

## Flex Circuit Design Company Begins 11th Year

Wow! It's hard to believe that it's been over ten years since I hung out my shingle in the winter of 1992.

Tom Woznicki

Now, after designing about a thousand flex circuits and working with over a hundred customers, Flex Circuit Design Company flew past its ten year anniversary and had its very best year in 2002.

It's just as if I knew what I was doing!

A **BIG** thank you to all my customers and all my friends in the industry for enabling me to make my living in a very enjoyable way!

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.



### Guest Column...

## Exotic Heavy Copper Flex Circuits

Robert Tarzwell

When engineers and designers normally think of flex circuits, they picture the thin ribbon-like circuits such as those used in printers and disk drives. There are, however, many other uses and types of flex circuits. One such example is a flex circuit with heavy copper. When I state heavy copper, I mean traces made copper between 8 oz. (11 mils) and 20 oz. (28 mils).

These heavy copper traces restrict the circuit's flexing but they remain flexible enough to be bent and manipulated to fit a particular application. One such circuit was conceived and manufactured for a large aerospace company, used flex material with 15 oz. traces, embedded within, to make a low profile, high current, wiring system that molded its way along a bulkhead.



Planar transformer using heavy-metal flex circuitry

Other applications require no bending at all but take advantage of polyimide's electrical properties, such as planar transformers. Polyimide has a higher breakdown voltage than FR4 per mil of thickness, and FR4 also suffers from seriously degraded dielectric ratings with exposure to temperature and extreme environmental conditions. With today's planar transformers approaching 20 layers, the dielectric layers must be as thin as possible, and using polyimide as the inner layer allows the fabricator to control the total component thickness. Also, at high altitude these circuits encounter corona with even relatively low voltage due to the reduced pressure. FR4 is very easy damaged by corona, which seems to attack the epoxy binder system. Polyimide, on the other hand, prevents corona generation and is mostly unaffected by it.

When heavy copper traces are needed you cannot just etch 10 oz. copper and expect the coverfilm to totally encapsulate the high, thick copper traces. Alternately, the

circuit can be manufactured with recessed traces. A sheet of heavy copper is imaged and partially etched down to about 3 mils (2 oz.) in the areas between the traces, as shown in figure 1 below. The copper sheets are then laminated together



Figure 1

with polyimide prepreg sheets in between. The heavy copper tracks are now surrounded with polyimide on three sides (figure 2). The areas of thinned copper between the traces are then etched away leaving the circuit ready to apply coverfilm (figure 3).

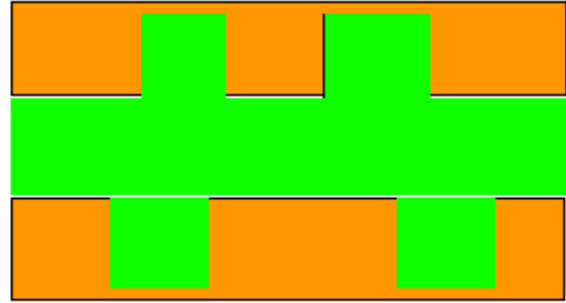


Figure 2

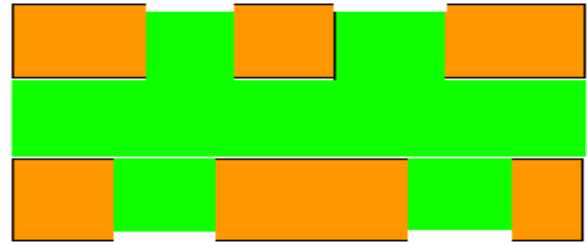


Figure 3

Alternatively, this method can be used to manufacture circuits with both thin and super thick copper

*The Flex Circuit News* is a bimonthly newsletter published by Tom Woznicki and Flex Circuit Design Company in San Jose, California. It is dedicated to providing information about all aspects of and promoting the use of flexible printed circuits in interconnection and electronic packaging.

*The Flex Circuit News* is a free publication that is delivered to subscribers by e-mail.

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

© Copyright 2003, Flex Circuit Design Company  
All rights reserved.

Got a question?

Send e-mail to  
[Twoznicki@AOL.com](mailto:Twoznicki@AOL.com) or call  
408-629-8343

Subscribe to  
The Flex Circuit News  
on the web

[www.flexdude.com](http://www.flexdude.com)



The material choice of  
flex circuit manufacturers is

**Gould® flex**

**ultrathin  
adhesiveless  
laminates**



► **Ideal Applications**

- Single and double sided high-density flexible circuits requiring copper thickness less than 18 micron.
- Rigid-flex circuits to eliminate adhesives with high CTE.
- Circuits requiring controlled characteristic impedance.
- Semiconductor packaging: BGA, µBGA, TAB, and chip scale packaging.
- Thin light-weight portable products.

► **For more information, contact:**

Gould Electronics Inc.  
34929 Curtis Blvd.  
Eastlake, OH 44095-4001  
440-953-5198 phone  
440-953-5152 fax  
[www.gouldelectronics.com](http://www.gouldelectronics.com)



**GOULD**  
Electronics

Gould Electronic Materials  
Specialty Products

traces all on one layer. Instead of etching the areas of thinned copper completely away we can etch them into narrow traces as shown in figure 4.

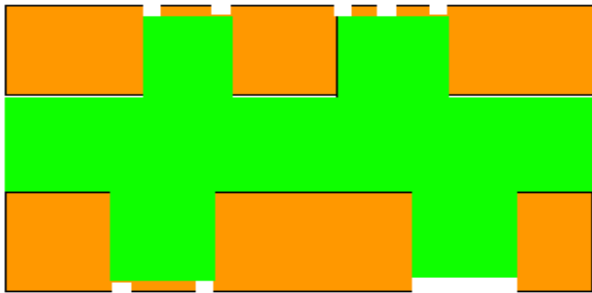


Figure 4 - thin copper traces between heavy copper traces

These narrow traces can also be used to solder components onto the circuit.

Another advantage of heavy copper flex circuits is that the conductors can extend beyond the outline of the circuit and formed into blades, lugs, pins and other features for easy attachment to power supplies and other equipment.

Robert Tarzwell is a consultant within the PCB industry, specializing in heavy copper and exotic power circuits. He has written two books on the subject which are available at his web page [www.megadawn.com](http://www.megadawn.com).



Dilbert reprinted by permission of United Media Syndicate

Ed. Note: A big thank you to Bob Tarzwell for submitting this article — we're always looking for good stuff to share!

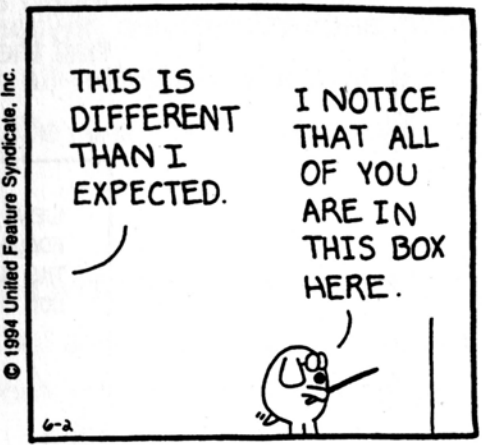
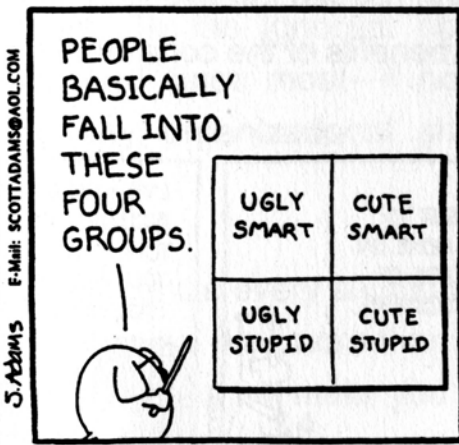
Where do you go to buy these heavy-metal flex circuits? Two of the best-known sources are Advanced Circuit Technology in New Hampshire and Tech-Etch in Massachusetts. Both companies offer a wide variety of flex circuits and other interconnection products.

Bob Tarzwell also recommends Aurora Circuits in Aurora, Illinois. I think it's just down the street from Stan Makita's Donuts.

**Advanced Circuit Technology**  
 100 Northeastern Boulevard  
 Nashua, NH 03062  
 Phone: 603-880-6000  
 Fax: 603-880-1785  
[www.act-flexcircuit.com](http://www.act-flexcircuit.com)

**Aurora Circuits, LLC**  
 2250 White Oak Circle  
 Aurora, IL 60505  
 Phone: 630-978-3830  
 Fax: 630-978-0120  
[www.auroracircuits.com](http://www.auroracircuits.com)

**Tech-Etch, Inc.**  
 45 Aldrin Road  
 Plymouth, MA 02360  
 Phone: 508-747-0300  
 Fax: 508-746-9639  
[www.tech-etch.com](http://www.tech-etch.com)



## Sad News...

### Flex2Chip Closes San Jose Facility

Flex2Chip closed its facility in San Jose, CA last month, causing customers to scramble for suppliers that can supply fine-line, two-metal-layer flex circuits in small and medium volumes. Flex2Chip, a subsidiary of Sunright Ltd., continues as an entity and plans to re-enter the market by building a new, high volume production facility in the Far East.

I got quite a few e-mails from folks looking for new sources. In the USA contact MicroConnex in Snoqualmie, Washington or Mound Flextek in Miamisburg, Ohio. MicroConnex is a small to medium volume manufacturer

with a separate laser division that can do microvias and microfeatures. Mound Flextek is a medium to high volume flex manufacturer with roll-to-roll fabrication equipment, but for now they can only produce single-metal-layer circuits.

There are two companies in Europe I know of that can produce

fine-line flex circuits and they are both in Switzerland — Cicorel and Dyconex. Both companies produce the full spectrum of flex circuits from fine-line flex circuits to rigid-flex circuits and can support volume production. Dyconex also has several rep firms in the USA. Their phone numbers and territories are on the Dyconex web page.

#### Cicorel SA

Route de l'Europe 8  
CH-2017 Boudry Switzerland  
Phone: 41-32-843-05-00  
Fax: 41-32-843-05-00  
www.cicorel.ch



#### MicroConnex, Inc.

34935 SE Douglas St. Ste. 200  
Snoqualmie, WA 98065  
Phone: 425-396-5707  
Fax: 425-396-5861  
www.microconnex.com



#### Dyconex AG

Grindelstrasse 40  
CH-8303 Bassersdorf Switzerland  
Phone: 41-43-266-1100  
Fax: 41-43-266-1101  
www.dyconex.com



#### Mound Flextek, Inc.

720 Mound Road, COS Bld 4241  
Miamisburg, OH 45342-6713  
Phone: 937-865-4327  
Fax: 937-865-4286  
www.flextekinc.com



### Quick-turn Prototypes & Medium Production

- Mass Production Quality Flex Circuits
- Single and Double-sided Designs
- Fine Line Trace and Space Capability  
0.0015" on 12um Cu  
0.002"/0.003" on 0.5 oz Cu
- Minimal Adhesive Squeeze-out
- Tight and Consistent Trace to Edge  
Registration With Burr-free Edges
- Controlled Impedance Circuits

#### Customers include:

DataPlay  
Flextronics  
Hewlett Packard  
IBM  
Maxtor  
Mektec Corporation  
Nitto Denko  
Samsung  
Saturn Electronics  
Schlumberger  
Seagate  
Verifone

Altaflex, Inc  
336 Martin Avenue  
Santa Clara, CA 95050  
Ph: (408) 727-6614  
Fax: (408) 988-8009  
www.altaflex.com



Quality, Service and On-time Delivery

## More Cool Stuff...

### Fractal AG Introduces New Adhesiveless Flex Material

According to my friend Tim Meehan at Eclectic Technologies, FRACTAL AG from Staßfurt (Germany) opened a new plant for the reel-to-reel production of adhesiveless flex material under the trade name FRAFLEX®.

What makes FRAFLEX® unique is that before sputtering and plating they create shallow, angled holes in the polyimide film. When the sputtered material is plated it creates barbs that anchor the copper to the polyimide without the need for a tie coat such as chromium or nickel. The illustrations at the right show a cross section illustration of the laminate and below it is a close-up photo of the actual

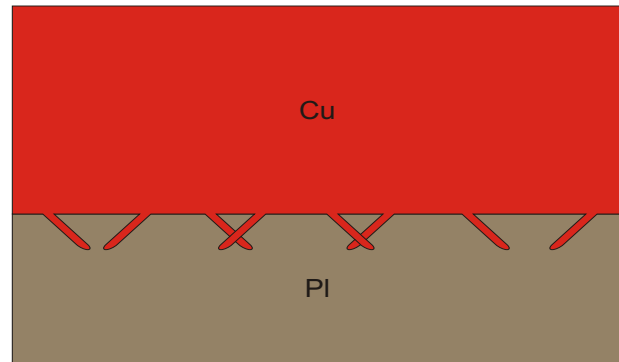
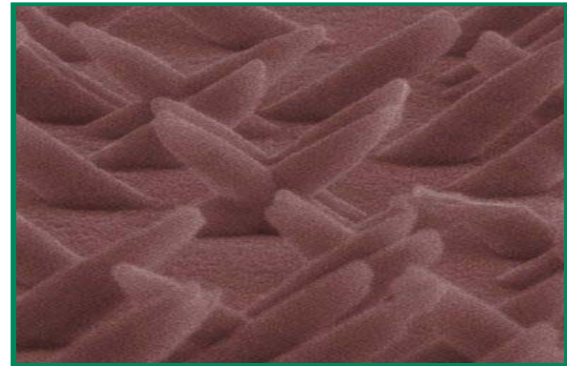


Illustration of mechanical bonding



Close up of copper barbs

**Fractal AG**  
**Eclectic Technologies, Inc.**  
San Francisco, CA  
Phone: 415-759-7849  
Fax: 415-753-0600  
[www.eclecticttechnologiesinc.com](http://www.eclecticttechnologiesinc.com)

## Excellence in the Design, Manufacture & Assembly of Flexible Circuits!



**Electrical Testing and Engineering Analysis**

**Quick-Turn Prototypes or Production Quantities**

**Automated Assembly**

**Photoimageable Coverlay - Eliminates Expensive  
Hard Tooling and Lead Time**

**Design and Turnkey Services Available**

### GC Aero Flexible Circuitry

3165 Fujita Street Torrance, CA 90505  
310-539-7600 Fax 326-7903 Modem 539-6784

[www.gcaero.com](http://www.gcaero.com)



copper barbs. The mechanical bonding to the polyimide gives FRAFLEX® a bond strength that is superior to other materials, even adhesive-based materials.

Also, because there is no tie coat it no special etching is needed, and scrap is easily recycled.

Eclectic Technologies is arranging the world-wide distribution of the Fractal AG material. Contact Tim at 415-759-7849 for more info.



Tim Meehan of Eclectic Technologies with Dr. Manfred Danziger of Fractal AG

Additional info is available at the Fractal AG web page [www.fractal-ag.de](http://www.fractal-ag.de).



### Analog Technologies: Another Source For Flip-Chip Proto Assemblies

For those of you considering using flip-chip-on-flex and are looking for an assembly vendor for prototypes, Analog Technologies in Minnesota may be your place. One of my customers here in Silicon Valley highly recommends them for quick turnaround and reasonable pricing. When you call ask for Dave Hartmann.

**Analog Technologies Corp.**  
11441 Rupp Drive  
Burnsville, MN 55337  
Phone: 952-894-9228  
[www.analog-tech.com](http://www.analog-tech.com)

### Need ACF Bonding?

Ito America in Scottsdale, Arizona sells equipment for ACF bonding and heat seal connectors, but they also have a job shop that will do prototype and small volume production runs!

Ito America is also the distributor for Sony Chemical ACF material. If you want to use someone else's material you'll need to send it along with your flex circuits, but expect a sales pitch on the wonders of the Sony ACF!

Tim Martinez runs the shop - call him at extension 202.

**Ito America Corporation**  
8010 E. Morgan Trail, #12B  
Scottsdale, AZ 85258  
Phone: 480-998-2250  
[www.itousa.com](http://www.itousa.com)

**Back issues of The Flex Circuit News are available on our web page - [www.flexdude.com](http://www.flexdude.com)**

**UNI-FLEX CIRCUITS**

Your One-stop Shop for Quick-turn Flex Circuits  
Quality Products, & Exceptional Service

- ◆ Single, Double & Multilayer Flex Circuits
- ◆ Cost Effective
- ◆ Prototype to Medium Quantities
- ◆ Engineering and Design Support
- ◆ 24-hour Fabrication Available

Uni-flex Circuits  
1782 Angela Street • San Jose, CA 95125  
Ph: (408) 998-5500 • Fax: (408) 998-5505  
Email: [uniflexcir@aol.com](mailto:uniflexcir@aol.com)  
[www.hometown.aol.com/uniflexcir](http://www.hometown.aol.com/uniflexcir)

## On A Personal Note...

### Old Guy Snowboarding

For me the past eight months have been extremely busy in all areas of life, with precious little time for any fun stuff (or writing newsletters - sorry 'bout that). Before I knew it was the end of March, so I broomed my schedule for one day and my son Mike and I drove to our favorite slope for a day of snowboarding.

Yep - snowboarding. I am a proud member of O.G.S. - Old Guys on Snowboards. You can see us in the lift lines among the tattooed, baggy-pants, snowboard dudes, or slowly carving our way down the mountain as the young folks go barreling down the mountain at breakneck speed. I really stand out because my beard is now very, very gray (see below).

I've been riding snowboards for about seven years now. I started because young Mike wanted to learn to snowboard and we took lessons together. I'd rate myself as a slightly-above-average rider. I stick to the blue slopes and I can usually get down the mountain without falling on my face (or butt). Naturally, Mike is much, much better than his old man, taking routes in and out of trees and jumping over stuff as I weave my way carefully down the mountain.

Is snowboarding harder than skiing? Can't say for sure since I never learned to ski. Seems to me it's easier to snowboard 'cause there's only one board to worry about instead of skis and poles. A snowboard is much wider so it glides through soft or slushy snow.



The hardest thing to do with a snowboard is getting off the chairlift. Because you only have one boot buckled it is sometimes like an albatross trying to land on the beach. Some of my most famous wipeouts occurred when I



Yep - that's me!

tried to get off a chair lift with a very steep descent. The only other thing I hate about snowboarding is when the trail becomes flat or slightly up hill. If you aren't going fast enough to get through the only thing you can do is sit down in the snow, unbuckle and walk to the crest of the next hill. Other than that, snowboarding is great fun!

When we got to the slopes we were pleasantly surprised by the conditions. While it was pretty slushy at the bottom of the hill, the top of the mountain

had wonderful snow and the temperature was in the mid-50s.

The best part: since we went on a Tuesday there was **n o b o d y** there! All day long we

went down the trails and right onto the lift for another ride. It was wonderful! We rode and rode until we were plum' tuckered out, then we packed up for the three-hour drive home.

I gotta do this more often next winter. Mike turns 20 this year — there won't be too many father-son trips left. By the time grandkids come along I'll be a really, really O.G.S.!

