Flex Circuit news

November 2000

IFT and Sheldahl Announce Merger

IFT Will Act As A Wholly Owned Subsidiary

Sheldahl and International Flex Technologies, Inc. (IFT) finally came to an agreement to merge their two companies. The deal will result in new owners for Sheldahl.

According to press releases, Sheldahl will acquire IFT for 7.6 million shares of stock. As part of the deal two investment firms, Morganthaler Partners (IFT's majority shareholder) and Ampersand Ventures, will invest $25 million for 4.9 million shares of Sheldahl common stock and 4.1 million shares of preferred convertible stock. This will give IFT, Morganthaler and Ampersand 49% of Sheldahl and make them the majority shareholders. In addition to this new funding, the new partners and Molex, a Sheldahl customer and joint venture partner, will be investing an additional $15 million to buy Sheldahl subordinated debt and warrants. In the end Molex will own approximately 10% of Sheldahl.

The new board of directors will include three of the current directors of Sheldahl, three designated by IFT, Morganthaler and Ampersand and one representative from Molex.

International Flex Technologies will maintain it's identity, operating as a wholly owned subsidiary of Sheldahl.

The story from Reuters is available at http://biz.yahoo.com/rf/001110/n10382168_2.html.

The press release from Sheldahl is available at http://www.sheldahl.com/News/PR/cpr110900.htm.

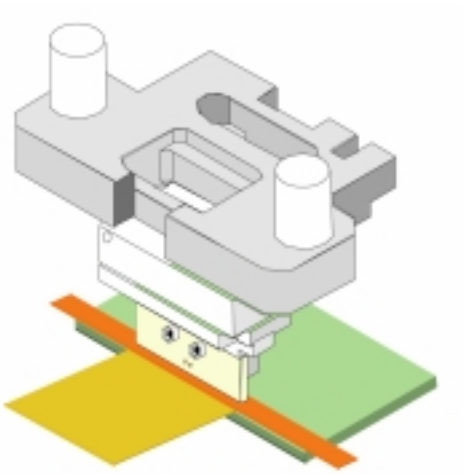
Throughout *The Flex Circuit News* there are links to the web pages of those companies or individuals mentioned in the articles, as well as links to advertisers web pages. Look for the pointing finger.

Hot-Bar Soldering

Attaching Flex Circuits Directly To Rigid Boards

Tom Woznicki

Sometimes customers ask my opinion on attaching flex circuits directly to rigid boards. I'm partial to connectors myself, but there are applications that routinely use direct attachment very successfully, such as LCD panels, cameras, cellular phones and pagers. This article will discuss when it's a good idea and how to do it successfully.



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There are a lot of benefits for using a direct flex-to-board connection. It saves vertical height, can be more reliable than fine pitch connectors and saves the cost of the connectors. Some disadvantages: It adds an extra process – each circuit typically takes 12 to 15 seconds of cycle time. Rework is difficult, often ruining the flex circuit. Also, if the flex is pulled it is easy to crack a solder joint or trace. Finally, to do it well you need proper equipment and fixtures.

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The first question to ask is whether you can afford to scrap the flex circuit if you need to rework the assembly. Removing a flex circuit from a PCB will almost always ruin the flex. If you're using a simple flex jumper that's cheap, it's probably worth taking the risk. But if you have an expensive flex circuit or a complex flex assembly I would explore every other option before using direct attachment.

If the risk/benefit analysis looks good, the next thing to consider is whether to use solder or bonding adhesive. Soldering is more cost effective, but if the pad pitch is 15 mils or less a z-axis bonding adhesive is probably the best method.

I spoke with Dave Johnson, Technology Marketing Manager for MicroJoin, the largest manufacturer of hot-bar equipment in the U.S.A. He gave me some good information to pass on to you.

Let's first talk about using solder. Success at hot-bar soldering depends on the pad pitch. 15 mil pitch is the point of pain – very difficult to do. 20 mil pitch is a little easier, 25 mil pitch no problem.



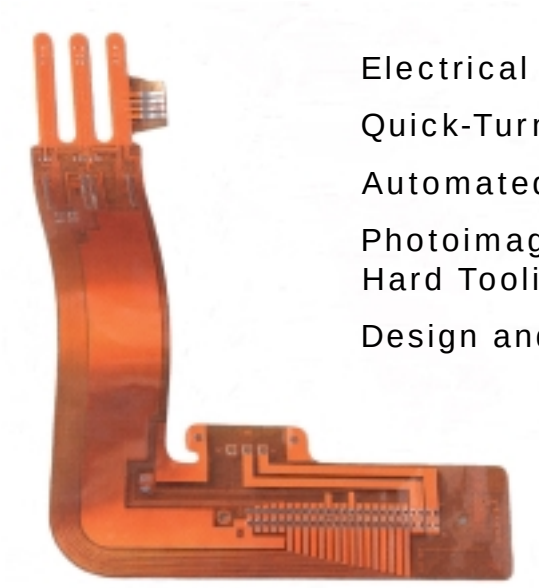
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Hot-bar rule number one:
Keep your fingers out of the machine!

The design of the flex goes a long way to the success of the hot-bar attachment. The pads on the flex circuit should be slightly smaller the pads

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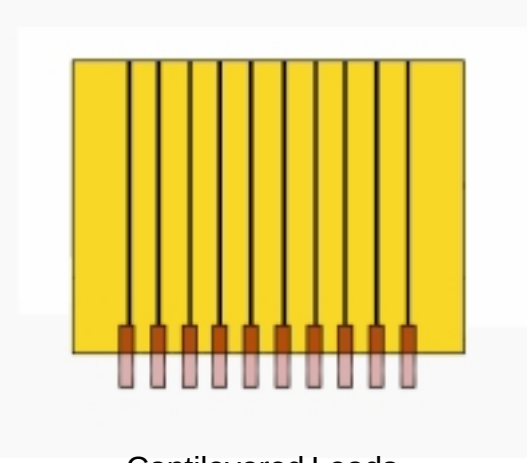
on the PCB to allow for excess solder to flow during the reflow process. Since molten solder can bridge a four mil gap, the pad size and spaces should be sized so that in the worst case of misalignment there is never less than four mils from a pad on the flex to an adjacent pad on the PCB. On the assembly drawing you need to specify the percentage of pad-to-pad overlap. Seventy-five percent pad coverage is typical for commercial/industrial application and ninety percent pad coverage is typical for hi-rel/military applications.

In addition to the size and spacing of the leads, the construction of the flex itself effects the hot-bar soldering process. Unfortunately the best flex constructions are more costly to manufacture.

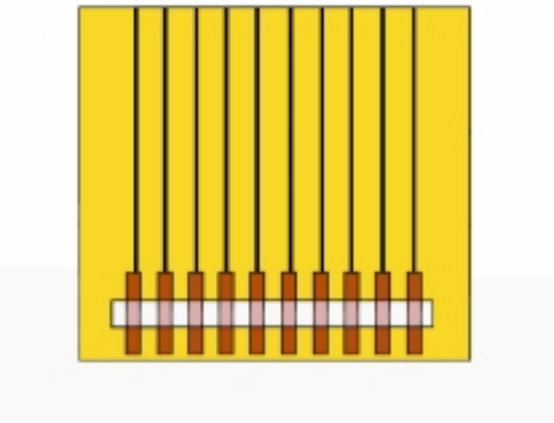
The best circuits for hot-bar soldering have completely exposed leads - either cantilevered leads that poke out the end of the flex circuit or traces that "fly" across an opening in the flex (also called "windowed" leads). On the right are illustrations of both cantilevered leads and windowed leads.

You can hot-bar solder a standard flex circuit, but it requires more cycle time because it takes longer for the heat to flow through the basefilm to reflow the solder. It also requires and more tooling and optical alignment equipment to achieve proper alignment to the pads on the PCB. The illustration to the right shows a standard flex with tooling holes on the flex circuit.

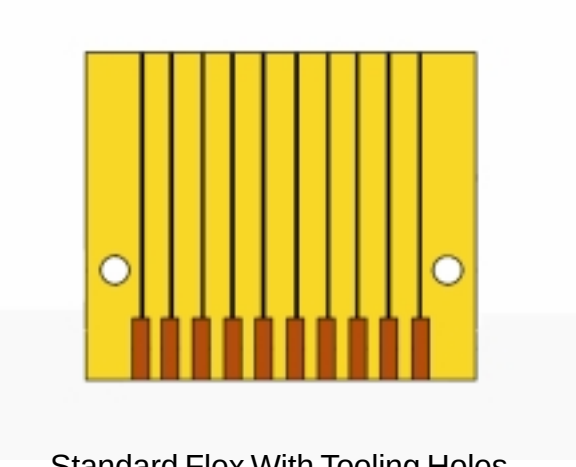
To make flying leads on a garden-variety flex you can either use a laser to remove the basefilm or chemically etch away the basefilm to expose the leads, leaving the copper traces suspended in air. If the traces and pitch are wide enough (15 mil traces on a 30 mil pitch) you can also use a technique called prepunching the basefilm. This method involves taking a piece of coverfilm and create openings where the unsupported leads are



Cantilevered Leads



Windowed or "Flying" Leads



Standard Flex With Tooling Holes

supposed to be, then laminating a sheet of copper to it. The traces are then etched as usual and coverfilm applied.

There are other ways to make cantilevered leads using patented manufacturing techniques such as Sculptured Flex from ACT or EZ Flex from Johnson-Matthey. These specialized flex circuits use extra thick copper to make robust "fingers" that extend beyond the edge of the circuit.

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You can get more info on Sculptured Flex Circuits at ACT's web page: www.act-flexcircuits.com.

For info on EZ Flex contact Flex Technology, one of their biggest licensees. You can also go to the September 1999 issue of The Flex Circuit News, pages 2- 4: www.flexdude.com/Back%20Issues/FCN9-99A.PDF.

Whatever method the manufacturer chooses to use, these exposed leads make alignment to the PCB very easy and allow for good heat transfer during the soldering process.

Note: If the pitch of the flying leads is big enough, say 50 mils, you can successfully use a soldering iron instead of a hot bar. However, I would recommend it only for prototypes or small volume applications.

Using Z-Axis Adhesives

As mentioned before, 15 mil pad pitch is the point of pain for using solder. Z-axis adhesives are a great solution for tighter pitches. These adhesives are filled with conductive particles and cast into films. They are also known as Z-Axis Films (ZAF) or Anisotropic Conductive Films (ACF).

A piece of the ACF is placed between the flex circuit and the PC board. When the hot-bar applies heat and pressure the flex circuit is lami-

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Flex Circuit Design Company is a consulting company that specializes in designing flexible printed circuits for OEMs and flex circuit manufacturers.

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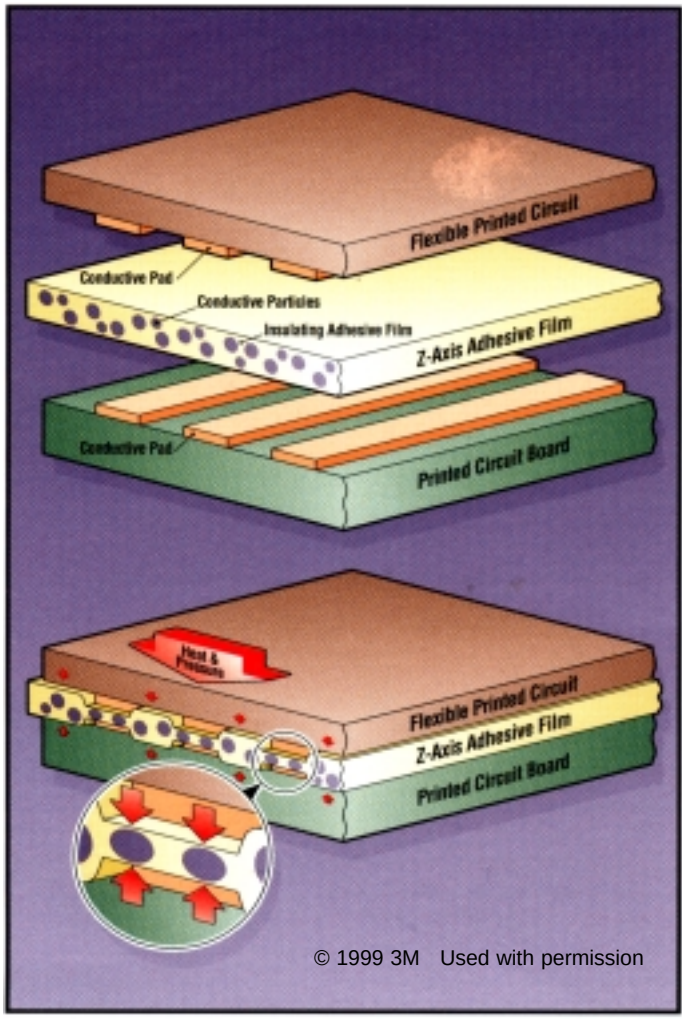
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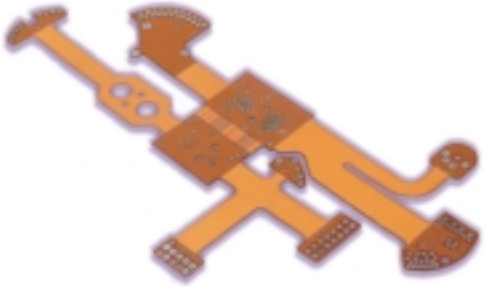
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nated to the PC board and the conductive particles make contact between the pads on flex circuit and the pads on the PC board. The films don't conduct electricity in the X or Y direction. This lamination also provides strain relief for the electrical connections.

The illustration above shows how the ACF is applied and how the conductive particles create the electrical contact only in the Z direction. It is from the 3M ACF brochure and is used with permission. You can get info on 3M's Z-axis films at their web page: www.3m.com/bonding/html/z_axis_films.html.

Choosing Equipment or Vendors

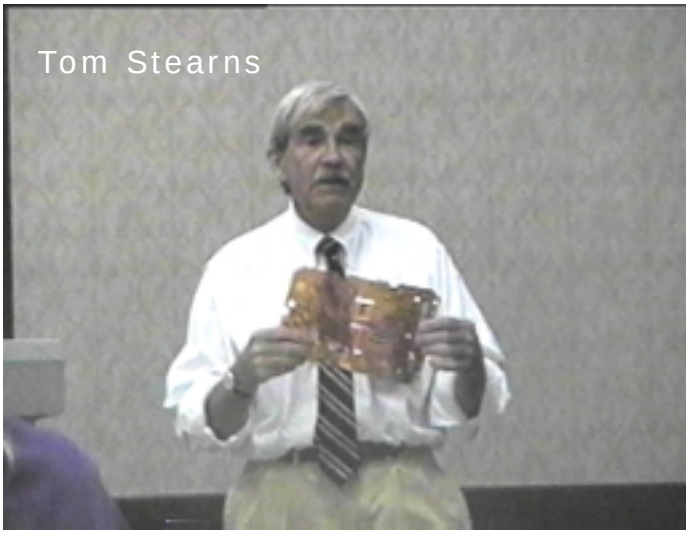
Finally, you need to either invest in the proper equipment or choose a vendor that has it. Hot bar equipment starts at about $6K for the basic thermode, but it can run over $100K for machines with bells and whistles that dispense flux, have visual alignment equipment, test equipment, etc. The type of flex circuit you use, the type of PC board, ceramic or glass it will attach to, the quantity of assemblies you need to make, etc. must all be considered.

In summary, direct attachment can be a very good way to connect flex circuits to PC boards, ceramics or glass, but there are pitfalls - keep you eyes open and do your homework!

A big thanks to Dave and the other smiling folks at MicroJoin for their help on this article and their permission to use graphics from their web page.

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Course on Flex Circuit Fundamentals

Bill Jacobi and Tom Stearns are at it again! This time they teaching a three day course on flex circuit fundamentals in the sunny South! The title is: FLEXIBLE CIRCUITRY: MATERIALS, DESIGN & FABRICATION.

What you will learn:

Methods used to manufacture both flex & rigid-flex.

New materials; their physical properties and how they are implementing higher performance.

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You are responsible for making your own lodging arrangements. Contact the hotel and mention the course name. A block of rooms have been reserved at $69.00 per night.

To register or to get more information contact Bill Jacobi. His phone number and e-mail are:

Phone: 910-295-4892
E-mail: BillJacobi@worldnet.att.net

DILBERT

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