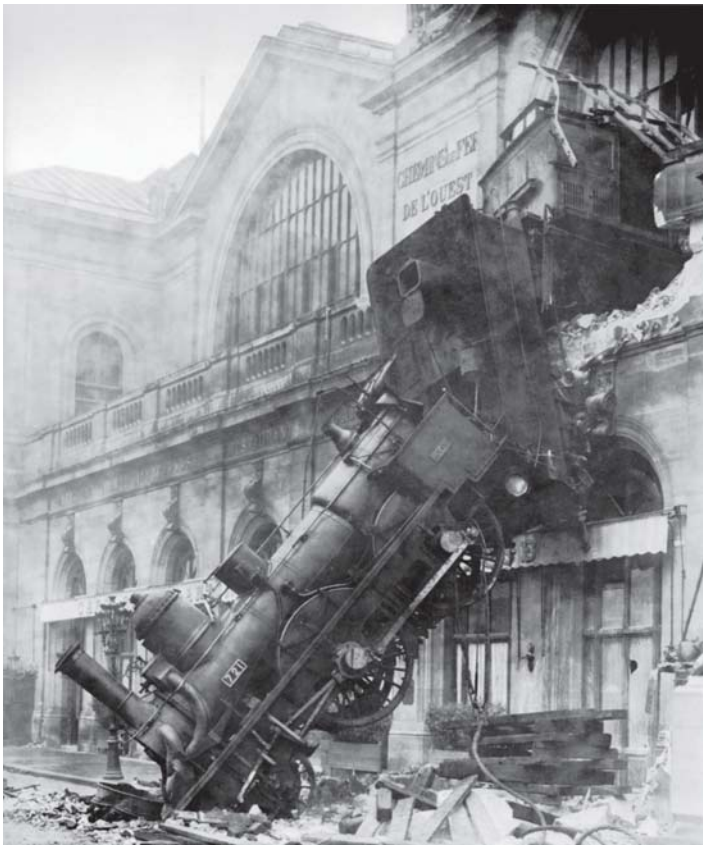
Just my opinion...

Flex Design - Should You To Do It Yourself?

Tom Woznicki - Flex Circuit Design Company

The urge to do it yourself is strong; whether fixing a faucet, cutting your kid's hair or flex circuit designing — after all, how hard can it be?

I say "Come on in — the water's warm!" The more flex applications the better! The industry has an army of very sharp CAM operators that turn bad designs into something manufacturable. In most cases they catch the things that could cause trouble down the road.



That said, recently I've worked with three companies that had real problems with flex circuit designs that they did themselves. Two were rigid-flex designs and the other was a dynamic flex — all three were flex applications that the customer had never tried before. The rigid-flex programs had unacceptable failures after first production runs. The dynamic flex application was a train wreck — shutting down production of a high profile product.

This is just my opinion and it's worth the price you're paying for it, but I'd like to propose four applications or situations where it might not be a good idea to do it yourself — especially if it's your first flex design or you have limited experience designing this type of flex. At the very least get another set of eyes to review your design before having circuits built.

1. Dynamic circuits. Does your flex circuit have to move as part of your product's function? Designing a dynamic circuit, especially a multilayer dynamic flex, is much trickier than a flex-to-install. More importantly they are more prone to field failures than flex-to-install. I have rarely seen enough life testing of proto-

types to be statistically significant — sometimes these circuits can work fine at the prototype stage but have an unacceptable failure rate in production.

2. Rigid-flex. These circuits can be expensive to build. It's one thing to scrap out a single-layer ZIF connector flex, but if your large eight-layer rigid-flex fails and you have to pay for another batch of expedited prototypes it will cost you plenty.

3. An adventurous purchasing department. Do your purchasing folks often pick vendors you've never heard of from far away places?

Let's face it — in today's economy every board shop's web page says "We can build flex circuits!" so your purchasing folks may be tempted by very low pricing. In this case you need very complete data and very detailed fab drawings down to a gnat's eyebrow to make sure the flex is built it properly. Anything unspecified will be done in a way that is easiest for the vendor. For example, the material they have on the shelf might not be the best for your application.

A corollary issue — after prototyping will the whole project be given to a contract manufacturer in Asia? The flex could be redesigned and by someone with no experience with flex circuits. If the flex circuit is a critical part of your product the design needs to be bulletproof and very well documented.

4. A tight time schedule. Is there time for a two putt? Unfortunately flex circuits are often the last thing designed in a product and they have to take care of every leftover design issue. More than once I've seen "Don't worry - it's only for prototypes" lead to a crisis in production as the product ramps and the flex design never got revisited for DFM.

If your schedule is tight, especially if it's expedited, the design package has to be like making instant soup — pour in the water and it's ready. If your data isn't ready to go to the floor and the salesperson and/or CAM guy need to ask you questions it chews into lead time.

Let me give you a closer look at one of the rigid-flex projects I referenced earlier — it was an eight-layer rigid-flex circuit with several tight folds. It was the company's first product with a rigid-flex circuit and they had an adventurous purchasing department who found a small board shop in California that said they could do rigid-flex; they gave them the order.

Turns out the fab drawing didn't specify rolled-annealed copper so the vendor used flex base material with cheaper ED copper. Unfortunately the tightest fold had the signal traces on the outside of the fold and a solid ground plane on the inside so when they folded the rigid-flex the signal traces naturally cracked.

I recommended specifying rolled-annealed copper in the next revision and modifying the ground plane to reduce the stress on the signal traces in the tight folding area (Figure 1). These two very small details made a huge difference. The second batch of protos had no cracked traces after installation!

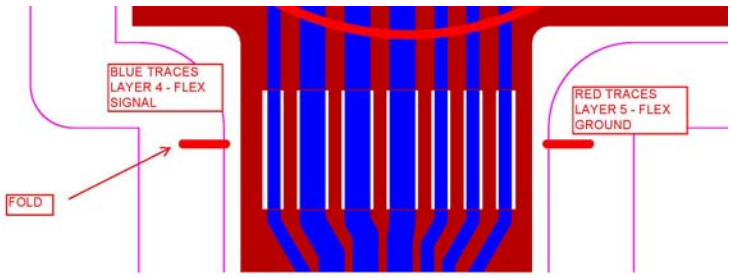


Figure 1 - modification of ground plane in tight folding area to reduce I beam effect.

Flex circuit design rules are not rocket science — just lots of little dos and don'ts that add up to a reliable circuit with good yields. This doesn't mean you can't bend some rules and get a flex circuit that works. They're are kinda like wearing seat belts — many times you can get to where you're going without them but sometimes you get an expensive ticket or worse.

A second set of eyes can pull your flex project back from the edge and onto the right track!

So if you've got a two-layer flex-to-install application, you've got some time in the schedule and you want to give flex design a try — great! But if it's a dynamic flex or rigid-flex and you're on a tight schedule with an adventurous buyer perhaps it's not the right time to try it yourself. At the very least get someone with flex experience to review the design before you release the order - it will be cheap insurance!

Tom Woznicki is the president of Flex Circuit Design Co., a consulting company in San Jose, CA.

Flex Circuit Design Co. specializes in designing flexible printed circuits for OEMs and flex circuit manufacturers. For more info go to www.flexdude.com.