

1. Assembly contains MLCC capacitors. MLCC capacitors are sensitive to heat. Temperatures shall be controlled when hand and reflow soldering.
2. Components highlighted YELLOW are not installed.
3. Components highlighted GREEN should be inspected for polarity prior to reflow or powering on the PCB. Pin 1 is indicated with a black dot.
 1. Components highlighted BLUE are TVS diodes. The part number in the BOM does NOT have polarity. If a different TVS diode is used then polarity inspection may be needed on these components. A black dot has been placed on the cathode side of the footprint.
4. Components highlighted RED are heavy components. Use an appropriate high-temperature staking material to stake these components prior to second reflow.
 1. Staking may be avoided if J1 is installed by hand after second reflow and the through-hole connections are made on J3 prior to second reflow.
5. Components highlighted PURPLE are the resistors in the resistor divider network the IR reflective sensor signal is being fed into.
6. See Detail A for the polarity of APA102-2020, D3. See the [Data Sheet](#) for additional package information.

Project:

HDD Clock V3.0 Driver Board PCB Assembly

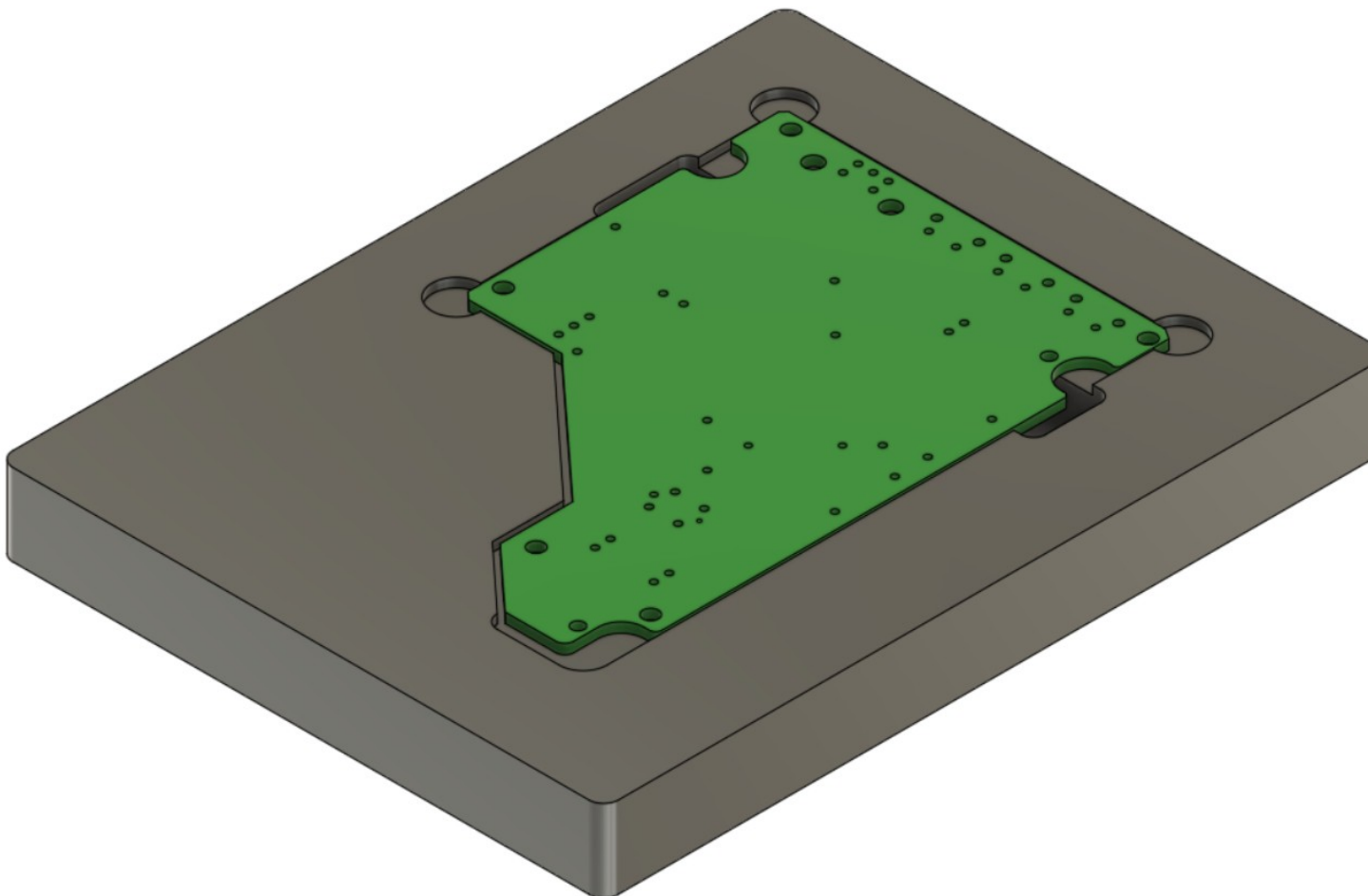
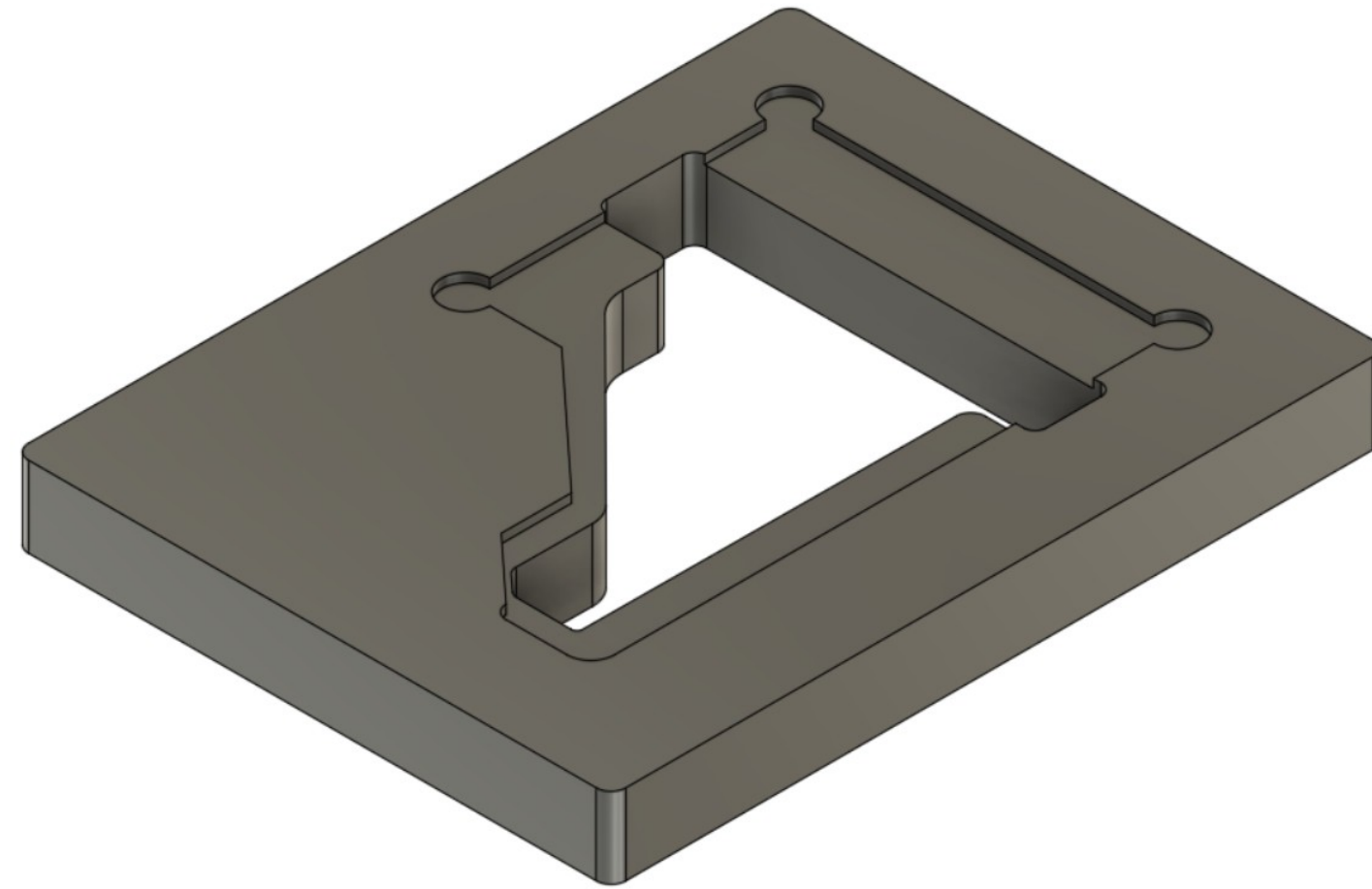
Pg. Description:

Bottom Side SMT Polarity and Component Notes

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7. Now that the bottom side of the PCB has been assembled we need to suspend the bottom components while applying solder paste and placing components.

The Driver Board Solder Paste Stencil Jig can be used for both applying solder paste to the top side of the PCB as well as a holder for the PCB while components are being placed.

Print settings for this jig:

1. Layer height of 0.25mm to ensure the PCB pocket is 1.5mm deep.
2. Enable ironing to ensure a smooth top surface
3. 10-15% infill should be sufficient

When using this jig ensure that it is not exposed to high heat.

Steps to use this jig:

1. Using double sided tape, secure the jig to the top of a stable surface.
2. Carefully place the Driver Board PCB, placed parts down, into the paste jig.
3. Align the stencil to the jig and secure it using tape. The jig is about the same size as the ordered solder stencil.
4. Using an appropriate tool, apply solder paste to the PCB.
5. Carefully remove the PCB from the jig using tweezers or leave it for parts placement.

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HDD Clock V3.0 Driver Board PCB Assembly		
Pg. Description:		
Top Side Solder Stencil Jig		
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Top Side

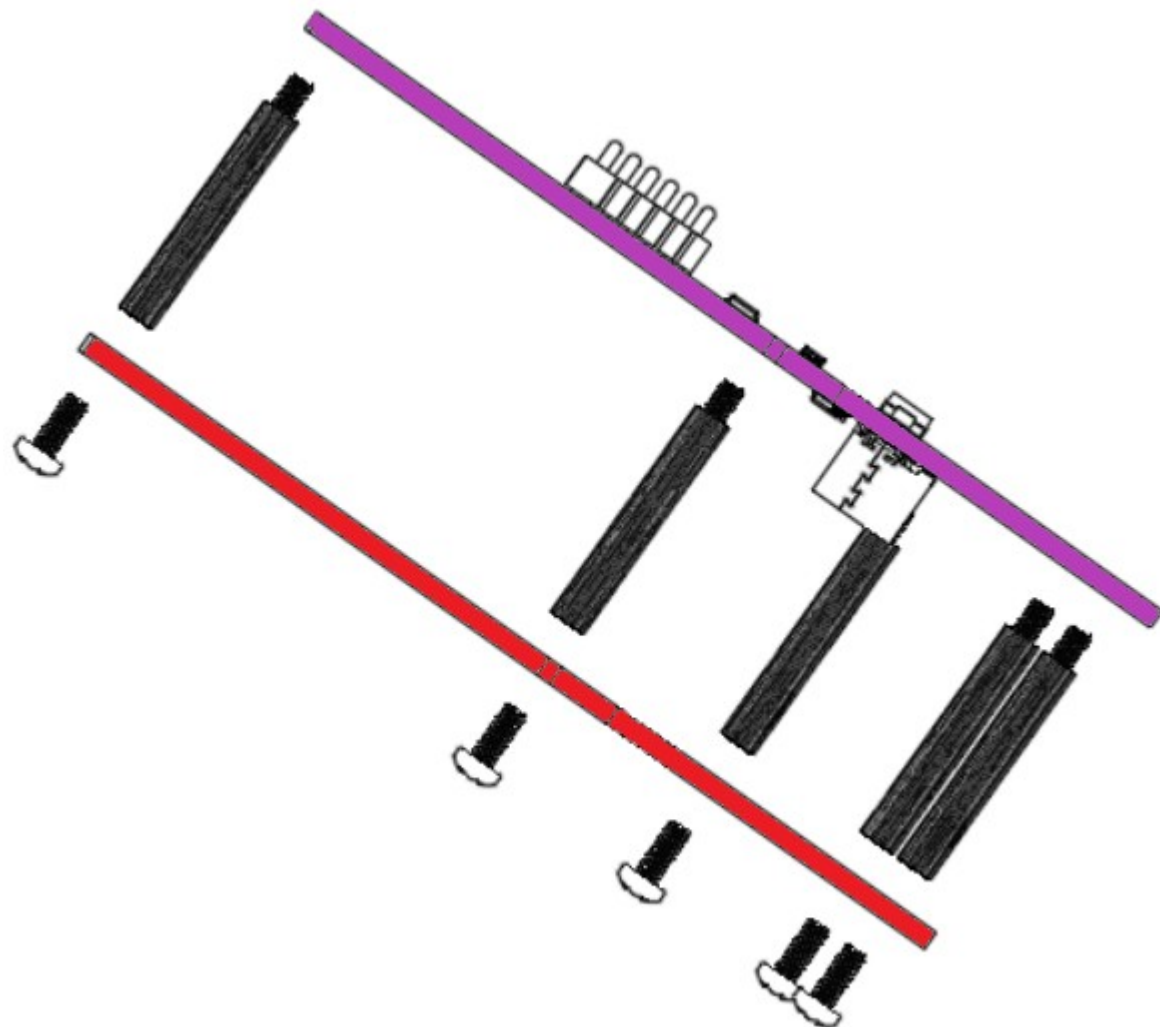
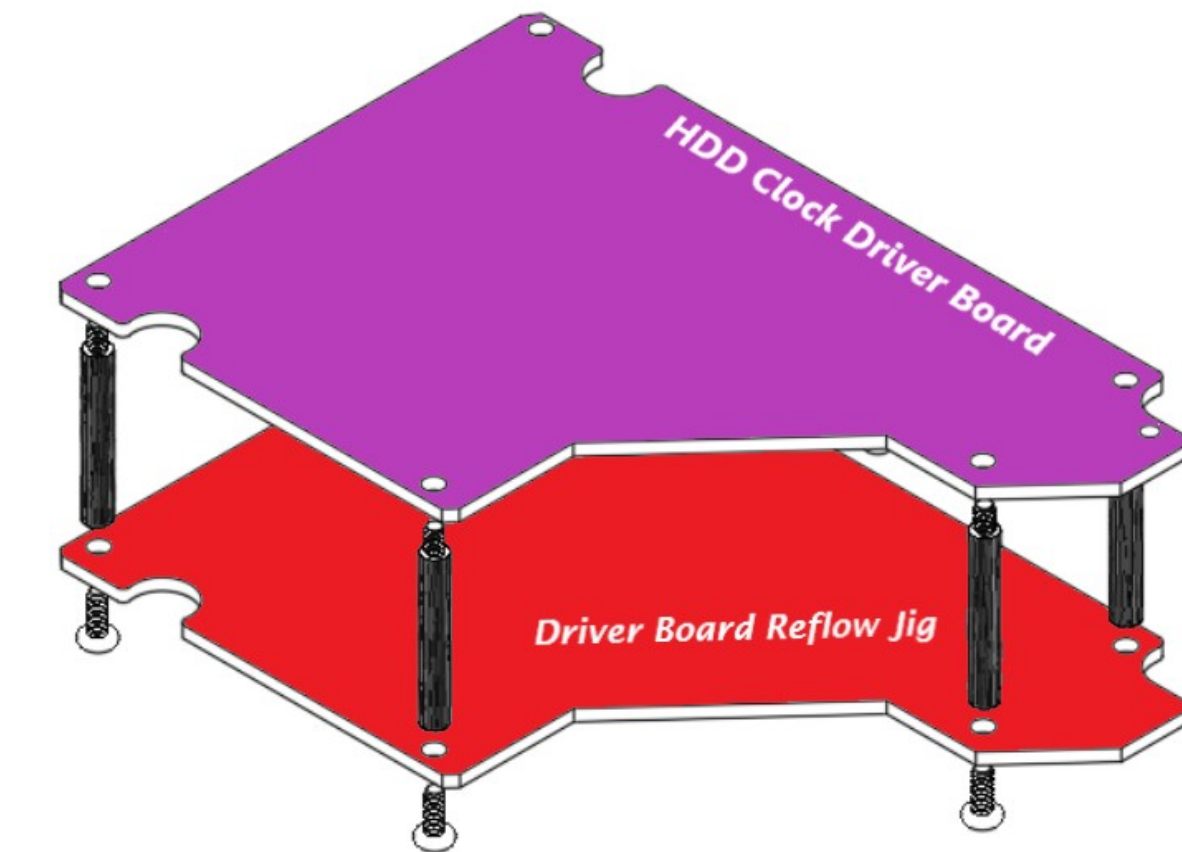


8. Assembly contains MLCC capacitors. MLCC capacitors are sensitive to heat. Temperatures shall be controlled when hand and reflow soldering.
9. Components highlighted YELLOW are not installed.
10. Components highlighted GREEN should be inspected for polarity prior to reflow or powering on the PCB. Pin 1 is indicated with a black dot.
 1. Components highlighted BLUE are TVS diodes. The part number in the BOM does NOT have polarity. If a different TVS diode is used then polarity inspection may be needed on these components. A black dot has been placed on the cathode side of the footprint.
11. Components highlighted RED are spring connectors. Placement of these components is **critical**. Ensure the connectors are as centered as possible.
12. L1, highlighted PURPLE, is the inductor for the boost converter circuit. If the chosen inductor will not fit in the HDD case due to height or footprint placement an alternate footprint (L2) is available on the bottom side of the PCB.
13. Components highlighted ORANGE are parts for the 3.3V LDO regulator circuit. the part number in the schematic sold out before it could be ordered. Ensure proper capacitor values are installed for the substitute LDO.
14. This side of the board will require the Driver Board Reflow Jig PCB to suspend the PCB during second reflow. See page 3 for instructions.
 1. These steps are necessary for reflow in a toaster oven. The solder jig raises the PCB so the bottom parts do not make contact with the the oven rack. Disregard this note if not using a toaster reflow oven.

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HDD Clock V3.0 Driver Board PCB Assembly		
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Top Side SMT Polarity and Component Notes		
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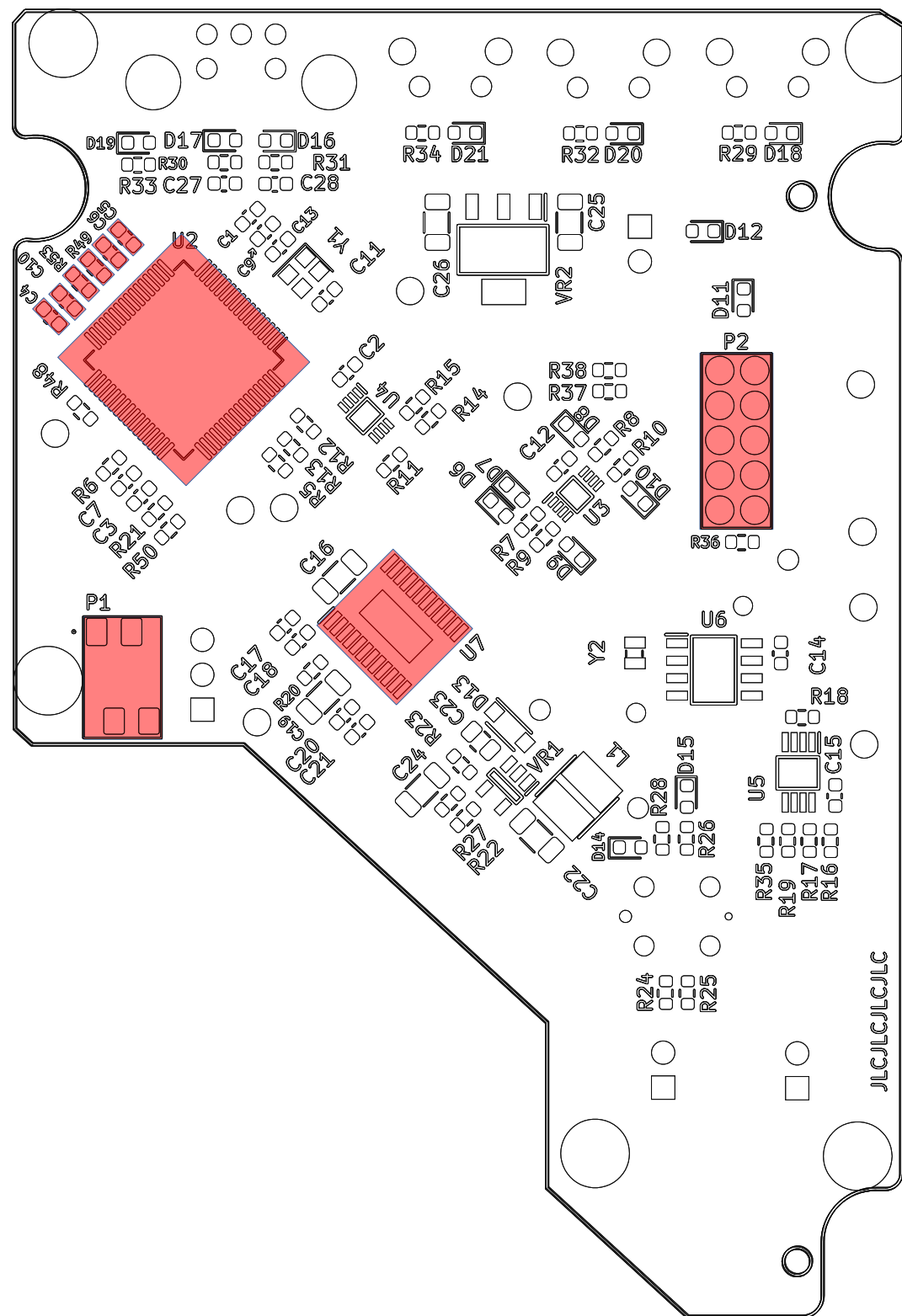
15. The HDD Clock V3.0 Driver Board PCB has components on both sides of the PCB that require a reflow soldering process. The reflow oven I have does not suspend the PCBs by the board edge. This makes reflowing 2 sides of a PCB difficult due to the parts on the bottom side. The Driver Board Reflow Jig PCB has been designed to suspend the PCB during second reflow. The following instructions outline how to use is jig.

1. Assemble, hand-tight, m2 screws and standoffs to each hole of the Driver Board Reflow Jig. Standoffs need to be at least 10mm long. Reference images to the left show, at scale, 20mm standoffs and 5mm screws. 10mm standoffs recommended.
2. Carefully place the HDD Clock Driver Board PCB with components placed onto the standoffs previously mounted to the Driver Board Reflow Jig.
 1. This fixture should be tested before any parts are assembled. If this assembly is difficult then consider pasting the board, mounting it to the jig then place top-side SMT components. Spring connector placement on this side of the PCB is critical.
 2. Do not use nuts to secure the HDD Clock Driver Board to the standoffs.
3. See page 4 for critical pre-second-reflow component inspections and reflow instructions.

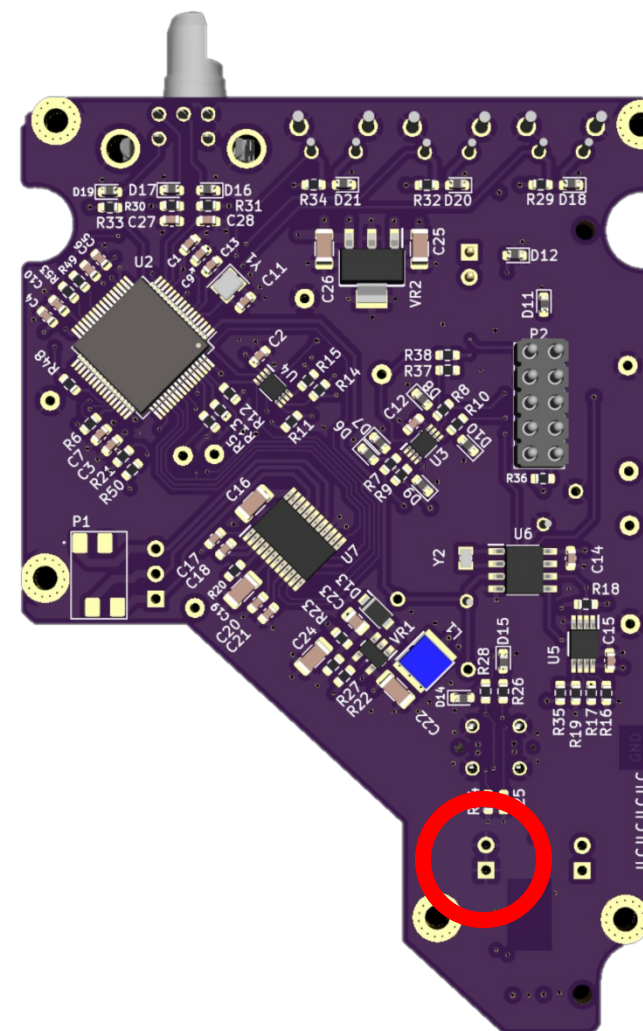


Project: HDD Clock V3.0 Driver Board PCB Assembly		
Pg. Description: Driver Board Reflow Jig Instructions		
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Top Side



16. Refer to page 2 for polarity inspection. Components highlighted RED have critical placement. Inspect these parts closely prior to reflow.
17. Reflow the assembly for the second time using the following instructions:
 1. See the Reference Image below for the recommended through-hole location to place the reflow oven thermocouple. Secure the thermocouple with Kapton tape ensuring the thermocouple is making contact with the copper of the PCB.
 2. Place the assembly on the middle of the reflow oven rack and carefully slide the rack into the oven taking care not to disturb any components.
 3. Reflow the PCB using the oven profile for the chosen solder paste.



Project:

HDD Clock V3.0 Driver Board PCB Assembly

Pg. Description:

Second Reflow Instructions

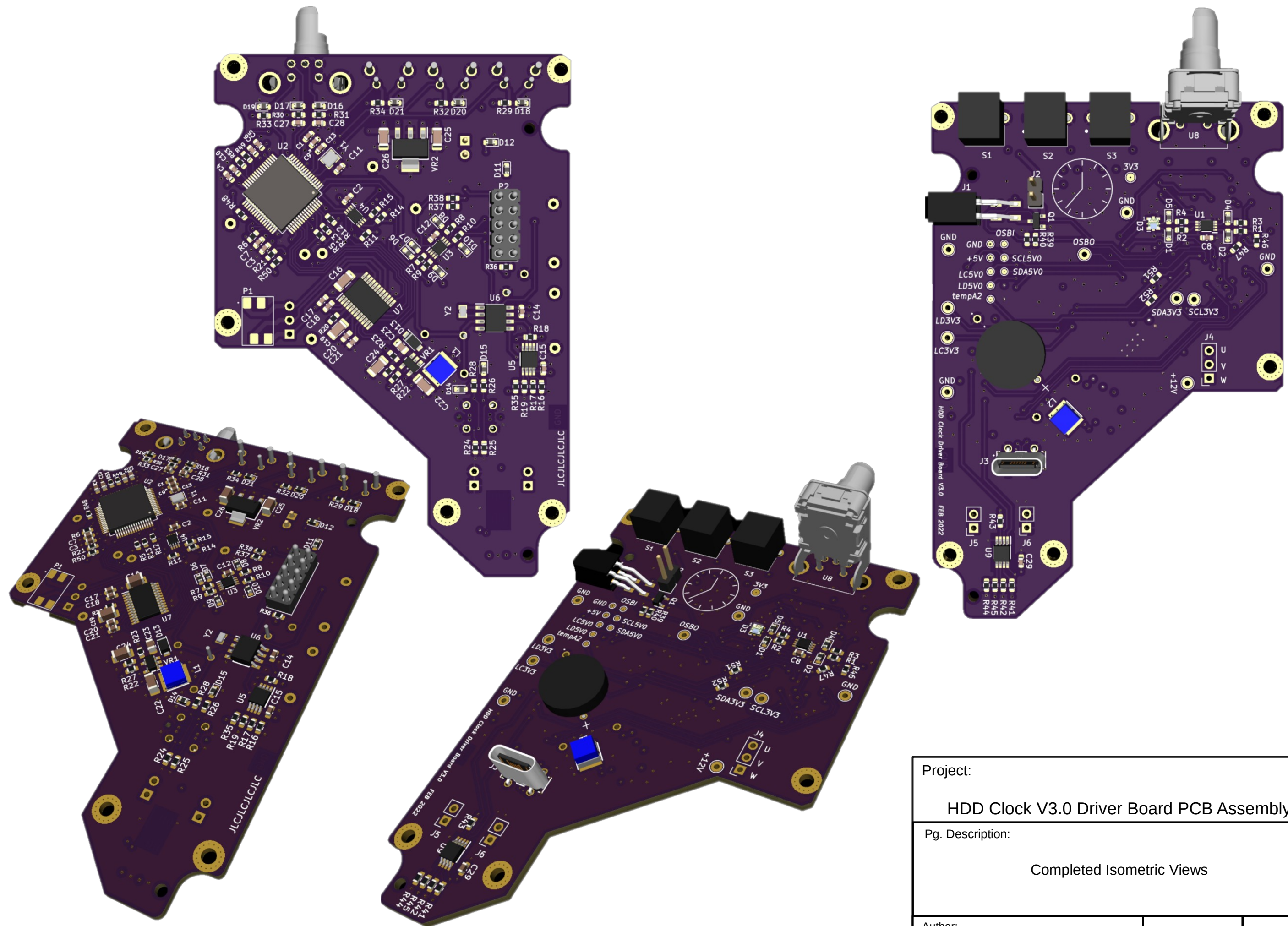
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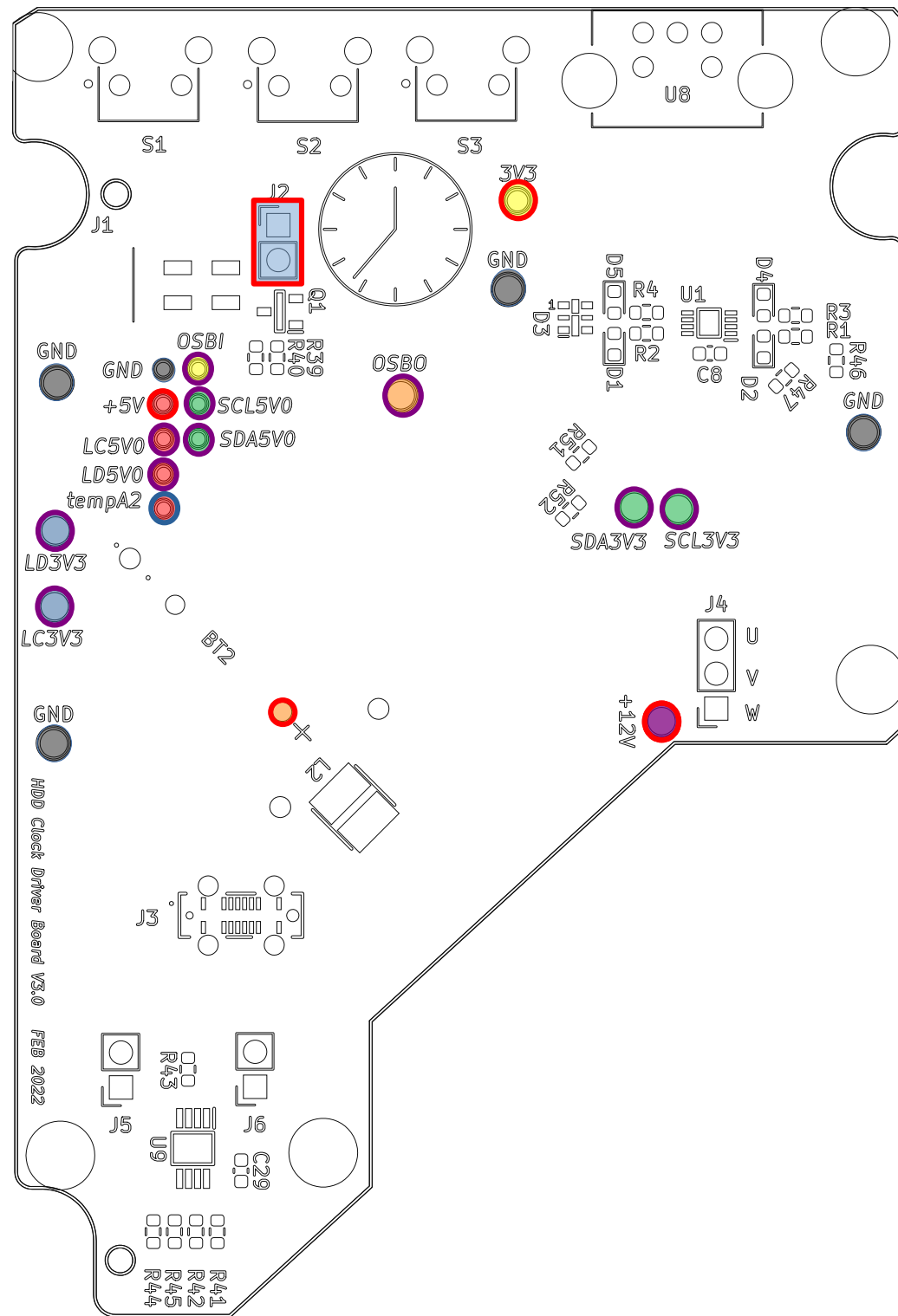
18. Components highlighted BLUE are installed through-hole components.
ensure leads are short enough to fit in HDD case
-BT2 has polarity. Positive pin is shown with a black dot.
19. Components highlighted YELLOW are not installed.
 1. These components may be installed later if an oscilloscope is to be connected to the motor (J6), or if +5V is to be injected into the PCB as a power source (J5 & J6).
20. Highlighted GREEN is an alternate footprint for BT2 (BT1).
 1. This footprint cannot be used if L2 is populated.
21. J3, highlighted RED, should have either had it's through-hole pins soldered or been staked prior to second reflow. If the through-hole pins are not soldered, solder them now.
22. Components highlighted PURPLE are optional through-hole test points. If desired, probe test points or wires can be soldered at these locations for testing.

<p>Project:</p> <p>HDD Clock V3.0 Driver Board PCB Assembly</p>		
<p>Pg. Description:</p> <p>Through-Hole Assembly</p>		
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Project:		
HDD Clock V3.0 Driver Board PCB Assembly		
Pg. Description:		
Completed Isometric Views		
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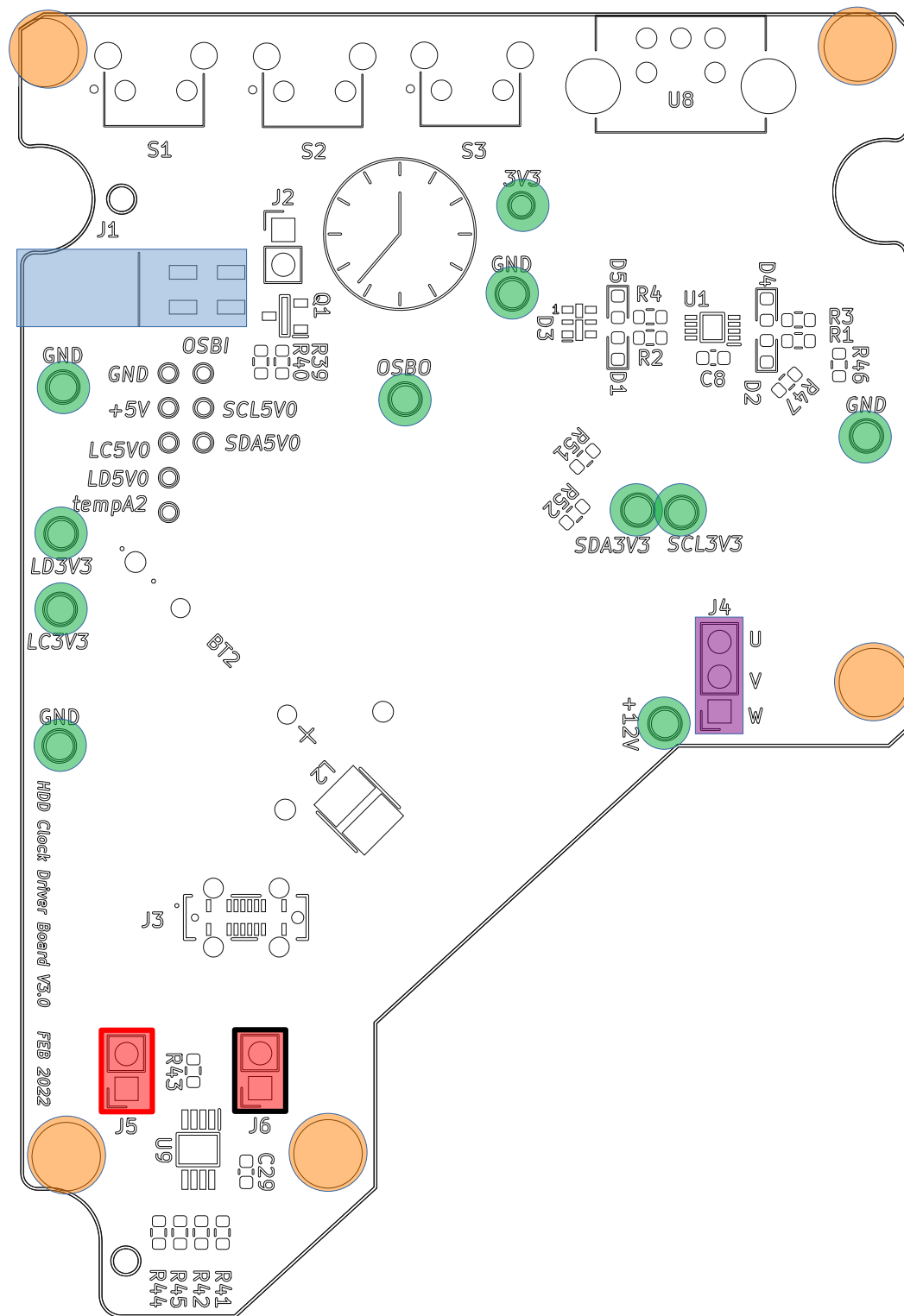
Bottom Side



23. Using a DMM in continuity mode, check for shorts between the highlighted test points 3V3 (yellow with red border), +5V (red with red border), +12V (purple with red border), + (positive pad of RTC battery; orange with red border) and GND (any of the test points highlighted black).
24. Test points SDA3V3 and SCL3V3, highlighted green with a purple border, are the 3.3V I2C test points. Devices connected to RTC lines:
 - Motor Driver IC
 - RTC
 - Temperature sensors (X3)
25. Test points LD3V3 and LC3V3, highlighted blue with a purple border, are the 3.3V data and clock connections for the APA102-2020 LEDs on the LED board. This is before the signal enters the buffer raising the signal to 5V levels. Test points LC5V0 and LD5V0, highlighted red with a purple border, are the test points for the LED signal and clock after they exit the buffer.
26. Test point OSBI, highlighted yellow with a purple border, is the optical sensor buffer in test point. Test point OSBO, highlighted orange with a purple border, is the optical sensor buffer out test point.
27. Header J2, highlighted blue with a red border, is used as a jumper connecting the 3.3V supply pin from the programming connector. Ensure the jumper is OFF when powering with the USB-C connector, J3, or injecting power via J5 and J6.
28. Test points SCL5V0 and SDA5V0, highlighted green with a purple border, are the 5V I2C test points. See note 24 for I2C device list.
29. Test point tempA2, highlighted red with a blue border, is the temperature alert test point for the temperature sensor on the LED board.

Project:		
HDD Clock V3.0 Driver Board PCB Assembly		
Pg. Description:		
Check For Power Shorts, Test Point Descriptions - Bottom		
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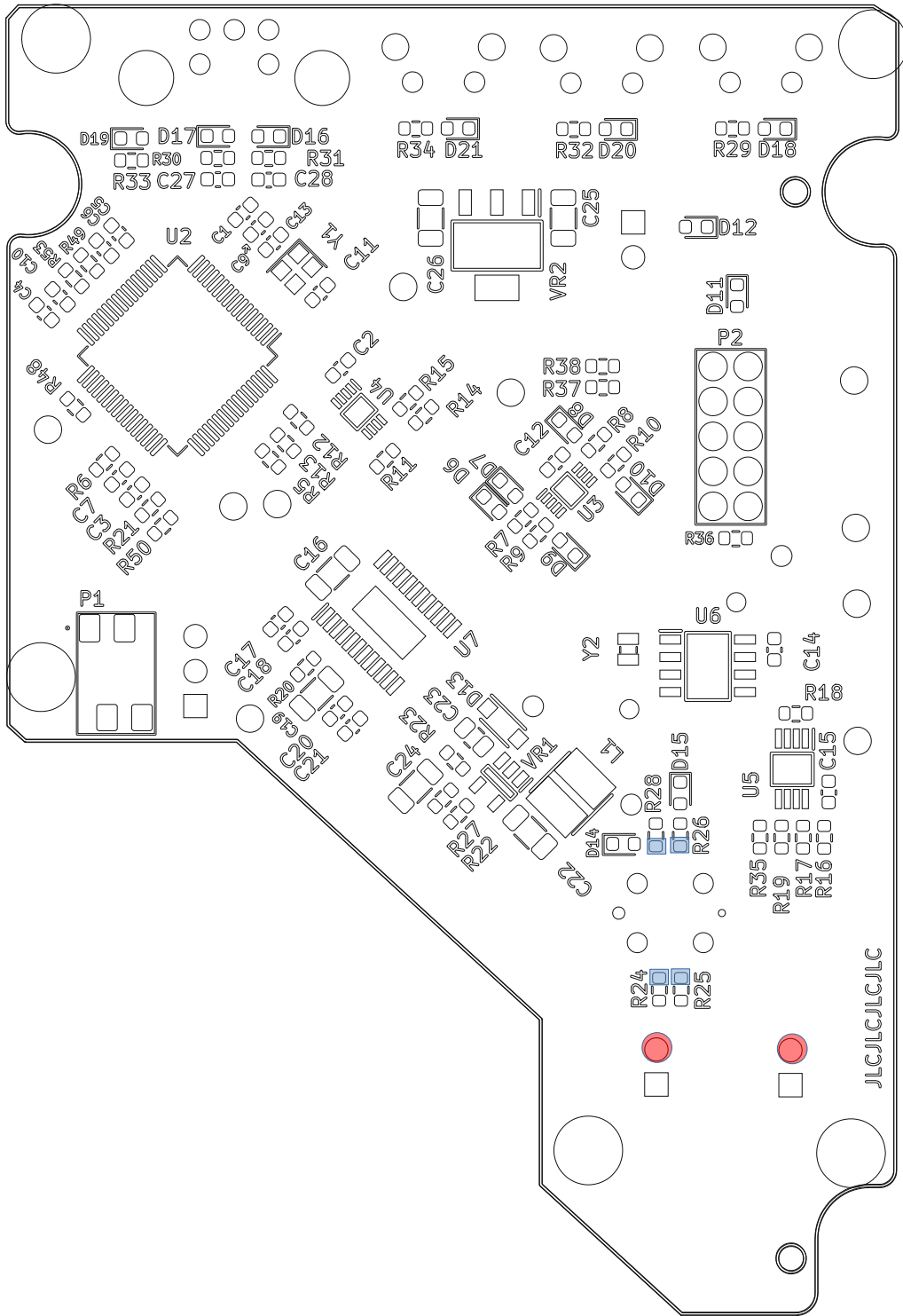
Bottom Side



30. Connector J1, highlighted blue, is a SWD interface used to program and debug the STM32F411 microcontroller. Ensure connections are correct between programming header and the programming device.
31. Connectors J5, highlighted red with a red border, and J6, highlighted red with a black border, can be used to inject power if the USB-C connector doesn't work out due to soldering issues or power needs.
32. Connector J4, highlighted purple, provides connections to the HDD spindle motor. Solder a header or wires here to connect the motor to an oscilloscope.
33. Optional TH test point locations, highlighted green, have been included in the PCB design. If desired, TH probe test points can be installed.
34. Mounting holes around the edge of the PCB, highlighted orange, can have m2 standoffs installed to elevate the board during manufacture and testing.

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HDD Clock V3.0 Driver Board PCB Assembly		
Pg. Description:		
Test Point Descriptions – Bottom Cont.		
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Top Side



35. Prior to applying power to the PCB, use a DMM to check for shorts between all the pads highlighted blue (SMT pad) and red (TH pad). None of these pads should be electrically connected. This is checking that the USB-C connector was installed correctly.

Project:		
HDD Clock V3.0 Driver Board PCB Assembly		
Pg. Description:		
Check For USB-C Connector Shorts		
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