

Autorouting – Is 98% the best you can do?

by Barry Olney, In-Circuit Design Pty Ltd | Australia

This Application Note describes how to best use an
Autorouter on a complex PCB design

I have used the following techniques successfully with a number of Autorouters. First tried on the Dazix Star Router, Cadence Prance-XL Router, Mentor Expedition Autoactive and the PADS Router but there is no reason why the techniques can't be applied to any router.

Let's assume that you have followed a methodology for placing and routing high speed/critical signals, fixed them, and that the remainder of the signals are non-critical. We will look at the scenario where we have the board 98% completed after a series of autorouter and manufacturing routines. 98% completion rate sounds pretty good but we all know that the router will leave the most difficult/longest traces for us to complete. And, the last 50 or so traces may take us days of frustration to finish off.

Of course, if a board won't route it may not be the routers fault. It could just be that we have bad placement with bus cross-overs or that we haven't defined enough signal layers in the stackup! I guess you get a feel for how many layers are required after doing a few boards. My general rule of thumb is that if you can't get at least 85% completion before you start tweaking the design then you will have serious problems. In this case, you may have to re-evaluate the placement, add a couple more signal layers or reduce the functionality of the design.

Perimeter Routing Technique

All routers tend to route inward because the algorithms are tuned to make the shortest possible connection of the two open ends. This is why you generally see a tangle of rats nets in the centre of the board where all the signals try to cross. Let's take advantage of this fact.

Here's the trick - define a route keep out perimeter channel 200 MIL around the edge of the board. But, don't enclose component pins that have connections. Most components should be 200 MIL from the edge anyway, but there will be connectors and interface devices etc that are closer. This channel will prove to be invaluable later to polish-off that last 2% of nets.

Autoroute the board to the best completion rate. Some rip-up and retry of connections should be tried and the via minimization and manufacturing features should be utilized. The autorouter will smooth the lines, remove ghost vias and staircases, eliminate unnecessary vias and reduce the etch length. But, we still have nets to route.

A via and fanout grid should be used initially to avoid blocking route channels. However, at this stage the via grid can be removed as we are only interested in making the connections since the main routes are in place. Invoke the autorouter again.

Finally, drop the route border to 50 MIL perimeter. This gives us 150 MIL of extra routing channel on all signal layers. Using 5/5 technology this equates to 15 additional traces per layer. To complete the remaining nets: manually route each net out to the edge, follow the perimeter around the board in either a clockwise or anticlockwise direction, and then route back in to terminate the connection. This allows an additional 30 traces per signal layer or for example, on a 12 layer board with 8 signal layers - 240 additional traces.

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