

IO Board Assembly

Populate and solder the IO board for the OpenVVF control module.

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IO Board Assembly

This guide covers populating and soldering the IO board for the OpenVVF control module. It is written as general guidance for experienced assemblers; it does not describe every individual component placement.

! **Important:** Use the interactive HTML assembly tool for this board. It shows the exact placement and orientation of every part and is the authoritative reference for the build. The steps below highlight key techniques and gotchas, but the tool should be followed for the full bill of materials and placement sequence.

ERRATA:

Some parts may appear missing from the photographs in this guide. They were not available when the photos were taken; the parts list in the interactive BOM is the authoritative source.

SAFETY

- Work in an ESD-safe area and use a grounded wrist strap or ESD mat. This board contains ESD-sensitive ICs and connectors.
- Use adequate ventilation or fume extraction while soldering.
- Confirm correct polarity on diodes, electrolytic capacitors, and connectors before soldering; reversed parts can damage the board when powered.

Required materials and tools

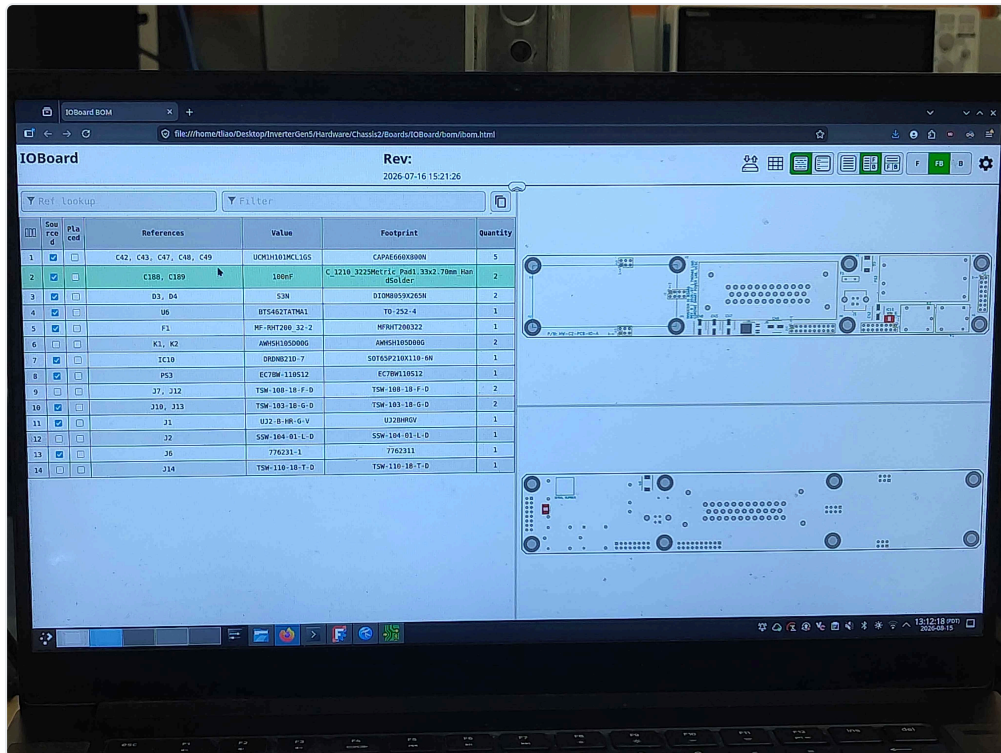
Item	Qty	Notes
IO board PCB	1	Control module IO board
Components per interactive BOM	as listed	See the HTML assembly tool for the full bill of materials
Solder	as needed	Leaded or lead-free, flux-core
Flux	as needed	No-clean or water-washable
Temperature-controlled soldering iron	1	With tips suitable for SMD and through-hole work
Soldering microscope or magnifier	1	Strongly recommended for fine-pitch parts
ESD-safe tweezers	1	For placing small parts
Flush cutters	1	For trimming leads
Heat gun	1	For heat-shrink, if used
Lint-free wipes and isopropyl alcohol	as needed	For flux cleanup
ESD wrist strap / mat	1	Mandatory for handling this board



IO board parts laid out for assembly

Step 1 - Open the interactive assembly tool

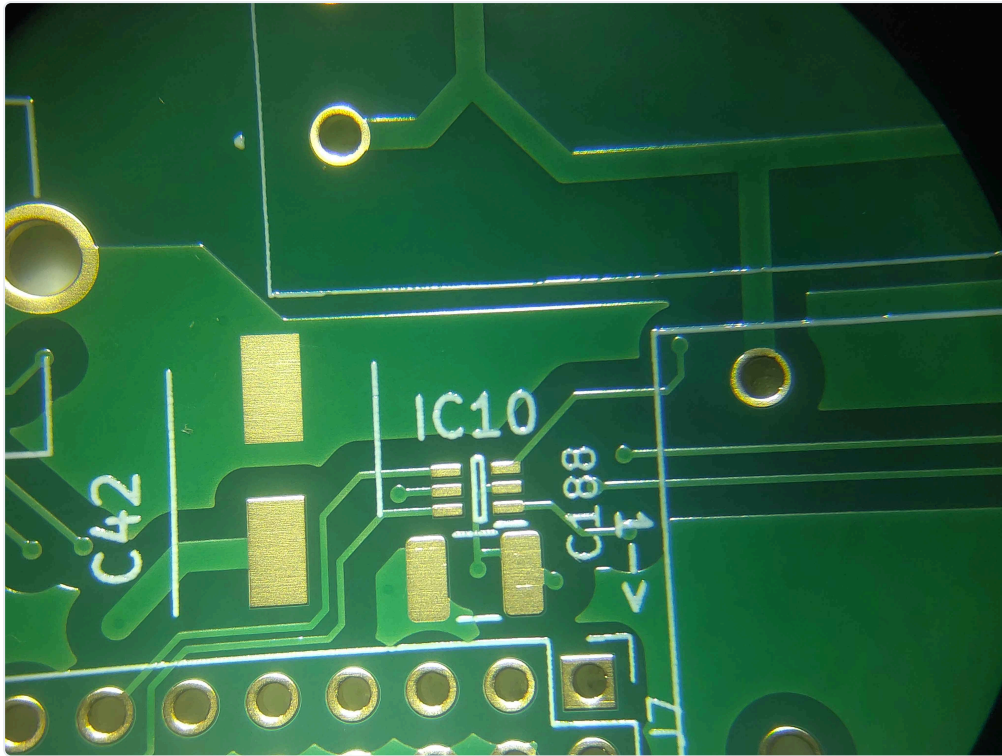
Before placing any parts, open the interactive HTML assembly tool for the IO board. Keep it visible throughout the build; it is the primary reference for part values, placements, and orientations.



Interactive BOM open on a screen showing IO board placements

Step 2 - Start with the smallest components

Populate the board from smallest to largest. Solder all of the small surface-mount parts first, then work up to larger SMD components, and do through-hole parts last. If the through-hole connectors and headers are soldered first, they physically block access to the SMD pads and make rework much harder.



Small SMD components being placed first

Step 3 - Use a microscope for fine-pitch work

A microscope or good bench magnifier makes a large difference when placing small ICs, resistors, and connectors. It helps verify alignment, check solder bridges, and inspect joint quality.

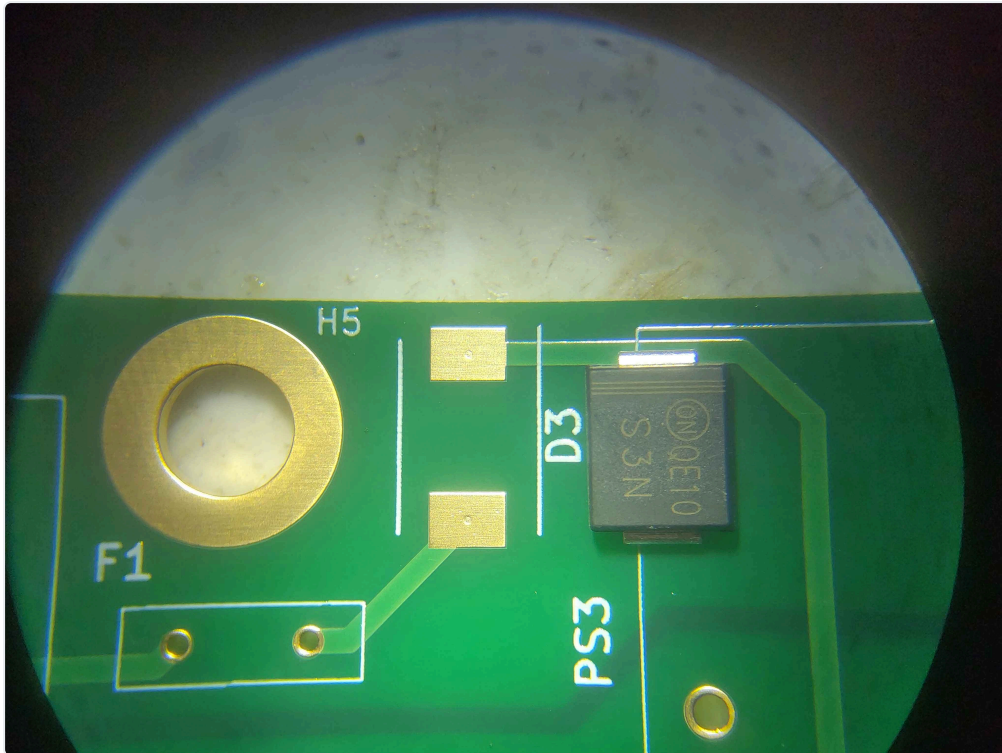


Soldering under a microscope

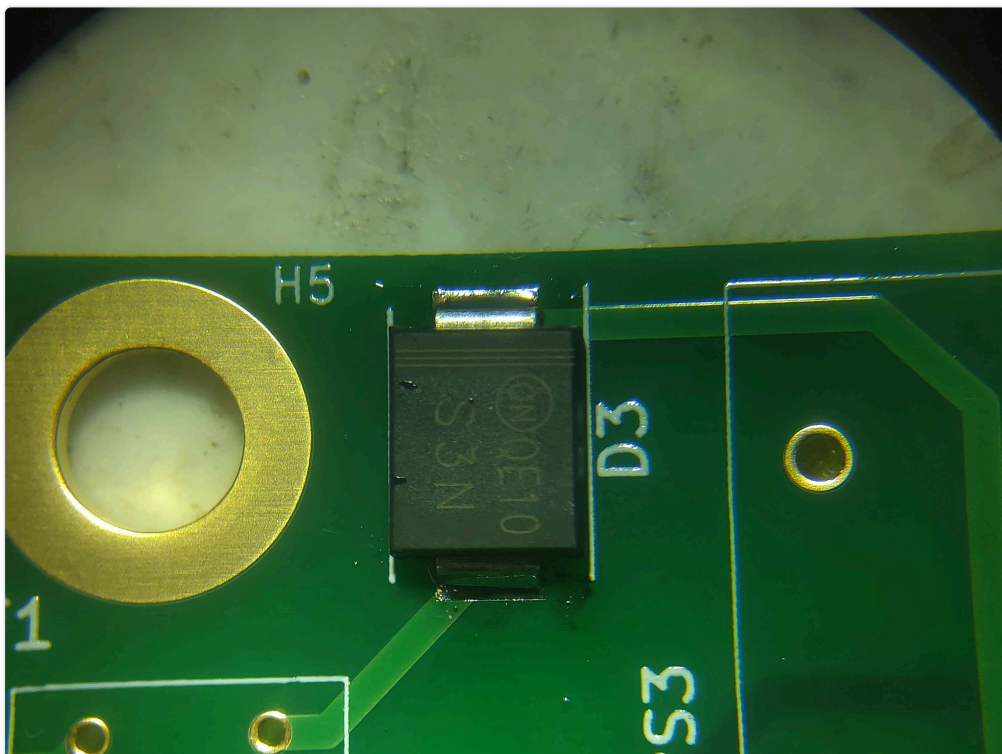
Step 4 - Align polarized parts to the silkscreen

Pay close attention to polarity marks on the PCB silkscreen.

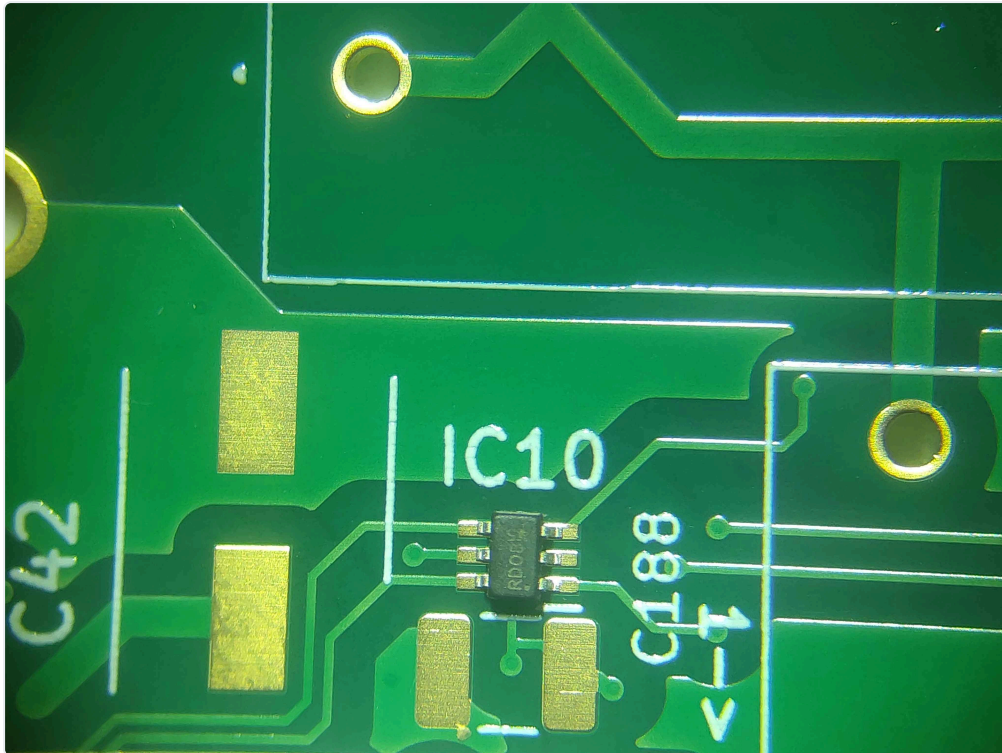
- For diodes, align the cathode bar on the package with the longer line on the diode symbol.
- For ICs, align the pin-1 dot or notch on the package with the dot/bar marked on the board.
- For polarized capacitors, align the positive lead with the **+** mark and the long-bar pad on the silkscreen.



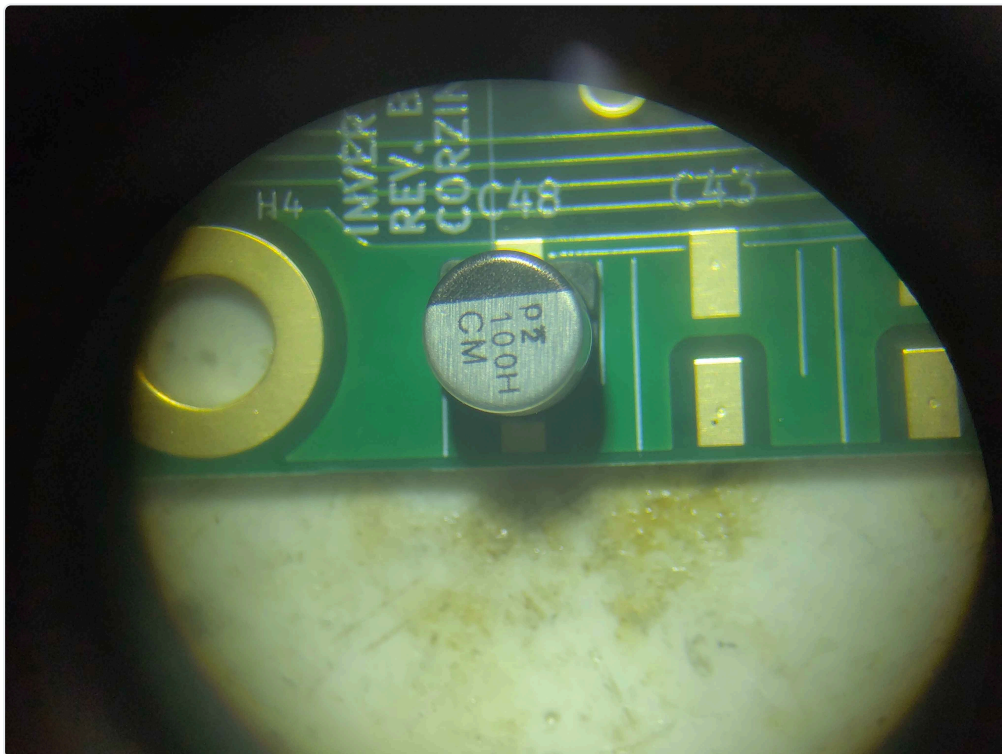
Diode polarity: package bar aligned with the longer silkscreen line



A soldered diode with polarity correctly aligned



IC polarity: package dot aligned with the board polarity mark



Polarized capacitor: positive lead aligned with the long-bar pad

Step 5 - Check connector orientation against the CAD model

Pin headers and connectors must be installed in the correct direction. The silkscreen is not always obvious, and some connectors may end up on the opposite side of the board from where you expect. Open the CAD model and confirm the orientation and mounting side of every header and connector before soldering.

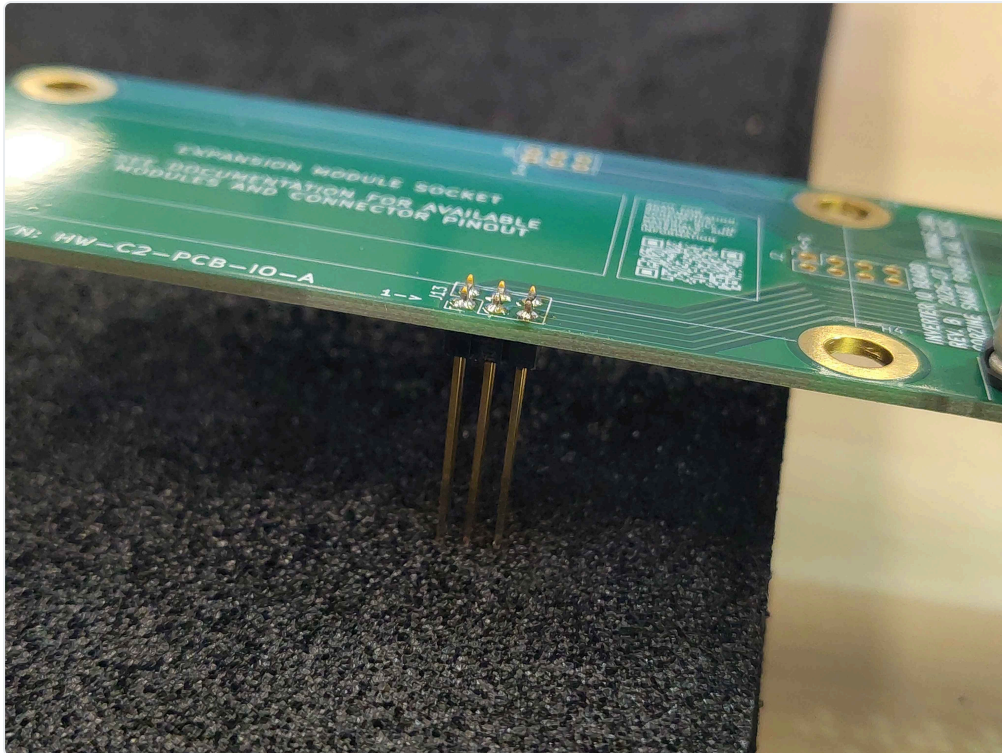
Warning: Soldering a pin header or shrouded connector in upside-down is difficult to fix and can ruin the board. Double-check the CAD model for every connector.



Checking connector placement and orientation against the CAD model

Step 6 - Solder connectors fully seated

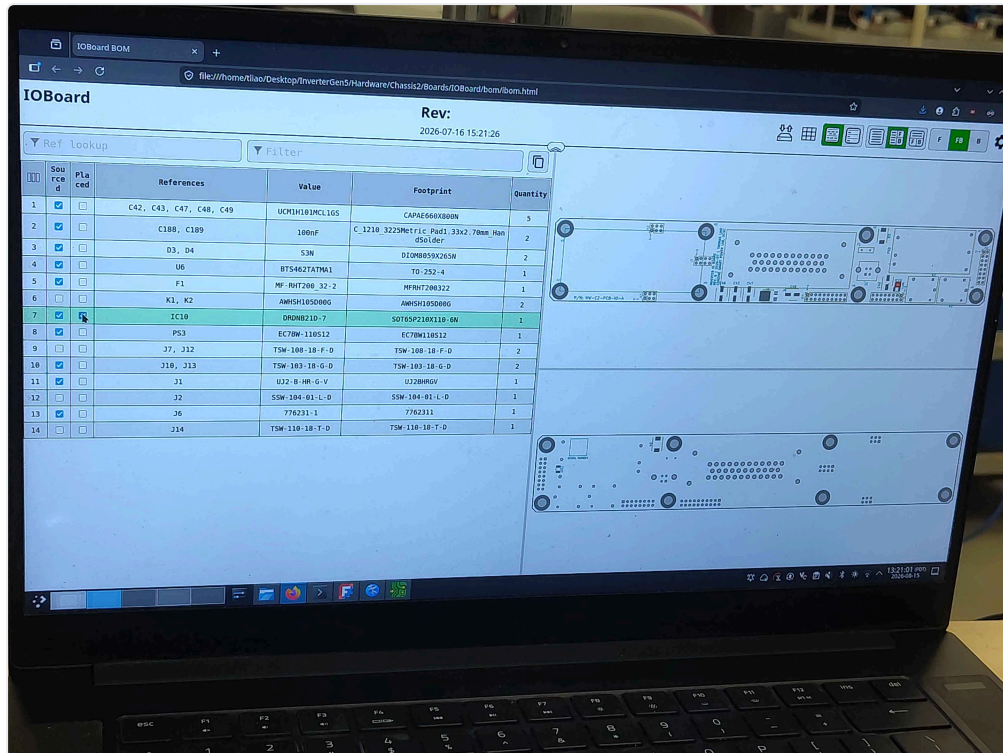
When soldering headers and connectors, make sure each one is fully seated against the board before soldering any pins. Tack one pin, check that the connector is flat and perpendicular, then solder the remaining pins. A connector that is not fully seated can cause mating problems or shorting later.



Pin headers fully seated and ready to be soldered

Step 7 - Mark progress in the interactive tool

As each part or group of parts is placed and soldered, mark it off in the interactive assembly tool. This keeps track of what is done and prevents parts from being skipped.



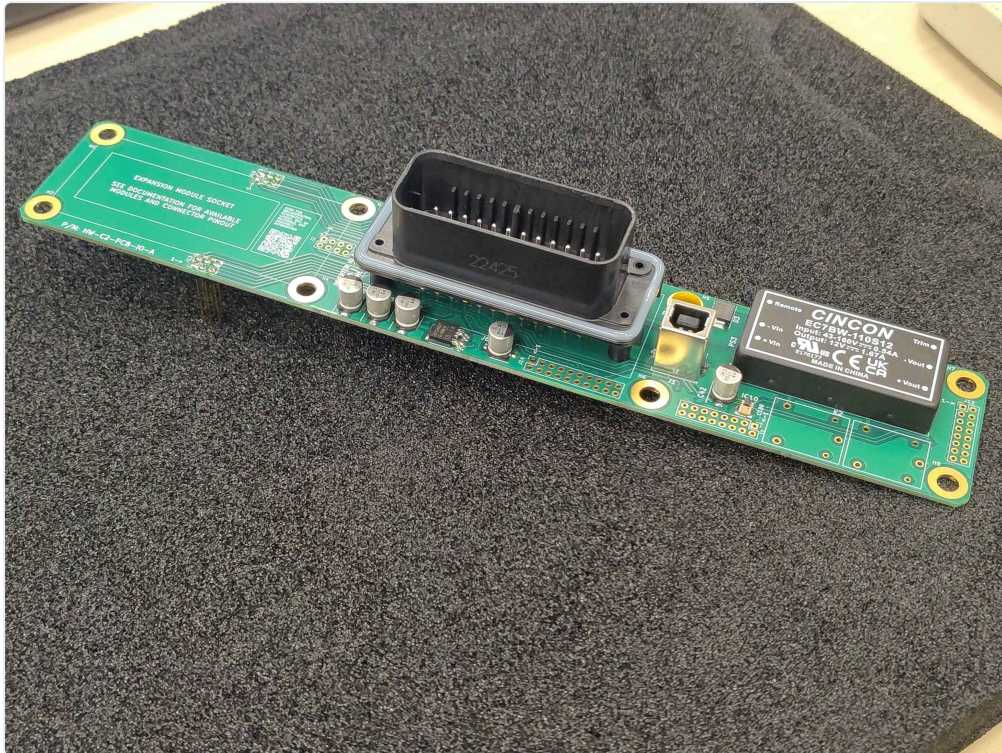
Checking off completed placements in the interactive BOM

Step 8 - Clean and inspect

After all soldering is complete, clean flux residue from the board with isopropyl alcohol and lint-free wipes. Inspect each joint under magnification for bridges, cold joints, and insufficient solder. Verify that all polarized parts are correctly oriented and that all connectors are fully seated.

Final assembly

The finished IO board should have all parts placed and soldered according to the interactive BOM, no solder bridges, clean flux residue, and all connectors fully seated and correctly oriented.



Completed IO board assembly

Next steps

With the IO board populated, proceed to the remaining control-module assembly steps described in the control assembly index ([OV-CA-INDEX](#)).