

## DIY Solar USB Charger - Altoids

by [JoshuaZimmerman](#) on April 22, 2011

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I'm an elementary school teacher in Milwaukee, Wisconsin. I like making random things and then teaching my students how to do the same.

If you're ever feeling the urge to donate money to a needy 4th grade science club... send me a message. All money sent will be used for SCIENCE!!!

### Intro: DIY Solar USB Charger - Altoids

I've been reading a bunch of blogs this fine Earth Day morning and have noticed that most of them are posting little write ups about green solar powered USB gadget chargers. They're all quite nice, but also quite expensive. I don't think I've seen any for less than \$60, and I've not seen one that really suits my style.

Instructables has quite a few guides on how to make Solar USB Chargers, including the very well done guide on how to combine a [Lady Ada Minty Boost circuit with a solar + lithium ion battery](#). Great, but a bit expensive to make and not a very simple project for the weekend DIY person.

Well luckily for us I know how to make one for under \$20 that is better in nearly every way and also completely fits into an Altoids Tin. Covert style.



### Step 1: What You Need

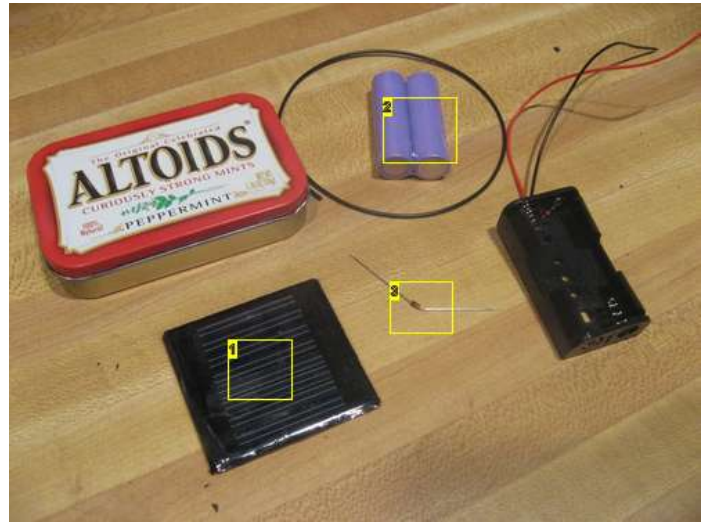
**Parts:**

- USB Charging Circuit
- Solar Panel 4V or greater
- AA Battery Holder
- AA Rechargeable Batteries
- 1N914 Diode
- Altoid Tin (or whatever)
- Wire

**Tools:**

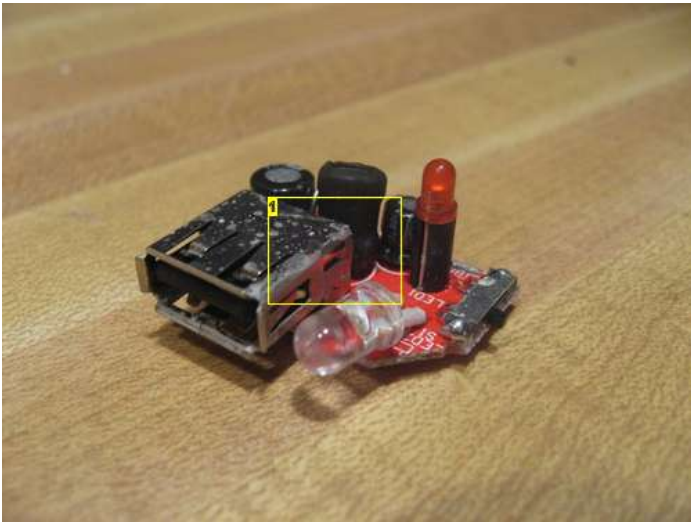
- Soldering Iron
- Solder
- Tin Snips
- Melt Glue Gun and Glue
- Tape

Cost is less than \$30. I can make one for under \$10 when I buy parts in bulk. I have a kit available at my website [BrownDogGadgets.com](http://www.browndoggadgets.com) which has everything you need to make this project. Also, if you're lazy, I do sell made versions in a variety of tin styles.



**Image Notes**

- 1. 4V @ 50 ma
- 2. AA NiMh 3000 ma
- 3. 1N914 Diode



**Image Notes**

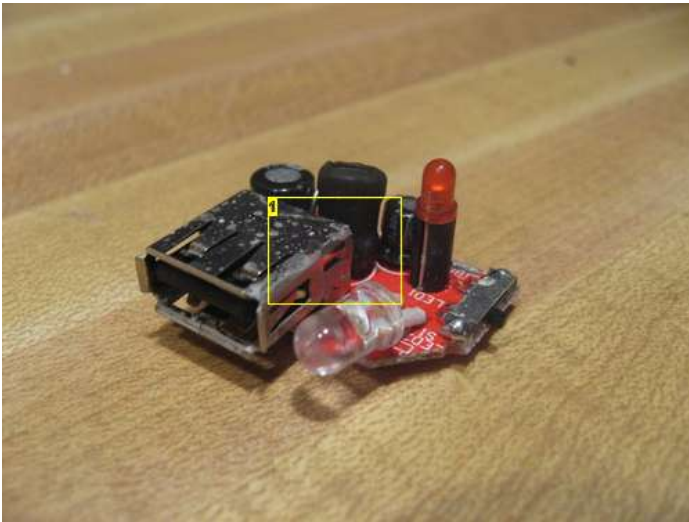
- 1. DC to USB circuit.

**Step 2: DC to USB Converter**

The central brain of our project is a DC to USB converter circuit. This takes our AA power and changes it into the 5Vs we need for charging USB. There are several ways of doing this.

- 1) You can make one yourself using Lady Ada's Minty Boost kit. It's \$20 and requires soldering. It also charges almost every gadget under the sun, including new Apple Products.
- 2) You can buy a premade circuit off ebay, or even off my website [BrownDogGadgets.com](http://BrownDogGadgets.com). They cost around \$10 but probably don't charge newer Apple products (because Apple is a poo poo head and new iPhones and iPods don't follow USB standards).
- 3) You can rip one out of a cheap USB charger. eBay and or Amazon are great places to look. Some of them even do charge up Apple products. (Think of it as up-cycling.)

Whatever you do, don't try and make a 6V or 9V circuit and then use a voltage limiter to take it back down to 5V. That's sloppy and inefficient. You can do it, and it works, but there are far better options.



**Image Notes**  
1. DC to USB circuit.



**Image Notes**  
1. Adafruit Minty Boost



**Image Notes**  
1. One of many AA to USB chargers. They're not cheap.

### Step 3: Choose Some Batteries

What I really find annoying is that on all the commercial solar USB chargers I see their internal battery is only 1000 ma. That isn't a lot. A rechargeable AA battery has between 2000 - 3000 ma of current in it. Once again, we can do better.

We need to use rechargeable batteries for this project. I prefer NiMh AAs over everything else because they're easy to find, cheap, and reliable. You probably even have a few at home. Since we're using two AAs in this project our charger will have 2000 - 3000 ma of current. You could even have two sets of AAs in parallel and boost that capacity to 4000 - 6000 ma.

An added bonus from rechargeable AAs is that you can take them out of the Solar Charger, charge them up or replace them, and be on your way.

If you're making this project into a very small container you can use a smaller NiMh battery pack. You can find these at places like American Science and Surplus as well as many places on the web.



#### Step 4: Choose Your Solar

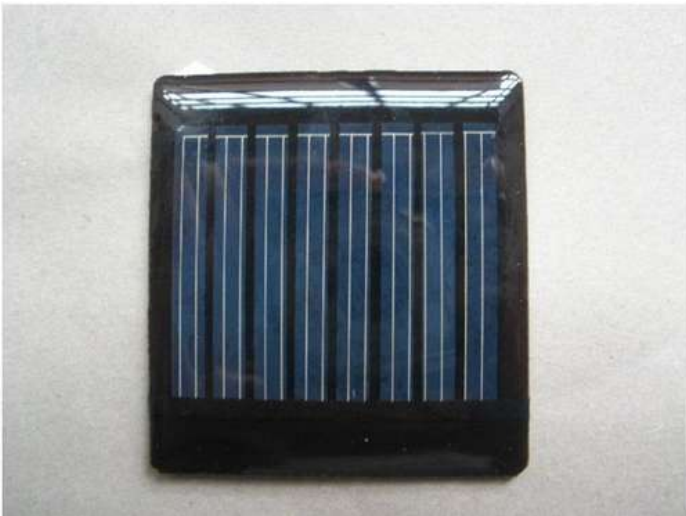
If we use two rechargeable AAs that put out a total of 2.4Vs we're going to need a solar panel that is at least 3 - 4Vs just to meet basic levels of charging. The higher the voltage of our solar cell (or cells) the less light we need to charge up our batteries.

Now we're also trying to fit this into an Altoids Tin, so we're limited in space. I have found some great 4V solar cells that perfectly fit into Altoids Tins. They're the same ones I use with my Solar AA Altoids Charger.

Sure, a bigger and better solar cell would give us added power, but it wouldn't fit into our tin. (Something that has annoyed me with nearly every Altoids Solar Guide out there.)

You could also use a combination of several smaller cells to get your four volts. For example, 2V cells are very cheap and small on ebay. You could easily connect two of those in a series to get your 4Vs.

Just remember that when charging NiMh batteries we don't want to throw more than 10% of their capacity at them at any one time. For instance if your battery has a capacity of 2000 ma we can only use a solar cell that puts out 200 ma or less of current. This isn't usually a problem unless you're using a massive solar cell or a big combination of cells. None the less, keep this in mind.



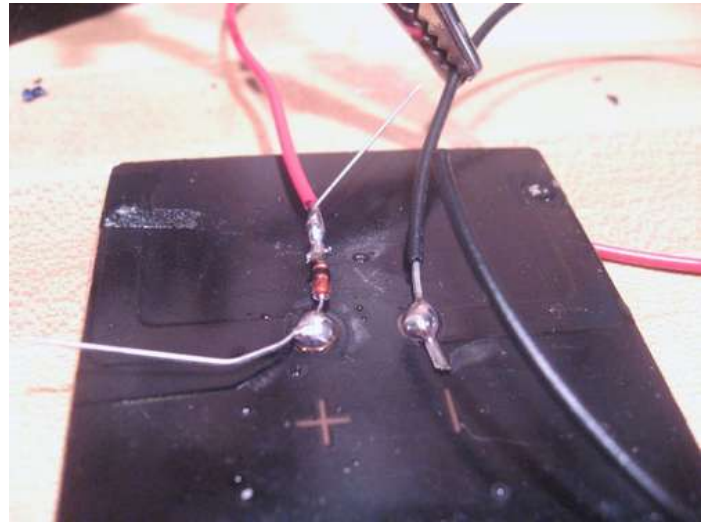
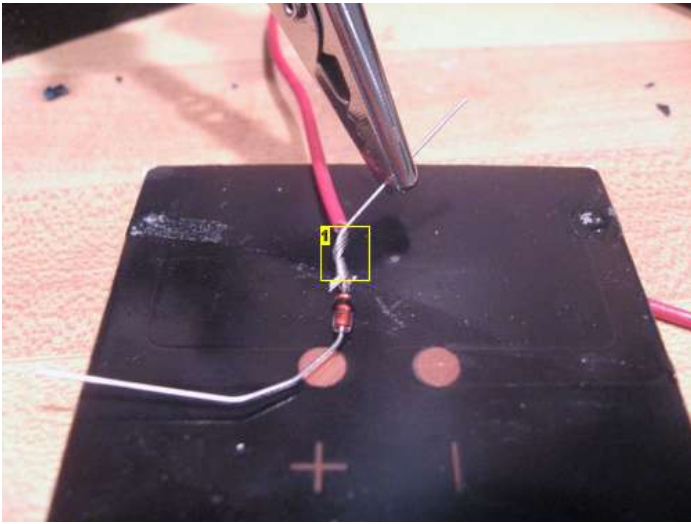
#### Step 5: Wire Up The Solar

First, we're going to wire up our solar panel.

I like to connect my 1N914 diode directly to the solar panel. When soldering make sure the black bar on the 1N914 diode is point away from the solar cell. The black bar is the negative side and prevents power backflow. If we put it in wrong we're going to prevent power from flowing into our circuit!

Then attach a long wires to both the diode and negative tab on your solar cell.

Then tape it up for protection.



**Image Notes**

1. Don't forget to solder the diode.

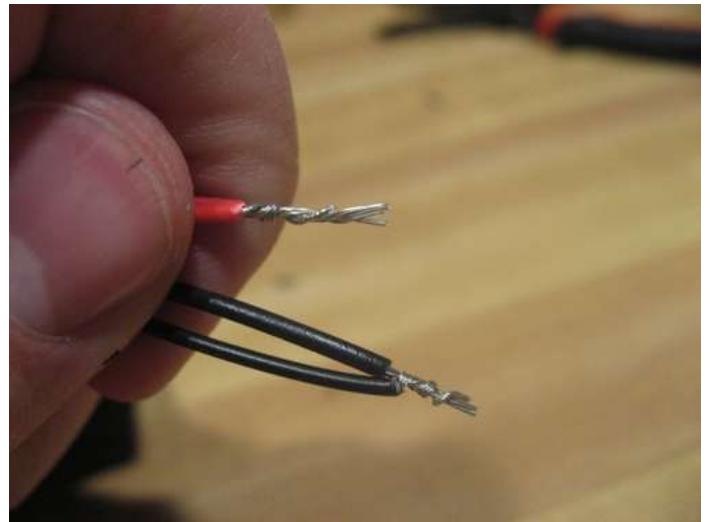
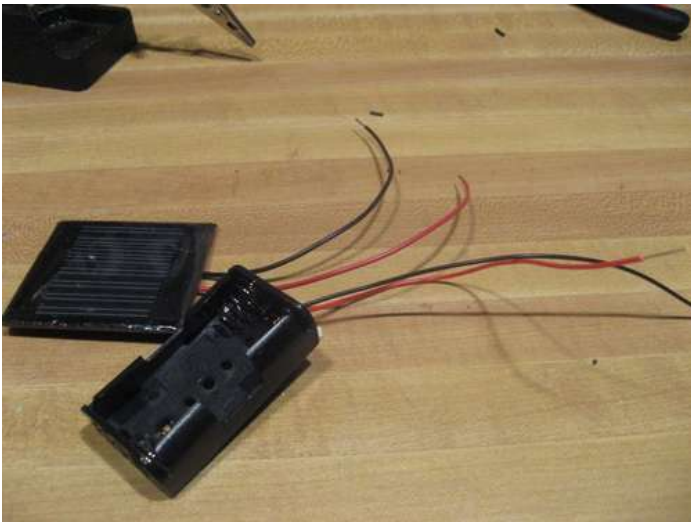
**Step 6: Connect The Battery Pack**

Now we connect the solar wires to the battery pack wires.

Just connect all the positive wires (red) with all the negative wires (black).

Solder.

Easy as pie. Sweet sweet solar pie.



## Step 7: Prepare the Charger

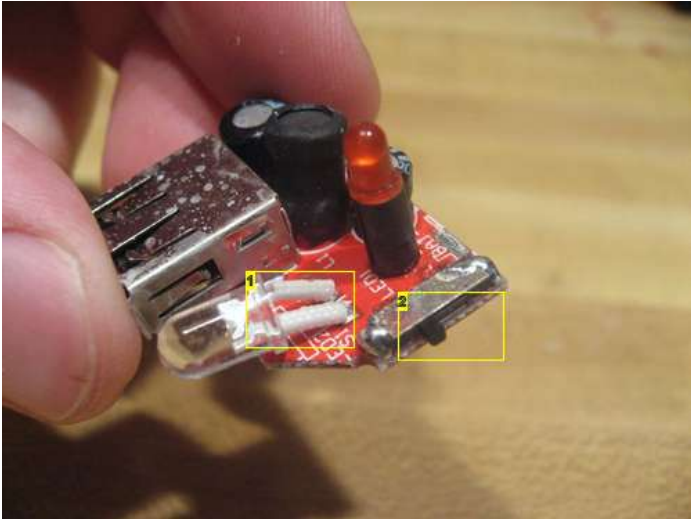
So the charging circuit I use also has a couple of LEDs on it. These in no way effect the USB charging and in fact are annoying. I remove them because they're useless and a waste of power. This is why I'm cutting them off in the pictures below.

You should NOT start cutting things away unless you know what you're doing. Seriously Ben, I know you're reading this. Stop cutting now. This is how you lost a finger.

Anyways, if you've bought a cheap charger to use you have to take it out of it's plastic, and disconnect any random wires or battery packs.

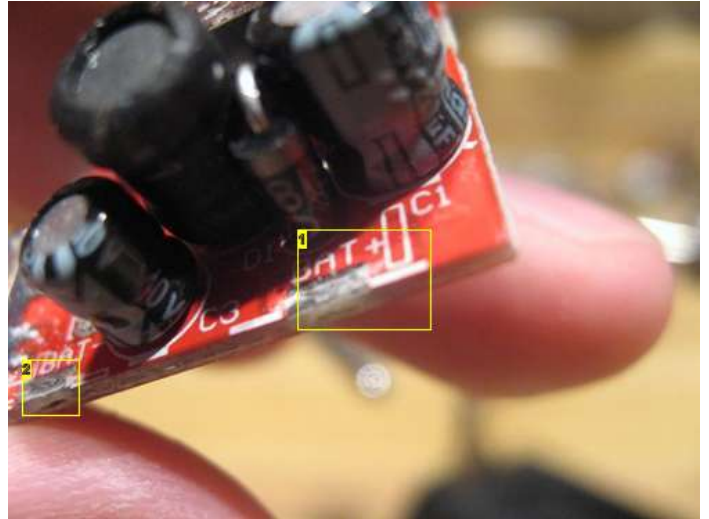
What you should be mindful of is where power connects to your board. Mine has a nice little + and - sign to guide me. You need figure this out on your own depending on your situation.

Lastly, and most importantly, you should watch out for any switches. For instance mine has a little switch on the side to go from "Light" to "Off" to "USB." I just keep mine set to "USB" as we don't lose any power unless something is plugged in.



### Image Notes

1. I cut this away for good measure.
2. I need to push this back all the way to keep it set to "USB." Yours may be different.



### Image Notes

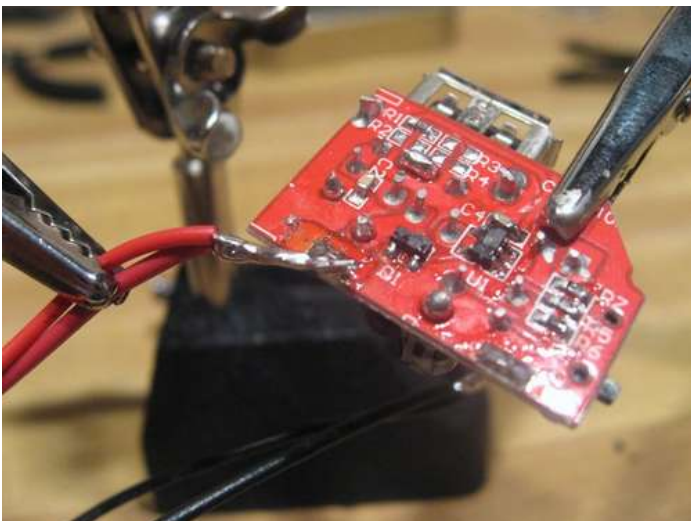
1. Positive
2. Negative

## Step 8: Solder The Charger

Now all you have to do is solder that bundle of positive, in my project red, wires to the positive point on the board. Then all the negative, in this project black, wires to the negative point on the board.

You're done with the circuit. You can test it now.

Usually I can charge a gadget just from sun. If it's not sunny the circuit should charge via batteries.

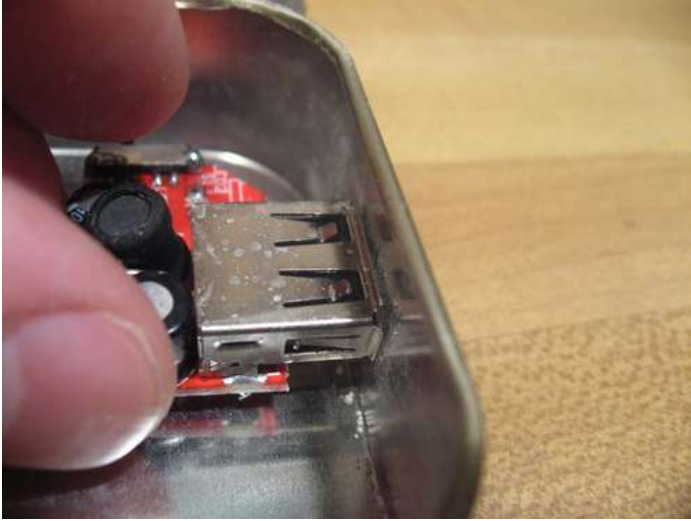


## Step 9: Cut Your Tin

I use Altoids Tins because they're the perfect size for this project. Plus very cute. I also enjoy mints.

Just use some tin snips to cut a hole big enough for the USB port.

If you want to be fancy you can also use a Dremel and make a nice rectangle hole in the side of the tin. I'm lazy, so I just cut it away.



## Step 10: Glue Everything In

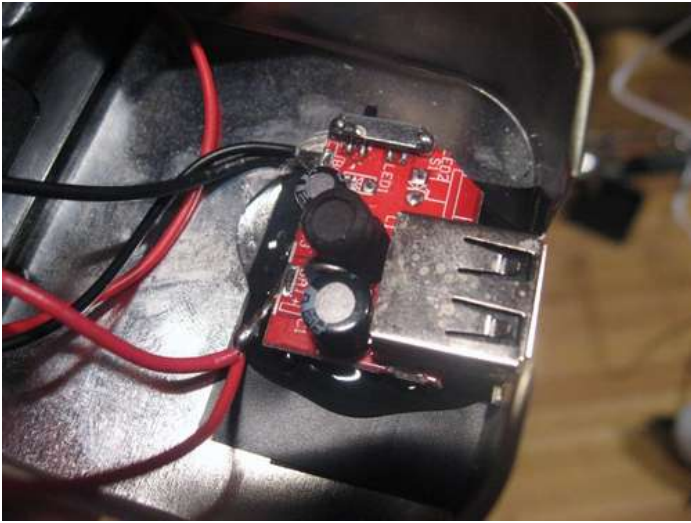
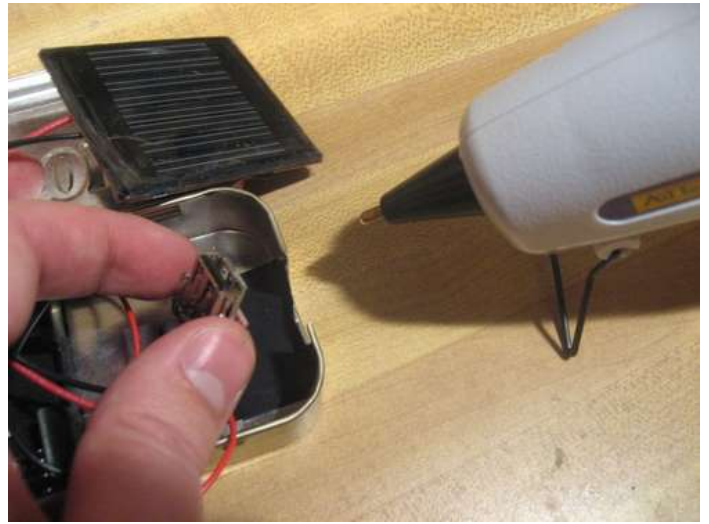
To be on the safe side I put down some electrical tape below my bare circuit board. Just to play it safe.

Now all you need to do is glue in your battery pack (though I use foam tape for that) and glue down your USB circuit.

Notice I use ample amounts of hot (melt) glue. Yummy.

Done and done.





### Step 11: Enjoy

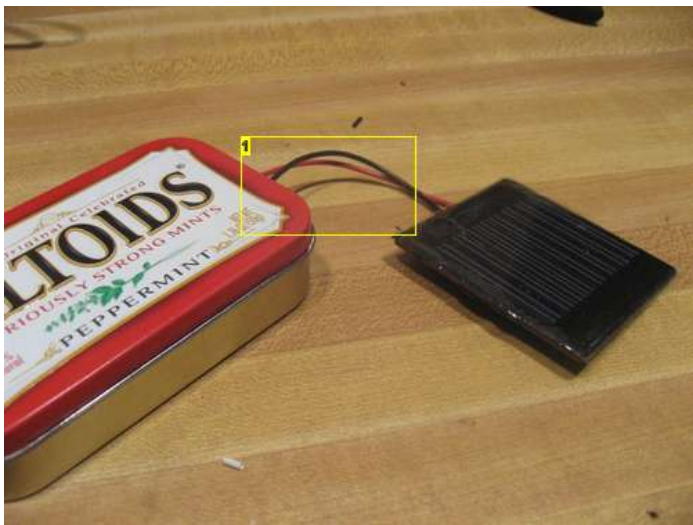
Now you're done. Enjoy the fact that you're being very green and clean.

Also, before someone chimes in... yes I do know batteries are not entirely green. If you want to be super green you should use some super capacitors for this project. They last forever, are super green, but are also quite expensive.

What I like about this project is that it's simple and handy. It makes for a nice gift.

If you need any parts you can always get them from my website, [BrownDogGadgets.com](http://www.browndoggadgets.com). All the money I make goes to doggy treats and more projects.

Thanks for reading!



**Image Notes**

1. There is enough room for the panel wires to come out through the USB hole. Handy I think.



**Image Notes**

1. The only thing that gives away that this is not filled with mints.

**Related Instructables**



**Mr. Buzz, the USB Solar Charger in a Cup** by nmccлана



**Usb iPod Charger: Powerdock** (Photos) by recordmasta001



**DIY 9v Usb Ipod, Cellphone, Mp3 Portable Charger! Very EASY!** by chazy



**How to make a solar iPod/iPhone charger -aka MightyMintyBoos** by Honus



**Create A Solar iPhone and USB Charger** (video) by hastyhost



**\$3 Emergency Solar Radio** by JoshuaZimmermar

**Comments**

**2 comments**

**Add Comment**



**iPodGuy** says:

I love your solar gadgets. Please don't stop making them!

Apr 23, 2011. 8:59 AM **REPLY**



**JoshuaZimmerman** says:

Ohhhh don't worry. I plan on making many more, as well as posting them online.

Plus it's summer! Summer should be all about solar.

Apr 23, 2011. 3:22 PM **REPLY**