

COMPONENT PLACEMENT

Placement decides how easy routing is and how well the board works. Connectors at the edges, decoupling caps at the power pin, parts grouped by function, and heat given room.

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Placement is where you decide how easy the board is to route and how well it works. Place with intent: connectors at the edges, each chip's decoupling capacitor hard against its power pin, related parts grouped by function, and hot parts given room. Good placement makes routing almost fall out. Bad placement fights you the whole way.

PLACE THE FIXED THINGS FIRST

Start with what cannot move: the connectors, mounting holes, and any part whose position is set by the enclosure or the outside world. A USB connector belongs at a board edge because a cable has to reach it. Once the fixed parts anchor the layout, everything else places around them.

GROUP BY FUNCTION

Keep a circuit's parts together: the power section in one region, the microcontroller and its support in another, any analog or sensing parts in their own quiet corner. Parts that connect on the schematic should sit near each other on the board, because every net you shorten now is a trace you do not fight later.

DECOUPLING CAPS TOUCH THE PIN

A decoupling capacitor only works if it is close. The loop from the capacitor to the chip's power pin and back through ground has inductance, and the longer that loop, the less the capacitor can react to a fast current demand. So the 100 nF cap goes right at the power pin, on the same side, with the shortest possible path, before you place anything less urgent.

GROUP BY FUNCTION AND PUT THE DECOUPLING CAP AT THE PIN: ROUTING GETS EASIER AND THE BOARD GETS QUIETER.

KEEP NOISY AND SENSITIVE APART, AND LEAVE ROOM FOR HEAT

A switching regulator or a fast digital bus radiates, and a sensitive analog input picks that up, so put distance between them. Give a part that dissipates real power, a regulator or a driver, open space and copper around it so its heat has somewhere to go. And leave lanes between the groups for the traces that will connect them.

LET THE RATSNEST GUIDE YOU

The ratsnest draws a straight line for every unrouted connection. When a placement makes those lines short and untangled, routing is easy. When the lines cross into a knot, the placement is telling you to move something. Nudge parts until the ratsnest looks calm, and only then start laying copper.

DEEP DIVE · RETURN-PATH-AWARE PLACEMENT

Placement sets more than trace length; it sets where return current flows. A signal's return travels in the ground plane directly under the trace, so a part placed such that its signal has to hop over a gap or a board cutout forces that return on a long detour, and that loop radiates. Placing related parts over the same continuous stretch of ground plane keeps every return short and tight, the same low-inductance idea that makes a plane beat a trace in the first place (All About Circuits).

- [All About Circuits. How to use return paths for better PCB design \(ground-plane impedance and return-current loops\).](https://allaboutcircuits.com)-
allaboutcircuits.com

CHECKPOINT

1. Where does a decoupling capacitor belong?

- Anywhere on the same board
- As close as possible to the chip's power pin**
- Next to the board's connector

ANSWER · B

A short loop keeps its inductance low so it can react to the chip's fast current demand.

2. Which parts do you place first?

- The fixed ones: connectors and mounting holes**
- The smallest resistors
- The decoupling capacitors

ANSWER · A

Anchor the layout with parts whose position is constrained, then place around them.

3. A knotted, crossing ratsnest is telling you what?

- The board is finished
- The copper is too thick
- The placement should change before you route**

ANSWER · C

Short, untangled ratsnest lines mean routing will be easy; a knot means move parts.

- Prerequisite: capacitors and decoupling
- See it on a real board: the L1.01 build
- Next: routing traces, width, current, and vias