Extra-Long Flex Boards

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LONG FLEX BOARDS

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A 36" long board will cost plenty. But, there are workarounds.

I have need for a long flex cable (~36"). I sent for quotes, and they all came back as "no-bid." Are long flex circuits really that much more difficult to build?

Long FPCs are more difficult to build. There are a lot of reasons for this. This month I will cover each, with possible workarounds.

Raw material size limitations. If your bids are from US-based manufacturers, they are probably getting their raw copper-clad materials in 24" x 36" sheets (unless special ordered). So even if the manufacturer makes its processing panel size 36" long, a 36"-long FPC would not fit unless it was run diagonally, which is not practical from a cost perspective. You may want to see if the fabricator is willing to purchase materials from Asia, which typically are delivered on long rolls. This would solve the raw material issue, but not any of the processing issues (covered later).

Also, most FPC suppliers use two or three standard panel sizes for virtually every circuit they make. These standard processing panel sizes are driven by raw material sheet size and the fabricator's equipment and processing limitations. All a fabricator's tooling and fixturing is set up to support these two to three standard processing panel sizes. This does not mean no fabricator is willing to run a non-standard processing panel, but rest assured, you will pay a hefty premium for it. A few US flex suppliers have developed the equipment and processing techniques for extremely long flex circuits and may be best suited for an application like yours. The downsides are your vendor base will be very small, and since super-long circuits are a very specialized product, they will be expensive.

FIGURE 1. **Extra-long flex circuits pose complex manufacturing challenges.**

Equipment limitations. Most PCB processing equipment has size limitations in both width and length. Some pieces of equipment such as etchers or resist strippers can run unlimited lengths of panels or materials and are restricted only in material width. Unfortunately, these are the exception, not the rule. There are processing techniques and tricks to get around these limitations on many pieces of equipment, but all come with associated processing yield impacts. Examples are:

- Laying material sideways on the CNC drill bed and using multiple spindles to drill the panel.
- Creating custom vacuum frames for printing large panels.
- Putting overlapped “seams” in cover material and doing the cover laminations in multiple steps with excess material hanging out the ends of the press platens.
- Laser-cutting the final outline using multiple indexing programs with excess material rolled up on each end of the work area.

While all these methods will work to process extra-long material or panels, a limited number of FPC vendors are willing to incorporate them, unless this is a very high volume or very high revenue project.

If your application does not have enough volume or revenue to interest manufacturers you contacted, try these design options to (hopefully) meet your requirements without pushing the processing limits of potential suppliers:

- Use two or more shorter sections of flex and connect them to get the final length required. There are many ways of making the connections. Some of the most popular are inline FPC/FFC mating connectors, anisotropic adhesive (may require a widening in the connection area), or soldered jumpers (only practical for small volume and limited number of traces that require connection).
- Use a standard OTS FFC (flat flexible cable) instead of an FPC (flexible printed circuit). Compared with an FPC, an FFC has significant termination limitations, but FFC could be considered for the bulk of the length. Then connect it to an FPC or standard PCB on each end. These connections can be made with ZIF (zero insertion force) connectors, which are inexpensive and readily available from multiple sources.
- Discrete wires. It may sound strange to have a Flexpert tell you to use wires, but the reality is flexible circuits are not a perfect fit in every application. If only a half dozen or fewer signals are needed, but they need to span ~30"+, discrete wires may be the best option. This is especially true if the total volume is very small. The total cost of ownership of a comparable solution in flex will likely be 10 times the cost of discrete wires in very low-volume applications.

All these options have some drawbacks, such as changes in the circuit profile in connection areas or the added bulk of discrete wires. These may or may not be a problem in a given application. If a single, continuous flex over 30" long is still needed, the best bet is probably one of the flex shops that specializes in this type of product. If you have a “go-to” flex vendor, have a conversation on your specific needs. That vendor should be able to tell you quickly if it is something it can support. If not, it should be able to steer you to a fabricator more suited to build very long flex circuits.

MARK FINSTAD is senior application engineer at Flexible Circuit Technologies (flexiblecircuit.com); MARK.FINSTAD@FLEXIBLECIRCUIT.COM