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How to Go Postal

by **Q-Branch** on January 3, 2007

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How to Go Postal

How to make your own **PCB** on free postal labels using conductive ink, epoxy and a few parts. By PCB I mean, **Post-Circuit Board**: as in enter the age of circuits painted on walls. And also because its on postage. Neither snow nor rain nor heat nor law nor gloom of night stays these couriers from the swift completion of their self-appointed rounds. Lets all Go Postal.

Another old project out of the dust bin of 2006 from the Graffiti Research Lab and The Eyebeam OpenLab.

Confront your fear of the hi-res video by clicking here.

...
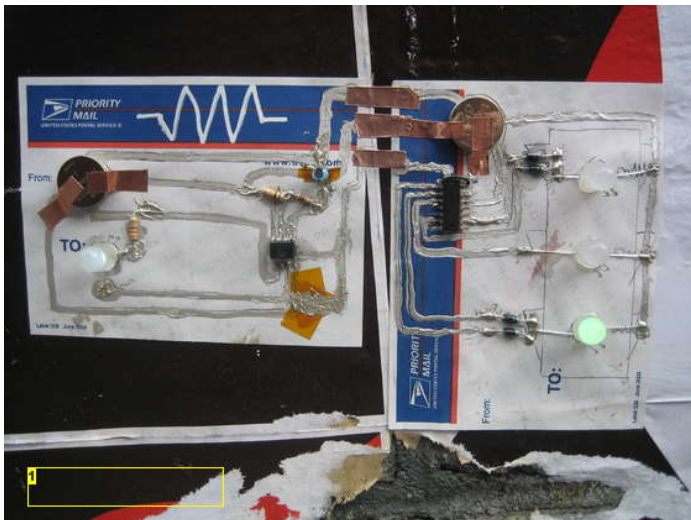
Image Notes
1. traffic lite PCB @ 11 spring street, January, 2006
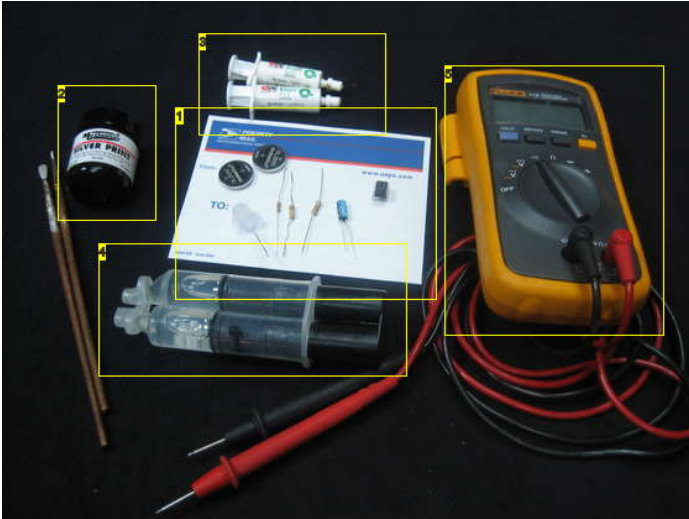

Image Notes
1. 55 timer hello world PCB

The essential ways and means to build a PCB:

1. a USPS Priority Mail postal label
2. a multimeter
3. 5-minute epoxy
4. conductive epoxy
5. conductive paint or ink
6. fine tip paint brush
7. copper tape
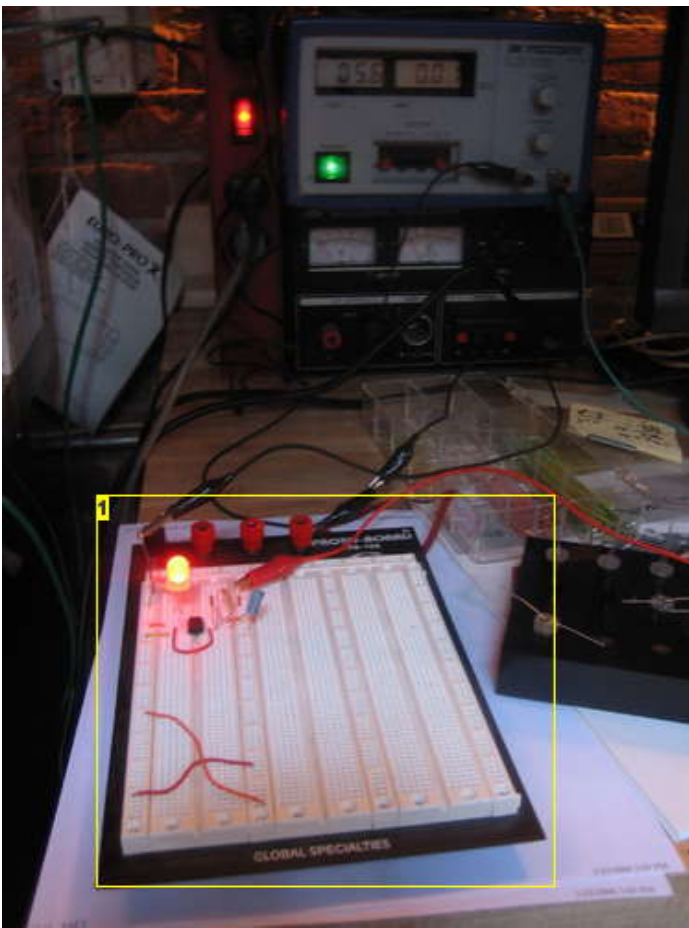8. Whatever specific electronic components you need for your circuit.

...

Image Notes
1. priority mail postal label
2. Silver Print from lessemf.com
3. conductive eposy from less emf
4. 5-minute expoxy from the hardware store
5. a multi-meter
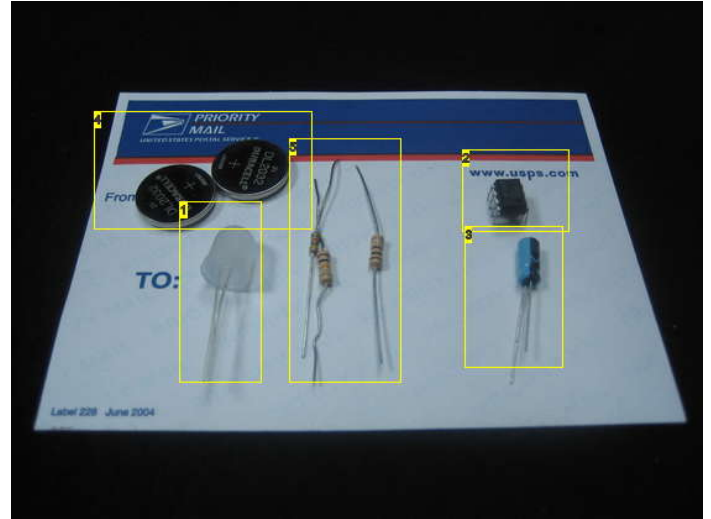
Image Notes
1. 3 volt LED
2. 555 timer IC chip
3. 10 uf cap .1 uf cap
4. CR2032 or better flat cell batteries
5. 100k ohm 200 ohm 47k ohm

Image Notes
1. build your circuit on a proto board before creating the circuit to make sure you
have the right component values and wiring

step 2: Circuit and Sticker Design

This instructable will detail one way to put a blinking LED circuit on postage, fabric, wood and other surfaces. But there's a lot of potential for what could be made using these materials and techniques and a world of simple circuits in textbooks and on the internet to try out. The conductive paint and ink will add resistance so you may need to experiment and tweak component values to get the effect you want. We've included some images and video of other examples including a traffic lite sticker and an homeage to Above created by Fred Zyda in the guerilla studios @ SIGGRAPH that uses timer and decadal counter ICs.

These are the parts we use to create a 555 timer-based flashing LED circuit:

1. 47k resistor (R1)
2. 100k resistor (R2)
3. 400 Ohm resistor (R3)
4. 10uf capacitor (C1)
6. 2 3 Volt DC CR2032 or better lithium batteries
7. 10mm 3 volt, 30mA LED (of any color)
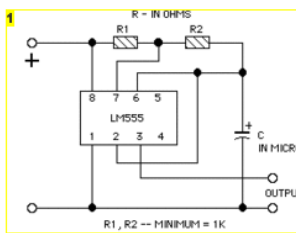8. 555NE timer IC Chip
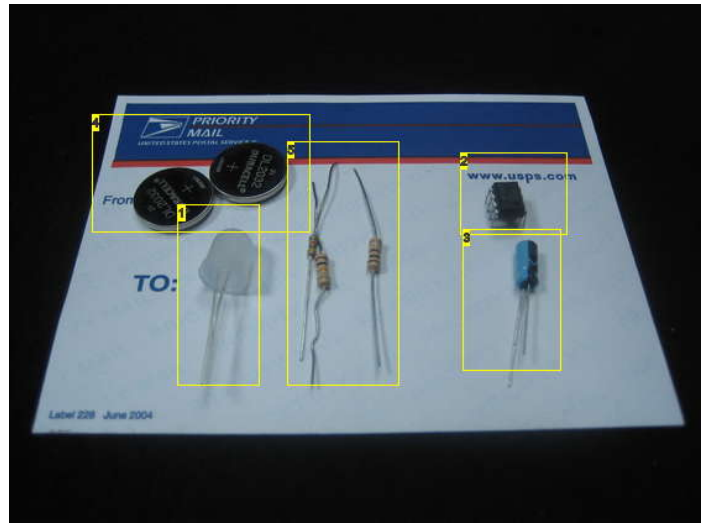
Image Notes
1. 3 volt LED
2. 555 timer IC chip
3. 10 uf cap .1 uf cap
4. CR2032 or better flat cell batteries
5. 100k ohm 200 ohm 47k ohm

BASIC ASTABLE OSCILLATOR CIRCUIT with CALCULATIONS FOR THE LM555 TIMER CHIP
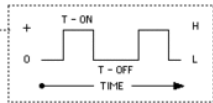©ROB PAISLEY 2003

ASTABLE OSCILLATOR

TO CALCULATE THE FREQUENCY -- $FHz = \dfrac{1}{0.693 \times (R1 + 2 \times R2) \times C}$

TO CALCULATE THE ON TIME -- $Tsec. = 0.693 \times (R1 + R2) \times C$

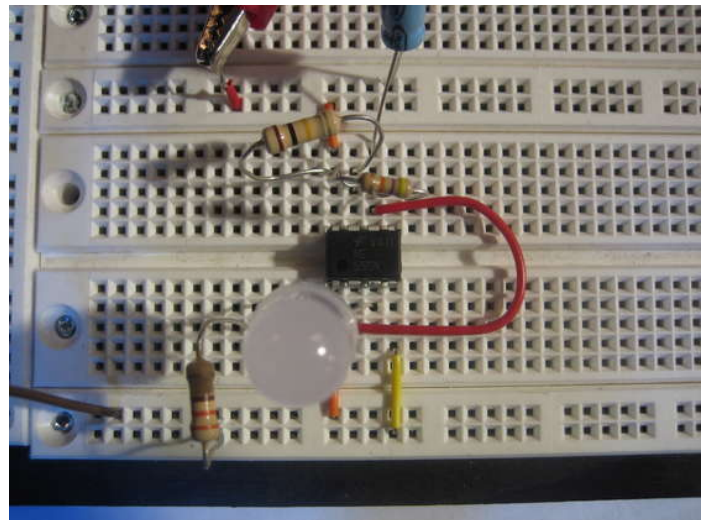TO CALCULATE THE OFF TIME -- $Tsec. = 0.693 \times R2 \times C$

TO CALCULATE THE PERCENT TIME HIGH -- $\% = \dfrac{R1 + R2}{R1 + 2R2}$
(DUTY CYCLE)

TO CALCULATE THE PERCENT TIME LOW -- $\% = \dfrac{R2}{R1 + 2R2}$

R1 , R2 -- MINIMUM = 1K
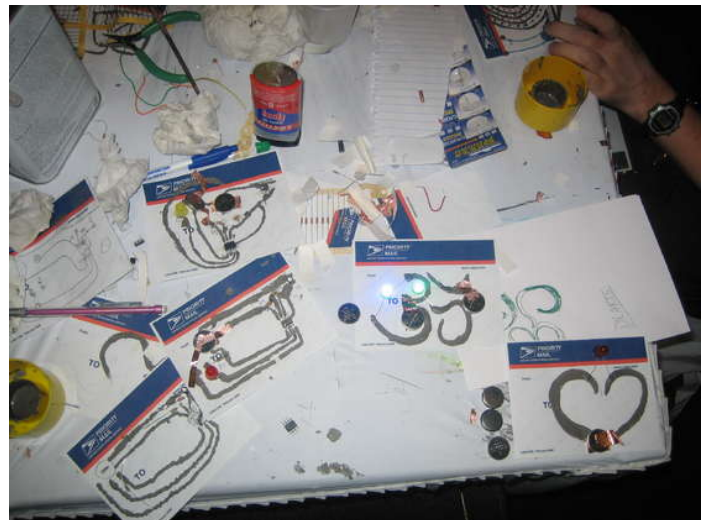
555 Astable calc 2003
http://home.cogeco.ca/~rpaisley4/CircuitIndex.html
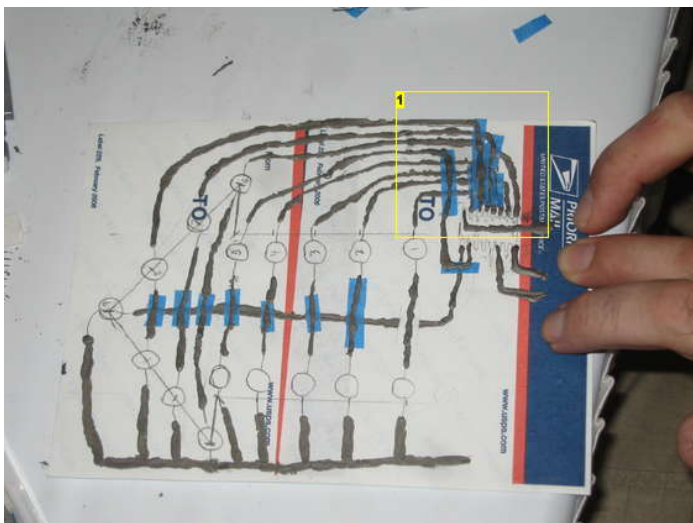
Image Notes
1. typical 555 timer circuit

Image Notes
1. copper tape instead of conductive ink or paint

Image Notes
1. multiple layers made using tape covered by conductive ink or paint

step 3: Circuit Still Life

Once you've tested your circuit, you can lay it out on the surface of your choice. You can trace the sticker design attached in this step to create the 555 timer circuit that will blink an LED or two. More complicated circuits will require multiple layers. Leave ~ 0.25 inches for each trace. I make small circular contact pads at locations where electronic components will contact the ink traces.

...
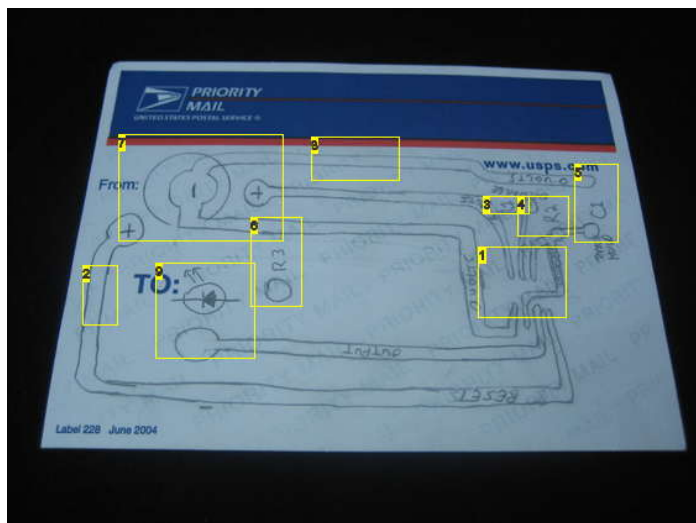
Image Notes
1. 555
2. positive trace
3. resistor R1
4. resistor R2
5. capacitor 10uf
6. current limiting resistor
7. battery
8. negative bus
9. LED

Image Notes
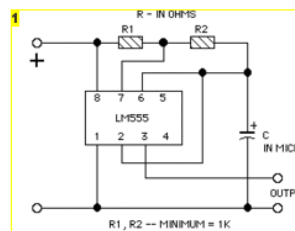1. typical 555 timer circuit

step 4: Leave a trace

Use a paint brush and conductive paint or ink to create the traces. It may require multiple coats. Allow the paint or ink to dry and use a multimeter to test for continuity on each of the traces.

This tutorial is multimeter 101 for those who need it. For PCBs all you need to know is how to use continuity mode.

...

step 5: Hook a Sticka Up

Now you can add your components. This happens in three steps:

1. Placement
Position the component so that it lays flat, or upright or on "it's back". Determine the position that is most stable for that given package or form factor. Bend the leads so that they touch your conductive contact pads or traces. Don't worry about cutting the excess lead yet.

2. Epoxy
Epoxy the component body to the postal label. Make sure to **not** get epoxy on the component leads or the traces as it will act as an insulator.

3. Bend and Clip
Once the epoxy has dried (in about 15 minutes) you can bend the leads so that they follow the traces and make contact exactly where you want them. Just clip off any excess.

4. Hook it Up
Now you can do two things. You can put a thick layer (glob) of conductive paint or ink on the area where the component leads make contact with the traces. This is the quick and dirty way. It is less stable but who are we kidding -- we're making a circuit on postage. You can also use conductive epoxy. The connection will be very strong, but it will require at least 6 hours drying time.

Check the photos for more details on attaching the hardware.

...
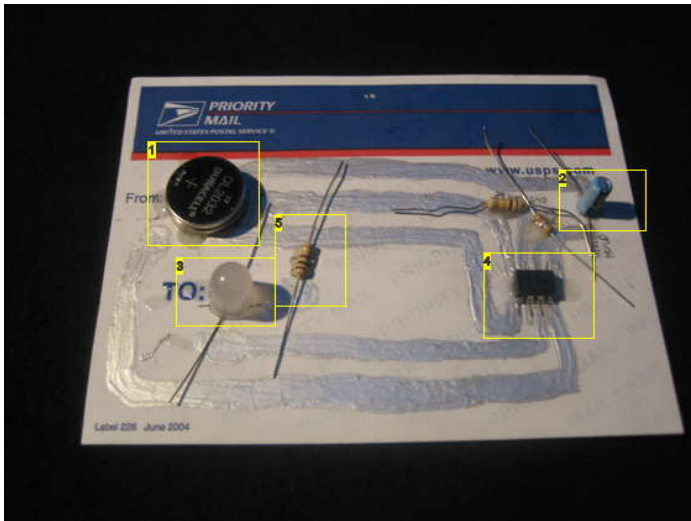
Image Notes
1. save the battery for later
2. this type of cap can rest on the bottom of the package if you bend the legs just right
3. LEDs can face out and rest on the bottom of their package
4. on ICs i put a dab of glue on the bottom and on the front and back.
5. resistors lay nice and flat
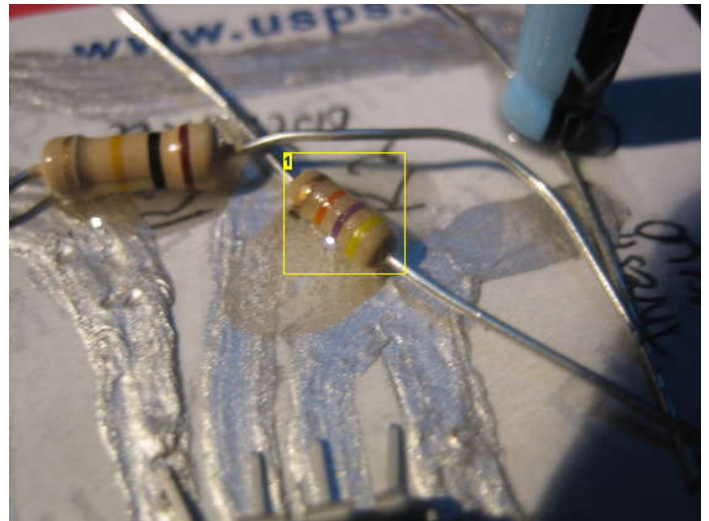
Image Notes
1. ready to get bent
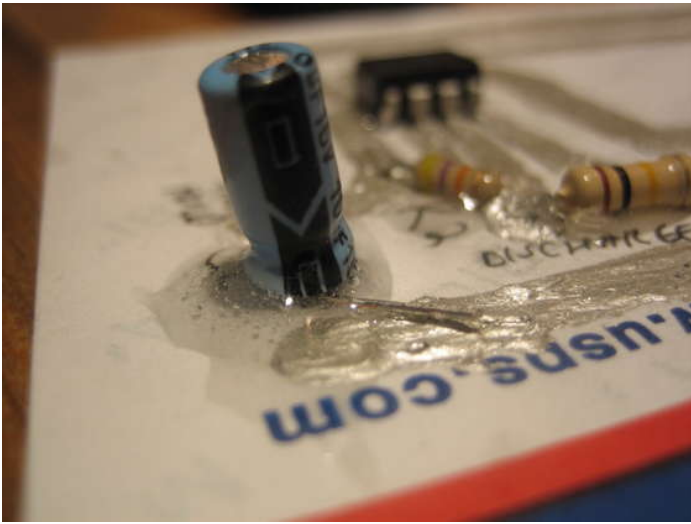
Image Notes
1. glued and bended. this aint a science yall. whoot whoot.
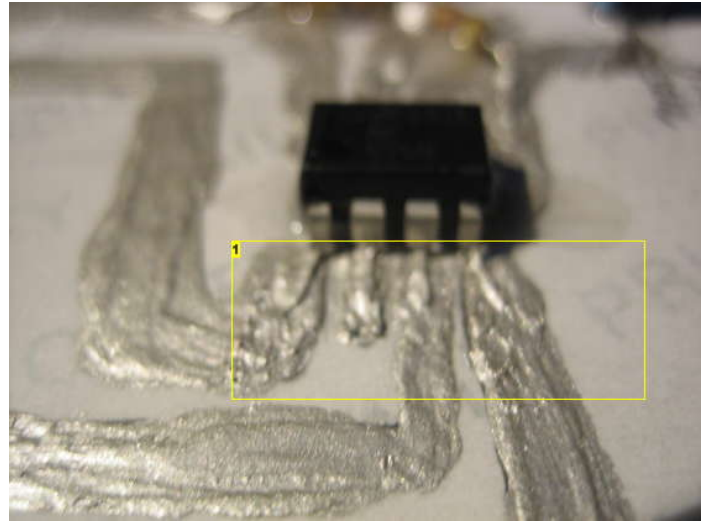
Image Notes
1. painted on with a fine tip brush. a cheap digiscope microscope is a good addition to the tool bench for this type of work.

Image Notes
1. a dab of paint will create electrical continuity. the joint won't be mechanically
very strong, but if the lead is preloaded into the paper it should work reliably once
its stuck to a wall.

step 6: The Juice

Depending on your circuit, you may be able to use a single battery. For the LED flasher circuit, I am using a 555 time that operates within a range of 3 - 15 volts DC. One 3 volt battery won't give you much operating life. So I make a six volt battery by using conductive epoxy or conductive tape to create a battery sandwhich that operates in parallel to give me a six volt bus. You can also use conductive velcro. When paper batteries become more common this will be less clunky.

...

Image Notes
1. conductive velcro attached with conductive epoxy
2. a small loop of copper tape also works to connect the two batteries together.
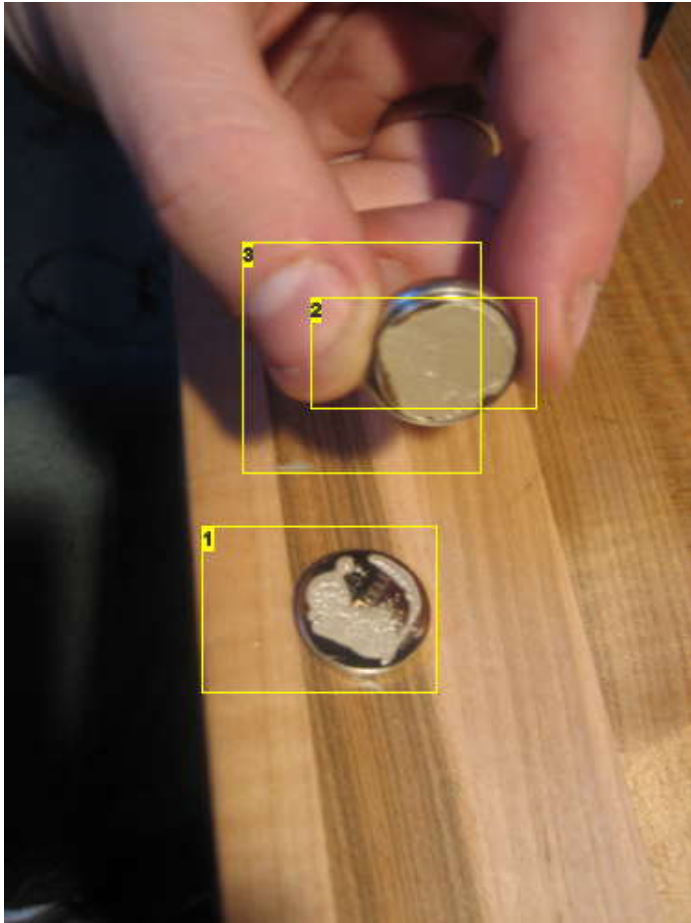
Image Notes
1. positive terminal
2. negative terminal
3. use less epoxy than this. the epoxy can create a short if you use too much

step 7: Crank it Up

Now you can attach the battery to the circuit. There are a number of ways to do this as well:

You can epoxy (conductive) the negative terminal to the negative trace on the postal label and run copper tape from the positive terminal of the battery to the positive traces. You can substitute the conductive epoxy with a loop of copper tape for a shorter term solution. You can add a dab of 5-minute epoxy to the battery to secure it in place. Conductive velcro is another method. It requires more fabrication time but allows you to change batteries in situ without destroying the traces by ripping up the conductive epoxy.

...
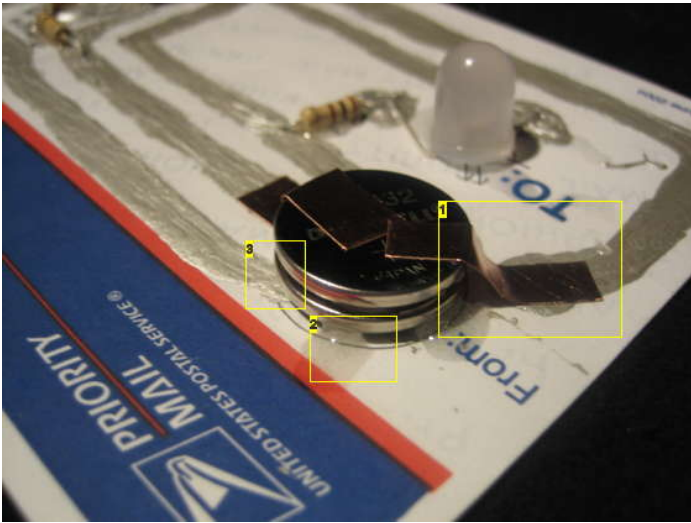
Image Notes
1. copper tape from positive terminal of the battery to the positive trace
2. a dab of 5-minute epoxy will help secure the battery to the label
3. negative trace runs underneath the battery to the negative terminal. The electrical connection is made with expoxy of copper tape or velcro

Image Notes
1. conductive velcro patch attached to the traces with conductive epoxy
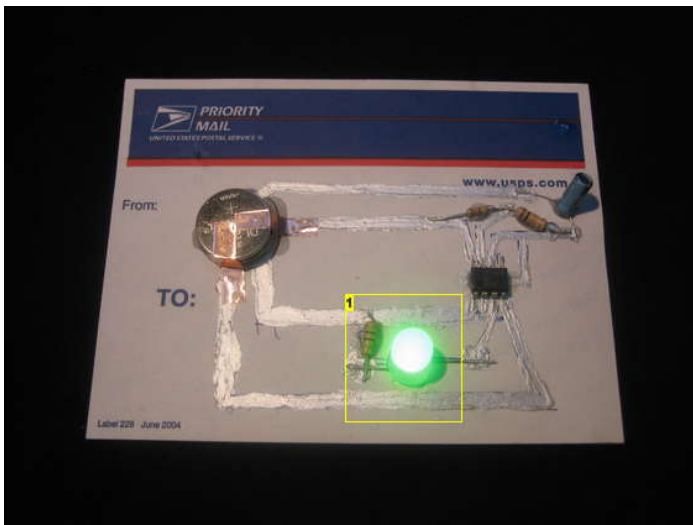
Image Notes
1. check my bling

Image Notes
1. red light district warning system

step 8: Ahhhh Stick It
Stick it real good...wall not included.

If you want to see some smart sticker placement check out Thundercut.
Mail this label to a city council member and win a free trip to Gitmo.

-v^vv⁻

...

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Comments

34 comments   **Add Comment**

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jianqiang says: Jan 25, 2009. 8:36 PM **REPLY**

Oi, was wondering what the song was in the first video. cool stuff, keep it up.

---

agis68 says: Nov 7, 2008. 10:05 PM **REPLY**

Ok but so.me comments

-for how long gonna be working this with so little V/A
-Too expensive for sparing money on the streets
- Too exposed in malicious manipulations and weather
- What's the necessity of this? I realy couldn't get it....

---

raikut says: Oct 2, 2008. 4:02 AM **REPLY**

but how long the circuit will operate with 2 * CR2032 batteries, I doubt????

---

agdollison says: Sep 6, 2008. 8:35 PM **REPLY**

so damn expensive

Gjdj3 says: Jun 30, 2008. 10:31 AM **REPLY**

So... how did this work out? Anyone get arrested?

Nice job. 5 Stars.

RevZ says: Mar 1, 2007. 2:42 PM **REPLY**

Q, I have a question for you.
I'm going to buy some parts to make a PCB like this, but I stumbled upon two (maybe important) matters:
(For your information, I will get the parts online from Conrad, so maybe you can look for the right parts for me)
1. The only elco's I can find are either 10ÂµF 63V or 10UF 16V for a SMD elco.
2. how many watts do the resistors need to be? i can choose either carbon-layer resistors or metal-layer resistors, and i can choose from 1/10 Watt to 1Watt.

Thanks in advance for your help, this is great stuff!!

---

imarzouka says: Apr 12, 2008. 9:34 PM **REPLY**

The resistor wattage is calculated based on the current and voltage going through them. Check out this calculator it will do that calculations for you
http://ledcalculator.net

---

servant74 says: Jun 23, 2007. 9:33 AM **REPLY**

Given these circuits, the smallest resistor wattages you can find will be OK. (1/10W is fine, I like to keep 1/8W around for misc stuff, and get larger when I need them).

---

kadris3 says: May 24, 2007. 10:41 AM **REPLY**

about any electrolitic will work as long as the voltage is 3x the supply voltage. observe polarity. long lead is plus+ just like the led. get the cheapest.

i use 1/2 watt resistors almost exclusively, but a 1/4 watt is more than adequate.
draw on the led is 20 mils at 3v. almost no pwr

---

kadris3 says: May 24, 2007. 10:32 AM **REPLY**

while building is cool, leds already exist w the flashing chip built in. all u need is the led itself. these come in white, blue, red, and the multi-color r/g/b/ flashing leds. i can't knock building though. i have been doing it fr years. love it. i use little squares of circuit board, routed out w a brand x dremmel tool. stuff left are the traces. drill the holes and stuff and solder. funfun.

---

http://www.instructables.com/id/How-to-Go-Postal/

curlyfry562 says:
Mar 24, 2007. 2:36 PM **REPLY**
P=VI
Watts = Voltage x Amps

mia.305 says:
Mar 3, 2008. 1:28 PM **REPLY**
I am not that savy with circuits and what not I did find these www.flashingblinkylights.com/jadejadeblinkingpins-p-1041.html
in my usual daily searches. The batts only last 8 hours according to the site, can these have battery life extended.

westfw says:
Jan 9, 2007. 12:37 AM **REPLY**
Someone should experiement with the various powdered conductive substances to come up with a formula for "conductive enough" paint that costs less
than $150/quart...

Q-Branch says:
Jan 9, 2007. 12:44 AM **REPLY**
true dat to a DIY recipe. While trying to ship or buy this stuff in Norway I found a company in the U.K. that would try to match the formula and sell it as a
multi-part powder to mix. I'll try to dig up that link.

Bongmaster says:
Feb 15, 2008. 6:51 AM **REPLY**
trying to find any shop that sells electrical components here in Norway is next to impossible :((this part of Norway anyway). My components box is
made entirely of harvested parts mainly.

cruz1 says:
Jan 18, 2008. 1:53 PM **REPLY**
so are these labels also pipebombs?
man, stupid people are stupid

Brennn10 says:
Nov 12, 2007. 4:20 AM **REPLY**
I do not know about you, but in today's society, most people will think that is a bomb if you put it in to the public.

locofocos says:
Sep 1, 2007. 7:53 PM **REPLY**
I know there are certain Christmas (gasp :)) tree light bulbs that you replace a normal one with at the beginning of the string and it makes all the lights,
including itself, blink. I'd like to see someone make a throwie from one of those.

dataphool says:
Feb 21, 2007. 8:15 PM **REPLY**
I have been out of the industry for 28 years, so I did not know conductive epoxy was available. Can you get it at RadioShack? That is a standard US Post
Office postcard? The USPO doesn't provide anything esoteric, does it? Looks like a really neat idea.

opm says:
Jan 19, 2007. 11:09 PM **REPLY**
OPM says: the old Polaroid film had its own flat paper battery to 'develope' the picture. This was the part of the photo that you threw away. If Kodak still
makes this stuff, a cheap(?) power source might be availble. I've gone digital, so I've lost track.

lemonie says:
Feb 12, 2007. 2:50 PM **REPLY**
Kodak had a surplus of these some years ago, they built a cheap torch around them to shift 'em. The design of the thing was awful, having to fit around a
cell which was (very roughly) 50x70 mm.
These batteries (they drove the motor & flash) extracted from Polaroid film-cartridges used to have a fair amount of charge left in them, plenty for LEDs
anyway.

paintpaintpaint says:
Jan 18, 2007. 4:37 AM **REPLY**
This looks like a super awesome way to get put in jail.
Regular graffiti lands you in jail for the night, this shit
makes you look like a terrorist. Once you start involving
blinking lights and makeshift wiring cops aren't going to give
a fuck how artsy fartsy you think you are.

fotd says:
Feb 1, 2007. 10:31 PM **REPLY**
lmao, I bet your saying "see told ya so" after yesterdays events.

bvicarious says:
Jan 19, 2007. 2:29 PM **REPLY**
Amen. Blinking lights have no place in a post-9/11 world.

tezcatbus says:
Jul 6, 2007. 2:08 PM **REPLY**

Thanks to this instructable, you can install blinky lights in the bunker under your back yard. We can't do much to pretty up a bunker mentality though, sorry. :(

star35 says:
Feb 1, 2007. 4:04 AM **REPLY**

"Blinking lights have no place in a post-9/11 world"
Wow! That has to be one of the saddest things I've ever heard :-(

Rectifier says:
Mar 5, 2007. 10:57 PM **REPLY**

Agreed. There is plenty of space for blinky lights in this world. I doubt a real bomb has ever had blinky lights on it, unless it was made by a kid to show off to his friends.

Post-9/11 world? Try post-9/11 USA... the rest of the world is doing just fine, thank you. Police overreaction to stuff like this is just that, dumb cops thinking they are hot shit. Nothing to do with "the state of the world".

qwerty90210 says:
Nov 23, 2007. 3:27 PM **REPLY**

I agree but, where do you live?

kix says:
Jan 17, 2007. 8:50 AM **REPLY**

luvverly job. would paint more elaborate shapes of circuit.... mmmhh.

samurai1200 says:
Jan 11, 2007. 12:21 AM **REPLY**

I freaking love your guys' work. Just getting into DIY electronics myself (and being a street artist), this is perfect. Keep up the good shit, GRL!

crapflinger says:
Jan 9, 2007. 3:29 PM **REPLY**

i know it's not as "fun" or "l337"..but couldn't you just use the copper tape to make your traces as well? same effect (i would think slightly "prettier") with less cost? also wouldn't it have less resistance than the conductive paint?

Q-Branch says:
Jan 10, 2007. 7:16 PM **REPLY**

Yes you can def use the copper tape to make the traces. I guess the appearance is a matter of taste, but I like the look of the copper tape myself. We made this:

http://graffitiresearchlab.com/?page_id=51#video

using copper tape under paint as the traces. The tape isnt too cheap. It ranges from tens to hundreds of dollars per ~ 60 yards depending on the conductivity and quality. The problem with the copper tape is that the cheaper stuff isnt conductive on both sides so you have to double it over to make connections between pieces of tape. On certain brands of copper tape the adhesive is actually conductive as well. This is problematic in that if you pull it up you lose conductivity. Also the adhesive is subject to changes based on temp and humidity, etc.

technick29 says:
Jan 9, 2007. 5:38 PM **REPLY**

Sweet instructable! Very detailed and creative. Good job.

Crash2108 says:
Jan 9, 2007. 11:14 AM **REPLY**

Kind of like my printed PCBs idea.