The Components You Need

by
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Welcome to the complex yet flexible world of component and material selection. This guide is intended to introduce you to some of the resources available to design engineers as they track down and select components for their products.

I have included many of the resources I have used in designing products for my electronics design business, Helius Designs Incorporated, from prototypes through to the marketable forms. As well, I have included some information relevant to home-based entrepreneurs.

No guide can completely cover the expansive list of companies and resources useful to electronics designers, but if you have found a new and useful source of materials or components, or anything else relevant to this guide, please contact me at eth@sfu.ca and I will include it.

As you prepare to design a piece of electronics, I would first advise you to assemble a library of catalogs and databooks, and start right away as it may take a month or two to receive them all. Follow the links in the next sections and have yourself sent the free literature. SFU Engineering also has a large collection of databooks and such, but I prefer to have the most recent and most useful books in an easy to find place, and always directly accessible.

Having acquired this material, when you think you might need a particular component, you can quickly check its specifications, see what equivalent components exist, compare the costs of these different components, and compare these costs at different distributors and retailers.

Retailers

This is your easiest and quickest way to obtain components, tools, and materials. You are likely familiar with Active Electronics:

Active Electronic Components Depot
3695 East 1st Ave.
Vancouver, BC
V5M 1C2
Tel: (604) 654-1057
Fax: (604) 293-1105
active.vancouver@future.ca
www.activestores.com

From Hastings, drive south down Boundary—they are on the right just before East 1st. Active carries a good selection of popular components, chemicals, and tools, and has a

student discount, though their prices are usually a little higher than the average. You should order the Future Active Catalog, which allows you to check prices before even going to the store. Items carried in the catalog but not available in the store can often be shipped to the store for you in as little as 5 days, depending on whether or not the item is currently stocked, and where it is in North America. Get the catalog, or perform online searches, at

Future Electronics - www.future-active.com

RP Electronics is the other retailer I frequently visit. They carry mostly tools and miscellaneous items (such as used equipment or surplus materials like fans and pots, though the surplus items are often quite overpriced), along with some components, and they also have a student discount. They are on the south side of Lougheed just west of Willingdon. They have a simple catalog put out by CIRCUIT-TEST.

R.P. Electronic Components Ltd.
2060 Rosser Avenue
Burnaby, BC
V5C 5Y1
Tel: (604) 738-6722
Fax: (604) 738-3002
info@rpelectronics.com
www.rpelectronics.com

Intek Electronics, located on the other side of East 1st from Active, carries some items the other two stores might not, and at reasonable prices. They have a wide selection of LEDs, switches, etc. You may also be able to find some useful local companies or outlets under Electronic Equipment & Supplies-Whol & Mfrs in the Telus Pages.

If you discover any other local electronics sources, please let me know.

Distributors

Components not available or too expensive at the retailers can be purchased from one of the many distributors.

Many students make exclusive use of Digi-Key; they offer next day delivery with $8.00 shipping charges (+ $6.50 handling if your order is under $32.50) for items of reasonable size and weight. Make sure you get their catalog (1000 pages of products):

Digi-Key - www.digikey.com

A few other distributors with good catalogs:

Allied Electronics – www.alliedelec.com
Electro Sonic - www.e-sonic.com/electrosonic/home.asp
Mouser Electronics – www.mouser.com
Newark Electronics - www.newark.com

Electronics Manufacturers

Going straight to the source is very important when trying to obtain data sheets or specific information about a component. There are so many semiconductor manufacturers that I won't even make an attempt to list all the main ones; simply flip through the semiconductor section of a catalog like Digi-Key's to get an idea of the specialty of each company. You'll likely find yourself frequenting at least the following sites:

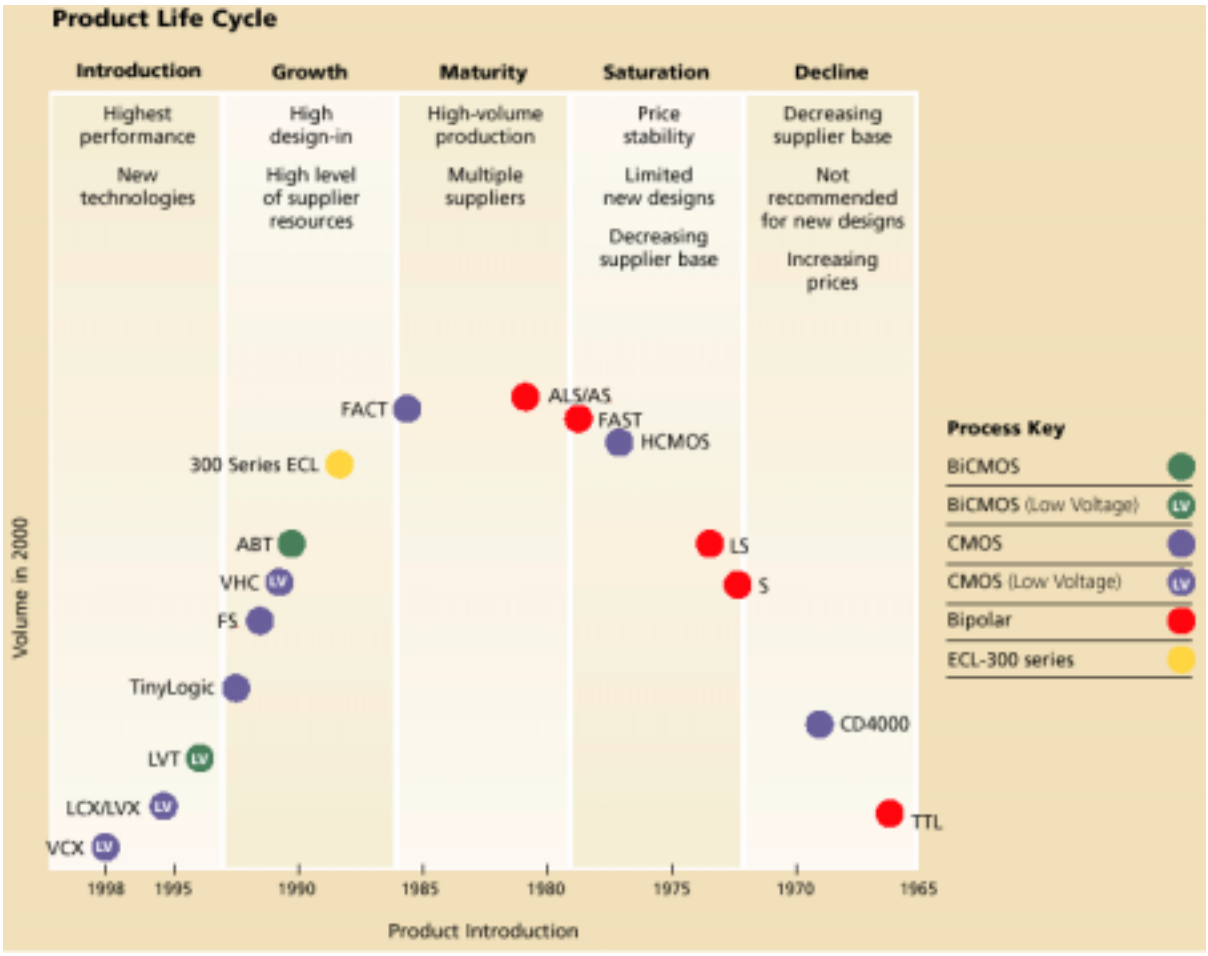
Fairchild Semiconductor - www.fairchildsemi.com
National Semiconductor - www.national.com
Texas Instruments - www.ti.com
Motorola Semiconductor - mot-sps.com

Many companies provide free product literature, mostly on CD, but may also distribute expansive databooks and product overviews (National and Maxim, for example). These companies, and others, can be great about providing product samples to design engineers. You will be more likely able to repeatedly request different samples if you have a company name behind you.

As an engineer, you will often want to analyze (reverse engineer) existing products for learning purposes. First, it is best to be familiar with the different components and devices commonly found in electronic circuits (also important for constructing your own designs). Reading the SFU Engineering Science Laboratory Handbook is a good way to do this. Now to identify the functions of chips, try to get a model number and manufacturer name from the writing on the chip. You may also have to use the Laboratory Handbook to match a logo to the semiconductor manufacturer. With this information you can often go to the manufacturer's web site for technical details, or further isolate the part or obtain information on out-of-date parts from an electronic component database such as

Chipdir - www.xs4all.nl/~ganswijk/chipdir

As a side note on selecting semiconductor devices, you would be wise to be aware of the lifecycle of different logic series. You must balance cost, performance, and accessibility, as described in the following chart copied from Fairchild Semiconductor's Logic Selection Guide (Literature Control #: 580146-004, found at www.fairchildsemi.com/collateral/, along with many other guides).



SFU Equipment/Supplies

Each project group gets a dollar limit (around $50) for requesting electronic components and supplies from the lab stores, which is located inside Lab 1. Usually you talk with Fred Heep for equipment requests, and the store hours are posted outside the store.

You may be able to scrounge for some materials, such as screws and scrap metal, from the Machine Shop. Hand tools are accessible to students, but you need special permission to use the power tools (instructions are posted inside the shop). If you can prove you know how to use a particular tool, this permission should be easy to obtain.

Printed Circuit Boards

Many groups will prove a design using breadboards, and then transfer the design to a perforated circuit board using either wire wrapping or soldering. This can work well if the design is not excessively complex, and is attractive when you are in a hurry but have little experience making printed circuit boards. However, you can (and most **will**) run into many complications with bad connections, solder bridges, etc. An elegant solution, particularly if your have some experience or plan to eventually market your product, is to create your own PCB. This is a skill that every company desires, and after doing it once you will save a tremendous amount of time in prototyping future designs.

Even with no experience, you very well could spend more, less productive time troubleshooting bad wiring than learning how to produce your own PCB.

To start, you can use the layout software at SFU or use the free Eagle layout software, though it is limited in its maximum board size:

Eagle - www.cadsoft.de/info.htm

There are numerous resources on standard layout practices on the web, in the library, and in the Laboratory Handbook. Once you have a layout, you can send it to a board shop or make it yourself. Each shop clearly explains what to send them. I recommend the prototype service of

Alberta Printed Circuits - www.apcircuits.com
Omni Graphics - www.omnigraph.com

If you are making your own board, you can transfer your circuit to the copper before etching using a UV process, but this is expensive. Get Press-N-Peel Blue transfer film from

Electronix Express - www.elexp.com

Read the directions and research the process on the internet, but in brief, laser print a mirrored version of your circuit on the film, iron the film onto a clean copper board, and etch in ferric chloride. The toner from the printer protects from being etched the copper that will become your circuit. The process might be a little tricky to master, but if you are careful you will figure it out quickly. I have made traces as small as 0.01" this way, but stick to 0.025" minimum if you can. Afterwards, you may want to protect the copper traces with liquid tin.

Materials

Specialized materials are more difficult to track down than electronics, particularly for small volume projects like prototypes. You won't likely be pursuing personally-designed injection molded housings. Some students end up sorting through material at the junkyard or wreckers.

This section could use development. Please contact me if you have experience to share.

Business Basics

Now that you have put hundreds of hours into designing a product, why not build a business around it, bring the product to a marketable form, and make some money?

From your design, lay out a PCB (which you or a board shop can manufacture), populate the boards yourself, put it in a stock housing (or design your own), and you're set to sell.

The following links will guide you through the construction of your business:

Business Basics for Engineers - www.sfu.ca/~mvolker/biz/index.htm
Business Services Checklist - www.smallbusinessbc.ca/workshop/checklist.html
Corporate Registry - www.fin.gov.bc.ca/registries/Corppg/
One Stop Business Services - www.onestopbc.ca
Revenue Canada, Business - www.ccra-adrc.gc.ca/tax/business/menu-e.html

If you plan to incorporate for the added liability protection, the basic registration will cost you around $350. It's quite easy with the following book, which is carried by most Staples or equivalent:

The Incorporation and Business Guide for British Columbia, Self-Counsel Press

Have fun!