

Every now and then, a really great concept comes along that seems to stay a "secret" and little known except for a few quiet insiders. Such as...

## Designing Ultra Broadband Transmission Line Transformers

Why is it that a long piece of coax may have many tens of thousands of picofarads of capacitance, yet easily transports UHF and even GigaHertz frequencies with low losses?

The answer is that the capacitance in any cable gets *distributed* along its length. At any given instant of time, an input signal should only see a tiny portion of the total capacitance.

On most lines, this tiny portion is balanced out against a tiny cancelling inductive reactance. Which makes a properly terminated line look and act like a pure (but lossless) resistor to a driving source.

A seemingly simple mod to a very ordinary looking transformer changes it into an extremely broadband one. Transformers based on *transmission line* principles that are flat from, say 20 MHz to 800 MHz are easily built. These have become quite important for cable tv, broadband instrument amplifiers, ham radio, radar, comm systems, and general rf work.

Figures one and two show you two transmission line transformers. First, some quick definitions: When wire is *bifilar* wound, two pieces of wire are tightly twisted together.

A *trifilar*, *quadfilar*, or *pentafilar* winding can similarly be formed with three, four, or five conductors.

Both of our examples are wound from three feet of #30 bifilar tightly twisted together to, say, fifteen turns per inch. These are wound on a high frequency ferrite toroidal core. Core size depends on the power level, but usually can be amazingly small.

Unlike most transformers, the tight coupling between the wires acts as a transmission line. Instead of the stray capacitance resonating against your inductance, a distributed network is formed instead. One that gives you

an exceptionally wide bandwidth.

Our figure one example uses these windings as a 1:1 phase inverter and isolator. Figure two instead piles the two windings on top of each other, giving you a 2:1 step-up or step-down ratio. Autotransformer style.

Which will equal a 4:1 impedance ratio. A trifilar version provides a 3:1 stepup and 9:1 impedance match. Or, depending on the tap, a 2:3 stepup for a 4:9 impedance match.

These transformers are extremely useful for antenna matching and for the interstage coupling of broadband rf amplifiers and wireless apps.

Extensions to these examples can give you multiple outputs for power splitting/combining uses. Or resolve other circuit matching needs.

Key properties of transmission line transformers are that they'll usually give you turns ratios of *small whole numbers*, and that the impedances are those ratios *squared*.

The toroidal core simply serves to raise the inductance of any tiny piece of transmission line and sets your *low* frequency cutoff. Once again, while these look and build more or less like an ordinary transformer, the math is wildly different and quite subtle.

Our resource sidebar shows some broadband transformer resources.

Your horse's mouth "must have" paper is Ruthroff's *Some Broadband*

*Transformers* from the August 1959 *Proc IRE* on pages 1337-1342.

Another paper is Guanella's *Novel Matching Systems for Higher Frequencies* in the September 1944 *Brown Boveri Review*, pages 327-329. The *Multipedance Broadband Transformer* story on page 39 of the August 1982 *QST* also is useful.

One long time proponent is Jerry Sevick who wrote *Transmission Line Transformers*, his *Transmission Line Transformer Design Handbook*, his *Building and Using Baluns & Ununs*, plus related technical articles.

Links to these can now be seen at [www.bytemark.com/amidon](http://www.bytemark.com/amidon) The *IEEE* has his useful but short *Design and Realization of Broadband Transmission Line Matching Transformers* up at [www.ieee.org](http://www.ieee.org) Additional useful newer references are at [www.primenet.com/~ctrask/trlxjmr.html](http://www.primenet.com/~ctrask/trlxjmr.html)

The leading source of ready-to-go transmission line transformers, power dividers, and such is *MiniCircuits* at [www.minicircuits.com](http://www.minicircuits.com) The bifilar and multi twist wire stocks are offered by *MWS Wire Industries* whose website is [www.mwswire.com](http://www.mwswire.com)

Among many others, suitable core material sources do include *Siemens*, *Fair-Rite*, *MMG*, *TDK*, *Kawatetsu*, and *Arnold* The latter is found up at [www.arnoldengr.com/mtc](http://www.arnoldengr.com/mtc) and has an extensive book list on magnetics.

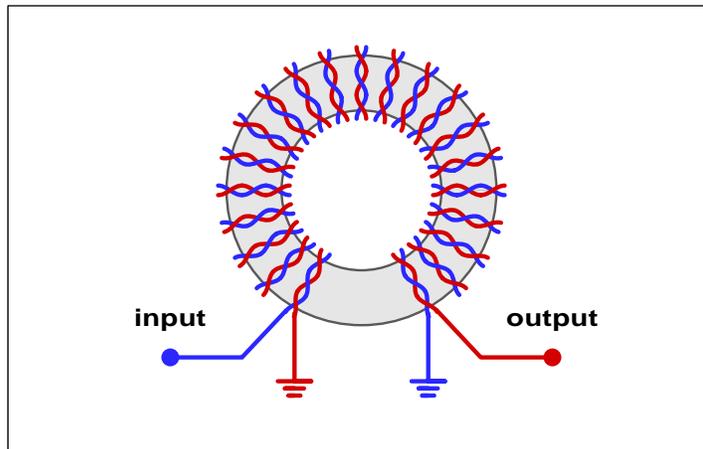


Fig. 1 – AN ULTRA BROADBAND 1:1 transmission line transformer.

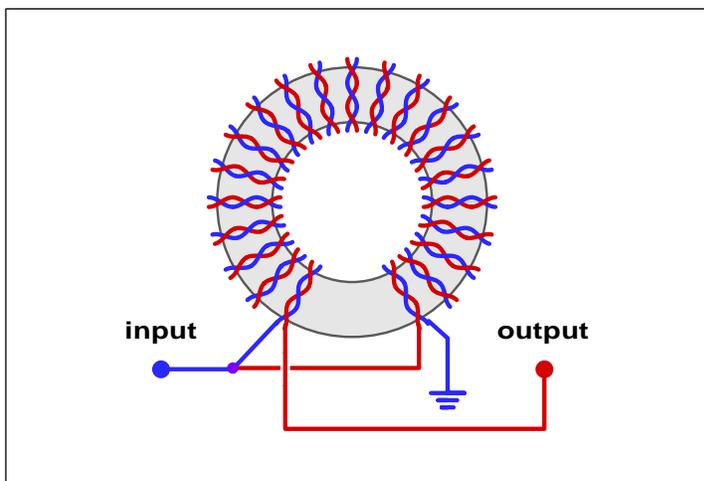


Fig. 2 – A 2:1 TURNS ratio gives a 4:1 impedance ratio ultra broadband transmission line transformer.

**Where to Get Parts**

Until very recently, finding small quantity parts for electronic or other technical projects could end up a real hassle. But these days, it has gotten utterly trivial. I'm overdue for a full blown resource listing, but let's do a rather quick summary here:

To get specific part info, you go to [www.questlink.com](http://www.questlink.com) or else on over to [www.chipcenter.com](http://www.chipcenter.com) The fastest and best link farm directly to your data sheet sites themselves appears to be the *Data Bookshelf* at [www.chrc.uuiu.c.edu/~dburke/databookshelf.html](http://www.chrc.uuiu.c.edu/~dburke/databookshelf.html).

Also reachable through the DATA button on my [www.tinaja.com](http://www.tinaja.com)

An Acrobat PDF reader or viewer is needed for nearly all web data sheets. This is usually gotten free on a click through from any data sheet site or directly from [www.adobe.com](http://www.adobe.com)

Additional useful engineering links are at [www.tinaja.com/eeweb01.html](http://www.tinaja.com/eeweb01.html)

Most semi houses now offer free samples on any email requests. The majority of them also have instant 24 hour online VISA ordering.

Announcements of new parts and ap notes still appear in the free trade journals. I prefer *E.E. Times* the best. Other choices are *EDN*, or *Electronic Design*, *Electronic Products*, and that *Electronic Component News*.

More specialized examples include

*R.F. Design*, *Measurement & Control*, *Sensors*, *Battery Power Products and Technology* or *PCIM*. The latter on power control and intelligent motion. Your only useful remaining non-ham hobby electronics mag is now *Circuit Cellar*. Subscription forms for these and zillions of others are found by clicking on the OXBRIDGE button on my *Guru's Lair* website.

The newer electronic distributors which include *Mouser*, *Jameco*, and *Digi-Key* all welcome small quantity orders and stock most of the popular parts. The old line distributor houses such as *Allied* or *Newark* tend to be much harder to work with and often have higher minimums and atrocious delivery. But supposedly offer a wide range of "full line" items.

There's lots of buys in electronics surplus, with *Marlin Jones* being one of dozens of examples. Surplus tends to be cheaper. But might not work, may not be what you think it is, and may not be there when you need it. Other surplus sources I particularly like are *American Science & Surplus* for mechanical goodies, *Fair Radio Sales* for classic military electronics, and *C&H Sales* for the "big mutha" iron such as motors, transformers, hydraulics, pneumatics, and such.

Hamfests and the military are other surplus sources. Which tend to end up super cheap but rather high risk. (I just bought a "resistance bridge" and received an "ethernet bridge" instead. Uh, not even close.) For a quick view of what the feds are up to, click on the DRMS1 button on my [home page](#).

Secondary markets in semis and parts are made by such resellers as *Electronic Expeditors*. Who do stock many millions of parts. But sell only what they have. Usually fax only and zero hand holding.

The consumer electronics parts can usually get cross referenced through the *ECG* or *NTE* catalogs. These folks have long had all sorts of interesting parts sold in small quantities. *Radio Shack* also has cross ref manuals and specialized parts help. The secret is that you have to ask, and some stores are very much better than others at support. Another useful resource is *Parts Express* for VCR's and such.

Obsolete or out-of-date semis can be found at *Rochester Electronics* or at *Luke Systems*.

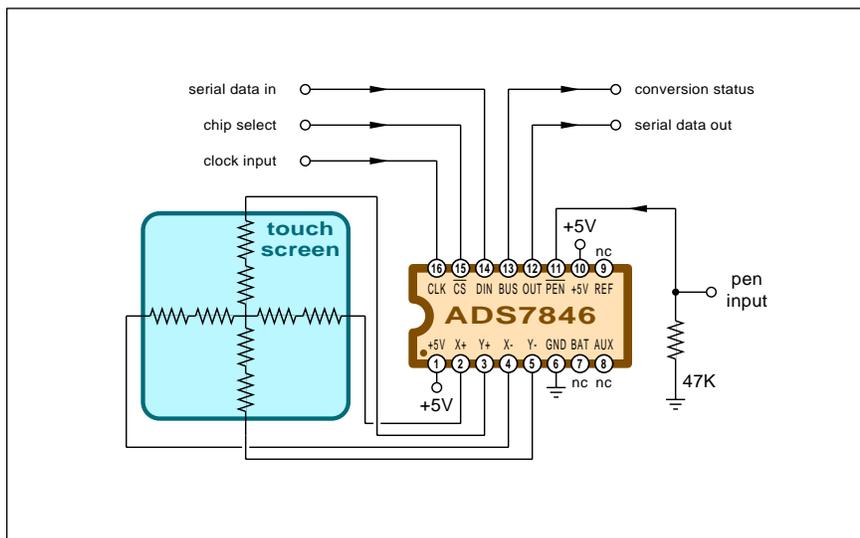


Fig. 3 – NEW TOUCH SCREEN INTERFACE chip and circuit from Burr-Brown offers eight-bit (256 points) or twelve-bit (4096 points) resolution. It can also sense Z axis stylus or finger pressure.

On the mechanical side, the best trade journals are *Machine Design* or *Design News*. Your best parts source is still *Small Parts*, while *Grainger* and *McMaster-Carr* are two of the most obvious big time distributors.

Semiconductor data books are on the way out and not worth bothering over these days. *Always make use of the online PDF data instead.*

Some "getting stuff" resources are up at [www.tinaja.com/resbn01.html](http://www.tinaja.com/resbn01.html) and other pages on my *Guru's Lair* website. I also have surplus bargains at [www.tinaja.com/barg01.html](http://www.tinaja.com/barg01.html) and offer a custom parts finding service at [www.tinaja.com/info01.html](http://www.tinaja.com/info01.html)

### Touch Screen Interface

I've never been really big on touch screens, because they seem to me to go up against fundamental cultural restraints. Ferinstance, most kids are taught from day one not to smear peanut butter and jelly on their tv screen or put their finger in their eye or get the camera dirty or jump into somebody's face or walk up to the movie screen. I feel that were it not for these subtle but profound taboos, touch screens would have seen great heaping bunches of major uses long ago. The big decline in graphic tablet interest is one of many examples.

Nonetheless, there does seem to be some modest interest in touch screens in such niche applications as personal assistants, kiosks, or in factory floor interface terminals.

*Burr-Brown* sells a new ADS7846 chip that handles most of the touch screen interface tasks for a micro or DSP system. Per figure three.

Their \$3.50 chip is a programmable multi channel A/D converter. This one works with a resistive sheet style touch screen. Your finger or a stylus grounds the screen at a selected point, giving four different voltages on the +X, -X, +Y, and -Y axes. These voltages can be compared to determine position to your choice of 8-bit (pda) or 12-bit (kiosk) accuracy.

In its spare time, the new chip also measures temperature and crudely senses the "Z-axis" or applied stylus pressure. This gets done by watching for differences between the absolute and differential resistance.

In use, you apply some clock and data pulses to set your measurement

```
% POSTSCRIPT SHOWPAGE DIVERTER
% =====
% Copyright c 2000 by Don Lancaster & Synergetics, Box 809, Thatcher, AZ, 85552
% (520) 428-4073 Email: don@tinaja.com Website: http://www.tinaja.com
% Consulting services available per http://www.tinaja.com/info01.html

% All commercial rights and all electronic media rights fully reserved.
% Linking welcome. Reposting expressly forbidden. Version 1.3

% One of the incredibly powerful features of the PostScript language is that
% most any proc can be redefined at any time. Even to a different type.

% Redefining the ~showpage~ operator can be particularly useful. For providing
% web undercolor or watermarks, adding page numbers, standardizing borders,
% selectively adding specific page features, doing right-left,logos, etc...

true setglobal globaldict begin                                % persist on save / restores
/validpage false store                                       % use for first underlay
/pagenumber 1 store                                           % running page number
/realshowpage {systemdict /showpage get exec} def            % grab real showpage

/showpage {                                                    % redefine showpage
  validpage{                                                  % if not setup
    [{overproc1}{overproc2}{overproc3}] {cvx exec}          % do overprocs
    forall realshowpage                                       % do real showpage
    /pagenumber pagenumber 1 add store                        % adjust page number
  } if
  /validpage true store                                       % after setup

  [{underproc1}{underproc2}{underproc3}] {cvx exec} % do underprocs
  forall } def

/overproc1 {} def /overproc2 {} def /overproc3 {} def % default null procs
/underproc1 {} def /underproc2 {} def /underproc3 {} def

% /underproc1 gives color background to part of each page. In this example, page
% three is conditionally made a different color...

/underproc1 {
  gsave pagenumber 3 eq {1 1 0.8}{1 0.8 1} ifelse           % pick some colors
  setrgbcolor 0 0 moveto 1000 0 rlineto 0 425              % fill page with color
  rlineto -1000 0 rlineto closepath fill grestore} def

% /overproc1 gives a border and a page number to each page...

/overproc1 {gsave /in {72 mul} def                          % adjust size
  0.5 in 0.5 in moveto 0 in 10 in rlineto                  % rectangular box
  7.5 in 0 rlineto 0 in -10 in rlineto closepath 5
  setlinewidth 1 setlinecap 1 setlinejoin stroke
  /Helvetica findfont 10 scalefont setfont                 % add page number
  0.8 in 0.8 in moveto (page ) show pagenumber 10
  string cvs show grestore} def

% Fake first page must ~always~ be used to start the underlay process...
showpage                                                     % set up first underlay
end false setglobal                                         % cease persistent

% This demo represents your original document...

/demo {/Helvetica findfont 12 scalefont setfont
  100 300 moveto (This is the original first page) show showpage
  100 300 moveto (This is the original second page) show showpage
  100 300 moveto (This is the original third page) show showpage
  100 300 moveto (This is the original fourth page) show showpage
} def

% As a demo, send the following code to Distiller (preferred) or to
% GhostScript or to a PostScript speaking printer...

demo                                                         % run demo

% To divert showpage on third party documents, set the above up as one or
% more files and add an ~uncommented~ line similar to....

%% (E:\medocs-E\divertsp\divisp01.ps) run

% near the beginning of each document to be overlaid or underlaid. Be CERTAIN
% to use "\" every time you mean "!" If you are working with existing .PDF files,
% print to disk as PostScript, enter the diversion line, and then redistill.

% Demos and sourcecode available at http://www.tinaja.com/post01.html and at
% http://www.tinaja.com/acrob01.html Consulting per don@tinaja.com
```

Fig. 4 – POSTSCRIPT SHOWPAGE DIVERTER performs sneaky tasks.

### TRANSMISSION LINE TRANSFORMER RESOURCES

#### Papers–

Guanella, **Novel HF Matching Systems**, *Brown Boveri Review*, Sep 44, pp 327-329  
Ruthroff, **Some Broadband Transformers**, *Proc IRE*, Aug 1959, pp. 1337-1342.  
Sevick, **Multipedance Broadband Transformer**, *QST*, August 1982, page 39.

#### Books–

IEEE Press, **Realization of Broadband Transmission Line Matching Transformers**  
Sevick, **Building and Using Baluns & Ununs**  
Sevick, **Transmission Line Transformer Design Handbook**  
Sevick, **Transmission Line Transformers**

For more book details, see [www.tinaja.com/amlink01.html](http://www.tinaja.com/amlink01.html)

#### Websites–

[www.bytemark.com/amidon](http://www.bytemark.com/amidon)  
[www.ieee.org](http://www.ieee.org)  
[www.primenet.com/~ctrask/trlxfrm.html](http://www.primenet.com/~ctrask/trlxfrm.html)  
[www.tinaja.com/info01.html](http://www.tinaja.com/info01.html)

#### Newsgroups–

[sci.electronics.design](mailto:sci.electronics.design)  
[alt.ham-radio.vhf-uhf](mailto:alt.ham-radio.vhf-uhf)

#### Products–

**Arnold Engineering**  
2470 Railroad St  
Corona CA 91720  
(909) 898-0999  
[www.arnoldeng.com](http://www.arnoldeng.com)

**Fair-Rite**  
PO Box J  
Wallkill NY 12589  
(914) 895-2055  
[www.fair-rite.com](http://www.fair-rite.com)

**Infineon/Siemens**  
1730 N First St  
San Jose CA 95112  
(408) 501-6002  
[www.infineon.com](http://www.infineon.com)

**Kawatetsu/Elite**  
17517 Fabrica Way Ste J  
Cerrito CA 90703  
(714) 522-8081  
[www.elitemagnetics.com](http://www.elitemagnetics.com)

**Mini-Circuits**  
PO Box 350166  
Brooklyn NY 11235  
(718) 934-4500  
[www.minicircuits.com](http://www.minicircuits.com)

**MMG-North American**  
126 Pennsylvania Ave  
Paterson NJ 07503  
(800) 664-7712  
[www.mmгна.com](http://www.mmгна.com)

**MWS Wire Industries**  
31200 Cedar Valley Dr  
Westlake Village CA 91362  
(818) 991-8553  
[www.mwswire.com](http://www.mwswire.com)

**TDK**  
1600 Feehanville Dr  
Mount Prospect IL 60056  
(708) 803-6100  
[www.component.tdk.com](http://www.component.tdk.com)

mode. Additional clock pulses then output your resistance values. These get converted into actual positions by software. See [www.burr-brown.com](http://www.burr-brown.com)

One source for the touch screens themselves is *Interlink Electronics*. Their *ePad* and *VersaPad* products seem interesting. One competitor is *Carrol Touch Technology*.

A useful touch screen FAQ is up at [www.repairfaq.org/filpg/LINK](http://www.repairfaq.org/filpg/LINK)

#### Web Searching Acrobat PDF

Virtually all of the useful technical info on the web is provided in *Adobe Acrobat* PDF format. Because of its unique ability to attractively present *exactly* what the author intended as a compact, single loading and platform independent file with a nearly infinite

mix of graphics, images, and fonts. But the majority of popular search engines remain HTML only.

And thus are largely incapable of finding a pig in a dishpan.

*Adobe Systems* is now providing a

#### NEED HELP?

Phone or email all your US Tech Musings questions to:

Don Lancaster  
Synergetics  
Box 809-EN  
Thatcher, AZ, 85552  
(520) 428-4073

US email: [don@tinaja.com](mailto:don@tinaja.com)  
Web page: [www.tinaja.com](http://www.tinaja.com)

great new PDF-only web searching engine. To date, it has intelligently indexed many millions of PDF docs. I've gotten super fast results to my searches for everything from NTSC comb filters to soil stabilizers up to carbon nanotubes. Their service was also able to find bunches of my own *Guru's Lair* PDF files.

The only possible downside of this superb service is that *Adobe* intends it primarily to promote Acrobat PDF. They are not particularly obligating themselves to index everything in PDF format on the web forever.

So, coverage in some areas might end up a tad slow or spotty. And, of course, they are unabashedly looking *only* for PDF files. But every time I have used it, their results have been right on. Spectacularly so.

HINT: Try searching on telephone numbers!

I've just added a new PDF button to the "mauve" search engine buttons on my home page at [www.tinaja.com](http://www.tinaja.com).

On your own website, it is super important to provide a local search engine that can deal with HTML and Acrobat PDF on an equal basis. The easiest way to do this is to have your ISP add the free *Adobe PDF IFilter 4.0* plug-in to his *Microsoft Internet Information Server 4.0*. Details are at [www.adobe.com/support/downloads/5c16.htm](http://www.adobe.com/support/downloads/5c16.htm) Check this one out.

It is also important when you offer PDF files to make sure your ISP has a feature called *byteserving*. This lets you view one PDF page while the rest of them are invisibly downloading in the background. More details through [www.tinaja.com/acrob01.html](http://www.tinaja.com/acrob01.html)

Verifying links on your online PDF files can be tricky. See the secrets at <http://www.tinaja.com/acrob01.html> that let you do just this.

What these do is scan a PDF file and extract a HTML format list of all linked urls. You then send this list to any HTML link checker such as *Dr. HTML* that you should be able to find at [www2.imagiware.com/RxHTML](http://www2.imagiware.com/RxHTML)

Something similar to Acrobat is now being included as a mainstream feature of the web. It is called *SVG*, short for *Scalable Vector Graphics*. You can pick up the full details at [www.w3.org](http://www.w3.org) Ready-to-use free beta plugins for major browsers are found at [www.adobe.com/svg](http://www.adobe.com/svg)

## PostScript Proc Diversion

One of many powerful features of *PostScript-as-language* is that you can *redefine* any proc at any time. Even changing its type. Although such on-the-fly mods can easily get you into serious trouble, they also solve sticky problems for you.

This month's handy PostScript-as-language figure four example shows you how to redefine your *showpage* operator.

Tricking it into doing other things immediately before or immediately after a page gets printed and ejected. For instance, you might add a logo, a copyright notice, or a new attractive border *before* your actual showpage. By working with a page counter, you can selectively insert charts or other stuff only on selected pages.

Or, by adding routines *after* your showpage, you can put a "file copy" or "confidential" or other watermark *underneath* your actual content. Or simply add a tint that avoids white backgrounds on web content. Either route can also be a convenient way of "standardizing" existing files or third party input sources.

Note that stuff *before* your actual showpage goes *on top of* what you are printing. Stuff *after* your actual showpage goes *underneath* the *next* sequential page.

Use of the underneath feature can lead to a big problem: Any tint areas, fills and other real job procs might completely mask or overwrite your underlay. Watch this detail.

To apply the "built in" version shown, you will bring the showpage diverter up in a word processor or editor and suitably modify it. It then must get resaved as a standard ASCII textfile (but usually with a .ps trailer) in an accessible place on your pc. You then send your modified job to the [Acrobat Distiller](#) or GhostScript, using either one as a host resident PostScript interpreter.

The mods should appear in your output .PDF file.

Fancier "file link" versions instead insert a *run* command and filename near the beginning of your file to be modified. This simplifies automation and batch processing.

You'll put your file link command after any initial header and comments

## NAMES AND NUMBERS

### Adhesives & Sealants

PO Box 400  
Flossmoor IL 60422  
(708) 922-0761  
[www.adhesivesmag.com](http://www.adhesivesmag.com)

### American Sci & Surp

3605 Howard St  
Skokie IL 60076  
(708) 982-0870  
[www.sciplus.com](http://www.sciplus.com)

### Bell Jar

35 Windsor Dr  
Amherst NH 03031  
(603) 429-0948  
[www.tiac.net/users/shansen](http://www.tiac.net/users/shansen)

### Burr-Brown

6730 S Tucson Blvd  
Tucson AZ 85706  
(520) 746-1111  
[www.burr-brown.com](http://www.burr-brown.com)

### C&H Sales

PO Box 5356  
Pasadena CA 91107  
(800) 325-9465  
[aaaim.com/CandH/index.htm](http://aaaim.com/CandH/index.htm)

### Carroll Touch

2800 Oakmont Dr  
Round Rock TX 78664  
(512) 671-5621  
[www.carrolltouch.com](http://www.carrolltouch.com)

### Circuit Cellar Ink

4 Park St #20  
Vernon CT 06066  
(203) 875-2751  
[www.circuitcellar.com](http://www.circuitcellar.com)

### ECG/Philips

PO Box 3277  
Williamsport PA 17701  
(717) 323-4691  
[www.ecgproducts.com](http://www.ecgproducts.com)

### Fair Radio Sales

PO Box 1105  
Lima OH 45802  
(419) 227-6573  
[www.fairradio.com](http://www.fairradio.com)

### Fuel Cell Bulletin

Box 945  
New York NY 10159  
(212) 633-7300  
[www.elsevier.com](http://www.elsevier.com)

### Hittite Microwave

12 Elizabeth Dr  
Chelmsford, MA 01824  
(978) 250-3343  
[www.hittite.com](http://www.hittite.com)

### Interlink Electronics

546 Flynn Rd  
Camarillo CA 93012  
(805) 484-8989  
[www.interlinkelec.com](http://www.interlinkelec.com)

### Jameco Electronics

1355 Shoreway Rd  
Belmont CA 94002  
(800) 536-4316  
[www.jameco.com](http://www.jameco.com)

### Marlin P Jones

Box 12685  
Lake Park FL 33403  
(407) 848-8236  
[www.mpja.com](http://www.mpja.com)

### Luke Systems Intl

27827 Via Amistosa #101  
Agoura Hills CA 91301  
(818) 991-9373  
[lukesys@nrc.com](mailto:lukesys@nrc.com)

### Microchip Technology

2355 W Chandler Blvd  
Chandler AZ 85224  
(480) 786-7200  
[www.microchip.com](http://www.microchip.com)

### Nature

65 Bleecker St  
New York NY 10012  
(212) 477-9628  
[www.nature.com](http://www.nature.com)

### NTE Electronics

44 Farrand St  
Bloomfield NJ 07003  
(201) 748-5089  
[www.nteinc.com](http://www.nteinc.com)

### Rochester Electronics

10 Malcolm Hoyt Dr  
Newburyport MA 01950  
(508) 462-9332  
[www.rocelec.com](http://www.rocelec.com)

### Seiko Instruments

2990 W Lomita Blvd  
Torrance CA 90505  
(310) 517-7770  
[www.seiko-usa-ecd.com](http://www.seiko-usa-ecd.com)

### Small Parts

PO Box 4650  
Miami Lakes FL 33014  
(305) 557-8222  
[www.smallparts.com](http://www.smallparts.com)

### STMicroelectronics

55 Old Bedford Rd  
Lincoln MA 01773  
(781) 259-0300  
[www.st.com](http://www.st.com)

### Synergetics

Box 809  
Thatcher AZ 85552  
(520) 428-4073  
[www.tinaja.com](http://www.tinaja.com)

### think3

2880 Lakeside Dr, Ste 250  
Santa Clara CA 95054  
(408) 987-2220  
[www.think3.com](http://www.think3.com)

## Tech Musings

but before actual procs.

The file linking commands may be inserted in most existing PostScript job files. If you already have a PDF file, just print to disk to generate a suitable PostScript program, and then modify the program.

Four big gotchas: First, **be sure to use double reverse slashes every time you want a single reverse slash in a PostScript filename.** Secondly, your new diversion code must *not* have a showpage or a control-D at its end.

You want to insert this diversion file as a continuous part of your code to be modified. Any artwork files, watermarks, charts, or whatever also must not have their own showpage or control-D endings, because these also are to be main job inserted.

With either the "built in" or "file link" methods, any input code that's already diverting showpage or doing other exotic stuff might need some special treatment. While diversion routines could get placed anywhere accessible, putting them in *globaldict* is often a very good choice.

Note that your modified "file link" ps code can't be sent to a PostScript printer unless the printer itself has an *internal* disk drive available.

Your final PDF distilled code, of course, can be sent to any printer, PostScript or otherwise.

Much more on all these techniques in [www.tinaja.com/post01.html](http://www.tinaja.com/post01.html) and in my [www.tinaja.com/acrob01.html](http://www.tinaja.com/acrob01.html)

Consulting services on these and lots of related subjects are available at [www.tinaja.com/info01.html](http://www.tinaja.com/info01.html)

Note that an "extra" non-printing first page gets called for by the code so all page underlays will get treated equally. But an easily removed extra final page might remain.

### New Tech Lit

From *Microchip Technology* their *2000 Technical Library CD-ROM*. More on PIC microcontrollers up at <http://www.tinaja.com/picup01.html>

Other CD ROM's of interest this month do include a *RF & Microwave Integrated Circuits* from the *Hittite Microwave* folks and a pair of *Data Disks* from *STM Microelectronics* Also, *Seiko Instruments* has a useful CD data and tech info disk.

A freebie 3-D mechanical design tutorial that is disguised as a *Monkey Wrench Conspiracy* intergalactic game is offered by *Think3*.

The sometimes hard-to-find *Nature* mag is widely regarded as the finest scientific journal in the world, with *Science* the close second. New fuel cells which directly use gasoline or other hydrocarbons without needing hydrogen reformation are described in *Nature's* March 16, 2000 issue in a letter by S. Park and others on pages 265-267. Website is [www.nature.com](http://www.nature.com)

There's also a new but pricey *Fuel Cells Bulletin* from *Elsevier*. More fuel cell info might be picked up at

[www.webconx.com/fuelcell.htm](http://www.webconx.com/fuelcell.htm) or at [www.tinaja.com/h2gas01.html](http://www.tinaja.com/h2gas01.html)

Non-destructive testing folks tend to be a quiet bunch, but you can find at least a few of them lurking at the [sci.techniques.testing.nondestructive](http://sci.techniques.testing.nondestructive) newsgroup or the new [www.ndt.org](http://www.ndt.org) website. I have got some nice eddy current probes and an older *Nortec* ultrasonic video thickness gauge at [www.tinaja.com/barg01.html](http://www.tinaja.com/barg01.html)

Featured print magazines for this month will include Steve Hanson's labor-of-love *Bell Jar* on amateur high vacuum techniques as well as the *Adhesives & Sealants Industry*.

A new Roger Allen book titled *A Quick Guide to Book-on-demand Printing* is all about do-it-yourself publishing opportunities. More on BOD at [www.tinaja.com/bod01.html](http://www.tinaja.com/bod01.html).

For the overwhelming majority of individuals and small scale startups, any involvement in patents is certain to end up as a monumental loss of time, energy, money, and sanity. You find out why along with tested and my proven workarounds in the *Case Against Patents* package. As per my [www.tinaja.com/patmt01.html](http://www.tinaja.com/patmt01.html)

The latest website additions at my *Guru's Lair* at [www.tinaja.com](http://www.tinaja.com) do include a new *eBay Insider Selling Secrets* tutorial, more new links, our ongoing online forum, and bunches of new surplus bargains. Click on [www.tinaja.com/barg01.html](http://www.tinaja.com/barg01.html)

Let's hear from you. ♦

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