. Place the Teensy Breakout board face-down in front of you. Place the surface mount DIP switch onto the box marked VUSB. The orientation of the part doesn't matter since the switch will either open or close the connection and its ON position is marked on the housing. Tack one side of the switch in place, then securely solder both leads onto the board. When the switch is in the ON position the Teensy will receive power via the USB connection, otherwise it will need to be hooked up to an external power source.
- 10. **If you're using a Teensy 3.0 (instead of a Teensy 3.1) then SKIP THIS STEP!** Place the Teensy Breakout board face-up on your work surface. Insert the provided gold pogo pin into the central hole outlined with a circle (*Drawing 9*). The thicker spring-loaded end should be facing away from the board, and the pin's thinner tail should sit in the hole. Flip the board over while holding the pin in place (use tape to secure it if you need to) and solder it in place from the other side.

- 11. Connect the two boards (*Drawing 10*) and secure them together with tape wrapped around their centers, being careful to make sure the gaps remain even on each side and the two boards are perfectly parallel. The pogo pin (if installed) will provide some resistance, but the boards should be pushed together as closely as possible. Position the assembly so the underside of the Teensy Breakout board is exposed. In opposite corners, tack several pins with solder and check again for proper alignment. Remove the tape and continue to solder all 51 through-hole pins connecting the Teensy to the Teensy Breakout board.
- 12. Cut two 24-pin lengths of through-hole header, and fit them along the two long edges of the Teensy Breakout board (*Drawing 11*). These exposed header pins will allow the assembly to interface with a standard breadboard. As before, the use of a breadboard to hold these pins in place while soldering them is highly recommended. Solder all 48 pins along both edges.
- 13. Being careful to apply light alternating pressure on opposite ends, remove the entire assembly from the breadboard. Applying too much pressure on one side can result in rapid release and rotation, causing the pins on the opposite side to bend or break off. Use of a slender metal tool (like a small screwdriver) to pry the assembly away from the breadboard, loosening it carefully from both ends, can greatly reduce the risk of bending or breaking any pins. Inspect the finished assembly to make sure everything is aligned correctly and that all pin connections are securely soldered (*Drawing 12*). Connect the Teensy to power with a USB cable and make sure it's working well.

Congratulations, you're finished!

→ If you enjoy using this board please consider leaving me a positive review on Tindie!
→ If you have any concerns or problems please to contact me at the email address below.

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