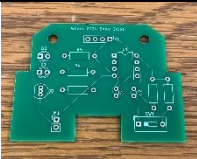


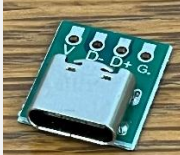


















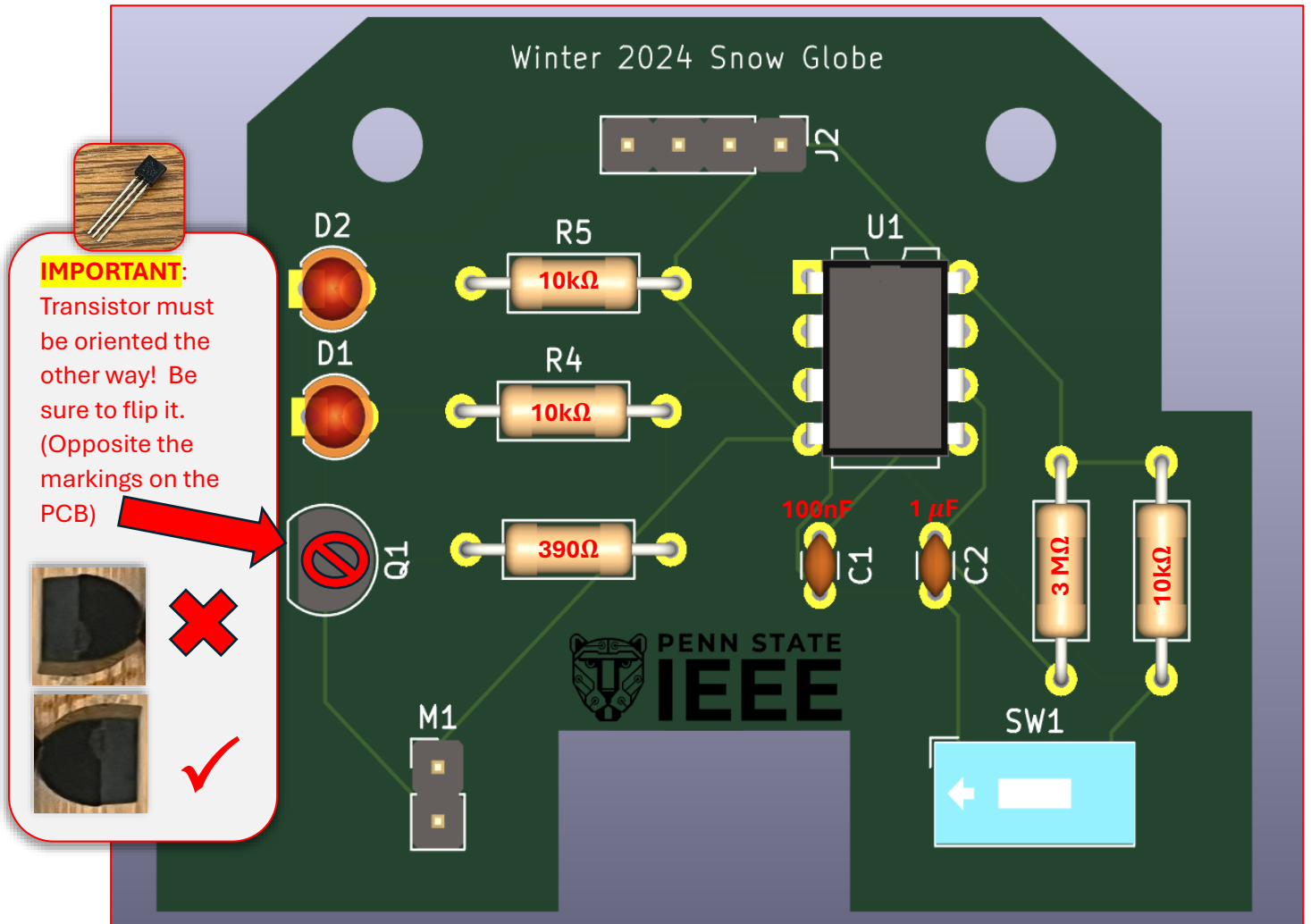
PSU IEEE WINTER 2024

Components for Snowglobe Workshop

COMPONENT	PHOTO	COMPONENT	PHOTO
[1] Printed Circuit Board		[1] Motor	
[1] 4-pin Headers		[1] USB-C Port	
[1] 390Ω Resistor <i>Band Colors: Orange, White, Brown, Gold</i>		[3] 10kΩ Resistors <i>Band Colors: Brown, Black, Orange, Gold</i>	
[1] Blue LED		[1] Green LED	
[16] Magnets		[5] screws	
[1] 100nF Capacitor		[1] Button Key switch	
[2] Motor Wires (1 Red, 1 Black)		[2] Button Wires (2 White)	
[1] 555 Timer IC chip		[1] IC Holder	
[1] NPN Transistor		[1] USB-C cable	
[1] 3MΩ Resistor <i>Band Colors: Orange, Black, Green, Gold</i>		[1] μF capacitor	

***Also in kit: [1] Pack of 4 rubber feet**



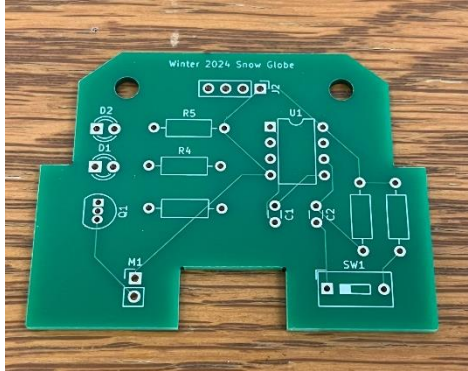
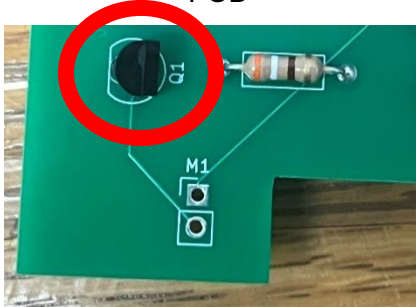
Snowglobe Workshop Component Values



KEY:

390 Ω Resistor [1]	Orange, White, Brown, Gold
10 k Ω Resistors [3]	Brown, Black, Orange, Gold
3 M Ω Resistor [1]	Orange, Black, Green, Gold
100 nF Capacitor [1]	Yellow
1 μ F Capacitor [1]	Blue

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Snowglobe Workshop
Instruction Manual

STEPS	PHOTOS
<p>Let's begin to build our DIY Motorized Snowglobe.</p> <p>Before we begin, take your chosen 3D-printed centerpiece and your correct stand. (For the Lion Shrine and Beaver stadium, the longer stand is needed; for the Logo, the shorter stand is used).</p> <p>Use super to attach the centerpiece to the stand. We will let this dry while we work on the circuit board.</p> <p>We'll start by soldering our circuit board. We'll begin with the transistor. IMPORTANT: The transistor is inserted opposite the marking on the PCB. So, the semicircle shape does NOT line up. You can reference the image to the right showing the bottom left of the PCB.</p> <p>Be careful while soldering the transistor. The pins are very close together, so you don't want to accidentally solder them together.</p> <p>Also, throughout soldering, try not to over-solder in general. This results in high amounts of solder on the back of the PCB, which will make it impossible to insert the PCB into the snowglobe base.</p>	   <p>PCB</p>  <p>Transistor orientation.</p>

Next, we'll do the resistors. Insert the resistors into the correct locations using the diagram. You can solder these 5 resistors at once or one by one. Resistors have no specific orientation, so they can be inserted either way.

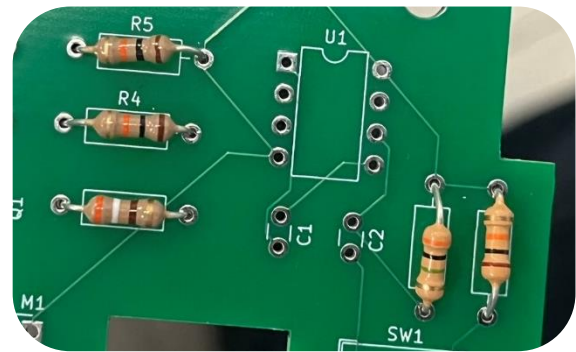
Your resistors should match with the first image to the right. (Future images may have slightly different resistors in place due to different circuit versions, so check your resistor placement against this image. Use the diagram and key to understand which colored resistors go where.)

Next, we can solder the capacitors. The yellow capacitor (100 nF) is on the left (C1). The blue capacitor (1 μ F) is on the right (C2).

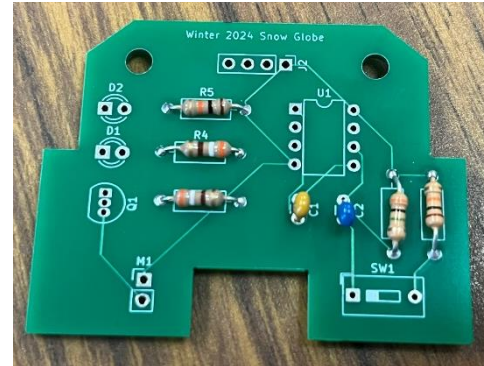
Now you can solder the IC Holder. Do NOT solder the IC chip itself; rather, we solder a holder which will hold the IC Chip. The IC Holder has a little notch on one end. This notch aligns with the notch on the PCB.

Now we can solder the LEDs. These colors are arbitrary, but we will use the Green LED for Power, and the Blue LED for the motor. The PWR LED (Green) is on the top (D2). The MOTOR LED (Blue) is on the bottom (D1).

LED Orientation: The longer legs of the LEDs are the positive legs; these legs go into the circle holes (right on the front of PCB). Similarly, the shorter legs of the LEDs are the negative legs; these legs go into the square holes (left on the front of PCB).



Resistors added. Match your resistors.



Capacitors added.



IC Holder installed.



LEDs added.

Now we can insert the 4-pin headers. These headers don't have any left-right orientation. Insert the shorter legs into the PCB; the longer ends stay out (for the USB port to go onto).

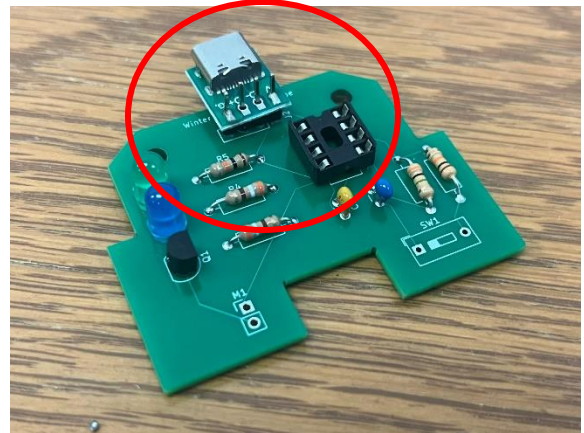
We now solder the USB-C port onto the 4-pin headers. Place the port onto the headers so that it faces away from the PCB. You only need to solder "V" and "G" on the USB port; the "D-" and "D+" can be ignored.

Next, we'll want to solder the motor wires. Solder the red wire to the side of the motor labeled with a plus sign (+). Solder the black wire to the other side of the motor.

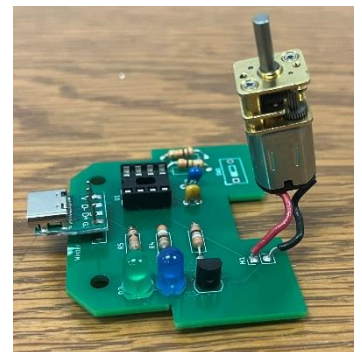
Once this is done, the other ends of the red and black wires get soldered to the PCB. The red gets soldered to the top hole, and the black gets soldered to the lower one.



4-pin Headers soldered.



USB-port soldered.



Wires correctly soldered to motor.
Motor soldered to PCB.

With the motor now soldered on, the PCB can now be inserted into the snowglobe base. Insert the motor first and slide it down while simultaneously inserting the PCB. The PCB should sit flush within its place. If it is sticking too high up, there may be too much solder beneath it, and you should trim off some of the excess without damaging the connections. (It may be popping up slightly, but the holes in the PCB are available for screws later).

Next, we can solder the two white wires to the ends of the keyboard switch. This switch will serve as the operating button for the snowglobe. Solder each of the two white wires to the two switch pins. It doesn't matter which wire is soldered to which pin.

Thread the switch with the two soldered wires **backwards** through the hole of the 3D base. It should click into place. (In other words, follow the arrow to the right. The switch will not fit if attempted to insert it forwards.) This **MUST** be done before soldering the other switch ends to the PCB.

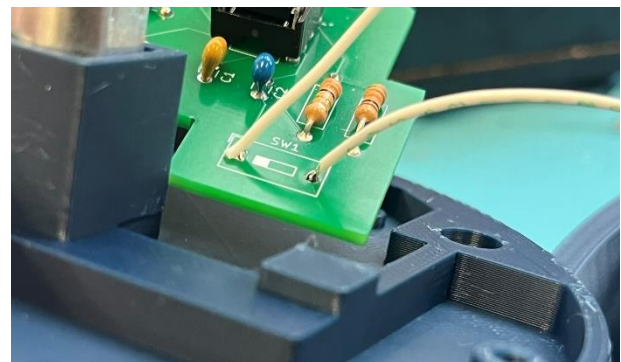
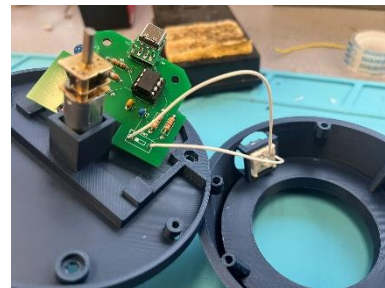
Now, we can solder the other switch ends to the PCB. It does not matter which pin of the switch is connected to which hole of the PCB. Solder either, but make sure the switch has been threaded through the base before soldering.



PCB installed.



Switch wires soldered and switch inserted.



Switch soldered to PCB.

The USB port may be raised up slightly. Use a screw with a blue spacer to screw it down. Do not over screw because you risk stripping the 3D mold. Screw it down until there's some resistance.

Each kit has 5 screws in it. There are 2 screw holes on the PCB to lock it down and 4 holes on the bottom to eventually close the base (6 total). It's up to you how you wish to use these 5 (whether it be 2 on the PCB and 3 on the bottom, 1 on the PCB and 4 on the bottom, etc.)

Now we can fill our globe. Fill it about $\frac{1}{2}$ - $\frac{3}{4}$ way with water, preferably distilled. Add glitter. Add some soap, to prevent the glitter from floating. Add a dash of isopropyl alcohol for bacteria mitigation. You may need to stir it a bit. Add the remaining needed water.

The glitter should sink. The soap may float, which is okay. We want as little glitter to be floating as possible, so it does not line the edge of the globe and harm the water-tight seal.

Now, press in the seal that has your glued-on centerpiece. It will squeeze excess water out, so do it over a sink or trash can. Press the edges as well as the middle. Eventually, it will not leak water once turned over. (There is a dip tray and drain holes in the snowglobe in case of accidental leakage).



PCB screwed down.



Snowglobe mixture added. Glitter has sunk.



Seal secured.

Test your circuit. The green light should turn on as soon as the USB is plugged in. It is dim so it may be hard to see. Clicking the button should turn on the blue light as well as spin the motor. Troubleshoot any circuit issues now before proceeding.



Plug the USB cable in and test the circuit.

If the circuit works, put the top of the base onto the bottom of the base. It should fit neatly. The USB port should also fit within the hole.



USB port fits.

Use your remaining screws to lock in the base. There's 4 holes on the bottom. Again, don't over do it or you'll break the mold.



Base screwed down.

Press in 2 magnets on each end of the outside propeller. To know the orientation of the magnets, they should stick to the magnets that are already in the free-spinning propeller inside your globe. Check by pressing the magnets against the bottom of your globe to find the orientation. Then, put 2 in each of the 4 holes in the outside propeller.

The propeller is then inserted onto the motor. Press it down onto the motor. There is a motor-shaped hole on one side, so it can only go down one way (with the magnets facing up).

Take your sealed globe and screw it on top. The two propellers will magnetically align, which allows for the snowglobe's water mixture to spin.

Add your 3d-printed cap onto the key switch. Align the pluses so it fits on. Also, add your 4 rubber feet to the bottom of the globe to prevent it from sliding. Then, plug in your snowglobe and start it up. It should work.

You've successfully created a DIY Motorized Snowglobe.

PSU IEEE FA24
WINTER SNOWGLOBE WORKSHOP



Outside propeller with magnets being installed.



Propeller inserted onto motor.



Globe screwed on. Cap added.



DONE.