
MAKING A BUTTERFLY SWITCH

SAFETY

Always wear safety goggles when using the drill. Also wear the goggles when pushing the watch pin into place.

TOOLS AND MATERIALS

REQUIRED TOOLS

- Safety goggles
- 3D printer
- Wire strippers
- Switch tester
- Small flat-head screwdriver
- Soldering iron

OPTIONAL TOOLS (THAT MAY HELP YOU REGARDLESS, OR THAT YOU WILL NEED IF THINGS GO WRONG)

- Needle-nose pliers
- 3rd hand
- Flush cutters
- Hand drill/drill press with drill bits

Metric	Imperial
1.2 mm	#56 (0.0465")
1.5 mm	#53 (0.0595")

MATERIALS

- Plastic for 3D printer

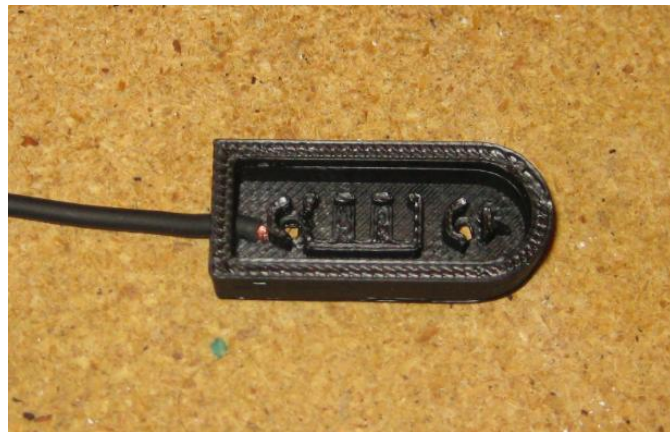
Switch Type	Standard	Standard with Clip	Tabbed base	Flat base
3D Models	<ul style="list-style-type: none">• Top (2.1 g)• Base (4.1 g)	<ul style="list-style-type: none">• Top (2.1 g)• Base (4.1 g)• Clip (2.1 g)	<ul style="list-style-type: none">• Top (2.1 g)• Tabbed Base (4.1 g)	<ul style="list-style-type: none">• Top (2.1 g)• Flat Base (4.2 g)
Total plastic	6.2 g	8.3 g	6.2 g	6.3 g

- Lever switch
 - Omron D2F-01L for light activation force (about 6 grams)
 - Available at [Newark](#), [Mouser](#), and [DigiKey](#)
 - Omron D2F-01FL for an ultra-light activation force (about 2 grams)
 - Available at [Newark](#), [Mouser](#), and [DigiKey](#)
- ½ x mono-to-mono cable (Switchcraft 33HR07233X)
 - Available at [DigiKey](#) and [Sager](#)

- 1 x 15 mm spring bar watch pin (1.5 mm tube diameter, 1.2 mm tip diameter)
 - Available at [Deal Extreme](#) (tested), [The Watch Prince](#) (not tested), and [Amazon](#) (not tested)
- Solder
- 2 x 2-56 x ¼" hex standoffs (Keystone Electronics 1797B)
 - Only needed for standard base and standard base with clip
 - Available at [DigiKey](#), [Mouser](#), and [Newark](#)
- 2 x 2-56 x ¼" Phillips screws
 - Only needed for standard base and standard base with clip
 - Available at [DigiKey](#)

ASSEMBLY INSTRUCTIONS

1. Cut the mono-to-mono cable into 2. This is your opportunity to make the cable for the switch as short or long as you want. For example, you can make one cable 30 cm and the other cable 150 cm.
2. Take one end of the cable, and feed it into the hole in the back of the base of the switch. Using needle-nose pliers or a screwdriver, push the cable up.



3. Pull through at least 10 cm of cable so that it is easier to work with.
4. Strip 1 cm of insulation from the end of the cable. Twist together the bare wires.

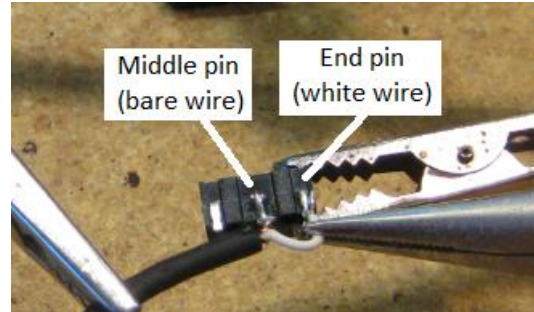


5. Strip 3 mm of insulation from the white wire.
6. Attach the mono plug to the switch tester. Touch the white wire to the bare wires. If the switch tester does not turn on, the cable is broken and cannot be used. Restart the process with another cable.
7. Tin the exposed wires. Cut the bare wire down to about 5 mm long.
8. Bend the pins of the lever switch 90 degrees, towards the side with the writing. Try to push the pins as close to the body of the switch as possible.



9. Tin the middle pin and the pin where the metal lever attaches to the body of the switch.

10. Solder the bare wire from the cable to the middle pin on the switch. Solder the white wire to the other pin that you tinned.



11. Attach the mono plug to a switch tester. Make sure that the switch tester turns on when you push down on the switch lever. If not, ensure that the solder connections are solid.

12. Pull the cable back through the hole in the base, until the switch is close to the rectangular holder in the base. Push the switch into the holder. This may take some force. Needle-nose pliers are recommended.



13. Push the wires down into the space between the switch and the wall of the base.

14. Push the hex standoffs into the two holders. Be careful not to break the holders.



15. Put a small amount of hot melt glue around the base, where the wire enters in the back. Wait for the glue to harden.

16. Slide the watch pin through the hole in the top so that it sticks out equally from each side.
- If there is still support material in the hole, or the hole is too small, put on your safety goggles and, using a #53/1.5mm drill bit, drill out the hole for the pin.



17. Put one side of the watch pin into one of the holes in the base.



18. Using a small flat screwdriver, push the other pin in as far as you can. With your other hand, push down on the top of the switch until the top clicks into place.
- If you are having trouble inserting the pin, take the pin out of the base. Go back to the previous step and try inserting the other side first.
 - If you have attempted to insert the pin into both holes but still have not succeeded in attaching the top, drill out the holes with a #56/1.2 mm drill bit.



TESTING

- Attach the switch to a switch tester. If the switch tester is off, the switch is operating correctly.
 - If the switch is always on, pull up on the tip of the switch, lightly at first. Eventually, you should hear the lever switch release and the switch tester will turn off. Let go of the switch. Repeat this process until the switch releases reliably. You can pull with quite a bit of force against the watch pins.
 - If pulling up on the switch does not fix the problem, you have 2 options. The first option is to print another top and/or base. Due to variations in the printed objects, it is possible that the base you have printed will work with a new top, or vice versa. The second option is to drill a larger hole in the top for the watch pin. This is a last-ditch option, as it is irreversible and may result in a non-functional switch.
- Push down on the switch. If the switch tester turns on, the switch is operating correctly. If the switch never turns on, listen to hear if the lever switch is clicking.
 - If the switch is clicking, that means there is a problem with the electrical circuit. You will have to remove the top from the base and check the solder connection between the switch and the cable.
 - If the switch is not clicking, you will have to remove the top from the base. Cut a piece of tape approximately 4 mm by 7 mm. Place the tape on the inside of the top, so that the lever switch will push against the tape. Put the top back on and test the switch again. Add as many layers as are needed to activate the switch tester.
- Release the switch. If the switch tester turns off, congratulations! You have just finished making a Butterfly Switch. If the switch tester does not turn off, check to see the source of the problem.
 - If the switch is stuck down at the bottom of the range of motion, try to feel where it is stuck. Remove the top from the base, and use flush cutters to cut away at any plastic that is rubbing.

- b. If the switch rises up, but does not fully release the lever switch, follow the instructions in the first testing step.