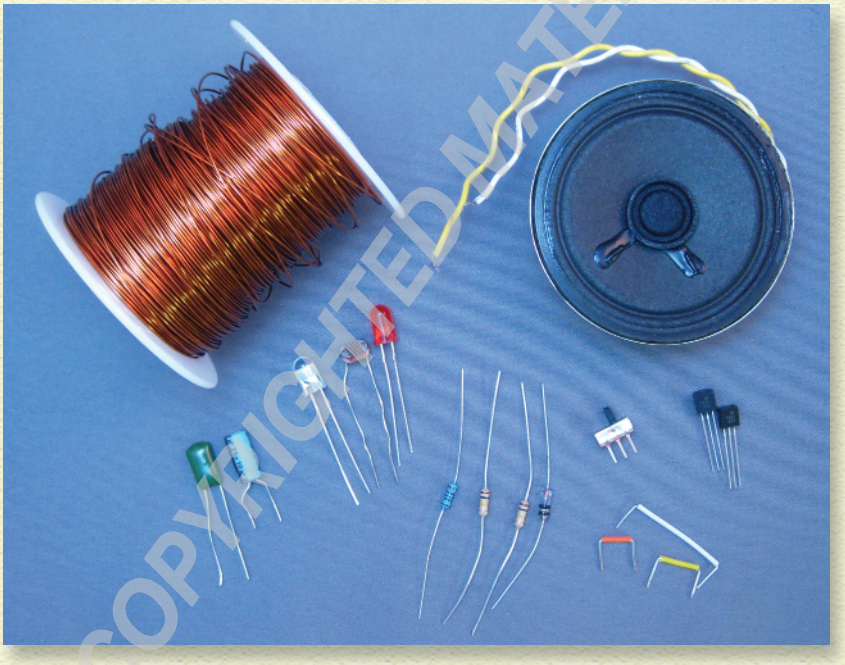
PROJECT 1 SHOPPING SPREE

DO YOU LIKE TO SHOP? (I DON'T!)

To build the projects in this book, you need to buy a bunch of *electronic components* (including resistors, capacitors, diodes, LEDs, transistors, a speaker, an earphone, and an integrated circuit), accessories (such as alligator clips and wires), tools (such as wire strippers), and other supplies.



PLAN YOUR SHOPPING SPREE

I wish I could name a store in a shopping mall close to your house where you could just walk in, pick out all the parts you need, plunk down about $50, and go home and start building projects. Unfortunately, there is no such store (even RadioShack stores no longer carry a wide variety of electronic components).

So, you will need to order many of your supplies online, which means you have to plan to allow time for shipping. The good news is that you can save a lot of money by shopping online, and you can get most of the components you need in just one online trip (with an adult's assistance or, at least, an adult's credit card). You may still need to go to a couple of local stores to pick up some tools and other supplies.

Here are some recommended suppliers:

- **Tayda Electronics:** The www.TaydaElectronics.com website is easy to use (see the sidebar "How to Order Online"). One visit to Tayda and you can order nearly every electronic component and some of the accessories you need at reasonable prices (many for just pennies).

Tayda has a $5 order minimum, so try to buy everything you need in one order.

With warehouses in Colorado (US) and Bangkok (Thailand), Tayda ships worldwide. Allow 1–4 weeks for delivery, depending on where you live.

I've provided Tayda part numbers for many of the components you need in the next section.

- **Fry's Electronics:** Between its stores (in several US states) and website (www.Frys.com), Fry's stocks many of the electronic components and accessories you need. Fry's ships worldwide.
- **Farnell element14:** Start at www.Farnell.com and select your country for the Farnell element14 company in your region. (The US company is called Newark.) You'll find all the electronic components and many accessories you need.

The Farnell website is geared for adults who work in the electronics industry, so you will probably need an adult's help to make sense out of the highly technical product descriptions.

» **RadioShack:** RadioShack has stores in many parts of the US, but the stores have a limited supply of electronic components. You may find a better selection on RadioShack's online store (www.RadioShack.com). Prices are significantly higher at RadioShack than at other online suppliers, but if you really need a certain component right away (say, for instance, you burned out all your LEDs and you need just one to finish a project) and your local store has it, it's worth the trip.

You can also find most (or all) of the components, accessories, tools, and supplies you need on www.Amazon.com or www.eBay.com. However, the product information is often unclear and incomplete, so be sure you know exactly what you're ordering.

Whenever you order online, make sure you understand how much the seller charges for shipping and how long it takes the seller to pack up and deliver your order.

BUDGET

If you're a smart shopper and order online, you can purchase all the electronic components and accessories you need for roughly $33 plus tax and shipping. (Of that $33, $16 is for two parts you need for Project 7, Radio.) You may spend about another $30 (plus tax) on tools and other supplies at local stores, if your family doesn't already have what you need. If you buy a lot of your components and supplies in a RadioShack store, budget another $20 or so.

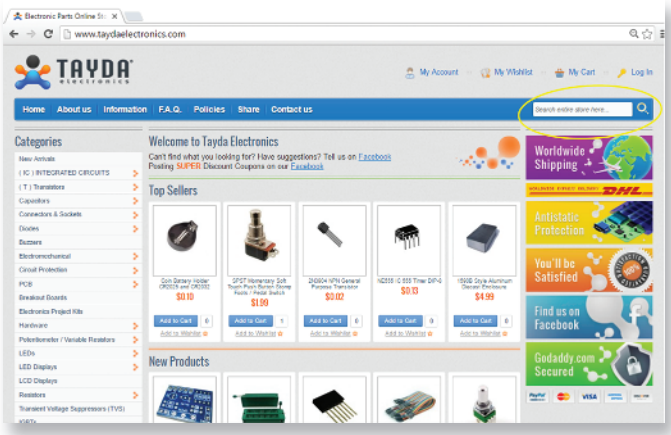
If you have a limited budget, you can save money by skipping Project 7. For as little as $20 to $22, you can buy all the components you need for Projects 2-6.

HOW TO ORDER ONLINE

You might find it helpful to see exactly how to shop for electronic components from an online supplier. Let's take a look at the steps involved in ordering from Tayda Electronics:

1 **In the address field of your favorite Internet browser, type the web address www.TaydaElectronics.com to bring up the home page for Tayda Electronics.**

2 **Locate the search field in the upper-right corner of the home page.**



3 **Type either a product code or a product name in the search field to bring up a product listing.**

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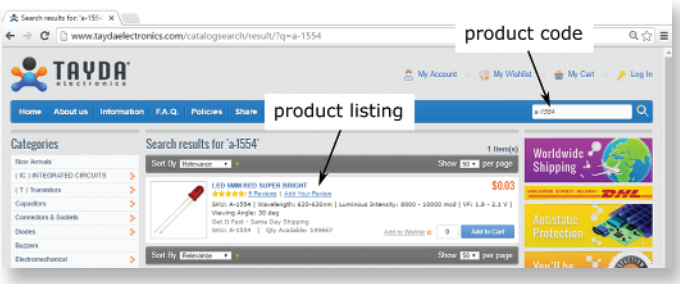
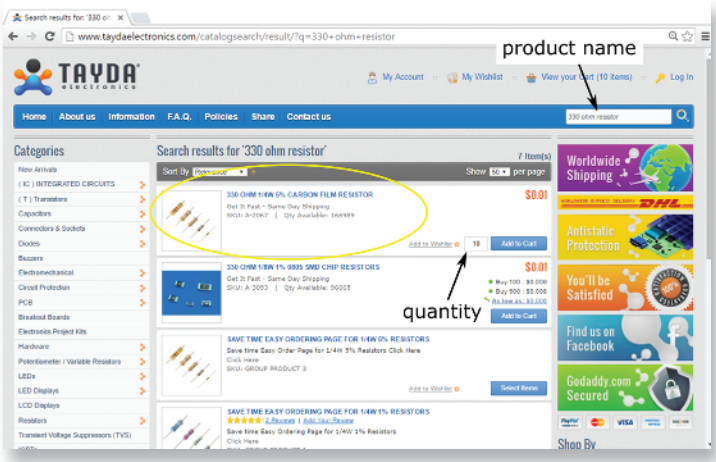


4 Choose the specific product you need.

For instance, there are different types of 330-ohm resistors, but the type you need is 1/4-watt (W) carbon film.

5 Type the quantity of the product you need.

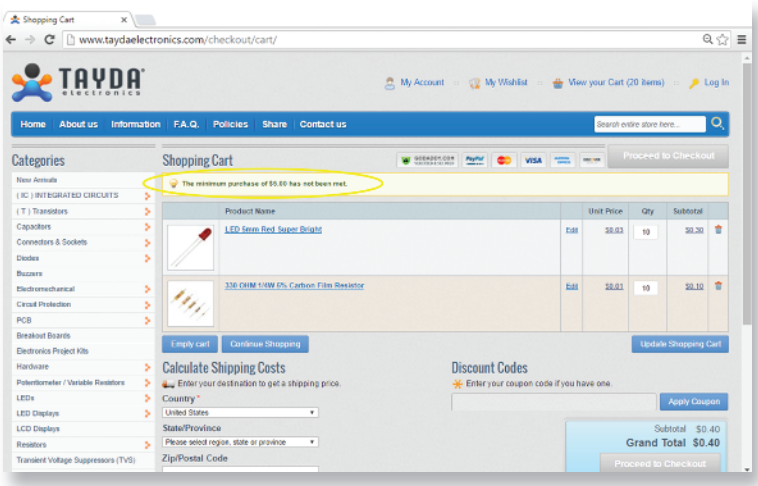
Note that some items have a minimum quantity. For instance, the resistors you need are sold in packs of ten.



6 **Add the item(s) to your shopping cart by clicking Add to Cart.**

7 **Repeat Steps 3-6 for each product you'd like to order.**

You can check to see what's in your shopping cart at any time by clicking View Your Cart at the top right of your screen. Note that Tayda requires a $5 minimum order.



8 **When you have selected all the products you want to order, click Proceed to Checkout, at the bottom of your shopping cart page.**

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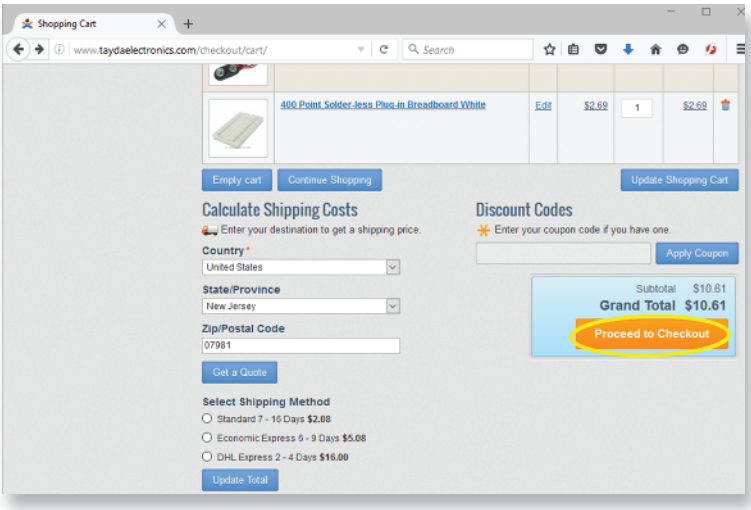


9 Ask an adult to complete the checkout process, which requires entering a customer name, a shipping address, and payment information.

ELECTRONIC COMPONENTS AND ACCESSORIES

This section provides a complete list of the electronic components and related parts you need to complete the projects in this book. In the list that follows, I sometimes specify a product code (identified by #) and price (as of this writing, in June 2016) to give you an idea of what to look for and roughly how much you should expect to pay. Here's your shopping list of electronic parts:

- **Batteries and accessories**
  - One (minimum) fresh 9-volt disposable (not rechargeable) alkaline battery ($2.50–$5.00). (I suggest you buy two.)

- One 9-volt battery clip (sometimes called a snap connector). Tayda Electronics #A-656 ($0.10), RadioShack #2700325 ($2.99), or similar.

- **Wire, alligator clips, and switches**

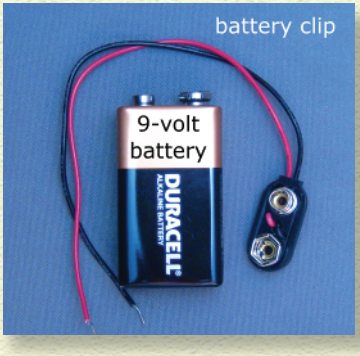
  - Jumper wires (optional). Precut, prestripped solid jumper wires in assorted lengths and colors are highly recommended so you don't have to make your own jumper wires. Newark #10R0135 (70 wires, $3.60), Newark #10R0134 (140 wires, $6.20), RadioShack #2760173 (140 wires, $6.99), or similar.

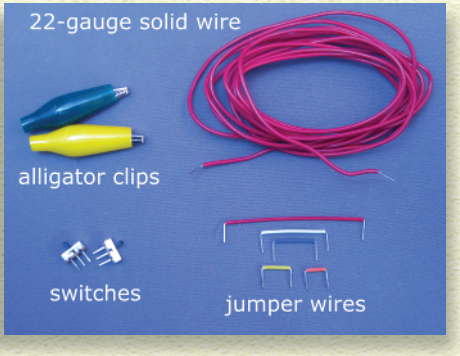
  - 22-gauge solid wire, insulated, 15 feet minimum. Multiple colors are preferable but not necessary. Tayda Electronics sells black (#A-4994), white (#A-4995), red (#A-4996), yellow (#A-4997), green (#A-4998), and blue (#A-4999) for $0.10 per foot. (I suggest you get at least one foot each of red wire and either black or blue wire, and the rest in any color.)

This wire must be solid wire so you can plug it into your solderless breadboard. Do not purchase stranded wire because stranded wire is not meant to be plugged into a solderless breadboard. If you purchase a product called hookup wire, make sure that it is solid, not stranded, hookup wire.

  - Alligator clips, fully insulated. Get one set of ten, preferably in assorted colors. RadioShack #2700378 (1 1/4-inch mini clips) or #2700356 (2-inch clips) or similar ($2.49–$3.49 per set). Also check online at Walmart, Amazon, or eBay.

  - Two (minimum) 3-pin single-pole, double-throw slide switches (abbreviated as SPDT or 1P2T). Make sure these switches are breadboard friendly with pins spaced 0.1 inch (2.54 mm) apart. Tayda Electronics #A-5102 ($0.78 each).





» **Resistors.** You'll need an assortment of resistor values (known as *resistances*). Look for carbon film resistors rated at 1/4 watt (W) or more with a tolerance of 20 percent or less.

Don't worry about the meaning of the type of resistor (that is, "carbon film"), the power rating (in watts), or the tolerance (a percentage). You just need this information for purchasing your resistors.

Listed next are the resistor values and the color codes used to identify them. You need only one or two resistors of each value, but suppliers sell resistors in packs of five, ten, or more, so purchase one pack of each. (Tayda Electronics sells ten-packs for $0.10 each. RadioShack sells five-packs for $1.49 each.) Here are the values you need:

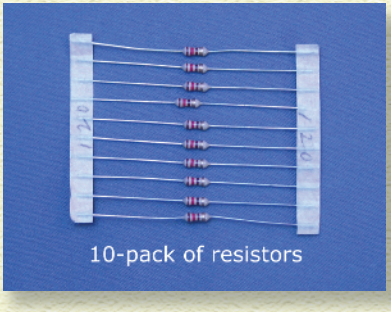
- 330 ohm (orange-orange-brown)
- 470 ohm (yellow-violet-brown)
- 10 kohm (brown-black-orange)
- 47 kohm (yellow-violet-orange)
- 100 kohm (brown-black-yellow)
- 470 kohm (yellow-violet-yellow)
- 1 Mohm (brown-black-green)
- 4.7 Mohm (yellow-violet-green)

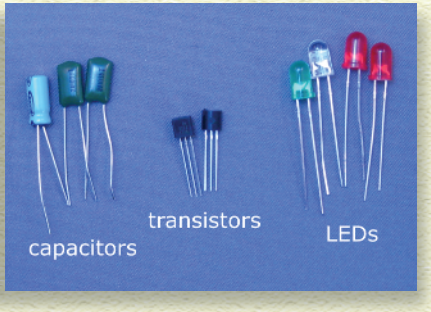
Ohms is the unit of measure for resistance. A kohm is 1,000 ohms and a Mohm is 1,000,000 ohms. Suppliers may list resistance values in Ω, kΩ, or MΩ, where Ω is the symbol for ohms.

- **Capacitors**
  - Two 0.01 µF Mylar film capacitors, rated for 16 volts (abbreviated V) or higher. Tayda Electronics #A-4106 ($0.04 each). (I recommend that you order four.)
  - One 4.7 µF electrolytic capacitor, rated for 16 V or higher. Tayda Electronics #A-4504 ($0.02 each). (I recommend that you order three.)

F is the abbreviation for farads, the unit of measure for capacitance. µF is the abbreviation for microfarads. A microfarad is 0.000001 farad.

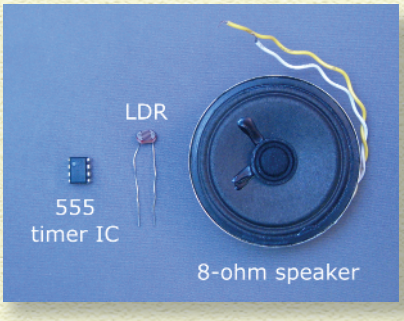
- **LEDs.** Minimum quantities are specified in the following list, but I recommend you purchase at least a few more of each. (They're cheap — and they're fryable.)
  - Two 5 millimeter (mm) red LEDs. Tayda Electronics #A-1554 ($0.03 each). (I suggest you buy ten.)
  - One 5 mm green LED. Tayda Electronics #A-1553 ($0.03 each). (I suggest you buy five.)
  - One 5 mm ultrabright clear (white) LED. Tayda Electronics #A-408 ($0.05 each). (I suggest you buy five.)
- **Transistors.** Buy one or two extra of each type, just in case you fry one. They cost pennies each online, or $1.49 each in RadioShack stores.
  - One 2N3904 general-purpose NPN bipolar transistor. Tayda Electronics #A-111 ($0.02).
  - One 2N3906 general-purpose PNP bipolar transistor. Tayda Electronics #A-117 ($0.02).





- **Miscellaneous**
  - One 555 timer integrated circuit (IC). This IC comes in a package known as an 8-pin DIP. Tayda Electronics #A-249 ($0.13 each). (Buy one or two extra.)
  - One light-dependent resistor (LDR, or photoresistor), any value. Tayda Electronics #A-1528 ($0.24) or similar. (Buy one or two extra.)
  - One 8-ohm, 0.5 W speaker. Tayda Electronics #A-4140 ($1.28), RadioShack #2730092 ($3.99), or similar.
- **Radio components.** Project 7, Radio, requires one inexpensive component and a couple of pricy components, one of which (the earphone) is not all that easy to find, because most electronics suppliers don't carry it.
  - One 1N34/1N34A germanium diode. Tayda Electronics #A-1716 ($0.24). (Buy at least two.)
  - One spool (at least 50 feet) of 24 gauge (AWG) magnet wire. Temco #MW0190 or similar. ($6.00–$15.00 online at Amazon or eBay.)
  - One piezoelectric earphone (sometimes called a crystal earphone or a crystal radio earphone). This earphone may or may not come with a 3.5 mm plug at the end of the wires. (You don't need the plug, but if you buy one with a plug, you can just cut it off.) Amplified

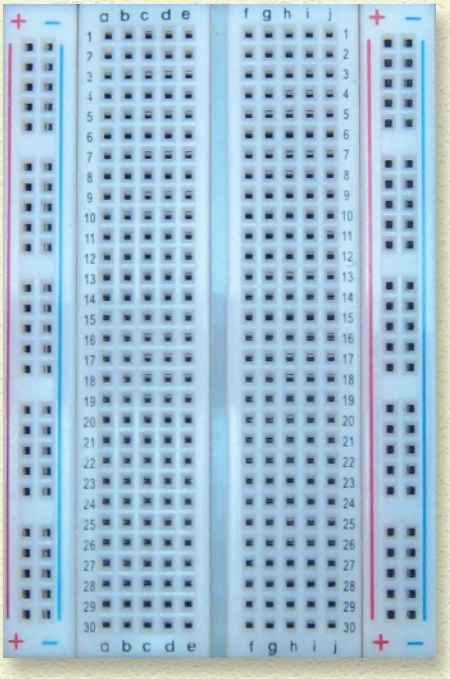
Parts #P-A480 (with plug at AmplifiedParts.com, eBay, or Amazon), Mini Science #CH905ST (without plug at miniscience.com), or similar. Expect to pay about $10 including shipping.



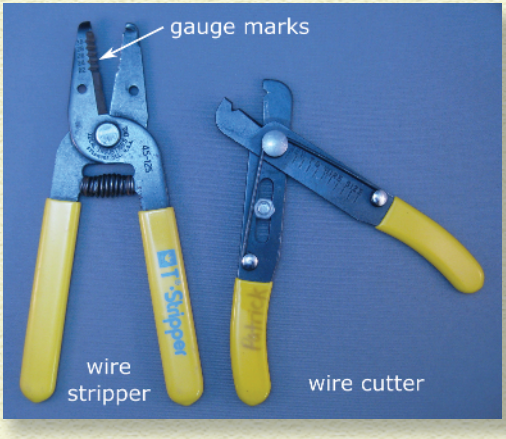
TOOLS AND SUPPLIES

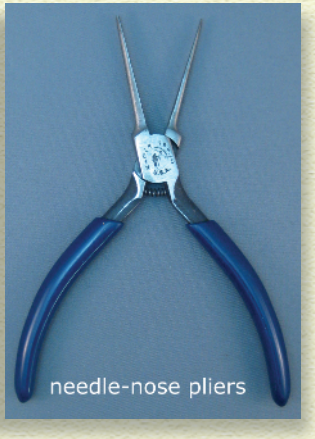
You need the following hand tools and other supplies to help you build your projects:

- **Solderless breadboard:** You use a solderless (pronounced "sodd-er-less") breadboard to build circuits. Purchase a breadboard that has 400 contact holes (also called tie points) and includes power rails (also called power lanes or bus lines), such as Tayda Electronics #A-1424 ($2.69) or RadioShack #2760003 ($9.99).



- **Wire stripper/cutter:** You use this tool to cut wires, trim component leads, and strip insulation from the end of wires. I recommend getting a gauged wire stripper/cutter, but you can use an adjustable wire stripper/cutter instead. Make sure your wire stripper can be adjusted to strip 22-gauge (22 AWG) wire. RadioShack #6400224 ($9.99) or similar. (Check your local hardware store or Walmart.)
- **Needle-nose pliers:** This handy tool helps you bend leads and wire and makes it easier to insert and remove components from your solderless breadboard. (Check your family's toolbox or get a set of 5-inch pliers for $6.00–$12.00 at a hardware store or Walmart.)





- **Safety glasses:** Okay, so you risk looking a bit nerdy wearing safety glasses while you work on your electronics projects. But better to look nerdy than to not be able to look at all because the wire that you just clipped went flying into your eye. (Some of the 3M safety glasses are actually attractive and cost $3-$10 plus shipping on Amazon.com.)
- **Electrical tape:** You need about 4–6 inches of 3/4-inch electrical tape, such as Scotch #4218-BA-40. ($2-$6 per roll at Walmart, Home Depot, or other hardware stores.)

- **One 9-by-12-inch sheet of adhesive craft foam.** Check your local craft store (roughly $1.00). (Amazon and Walmart sell multipacks for $12.00–$15.00.)
- **One package of assorted grit sandpaper.** If you don't already have sandpaper, you can purchase it from any hardware store, Walmart, Amazon.com, and other suppliers ($5.00 or less).
- **Three paper fasteners.** You may have some fasteners at home, but if you don't, you can buy a box of 60-100 for about $3.00 at Walmart or any office supply store.
- **Spray or liquid glue:** You can purchase a container at Walmart or any craft store for $2-$5.
- **Assorted items.** Scissors, one toilet paper roll, one paper towel roll, aluminum foil, one sheet of plain white paper, transparent or masking tape, a ruler, one piece of cardboard or plastic lid, and a large coffee can or other large metal object.